

Contract for: **Wastewater Treatment Facility**

Between: **English River Enterprises Property
Management LP**

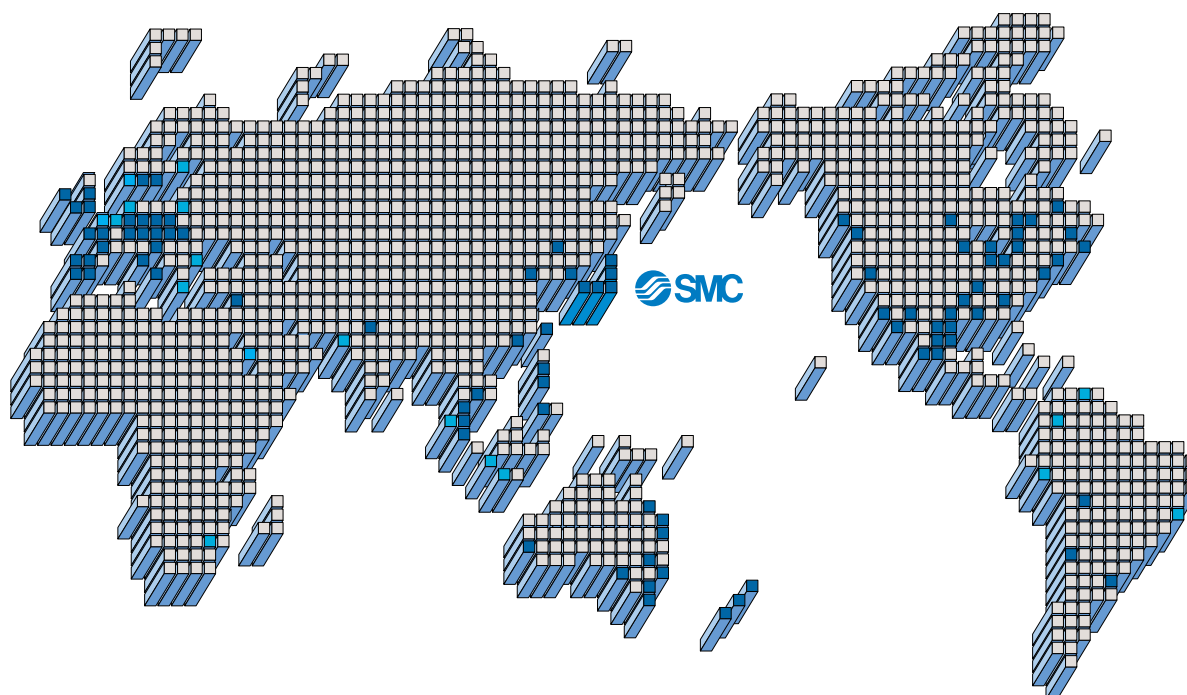
And: **Wright Construction Western Inc.**

Project: **7603-002-00**

Contract Date: **January 15, 2021**

Volume: **5 of 6**

SMC'S GLOBAL MANUFACTURING, DISTRIBUTION AND SERVICE NETWORK



EUROPE

AUSTRIA

SMC Pneumatik GmbH (Austria)

BELGIUM

SMC Pneumatics N.V./S.A.

BULGARIA

SMC Industrial Automation Bulgaria Eood

CROATIA

SMC Industrijska Automatika d.o.o.

CZECH REPUBLIC

SMC Industrial Automation CZ s.r.o.

DENMARK

SMC Pneumatik A/S

ESTONIA

SMC Pneumatics Estonia OÜ

FINLAND

SMC Pneumatics Finland Oy

FRANCE

SMC Pneumatique SA

GERMANY

SMC Pneumatik GmbH

GREECE

SMC Hellas E.P.E.

HUNGARY

SMC Hungary Ipari Automatizálási Kft.

IRELAND

SMC Pneumatics (Ireland) Ltd.

ITALY

SMC Italia S.p.A.

LATVIA

SMC Pnuematics Latvia SIA

LITHUANIA

UAB "SMC Pneumatics"

NETHERLANDS

SMC Pneumatics B.V.

NORWAY

SMC Pneumatics Norway AS

POLAND

SMC Industrial Automation Polska Sp.z.o.o.

ROMANIA

SMC Romania S.r.l.

RUSSIA

SMC Pneumatik LLC

SLOVAKIA

SMC Priemyselna Automatizacia Spol s.r.o.

SLOVENIA

SMC Industrijska Avtomatika d.o.o.

SPAIN/PORTUGAL

SMC España S.A.

SWEDEN

SMC Pneumatics Sweden AB

SWITZERLAND

SMC Pneumatik AG

U.K.

SMC Pneumatics (U.K.) Ltd.

ASIA

CHINA

SMC (China) Co., Ltd.

HONG KONG

SMC Pneumatics (Hong Kong) Ltd.

INDIA

SMC Pneumatics (India) Pvt. Ltd.

MALAYSIA

SMC Pneumatics (S.E.A.) Sdn. Bhd.

PHILIPPINES

Shoketsu SMC Corporation

SINGAPORE

SMC Pneumatics (S.E.A.) Pte. Ltd.

SOUTH KOREA

SMC Pneumatics Korea Co., Ltd.

TAIWAN

SMC Pneumatics (Taiwan) Co., Ltd.

THAILAND

SMC (Thailand) Ltd.

NORTH AMERICA

CANADA

SMC Pneumatics (Canada) Ltd.

MEXICO

SMC Corporation (Mexico), S.A. de C.V.

U.S.A.

SMC Corporation of America

SOUTH AMERICA

ARGENTINA

SMC Argentina S.A.

BOLIVIA

SMC Pneumatics Bolivia S.r.l.

BRAZIL

SMC Pneumáticos do Brasil Ltda

CHILE

SMC Pneumatics (Chile) S.A.

VENEZUELA

SMC Neumatica Venezuela S.A.

OCEANIA

AUSTRALIA

SMC Pneumatics (Australia) Pty. Ltd.

NEW ZEALAND

SMC Pneumatics (N.Z.) Ltd.



Safety Instructions

Be sure to read "Precautions for Handling Pneumatic Devices" (M-03-E3A) before using.

SMC Corporation

Akihabara UDX 15F,
4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, JAPAN
Phone: 03-5207-8249 Fax: 03-5298-5362
URL <http://www.smcworld.com>
© 2008 SMC Corporation All Rights Reserved

Specifications are subject to change without prior notice
and any obligation on the part of the manufacturer.

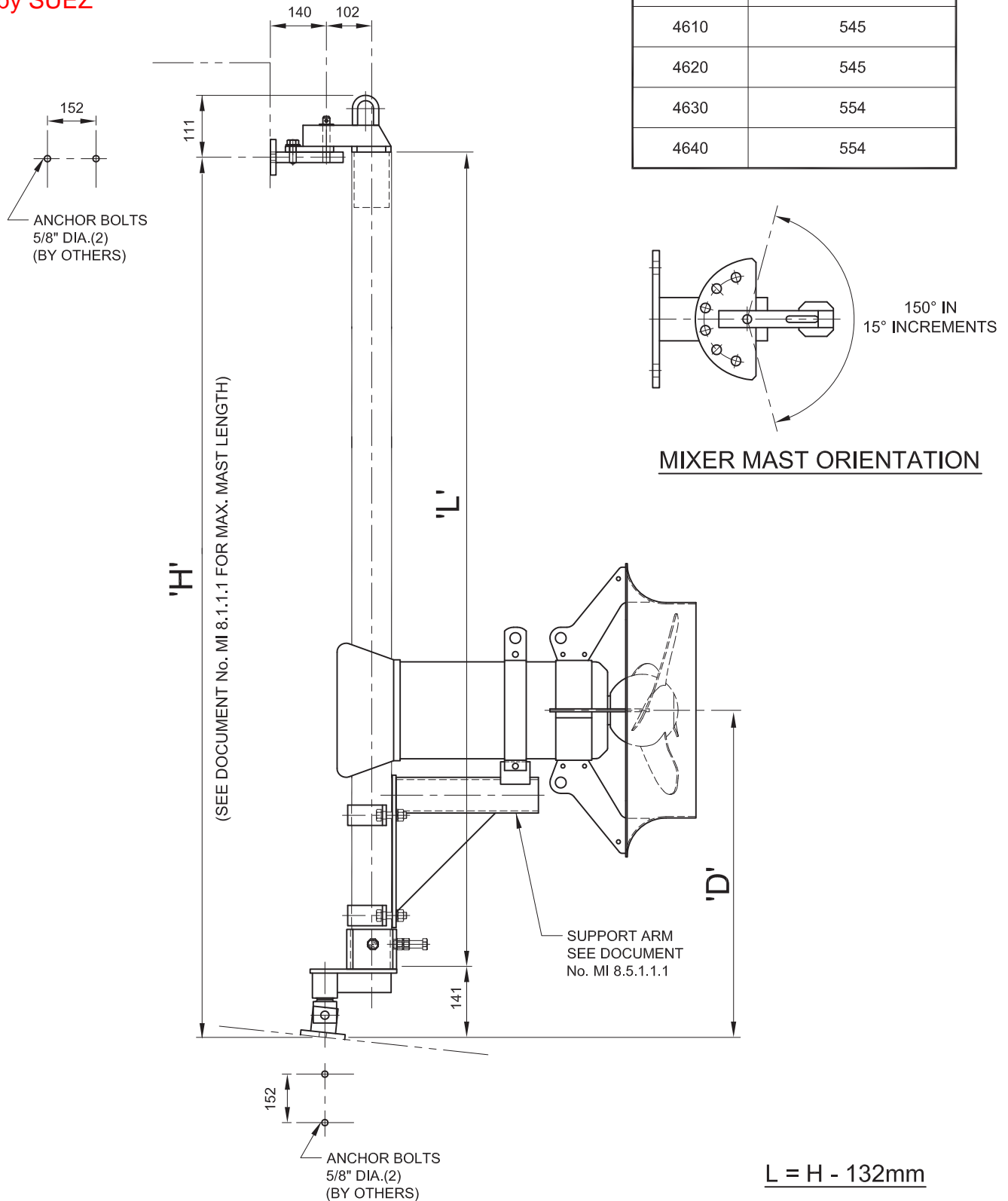
D-DN

1st printing MT printing MT 16400DN Printed in Japan.

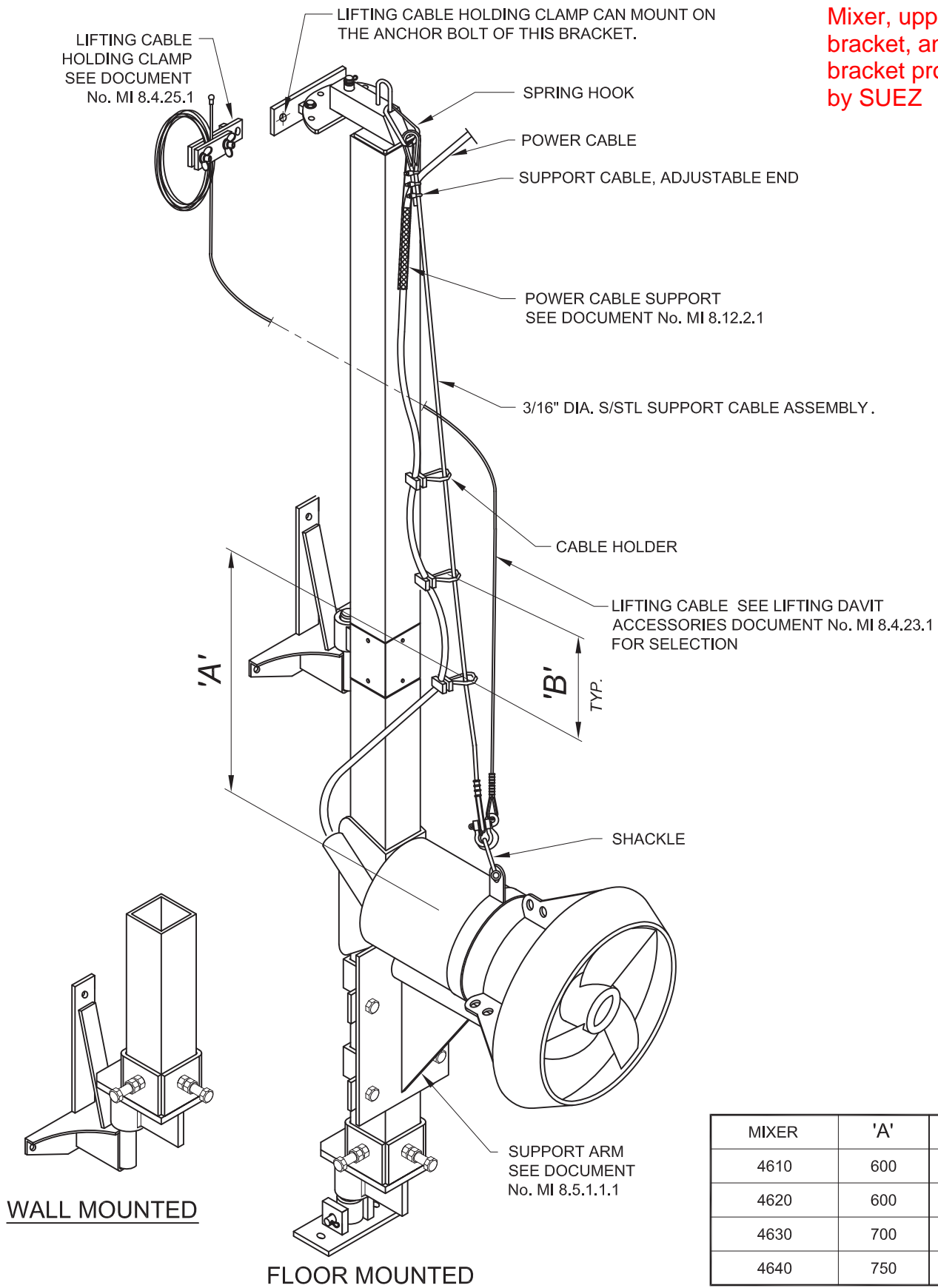
This catalog is printed on recycled paper with concern for the global environment.

Mixer, upper
bracket, and lower
bracket provided
by SUEZ

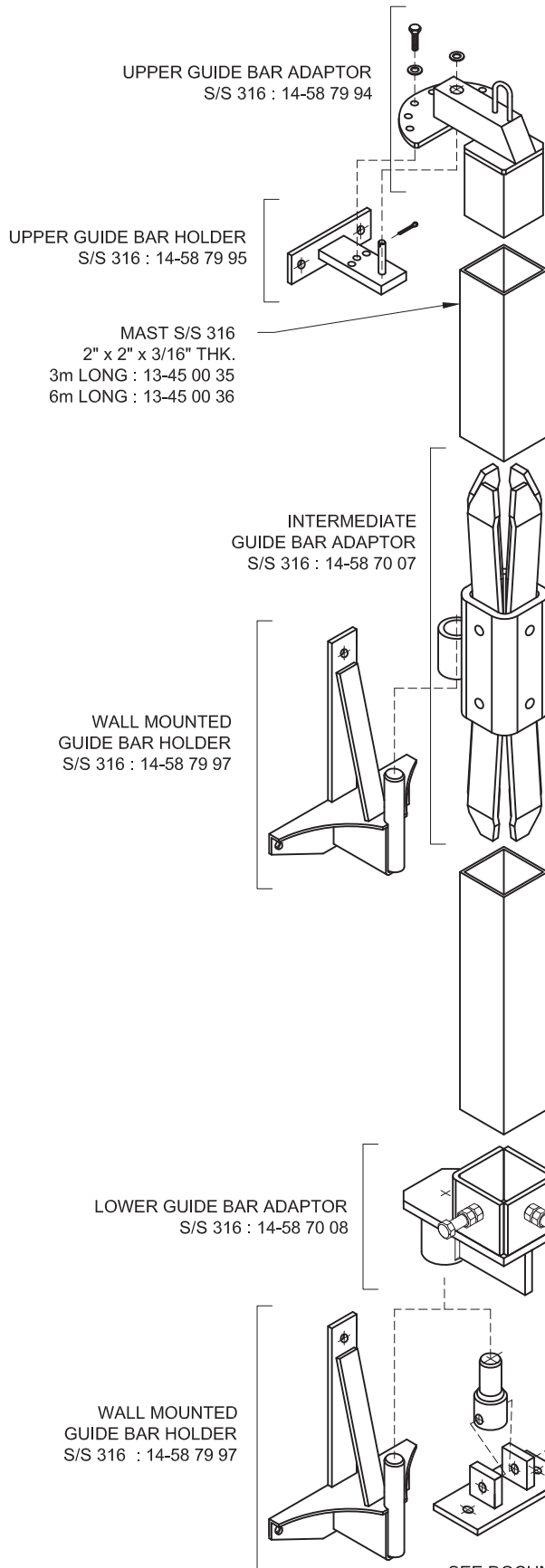
LOWEST POSITION OF MIXER ϕ ABOVE FLOOR (DIM 'D')	
MIXER	WITH / WITHOUT JET RING
4610	545
4620	545
4630	554
4640	554



Mixer, upper bracket, and lower bracket provided by SUEZ



SEE DOCUMENT No. MI 8.2.1.2 FOR PART NUMBERS.



ADDITIONAL ACCESSORIES REQUIRED:

SPRING HOOK(S/S 316) P/N 84 52 84

POWER CABLE SUPPORT :

STAINLESS STEEL :

FOR 11-18mm O.D. CABLE P/N 83 57 23

FOR 19-24mm O.D. CABLE P/N 83 57 24

FOR 25-36mm O.D. CABLE P/N 83 57 25

POLYESTER

FOR 12-25mm O.D. CABLE P/N 482 01 01

FOR 26-30mm O.D. CABLE P/N 482 01 02

SUPPORT CABLE ASSEMBLY S/S 316 : (CUT TO LENGTH ON ASSEMBLY)

6m LONG P/N 13-50 05 30

12m LONG P/N 13-50 05 31

POWER CABLE HOLDER:

FOR 11-18mm O.D. CABLE P/N 83 45 62

FOR 19-27mm O.D. CABLE P/N 83 45 63

FOR 26-36mm O.D. CABLE P/N 83 45 64

LIFTING CABLE HOLDING CLAMP:

S/S 316 P/N 13-50 05 13

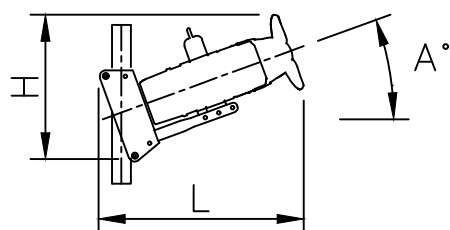
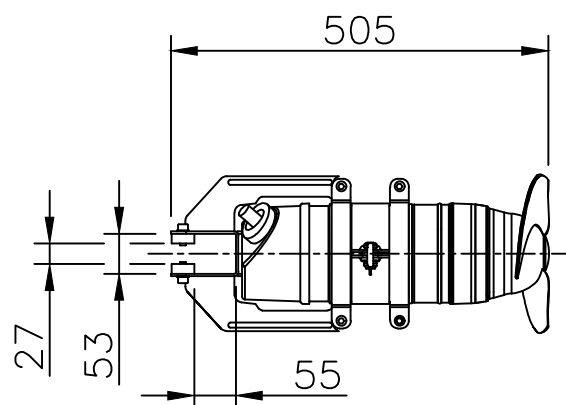
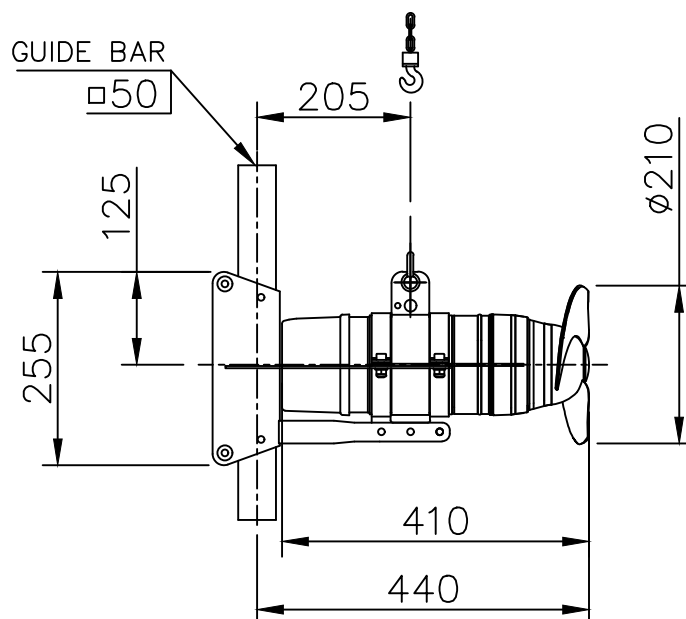
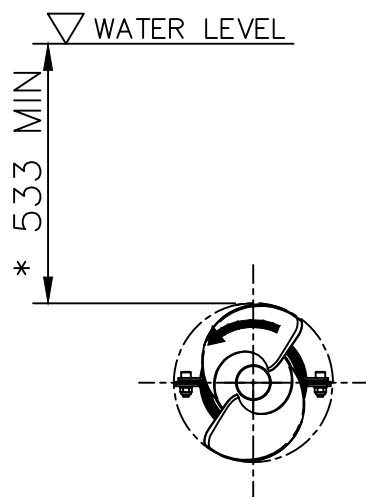
SHACKLE(S/S 316)

P/N 13-44 00 40

SUPPORT ARM

MODEL	PART NUMBER MATERIAL : S/S 316
4610	13-51 03 57
4620	13-51 03 57
4630	13-51 03 58
4640	13-51 03 59

SUPPORT ARM
SEE DOCUMENT
No. MI 8.5.1.1.1



* Guideline value, recommended minimum submergence can be lower. Contact Xylem Water Solutions for more information.

Dimensional chart

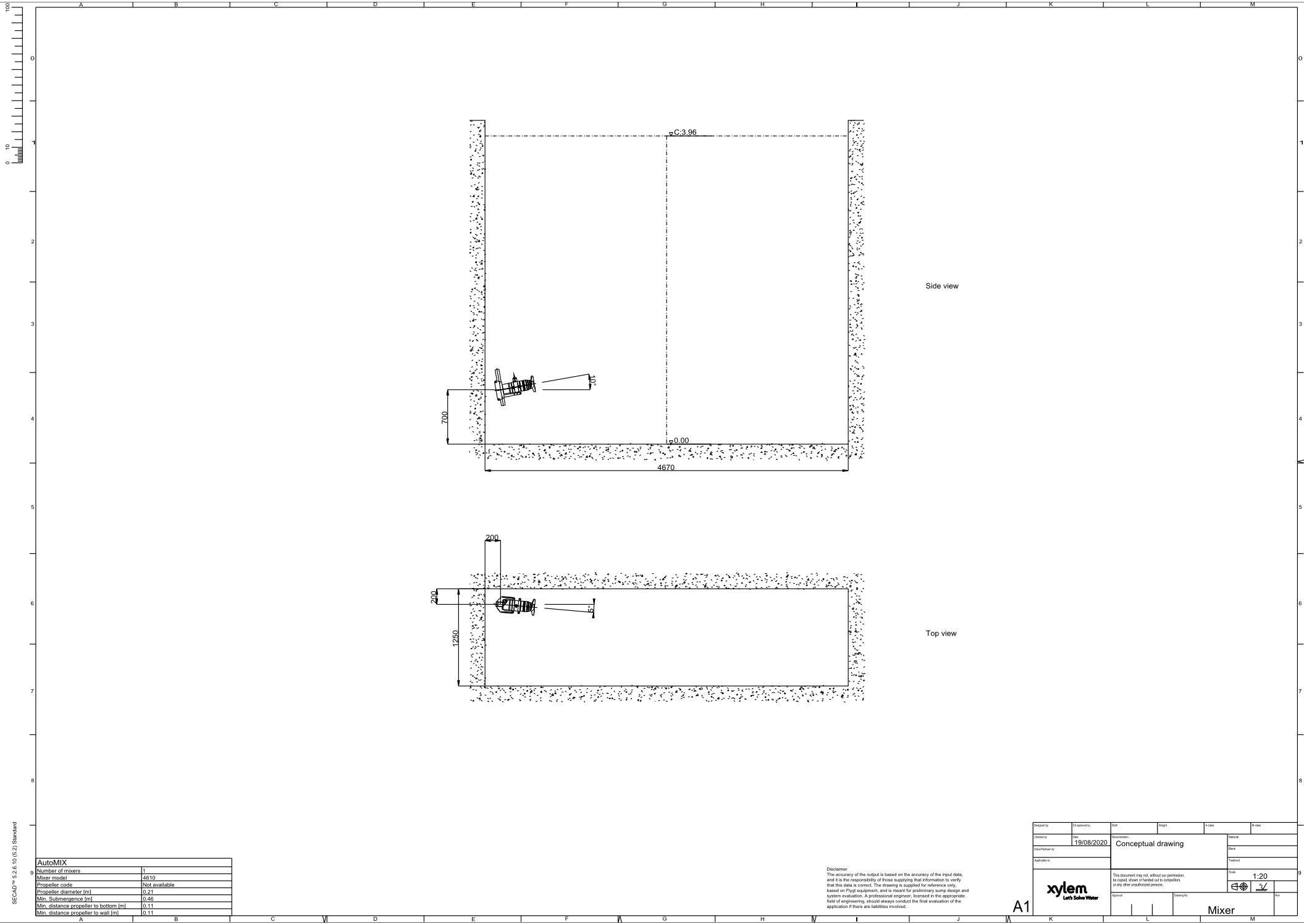
A°	-20	-10	0	10	20
H	405	340	295	340	405
L	550	530	505	530	550

Weight (kg)
Mixer
21

TOLERANCE: UNLESS OTHERWISE SPEC. ± 5



SR	4610	Scale	1:10	Date	190523
Single guide bar		Drawing number	7523700	Revision	4
Without Jetring					



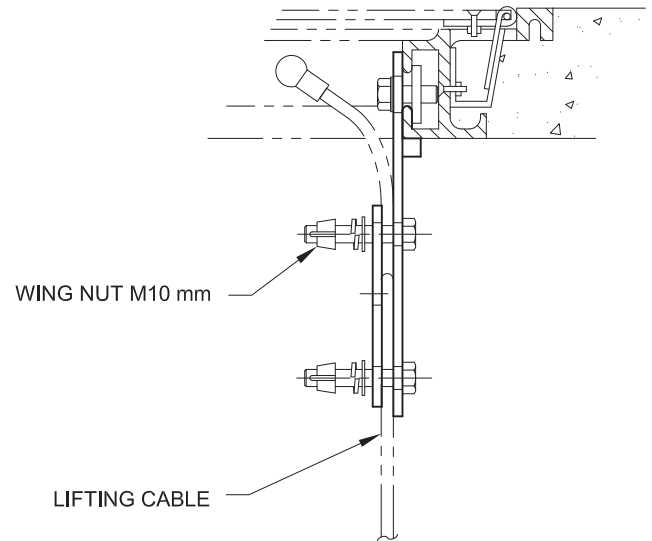
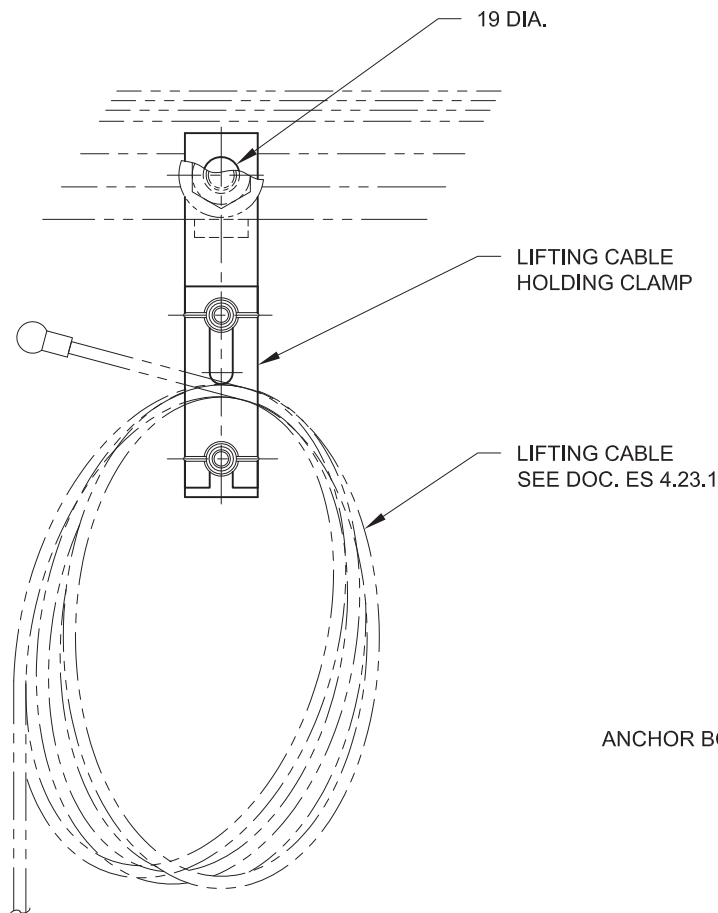
SECAD™ 5.2.6.10 (6.2) Standard

AutoMIX	
Number of mixers	1
Mixer model	4610
Propeller code	Not available
Propeller diameter [m]	0.21
Min. Submergence [m]	0.46
Min. distance propeller to bottom [m]	0.11
Min. distance propeller to wall [m]	0.11

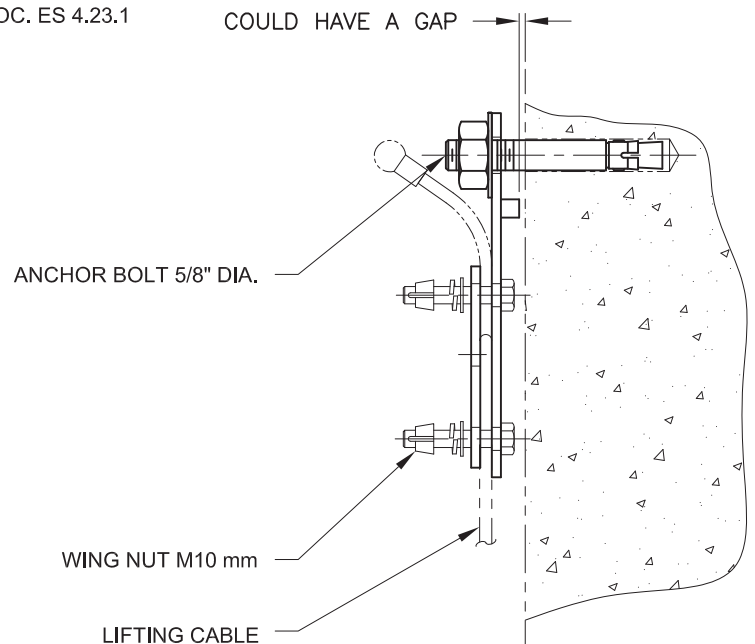
Disclaimer
The accuracy of the output is based on the accuracy of the input data, and it is the responsibility of those supplying that information to verify that this data is correct. The drawing is supplied for reference only, based on Fygi equipment, and is meant for preliminary using design and system evaluation. A professional engineer, licensed in the appropriate field of engineering, should always conduct the final evaluation of the application if there are liabilities involved.

Designed by	19/08/2020	Drawn	19/08/2020	Checked	19/08/2020
Check by	19/08/2020	Reviewed	19/08/2020	Material	19/08/2020
Quantity	1	Conceptual drawing	1	Drawn	19/08/2020
Applicable to				Approved	19/08/2020
This document may not, without our permission, be copied, altered or modified in any way without our written consent.				Scale	1:20
xylem Let's Solve Water				Rev	1
A1				Mixer	

**For information only,
not by SUEZ**



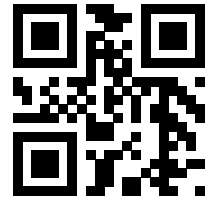
ACCESS FRAME
INSTALLATION



IN CONCRETE
WALL INSTALLATION

LIFTING CABLE HOLDING CLAMP

Material : Galvanized Steel : P/N 13-50 05 14
Stainless Steel 316: P/N 13-50 05 13



Flygt SR 4610/4620

Table of Contents

1 Introduction and Safety.....	3
1.1 Introduction.....	3
1.2 Safety terminology and symbols.....	3
1.3 User safety.....	4
1.4 Ex-approved products.....	4
1.5 Special hazards.....	5
1.5.1 Confined spaces.....	5
1.5.2 Drowning.....	6
1.5.3 Biological hazards.....	6
1.5.4 Wash the skin and eyes.....	6
1.6 Protecting the environment.....	6
1.7 End of life product disposal.....	6
1.8 Spare parts.....	7
1.9 Warranty.....	7
2 Transportation and Storage.....	8
2.1 Examine the delivery.....	8
2.1.1 Examine the package.....	8
2.1.2 Examine the unit.....	8
2.2 Transportation guidelines.....	8
2.2.1 Precautions.....	8
2.2.2 Lifting.....	8
2.3 Temperature ranges for transportation, handling and storage.....	9
2.4 Storage guidelines.....	10
3 Product Description.....	11
3.1 General description.....	11
3.2 The data plate.....	12
3.3 Approvals.....	13
3.4 Product denomination.....	14
4 Installation.....	16
4.1 Install the mixer.....	16
4.1.1 Install on a cantilever bar.....	16
4.1.2 Install on a single guide bar.....	22
4.1.3 Install on a bottom fixing plate.....	25
4.2 Position the mixer.....	25
4.2.1 Position parameters.....	25
4.2.2 Propeller clearance.....	27
4.2.3 Set the horizontal angle.....	27
4.2.4 Set the vertical angle.....	29
4.3 Electrical installation.....	30
4.3.1 Make the electrical connections.....	30
4.3.2 Power isolation.....	31
4.3.3 Grounding (earthing)	32
4.3.4 Threaded cable entry option.....	32
4.3.5 Prepare the SUBCAB™ cables.....	32
4.3.6 Connect the motor cable to the mixer.....	33
4.3.7 Connect the motor cable to the starter and monitoring equipment.....	34
4.4 Cable charts.....	35
4.4.1 Cable connections.....	37

5 Operation.....	39
5.1 Power isolation.....	39
5.2 Start the mixer.....	39
 6 Maintenance.....	 41
6.1 Precautions.....	41
6.1.1 Ventilate the work area.....	42
6.1.2 Inspect the work area before permit-required hot work.....	42
6.1.3 Rotating propeller.....	42
6.2 Requirements for maintenance.....	42
6.3 Torque values.....	42
6.4 Maintenance intervals.....	43
6.4.1 Categorization of operating conditions.....	43
6.4.2 Maintenance schedule.....	44
6.5 Service actions.....	44
6.5.1 Inspections.....	44
6.5.2 Overhaul.....	45
6.5.3 Service in case of alarm.....	45
6.6 Inspect the stator housing.....	45
6.7 Change the oil.....	46
6.7.1 Drain the oil.....	46
6.7.2 Fill the oil.....	47
6.8 Change the propeller.....	48
6.8.1 Remove the jet ring, guiding claw, and propeller.....	48
6.8.2 Assemble the propeller, jet ring, and guiding claw.....	49
 7 Troubleshooting.....	 52
7.1 Electrical troubleshooting.....	52
7.2 The mixer does not start.....	52
7.3 The mixer starts-stops-starts in rapid sequence.....	53
7.4 The mixer runs but the motor protection trips.....	53
 8 Technical Reference.....	 55
8.1 Motor data.....	55
8.2 Application limits.....	55

1 Introduction and Safety

1.1 Introduction

Purpose of the manual

The purpose of this manual is to provide the necessary information for working with the unit. Read this manual carefully before starting work.

Read and keep the manual

Save this manual for future reference, and keep it readily available at the location of the unit.

Intended use



WARNING:

Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment and the surroundings. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

Other manuals

See also the safety requirements and information in the original manufacturer's manuals for any other equipment furnished separately for use in this system.




1.2 Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:



- Personal accidents and health problems
- Damage to the product and its surroundings
- Product malfunction

Hazard levels

Hazard level	Indication
 DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
 WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
 CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
NOTICE:	Notices are used when there is a risk of equipment damage or decreased performance, but not personal injury.

Special symbols

Some hazard categories have specific symbols, as shown in the following table.

Electrical hazard	Magnetic fields hazard
 Electrical Hazard:	 CAUTION:

1.3 User safety

All regulations, codes, and health and safety directives must be observed.

The site

- Observe lockout/tagout procedures before starting work on the product, such as transportation, installation, maintenance, or service.
- Pay attention to the risks presented by gas and vapors in the work area.
- Always be aware of the area surrounding the equipment, and any hazards posed by the site or nearby equipment.

Qualified personnel

This product must be installed, operated, and maintained by qualified personnel only.

Protective equipment and safety devices

- Use personal protective equipment as needed. Examples of personal protective equipment include, but are not limited to, hard hats, safety goggles, protective gloves and shoes, and breathing equipment.
- Make sure that all safety features on the product are functioning and in use at all times when the unit is being operated.

1.4 Ex-approved products

Follow these special handling instructions if you have an Ex-approved unit.

Personnel requirements

These are the personnel requirements for Ex-approved products in potentially explosive atmospheres:

- All work on the product must be carried out by certified electricians and Xylem authorized mechanics. Special rules apply to installations in explosive atmospheres.
- All users must know about the risks of electric current and the chemical and physical characteristics of the gas, the vapor, or both present in hazardous areas.
- Any maintenance for Ex-approved products must conform to international and national standards (for example, IEC/EN 60079-17).

Xylem disclaims all responsibility for work done by untrained and unauthorized personnel.

Product and product handling requirements

These are the product and product handling requirements for Ex-approved products in potentially explosive atmospheres:

- Only use the product in accordance with the approved motor data.
- You must fully submerge the Ex-approved product during normal operation. Dry running during service and inspection is only permitted outside the classified area.
- Before you start work on the product, make sure that the product and the control panel are isolated from the power supply and the control circuit, so they cannot be energized.
- Do not open the product while it is energized or in an explosive gas atmosphere.
- Intrinsically safe circuits are normally required for the automatic level-control system by the level regulator if mounted in zone 0.

- The yield stress of fasteners must be in accordance with the approval drawing and the product specification.
- Do not modify the equipment without approval from an Ex-approved Xylem representative.
- Only use original Xylem spare parts that are provided by an Ex-approved Xylem representative.
- The thermal contacts that are fitted to the stator windings must be connected correctly to a separate motor control circuit and in use. The thermal contacts shall be connected to a monitoring device, which disconnects the power supply immediately upon activation. This action prevents the rise of temperatures above the temperature value for the approval classification.
- The width of flameproof joints is more than the values specified in the tables of the EN/IEC 60079-1 standard. For information contact the manufacturer.
- The gap of flameproof joints is less than the values specified in Table 2 of the EN/IEC 60079-1 standard. For information contact the manufacturer.
- It is NOT allowed to repair the flameproof joints.
- Ambient temperature: -20°C to 60°C

Guidelines for compliance

Compliance is fulfilled only when you operate the unit within its intended use. Do not change the conditions of the service without the approval of an Ex-approved Xylem representative. When you install or maintain explosion proof products, always comply with the directive and applicable standards (for example, IEC/EN 60079-14).

Minimum permitted liquid level

See the dimensional drawings of the product for the minimum permitted liquid level according to the approval for explosion proof products. If the information is missing on the dimensional drawing, the product must be fully submerged. Level-sensing equipment must be installed if the product can be operated at less than the minimum submersion depth.

Monitoring equipment

For additional safety, use condition-monitoring devices. Examples of condition-monitoring devices include, but are not limited to, the following:

- Level indicators
- Temperature detectors in addition to the stator thermal detectors

Any thermal detectors or thermal protection devices delivered with the pump must be installed and in use at all times.

The site owner is responsible for selection, installation, and proper maintenance of functional monitoring equipment for motor protection.

1.5 Special hazards

1.5.1 Confined spaces



DANGER: Inhalation Hazard

The chamber or tank where the equipment is installed should be treated as a confined space. Always follow the applicable safety laws, regulations and guidelines for confined spaces.

Never work alone in a confined space. Before entering the space, check that the following requirements are complied with:

- The atmosphere contains sufficient oxygen
- The atmosphere contains no explosive or toxic gases
- If there is a risk of insufficient oxygen or toxic or hazardous gases, then use an airline respirator or self-contained breathing apparatus.

- All energy sources are locked out and tagged out
- Adequate ventilation is in place
- There is a clear path of retreat
- Monitoring is in place for hazards which can develop after entering the confined space
- The applicable safety laws, regulations, and guidelines for confined spaces are understood and followed.

1.5.2 Drowning

Spaces that are not fully drained or dry can pose a risk of drowning. It takes relatively little standing water or other liquid to create a drowning hazard. For example, insufficient oxygen or the presence of a toxic material can make a worker unconscious, which makes them vulnerable to drowning if they fall face down into a small pool of water. Never work alone where there is a risk of drowning.

1.5.3 Biological hazards

The product is designed for use in liquids that can be hazardous to your health. Observe these rules when you work with the product:

- Make sure that all personnel who may come into contact with biological hazards are vaccinated against diseases to which they may be exposed.
- Observe strict personal cleanliness.



WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.

1.5.4 Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	<ol style="list-style-type: none">1. Hold your eyelids apart forcibly with your fingers.2. Rinse the eyes with eyewash or running water for at least 15 minutes.3. Seek medical attention.
Chemicals or hazardous fluids on skin	<ol style="list-style-type: none">1. Remove contaminated clothing.2. Wash the skin with soap and water for at least 1 minute.3. Seek medical attention, if necessary.

1.6 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites

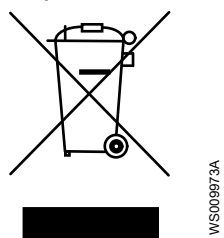


CAUTION: Radiation Hazard

Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

1.7 End of life product disposal

Handle and dispose of all waste in compliance with local laws and regulations.

Correct disposal of this product – WEEE Directive on waste electrical and electronic equipment

This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

1.8 Spare parts



CAUTION:

Only use the manufacturer's original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the warranty.

1.9 Warranty

For information about warranty, see the sales contract.

2 Transportation and Storage

2.1 Examine the delivery

2.1.1 Examine the package

1. Examine the package for damaged or missing items upon delivery.
2. Record any damaged or missing items on the receipt and freight bill.
3. If anything is out of order, then file a claim with the shipping company.
If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.2 Examine the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. To determine whether any parts have been damaged or are missing, examine the product.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
Use care around nails and straps.
4. If there is any issue, then contact a sales representative.

2.2 Transportation guidelines

2.2.1 Precautions



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



Position and fastening

The unit can be transported either horizontally or vertically. Make sure that the unit is correctly fastened during transportation, and cannot roll or fall over.

2.2.2 Lifting

Always inspect the lifting equipment and tackle before starting any work.



WARNING: Crush Hazard

Always lift the unit by its designated lifting points.
Use suitable lifting equipment and ensure that the product is properly harnessed.
Wear personal protective equipment.
Stay clear of cables and suspended loads.

NOTICE:

Never lift the unit by its cables or hose.

Lifting equipment

Lifting equipment is always required to handle the unit. The lifting equipment must fulfill the following requirements:

- The minimum height between the lifting hook and the floor must be sufficient to lift the unit. Contact a Xylem representative for more information.
- The lifting equipment must be able to hoist the unit straight up and down, preferably without the need for resetting the lifting hook.
- The lifting equipment must be correctly anchored and in good condition.
- The lifting equipment must support the weight of the entire assembly. Only authorized personnel may use the lifting equipment.
- Two sets of lifting equipment must be used to lift the unit for repair work.
- The lifting equipment must be dimensioned to lift the unit with any remaining pumped media in it.
- The lifting equipment must not be oversized.



CAUTION: Crush Hazard

Over-dimensioned lifting equipment can lead to injury. A site-specific risk analysis must be done.

2.3 Temperature ranges for transportation, handling and storage

Handling at freezing temperature

At temperatures below freezing, the product and all installation equipment, including the lifting gear, must be handled with extreme care.

Make sure that the product is warmed up to a temperature above the freezing point before starting up. Avoid rotating the impeller/propeller by hand at temperatures below the freezing point. The recommended method to warm the unit up is to submerge it in the liquid which will be pumped or mixed.

NOTICE:

Never use a naked flame to thaw the unit.

Unit in as-delivered condition

If the unit is still in the condition in which it left the factory - all packing materials are undisturbed - then the acceptable temperature range during transportation, handling and storage is: -50°C (-58°F) to +60°C (+140°F).

If the unit has been exposed to freezing temperatures, then allow it to reach the ambient temperature of the sump before operating.

Lifting the unit out of liquid

The unit is normally protected from freezing while operating or immersed in liquid, but the impeller/propeller and the shaft seal may freeze if the unit is lifted out of the liquid into a surrounding temperature below freezing.

Follow these guidelines to avoid freezing damage:

1. Empty all pumped liquid, if applicable.
2. Check all liquids used for lubrication or cooling, both oil and water-glycol mixtures, for the presence of unacceptable amounts of water. Change if needed.

Water-glycol mixtures: Units equipped with an internal closed-loop cooling system are filled with a mixture of water and 30% glycol. This mixture remains a flowing liquid at temperatures down to -13°C (9°F). Below -13°C (9°F), the viscosity increases such that the glycol mixture will lose its flow properties. However, the glycol-water mixture will not solidify completely and thus cannot harm the product.

2.4 Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

Protect the product against humidity, heat sources, and mechanical damage.

NOTICE:

Do not place heavy weights on the packed product.

Long-term storage

If the unit is stored more than six months, then the following apply:

- Before operating the unit after storage, it must be inspected with special attention to the seals and the cable entry.
- The impeller/propeller must be rotated every other month to prevent the seals from sticking together.

3 Product Description

3.1 General description

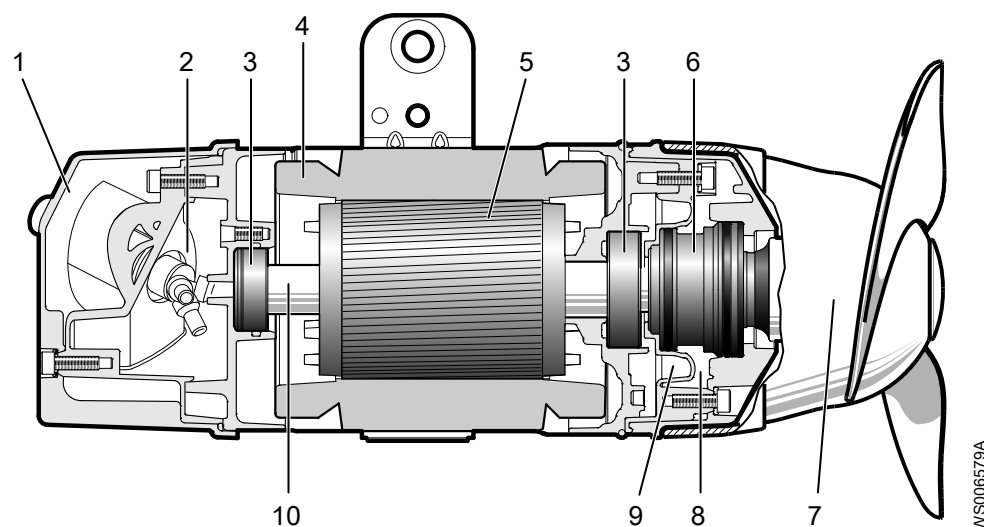
Mixer design

The mixer is submersible and driven by an electric motor.

Intended use

The product is intended for moving waste water, sludge, raw and clean water. Always follow the limits given in [Application limits](#) on page 55. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

Illustration



Parts

Position	Part	Description
1	Cable entry	Spacer sleeve, compressible rubber bushings, and washers to relieve the cable
2	Junction box	Completely sealed off from the surrounding liquid
3	Bearings	Deep-groove ball bearing
4	Thermal contacts	For more information, see Monitoring equipment.
5	Electric motor	For information about the motor, see Motor data on page 55
6	Mechanical face seal	One stationary and one rotating seal ring
7	Propeller	Double-bladed propeller available in different angles
8	Oil housing	A housing with oil that lubricates and cools the seals, and acts as a buffer against penetrating liquid
9	Inspection chamber	Any leakage through the inner seal will be directed to the inspection chamber

Position	Part	Description
10	Shaft	Integrated rotor, completely sealed off from the surrounding liquid

Monitoring equipment

The following applies to the monitoring equipment of the mixer:

- The stator incorporates thermal contacts connected in series that activates the alarm at overtemperature.
- The thermal contacts open at 140°C (285°F).
- The sensors must be connected to either the MiniCAS II monitoring unit or an equivalent unit.
- The monitoring equipment must be of a design that makes automatic restart impossible.
- The mixer can be equipped with an inspection sensor FLS for sensing the presence of any liquid in the connection chamber.
- The mixer can be equipped with a Variable Frequency Drive (VFD).

Spare parts

Modifications to the unit/installation should only be carried out after consulting with the local sales and service representative. Original spare parts and accessories authorized by the manufacturer are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation. For more information contact your local sales and service representative.

Mixer versions

Standard versions:

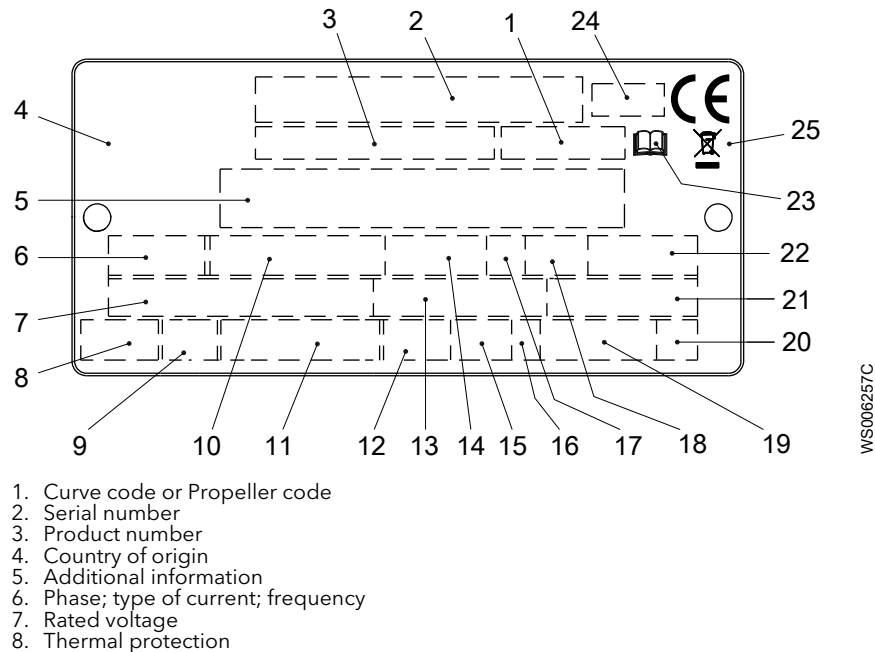
- High-grade steel (ASTM 316L)
- Warm-liquid version

Ex-approved versions:

- High-grade steel (ASTM 316L)

3.2 The data plate

The data plate is a metal label that is located on the main body of the products. The data plate lists key product specifications. Specially approved products also have an approval plate.




9. Thermal class
10. Rated shaft power
11. International standard
12. Degree of protection
13. Rated current
14. Rated speed
15. Maximum submergence
16. Direction of rotation: L=left, R=right
17. Duty class
18. Duty factor
19. Product weight
20. Locked rotor code letter
21. Power factor
22. Maximum ambient temperature
23. Read installation manual
24. Notified body, only for EN-approved Ex products
25. WEEE-Directive symbol

Figure 1: The data plate

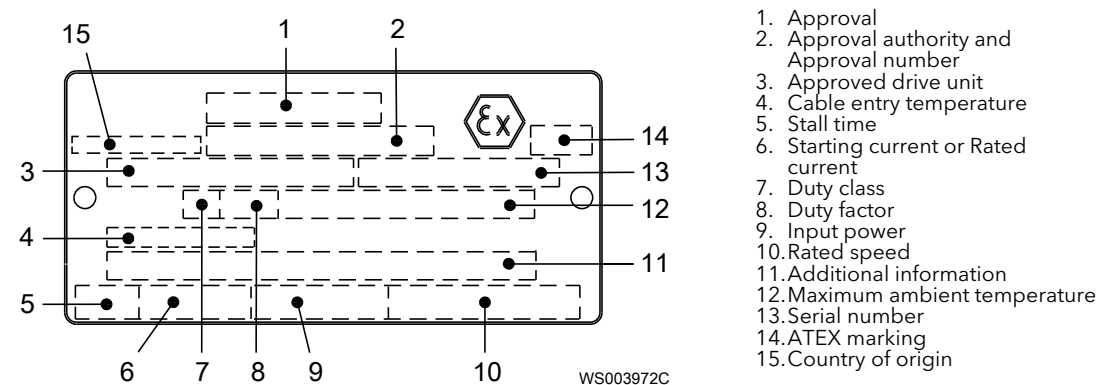
3.3 Approvals

Product approvals for hazardous locations

Product	Approval
4610.490	European Norm (EN)
4620.490	<ul style="list-style-type: none"> • ATEX Directive • EN 60079-0:2012/A11:2013, EN 60079-1:2014, EN ISO 80079-36:2016, EN ISO 80079-37:2016 •  II 2 G Ex db h IIB T3 Gb
	IEC <ul style="list-style-type: none"> • IECEx scheme • IEC 60079-0:2011, IEC 60079-1:2014; IEC 80079-36:2016; IEC 80079-37:2016 • Ex db h IIB T3 Gb
	FM (FM Approvals) <ul style="list-style-type: none"> • Explosion proof for use in Class I, Div. 1, Group C and D • Dust ignition proof for use in Class II, Div. 1, Group E, F and G • Suitable for use in Class III, Div. 1, Hazardous Locations
	CSA Ex <ul style="list-style-type: none"> • Explosion proof for use in Class I, Div. 1, Group C and D

EN approval plate

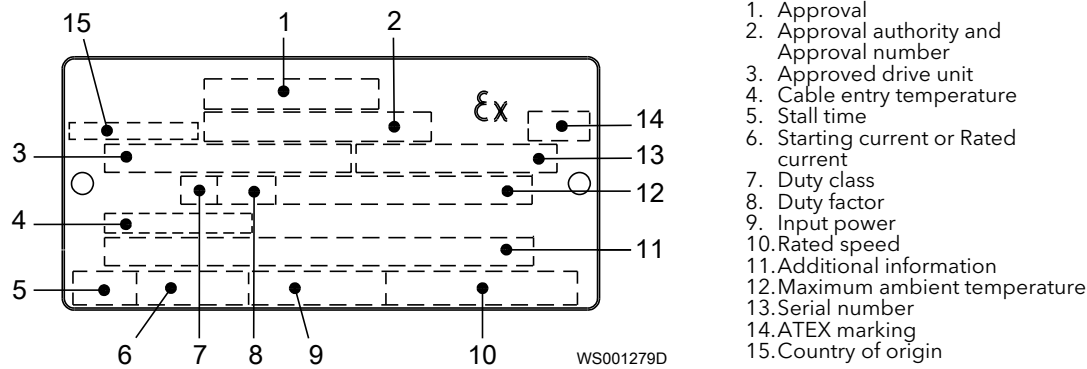
This illustration describes the EN approval plate and the information that is contained in its fields.



IEC approval plate

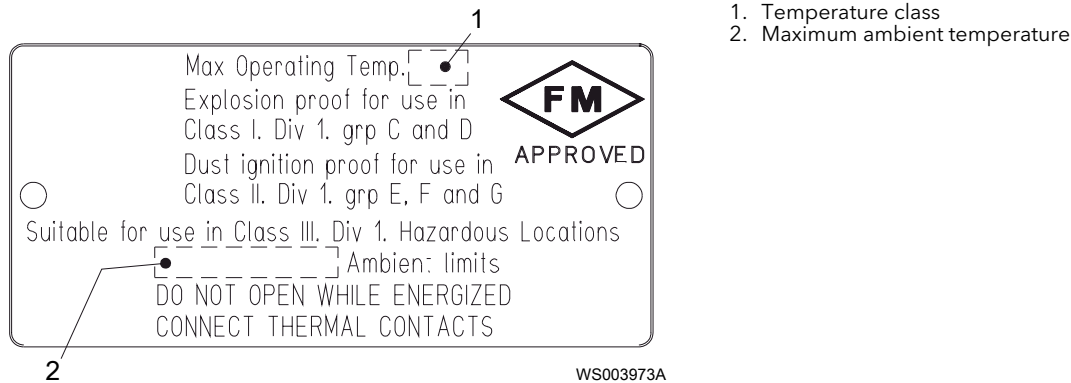
This illustration describes the IEC approval plate and the information that is contained in its fields.

International Norm; not for EU member countries.



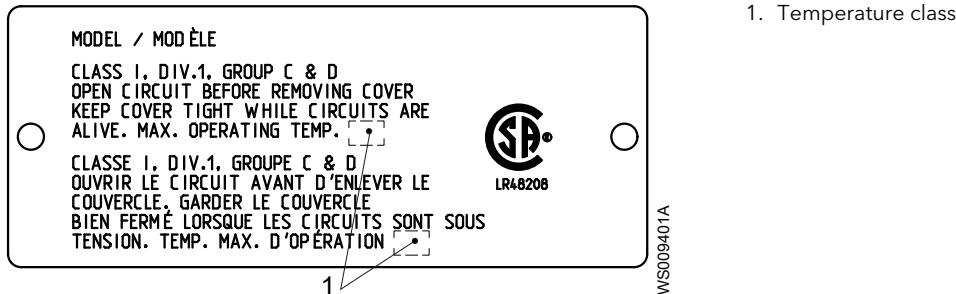
FM approval plate

This illustration describes the FM approval plate and the information that is contained in its fields.



CSA approval plate

This illustration describes the CSA approval plate and the information that is contained in its fields.



3.4 Product denomination

Reading instruction

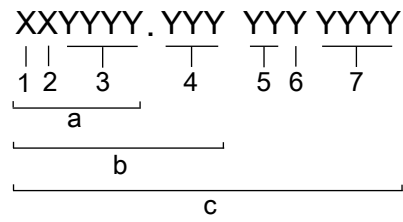
In this section, code characters are illustrated accordingly:

X = letter

Y = digit

The different types of codes are marked up with a, b and c. Code parameters are marked up with numbers.

Codes and parameters



WS006265B

Type of Callout	Number	Indication
Type of code	a	Sales denomination
	b	Product code
	c	Serial number
Parameter	1	Hydraulic end
	2	Type of installation
	3	Sales code
	4	Version
	5	Production year
	6	Production cycle
	7	Running number

4 Installation

4.1 Install the mixer

Before starting work, make sure that the safety instructions have been read and understood.



DANGER: Inhalation Hazard

The chamber or tank where the equipment is installed should be treated as a confined space. Always follow the applicable safety laws, regulations and guidelines for confined spaces.



WARNING: Crush Hazard

Always lift the unit by its designated lifting points.
Use suitable lifting equipment and ensure that the product is properly harnessed.
Wear personal protective equipment.
Stay clear of cables and suspended loads.

NOTICE:

All mounting to the floor should be made with chemical anchor bolts. The chemical anchor bolts must be dimensioned for the maximum service load, and if applicable, seismic load. The anchor bolts must meet local regulations and codes.

Provide a suitable barrier around the work area, for example, a guard rail.

For information about measurements, see the dimensional drawings of the product.

Vent the tank of a sewage station in accordance with local plumbing codes.

Permanent support of the mixer

Chains may be used for raising and lowering the mixer, but are not recommended for permanent support of the mixer weight. All chains and their welds are vulnerable to sustained dynamic load.

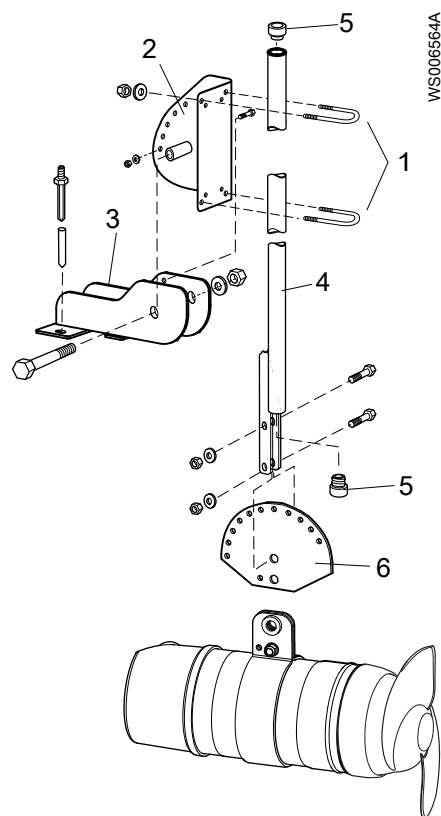
If a chain is used as a permanent support of the mixer, then frequent inspections of the chain are required.

4.1.1 Install on a cantilever bar

You install the mixer on the cantilever bar with one of the following brackets:

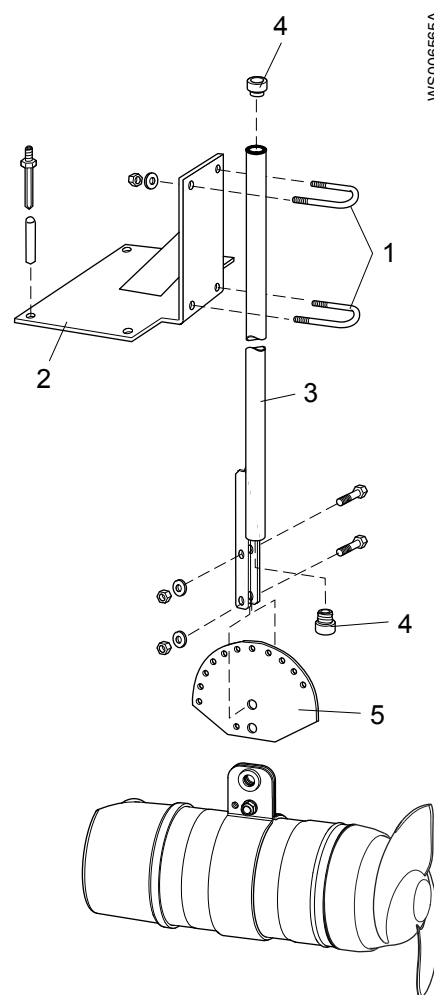
- Adjustable bracket
- Floor-mounted bracket
- Wall-mounted bracket

4.1.1.1 Types of brackets



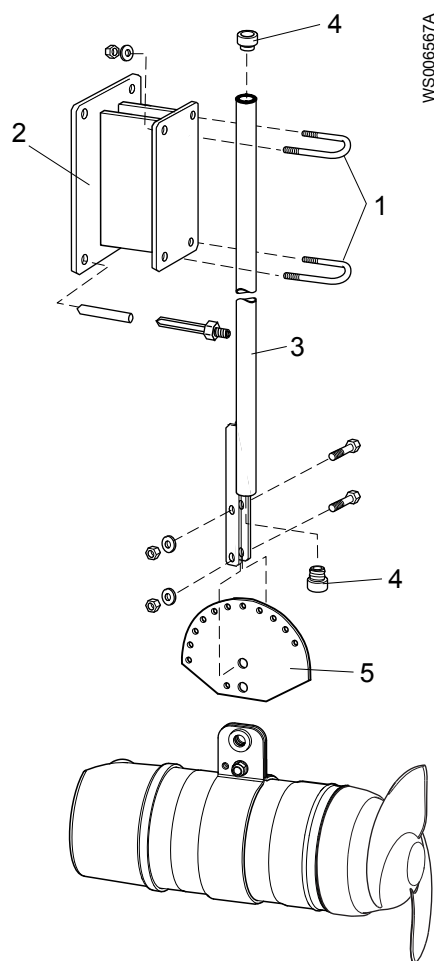
- 1. Clamp
- 2. Lock plate
- 3. Bracket
- 4. Guide bar
- 5. Bar plug
- 6. Lock plate

Figure 2: Adjustable bracket



- 1. Clamp
- 2. Bracket
- 3. Guide bar
- 4. Bar plug
- 5. Lock plate

Figure 3: Floor-mounted bracket



1. Clamp
2. Bracket
3. Guide bar
4. Bar plug
5. Lock plate

Figure 4: Wall-mounted bracket

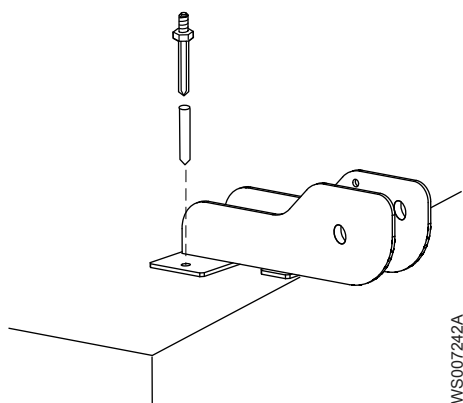
4.1.1.2 Install with a bracket

1. Position and mount the bracket.

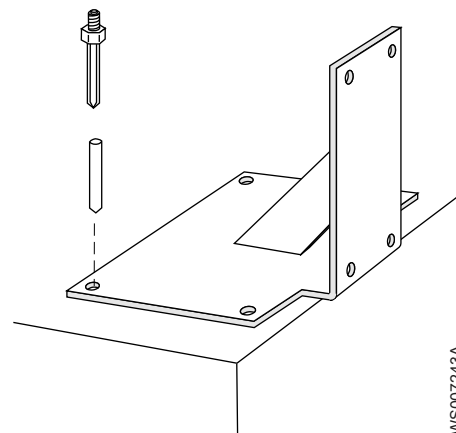
If you use an adjustable, floor-mounted, or wall-mounted bracket:

If the material is...	Then anchor with...
concrete	chemical anchors
steel	fixing bolts

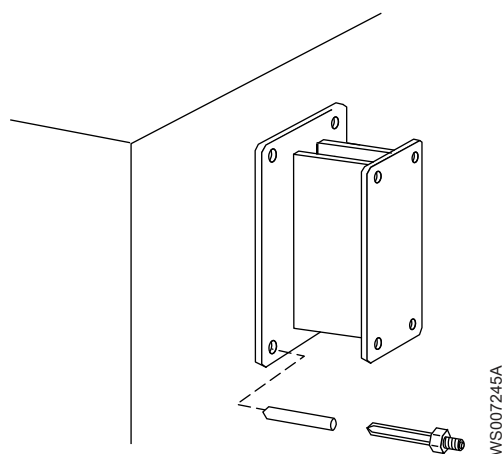
Adjustable bracket



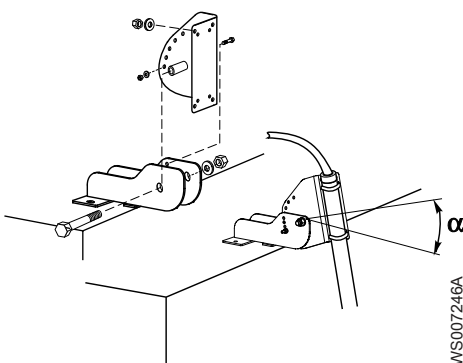
Floor-mounted bracket



Wall-mounted bracket

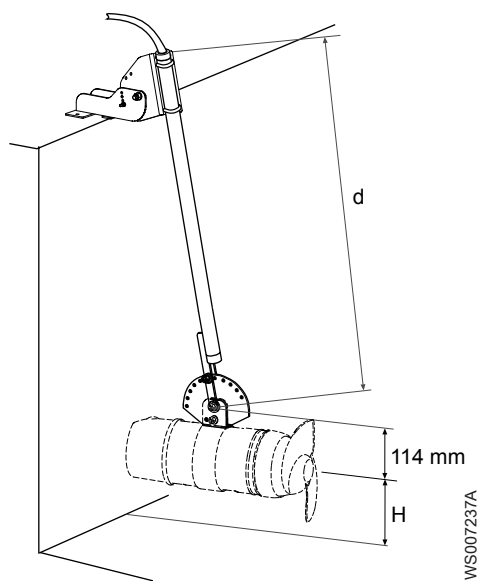


2. If you use an adjustable bracket, place the lock plate in position on the bracket, and tighten the indexing screw.

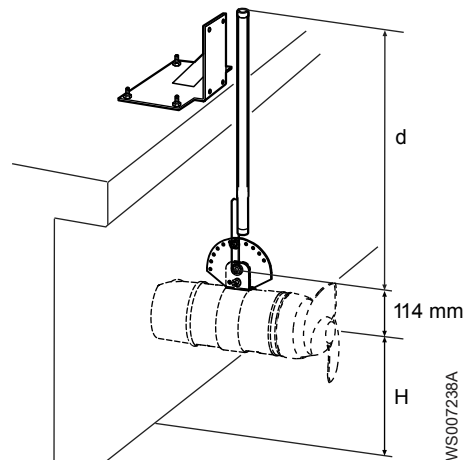


3. Measure the distance (d), and if necessary, cut the bar.
 "d" represents the distance to the position of the mixer, and "H" represents the position of the mixer relative to the floor.

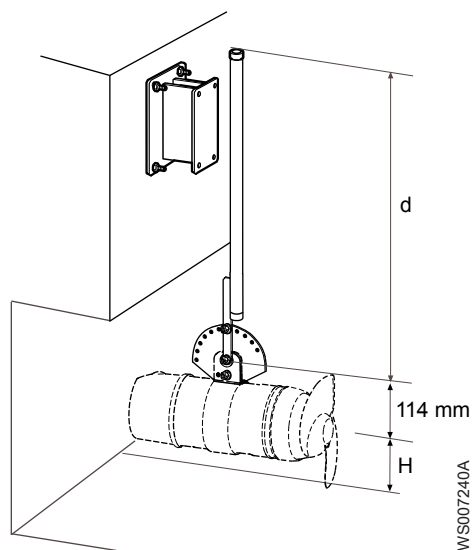
Adjustable bracket



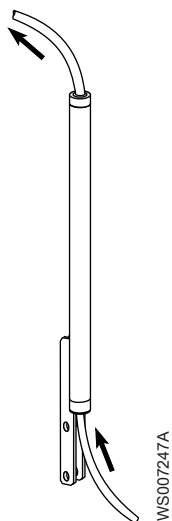
Floor-mounted bracket



Wall-mounted bracket



4. Run the power cable:
 - a) Insert the lower bar plug.
 - b) Run the mixer power cable through the bar.
 - c) Insert the upper bar plug.

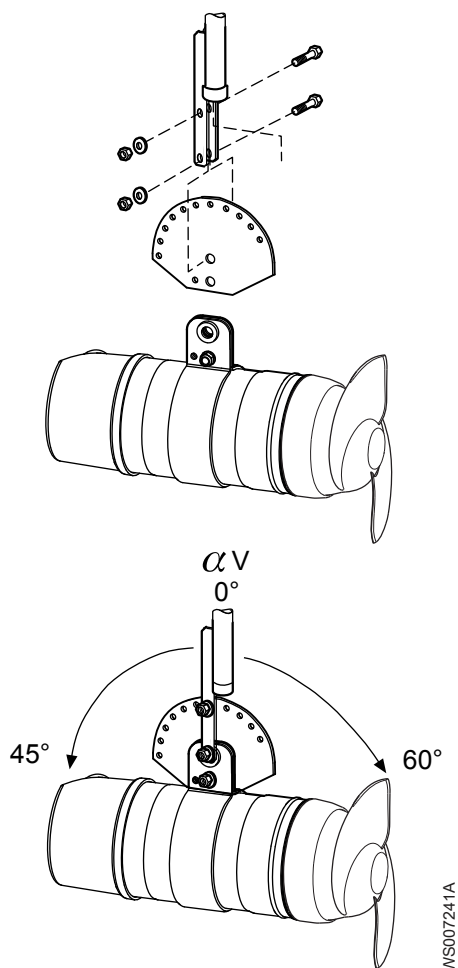


5. Mount the mixer:

- Fit the lock plate and the mixer to the end of the bar.
- Adjust the vertical angle.

For information about the correct angle setting, see [Position the mixer](#) on page 25.

- Insert the indexing screw to prevent the lock plate from rotating.



6. If you use...	Then...
an adjustable bracket	place the bar on the inclinable guide.

If you use...	Then...
a floor-mounted bracket	place the bar on the bracket.
a wall-mounted bracket	place the bar on the bracket.

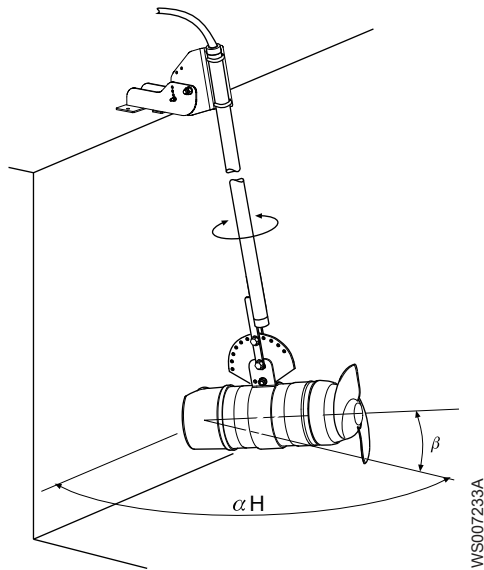
7. Position the mixer:

a) Adjust the horizontal angle.

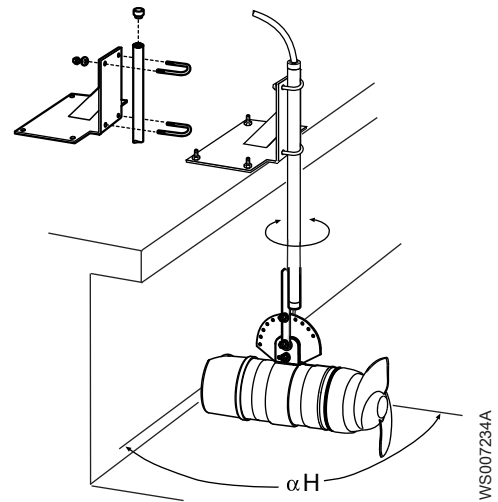
For information about the correct angle setting, see [Position the mixer](#) on page 25.

b) Lock the unit in position with the clamps.

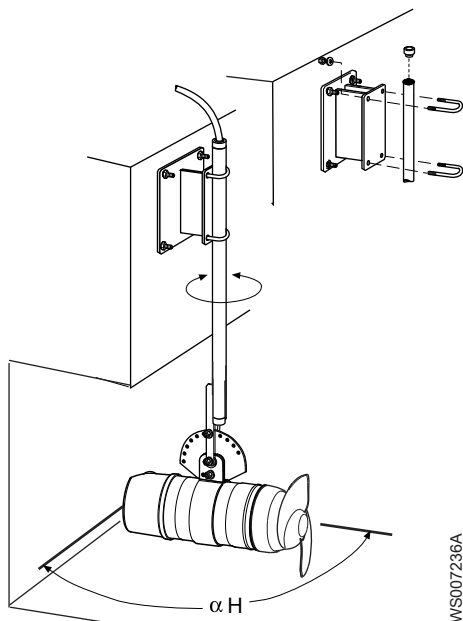
Adjustable bracket



Floor-mounted bracket



Wall-mounted bracket

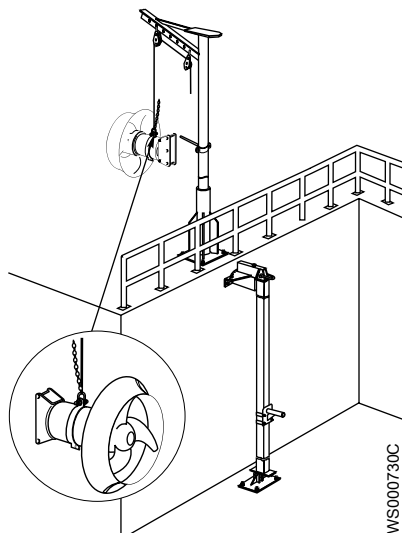


4.1.2 Install on a single guide bar

The mixer and some of the installation material shown in these figures may not correspond to your equipment.

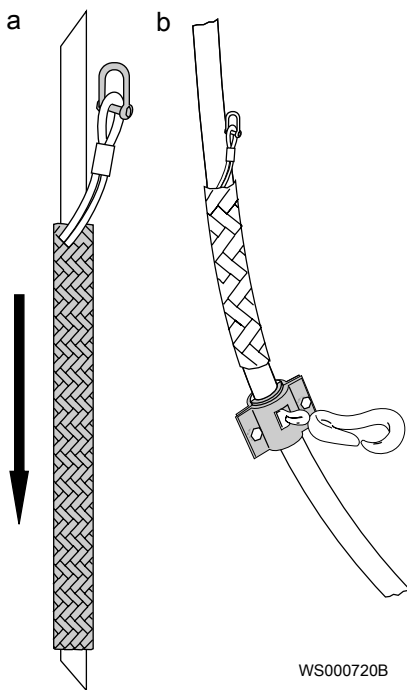
1. Attach the chains or wires:

- a) Attach the lifting chain or wire to the mixer with a shackle.
- b) Attach the support chain or wire for the power cable to the mixer.



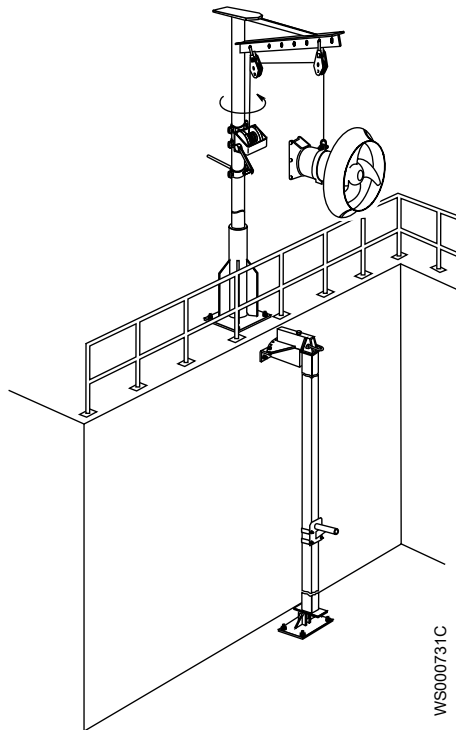
2. Prepare the power cable:

- a) Place the support grip in position on the power cable.
- b) Place cable holders on the power cables every 1.5 m (4.9 ft).
- c) Attach the cable holders to the support chain or wire.

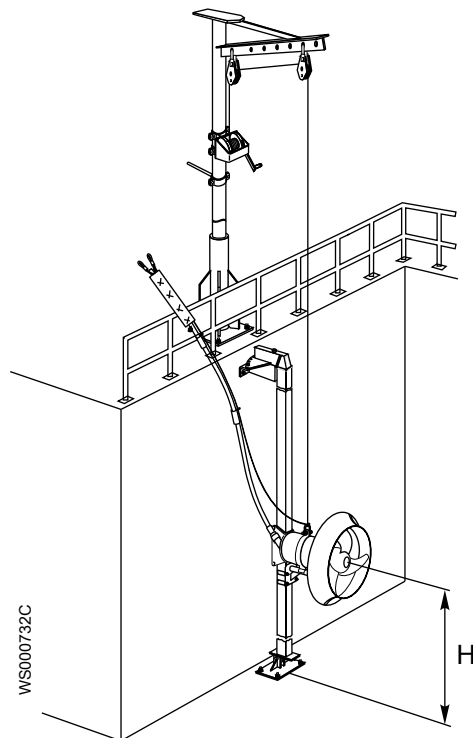


3. Mount the mixer:

- a) Set the vertical angle.
For more information, see [Set the vertical angle](#) on page 29.
- b) Raise the mixer.
- c) Pivot the mixer with the operating bar on the davit.
- d) Lower the mixer onto the guide bar.



4. Position the mixer on the support at the given height "H".
For more information, see [Position parameters](#) on page 25.



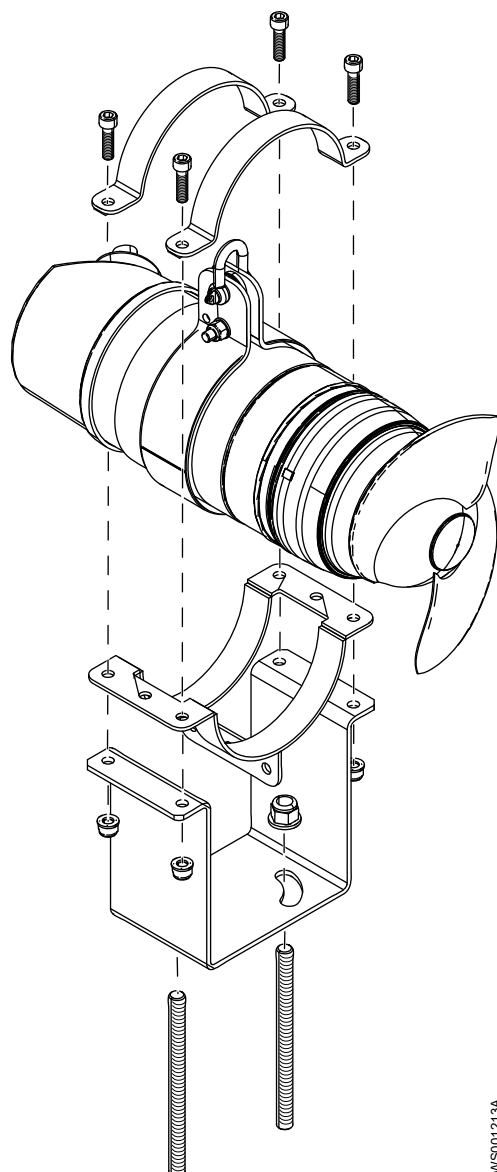
5. Secure the chains or wires, and tighten the power cable.

NOTICE:

The power cable must not carry the weight of the mixer.

4.1.3 Install on a bottom fixing plate

This figure shows how the mixer is installed on the bottom fixing plate.



1. Position and mount the fixing plate:

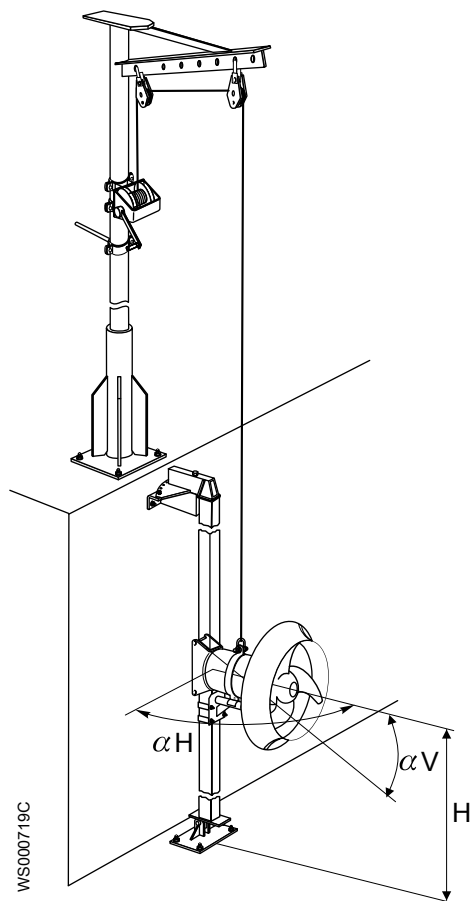
Material	Fastening method
Concrete	Chemical anchors
Steel	Fixing bolts or welded

2. Mount the mixer between the brackets onto the fixing plate.

4.2 Position the mixer

Unsymmetrical and swirling inflow to the mixer leads to undesirable mechanical loads that stress both the propeller and the installation equipment. Mixers with two blades are especially sensitive to this type of inflow due to a typical dynamic response to these variations. For more information, please contact your local sales and service representative.

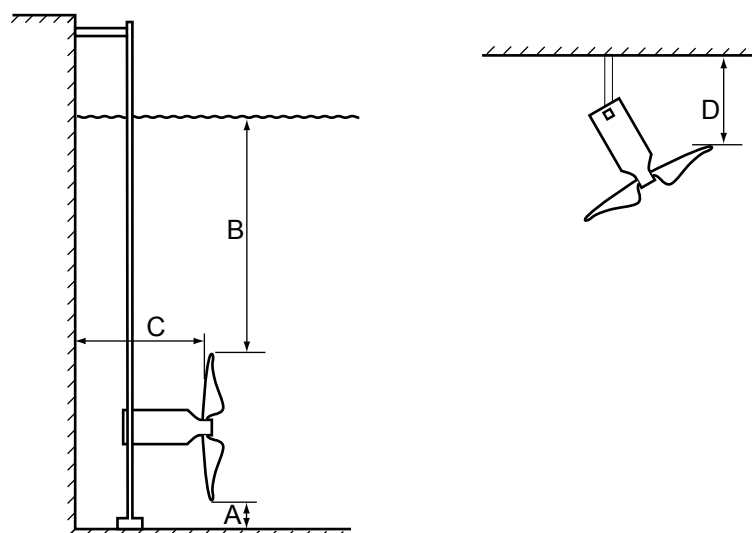
4.2.1 Position parameters



Parameter	Description
H	This parameter represents the height from the tank bottom and is set when the mixer is installed on the guide bar.
αH	This parameter represents the horizontal angle and is set when the mixer is installed on the guide bar.
αV	This parameter represents the vertical angle.

4.2.2 Propeller clearance

This figure shows the propeller clearance. It is the minimum distance between the propeller blade and the surrounding environment.



WS004434A

Minimum propeller clearance

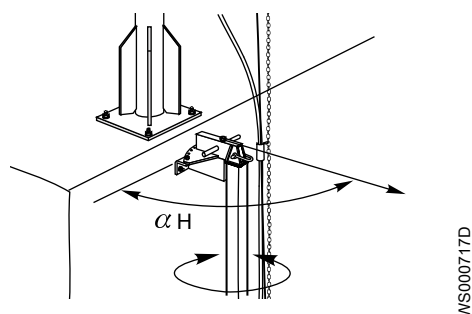
Clearance	Description	Value
A	Peak position of the propeller blade to the bottom of the tank	Propeller diameter
B	Peak position of the propeller blade to the liquid level	See the dimensional drawing
C	Propeller blade to the back wall	1.5 times the propeller diameter
D	Peak position of the propeller blade to the side wall	0.5 times the propeller diameter

Obstacles and walls downstream of the mixer

The clear distance downstream of the mixer must be at least ten times the propeller diameter.

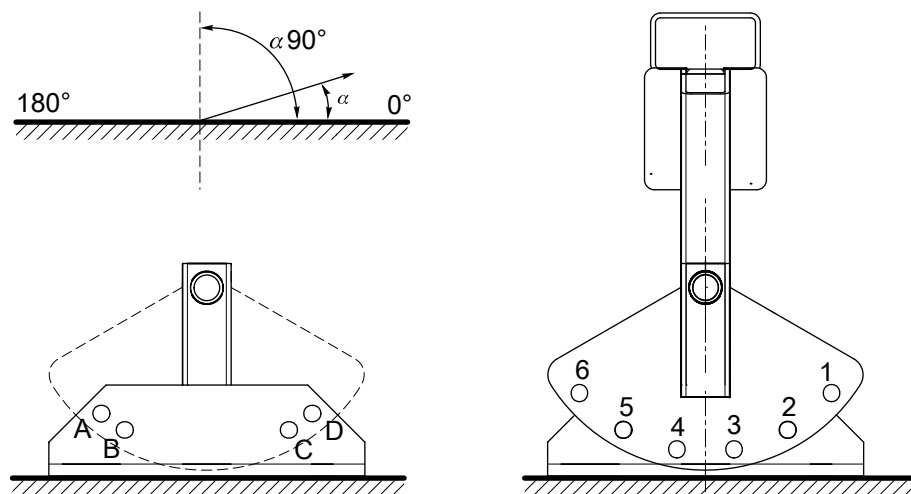
4.2.3 Set the horizontal angle

1. Rotate the guide bar to set the horizontal angle.



WS000717D

2. Place the indexing screw in the corresponding hole to fasten the angle.
Make sure to maintain the propeller clearance, see [Propeller clearance](#) on page 27.



WS004109A

Table 1: Identification of the horizontal angle for 0-90 degrees

α H	Letter	Numeral	Other possible combinations	
			Letter	Numeral
0	A	1	-	-
10	B	1	-	-
20	A	2	-	-
30	B	2	-	-
40	A	3	-	-
50	B	3	-	-
60	A	4	-	-
70	B	4	C	1
80	A	5	D	1
90	B	5	C	2

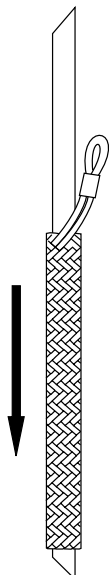
Table 2: Identification of the horizontal angle for 100-180 degrees

α H	Letter	Numeral	Other possible combinations	
			Letter	Numeral
100	A	6	D	2
110	B	6	C	3
120	D	3	-	-
130	C	4	-	-
140	D	4	-	-
150	C	5	-	-
160	D	5	-	-
170	C	6	-	-
180	D	6	-	-

- Place the support grip in position on the power cable, and attach the grip to the shackle.

NOTICE:

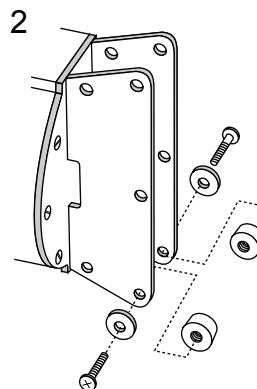
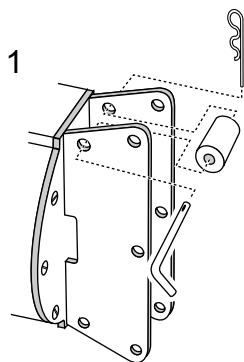
You must use the support grip when the mixer is held in position by a wire instead of a chain.



WS000721B

4.2.4 Set the vertical angle

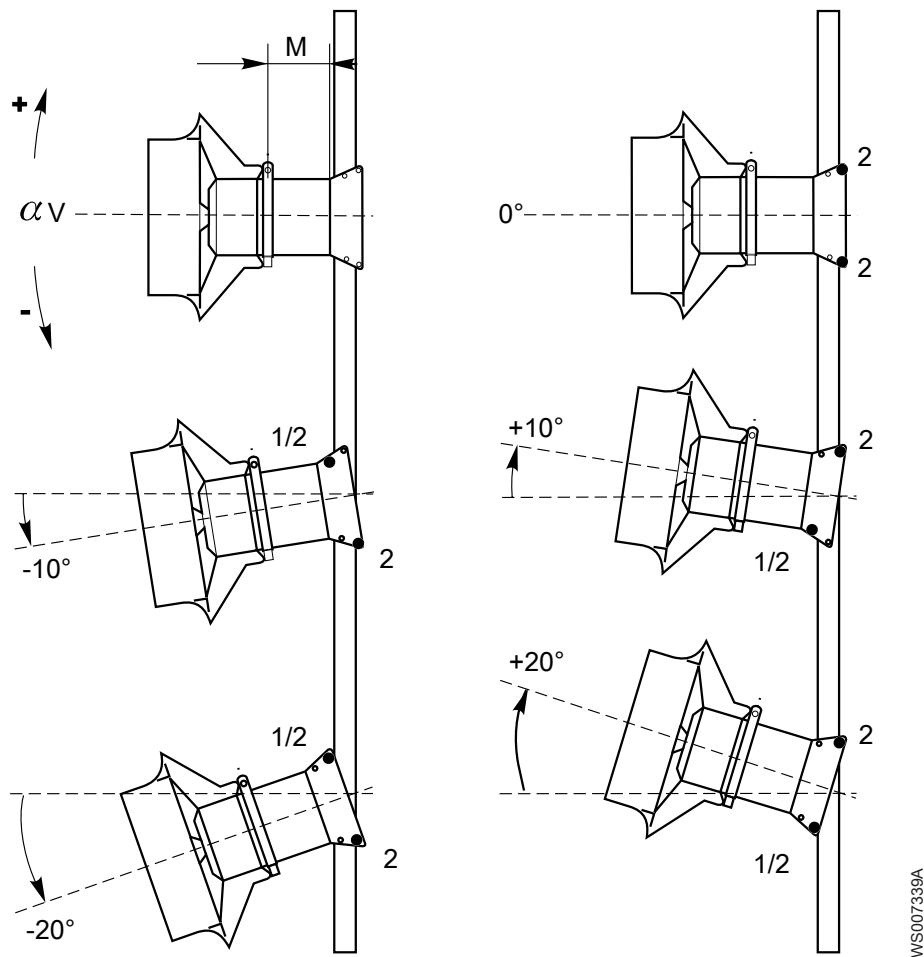
The figures show examples of how to assemble Type-1 rollers and Type-2 rollers on the rear guide of the mixer.



WS0007340A

1. Put a set of rollers on the rear guide according to the illustration, to accomplish the correct angle.

Type-1 rollers can only be used in front of the guide bar. Type-2 rollers can be used either on the front, or the rear, of the guide bar.



2. Check and correct the position of the lifting equipment.

The M measurement identifies the correct position. See the dimensional drawings for the product.

If further fine-tuning is needed for horizontal alignment, then different lifting holes can be selected.

4.3 Electrical installation

4.3.1 Make the electrical connections

General precautions



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



**WARNING: Electrical Hazard**

Risk of electrical shock or burn. A certified electrician must supervise all electrical work. Comply with all local codes and regulations.

**WARNING: Electrical Hazard**

There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out, or if there is fault or damage on the product. Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.

**CAUTION: Electrical Hazard**

Prevent cables from becoming sharply bent or damaged.

Requirements

Check that the following requirements are met:

- The supply authority must be notified before installing the unit if it will be connected to the public mains. When the unit is connected to the public power supply, it may cause flickering of incandescent lamps when started.
- The mains voltage and frequency must agree with the specifications on the data plate.
- The fuses and circuit breakers must have the proper rating, and the unit must be connected to an overload protection (motor protection breaker) that is set to the rated power. See the specifications on the data plate. The starting current in direct-on-line starting can be up to six times higher than the rated current.
- The fuse rating and the cables must be in accordance with the local rules and regulations.
- If intermittent operation is prescribed, the unit must be provided with monitoring equipment supporting such operation.
- For FM-approved mixers, a leakage sensor must be connected and in use in order to meet approval requirements.

Cables

When choosing cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- If a cable has been used before, a short piece must be peeled off when refitting it so that the cable entry seal sleeve does not close around the cable at the same point again. If the cable covering is damaged, replace the cable (contact a local sales and service representative).
- The cable entry seal sleeve and washers must conform to the outside diameter of the cable.
- A screened cable must be used according to the European CE requirements if a Variable Frequency Drive (VFD) is used. For more information, contact your local sales and service representative (VFD-supplier).
- The voltage drop in long cables must be taken into account. The drive unit's rated voltage is the voltage measured at the terminal board in the upper part of the product.
- For SUBCAB cables, the twisted pair copper foil must be trimmed.

4.3.2 Power isolation

The power supply to the mixer must be designed such that the mixer can be completely isolated from it.

4.3.3 Grounding (earthing)



DANGER: Electrical Hazard

All electrical equipment must be grounded (earthed). Test the ground (earth) lead to verify that it is connected correctly and that the path to ground is continuous.



WARNING: Electrical Hazard

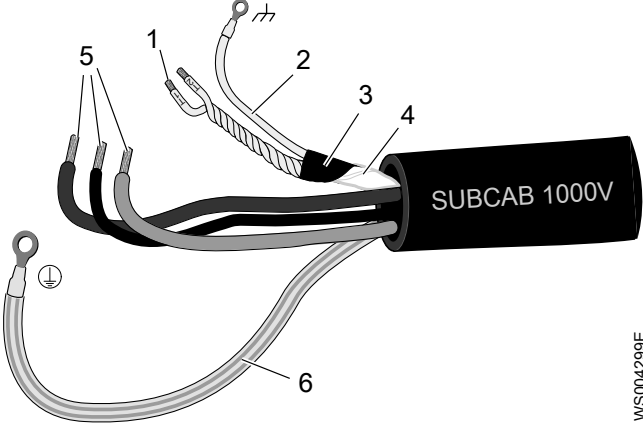
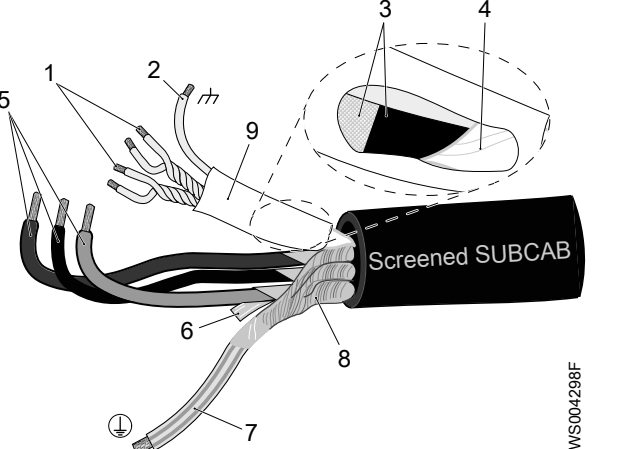
If the power cable is jerked loose, then the ground (earth) conductor must be the last conductor to come loose from its terminal. Make sure that the ground (earth) conductor is longer than the phase conductors at both ends of the cable.

4.3.4 Threaded cable entry option

If the threaded cable entry option is used, then the cable protection must be installed in accordance with the accompanying instructions. Improper installation can damage the cables.

4.3.5 Prepare the SUBCAB™ cables

This section applies to SUBCAB™ cables with twisted-pair control conductors.

The prepared SUBCAB™ cable	The prepared screened SUBCAB™ cable, without cable lugs
 <p>1. T1+T2 twisted pairs in control element 2. Drain wire in control element (tinned copper strands) with shrink tube 3. Aluminum and textile layers 4. Insulation jacket or plastic jacket, for the control element 5. Power conductors 6. Ground (earth) conductor with yellow-green shrink tube</p> <p style="text-align: right;">WS004299E</p>	 <p>1. T1+T2 and T3+T4 twisted pairs in control element 2. Drain wire in control element (tinned copper strands) with shrink tube 3. Aluminum and textile layers 4. Insulation jacket or plastic jacket, for the control element 5. Power conductors 6. Plastic laminated aluminum foil, screen 7. Ground (earth) conductor with yellow-green shrink tube 8. Uncovered screen/braided wire 9. shrink tube</p> <p style="text-align: right;">WS004298F</p>

1. Peel off the outer jacket at the end of the cable.

2. Prepare the control element:

a) Peel the insulation jacket or plastic jacket.

b) Peel the aluminum and textile layers.

The aluminum foil is a conductive screen. Do not peel more than necessary, and remove the peeled foil.

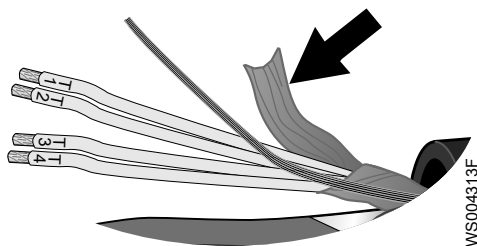


Figure 5: Aluminum foil on the control element.

- c) Put a white shrink tube over the drain wire.
- d) Twist T1+T2 and T3+T4.
- e) Put a shrink tube over the control element.

Make sure that the conductive aluminum foil and drain wire are covered.

3. Prepare the ground (earth) conductor of the SUBCAB™ cable:
 - a) Peel the yellow-green insulation from the ground (earth) conductor.
 - b) Check that the ground (earth) conductor is at least 10% longer than the phase conductors in the cabinet.
 - c) If applicable, put a cable lug on the ground conductor.
4. Prepare the ground (earth) conductor of the screened SUBCAB™ cable:
 - a) Untwist the screens around the power conductors.
 - b) Twist all power conductor screens together to create a ground (earth) conductor.
 - c) Put a yellow-green shrink tube over the ground (earth) conductor.
Leave a short piece uncovered.
 - d) Check that the connected ground (earth) conductor has sufficient slack. The conductor must stay connected even if the power conductors are pulled loose.
5. Prepare the power conductors:
 - a) Remove the aluminum foil around each power conductor.
 - b) Peel the insulation from each power conductor.
6. Prepare the ends of the ground (earth) conductor, the power conductors, and the drain wire:

Connection type	Action
Screw	Fit cable lugs to the ends.
Terminal block	Fit end sleeves or leave the ends as they are.

4.3.6 Connect the motor cable to the mixer

NOTICE:

Leakage into the electrical parts can cause damaged equipment or a blown fuse. Keep the end of the motor cable dry at all times.

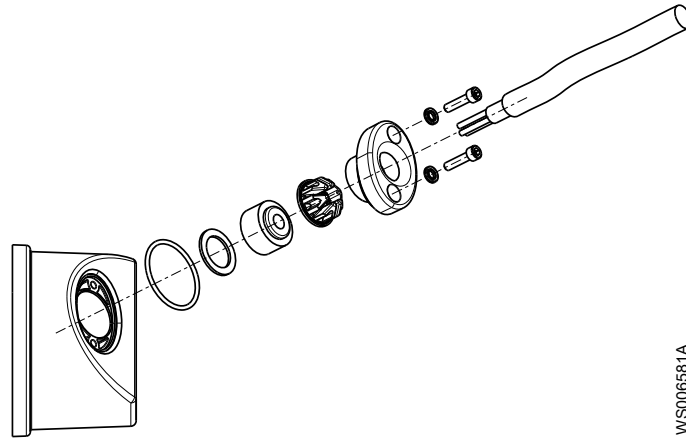


Figure 6: Cable insertion assembly

The mixer is normally delivered with the cable connected.

1. Remove the entrance cover, fixing plate, and O-ring from the mixer housing.
You will have access to the terminal board.
2. Pull the cable into the junction box.
3. Connect the motor leads, the ground (earth) lead and the control leads.
Check the data plate to select the correct cable chart.
The ground (earth) lead must be 100 mm (4.0 in) longer than the phase leads in the junction box of the unit.
4. Make sure that the mixer is correctly connected to ground (earth).
5. Make sure that any thermal contacts are properly connected to the terminal board.
6. Install the O-ring, fixing plate, and entrance cover on the mixer housing.
7. Assemble and fasten the cable entry.
Make sure that the gland screw bottoms out when fastened.
For more information about the cable entry, see Parts List.
8. Check the insulation for the connections with a megger.
The insulation between the phases and between any phase and earth must be > 5 M Ohm.

4.3.7 Connect the motor cable to the starter and monitoring equipment



DANGER: Explosion/Fire Hazard

Special rules apply to installations in explosive or flammable atmospheres. Do not install the product or any auxiliary equipment in an explosive zone unless it is rated explosion-proof or intrinsically-safe. If the product is rated explosion-proof or intrinsically-safe, then see the specific explosion-proof information in the safety chapter before taking any further actions.

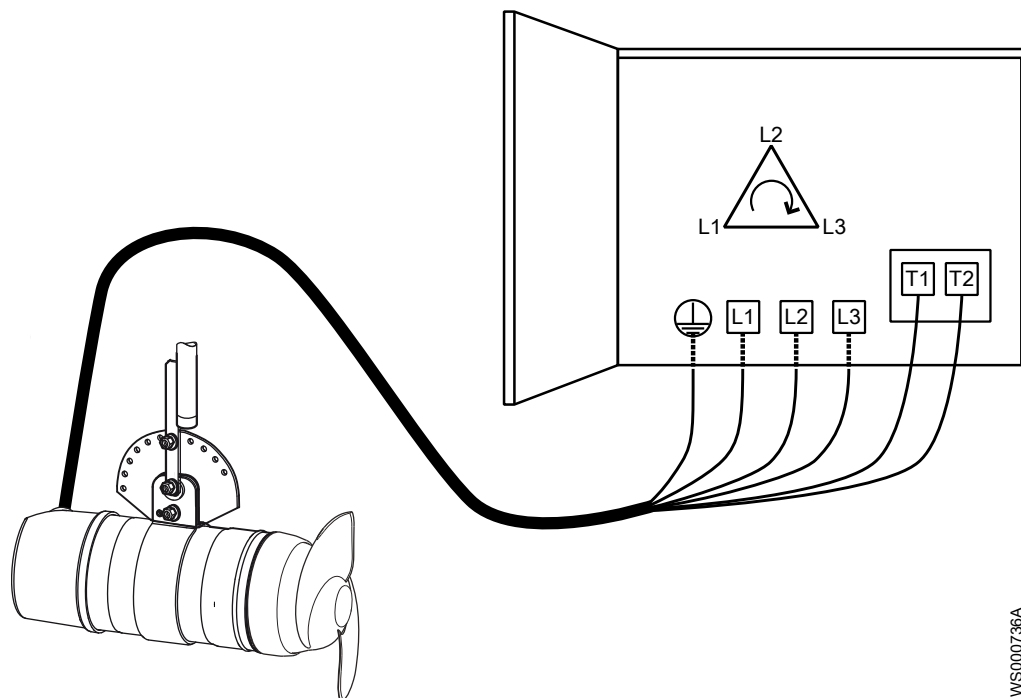


Figure 7: Connection of the motor cable.

1. Connect the T1 and T2 control conductors to the MiniCAS II monitoring equipment.

NOTICE:

The thermal contacts are incorporated in the stator. Connect them to 24 V over separate fuses to protect other automatic equipment.

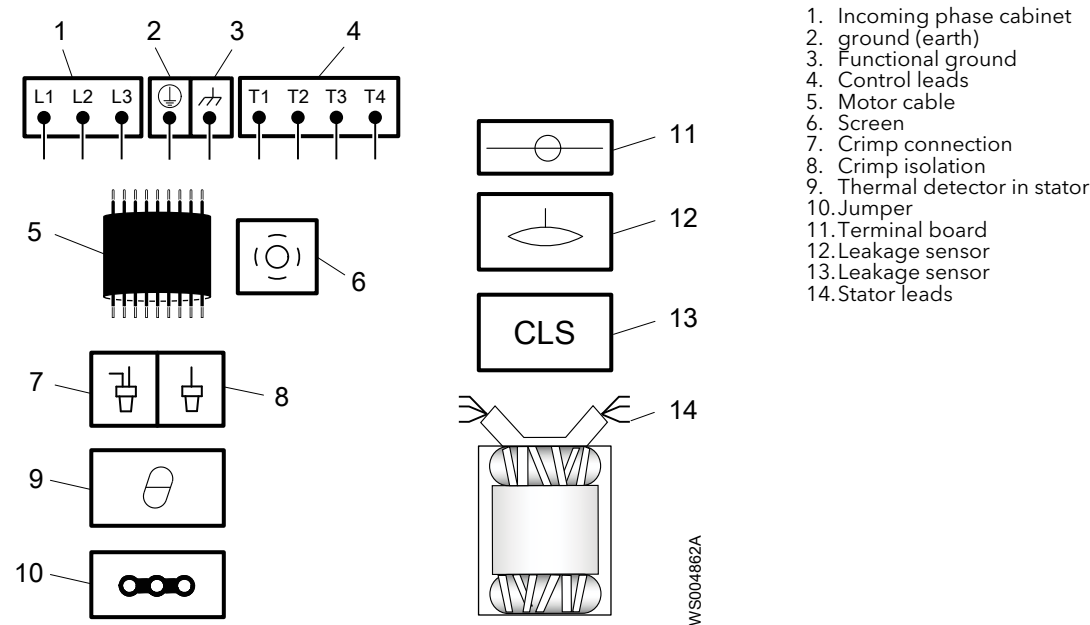
2. Connect the mains conductors (L1, L2, L3, and ground (earth)) to the starter equipment.
See the applicable cable charts for the color codes of the conductors.

4.4 Cable charts

This section contains general connection information. It also provides cable charts that show connection alternatives for use with different cables and power supply.

Symbols

The figures in this section illustrate how to interpret the connection strip symbols.



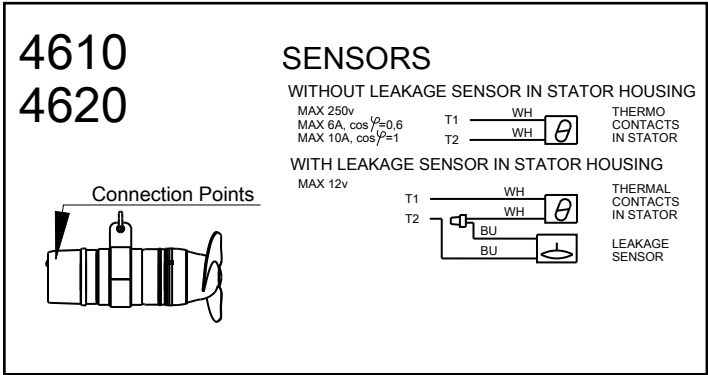
Color code standard

Code	Description
BN	Brown
BK	Black
WH	White
OG	Orange
GN	Green
GNYE	Green-Yellow
RD	Red
GY	Grey
BU	Blue
YE	Yellow

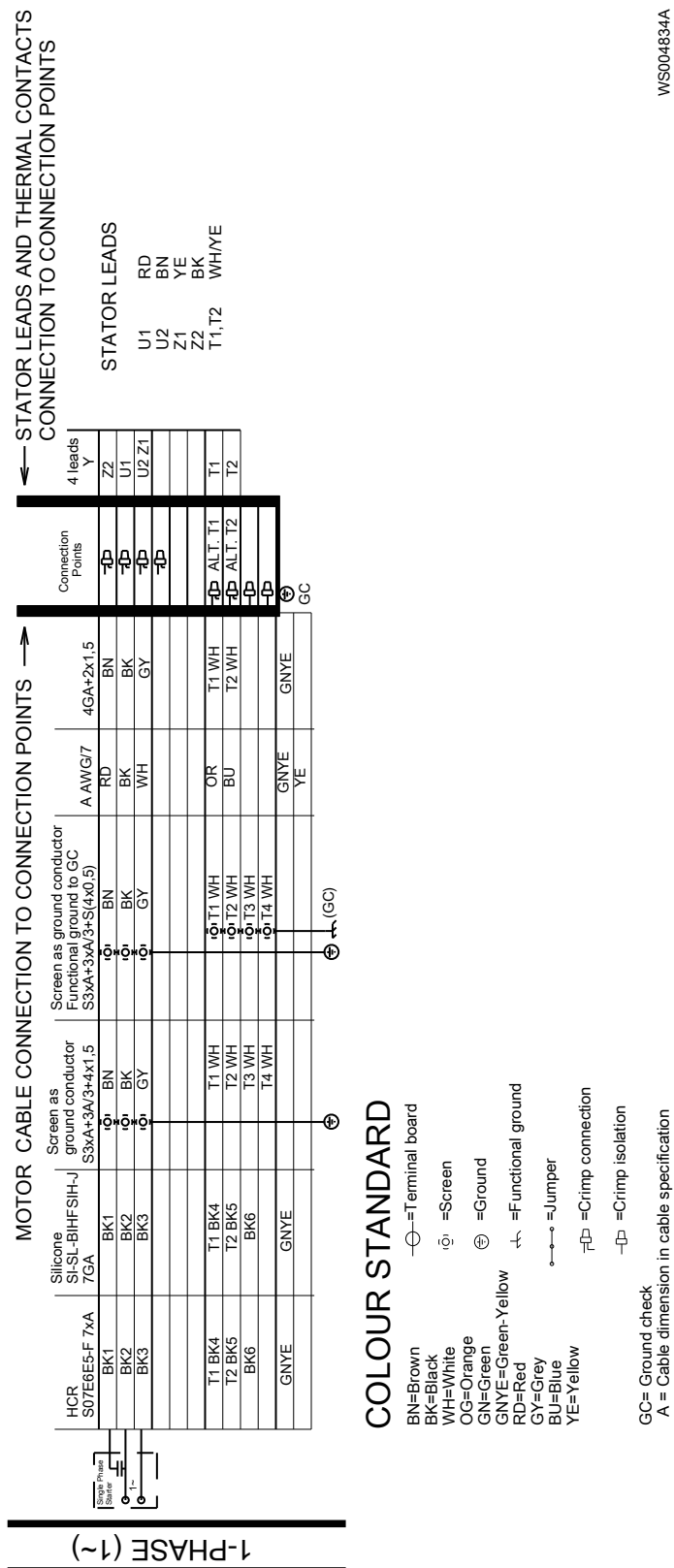
Sensor connections

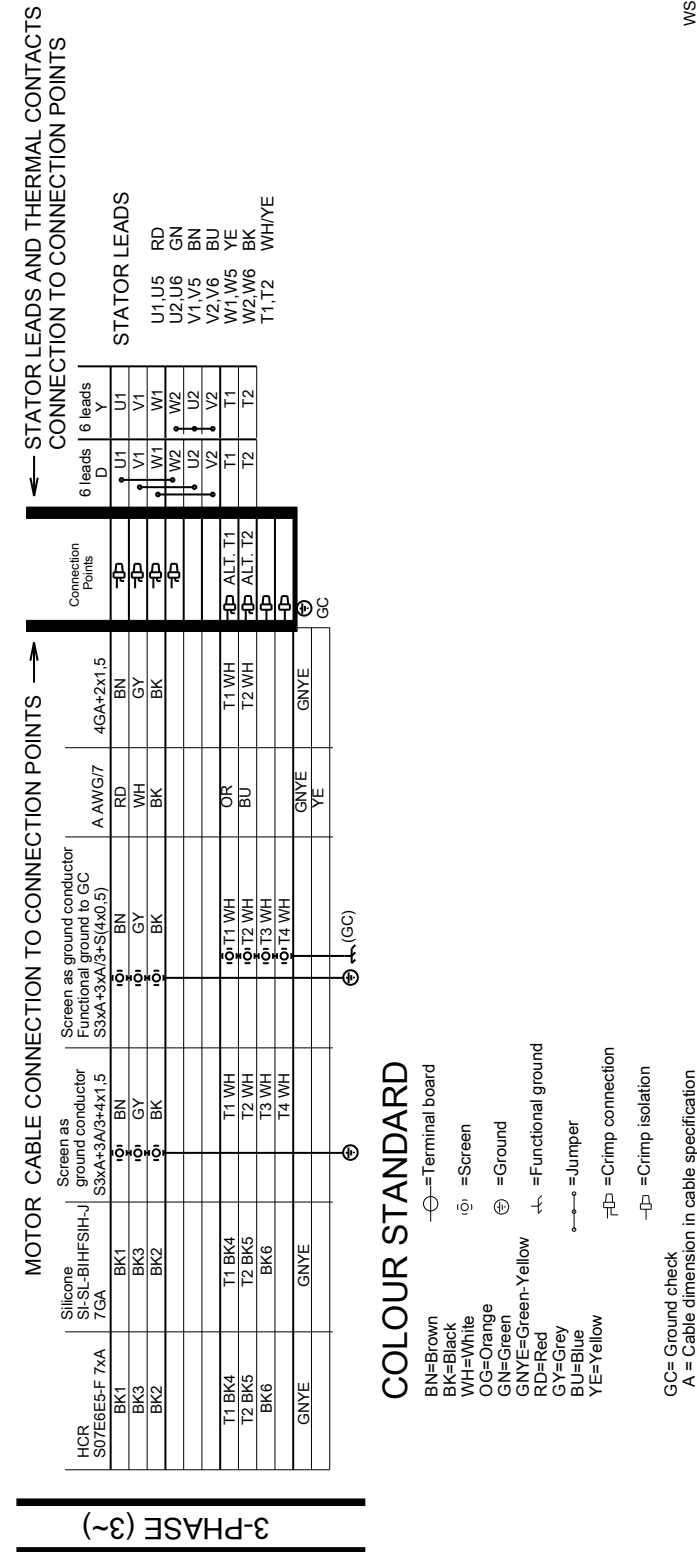
The mixer is always equipped with thermal contacts incorporated in the stator.

The mixer can also have an optional water leakage sensor (FLS). A leakage sensor is mandatory if the mixer has FM approval.



4.4.1 Cable connections





WS004835A

Figure 9: 3-phase connection

5 Operation

Noise level

The noise level of the unit is normally lower than 70 dB, but in some installations at certain operation points on the performance curve the noise level of 70 dB can be exceeded.

Distance to wet areas



WARNING: Electrical Hazard

Risk of electrical shock or burn. You must connect an additional ground- (earth-) fault protection device to the grounded (earthed) connectors if persons are likely to come into contact with liquids that are also in contact with the pump or pumped liquid.



CAUTION: Electrical Hazard

Risk of electrical shock or burn. The equipment manufacturer has not evaluated this unit for use in swimming pools. If used in connection with swimming pools then special safety regulations apply.

5.1 Power isolation

The power supply to the mixer must be designed such that the mixer can be completely isolated from it.

Permanent support of the mixer

Chains may be used for raising and lowering the mixer, but are not recommended for permanent support of the mixer weight. All chains and their welds are vulnerable to sustained dynamic load.

If a chain is used as a permanent support of the mixer, then frequent inspections of the chain are required.

5.2 Start the mixer



WARNING: Crush Hazard

Moving parts can entangle or crush. Make sure nobody is close to the unit when it is started.

NOTICE:

The maximum number of starts allowed per hour is 30.

NOTICE:

Make sure the mixer is fixed to the guide bar before starting the mixer.

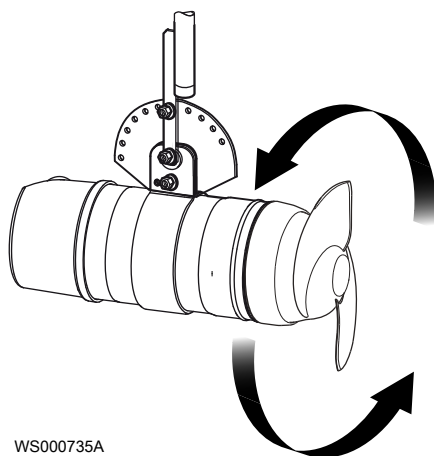
Before you start the mixer, the following requirements must be met:

- There is oil in the oil casing.
- The motor cable entry is securely tightened.
- The monitoring equipment incorporated in the product is correctly connected.

1. Start the motor briefly to check the direction of rotation.

The correct direction of propeller rotation is counterclockwise when you look at the mixer from the propeller side. See the illustration.

The illustration shows the correct direction of rotation.

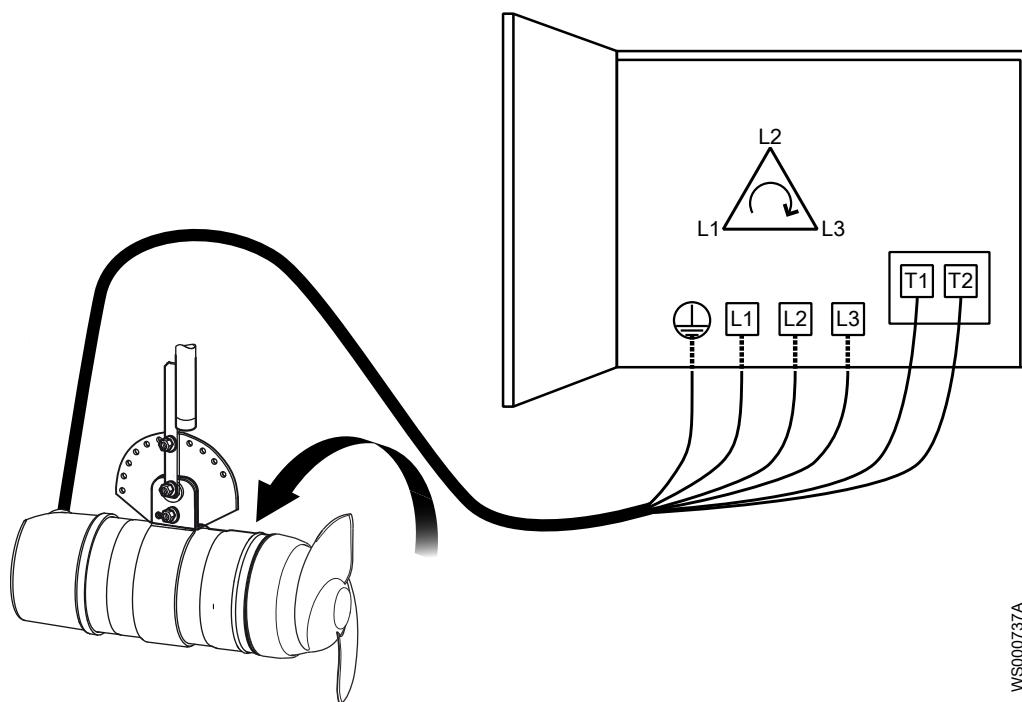


WS000735A

2. If the direction of rotation is incorrect, do as follows:

- a) Stop the motor.
- b) Disconnect the power supply.
- c) Change positions of two of the three mains leads to the power supply.

For instructions on how to connect the power supply, see [Electrical installation](#) on page 30.



WS000737A

Figure 10: Correct motor cable connection

- d) Start the motor briefly to check that the direction of rotation is correct.

6 Maintenance

6.1 Precautions

Before starting work, make sure that the safety instructions have been read and understood.



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



DANGER: Inhalation Hazard

Before entering the work area, make sure that the atmosphere contains sufficient oxygen and no toxic gases.



DANGER: Inhalation Hazard

The chamber or tank where the equipment is installed should be treated as a confined space. Always follow the applicable safety laws, regulations and guidelines for confined spaces.



WARNING: Crush Hazard

Make sure that the unit cannot roll or fall over and injure people or damage property.



WARNING: Biological Hazard

Infection risk. Rinse the unit thoroughly with clean water before working on it.



WARNING: Electrical Hazard

Risk of electrical shock or burn. A certified electrician must supervise all electrical work. Comply with all local codes and regulations.



WARNING: Electrical Hazard

There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out, or if there is fault or damage on the product. Visually inspect equipment for damaged cables, cracked casings or other signs of damage. Make sure that electrical connections have been correctly made.



CAUTION: Electrical Hazard

Prevent cables from becoming sharply bent or damaged.

Ground continuity verification

A ground (earth) continuity test must always be performed after service.

6.1.1 Ventilate the work area

Before starting work, make sure that the work area is well-ventilated.

6.1.2 Inspect the work area before permit-required hot work



WARNING: Explosion/Fire Hazard

Before starting any permit-required hot work such as welding, gas cutting, grinding, or using electrical handtools, do the following: 1. Check the explosion risk. 2. Provide sufficient ventilation.

6.1.3 Rotating propeller



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



6.2 Requirements for maintenance

Stage	Requirement
Before reassembly	<ul style="list-style-type: none"> All components must cool off All parts, particularly O-ring grooves, must be thoroughly cleaned All O-rings, gaskets, and seal washers must be changed All springs, screws, and O-rings must be lubricated with grease
At reassembly	Existing index markings must be in line.
Before operation	<ul style="list-style-type: none"> The reassembled drive unit must be insulation-tested The reassembled product must always be test-run

6.3 Torque values

All screws and nuts must be lubricated to achieve correct tightening torque. Screws that are screwed into stainless steel must have the threads coated with suitable lubricants to prevent seizing.

If there is a question regarding the tightening torques, then contact a sales or authorized service representative.

Screws and nuts

Table 3: Stainless steel, A2 and A4, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
50	1.0 (0.74)	2.0 (1.5)	3.0 (2.2)	8.0 (5.9)	15 (11)	27 (20)	65 (48)	127 (93.7)	220 (162)	434 (320)
70, 80	2.7 (2)	5.4 (4)	9.0 (6.6)	22 (16)	44 (32)	76 (56)	187 (138)	364 (268)	629 (464)	1240 (915)
100	4.1 (3)	8.1 (6)	14 (10)	34 (25)	66 (49)	115 (84.8)	248 (183)	481 (355)	–	–

Table 4: Steel, torque Nm (ft-lbs)

Property class	M4	M5	M6	M8	M10	M12	M16	M20	M24	M30
8.8	2.9 (2.1)	5.7 (4.2)	9.8 (7.2)	24 (18)	47 (35)	81(60)	194 (143)	385 (285)	665 (490)	1310 (966.2)
10.9	4.0 (2.9)	8.1 (6)	14 (10)	33 (24)	65 (48)	114 (84)	277 (204)	541 (399)	935 (689)	1840 (1357)
12.9	4.9 (3.6)	9.7 (7.2)	17 (13)	40 (30)	79 (58)	136 (100)	333 (245)	649 (480)	1120 (825.1)	2210 (1630)

Table 5: Brass, torque Nm (ft-lbs)

M5	M8	M10
2.7 (2.0)	11 (8.1)	22 (16.2)

Hexagon screws with countersunk heads

For hexagon socket head screws with countersunk head, maximum torque for all property classes must be 80% of the values for property class 8.8 above.

6.4 Maintenance intervals

The maintenance intervals are applicable to different types of maintenance and depend on the application and the operating conditions.

6.4.1 Categorization of operating conditions

Operating conditions, less than 40°C (104°F)

Table 6: Water and wastewater applications

Application	Operating condition
Pumping station	Heavy duty
Retention basin	Heavy duty
Moving bed biofilm reactor (MBBR)	Heavy duty
Seawater	Heavy duty
Others	Normal duty

Table 7: Biogas and agriculture applications

Application	Operating condition
Fluid manure	Normal duty
Digestate	Normal duty
Digester <ul style="list-style-type: none"> For example, energy crops and solid manure 	Heavy duty
Pre-treatment and hydrolysis <ul style="list-style-type: none"> For example, energy crops and solid manure 	Heavy duty

Table 8: Municipal sludge applications

Application	Operating condition
Anaerobic stabilized sludge, mezophilic	Normal duty
Aerobic stabilized sludge	Normal duty
Anaerobic stabilized sludge, thermophilic	Heavy duty
Others	Normal duty

Table 9: Drilling mud and industrial process applications

Application	Operating condition
Drilling mud	Heavy duty
Light-duty industry	Normal duty
Heavy-duty industry	For more information, contact the sales and service representative.

Operating conditions, more than 40°C (104°F)

A media temperature above 40°C (104°F) is categorized as heavy duty operating conditions for all applications.

6.4.2 Maintenance schedule

The maintenance intervals are valid if the product is selected, installed, and positioned according to Xylem guidelines.

Type of maintenance	Purpose	Operating condition	Interval
Initial inspection, on-site	<ul style="list-style-type: none"> Make sure that the installation is correct. Determine the recommended maintenance intervals for the specific installation. 	All duties	Within the first 3 months of operation
Periodic inspection, on-site	<ul style="list-style-type: none"> Assess the general condition of the equipment. Take measures to minimize the life cycle cost, prevent unplanned downtime, and preserve operation efficiency. 		8,000 hours or 2 years, whichever comes first
Overhaul, at an authorized workshop	<ul style="list-style-type: none"> Replace wear parts and key components for a long equipment lifetime and for preserving operation efficiency. 	Normal duty	24,000 hours or 6 years, whichever comes first
		Heavy duty	8,000 hours or 2 years, whichever comes first

In biogas digester applications, perform the initial inspection after installation or within the first three months of operation.

If the periodic inspections are not performed according to the schedule, then shorten the interval of the overhaul. For more information, contact the sales and service representative.

6.5 Service actions

6.5.1 Inspections

The initial inspection and periodic inspections are performed on-site.

Service item	Action
Power cable	<ul style="list-style-type: none"> Check for damage. If necessary, replace the power cable. Check the cable support. If necessary, adjust it.
Oil housing	<ul style="list-style-type: none"> Check the oil. If necessary, change it. Replace the O-rings of the filling plug.

Service item	Action
Lifting handle	Check the condition. If necessary, replace parts.
Control cabinet	Check the power connections.
Stator protection	<ul style="list-style-type: none"> Check the thermal contacts. Normally closed circuit, interval 0–1 ohm. Check the resistance of the thermistors. The correct value is between 20–250 ohm. The maximum measuring voltage is 2 VDC.
Insulation	Use a megger maximum 1000 V. <ul style="list-style-type: none"> Check that the resistance between the ground (earth) and phase lead is more than 5 megohms. Do a phase-to-phase resistance check, maximum 50 ohm.
Motor condition	Check the running values of the voltage and amperage.
Personal safety	Check the guide rails, covers, and other protections.
Installation equipment and lifting device	Check the mounting and installation conditions. If necessary, replace parts. Follow the local regulations.
Position of the unit	Check the position to get the correct load and to fulfill the process requirements.
Overload protection	Check that the settings are correct.
Propeller	<ul style="list-style-type: none"> Check for wear. If necessary, replace parts. Check the direction of the rotation.
Zinc anode	If applicable, check the consumption. If necessary, replace the zinc anode.

6.5.2 Overhaul

The overhaul is performed at an authorized workshop.

Service item	Action
Bearings	Replace the bearings.
O-rings	Replace the O-rings.
Mechanical seals	Replace the mechanical seals.
Junction box	<ul style="list-style-type: none"> Check that the junction box is clean and dry. Check the power connections.
Other actions	See Inspections on page 44.

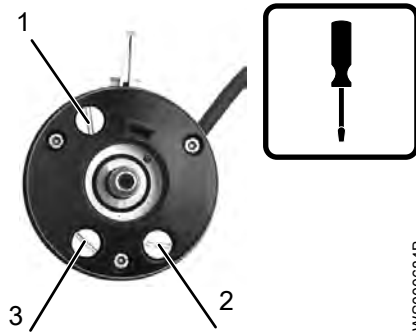
6.5.3 Service in case of alarm

Alarm source	Action
FLS	<ol style="list-style-type: none"> Check the connection chamber for any leakage, and drain if necessary. Check mechanical seals and O-rings and replace any damaged seals with new ones.
Thermal contact	<ol style="list-style-type: none"> Check the connections and the electrical motor. Check the temperature and viscosity of the mixed liquid. Check that the position is according to the installation requirements.
Overload protection	Check that the propeller can rotate freely.

6.6 Inspect the stator housing

A screwdriver is required for this procedure.

- Attach the mixer in a screw vice.
Use the lifting handle as an attachment.
- Loosen and remove the inspection plug and O-ring.



1. Oil plug (filling)
2. Oil plug (drainage)
3. Inspection plug

3. Undo the mixer from the screw vice and turn the mixer upside down over an oil tray.



4. If any liquid runs out, replace the seal.

6.7 Change the oil

Before you change the oil, the propeller must be removed. See [Remove the jet ring, guiding claw, and propeller](#) on page 48.

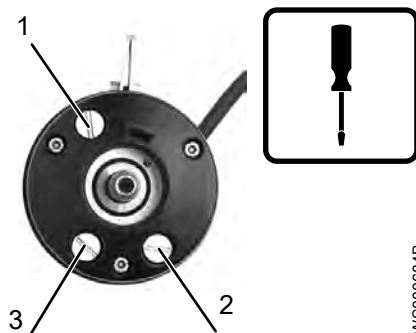
6.7.1 Drain the oil



CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

1. Unscrew the two oil plugs.



1. Oil plug (filling)
2. Oil plug (drainage)
3. Inspection plug

2. Hold the mixer over a cup and allow the oil to run out.
Turn the mixer back and forth to make sure that all oil is drained.



3. Check for water in the oil. If there is water in the oil, do as follows:
 - a) Replace the shaft seal and the O-rings.
 - b) Check the oil housing for any damage, and replace if necessary.

6.7.2 Fill the oil



CAUTION: Compressed Gas Hazard

Air inside the chamber may cause parts or liquid to be propelled with force. Be careful when opening. Allow the chamber to de-pressurize before removal of the plug.

The mixer is delivered from the factory with paraffin oil with a viscosity close to ISO VG32. Recommended oil: 90 17 52.

Examples of suitable oil types are the following:

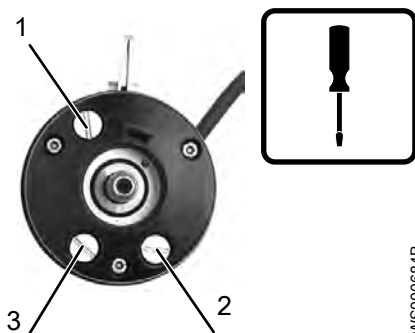
- Statoil MedicWay 32™
- BP Enerpar M 004™
- Shell Ondina 927™
- Shell Ondina X430™

The required oil quantity is 0.15 L (0.16 qt).

The following tools are required for this procedure:

- Funnel
- Torque wrench

1. Unscrew the two oil plugs.



1. Oil plug (filling)
2. Oil plug (drainage)
3. Inspection plug

2. With the mixer in a vertical position, fill with new oil through the oil filling hole.



3. Replace the O-rings of the oil plugs and put the oil plugs back. Tighten the plugs.
Tightening torque: 10 Nm (7.4 ft-lbs).

If you replaced the shaft seals, then inspect the oil after one week of operation.

6.8 Change the propeller



CAUTION: Cutting Hazard

Sharp edges. Wear protective clothing.

The following tools are needed for this procedure:

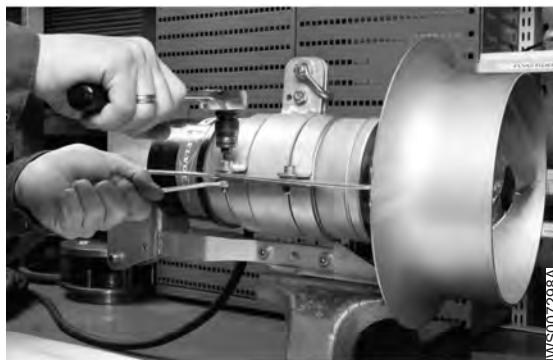
- Hexagon socket wrench (13 mm)
- Hexagon socket head cup wrench (6 mm)
- Screwdriver
- Tool 82 93 11
- Torque wrench (6 mm)

6.8.1 Remove the jet ring, guiding claw, and propeller

The following tools are used in this procedure:

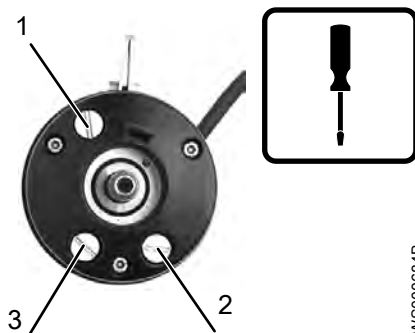
- Hexagon socket wrench (13 mm)
- Hexagon socket head cup wrench (6 mm)
- Screwdriver

1. Remove the jet ring and the guiding claw:
 - a) Loosen the screws, washers, and nuts.



- b) Remove the clamp, the jet ring, and the guiding claw.
2. Remove the propeller:

- a) Remove the plastic plug.
 - b) Loosen the central screw and washer.
 - c) Remove the propeller together with screw and washer.
3. Check for seal leakage:
- a) Attach the mixer in a screw vice.
Use the lifting handle as an attachment.
 - b) Loosen and remove the inspection plug and O-ring.



WS000684B

1. Oil plug (filling)
2. Oil plug (drainage)
3. Inspection plug

- c) Undo the mixer from the screw vice and turn the mixer upside down over an oil tray.



WS007299A

- d) If any liquid runs out, replace the seal.

6.8.2 Assemble the propeller, jet ring, and guiding claw

Before following this procedure, you must fill the oil. See [Fill the oil](#) on page 47.

The following tools are used in this procedure:

- Hexagon socket wrench (13 mm)
- Hexagon socket head cup wrench (6 mm)
- Strap mounting tool 82 93 11
- Torque wrench (6 mm)

1. Mount the protective ring.
2. Press it down towards the oil housing until it bottoms out.



3. Put on the strap and tighten it 7 ± 2 mm (0.28 ± 0.08 in.) from the bottom edge.



4. Mount the propeller onto the shaft.
5. Fit the screw and tighten it to 17 Nm (12.6 ft-lbs).

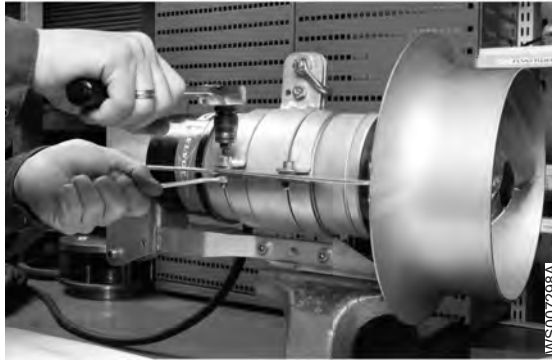


6. Press the plastic plug in place.
7. Mount the jet ring and guiding claw:
 - a) Attach the mixer to the screw vice.
 - b) Mount the jet ring towards the lifting handle.

NOTICE:

Note the position of the electric poles (polar position).

- c) Fit the clamp, screws, washers, and nuts.
- d) Tighten the screws to 17 Nm (12.6 ft-lbs).
- e) Make sure that the propeller rotates free from the jet ring.
- f) Mount the guiding claw.



7 Troubleshooting

7.1 Electrical troubleshooting



DANGER: Electrical Hazard

Troubleshooting a live control panel exposes personnel to hazardous voltages. Electrical troubleshooting must be done by a qualified electrician.

Follow these guidelines when troubleshooting:

- Disconnect and lock out the power supply except when conducting checks that require voltage.
- Make sure that no one is near the unit when the power supply is reconnected.
- When troubleshooting electrical equipment, use the following:
 - Universal instrument multimeter
 - Test lamp (continuity tester)
 - Wiring diagram

7.2 The mixer does not start



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



Cause	Remedy
An alarm signal has been triggered on the control panel.	Check the thermal contacts, and that the overload protection has not tripped.
The mixer does not start automatically, but can be started manually.	Check that: <ul style="list-style-type: none"> • All connections are intact. • The relay and contactor coils are intact. • The control switch (Man/Auto) makes contact in both positions.
The installation is not receiving voltage.	Check that: <ul style="list-style-type: none"> • The main power switch is on. • There is control voltage to the start equipment. • The fuses are intact. • There is voltage in all phases of the supply line. • All fuses have power and that they are securely fastened to the fuse holders. • The overload protection is not tripped. • The motor cable is not damaged.
The propeller is stuck.	<ul style="list-style-type: none"> • Clean the propeller • Clean the jet ring Check the propeller clearance to the jet ring, and that the propeller and shaft can be rotated.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see [Product Description](#) on page 11.

7.3 The mixer starts-stops-starts in rapid sequence



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



Cause	Remedy
The self-holding function of the contactor malfunctions.	Check the voltage in the control circuit in relation to the rated voltages on the coil, and that the contactor connections are intact.

If the problem persists, then contact a sales or authorized service representative.
Always state the serial number of the product, see [Product Description](#) on page 11.

7.4 The mixer runs but the motor protection trips



DANGER: Crush Hazard

Moving parts can entangle or crush. Always disconnect and lock out power before servicing to prevent unexpected startup. Failure to do so could result in death or serious injury.



NOTICE:

Do NOT override the motor protection repeatedly if it has tripped. Doing so may result in equipment damage.

Cause	Remedy
The motor protection is set too low.	Set the motor protection according to specifications on the data plate.
There is a malfunction in the overload protection.	Replace the overload protection.
The propeller is difficult to rotate by hand.	<ul style="list-style-type: none"> • Clean the propeller. • Check that the propeller size is correct. • Check the propeller clearance to the jet ring. • Check if the shaft has too much play due to worn out bearing.
The installation does not receive full voltage on all three phases.	<ul style="list-style-type: none"> • Check the motor fuses. Replace fuses that have tripped. • If the fuses are intact, then notify a certified electrician.
The phase currents vary or are too high.	Contact a sales or authorized service representative.
The rated speed differs from what is stated on the data plate.	Contact a sales or authorized service representative.

Cause	Remedy
The density of the liquid is too high.	<ul style="list-style-type: none">• Dilute the liquid.• Change the propeller blades or to a more suitable mixer.• Contact a sales or authorized service representative.

If the problem persists, then contact a sales or authorized service representative.

Always state the serial number of the product, see [Product Description](#) on page 11.

8 Technical Reference

8.1 Motor data

Feature	Description
Motor type	Squirrel-cage 4-pole induction motor
Frequency	50 Hz 60 Hz
Supply	1-phase (only 4620) or 3-phase
Starting method	<ul style="list-style-type: none"> • Direct on-line • Variable Frequency Drive (VFD)
Maximum starts per hour	30 evenly-spaced starts per hour
Voltage variation	<ul style="list-style-type: none"> • Continuously running: Maximum $\pm 5\%$ • Intermittently running: Maximum $\pm 10\%$
Voltage imbalance between the phases	Maximum of 2%
Stator insulation class	F (155°C [311°F])

Motor encapsulation

Motor encapsulation is in accordance with IP68.

8.2 Application limits

Data	Description
Liquid temperature	Maximum 40°C (104°F) Warm liquid version: 60°C (140°F) or 90°C (195°F)
Liquid density	1100 kg/m ³ (9.2 lb per US gal) maximum
pH of the mixed liquid	1–12
Depth of immersion	Maximum 20 m (65 ft)

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com



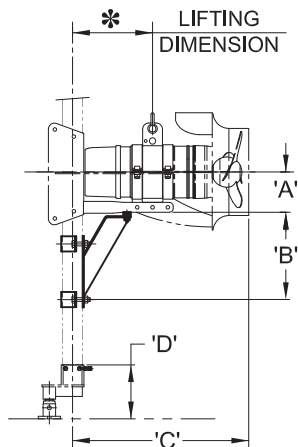
Xylem Water Solutions Global
Services AB
361 80 Emmaboda
Sweden
Tel: +46-471-24 70 00
Fax: +46-471-24 74 01
<http://tpi.xyleminc.com>
[www.xylemwatersolutions.com/
contacts/](http://www.xylemwatersolutions.com/contacts/)

Visit our Web site for the latest version of this document
and more information

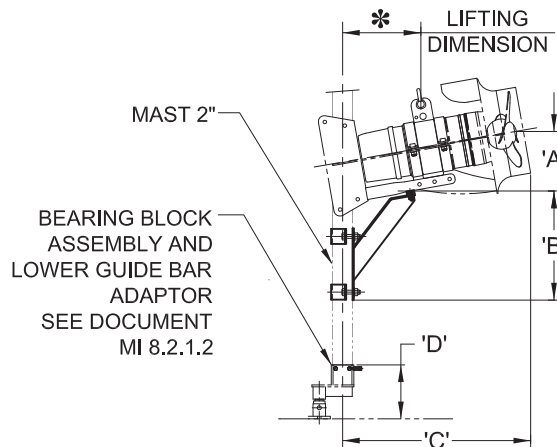
The original instruction is in English. All non-English
instructions are translations of the original instruction.

© 2011 Xylem Inc

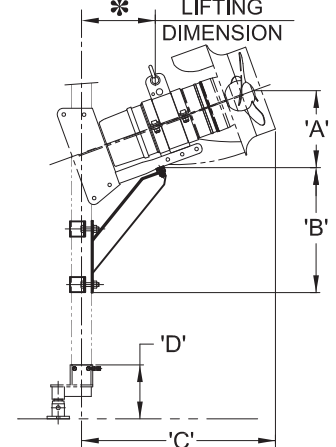
SHOWN IN POSITION 0°



SHOWN IN POSITION 10°

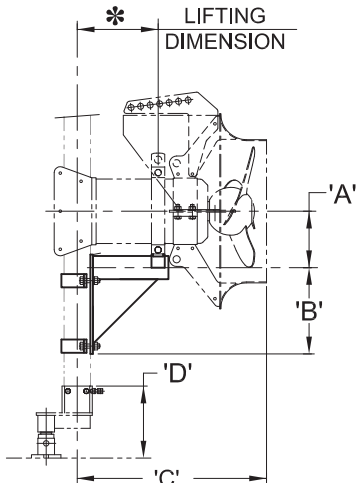


SHOWN IN POSITION 20°

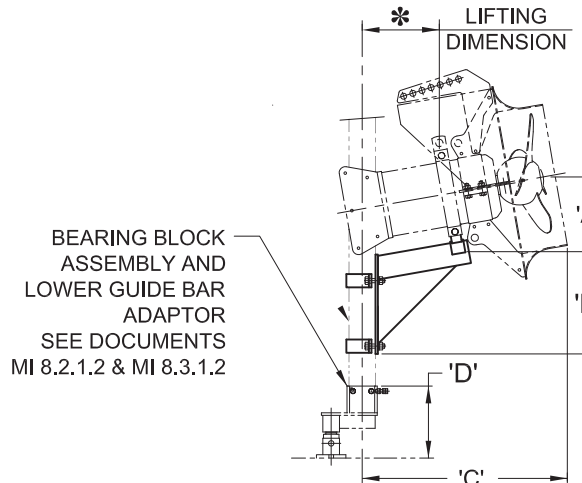


MODEL 4610 & 4620

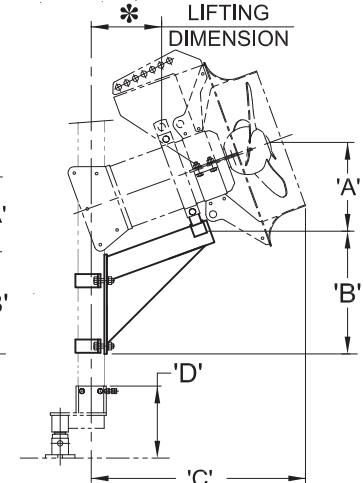
SHOWN IN POSITION 0°



SHOWN IN POSITION 10°



SHOWN IN POSITION 20°



MODEL 4630, 4640, 4650, 4660, 4670 & 4680

DIMENSIONAL & PART No. CHART

MODEL	MAST	POSITION 0°				POSITION 10°				POSITION 20°			
		'A'	'B'	'C'	'D'	'A'	'B'	'C'	'D'	'A'	'B'	'C'	'D'
4610	2"	13-51 03 57				13-51 03 86				13-51 03 93			
		102	240	445	192	150	274	475	192	195	316	490	192
4620	2"	13-51 03 57				13-51 03 86				13-51 03 93			
		102	240	445	192	150	274	475	192	195	316	490	192
4630	2"	13-51 03 58				13-51 03 87				13-51 03 94			
		159	191	501	192	200	234	550	192	244	318	576	192
4640	2"	13-51 03 59				13-51 03 88				13-51 03 95			
		159	191	541	192	205	238	591	192	253	327	618	192
4650	4"	13-51 03 60				13-51 03 89				13-51 03 96			
		221	330	779	276	293	486	857	276	386	569	895	276
4660	4"	13-51 03 61				13-51 03 90				13-51 03 97			
		221	330	889	276	300	479	965	276	409	589	994	276
4670	4"	13-51 03 62				13-51 03 91				13-51 03 98			
		277	330	891	276	371	418	1005	276	435	534	1052	276
4680	4"	13-51 03 63				13-51 03 92				13-51 03 99			
		277	430	1041	276	376	555	1146	276	450	657	1191	276

MATERIAL : STAINLESS STEEL 316
DIMENSIONS ARE IN mm

* FOR LIFTING DIMENSION SEE
SPECIFIC MIXER DRAWING

N.T.S.



Aeration and Mixing System Design Summary

Project Name: 506752
Location: English River, SK

Design Brief #: Aeration
Date: 9/22/2020

Client: SUEZ
Client Location: ONT

Calculated By: GCD

Can EDI provide preliminary layout drawing for the bioreactors and TWAS based on the IFT drawings provided? we can provide CAD file for use if needed.

General Notes

- 1) Each design calculation is for 1 tank only
- 2) System design under standard conditions in clean water according to ASCE standard.
- 3) System design based on limiting airflow requirement (oxygenation or mixing).
- 4) Cell values assumed by EDI are Bold and Underlined
- 5) Alternate inputs that differ from design inputs are highlighted blue
- 6) Estimated Blower Operating Pressure includes pressure to the top of the drop, estimated yard pipe and blower losses, and 0.5 psig overpressure.

Pre Aeration Geometry:

Design Scenario	Units	Phase 1-MMF	Phase 1-MDF	Phase 2-MMF	Phase 2-MDF
(1) Length	ft	23.75	23.75	23.75	23.75
(2) Width	ft	7.00	7.00	7.00	7.00
(3) Outer Diameter	ft	-	-	-	-
(4) Inner Diameter (For Donut Shape)	ft	-	-	-	-
(5) Side Slope Ratio, Length / Height (if Applicable)	L/H	-	-	-	-
(6) Water Depth	ft	11.32	11.32	12.43	12.43
(7) Aeration Depth	ft	10.30	10.30	10.30	10.30
(8) Aerated Tank Floor Area (AT)	ft ²	166	166	166	166
(9) Aerated Tank Volume (VT)	ft ³	1,882	1,882	2,068	2,068

Pre Aeration Diffuser Information:

Design Scenario	Units	Phase 1-MMF	Phase 1-MDF	Phase 2-MMF	Phase 2-MDF
(10) Diffuser Membrane Type	-	1 Panel	1 Panel	1 Panel	1 Panel
(11) Diffuser Assembly Type	-	MiniPanel MP1	MiniPanel MP1	MiniPanel MP1	MiniPanel MP1
(12) Perforation Size	-	Micro	Micro	Micro	Micro
(13) Quantity of Diffuser Membranes per Diffuser Assembly	-	2	2	2	2
(14) Number of Diffuser Membranes Required	-	26	26	26	26
(15) Number of Diffuser Assemblies Required	-	13	13	13	13
(16) Perforated Membrane Area per Diffuser Membrane	ft ²	0.88	0.88	0.88	0.88
(17) Perforated Membrane Area per Diffuser Assembly	ft ²	1.76	1.76	1.76	1.76
(18) Total Perforated Membrane Area Requirement (AD)	ft ²	22.88	22.88	22.88	22.88
(19) Design Density - Floor Coverage (AD / AT)	-	0.14	0.14	0.14	0.14
(20) Design Density - (AT / AD)	-	7.27	7.27	7.27	7.27

Pre Aeration Mixing:

Design Scenario	Units	Phase 1-MMF	Phase 1-MDF	Phase 2-MMF	Phase 2-MDF
(21) Specific Airflow Rate for Mixing	scfm/ft ²	0.12	0.12	0.12	0.12
(22) Volumetric Airflow Rate for Mixing	scfm/1000ft ³	10.60	10.60	10.60	10.60
(23) Airflow Requirement for Mixing (Q _{mix})	scfm	20	20	20	20

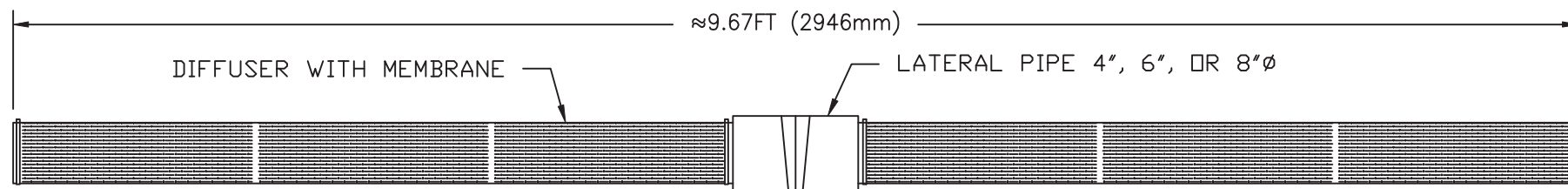
Pre Aeration Oxygen Requirement:

Design Scenario	Units	Phase 1-MMF	Phase 1-MDF	Phase 2-MMF	Phase 2-MDF
(24) Standard Oxygen Requirement (SOR = SOTR)	lb O ₂ /hr	11.8	11.8	18.6	16.3
(25) Airflow Requirement for Process (Q _{oxy})	scfm	55	55	92	79
(26) System Determining Airflow (Q _{mix} or Q _{oxy})	scfm	55	55	92	79
(27) Specific Airflow per Aerated Tank Floor Area	scfm/ft ²	0.33	0.33	0.55	0.48
(28) Airflow per Diffuser Membrane	scfm	2.10	2.10	3.54	3.04
(29) Diffuser Membrane Flux Rate	scfm/ft ²	2.39	2.39	4.03	3.46
(30) Standard Oxygen Transfer Efficiency (SOTE)	%	20.76	20.77	19.34	19.74
(31) Specific Standard Oxygen Transfer Efficiency (SSOTE)	%/ft	2.02	2.02	1.88	1.92
(34) Estimated Blower Operating Pressure	psig	6.33	6.33	6.42	6.39

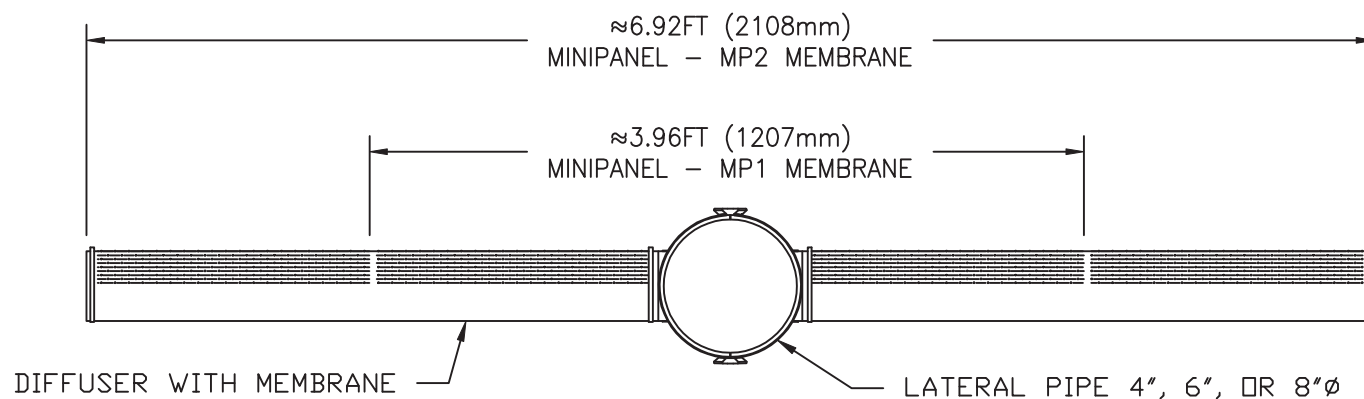


Pre Aeration AOR to SOR Calculation:

Design Scenario	Units	Phase 1-MMF	Phase 1-MDF	Phase 2-MMF	Phase 2-MDF
(49) Daily Aeration Time	h/d	24	24	24	24
(50) AOR per Hour	lb O ₂ /h	4.48	5.10	6.77	6.77
(51) α = Ratio of Oxygen Transfer Rate in Wastewater to Clean Water	-	0.54	0.54	0.52	0.52
(52) β = Ratio of Oxygen Saturation in Wastewater to Clean Water	-	0.95	0.95	0.95	0.95
(53) Site Elevation	ft	1,653.00	1,653.00	1,653.00	1,653.00
(54) Dissolved Oxygen (DO)	mg O ₂ /L	2.00	1.00	2.00	1.00
(55) Winter Wastewater Temperature (Tw)	°F	48	48	48	48
(56) Summer Wastewater Temperature (Ts)	°F	68	68	68	68
(57) AOR / SOR Winter	-	0.391	0.432	0.377	0.416
(58) AOR / SOR Summer	-	0.378	0.431	0.364	0.415
(24) Standard Oxygen Requirement (SOR = SOTR)	lb O ₂ /hr	11.8	11.8	18.6	16.3
(59) SOR Daily Design Value	lb O ₂ /d	284.4	284.3	446.4	391.6



PLAN VIEW OF MINIPANEL - MP3 MEMBRANE



SIDE VIEW OF MINIPANEL - MP1 & MP2 MEMBRANE

MEMBRANE ACTIVE AREA				
	SIMPLEX UNIT		DUPLEX UNIT	
MP1	0.88 FT ²	0.082 M ²	1.76 FT ²	0.164 M ²
MP2	1.76 FT ²	0.164 M ²	3.52 FT ²	0.328 M ²
MP3	2.64 FT ²	0.246 M ²	5.28 FT ²	0.492 M ²

NOTES:

1. DIFFUSER UNITS NON-BUOYANT AS WATER ALLOWED INTO END TO APPROXIMATELY 0.67FT FROM SUBHEADER.

FLEXAIR® AERATION PANEL

MINIPANEL MODEL - MP1, MP2, & MP3

EDI FLEXAIR® AERATION-MIXING SYSTEM

DATE: 1/12/2007

SCALE: N.T.S

ENG. BY:

CET

DWG. BY:

MLB

REV

F

DATE

12/2/15

DWG NO:

31896

ENVIRONMENTAL DYNAMICS INC.

5601 PARIS ROAD

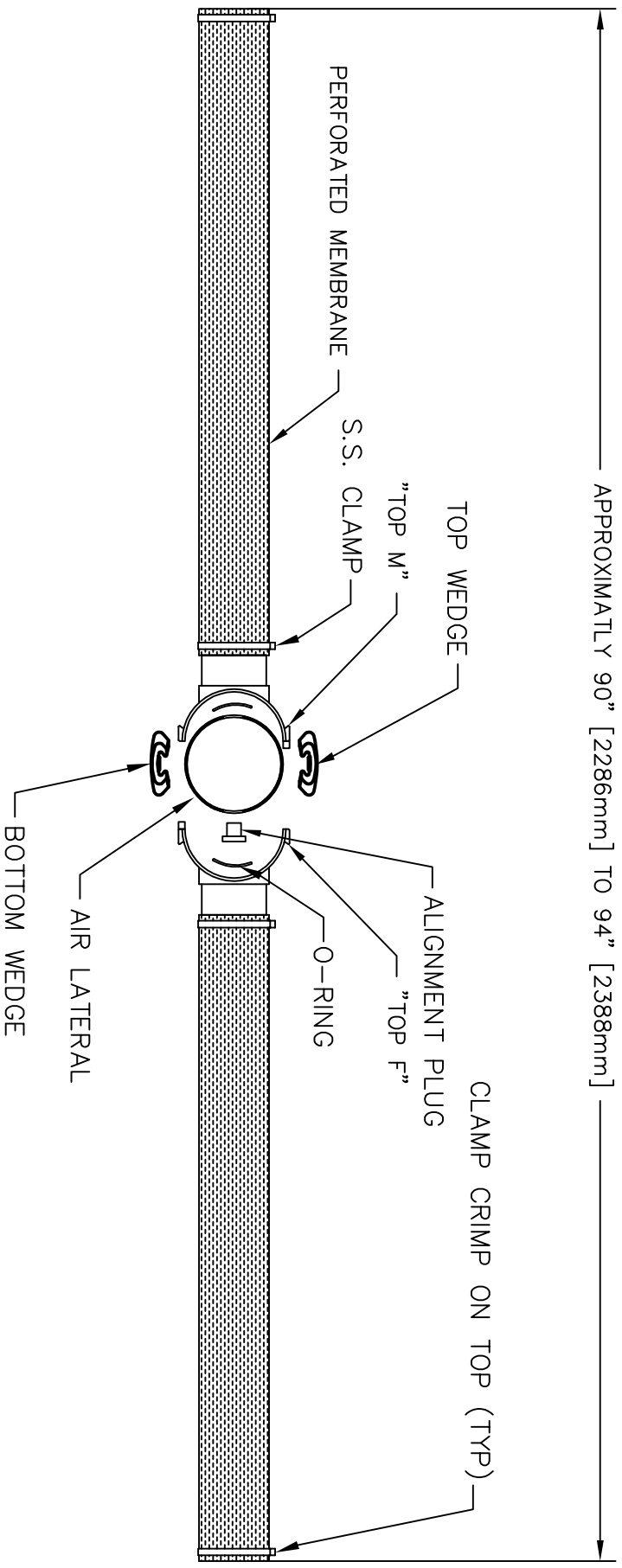
COLUMBIA, MISSOURI 65202

PHONE: 573-474-9456

FAX: 573-474-6988

WWW.WASTEWATER.COM





FLEXAIR® 84P MAGNUM DIFFUSER ASSEMBLY

WITH SDM SADDLE

TYPICAL SALES DETAIL

DATE: 1/11/2007 SCALE: N.T.S

ENG. BY: DWG. BY:

REV C DATE 10/11/11

DWG NO: 31895

ENVIRONMENTAL DYNAMICS INC.

5601 PARIS ROAD

COLUMBIA, MISSOURI 65202

PHONE: 573-474-9456

FAX: 573-474-6988

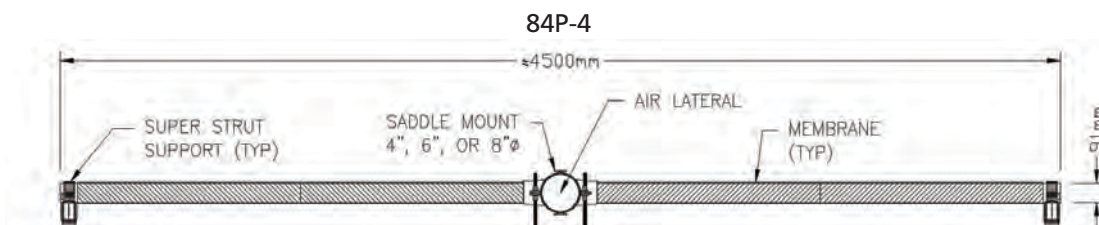
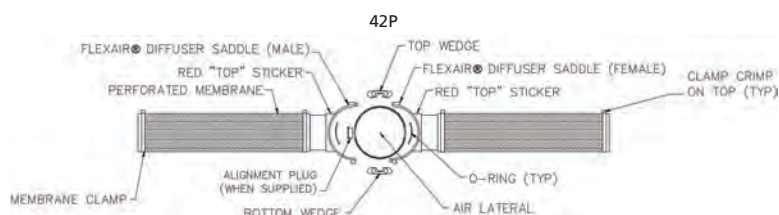
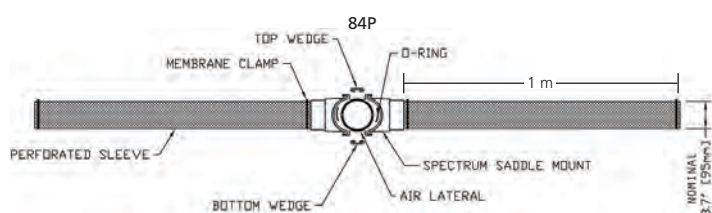
WWW.WASTEWATER.COM

FlexAir™ Magnum

Fine Bubble Flexible Membrane Diffuser



- Ideal for fine-bubble aeration upgrades
- Efficient geometry supports high-density installations of over 65% floor coverage
- Non-buoyant design for reduced uplift and stress on mounting connection
- Premium quality membranes available in EPDM, urethane, and Matrix Plus™ for reduced fouling and minimum maintenance
- Non-metallic construction available for maximum chemical, temperature, and UV resistance
- Triple-check valve design minimizes entry of liquid/solids into piping. Ideal for on/off applications



METRIC					ENGLISH				
Model	Typical Airflow	Overall Length	Operational Weight	Dry Weight	Model	Typical Airflow	Overall Length	Operational Weight	Dry Weight
	m ³ /h	mm	kg	kg		scfm	in	lb	lb
42P micro	0–16	1390	2.6	3.2	42P micro	0–10	54.8	5.8	7.1
42P high-cap	0–28	1390	2.6	3.2	42P high-cap	0–18	54.8	5.8	7.1
84P micro	0–32	2400	2.9	5.2	84P micro	0–20	94.3	6.3	11
84P high-cap	0–55	2400	2.9	5.2	84P high-cap	0–35	94.3	6.3	11
84P-4 micro	0–64	4880	16.6	10.4	84P-4 micro	0–40	192	36.7	23
84P-4 high-cap	0–110	4880	16.6	10.4	84P-4 high-cap	0–70	192	36.7	23

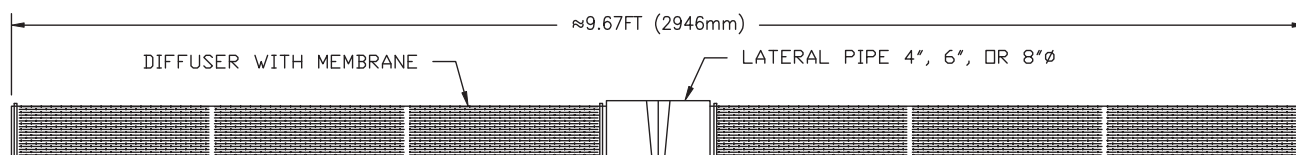
- * Values listed are per tube unless noted
- Optimum oxygen transfer efficiency is achieved when operating in the middle to low end of the airflow range.
- The approximate operating pressure of the diffuser at the mid-range is 10–22.5 inches H₂O (2.5–5.6kPa).
- Operating the unit at the high end of the range will result in reduced performance and increased operating pressure.
- Use the maximum airflow value for short term operations such as peak loads or system maintenance.

FlexAir™ MiniPanel

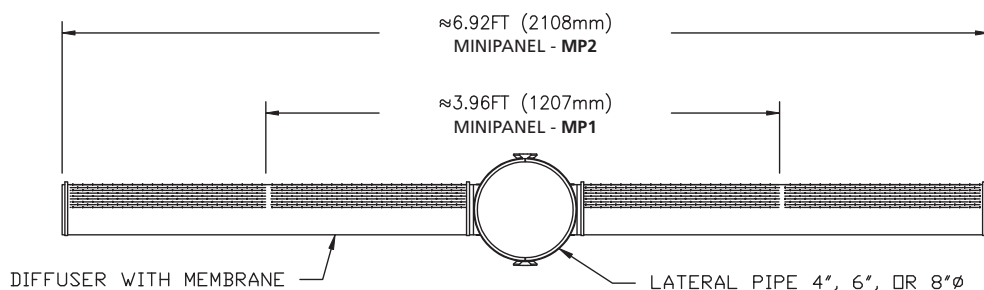
MP1, MP2, & MP3

- Fits 4", 6", 8", 110 mm and 160 mm air piping—plastic or stainless steel
- PVC construction for maximum chemical & UV resistance, and optional CPVC for maximum temperature resistance
- NanoPore™ and MicroPore™ perforation options available to match oxygen transfer, airflow and operating pressure requirements
- Simplex (single-arm) and Duplex (two-arm) configurations possible
- Horizontal projected diffuser area for maximum OTE performance. System geometry supports high-density installations of over 65% floor coverage
- Non-buoyant & cantilever design for reduced stress on mounting connections and for water cooling
- Advanced technology premium-quality membranes available in EPDM, polyurethane, PTFE Matrix™ and others

PLAN VIEW OF MINIPANEL - MP3 DIFFUSER UNIT



SIDE VIEW OF MINIPANEL - MP1 & MP2 DIFFUSER UNIT



METRIC

Diffuser Type	Perforation Type	Design Airflow m³/h	Active Surface Area m²	Operating Buoyancy kg	Dry Weight kg
MP1	Nano	0–4	.082	1.18	2.13
	Micro	0–10	.082	1.18	2.13
MP2	Nano	0–8	.164	1.74	3.42
	Micro	0–20	.164	1.74	3.42
MP3	Nano	0–13	.246	2.29	4.71
	Micro	0–32	.246	2.29	4.71

ENGLISH

Diffuser Type	Perforation Type	Design Airflow scfm	Active Surface Area ft²	Operating Buoyancy lb	Dry Weight lb
MP1	Nano	0–2.5	.88	2.6	4.7
	Micro	0–6.5	.88	2.6	4.7
MP2	Nano	0–5	1.76	3.85	7.55
	Micro	0–13	1.76	3.85	7.55
MP3	Nano	0–8	2.64	5.05	10.4
	Micro	0–20	2.64	5.05	10.4

- * Values listed are per tube unless noted
- * For high-capacity units, active area & air capacity doubled.
- Optimum oxygen transfer efficiency is achieved when operating in the middle to low end of the airflow range.
- The approximate operating pressure of the diffuser at the mid-range is 13 to 16 inches (3.2–4.0 kPa).
- Operating the unit at the high end of the range will result in reduced performance and increased operating pressure.
- Use the maximum airflow value for short-term operations such as peak loads or system maintenance.
- Short-term operation (peak conditions) up to 2x design airflow.

PLB Conveyor Compactor

Installation, Operation and Maintenance Manual

Include JWC typical submission sheet summarizing properties of equipment to be provided.

About this manual

Thank you for purchasing your IPEC PLB Series Conveyor Compactor. Please read these instructions before you attempt to install and operate your press. You can refer any questions to the IPEC Service Department.

This manual is divided into eight sections:

Section 1.0 General Information

Section 2.0 Installation

Section 3.0 Operation

Section 4.0 Maintenance

Section 5.0 Troubleshooting

Section 6.0 Components

Section 7.0 Drawings

Section 8.0 Passivation

Section 9.0 Warranty

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

Table of Contents

Section 1.0	General Information	4
Section 2.0	Installation	4
2.1	Handling Techniques	4
2.2	Initial Inspection	4
2.3	Location	4
2.4	Mounting	5
2.5	Piping Practices	5
2.6	Water Flush	5
2.7	Electrical Connections	5
Section 3.0	Operation	6
3.1	Start-Up Check List	6
3.2	Start-Up	6
3.3	Operations Checks	6
3.4	Operation	7
Section 4.0	Maintenance	8
4.1	Lubrication	8
4.2	Disassembly/Assembly	8
Section 5.0	Troubleshooting	12
Section 6.0	Components	13
Section 7.0	Drawings	
Section 8.0	Passivation	
Section 9.0	Warranty	

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

Section 1.0

General Information

- 1.1 This instruction manual is intended to assist with the installation, operation and maintenance of IPEC Conveyor Compactors. It is recommended that this manual be thoroughly reviewed prior to installation or operation of the screen.
- 1.2 The IPEC PLB Conveyor Compactor is designed to extract moisture from solids by compaction. Only solids capable of withstanding a high shear are suitable for this application. Solids made up of only fine particles, or soft particles, are not generally considered suitable. The amount of liquid that can be extracted depends on the type of solids. Typically, influent feeds of 1% - 10% solids are treated to 20% - 45% solids.
- 1.3 The press extracts liquids by compaction of the slurry against a tubular screen element with perforated round or slotted holes. Solids are retained by the surface areas; liquid is passed through the holes. Compaction is accomplished by transport of the influent solids by the rotation of the screw. The screw is designed so that pressure is gradually increased during transport, which helps in retaining solids. An adjustable pressure gate on the discharge end of the tube sets the final compaction force.

Section 2.0

Installation

2.1 Handling Techniques

Care should be used in moving the unit. The press unit should be lifted up by the frame only, using a forklift.

CAUTION: DO NOT PUT ANY LOAD ON THE PRESS SCREW OR TENSIONING ARMS.

2.2 Initial Inspection

Examine the equipment for any obvious damage or misalignment. Tighten any nuts and bolts that may have loosened during shipment.

2.3 Location

Locate the unit suitably to permit direct gravity discharge of pressed solids to a pit or bin. Ensure there is sufficient room for inspection and maintenance. For best access for disassembly of the unit, space to remove the screw (one screw length) should be provided in front of the discharge end. To remove the drive, twelve inches is required at the drive end.

PLB Series Conveyor Compactor

Installation, Operation and Maintenance Manual

2.4 Mounting

The press screw is mounted on a structural steel frame. The unit should be firmly secured to the base plates. Ensure that alignment to inlet and drain lines are in accordance with site drawings and that connections have been made before final setting.

2.5 Piping Practices

All piping should be supported independently and lined up with the inlet, shower and drain connections. **NEVER DRAW PIPING INTO PLACE BY USE OF FORCE AT THE FLANGED CONNECTION OF THE PRESS.**

2.6 Water Flush

Connect water line to NPNT port on press zone. For manual operation, install shut off valve (1/4 turn ball valve) near inlet. Most applications require a frequent showering with fresh water to flush organic residue from inert solids. Typically, a 6-10 second spray every 1-2 minutes will produce a clean dry solid plug. For application requiring frequent flushing, install automatic valve (solenoid). Supply appropriate timers or PLC control circuitry to sequence.

2.7 Electrical Connections

Connect power wiring to motor. Press can be operated using start signal to cross the line motor starter. Start should be interlocked to the infeed signal. A delay function on the infeed signal is recommended, timed to empty the Conveyor Compactor before periods of shutdown.

A frequency drive speed controller is sometimes required for best operation of the press. See Section 3.4. Check motor data to confirm ranges possible with motor supplied.

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

Section 3.0

Operation

3.1 Start-Up Check List

- 3.1.1 Lubrication – Ensure that the drive has adequate oil level as per the manufacturer's instruction manual. The shaft bearing has been lubricated before shipment.
- 3.1.2 Electrical – With motor power and control power locked out, check all conductor terminations and grounding. Check circuitry or operation switches and make and break contact on safety switches. Ensure that pull cord cable is tensioned. With power on, but with motors locked out in the field, review all VFD programming and check against the supplier's settings. (See VFD – Appendix B).
- 3.1.3 Piping – Check drainage and water shower connections.
- 3.1.4 Screw – Inspect along the full length of the screw. Remove all package materials and temporary bracing and assembly/construction debris. Ensure that no steel or other hard objects of in contact with the screw.

3.2 Start-Up

Start up the press drive to rotate drum. Check for proper rotation (clockwise from the drive end). Initially, run the drive at a low speed (20 Hz). There may be some minor scraping noises since the screw rides on the liners and screen.

The noises will disappear during actual operation due to the formation of a solids plug in the press zone.

3.3 Operation Checks

- 3.3.1 Inspect the Conveyor Compactor carefully and frequently during the first few hours of operation. Check complete unit for excessive vibration or unusual noises.
- 3.3.2 The screen elements may “blind” due to build-up of solids lodged between the screw and the screen element. If blinding is a persistent problem, check with the factory.

PLB Series Conveyor Compactor

Installation, Operation and Maintenance Manual

3.4 Operation

- 3.4.1 The shaftless Conveyor Compactor is designed to extract free water from coarse solids. Influent feeds containing mostly fine or very soft particulates may not be suitable. However, combinations of coarse and fine solids can be processed adequately with the appropriate settings for screw speed, plug press and flush wash sequence. As a general rule, 'fine' solids are processed at a slower speed, lower gate tension and/or more frequent shower applications.
- 3.4.2 The press can work with varying influent feeds. It is best to match operating sequence and speeds with the infeed rate. This avoids wear on liners and screen sections. A solids plug is always formed at the discharge end. To prevent this plug from solidifying, avoid long periods of non-use. During these times operate the shower system on a periodic cycle to keep the plug moist and free. During normal operations the shower is operated periodically to flush the fine solids expressed through the screen.

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

Section 4.0

Maintenance

4.1 Lubrication

Follow the lubrication schedule given below.

COMPONENT	FREQUENCY OF LUBRICATION	TYPE OF LUBRICANT	BRAND
Gear Box	Annually	Gear oil	Shell Omala 220

4.2 Disassembly/Assembly

4.2.1 Influent End Disassembly

- Lock out power. Access junction box on motor and disconnect power wires from terminal studs. Disassemble conduit at union adapter then remove wiring from electric motor. Remove friction fit dust cap from end of drive; remove hex cap bolt and heavy-duty washer from end of shaft. Remove the four (4) hex nuts holding the drive flange on to the end plate of the press housing.
- Since the drive is too heavy for manual manipulation, it is recommended that a davit or overhead frame and hoist be used with attachment to the eyelet of the drive casing. Slide the drive axially away from the screw shaft until mostly free, and then insure drive is supported by the hoist. If the drive is locked tightly onto the screw shaft due to long term drying of the shaft compound, the drive can be broken free using the extractor nut located between the shaft and the outboard end of the hollow drive shaft. Use a 7/8" NC hex cap screw, threaded into the extractor nut. Turning the cap screw through the nut and against the screw shaft will force the drive away from the shaft.

4.2.2 Discharge Gate

- Pull the tensioning arm away from positioning slots, and then drop arm and release tension. Remove bolt on the end of the gate rod, then slide the rod through the pivot holes.
- Tensioning arm can be disassembled by removing fasteners on each side of the housing. Once free, slide arm mounting ends to expose springs. Remove hex nuts from ends of arms, slide off tensioning springs.

PLB Series Conveyor Compactor

Installation, Operation and Maintenance Manual

4.2.3 Press Screen Removal

- a. Remove discharge gate as per instruction 4.2.2(a). Dislodge any built-up solids in the plug zone and manually remove. Using a 9/16" socket, remove all countersunk bolts on the discharge end. Remove discharge end plate. Access the press zone screen cylinder through the end and top openings to slide it out through the end. Due to dried press solids along the screen flange, it may be necessary to first apply dislodging force along the screen perimeter, using a mallet or a small pry bar.

4.2.4 Screw Removal

The screw can be removed from either end. It is simpler to remove through the discharge end, since the drive would be left intact. In either case the top covers should be removed.

- a. To remove the screw through the discharge end, first remove the discharge gate as per instruction 4.2.2(a). Remove all solids in the plug area in the press zone. At the drive, remove the dust cap and shaft securing bolt and washer. Slide the screw axially towards the discharge end. If the shaft does not move freely from the drive bore, use the extraction nut (see instruction 4.2.1). During removal the screw will need to be supported using a sling, overhead hoist, or lifting bar.
- b. To remove the screw through the influent end, first remove the end plate by removing the flange fasteners. The screen can be removed by sliding axially towards the discharge end. Once free of the press zone screen and/or influent fitting, the screw can be lifted out of the housing, support by slings and overhead hoist.

4.2.5 Trough Liner Replacement

Liners should be replaced whenever there is excessive contact between screw and screen or housing due to long term wear or whenever the liner is cracked or ripped. Do not allow wear to extend past half of original thickness.

- a. Remove covers and screw as per instruction 4.2.4. Liners are supplied in sections, remove individually. Using a flat head screwdriver pry the liner away from the retaining lugs along the edge of the liner. Once free pull the released edge upwards past the lugs. Clean out any accumulation of solids along the trough bottom.
- b. Place the new liner directly over the section that has been removed. Apply hand force along the bottom of liner and drive directly downward. Insure one

PLB Series Conveyor Compactor

Installation, Operation and Maintenance Manual

edge of liner is beneath retaining lugs and the other edge can be forced under the lug by hitting with a wood block [2" X 4" X 10"] and mallet.

- c. Reinstall screw and covers.

4.2.6 Influent Screen Brush Replacement

Brush is supplied in one (1) revolution segments. Compactor units usually have a full segment plus a partial segment of brush.

Lock out power and remove top access cover. Remove bolts attaching brush ring to screw. To access all bolts, it may be necessary to re-engage power and move the screw part of a revolution. Always lock out power before performing any maintenance in or around the screw.

Remove the brush and clean the screw of any residue solids. Using vice grips or 'C' clamps, position the replacement brush segment onto the screw, ensuring that the mounting holes on the brush align with the corresponding tapped holes on the screw. Apply no-cease compound to the stainless-steel fasteners, then install and tighten.

4.2.7 Assembly

The compactor unit should be assembled in the following sequence: liner; screens; screw; drive; shower sections and nozzles; discharge and tensioning arm; covers. Some modification to this sequence is possible since the screw can be inserted from either end and some components do not necessarily block access to other components.

- a. Liner

Install as per instruction 4.2.5.

- b. Screens

The influent end screen is not attached, but rests freely in the opening. Place the screen into position, ensuring that it is in contact with the housing all along the entire perimeter of the screen.

Slide the press zone screen through the discharge end opening. Align holes in the screen flange to mate with the anti-torsional pin on the housing. Position the screen so that the screen end is flush with the housing. Place the discharge end plate onto the end of the compactor housing and fasten.

PLB Series Conveyor Compactor

Installation, Operation and Maintenance Manual

c. Screw

Using appropriate rigging and an overhead hoist place the screw into the trough and slide the screw, axially, to extend into the compactor screen. Rest the screw in a temporary position with the shaft fully within the housing.

d. Drive

Mount the influent end plate on to the flanged ends of the housing and install fasteners. Place neoprene gasket into recessed ring. Lift drive and align drive mounting flange with studs on the end plate. Position the drive so that the flange mates with the corresponding recess on the end plate fasten using hex nuts and lock washers.

Apply no-seize compound to shaft, drive bore and keyway. Slide screw shaft into bore of drive, install key into keyway. From the drive side, place the extractor nut into hollow bore and install the snap ring into the groove located about 1" from the end of the hollow bore. Insure that the screw shaft extends fully to the extractor nut snap ring and secure using the hex head bolt and heavy-duty washer. Replace dust cap, slide the seal into the slot and secure.

e. Shower Nozzles

All nozzles and shower pipe sections are mounted with nozzles aligned with the slots on the screen.

f. Tensioning Gate

Install gate and tensioning arm in reverse of assembly instruction 4.2.1.

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

Section 5.0

Troubleshooting

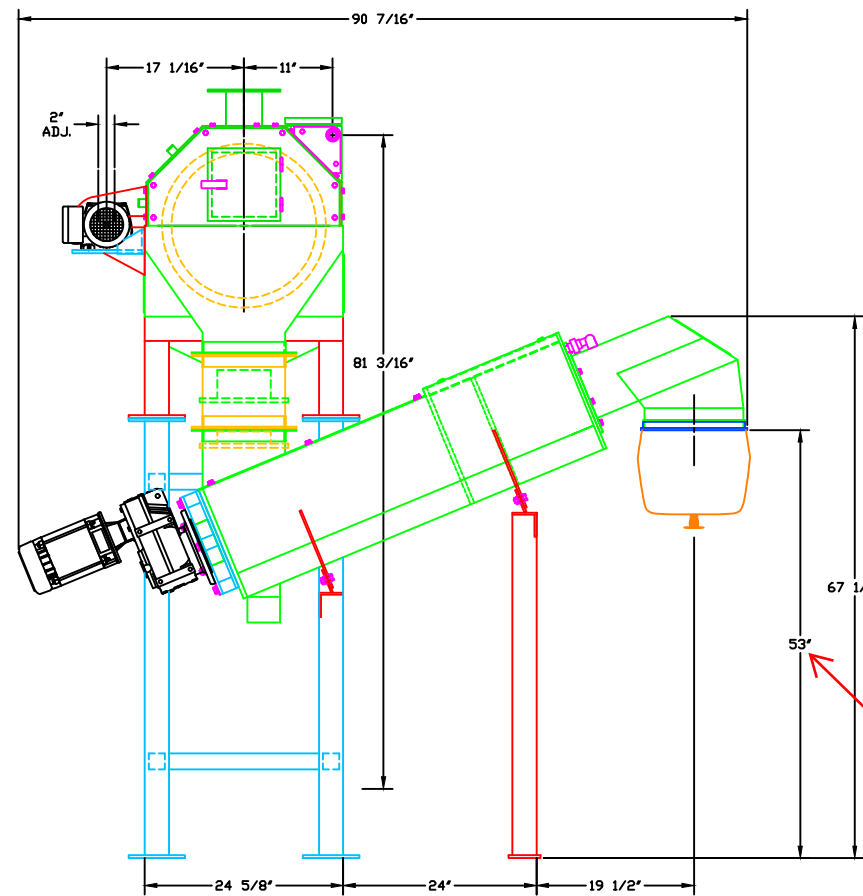
5.1 Troubleshooting

PROBLEM	CAUSE	CORRECTIVE MEASURE
Screeching noise	Contact of screw with screw or frame.	<ul style="list-style-type: none">◦ Screw bent - remove and straighten or replace.◦ Screw can be deflected due to tension - reduce pressure on pressure plate.◦ Material caught in screw - manually remove material.
Excessive solids in pressate	Pressure too high for type of solids	<ul style="list-style-type: none">◦ Reduce pressure by dropping tension arm to lower contact position.◦ Replace springs with ones of less tension.
Liquid in discharge solids	Pressure too low Screens blinded	<ul style="list-style-type: none">◦ Increase pressure on springs or replace with higher tension springs.◦ Manually clean screens with water spray.
Screw does not turn	VFD on overload Gear drive broken Screw bound with solids	<ul style="list-style-type: none">◦ Reset ETO and/or check VFD manual.◦ Check motor and/or gearbox as per manufacturer's manual◦ Reduce tension on pressure plate.◦ Manually remove solids.

PLB Series Conveyor Compactor Installation, Operation and Maintenance Manual

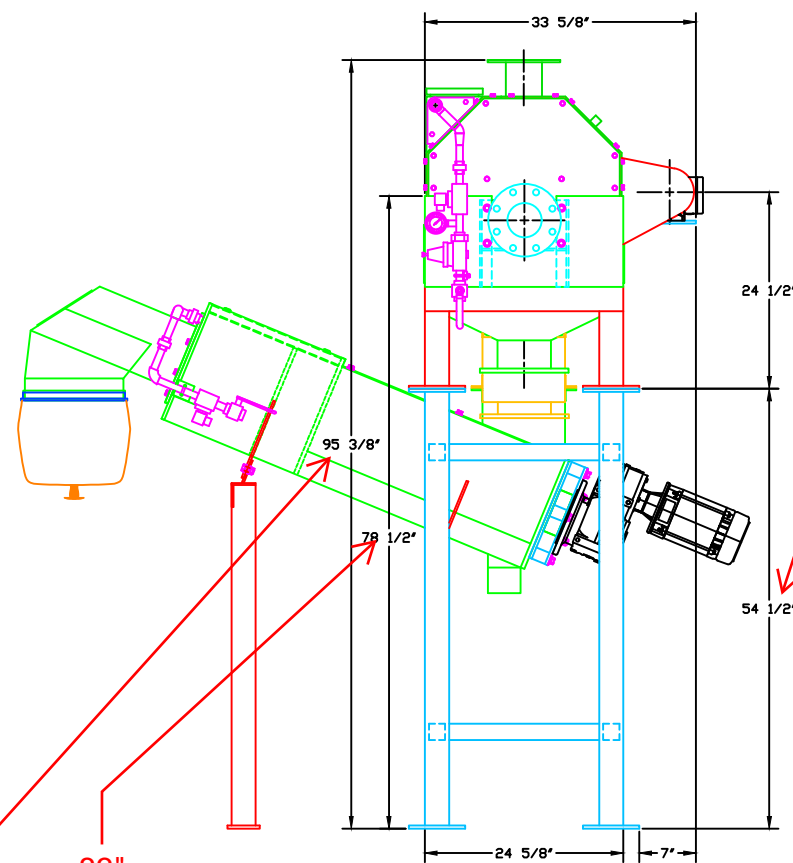
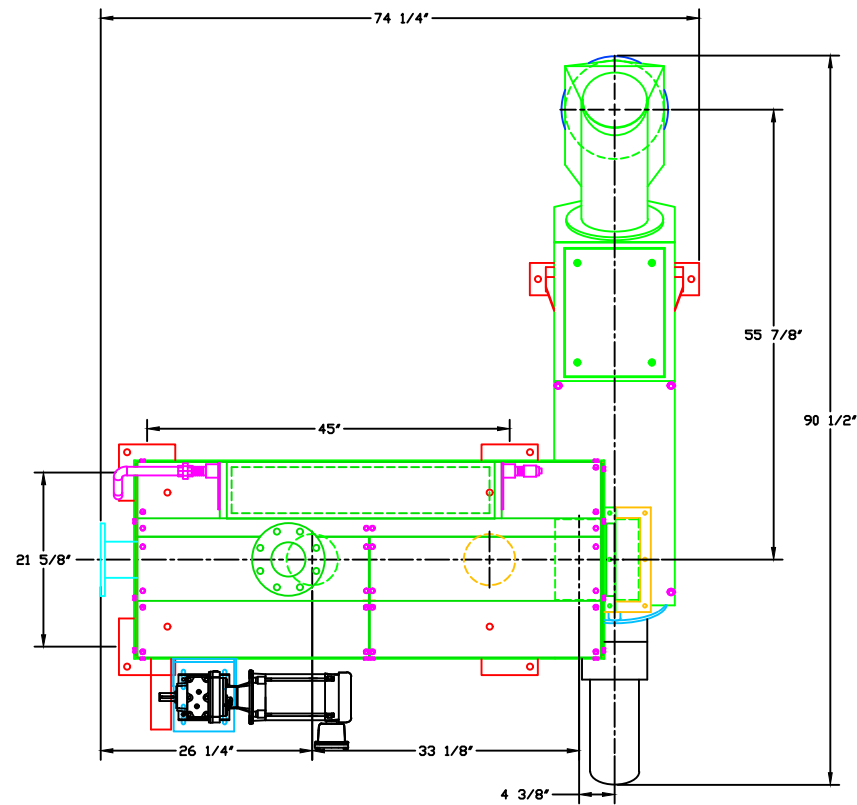
Section 6.0

Components



71.75

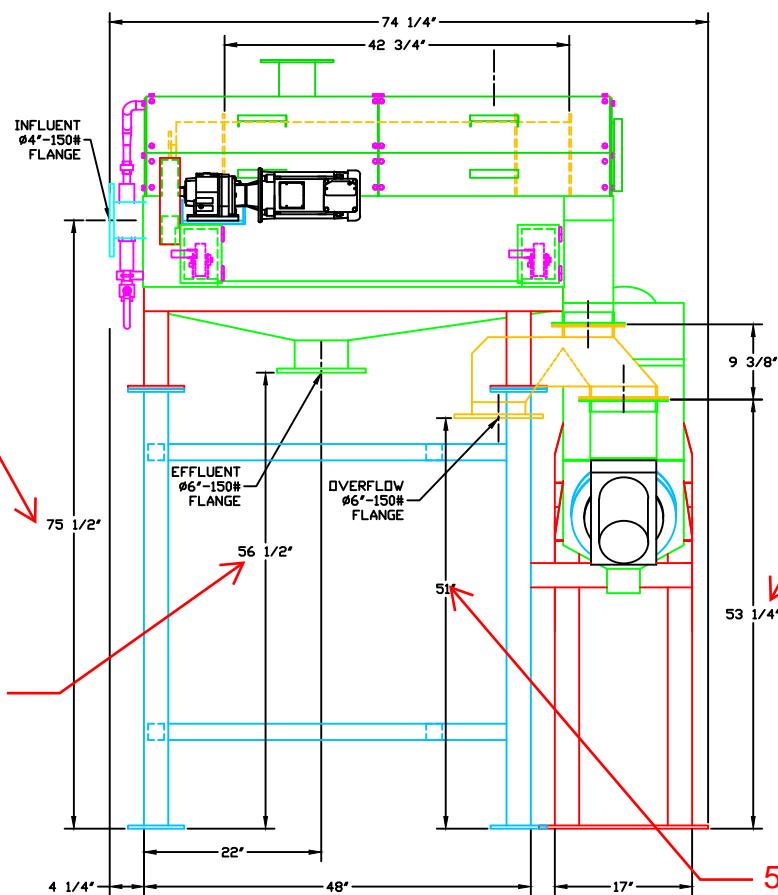
57.5



59

99-7/8

83



57.75

NOT FOR CONSTRUCTION

2	INCREASE OAH 8 1/2"	09/09/20	ARC
1	UPDATE	01/09/20	ARC
SYM.	DESCRIPTION	DATE	BY

REVISIONS			
CUSTOMER:		TITLE:	
***		JWCC	
***		JWC ENVIRONMENTAL CANADA ULC 2889 NORLAND AVE. BURNABY, B.C. CANADA. V5B 3A9 1 800 663 8409	
QUOTE NO: 20191211		PROJECT: ***	
SCALE: ***			
DRAWN: A.R.C.		CHK'D: A.R.I.	
DATE: AUG. 24, 2020		DATE: AUG. 24, 2020	
DWG. NO: M18PLB6201		REV. 2	

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

About this manual

Thank you for purchasing your IPEC IFM Series internally-fed rotary screen. Please read these instructions *before* you attempt to install and operate your screen. You can refer any questions to the IPEC Service Department.

This manual is divided into eight sections:

Section 1	General Information
Section 2	Installation
Section 3	Operating Instructions
Section 4	Mechanical Maintenance
Section 5	Major Components
Section 6	Troubleshooting
Section 7	Drawings
Section 8	Passivation
Section 9	Warranty

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

TABLE OF CONTENTS

1.1	General Information.....	1
1.2	Components.....	1
1.2.1	Headbox.....	1
1.2.2	Screen Drum.....	1
1.2.3	External Spray System.....	2
1.2.4	Internal Spray System (Optional).....	2
1.2.5	Frame Enclosure.....	2
1.2.6	Mechanical.....	2
1.3	Operation.....	3
2.1	Installation.....	4
2.1.1	Inspection.....	4
2.1.2	Moving Screen.....	4
2.2	Site.....	4
2.2.1	Base Area.....	4
2.2.2	Access.....	4
2.2.3	Mounting.....	4
2.3	Piping.....	5
2.3.1	Influent Piping.....	5
2.3.2	Effluent Piping.....	5
2.3.3	Spray Bar Piping.....	5
2.4	Electrical.....	6
2.5	Mechanical.....	6
3.1	Operating Instructions.....	7
3.2	Start Up.....	7
3.3	Extended Shut-down.....	8
3.4	Operating The IFM.....	9
3.4.1	Weir Adjustment.....	9
3.4.2	Drum Speed.....	9
3.4.3	Spray System.....	9
4.1	Mechanical Maintenance.....	10
4.2	Wheel Removal.....	10
4.3	Wheel Installation.....	12
4.4	Drum Removal.....	12
4.5	Mechanical Maintenance Schedule Sheet.....	13
5.1	Major Components.....	14
6.1	Troubleshooting.....	15
7.1	Drawings.....	
8.1	Passivation.....	
9.1	Warranty.....	

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

1.1 General Information

The IPEC IFM Rotary Screen is a device to remove suspended solids from wastewater. The separation process consists of flow of water by gravity over a screen surface which retains the solids. The IFM screen retains and moves the solids in such a way to insure a high throughput, with minimal physical size requirement.

The IPEC IFM Rotary Screen is made up of a cylindrical screen drum, an influent headbox and distribution weir, an enclosure with separate filtered water and reject solids outlets, spray shower drum cleaning system, and a gearmotor, chain and sprocket mechanical drive.

The IFM Series Rotary Screen is available with 36", 48" and 60" diameter drums. The IFM unit is ideally suited for high flow and light solids loading applications.

1.2 Components

1.2.1 Headbox

The standard headbox supplied is a flooded, trough-shaped tank, where influent enters a flanged connection on one end. The headbox is bolted on one end section of the enclosure, and part of the headbox extends into the interior of the screen drum. The sides of the headbox inside the drum are cut away to allow water to pass over adjustable weirs onto the screen.

The standard headbox is shaped and baffled to allow an even flow at the weirs. The headbox contains a cleanout port.

1.2.2 Screen Drum

The IFM Rotary Screen drum is a perforated plate screen cylinder attached on each end short to solid cylinders. The drum freely rests horizontally, on four wheels, spaced to ride on the solid cylinder sections of the drum. The influent end of the drum has an end plate to prevent water escaping. The other end is fully open for solids discharge.

The drum is fitted with a series of bars mounted on the screen's interior surface in a fashion that directs solids axially during rotation.

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

1.2.3 External Spray System

IFM Rotary Screens are equipped with an external spray bar for continual or intermittent cleaning of the screen slots using water or steam. The spray bar is mounted on the enclosure frame and contains fan shaped nozzles oriented to align directly with the screen openings. Nozzles are spaced 3 inches apart. The spray bar has NPT connections on either end for connection to supply.

1.2.4 Internal Spray System (Optional)

The internal spray bar is mounted on the interior section of the headbox. The fan jet nozzles are spaced at 4 inch intervals and are directed at a 60° angle so the spray will contact the drum obliquely. The spray bar is designed to clean the face of the wedge wire as well as the openings between the wires. The water source connection for the internal spray bar is accessible on the outside of the drum.

1.2.5 Frame Enclosure

The headbox, screen drum, spray bars, and mechanical components mount separately in an enclosure fitted with structural support members. This enclosure frame has top and bottom members with the bottom part having legs and mounting plates. The upper enclosure is in sections that can be easily removed for access to the interior equipment.

1.2.6 Mechanical

The IFT Rotary Screen drive system consists of a fixed speed gearedrive, drive sprocket, roller chain and driven sprocket, which is mounted on the influent endplate of the screen drum. The drive is a helical gear box with integral or C-flange motor. The drive sprocket is keyed and secured to the gearbox shaft with a set screw. The driven sprocket is bolted to the drum. The chain and sprocket are protected by a chain guard.

The wheels are constructed of solid, high density, polyurethane and fitted with precision ball bearings. They are secured to a stainless steel axle mounted in a support frame that is bolted to the frame. The bearings are grease lubricated through a passageway along the centre of the axle. The grease nipple is fitted on the end of the axle.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

1.3 Operation

Raw water entering the headbox is directed by baffles to flow at a slow, even speed over the distribution weirs. Water falls onto the side walls of the drum. The steeply directed influent flow and the movement of the drum create a shearing action at the water/screen interface that helps direct solids tangentially, rather than radially outward. Because of this, the solids separation is greater than the actual opening size. Solids, moving tangentially into the bottom of the drum, aggregate, and are nudged longitudinally by small deflector plates to the open drum end. Screened water is directed by the splash guards to the effluent opening.

The distribution weirs extend to only about two-thirds the screen length. The section not under the headbox is the solids free draining section that allows free liquid to escape the solids mass before discharge.

Under operation, the part of the cylinder actively performing separation is the lower sloped side walls. As the drum rotates out of the active zone, solids moving with it tend to dislodge by gravity and fall back into the drum bottom. To ensure that solids do not get permanently entrapped in the slot openings, the spray system is engaged to wash out any solids retained in the openings.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

2.1 Installation

2.1.1 Inspection

Before un-crating, examine packaging for any obvious damage. After un-crating, inspect for damage or unattached parts. Report any damage to your carrier and also notify IPEC.

Check all fasteners to ensure that they did not vibrate loose during shipment.

2.1.2 Moving Screen

The IFM Rotary Screen can be moved with forklift truck, with the forks placed under the transport skid. If overhead lifting equipment is used, using shackles, attach cables to lifting lugs at the four corners of the housing. It may be required to use spreader bars to ensure that no external forces are placed on the housing or covers. Always transport the IFM unit in level position.

2.2 Site

2.2.1 Base Area

The IFM Rotary Screen is designed for mounting on a level concrete or steel structure. The unit must be fully supported under the four legs of the enclosure frame

2.2.2 Access

An area two feet wide along the side of the unit must be left clear to adequately service, clean and monitor operation.

To remove the drum, an area above the unit of at least drum size, must be left open.

2.2.3 Mounting

Level the unit at the assigned location. Place shims under the leg base. Bolt the unit to the floor at each base plate. Do not allow securing force to distort the housing.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

2.3 Piping

2.3.1 Influent Piping

Connect the influent pipe to the standard (ANSI) pipe flange on the headbox. Do not use the headbox to support the piping.

Influent delivery may be either force main (pump) or gravity fed.

On a gravity system, the influent pipe should be horizontal, vented and sized at full port. Influent velocity in the pipe should not exceed 3 feet per second at the inlet port.

A pumped influent system requires an influent tank. The tank converts the higher velocity force main to the more moderate 2 – 3 feet per second flow required for even distribution onto the screen. With the tank option, force main influent velocity should be less than 12 feet per second to the tank.

2.3.2 Effluent Piping

Connect the effluent pipe to the standard (ANSI) pipe flange on the bottom of the drain pan. Do not use unit to support the pipe.

Long horizontal runs of drain pipe may not be able to accommodate the maximum capacity of the unit. Where reduced size drain pipe is used, ensure that the size, head and venting is sufficient.

Where the effluent line connects to a vessel with a water line above the inlet point, ensure piping is sufficient for self-venting.

2.3.3 Spray Bar Piping

The spray bar can be connected at either end with NPT fittings. A union or quick connect should be placed near the terminal. Be sure to route the piping so that it does not block areas of access to major components for removal and/or maintenance purposes.

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

2.4 Electrical

Connect the drive motor to the proper power source, as listed on the motor name plate. Control wiring or controls may not be supplied by IPEC. If not, review recommendations in Appendix E.

Electrical connections must be in accordance to all national and local codes.

2.5 Mechanical

Remove packing plug from gearbox and install supplied breather plug.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

3.1 Operating Instructions

The IFM Rotary Screen is designed to screen solids laden influent. Operating the screen for long periods without water is wasted power, extra water spray consumption, and unnecessary mechanical wear.

3.2 Start Up

Use the following procedure if the unit is initially installed or has shut down for a lengthy period.

- 3.2.1** Remove the inlet cover, discharge covers and the wheel covers and check if the wheels engage the drum squarely. Check the front and back of the drum to ensure that the drum is centred on the frame and is level. If one or more of the above conditions is not met, adjustments must be made.
- 3.2.2** Remove the chain guard and check the alignment of the two sprockets and the tension on chain. There should be a slight drop in the chain away from the theoretical tangent to tangent span of the chain. Adjust the position of the drive or drive sprocket if required. Reinstall the chain guard cover.
- 3.2.3** Check oil level in the gear reducer and fill to proper level. Install the gearbox breather plug, supplied separately, or remove the rubber grommet on breather plugs that have been factory installed. Review gear drive manual for other recommended inspections.
- 3.2.4** Check the position of the distribution weir and ensure adjustment bolts are secure. Check the clean out on the weir box and ensure that it is fastened close.
- 3.2.5** Start the drum motor, watching for any non-rotational movement in the drum. Normal rotation is clockwise. Stop the motor if rotation has to be reversed. Check noise level of chain.
- 3.2.6** While drum is rotating, turn on spray water to spray bar. Ensure that all nozzles are functional, the full length of the drum is contacted, and that the flat fan jet of the spray aligns radially with the slot. Adjust if necessary.
- 3.2.7** Start the influent. Inspect the headbox and observe headbox turbulence. The distribution weir may have to be adjusted to ensure an even flow onto the screen surface.
- 3.2.8** Reinstall covers.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

3.3 Extended Shut-down

If the IFM Rotary Screen is to be shut down for a long period of time, the unit should be drained and cleaned so that solids do not dry up on the surfaces and in the screen openings. The following steps will prevent problems.

3.3.1 Shut off influent to the headbox and the drive motor.

3.3.2 Open the drain on the headbox to allow water to discharge.

3.3.3 Start up the drive and turn on the spray system. Hose down the inside of the headbox and all parts of the screen drum, splash guards and headbox that are accessible from outside the unit. Do not stick hose nozzles or other cleaning equipment into the interior of the screen drum under rotation, or allow them to come in contact with any moving part of the unit.

3.3.4 Stop the spray system and the drive unit. Reinstall the drain cover on the headbox.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

3.4 Operating the IFM

3.4.1 Weir Adjustment

Adjust the distribution weir at the highest point that will handle the maximum anticipated influent flow rate without causing spillage over headbox sides or ends. Best results are usually obtained when there is an even flow across the full length. However, the weirs can be tilted somewhat if quicker solids removal or drier solids is required. The weirs are generally set up for equal spillage over both sides. By design, the side with the downward movement of the drum is capable of higher screening capacity. Adjust if appropriate to meet flow rate.

3.4.2 Drum Speed

The IFM unit is designed to operate at 4 rpm. This speed can be modified by changing sprockets if process conditions dictate.

For maximum longevity of the IFM unit, a low drum speed is recommended. Proper drum speed depends on solids concentration. Speed should be fast enough to prevent pooling of water on the bottom section of the screen. Also, the solids build-up that will accumulate towards the discharge end of the IFM can be decreased by increasing drum speed.

Best solids dewatering is at low drum speeds. Provided that the screen surface remains clean, solids may be able to accumulate in larger masses in the bottom of the drum. In this case, larger deflector plates could be installed to transport the solids. Check with IPEC for sizing.

3.4.3 Spray System

Adjust the spray bar so that the flat fan spray, under operating pressure, aligns in the same radial and longitudinal direction as the screen slots. Many screen situations do not require a continuous spray to maintain a clean screen face. In these cases, automatic (for short cycles) or manual (long time) spray application cycle can be implemented.

If solids contain congealing fats or oils, then spray with hot water or steam. If influent contain gelatinous materials, a higher flow could be required.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

4.1 Mechanical Maintenance

- 4.1.1 To ensure adequate cooling of the drive motor, remove build-up of dust, dirt or sludge material from depositing on the cooling fins of the motor casing or in and around the motor fan.
- 4.1.2 On gear box units equipped with ventilation ports, ensure that build-ups do not plug the opening **monthly**.
- 4.1.3 Gear box lubricating oil level should be checked every **3 months**. An oil change should be carried out after the initial 6 months of operation, and once every two years thereafter. However, under severe environments or operating conditions, oil should be changed more frequently.

It is recommended the lubricating oil listed in the gear drive manual be used. Other oils with comparable specifications can be used, but it is generally not permissible to mix oils from different manufacturers.
- 4.1.4 The drive chain should be oiled once per week for continuously operating units. Lightweight, non-detergent oil is standard. Drive chain tension and sprocket alignment should be checked **monthly**.
- 4.1.5 Wheels and bearings should be greased **monthly**. Standard petroleum based bearing grease is normally used.

4.2 Wheel Removal

The screen drum is held in place by the four wheels. It is important that, whenever maintenance is performed on the wheels, the screen drum is secured. Remove a wheel from the IFM unit as follows:

- 4.2.1 Stop the influent. Allow the IFM drive unit and spray system to operate several minutes to remove the residual solids.
- 4.2.2 Stop the drive unit and spray.
- 4.2.3 Stop drive and lock out power. Remove cover.
- 4.2.4 Remove wheel cover.
- 4.2.5 Place wood or rubber chocks on the base frame against the roll cylinder to prevent vertical displacement of drum.
- 4.2.6 Unbolt the wheel frame from the base frame and pull the whole wheel assembly directly away from the roll cylinders. Remove as a unit then disassemble as follows:

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

- a) Unbolt the wheel axle, and disengage the axle from the frame.
- b) To remove the wheel bearing, use press to force the bearing from the wheel core.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

4.3 Wheel Installation

4.3.1 Insure that the shaft is free of rust.

4.3.2 After ensuring that the bore of the wheel is clean, position the wheel in the frame, then slide the axle through the frame and wheel. Attach axle locking nut.

4.3.3 Place the wheel assembly at the respective location on the base frame. Ensure that the wheel support frame is square to the base frame, then install the three bolts and lock washers to attach the wheel assembly. Tighten securely.

4.3.4 Remove any temporary supports and position drum onto wheels. Install bolts in front and back of wheel frame base before final tightening. Insure that wheels are square to the drum, drum is centred on enclosure, and drum is level. Adjustments in the opposite side wheel frame may have to be made to insure all alignment parameters. Tighten frame bolts.

4.4 Drum Removal

To remove the drum, some sort of secure overhead mechanical lifting device may be required to ensure safety of the drum.

4.4.1 Follow 4.2.1 to 4.2.3.

4.4.2 Disconnect spray bar piping and chain guard. Remove guard all enclosure covers.

4.4.3 Disconnect the spray collection trough and remove the distribution weirs.

4.4.4 On IFM units with the headbox supported on the solid discharge end, unbolt the tank support arms at both ends and remove.

4.4.5 Unbolt influent piping and remove piping for headbox clearance. Unbolt headbox flange fasteners, then slide headbox from interior of drum.

4.4.6 The drum should be lifted by placing a sling around each roll ring, fastening the sling to overhead lifting device, and applying necessary force to elevate the drum about 2 inches above the wheels. Position drum so that drum ends clear all support structure. Once clear, the drum can be lifted vertically. It is now completely free of the frame. When depositing the drum outside the frame, ensure that it is supported by the roll ring section. Do not allow any localized force to bear on the screen section of the drum.

IFM Series Rotary Screen

Installation, Operation and Maintenance Manual

4.5 Mechanical Maintenance Schedule Sheet

This schedule is intended for use in a preventive maintenance program. Service frequencies are estimates for typical environments. These frequencies should be adjusted as necessary to accommodate the operating environment. When checking the components, check for unusual noise, leakage, or heat build-up.

	Manual Section	Weekly	Monthly	Three Months	Two Years
Drive Motor, Cooling Fins, Casing	4.1.1		I		
Gear Box Ventilation Openings	4.1.2		I		
Gear Box Lubricating Oil	4.1.3			I	S
Drive Chain Lubrication	4.1.4	S			
Wheels, Bearings Grease	4.1.5		S		
Wheel Position and Wear	4.1.5		I		

Inspection Codes: I = Inspection S = Service

IFM Series Rotary Screen Installation, Operation and Maintenance Manual

5.1 Major Components

IFM Series Rotary Screen

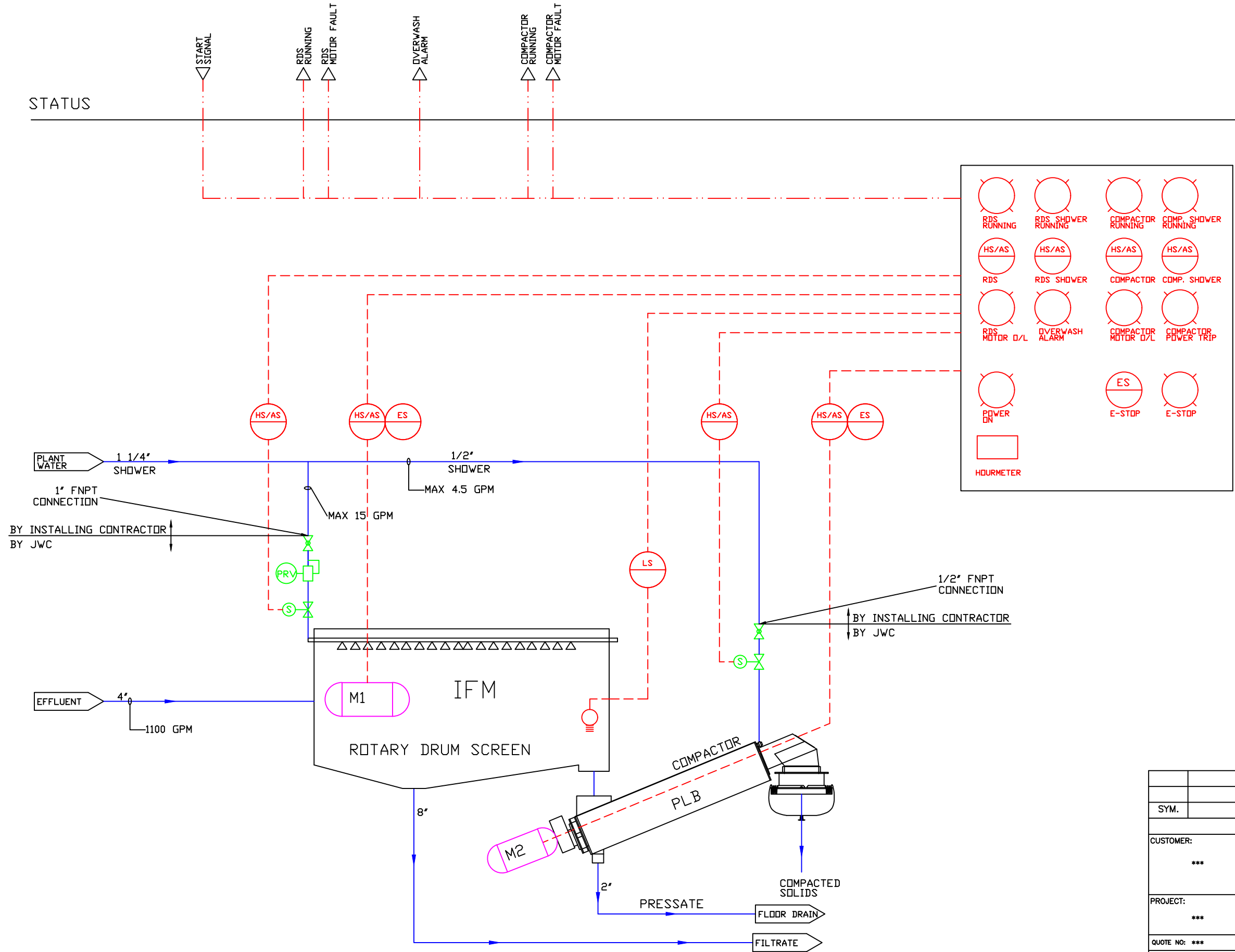
Installation, Operation and Maintenance Manual

6.1 Trouble Shooting

Mechanical

Symptom	Indication	Problem	Correction
Drum does not ride smoothly	Scraping noise	Drum shifted axially, axial stabilizers worn	Replace worn stabilizers
		Drum shifted radially	Inspect wheels and wheel bearings, replace if bore does not match shaft. Review lubrication schedule
Drive chain misaligned	Rattling noise	Drive sprocket worn or misaligned	Realign drive sprocket Readjust slack in drive sprocket/driven sprocket
		Drive chain stretched or linkage pins worn	Replace chain
Water leaking from unit	Water along covers or through wheel wells	Spray nozzles misaligned	1. Align all internal nozzles radially 2. Align end nozzles axially
		Spray nozzles partially plugged	Clean out or replace nozzles
Excessive water in discharge solids	Free water in solids	Screen partially blinded	Manually clean screen. Check shower nozzles & shower pressure
		Too high solids load or hydraulic flow	Check operating parameters, throttle flow if necessary
		Blockages in headbox	Clean out headbox or along full length of weirs.
Filtrate water spilling from housing		Outlet piping blocked	Clean lines
		Outlet pipe under stress due to un-vented flow	Check for submerged outlet. Check with IPEC for effluent sizing charts.
Drive Fault	Rattling noise	Drive/motor connection fault	Replace coupling
		Gear Wear	Hand rotate gear from motor fan. Inconsistent movement indicates gear or bearing worn.
	Oil Leak	Seal fault	Check breather plug 1. Seal may have popped from internal pressure. 2. Worn output or input bearing. Replace bearing and seal.

STATUS



SYM.	DESCRIPTION	DATE	BY
REVISIONS			
CUSTOMER: ***	TITLE: IFM 36 ROTARY SCREEN C/W SCREENINGS COMPACTOR PROCESS & INSTRUMENT DIAGRAM	JWCC JWC ENVIRONMENTAL CANADA ULC 2889 NORLAND AVE. BURNABY, B.C. CANADA. V5B 3A9 1 800 663 8409	
PROJECT: ***			
QUOTE NO: ***	PROJECT: ***	SCALE: ***	
DRAWN: A.R.C.	CHK'D: A.R.I.	DWG. NO: M36PLB401	REV. 0
DATE: ***	DATE: ***		

High Flow Pump Accessories: Backpressure and Pressure Relief Valves

Description

Part No.

Backpressure, antisiphon and pressure relief valves



In-line pressure relief valve (3 port)



Backpressure valve (2 port)



Backpressure valve on tee for pressure relief

Technical data

Size:

1/2", 3/4", 1", 1-1/2" and 2" NPT

Diaphragm

Materials:

PTFE-faced EPDM

Liquid Handling

Materials:

PP, PVC, PTFE, PVDF
316 Stainless Steel

Pressure Adjustment:

0-150 psig (0-10.3 bar)

Flow rates @ 150 psig:

1/2" (PP, PVC) - 200 U.S. gph (757 L/h)
1/2" (PVDF, TT, SS) - 300 U.S. gph (1135 L/h)
3/4" - 300 U.S. gph (1135 L/h)
1" - 500 U.S. gph (1893 L/h)
1-1/2" - 900 U.S. gph (3407 L/h)
2" - 1200 U.S. gph (4542 L/h)

Max. Temperature:

PP - 195°F (90°C)
PVC - 140°F (60°C)
PTFE - 250°F (121°C)
PVDF - 250°F (121°C)
316 Stainless - 250°F (121°C)

Backpressure (2-port) valves may be used in-line to provide a constant discharge pressure for protection from siphoning, or they may be teed off of the discharge line for pressure relief, discharging back to the source tank or to the pump suction line to create a bypass.

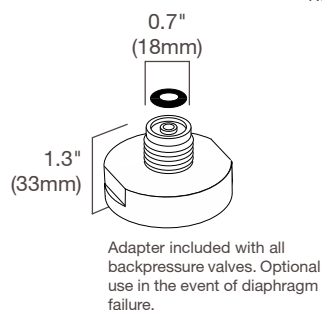
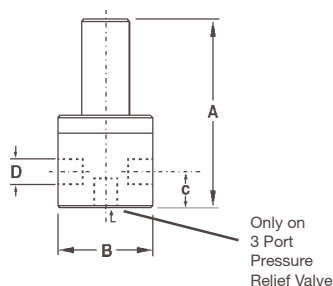
Pressure relief (3-port) valves are mounted in the discharge line, featuring a separate relief port which discharges back to the source tank or to the pump suction line to create a bypass.

Backpressure valves provide several functions: they improve repeatability by providing a constant discharge pressure; they provide antisiphon protection for discharge into pressurized water lines or vacuums, or where suction head exceeds discharge head; and they minimize pulsation when used in conjunction with a pulsation dampener.

In-line backpressure/antisiphon and pressure relief valves

These adjustable backpressure (2-port) and pressure relief (3-port) valves have FNPT ports and require tubing adapters for use with flexible tubing.

Can be adjusted with screwdriver.



DIMENSIONS: 1/2" to 2" valves

D	A (in)	B (in)	C (in)
1/2"	4.9	2.6	1.2
*1/2"	*5.5	*3.5	*1.125
3/4"	5.4	3.5	1.1
1"	5.7	3.9	1.4
1-1/2"	8.5	4.6	2.2
2"	8.5	4.6	2.2

*Note: Dimensions apply to SS and PTFE valves only.

High Flow Pump Accessories: Backpressure and Pressure Relief Valves

Description	Part No.
-------------	----------

Backpressure, antisiphon and pressure relief valves

1/2" FNPT valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1006846	1006858
PVC	1006850	1006862
PVDF	1006854	1006866
316 SS	1008796	1008800

3/4" FNPT valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1006847	1006859
PVC	1006851	1006863
PVDF	1006855	1006867
316 SS	1008797	1008801

1" FNPT valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1006848	1006860
PVC	1006852	1006864
PVDF	1006856	1006868
316 SS	1008798	1008802

1-1/2" FNPT valves

Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1006849	1006861
PVC	1006853	1006865
PVDF	1006857	1006869
316 SS	7302243	7302261

2" FNPT valves

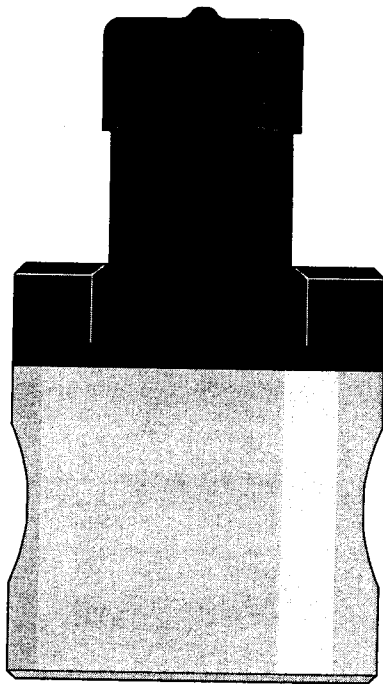
Material	Backpressure Valve (2-port)	Pressure Relief Valve (3-port)
PP	1009448	1009456
PVC	1009449	1009457
PVDF	1009450	1009458
316 SS	7302247	7302265

Spare diaphragms

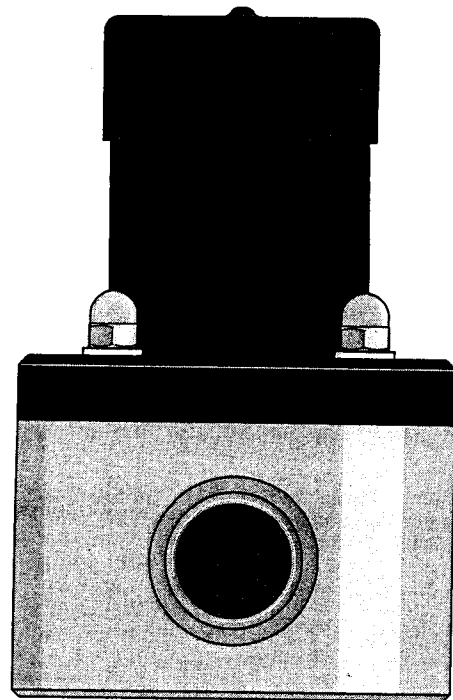
3/4" - 1" valve PTFE/EPDM	1006814	1006814
1-1/2" - 2" valve PTFE/EPDM	1006815	1006815
1/4" - 1/2" valve PTFE/EPDM	1006813	1006813

Operating Instructions

Backpressure valve BPV-DM



Size 1/4", 1/2"



Size 3/4", 1", 1 1/2", 2"

General instructions for use

Please read through these instructions for use carefully. They will enable you to make the best possible use of this operating instructions manual.

The following sections are highlighted in the text:

- Enumerated points
- Instructions

Working instructions:

IMPORTANT

Guidelines are intended to make your work easier.

and safety instructions:



WARNING

Describes a potentially dangerous situation. Could result in serious injury if preventative measures are not taken.



NOTICE

Describes a potentially dangerous situation. Non-observance can lead to damage to property.

Please read the operating instructions through completely before commissioning this equipment! Do not discard! Any part which has been subject to misuse is excluded from the warranty!

	Page
General instructions for use	2
1 General description	4
2 Safety	4
3 Installation	5
4 Commissioning	6
5 Maintenance	8
6 Repairs	9
7 Troubleshooting	11
8 Technical data	11
9 Installation examples	13
10 Spare parts	14
11 Dimensional drawing	15

1 General description

The backpressure valves in the BPV-DM series are internal-flow diaphragm valves.

The BPV-DM series backpressure valves serve to produce a constant counter flow for precise feed and/or to protect against overdosing or to increase metering precision in the case of fluctuating backpressure metering, against atmospheric pressure or into a vacuum.

They are particularly suitable for use in connection with pulsation dampeners to produce low-pulsation metering.

2 Safety

Correct use

- The backpressure valves are only suitable for use with liquids.
- The BPV-DM backpressure valves are designed to produce a constant backpressure for precise feed and/or to protect against overdosing or to increase metering precision in the case of fluctuating backpressure metering, against atmospheric pressure or into a vacuum.
- The BPV-DM backpressure valves are used in conjunction with pulsation dampeners to produce low-pulsation metering.
- The stated BPV-DM properties are only guaranteed in connection with ProMinent pumps!
- All other uses and modifications are forbidden.
- The backpressure valves are not designed for use with gaseous chemicals or solids.
- The BPV-DM backpressure valves are not safety valves!
- The BPV-DM backpressure valves must not be used as safety valves!
- The backpressure valves may not be used with chemicals which will attack the valve materials (see ProMinent resistance lists in the product catalogue and homepage).
- The backpressure valves may not be operated outside the ambient and operating conditions specified in these operating instructions (e.g. P-T diagram).
- The backpressure valves may be operated by suitably trained and authorised personnel only.



NOTICE

- The BPV-DM diaphragm must be examined monthly by a competent person regarding any possible damage e. g. ruptured or swollen diaphragms. See chapter 7 "Repairs" dismantling the backpressure valve.
Otherwise the BPV-DM may block therefore bursting the dosing pipe as well as badly damaging the pump.
- Always secure pressure pipes with a separate safety valve against excess pressure!
Otherwise the BPV-DM may block therefore bursting the dosing pipe as well as badly damaging the pump.
- Wear protective clothing and glasses when working with or near chemicals!
- Flush all components that are in contact with chemicals prior to servicing!
- Secure all chemicals and equipment making them inaccessible to children and pets!
- Dispose of all chemicals and waste according to all local, state and federal regulations.

3 Installation



NOTICE

- Backpressure valves are not absolutely watertight when closed, i.e. they are not stop valves.
Use e.g. a solenoid valve for this purpose.
- Always secure pressure pipes with a separate safety valve against excess pressure!
Otherwise the BPV-DM may block therefore bursting the dosing pipe as well as badly damaging the pump.
- Remove all water from backpressure valves before assembly if used with materials which should not come into contact with water.
- The backpressure valves should not be installed under mechanical stress (e.g. from the pipework system).
- Note the direction of flow through the backpressure valve (direction of flow arrow on valve body).

- The backpressure valves may not be used with chemicals which will attack the valve materials (see ProMinent resistance lists in the product catalogue or on the homepage).
- Observe national regulations.

IMPORTANT

Valves can be assembled anywhere in the pipe system and in any position (Note the direction of flow!).

4 Commissioning

The pressure temperature diagram (P-T diagram) gives the material resistances of the different backpressure valve versions (for water).



NOTICE

The pressure and the temperature of the metering chemical must lie below the corresponding curve. The backpressure valve may otherwise fail prematurely.

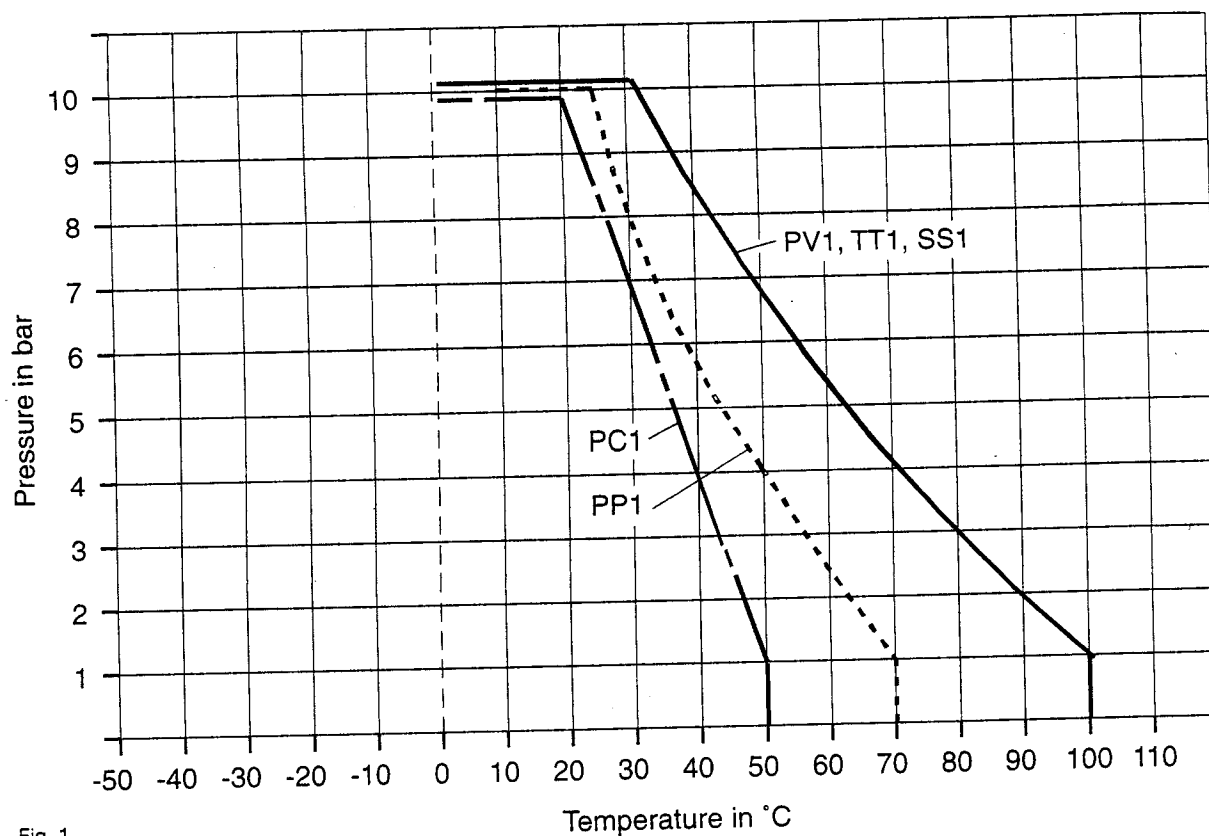


Fig. 1
3322-4



WARNING

- If the preset pressure is too high, system parts may burst.



NOTICE

- The preset pressure P_E at the backpressure valve must always be less than the maximum admissible operating P_N of the pulsation dampener, pump and pipework.
- Note that a dangerous situation can arise within the system if the stop valve is opened or flow is admitted before the backpressure valve has been adjusted. Ensure you have followed the correct procedures.
- The preset pressure P_E at the backpressure valve must always be greater than the admission pressure P_V plus the differential pressure ΔP which occurs as a result of delayed mass in the tubing between pump and BPV (see figure):

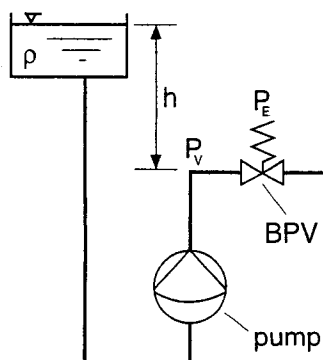
$$P_E > P_V + \Delta P$$

ΔP is approx. 1.5 bar
in standard tubing
up to approx. 3 m length

Admission pressure P_V on the backpressure valve is caused by a fluid column height h and a fluid density ρ (see figure):

$$P_V = \frac{h \times \rho}{1000}$$

P_V in bar
 h in cm
 ρ in g/cm³



Settings instructions



NOTICE

- The backpressure valve must be preset under the operating conditions in which it will eventually be used. Never adjust on a test bed and then install into a system. (Note the viscosity of the metering chemical).

A manometer should be installed in the pipework to enable the pressure to be set precisely (see also "Installation examples").

- Remove cap seal (7) (see Fig. 2).
- Unscrew the pressure adjuster (6) to release the pressure (until it moves freely).
- Open the stop valves in the discharge line.
- Switch on the pump.
- Set the desired operating pressure by screwing in the pressure adjuster plate (6) (read the pressure setting off the manometer).
- Check for a short period to see whether the operating pressure setting remains constant and that the threaded connections are watertight.

Depressurising

- Unscrew the pressure adjuster (6) to release the pressure.
- Recheck the set pressure later as described under "Settings".

5 Maintenance

Once every
month:



WARNING

- If in any doubt at all change the diaphragm, otherwise the BPV-DM can block!
Otherwise the BPV-DM may block therefore bursting the dosing pipe as well as badly damaging the pump.
- The required maintenance interval may be shorter depending on the metering chemical and the operating conditions.
Otherwise the BPV-DM may block therefore bursting the dosing pipe as well as badly damaging the pump.

The BPV-DM diaphragm must be examined monthly by a competent person regarding any possible damage e. g. ruptured or swollen diaphragms. See chapter 7 "Repairs" dismantling the backpressure valve.

6 Repairs

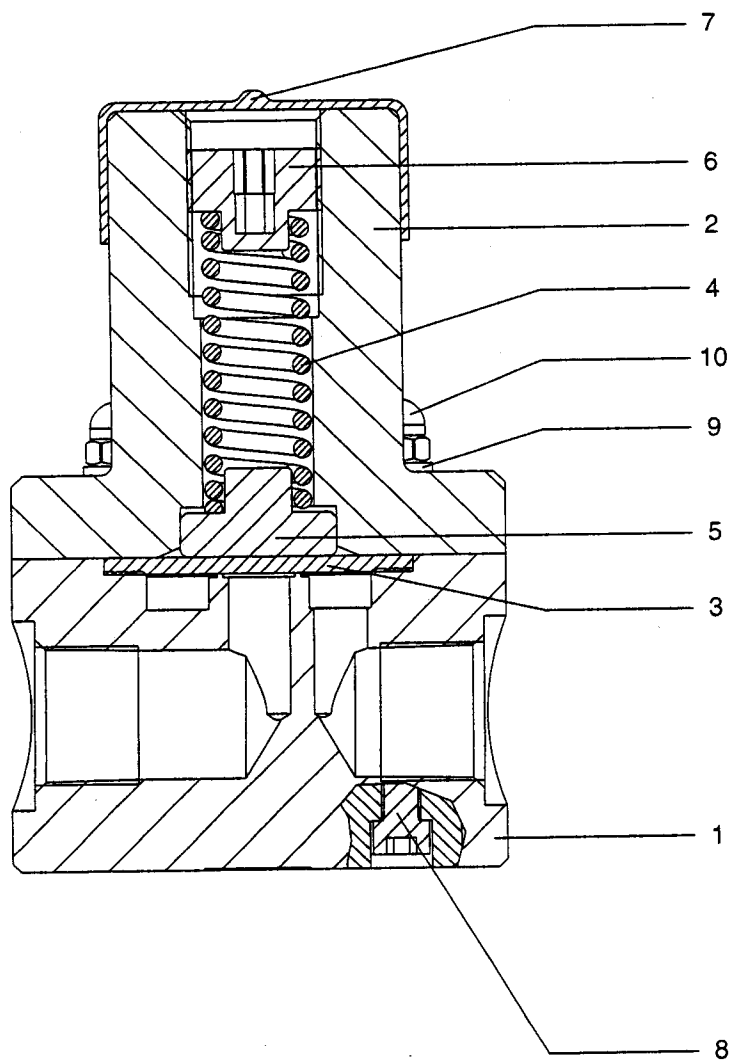


NOTICE

- **Protect yourself against hazardous chemicals.**
- **Isolate pipework and empty.**
- **Empty backpressure valve and flush out with a neutral rinsing agent.**

Dismantling backpressure valve (see Fig. 2):

- Place valve upright.
- Remove cap seal (7).
- Loosen pressure adjuster (6) until the compression spring (4) is fully relaxed.
- Loosen housing screws (8) on the valve body (1) and loosen and pull out cover (2).
- Remove the cover (2).
- Release the diaphragm (3) from the cover (2) with a blunt instrument.
- Allow compression spring (4) and plate spring (5) to drop out of the cover (2).
- Check the diaphragm (3) for changes and replace if in any doubt.
- Position a new diaphragm on the valve body with the teflon layer face down (light grey)!



Pos. 8-10 only for valves NPT $\frac{3}{4}$ " - 2"

Fig. 2
63_03-101_00_14-74x

Reassemble backpressure valve:

Reverse above procedure to reassemble.

Starting torque for housing screws:

5-6 Nm (sizes $\frac{3}{4}$ " and 1")

8-9 Nm (size 1 $\frac{1}{2}$ " and 2")

IMPORTANT

Recheck the starting torque of the screws after 24 hours in operation.

7 Troubleshooting

(see Fig. 2)



WARNING

If the BPV-DM pressure adjuster is leaking pressure in front of the BPV-DM could build up resulting in a burst.

In case of leakage necessary safety measures are to be taken and the pressure should be reduced immediately.

Fault	Cause	Remedy
Pressure increases over the preset value	Diaphragm (3) faulty	Replace diaphragm (3) (see section 6)
Does not reach preset pressure	Valve the wrong way around	Rotate valve (note direction of arrow)
Leak at diaphragm (3) height	Insufficient torque on the screws (causing lack of diaphragm tension)	Retighten grub screws (8) and nuts (10) (see section 6)
Leak at pressure adjuster (6)	Diaphragm (3) faulty	Replace diaphragm (3) (see section 6)

8 Technical data

Storage and transport temperature:

The backpressure valve must never be exposed to frost!

Maximum admissible operating temperature: see P-T diagram (Fig. 1)

The Q_{\max} maximum flow of the backpressure valves has been fixed at a pressure of $P_{\max} = 45 \text{ psi} = 3.4 \text{ bar}$ (preset pressure = $30 \text{ psi} = 2.3 \text{ bar}$):

Valve type	Q_{\max}	
	gal / h	l / h
BPV-DM NPT 1/4"	132	500
BPV-DM NPT 1/2"	132	500
BPV-DM NPT 3/4"	235	890
BPV-DM NPT 1"	345	1300
BPV-DM NPT 1 1/2"	740	2800
BPV-DM NPT 2"	740	2800

The values for Q_{\max} are valid for constant flow velocity of water at 77 °F (25 °C) only!

Technical data

The following applies for the flow velocity when operating dosing pumps without pulse damper $Q_{u_{max}}$:

$$\begin{aligned} \text{Motor dosing pumps: } Q_{u_{max}}^u &= Q_{max} / 3 \\ \text{Solenoid dosing pumps: } Q_{u_{max}}^u &= Q_{max} / 20 \end{aligned}$$

Combination options:

The backpressure valve/ pump combination options are restricted by the maximum flow of the backpressure valve.

Materials

Pos.	Description	PP valve	PVC valve	PVDF valve	SS valve
1	Valve body	PP	PVC	PVDF	316S/1.4404
2	Cover	PVC	PVC	PVDF	316S/1.4404
3	Diaphragm	EPDM/PTFE rubberised			
4	Compression spring	1.4310			
5	Plate spring	PVDF			
6	Pressure adjuster	PVDF			
7	Cap seal	PE			
8 *	Grub screw ISO 4762	V2A			
9 *	Disc DIN 125	V2A			
10 *	Nut DIN 1587	V2A			

* not size 1/4" and 1/2"

9 Installation examples

IMPORTANT

Read through the operating instructions for your pump (learn more from e.g. "General operating instructions for ProMinent® motor-driven metering pumps and hydraulic accessories")

Examples:

1. Use as backpressure valve to produce a constant counter flow
2. Use with pulsation dampeners to produce low-pulsation metering
3. Use with high admission pressure

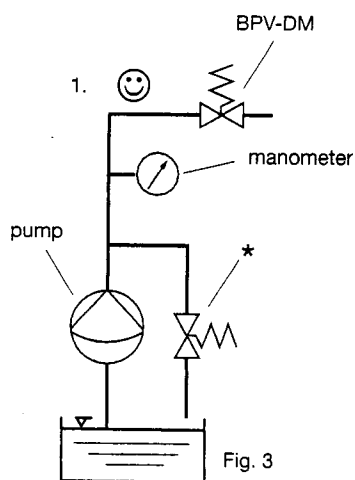


Fig. 3

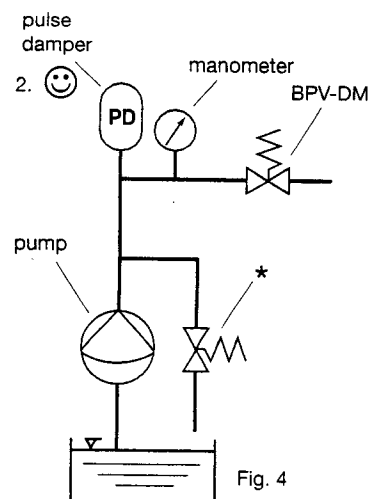


Fig. 4

* safety pressure relief valves

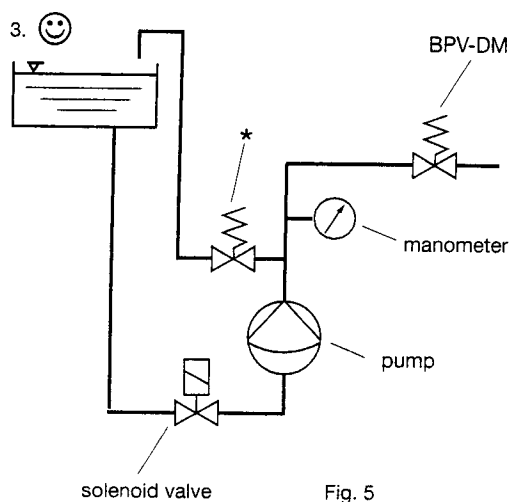


Fig. 5

* safety pressure relief valves



WARNING

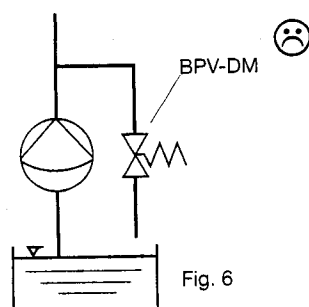
- The BPV-DM backpressure valve may block due to a diaphragm rupture and therefore the dosing pipe may burst and the pump could be badly damaged!

Always secure pressure pipes with a separate safety valve against excess pressure!

- The BPV-DM backpressure valves must not be used as safety valves!

They may block due to a diaphragm rupture and therefore the dosing pipe may burst and the pump could be badly damaged!

Always use a safety relief valve as a relief valve!



10 Spare parts

Description	Position*	Connections					
		1/4"	1/2"	3/4"	1"	1 1/2"	2"
Diaphragm	3	1006813	1006813	1006814	1006814	1006815	1006815
Compression spring	4	1006810	1006810	1006811	1006811	1006812	1006812

* see Fig. 2

11 Dimensional drawing

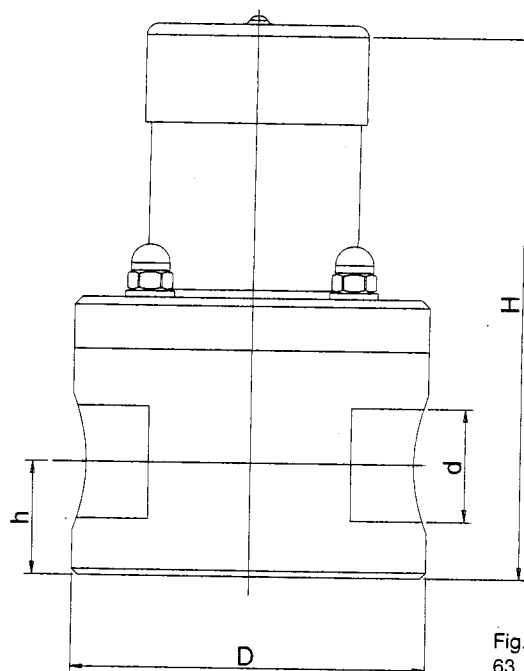


Fig. 7
63_03-101-00_16-74

d ["]	Thread type	h [mm]	D [mm]	H [mm]
1/4	NPT	31	65	125
1/2	NPT	31	65	125
3/4	NPT	28	88	136
1	NPT	36	98	145
1 1/2	NPT	56	118	217
2	NPT	56	118	217

Addresses and delivery through manufacturer:

ProMinent Fluid Controls Ltd.
Finisklin Industrial Estate
Sligo, Co. Sligo
Ireland
Tel.: +353 (71) 51222
Fax: +353 (71) 51225
prominent@indigo.ie

KOBOLD KAL-L (KAL-8000 Series)

Thermal Air Flow Switch

User Instructions



KOBOLD Instruments Inc. 1801 Parkway View Drive Pittsburgh PA 15205

Phone (412) 788-2830 • Fax (412)-788-4890

Manual-KAL-L_3-99

Table Of Contents

1.0	General	1
2.0	Specifications.....	1
3.0	Mechanical Installation.....	3
3.1	Installation General	3
3.2	Installation of Units with NPT Thread Connection.....	5
3.3	Installation of Units with HVAC Flange Connection	5
4.0	Electrical Connections	5
5.0	Operation	6
5.1	Flow Setpoint Adjustment	6
5.2	Adjustment of the Start-up Time Delay	8
6.0	Maintenance	9
7.0	Need Help with Your KAL-L Flow Switch?	9

List of Diagrams

Diagram 2.1:	Dimensions.....	2
Diagram 3.1:	General Installation	4
Diagram 3.2:	Required Straight Pipe Runs.....	4
Diagram 4.1:	Electrical Connections.....	5
Diagram 5.1:	Interior Controls Layout for the KAL-L.....	6

List of Tables

Table 2.1:	Model Number Codes	3
------------	--------------------------	---

CAUTION: For safety reasons, please read the cautionary information located at the end of the manual, before attempting installation.

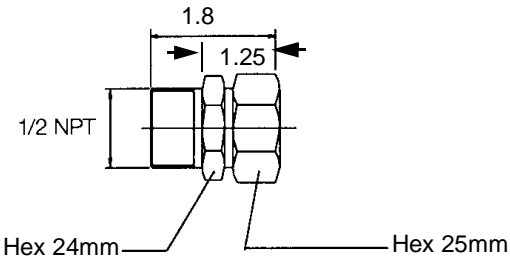
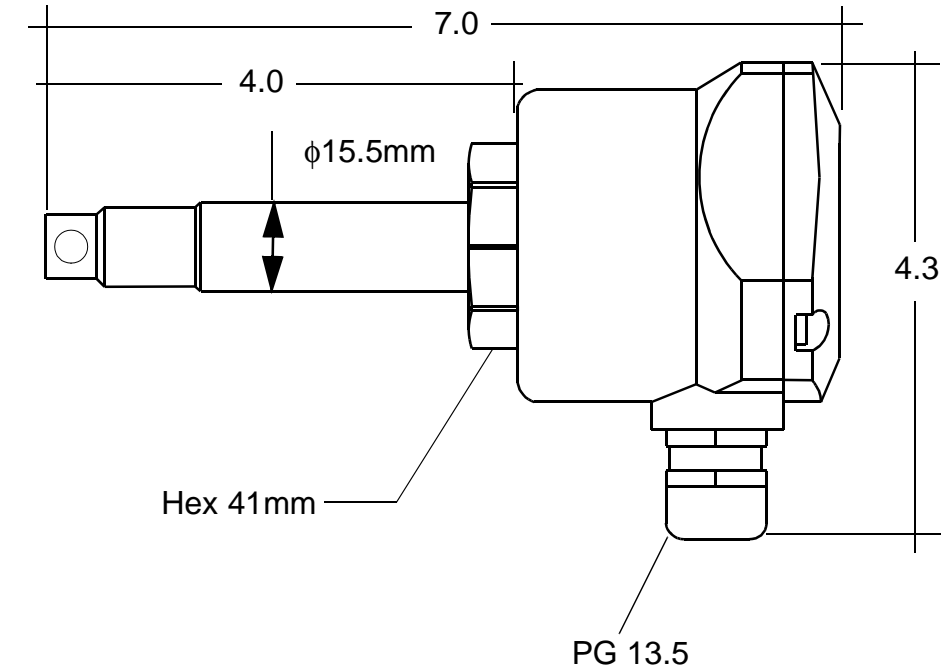
1.0 General

The KAL-L (KAL-8000 Series) Thermal Air Flow Switch uses the proven calorimetric principle to monitor the flow of air or non-hazardous gases. A sensing resistive thermal device (RTD) is heated to a few degrees above the temperature of the flow medium. As the medium flows across the sensing RTD it cools the RTD. The rate of cooling is proportional to flowrate. A second RTD measures medium temperature and the KAL-L electronics uses this measurement to compensate for changes in medium temperatures thus preventing false readings due to medium temperature transients. If the measured flow value drops below the setpoint value, an output relay is activated providing an alarm or control input.

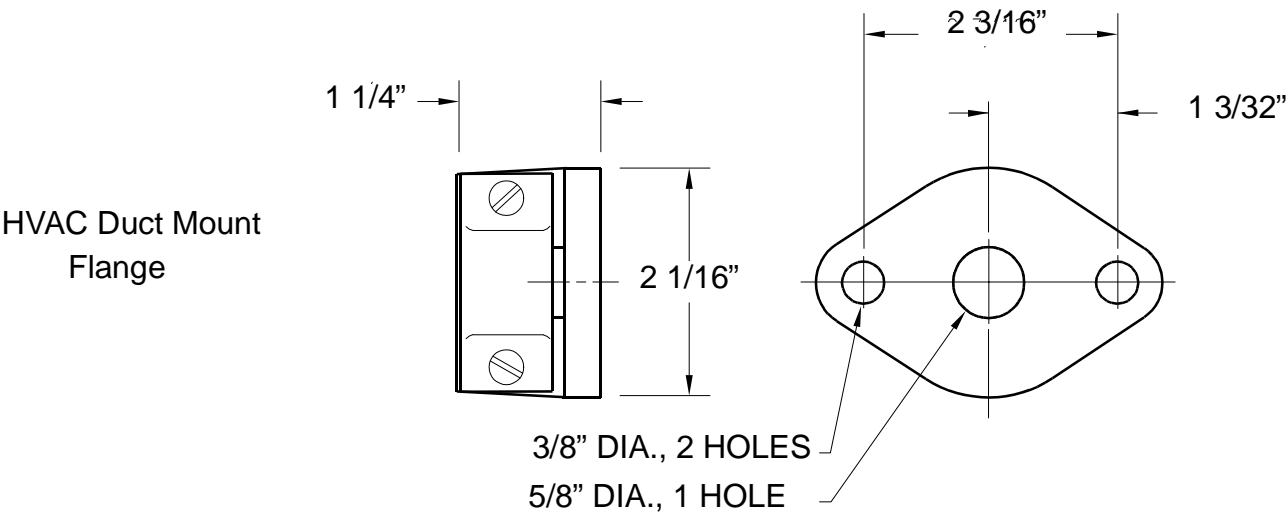
2.0 Specifications

Switching Range:	3.3 to 66. feet/second @68°F/14.5 PSIA Restricted span for other pressure and temperature conditions
Accuracy:	±10% of flow rate
Repeatability:	±1% of flow rate
Display	
Flowrate:	8 LED trend indicator
Switchpoint:	Flashing LED in trend indicator
Switch Status:	Dual colored LED RED = Flow below switchpoint GREEN = Flow above switchpoint
Max. Temperature Gradient:	30°K(°C)/Min. @ 25 feet/sec and 190°F
Response Time:	Adjustable 1 to 60 seconds
Warm-up Time:	30 seconds
Max. Pressure:	120 PSIG
Temperature Range	
Process:	-10 to +250°F
Ambient:	+15 to +140°F
Wetted Parts:	Ni-Plated brass
Housing:	Nylon
Electrical Data	
Power Requirements:	24 VDC/VAC +10%/-15%
Switch Characteristics:	1-SPDT relay Max. 250 VAC/4 A/1000 VA
Electrical Connection	
Standard:	PG 13.5 Cable gland
Optional:	1/2" NPT Conduit or M-12 plug
Protection:	NEMA 4/IP 65

Diagram 2.1 Dimensions



1/2" NPT
Compression Fitting



All dimensions in inches
Unless otherwise noted

Table 2.1 Model Number Codes

Model Code	Description
KAL-8115	15mm smooth bore probe with 1/2" NPT compression fitting
KAL-8115FL	15mm diameter probe with clamping flange per DIN 43 743
Options	
Option Suffix	Description
-M12	NEMA 4 electrical plug connector
-C	1/2" NPT conduit connection

3.0 Mechanical Installation**CAUTION**

Prior to mechanical installation, ensure that the process flow velocity to be monitored is within the switching range of the device. Also ensure that system temperature and pressure are within the limit of the device. See Section 2.0 "Specifications".

3.1 Installation General

The following general installation instructions and precautions apply to all KAL-8000 series installations:

- 3.1.1 The probe tip **must be inserted a minimum of 3/8" beyond the inside diameter of the pipe or duct into which it is to be installed.** Best results are obtained if the probe is inserted into the pipe or duct 1/2" or greater.
- 3.1.2 In order to ensure that the sensing elements are facing directly into the flow stream, a notch has been placed on the probe hex nut to aid in alignment. For optimal results, the probe should be installed so that the notch is aligned directly over the centerline of the pipe or duct.
- 3.1.3 In order to ensure a uniform flow profile across the probe tip, install the probe to allow for 10 pipe diameters of straight run piping upstream and 5 downstream. This piping should be free of tees, elbows, bends, valves, dampers or any other such appurtenances.
- 3.1.4 The probe should not be installed in the lower hemisphere of the pipe or duct. Liquid and debris which collect in the lower portion of the pipe will cause the probe to function erratically if they come in contact with the probe.

Diagram 3.1 General Installation

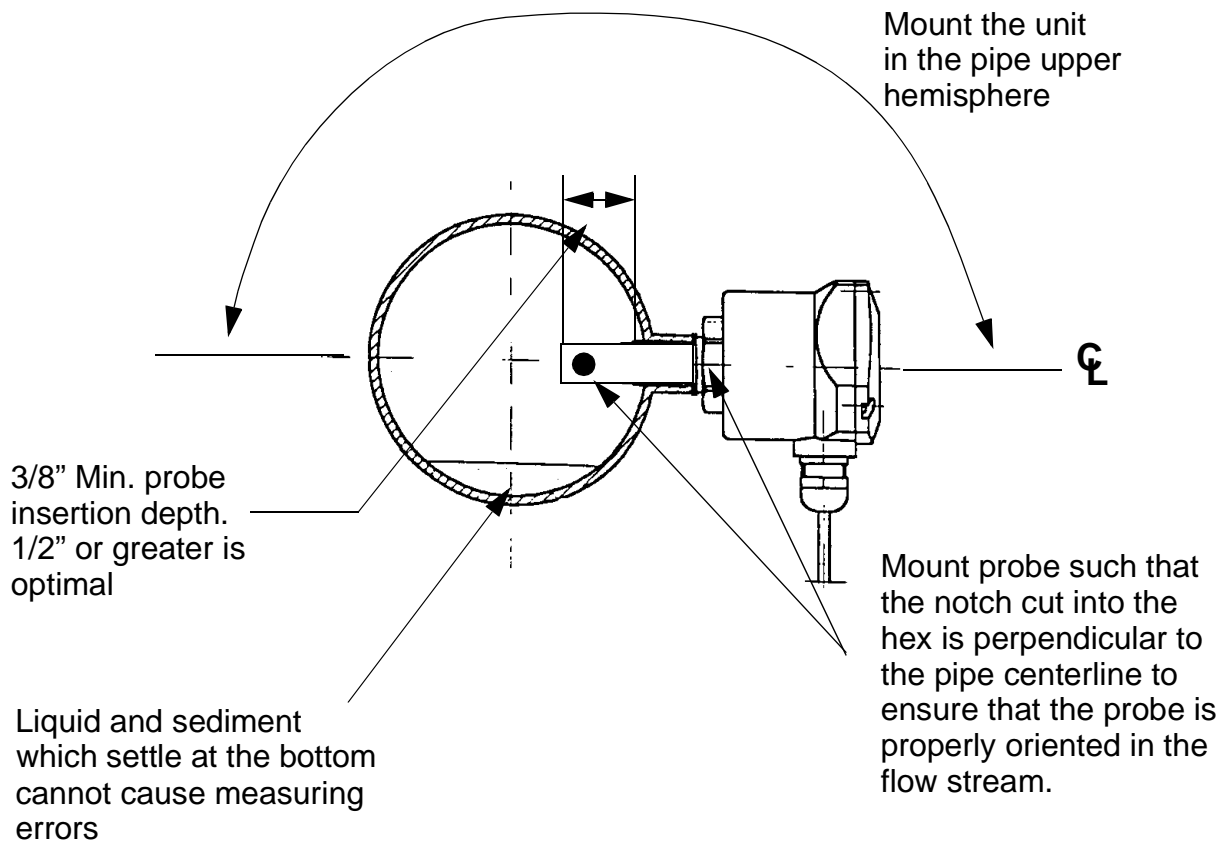
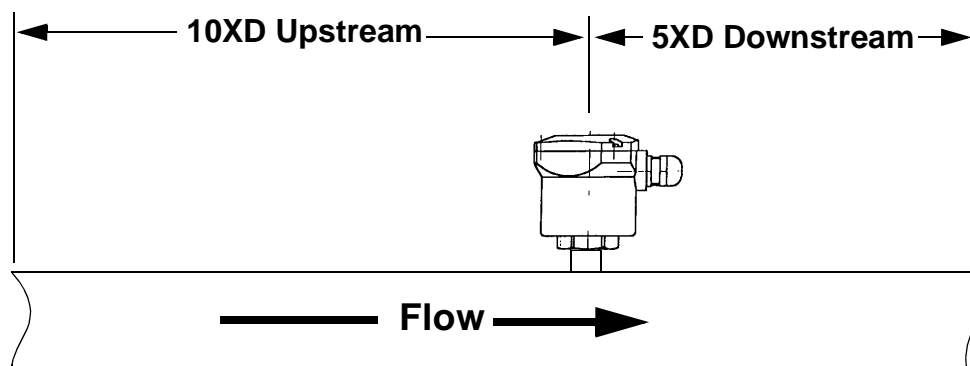


Diagram 3.2 Required Straight Pipe Runs



- 3.2.1 Units with NPT threaded connections are best suited for round pipes or ducts in which systems are under pressure. The NPT connection makes a leaktight seal to 120 PSIG.
- 3.2.2 The threaded connection should be installed into a pipe via a 1/2" weld coupling or a pipe tee with 1/2" connection. If a bushing is used to reduce a larger fitting size to 1/2", ensure that the probe insertion requirements are met. See Section 3.1 "Installation General".
- 3.2.3 Ensure that a thread sealant such as teflon tape is used to seal the threads.

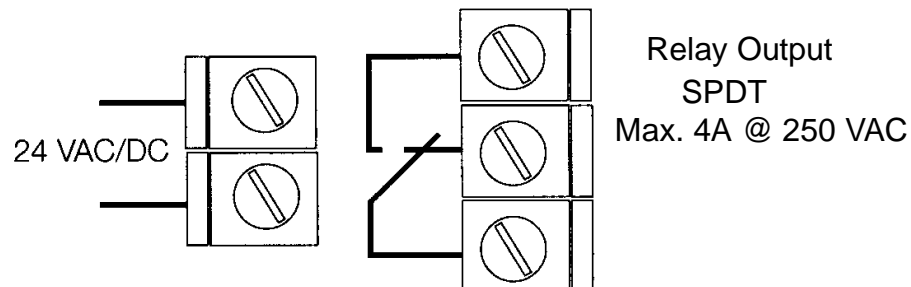
3.3 Installation of Units with HVAC Flange Connection

- 3.3.1 Units with flanged connections are best suited for square ducts in HVAC applications where adding an NPT connection is impractical.
- 3.3.2 Prior to installing the flange, the flange face which contacts the surface of the HVAC duct should be sealed using a field manufactured gasket or RTV compound. This will minimize leakage at the flange face.

4.0 Electrical Connections

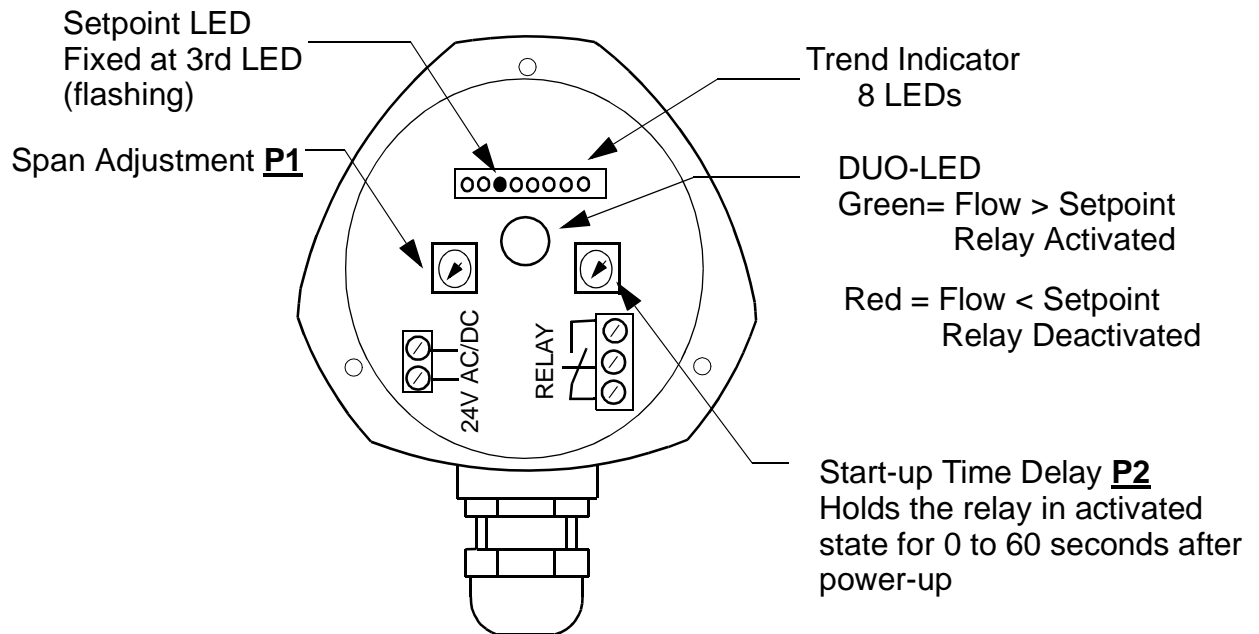
- 4.0.1 All electrical connections are made at the terminal blocks inside the electronics enclosure of the KAL-L.
- 4.0.2 The KAL-L can operate using a power supply of 24 VAC or DC. **When DC voltage is used, the input supply is non-polarized. The polarity of the DC input voltage does not matter and can be wired in either direction without affecting the operation of the unit.**

Diagram 4.1 Electrical Connections



5.0 Operation

Diagram 5.1 Interior Controls Layout for the KAL-L



5.1 Flow Setpoint Adjustment

The section describes the procedures for adjustment of the flow setpoint for three scenarios:

- Adjustment of precise setpoint on falling flow.
- Adjustment of precise setpoint on rising flow.
- Setup for flow/no flow detection.

5.1.1 Flow Setpoint Adjustment - General

The flow switch point on the KAL-L is fixed at 50% of its span. Because of the trend indicator's non-linear response, this corresponds to the third LED on the indicator bar. The third LED is wired to flash permanently to allow users to judge the location of the flow setpoint relative to system flow.

The flow switch point is set by adjusting the span potentiometer P1. Doing this increases or decreases the span of the trend indicator thereby changing the point at which the KAL-L switches. The next three sections describe how to set the KAL-L switchpoint in specific situations

5.1.2 Adjustment of Precise Setpoint on Falling Flow

To adjust the KAL-L for a precise switchpoint on falling flow, refer to Diagram 5.1 on page 6 and proceed as follows:

- 5.1.2.1 With power connected to the KAL-L, adjust the span potentiometer **P1** clockwise to its right hand stop. Turn time delay potentiometer **P2** counter-clockwise to its far lefthand stop.
- 5.1.2.2 Initiate system flow and adjust it to the desired switchpoint flow rate. Note that at this time the DUO LED should be green. If it is red your desired flowrate is below the measuring capability of the KAL-L.
- 5.1.2.3 Slowly turn **P1** counter-clockwise. You will note that the LEDs on the trend indicator will extinguish sequentially as the span is reduced. Continue turning **P1** counter-clockwise until the trend indicator span is reduced to the third LED (which is flashing). At this point, the DUO-LED turns red and the relay switches over. The KAL-L is now adjusted at the desired setpoint.
- 5.1.2.4 Adjust system flow to normal.

5.1.3 Adjustment of Precise Setpoint on Rising Flow

To adjust the KAL-L for a precise switchpoint on rising flow, refer to Diagram 5.1 on page 6 and proceed as follows:

- 5.1.3.1 With power connected to the KAL-L, adjust the span potentiometer **P1** counter-clockwise to its left hand stop. Turn time delay potentiometer **P2** counter-clockwise to its far lefthand stop.
- 5.1.3.2 Initiate system flow and adjust it to the desired switchpoint flow rate.
- 5.1.3.3 Slowly turn **P1** clockwise. You will note that the LEDs on the trend indicator will light sequentially as the span is increased from zero. Continue turning **P1** clockwise until the trend indicator span is increased to the third LED (which is flashing). At this point, the DUO-LED turns green and the relay switches over. The KAL-L is now adjusted at the desired setpoint.
- 5.1.3.4 Adjust system flow to its normal value.

5.1.4 Setup of the KAL for Flow/No-flow Detection

Alternatively, the KAL-L can be quickly set-up to switch on a loss of flow. Using this procedure does not yield a precise switchpoint but is generally acceptable for flow/no-flow detection. When set up in this manner, the KAL-L will switch when approximately a 50% reduction from normal flow occurs. To set the KAL-L for flow/no-flow detection, refer to Diagram 5.1 and proceed as follows:

- 5.1.4.1 With power connected to the KAL-L, adjust the span potentiometer **P1** counter-clockwise to its left hand stop. Turn time delay potentiometer **P2** counter-clockwise to its far lefthand stop.
- 5.1.4.2 Initiate system flow. Ensure that system flow rate is at normal operating value.
- 5.1.4.3 Slowly turn **P1** clockwise. You will note that the LEDs on the trend indicator will light sequentially as the span is increased from zero. Continue turning **P1** clockwise just until all 8 trend indicator LEDs are lit. As the trend indicator span is adjusted past the third LED (which is flashing) note that the DUO LED changes from red to green and the relay switches over.
- 5.1.4.4 The KAL-L is now adjusted for flow/no flow detection. The switch point will occur on a flow rate reduction of approximately 50% from normal operating value.

5.2 Adjustment of the Start-up Time Delay

The KAL-L has a start-up time delay feature which holds the output relay in the activated state and disables flow monitoring for a period of up to 60 seconds after power-up of the KAL-L. This feature is designed to prevent nuisance alarms during system start-up and until steady state flow conditions are achieved.

To adjust the start-up time delay, refer to Diagram 5.1 on page 6 and proceed as follows:

- 5.2.1 Potentiometer **P2** adjusts the start-up time delay. Turning **P2** counter-clockwise to its far left hand stop adjusts the time delay to zero. Turning **P2** clockwise increases the time delay to a maximum possible of 60 seconds at the far right hand stop. The time delay adjustment is approximately linear between the left and right hand stops.

6.0 Maintenance

The KAL-L is an electronic device which uses no moving parts. This design ensures reliable operation and long service life. Dirt and debris which can build up on the sensing probe over time will result in degraded performance. For this reason we strongly recommend that the proper filtration be installed in the system. It is also recommended that the KAL-L be occasionally removed from the system and its measuring probe inspected for dirt buildup and cleaned as needed. The frequency of this cleaning will vary depending on the cleanliness of the system.

7.0 Need Help with Your KAL-L Flow Switch?

Contact one of our friendly engineers at 412-788-2830.

CAUTION

PLEASE READ THE FOLLOWING WARNINGS BEFORE ATTEMPTING
INSTALLATION OF YOUR NEW DEVICE. FAILURE TO HEED THE
INFORMATION HEREIN MAY RESULT IN EQUIPMENT FAILURE AND
POSSIBLE SUBSEQUENT PERSONAL INJURY.

- **User's Responsibility for Safety:** KOBOLD manufactures a wide range of process sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, to install it per these installation instructions, to perform tests of the installed system, and to maintain all components. The failure to do so could result in property damage or serious injury.
- **Proper Installation and Handling:** Use a proper sealant with all installations. Never overtighten the unit within the fitting. **Never use the housing to thread the unit into its fitting.** Always use only an appropriate sized wrench on the hex portion of the probe. Always check for leaks prior to system start-up.
- **Wiring and Electrical:** A supply voltage of 24 Volts AC or DC +10%/-15% is used to power the KAL-L. The sensor systems should never exceed this rating. Electrical wiring of the sensor should be performed in accordance with all applicable national, state, and local codes.
- **Temperature and Pressure:** The KAL-K is designed for use in application temperatures from -10 to 250°F, and for use at pressures up to 115 PSIG. Operation outside these limitations will cause damage to the unit and possible personal injury.
- **Material Compatibility:** The KAL-K sensor probe is made of nickel plated brass. The housing is polycarbonate. Check your model number with the wetted materials specification in Section 2.0, "Specifications", on page 1 of this manual. Make sure that the model which you have selected is chemically compatible with the application environment. While the switch housing is liquid resistant when installed properly, it is not designed to be immersed. It should be mounted in such a way that it does not normally come into contact with liquid.
- **Flammable, Explosive and Hazardous Applications:** The KAL-L is not an explosion-proof or intrinsically safe design. It should not be used in hazardous areas where risk of explosion exists.
- **Make a Fail-safe System:** Design a fail-safe system that accommodates the possibility of switch or power failure as well as operator error. In critical applications, KOBOLD recommends the use of redundant backup systems and alarms in addition to the primary system.

KAL-L THERMAL AIR FLOW SWITCH



Flow
Pressure
Level
Temperature
measurement
monitoring
control

BAAN NUMBERS
1022883



- Negligible Pressure Loss
- No Moving Parts
- Adjustable Response Time
- Temperature Compensated
- Easy to Install

S5



USA

KOBOLD Instruments Inc.
1801 Parkway View Drive
USA- Pittsburgh, PA 15205
☎ +1 412-788-2830
Fax +1 412-788-4890
E-mail: info@koboldusa.com



CANADA

KOBOLD Instruments Canada Inc.
9A Aviation
Pointe-Claire, QC H9R 4Z2
☎ +1 514-428-8090
Fax +1 514-428-8899
E-mail: kobold@kobold.ca

Visit KOBOLD Online at
www.kobold.com

Model:
KAL-L



The Kobold KAL-L flow switch allows rapid detection of flow rate change of non-hazardous gases. Fast reaction times are guaranteed by the KAL-L's analog electronic design. Through use of two RTDs... one to sense flow and the other to detect ambient temperature, the switch can compensate for thermal changes in its surroundings. This "smart" behavior minimizes erroneous switching due to spurious changes caused by things such as the weather.

Any conceivable pipe size can be accommodated by the KAL-L's insertion style design. Knowledge of the flow velocity in your system is all that you need to make the KAL-L work.

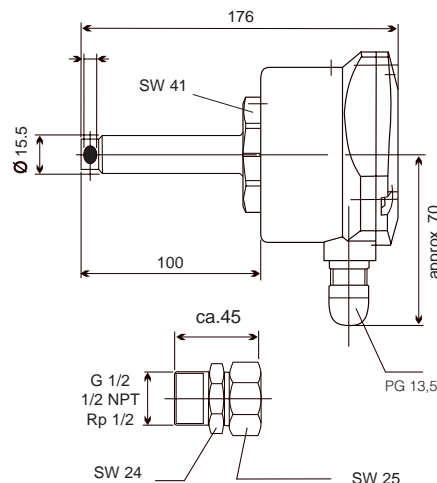
Specifications

Range:	3.3 - 66 ft/sec @20°C, 14.5 PSIA (restricted span for other pressure and temperature conditions)
Switchpoint:	potentiometer adjustable
Accuracy:	±10% of flow rate
Reproducibility:	±1% of flow rate
Display	
Flow Rate:	8-LED flow trend
Switch Status:	two-color LED
Maximum Temperature Gradient	30°K(°C)/min @ 8m/s, 90°C
Response Time:	1 to 60 sec (adjustable)
Warm-up Time:	30 sec
Maximum Pressure:	120 PSIG
Maximum Temperature	
Process:	-10°F to +250°F
Ambient:	+15°F to +140°F
Wetted Parts:	Ni-plated brass
Housing Material:	Nylon
Electrical Data	
Power Supply:	24 VDC/VAC -15%/+10%
Switch:	Qty. 1 - SPDT
Max. Voltage:	250 VAC
Max. Current:	4 A
Max. Power:	1,000 VA
Wiring Connector	
Standard:	PG13.5 cable gland
Optional:	1/2" NPT conduit
Protection:	NEMA 4

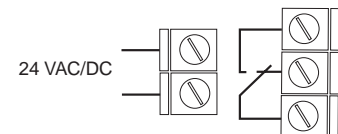


KOBOLD KAL-L Flow Switch

Dimensions (millimeter)



Electrical Connection



KAL-L Ordering Information

Fitting	Order Number
1/2" NPT	KAL-8115
2-Bolt Flange	KAL-8115FL
Smooth Shank	KAL-8100
Options:	-C: Conduit Hub -M12: Quick disconnect



Level



Pressure



Flow



Temperature

Liquid
Analysis

Registration

Systems
Components

Services



Solutions

Technical Information

RTD TH13, TH14 and TH15

RTD assemblies in Thermowells with spring loaded insert and enclosure for process industry



Areas of application

The TH13, TH14 and TH15 temperature sensors are RTD assemblies installed in Thermowells and designed for use in all types of process industries, including harsh environments, due to their rugged design.

The sensor is made up of a measurement probe with an insulated RTD element, sheath and a thermowell made of bar-stock material.

The sensor assemblies can be used in process industries such as:

- Chemicals
- Petrochemical
- Power plants
- Refineries
- Offshore Platforms

Head transmitters

Instead of directly wiring your temperature sensors to your control system, use transmitters to reduce wiring and maintenance costs while increasing measurement accuracy.

Field transmitters

Temperature field transmitters with HART® or FOUNDATION Fieldbus™ protocol for highest reliability in harsh industrial environments. Blue backlit display with large measured value, bargraph and fault condition indication for ease of reading.

Your benefits

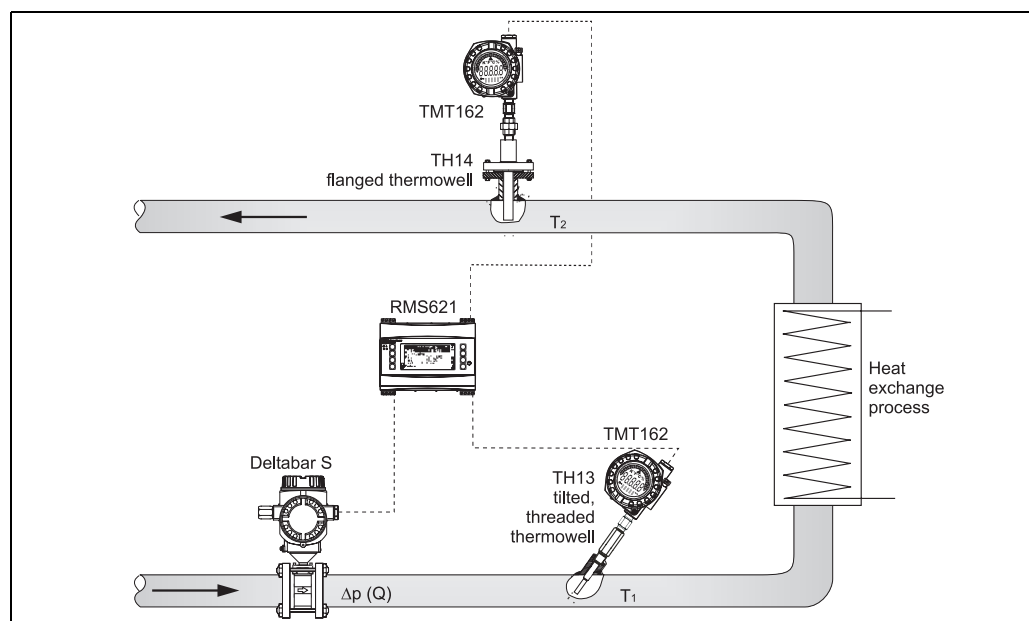
- One source shopping for temperature measurement solutions. World class transmitter with integrated sensor offering for heavy process industry applications.
- Remove and install straight out of the box!
- Improved galvanic isolation on most devices (2 kV)
- Simplified model structure: Competitively priced, offers great value. Easy to order and reorder. A single model number includes sensor, thermowell and transmitter assembly for a complete point solution
- All iTEMP® transmitters provide long term stability $\leq 0.05\%$ per year

Function and system design

Measuring principle

The RTD (Resistance Temperature Detector) element consists of an electrical resistance with a value of $100\ \Omega$ at $0\ ^\circ\text{C}$ (called Pt100, in compliance with IEC 60751), which increases at higher temperatures according to a coefficient characteristic of resistor material (platinum). In industrial thermometers that comply with the IEC 60751 standard, the value of this coefficient is $\alpha = 0.00385\ ^\circ\text{C}^{-1}$, calculated between 0 and $100\ ^\circ\text{C}$ (32 and $212\ ^\circ\text{F}$).

Measuring system



Example of an application of the temperature assemblies

Water – heat Differential

Calculation of heat quantity which is emitted or absorbed by a water flow in a heating or cooling system. The quantity of heat is calculated from the process variable for Δp flow (Q) and the differential from the feed and return temperature ($T_2 - T_1$). Bidirectional energy calculations, such as the calculating systems with changing flow direction (charging/discharging the heat accumulator) are also possible.

Energy manager RMS621

Energy conservation and cost expenditures are significant issues in today's industry. Accurate flow monitoring and calculation is the basis for thorough analysis and billing of energy. This data can serve as a basis to maximize savings potential and help in controlling operational costs on a daily basis. Endress+Hauser's energy managers provide accurate and reliable calculations for the monitoring and control of energy consumption (both produced and consumed) according to international standards, e.g. IAPWS-IF 97, AGA8, ISO 5167 etc. For RMS621 details see Technical Information.

iTEMP® TMT162 Temperature Field Transmitter

Aluminum or stainless steel dual compartment explosion – proof enclosure and compact, fully potted electronics provide the ultimate protection in harshest environments. TMT162 prevents costly plant shutdowns by detecting corrosion on RTDs or thermocouples before it corrupts the measured value. Endress+Hauser's Field Temperature Transmitters with backlit display and sensor backup functionality are designed with safety in mind to keep your plant, equipment and personnel safe. For TMT162 details see Technical Information.

Deltabar S/Cerabar S

The evolution series of Cerabar S/Deltabar S represents a decisive step ahead in making pressure instrumentation better and safer for the process industry. The development of new products thrives especially on the knowledge, commitment and experience of staff members. Permanent high performance can only be achieved if dedicated and enthusiastic people provide their ideas. Endress+Hauser's instruments are not only supposed to distinguish themselves for customers and users by technological novelties but also by the presence of people supporting this progress, be it in service, sales or production. For Deltabar S & Cerabar S details see Technical Information.

Equipment architecture

The single and duplex element RTDs are designed to measure temperature in a variety of processes and laboratory applications. These RTDs are specifically designed for use in two different process temperature ranges and they will provide accurate and repeatable temperature measurement through a broad temperature range of -328 to 1112 °F (-200 to 600 °C). Low range thin film RTDs -58 to 392 °F (-50 to 200 °C) are constructed using silver plated and copper internal leads, PTFE wire insulations with potting compounds to resist moisture penetration. High range RTDs -328 to 1112 °F (-200 to 600 °C) are constructed with nickel internal leads inside swaged MgO insulated cables to allow higher temperature measurements at the RTD element and to provide higher temperature lead protection along the sheath.

Measurement range

Construction	Model code (class and type of sensor)	max. range
Low temperature range	TH13-_____(A/C/E/G/J/L) _____	-58 to 392 °F (-50 to 200 °C)
	TH14-_____(A/C/E/G/J/L) _____	
	TH15-_____(A/C/E/G/J/L) _____	
High temperature range	TH13-_____(B/D/F/H/K/M) _____	-328 to 1112 °F (-200 to 600 °C)
	TH14-_____(B/D/F/H/K/M) _____	
	TH15-_____(B/D/F/H/K/M) _____	



Note!

Options J, K, L, M are duplex platinum elements of two sensors inside the same sheath.

Calibration specifications

3 point sensor calibration		
-40 to 0 °C	0 to 100 °C	+40 to 215 °C
-40 to 32 °F	32 to 212 °F	104 to 420 °F
Minimum length requirements for calibrated sensors = 6"		



Note!

Use option code 'B' (Block: Test; calibration) for RTD calibration, the three temperature points need to be specified in 5 °C (9 °F) increments.

The manufacturer provides comparison temperature calibrations from -40 to +215 °C (-40 to +420 °F) on the international temperature scale of 1990. Calibrations are traceable to standards maintained by the national institute of standards and technology (NIST). Calibration services are in conformance with ASTM E220, IEC 17025 and ANSI/NCSS Z540-1-1994. The report of calibration is referenced to the serial number of the RTD assembly.

Three point calibrations are provided, given that the specified temperatures are within the recommended range and the minimum length requirements are met as specified. The minimum length is based on overall length 'x' of the spring loaded insert.

Electronics

Family of temperature transmitters	Measurement assemblies with iTEMP® transmitters are an installation ready solution to improve the functionality of temperature measurement by increasing accuracy and reliability when compared to direct wired sensors. Overall installation costs are lower than with direct wired sensors, since an inexpensive pair of signal (4 to 20 mA) wires can be run over long distances.
PC programmable devices TMT180 and TMT181	PC programmable head transmitters offer you extreme flexibility and help control costs with the ability to stock one device and program it for your needs. Regardless of your choice of output, all iTEMP® transmitters can be configured quickly and easily with a PC. To help you with this task, Endress+Hauser offers free software ReadWin® 2000 which can be downloaded from our website. Go to www.readwin2000.com to download ReadWin® 2000 today. For details see Technical Information.
HART® TMT182 head transmitter	HART® communication is all about easy, reliable data access and getting better information more inexpensively. iTEMP® transmitters integrate seamlessly into your existing control system and provide painless access to preventative diagnostic information. Configuration with a DXR275 or 375 hand-held or a PC with configuration program (FieldCare, ReadWin® 2000) or configure with AMS or PDM. For details, see Technical Information.
Field transmitter TMT162 - Dual compartment housing	Field transmitter with HART® communication, FOUNDATION Fieldbus™ protocol and blue backlit display. Can be read easily from a distance, in sunlight and at night. Large measurement value, bargraph and fault indication display. Benefits are: dual sensor input, highest reliability in harsh industrial environments, mathematic functions, thermometer drift monitoring, sensor back-up functionality, corrosion detection and sensor transmitter matching by accepting Callendar Van Dusen constants. For details, see Technical Information.
Field transmitter TMT142 - Single compartment housing	Field transmitter with HART® communication. The one channel TMT142 allows for cost effective replacement of smaller transmitters with tiny display and old style analog transmitters. Large and brilliant blue backlit display. Regardless of whether you install the transmitter in a dark location or in direct sunlight, you still get a clear temperature reading. Reliable temperature measurement through advanced diagnostics. For details, see Technical Information.
PROFIBUS® PA TMT184 head transmitter	Universally programmable head transmitter with PROFIBUS®-PA fieldbus communication. Converting various input signals into a digital output signal. High accuracy in the total ambient temperature range. Swift and easy operation, visualisation and maintenance using a PC direct from the control panel, e. g. using operating software such as FieldCare, Simatic PDM or AMS. DIP switch for address setting, makes start up and maintenance save and reliable. For details, see Technical Information.

Performance characteristics

Response time 63% response time per ASTM E644

RTD assembly TH15 without thermowell

Construction	RTD insert ø ¼"
High temperature range	3 s
Low temperature range	9 s



Note!
Response time for the sensor assembly without transmitter.

Response time examples for RTD assemblies with thermowell TH13 and TH14

Construction	Stepped thermowell	Tapered thermowell	¾" straight thermowell
High temperature range	20 s	25 s	30 s
Low temperature range	25 s	30 s	35 s



Note!

Response times for RTD assemblies with thermowell are provided for general design guidance without transmitter

When the temperature of a process media changes, the output signal of a RTD assembly follows this change after a certain time delay. The physical cause is the time related to heat transfer from the process media through the thermowell and the insert to the sensor element (RTD). The manner in which the reading follows the change in temperature of the assembly over time is referred to as the response time. Variables that influence or impact the response time are:

- Wall thickness of thermowell
- Spacing between RTD insert and thermowell
- Sensor packaging
- Process parameters such as media, flow velocity, etc.

Maximum measured error

RTD corresponding to IEC 60751

Class	max. Tolerances (°C)
A	$\pm(0.15 + 0.002 \cdot t)$, Temperature range: -100 °C to 450 °C
B	$\pm(0.3 + 0.005 \cdot t)$, Temperature range: -200 °C to 600 °C

1) $|t|$ = absolute value °C

Note!

For measurement errors in °F, calculate using equation above in °C, then multiply the outcome by 1.8.

Measurement accuracy transmitter

TMT180 Pt100 PCP	TMT181 multi-functional PCP	TMT182 HART®	TMT184 PROFIBUS®-PA	TMT162 FF Field transmitter	TMT142 and TMT162 HART® Field transmitter	
0.36 °F (0.2 °C) or 0.08% ¹	0.36 °F (0.2 °C) or 0.08% ²	0.36 °F (0.2 °C) or 0.08% ²	0.27 °F (0.15 °C)	0.18 °F (0.1 °C)	Accuracy	
					Digital	D/A ²
					0.18 °F (0.1 °C)	0.02%

1) % is related to the adjusted measurement range (the larger value applies)

2) % relates to the set span. Accuracy = digital + D/A accuracy

Transmitter long-term stability ≤ 0.18 °F / year (≤ 0.1 °C/year) or $\leq 0.05\%$ / year

Data under reference conditions; % relates to the set span. The larger value applies.

Insulation resistance

Insulation resistance between terminals and probe sheath, test voltage 250 V.

- ≥ 100 MΩ at 77 °F (25 °C)
- ≥ 10 MΩ at 572 °F (300 °C)

Self heating

RTD elements are not self-powered and require a small current be passed through the device to provide a voltage that can be measured. Self-heating is the rise of temperature within the element itself, caused by the current flowing through the element. This self-heating appears as a measurement error and is affected by the thermal conductivity and velocity of the process being measured; it is negligible when an Endress+Hauser iTEMP[®] temperature transmitter is connected.

Sensor current

Sensor current of Endress+Hauser iTEMP[®] transmitters

Transmitter type	Sensor current
TMT180 & TMT181 PCP	≤ 0.6 mA
TMT182 HART [®]	≤ 0.2 mA
TMT184 PROFIBUS [®] -PA	≤ 0.2 mA
TMT162 HART [®] , FF Field transmitter	≤ 0.3 mA
TMT142 HART [®] Field transmitter	≤ 0.3 mA

Galvanic isolation

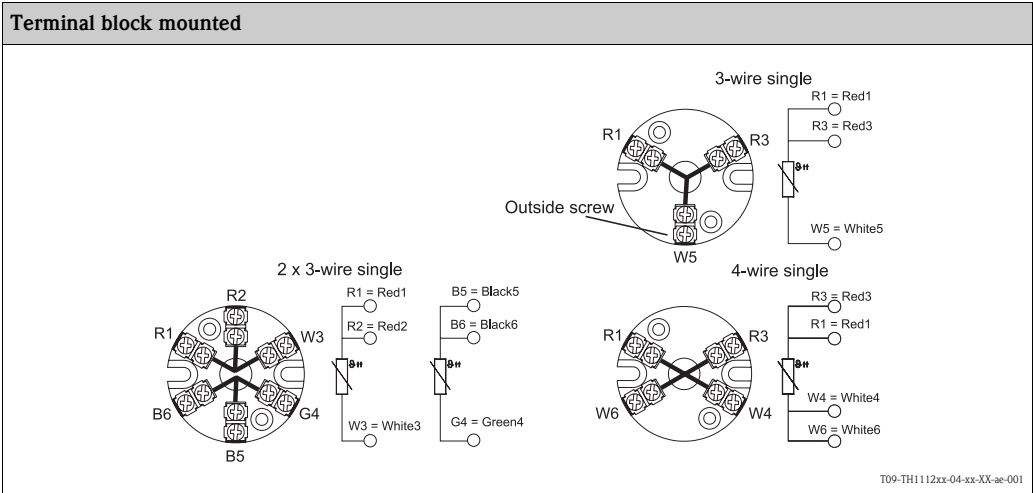
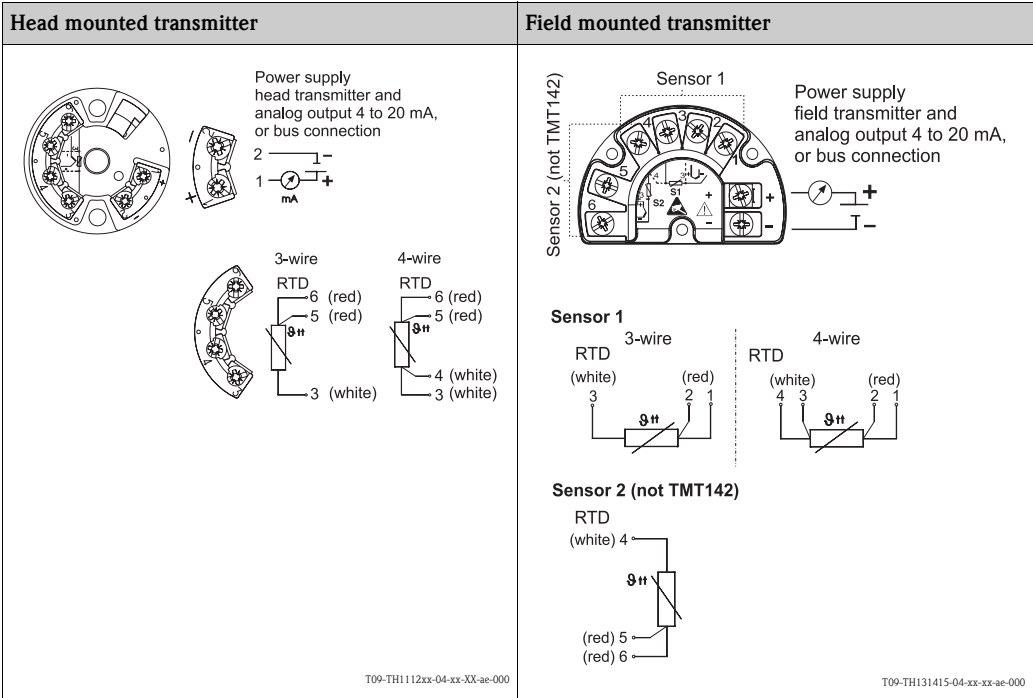
Galvanic isolation of Endress+Hauser iTEMP[®] transmitters (input/output)

Transmitter type	Galvanic isolation
TMT181 PCP	$\hat{U} = 3.75 \text{ kV AC}$
TMT182 HART [®]	$U = 2 \text{ kV AC}$
TMT184 PROFIBUS [®] -PA	
TMT162 HART [®] , FF Field transmitter	
TMT142 HART [®] Field transmitter	

Wiring

Wiring diagrams

Type of sensor connection



Note!
The blocks and transmitters are shown as they sit inside the heads in reference to the conduit opening.

Wire specifications

24AWG, 19 strand silver plated copper with 0.010" PTFE extruded outer.

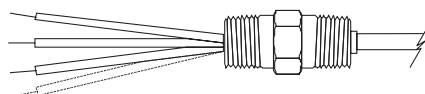
Electrical connection

Flying leads, standard 3" for wiring in connection head, head mounted transmitter or terminal block mounted

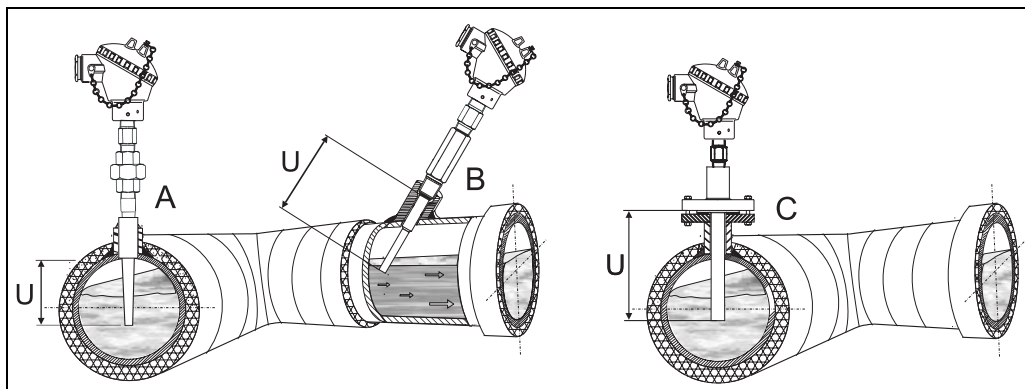
Flying leads, 5½" for wiring with TMT162 or TMT142 assemblies

Design of leads

Flying leads 3" or 5½" with brass crimped sleeves

**Installation conditions****Orientation**

No restrictions for installation orientation.

Installation instructions

T09-TH1314x15-11-xx-xx-ae-000

Examples for pipe installation - In pipes with a small cross section the sensor tip should reach or extend slightly past the center line of the pipe (=U).

A: TH13 assembly socket weld installation

B: Threaded, tilted installation of TH13 assembly

C: Flange installation of TH14 assembly

Immersion

Minimum immersion per ASTM E644, $\Delta T \leq 0.09\text{ }^{\circ}\text{F}$ ($0.05\text{ }^{\circ}\text{C}$)

Immersion RTD assembly TH15 without thermowell

Construction	RTD Insert $\varnothing\text{ } \frac{1}{4}\text{''}$ Minimum Immersion (Inch)
High temperature range	1 $\frac{1}{4}\text{''}$
Low temperature range	$\frac{3}{4}\text{''}$

For temperature assemblies with thermowell (TH13 and TH14) the minimum immersion is the depth to which the thermowell is immersed in the medium, measured from the tip. To minimize errors from ambient temperature the following minimum immersion lengths are recommended:

Construction	Minimum Immersion (Inch)
Stepped thermowell	2 $\frac{1}{2}\text{''}$
Tapered thermowell	4 $\frac{1}{2}\text{''}$
$\frac{3}{4}\text{''}$ straight thermowell	4"
Weld in thermowell	4 $\frac{1}{2}\text{''}$

Environmental conditions

Ambient temperature

Housing without head-mounted transmitter

- Aluminum pressure die-cast housing -40 to 300 $^{\circ}\text{F}$ (-40 to 150 $^{\circ}\text{C}$)
- Plastic housing -40 to 185 $^{\circ}\text{F}$ (-40 to 85 $^{\circ}\text{C}$)
- Deep drawn SS housing without display -40 to 300 $^{\circ}\text{F}$ (-40 to 150 $^{\circ}\text{C}$)

Housing with head-mounted transmitter

- -40 to 185 $^{\circ}\text{F}$ (-40 to 85 $^{\circ}\text{C}$)

Field transmitter without display

- -40 to 185 $^{\circ}\text{F}$ (-40 to 85 $^{\circ}\text{C}$)

Shock and vibration resistance 4g / 2 to 150 Hz as per IEC 60 068-2-6

Process conditions

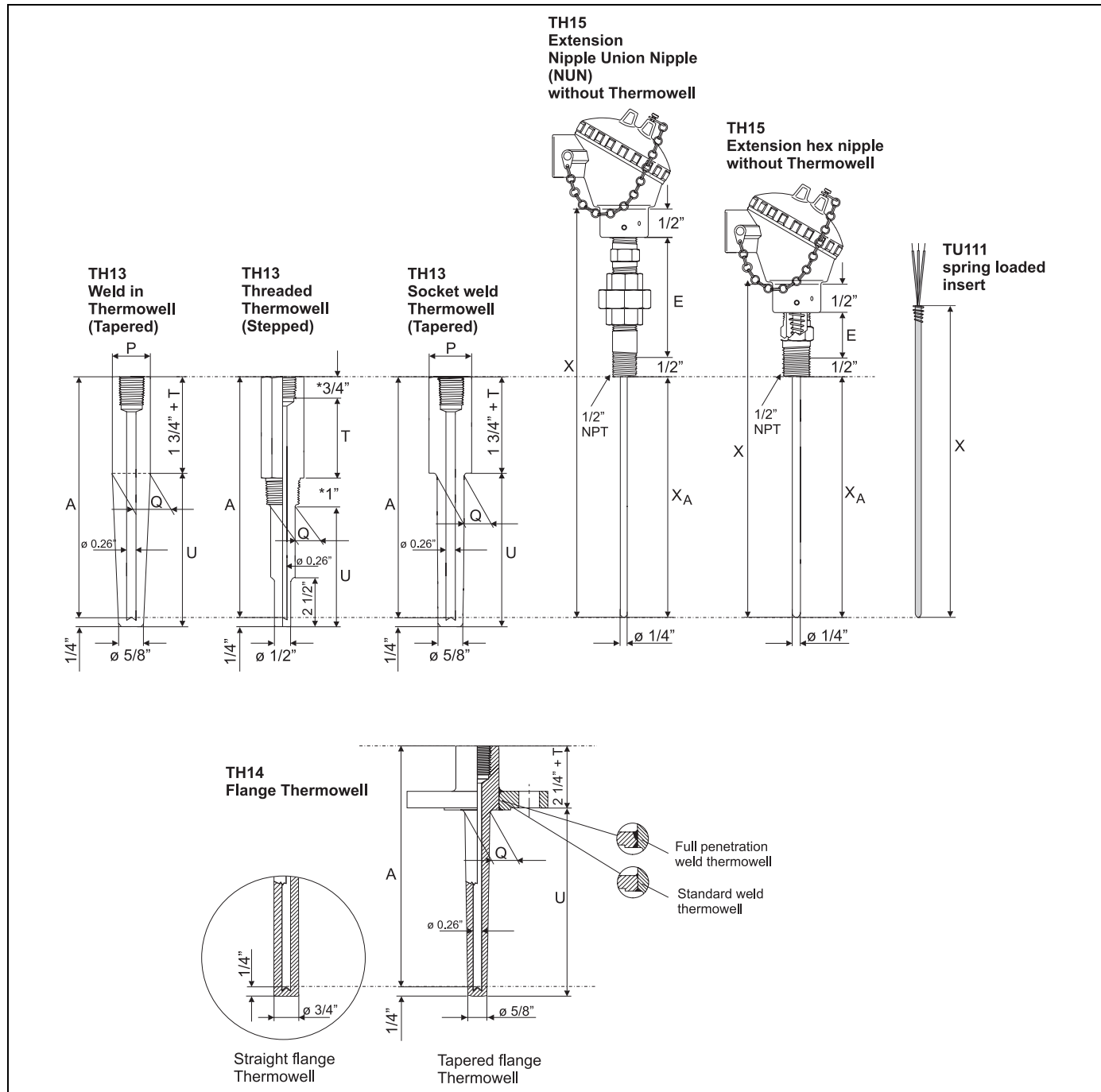
Thermowells are used in measuring the temperature of a moving fluid in a conduit, where the stream exerts an appreciable force. The limiting value for the thermowells is governed by the temperature, the pressure and the speed of the medium, the immersion length, the materials of the thermowells and the medium, etc.

Calculations for stress and vibration of thermowells can be done according to ASME PTC 19.3-1974 standard, please consult Endress+Hauser.

Mechanical construction

Design, dimensions

All dimensions in inches. For the values related to this graphic please refer to the tables and equations below.



*For TH13 thermowells with 1/2" NPT - 1" Process thread length and 3/4" Hex length dimensions are reversed.

Pos. P: Pipe size

Pos. Q: Thermowell diameter

Pos. T: Lag dimension (see product structure)

Pos. U: Thermowell immersion length

Pos. X_A, A: Immersion length RTD sensor; Thermowell drilled length

Pos. X: Insert overall length

All thermowells are marked with:

- Material I.D.
- CRN# (Canadian Registration Number)
- Heat No.

Dimensions of TH13					
U	E	T	Process connection	Shape of Thermowell	ø Q
2½", 4½", 7½", 10½" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	3" or specified length 1" to 6" in ½" increments	½" NPT	Stepped (Standard duty) Tapered (Heavy duty)	5/8" ¹¹ / ₁₆ "
			¾" NPT	Stepped (Standard duty) Tapered (Heavy duty)	¾" 7/8"
			1" NPT	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1 ¹ / ₁₆ "
			¾" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	¾" ¾"
			1" Socket weld	Stepped (Standard duty) Tapered (Heavy duty)	7/8" 1"
			¾" weld in	Tapered (Heavy duty)	1.050"
			1" weld in	Tapered (Heavy duty)	1.315"
Immersion length RTD sensor = Thermowell drilled length X _A = A + U + 1½" + T Insert overall length X = A + E + 1"					
P = Pipe size ■ Nom. ¾"; Dia. = 1.050" ■ Nom. 1"; Dia. = 1.315"					

Dimensions of TH14 Flange rating: ASME B16.5				
U	E	T	Flange size	ø Q, Tapered version
2", 4", 7", 10" specified length 2" to 18" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7" Material: Steel or 316SS	specified length 1" to 10" in ½" increments	1"	7/8"
			1½"	1 ¹ / ₁₆ "
			2"	1 ¹ / ₁₆ "
Immersion length RTD sensor - Thermowell drilled length X _A = A = U + 2" + T Insert overall length X = A + E + 1"				

Dimensions of TH15 (without Thermowell)	
Immersion length RTD sensor X_A	E
4", 6", 9", 12", 14" specified length 4" to 30" in ½" increments	Hex nipple = 1" or Nipple Union Nipple (NUN) = 4" or 7"

Weight

From 1 to 10 lbs

Material

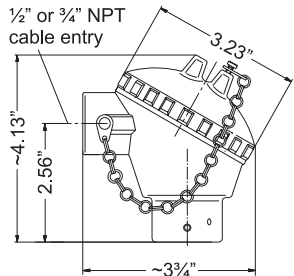
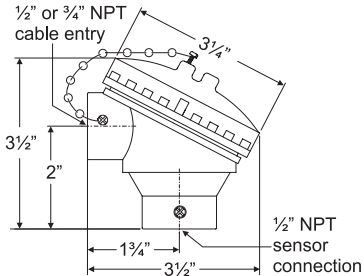
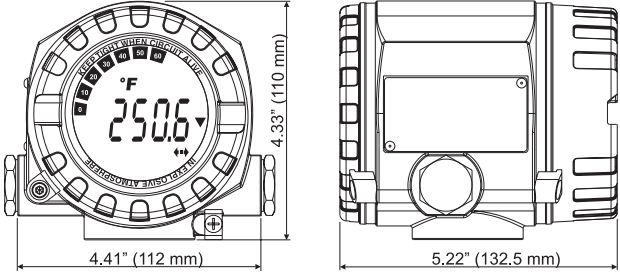
Wetted parts 316SS

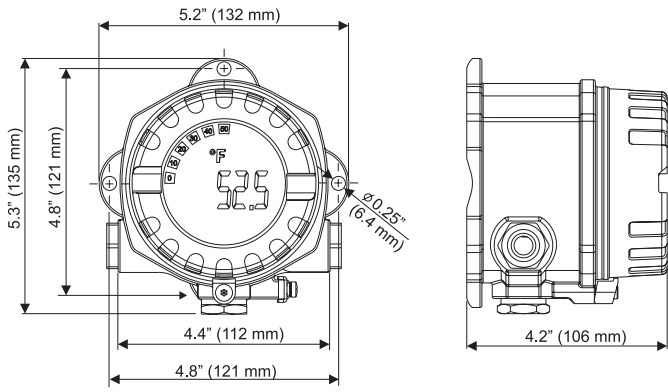
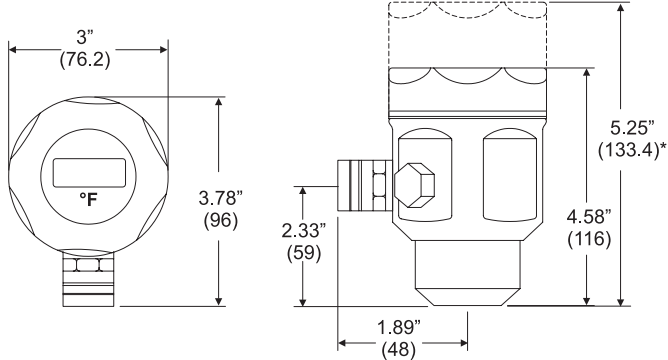
Thermowell material

Wetted parts 316SS for usage up to 1700 °F (927 °C). 316SS has good oxidation and corrosion resistance in a wide range of industrial environments with improved resistance to mild acid and pitting corrosion. Exposure to carbide precipitation, reduces corrosion resistance in the 800 to 1000 °F (427 to 538 °C) temperature range. Good mechanical properties for -300 to 1450 °F (-184 to 788 °C) temperature range. Generally regarded as standard protection tube material, other materials are available upon request.

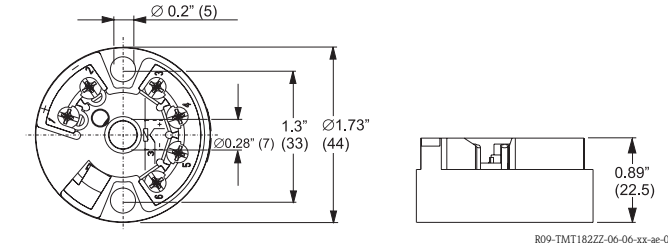
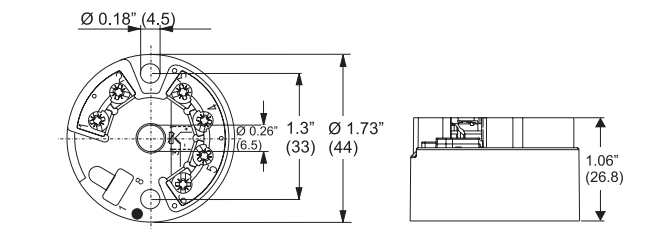
System components

Housing

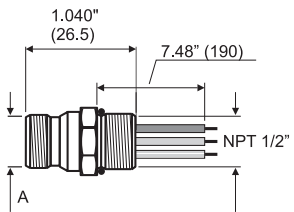
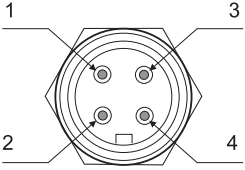
Type of housing	Specification
<p>Connection head Aluminum</p>  <p style="text-align: right; font-size: small;">T09-TH11XXXX-06-XX-XX-ae-001</p>	<ul style="list-style-type: none"> Material: Die-cast Aluminum head Sensor connection: 1/2" NPT Female Cable entry: 1/2" NPT or 3/4" NPT Female. 1/2" NPT has a Al reducer bushing Body paint: Spray SPU, RAL5012 Cover paint: Spray SPU, RAL7035 Coating thread (body-cover), lubricant acc. E+H standard, MgO coating; benefits include ease of opening/closing cover and improved thread engagement. Improves lifetime of the connection head. Degree of protection NEMA 4X (IP 66)
<p>Connection head plastic</p>  <p style="text-align: right; font-size: small;">T09-TH11XXXX-06-XX-XX-ae-000</p>	<ul style="list-style-type: none"> Polypropylene, FDA compliant Sensor connection: 1/2" NPT Female Cable entry: 1/2" NPT or 3/4" NPT Female. 1/2" NPT with nylon reducer bushing (FDA compliant) Degree of protection NEMA 4X
<p>Temperature field transmitter iTEMP® TMT162</p>  <p style="text-align: right; font-size: small;">T09-TMT162ZZ-06-00-XX-ae-001</p>	<ul style="list-style-type: none"> Material: Die-cast aluminum housing AlSi10Mg with powder coating on polyester base Separate electronics compartment and connection compartment Display rotatable in 90° increments Cable entry: 2 x 1/2" NPT Degree of protection NEMA 4X (IP 67) Brilliant blue backlit display with ease of visibility in bright sunshine or pitch darkness Gold plated terminals to avoid corrosion and additional measurement errors <p>Details see Technical Information (see 'Documentation')</p>

Type of housing	Specification
<p>Temperature field transmitter iTEMP® HART® TMT142</p>  <p style="text-align: right;">T09-TMT142ZZ-06-00-06-ae-001</p>	<ul style="list-style-type: none"> Material: Die-cast aluminum housing AlSi10Mg with powder coating on polyester base Display rotatable in 90° increments Cable entry: 3 x ½" NPT Degree of protection NEMA 4X (IP 67) Brilliant blue backlit display with ease of visibility in bright sunshine or pitch darkness Gold plated terminals to avoid corrosion and additional measurement errors <p>Details see Technical Information (see 'Documentation')</p>
<p>Connection head deep drawn stainless steel, TA20J style</p>  <p style="text-align: right;">a0005938</p> <p><i>* dimensions with optional display</i></p>	<ul style="list-style-type: none"> Material: Deep drawn stainless steel AISI 316L SS (hygienic design) Optional with display and/or head transmitter Sensor connection: ½" NPT female Cable entry: ½" NPT female Degree of protection NEMA 4X (IP 66) <p>Display:</p> <ul style="list-style-type: none"> 4 digits 7-segments LC display (loop powered) Maximum error: 0.1% of programmed range Loop drop: 2.5 V at 22 mA Max. ambient temperature: -4 to 160 °F (-20 to 70 °C) <p>The programming is executed through 3 keys mounted on the bottom of the display.</p>

Head transmitter

Type of transmitter)	Specification
<p>iTEMP® TMT18x</p>  <p style="text-align: right;">R09-TMT182ZZ-06-06-xx-ae-001</p>	<ul style="list-style-type: none"> Material Housing: PC Potting: PUR Terminals: Cable up to max. 16 AWG (secure screws) or with wire end ferrules Eyelets for easy connection of a HART®-handheld terminal with alligator clips Degree of protection NEMA 4 (see also type of connection head) <p>Details see Technical Information (see 'Documentation')</p>
<p>iTEMP® PA TMT184</p>  <p style="text-align: right;">T09-TMT184ZZ-06-06-xx-ae-001</p>	

Fieldbus connector

Type (dimensions in inches [mm])	Specification	
<p>Fieldbus connector to PROFIBUS® -PA or FOUNDATION Fieldbus™</p>  <p>Pos. A: M12 on PROFIBUS® -PA connector 7/8-16 UNC on FOUNDATION Fieldbus™ connector</p> <p><small>T09-FFCONNEC-06-xx-xx-ae-000</small></p>	<p>■ Ambient temperature: -40 to 300 °F (-40 to 150 °C) ■ Degree of protection IP 67</p> <p>Wiring diagram:</p>  <p><small>a0006023</small></p>	
	<p>PROFIBUS® -PA Pos 1: grey (shield) Pos 2: brown (+) Pos 3: blue (-) Pos 4: not connected</p>	<p>FOUNDATION Fieldbus™ Pos 1: blue (-) Pos 2: brown (+) Pos 3: not connected Pos 4: ground (green/yellow)</p>

Certificates and approvals

CE Mark

The iTEMP® Series of temperature transmitters complies with the legal requirements laid out within the EU regulations.

Other standards and guidelines

- IEC 60529:
Degrees of protection by housing (IP-Code).
- IEC 61010:
Safety requirements for electrical measurement, control and laboratory instrumentation.
- ASTM E644:
American society for testing and materials, standard test methods for testing industrial resistance thermometers.
- NEMA - ANSI / NEMA 250
Standardization association for the electrical industry.
- IEC 60571
Industrial platinum resistance thermometer
- ASME PTC 19.3 - 1974
Performance test codes

UL

Temperature transmitters are recognized components to UL 3111-1 (iTEMP® Series) except for TMT184 PROFIBUS®-PA.

CSA GP

The installed and assembled transmitters (iTEMP® Series) are CSA GP approved, except TMT184 PROFIBUS® PA

Ordering information

Product structure, RTD assembly in thermowell TH13

TH13-	RTD assembly in thermowell, TH13				
	TW Immersion length U:				
	1	2½ inch			
	2	4½ inch			
	3	7½ inch			
	4	10½ inch			
	8 inch (0.5" increments)			
	Y	special			
	Process connection, TW Material, 1 inch:				
	A1	½" NPT 316SS			
	A2	¾" NPT 316SS			
	A3	1" NPT 316SS			
	B1	Socket weld ¾" 316SS			
	B2	Socket weld 1" inch 316SS			
	C1	Weld in ¾" 316SS			
	C2	Weld in 1" inch 316SS			
	YY	Special			
	Shape of TW:				
	2	Stepped, Standard Duty			
	3	Tapered, Heavy Duty			
	9	Special			
	Lag of TW T:				
	A	None			
	E	3 inch			
	X	... inch (0.5" increments)			
	Y	Special			
	Extension:				
	1	Hex nipple 316SS, E=1"			
	2	Nipple Union Nipple 316SS, E=4"			
	3	Hex nipple steel, E=1"			
	4	Nipple Union Nipple, steel, E=4"			
	5	Nipple Union Nipple, steel, E=7"			
	6	Nipple Union Nipple, 316SS, E=7"			
	9	Special			
	Class; Type Sensor IEC751; Connection:				
	A	1 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)			
	B	1 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)			
	C	1 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)			
	D	1 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)			
	E	1 Pt100 class B, 4 wire low, -50 to 200 °C (-58 to 392 °F)			
	F	1 Pt100 class B, 4 wire high, -200 to 600 °C (-328 to 1112 °F)			
	G	1 Pt100 class A, 4 wire low, -50 to 200 °C (-58 to 392 °F)			
	H	1 Pt100 class A, 4 wire high, -200 to 600 °C (-328 to 1112 °F)			
	J	2 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)			
	K	2 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)			
	L	2 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)			
	M	2 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)			
	Y	Special			
TH13-					← Order code (Part 1)

Product structure, RTD assembly in flanged thermowell TH14

TH14-	RTD assembly in flanged thermowell, TH14					
	TW Immersion length U					
	1	2 inch				
	2	4 inch				
	3	7 inch				
	4	10 inch				
	8 inch (0.5" increments)				
	Y	Special version				
	Flange size; TW Material per 1 inch:					
	A	1 inch 316SS				
	B	1½ inch 316SS				
	C	2 inch 316SS				
	Y	Special				
	Rating; Type:					
	1	150 psi; RF				
	2	300 psi; RF				
	3	600 psi; RF				
	9	Special				
	Shape of TW; Welding:					
	1	Straight; standard				
	2	Tapered; standard				
	3	Straight; full penetration				
	4	Tapered; full penetration				
	9	Special				
	Lag of TW, T:					
	A	None				
	X inch (0.5" increments)				
	Y	Special				
	Extension:					
	1	Hex nipple 316SS, E=1"				
	2	Nipple Union Nipple 316SS, E=4"				
	3	Hex nipple steel, E=1"				
	4	Nipple Union Nipple, steel, E=4"				
	5	Nipple Union Nipple, steel, E=7"				
	6	Nipple Union Nipple, 316SS, E=7"				
	9	Special				
	Class; Type Sensor IEC751; Connection:					
	A	1 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)				
	B	1 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)				
	C	1 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)				
	D	1 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)				
	E	1 Pt100 class B, 4 wire low, -50 to 200 °C (-58 to 392 °F)				
	F	1 Pt100 class B, 4 wire high, -200 to 600 °C (-328 to 1112 °F)				
	G	1 Pt100 class A, 4 wire low, -50 to 200 °C (-58 to 392 °F)				
	H	1 Pt100 class A, 4 wire high, -200 to 600 °C (-328 to 1112 °F)				
	J	2 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)				
	K	2 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)				
	L	2 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)				
	M	2 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)				
	Y	Special				
TH14-						← Order code (Part 1)

										Enclosure; communication:	
										A	None
										B	E+H blue Al + cover, 1/2" NPT cable entry
										C	E+H blue Al + cover, 3/4" NPT cable entry
										D	Plastic PP white 1/2" NPT cable entry
										E	Plastic PP white 3/4" NPT cable entry
										F	SS316L (TA20J), 1/2" NPT
										G	SS316L (TA20J), LCD, 1/2" NPT
										H	AL Field Housing, 1 Input, 1/2" NPT, HART
										I	AL Field Housing, 1 Input, Display, HART, 1/2" NPT
										J	AL Field Housing, 2 Input, 1/2" NPT, HART
										K	AL Field Housing, 2 Input, Display, HART, 1/2" NPT
										L	AL Field Housing, 2 Input, 1/2" NPT, FF
										M	AL Field Housing, 2 Input, Display, FF, 1/2" NPT
										Y	Special
										Electrical connection:	
										A	Programmable RTD TMT180
										C	Programmable TMT181 NON Ex
										D	Programmable TMT181 FM IS
										E	Programmable TMT181 CSA IS
										F	Profibus PA TMT184, non Ex
										G	Profibus PA TMT184, FM IS
										H	Profibus PA TMT184, CSA IS
										I	TMT162, non Ex, Dual Compartment
										J	TMT162, FM IS, Dual Compartment
										K	TMT162, CSA IS, Dual Compartment
										L	HART TMT142 non Ex, Single Compartment
										M	HART TMT142, FM IS, Single Compartment
										N	HART TMT142, CSA IS, Single Compartment
										O	HART TMT182, FM IS Advanced Diagnostic
										P	HART TMT182 NON Ex
										R	HART TMT182 FM IS
										T	HART TMT182 CSA IS
										Y	Special
										2	Flying Leads
										3	Terminal block
										Additional option:	
										1	None
										2	Profibus PA Plug M12
										3	Foundation Fieldbus Plug 7/8"
										9	special version
										Test; Calibration:	
										A	None
										B	Sensor calibration certificate
										Y	Special version
										Model:	
										K	Standard model, North American region
										Y	Special version
TH14-										← Order code (complete)	

Product structure, RTD assembly TH15

TH15-	RTD assembly, TH15			
	Immersion length X_A			
	1	4 inch		
	2	6 inch		
	3	9 inch		
	4	12 inch		
	5	14 inch		
	8 inch (0.5" increments)		
	Y	Special version		
	Sheath diameter price per 2 inch:			
	A	¼ inch 316SS		
	Y	Special		
	Extension:			
	1	Hex nipple 316SS, E=1"		
	2	Nipple Union Nipple 316SS, E=4"		
	3	Hex nipple steel, E=1"		
	4	Nipple Union Nipple, steel, E=4"		
	5	Nipple Union Nipple, steel, E=7"		
	6	Nipple Union Nipple, 316SS, E=7"		
	9	Special		
	Class; Type Sensor IEC751; Connection:			
	A	1 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)		
	B	1 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)		
	C	1 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)		
	D	1 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)		
	E	1 Pt100 class B, 4 wire low, -50 to 200 °C (-58 to 392 °F)		
	F	1 Pt100 class B, 4 wire high, -200 to 600 °C (-328 to 1112 °F)		
	G	1 Pt100 class A, 4 wire low, -50 to 200 °C (-58 to 392 °F)		
	H	1 Pt100 class A, 4 wire high, -200 to 600 °C (-328 to 1112 °F)		
	J	2 Pt100 class B, 3 wire low, -50 to 200 °C (-58 to 392 °F)		
	K	2 Pt100 class B, 3 wire high, -200 to 600 °C (-328 to 1112 °F)		
	L	2 Pt100 class A, 3 wire low, -50 to 200 °C (-58 to 392 °F)		
	M	2 Pt100 class A, 3 wire high, -200 to 600 °C (-328 to 1112 °F)		
	Y	Special		
	Enclosure; communication:			
	A	None		
	B	E+H blue Al + cover, ½" NPT cable entry		
	C	E+H blue Al + cover, ¾" NPT cable entry		
	D	Plastic PP white ½" NPT cable entry		
	E	Plastic PP white ¾" NPT cable entry		
	F	SS316L (TA20J), ½" NPT		
	G	SS316L (TA20J), LCD, ½" NPT		
	H	AL Field Housing, 1 Input, ½" NPT, HART		
	I	AL Field Housing, 1 Input, Display, HART, ½" NPT		
	J	AL Field Housing, 2 Input, ½" NPT, HART		
	K	AL Field Housing, 2 Input, Display, HART, ½" NPT		
	L	AL Field Housing, 2 Input, ½" NPT, FF		
	M	AL Field Housing, 2 Input, Display, FF, ½" NPT		
	Y	Special		
TH15-				← Order code (part 1)

										Electrical connection:	
										A	Programmable RTD TMT180
										C	Programmable TMT181 NON Ex
										D	Programmable TMT181 FM IS
										E	Programmable TMT181 CSA IS
										F	Profibus PA TMT184, non Ex
										G	Profibus PA TMT184, FM IS
										H	Profibus PA TMT184, CSA IS
										I	TMT162, non Ex, Dual Compartment
										J	TMT162, FM IS, Dual Compartment
										K	TMT162, CSA IS, Dual Compartment
										L	HART TMT142 non Ex, Single Compartment
										M	HART TMT142, FM IS, Single Compartment
										N	HART TMT142, CSA IS, Single Compartment
										O	HART TMT182, FM IS Advanced Diagnostic
										P	HART TMT182 NON Ex
										R	HART TMT182 FM IS
										T	HART TMT182 CSA IS
										Y	Special
										2	Flying Leads
										3	Terminal block
										Documentation Requirement:	
										1	Standard
										9	Other
										Test; Calibration:	
										A	None
										B	Sensor calibration certificate
										Y	Other
										Model:	
										K	Standard model, North American region
										Y	Other
										Additional option:	
										1	None
										2	Profibus PA Plug M12
										3	Foundation Fieldbus Plug 7/8"
										9	special version
TH15-											← Order code (complete)

Documentation

- Compact instructions TH13 RTD assembly in thermowell (KA190r/24/ae)
- Compact instructions TH14 RTD assembly in flanged thermowell (KA192r/24/ae)
- Compact instructions TH15 RTD assembly - spring loaded (KA195r/24/ae)
- Technical information Temperature field transmitter iTEMP® TMT162 (TI086r/24/ae)
- Technical information Temperature field transmitter iTEMP® HART® TMT142 (TI107r/24/ae)
- Technical information Temperature head transmitter iTEMP® Pt TMT180 (TI088r/24/ae)
- Technical information Temperature head transmitter iTEMP® PCP TMT181 (TI070r/24/ae)
- Technical information Temperature head transmitter iTEMP® HART® TMT182 (TI078r/24/ae)
- Technical information Temperature head transmitter iTEMP® PA® TMT184 (TI079r/24/ae)

Application example:

- Technical information Energy manager RMS621 (TI092r/24/ae)
- Technical information Cerabar S (TI383r/24/ae)
- Technical information Deltabar S (TI384r/24/ae)

United States

Endress+Hauser, Inc.
2350 Endress Place
Greenwood, IN 46143
Tel: 317-535-7138
Sales: 888-ENDRESS
Service: 800-642-8737
FAX: 317-535-8498
inquiry@us.endress.com
www.us.endress.com

Canada

Endress+Hauser Canada
1075 Sutton Drive
Burlington, ON L7L 5Z8
Tel: 905-681-9292
800-668-3199
FAX: 905-681-9444
www.ca.endress.com

Mexico

Endress+Hauser (Mexico) S.A. de C.V.
Av. Gustavo Baz No. 43
Fracc. Bosques de Echegaray
Naucalpan de Juárez, C.P. 53310,
Estado de Mexico
Mexico
Tel: (52) 55 5371 1110
FAX: (52) 55 5371 1128
E-mail: eh.mexico@mx.endress.com

Endress+Hauser 

People for Process Automation

1. Introduction



A diaphragm seal is a device that attaches to the process side of a pressure-measuring instrument to separate the instrument from the process fluid while transmitting pressure across a flexible membrane. The volume enclosed by the diaphragm, the top housing, and the measuring element is completely filled with a pressure transfer fluid. A change in pressure at the process connection causes a displacement of the filling fluid due to deflection of the diaphragm, transferring the change in pressure to the sensing element of the pressure instrument.

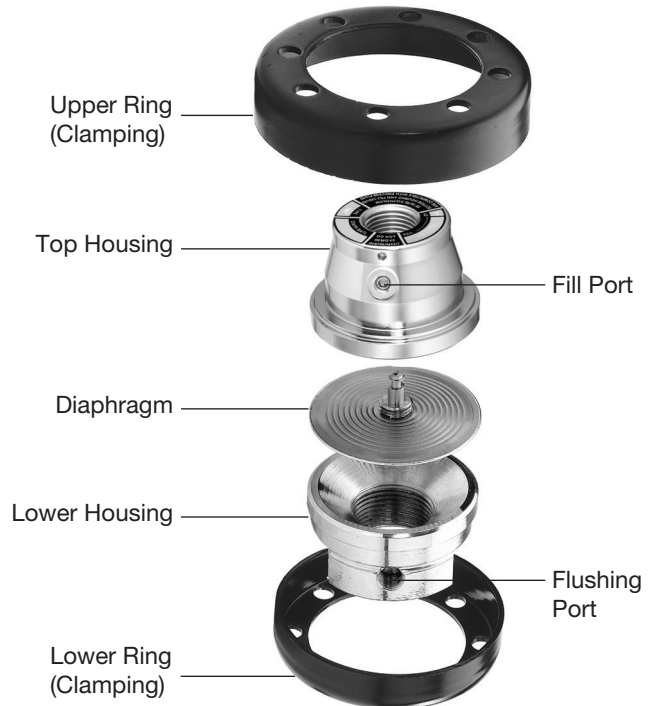
2. Safety Information

WARNING: Serious injury or equipment damage can result from failure to properly install, maintain, or operate these components. To assure safe operation and maintenance procedures, read carefully and follow the instructions in this manual.

- Follow all instructions in this document to avoid exposure to pressurized fluid
- Use proper tools and safety equipment in installing or maintaining components
- Assure that process pressure and temperatures are properly monitored and maintained, and the process fluid is appropriate and compatible with the wetted materials of the diaphragm seal
- Follow all of your company's safety procedures in the event of a leak or diaphragm seal failure

3. Diaphragm Seal Components

Though the exact components will vary between specific models, most diaphragm seals will share the same essential parts.



3.1 Top Housing

The top housing of the diaphragm seal is used to connect to the pressure measurement instrument. The fill port allows for assemblies to be vacuum filled, then sealed with a ball bearing in a conical seat and secured with a set screw.

3.2 Diaphragm

The diaphragm serves to separate the process fluid from the filling fluid, and as such is a component wetted to the process. Diaphragms can be welded or threaded into the top housing, which in turn can be welded or clamped to a lower housing. Changes in pressure cause the diaphragm to deflect, displacing fill fluid and transmitting pressure to the pressure-measuring instrument. It is important to ensure that a diaphragm has sufficient displacement to operate a pressure-measuring instrument across its entire span. For detailed diaphragm seal and instrument compatibility, see Ashcroft Product Information Page DS-PI-82, "Minimum and Maximum Pressures for Diaphragm Seals," found at Ashcroft.com

3.3 PTFE Gasket

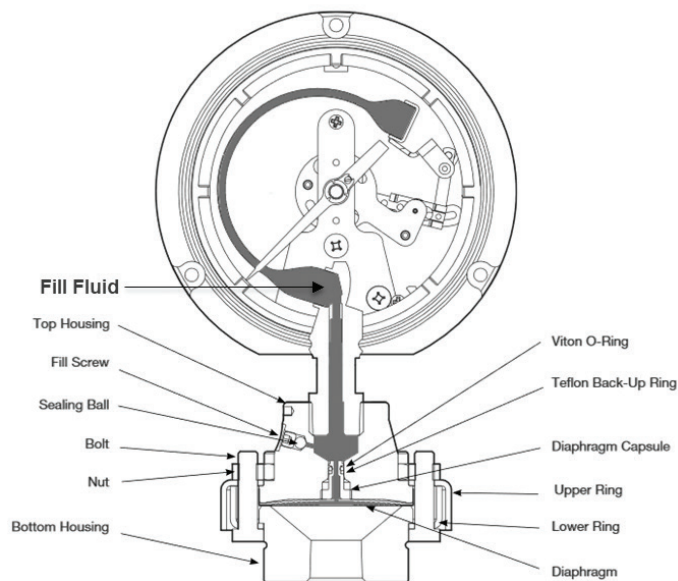
All 100- and 200-series seals are supplied with a single-use PTFE skirted gasket. Refer to Section 4.2.3 for process considerations related to these gaskets.

3.4 Lower Housing

The lower housing connects a diaphragm seal to the user's process, and is therefore a wetted part. Lower housings are designed to mate with the process. They are available in a wide variety of thread sizes. Lower housings can optionally be provided with threaded flushing connections which can be used to clean the inside of the seal or to flush out process media.

3.5 Fill Fluid

A filling fluid (sometimes referred to as "system fill," "pressure sensing fluid," or "hydraulic fluid") is required to transmit pressure from the diaphragm membrane to the pressure sensing device. Diaphragm seal assemblies are filled via a vacuum filling process that ensures the system contains no air gaps. Fill fluids are selected based on operating conditions; primarily temperature. Though normally not in contact with the process media, a diaphragm failure may bring process media in contact with the fill fluid, so compatibility with the process media should be a consideration.



4. Specifications

4.1 100/200/300-Series Seals

4.1.1 Threaded Seals: 100, 101, 200, 201, 300, 301

Connections	100, 200, 300: threaded process connection 101, 201, 301: threaded process connection with flushing port
Process Connection Sizes	¼ to 1½ NPT female ¼ to 1 NPT male
Instrument Connection Sizes	¼ or ½ NPT female
Pressure Ratings	2,500 psi (5,000 psi optional)
Added Instrument Tolerance	±0.5% typical
Wetted Components	Diaphragm, bottom housing, PTFE gasket
Non-Wetted Components	Top Housing, clamp rings, assembly hardware

4.2 Temperature Information

4.2.1 Thermal Dissipation

Seals will dissipate thermal energy, though ambient and process conditions will greatly affect the amount of heat that can be lost through the seal. Accessories designed for dissipating heat, such as siphons or capillaries, should be used whenever dealing with elevated process temperatures.

4.2.2 Elastomers and Polymeric materials

Seals made with elastomeric or polymeric wetted components will have lower pressure ratings than those made from metallic components. Refer to the applicable data sheet for temperature and pressure ratings for seals with non-metallic diaphragms or bottom housings.

4.2.3 PTFE Gasketing

The highest acceptable process temperature for PTFE gaskets is 500°F. The lowest acceptable temperature is limited by the fill fluid, the lowest of which is Syltherm XLT, rated to -150°F. For process temperatures below -150°F or exceeding 500°F, consider a temperature dissipating device, such as capillary or a microTube™ or siphon. For processes that are not compatible with PTFE, consider an all-welded diaphragm seal.

5. Fill Fluid Specifications

Fill Fluid	Temperature	Viscosity (cSt at RT)	Variation Code	Notes
Glycerin (food grade)	0°F to 400°F (-18°C to 204°C)	1,300	CG	Direct-mounting only. Not for use with vacuum service
50 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	50	CK	
10 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	10	DJ	
Halocarbon® 4.2	-70°F to 300°F (-57°C to 199°C)	4.2	CF	For use with oxygen/oxidizing process media
Slytherm® 800	-40°F to 750°F (-40°C to 400°C)	10	HA	High temperature applications
Syltherm® XLT	-150°F to 500°F (-100°C to 260°C)	1.4	CC	Low temperature applications
Calflo® AF	-20°F to 600°F (-29°C to 316°C)	60	KF	High temperature, silicone-free
Mineral Oil	10°F to 400°F (-12°C to 204°C)	75	MY	
Neobee® M-20 (food grade)	5°F to 400°F (-15°C to 204°C)	9.5	NM	
Silicone (food grade)	-40°F to 500°F (-40°C to 260°C)	350	CZ	
Distilled Water	40°F to 185°F (4°C to 85°C)	0.9	FJ	
50/50 Glycerin/Water	15°F to 200°F (-9°C to 93°C)	30	GH	
Propylene Glycol	-50°F to 325°F (-46°C to 163°C)	54	CV	
Ethylene Glycol	20°F to 325°F (-7°C to 163°C)	14	FK	
50/50 Ethylene Glycol/Water	-25°F to 190°F (-32°C to 88°C)	2.9	CT	
80/20 Glycerin/Water	15°F to 225°F (-9°C to 107°C)	270	GR	
95/5 Water/Propylene Glycol	40°F to 185°F (4°C to 85°C)	1.0	PY	

6. Installation

6.1 General Information

Instruments attached and filled to diaphragm seals should never be tightened or loosened at the top housing. Doing so will alter the dynamics of the fill fluid and diaphragm movement, causing errors in the reading. Assemblies should ONLY be installed and/or tightened at the diaphragm seal lower housing. Most diaphragm seals can be purchased with either a locking device (XLD) or with the instrument welded to the top housing of the seal to prevent tampering (XDU).

Diaphragm seals should be installed in accordance with any safety precautions or installation specifications applicable to the end user. That said, the general principles in the following sections still apply.

6.2 Flushing Ports

Use of flushing ports is application-specific and are often used when process media has the potential to clog inside the lower housing, whether due to process media solidification, suspended solids, polymerization, or other factors. Diaphragm seals with flushing ports must have the flushing ports plugged prior to startup. Flushing ports on most seals are 1/4 NPT, though some configurations may have 1/8 or 1/2 NPT flushing ports. Diaphragm seals can be ordered with the flushing ports pre-plugged with the "XPU" variation. Note that to prevent thread galling or stripping, factory-installed flush plugs may not be fully tightened and should be checked for tightness prior to pressurization.

6.3 Threaded Seals

Note: Torque should never be applied to the pressure instrument when installing the diaphragm seal. Most seals are supplied with either wrench flats or spanner holes to be used when installing the seal into process piping.

Threaded seals are most commonly supplied with NPT threads per ASME B1.20.1. NPT threads require the use of a suitable thread sealant, such as pipe dope or PTFE tape, and must be tightened securely to prevent galled threads and to ensure a leak-tight seal. Torque values will vary by connection size, though 2-3 full turns past finger-tight is often used as a guideline. Refer to ASME B1.20.1 for detailed information regarding NPT threads. For alternate thread types (metric, BSP, etc.), refer to the applicable specification.

7. Maintenance

7.1 Storage

Diaphragm seal assemblies should be stored in accordance with the storage requirements for all instruments attached, as well as any temperature limits listed above. Common instrumentation is shown in the table below. Refer to the respective data sheets or maintenance guides for detailed storage requirements for Ashcroft pressure instruments. Note that certain fill fluids (e.g., distilled water) may have storage and process temperature limitations narrower than the below data.

Pressure Instrument	Minimum Storage Temperature °F (°C)	Maximum Storage Temperature °F (°C)
Pressure Gauge (Dry)	-40 (-40)	250 (121)
Pressure Gauge (Glycerin-filled)	0 (-18)	150 (66)
B-series switches	-20 (-28)	150 (65)
A- Series Switches	-40 (-40)	257 (125)

7.2 Frequency of Inspection

Inspection frequency is application-specific and depends on the severity of the service and how critical the accuracy of the pressure instrument is. For example, a monthly inspection may be necessary for severe service applications, such as corrosive process media or heavy pulsation and vibration. Annual inspections, or even less frequent schedules, are often employed in non-critical applications.

7.3 Removal from Service

Diaphragm seals should be properly isolated and vented from the process prior to disassembly. Most diaphragms can be inspected by removing the diaphragm seal from the process (either by unthreading or by removing it from the mating flange) and viewing the diaphragm through the lower housing. If additional inspection is needed, 100- and 200-series diaphragm seals can be disassembled by removing the clamping screws and separating the top housing and diaphragm from the lower housing. Note that the PTFE wetted gaskets on certain seals are single use, and must be replaced anytime the compression is lost. Replacement gaskets can be ordered from Ashcroft (part number 124A287-01). 300-series seal should not be disassembled, as the diaphragm is merely clamped between the top and bottom housing; disassembling will result in loss of fill fluid.

7.4 Diaphragm Seal Failures and Troubleshooting

100, 200, and 300-series diaphragm seal are continuous duty as defined by ASME B40.2. Should the pressure instrument fail or be removed accidentally, the diaphragm will seat against a matching surface in the top housing preventing damage to the diaphragm or leakage of the process fluid.

In the event that a diaphragm failure is suspected, the assembly should be immediately isolated from the process and the cause for failure determined. Most diaphragm failures are caused by corrosion, high temperatures, or fill leakage. Process media build-up in the lower housing can also require cleaning or replacement. In the event of a diaphragm failure due to corrosion, it is critical that the wetted materials of the assembly be evaluated for compatibility before it is replaced.

7.4.1 Troubleshooting Guide

Symptom	Possible Cause	Solution
Instrument not responding to pressure	Poor filling process, loss of fill fluid	Refill diaphragm seal and instrument assembly
	Process media clog or accumulation in lower housing	Clean out lower housing; alternately, use a seal with a flushing port
Process media leaking from process connection	Threaded seals: Inadequate thread sealing	Check that the seal has been properly torqued and that the threads have been sealed with pipe dope or PTFE tape
Rusted bolts/top housing/flange	Corrosive atmosphere	In most cases rust will not affect the performance of the seal. Consider more corrosion-resistant non-wetted materials.
Upscale shift on pressure reading	Temperature error – High Temp	Consider a heat dissipation accessory, such as a capillary or MicroTube™ Siphon
	Overfilling	Refill diaphragm seal and instrument assembly
	Diaphragm permeation	Certain process media can permeate the very thin diaphragm material and react with fill fluid. Review wetted material compatibility

100/101, 200/201, 300/301 Threaded Diaphragm Seal

FEATURES

- 316L stainless steel top housing (STD.)
- Available in wide range of wetted materials for process compatibility
- Flushing port (101, 201, 301) provides for easy cleaning of process
- Continuous duty design contains process if instrument is inadvertently removed

TYPICAL USES

- Oil and Gas
- Refineries
- Chemical and Petrochemical
- Water and Wastewater
- NACE Compliant Processes (Sour Gas Separation)
- Biogas and Biodiesel



100 Series
Diaphragm Threaded To Top Housing - flexible design

200 Series
Diaphragm Welded or Bonded To Top Housing - eliminates leak path

300 Series
Diaphragm Clamped Between Upper & Lower Housing - flexible design for elastomeric diaphragms

SPECIFICATIONS

Connection Style:	100, 200, 300: Threaded 101, 201, 301: Threaded with flushing port
Process Connection Size:	¼ to ½ NPT Female, ¼ to 1 NPT Male
Fill Fluid:	See table 3 on page 4
Pressure Rating (MAWP):	2500 psi; 5000 psi (OPT.)
Instrument Connection Size:	¼ to ½ NPT
Approvals:	CRN

WETTED COMPONENTS

Diaphragm	Bottom Housing	Gasket
See table 1 on page 3	See table 2 on page 3	PTFE (rated for -150°F to 500°F)

NON-WETTED COMPONENTS

Top Housing	Bolt/Clamp Rings	Nuts/Bolts
316L SS (STD.) Monel® Titanium	Carbon steel	Zinc plated alloy steel

KEY BENEFITS

- Protects instrumentation from corrosive media
- Prevents pressure measuring instrument from clogging
- Dissipates elevated process temperature

100/101, 200/201, 300/301 Threaded Diaphragm Seal

ORDERING CODE	Example:	10	2	01	S	S	02T	XCK	NH
Process Connection Size									
25 - 1/4" NPT Female									
50 - 1/2" NPT Female									
75 - 3/4" NPT Female									
10 - 1" NPT Female		10							
15 - 1 1/2" NPT Female									
02 - 1/4" NPT Male									
04 - 1/2" NPT Male									
06 - 3/4" NPT Male									
08 - 1" NPT Male									
SA - 1/4" Socket weld									
SB - 1/2" Socket weld									
SC - 3/4" Socket weld									
SD - 1" Socket weld									
Diaphragm Type									
1 - 100 series capsule diaphragm threaded into top housing									
2 - 200 series diaphragm welded (metallic) or bonded (elastomeric) to top housing			2						
3 - 300 series elastomeric diaphragm clamped between top and lower housing									
Flushing Port									
00 - No flushing port									
01 - Flushing port in lower housing				01					
Diaphragm Materials (See Table 1 on page 3)									
S - 316L Stainless steel					S				
Bottom Housing Materials (See Table 2 on page 3)									
S - 316L Stainless steel						S			
Instrument Connection Size									
02T - 1/4" NPT Female instrument connection							02T		
04T - 1/2" NPT Female instrument connection									
Options (if choosing an option(s) must include an "X")								X__	
Fill Fluid (for seals attached to instruments, see Table 3 on page 4 for more available fill fluids)									
CK - 50 cSt Silicone								CK	
Optional Features (for more options, see table 4 on page 5)									
NH - Stainless steel instrument tag									NH

100/101, 200/201, 300/301 Threaded Diaphragm Seal

TABLE 1 - DIAPHRAGM MATERIALS

Material	Letter Code	100 Series	200 Series	300 Series	Notes
316L Stainless Steel	S	•	•		
304L Stainless Steel	C	•	•		
904L Stainless Steel	F		•		
Monel® 400	P	•	•		200-series must be ordered with XYM Monel® top housing option
Tantalum	U	•	•		
Hastelloy® C-276	H	•	•		
Hastelloy® B	G	•	•		
Hastelloy® C-22	J	•	•		
Carpenter 20®	D	•	•		
PTFE	T		•	•	Temp limits: -40°F to 400°F
Viton®	Y		•	•	Temp limits: -40°F to 350°F Max. pressure: 500 psi
Kalrez®	K		•	•	Temp limits: 30°F to 212°F Max. pressure: 500 psi
Nickel	N	•	•		
Titanium	Ti		•		Includes titanium top housing
Gold Plated 316L Stainless Steel	W	•			

TABLE 2 - BOTTOM HOUSING MATERIALS

Material	Letter Code	Notes
316L Stainless Steel	S	
304L Stainless Steel	C	
904L Stainless Steel	F	
Carbon Steel	B	
Monel® 400	M	
Hastelloy® C-276	H	
Hastelloy® B	G	
Hastelloy® C-22	J	
Duplex 2205®	Z	
Super Duplex 2507®	A	Contact Ashcroft for availability
Carpenter 20®	D	
Inconel® 625	W	
Incoloy® 825	L	
Nickel	N	
Titanium	Ti	
PVDF	KY	Only offered in ½ NPT, ¼ NPT, and socket weld process connections. Not available with flushing connection. PVDF Temperature Limits: 200 psi - 74°F, 125 psi - 125°F, 80 psi - 150°F
PVC	V	Only offered in ½ NPT, ¼ NPT, and socket weld process connections. Not available with flushing connection. PVC Temperature Limits: 200 psi - 74°F, 125 psi - 125°F, 80 psi - 150°F

100/101, 200/201, 300/301 Threaded Diaphragm Seal

TABLE 3 - FILL FLUIDS

Fill Fluid	Temperature	Viscosity (cSt at 70°F (21°C))	Variation Code	Notes
Glycerin (food grade)	0°F to 400°F (-18°C to 204°C)	1,300	CG	Direct-mounting only. Not for use with vacuum service
50 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	50	CK	
10 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	10	DJ	
Halocarbon® 4.2	-70°F to 300°F (-57°C to 199°C)	4.2	CF	For use with oxygen/ oxidizing process media
Syltherm® 800	-40°F to 750°F (-40°C to 400°C)	10	HA	High temperature applications
Syltherm® XLT	-150°F to 500°F (-100°C to 260°C)	1.4	CC	Low temperature applications
Calflo® AF	-20°F to 600°F (-29°C to 316°C)	60	KF	High temperature, silicone-free
Mineral Oil	10°F to 400°F (-12°C to 204°C)	75	MY	
Neobee® M-20 (food grade)	5°F to 400°F (-15°C to 204°C)	9.5	NM	
Silicone (food grade)	-40°F to 500°F (-40°C to 260°C)	350	CZ	
Distilled Water	40°F to 185°F (4°C to 85°C)	0.9	FJ	
50/50 Glycerin/Water	15°F to 200°F (-9°C to 93°C)	30	GH	
Propylene Glycol	-50°F to 325°F (-46°C to 163°C)	54	CV	
Ethylene Glycol	20°F to 325°F (-7°C to 163°C)	14	FK	
50/50 Ethylene Glycol/Water	-25°F to 190°F (-32°C to 88°C)	2.9	CT	
80/20 Glycerin/Water	15°F to 225°F (-9°C to 107°C)	270	GR	
95/5 Water/Propylene Glycol	40°F to 185°F (4°C to 85°C)	1.0	PY	

100/101, 200/201, 300/301 Threaded Diaphragm Seal

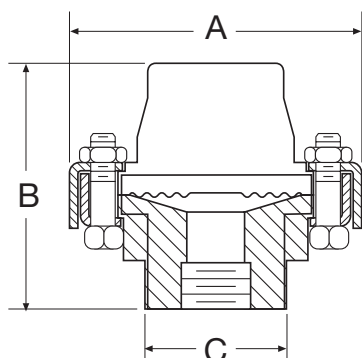
TABLE 4 - OPTIONS

Code	Option	Notes
Flushing Port		
AW	Single ½" flushing connection	Process connection must be ¾ NPT or smaller
DB	Dual ½" flushing connections	Process connection must be ¾ NPT or smaller
DK	Dual ¼" flushing connections	
PU	Pipe plug for flushing connection	Plug will match bottom housing material. Seals with flushing connections only
Top Housing		
YM	Monel® 400 top housing	Must be ordered with Monel® or tantalum diaphragm
Assembly/Hardware		
SB	Stainless steel clamping bolts	
SE	Stainless steel rings and bolts	
HP	High-pressure clamping rings	Increases MAWP to 5,000 psi unless otherwise limited by material
LD	Stainless steel locking device	
NH	Stainless steel instrument tag	
NX	Teflon®-free diaphragm seal	200 psi maximum working pressure, 200 series only
DU	Instrument welded to top housing	Instrument socket must be like-material to top housing
Other		
MQ	Positive material identification	
NH	Stainless steel instrument tag	
6B	Cleaned for oxygen service	
CD-5	NACE compliance certificate	Stainless, Hastelloy®, or Monel® wetted materials Must be ordered as a separate line item

DIMENSIONS in [] are millimeters

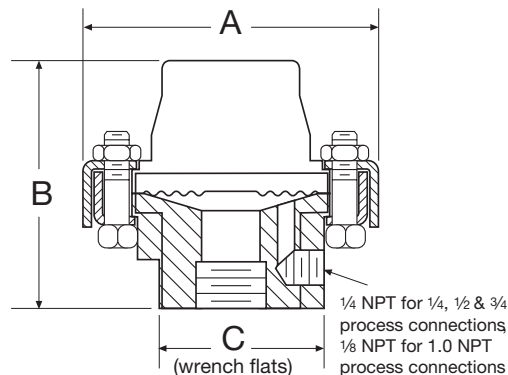
For reference only, consult Ashcroft for specific dimensional drawings

100, 200, 300 THREADED DIAPHRAGM SEAL



A	B	C
3¾ [95]	2⅞ [73]	1⅓ [46]

101, 201, 301 THREADED DIAPHRAGM SEAL WITH FLUSHING PORT



A	B	C
3¾ [95]	2⅞ [73]	1⅓ [46]

ASHCROFT®

Stainless Steel
Case Gauges

NOW WITH

PLUS!
Performance



ISO 9001
REGISTERED FIRM

DRESSER

Measurement
BULLETIN SS-1

Introduction

Ashcroft® Stainless Steel Case Pressure Gauges

For demanding applications where corrosion resistance and reliable operation are critical, look to Ashcroft® stainless steel case pressure gauges to fulfill your requirements. These designs perform well in many applications where vibration, pulsation and mechanical shock are present. Offered in stainless steel, including a stainless steel case, bourdon tube, socket and movement, these gauges meet the needs of many corrosive environments.

Stainless steel gauges ensure long service life in the harshest, most demanding environments. Applications where Ashcroft stainless steel case gauges are typically used for their lasting performance include process and chemical plants, petrochemical refineries, pharmaceutical, food and beverage processing, and pulp and paper mills. Ashcroft stainless steel case gauges will perform well:

- In applications where vibration, pulsation and mechanical shock are major factors.
- In corrosive environments when a stainless steel case and ring are required.

We offer our stainless steel case pressure gauges in a selection of accuracies, materials and sizes to meet the wide-ranging requirements of the industrial marketplace. When selecting an Ashcroft stainless steel case gauge, consider the following:

Process media — Ashcroft stainless steel case gauges are available in a broad range of bourdon tube and socket materials to suit your product needs.

Pressure gauge range — A wide selection of ranges from vacuum through 15,000 psi (up to 30,000 psi on 4½" and 6" 1009) including compound and metric ranges are available.

Operating environment — All Ashcroft stainless steel case gauges have a 304 series stainless steel case and ring and are available hermetically sealed or weatherproof. They are also available liquid filled with a built-in throttle plug to help protect the gauge against pressure surges or spikes.

Accuracy requirements — Ashcroft Type 1009 gauges come standard with 1% full scale ASME Grade 1A accuracy. Ashcroft Type 1008 gauges come

standard with a 3/2/3% ASME Grade B accuracy.

Dial size — Available in 2½" through 6" and 40mm through 100mm dial sizes, Ashcroft selection of stainless steel gauge case sizes is unsurpassed.

Connections — ½ NPT, ¼ NPT, ½ NPT, JIS, BSP, and automotive connections available.

Mounting requirements — Ashcroft stainless steel case gauges are available for stem, surface or flush mounting.

Dresser Instrument offers two series of Ashcroft gauges — Type 1008 and 1009 to meet your stainless steel case requirements.



CONTENTS

Page	
2 & 3	Introduction
4 & 5	Features & Benefits
6 & 7	Other Stainless Steel Case Gauges Warranty and Movement
8 & 9	Specification Matrix
10 & 11	Product Selection and Media Application
12 & 13	1008 Range Tables
14	1009 Range Tables
15	Options
16	How to Order
17	1008 General Dimensions
18 & 19	1009 General Dimensions

Introduction

Ashcroft® Stainless Steel Case Pressure Gauges



Features & Benefits

Ashcroft® Stainless Steel Case 1008 Pressure Gauges

Type 1008 Stainless Steel Case Gauge — 63mm and 100mm Case Sizes

These stainless steel case gauges offer reliable performance under the most demanding applications where vibration and pulsation dominate the operating conditions. They are offered in a selection of metric case sizes in stem, surface or panel mounting to meet a variety of requirements.

63mm and 100mm Type 1008 pressure gauge ranges, with the patented *PowerFlex™* movement, are designed for maximum life under pulsating service conditions.

The 63mm and 100mm sizes of our Type 1008 gauges share some unique features that offer benefits not available elsewhere.

- Because the socket of the 1008S is welded to the case, the gauge is stronger and more durable, with less risk of liquid-filled gauges leaking. And because there are no screws needed to hold the system in place, we eliminate leak paths when the gauge is liquid filled.
- The patented *PowerFlex™* movement offers superior shock, vibration and pulsation performance.
- True Zero™ indication with no stop pin — a unique safety benefit.

- Because weld nuts are standard on all back-connect gauges, you will enjoy the flexibility to panel mount any back-connect gauge.
- The date of manufacture is coded on the socket of each gauge for quality assurance.*
- We ship all gauges in a unique carton-within-carton package, so your gauges arrive in good condition.
- These Ashcroft gauges are made in the USA — for the best availability and quality! Need it now? Ashcroft Gold Service offers 2-5 day shipment.

40mm and 50mm Case Sizes

The 40mm and 50mm sizes of our Type 1008 gauges share some of their own unique features. These gauges bring all stainless steel construction (case, ring, bourdon tube and socket) to the requirement for smaller dial diameters.

Features of the 40mm and 50mm 1008 gauges include:

- Stainless steel case and ring for maximum resistance to corrosion.
- 316 stainless steel bourdon tube and socket for maximum resistance to corrosion.
- Available with front flange or U-clamp for panel mounting.
- Available with *PLUS!™* or liquid fill in lower or back connections for better performance and longer gauge life in pulsating and vibrating applications.
- Ranges from vacuum through 15,000 psi, including compound.

Type 1009 Stainless Steel Case Gauge — 2½" and 3½" Case Sizes

The Type 1009 Duralife® gauge in 2½" and 3½" case sizes represents another technological breakthrough in gauge manufacture. Duralife® 1009 gauges provide significant features and benefits for many applications and are offered in stem, surface or panel mount configurations.

The combination of features in the 1009 Ashcroft Duralife® gauge reflects the finest in gauge technology for



Type 1008 shown

*Excludes 1008A

Features & Benefits

Ashcroft® Stainless Steel-Case 1009 Pressure Gauges

vibration, shock and pulsation applications. Pressure ranges from vacuum through 15,000 psi, including compound, are available. Metric ranges are also offered. All 2½" and 3½" Duralife® gauges are manufactured to ASME Grade 1A accuracy of 1% over the entire dial arc. They offer zero and span adjustments and can be recalibrated in the field.

The 2½" and 3½" Type 1009 Duralife® gauges share some unique features that offer benefits not available elsewhere.

- Because the socket is welded to the case, the gauge is stronger and more durable, with less risk of liquid-filled leaking since there are no screws needed to hold the system in place. Potential leak paths are eliminated.

- The patented *PowerFlex™* movement offers superior shock, vibration and pulsation performance, resulting in outstanding durability.
- The True Zero™ indication with no stop pin is a unique safety benefit.
- With weld nuts standard on all back-connect gauges, you have the flexibility to panel mount any back-connect gauge.
- An optional external adjust or Easy Zero™ feature on the 3½" 1009 is offered on both dry and liquid filled versions. Adjustment tolerances are ±5% of full scale range.
- Each gauge is date coded on the socket for quality assurance.
- We ship all gauges in a unique carton-within-carton package, so your gauges arrive in good condition — far fewer gauges are received out of calibration with our "leading-edge" packaging method.

- Type 1009S Duralife® gauges are all-stainless steel construction for maximum resistance to corrosion.
- Because these gauges are fully recalibratable, there is no need to purchase a new gauge if recalibration is needed — this benefit includes zero and span adjustments. (Consult ASME B40.1 for gauge life and recalibration.)
- Five-Year Warranty gives you the best total value.
- Ashcroft Duralife® gauges are made in the USA — for the best availability and quality!

4½" & 6" Case Sizes

The 4½" and 6" sizes of our Type 1009 gauges share some of their own unique features. Built for long life and sustained accuracy under the most adverse operating conditions, these gauges are available with many features that offer benefits you won't find elsewhere:

- Stainless steel case and ring for maximum resistance to corrosion.
- Adjustable micrometer pointer for field recalibration.
- Rotary geared movement for field linearity adjustment.
- Variety of bourdon tube materials to meet many different application requirements.
- Available liquid filled in lower or back connections for better performance and longer gauge life in pulsating and vibrating applications.
- Pressure ranges from vacuum through 30,000 psi.



Type 1009 shown

Other Stainless Steel Case Gauges

Ashcroft® Stainless Steel Case Pressure Gauges

PLUS!™ Performance

An exclusive, new, optional feature provides virtually liquid-filled performance in a dry gauge.

The Ashcroft PLUS!™ feature is a patent-pending design incorporated into the industry-standard Ashcroft pressure gauge.

Historically, pulsation and vibration have reduced gauge life and made gauges difficult to read.

Customers have had no alternative to liquid-filled gauges to solve vibration and pulsation problems, until now!

Advantages Versus Liquid-Filled Gauges

- Saves money
 - Lower purchase price versus liquid-filled gauges
 - Eliminates costly specialty fills
 - Allows easy standardization to reduce misapplications
- Reduces possibility of leaks
- Lighter weight...easier to handle
- Eliminates liquid-fill lines...easier to read
- Easy recalibration
- Wider ambient temperature range than glycerin
- Eliminates disposal and environmental issues

Advantages Versus Dry Gauges

- Steady pointer...same as liquid-filled gauges
- 100% longer life gauges...reduces gauge usage 50%!

Hydraulic Gauges

These gauges are especially suitable for applications on hydraulic presses, pumps and systems using high-pressure hydraulic fluids. 4½" and 6" Type 1009 gauges for this application are offered with a throttle plug and slotted link to protect the movement and system of the gauge from severe pressure spikes and surges. A liquid-filled gauge is also available to help protect internal moving parts of the gauge.

The 63mm and 100mm Type 1008 gauges and 2½" and 3½" Type 1009 gauges employing the unique Power Flex™ movement and a throttle plug are ideally suited for hydraulic applications where severe service is a consideration. Available in dry PLUS!™ or liquid-filled versions, these gauges will meet your severe application needs.

Refrigeration Gauges

Available with 63mm and 100mm Type 1008 gauges and 2½" through 6" Type 1009 gauges, these Ashcroft gauges have corresponding temperature scales for refrigerants 11, 12, 22, 114, 123, 134A, 500, 502 and ammonia. To meet the stringent requirements of an ammonia refrigeration system, a gauge with a stainless steel tube and socket is recommended. Both 4½" and 6" Type 1009 gauges can be furnished with a stainless steel tube and a steel or stainless steel socket.

Ashcroft stainless steel case refrigeration gauges come equipped with all the features made available on the standard product.

Receiver Gauges

Used in conjunction with pneumatic transmitters, Ashcroft® receiver gauges indicate pressure, temperature, flow or any information that can be transmitted by proportional variations in air pressure.

For information concerning other receiver gauges offered, consult Customer Service, Stratford, CT.

Liquid-Filled Gauges

Constant lubrication of the movement minimizes wear on all moving gauge parts. The liquid fill, usually glycerin or silicone, acts as a dampening agent for the bourdon tube and movement, thus reducing gauge pointer flutter. Under adverse environmental conditions, corrosive elements may attack internal parts and shorten gauge service life. Liquid filling a gauge helps prevent corrosive effects caused by adverse environments. All liquid-filled gauges 30 psi and above are fitted with throttle plugs to provide additional dampening.

Ashcroft stainless steel case gauges with dial sizes from 40mm through 100mm and 2½" through 6" are available liquid filled or field liquid fillable. Simply specify XLJ to order a stainless steel-case gauge that can be filled in the field. Gauge accuracy on liquid filled Type 1009 gauges with 2½", 3½" or 100mm dial size is up to 1.5% full scale.



Panel Gauges

Ashcroft stainless steel case panel mounted gauges with back connections are available with a three hole front flange or a U-clamp. Generally, a front flange is used when there is limited access to the back of the panel.

A U-clamp is the most common method of panel mounting when there is access to the back of the panel. Ashcroft back connect stainless steel gauges are available for panel mounting with dial sizes from 40mm through 100mm and 2½" thru 6". The back connect 2½" and 3½" Duralife 1009 gauges and the 63mm and 100mm 1008 gauges come standard with weld nuts on the back of the case. This feature allows for easy conversion to panel mounting with either a U-clamp or front flange. The 2½" and 3½" 1009 lower connect gauges are also available for wall mounting with an available back flange.



Warranty & Movement

Duralife® 2½", 3½", 100mm
Type 1009 gauges

The patented pressure system consists of a *PowerFlex™* movement and unitized bourdon tube assembly that provides increased gauge life and stability. This truly unique design has a stainless steel movement suspended between the bourdon tube and socket with a link wire. This spring suspension significantly reduces the level of forces transmitted to the precision moving parts, greatly extending the wear life in applications where vibration and pulsation are constant factors. Since the system is welded to the case, there are no screws to loosen under conditions of pulsation and vibration.



All 2½", 3½" and 100mm Type 1009 Duralife gauges come standard with a limited five year warranty. For a copy of our warranty call or write:

Dresser Instrument
Dresser, Inc.
250 East Main Street
Stratford, CT 06614-5145
203-378-8281

Ask for Customer Service

Specification Matrix

Ashcroft® Stainless Steel Case Pressure Gauges



Specifications	Type 1008, 40mm	Type 1008, 50mm	Type 1008A, 63-100mm	Type 1008S
Accuracy	3-2-3% ASME Grade B	3-2-3% ASME Grade B	3-2-3% ASME Grade B	3-2-3% AS
Case Style	Open Front		Open Front	Open
Case Material	304 Stainless Steel		304 Stainless Steel	304 Stair
Dial Size (Code)	40mm (40)	50mm (50)	63mm (63), 100mm (10)	63mm (63),
Dial Material & Color	Aluminum, white background w/black markings			
Ring Type	304 Stainless Steel Push-In		304 Stainless Steel Crimped	304 Stainless
Bourdon Tube (Code)	316 Stainless Steel (S)		Bronze (A)	316 Stainle
Socket Material	316 Stainless Steel		Brass (socket O ring standard)	316 SS, Socke
Range Limits	Vac/15,000 psi-(40mm)	Vac/15,000 psi-(50mm)	Vac/6000 psi	Vac/15
Connection Size (Code)	½ NPT (01)	½ NPT (01) ¼ NPT (02)	¼ NPT (02)	¼ NPT (02),
Connection Location	Lower (L), Back (B)		Lower (L), Back (B)	Lower (L)
Mounting	Stem, Flush		Stem, Flush	Stem,
Movement	300 Series SS (conventional)		Brass (<i>PowerFlex™</i>) with polyester segment	300 Series SS with polyes
Pointer	Nonadjustable (Aluminum)		Nonadjustable (Aluminum)	Nonadjustabl
Window	Glass		Polycarbonate	Polycar
Warranty	One Year		One Year	One
Options	Code			
PLUS!™ Performance (LL)	N/A		N/A	Avail
Glycerin Fill (L)	Standard		Standard	Star
Silicone Fill (GV)	N/A		Available	Avail
Halocarbon Fill (GX)	N/A		N/A	Avail
Weatherproof, hermetic seal (LJ)	Available		Available	Avail
U-Clamp (UC)	Available		Available	Avail
Front Flange Ring (FF)	Available		Available	Avail
Retrofit Flange (RF)	N/A		Available	Avail
Back Flange (FW)	N/A		N/A	N
Wall Mounting Bracket (BF)	N/A		N/A	N
Acrylic Window (PD)	N/A		N/A	N
Polycarbonate Window (PD)	Standard on liquid filled gauge		Standard	Star
Shatterproof Glass (SG)	Available		N/A	N

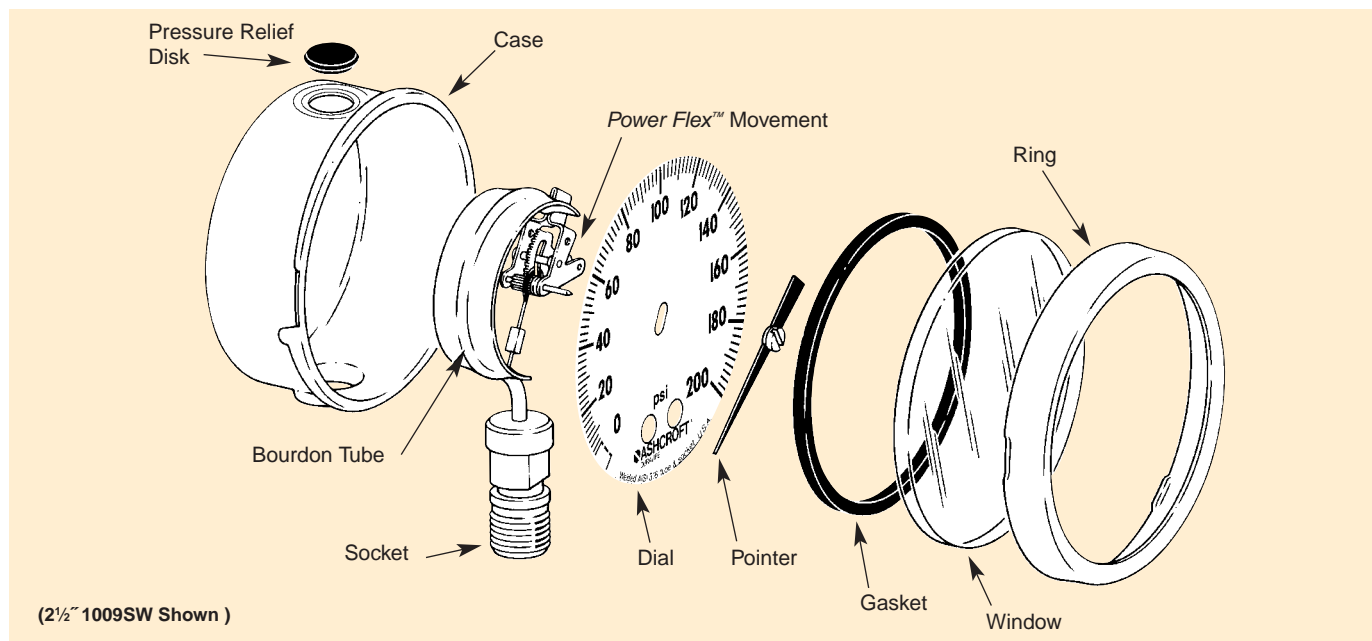


63-100mm	Type 1009, 2½"-3½"	Type 1009, 100mm (XMG)	Type 1009, 4½"	Type 1009, 6"
ME Grade B	1% ASME Grade A	1% ASME Grade A	1% ASME Grade A	1% ASME Grade A
Front	Open Front	Open Front	Open Front	Open Front
less Steel	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel	304 Stainless Steel
100mm (10)	2½" (25), 3½" (35)	100mm (10)	4½" (45)	6" (60)
	Brushed Aluminum, w/black markings	Aluminum, white background w/black markings	Brushed Aluminum, w/black markings	
Steel Crimped	304 Stainless Steel Bayonet	304 Stainless Steel Bayonet	304 Stainless Steel Bayonet	304 Stainless Steel Bayonet
ss Steel (S)	316 Stainless Steel	316 Stainless Steel (SW)	Bronze Tube, Brass Socket (A)	4130 Alloy Steel Tube & Socket (B)
			316 SS Tube, Steel Socket (R)	316 SS Tube & Socket (S)
			Monel Tube & Socket (P)	
t Weld to Case	Bronze, Socket Weld to Case (AW) 316 SS, Socket Weld to Case (SW)	316 SS, Socket Welded to Case		
000 psi	Vac/15,000 psi	Vac/15,000 psi	Vac/30,000 psi	Vac/30,000 psi
½ NPT (04)*	¼ NPT (02), ½ NPT (04)*	½ NPT (04)	¼ NPT (02), ½ NPT (04)	¼ NPT (02), ½ NPT (04)
, Back (B)	Lower (L), Back (B)	Lower (L)	Lower (L), Back (B)	Lower (L), Back (B)
Flush	Stem, Surface, Flush	Stem, Surface	Stem, Surface, Flush	Stem, Surface, Flush
(PowerFlex™) er segment	300 Series SS (PowerFlex™)	300 Series SS (PowerFlex™)	400 Series SS (Conventional)	400 Series SS (Conventional)
e (Aluminum)	Adjustable (Aluminum)	Micrometer Adjustable (Aluminum)	Micrometer Adjustable (Aluminum)	Micrometer Adjustable (Aluminum)
arbonate	Polycarbonate	Shatterproof Glass	Glass	Glass
Year	Five Years	Five Years	One Year	One Year
able	Available	Available	Available	Available
dard	Standard	Standard	Standard	Standard
able	Available	Available	Available	Available
able	Available	Available	Available	Available
able	Available	Available	Available	Available
able	Available	Available	Available	Available
able	Available	Available	Available	Available
able	Available (3½")	N/A	Available	N/A
/A	Available	Available	N/A	N/A
/A	N/A	N/A	Available	Available
/A	N/A	N/A	Available	Available
dard	Standard	Available	N/A	N/A
/A	Available	Standard	Available	Available

* 3½" or 100mm lower only.

Product Selection Information

Ashcroft® Stainless Steel Case Pressure Gauges



Consult ASME B40.1 for guidance in gauge selection

WARNING: To prevent misapplication, pressure gauges should be selected considering media and ambient operating conditions. Improper application can be detrimental to the gauge, causing failure and possible personal injury or property damage. The information contained in this catalog is offered as a guide to assist in making the proper selection of a pressure gauge. Additional information is available from Dresser Instrument Division or www.ashcroft.com.

Pressure Ranges:

As recommended by ASME B40.1, select a gauge with a full scale pressure range of approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Failure to select a gauge range within these criteria may ultimately result in fatigue failure of the bourdon tube.

Operating Conditions:

The operating conditions to which a gauge will be subjected must be considered. If the gauge will be subjected to severe vibration or pressure pulsation, liquid filling the gauge will be necessary to obtain normal product life.

Other than discoloration of the dial and hardening of the gasketing that may occur as ambient temperatures exceed 150°F, stainless steel gauges

(that are not liquid filled) can withstand continuous ambient temperatures as high as 250°F. Liquid-filled gauges can withstand ambient temperatures up to 200°F. Accuracy will be affected by approximately 1.5% per 100°F.

Gauges with welded joints will withstand 750°F (450°F with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost.

Proper selection of the bourdon system material is dependent on the process fluid to which the system will be subjected. If the correct material is not available, the use of a diaphragm seal may be necessary to protect the system from the process fluid. Liquid filled gauges with throttle plugs are recommended for the discharge side of positive displacement pumps.

Pressure Elements:

Available in a wide variety of materials, including: phosphor bronze, alloy steel, 316 stainless steel and K Monel.

Cases:

Ashcroft stainless steel case gauges have 304 stainless steel cases. The 2½", 3½", 100mm 1009 and the 63mm and 100mm 1008 are field convertible. These gauges can be converted to hermetically sealed, weatherproof or liquid filled by changing the fill plug and adding a throttle plug. The 40mm and 50mm 1008 gauges can be furnished from the factory hermetically sealed,

weatherproof or liquid fillable. Specify the XLJ variation. With the exception of 40mm and 50mm 1008 gauges, all **dry** stainless steel gauges come standard with a vented pressure relief disc. These gauges with the vented plug **are not** weatherproof or hermetically sealed. If a weatherproof or hermetically sealed gauge is required, specify the XLJ variation and your gauge will be shipped with a solid nonventing plug.

Rings:

The ring, which retains the window, is push-in, crimped or bayonet (cam) depending on the type number.

Movements:

Movements are designed and materials of construction selected to reduce friction and extend wear life.

Dials:

Dials are uniformly graduated and have highly legible black markings. All 1009 gauges, with the exception of 1009 XMG, have a brushed aluminum dial with black markings. Type 1008 gauges have a white dial with black markings.

Windows:

Depending on the size and type, Ashcroft stainless steel case gauges are available with polycarbonate, acrylic, shatterproof glass or glass windows.

Pointers:

Depending on the type, Ashcroft stainless steel gauges are available with adjustable or fixed pointers.

Media Application Table

Ashcroft® Stainless Steel Case Pressure Gauges

The media being measured must be compatible with the wetted parts of the pressure instrument. To use the chart below, locate the media whose pressure is to be measured and select a suitable material from those available. Diaphragm seal information is contained in Bulletin DS-1. This is a simplified chart and

assumes the media temperature is below 200°F. *PLUS!* option, throttling devices and/or a liquid-filled instrument are recommended in applications with pulsation or vibration. These recommendations are only a guide, as service life is dependent on temperature, concentrations, catalysts that may be added, or

other conditions beyond our control. Consult Stratford, CT Customer Service for specific applications and for any media not listed. More complete corrosion guide available on our website at www.ashcroft.com in the Application Data Section.

Media Application	Pressure Instrument Material				
	Brass or bronze	Steel	Stainless steel	Monel	Diaphragm seals*
Acetone	•		•	•	
Acetic Acid <40%			•		
Acetic Anhydride					•
Acetylene (Dry)		•	•		
Acrolein 100%					•
Air	•	•	•	•	
Alcohol, Ethyl	•	•	•	•	
Alum. Chloride >10%					•
Alum. Sulfate 10-50%					•
Ammonia Gas (Dry)		•	•		
Ammonium Chloride <40%					•
Ammonium Nitrate <50%			•		
Ammonium Sulfate <60%					•
Aniline >99%			•		
Argon	•	•	•	•	
Beer			•		
Benzidine >99%					•
Benzene <50%			•	•	
Benzoic Acid <70%					•
Boric Acid <25%			•		
Bromine (Dry)					•
Butane	•	•	•	•	
Butyric Acid <10%					•
Calcium Chloride <80%					•
Calcium Hydroxide <50%					•
Carbon Dioxide	•	•	•	•	
Carbon Monoxide >99%	•	•	•	•	
Chlorine (Dry)					•
Chlorine (Moist)					•
Chloroform (Dry)			•	•	
Chromic Acid					•
Citric Acid 10-50%			•		
Corn Oil			•		

Media Application	Pressure Instrument Material				
	Brass or bronze	Steel	Stainless steel	Monel	Diaphragm seals*
Crude Oil (Sour)				•	
Crude Oil (Sweet)			•	•	
Ethyl Acetate					•
Ethylene Oxide >99%	•		•	•	
Ferric Chloride <40%					•
Ferric Sulfate <10%			•		
Ferrous Chloride <30%					•
Ferrous Sulfate <50%					•
Fluorine Gas (Dry)				•	
Formaldehyde <95%				•	
Formic Acid					•
Freons		•	•		
Furfural <10%					•
Gasoline			•		
Glycerin >99%	•	•	•	•	
Hydrobromic Acid					•
Hydrochloric Acid					•
Hydrofluoric Acid					•
Hydrofluosilic Acid					•
Hydrogen ①	•		•		
Hydrogen Peroxide <50%					•
Kerosene	•	•	•	•	
Lactic Acid <70%			•		
Magnesium Chloride <40%					•
Mercuric Chloride <60%					•
Mercury >99%			•		
Milk			•		
Naphtha >99%	•	•	•	•	
Naphthalene >99%			•	•	
Nickel Chloride >99%					•
Nitric Acid <95%			•		
Nitrogen	•	•	•	•	
Oleic Acid					•

Media Application	Pressure Instrument Material				
	Brass or bronze	Steel	Stainless steel	Monel	Diaphragm seals*
Oxalic Acid					•
Oxygen (Gas) ②			•	•	
Palmitic Acid >99%			•		
Phosphoric Acid <80%			•		
Picric Acid <10%			•		
Propane (Dry)		•	•	•	
Sea Water (Flowing)				•	
Silver Nitrate <70%					•
Sodium Bicarbonate <20%			•	•	
Sodium Bisulfate <30%					•
Sodium Carbonate <40%			•	•	
Sodium Chromate <60%	•	•	•	•	
Sodium Cyanide		•	•		
Sodium Hydroxide < 40%				•	
Sodium Hypochlorite <25%					•
Sodium Phosphate, Tri <60%		•	•	•	
Sodium Silicate <50%		•	•	•	
Sodium Sulfide <50%					•
Stannous Chloride <10%					•
Steam (Use siphon)	•	•	•	•	
Stearic Acid			•		
Sulfur Dioxide (Dry) >99%					•
Sulfur Trioxide (Dry) >99%					•
Sulfuric Acid					•
Tannic Acid <80%		•	•	•	
Tartaric Acid <50%			•	•	
Tin Chloride (ous) <10%					•
Toluene >99%	•	•	•	•	
Turpentine >98%	•	•	•	•	
Water (Tap)	•		•	•	
Whiskey			•		
Zinc Chloride <25%					•
Zinc Sulphate <40%					•

① Over 1000 psi – entire system must be 316 stainless steel. Applicable only to hydrogen.

② Monel and 316 stainless steel are acceptable for oxygen service, provided the instrument has been cleaned for oxygen service and is free from oil.

* Any standard Bourdon tube material may be used in conjunction with a diaphragm seal, but the gauge selection should take into consideration the corrosive environment in which it is to operate. For diaphragm seals see Bulletin DS-1.

Range Tables

Ashcroft® 1008 Stainless Steel Case, Dual and Single Scale
40mm, and 50mm Pressure Gauges

Standard Single Scale Ranges

Pressure – Single Scale psi				
Range	Figure interval		Minor graduation	
0/15	3		0.5	
0/30	5		0.5	
0/60	10		1	
0/100	20		2	
0/160	20		2	
0/200	40		5	
0/300	50		5	
0/400	50		5	
0/600	100		10	
0/800	200		20	
0/1000	200		20	
0/1500	300		50	
0/2000	400		50	
0/3000	500		50	
0/5000	1000		100	
0/6000	1000		100	
0/7500	1000		100	
0/10,000	2000		200	
0/15,000	3000		500	
Compound – Single Scale				
Range	Figure interval		Minor graduation	
	in. Hg	psi	in. Hg	psi
30" Hg/15 psi	5	3	1	0.5
30" Hg/30 psi	10	5	1	0.5
30" Hg/60 psi	10	10	2	1
30" Hg/100 psi	30	20	5	2
30" Hg/150 psi	30	30	15	5
30" Hg/300 psi	30	50	30	5
Vacuum – Single Scale				
Range	Figure interval		Minor graduation	
30/0 in Hg	5 in.		0.5 in.	

Metric Single Scale Ranges

Pressure – Single Scale kg/cm², bar, kPa						
Range		Figure interval	Minor grads.	Range kPa	Figure interval	Minor grads.
kg/cm²	bar					
0-1	0-1	0.2	0.02	0-100	20	2
0-2	0-2	0.2	0.02	0-160	20	2
0-2.5	0-2.5	0.5	0.05	0-250	50	5
0-4	0-4	0.5	0.05	0-400	50	5
0-6	0-6	1	0.1	0-600	100	10
0-10	0-10	2	0.2	0-1000	200	20
0-16	0-16	2	0.2	0-1600	200	20
0-25	0-25	5	0.5	0-2500	500	50
0-40	0-40	5	0.5	0-4000	500	50
0-60	0-60	10	1	0-6000	1000	100
0-100	0-100	20	2	0-10,000	2000	200
0-160	0-160	20	2	0-16,000	2000	200
0-250	0-250	50	5	0-25,000	5000	500
0-400	0-400	50	5	0-40,000	5000	500
0-600	0-600	100	10	0-60,000	10,000	1000
0-1000	0-1000	200	20	0-100,000	20,000	2000
0-1600	0-1600	200	20	0-160,000	20,000	2000
Compound – Single Scale kg/cm², bar, kPa						
Range		Figure interval	Minor grads.	Range kPa	Figure interval	Minor grads.
kg/cm²	bar					
-1/0/1	-1/0/1	0.2	0.02	-100/100	20	2
-1/0/1.5	-1/0/3	0.5	0.05	-100/150	50	5
-1/0/3	-1/0/3	0.5	0.05	-100/300	50	5
-1/0/5	-1/0/5	1	0.1	-100/500	100	10
-1/0/9	-1/0/9	2	0.2	-100/900	200	20
-1/0/15	-1/0/15	3	0.5	-100/1500	300	50
-1/0/24	-1/0/24	5	0.5	-100/2400	500	50
Vacuum – Single Scale kg/cm², bar, kPa						
Range		Figure interval	Minor grads.	Range kPa	Figure interval	Minor grads.
kg/cm²	bar					
-1/0	-1/0	0.2	0.02	-100/0	20	2

Metric & psi Dual Scale Ranges*

Pressure – Dual Scale				
Range (outer scale is psi)	Figure interval		Minor graduation	
	kg/cm²	psi	kg/cm²	psi
0/1 kg/cm²-15 psi	0.2	3	0.02	0.5
0/2 kg/cm²-30 psi	0.5	5	0.05	0.5
0/4 kg/cm²-60 psi	1	10	0.1	1
0/7 kg/cm²-100 psi	1	20	0.2	2
0/11 kg/cm²-160 psi	2	20	0.2	2
0/14 kg/cm²-200 psi	2	40	0.5	5
0/21 kg/cm²-300 psi	5	50	0.5	5
0/28 kg/cm²-400 psi	5	50	0.5	5
0/42 kg/cm²-600 psi	10	100	1	10
0/50 kg/cm²-800 psi	10	200	1	20
0/70 kg/cm²-1000 psi	10	200	2	20
0/105 kg/cm²-1500 psi	20	300	2	50
0/140 kg/cm²-2000 psi	20	400	2	50
0/210 kg/cm²-3000 psi	50	500	5	50
0/350 kg/cm²-5000 psi	50	1000	10	100
0/420 kg/cm²-6000 psi	100	1000	10	100
0/500 kg/cm²-7500 psi	100	1000	10	100
0/700 kg/cm²-10,000 psi	100	2000	20	200
0/1050 kg/cm²-15,000 psi	200	3000	20	500
Range	Figure interval		Minor graduation	
	bar	psi	bar	psi
0/1 bar-15 psi	0.2	3	0.02	0.5
0/2 bar-30 psi	0.5	5	0.05	0.5
0/4 bar-60 psi	1	10	0.1	1
0/7 bar-100 psi	1	20	0.2	2
0/10 bar-160 psi	2	20	0.2	2
0/14 bar-200 psi	2	40	0.5	5
0/20 bar-300 psi	5	50	0.5	5
0/27 bar-400 psi	5	50	0.5	5
0/40 bar-600 psi	10	100	1	10
0/55 bar-800 psi	10	200	1	20
0/70 bar-1000 psi	10	200	2	20
0/100 bar-1500 psi	20	300	2	50
0/140 bar-2000 psi	20	400	2	50
0/200 bar-3000 psi	50	500	5	50
0/340 bar-5000 psi	50	1000	10	100
0/400 bar-6000 psi	100	1000	10	100
0/500 bar-7500 psi	100	1000	10	100
0/700 bar-10,000 psi	100	2000	20	200
0/1000 bar-15,000 psi	200	3000	20	500
Range	Figure interval		Minor graduation	
	kPa	psi	kPa	psi
0/100 kPa-15 psi	20	3	2	0.5
0/200 kPa-30 psi	50	5	5	0.5
0/400 kPa-60 psi	100	10	10	1
0/700 kPa-100 psi	100	20	20	2
0/1000 kPa-160 psi	200	20	20	2
0/1400 kPa-200 psi	200	40	50	5
0/2000 kPa-300 psi	500	50	50	5
0/2700 kPa-400 psi	500	50	50	5
0/4000 kPa-600 psi	1000	100	100	10
0/5500 kPa-800 psi	1000	200	100	20
0/7000 kPa-1000 psi	1000	200	200	20
0/10,000 kPa-1500 psi	2000	300	200	50
0/14,000 kPa-2000 psi	2000	400	200	50
0/20,000 kPa-3000 psi	5000	500	500	50
0/34,000 kPa-5000 psi	5000	1000	1000	100
0/40,000 kPa-6000 psi	10,000	1000	1000	100
0/50,000 kPa-7500 psi	10,000	1000	1000	100
0/70,000 kPa-10,000 psi	10,000	2000	2000	200
0/100,000 kPa-15,000 psi	20,000	3000	2000	500

*Inner scale is dominant

Range Tables

Ashcroft® 1008 Stainless Steel Case, Dual and Single Scale
63mm and 100mm Pressure Gauges

Metric & psi Dual Scale Ranges*

Pressure					
Units of Measurement				Figure interval	Minor graduation
inner psi	outer kg/cm ²	outer bar	outer kPa		
0/15	1	1	100	1	0.2
0/30	2	2	200	5	0.5
0/60	4	4	400	5	1
0/100	7	7	700	20	2
0/160	11	10	1100	20	2
0/200	14	14	1400	20	2
0/300	21	20	2000	30	5
0/400	28	27	2800	50	10
0/600	42	42	4000	100	10
0/800	50	50	5500	100	20
0/1000	70	70	7000	100	10
0/1500	105	100	10,000	200	20
0/2000	140	140	14,000	200	20
0/3000	210	200	20,000	300	50
0/5000	350	320	34,000	500	50
0/6000	420	400	40,000	1000	100
0/7500	520	520	50,000	1000	100
0/10,000	700	700	70,000	1000	100
0/15,000	1050	1050	100,000	2000	200

*Inner scale is dominant

Standard Single Scale Ranges

Pressure		
Units psi	Figure interval	Minor graduation
0/15	3	0.5
0/30	5	0.5
0/60	10	1
0/100	20	2
0/160	20	2
0/200	40	5
0/300	50	5
0/400	50	5
0/600	100	10
0/800	100	10
0/1000	200	10
0/1500	200	20
0/2000	400	20
0/3000	500	50
0/5000	1000	100
0/6000	1000	100
0/7500	1000	100
0/10,000	2000	100
0/15,000	2000	200

Vacuum		
Units in. Hg	Figure int.	Minor grad.
30/0	5 in.	0.5 in.

Compound		
Units	Figure interval	
	in. Hg	psi
30" Hg/15 psi	5	3
30" Hg/30 psi	10	5
30" Hg/60 psi	10	10
30" Hg/100 psi	30	10
30" Hg/150 psi	30	20
30" Hg/300 psi	30	50

Metric Single Scale Ranges

Pressure						
Units of Measurement		Figure interval	Minor graduation	Unit of measure	Figure interval	Minor graduation
kg/cm ²	bar			kPa		
0/1	0/1	0.1	0.01	0/100	10	1
0/1.6	0/1.6	0.2	0.02	0/160	20	2
0/2.5	0/2.5	0.5	0.05	0/250	50	5
0/4	0/4	0.5	0.05	0/400	50	10
0/6	0/6	0.5	0.1	0/600	50	10
0/10	0/10	1	0.1	0/1000	100	10
0/16	0/16	2	0.2	0/1600	200	20
0/25	0/25	5	1	0/2500	500	50
0/40	0/40	5	1	0/4000	500	100
0/60	0/60	5	1	0/6000	500	100
0/100	0/100	20	2	0/10,000	1000	100
0/160	0/160	20	2	0/16,000	2000	200
0/250	0/250	50	5	0/25,000	5000	500
0/400	0/400	50	10	0/40,000	5000	1000
0/600	0/600	50	10	0/60,000	5000	500
0/1000	0/1000	100	10	0/100,000	10,000	1000
0/1600	0/1600	200	20	0/160,000	20,000	2000

Vacuum						
-1/0	-1/0	0.1	0.01	-100/0	10	1

Compound						
-1/0/1.5	-1/0/1.5	0.2	0.02	-100/0/150	50	5
-1/0/3	-1/0/3	0.5	0.05	-100/0/300	50	5
-1/0/5	-1/0/5	0.5	0.1	-100/0/500	50	10
-1/0/9	-1/0/9	1	0.1	-100/0/900	100	10
-1/0/15	-1/0/15	2	0.2	-100/0/1500	200	20
-1/0/24	-1/0/24	5	0.5	-100/0/2400	500	50

Range Tables

Ashcroft® 1009 Stainless Steel Case

2½", 3½", 4½", 6" and 100mm Pressure Gauges

Standard Ranges

Pressure		
psi	Figure interval	Minor graduation
0/15	1	0.2
0/30	5	0.5
0/60	5	1
0/100	10	1
0/160	20	2
0/200	20	2
0/300	30	5
0/400	50	5
0/600	50	10
0/800	100	10
0/1000	100	10
0/1500	200	20
0/2000	200	20
0/3000	300	50
0/5000	500	50
0/6000	1000	100
0/7500	1000	100
0/10,000	1000	100
0/15,000	2000	200
0/20,000	2000	200
0/30,000	3000	500

Compound				
Range	Figure interval		Minor graduation	
	in. Hg	psi	in. Hg	psi
30" Hg/15 psi	5	3	1	0.5
30" Hg/30 psi	10	5	1	1
30" Hg/60 psi	10	10	2	1
30" Hg/100 psi	10	10	2	1
30" Hg/150 psi	10	20	5	2
30" Hg/300 psi	30	25	5	5
Vacuum				
Range	Figure interval		Minor graduation	
30/0 in. Hg	5 in.		0.5 in.	

Metric Ranges

Pressure							
kg/cm ² (kilograms per sq. centimeter)	bar	Figure interval	Minor graduation	kPa (kilopascal)	Figure interval	Minor graduation	psi outer scale of dual range*
0/1	0/1	0.1	0.01	0/100	10	1	0/14
0/1.6	0/1.6	0.2	0.02	0/160	20	2	0/22
0/2.5	0/2.5	0.5	0.05	0/250	50	5	0/35
0/4	0/4	0.5	0.05	0/400	50	5	0/55
0/6	0/6	0.5	0.1	0/600	50	10	0/85
0/10	0/10	1	0.1	0/1000	100	10	0/140
0/16	0/16	2	0.2	0/1600	200	20	0/220
0/25	0/25	5	0.5	0/2500	500	50	0/350
0/40	0/40	5	0.5	0/4000	500	50	0/550
0/60	0/60	5	1	0/6000	500	100	0/850
0/100	0/100	10	1	0/10,000	1000	100	0/1400
0/160	0/160	20	2	0/16,000	2000	200	0/2200
0/250	0/250	50	5	0/25,000	5000	200	0/3500
0/400	0/400	50	5	0/40,000	5000	500	0/5500
0/600	0/600	50	10	0/60,000	5,000	500	0/8500
0/1000	0/1000	100	10	0/100,000	10,000	1000	0/14,000
0/1600	0/1600	200	20	0/160,000	20,000	2000	0/22,000
Vacuum							
-1/0	-1/0	0.1	0.01	-100/0	10	1	30" Hg
Compound							
-1/0/1.5	-1/0/1.5	0.05	0.05	-100/0/150	50	5	30" Hg/0/20
-1/0/3	-1/0/3	0.05	0.05	-100/0/300	50	5	30" Hg/0/40
-1/0/5	-1/0/5	0.5	0.1	-100/0/500	50	10	30" Hg/0/70
-1/0/9	-1/0/9	1	0.1	-100/0/900	100	10	30" Hg/0/125
-1/0/15	-1/0/15	2	0.2	-100/0/1500	200	20	30" Hg/0/215
-1/0/24	-1/0/24	5	0.2	-100/0/2400	500	20	30" Hg/0/340

*Inner scale is dominant

Case and ring options		Code	Comments
Hermetically Sealed or Weatherproof Liquid-Fillable Case	LJ		Gauge furnished dry or for liquid filling. Includes a solid fill plug and throttle plug for ranges 30 psi and above.
U-Clamp	UC		Used for panel mounting back-connect gauges.
Front Flange	FF		Includes 3 holes for panel mounting gauges (back-connect only).
Wall Mounting Bracket	BF		Available on 4½" 1009 lower or back-connect."
Back Flange for Wall Mounting	FW		Available on 2½" and 3½" 1009 lower or back-connect.
Retrofit Flange	RF		Available on 63mm and 100mm 1008 back-connect gauges for panel mounting. (Includes U-clamp.)
Metric Gauge	MG		Available on 3½" 1009 with ½ NPT lower connection. Gauge supplied with micrometer pointer, white dial and safety glass.
Bourdon tube and system assembly options			
SS Throttle Plug – (restrictor) Push-in Design	TU		SS push-in type with a 0.013" orifice for 2½", 3½", 100mm 1009, 63mm, 100mm 1008. Throttle plug standard on all 2½", 3½" 1009, 40mm thru 100mm 1008 liquid filled gauges 30 psi-1000 psi
SS Throttle Plug (restrictor) Helical Design	TS		Standard on all 2½", 3½", 100mm 1009s, 40mm, thru 100mm 1008 liquid filled gauges with ranges of 1500 psi and above. 4½", 6" 1009 furnished with thread-in design with a .031" orifice.
Liquid Filled Gauge Without Throttle Plug	WP		Required when the process may clog a throttle plug on the gauge.
Cleaning for Gaseous Oxygen	6B		If gauge is liquid filled specify Halocarbon as the fill or utilize <i>PLUS!</i> Performance (LL).
Liquid filling options			
Silicone Fill	GV		Not available on 40mm and 50mm 1008 gauges.
Halocarbon Fill	GX		Not available on 40mm and 50mm 1008. For oxidizing media. Examples: chlorine, oxygen, nitric acid and sulfuric acid.
Pointer options			
Red Set-Hand (Single)	SH		Available on 1009 only. Single stationary set-hand used to indicate a specific pressure.
Red Set-Hand (Double)	SJ		Available on 1009 only. Double stationary set-hand used to indicate 2 specific pressures.
Red Set-Hand (Adjustable)	EU		Available on 1009 only.
Maximum Pointer	EP		Available on 4½" and 6" 1009 only. Externally reset by a knob on outside of an acrylic window.
Minimum Pointer	EQ		Available on 4½" and 6" 1009 only. Externally reset by a knob on outside of an acrylic window.
Window options			
Polycarbonate Window	PD		Ambient temperature limits –50/270°F. 40mm, 50mm 1008 and 100mm 1009 only. XPD standard on 2½", 3½" 1009 and 63mm and 100mm 1008.
Acrylic Window	PD		4½" and 6" 1009 only. Ambient temperature limits –50/180°F.
Shatterproof Glass	SG		Not available on 63mm, 100mm 1008. Ambient temperature limits –50/200°F.
External Zero Adjustable Pointer (Easy Zero™)	EA		Available in 3½" 1009 with ¼ NPT only. Dry or liquid filled.
Marking and tagging options			
Dial Marking	DA		Service marking printed on dial.
Paper Tagging of Carton and Gauge	NN		Tag is bonded to gauge case and carton.
Stainless Steel Tagging of Gauge Case	NH		300 series stainless steel tag is wired to gauge case.
Calibration options			
Accuracy 0.5% full scale	AN		4½" and 6" 1009 only.
Test and certificate options			
Certificate of Conformance	CD-1		Conformance to specifications and/or drawings.
Individual Certified Calibration Chart	CD-4		
Special connection options			
½ NPT	O1		Available on 2½", 3½" 1009SW.
SAE 7/16" and 20 straight thread	RW		Not available on 40mm, 50mm 1008
7/16" and 20 UNF-3A 37° Flare	EJ		Not available on 40mm, 50mm 1008
¼" straight JIS, BSP	KJ		Not available on 40mm, 50mm 1008
¼" tapered JIS, BSP	KA		Not available on 40mm, 50mm 1008
¾" straight JIS, BSP	KP		3½", 100mm 1009SW lower connection only
½" straight JIS, BSP	KN		3½", 100mm 1009SW lower connection only
¾" tapered JIS, BSP	KR		3½", 100mm 1009SW lower connection only
½" tapered JIS, BSP	KQ		3½", 100mm 1009SW lower connection only
G ¼" DIN	13		Not available on 40mm, 50mm 1008

How to Order

Ashcroft® Stainless Steel Case Pressure

Table A – Case selection and mounting

Dial Size	Ordering Code	Case Type	Case: Finish & Material	Ring: Style, Finish & Material	Mounting/Connection
2½", 3½"	(25) (35)	1009	Polished 304 SS	Bayonet, Lock ring	Stem – Lower or back
100mm	(10)	1009	Polished 304 SS	Polished 304 SS	Surface – Lower or back: specify (XFW) back flange Flush – Back: specify front flange (FF) or U-clamp (UC)
4½", 6"	(45) (60)	1009	Polished 304 SS	Bayonet, Lock ring Polished 304 SS	Stem – Lower or back Surface – Lower or back, wall mount bracket (BF) Flush – Back: specify front flange (FF) or U-clamp (UC)
40mm, 50mm	(40) (50)	1008	Polished 304 SS	Push-In, Polished 304 SS	Stem – Lower or back Flush – Back: specify front flange (FF) or U-clamp (UC)
63mm 100mm	(63) (10)	1008	304 SS	Crimped 304 SS	Stem – Lower or back Flush – Back: specify front flange (FF), U-clamp (UC) or retrofit flange (RF)

Table B – System, connection and location

Dial Size	Case Type	Tube and Socket Code	Tube and Socket Material	NPT Conn. and Code	Conn. Location and Code	Range Selection Limits (psi)
(2½", 3½" 100mm)	1009	(AW)	Welded 316 SS tube, bronze socket	(02) ¼ std. (04) ½ opt. ⁽¹⁾	(L) lower (B) back	Vac/1000
		(SW)	Welded 316 SS tube and socket			Vac/15,000
(4½", 6")		(A)	Grade A phosphor bronze tube, brass tip silver brazed brass socket	(02) ¼ std. (04) ½ opt.		Vac/1000
		(B)	4130 alloy steel tube, 1019 steel socket			Vac/5000
		(R)	316 SS tube, 1019 steel socket			Vac/20,000
		(S)	316 SS tube and socket			Vac/20,000
(40/50mm)	1008	(S)	316 SS tube and socket	(01) ⅛ std., 40mm ⁽²⁾ (02) ¼ std., 50mm	Vac/15,000	
(A)		Phosphor bronze tube, brass socket, soldered	(02) ¼ std.		Vac/6000	
(63/100mm)		(S)	Welded 316 SS tube and socket	(02) ¼ std. (04) ½ opt. ⁽¹⁾	Vac/15,000	

NOTES:

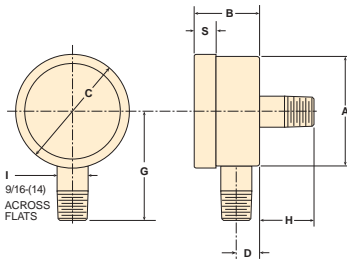
(1) 3½"/100mm 1009SW, 100mm 1008S lower connect only

(2) Not available with ¼ NPT

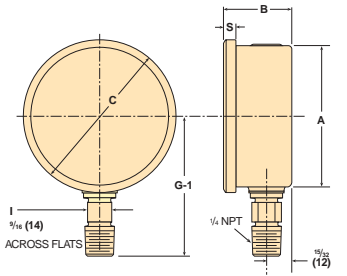
To order an Ashcroft Stainless Steel Case Pressure Gauge (sample coding shown)

Select:	25	1009	SWL	02L	XGV	160 psi
1. Dial size – 2½"						
2. Case type – 1009						
3. Bourdon tube and socket 316SS						
4. Connection – ¼ NPT Lower						
5. Optional features – Silicone filled						
6. Pressure range (see range tables on pages 12 through 14)						

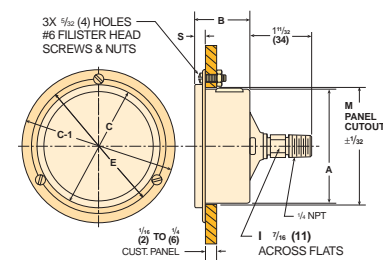
Case Type 1008 – 40mm & 50mm



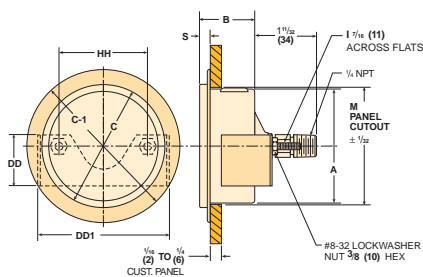
40/50mm lower and back connection



63/100mm 1008S/SL lower connection

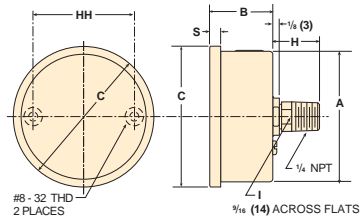


63/100mm 1008S/SL back connection (XFF) Front Flange

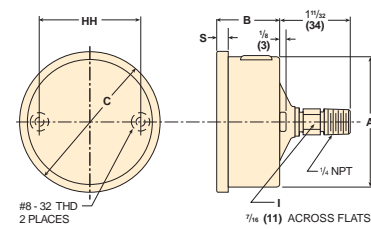


63/100mm 1008S/SL back connection (XRF) Retrofit Front Flange

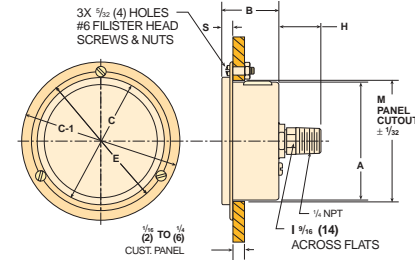
Case Type 1008 – 63mm & 100mm



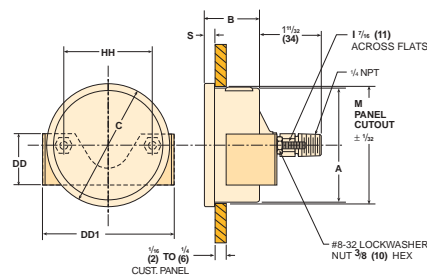
63/100mm 1008A/AL back connection



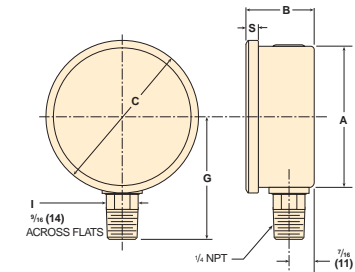
63/100mm 1008S/SL back connection



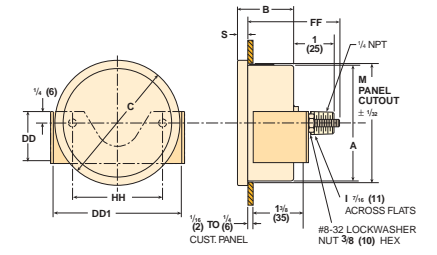
63/100mm 1008A/AL back connection (XFF) Front Flange



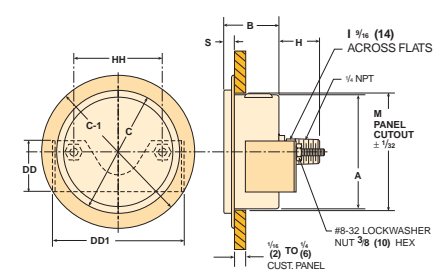
63/100mm 1008S back connection (XUC) U-clamp



63/100mm 1008A/AL lower connection

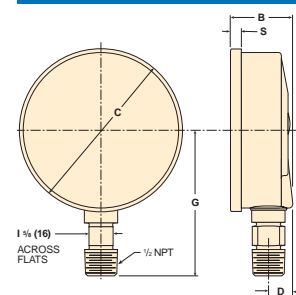


63/100mm 1008A/AL back connection (XUC) U-clamp



63/100mm 1008A/AL back connection (XRF) Retrofit Front Flange

Case Type 1008S – 100mm with 1/2 NPT



100mm 1008S/SL lower connection

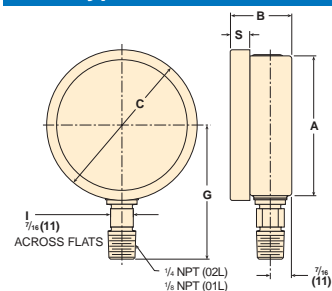
Gauge Size	A	A-1	B	C	C-1	D	DD	DD1	E	FF	G	G-1	H	HH	I	J	L	M	S	Dry Weight	LF Weight
(40) 1 1/2	(41) 1 5/8		(25) 3 1/32	(42) 1 21/32		(10) 3/8					(43) 1 11/16		(20) 2 5/32		(14) 9/16				(8) 5/16	.08kg .17#	.10kg .22#
(50) 2	(52) 2 1/16		(29) 1 1/8	(53) 2 3/32		(10) 3/8					(48) 1 7/8		(24) 1 5/16		(14) 9/16				(10) 3/8	.12kg .26#	.17kg .37#
(63) 2 1/2	(63) 2 1/2		(31) 1 7/32	(69) 2 23/32	(86) 3 3/8	(19) 3/4	(29) 1 1/8	(73) 2 7/8	(79) 3 3/8	(46) 1 13/16	(55) 2 5/32	(64) 2 1/2	(23) 2 9/32	(49) 1 15/16	(11) 7/16	(4) 5/32	(71) 2 3/16	(64) 2 17/32	(6) 1/4	.11kg .25#	.21kg .47#
(100) 3 1/2	(100) 3 15/16	(94) 3 23/32	(31) 1 7/32	(106) 4 5/32	(133) 5 7/32	(22) 7/8	(29) 1 1/8	(106) 4 3/16	(116) 4 9/16	(46) 1 13/16	(86) 3 3/8	(81) 3 3/16	(86) 3 3/8	(76) 3	(11) 7/16	(6) 1/4	(97) 3 3/16	(101) 3 31/32	(6) 1/4	.18kg .40#	.42kg .94#
(100) 1/2 NPT	(100) 3 15/16		(39) 1 17/32	(106) 4 5/32							(94) 3 11/16	(92) 3 5/8			(16) 5/8				(6) 1/4	.23kg .50#	.45kg .97#

Note: Dimensions in brackets () are millimeters.

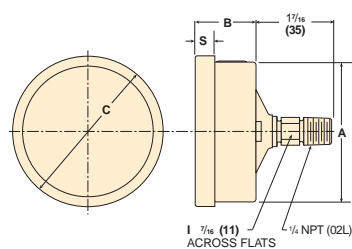
Dimensions

Ashcroft® Stainless Steel Case Pressure Gauges

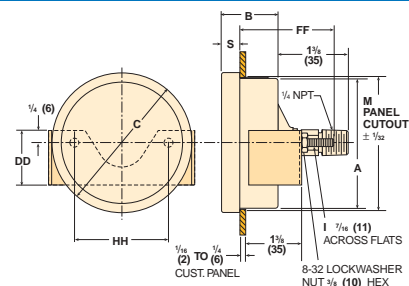
Case Type 1009 – 2½" & 3½"



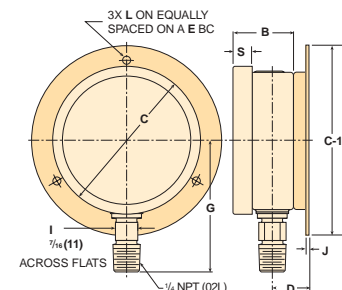
2½" & 3½" 1009 lower connected



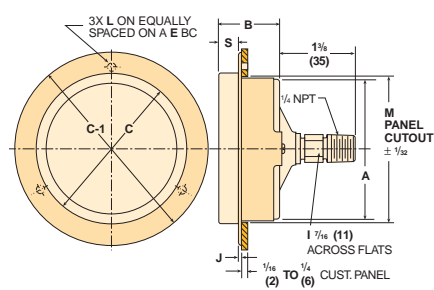
2½" & 3½" 1009 back connected



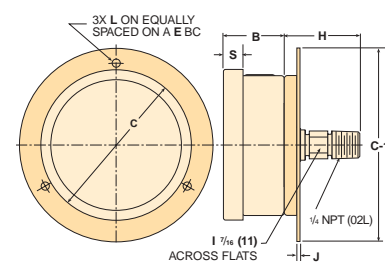
2½" & 3½" 1009 back connected (XUC)



2½" & 3½" 1009 lower connected (XFW)

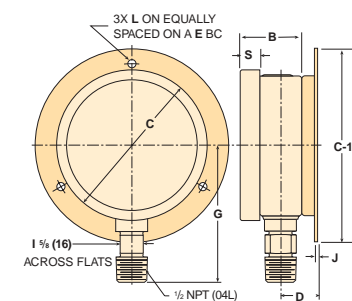


2½" & 3½" 1009 back connected (XFF)

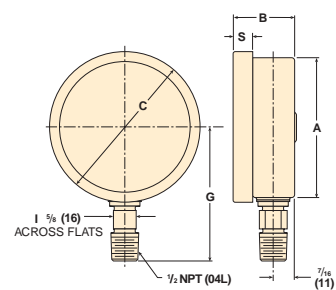


2½" & 3½" back connected (XFW)

Case Type 1009 – 100mm



100mm 1009 lower connected (XFW)

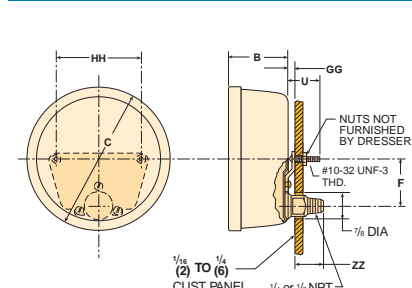


100mm 1009 lower connection

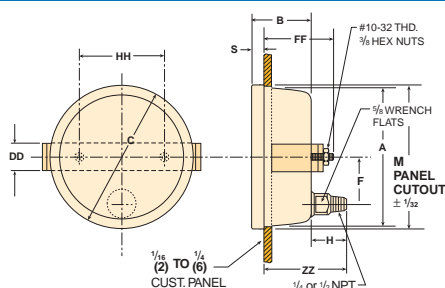
Gauge Size																	Weight	
	A	B	C	C-1	D	DD	E	FF	G	H	HH	I	J	L	M	S	Dry	LF
2½" (63)	2 21/32 (67)	1 3/16 (30)	2 7/8 (73)	3 11/16 (94)	3/4 (19)	1 1/8 (29)	3 1/8 (79)	1 11/16 (43)	2 9/16 (65)	1 3/32 (28)	2 1/16 (52)	7/16 (11)	1/16 (2)	5/32 (4)	2 11/16 (68)	3/8 (10)	.26# .12kg	.50# .32kg
3½" (100)	3 19/32 (91)	1 9/32 (33)	3 31/32 (100)	5 7/32 (133)	7/8 (22)	1 1/32 (26.4)	4 9/16 (106)	2 29/32 (48)	3 (76)	3 (76)	2 13/32 (61)	7/16 (11)	5/32 (4)	7/32 (6)	3 21/32 (93)	1 5/32 (12)	.44# .20kg	.88# .40kg
(100)	3 19/32 (91)	1 19/32 (40)	3 31/32 (100)	5 7/32 (133)	7/8 (22)		4 9/16 (116)		3 11/16 (94)			5/8 (16)	5/32 (4)	7/32 (6)		1 5/32 (12)	.50# .23kg	.97# .45kg

Note: Dimensions in brackets () are millimeters.

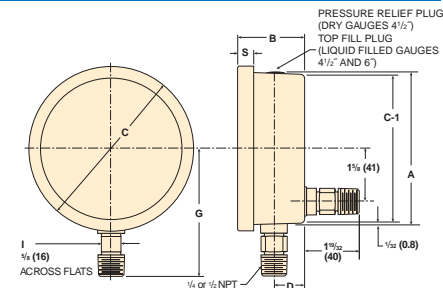
Case Type 1009 – 4½" & 6"



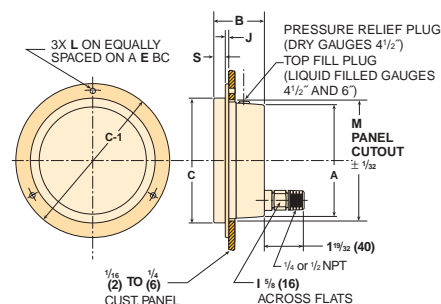
4½" & 6" 1009 back connected, wall mounting bracket (XBF)



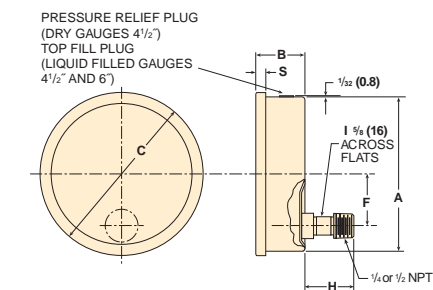
4½" & 6" 1009 back connected U-clamp (XUC)



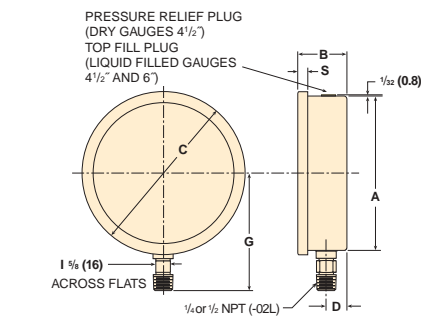
4½" 1009 lower or back connected



4½" & 6" 1009 back connected, front flange (XFF)



6" 1009 back connected



6" 1009 lower connected

STD.

Gauge Size	A	B	C	D	F	G	I	S	Weight Dry	Weight LF
4½ (100)	4 ²³ / ₃₂ (120)	2 ¹ / ₁₆ (52)	5 ³ / ₃₂ (129)	1 ⁵ / ₁₆ (24)	1 ⁵ / ₈ (41)	3 ¹⁵ / ₁₆ (100)	5/8 (16)	1 ⁵ / ₃₂ (12)	1.75# .79kg	2.40# 1.1kg
6 (160)	6 ⁵ / ₁₆ (160)	2 (51)	6 ²¹ / ₃₂ (169)	2 ⁷ / ₃₂ (22)	1 ⁵ / ₈ (41)	4 ¹³ / ₁₆ (122)	5/8 (16)	1 ³ / ₃₂ (10)	2.25# 1kg	4.12# 1.85k

XFF

Gauge Size	A	B	C	C-1	E	I	J	L	M	S	Weight Dry	Weight LF
4½ (100)	4 ²³ / ₃₂ (120)	2 ¹ / ₁₆ (52)	5 ³ / ₃₂ (129)	6 ⁹ / ₃₂ (160)	5 ¹¹ / ₁₆ (144)	5/8 (16)	5 ⁵ / ₃₂ (4)	7 ⁷ / ₃₂ (6)	4 ¹⁵ / ₁₆ (125)	1 ⁵ / ₃₂ (12)	1.75# .79kg	2.40# 1.1kg
6 (160)	6 ⁵ / ₁₆ (160)	2 (51)	6 ²¹ / ₃₂ (169)	7 ⁵ / ₈ (194)	7 ¹ / ₃₂ (179)	5/8 (16)	1 ¹ / ₁₆ (2)	1/4 (6)	6 ⁷ / ₁₆ (163)	1 ³ / ₃₂ (10)	2.25# 1kg	4.12# 1.85k

XBF

Gauge Size	A	B	C	F	GG	HH	U	ZZ	Weight Dry	Weight LF
4½ (100)	4 ²³ / ₃₂ (120)	2 ¹ / ₁₆ (52)	5 ³ / ₃₂ (129)	1 ⁵ / ₈ (41)	3 ¹ / ₁₆ (5)	3 (76)	1 ⁷ / ₁₆ (37)	1 ⁷ / ₁₆ (37)	1.75# .79kg	2.40# 1.1kg
6 (160)	6 ⁵ / ₁₆ (160)	2 (51)	6 ²¹ / ₃₂ (169)	1 ⁵ / ₈ (41)	3 ¹ / ₁₆ (5)	4 ¹ / ₂ (114)	1 ⁷ / ₁₆ (37)	1 ⁷ / ₁₆ (37)	2.25# 1kg	4.12# 1.85k

XUC

Gauge Size	A	B	C	DD	F	FF	H	HH	I	M	S	ZZ	Weight Dry	Weight LF
4½ (100)	4 ²³ / ₃₂ (120)	2 ¹ / ₁₆ (52)	5 ³ / ₃₂ (129)	1 (25)	1 ⁵ / ₈ (41)	2 ⁵ / ₁₆ (59)	1 ⁵ / ₈ (41)	3 (76)	5/8 (16)	4 ¹³ / ₁₆ (122)	1 ⁵ / ₃₂ (12)	3 ⁹ / ₃₂ (83)	1.75# .79kg	2.40# 1.1kg
6 (160)	6 ⁵ / ₁₆ (160)	2 (51)	6 ²¹ / ₃₂ (169)	1 (25)	1 ⁵ / ₈ (41)	2 ⁵ / ₈ (67)	1 ⁵ / ₈ (41)	4 ¹ / ₂ (114)	5/8 (16)	6 ⁷ / ₁₆ (163)	1 ³ / ₃₂ (10)	3 ³ / ₁₆ (81)	2.25# 1kg	4.12# 1.85k

Note: Dimensions in brackets () are millimeters.

Instrument Division Sales and Customer Service Locations

U.S. & International Headquarters

Stratford, Connecticut
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 378-8281
Fax: (203) 385-0357

U.S. Operations

Industrial Instrument Operations
Stratford, Connecticut
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 378-8281
Fax: (203) 381-9042

APG Operations (Control, Transducer and Precision Instruments)
Shelton, Connecticut
Two Research Drive
Shelton, CT 06484
Tel: (203) 925-4000
Fax: (203) 925-4010

Commercial Instrument Operations
Berea, Kentucky
200 Harrison Road
Berea, KY 40403
Tel: (859) 986-9333
Fax: (859) 986-7676

U.S. Sales Offices

Chicago, Illinois Midwest Region
400 W. Lake Street
Suite 318
Roselle, IL 60172-3573
Tel: (630) 980-9030
Fax: (630) 980-9440

Houston, Texas Southwest Region
605 Bel Air Blvd.
Suite 10
Mobile, AL 36606
Tel: (251) 473-1692
Fax: (251) 473-1782

Mobile, Alabama Southeast Region
605 Bel Air Blvd.
Suite 10
Mobile, AL 36606
Tel: (251) 473-1692
Fax: (251) 473-1782

Stratford, Connecticut Northeast Region
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 385-0670
Fax: (203) 385-0756

Stratford, Connecticut Pacific Region
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 385-0399
Fax: (203) 385-0402

International Operations

Brazil
Dresser Industria e Comercio Ltda.
Rua Senador Vergueiro #433
09521-320 Sao Caetano do Sul
Sao Paulo, Brazil
Tel: 55-11-4224-7400
Fax: 55-11-4224-7477
E-Mail: vendas.instrumentos@dresser.com

Brazil (Jacarei)
Dresser Industria e Comercio Ltda.
Divisao Masoneilan
Rua Particular - Estrada Velha Rio De Janeiro -
Sao Paulo, KM 101 Jacarei,
Sao Paulo Caixa
Postal 167, CEP 12305-330
Tel: 55-11-3958-2011
Fax: 55-11-3958-2670
E-Mail: dresserjac@uol.com.br

Canada
Dresser Canada, Inc.
2135 Meadowpine Blvd.
Mississauga,
Ontario L5N 6L5 Canada
Tel: 905-826-8411
Fax: 905-826-9106
E-Mail: Lance_Barette@dresser.com

China
Dresser Industries, Inc.
Room #2404, Capital Mansion
No. 6 Xin Yuan Nan Road Beijing,
People's Republic of China 100004
Tel: 86-10-84862440/1/2/3/4
Fax: 86-10-84862445
E-Mail: dresser@public3.bta.net.cn

France
Dresser Europe GmbH
74, Rue d'Arceuil
F 95478, France
Tel: 33 (0) 1 60372530
Fax: 33 (0) 1 60372539
E-Mail: dresser.europe@wanadoo.fr

Germany
Dresser Europe GmbH
Postfach 11 20 Max-Planck-Str. 1
D-52499 Baesweiler, Germany
Tel: 49-24-01-8080
Fax: 49-24-01-7027
E-Mail: jbierrmans@dresserbae.de

Germany
Ebro Electronic GmbH
Peringerstr 10D-85055
Ingolstadt, Germany
Tel: 49-84-1-95478-0
Fax: 49-84-1-95478-80
E-Mail: info@ebro.de

Japan
Dresser Japan Ltd.
Room 818, Shin Tokyo Building
3-1 Marunouchi 3-Chome,
Chiyoda-ku, Tokyo, Japan
Tel: 813-3201-1501
Fax: 813-3213-6567
E-Mail: yuichi.yamamoto@dresserjapan.co.jp

Korea

Dresser International, S.A
#2015 Kuk Dong Bldg.
60-1, 3-KA, Choongmu-Ro,
Chung-ku, Seoul, Korea 100-705
Tel: 82-2-2274-0792
Fax: 82-2-2274-0794
E-Mail: dkisjlee@chollian.net

Mexico

Dresser Instruments S.A. De C.V.
Mexico Operations
Henry Ford No. 114
Esq. Foulton Fracc.
Industrial San Nicolas
54030 Tlalneplanla,
Edo De Mexico
Tel: (52)55-53-10-72-17
(52)55-53-10-89-83
(52)55-53-10-28-29
(52)55-53-10-28-75
Fax: (52)55-53-10-26-08
E-Mail: mendiet@avantel.net

Saudi Arabia

Dresser Al Rushaid Valve & Instrument Co. (DARVICO)
P.O. Box 10145
Jubail Industrial City
Saudi Arabia 31961
Tel: 966-3-341-0278
Fax: 966-3-341-7624
E-Mail: bill_dumasia@darvico.com
E-Mail: sam_dastur@darvico.com

Singapore

Dresser Singapore
Instrument Operations
Block 1004 Toa Payoh North
#07-15/17 Singapore 318995
Tel: 65-252-6602
Fax: 65-252-6603
E-Mail: john.wong@dresser.com

United Kingdom

Dresser Europe GmbH
East Gillibrands, Skelmersdale
Lancashire, WN8 9TU
United Kingdom
Tel: 14-16-95-52600
Fax: 14-16-95-52693
E-Mail: Johanna.Gribben@dresser-instrument.co.uk
E-Mail: sales@dresser-instrument.co.uk

Venezuela

Manufactures Petroleras
Venezolanas (M.P.V.)
KM 7 Carretera A El Mojan Calle 18,
#15B355 ZONA Ind. Norte Sector
Canchancha Maracaibo Edo
Zulia Venezuela
Tel: 58-61-579-762/070
Fax: 58-61-579-461
E-Mail: contactenos@mapvensa.com
E-Mail: ventasmpv@telcel.net.ve

Visit our web site
www.ashcroft.com



DESIGNED FOR SAFETY AND LONGER LIFE

- Patented PowerFlex™ movement isolates movement from shock and vibration for longer life
- All stainless, all-welded construction for long life
- New PLUS!™ Performance Option:
 - Liquid-filled performance in a dry gauge
 - Fights vibration and pulsations without liquid-fill headaches
 - See page 174 for details
 - Order as option XLL

- True Zero™ pointer indication – no stop pin to mask false zero reading – ensures safety and process control

OTHER FEATURES:

Available in 63mm and 100mm dial sizes, 1008S pressure gauges are field liquid fillable and field convertible for panel mounting. ASME Grade B, 3-2-3% accuracy is standard. The gauge is available dry, liquid-filled weatherproof or hermetically sealed and now with PLUS!™ performance option.



STANDARD RANGES

Single-Scale Dial	Dual-Scale Dial	
psi	psi Inner Arc	kPa Outer Arc
0/15	0/15	0/100
0/30	0/30	0/200
0/60	0/60	0/400
0/100	0/100	0/700
0/160	0/160	0/1100
0/200	0/200	0/1400
0/300	0/300	0/2000
0/400	0/400	0/2800
0/600	0/600	0/4000
Vacuum in Hg	in Hg	Vacuum
30/0	30/0	-100/0
Comp. in Hg/psi	in Hg/psi	kPa
30/15	30/15	-100/100
30/30	30/30	-100/200
30/60	30/60	-100/400
30/100	30/100	-100/700
30/150	30/150	-100/1000
30/300	30/300	-100/2000
psi	psi Inner Arc	kPa Outer Arc
0/1000	0/1000	0/7000
0/1500	0/1500	0/10,000
0/2000	0/2000	0/14,000
0/3000	0/3000	0/20,000
0/5000	0/5000	0/34,000
0/6000	0/6000	0/40,000
0/7500	0/7500	0/50,000
0/10,000	0/10,000	0/70,000
0/15,000	0/15,000	0/100,000

DUAL-SCALE AMMONIA RANGES

Compound in Hg/psi	°F Outer Arc
Vac/150	-40/84°F
Vac/300	-40/125°F

BOURDON SYSTEM SELECTION

Ordering Code	Bourdon Tube & Tip Material ⁽¹⁾	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn. ⁽³⁾
S	316 stainless steel	316 stainless steel	C-Tube	Vac/800	¼, ½ & ¾ ⁽²⁾
S	316 stainless steel	316 stainless steel	Helical	1000/15,000	¼, ½ & ¾

(1) For selection of the correct bourdon system material, see the media application table on page 178.

(2) ½ NPT available 100mm lower only.

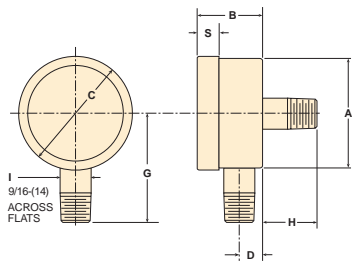
(3) ¼" JIS, BSP or DIN threads available.

TO ORDER THIS 1008 PRESSURE GAUGE:

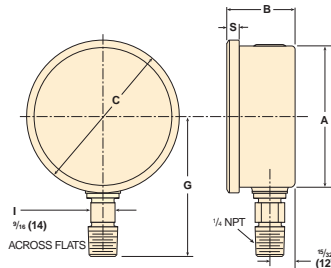
Select: _____ 63 _____ 1008 _____ S _____ L _____ 02L _____ XXX _____ 1000 psi

- Dial size—63mm or 100mm _____
- Case type—1008 _____
- Tube and socket material _____
- Liquid filled (glycerin), leave blank if dry _____
- Connection size—¼ (01), ½ (02), ¾ (04) _____
- Connection location—Lower (L), Back (B) _____
- Optional Features—see page 108 _____
- Standard pressure range—1000 psi _____

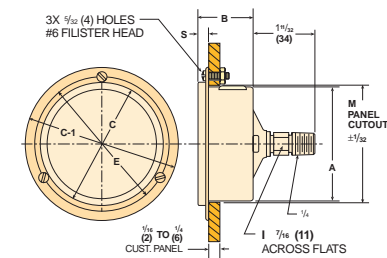
Case Type 1008 – 40mm & 50mm



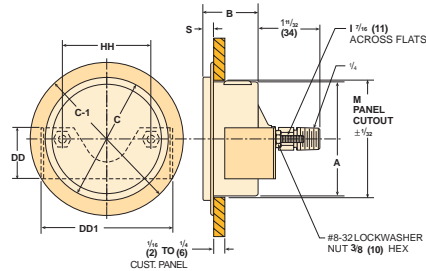
40/50mm lower and back connection



63/100mm 1008S/SL lower connection

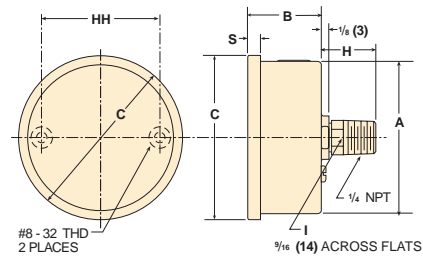


63/100mm 1008S/SL back connection (XFF) Front Flange

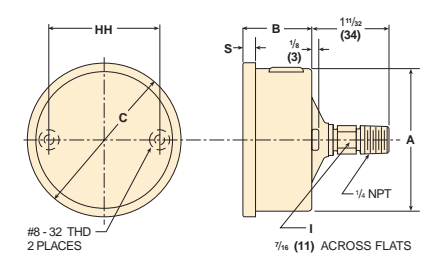


63/100mm 1008S/SL back connection (XRF) Retrofit Front Flange

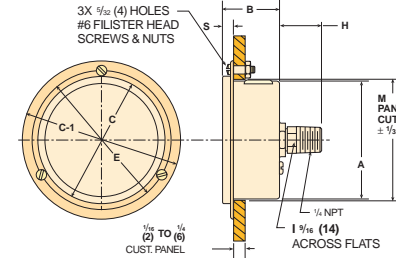
Case Type 1008 – 63mm & 100mm



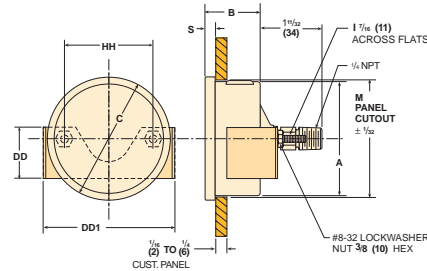
63/100mm 1008A/AL back connection



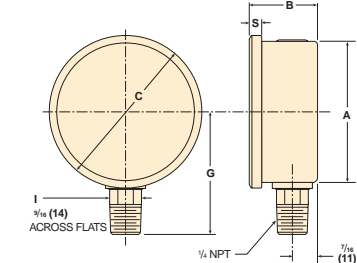
63/100mm 1008S/SL back connection



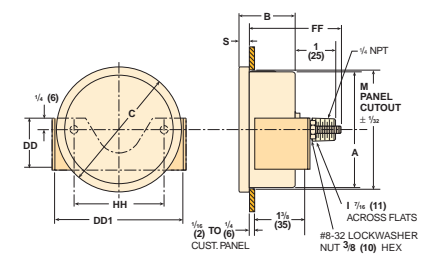
63/100mm 1008A/AL back connection (XFF) Front Flange



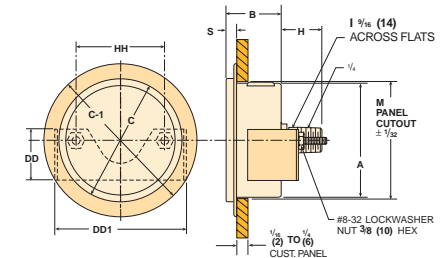
63/100mm 1008S back connection (XUC) U-clamp



63/100mm 1008A/AL lower connection

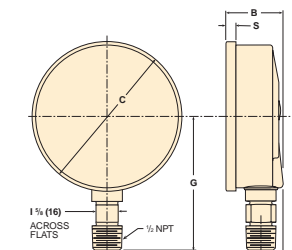


63/100mm 1008A/AL back connection (XUC) U-clamp



63/100mm 1008A/AL back connection (XRF) Retrofit Front Flange

Case Type 1008S – 100mm with 1/2 NPT



100mm 1008S/SL lower connection

Gauge																				Weight	
Size	A	A-1	B	C	C-1	D	DD	DD1	E	FF	G	G-1	H	HH	I	J	L	M	S	Dry	LF
(40) 1 1/2	(41) 1 5/8		(25) 3 1/32	(42) 1 21/32		(10) 3/8					(43) 1 11/16		(20) 25/32		(14) 9/16				(8) 5/16	.08kg .17#	.10kg .22#
(50) 2	(52) 2 1/16		(29) 1 1/8	(53) 2 3/32		(10) 3/8					(48) 1 7/8		(24) 15/16		(14) 9/16				(10) 3/8	.12kg .26#	.17kg .37#
(63) 2 1/2	(63) 2 1/2		(31) 1 7/32	(69) 2 23/32	(86) 3 3/8	(19) 3/4	(29) 1 1/8	(73) 2 7/8	(79) 3 1/8	(46) 1 13/16	(55) 2 5/32	(64) 2 1/2	(23) 29/32	(49) 1 15/16	(11) 7/16	(4) 5/32	(71) 2 3/16	(64) 2 17/32	(6) 1/4	.11kg .25#	.21kg .47#
(100) 3 1/2	(100) 3 15/16	(94) 3 23/32	(31) 1 7/32	(106) 4 5/32	(133) 5 7/32	(22) 7/8	(29) 1 1/8	(106) 4 3/16	(116) 4 9/16	(46) 1 13/16	(86) 3 3/8	(81) 3 3/16	(86) 3 3/8	(76) 3	(11) 7/16	(6) 1/4	(97) 3 3/16	(101) 3 31/32	(6) 1/4	.18kg .40#	.42kg .94#
(100) 3 1/2	(100) 3 15/16		(31) 1 7/32	(106) 4 5/32								(91) 3 5/8			(16) 5/8				(6) 1/4	.23kg .50#	.45kg .97#

Note: Dimensions in brackets () are millimeters.

Type 1008S Stainless Case Gauge with Stainless Steel System



FEATURES

- *Patented PowerFlex™ movement*
- *All stainless steel welded construction*
- *1.6% full scale accuracy*
- *True Zero™ pointer indication*
- *NEW ventable plug*
- *NEW MSL helium leak tested to 1X10⁻⁶ ATM -cc/sec*
- *Meets ASME B40.100 and EN837-1 standards*
- *RoHS compliant*
- *CRN approved*
- *1 year limited warranty*

Ashcroft is pleased to reintroduce the 1008S pressure gauge. This gauge has been upgraded with many new features outlined above while maintaining the tried and true performance and quality you have come to expect.

1008S gauges provide significant features and benefits. New features include a ventable plug that can be sealed or vented depending on your environment.

The combination of features including the patented PowerFlex™ movement and optional PLUS!™ Performance dampening system in the Ashcroft 1008S gauge is the finest gauge technology for vibration, shock and pulsation applications. Available in pressure ranges from vacuum to 15,000 psi, including compound and metric ranges.

PRODUCT SPECIFICATIONS

Ashcroft Type No.:	1008S
Sizes:	63mm, 100mm
Case:	304SS
Ring:	304SS crimped
Window:	Polycarbonate
Dial:	Black figures on white background, aluminum
Pointer:	Friction adjust, black, aluminum
Bourdon Tube:	316L stainless steel C-Shaped (vacuum-600 psi and compound) Helical (1000 psi-15000 psi)
Socket:	316L stainless steel
Movement:	300 series stainless steel, PowerFlex, polyester segment, overload/underload stops
Connections:	1/8 and 1/4 NPT, lower or lower back 1/2 NPT lower (100mm) only
Ranges:	Vac-15000 psi and compound
Accuracy:	1.6% full scale
Fill Plug:	Ventable
Protection:	Nema 4X / IP65 plug sealed Nema 3 / IP54 plug vented
Ambient Temperature Limitations:	-40°F to 200°F dry +20°F to 150°F glycerin filled -40°F to 150°F silicone filled (based on standard polycarbonate window)
OPTIONAL FEATURES	
Liquid fill:	Glycerin, silicone, halocarbon (includes throttle plug)
Dampening:	PLUS!™ Performance (LL) (includes throttle plug)
Connections:	Metric and SAE
Mounting:	U-clamp (UC), Front flange (FF),
Dials:	Receiver ranges, refrigerant ranges; custom dials

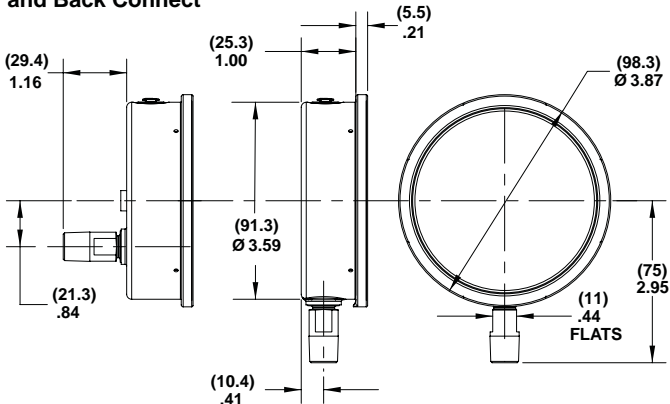
HOW TO ORDER (Typical example)

	63	1008	S (L)	02L	XXX	100#
Dial Size: 63mm (63), 100mm (10)						
Case Type: 1008						
Tube and Socket Material: 316L SS						
Liquid Filled: (glycerin) leave blank if dry						
Connection Size: 1/8 (01), 1/4 (02), 1/2 (04) 100mm lower only						
Connection Location: Lower (L), Lower Back (B)						
Options:						
Range: 0/100 psi						

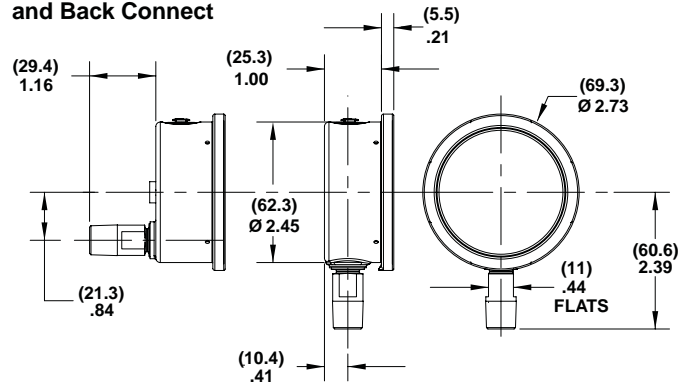
Type 1008S Stainless Case Gauge with Stainless Steel System

DIMENSIONS

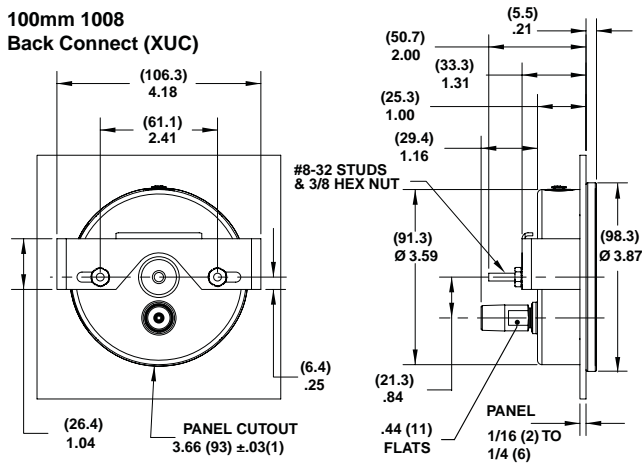
100mm 1008 Lower and Back Connect



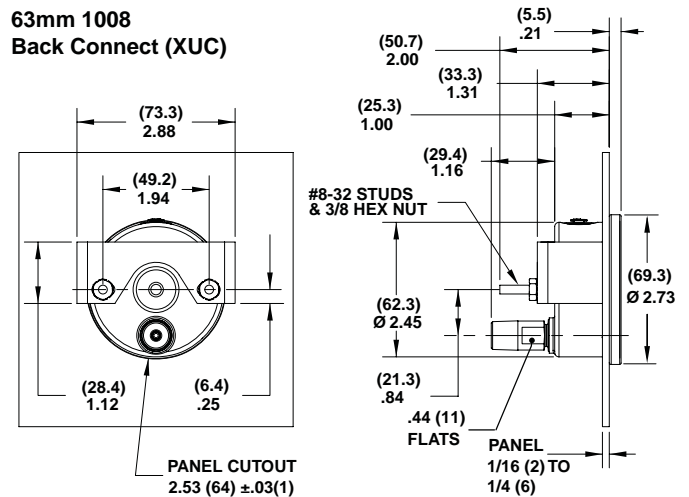
63mm 1008 Lower and Back Connect



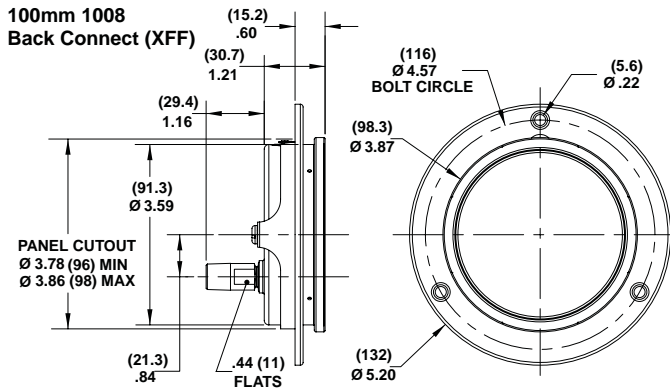
100mm 1008 Back Connect (XUC)



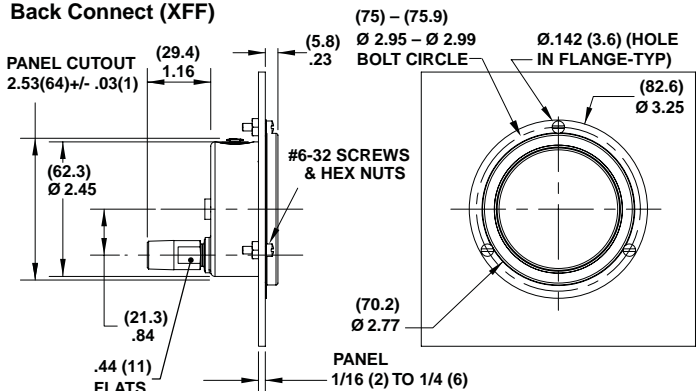
63mm 1008 Back Connect (XUC)



100mm 1008 Back Connect (XFF)



63mm 1008 Back Connect (XFF)



Technical Information

Cerabar M

PMC51, PMP51, PMP55

Process pressure measurement

Pressure transmitter with ceramic and metal sensors



Application

The device is used for the following measuring tasks:

- Absolute pressure and gauge pressure measurement in gases, steams or liquids in all areas of process engineering and process measurement technology
- Level, volume or mass measurement in liquids
- High process temperature
 - without diaphragm seals up to 130 °C (266 °F), for a maximum of 60 minutes
 - 150 °C (302 °F)
 - with diaphragm seals up to 400 °C (752 °F)
- High pressure up to 400 bar (6 000 psi)
- International usage thanks to a wide range of approvals

Your benefits

- Very good reproducibility and long-term stability
- High reference accuracy up to $\pm 0.15\%$
as PLATINUM version: $\pm 0.075\%$
- Turn down up to 100:1
- Uniform platform for differential pressure, hydrostatics and pressure (Deltabar M – Deltapilot M – Cerabar M)
- Simple, fast commissioning through a user interface designed for real-world applications
- Used for process pressure monitoring up to SIL2, certified to IEC 61508 Edition 2.0 and IEC 61511 by TÜV NORD
- The patented TempC membrane for the diaphragm seal reduces measured errors caused by environmental and process temperature influences to a minimum
- ASME-BPE-compliant device versions

Table of contents

Document information	5	Reference accuracy – PMC51	28
Document function	5	Thermal change in the zero output and the output span – PMC51	28
Symbols used	5	Total performance – PMC51	29
Documentation	6	Long-term stability	29
Terms and abbreviations	7	Total Error - PMC51	30
Turn down calculation	8	Warm-up period	30
 Function and system design	 9	 Performance characteristics of the metallic process isolating diaphragm	 31
Device selection	9	Reference operating conditions	31
Measuring principle	11	Uncertainty of measurement for small absolute pressure ranges	31
Level measurement (level, volume and mass)	12	Performance Characteristics Conformance	31
Electrical differential pressure measurement with gauge pressure sensors	12	Influence of orientation	31
Communication protocol	13	Reference accuracy – PMP51 , PMP55	32
 Input	 14	Thermal change in the zero output and the output span – PMP51 and PMP55	33
Measured variable	14	Total Performance – PMP51	34
Measuring range	14	Long-term stability	34
 Output	 16	Total Error - PMP51	35
Output signal	16	Warm-up period	35
Signal range 4 to 20 mA	16	 Installation	 36
Signal on alarm	16	General installation instructions	36
Load - 4 to 20 mA Analog 4...20 mA HART	16	Measuring arrangement for devices without diaphragm seal – PMC51, PMP51	36
Resolution	17	Measuring arrangement for devices with diaphragm seal – PMP55	36
Dead time, Time constant	17	Wall and pipe mounting, transmitter (optional)	37
Dynamic behavior current output (analog electronics)	17	Wall and pipe-mounting manifold (optional)	37
Dynamic behavior current output (HART electronics)	17	"Separate housing" version	38
Dynamic behavior digital output (HART electronics)	17	Oxygen applications	39
Dynamic behavior PROFIBUS PA	17	PWIS cleaning	39
Dynamic behavior FOUNDATION Fieldbus	18	Ultrapure gas applications (PMC51 und PMP51)	39
Damping	18	Applications with hydrogen	39
Firmware version	18	 Environment	 40
Protocol-specific data HART	19	Ambient temperature range	40
Protocol-specific data PROFIBUS PA	19	Storage temperature range	40
Protocol-specific data FOUNDATION Fieldbus	20	Climate class	40
 Power supply	 22	Degree of protection	40
Terminal assignment	22	Vibration resistance	40
Supply voltage	22	Electromagnetic compatibility	41
Current consumption	23	 Process	 42
Electrical connection	23	Process temperature range PMC51	42
Terminals	23	Process temperature limits	42
Cable entry	23	Process temperature limits of flexible capillary armoring: PMP55	44
Device plug connectors	24	Pressure specifications	44
Cable specification	25	 Mechanical construction	 45
Start-up current	26	Device height	45
Residual ripple	26	F31 housing, aluminum	45
Influence of power supply	26	F15 housing, stainless steel (hygienic)	46
Overvoltage protection (optional)	26		
 Performance characteristics of the ceramic process isolating diaphragm	 27		
Reference operating conditions	27		
Influence of orientation	27		
Uncertainty of measurement for small absolute pressure ranges	27		

PMC51: process connections with internal process isolating diaphragm	47	System integration (Except analog electronics)	106
PMC51: process connections with internal process isolating diaphragm	49	Planning instructions for diaphragm seal systems	107
PMC51: process connections with internal process isolating diaphragm - height H	49	Applications	107
PMC51: process connections with flush-mounted process isolating diaphragm	50	Function and design	108
PMC51: process connections with flush-mounted process isolating diaphragm	51	Diaphragm seal filling oils	109
PMC51: process connections with flush-mounted process isolating diaphragm - height H	51	Operating temperature range	109
PMC51: process connections with flush-mounted process isolating diaphragm	52	Cleaning instructions	110
PMC51: process connections with flush-mounted process isolating diaphragm - height H	54	Installation instructions	110
PMC51: hygienic process connections with flushmounted process isolating diaphragm	55	Vacuum applications	111
PMP51: process connections with internal process isolating diaphragm	60	Certificates and approvals	113
PMP51: process connections with internal process isolating diaphragm	61	CE mark	113
PMP51: process connections with flush-mounted process isolating diaphragm	62	RoHS	113
ANSI threaded connection	64	RCM-Tick marking	113
PMP51: process connections with flush-mounted process isolating diaphragm	65	Ex approvals	113
PMP51: process connections with flush-mounted process isolating diaphragm	66	EAC conformity	113
PMP51: hygienic process connections with flushmounted process isolating diaphragm	67	Suitable for hygiene applications	113
Valve manifold DA63M- (optional)	71	Certificate of Compliance ASME BPE 2012	114
PMP51: process connections	72	Functional safety SIL	114
PMP55 basic device - examples	73	CRN approvals	114
PMP55: process connections with flush-mounted process isolating diaphragm	74	Other standards and guidelines	114
PMP55: process connections with flush-mounted process isolating diaphragm	75	AD2000	114
PMP55: process connections with flush-mounted process isolating diaphragm	76	Pressure Equipment Directive 2014/68/EU (PED)	114
PMP55: process connections with flush-mounted process isolating diaphragm	77	Manufacturer declaration	115
PMP55: hygienic process connections with flushmounted process isolating diaphragm	78	Marine approval	116
PMP55: hygienic process connections with flushmounted process isolating diaphragm	79	Drinking water approval	116
PMP55: process connections with flush-mounted process isolating diaphragm	85	Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ ISA 12.27.01	116
PMP55: process connections with flush-mounted process isolating diaphragm	87	Inspection certificate	116
PMP55 process connections	90	Calibration; unit	117
Wall and pipe mounting with "Separate housing" version	93	Calibration	117
Reduction in installation height	94	Service	117
Weight	94	Ordering information	118
Materials not in contact with process	95	Scope of delivery	118
Materials in contact with the process	98	Measuring point (TAG)	118
Seals	99	Configuration data sheet (HART, PROFIBUS PA, FOUNDATION Fieldbus electronics)	118
Fill fluid	99	Configuration data sheet (Analog electronics)	121
Operability	101	Additional documentation	122
Operating concept	101	Field of Activities	122
Local operation	101	Technical Information	122
Operating languages	104	Special Documentation	122
Remote operation	105	Operating Instructions	122
		Brief operating instruction	122
		Functional safety manual (SIL)	122
		Safety Instructions	122
		Accessories	125
		Manifolds	125
		Additional mechanical accessories	125
		Welding necks and Weld-in tool flanges	125
		Mounting bracket for wall and pipe mounting	126
		M12 connector	126
		Registered trademarks	126
		HART®	126
		PROFIBUS®	126

FOUNDATION™Fieldbus	126
---------------------------	-----





Document information

Document function



The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

Symbols used









Safety symbols

Symbol	Meaning
	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning	Symbol	Meaning
	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.		Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

Symbols for certain types of information


Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3. ...	Series of steps

Symbol	Meaning
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections

Documentation

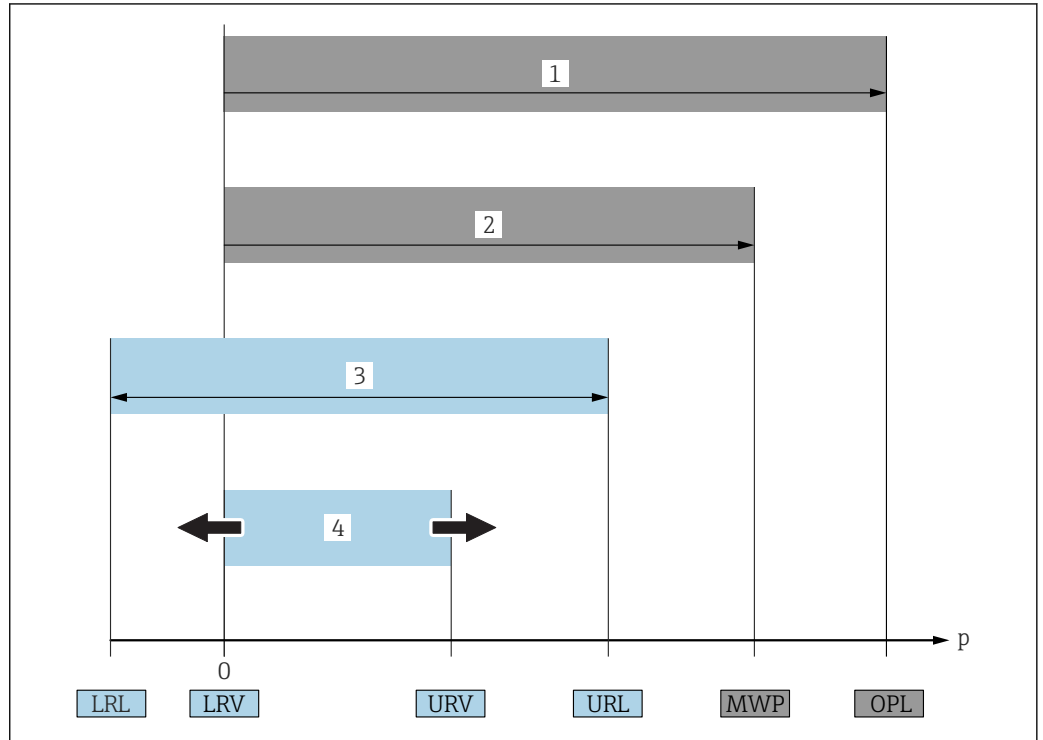
See chapter "Additional documentation" →  122



The document types listed are available:

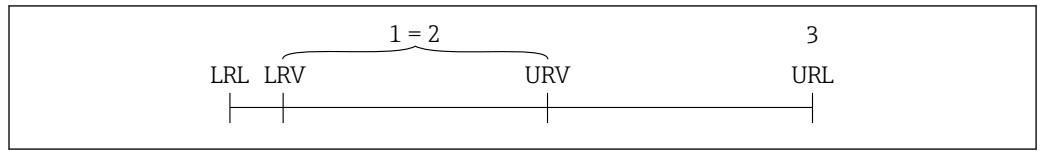
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Terms and abbreviations



A0029505

Item	Term/abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes see the → 44 section. The OPL may only be applied for a limited period of time.
2	MWP	The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes see the → 44 section. The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.
4	Calibrated/adjusted span	Span between LRV and URV Factory setting: 0 to URL Other calibrated spans can be ordered as customized spans.
p	-	Pressure
-	LRL	Lower range limit
-	URL	Upper range limit
-	LRV	Lower range value
-	URV	Upper range value
-	TD (Turn down)	Turn down Example - see the following section.

Turn down calculation

A0029545

- 1 Calibrated/adjusted span
- 2 Zero point-based span
- 3 URL sensor

Example

- Sensor: 10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

Turn down (TD):

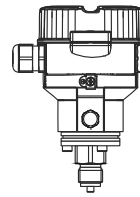
$$TD = \frac{URL}{|URV - LRV|}$$

$$TD = \frac{10 \text{ bar (150 psi)}}{|5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

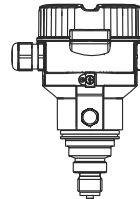
Function and system design

Device selection



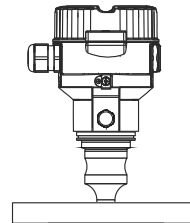
A0023673

PMC51 with capacitive measuring cell and ceramic process isolating diaphragm (Ceraphire®)



A0023675

PMP51 with piezoresistive measuring cell and metallic welded process isolating diaphragm



A0023676

PMP55 with diaphragm seal

Field of application

- Gauge pressure and absolute pressure
- Level

Process connections

PMC51:

- Thread
- EN flanges DN 25 – DN 80
- ANSI flanges 1" – 4"
- JIS flanges 50 A – 100 A
- Flush-mounted hygienic connections

PMP51:

- Thread
- EN flanges DN 25 – DN 80
- ANSI flanges 1" – 4"
- Prepared for diaphragm seal mount
- Flush-mounted hygienic connections

PMP55:

Wide range of diaphragm seals

Measuring ranges

- PMC51: From –100/0 to 100 mbar (–1.5/0 to 1.5 psi) to –1/0 to 40 bar (–15/0 to 600 psi)
- PMP51: From –400/0 to 400 mbar (–6/0 to 6 psi) to –1/0 to 400 bar (–15/0 to 6000 psi)
- PMP55: From –400/0 to 400 mbar (–6/0 to 6 psi) to –1/0 to 400 bar (–15/0 to 6000 psi)

OPL

- PMC51: max. 60 bar (900 psi)
- PMP51: max. 600 bar (9 000 psi)
- PMP55: max. 600 bar (9 000 psi)

Process temperature range

- PMC51: -20 to +130 °C (-4 to +266 °F)
For a maximum of 60 minutes: +150 °C (+302 °F)
- PMP51: -40 to +130 °C (-40 to +266 °F)
For a maximum of 60 minutes: +150 °C (+302 °F)
- PMP55: -70 to +400 °C (-94 to +752 °F)
(depending on the filling oil)

Ambient temperature range

- Without LCD: -40 to +85 °C (-40 to +185 °F)
- With LCD display: -20 to +70 °C (-4 to +158 °F)
(extended temperature application range -40 to +85 °C (-40 to +185 °F) with limitations in optical properties, such as display speed and contrast)
- Separate housing: -20 to +60 °C (-4 to +140 °F)
- PMP55: Diaphragm seal systems depending on the version

Reference accuracy

- PMC51: Up to ±0.15% of the set span
PLATINUM-Version: up to ±0.075% of the set span
- PMP51: Up to ±0.15% of the set span
PLATINUM-Version: up to ±0.075% of the set span
- PMP55: Up to ±0.15% of the set span

Supply voltage

- 11.5 to 45 V DC (versions with plug-in connection 35 V DC)
- For intrinsically safe device versions: 11.5 to 30 V DC

Output

4 to 20 mA, 4 to 20 mA with superimposed HART protocol, PROFIBUS PA or FOUNDATION Fieldbus

Options

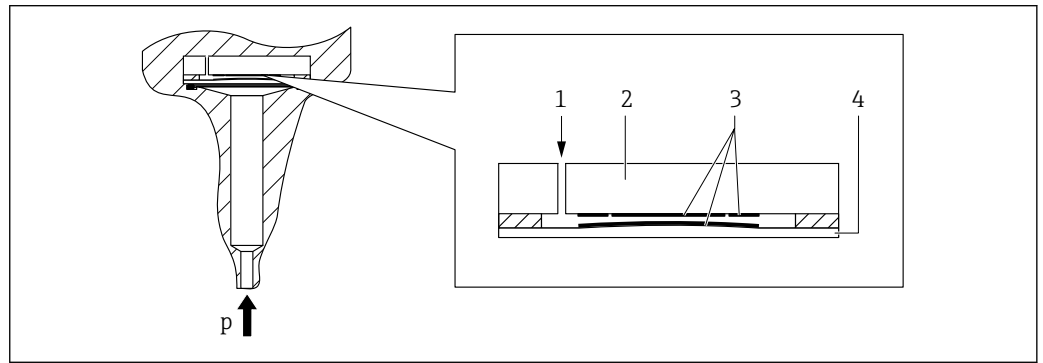
- Inspection certificate 2.2 or 3.1 or other certificates
- 3A approval and EHEDG approval
- Specific firmware versions
- Initial device settings
- Separate housing
- Broad range of accessories
- NACE-compliant materials

Specialties

- PMC51:
 - Metal-free measurement with PVDF connection
 - Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops
- PMP51:
 - Process connections with minimum oil volume
 - Gas-tight, elastomer-free
- PMP55:
 - Wide range of diaphragm seals
 - For extreme medium temperatures
 - Process connections with minimum oil volume
 - Completely welded versions

Measuring principle

Ceramic process isolating diaphragm used in PMC51 (Ceraphire®)



A0020465

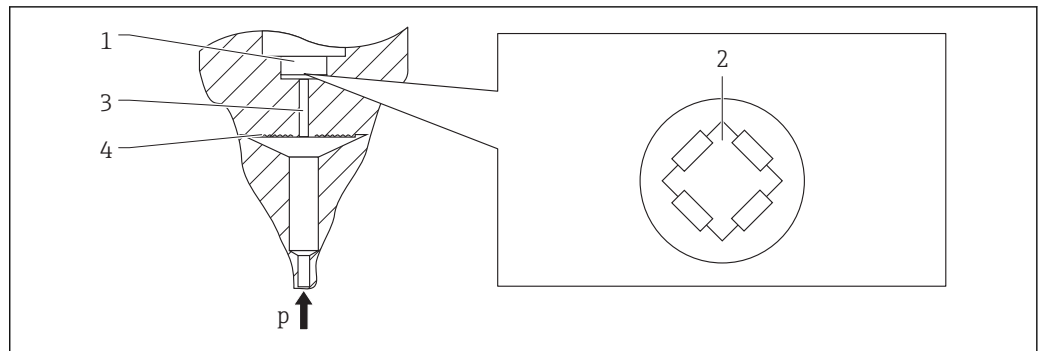
- 1 Air pressure (gauge pressure sensors)
- 2 Ceramic substrate
- 3 Electrodes
- 4 Ceramic process isolating diaphragm

The ceramic sensor is a dry sensor, i.e. the process pressure acts directly on the robust ceramic process isolating diaphragm and deflects it. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic substrate and the process isolating diaphragm. The measuring range is determined by the thickness of the ceramic process isolating diaphragm.

Advantages:

- Guaranteed overload resistance up to 40 times the nominal pressure
- Thanks to ultrapure 99.9% ceramic (Ceraphire®, see also "www.endress.com/ceraphire")
 - extremely high chemical stability, comparable with Alloy C
 - high mechanical stability
- Can be used in absolute vacuum

Metallic process isolating diaphragm used in PMP51 and PMP55



A0016448

- 1 Silicon measuring element, substrate
- 2 Wheatstone bridge
- 3 Channel with fill fluid
- 4 Metallic process isolating diaphragm

PMP51

The operating pressure deflects the process isolating diaphragm and a fill fluid transfers the pressure to a resistance bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

Advantages:

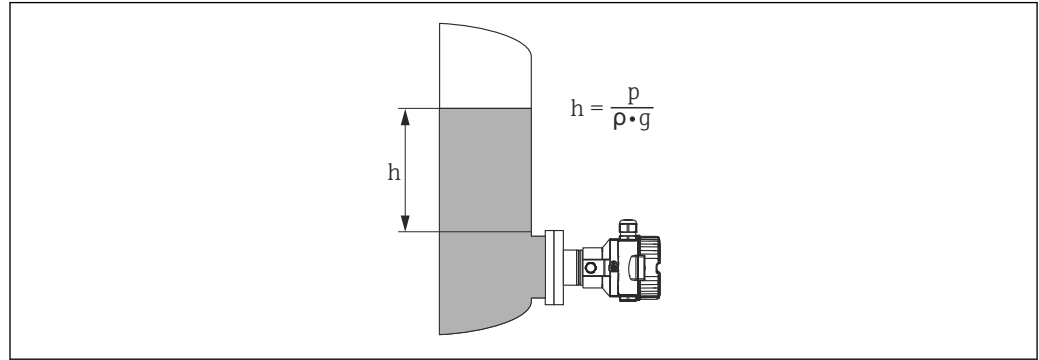
- Can be used for process pressure up to 400 bar (6 000 psi)
- High long-term stability
- Guaranteed overload resistance up to 4 times the nominal pressure
- Significantly less thermal effect compared to diaphragm seal systems

PMP55

The operating pressure acts on the process isolating diaphragm of the diaphragm seal and is transferred to the process isolating diaphragm of the sensor by a diaphragm seal fill fluid. The process isolating diaphragm is deflected and a fill fluid transfers the pressure to a resistance bridge. The pressure-dependent change in the bridge output voltage is measured and evaluated.

Advantages:

- Depending on the version, can be used for process pressure up to 400 bar (6 000 psi) and simultaneous extreme process temperatures
- High long-term stability
- Guaranteed overload resistance up to 4 times the nominal pressure

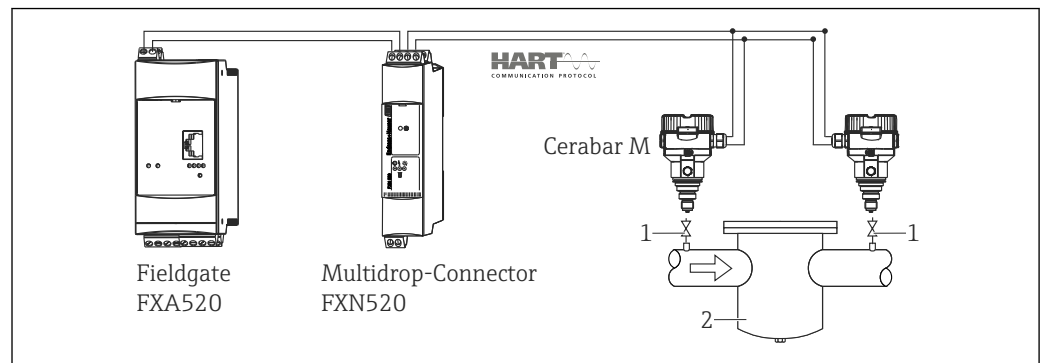
Level measurement (level, volume and mass)

A0023678

- h* Height (level)
p Pressure
ρ Density of the medium
g Gravitation constant

Your benefits

- Choice of different level measuring modes in the device software
- Volume and mass measurements in any tank shapes by means of a freely programmable characteristic curve
- Choice of diverse level units
- Has a wide range of uses, even in the following cases:
 - in the event of foam formation
 - in tanks with agitators or screen fittings
 - in the event of liquid gases

Electrical differential pressure measurement with gauge pressure sensors

A0023680

- 1 Shut-off valves
 2 e.g. filter

In the example given, two Cerabar M devices (each with a gauge pressure sensor) are interconnected. The pressure difference can thus be measured using two independent Cerabar M devices.

⚠ WARNING

Risk of explosion!

- ▶ If using intrinsically safe devices, strict compliance with the rules for interconnecting intrinsically safe circuits as stipulated in IEC60079-14 (proof of intrinsic safety) is mandatory.

Communication protocol

- 4 to 20 mA without communication protocol (analog electronics)
- 4 to 20 mA with HART communication protocol
- PROFIBUS PA
 - The Endress+Hauser devices meet the requirements of the FISCO model.
 - Due to a low current consumption of $11\text{ mA} \pm 1\text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 8 devices for Ex ia, CSA IS and FM IS applications or up to 31 devices for all other applications e.g. in non-hazardous areas, Ex nA etc. Further information on PROFIBUS PA can be found in Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.
- FOUNDATION Fieldbus
 - The Endress+Hauser devices meet the requirements of the FISCO model.
 - Due to a low current consumption of $16\text{ mA} \pm 1\text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO: up to 6 devices for Ex ia, CSA IS and FM IS applications or up to 22 devices for all other applications e.g. in non-hazardous areas, Ex nA etc. Further information on FOUNDATION Fieldbus, such as requirements for bus system components, can be found in Operating Instructions BA00013S "FOUNDATION Fieldbus Overview".

Input

Measured variable

Measured process variables

- Analog electronics: Absolute pressure and gauge pressure
- HART, PROFIBUS PA, FOUNDATION Fieldbus: Absolute pressure and gauge pressure, from which level (level, volume or mass) is derived

Measuring range

PMC51 – with ceramic process isolating diaphragm (Ceraphire®) for gauge pressure

Sensor	Maximum sensor measuring range		Smallest calibratable measuring span (preset at the factory) ¹⁾	MWP	OPL	Vacuum resistance	Option ²⁾
	lower (LRL)	upper (URL)					
	[bar (psi)]	[bar (psi)]				[bar _{abs} (psi _{abs})]	
100 mbar (1.5 psi)	-0.1 (-1.5)	+0.1 (+1.5)	0.01 (0.15)	2.7 (40.5)	4 (60)	0.7 (10.5)	1C
250 mbar (3.75 psi)	-0.25 (-3.75)	+0.25 (+3.75)	0.01 (0.15)	3.3 (49.5)	5 (75)	0.5 (7.5)	1E
400 mbar (6 psi)	-0.4 (-6)	+0.4 (+6)	0.02 (0.3)	5.3 (79.5)	8 (120)	0	1F
1 bar (15 psi)	-1 (-15)	+1 (+15)	0.05 (1)	6.7 (100.5)	10 (150)	0	1H
2 bar (30 psi)	-1 (-15)	+2 (+30)	0.1 (1.5)	12 (180)	18 (270)	0	1K
4 bar (60 psi)	-1 (-15)	+4 (+60)	0.2 (3)	16.7 (250.5)	25 (375)	0	1M
10 bar (150 psi)	-1 (-15)	+10 (+150)	0.5 (7.5)	26.7 (400.5)	40 (600)	0	1P
40 bar (600 psi)	-1 (-15)	+40 (+600)	2 (30)	40 (600)	60 (900)	0	1S

1) Factory calibration turn down: Max 20:1, higher on request or configurable in the device.

2) Product Configurator, "Sensor range" ordering feature

PMC51 – with ceramic process isolating diaphragm (Ceraphire®) for absolute pressure

Sensor	Maximum sensor measuring range		Smallest calibratable measuring span (preset at the factory) ¹⁾	MWP	OPL	Vacuum resistance	Option ²⁾
	lower (LRL)	upper (URL)					
	[bar _{abs} (psi _{abs})]	[bar _{abs} (psi _{abs})]					
100 mbar (1.5 psi)	0	+0.1 (+1.5)	0.01 (0.15)	2.7 (40.5)	4 (60)	0	2C
250 mbar (3.75 psi)	0	+0.25 (+3.75)	0.01 (0.15)	3.3 (49.5)	5 (75)	0	2E
400 mbar (6 psi)	0	+0.4 (+6)	0.02 (0.3)	5.3 (79.5)	8 (120)	0	2F
1 bar (15 psi)	0	+1 (+15)	0.05 (1)	6.7 (100.5)	10 (150)	0	2H
2 bar (30 psi)	0	+2 (+30)	0.1 (1.5)	12 (180)	18 (270)	0	2K
4 bar (60 psi)	0	+4 (+60)	0.2 (3)	16.7 (250.5)	25 (375)	0	2M
10 bar (150 psi)	0	+10 (+150)	0.5 (7.5)	26.7 (400.5)	40 (600)	0	2P
40 bar (600 psi)	0	+40 (+600)	2 (30)	40 (600)	60 (900)	0	2S

1) Factory calibration turn down: Max 20:1, higher on request or configurable in the device.

2) Product Configurator, "Sensor range" ordering feature

PMP51 and PMP55 – metallic process isolating diaphragm for gauge pressure

Sensor	Maximum sensor measuring range		Smallest calibratable measuring span (preset at the factory) ¹⁾	MWP	OPL	Vacuum resistance ²⁾	Option ³⁾
	lower (LRL)	upper (URL)				Silicone oil/ Inert oil/ Synthetic oil	
	[bar (psi)]	[bar (psi)]				[bar _{abs} (psi _{abs})]	
400 mbar (6 psi)	-0.4 (-6)	+0.4 (+6)	0.02 (0.3)	4 (60)	6 (90)	0.01/0.04/0.01 (0.15/0.6/0.15)	1F
1 bar (15 psi)	-1 (-15)	+1 (+15)	0.05 (1)	6.7 (100)	10 (150)		1H
2 bar (30 psi)	-1 (-15)	+2 (+30)	0.1 (1.5)	13.3 (200)	20 (300)		1K
4 bar (60 psi)	-1 (-15)	+4 (+60)	0.2 (3)	18.7 (280.5)	28 (420)		1M
10 bar (150 psi)	-1 (-15)	+10 (+150)	0.5 (7.5)	26.7 (400.5)	40 (600)		1P
40 bar (600 psi)	-1 (-15)	+40 (+600)	2 (30)	100 (1500)	160 (2400)		1S
100 bar (1 500 psi)	-1 (-15)	+100 (+1500)	5 (75)	100 (1500)	400 (6000)		1U
400 bar (6 000 psi)	-1 (-15)	+400 (+6000)	20 (300)	400 (6000)	600 (9000)		1W

1) Factory calibration turn down: Max 20:1, higher on request or configurable in the device.

2) The vacuum resistance applies to the measuring cell at reference conditions. The pressure and temperature application limits of the selected filling oil must also be observed for the PMP55. → 109.

3) Product Configurator, "Sensor range" ordering feature

PMP51 and PMP55 – metallic process isolating diaphragm for absolute pressure

Sensor	Maximum sensor measuring range		Smallest calibratable measuring span (preset at the factory) ¹⁾	MWP	OPL	Vacuum resistance ²⁾	Option ³⁾
	lower (LRL)	lower (URL)				Silicone oil/ Inert oil/ Synthetic oil	
	[bar _{abs} (psi _{abs})]	[bar _{abs} (psi _{abs})]				[bar _{abs} (psi _{abs})]	
400 mbar (6 psi)	0	+0.4 (+6)	0.02 (0.3)	4 (60)	6 (90)	0.01/0.04/0.01 (0.15/0.6/0.15)	2F
1 bar (15 psi)	0	+1 (+15)	0.05 (1)	6.7 (100)	10 (150)		2H
2 bar (30 psi)	0	+2 (+30)	0.1 (1.5)	13.3 (200)	20 (300)		2K
4 bar (60 psi)	0	+4 (+60)	0.2 (3)	18.7 (280.5)	28 (420)		2M
10 bar (150 psi)	0	+10 (+150)	0.5 (7.5)	26.7 (400.5)	40 (600)		2P
40 bar (600 psi)	0	+40 (+600)	2 (30)	100 (1500)	160 (2400)		2S
100 bar (1 500 psi)	0	+100 (+1500)	5 (75)	100 (1500)	400 (6000)		2U
400 bar (6 000 psi)	0	+400 (+6000)	20 (300)	400 (6000)	600 (9000)		2W

1) Factory calibration turn down: Max 20:1, higher on request or configurable in the device.

2) The vacuum resistance applies to the measuring cell at reference conditions. The pressure and temperature application limits of the selected filling oil must also be observed for the PMP55. → 109.

3) Product Configurator, "Sensor range" ordering feature

Output

Output signal

- 4 to 20 mA analog, 2-wire
- 4 to 20 mA with superimposed digital communication protocol HART 6.0, 2-wire
- Digital communication signal PROFIBUS PA (Profile 3.02)
- Digital communication signal FOUNDATION Fieldbus

Output	Option ¹⁾
4 to 20mA	1
4 to 20mA HART	2
PROFIBUS PA	3
FOUNDATION Fieldbus	4

1) Product Configurator, "Output" ordering feature

Signal range 4 to 20 mA

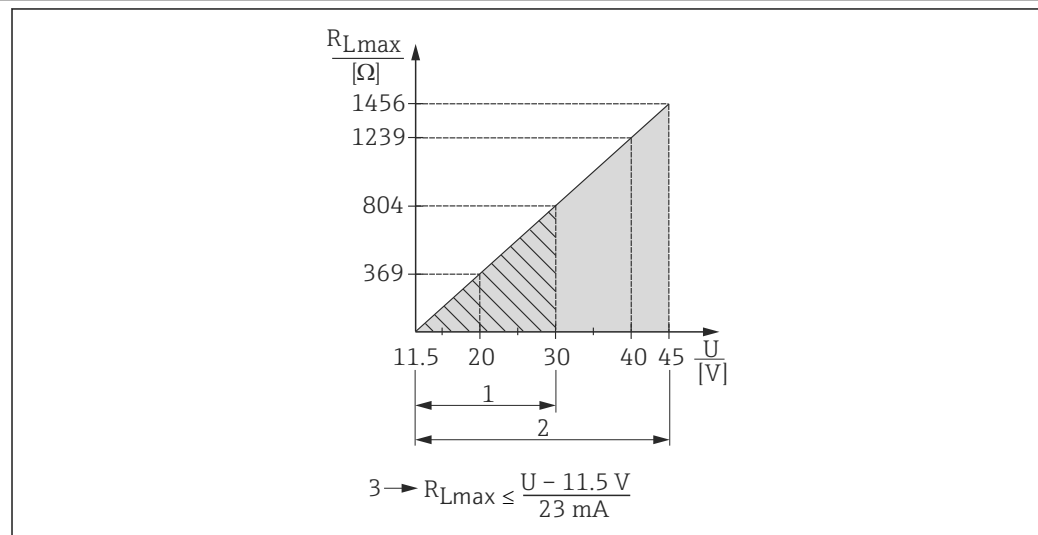
4 to 20 mA Analog, 4 to 20 mA HART: 3.8 to 20.5 mA

Signal on alarm

As per NAMUR NE 43

- 4 to 20 mA Analog:
 - Signal overshoot: > 20.5 mA
 - Signal undershoot: < 3.8 mA
 - Min Alarm (3.6 mA)
- 4 to 20 mA HART:
 - Options:
 - Max. alarm: can be set from 2.1 to 2.3 mA (factory setting: 2.2 mA)
 - Hold measured value: last measured value is held
 - Min. alarm: 3.6 mA
- PROFIBUS PA: can be set in the Analog Input block
 - Options: Last Valid Out Value (factory setting), Fail-safe Value, Status Bad
- FOUNDATION Fieldbus: can be set in the Analog Input block
 - Options: Last Good Value, Fail-safe Value (factory setting), Wrong Value

Load - 4 to 20 mA Analog 4...20 mA HART



A0023090

- 1 Supply voltage 11.5 to 30 V DC for intrinsically safe device versions (not for analog)
- 2 Supply voltage 11.5 to 45 V DC (versions with plug-in connector 35 V DC) for other types of protection and for uncertified device versions
- 3 R_{Lmax} Maximum load resistance
- U Supply voltage



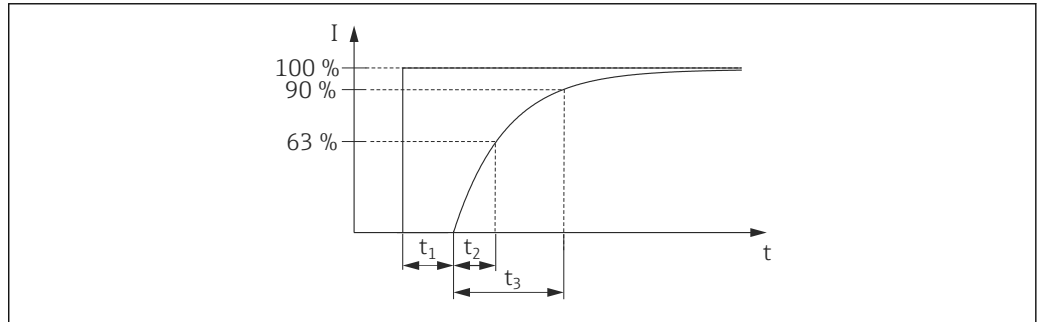
When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must be taken into account.

Resolution

- Current output: 1 μ A
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

Dead time, Time constant

Presentation of the dead time and the time constant:



A0019786

Dynamic behavior current output (analog electronics)

	Type	Dead time (t_1) [ms]	Time constant T63 (= t_2) [ms]	Time constant T90 (= t_3) [ms]
max.	PMC51	60	40	50
max.	PMP51	40	40	50
max.	PMP55	PMP51 + influence of the diaphragm seal		

Dynamic behavior current output (HART electronics)

	Type	Dead time (t_1) [ms]	Time constant T63 (= t_2) [ms]	Time constant T90 (= t_3) [ms]
max.	PMC51	50	85	200
max.	PMP51	70	80	185
max.	PMP55	PMP51 + influence of the diaphragm seal		

Dynamic behavior digital output (HART electronics)

	Type	Dead time (t_1) [ms]	Dead time (t_1) [ms] + Time constant T63 (= t_2) [ms]	Dead time (t_1) [ms] + Time constant T90 (= t_3) [ms]
min.	PMC51	210	295	360
max.		1010	1095	1160
min.	PMP51	210	285	345
max.		1010	1085	1145
max.	PMP55	PMP51 + influence of the diaphragm seal		

Reading cycle

- Acyclic: max. 3/s, typical 1/s (depends on command # and number of preambles)
- Cyclic (Burst): max. 3/s, typical 2/s

The device commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Cycle time (update time)

Cyclic (Burst): min. 300 ms

Response time

- Acyclic: min. 330 ms, typical 590 ms (depends on command # and number of preambles)
- Cyclic (Burst): min. 160 ms, typical 350 ms (depends on command # and number of preambles)

Dynamic behavior PROFIBUS PA

	Type	Dead time (t_1) [ms]	Dead time (t_1) [ms] + Time constant T63 (= t_2) [ms]	Dead time (t_1) [ms] + Time constant T90 (= t_3) [ms]
min.	PMC51	85	170	235
max.		1185	1270	1335

	Type	Dead time (t ₁) [ms]	Dead time (t ₁) [ms] + Time constant T63 (= t ₂) [ms]	Dead time (t ₁) [ms] + Time constant T90 (= t ₃) [ms]
min.	PMP51	85	160	220
max.		1185	1260	1320
max.	PMP55	PMP51 + influence of the diaphragm seal		

Reading cycle (SPS)

- Acyclic: typical 25/s
- Cyclic: max. 30/s (dependent on the number and type of function blocks used in a closed-control loop)

Cycle time (update time)

min. 100 ms

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

Response time

- Acyclic: approx. 23 to 35 ms (depends on Min. Slave Interval)
- Cyclic: approx. 8 to 13 ms (depends on Min. Slave Interval)

**Dynamic behavior
FOUNDATION Fieldbus**

	Type	Dead time (t ₁) [ms]	Dead time (t ₁) [ms] + Time constant T63 (= t ₂) [ms]	Dead time (t ₁) [ms] + Time constant T90 (= t ₃) [ms]
min.	PMC51	95	180	245
max.		1095	1180	1245
min.	PMP51	95	170	230
max.		1095	1170	1230
max.	PMP55	PMP51 + influence of the diaphragm seal		

Reading cycle

- Acyclic: typical 5/s
- Cyclic: max. 10/s (dependent on the number and type of function blocks used in a closed-control loop)

Cycle time (update time)

Cyclic: min. 100 ms

Response time

- Acyclic: typical 70 ms (for standard bus parameter settings)
- Cyclic: max. 20 ms (for standard bus parameter settings)

Damping

A damping affects all outputs (output signal, display):

- Via on-site display, handheld terminal or PC with operating program, continuous from 0...999 s
- Via DIP-switch on the electronic insert, switch position "on" (= set value) and "off" (= damping switched off)
- Factory setting: 2 s

Firmware version

Designation	Option ¹⁾
01.00.zz, FF, DevRev01	76
01.00.zz, PROFIBUS PA, DevRev01	77
01.00.zz, HART, DevRev01	78

1) Product Configurator, "Firmware version" ordering feature

Protocol-specific data HART

Manufacturer ID	17 (11 hex)
Device Type Code	25 (19 hex)
Device Revision	01 (01 hex) - SW version 01.00.zz
HART specification	6
DD Revision	<ul style="list-style-type: none"> 01 (Dutch)) 02 (Russian))
Device description files (DTM, DD)	Information and files can be found: <ul style="list-style-type: none"> www.endress.com www.fieldcommgroup.org
HART load	Min. 250 Ω
HART device variables	<p>The measured values can be freely assigned to the device variables:</p> <p>Measured values for PV (primary variable)</p> <ul style="list-style-type: none"> Pressure Level Tank content <p>Measured values for SV, TV (second and third variable)</p> <ul style="list-style-type: none"> Pressure Level <p>Measured values for QV (fourth variable)</p> <p>Temperature</p>
Supported functions	<ul style="list-style-type: none"> Burst mode Additional Transmitter Status Device Locking Alternative operating modes

Protocol-specific data PROFIBUS PA

Manufacturer ID	17 (11 hex)
Ident number	1554 hex
Profile Version	3.02 SW Version 01.00.zz
GSD Revision	5
DD Revision	1
GSD File	Information and files can be found: <ul style="list-style-type: none"> www.endress.com www.profibus.org
DD Files	
Output values	<p>Measured values for PV (via Analog Input Function Block)</p> <ul style="list-style-type: none"> Pressure Level Tank content <p>Measured values for SV</p> <ul style="list-style-type: none"> Pressure Temperature
Input values	Input value sent from PLC, can be shown on display
Supported functions	<ul style="list-style-type: none"> Identification & Maintenance <ul style="list-style-type: none"> Simple device identification via control system and nameplate Condensed status Automatic ident number adaptation and switchable to following ident numbers: <ul style="list-style-type: none"> 9700: Profile-specific transmitter identification number with the "Classic" or "Condensed" status. 151C: Compatibility mode for the old Cerabar M (PMC41, PMC45, PMP41, PMP45, PMP46, PMP48). 1553: Identification number for the new Cerabar M (PMC51, PMP51, PMP55). Device locking: The device can be locked by hardware or software.

**Protocol-specific data
FOUNDATION Fieldbus**

Device Type	0x1019
Device Revision	01 (hex)
DD Revision	0x01021
Device description files (DTM, DD)	Information and files can be found: <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.fieldcommgroup.org
CFF Revision	0x000102
ITK Version	5.2.0
ITK-Certification Driver-No.	IT067700
Link-Master (LAS) capable	yes
Link Master / Basic Device selectable	Yes; Factory setting: Basic Device
Number of VCRs	44
Number of Link Objects in VFD	50
Number of FB-Schedule Objects	40

Virtual communication references (VCRs)

Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

Link settings

Slot time	4
Min. Inter PDU delay	12
Max. response delay	40

Transducer Blocks

Block	Content	Output values
TRD1 Block	Contains all parameters related to the measurement	<ul style="list-style-type: none"> ▪ Pressure or level (channel 1) ▪ Process temperature (channel 2) ▪ Measured pressure value (channel 3) ▪ Max. pressure (channel 4) ▪ Level before linearization (channel 5)
Diagnostic Block	Contains diagnostic information	Error code via DI channels (channel 10 to 15)
Display Block	Contains parameters to configure the onsite display	No output values

Function blocks

Block	Content	Number of blocks	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device.	1		enhanced
Analog Input Block 1 Analog Input Block 2	The AI Block receives the measuring data from the Sensor Block, (selectable via a channel number) and makes the data available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode.	2	25 ms	enhanced
Digital Input Block	This block contains the discrete data of the Diagnose Block (selectable via a channel number 10 to 15) and provides them for other blocks at the output.	1	20 ms	standard
Digital Output Block	This block converts the discrete input and thus initiates an action (selectable via a channel number) in the DP Flow Block or in the im TRD1 Block. Channel 20 resets the counter for max. pressure transgressions value.	1	20 ms	standard
PID Block	The PID Block serves as a proportional-integral-derivative controller and is used almost universally for closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	40 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be performed.	1	35 ms	standard
Input Selector Block	The Input Selector Block facilitates the selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI Blocks. The block performs maximum, minimum, average and 'first good' signal selection. Inputs IN1 to IN4 can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_1_CONTENT).	1	30 ms	standard
Signal Characterizer Block	The Signal Characterizer Block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is generated by a single look-up table with 21 arbitrary x-y pairs.	1	40 ms	standard
Integrator Block	The Integrator Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input Block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating a binary signal when the setpoint is reached.	1	35 ms	standard

Additional function block information:

Instantiate Function Block	YES
Number of additional instantiatable function blocks	20

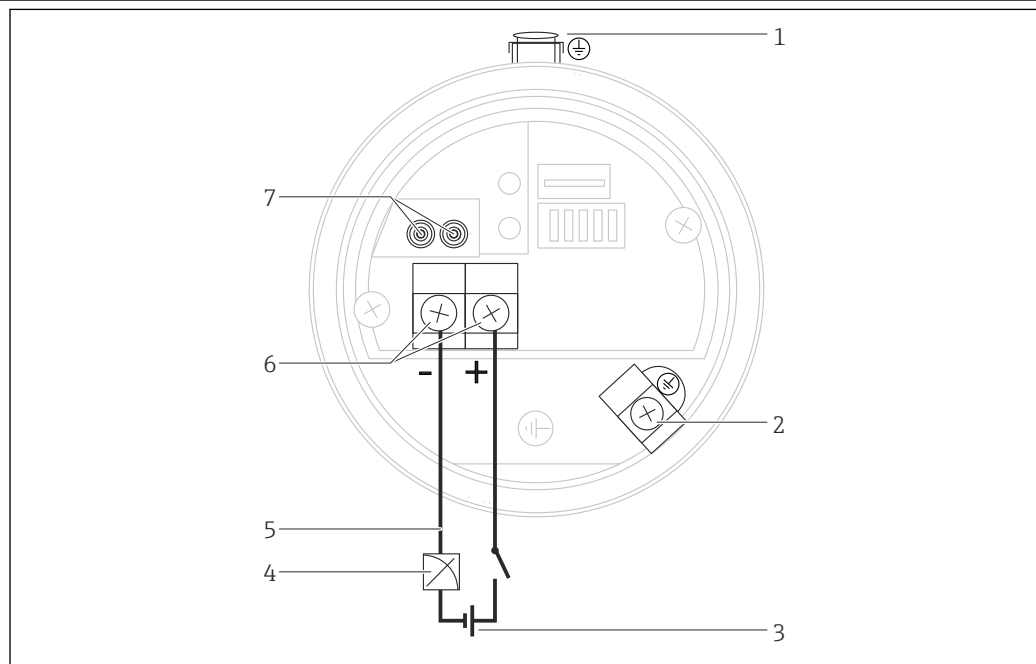
Power supply

⚠ WARNING

An incorrect connection compromises electrical safety!

- ▶ When using the measuring device in hazardous areas, the relevant national standards and regulations as well as the safety instructions or installation or control drawings must be observed. → 122.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas → 122.
- ▶ According to IEC/EN61010 a suitable disconnecter has to be installed for the device.
- ▶ HART: Overvoltage protection HAW569-DA2B for the non-hazardous area, ATEX II 2 (1) Ex ia IIC and IEC Ex ia can be ordered as an option (see "Ordering information" ordering feature).
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

Terminal assignment



A0023505

- 1 External grounding terminal (only for devices with certainly approvals or if "Measuring point" (TAG) is ordered)
- 2 Internal grounding terminal
- 3 Supply voltage → 22
- 4 4...20 mA for HART devices
- 5 For HART and FOUNDATION Fieldbus devices: With a handheld terminal, all the parameters can be configured anywhere along the bus line via menu operation.
- 6 Terminals
- 7 For HART devices: test terminals, see section "Taking 4 to 20 mA test signal" → 22

Supply voltage

4 to 20 mA HART

Type of protection	Supply voltage
Intrinsically safe	11.5 to 30 V DC
<ul style="list-style-type: none"> ▪ Other types of protection ▪ Devices without certificate 	11.5 to 45 V DC (versions with plug-in connection 35 V DC)

Taking 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the test terminals without interrupting the measurement.

PROFIBUS PA

Version for non-hazardous areas: 9 to 32 V DC

FOUNDATION Fieldbus

Version for non-hazardous areas: 9 to 32 V DC

Current consumption

- PROFIBUS PA: 11 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 16 mA ±1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Electrical connection

Cable entry	Degree of protection	Option ¹⁾
M20 gland	IP66/68 NEMA 4X/6P	A
G ½" thread	IP66/68 NEMA 4X/6P	C
NPT ½" thread	IP66/68 NEMA 4X/6P	D
M12 plug	IP66/67 NEMA 4X/6P	I
7/8" plug	IP66/68 NEMA 4X/6P	M
HAN7D plug 90 deg	IP65	P
PE cable 5m	IP66/68 NEMA4X/6P + pressure compensation via cable	S
M16 valve connector	IP64	V

1) Product Configurator, "Electrical connection" ordering feature

PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding, and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and the PNO Guideline.

FOUNDATION Fieldbus


The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Terminals

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm² (20 to 12 AWG)

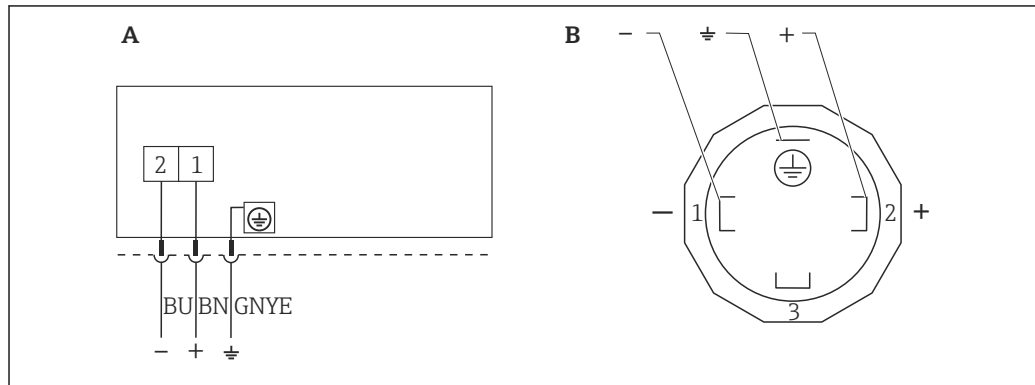
Cable entry

Approval	Type	Clamping area
Standard, CSA GP ATEX II1/2G or II2G Ex ia, IEC Ex ia Ga/Gb or Ex ia Gb, FM/ CSA IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
ATEX II1/2D Ex t, II1/2GD Ex ia, II3G Ex nA, IEC Ex t Da/Db	Metal M20x1.5 (Ex e)	7 to 10.5 mm (0.28 to 0.41 in)

For other technical data, see the housing section →  45

Device plug connectors

Devices with valve connector (HART)



A0023097

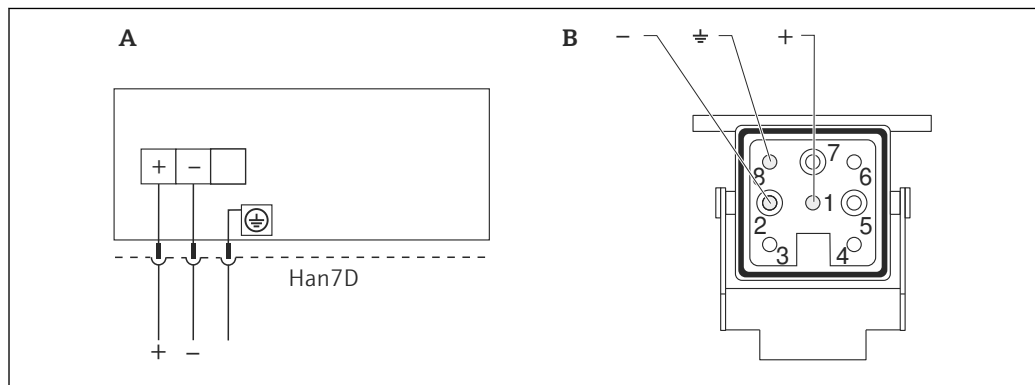
1 BN = brown, BU = blue, GNYE = green

A Electrical connection for devices with valve connector

B View of the plug connector at the device

Material: PA 6.6

Devices with Harting plug Han7D (HART)



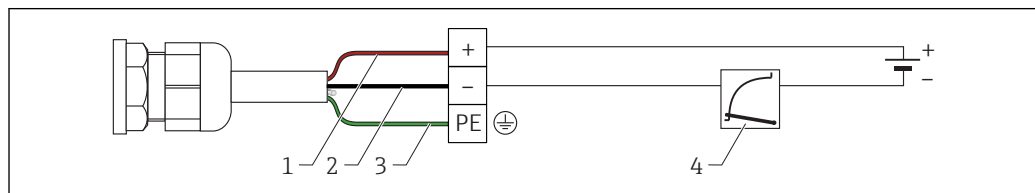
A0019990

A Electrical connection for devices with Harting plug Han7D

B View of the plug-in connector at the device

Material: CuZn, contacts for plug-in jack and connector are gold-plated

Connecting the cable version (all device versions)



A0019991

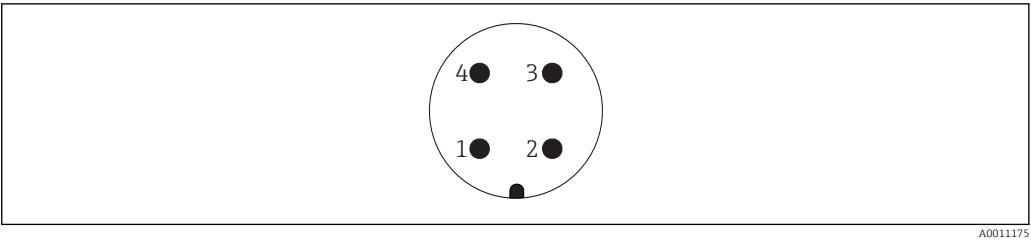
1 RD = red

2 BK = black

3 GNYE = green

4 4...20 mA

Devices with M12 plug(Analog, HART, PROFIBUS PA)



- 1 *Signal +*
- 2 *Not assigned*
- 3 *Signal -*
- 4 *Earth*

Endress+Hauser offers the following accessories for devices with an M12 connector:

Plug-in jack M 12x1, straight

- Material: body PA; coupling nut CuZn, nickel-plated
- Degree of protection (fully locked): IP66/67
- Order number: 52006263

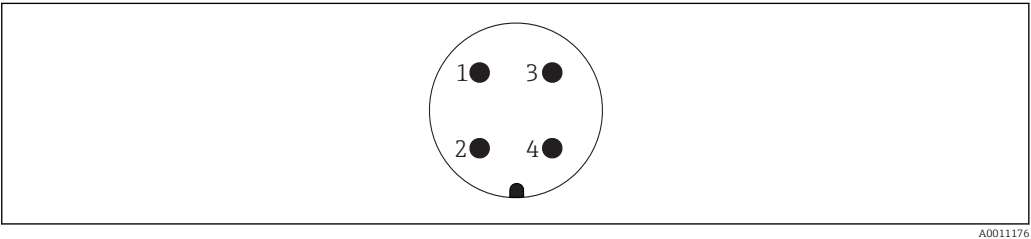
Plug-in jack M 12x1, elbowed

- Material: body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP66/67
- Order number: 71114212

Cable 4x0.34 mm² (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)

- Material: body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP66/67
- Order number: 52010285

Devices with 7/8" plug (Analog, HART, FOUNDATION Fieldbus)



- 1 *Signal -*
- 2 *Signal +*
- 3 *Not assigned*
- 4 *Shield*

External thread: 7/8 - 16 UNC

- Material: 316L (1.4401)
- Protection: IP66/68

Cable specification

Analog

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- The cable outer diameter depends on the cable entry used.

HART

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- The cable outer diameter depends on the cable entry used.

PROFIBUS PA

Use a twisted, shielded two-wire cable, preferably cable type A

i For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", the PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

Use a twisted, shielded two-wire cable, preferably cable type A

i For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Start-up current

- Analog electronics:: 12 mA
- HART: 12 mA or 22 mA (selectable)

Residual ripple

No influence on 4 to 20 mA signal up to $\pm 5\%$ residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)].

Influence of power supply

$\leq 0.001\%$ of URL/V

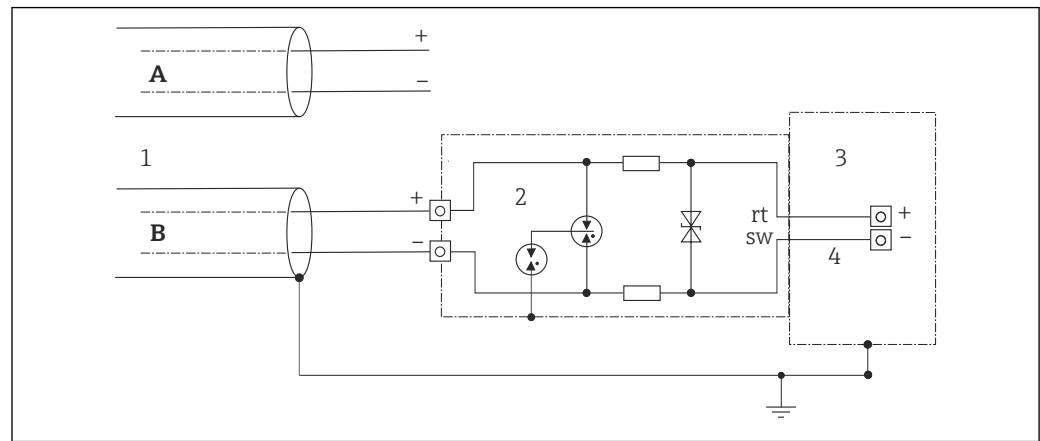
Overvoltage protection (optional)

The device can be fitted with overvoltage protection. The overvoltage protection is mounted at the factory on the housing thread (M20x1.5) for the cable gland and is approx. 70 mm (2.76 in) in length (take additional length into account when installing). The device is connected as illustrated in the following graphic.

For details refer to TI01013KDE, XA01003KA3 and BA00304KA2.

Ordering information:

Product Configurator, "Mounted accessories" ordering feature, option NA

Wiring

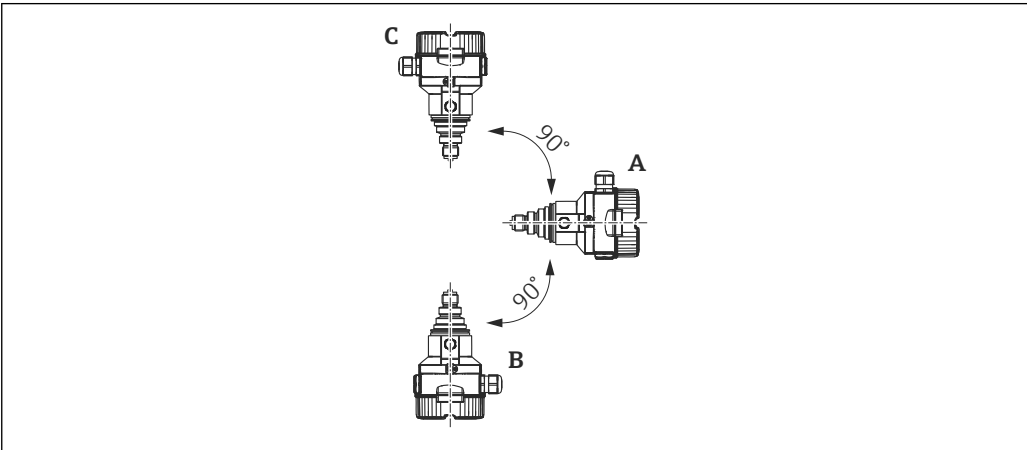
A0023111

- A Without direct shield grounding
- B With direct shield grounding
- 1 Incoming connection cable
- 2 HAW569-DA2B
- 3 Unit to be protected
- 4 Connection cable

Performance characteristics of the ceramic process isolating diaphragm

Reference operating conditions	<ul style="list-style-type: none">■ As per IEC 60770■ Ambient temperature T_A = constant, in the range of +21 to +33 °C (+70 to +91 °F)■ Humidity ϕ = constant, in the range of: 5 to 80 % RH■ Ambient pressure p_U = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)■ Position of the measuring cell: constant, in the range of: $\pm 1^\circ$ horizontally■ Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value■ Span based on zero point■ Material of the process isolating diaphragm: Al_2O_3 (aluminum oxide ceramic Ceraphire®)■ Supply voltage: 24 V DC ± 3 V DC■ Load with HART: 250 Ω
--------------------------------	--

Influence of orientation



A0023697

Measuring error in mbar (psi)

Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
Calibration position, no measuring error	< +0.2 mbar (+0.003 psi)	< -0.2 mbar (-0.003 psi)

 Position-dependent zero point shift can be corrected at the device →  36

Uncertainty of measurement for small absolute pressure ranges	<p>The smallest expanded uncertainty of measurement that can be returned by our standards is:</p> <ul style="list-style-type: none">■ 0.4% of the measured value in the range of 1 to 30 mbar (0.0145 to 0.435 psi)■ 1% of the measured value in the range < 1 mbar (0.0145 psi).
---	---

Reference accuracy – PMC51

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

Gauge pressure sensors		
Measuring cell	Standard reference accuracy	Platinum reference accuracy
100 mbar (1.5 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.0075 % x TD
250 mbar (3.75 psi), 400 mbar (6 psi), 1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.1 %
40 bar (600 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.0075 % x TD

Absolute pressure sensors		
Measuring cell	Standard reference accuracy	Platinum reference accuracy
100 mbar (1.5 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.015 x TD 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.015 % x TD
250 mbar (3.75 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.1 %
400 mbar (6 psi), 1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.1 %
40 bar (600 psi)	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.15 % TD > 10:1 to TD 20:1 = ±0.2 % 	<ul style="list-style-type: none"> TD 1:1 to ≤ TD 10:1 = ±0.075 % TD > 10:1 to TD 20:1 = ±0.0075 % x TD

**Thermal change in the zero
output and the output span –
PMC51**
PMC51 with thread or flange

Signal output	Measuring cell	% of the calibrated measuring span		
		–40 to –20 °C (–40 to –4 °F)	–10 to +60 °C (+14 to +140 °F)	–20 to +100 °C (–4 to +212 °F)
HART, PROFIBUS PA, FOUNDATION Fieldbus	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±(0.6 + 0.45 x TD)	±0.2 + 0.275 x TD	±(0.4 + 0.425 x TD)
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.5 + 0.35 x TD	±0.1 + 0.15 x TD	±(0.225 + 0.525 x TD)
Analog (4 to 20 mA)	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±(0.6 + 0.45 x TD)	±0.4 + 0.275 x TD	±0.7 + 0.425 x TD
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.5 + 0.35 x TD	±0.3 + 0.15 x TD	±0.525 + 0.525 x TD

PMC51 with hygienic process connection

Signal output	Measuring cell	% of the calibrated measuring span	
		-10 to +60 °C (+14 to +140 °F)	-20 to +130 °C (-4 to +266 °F)
HART, PROFIBUS PA, FOUNDATION Fieldbus	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	$\pm(0.4 + 0.275 \times \text{TD})$	$\pm(0.7 + 0.425 \times \text{TD})$
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	$\pm(0.3 + 0.15 \times \text{TD})$	$\pm(0.525 + 0.525 \times \text{TD})$
Analog (4 to 20 mA)	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	$\pm(0.4 + 0.275 \times \text{TD})$	$\pm(0.7 + 0.425 \times \text{TD})$
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	$\pm(0.3 + 0.15 \times \text{TD})$	$\pm(0.525 + 0.525 \times \text{TD})$

Total performance – PMC51

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change in the zero point. All specifications apply to the temperature range -10 to +60 °C (+14 to +140 °F) and Turndown 1:1.

Signal output	Measuring cell	% URL
HART, PROFIBUS PA, FOUNDATION Fieldbus	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	± 0.575
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	± 0.5
Analog (4 to 20 mA)	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	± 0.775
	1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	± 0.7

Long-term stability**For devices with thread or flange:**

	Measuring range	Long-term stability of URL / 1 year	Long-term stability of URL / 5 years	Long-term stability of URL / 10 years
PMC51	≤ 1 bar (15 psi)	± 0.2 %	± 0.4 %	± 0.5 %
	> 1 bar (15 psi)	± 0.1 %	± 0.25 %	± 0.4 %

For devices with hygienic process connections:

	Measuring range	Long-term stability of URL / 1 year
PMC51	≤ 1 bar (15 psi)	± 0.35 %
	> 1 bar (15 psi)	± 0.2 %

Total Error - PMC51

The total error comprises the long-term stability and the total performance. All specifications apply to the temperature range -10...+60 °C (+14...+140 °F) and Turndown 1:1.

	Signal output	Measuring cell	% URL / 1 Jahr
PMC51 with thread or flange	HART, PROFIBUS PA, FOUNDATION Fieldbus	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±0.55
		1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.47
	Analog (4 to 20 mA)	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±0.75
		1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.67
PMC51 with hygienic process connection	HART, PROFIBUS PA, FOUNDATION Fieldbus	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±0.925
		1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.7
	Analog (4 to 20 mA)	100 mbar (1.5 psi), 250 mbar (3.75 psi), 400 mbar (6 psi)	±1.125
		1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	±0.9

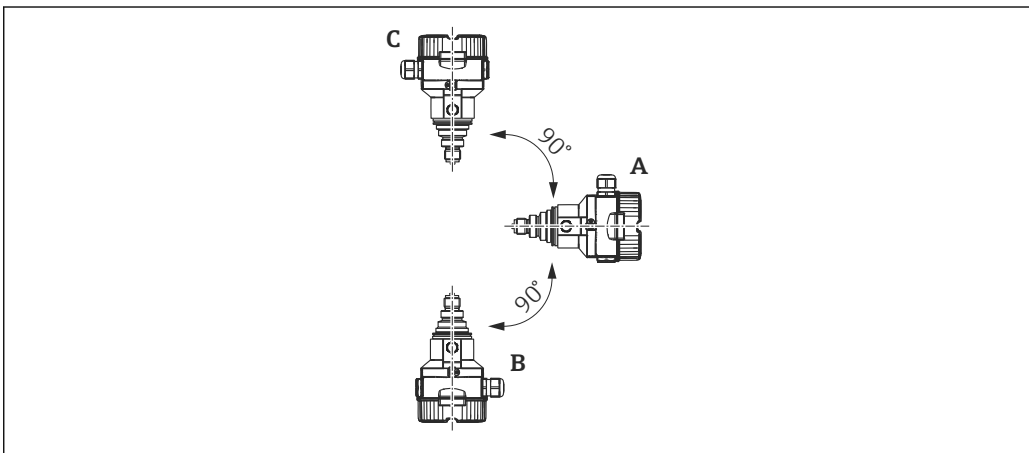
Warm-up period

- 4 to 20 mA analog: ≤1,5 s
- 4 to 20 mA HART: ≤5 s
- PROFIBUS PA: ≤8 s
- FOUNDATION Fieldbus: ≤20 s (after a TOTAL-reset ≤45 s)

Performance characteristics of the metallic process isolating diaphragm

Reference operating conditions	<ul style="list-style-type: none">■ As per IEC 60770■ Ambient temperature T_A = constant, in the range of: +21 to +33 °C (+70 to +91 °F)■ Humidity ϕ = constant, in the range of: 5 to 80 % RH■ Ambient pressure p_A = constant, in the range of: 860 to 1 060 mbar (12.47 to 15.37 psi)■ Position of the measuring cell: constant, in range $\pm 1^\circ$ horizontally■ Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value■ Span based on zero point■ Material of the process isolating diaphragm: AISI 316L■ Filling oil: NSF-H1 synthetik oil according to FDA 21 CFR 178.3570■ Supply voltage: 24 V DC ± 3 V DC■ Load with HART: 250 Ω
Uncertainty of measurement for small absolute pressure ranges	<p>The smallest expanded uncertainty of measurement that can be returned by our standards is:</p> <ul style="list-style-type: none">■ 0.4% of the measured value in the range of 1 to 30 mbar (0.0145 to 0.435 psi)■ 1% of the measured value in the range < 1 mbar (0.0145 psi).
Performance Characteristics Conformance	All performance characteristics are in conformance to $\geq \pm 3$ sigma.

Influence of orientation



A0023697

Measuring error in mbar (psi)

	Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
PMP51 with process connections ½" thread and Silicone oil	Calibration position, no measuring error	< +4 mbar (+0.06 psi)	< -4 mbar (-0.06 psi)
PMP51 with process connections > thread ½" and flanges		< +10 mbar (+0.145 psi) This value is doubled for inert oil.	< -10 mbar (-0.145 psi) This value is doubled for inert oil.

 Position-dependent zero point shift can be corrected at the device. →  36

**Reference accuracy –
PMP51, PMP55**

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

PMP51 and PMP55 without capillary		
Measuring cell	Standard reference accuracy	Platinum reference accuracy ¹⁾
400 mbar (6 psi)	<ul style="list-style-type: none"> TD 1:1 = $\pm 0.15\%$ TD >1:1 to TD 20:1 = $\pm 0.15\% \times \text{TD}$ 	Not available
	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 = $\pm 0.3\%$ TD >1:1 to TD 10:1 = $\pm 0.3\% \times \text{TD}$ 	Not available
1 bar (15 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 5:1 = $\pm 0.15\%$ TD >5:1 to TD 20:1 = $\pm 0.03\% \times \text{TD}$ 	<ul style="list-style-type: none"> TD 1:1 to TD 2.5:1 = $\pm 0.075\%$ TD >2.5:1 to TD 20:1 = $\pm 0.03\% \times \text{TD}$
	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 = $\pm 0.3\%$ TD >1:1 to TD 10:1 = $\pm 0.3\% \times \text{TD}$ 	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 = $\pm 0.2\%$ TD >1:1 to TD 10:1 = $\pm 0.2\% \times \text{TD}$
2 bar (30 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.015\% \times \text{TD}$ 	<ul style="list-style-type: none"> TD 1:1 to TD 5:1 = $\pm 0.075\%$ TD >5:1 to TD 20:1 = $\pm 0.015\% \times \text{TD}$
	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 5:1$ = $\pm 0.15\%$ TD >5:1 to TD $\leq 10:1$ = $\pm 0.2\%$ 	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 5:1$ = $\pm 0.075\%$ TD >5:1 to TD $\leq 10:1$ = $\pm 0.1\%$
4 bar (60 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$ 	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.075\%$ TD 10:1 to TD 20:1 = $\pm 0.0075\% \times \text{TD}$
	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 10:1$ = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$ 	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 10:1$ = $\pm 0.075\%$ TD >10:1 to TD 20:1 = $\pm 0.1\%$
10 bar (150 psi), 40 bar (600 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$ 	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.075\%$ TD 10:1 to TD 20:1 = $\pm 0.1\%$
	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 10:1$ = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$ 	PMP51 with hygienic process connection: <ul style="list-style-type: none"> TD 1:1 to TD $\leq 10:1$ = $\pm 0.075\%$ TD >10:1 to TD 20:1 = $\pm 0.1\%$
100 bar (1 500 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$ 	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.075\%$ TD 10:1 to TD 20:1 = $\pm 0.15\%$
400 bar (6 000 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 5:1 = $\pm 0.15\%$ TD >5:1 to TD 20:1 = $\pm (0.03\% \times \text{TD})$ 	<ul style="list-style-type: none"> TD 1:1 to TD 5:1 = $\pm 0.15\%$ TD >5:1 to TD 20:1 = $\pm (0.03\% \times \text{TD})$

1) Only PMP51, PMP55 with direct diaphragm seal mounting

Measuring cell	PMP55 with capillary
400 mbar (6 psi)	<ul style="list-style-type: none"> TD 1:1 = $\pm 0.15\%$ TD >1:1 to TD 20:1 = $\pm 0.15\% \times \text{TD}$
1 bar (15 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 3.75:1 = $\pm 0.15\%$ TD >3.75:1 to TD 20:1 = $\pm 0.04\% \times \text{TD}$
2 bar (30 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 3.75:1 = $\pm 0.15\%$ TD >3.75:1 to TD 20:1 = $\pm 0.04\% \times \text{TD}$
4 bar (60 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$
10 bar (150 psi), 40 bar (600 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$
100 bar (1 500 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 10:1 = $\pm 0.15\%$ TD >10:1 to TD 20:1 = $\pm 0.2\%$
400 bar (6 000 psi)	<ul style="list-style-type: none"> TD 1:1 to TD 5:1 = $\pm 0.15\%$ TD >5:1 to TD 20:1 = $\pm (0.03\% \times \text{TD})$

Thermal change in the zero output and the output span – PMP51 and PMP55**PMP51 and PMP55 (basic device)**

When using a PMP55, the influence from the respective diaphragm seal must also be taken into account → 107.

	-10 to +60 °C (+14 to +140 °F)	-40 to -10 °C (-40 to +14 °F) +60 to +85 °C (+140 to +185 °F)
Measuring cell	% of the calibrated measuring span	
400 mbar (6 psi), 1 bar (15 psi), 2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi), 100 bar (1 500 psi)	$\pm(0.34 + 0.15 \times \text{TD})$	$\pm(0.4 + 0.25 \times \text{TD})$
400 bar (6 000 psi)	$\pm(0.3 + 0.35 \times \text{TD})$	$\pm(0.3 + 0.7 \times \text{TD})$

PMP51 with hygienic process connection

Signal output	Measuring cell	-10 to +60 °C (+14 to +140 °F)	-40 to -10 °C (-40 to +14 °F) +60 to +125 °C (+140 to +257 °F)
		% of the calibrated measuring span	
HART, PROFIBUS PA, FOUNDATION Fieldbus	Clamp ½" / 400 mbar (6 psi)	$\pm(0.1 + 0.4 \times \text{TD})$	$\pm(0.8 + 1.5 \times \text{TD})$
	400 mbar (6 psi), 1 bar (15 psi)	$\pm(0.1 + 0.25 \times \text{TD})$	$\pm(0.1 + 1.1 \times \text{TD})$
	2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	$\pm(0.1 + 0.2 \times \text{TD})$	$\pm(0.1 + 0.5 \times \text{TD})$
Analog (4 to 20 mA)	Clamp ½" / 400 mbar (6 psi)	$\pm(0.3 + 0.4 \times \text{TD})$	$\pm(1.1 + 1.5 \times \text{TD})$
	400 mbar (6 psi), 1 bar (15 psi)	$\pm(0.3 + 0.25 \times \text{TD})$	$\pm(0.4 + 1.1 \times \text{TD})$
	2 bar (30 psi), 4 bar (60 psi), 10 bar (150 psi), 40 bar (600 psi)	$\pm(0.3 + 0.2 \times \text{TD})$	$\pm(0.4 + 0.5 \times \text{TD})$

Total Performance – PMP51 The "Total performance" specification comprises the non-linearity including hysteresis, nonreproducibility as well as the thermal change in the zero point. All specifications apply to the temperature range –10 to +60 °C (+14 to +140 °F) and Turndown 1:1.

Signal output	Measuring cell	PMP51	PMP51 with hygienic process connection	PMP51 with gold/rhodium-coated process isolating diaphragm
		% des URL		
HART, PROFIBUS PA, FOUNDATION Fieldbus	400 mbar (6 psi)	±0.34	±0.34	±1.25
	1 bar (15 psi)		±0.25	±0.75
	2 bar (30 psi)		±0.25	±0.45
	4 bar (60 psi)	±0.30	±0.25	±0.3
	10 bar (150 psi), 40 bar (600 psi)	±0.25	±0.25	±0.25
	100 bar (1 500 psi)	±0.25	-	±0.25
	400 bar (6 000 psi)	±0.4	-	±0.4
Analog (4 to 20 mA)	400 mbar (6 psi)	±0.34	±0.54	±1.25
	1 bar (15 psi)		±0.54	±0.75
	2 bar (30 psi)		±0.45	±0.45
	4 bar (60 psi)	±0.30	±0.45	±0.3
	10 bar (150 psi), 40 bar (600 psi)	±0.25	±0.45	±0.25
	100 bar (1 500 psi)	±0.25	-	±0.25
	400 bar (6 000 psi)	±0.4	-	±0.4

Long-term stability**For devices with thread or flange:**

	Measuring range	Long-term stability of URL / 1 year	Long-term stability of URL / 5 years	Long-term stability of URL / 10 years
PMP51	all	±0.1 %	±0.2 %	±0.25 %
PMP55	all	To determine long-term stability, the basic device (PMP51) is observed without the attached diaphragm seal.		

For devices with hygienic process connections:

	Measuring range	Long-term stability of URL / 1 year
PMP51	≤ 1 bar (15 psi)	±0.25 %
	> 1 to 10 bar (15 to 150 psi)	±0.1 %
	40 bar (600 psi)	±0.1 %
	100 bar (1 500 psi)	±0.1 %
	400 bar (6 000 psi)	±0.1 %

Total Error - PMP51

The total error comprises the long-term stability and the total performance. All specifications apply to the temperature range $-10...+60\text{ }^{\circ}\text{C}$ ($+14...+140\text{ }^{\circ}\text{F}$) and Turndown 1:1.

Signal output	Measuring cell	% of URL/year
HART, PROFIBUS PA, FOUNDATION Fieldbus	400 mbar (6 psi)	± 0.59
	1 bar (15 psi) bis 100 bar (1 500 psi)	± 0.35
	400 bar (6 000 psi)	± 0.50
Analog (4 to 20 mA)	400 mbar (6 psi)	± 0.79
	1 bar (15 psi) bis 100 bar (1 500 psi)	± 0.55
	400 bar (6 000 psi)	± 0.50

Warm-up period

- 4 to 20 mA Analog: $\leq 1,5\text{ s}$
- 4 to 20 mA HART: $\leq 5\text{ s}$
- PROFIBUS PA: $\leq 8\text{ s}$
- FOUNDATION Fieldbus: $\leq 20\text{ s}$ (after a TOTAL-reset $\leq 45\text{ s}$)

Installation

General installation instructions

The position-dependent zero point shift can be corrected:

- directly at the device via operating keys on the electronic insert
- directly at the device via operating keys on the display (except analog electronics)
- via digital communication if the cover is not open (except analog electronics).
- Endress+Hauser offers a mounting bracket for installing the device on pipes or walls.
- Use flushing rings for flange and cell diaphragm seals if medium buildup or clogging can be expected at the diaphragm seal connection. The flushing ring can be inserted between the process connection and the diaphragm seal. Thanks to the two lateral flushing bore holes, material buildup in front of the process isolating diaphragm can be rinsed away and the pressure chamber can be ventilated.
- To guarantee the leak-tightness of the transmitter, Endress+Hauser recommends that only genuine cable glands be used (also available as spare parts).

Measuring arrangement for devices without diaphragm seal – PMC51, PMP51

Cerabar M transmitters without diaphragm seals are mounted as per the norms for a manometer (DIN EN 837-2). We recommend the use of shutoff devices and siphons. The orientation depends on the measuring application.

Pressure measurement in gases

Mount Cerabar M with shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

Use a siphon if measuring pressure in steams. The siphon reduces the temperature to almost the ambient temperature. Fill the siphon with liquid before commissioning. Preferably mount the Cerabar M with a siphon below the tapping point.

Advantages:

- Defined water column only causes minimal/negligible measured errors
- Only minimal/negligible thermal effects on the device
The device may also be mounted above the tapping point. Pay attention to the maximum permitted ambient temperature of the transmitter!
- Fill the siphon with liquid before commissioning.


Pressure measurement in liquids

Mount Cerabar M with shutoff device below or at the same level as the tapping point.

Level measurement

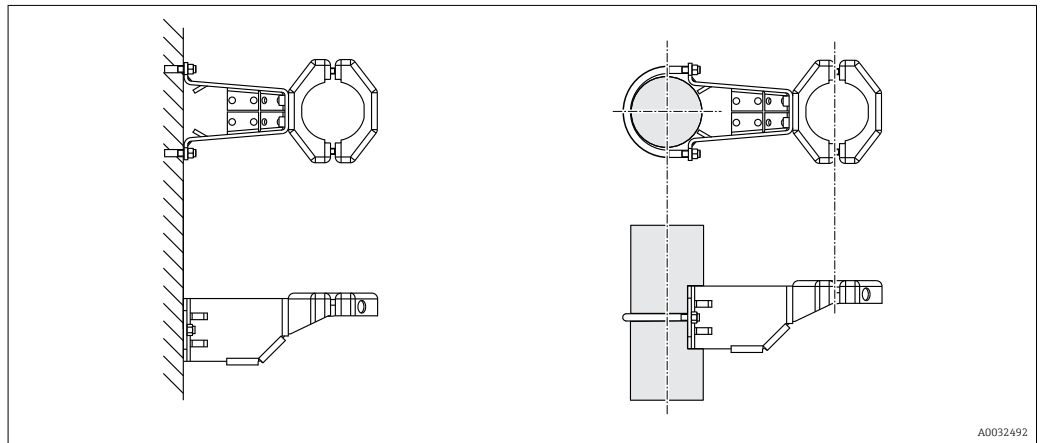
- Mount Cerabar M below the lowest measuring point (zero point of the measurement).
- Do not mount the device at the following positions: In the filling curtain, in the tank outlet or at a point in the vessel which could be affected by pressure pulses from an agitator or a pump.
- The calibration and functional test can be carried out more easily if you mount the device downstream of a shutoff device.

Measuring arrangement for devices with diaphragm seal – PMP55

→  107

Wall and pipe mounting, transmitter (optional)

Endress+Hauser offers the following mounting bracket for installing the device on pipes or walls:



Ordering information:

- Product configurator "Accessory Enclosed" ordering feature, option PA.
- included in the delivery for devices with a separate housing (available for order via feature "Separate housing")
- available for order as a separate accessory (Part No.: 71102216).

Further details →  93.

Wall and pipe-mounting manifold (optional)



Technical data (e.g. dimensions or order numbers for screws) see accessory document SD01553P/00/ EN.

Ordering information:

Product Configurator "Accessory Enclosed" ordering feature, version "PK"

"Separate housing" version

With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This allows for trouble-free measurement:


- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations

You can choose between different cable versions:

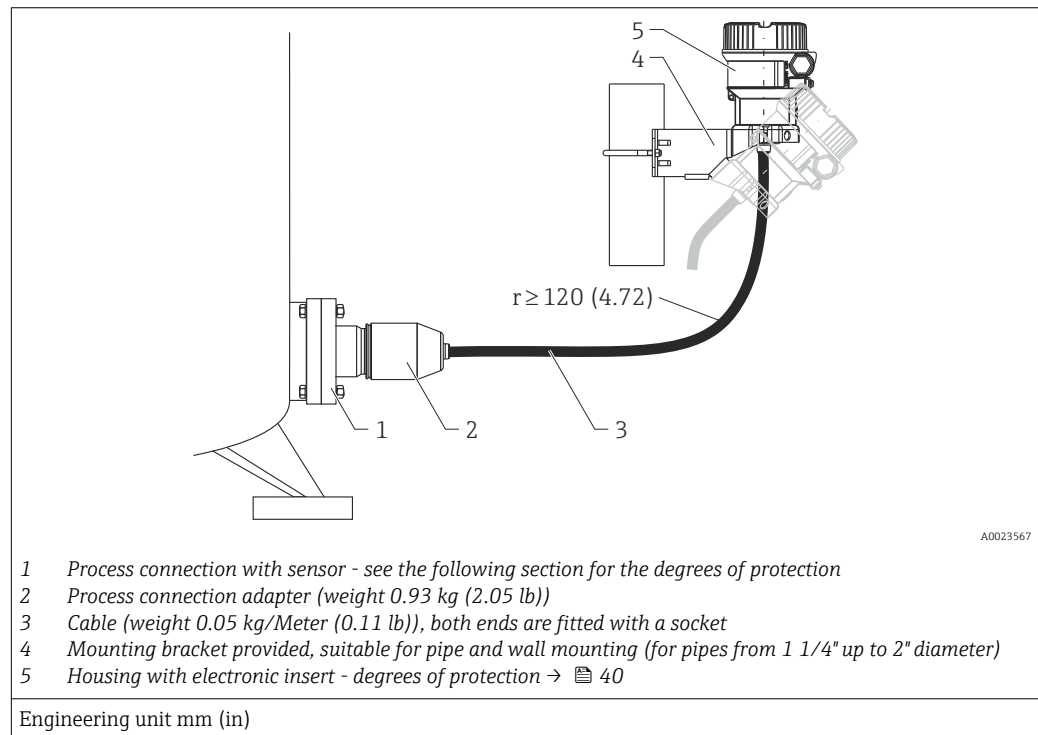
- PE: 2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft)
- FEP: 5 m (16 ft).

Ordering information:

- Product Configurator, "Separate housing" ordering feature
- Product Configurator, "Enclosed accessories" ordering feature, option PA

For the dimensions →  93

In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted. The housing and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing and the sensor.



Degree of protection for the process connection and sensor with the use of

- FEP-cabel:
 - IP 69 ¹⁾
 - IP 66 NEMA 4/6P
 - IP 68 (1,83 mH₂O für 24 h) NEMA 4/6P
- PE-cabel:
 - IP 66 NEMA 4/6P
 - IP 68 (1,83 mH₂O für 24 h) NEMA 4/6P

Technical data of the PE and FEP cable:

- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N (101.16 lbf)
- Resistance to UV light

1) Identification of IP protection category according to DIN EN 60529. The earlier designation "IP69K" according to DIN 40050 Part 9 is no longer valid (the standard was withdrawn on November 1, 2012). The tests required for both standards are identical.

Use in hazardous area:

- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installation only

Oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:

- All components of the system, such as measuring devices, must be cleaned in accordance with the BAM (DIN 19247) requirements.
- Dependent on the materials used, a certain maximum temperature and a maximum pressure for oxygen applications must not be exceeded.

The devices suitable for gaseous oxygen applications are listed in the following table with the specification p_{\max}

Order code for devices ¹⁾ , cleaned for oxygen applications	p_{\max} for oxygen applications	T_{\max} for oxygen applications
PMC51 ²⁾ – devices with sensors, nominal value < 10 bar (150 psi)	Over pressure limit (OPL) of sensor ³⁾ ⁴⁾	60 °C (140 °F)
PMC51 – devices with sensors, nominal value ≥ 10 bar (150 psi)	40 bar (600 psi)	60 °C (140 °F)
PMP51, PMP55 ⁵⁾	Depends on the lowest-rated element, with regard to pressure, of the selected components: over pressure limit (OPL) of sensor, process connection (1.5 x PN) or fill fluid (160 bar (2 320 psi))	85 °C (185 °F)

1) Only device, not accessory or enclosed accessory

2) Product Configurator, "Service" ordering feature, option "HB"

3) Product Configurator, "Sensor range" ordering feature

4) PMC51 with PVDF thread or PVDF flange $p_{\max} = 15$ bar (225 psi) 15 bar (225 psi)

5) Product Configurator, "Service" ordering feature, option "HB"

PWIS cleaning

Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops, for instance.

Ordering information:

Ordering information: Product Configurator, "Service" ordering feature, option HC

The stability of the materials used must be checked before using them in the medium.

Ultrapure gas applications (PMC51 und PMP51)

Endress+Hauser also provides devices which have been cleaned of oil and grease for special applications, such as for ultrapure gas. No special restrictions regarding the process conditions apply to these devices.

Ordering information:

Product Configurator, "Service" ordering feature, option "HA"

Applications with hydrogen


A **ceramic** process isolating diaphragm or a **gold-plated** metal process isolating diaphragm offers universal protection against hydrogen diffusion, both in gas applications and in applications with aqueous solutions.


Applications with hydrogen in aqueous solutions

A **gold/rhodium-plated** metal process isolating diaphragm (AU/Rh) offers effective protection against hydrogen diffusion.

Environment


Ambient temperature range

Version	PMC51	PMP51	PMP55
Without LCD display	-40 to +85 °C (-40 to +185 °F)		
With LCD display ¹⁾	-20 to +70 °C (-4 to +158 °F)		
With M12 plug , elbowed	-25 to +85 °C (-13 to +185 °F)		
With separate housing	-20 to +60 °C (-4 to +140 °F) (installation without insulation)		—
Diaphragm seal systems ²⁾	—	—	→  107


- 1) Extended temperature application range (-40 to +85 °C (-40 to +185 °F)) with restrictions in optical properties such as display speed and contrast
- 2) Ambient temperature range and process temperature range are mutually dependent - see chapter "Thermal insulation" →  110

NOTICE

High temperatures or vibrations can destroy the device!

- For high-temperature applications, either a PMP55 with a temperature isolator or with a capillary can be used. If vibrations also occur in the application, Endress+Hauser recommends you use a PMP55 with a capillary. If a PMP55 with a temperature isolator or capillary is used, we recommend a suitable bracket for mounting (see "Wall and pipe mounting, transmitter (optional)" →  37).

Storage temperature range



Version	PMC51	PMP51	PMP55
Without LCD display	-40 to +90 °C (-40 to +185 °F)		
With LCD display	-40 to +85 °C (-40 to +185 °F)		
With M12 plug , elbowed	-25 to +85 °C (-13 to +185 °F)		
With separate housing	-40 to +60 °C (-40 to +140 °F)		—
Diaphragm seal systems ¹⁾	—	—	→  107

- 1) Devices with PVC-sheathed capillary: -25 to +90 °C (-13 to +194 °F)

Climate class

Class 4K4H (air temperature: -20 to +55 °C (-4 to +131 °F), relative humidity: 4 to 100%) satisfied as per DIN EN 60721-3-4 (condensation possible)

Degree of protection


- Depending on the used electrical connection →  23
- Ordering information:
Product Configurator, "Electrical connection" ordering feature
- Separate housing →  38

Vibration resistance

Device/Additional option	Test standard	Vibration resistance
Devices without mounting bracket	GL VI-7-2 <ul style="list-style-type: none"> Part 7: Guidelines for the Performance of Type Approvals Chapter 2: Test Requirements for Electrical / Electronic Equipment and Systems 	guaranteed for 5 to 25 Hz: ±1.6 mm (0.06 in); 25 to 100 Hz: 4 g in all 3 planes
	IEC 61298-3 IEC 60068-2-6	guaranteed for 10 to 60 Hz: ±0.35 mm (0.01 in); 60 to 2000 Hz: 5 g in all 3 planes
Devices with mounting bracket	IEC 61298-3 IEC 60068-2-6	guaranteed for 10 to 60 Hz: ±0.15 mm (0.01 in); 60 to 500 Hz: 2 g in all 3 planes

NOTICE

Strong vibrations can destroy the device!

- ▶ For high-vibration applications a PMC51/ PMP51 with a separate housing can be used.
- ▶ For high-vibration applications a PMP55 with a capillary can be used.
- ▶ We recommend a suitable bracket for mounting (→  37).

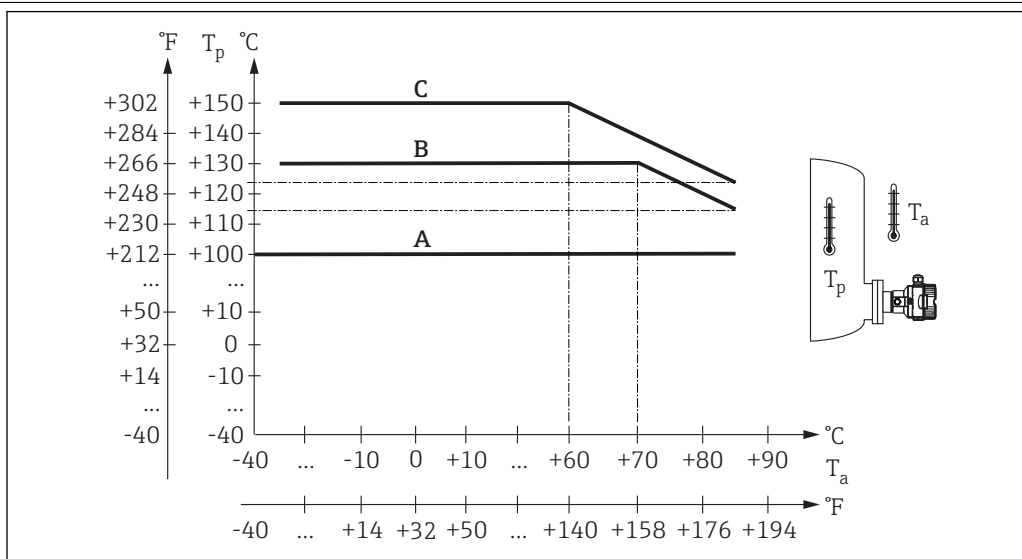
**Electromagnetic
compatibility**

- Electromagnetic compatibility as per all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21).
- Max. deviation : < 0.5 % of the span

Further details can be found in the manufacturer declaration.

Process

Process temperature range PMC51



A0023699

A, B and C see next section. T_a = Ambient temperature. T_p = Process temperature

Process temperature limits

For oxygen applications, observe → 39

PMC51 (with ceramic process isolating diaphragm)

- A: -40 to +100 °C (-40 to +212 °F) for process connections with threaded connection or flange
- B: -20 to +130 °C (-4 to +266 °F) for hygienic process connections
- C: For max. 60 minutes: +150 °C (+302 °F) for hygienic process connections
- With applications involving saturated steam, a device with a metallic process isolating diaphragm must be used, or a siphon for temperature isolation should be provided during installation.
- Observe the process temperature range of the seal. See also the following table.

Seal	Notes	Process temperature range		Option ¹⁾
		Thread or flange	Hygienic process connections	
FKM Viton	-	-20 to +100 °C (-4 to +212 °F)	-	A
FKM Viton	cleaned for O2 application	-5 to +60 °C (+23 to +140 °F)	-	A ²⁾
FKM Viton	FDA , 3A Class I, USP Class VI	-5 to +100 °C (+23 to +212 °F)	-5 to +150 °C (+23 to +302 °F)	B
FFKM Perlast G75LT	-	-20 to +100 °C (-4 to +212 °F)	-20 to +150 °C (-4 to +302 °F)	C
NBR	FDA ³⁾	-10 to +100 °C (+14 to +212 °F)	-	F
NBR, low temperature	-	-40 to +100 °C (-40 to +212 °F)	-	H
HNBR	FDA ³⁾ , 3A Class I, KTW, AFNOR, BAM	-25 to +100 °C (-13 to +212 °F)	-20 to +100 °C (-4 to +212 °F)	G
EPDM 70	FDA ³⁾	-40 to +100 °C (-40 to +212 °F)	-	J
EPDM 291	FDA ³⁾ , 3A Class II, USP Class VI, DVGW, KTW, W270, WRAS, ACS, NSF61	-15 to +100 °C (+5 to +212 °F)	-15 to +150 °C (+5 to +302 °F)	K
FFKM Kalrez 6375	-	+5 to +100 °C (+41 to +212 °F)	-	L
FFKM Kalrez 7075	-	+5 to +100 °C (+41 to +212 °F)	-	M
FFKM Kalrez 6221	FDA ³⁾ , USP Class VI	-5 to +100 °C (+23 to +212 °F)	-5 to +150 °C (+23 to +302 °F)	N
Fluoroprene XP40	FDA ³⁾ , USP Class VI, 3A Class I	+5 to +100 °C (+41 to +212 °F)	+5 to +150 °C (+41 to +302 °F)	P
VMQ Silicone	FDA ³⁾	-35 to +85 °C (-31 to +185 °F)	-20 to +85 °C (-4 to +185 °F)	S

1) Product Configurator, order code for "Seal"

2) With "HB" option, see Product Configurator, "Service" ordering feature

3) Suitable for foods FDA 21 CFR 177.2600

Applications with jumps in temperature

Extreme jumps in temperature can result in temporary measuring errors. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the jump in temperature and the longer the time interval involved.



For further information please contact your local Endress+Hauser Sales Center.

PMP51 (with metallic process isolating diaphragm)

Designation	Temperature operating range
Process connections with internal process isolating diaphragm	-40 to +125 °C (-40 to +257 °F)
Process connections with flush-mounted process isolating diaphragm	-40 to +100 °C (-40 to +212 °F)
Hygienic process connections	-40 to +130 °C (-40 to +266 °F) For a maximum of 60 minutes: 150 °C (302 °F)

PMP55 (with diaphragm seal)

Depends on diaphragm seal and filling oil: -70 °C (-94 °F) up to +400 °C (+752 °F). Observe the temperature application limits → 109.

Devices with PTFE coated process isolating diaphragm

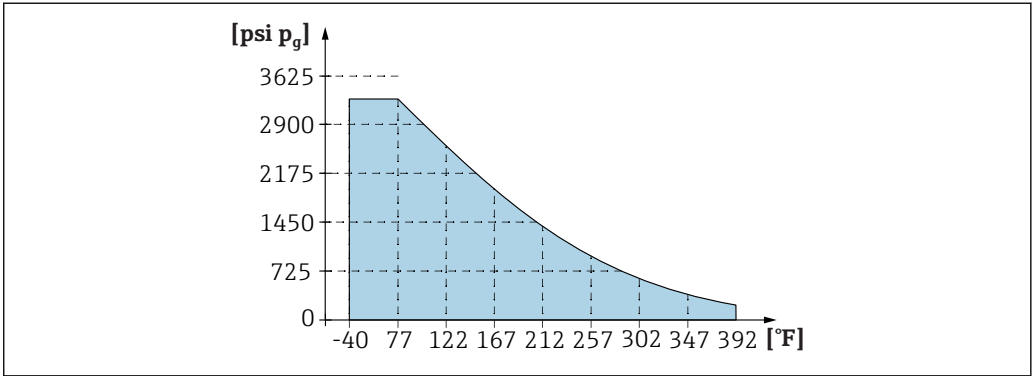
The non-stick coating has excellent gliding properties and is used to protect the process isolating diaphragm against abrasive media.

NOTICE

Destruction of the device due to incorrect use of PTFE foil!

- The PTFE foil is designed to protect the unit against abrasion. It does not provide protection against corrosive media.

For the range of application of the 0.25 mm (0.01 in) PTFE foil on an AISI 316L (1.4404/1.4435) process isolating diaphragm, see the following diagram:



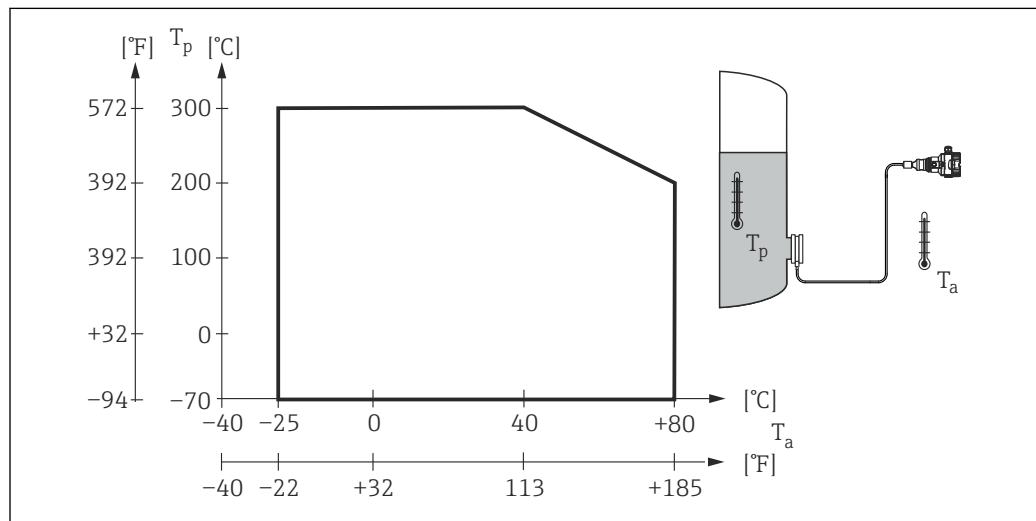
A0026949-EN



For vacuum applications: $p_{\text{abs}} \leq 1 \text{ bar (14.5 psi)}$ to $0.05 \text{ bar (0.725 psi)}$ up to max. +150 °C (302 °F).

Process temperature limits of flexible capillary armoring: PMP55

- 316L: No restrictions
- PTFE: No restrictions
- PVC: See the following diagram



A0028227

Pressure specifications

⚠ WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- ▶ For pressure specifications, see the "Measuring range" section and the "Mechanical construction" section.
- ▶ Only operate the measuring device within the prescribed limits!
- ▶ The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- ▶ The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited time. Observe temperature dependency of the MWP. The pressure values permitted at higher temperatures can be found in the standards EN 1092-1: 2001 Tab. 18 (With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.), ASME B 16.5a – 1998 Tab. 2-2.2 F316, ASME B 16.5a – 1998 Tab. 2.3.8 N10276, JIS B 2220.
- ▶ OPL (Over Pressure Limit = sensor overload limit): The test pressure corresponds to the over pressure limit of the sensor and may only be applied for a limited time period to ensure measurement within specification and in order to avoid permanent damage. In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value.
- ▶ Oxygen applications: The values for "p_{max} and T_{max} for oxygen applications" may not be exceeded → 39.
- ▶ Devices with ceramic process isolating diaphragm: Avoid steam hammering! Steam hammering can cause zero point drift. Recommendation: Residue (such as condensation or drops of water) can remain at the process isolating diaphragm after CIP cleaning and lead to local steam hammering if immediately steam is introduced. In practice, drying the process isolating diaphragm (e.g. by blowing off excess moisture) has proven to be a successful way of avoiding steam hammering.

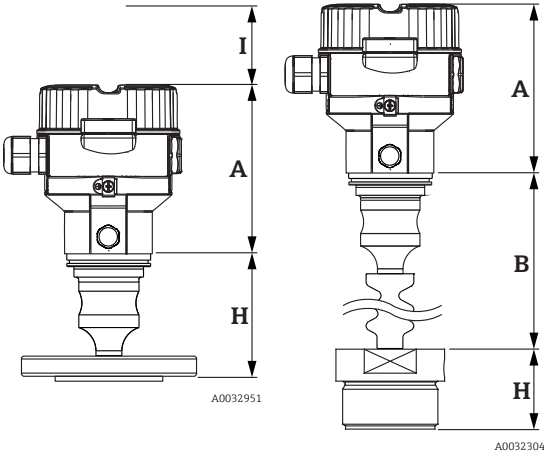
Mechanical construction

Device height

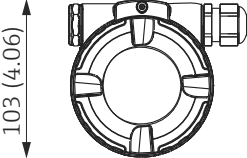
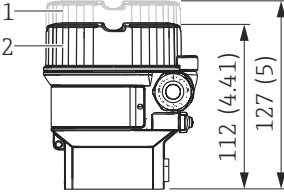
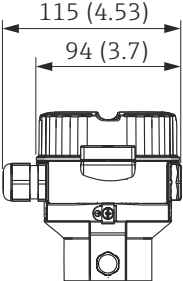
The device height is calculated from

- the height of the housing
- the height of optional mounted parts such as temperature isolators or capillaries
- the height of the relevant process connection.

The individual heights of the components can be found in the following sections. To calculate the device height, simply add up the individual heights of the components. If necessary, the installation space (the space used to install the device) must also be taken into account. You can use the following table for this:

Section	Page	Height	Example
Housing height	→ 45 ff.	(A)	
Optional mounted parts	→ 73	(B)	
Process connections	→ 47 → 60	(H)	
Installation space	-	(I)	
Installation space			

F31 housing, aluminum



1 Cover with viewing window

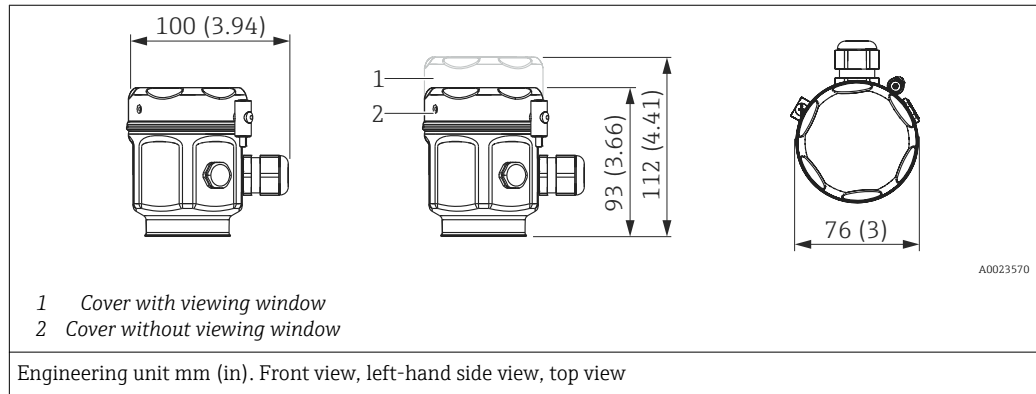
2 Cover without viewing window

Engineering unit mm (in). Front view, left-hand side view, top view

Material	Weight kg (lbs)		Option ¹⁾
	With display	Without display	
Aluminium ²⁾	1.1 (2.43)	1.0 (2.21)	I
Aluminum with glass viewing window ²⁾			J

1) Product Configurator, "Housing" ordering feature

2) Degree of protection dependent on cable entry used → 40

**F15 housing, stainless steel
(hygienic)**

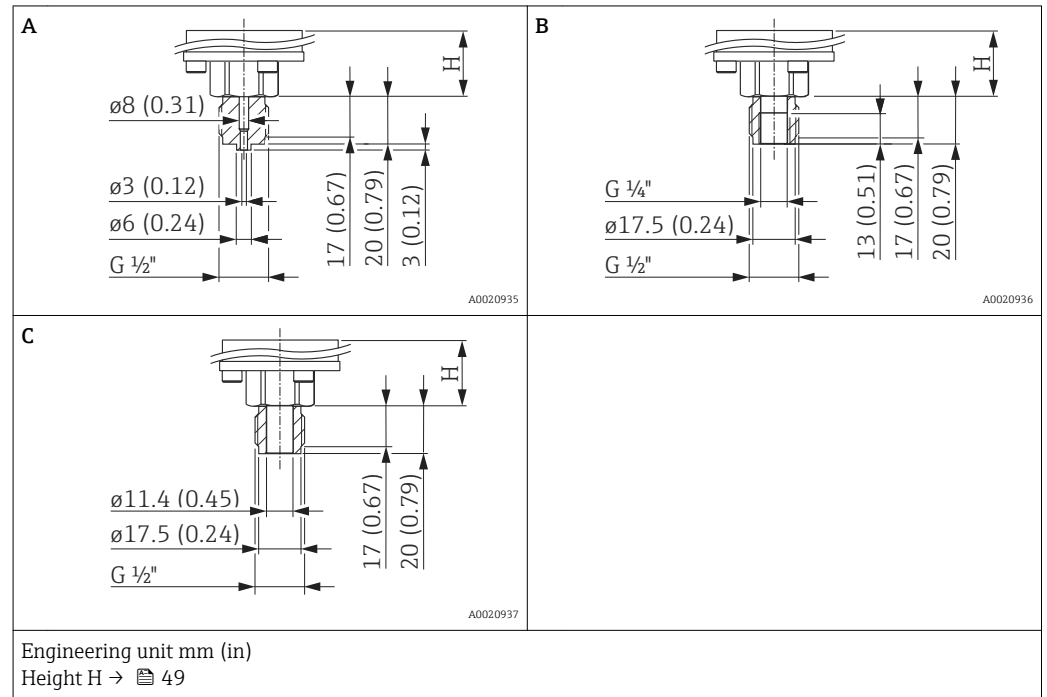
Material	Weight kg (lbs)		Option ¹⁾
	With display	Without display	
Stainless steel ²⁾	1.1 (2.43)	1.0 (2.21)	Q
Stainless steel with glass viewing window ²⁾			R
Stainless steel with plastic viewing window ²⁾			S

1) Product Configurator, "Housing" ordering feature

2) Product Configurator, "Housing" ordering feature → 40

PMC51: process connections with internal process isolating diaphragm

ISO 228 G threaded connection

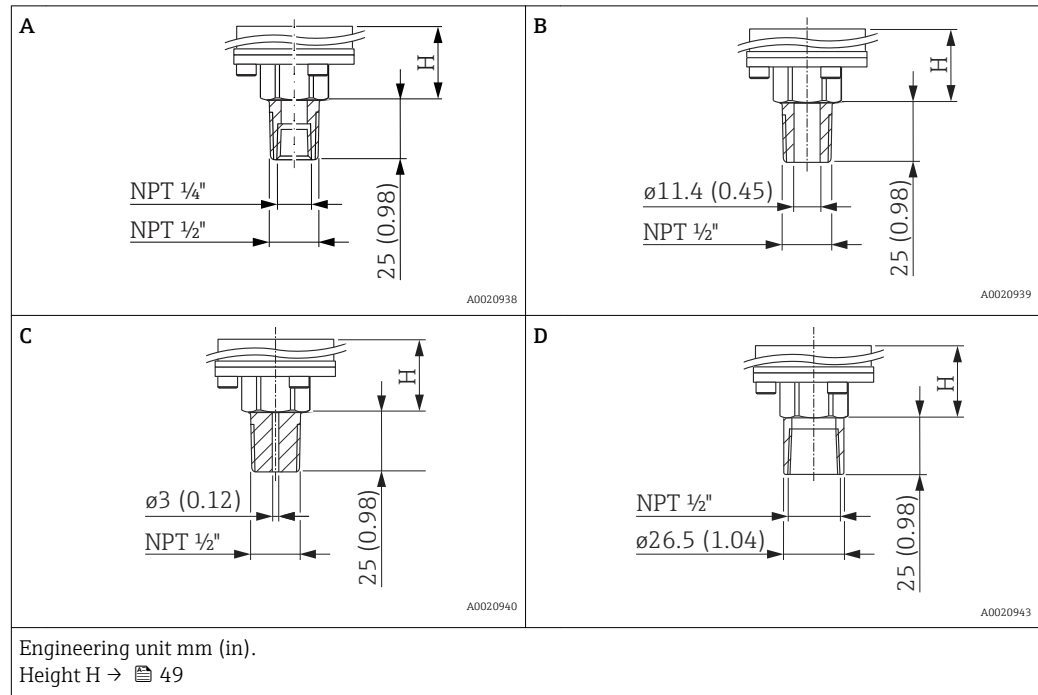


Item	Designation	Material	Weight	Approval ¹⁾	Option ²⁾
			kg (lb)		
A	Thread ISO 228 G 1/2" A EN 837	AISI 316L	0.63 (1.39)	CRN	GCJ
		Alloy C276 (2.4819)		CRN	GCC
		PVDF <ul style="list-style-type: none"> Mount only with enclosed mounting bracket MWP 10 bar (150 psi), OPL max. 15 bar (225 psi) Process temperature range: -10 to +60 °C (+14 to +140 °F) 		-	GCF
B	Thread ISO 228 G 1/2" A, G 1/4" (female))	AISI 316L		CRN	GLJ
		Alloy C276 (2.4819)		CRN	GLC
C	Thread ISO 228 G 1/2" A, Bore 11.4 mm (0.45 in)	AISI 316L		CRN	GMJ
		Alloy C276 (2.4819)		CRN	GMC

1) CSA approval: Product Configurator, "Approval" ordering feature

2) Product Configurator, "Process connection" ordering feature

ANSI threaded connection



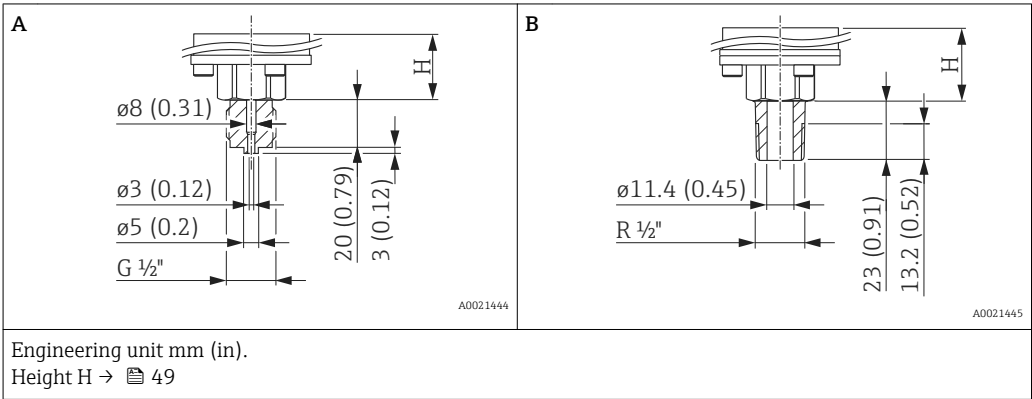
Item	Designation	Material	Weight	Approval ¹⁾	Option ²⁾
			kg (lb)		
A	ANSI 1/2" MNPT, 1/4" FNPT	AISI 316L	0.63 (1.39)	CRN	RLJ
		Alloy C276 (2.4819)		CRN	RLC
B	ANSI 1/2" MNPT, Bore 11.4 mm (0.45 in)	AISI 316L		CRN	RKJ
		Alloy C276 (2.4819)		CRN	RKC
C	ANSI 1/2" MNPT, Bore 3 mm (0.12 in)	PVDF <ul style="list-style-type: none"> Mount only with enclosed mounting bracket MWP 10 bar (150 psi), OPL max. 15 bar (225 psi) Process temperature range: +10 to +60 °C (+14 to +140 °F) 		-	RJF
D	ANSI 1/2" FNPT Bore 11.4 mm (0.45 in)	AISI 316L		CRN	R1J
		Alloy C276 (2.4819)		CRN	R1C

1) CSA approval: Product Configurator, "Approval" ordering feature

2) Product Configurator, "Process connection" ordering feature

PMC51: process connections
with internal process
isolating diaphragm

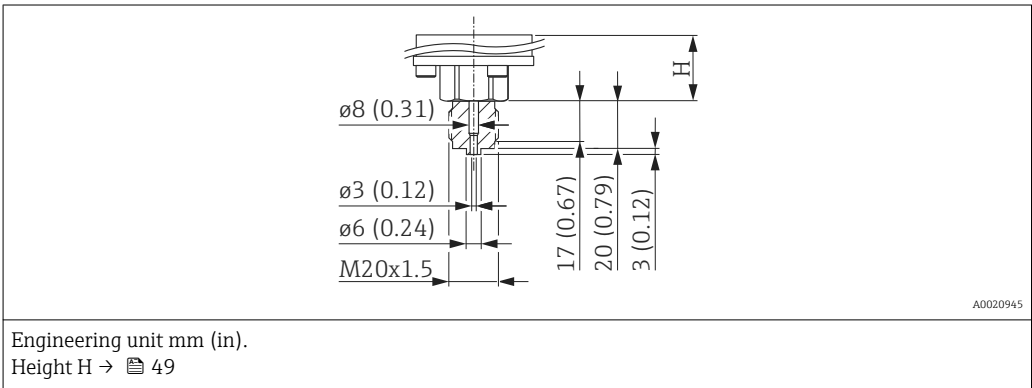
JIS threaded connection



Item	Designation	Material	Weight	Option ¹⁾
			kg (lb)	
A	JIS B0202 G 1/2" (male))	AISI 316L	0.63 (1.39)	GNJ
B	JIS B0203 R 1/2" (male))			GOJ

1) Product Configurator, "Process connection" ordering feature

DIN 13 threaded connection



Designation	Material	Weight	Option ¹⁾
		kg (lb)	
DIN 13 M20 x 1,5, EN 837 Bore3 mm (0.12 in)	AISI 316L	0.63 (1.39)	G5J
	Alloy C276 (2.4819)		G6J

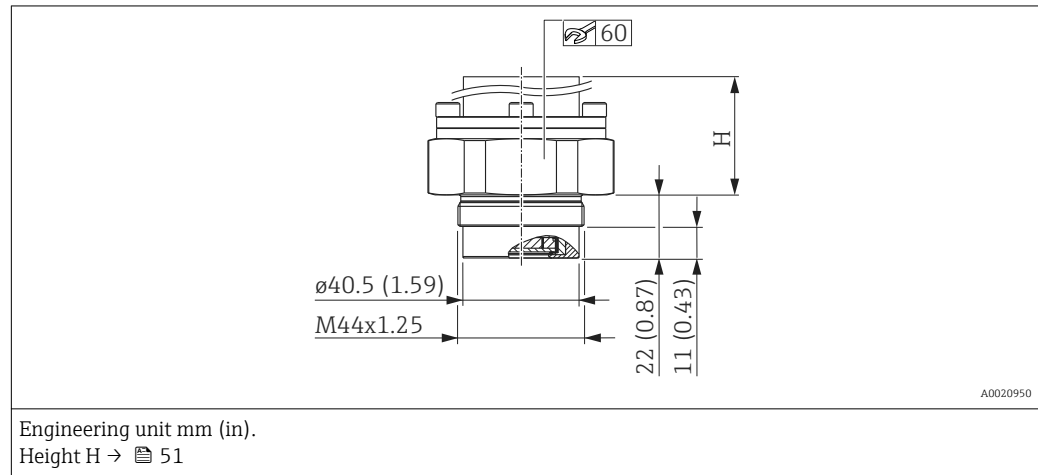
1) Product Configurator, "Process connection" ordering feature

PMC51: process connections
with internal process
isolating diaphragm - height
H

F31 housing	F15 housing
27 mm (1.06 in)	34 mm (1.34 in)

**PMC51: process connections
with flush-mounted process
isolating diaphragm**

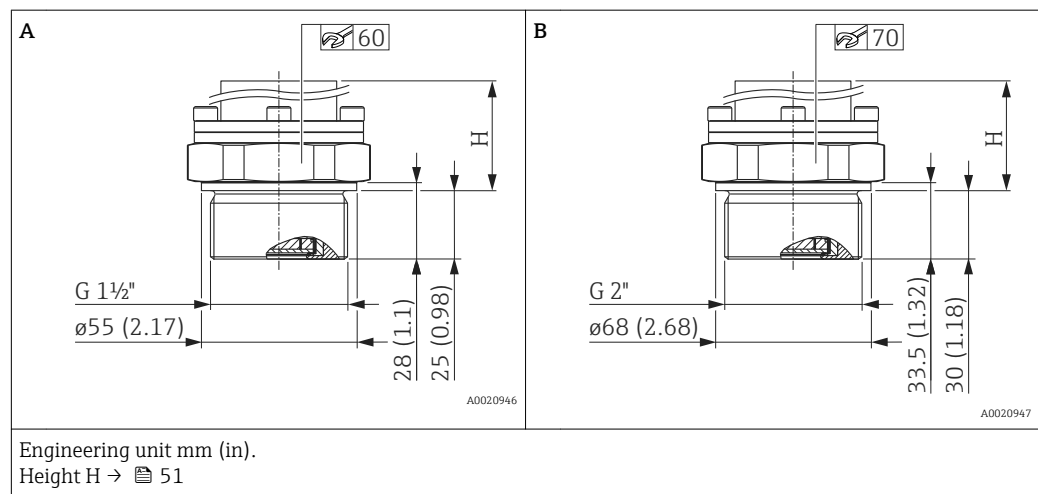
DIN 13 threaded connection



Designation	Material	Weight	Option ¹⁾
		kg (lb)	
DIN 13 M44 x 1.25	AISI 316L	0.63 (1.39)	G4J

1) Product Configurator, "Process connection" ordering feature

ISO 228 G threaded connection

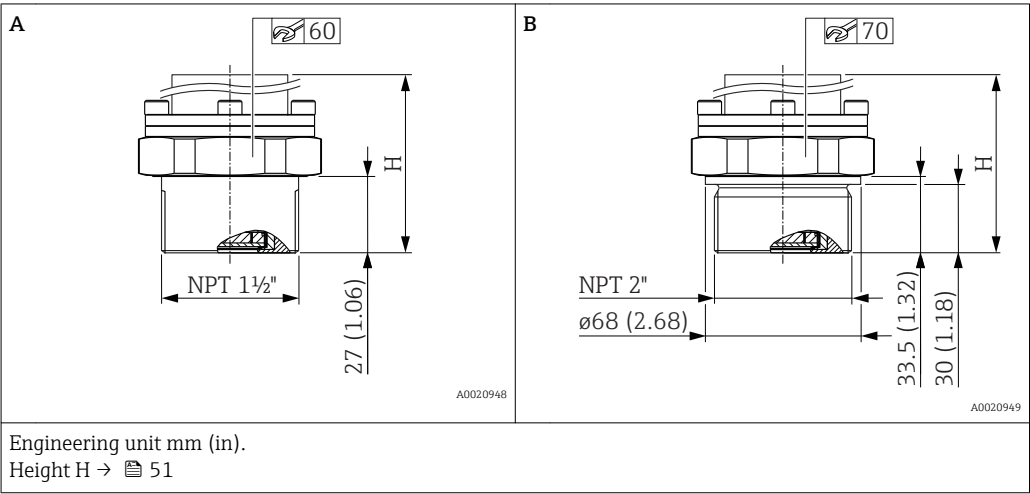


Item	Designation	Material	Weight	Option ¹⁾
			kg (lb)	
A	Thread ISO 228 G 1 1/2" A	AISI 316L	0.63 (1.39)	GVJ
B	Thread ISO 228 G 2" A	AISI 316L		GWJ

1) Product Configurator, "Process connection" ordering feature

PMC51: process connections
with flush-mounted process
isolating diaphragm

ANSI threaded connection



Position	Designation	Material	Weight	Approval ¹⁾	Option ²⁾
			kg (lb)		
A	Thread ANSI 1 1/2" MNPT	AISI 316L	0.63 (1.39)	CRN	U7J
B	Thread ANSI 2" MNPT	AISI 316L		CRN	U8J

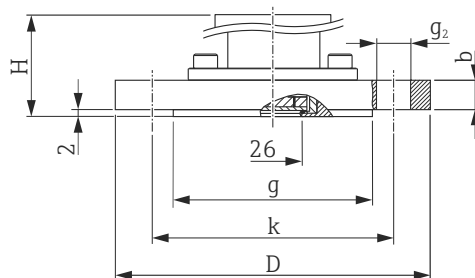
- 1) CSA approval: Product Configurator, order code for "Approval"
2) Product Configurator, "Process connection" section

PMC51: process connections
with flush-mounted process
isolating diaphragm - height
H

Process connection	F31 housing	F15 housing
DIN 13 M44 x 1.25	53 mm (2.09 in)	60 mm (2.36 in)
Thread ISO 228 G 1 1/2" A	50 mm (1.97 in)	57 mm (2.24 in)
Thread ISO 228 G 2" A	45 mm (1.77 in)	52 mm (2.05 in)
Thread ANSI 1 1/2" MNPT	48 mm (1.89 in)	55 mm (2.17 in)
Thread ANSI 2" MNPT	45 mm (1.77 in)	52 mm (2.05 in)

**PMC51: process connections
with flush-mounted process
isolating diaphragm**

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527



A0020955

D Diameter of flange
b Thickness
g Raised face
k Hole circle
g₂ Diameter of hole

Engineering unit mm.
 Height H → 54

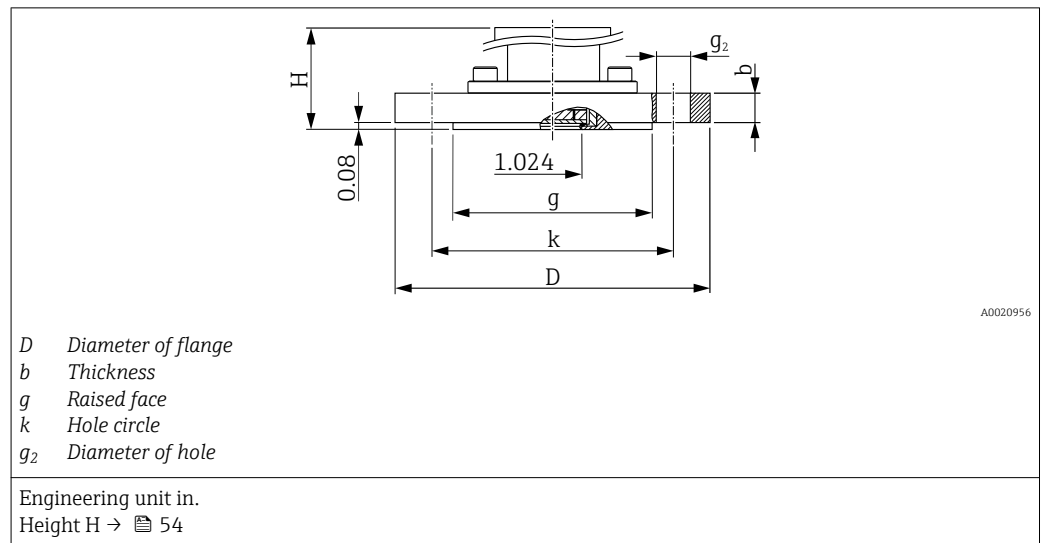
Flange							Boltholes			Weight	Option ¹⁾
Material	Nominal diameter	Nominal pressure	Shape ²⁾	D	b	g	Quantity	g ₂	k		
				mm	mm	mm		mm	mm	kg (lb)	
AISI 316L	DN 25	PN 10-40	B1 (D)	115	18	68	4	14	85	1.4 (3.09)	CNJ
AISI 316L	DN 32	PN 10-40	B1 (D)	140	18	78	4	18	100	2.0 (4.41)	CPJ
AISI 316L	DN 40	PN 10-40	B1 (D)	150	18	88	4	18	110	2.4 (5.29)	CQJ
ECTFE ³⁾	DN 40	PN 10-40	B2 (E)	150	21	88	4	18	110	2.6 (5.73)	CQP
AISI 316L	DN 50	PN 10-40	B1 (D)	165	20	102	4	18	125	3.2 (7.06)	CXJ
PVDF	DN 50	PN 10-16	B2 (E)	165	21.4	102	4	18	125	0.6 (1.32)	CFF
ECTFE ³⁾	DN 50	PN 25-40	B2 (E)	165	20	102	4	18	125	3.2 (7.06)	CRP
AISI 316L	DN 80	PN 10-40	B1 (D)	200	24	138	8	18	160	5.4 (11.91)	CZJ
ECTFE ³⁾	DN 80	PN 25-40	B2 (E)	200	24	138	8	18	160	5.5 (12.13)	CSP

1) Product Configurator, "Process connection" section

2) Description as per DIN 2527 provided in brackets

3) ECTFE coating on AISI 316L (1.4404). When operating in hazardous areas, avoid electrostatic charging of the plastic surfaces.

ASME flanges, connection dimensions as per ANSI B 16.5, raised face RF



A0020956

Flange						Boltholes			Weight	Approval ¹⁾	Option ²⁾
Material	Nominal diameter	Class	D	b	g	Quantity	<i>g₂</i>	k			
	[in]	[lb./sq.in]	[in]	[in]	[in]		[in]	[in]	[kg (lb)]		
AISI 316/316L ³⁾	1	150	4.25	1.18	2	4	0.62	3.12	0.9 (1.98)	-	ACJ ⁴⁾
AISI 316/316L ³⁾	1	300	4.88	1.18	2	4	0.75	3.5	1.4 (3.09)	-	ANJ ⁴⁾
AISI 316/316L ³⁾	1 ½	150	5	0.69	2.88	4	0.62	3.88	1.0 (2.21)	CRN	AEJ
AISI 316/316L ³⁾	1 ½	300	6.12	0.81	2.88	4	0.88	4.5	2.6 (5.73)	CRN	AQJ
AISI 316/316L ³⁾	2	150	6	0.75	3.62	4	0.75	4.75	2.4 (5.29)	CRN	AFJ
ECTFE ⁵⁾	2	150	6	0.75	3.62	4	0.75	4.75	2.4 (5.29)	-	AFN
PVDF	2	150	6	0.75	3.62	4	0.75	4.75	0.5 (1.1)	-	AFF
AISI 316/316L ³⁾	2	300	6.5	0.88	3.62	8	0.75	5	3.2 (7.06)	CRN	ARJ
AISI 316/316L ³⁾	3	150	7.5	0.94	5	4	0.75	6	4.9 (10.8)	CRN	AGJ
ECTFE ⁵⁾	3	150	7.5	0.94	5	4	0.75	6	4.9 (10.8)	-	AGN
PVDF	3	150	7.5	0.94	5	4	0.75	6	0.9 (1.98)	-	AGF
AISI 316/316L ³⁾	3	300	8.25	1.12	5	8	0.88	6.62	6.8 (14.99)	CRN	ASJ
AISI 316/316L ³⁾	4	150	9	0.94	6.19	8	0.75	7.5	7.1 (15.66)	CRN	AHJ
ECTFE ⁵⁾	4	150	9	0.94	6.19	8	0.75	7.5	7.1 (15.66)	-	AHN
AISI 316/316L ³⁾	4	300	10	1.25	6.19	8	0.88	7.88	11.6 (25.58)	CRN	ATJ

1) CSA approval: Product Configurator, order code for "Approval"

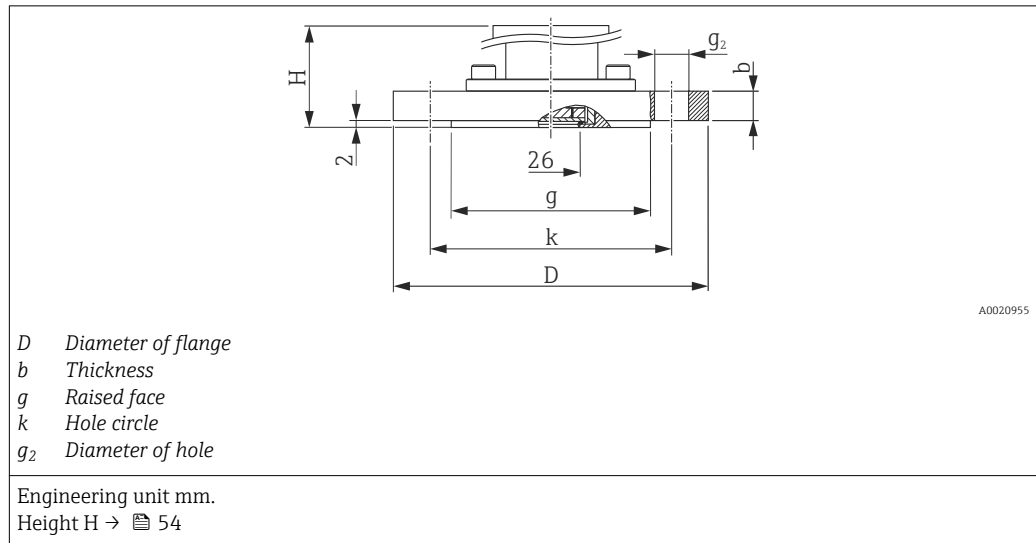
2) Product Configurator, "Process connection" section

3) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

4) Screws must be 15 mm (0.59 in) longer than the standard flange screws.

5) ECTFE coating on AISI 316/316L. When operating in hazardous areas, avoid electrostatic charging of the plastic surfaces.

JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



Flange						Boltholes			Weight	Option ¹⁾
Material	Nominal diameter	Nominal pressure	D	b	g	Quantity	g ₂	k		
			mm	mm	mm		mm	mm	kg (lb)	
AISI 316L (1.4435)	50 A	10 K	155	16	96	4	19	120	2.0 (4.41)	KFJ
	80 A	10 K	185	18	127	8	19	150	3.3 (7.28)	KGJ
	100 A	10 K	210	18	151	8	19	175	4.4 (9.7)	KHJ

1) Product Configurator, "Process connection" section

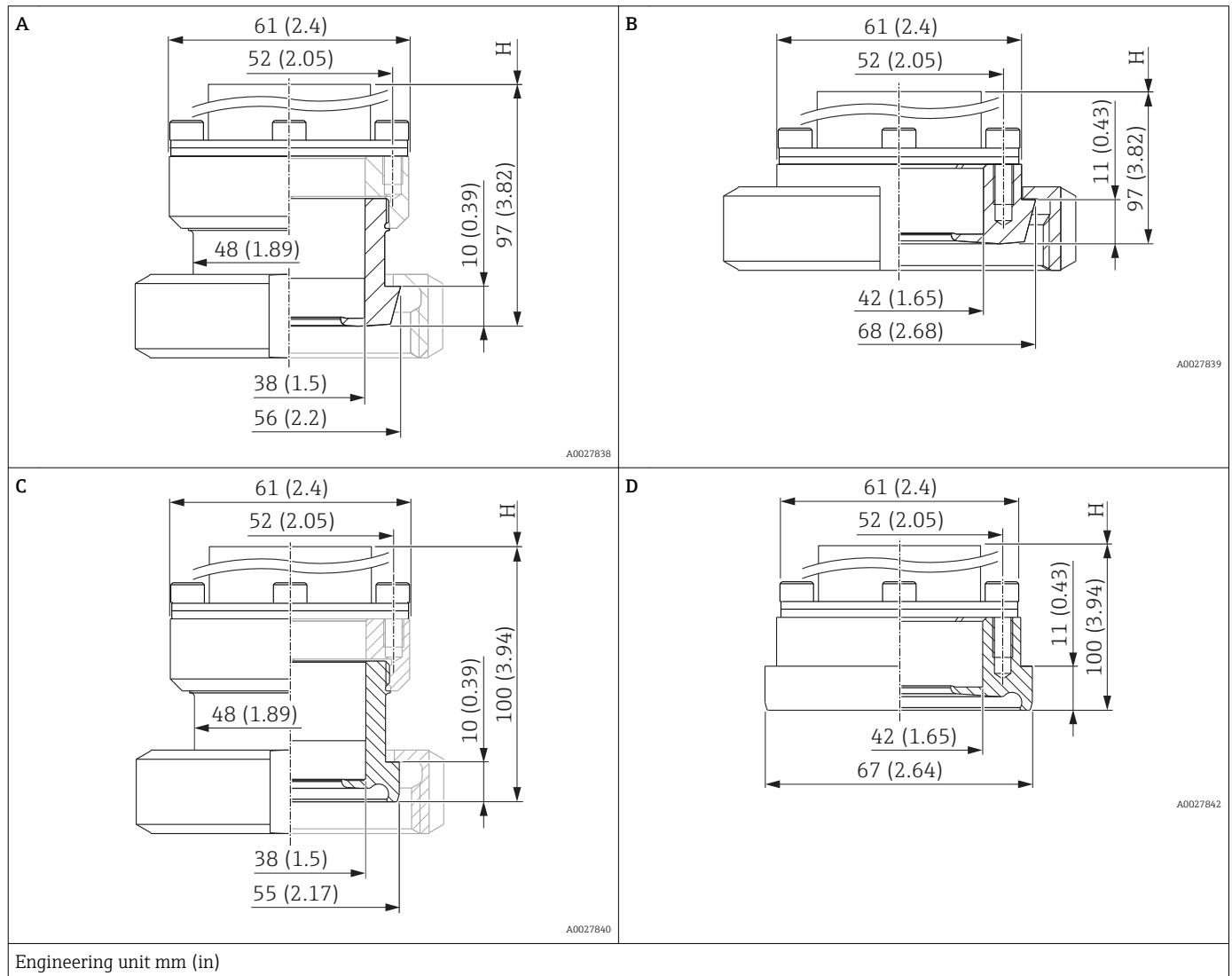
**PMC51: process connections
with flush-mounted process
isolating diaphragm - height
H**

F31 housing	F15 housing
94 mm (3.7 in)	98 mm (3.86 in)

PMC51: hygienic process connections with flushmounted process isolating diaphragm

In order to guarantee a hygiene approval, a seal with appropriate approval must be selected for the hygienic process connection:

- For 3A approval, you require a seal made of EPDM or HNBR → 42
- For EHEDG approval, you require a seal made of VMQ silicone, FFKM Kalrez → 42



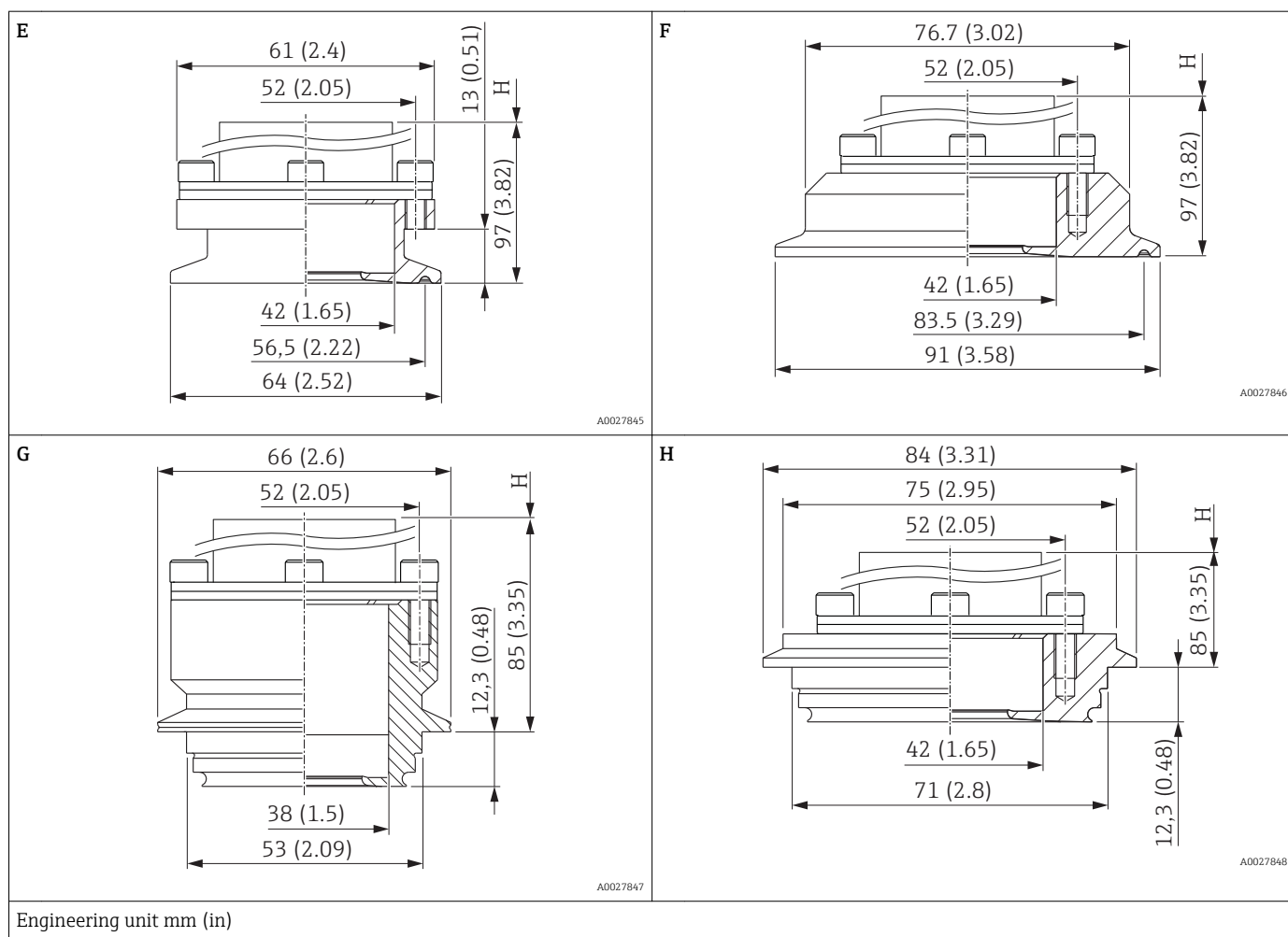
Position	Designation	Nominal pressure	Material ¹⁾	Weight	Approval ²⁾	Option ³⁾
				kg (lb)		
A	DIN 11851 DN40	PN 25	AISI 316L (1.4435)	0.7 (1.54)	EHEDG, 3A with seal FDA, ASME-BPE, CRN	MZJ ⁴⁾
B	DIN 11851 DN50	PN 25		0.9 (1.98)	EHEDG, 3A with seal FDA, ASME-BPE, CRN	MRJ ⁴⁾
C	DIN 11864 DN40, Rohr DIN 11866-A	PN 16		0.66 (1.46)	EHEDG, 3A with seal FDA, ASME-BPE	NCJ ⁴⁾
D	DIN 11864 DN50, Rohr DIN 11866-A	PN 16		0.29 (0.64)	EHEDG, 3A with seal FDA, ASME-BPE	NDJ ⁴⁾

1) Delta-ferrite content < 1 %. The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ (30 μin).

2) CSA approval: Product Configurator, order code for "Approval"

3) Product Configurator, "Process connection" section

4) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).



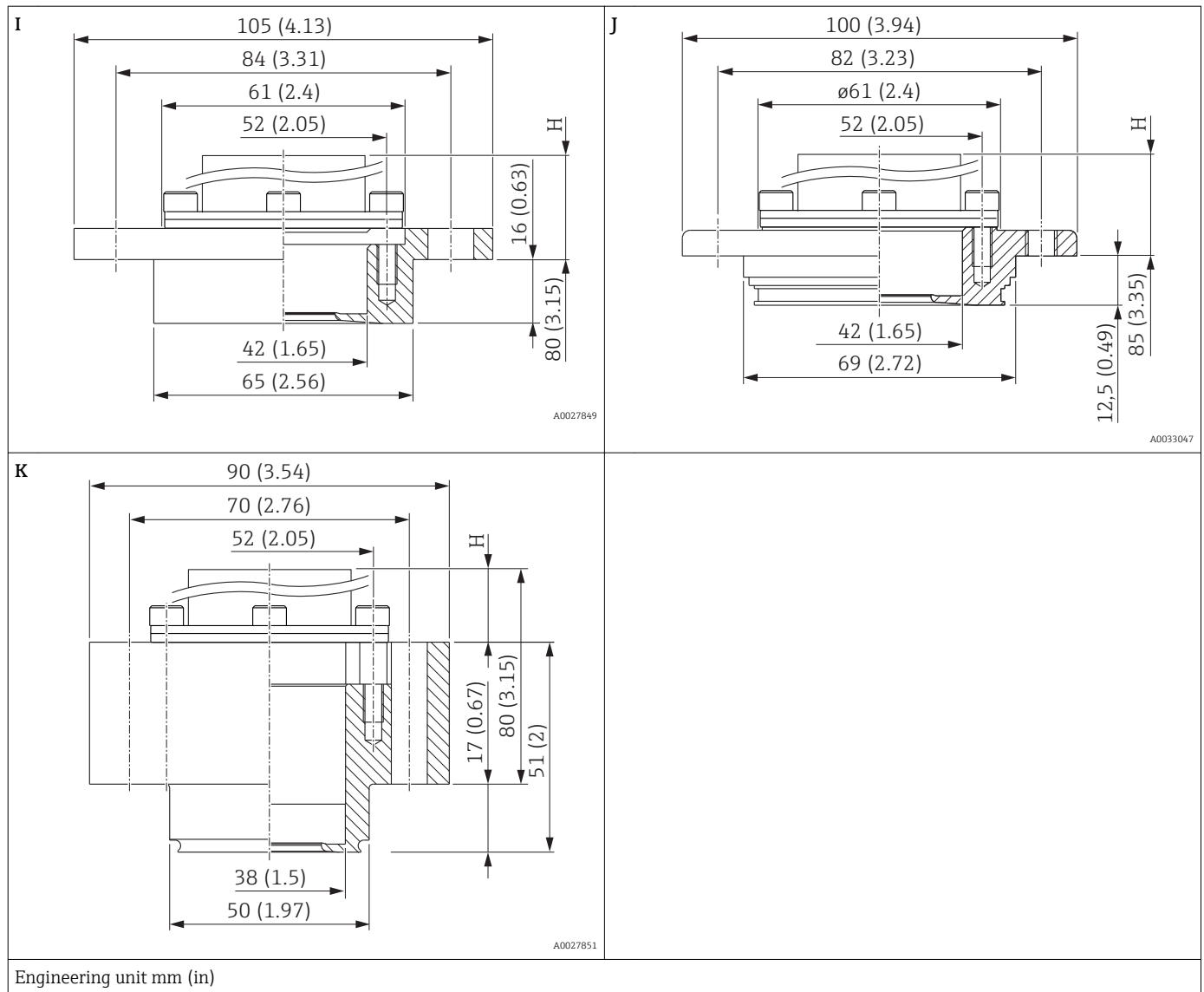
Position	Designation	Nominal pressure	Material ¹⁾	Weight	Approval ²⁾	Option ³⁾
				kg (lb)		
E	Tri-Clamp ISO 2852, DN40-DN51 (2")	PN 40	AISI 316L (1.4435)	0.65 (1.44)	EHEDG, 3A with seal FDA, CRN, ASME-BPE	TDJ ⁴⁾
F	Tri-Clamp ISO 2852, DN76.1 (3")	PN 40		0.9 (1.98)	EHEDG, 3A with seal FDA, CRN, ASME-BPE	TFJ
G	Varivent F pipe, DN25-32	PN 40		0.46 (1)	EHEDG, 3A with seal FDA, ASME-BPE	TQJ
H	Varivent N pipe, DN40-162	PN 40		1 (2.21)	EHEDG, 3A with seal FDA, ASME-BPE	TRJ

1) Delta ferrite content < 1 %. The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ (30 μin).

2) CSA approval: Product Configurator, "Approval" ordering feature

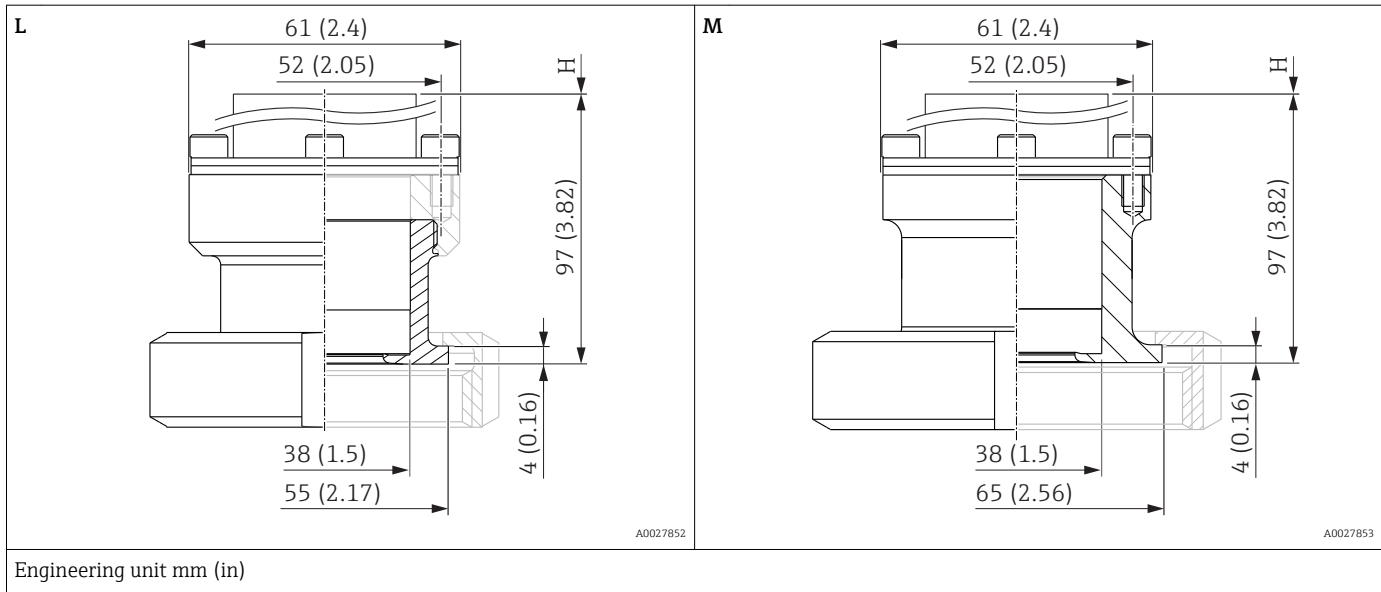
3) Product Configurator, "Process connection" section

4) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).



Position	Designation	Nominal pressure	Material ¹⁾	Weight	Approval ²⁾	Option ³⁾
				kg (lb)		
I	DRD, DN50 (65 mm)	PN 25	AISI 316L (1.4435)	0.9 (1.98)	FDA	TIJ ⁴⁾
J	APV Inline, DN50	PN 40		0.52 (1.15)	3A with seal FDA, CRN, ASME-BPE	TMJ
K	NEUMO BioControl, DN50	PN 16		1.34 (2.6)	3A with seal FDA, ASME-BPE	S4J ⁵⁾

- 1) Delta ferrite content < 1 %. The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ (30 μin).
- 2) CSA approval: Product Configurator, "Approval" ordering feature
- 3) Product Configurator, "Process connection" section
- 4) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).
- 5) 4 screws DIN912 M8 x 45 are enclosed (material A4-80)



Position	Designation	Nominal pressure	Material ¹⁾	Weight	Approval ²⁾	Option ³⁾
				kg (lb)		
L	SMS 1 ½"	PN 25	AISI 316L (1.4435)	0.65 (1.43)	EHEDG, 3A, ASME-BPE	TXJ ⁴⁾
M	SMS 2"	PN 25		0.65 (1.43)		T7J ⁴⁾

1) Delta ferrite content < 1 %. The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ (30 μin).

2) CSA approval: Product Configurator, "Approval" ordering feature

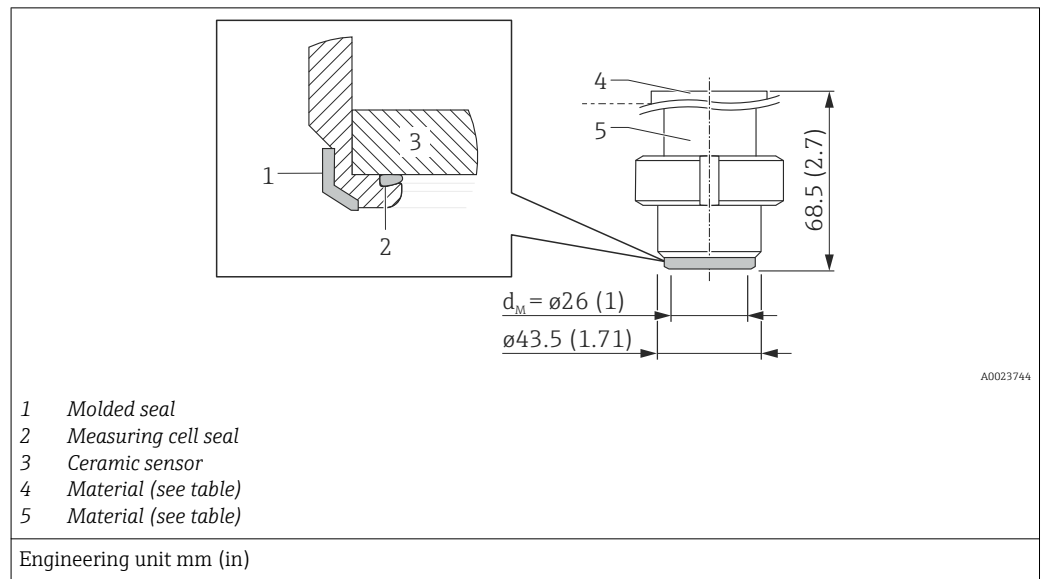
3) Product Configurator, "Process connection" section

4) Endress+Hauser supplies the slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

Height H

Position	Process connection	F31 housing	F15 housing
A	DIN 11851 DN40	48 mm (1.89 in)	54 mm (2.13 in)
B	DIN 11851 DN50	70 mm (2.76 in)	77 mm (3.03 in)
C	DIN 11864 DN40, pipe DIN 11866-A	48 mm (1.89 in)	54 mm (2.13 in)
D	DIN 11864 DN50, pipe DIN 11866-A	70 mm (2.76 in)	77 mm (3.03 in)
E	Tri-Clamp ISO 2852, DN40-DN51 (2")	70 mm (2.76 in)	77 mm (3.03 in)
F	Tri-Clamp ISO 2852, DN76.1 (3")	70 mm (2.76 in)	77 mm (3.03 in)
G	Varivent F pipe, DN25-32	48 mm (1.89 in)	54 mm (2.13 in)
H	Varivent N pipe, DN40-162	70 mm (2.76 in)	77 mm (3.03 in)
I	DRD, DN50 (65 mm)	70 mm (2.76 in)	77 mm (3.03 in)
J	APV Inline, DN50	70 mm (2.76 in)	77 mm (3.03 in)
K	NEUMO BioControl, DN50	48 mm (1.89 in)	54 mm (2.13 in)
L	SMS 1 ½"	48 mm (1.89 in)	54 mm (2.13 in)
M	SMS 2"	48 mm (1.89 in)	54 mm (2.13 in)

Universal adapter



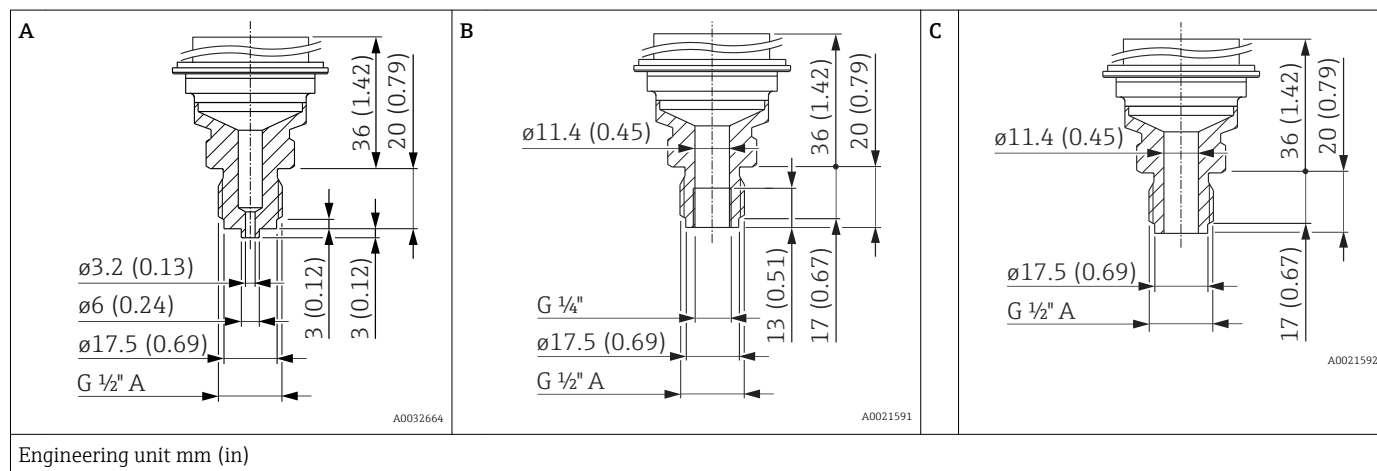
Designation	Nominal pressure	Material ^{1) 2)}	Weight	Approval Process connection ³⁾	Option ⁴⁾
			[kg (lb)]		
Universal adapter with pre-installed silicone molded seal	PN 10	<ul style="list-style-type: none"> 4: top section AISI 316L (1.4404) 5: bottom section AISI 316L (1.4435) 	0.74 (1.63)	EHEDG, 3A with seal FDA, ASME-BPE	UPJ
Universal adapter with pre-installed EPDM molded seal				EHEDG, 3A, ASME-BPE	UNJ

- 1) The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ (30 μin).
- 2) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (1.4301) or in AISI 304L (1.4307).
- 3) EHEDG or 3A approval only with approved process connection.
- 4) Product Configurator, "Process connection" section

Material of the molded seal (changeable seal)	Material of the measuring cell seal at the ceramic sensor (seal not changeable)	Approval of measuring cell seal	Option ¹⁾
Silicone (Spare part order no.: 52023572)	EPDM	FDA ²⁾ 3A Class II, USP Class VI. DVGW, KTW, W270, WRAS, ACS, NSF61	K
EPDM (Spare part order no.: 71100719)	EPDM	FDA ²⁾	J

- 1) Product Configurator, "Seal" ordering feature
- 2) food-safe FDA 21 CFR 177.2600

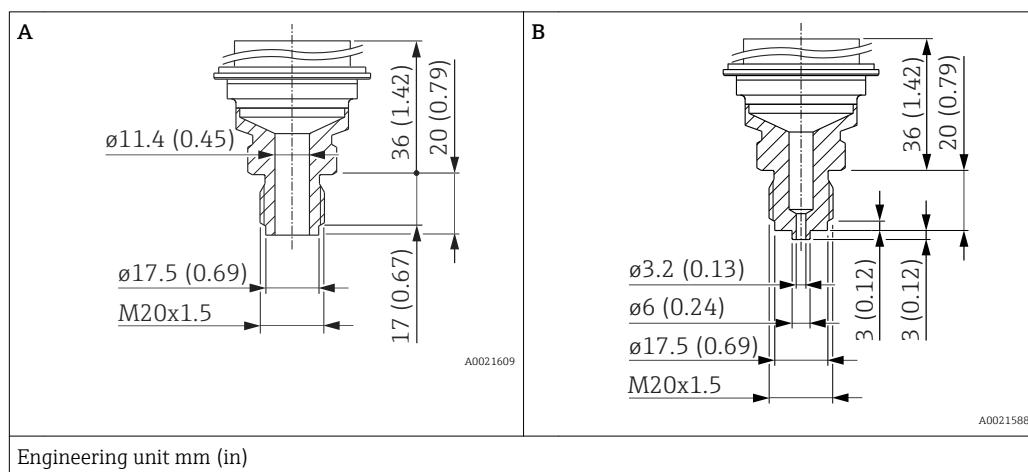
PMP51: process connections with internal process isolating diaphragm **ISO 228 G threaded connection**



Item	Designation	Material	Weight kg (lb)	Option ¹⁾
A	Thread ISO 228 G $\frac{1}{2}" A$ EN 837	AISI 316L	0.63 (1.39)	GCJ
		Alloy C276 (2.4819)		GCC
B	Thread ISO 228 G $\frac{1}{2}" A$, G $\frac{1}{4}"$ (female)	AISI 316L		GLJ
		Alloy C276 (2.4819)		GLC
C	Thread ISO 228 G $\frac{1}{2}" A$, Bore 11.4 mm (0.45 in)	AISI 316L		GMJ
		Alloy C276 (2.4819)		GMC

1) Product Configurator, "Process connection" ordering feature

DIN 13 threaded connection

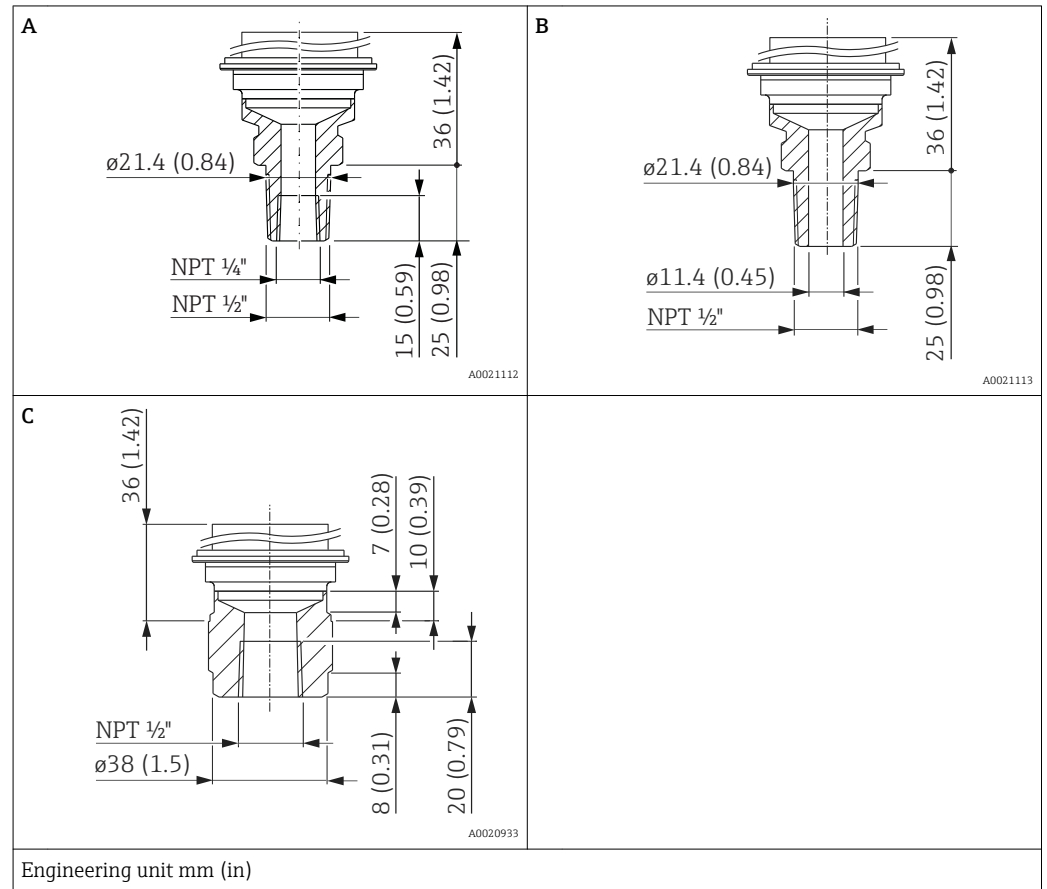


Item	Designation	Material	Weight kg (lb)	Option ¹⁾
A	DIN 13 M20 x 1,5 Bore 11.4 mm (0.45 in)	AISI 316L	0.6 (1.32)	G1J
		Alloy C276 (2.4819)		G2J
B	DIN 13 M20 x 1,5, EN 837, Bore 3 mm (0.12 in)	AISI 316L		G5J
		Alloy C276 (2.4819)		G6J

1) Product Configurator, "Process connection" ordering feature

PMP51: process connections with internal process isolating diaphragm

ANSI threaded connection

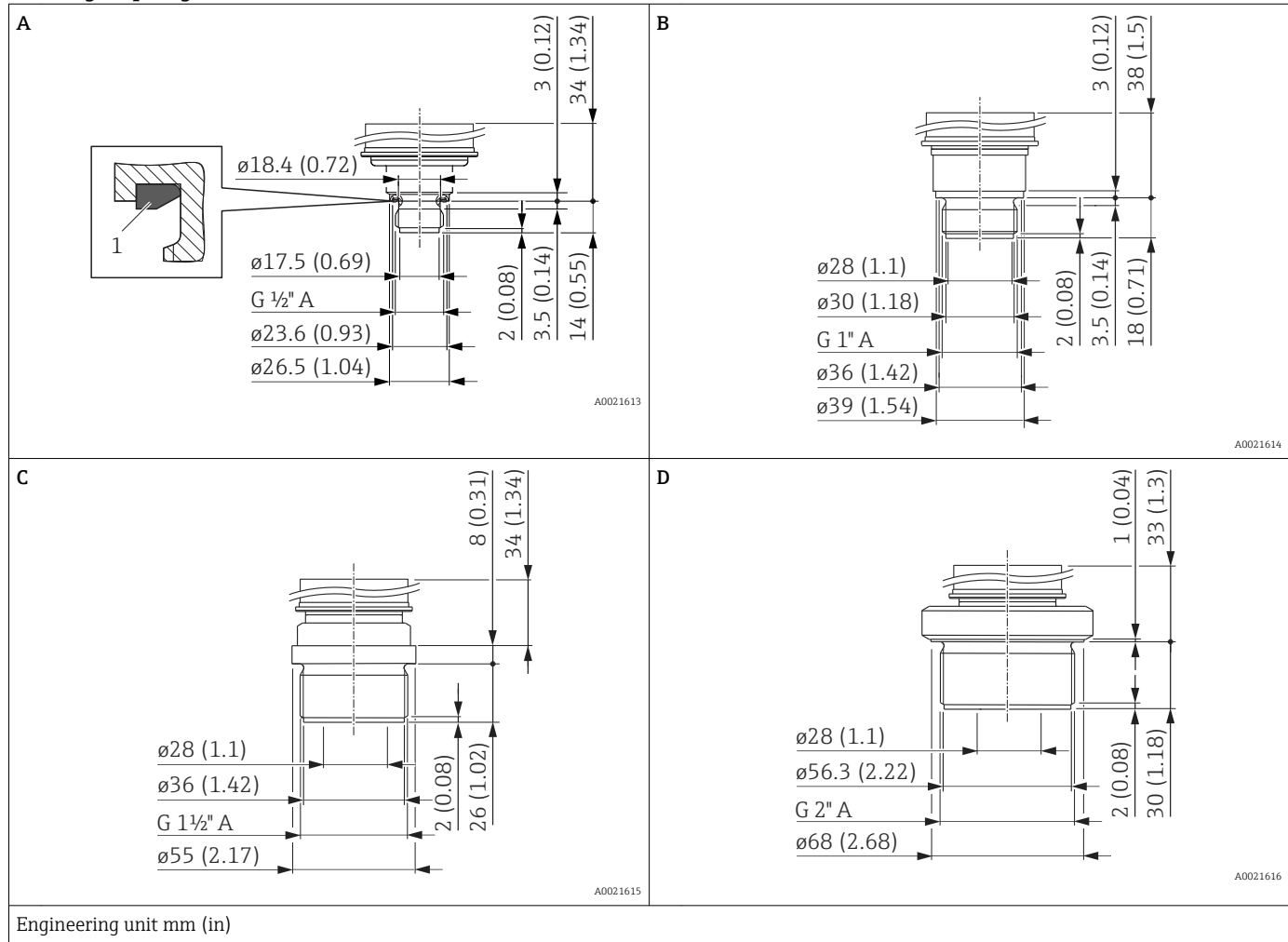


Item	Designation	Material	Weight	Approval ¹⁾	Option ²⁾
			kg (lb)		
A	ANSI 1/2" MNPT, 1/4" FNPT	AISI 316L	0.63 (1.39)	CRN	RLJ
		Alloy C276 (2.4819)		CRN	RLC
B	ANSI 1/2" MNPT, Bore 11.4 mm (0.45 in) = 400 bar (6 000 psi)	AISI 316L		CRN	RKJ
		Alloy C276 (2.4819)		CRN	RKC
C	ANSI 1/2" FNPT	AISI 316L	0.7 (1.54)	CRN	R1J
		Alloy C276 (2.4819)		CRN	R1C

1) CSA approval: Product Configurator, "Approval" ordering feature

2) Product Configurator, "Process connection" ordering feature

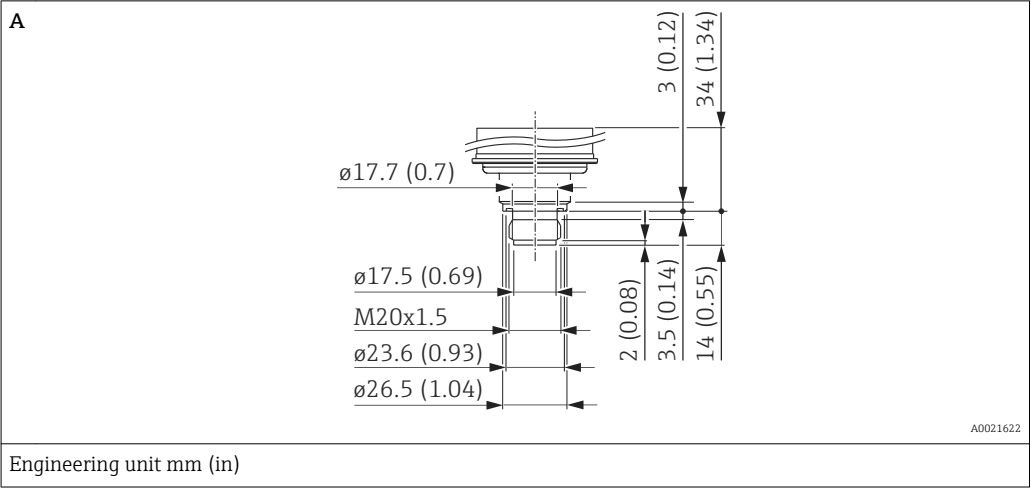
**PMP51: process connections
with flush-mounted process
isolating diaphragm** **ISO 228 G threaded connection**



Item	Designation	Material	Weight	Option ¹⁾
			kg (lb)	
A	Thread ISO 228 G 1/2" A DIN 3852 FKM seal (item 1) pre-installed	AISI 316L	0,4 (0.88)	GRJ
		Alloy C276 (2.4819)		GRC
B	Thread ISO 228 G 1" A	AISI 316L	0,7 (1.54)	GTJ
C	Thread ISO 228 G 1 1/2" A	AISI 316L	1,1 (2.43)	GVJ
D	Thread ISO 228 G 2" A	AISI 316L	1,5 (3.31)	GWJ

1) Product Configurator, "Process connection" ordering feature

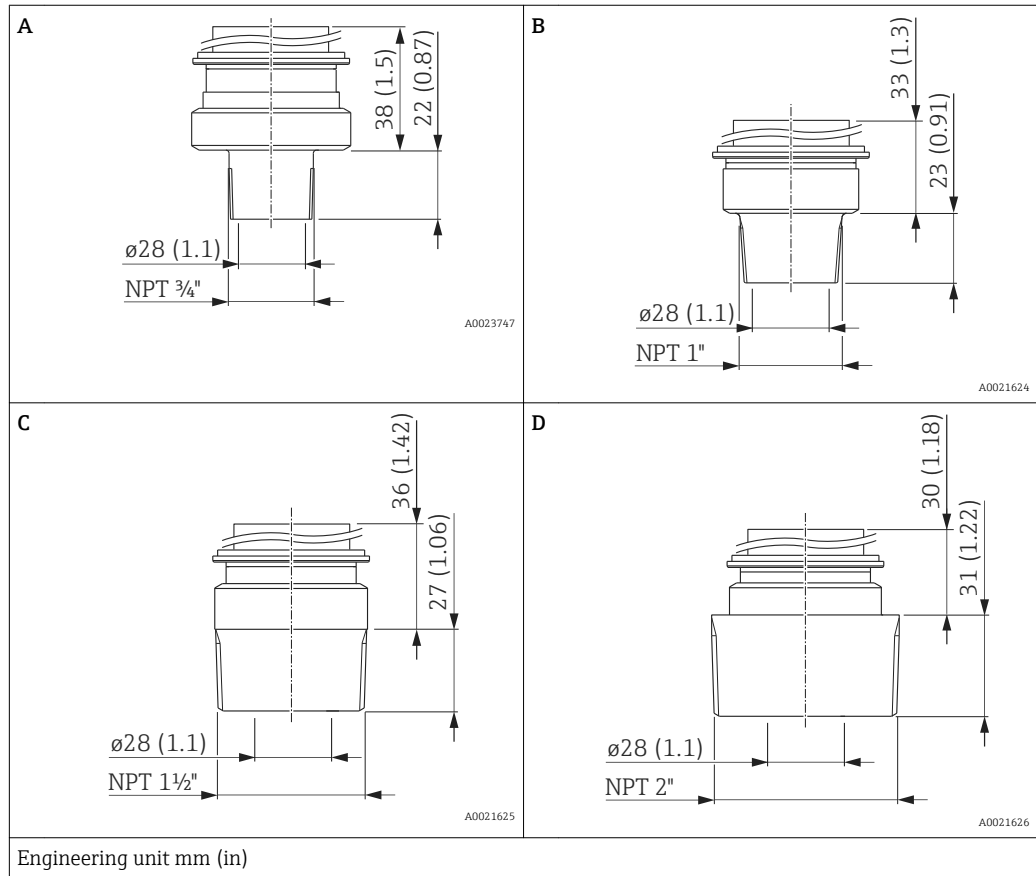
DIN 13 threaded connection



Designation	Material	Weight	Option ¹⁾
		kg (lb)	
DIN 13 M20 x 1,5	AISI 316L	0,6 (1.32)	G7J
	Alloy C276 (2.4819)		G8J

1) Product Configurator, "Process connection" ordering feature

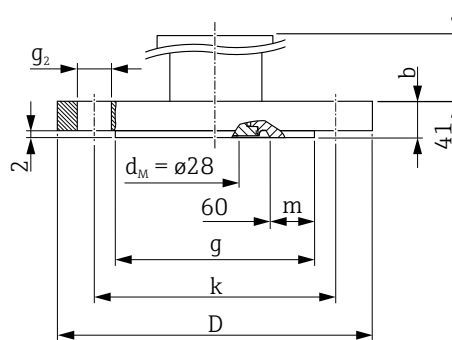
ANSI threaded connection



Position	Designation	Material	Weight	Approval ¹⁾	Option ²⁾
			kg (lb)		
A	ANSI 3/4" MNPT	AISI 316L	0.6 (1.32)	-	U4J
B	ANSI 1" MNPT		0.7 (1.54)	CRN	U5J
C	ANSI 1 1/2" MNPT		1 (2.21)	CRN	U7J
D	ANSI 2" MNPT		1.3 (2.87)	CRN	U8J

1) CSA approval: Product Configurator, order code for "Approval"

2) Product Configurator, "Process connection" section

**PMP51: process connections
with flush-mounted process
isolating diaphragm**
EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527


A0022643

D Diameter of flange
b Thickness
g Raised face
m Width of raised face
k Hole circle
g₂ Diameter of hole
d_M Max. diameter of the process isolating diaphragm

Engineering unit mm

Flange ¹⁾							Boltholes			Weight Flange	Option ²⁾
Nominal diameter	Nominal pressure	Shape ³⁾	D	b	g	m	Quantity	g ₂	k		
			[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[kg (lb)]	
DN 25	PN 10-40	B1 (D)	115	18	68 ⁴⁾	4	4	14	85	1.2 (2.65)	CNJ
DN 32	PN 10-40	B1 (D)	140	18	78 ⁴⁾	9	4	18	100	1.9 (4.19)	CPJ
DN 40	PN 10-40	B1 (D)	150	18	88 ⁴⁾	14	4	18	110	2.2 (4.85)	CQJ
DN 50	PN 10-40	B1 (D)	165	20	102	-	4	18	125	3.0 (6.62)	CXJ
DN 80	PN 10-40	B1 (D)	200	24	138	-	8	18	160	5.3 (11.69)	CZJ

1) Material: AISI 316L

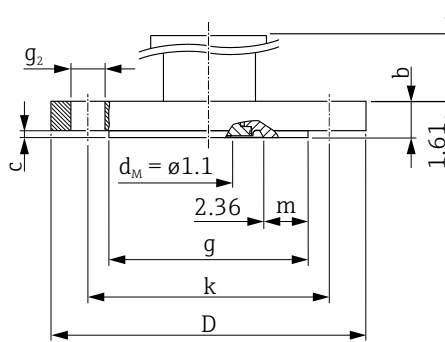
2) Product Configurator, "Process connection" section

3) Description as per DIN 2527 provided in brackets

4) With these process connections the raised face is smaller than described in the standard. Due to the smaller raised face, a special seal must be used.

**PMP51: process connections
with flush-mounted process
isolating diaphragm**

ASME flanges, connection dimensions as per ASME B 16.5, raised face RF*



A0022645

D Diameter of flange
b Thickness
g Raised face
c Raised face
k Hole circle
g₂ Diameter of hole
d_M Max. diaphragm diameter

Engineering unit in.
 (*all apart from AN, see table below)

Flange ¹⁾							Boltholes			Weight	Approval ²⁾	Option ³⁾
Nominal diameter	Class/nominal pressure	D	b	g	c	m	Quantity	g ₂	k			
[in]	lb./sq.in	[in]	[in]	[in]	[in]	[in]		[in]	[in]	[kg (lb)]		
1	300	4.88	0.69	2 ⁴⁾	0.06	0.2	4	0.75	3.5	1.3 (2.87)	CRN	ANJ
1 ½	150	5	0.69	2.88 ⁴⁾	0.08	0.52	4	0.62	3.88	1.5 (3.31)	CRN	AEJ
1 ½	300	6.12	0.81	2.88 ⁴⁾	0.08	0.52	4	0.88	4.5	2.6 (5.73)	CRN	AQJ
2	150	6	0.75	3.62	0.08	-	4	0.75	4.75	2.4 (5.29)	CRN	AFJ
2	300	6.5	0.88	3.62	0.08	-	8	0.75	5	3.2 (7.06)	CRN	ARJ
3	150	7.5	0.94	5	0.08	-	4	0.75	6	4.9 (10.8)	CRN	AGJ
3	300	8.25	1.12	5	0.08	-	8	0.88	6.62	6.7 (14.77)	CRN	ASJ
4	150	9	0.94	6.19	0.08	-	8	0.75	7.5	7.1 (15.66)	CRN	AHJ
4	300	10	1.25	6.19	0.08	-	8	0.88	7.88	11.6 (25.88)	CRN	ATJ

- 1) Material: AISI 316/316L; Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
 2) CSA approval: Product Configurator, "Approval" ordering feature
 3) Product Configurator, "Process connection" section
 4) With these process connections the raised face is smaller than described in the standard. Due to the smaller raised face, a special seal must be used.

PMP51: hygienic process connections with flushmounted process isolating diaphragm

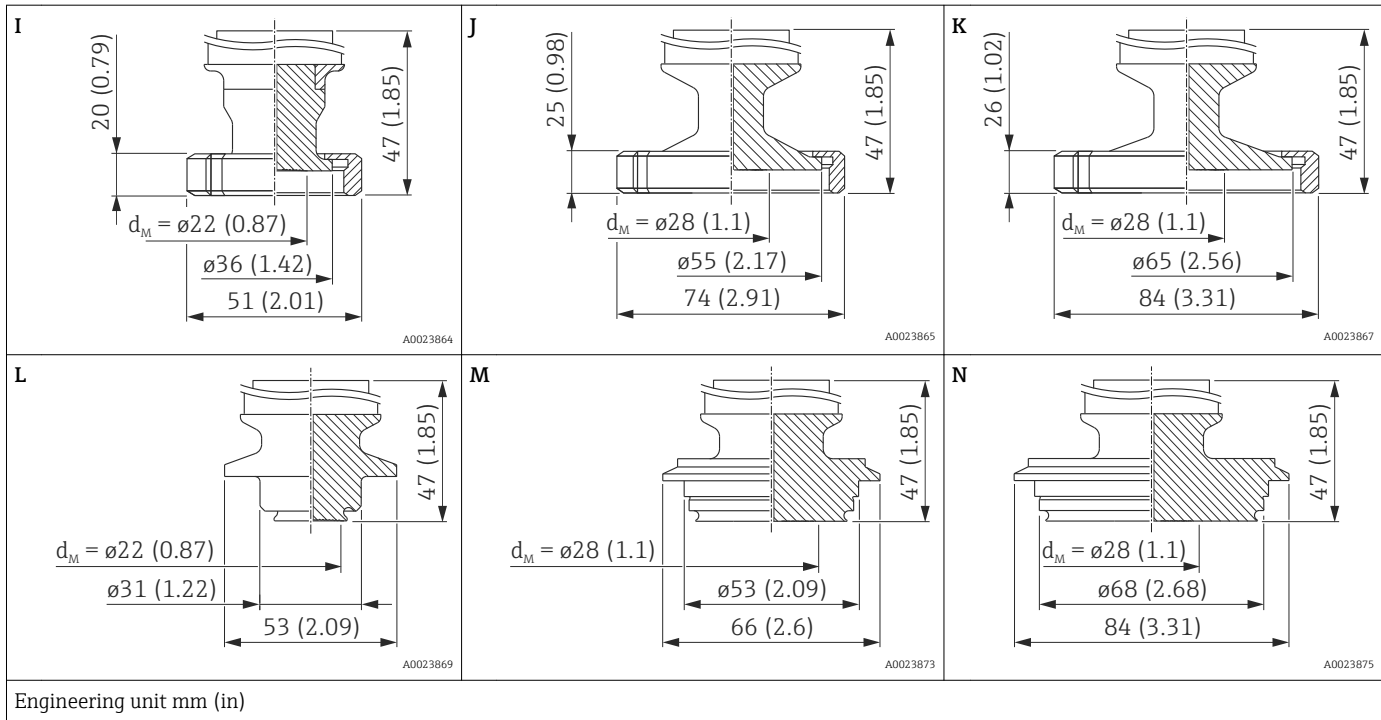
<p>A</p> <p>$d_M = \text{ø}17 (0.67)$ $\text{ø}28 (1.1)$ $34 (1.34)$ $47 (1.85)$</p> <p>A0023749</p>	<p>B</p> <p>$d_M = \text{ø}22 (0.87)$ $\text{ø}43,5 (1.71)$ $50,5 (1.99)$ $47 (1.85)$</p> <p>A0023772</p>	<p>C</p> <p>$d_M = \text{ø}28 (1.1)$ $\text{ø}43,5 (1.71)$ $50,5 (1.99)$ $47 (1.85)$</p> <p>A0023773</p>
<p>D</p> <p>$d_M = \text{ø}28 (1.1)$ $\text{ø}56,5 (2.22)$ $64 (2.52)$ $47 (1.85)$</p> <p>A0023775</p>	<p>E</p> <p>$21 (0.83)$ $d_M = \text{ø}28 (1.1)$ $\text{ø}44 (1.73)$ $63 (2.48)$ $47 (1.85)$</p> <p>A0023777</p>	<p>F</p> <p>$21 (0.83)$ $d_M = \text{ø}28 (1.1)$ $\text{ø}50 (1.97)$ $70 (2.76)$ $47 (1.85)$</p> <p>A0023859</p>
<p>G</p> <p>$21 (0.83)$ $d_M = \text{ø}28 (1.1)$ $\text{ø}56 (2.2)$ $78 (3.07)$ $47 (1.85)$</p> <p>A0023861</p>	<p>H</p> <p>$22 (0.87)$ $d_M = \text{ø}28 (1.1)$ $\text{ø}69 (2.72)$ $92 (3.62)$ $47 (1.85)$</p> <p>A0023863</p>	
Engineering unit mm (in)		

Item ^{1) 2)}	Designation	Nominal pressure	Weight	Approval	Option ³⁾
			kg (lb)		
A	Clamp ISO2852, DN 18-22, DIN 32676 DN 15-20	PN 40	0.5 (1.10)	EHEDG, 3A, ASME-BPE	TBJ
B	Tri-Clamp ISO2852 DN 25 (1"), DIN 32676 DN 25	PN 40	0.6 (1.32)	EHEDG, 3A, ASME-BPE	TCJ
C	Tri-Clamp ISO2852 DN 38 (1½"), DIN 32676 DN 40	PN 40	0.6 (1.32)	EHEDG, 3A, ASME-BPE	TJJ
D	Tri-Clamp ISO2852 DN 40-51 (2"), DIN 32676 DN 50	PN 40	0.7 (1.54)	EHEDG, 3A, ASME-BPE	TDJ
E	DIN 11851 DN 25	PN 40	0.7 (1.54)	EHEDG, 3A, ASME-BPE	MXJ
F	DIN 11851 DN 32	PN 40	0.8 (1.76)	EHEDG, 3A, ASME-BPE	MIJ
G	DIN 11851 DN 40	PN 40	0.9 (1.98)	EHEDG, 3A, ASME-BPE	MZJ
H	DIN 11851 DN 50	PN 25	1.1 (2.43)	EHEDG, 3A, ASME-BPE	MRJ

1) Material: AISI 316L (1.4435)

2) The roughness of the surface in contact with the medium is $R_a 0.76 \mu\text{m}$ (30 μin). Version optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a 0.38 \mu\text{m}$ (15 μin), electropolished; to be ordered using order feature 570 "Service", option "HK" in the order code.

3) Product Configurator, "Process connection" ordering feature

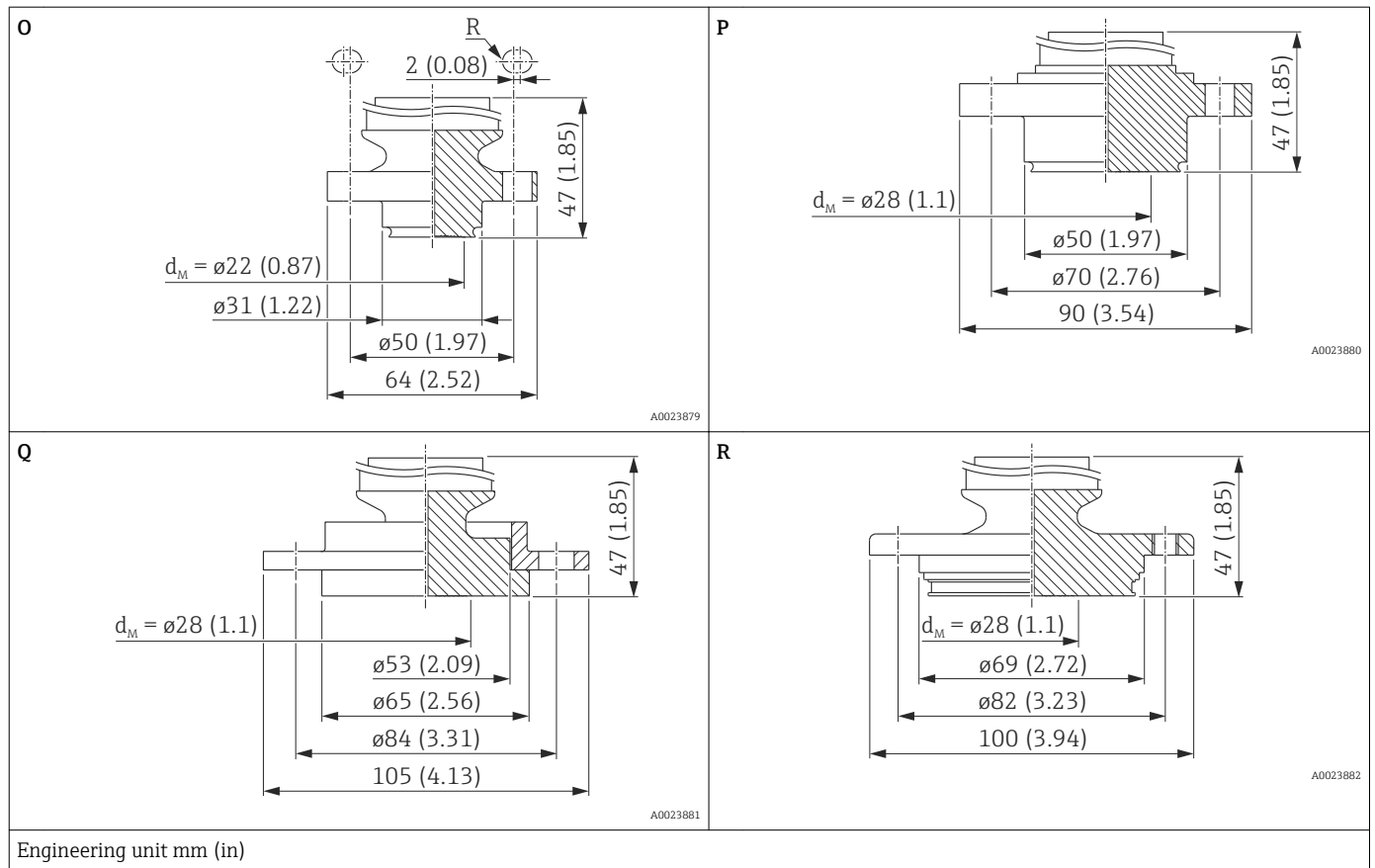


Item ^{1) 2)}	Designation	Nominal pressure	Weight	Approval	Option ³⁾
			kg (lb)		
I	SMS 1"	PN 25	0.7 (1.54)	EHEDG, 3A, ASME-BPE	T6J
J	SMS 1½"	PN 25	0.8 (1.76)	EHEDG, 3A, ASME-BPE	T7J
K	SMS 2"	PN 25	0.9 (1.98)	EHEDG, 3A, ASME-BPE	TXJ
L	Varivent B pipe DN 10-15	PN 40	0.7 (1.54)	EHEDG, 3A, ASME-BPE	TPJ
M	Varivent F pipe DN 25-32	PN 40	0.9 (1.98)	EHEDG, 3A, ASME-BPE	TQJ
N	Varivent N pipe DN 40-162	PN 40	1.1 (2.43)	EHEDG, 3A, ASME-BPE	TRJ

1) Material: AISI 316L (1.4435)

2) The roughness of the surface in contact with the medium is $R_a 0.76 \mu\text{m}$ ($30 \mu\text{in}$). Version optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a 0.38 \mu\text{m}$ ($15 \mu\text{in}$), electropolished; to be ordered using order feature 570 "Service", option "HK" in the order code.

3) Product Configurator, "Process connection" ordering feature

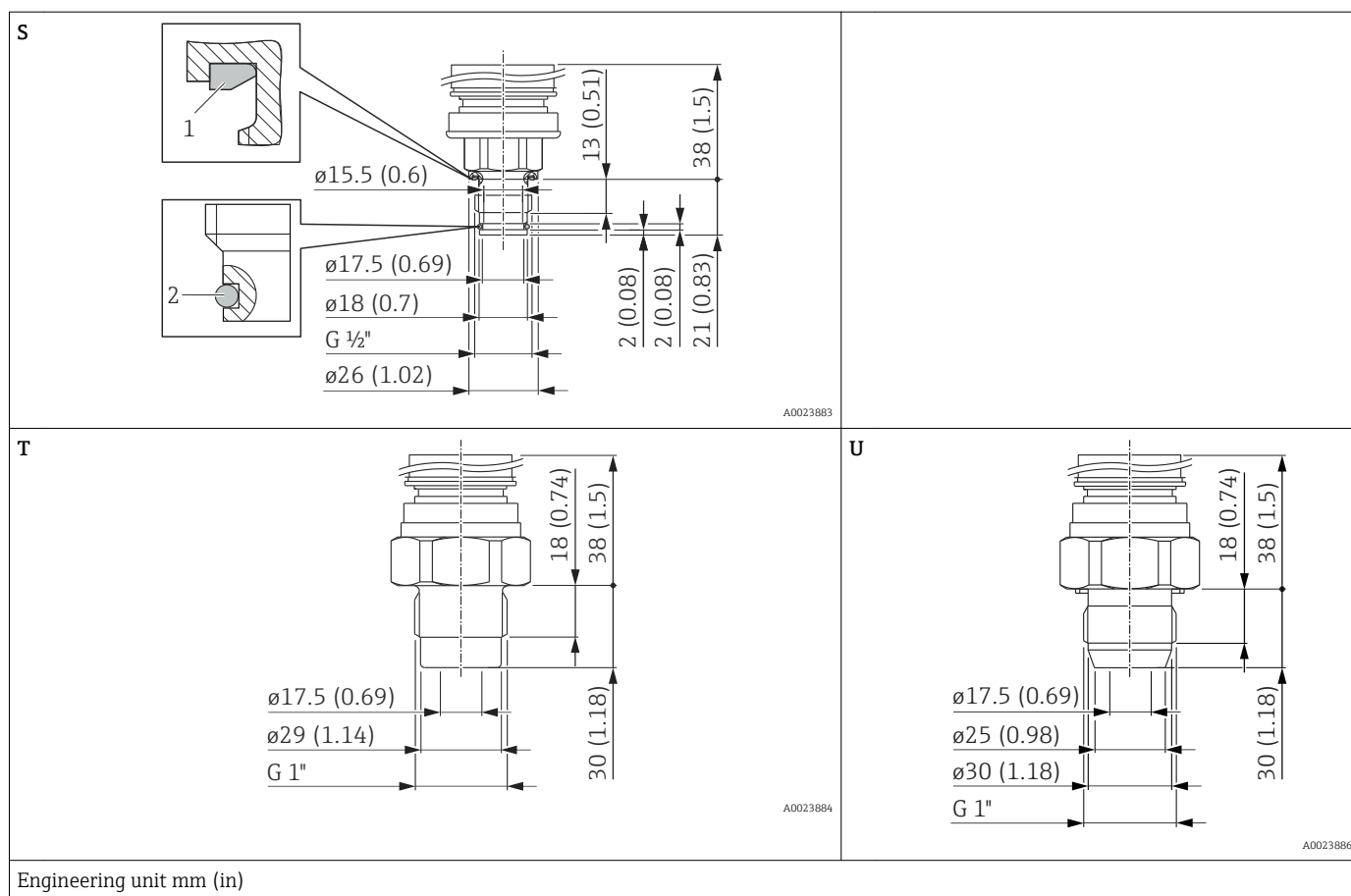


Item ^{1) 2)}	Designation	Nominal pressure	Bolthole		Weight	Approval	Option ³⁾
			Quantity	Diameter			
				mm (in)	kg (lb)		
O	NEUMO BioControl D 25	PN 16	4	R: 3.5 (0.14)	0.8 (1.76)	EHEDG, 3A, ASME-BPE	S1J
P	NEUMO BioControl D 50	PN 16	4	9 (0.35)	1.2 (2.65)	EHEDG, 3A, ASME-BPE	S4J
Q	DRD DN 50	PN 25	4	11.5 (0.45)	1.0 (2.21)	ASME-BPE	TIJ
R	APV Inline DN 50	PN 40	6	8.6 (0.34)	1.2 (2.65)	EHEDG, 3A, ASME-BPE	TPJ
			2	M8			

1) Material: AISI 316L (1.4435)

2) The roughness of the surface in contact with the medium is $R_a 0.76 \mu\text{m}$ (30 μin). Version optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a 0.38 \mu\text{m}$ (15 μin), electropolished; to be ordered using order feature 570 "Service", option "HK" in the order code.

3) Product Configurator, "Process connection" ordering feature



Item ^{1) 2)}	Designation	Seal		Nominal pressure	Weight kg (lb)	Approval	Option ³⁾
		Item	Designation				
S	Thread ISO228 G 1/2"	1	FKM molded seal pre-installed	PN 40	0.5 (1.1)	ASME-BPE	GOJ
		2	FKM O-ring pre-installed				
T	Thread ISO228 G1"	-	Sealing via O-ring. VMQ O-ring included with the accessories QE and QF.	PN 40	0.8 (1.76)	3A, ASME-BPE	GZJ ⁴⁾
U	Thread ISO228 G1"	1	Metall joint	PN 100	0.8 (1.76)	ASME-BPE	GXJ

1) Material: AISI 316L (1.4435)

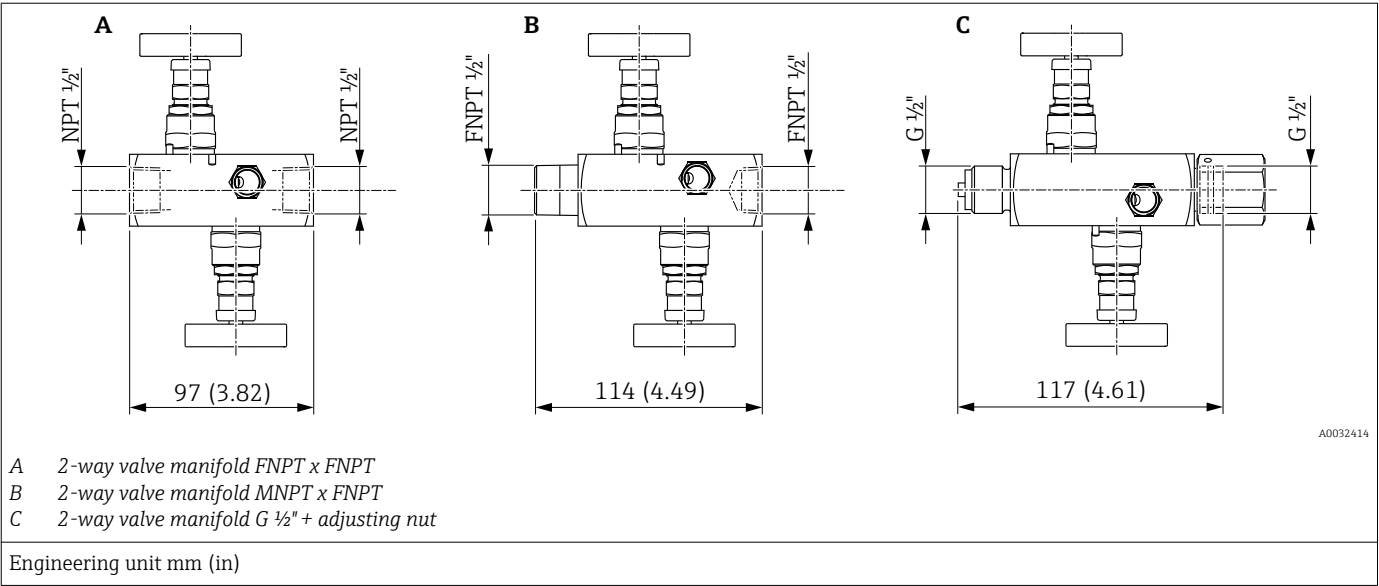
2) The roughness of the surface in contact with the medium is $R_a 0.76 \mu\text{m}$ ($30 \mu\text{in}$). Version optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a 0.38 \mu\text{m}$ ($15 \mu\text{in}$), electropolished; to be ordered using order feature 570 "Service", option "HK" in the order code.

3) Product Configurator, "Process connection" ordering feature

4) EHEDG in combination with EHEDG certified process- or weld in adapter; details see TI00426F.

**Valve manifold DA63M-
(optional)**

Endress+Hauser supplies milled valve manifolds via the transmitter's product structure in the following versions:



2-way valve manifolds in 316L or AlloyC can be

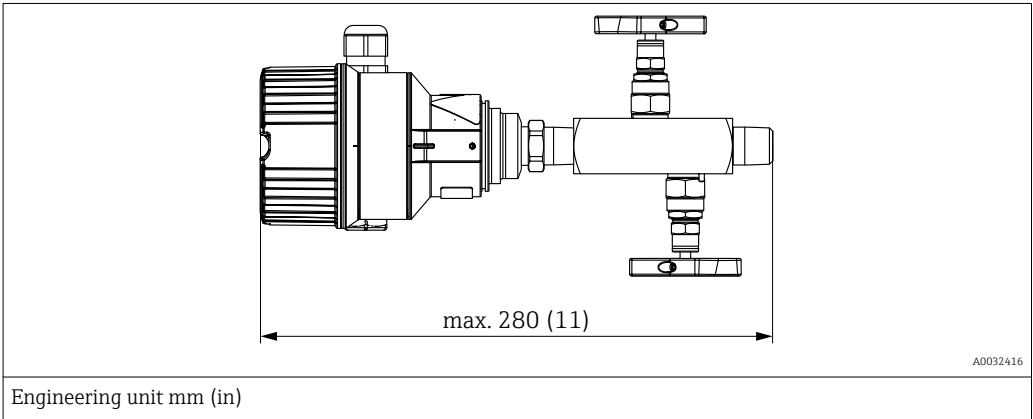
- ordered as an enclosed accessory (seal for mounting is enclosed)
- ordered as a mounted accessory (mounted valve manifolds are supplied with a documented leakage test).

Certificates ordered with the equipment (e.g. 3.1 material certificate and NACE) and tests (e.g. PMI and pressure test) apply to the transmitter and the valve manifold.

For other details (order option, dimension, weight, materials), see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

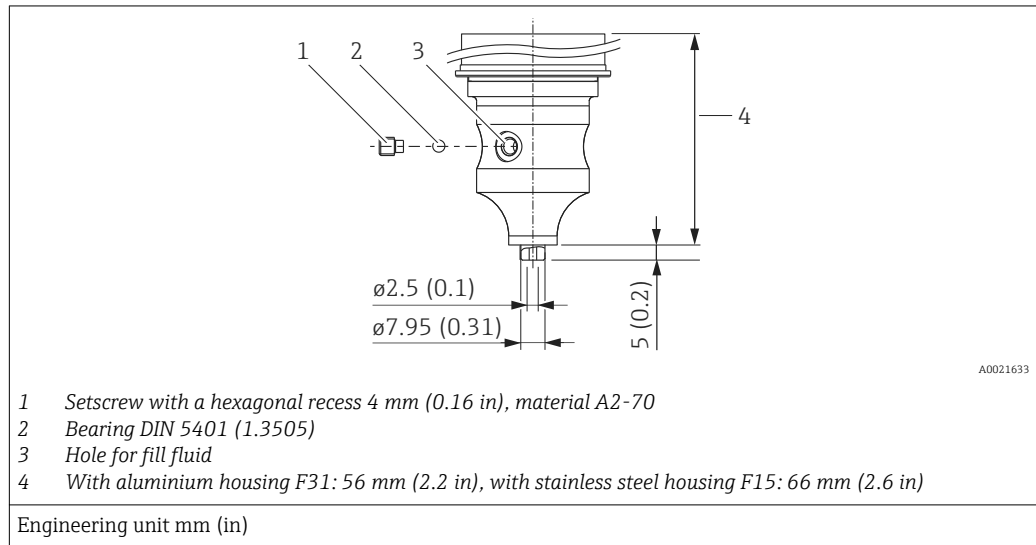
During the operating life of the valves, it may be necessary to re-tighten the packing.

Mounting on valve manifold



Ordering information:

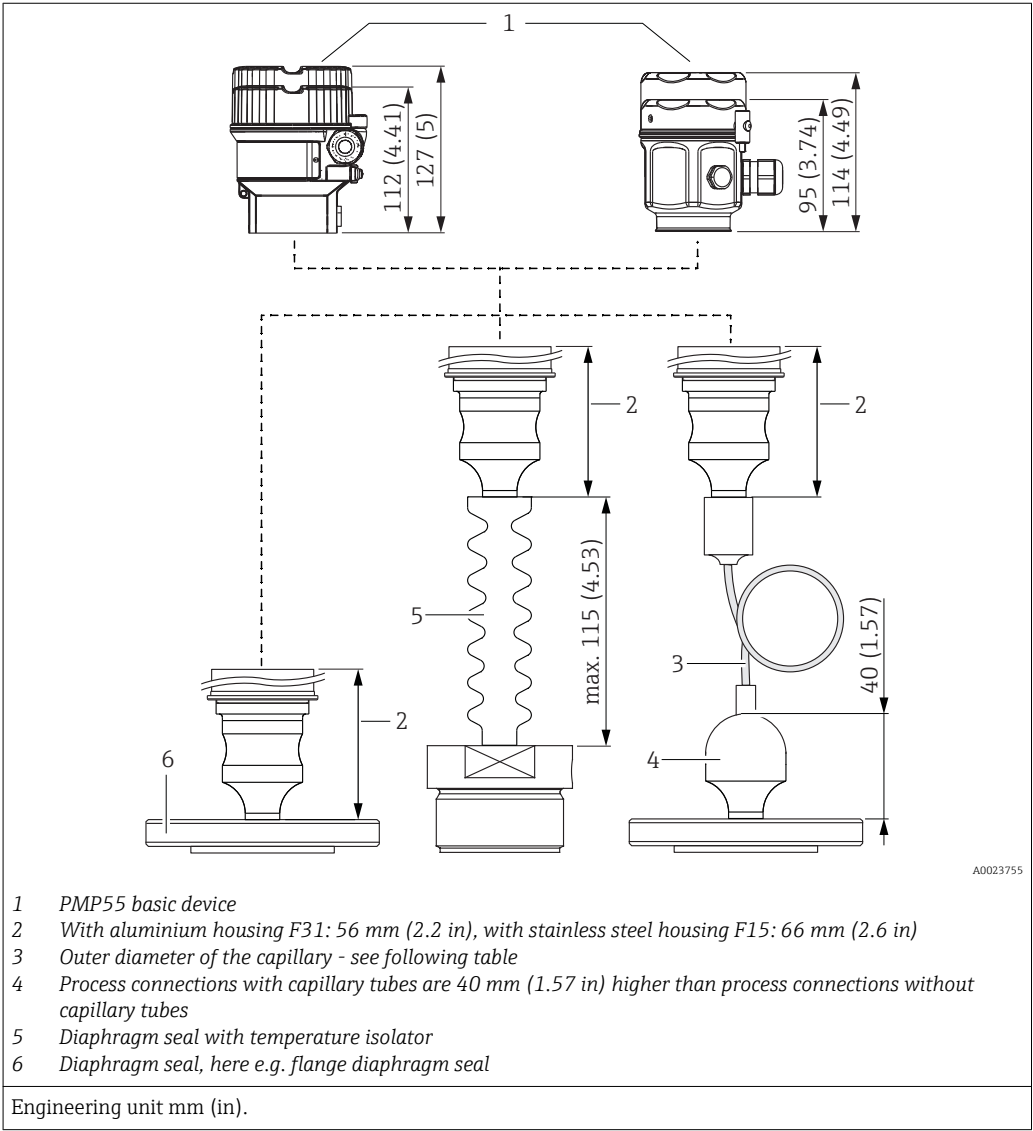
Product Configurator, order code for "Accessories mounted".

PMP51: process connections Prepared for diaphragm seal mount


Material	Designation	Weight kg (lb)	Approval ¹⁾	Option ²⁾
AISI 316L (1.4404)	Prepared for diaphragm seal mount	1.9 (4.19)	CRN	XSJ

- 1) CSA approval: Product Configurator, "Approval" ordering feature
 2) Product Configurator, "Process connection" ordering feature

PMP55 basic device - examples



Outer diameter of capillary

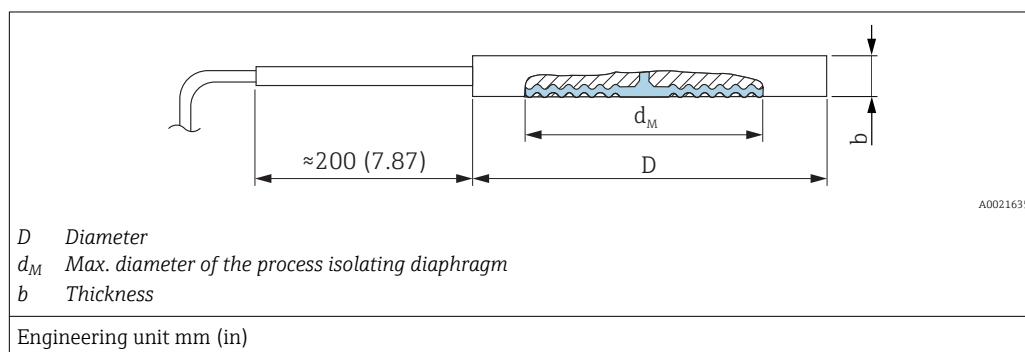
Designation	Outer diameter
Flexible armor made from 316L	8 mm (0.31 in)
Flexible armor with PVC-coating	10 mm (0.39 in)
Flexible armor with PTFE-coating	12.5 mm (0.49 in)

Diaphragm seal connection

Designation	OptionProduct Configurator, "Diaphragm seal connection" ordering feature
Direct	A
Temperature isolator	B
..... m capillary	D
..... ft capillary	E

**PMP55: process connections
with flush-mounted process
isolating diaphragm**


- The weights of the diaphragm seals are given in the tables. For weight of housing, see → 45
- The following drawings are schematic diagrams. In other words, the dimensions of a diaphragm seal supplied may deviate from the dimensions given in this document.
- Observe the information in the "Planning instructions for diaphragm seal systems" ordering feature → 107
- For further information please contact your local Endress+Hauser Sales Center.

Diaphragm seal cell structure (Pancake)


Flange					Diaphragm seal		Approval ¹⁾	Option ²⁾
Material	Nominal diameter	Nominal pressure ³⁾	D	b	d_M	Weight		
			[mm]	[mm]	[mm]	[kg (lb)]		
AISI 316L	DN 50	PN 16-400	102	20	59	1.3 (2.87)	-	UJ
	DN 80	PN 16-400	138	20	89	2.3 (5.07)	-	UJJ
	DN 100	PN 16-400	162	20	89	3.1 (6.84)	-	UKJ
	[in]	[lb/sq.in]	[in (mm)]	[in (mm)]	[in (mm)]			
	2	150-2500	3.89 (99)	0.79 (20)	2.32 (59)	1.3 (2.87)	CRN	ULJ
	3	150-2500	5.00 (127)	0.79 (20)	3.50 (89)	2.3 (5.07)	CRN	UMJ
	4	150-2500	6.22 (158)	0.79 (20)	3.50 (89)	3.1 (6.84)	CRN	URJ

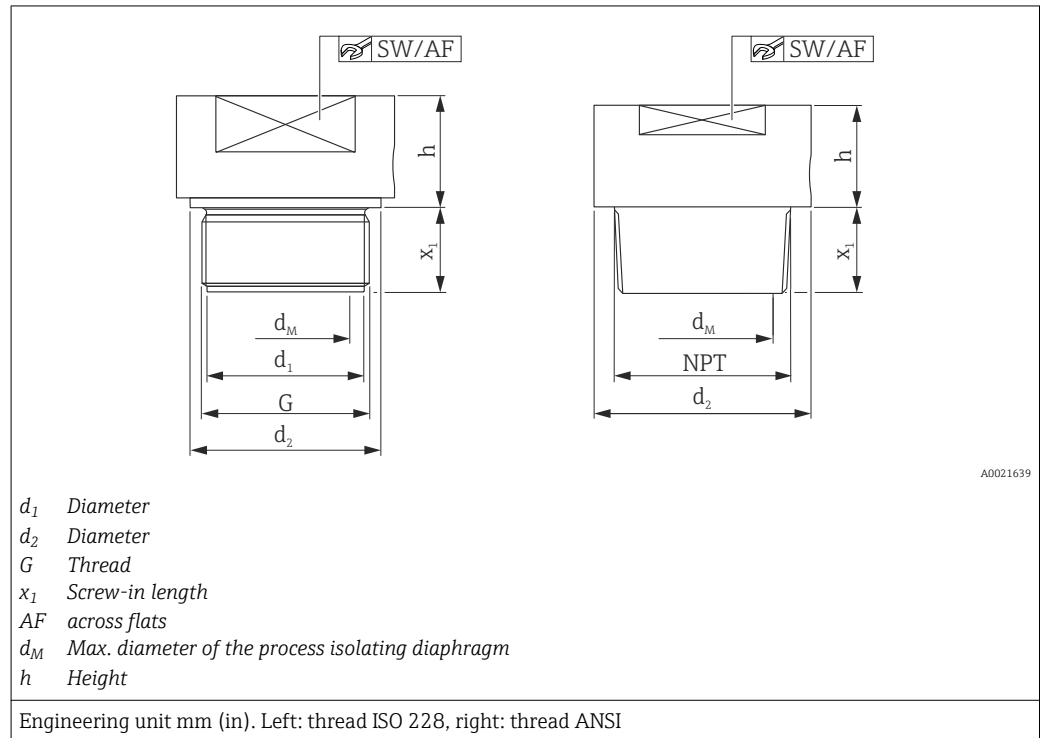
1) CSA approval: Product Configurator, order code for "Approval"

2) Product Configurator, "Process connection" section

3) The specified nominal pressure applies to the diaphragm seal. The maximum pressure for the measuring device is dependent on the lowest-rated element, with regard to pressure, of the selected components → 44.

PMP55: process connections with flush-mounted process isolating diaphragm

Thread ISO 228 and ANSI



A0021639

Threaded connection							Diaphragm seal			Approval ¹⁾	Option ²⁾
Material	G	Nominal pressure	d_1	d_2	x_1	SW/AF	d_M	h	Weight		
		PN	[mm]	[mm]	[mm]		[mm]	[mm]	[kg (lb)]		
AISI 316L	G 1" A	400	30	39	21 ³⁾	41	30	19	0.4 (0.88)	-	GTJ
Alloy C276									0.5 (1.1)	-	GTC
AISI 316L	G 1 ½" A	400	44	55	30	50	42	20	0.9 (1.98)	-	GVJ
Alloy C276									1.0 (2.21)	-	GVC
AISI 316L	G 2"	400	56	68	30	65	50	20	1.9 (4.19)	-	GWJ
Alloy C276									2.1 (4.63)	-	GWC
AISI 316L	1" MNPT	400	-	45	28	41	24	17	0.6 (1.32)	CRN	U5J
Alloy C276									0.7 (1.54)	CRN	U5C
AISI 316L	1 ½" MNPT	400	-	60	30	41	36	20	0.9 (1.98)	CRN	U7J
Alloy C276									1.0 (2.21)	CRN	U7C
AISI 316L	2" MNPT	400	-	78	30	65	38	35	1.8 (3.97)	CRN	U8J
Alloy C276									2.0 (4.41)	CRN	U8C

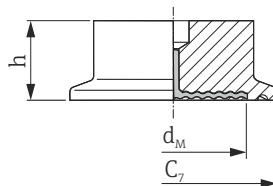
1) CSA approval: Product Configurator, order code for "Approval"

2) Product Configurator, order code for "Process connection"

3) 28 mm (1.1 in) in conjunction with high-temperature oil

**PMP55: process connections
with flush-mounted process
isolating diaphragm**

Tri-Clamp ISO 2852



A0021644

C_7 Diameter

h Height

d_M Max. diameter of the process isolating diaphragm

Engineering unit mm (in)

Material ¹⁾	Nominal diameter ISO 2852	Nominal diameter DIN 32676	Nominal diameter [in]	C_7 [mm]	d_M		h [mm]	Weight [kg (lb)]	Approval ²⁾	Option ³⁾
					Standard	With TempC diaphragm				
					[mm]	[mm]				
AISI 316L	ND 25 / 33.7	DN 25	1	50.5	24	-	37	0.32 (0.71)	EHEDG, 3A, CRN, ASME-BPE	TCJ
	ND 38	DN 40	1 ½	50.5	36	36	30	1 (2.21)	EHEDG, 3A, CRN, ASME-BPE	TJJ ^{4) 5)}
	ND 51 / 40	DN 50	2	64	48	41	30	1.1 (2.43)	EHEDG, 3A, CRN, ASME-BPE	TDJ ^{4) 5)}
	ND 63.5	-	2 ½	77.5	61	61	30	0.7 (1.54)	EHEDG, 3A, ASME-BPE	TEJ ⁶⁾
	ND 76.1	-	3	91	73	61	30	1.2 (2.65)	EHEDG, 3A, CRN, ASME-BPE	TFJ ⁵⁾

1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard. Lower surface roughness available on request

2) CSA approval: Product Configurator, order code for "Approval"

3) Product Configurator, order code for "Process connection"

4) Process connections without TempC diaphragm: diaphragm seal versions optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a < 0.38 \mu\text{m}$ (15 μin), electropolished; ordering information: Product Configurator "Service" ordering feature, option HK

5) Alternatively available with TempC diaphragm.

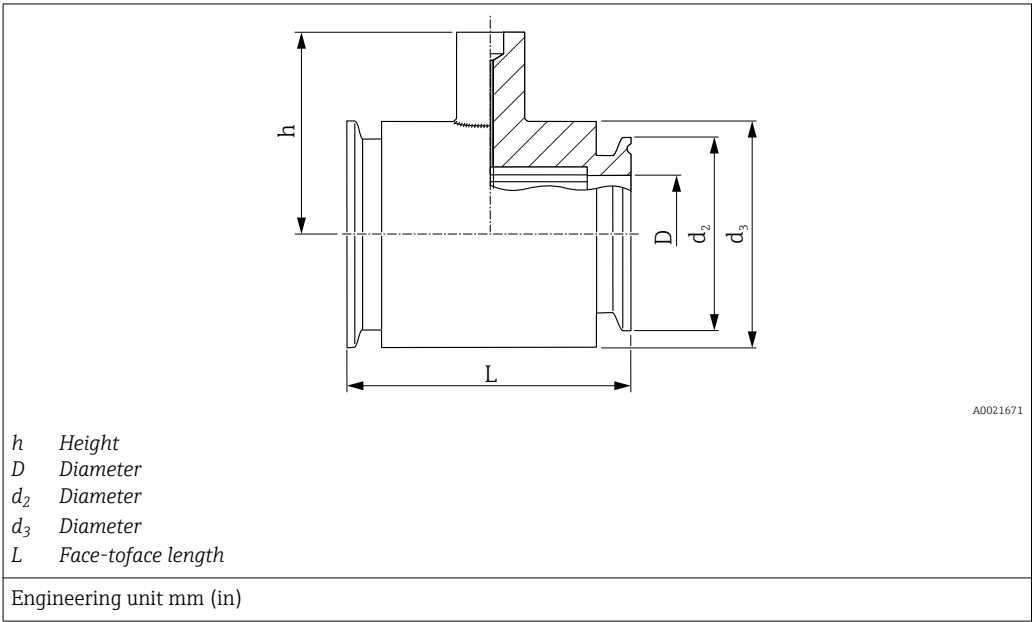
6) With TempC diaphragm



PN max. = 40 bar (580 psi). The maximum PN depends on the used clamp.

**PMP55: process connections
with flush-mounted process
isolating diaphragm**

Pipe diaphragm seal Tri-Clamp ISO 2852

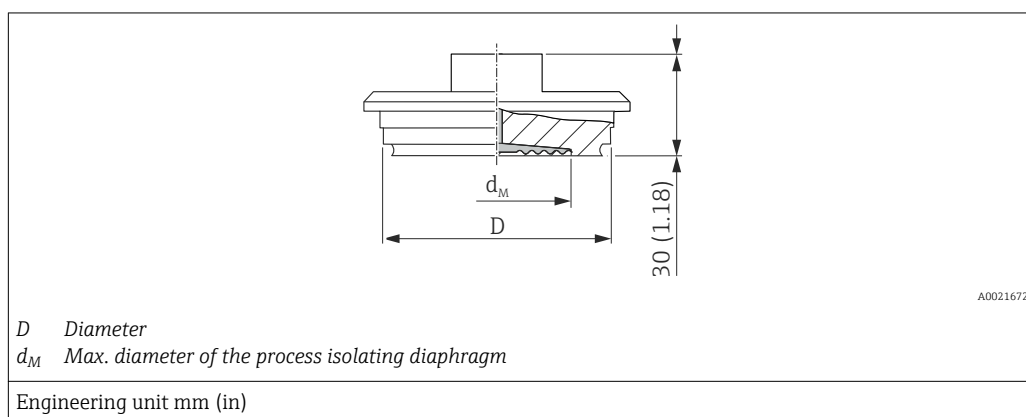


Material ¹⁾	Nominal diameter ISO 2852	Nominal diameter [in]	Nominal pressure	D [mm]	d ₂ [mm]	d ₃ [mm]	h [mm]	L [mm]	Weight [kg (lb)]	Approval ²⁾	Option ³⁾
AISI 316L	DN 10	3/4	PN 40	10.5	25	34	41.5	140	0.6 (1.32)	3A, CRN	SIJ
	DN 25	1	PN 40	22.5	50.5	54	67	126	1.7 (3.75)	3A, CRN	SBJ
	DN 38	1 1/2	PN 40	35.5	50.5	69	67	126	1.0 (2.21)	3A, CRN	SCJ ⁴⁾
	DN 51	2	PN 40	48.6	64	78	79	100	1.7 (3.75)	3A, CRN	SDJ ⁴⁾

- 1) Surface roughness of the wetted surfaces $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$) as standard.
- 2) CSA approval: Product Configurator, order code for "Approval"
- 3) Product Configurator, order code for "Process connection"
- 4) incl. 3.1 and pressure test according to Pressure Equipment Directive, Category II

PMP55: hygienic process connections with flushmounted process isolating diaphragm

Varivent for pipes



Material ¹⁾	Designation	Nominal pressure	D	d _M		Weight	Approval	Option ²⁾
				Standard	With TempC diaphragm			
				[mm]	[mm]			
AISI 316L	Type F for tubes DN 25 - DN 32	PN 40	50	34	36	0.4 (0.88)	EHEDG, 3A, ASME-BPE	TQJ ³⁾
AISI 316L	Type N for tubes DN 40 - DN 162	PN 40	68	58	61	0.8 (1.76)	EHEDG, 3A, ASME-BPE	TRJ ^{4) 3)}

1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.

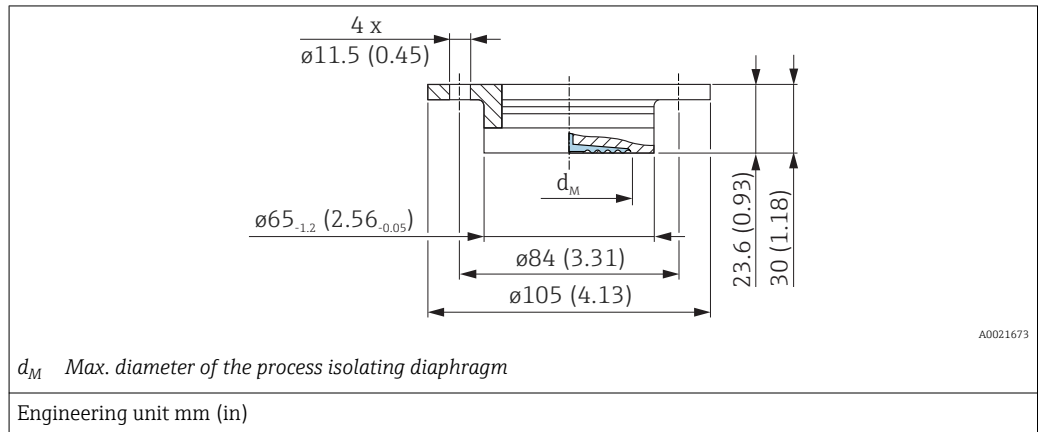
2) Product Configurator, order code for "Process connection"

3) Alternatively available with TempC diaphragm.

4) Diaphragm seal versions optionally in conformity with ASME-BPE for use in biochemical processes, wetted surfaces $R_a < 0.38 \mu\text{m}$ (15 μin), electropolished; ordering information: Product Configurator "Service" ordering feature, option HK. In combination with the "Electropolished" option, the wetted parts of the Varivent connection type N are made of 316L (1.4435).

PMP55: hygienic process connections with flushmounted process isolating diaphragm

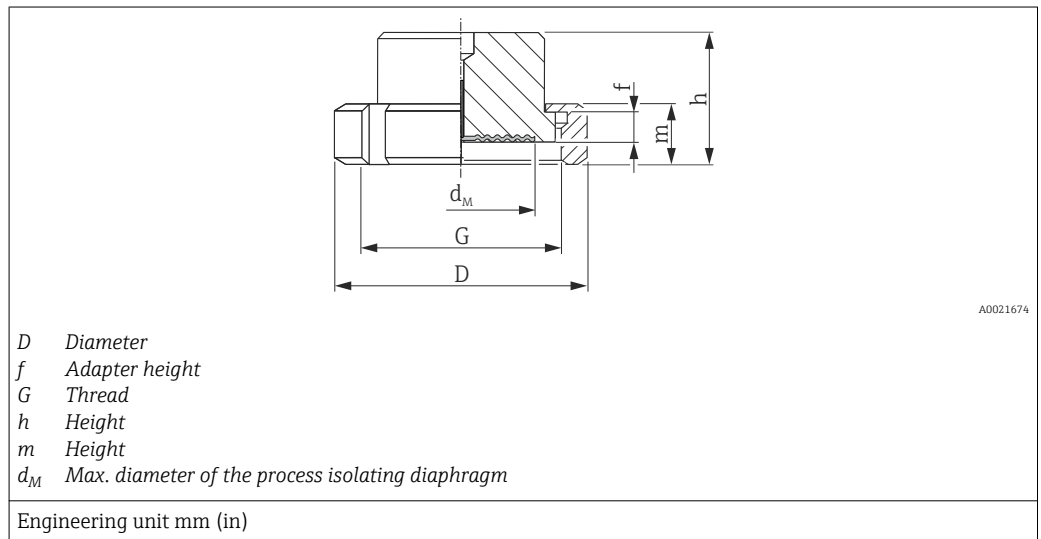
DRD DN50 (65 mm)



Material ¹⁾	Nominal pressure	d_M		Weight	Option ²⁾
		Standard	With TempC diaphragm		
		[mm]	[mm]	[kg (lb)]	
AISI 316L	PN 25	50	48	0.75 (1.65)	TIJ ³⁾

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection"
- 3) Alternatively available with TempC diaphragm.

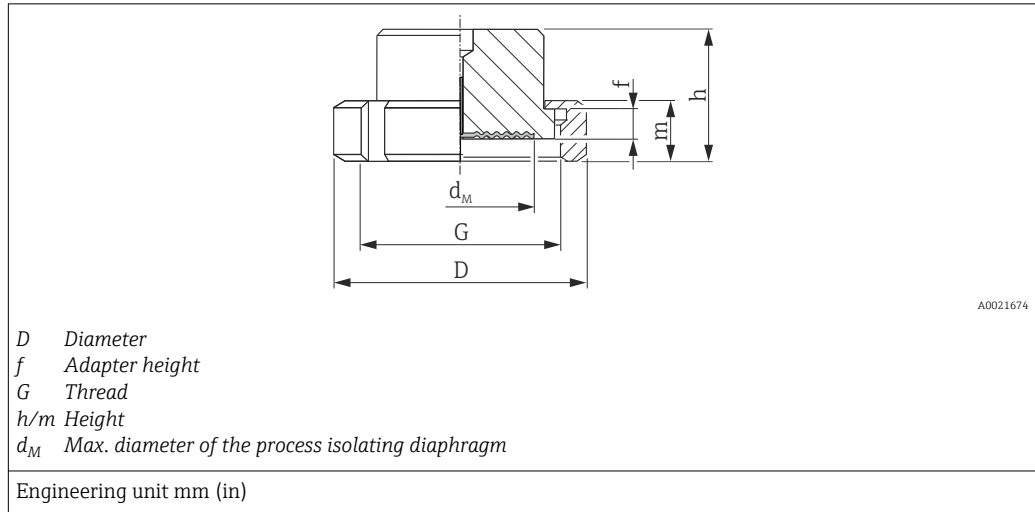
SMS nozzles with coupling nut



Material ¹⁾	Nominal diameter	Nominal pressure	D	f	G	m	h	d_M	Weight	Approval	Option ²⁾
			[mm]	[mm]		[mm]	[mm]	[mm]			
AISI 316L	1	PN 25	54	3.5	Rd 40 – 1/6	20	42.5	24	0.25 (0.55)	3A, EHEDG, ASME-BPE	T6J
	1 ½	PN 25	74	4	Rd 60 – 1/6	25	57	36	0.65 (1.43)		T7J ³⁾
	2	PN 25	84	4	Rd 70 – 1/6	26	62	48	1.05 (2.32)		TXJ ³⁾

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection"
- 3) Alternatively available with TempC diaphragm.

APV-RJT nozzles with coupling nut

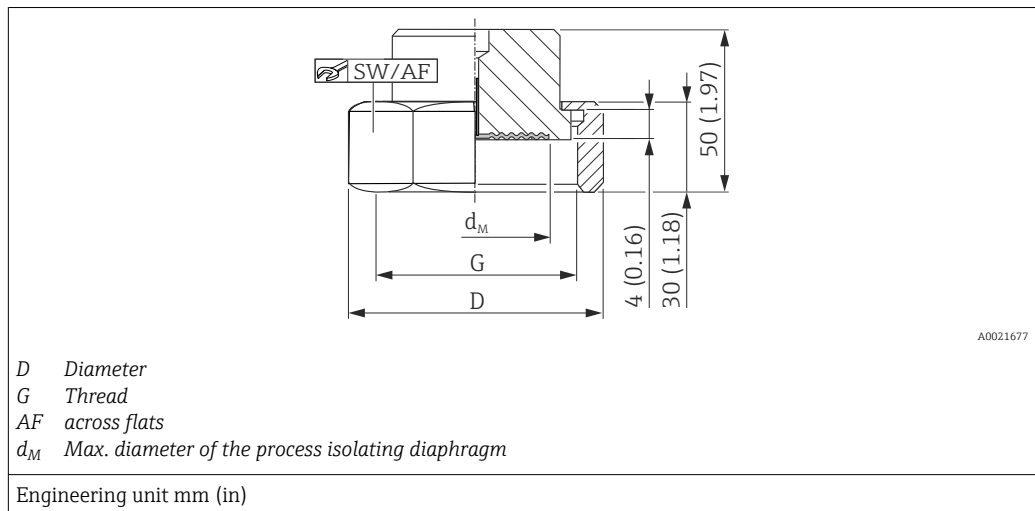


Material ¹⁾	Nominal diameter	Nominal pressure	D	f	G	m	h	d _M	Weight	Option ²⁾
	[in]	[bar]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lb)]	
AISI 316L	1	PN 40	77	6.5	1 13/16 – 1/8"	22	42.6	21	0.45 (0.99)	T0J
	1 ½	PN 40	72	6.4	2 5/16 – 1/8"	22	42.6	28	0.75 (1.65)	T1J
	2	PN 40	86	6.4	2 7/8 – 1/8"	22	42.6	38	1.2 (2.65)	T2J

1) Surface roughness of the wetted surfaces R_a < 0.8 µm (31.5 µin) as standard.

2) Product Configurator, order code for "Process connection"

APV-ISS nozzles with coupling nut

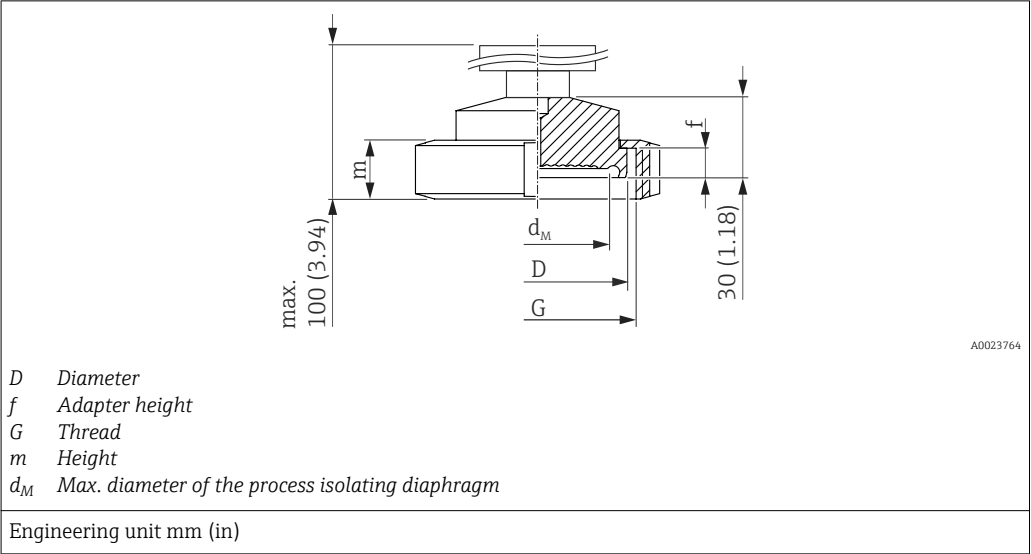


Material ¹⁾	Nominal diameter	Nominal pressure	D	G	SW/AF	d _M	Weight	Option ²⁾
	[in]	[bar]	[mm]			[mm]	[kg (lb)]	
AISI 316L	1	PN 40	54.1	1 ½" – 1/8"	46.8	24	0.4 (0.88)	T3J
	1 ½	PN 40	72	2" – 1/8"	62	34	0.6 (1.32)	T4J
	2	PN 40	89	2 ½" – 1/8"	77	45	1.1 (2.43)	T5J

1) Surface roughness of the wetted surfaces R_a < 0.8 µm (31.5 µin) as standard.

2) Product Configurator, order code for "Process connection"

Aseptic screwed union, nozzle, DIN 11864-1 Form A; pipe DIN 11866-A

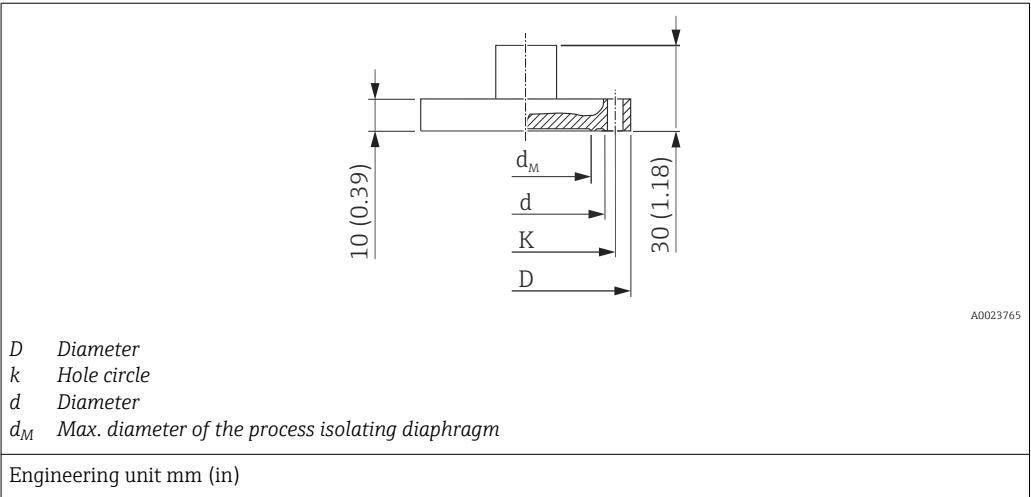


Material ¹⁾	Taper adapter				Slotted nut		Diaphragm seal		Approval	Option ²⁾
	Nominal diameter	Nominal pressure	D	f	G	m	d _M	Weight		
	[in]	[bar]	[mm]	[mm]			[mm]	[kg (lb)]		
AISI 316L	DN 40	PN 40	55	10	Rd 65 x 1/6"	21	36	0.63 (1.39)	EHEDG, 3A, ASME-BPE	NCJ
	DN 50	PN 25	67	11	Rd 78 x 1/6"	22	48	0.92 (2.03)	EHEDG, 3A, ASME-BPE	NDJ

1) Surface roughness of the wetted surfaces $R_a < 0.8 \mu\text{m}$ (31.5 μin) as standard.

2) Product Configurator, "Process connection" section

Aseptic flange connection, DIN 11864-2 Form A; pipe DIN 11866-1

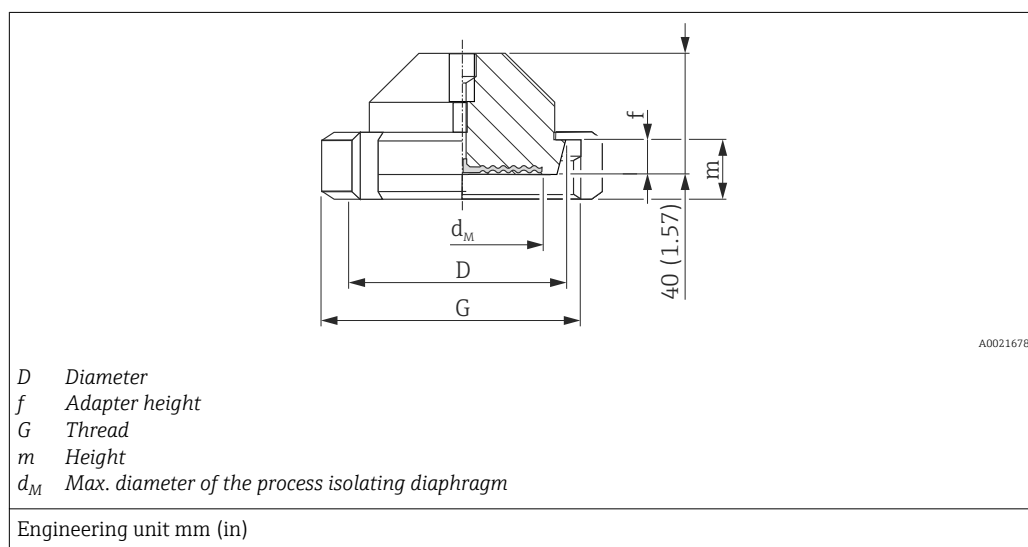


Material ¹⁾	Collar flange					Diaphragm seal		Approval	Option ²⁾
	Nominal diameter	Nominal pressure	K	d	D	d _M	Weight		
	[in]	[bar]	[mm]	[mm]	[mm]	[mm]	[kg (lb)]		
AISI 316L	DN 32	PN 16	59	47.7	76	25	1.5 (3.31)	EHEDG, 3A, ASME-BPE	NFJ
	DN 40		65	53.7	82	35	1.7 (3.75)	EHEDG, 3A, ASME-BPE	NXJ
	DN 50		77	65.7	94	45	2.2 (4.85)	EHEDG, 3A, ASME-BPE	NZJ

1) Surface roughness of the wetted surfaces $R_a < 0.8 \mu\text{m}$ (31.5 μin) as standard.

2) Product Configurator, "Process connection" section

Taper adapter with coupling nut, DIN 11851



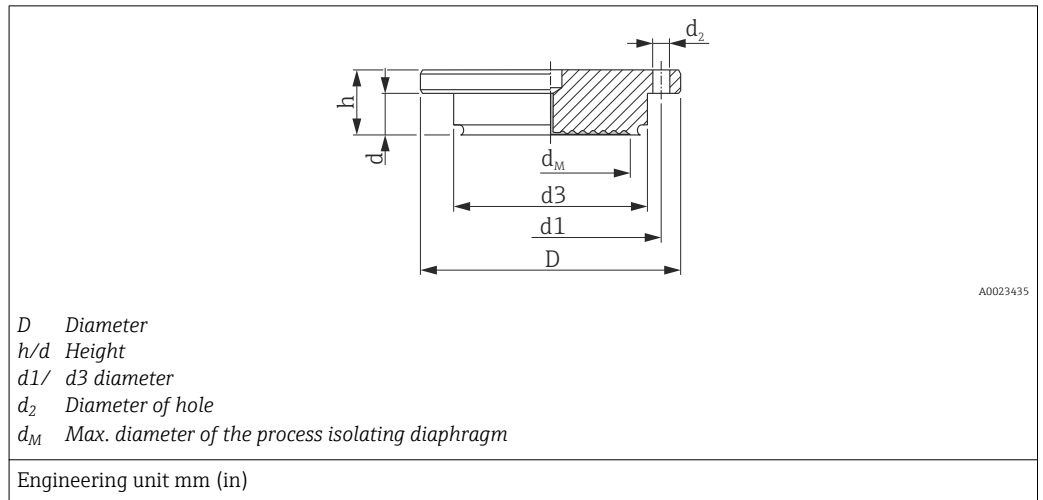
Material ¹⁾	Taper adapter				Slotted nut		Diaphragm seal			Approval	Option ²⁾
	Nominal diameter	Nominal pressure	D	f	G	m	d _M		Weight		
		PN					Standard	With TempC diaphragm			
	[in]	[bar]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lb)]		
AISI 316L	DN 32	PN 40	50	10	Rd 58 x 1/6"	21	32	28	0.45 (0.99)	EHEDG, 3A, ASME-BPE	MIJ ³⁾
	DN 40	PN 40	56	10	Rd 65 x 1/6"	21	38	36	0.45 (0.99)	EHEDG, 3A, ASME-BPE	MZJ ³⁾
	DN 50	PN 25	68.5	11	Rd 78 x 1/6"	19	52	48	1.1 (2.43)	EHEDG, 3A, ASME-BPE	MRJ ³⁾
	DN 65	PN 25	86	12	Rd 95 x 1/6"	21	66	61	2.0 (4.41)	EHEDG, 3A, ASME-BPE	MSJ ³⁾
	DN 80	PN 25	100	12	Rd 110 x 1/4"	26	81	61	2.55 (5.62)	EHEDG, 3A, ASME-BPE	MTJ ³⁾

1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.

2) Product Configurator, "Process connection" section

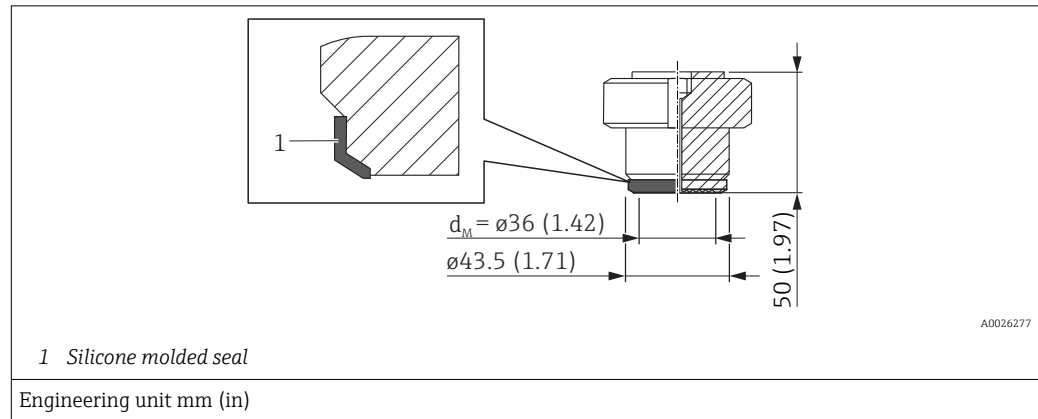
3) Alternatively available with TempC diaphragm.

NEUMO BioControl



Material ¹⁾	NEUMO BioControl Process temperature range: -10 to +200 °C (+14 to +392 °F)								Diaphragm seal			Approval	Option ²⁾
									d _M		Weight		
	Nominal diameter	Nominal pressure	D	d	d ₂	d ₃	d ₁	h	Standard	With TempC diaphragm			
		[bar]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]		
AISI 316L	DN 50	PN 16	90	17	4 x Ø 9	50	70	27	40	36	1.1 (2.43)	3A, ASME-BPE	S4J ³⁾
	DN 80	PN 16	140	25	4 x Ø 11	87.4	115	37	61	61	2.6 (5.73)	EHEDG, 3A, ASME-BPE	S6J ⁴⁾

- 1) Surface roughness of the wetted surfaces $R_a < 0.76 \mu\text{m}$ (29.9 μin) as standard.
- 2) Product Configurator, order code for "Process connection"
- 3) Alternatively available with TempC diaphragm.
- 4) With TempC diaphragm

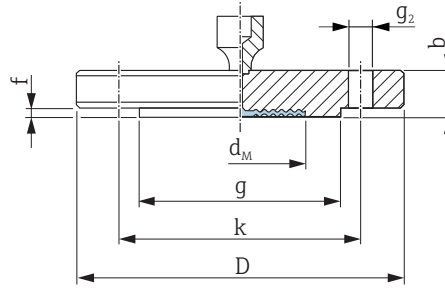
Universal adapter

Designation	Nominal pressure	Material ¹⁾	Weight	Approval ²⁾	Option ³⁾
			[kg (lb)]		
Universal adapter with silicone molded seal (spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI	PN 10	AISI 316L (1.4435)	0.8 (1.76)	EHEDG, 3A, ASME-BPE	UPJ ^{4) 5)}

- 1) The roughness of the surface in contact with the medium is $R_a < 0.76 \mu\text{m}$ ($29.9 \mu\text{in}$). Optionally available as an ASME-BPE-compliant version for use in biochemical processes, surfaces in contact with medium $R_a < 0.38 \mu\text{m}$ ($15 \mu\text{in}$) electropolished, ordering information: Product Configurator, order code for "Service", option "HK"
- 2) EHEDG or 3A approval only with approved process connection.
- 3) Product Configurator, "Process connection" section
- 4) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (1.4301) or in AISI 304L (1.4307).
- 5) Alternatively available with TempC diaphragm.

**PMP55: process connections
with flush-mounted process
isolating diaphragm**

**EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527 and DIN 2501-1
A0021680**



A0021680

D Diameter of flange
b Thickness
g Raised face
f Raised face
k Hole circle
g₂ Diameter of hole
d_M Max. diameter of the process isolating diaphragm

Engineering unit mm

Flange ^{1) 2) 3)}							Boltholes			Diaphragm seal		Option ⁴⁾
Nominal diameter	Nominal pressure	Shape ⁵⁾	D	b	g	f	Quantity	g ₂	k	d _M	Weight	
			[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lb)]	
DN 25	10-40	B1 (D)	115	18	68	3	4	14	85	32	2.1 (4.63)	CNJ ⁶⁾
DN 25	63-160	B2 (E)	140	24	68	2	4	18	100	28	2.5 (5.51)	QIJ
DN 25	250	B2 (E)	150	28	68	2	4	22	105	28	3.7 (8.16)	QJJ
DN 25	400	B2 (E)	180	38	68	2	4	26	130	28	7.0 (15.44)	QSJ
DN 32	10-40	B1 (D)	140	18	77	2.6	4	18	100	34	1.9 (4.19)	CPJ
DN 40	10-40	B1 (D)	150	18	87	2.6	4	18	110	48	2.2 (4.85)	CQJ
DN 50	10-40	B1 (D)	165	20	102	3	4	18	125	59	3.0 (6.62)	CXJ ⁶⁾
DN 50	63	B2 (E)	180	26	102	3	4	22	135	59	4.6 (10.14)	PDJ
DN 50	100-160	B2 (E)	195	30	102	3	4	26	145	59	6.2 (13.67)	QOJ
DN 50	250	B2 (E)	200	38	102	3	8	26	150	59	7.7 (16.98)	QMJ
DN 50	400	B2 (E)	235	52	102	3	8	30	180	59	14.7 (32.41)	QVJ
DN 80	10-40	B1 (D)	200	24	138	3.5	8	18	160	89	5.3 (11.69)	CZJ ⁶⁾
DN 80	100	B2 (E)	230	32	138	4	8	24	180	89	8.9 (19.62)	PPJ
DN 100	100	B2 (E)	265	36	175	5	8	30	210	89	13.7 (30.21)	PQJ

1) Material: AISI 316L

2) The roughness of the surface in contact with the medium, including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium>gold or PTFE is $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$). Lower surface roughness on request.

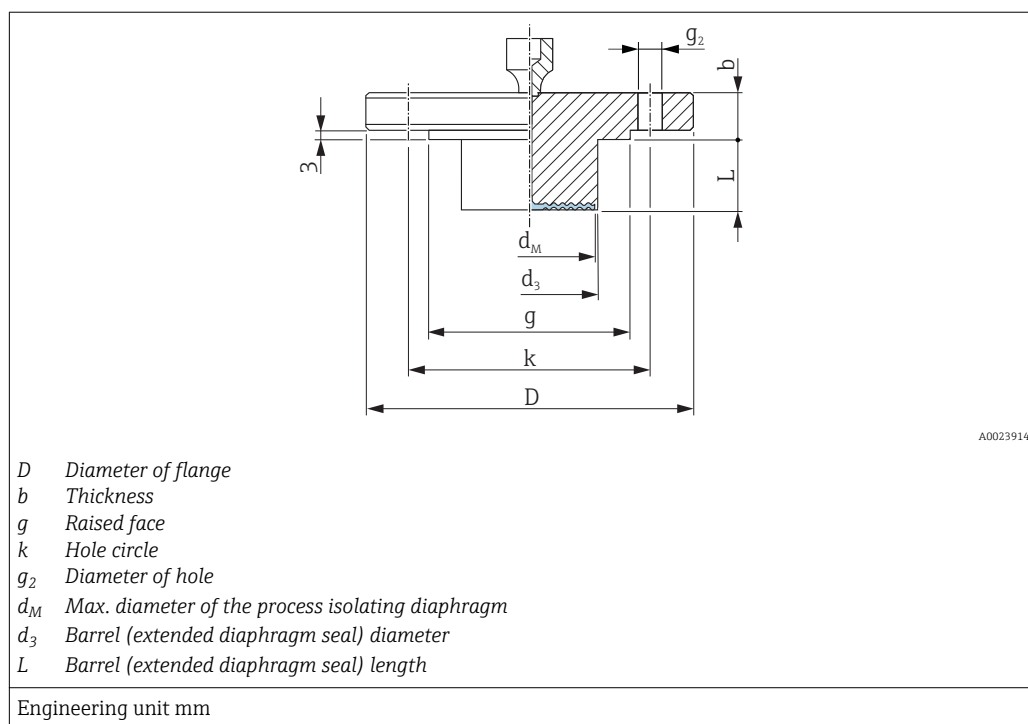
3) The flange raised face is made of the same material as the process isolating diaphragm.

4) Product Configurator, "Process connection" section

5) Description as per DIN 2527 provided in brackets

6) Alternatively available with TempC membrane. Diameter of process isolating diaphragm modified in TempC version: DN25: 28 mm; DN50: 61 mm.

EN/DIN flanges with barrel (extended diaphragm seal), connection dimensions as per EN 1092- 1/DIN 2527 and DIN 2501-1



Flange ^{1) 2)}						Boltholes			Diaphragm seal		Option ³⁾
Nominal diameter	Nominal pressure	Shape ⁴⁾	D	b	g	Quantity	g ₂	k	d _M	Weight	
			[mm]	[mm]	[mm]		[mm]	[mm]	d _M	[kg (lb)]	
DN 50	PN 10-40	B1 (D)	165	20	102	4	18	125	47	⁵⁾	FDJ ⁵⁾
DN 80	PN 10-40	B1 (D)	200	24	138	8	18	160	72	⁵⁾	FEJ ⁵⁾

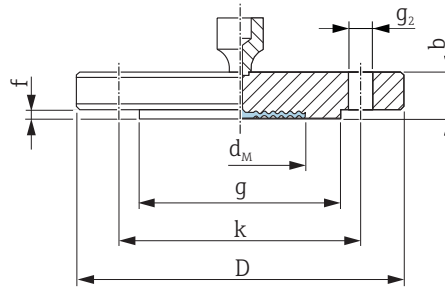
- 1) Material: AISI 316L
 2) In the case of process isolating diaphragms made of Alloy C276, Monel or tantalum, the raised face of the flange and the barrel pipe are made of 316L
 3) Product Configurator, "Process connection" section
 4) Description as per DIN 2527 provided in brackets
 5) Available with 50 mm (1.97 in), 100 mm (3.94 in) and 200 mm (7.87 in) barrel, (extended diaphragm seal), for barrel (extended diaphragm seal) diameter and weight see the following table

Option ¹⁾	Nominal diameter	Nominal pressure	(L)	d ₃	Weight
			[mm]	[mm]	[kg (lb)]
FDJ	DN 50	PN 10-40	50 / 100 / 200	48.3	3.2 (7.1) / 3.8 (8.4) / 4.4 (9.7)
FEJ	DN 80	PN 10-40	50 / 100 / 200	76	6.2 (13.7) / 6.7 (14.8) / 7.8 (17.2)

- 1) Product Configurator, order code for "Process connection"

**PMP55: process connections
with flush-mounted process
isolating diaphragm**

ASME flanges, connection dimensions as per ASME B 16.5, raised face RF



A0023913

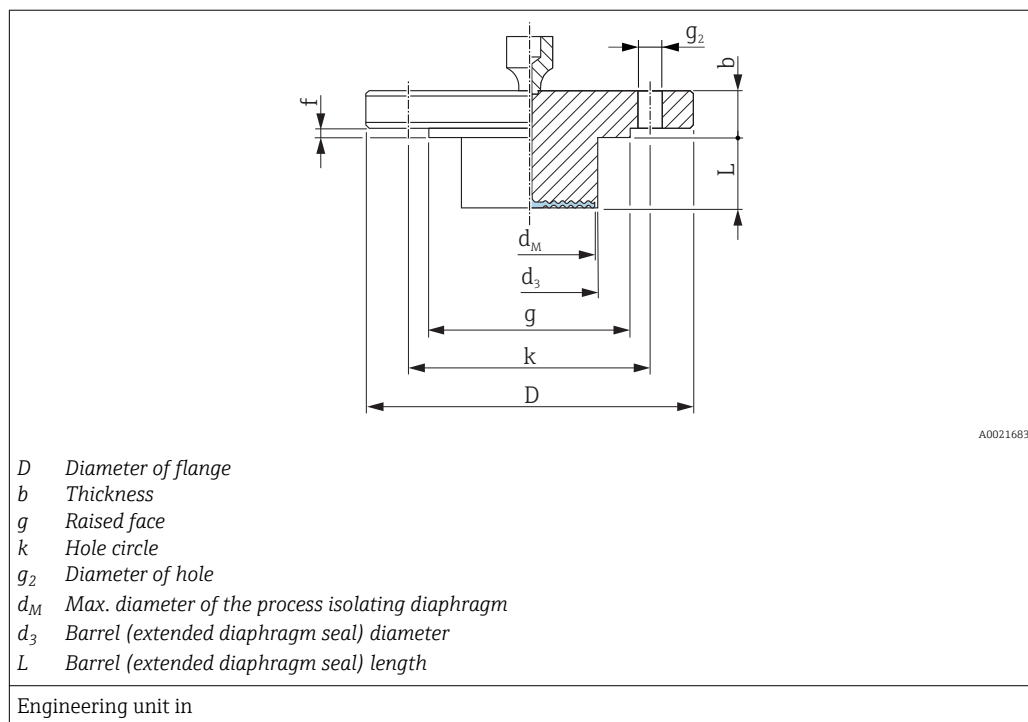
D Diameter of flange
b Thickness
g Raised face
f Raised face
k Hole circle
g₂ Diameter of hole
d_M Max. diaphragm diameter

Engineering unit in

Flange ^{1) 2) 3)}						Boltholes			Diaphragm seal		Approval ⁴⁾	Option ⁵⁾
Nominal diameter	Class	D	b	g	f	Quantity	g ₂	k	d _M	Weight		
[in]	[lb./sq.in]	[in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lb)]		
1	150	4.25	0.56	2	0.08	4	0.62	3.12	1.26	1.2 (2.65)	CRN ⁶⁾	ACJ ⁷⁾
1	300	4.88	0.69	2	0.08	4	0.75	3.5	1.26	1.3 (2.87)	CRN	ANJ ⁷⁾
1	400/600	4.88	0.69	2	0.25	4	0.75	3.5	1.26	1.4 (3.09)	CRN	A0J
1	900/1500	5.88	1.12	2	0.25	4	1	4	1.26	3.2 (7.06)	CRN	A2J
1	2500	6.25	1.38	2	0.25	4	1	4.25	1.26	4.6 (10.14)	CRN	A4J
1 ½	150	5	0.69	2.88	0.06	4	0.62	3.88	1.89	1.5 (3.31)	CRN	AEJ
1 ½	300	6.12	0.81	2.88	0.06	4	0.88	4.5	1.89	2.6 (5.73)	CRN	AQJ
2	150	6	0.75	3.62	0.06	4	0.75	4.75	2.32	2.2 (4.85)	CRN	AFJ ⁷⁾
2	300	6.5	0.88	3.62	0.06	8	0.75	5	2.32	3.4 (7.5)	CRN	ARJ ⁷⁾
2	400/600	6.5	1	3.62	0.25	8	0.75	5	2.32	4.3 (9.48)	CRN	A1J
2	900/1500	8.5	1.5	3.62	0.25	8	1	6.5	2.32	10.3 (22.71)	CRN	A3J
2	2500	9.25	2	3.62	0.25	8	1.12	6.75	2.32	15.8 (34.84)	CRN	A5J
3	150	7.5	0.94	5	0.06	4	0.75	6	3.5	5.1 (11.25)	CRN	AGJ ⁷⁾
3	300	8.25	1.12	5	0.06	8	0.75	6	3.5	7.0 (15.44)	CRN	ASJ ⁷⁾
4	150	9	0.94	6.19	0.06	8	0.75	7.5	3.5	7.2 (15.88)	CRN	AHJ
4	300	10	1.25	6.19	0.06	8	0.88	7.88	3.5	11.7 (25.8)	CRN	ATJ

- 1) Material AISI 316/316L: Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium>gold or PTFE is $R_a < 0.8 \mu\text{m}$ ($31.5 \mu\text{in}$). Lower surface roughness on request.
- 3) The flange raised face is made of the same material as the process isolating diaphragm.
- 4) CSA approval: Product Configurator, order code for "Approval"
- 5) Product Configurator, order code for "Process connection"
- 6) CRN approval not for TempC membrane.
- 7) Alternatively available with TempC membrane. Diameter of process isolating diaphragm is modified in TempC version: nominal diameter 1": 1.1 in; 2": 2.40 in.

ASME flanges with barrel (extended diaphragm seal), connection dimensions as per ASME B 16.5, raised face RF



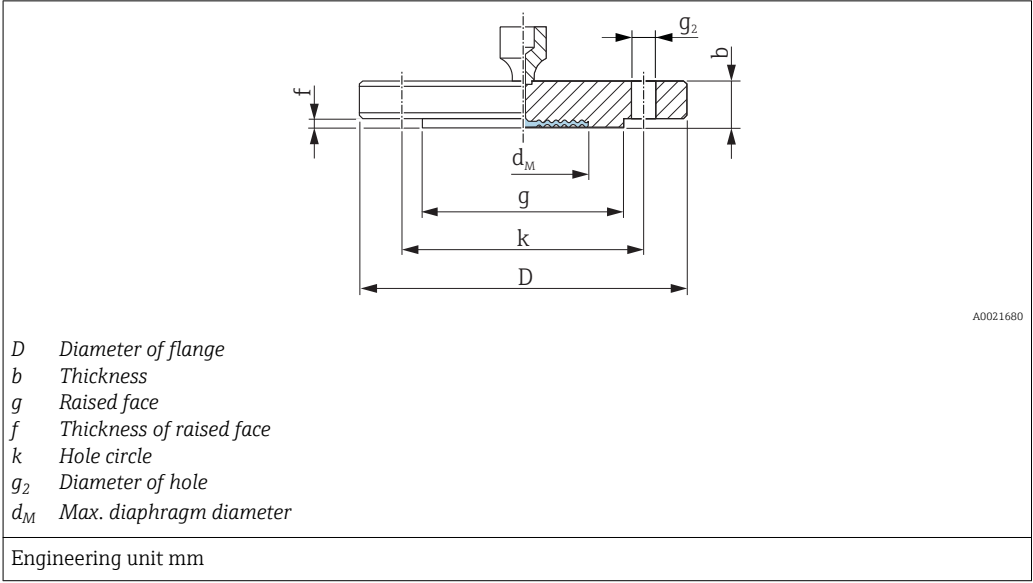
Flange ^{1) 2)}						Boltholes			Diaphragm seal		Approval ³⁾	Option ⁴⁾
Nominal diameter	Class	D	b	g	f	Quantity	<i>g₂</i>	<i>k</i>	<i>d_M</i>	Weight		
[in]	[lb./sq.in]	[in]	[in]	[in]	[in]		[in]	[in]	[in]	[kg (lb)]		
2	150	6	0.75	3.62	0.06	4	0.75	4.75	1.85	⁵⁾	CRN	FMJ ⁵⁾
3	150	7.5	0.94	5	0.06	4	0.75	6	2.83	⁵⁾	CRN	FNJ ⁵⁾
3	300	8.25	1.12	5	0.06	8	0.88	6.62	2.83	⁵⁾	CRN	FWJ ⁵⁾
4	150	9	0.94	6.19	0.06	8	0.75	7.5	3.5	⁵⁾	CRN	FOJ ⁵⁾
4	300	10	1.25	6.19	0.06	8	0.88	7.88	3.5	⁵⁾	CRN	FXJ ⁵⁾

- 1) Material: AISI 316/316L. Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)
2) In the case of process isolating diaphragms made of Alloy C276, Monel or tantalum, the raised face of the flange and the barrel pipe are made of 316L.
3) CSA approval: Product Configurator, "Approval" ordering feature
4) Product Configurator, "Process connection" section
5) Available with 2", 4", 6" and 8" barrel (extended diaphragm seal), for barrel (extended diaphragm seal) diameter and weight see the following table

Option ¹⁾	Nominal diameter	Class	(L)	<i>d₃</i>	Weight
	[in]	[lb./sq.in]	in (mm)	in (mm)	[kg (lb)]
FMJ	2	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	1.9 (48.3)	3.0 (6.6) / 3.4 (7.5) / 3.9 (8.6) / 4.4 (9.7)
FNJ	3	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	2.99 (76)	6.0 (13.2) / 6.6 (14.5) / 7.1 (15.7) / 7.8 (17.2)
FWJ	3	300	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	2.99 (76)	7.9 (17.4) / 8.5 (18.7) / 9.0 (19.9) / 9.6 (21.2)
FOJ	4	150	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	3.7 (94)	8.6 (19) / 9.9 (21.8) / 11.2 (24.7) / 12.4 (27.3)
FXJ	4	300	2 (50.8) / 4 (101.6) / 6 (152.4) / 8 (203.2)	3.7 (94)	13.1 (28.9) / 14.4 (31.6) / 15.7 (34.6) / 16.9 (37.3)

- 1) Product Configurator, order code for "Process connection"

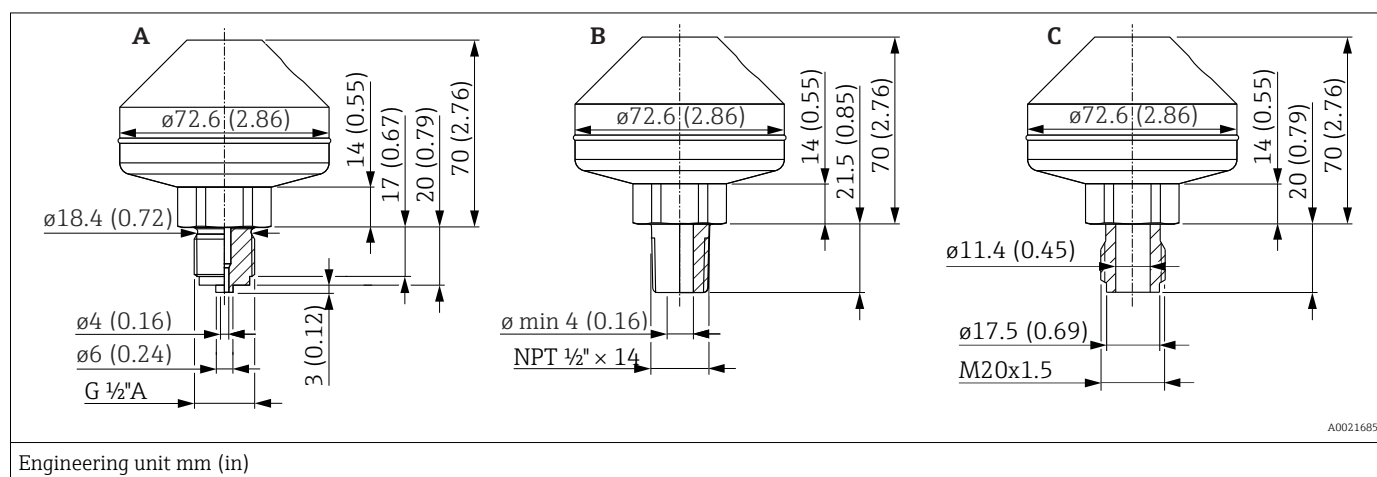
JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



Flange ^{1) 2) 3)}						Boltholes			Diaphragm seal		Option ⁴⁾
Nominal diameter	Nominal pressure	D	b	g	f	Quantity	g_2	k	d_M	Weight	
		[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]	[kg (lb)]	
25 A	10 K	125	14	67	1	4	19	90	32	1.5 (3.31)	KCJ
40 A	10 K	140	16	81	2	4	19	105	48	2.0 (4.41)	KEJ
50 A	10 K	155	16	96	2	4	19	120	59	2.3 (5.07)	KFJ
80 A	10 K	185	18	127	2	8	19	150	89	3.3 (7.28)	KGJ
100 A	10 K	210	18	151	2	8	19	175	89	4.4 (9.7)	KHJ

- 1) material: AISI 316L
- 2) The roughness of the surface in contact with the medium including the raised face of the flanges (all standards) made of Alloy C276, Monel, tantalum, rhodium>gold or PTFE is $R_a < 0.8 \mu m$ (31.5 μin). Lower surface roughness on request.
- 3) The flange raised face is made of the same material as the process isolating diaphragm.
- 4) Product Configurator, "Process connection" section

PMP55 process connections Welded separators

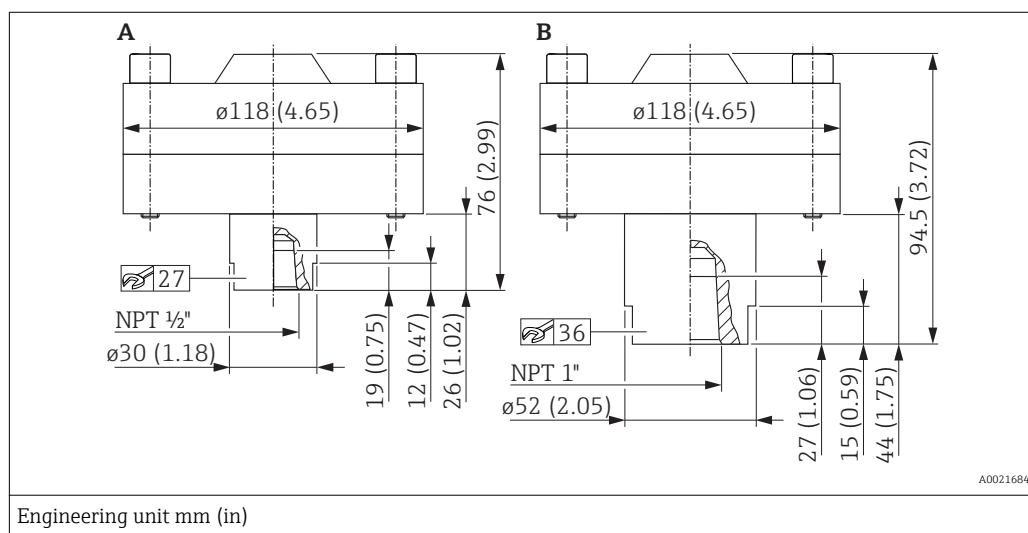


Position	Description	Material	Measuring range	Nominal pressure	Approval	Weight	Option ¹⁾
			[bar (psi)]			[kg (lb)]	
A	Welded, ISO 228 G ½ A EN837	AISI 316L	≤ 160 (2320)	PN 160	-	1.43 (3.15)	UBJ
B	Welded, ANSI ½ MNPT				CRN ²⁾		UCJ
C	Welded, Gewinde DIN13 M20x1.5				-		UFJ

1) Product Configurator, order code for "Process connection"

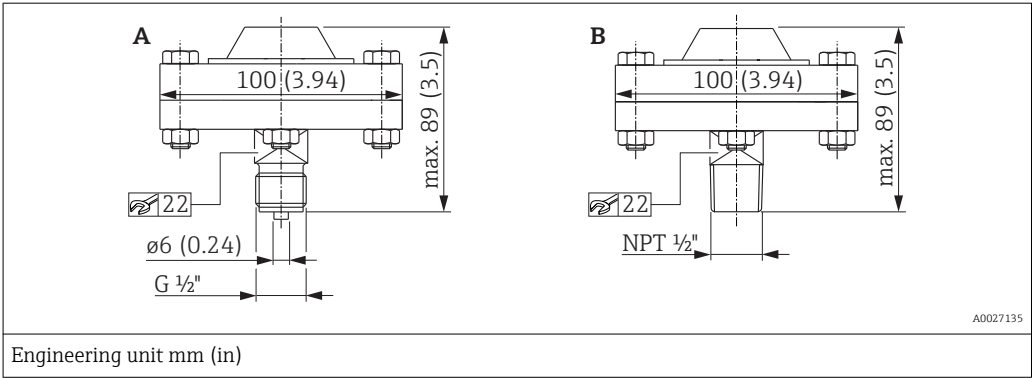
2) CSA approval: Product Configurator, order code for "Approval"

Threaded separators



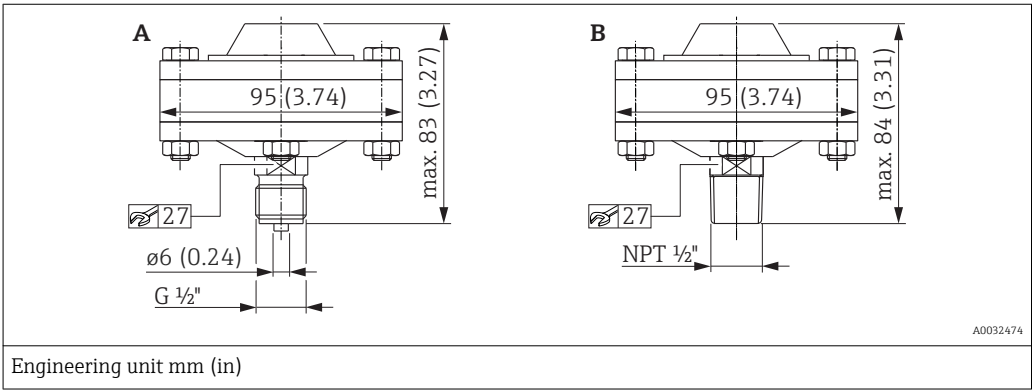
Position	Description	Material	Measuring range	Nominal pressure	Weight	Option ¹⁾
			[bar (psi)]		[kg (lb)]	
A	Threaded, ½" NPT with FKM Viton seal -20 to +200 °C (-4 to +392 °F)	AISI 316L screws made of A4	≤ 250 (3625)	PN 250	4.75 (10.47)	UGJ
B	Threaded, 1" NPT with FKM Viton seal -20 to +200 °C (-4 to +392 °F)				5.0 (11.03)	UHJ

1) Product Configurator, order code for "Process connection"



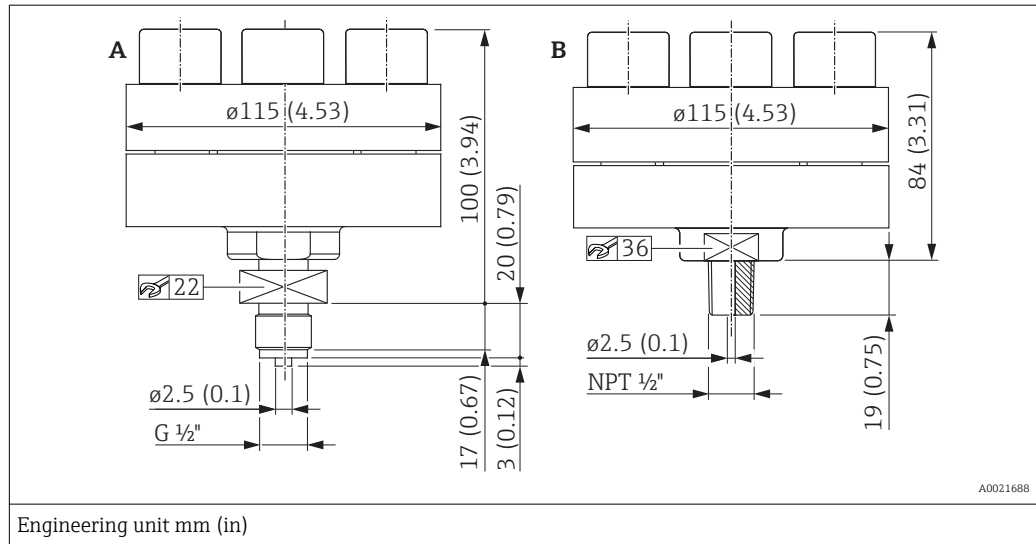
Position	Description	Material	Measuring range	Nominal pressure	Weight	Option ¹⁾
			[bar (psi)]		[kg (lb)]	
A	Threaded, ISO 228 G ½ A EN837 with PTFE seal –40 to +260 °C (–40 to +500 °F)	AISI 316L, screws made of A4	≤ 40 (580)	PN 40	1.43 (3.15)	UDJ ²⁾
B	Threaded, ANSI ½ MNPT with PTFE seal –40 to +260 °C (–40 to +500 °F)					UEJ ²⁾

- 1) Product Configurator, order code for "Process connection"
2) In combination with silicone oil, inert oil and plant oil.



Position	Description	Material	Measuring range	Nominal pressure	Weight	Option ¹⁾
			[bar (psi)]		[kg (lb)]	
A	Threaded, ISO 228 G ½ A EN837 with metal seal (silver-plated) –60 to +400 °C (–76 to +752 °F)	AISI 316L, screws made of A4	≤ 40 (580)	PN 40	1.38 (3.04)	UDJ ²⁾
B	Threaded, ANSI ½ MNPT with metal seal (silverplated) –60 to +400 °C (–76 to +752 °F)					UEJ ²⁾

- 1) Product Configurator, order code for "Process connection"
2) In combination with high-temperature oil.

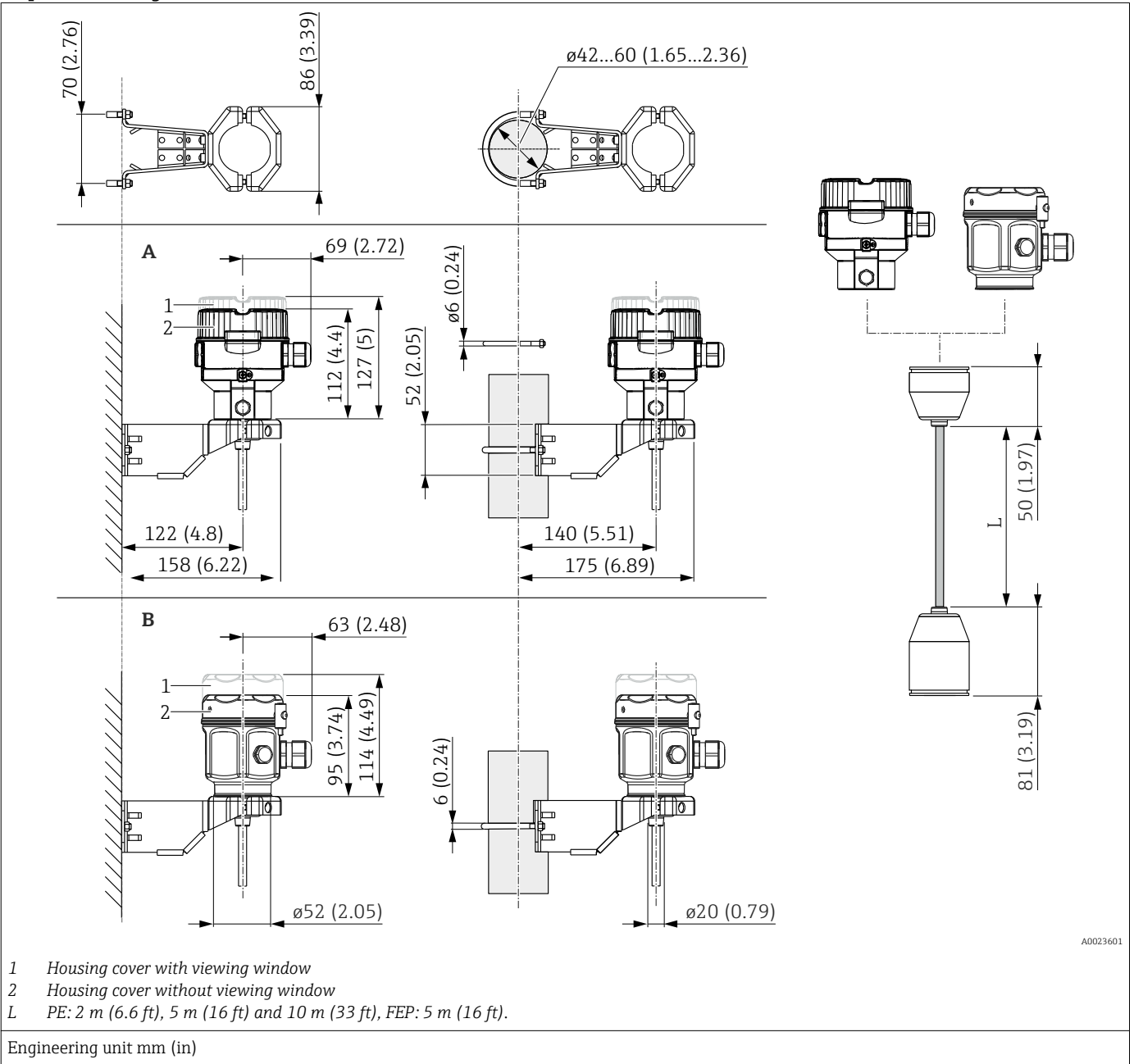


Position	Description	Material	Measuring range	Nominal pressure ¹⁾	Weight	Option ²⁾
			[bar (psi)]		[kg (lb)]	
A	Threaded, ISO 228 G 1/2 A EN837, with integrated seal lip -60 to +400 °C (-76 to +752 °F)	AISI 316L, screws made of A4	> 40 (580)	PN 400	4.75 (10.47)	UDJ
B	Threaded, ANSI 1/2 MNPT, with integrated seal lip -60 to +400 °C (-76 to +752 °F)					UEJ

1) This separator is assembled prior to delivery and must not be disassembled!

2) Product Configurator, order code for "Process connection"

Wall and pipe mounting with
"Separate housing" version



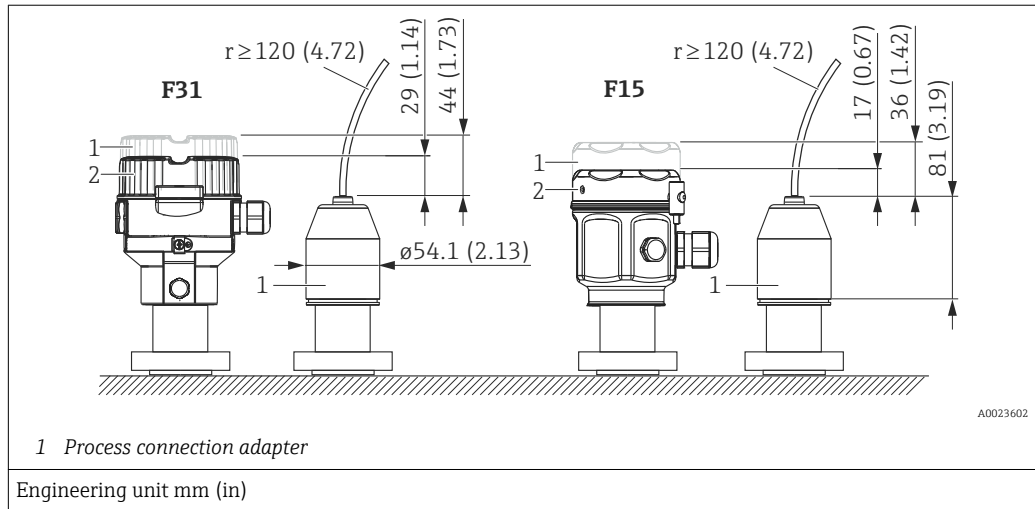
Item	Designation	Weight (kg (lb))		Option ¹⁾
		Housing (F31 or F15)	Mounting bracket	
A	Dimensions with F31 housing	→ 45	0,5 (1.10)	U
B	Dimensions with F15 housing			

1) Product Configurator, "Separate housing" ordering feature

Also available for order as a separate accessory: part number 71102216

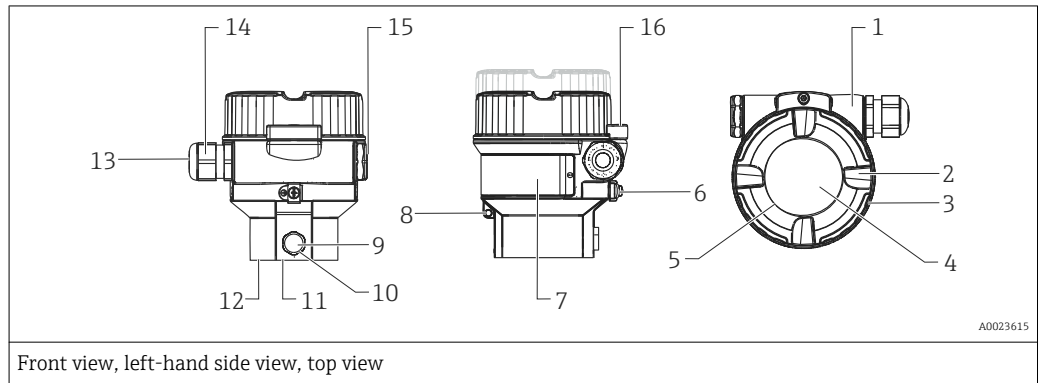
Reduction in installation height

If the separate housing is used, the mounting height of the process connection is reduced compared to the dimensions of the standard version.

**Weight**

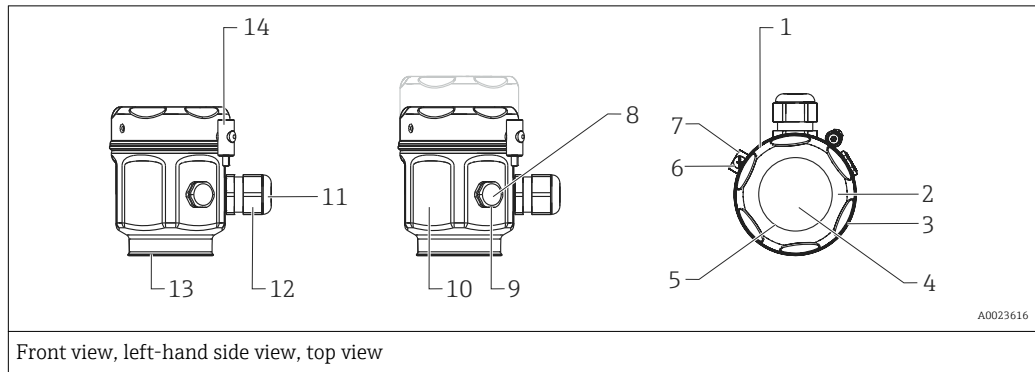
Component part	Weight
Housing	See "Housing" section
Process connection	See "Process connections" section
Capillary with armoring made of AISI 316L (1.4404)	0.16 kg/m (0.35 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line)
Capillary with armoring made of AISI 316L (PVC)	0.21 kg/m (0.46 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line)
Capillary with armoring made of AISI 316L (PTFE)	0.29 kg/m (0.64 lb/m) + 0.2 kg (0.44 lb) (weight per capillary line)

Materials not in contact with process F31 housing



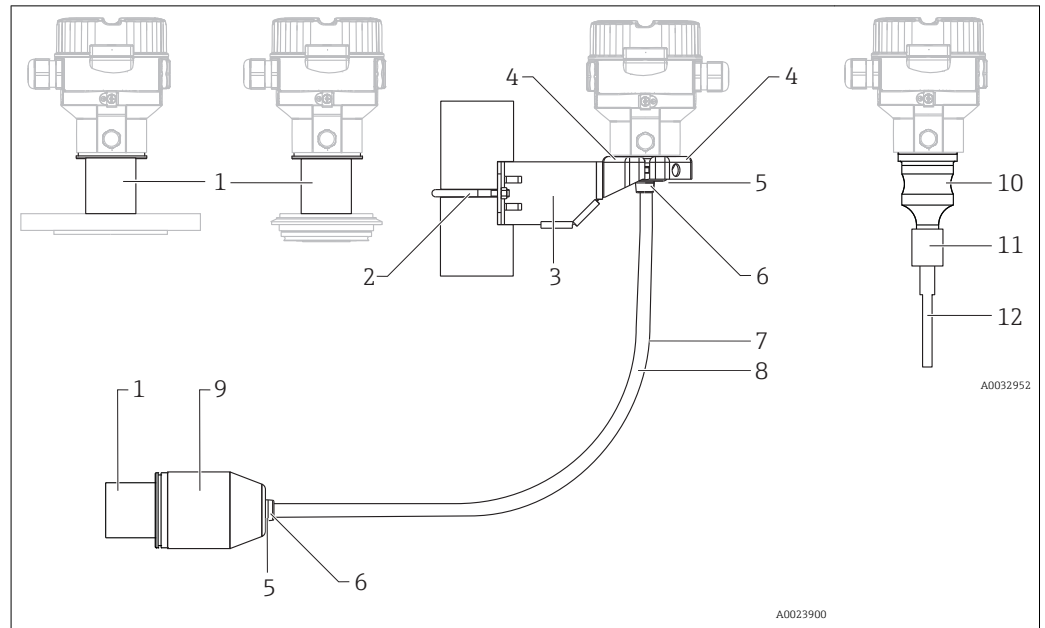
Item number	Component part	Material
1	F31 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
3	Cover seal	EPDM
4	Sight glass	Mineral glass
5	Sight glass seal	Silicone (VMQ)
6	External ground terminal	AISI 304 (1.4301)
7	Nameplates	Plastic film
8	Attachement for tie-on label	AISI 304 (1.4301)/ AISI 316 (1.4401)
9	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
10	Pressure compensation filter, O-ring	VMQ or EPDM
11	Sealing ring	EPDM
12	Snap ring	PC Plastic
13	Seal of cable gland and blind plug	EPDM/NBR
14	Cable gland	Polyamide (PA), for dust ignition-proof: CuZn nickel-plated
15	Blind plug	PBT-GF30 FR for dust ignition-proof, Ex d, FM XP and CSA XP: AISI 316L (1.4435)
16	Cover clamp	Clamp AISI 316L (1.4435), screw A4

F15 housing

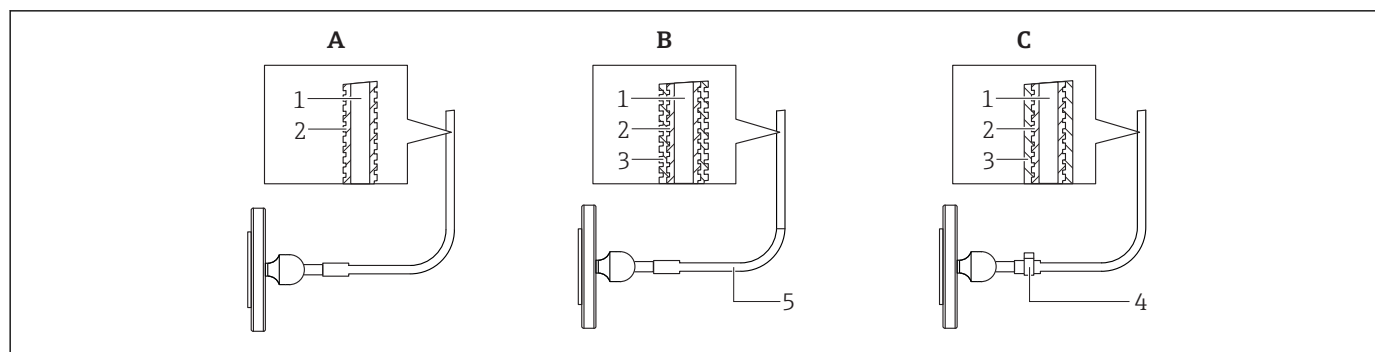


Item number	Component part	Material
1	F15 housing	AISI 316L (1.4404)
2	Cover	
3	Cover seal	Silicone with PTFE coating
4	Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS	Polycarbonate (PC)
4	Sight glass for ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA dust ignition-proof	Mineral glass
5	Sight glass seal	Silicone (VMQ)
6	External ground terminal	AISI 304 (1.4301)
7	Attachement for tie-on label	AISI 304 (1.4301)/ AISI 316 (1.4401)
8	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
9	Pressure compensation filter, O-ring	VMQ or EPDM
10	Nameplates	lasered
11	Cable gland	Polyamide (PA), for dust ignition-proof: CuZn nickel-plated
12	Seal of cable gland and blind plug	NBR/Silicone/EPDM
13	Sealing ring	EPDM
14	Screw	A4-50

Connecting parts



Item number	Component part	Material
1	Connection between the housing and process connection	AISI 316L (1.4404)
2	Mounting bracket	Bracket AISI 316L (1.4404)
3		Screw and nuts A4-70
4		Half-shells: AISI 316L (1.4404)
5	Seal for cable from Separate housing	FKM, EPDM
6	<ul style="list-style-type: none"> ■ Gland for cable from separate housing: ■ Screws: 	<ul style="list-style-type: none"> ■ AISI 316L (1.4404) ■ A2
7	PE cable for separate housing	Abrasion-proof cable with strain-relief Dynema members; shielded using aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
8	FEP cable for separate housing	Abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant
9	Process connection adapter for separate housing	AISI 316L (1.4404)
10	Cell body	AISI 316L (1.4404)
11	Connection between body of measuring cell and capillary	AISI 316L (1.4404)
12	Shrink tubing (available only if capillary armoring comprises PVC coating or PTFE sheath)	Polyolefin



A0028087

Position	Component part	A Standard ¹⁾ Armor for capillary	B PVC-coated Armor for capillary	C PTFE hose Armor for capillary
1	Capillary	AISI 316 Ti (1.4571)	AISI 316 Ti (1.4571)	AISI 316 Ti (1.4571)
2	Flexible armor for capillary	AISI 316L (1.4404) ²⁾	AISI 316L (1.4404)	AISI 316L (1.4404)
3	Coating/armor	-	PVC ³⁾	PTFE ⁴⁾
4	Single-ear clamp	-	-	1.4301
5	Shrink tubing at capillary junction	-	Polyolefin	-

1) If no option is specified when ordering, order option "SA" is supplied.

2) Product Configurator, order code for "Armor for capillary:" option "SA"

3) Product Configurator, order code for "Capillary armoring:" option "SB"

4) Product Configurator, order code for "Capillary armoring:" option "SC"

Materials in contact with the process

NOTICE

- ▶ The wetted device components are listed in the "Mechanical construction" → 45 and "Ordering information" → 118 sections.

Delta-ferrite content

The delta-ferrite content of the wetted parts material can be guaranteed and certified to $\leq 3\%$ if the option "KF" is chosen in the Product Configurator "Material of the process isolating diaphragm" ordering feature. When PMC51 with hygienic process connections is chosen, the deltaferrite content can be guaranteed and certified to $\leq 1\%$ if the option "KF" is chosen in the Product Configurator "Material of the process isolating diaphragm" ordering feature.

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all process wetted device components:

- They do not contain any materials derived from animals.
- No auxiliaries or operating materials derived from animals are used in production or processing.

Process connections

- "Clamp connections" and "Hygienic process connections" (see also "Ordering information" ordering feature): AISI 316L (DIN/EN material number 1.4435)
- Endress+Hauser supplies process connections with threaded connections and DIN/ EN flanges made of stainless steel as per AISI 316L (DIN/EN material number 1.4404 (AISI 316) or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1 Tab.18. The chemical composition of the two materials can be identical.
- Some process connections are also available in the material Alloy C276 (DIN/EN material number 2.4819). See the information in the "Mechanical construction" ordering feature.

Process isolating diaphragm

Type	Designation	Option ¹⁾
PMC51	Al ₂ O ₃ aluminum oxide ceramic (FDA ²⁾ , USP Class VI+121°C), ultrapure 99.9 % (see also www.endress.com/ceraphire)	Standard
PMP51	AISI 316L (DIN/EN material number 1.4435)	A
	AISI 316L with gold-rhodium coating	M
	Alloy C276 (DIN/EN material number 2.4819)	B
PMP55	AISI 316L (DIN/EN material number 1.4435)	A
	AISI 316L, TempC	E
	AISI 316L with gold-rhodium coating	M
	AISI 316L with 0.25 mm (0.01 in) PTFE coating	S
	Alloy C276 (DIN/EN material number 2.4819)	B ³⁾
	Monel (2.4360)	C ³⁾
	Tantal (UNS R05200)	D ³⁾

- 1) Product Configurator, "Material of the process isolating diaphragm" ordering feature
- 2) The US Food & Drug Administration (FDA) has no objections to the use of ceramics made from aluminum oxide as a surface material in contact with foodstuffs. This declaration is based on the FDA certificates of our ceramic suppliers.
- 3) The flange raised face is made from the same material as the process isolating diaphragm.

Seals

Type	Designation	Option ¹⁾
PMC51	FKM Viton	A
	FKM Viton, FDA, 3A Class I, USP Class VI	B
	FFKM Perlast G75LT	C
	NBR	F
	HNBR, FDA, 3A Class II, KTW, AFNOR, BAM	G
	NBR, Low temperature	H
	EPDM, FDA	J
	EPDM, FDA, 3A Class II, USP Class VI+121°C, DVGW, KTW, W270, WRAS, ACS, NSF61	K
	FFKM Kalrez 6375	L
	FFKM Kalrez 7075	M
	FFKM Kalrez 6221, FDA, USP Class VI	N
	Fluoroprene XP40, FDA, USP Class VI+121°C, 3A Class I	P
	VMQ Silicone, FDA	S

- 1) Product Configurator, "Seal" ordering feature

Fill fluid

Designation	Option PMP51 ¹⁾
Silicone oil	1
Inert oil	2
NSF-H1 synthetisk oil according to FDA 21 CFR 178.3570	3

- 1) Product Configurator, "Fill fluid" ordering feature

Designation	Option PMP55 ¹⁾
Silicone oil, suitable for foods FDA 21 CFR 175.105	1
Inert oil	2
Vegetable oil, Suitable for foods FDA 21 CFR 172.856	4
High-temperature oil	5
Low-temperature oil	6

1) Only select FDA-approved filling oils for diaphragm seal devices with 3-A and EHEDG certification!

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnosis
- Expert level

Quick and safe commissioning

Guided menus for applications

Reliable operation

- Local operation possible in several languages
- Standardized operation at the device and in the operating tools
- Parameters relating to measured values can be locked/unlocked using the device's write protection switch, using the device software or via remote control

Efficient diagnostic behavior increases measurement availability

- Remedial measures are integrated in plain text
- Diverse simulation options

Local operation

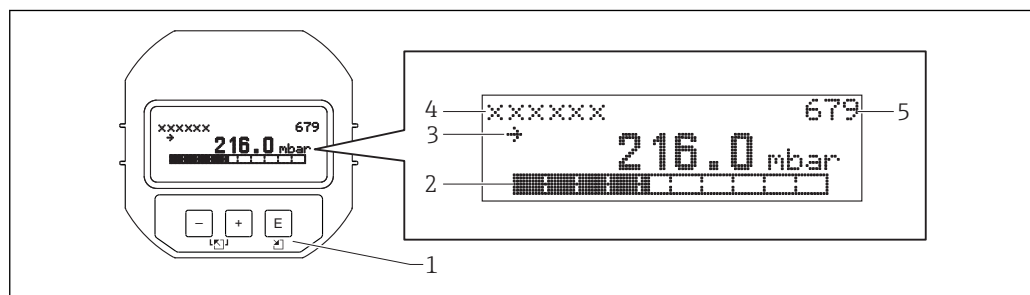
Local display (optional) for devices with HART-, PROFIBUS PA- or FOUNDATION Fieldbus-Elektronik

A 4-line liquid crystal display (LCD) is used for display and operation. The local display shows measured values, dialog texts as well as fault and notice messages in plain text, thereby supporting the user at every stage of operation. The liquid crystal display of the device can be turned in 90° stages. Depending on the orientation of the device, this makes it easy to operate the device and read the measured values.

Functions

- 8-digit measured value display including sign and decimal point, bar graph for 4 to 20 mA HART as current display; or for PROFIBUS PA as graphic display of the standardized value of the AI Block; for FOUNDATION Fieldbus as graphic display of the transducer output in relation to the set pressure range.
- Simple and complete menu guidance as parameters are split into several levels and groups
- Each parameter is given a 3-digit ID number for easy navigation
- Possibility of configuring the display to suit individual requirements and preferences, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature etc.
- Comprehensive diagnostic functions (fault and warning message, peak-hold indicators etc.)

Overview



A0016498

- 1 Operating keys
- 2 Bar graph
- 3 Symbol
- 4 Header line
- 5 Parameter identification number

Ordering information: Product Configurator, "Output, Operation" ordering feature

Function	Operation via display			
	Analog electronic	HART	PROFIBUS PA	FOUNDATION Fieldbus
Position adjustment (zero point correction)	—	✓	✓	✓
Setting lower range value and upper range value - reference pressure present at the device	—	✓	✓	✓
Device reset	—	✓	✓	✓
Locking and unlocking parameters relevant to the measured value	—	✓	✓	✓
Value acceptance indicated by the green LED	—	—	—	—
Switching damping on and off	—	✓	✓	✓

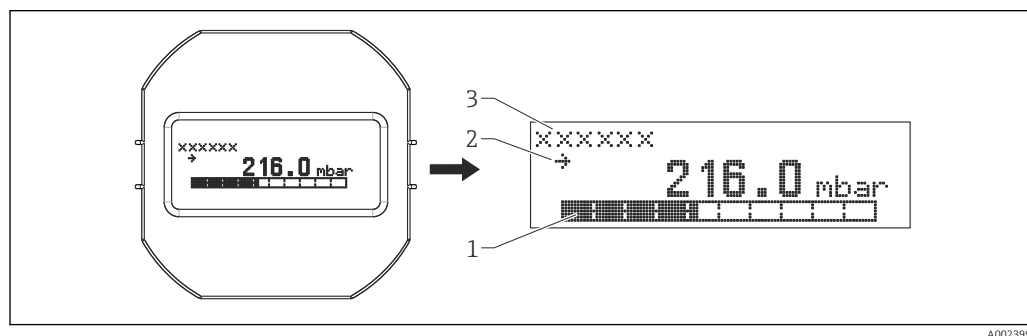
Local display (optional) for devices with analog electronics

A 4-line liquid crystal display (LCD) is used. The local display shows measured values, fault messages and notice messages. The liquid crystal display of the device can be turned in 90° stages. Depending on the orientation of the device, this makes it easy to operate the device and read the measured values.

Functions:

- 8-digit measured value display including sign and decimal point, bar graph for 4 to 20 mA as current display.
- Diagnostic functions (fault and warning message etc.)

Overview



A0023993

- 1 Bar graph
2 Symbol
3 Parameter name

Ordering information: Product Configurator, "Display, operation" ordering feature

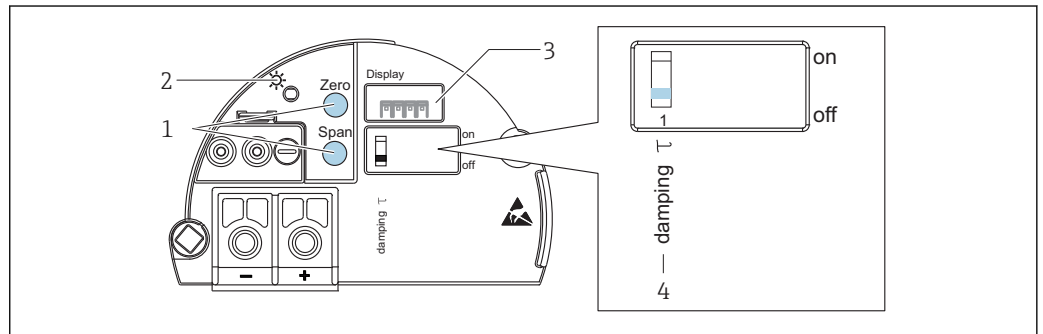
Operating keys and elements located inside on the electronic insert

Function	Operation with operating keys and elements on the electronic insert			
	Analog electronics	HART	PROFIBUS PA	FOUNDATION Fieldbus
Position adjustment (zero point correction)	✓	✓	✓	✓
Setting lower range value and upper range value - reference pressure present at the device	✓	✓	—	—
Device reset	✓	✓	✓	✓
Locking and unlocking parameters relevant to the measured value	—	✓	✓	✓
Value acceptance indicated by the green LED	✓	✓	✓	✓
Switching damping on and off	✓	✓	✓	✓

Ordering information:

Product Configurator, "Output, Operation" ordering feature

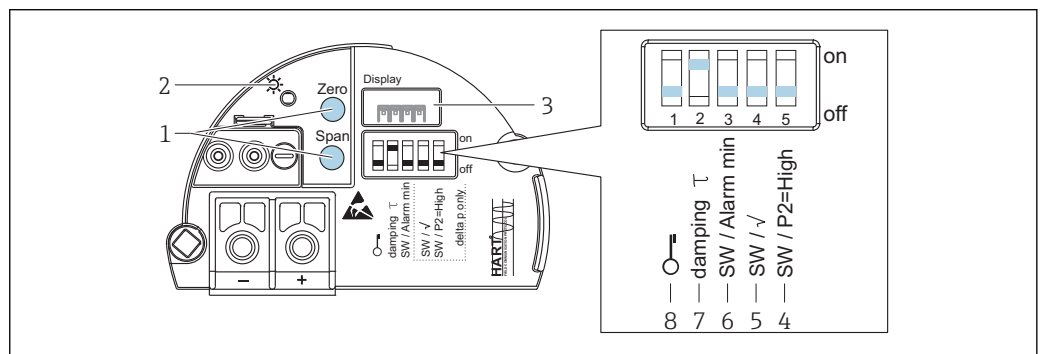
Analog



A0032657

- 1 Operating keys for lower range value (zero), upper range value (span), position zero adjustment or reset
- 2 Green LED to indicate successful operation
- 3 Slot for optional local display
- 4 DIP switch for switching damping on/off

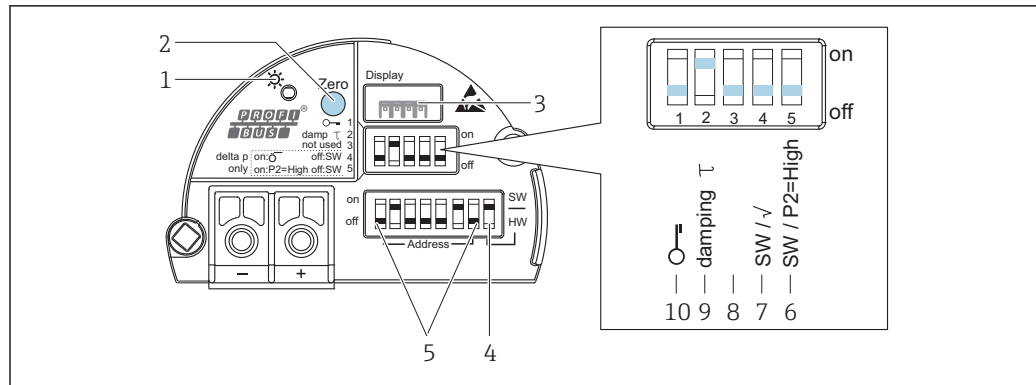
HART



A0032658

- 1 Operating keys for lower range value (zero) and upper range value (span)
- 2 Green LED to indicate successful operation
- 3 Slot for optional local display
- 4 DIP switch only for Deltabar M
- 5 DIP switch only for Deltabar M
- 6 DIP switch for alarm current SW / Alarm Min (3.6 mA)
- 7 DIP switch for switching damping on/off
- 8 DIP switch for locking/unlocking parameters relevant to the measured value

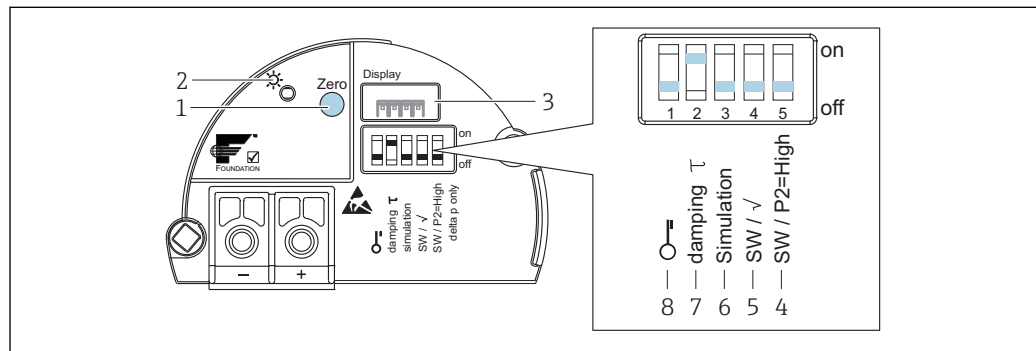
PROFIBUS PA



A0032659

- 1 Green LED to indicate successful operation
- 2 Operating key for position zero adjustment (Zero) or reset
- 3 Slot for optional local display
- 4 DIP-switch for bus address SW / HW
- 5 DIP-switch for hardware address
- 6 DIP switch only for Deltabar M
- 7 DIP switch only for Deltabar M
- 8 Not used
- 9 DIP switch for switching damping on/off
- 10 DIP switch for locking/unlocking parameters relevant to the measured value

FOUNDATION Fieldbus



A0032660

- 1 Operating key for position zero adjustment (Zero) or reset
- 2 Green LED to indicate successful operation
- 3 Slot for optional local display
- 4 DIP switch only for Deltabar M
- 5 DIP switch only for Deltabar M
- 6 DIP-switch for simulation mode
- 7 DIP switch for switching damping on/off
- 8 DIP switch for locking/unlocking parameters relevant to the measured value

Operating languages

You can also choose another language in addition to the standard language "English":




Designation	Option ¹⁾
English	AA
German	AB
French	AC
Spanish	AD
Italian	AE
Dutch	AF

Designation	Option ¹⁾
Chinese	AK
Japanese	AL

1) Product Configurator "Additional Operation Language" ordering feature

Remote operation

All software parameters are accessible depending on the position of the write protection switch on the device.

Hardware and software for remote operation	HART	PROFIBUS PA	FOUNDATION Fieldbus
FieldCare →  105	✓ ¹⁾	✓ ²⁾	✓
FieldXpert SFX100 →  105	✓	—	✓
NI-FBUS Configurator →  106	—	—	✓

1) Commubox FXA195 required

2) Profiboard or Proficard required

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:

- Configuration of transmitters in offline and online mode
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:

- HART via Commubox FXA195 and USB interface of a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Service interface with Commubox FXA291 and ToF adapter FXA291 (USB).



For further information, please contact your local Endress+Hauser Sales Center.

Field Xpert SFX100

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It offers wireless communication via the optional VIATOR Bluetooth modem from Endress+Hauser. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA00060S/04/EN.

Commubox FXA195

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or laptop. For details refer to TI00405C/07/EN.



For the following Endress+Hauser devices you will need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar M
- Deltabar M
- Deltapilot M

ToF Adapter FXA291

The ToF adapter FXA291 connects the Commubox FXA291 with devices of the ToF platform, pressure equipment and Gammapiot via the USB interface of a personal computer or a notebook. For details refer to KA00271F.

Profiboard

For connecting a PC to the PROFIBUS.

Proficard

For connecting a laptop to the PROFIBUS.

FF configuration program

FF configuration program, such as NI-FBUS Configurator, to

- connect devices with "FOUNDATION Fieldbus signal" into an FF-network
- set FF-specific parameters

Operation with NI-FBUS Configurator:

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.

You can use the NI-FBUS Configurator to configure a fieldbus network as follows:

- Set block and device tags
- Set device addresses
- Create and edit function block control strategies (function block applications)
- Configure vendor-defined function and transducer blocks
- Create and edit schedules
- Reading and writing of data from control and regulation systems
- Invoke methods specified in the manufacturer-specific DD (e.g. basic device settings)
- Display DD menus (e.g. tab for calibration data)
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace a virtual device by a real device
- Save and print a configuration

System integration (Except analog electronics)

The device can be given a tag name (max. 8 alphanumeric characters)

Designation	Option ¹⁾
Tagging (TAG), see additional spec.	Z1
Bus address, see additional spec.	Z2

1) Product configurator "Marking" ordering feature

Planning instructions for diaphragm seal systems

NOTICE

Diaphragm seal systems sized/ordered incorrectly

The performance and the permitted range of application of a diaphragm seal system depend on the process isolating diaphragm used, the filling oil, the coupling, the unit design and on the specific process and ambient conditions present in the individual application.

- To help you select the right diaphragm seal systems for your particular applications, Endress+Hauser provides its customers with the "Applicator Sizing Diaphragm Seal" selection tool, which is available free of charge at "www.endress.com/applicator" or as a download.

The screenshot displays the "Applicator Sizing Diaphragm Seal" web application. The top navigation bar includes "Home", "Sizing", and "Pressure". The main content area is titled "Sizing Diaphragm Seal" and includes a "Dimensioning pressure devices" link. The "General parameters" section shows the product "Cerabar S PMP55" and the order code "PMP55-1H61B3". Below this, there is a "1 Message(s)" section. The "Transmitter data" section includes fields for Sensor (1bar/100Pa/1 Spd gauge), Adjusted span (14.504), Membrane material (316L), Process connection classes (All), Diaphragm seal (DN50 PN10-40 B1, 316L), Transmitter mounting (direct), and Fill fluid (Silicone oil). The "Measurement accuracy and offset" section shows error due to change in process temperature (0.133) and error due to change in ambient temperature (0.202). The "Calibration offset" section shows maximum offset after installation (-0.1) and maximum offset after installation (-0.4). The "Performance data" section shows response time Tau (16.3) (0.2) and diaphragm deflection (-23). The "Process and ambient conditions" section shows process temperature (14 to 212 °F), ambient temperature (14 to 140 °F), and static pressure (13.053 to 29.008 psi). The interface also includes buttons for "Print Sizing", "Add to shop basket", "Configurator", and "Reset".

A0034616



For further details, or for information on an optimum diaphragm seal solution, please contact your local Endress+Hauser Sales Center.

Applications

Diaphragm seal systems should be used if the process and the device need to be separated. Diaphragm seal systems offer clear advantages in the following instances:

- In the case of extreme process temperatures
- For aggressive media
- If extreme measuring point cleaning is necessary, or in the event of very damp mounting locations
- If the measuring point is exposed to severe vibrations
- For mounting locations that are difficult to access

Function and design

Diaphragm seals separate the measuring system from the process.

A diaphragm seal system consists of:

- A diaphragm seal
- A capillary tube or a temperature isolator if necessary
- Fill fluid and
- a pressure transmitter.

The process pressure acts via the process isolating diaphragm of a diaphragm seal on the liquid-filled system, which transfers the process pressure to the sensor of the pressure transmitter.

Endress+Hauser delivers all diaphragm seal systems as welded versions. The system is hermetically sealed, which ensures greater reliability.

The diaphragm seal determines the application range of the system on the basis of

- The diameter of the process isolating diaphragm
- The process isolating diaphragm: stiffness and material
- The design (oil volume)

Diameter of the process isolating diaphragm

The greater the diameter of the process isolating diaphragm (less stiff), the smaller the temperature effect on the measurement result.

Stiffness of the process isolating diaphragm

The stiffness depends on the diameter of the process isolating diaphragm, the material, any existing coating, the thickness and shape of the process isolating diaphragm. The thickness of the process isolating diaphragm and the shape are determined by the design. The stiffness of a process isolating diaphragm of a diaphragm seal influences the temperature application range and the measuring error caused by temperature effects.

The Endress+Hauser TempC membrane: Highest accuracy and process safety when measuring pressure and differential pressure using diaphragm seals

To measure with even greater accuracy in these applications and increase process safety, Endress+Hauser has developed the TempC diaphragm which is based on a completely revolutionary technology. This diaphragm guarantees the utmost level of accuracy and process safety in diaphragm seal applications.

- The very low temperature effect minimizes the effect of process and ambient temperature fluctuations, thereby guaranteeing accurate and reliable measurements. Measurement inaccuracies caused by temperature are reduced to a minimum.
- The TempC membrane can be used at temperatures between -70°C (-94°F) and $+400^{\circ}\text{C}$ ($+752^{\circ}\text{F}$). This guarantees maximum process safety even for very long sterilization and cleaning cycles (SIP/CIP) in tanks and pipes at high temperatures.
- With a smaller process connection, the new diaphragm measures at least as accurately as a conventional diaphragm with a larger diameter. With a smaller process connection, the new membrane measures at least as accurately as a conventional membrane with a larger diameter.
- Due to the geometry of the membrane, an overshoot occurs initially immediately following a temperature shock. This results in a transient response, the duration and deviation of which are significantly less compared to traditional membrane types. In the case of batch processes, these shorter recovery times mean a far higher level of availability of the production facilities. For TempC membranes, the effect of the overshoot on the output signal can be reduced by adjusting the damping.
- In addition, TempC Membrane convinces customers by its better hygiene cleanability as well as insensitivity to strong pressure load changes.

Ordering information:

See the Product Configurator for the individual process connection and the choice of process isolating diaphragm.

Selection in the Applicator:

Under "Transmitter data" in the "Membrane material" field.

Capillary

As standard, capillaries with an internal diameter of 1 mm (0.04 in) are used.

The capillary tube influences the thermal change, the ambient temperature operating range and the response time of a diaphragm seal system as a result of its length and internal diameter.

Filling oil

Observe the temperatures and pressures during commissioning and cleaning. A further selection criterion is the compatibility of the filling oil with the requirements of the medium. For example, only filling oils that do not present a health hazard are used in the food industry, e.g. vegetable oil or silicone oil. (See also the following section "Diaphragm seal filling oils".)

The filling oil used influences the thermal change, the temperature application range of a diaphragm seal system and the response time. A temperature change results in a volume change in the filling oil. The volume change depends on the thermal expansion coefficient of the filling oil and on the volume of the fill fluid at calibration temperature (constant in the range: +21 to +33 °C (+70 to +91 °F)).

For example, the filling oil expands in the event of a temperature increase. The additional volume presses against the process isolating diaphragm of a diaphragm seal. The stiffer a process isolating diaphragm is, the greater its return force, which counteracts a volume change and acts together with the process pressure on the measuring cell, thus shifting the zero point.

Pressure transmitter

The pressure transmitter influences the temperature application range, the thermal change and the response time as a result of its volume change. The volume change is the volume that has to be shifted in order to pass through the complete measuring range.

Pressure transmitters from Endress+Hauser are optimized with regard to minimum volume change.

Diaphragm seal filling oils

Filling oil	Permissible temperature range ¹⁾ at 0.05 bar (0.725 psi) ≤ p _{abs} ≤ 1 bar (14.5 psi)	Permitted temperature range ¹⁾ at p _{abs} ≥ 1 bar (14.5 psi)	Option ²⁾
Silicone oil	-40 to +180 °C (-40 to +356 °F)	-40 to +250 °C (-40 to +482 °F)	1
Inert oil	-40 to +80 °C (-40 to +176 °F)	-40 to +175 °C (-40 to +347 °F)	2
Vegetable oil	-10 to +120 °C (+14 to +248 °F)	-10 to +200 °C (+14 to +392 °F)	4
Hightemperature oil	-10 to +200 °C (+14 to +392 °F)	-10 to +400 °C (+14 to +752 °F) ^{3) 4) 5)}	5
Low temperature oil	-70 to +80 °C (-94 to +176 °F)	-70 to +180 °C (-94 to +356 °F)	6

- 1) Observe temperature limits of the device and of the system
- 2) Product Configurator, "Fill fluid" ordering feature
- 3) 325 °C (617 °F) at ≥ 1 bar (14.5 psi) absolute pressure.
- 4) 350 °C (662 °F) at ≥ 1 bar (14.5 psi) absolute pressure (max. 200 hours).
- 5) 400 °C (752 °F) at ≥ 1 bar (14.5 psi) absolute pressure (max. 10 hours).

Additional data:

Filling oil	Density [g/cm ³] / [SGU]	Viscosity [mm ² /s] / [cSt] bei 25 °C (77 °F)	Expansion coefficient ¹⁾ [1/K]	Notes ²⁾	Option ³⁾
Silicone oil	0.96	100	0.00096	suitable for foods FDA 21 CFR 175.105	1
Inert oil	1.87	27	0.000876	For ultrapure gas and oxygen applications	2
Vegetable oil	0.94	9.5	0.00101	suitable for foods FDA 21 CFR 172.856	4
Hightemperature oil	1.00	150	0.00096	High temperatures	5
Low temperature oil	0.92	4.4	0.00108	Low temperatures	6

- 1) The thermal change in the diaphragm seal and other important technical features can be found in the "Applicator Sizing Diaphragm Seal" selection tool.
- 2) Only select FDA-approved filling oils for diaphragm seal devices with 3-A and EHEDG certification!
- 3) Product Configurator, "Fill fluid" ordering feature

Operating temperature range The operating temperature range of a diaphragm seal system depends on the fill fluid, capillary length and internal diameter, process temperature and oil volume of the diaphragm seal.

The range of application can be extended by using a fill fluid with a smaller expansion coefficient and a shorter capillary.

Cleaning instructions

Endress+Hauser offer flushing rings as accessories to clean process isolating diaphragms without taking the transmitters out of the process.



For further information please contact your local Endress+Hauser Sales Center.

We recommend you perform CIP (cleaning in place (hot water)) before SIP (sterilization in place (steam)) for pipe diaphragm seals. A frequent use of sterilization in place (SIP) will increase the stress on the process isolating diaphragm. Under unfavorable circumstances in the long term view we cannot exclude that a frequent temperature change could lead to a material fatigue of the process isolating diaphragm and possibly to a leakage.

Installation instructions

Diaphragm seal systems

- A diaphragm seal together with the transmitter form a closed, calibrated system, which is filled through openings in the diaphragm seal and in the transmitter's measurement system. These openings are sealed and must not be opened.
- In the case of devices with diaphragm seals and capillaries, the zero point shift caused by the hydrostatic pressure of the filling liquid column in the capillaries must be taken into account when selecting the measuring cell. If a measuring cell with a small measuring range is selected, a position adjustment can cause range violation.
- For devices with a temperature isolator or capillary, a suitable fastening device (mounting bracket) is recommended.
- When mounting, sufficient strain relief must be provided for the capillary line to prevent the capillary from bending (capillary bending radius ≥ 100 mm (3.94 in))

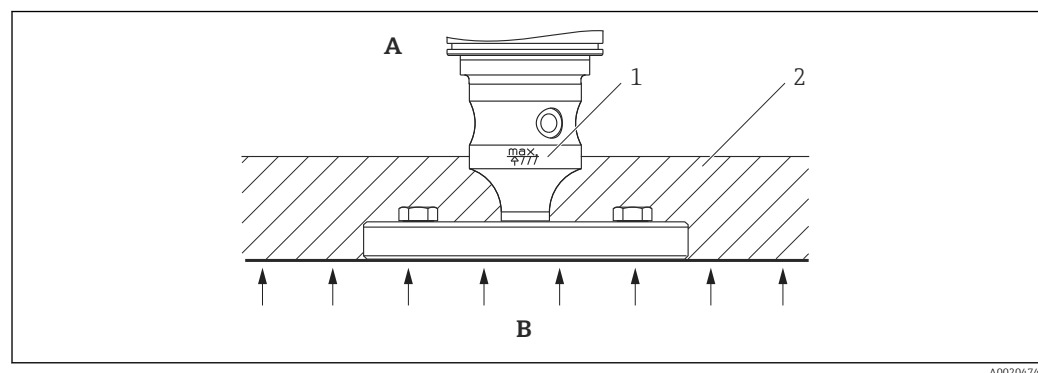
Capillary

In order to obtain more precise measurement results and to avoid a defect in the device, mount the capillaries as follows:

- Vibration-free (in order to avoid additional pressure fluctuations)
- Not in the vicinity of heating or cooling lines
- Insulate if the ambient temperature is below or above the reference temperature
- With a bending radius of ≥ 100 mm (3.94 in)

Thermal insulation

The PMP55 may only be insulated up to a certain height. The maximum permitted insulation height is indicated on the devices and applies to an insulation material with a heat conductivity ≤ 0.04 W/(m x K) and to the maximum permitted ambient and process temperature. The data were determined under the most critical application "quiescent air". Maximum permitted insulation height, here indicated on a PMP55 with a flange:

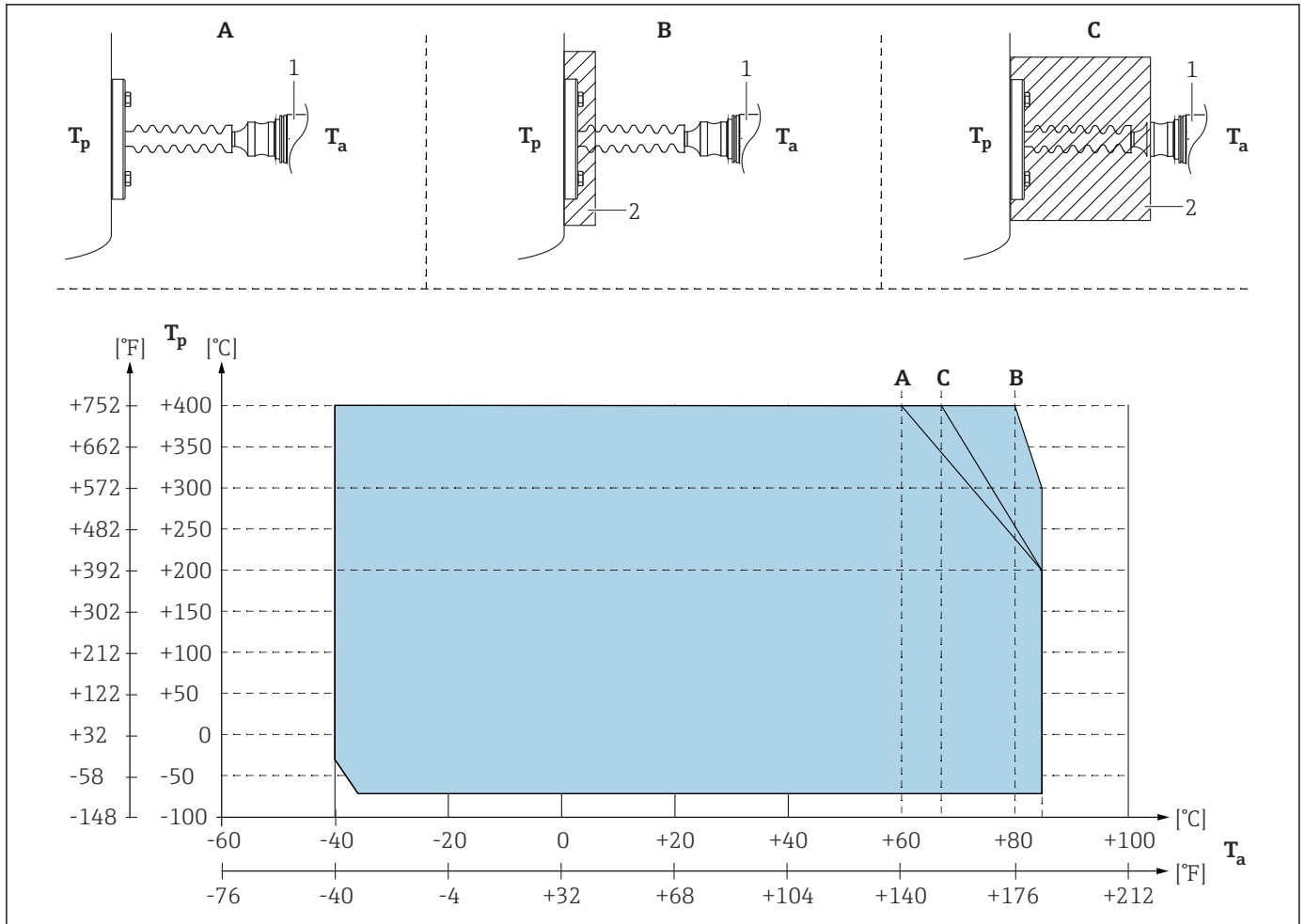


A0020474

- A Ambient temperature ≤ 70 °C (158 °F)
 B Process temperature max. 400 °C (752 °F), depending on the diaphragm seal filling oil used
 1 Maximum permitted insulation height
 2 Insulation material

Mounting with temperature isolator

Endress+Hauser recommends the use of temperature isolators in the event of constant extreme medium temperatures which lead to the maximum permissible electronics temperature of +85 °C (+185 °F) being exceeded. Depending on the filling oil used, diaphragm seal systems with temperature isolators can be used for maximum temperatures of up to +400 °C (+752 °F) → 109, "Diaphragm seal filling oils" section. To minimize the influence of rising heat, Endress+Hauser recommends the device be mounted horizontally or with the housing pointing downwards. The additional installation height also brings about a maximum zero point shift of 21 mbar (0.315 psi) due to the hydrostatic column in the temperature isolator. You can correct this zero point shift at the device.



- 1 Transmitter
2 Insulation material

Position	Insulation	Ambient temperature (T_a) at transmitter	Maximum process temperature (T_p)
A	No insulation	60 °C (140 °F)	400 °C (752 °F) ¹⁾
		85 °C (185 °F)	200 °C (392 °F)
B	30 mm (1.18 in) Insulation	80 °C (176 °F)	400 °C (752 °F)
		85 °C (185 °F)	300 °C (572 °F)
C	Maximum insulation	67 °C (153 °F)	400 °C (752 °F)
		85 °C (185 °F)	200 °C (392 °F)

1) Process temperature: max.400 °C (752 °F), depending on the diaphragm seal filling oil used

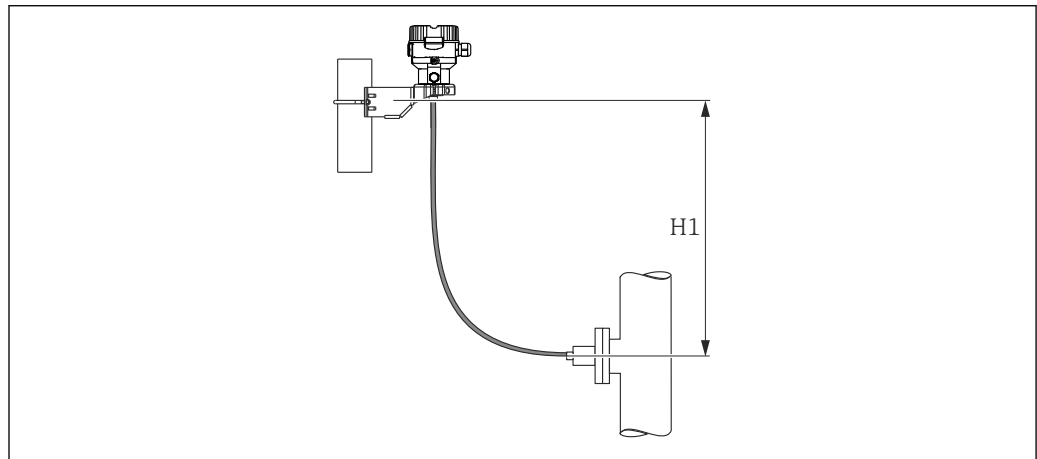
Vacuum applications

Mounting instructions

For vacuum applications, pressure transmitters with a ceramic measuring membrane (oil-free) are preferable.

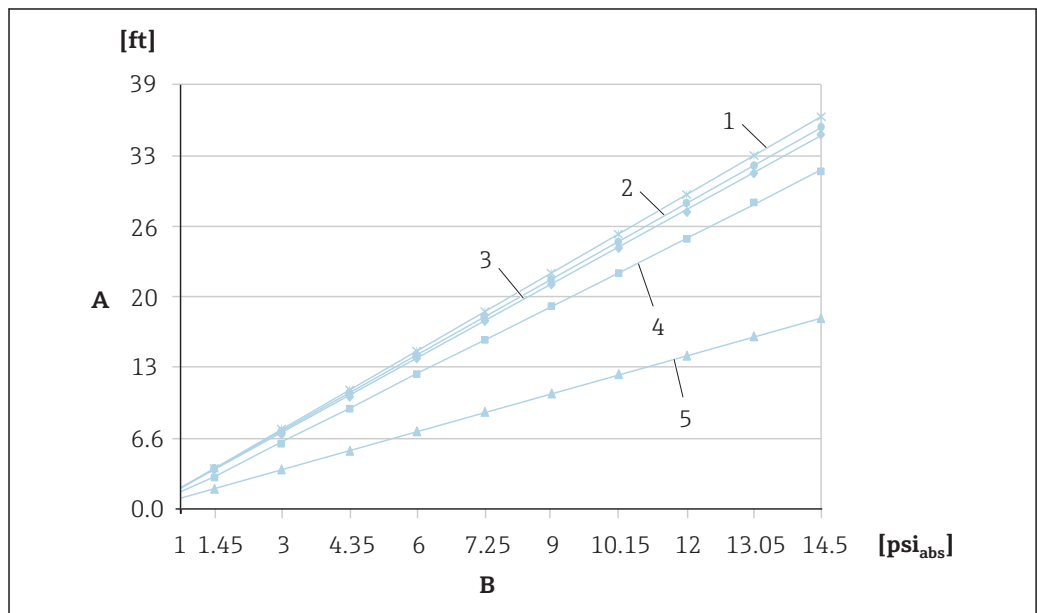
For applications under vacuum, Endress+Hauser recommends mounting the pressure transmitter below the diaphragm seal. This prevents vacuum loading of the diaphragm seal caused by the presence of fill fluid in the capillary.

When the pressure transmitter is mounted above the diaphragm seal, the maximum height difference $H1$ in accordance with the illustrations below must not be exceeded. The following diagram depicts installation above the lower diaphragm seal:



A0023994




The maximum height difference depends on the density of the filling oil and the smallest ever pressure that is permitted to occur at the diaphragm seal (empty vessel), see illustration below. The following diagram depicts the maximum installation height above the diaphragm seal for vacuum applications.



A0023986-EN

- A Height difference $H1$
 B Pressure at diaphragm seal
 1 Low temperature oil
 2 Vegetable oil
 3 Silicone oil
 4 High-temperature oil
 5 Inert oil

Certificates and approvals

CE mark	The device meets the legal requirements of the relevant EC directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.
RoHS	The measuring system complies with the substance restrictions of the Restriction on Hazardous Substances Directive 2011/65/EU (RoHS 2).
RCM-Tick marking	<p>The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.</p> <div style="text-align: center;">  </div> <p style="text-align: right; font-size: small;">A0029561</p>
Ex approvals	<ul style="list-style-type: none"> ■ ATEX ■ IECEx ■ FM ■ CSA ■ NEPSI ■ Also combinations of different approvals <p>All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas →  122.</p>
EAC conformity	<p>The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity together with the standards applied.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.</p>
Suitable for hygiene applications	<p>The device is available with hygienic process connections (overview: see order code). The materials of the hygienic process connections in contact with food comply with Regulation (EC) 1935/2004.</p> <div style="background-color: yellow; padding: 2px; display: inline-block;">  CAUTION </div> <p>Contamination in the process! Risk of contamination if incorrect seals and parts are used!</p> <ul style="list-style-type: none"> ▶ To avoid the risk of contamination, when installing the device comply with the design principles of EHEDG, Guideline 37 "Hygienic Design and Application of Sensors" and Guideline 16 "Hygienic Pipe Couplings". ▶ Suitable assemblies and seals must be used to ensure hygienic design in accordance with 3-A SSI and EHEDG specifications. ▶ The leak-proof connections can be cleaned with the cleaning methods typical of this industry (CIP and SIP). Attention must be paid to the pressure and temperature specifications of the sensor and process connections for CIP and SIP processes (clean in place/sterilize in place). ▶ Only select FDA-approved filling oils for diaphragm seal devices with 3-A and EHEDG certification!



The gap-free connections can be cleaned of all residue using the typical cleaning methods within this industry.

Certificate of Compliance ASME BPE 2012

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LW"

Functional safety SIL

The Cerabar M with 4 to 20 mA output signal has been developed to assessed and certified by TÜV NORD CERT as per IEC 61508 Edition 2.0 and IEC 61511. These devices can be used to monitor the process level and pressure up to SIL 2. For a detailed description of the safety functions with Cerabar M, settings and functional safety data, see the "Functional safety manual - Cerabar M" SD00347P.

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LA"

CRN approvals

Some device versions have CRN approval. A CRN-approved process connection with a CSA approval must be ordered for a CRN-approved device. PMP55 devices with a capillary are not CRN-approved. These devices are fitted with a separate plate bearing the registration number OF10525.5C

Ordering information:

Product Configurator, "Process connection" section and

Product Configurator, "Approval" ordering feature

Other standards and guidelines

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity. The following were also applied:

DIN EN 60770 (IEC 60770):

Transmitters for use in industrial-process control systems Part 1: Methods for inspection and routine testing

DIN 16086:

Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications in data sheets

EN 61326-Serie:

EMC product family standard for electrical equipment for measurement, control and laboratory use.

EN 60529:

Degrees of protection by housing (IP code)

AD2000

The pressure retaining material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10.

Pressure Equipment Directive 2014/68/EU (PED)

Pressure equipment with allowable pressure ≤ 200 bar (2 900 psi)

Pressure equipment (having a maximum allowable pressure $PS \leq 200$ bar (2 900 psi)) can be classified as pressurized equipment in accordance with Pressure Equipment Directive 2014/68/EU. If the maximum allowable pressure is ≤ 200 bar (2 900 psi) and the pressurized volume of the pressure equipment is ≤ 0.1 l, the pressure equipment is subject to the Pressure Equipment Directive (cf. Pressure Equipment Directive 2014/68/EU, Article 4, point 3). The Pressure Equipment Directive only requires that the pressure equipment shall be designed and manufactured in accordance with the "sound engineering practice of a Member State".

Reasons:

- Pressure Equipment Directive (PED) 2014/68/EU Article 4, point 3
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05 + A-06

Note:

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

Pressure equipment with allowable pressure > 200 bar (2 900 psi)

Pressure equipment designated for application in every process fluid having a pressurized volume of < 0,1 l and a max. allowable pressure PS > 200 bar (2 900 psi) shall satisfy the essential safety requirements set out in Annex I of the Pressure Equipment Directive 2014/68/EU. According to Article 13 pressure equipment shall be classified by category in accordance with Annex II. The conformity assessment of the pressure equipment shall be determined by the category I under consideration of the above-mentioned low pressurized volume. These devices shall be provided with CE marking.

Reasons:

- Pressure Equipment Directive 2014/68/EU, Article 13, Annex II
- Pressure equipment directive 2014/68/EU, Commission's Working Group "Pressure", Guideline A-05

Note:

A partial examination shall be performed for pressure instruments that are part of safety equipment for the protection of a pipe or vessel from exceeding allowable limits (equipment with safety function in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

The following also applies:

- PMP51 /PMP55 with threaded connection and internal process isolating diaphragm PN > 200:
Suitable for stable gases in group 1, category I, module A
- PMP55 with pipe diaphragm seal ≥ 1.5"/PN40:
Suitable for stable gases in group 1, category II, module A2
- PMP55 with separators PN400:
Suitable for stable gases in group 1, category I, module A

Manufacturer declaration

Depending on the desired configuration, the following documents can be ordered additionally with the device:

- FDA conformity
- TSE-free, materials free from animal origin
- Regulation EC 2023/ 2006 (GMP)
- Regulation (EC) No. 1935/2004 on materials intended to come into contact with food

Downloading the Declaration of Conformity

<http://www.endress.com/en/download>

Downloads

Search and download operating manuals, brochures, publications, software updates, videos, certificates and a whole host of other documents!

Media Type

1 Approvals & Certificates
2 Manufact. Declaration

Product Code

3

Text Search

Advanced Search
Reset
Search
4

A0031778

1. Select "Approvals & Certificates"
2. Select "Manufact. Declaration"
3. Enter the required product code
4. Click "Search"

The available downloads are displayed.

Marine approval

Designation	Option ¹⁾
GL (Germanischer Lloyd)	LE
ABS (American Bureau of Shipping)	LF
LR (Lloyd's Register)	LG
BV (Bureau Veritas)	LH
DNV (Det Norske Veritas)	LI

1) Product Configurator, "Additional approval" ordering feature

Drinking water approval

NSF 61 - approval for PMC51 and PMP51

UBA / W270 - approval for PMC51 and PMP51

Ordering information:

Product Configurator, "Additional approval" ordering feature, option "LR"

Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ ISA 12.27.01

Endress+Hauser instruments are designed according to ANSI/ISA 12.27.01 either as single seal or dual seal devices with annunciation, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/ NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.

Further information can be found in the control drawings of the relevant devices.

Inspection certificate

Designation	PMC51	PMP51	PMP55	Option ¹⁾
3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate	✓	✓	✓	JA ²⁾
Conformity to NACE MR0175, wetted metallic parts	✓	✓	✓	JB ²⁾
Conformity to NACE MR0103, wetted metallic parts	✓	✓	✓	JE ²⁾
Conformity to AD2000, wetted metallic parts, excepting process membrane	—	✓	✓	JF
Surface finish measurement ISO4287/Ra, wetted metallic parts, Inspection certificate	✓	✓	✓	KB
Helium leak test, internal procedure, inspection certificate	✓	✓	✓	KD

Designation	PMC51	PMP51	PMP55	Option ¹⁾
Pressure test, internal procedure, inspection certificate	✓	✓	✓	KE
3.1 Material certificate+Delta-Ferrit measurement, internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	✓	✓	✓	KF
3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	—	✓	✓	KG
Welding documentation, wetted/pressurized seams	—	✓	—	KS

- 1) Product Configurator, "Test, certificate" ordering feature
2) The selection of this feature for coated process isolating diaphragm / process connections refers to the metallic base material.

Calibration; unit

Designation	Option ¹⁾
Sensor range; %	A
Sensor range; mbar/bar	B
Sensor range; kPa/MPa	C
Sensor range; mm/mH ₂ O	D
Sensor range; inH ₂ O/ftH ₂ O	E
Sensor range; psi	F
Customized pressure; see additional specification	J
Customized level; see additional specification	K

- 1) Product Configurator, "Calibration; unit" ordering feature

Calibration

Designation	Option ¹⁾
Factory calib. certificate 5-point	F1
DKD/DAkkS calib. certificate 10-point ²⁾	F2

- 1) Product Configurator "Calibration" ordering feature
2)

Service

Designation	Option ¹⁾
Cleaned from oil+grease ²⁾	HA
Cleaned for oxygen service ²⁾	HB
Cleaned from PWIS (PWIS = paint wetting impairment substances) ²⁾	HC
Adjusted min alarm current	IA
Adjusted HART Burst Mode PV	IB

- 1) Product Configurator "Service" ordering feature
2) Only device, not accessory or enclosed accessory

Ordering information

Detailed ordering information is available as follows:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search field → Open product page → The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
 - Depending on the device: direct input of information specific to the measuring point, such as measuring range or operating language
 - Automatic verification of exclusion criteria
 - Automatic generation of the order code with its breakdown in PDF or Excel output format
 - Ability to order directly in the Endress+Hauser Online Shop

Scope of delivery

- Device
- Optional accessories
- Brief Operating Instruction
- Calibration certificates
- Optional certificates

Measuring point (TAG)

Ordering feature	895: Marking
Option	Z1: Tagging (TAG), see additional spec.
Position of the measuring point marking	To be selected in the additional specifications: <ul style="list-style-type: none"> ■ Tag plate Stainless Steel ■ Self-adhesive paper label ■ Supplied label/plate ■ RFID TAG ■ RFID TAG + Tag plate Stainless Steel ■ RFID TAG + Self-adhesive paper label ■ RFID TAG + Supplied label/plate
Definition of the measuring point designation	To be defined in the additional specifications: 3 lines containing up to 18 characters each The measuring point designation appears on the selected label and/or the RFID TAG.
Identification on electronic nameplate (ENP)	32 characters
Identification on display module	10 characters

Configuration data sheet (HART, PROFIBUS PA, FOUNDATION Fieldbus electronics)

Pressure

If the option "J" was selected in the "Calibration; Unit" ordering feature of the Product Configurator, the following configuration data sheet must be completed and included with the order.

Pressure Engineering Unit			
<input type="checkbox"/> mbar	<input type="checkbox"/> mmH ₂ O	<input type="checkbox"/> mmHg	<input type="checkbox"/> Pa
<input type="checkbox"/> bar	<input type="checkbox"/> mH ₂ O	<input type="checkbox"/> kgf/cm ²	<input type="checkbox"/> kPa
<input type="checkbox"/> psi	<input type="checkbox"/> ftH ₂ O		<input type="checkbox"/> MPa
	<input type="checkbox"/> inH ₂ O		

Calibration Range / Output	
Low range value (LRV):	_____ [Pressure engineering unit]
Upper range value (URV):	_____ [Pressure engineering unit]

Display Information	
1st Value Display ¹⁾	2nd Value Display ¹⁾
<input type="checkbox"/> Main Value	<input type="checkbox"/> none (Default)
	<input type="checkbox"/> Main Value [%]
	<input type="checkbox"/> Pressure
	<input type="checkbox"/> Current [mA] (HART only)
	<input type="checkbox"/> Temperature

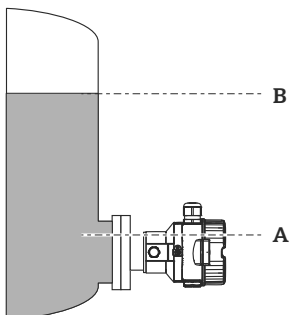
1) (Depending on sensor and communication variant)

Damping	
Damping	_____ sec (Default 2 sec)

Smallest span (factory calibration) → 14

Level

If the option "K" was selected in the "Kalibration; Einheit" ordering feature of the Product Configurator, the following configuration data sheet must be completed and included with the order.

Pressure Engineering Unit		Output Unit (Scaled unit)						
<input type="checkbox"/> mbar	<input type="checkbox"/> mmH ₂ O	<input type="checkbox"/> mmHg	<input type="checkbox"/> Pa	Masse	Längen	Volumen	Volumen	Prozent
<input type="checkbox"/> bar	<input type="checkbox"/> mH ₂ O	<input type="checkbox"/> kgf/cm ²	<input type="checkbox"/> kPa	<input type="checkbox"/> kg	<input type="checkbox"/> m	<input type="checkbox"/> l	<input type="checkbox"/> gal	<input type="checkbox"/> %
<input type="checkbox"/> psi	<input type="checkbox"/> ftH ₂ O		<input type="checkbox"/> MPa	<input type="checkbox"/> t	<input type="checkbox"/> dm	<input type="checkbox"/> hl	<input type="checkbox"/> lgal	
	<input type="checkbox"/> inH ₂ O			<input type="checkbox"/> lb	<input type="checkbox"/> cm	<input type="checkbox"/> m ³		
					<input type="checkbox"/> mm	<input type="checkbox"/> ft ³		
					<input type="checkbox"/> ft	<input type="checkbox"/> in ³		
					<input type="checkbox"/> inch			
Empty pressure [a]: _____		Empty calibration [a]: _____		Example				
Low pressure value (empty) [Pressure engineering unit]		Low level value (empty) [Scaled Unit]						
Full pressure [b]: _____		Full calibration [b]: _____						
High pressure value (full) [Pressure engineering unit]		High level value (full) [Scaled Unit]						

A0024007

A 0 mbar / 0m
B 300 mbar (4.5 psi) / 3 m (9.8 ft)

Display Information	
1st Value Display ¹⁾	2nd Value Display
<input type="checkbox"/> Main Value	<input type="checkbox"/> none (Default)
	<input type="checkbox"/> Main Value [%]
	<input type="checkbox"/> Pressure
	<input type="checkbox"/> Current [mA] (HART only)
	<input type="checkbox"/> Temperature

1) (Depending on sensor and communication variant)

Damping		
Damping:	<input type="text"/>	sec (Default 2 sec)

**Configuration data sheet
(Analog electronics)**

Pressure

If the option "J" was selected in the "Kalibration; Einheit" ordering feature of the Product Configurator, the following configuration data sheet must be completed and included with the order.

Pressure Engineering Unit			
<input type="checkbox"/> mbar	<input type="checkbox"/> mmH ₂ O	<input type="checkbox"/> mmHg	<input type="checkbox"/> Pa
<input type="checkbox"/> bar	<input type="checkbox"/> mH ₂ O	<input type="checkbox"/> kgf/cm ²	<input type="checkbox"/> kPa
<input type="checkbox"/> psi	<input type="checkbox"/> ftH ₂ O		<input type="checkbox"/> MPa
	<input type="checkbox"/> inH ₂ O		

Calibration Range / Output		
Low range value (LRV):	_____	[Pressure engineering unit]
Upper range value (URV):	_____	[Pressure engineering unit]

Display Information	
1st Value Display ¹⁾	2st Value Display
<input type="checkbox"/> Main Value	<input type="checkbox"/> none (Default)

1) Depending on sensor and communication variant

Damping	
Damping:	_____ sec (Default 2 sec)

Smallest span (factory calibration) →  14

Additional documentation

Field of Activities	Pressure measurement, powerful instruments for process pressure, differential pressure, level and flow: FA00004P/00/EN
Technical Information	<ul style="list-style-type: none"> ■ Deltabar M: TI00434P/00/EN ■ Deltapilot M: TI00437P/00/EN ■ EMC test procedures: TI00241F/00/EN ■ Weld-in adapter, adapter and flanges: TI00426F/00/EN
Special Documentation	Mechanical accessories for pressure measuring devices: SD01553P/00/EN
Operating Instructions	<ul style="list-style-type: none"> ■ 4...20 mA Analog: BA00385P/00/EN ■ 4...20 mA HART: BA00382P/00/EN ■ PROFIBUS PA: BA00383P/00/EN ■ FOUNDATION Fieldbus: BA00384P/00/EN
Brief operating instruction	<ul style="list-style-type: none"> ■ 4...20 mA Analog: KA01036P/00/EN ■ 4...20 mA HART: KA01030P/00/EN ■ PROFIBUS PA: KA01031P/00/EN ■ FOUNDATION Fieldbus: KA01032P/00/EN
Functional safety manual (SIL)	Cerabar M (4...20 mA): SD00347P/00/EN

Safety Instructions

Directive	Approval	Category	Type	Housing		Electronics	Documentation	Option ¹⁾
				F31	F15			
ATEX	Ex ia IIC	II 1/2 G	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00464P/00	BA
ATEX	Ex t IIC	II 1/2 D	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00466P/00	BB
ATEX	Ex d	II 2 G	PMP51 PMP55	✓	—	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00467P/00	BC
ATEX	Ex nA	II 3 G	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00469P/00	BD
ATEX	Ex ia IIC	II 2 G	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00464P/00	BE
ATEX	Ex ia IIC	II 1/2 D	PMC51	✓	✓	4...20 mA HART	XA00465P/00	BF
ATEX	Ex ic IIC	II 3 G	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00489P/00	BG
ATEX	Ex ia Ex ia IIC	II 1/2 G II 1/2 D	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00468P/00	B1
ATEX	Ex ia IIC	II 2 G II 1/2 G	PMP51 PMP55	✓	✓	4...20 mA HART	XA00468P/00	B2
ATEX	Ex d IIC Ex ia IIC	II 2 G II 1/2 G	PMP51 PMP55	✓	—	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00504P/00	8A

1) Product Configurator, "Approval" ordering feature

Directive	Approval	EPL	Type	Housing		Electronics	Documentation	Option ¹⁾
				F31	F15			
IECEEx	Ex ia IIC	Ga/Gb	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00470P/00	IA
IECEEx	Ex d IIC	Gb	PMP51 PMP55	✓	—	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00471P/00	IB
IECEEx	Ex t IIIC	Da/Db	PMP51 PMP55	✓	✓	4...20 mA HART	XA00472P/00	ID
IECEEx	Ex ic	Gc	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00488P/00	IE
IECEEx	Ex ia IIIC	Da/Db	PMC51	✓	✓	4...20 mA HART	XA00487P/00	IF
IECEEx	Ex ia IIC Ex ia IIIC	Ga/Gb Da/Db	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00473P/00	I1

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Type	Housing		Electronics	Documentation	Option ¹⁾
			F31	F15			
NEPSI	Ex ia IIC T6	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	XA00533P/00	NA
NEPSI	Ex d IIC T6 Gb	PMP51 PMP55	✓	—	4...20 mA HART	XA00515P/00	NB

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Electronics	Dokumentation	Option ¹⁾
TIIS	Ex ia IIC T4	4...20 mA HART	—	TA

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Electronics	Dokumentation	Option ¹⁾
INMETRO	Ex ia IIC T6...T4 Ga/Gb Ex ia IIC T6...T3 Ga/Gb	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA01302P/00	MA
INMETRO	Ex d IIC T6/T4 Gb	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA01284P/00	MB

1) Product Configurator, "Approval" ordering feature

Installation/Control Drawings

Directive	Approval	Type	Housing		Electronics	Documentation	Option ¹⁾
			F31	F15			
FM	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia FM NI Cl.I Div.2 Gr.A-D FM IS: Zone 0,1,2,20,21,22/FM NI: Zone 2	PMC51 PMP51 PMP55	✓	✓	<ul style="list-style-type: none"> 4...20 mA HART PROFIBUS PA, FOUNDATION Fieldbus 	<ul style="list-style-type: none"> XA00563P/00 XA00564P/00 	FA
FM	FM XP Cl.I, II Div.1 Gr.A-D, AEx d (Factory sealed) Zone 1,2	PMP51 PMP55	✓	—	<ul style="list-style-type: none"> 4...20 mA HART PROFIBUS PA FOUNDATION Fieldbus 	XA01163P/00	FB

Directive	Approval	Type	Housing		Electronics	Documentation	Option ¹⁾
			F31	F15			
FM	FM DIP Cl.II, III Div.1 Gr.A-D Zone 21, 22	PMP51 PMP55	✓	✓	4...20 mA HART	In preparation	FC
FM	FM NI Cl.I Div.2 Gr.A-D, Zone 2	PMC51 PMP51 PMP55	✓	✓	4...20 mA HART	FM3035394	FD
FM	FM IS/XP Cl.I, II Div.1 Gr.A-G, Zone 1,2	PMP51 PMP55	✓	—	<ul style="list-style-type: none"> 4...20 mA HART PROFIBUS PA, FOUNDATION Fieldbus 	<ul style="list-style-type: none"> XA01160P/00 XA00567P/00 	F1
CSA	C/US IS Cl.I,II,III Div.1 Gr.A-G, C/US IS Cl.I Div.2 Gr.A-D, Ex ia	PMC51 PMP51 PMP55	✓	✓	<ul style="list-style-type: none"> 4...20 mA HART PROFIBUS PA, FOUNDATION Fieldbus 	<ul style="list-style-type: none"> XA00556P/00 XA00558P/00 	CA
CSA	CSA C/US CP Cl.I, II Div.1 Gr.B-G, Ex d (factory sealed) Zone 1,2	PMP51 PMP55	✓		4...20 mA HART	XA00577P/00	CB
CSA	CSA C/US Cl.II, III Div.1 Gr.E-G, Zone 21,22	PMP51 PMP55	✓	✓	4...20 mA HART	In preparation	CC
CSA	CSA C/US IS/XP Cl.I, II Div.1 Gr.A-G/B-G, Zone 1,2	PMP51 PMP55	✓	—	<ul style="list-style-type: none"> 4...20 mA HART PROFIBUS PA, FOUNDATION Fieldbus 	<ul style="list-style-type: none"> XA00577P/00 XA00561P/00 	C1
FM CSA	FM/CSA IS + XP Cl.I, II Div.1 Gr.A-D/B-G FM IS/FM XP Cl.I, II Div.1 Gr.A-G+ CSA IS/XP Cl.I, II Div.1 Gr.A-G, Zone 1,2	PMP55	✓	—	4...20 mA HART	In preparation	8B

1) Product Configurator, "Approval" ordering feature

Combination certificate

Directive	Approval	Type	Electronics	Documentation	Option ¹⁾
KEMA/ FM / CSA	ATEX II Ex ia + FM/CSA IS ATEX II 1/2G Ex ia IIC T6 + FM/CSA IS Cl.I Div.1 Gr.AD, FM/CSA: Zone 0,1,2	PMC51	4...20 mA HART, PROFIBUS PA, FOUNDATION Fieldbus	XA00464P/00	8C
			4...20 mA HART	XA00556P/00 + XA00536P/00	
			PROFIBUS PA, FOUNDATION Fieldbus	XA00564P/00	

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Electronics	Documentation	Option ¹⁾
KEMA/ FM / CSA	ATEX II Ex ia + FM/CSA IS ATEX II 1/2G Ex ia IIC T6 + FM/CSA IS Cl.I Div.1 Gr.A-D, FM/CSA: Zone 0,1,2	4...20 mA HART	<ul style="list-style-type: none"> ZD00236P/00 ZD00239P/00 	8C
		PROFIBUS PA, FOUNDATION Fieldbus	XA00474P/00	

1) Product Configurator, "Approval" ordering feature

Accessories

Manifolds

→  71

For details see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".

Additional mechanical accessories

Oval flange adapters, pressure gauge valves, shutoff valves, siphons, condensate pots, cable shortening kits, adapter test, flushing rings, block&bleed valves, protective roofs.

For details see SD01553P/00/EN "Mechanical accessories for pressure measuring devices".


Welding necks and Weld-in tool flanges

For dimensions and technical data see technical Information TI00426F/00.

Designation	PMC51	PMP51	PMP55	Option ¹⁾
Weld-in adapter G1/2, 316L,	—	✓	✓	QA
Weld-in adapter G1/2, 316L, 3.1 EN10204-3.1 material, inspection certificate	—	✓	✓	QB
Weld-in tool adapter G1/2, Brass	—	✓	✓	QC
Weld-in adapter G1, 316L, conical metal joint	—	✓	—	QE
Weld-in adapter G1, 316L, 3.1 EN10204-3.1 material, inspection certificate, conical metal joint	—	✓	—	QF
Weld-in tool adapter G1, Brass conical metal joint	—	✓	—	QG
Weld-in adapter G1-1/2, 316L	✓	✓	✓	QJ
Weld-in adapter G1-1/2, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	✓	✓	QK
Weld-in tool adapter G1-1/2, Brass	✓	✓	✓	QL
Weld-in flange DRD DN50 65mm, 316L	✓	✓	✓	QP
Weld-in fl. DRD DN50 65mm, 316L 3.1 EN10204-3.1 material, inspection certificate	✓	✓	✓	QR
Weld-in tool flange DRD DN50 65mm, Brass	✓	✓	✓	QS
Weld-in adapter Uni D65, 316L	✓	—	—	QT
Weld-in adapter Uni D65, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	QU
Weld-in tool adapter Uni D65/D85, Brass	✓	—	—	Q1
Weld-in adapter Uni D85, 316L	✓	—	—	Q2
Weld-in adapter Uni D85, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	Q3
Adapter Uni > DIN11851 DN40, 316L, slotted-nut	✓	—	—	RA
Adapter Uni > DIN11851 DN50, 316L, slotted-nut	✓	—	—	RB
Adapter Uni > DRD DN50 65mm, 316L	✓	—	—	RC
Adapter Uni > Clamp 2", 316L	✓	—	—	RD
Adapter Uni > Clamp 3", 316L	✓	—	✓	RE
Adapter Uni > Varivent N, 316L	✓	—	—	RF
Adapter Uni > Cherry Burell 2", 316L	✓	—	—	RH
Adapter Uni > DIN11851 DN40, 316L, 3.1, slotted-nut, EN10204-3.1 material, inspection certificate	✓	—	—	R1
Adapter Uni > DIN11851 DN50, 316L, 3.1, slotted-nut, EN10204-3.1 material, inspection certificate	✓	—	—	R2
Adapter Uni > DRD DN50 65mm, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	R3
Adapter Uni > Clamp 2", 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	R4
Adapter Uni > Clamp 3", 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	✓	R5
Adapter Uni > Varivent, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	R6
Adapter Uni > Cherry Burell, 316L, 3.1 EN10204-3.1 material, inspection certificate	✓	—	—	R7

1) Product Configurator, "Accessories" ordering feature

For dimensions and technical data see technical Information TI00426F/00.

**Mounting bracket for wall
and pipe mounting** →  37

M12 connector →  24

Registered trademarks

HART® Registered trademark of the FieldComm Group, Austin, USA

PROFIBUS® Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

FOUNDATION™Fieldbus Registered trademark of the FieldComm Group, Austin, USA



www.addresses.endress.com

MJK 7030 Float Switch Installation Instructions.

Applies to Part Numbers 202810, 202811, and 202811-100ft.

Counter weights, ring bolts, pipe, cable ties, and screws referenced in this manual are not supplied with the MJK Float Switch but are referenced as part of installation examples.

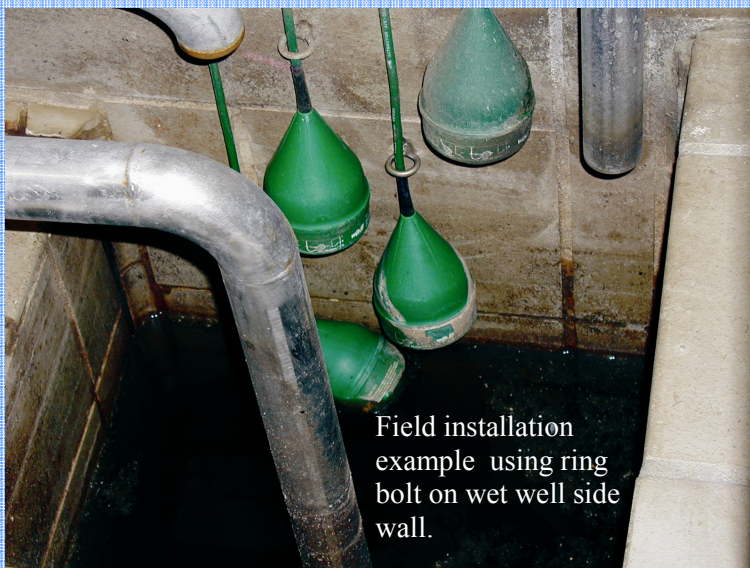
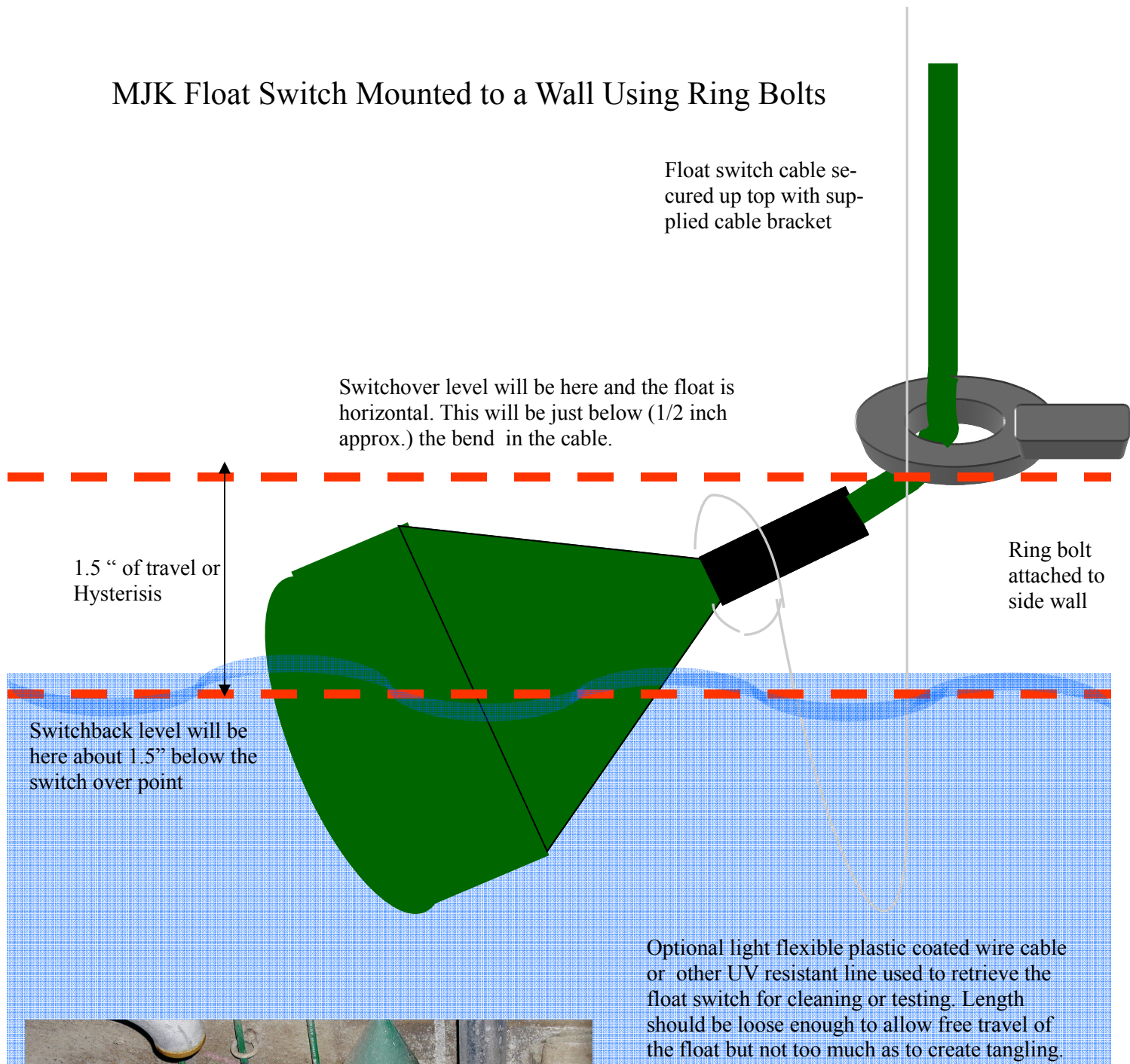


MJK North America, Inc.
37 Sherwood Terrace, #126
Lake Bluff, IL 60044

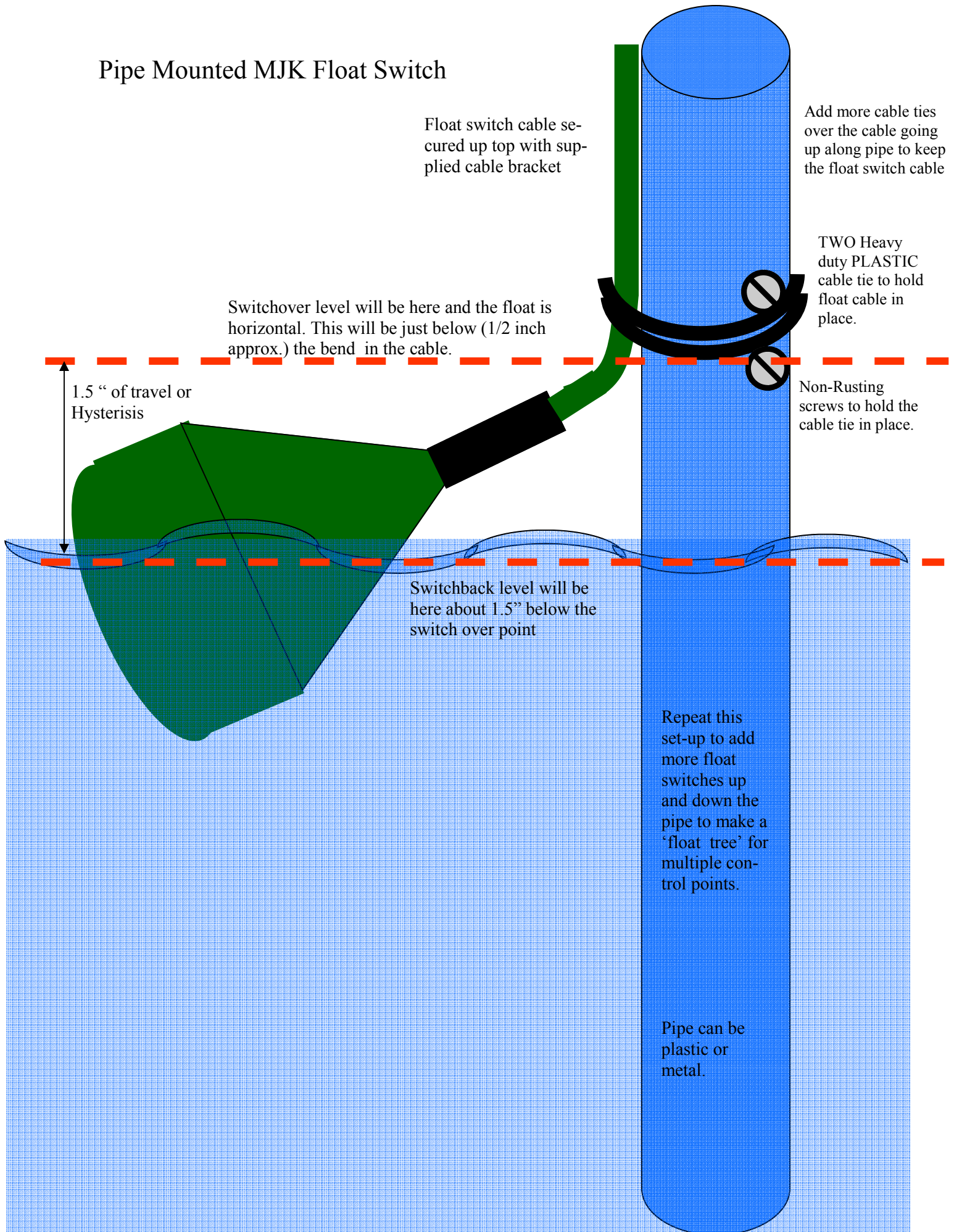
Tel.: 847-482-8655
877-MJK-LINK
Fax: 847-482-8654

mjkusa@mjk.com
www.mjk.com

MJK Float Switch Mounted to a Wall Using Ring Bolts



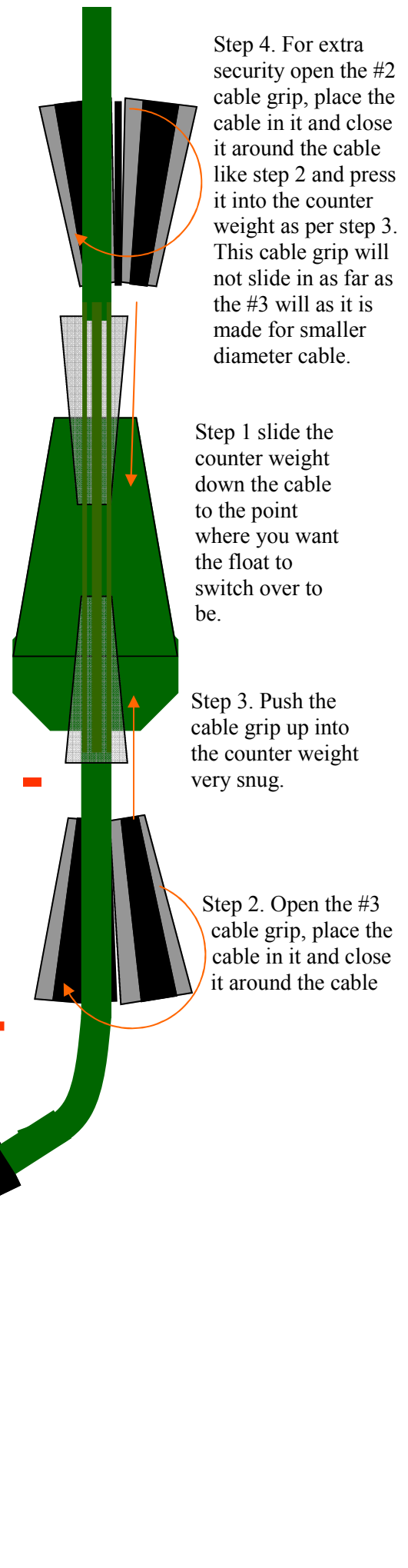
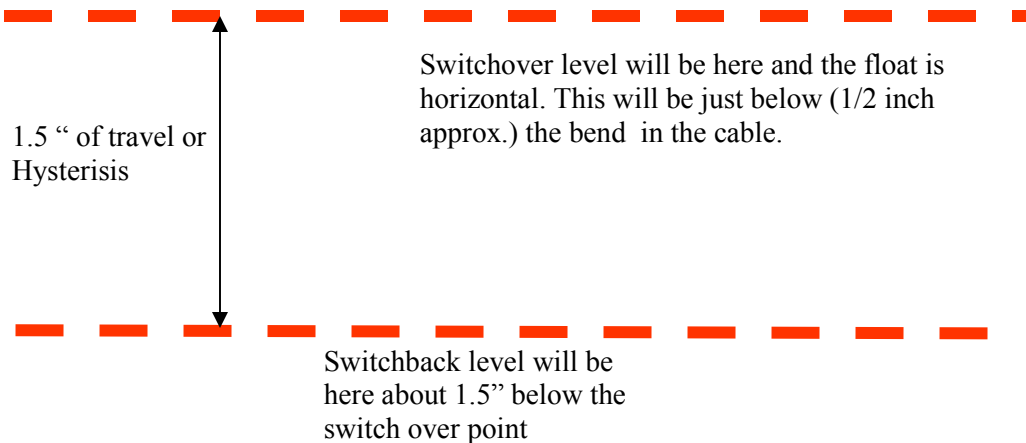
Pipe Mounted MJK Float Switch



Using the MJK Counter Weight to Position Where the MJK Float Switch Switchover Occurs.

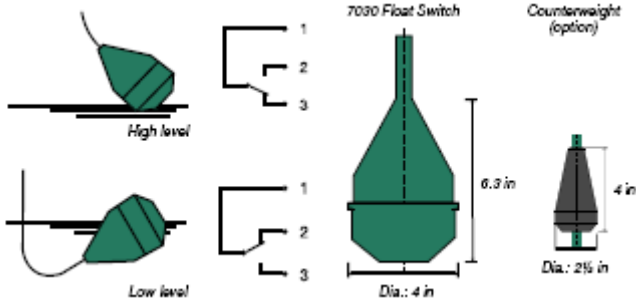


Hang the Float Switches using the supplied cable bracket . Position the Counter Weight 4 to 8 inches above the float switch. Do not position the counter weight too close to the black cable fitting at the top of the float switch or the cable may not bend properly. See photo at left for a proper installation example.



MJK Part no.	Data Sheet Description
202810	7030 Float Switch, w/39ft cable
202811	7030 Float Switch w/65ft cable
202811-100FT	7030 Float Switch w/100 ft. cable
560917	Counter weight
560916	Cable Bracket for 7030 Float Switches and standard cable for 1100/1100T/1400 series submersible level transmitters.

Connection and dimension



Specifications:	
Contact system:	Mechanical change-over switch (SPDT)
Max. load:	16 A @ 230 VAC, 0.5 A @ 230 VDC
Temperature:	- 5 to + 150 °F
Materials:	Polypropylene / Oil resistant PVC (float housing / cable)
Cable:	3 x AWG 17, oil resistant PVC insulation, Length 39 ft, dia. 1/2 in.
Approvals:	CE: EN50081-1, EN50082-1 UL: ULS 161.3 (µ-switch)

General

The exceptional reliability of the 7030 Float Switch makes it very suitable for many highly automated systems to provide additional protection against control system failures, preventing pumps from running dry etc. Traditional mercury switches are replaced with up-to-date environmentally friendly

materials in the 7030 Float Switch. The extra durability of the potted switching components, strong multi-fiber flexible cable, rugged polypropylene enclosure, allow the 7030 to deliver reliable results where other float switches fail.

Features

- Environmental friendly - no mercury!
 - Unmatched rugged construction for durability.
 - Very reliable electromechanical contact system - guaranteed for up to 20 million operations.
 - The relay contact switch handles loads up to 16 Amps AC so a motor starter can
- be connected directly.
 - Includes 39 ft or 65 ft of rugged, oil resistant PVC cable and polypropylene cable bracket.
 - SPDT relay allows normally open or normally closed configurations that are selected by how it is wired.

Warranty

MJK 7030 series Float Switches carry a five-year limited warranty against defects in materials or workmanship and that they will comply with written specifications supplied by MJK current at the time of shipment to the customer. The Warranty period begins once the product is installed or otherwise put into operation, or 90 days after the date of delivery to the buyer, whichever is soonest. MJK products are not warranted against abuse, misuse, or normal wear and tear. MJK will at MJK’s discretion, repair or exchange defective product covered under warranty at no cost to the buyer provided the buyer returns the item, freight prepaid to MJK with a return authorization issued by MJK. The buyer is liable for expenses and risks, associated with return delivery to our company. MJK is not liable for direct or indirect damages due to product failure under warranty or out of warranty.

Liability

MJK North America Inc. an Illinois Corporation is the manufacturer and wholesale seller of record, not the retail seller of record. MJK’s liability is limited to the costs of its products and services, unless otherwise indicated by state or provincial law.

Return of Goods

Products custom manufactured to the specifications of a customer cannot be returned, except if covered by warranty, nor can an order for custom manufactured products be cancelled once issued to MJK, except with written permission from MJK. Restocking fees and/or manufacturing costs may be assessed for the cancellation of custom product orders. Standard products can only be returned with a return goods authorization issued by MJK. Returns of goods ordered in error or for stock reduction purposes, which are returned unused, complete and in their original packaging, will be accepted when return authorization is obtained. The buyer will be assessed a 10% re-stocking charge based on the purchase price of the product. Product credit, less the restocking charge, will be issued upon inspection of the returned goods

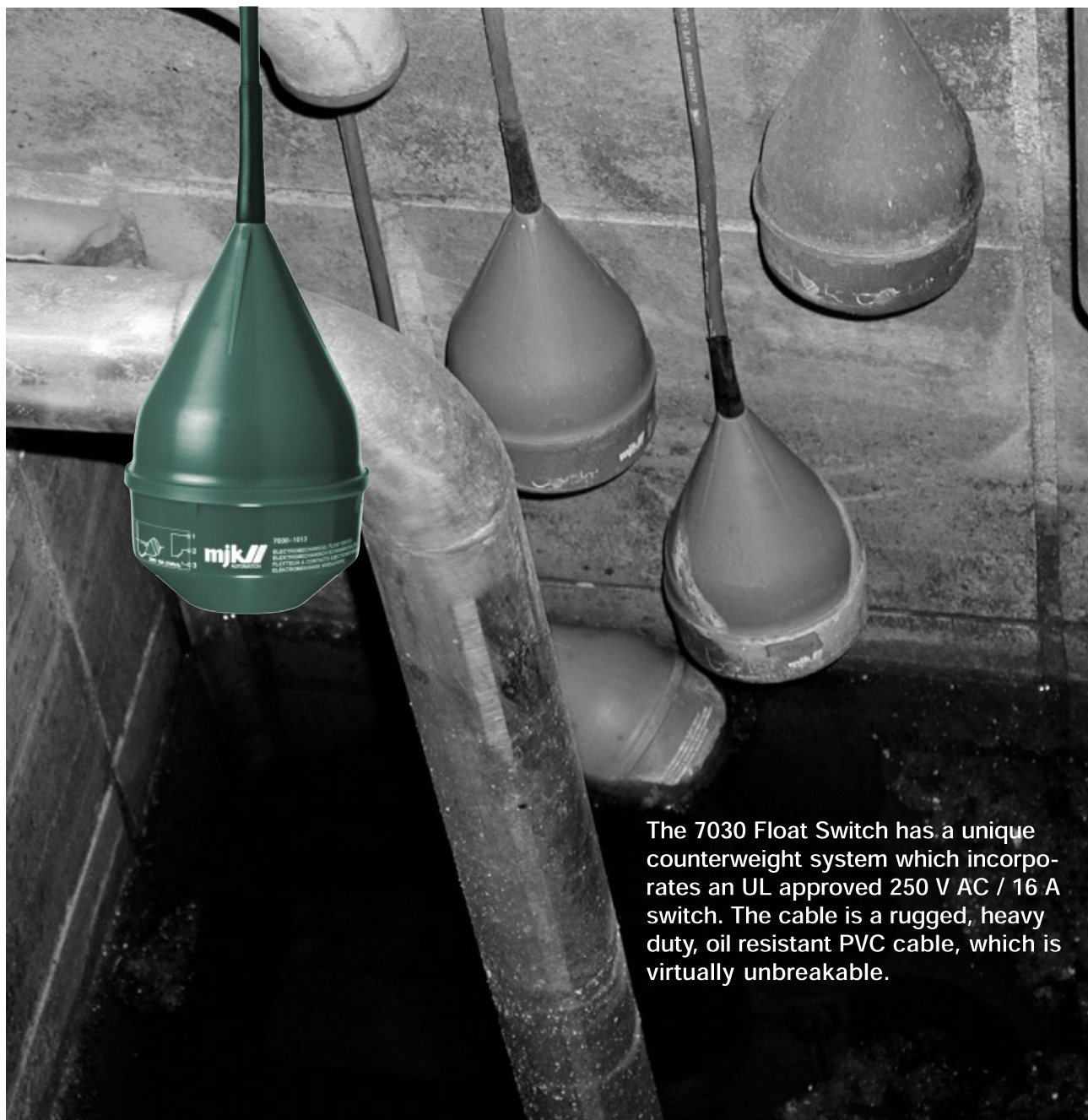
Represented by/Distributed by

Float Switch Model 7030 Mercury Free with break resistant cable



2.71

Environmentally friendly and highly durable.



The 7030 Float Switch has a unique counterweight system which incorporates an UL approved 250 V AC / 16 A switch. The cable is a rugged, heavy duty, oil resistant PVC cable, which is virtually unbreakable.

General

The exceptional reliability of the 7030 Level Switch makes it very suitable in many highly automated systems to provide additional protection against control system failures, preventing pumps from dry running etc.

Traditional mercury switches are replaced with up-to-date environmentally friendly materials in the 7030 Float Switch.

Features

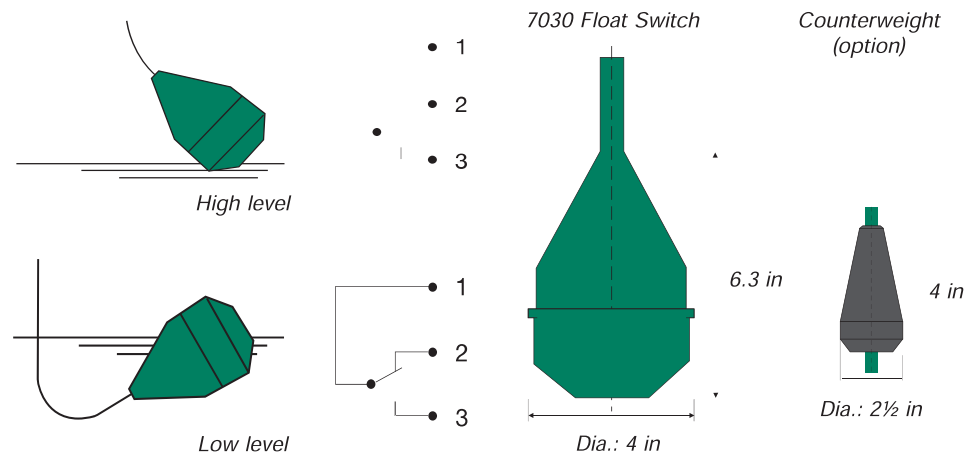
- Environmental friendly - **no mercury!**
- The float housing is made from polypropylene for durability.
- Very reliable electromechanical contact system - guaranteed up to 20 million operations.
- The changeover switch can handle loads up to 16 A AC so a motor starter can be connected directly.
- Delivered with 39 ft of rugged, oil resistant cable.

Function

A hermetically sealed microswitch is activated by a moving counterweight when the float changes its position in the fluid. The changeover hysteresis can be adjusted by means of a counterweight placed on the cable.

The counterweight also ensures that the 7030 float switch is always correctly positioned and makes the bend of the cable less sharp.

Connection and dimension



Specifications and order numbers

Specifications:

Contact system:	Mechanical change-over switch (SPDT)
Max. load:	16 A @ 200 VAC, 0.5 A @ 220 VDC
Temperature	- 5 to + 150 °F
Materials:	Polypropylene / Oil resistant PVC (float housing / cable)
Cable:	3 X AWG 17, oil resistant PVC insulation. Length 39 ft, dia. 1/3 in.
Approvals:	CE: EN50081-1, EN50082-1 UL: U83 161 3 (μ-switch)

Order numbers:

202810	7030 Float Switch w. 39 ft of cable
560917	Counterweight

ProMinent® Low Flow Pump Accessories: Float Switches for gamma series pumps

Description	Part No.
Float switches, two stage	



2380/4

Float switch, two-stage (includes ceramic weight - do not use ceramic weight for fluoride service)

To monitor the fluid level in the chemical tank. Two-stage function, first stage is early warning annunciation, second stage will shut down pump after an additional drop in the fluid level of approximately 1.2" (30 mm).

With 3-pole round connector, suitable for direct connection to ProMinent gamma series.

Technical data:

Max. contact load 60 V, 0.3 A, 5 W/5 VA, temperature range -13°F to 167°F (-25°C to 75°C).

Materials:

PP body, foamed PP float 7/8" (21 mm) dia., PE cable			
PP with 3-pole round connector	cable length	6 ft. (2 m)	7142093
		15 ft. (5 m)	7142095
PVC body, foamed PP float 7/8" (21 mm) dia., PE cable			
PVC with 3-pole round connector	cable length	6 ft. (2 m)	7142043
		15 ft. (5 m)	7142038
PVDF body, foamed PVDF float 1" (25 mm) dia., PE cable			
PVDF with 3-pole round connector	cable length	6 ft. (2 m)	7792639
		15 ft. (5 m)	7792640

Ceramic weight for float switch



1086/4

1.53" dia. x 1.26" (39 mm x 32 mm)	with oval opening .51" x 1.06" (13 mm x 27 mm)	404004
---------------------------------------	---	--------

With two-stage float switches with round connector, the weight is slid into position from below after the float has been removed.

Note: Not for use in fluoride application (e.g. hydrofluosilicic acid).

Technical Information

Deltapilot M

FMB50, FMB51, FMB52, FMB53

Hydrostatic level measurement

Pressure sensor with the CONTITE™ measuring cell
Condensate-resistant



Application

The device is used for the following measuring tasks:

- Hydrostatic pressure measurement in liquids and paste-like media in all areas of process engineering, process measuring technology, pharmaceuticals and the food industry
- Level, volume or mass measurements in liquids

Your benefits

- Very good reproducibility and long-term stability
- Maximum plant safety provided by one-of-a-kind, condensate-proofed CONTITE measuring cell
- High reference accuracy: $\pm 0.2\%$
optionally $\pm 0.1\%$
- Turn down 100:1
- Standardized platform for differential pressure, hydrostatics, and pressure (Deltabar S – Deltapilot S – Cerabar S)
- Simple, fast commissioning through a user interface designed for real-world applications
- Used for process pressure monitoring up to SIL2, certified to IEC 61508 Edition 2.0 and IEC 61511 by TÜV NORD
- Usage in drinking water: KTW, NSF

Table of contents





Document information	4	Total error	27
Symbols used	4	Warm-up period	27
Terms and abbreviations	6		
Function and system design	7	Installation	28
Device selection	7	General installation instructions	28
Measuring principle	9	FMB50	28
Level measurement in closed tanks with pressure overlay ..	10	FMB51/FMB52/FMB53	28
Density measurement	11	Supplementary installation instructions	29
Level measurement with automatic density correction (with media changing in the tank)	11	Wall and pipe mounting	29
Electrical differential pressure measurement with gauge pressure sensors	12	"Separate housing" version	30
Communication and data processing	12	Oxygen applications	31
		PWIS cleaning	31
		Applications with hydrogen	31
		Special measuring cells for acids, alkalis or sea water (not FMB50)	31
Input	13	Environment	32
Measured variable	13	Ambient temperature limits	32
Measuring range	13	Storage temperature range	32
		Climate class	32
Output	14	Degree of protection	32
Output signal	14	Vibration resistance	32
Signal range – 4 to 20 mA HART	14	Electromagnetic compatibility	32
Signal on alarm	14		
Load - 4 to 20 mA HART	14	Process	33
Dead time, time constant	15	Process temperature range	33
Dynamic behavior: current output	15	Lateral load FMB51 (static)	33
Dynamic behavior: HART	15	Pressure specifications	33
Dynamic behavior: PROFIBUS PA	16		
Dynamic behavior: FOUNDATION Fieldbus	16	Mechanical construction	34
Damping	16	Device height	34
Firmware version	16	F31 housing, aluminum	34
Galvanic isolation	17	F15 housing, stainless steel (hygienic)	35
Protocol-specific data	17	Process connections FMB50, FMB51, FMB52	35
		Process connections FMB50, FMB51, FMB52	36
Power supply	21	Process connections FMB50, FMB51, FMB52 - continued ..	37
Terminal assignment	21	Process connections FMB50, FMB51, FMB52 - continued ..	38
Supply voltage	21	Process connections FMB50 - continued	39
Current consumption	22	Process connections FMB50 - continued	40
Electrical connection	22	Process connections FMB51 (rod version)	42
Terminals	22	Process connections FMB52 (cable version)	44
Cable entry	22	Dimensions of FMB53 with F31 housing, suspension clamp and mounting bracket	46
Connector	23	Dimensions of FMB53 with F15 housing, suspension clamp and mounting bracket	47
Cable specification	24	Wall and pipe mounting with "Separate housing" version ...	48
Start-up current HART	24	Materials not in contact with process	51
Residual ripple	24	Materials in contact with the process	54
Influence of power supply	24		
Overvoltage protection (optional)	25	Operability	57
		Operating concept	57
Performance characteristics	26	Onsite operation	57
Reference operating conditions	26	Operating languages	59
Influence of orientation	26	Remote operation	59
Calibration position	26	System integration	60
Resolution	26		
Reference accuracy	26		
Thermal change in the zero output and the output span ...	27		
Total performance	27		
Long-term stability	27		

Certificates and approvals	61
CE mark	61
C-tick symbol	61
Ex approvals	61
Suitability for hygienic processes	61
Pharma (CoC) (FMB50 only)	61
Functional safety SIL	61
Overfill protection	62
AD2000	62
Pressure Equipment Directive (PED)	62
Marine approval	62
Other standards and guidelines	62
Drinking water approval	62
Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01	62
Inspection certificate	62
Calibration; unit	63
Calibration	63
Service	63
 Ordering information	 64
Configuration data sheet	64
 Accessories	 66
Suspension clamp (FMB53 only)	66
Extension cable shortening kit (FMB53 only)	66
M12 connector	66
Welding necks and Weld-in tool flanges	66
Adapter Uni for FMB50	67
 Documentation	 68
Technical Information	68
Operating Instructions	68
Brief Operating Instructions	68
Functional safety manual (SIL)	68
Safety Instructions	68
Installation/Control Drawings	69
Combination certificate	69
Overfill protection	69
 Registered trademarks	 70
HART®	70
PROFIBUS®	70
FOUNDATION™ Fieldbus	70







Document information

Symbols used






Safety symbols

Symbol	Meaning
 A0011189-EN	DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.









Electrical symbols

Symbol	Meaning
 A0018335	Direct current A terminal at which DC voltage is present or through which direct current flows.
 A0018336	Alternating current A terminal at which alternating voltage is present or through which alternating current flows.
 A0018337	Direct current and alternating current <ul style="list-style-type: none"> ■ A terminal at which alternating voltage or DC voltage is present. ■ A terminal through which alternating current or direct current flows.
 A0018338	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0018339	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.



Tool symbols

Symbol	Meaning
 A0011219	Phillips head screwdriver
 A0011220	Flat-blade screwdriver
 A0013442	Torx screwdriver
 A0011222	Hexagon wrench
 A0011221	Allen screw

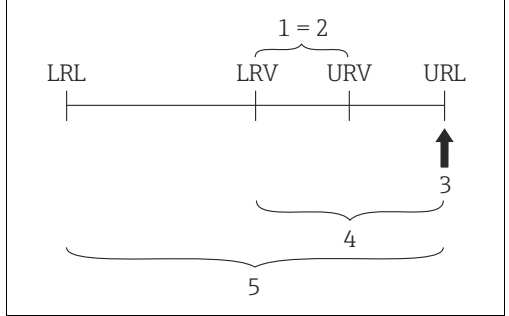
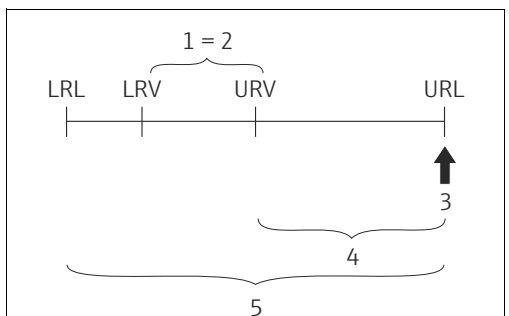
Symbols for certain types of information

Symbol	Meaning
 A0011182	Permitted Indicates procedures, processes or actions that are permitted.
 A0011183	Preferred Indicates procedures, processes or actions that are preferred.
 A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.
 A0015483	Reference to documentation Refers to the corresponding device documentation.
 A0015484	Reference to page Refers to the corresponding page number.
 A0015486	Reference to graphics Refers to the corresponding graphic number and page number.
1. , 2. , ...	Series of steps
 A0015488	Help in the event of a problem

Symbols in graphics


Symbol	Meaning
1, 2, 3, 4 etc.	Numbering for main items
1. , 2. , ...	Series of steps
A, B, C, D etc.	Views
A-A, B-B, etc.	Sections
 A0011187	Hazardous area Indicates the hazardous area.
 A0011188	Safe area (non-hazardous area) Indicates the non-hazardous area.

Terms and abbreviations

Term/abbreviation	Explanation
MWP	The MWP (maximum working pressure) for the individual sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Pay attention to the pressure-temperature dependence also. For the relevant standards and additional notes, see section "→ 33".
OPL	The OPL (over pressure limit = sensor overload limit) for the sensor depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Pay attention to the pressure-temperature dependence also. For the relevant standards and additional notes, see section "→ 33".
LRL	Lower range limit
URL	Upper range limit
LRV	Lower range value
URV	Upper range value
TD	Turn down
<p><i>Case 1:</i></p> <ul style="list-style-type: none"> Lower range value (LRV) \leq Upper range value (URV) <p><i>Example:</i></p> <ul style="list-style-type: none"> Lower range value (LRV) = 0 mbar Upper range value (URV) = 40 mbar (0.6 psi) Nominal value (URL) = 400 mbar (6 psi) <p><i>Turn down:</i></p> <ul style="list-style-type: none"> $TD = URL / URV = 10:1$ <p><i>Set span:</i></p> <ul style="list-style-type: none"> $URV - LRV = 40 \text{ mbar (0.6 psi)}$ This span is based on the zero point. 	 <p><small>A0019783</small></p> <p><i>Example: 400 mbar (6 psi) measuring cell</i></p>
<p><i>Case 2:</i></p> <ul style="list-style-type: none"> Lower range value (LRV) \geq Upper range value (URV) <p><i>Example:</i></p> <ul style="list-style-type: none"> Lower range value (LRV) = -200 mbar (3 psi) Upper range value (URV) = 0 bar Nominal value (URL) = 400 mbar (6 psi) <p><i>Turn down:</i></p> <ul style="list-style-type: none"> $TD = URL / (LRV) = 2:1$ <p><i>Set span:</i></p> <ul style="list-style-type: none"> $URV - LRV = 200 \text{ mbar (3 psi)}$ This span is based on the zero point. 	 <p><small>A0016451</small></p> <p><i>Example: 400 mbar (6 psi) measuring cell</i></p> <ol style="list-style-type: none"> Set span Span based on zero point Nominal value $\hat{=}$ upper range limit (URL) Nominal measuring range Sensor measuring range

Function and system design

Device selection

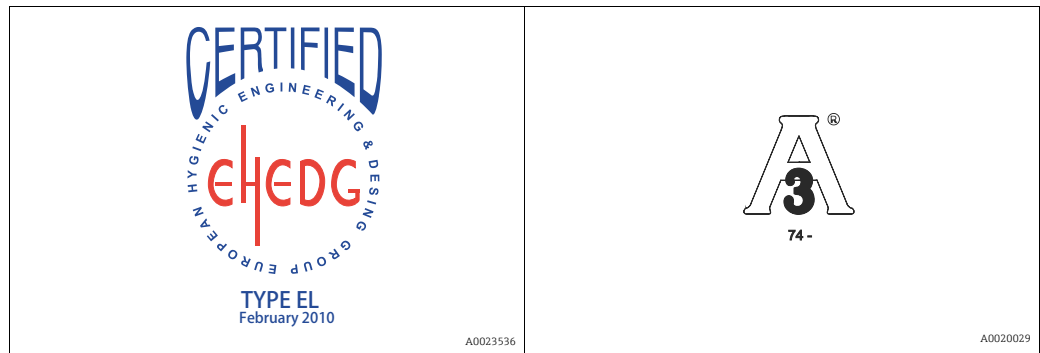
Deltapilot M – Product family	FMB50	FMB51	FMB52	FMB53
	<div> <</div>			

FMB50, FMB51, FMB52 universal application

- Modular probe program to ensure optimum process adaptation
- FMB50 compact version: installation in the tank from below or from the side
- FMB51, FMB52 rod and cable extension: installation from above, i.e. easy to retrofit ground tanks, no additional opening in the vessel floor

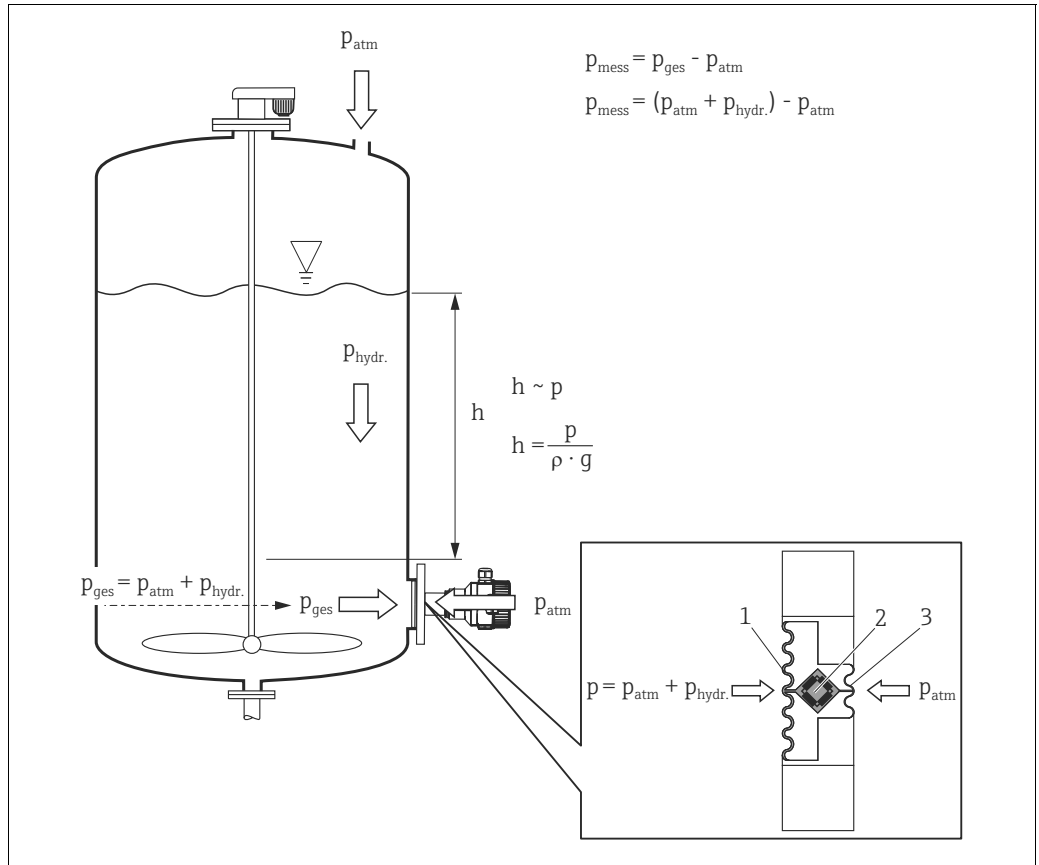
FMB50 optimized for hygienic applications

- All typical flush-mounted process connections can be supplied
- Welding flanges
- Stainless steel housing
- All the sanitary process connections are gap-free and can be cleaned so that the unit is free of residue, e.g. CIP cleaning
- USDA/H1-approved transfer liquid as per FDA Directive
- 3A approval or EHEDG approvals

**FMB53 for level measurement in water and wastewater**

- The housing with the electronic insert is mounted outside shafts and vessels in such a way that it is protected from flooding. The extension cable is secured with a suspension clamp.
- The measuring cell tube made of stainless steel (AISI 316L) and the Alloy process isolating diaphragm allow use in aggressive media such as wastewater for example.
- Extension cable up to 400 m (1312 ft) in length (up to 100 m (328 ft) in Ex-areas) without strain relief.
- Special measuring cell with gold/rhodium coating for applications in which severe hydrogen formation can occur (e.g. digested sludge); → 31.
- Special measuring cell with gold/platinum coating for acids, alkalis or sea water; → 31.

Measuring principle



Deltapilot M hydrostatic level measurement and measuring principle

- 1 Rear isolating membrane of the CONTITE™ measuring cell
- 2 Measuring element
- 3 Process isolating diaphragm
- g Gravitational acceleration
- h Level height
- p_{ges} Total pressure = hydrostatic pressure + atmospheric pressure
- p_{atm} Atmospheric pressure
- $p_{\text{hydr.}}$ Hydrostatic pressure
- p_{mess} Measured pressure in the measuring cell = hydrostatic pressure
- ρ Density of the medium

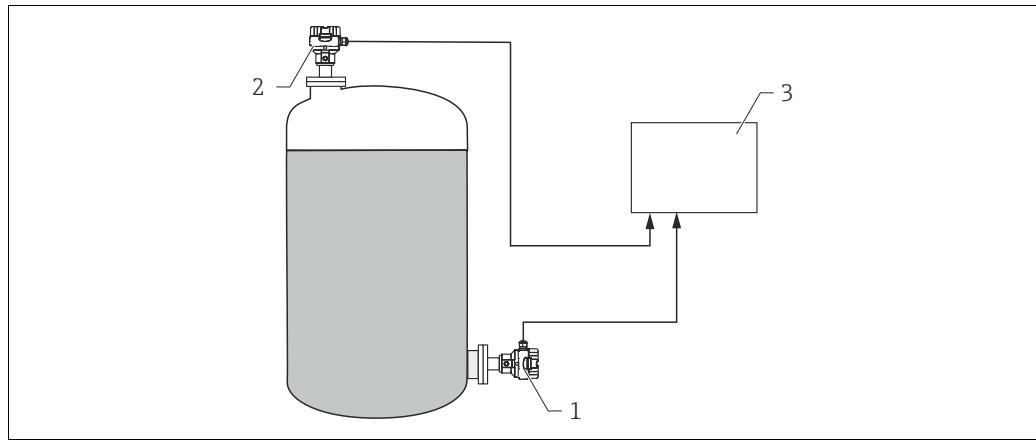
Due to its weight, a liquid column creates hydrostatic pressure. If the density is constant, the hydrostatic pressure depends solely on the height h of the liquid column.

The CONTITE™ measuring cell, which works on the principle of the gauge pressure sensor, constitutes the core of Deltapilot M. In contrast to conventional gauge pressure sensors, the precision measuring element (2) in the CONTITE™ measuring cell is absolutely protected, situated between the process isolating diaphragm (3) and the rear isolating membrane (1). Thanks to this hermetic sealing of the measuring element, the CONTITE™ measuring cell is absolutely insensitive to condensate/condensation and aggressive gases. The pressure applied is transferred from the process isolating diaphragm to the measuring element by means of an oil without any loss in pressure. Any measured errors due to fluctuations in temperature are compensated for in the electronics unit by means of the sensor temperature.

A linearization function with max. 32 points, based on a table entered either manually or semi-automatically, can be activated locally or remotely. This function facilitates measurement in engineering units, and provides a linear output signal for spherical and horizontal cylindrical vessels, and vessels with a conical outlet.

Level measurement in closed tanks with pressure overlay

You can determine the differential pressure in tanks with pressure overlay using two Deltapilot M. The pressure measured values of the two probes are sent to a signal processing unit such as Endress+Hauser RMA or a PLC. The signal processing unit or PLC determines the difference in pressure and uses this to calculate the level and the density where necessary.



A0023542

Level measurement in a closed tank with pressure overlay

- 1 Deltapilot 1 measures the total pressure (hydrostatic pressure and top pressure)
- 2 Deltapilot 2 measures the top pressure
- 3 Signal processing unit determines the difference in pressure and uses this to calculate the level

NOTICE

Measured errors can occur.

Large measured errors can occur if the ratio of the level to the top pressure is $>1:6$. This does not affect reproducibility.

- ▶ When selecting the measuring cell, make sure you select measuring ranges that are sufficiently wide (→ see example).

Example:

- Max. hydrostatic pressure = 600 mbar (9 psi)
- Max. top pressure (Deltapilot 2) = 300 mbar (4.5 psi)
- Max. total pressure, measured with Deltapilot 1 = 300 mbar (4.5 psi) + 600 mbar (9 psi) = 900 mbar (13.5 psi) ⇒ measuring cell to be selected: 0 to 1200 mbar (0 to 18 psi)
- Max. pressure, measured with Deltapilot 2: 300 mbar (4.5 psi) ⇒ measuring cell to be selected: 0 to 400 mbar (6 psi)

NOTICE

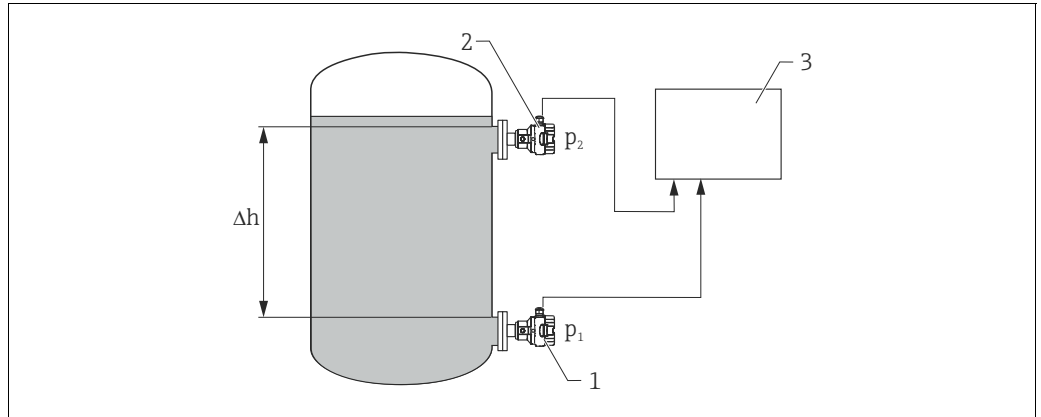
Possibility of probe 2 flooding during differential pressure measurement.

Measured errors can occur.

- ▶ When installing, make sure that probe 2 cannot be flooded.

Density measurement

You can measure the density in tanks with pressure overlay using two Deltapilot M and a signal processing unit or a PLC. The signal processing unit or the PLC calculates the density from the known distance between the two Deltapilot M devices Δh and the two measured values p_1 and p_2 .



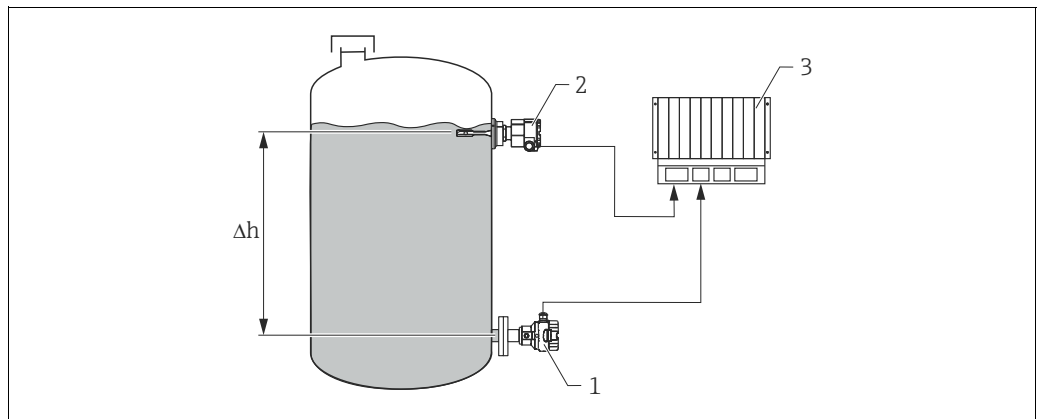
A0023544

Level measurement in a closed tank with pressure overlay

- 1 Deltapilot 1 determines pressure measured value p_1
- 2 Deltapilot 2 determines pressure measured value p_2
- 3 Signal processing unit determines the density from the two measured values p_1 and p_2 and the distance Δh

Level measurement with automatic density correction (with media changing in the tank)

Level measurement with automatic density correction is possible in conjunction with a limit switch such as Liquiphant and a PLC. The limit switch always switches at the same level. In the switch point, the signal processing unit determines the corrected density from the pressure of the Deltapilot M currently measured and the known distance between Deltapilot M and the limit switch. The signal processing unit then calculates the level from the new density and the measured pressure of the Deltapilot M.

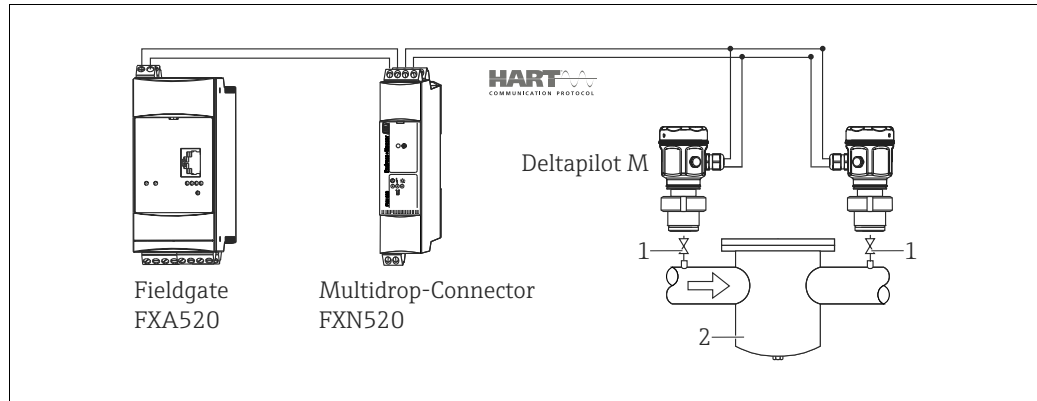


A0023546

Level measurement with automatic density correction

- 1 Deltapilot M
- 2 Liquiphant
- 3 PLC

Electrical differential pressure measurement with gauge pressure sensors



- 1 Shut-off valves
2 e.g. filter

In the example given, two Deltapilot M devices (each with a gauge pressure sensor) are interconnected. The pressure difference can thus be measured using two independent Deltapilot M devices.

⚠ WARNING

Risk of explosion!

- ▶ If using intrinsically safe devices, strict compliance with the rules for interconnecting intrinsically safe circuits as stipulated in IEC60079-14 (proof of intrinsic safety) is mandatory.

Communication and data processing

- 4 to 20 mA with HART communication protocol
 - PROFIBUS PA
 - The Endress+Hauser devices meet the requirements of the FISCO model.
 - Due to the low current consumption of $11 \text{ mA} \pm 1 \text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO:
 - up to 8 Deltapilot M for Ex ia, CSA IS and FM IS applications
 - up to 31 Deltapilot M for all other applications, e.g. in non-hazardous areas, Ex nA, etc.
- Further information on PROFIBUS PA can be found in Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and in the PNO Guideline.
- FOUNDATION Fieldbus
 - The Endress+Hauser devices meet the requirements of the FISCO model.
 - Due to the low current consumption of $16 \text{ mA} \pm 1 \text{ mA}$, the following number of devices can be operated on one bus segment if installing as per FISCO:
 - up to 6 Deltapilot M for Ex ia, CSA IS and FM IS applications
 - up to 22 Deltapilot M for all other applications, e.g. in non-hazardous areas, Ex nA, etc.
- Further information on FOUNDATION Fieldbus, such as requirements for bus system components can be found in Operating Instructions BA00013S "FOUNDATION Fieldbus Overview".

Input

Measured variable Hydrostatic pressure

Measuring range

Nominal value	Range limit		Smallest calibratable span (preset at the factory) ¹⁾	MWP	OPL	Vacuum resistance ²⁾ Synthetic oil/ Inert oil [bar _{abs} (psi _{abs})]	Option ³⁾
	lower (LRL) ⁴⁾	upper (URL)					
[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]		
0.1 (1.5)	-0.1 (-1.5)	+0.1 (+1.5)	0.01 (0.15)	2.7 (40.5)	4 (60)	0.01/0.04 (0.145/0.6)	1C
0.4 (6)	-0.4 (-6)	+0.4 (+6)	0.02 (0.3)	5.3 (79.5)	8 (120)		1F
1.2 (18)	-1 (-15)	+1.2 (+18)	0.06 (1)	16 (240)	24 (360)		1H
4 (60)	-1 (-15)	+4 (+60)	0.2 (3)	16 (240)	24 (360)		1M
10 (150)	-1 (-15)	+10 (+150)	0.5 (7.5)	27 (405)	40 (600)		1P

1) Factory calibration Turn down: Max 20:1, higher on request.

2) The vacuum resistance applies to the measuring cell at reference conditions.

3) Product Configurator, "Sensor range" ordering feature

4) By default, the device is set to a lower range limit of 0 bar. Please specify in the order if the lower range limit is to be set to a different default value.

Output

Output signal

- 4 to 20 mA with superimposed digital communication protocol HART 6.0, 2-wire
- Digital communication signal PROFIBUS PA (Profile 3.02)
- Digital communication signal FOUNDATION Fieldbus

Output	Option ¹⁾
4 to 20mA HART	2
PROFIBUS PA	3
FOUNDATION Fieldbus	4

1) Product Configurator, "Output" ordering feature

Signal range – 4 to 20 mA HART

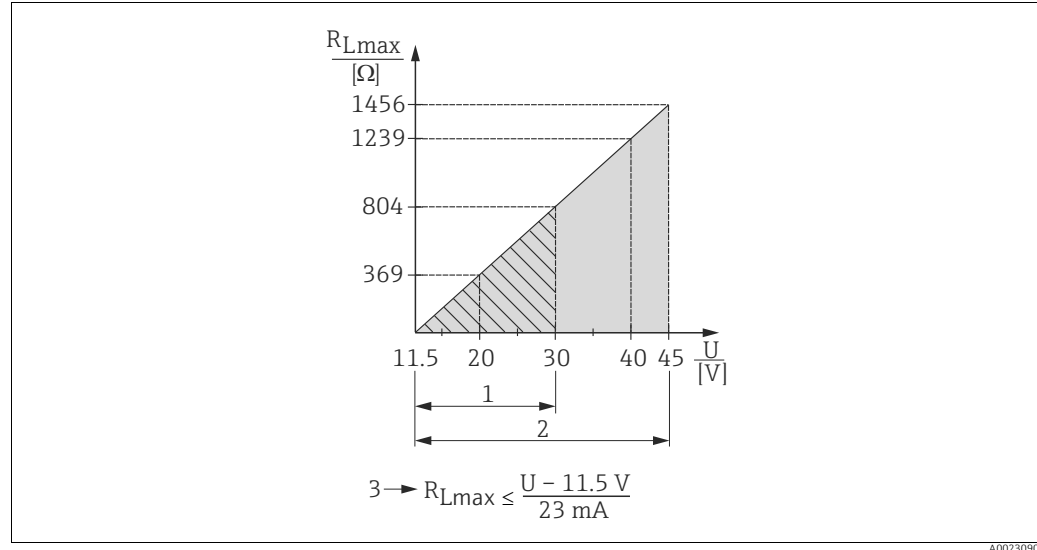
3.8 to 20.5 mA

Signal on alarm

As per NAMUR NE 43

- 4 to 20 mA HART
Options:
 - Max. alarm: can be set from 21 to 23 mA (Factory setting: 22 mA)
 - Hold measured value: last measured value is held
 - Min. alarm: 3.6 mA
- PROFIBUS PA: can be set in the Analog Input block,
Options: Last Valid Out Value (factory setting), Fail-safe Value, Status Bad
- FOUNDATION Fieldbus: can be set in the Analog Input block,
Options: Last Good Value, Fail-safe Value (factory setting), Wrong Value

Load - 4 to 20 mA HART



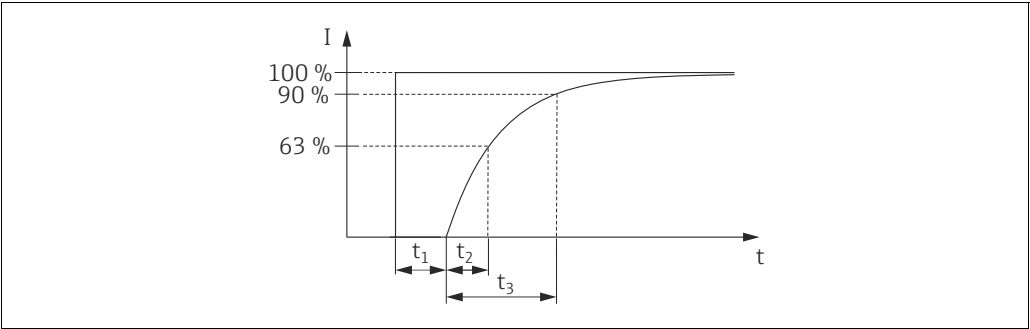
Load diagram

- 1 Power supply 11.5 to 30 V DC for intrinsically safe device versions
 2 Power supply 11.5 to 45 V DC (versions with plug-in connector 35 V DC) for other types of protection and for uncertified device versions
 R_{Lmax} Maximum load resistance
 U Supply voltage



When operating via a handheld terminal or via a PC with an operating program, a minimum communication resistance of 250 Ω must be taken into account.

Dead time, time constant



Presentation of the dead time and the time constant

A0019786

Dynamic behavior:
current output

	Type	Dead time (t_1) [ms]	Time constant T_{63} ($= t_2$) [ms]	Time constant T_{90} ($= t_3$) [ms]
max.	FMB50	60	90	210
max.	FMB51 FMB52 FMB53	500	250	-

Dynamic behavior: HART

	Type	Dead time (t_1) [ms]	Dead time (t_1) [ms] + Time constant T_{63} ($= t_2$) [ms]	Dead time (t_1) [ms] + Time constant T_{90} ($= t_3$) [ms]
min.	FMB50	220	310	370
max.		1020	1110	1170
min.	FMB51	660	910	-
max.	FMB52 FMB53	1460	1710	-

Reading cycle

- Acyclic: max. 3/s, typical 1/s (depends on command # and number of preambles)
- Cyclic (Burst): max. 3/s, typical 2/s

The Deltapilot M commands the BURST MODE function for cyclic value transmission via the HART communication protocol.

Cycle time (update time)

Cyclic (Burst): min. 300 ms

Response time

- Acyclic: min. 330 ms, typical 590 ms (depends on command # and number of preambles)
- Cyclic (Burst): min. 160 ms, typical 350 ms (depends on command # and number of preambles)

**Dynamic behavior:
PROFIBUS PA**

	Type	Dead time (t ₁) [ms]	Dead time (t ₁) [ms] + Time constant T63 (= t ₂) [ms]	Dead time (t ₁) [ms] + Time constant T90 (= t ₃) [ms]
min.	FMB50	95	185	245
max.		1195	1285	1345
min.	FMB51	535	785	-
max.	FMB52 FMB53	1635	1885	-

Reading cycle

- Cyclic: max. 30/s (dependent on the number and type of function blocks used in a closed-control loop)
- Acyclic: typical 25/s

Cycle time (update time)

min. 100 ms

The cycle time in a bus segment in cyclic data communication depends on the number of devices, on the segment coupler used and on the internal PLC cycle time.

Response time

- Cyclic: approx. 8 to 13 ms (depends on Min. Slave Interval)
- Acyclic: approx. 23 to 35 ms (depends on Min. Slave Interval)

**Dynamic behavior:
FOUNDATION Fieldbus**

	Type	Dead time (t ₁) [ms]	Dead time (t ₁) [ms] + Time constant T63 (= t ₂) [ms]	Dead time (t ₁) [ms] + Time constant T90 (= t ₃) [ms]
min.	FMB50	105	195	255
max.		1105	1195	1255
min.	FMB51	545	795	-
max.	FMB52 FMB53	1545	1795	-

Reading cycle

- Cyclic: max. 10/s (dependent on the number and type of function blocks used in a closed-control loop)
- Acyclic: typical 5/s

Cycle time (update time)

Cyclic: min. 100 ms

Response time

- Cyclic: max. 20 ms (for standard bus parameter settings)
- Acyclic: typical 70 ms (for standard bus parameter settings)

Damping

A damping affects all outputs (output signal, display).

- Via on-site display, handheld terminal or PC with operating program, continuous from 0...999 s
- Via DIP-switch on the electronic insert, switch position "on" (= set value) and "off" (= damping switched off)
- Factory setting: 2 s

Firmware version

Designation	Option ¹⁾
01.00.zz, FF, DevRev01	76
01.00.zz, PROFIBUS PA, DevRev01	77
01.00.zz, HART, DevRev01	78

1) Product Configurator, "Firmware version" ordering feature

Galvanic isolation

The following devices have a galvanic isolation between electronic and probe:

- FMB51, FMB52, FMB53
- FMB50 with separate housing

Protocol-specific data**HART**

Manufacturer ID	17 (11 hex)
Device Type Code	35 (23 hex)
Device Revision	01 (01 hex) - SW version 01.00.zz
HART specification	6
DD Revision	<ul style="list-style-type: none"> ■ 01 (Dutch) ■ 02 (Russian)
Device description files (DTM, DD)	Information and files can be found: <ul style="list-style-type: none"> ■ www.endress.com ■ www.hartcomm.org
HART load	Min. 250 Ω
HART device variables	The measured values can be freely assigned to the device variables: Measured values for PV (primary variable) <ul style="list-style-type: none"> ■ Pressure ■ Level ■ Tank content Measured values for SV, TV (second and third variable) <ul style="list-style-type: none"> ■ Pressure ■ Level Measured values for QV (fourth variable) <ul style="list-style-type: none"> ■ Temperature
Supported functions	<ul style="list-style-type: none"> ■ Burst mode ■ Additional Transmitter Status ■ Device Locking ■ Alternative operating modes

PROFIBUS PA

Manufacturer ID	17 (11 hex)
Ident number	1554 hex
Profile Version	3.02 <ul style="list-style-type: none"> ■ SW Version 01.00.zz
GSD Revision	5
DD Revision	1
GSD File	Information and files can be found: <ul style="list-style-type: none"> ■ www.endress.com ■ www.profibus.org
DD Files	
Output values	Measured values for PV (via Analog Input Function Block) <ul style="list-style-type: none"> ■ Pressure ■ Flow ■ Level ■ Tank content Measured values for SV <ul style="list-style-type: none"> ■ Pressure ■ Temperature

Input values	Input value sent from PLC, can be shown on display
Supported functions	<ul style="list-style-type: none"> ▪ Identification & Maintenance Simple device identification via control system and nameplate ▪ Condensed status¹⁾ ▪ Automatic ident number adaptation and switchable to following ident numbers¹⁾: <ul style="list-style-type: none"> – 9700: Profile-specific transmitter identification number with the "Classic" or "Condensed" status". – 1503: Compatibility mode for the old Deltapilot M (DB50, DB50L, DB51, DB52, DB53). – 1555: Identification number for the new Deltapilot M (FMB50, FMB51, FMB52, FMB53). ▪ Device locking: The device can be locked by hardware or software.

1) Only with Profile Version 3.02

Data of the FOUNDATION Fieldbus interface

Basic data

Device Type	0x1023
Device Revision	01 (hex)
DD Revision	0x01021
CFF Revision	0x000102
ITK Version	5.2.0
ITK Certification Driver No.	IT067500
Link-Master (LAS) capable	Yes
Link Master / Basic Device selectable	Yes; Factory setting: Basic Device
Number of VCRs	44
Number of Link Objects in VFD	50
Number of FB-Schedule Objects	40

Virtual communication references (VCRs)

Permanent Entries	44
Client VCRs	0
Server VCRs	5
Source VCRs	8
Sink VCRs	0
Subscriber VCRs	12
Publisher VCRs	19

Link settings

Slot time	4
Min. inter PDU delay	12
Max. response delay	40

Transducer Blocks

Block	Content	Output values
TRD1 Block	Contains all parameters related to the measurement	<ul style="list-style-type: none"> ■ Pressure or level (channel 1) ■ Process temperature (channel 2) ■ Measured pressure value (channel 3) ■ Max. pressure (channel 4) ■ Level before linearization (channel 5)
Diagnostic Block	Contains diagnostic information	<ul style="list-style-type: none"> ■ Error code via DI channels (channel 10 to 15)
Display Block	Contains parameters to configure the onsite display	No output values

Function blocks

Block	Content	Number of blocks	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identify the device. It is an electronic version of a nameplate of the device.	1		enhanced
Analog Input Block 1 Analog Input Block 2	The AI Block receives the measuring data from the Sensor Block, (selectable via a channel number) and makes the data available to other function blocks at its output. Enhancement: digital outputs for process alarms, fail safe mode.	2	25 ms	enhanced
Digital Input Block	This block contains the discrete data of the Diagnose Block (selectable via a channel number 10 to 15) and provides them for other blocks at the output.	1	20 ms	Standard
Digital Output Block	This block converts the discrete input and thus initiates an action (selectable via a channel number) in the DP Flow Block or in the TRD1 Block. Channel 20 resets the counter for max. pressure transgressions value and Channel 21 resets the Totalizer.	1	20 ms	Standard
PID Block	The PID Block serves as a proportional-integral-derivative controller and is used almost universally for closed-loop-control in the field including cascade and feedforward. Input IN can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_CONTENT).	1	40 ms	Standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be performed.	1	35 ms	Standard
Input Selector Block	The Input Selector Block facilitates the selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI Blocks. The block performs maximum, minimum, average and 'first good' signal selection. Inputs IN1 to IN4 can be indicated on the display. The selection is performed in the Display Block (DISPLAY_MAIN_LINE_1_CONTENT).	1	30 ms	Standard

Block	Content	Number of blocks	Execution time	Functionality
Signal Characterizer Block	The Signal Characterizer Block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is generated by a single look-up table with 21 arbitrary x-y pairs.	1	40 ms	Standard
Integrator Block	The Integrator Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input Block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating a binary signal when the setpoint is reached.	1	35 ms	Standard

Additional function block information:

Instantiate Function Block	YES
Number of instantiate blocks	20

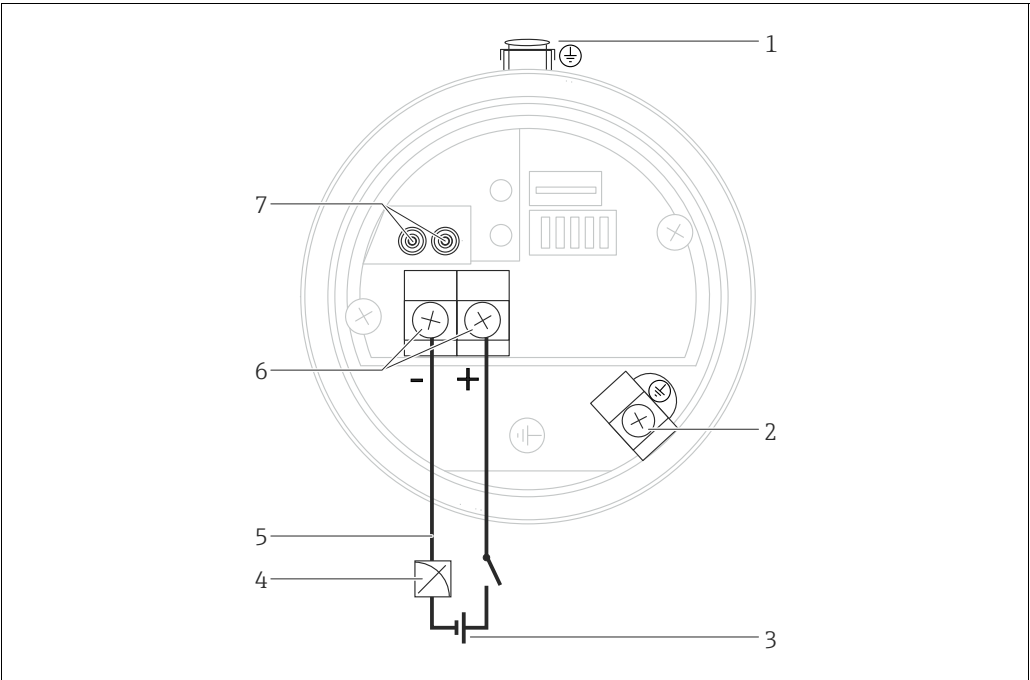
Power supply

⚠ WARNING

Incorrect connection can limit electrical safety!

- ▶ When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings → 68 ff, "Safety instructions" and "Installation/Control Drawings" ordering features.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is provided with all Ex-systems as standard → 68 ff, "Safety instructions" and "Installation/Control Drawings" ordering features.
- ▶ According to IEC/EN61010 a suitable disconnecter has to be installed for the device
- ▶ HART: Overvoltage protection HAW569-DA2B for the non-hazardous area, ATEX II 2 (1) Ex ia IIC and IEC Ex ia can be ordered as an option (see "Ordering information" ordering feature).
- ▶ Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
- ▶ The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply.

Terminal assignment



Electrical connection

- 1 External grounding terminal
- 2 Internal grounding terminal
- 3 Supply voltage → 21
- 4 4...20 mA for HART devices
- 5 For HART and FOUNDATION Fieldbus devices: With a handheld terminal, all the parameters can be configured anywhere along the bus line via menu operation.
- 6 Terminals
- 7 For HART devices: test terminals, see section "Taking 4 to 20 mA test signal"

Supply voltage

4 to 20 mA HART

Type of protection	Supply voltage
▪ Intrinsically safe	11.5 ... 30 V DC
▪ Other types of protection ▪ Devices without certificate	11.5 to 45 V DC (versions with plug-in connection 35 V DC)

Taking 4 to 20 mA test signal

A 4 to 20 mA test signal may be measured via the test terminals without interrupting the measurement.

PROFIBUS PA

- Version for non-hazardous areas: 9 to 32 V DC

FOUNDATION Fieldbus

- Version for non-hazardous areas: 9 to 32 V DC

Current consumption

- PROFIBUS PA: 11 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21
- FOUNDATION Fieldbus: 16 mA ± 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21

Electrical connection

Cable entry	Degree of protection	Option ¹⁾
M20 gland	IP66/68 NEMA 4X/6P	A
G ½" thread	IP66/68 NEMA 4X/6P	C
NPT ½" thread	IP66/68 NEMA 4X/6P	D
M12 plug	IP66/67 NEMA 4X/6P	I
7/8" plug	IP66/68 NEMA 4X/6P	M
HAN7D connector, 90 deg	IP65	P
PE cable 5m ²⁾	IP66/68 NEMA4X/6P + pressure compensation via cable	S
M16 valve connector	IP64	V

1) Product Configurator, "Electrical connection" ordering feature

2) Only for FMB50

PROFIBUS PA

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding, and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning" and the PNO Guideline.

FOUNDATION Fieldbus

The digital communication signal is transmitted to the bus via a 2-wire connection. The bus also provides the power supply. For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

Terminals

For wire cross-sections of 0.5 to 2.5 mm² (20 to 14 AWG)

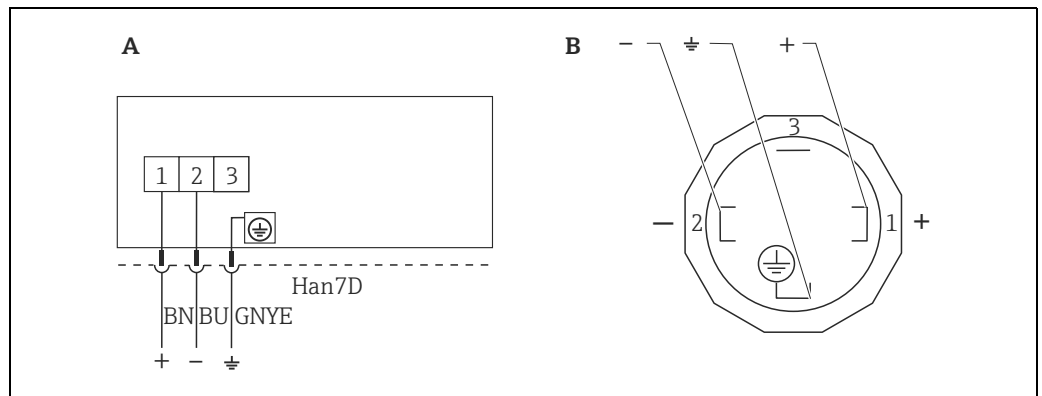
Cable entry

Approval	Type	Clamping area
Standard, CSA GP ATEX II1/2G or II2G Ex ia, IEC Ex ia Ga/Gb or Ex ia Gb, FM/ CSA IS	Plastic M20x1.5	5 to 10 mm (0.2 to 0.39 in)
ATEX II1/2D Ex t, II1/2GD Ex ia, II3G Ex nA, IEC Ex t Da/Db	Metal M20x1.5 (Ex e)	7 to 10.5 mm (0.28 to 0.41 in)

For other technical data, see the housing section → 34 ff.

Connector

Devices with valve connector



A0023097

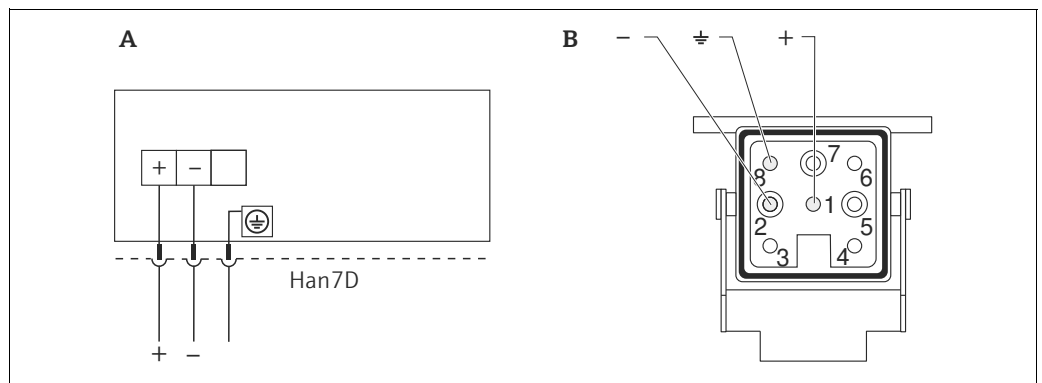
BN = brown, BU = blue, GNYE = green/yellow

A Electrical connection for devices with valve connector

B View of the connection on the device

Material: PA 6.6

Devices with Harting plug Han7D



A0019990


A Electrical connection for devices with Harting plug Han7D

A Electrical connection for devices with
B View of the connection on the device

Material: CuZn, gold-plated contacts of plug-in jack and connector

Devices with M12 plug

PIN assignment for M12 connector

PIN assignment for M12 connector	PIN	Meaning
	1	Signal +
	2	Not assigned
	3	Signal -
	4	Earth

A0011175

Endress+Hauser offers the following accessories for devices with an M12 plug:

Plug-in jack M 12x1, straight

- Material: body PA; coupling nut CuZn, nickel-plated

- Degree of protection (fully locked): IP66/67
- Order number: 52006263

Plug-in jack M 12x1, elbowed

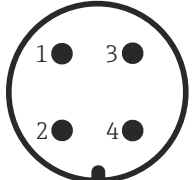
- Material: body PBT/PA; coupling nut GD-Zn, nickel-plated
- Degree of protection (fully locked): IP66/67
- Order number: 71114212

Cable 4x0.34 mm² (20 AWG) with M12 socket, elbowed, screw plug, length 5 m (16 ft)

- Material: body PUR; coupling nut CuSn/Ni; cable PVC
- Degree of protection (fully locked): IP66/67
- Order number: 52010285

Devices with 7/8" plug

PIN assignment for 7/8" connector

PIN assignment for 7/8" connector	PIN	Meaning
	1	Signal -
	2	Signal +
	3	Not assigned
	4	Shield

A0011176

External thread: 7/8 - 16 UNC

- Material: 316L (1.4401)
- Protection: IP66/68

Cable specification

HART

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- The cable outer diameter depends on the cable entry used.

PROFIBUS PA

Use a twisted, shielded two-wire cable, preferably cable type A



For further information on the cable specifications, see Operating Instructions BA00034S "PROFIBUS DP/PA: Guidelines for planning and commissioning", the PNO Guideline 2.092 "PROFIBUS PA User and Installation Guideline" and IEC 61158-2 (MBP).

FOUNDATION Fieldbus

Use a twisted, shielded two-wire cable, preferably cable type A



For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

Start-up current HART

12 mA or 22 mA (selectable)

Residual ripple

No influence on 4 to 20 mA signal up to ± 5 % residual ripple within the permitted voltage range [according to HART hardware specification HCF_SPEC-54 (DIN IEC 60381-1)]

Influence of power supply

≤ 0.001 % of URL/V

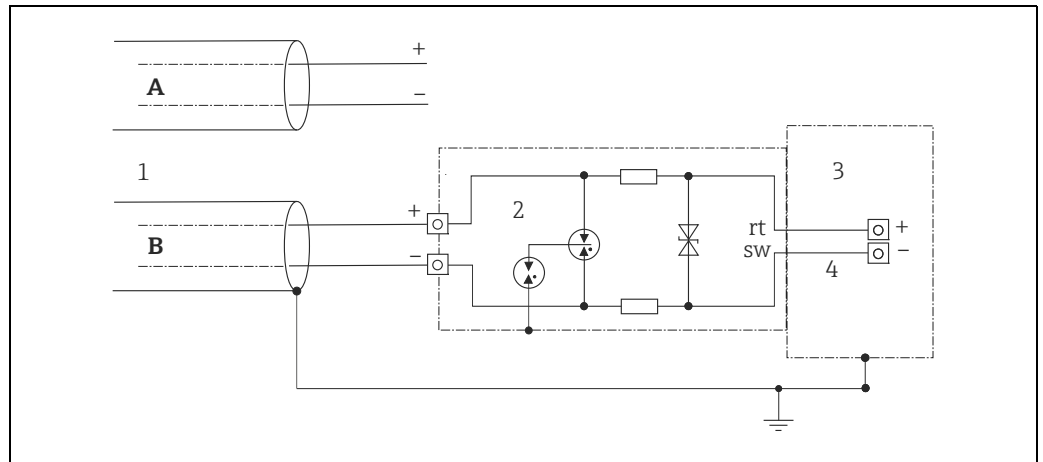
**Overvoltage protection
(optional)**

The device can be fitted with overvoltage protection. The overvoltage protection is mounted at the factory on the housing thread (M20x1.5) for the cable gland and is approx. 70 mm (2.76 in) in length (take additional length into account when installing). The device is connected as illustrated in the following graphic.

For details refer to TI001013KEN, XA01003KA3 and BA00304KA2.

Ordering information:

Product Configurator, "Mounted accessories" ordering feature, option NA



A0023111

- A Without direct shield grounding
- B With direct shield grounding
- 1 Incoming connection cable
- 2 HAW569-DA2B
- 3 Unit to be protected
- 4 Connection cable

Performance characteristics

Reference operating conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of: +21 to +33 °C (+70 to 91°F)
- Humidity ϕ = constant, in the range of: 5 to 80 % RH
- Ambient pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell: constant, in range: FMB50: horizontally $\pm 1^\circ$
FMB51/FMB52/FMB53: vertically $\pm 1^\circ$
- Input of LOW SENSOR TRIM and HIGH SENSOR TRIM for lower range value and upper range value
- Span based on zero point
- Material of the process isolating diaphragm: Alloy C276 (2.4819) and Alloy C276 (2.4819) with coating (AuRh or AuPt)
- Measuring cell material (meter body): Alloy C276 (2.4819), 316L (1.4435)
- Filling oil: synthetic oil (FDA)/inert oil
- Supply voltage: 24 V DC \pm 3 V DC
- Load with HART: 250 Ω

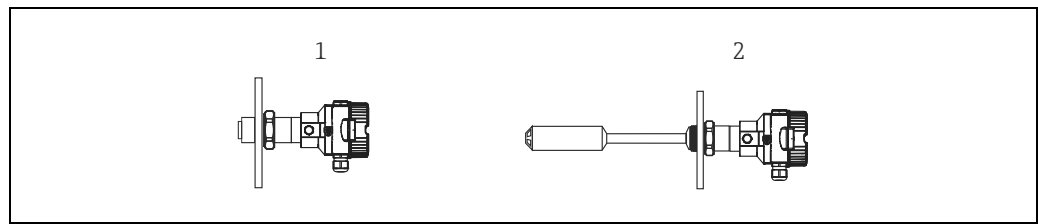
Influence of orientation

- < 2.3 mbar (0.0345 psi) when using synthetic oil (FDA)
- < 5 mbar (0.075 psi) when using inert oil



Position-dependent zero point shift can be corrected → 28, "General installation instructions" ordering feature.

Calibration position



A0023545

1 FMB50

2 FMB51, FMB52, FMB53

To minimize the effect of the orientation (e.g. in the case of vertical device installation), position offset is preset at the factory.

Resolution

- Current output: 1 μ A
- Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

Reference accuracy

The reference accuracy comprises the non-linearity according to limit point setting, hysteresis and non-reproducibility as per IEC 60770. The data refer to the calibrated span.

Reference accuracy in % of the calibrated span			
Measuring cell	TD	"Standard" option ¹⁾	"Platinum" option ¹⁾
0.1 bar (1.5 psi)	<ul style="list-style-type: none"> ■ TD 1:1 to TD 2:1 ■ TD > 2:1 to TD 4:1 	<ul style="list-style-type: none"> ■ < 0.2 ■ < 0.1 x TD 	<ul style="list-style-type: none"> ■ < 0.15 ■ < 0.075 x TD
0.4 bar (6 psi)	<ul style="list-style-type: none"> ■ TD 1:1 to TD 4:1 ■ TD > 4:1 to TD 10:1 	<ul style="list-style-type: none"> ■ < 0.2 ■ < 0.05 x TD 	<ul style="list-style-type: none"> ■ < 0.15 ■ < 0.0375 x TD
1.2 bar (18 psi)	<ul style="list-style-type: none"> ■ TD 1:1 to TD 2:1 ■ TD > 2:1 to TD 12:1 	<ul style="list-style-type: none"> ■ < 0.2 ■ < 0.1 x TD 	<ul style="list-style-type: none"> ■ < 0.1 ■ < 0.05 x TD
4 bar (60 psi)	<ul style="list-style-type: none"> ■ TD 1:1 to TD 4:1 ■ TD > 4:1 to TD 20:1 	<ul style="list-style-type: none"> ■ < 0.2 ■ < 0.05 x TD 	<ul style="list-style-type: none"> ■ < 0.1 ■ < 0.025 x TD
10 bar (150 psi)	<ul style="list-style-type: none"> ■ TD 1:1 to TD 2.5:1 ■ TD > 2.5:1 to TD 20:1 	<ul style="list-style-type: none"> ■ < 0.2 ■ < 0.08 x TD 	<ul style="list-style-type: none"> ■ < 0.1 ■ < 0.04 x TD

1) Product Configurator, "Reference accuracy" ordering feature

Thermal change in the zero output and the output span

Version	Measuring cell	-10 to +60 °C (+14 to +140°F)	60 to 85 °C (140 to 185°F)	Only FMB50: 85 to 100 °C (185 to 212°F)
		% of the calibrated span		
FMB50 FMB51/52/53 snap-on	0.1 bar (1.5 psi)	< (0.32 + 0.30 x TD)	< (0.34 + 0.40 x TD)	< (0.34 + 0.55 x TD)
FMB51/52/53 welded	0.1 bar (1.5 psi)	< (0.32 + 0.50 x TD)	< (0.34 + 0.60 x TD)	-
FMB50/51/52/53	0.4 bar (6 psi)	< (0.31 + 0.25 x TD)	< (0.32 + 0.30 x TD)	-
	1.2 bar (18 psi), 4 bar (60 psi), 10 bar (150 psi)	< (0.31 + 0.10 x TD)	< (0.32 + 0.15 x TD)	< (0.33 + 0.20 x TD)

Total performance

The "Total performance" specification comprises the non-linearity including hysteresis, non-reproducibility as well as the thermal change in the zero point.

Total performance in % of the URL				
Version	Measuring cell	-10 to +60 °C (+14 to +140°F)	60 to 85 °C (140 to 185°F)	85 to 100 °C (185 to 212°F)
FMB50 FMB51/52/53 snap-on	0.1 bar (1.5 psi)	< 0.35	< 0.45	< 0.6
FMB51/52/53 welded	0.1 bar (1.5 psi)	< 0.8	< 1	< 1.4
FMB50/51/52/53	0.4 bar (6 psi)	< 0.35	< 0.45	< 0.6
	1.2 bar (18 psi), 4 bar (60 psi), 10 bar (150 psi)	< 0.15	< 0.2	< 0.25

Long-term stability

Measuring cell	Long-term stability [%]
0.1 bar (1.4 psi)	<ul style="list-style-type: none"> < 0.18 of the upper range limit (URL) / year < 0.45 of the upper range limit (URL) / 5 years
0.4 bar (6 psi) 1.2 bar (18 psi)	<ul style="list-style-type: none"> < 0.1 of the upper range limit (URL) / year < 0.25 of the upper range limit (URL) / 5 years
4 bar (60 psi) 10 bar (150 psi)	<ul style="list-style-type: none"> < 0.05 of the upper range limit (URL) / year < 0.125 of the upper range limit (URL) / 5 years

Total error

The total error comprises the long-term stability and the total performance:

Measuring cell	% of the URL/year (in the permitted temperature range)
0.1 bar (1.5 psi)	<ul style="list-style-type: none"> Snap-on: ±0.63 Welded: ±1.0
0.4 bar (6 psi)	±0.61
1.2 bar (18 psi)	±0.27
4 bar (60 psi), 10 bar (150 psi)	±0.25

Warm-up period

- 4 to 20 mA HART:
 - FMB50 = ≤5 s
 - FMB51/FMB52/FMB53 = ≤8 s
- PROFIBUS PA: ≤8 s
- FOUNDATION Fieldbus: ≤20 s (after a TOTAL-reset ≤45 s)

Installation

General installation instructions

- The position-dependent zero point shift can be corrected:
 - directly at the device via an operating key
 - directly at the device via operating keys on the display
 - via digital communication if the cover is not open

⚠ WARNING

Risk of explosion!

In hazardous areas, comply strictly with the safety instructions when the housing cover is closed and open.

- The local display can be rotated in 90° stages.

FMB50

Level measurement

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
 - in the filling curtain
 - in the tank outflow
 - or at a point in the tank that can be affected by pressure pulses from the agitator
- The calibration and functional test can be carried out more easily if you mount the device downstream of a shutoff device.
- Deltapilot M must be included in the insulation for media that can harden when cold.

Pressure measurement in gases

Mount Deltapilot M with shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

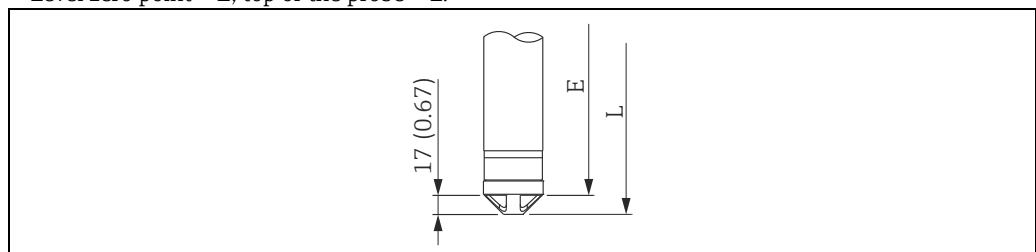
- Mount Deltapilot M with siphon above the tapping point.
- Fill the siphon with liquid before commissioning.
The siphon reduces the temperature to almost the ambient temperature.

Pressure measurement in liquids

Mount Deltapilot M with the shutoff device below or at the same level as the tapping point.

FMB51/FMB52/FMB53

- When mounting rod and cable versions, make sure that the probe head is located at a point as free as possible from flow. To protect the probe from impact resulting from lateral movement, mount the probe in a guide tube (preferably made of plastic) or secure it with a clamping fixture.
- In the case of devices for hazardous areas, comply strictly with the safety instructions when the housing cover is open.
- The length of the extension cable or the probe rod is based on the planned level zero point. The height of the protective cap must be taken into consideration when designing the layout of the measuring point. The level zero point (E) corresponds to the position of the process isolating diaphragm.
Level zero point = E; top of the probe = L.



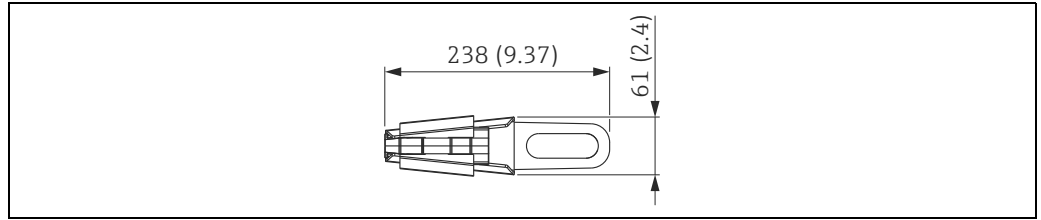
- Suspension clamp (required for FMB53)

Material: → 54 ff

Ordering information:

Order number: 52010869 → 64 ff

Product Configurator, "Accessory enclosed" ordering feature, option "PO".



Engineering unit mm (in)

A0023566

Supplementary installation instructions

Process isolating diaphragm

- Do not clean or touch process isolating diaphragms with hard or pointed objects.
- The process isolating diaphragm in the rod and cable version is protected against mechanical damage by a plastic cap.

Seal

- Deltapilot M devices with a G 1 ½ thread:
When screwing the device into the tank, the flat seal has to be positioned on the sealing surface of the process connection. To avoid additional strain on the process isolating diaphragm, the thread should never be sealed with hemp or similar materials.
- Deltapilot M devices with NPT threads:
 - Wrap Teflon tape around the thread to seal it.
 - Tighten the device at the hexagonal bolt only. Do not turn the device at the housing.
 - Do not overtighten the thread when screwing in the screw. Max. torque: 20 to 30 Nm (14.75 to 22.13 lbf ft)

Sealing the probe housing

Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.

- Always firmly tighten the housing cover and the cable entries.
- Lubricant is provided on the O-ring seal in the housing cover and on the thread of the aluminum cover. To ensure that the cover seals tight, any lubricant which has been removed must be replaced. Use silicone grease or graphite paste as the lubricant. Mineral oil-based grease can destroy the O-ring.

PE cable length > 300 m (984 ft)

- Two suspension clamps must be used for PE cables longer than 300 meters (984 ft).

Cable length tolerances

- FMB52
 - Cable length < 5 m (16 ft): up to -35 mm (-1.38 in)
 - Cable length 5...10 m (16...33 ft): up to -75 mm (-2.95 in)
 - Cable length 10...100 m (33...328 ft): up to -100 mm (-3.94 in)
- FMB53
 - Cable length < 5 m (16 ft): up to ±17.5 mm (±0.69 in)
 - Cable length 5...10 m (16...33 ft): up to ±37.5 mm (±1.48 in)
 - Cable length 10...100 m (33...328 ft): up to ±50 mm (±1.97 in)

Rod length tolerances

- FMB51
 - Rod length < 4000 mm (157 in): up to -4 mm (-0.16 in)

Wall and pipe mounting

Endress+Hauser offers a mounting bracket for installing the device on pipes or walls. The mounting bracket is

- included in the delivery for the FMB50/51/52 with a separate housing (available for order via feature 600) and for the FMB53
- available for order as a separate accessory (Part No.: 71102216).

For the dimensions, see → 48.

"Separate housing" version

With the "separate housing" version, you are able to mount the housing with the electronics insert at a distance from the measuring point. This allows for trouble-free measurement:

- Under particularly difficult measuring conditions (at installation locations that are cramped or difficult to access)
- If rapid cleaning of the measuring point is required
- If the measuring point is exposed to vibrations

You can choose between different cable versions:

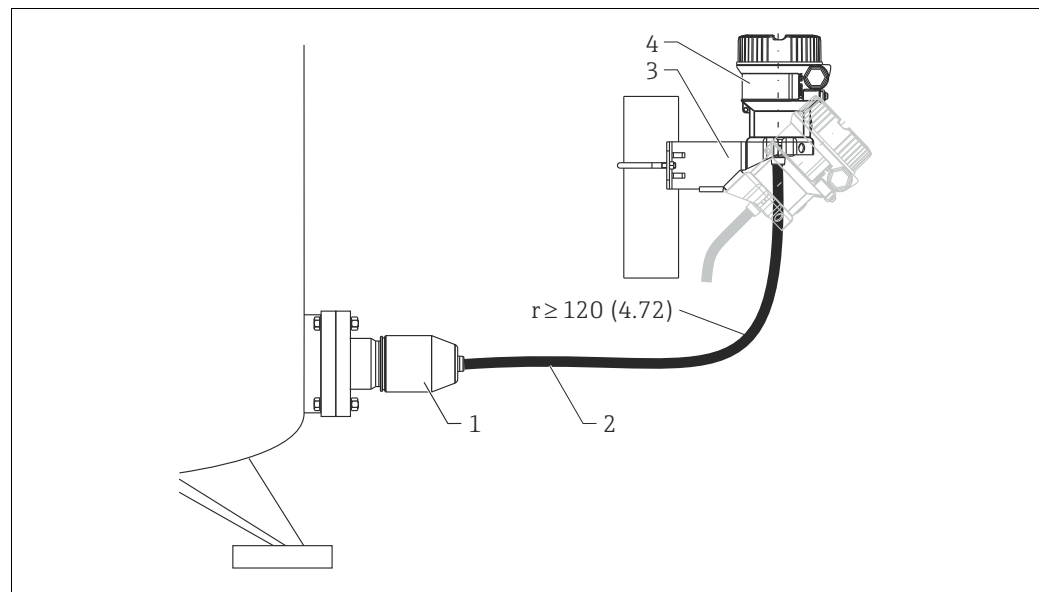
- PE (2 m (6.6 ft), 5 m (16 ft) and 10 m (33 ft))
- FEP (5 m (16 ft)).

Ordering information:

Product Configurator, "Separate housing" ordering feature

Product Configurator, "Enclosed accessories" ordering feature, option PA

For the dimensions, see → 48.



Engineering unit mm (in)

In the case of the "separate housing" version, the sensor is delivered with the process connection and cable ready mounted. The housing and a mounting bracket are enclosed as separate units. The cable is provided with a socket at both ends. These sockets are simply connected to the housing and the sensor.

- 1 Process connection with sensor - see the following section for the degrees of protection
- 2 Cable, both ends are fitted with a socket
- 3 Mounting bracket provided, suitable for pipe and wall mounting (for pipes from 1 1/4" up to 2" diameter)
- 4 Housing with electronic insert - degrees of protection → 32 ff

Degree of protection for the process connection and sensor with the use of

- FEP cable:
 - IP 69K
 - IP 66 NEMA 4/6P
 - IP 68 (1.83 mH₂O for 24 h) NEMA 4/6P
- PE cable:
 - IP 66 NEMA 4/6P
 - IP 68 (1.83 mH₂O for 24 h) NEMA 4/6P

Technical data of the PE and FEP cable:

- Minimum bending radius: 120 mm (4.72 in)
- Cable extraction force: max. 450 N (101 lbf)
- Resistance to UV light

Use in hazardous area:

- Intrinsically safe installations (Ex ia/IS)
- FM/CSA IS: for Div.1 installation only

Oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics. As a result, the following are some of the precautions that must be taken:



- All components of the system, such as measuring devices, must be cleaned in accordance with the BAM (DIN 19247) requirements.
- Depending on the materials used, a certain maximum temperature and maximum pressure must not be exceeded for oxygen applications. The maximum temperature T_{\max} for oxygen applications is 60 °C (140°F).

The devices suitable for gaseous oxygen applications are listed in the following table with the specification p_{\max} .

Order code for devices ¹⁾ cleaned for oxygen applications	p_{\max} for oxygen applications
FMB50 ²⁾	<ul style="list-style-type: none"> ■ Depends on the lowest-rated element, with regard to pressure, of the selected components: over pressure limit (OPL) of the sensor or process connection (1.5 x PN)³⁾ ■ Depends on filling oil ⁴⁾
FMB51 ²⁾	<ul style="list-style-type: none"> ■ Depends on the lowest-rated element, with regard to pressure, of the selected components: over pressure limit (OPL) of the sensor or process connection (1.5 x PN) ³⁾ ■ Depends on filling oil ⁴⁾ ■ Depends on seal material

1) Only device, not accessory or enclosed accessory

2) Product Configurator, "Service" ordering feature, option "HB"

3) →  13, "Measuring range" ordering feature and →  34 ff, "Mechanical construction" ordering feature

4) Oxygen applications possible with FKM seal and inert oil.

PWIS cleaning

Special cleaning of the transmitter to remove paint-wetting substances, for use in paint shops, for instance.

Ordering information:

Product Configurator, "Service" ordering feature, option HC

The stability of the materials used must be checked before using them in the medium.

The protective cap of the process isolating diaphragm must be removed if necessary (FMB51/FMB52/FMB53).

Applications with hydrogen

With regard to materials in which hydrogen formation takes place (e.g. digested sludge), hydrogen atoms can diffuse through the metal process isolating diaphragm. This can result in incorrect measurement results.

Endress+Hauser offers process isolating diaphragms with a gold/rhodium coating for such instances.

Ordering information:

Product Configurator, "Process isolating diaphragm material" ordering feature, option L

NOTICE

To reduce the formation of hydrogen, you should not use galvanized assemblies.

Special measuring cells for acids, alkalis or sea water (not FMB50)

For acids, alkalis or sea water, Endress+Hauser offers process isolating diaphragms with a gold/platinum coating.

NOTICE

With temperature exposure (up to 85°C(185°F)) there is an additional zero point deviation of 1.1 mbar (0.0165 psi).

Ordering information:

Product Configurator, "Process isolating diaphragm material" ordering feature, option N

Environment

Ambient temperature limits

Version	FMB50	FMB51	FMB52	FMB53
Without LCD display	-40 °C to +85 °C (-40°F to +185°F)		With PE cable: -40 °C to +70 °C (-40°F to +158°F) With FEP cable: -40 °C to +80 °C (-40°F to +176°F)	
With LCD display ¹⁾	-20 °C to +70 °C (-4°F to +158°F)			
With M12 plug , elbowed	-25 °C to +85 °C (-13°F to +185°F)		With PE cable: -25 °C to +70 °C (-13°F to +158°F) With FEP cable: -25 °C to +80 °C (-13°F to +176°F)	
With separate housing (PE and FEP cable)	-20 °C to +60 °C (-4°F to +140°F)			

- 1) Extended temperature application range (-40 °C to +85 °C (-40°F to +185°F)) with restrictions in optical properties such as display speed and contrast


Storage temperature range

Version	FMB50	FMB51	FMB52	FMB53
Without LCD display	-40 °C to +90 °C (-40°F to +194°F)		With PE cable: -40 °C to +70 °C (-40°F to +158°F) With FEP cable: -40 °C to +80 °C (-40°F to +176°F)	
With LCD display	-40 °C to +85 °C (-40°F to +185°F)			
With M12 plug , elbowed	-25 °C to +90 °C (-13°F to +194°F)		With PE cable: -25 °C to +70 °C (-13°F to +158°F) With FEP cable: -25 °C to +80 °C (-13°F to +176°F)	
With separate housing and FEP cable	-20 °C to +60 °C (-4°F to +140°F)			

Climate class

Class 4K4H (air temperature: -20 to 55 °C (-4 to +131°F), relative humidity: 4 to 100%) satisfied as per DIN EN 60721-3-4 (condensation possible)

Degree of protection

- F31 housing: IP 68 (1.83 mH₂O for 24 h)
- Ordering information:
Product Configurator, "Electrical connection" ordering feature
- Separate housing →  30

Vibration resistance

Device/accessory	Test standard	Vibration resistance
FMB50, FMB52, FMB53	GL VI-7-2 <ul style="list-style-type: none"> ■ Part 7: Guidelines for the Performance of Type Approvals ■ Chapter 2: Test Requirements for Electrical / Electronic Equipment and Systems 	Guaranteed for: 5 to 25 Hz: ±1.6 mm (0.06 in); 25 to 100 Hz: 4 g in all 3 planes
FMB50, FMB52, FMB53 with mounting bracket	IEC 61298-3	Guaranteed for: 10 to 60 Hz: ±0.15 mm (0.01 in); 60 to 500 Hz: 2 g in all 3 planes
FMB51	IEC 60068-2-6	Guaranteed for: 10 to 60 Hz: ±0.075 mm (0.003 in) 60 to 150 Hz 1g in all 3 planes

Electromagnetic compatibility

- Electromagnetic compatibility as per all the relevant requirements of the EN 61326 series and NAMUR Recommendation EMC (NE21). Details can be found in the Declaration of Conformity (in the Download area of "www.de.endress.com", "search area - Approvals and Certificates", "Manufact. Declaration").
- Max. deviation during EMC-tests < 0.5% of the span
- All tests were performed with full measurement range (TD 1:1).

Process

Process temperature range

FMB50	FMB51	FMB52	FMB53
-10 °C to +100 °C (+14°F to 212°F) 135 °C (275°F) for 30 min. maximum	-10 °C to +85 °C (+14°F to +185°F)	With PE cable: -10 °C to +70 °C (-14°F to 158°F) With FEP cable: -10 °C to +80 °C (-14°F to 176°F)	
	Min. process temperature when using the KALREZ seal: -3 °C (27°F)		

Lateral load FMB51 (static) ≤30 Nm

Pressure specifications

WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure → [13 ff](#), "Measuring range" ordering feature and → [34 ff](#) "Mechanical construction" ordering feature

- ▶ Only operate the measuring device within the prescribed limits!
- ▶ The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (68°F), (100°F (38 °C) for ANSI flanges), and may be applied to the device for an unlimited time. Pay attention to pressure-temperature dependencies.
- ▶ Please refer to the following standards for pressure values permitted at higher temperatures
EN 1092-1: 2001 Tab. 18 ¹⁾
ASME B 16.5a – 1998 Tab. 2-2.2 F316
ASME B 16.5a – 1998 Tab. 2.3.8 N10276
JIS B 2220.
- ▶ The MWP applies for the temperature ranges indicated in the "Ambient temperature limits" (→ [32](#)) and "Process temperature limits" ordering features (see above).
- ▶ The test pressure corresponds to the over pressure limit of the device (OPL = 1.5 x MWP) and may be applied for only a limited time period in order to avoid permanent damage.
- ▶ The Pressure Equipment Directive (EC Directive 97/23/EC) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- ▶ In the case of sensor range and process connection combinations where the OPL (over pressure limit) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value (1.5 x PN; PN = MWP).
- ▶ In oxygen applications, the values for "p_{max} and T_{max} for oxygen applications" as per → [31](#), "Oxygen applications" ordering feature may not be exceeded.

1) With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Mechanical construction

Device height

The device height is calculated from

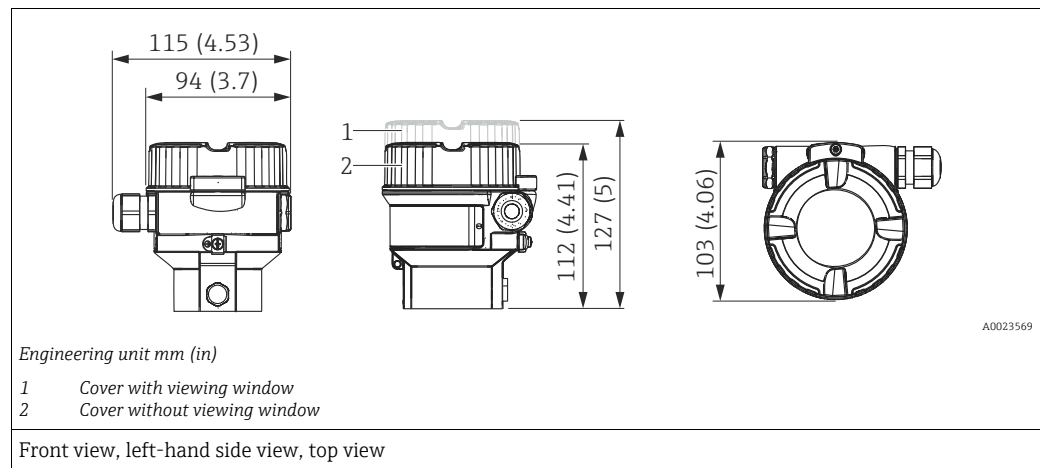
- the height of the housing and
- the height of the individual process connection.

The individual heights of the components are listed in the following sections. To calculate the device height simply add up the individual heights of the components. Where applicable also take into consideration the installation distance (space that is used to install the device).

You can use the following table for this purpose:

Section	Page	Height
Housing height	→ 34 ff	
Process connections	→ 35 ff	
Installation distance		
Device height		

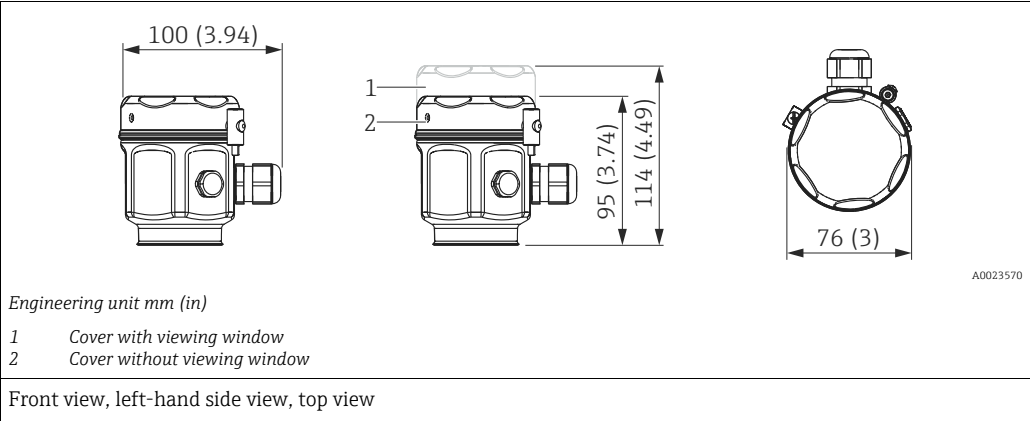
F31 housing, aluminum



Material	Weight kg (lbs)		Option ¹⁾
	With display	Without display	
Aluminum	1.1 (2.43)	1.0 (2.21)	I
Aluminum with glass viewing window			J

1) Product Configurator, "Housing" ordering feature

F15 housing, stainless steel (hygienic)

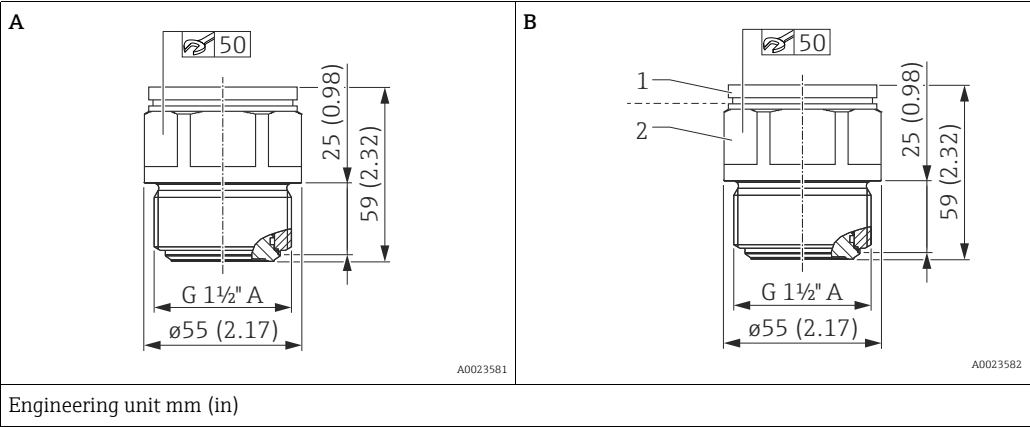


Material	Weight kg (lbs)		Option ¹⁾
	With display	Without display	
Stainless steel	1.1 (2.43)	1.0 (2.21)	Q
Stainless steel with glass viewing window			R
Stainless steel with plastic viewing window			S

1) Product Configurator, "Housing" ordering feature

Process connections FMB50, FMB51, FMB52

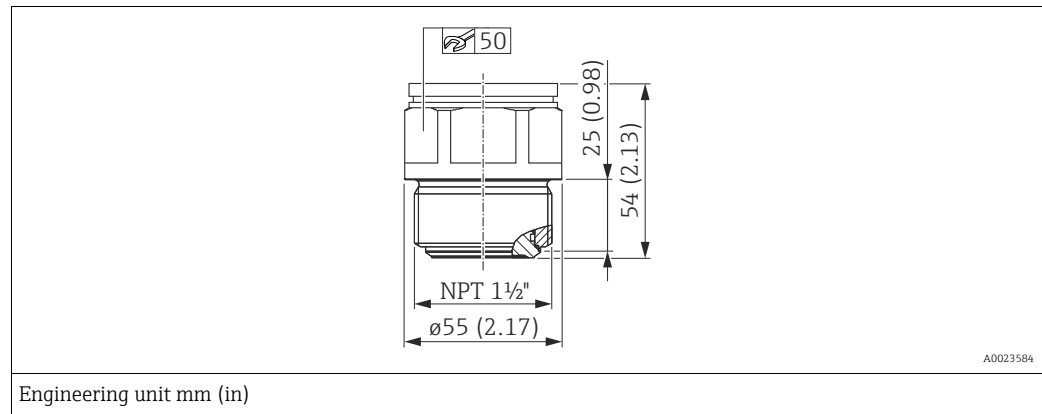
ISO 228 G threaded connection



Item	Designation	Material	Weight kg (lbs)	Option ¹⁾
A	Thread ISO 228 G 1 ½" A	AISI 316L (1.4435)	0.8 (1.76)	GGJ
B	Thread ISO 228 G 1 ½" A	▪ 1: top section AISI 316L (1.4435) ▪ 2: bottom section Alloy C276 (2.4819)		GGC

1) Product Configurator, "Process connection" section

Threaded connection NPT

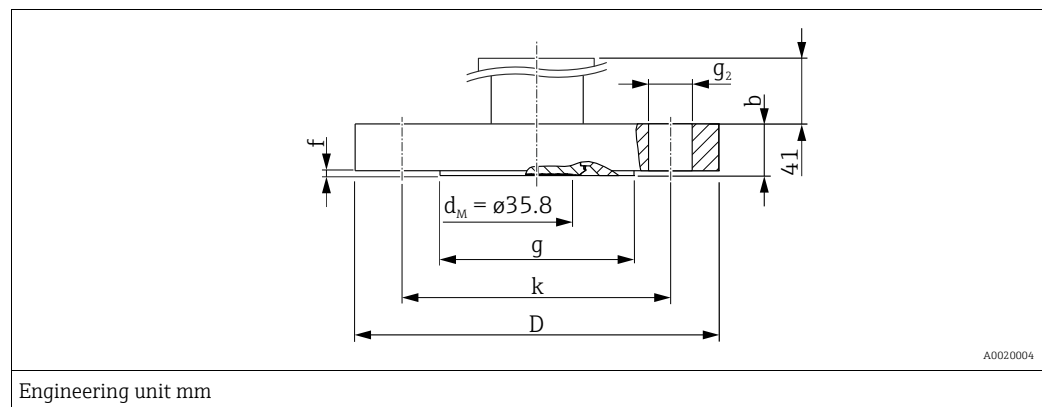


Designation	Material	Weight kg (lbs)	Option ¹⁾
Thread ANSI 1 1/2" MNPT	AISI 316L (1.4435)	0.8 (1.76)	RGJ

1) Product Configurator, "Process connection" section

Process connections FMB50, FMB51, FMB52

EN/DIN flanges, connection dimensions as per EN 1092-1/DIN 2527



Flange ¹⁾								Boltholes			Weight	Option ²⁾
Material ³⁾	Nominal diameter	Nominal pressure	Shape ⁴⁾	Diameter	Thick-ness	Diameter of raised face	Height of raised face	Quant-ity	Diameter	Hole circle		
				D	b	g	f		g ₂	k	[kg (lbs)]	
				[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		
AISI 316L	DN 40	PN 10/16	B1 (C)	150	18	88	2	4	18	110	3.05 (6.72)	CEJ
AISI 316L	DN 50	PN 10/16	B1 (C)	165	18	102	2	4	18	125	3.75 (8.27)	CFJ
AISI 316L	DN 80	PN 10/16	B1 (C)	200	20	138	2	8	18	160	5.55 (12.24)	CGJ
AISI 316L	DN 100	PN 10/16	B1 (C)	220	20	158	2	8	18	180	6.75 (14.88)	CHJ

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges, is < R_a 0.8 µm (31.5 µin). Lower surface roughness available on request.

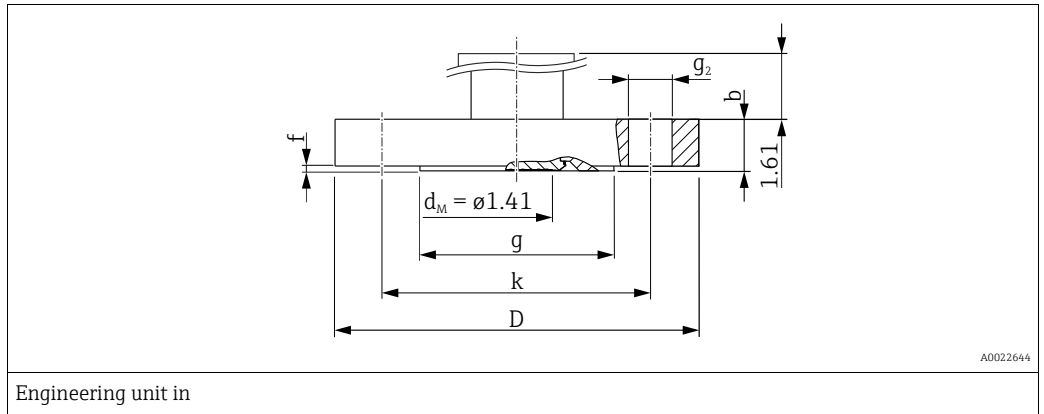
2) Product Configurator, "Process connection" section

3) Endress+Hauser supplies DIN/EN stainless steel flanges as per AISI 316L (DIN/ EN material number 1.4404 or 14435). With regard to their stability-temperature property, the materials 1.4404 and 1.4435 are grouped together under 13E0 in EN 1092-1: 2001 Tab.18. The chemical composition of the two materials can be identical.

4) Designation as per DIN 2526 in brackets

Process connections FMB50,
FMB51, FMB52 - continued

ASME flanges, connection dimensions as per ANSI B 16.5, raised face RF

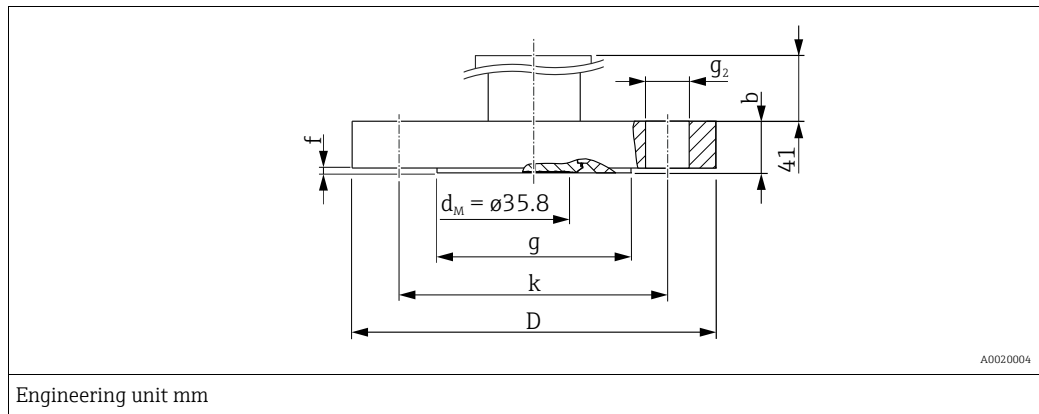


Flange ¹⁾							Boltholes			Weight	Option ²⁾
Material ³⁾	Nominal diameter	Class	Diameter	Thick-ness	Diameter of raised face	Height of raised face	Quantity	Diameter	Hole circle		
	[in]	[lb./sq in]	D	b	g	f		g ₂	k	[kg (lbs)]	
AISI 316/316L	1 ½	150	5	0.69	2.88	0.06	4	0.62	3.88	2.55 (5.62)	AEJ (not FMB51/52)
AISI 316/316L	2	150	6	0.75	3.62	0.06	4	0.75	4.75	3.45 (7.61)	AFJ
AISI 316/316L	3	150	7.5	0.94	5	0.06	4	0.75	6	6.15 (13.56)	AGJ
AISI 316/316L	4	150	9	0.94	6.19	0.06	8	0.75	7.5	8.25 (18.19)	AHJ

- 1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges, is < R_a 0.8 µm (31.5 µin). Lower surface roughness available on request.
- 2) Product Configurator, "Process connection" section
- 3) Combination of AISI 316 for required pressure resistance and AISI 316L for required chemical resistance (dual rated)

Process connections FMB50,
FMB51, FMB52 - continued

JIS flanges, connection dimensions as per JIS B 2220 BL, raised face RF



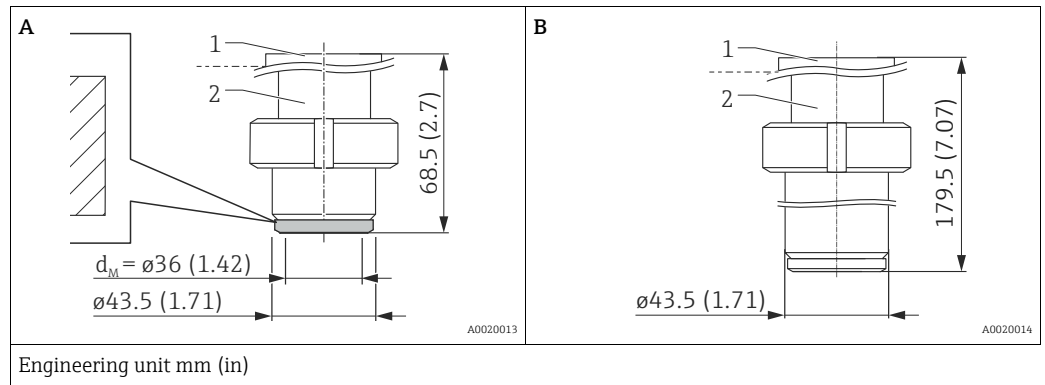
Flange ¹⁾							Boltholes			Weight	Option ²⁾
Material	Nominal diameter	Nominal pressure	Diameter	Thick-ness	Diameter of raised face	Height of raised face	Quantity	Diameter	Hole circle		
			D	b	g	f		g ₂	k	[kg (lbs)]	
			[mm]	[mm]	[mm]	[mm]		[mm]	[mm]		
AISI 316L (1.4435)	40 A	10 K	140	16	81	2	4	19	105	2.55 (5.62)	KEJ
	50 A	10 K	155	16	96	2	4	19	120	2.95 (6.50)	KFJ
	80 A	10 K	185	18	126	2	8	19	150	4.25 (9.37)	KGJ
	100 A	10 K	210	18	151	2	8	19	175	5.35 (11.79)	KHJ

1) The roughness of the surface in contact with the medium, including the sealing surface of the flanges (all standards), is < R_a 0.8 µm (31.5 µin). Lower surface roughness available on request.

2) Product Configurator, "Process connection" section

Process connections FMB50 - continued

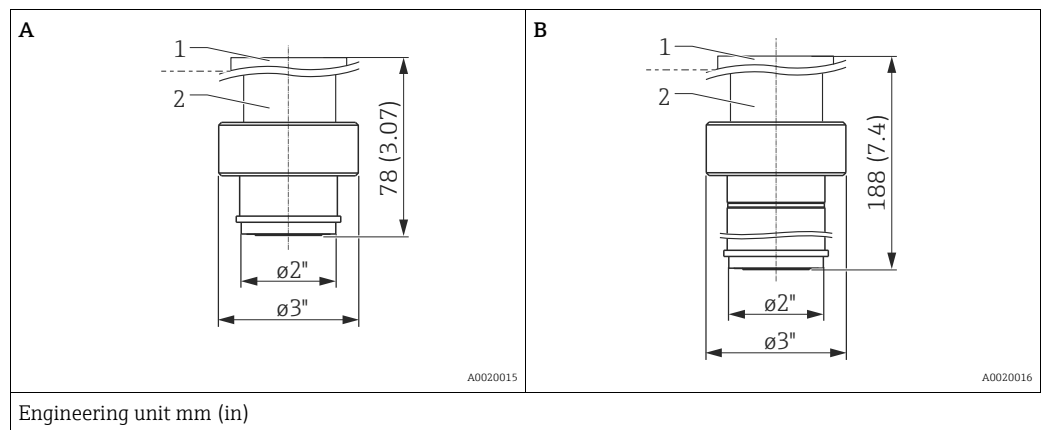
Universal adapter



Item ¹⁾	Designation	Material	Approval	Weight kg (lbs)	Option ²⁾
A	Universal process adapter incl. silicone molded seal (spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI-70C	<ul style="list-style-type: none"> 1: top section AISI 316L (1.4404) 2: bottom section AISI 316L (1.4435) 	EHEDG, 3A	0.8 (1.76)	UPJ ³⁾
	Universal process adapter incl. EPDM molded seal (order no.: 71100719) EPDM-70, FDA, USP Class VI; (5 pieces)				UNJ ³⁾
B	Universal process adapter, 6 inch extension incl. silicone molded seal (spare part no.: 52023572) FDA 21CFR177.2600/USP Class VI-70C		EHEDG, 3A	1.7 (3.75)	UQJ ³⁾
	Universal process adapter, 6 inch extension incl. EPDM molded seal (order no.: 71100719) EPDM-70, FDA, USP Class VI; (5 pieces)				UOJ ³⁾

- 1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76 \mu\text{m}$ (30 μin) as standard. Surface roughness $R_a < 0.38 \mu\text{m}$ electropolished (wetted) Ordering information: Product Configurator, "Service" ordering feature, option "HK".
- 2) Product Configurator, "Process connection" section
- 3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (1.4301) or in AISI 304L (1.4307).

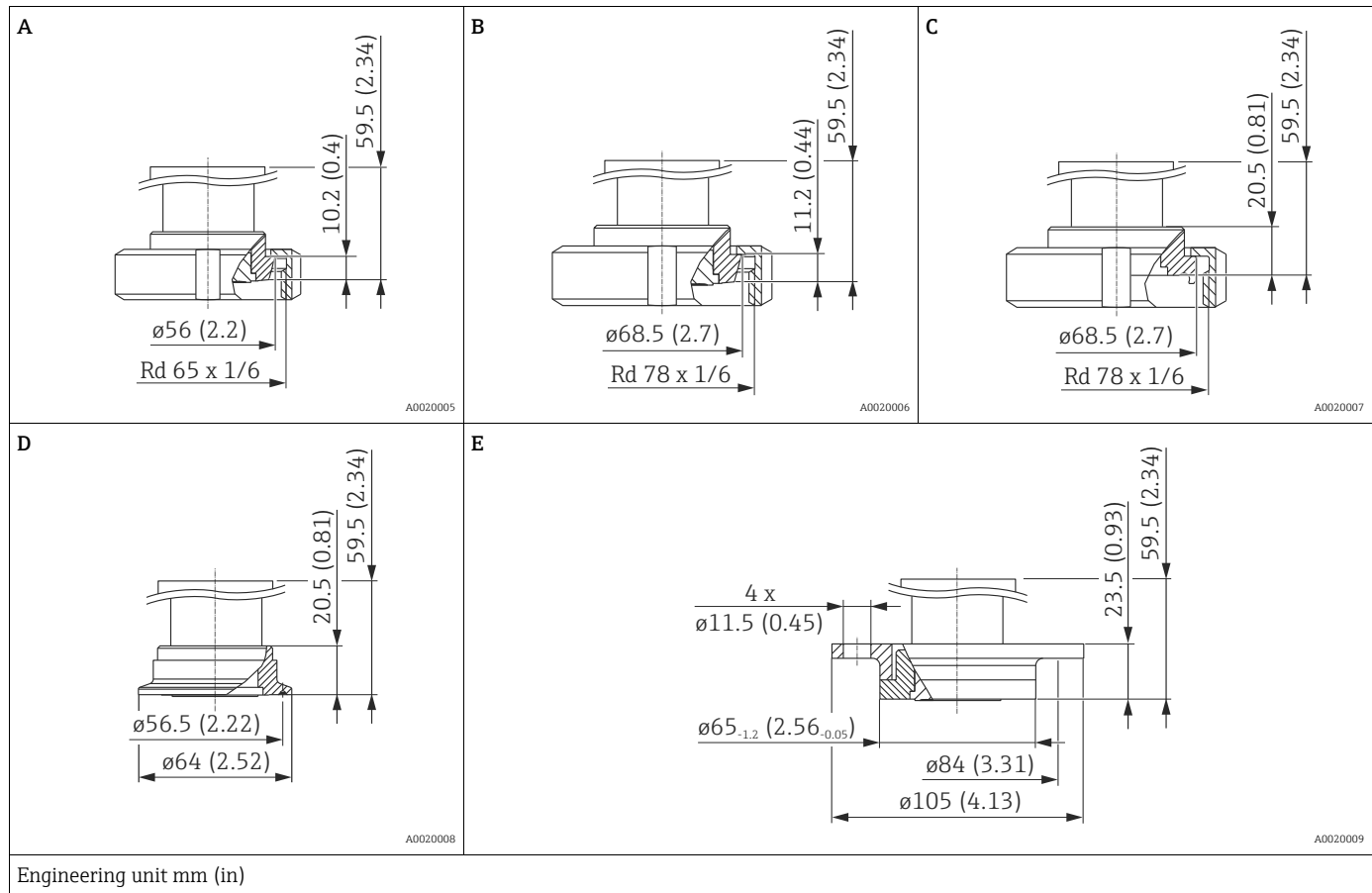
Anderson process adapter



Item ¹⁾	Designation	Material	Approval	Weight kg (lbs)	Option ²⁾
A	Short Anderson process adapter, 2-3/16", 316L, incl. silicone molded seal FDA 21CFR177.2600	<ul style="list-style-type: none"> 1: top section AISI 316L (1.4404) 2: bottom section AISI 316L (1.4435) Slotted nut AISI 316L (1.4404) 	3A	1.5 (3.31)	USJ
B	Long Anderson process adapter, 6-1/2", 316L, incl. silicone molded seal FDA 21CFR177.2600		3A	2.9 (6.39)	UTJ

- 1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76 \mu\text{m}$ (30 μin) as standard. Lower surface roughness available on request.
- 2) Product Configurator, "Process connection" section

Process connections FMB50 - Hygienic connections
continued

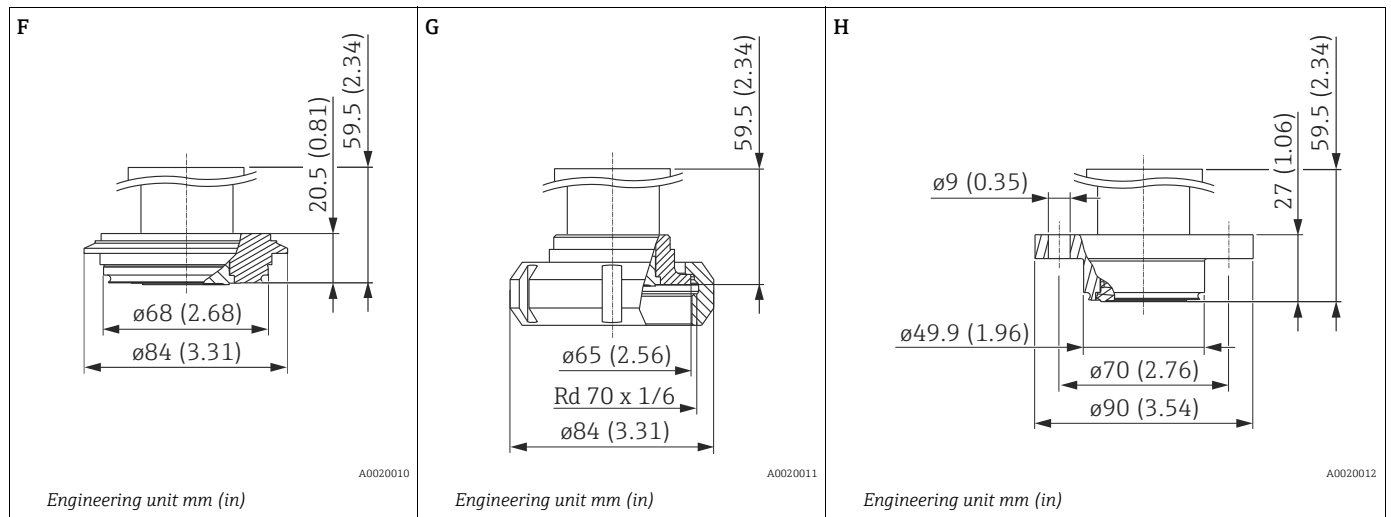


Item ¹⁾	Designation	Material	Approval	Weight kg (lbs)	Option ²⁾
A	DIN 11851 DN 40 PN 25	AISI 316L (1.4435)	EHEDG, 3A	0.7 (1.54)	MZJ ³⁾
B	DIN 11851 DN 50 PN 25		EHEDG, 3A	0.9 (1.98)	MRJ ³⁾
C	DIN11864-1 A DN50 PN16 pipe DIN11866-A, slotted nut, 316L		EHEDG, 3A	1 (2.21)	NDJ ³⁾
D	Tri-Clamp ISO 2852 DN 40 – DN 51 (2"), DIN 32676 DN 50		EHEDG, 3A	0.7 (1.54)	TDJ ³⁾
E	DRD DN 50 (65 mm) PN 25, slotted nut AISI 304 (1.4301)		-	1.1 (1.98)	TIJ

1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76 \mu\text{m}$ (30 μin) as standard. Lower surface roughness available on request.

2) Product Configurator, "Process connection" section

3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).



Item ¹⁾	Designation	Material	Approval	Weight kg (lbs)	Option ²⁾
F	Varivent Type N for pipes 40 – 162, PN 40	AISI 316L (1.4435)	EHEDG, 3A	1 (2.21)	TRJ
G	SMS 2", PN 25		EHEDG	0.7 (1.54)	TXJ ³⁾
H	NEUMO, D50, PN 16, 316L		3A	0.8 (1.76)	S4J

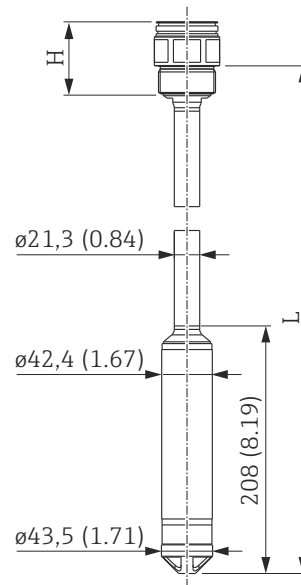
1) Surface roughness of the surfaces in contact with the medium $R_a \leq 0.76 \mu\text{m}$ (30 μin) as standard. Lower surface roughness available on request.

2) Product Configurator, "Process connection" section

3) Endress+Hauser supplies these slotted nuts in stainless steel AISI 304 (DIN/EN material number 1.4301) or in AISI 304L (DIN/EN material number 1.4307).

**Process connections FMB51
(rod version)**

Threaded connection ISO 228 and NPT



A0023592

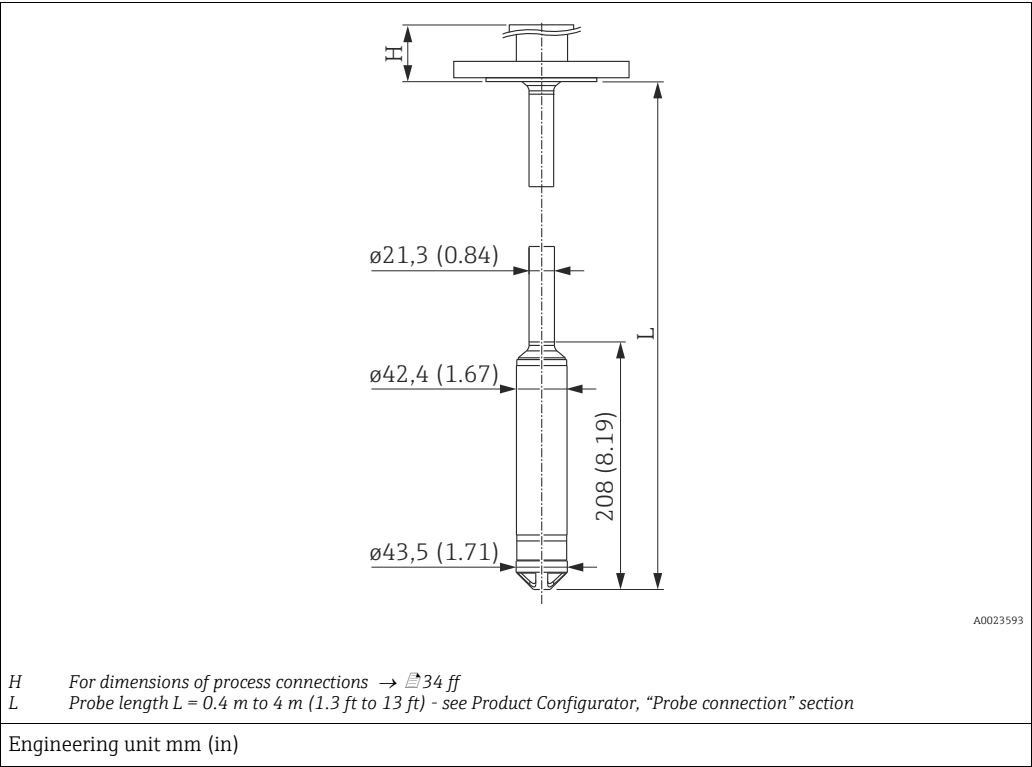
H For dimensions of process connections → 34 ff

L Probe length $L = 0.4\text{ m to }4\text{ m}$ (1.3 ft to 13 ft) - see Product Configurator, "Probe connection" section

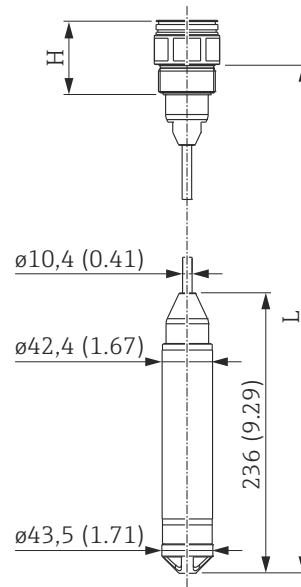
Engineering unit mm (in)

Process connection incl. sensor	Weight
Housing weight	→ 34 ff
Process connection weight	→ 35 ff
Pipe incl. cable	0.77 kg/m (1.70 lbs/3.3 ft)
Threaded connection incl. measuring cell tube and sensor	1.65 kg (3.64 lbs)
Flange connection incl. measuring cell tube and sensor, without a flange	-
Total weight of device	

EN/DIN, ANSI and JIS flanges



Process connection incl. sensor	Weight
Housing weight	→ 34 ff
Process connection weight	→ 35 ff
Pipe incl. cable	0.77 kg/m (1.70 lbs/3.3 ft)
Threaded connection incl. measuring cell tube and sensor	-
Flange connection incl. measuring cell tube and sensor, without a flange	1.3 kg (2.87 lbs)
Total weight of device	

**Process connections FMB52
(cable version)**
Threaded connection ISO 228 and NPT


A0023594

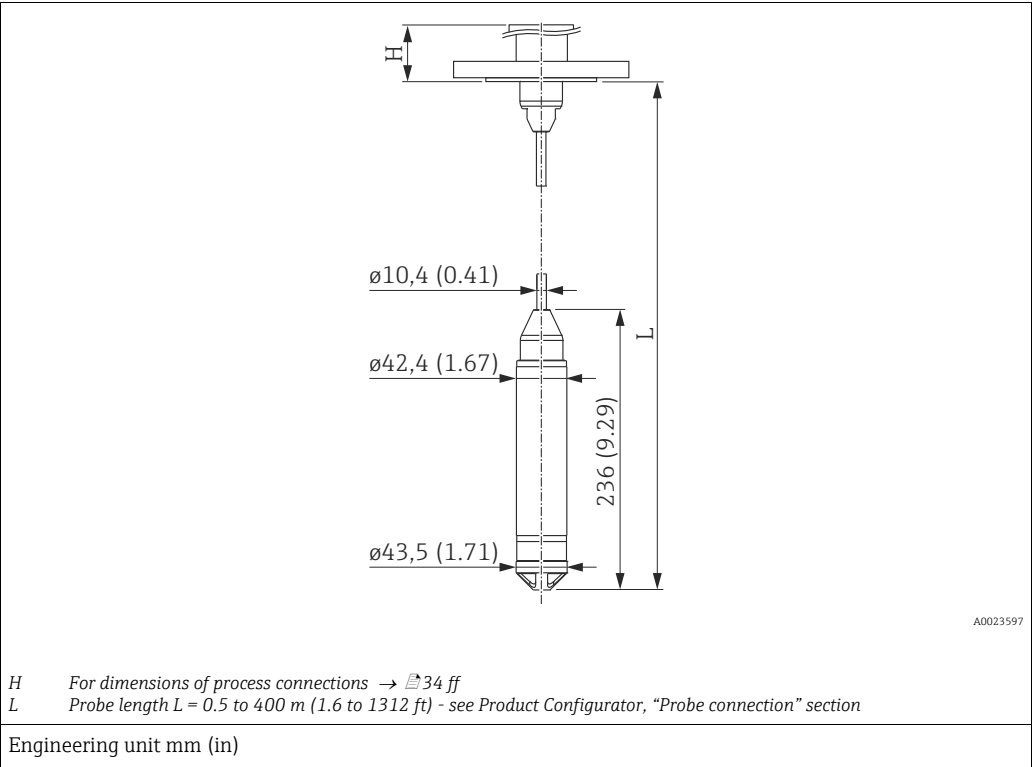
H For dimensions of process connections → 34 ff

L Probe length $L = 0.5$ to 400 m (1.6 to 1312 ft) - see Product Configurator, "Probe connection" section

Engineering unit mm (in)

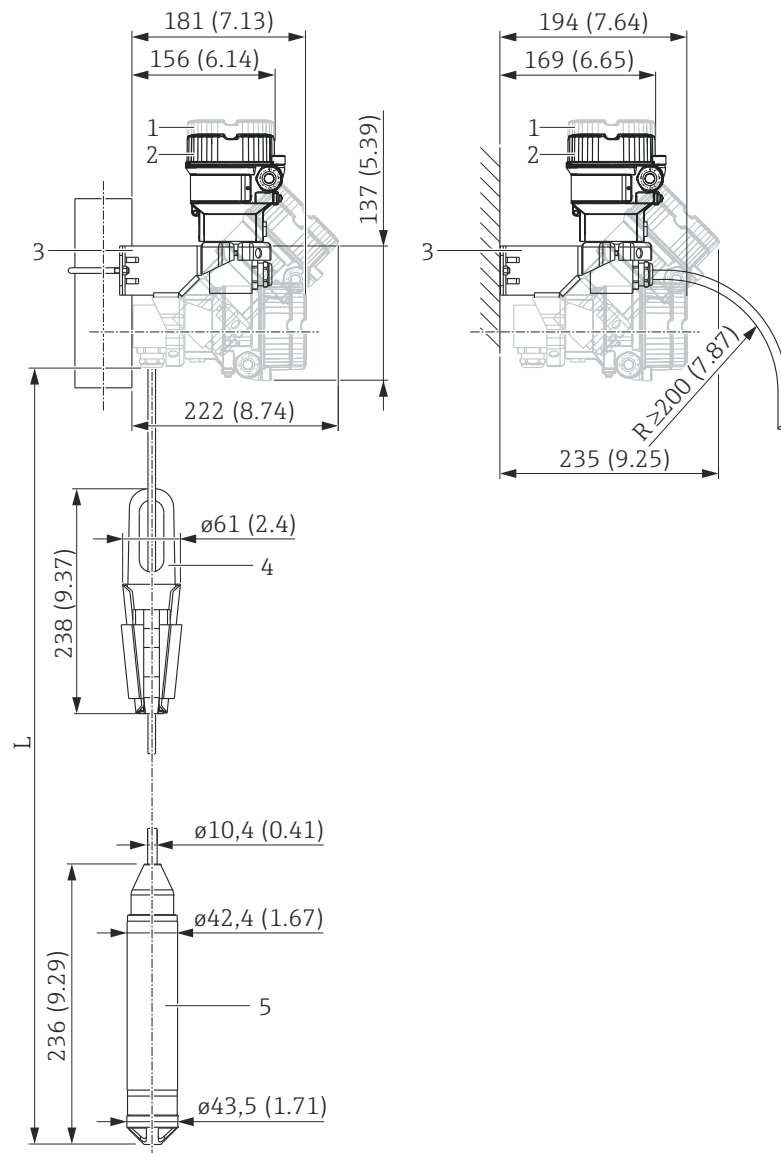
Process connection incl. sensor	Weight
Housing weight	→ 34 ff
Process connection weight	→ 35 ff
PE cable	0.13 kg/m (0.28 lbs/3.3 ft)
FEP cable	0.18 kg/m (0.40 lbs/3.3 ft)
Threaded connection incl. measuring cell tube and sensor	1.65 kg (3.64 lbs)
Flange connection incl. measuring cell tube and sensor, without a flange	-
Total weight of device	

EN/DIN, ANSI and JIS flanges



Process connection incl. sensor	Weight
Housing weight	→ 34 ff
Process connection weight	→ 35 ff
PE cable	0.13 kg/m (0.28 lbs/3.3 ft)
FEP cable	0.18 kg/m (0.40 lbs/3.3 ft)
Flange connection incl. measuring cell tube and sensor, without a flange	1.3 kg (2.87 lbs)
Total weight of device	

Dimensions of FMB53 with F31 housing, suspension clamp and mounting bracket



A0023598

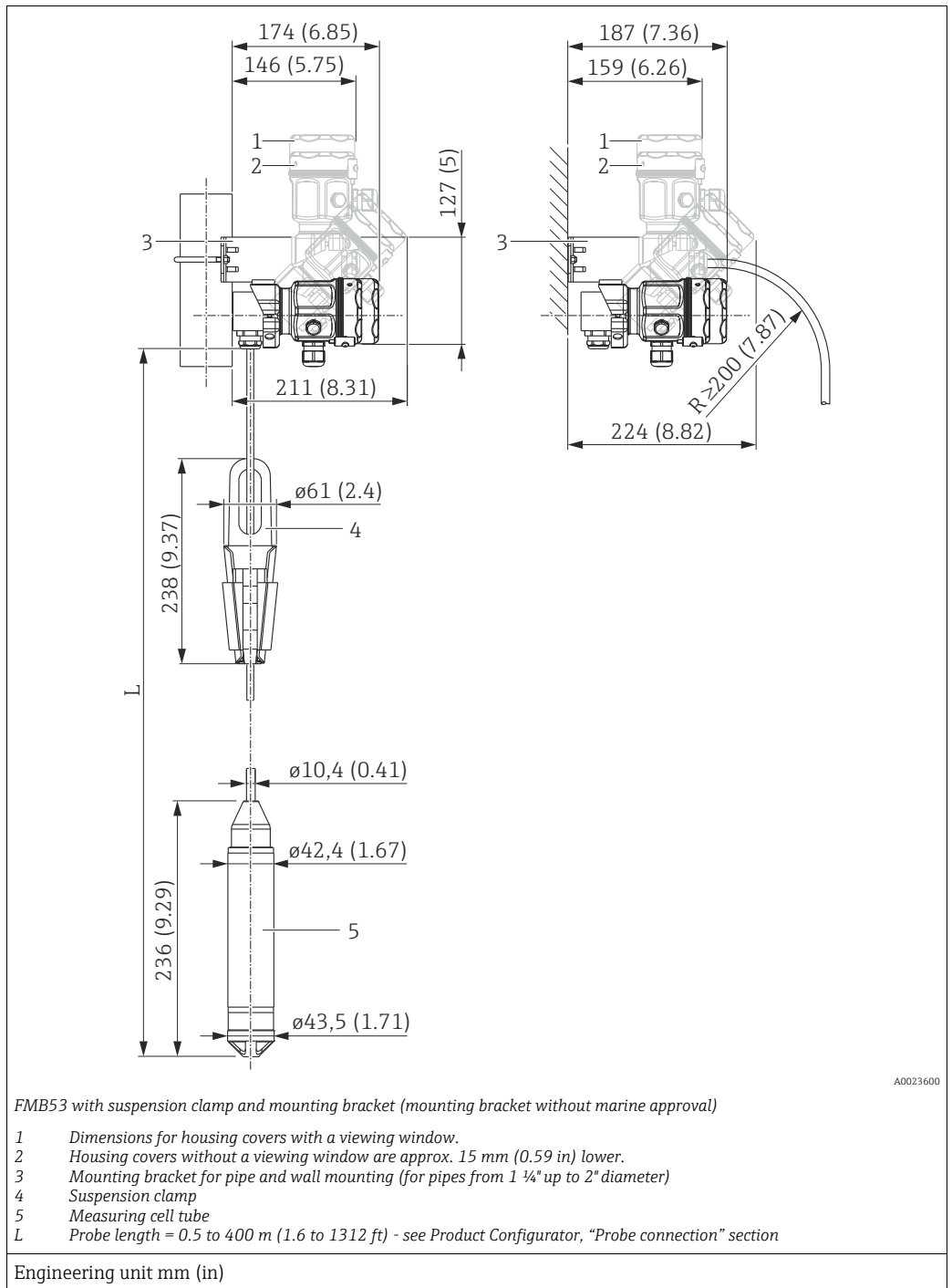
FMB53 with suspension clamp and mounting bracket (mounting bracket without marine approval)


- 1 Dimensions for housing covers with a viewing window.
- 2 Housing covers without a viewing window are approx. 15 mm (0.59 in) lower.
- 3 Mounting bracket for pipe and wall mounting (for pipes from 1 1/4" up to 2" diameter)
- 4 Suspension clamp
- 5 Measuring cell tube
- L Probe length = 0.5 to 400 m (1.6 to 1312 ft) - see Product Configurator, "Probe connection" section

Engineering unit mm (in)

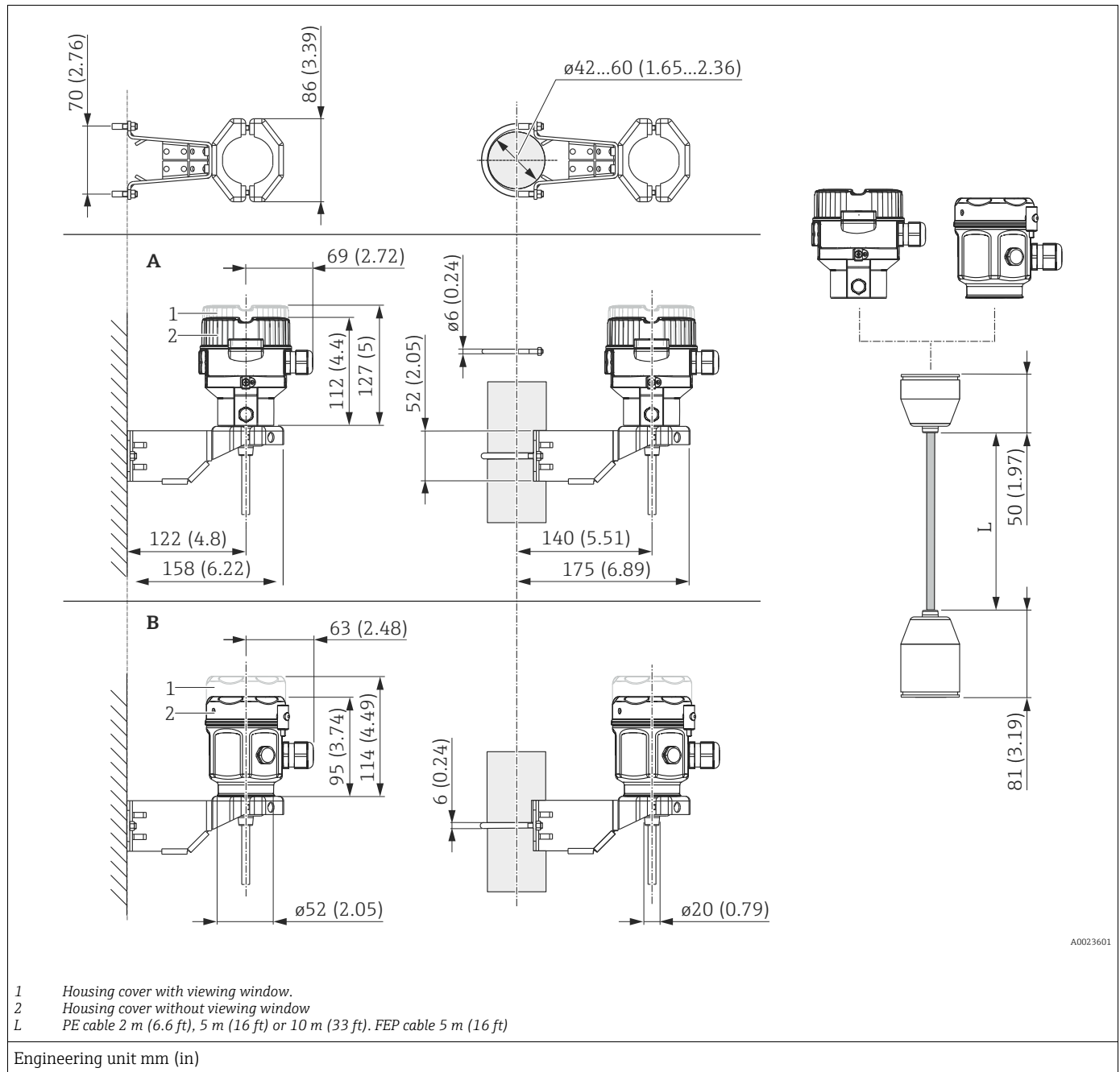
Process connection incl. sensor	Weight
Housing weight	→ 34 ff
PE cable (cable length > 120 m (394 ft) = Delivery on cable reel)	0.13 kg/m (0.28 lbs/3.3 ft)
FEP cable (cable length > 120 m (394 ft) = Delivery on cable reel)	0.18 kg/m (0.40 lbs/3.3 ft)
Mounting bracket	0.2 kg (0.44 lbs)
Pipe bend incl. cable entry	0.65 kg (1.43 lbs)
Suspension clamp	0.4 kg (0.88 lbs)
Measuring cell tube incl. sensor	1.0 kg (2.21 lbs)
Total weight of device	


Dimensions of FMB53 with F15 housing, suspension clamp and mounting bracket



Process connection incl. sensor	Weight
Housing weight	→  34 ff
PE cable (cable length > 120 m (394 ft) = Delivery on cable reel)	0.13 kg/m (0.28 lbs/3.3 ft)
FEP cable (cable length > 120 m (394 ft) = Delivery on cable reel)	0.18 kg/m (0.40 lbs/3.3 ft)
Mounting bracket	0.2 kg (0.44 lbs)
Pipe bend incl. cable entry	0.65 kg (1.43 lbs)
Suspension clamp	0.4 kg (0.88 lbs)
Measuring cell tube incl. sensor	1.0 kg (2.21 lbs)
Total weight of device	

Wall and pipe mounting with "Separate housing" version



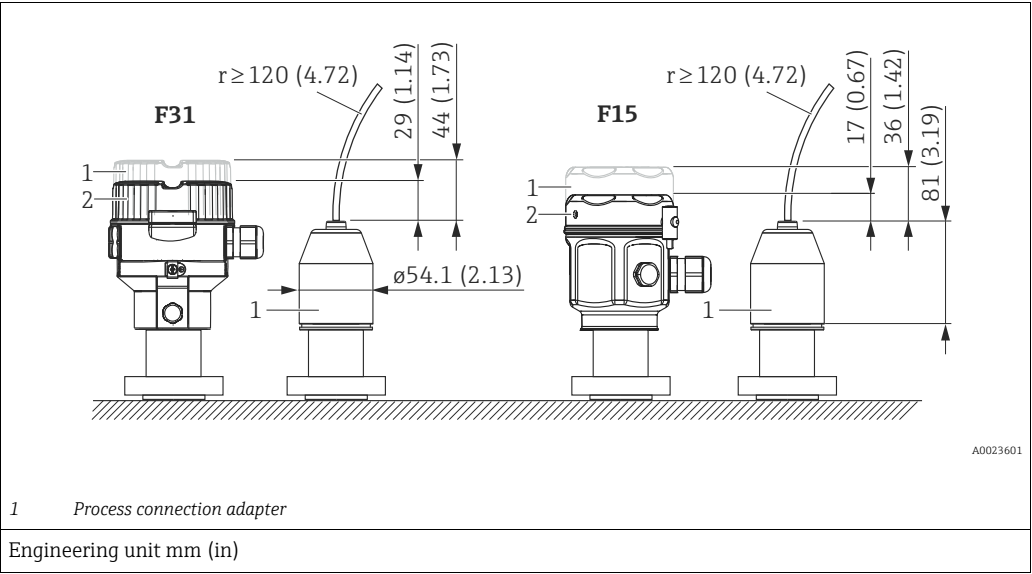
Item	Designation	Weight		Option ¹⁾
		Housing (F31 or F15)	Mounting bracket	
A	Dimensions with F31 housing	→  34 ff	0.5 kg (1.10)	U
B	Dimensions with F15 housing			

1) Product Configurator, "Separate housing" ordering feature

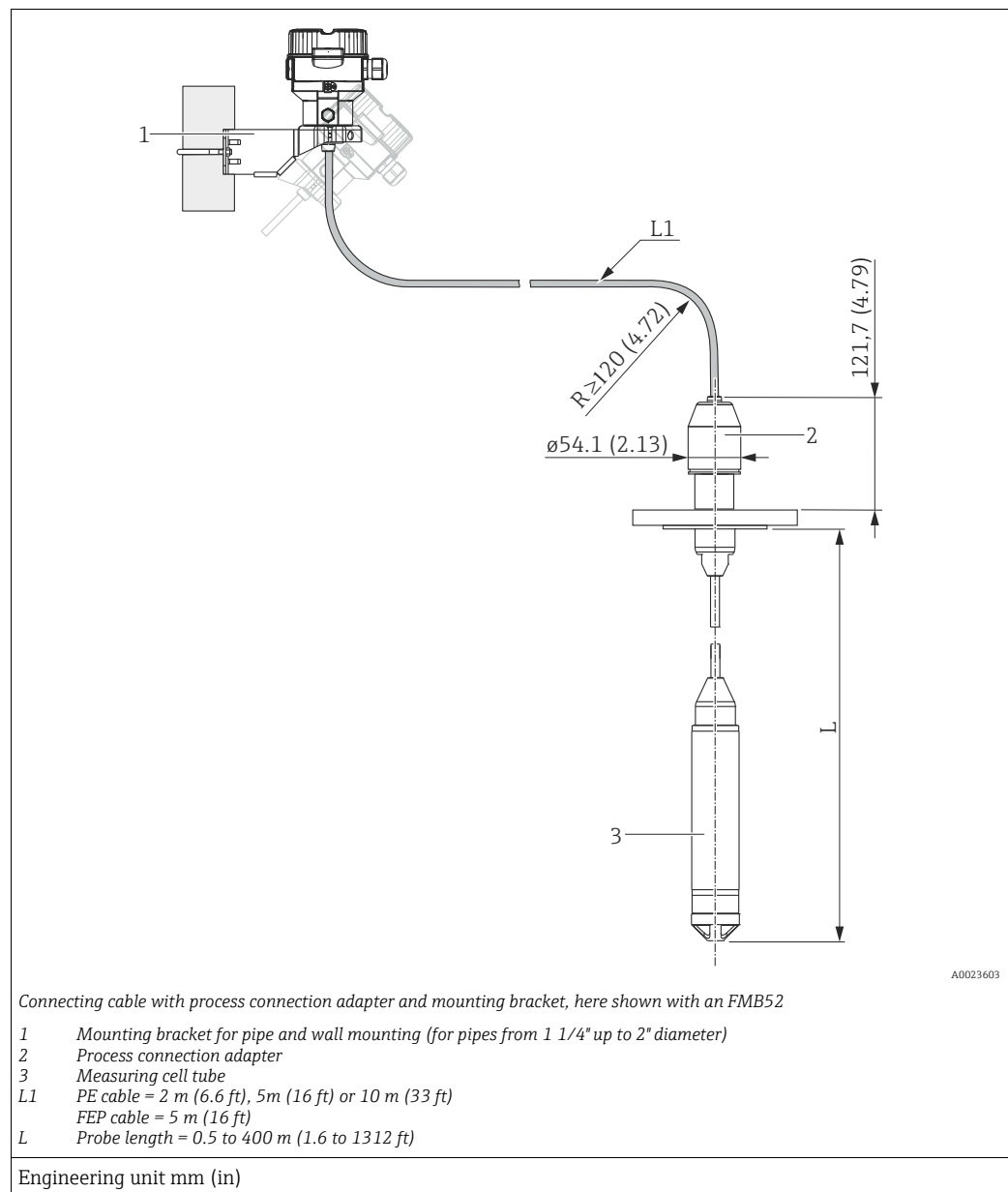
Also available for order as a separate accessory: part number 71102216

Reduction in installation height

If the separate housing is used, the mounting height of the process connection is reduced compared to the dimensions of the standard version.



Example for a "Separate housing" version



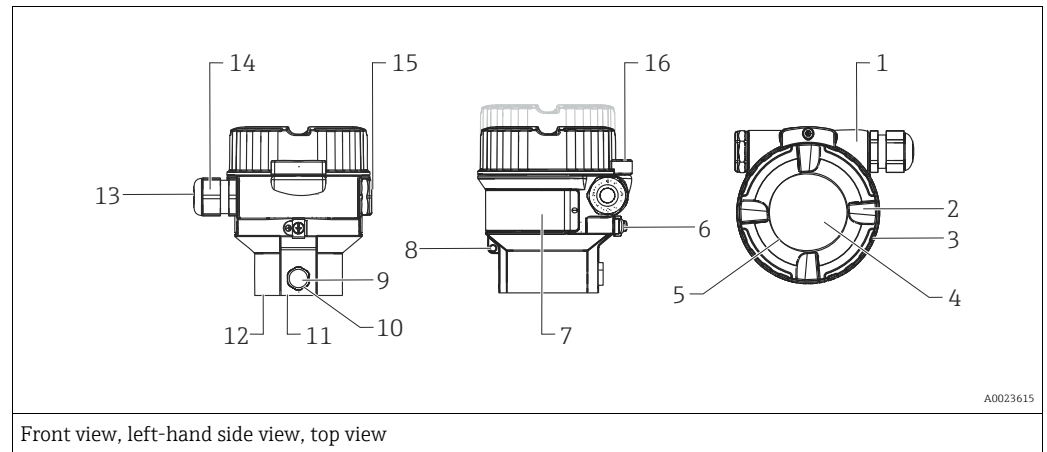
Process connection incl. sensor	Weight
Separate housing for FMB50	Weight of housing (→ 34 ff) + 0.5 kg (1.10 lbs)
Separate housing for FMB51 and FMB52	Weight of housing (→ 34 ff) + 0.65 kg (1.43 lbs)
Process connection adapter	0.4 kg (0.88 lbs)
Mounting bracket	0.2 kg (0.44 lbs)
Pipe bend incl. cable entry	0.65 kg (1.43 lbs)
PE cable 2 m (6.6 ft)	0.16 kg (0.35 lbs)
PE cable 5 m (16 ft)	0.32 kg (0.71 lbs)
Total weight of device	



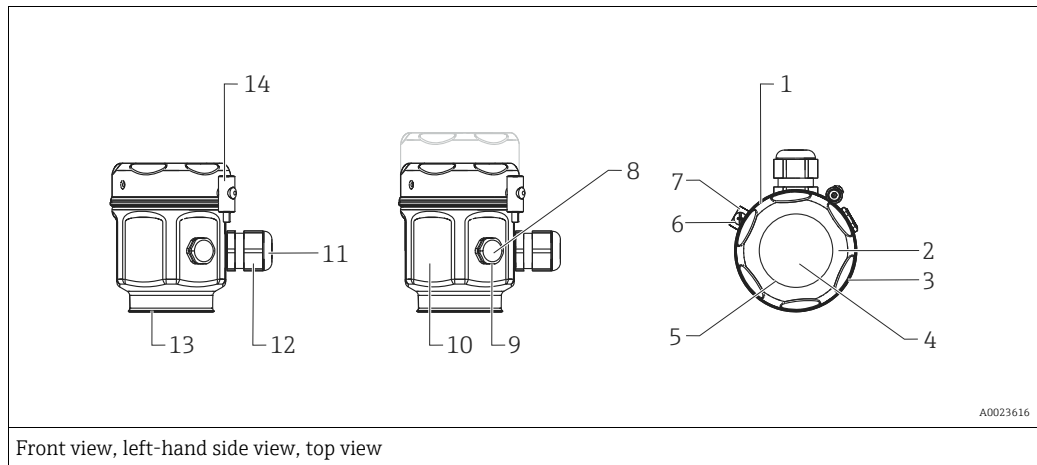
Ordering information for FMB50, FMB51, FMB52: Product Configurator, "Separate housing" ordering feature

Materials not in contact with
process

F31 housing

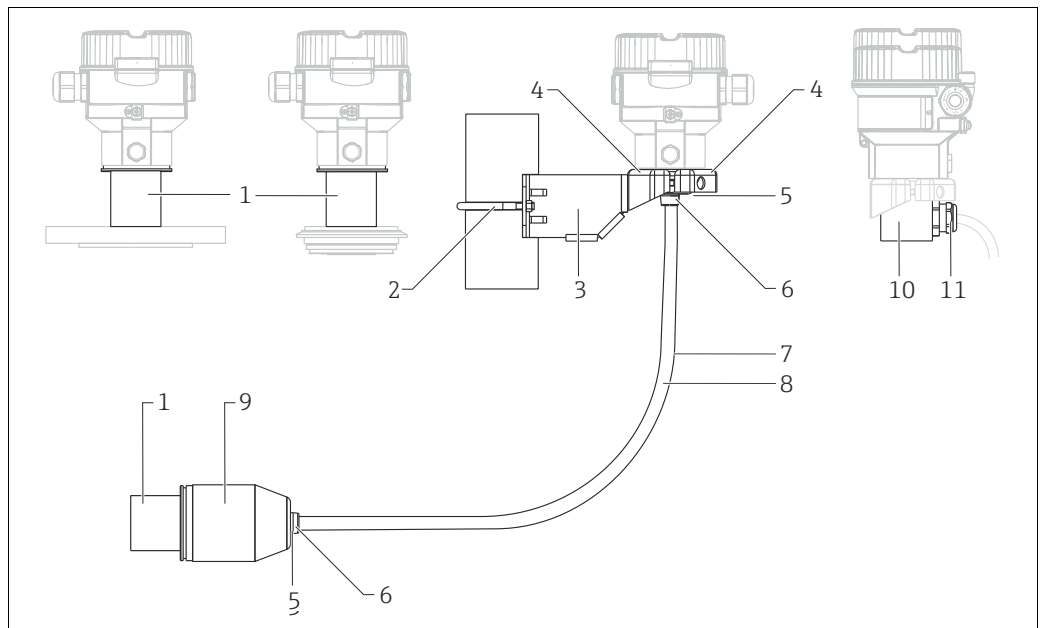


Item number	Component part	Material
1	F31 housing, RAL 5012 (blue)	Die-cast aluminum with protective powder-coating on polyester base
2	Cover, RAL 7035 (gray)	Die-cast aluminum with protective powder-coating on polyester base
3	Cover seal	EPDM
4	Sight glass	Mineral glass
5	Sight glass seal	Silicone (VMQ)
6	External ground terminal	AISI 304 (1.4301)
7	Nameplates	Plastic film
8	Attachment for tie-on label	AISI 304 (1.4301)/ AISI 316 (1.4401)
9	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
10	Pressure compensation filter, O-ring	VMQ or EPDM
11	Sealing ring	EPDM
12	Snap ring	PC Plastic
13	Seal of cable gland and blind plug	EPDM/NBR
14	Cable gland	Polyamide (PA), for dust ignition-proof: CuZn nickel-plated
15	Blind plug	PBT-GF30 FR for dust ignition-proof, Ex d, FM XP and CSA XP: AISI 316L (1.4435)
16	Cover clamp	Clamp AISI 316L (1.4435), screw A4

F15 housing

Item number	Component part	Material
1	F15 housing	AISI 316L (1.4404)
2	Cover	
3	Cover seal	Silicone with PTFE coating
4	Sight glass for non-hazardous area, ATEX Ex ia, NEPSI Zone 0/1 Ex ia, IECEx Zone 0/1 Ex ia, FM NI, FM IS, CSA IS	Polycarbonate (PC)
4	Sight glass for ATEX 1/2 D, ATEX 1/3 D, ATEX 1 GD, ATEX 1/2 GD, ATEX 3 G, FM DIP, CSA dust ignition-proof	Mineral glass
5	Sight glass seal	Silicone (VMQ)
6	External ground terminal	AISI 304 (1.4301)
7	Attachment for tie-on label	AISI 304 (1.4301)/ AISI 316 (1.4401)
8	Pressure compensation filter	AISI 316L (1.4404) and PBT-FR
9	Pressure compensation filter, O-ring	VMQ or EPDM
10	Nameplates	lasered
11	Cable gland	Polyamide (PA), for dust ignition-proof: CuZn nickel-plated
12	Seal of cable gland and blind plug	NBR/Silicone/EPDM
13	Sealing ring	EPDM
14	Screw	A4-50

Connecting parts



A0023617

Item number	Component part	Material
1	Connection between the housing and process connection	AISI 316L (1.4404)
2	Mounting bracket	Bracket AISI 316L (1.4404)
3		Screw and nuts A4-70
4		Half-shells: AISI 316L (1.4404)
5	Seal for cable from separate housing	FKM, EPDM
6	Gland for cable from separate housing; Screws:	AISI 316L (1.4404) A2
7	PE cable for separate housing	Abrasion-proof cable with strain-relief Dynema members; shielded using aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
8	FEP cable for separate housing	Abrasion-proof cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant
9	Process connection adapter for separate housing	AISI 316L (1.4404)
10	Housing adapter	FMB50, FMB51, FMB52: AISI 316L (1.4404) FMB53: AISI 304 (1.4301)
11	Cable gland: Sealing insert: O-ring:	CuZn nickel-plated TPE-V NBR

Fill fluid

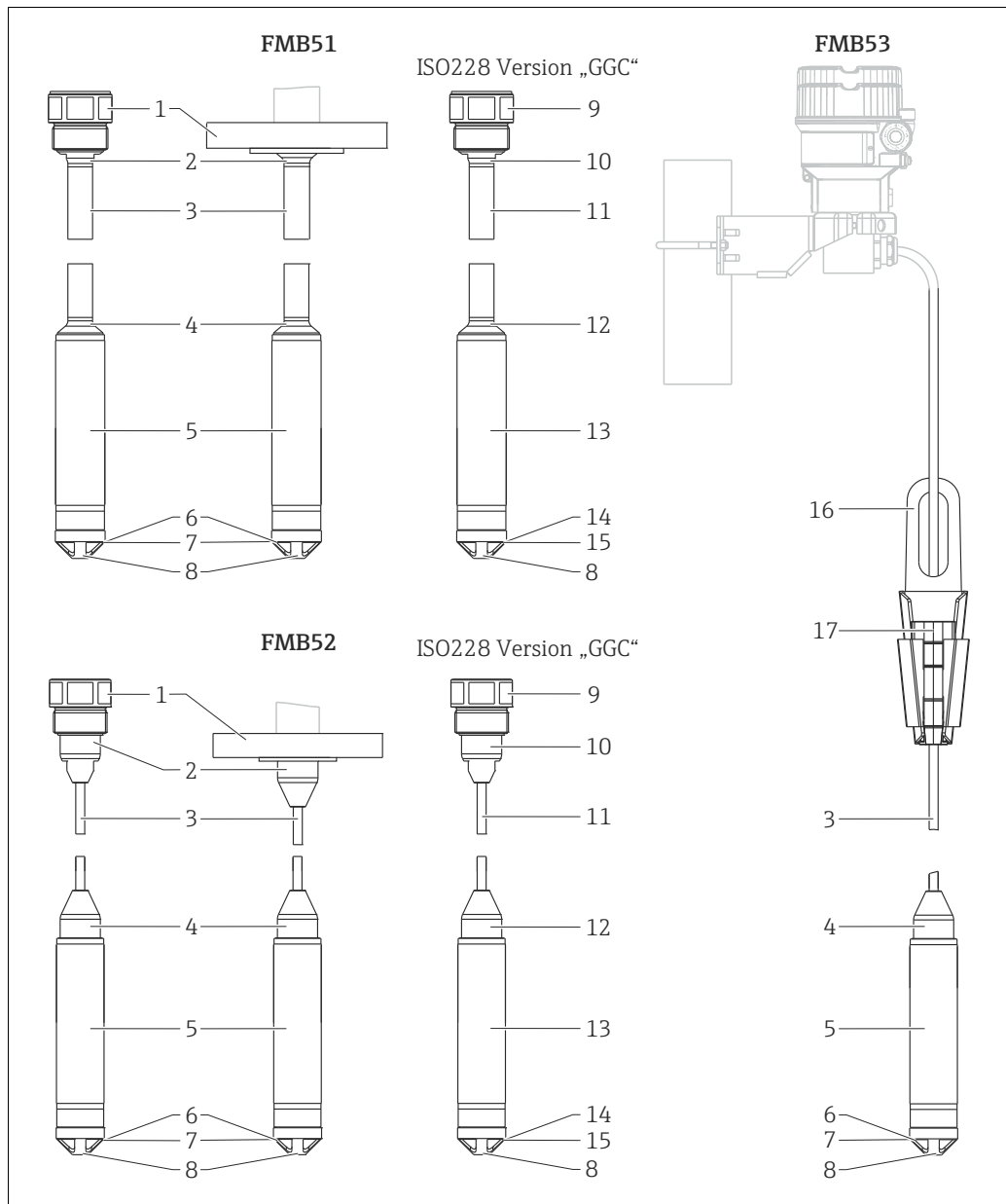
Designation	Option ¹⁾
Inert oil	2
Synthetic oil polyalphaolefin FDA 21 CFR 178.3570, NSF H1	3

1) Product Configurator, "Fill fluid" section

Materials in contact with the process



The wetted device components are listed in the "Mechanical construction" (→ 34 ff) and "Ordering information" (→ 64 ff) sections.



A0023619

Item number	Component part	Material
1	Process connection	→ 34 ff
2	Socket	AISI 316L (1.4404)

Item number	Component part	Material
3	Rod	AISI 316L (1.4435)
	PE cable	Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with polyethylene (PE-LD), black/blue; copper wires, twisted, UV-resistant
	PE cable (Usage in drinking water)	Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with polyethylene (PE-LD), black; copper wires, twisted, UV-resistant
	FEP cable	Abrasion-proof cable; shielded using galvanized steel wire netting and aluminum-coated film; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted, UV-resistant
4	Socket	AISI 316L (1.4404)
5	Probe tube	AISI 316L (1.4404)

Item number	Component part	Material
6	Process isolating diaphragm and meter body	→ 64 ff
7	Seals	→ 64 ff
8	Protection cap	PPO
9	Process connection	Alloy C276 (2.4819)
10	Socket	Alloy C4 (2.4610)
11	Rod	Alloy C4 (2.4610)
12	Socket	Alloy C4 (2.4610)
13	Probe tube	Alloy C22 (2.4602)
14	Process isolating diaphragm and meter body	→ 64 ff
15	Seals	→ 64 ff
16	Suspension clamp	AISI 316L (1.4404)
17	Clamping jaw	PA-GF

DIN/EN flanges

Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L as per material numbers 1.4435 or 1.4404. With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Process isolating diaphragm

Material	Option ¹⁾
Alloy C	B
Rhodium>Gold>AlloyC	L
Platinum>Gold>AlloyC (not FMB50)	N

- 1) Product Configurator, "Material of process isolating diaphragm" ordering feature

Seals

Designation	Option ¹⁾
FKM Viton	A ²⁾
EPDM	J ²⁾
Kalrez 6375	L ²⁾
None, welded cell	U

1) Product Configurator, "Seal" ordering feature

2) Not FMB50

TSE Certificate of Suitability (Transmissible Spongiform Encephalopathy)

The following applies to all process wetted device components:

- They do not contain any materials derived from animals.
- No auxiliaries or operating materials derived from animals are used in production or processing.

Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning

Guided menus for applications

Reliable operation

- Onsite operation possible in several languages
- Standardized operation at the device and in the operating tools
- Parameters relating to measured values can be locked/unlocked using the device's write protection switch, using the device software or via remote control.

Efficient diagnostics increase measurement availability

- Remedial measures are integrated in plain text
- Diverse simulation options

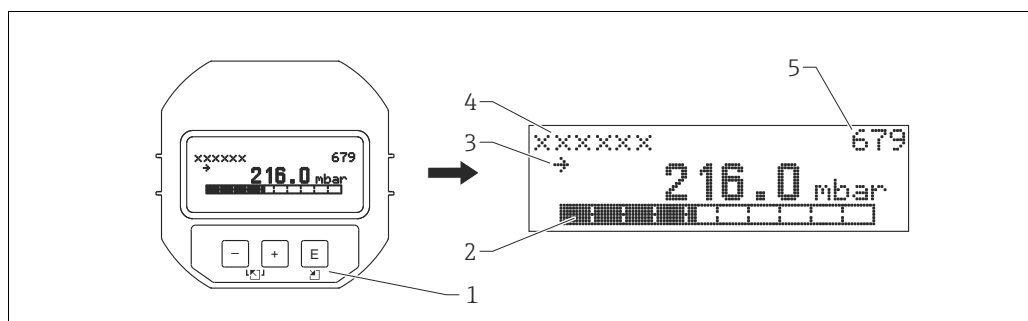
Onsite operation

Local display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The local display shows measured values, dialog texts as well as fault and notice messages in plain text, thereby supporting the user at every stage of operation. The liquid crystal display of the device can be turned in 90° stages. Depending on the orientation of the device, this makes it easy to operate the device and read the measured values.

Functions:

- 8-digit measured value display including sign and decimal point, bar graph for 4 to 20 mA HART as current display; or for PROFIBUS PA as graphic display of the standardized value of the AI Block; for FOUNDATION Fieldbus as graphic display of the transducer output in relation to the set pressure range.
- Simple and complete menu guidance as parameters are split into several levels and groups
- Each parameter is given a 3-digit ID number for easy navigation
- Possibility of configuring the display to suit individual requirements and preferences, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature etc.
- Comprehensive diagnostic functions (fault and warning message etc.)



A0016498

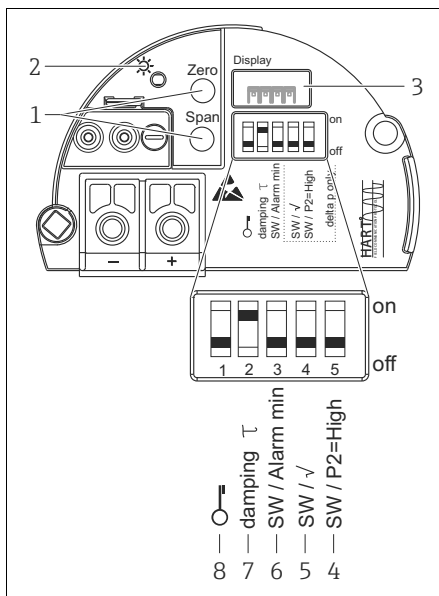
- 1 Operating keys
- 2 Bar graph
- 3 Symbol
- 4 Header
- 5 Parameter ID number

Ordering information:

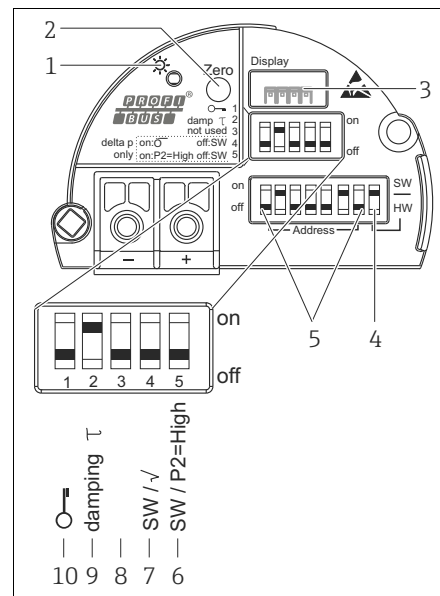
Product Configurator, "Output; operation" ordering feature

Function	Operation via display		
	HART	PROFIBUS PA	FOUNDATION Fieldbus
Position adjustment (zero point correction)	✓	✓	✓
Setting lower range value and upper range value - reference pressure present at the device	✓	✓	✓
Device reset	✓	✓	✓
Locking and unlocking parameters relevant to the measured value	✓	✓	✓
Value acceptance indicated by the green LED	—	—	—
Switching damping on and off	✓	✓	✓

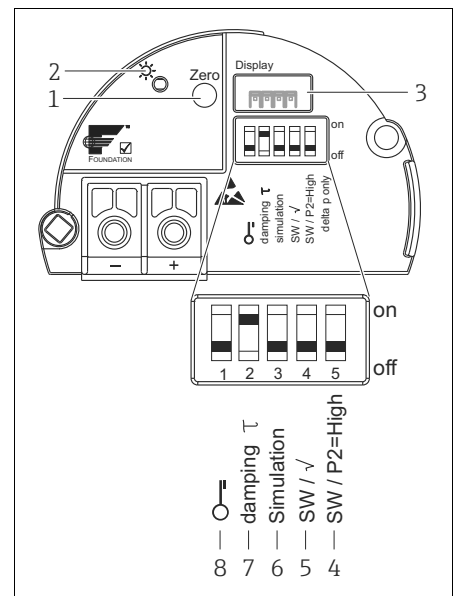
Operating keys and elements located on the electronic insert



A0023125



A0023126



A0023127

HART electronic insert

- 1 Operating keys for lower range value (zero) and upper range value (span)
- 2 Green LED to indicate successful operation
- 3 Slot for optional local display
- 4 DIP switch only for Deltabar M
- 5 DIP switch only for Deltabar M
- 6 DIP switch for alarm current SW / Alarm Min (3.6 mA)
- 7 DIP switch for switching damping on/off
- 8 DIP switch for locking/unlocking parameters relevant to the measured value

PROFIBUS PA electronic insert

- 1 Green LED to indicate successful operation
- 2 Operating key for position zero adjustment or reset (Zero)
- 3 Slot for optional local display
- 4 DIP switch for bus address SW / HW
- 5 DIP switch for hardware address
- 6 DIP switch only for Deltabar M
- 7 DIP switch only for Deltabar M
- 8 Not used
- 9 DIP switch for switching damping on/off
- 10 DIP switch for locking/unlocking parameters relevant to the measured value

FOUNDATION Fieldbus electronic insert

- 1 Operating key for position zero adjustment or reset (Zero)
- 2 Green LED to indicate successful operation
- 3 Slot for optional local display
- 4 DIP switch only for Deltabar M
- 5 DIP switch only for Deltabar M
- 6 DIP switch for simulation mode
- 7 DIP switch for switching damping on/off
- 8 DIP switch for locking/unlocking parameters relevant to the measured value

Function	Operation with operating keys and elements on the electronic insert		
	HART	PROFIBUS PA	FOUNDATION Fieldbus
Position adjustment (zero point correction)	✓	✓	✓
Setting lower range value and upper range value - reference pressure present at the device	✓	—	—
Device reset	✓	✓	✓
Locking and unlocking parameters relevant to the measured value	✓	✓	✓
Value acceptance indicated by the green LED	✓	✓	✓
Switching damping on and off	✓	✓	✓

Ordering information:
Product Configurator, "Display, operation" ordering feature

Operating languages

You can also choose another language in addition to the standard language "English":

Designation	Option ¹⁾
English	AA
German	AB
French	AC
Spanish	AD
Italian	AE
Dutch	AF
Chinese	AK
Japanese	AL

1) Product Configurator, "Additional operating language" ordering feature

Remote operation

All software parameters are accessible depending on the position of the write protection switch on the device.

Hardware and software for remote operation	HART	PROFIBUS PA	FOUNDATION Fieldbus
FieldCare → 59 ff	✓ ¹⁾	✓ ²⁾	✓
FieldXpert SFX100 → 59 ff	✓	—	✓
NI-FBUS Configurator → 60 ff	—	—	✓

1) Commubox FXA195 required → 60 ff

2) Profiboard or Proficard required → 60 ff

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:

- Configuration of transmitters in offline and online mode
- Loading and saving device data (upload/download)
- HistoROM®/M-DAT analysis
- Documentation of the measuring point

Connection options:

- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Service interface with Commubox FXA291 and ToF adapter FXA291 (USB).

For further information please contact your local Endress+Hauser Sales Center.

Field Xpert SFX100

Field Xpert is an industrial PDA with integrated 3.5" touchscreen from Endress+Hauser based on Windows Mobile. It offers wireless communication via the optional VIATOR Bluetooth modem or via WiFi and Endress+Hauser's Fieldgate FXA520. Field Xpert also works as a stand-alone device for asset management applications. For details refer to BA00060S/04/EN.

Commubox FXA195

For intrinsically safe HART communication with FieldCare via the USB interface. For details refer to TI00404F/00/EN.

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. For details, see TI00405C/07/EN.



For the following Endress+Hauser devices, you also need the "ToF adapter FXA291" accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70

ToF adapter FXA291

The ToF adapter FXA291 connects the Commubox FXA291 to devices in the ToF platform, pressure devices and Gammapilot via the USB port of a computer or laptop. For details, see KA00271F.

Profiboard

For connecting a PC to PROFIBUS.

Proficard

For connecting a laptop to PROFIBUS.

FF configuration program

FF configuration program, such as NI-FBUS Configurator, to

- connect devices with "FOUNDATION Fieldbus signal" into an FF-network
- set FF-specific parameters

Remote operation via:

- Operation with NI-FBUS Configurator:

The NI-FBUS Configurator is an easy-to-use graphical environment for creating linkages, loops, and a schedule based on the fieldbus concepts.

You can use the NI-FBUS Configurator to configure a fieldbus network as follows:

- Set block and device tags
- Set device addresses
- Create and edit function block control strategies (function block applications)
- Configure vendor-defined function and transducer blocks
- Create and edit schedules
- Read and write to function block control strategies (function block applications)
- Invoke Device Description (DD) methods
- Display DD menus
- Download a configuration
- Verify a configuration and compare it to a saved configuration
- Monitor a downloaded configuration
- Replace a virtual device by a real device
- Save and print a configuration


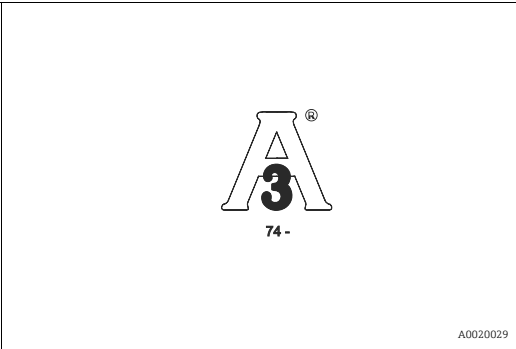

System integration

The device can be given a tag name (max. 8 alphanumeric characters).

Designation	Option ¹⁾
Measuring point (TAG), see additional specifications	Z1
Bus address, see additional specifications	Z2

1) Product Configurator, "Identification" ordering feature

Certificates and approvals

CE mark	<p>The device meets the legal requirements of the relevant EC directives.</p> <p>Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.</p>
C-tick symbol	<p>The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".</p>
Ex approvals	<ul style="list-style-type: none"> ■ ATEX ■ FM ■ CSA ■ Also combinations of different approvals <p>All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.</p> <p>→ 68 ff, "Safety Instructions" and "Installation/Control Drawings" ordering features.</p>
Suitability for hygienic processes	<p>All materials in contact with foodstuffs comply with framework Regulation (EC) 1935/2004. The Deltapilot is available with hygienic process connections (overview: see order code).</p> <p>⚠ CAUTION</p> <p>Contamination in the process!</p> <p>Risk of contamination if incorrect seals and parts are used!</p> <ul style="list-style-type: none"> ▶ To avoid the risk of contamination, when installing the device comply with the design principles of EHEDG, Guideline 37 "Hygienic Design and Application of Sensors" and Guideline 16 "Hygienic Pipe Couplings". ▶ Suitable assemblies and seals must be used to ensure hygienic design in accordance with 3-A SSI and EHEDG specifications. ▶ The leak-proof connections can be cleaned with the cleaning methods typical of this industry (CIP and SIP). Attention must be paid to the pressure and temperature specifications of the sensor and process connections for CIP and SIP processes (clean in place/sterilize in place). <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p></p> <p>Gap-free connections can be cleaned without residue using the usual cleaning methods.</p>
Pharma (CoC) (FMB50 only)	<p>Certificate of Compliance (CoC) (according to ASME BPE-2007)</p> <p>Ordering information: Product Configurator, "Additional options 1" ordering feature, option "LW"</p>
Functional safety SIL	<p>The Deltapilot M with 4 to 20 mA output signal has been developed to assessed and certified by TÜV NORD CERT as per IEC 61508 Edition 2.0 and IEC 61511. These devices can be used to monitor the process level and pressure up to SIL 2. For a detailed description of the safety functions with Deltapilot M, settings and functional safety data, see the "Functional safety manual - Deltapilot M" SD00347P.</p> <p>Ordering information: Product Configurator, "Additional approval:" ordering feature, option "LA".</p>

Overfill protection WHG (FMB50, FMB51, FMB52): see document ZE00275P

Ordering information:
Product Configurator, "Additional approval" ordering feature, option "LC".

AD2000 The pressure retaining material 316L (1.4435/1.4404) corresponds to AD2000 - W2/W10.

Pressure Equipment Directive (PED) The Deltapilot M device corresponds to Article 3 (3) of the EC directive 97/23/EC (Pressure Equipment Directive) and has been designed and manufactured according to good engineering practice.

Marine approval

Designation	FMB50	FMB51	FMB52	FMB53	Option ¹⁾
GL	✓	✓	—	✓	LE
ABS	✓	✓	—	✓	LF
LR	✓	✓	—	✓	LG
BV	✓	✓	—	✓	LH
DNV	✓	✓	—	✓	LI

1) Product Configurator, "Additional options 1" and "Additional options 2" ordering feature

Other standards and guidelines

DIN EN 60770 (IEC 60770):
Transmitters for use in industrial process control systems
Part 1: Methods for inspection and routine testing

DIN 16086:
Electrical pressure measuring instruments, pressure sensors, pressure transmitters, pressure measuring instruments, concepts, specifications on data sheets

EN 61326 series:
EMC product family standard for electrical equipment for measurement, control and laboratory use.

Drinking water approval

Designation	Option ¹⁾
KTW	LQ
NSF61	LR
ACS (under development)	LS

1) Product Configurator, "Additional options 1" and "Additional options 2" ordering feature

Classification of process sealing between electrical systems and (flammable or combustible) process fluids in accordance with ANSI/ISA 12.27.01

Endress+Hauser instruments are designed according to ANSI/ISA 12.27.01 either as single seal or dual seal devices with annunciation, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids.

Further information can be found in the control drawings of the relevant devices.

Inspection certificate

Designation	FMB50	FMB51	FMB52	FMB53	Option ¹⁾
3.1 Material certificate, wetted metallic parts, EN10204-3.1 inspection certificate	✓	✓	✓	✓	JA
Conformity to NACE MR0175, wetted metallic parts	✓	✓	✓	✓	JB
Conformity to NACE MR0103, wetted metallic parts	✓	✓	✓	✓	JE
Conformity to AD2000, wetted metallic parts, excepting process membrane	✓	—	—	—	JF
Surface finish measurement ISO4287/Ra, wetted metallic parts, Inspection certificate	✓	—	—	—	KB

Designation	FMB50	FMB51	FMB52	FMB53	Option ¹⁾
Helium leak test, internal procedure, inspection certificate	✓	✓	✓	✓	KD
Pressure test, internal procedure, inspection certificate	✓	✓	✓	—	KE
3.1 Material certificate+Delta-Ferrit measurement, internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	✓	—	—	—	KF
3.1 Material certificate+PMI test (XRF), internal procedure, wetted metallic parts, EN10204-3.1 inspection certificate	✓	✓	✓	✓	KG

1) Product Configurator, "Test, certificate" ordering feature

Calibration; unit

Designation	Option ¹⁾
Sensor range; %	A
Sensor range; mbar/bar	B
Sensor range; kPa/MPa	C
Sensor range; mm/mH ₂ O	D
Sensor range; inH ₂ O/ftH ₂ O	E
Sensor range; psi	F
Customized pressure; see additional specification	J
Customized level; see additional specification	K

1) Product Configurator, "Calibration; unit" ordering feature

Calibration

Designation	Option ¹⁾
Factory calibration, 5-point	F1
DKD/DAkkS calibration certificate 10-point ²⁾	F2

1) Product Configurator, "Calibration" ordering feature

2) Only for FMB50

Service

Designation	Option ¹⁾
Oil and grease removed ²⁾	HA
Cleaned for oxygen service ²⁾	HB
Cleaned from PWIS (PWIS = paint wetting impairment substances) ²⁾	HC
Configured min alarm current	IA
Configured HART Burst Mode PV	IB

1) Product Configurator, "Service" ordering feature

2) Only device, not accessory or enclosed accessory

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Products → Select product → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to measuring point, such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Configuration data sheet

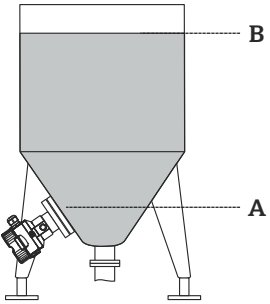
Pressure

The following configuration data sheet has to be filled in and included with the order if the option J - Customized pressure has been selected in feature 90 "Calibration; unit" in the ordering information.

Pressure Engineering Unit	
<input type="checkbox"/> mbar	<input type="checkbox"/> mmH ₂ O
<input type="checkbox"/> bar	<input type="checkbox"/> mH ₂ O
<input type="checkbox"/> psi	<input type="checkbox"/> inH ₂ O
<input type="checkbox"/> mmHg	<input type="checkbox"/> kgf/cm ²
<input type="checkbox"/> Pa	<input type="checkbox"/> kPa
<input type="checkbox"/> MPa	
Calibration Range / Output	
Low range value (LRV):	_____ [pressure engineering unit]
Upper range value (URV):	_____ [pressure engineering unit]
Display Information	
1st Value Display ¹⁾	2nd Value Display ¹⁾
<input type="checkbox"/> Main Value	<input type="checkbox"/> none (Default)
	<input type="checkbox"/> Main Value [%]
	<input type="checkbox"/> Pressure
	<input type="checkbox"/> Current [mA] (HART only)
	<input type="checkbox"/> Temperature
¹⁾ Depending on sensor and communication variant	
Damping	
Damping:	_____ sec (Default 2 sec)

Level



The following configuration data sheet has to be filled in and included with the order if the option K - Customized level has been selected in feature 90 "Calibration; unit" in the ordering information.

Pressure Engineering Unit		Output Unit (Scaled unit)						
<input type="checkbox"/> mbar	<input type="checkbox"/> mmH ₂ O	<input type="checkbox"/> mmHg	<input type="checkbox"/> Pas	Mass	Length	Volume	Volume	Percent
<input type="checkbox"/> bar	<input type="checkbox"/> mH ₂ O		<input type="checkbox"/> kPa	<input type="checkbox"/> kg	<input type="checkbox"/> m	<input type="checkbox"/> l	<input type="checkbox"/> gal	<input type="checkbox"/> %
	<input type="checkbox"/> ftH ₂ O	<input type="checkbox"/> kgf/cm ²	<input type="checkbox"/> MPa	<input type="checkbox"/> t	<input type="checkbox"/> dm	<input type="checkbox"/> hl	<input type="checkbox"/> lgal	
<input type="checkbox"/> psi	<input type="checkbox"/> inH ₂ O			<input type="checkbox"/> lb	<input type="checkbox"/> cm			
					<input type="checkbox"/> mm	<input type="checkbox"/> m ³		
						<input type="checkbox"/> ft ³		
					<input type="checkbox"/> ft	<input type="checkbox"/> in ³		
					<input type="checkbox"/> inch			
<div>Empty pressure [a]: Low pressure value (empty) _____ [pressure engineering unit]</div> <div>Full pressure [b]: High pressure value (full) _____ [pressure engineering unit]</div> <div>Empty calibration [a]: Low level value (empty) _____ [Scaled Unit]</div> <div>Full calibration [b]: High level value (full) _____ [Scaled Unit]</div> <div><div>Example</div><div></div><div>A 0 mbar / 0m B 300 mbar (4.5psi) / 3 m (9.8 ft).</div></div>								
Display Information								
1st Value Display ¹⁾ <input type="checkbox"/> Main Value		2nd Value Display ¹⁾ <input type="checkbox"/> none (Default) <input type="checkbox"/> Main Value [%] <input type="checkbox"/> Pressure <input type="checkbox"/> Current [mA] (HART only) <input type="checkbox"/> Temperature						
¹⁾ Depending on sensor and communication variant								
Damping								
Damping: _____ sec (Default 2 sec)								



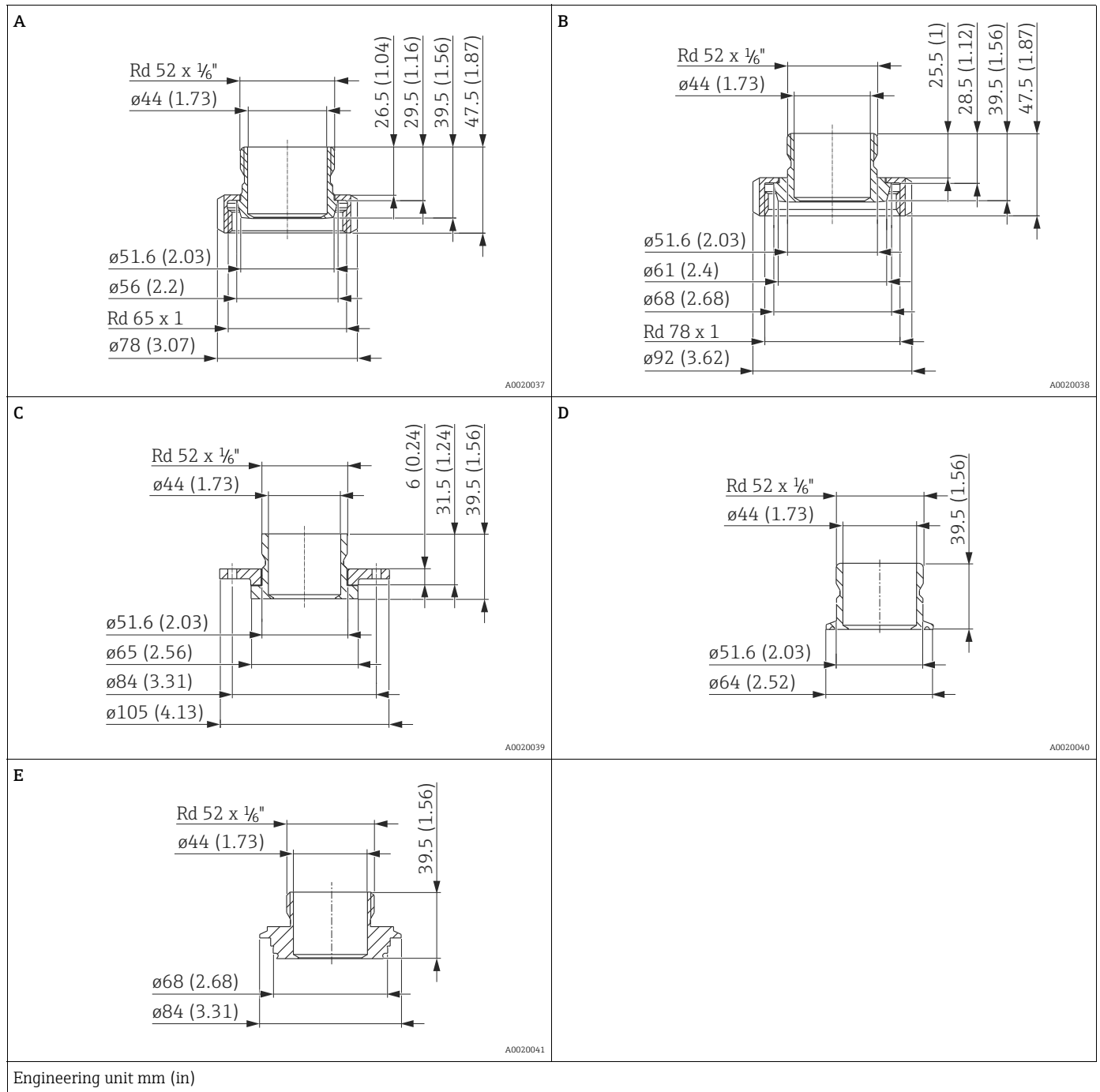
Smallest calibratable span (preset at the factory) → 13.

Accessories

Suspension clamp (FMB53 only)	→  29 ff
Extension cable shortening kit (FMB53 only)	See Product Configurator, "Accessory enclosed" ordering feature, option "PW" or can be ordered as a separate accessory (part no. 71125862). For details refer to SD00553P/00/A2.
M12 connector	→  23 ff Ordering information: Product Configurator, "Enclosed accessories" ordering feature, option "RL, RM, RN".
Welding necks and Weld-in tool flanges	See technical Information TI00426F/00.

Adapter Uni for FMB50

The following adapters can be used to create a connection between the customer's process connection and the Deltapilot S FMB50 with a universal adapter:



Item	Designation	Material	Weight kg (lbs)	Order number	Order number with 3.1 inspection certificate	Option ¹⁾
A	DIN11851 DN40	AISI 316L (1.4435)	0.2 (0.44)	71114172	71114178	RA / R1
B	DIN11851 DN50		0.3 (0.66)	71114173	71114205	RB / R2
C	DRD DN50		0.6 (1.32)	71114174	71114206	RC / R3
D	Clamp 2"		0.2 (0.44)	71114176	71114207	RD / R4
E	Varivent		0.5 (1.1)	71114177	71114208	RF / R6

1) Product Configurator, "Enclosed accessories" section

Documentation

Technical Information	<ul style="list-style-type: none"> ■ EMC test procedures: TI00241F/00/EN ■ Deltabar M: TI00434P/00/EN ■ Cerabar M: TI00436P/00/EN
Operating Instructions	<ul style="list-style-type: none"> ■ 4...20 mA HART: BA00382P/00/EN ■ PROFIBUS PA: BA00383P/00/EN ■ FOUNDATION Fieldbus: BA00384P/00/EN
Brief Operating Instructions	<ul style="list-style-type: none"> ■ 4...20 mA HART: KA01033P/00/EN ■ PROFIBUS PA: KA01034P/00/EN ■ FOUNDATION Fieldbus: KA01035P/00/EN
Functional safety manual (SIL)	Deltapilot M (4 to 20 mA): SD00347P/00/EN

Safety Instructions

Directive	Approval	Category	Type	Electronics	Documentation	Option ¹⁾
ATEX	Ex ia IIC	II 1/2 G	FMB50, FMB51, FMB52	– 4 to 20 mA HART	– XA00474P/00	BA
	Ex t IIC	II 1/2 D	FMB50, FMB51	– 4 to 20 mA HART	– XA00475P/00	BB
	Ex nA	II 3 G	FMB50, FMB51, FMB52, FMB53	– 4 to 20 mA HART – PROFIBUS PA – FOUNDATION Fieldbus	– XA00477P/00	BD
	Ex ia IIC	II 2 G	FMB50, FMB51, FMB52, FMB53	– 4 to 20 mA HART	– XA00474P/00	BE
	Ex ic IIC	II 3 G	FMB50, FMB51, FMB52, FMB53	– 4 to 20 mA HART	– XA00494P/00	BG
	Ex ia IIC Ex ia IIC	II 1/2 G II 1/2 D	FMB50, FMB51	– 4 to 20 mA HART	– XA00476P/00	B1

1) Product Configurator, "Approval" ordering feature

Directive	Approval	EPL	Type	Electronics	Documentation	Option ¹⁾
IECEx	Ex ia IIC	Ga/Gb	FMB50, FMB51, FMB52	– 4 to 20 mA HART	– XA00478P/00	IA
	Ex ia IIC	Gb	FMB52, FMB53	– 4 to 20 mA HART	– XA00478P/00	IC
	Ex t IIC	Da/Db	FMB50, FMB51	– 4 to 20 mA HART	– XA00479P/00	ID
	Ex ic IIC	Gc	FMB50, FMB51, FMB52, FMB53	– 4 to 20 mA HART	– XA00493P/00	IE
	Ex ia IIC Ex ia IIC	Ga/Gb Da/Db	FMB50, FMB51	– 4 to 20 mA HART	– XA00480P/00	I1

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Type	Electronics	Documentation	Option ¹⁾
NEPSI	Ex ia IIC	FMB50, FMB51, FMB52, FMB53	– 4 to 20 mA HART – PROFIBUS PA – FOUNDATION Fieldbus	– XA00535P/00	NA

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Electronics	Documentation	Option ¹⁾
TIIS	Ex ia IIC T4	- 4 to 20 mA HART	-	TA

1) Product Configurator, "Approval" ordering feature

Directive	Approval	Type	Electronics	Documentation	Option ¹⁾
INMETRO	Ex ia IIC T6...T4 Ga/Gb Ex ia IIC T6...T4 Gb	FMB50, FMB51, FMB52	- 4 to 20 mA HART - PROFIBUS PA - FOUNDATION Fieldbus	- XA01304P/00	MA

1) Product Configurator, "Approval" ordering feature

Installation/Control Drawings

Directive	Approval	Type	Electronics	Documentation	Option ¹⁾
FM	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, FM NI Cl.I Div.2 Gr.A-D, FM IS: Zone 0, 1, 2, 20, 21, 22/ FM NI: Zone 2	FMB50	- 4 to 20 mA HART - PROFIBUS PA, FOUNDATION Fieldbus	- ZD00236P/00 - XA00566P/00	FA
	FM IS Cl.I,II,III Div.1 Gr.A-G, AEx ia, Zone 0,1, 2, 20, 21, 22	FMB51	- 4 to 20 mA HART - PROFIBUS PA, FOUNDATION Fieldbus	- - XA00566P/00	
	FM DIP Cl.II,III Div.1 Gr.E-G, Zone 21, 22	FMB50, FMB51	- 4 to 20 mA HART - PROFIBUS PA - FOUNDATION Fieldbus	-	FC
	FM NI Cl.I Div.2 Gr.A-D, Zone 2	FMB50, FMB51	- 4 to 20 mA HART - PROFIBUS PA - FOUNDATION Fieldbus	-	FD
	FM IS Cl.I Div.1 Gr.A-D, AEx ia, Zone 0, 1, 2	FMB52, FMB53	- 4 to 20 mA HART - PROFIBUS PA, FOUNDATION Fieldbus	- ZD00236P/00 - XA00566P/00	FE
CSA	C/US IS Cl.I,II,III Div.1 Gr.A-G, C/US IS Cl.I Div.2 Gr.A-D, Ex ia, Zone 0,1, 2	FMB50, FMB53	- 4 to 20 mA HART - PROFIBUS PA, FOUNDATION Fieldbus	- ZD00239P/00 - XA00560P/00	CA
	C/US IS Cl.I,II,III Div.1 Gr.A-G, C/US IS Cl.I Div.2 Gr.A-D, Ex ia C: Zone 0, 1, 2/ US: Zone 0, 1, 2, 20, 21, 22	FMB51, FMB52	- 4 to 20 mA HART - PROFIBUS PA, FOUNDATION Fieldbus	- - XA00560P/00	
	CSA C/US Cl.II, III Div.1 Gr.E-G	FMB50	- 4 to 20 mA HART	-	CC
	CSA C/US Cl.II, III Div.1 Gr.E-G US: Zone 21, 22	FMB51	- 4 to 20 mA HART	-	

1) Product Configurator, "Approval" ordering feature

Combination certificate

Directive	Approval	Electronics	Documentation	Option ¹⁾
KEMA/ FM / CSA	ATEX II Ex ia + FM/CSA IS ATEX II 1/2G Ex ia IIC T6 + FM/CSA IS Cl.I Div.1 Gr.A-D, FM/CSA: Zone 0,1,2	- 4 to 20 mA HART	- ZD00236P/00 - ZD00239P/00	8C
		PROFIBUS PA, FOUNDATION Fieldbus	- XA00474P/00	

1) Product Configurator, "Approval" ordering feature

Overfill protection

WHG (FMB50, FMB51, FMB52): ZE00275P/00/DE

Registered trademarks

HART®	Registered trademark of the HART Communication Foundation, Austin, USA
PROFIBUS®	Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany
FOUNDATION™ Fieldbus	Registered trademark of the Fieldbus Foundation, Austin, Texas, USA



71260308

www.addresses.endress.com

Technical Information

Proline Promag W 400

Electromagnetic flowmeter



Sensor with EN ISO 12944 corrosion protection and state-of-the-art transmitter for Water & Wastewater

Application

- The bidirectional measuring principle is virtually independent of pressure, density, temperature and viscosity
- The specialist in the water and wastewater industry for the most demanding applications

Device properties

- International drinking water approvals
- Degree of protection IP68 (Type 6P enclosure)
- Approved for custody transfer to MI-001/OIML R49
- Transmitter housing made of durable polycarbonate or aluminum
- WLAN access
- Integrated data logger: measured values monitoring

Your benefits

- For direct underground installation or permanent underwater use
- Safe, reliable long-term operation – robust and completely welded sensor
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Safe operation – no need to open the device due to display with touch control, background lighting
- Time-saving local operation without additional software and hardware – integrated web server
- Integrated verification – Heartbeat Technology

Table of contents

About this document	4	Impact resistance	42
Symbols used	4	Mechanical load	42
Function and system design	5	Electromagnetic compatibility (EMC)	42
Measuring principle	5	Process	42
Measuring system	6	Medium temperature range	42
Equipment architecture	7	Conductivity	42
Safety	7	Pressure-temperature ratings	42
Input	8	Pressure tightness	45
Measured variable	8	Flow limit	45
Measuring range	8	Pressure loss	45
Operable flow range	12	System pressure	46
Input signal	12	Vibrations	46
Output	12	Custody transfer mode	47
Output signal	12	Mechanical construction	47
Signal on alarm	14	Dimensions in SI units	47
Low flow cut off	15	Dimensions in US units	71
Galvanic isolation	15	Weight	93
Protocol-specific data	16	Measuring tube specification	111
Power supply	20	Materials	113
Terminal assignment	20	Fitted electrodes	115
Pin assignment, device plug	22	Process connections	115
Supply voltage	23	Surface roughness	116
Power consumption	23	Operability	116
Current consumption	23	Operating concept	116
Power supply failure	23	Languages	116
Electrical connection	24	Local display	116
Potential equalization	28	Remote operation	117
terminals	30	Service interface	119
Cable entries	30	Supported operating tools	120
Cable specification	30	HistoROM data management	122
Performance characteristics	33	Certificates and approvals	123
Reference operating conditions	33	CE mark	123
Maximum measured error	33	C-Tick symbol	123
Repeatability	34	Ex approval	123
Influence of ambient temperature	34	Drinking water approval	123
Installation	35	HART certification	123
Mounting location	35	Certification PROFIBUS	123
Orientation	36	Modbus RS485 certification	123
Inlet and outlet runs	37	EtherNet/IP certification	123
Adapters	37	Radio approval	123
Length of connecting cable	38	Measuring instrument approval	123
Mounting the transmitter housing	39	Other standards and guidelines	124
Special mounting instructions	39	Ordering information	124
Environment	40	Product generation index	124
Ambient temperature range	40	Application packages	125
Storage temperature	41	Cleaning	125
Atmosphere	41	Diagnostics functions	125
Degree of protection	41	Heartbeat Technology	125
Vibration resistance	41		
Shock resistance	41		

Accessories 125
Device-specific accessories 126
Communication-specific accessories 126
Service-specific accessories 127
System components 127






Supplementary documentation 128
Standard documentation 128
Supplementary device-dependent documentation 128

Registered trademarks 129






About this document

Symbols used









Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> ■ Inner ground terminal: Connects the protective earth to the mains supply. ■ Outer ground terminal: Connects the device to the plant grounding system.




Communication symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local network.
	Bluetooth Wireless data transmission between devices over a short distance.
	LED Light emitting diode is off.
	LED Light emitting diode is on.
	LED Light emitting diode is flashing.

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation.
	Reference to page.
	Reference to graphic.
	Visual inspection.

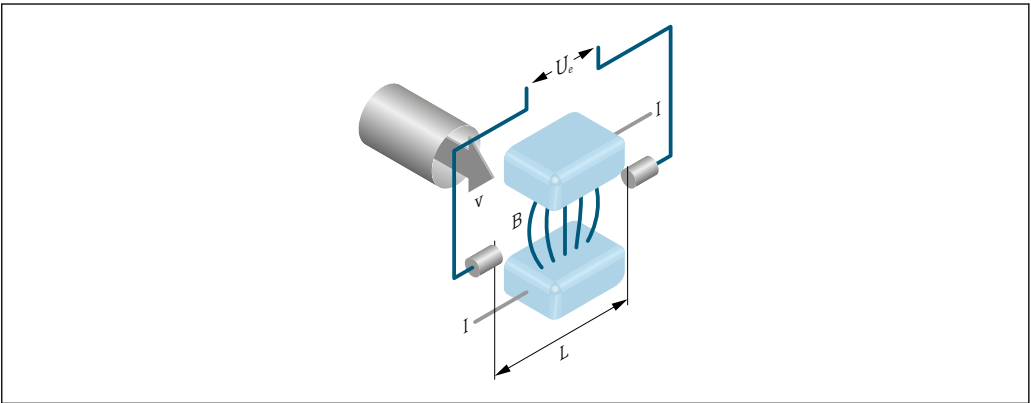
Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1, 2, 3, ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



- U_e Induced voltage
- B Magnetic induction (magnetic field)
- L Electrode spacing
- I Current
- v Flow velocity

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

Formulae for calculation

- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

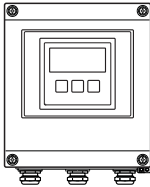
Measuring system

The device consists of a transmitter and a sensor.

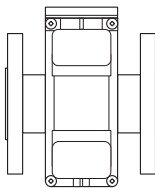
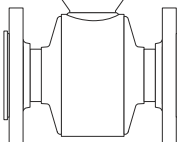
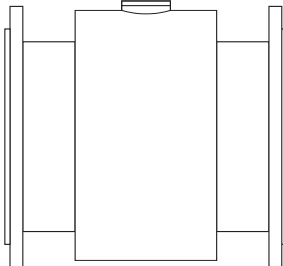
Two device versions are available:

- Compact version – transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

Transmitter

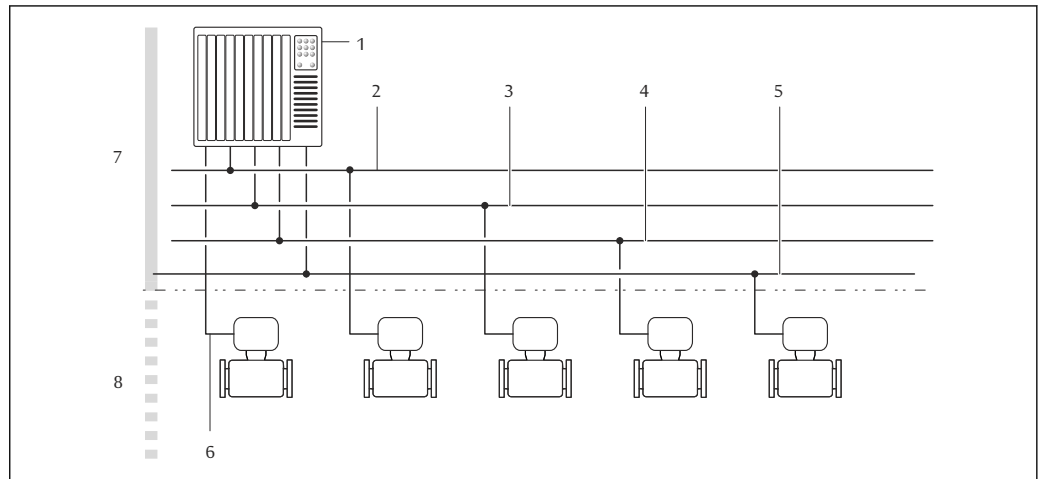
Promag 400  <small>A0017117</small>	Device versions and materials <ul style="list-style-type: none"> ■ Compact version: compact housing <ul style="list-style-type: none"> – Polycarbonate plastic – Aluminum, AlSi10Mg, coated ■ Remote version: wall-mount housing <ul style="list-style-type: none"> – Polycarbonate plastic – Aluminum, AlSi10Mg, coated Configuration: <ul style="list-style-type: none"> ■ External operation via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications ■ Via operating tools (e.g. FieldCare) ■ Via Web browser (e.g. Microsoft Internet Explorer) ■ Also for device version with EtherNet/IP output: <ul style="list-style-type: none"> – Via Add-on Profile Level 3 for automation system from Rockwell Automation – Via Electronic Data Sheet (EDS) ■ Also for device version with PROFIBUS DP output: <ul style="list-style-type: none"> – Via PDM driver for Siemens automation system
---	--

Sensor

Promag W <i>Fixed flange: DN 25 to 300 (1 to 12")</i>  <small>A0017040</small>	<ul style="list-style-type: none"> ■ Nominal diameter range: DN 25 to 2000 (1 to 78") ■ Materials: <ul style="list-style-type: none"> – Sensor housing: aluminum, AlSi10Mg, coated; carbon steel with protective varnish – Sensor connection housing (standard): aluminum, AlSi10Mg, coated – Sensor connection housing (option): polycarbonate – Measuring tubes ¹⁾: <ul style="list-style-type: none"> DN 25 to 300 (1 to 12"): stainless steel, 1.4301/1.4306/304/304L DN 350 to 2000 (14 to 78"): stainless steel, 1.4301/304 – Liner: hard rubber, polyurethane – Electrodes: stainless steel, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum – Process connections: <ul style="list-style-type: none"> Stainless steel, 1.4404/1.4571/F316L Carbon steel, A105/A181/A515(70)/FE410WB/P250GH/ P235 GH/P265GH/S235JRG2/S235JR+N/S275JR – Seals: as per DIN EN 1514-1 Form IBC – Ground disks: stainless steel, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum
<i>Fixed flange: DN 25 to 300 (1 to 12")</i>  <small>A0022673</small>	
<i>Fixed flange: DN 350 to 2000 (14 to 78")</i>  <small>A0017041</small>	

1) For carbon steel flange material with Al/Zn protective coating (DN 25 to 300 (1 to 12")), protective varnish (IP68) (DN 50 to 300 (2 to 12")) or protective varnish ≥ DN 350 (14")

Equipment architecture



A0021560

1 Possibilities for integrating measuring devices into a system

- 1 Control system (e.g. PLC)
- 2 EtherNet/IP
- 3 PROFIBUS DP
- 4 Modbus RS485
- 5 4-20 mA HART, pulse/frequency/switch output
- 6 Non-hazardous area
- 7 Non-hazardous area and Zone 2/Div. 2

Safety

IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section.

Protecting access via hardware write protection

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the motherboard). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered.

Protecting access via a password

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- **User-specific access code**
Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- **WLAN passphrase**
The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.

User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

WLAN passphrase

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to "Read only" access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.



For detailed information, see the "Description of Device Parameters" document pertaining to the device → 128

Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server. The connection is via the service interface (CDI-RJ45) or the WLAN interface. For device versions with the EtherNet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with EtherNet/IP or PROFINET (RJ45 connector).

The Web server is enabled when the device is delivered. The Web server can be disabled if necessary (e.g. after commissioning) via the **Web server functionality** parameter.

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.



For detailed information, see the "Description of Device Parameters" document pertaining to the device → 128

Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity



In custody transfer: only volume flow

Calculated measured variables

Mass flow

Measuring range

Typically $v = 0.01$ to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: ≥ 5 $\mu\text{S}/\text{cm}$ for liquids in general

Flow characteristic values in SI units ¹⁾

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.3/10 m/s)	Factory settings		
			Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
25	1	9 to 300 dm³/min	75 dm³/min	0.5 dm³	1 dm³/min
32	–	15 to 500 dm³/min	125 dm³/min	1 dm³	2 dm³/min
40	1 ½	25 to 700 dm³/min	200 dm³/min	1.5 dm³	3 dm³/min
50	2	35 to 1 100 dm³/min	300 dm³/min	2.5 dm³	5 dm³/min
65	–	60 to 2 000 dm³/min	500 dm³/min	5 dm³	8 dm³/min
80	3	90 to 3 000 dm³/min	750 dm³/min	5 dm³	12 dm³/min
100	4	145 to 4 700 dm³/min	1 200 dm³/min	10 dm³	20 dm³/min
125	–	220 to 7 500 dm³/min	1 850 dm³/min	15 dm³	30 dm³/min
150	6	20 to 600	150	0.025	2.5
200	8	35 to 1 100	300	0.05	5
250	10	55 to 1 700	500	0.05	7.5
300	12	80 to 2 400	750	0.1	10
350	14	110 to 3 300	1 000	0.1	15
375	15	140 to 4 200	1 200	0.15	20
400	16	140 to 4 200	1 200	0.15	20
450	18	180 to 5 400	1 500	0.25	25
500	20	220 to 6 600	2 000	0.25	30
600	24	310 to 9 600	2 500	0.3	40
700	28	420 to 13 500	3 500	0.5	50
750	30	480 to 15 000	4 000	0.5	60
800	32	550 to 18 000	4 500	0.75	75
900	36	690 to 22 500	6 000	0.75	100
1 000	40	850 to 28 000	7 000	1	125
–	42	950 to 30 000	8 000	1	125
1 200	48	1 250 to 40 000	10 000	1.5	150
–	54	1 550 to 50 000	13 000	1.5	200
1 400	–	1 700 to 55 000	14 000	2	225
–	60	1 950 to 60 000	16 000	2	250
1 600	–	2 200 to 70 000	18 000	2.5	300
–	66	2 500 to 80 000	20 500	2.5	325
1 800	72	2 800 to 90 000	23 000	3	350
–	78	3 300 to 100 000	28 500	3.5	450
2 000	–	3 400 to 110 000	28 500	3.5	450

- 1) Order code for "Design", option A "Insertion length short ISO/DVGW until DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long ISO/DVGW until DN400, DN450-2000 1:1.3"

Flow characteristic values in SI units ¹⁾

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.12/5 m/s)	Factory settings		
			Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 4 pulse/s)	Low flow cut off (v ~ 0.01 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
50	2	15 to 600 dm³/min	300 dm³/min	1.25 dm³	1.25 dm³/min
65	–	25 to 1 000 dm³/min	500 dm³/min	2 dm³	2 dm³/min
80	3	35 to 1 500 dm³/min	750 dm³/min	3 dm³	3.25 dm³/min
100	4	60 to 2 400 dm³/min	1 200 dm³/min	5 dm³	4.75 dm³/min
125	–	90 to 3 700 dm³/min	1 850 dm³/min	8 dm³	7.5 dm³/min
150	6	145 to 5 400 dm³/min	2 500 dm³/min	10 dm³	11 dm³/min
200	8	220 to 9 400 dm³/min	5 000 dm³/min	20 dm³	19 dm³/min
250	10	20 to 850	500	0.03	1.75
300	12	35 to 1 300	750	0.05	2.75

- 1) Order code for "Design", option C "Insertion length short ISO/DVGW until DN300, w/o inlet and outlet runs, constricted meas.tube"

Flow characteristic values in US units ¹⁾

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.3/10 m/s)	Factory settings		
			Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
1	25	2.5 to 80	18	0.2	0.25
–	32	4 to 130	30	0.2	0.5
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
–	65	16 to 500	130	1	2
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
–	125	60 to 1 950	450	5	7
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1 200	10	15
10	250	250 to 7 500	1 500	15	30
12	300	350 to 10 600	2 400	25	45
14	350	500 to 15 000	3 600	30	60
15	375	600 to 19 000	4 800	50	60
16	400	600 to 19 000	4 800	50	60
18	450	800 to 24 000	6 000	50	90
20	500	1 000 to 30 000	7 500	75	120
24	600	1 400 to 44 000	10 500	100	180
28	700	1 900 to 60 000	13 500	125	210
30	750	2 150 to 67 000	16 500	150	270

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.3/10 m/s)	Factory settings		
			Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
32	800	2 450 to 80 000	19 500	200	300
36	900	3 100 to 100 000	24 000	225	360
40	1000	3 800 to 125 000	30 000	250	480
42	–	4 200 to 135 000	33 000	250	600
48	1200	5 500 to 175 000	42 000	400	600
54	–	9 to 300 Mgal/d	75 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
–	1400	10 to 340 Mgal/d	85 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
60	–	12 to 380 Mgal/d	95 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
–	1600	13 to 450 Mgal/d	110 Mgal/d	0.0008 Mgal/d	1.7 Mgal/d
66	–	14 to 500 Mgal/d	120 Mgal/d	0.0008 Mgal/d	2.2 Mgal/d
72	1800	16 to 570 Mgal/d	140 Mgal/d	0.0008 Mgal/d	2.6 Mgal/d
78	–	18 to 650 Mgal/d	175 Mgal/d	0.0010 Mgal/d	3.0 Mgal/d
–	2000	20 to 700 Mgal/d	175 Mgal/d	0.0010 Mgal/d	2.9 Mgal/d

- 1) Order code for "Design", option A "Insertion length short ISO/DVGW until DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long ISO/DVGW until DN400, DN450-2000 1:1.3"

Flow characteristic values in US units ¹⁾

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.12/5 m/s)	Factory settings		
			Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 4 pulse/s)	Low flow cut off (v ~ 0.01 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
2	50	4 to 160	75	0.3	0.35
–	65	7 to 260	130	0.5	0.6
3	80	10 to 400	200	0.8	0.8
4	100	16 to 650	300	1.2	1.25
–	125	24 to 1 000	450	1.8	2
6	150	40 to 1 400	600	2.5	3
8	200	60 to 2 500	1 200	5	5
10	250	90 to 3 700	1 500	6	8
12	300	155 to 5 700	2 400	9	12

- 1) Order code for "Design", option C "Insertion length short ISO/DVGW until DN300, w/o inlet and outlet runs, constricted meas.tube"



To calculate the measuring range, use the *Applicator* sizing tool → 127

Recommended measuring range


"Flow limit" section → 45



For custody transfer, the applicable approval determines the permitted measuring range, the pulse value and the low flow cut off.

Operable flow range

Over 1000 : 1

 For custody transfer, the operable flow range is 100 : 1 to 250 : 1, depending on the nominal diameter. Further details are specified by the applicable approval.

Input signal**External measured values**

 Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section →  127

It is recommended to read in external measured values to calculate the following measured variables:
Corrected volume flow

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:

- HART protocol
- Burst mode

Digital communication

The measured values can be written from the automation system to the measuring via:

- PROFIBUS DP
- Modbus RS485
- EtherNet/IP

Status input

Maximum input values	<ul style="list-style-type: none"> ■ DC 30 V ■ 6 mA
Response time	Adjustable: 5 to 200 ms
Input signal level	<ul style="list-style-type: none"> ■ Low signal: DC -3 to +5 V ■ High signal: DC 12 to 30 V
Assignable functions	<ul style="list-style-type: none"> ■ Off ■ Reset totalizers 1-3 separately ■ Reset all totalizers ■ Flow override

Output

Output signal**Current output**

Current output	Can be set as: <ul style="list-style-type: none"> ■ 4-20 mA NAMUR ■ 4-20 mA US ■ 4-20 mA HART ■ 0-20 mA
Maximum output values	<ul style="list-style-type: none"> ■ DC 24 V (no flow) ■ 22.5 mA
Load	0 to 700 Ω
Resolution	0.5 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Flow velocity ■ Conductivity ■ Electronic temperature

Pulse/frequency/switch output

Function	<ul style="list-style-type: none"> ■ With the order code for "Output; Input", option H: output 2 can be set as a pulse or frequency output ■ With the order code for "Output; Input", option I: output 2 and 3 can be set as a pulse, frequency or switch output ■ With the order code for "Output; Input", option J: output 2 firmly assigned as certified pulse output
Version	Passive, open collector
Maximum input values	<ul style="list-style-type: none"> ■ DC 30 V ■ 250 mA
Voltage drop	For 25 mA: ≤ DC 2 V
Pulse output	
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow
Frequency output	
Output frequency	Adjustable: 0 to 12 500 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Conductivity ■ Flow velocity ■ Electronic temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	<ul style="list-style-type: none"> ■ Off ■ On ■ Diagnostic behavior ■ Limit value: <ul style="list-style-type: none"> – Off – Volume flow – Mass flow – Conductivity – Flow velocity – Totalizer 1-3 – Electronic temperature ■ Flow direction monitoring ■ Status <ul style="list-style-type: none"> – Empty pipe detection – Low flow cut off

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud

Modbus RS485

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	Integrated, can be activated via DIP switch on the transmitter electronics module

EtherNet/IP

Standards	In accordance with IEEE 802.3
------------------	-------------------------------

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Current output 4 to 20 mA

4 to 20 mA

Failure mode	Choose from: <ul style="list-style-type: none"> ■ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ■ 4 to 20 mA in accordance with US ■ Min. value: 3.59 mA ■ Max. value: 22.5 mA ■ Freely definable value between: 3.59 to 22.5 mA ■ Actual value ■ Last valid value
---------------------	--

0 to 20 mA

Failure mode	Choose from: <ul style="list-style-type: none"> ■ Maximum alarm: 22 mA ■ Freely definable value between: 0 to 22.5 mA
---------------------	---

HART current output

Device diagnostics	Device condition can be read out via HART Command 48
---------------------------	--

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: <ul style="list-style-type: none"> ■ Actual value ■ No pulses
Frequency output	
Failure mode	Choose from: <ul style="list-style-type: none"> ■ Actual value ■ 0 Hz ■ Defined value: 0 to 12 500 Hz
Switch output	
Failure mode	Choose from: <ul style="list-style-type: none"> ■ Current status ■ Open ■ Closed

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
----------------------------------	---

Modbus RS485

Failure mode	Choose from: <ul style="list-style-type: none">■ NaN value instead of current value■ Last valid value
---------------------	--

EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly
---------------------------	--

Local display

Plain text display	With information on cause and remedial measures
Backlight	Red backlighting indicates a device error.



Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
 - HART protocol
 - PROFIBUS DP
 - Modbus RS485
 - EtherNet/IP
- Via service interface
 - CDI-RJ45 service interface
 - WLAN interface

Plain text display	With information on cause and remedial measures
---------------------------	---



Additional information on remote operation → 117

Web server

Plain text display	With information on cause and remedial measures
---------------------------	---

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: <ul style="list-style-type: none">■ Supply voltage active■ Data transmission active■ Device alarm/error has occurred■ EtherNet/IP network available■ EtherNet/IP connection established
---------------------------	--

Low flow cut off	The switch points for low flow cut off are user-selectable.
-------------------------	---

Galvanic isolation	The following connections are galvanically isolated from each other: <ul style="list-style-type: none">■ Inputs■ Outputs■ Power supply
---------------------------	--

Protocol-specific data

HART


Manufacturer ID	0x11
Device type ID	0x69
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
Dynamic variables	<p>Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables.</p> <p>Measured variables for PV (primary dynamic variable)</p> <ul style="list-style-type: none"> ▪ Off ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ Flow velocity ▪ Electronic temperature <p>Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)</p> <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3
Device variables	<p>Read out the device variables: HART command 9 The device variables are permanently assigned.</p> <p>A maximum of 8 device variables can be transmitted:</p> <ul style="list-style-type: none"> ▪ 0 = volume flow ▪ 1 = mass flow ▪ 2 = conductivity ▪ 3 = flow velocity ▪ 4 = electronic temperature ▪ 5 = totalizer 1 ▪ 6 = totalizer 2 ▪ 7 = totalizer 3

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1562
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.profibus.org
Output values (from measuring device to automation system)	<p>Analog input 1 to 4</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Flow velocity ▪ Conductivity ▪ Electronic temperature <p>Digital input 1 to 2</p> <ul style="list-style-type: none"> ▪ Empty pipe detection ▪ Low flow cut off ▪ Verification status <p>Totalizer 1 to 3</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow


Input values (from automation system to measuring device)	Analog output 1 (fixed assignment) External density Digital output 1 to 2 (fixed assignment) <ul style="list-style-type: none"> ■ Digital output 1: switch positive zero return on/off ■ Digital output 2: start verification Totalizer 1 to 3 <ul style="list-style-type: none"> ■ Totalize ■ Reset and hold ■ Preset and hold ■ Stop ■ Operating mode configuration: <ul style="list-style-type: none"> – Net flow total – Forward flow total – Reverse flow total
Supported functions	<ul style="list-style-type: none"> ■ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ■ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ■ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	<ul style="list-style-type: none"> ■ DIP switches on the I/O electronics module ■ Via operating tools (e.g. FieldCare)

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	<ul style="list-style-type: none"> ■ 03: Read holding register ■ 04: Read input register ■ 06: Write single registers ■ 08: Diagnostics ■ 16: Write multiple registers ■ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: <ul style="list-style-type: none"> ■ 06: Write single registers ■ 16: Write multiple registers ■ 23: Read/write multiple registers
Supported baud rate	<ul style="list-style-type: none"> ■ 1 200 BAUD ■ 2 400 BAUD ■ 4 800 BAUD ■ 9 600 BAUD ■ 19 200 BAUD ■ 38 400 BAUD ■ 57 600 BAUD ■ 115 200 BAUD
Data transfer mode	<ul style="list-style-type: none"> ■ ASCII ■ RTU
Data access	Each device parameter can be accessed via Modbus RS485.  For Modbus register information

EtherNet/IP

Protocol	<div>■ The CIP Networks Library Volume 1: Common Industrial Protocol</div> <div>■ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP</div>		
Communication type	<div>■ 10Base-T</div> <div>■ 100Base-TX</div>		
Device profile	Generic device (product type: 0x2B)		
Manufacturer ID	0x49E		
Device type ID	0x1067		
Baud rates	Automatic ¹⁰ / ₁₀₀ Mbit with half-duplex and full-duplex detection		
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs		
Supported CIP connections	Max. 3 connections		
Explicit connections	Max. 6 connections		
I/O connections	Max. 6 connections (scanner)		
Configuration options for measuring device	<div>■ DIP switches on the electronics module for IP addressing</div> <div>■ Manufacturer-specific software (FieldCare)</div> <div>■ Custom Add-on Profile for Rockwell Automation control systems</div> <div>■ Web browser</div> <div>■ Electronic Data Sheet (EDS) integrated in the measuring device</div>		
Configuration of the EtherNet interface	<div>■ Speed: 10 MBit, 100 MBit, auto (factory setting)</div> <div>■ Duplex: half-duplex, full-duplex, auto (factory setting)</div>		
Configuration of the device address	<div>■ DIP switches on the electronics module for IP addressing (last octet)</div> <div>■ DHCP</div> <div>■ Manufacturer-specific software (FieldCare)</div> <div>■ Custom Add-on Profile for Rockwell Automation control systems</div> <div>■ Web browser</div> <div>■ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)</div>		
Device Level Ring (DLR)	No		
Fix Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	32

Input Assembly	<ul style="list-style-type: none">▪ Current device diagnostics▪ Volume flow▪ Mass flow▪ Conductivity▪ Totalizer 1▪ Totalizer 2▪ Totalizer 3		
Configurable Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x65	88
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x65	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88
Configurable Input Assembly	<ul style="list-style-type: none">▪ Volume flow▪ Mass flow▪ Electronic temperature▪ Conductivity▪ Totalizer 1 to 3▪ Flow velocity▪ Volume flow unit▪ Mass flow unit▪ Temperature unit▪ Conductivity unit▪ Unit totalizer 1-3▪ Flow velocity unit▪ Verification result▪ Verification status		
	 The range of options increases if the measuring device has one or more application packages.		
Fix Output			
Output Assembly	<ul style="list-style-type: none">▪ Activation of reset totalizers 1-3▪ Activation of reference density compensation▪ Reset totalizers 1-3▪ External density▪ Density unit▪ Activation verification▪ Start verification		

Configuration	
Configuration Assembly	<p>Only the most common configurations are listed below.</p> <ul style="list-style-type: none"> ■ Software write protection ■ Mass flow unit ■ Mass unit ■ Volume flow unit ■ Volume unit ■ Density unit ■ Conductivity ■ Temperature unit ■ Totalizer 1-3: <ul style="list-style-type: none"> - Assignment - Unit - Operating mode - Failure mode ■ Alarm delay

Power supply

Terminal assignment

Transmitter: 0-20 mA/4-20 mA HART

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
terminals	terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G ½" ■ Option D: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option L (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	-
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	-15 to +10%	50/60 Hz, ±4 Hz

Signal transmission 0-20 mA/4-20 mA HART and additional outputs and inputs

Order code for "Output" and "Input"	Terminal numbers							
	Output 1		Output 2		Output 3		Input	
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option H	<ul style="list-style-type: none"> ■ 4-20 mA HART (active) ■ 0-20 mA (active) 		Pulse/frequency output (passive)		Switch output (passive)		-	
Option I	<ul style="list-style-type: none"> ■ 4-20 mA HART (active) ■ 0-20 mA (active) 		Pulse/frequency/switch output (passive)		Pulse/frequency/switch output (passive)		Status input	
Option J	<ul style="list-style-type: none"> ■ 4-20 mA HART (active) ■ 0-20 mA (active) 		Permanently assigned Pulse output adjusted (passive)		Pulse/frequency/switch output (passive)		Status input	

Transmitter: PROFIBUS DP

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
terminals	terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G ½" ■ Option D: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option L (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

PROFIBUS DP signal transmission

Order code for "Output" and "Input"	Terminal numbers	
	26 (RxD/TxD-P)	27 (RxD/TxD-N)
Option L	B	A
Order code for "Output": Option L: PROFIBUS DP, for use in non-hazardous areas and Zone 2/div. 2		

Transmitter: Modbus RS485

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
terminals	terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G ½" ■ Option D: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option L (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

Signal transmission Modbus RS485

Order code for "Output" and "Input"	Terminal numbers	
	26 (+)	27 (-)
Option M	B	A

Transmitter: EtherNet/IP

The sensor can be ordered with terminals or a device plug.

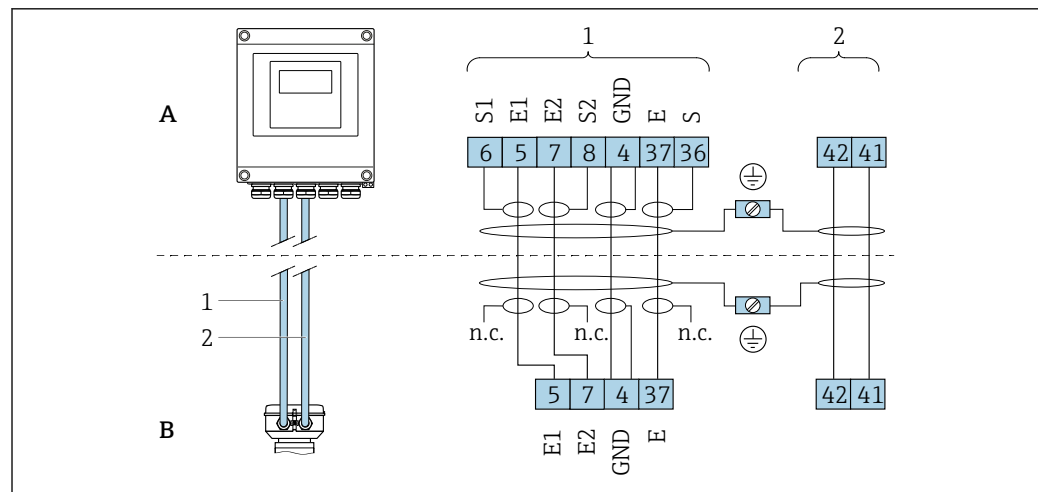
Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
terminals	terminals	<ul style="list-style-type: none"> Option A: coupling M20x1 Option B: thread M20x1 Option C: thread G ½" Option D: thread NPT ½"
Device plug	terminals	<ul style="list-style-type: none"> Option L: plug M12x1 + thread NPT ½" Option N: plug M12x1 + coupling M20 Option P: plug M12x1 + thread G ½" Option U: plug M12x1 + thread M20

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option L (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

EtherNet/IP signal transmission

Order code for "Output"	Connection via
Option N	EtherNet/IP connector

Remote version

A0032059

2 Remote version terminal assignment

A Transmitter wall-mount housing

B Sensor connection housing

1 Electrode cable

2 Coil current cable

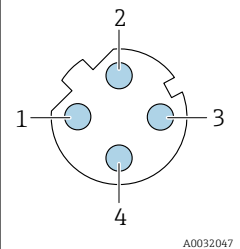
n.c. Not connected, insulated cable shields

Terminal No. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Pin assignment, device plug

Order codes for the M12x1 connectors, see the "Order code for electrical connection" column:
EtherNet/IP → 22

EtherNet/IP*Device plug for signal transmission (device side)*

	Pin	Assignment		Coding	Plug/socket
	1	+	Tx	D	Socket
	2	+	Rx		
	3	-	Tx		
	4	-	Rx		



Recommended plug:

- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- When using the device in a hazardous location, use a suitably certified plug.

Supply voltage**Transmitter**

Order code for "Power supply"	terminal voltage		Frequency range
Option L	DC 24 V	±25%	–
	AC 24 V	±25%	50/60 Hz, ±4 Hz
	AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

Power consumption

Order code for "Output"	Maximum power consumption
Option H: 4-20mA HART, pulse/frequency/switch output, switch output	30 VA/8 W
Option I: 4-20mA HART, 2 x pulse/frequency/switch output, status input	30 VA/8 W
Option J: 4-20mA HART, certified pulse output, pulse/frequency/switch output, status input	30 VA/8 W
Option L: PROFIBUS DP	30 VA/8 W
Option M: Modbus RS485	30 VA/8 W
Option N: EtherNet/IP	30 VA/8 W

Current consumption**Transmitter**

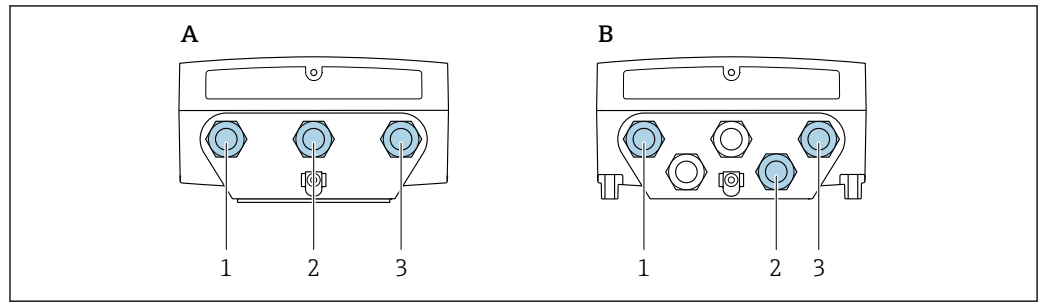
Order code for "Power supply"	Maximum Current consumption	Maximum switch-on current
Option L: AC 100 to 240 V	145 mA	25 A (< 5 ms)
Option L: AC/DC 24 V	350 mA	27 A (< 5 ms)

Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter



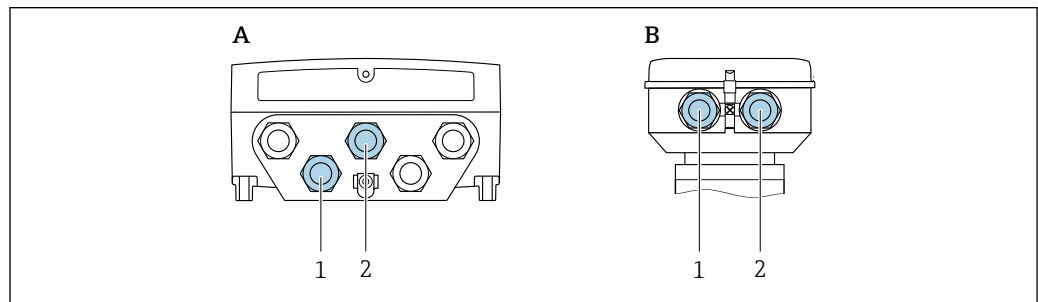
A0032041

■ 3 Supply voltage and signal transmission connection

- A Compact version
 B Remote version wall-mount housing
 1 Cable entry for supply voltage
 2 Cable entry for signal transmission
 3 Cable entry for signal transmission

Remote version connection

Connecting cable



A0032042

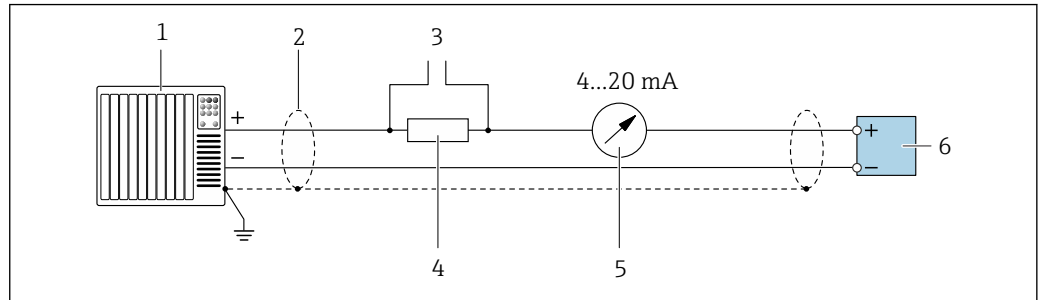
■ 4 Connecting cable connection: electrode and coil current cable

- A Transmitter wall-mount housing
 B Sensor connection housing
 1 Electrode cable
 2 Coil current cable

- Fix the cable run or route it in an armored conduit.
 Cable movements can influence the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter .

Connection examples

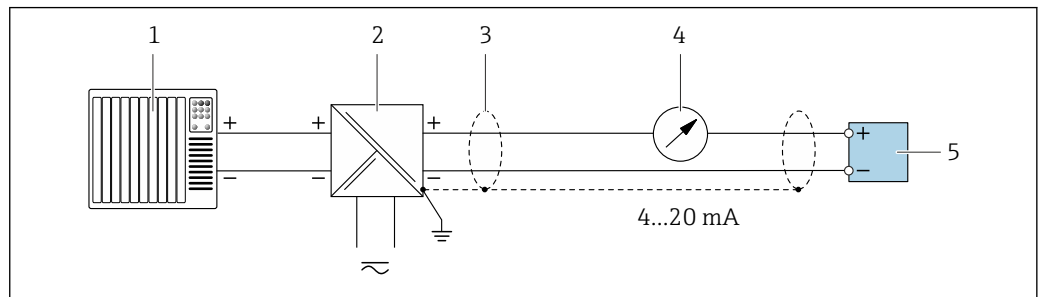
Current output 4 to 20 mA HART



A0029055

5 Connection example for 4 to 20 mA HART current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 30
- 3 Connection for HART operating devices → 117
- 4 Resistor for HART communication ($\geq 250 \Omega$): observe maximum load → 12
- 5 Analog display unit: observe maximum load → 12
- 6 Transmitter

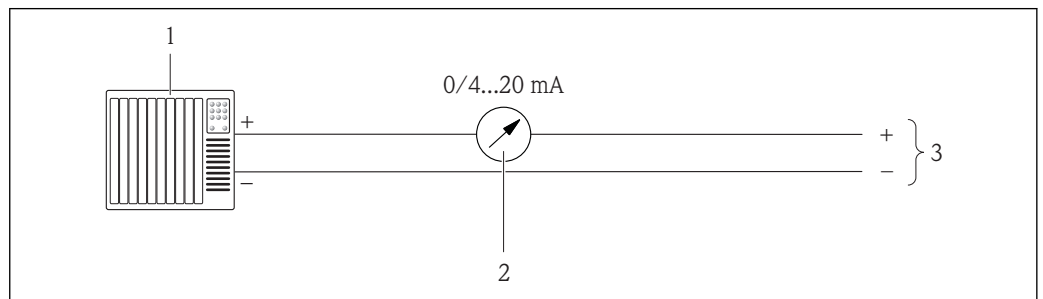


A0028762

6 Connection example for 4 to 20 mA HART current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply
- 3 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 30
- 4 Analog display unit: observe maximum load → 12
- 5 Transmitter

Current output 4-20 mA

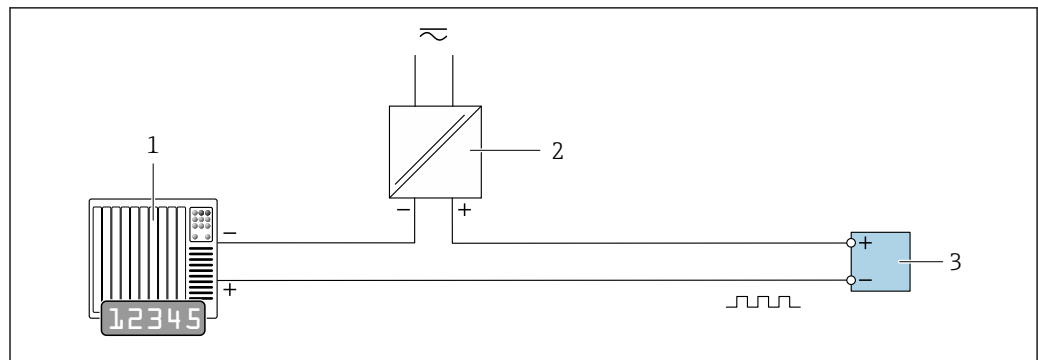


A0017162

7 Connection example for 0-20 mA current output (active) and 4-20 mA current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Analog display unit: observe maximum load
- 3 Transmitter

Pulse/frequency output

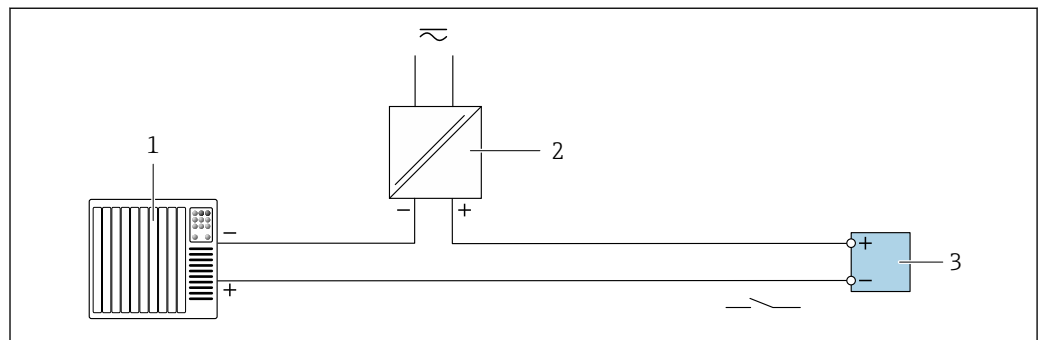


A0028761

8 Connection example for pulse/frequency output (passive)

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 13

Switch output

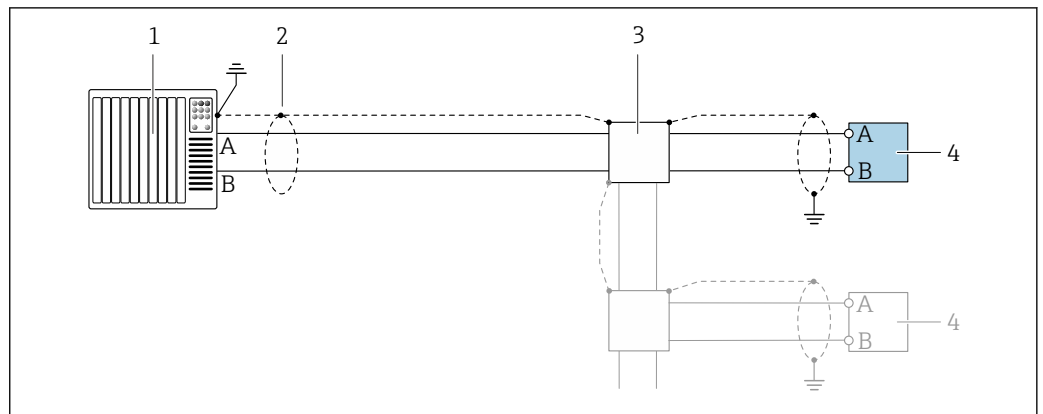


A0028760

9 Connection example for switch output (passive)

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 13

PROFIBUS DP

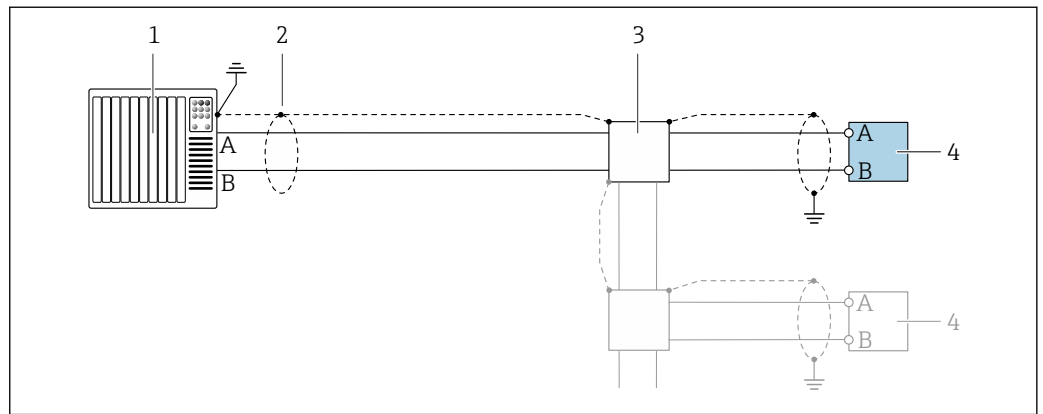


10 Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2

- 1 Control system (e.g. PLC)
- 2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 3 Transmitter

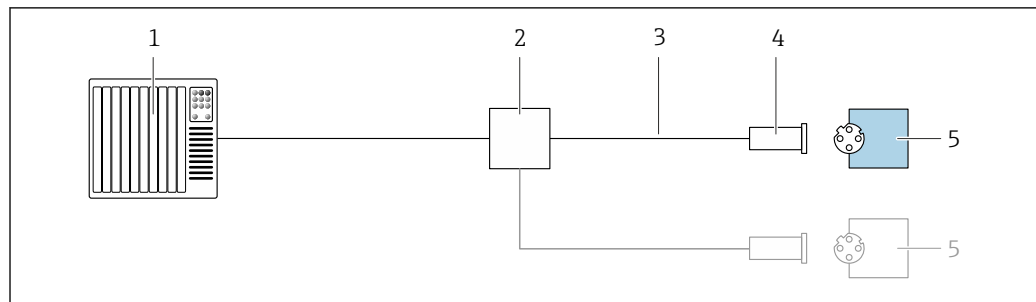
i If baud rates > 1.5 Mbaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Modbus RS485



11 Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2

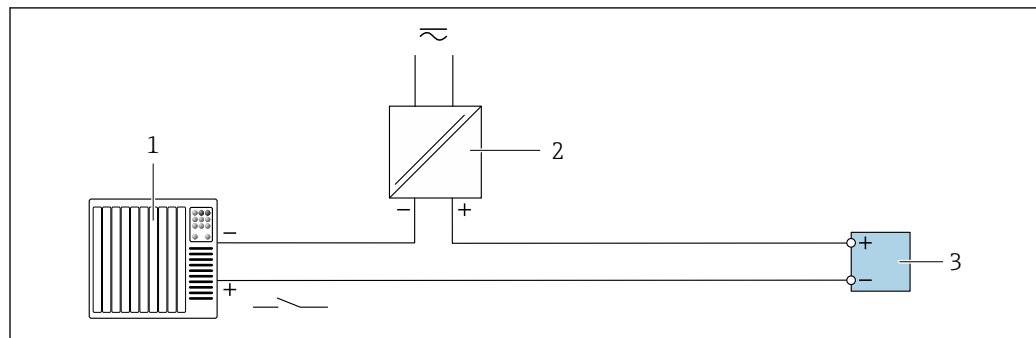
- 1 Control system (e.g. PLC)
- 2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 3 Distribution box
- 4 Transmitter

EtherNet/IP

A0028767

12 Connection example for EtherNet/IP

- 1 Control system (e.g. PLC)
- 2 Ethernet switch
- 3 Observe cable specifications
- 4 Device plug
- 5 Transmitter

Status input

A0028764

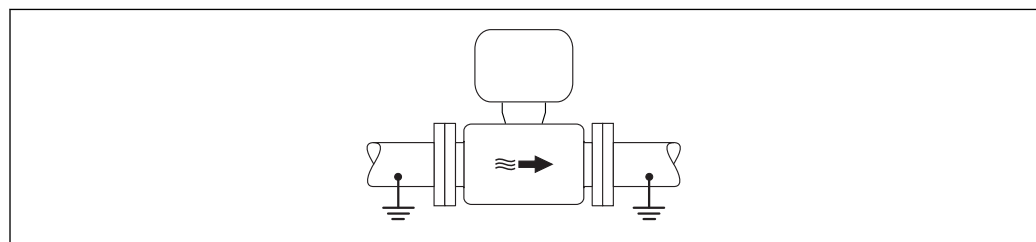
13 Connection example for status input

- 1 Automation system with status output (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values

Potential equalization**Requirements**

Please consider the following to ensure correct measurement:

- Same electrical potential for the medium and sensor
- Remote version: same electrical potential for the sensor and transmitter
- Company-internal grounding concepts
- Pipe material and grounding

Connection example, standard scenario*Metal, grounded pipe*

A0016315

14 Potential equalization via measuring tube

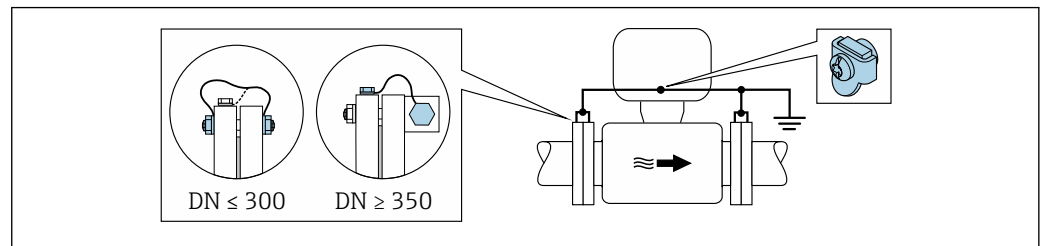
Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:

- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm ² (0.0093 in ²)
---------------------	---



15 Potential equalization via ground terminal and pipe flanges

Note the following when installing:

- Connect both sensor flanges to the pipe flange via a ground cable and ground them.
- Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose. To mount the ground cable:
 - If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
 - If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

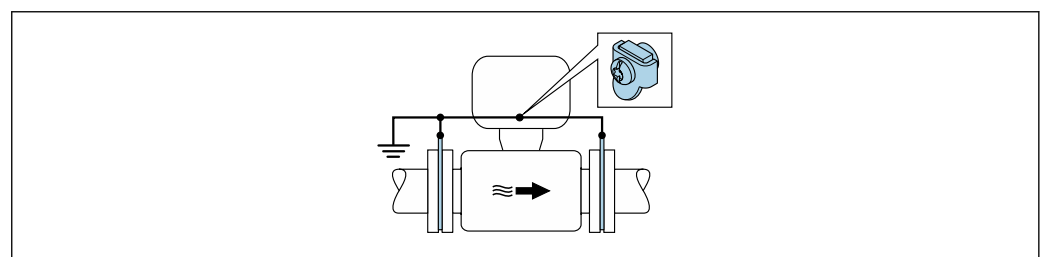
i You can order the necessary ground cable from Endress+Hauser: → 126.

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:

- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm ² (0.0093 in ²)
---------------------	---



16 Potential equalization via ground terminal and ground disks

Note the following when installing:

The ground disks must be connected to the ground terminal via the ground cable and be connected to ground potential.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

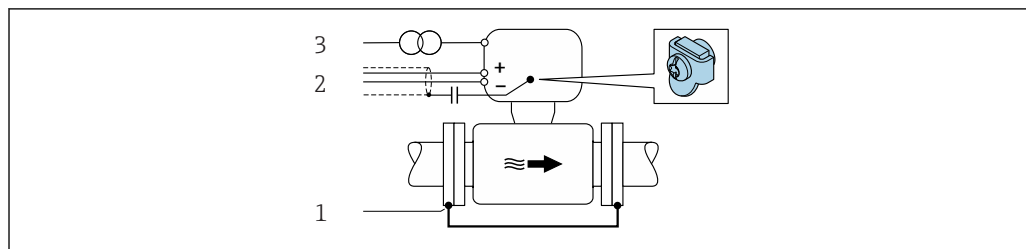
i The ground cable and ground disks can be ordered from Endress+Hauser → 126.

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:

- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment

Ground cable	Copper wire, at least 6 mm ² (0.0093 in ²)
---------------------	---



A0030377

- 1 Connection of the two flanges of the pipe via a ground cable
- 2 Signal line shielding via a capacitor
- 3 Measuring device connected to power supply such that it is floating in relation to the protective ground (isolation transformer)

Note the following when installing:

The sensor is installed in the pipe in a way that provides electrical insulation.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

i You can order the necessary ground cable from Endress+Hauser: → 126.

terminals**Transmitter**

- Supply voltage cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Signal cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Electrode cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Coil current cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Sensor connection housing

Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries**Cable entry thread**

- M20 x 1.5
- Via adapter:
 - NPT ½"
 - G ½"

Cable gland

- For standard cable: M20 × 1.5 with cable Ø6 to 12 mm (0.24 to 0.47 in)
- For reinforced cable: M20 × 1.5 with cable Ø9.5 to 16 mm (0.37 to 0.63 in)

i If metal cable entries are used, use a grounding plate.

Cable specification**Permitted temperature range**

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

PROFIBUS DP

The IEC 61158 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm ² (22 AWG)
Cable type	Twisted pairs
Loop resistance	$\leq 110 \Omega/\text{km}$
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Modbus RS485

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm ² (22 AWG)
Cable type	Twisted pairs
Loop resistance	$\leq 110 \Omega/\text{km}$
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.



For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

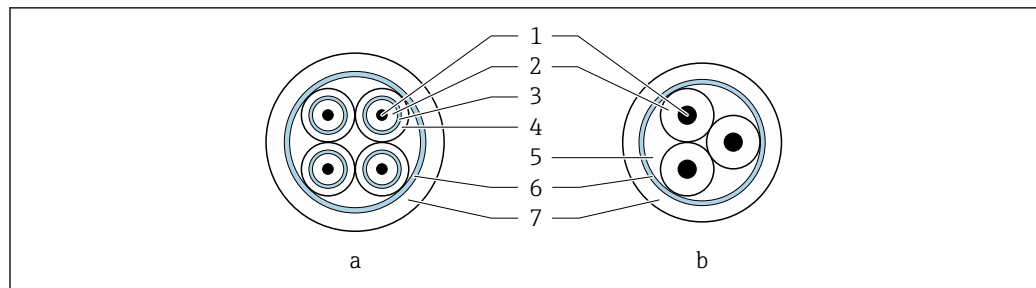
Connecting cable for remote version*Electrode cable*

Standard cable	3 \times 0.38 mm ² (20 AWG) with common, braided copper shield ($\phi \sim 9.5$ mm (0.37 in)) and individual shielded cores
Cable for empty pipe detection (EPD)	4 \times 0.38 mm ² (20 AWG) with common, braided copper shield ($\phi \sim 9.5$ mm (0.37 in)) and individual shielded cores


Conductor resistance	≤50 Ω/km (0.015 Ω/ft)
Capacitance: core/shield	≤420 pF/m (128 pF/ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)

Coil current cable

Standard cable	3 × 0.75 mm ² (18 AWG) with common, braided copper shield (Φ ~9 mm (0.35 in))
Conductor resistance	≤37 Ω/km (0.011 Ω/ft)
Capacitance: core/core, shield grounded	≤120 pF/m (37 pF/ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)
Test voltage for cable insulation	≤ AC 1433 V r.m.s. 50/60 Hz or ≥ DC 2026 V



A0029151

 17 Cable cross-section

- a Electrode cable
 b Coil current cable
 1 Core
 2 Core insulation
 3 Core shield
 4 Core jacket
 5 Core reinforcement
 6 Cable shield
 7 Outer jacket



A connecting cable can be ordered from Endress+Hauser for IP68:

- Pre-terminated cables that are already connected to the sensor.
- Pre-terminated cables, where the cables are connected by the customer onsite (incl. tools for sealing the connection compartment)

Reinforced connecting cables


Reinforced connecting cables with an additional, reinforcing metal braid should be used for:

- When laying the cable directly in the ground
- Where there is a risk of damage from rodents
- If using the device below IP68 degree of protection



Reinforced connecting cables with an additional, reinforcing metal braid can be ordered from Endress+Hauser .


Operation in zones of severe electrical interference

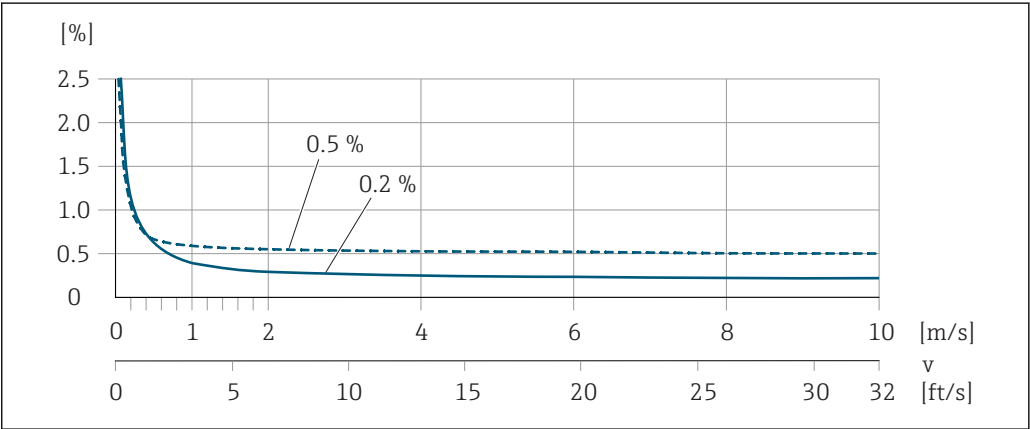
The measuring system meets the general safety requirements →  124 and EMC specifications →  42.

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

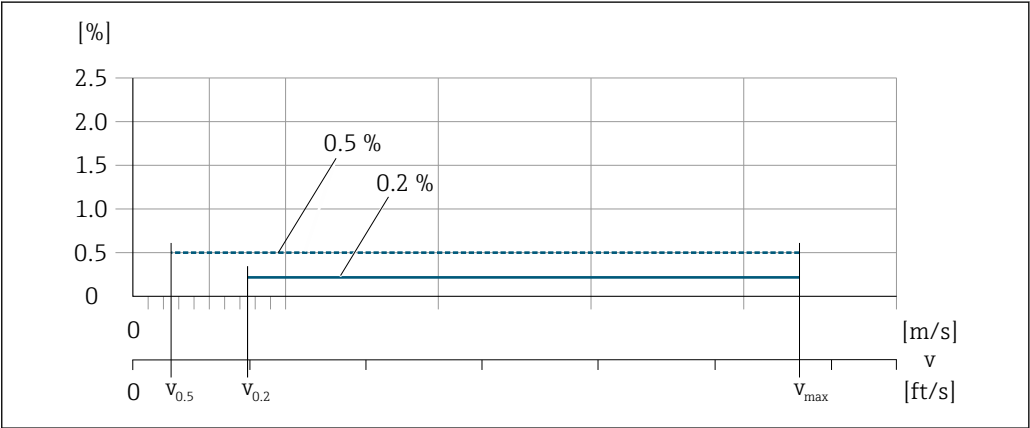
Performance characteristics

Reference operating conditions	<ul style="list-style-type: none">■ Error limits following DIN EN 29104, in future ISO 20456■ Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi)■ Data as indicated in the calibration protocol■ Accuracy based on accredited calibration rigs according to ISO 17025
--------------------------------	---

Maximum measured error	<p>Error limits under reference operating conditions</p> <p>o.r. = of reading</p> <p>Volume flow</p> <ul style="list-style-type: none">■ $\pm 0.5\%$ o.r. ± 1 mm/s (0.04 in/s)■ Optional: $\pm 0.2\%$ o.r. ± 2 mm/s (0.08 in/s) <p> Fluctuations in the supply voltage do not have any effect within the specified range.</p>
------------------------	---



18 Maximum measured error in % o.r.



19 Flat Spec in % o.r.

Flat Spec flow values 0.5 %

Nominal diameter		$v_{0.5}$		v_{max}	
[mm]	[in]	[m/s]	[ft/s]	[m/s]	[ft/s]
25 to 600 ¹⁾	1 to 24	0.5	1.64	10	32
50 to 300 ²⁾	2 to 12	0.25	0.82	5	16

- 1) Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"
- 2) Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Flat Spec flow values 0.2 %

Nominal diameter		$v_{0.2}$		v_{max}	
[mm]	[in]	[m/s]	[ft/s]	[m/s]	[ft/s]
25 to 600 ¹⁾	1 to 24	1.5	4.92	10	32
50 to 300 ²⁾	2 to 12	0.6	1.97	4	13

- 1) Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"
- 2) Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Electrical conductivity

Max. measured error not specified.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	Max. $\pm 5 \mu A$
-----------------	--------------------

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ± 50 ppm o.r. (over the entire ambient temperature range)
-----------------	--

Repeatability

o.r. = of reading

Volume flowmax. ± 0.1 % o.r. ± 0.5 mm/s (0.02 in/s)**Electrical conductivity**Max. ± 5 % o.r.**Influence of ambient temperature****Current output**

o.r. = of reading

Temperature coefficient	Max. ± 0.005 % o.r./°C
--------------------------------	----------------------------

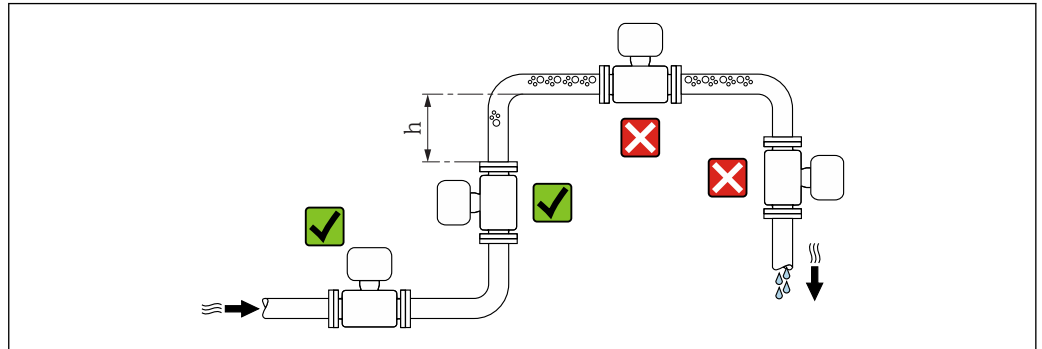
Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.
--------------------------------	---

Installation

No special measures such as supports etc. are necessary. External forces are absorbed by the construction of the device.

Mounting location

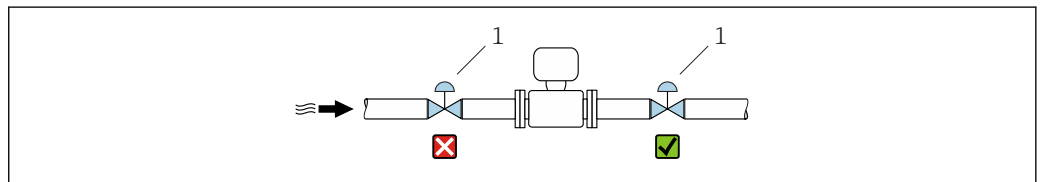


A0029343

Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: $h \geq 2 \times DN$



Not necessary in the case of order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"



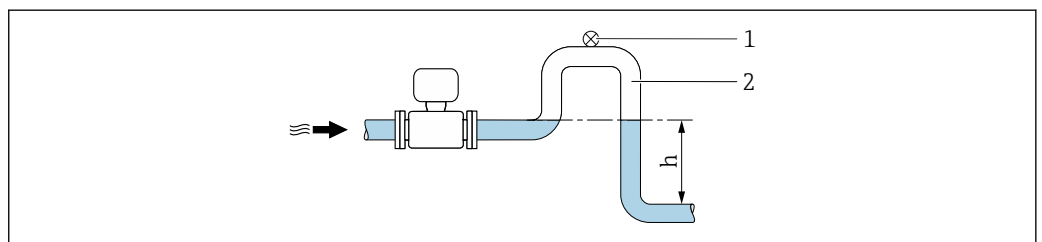
A0033017

20 Installation of the sensor after a control valve is not recommended

1 Control valve

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length $h \geq 5 \text{ m}$ (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.



A0028981

21 Installation in a down pipe

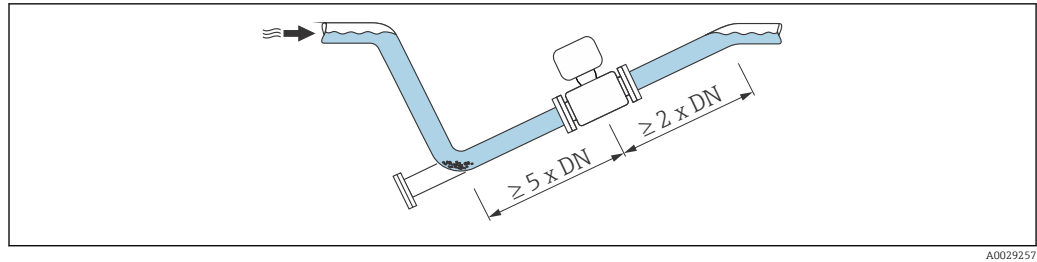
1 Vent valve

2 Pipe siphon

h Length of down pipe

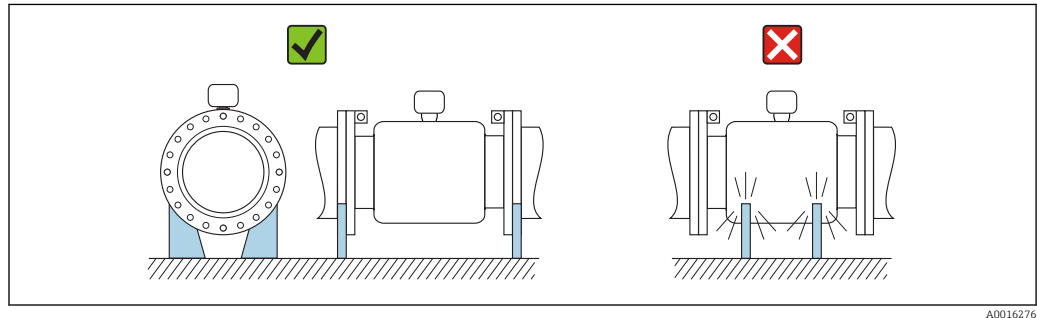
Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration.



A0029257

For heavy sensors DN ≥ 350 (14")



A0016276

Orientation

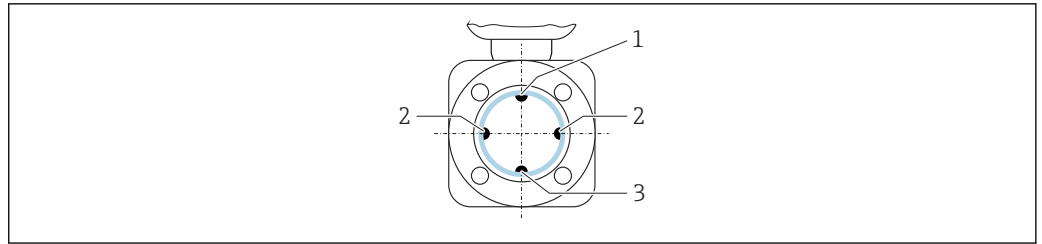
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

Orientation			Recommendation
A	Vertical orientation	A0015591	✓✓
B	Horizontal orientation, transmitter at top	A0015589	✓✓ ¹⁾
C	Horizontal orientation, transmitter at bottom	A0015590	✓✓ ^{2) 3)}
D	Horizontal orientation, transmitter at side	A0015592	✗

- 1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
- 2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.
- 3) To prevent the electronics module from overheating in the case of a sharp rise in temperature (e.g. CIP- or SIP processes), install the device with the transmitter component pointing downwards.

Horizontal

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.

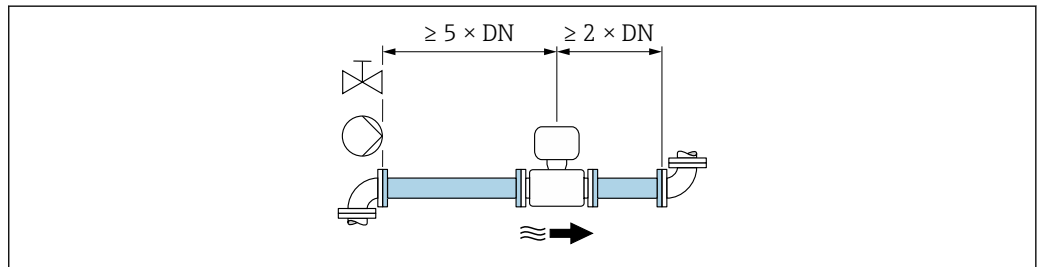


A0029344

- 1 EPD electrode for empty pipe detection
- 2 Measuring electrodes for signal detection
- 3 Reference electrode for potential equalization

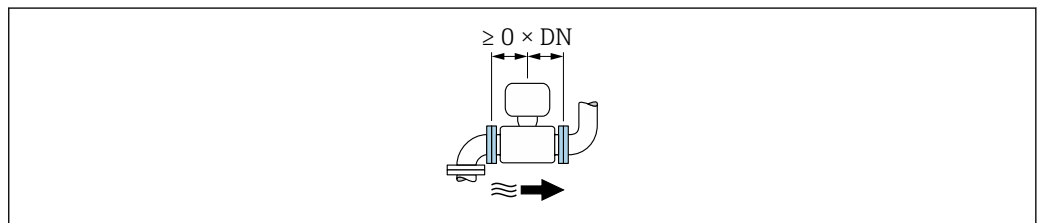
Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows. Observe the following inlet and outlet runs to comply with accuracy specifications:



A0028997

- 22 Order code for "Design", option A "Insertion length short, ISO/DVGW until DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW until DN400, DN450-2000 1:1.3"



A0032859

- 23 Order code for "Design", option C "Insertion length short ISO/DVGW until DN300, w/o inlet and outlet runs, constricted meas.tube"

i To keep within the in-service maximum permissible errors for custody transfer no additional requirements apply with regard to the graphic illustrated above.

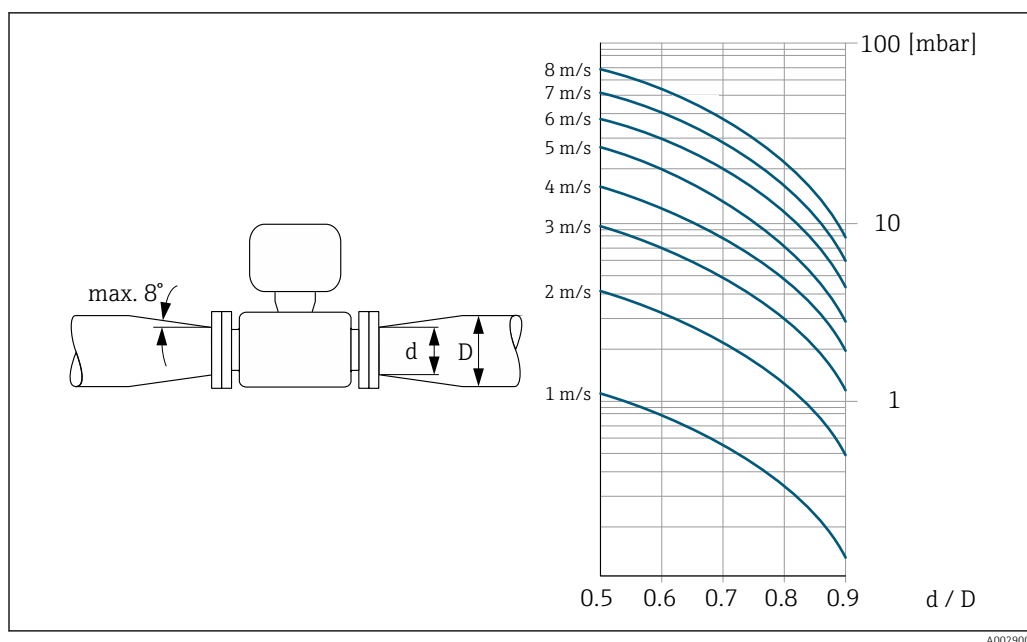
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:

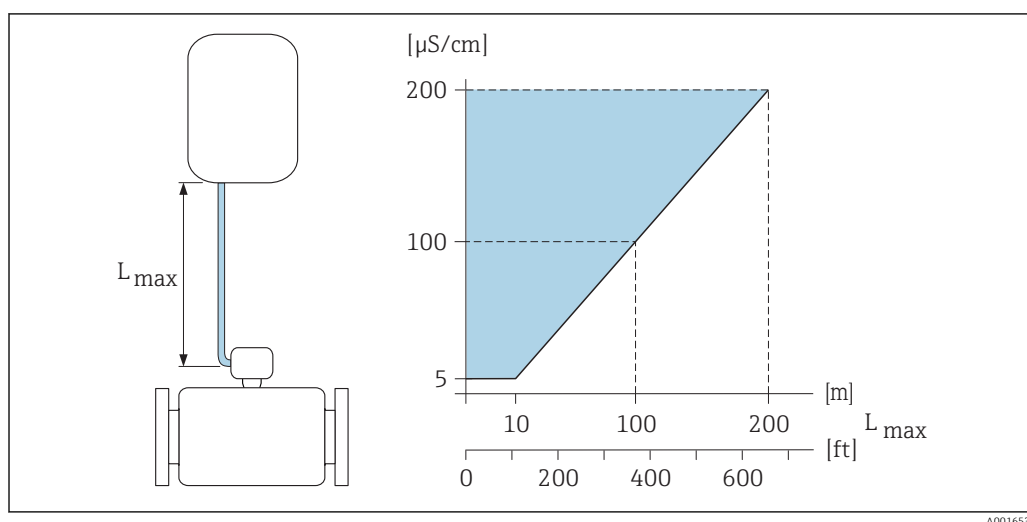
- Calculate the ratio of the diameters d/D .
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

i The nomogram only applies to liquids with a viscosity similar to that of water.



Length of connecting cable

To ensure correct measuring results when using the remote version, observe the maximum permitted length of the connecting cable L_{\max} . This length is determined by the conductivity of the fluid.
If measuring liquids in general: 5 $\mu\text{S}/\text{cm}$



24 Permitted length of connecting cable for remote version

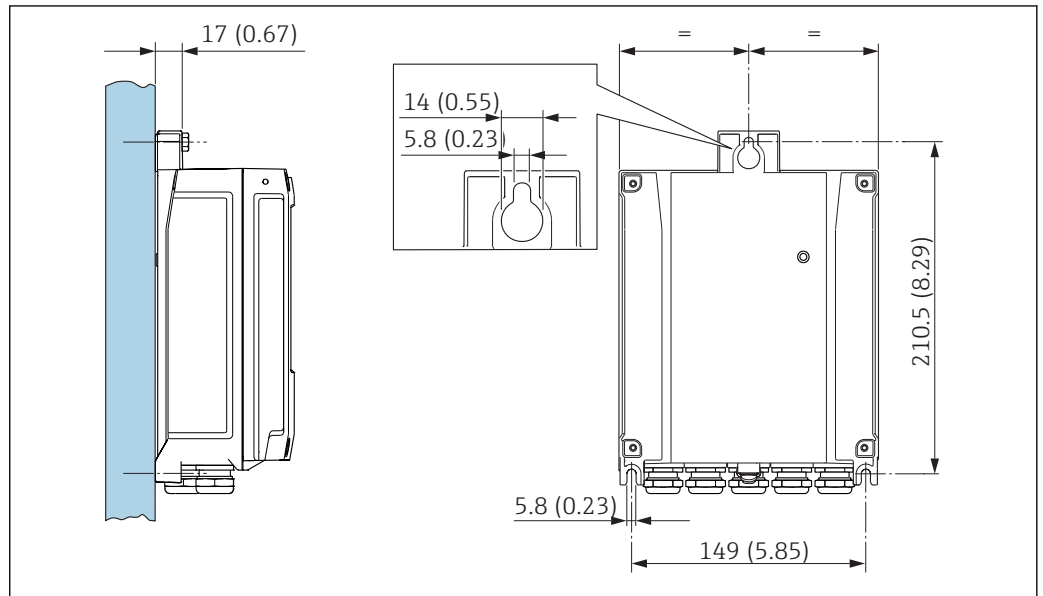
Colored area = permitted range

L_{\max} = length of connecting cable in [m] ([ft])

$[\mu\text{S}/\text{cm}]$ = fluid conductivity

Mounting the transmitter housing

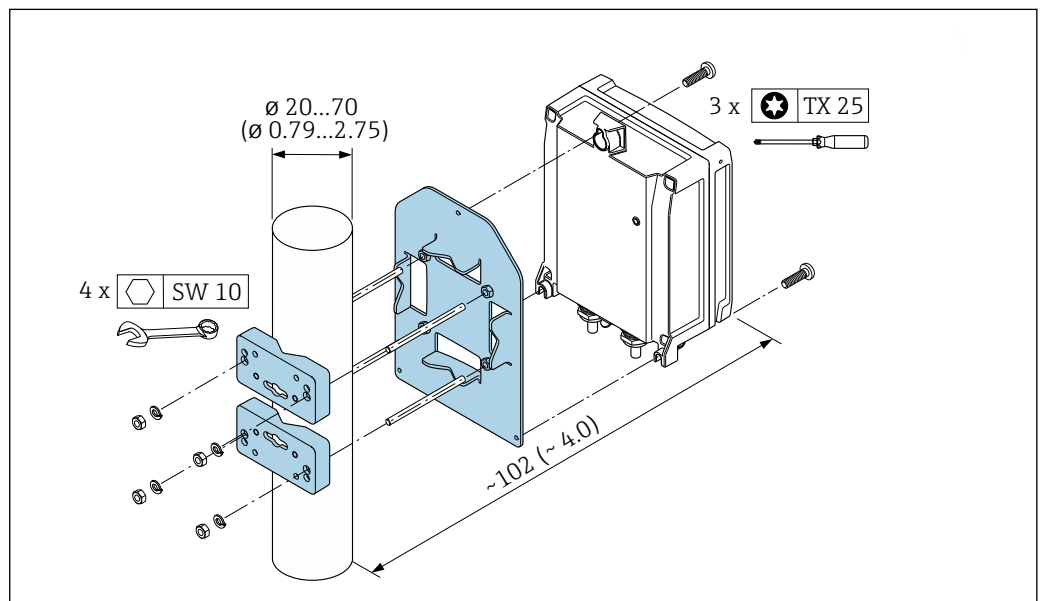
Wall mounting



A0020523

25 Engineering unit mm (in)

Post mounting



A0029051

26 Engineering unit mm (in)

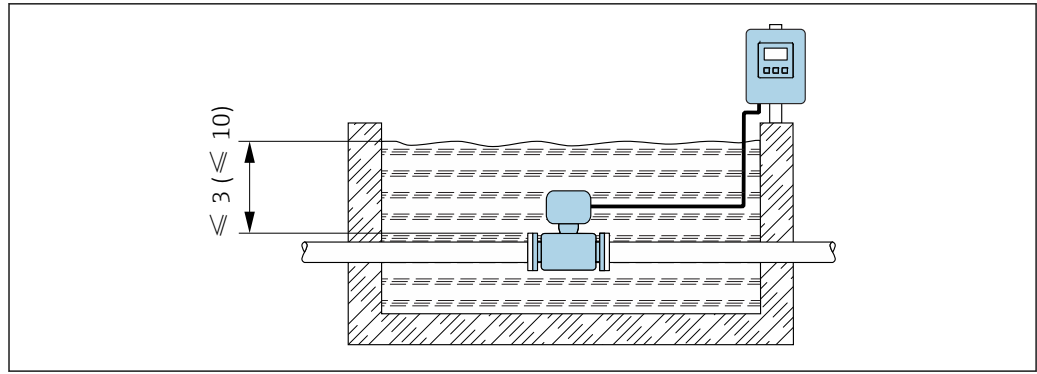
Special mounting instructions

Display protection

To ensure that the optional display protection can be easily opened, maintain the following minimum head clearance: 350 mm (13.8 in)

Permanent immersion in water

A fully welded remote version with IP68 protection is optionally available for permanent immersion in water ≤ 3 m (10 ft) or in exceptional cases for use for up to 48 hours at ≤ 10 m (30 ft). The measuring device meets the requirements of corrosion categories C5-M and Im1/Im2/Im3. The fully welded design along with the connection compartment sealing system ensure that moisture cannot enter the measuring device.



A0029320

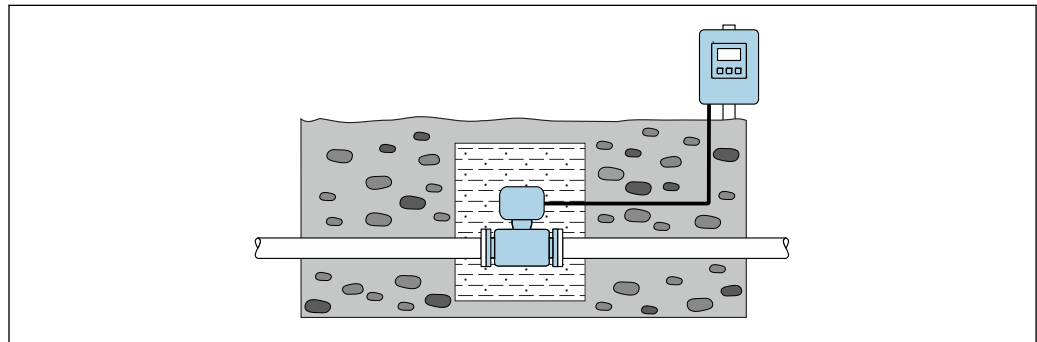
27 Engineering unit in m(ft)



Replacement of cable gland on connection housing

Buried applications

A remote version with IP68 protection is optionally available for buried applications. The measuring device satisfies the certified corrosion protection Im1/Im2/Im3 in accordance with EN ISO 12944. It can be used directly underground without the need for additional protective measures. The device is mounted in accordance with the usual regional installation regulations (e.g. EN DIN 1610).



A0029321

Environment

Ambient temperature range

Transmitter	-40 to +60 °C (-40 to +140 °F)
Local display	-20 to +60 °C (-4 to +140 °F), the readability of the display may be impaired at temperatures outside the temperature range.
Sensor	<ul style="list-style-type: none"> ■ Process connection material, carbon steel: -10 to +60 °C (+14 to +140 °F) ■ Process connection material, stainless steel: -40 to +60 °C (-40 to +140 °F) <p>Mount the transmitter separately from the sensor if both the ambient and fluid temperatures are high.</p>
Liner	Do not exceed or fall below the permitted temperature range of the liner .



If operating outdoors:

- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.


- If the compact version of the device is insulated at low temperatures, the insulation must also include the device neck.
- Protect the display against impact.
- Protect the display from abrasion by sand in desert areas.

 You can order a display guard from Endress+Hauser : →  126

Temperature tables

-  Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.
-  For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.


Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors. →  40

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Atmosphere

If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.

 If you are unsure, please contact your Endress+Hauser Sales Center for clarification.

Degree of protection

Transmitter

- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure

Sensor

- As standard: IP66/67, type 4X enclosure
- Optionally available for remote version:
 - IP66/67, type 4X enclosure; fully welded, with protective varnish EN ISO 12944 C5-M. Suitable for use in corrosive atmospheres.
 - IP68, type 6P enclosure; fully welded, with protective varnish as per EN ISO 12944 C5-M. Suitable for permanent immersion in water ≤ 3 m (10 ft) or up to 48 hours at depths ≤ 10 m (30 ft).
 - IP68, type 6P enclosure; fully welded, with protective varnish as per EN ISO 12944 Im1/Im2/Im3. Suitable for permanent immersion in saline water ≤ 3 m (10 ft) or up to 48 hours at depths ≤ 10 m (30 ft) or in buried applications.

Vibration resistance

Compact version



- Vibration, sinusoidal according to IEC 60068-2-6
 - 2 to 8.4 Hz, 3.5 mm peak
 - 8.4 to 2 000 Hz, 1 g peak
- Vibration broad-band random, according to IEC 60068-2-64
 - 10 to 200 Hz, 0.003 g²/Hz
 - 200 to 2 000 Hz, 0.001 g²/Hz
 - Total: 1.54 g rms

Remote version




- Vibration, sinusoidal according to IEC 60068-2-6
 - 2 to 8.4 Hz, 7.5 mm peak
 - 8.4 to 2 000 Hz, 2 g peak
- Vibration broad-band random, according to IEC 60068-2-64
 - 10 to 200 Hz, 0.01 g²/Hz
 - 200 to 2 000 Hz, 0.003 g²/Hz
 - Total: 2.70 g rms

Shock resistance

Shock, half-sine according to IEC 60068-2-27
6 ms 50 g

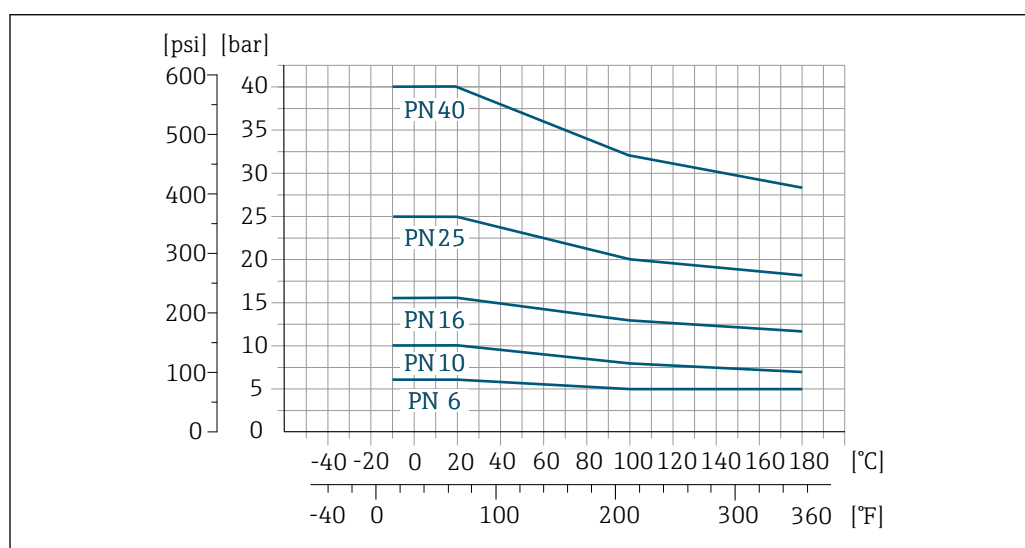
Impact resistance	Rough handling shocks according to IEC 60068-2-31
Mechanical load	<ul style="list-style-type: none"> ■ Protect the transmitter housing against mechanical effects, such as shock or impact; the use of the remote version is sometimes preferable. ■ Never use the transmitter housing as a ladder or climbing aid.
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> ■ As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) ■ Complies with emission limits for industry as per EN 55011 (Class A) ■ Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784 <p> The following applies for PROFIBUS DP: If baud rates > 1.5 Mbaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.</p> <p> Details are provided in the Declaration of Conformity.</p>

Process


Medium temperature range	<ul style="list-style-type: none"> ■ 0 to +80 °C (+32 to +176 °F) for hard rubber, DN 50 to 2000 (2 to 78") ■ -20 to +50 °C (-4 to +122 °F) for polyurethane, DN 25 to 1200 (1 to 48") <p> In custody transfer mode, the permitted fluid temperature is 0 to +50 °C (+32 to +122 °F).</p>
Conductivity	<p>≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values.</p> <p> Note that in the case of the remote version, the requisite minimum conductivity also depends on the cable length →  38.</p>

Pressure-temperature ratings	The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.
-------------------------------------	--

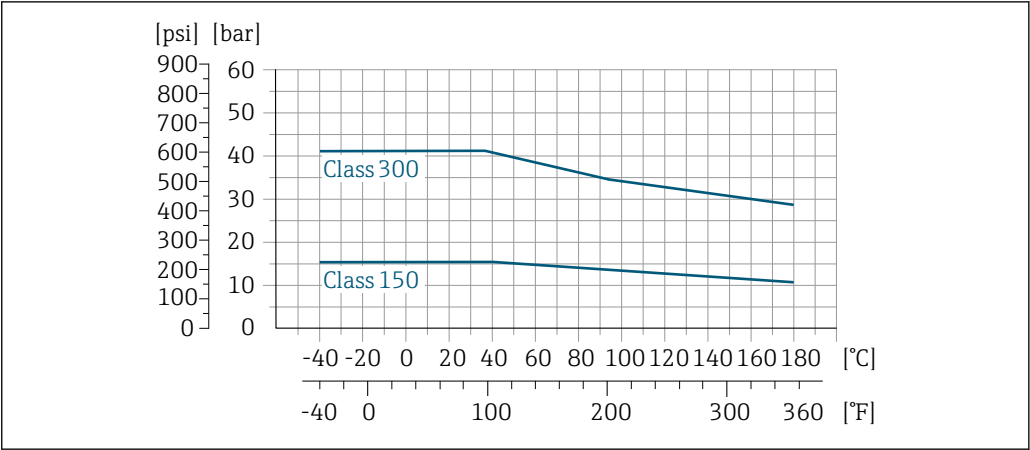
Process connection: fixed flange according to EN 1092-1 (DIN 2501)



A0029390-EN

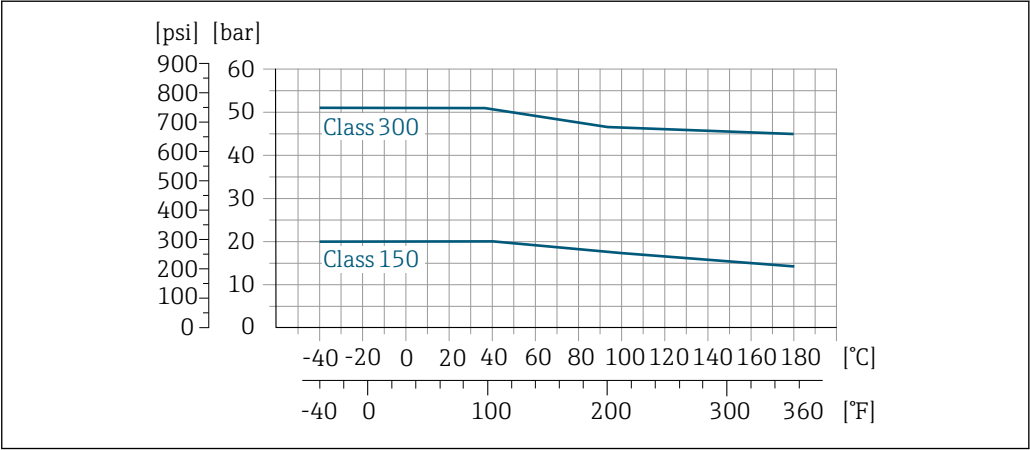
 28 Process connection material: stainless steel, 1.4404/1.4571/F316L; carbon steel, A105/FE410WB/P250GH/S235JRG2/S235JR+N

Process connection: fixed flange according to ASME B16.5



A0029394-EN

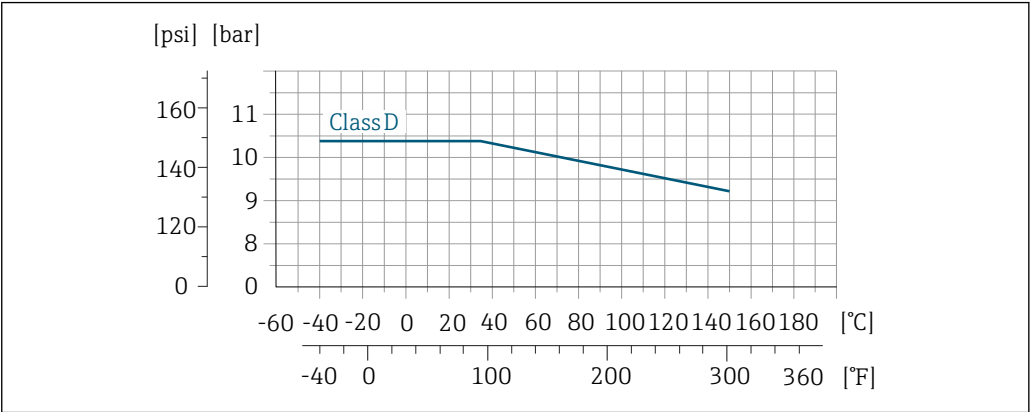
29 Process connection material: stainless steel, F316L similar to 1.4404



A0029393-EN

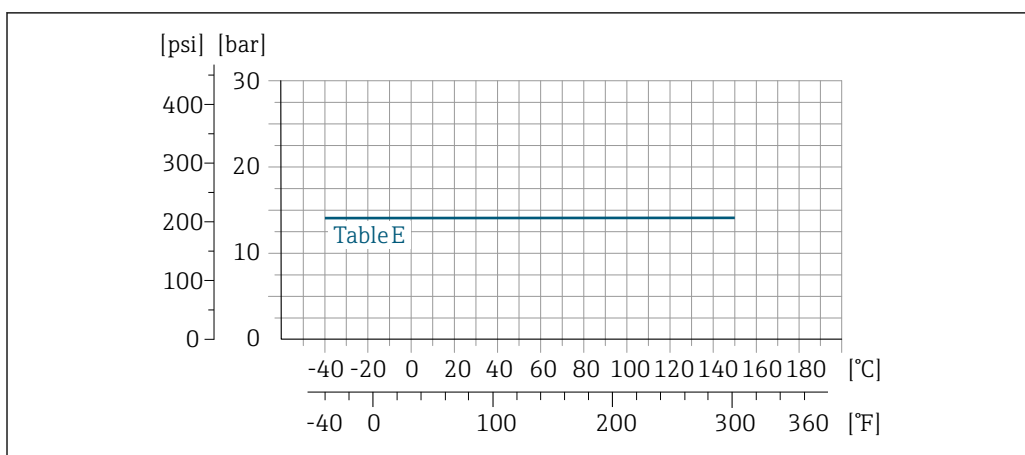
30 Process connection material: carbon steel, A105/A515(70)

Process connection: fixed flange according to AWWA C207



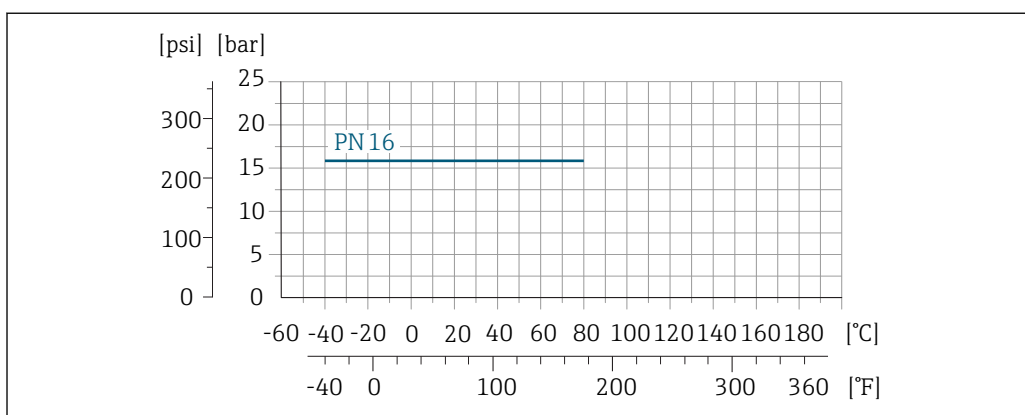
A0029818-EN

31 Process connection material: carbon steel, A105/A181/P265GH/S275JR

Process connection: fixed flange according to AS 2129

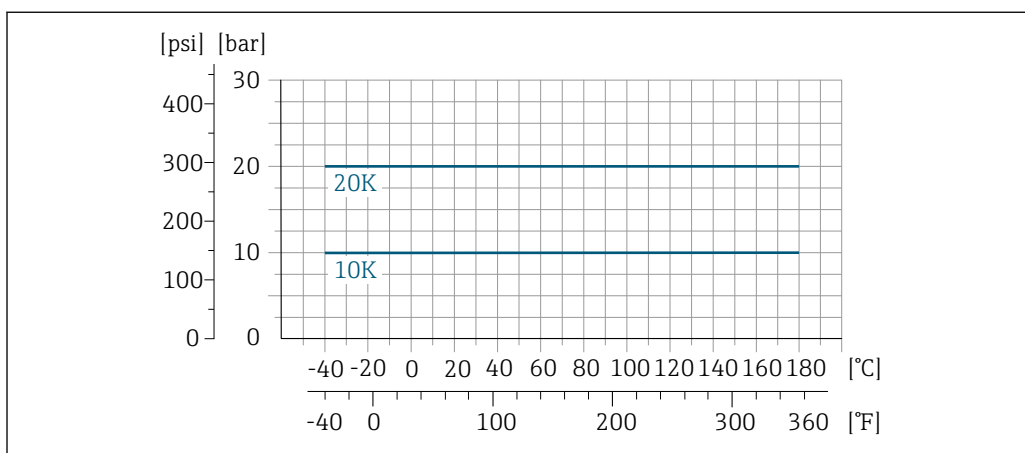
A0029398-EN

32 Process connection material: carbon steel, A105/FE410WB/P235GH/P265GH/S235JRG2

Process connection: fixed flange according to AS 4087

A0029817-EN

33 Process connection material: carbon steel, A105/P265GH/S275JR

Process connection: fixed flange according to JIS B2220

A0029397-EN

34 Process connection material: stainless steel, F316L similar to 1.4404; carbon steel, A105/A350LF2

Pressure tightness

Liner: hard rubber

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)	+80 °C (+176 °F)
50...2000	2...78	0 (0)	0 (0)	0 (0)

Liner: polyurethane

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)
25...1200	1...48	0 (0)	0 (0)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:

- $v < 2 \text{ m/s}$ (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- $v > 2 \text{ m/s}$ (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludge)

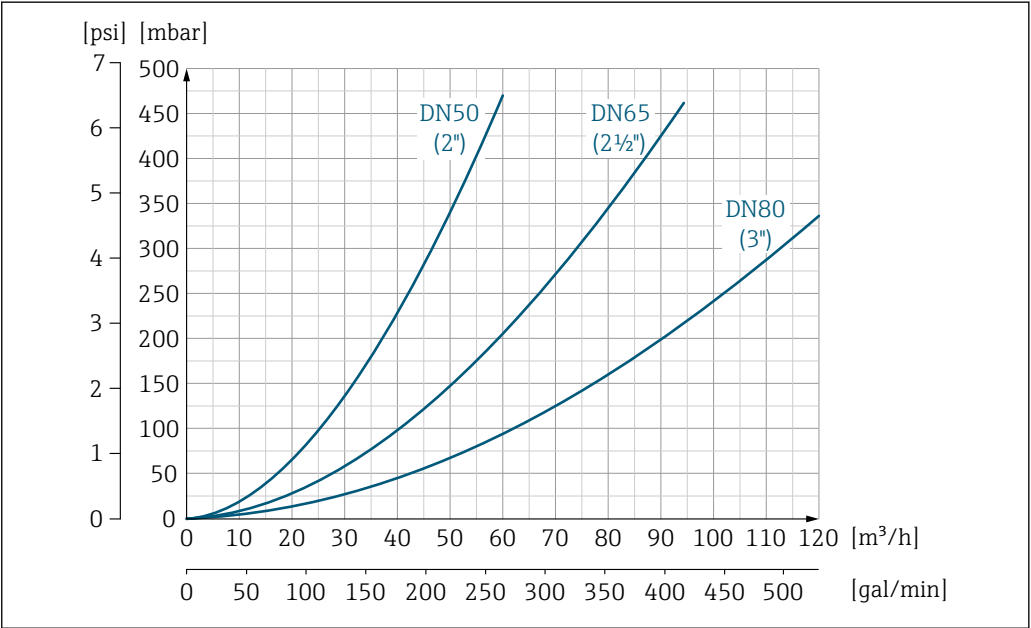
i A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

i For an overview of the full scale values for the measuring range, see the "Measuring range" section → 8

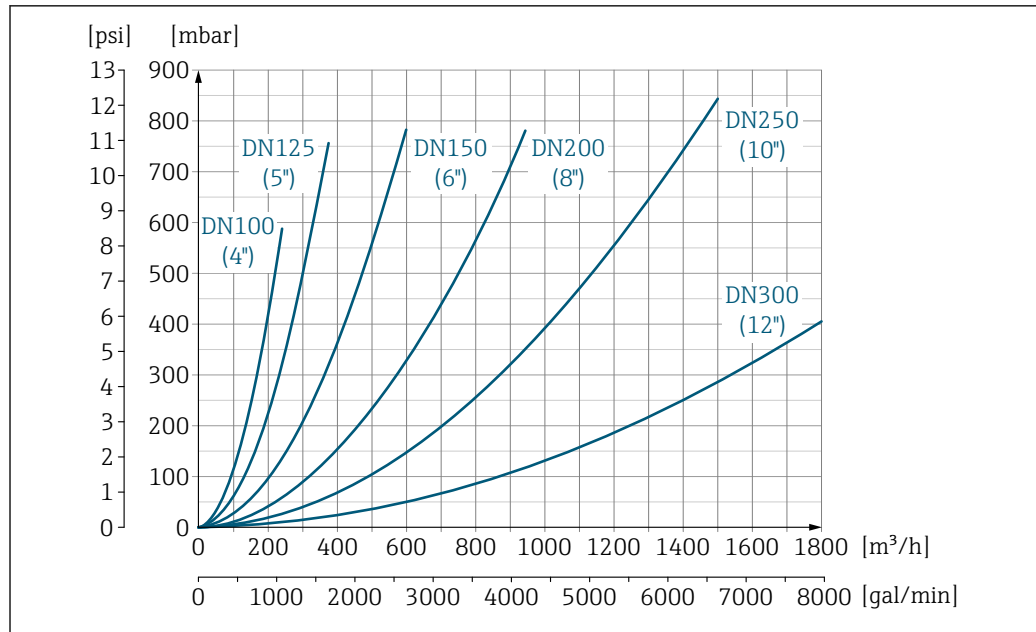
i For custody transfer, the applicable approval determines the permitted measuring range.

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 37



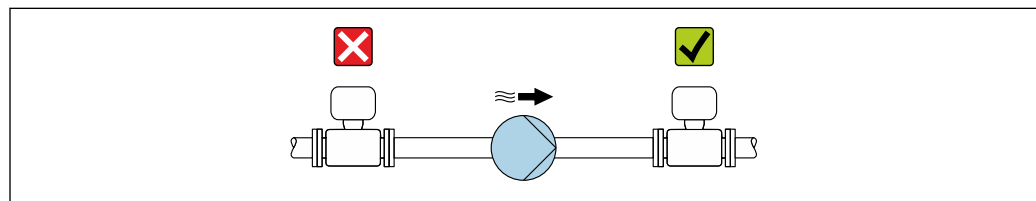
35 Pressure loss DN 50 to 80 (2 to 3") in the case of order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"



A0032668-EN

36 Pressure loss DN 100 to 300 (4 to 12") in the case of order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

System pressure



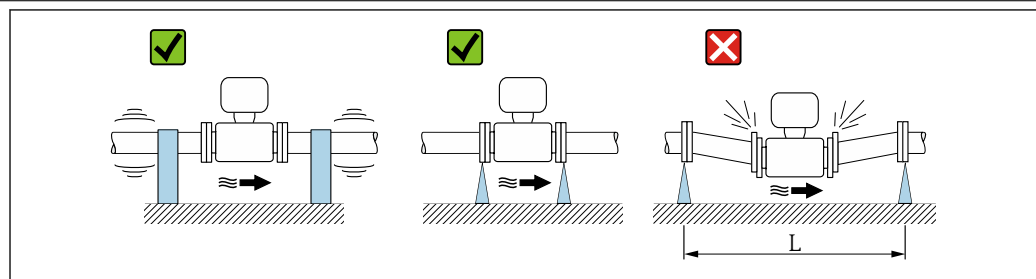
A0028777

Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

i Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- i** ■ Information on the liner's resistance to partial vacuum → 45
- i** ■ Information on the shock resistance of the measuring system → 42
- Information on the vibration resistance of the measuring system → 41

Vibrations



A0029004

37 Measures to avoid device vibrations ($L > 10\text{ m}$ (33 ft))

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

It is also advisable to mount the sensor and transmitter separately.

- i** ■ Information on the shock resistance of the measuring system → 42
- Information on the vibration resistance of the measuring system → 41

Custody transfer mode

The measuring device is optionally tested in accordance with OIML R137 and has an EU type-examination certificate according to Measuring Instruments Directive 2014/32/EU for service subject to legal metrological control ("custody transfer") for cold water (Annex III).

The permitted fluid temperature in these applications is 0 to +50 °C (+32 to +122 °F).

The device is used with a legally controlled totalizer on the local display and optionally with legally controlled outputs.

Measuring devices subject to legal metrological control totalize in both directions, i.e. all the outputs consider flow components in the positive (forward) and negative (reverse) flow direction.

Generally a measuring device subject to legal metrological control is secured against tampering by seals on the transmitter or sensor. These seals may normally only be opened by a representative of the competent authority for legal metrology controls.

After putting the device into circulation or after sealing the device, operation is only possible to a limited extent.

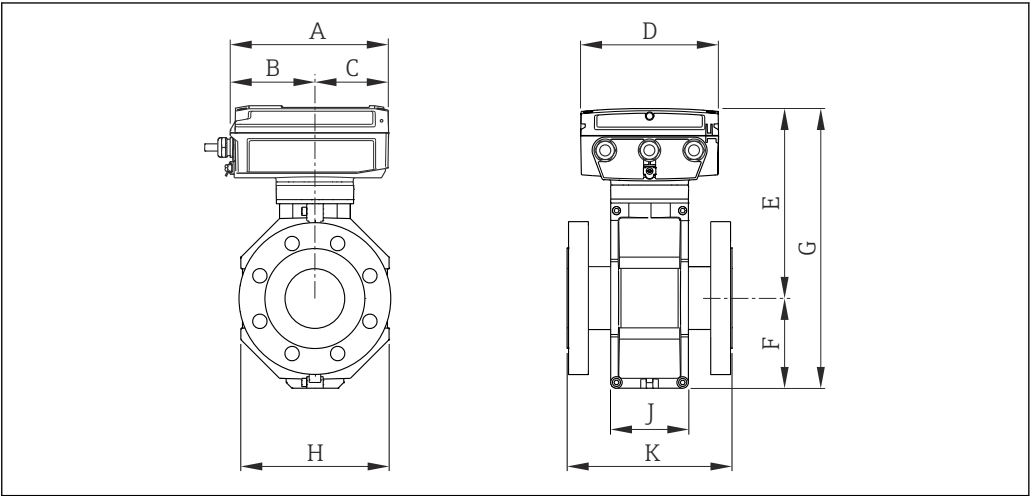
Detailed ordering information is available from your local Endress+Hauser sales center for national approvals (outside Europe) as cold water meters based on OIML R49.

Mechanical construction

Dimensions in SI units

Compact version

Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated"



A0020352

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	193	103	90	167	201	84	285	120	94	200
32	193	103	90	167	201	84	285	120	94	200
40	193	103	90	167	201	84	285	120	94	200
50	193	103	90	167	201	84	285	120	94	200
65	193	103	90	167	226	109	335	180	94	200
80	193	103	90	167	226	109	335	180	94	200
100	193	103	90	167	226	109	335	180	94	250

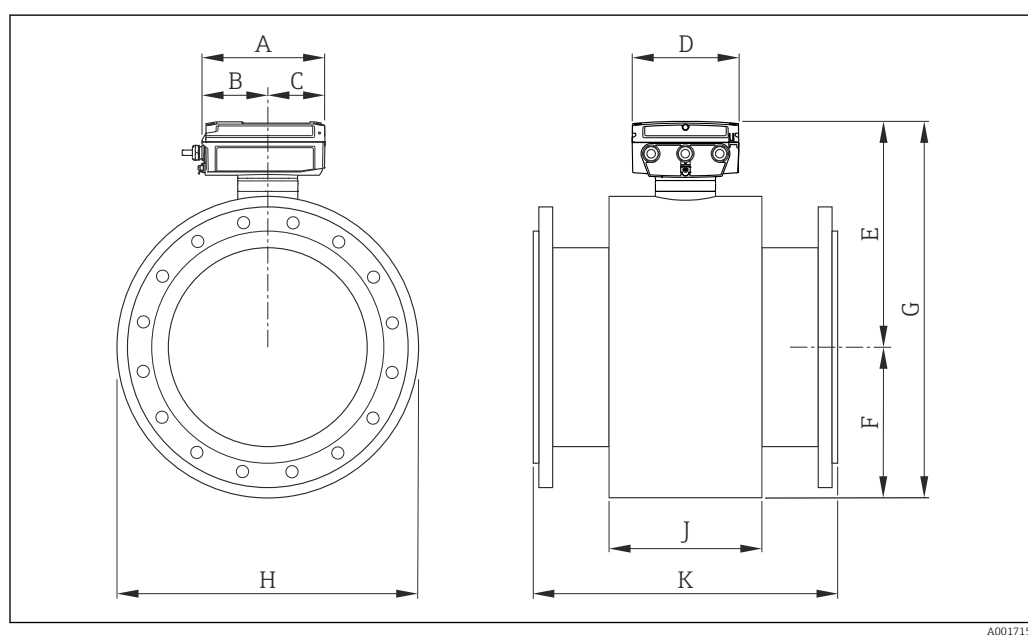
DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
125	193	103	90	167	266	150	416	260	140	250
150	193	103	90	167	266	150	416	260	140	300
200	193	103	90	167	291	180	471	324	156	350
250	193	103	90	167	316	205	521	400	166	450
300	193	103	90	167	341	230	571	460	166	500

- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	193	103	90	167	201	84	285	120	94	200
65	193	103	90	167	201	84	285	120	94	200
80	193	103	90	167	226	109	335	180	94	200
100	193	103	90	167	226	109	335	180	94	250
125	193	103	90	167	226	109	335	180	94	250
150	193	103	90	167	226	109	335	180	94	300
200	193	103	90	167	266	150	416	260	140	350
250	193	103	90	167	266	150	416	260	140	450
300	193	103	90	167	291	180	471	324	156	500

- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

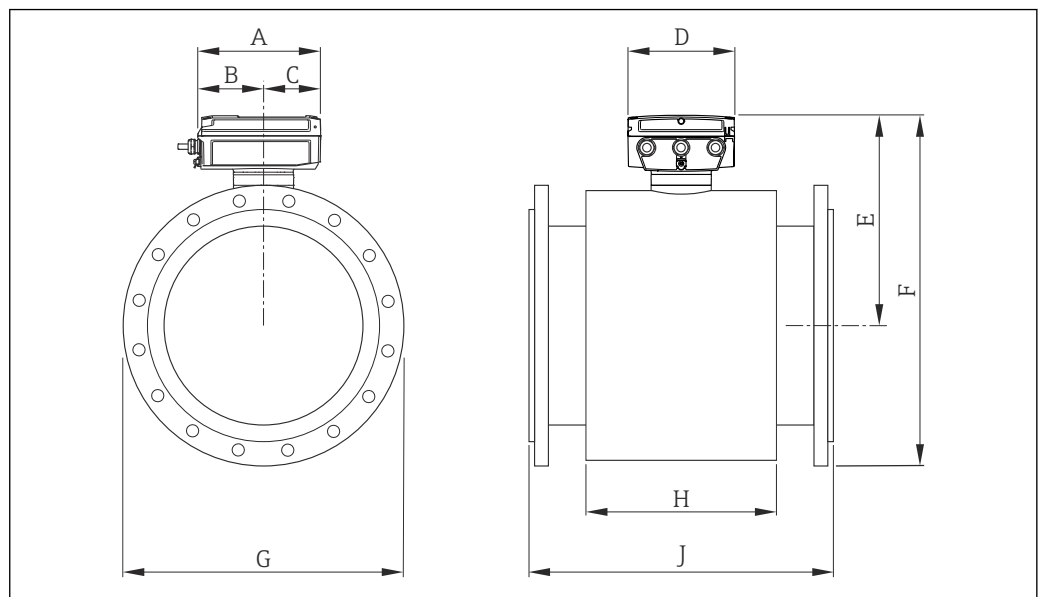


A0017154

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	193	103	90	167	432	282	714	564	288	550
375	193	103	90	167	458	308	766	616	288	600
400	193	103	90	167	458	308	766	616	288	600
450	193	103	90	167	483	333	816	666	292	650
500	193	103	90	167	508	359	867	717	292	650
600	193	103	90	167	560	410	970	821	402	780
700	193	103	90	167	662	512	1174	1024	589	910
750	193	103	90	167	662	512	1174	1024	626	975
800	193	103	90	167	683	534	1217	1067	647	1040
900	193	103	90	167	760	610	1370	1220	785	1170
1000	193	103	90	167	836	686	1522	1372	862	1300
1050	193	103	90	167	862	712	1574	1424	912	1365
1200	193	103	90	167	961	811	1772	1622	992	1560
1350	193	103	90	167	1062	912	1974	1824	1252	1755
1400	193	103	90	167	1137	987	2124	1974	1252	1820
1500	193	103	90	167	1161	1011	2172	2022	1392	1950
1600	193	103	90	167	1206	1056	2262	2112	1482	2080
1650	193	103	90	167	1243	1093	2336	2186	1482	2145
1800	193	103	90	167	1338	1188	2526	2376	1632	2340
2000	193	103	90	167	1388	1238	2626	2476	1732	2600

- 1) EN (DIN), AS; For flanges according to AS, only nominal diameters DN 350, 400, 500 and 600 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated";
order code for "Design", option A "Insertion length short"



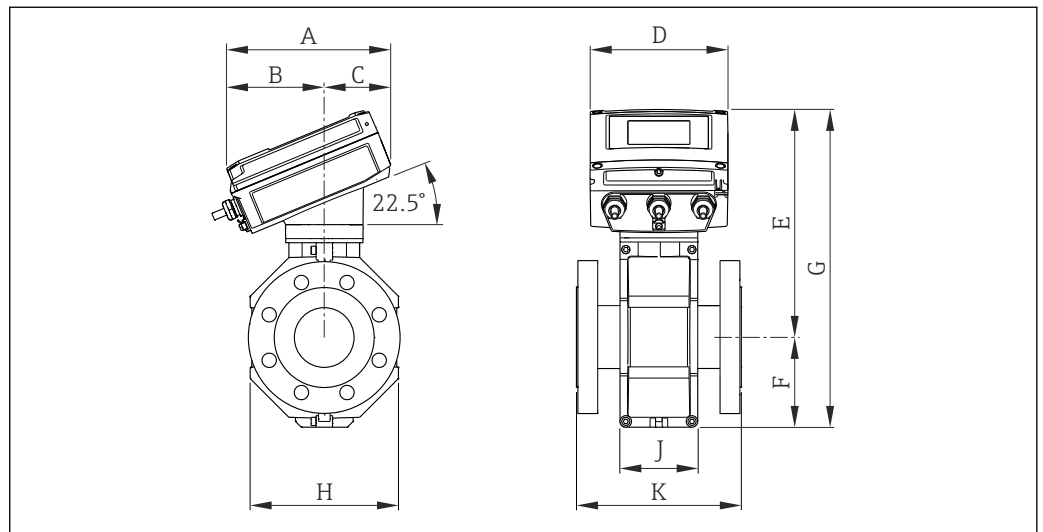
A0017153

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	H [mm]	J [mm]
350	193	103	90	167	386	290	550
375	193	103	90	167	412	290	600
400	193	103	90	167	412	290	600
450	193	103	90	167	440	290	600
500	193	103	90	167	465	290	600
600	193	103	90	167	506	290	600
700	193	103	90	167	571	424	700
750	193	103	90	167	608	454	750
800	193	103	90	167	627	500	800
900	193	103	90	167	677	580	900
1000	193	103	90	167	727	664	1000
1050	193	103	90	167	763	759	1050
1200	193	103	90	167	841	832	1200
1350	193	103	90	167	953	1008	1350
1400	193	103	90	167	953	1008	1400
1500	193	103	90	167	1053	1147	1500
1600	193	103	90	167	1053	1147	1600
1650	193	103	90	167	1104	1284	1650
1800	193	103	90	167	1161	1379	1800
2000	193	103	90	167	1272	1569	2000

DN [mm]	Dimension F							Dimension G						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
350	631	638	702	653	648	603	653	490	505	520	533	525	490	540
375	–	–	–	–	687	–	–	–	–	–	–	550	–	–
400	682	694	760	710	702	673	718	540	565	580	597	580	560	605
450	737	747	823	757	760	733	788	595	615	640	635	640	620	675
500	787	800	926	814	817	788	843	645	670	715	699	705	675	730
600	883	896	1026	912	918	908	958	755	780	840	813	825	795	845
700	1001	1018	1145	1034	1026	1018	–	860	895	910	927	910	905	–
750	–	–	–	1100	1106	1083	–	–	–	–	984	995	970	–
800	1115	1135	1240	1157	1157	–	–	975	1015	1025	1060	1060	–	–
900	1215	1235	1240	1261	1265	–	–	1075	1115	1125	1168	1175	–	–
1000	1315	1342	1355	1372	1355	–	–	1175	1230	1255	1289	1255	–	–
1050	–	–	–	1436	–	–	–	–	–	–	1346	–	–	–
1200	1544	1569	1584	1597	1586	–	–	1405	1455	1485	1511	1490	–	–
1350	–	–	–	1795	–	–	–	–	–	–	1683	–	–	–
1400	1768	1791	1796	–	–	–	–	1630	1675	1685	–	–	–	–
1500	–	–	–	1980	–	–	–	–	–	–	1854	–	–	–

DN [mm]	Dimension F							Dimension G							
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS		
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	[mm]	10K [mm]	20K [mm]
1600	1968	2011	2019	–	–	–	–	1830	1915	1930	–	–	–	–	–
1650	–	–	–	2120	–	–	–	–	–	–	2032	–	–	–	–
1800	2183	2218	2226	2259	–	–	–	2045	2115	2130	2197	–	–	–	–
2000	2404	2434	2444	2453	–	–	–	2265	2325	2345	2362	–	–	–	–

Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"



A0020353

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

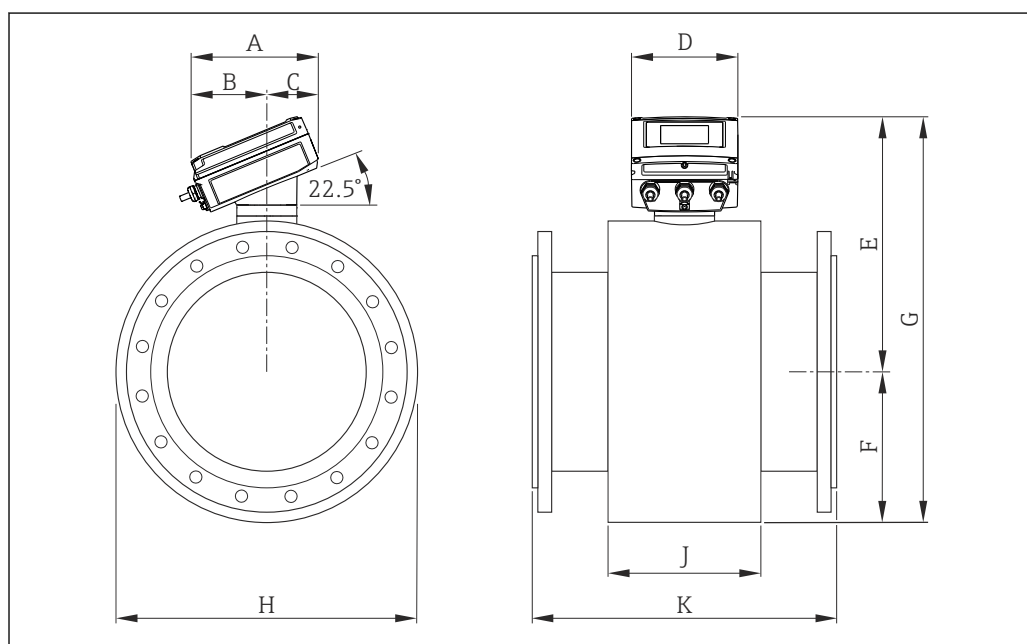
DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	199	119	80	167	248	84	332	120	94	200
32	199	119	80	167	248	84	332	120	94	200
40	199	119	80	167	248	84	332	120	94	200
50	199	119	80	167	248	84	332	120	94	200
65	199	119	80	167	273	109	382	180	94	200
80	199	119	80	167	273	109	382	180	94	200
100	199	119	80	167	273	109	382	180	94	250
125	199	119	80	167	313	150	463	260	140	250
150	199	119	80	167	313	150	463	260	140	300
200	199	119	80	167	338	180	518	324	156	350
250	199	119	80	167	363	205	568	400	166	450
300	199	119	80	167	388	230	618	460	166	500

- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	199	119	80	167	248	84	332	120	94	200
65	199	119	80	167	248	84	332	120	94	200
80	199	119	80	167	273	109	382	180	94	200
100	199	119	80	167	273	109	382	180	94	250
125	199	119	80	167	273	109	382	180	94	250
150	199	119	80	167	273	109	382	180	94	300
200	199	119	80	167	313	150	463	260	140	350
250	199	119	80	167	313	150	463	260	140	450
300	199	119	80	167	338	180	518	324	156	500

- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



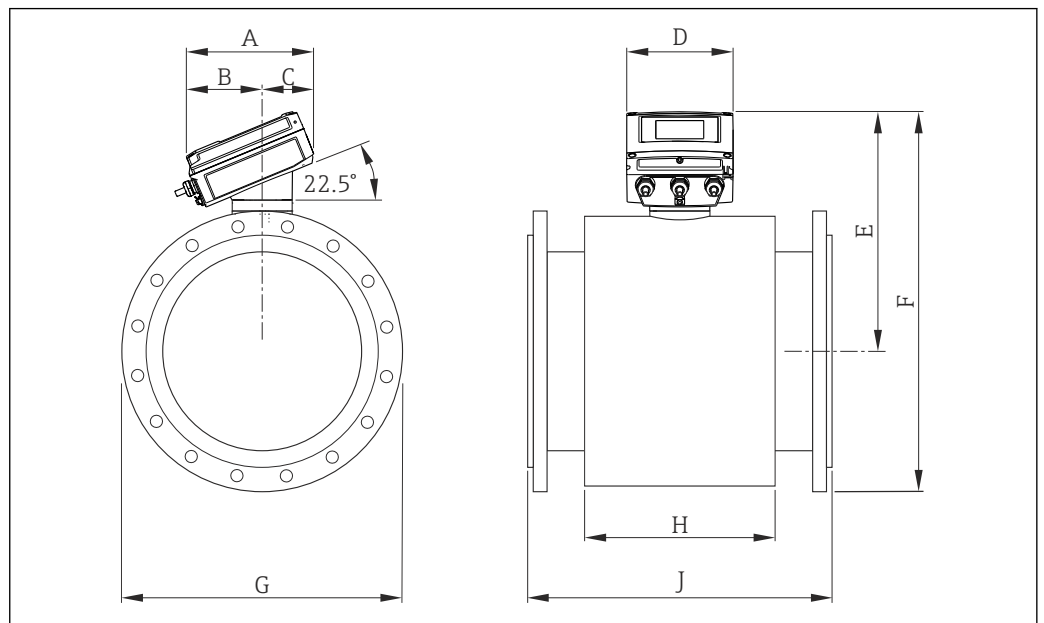
A0020396

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	199	119	80	167	477	282	759	564	288	550
375	199	119	80	167	503	308	811	616	288	600
400	199	119	80	167	503	308	811	616	288	600
450	199	119	80	167	528	333	861	666	292	650
500	199	119	80	167	553	359	912	717	292	650
600	199	119	80	167	605	410	1015	821	402	780
700	199	119	80	167	707	512	1219	1024	589	910
750	199	119	80	167	707	512	1219	1024	626	975
800	199	119	80	167	728	534	1262	1067	647	1040

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
900	199	119	80	167	805	610	1415	1220	785	1170
1000	199	119	80	167	881	686	1567	1372	862	1300
1050	199	119	80	167	907	712	1619	1424	912	1365
1200	199	119	80	167	1006	811	1817	1622	992	1560
1350	199	119	80	167	1107	912	2019	1824	1252	1755
1400	199	119	80	167	1182	987	2169	1974	1252	1820
1500	199	119	80	167	1206	1011	2217	2022	1392	1950
1600	199	119	80	167	1251	1056	2307	2112	1482	2080
1650	199	119	80	167	1288	1093	2381	2186	1482	2145
1800	199	119	80	167	1383	1188	2571	2376	1632	2340
2000	199	119	80	167	1433	1238	2671	2476	1732	2600

- 1) EN (DIN), AS; For flanges according to AS, only nominal diameters DN 350, 400, 500 and 600 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"; order code for "Design", option A "Insertion length short"



A0020393

DN	A	B	C	D	E	H	J
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	199	119	80	167	431	290	550
375	199	119	80	167	457	290	600
400	199	119	80	167	457	290	600
450	199	119	80	167	485	290	600
500	199	119	80	167	510	290	600
600	199	119	80	167	551	290	600
700	199	119	80	167	616	424	700

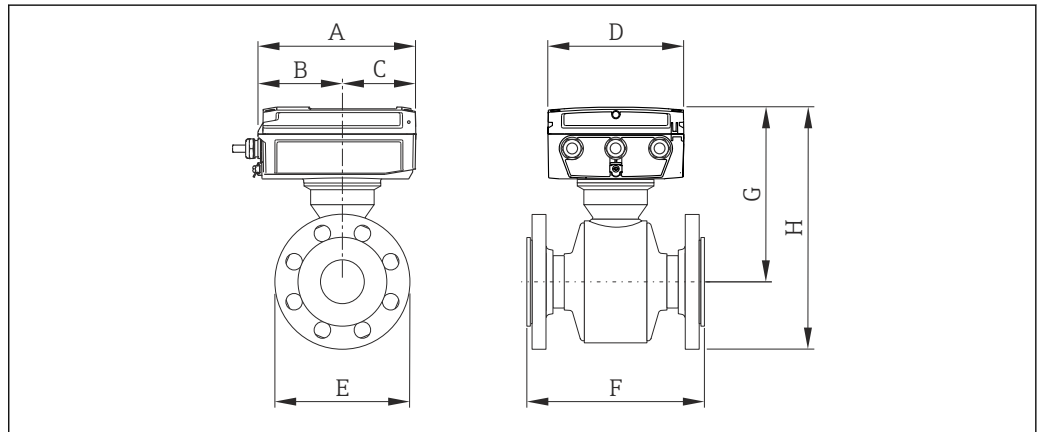
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	H [mm]	J [mm]
750	199	119	80	167	653	454	750
800	199	119	80	167	672	500	800
900	199	119	80	167	722	580	900
1000	199	119	80	167	772	664	1000
1050	199	119	80	167	808	759	1050
1200	199	119	80	167	886	832	1200
1350	199	119	80	167	998	1008	1350
1400	199	119	80	167	953	1008	1400
1500	199	119	80	167	1098	1147	1500
1600	199	119	80	167	1098	1147	1600
1650	199	119	80	167	1149	1284	1650
1800	199	119	80	167	1206	1379	1800
2000	199	119	80	167	1317	1569	2000

DN [mm]	Dimension F							Dimension G						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
350	676	683	618	698	693	603	653	490	505	520	533	525	490	540
375	–	–	–	–	732	–	–	–	–	–	–	550	–	–
400	727	739	672	755	747	673	718	540	565	580	597	580	560	605
450	782	792	732	802	805	733	788	595	615	640	635	640	620	675
500	832	845	795	859	862	788	843	645	670	715	699	705	675	730
600	928	941	898	957	963	908	958	755	780	840	813	825	795	845
700	1046	1063	1008	1079	1071	1018	–	860	895	910	927	910	905	–
750	–	–	–	1145	1151	1083	–	–	–	–	984	995	970	–
800	1160	1180	1112	1202	1202	–	–	975	1015	1025	1060	1060	–	–
900	1260	1280	1212	1306	1310	–	–	1075	1115	1125	1168	1175	–	–
1000	1360	1387	1327	1417	1400	–	–	1175	1230	1225	1289	1255	–	–
1050	–	–	–	1481	–	–	–	–	–	–	1346	–	–	–
1200	1589	1614	1556	1642	1631	–	–	1405	1455	1255	1511	1490	–	–
1350	–	–	–	1840	–	–	–	–	–	–	1683	–	–	–
1400	1813	1836	1768	–	–	–	–	1630	1675	1685	–	–	–	–
1500	–	–	–	2025	–	–	–	–	–	–	1854	–	–	–
1600	2013	2056	1991	–	–	–	–	1830	1915	1930	–	–	–	–
1650	–	–	–	2165	–	–	–	–	–	–	2032	–	–	–
1800	2228	2263	2198	2304	–	–	–	2045	2115	2130	2197	–	–	–
2000	2449	2479	2416	2498	–	–	–	2265	2325	2345	2362	–	–	–

Order code for "Sensor option", option CA in combination with order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N



- Order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N available for order in conjunction with order code for "Housing", option M "Compact, polycarbonate"
- Order code for "Calibration flow", options H/K also available for order in conjunction with order code for "Housing", option A "Compact, aluminum, coated"



A0021328

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
25	193	103	90	167	200	211
32	193	103	90	167	200	211
40	193	103	90	167	200	211
50	193	103	90	167	200	211
65	193	103	90	167	200	224
80	193	103	90	167	200	229
100	193	103	90	167	250	241
125	193	103	90	167	250	254
150	193	103	90	167	300	276
200	193	103	90	167	350	301
250	193	103	90	167	450	335
300	193	103	90	167	500	360

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
50	193	103	90	167	200	211
65	193	103	90	167	200	224
80	193	103	90	167	200	229
100	193	103	90	167	250	229
125	193	103	90	167	250	229
150	193	103	90	167	300	241
200	193	103	90	167	350	254

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
250	193	103	90	167	450	276
300	193	103	90	167	500	301

Dimension E										
DN [mm]	EN (DIN)				ASME		AS		JIS	
	PN 10 [mm]	PN 16 [mm]	PN 25 [mm]	PN 40 [mm]	Class 150 [mm]	Class 300 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]	20K [mm]
25	–	–	–	140	140	140	140	–	140	140
32	–	–	–	140	–	–	–	–	140	140
40	–	–	–	150	140	155	–	–	140	140
50	–	–	–	165	153	165	150	150	155	155
65	–	185	–	185	–	–	–	–	175	175
80	–	200	–	200	191	210	185	185	185	200
100	–	220	–	235	229	254	215	215	210	225
125	–	250	–	270	–	–	–	–	250	270
150	–	285	–	300	280	318	280	280	280	305
200	340	340	360	–	343	–	335	335	330	350
250	395	405	425	–	407	–	405	405	400	430
300	445	460	485	–	483	–	455	455	445	480

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension H										
DN [mm]	EN (DIN)				ASME		AS		JIS	
	PN 10 [mm]	PN 16 [mm]	PN 25 [mm]	PN 40 [mm]	Class 150 [mm]	Class 300 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]	20K [mm]
25	–	–	–	282	281	258	–	–	282	258
32	–	–	–	282	–	–	–	–	282	258
40	–	–	–	286	281	265	–	–	282	258
50	–	–	–	294	286	270	–	–	289	265
65	–	316	–	–	–	–	–	–	311	288
80	–	329	–	–	324	309	321	321	321	305
100	–	351	–	–	356	344	349	349	346	330
125	–	379	–	–	–	–	–	–	379	365
150	–	418	–	–	416	410	416	416	416	404
200	448	471	458	–	474	–	469	469	466	452
250	508	537	523	–	537	–	537	537	535	526
300	558	590	578	–	602	–	587	587	582	576

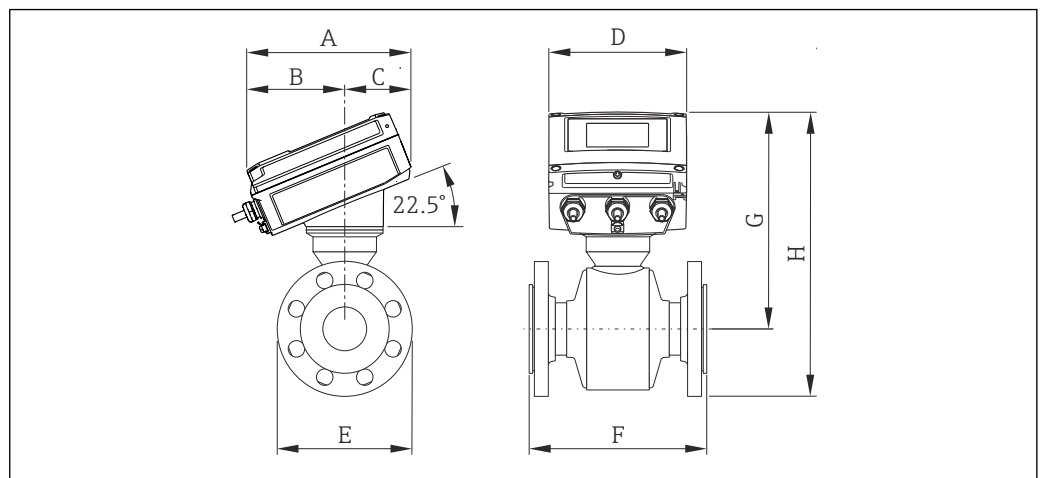
Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension H						
DN [mm]	EN (DIN)		ASME	AS		JIS
	PN 16 [mm]	PN 40 [mm]	Class 150 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]
50	–	294	286	–	–	289
65	316	–	–	–	–	311
80	329	–	324	321	321	321
100	334	–	339	331	331	329
125	354	–	–	–	–	354
150	384	–	381	381	381	381
200	424	–	427	422	422	419
250	478	–	478	478	478	476
300	531	–	544	529	529	524

Order code for "Sensor option", option CA in combination with order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N



- Order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N available for order in conjunction with order code for "Housing", option Q "Compact, polycarbonate, inclined"
- Order code for "Calibration flow", options H/K also available for order in conjunction with order code for "Housing", option R "Compact, aluminum, coated, inclined"



A0021329

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
25	199	119	80	167	200	268
32	199	119	80	167	200	268
40	199	119	80	167	200	268
50	199	119	80	167	200	268
65	199	119	80	167	200	281
80	199	119	80	167	200	286
100	199	119	80	167	250	298

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
125	199	119	80	167	250	311
150	199	119	80	167	300	333
200	199	119	80	167	350	358
250	199	119	80	167	450	392
300	199	119	80	167	500	417

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	F [mm]	G [mm]
50	199	119	80	167	200	268
65	199	119	80	167	200	281
80	199	119	80	167	200	286
100	199	119	80	167	250	281
125	199	119	80	167	250	286
150	199	119	80	167	300	298
200	199	119	80	167	350	311
250	199	119	80	167	450	333
300	199	119	80	167	500	358

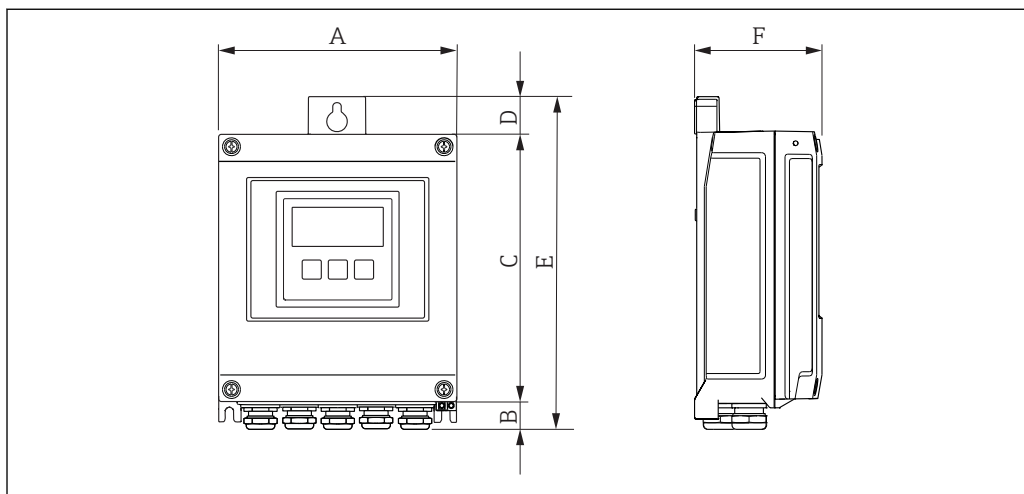
Dimension E										
DN [mm]	EN (DIN)				ASME		AS		JIS	
	PN 10 [mm]	PN 16 [mm]	PN 25 [mm]	PN 40 [mm]	Class 150 [mm]	Class 300 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]	20K [mm]
25	–	–	–	140	140	140	140	–	140	140
32	–	–	–	140	–	–	–	–	140	140
40	–	–	–	150	140	155	–	–	140	140
50	–	–	–	165	153	165	150	150	155	155
65	–	185	–	185	–	–	–	–	175	175
80	–	200	–	200	191	210	185	185	185	200
100	–	220	–	235	229	254	215	215	210	225
125	–	250	–	270	–	–	–	–	250	270
150	–	285	–	300	280	318	280	280	280	305
200	340	340	360	–	343	–	335	335	330	350
250	395	405	425	–	407	–	405	405	400	430
300	445	460	485	–	483	–	455	455	445	480

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension H										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	–	–	–	338	336	312	–	–	338	312
32	–	–	–	338	–	–	–	–	338	312
40	–	–	–	343	336	320	–	–	338	312
50	–	–	–	351	343	325	–	–	346	320
65	–	373	–	–	–	–	–	–	368	342
80	–	386	–	–	381	364	378	378	378	359
100	–	408	–	–	413	399	406	406	403	385
125	–	436	–	–	–	–	–	–	436	420
150	–	475	–	–	473	465	473	473	473	459
200	502	528	512	–	531	–	526	526	523	507
250	563	594	578	–	594	–	594	594	592	580
300	613	647	633	–	659	–	644	644	639	630

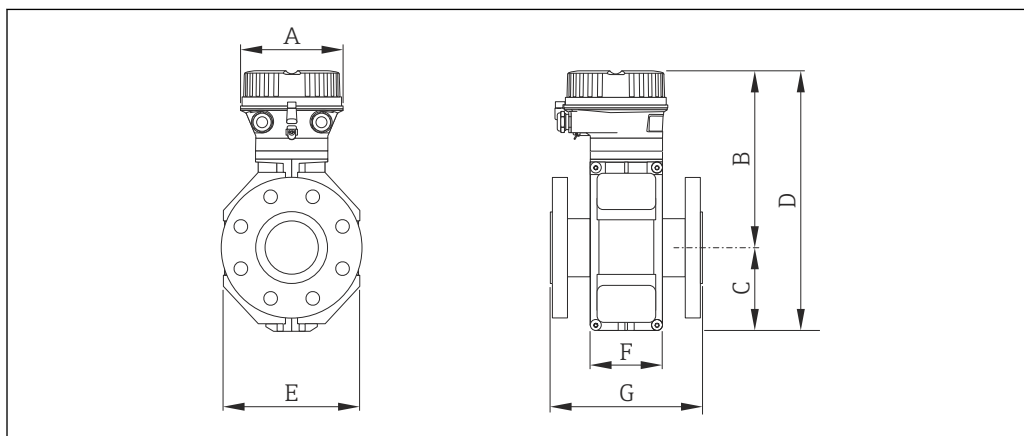
Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension H						
DN	EN (DIN)		ASME	AS		JIS
	PN 16	PN 40	Class 150	Table E	PN 16	10K
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	–	351	345	–	–	346
65	373	–	–	–	–	368
80	386	–	382	378	378	378
100	391	–	396	388	388	386
125	411	–	–	–	–	411
150	441	–	438	438	438	438
200	481	–	483	479	479	476
250	535	–	537	536	536	533
300	588	–	600	586	586	581

Remote version*Transmitter remote version**Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"*

A0020522

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
167	21	187	24	232	80

Sensor remote version

A0017282

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN ¹⁾ [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G ²⁾ [mm]
25	136	200	84	284	120	94	200
32	136	200	84	284	120	94	200
40	136	200	84	284	120	94	200
50	136	200	84	284	120	94	200
65	136	225	109	334	180	94	200
80	136	225	109	334	180	94	200

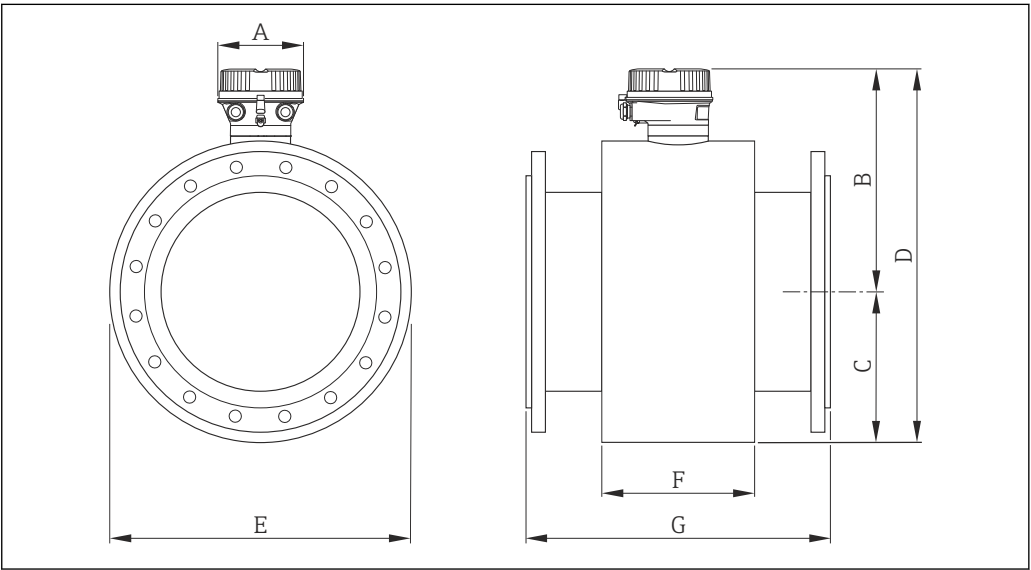
DN ¹⁾	A	B	C	D	E	F	G ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
100	136	225	109	334	180	94	250
125	136	265	150	415	260	140	250
150	136	265	150	415	260	140	300
200	136	290	180	470	324	156	350
250	136	315	205	520	400	156	450
300	136	340	230	570	460	166	500

- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾	A	B	C	D	E	F	G ²⁾
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	136	200	84	284	120	94	200
65	136	200	84	284	120	94	200
80	136	225	109	334	180	94	200
100	136	225	109	334	180	94	250
125	136	225	109	334	180	94	250
150	136	225	109	334	180	94	300
200	136	265	150	415	260	140	350
250	136	265	150	415	260	140	450
300	136	290	180	470	324	156	500

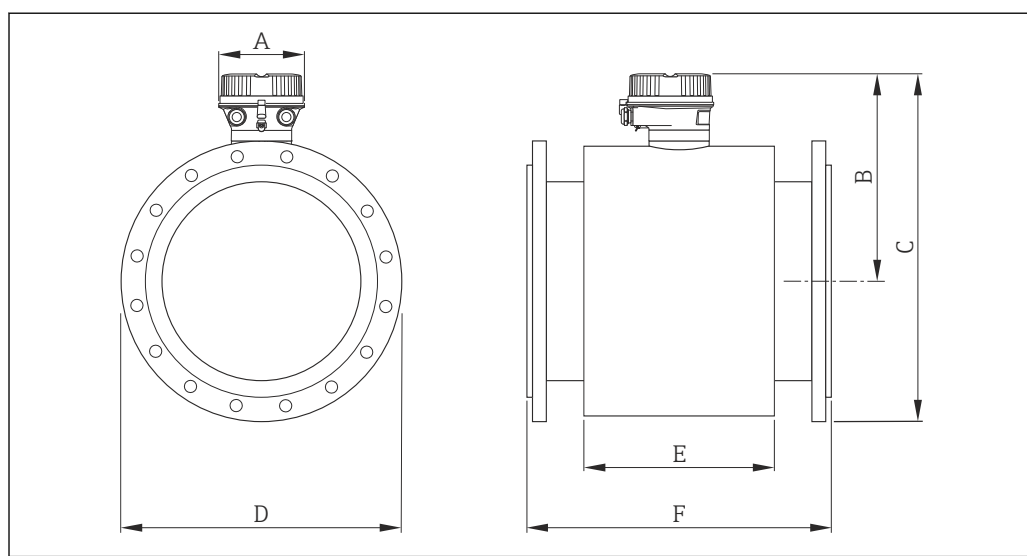
- 1) EN (DIN), AS, JIS; For flanges according to AS, only nominal diameters DN 80, 100 and 150 to 300 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



DN ¹⁾ [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G ²⁾ [mm]
350	136	407	282	689	564	288	550
375	136	433	308	741	616	288	600
400	136	433	308	741	616	288	600
450	136	458	333	791	666	292	650
500	136	483	359	842	717	292	650
600	136	535	411	946	821	402	780
700	136	637	512	1149	1024	589	910
750	136	637	512	1149	1024	626	975
800	136	658	534	1192	1067	647	1040
900	136	735	610	1345	1220	785	1170
1000	136	811	686	1497	1372	862	1300
1050	136	837	712	1549	1424	912	1365
1200	136	936	811	1747	1622	992	1560
1350	136	1037	912	1949	1824	1252	1755
1400	136	1112	987	2099	1974	1252	1820
1500	136	1136	1011	2147	2022	1392	1950
1600	136	1181	1056	2237	2112	1482	2080
1650	136	1218	1093	2311	2186	1482	2145
1800	136	1313	1188	2501	2376	1632	2340
2000	136	1363	1238	2601	2476	1732	2600

- 1) EN (DIN), AS; For flanges according to AS, only nominal diameters DN 350, 400, 500 and 600 are available.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option A "Insertion length short"



A0017284

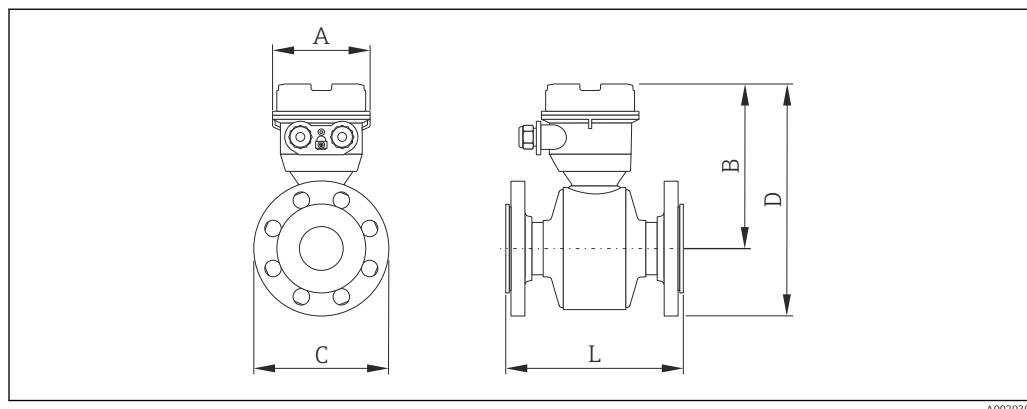
DN [mm]	A [mm]	B [mm]	E [mm]	F [mm]
350	136	358	290	550
375	136	384	290	600
400	136	384	290	600
450	136	412	290	600
500	136	437	290	600
600	136	478	290	600
700	136	543	424	700
750	136	579	454	750
800	136	599	500	800
900	136	649	580	900
1000	136	699	664	1000
1050	136	735	759	1050
1200	136	813	832	1200
1350	136	925	1008	1350
1400	136	925	1008	1400
1500	136	1025	1147	1500
1600	136	1025	1147	1600
1650	136	1076	1284	1650
1800	136	1133	1379	1800
2000	136	1244	1569	2000

DN [mm]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
350	603	610	616	625	620	603	653	490	505	520	533	525	490	540
375	–	–	–	–	659	–	–	–	–	–	–	550	–	–
400	654	666	672	682	674	673	718	540	565	580	597	580	560	605
450	709	719	729	729	732	733	788	595	615	640	635	640	620	675
500	759	772	791	786	789	788	843	645	670	715	699	705	675	730
600	855	868	903	884	890	908	958	755	780	840	813	825	795	845
700	973	990	1009	1006	998	1018	–	860	895	910	927	910	905	–
750	–	–	–	1072	1078	1083	–	–	–	–	984	995	970	–
800	1087	1107	1123	1129	1129	–	–	975	1015	1025	1060	1060	–	–
900	1187	1207	1223	1233	1237	–	–	1075	1115	1125	1168	1175	–	–
1000	1287	1314	1338	1344	1327	–	–	1175	1230	1225	1289	1255	–	–
1050	–	–	–	1408	–	–	–	–	–	–	1346	–	–	–
1200	1516	1541	1567	1569	1558	–	–	1405	1455	1255	1511	1490	–	–
1350	–	–	–	1767	–	–	–	–	–	–	1683	–	–	–
1400	1740	1763	1779	–	–	–	–	1630	1675	1685	–	–	–	–
1500	–	–	–	1952	–	–	–	–	–	–	1854	–	–	–

DN [mm]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
1600	1940	1983	2002	–	–	–	–	1830	1915	1930	–	–	–	–
1650	–	–	–	2092	–	–	–	–	–	–	2032	–	–	–
1800	2155	2190	2209	2231	–	–	–	2045	2115	2130	2197	–	–	–
2000	2376	2406	2427	2425	–	–	–	2265	2325	2345	2362	–	–	–

Order code for "Sensor option", option CA...CE "Corrosion protection"

Option	Description
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M
CB	IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CC	IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CD	Buried IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 Im2/Im3
CE	Buried IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 Im2/Im3



A0020399

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [mm]	A [mm]	B [mm]	L [mm]
25	112	188	200
32	112	188	200
40	112	188	200
50	112	188	200
65	112	201	200
80	112	206	200
100	112	218	250
125	112	231	250
150	112	253	300
200	112	278	350
250	112	312	450
300	112	337	500

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN [mm]	A [mm]	B [mm]	L [mm]
50	112	188	200
65	112	201	200
80	112	206	200
100	112	201	250
125	112	206	250
150	112	218	300
200	112	231	350
250	112	253	450
300	112	278	500

Dimension C										
DN [mm]	EN (DIN)				ASME		AS		JIS	
	PN 10 [mm]	PN 16 [mm]	PN 25 [mm]	PN 40 [mm]	Class 150 [mm]	Class 300 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]	20K [mm]
25	–	–	–	140	110	140	140	–	140	140
32	–	–	–	140	–	–	–	–	140	140
40	–	–	–	150	125	155	–	–	140	140
50	–	–	–	165	150	165	150	150	155	155
65	–	185	–	185	–	–	–	–	175	175
80	–	200	–	200	190	209.6	185	185	185	200
100	–	220	–	325	230	254	215	215	210	225
125	–	250	–	270	–	–	–	–	250	270
150	–	285	–	300	280	317.5	280	280	280	305
200	340	340	360	–	345	–	335	335	330	350
250	395	405	425	–	405	–	405	405	400	430
300	445	460	485	–	485	–	455	455	445	480

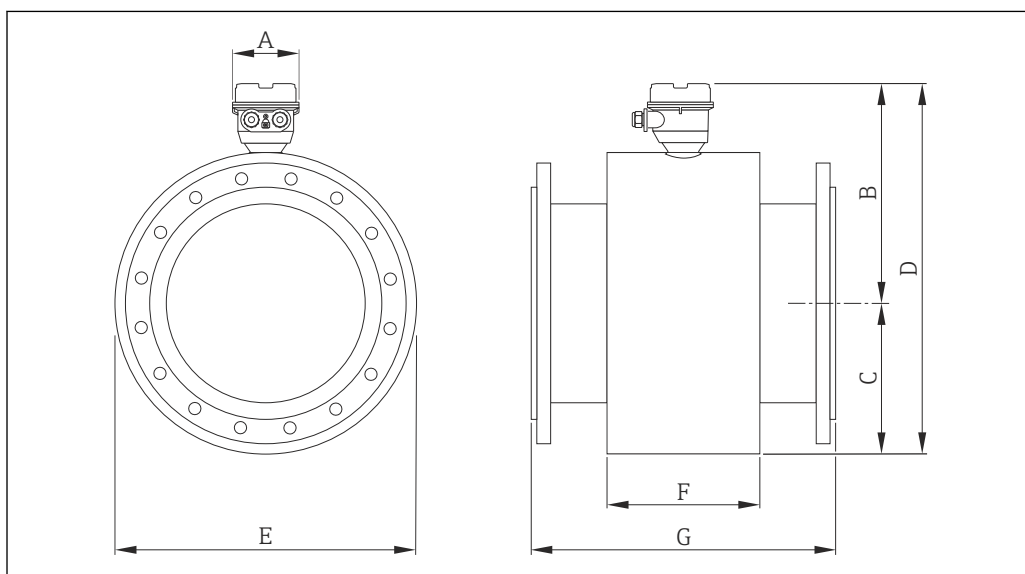
Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension D										
DN [mm]	EN (DIN)				ASME		AS		JIS	
	PN 10 [mm]	PN 16 [mm]	PN 25 [mm]	PN 40 [mm]	Class 150 [mm]	Class 300 [mm]	Table E [mm]	PN 16 [mm]	10K [mm]	20K [mm]
25	–	–	–	259	258	260	–	–	259	260
32	–	–	–	259	–	–	–	–	259	260
40	–	–	–	263	258	267	–	–	259	260
50	–	–	–	271	263	272	–	–	266	267
65	–	293	–	–	–	–	–	–	288	290
80	–	306	–	–	301	311	298	298	298	307

Dimension D										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
100	–	328	–	–	333	346	326	326	323	332
125	–	356	–	–	–	–	–	–	356	367
150	–	395	–	–	393	412	393	393	393	406
200	450	448	460	–	451	–	446	446	443	454
250	510	514	525	–	514	–	514	514	512	528
300	560	567	580	–	579	–	564	564	559	578

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension D						
DN	EN (DIN)		ASME	AS		JIS
	PN 16	PN 40		Table E	PN 16	
[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
50	–	271	263	–	–	266
65	293	–	–	–	–	288
80	306	–	301	298	298	298
100	311	–	316	308	308	306
125	331	–	–	–	–	331
150	361	–	358	358	358	358
200	401	–	404	399	399	396
250	455	–	455	455	455	453
300	508	–	521	506	506	501



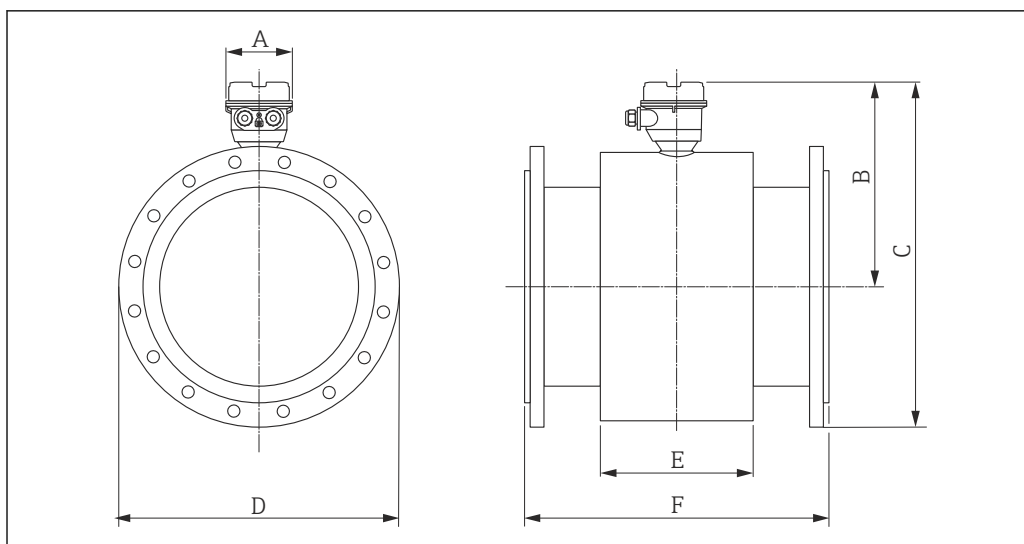
A0020435

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G ¹⁾ [mm]
350	112	395	282	677	564	288	550
375	112	421	308	729	616	288	600
400	112	421	308	729	616	288	600
450	112	446	333	779	666	292	650
500	112	472	359	830	717	292	650
600	112	524	411	934	821	402	780
700	112	625	512	1137	1024	589	910
750	112	625	512	1137	1024	626	975
800	112	647	534	1180	1067	647	1040
900	112	723	610	1333	1220	785	1170
1000	112	799	686	1485	1372	862	1300
1050	112	825	712	1537	1424	912	1365
1200	112	924	811	1735	1622	992	1560
1350	112	1025	912	1937	1824	1252	1755
1400	112	1100	987	2087	1974	1252	1820
1500	112	1124	1011	2135	2022	1392	1950
1600	112	1169	1056	2225	2112	1482	2080
1650	112	1206	1093	2299	2186	1482	2145
1800	112	1301	1188	2489	2376	1632	2340
2000	112	1351	1238	2589	2476	1732	2600

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option A "Insertion length short" and order code for "Sensor option", option CA...CE "Corrosion protection"

Option	Description
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M
CB	IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CC	IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CD	Buried IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 Im2/Im3
CE	Buried IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 Im2/Im3



A0018158

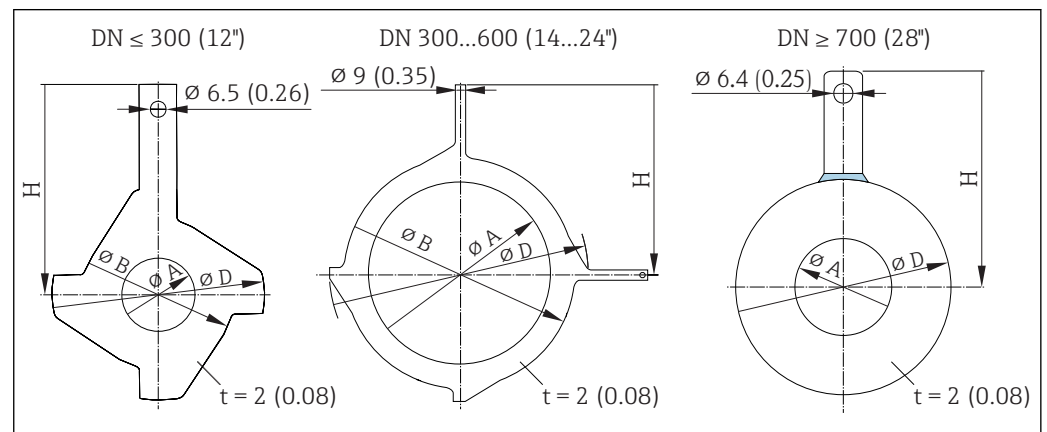
DN [mm]	A [mm]	B [mm]	E [mm]	F [mm]
350	112	350	290	550
375	112	376	290	600
400	112	376	290	600
450	112	403	290	600
500	112	428	290	600
600	112	478	290	600
700	112	549	424	700
750	112	586	454	750
800	112	605	500	800
900	112	655	580	900
1000	112	705	664	1000
1050	112	741	759	1050
1200	112	819	832	1200
1350	112	931	1008	1350
1400	112	931	1008	1400
1500	112	1031	1147	1500
1600	112	1031	1147	1600
1650	112	1082	1284	1650
1800	112	1139	1379	1800
2000	112	1250	1569	2000

DN [mm]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
350	595	603	610	–	613	603	653	490	505	520	–	525	490	540
375	–	–	–	–	651	–	–	–	–	–	–	550	–	–

DN [mm]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	10K [mm]	20K [mm]
400	646	659	666	–	666	673	718	540	565	580	–	580	560	605
450	701	711	723	–	723	733	788	595	615	640	–	640	620	675
500	751	763	786	–	781	788	843	645	670	715	–	705	675	730
600	856	868	898	–	891	908	958	755	780	840	–	825	795	845
700	979	996	1004	1012	1004	1018	–	860	895	910	927	910	905	–
750	–	–	–	1078	1084	1083	–	–	–	–	984	995	970	–
800	1093	1113	1118	1135	1135	–	–	975	1015	1025	1060	1060	–	–
900	1193	1213	1218	1239	1243	–	–	1075	1115	1125	1168	1175	–	–
1000	1293	1320	1333	1350	1333	–	–	1175	1230	1225	1289	1255	–	–
1050	–	–	–	1414	–	–	–	–	–	–	1346	–	–	–
1200	1522	1547	1562	1575	1564	–	–	1405	1455	1255	1511	1490	–	–
1350	–	–	–	1773	–	–	–	–	–	–	1683	–	–	–
1400	1746	1769	1774	–	–	–	–	1630	1675	1685	–	–	–	–
1500	–	–	–	1958	–	–	–	–	–	–	1854	–	–	–
1600	1946	1989	1997	–	–	–	–	1830	1915	1930	–	–	–	–
1650	–	–	–	2098	–	–	–	–	–	–	2032	–	–	–
1800	2161	2196	2204	2237	–	–	–	2045	2115	2130	2197	–	–	–
2000	2382	2412	2422	2431	–	–	–	2265	2325	2345	2362	–	–	–

Accessories

Ground disks for flange connections



A0015442

38 Engineering unit mm (in)

DN [mm]	Pressure rating	A [mm]	B [mm]	D [mm]	H [mm]
25	1)	26	62	77.5	87.5
32	1)	35	80	87.5	94.5
40	1)	41	82	101	103

DN [mm]	Pressure rating	A [mm]	B [mm]	D [mm]	H [mm]
50	¹⁾	52	101	115.5	108
65	¹⁾	68	121	131.5	118
80	¹⁾	80	131	154.5	135
100	¹⁾	104	156	186.5	153
125	¹⁾	130	187	206.5	160
150	¹⁾	158	217	256	184
200	¹⁾	206	267	288	205
250	¹⁾	260	328	359	240
300	¹⁾	312	375	413	273
350	DIN, PN 6	343	433	479	365
350	DIN, PN 10	343	400	479	365
350	ASME, Class 150	343	400	479	365
400	DIN, PN 6	393	470	542	395
400	DIN, PN 10	393	469	542	395
400	ASME, Class 150	393	469	542	395
450	DIN, PN 6	439	525	583	417
450	DIN, PN 10	439	535	583	417
450	ASME, Class 150	439	535	583	417
500	DIN, PN 6	493	575	650	460
500	DIN, PN 10	493	588	650	460
500	ASME, Class 150	493	588	650	460
600	DIN, PN 6	593	676	766	522
600	DIN, PN 10	593	688	766	522
600	ASME, Class 150	593	688	766	522
700	DIN, PN 6	697	–	786	460
700	DIN, PN 10	693	–	813	480
700	AS, PN 16	687	–	807	490
700	AWWA, Class D	693	–	832	494
750	AWWA, Class D	743	–	833	523
800	DIN, PN 6	799	–	893	520
800	DIN, PN 10	795	–	920	540
800	AS, PN 16	789	–	914	550
800	AWWA, Class D	795	–	940	561
900	DIN, PN 6	897	–	993	570
900	DIN, PN 10	893	–	1020	590
900	AS, PN 16	886	–	1014	595
900	AWWA, Class D	893	–	1048	615
1000	DIN, PN 6	999	–	1093	620
1000	DIN, PN 10	995	–	1127	650

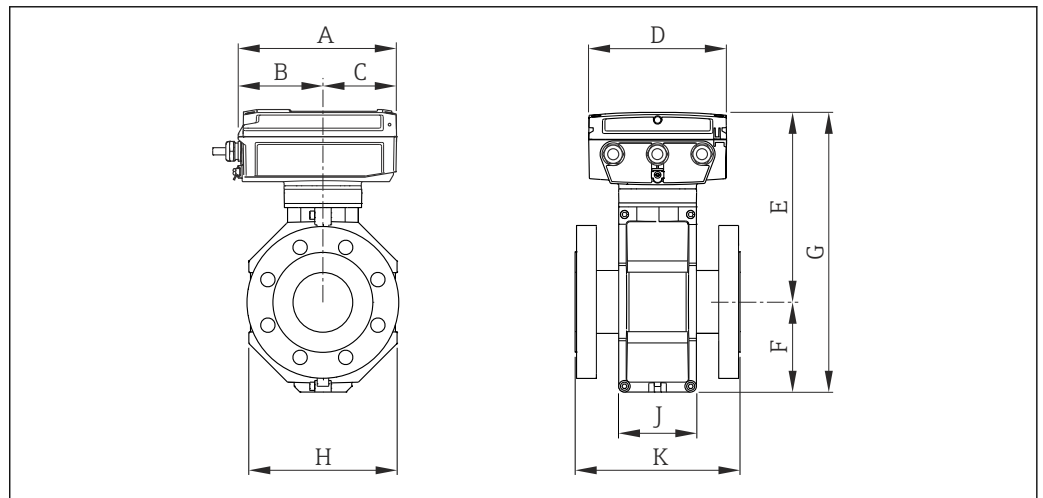
DN [mm]	Pressure rating	A [mm]	B [mm]	D [mm]	H [mm]
1000	AS, PN 16	988	–	1131	660
1000	AWWA, Class D	995	–	1163	675
1050	AWWA, Class D	1044	–	1220	704
1200	DIN, PN 6	1203	–	1310	733

- 1) Ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version.

Dimensions in US units

Compact version

Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated"



Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	J [in]	K ²⁾ [in]
1	7.60	4.06	3.54	6.57	7.91	3.31	11.2	4.72	3.70	7.87
1 ½	7.60	4.06	3.54	6.57	7.91	3.31	11.2	4.72	3.70	7.87
2	7.60	4.06	3.54	6.57	7.91	3.31	11.2	4.72	3.70	7.87
3	7.60	4.06	3.54	6.57	8.90	4.29	13.2	7.09	3.70	7.87
4	7.60	4.06	3.54	6.57	8.90	4.29	13.2	7.09	3.70	9.84
6	7.60	4.06	3.54	6.57	10.5	5.91	16.4	10.2	5.51	11.8
8	7.60	4.06	3.54	6.57	11.5	7.09	18.5	12.8	6.14	13.8
10	7.60	4.06	3.54	6.57	12.4	8.07	20.5	15.8	6.14	17.7
12	7.60	4.06	3.54	6.57	13.4	9.06	22.5	18.1	6.54	19.7

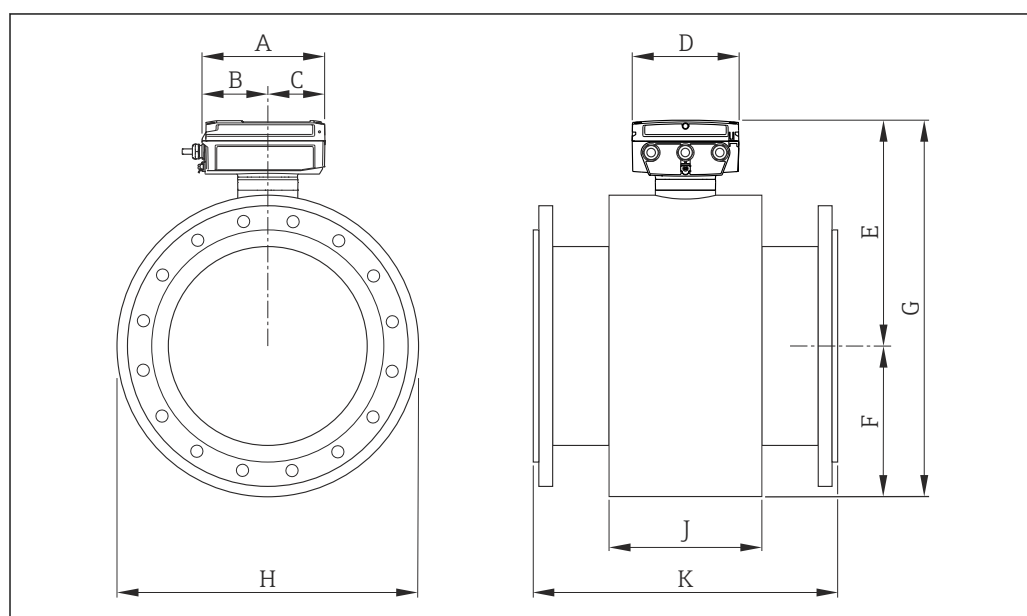
- 1) ASME
2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
2	7.60	4.06	3.54	6.57	7.91	3.31	11.2	4.72	3.70	7.87
3	7.60	4.06	3.54	6.57	8.90	4.29	13.2	7.09	3.70	7.87
4	7.60	4.06	3.54	6.57	8.90	4.29	13.2	7.09	3.70	9.84
6	7.60	4.06	3.54	6.57	8.90	4.29	13.2	7.09	3.70	11.8
8	7.60	4.06	3.54	6.57	10.5	5.91	16.4	10.2	5.51	13.8
10	7.60	4.06	3.54	6.57	10.5	5.91	16.4	10.2	5.51	17.7
12	7.60	4.06	3.54	6.57	11.5	7.09	18.5	12.8	6.14	19.7

1) ASME

2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



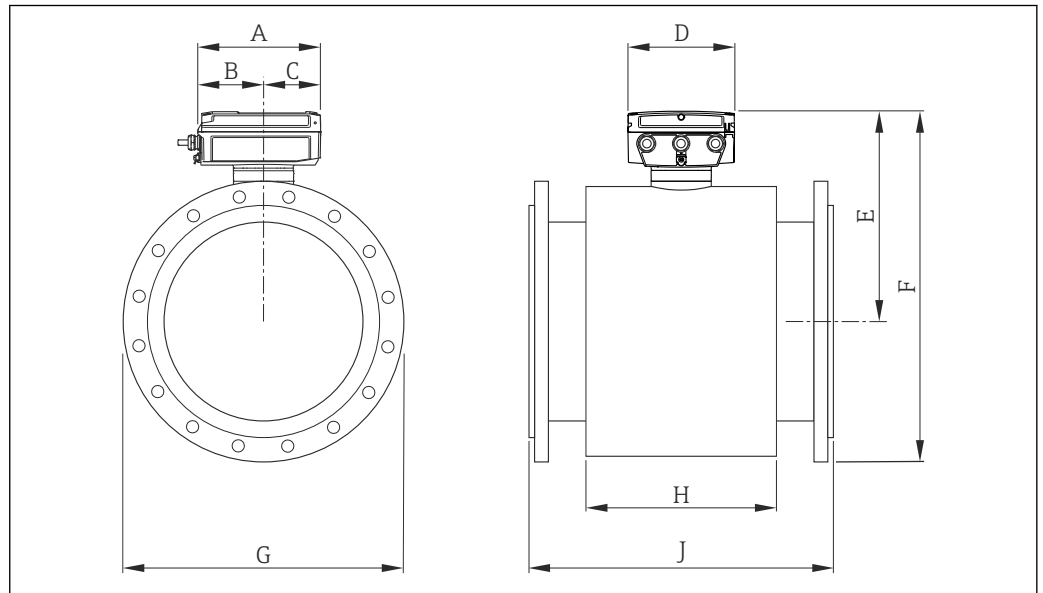
A0017154

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
14	7.60	4.06	3.54	6.57	17.0	11.1	28.1	22.2	11.3	21.7
15	7.60	4.06	3.54	6.57	18.0	12.1	30.1	24.2	11.3	23.6
16	7.60	4.06	3.54	6.57	18.0	12.1	30.1	24.2	11.3	23.6
18	7.60	4.06	3.54	6.57	19.0	13.1	32.1	26.2	11.5	25.6
20	7.60	4.06	3.54	6.57	20.0	14.1	34.1	28.2	11.5	25.6
24	7.60	4.06	3.54	6.57	22.1	16.2	38.3	32.3	15.8	30.7
28	7.60	4.06	3.54	6.57	26.1	20.1	46.2	40.3	23.2	35.8
30	7.60	4.06	3.54	6.57	26.1	20.1	46.2	40.3	24.6	38.4
32	7.60	4.06	3.54	6.57	26.9	21.0	47.9	42.0	25.5	40.9
36	7.60	4.06	3.54	6.57	29.9	24.0	53.9	48.0	30.9	46.0
40	7.60	4.06	3.54	6.57	32.9	27.0	59.9	54.0	33.9	51.2
42	7.60	4.06	3.54	6.57	33.9	28.0	61.9	56.0	35.9	53.7

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
48	7.60	4.06	3.54	6.57	37.8	31.9	69.7	63.8	39.0	61.4
54	7.60	4.06	3.54	6.57	41.8	35.9	77.7	71.8	42.3	69.1
60	7.60	4.06	3.54	6.57	45.7	39.8	85.5	79.6	54.8	76.8
66	7.60	4.06	3.54	6.57	48.9	43.0	91.9	86.0	58.4	84.4
72	7.60	4.06	3.54	6.57	52.7	46.8	99.5	93.5	64.2	92.1
78	7.60	4.06	3.54	6.57	54.7	48.7	103.4	97.5	68.2	102.3

- 1) ASME, AWWA; flanges ≤ 24 in only available according to ASME, flanges ≥ 28 in only available according to AWWA.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated";
order code for "Design", option A "Insertion length short"

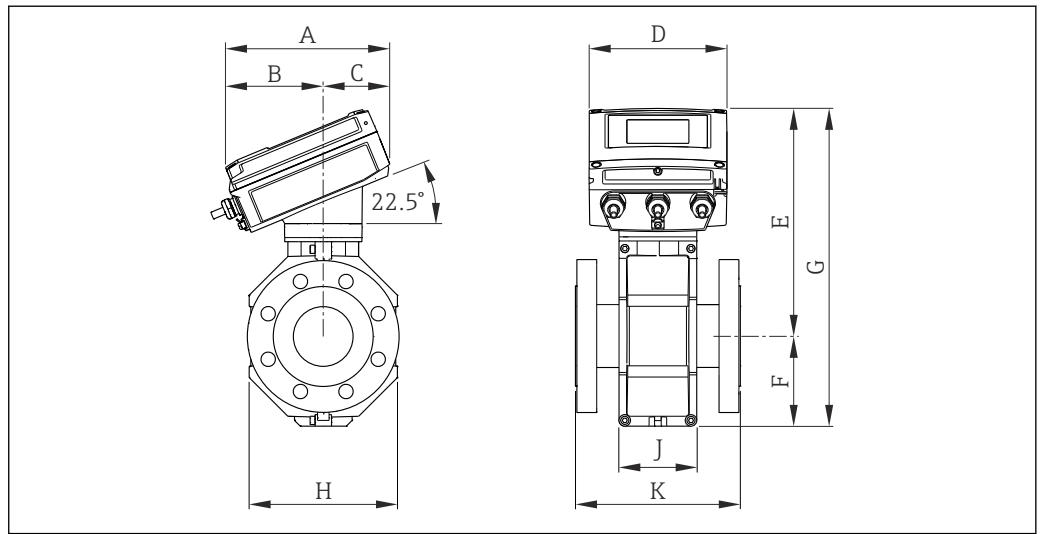


DN	A	B	C	D	E	H	J
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
14	7.60	4.06	3.54	6.57	15.2	11.4	21.6
15	7.60	4.06	3.54	6.57	16.2	11.4	23.6
16	7.60	4.06	3.54	6.57	16.2	11.4	23.6
18	7.60	4.06	3.54	6.57	17.3	11.4	23.6
20	7.60	4.06	3.54	6.57	18.3	11.4	23.6
24	7.60	4.06	3.54	6.57	19.9	11.4	23.6
28	7.60	4.06	3.54	6.57	22.5	16.7	27.6
30	7.60	4.06	3.54	6.57	23.9	17.9	29.5
32	7.60	4.06	3.54	6.57	24.7	19.7	31.5
36	7.60	4.06	3.54	6.57	26.6	22.8	35.4
40	7.60	4.06	3.54	6.57	28.6	26.2	39.4
42	7.60	4.06	3.54	6.57	30.0	29.9	41.3
48	7.60	4.06	3.54	6.57	33.1	32.8	47.2

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	H [in]	J [in]
54	7.60	4.06	3.54	6.57	37.5	39.7	53.1
60	7.60	4.06	3.54	6.57	41.4	45.2	59.0
66	7.60	4.06	3.54	6.57	43.4	50.6	64.9
72	7.60	4.06	3.54	6.57	45.7	54.3	70.8
78	7.60	4.06	3.54	6.57	50.1	61.8	78.7

DN [in]	Dimension F							Dimension G						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]
14	24.8	25.1	27.6	25.7	25.5	23.74	25.71	19.3	19.9	20.5	21.0	20.7	19.29	21.26
15	–	–	–	–	27	–	–	–	–	–	–	21.7	–	–
16	26.8	27.3	30.0	27.0	27.6	26.50	28.27	21.3	22.2	22.8	23.5	22.8	22.05	23.82
18	29.0	29.4	32.4	29.8	29.9	28.86	31.02	23.4	24.2	25.2	25.0	25.2	24.41	26.57
20	31.0	31.5	36.5	32.0	32.1	31.02	33.19	25.4	26.4	28.1	27.5	27.8	26.57	28.74
24	34.7	35.3	40.4	35.9	36.1	35.75	37.72	29.7	30.7	33.1	32.0	32.5	31.30	33.27
28	39.4	40.1	45.1	40.7	40.4	40.08	–	33.9	35.2	35.8	36.5	35.8	35.63	–
30	–	–	–	43.3	43.5	42.64	–	–	–	–	38.7	39.2	38.19	–
32	43.9	44.7	48.8	45.5	45.5	–	–	38.4	40.0	40.4	41.7	41.7	–	–
36	47.8	48.6	48.8	49.6	49.8	–	–	42.3	43.9	44.3	46.0	46.3	–	–
40	51.7	52.8	53.4	54.0	53.3	–	–	46.3	48.4	49.4	50.7	49.4	–	–
42	–	–	–	56.5	–	–	–	–	–	–	53.0	–	–	–
48	60.8	61.7	62.4	62.9	62.4	–	–	55.3	57.3	58.5	59.5	58.7	–	–
54	–	–	–	70.6	–	–	–	–	–	–	66.3	–	–	–
60	–	–	–	77.9	–	–	–	–	–	–	73.0	–	–	–
66	–	–	–	83.4	–	–	–	–	–	–	80.0	–	–	–
72	85.9	87.3	87.6	88.9	–	–	–	80.5	83.3	83.9	86.5	–	–	–
78	94.6	95.8	96.2	96.6	–	–	–	89.2	91.5	92.3	93.0	–	–	–

Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"



A0020353

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1	7.83	4.69	3.15	6.57	9.76	3.31	13.1	4.72	3.70	7.87
1 ½	7.83	4.69	3.15	6.57	9.76	3.31	13.1	4.72	3.70	7.87
2	7.83	4.69	3.15	6.57	9.76	3.31	13.1	4.72	3.70	7.87
3	7.83	4.69	3.15	6.57	10.7	4.29	15.0	7.09	3.70	7.87
4	7.83	4.69	3.15	6.57	10.7	4.29	15.0	7.09	3.70	9.84
6	7.83	4.69	3.15	6.57	12.3	5.91	18.2	10.2	5.51	11.8
8	7.83	4.69	3.15	6.57	13.3	7.09	20.4	12.8	6.14	13.8
10	7.83	4.69	3.15	6.57	14.3	8.07	22.4	15.8	6.14	17.7
12	7.83	4.69	3.15	6.57	15.3	9.06	24.3	18.1	6.54	19.7

1) ASME

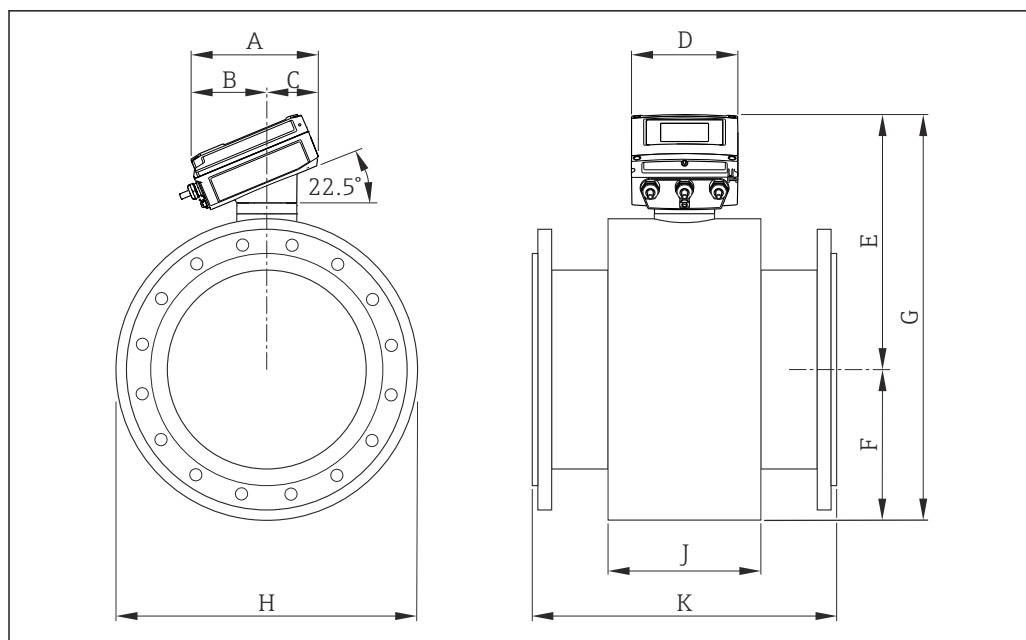
2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
2	7.83	4.69	3.15	6.57	9.76	3.31	13.1	4.72	3.70	7.87
3	7.83	4.69	3.15	6.57	10.7	4.29	15.0	7.09	3.70	7.87
4	7.83	4.69	3.15	6.57	10.7	4.29	15.0	7.09	3.70	9.84
6	7.83	4.69	3.15	6.57	10.7	4.29	15.0	7.09	3.70	11.8
8	7.83	4.69	3.15	6.57	12.3	5.91	18.2	10.2	5.51	13.8
10	7.83	4.69	3.15	6.57	12.3	5.91	18.2	10.2	5.51	17.7
12	7.83	4.69	3.15	6.57	13.3	7.09	20.4	12.8	6.14	19.7

1) ASME

2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



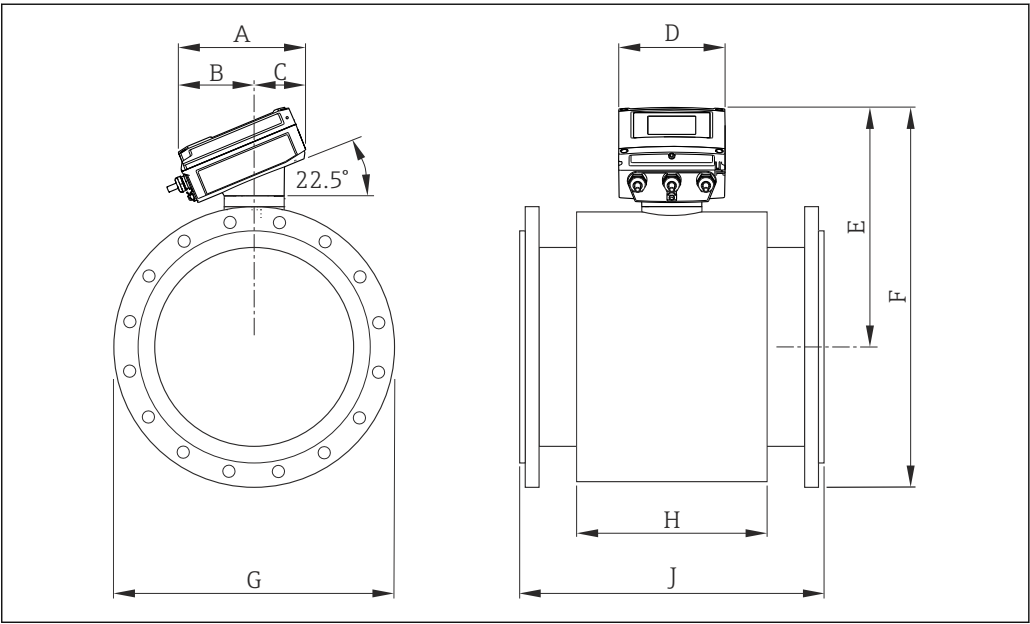
A0020396

DN ¹⁾	A	B	C	D	E	F	G	H	J	K ²⁾
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
14	7.83	4.69	3.15	6.57	18.8	11.1	29.9	22.2	11.3	21.7
15	7.83	4.69	3.15	6.57	19.8	12.1	31.9	24.2	11.3	23.6
16	7.83	4.69	3.15	6.57	19.8	12.1	31.9	24.2	11.3	23.6
18	7.83	4.69	3.15	6.57	20.8	13.1	33.9	26.2	11.5	25.6
20	7.83	4.69	3.15	6.57	21.8	14.1	35.9	28.2	11.5	25.6
24	7.83	4.69	3.15	6.57	23.8	16.2	40.0	32.3	15.8	30.7
28	7.83	4.69	3.15	6.57	27.8	20.2	48.0	40.3	23.2	35.8
30	7.83	4.69	3.15	6.57	27.8	20.2	48.0	40.3	24.6	38.4
32	7.83	4.69	3.15	6.57	28.7	21.0	49.7	42.0	25.5	40.9
36	7.83	4.69	3.15	6.57	32.7	24.0	55.7	48.0	30.9	46.0
40	7.83	4.69	3.15	6.57	34.7	27.0	61.7	54.0	33.9	51.2
42	7.83	4.69	3.15	6.57	35.7	28.0	63.7	56.0	35.9	53.7
48	7.83	4.69	3.15	6.57	39.6	31.9	71.5	63.8	39.0	61.4
54	7.83	4.69	3.15	6.57	43.6	35.9	79.5	71.8	42.3	69.1
60	7.83	4.69	3.15	6.57	47.5	39.8	87.3	79.6	54.8	76.8
66	7.83	4.69	3.15	6.57	50.7	43.0	93.7	86.0	58.4	84.4
72	7.83	4.69	3.15	6.57	54.4	46.8	101.2	93.5	64.2	92.1
78	7.83	4.69	3.15	6.57	56.4	48.8	105.2	97.5	68.2	102.3

1) ASME, AWWA; flanges ≤ 24 in only available according to ASME, flanges ≥ 28 in only available according to AWWA.

2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"; order code for "Design", option A "Insertion length short"



A0020393

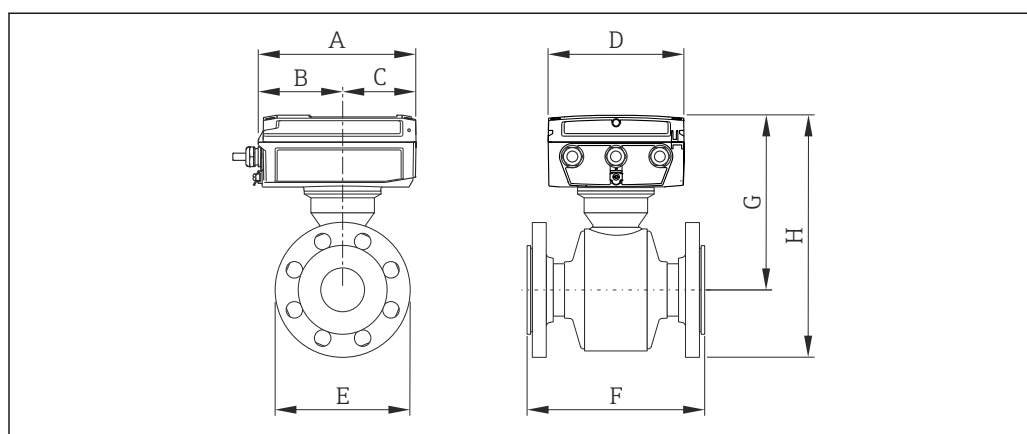
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	H [in]	J [in]
14	7.83	4.69	3.15	6.57	17.0	11.4	21.6
15	7.83	4.69	3.15	6.57	18.0	11.4	23.6
16	7.83	4.69	3.15	6.57	18.0	11.4	23.6
18	7.83	4.69	3.15	6.57	19.1	11.4	23.6
20	7.83	4.69	3.15	6.57	20.1	11.4	23.6
24	7.83	4.69	3.15	6.57	21.7	11.4	23.6
28	7.83	4.69	3.15	6.57	24.3	16.7	27.6
30	7.83	4.69	3.15	6.57	25.7	17.9	29.5
32	7.83	4.69	3.15	6.57	26.5	19.7	31.5
36	7.83	4.69	3.15	6.57	28.4	22.8	35.4
40	7.83	4.69	3.15	6.57	30.4	26.2	39.4
42	7.83	4.69	3.15	6.57	31.8	29.9	41.3
48	7.83	4.69	3.15	6.57	34.9	32.8	47.2
54	7.83	4.69	3.15	6.57	39.3	39.7	53.1
60	7.83	4.69	3.15	6.57	43.2	45.2	59.0
66	7.83	4.69	3.15	6.57	45.2	50.6	64.9
72	7.83	4.69	3.15	6.57	47.5	54.3	70.8
78	7.83	4.69	3.15	6.57	51.9	61.8	78.7

DN [in]	Dimension F							Dimension G						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]
14	26.6	26.9	24.3	27.5	27.3	23.74	25.71	19.3	19.9	20.5	21.0	20.7	19.29	21.26
15	–	–	–	–	28.8	–	–	–	–	–	–	21.7	–	–
16	28.6	29.1	26.5	28.8	29.4	26.50	28.27	21.3	22.2	22.8	23.5	22.8	22.05	23.82
18	30.8	31.2	28.8	31.6	31.7	28.86	31.02	23.4	24.2	25.2	25.0	25.2	24.41	26.57
20	32.8	33.3	31.3	33.8	33.9	31.02	33.19	25.4	26.4	28.1	27.5	27.8	26.57	28.74
24	36.5	37.1	35.4	37.7	37.9	35.75	37.72	29.7	30.7	33.1	32.0	32.5	31.30	33.27
28	41.2	41.9	39.7	42.5	42.2	40.08	–	33.9	35.2	35.8	36.5	35.8	35.63	–
30	–	–	–	45.1	45.3	42.64	–	–	–	–	38.7	39.2	38.19	–
32	45.7	46.5	43.8	47.3	47.3	–	–	38.4	40.0	40.4	41.7	41.7	–	–
36	49.6	50.4	47.7	51.4	49.8	–	–	42.3	43.9	44.3	46.0	46.3	–	–
40	53.5	54.6	52.2	55.8	55.1	–	–	46.3	48.4	48.2	50.7	49.4	–	–
42	–	–	–	58.3	–	–	–	–	–	–	53.0	–	–	–
48	62.6	63.5	61.3	64.7	64.2	–	–	55.3	57.3	49.4	59.5	58.7	–	–
54	–	–	–	72.4	–	–	–	–	–	–	66.3	–	–	–
60	–	–	–	79.7	–	–	–	–	–	–	73.0	–	–	–
66	–	–	–	85.2	–	–	–	–	–	–	80.0	–	–	–
72	87.7	89.1	86.5	90.7	–	–	–	80.5	83.3	83.9	86.5	–	–	–
78	96.4	97.6	95.1	98.4	–	–	–	89.2	91.5	92.3	93.0	–	–	–

Order code for "Sensor option", option CA in combination with order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N



- Order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N available for order in conjunction with order code for "Housing", option M "Compact, polycarbonate"
- Order code for "Calibration flow", options H/K also available for order in conjunction with order code for "Housing", option A "Compact, aluminum, coated"



A0021328

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and
 order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [in]	A [in]	B [in]	C [in]	D [in]	F [in]	G [in]
1	7.60	4.06	3.54	6.57	7.87	8.31
2	7.60	4.06	3.54	6.57	7.87	8.31
3	7.60	4.06	3.54	6.57	7.87	9.00
4	7.60	4.06	3.54	6.57	9.84	9.49
6	7.60	4.06	3.54	6.57	11.8	10.8
8	7.60	4.06	3.54	6.57	13.8	11.9
10	7.60	4.06	3.54	6.57	17.7	13.2
12	7.60	4.06	3.54	6.57	19.7	14.2

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet
 runs, constricted meas.tube"

DN [in]	A [in]	B [in]	C [in]	D [in]	F [in]	G [in]
2	7.60	4.06	3.54	6.57	7.87	8.31
3	7.60	4.06	3.54	6.57	7.87	9.00
4	7.60	4.06	3.54	6.57	9.84	9.00
6	7.60	4.06	3.54	6.57	11.8	9.49
8	7.60	4.06	3.54	6.57	13.8	10.0
10	7.60	4.06	3.54	6.57	17.7	10.8
12	7.60	4.06	3.54	6.57	19.7	11.9

Dimension E										
DN [in]	EN (DIN)				ASME		AS		JIS	
	PN 10 [in]	PN 16 [in]	PN 25 [in]	PN 40 [in]	Class 150 [in]	Class 300 [in]	Table E [in]	PN 16 [in]	10K [in]	20K [in]
1	–	–	–	5.51	5.51	5.51	5.51	–	5.51	5.51
2	–	–	–	6.50	6.02	6.50	5.91	5.91	6.10	6.10
3	–	7.87	–	7.87	7.52	8.27	7.28	7.28	7.28	7.87
4	–	8.66	–	9.25	9.02	10.0	8.46	8.46	8.27	8.86
6	–	11.2	–	11.8	11.0	12.5	11.0	11.0	11.0	12.0
8	13.4	13.4	14.2	–	13.5	–	13.2	13.2	13.0	13.8
10	15.6	15.9	16.7	–	16.0	–	15.9	15.9	15.8	16.9
12	17.5	18.1	19.1	–	19.0	–	17.9	17.9	17.5	18.9

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension H										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1	–	–	–	11.1	11.1	10.2	–	–	11.1	10.2
2	–	–	–	11.6	11.3	10.6	–	–	11.4	10.4
3	–	12.9	–	–	12.7	12.2	12.6	12.6	12.6	12
4	–	13.8	–	–	14.0	13.5	13.7	13.7	13.6	13
6	–	16.5	–	–	16.4	16.1	16.4	16.4	16.4	15.9
8	17.6	18.5	18	–	18.6	–	18.4	18.4	18.3	17.8
10	20	21.1	20.6	–	21.1	–	21.1	21.1	21.0	20.7
12	22	23.2	22.8	–	23.7	–	23.1	23.1	22.9	22.7

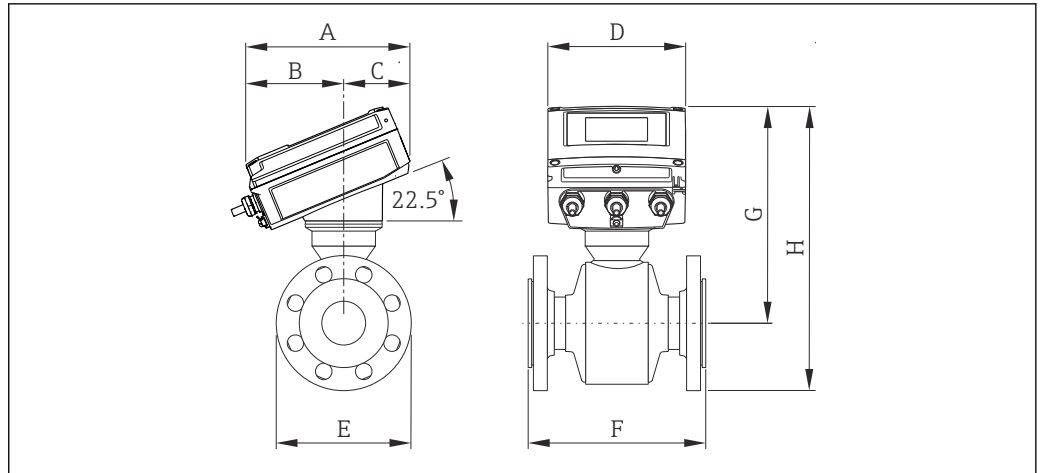
Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension H						
DN	EN (DIN)		ASME	AS		JIS
	PN 16	PN 40	Class 150	Table E	PN 16	10K
[in]	[in]	[in]	[in]	[in]	[in]	[in]
2	–	11.6	11.3	–	–	11.4
3	12.9	–	12.7	12.6	12.6	12.6
4	13.1	–	13.3	13.0	13.0	12.9
6	15.1	–	15.0	15.0	15.0	15.0
8	16.7	–	16.8	16.6	16.6	16.5
10	18.8	–	18.8	18.8	18.8	18.7
12	20.9	–	21.4	20.8	20.8	20.6

Order code for "Sensor option", option CA in combination with order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N



- Order code for "Calibration flow", options A/B/D/E/F/G/H/K/M/N available for order in conjunction with order code for "Housing", option Q "Compact, polycarbonate, inclined"
- Order code for "Calibration flow", options H/K also available for order in conjunction with order code for "Housing", option R "Compact, aluminum, coated, inclined"



A0021329

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and
 order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [in]	A [in]	B [in]	C [in]	D [in]	F [in]	G [in]
1	7.83	4.69	3.15	6.57	7.87	10.6
2	7.83	4.69	3.15	6.57	7.87	10.6
3	7.83	4.69	3.15	6.57	7.87	11.2
4	7.83	4.69	3.15	6.57	9.84	11.7
6	7.83	4.69	3.15	6.57	11.8	13.1
8	7.83	4.69	3.15	6.57	13.8	14.1
10	7.83	4.69	3.15	6.57	17.7	15.4
12	7.83	4.69	3.15	6.57	19.7	16.4

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN [in]	A [in]	B [in]	C [in]	D [in]	F [in]	G [in]
2	7.83	4.69	3.15	6.57	7.87	10.6
3	7.83	4.69	3.15	6.57	7.87	11.2
4	7.83	4.69	3.15	6.57	9.84	11.1
6	7.83	4.69	3.15	6.57	11.8	11.7
8	7.83	4.69	3.15	6.57	13.8	12.2
10	7.83	4.69	3.15	6.57	17.7	13.1
12	7.83	4.69	3.15	6.57	19.7	14.1

Dimension E

DN [in]	EN (DIN)				ASME		AS		JIS	
	PN 10 [in]	PN 16 [in]	PN 25 [in]	PN 40 [in]	Class 150 [in]	Class 300 [in]	Table E [in]	PN 16 [in]	10K [in]	20K [in]
1	–	–	–	5.51	5.51	5.51	5.51	–	5.51	5.51
2	–	–	–	6.50	6.02	6.50	5.91	5.91	6.10	6.10

Dimension E										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
3	–	7.87	–	7.87	7.52	8.27	7.28	7.28	7.28	7.87
4	–	8.66	–	9.25	9.02	10.0	8.46	8.46	8.27	8.86
6	–	11.2	–	11.8	11.0	12.5	11.0	11.0	11.0	12.0
8	13.4	13.4	14.2	–	13.5	–	13.2	13.2	13.0	13.8
10	15.6	15.9	16.7	–	16.0	–	15.9	15.9	15.7	16.9
12	17.5	18.1	19.1	–	19.0	–	17.9	17.9	17.5	18.9

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension H										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1	–	–	–	13.3	13.2	12.3	–	–	13.3	12.3
2	–	–	–	13.8	13.5	12.8	–	–	13.6	12.6
3	–	15.2	–	–	15.0	14.3	14.9	14.9	14.9	14.1
4	–	16.1	–	–	16.3	15.7	16.0	16.0	15.9	15.2
6	–	18.7	–	–	18.6	18.3	18.6	18.6	18.6	18.1
8	19.8	20.8	20.2	–	20.9	–	20.7	20.7	20.6	20.0
10	22.2	23.4	22.8	–	23.4	–	23.4	23.4	23.3	22.8
12	24.1	25.5	24.9	–	26.0	–	25.4	25.4	25.2	24.8

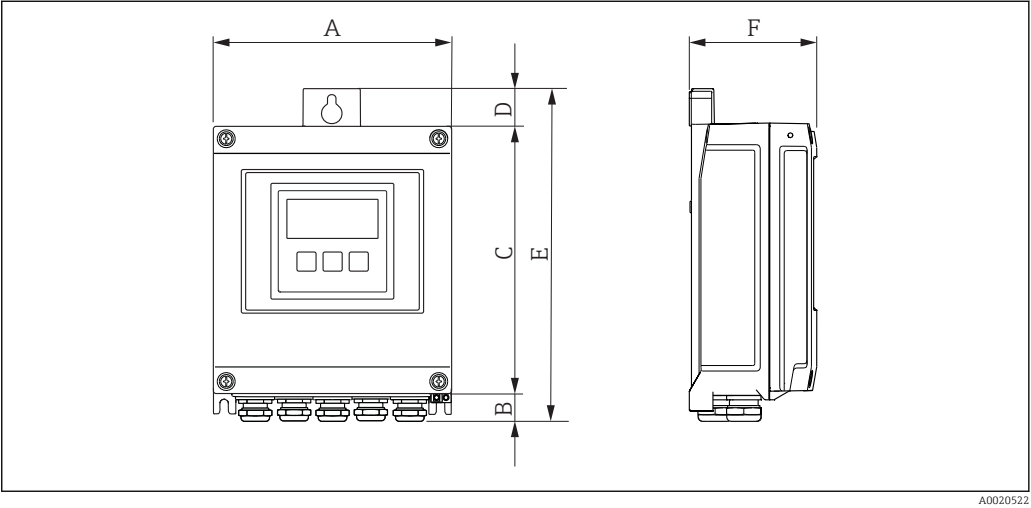
Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension H						
DN	EN (DIN)		ASME	AS		JIS
	PN 16	PN 40	Class 150	Table E	PN 16	10K
	[in]	[in]	[in]	[in]	[in]	[in]
2	–	13.8	13.6	–	–	13.6
3	15.2	–	15.0	14.9	14.9	14.9
4	15.4	–	15.6	15.3	15.3	15.2
6	17.3	–	17.3	17.3	17.3	17.3
8	18.9	–	19.0	18.9	18.9	18.7
10	21.1	–	21.1	21.1	21.1	21.0
12	23.2	–	23.6	23.1	23.1	22.9

Remote version

Transmitter remote version

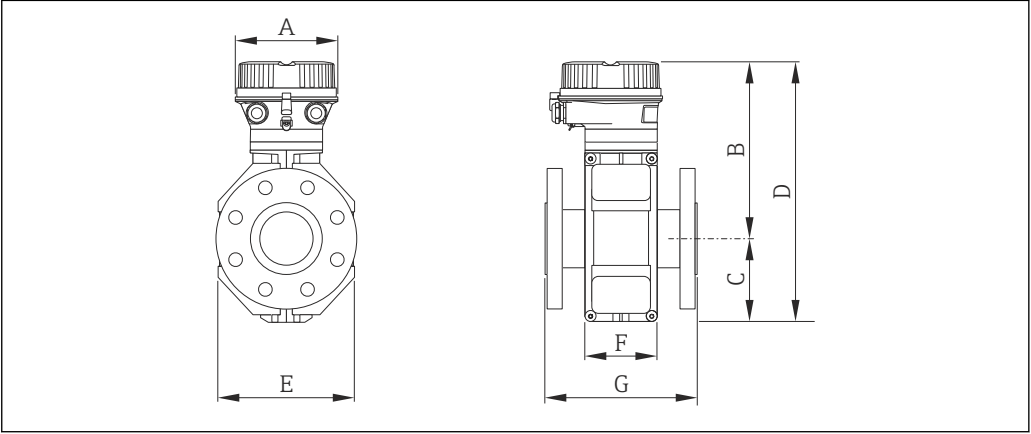
Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



A0020522

A [in]	B [in]	C [in]	D [in]	E [in]	F [in]
6.57	0.83	7.36	0.94	9.13	3.15

Sensor remote version



A0017282

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ²⁾ [in]
1	5.35	7.87	3.31	11.2	4.72	3.70	7.87
1 ½	5.35	7.87	3.31	11.2	4.72	3.70	7.87
2	5.35	7.87	3.31	11.2	4.72	3.70	7.87
3	5.35	8.86	4.29	13.1	7.09	3.70	7.87
4	5.35	8.86	4.29	13.1	7.09	3.70	9.84
6	5.35	10.4	5.91	16.3	10.2	5.51	11.8

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ²⁾ [in]
8	5.35	11.4	7.09	18.5	12.8	6.14	13.8
10	5.35	12.4	8.07	20.5	15.8	6.14	17.7
12	5.35	13.4	9.06	22.4	18.1	6.54	19.7

1) ASME

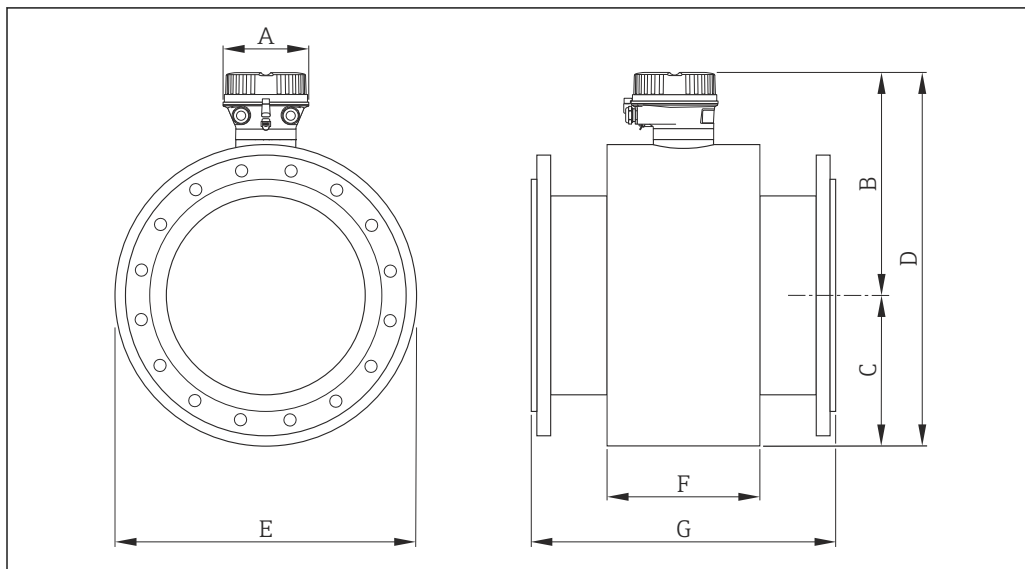
2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ²⁾ [in]
2	5.35	7.87	3.31	11.2	4.72	3.70	7.87
3	5.35	8.86	4.29	13.1	7.09	3.70	7.87
4	5.35	8.86	4.29	13.1	7.09	3.70	9.84
6	5.35	8.86	4.29	13.1	7.09	3.70	11.8
8	5.35	10.4	5.91	16.3	10.2	5.51	13.8
10	5.35	10.4	5.91	16.3	10.2	5.51	17.7
12	5.35	11.4	7.09	18.5	12.8	6.14	19.7

1) ASME

2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



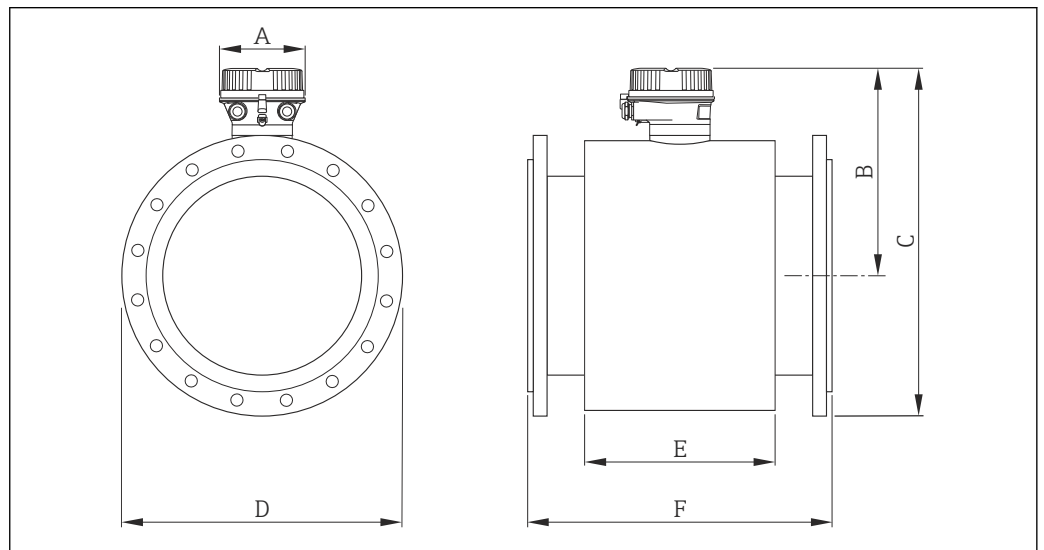
A0017283

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ²⁾ [in]
14	5.35	16.0	11.1	29.3	22.2	11.3	21.7
15	5.35	17.0	12.1	31.3	24.2	11.3	23.6
16	5.35	17.0	12.1	31.3	24.2	11.3	23.6
18	5.35	18.0	13.1	33.3	26.2	11.5	25.6
20	5.35	19.0	14.1	35.3	28.2	11.5	25.6

DN ¹⁾ [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ²⁾ [in]
24	5.35	21.1	16.2	39.4	32.3	15.8	30.7
28	5.35	25.1	20.1	45.2	40.3	23.2	35.8
30	5.35	25.1	20.1	45.2	40.3	24.6	38.4
32	5.35	25.9	21.0	46.9	42.0	25.5	40.9
36	5.35	28.9	24.0	52.9	48.0	30.9	46.0
40	5.35	31.9	27.0	58.9	54.0	33.9	51.2
42	5.35	32.9	28.0	60.9	56.0	35.9	53.7
48	5.35	36.8	31.9	68.7	63.8	39.0	61.4
54	5.35	40.8	35.9	76.7	71.8	42.3	69.1
60	5.35	44.7	39.8	84.5	79.6	54.8	76.8
66	5.35	47.9	43.0	91.0	86.0	58.4	84.4
72	5.35	51.7	46.8	98.4	93.5	64.2	92.1
78	5.35	53.6	48.7	102.4	97.5	68.2	102.3

- 1) ASME, AWWA; flanges ≤ 24 in only available according to ASME, flanges ≥ 28 in only available according to AWWA.
- 2) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option A "Insertion length short"



A0017284

DN [in]	A [in]	B [in]	E [in]	F [in]
14	5.35	14.1	11.4	21.6
15	5.35	15.1	11.4	23.6
16	5.35	15.1	11.4	23.6
18	5.35	16.2	11.4	23.6
20	5.35	17.2	11.4	23.6
24	5.35	18.8	11.4	23.6
28	5.35	21.6	16.7	27.6

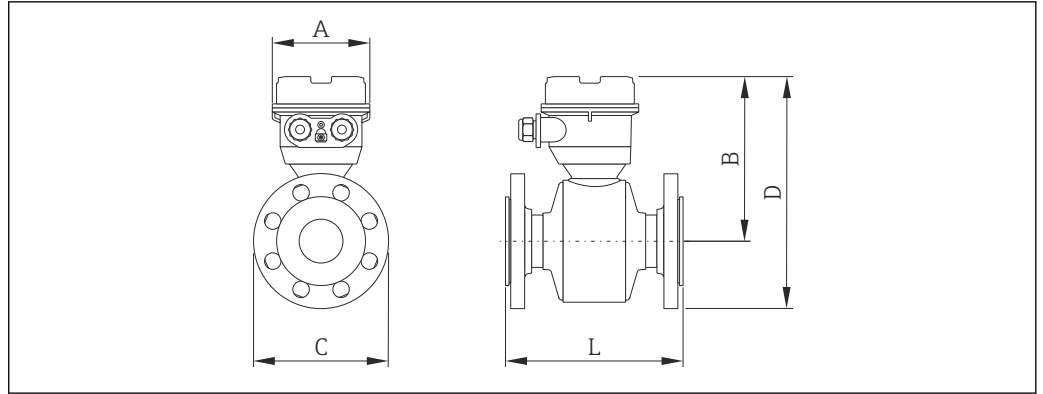
DN [in]	A [in]	B [in]	E [in]	F [in]
30	5.35	23.0	17.9	29.5
32	5.35	23.6	19.7	31.5
36	5.35	25.6	22.8	35.4
40	5.35	27.5	26.2	39.4
42	5.35	28.9	29.9	41.3
48	5.35	32.0	32.8	47.2
54	5.35	36.4	39.6	53.1
60	5.35	40.4	45.2	59.0
66	5.35	42.4	50.6	64.9
72	5.35	44.6	54.2	70.8
78	5.35	49.0	61.8	78.7

DN [in]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]
14	23.7	24.0	24.3	24.6	24.4	23.74	25.71	19.3	19.9	20.5	21.0	20.7	19.29	21.26
15	–	–	–	–	25.9	–	–	–	–	–	–	21.7	–	–
16	25.8	26.2	26.5	26.9	26.5	26.50	28.27	21.3	22.2	22.8	23.5	22.8	22.05	23.82
18	27.9	28.3	28.7	28.7	28.8	28.86	31.02	23.4	24.2	25.2	25.0	25.2	24.41	26.57
20	29.9	30.4	31.1	30.9	31.1	31.02	33.19	25.4	26.4	28.1	27.5	27.8	26.57	28.74
24	33.7	34.2	35.6	34.8	35.0	35.75	37.72	29.7	30.7	33.1	32.0	32.5	31.30	33.27
28	38.5	39.2	39.7	39.8	39.5	40.08	–	33.9	35.2	35.8	36.5	35.8	35.63	–
30	–	–	–	42.4	42.4	42.64	–	–	–	–	38.7	39.2	38.19	–
32	43.0	43.8	44.2	44.6	44.6	–	–	38.4	40.0	40.4	41.7	41.7	–	–
36	46.9	47.7	48.2	48.7	48.9	–	–	42.3	43.9	44.3	46.0	46.3	–	–
40	50.8	51.9	52.7	53.1	52.4	–	–	46.3	48.4	48.2	50.7	49.4	–	–
42	–	–	–	55.6	–	–	–	–	–	–	53.0	–	–	–
48	59.9	60.8	61.7	62.0	61.5	–	–	55.3	57.3	49.4	59.5	58.7	–	–
54	–	–	–	69.6	–	–	–	–	–	–	66.3	–	–	–
60	–	–	–	76.9	–	–	–	–	–	–	73.0	–	–	–
66	–	–	–	82.4	–	–	–	–	–	–	80.0	–	–	–
72	84.9	86.3	87.0	87.9	–	–	–	80.5	83.3	83.9	86.5	–	–	–
78	93.6	94.7	95.6	95.5	–	–	–	89.2	91.5	92.3	93.0	–	–	–

Order code for "Sensor option", option CA...CE "Corrosion protection"

Option	Description
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M
CB	IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CC	IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3

Option	Description
CD	Buried IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 Im2/Im3
CE	Buried IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 Im2/Im3



A0020399

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

DN [in]	A [in]	B [in]	E [in]
1	4.41	7.40	7.87
2	4.41	7.40	7.87
3	4.41	8.11	7.87
4	4.41	8.58	9.84
6	4.41	9.96	11.8
8	4.41	10.9	13.8
10	4.41	12.3	17.7
12	4.41	13.3	19.7

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

DN [in]	A [in]	B [in]	E [in]
2	4.41	7.40	7.87
3	4.41	8.11	7.87
4	4.41	7.91	9.84
6	4.41	8.58	11.8
8	4.41	9.09	13.8
10	4.41	9.96	17.7
12	4.41	10.9	19.7

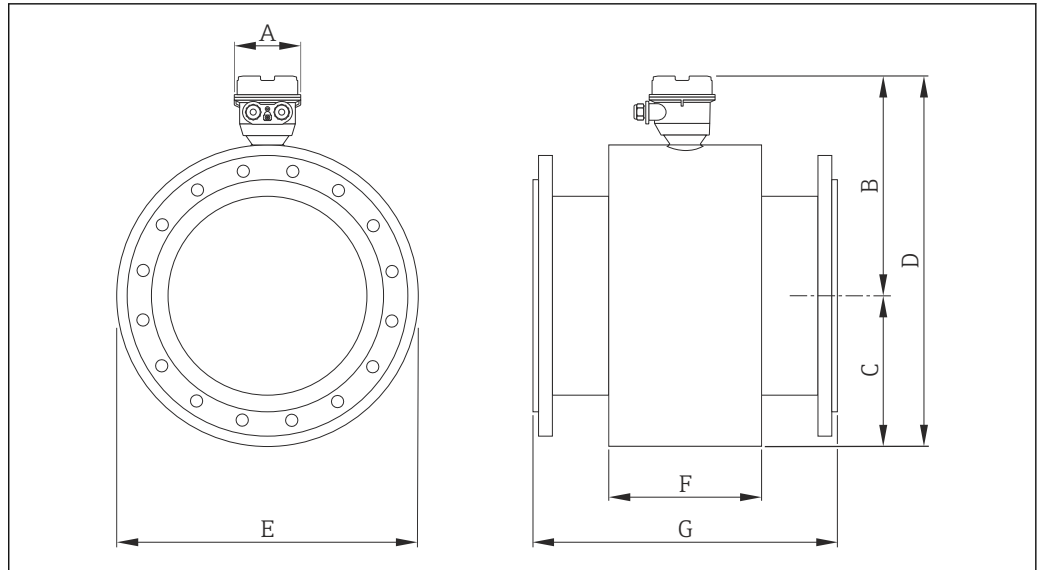
Dimension C										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1	–	–	–	5.51	4.33	5.51	5.51	–	5.51	5.51
2	–	–	–	6.50	5.91	6.50	5.91	5.91	6.10	6.10
3	–	7.87	–	7.87	7.48	8.25	7.28	7.28	7.28	7.87
4	–	8.66	–	12.8	9.06	10.0	8.46	8.46	8.27	8.86
6	–	11.2	–	11.8	11.0	12.5	11.0	11.0	11.0	12.0
8	13.4	13.4	14.2	–	13.6	–	13.2	13.2	13.0	13.8
10	15.6	15.9	16.7	–	16.0	–	15.9	15.9	15.8	16.9
12	17.5	18.1	19.1	–	19.1	–	17.9	17.9	17.5	18.9

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

Dimension D										
DN	EN (DIN)				ASME		AS		JIS	
	PN 10	PN 16	PN 25	PN 40	Class 150	Class 300	Table E	PN 16	10K	20K
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
1	–	–	–	10.2	10.2	10.2	–	–	10.2	10.2
2	–	–	–	10.6	10.4	10.7	–	–	10.5	10.5
3	–	12.0	–	–	11.8	12.2	11.7	11.7	11.7	12.1
4	–	12.9	–	–	13.1	13.6	12.8	12.8	12.7	13.1
6	–	15.6	–	–	15.5	16.2	15.5	15.5	15.5	16.0
8	17.7	17.6	18.1	–	17.7	–	17.5	17.5	17.4	17.9
10	20.1	20.2	20.7	–	20.2	–	20.2	20.2	20.1	20.8
12	22.0	22.3	22.8	–	22.8	–	22.2	22.2	22.0	22.8

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Dimension D						
DN	EN (DIN)		ASME	AS		JIS
	PN 16	PN 40		Table E	PN 16	
[in]	[in]	[in]	[in]	[in]	[in]	[in]
2	–	10.6	10.4	–	–	10.5
3	12.0	–	11.8	11.7	11.7	11.7
4	12.2	–	12.4	12.1	12.1	12.0
6	14.2	–	14.1	14.1	14.1	14.1
8	15.8	–	15.9	15.7	15.7	15.6
10	17.9	–	17.9	17.9	17.9	17.8
12	20.0	–	20.5	19.9	19.9	19.7



A0020435

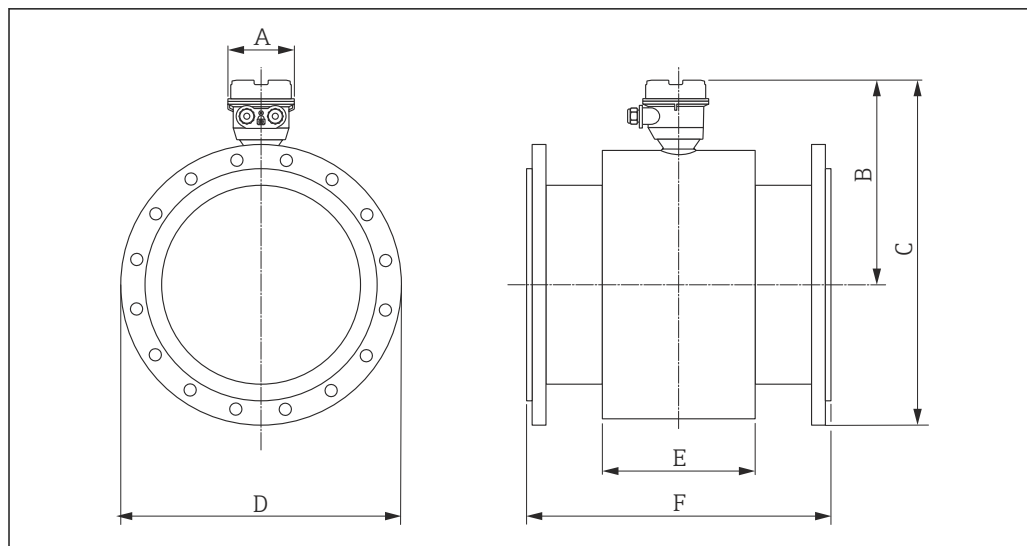
DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ¹⁾ [in]
14	4.41	15.6	11.1	26.7	22.2	11.3	21.7
15	4.41	16.6	12.1	28.7	24.2	11.3	23.6
16	4.41	16.6	12.1	28.7	24.2	11.3	23.6
18	4.41	17.6	13.1	30.7	26.2	11.5	25.6
20	4.41	18.6	14.1	32.7	28.2	11.5	25.6
24	4.41	20.6	16.2	36.8	32.3	15.8	30.7
28	4.41	24.6	20.2	44.8	40.3	23.2	35.8
30	4.41	24.6	20.2	44.8	40.3	24.6	38.4
32	4.41	25.5	21.0	46.5	42.0	25.5	40.9
36	4.41	28.5	24.0	52.5	48.0	30.9	46.0
40	4.41	31.5	27.0	58.5	54.0	33.9	51.2
42	4.41	32.5	28.0	60.5	56.0	35.9	53.7
48	4.41	36.4	31.9	68.3	63.8	39.0	61.4
54	4.41	40.4	35.9	76.3	71.8	42.3	69.1
60	4.41	44.3	39.8	84.1	79.6	54.8	76.8
66	4.41	47.5	43.0	90.5	86.0	58.4	84.4
72	4.41	51.2	46.8	98.0	93.5	64.2	92.1
78	4.41	53.2	48.7	101.9	97.5	68.2	102.3

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

Order code for "Design", option A "Insertion length short" and order code for "Sensor option", option CA...CE "Corrosion protection"

Option	Description
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M
CB	IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3
CC	IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 C5-M/Im1/Im2/Im3

Option	Description
CD	Buried IP68, Type 6P, fact-potted; corrosion protection EN ISO 12944 Im2/Im3
CE	Buried IP68, Type 6P, cust-potted; corrosion protection EN ISO 12944 Im2/Im3



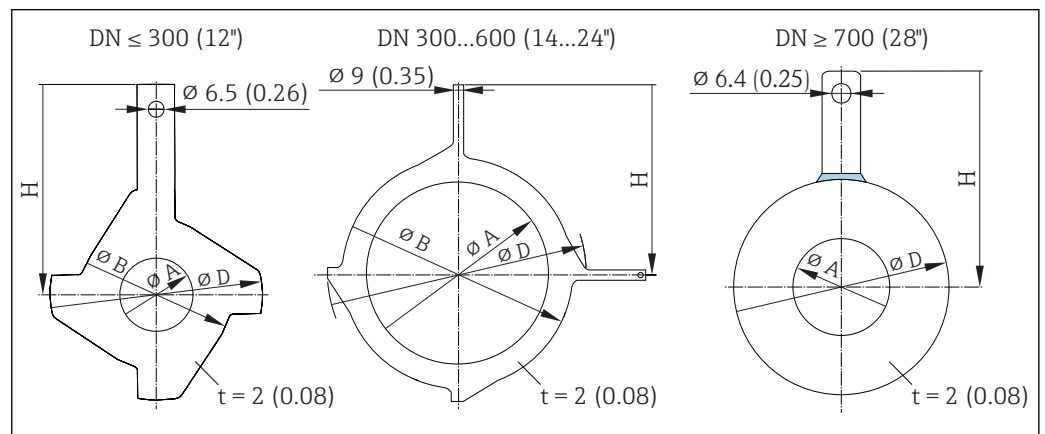
A0018158

DN [in]	A [in]	B [in]	E [in]	F [in]
14	4.41	13.8	11.4	21.7
15	4.41	14.8	11.4	23.6
16	4.41	14.8	11.4	23.6
18	4.41	15.9	11.4	23.6
20	4.41	16.9	11.4	23.6
24	4.41	18.8	11.4	23.6
28	4.41	21.6	16.7	27.6
30	4.41	23.1	17.9	29.5
32	4.41	23.8	19.7	31.5
36	4.41	25.8	22.8	35.4
40	4.41	27.8	26.2	39.4
42	4.41	29.2	29.9	41.3
48	4.41	32.2	32.8	47.2
54	4.41	36.7	39.7	53.2
60	4.41	40.6	45.2	59.1
66	4.41	42.6	50.6	65.0
72	4.41	44.8	54.3	70.9
78	4.41	49.2	61.8	78.7

DN [in]	Dimension C							Dimension D						
	EN (DIN)			ASME	AS	JIS		EN (DIN)			ASME	AS	JIS	
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	10K [in]	20K [in]
14	23.4	23.7	24.0	–	24.1	23.74	25.71	19.3	19.9	20.5	–	20.7	19.29	21.26
15	–	–	–	–	25.6	–	–	–	–	–	–	21.7	–	–
16	25.4	25.9	26.2	–	26.2	26.50	28.27	21.3	22.2	22.8	–	22.8	22.05	23.82
18	27.6	28.0	28.5	–	28.5	28.86	31.02	23.4	24.2	25.2	–	25.2	24.41	26.57
20	29.6	30.0	30.9	–	30.7	31.02	33.19	25.4	26.4	28.1	–	27.8	26.57	28.74
24	33.7	34.2	35.4	–	35.1	35.75	37.72	29.7	30.7	33.1	–	32.5	31.30	33.27
28	38.5	39.2	39.5	39.8	39.5	40.08	–	33.9	35.2	35.8	36.5	35.8	35.63	–
30	–	–	–	42.4	42.7	42.64	–	–	–	–	38.7	39.2	38.19	–
32	43.0	43.8	44.0	44.7	44.7	–	–	38.4	40.0	40.4	41.7	41.7	–	–
36	47.0	47.8	48.0	48.8	48.9	–	–	42.3	43.9	44.3	46.0	46.3	–	–
40	50.9	52.0	52.5	53.1	52.5	–	–	46.3	48.4	48.2	50.7	49.4	–	–
42	–	–	–	55.7	–	–	–	–	–	–	53.0	–	–	–
48	59.9	60.9	61.5	62.0	61.6	–	–	55.3	57.3	49.4	59.5	58.7	–	–
54	–	–	–	69.8	–	–	–	–	–	–	66.3	–	–	–
60	–	–	–	77.1	–	–	–	–	–	–	73.0	–	–	–
66	–	–	–	82.6	–	–	–	–	–	–	80.0	–	–	–
72	85.1	86.5	86.8	88.1	–	–	–	80.5	83.3	83.9	86.5	–	–	–
78	93.8	95.0	95.4	95.7	–	–	–	89.2	91.5	92.3	93.0	–	–	–

Accessories

Ground disks for flange connections



A0015442

39 Engineering unit mm (in)

DN [in]	Pressure rating	A [in]	B [in]	D [in]	H [in]
1	¹⁾	1.02	2.44	3.05	3.44
1 ¼	¹⁾	1.38	3.15	3.44	3.72
1 ½	¹⁾	1.61	3.23	3.98	4.06

DN [in]	Pressure rating	A [in]	B [in]	D [in]	H [in]
2	¹⁾	2.05	3.98	4.55	4.25
2 ½	¹⁾	2.68	4.76	5.18	4.65
3	¹⁾	3.15	5.16	6.08	5.31
4	¹⁾	4.09	6.14	7.34	6.02
5	¹⁾	5.12	7.36	8.13	6.30
6	¹⁾	6.22	8.54	10.1	7.24
8	¹⁾	8.11	10.5	11.3	8.07
10	¹⁾	10.2	12.9	14.1	9.45
12	¹⁾	12.3	14.8	16.3	10.8
14	DIN, PN 6	13.5	16.5	18.9	14.4
14	DIN, PN 10	13.5	15.8	18.9	14.4
14	ASME, Class 150	13.5	15.8	18.9	14.4
16	DIN, PN 6	15.5	18.5	21.3	15.6
16	DIN, PN 10	15.5	18.5	21.3	15.6
16	ASME, Class 150	15.5	18.5	21.3	15.6
18	DIN, PN 6	17.3	20.7	23.0	16.4
18	DIN, PN 10	17.3	21.1	23.0	16.4
18	ASME, Class 150	17.3	21.1	23.0	16.4
20	DIN, PN 6	19.4	23.3	25.6	18.1
20	DIN, PN 10	19.4	23.2	25.6	18.1
20	ASME, Class 150	19.4	23.2	25.6	18.1
24	DIN, PN 6	23.4	27.3	30.2	20.6
24	DIN, PN 10	23.4	27.1	30.2	20.6
24	ASME, Class 150	23.4	27.1	30.2	20.6
28	DIN, PN 6	27.4	–	30.9	18.1
28	DIN, PN 10	27.3	–	32.0	18.9
28	AS, PN 16	27.1	–	31.8	19.3
28	AWWA, Class D	27.3	–	32.8	19.5
30	AWWA, Class D	29.3	–	32.8	20.6
32	DIN, PN 6	31.5	–	35.2	20.5
32	DIN, PN 10	31.3	–	36.2	21.3
32	AS, PN 16	31.1	–	36.0	21.7
32	AWWA, Class D	31.3	–	37.0	22.1
36	DIN, PN 6	35.3	–	39.1	22.4
36	DIN, PN 10	35.2	–	40.2	23.2
36	AS, PN 16	34.9	–	39.9	23.4
36	AWWA, Class D	35.2	–	41.3	24.2
40	DIN, PN 6	39.3	–	43.0	24.4
40	DIN, PN 10	39.2	–	44.4	25.6

DN [in]	Pressure rating	A [in]	B [in]	D [in]	H [in]
40	AS, PN 16	38.9	–	44.5	26.0
40	AWWA, Class D	39.2	–	45.8	26.6
42	AWWA, Class D	41.1	–	48.0	27.7
48	DIN, PN 6	47.4	–	51.6	28.9

- 1) Ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version.

Weight

All values (weight exclusive of packaging material) refer to devices for standard pressure ratings.
Different values due to different transmitter versions:

Compact version

Weight data:

- Including the transmitter
 - Order code for "Housing", option **M, Q**: 1.3 kg (2.9 lb)
 - Order code for "Housing", option **A, R**: 2.0 kg (4.4 lb)
- Excluding packaging material

Weight in SI units

Standard version

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
25	PN 40	5
32	PN 40	6
40	PN 40	8
50	PN 40	9
65	PN 16	10
80	PN 16	12
100	PN 16	14
125	PN 16	20
150	PN 16	24
200	PN 10	43
250	PN 10	63
300	PN 10	68
350	PN 6	105
375	PN 6	120
400	PN 6	120
450	PN 6	161
500	PN 6	156
600	PN 6	208
700	PN 6	304
800	PN 6	357

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
900	PN 6	485
1000	PN 6	589
1200	PN 6	850
1400	PN 6	1300
1600	PN 6	1700
1800	PN 6	2200
2000	PN 6	2800

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

EN 1092-1 (DIN 2501)		
DN [mm]	Pressure rating	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
50	PN 40	9.6
65	PN 16	11.0
80	PN 16	13.4
100	PN 16	15.0
125	PN 16	24.0
150	PN 16	29.3
200	PN 16	51.3
250	PN 16	80.1
300	PN 16	93.7

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

AS 4087, PN 16	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
80	12
100	14
150	24

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

AS 4087, PN 16	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
80	13.4
100	15.0
150	29.3

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

JIS B2220, 10K	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
25	5
32	5
40	6
50	7
65	9
80	11
100	13
125	19
150	23
200	40
250	68
300	70
350	79
400	100
450	128
500	142
600	188
700	280
750	331

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

JIS B2220, 10K	
DN [mm]	Weight [kg]
	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
50	7.6
65	10.0
80	12.4
100	14.8
125	23.4
150	30.0
200	49.2
250	82.9
300	88.2

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option A

Option A "Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"

EN 1092-1			
DN [mm]	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾		
	Weight [kg]		
	PN 6	PN 10	PN 16
450	100	115	145
500	115	133	185
600	156	166	274
700	198	253	307
800	262	343	416
900	345	431	525
1000	446	560	725
1200	639	837	1192
1400	1036	1348	1713
1600	1384	1985	2448
1800	1829	2570	3300
2000	2506	3178	4168

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

AS 2129, Table E	
DN [mm]	Weight [kg]
	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
450	147
500	183

AS 2129, Table E

DN [mm]	Weight [kg]
	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
600	267
700	347
750	434
800	494
900	691
1 000	786
1 200	1 246

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

AS 4087, PN 16

DN [mm]	Weight [kg]
	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
450	137
500	185
600	265
700	368
750	446
800	523
900	703
1 000	784
1 200	1 228

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Calibration flow", options H and K, or options H/K or order code for "Sensor option", option CA

Option	Description
H	MID Type Examination Cert MI-001
K	OIML R49 Class 2
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

EN 1092-1

DN [mm]	Pressure rating	Weight [kg]
		Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
25	PN 40	9
32	PN 40	10
40	PN 40	11

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
50	PN 40	12
65	PN 16	13
80	PN 16	15
100	PN 16	17
125	PN 16	22
150	PN 16	27
200	PN 10	38
250	PN 10	51
300	PN 10	60

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

EN 1092-1 (DIN 2501)		
DN [mm]	Pressure rating	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
50	PN 40	12.6
65	PN 16	14.0
80	PN 16	16.4
100	PN 16	18.0
125	PN 16	26.0
150	PN 16	32.3
200	PN 16	46.3
250	PN 16	68.1
300	PN 16	85.7

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

AS 2129, PN 16	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
80	15
100	17
150	27

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

AS 2129, PN 16	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
80	16.4
100	18.0
150	32.3

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

JIS B2220, 10K	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
25	9
32	10
40	10
50	11
65	12
80	13
100	15
125	20
150	25
200	34
250	50
300	57
350	79
400	100
450	128
500	142
600	188
700	280
750	331

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

JIS B2220, 10K	
DN [mm]	Weight [kg] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
50	11.6
65	13.0
80	14.4
100	16.8
125	24.4
150	32.0
200	43.2
250	64.9
300	75.2

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

Weight in US units

Standard version

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

ASME B16.5, Class 150	
DN [in]	Weight [lbs] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
1	11
1½	18
2	20
3	26
4	31
6	53
8	95
10	161
12	238
14	386
16	452
18	562
20	628
24	893

1) Values for aluminum transmitter, AlSi10Mg, coated: + 1.5 lbs

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

ASME B16.5, Class 150	
DN [in]	Weight [lbs] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
2	21.3
3	29.1
4	35.6
6	68.4
8	116.2
10	198.9
12	285.2

1) Values for aluminum transmitter, AlSi10Mg, coated: + 1.5 lbs

AWWA C207, Class D	
DN [in]	Weight [lbs] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
28	882
30	1 014
32	1 213
36	1 764
40	1 985
42	2 426
48	3 087
54	4 851
60	5 954
66	8 159
72	9 041
78	10 143

1) Values for aluminum transmitter, AlSi10Mg, coated: + 1.5 lbs

Order code for "Design", option A

Option A "Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"

ASME B16.5, Class 150	
DN [in]	Weight [lbs] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
18	423
20	505
24	668

1) Values for aluminum transmitter, AlSi10Mg, coated: + 1.5 lbs

AWWA C207, Class D	
DN [in]	Weight [lbs] Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾
28	589
30	703
32	847
36	1039
40	1346
42	1567
48	2062
54	2895
60	3595
66	4931
72	5709
78	6928

1) Values for aluminum transmitter, AlSi10Mg, coated: + 1.5 lbs

Order code for "Sensor option", option CA

Option CA "IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and
order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
1	17.6
1½	19.8
2	24.3
3	33.1
4	41.9
6	61.7
8	97.0
10	134.5
12	189.6

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet
runs, constricted meas.tube"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
2	25.6
3	36.2
4	46.5
6	77.1
8	118.2

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
10	172.4
12	236.8

Transmitter remote version*Wall-mount housing*

Depends on the material of the wall-mount housing:

- Polycarbonate plastic: 1.3 kg (2.9 lb)
- Aluminum, AlSi10Mg, coated: 2.0 kg (4.4 lb)

Sensor remote version

Weight data:

- Including sensor connection housing
- Excluding the connecting cable
- Excluding packaging material

*Weight in SI units**Standard version*

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg]
25	PN 40	5
32	PN 40	6
40	PN 40	7
50	PN 40	9
65	PN 16	10
80	PN 16	12
100	PN 16	14
125	PN 16	20
150	PN 16	24
200	PN 10	43
250	PN 10	63
300	PN 10	68
350	PN 6	103
375	PN 6	118
400	PN 6	118
450	PN 6	159
500	PN 6	154
600	PN 6	206
700	PN 6	302
800	PN 6	355
900	PN 6	483

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg]
1000	PN 6	587
1200	PN 6	848
1400	PN 6	1298
1600	PN 6	1698
1800	PN 6	2198
2000	PN 6	2798

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

EN 1092-1		
DN [mm]	Pressure rating	Weight [kg]
50	PN 40	9.6
65	PN 16	11.0
80	PN 16	13.4
100	PN 16	15.0
125	PN 16	24.0
150	PN 16	29.3
200	PN 16	51.3
250	PN 16	80.1
300	PN 16	93.7

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

AS 4087, PN 16	
DN [mm]	Weight [kg]
80	12
100	14
150	24

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

AS 4087, PN 16	
DN [mm]	Weight [kg]
80	13.4
100	15.0
150	29.3

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

JIS B2220, 10K	
DN [mm]	Weight [kg]
25	5
32	5
40	6
50	7
65	9
80	11
100	13
125	19
150	23
200	40
250	67
300	70
350	79
400	100
450	128
500	142
600	188
700	280
750	331

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

JIS B2220, 10K	
DN [mm]	Weight [kg]
50	7.6
65	10.0
80	12.4
100	14.8
125	23.4
150	30.0
200	49.2
250	81.9
300	88.2

Order code for "Design", option A

Option A "Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"

EN 1092-1			
DN [mm]	Weight [kg]		
	PN 6	PN 10	PN 16
450	98	115	145
500	113	131	188
600	154	166	274
700	198	253	307
800	262	343	416
900	345	431	525
1000	446	560	725
1200	639	837	1192
1400	1036	1348	1713
1600	1384	1985	2448
1800	1829	2570	3300
2000	2506	3178	4168

AS 2129, Table E	
DN [mm]	Weight [kg]
450	147
500	181
600	263
700	345
750	432
800	492
900	689
1000	786
1200	1246

AS 4087, PN 16	
DN [mm]	Weight [kg]
450	137
500	185
600	265
700	366
750	444
800	523
900	701
1000	784
1200	1228

Order code for "Calibration flow", options H and K or order code for "Sensor option", option CA

Option	Description
H	MID Type Examination Cert MI-001
K	OIML R49 Class 2
CA	IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

EN 1092-1		
DN [mm]	Pressure rating	[kg]
25	PN 40	6.5
32	PN 40	8
40	PN 40	8.5
50	PN 40	10
65	PN 16	11
80	PN 16	13
100	PN 16	15
125	PN 16	20
150	PN 16	25
200	PN 10	36
250	PN 10	49
300	PN 10	58

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

EN 1092-1		
DN [mm]	Pressure rating	[kg]
50	PN 40	10.6
65	PN 16	12.0
80	PN 16	14.4
100	PN 16	16.0
125	PN 16	24.0
150	PN 16	30.3
200	PN 16	44.3
250	PN 16	66.1
300	PN 16	83.7

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

AS 4087, PN 16	
DN [mm]	[kg]
80	13
100	15
150	25

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

AS 4087, PN 16	
DN [mm]	[kg]
80	14.4
100	16.0
150	30.3

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

JIS B2220, 10K	
DN [mm]	Weight [kg]
25	6.5
32	7.5
40	7.5
50	9
65	10
80	11
100	13
125	18
150	23
200	32
250	48
300	55
350	79
400	100
450	128
500	142
600	188
700	280
750	331

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

JIS B2220, 10K	
DN [mm]	Weight [kg]
50	9.6
65	11.0
80	12.4
100	14.8
125	22.4
150	30.0
200	41.2
250	62.9
300	73.2

Weight in US units

Standard version

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
1	11
1½	15
2	20
3	26
4	31
6	53
8	95
10	161
12	238
14	381
16	448
18	558
20	624
24	889

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
2	21.3
3	29.1
4	35.6

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
6	68.4
8	116.2
10	198.9
12	285.2

AWWA C207, Class D	
DN [in]	Weight [lbs]
28	878
30	1010
32	1208
36	1760
40	1980
42	2421
48	3083
54	4847
60	5949
66	8154
72	9036
78	10139

Order code for "Design", option A

Option A "Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
18	420
20	501
24	721

AWWA C207, Class D	
DN [in]	Weight [lbs]
28	606
30	740
32	881
36	1093
40	1463
42	1695
48	2277
54	3165

AWWA C207, Class D	
DN [in]	Weight [lbs]
60	3 930
66	5 425
72	6 295
78	7 782

Order code for "Sensor option", option CA

Option CA "IP66/67, Type 4X, fully welded; corrosion protection EN ISO 12944 C5-M"

Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
1	13
1½	15.5
2	20
3	29
4	37
6	57
8	93
10	130
12	185

Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
2	21.3
3	32.1
4	41.6
6	72.4
8	114.2
10	167.9
12	232.2

Measuring tube specification

Nominal diameter		Pressure rating				Measuring tube internal diameter			
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane	
[mm]	[in]					[mm]	[in]	[mm]	[in]
25	1	PN 40	Class 150	–	20K	–	–	24	0.94
32	–	PN 40	–	–	20K	–	–	32	1.26
40	1 ½	PN 40	Class 150	–	20K	–	–	38	1.50

Nominal diameter		Pressure rating				Measuring tube internal diameter			
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane	
[mm]	[in]					[mm]	[in]	[mm]	[in]
50	2	PN 40	Class 150	Table E, PN 16	10K	50	1.97	50	1.97
65	–	PN 16	–	–	10K	66	2.60	66	2.60
80	3	PN 16	Class 150	Table E, PN 16	10K	79	3.11	79	3.11
100	4	PN 16	Class 150	Table E, PN 16	10K	102	4.02	102	4.02
125	–	PN 16	–	–	10K	127	5.00	127	5.00
150	6	PN 16	Class 150	Table E, PN 16	10K	156	6.14	156	6.14
200 ¹⁾	8	PN 10	Class 150	Table E, PN 16	10K	204	8.03	204	8.03
200 ²⁾	8	PN 16	Class 150	Table E, PN 16	10K	201	7.91	–	–
250 ¹⁾	10	PN 10	Class 150	Table E, PN 16	10K	258	10.2	258	10.2
250 ²⁾	10	PN 16	Class 150	Table E, PN 16	10K	251	9.88	–	–
300 ¹⁾	12	PN 10	Class 150	Table E, PN 16	10K	309	12.2	309	12.2
300 ²⁾	12	PN 16	Class 150	Table E, PN 16	10K	309	12.2	–	–
350	14	PN 6	Class 150	Table E, PN 16	10K	337	13.3	342	13.5
375	15	–	–	PN 16	10K	389	15.3	–	–
400	16	PN 6	Class 150	Table E, PN 16	10K	387	15.2	392	15.4
450	18	PN 6	Class 150	–	10K	436	17.1	437	17.2
500	20	PN 6	Class 150	Table E, PN 16	10K	487	19.1	492	19.4
600	24	PN 6	Class 150	Table E, PN 16	10K	585	23.0	594	23.4
700	28	PN 6	Class D	Table E, PN 16	10K	690	27.1	692	27.2
750	30	–	Class D	Table E, PN 16	10K	741	29.1	742	29.2
800	32	PN 6	Class D	Table E, PN 16	–	788	31.0	794	31.3
900	36	PN 6	Class D	Table E, PN 16	–	889	35.0	891	35.1
1000	40	PN 6	Class D	Table E, PN 16	–	991	39.0	994	39.1
–	42	–	Class D	–	–	1043	41.1	1043	41.1
1200	48	PN 6	Class D	Table E, PN 16	–	1191	46.9	1197	47.1
–	54	–	Class D	–	–	1339	52.7	–	–
1400	–	PN 6	–	–	–	1402	55.2	–	–
–	60	–	Class D	–	–	1492	58.7	–	–
1600	–	PN 6	–	–	–	1600	63.0	–	–
–	66	–	Class D	–	–	1638	64.5	–	–
1800	72	PN 6	Class D	–	–	1786	70.3	–	–
2000	78	PN 6	Class D	–	–	1989	78.3	–	–

- 1) Order code for "Design", option A "Insertion length short, ISO/DVGW to DN400, DN450-2000 1:1" and order code for "Design", option B "Insertion length long, ISO/DVGW to DN400, DN450-2000 1:1.3"
- 2) Order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"

Materials**Transmitter housing***Compact version, standard*

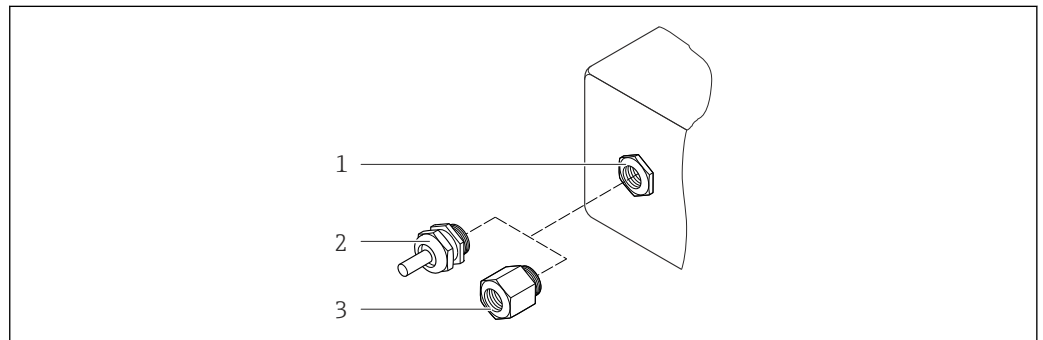
- Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **M**: polycarbonate plastic
- Window material:
 - For order code for "Housing", option **A**: glass
 - For order code for "Housing", option **M**: plastic

Compact version, inclined

- Order code for "Housing", option **R** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **Q**: polycarbonate plastic
- Window material:
 - For order code for "Housing", option **R**: glass
 - For order code for "Housing", option **Q**: plastic

Remote version (wall-mount housing)

- Order code for "Housing", option **P** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **N**: polycarbonate plastic
- Window material:
 - For order code for "Housing", option **P**: glass
 - For order code for "Housing", option **N**: plastic

Cable entries/cable glands

40 Possible cable entries/cable glands

- 1 Female thread M20 × 1.5
- 2 Cable gland M20 × 1.5
- 3 Adapter for cable entry with internal thread G ½" or NPT ½"

Compact and remote versions and sensor connection housing

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Plastic
Remote version: cable gland M20 × 1.5 Option of reinforced connecting cable	<ul style="list-style-type: none"> ■ Sensor connection housing: Nickel-plated brass ■ Transmitter wall-mount housing: Plastic
Adapter for cable entry with internal thread G ½" or NPT ½"	Nickel-plated brass

Device plug

Electrical connection	Material
Plug M12x1	<ul style="list-style-type: none"> ■ Socket: Stainless steel, 1.4404 (316L) ■ Contact housing: Polyamide ■ Contacts: Gold-plated brass

Connecting cable for remote version

Electrode and coil current cable

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

- Standard: aluminum, AlSi10Mg, coated (IP66/67)
- Option:
 - Polycarbonate for IP68 with DN 50 to 300 (2 to 12")
 - Polycarbonate for order code "Sensor option", option CA...CE "Corrosion protection" with DN 350 to 2000 (14 to 78")

Sensor housing

- DN 25 to 300 (1 to 12"):
 - Aluminum, AlSi10Mg, coated
 - Carbon steel with Al/Zn protective coating
- DN 25 to 300 (1 to 12"):
 - Carbon steel with protective varnish (IP68)
- DN 350 to 2000 (14 to 78"):
 - Carbon steel with protective varnish

Measuring tubes

- DN 25 to 300 (1 to 12")¹⁾: stainless steel, 1.4301/1.4306/304/304L
- DN 350 to 1200 (14 to 48")¹⁾: stainless steel, 1.4301/304
- DN 1350 to 2000 (54 to 78")¹⁾: stainless steel, 1.4301 similar to 304

Liner

- DN 25 to 1200 (1 to 48"): polyurethane
- DN 50 to 2000 (2 to 78"): hard rubber

Electrodes

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Process connections*EN 1092-1 (DIN 2501)*

- DN 25 to 300¹⁾:
 - Stainless steel, 1.4571/F316L
 - Carbon steel, S235JRG2/S235JR+N/P250GH/E250C
- DN 350 to 600¹⁾:
 - Stainless steel, 1.4571/F316L
 - Carbon steel, P245GH
- >DN 600²⁾:
 - Stainless steel, 1.4404/F316L
 - Carbon steel, P245GH

1) For carbon steel flange material with Al/Zn protective coating (DN 25 to 300 (1 to 12")), protective varnish (IP68) (DN 50 to 300 (2 to 12")) or protective varnish ≥ DN 350 (14")

2) Order code for "Design", option A "Insertion length short"

ASME B16.5

- DN 25 to 1200 (1 to 48"):
Stainless steel, F316L similar to 1.4404
- DN 25 to 300 (1 to 12") ²⁾:
Carbon steel, A105 similar to 1.0432
- DN 350 to 1200 (14 to 48") ²⁾:
Carbon steel, A105

*AWWA C207*DN 48 to 78" ²⁾:

Carbon steel, P265GH/S275JR/A105/A181 Class 70/E250C

AS 2129

- DN 50 to 1200:
Carbon steel, A105/S235JRG2
- DN 350 to 1200 ²⁾:
Carbon steel, P235GH/P265GH/A105

AS 4087

- DN 50 to 1200:
Carbon steel, A105/S275JR
- DN 350 to 1200 ²⁾:
Carbon steel, A105/P265GH/S275JR

JIS B2220

- Stainless steel, F316L similar to 1.4404
- Carbon steel, A105/A350LF2 ¹⁾

Seals

As per DIN EN 1514-1, form IBC

Accessories*Display protection*

Stainless steel, 1.4301 (304L)

Ground disks

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Fitted electrodes

Measurement, reference and empty pipe detection electrodes available as standard with:

- 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum


Process connections

- EN 1092-1 (DIN 2501) ³⁾
 - DN ≤ 300: fixed flange (PN 10/16/25/40) = form A
 - DN ≥ 350: fixed flange (PN 6/10/16/25) = flat face
 - DN 450 to 2000 ⁴⁾: fixed flange (PN 6/10/16) = flat face
- ASME B16.5
 - DN 25 to 600 (1 to 24"): fixed flange (Class 150)
 - DN 350 to 2000 (14 to 78") ⁴⁾: fixed flange (Class 150)
 - DN 25 to 150 (1 to 6"): fixed flange (Class 300)
- AWWA C207
 - DN 48 to 72": fixed flange (Class D)
 - DN 48 to 78" ⁴⁾: fixed flange (Class D)

3) Dimensions as per DIN 2501, DN 65 (2 ½") PN 16 and DN 600 (24") PN 16 only as per EN 1092-1

4) Order code for "Design", option A "Insertion length short"

- AS 2129
 - DN 50 to 1200: fixed flange (Table E)
 - DN 350 to 1200 ⁴⁾: fixed flange (Table E)
- AS 4087
 - DN 50 to 1200): fixed flange (PN 16)
 - DN 350 to 1200 ⁴⁾: fixed flange (PN 16)
- JIS B2220
 - DN 50 to 750: fixed flange (10K)
 - DN 25 to 600: fixed flange (20K)

 For information on the different materials used in the process connections

Surface roughness

Electrodes with 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum:
 ≤ 0.3 to $0.5 \mu\text{m}$ (11.8 to $19.7 \mu\text{in}$)
 (All data relate to parts in contact with fluid)


Operability

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Fast and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Device access via Web server or SmartBlue app →  127
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

Reliable operation

- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase measurement availability

- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Languages

Can be operated in the following languages:

- Via local operation:
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool:
English, German, French, Spanish, Italian, Chinese, Japanese
- Via Web browser (only available for device versions with HART, PROFIBUS DP and EtherNet/IP):
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish

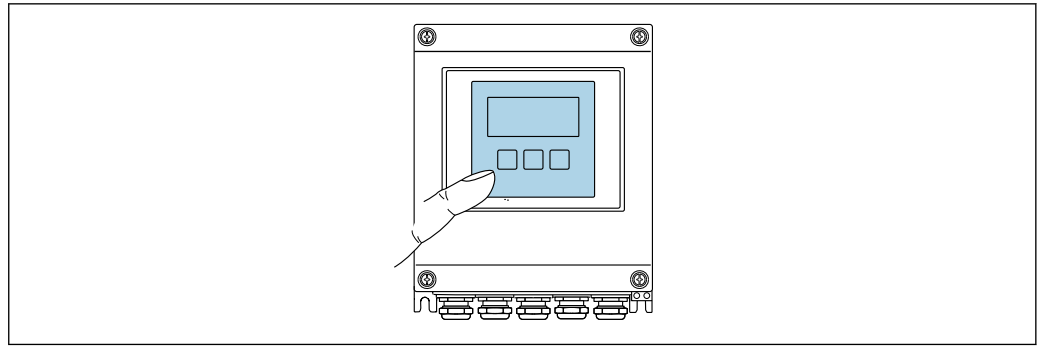
Local display

Via display module

Two display modules are available:

- Standard:
4-line, illuminated, graphic display; touch control
- Optionally via order code for "Display", option **W1** "WLAN display":
4-line, illuminated, graphic display; touch control + WLAN

 Information about WLAN interface →  119



A0032074

41 Operation with touch control

Display elements

- 4-line, illuminated, graphic display
 - White background lighting; switches to red in event of device errors
 - Format for displaying measured variables and status variables can be individually configured
 - Permitted ambient temperature for the display: -20 to $+60$ °C (-4 to $+140$ °F)
- The readability of the display may be impaired at temperatures outside the temperature range.

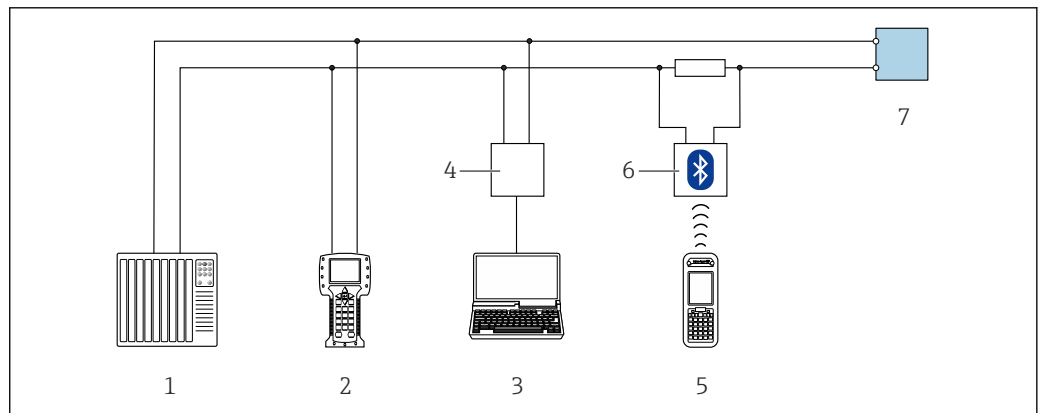
Operating elements

- External operation via touch control (3 optical keys) without opening the housing: \boxplus , \boxminus , \boxtimes
- Operating elements also accessible in the various zones of the hazardous area

Remote operation

Via HART protocol

This communication interface is available in device versions with a HART output.



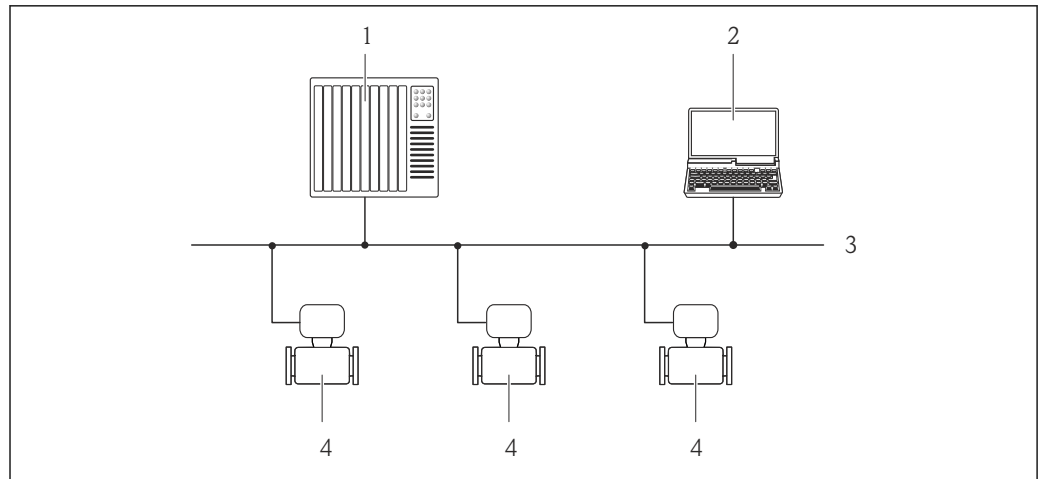
A0028747

42 Options for remote operation via HART protocol

- 1 Control system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)
- 4 Commubox FXA195 (USB)
- 5 Field Xpert SFX350 or SFX370
- 6 VIATOR Bluetooth modem with connecting cable
- 7 Transmitter

Via PROFIBUS DP network

This communication interface is available in device versions with PROFIBUS DP.



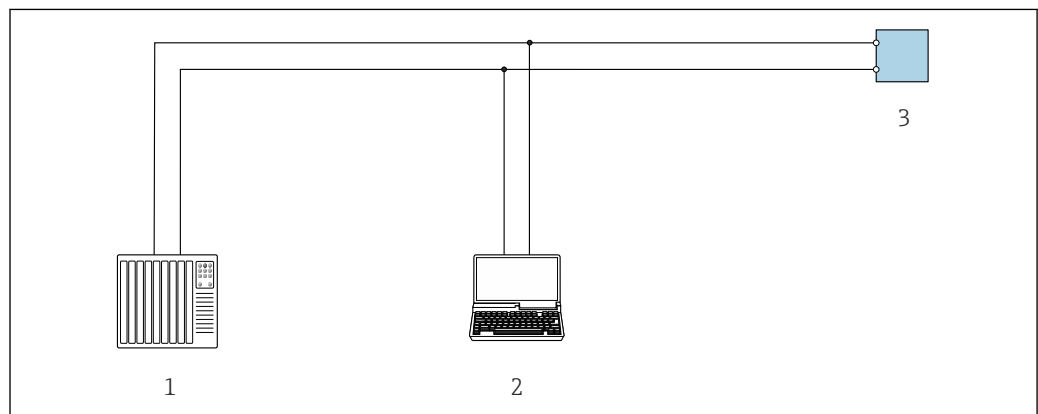
A0020903

43 Options for remote operation via PROFIBUS DP network

- 1 Automation system
- 2 Computer with PROFIBUS network card
- 3 PROFIBUS DP network
- 4 Measuring device

Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus-RS485 output.



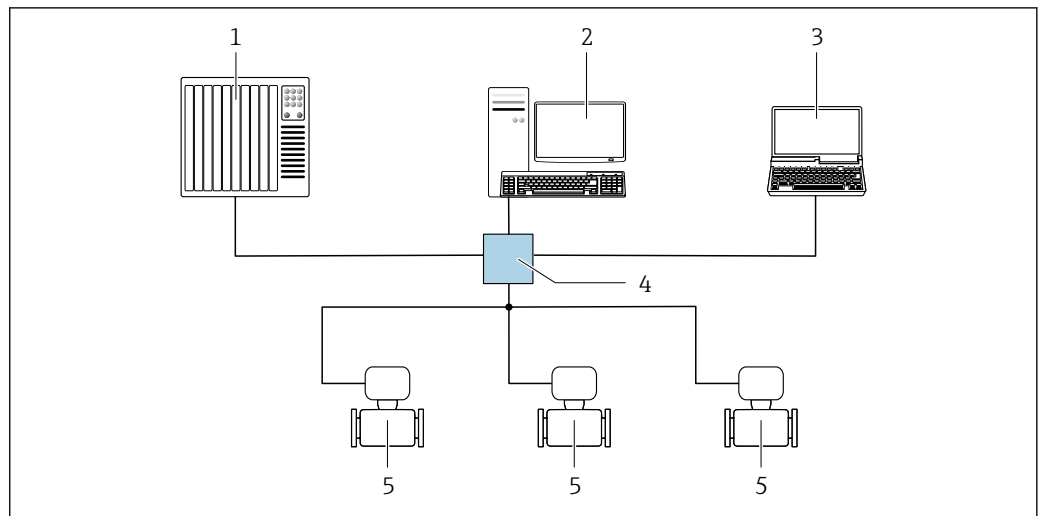
A0029437

44 Options for remote operation via Modbus-RS485 protocol (active)

- 1 Control system (e.g. PLC)
- 2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 3 Transmitter

Via EtherNet/IP network

This communication interface is available in device versions with EtherNet/IP.

Star topology

A0032078

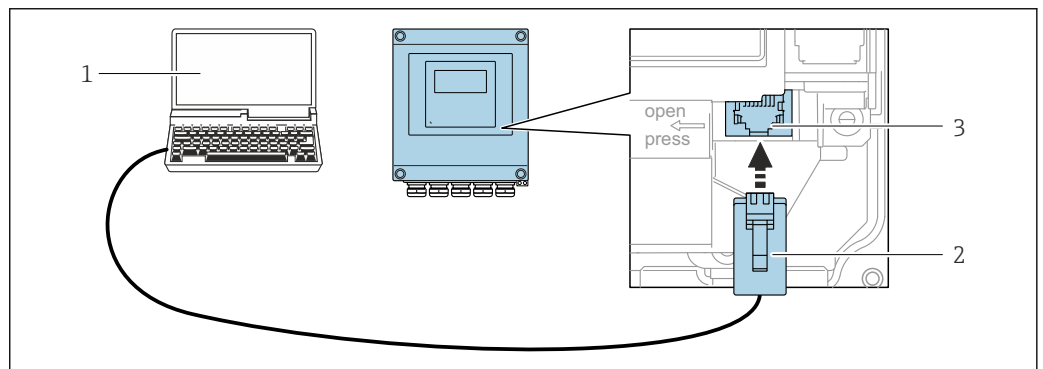
45 Options for remote operation via EtherNet/IP network: star topology

- 1 Automation system, e.g. "RSLogix" (Rockwell Automation)
- 2 Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
- 3 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"
- 4 Ethernet switch
- 5 Measuring device

Service interface**Via service interface (CDI-RJ45)**

This communication interface is present in the following device version:

- Order code for "Output", option **H**: 4-20/0-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **I**: 4-20/0-20 mA HART, pulse/frequency/switch output, status input
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **N**: EtherNet/IP
- Order code for "Output", option **M**: Modbus RS485



A0029163

46 Connection via service interface (CDI-RJ45)

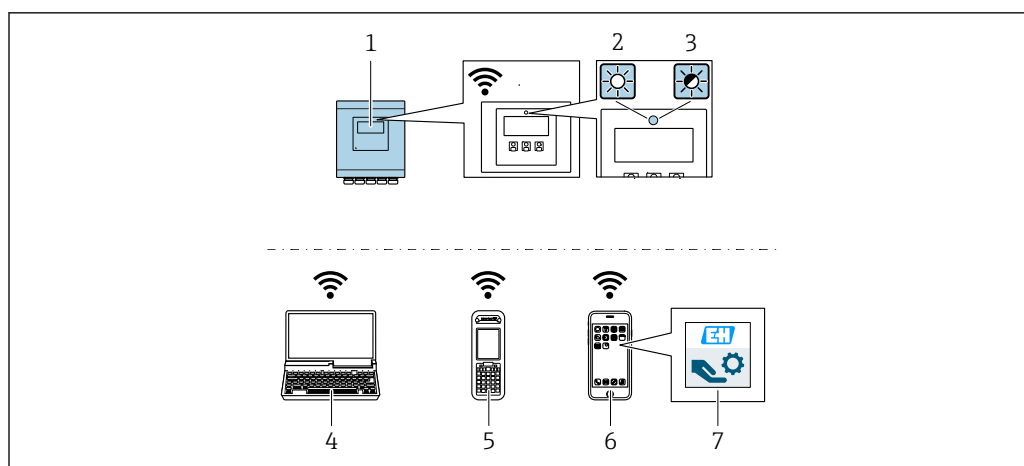
- 1 Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 2 Standard Ethernet connecting cable with RJ45 plug
- 3 Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server

Via WLAN interface

The optional WLAN interface is available on the following device version:


Order code for "Display", option **W1** "WLAN display":

4-line, illuminated, graphic display; touch control + WLAN





A0032079

- 1 Transmitter with integrated WLAN antenna
- 2 LED lit constantly: WLAN reception is enabled on measuring device
- 3 LED flashing: WLAN connection established between operating unit and measuring device
- 4 Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)
- 5 Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)
- 6 Smartphone or tablet
- 7 SmartBlue App

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) <ul style="list-style-type: none"> ■ Access point with DHCP server (default setting) ■ Network
Encryption	WPA2-PSK/AES 128 bit
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	<ul style="list-style-type: none"> ■ Internal antenna ■ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Available as an accessory .  Only one antenna active in each case!
Max. range	50 m (164 ft)
Materials: External WLAN antenna	<ul style="list-style-type: none"> ■ Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass ■ Adapter: Stainless steel and nickel-plated brass ■ Cable: Polyethylene ■ Connector: Nickel-plated brass ■ Angle bracket: Stainless steel

Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with Web browser	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface ■ Ethernet-based fieldbus (EtherNet/IP) 	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface ■ Fieldbus protocol 	→  127
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface ■ Fieldbus protocol 	→  127
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus fieldbus protocol	Operating Instructions BA01202S Device description files: Use update function of handheld terminal



Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) by Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) by Siemens → www.siemens.com
- Asset Management Solutions (AMS) by Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 by Emerson → www.emersonprocess.com
- Field Device Manager (FDM) by Honeywell → www.honeywellprocess.com
- FieldMate by Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The associated device description files are available at: www.endress.com → Downloads


Web server

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) or via a WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display", option **W1** "WLAN display": 4-line, illuminated; touch control + WLAN. The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

Supported functions

Data exchange between the operating unit (such as a notebook for example) and the measuring device:

- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package →  125)



Webserver special documentation

HistoROM data management The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.



When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.

Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device:

	Device memory	T-DAT	S-DAT
Available data	<ul style="list-style-type: none"> Device firmware package Driver for system integration e.g.: <ul style="list-style-type: none"> DD for HART GSD for PROFIBUS DP EDS for EtherNet/IP 	<ul style="list-style-type: none"> Event history, such as diagnostic events Measured value memory ("Extended HistoROM" order option) Current parameter data record (used by firmware at run time) Maximum indicators (min/max values) Totalizer values 	<ul style="list-style-type: none"> Sensor data: diameter etc. Serial number User-specific access code (to use the "Maintenance" user role) Calibration data Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface board in the connection compartment	Can be plugged into the user interface board in the connection compartment	In the sensor plug in the transmitter neck part

Data backup

Automatic

- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors

Data transfer

Manual

- Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)
- Transmission of the drivers for system integration via Web server, e.g.:
 - GSD for PROFIBUS DP
 - EDS for EtherNet/IP

Event list

Automatic

- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server




Data logging

Manual

If the **Extended HistoROM** application package (order option) is enabled:

- Record up to 1 000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

CE mark	<p>The measuring system is in conformity with the statutory requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.</p> <p>Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.</p>
C-Tick symbol	<p>The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".</p>
Ex approval	<p>The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.</p> <p> The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.</p> <p>ATEX, IECEX</p> <p>Currently, the following versions for use in hazardous areas are available:</p>
Drinking water approval	<ul style="list-style-type: none"> ■ ACS ■ KTW/W270 ■ NSF 61 ■ WRAS BS 6920
HART certification	<p>HART interface</p> <p>The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified according to HART 7 ■ The device can also be operated with certified devices of other manufacturers (interoperability)
Certification PROFIBUS	<p>PROFIBUS interface</p> <p>The measuring device is certified and registered by the PNO (PROFIBUS User Organization Organization). The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified in accordance with PROFIBUS PA Profile 3.02 ■ The device can also be operated with certified devices of other manufacturers (interoperability)
Modbus RS485 certification	<p>The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.</p>
EtherNet/IP certification	<p>The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ■ Certified in accordance with the ODVA Conformance Test ■ EtherNet/IP Performance Test ■ EtherNet/IP PlugFest compliance ■ The device can also be operated with certified devices of other manufacturers (interoperability)
Radio approval	<p>The measuring device has radio approval.</p> <p> For detailed information on the radio approval, see the Special Documentation →  128</p>
Measuring instrument approval	<p>The measuring device is (optionally) approved as a cold water meter (MI-001) for volume measurement in service subject to legal metrological control in accordance with the European Measuring Instruments Directive 2004/22/EC (MID).</p> <p>The measuring device is qualified to OIML R49: 2006 and has an OIML Certificate of Conformity (optional).</p>

Other standards and guidelines

- EN 60529
Degrees of protection provided by enclosures (IP code)
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326
Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-61010-1 (82.02.01): 2004
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- CAN/CSA-C22.2 No. 61010-1-04
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
Self-monitoring and diagnosis of field devices
- NAMUR NE 131
Requirements for field devices for standard applications

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Product generation index

Release date	Product root	Modification
01.07.2012	5W4B	Original
01.11.2016	5W4C	<ul style="list-style-type: none"> ■ Web server: current version ■ Logbook: current concept, including Parameter Change ■ Upload/download: current concept ■ Heartbeat Technology: new hardware, diagnostics, events ■ Security concept: encrypted password transmission ■ WLAN ■ Custody transfer mode



More information is available from your Sales Center or at:

www.service.endress.com → Downloads

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.


Cleaning	Package	Description
	Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).
Diagnostics functions	Package	Description
	Extended HistoROM	Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries. Data logging (line recorder): <ul style="list-style-type: none"> Memory capacity for up to 1000 measured values is activated. 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.
Heartbeat Technology	Package	Description
	Heartbeat Verification +Monitoring	<p>Heartbeat Verification Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".</p> <ul style="list-style-type: none"> Functional testing in the installed state without interrupting the process. Traceable verification results on request, including a report. Simple testing process via local operation or other operating interfaces. Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. Extension of calibration intervals according to operator's risk assessment. <p>Heartbeat Monitoring Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:</p> <ul style="list-style-type: none"> Draw conclusions - using these data and other information - about the impact process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. Schedule servicing in time. Monitor the process or product quality, e.g. gas pockets.

Accessories


Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories







For the transmitter



Accessories	Description
Display protection	Is used to protect the display against impact or scoring from sand in desert areas.  For details, see Special Documentation SD00333F
Connecting cable for remote version	Coil current and electrode cables, various lengths, reinforced cables available on request.
Ground cable	Set, consisting of two ground cables for potential equalization.
Post mounting kit	Post mounting kit for transmitter.
Compact → Remote conversion kit	For converting a compact device version to a remote device version.
Conversion kit Promag 50/53 → Promag 400	For converting a Promag with transmitter 50/53 to a Promag 400.

For the sensor




Accessories	Description
Ground disks	Are used to ground the medium in lined measuring tubes to ensure proper measurement.  For details, see Installation Instructions EA00070D

Communication-specific accessories


Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  For details, see "Technical Information" TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.  For details, see the "Technical Information" document TI405C/07
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.  For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity.  For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser.  For details, see "Technical Information" TI00025S and Operating Instructions BA00051S

Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices and can be used in non-hazardous areas.  For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices and can be used in the non-hazardous area and in the hazardous area.  For details, see Operating Instructions BA01202S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: <ul style="list-style-type: none"> Choice of measuring devices for industrial requirements Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. Graphic illustration of the calculation results Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: <ul style="list-style-type: none"> Via the Internet: https://wapps.endress.com/applicator As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.  For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices.  For details, see Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.  For details, see "Technical Information" TI00405C

System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.  For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

Supplementary documentation



For an overview of the scope of the associated Technical Documentation, refer to the following:

- The *W@M Device Viewer* : Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

Standard documentation

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Promag W	KA01266D

Transmitter Brief Operating Instructions

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Proline D 400	KA01263D	KA01112D		
Proline L 400		KA01113D		
Proline W 400		KA01114D		

Operating Instructions

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag W 400	BA01063D	BA01234D	BA01231D	BA01214D

Description of device parameters

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag 400	GP01043D	GP01044D	GP01045D	GP01046D

Supplementary device-dependent documentation

Special Documentation

Content	Documentation code
Heartbeat Technology	SD01847D
Display modules A309/A310	SD01793D
Information on Custody Transfer Measurement	SD01230D

Content	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Web server	SD01811D	SD01813D	SD01812D	SD01814D

Installation Instructions

Contents	Comment
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory .

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas, USA

PROFIBUS®

Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

EtherNet/IP™

Trademark of ODVA, Inc.

Microsoft®

Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

www.addresses.endress.com



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Technical Information

Proline Promag 10W

Electromagnetic Flow Measuring System

Flow measurement of liquids in water or wastewater applications



Application

Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of $\geq 50 \mu\text{S}/\text{cm}$:

- Drinking water
- Wastewater
- Sewage sludge
- Flow measurement up to $110000 \text{ m}^3/\text{h}$ (484315 gal/min)
- Fluid temperature up to $+80^\circ\text{C}$ (176°F)
- Process pressures up to 40 bar (580 psi)
- Lengths in accordance with DVGW/ISO

Application-specific lining materials:

- Polyurethane
- Hard rubber

Lined measuring pipes with materials approved for drinking water:

- KTW
- WRAS
- NSF
- ACS

Your benefits

Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:

- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:

- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

Table of contents

Function and system design	3	Mechanical construction	20
Measuring principle	3	Design, dimensions	20
Measuring system	3	Weight	32
Input	4	Measuring tube specifications	34
Measured variable	4	Material	35
Measuring ranges	4	Material load diagram	35
Operable flow range	4	Fitted electrodes	37
Output	4	Process connections	38
Output signal	4	Surface roughness	38
Signal on alarm	4	Human interface	38
Load	4	Display elements	38
Low flow	4	Operating elements	38
Galvanic isolation	4	Remote operation	38
Power supply	5	Certificates and approvals	38
Electrical connection, measuring unit	5	CE mark	38
Electrical connection, terminal assignment	5	C-tick mark	38
Electrical connection, remote version	6	Ex approval	38
Supply voltage (power supply)	6	Other standards and guidelines	38
Cable entry	6	Pressure measuring device approval	38
Remote version cable specifications	7	Ordering information	39
Power consumption	7	Accessories	39
Power supply failure	7	Documentation	39
Potential equalization	8	Registered trademarks	39
Performance characteristics	9		
Reference operating conditions	9		
Maximum measured error	9		
Repeatability	9		
Operating conditions: Installations	10		
Installation instructions	10		
Inlet and outlet run	13		
Adapters	14		
Length of connecting cable	15		
Operating conditions: Environment	16		
Ambient temperature range	16		
Storage temperature	16		
Degree of protection	16		
Shock and vibration resistance	16		
Electromagnetic compatibility (EMC)	16		
Operating conditions: Process	17		
Medium temperature range	17		
Conductivity	17		
Medium pressure range (nominal pressure)	17		
Pressure tightness	17		
Limiting flow	18		
Pressure loss	19		

Function and system design

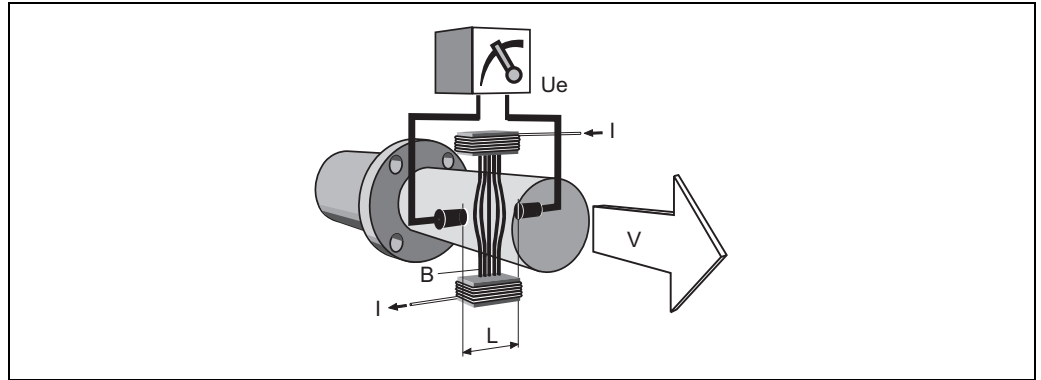
Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.

In the electromagnetic measuring principle, the flowing medium is the moving conductor.

The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area.

The DC magnetic field is created through a switched direct current of alternating polarity.



$$U_e = B \cdot L \cdot v$$

$$Q = A \cdot v$$

U_e Induced voltage

B Magnetic induction (magnetic field)

L Electrode spacing

v Flow velocity

Q Volume flow

A Pipe cross-section

I Current strength

Measuring system

The measuring system consists of a transmitter and a sensor.

Two versions are available:

- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:

- Promag 10 (key operation, two-line, unilluminated display)

Sensor:

- Promag W
DN 25 to 2000 (1 to 78")

Input

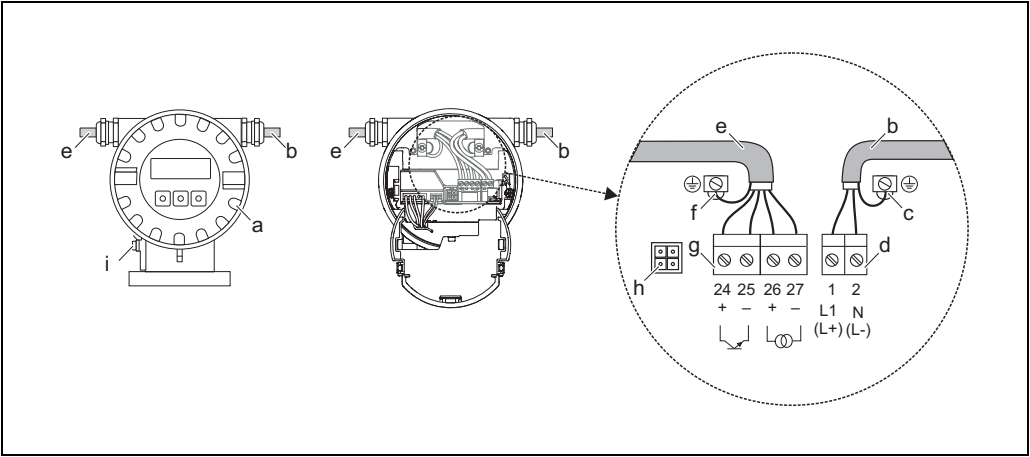
Measured variable	Flow velocity (proportional to induced voltage)
Measuring ranges	Typically $v = 0.01$ to 10 m/s (0.033 to 33 ft/s) with the specified accuracy
Operable flow range	Over $1000 : 1$

Output

Output signal	<p>Current output</p> <ul style="list-style-type: none"> ■ Galvanically isolated ■ Active: 4 to 20 mA, $R_L < 700 \Omega$ (for HART: $R_L \geq 250 \Omega$) ■ Full scale value adjustable ■ Temperature coefficient: typ. $2 \mu\text{A}/^\circ\text{C}$, resolution: $1.5 \mu\text{A}$ <p>Pulse/status output</p> <ul style="list-style-type: none"> ■ Galvanically isolated ■ Passive: 30 V DC / 250 mA ■ Open collector ■ Can be configured as: <ul style="list-style-type: none"> – Pulse output Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz – Status output For example, can be configured for error messages, empty pipe detection, flow recognition, limit value
Signal on alarm	<p>Current output</p> <p>Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)</p> <p>Pulse output</p> <p>Failsafe mode can be selected</p> <p>Status output</p> <p>"Not conductive" in the event of fault or power supply failure</p>
Load	See "Output signal"
Low flow	Low flow cutoff, switch-on point can be selected as required
Galvanic isolation	All circuits for inputs, outputs and power supply are galvanically isolated from each other.

Power supply

Electrical connection, measuring unit



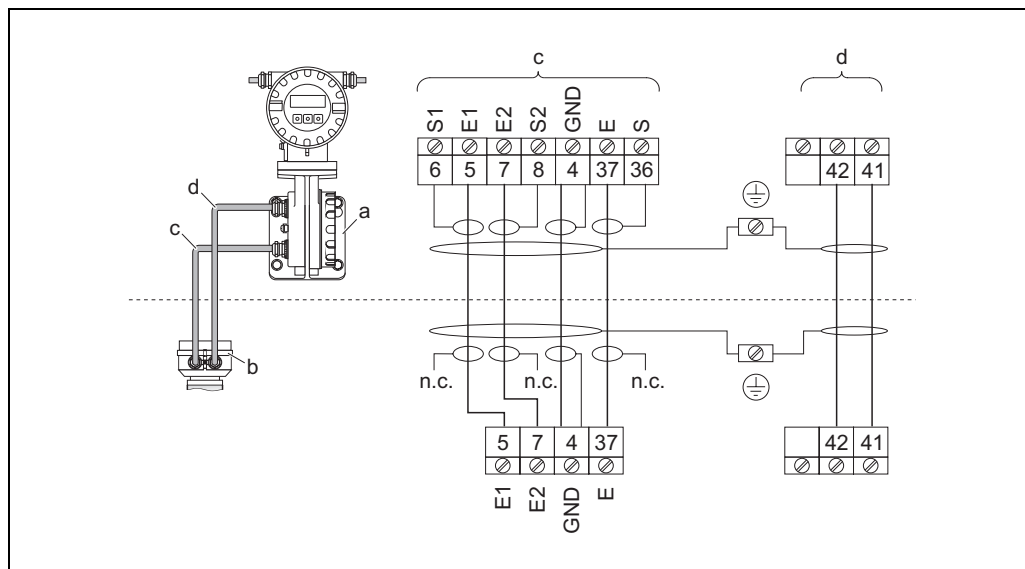
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

- a Electronics compartment cover
- b Power supply cable
- c Ground terminal for power supply cable
- d Terminal connector for power supply cable
- e Signal cable
- f Ground terminal for signal cable
- g Terminal connector for signal cable
- h Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)
- i Ground terminal for potential equalization

Electrical connection, terminal assignment

Order version	Terminal No.					
	24 (+)	25 (-)	26 (+)	27 (-)	1 (L1/L+)	2 (N/L-)
10***_*****A	Pulse/status output		HART current output		Power supply	
Functional values	See “Output signal”				See “Supply voltage”	

Electrical connection, remote version



A0012461

Connecting the remote version

- a* Wall-mount housing connection compartment
- b* Sensor connection housing cover
- c* Signal cable
- d* Coil current cable
- n.c.* Not connected, insulated cable shields

Cable colors/numbers for terminals:

5/6 = brown; 7/8 = white; 4 = green; 37/36 = yellow

Supply voltage (power supply)

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz, 11 to 40 V DC

Cable entry

Power supply and signal cables (inputs/outputs):

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:

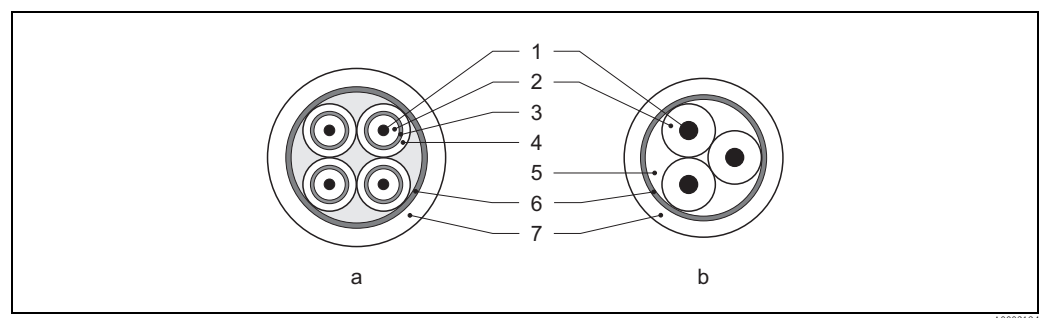
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications**Coil cable**

- $2 \times 0.75 \text{ mm}^2$ (18 AWG) PVC cable with common, braided copper shield ($\varnothing \sim 7 \text{ mm} / 0.28''$)
- Conductor resistance: $\leq 37 \text{ } \Omega/\text{km}$ ($\leq 0.011 \text{ } \Omega/\text{ft}$)
- Capacitance core/core, shield grounded: $\leq 120 \text{ pF/m}$ ($\leq 37 \text{ pF/ft}$)
- Operating temperature: -20 to $+80 \text{ }^\circ\text{C}$ (-4 to $+176 \text{ }^\circ\text{F}$)
- Cable cross-section: max. 2.5 mm^2 (16 AWG)
- Test voltage for cable insulation: $\geq 1433 \text{ V AC r.m.s. } 50/60 \text{ Hz}$ or $\geq 2026 \text{ V DC}$

Signal cable

- $3 \times 0.38 \text{ mm}^2$ (20 AWG) PVC cable with common, braided copper shield ($\varnothing \sim 7 \text{ mm} / 0.28''$) and individual shielded cores
- Conductor resistance: $\leq 50 \text{ } \Omega/\text{km}$ ($\leq 0.015 \text{ } \Omega/\text{ft}$)
- Capacitance core/shield: $\leq 420 \text{ pF/m}$ ($\leq 128 \text{ pF/ft}$)
- Operating temperature: -20 to $+80 \text{ }^\circ\text{C}$ (-4 to $+176 \text{ }^\circ\text{F}$)
- Cable cross-section: max. 2.5 mm^2 (16 AWG)



- a* *Signal cable*
b *Coil current cable*
- 1* *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Operation in zones of severe electrical interference

The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendation NE 21.

**Caution!**

Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Power consumption**Power consumption**

- 85 to 250 V AC: $< 12 \text{ VA}$ (incl. sensor)
- 20 to 28 V AC: $< 8 \text{ VA}$ (incl. sensor)
- 11 to 40 V DC: $< 6 \text{ W}$ (incl. sensor)

Switch-on current

- Max. 16 A ($< 5 \text{ ms}$) for 250 V AC
- Max. 5.5 A ($< 5 \text{ ms}$) for 28 V AC
- Max. 3.3 A ($< 5 \text{ ms}$) for 24 V DC

Power supply failure

Lasting min. $\frac{1}{2}$ cycle frequency: EEPROM saves measuring system data

Potential equalization



Warning!


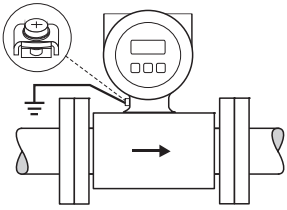
The measuring system must be included in the potential equalization.

Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.


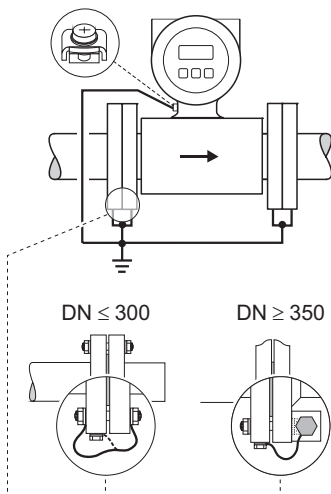
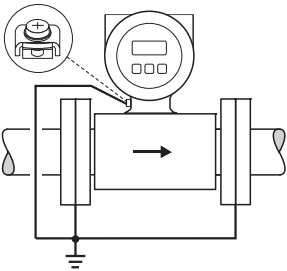
The following should also be taken into consideration for potential equalization:

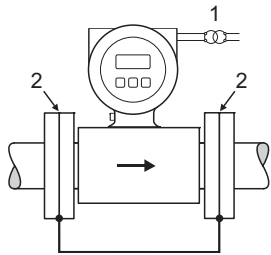
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see table)

Standard situation

Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> ■ Metal, grounded pipe <p>Potential equalization takes place via the ground terminal of the transmitter.</p> <p> Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.</p>	 <p style="text-align: right;">A0010831</p> <p><i>Via the ground terminal of the transmitter</i></p>

Special situations

Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> ■ Metal pipe that is not grounded <p>This connection method also applies in situations where:</p> <ul style="list-style-type: none"> ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. <p>Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, at least 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose.</p> <p>Ground cable installation depends on the nominal diameter:</p> <ul style="list-style-type: none"> ■ DN ≤ 300 (12"): The ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350 (14"): The ground cable is mounted directly on the metal transport bracket. <p> Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.</p>	 <p style="text-align: right;">A0010832</p> <p><i>Via the ground terminal of the transmitter and the flanges of the pipe</i></p>
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> ■ Plastic pipe ■ Pipe with insulating lining <p>This connection method also applies in situations where:</p> <ul style="list-style-type: none"> ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. <p>Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, at least 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions.</p>	 <p style="text-align: right;">A0010833</p> <p><i>Via the ground terminal of the transmitter and the optionally available ground disks</i></p>

Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none">■ Pipe with a cathodic protection unit <p>The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, at least 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws.</p> <p>Note the following when installing:</p> <ul style="list-style-type: none">■ The applicable regulations regarding potential-free installation must be observed.■ There should be no electrically conductive connection between the pipe and the device.■ The mounting material must withstand the applicable torques.	 <p><i>Potential equalization and cathodic protection</i></p> <p>1 Power supply isolation transformer 2 Electrically isolated</p> <p>A0010834</p>

Performance characteristics

Reference operating conditions

- As per DIN EN 29104 and VDI/VDE 2641:**
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
 - Ambient temperature: +22 °C ± 2 K (+72 °F ± 2 K)
 - Warm-up period: 30 minutes

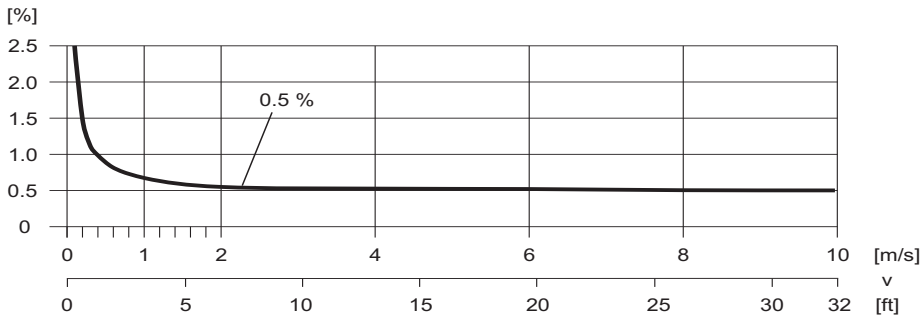
Installation conditions:

- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 2 mm/s (±0.5% o.r. ± 0.08 in/s) (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.



Max. measured error in % of reading

A0003200

Repeatability

Max. ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Operating conditions: Installations

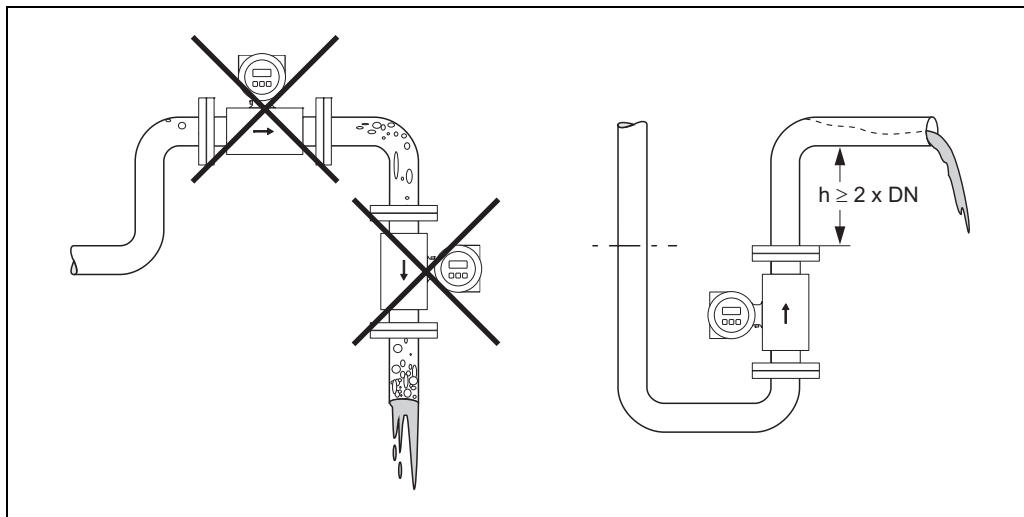
Installation instructions

Mounting location

Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.

Avoid the following installation locations in the pipe:

- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



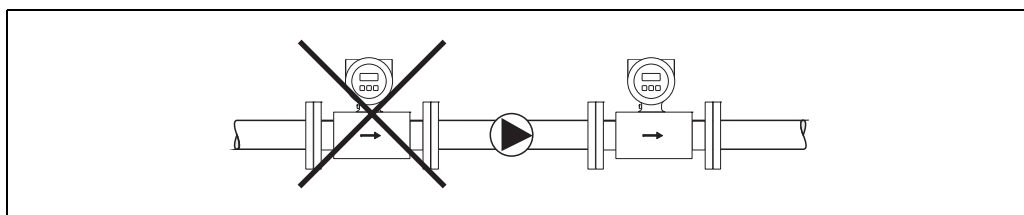
A0003202

Mounting location

Installation of pumps

Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".

Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 16, Section "Shock and vibration resistance".



A0003203

Installation of pumps

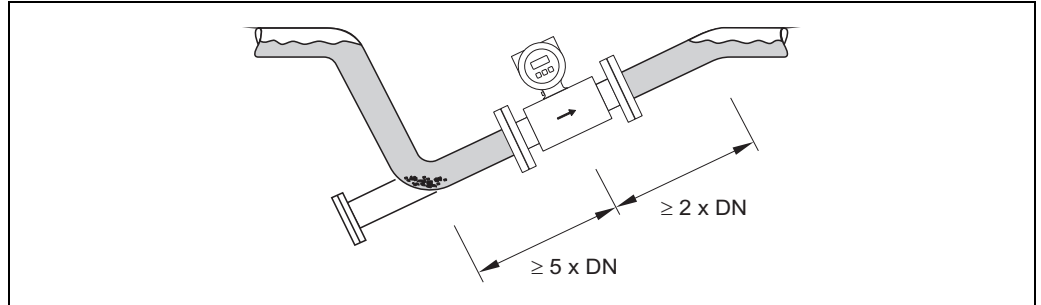
Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.

The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

**Caution!**

Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.

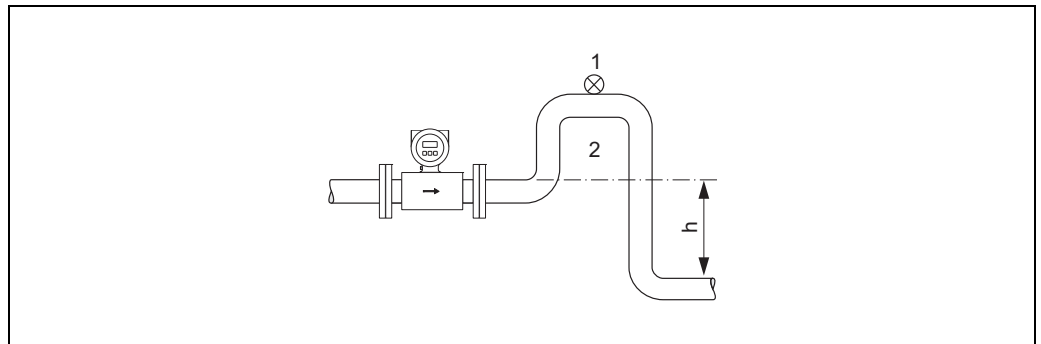


A0003204

Installation with partially filled pipes

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes $h \geq 5 \text{ m}$ (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".



A0008157

Installation measures for vertical pipes

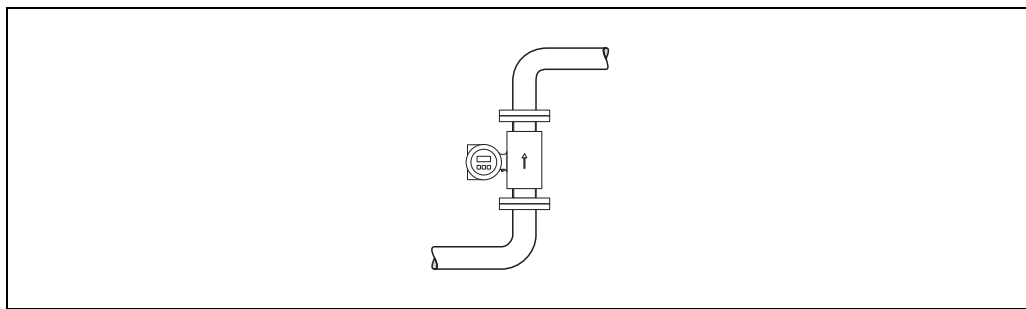
- 1 Vent valve
- 2 Pipe siphon
- h Length of the down pipe

Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



A0008156

Vertical orientation

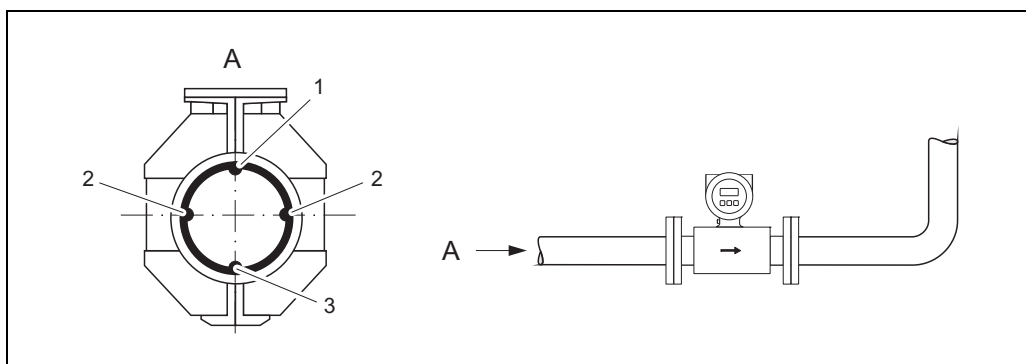
Horizontal orientation

The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.



Caution!

Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.



A0003207

Horizontal orientation

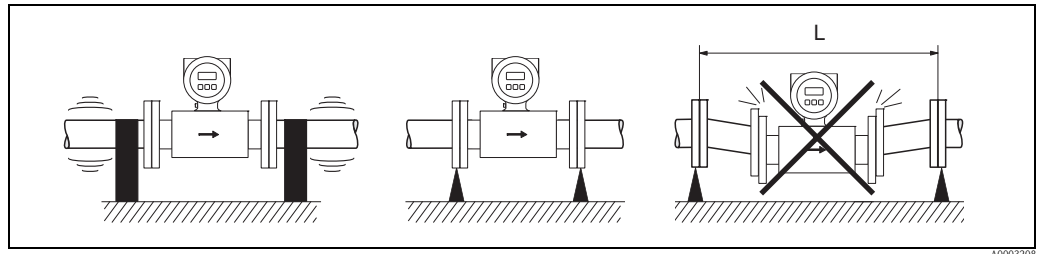
- 1 EPD electrode for empty pipe detection
- 2 Measuring electrodes for signal detection
- 3 Reference electrode for potential equalization

Vibrations

Secure the piping and the sensor if vibration is severe.

**Caution!**

If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 16, Section "Shock and vibration resistance".



Measures to prevent vibration of the measuring device

$L > 10 \text{ m (33 ft)}$

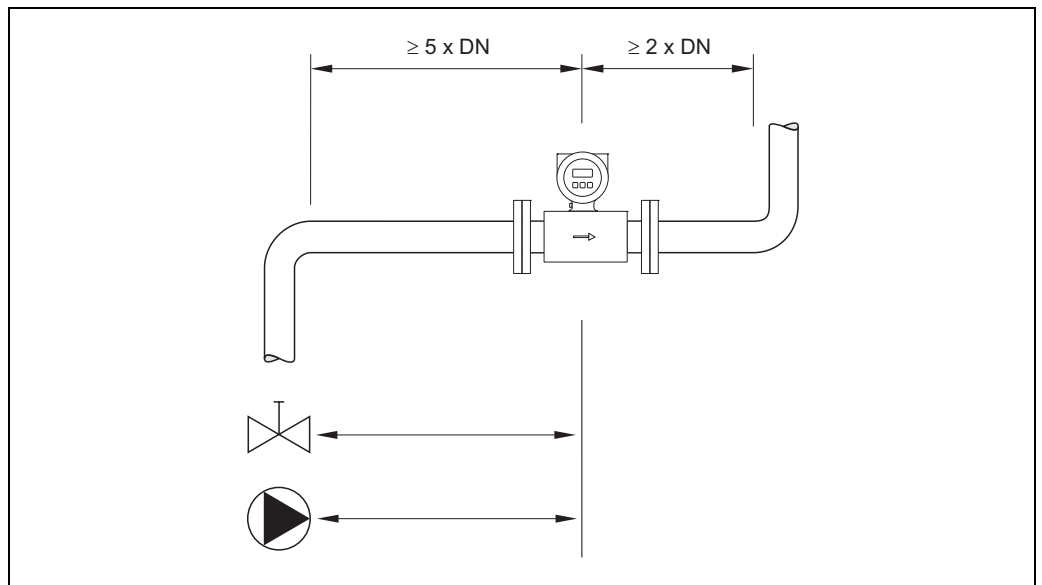
A0003206

Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:

- Inlet run: $\geq 5 \times \text{DN}$
- Outlet run: $\geq 2 \times \text{DN}$



Inlet and outlet run

A0003210

Adapters

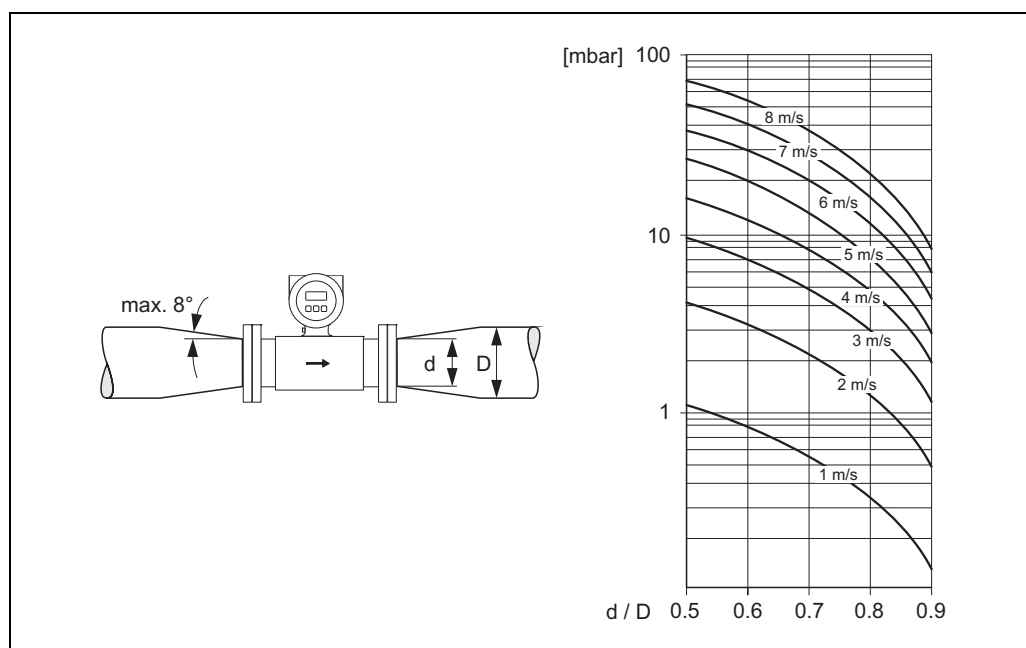
Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.



Note!

The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D .
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



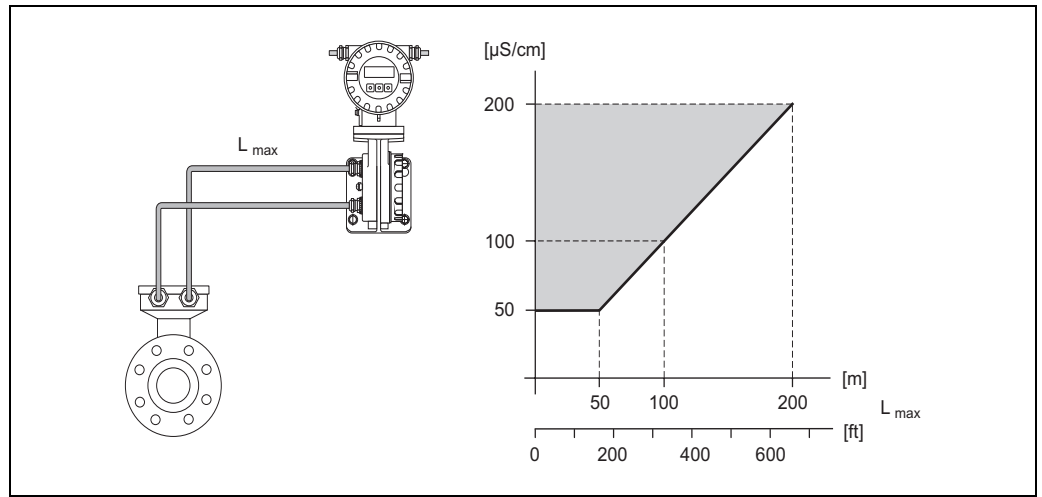
A0003213

Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{\max} is determined by the fluid conductivity. A minimum conductivity of $50 \mu\text{S}/\text{cm}$ is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).






Permitted length of connecting cable for remote version

Area marked in gray = permitted range; L_{\max} = length of connecting cable in [m] ([ft]); fluid conductivity in $\mu\text{S}/\text{cm}$

A0003214

Operating conditions: Environment

Ambient temperature range	<p>Transmitter</p> <ul style="list-style-type: none"> ■ -20 to +60 °C (-4 to +140 °F) <p>Sensor</p> <ul style="list-style-type: none"> ■ Flange material carbon steel: -10 to +60 °C (+14 to +140 °F) ■ Flange material stainless steel: -40 to +60 °C (-40 to +140 °F) <p> Caution! The permitted temperature range of the measuring tube lining may not be undershot or overshot (→  17, Section "Medium temperature range").</p> <p>Please note the following points:</p> <ul style="list-style-type: none"> ■ Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions. ■ The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.
Storage temperature	<p>The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.</p> <p> Caution!</p> <ul style="list-style-type: none"> ■ The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures. ■ A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.
Degree of protection	<ul style="list-style-type: none"> ■ Standard: IP 67 (NEMA 4X) for transmitter and sensor. ■ Optional: IP 68 (NEMA 6P) for sensor for remote version. ■ For information regarding applications where the device is buried directly in the soil or is installed in a flooded wastewater basin please contact your local Endress+Hauser Sales Center.
Shock and vibration resistance	Acceleration up to 2 g following IEC 600 68-2-6
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> ■ As per IEC/EN 61326 as well as NAMUR Recommendation NE 21 ■ Emission: to limit value for industry EN 55011

Operating conditions: Process

Medium temperature range

The permitted temperature depends on the measuring tube lining:

- Polyurethane: -20 to +50 °C (-4 to +122 °F) (DN 25 to 1200 / 1 to 48")
- Hard rubber: 0 to +80 °C (+32 to +176 °F) (DN 50 to 2000 / 2 to 78")

Conductivity



The minimum conductivity is: $\geq 50 \mu\text{S}/\text{cm}$

Note!

In the remote version, the necessary minimum conductivity also depends on the cable length
(→ 15, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501)
 - PN 6 (DN 350 to 2000 / 14 to 78")
 - PN 10 (DN 200 to 2000 / 8 to 78")
 - PN 16 (DN 65 to 2000 / 3 to 78")
 - PN 25 (DN 200 to 1000 / 8 to 40")
 - PN 40 (DN 25 to 150 / 1 to 6")
- ANSI B 16.5
 - Class 150 (DN 25 to 600 / 1 to 24")
 - Class 300 (DN 25 to 150 / 1 to 6")
- AWWA
 - Class D (DN 700 to 2000 / 28 to 78")
- JIS B2220
 - 10 K (DN 50 to 300 / 2 to 12")
 - 20 K (DN 25 to 300 / 1 to 12")
- AS 2129
 - Table E (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")
- AS 4087
 - PN 16 (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")

Pressure tightness

Measuring tube lining: Polyurethane

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:			
		25 °C (77 °F)		50 °C (122 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
25 to 1200	1 to 48"	0	0	0	0

Measuring tube lining: Hard rubber

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:					
		25 °C (77 °F)		70 °C (158 °F)		80 °C (176 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]	[mbar]	[psi]
50 to 2000	2 to 78"	0	0	0	0	0	0

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.


The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- $v < 2 \text{ m/s}$ (6.5 ft/s): for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
- $v > 2 \text{ m/s}$ (6.5 ft/s): for fluids causing build-up such as wastewater sludges etc.

Flow characteristic values (SI units)					
Diameter		Recommended flow	Factory settings		
		Min./max. full scale value	Full scale value	Pulse value	Low flow
[mm]	[inch]	($v \sim 0.3$ or 10 m/s)	Current output ($v \sim 2.5 \text{ m/s}$)	($\sim 2 \text{ pulses/s}$)	($v \sim 0.04 \text{ m/s}$)
25	1"	9 to 300 dm^3/min	75 dm^3/min	0.50 dm^3	1 dm^3/min
32	–	15 to 500 dm^3/min	125 dm^3/min	1.00 dm^3	2 dm^3/min
40	1½"	25 to 700 dm^3/min	200 dm^3/min	1.50 dm^3	3 dm^3/min
50	2"	35 to 1100 dm^3/min	300 dm^3/min	2.50 dm^3	5 dm^3/min
65	–	60 to 2000 dm^3/min	500 dm^3/min	5.00 dm^3	8 dm^3/min
80	3"	90 to 3000 dm^3/min	750 dm^3/min	5.00 dm^3	12 dm^3/min
100	4"	145 to 4700 dm^3/min	1200 dm^3/min	10.00 dm^3	20 dm^3/min
125	–	220 to 7500 dm^3/min	1850 dm^3/min	15.00 dm^3	30 dm^3/min
150	6"	20 to 600 m^3/h	150 m^3/h	0.025 m^3	2.5 m^3/h
200	8"	35 to 1100 m^3/h	300 m^3/h	0.05 m^3	5.0 m^3/h
250	10"	55 to 1700 m^3/h	500 m^3/h	0.05 m^3	7.5 m^3/h
300	12"	80 to 2400 m^3/h	750 m^3/h	0.10 m^3	10 m^3/h
350	14"	110 to 3300 m^3/h	1000 m^3/h	0.10 m^3	15 m^3/h
375	15"	140 to 4200 m^3/h	1200 m^3/h	0.15 m^3	20 m^3/h
400	16"	140 to 4200 m^3/h	1200 m^3/h	0.15 m^3	20 m^3/h
450	18"	180 to 5400 m^3/h	1500 m^3/h	0.25 m^3	25 m^3/h
500	20"	220 to 6600 m^3/h	2000 m^3/h	0.25 m^3	30 m^3/h
600	24"	310 to 9600 m^3/h	2500 m^3/h	0.30 m^3	40 m^3/h
700	28"	420 to 13500 m^3/h	3500 m^3/h	0.50 m^3	50 m^3/h
–	30"	480 to 15000 m^3/h	4000 m^3/h	0.50 m^3	60 m^3/h
800	32"	550 to 18000 m^3/h	4500 m^3/h	0.75 m^3	75 m^3/h
900	36"	690 to 22500 m^3/h	6000 m^3/h	0.75 m^3	100 m^3/h
1000	40"	850 to 28000 m^3/h	7000 m^3/h	1.00 m^3	125 m^3/h
–	42"	950 to 30000 m^3/h	8000 m^3/h	1.00 m^3	125 m^3/h
1200	48"	1250 to 40000 m^3/h	10000 m^3/h	1.50 m^3	150 m^3/h
–	54"	1550 to 50000 m^3/h	13000 m^3/h	1.50 m^3	200 m^3/h
1400	–	1700 to 55000 m^3/h	14000 m^3/h	2.00 m^3	225 m^3/h
–	60"	1950 to 60000 m^3/h	16000 m^3/h	2.00 m^3	250 m^3/h
1600	–	2200 to 70000 m^3/h	18000 m^3/h	2.50 m^3	300 m^3/h
–	66"	2500 to 80000 m^3/h	20500 m^3/h	2.50 m^3	325 m^3/h
1800	72"	2800 to 90000 m^3/h	23000 m^3/h	3.00 m^3	350 m^3/h
–	78"	3300 to 100000 m^3/h	28500 m^3/h	3.50 m^3	450 m^3/h
2000	–	3400 to 110000 m^3/h	28500 m^3/h	3.50 m^3	450 m^3/h

Flow characteristic values (US units)					
Diameter		Recommended flow rate Min./max. full scale value (v ~ 0.3 or 10 m/s)	Factory settings		
[inch]	[mm]		Full scale value Current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow (v ~ 0.04 m/s)
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
–	32	4 to 130 gal/min	30 gal/min	0.20 gal	0.50 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
–	65	16 to 500 gal/min	130 gal/min	1 gal	2.0 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2 gal	4.0 gal/min
–	125	60 to 1950 gal/min	450 gal/min	5 gal	7.0 gal/min
6"	150	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min
8"	200	155 to 4850 gal/min	1200 gal/min	10 gal	15 gal/min
10"	250	250 to 7500 gal/min	1500 gal/min	15 gal	30 gal/min
12"	300	350 to 10600 gal/min	2400 gal/min	25 gal	45 gal/min
14"	350	500 to 15000 gal/min	3600 gal/min	30 gal	60 gal/min
15"	375	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
16"	400	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
18"	450	800 to 24000 gal/min	6000 gal/min	50 gal	90 gal/min
20"	500	1000 to 30000 gal/min	7500 gal/min	75 gal	120 gal/min
24"	600	1400 to 44000 gal/min	10500 gal/min	100 gal	180 gal/min
28"	700	1900 to 60000 gal/min	13500 gal/min	125 gal	210 gal/min
30"	–	2150 to 67000 gal/min	16500 gal/min	150 gal	270 gal/min
32"	800	2450 to 80000 gal/min	19500 gal/min	200 gal	300 gal/min
36"	900	3100 to 100000 gal/min	24000 gal/min	225 gal	360 gal/min
40"	1000	3800 to 125000 gal/min	30000 gal/min	250 gal	480 gal/min
42"	–	4200 to 135000 gal/min	33000 gal/min	250 gal	600 gal/min
48"	1200	5500 to 175000 gal/min	42000 gal/min	400 gal	600 gal/min
54"	–	9 to 300 Mgal/min	75 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1400	10 to 340 Mgal/min	85 Mgal/min	0.0005 Mgal	1.3 Mgal/min
60"	–	12 to 380 Mgal/min	95 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1600	13 to 450 Mgal/min	110 Mgal/min	0.0008 Mgal	1.7 Mgal/min
66"	–	14 to 500 Mgal/min	120 Mgal/min	0.0008 Mgal	2.2 Mgal/min
72"	1800	16 to 570 Mgal/min	140 Mgal/min	0.0008 Mgal	2.6 Mgal/min
78"	–	18 to 650 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min
–	2000	20 to 700 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min

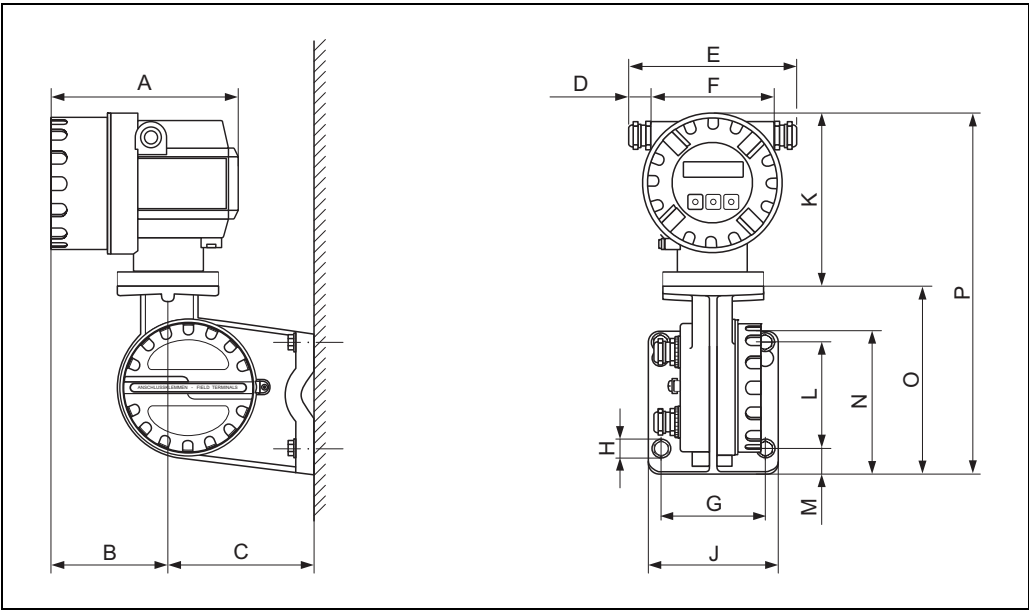
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→  14, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter, remote version



Transmitter dimensions, remote version

Dimensions in SI units

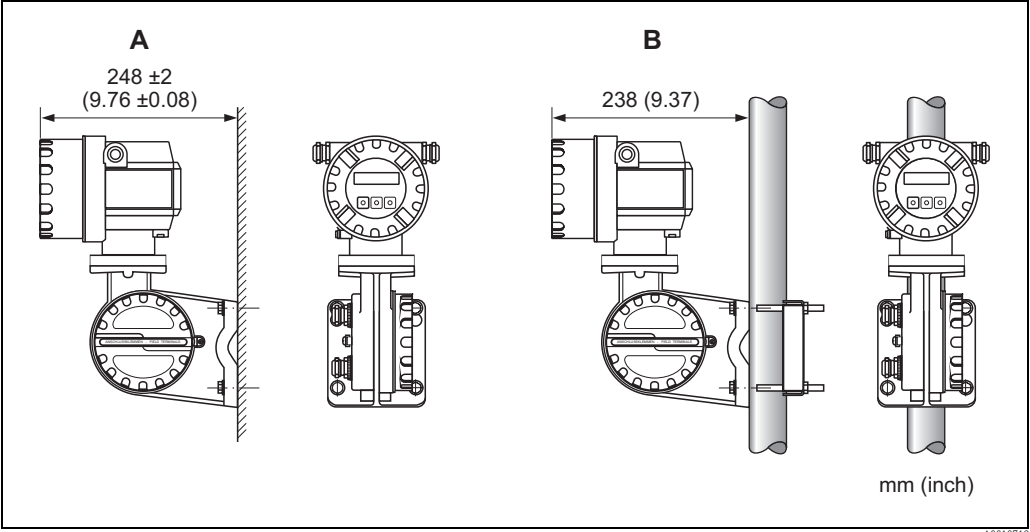
A	B	C	D	E	F	G	Ø H
178	113	135	20 to 30	161 to 181	113	100	8.6 (M8)
J	K	L	M	N	O	P	
123	150	100	25	133	177.5	327.5	

All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	Ø H
7.00	4.45	5.31	0.79 to 1.81	6.34 to 7.13	4.45	3.94	0.34 (M8)
J	K	L	M	N	O	P	
4.84	5.90	3.94	0.98	5.24	6.99	12.89	

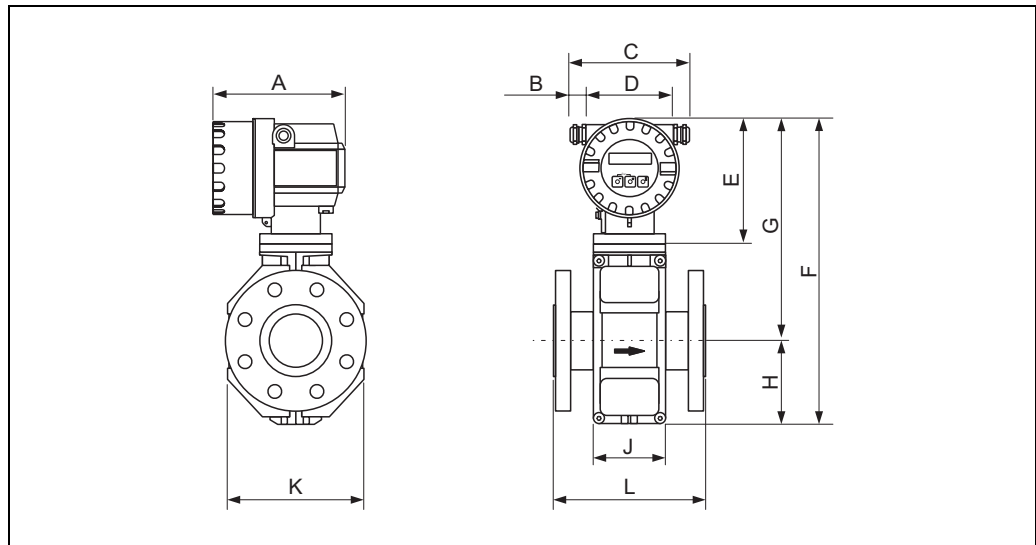
All dimensions in [inch]



A0010719

Transmitter mounting, remote version

- A Direct wall mounting
- B Pipe mounting

Compact version DN ≤ 300 (12")

A0012464

Dimensions in SI units

DN EN (DIN) / JIS / AS ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J	K
25	200	178	20 to 30	161 to 181	113	150	341	257	84	94	120
32	200						341	257	84	94	120
40	200						341	257	84	94	120
50	200						341	257	84	94	120
65	200						391	282	109	94	180
80	200						391	282	109	94	180
100	250						391	282	109	94	180
125	250						472	322	150	140	260
150	300						472	322	150	140	260
200	350						527	347	180	156	324
250	450						577	372	205	166	400
300	500						627	397	230	166	460

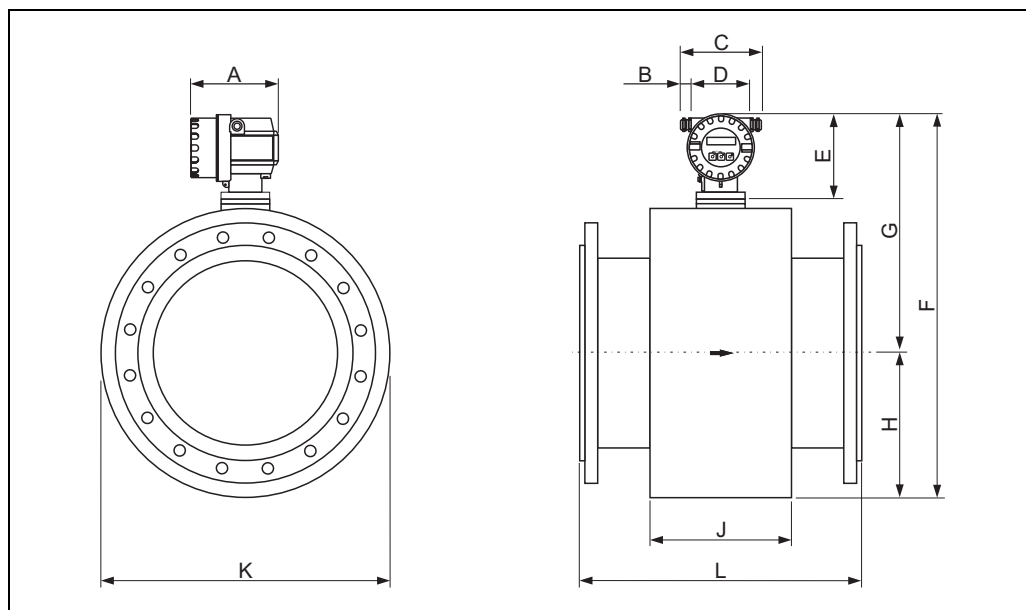
¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

²⁾ For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions in US units

DN ANSI	L ¹⁾	A	B	C	D	E	F	G	H	J	K
1"	7.87	7.01	0.79 to 1.18	6.34 to 7.13	4.45	5.91	13.4	10.1	3.31	3.70	4.72
1½"	7.87						13.4	10.1	3.31	3.70	4.72
2"	7.87						13.4	10.1	3.31	3.70	4.72
3"	7.87						15.4	11.1	4.29	3.70	7.09
4"	9.84						15.4	11.1	4.29	3.70	7.09
6"	11.8						18.6	12.7	5.91	5.51	10.2
8"	13.8						20.8	13.7	7.09	6.14	12.8
10"	17.7						22.7	14.7	8.07	6.14	15.8
12"	19.7						24.7	15.6	9.06	6.54	18.1

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Compact version DN ≥ 350 (14")

A0003218

Dimensions in SI units

DN EN (DIN) / AS ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J	K
350	550	178	20 to 30	161 to 181	113	150	738.5	456.5	282.0	276	564
375	600						790.5	482.5	308.0	276	616
400	600						790.5	482.5	308.0	276	616
450	650						840.5	507.5	333.0	292	666
500	650						891.5	533.0	358.5	292	717
600	780						995.5	585.0	410.5	402	821
700	910						1198.5	686.5	512.0	589	1024
750	975						1198.5	686.5	512.0	626	1024
800	1040						1241.5	708.5	533.5	647	1067
900	1170						1394.5	784.5	610.0	785	1220
1000	1300						1546.5	860.5	686.0	862	1372
1050	1365						1598.5	886.5	712.0	912	1424
1200	1560						1796.5	985.5	811.0	992	1622
1350	1755						1998.5	1086.5	912.0	1252	1824
1400	1820						2148.5	1161.5	987.0	1252	1974
1500	1950						2196.5	1185.5	1011.0	1392	2022
1600	2080						2286.5	1230.5	1056.0	1482	2112
1650	2145						2360.5	1267.5	1093.0	1482	2186
1800	2340						2550.5	1362.5	1188.0	1632	2376
2000	2600						2650.5	1412.5	1238.0	1732	2476

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

²⁾ For flanges to AS, only DN 350, 400, 500 and 600 are available.

All dimensions in [mm]

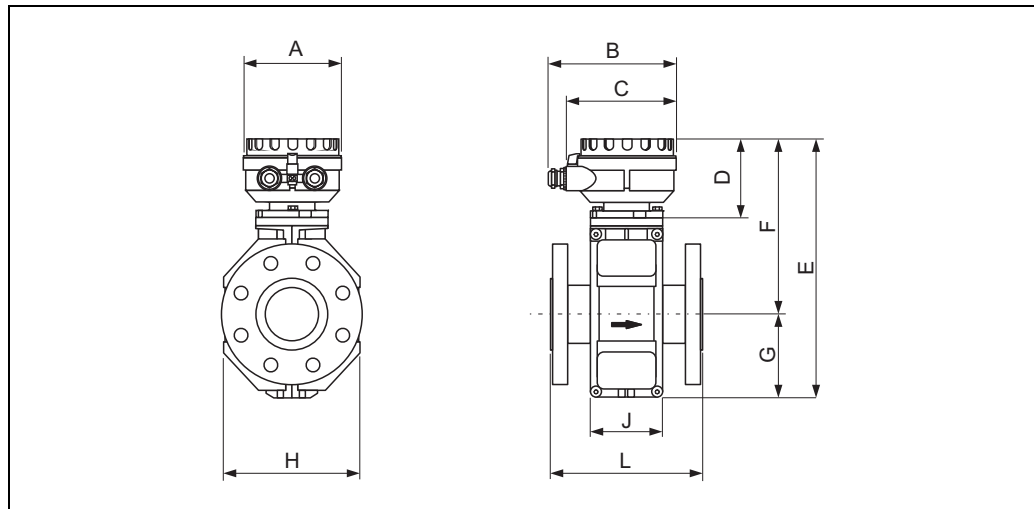
Dimensions in US units

DN ANSI / AWWA ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J	K
14"	21.6	7.01	0.79 to 1.18	6.34 to 7.13	4.45	5.91	29.1	17.9	11.1	10.9	22.2
15"	23.6						31.1	18.9	12.1	10.9	24.2
16"	23.6						31.1	18.9	12.1	10.9	24.2
18"	25.6						33.1	19.9	13.1	11.5	26.2
20"	25.6						35.1	20.9	14.1	11.5	28.2
24"	30.7						39.2	23.0	16.2	15.8	32.3
28"	35.8						47.2	27.0	20.1	23.2	40.3
30"	38.4						47.2	27.0	20.1	24.6	40.3
32"	40.9						48.9	27.9	21.0	25.5	42.0
36"	46.0						54.9	30.9	24.0	30.9	48.0
40"	51.2						60.9	33.9	27.0	33.9	54.0
42"	53.7						62.9	34.9	28.0	35.9	56.0
48"	61.4						71.7	38.8	31.9	39.0	63.8
54"	69.1						78.7	42.8	35.9	42.3	71.8
56"	71.7						84.6	45.7	38.9	49.3	77.7
60"	76.8						86.5	46.7	39.8	54.8	79.6
64"	81.9						90.0	48.4	41.6	58.4	83.2
66"	84.4						92.9	49.9	43.0	58.4	86.0
72"	92.1						100.4	53.6	46.8	64.2	93.5
78"	102.3						104.3	55.6	48.7	68.2	97.5

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

²⁾ Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.

All dimensions in [inch]

Sensor, remote version DN ≤ 300 (12")

A0012462

Dimensions in SI units

DN EN (DIN) / JIS / AS ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J
25	200	129	163	143	102	286	202	84	120	94
32	200	129	163	143	102	286	202	84	120	94
40	200	129	163	143	102	286	202	84	120	94
50	200	129	163	143	102	286	202	84	120	94
65	200	129	163	143	102	336	227	109	180	94
80	200	129	163	143	102	336	227	109	180	94
100	250	129	163	143	102	336	227	109	180	94
125	250	129	163	143	102	417	267	150	260	140
150	300	129	163	143	102	417	267	150	260	140
200	350	129	163	143	102	472	292	180	324	156
250	450	129	163	143	102	522	317	205	400	166
300	500	129	163	143	102	572	342	230	460	166

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

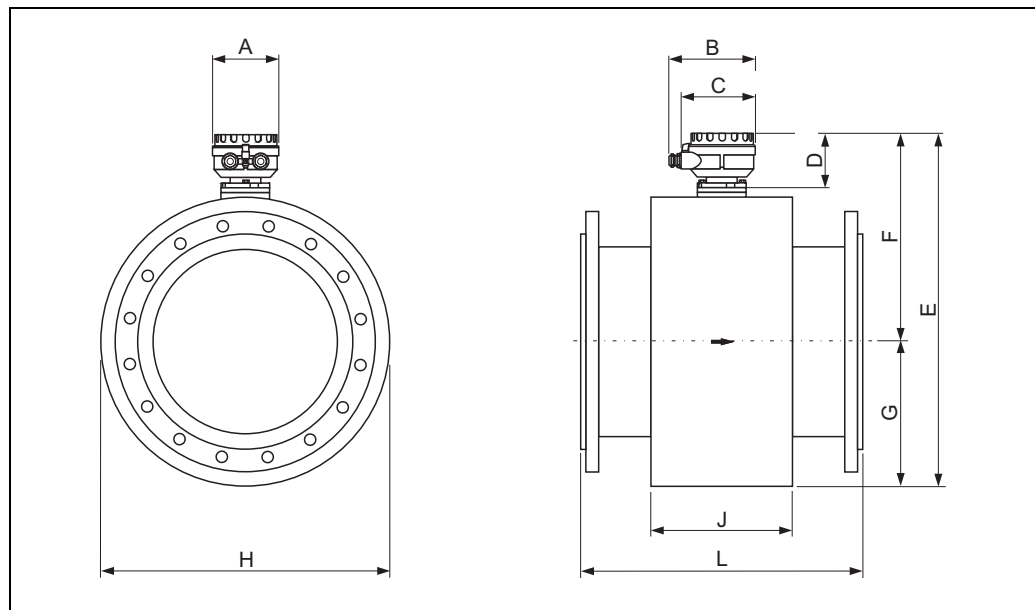
²⁾ For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.

All dimensions in [mm]

Dimensions in US units

DN ANSI	L ¹⁾	A	B	C	D	E	F	G	H	J
1"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
1½"	7.87					11.3	7.95	3.32	4.72	3.70
2"	7.87					11.3	7.95	3.32	4.72	3.70
3"	7.87					13.2	8.94	4.30	7.10	3.70
4"	9.84					13.2	8.94	4.30	7.10	3.70
6"	11.8					16.4	10.5	5.91	10.2	5.51
8"	13.8					18.6	11.5	7.10	12.8	6.14
10"	17.7					20.6	12.5	8.08	15.8	6.14
12"	19.7					22.5	13.5	9.06	18.1	6.54

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Sensor, remote version DN ≥ 350 (14")

A0003220

Dimensions in SI units

DN EN (DIN) / AS ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J
350	550	129	163	143	102	683.5	401.5	282.0	564	276
375	600					735.5	427.5	308.0	616	276
400	600					735.5	427.5	308.0	616	276
450	650					785.5	452.5	333.0	666	292
500	650					836.5	478.0	358.5	717	292
600	780					940.5	530.0	410.5	821	402
700	910					1143.5	631.5	512.0	1024	589
750	975					1143.5	631.5	512.0	1024	626
800	1040					1186.5	653.0	533.5	1067	647
900	1170					1339.5	729.5	610.0	1220	785
1000	1300					1491.5	805.5	686.0	1372	862
1050	1365					1543.5	831.5	712.0	1424	912
1200	1560					1741.5	930.5	811.0	1622	992
1350	1755					1943.5	1031.5	912.0	1824	1252
1400	1820					2093.5	1106.5	987.0	1974	1252
1500	1950					2141.5	1130.5	1011.0	2022	1392
1600	2080					2231.5	1175.5	1056.0	2112	1482
1650	2145					2305.5	1212.5	1093.0	2186	1482
1800	2340					2495.5	1307.5	1188.0	2376	1632
2000	2600					2595.5	1357.5	1238.0	2476	1732

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

²⁾ For flanges to AS, only DN 350, 400, 500 and 600 are available.

All dimensions in [mm]

Dimensions in US units

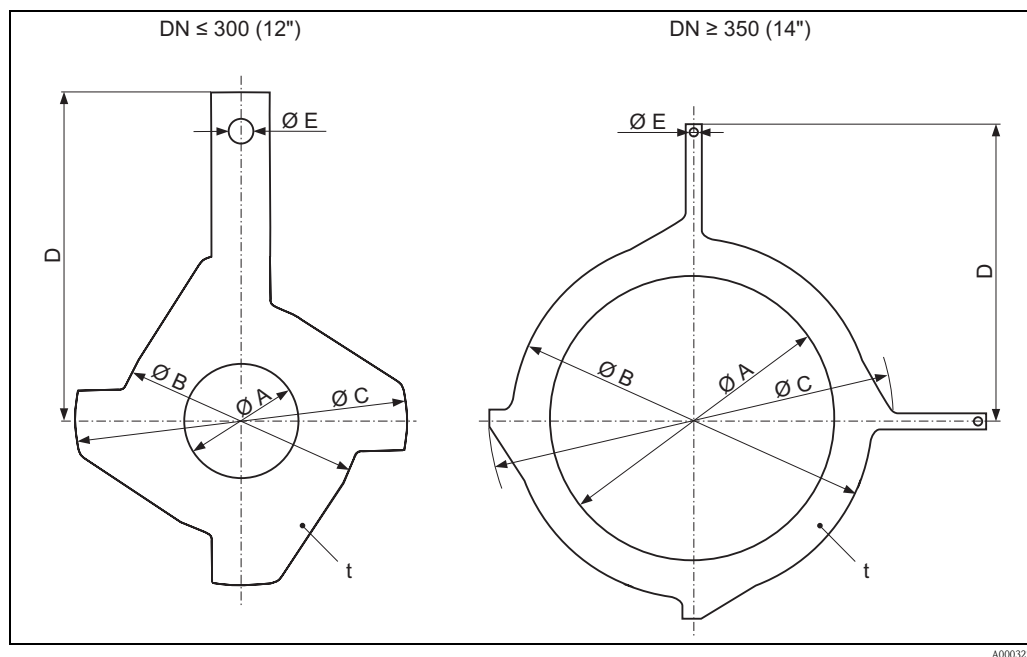
DN ANSI / AWWA ²⁾	L ¹⁾	A	B	C	D	E	F	G	H	J
14"	21.6	5.08	6.42	5.63	4.02	29.1	15.8	11.1	22.2	10.9
15"	23.6					31.1	16.8	12.1	24.2	10.9
16"	23.6					31.1	16.8	12.1	24.2	10.9
18"	25.6					33.1	17.8	13.1	26.2	11.5
20"	25.6					35.1	18.8	14.1	28.2	11.5
24"	30.7					39.2	20.9	16.2	32.3	15.8
28"	35.8					45.0	24.9	20.1	40.3	23.2
30"	38.4					45.0	24.9	20.1	40.3	24.6
32"	40.9					46.7	25.7	21.0	42.0	25.5
36"	46.0					52.7	28.7	24.0	48.0	30.9
40"	51.2					58.7	31.7	27.0	54.0	33.9
42"	53.7					60.7	32.7	28.0	56.0	35.9
48"	61.4					68.5	36.6	31.9	63.8	39.0
54"	69.1					76.5	40.6	35.9	71.8	42.3
56"	71.7					82.4	43.6	38.9	77.7	49.3
60"	76.8					84.3	44.5	39.8	79.6	54.8
64"	81.9					87.9	46.3	41.6	83.2	58.4
66"	84.4					90.8	47.7	43.0	86.0	58.4
72"	92.1					98.2	51.5	46.8	93.5	64.2
78"	102.3					102.2	53.4	48.7	97.5	68.2

¹⁾ The length is regardless of the pressure rating selected. Fitting length to DVGW.

²⁾ Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.

All dimensions in [inch]

Ground disk for flange connections



A0003221

Dimensions (SI units)

DN ¹⁾ EN (DIN) / JIS / AS ²⁾	A	B	C	D	E	t
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5		
40	41	82	101	103		
50	52	101	115.5	108		
65	68	121	131.5	118		
80	80	131	154.5	135		
100	104	156	186.5	153		
125	130	187	206.5	160		
150	158	217	256	184		
200	206	267	288	205		
250	260	328	359	240		
300 ³⁾	312	375	413	273		
300 ⁴⁾	310	375	404	268		
350 ³⁾	343	433	479	365	9.0	
375 ³⁾	393	480	542	395		
400 ³⁾	393	480	542	395		
450 ³⁾	439	538	583	417		
500 ³⁾	493	592	650	460		
600 ³⁾	593	693	766	522		

¹⁾ Ground disks can be used for all flange standards/pressure ratings that can be delivered, except for DN ≥ 300.

²⁾ Only DN 32, 40, 65 and 125 are available for flanges according to AS.

³⁾ PN 10/16

⁴⁾ PN 25, JIS 10K/20K

All dimensions in [mm]

Dimensions (US units)

DN ¹⁾ ANSI	A	B	C	D	E	t
1"	1.02	2.44	3.05	3.44	0.26	0.08
1½"	1.61	3.23	3.98	4.06		
2"	2.05	3.98	4.55	4.25		
3"	3.15	5.16	6.08	5.31		
4"	4.09	6.14	7.34	6.02		
6"	6.22	8.54	10.08	7.24		
8"	8.11	10.5	11.3	8.07		
10"	10.2	12.9	14.1	9.45		
12"	12.3	14.8	16.3	10.8		
14"	13.5	17.1	18.9	14.4	0.35	
15"	15.45	18.9	21.3	15.6		
16"	15.45	18.9	21.3	15.6		
18"	17.3	21.2	23.0	16.4		
20"	19.4	23.3	25.6	18.1		
24"	23.4	27.3	30.1	20.6		

¹⁾ Ground disks can be used for all flange standards/pressure ratings.
All dimensions in [inch]

Weight

Weight in SI units

Weight data in kg									
Diameter		Compact version			Remote version (without cable)				
[mm]	[inch]	EN (DIN) / AS ¹⁾	JIS	ANSI / AWWA	EN (DIN) / AS ¹⁾	JIS	ANSI / AWWA	Transmitter Wall housing	
25	1"	5.7	5.7	5.7	5.3	5.3	5.3	3.1	
32	–	6.4	5.7	–	6.0	5.3	–		
40	1½"	7.8	6.7	7.8	7.4	6.3	7.4		
50	2"	9.0	7.7	9.0	8.6	7.3	8.6		
65	–	10.4	9.5	–	10.0	9.1	–		
80	3"	12.4	10.9	12.4	12.0	10.5	12.0		
100	4"	14.4	13.1	14.4	14.0	12.7	14.0		
125	–	19.9	19.4	–	19.5	19.0	–		
150	6"	23.9	22.9	23.9	23.5	22.5	23.5		
200	8"	43.4	40.3	43.3	43	39.9	43		
250	10"	63.4	67.8	73.4	63	67.4	73		
300	12"	68.4	70.7	108.4	68	70.3	108		
350	14"	105		175	103		173		
375	15"	120		–	118		–		
400	16"	120		205	118		203		
450	18"	161		255	159		253		
500	20"	156		285	154		283		
600	24"	208		405	206		403		
700	28"	304		400	302		398		
–	30"	–		460	–		458		
800	32"	357		550	355		548		
900	36"	485		800	483		798		
1000	40"	589		900	587		898		
–	42"	–		1100	–		1098		
1200	48"	850		1400	848		1398		
–	54"	–		2200	–		2198		
1400	–	1300		–	1298		–		
–	60"	–		2700	–		2698		
1600	–	1700		–	1698		–		
–	66"	–		3700	–		3698		
1800	72"	2200		4100	2198		4098		
–	78"	–		4600	–		4598		
2000	–	2800		–	2798		–		

¹⁾ For flanges to AS, only DN 80, 100, 150 to 400, 500 and 600 are available.

- Transmitter (compact version): 1.8 kg
- Weight data valid for standard pressure ratings and without packaging material

Weight in US units (only ANSI/AWWA)

Weight data in lbs					
Diameter		Compact version		Remote version (without cable)	
[mm]	[inch]	ANSI /AWWA		Sensor ANSI / AWWA	Transmitter Wall housing
25	1"	Class 150	12.6	Class 150	6.8
40	1½"		17.2		
50	2"		19.9		
80	3"		27.3		
100	4"		31.8		
150	6"		52.7		
200	8"		95.5		
250	10"		162.1		
300	12"		239.0		
350	14"		380.1		
400	16"		448.5		
450	18"		558.8		
500	20"		624.9		
600	24"		889.5		
700	28"	Class D	878.5	Class D	
–	30"		1010.8		
800	32"		1209.2		
900	36"		1760.5		
1000	40"		1981.0		
–	42"		2422.0		
1200	48"		3083.5		
–	54"		4847.5		
–	60"		5950.0		
–	66"		8155.0		
1800	72"		9037.0		
–	78"		10139.0		

- Transmitter (compact version): 4.0 lbs
- Weight data valid for standard pressure ratings and without packaging material

Measuring tube specifications

Diameter		Pressure rating						Internal diameter			
[mm]	[inch]	EN (DIN) [bar]	AS 2129	AS 4087	ANSI [lbs]	AWWA	JIS	Hard rubber		Polyurethane	
								[mm]	[inch]	[mm]	[inch]
25	1"	PN 40	–	–	Cl. 150	–	20 K	–	–	24	0.94
32	–	PN 40	–	–	–	–	20 K	–	–	32	1.26
40	1½"	PN 40	–	–	Cl. 150	–	20 K	–	–	38	1.50
50	2"	PN 40	Table E	PN 16	Cl. 150	–	10 K	50	1.97	50	1.97
65	–	PN 16	–	–	–	–	10 K	66	2.60	66	2.60
80	3"	PN 16	Table E	PN 16	Cl. 150	–	10 K	79	3.11	79	3.11
100	4"	PN 16	Table E	PN 16	Cl. 150	–	10 K	102	4.02	102	4.02
125	–	PN 16	–	–	–	–	10 K	127	5.00	127	5.00
150	6"	PN 16	Table E	PN 16	Cl. 150	–	10 K	156	6.14	156	6.14
200	8"	PN 10	Table E	PN 16	Cl. 150	–	10 K	204	8.03	204	8.03
250	10"	PN 10	Table E	PN 16	Cl. 150	–	10 K	258	10.2	258	10.2
300	12"	PN 10	Table E	PN 16	Cl. 150	–	10 K	309	12.2	309	12.2
350	14"	PN 6	Table E	PN 16	Cl. 150	–	–	342	13.5	342	13.5
375	15"	–	–	PN 16	–	–	–	392	15.4	–	–
400	16"	PN 6	Table E	PN 16	Cl. 150	–	–	392	15.4	392	15.4
450	18"	PN 6	–	–	Cl. 150	–	–	437	17.2	437	17.2
500	20"	PN 6	Table E	PN 16	Cl. 150	–	–	492	19.4	492	19.4
600	24"	PN 6	Table E	PN 16	Cl. 150	–	–	594	23.4	594	23.4
700	28"	PN 6	–	–	–	Class D	–	692	27.2	692	27.2
–	30"	–	–	–	–	Class D	–	742	29.2	742	29.2
800	32"	PN 6	–	–	–	Class D	–	794	31.3	794	31.3
900	36"	PN 6	–	–	–	Class D	–	891	35.1	891	35.1
1000	40"	PN 6	–	–	–	Class D	–	994	39.1	994	39.1
–	42"	–	–	–	–	Class D	–	1043	41.1	1043	41.1
1200	48"	PN 6	–	–	–	Class D	–	1197	47.1	1197	47.1
–	54"	–	–	–	–	Class D	–	1339	52.7	–	–
1400	–	PN 6	–	–	–	–	–	1402	55.2	–	–
–	60"	–	–	–	–	Class D	–	1492	58.7	–	–
1600	–	PN 6	–	–	–	–	–	1600	63.0	–	–
–	66"	–	–	–	–	Class D	–	1638	64.5	–	–
1800	72"	PN 6	–	–	–	Class D	–	1786	70.3	–	–
2000	78"	PN 6	–	–	–	Class D	–	1989	78.3	–	–

Material

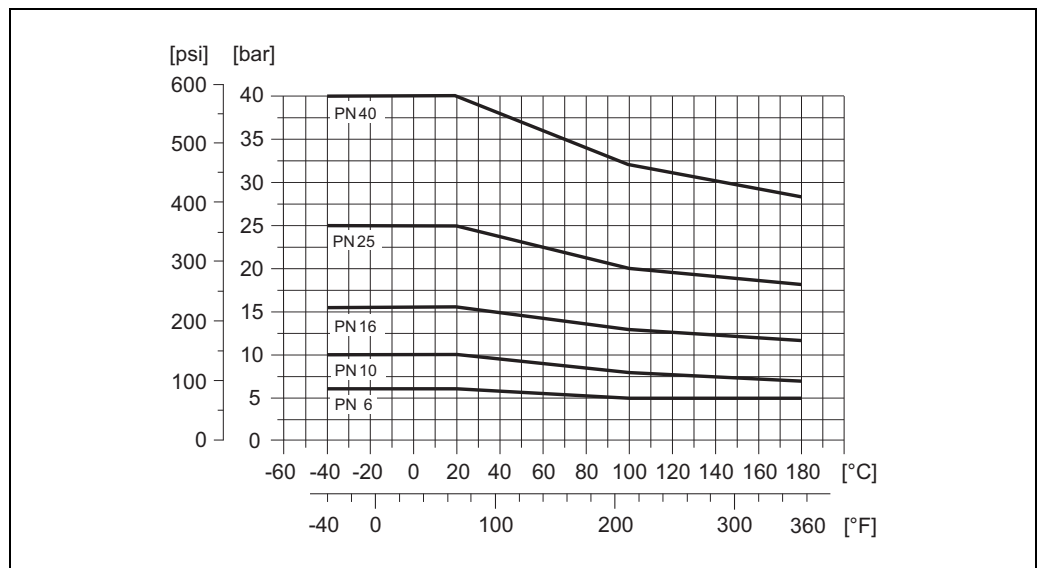
- Housing: powder-coated die-cast aluminum
- Sensor housing
 - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
 - DN 350 to 2000 (14 to 78"): with protective lacquering
- Measuring tube
 - DN ≤ 300 (12"): stainless steel 1.4301 or 1.4306/304L;
(Flange material: carbon steel with Al/Zn protective coating)
 - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L;
(Flange material: carbon steel with protective lacquering)
- Electrodes: 1.4435/316L, Alloy C-22
- Flanges
 - EN 1092-1 (DIN2501): RSt37-2 (S235JRG2); C22, Fe 410W B
(DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
 - ANSI: A105
(DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
 - AWWA: 1.0425 (with protective lacquering)
 - JIS: RSt37-2 (S235JRG2); HII; 1.0425
(DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
 - AS 2129
 - (DN 25, 80, 100, 150...1200 / 1", 3", 4", 6...48"): A105 or RSt37-2 (S235JRG2)
 - (DN 50, 80, 350, 400, 500 / 2", 3", 14", 16", 20"): A105 or St44-2 (S275JR)
 - AS 4087: A105 or St44-2 (S275JR)
(DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Material load diagram**Caution!**

The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material.

Flange connection to EN 1092-1 (DIN 2501)

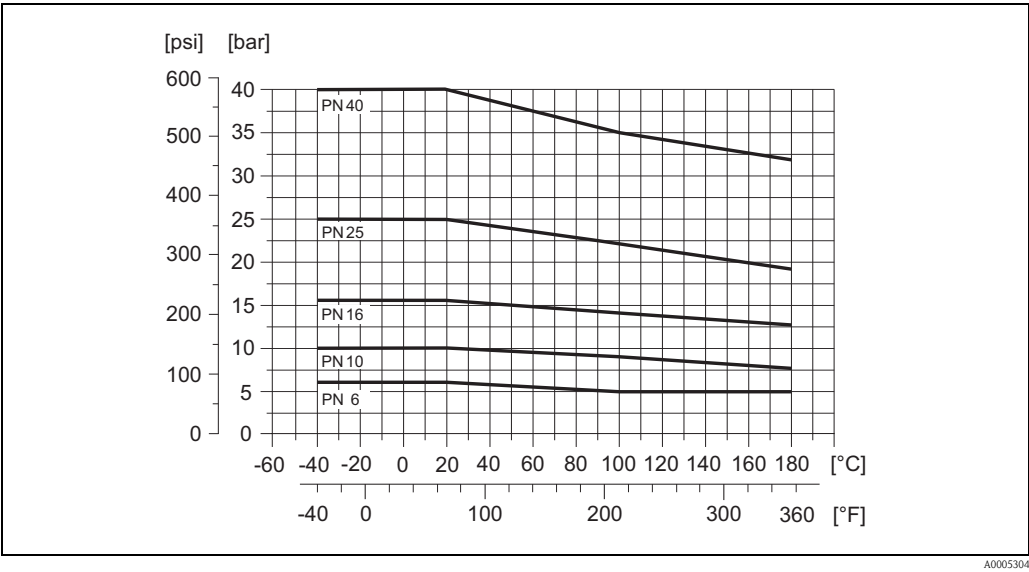
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



A0005594

Flanschanschluss nach EN 1092-1 (DIN 2501)

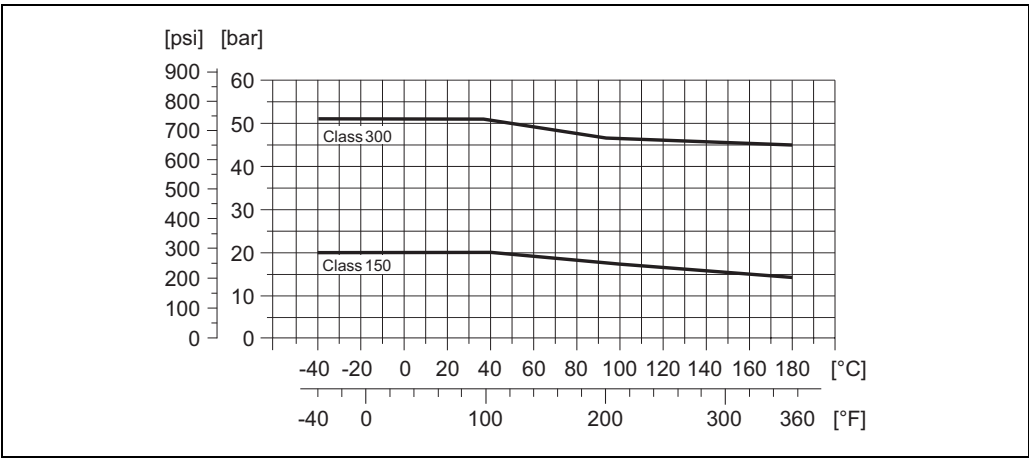
Werkstoff: 316L / 1.4571



A0005304

Flange connection to ANSI B16.5

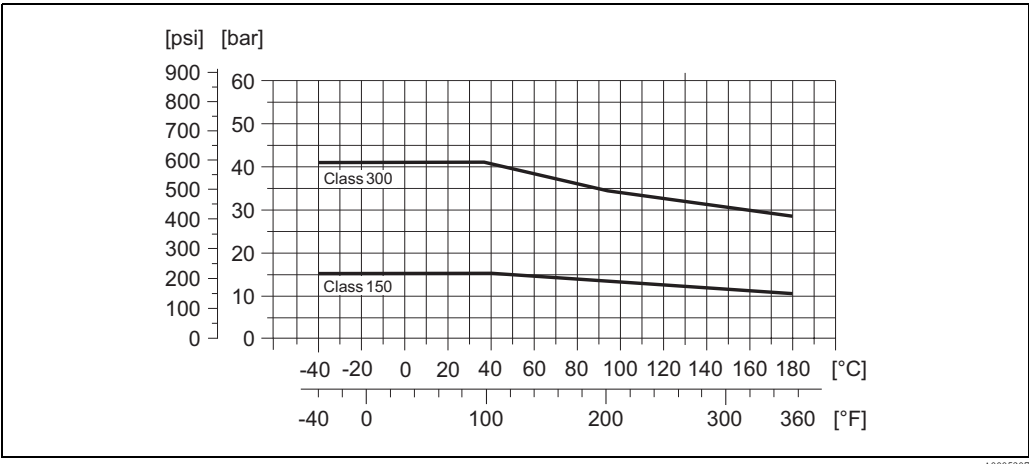
Material: A 105



A0003226

Flanschanschluss nach ANSI B16.5

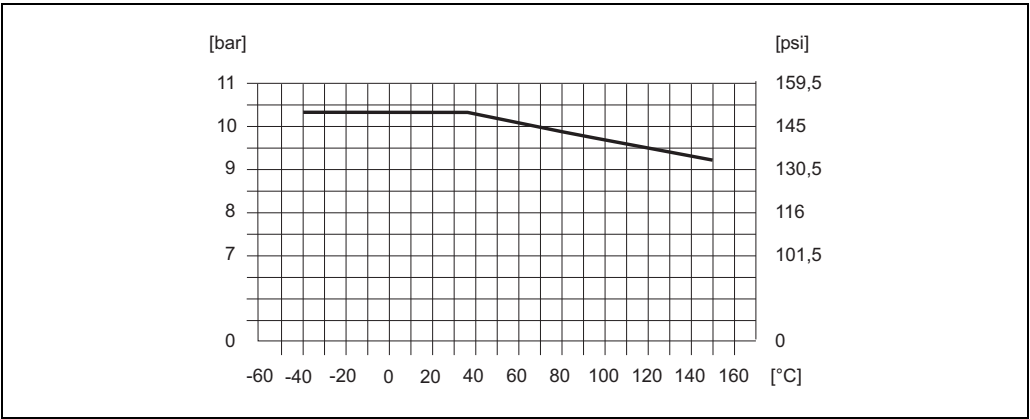
Werkstoff: F316L



A0005307

Flange connection to AWWA C207, Class D

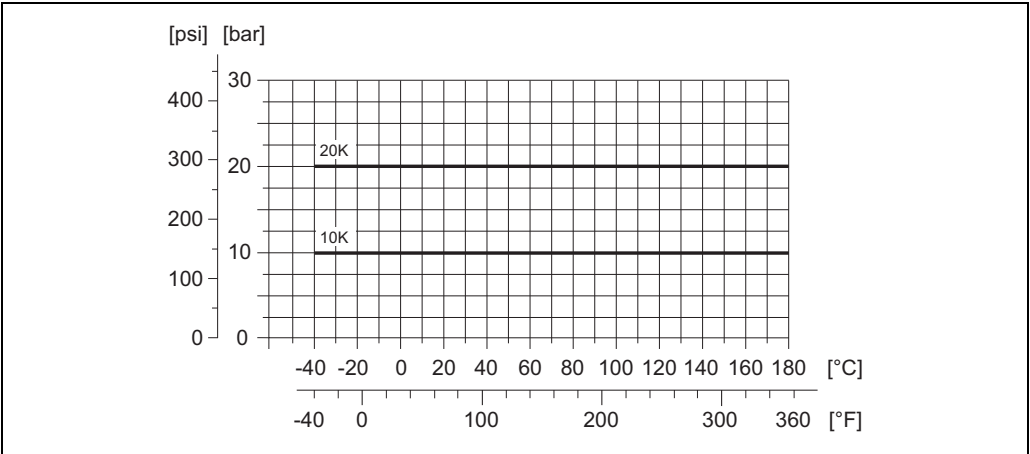
Material: 1.0425



A0005592

Flange connection to JIS B2220

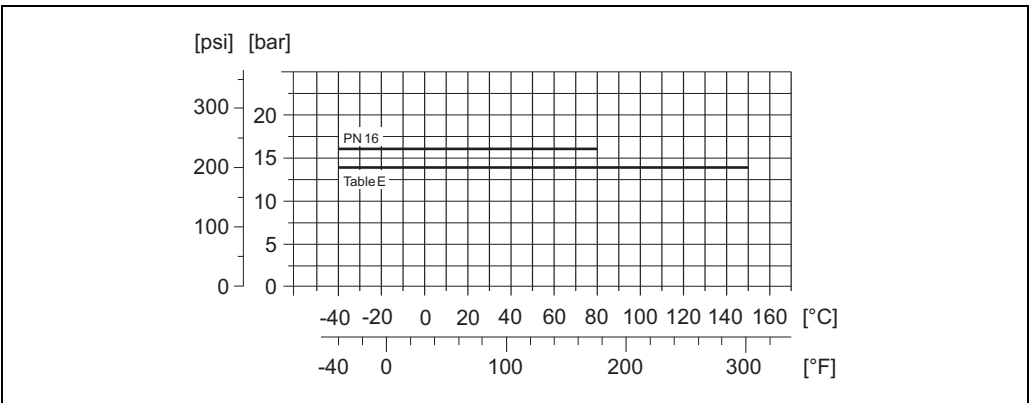
Material: RSt37-2 (S235)RG2 / HII / 1.0425 / 316L



A0005228

Flange connection to AS 2129 Table E or AS 4087 PN 16

Material: A105 / RSt37-2 (S235)RG2 / St44-2 (S275)JR



A0005595

Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes available as standard with:

- 1.4435
- Alloy C-22

Process connections	Flange connection: <ul style="list-style-type: none"> ■ EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B (Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 10921) ■ ANSI B16.5 ■ AWWA C 207, Class D ■ JIS B2220 ■ AS 2129 Table E ■ AS 4087 PN 16
----------------------------	--

Surface roughness	Electrodes with 1.4435 (AISI 316L), Alloy C-22: ≤ 0.3 to 0.5 µm (12 to 20 µin) (All data refer to parts in contact with medium)
--------------------------	--

Human interface

Display elements	<ul style="list-style-type: none"> ■ Liquid crystal display: unilluminated, two-line, 16 characters per line ■ Display (operating mode) preconfigured: volume flow and totalizer status ■ 1 totalizer
-------------------------	--

Operating elements	Local operation via three keys (◀, +, ▶)
---------------------------	--

Remote operation	Operation via HART protocol and FieldCare
-------------------------	---

Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
----------------	---

C-tick mark	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
--------------------	--

Ex approval	Information about currently available Ex versions (FM, CSA etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.
--------------------	---

Other standards and guidelines	<ul style="list-style-type: none"> ■ EN 60529 Degrees of protection by housing (IP code). ■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ■ IEC/EN 61326 "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC requirements). ■ ANSI/ISA-S82.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements. Pollution degree 2, Installation Category II. ■ CAN/CSA-C22.2 No. 1010.1-92 Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II.
---------------------------------------	---

Pressure measuring device approval	Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.
---	--

Ordering information

Your Endress +Hauser service organization can provide detailed ordering information and information on the order codes on request.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

Registered trademarks

KALREZ® and VITON®

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®

Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

FieldCare®, Fieldcheck®, Field Xpert™, Applicator®

Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel. +41 61 715 81 00
Fax +41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser 
People for Process Automation



**6 Series
Pressure Switch**

Type J6



**UNITED ELECTRIC
CONTROLS
Installation and Maintenance
Instructions**

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warranties.

GENERAL



BEFORE INSTALLING, CHECK THE SENSOR MODEL SELECTED FOR COMPATIBILITY TO THE PROCESS MEDIA IN CONTACT WITH THE SENSOR AND WETTED PARTS.

J6 pressure switches are activated when a bellows or piston sensor responds to a pressure change. This response, at a pre-determined set point, actuates a single snap-action switch, converting the pressure signal into an electrical signal. Set point may be varied by turning the internal adjustment screw. (See Part II – Adjustments).



PROOF PRESSURE* LIMITS STATED IN THE LITERATURE AND ON NAMEPLATES MUST NEVER BE EXCEEDED, EVEN BY SURGES IN THE SYSTEM. OCCASIONAL OPERATION OF UNIT UP TO PROOF PRESSURE IS ACCEPTABLE (E.G., START-UP, TESTING). CONTINUOUS OPERATION SHOULD NOT EXCEED THE DESIGNATED OVER RANGE PRESSURE**.

*Proof Pressure

The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage (e.g., start-up, testing). The unit may require re-gapping.

**Over Range Pressure

The maximum pressure to which a pressure sensor may be continuously subjected without causing damage and maintaining set point repeatability.



THESE PRODUCTS DO NOT HAVE ANY FIELD REPLACEABLE PARTS.

Please refer to product bulletin for product specifications. UE product bulletins may be found at www.ueonline.com

Part I - Installation

Tools Needed

- Adjustable wrench
- Phillips head screwdriver

MOUNTING

J6 pressure switches may be mounted and operated in any position. They may be surface mounted via the two mounting ears on either side of the enclosure, or mounted directly to a rigid pipe by using the pressure connection.



ALWAYS LOCATE UNITS WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. DO NOT MOUNT UNIT IN AMBIENT TEMPERATURES EXCEEDING PUBLISHED LIMITS.



UNIT MAY BE MOUNTED IN ANY POSITION PROVIDED THE ELECTRICAL CONDUIT IS NOT FACING UP. THE RECOMMENDED MOUNTING POSITION IS VERTICAL (PRESSURE CONNECTION FACING DOWN), SPECIFICALLY WHERE HEAVY CONDENSATION IS EXPECTED.



ALWAYS HOLD A WRENCH ON THE PRESSURE HOUSING HEX WHEN MOUNTING UNIT. DO NOT TIGHTEN BY TURNING ENCLOSURE. THIS WILL DAMAGE SENSOR AND WEAKEN SOLDER OR WELDED JOINTS.

On models supplied with an external manual reset button, be sure to leave sufficient finger space over the reset button for the operator to reset the switch.

WIRING



DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING UNIT. WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG. THE RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN-LBS.



ELECTRICAL RATINGS STATED IN LITERATURE AND ON NAMEPLATE SHOULD NEVER BE EXCEEDED. OVERLOAD ON A SWITCH CAN CAUSE FAILURE ON THE FIRST CYCLE.

Remove the four screws retaining the cover and cover gasket. A 1/2" NPT conduit connection is provided on the upper left hand side of the enclosure. The three switch terminals are clearly labeled common, normally open and normally closed.

For optional switches supplied with lead wires, the following color coding applies:

	Manual Reset (Option 1530)
	SPDT
Common	Violet
Normally Open	Blue
Normally Closed	Black

A threaded grounding boss, tapped #10-32, is provided in the lower left corner of the enclosure. Keep the wires as short as possible to prevent interference with the plunger, or the optional manual reset button or adjustable deadband switch wheel.

Part II - Adjustments

Tools Needed

Models 126, 134, S126B, S134B: 3/16" & 1/4" open-end wrenches
Models 136-160, S136B-S164B, 680: 5/8" open-end wrench
Models 258-274, 354-364: 11/16" open-end wrench
Models 218-230: 1/4" open-end wrench
Models 610-614: 3/16" open-end wrench

Pressure Models

For set point adjustment, connect unit to a calibrated pressure source. Remove cover and gasket. The adjusting screw, labeled "A" in Figures 1 & 2, is located beneath the switch and is turned to adjust the set point. Using the appropriately sized open-end wrench (see Tools Needed above), turn the adjustment screw towards the left (clockwise) to increase set point or towards the right (counter-clockwise) to decrease set point.

Vacuum Models

For set point adjustment, connect unit to a calibrated source. Remove cover and gasketing. The adjusting screw, labeled "A" in Figures 1 & 2, is located beneath the switch and is turned to adjust the set point. Using a 1/4" open-end wrench, turn the adjustment screw towards the right (counter-clockwise) to increase set point (towards full vacuum) or towards the left (clockwise) to decrease set point (towards 0 psig).

NOTE: For models 126-134 & S126B-S134B, use 3/16" open-end wrench to keep item B (Figure 2) from turning.

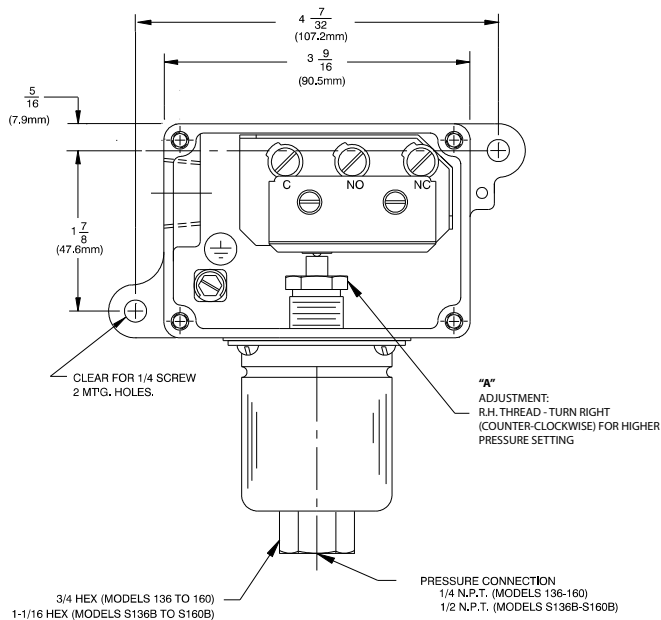


Figure 1: Models 136-160, S136B-S164B, 258-274, and 354-364

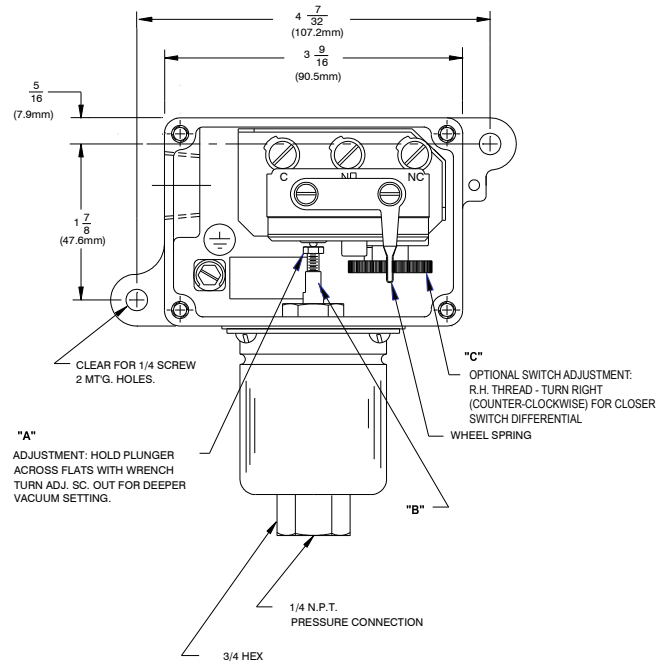


Figure 2: Models 126, 134, S126B, S134B, 218-230, 610-614, 680

NOTE: Picture shows optional adjustable deadband switch (option 1520)

Types with Adjustable Deadband Switch (Option 1520)

Types with option code 1520 incorporate a snap switch with integral adjustment wheel (Item C in Fig. 2). Turning this wheel raises or lowers the pressure rise set point. The fall set point remains constant. To use the adjustable deadband switch:

- Determine set point and deadband values. For example, a rising set point of 20 psi with a deadband value of 6 psi.
- Set the falling set point at desired deadband value (determined by subtracting the deadband value from the desired set point) using the standard adjustment screw as outlined above. Using the example from set 1, $20 - 6 = 14$, so you would set the fall set point at 14 psi. This is your constant.
- Set your deadband by turning the adjustment wheel left to raise or right to lower the set point. Using the example from step 1, turn the wheel left or right until 20 psi is achieved. This is your set point.

Consult UE for additional information.

Types with Manual Reset Switch (Option 1530)

These optional models incorporate a snap switch that when actuated, remains actuated until the pressure decreases and the reset button (located on top of the enclosure) is manually depressed to reset the switch.

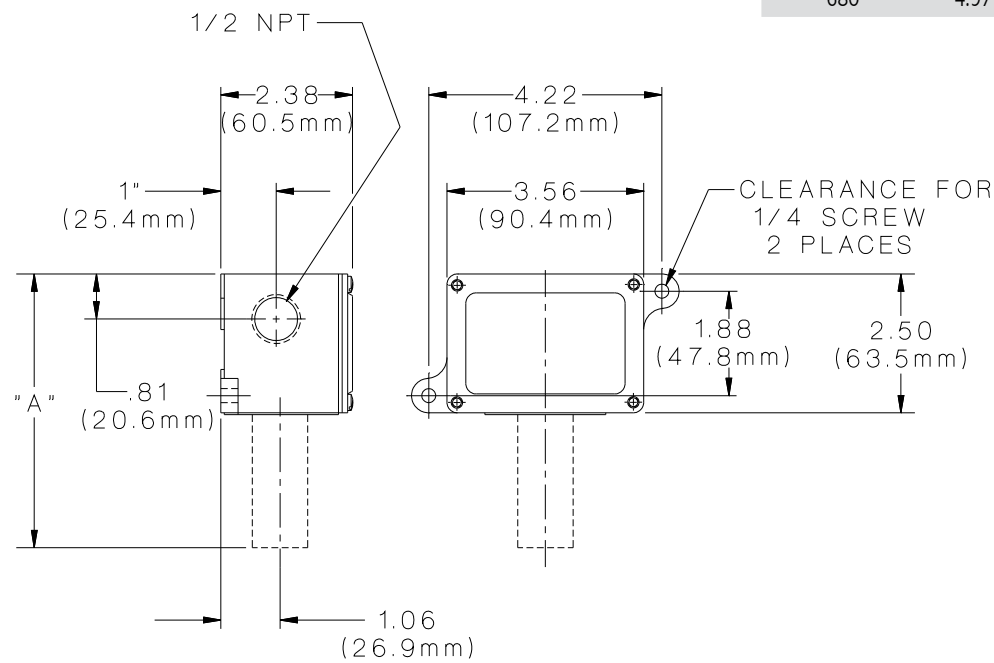


REPLACE COVER AND GASKET WHEN ALL OPERATIONS ARE COMPLETE AND BEFORE USING.

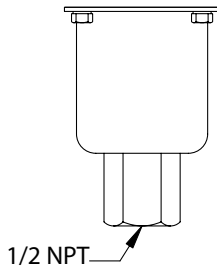
Dimensions

Dimensional drawings for all models may be found at www.ueonline.com.

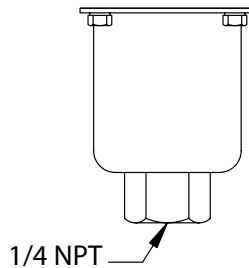
Dimension A			
Models	Inches	mm	NPT
126-160	5.06	128,5	1/4
S126B-S164B	5.47	138,9	1/2
218-230	4.31	109,5	1/4
258-274	4.75	120,7	1/4
354-364	4.78	121,4	1/4
610-614	5.72	145,3	1/4
680	4.97	126,2	1/4



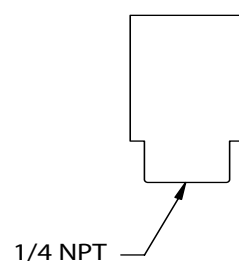
Pressure Connections



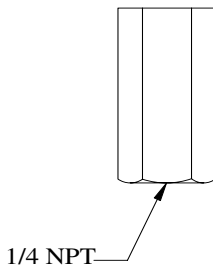
Models S1261B-S164B



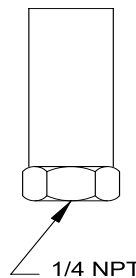
Models 126-160



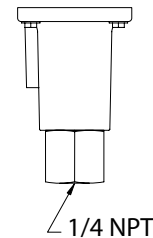
Models 218-230



Models 258-274



Models 354-364, 680



Models 610-614

RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

SELLER'S LIABILITY TO BUYER FOR ANY LOSS OR CLAIM, INCLUDING LIABILITY INCURRED IN CONNECTION WITH (I) BREACH OF ANY WARRANTY WHATSOEVER, EXPRESSED OR IMPLIED, (II) A BREACH OF CONTRACT, (III) A NEGLIGENT ACT OR ACTS (OR NEGLIGENT FAILURE TO ACT) COMMITTED BY SELLER, OR (IV) AN ACT FOR WHICH STRICT LIABILITY WILL BE INPUTTED TO SELLER, IS LIMITED TO THE "LIMITED WARRANTY" OF REPAIR AND/OR REPLACEMENT AS SO STATED IN OUR WARRANTY OF PRODUCT. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR OTHER DAMAGES OF A LIKE GENERAL NATURE, INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS OR PRODUCTION, OR LOSS OR EXPENSES OF ANY NATURE INCURRED BY THE BUYER OR ANY THIRD PARTY.

UE specifications subject to change without notice.



**UNITED ELECTRIC
CONTROLS**

P.O. Box 9143, Watertown, MA 02471-9143 USA

617 926-1000 Fax 617 926-2568

<http://www.ueonline.com>

PRESSURE, VACUUM, DIFFERENTIAL PRESSURE AND TEMPERATURE SWITCHES



FEATURES

- Single Switch Output
- Epoxy Coated and Gasketed Cast Aluminum Enclosure Designed to meet Enclosure Type 4X
- Tamper-Resistant Set Point "Lock"
- Heat Trace and Freeze Protection Thermostats
- Proof Pressures to 10,000 psi (689,5 bar)
- Adjustable Ranges:
 - Pressure:
30 "Hg Vac to 5000 psi
(-1 to 344,7 bar)
 - "wc Ranges:
300 "wc Vacuum to 250 "wc Pressure
(-746,7 to 622,3 mbar)
 - Differential Pressure:
0.2 "wcd to 500 psid
(0,5 mbar to 34,5 bar)
 - Temperature:
-180 to 650°F
(-117.8 to 343.3°C)

OVERVIEW

The 100 Series is a cost-effective pressure and temperature switch for process plants and OEM equipment. The rugged, one piece enclosure features a slanted cover for wiring accessibility.

A wide variety of microswitch and process-connection options make this versatile series ideal for applications requiring a rugged weather-proof mechanical switch.

Typical applications that utilize the 100 Series are heat tracing, freeze protection, processing equipment (pumps, compressors), inputs for annunciator panels, and fire suppression systems.

FEATURES

- UL listed and cUL certified.
CE compliant to low voltage directive and pressure equipment directive. Optional ATEX or GOST intrinsic safety compliance
- Single switch (SPDT or DPDT) output
- Welded stainless steel diaphragm models
- Ultra low pressure, "wc models
- Optional sensor material for corrosive media
- Polished stainless steel sanitary connection
- Pump switch model with wide adjustable deadband



"Clam shell" design allows for ease in wiring (pressure model shown)

Differential pressure model

Bulb and capillary temperature model with manual reset option

SPECIFICATIONS

STORAGE TEMPERATURE	-65 to 160°F (-54 to 71°C)
AMBIENT	-40 to 160°F (-40 to 71°C); models 520-525, 540-548, 700-706: 0 to 160°F
TEMPERATURE LIMITS	(-18 to 71°C); Set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Temperature models: ± 1% of adjustable range Pressure models 15623, 171-174, 218, 270-376, 520-535, 540-543, 700-706, 560-564: ± 1% of adjustable range; models 190-194, 183-189, 483-494, 544-548, 565-567, 610-680: ±1.5% of adjustable range Internal set point lock on all pressure models
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed, captive cover screws
ENCLOSURE CLASSIFICATION	Designed to meet Enclosure Type 4X requirements
SWITCH OUTPUT	One SPDT snap action switch; switch may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15 A 125/250/480 VAC resistive except for H100-15623, 20A 125/250/480 VAC resistive, B100-13546 and E100-13545, 22A/480 VAC. Electrical switches have limited DC capabilities. Consult factory for additional information.
WEIGHT	2-7 lbs; Varies with model
ELECTRICAL CONNECTION	1/2" NPT (female); Two 7/8" diameter knockouts
PRESSURE CONNECTION	Models 15623, 218, 270-376, 610-680, 701-706: 1/4" NPT (female); Models: 171-194, 483-494, 520-535: 1/2" NPT (female); Models 540-548: 1/8" NPT (female); Models 560-564: 2" Sanitary Fitting; Models 565-567: 1.5" Sanitary Fitting (Sanitary fittings mate with Tri-Clamp® fitting systems)
TEMPERATURE ASSEMBLY	Bulb and capillary: 6 feet 304 stainless steel except for E100-13545, 10 feet 304 stainless steel Immersion stem: nickel-plated brass (standard) except for B100-13546 stainless steel; optional 316L stainless steel
FILL	Models 1BS/BC are solvent filled, models 2-8 non-toxic oil filled
TEMPERATURE DEADBAND	Type F typically 1% and type B , C , and E typically 2% of range under laboratory conditions (70°F ambient circulating bath at rate of 1/2°F per minute change)
HEAT TRACING OR FREEZE PROTECTION	Thermostats designed specifically for heat tracing and freeze protection ambient sensing applications are available with types B100 and E100

APPROVALS



UNITED STATES AND CANADA

UL Listed, cUL Certified

Temperature: UL 873, file # E10667; CSA C22.2 No. 24

Pressure: UL 508, file # E42272; CSA C22.2 No. 14



EUROPEAN UNION

CENELEC/TÜV SÜddeutschland Bau und Betrieb GmbH (N.B. #0036)

TÜV certified to PED (97/23/EC)

Category IV, Module H1 (must select option M407)

Certificate #USA 02/04/38/001 thru USA 02/07/38/033

Compliant to LVD (73/23/EC & 93/68/EEC)

Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD



CENELEC/DEMKO A/S (N.B. #0539)

Demko A/S certified to ATEX Directive (94/9/EC)

II 1 G EEx ia IIC T6, Tamb. = -50°C to +60°C

EN 50014, EN 50020, EN 50284, EN 60079

Certificate #DEMKO 03 ATEX 0335063 (must select option code M405)



RUSSIA

Gosgostekhnadzor Permit (must select option code M406)

OExia IIC T6, Tamb. = -50°C to +60°C

Certificate #RRS 04-8897

PRESSURE MODEL CHART

Model	Adjustable Set Point Range Low end of range on fall; High end of range on rise		Deadband		Over Range Pressure*		Proof Pressure**	
	"wc	mbar	"wc	mbar	psi	bar	psi	bar
Type H100								
Buna N diaphragm and O-Ring with aluminum 1/2" NPT (female) pressure connection (other wetted materials available see page 9)								
520	300 Vac to 0	-746,7 to 0	0.2 to 8	0,5 to 19,9	200	13,8	400	27,6
521	10 Vac to 10	-24,9 to 24,9	0.1 to 0.6	0,2 to 1,5	200	13,8	400	27,6
522	50 Vac to 50	-124,5 to 124,5	0.1 to 3	0,2 to 7,5	200	13,8	400	27,6
523	0.5 to 5.0	1,2 to 12,4	0.1 to 0.3	0,2 to 0,7	200	13,8	400	27,6
524	2.5 to 50	6,2 to 124,5	0.1 to 0.8	0,2 to 2,0	200	13,8	400	27,6
525	10 to 250	24,9 to 622,3	0.1 to 6	0,2 to 14,9	200	13,8	400	27,6
Welded 316L stainless steel diaphragm and 1/2" NPT (female) pressure connection								
530	300 Vac to 0	-746,7 to 0	0.2 to 15	0,5 to 37,3	50	3,4	100	6,9
531	10 Vac to 10	-24,9 to 24,9	0.1 to 0.6	0,2 to 1,5	50	3,4	100	6,9
532	50 Vac to 50	-124,5 to 124,5	0.1 to 3	0,2 to 7,5	50	3,4	100	6,9
533	0.5 to 5.0	1,2 to 12,4	0.1 to 0.3	0,2 to 0,7	50	3,4	100	6,9
534	2.5 to 50	6,2 to 124,5	0.1 to 0.8	0,2 to 2,0	50	3,4	100	6,9
535	10 to 250	24,9 to 622,3	0.1 to 10	0,2 to 24,9	50	3,4	100	6,9
	psi	bar (unless noted)	psi	mbar	psi	bar	psi	bar
Welded 316L stainless steel diaphragm and 1/2" NPT (female) pressure connection, large 0.72" orifice for clean-out purposes								
171	1 to 20	68,9 mbar to 1,4 bar	0.1 to 1	6,9 to 68,9	500	34,5	1000	68,9
172	2 to 50	0,1 to 3,4	0.1 to 1.5	6,9 to 103,4	500	34,5	1000	68,9
173	4 to 100	0,3 to 6,9	0.1 to 2.5	6,9 to 172,4	500	34,5	1000	68,9
174	8 to 200	0,6 to 13,8	0.1 to 3.5	6,9 to 241,3	500	34,5	1000	68,9
2" sanitary welded 316L stainless steel diaphragm and pressure connection. Mates with Tri-Clamp® fitting systems								
560	0.5 to 15	34,5 mbar to 1,0 bar	0.1 to 1	6,9 to 68,9	200	13,8	300	20,7
561	1 to 25	68,9 mbar to 1,7 bar	0.1 to 1.5	6,9 to 103,4	200	13,8	300	20,7
562	2 to 50	0,1 to 3,4	0.1 to 2.5	6,9 to 172,4	200	13,8	300	20,7
563	4 to 100	0,3 to 6,9	0.1 to 4	6,9 to 275,8	200	13,8	300	20,7
564	8 to 200	0,6 to 13,8	0.1 to 5	6,9 to 344,7	200	13,8	300	20,7

Tri-Clamp® is a registered trademark of Tri-Clover Inc.

Application Note: The use of metallic diaphragms where higher pressure shock or heavy cycling is expected should be avoided. Models 171-174 should not be used where system or start-up vacuum pressure might exceed 26" Hg Vac (-0.9 bar). Use of optional diaphragm materials for models 483-489 may increase deadband.

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**			
	Low end of range on fall; High end of range on rise									
	psi	bar	psi	bar	psi	bar	psi	bar		
Type H100	(unless noted)		(unless noted)							
1.5" sanitary welded 316L stainless steel diaphragm and pressure connection. Mates with Tri-Clamp® fitting systems										
565	5 to 30	0,3 to 2,1	1 to 5	68,9 mbar to 0,3 bar	1000	68,9	1500	103,4		
566	10 to 100	0,7 to 6,9	1 to 12	68,9 mbar to 0,8 bar	1000	68,9	1500	103,4		
567	15 to 300	1,0 to 20,7	3 to 22	0,2 to 1,5	1000	68,9	1500	103,4		
Buna N diaphragm and O-Ring with nickel-plated brass 1/4" NPT (female) pressure connection; Option M540 Viton® diaphragm and O-Ring available for models 701-705										
701	1.5 to 30	103,4 mbar to 2,1 bar	1 to 2	68,9 mbar to 0,1 bar	500	34,5	600	41,4		
702	3 to 100	0,2 to 6,9	1 to 4	68,9 mbar to 0,3 bar	500	34,5	600	41,4		
703	9 to 300	0,6 to 20,7	1 to 5	68,9 mbar to 0,3 bar	500	34,5	600	41,4		
704	15 to 500	1,0 to 34,5	2 to 8	0,1 to 0,6	1500	103,4	2500	172,4		
705	30 to 1000	2,1 to 68,9	3 to 20	0,2 to 1,4	1500	103,4	2500	172,4		
706	100 to 1700	6,9 to 117,2	10 to 30	0,7 to 2,1	2000	137,9	2500	172,4		
Viton® diaphragm and O-Ring with 303 stainless steel 1/4" NPT (female) pressure connection (includes adjustable deadband switch)										
15623	20 to 200	1,4 to 13,8	12 to 26	0,8 to 1,8	500	34,5	1000	68,9		
316L stainless steel diaphragm (optional Hastelloy® C, Monel® or Tantalum); Viton® GLT O-Ring (optional Kalrez®, Silicone, Ethylene Propylene, or Aflas®); 316 stainless steel 1/2" NPT (female) pressure connection (optional Hastelloy® B or C, or Monel®), large 0.72" orifice for clean-out purposes. Models 188 and 189 have a 316L stainless steel 1/2" NPT (female) pressure connection										
183	1 to 20	0,1 to 1,4	0.3 to 2.5	20,7 to 172,4 mbar	500	34,5	1000	68,9		
184	2 to 50	0,1 to 3,4	0.3 to 3	20,7 to 206,8 mbar	500	34,5	1000	68,9		
185	4 to 100	0,3 to 6,9	0.5 to 6	34,5 to 413,7 mbar	500	34,5	1000	68,9		
186	8 to 200	0,6 to 13,8	1 to 11	0,1 to 0,8	500	34,5	1000	68,9		
188	50 to 1000	3,4 to 68,9	25 to 125	1,7 to 8,6	2000	137,9	7000	482,6		
189	250 to 3500	17,2 to 241,3	50 to 300	3,4 to 20,7	4000	275,8	7000	482,6		
Welded 316 stainless steel diaphragm and 1/2" NPT (female) pressure connection, large 0.72" orifice for clean-out purposes										
	Lower 75% range span				Top 25% range span					
	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar
190	5 to 30	0,3 to 2,1	1 to 3	0,1 to 0,2	6 max	0,4	1500	103,4	2500	172,4
191	10 to 100	0,7 to 6,9	1 to 8	0,1 to 0,6	15 max	1,0	1500	103,4	2500	172,4
192	15 to 300	1,0 to 20,7	3 to 18	0,2 to 1,2	25 max	1,7	1500	103,4	2500	172,4
193	20 to 500	1,4 to 34,5	4 to 30	0,3 to 2,1	45 max	3,1	1500	103,4	2500	172,4
194	80 to 1700	5,5 to 117,2	5 to 120	0,3 to 8,3	150 max	10,3	2000	137,9	2500	172,4
Welded 316 stainless steel diaphragm and 1/2" NPT (female) pressure connection, 0.06" orifice to dampen pulsations										
490	5 to 30	0,3 to 2,1	1 to 3	0,1 to 0,2	6 max	0,4	1500	103,4	2500	172,4
491	10 to 100	0,7 to 6,9	1 to 8	0,1 to 0,6	15 max	1,0	1500	103,4	2500	172,4
492	15 to 300	1,0 to 20,7	3 to 18	0,2 to 1,2	25 max	1,7	1500	103,4	2500	172,4
493	20 to 500	1,4 to 34,5	4 to 30	0,3 to 2,1	45 max	3,1	1500	103,4	2500	172,4
494	80 to 1700	5,5 to 117,2	5 to 120	0,3 to 8,3	150 max	10,3	2000	137,9	2500	172,4

Hastelloy® is a registered trademark of Haynes International, Inc.

Monel® is a registered trademark of the INCO family of companies.

Viton® and Kalrez® are registered trademarks of Dupont Dow Elastomers.

Aflas® is a registered trademark of Asahi Glass, Inc.

*** Over Range Pressure:** The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability.

**** Proof Pressure:** The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage. The unit may require calibration (e.g., start-up, testing).

Deadband Note: Models 190-194, 490-494 are expressed as the lower 75% and top 25% of the range span because of the operating characteristics of the diaphragm sensor and switch.



PRESSURE MODEL CHART

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**	
	Low end of range on fall; High end of range on rise							
Type H100	psi (unless noted)	bar (unless noted)	psi	bar (unless noted)	psi	bar	psi	bar
316L stainless steel diaphragm (optional Hastelloy® C, Monel® or Tantalum) Viton® GLT O-Ring (optional Kalrez®, Silicone, ethylene propylene or Aflas®), 316 stainless steel 1/2" NPT (female) pressure connection (optional Hastelloy® B or C, or Monel®), 0.06" orifice. Models 488 and 489 316L pressure connection								
483	1 to 20	0,1 to 1,4	0.3 to 2.5	20,7 to 172,4 mbar	500	34,5	1000	68,9
484	2 to 50	0,1 to 3,4	0.3 to 3	20,7 to 206,8 mbar	500	34,5	1000	68,9
485	4 to 100	0,3 to 6,9	0.5 to 6	34,5 to 413,7 mbar	500	34,5	1000	68,9
486	8 to 200	0,6 to 13,8	1 to 11	0,1 to 0,8	500	34,5	1000	68,9
488	50 to 1000	3,4 to 68,9	25 to 125	1,7 to 8,6	2000	137,9	7000	482,6
489	250 to 3500	17,2 to 241,3	50 to 300	3,4 to 20,7	4000	275,8	7000	482,6
Phosphor bronze bellows with nickel-plated brass 1/4" NPT (female) pressure connection. Model 218 has 300 series stainless steel spring exposed to media								
218	30 "Hg Vac to 0	-1 to 0	1 to 2 "Hg	33,9 to 67,7 mbar	0	0	30	2,1
270	4 to 200	0,3 to 13,8	1 to 8	0,1 to 0,6	200	13,8	250	17,2
274	6 to 300	0,4 to 20,7	1 to 10	0,1 to 0,7	300	20,7	350	24,1
Welded 316L stainless steel bellows and 1/4" NPT (female) pressure connection								
358	15 to 200	1,0 to 13,8	1 to 3	0,1 to 0,2	200	13,8	800	55,2
361	20 to 300	1,4 to 20,7	1 to 4	0,1 to 0,3	300	20,7	800	55,2
376	25 to 500	1,7 to 34,5	1.5 to 5	0,1 to 0,3	500	34,5	800	55,2
303 stainless steel piston, Buna N O-Ring with 303 stainless steel 1/4" NPT (female) pressure connection (Not recommended for gas service since drying of O-Ring seal can allow bleeding of medium into the atmosphere)								
610	75 to 1000	5,2 to 68,9	30 to 150	2,1 to 10,3	6000	413,7	10,000	689,5
612	125 to 3000	8,6 to 206,8	40 to 250	2,8 to 17,2	6000	413,7	10,000	689,5
616	700 to 5000	48,3 to 344,7	40 to 375	2,8 to 25,9	6000	413,7	10,000	689,5
316 stainless steel bellows and 1/4" NPT (female) pressure connection (Not recommended for gas applications or for rapid or high cycling pressure changes)								
680	100 to 1700	6,9 to 117,2	9 to 40	0,6 to 2,8	1700	117,2	2500	172,4

DIFFERENTIAL PRESSURE MODEL CHART

Model	Adjustable Set Point Range		Deadband		Working Pressure***		Proof Pressure**	
	Low end of range on fall; High end of range on rise							
Type H100K	psid (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar	psi	bar
Kapton® Diaphragm, Buna N sealing diaphragms and epoxy coated aluminum 1/8" NPT (female) pressure connections								
540	0.2 to 7 "wcd	0,5 to 17,4 mbar	0.05 to 0.6 "wc	0,1 to 1,5 mbar	30 "Hg to 200	-1 to 13,8	400	27,6
541	1 to 20 "wcd	2,5 to 49,8 mbar	0.1 to 1.0 "wc	0,2 to 2,5 mbar	30 "Hg to 200	-1 to 13,8	400	27,6
542	5 to 50 "wcd	12,4 to 124,5 mbar	0.2 to 2.5 "wc	0,5 to 6,2 mbar	30 "Hg to 200	-1 to 13,8	400	27,6
543	10 to 200 "wcd	24,9 to 497,8 mbar	0.5 to 8 "wc	1,2 to 19,9 mbar	30 "Hg to 200	-1 to 13,8	400	27,6
544	2 to 20	0,1 to 1,4	0.1 to 1.3	6,9 to 89,6 mbar	30 "Hg to 1200	-1 to 82,7	2500	172,4
545	5 to 50	0,3 to 3,4	0.2 to 2.2	13,8 to 151,7 mbar	30 "Hg to 1200	-1 to 82,7	2500	172,4
546	10 to 125	0,7 to 8,6	0.4 to 5.0	27,6 mbar to 0,3 bar	30 "Hg to 1200	-1 to 82,7	2500	172,4
547	50 to 250	3,4 to 17,2	0.8 to 10	0,1 to 0,7	30 "Hg to 1200	-1 to 82,7	2500	172,4
548	100 to 500	6,9 to 34,5	2.0 to 15	0,1 to 1,0	30 "Hg to 1200	-1 to 82,7	2500	172,4

Kapton® is a registered trademark of E.I. DuPont.

TEMPERATURE MODEL CHART

Model	Adjustable Set Max. Temp Point Range		Scale		Stem/Bulb Size† Division		
	°F	°C	°F	°C	°F	°C	OD x Length
Type B100 Internal adjustment via reference dial Type C100 No reference dial; model 13546 not available							
120	0 to 225	-17.8 to 107.2	275	135	10	5	9/16" x 1-7/8" below 1/2 "NPT thread (nickel-plated brass)
121	200 to 425	93.3 to 218.3	475	246.1	10	5	9/16" x 1-7/8" below 1/2 "NPT thread (nickel-plated brass)
13546	15 to 140	-9.4 to 60	160	71.1	5	2	9/16" x 2-11/16" long stainless steel (Freeze Protection)
Type E100 Stainless steel bulb and capillary; internal adjustment via reference dial							
2BSA	-120 to 100	-84.4 to 37.8	150	65.6	10	5	3/8 x 2-7/16"
2BSB	30 to 250	-1.1 to 121.1	300	148.9	10	5	3/8 x 2-7/16"
3BS	100 to 400	37.8 to 204.4	450	232.2	10	5	3/8 x 2-1/8"
4BS	25 to 100	-3.9 to 37.8	150	65.6	2	1	3/8 x 6-3/4"
5BS	-20 to 80	-28.9 to 26.7	130	54.4	5	2	3/8 x 5"
8BS	350 to 640	176.7 to 337.8	690	365.6	10	5	3/8 x 3-1/4"
13545	25 to 325	-3.9 to 162.8	360	182.2	10	5	1/8 x 11-5/8" (Heat Tracing)
Copper bulb and capillary							
2BCA	-120 to 100	-84.4 to 37.8	150	65.6	10	5	3/8 x 2-7/16"
2BCB	30 to 250	-1.1 to 121.1	300	148.9	10	5	3/8 x 2-7/16"
3BC	100 to 400	37.8 to 204.4	450	232.2	10	5	3/8 x 2-1/8"
4BC	25 to 100	-3.9 to 37.8	150	65.6	2	1	3/8 x 6-3/4"
5BC	-20 to 80	-28.9 to 26.7	130	54.4	5	2	3/8 x 5"
8BC	350 to 640	176.7 to 337.8	690	365.6	10	5	3/8 x 3-1/4"
Type F100 Stainless steel bulb and capillary; no reference dial							
1BS	-180 to 120	-117.8 to 48.9	170	76.7	N/A		3/8 x 3-3/4"
2BS	-125 to 350	-87.2 to 176.7	400	204.4	N/A		3/8 x 2-7/16"
3BS	-125 to 500	-87.2 to 260	550	287.8	N/A		3/8 x 2-1/8"
4BS	-40 to 120	-40 to 48.9	170	76.7	N/A		3/8 x 6-3/4"
5BS	-40 to 180	-40 to 82.2	230	110	N/A		3/8 x 5"
6BS	0 to 250	-17.8 to 121.1	300	148.9	N/A		3/8 x 4-1/2"
7BS	0 to 400	-17.8 to 204.4	450	232.2	N/A		3/8 x 3"
8BS	50 to 650	10 to 343.3	700	371.1	N/A		3/8 x 3-1/4"
Copper bulb and capillary							
1BC	-180 to 120	-117.8 to 48.9	170	76.7	N/A		3/8 x 3-3/4"
2BC	-125 to 350	-87.2 to 176.7	400	204.4	N/A		3/8 x 2-7/16"
3BC	-125 to 500	-87.2 to 260	550	287.8	N/A		3/8 x 2-1/8"
4BC	-40 to 120	-40 to 48.9	170	76.7	N/A		3/8 x 6-3/4"
5BC	-40 to 180	-40 to 82.2	230	110	N/A		3/8 x 5"
6BC	0 to 250	-17.8 to 121.1	300	148.9	N/A		3/8 x 4-1/2"
7BC	0 to 400	-17.8 to 204.4	450	232.2	N/A		3/8 x 3"
8BC	50 to 650	10 to 343.3	700	371.1	N/A		3/8 x 3-1/4"

†Optional immersion stem lengths and capillary lengths are available.

* **Over Range Pressure:** The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability.** **Proof Pressure:** The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).*** **Working Pressure Range:** The pressure range within which two opposing sensors can be safely operated and still maintain set point adjustability provided the difference in pressure between them does not exceed the designated adjustable range.



HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed.

FOR MULTIPLE OPTIONS: Call United Electric Controls.

TYPE

DESCRIPTION

PRESSURE

Type H100 - One SPDT output; epoxy coated enclosure; internal adjustment with "High-Low" reference scale

DIFFERENTIAL PRESSURE

Type H100K - One SPDT output; epoxy coated enclosure; internal adjustment with "High-Low" reference scale

TEMPERATURE

Type B100 - Immersion stem; one SPDT output; internal adjustment with reference dial

Type C100 - Immersion stem; one SPDT output; internal adjustment with no reference

Type E100 - Bulb and capillary; one SPDT output; internal adjustment with reference dial

Type F100 - Bulb and capillary; one SPDT output; internal adjustment with no reference

SWITCH OPTIONS*

0140	Gold contacts, 1 A 125 VAC resistive
0500	Close deadband, 5 A 125/250 VAC resistive; NOT AVAILABLE MODELS 520-535
1010	DPDT switch, 10 A 125/250 VAC resistive; deadband and minimum set point will increase. NOT AVAILABLE TEMPERATURE VERSIONS, TYPE H100K OR MODELS 171-194, 483-567 AND MODEL 680
1070	10 A 125 VDC resistive; deadband and minimum set point will increase NOT AVAILABLE MODELS 171-194, 483-567
1519	Adjustable deadband, 15 A 125/250/480 VAC resistive; adjustment wheel changes rise setting only. If adjustment on fall setting is required, use primary adjustment NOT AVAILABLE TYPES B100, E100 OR MODELS 171-194, 483-494, 560-567, 610-616
1530	External manual reset, 15 A 125/250/480 VAC resistive; latches on rise, only.
1535	High ambient, 15 A 125/250 VAC resistive; temperatures up to 250°F (121.1°C). NOT AVAILABLE MODELS 520-535
1537	Vapor sealed switch, 15 A 125/250 VAC resistive. NOT AVAILABLE MODELS 523, 533
2000	20 A 125/250/480 VAC resistive. NOT AVAILABLE TYPE H100K OR MODELS 520-535
3000	30 A 125/250/480 VAC resistive. NOT AVAILABLE TYPE H100K OR MODELS 171-194, 483-567, 680

* All switches have limited DC capabilities. Consult factory for details.

OTHER OPTIONS

M020	Red status light, 115 VAC only
M201	Factory set one switch; specify increasing or decreasing pressure or temperature and setpoint
M277	Range indicated on nameplate in kPa or MPa, factory selected. NOT AVAILABLE ON TEMPERATURE VERSIONS
M278	Range indicated on nameplate in Kg/cm ² . NOT AVAILABLE ON TEMPERATURE VERSIONS
M405	European ATEX Intrinsic safety compliance
M406	Russian Gosgortekhnadzor Intrinsic Safety compliance
M407	CE compliance to Pressure Equipment Directive (category IV). NOT AVAILABLE ON TEMPERATURE VERSIONS, models 218, 520-524, 530-534
M444	Paper ID tag
M446	Stainless steel ID tag & wire attachment
M449	Mounting bracket kit. Required for models 520-535 when surface mounting. Use kit part number 6361-701 for other models
M504	316L stainless steel immersion stem. AVAILABLE TEMPERATURE MODELS 120, 121 ONLY
M540	Viton® construction (deadband and low end range may increase slightly); wetted parts include Viton® diaphragm and O-ring plus stainless steel pressure connection. AVAILABLE ON MODELS 610-616 (O-ring only), 701-705, and 540-548 (sealing diaphragms only, main diaphragm remains Kapton®, pressure connections remain aluminum)
M550	Oxygen service cleaning; internal construction may change. NOT AVAILABLE ON PRESSURE MODEL 706
M914	1/2" NPT (female) stainless steel pressure connection. AVAILABLE MODELS 358-376
M921	Brass pressure connection. AVAILABLE MODELS 610-616
6361-704	Surface and Pipe Mounting Hardware (required for model 520-535, 540-548 when surface mounting)

OPTIONAL SENSOR MATERIAL FOR "WC RANGES". AVAILABLE MODELS 520-525

XC001	Aluminum pressure connection, Viton® diaphragm, Viton® O-ring
XC002	Aluminum pressure connection, Kapton® diaphragm, Buna N O-ring
XC003	Aluminum pressure connection, Kapton® diaphragm, Viton® O-ring
XC004	316L Stainless steel pressure connection, 316L stainless steel diaphragm, Viton® O-ring. (Over range pressure is limited to 100 psi)
XC005	316L Stainless steel pressure connection, Viton® diaphragm, Viton® O-ring
XC006	316L Stainless steel pressure connection, Kapton® diaphragm, Viton® O-ring
XC007	316L Stainless steel pressure connection, Teflon® diaphragm, Viton® O-ring

OPTIONAL SENSOR MATERIALS FOR CORROSIVE MEDIA. AVAILABLE MODELS 183-189, 483-489

XD002	Hastelloy C diaphragm
XD003	Monel diaphragm
XD004	Tantalum diaphragm
XP111	Hastelloy B pressure connection
XP112	Hastelloy C pressure connection
XP113	Monel pressure connection
XR211	Kalrez® O-ring
XR212	Silicone O-ring. NOT AVAILABLE MODELS 188-189, 488-489
XR213	Ethylene propylene O-ring
XR214	Aflas® O-ring

OPTIONAL FLUSH MOUNT FLANGES. AVAILABLE MODELS 560-567

Other flanges (150# and 300#) available, please consult UE. Flanges conform to ANSI B16.5. Maximum pressure is limited by flange rating.

F196	Flush mounted flange, 150#, 1" lap joint, raised face AVAILABLE MODELS 565-567 ONLY
F197	Flush mounted flange, 150#, 2" lap joint, raised face AVAILABLE MODELS 560-564 ONLY
F198	Flush mounted flange, 300#, 1" lap joint, raised face AVAILABLE MODELS 565-567 ONLY
F199	Flush mounted flange, 300#, 2" lap joint, raised face AVAILABLE MODELS 560-564 ONLY

Note: No options are available on Heat Trace and Freeze Protection models 13546 and 13545 or pump switch model 15623 except M201, M444 and M446.



OPTIONS FOR TEMPERATURE MODELS

UNION CONNECTORS**

Option	Replacement Number	Description
	<u>Brass</u>	
W027	SD6213-27	1/2" NPT w/ 3/4" bushing
W045	SD6213-45	3/4" NPT
W051	SD6213-51	1/2" NPT
	<u>304 Stainless Steel</u>	
W028	SD6213-28	1/2" NPT w/ 3/4" bushing
W046	SD6213-46	3/4" NPT
W050	SD6213-50	1/2" NPT

THERMOWELLS**

For all bulb & capillary switches, except Model 13545

	<u>Brass</u>	
W075	SD6225-75	1/2" NPT with 3/4" NPT adapter bushing, 4" BT
W191	SD6225-191	1/2" NPT, 4" BT
W118	SD6225-118	1/2" NPT with 3/4" NPT adapter bushing, 7" BT
W192	SD6225-192	1/2" NPT, 7" BT
	<u>316 Stainless Steel</u>	
W076	SD6225-76	3/4" NPT, 4.5" BT
W193	SD6225-193	1/2" NPT, 4.5" BT
W119	SD6225-119	3/4" NPT, 7.5" BT
W177	SD6225-177	1/2" NPT, 7.5" BT

For all immersion stem switches; except Model 13546

W139	SD6225-139	3/4" NPT X 1-23/32" BT, BRASS
W140	SD6225-140	3/4" NPT X 1-23/32" BT, 316 ST/ST

W000 IMMERSION STEM AND THERMOWELLS

Note: Option W000 is a special Immersion Stem construction that has no external thread. This option fits inside a special thermowell and is secured with a set-screw.

Option	Description
W000	Immersion stem only, brass
W097	Immersion stem and thermowell. Includes W000 stem and 1/2" NPT x 1-23/32" BT brass thermowell
W099	Immersion stem and thermowell. Includes W000 stem and 1/2" NPT x 1-23/32" BT 316 st/st thermowell.

OPTIONAL LENGTHS:

Optional immersion stem lengths to 15" available in brass, with or without 316 st/st thermowell. Consult UE for additional information. Optional capillary length to *50' available in copper or 304 st/st. Armor or Teflon® capillary protection available to lengths less than or equal to capillary length. Consult UE for additional information.

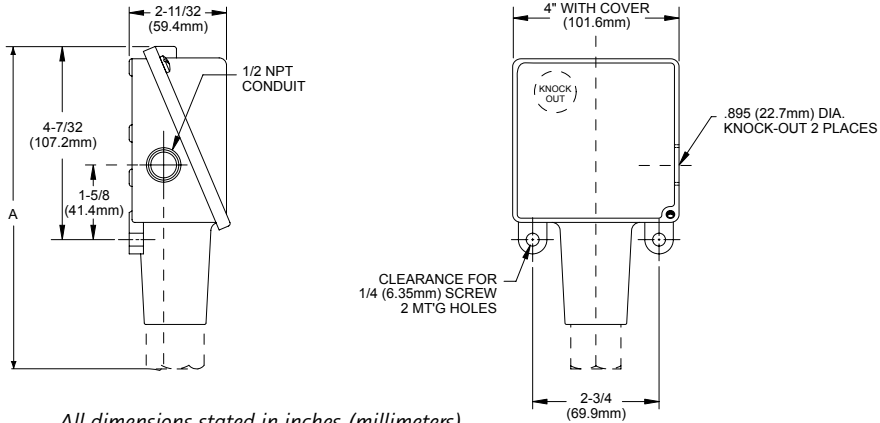
*Consult UE regarding repeatability and ambient effects on capillary lengths over 30'.

** Dimensional drawings for union connectors and thermowells may be found at www.ueonline.com

DIMENSIONAL DRAWINGS

Dimensional drawings for all models may be found at www.ueonline.com

Types B100, C100, E100, F100, H100, H100K

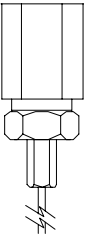


All dimensions stated in inches (millimeters)

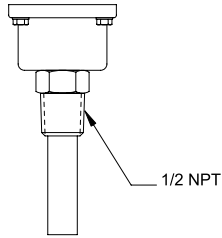
Dimension A			
Models	Inches	mm	NPT
Pressure			
171-174	7.63	193,7	1/2"
183-186, 484-486	7.56	192,1	1/2"
188-189, 488-489	6.63	168,3	1/2"
190-194, 490-494	6.63	168,3	1/2"
218	6.56	166,7	1/4"
270-274	7.00	177,8	1/4"
358-376	7.00	177,8	1/4"
520-525	8.44	214,4	1/2"
530-535	8.00	203,2	1/2"
560-564	6.63	168,3	2" Sanitary Fitting
565-567	6.63	168,3	1 1/2" Sanitary Fitting
610-616, 680	7.00	177,8	1/4"
701-706, 15623	6.63	168,3	1/4"
Differential Pressure			
540-543	8.47	215,0	1/8"
544-548	8.53	216,6	1/8"
Temperature			
120, 121, 13546	9.38	238,1	Immersion stem
18C-88C 18S-88S, 13545	8.69	220,6	Bulb & capillary

Temperature Sensors

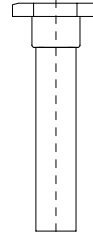
Models 18C-88C, 18S-88S, 13545



Models 120,121

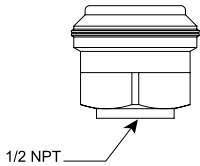


Model 13546

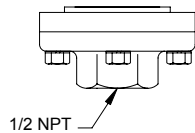


Pressure Sensors

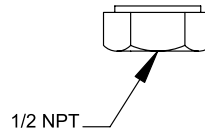
Models 171-174



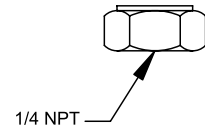
Models 183-186, 483-486



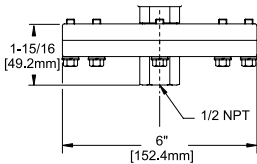
Models 188-194, 488-494



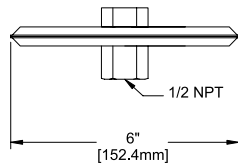
Models 218-376, 610-706, 15623



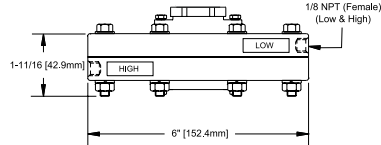
Models 520-525



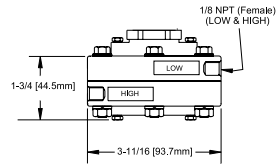
Models 530-535



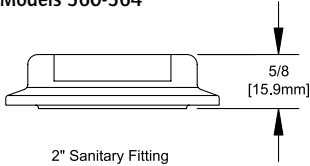
Models 540-543



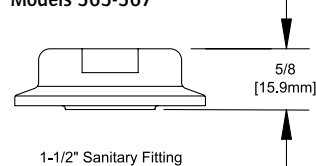
Models 544-548



Models 560-564



Models 565-567



RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be inputted to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of product. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

UE specifications subject to change without notice.

U.S. SALES OFFICES

United Electric Controls
32 Highland Rd.
South Hampton, NH 03827
Phone: 603-394-0078
FAX: 603-394-0175

United Electric Controls
28 N. Wise Ave.
Freeport, IL 61032
Phone: 815-235-3501
FAX: 815-235-3847

United Electric Controls
1022 Vineyard Drive
Conyers, GA 30013
Phone: 770-483-8400
FAX: 770-929-8716

United Electric Controls
5829 Grazing Court
Mason, OH 45040
Phone: 513-398-3175
FAX: 513-398-3076

United Electric Controls
102 Salazar Court
Clayton, CA 94517
Phone: 925-524-0210
FAX: 925-524-0210

United Electric Controls
27 Summit Terrace
Sparta, NJ 07871
Phone: 973-271-2550
FAX: 973-729-6099

United Electric Controls
12630 Summerwood Glen
Houston, TX 77041
Phone: 832-243-0119
FAX: 832-243-0140

CANADA

EASTERN
68 Mosley Crescent
Brampton, Ontario
Canada L6Y 5C8
Phone: 905-455-5131
FAX: 905-455-5131

INTERNATIONAL OFFICES

BELGIUM
United Electric Controls-Europe
G. Van Gervenstraat 19A
B-9120 Beveren-Waas, Belgium
Phone: 32-37554-383
FAX: 32-37552-747

CHINA
United Electric Controls
Room 1114, No. 511
Shenshi Building
Weihai Road
Shanghai 200041, P.R. China
Phone: +8621-6255 8059
FAX: +8621-6255 8349

GERMANY
United Electric Controls
An Der Zentlinde 21
D-64711 Erbach, Germany
Phone: 496-062-7400
FAX: 496-062-7501

MALAYSIA
United Electric Controls, Far East
No. 1-2-2, 2nd Floor
Jalan 4/101C
Cheras Business Centre
Batu 5, Jalan Cheras
56100 Kuala Lumpur, Malaysia
Phone: 603-9133-4122
FAX: 603-9133-4155

RUSSIA
United Electric Controls, Moscow
Alyabyeva str., 4-1-4
Moscow, 121309, Russia
Phone: +7 (095) 792-88-06
FAX: +7 (095) 142-34-60

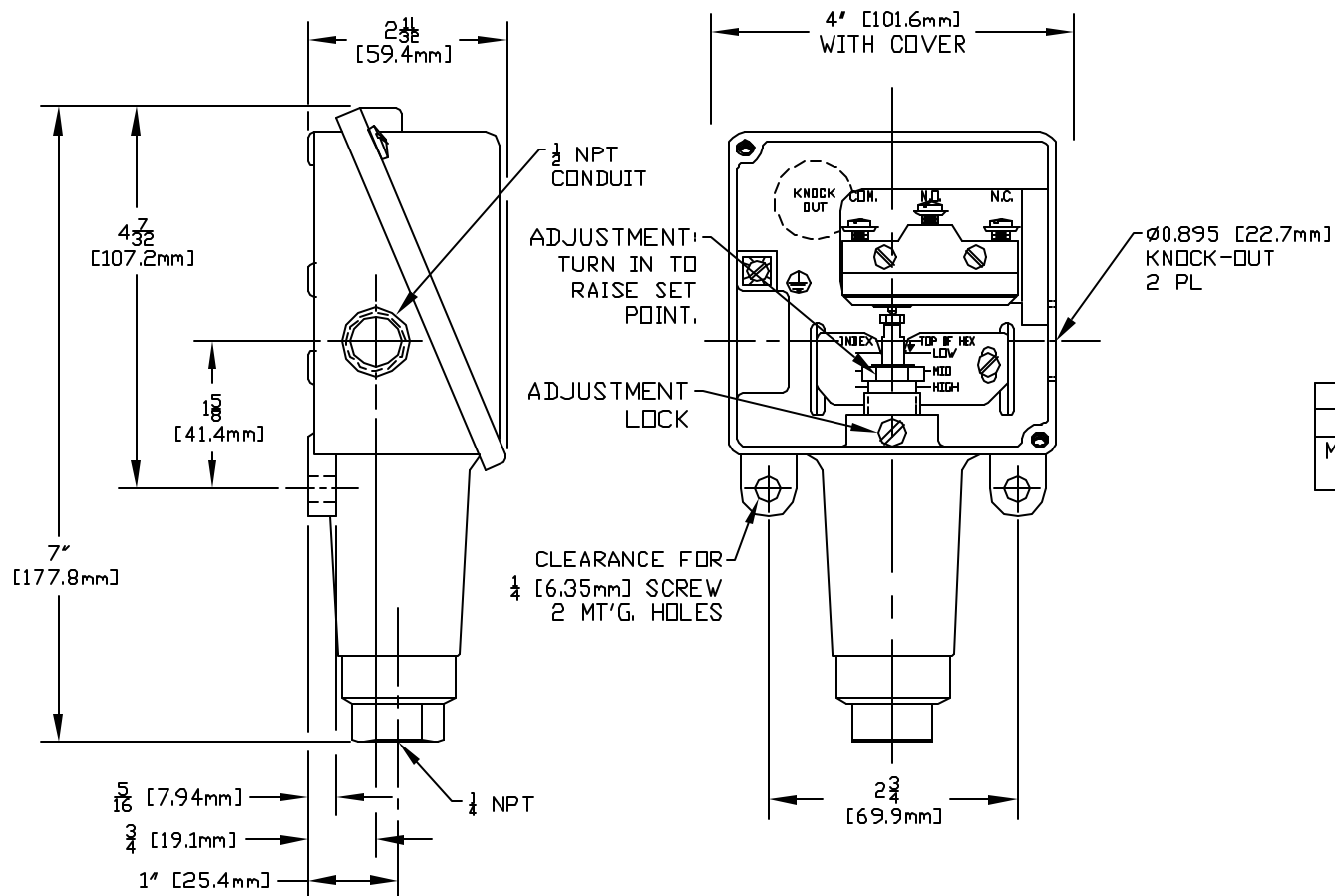
WESTERN
148 Silver Ridge Close N.W.
Calgary, Alberta
Canada T3B 3T4
Phone: 403-247-3724
FAX: 403-247-3724



UNITED ELECTRIC
CONTROLS

180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
<http://www.ueonline.com>


A-12706



UL LISTED, CSA CERTIFIED,
CONFORMS TO NEMA 4X & IP65
REQUIREMENTS.

I & M SHEET IMP100.

274	6 TO 300	0.4 TO 20.7
270	4 TO 200	0.3 TO 13.8
MODEL NO.	psi	bar
	ADJUSTABLE RANGE	
	LOW END OF RANGE ON FALL	
	HIGH END OF RANGE ON RISE	

					ORIGINAL DATE 12-5-85	TITLE	H100	 UNITED ELECTRIC CONTROLS COMPANY WATERTOWN * MASSACHUSETTS
R	CHANGED kPa TO bar. ECN#E0046	10-23-02	S.R.	H.N.	DRWN J.S. MACHADO			
P	ADDED 1" (25.4mm) & 5/16 (7.94mm) DIMENSIONS. ECN#C6848	10-31-97	P.W.	A.M.	CHKD J.S. MACHADO			
N	REV. COVER SCREW AND ADDED "O" RING ON "M" DWG. ECN#C4972	11-10-95	A.E.	J.S.M.	APPD J.S. MACHADO			
M	REV. BELLOWS ASSEMBLY AND ADDED BELLOWS ADAPTOR ON "M" DWG. ECN#C4148	12-22-94	A.E.	J.S.M.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES			
L	REVISED & UPDATED PER ECN#C2515	7-23-93	P.W.	A.M.				
SYM	DESCRIPTION	DATE	DWN	APPD			DWG NO	A-12706
REVISIONS					DO NOT SCALE THIS DRAWING	SCALE HALF		

PRESSURE, VACUUM, DIFFERENTIAL PRESSURE AND TEMPERATURE SWITCHES



FEATURES

- 1, 2 & 3 Switch Output
- Epoxy Coated Enclosure designed to meet enclosure type 4X
- Wide variety of pressure assembly configurations and materials
- Setting via reference dial or hex screw adjustment
- Optional terminal block wiring
- Adjustable Ranges:
 - "WC ranges: 300 "wc vacuum to 250 "wc pressure (-746,7 to 622,3 mbar)
 - Pressure: 30 "Hg Vac to 6000 psi (-1,0 to 413,7 bar)
 - Differential pressure: 1" wcd to 200 psid (2,5 mbar to 13,8 bar)
 - Temperature: -180 to 650 °F (-117,8 to 343,3 °C)



OVERVIEW

The 400 Series is a versatile family of pressure, differential pressure and temperature switches for applications which require single or multiple switching capabilities. Dual and triple switch versions provide multi-output for alarm and shutdown, pre-alarm and alarm, high/low limit or level staging functions.

A wide variety of microswitch and process connection options, along with a weather-tight enclosure, make the 400 Series an ideal choice for most ordinary location applications. Its worldwide use is assured with approvals and certifications to agency standards.

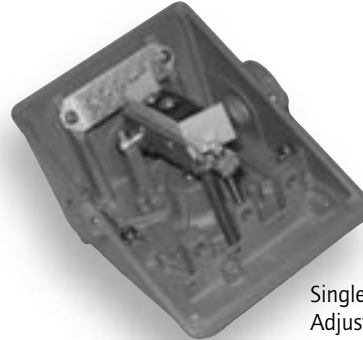
Widely used throughout the process industries, the 400 Series provides threshold protection and control for many critical functions. Typical installations are found in industrial gas production, energy generation including pumps, turbines and compressors, pulp and paper, and water and wastewater treatment.

FEATURES

- UL listed and cUL certified. FM approved. CE compliant to low voltage directive and pressure equipment directive. Optional ATEX intrinsic safety compliance.
- One, two or three switch output may be separated up to 100% of range.
- Setting via reference dial or hex screw adjustment.
- Wide variety of available options and pressure sensor modules.
- Most models available for immediate delivery.



Differential Pressure Model with M210 Option - Dial Indication



Single Switch Output, Hex Screw Adjustment Model with M100 option - Terminal Block Wiring



Temperature Model with Remote Bulb & Capillary and M321 option - Gasketed Lexan Window

Dual Switch, Low Water Column Differential Pressure Model



SPECIFICATIONS

STORAGE TEMPERATURE	-65 to 160°F (-54 to 71°C)
AMBIENT TEMPERATURE LIMITS	-40 to 160°F (-40 to 71°C); set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Temperature models: ± 2% of adjustable range Pressure: models 126-376, 520-535, 540-547, 570-572, S126B-S164B: ± 2% of adjustable range; models 440-457, 550-559: ± 1% of adjustable range; models 610-614: ± 3% of adjustable range
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed, captive cover screws
ENCLOSURE CLASSIFICATION	Designed to meet enclosure type 4X requirements
SWITCH OUTPUT	One, two or three SPDT switches, may be separated up to 100% of range except models 521-524, 531-534: 50%; models 520, 525, 530, 535, 570-572: 30%; switches may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15 A 125/250/480 VAC resistive. Electrical switches have limited DC capabilities. Consult factory for additional information.
WEIGHT	Approx. 3 to 7.5 lbs.; varies with model
ELECTRICAL CONNECTION	One 3/4" NPT and two 7/8" diameter knockouts
PRESSURE CONNECTION	All models 1/4" NPT (female) except models S126B-S164B, 520-535: 1/2" NPT (female); models 540-547: 1/8" NPT (female)
TEMPERATURE ASSEMBLY	'E' types use the same assemblies as 'F' types, however, range spans are limited due to use of reference dials Bulb and capillary: 6 feet 304 stainless steel Immersion stem: models 120 & 121: nickel-plated brass; optional 316L stainless steel available
FILL	Temperature Models: Model 1BS: solvent filled; models 2-8: non-toxic oil filled
TEMPERATURE DEADBAND	Type F typically 1% and type E, B & C typically 2% of range under laboratory conditions (70°F ambient circulating bath at rate of 1/2°F per minute change)
DIFFERENTIAL PRESSURE INDICATOR (OPTION M210)	Differential pressure indication available J400K, J402K models 147-S157B; accuracy approximately 1-1/2% mid 50% of range, 3% at ends; window is plexiglass and gasketed; indicator may be field adjusted for approximately ±1% accuracy at any set point within range

APPROVALS



UNITED STATES AND CANADA

UL Listed, **cUL** Certified

Temperature: UL 873, file # E10667

CSA C22.2 No. 24 - File #E10667

Pressure: UL 508, file # E42272

CSA C22.2 No. 14 - File #E42272



UL Recognized, **cUL** Recognized

Temperature: UL 873, file # E10667

Pressure: UL 508, file # E42272 (available type 403)



FM Approval

Temperature: Class 3545

Pressure: 3510



EUROPE

CENELEC/DEMKO A/S (N.B. #0539)



Demko A/S certified to **ATEX** Directive (94/9/EC)

II 1 G EEx ia IIC T6, Tamb.= -50°C to +60°C

EN 50014, EN 50020, EN 50284, EN 60079

Certificate #DEMKO 03 ATEX 0335063 (Must select option code M405)



CENELEC/TÜV Süddeutschland Bau und Betrieb GmbH (N.B. #0036)

TÜV certified to PED (97/23/EC)

Category IV, Module H1 (must select option M407)

Certificate #USA 02/04/38/001 thru USA 02/07/38/033

UEC Compliant to LVD (73/23/EC & 93/68/EEC)

Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD



RUSSIA

Gosgortekhnadzor Permit (Must select option code M406)

OExia IIC T6, Tamb.= -50°C to +60°C

Certificate #RRS 04-8897

PRESSURE MODEL CHART

Type J400, single switch output with internal hex screw adjustment

Type J402, dual switch output with internal hex screw adjustment

Type J403, triple switch output with internal hex screw adjustment

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**	
	Low end of range on fall; High end of range on rise		Deadband doubles for 2 and 3 switch types					
	"wc	mbar	"wc	mbar	psi	bar	psi	bar
Buna-N diaphragm and O-Ring with epoxy coated aluminum 1/2" NPT (female) pressure connection (Other wetted materials available, see pg. 12)								
520†	300 Vac to 0	-746,7 to 0	0.2 to 12	0,5 to 29,9	200	13,8	400	27,6
521†	10 Vac to 10	-24,9 to 24,9	0.1 to 1	0,2 to 2,5	200	13,8	400	27,6
522†	50 Vac to 50	-124,5 to 124,5	0.1 to 5	0,2 to 12,4	200	13,8	400	27,6
523†	0.5 to 5.0	1,2 to 12,4	0.1 to 0.3	0,2 to 0,7	200	13,8	400	27,6
524†	2.5 to 50	6,2 to 124,5	0.1 to 2	0,2 to 5,0	200	13,8	400	27,6
525†	10 to 250	24,9 to 622,3	0.1 to 10	0,2 to 24,9	200	13,8	400	27,6
Welded 316L stainless steel diaphragm and 1/2" NPT (female) pressure connection								
530†	300 Vac to 0	-746,7 to 0	0.2 to 15	0,5 to 37,3	50	3,4	100	6,9
531†	10 Vac to 10	-24,9 to 24,9	0.1 to 1	0,2 to 2,5	50	3,4	100	6,9
532†	50 Vac to 50	-124,5 to 124,5	0.1 to 6	0,2 to 14,9	50	3,4	100	6,9
533†	0.5 to 5.0	1,2 to 12,4	0.1 to 0.3	0,2 to 0,7	50	3,4	100	6,9
534†	2.5 to 50	6,2 to 124,5	0.1 to 2.5	0,2 to 6,2	50	3,4	100	6,9
535†	10 to 250	24,9 to 622,3	0.1 to 10	0,2 to 24,9	50	3,4	100	6,9
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)
316L stainless steel diaphragm, Viton® O-Ring with 316L stainless steel 1/4" NPT (female) pressure connection								
570	0 to 20	0 to 1,4	0.2 to 4	13,8 to 275,8 mbar	20	1,4	225	15,5
571	0 to 50	0 to 3,4	0.7 to 6	48,3 to 413,7 mbar	50	3,4	225	15,5
572	0 to 100	0 to 6,9	1 to 7	0,1 to 0,5	100	6,9	225	15,5
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connection								
S126B	30 "Hg Vac to 0	-1 to 0	0.2 to 0.9 "Hg	-6,8 to -30,5 mbar	3	0,2	5	0,3
S134B	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1.2 "Hg	-6,9 to -40,6 mbar	20	1,4	25	1,7
S137B	0 to 80 "wc	0 to 199,1 mbar	2 to 6 "wc	5 to 14,9 mbar	80 "wc	199,1 mbar	5	0,3
S144B	0 to 20	0 to 1,4	0.1 to 0.5	6,9 to 34,5 mbar	20	1,4	25	1,7
S146B	0 to 30	0 to 2,1	0.1 to 0.6	6,9 to 41,4 mbar	30	2,1	40	2,8
S156B	0 to 100	0 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	200	13,8
S164B	0 to 200	0 to 13,8	0.3 to 2	20,7 to 137,9 mbar	200	13,8	200	13,8
Welded 316L stainless steel bellows and 1/4" NPT (female) pressure connection								
358	0 to 200	0 to 13,8	1.5 to 8	0,1 to 0,6	200	13,8	250	17,2
361	0 to 300	0 to 20,7	2 to 9	0,1 to 0,6	300	20,7	350	24,1
376	0 to 500	0 to 34,5	3 to 12	0,2 to 0,8	500	34,5	575	39,6
303 stainless steel piston with Buna-N O-Ring and 303 stainless steel 1/4" NPT (female) pressure connection (not recommended for gas service since drying of the O-Ring seal can allow bleeding of medium into the atmosphere)								
610	100 to 1,000	6,9 to 68,9	30 to 150	2,1 to 10,3	1,000	68,9	10,000	689,5
612	200 to 3,000	13,8 to 206,8	40 to 250	2,8 to 17,2	3,000	206,8	10,000	689,5
614	500 to 6,000	34,5 to 413,7	50 to 400	3,4 to 27,6	6,000	413,7	10,000	689,5

***Over Range Pressure:** The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability

****Proof pressure:** The maximum pressure to which a pressure sensor may be subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).

Viton® is a registered trademark of Dupont Dow Elastomers.

† Model not available on types J400 and J403



400 Series

400 Series

PRESSURE MODEL CHART

Type J400, single switch output with internal hex adjustment

Type J402, dual switch output with internal hex adjustment

Type J403, triple switch output with internal hex adjustment

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**	
	Low end of range on fall; High end of range on rise		Deadband doubles for 2 and 3 switch types					
	psi (unless noted)	bar (unless noted)	psi	bar	psi (unless noted)	bar	psi	bar
Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Models 126 and 134 have zinc-plated steel spring exposed to media								
126	30 "Hg Vac to 0	-1 to 0	0.2" to 0.9 "Hg	-6,8 to 30,5 mbar	3	0,2	5	0,3
134	30 "Hg Vac to 20 psi	-1 to 1,4	0.2" to 1.2 "Hg	-6,8 to 40,6 mbar	20	1,4	25	1,7
137	0 to 80 "wc	0 to 199,1 mbar	2 to 6 "wc	5 to 14,9 mbar	80 "wc	199,1 mbar	5	0,3
144	0 to 20	0 to 1,4	0.1 to 0.5	6,9 to 34,5 mbar	20	1,4	25	1,7
146	0 to 30	0 to 2,1	0.1 to 0.6	6,9 to 41,4 mbar	30	2	40	2,8
156	0 to 100	0 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	125	8,6
164	0 to 200	0 to 13,8	0.3 to 2	20,7 to 137,9 mbar	200	13,8	200	13,8
Phosphor bronze bellows with nickel-plated brass 1/4" NPT (female) pressure connection								
270	0 to 200	0 to 13,8	1.5 to 8	0,1 to 0,6	200	13,8	250	17,2
274	0 to 300	0 to 20,7	2 to 10	0,1 to 0,7	300	20,7	350	24,1
Buna-N diaphragm and O-Ring with aluminum 1/4" NPT (female) pressure connection and cap								
440††	0 to 2 "wc	0 to 5 mbar	0.07 to 0.25 "wc	0,2 to 0,6 mbar	3	0,2	225	15,5
441†††	0 to 10 "wc	0 to 24,9 mbar	0.15 to 0.3 "wc	0,4 to 0,7 mbar	3	0,2	225	15,5
442	0 to 20 "wc	0 to 49,8 mbar	0.2 to 0.5 "wc	0,5 to 1,2 mbar	3	0,2	225	15,5
443	0 to 80 "wc	0 to 199,1 mbar	0.5 to 1.8 "wc	1,2 to 4,5 mbar	3	0,2	225	15,5
448	80 Vac to 0 "wc	-199,1 to 0 mbar	1 to 3 "wc	2,5 to 7,5 mbar	3	0,2	225	15,5
449†††	0 to 20 "wc	0 to 49,8 mbar	1 to 2 "wc	2,5 to 5,0 mbar	3	0,2	225	15,5
450	30 "Hg Vac to 0	-1 to 0	0.1 to 0.4 "Hg	-3,4 to 13,5 mbar	3	0,2	225	15,5
451	0 to 80 "wc	0 to 199,1 mbar	1 to 3 "wc	2,5 to 7,5 mbar	3	0,2	225	15,5
452	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1 "Hg	-6,8 to 33,9 mbar	20	1,4	225	15,5
453	0 to 20	0 to 1,4	0.05 to 0.2	3,4 to 13,8 mbar	20	1,4	225	15,5
454	0 to 30	0 to 2,1	0.05 to 0.3	3,4 to 20,7 mbar	30	2,1	225	15,5
Teflon® diaphragm and O-Ring with 316L stainless steel 1/4" NPT (female) pressure connection and cap								
550	30 "Hg Vac to 0	-1 to 0	0.1 to 0.6 "Hg	-3,4 to 20,3 mbar	3	0,2	225	15,5
551	0 to 80 "wc	0 to 199,1 mbar	1.5 to 3.5 "wc	3,7 to 8,7 mbar	80"wc	199,1 mbar	225	15,5
552	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1 "Hg	-6,8 to 33,9 mbar	20	1,4	225	15,5
553	0 to 20	0 to 1,4	0.05 to 0.3	3,4 to 20,7 mbar	20	1,4	225	15,5
554	0 to 30	0 to 2,1	0.1 to 0.4	6,9 to 27,6 mbar	30	2,1	225	15,5
555	0 to 100	0 to 6,9	0.25 to 0.75	17,2 to 51,7 mbar	100	6,9	225	15,5

Teflon® is a registered trademark of E.I. DuPont.

†† Model not available on types J402 and J403

††† Model not available on type J403

PRESSURE MODEL CHART

Type H400, single switch output with internal adjustment via reference dial

Type H402, dual switch output with internal adjustment via reference dial

Type H403, triple switch output with internal adjustment via reference dial

Model	Adjustable Set Point Range		Deadband		Proof Pressure**		Scale Division
	High end of range on rise Low end of range on fall; psi (unless noted)	bar (unless noted)	Deadband doubles for 2 and 3 switch types psi (unless noted)	bar (unless noted)	psi	bar	psi (unless noted)
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connection							
S126B	30 "Hg Vac to 0	-1 to 0	0.2 to 0.9 "Hg	-6,8 to -30,5 mbar	5	0,3	2 "Hg
S134B	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1.2 "Hg	-6,8 to -40,6	25	1,7	2 "Hg & 2 psi
S137B†	0 to 80 "wc	0 to 199,1 mbar	2 to 6 "wc	5 to 14,9 mbar	5	0,3	5 "wc
S144B	0 to 20	0 to 1,4	0.1 to 0.5	6,9 to 34,5 mbar	25	1,7	1
S146B	0 to 30	0 to 2,1	0.1 to 0.6	6,9 to 41,4 mbar	40	2,8	1
S156B	0 to 100	0 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	200	13,8	5
S164B	0 to 200	0 to 13,8	0.3 to 2	20,7 to 137,9 mbar	200	13,8	10
Welded 316L stainless steel bellows and 1/4" NPT (female) pressure connection							
358	0 to 200	0 to 13,8	1.5 to 8	0,1 to 0,6	250	17,2	10
361	0 to 300	0 to 20,7	2 to 9	0,1 to 0,6	350	24,1	10
376	0 to 500	0 to 34,5	3 to 12	0,2 to 0,8	575	39,6	20
Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Models 126 and 134 have zinc-plated steel spring exposed to media							
126	30 "Hg Vac to 0	-1 to 0	0.2 to 0.9 "Hg	-6,8 to -30,5 mbar	5	0,3	2 "Hg
134	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1.2 "Hg	-6,8 to -40,6 mbar	25	1,7	2 "Hg & 2 psi
137†	0 to 80 "wc	0 to 199,1 mbar	2 to 6 "wc	5 to 14,9 mbar	5	0,3	5 "wc
144	0 to 20	0 to 1,4	0.1 to 0.5	6,9 to 34,5 mbar	25	1,7	1
146	0 to 30	0 to 2,1	0.1 to 0.6	6,9 to 41,4 mbar	40	2,8	1
156	0 to 100	0 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	125	8,6	5
164	0 to 200	0 to 13,8	0.3 to 2	20,7 to 137,9 mbar	200	13,8	10
Phosphor bronze bellows with nickel plated brass 1/4" NPT (female) pressure connection							
270††	0 to 200	0 to 13,8	1.5 to 8	0,1 to 0,6	250	17,2	10
274††	0 to 300	0 to 20,7	2 to 10	0,1 to 0,7	350	24,1	10
Buna-N diaphragm and O-Ring with aluminum 1/4" NPT (female) pressure connection and cap							
440†	0 to 2 "wc	0 to 5 mbar	0.07 to 0.25 "wc	0,2 to 0,6 mbar	225	15,5	0.1 "wc
441†	0 to 10 "wc	0 to 24,9 mbar	0.15 to 0.3 "wc	0,4 to 0,7 mbar	225	15,5	0.5 "wc
442†	0 to 20 "wc	0 to 49,8 mbar	0.2 to 0.5 "wc	0,5 to 1,2 mbar	225	15,5	1 "wc
443†	0 to 80 "wc	0 to 199,1 mbar	0.5 to 1.8 "wc	1,2 to 4,5 mbar	225	15,5	5 "wc
448†	80 "wc Vac to 0	-199,1 to 0 mbar	1 to 3 "wc	2,5 to 7,5 mbar	225	15,5	5 "wc
450††	30 "Hg Vac to 0	-1 to 0	0.1 to .04 "Hg	-3,4 to -13,5 mbar	225	15,5	2 "Hg
452††	30 "Hg Vac to 20 psi	-1 to 1,4	0.1 to 1 "Hg	-3,4 to -33,9 mbar	225	15,5	2 "Hg & 2 psi
453††	0 to 20	0 to 1,4	0.05 to 0.2	3,4 to 13,8 mbar	225	15,5	1
454††	0 to 30	0 to 2,1	0.05 to 0.3	3,4 to 20,7 mbar	225	15,5	1

****Proof pressure:** The maximum pressure to which a pressure sensor may be subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).

Teflon® is a registered trademarks of E.I. DuPont.

† Model not available on types H402 and H403

†† Model not available on type H403



PRESSURE MODEL CHART

Type H400, single switch output with internal adjustment via reference dial

Type H402, dual switch output with internal adjustment via reference dial

Type H403, triple switch output with internal adjustment via reference dial

Model	Adjustable Set Point Range		Deadband		Proof Pressure**		Scale Division
	Low end of range on fall; High end of range on rise		Deadband doubles for 2 and 3 switch types		psi	bar	psi (unless noted)
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)			
Teflon® diaphragm, O-Ring with 316L stainless steel 1/4" NPT (female) pressure connection and cap							
550††	30 "Hg Vac to 0	-1 to 0	0.1 to 0.6 "Hg	-3,4 to -20,3 mbar	225	15,5	2 "Hg
551†	0 to 80 "wc	0 to 199,1 mbar	1.5 to 3.5 "wc	3,7 to 8,7 mbar	225	15,5	5 "wc
552††	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 1 "Hg	-6,8 to -33,9 mbar	225	15,5	2 "Hg & 2 psi
453††	0 to 20	0 to 1,4	0.05 to 0.3	3,4 to 20,7 mbar	225	15,5	1
454††	0 to 30	0 to 2,1	0.1 to 0.4	6,9 to 27,6 mbar	225	15,5	1
555††	0 to 100	0 to 6,9	0.25 to 0.75	17,2 to 51,7 mbar	225	15,5	5

****Proof pressure:** The maximum pressure to which a pressure sensor may be subjected, which causes no permanent damage. The unit may require calibration (e.g. start-up, testing).

† Model not available on types H402 and H403

†† Model not available on type H403

DIFFERENTIAL PRESSURE MODEL CHART

Type J400K, single switch output with internal hex screw adjustment

Type J402K, dual switch output with internal hex screw adjustment

Model	Adjustable Set Point Range		Deadband		Working Pressure***		Proof Pressure**	
	Low end of range on fall; High end of range on rise		Deadband doubles for 2 and 3 switch types					
	psid (unless noted)	bar (unless noted)	psi (unless noted)	mbar	psi	bar	psi	bar
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connections								
S147B	3 to 30	0,2 to 2,1	0.5 to 2	34,5 to 137,9	30 "Hg Vac to 100	-1 to 6,9	300	20,7
S157B	10 to 100	0,7 to 6,9	0.5 to 3	34,5 to 206,8	30 "Hg Vac to 180	-1 to 12,4	300	20,7
Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connections								
147	3 to 30	0,2 to 2,1	0.5 to 2	34,5 to 137,9	30 "Hg Vac to 100	-1 to 6,9	180	12,4
157	10 to 100	0,7 to 6,9	0.5 to 3	34,5 to 206,8	30 "Hg Vac to 150	-1 to 10,3	180	12,4
Buna-N diaphragm and O-Ring with aluminum 1/4" NPT (female) pressure connections								
455	5 to 80 "wcd	12,4 to 199,1 mbar	1 to 4 "wc	2,5 to 10	30 "Hg Vac to 225	-1 to 15,5	225	15,5
456	2 to 20	0,1 to 1,4	0.1 to 0.3	6,9 to 20,7	30 "Hg Vac to 225	-1 to 15,5	225	15,5
457	3 to 30	0,2 to 2,1	0.1 to 0.4	6,9 to 27,6	30 "Hg Vac to 225	-1 to 15,5	225	15,5

*****Working Pressure Range:** The pressure range within which two opposing sensors can be safely operated and still maintain set point adjustability provided the difference in pressure between them does not exceed the designated adjustable range.

DIFFERENTIAL PRESSURE MODEL CHART

Type J400K, single switch output with internal hex screw adjustment

Type J402K, dual switch output with internal hex screw adjustment

Model	Adjustable Set Point Range		Deadband		Working Pressure***		Proof Pressure**	
	Low end of range on fall; High end of range on rise		Deadband doubles for 2 and 3 switch types					
	psid (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi	bar	psi	bar
Kapton® diaphragm, Buna-N sealing diaphragms with aluminum 1/8" NPT (female) pressure connections (J402K only)								
540†	1 to 7 "wcd	2.5 to 17,4 mbar	0.1 to 0.5"wc	0,2 to 1,2 mbar	30 "Hg Vac to 200	-1 to 13,8	400	27,6
541†	2 to 20 "wcd	5 to 49,8 mbar	0.5 to 2 "wc	1,2 to 5 mbar	30 "Hg Vac to 200	-1 to 13,8	400	27,6
542†	5 to 50 "wcd	12,4 to 124,5 mbar	0.5 to 5 "wc	1,2 to 12,4 mbar	30 "Hg Vac to 200	-1 to 13,8	400	27,6
543†	15 to 100 "wcd	37,3 to 248,9 mbar	0.5 to 7 "wc	1,2 to 17,4 mbar	30 "Hg Vac to 200	-1 to 13,8	400	27,6
544†	2 to 20	0,1 to 1,4	1 to 2.5	0,1 to 0,2	30 "Hg Vac to 1200	-1 to 82,7	2500	172,4
545†	5 to 50	0,3 to 3,4	1 to 3	0,1 to 0,2	30 "Hg Vac to 1200	-1 to 82,7	2500	172,4
546†	10 to 100	0,7 to 6,9	1 to 5	0,1 to 0,3	30 "Hg Vac to 1200	-1 to 82,7	2500	172,4
547†	20 to 200	1,4 to 13,8	1 to 7	0,1 to 0,5	30 "Hg Vac to 1200	-1 to 82,7	2500	172,4
Teflon® and Buna-N diaphragms, Buna-N O-Ring with aluminum 1/4" NPT (female) pressure connections								
559	10 to 100	0,7 to 6,9	0.2 to 1	13,8 to 68,9 mbar	30 "Hg Vac to 225	-1 to 15,5	225	15,5

Type H400K, single switch output with internal adjustment via reference dial

Type H402K, dual switch output with internal adjustment via reference dial

Buna-N diaphragm and O-Ring with 1/4" NPT (female) aluminum pressure connections								
455	5 to 80 "wcd	12,4 to 199,1 mbar	1 to 4 "wc	2,5 to 10 mbar	30 "Hg Vac to 225	-1 to 15,5	225	15,5
456	2 to 20	0,1 to 1,4	0.1 to 0.3	6,9 to 20,7 mbar	30 "Hg Vac to 225	-1 to 15,5	225	15,5
457	3 to 30	0,2 to 2,1	0.1 to 0.4	6,9 to 27,6 mbar	30 "Hg Vac to 225	-1 to 15,5	225	15,5
Teflon and Buna-N diaphragms, Buna-N O-Ring with aluminum pressure connections								
559	10 to 100	0,7 to 6,9	0.2 to 1	13,8 to 68,9 mbar	30 "HgVac to 225	-1 to 15,5	225	15,5

***Working Pressure Range: The pressure range within which two opposing sensors can be safely operated and still maintain set point adjustability provided the difference in pressure between them does not exceed the designated adjustable range.

Kapton® and Teflon® are registered trademarks of E.I. DuPont.

† Model not available on type J400K



TEMPERATURE MODEL CHART

Type B400, single switch output, immersion stem, internal adjustment via reference dial
 Type B402, dual switch output, immersion stem, internal adjustment via reference dial
 Type B403, triple switch output, immersion stem, internal adjustment via reference dial
 Type C400, single switch output, immersion stem, internal hex screw adjustment
 Type C402, dual switch output, immersion stem, internal hex screw adjustment
 Type C403, triple switch output, immersion stem, internal hex screw adjustment
 Type E400, single switch output, bulb & capillary***, internal adjustment via reference dial
 Type E402, dual switch output, bulb & capillary***, internal adjustment via reference dial
 Type E403, triple switch output, bulb & capillary***, internal adjustment via reference dial
 Type F400, single switch output, bulb & capillary***, internal hex screw adjustment
 Type F402, dual switch output, bulb & capillary***, internal hex screw adjustment
 Type F403, triple switch output, bulb & capillary***, internal hex screw adjustment

Model	Adjustable Set Point Range		Max. Temp.		Scale Division††		Stem or Bulb Size* /Finish**
	°F	°C	°F	°C	°F	°C	
Type B400, B402, B403, single, dual, or triple switch output, immersion stem, internal adjustment via reference dial.							
Type C400, C402, C403, single, dual, or triple switch output, immersion stem, internal hex screw adjustment							
120	0 to 225	-17.8 to 107.2	275	135	5	5	9/16" x 1-7/8" nickel-plated brass
121	200 to 425	93.3 to 218.3	475	246.1	5	5	9/16" x 1-7/8" nickel-plated brass
Type E400, E402, E403, single, dual, or triple switch output, bulb & capillary***, internal adjustment via reference dial							
2BSA	-120 to 100	-84.4 to 37.8	150	65.6	10	5	3/8 x 2-7/16"
5BS	-20 to 80	-28.9 to 26.7	130	54.4	5	2	3/8 x 5"
4BS	25 to 100	-3.9 to 37.8	150	65.6	5	2	3/8 x 6-3/4"
2BSB	30 to 250	-1.1 to 121.1	300	148.9	10	5	3/8 x 2-5/8"
3BS	100 to 400	37.8 to 204.4	450	232.2	10	10	3/8 x 2-1/8"
8BS	350 to 640	176.7 to 337.8	690	365.6	10	10	3/8 x 3-1/4"
Type F400, F402, F403, single, dual, or triple switch output, bulb & capillary***, internal hex screw adjustment							
1BS†	-180 to 120	-117.8 to 48.9	170	76.7	N/A		3/8 x 3-3/4"
2BS	-125 to 350	-87.2 to 176.7	400	204.4	N/A		3/8 x 2-7/16"
3BS	-125 to 500	-87.2 to 260	550	287.8	N/A		3/8 x 2-1/8"
4BS	-40 to 120	-40 to 48.9	170	76.7	N/A		3/8 x 6-3/4"
5BS	-40 to 180	-40 to 82.2	230	110	N/A		3/8 x 5"
6BS	0 to 250	-17.8 to 121.1	300	148.9	N/A		3/8 x 4-1/2"
7BS	0 to 400	-17.8 to 204.4	450	232.2	N/A		3/8 x 3"
8BS	50 to 650	10 to 343.3	700	371.1	N/A		3/8 x 3-1/4"

† Model not available on type F403

†† Only applies to types B400, B402, B403, E400, E402 and E403

* Optional immersion stem lengths and capillary lengths are available

** Optional stainless steel immersion stem and capillary covering available

*** Standard capillary lengths are 6ft

HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed.

FOR MULTIPLE OPTIONS: Call United Electric Controls.

TYPE

DESCRIPTION

PRESSURE

- Type J400 - One SPDT output; internal adjustment with no reference dial
- Type J402 - Two SPDT outputs; internal adjustment with no reference dial
- Type J403 - Three SPDT outputs; internal adjustment with no reference dial
- Type H400 - One SPDT output; internal adjustment with reference dial
- Type H402 - Two SPDT outputs; internal adjustment with reference dial
- Type H403 - Three SPDT outputs; internal adjustment with reference dial

DIFFERENTIAL PRESSURE

- Type J400K - One SPDT output; internal adjustment with no reference dial
- Type J402K - Two SPDT outputs; internal adjustment with no reference dial
- Type H400K - One SPDT output; internal adjustment with reference dial
- Type H402K - Two SPDT outputs; internal adjustment with reference dial

TEMPERATURE

- Type B400 - Immersion stem; one SPDT output; internal adjustment with reference dial
- Type B402 - Immersion stem; two SPDT outputs; internal adjustment with reference dial
- Type B403 - Immersion stem; three SPDT outputs; internal adjustment with reference dial
- Type C400 - Immersion stem; one SPDT output; internal adjustment with no reference dial
- Type C402 - Immersion stem; two SPDT outputs; internal adjustment with no reference dial
- Type C403 - Immersion stem; three SPDT outputs; internal adjustment with no reference dial
- Type E400 - Bulb and capillary; one SPDT output; internal adjustment with reference dial
- Type E402 - Bulb and capillary; two SPDT outputs; internal adjustment with reference dial
- Type E403 - Bulb and capillary; three SPDT outputs; internal adjustment with reference dial
- Type F400 - Bulb and capillary; one SPDT output; internal adjustment with no reference dial
- Type F402 - Bulb and capillary; two SPDT outputs; internal adjustment with no reference dial
- Type F403 - Bulb and capillary; three SPDT outputs; internal adjustment with no reference dial



HOW TO ORDER OPTIONS

SWITCH OPTIONS* DESCRIPTION

0140	Gold contacts, 1 A 125 VAC resistive. Not available models 440-443
0500	Close deadband, 5 A 125/250 VAC resistive. Not available models 440-443
1010	D PDT switch, 10 A 125/250 VAC resistive. Not available temperature versions, Type J403, Type H403 and models 440-449, 520-535, 540-547, 570-572
1070	10 A 125 VDC resistive; deadband and minimum set point will increase. Not available types B, E and models 440-449, 520-535, 540-547, 570-572
1520	Adjustable deadband, 15 A 125/250/277 VAC resistive. Adjustment wheel changes rise setting only if adjustment on fall setting is required, use primary adjustment. NOTE: For Type J403, not available on middle switch. Not available types B, E, H, C403, or models 440-443, 520-535, 540-547, 570-572, 610-614
1530	External manual reset, 15 A 125/250/480 VAC resistive, latches on rise only. Not available triple switch versions, or models 440-443, 520-535, 570-572
1535	High ambient, 15 A 125/250/480 VAC resistive; temperatures up to 250°F/145°C. Not available models 440-443, 520-535
1537	Vapor-sealed 15 A 125/250 VAC resistive. Not available models 440-443, 520-535
1539	Fungus resistant case, 15 A 125/250 VAC resistive. Not available models 440-443, 520-535
2000	20 A 125/250/480 VAC resistive. Not available models 440-443, 520-535, 540-547, 570-572

OTHER OPTIONS

M020	Red status light, 115 VAC only. Specify whether light goes on or off with increasing or decreasing pressure or temperature. Not available J400K, H400K, J402K, H402K or models 440-443
M201	Factory set one switch
M202	Factory set two switches. Not available single switch versions
M203	Factory set three switches; note: the third or middle switch must always be set to highest pressure or temperature when switches are set apart. Not available single or dual switch versions
M210	Differential pressure indication. available J400K and J402K, models 147, S147B, 157 & S157B
M277	Range indicated on nameplate in kPa or MPa, factory selected. Not available temperature versions
M278	Range indicated on nameplate in Kg/cm ² . Not available temperature versions
M321	Gasketed Lexan® window. Not available on J, C, F Types
M405	Intrinsic safety compliance for European Union per ATEX standards
M406	Intrinsic safety compliance for Russia per Gosgortekhnadzor standards
M407	CE Compliance to Pressure Equipment Directive (category IV). Not available models 126, 137, 440-448, 451, 520-524, 530-534, 550-551, S126B, S137B
M444	Paper ID tag
M446	Stainless steel ID tag & wire attachment
M449	Mounting bracket kit. Required for models 520-535 when surface mounting. Use kit part number 6361-704 for other models
M504	316L Stainless steel immersion temperature stem. Available temperature models 120, 121 only
M540	Viton® construction (deadbands and low end of range may increase slightly); wetted parts include Viton® diaphragm and/or O-Ring plus standard connection material. Available models 448-457, 610-614, 540-547
M550	Oxygen service cleaning; internal construction may change. Not available Types E & F, and models 440-443
M900	Watertight conduit fitting; converts 7/8" hole to 1/2" NPT fitting. Required for product to meet NEMA 4X if using knockout holes for wiring
M913	1/4" NPT (female) stainless steel pressure connection. Available models S126B-S164B
M914	1/2" NPT (female) stainless steel pressure connection. Available models 358-376
M921	1/4" NPT (female) brass pressure connection. Available models 610-614, Type J402 only.
6361-704	Surface and Pipe Mounting Hardware (required for models 520-535, 540-547 when surface mounting)

OPTIONAL MATERIAL FOR "WC SENSORS: (AVAILABLE MODELS 520-525)

XC001	Aluminum pressure connection, Viton® Diaphragm, Viton® O-Ring
XC002	Aluminum pressure connection, Kapton® Diaphragm, Buna-N O-Ring
XC003	Aluminum pressure connection, Kapton® Diaphragm, Viton® O-Ring
XC004	316L stainless steel pressure connection, 316L stainless steel diaphragm, Viton® O-Ring (Over range pressure is limited to 100 psi)
XC005	316L stainless steel pressure connection, Viton® diaphragm, Viton® O-Ring
XC006	316L stainless steel pressure connection, Kapton® diaphragm, Viton® O-Ring
XC007	316L stainless steel pressure connection, Teflon® diaphragm, Viton® O-Ring

Kapton® and Teflon® are registered trademarks of E.I. DuPont. Lexan® is a registered trademark of General Electric Company. Viton® is a registered trademark of DuPont Dow Elastomers.

*All switches have limited DC capabilities. Consult factory for details.

OPTIONS FOR TEMPERATURE MODELS

UNION CONNECTORS

For all bulb & capillary switches, types E and F

Option	Replacement Number	Description
	<u>Brass</u>	
W027	SD6213-27	1/2" NPT w/ 3/4" bushing
W045	SD6213-45	3/4" NPT
W051	SD6213-51	1/2" NPT
	<u>304 Stainless Steel</u>	
W028	SD6213-28	1/2" NPT w/ 3/4" bushing
W046	SD6213-46	3/4" NPT
W050	SD6213-50	1/2" NPT

THERMOWELLS

For all bulb & capillary switches, types E and F

	<u>Brass</u>	
W075	SD6225-75	1/2" NPT with 3/4" NPT adapter bushing, 4" BT
W191	SD6225-191	1/2" NPT, 4" BT
W118	SD6225-118	1/2" NPT with 3/4" NPT adapter bushing, 7" BT
W192	SD6225-192	1/2" NPT, 7" BT
	<u>316 Stainless Steel</u>	
W076	SD6225-76	3/4" NPT, 4.5" BT
W193	SD6225-193	1/2" NPT, 4.5" BT
W119	SD6225-119	3/4" NPT, 7.5" BT
W177	SD6225-177	1/2" NPT, 7.5" BT

For all immersion stem switches; types B and C

W139	SD6225-139	3/4" NPT X 1-23/32" BT, BRASS
W140	SD6225-140	3/4" NPT X 1-23/32" BT, 316 ST/ST

W000 IMMERSION STEM AND THERMOWELLS

Note: Option W000 is a special Immersion Stem construction that has no external thread. This option fits inside a special thermowell and is secured with a set-screw. Available on types B and C only.

Option	Description
W000	Immersion stem only, brass
W097	Immersion stem and thermowell. Includes W000 stem and 1/2" NPT x 1-23/32" BT brass thermowell
W099	Immersion stem and thermowell. Includes W000 stem and 1/2" NPT x 1-23/32" BT 316 st/st thermowell.

OPTIONAL LENGTHS:

Optional immersion stem lengths to 15" available in brass, with or without 316 st/st thermowell. Consult UE for additional information. Optional capillary length to *50' available in copper or 304 st/st. Armor or Teflon® capillary protection available to lengths less than or equal to capillary length. Consult UE for additional information.

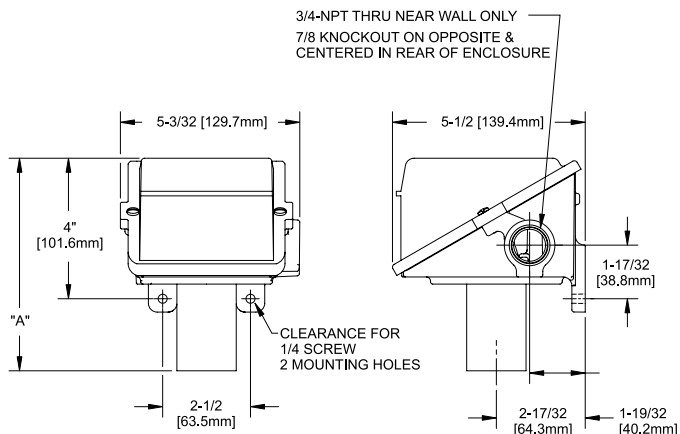
DIMENSIONAL DRAWINGS

Internal Set Point Adjustment

Types J400, J402, J403, J400K, J402K, C400, C402, C403, F400, F402, F403

Set Point Adjustment via Reference Dial

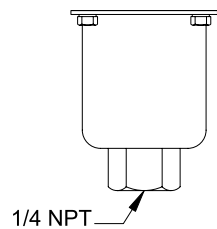
Types H400, H402, H403, H400K, H402K, B400, B402, B403, E400, E402, E403



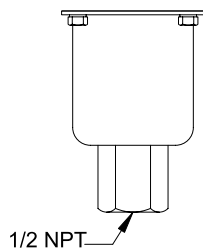
Dimension A			
Models	Inches	mm	NPT
PRESSURE			
126-164	5.50	139,7	1/4
S126B-S164B	5.91	150,0	1/2
270-376	5.50	139,7	1/4
440-443, 449			
451, 453, 454	4.25	108,74	1/4
448, 450, 452	5.03	127,79	1/4
520-525	8.25	209,5	1/2
530-535	8.12	206,20	1/2
551, 553-555	4.56	115,88	1/4
550, 552	5.03	127,79	1/4
570-572	4.56	115,8	1/4
610-614	6.31	160,30	1/4
DIFFERENTIAL PRESSURE			
147-157	6.13	155,57	1/4
S147B-S157B	6.13	155,57	1/2
455-559	7.00	178,05	1/4
540-543	7.97	202,4	1/8
544-547	8.03	204,0	1/8
TEMPERATURE			
120, 121	7.38	187,3	Immersion Stem
1BS-8BS	6.72	170,7	Bulb & Capillary

Pressure Sensors All dimensions stated in inches (millimeters)

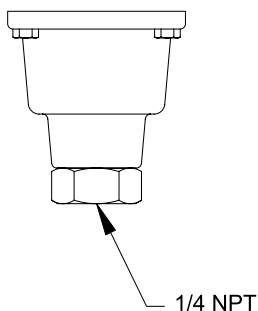
Models 126-164



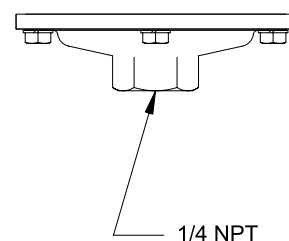
Models S126B-S164B



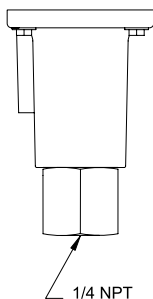
Models 270-376



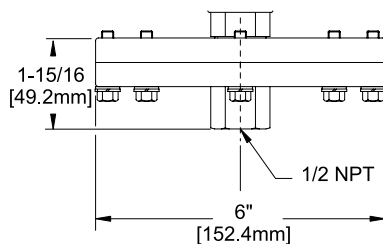
Models 440-454,
550-555, 570-572



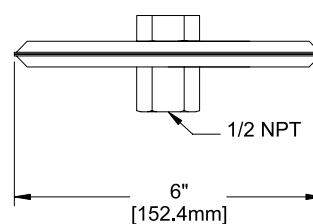
Models 610-614



Models 520-525



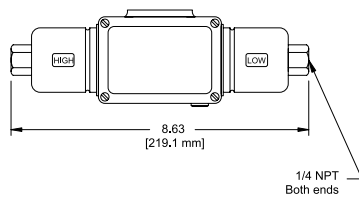
Models 530-535



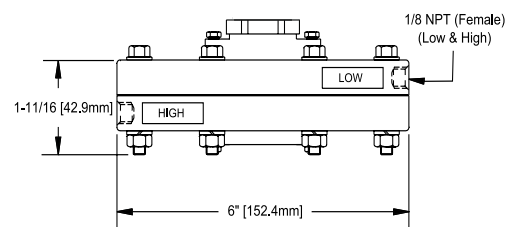
DIMENSIONAL DRAWINGS

Differential Pressure Sensors

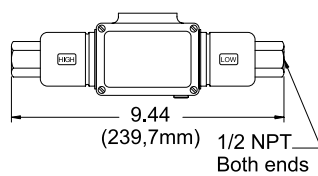
Models 147-157



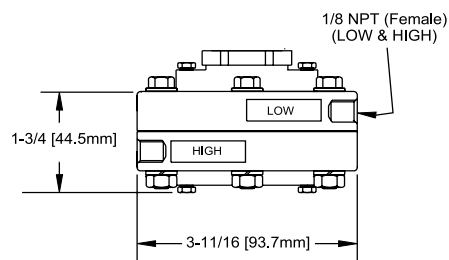
Models 540-543



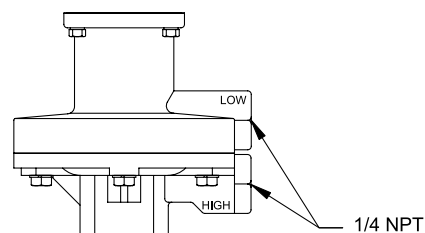
Models S147B-S157B



Models 544-547

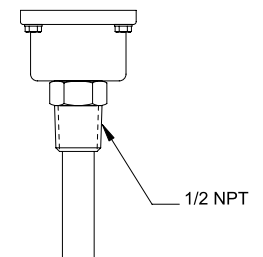


Models 455-559



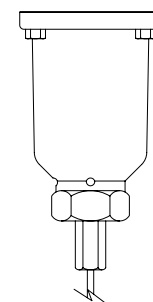
Temperature Sensors

Models 120-121



Local mount temperature version

Models 1BS-8BS



Remote mount temperature version

RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be inputted to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of product. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

UE specifications subject to change without notice.

U.S. SALES OFFICES

United Electric Controls
32 Highland Rd.
South Hampton, NH 03827
Phone: 603-394-0078
FAX: 603-394-0175

United Electric Controls
28 N. Wise Ave.
Freeport, IL 61032
Phone: 815-235-3501
FAX: 815-235-3847

United Electric Controls
1022 Vineyard Drive
Conyers, GA 30013
Phone: 770-483-8400
FAX: 770-929-8716

United Electric Controls
5829 Grazing Court
Mason, OH 45040
Phone: 513-398-3175
FAX: 513-398-3076

United Electric Controls
102 Salazar Court
Clayton, CA 94517
Phone: 925-524-0210
FAX: 925-524-0210

United Electric Controls
27 Summit Terrace
Sparta, NJ 07871
Phone: 973-271-2550
FAX: 973-729-6099

United Electric Controls
12630 Summerwood Glen
Houston, TX 77041
Phone: 832-243-0119
FAX: 832-243-0140

CANADA

EASTERN
68 Mosley Crescent
Brampton, Ontario
Canada L6Y 5C8
Phone: 905-455-5131
FAX: 905-455-5131

INTERNATIONAL OFFICES

BELGIUM
United Electric Controls-Europe
G. Van Gervenstraat 19A
B-9120 Beveren-Waas, Belgium
Phone: 32-37554-383
FAX: 32-37552-747

CHINA
United Electric Controls
Room 1114, No. 511
Shenshi Building
Weihai Road
Shanghai 200041, P.R. China
Phone: +8621-6255 8059
FAX: +8621-6255 8349

GERMANY
United Electric Controls
An Der Zentlinde 21
D-64711 Erbach, Germany
Phone: 496-062-7400
FAX: 496-062-7501

MALAYSIA
United Electric Controls, Far East
No. 1-2-2, 2nd Floor
Jalan 4/101C
Cheras Business Centre
Batu 5, Jalan Cheras
56100 Kuala Lumpur, Malaysia
Phone: 603-9133-4122
FAX: 603-9133-4155

RUSSIA
United Electric Controls, Moscow
Alyabyeva str., 4-1-4
Moscow, 121309, Russia
Phone: +7 (095) 792-88-06
FAX: +7 (095) 142-34-60

WESTERN
148 Silver Ridge Close N.W.
Calgary, Alberta
Canada T3B 3T4
Phone: 403-247-3724
FAX: 403-247-3724



UNITED ELECTRIC
CONTROLS

180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
<http://www.ueonline.com>

PRESSURE AND VACUUM SWITCHES ADJUSTABLE DEADBAND MODELS



FEATURES

- Gasketed, Die Cast Aluminum Enclosure with Epoxy Coating
- SPDT Switch Output
- Adjustable Deadband Models/Option
- Sealed, Isolated Metal Bellows Sensors
- Adjustable Pressure Ranges:
30 "Hg Vac to 6000 psi
(-1 to 414 bar)

OVERVIEW

The UE J6 is a reliable, sensitive pressure switch, originally designed for instrument air applications in process plants. Its compact design and combination of set-point sensitivity and narrow or optional adjustable deadband, offers cost-saving solutions for a variety of applications.

The J6 is ideally suited for a wide range of industrial processes such as alarm/shutdown and low/high service pressures. OEMs also utilize the J6 in machinery and equipment for threshold protection.

FEATURES

- UL listed and cUL certified
- Optional ATEX or GOST intrinsic safety compliance
- Designed to meet Enclosure Type 4X
- SPDT switch output
- Adjustable deadband models for precise on-off control
- Brass or stainless steel bellows sensors
- External manual reset option



SPECIFICATIONS

STORAGE TEMPERATURE	-65° to 160°F (-54 to 71 °C)
AMBIENT TEMPERATURE LIMITS	-40° to 160°F (-40 to 71 °C); set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Models 126-364, 680: ± 1% of adjustable range; models 610-614: ± 1.5% of adjustable range
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed; captive cover screws
ENCLOSURE CLASSIFICATION	Designed to meet Enclosure Type 4X requirements
SWITCH OUTPUT	One SPDT; switch may be wired "normally open" or "normally closed"; J6D has an adjustable deadband switch
ELECTRICAL RATING	15 A 125/250/480 VAC resistive. Electrical switches have limited DC capabilities. Consult factory for additional information.
WEIGHT	Approx. 1 lb., 8 oz. (0.68 kg.)
ELECTRICAL CONNECTION	1/2" NPT (female)
PRESSURE CONNECTION	All models 1/4" NPT (female) except models S126B-S160B: 1/2" NPT (female)

APPROVALS



UNITED STATES AND CANADA

UL Listed,
UL 508, file #E42272
cUL Certified
CSA C22.2 No. 14, file #42272



RUSSIA

Gosgostekhnadzor Permit (**OPTIONAL - Code M406**)
OExia IIC T6, Tamb. = -50°C to +60°C
Certificate #RRS 04-8897



EUROPEAN UNION

CENELEC/DEMKO A/S (N.B. #0539)
Demko A/S certified to **ATEX** Directive (94/9/EC)
II 1 G EEx ia IIC T6, Tamb. = -50°C to +60°C (**OPTIONAL - Code M405**)
EN 50014, EN 50020, EN 50284, EN 60079
Certificate #DEMKO 03 ATEX 0335063



CENELEC/TÜV Süddeutschland Bau und Betrieb GmbH (N.B. #0036)

TÜV certified to PED (97/23/EC)
Category IV, Module H1 (**OPTIONAL - Code M407**)
Certificate #USA 02/04/38/001 thru USA 02/07/38/033

UEC Compliant to LVD (73/23/EC & 93/68/EEC)
Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD

PRESSURE MODEL CHART

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**	
	Low end of range on fall; High end of range on rise							
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connection								
S126B	30 "Hg Vac to 0 psi	-1 to 0	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	3	0,2	5	0,3
S134B	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	20	1,4	25	1,7
S136B	0 to 50" wc	0 to 124,5 mbar	3 to 6 "wc	7,5 to 14,9 mbar	50 "wc	124,5 mbar	5	0,3
S142B	0 to 18	0 to 1,2	4 to 7 "wc	10 to 17,4 mbar	18	1,2	25	1,7
S148B	0 to 40	0 to 2,8	0.1 to 0.4	6,9 to 27,6 mbar	40	2,8	40	2,8
S152B	0 to 50	0 to 3,4	0.1 to 0.5	6,9 to 34,5 mbar	50	3,4	75	5,2
S156B	3 to 100	0,2 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	125	8,6
S160B	50 to 180	3,4 to 12,4	0.3 to 1	20,7 to 68,9 mbar	180	12,4	180	12,4
Welded 316L stainless steel bellows and 1/4" NPT (female) pressure connection (Model 680 not recommended for rapid or high cycling pressure changes)								
354	0 to 50	0 to 3,4	1.5 to 2.5	0,1 to 0,2	50	3,4	75	5,2
356	0 to 100	0 to 6,9	2 to 4	0,1 to 0,3	100	6,9	150	10,3
358	0 to 200	0 to 13,8	3 to 5	0,2 to 0,3	200	13,8	250	17,2
360	0 to 250	0 to 17,2	3 to 5	0,2 to 0,3	250	17,2	330	22,8
362	0 to 350	0 to 24,1	2 to 8	0,1 to 0,6	350	24,1	430	29,6
364	0 to 500	0 to 34,5	3 to 9	0,2 to 0,62	500	34,5	575	39,6
680	100 to 1700	6,9 to 117,2	9 to 23	0,6 to 1,6	1700	117,2	2500	172,4
303 stainless steel piston with Buna N O-ring and 303 stainless steel 1/4" NPT (female) pressure connection (not recommended for gas service since drying of the O-ring can allow bleeding of the medium into the atmosphere)								
610	75 to 1000	5,2 to 68,9	30 to 150	2,1 to 10,3	1000	68,9	10,000	689,5
612	125 to 3000	8,6 to 206,8	40 to 250	2,8 to 17,2	3000	206,8	10,000	689,5
614	500 to 6000	34,5 to 413,7	50 to 400	3,4 to 27,6	6000	413,7	10,000	689,5

* **Over Range Pressure:** The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability.

** **Proof Pressure:** The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage. The unit may require calibration (e.g., start-up, testing).

Model	Adjustable Set Point Range		Deadband		Over Range Pressure*		Proof Pressure**	
	Low end of range on fall; High end of range on rise							
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)

Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Models 126 and 134 have zinc-plated steel spring exposed to media

126	30 "Hg Vac to 0 psi	-1 to 0	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	3	0,2	5	0,3
134	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	20	1,4	25	1,7
136	0 to 50" wc	0 to 124,5 mbar	3 to 6 "wc	7,5 to 14,9 mbar	50 "wc	124,5 mbar	5	0,3
142	0 to 18	0 to 1,2	4 to 7 "wc	10 to 17,4 mbar	18	1,2	25	1,7
148	0 to 40	0 to 2,8	0.1 to 0.4	6,9 to 27,6 mbar	40	2,8	40	2,8
152	0 to 50	0 to 3,4	0.1 to 0.5	6,9 to 34,5 mbar	50	3,4	75	5,2
156	3 to 100	0,2 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	125	8,6
160	50 to 180	3,4 to 12,4	0.3 to 1	20,7 to 68,9 mbar	180	12,4	180	12,4

Phosphor bronze bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Model 218 has 300 series stainless steel spring exposed to media

218	30 "Hg Vac to 0 psi	-1 to 0	1 to 2 "Hg	33,9 to 67,7 mbar	0	0	30	2,1
222	0 to 20	0 to 1,4	0.5 to 1	34,5 to 68,9 mbar	20	1,4	30	2,1
224	0 to 30	0 to 2,1	0.5 to 1	34,5 to 68,9 mbar	30	2,1	45	3,1
226	0 to 50	0 to 3,4	0.7 to 1.3	48,3 to 89,6 mbar	50	3,4	75	5,2
230	0 to 100	0 to 6,9	1 to 2	68,9 mbar to 0,1 bar	100	6,9	110	7,6
258	0 to 50	0 to 3,4	1.5 to 2.5	0,1 to 0,2	50	3,4	75	5,2
266	0 to 100	0 to 6,9	2 to 5	0,1 to 0,3	100	6,9	150	10,3
270	0 to 200	0 to 13,8	3 to 5	0,2 to 0,3	200	13,8	250	17,2
272	0 to 250	0 to 17,2	3 to 5	0,2 to 0,3	250	17,2	330	22,8
274	0 to 300	0 to 20,7	4 to 6	0,3 to 0,4	300	20,7	350	24,1

Type J6D

Standard adjustable deadband models; additional models are available with adjustable deadband by specifying option 1520. Refer to options on page 6 for availability.

Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Models 126 and 134 have zinc-plated steel spring exposed to media

126	30 "Hg Vac to 0 psi	-1 to 0	0.3 to 1.25 "Hg	10,2 to 42,3 mbar	3	0,2	5	0,3
134	30 "Hg Vac to 20 psi	-1 to 1,4	0.3 to 1.25 "Hg	10,2 to 42,3 mbar	20	1,4	25	1,7
142	0 to 18	0 to 1,2	5 to 16 "wc	12,4 to 39,8 mbar	18	1,2	25	1,7
148	0 to 40	0 to 2,8	0.1 to 0.8	6,9 to 55,2 mbar	40	2,8	40	2,8
156	3 to 100	0,2 to 6,9	0.5 to 2	34,5 to 137,9 mbar	100	6,9	125	8,6



HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed. *FOR MULTIPLE OPTIONS:* Call United Electric Controls.

TYPE

DESCRIPTION

Pressure

Type J6 - One SPDT output; epoxy coated enclosure; internal adjustment with no reference dial
Type J6D - Adjustable deadband; one SPDT output; epoxy coated enclosure; internal adjustment with no reference dial

SWITCH OPTIONS*

0140	Gold flashed contacts, 1 A 125 VAC resistive; NOT AVAILABLE TYPE J6D
0500	Close deadband, 5 A 125/250 VAC resistive; NOT AVAILABLE TYPE J6D
1070	10 A 125 VDC resistive; deadband and minimum set point will increase; NOT AVAILABLE TYPE J6D
1520	Adjustable deadband, 15 A 125/250/277 VAC resistive. Adjustment wheel changes rise setting only - if adjustment on fall setting is required, use primary adjustment. NOT AVAILABLE ON MODELS 258-274, 354-364, 610-614, 680. NOTE: Type J6D includes option.
1530	External manual reset, 15 A 125/250/480 VAC resistive, latches on rising pressure only; NOT AVAILABLE TYPE J6D
2000	20 A 125/250 VAC resistive; NOT AVAILABLE TYPE J6D

SENSOR AND OTHER OPTIONS

M201	Factory set one switch; specify increasing or decreasing pressure and set point
M277	Range indicated on nameplate in kPa or MPa factory selected
M278	Range indicated on nameplate in Kg/cm ²
M405	Intrinsic safety compliance for European Union per ATEX standards
M406	Intrinsic safety compliance for Russia per Gosgortekhnadzor standards
M407	CE compliance to Pressure Equipment Directive (category IV); NOT AVAILABLE MODELS 126, 218, S126B
M444	Paper ID tag
M446	Stainless steel ID tag & wire attachment
M540	Viton® construction (deadbands and low end of range may increase slightly); wetted parts include Viton® O-ring and standard connection material. AVAILABLE ON MODELS 610-614 ONLY
M550	Oxygen service cleaning; internal construction may change
M913	1/4" NPT (female) 316L stainless steel pressure connection. AVAILABLE MODELS S126-S160B
M914	1/2" NPT (female) 316L stainless steel pressure connection. AVAILABLE MODELS 354-364

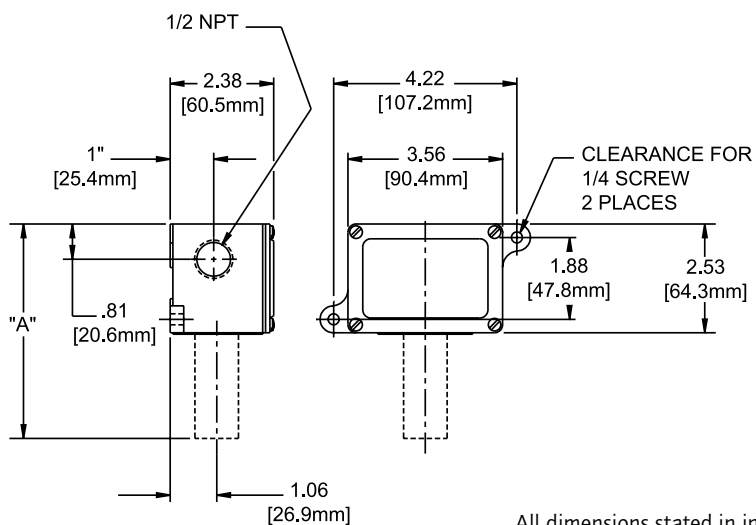
* All switches have limited DC capabilities. Consult factory for details.
Viton® is a registered trademark of E.I. DuPont

DIMENSIONAL DRAWINGS

Dimensional drawings for all models may be found at www.ueonline.com

Internal Set Point Adjustment

Types J6, J6D

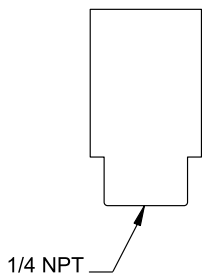


All dimensions stated in inches (millimeters)

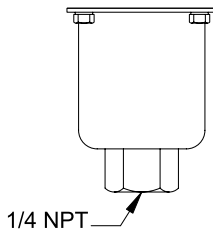
Models	Dimension A		
	Inches	mm	NPT
126-160	5.06	128.5	1/4
S126B-S160B	5.47	138.9	1/2
218-230	4.31	109.5	1/4
258-274	4.75	120.7	1/4
354-364	4.78	121.4	1/4
610-614	5.72	145.3	1/4
680	4.97	126.2	1/4

Pressure Sensors

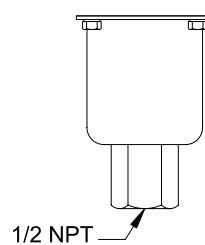
Models 218-230



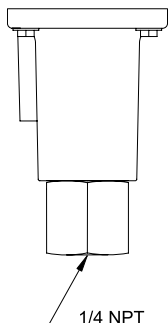
Models 126-160



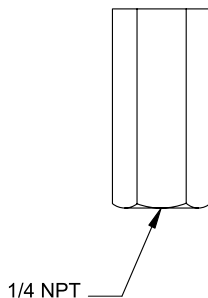
Models S126B-S160B



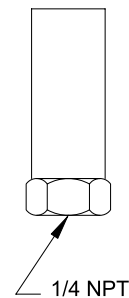
Models 610-614



Models 258-274



Models 354-364, 680



RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. Orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- For all applications, a factory set unit should be tested before use.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts, INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be inputted to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of product. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

UE specifications subject to change without notice.

U.S. SALES OFFICES

United Electric Controls
32 Highland Rd.
South Hampton, NH 03827
Phone: 603-394-0078
FAX: 603-394-0175

United Electric Controls
28 N. Wise Ave.
Freeport, IL 61032
Phone: 815-235-3501
FAX: 815-235-3847

United Electric Controls
1022 Vineyard Drive
Conyers, GA 30013
Phone: 770-483-8400
FAX: 770-929-8716

United Electric Controls
5829 Grazing Court
Mason, OH 45040
Phone: 513-398-3175
FAX: 513-398-3076

United Electric Controls
102 Salazar Court
Clayton, CA 94517
Phone: 925-524-0210
FAX: 925-524-0210

United Electric Controls
27 Summit Terrace
Sparta, NJ 07871
Phone: 973-271-2550
FAX: 973-729-6099

United Electric Controls
12630 Summerwood Glen
Houston, TX 77041
Phone: 832-243-0119
FAX: 832-243-0140

CANADA

EASTERN
68 Mosley Crescent
Brampton, Ontario
Canada L6Y 5C8
Phone: 905-455-5131
FAX: 905-455-5131

INTERNATIONAL OFFICES

BELGIUM
United Electric Controls-Europe
G. Van Gervenstraat 19A
B-9120 Beveren-Waas, Belgium
Phone: 32-37554-383
FAX: 32-37552-747

CHINA
United Electric Controls
Room 1114, No. 511
Shenshi Building
Weihai Road
Shanghai 200041, P.R. China
Phone: +8621-6255 8059
FAX: +8621-6255 8349

GERMANY
United Electric Controls
An Der Zentlinde 21
D-64711 Erbach, Germany
Phone: 496-062-7400
FAX: 496-062-7501

MALAYSIA
United Electric Controls, Far East
No. 1-2-2, 2nd Floor
Jalan 4/101C
Cheras Business Centre
Batu 5, Jalan Cheras
56100 Kuala Lumpur, Malaysia
Phone: 603-9133-4122
FAX: 603-9133-4155

MEXICO
United Electric Controls
Andador Austria 102
Fracc. Petroquimica CP 89365
Tampico, Tamaulipas Mexico
Phone: 833-132-3726
FAX: 833-132-3726

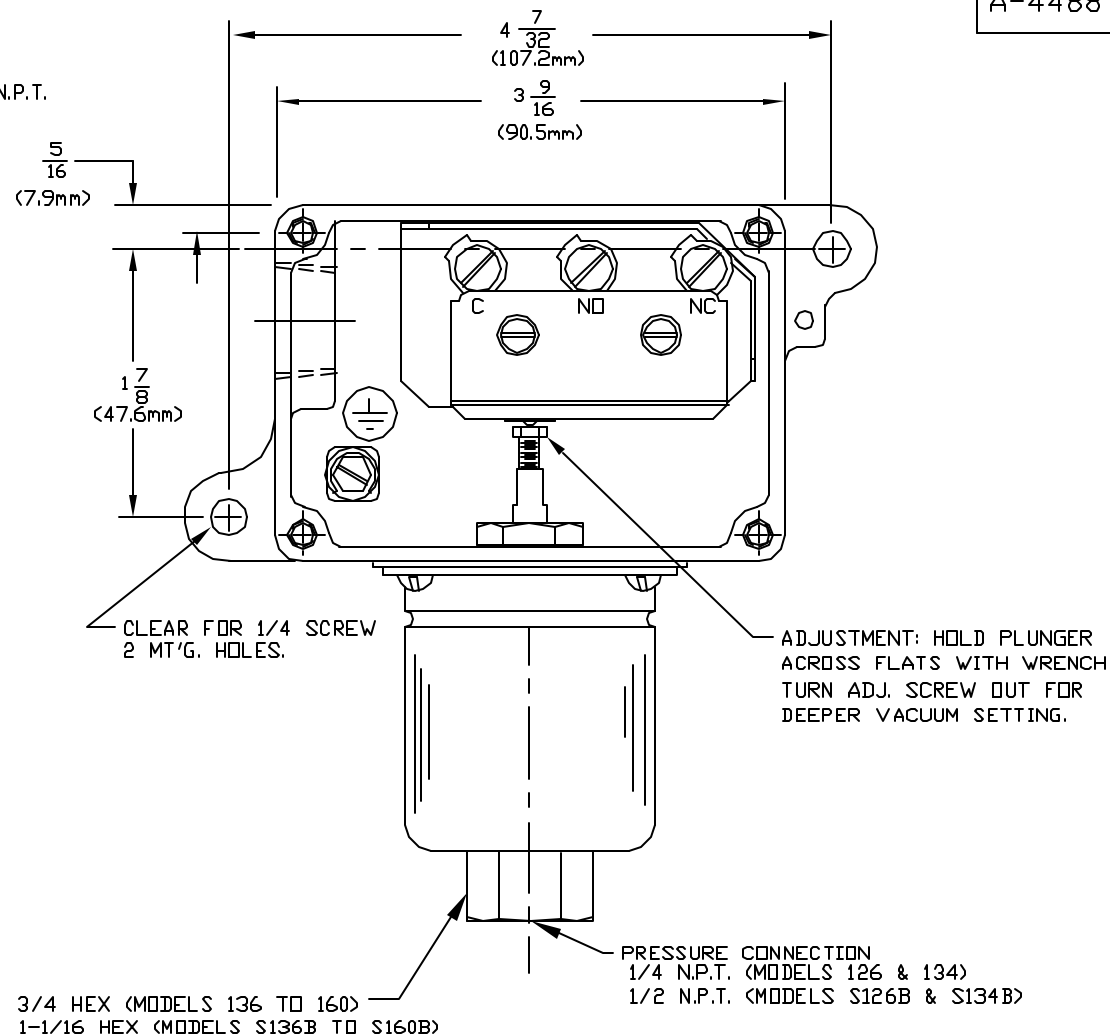
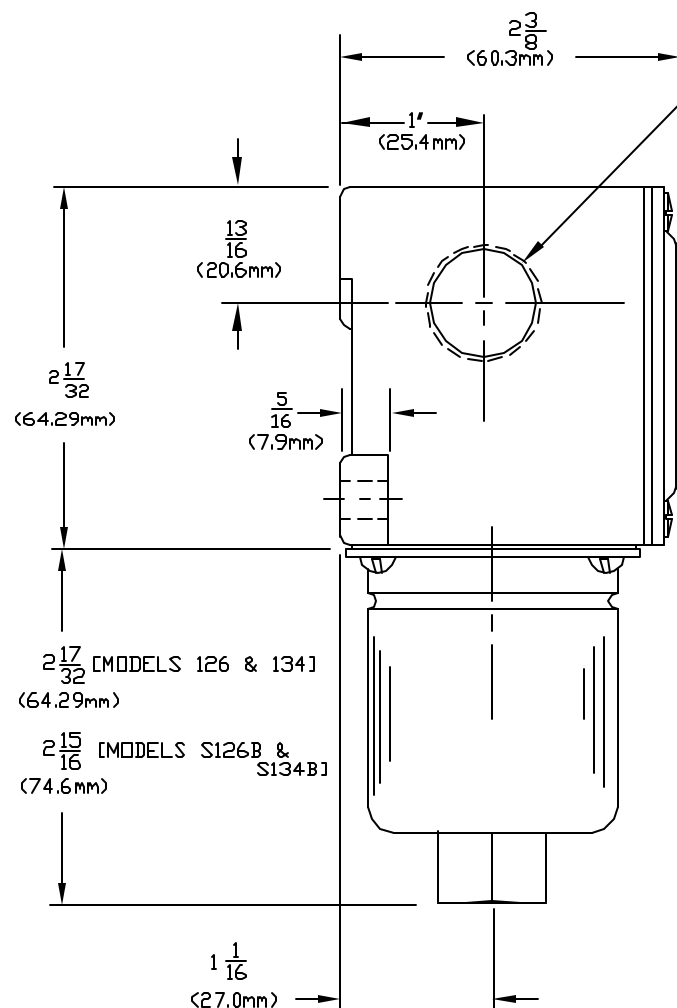
RUSSIA
United Electric Controls, Moscow
Kuusinena str., 19A, Office 310
Moscow, 125252, Russia
Phone: +7 (095) 792-88-06
FAX: +7 (095) 258-92-12

WESTERN
148 Silver Ridge Close N.W.
Calgary, Alberta
Canada T3B 3T4
Phone: 403-247-3724
FAX: 403-247-3724



UNITED ELECTRIC
CONTROLS

180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
<http://www.ueonline.com>



COVER REMOVED IN FRONT VIEW

R	DESCRIPTION	DATE	PLW	L.K.
SYM	REVISIONS			

ORIGINAL DATE	4-7-54
DRWN	GLENN V. REIS
CHKD	A.B.
APPD	A.B.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS $\pm 1/64$ 2 PLACE DEC 3 PLACE DEC ANGLES ± 0.01 ± 0.005 $\pm 1/2^\circ$ DO NOT SCALE THIS DRAWING	

TITLE	TYPE J6 MODELS: 126 & 134 S126B & S134B
SCALE	3/4:1



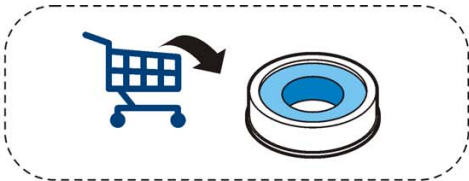
UNITED ELECTRIC
CONTROLS COMPANY
WATERTOWN * MASSACHUSETTS

DWG NO
A-4488

DF001
REV. B

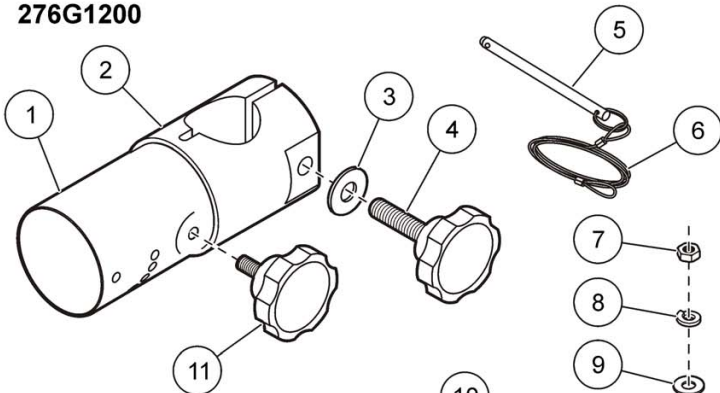
**9253000, 9253100, 9254000, 9254100,
9255000, 9255100, 9256000, 9246100**

DOC273.99.80174

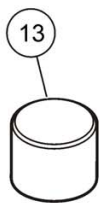
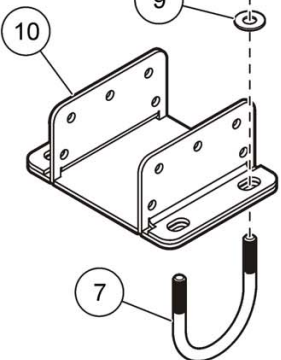
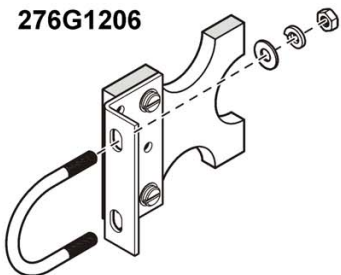


**9253000, 9253100, 9254000, 9254100
9255000, 9255100, 9256000, 9256100**

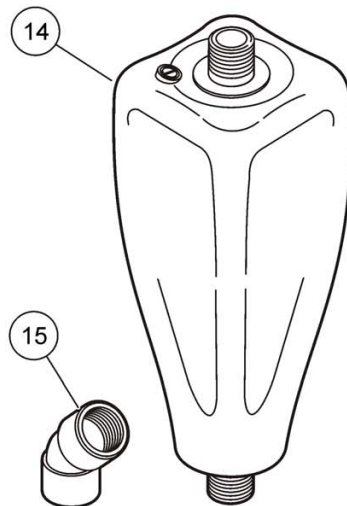
276G1200



276G1206



**9253100, 9254100
9255100, 9256100**



**9253000
9253100**



**9254000
9254100**



**9255000
9255100**

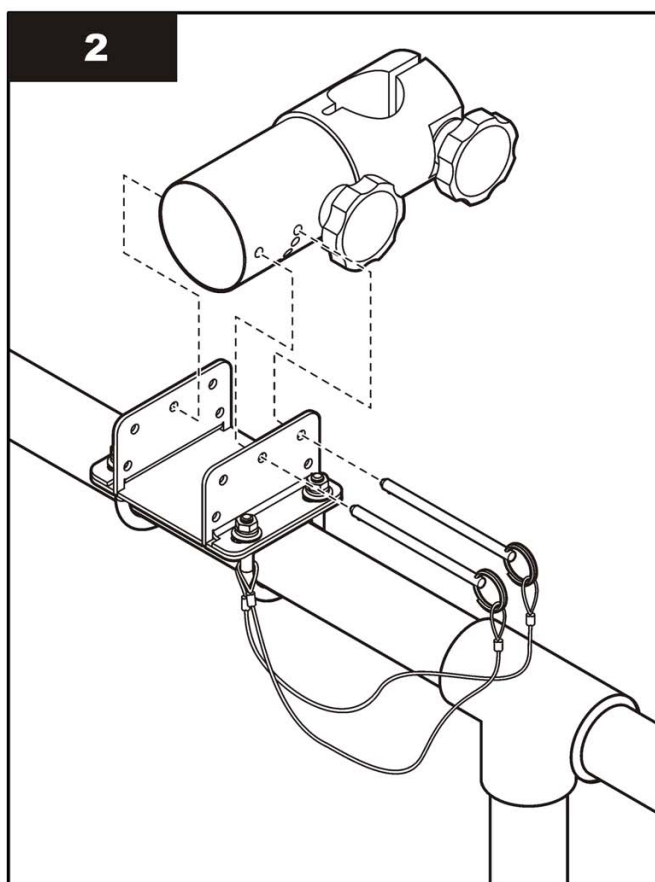
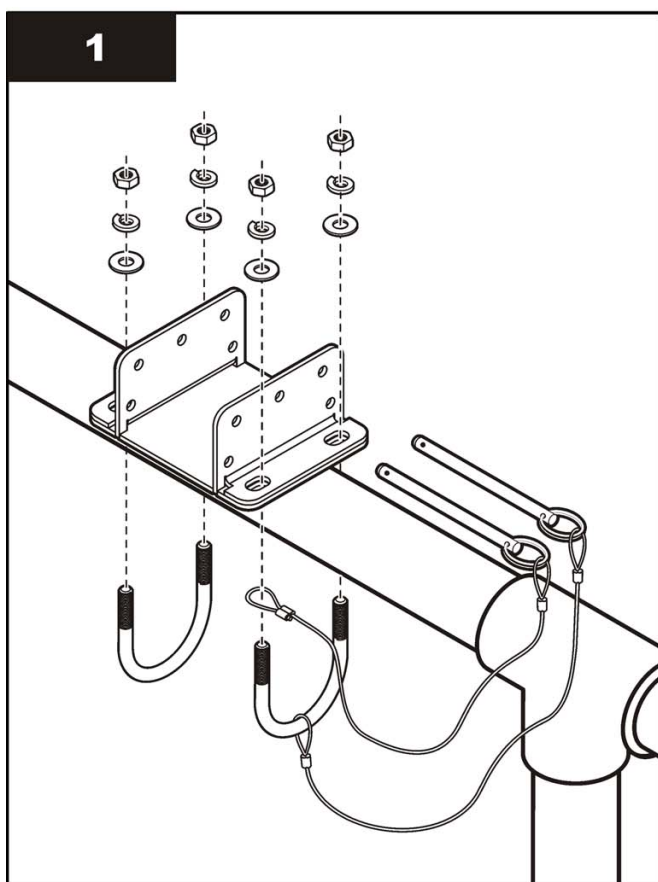
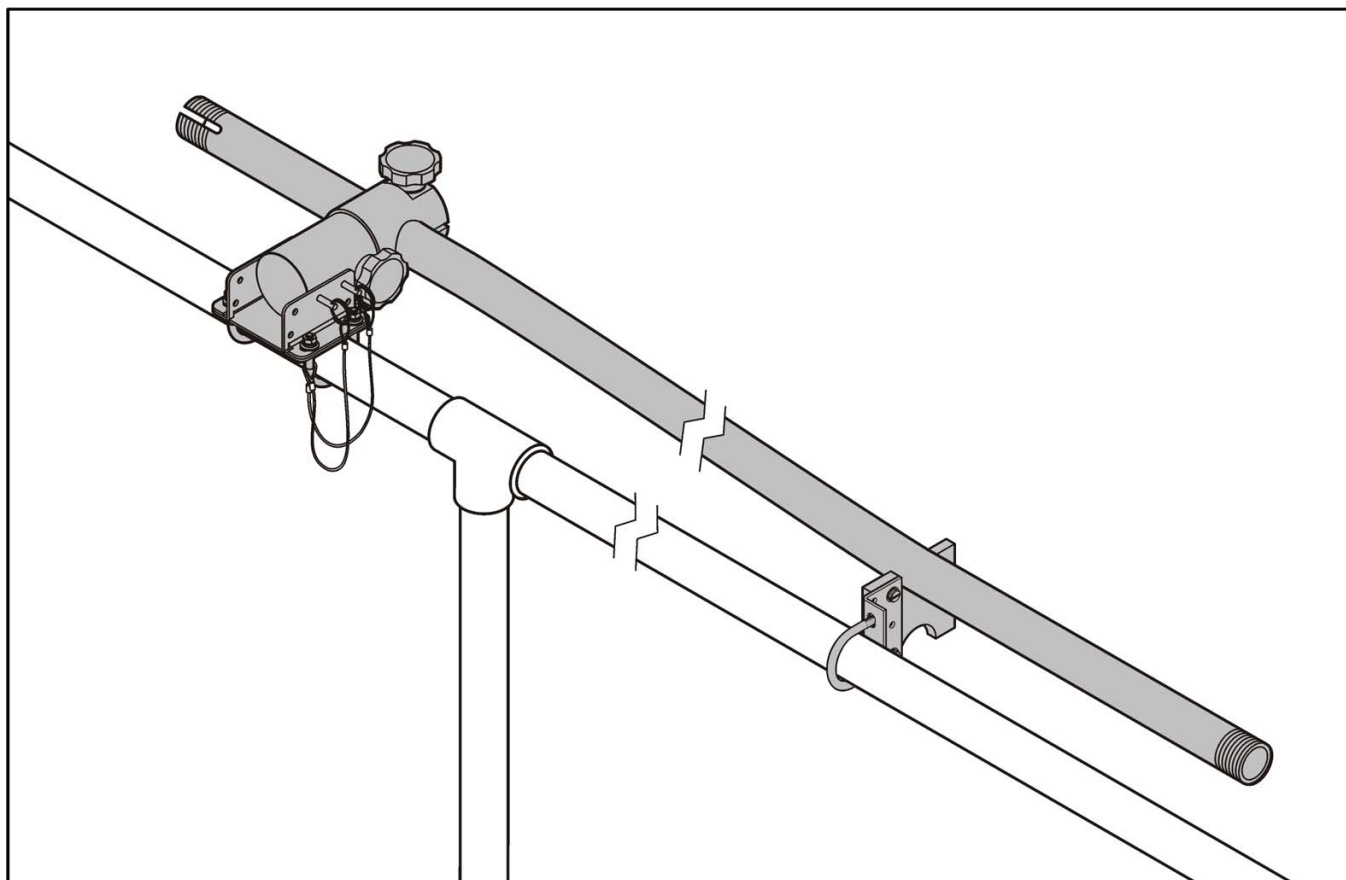


**9256000
9256100**



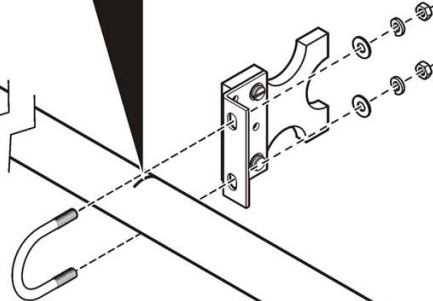
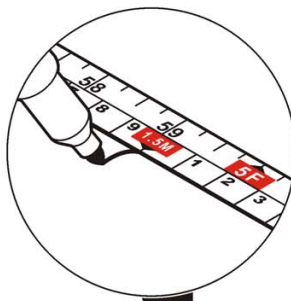
1	9110800	6	9H1394	11	9092700	16	9253200
2	9110900	7	9H1000	12	9256300-095	17	9254200
3	SE 966	8	8H1337	13	1P2116-107	18	9255200
4	9092800	9	8H1347	14	5792002	19	9256200
5	9H1285-040	10	276A3A1203	15	1P2106-107		

**9253000, 9253100, 9254000, 9254100, 9255000, 9255100,
9256000, 9256100**



3

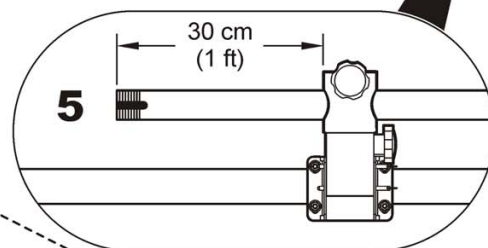
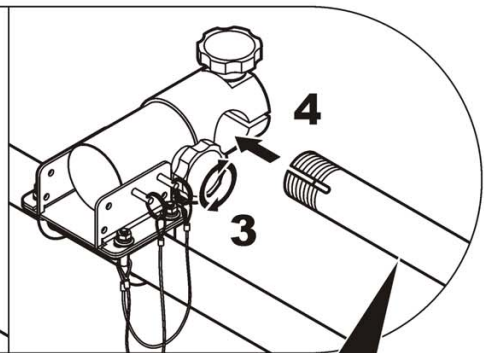
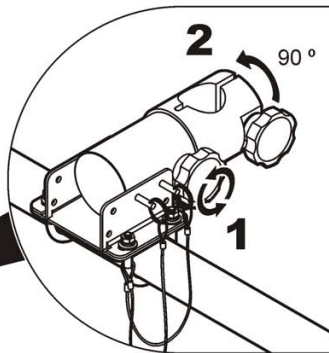
13 mm



1.5 m (5 ft)

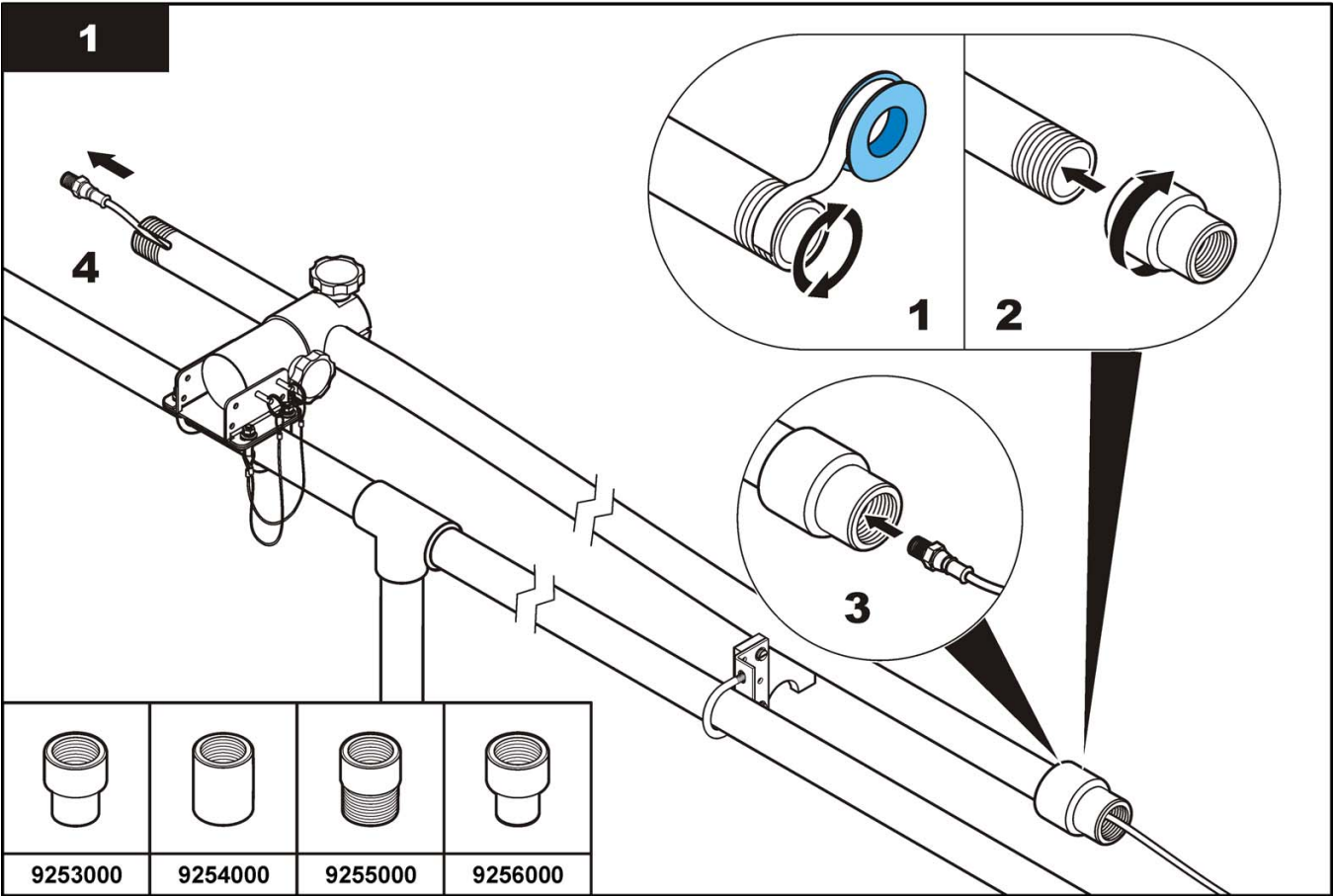
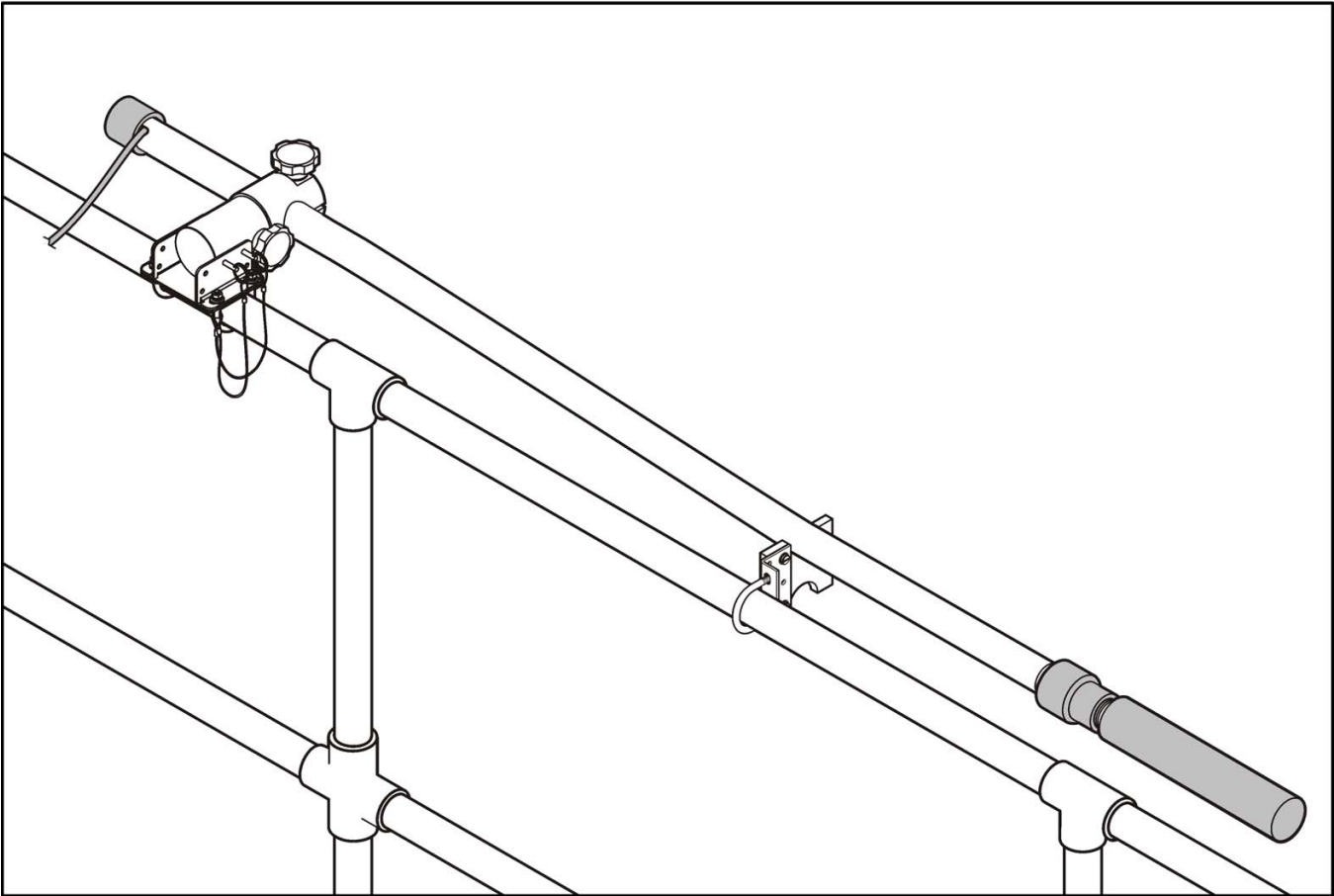
Distance from main floor to water level is about 2.1m. road length to ensure sensor is submerged, about 2.5m. Provide Flange connection instead of swivel and rail mount bracket.

4






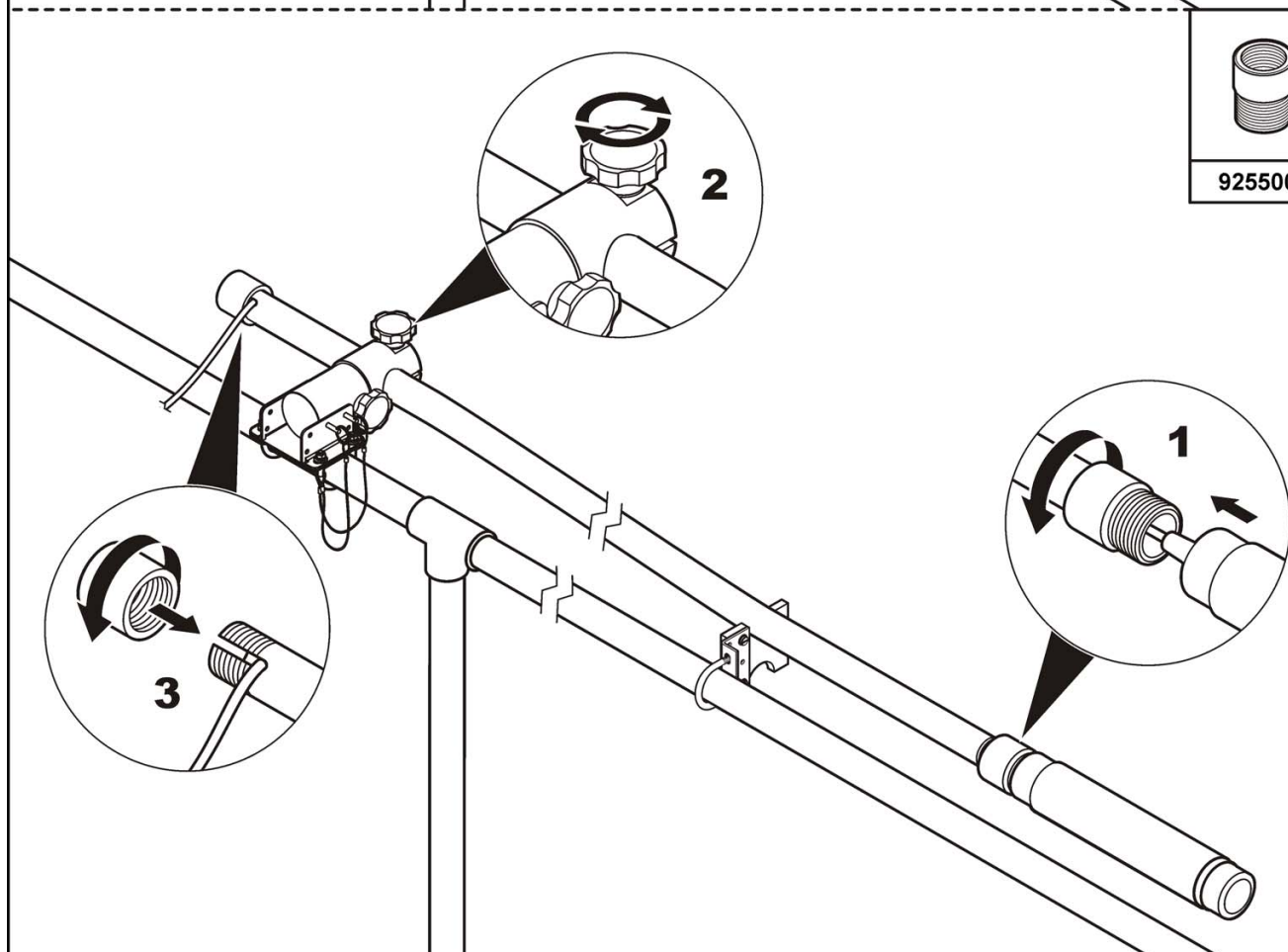
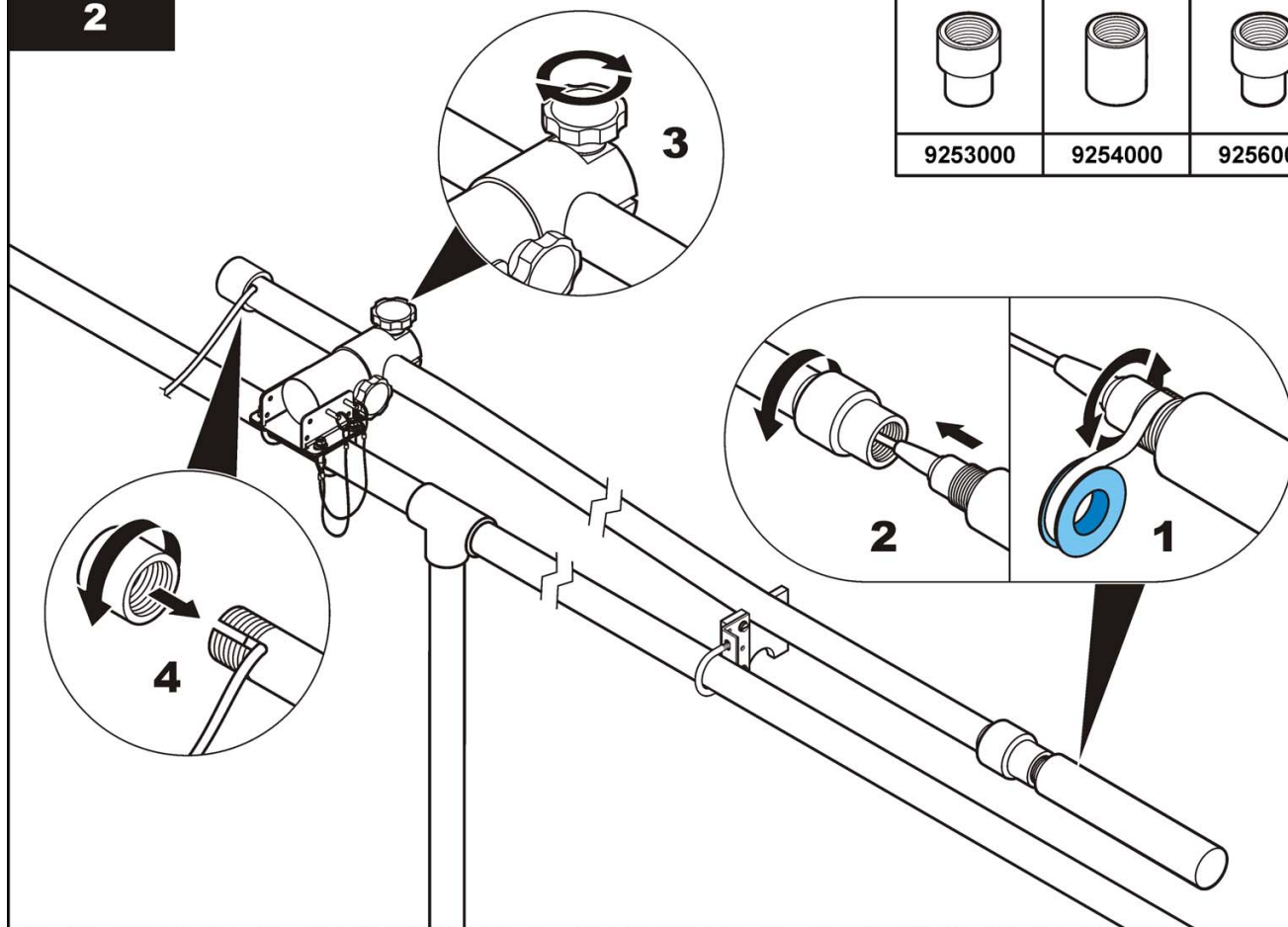
6


9253000, 9254000, 9255000, 9256000



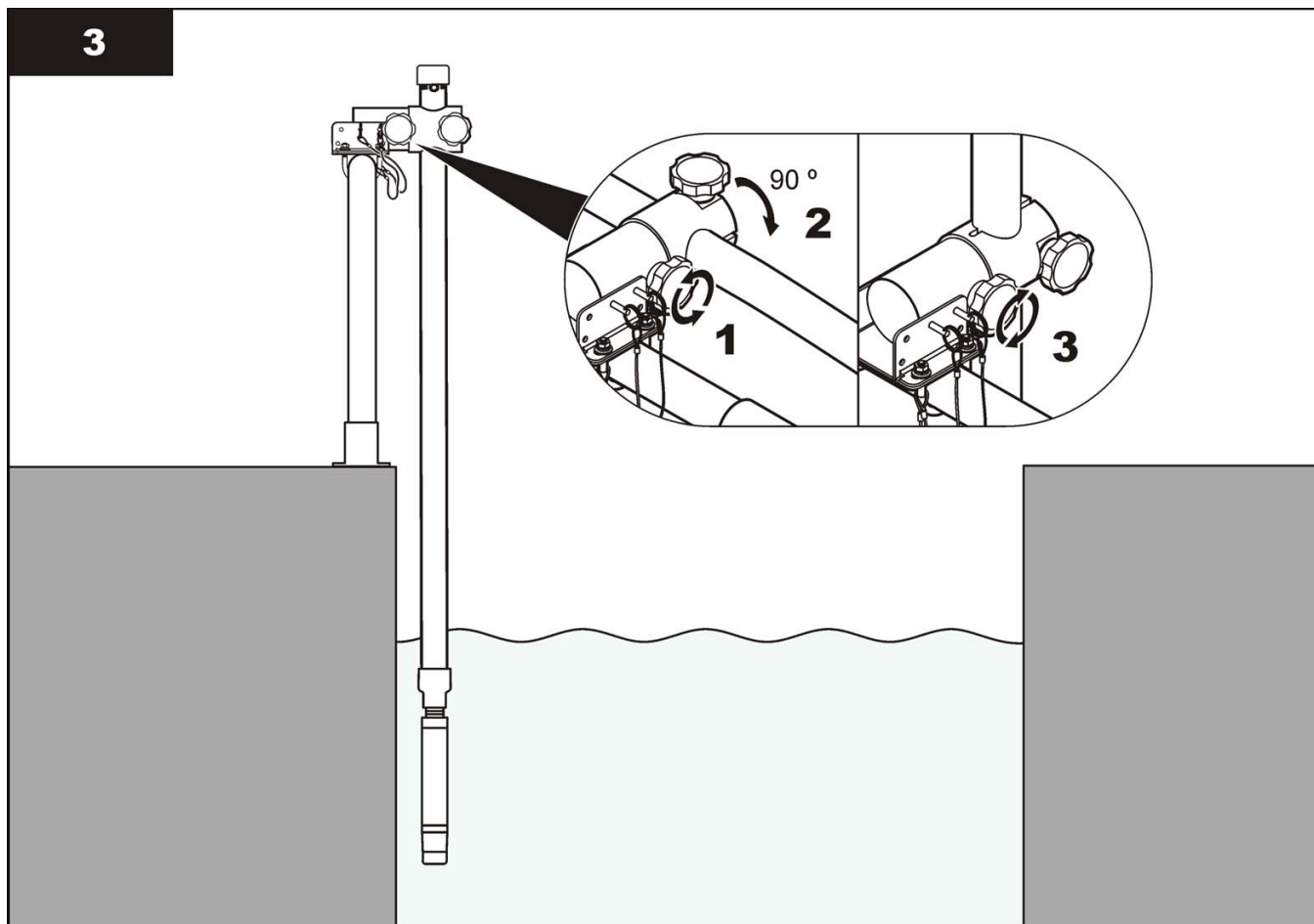
2

		
9253000	9254000	9256000

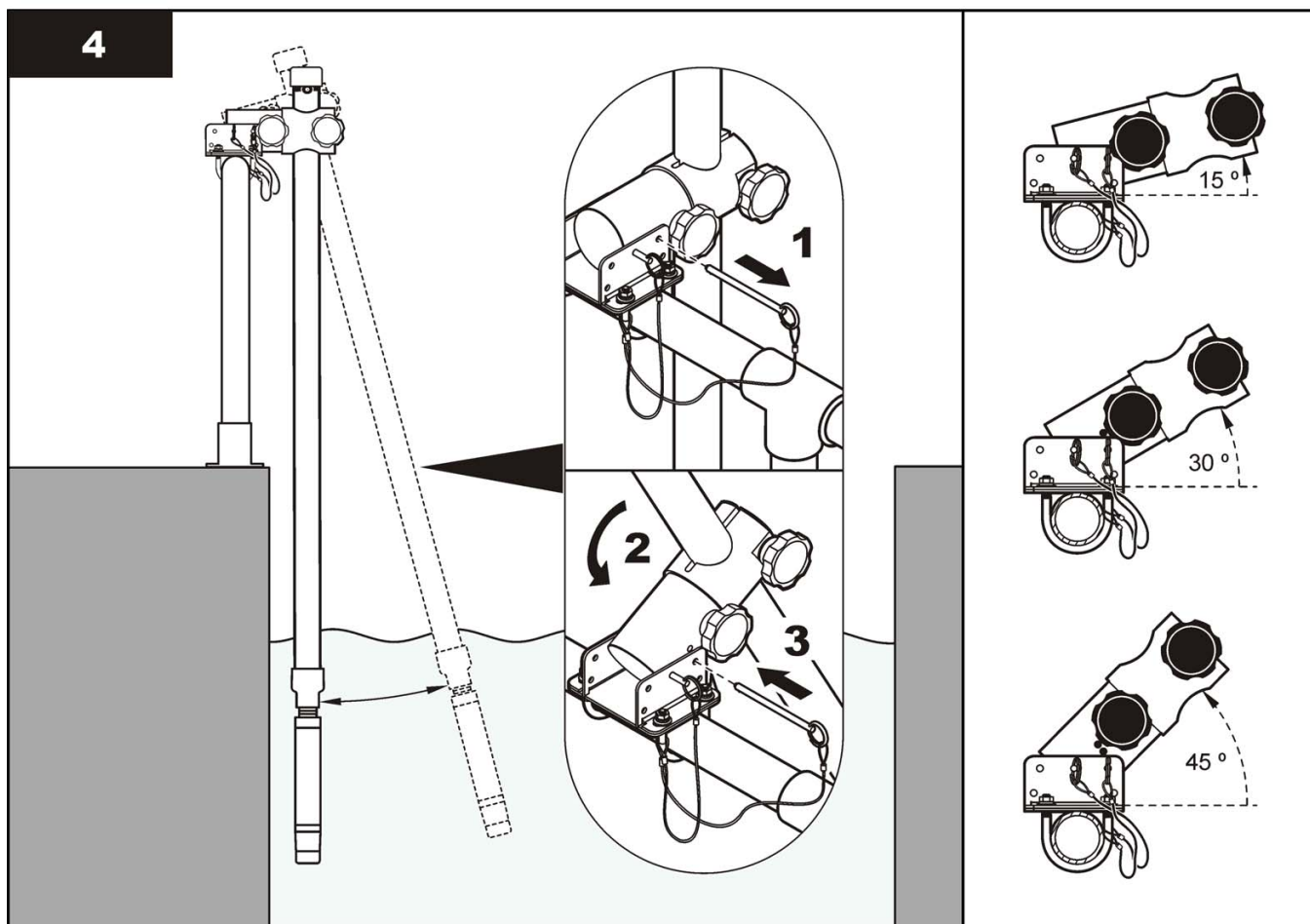



9255000

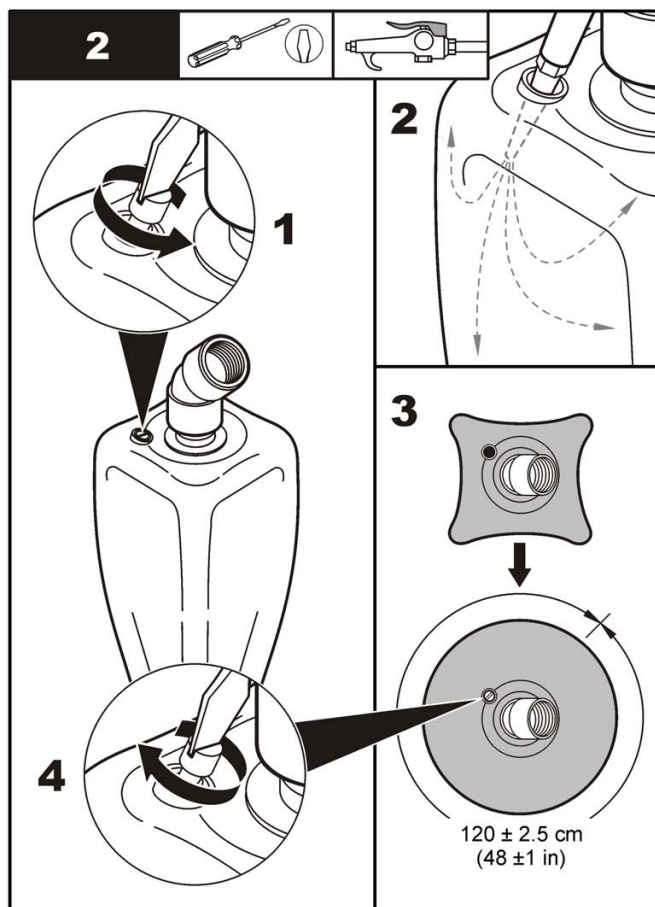
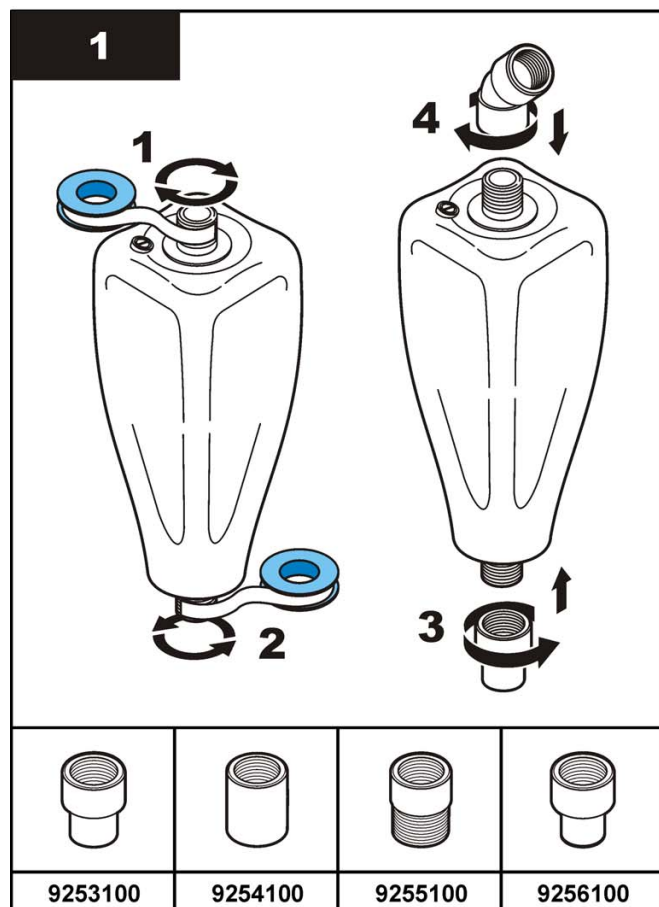
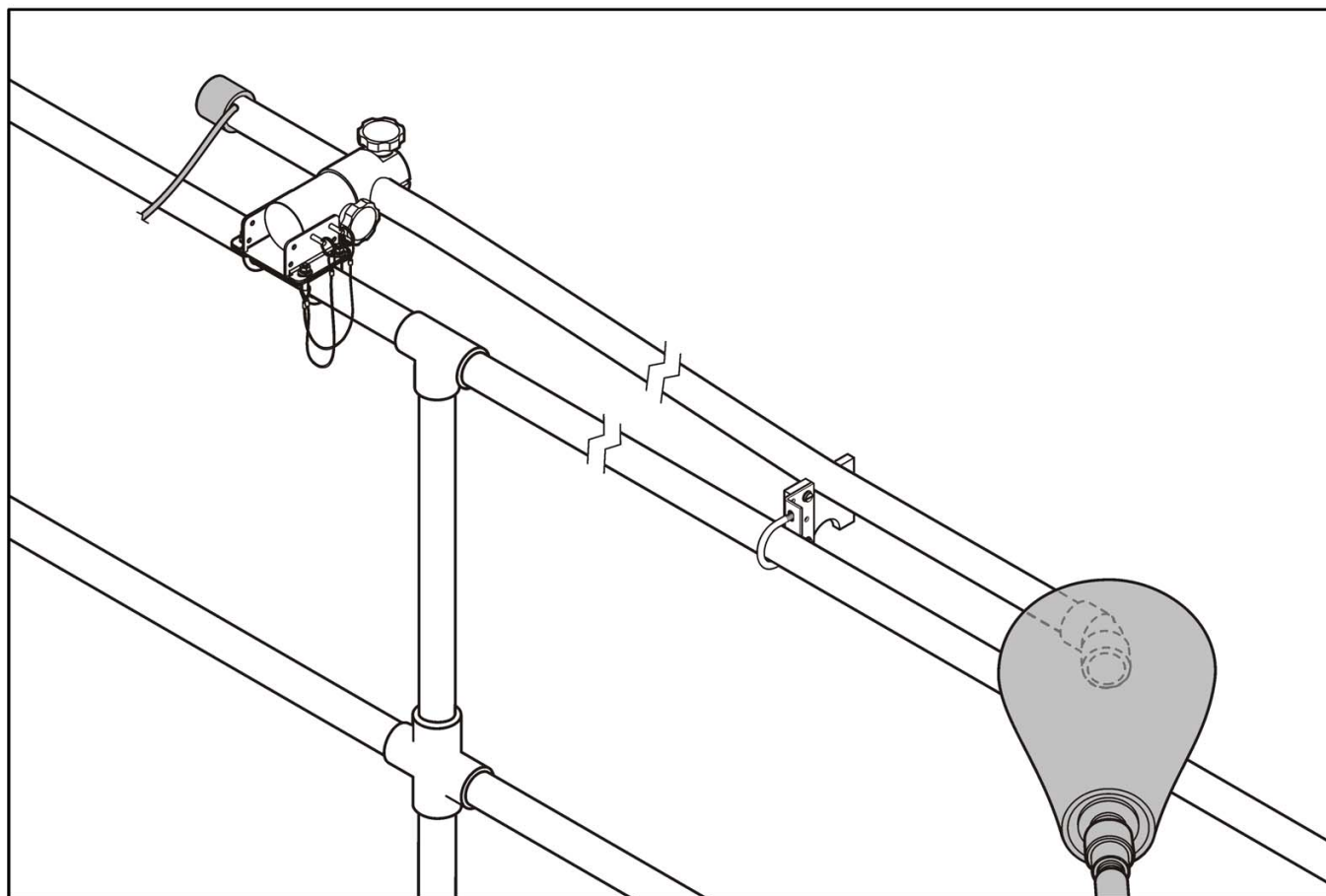
3

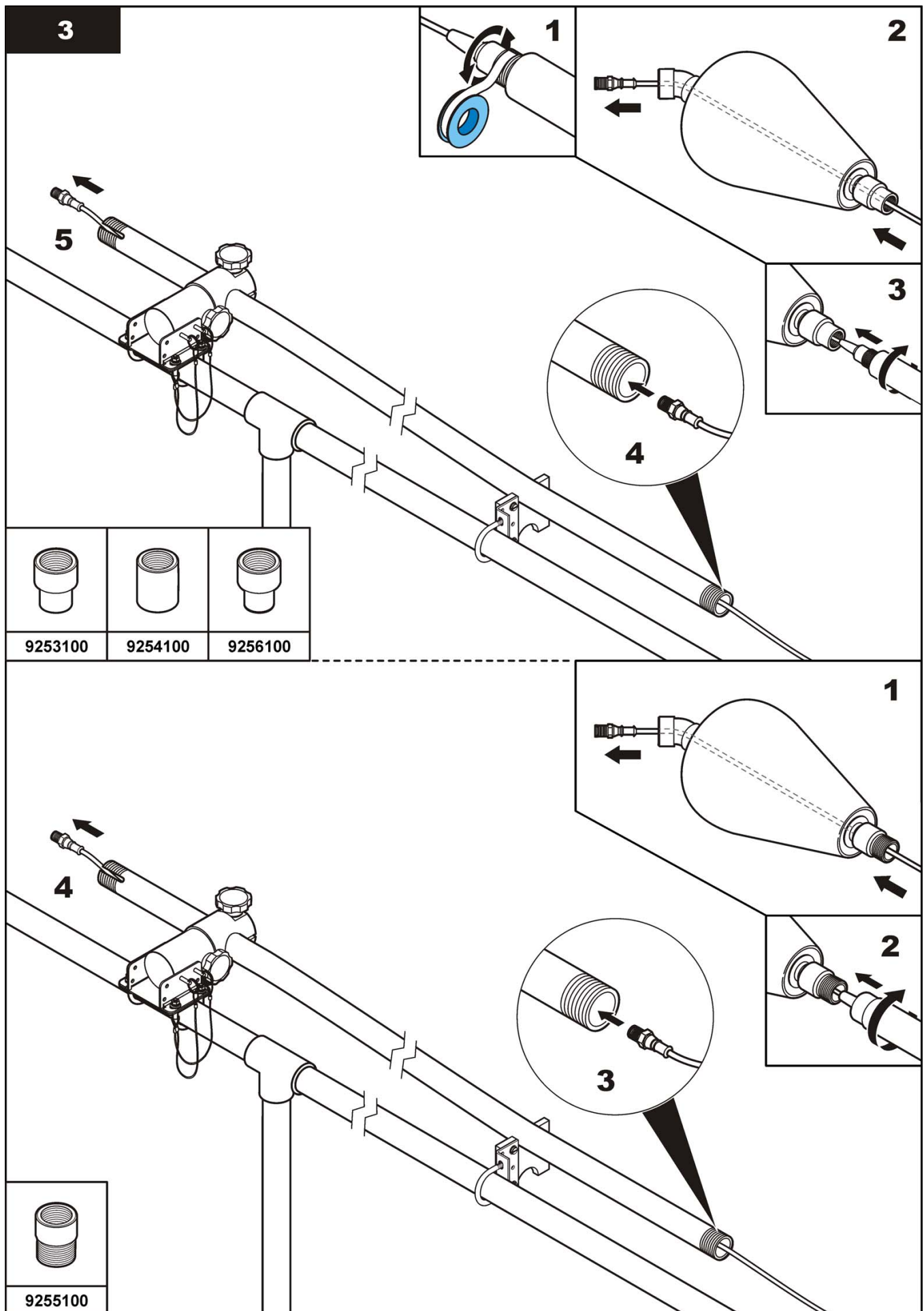


4

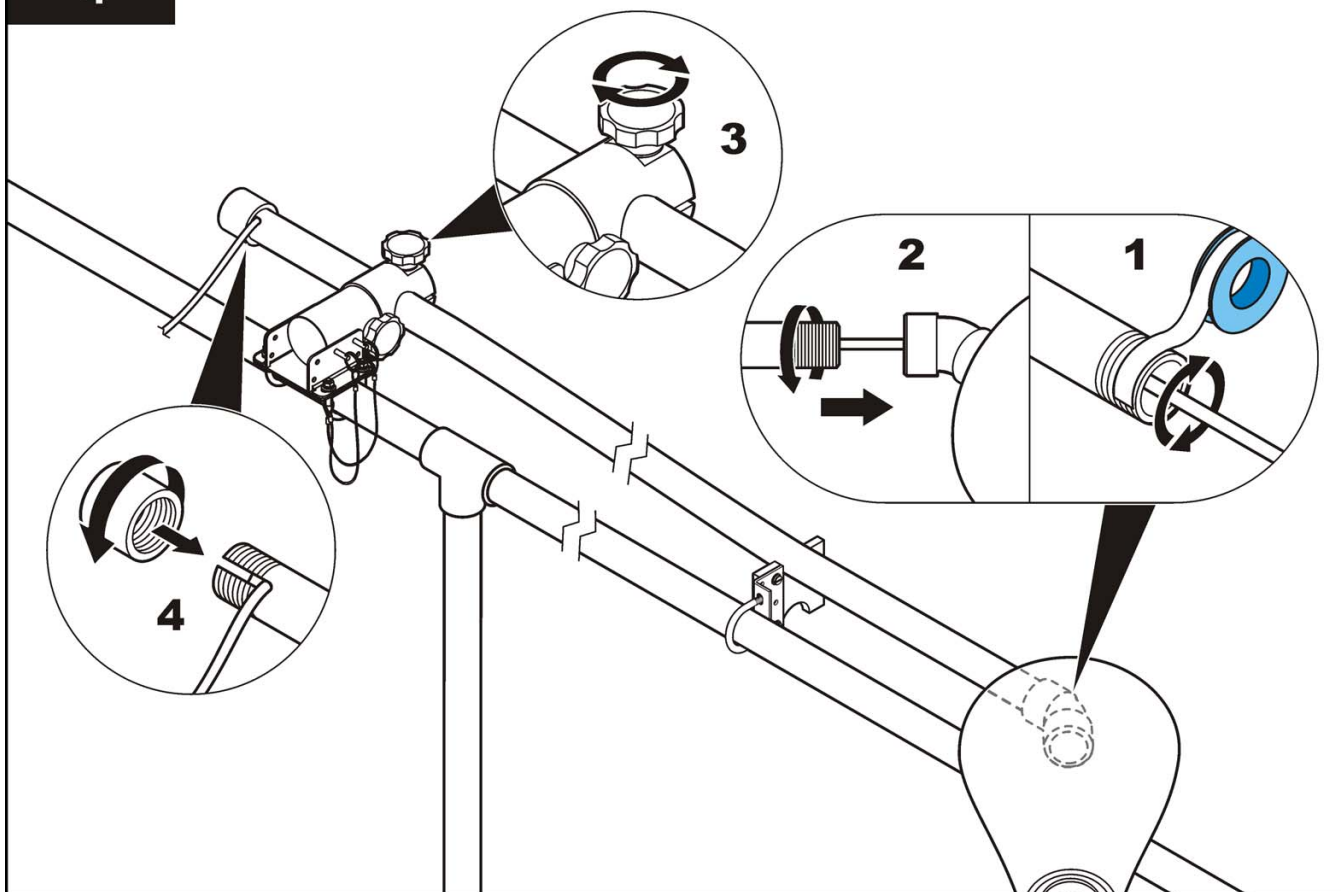


9253100, 9254100, 9255100, 9256100

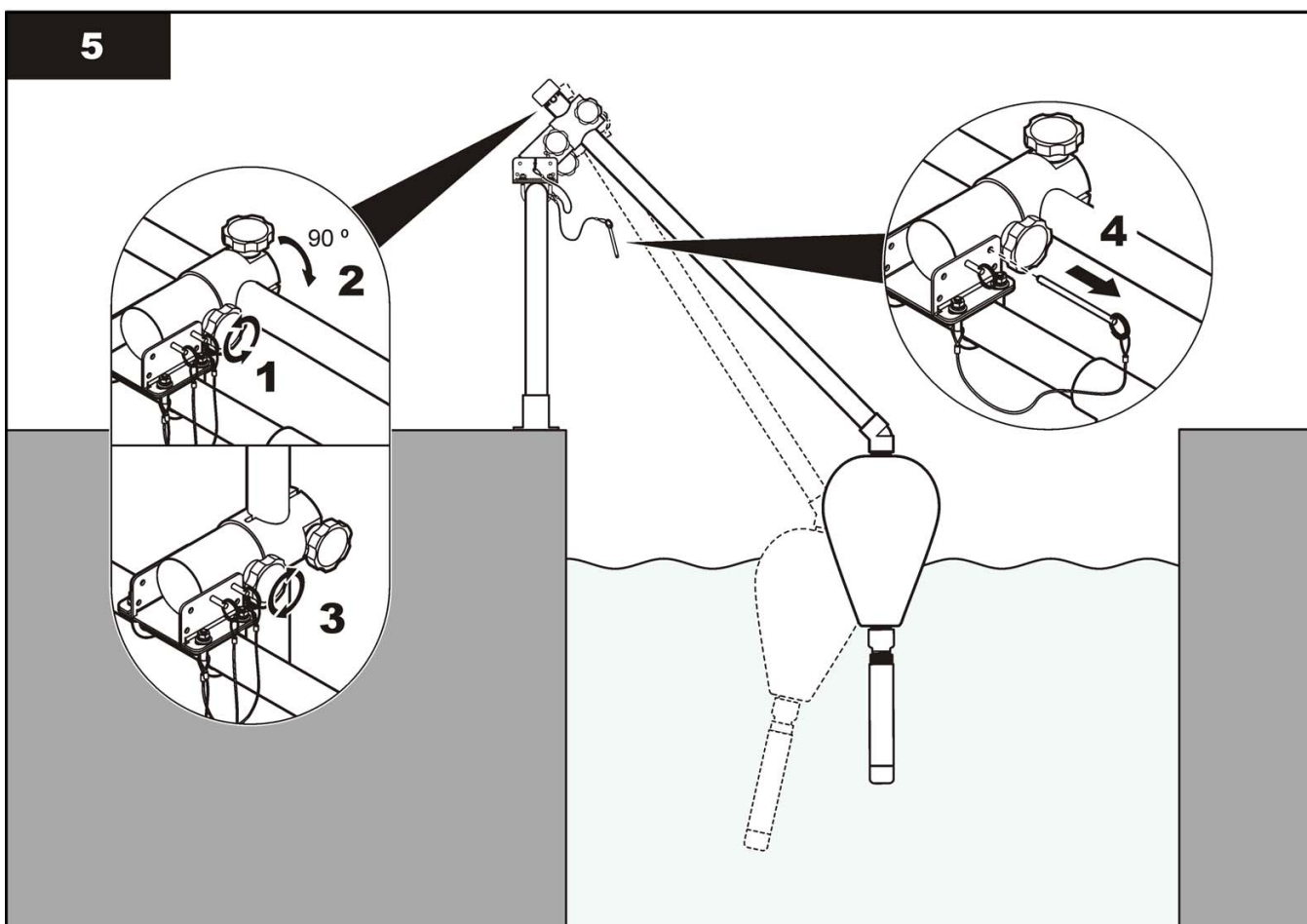




4



5



HACH COMPANY World Headquarters

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.
Tel. (970) 669-3050
(800) 227-4224 (U.S.A. only)
Fax (970) 669-2932
orders@hach.com
www.hach.com

HACH LANGE GMBH

Willstätterstraße 11
D-40549 Düsseldorf, Germany
Tel. +49 (0) 2 11 52 88-320
Fax +49 (0) 2 11 52 88-210
info@hach-lange.de
www.hach-lange.de

HACH LANGE Srl

6, route de Compois
1222 Vézenaz
SWITZERLAND
Tel. +41 22 594 6400
Fax +41 22 594 6499

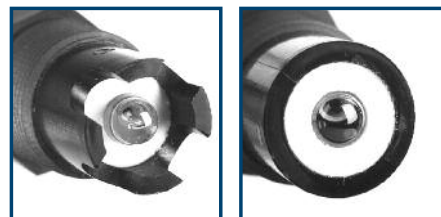


3/4-inch Combination pH and ORP Sensor Kits

pH/ORP



Use the Digital Gateway to make any Hach analog combination pH or ORP sensor compatible with the Hach sc1000 Controller.



Digital combination pH and ORP sensors are available in convertible, insertion, and sanitary mounting styles. Choose from rugged dome electrodes or "easy-to-clean" flat glass electrodes.

DW

WW

PW

IW

Features and Benefits

Low Price—High Performance

These combination sensors are designed for specialty applications for immersion or in-line mounting. The reference cell features a double-junction design for extended service life, and a built-in solution ground. The body is molded from chemically-resistant Ryton® or PVDF, and the reference junction is coaxial porous PTFE. All sensors are rated 0 to 105°C up to 100 psig, and have integral 4.5 m (15 ft.) cables with tinned leads. The PC-series (for pH) and RC-series (for ORP) combination sensors are ideal for measuring mild and aggressive media.

Special Electrode Configurations

Sensors with rugged dome electrodes, "easy-to-clean" flat glass electrodes, and even HF (hydrofluoric acid) resistant glass electrodes are available for a wide variety of process solutions.

Temperature Compensation Element Option

The PC-series combination pH sensors are available with or without a Pt 1000 ohm RTD temperature element. The RC-series combination ORP sensors are supplied without a temperature element.

Versatile Mounting Styles

Sensors are available in three mounting styles—convertible, insertion, and sanitary. Please turn to page 3 for more information.

Full-Featured "Plug and Play" Hach sc Digital Controllers

There are no complicated wiring or set up procedures with any Hach sc controller. Just plug in any combination of Hach digital sensors and it's ready to use—it's "plug and play."

One or multiple sensors—The sc controller family allows you to receive data from up to eight Hach digital sensors in any combination using a single controller.

Communications—Multiple alarm/control schemes are available using the relays and PID control outputs. Available communications include analog 4-20 mA, digital MODBUS® (RS485 and RS232) or Profibus DP protocols. (Other digital protocols are available. Contact your Hach representative for details.)

Data logger—A built-in data logger collects measurement data, calibration, verification points, and alarm history.

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage



Be Right™

Specifications*

Most pH applications fall in the 2.5-12.5 pH range. General purpose pH glass electrodes perform well in this range. Some industrial applications require accurate measurements and control at pH values below 2 or above 12. Consult Hach Technical Support for details on these applications.

Combination pH Sensors

Measuring Range

0 to 14 pH

Accuracy

Less than 0.1 pH under reference conditions

Temperature Range

0 to 105°C (32 to 221°F)

Flow Rate

0 to 2 m/s (0 to 6.6 ft./s); non-abrasive

Pressure Range

0 to 6.9 bar at 100°C (0 to 100 psig at 212°F)

Signal Transmission Distance

100 m (328 ft.) when used with the Hach Digital Gateway and a Hach sc Digital Controller.

1000 m (3280 ft.) when used with the Hach Digital Gateway, Termination Box, and a Hach sc Digital Controller.

Sensor Cable

Integral coaxial cable (plus two conductors for temperature compensator option); 4.5 m (15 ft.) long

Wetted Materials

Convertible style: Ryton® body (glass filled)

Insertion style: PVDF body (Kynar®)

Sanitary style: 316 stainless steel sleeved PVDF body

Common materials for all sensor styles include PTFE double junction, glass process electrode, and Viton® O-rings

Warranty

90 days

Combination ORP Sensors

Measuring Range

-2000 to +2000 millivolts

Accuracy

Limited to calibration solution accuracy (± 20 mV)

Temperature Range

0 to 105°C (32 to 221°F)

Flow Rate

0 to 2 m/s (0 to 6.6 ft./s); non-abrasive

Pressure Range

0 to 6.9 bar at 100°C (0 to 100 psig at 212°F)

Signal Transmission Distance

100 m (328 ft.) when used with the Hach Digital Gateway and a Hach sc Digital Controller.

1000 m (3280 ft.) when used with the Hach Digital Gateway, Termination Box, and a Hach sc Digital Controller.

Sensor Cable

Integral coaxial cable; 4.5 m (15 ft.) long; terminated with stripped and tinned wires

Wetted Materials

Convertible style: Ryton® body (glass filled)

Insertion style: PVDF body (Kynar®)

Common materials for all sensor styles include PTFE double junction, glass with platinum process electrode, and Viton® O-rings

Warranty

90 days

*Specifications subject to change without notice.

Ryton® is a registered trademark of Phillips 66 Co.; Viton® is a registered trademark of E.I. DuPont de Nemours + Co.; Kynar® is a registered trademark of Pennwalt Corp.

Engineering Specifications

1. The pH sensor shall be available in convertible, insertion or sanitary styles. The ORP sensor shall be available in only convertible or insertion styles.
2. The convertible style sensor shall have a Ryton® body. The insertion style sensor shall have a PVDF body. The sanitary style sensor shall have a 316 stainless steel sleeved PVDF body. Common materials for all sensor styles shall include a PTFE double junction, and Viton® O-rings. The pH sensor shall have a glass pH electrode. The ORP sensor shall have a platinum ORP electrode.
3. The convertible style pH sensor shall be available with or without a built-in Pt 1000 ohm RTD temperature element. Insertion and sanitary style pH sensors shall have a built-in Pt 1000 ohm RTD temperature element. Convertible and insertion style ORP sensors shall not have a built-in temperature element.
4. The sensor shall communicate via MODBUS® RS-485 to a Hach sc Digital Controller.
5. The sensor shall be Hach Company Model PC sc or PC-series for pH measurement or Model PC sc or RC-series for ORP measurement.

Dimensions

Convertible Style Sensor

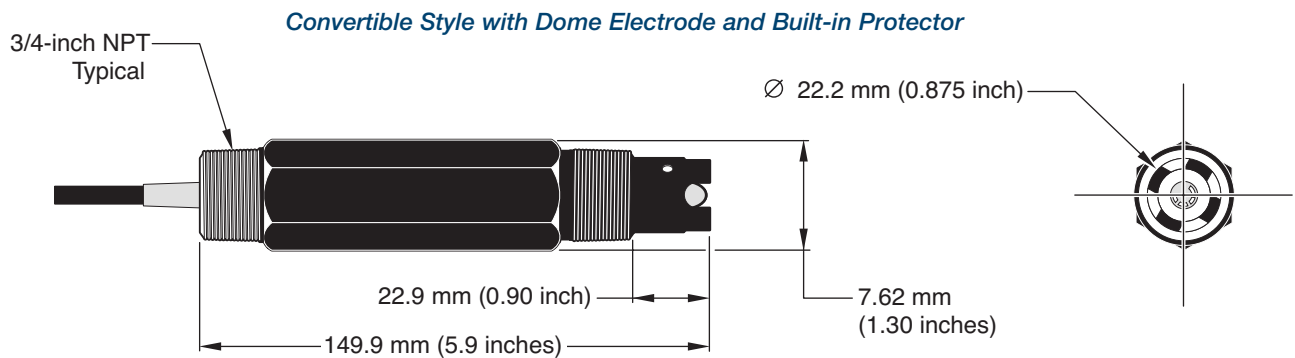
The convertible style sensor has a Ryton® body that features 3/4-inch NPT threads on both ends. The sensor can be directly mounted into a standard 3/4-inch pipe tee for flow-through mounting or fastened onto the end of a pipe for immersion mounting. The convertible style sensor enables inventory consolidation, thereby reducing associated costs. Mounting tees and immersion mounting hardware are offered in a variety of materials to suit application requirements.

Insertion Style Sensor

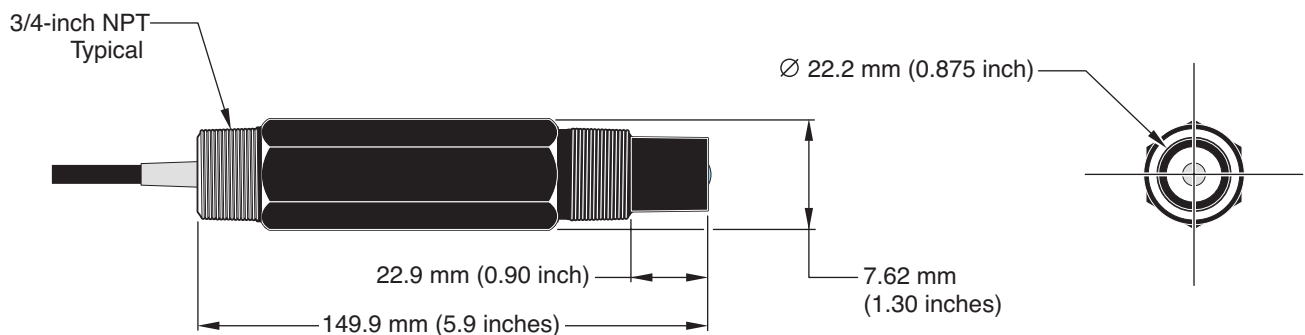
Insertion style sensors feature a longer, non-threaded PVDF body with two Viton® O-rings, providing a seal when used with the optional Hach insertion mount hardware assembly. This ball valve hardware enables sensor insertion and retraction from a pipe or vessel without having to stop the process flow.

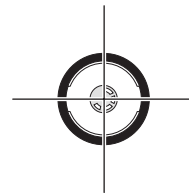
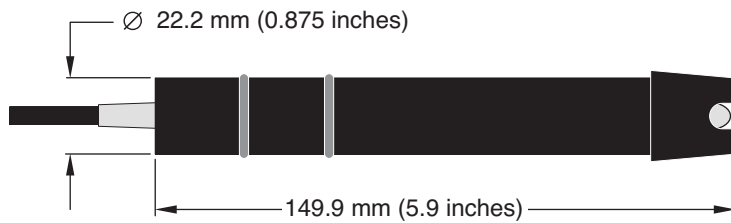
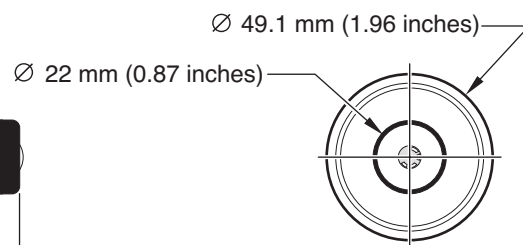
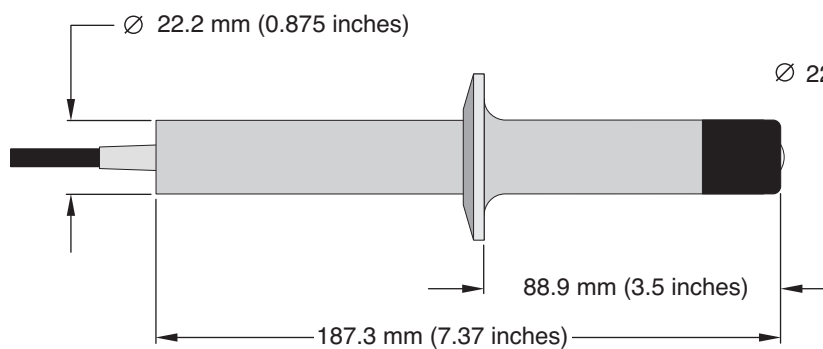
Sanitary Style Sensor

The sanitary style sensor, offered for pH measurement, has a 316 stainless steel-sleeved PVDF body with a 2-inch flange. The sensor mates to a standard 2-inch Tri-Clover fitting. The optional Hach sanitary mounting hardware includes a standard 2-inch sanitary tee, sanitary clamp, and Viton® sanitary gasket.



Convertible Style with Flat Electrode



Dimensions *continued**Insertion Style with Dome Electrode and Built-In Protector**Sanitary Style*

Ordering Information

Digital PC sc and RC sc 3/4-inch Combination pH/ORP Sensors

All PC sc and RC sc 3/4-inch combination sensors come complete with an integral 4.5 m (15 ft.) sensor cable, Digital Gateway, and 1 m (3.3 ft.) digital extension cable.

<i>Product Number</i>	<i>Measurement</i>	<i>Sensor Style</i>	<i>Body Material</i>	<i>Electrode Type</i>	<i>Temp. Comp.</i>
DPC1R1N	pH	Convertible	Ryton	General purpose glass	None
DPC1R1A	pH	Convertible	Ryton	General purpose glass	Pt 1000 ohm RTD
DPC1R2N	pH	Convertible	Ryton	Flat glass, general purpose	None
DPC1R2A	pH	Convertible	Ryton	Flat glass, general purpose	Pt 1000 ohm RTD
DPC1R3A	pH	Convertible	Ryton	HF-resistant glass (see Note)	Pt 1000 ohm RTD
DPC2K1A	pH	Insertion	PVDF	General purpose glass	Pt 1000 ohm RTD
DPC2K2A	pH	Insertion	PVDF	Flat Glass	Pt 1000 ohm RTD
DPC3K2A	pH	Sanitary	316 SS/PVDF	General purpose glass	Pt 1000 ohm RTD
DRC1R5N	ORP	Convertible	Ryton	Platinum	None
DRC2K5N	ORP	Insertion	PVDF	Platinum	None

NOTE

The HF (hydrofluoric acid) resistant glass electrode reduces the HF dissolution of the complete glass surface to extend the lifetime of the electrode in acid fluoride solutions. The electrode will last longer than conventional glass pH electrodes. How much longer depends on the HF concentration and temperature of the solution.

Replacement Digital Gateway

6120600 Use the Digital Gateway to connect analog PC and RC sensors to a Hach sc Digital Controller.

Ordering Information *continued*

Analog PC and RC 3/4-inch Combination pH/ORP Sensors

All PC and RC 3/4-inch combination sensors come with an integral 4.5 m (15 ft.) standard length sensor cable.

<i>Product Number</i>	<i>Measurement</i>	<i>Sensor Style</i>	<i>Body Material</i>	<i>Electrode Type</i>	<i>Temp. Comp.</i>
PC1R1N	pH	Convertible	Ryton	General purpose glass	None
PC1R1A	pH	Convertible	Ryton	General purpose glass	Pt 1000 ohm RTD
PC1R2N	pH	Convertible	Ryton	Flat glass, general purpose	None
PC1R2A	pH	Convertible	Ryton	Flat glass, general purpose	Pt 1000 ohm RTD
PC1R3A	pH	Convertible	Ryton	HF-resistant glass	Pt 1000 ohm RTD
PC2K1A	pH	Insertion	PVDF	General purpose glass	Pt 1000 ohm RTD
PC2K2A	pH	Insertion	PVDF	Flat Glass	Pt 1000 ohm RTD
PC3K2A	pH	Sanitary	316 SS/PVDF	General purpose glass	Pt 1000 ohm RTD
RC1R5N	ORP	Convertible	Ryton	Platinum	None
RC2K5N	ORP	Insertion	PVDF	Platinum	None

Accessories for Digital and Analog 3/4-inch combination pH/ORP Sensors

Cables

Digital cables are used only with digital sensors or gateways when connecting to a Hach sc Digital Controller.

6122400	Digital Extension Cable, 1 m (3.3 ft)
5796000	Digital Extension Cable, 7.7 m (25 ft)
5796100	Digital Extension Cable, 15 m (50 ft)
5796200	Digital Extension Cable, 31 m (100 ft)

Analog cables are used only with analog sensors, junction box, and controller.

1W1100	Analog Interconnect Cable (order per foot)
---------------	--

Digital Termination Box

Used with digital extension cables when the desired cable length between the digital sensor/digital gateway and the Hach sc Digital Controller is between 100 m (328 ft) and 1000 m (3280 ft).

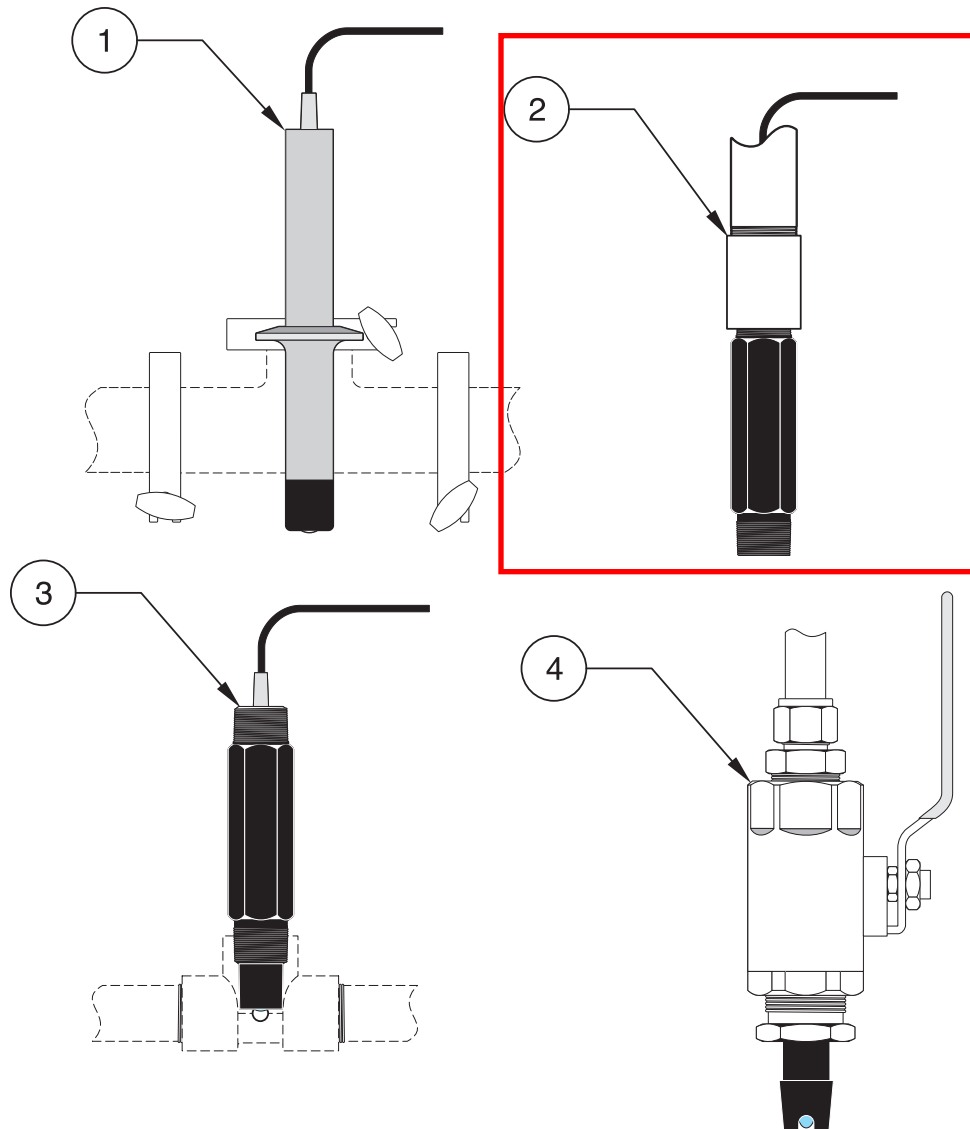
5867000	Digital Termination Box
----------------	-------------------------

Analog Junction Box

Used with analog interconnect cable when the desired cable length between analog sensor and analog controller is greater than the standard length of sensor cable. Each junction box includes terminal strip and gasket.

60A2053	Junction Box, Surface-mount, aluminum (includes mounting hardware)
60A9944	Junction Box, Pipe-mount, PVC, for 1/2-inch diameter pipe (includes mounting hardware)
60G2052	Junction Box, Pipe-mount, PVC, for 1-inch diameter pipe (includes mounting hardware)
76A4010-001	Junction Box, NEMA 4X (no mounting hardware included)

Ordering Information *continued*



1. Sanitary Mounting

2. Immersion Mounting

3. Flow-through Mounting

4. Insertion Mounting

Mounting Hardware for PC sc and RC sc Combination Sensors

Sanitary Mount Hardware

- 9H1310** 2-inch Sanitary Tee
- 9H1132** 2-inch Sanitary Clamp
- 9H1384** 2-inch Sanitary Viton Gasket

Immersion Mount Hardware

Each immersion hardware includes a 1/2-inch diameter x 4 foot long pipe, 1/2 x 3/4-inch NPT coupling, and plastic pipe-mount junction box with terminal strip.

- MH432G** CPVC Pipe

Flow-through Mount Hardware

Each tee is a standard 3/4-inch tee with 3/4-inch NPT threads on all three openings.

- MH313N3NZ** 316 SS Tee
- MH333N3NZ** CPVC Tee
- MH373N3NZ** PVC Tee

Insertion Mount Hardware

The insertion hardware includes a 1-1/2 inch ball valve, 1-1/2 inch NPT close nipple for process connection, sensor connection tube, stainless steel extension pipe, and stainless steel compression fitting with washer and lock nut.

- MH116M3MZ** 316 SS Hardware

Distance from main floor to water level is about 2.1m. provide two (2) 4 foot long pipes with connection fitting between. Provide Flange connection.

To complete your pH and ORP measurement system, choose from these Hach controllers...

Model sc200 Controller

(see Lit. #2665)

The sc200 controller platform can be configured to operate either 2 Digital Sensor Inputs, or 1 or 2 Analog Sensor Inputs, or a combination of Digital and Analog Sensor Inputs. Customers may choose their communication options from a variety of offerings ranging from MODBUS RTU to Profibus DPV1.



sc200 for Hach Digital Sensors

- LXV404.99.00552** sc200 controller, 2 channel, digital
- LXV404.99.00502** sc200 controller, 1 channel, digital
- LXV404.99.00542** sc200 controller, 2 channel, digital & mA input
- LXV404.99.00512** sc200 controller, 2 channel, digital & pH/DO
- LXV404.99.00522** sc200 controller, 2 channel, digital & Conductivity
- LXV404.99.00532** sc200 controller, 2 channel, digital & Flow

sc200 for Hach Analog Sensors

- LXV404.99.00102** sc200 controller, 1 channel, pH/DO
- LXV404.99.00112** sc200 controller, 2 channel, pH/DO
- LXV404.99.00202** sc200 controller, 1 channel, Conductivity
- LXV404.99.00222** sc200 controller, 2 channel, Conductivity
- LXV404.99.00212** sc200 controller, 2 channel, pH/DO & Conductivity
- LXV404.99.00302** sc200 controller, 1 channel, Flow
- LXV404.99.00332** sc200 controller, 2 channel, Flow
- LXV404.99.00312** sc200 controller, 2 channel, Flow & pH/DO
- LXV404.99.00322** sc200 controller, 2 channel, Flow & Conductivity

Note: Other sensor combinations are available. Please contact Hach Technical Support or your Hach representative.

Note: Communication options (MODBUS and Profibus DPV1) are available.

Model sc1000 Controller

(see Lit. #2403)

Each sc1000 Probe Module provides power to the system and can accept up to 8 digital sensors/expansion boards. Probe Modules can be networked together to accommodate up to 32 digital sensors/expansion boards attached to the same network.



- LXV402.99.00002** sc1000 Display Module
- LXV400.99.1R572** sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V
- LXV400.99.1B572** sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, RS-485 (MODBUS), 110-230V
- LXV400.99.1F572** sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, PROFIBUS DP, 110-230V
- LXV400.99.1R582** sc1000 Probe Module, 6 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V

LIT2470 Rev 2

Printed in U.S.A.

©Hach Company, 2016. All rights reserved.

In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.



At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

In the United States, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 800-227-4224
Fax: 970-669-2932
E-mail: orders@hach.com
www.hach.com

U.S. exporters and customers in Canada, Latin America, sub-Saharan Africa, Asia, and Australia/New Zealand, contact:

HACH COMPANY World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 970-669-3050
Fax: 970-461-3939
E-mail: intl@hach.com
www.hach.com

In Europe, the Middle East, and Mediterranean Africa, contact:

HACH LANGE GmbH
Willstätterstraße 11
D-40549 Düsseldorf
GERMANY
Tel: +49 (0) 211 5288-0
Fax: +49 (0) 211 5288-143
E-mail: info@hach-lange.de
www.hach-lange.com



Be Right™



Catalog Number 6120118

Digital PC sc and RC sc $\frac{3}{4}$ -inch Combination pH/ORP Sensor

USER MANUAL

October 2005, Edition 4

Table of Contents

Section 1 Specifications	5
Section 2 General Information	7
2.1 Safety Information	7
2.1.1 Use of Hazard Information	7
2.1.2 Precautionary Labels	7
2.2 General Sensor Information	8
2.2.1 Sensor Body Styles	8
2.3 The Digital Gateway	9
2.4 Operating Precaution	9
Section 3 Installation	11
3.1 Wiring the sc Sensor to the Digital Gateway	11
3.2 Connecting/Wiring the Digital Gateway to the sc100 Controller	13
3.2.1 Connecting the Digital Gateway Sensor in a Non-hazardous Location	13
3.2.1.1 Attaching the Digital Gateway with a Quick-connect Fitting in a Non-hazardous Location	13
3.2.1.2 Hard-wiring the Digital Gateway to the sc100	14
3.2.2 Connecting the Digital Gateway to a sc100 Controller in a Hazardous Location	15
3.2.2.1 Attaching the Digital Gateway with a Quick-Connect Fitting in a Hazardous Location	16
3.3 Connecting the Sensor to the sc1000	16
3.3.1 Connecting the Sensor using the Quick-connect Fittings	16
3.4 Mounting the Digital Gateway	17
Section 4 User Interface and Navigation	19
4.1 Using the sc100 Controller	19
4.1.1 Controller Display Features	20
4.1.2 Important Key Presses	20
4.2 Using the sc1000 Controller	21
4.2.1 Display Features	21
4.2.1.1 Using the Pop-up Toolbar	21
4.2.1.2 Using the Menu Windows	21
4.2.1.3 Navigating the Menu Windows	22
Section 5 Operation	25
5.1 Sensor Setup	25
5.2 Sensor Data Logging	25
5.6 pH Calibration	28
5.6.1 One Point Automatic Calibration	28
5.6.2 Two Point Automatic Calibration	28
5.6.3 One Point Manual Calibration	29
5.6.4 Two Point Manual Calibration	29
5.7 ORP Calibration	30
5.7.1 One-point Manual Calibration	30
5.8 Concurrent Calibration of Two Sensors for pH and ORP	30
5.9 Adjusting the Temperature	31
Section 6 Maintenance	33
6.1 Maintenance Schedule	33
6.2 Cleaning the Sensor	34
Section 7 Troubleshooting	35
7.1 Error Codes	35
7.2 Warnings	35

Table of Contents

7.3 Troubleshooting the pH or ORP Sensor35

Section 8 Replacement Parts and Accessories.....37

8.1 Replacement Items, Accessories, and Reagent and Standards37

Section 9 How to Order39

Section 10 Repair Service.....40

Section 11 Limited Warranty41

Section 12 Compliance Information43

 B.1 pH Measurement Theory47

 B.2 PID Controller Basics48

Section 1 Specifications

Specifications are subject to change without notice.

Table 1 Combination pH and ORP Sensor Specifications

Components	Corrosion-resistant materials, fully-immersible probe with 4.6 m (15 ft) cable
Measuring Range (pH)	0 to 14 pH
Measuring Range (ORP)	–2000 to +2000 mV
Measuring Range (Temperature)	0 to 105 °C (32 to 221 °F)
Probe Operating Temperature	0 to 105 °C (32 to 221 °F)
Probe Storage Temperature	–30 to 70 °C (–22 to 158 °F); 0 to 95% relative humidity, non-condensing
Temperature Compensation	pH: Pt 1000 ohm RTD ORP: N/A
Accuracy (Analyzer only)	pH: 0.1% of span ORP: Limited to calibration solution accuracy (± 20 mV)
Stability (Analyzer only)	0.05% or span per 24 hours, non-cumulative
Repeatability (Analyzer only)	0.1% of span or better
Temperature Accuracy (Analyzer only)	±0.5 °C (±0.9 °F)
Temperature Drift (Analyzer only)	Zero and Span: less than 0.03% of span per °C
Calibration Methods (Analyzer only)	Two point automatic, one point automatic, two point manual, one point manual
Maximum Probe Immersion Depth/ Pressure	Submersible to 107 m (350 ft)/1050 kPa (150 psi)
Sensor Interface	Modbus from digital gateway
Probe Cable Length	4.6 m (15 ft)
Probe Weight	Depends on selected sensor
Probe Dimensions	See Figure 1 on page 8 through Figure 4 on page 9 .

Table 2 Digital Gateway Specifications

Weight	145 g (5 oz)
Dimensions	17.5 x 3.4 cm (7 x 1 ³ / ₈ in.)
Operating Temperature	–20 to 60 °C (–4 to 140 °F)

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

This product is acceptable for use in a Hazardous Location when used with an sc100 Controller and installed per Control Drawing 58600-78 as described in the sc100 Controller Manual, Cat. No. 5860018.

2.1.1 Use of Hazard Information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION






Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.

2.2 General Sensor Information

Optional equipment, such as mounting hardware for the probe, is supplied with instructions for all user installation tasks. Several mounting options are available, allowing the probe to be adapted for use in many different applications.

2.2.1 Sensor Body Styles

Combination pH and ORP sensors are available in three body styles:

- **Convertible Body Style (Figure 1 and Figure 2)**— has ¾-in. NPT threads at both ends of the body for mounting in any of the following configurations:
 - into a standard ¾-in. NPT pipe tee
 - onto the end of a pipe for immersion into a vessel
- **Insertion Body Style (Figure 3)**— for mounting into the pipe adapter of a ball valve hardware assembly. This hardware enables the sensor to be inserted into or retracted from the process without stopping the process flow.
- **Sanitary Body Style (Figure 4)**— features a built-in 2-in. flange for mounting into a 2-in. sanitary tee. Included with the sanitary-style sensor is a special cap and EDPM compound gasket for use with the sanitary hardware.

Figure 1 Convertible Style Sensor with Flat Electrode

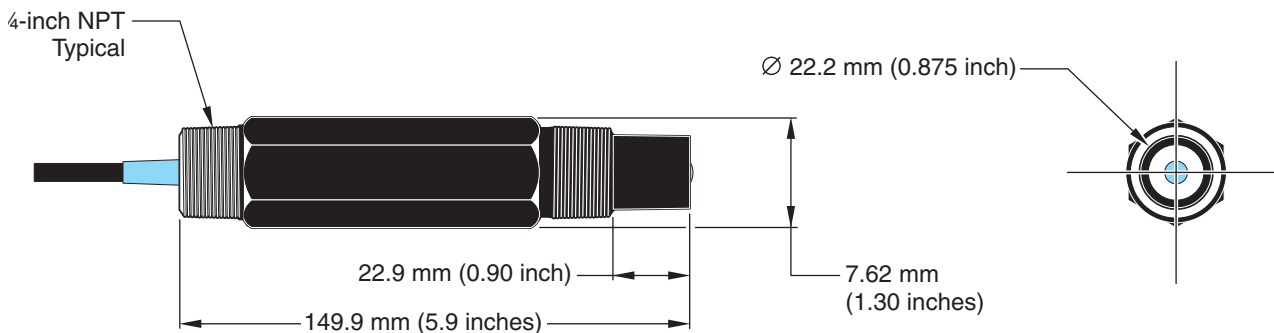


Figure 2 Convertible-style Sensor with Dome Electrode

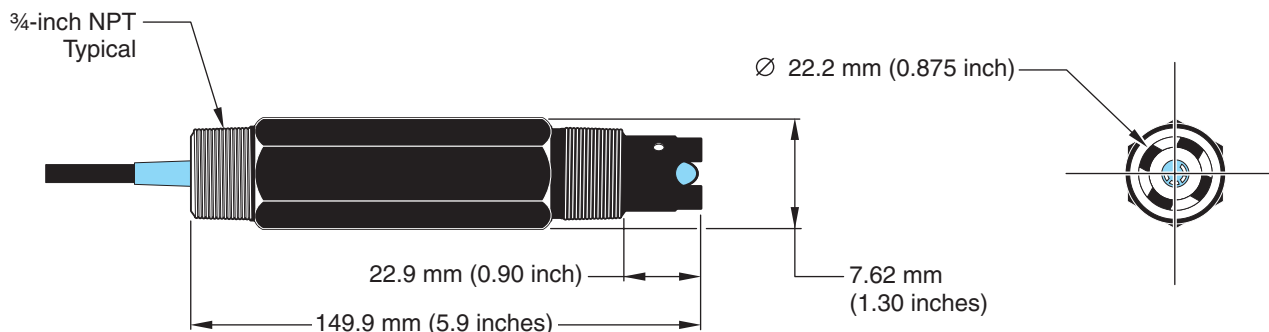
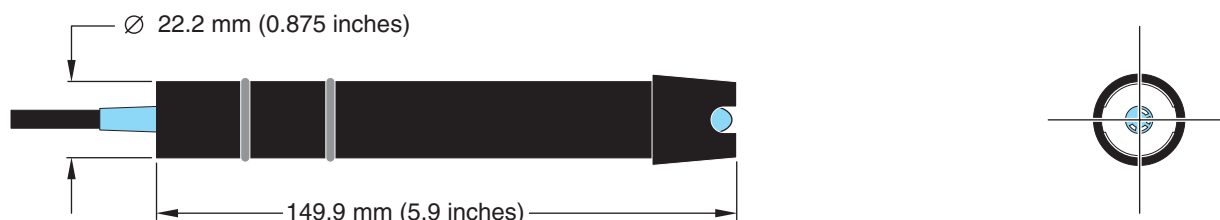
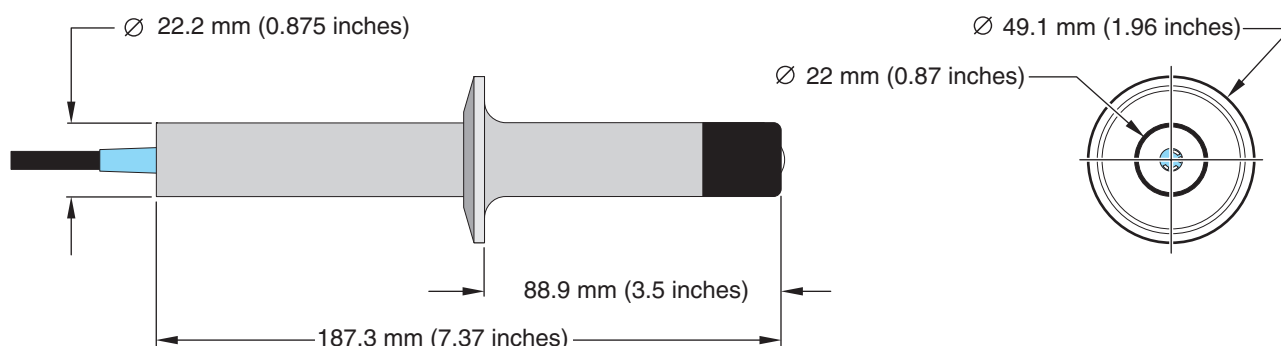


Figure 3 Insertion Style Sensor with Domed Electrode**Figure 4 Sanitary-style Sensor**

2.3 The Digital Gateway

The digital gateway was developed to provide a means to use existing analog sensors with the new digital controllers. The gateway contains all the necessary software and hardware to interface with the controller and output a digital signal.

2.4 Operating Precaution

Before placing the pH or ORP sensor into operation, remove the protective cap to expose the process electrode and reference junction. Save the protective cap for future use.

For short-term storage (when sensor is out of the process for more than one hour), fill the protective cap with pH 4 buffer or DI water and place the cap back on the sensor. Keeping the process electrode and reference junction moist will avoid slow response when the sensor is placed back in operation.

For extended storage, repeat the short-term storage procedure every 2 to 4 weeks, depending on the surrounding environmental conditions.

CAUTION

If the pH process electrode breaks, handle the sensor very carefully to prevent injury.

The process electrode at the pH sensor tip has a glass bulb, which can break. Do not subject this electrode to abrupt impact or other mechanical abuse.

The gold or platinum process electrode at the ORP sensor tip has a glass shank (hidden by the salt bridge) which can break. Do not subject this electrode to impact or other mechanical abuse.

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER

Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.

The Combination pH/ORP Sensor can be used with either an sc100 or sc1000 controller. Refer to [section 3.2 on page 13](#) for sc100 installation instructions and [section 3.3 on page 16](#) for sc1000 installation instructions.

The sc sensor should be wired to the digital gateway before connecting the digital gateway to the sc100 or sc1000 Controller. The digital gateway is designed to provide a digital interface to the appropriate digital controller. Refer to [section 3.1](#) for more information.

3.1 Wiring the sc Sensor to the Digital Gateway

DANGER

The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER

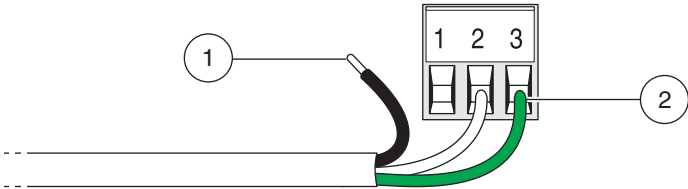
Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

1. Route the cable from the sensor through the strain relief in the digital gateway then properly terminate the wire ends (see [Figure 5](#)).

Note: *Do not tighten the strain relief until the digital gateway is wired and the two halves are threaded securely together.*

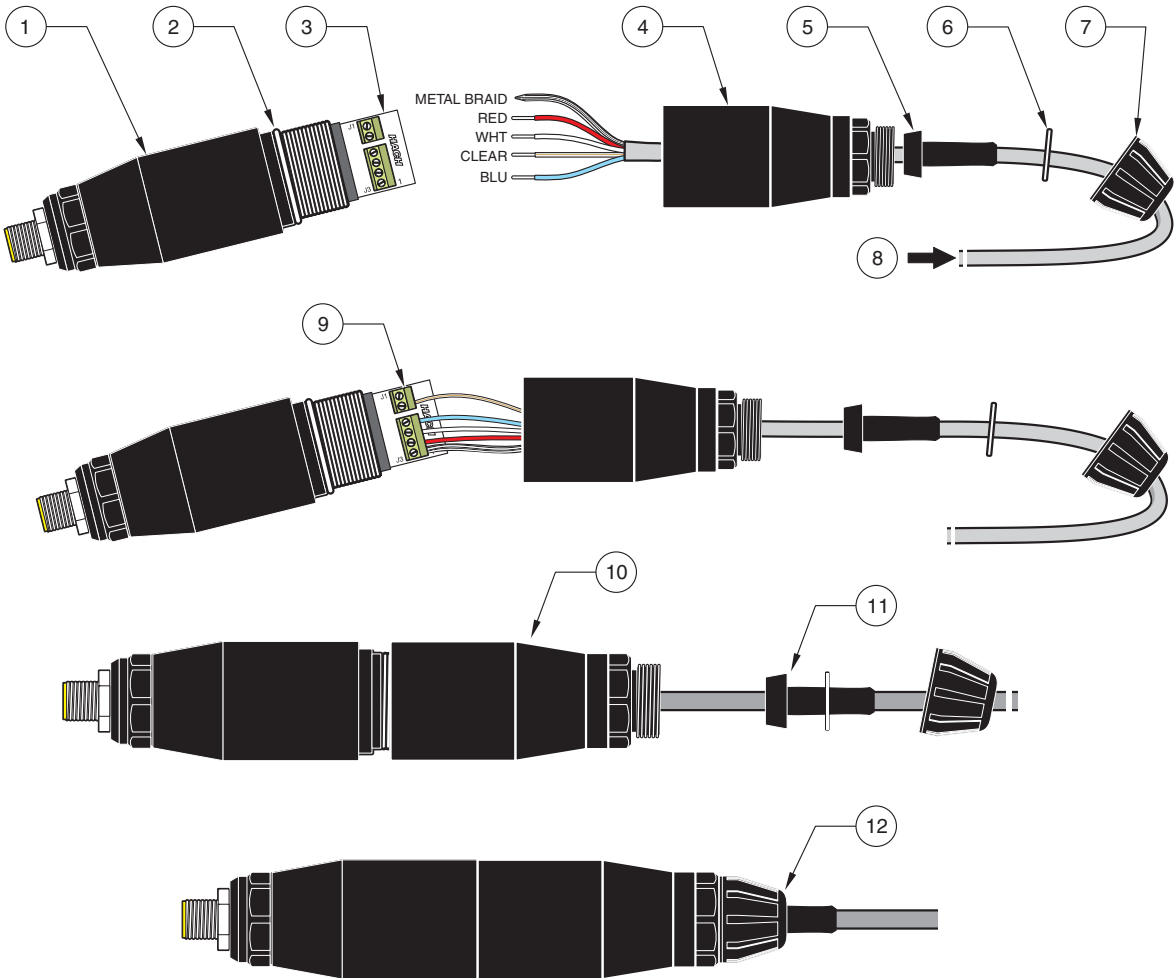
2. Insert the wires as shown in [Table 3](#) and [Figure 6](#).
3. Make sure the O-ring is properly installed between the two halves of the digital gateway and thread the two halves together. Hand tighten.
4. Tighten the strain relief to secure the sensor cable.
5. Connect the digital gateway to the controller.
 - sc100 Non-hazardous Location—[section 3.2.1.1 on page 13](#)
 - sc100 Hazardous Location—[section 3.2.2.1 on page 16](#)
 - sc1000 Connection Instructions—Refer to [section 3.3 on page 16](#).

Figure 5 Proper Wire Preparation and Insertion



- | | |
|----------------------------------|---|
| 1. Strip 1/4-inch of insulation. | 2. Seat insulation against connector with no bare wire exposed. |
|----------------------------------|---|

Figure 6 Wiring and Assembling the Digital Gateway



- | | |
|--------------------------|---|
| 1. Digital gateway front | 7. Cord grip |
| 2. O-ring | 8. From sensor |
| 3. Sensor wire connector | 9. Insert wires into connector according to Table 3 . Use the included 2 mm screwdriver (Cat. No. 6134300) to secure connections. |
| 4. Digital gateway back | 10. Screw back of digital gateway onto front. |
| 5. Cable bushing | 11. Push cable bushing and anti-rotation washer into back. |
| 6. Anti-rotation washer | 12. Fasten cord grip securely. Assembly is complete. |

Table 3 Wiring the Digital Gateway (Cat. No. 6120800)

Sensor (wire color)	Sensor Signal without Ground Rod	Sensor Signal with Ground Rod ¹	Digital Gateway
Metal Braid ²	Jumper 2 from J3-1 to J3-3 ³	Ref	J3-1
White	Temp +	Temp +	J3-2
Red	Temp –	Temp –	J3-3
Blue	Ref	Solution Ground	J3-4
Clear	Active/Measuring	Active/Measuring	J1-5
not used	not used	not used	J1-6

¹ Some applications require the use of an external ground rod with the combination electrode. Use this wiring scheme for these applications.

² If Metal Braid is “tinned”, cut the tinned area off and twist the wire to insert into connector.

³ Customer-supplied (required)

3.2 Connecting/Wiring the Digital Gateway to the sc100 Controller

DANGER

The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations . See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER

Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

The digital gateway should be wired to the sensor before connecting to the controller.

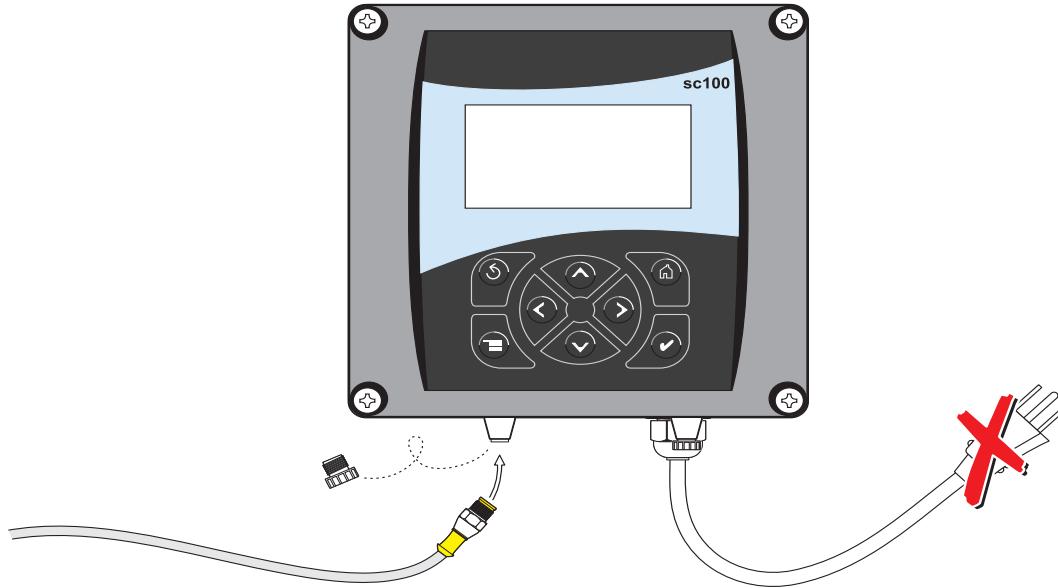
3.2.1 Connecting the Digital Gateway Sensor in a Non-hazardous Location

3.2.1.1 Attaching the Digital Gateway with a Quick-connect Fitting in a Non-hazardous Location

Important Note: The standard quick-connect fitting is NOT suitable for Class 1, Division 2 Hazardous Location installations without the connector lock installed, see [section 3.2.1 on page 13](#) for more information.

The digital gateway is supplied with a keyed quick-connect fitting for easy attachment to the controller, see [Figure 7](#). Retain the connector cap to seal the connector opening in case the sensor must be removed. Optional extension cables may be purchased to extend the sensor cable length. If the total cable length exceeds 100 m (328 ft), a termination box must be installed. See [Replacement Parts and Accessories on page 37](#).

Figure 7 Attaching the Digital Gateway using the Quick-connect Fittings



3.2.1.2 Hard-wiring the Digital Gateway to the sc100

Important Note: Hard-wiring the digital gateway to the sc100 is not an approved method for Class 1, Division 2 Hazardous Locations.

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5, see [Figure 8 on page 15](#).
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.

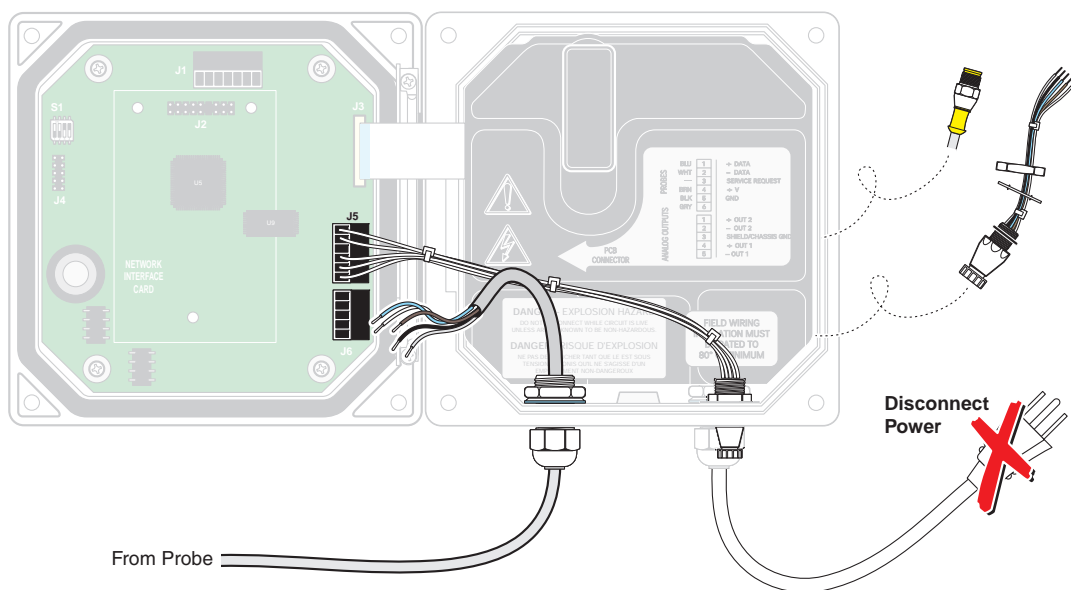
Note: Use of strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.

7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat. No. 16664) and an available access hole in the controller enclosure. Tighten the fitting.
8. Reinstall the plug on the sensor access opening to maintain the environmental rating.
9. Wire as shown in [Table 4](#) and [Figure 8](#).
10. Close and secure the cover.

Table 4 Wiring the Sensor at Terminal Block J5

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (–)	White
3	Service Request	No Connection
4	+12 V dc	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick disconnect fitting)

Figure 8 Hard-wiring the Digital Gateway



3.2.2 Connecting the Digital Gateway to a sc100 Controller in a Hazardous Location

DANGER

The sc100 and certain versions of the sensor are suitable for use in Class 1, Division 2, Groups A, B, C, D Hazardous Locations. See Control Drawing 58600-78 in the sc100 Controller Manual, Cat. No. 58600-18 for acceptable sensor versions and installation requirements.

DANGER

Le sc100 et certaines versions du capteur peuvent être utilisés dans des endroits dangereux de la Classe 1, Division 2, Groupes A, B, C, D. Reportez-vous au schéma de contrôle 58600-78 du Manuel du contrôleur sc100, Réf. 58600-18 pour connaître les versions des capteurs admises et les conditions d'installation.

DANGER

Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER

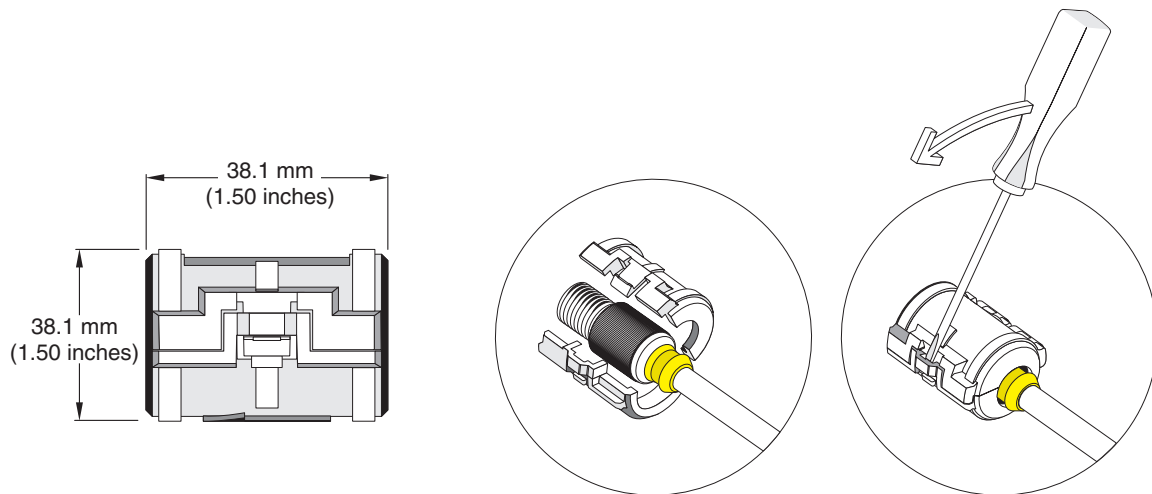
Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est désigné non dangereux avant de remplacer le aucun composant.

3.2.2.1 Attaching the Digital Gateway with a Quick-Connect Fitting in a Hazardous Location

The digital gateway is supplied with a keyed quick-connect fitting for easy attachment to the controller, see [Figure 7 on page 14](#). For Hazardous Locations, a connector safety lock (Cat. No. 6139900) must be installed. Retain the connector cap to seal the connector opening in case the sensor must be removed.

1. Remove the connector cap from the sc100 controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Connect the digital gateway connector to the sensor plug on the sc100.
3. Install the connector safety lock ([Figure 9](#)). Align the lock over the connector and squeeze the two halves together to lock. To remove the connector safety lock, insert a small flat-blade screwdriver into the locking groove. Pivot the screwdriver away from the groove and separate the two halves ([Figure 9](#)).

Figure 9 **Installing the Connector Safety Lock**



3.3 Connecting the Sensor to the sc1000

3.3.1 Connecting the Sensor using the Quick-connect Fittings

1. Unscrew the connector cap from the controller. Retain the connector cap to seal the connector opening in case the sensor must be removed.
2. Push the digital gateway connector into the socket.
3. Hand-tighten the union nut.

Note: Do not use the middle connection for the sensors as this is reserved for the display module.

3.4 Mounting the Digital Gateway

The digital gateway is supplied with a mounting clip for mounting to a wall or other flat surface. See [Figure 10](#) for dimensions. Use an appropriate fastener to secure it to the wall, see [Figure 11](#). After the sensor is wired to the digital gateway and the two halves are threaded together, place the mounting clip over the center of the digital gateway and squeeze the clip together to secure.

Figure 10 Digital Gateway Dimensions

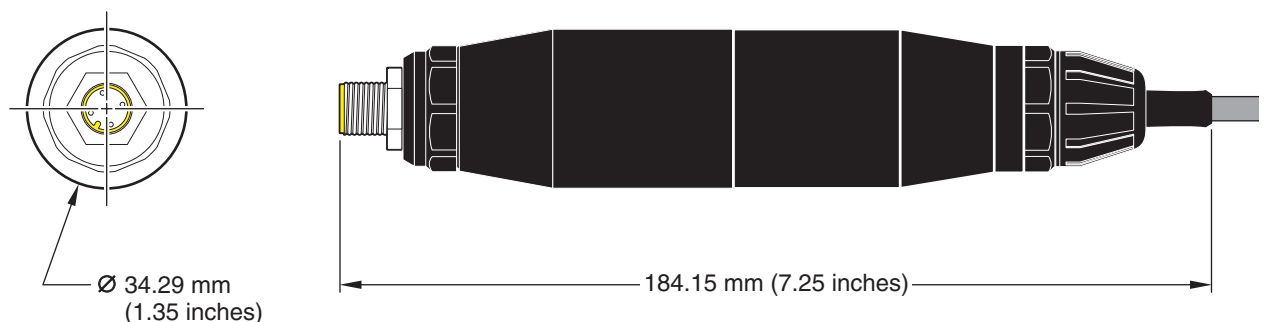
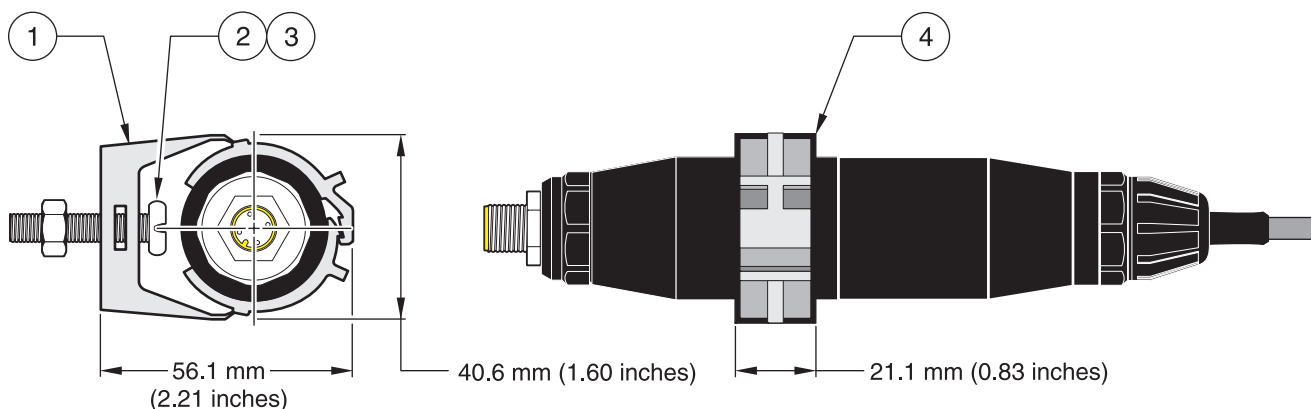


Figure 11 Mounting the Digital Gateway



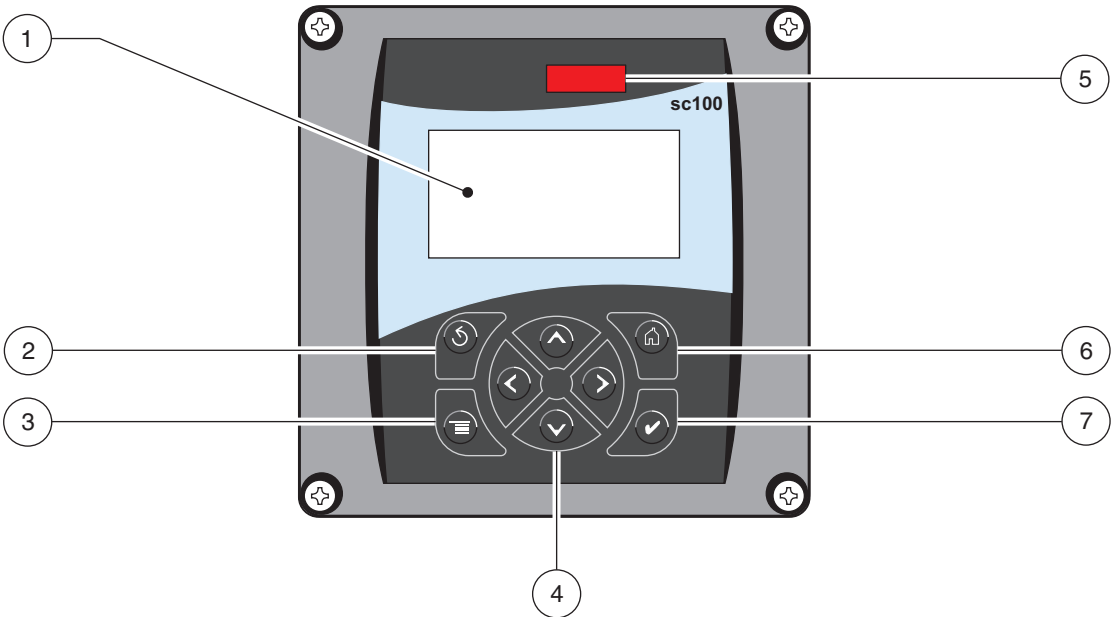
1. Mounting Clip	3. Hex Nut, ¼-28
2. Screw, pan head, ¼-28 x 1.25-in.	4. Mount clip, insert digital gateway, squeeze clip closed.

Section 4 User Interface and Navigation

4.1 Using the sc100 Controller

The front of the controller is shown in [Figure 12](#). The keypad consists of the eight keys described in [Table 5](#).

Figure 12 Front of the Controller



1. Instrument display	5. IrDA window
2. BACK key	6. HOME key
3. MENU key	7. ENTER key
4. RIGHT, LEFT, UP, and DOWN keys	

Table 5 Controller Key Functions/Features

Number	Key	Function
2		Moves back one level in the menu structure.
3		Moves to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigates through the menus, changes settings, and increments and decrements digits.
5		Moves to the Main Measurement screen from any other screen. This key is not active in menus where a selection or other input must be made.
6		Accepts an input value, updates, or accepts displayed menu options.

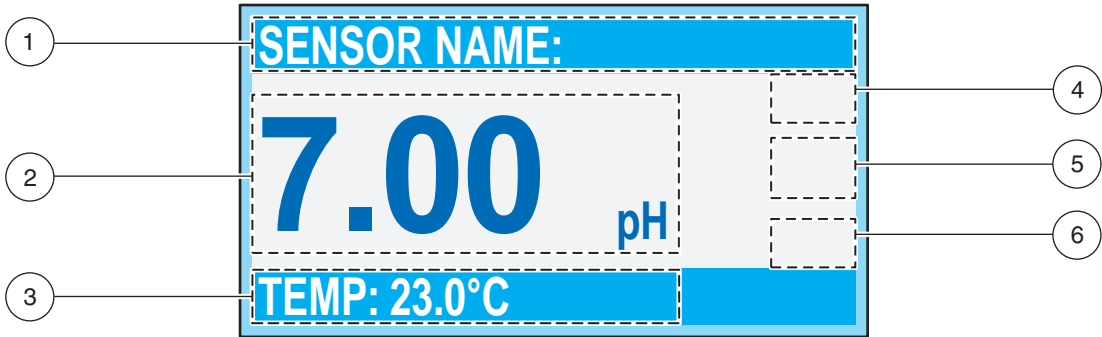
4.1.1 Controller Display Features

When a sensor is connected and the controller is in measurement mode, the controller automatically identifies the connected sensors and displays associated measurements.

The display will flash on startup, when a sensor error has occurred, and when a sensor is being calibrated.

An active system warning will cause the warning icon (a triangle with an exclamation point inside) to be displayed on the right side of the display. See [Figure 13](#).

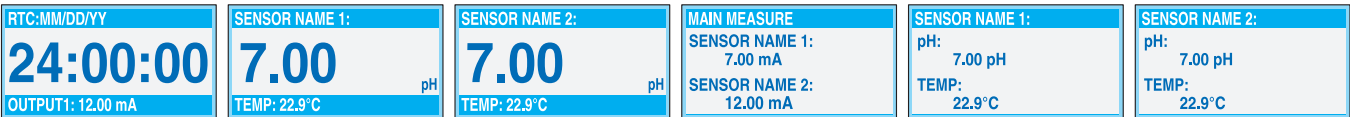
Figure 13 Display



1. Status bar. Indicates the sensor name and status of relays. The relay letter is displayed when the relay is energized.	4. Parameter
2. Main measurement	5. Warning icon area
3. Secondary measurement (if applicable)	6. Measurement units

4.1.2 Important Key Presses

- Press **HOME** then the **RIGHT** or **LEFT** key to display two readings when two sensors are connected. Continue to press the **RIGHT** or **LEFT** key to toggle through the available display options as shown below.



- Press the **UP** and **DOWN** keys to toggle the status bar at the bottom of the measurement display to display the secondary measurement (temperature) and output information.



- When in Menu mode, an arrow may appear on the right side of the display to indicate that more menus are available. Press the **UP** or **DOWN** key (corresponding to the arrow direction) to display additional menus.



4.2 Using the sc1000 Controller

The sc1000 is a touch screen application. Use your finger to touch keys and menu commands. In normal operation the touch screen displays the measured values for the sensors selected.








4.2.1 Display Features

4.2.1.1 Using the Pop-up Toolbar

The pop-up toolbar provides access to the controller and sensor settings. The toolbar is normally hidden from view. To view the toolbar, touch the bottom-left of the screen.

Figure 14 Pop-up Toolbar Functions



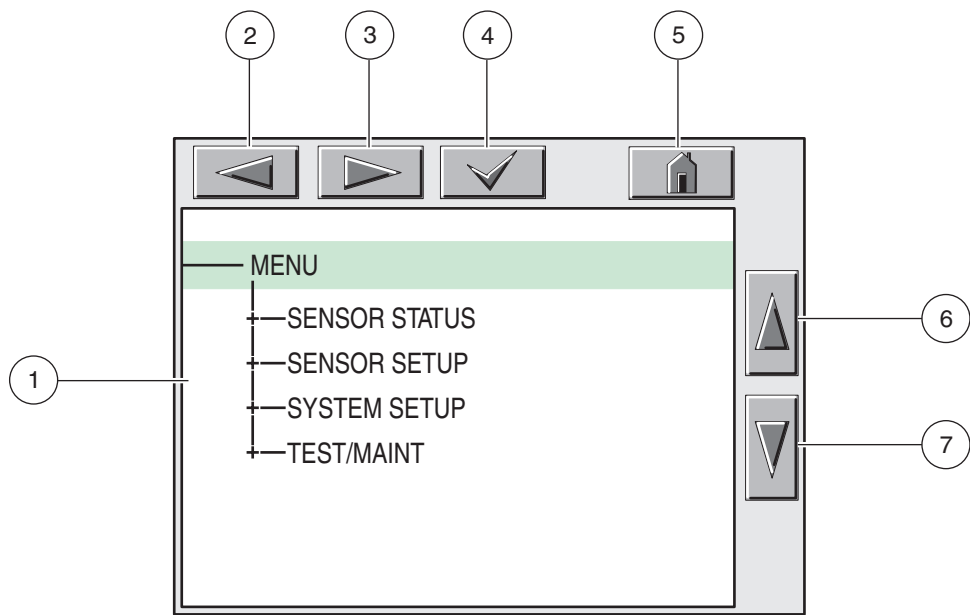
	MAIN MENU —displays the Main Menu Structure
	UP Arrow —scrolls up to the previous displayed value.
	Displays one value.
	Displays two values at the same time.
	Displays four values at the same time.
	LIST —displays the list of connected devices and sensors.
	DOWN Arrow —scrolls down to the next displayed value.

4.2.1.2 Using the Menu Windows

If the Menu button (from the pop-up toolbar) is selected, the Main Menu screen is opened. The Main Menu screen allows the user to view the sensor status, configure the sensor setup, system setup, and perform diagnostics.

The menu structure may vary depending on the configuration of the system.

Figure 15 Main Menu



1.	Display Area
2.	BACK
3.	FORWARD
4.	ENTER—confirms the entry or selection.
5.	HOME—changes to the display of measured values. The pop-up toolbar cannot open from the menu window. To view the Main Menu from this display, touch the Home button and then the bottom of the screen.
6.	UP—scrolls up
7.	DOWN—scrolls down

4.2.1.3 Navigating the Menu Windows

To view a menu item, touch the menu item or use the **UP** and **DOWN** keys to highlight the item. The menu item remains highlighted for approximately 4 seconds after it is selected. To view the highlighted command, select the area to the left of the menu item or select the **ENTER** button.

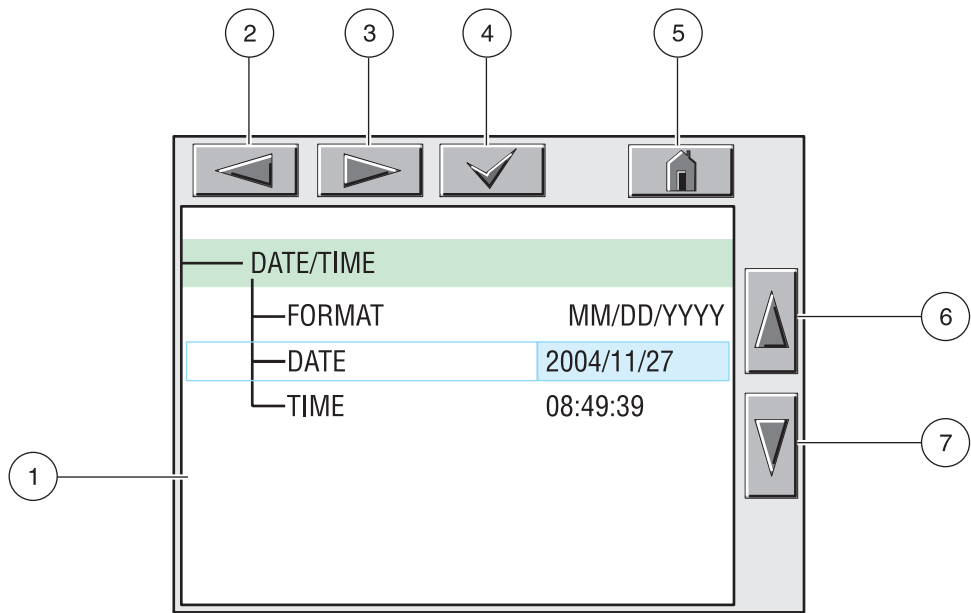
A “+” next to a menu command indicates there is a submenu. Touch the “+” to view the submenu. An “i” next to a menu command indicates it is information only.

If a menu item is editable, highlight the item and touch the far-left part of the menu item until it is highlighted and press **ENTER** or double-tap the highlighted item. A keypad will be displayed to change an entry (Figure 17 on page 23) or a list box will be displayed (Figure 18 on page 24).

Messages are displayed in the message window (Figure 19 on page 24).

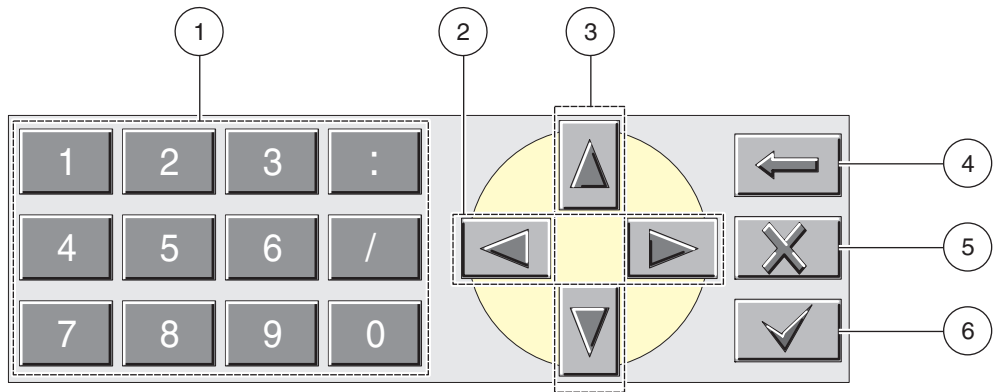
If an entry is incorrect, repeat the entry with the correct values. If the entry is outside the working range, a correction to the entry is made automatically.

Figure 16 Changing a Menu Item



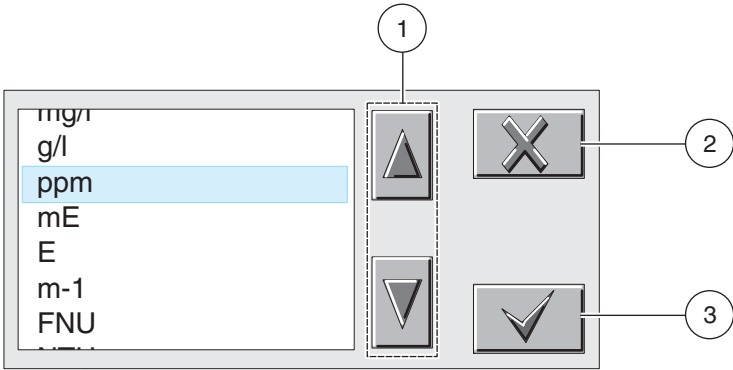
1. Display Area	5. HOME—changes to the display of measured values.
2. BACK	6. UP—scrolls up
3. FORWARD	7. DOWN—scrolls down
4. ENTER—confirms the entry or selection.	

Figure 17 Keypad



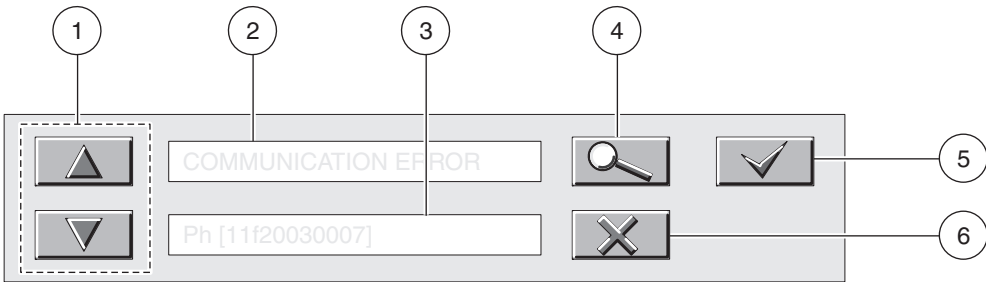
1. Enters numbers or the character as shown on the button.
2. Moves the cursor one position to the left or to the right.
3. Increase/Decrease a number or letter at the cursor position. Keep the button pressed to change the numbers/characters continuously.
4. Deletes the character to the left of the cursor.
5. CANCEL—cancels the entry.
6. ENTER—confirms the entry or selection.

Figure 18 List Box



- | |
|--|
| 1. Scrolls up or down |
| 2. CANCEL —cancels and entry. |
| 3. ENTER —confirms a selection. |

Figure 19 Message window



- | |
|---|
| 1. Scrolls up or down. |
| 2. Displays the messages or warnings. |
| 3. Displays details on the selected entry. |
| 4. This button changes back to the previous display. |
| 5. ENTER —confirms an entry. |
| 6. CANCEL —cancels an entry. |

5.1 Sensor Setup

When a sensor is initially installed, the serial number of the Digital Gateway will be displayed as the sensor name. To change the sensor name refer to the following instructions:

1. Select Main Menu.
2. From the Main Menu, select SENSOR SETUP and confirm.
3. Highlight the appropriate sensor if more than one sensor is attached and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu.

5.2 Sensor Data Logging

The sc1000 controller provides a data log for each sensor.

The sc100 provides three data logs (one for each sensor and one for calculated values). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through the digital network port, service port, or the IrDA port. DataCom is needed for downloading logs to a computer.

5.3 Sensor Diagnostics Menu for pH and ORP

SELECT SENSOR (if more than one sensor is attached)

STATUS	
ERROR LIST	See section 7.1 on page 35 .
WARNING LIST	See section 7.2 on page 35 .

5.4 pH Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

CALIBRATE (Main Menu Item)	
1 POINT AUTO	Calibration with a single buffer — normally pH 7.
2 POINT AUTO	Calibration with two buffers — normally pH 7 and pH 4 or 10.
1 POINT MANUAL	Calibration against a single known sample.
2 POINT MANUAL	Calibration against two samples, both with a known pH.
TEMP ADJUST	Adjust the displayed temperature by up to ± 15 °C.
DEFAULT SETUP	Restores the system to the original factory calibration.
CONFIGURE	
EDIT NAME	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters.
SELECT MEASURE	Select the appropriate measurement units to display.
DISPLAY FORMAT	Select the measurement resolution (xx.xx pH or xx.x pH).
TEMP UNITS	Choose from the displayed options (°C or °F).
LOG SETUP	Choose SENSOR INTERVAL to set the sensor log interval or select TEMP INTERVAL to set the temperature log interval.

5.4 pH Sensor Setup Menu (continued)

CONFIGURE (continued)	
REJECT FREQ	Choose 50 or 60 Hz depending on the power line frequency for optimal noise rejection. Default is 60 Hz.
FILTER	Select 0–60 second signal averaging time.
TEMP ELEMENT	Select type of temperature element from the displayed choices.
SELECT BUFFER	Select the buffer type (standard 4, 7, 10 or DIN 19267) from the displayed choices.
PURE H2O COMP	Allows the user to specify that ammonia, morpholine, or other user-defined electrolyte is being used in the application, allowing a temperature-dependent linear slope factor to be applied to the measured pH.
CAL DAYS	Number of days since the last calibration. Default notification at 60 days.
SENSOR DAYS	Number of days the sensor has been in operation. Default notification at 365 days.
DEFAULT SETUP	Resets all user-editable options to their factory-defaults.
DIAG/TEST	
PROBE INFO	Display the sensor type, entered name of the sensor (Default: Digital Gateway serial number and name), the sensor serial number, the software version number, and the sensor driver version number.
CAL DATA	Displays the pH slope and the date of the last calibration.
SIGNALS	<p>SENSOR SIGNAL: Displays the sensor output in mV</p> <p>SENSOR ADC COUNTS: Displays the sensor ADC counts</p> <p>TEMP ADC COUNTS: Displays raw data for temperature ADC counts. ADC counts are comparable to A/D counts and are for sensor electronic diagnostic purposes only.</p> <p>ELECTRODE STATE: Identifies the state of the electrode (good or bad) depending on whether the impedance is within preset limits.</p> <p>ACTIVE ELECT: Displays the impedance (Mohms) of the active electrode if Imped Status is set to Enabled.</p> <p>IMPED STATUS: Sensor diagnostic. Choose Enabled or Disabled.</p>
COUNTERS	<p>SENSOR DAYS: Displays the cumulative days the sensor has been in use.</p> <p>RESET SENSOR: Allows the sensor counter to be reset to zero.</p> <p>ELECTRODE DAYS: Cumulative days the electrode has been in use.</p>

5.5 ORP Sensor Setup Menu

SELECT SENSOR (if more than one sensor is attached)

CALIBRATE (Main Menu Item)	
1 POINT MANUAL	Calibration against a single known sample.
TEMP ADJUST	Adjust the displayed temperature by up to ± 15 °C.
DEFAULT SETUP	Restores the system to the original factory calibration.
CONFIGURE	
EDIT NAME	Enter up to a 10-digit name in any combination of symbols and alpha or numeric characters.
SELECT SENSOR	Choose from the displayed sensor type (pH or ORP).
TEMP UNITS	Choose from the displayed options (°C or °F).
LOG SETUP	Choose SENSOR INTERVAL to set the sensor log interval or select TEMP INTERVAL to set the temperature log interval.
AC FREQUENCY	Choose 50 or 60 Hz depending on the power line frequency for optimal noise rejection. Default is 60 Hz.
FILTER	Select 0–60 second signal averaging time.
TEMP ELEMENT	Select type of temperature element from the displayed choices.
CAL DAYS	Number of days since the last calibration. Default notification at 60 days.
SENSOR DAYS	Number of days the sensor has been in operation. Default notification at 365 days.
IMPED LIMITS	Set min/max electrode sensor impedance limits.
DEFAULT SETUP	Resets all user-editable options to their factory-defaults.
DIAG/TEST	
PROBE INFO	Display the sensor type, entered name of the sensor (Default: Digital Gateway serial number and name), the sensor serial number, the software version number, and the sensor driver version number.
CAL DATA	Displays the slope and the date of the last calibration.
SIGNALS	<p>SENSOR SIGNAL: displays the sensor output in mV</p> <p>SENSOR ADC COUNTS: displays the sensor ADC counts</p> <p>TEMP ADC COUNTS: shows raw data for temperature ADC counts. ADC counts are comparable to A/D counts and are for sensor electronic diagnostic purposes only.</p> <p>ELECTRODE STATE: Identifies the state of the electrode (good or bad) depending on whether the impedance is within preset limits.</p> <p>ACTIVE ELECT: Shows the impedance (Mohms) of the active electrode if Imped Status is set to Enabled.</p> <p>IMPED STATUS: Sensor diagnostic. Choose Enabled or Disabled.</p>
COUNTERS	<p>SENSOR DAYS: displays the cumulative days the sensor has been in use.</p> <p>RESET SENSOR: allows the sensor counter to be reset to zero.</p> <p>ELECTRODE DAYS: Cumulative days the electrode has been in use.</p>

5.6 pH Calibration

The manufacturer offers one and two point automatic and manual calibrations for pH. An automatic calibration identifies the buffer table corresponding to the chosen buffer and automatically calibrates the probe after it stabilizes. A manual calibration is performed by placing the pH sensor in any buffer or sample with a known value and then entering that known value into the controller.

The value of the sample used in the manual calibration may be determined by laboratory analysis or comparison reading.

5.6.1 One Point Automatic Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 1 POINT AUTO. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Move the clean probe to buffer and confirm to continue.
6. Confirm when stable. A screen will display 1 Point Auto Complete and the slope (XX.X mV/pH).
7. Return the probe to process.

5.6.2 Two Point Automatic Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 2 POINT AUTO. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Move the clean probe to Buffer 1 and confirm.
6. Confirm when stable.
7. Move the clean probe to Buffer 2 and confirm.
8. Confirm when stable. A screen will display 2 Point Calibration Complete and the slope (XX.X mV/pH).
9. Return the probe to process.

5.6.3 One Point Manual Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 1 POINT MANUAL. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Move the clean probe to solution and confirm to continue.
6. Confirm when stable. Edit the solution value using the keypad and confirm.
7. Confirm when stable. A screen will display 1 Point Manual Complete and the slope (XX.X mV/pH).
8. Return the probe to process.

5.6.4 Two Point Manual Calibration

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 2 POINT MANUAL CAL. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Move the clean probe to Solution 1 and confirm.
6. Confirm when stable. Edit the solution value using the keypad and confirm.
7. Move probe to solution 1 and confirm.
8. Confirm when stable. Edit the solution value using the keypad and confirm.
9. A screen will display 2 Point Manual Cal Complete and the slope (XX.X mV/pH).
10. Return the probe to process.

5.7 ORP Calibration

5.7.1 One-point Manual Calibration

The manufacturer offers a one point manual calibration for ORP. The value of the sample used in the manual calibration may be determined by laboratory analysis or comparison reading.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select 1 POINT MANUAL CAL. Select the available Output Mode (Active, Hold, or Transfer) from the list box and confirm.
5. Move the clean probe to Solution and confirm.
6. Confirm when stable. Edit the solution value using the keypad and confirm.
7. A screen will display 1 Point Manual Complete and the slope (XX.X mV).
8. Return the probe to process.

5.8 Concurrent Calibration of Two Sensors for pH and ORP

1. Begin a calibration on the first sensor and continue until "Wait to Stabilize" is displayed.
2. Select LEAVE and confirm. The display will return to the main measurement screen. The reading for the sensor currently being calibrated will flash.
3. Begin the calibration for the second sensor and continue until "Wait to Stabilize" is displayed.
4. Select LEAVE and confirm. The display will return to the main measurement screen and the reading for both sensors will flash. The calibration for both sensors are now running in the background.
5. To return to the calibration of either sensor select SENSOR SETUP from the Main Menu and confirm. Select the appropriate sensor and confirm.
6. The calibration in progress will be displayed. Continue with the calibration.

5.9 Adjusting the Temperature

View or change the temperature using the steps below:

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Select the appropriate sensor if more than one is attached and confirm.
3. Select CALIBRATE and confirm.
4. Select TEMP ADJUST and confirm.
5. Select MEASURED TEMP and confirm.
6. The temperature will be displayed. Select the temperature to edit and confirm.

Section 6 Maintenance

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

DANGER

Seul un technicien qualifié peut effectuer les tâches d'installation décrites dans cette section du manuel.



DANGER

Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

DANGER

Risque d'explosion. Couper le courant ou s'assurer que l'emplacement est désigné non dangereux avant de remplacer le composant.

DANGER

Explosion hazard. Substitution of components may impair suitability for Class 1, Division 2.

DANGER

Risque d'explosion. La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe 1, Division 2.

6.1 Maintenance Schedule

Maintenance Task	90 days	Annually
Clean the sensor ¹	x	
Inspect sensor for damage	x	
Calibrate Sensor (if required by regulatory agency)	Per the schedule mandated by your regulatory agency.	

¹ Cleaning frequency is application dependent. More or less frequent cleaning will be appropriate in some applications.

6.2 Cleaning the Sensor

CAUTION

Before cleaning with acid, determine if the chemical reaction between the acid and the sample will create a hazardous chemical reaction. (For example, do not put a sensor that is used in a cyanide bath directly into a strong acid for cleaning because this chemical combination may produce poisonous cyanide gas.)

DANGER

Acids are hazardous. Always wear appropriate eye protection and clothing in accordance with material safety data sheet recommendations.

1. Clean the exterior of the sensor with a stream of water. If debris remains remove loose contaminate buildup by carefully wiping the entire measuring end of the sensor with a soft clean cloth. Rinse the sensor with clean, warm water.
2. Prepare a mild soap solution of warm water and dish detergent or other non-abrasive soap that does not contain lanolin.

Note: Lanolin will coat the glass process electrode and can adversely affect sensor performance.

3. Soak the sensor for 2 to 3 minutes in the soap solution.
4. Use a small soft-bristle brush and scrub the entire measuring end of the sensor, thoroughly cleaning the electrode and reference junction surfaces. If surface deposits cannot be removed by detergent solution cleaning, use muriatic acid (or other dilute acid) to dissolve them. The acid should be as dilute as possible, do not use stronger than 3% HCL. Experience will determine which acid to use and the appropriate dilution ratio. Some stubborn coatings may require a different cleaning agent. For assistance, contact [Technical and Customer Service \(U.S.A. only\) on page 39](#).
5. Soak the entire measuring end of the sensor in dilute acid for no more than 5 minutes. Rinse the sensor with clean, warm water then place the sensor back into the mild soap solution for 2 to 3 minutes to neutralize any remaining acid.
6. Remove the sensor from the soap solution, and rinse the sensor again in clean, warm water.
7. After cleaning, always calibrate the measurement system. Refer to [section 4.7 on page 25](#) or [section 4.8 on page 29](#).

Section 7 Troubleshooting

7.1 Error Codes

When a sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and all relays and analog outputs associated with this sensor will be held. The following conditions will cause the sensor reading to flash:

- Sensor calibration
- Relay timer washing cycle
- Loss of communication

Highlight the Sensor Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the cause of the error. Errors are defined in [Table 6](#).

Table 6 Error Codes

Displayed Error	Definition	Resolution
ADC FAILURE	System measurement fails	Contact Technical Consulting Services.

7.2 Warnings

A sensor warning will leave all menus, relays, and outputs functioning normally, but will cause a warning icon to flash on the right side of the display. Highlight the Sensor Diag menu and press **ENTER** to determine the cause of the warning.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Warnings are defined in [Table 7](#).

Table 7 Warning Codes

Displayed Warning	Definition	Resolution
PROBE OUT RANGE	Measured pH/ORP exceeds the expected value range.	Contact Technical Consulting Services.
TEMP OUT RANGE	Measured temperature exceeds the expected value range.	Contact Technical Consulting Services.
FLASH FAILURE	System flash memory write has failed.	Contact Technical Consulting Services.
REF ELECTRODE	Standard Electrode is not performing within the required specifications.	Contact Technical Consulting Services.

7.3 Troubleshooting the pH or ORP Sensor

Clean the sensor using the procedure described in [section 6.2 on page 34](#) and then calibrate the sensor as shown in [section 4.7 on page 25](#) or [section 4.8 on page 29](#). If the measuring system cannot be calibrated after cleaning, contact [Technical and Customer Service \(U.S.A. only\) on page 39](#).

Section 8 Replacement Parts and Accessories

8.1 Replacement Items, Accessories, and Reagent and Standards

Item Description	QTY	Catalog Number
Instruction manual, Combination pH System, English	each	6120118
Cable, sensor extension, 1 m (3 ft)	each	6122400
Cable, sensor extension, 7.7 m (25 ft)	each	5796000
Cable, sensor extension, 15 m (50 ft)	each	5796100
Cable, sensor extension, 31 m (100 ft)	each	5796200
Connector Safety Lock	each	6139900
Termination box	each	586700
Plug, sealing, conduit opening	each	5868700
Strain relief, Heyco	each	16664
Buffer, pH 7	500 mL (1 pint)	2283549
Buffer, pH 4	500 mL (1 pint)	2283449
Buffer, pH 10	500 mL (1 pint)	2283649
Buffer, pH 7	1 gallon	2283556
Buffer, pH 4	1 gallon	2283456
Buffer, pH 10	1 gallon	2283656
ORP Standard Solution, 200 mV	500 mL (1 pint)	25M2A1001-115
ORP Standard Solution, 600 mV	500 mL (1 pint)	25M2A1002-115
ORP Standard Solution, 200 mV	1 gallon	25M2A1001-123
ORP Standard Solution, 600 mV	1 gallon	25M2A1002-123

Section 9 How to Order

U.S.A. Customers

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:

(970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Ordering information by e-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an e-mail to: intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:

Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

**In Latin America, the Caribbean, the Far East,
Indian Subcontinent, Africa, Europe, or the Middle East:**

Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 12 Compliance Information

Hach Company certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100 Controller/sc1000 Controller and the pH Combination sensor** has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 (ETL Listing # 65454)
CSA C22.2 No. 1010.1 (ETLc Certification # 65454)
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC**: Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electrostatic Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electromagnetic Field Immunity (Criteria A)
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional Immunity Standard/s include:

ENV 50204:1996 Radiated Electromagnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **89/336/EEC EMC: EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment
EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11), Class “A” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

FCC PART 15, Class “A” Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Controller from its power source to verify that it is or is not the source of the interference.
2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.
3. Move the Controller away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Appendix A Modbus Register Information

Table 8 Sensor Modbus Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Tags	SensorMeasTag	40001	Integer	1	R	Sensor measurement tag
Measurements	pHMeas	40002	Float	2	R	pH /ORP measurement
Tags	TempMeasTag	40004	Integer	1	R	Temperature measurement tag
Measurements	TempDegCMeas	40005	Float	2	R	Temperature measurement
Configuration	SensorName	40007	String	6	R/W	Sensor name
Tags	FuncCode	40013	Integer	1	R/W	Function code tag
Tags	NextState	40014	Integer	1	R/W	Next state tag
Configuration	MeasType	40015	Integer	1	R/W	Measurement type—pH or ORP
Configuration	TempUnits	40016	Integer	1	R/W	Temperature units—C or F
Configuration	pHFormat	40017	Integer	1	R/W	pH display format
Configuration	TaggedPhFormat	40018	Long	2	R	pH display tagged format
Configuration	Filter	40020	Integer	1	R/W	Sensor filter
Configuration	TempElementType	40021	Integer	1	R/W	Temperature element type
Tags	TempUserValueTag	40022	Integer	1	R	Temperature user value tag
Configuration	TempUserDegCValue	40023	Float	2	R/W	Temperature user value
Configuration	pHBuffer	40025	Integer	1	R/W	pH buffer type
Configuration	PureWaterCompType	40026	Integer	1	R/W	Pure H ₂ O compensation type
Configuration	PureWaterCompUser	40027	Float	2	R/W	Pure H ₂ O compensation user val
Calibration	OutputMode	40029	Integer	1	R/W	Output mode
Calibration	CalLeave	40030	Integer	1	R/W	Cal leave mode
Calibration	CalAbort	40031	Integer	1	R/W	Cal abort mode
Tags	CalEditValueTag	40032	Integer	1	R	Cal edit value tag
Calibration	CalEditPhValue	40033	Float	2	R/W	Cal edit value
Diagnostics	pHSlope	40035	Float	2	R	pH slope
Diagnostics	SoftwareVersion	40037	String	6	R	Software version
Diagnostics	SerialNumber	40043	String	6	R	Serial number
Diagnostics	pHOffset	40049	Float	2	R	pH offset
Diagnostics	OrpOffset	40051	Float	2	R	Orp offset
Calibration	CalCode	40053	Integer	1	R	Cal code
Configuration	SensorLogInterval	40054	Integer	1	R/W	Sensor data log interval
Configuration	TempLogInterval	40055	Integer	1	R/W	Temperature data log interval
Diagnostics	pHmV	40056	Float	2	R	pH mV
Diagnostics	ProdDate	40058	Date	2	R/W	Production date
Diagnostics	StdElectrode	40060	Float	2	R	Standard electrode impedance
Diagnostics	RefElectrode	40062	Float	2	R	Reference electrode impedance
Diagnostics	LastCalDate	40064	Date	2	R	Last calibration date
Diagnostics	SensorDays	40066	Integer	1	R	Sensor running days
Diagnostics	ElectrodeDays	40067	Integer	1	R	Electrode running days
Diagnostics	ElectrodeStatus	40068	Integer	1	R	Electrode status
Diagnostics	SensorType	40069	Integer	1	R	Sensor type
Configuration	RejectFrequency	40070	Integer	1	R/W	Reject frequency
Diagnostics	DeviceDriver	40071	String	5	R	Device driver

Table 8 Sensor Modbus Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Configuration	CalWarningDays	40076	Integer	1	R/W	Calibration warning days
Configuration	SensorWarningDays	40077	Integer	1	R/W	Sensor warning days

Appendix B General pH Information

B.1 pH Measurement Theory

pH is the negative logarithm of the hydrogen ion activity and a measure of the acidity or alkalinity of a solution.

$$\text{pH} = -\log A[\text{H}^+]$$

pH is normally measured using a glass electrode and a reference electrode.

The glass electrode acts as a transducer, converting chemical energy (the hydrogen ion activity) into an electrical energy (measured in millivolts). The reaction is balanced and the electrical circuit is completed by the flow of ions from the reference solution to the solution under test.

The electrode and reference solution together develop a voltage (emf) whose magnitude depends on the type of reference electrode, the internal construction of the glass electrode, the pH of the solution and the temperature of the solution. This voltage is expressed by the Nernst Equation:

$$E = E_0 - (2.3 RT/F) \times \log A[\text{H}^+]$$

$$E = E_0 - (\text{slope}) \times \log A[\text{H}^+]$$

where:

E = the emf of the cell

E_0 = the zero potential (isopotential) of the system. It depends on the internal construction of the glass and reference electrodes.

R = gas constant

T = temperature in Kelvin

$A[\text{H}^+]$ = activity of the hydrogen ion (assumed to be equivalent to the concentration of hydrogen ions)

F = Faraday constant

For every unit change in pH (or decade change in ion concentration) the emf of the electrode pair changes by 59.16 mV at 25 °C. This value is known as the Nernstian Slope of the electrode.

The pH electrode pair is calibrated using solutions of known and constant hydrogen ion concentration, called buffer solutions. The buffer solutions are used to calibrate both the electrode isopotential and slope.

B.2 PID Controller Basics

A pH control loop operates as follows: The pH meter measures the value of the pH in the effluent, and, if the pH is different from the setpoint, the controller actuates the reagent pump (or valve) that adds reagent to a mixing tank. The added reagent adjusts the pH value of the process.

The physical layout of the loop, the sizing of the pump (valve), type of mixing tank, and location of the pH electrodes all have a major impact on the ultimate performance of the loop, after the controller is tuned for optimal performance. The largest single performance factor is the delay time around the loop. This includes the response time of the electrode/meter, time required to deliver the reagent to the process water, time required for the reagent to mix with and react with the process water, and the time required to deliver the completely mixed water to the electrode. If the delay times are too long or the mixing is not complete, the control will be poor regardless of how well the controller is tuned.

The Process pH Meter uses a PID (proportional, integral (reset), derivative (rate) control) control algorithm. Each of the instrument settings along with their effects on the control loop, are described below.

Mode

Manual: The manual output is specified in percent of full-scale PID output (4–20 mA) and is commonly used for testing the output device.

Auto: Allows the process to be controlled automatically using information specified in the Phase, Setpoint, Proportional Band, Integral, and Derivative menus as follows:

Phase

Direct: The control output action will cause the process value to increase.

Reverse: The control output action will cause the process value to decrease.

Setpoint

The setpoint is defined as the desired process value in pH

Proportional Band

The proportional band is the range in pH from the setpoint value where the controller provides proportional control. For example, the desired setpoint for the process is pH 7.0 and the process requires that a reagent must be added to the process water to bring it up to pH 7.0. If the proportional band is set to pH 1.0, the controller will provide proportional output control over the range of pH 6.0 to 8.0. When the process is at pH 6.0, the controller will provide a 100% control output level (assuming that Phase is set to Direct). When the process is at pH 7.0, the proportional control will provide a 0% control output level. When the process is at pH 6.5 the proportional control will provide a 50% output. The output action is equal to the difference between the setpoint and the process value, divided by the proportional band value.

Integral

The integral value is used to reduce the steady state error, between the process value and the setpoint, to zero. For example, assume a process can be manually controlled at a level of pH 8.0 by sending a 35% control output level to a reagent pump. Now, say that the system is set up for the controller to provide proportional only control, with the controller setpoint set to pH 8.0 and the proportional band set to pH 1.0. Note that the nearer the process gets to the pH 8.0 setpoint, the lower the control output level is. In fact, when the process is at pH 8.0, the output level will be 0%. Since the process requires that the pump be operated at 35% for the process to reach pH 8.0, its apparent that proportional-only control will never quite reach the desired setpoint of pH 8.0. This is where the integral control comes in.

Integral control can be thought of as adding up the output action from the proportional control over time. For example, the proportional control output reaches a steady state level of 5%. If the integral time is set to five minutes, the integral action of the controller will add an additional 5% to the controller output level over a 5-minute interval. The integral action is additive, so for every 5-minute interval an additional 5% is added to the controller's output level. This will allow the controller to bring the process to the desired setpoint level. Note that the longer the integral time setting, the longer it takes for the integral action to affect the process. The integral control action is disabled by setting it to zero. Note that the integral time is in minutes.

Derivative

Derivative control is used to adjust the control output level based upon the rate at which the process value is approaching or passing the setpoint. Derivative control action would be used in cases where the process value can rapidly ramp up and overshoot the setpoint. The derivative setting is in minutes. The output action of the derivative control is equal to the rate of change of the process (in pH units per minute) times the derivative time, divided by the proportional band, times negative one. For example, if the process pH is changing at a rate of pH 0.20 per minute, the derivative time is set to 3.0 minutes, the proportional band is set to pH 0.80, and the action is "direct" the derivative control output action will be approximately equal to: $(-0.20 \text{ pH/minute} \times 3.0 \text{ minute}) / 0.80 \text{ pH} = -75\%$.

During calibration, the analog outputs can remain active, be held, or be transferred to a preset mA value.

B

Buttons

- List box 23
- Toolbar 21

C

Cleaning

- Sensor 34

Compliance Information 43

D

- Derivative 48
- Derivative (Rate) Control 48
- Display 20

E

Entries

- Incorrect 22

Error Codes 35

I

- Integral 48
- Integral (Reset) 48

K

Key

- Functions 19

L

- List box 23

M

- Maintenance Schedule 33
- Menu command
 - Marking 21, 22
- Menu windows 21

N

- Normal operation 21

P

Parts

- Replacement 37

PID control

- Proportional 48
- Proportional 48
- Proportional Band 48

S

- Safety Information 7

Sensor Cable

- Connecting 13
- Wiring 13

- Specifications 5

T

- Toolbar 21

W

- Warnings 35
- Warranty 41

sc200™ UNIVERSAL CONTROLLER

Applications

- Drinking Water
- Wastewater
- Industrial Water
- Power



One Controller for the Broadest Range of Sensors.

Choose from 30 digital and analog sensor families for up to 17 different parameters.

Maximum Versatility

The sc200 controller allows the use of digital and analog sensors, either alone or in combination, to provide compatibility with Hach's broad range of sensors, eliminating the need for dedicated, parameter-specific controllers.

Ease of Use and Confidence in Results

Large, high-resolution, transreflective display provides optimal viewing resolution in any lighting condition. Guided calibration procedures in 19 languages minimize complexity and reduce operator error. Password-protected SD card reader offers a simple solution for data download and transfer. Visual warning system provides critical alerts.

Wide Variety of Communication Options

Utilize two to five analog outputs to transmit primary and secondary values for each sensor, or integrate Hach sensors and analyzers into MODBUS RS232/RS485, Profibus® DP, and HART networks.



Password protected SD card reader offers a simple solution for data download and transfer, and sc200 and digital sensor configuration file duplication and backup.

Controller Comparison



Features	Previous Models		sc200™ Controller	Benefits
	sc100™ Controller	GLI53 Controller		
Display	64 x 128 pixels 33 x 66 mm (1.3 x 2.6 in.)	64 x 128 pixels 33 x 66 mm (1.3 x 2.6 in.)	160 x 240 pixels 48 x 68 mm (1.89 x 2.67 in.) Transreflective	<ul style="list-style-type: none"> Improved user interface—50% bigger Easier to read in daylight and sunlight
Data Management	irDA Port/PDA Service Cable	N/A	SD Card Service Cable	<ul style="list-style-type: none"> Simplifies data transfer Standardized accessories/ max compatibility
Sensor Inputs	2 Max Direct Digital Analog via External Gateway	2 Max Analog Depending on Parameter	2 Max Digital and/or Analog with Sensor Card	<ul style="list-style-type: none"> Simplifies analog sensor connections Works with analog and digital sensors
Analog Inputs	N/A	N/A	1 Analog Input Signal Analog 4-20mA Card	<ul style="list-style-type: none"> Enables non-sc analyzer monitoring Accepts mA signals from other analyzers for local display Consolidates analog mA signals to a digital output
4-20 mA Outputs	2 Standard	2 Standard	2 Standard Optional 3 Additional	<ul style="list-style-type: none"> Total of five (5) 4-20 mA outputs allows multiple mA outputs per sensor input
Digital Communication	MODBUS RS232/RS485 Profibus DP V1.0	HART	MODBUS RS232/RS485 Profibus DP V1.0 HART 7.2	<ul style="list-style-type: none"> Unprecedented combination of sensor breadth and digital communication options

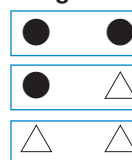
Choose from Hach's Broad Range of Digital and Analog Sensors

Parameter	Sensor	Digital or Analog
Ammonia	AMTAX™ sc, NH4D sc, AISE sc, AN-ISE sc	●
Chlorine	CLF10 sc, CLT10 sc, 9184 sc	●
Chlorine Dioxide	9185 sc	●
Conductivity	GLI 3400 Contacting, GLI 3700 Inductive	△
Dissolved Oxygen	LDO® Model 2, 5740 sc	●
Dissolved Oxygen	5500	△
Flow	U53, F53 Sensors	△
Nitrate	NITRATAX™ sc, NO3D sc, NISE sc, AN-ISE sc	●
Oil in Water	FP360 sc	●
Organics	UVAS sc	●
Ozone	9187 sc	●
pH/ORP	pHD	●
pH/ORP	pHD, pH Combination, LCP	△
Phosphate	PHOSPHAX™ sc	●
Sludge Level	SONATAX™ sc	●
Suspended Solids	SOLITAX™ sc, TSS sc	●
Turbidity	1720E, FT660 sc, SS7 sc, ULTRATURB sc, SOLITAX sc, TSS sc	●
Ultra Pure Conductivity	8310, 8311, 8312, 8315, 8316, 8317 Contacting	△
Ultra Pure pH/ORP	8362	△

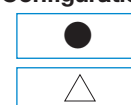
● = Digital △ = Analog

Connect up to two of any of the sensors listed above, in any combination, to meet your application needs. The diagrams below demonstrate the potential configurations. Operation of analog sensors requires the controller to be equipped with the appropriate sensor module. Contact Hach Technical Support for help with selecting the appropriate module.

2 Channel Configurations



1 Channel Configurations



Specifications*

Dimensions (H x W x D)	5.7 in x 5.7 in x 7.1 in (144 mm x 144 mm x 181 mm)
Display	Graphic dot matrix LCD with LED backlighting, transreflective
Display Size	1.9 x 2.7 in. (48 mm x 68 mm)
Display Resolution	240 x 160 pixels
Weight	3.75 lbs. (1.70 kg)
Power Requirements (Voltage)	100 - 240 V AC, 24 V DC
Power Requirements (Hz)	50/60 Hz
Operating Temperature Range	-20 to 60 °C , 0 to 95% RH non-condensing
Analog Outputs	Two (Five with optional expansion module) to isolated current outputs, max 550 Ω , Accuracy: $\pm 0.1\%$ of FS (20mA) at 25 °C, $\pm 0.5\%$ of FS over -20 °C to 60 °C range
Analog Output Functional Mode	Operational Mode: measurement or calculated value Linear, Logarithmic, Bi-linear, PID
Security Levels	2 password-protected levels
Mounting Configurations	Wall, pole, and panel mounting
Enclosure Rating	NEMA 4X/IP66
Conduit Openings	1/2 in NPT Conduit
Relay: Operational Mode	Primary or secondary measurement, calculated value (dual channel only) or timer

Relay Functions

Scheduler (Timer), Alarm, Feeder Control, Event Control, Pulse Width Modulation, Frequency Control, and Warning

Relays

Four electromechanical SPDT (Form C) contacts, 1200 W, 5 A

Communication

MODBUS RS232/RS485, PROFIBUS DPV1, or HART 7.2 optional

Memory Backup

Flash memory

Electrical

Certifications

EMC

CE compliant for conducted and radiated emissions:

- CISPR 11 (Class A limits)

- EMC Immunity EN 61326-1 (Industrial limits)

Safety

cETLus safety mark for:

- General Locations per ANSI/UL 61010-1 & CAN/CSA C22.2. No. 61010-1

- Hazardous Location Class I, Division 2, Groups A,B,C & D (Zone 2, Group IIC) per FM 3600 / FM 3611 & CSA C22.2 No. 213 M1987 with approved options and appropriately rated Class I, Division 2 or Zone 2 sensors

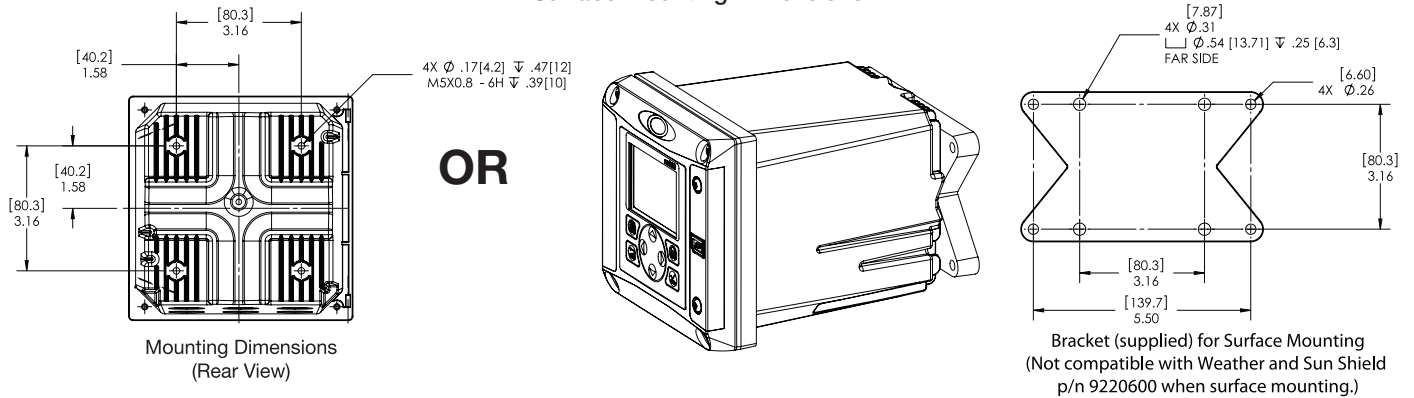
cULus safety mark

- General Locations per UL 61010-1 & CAN/CSA C22.2. No. 61010-1

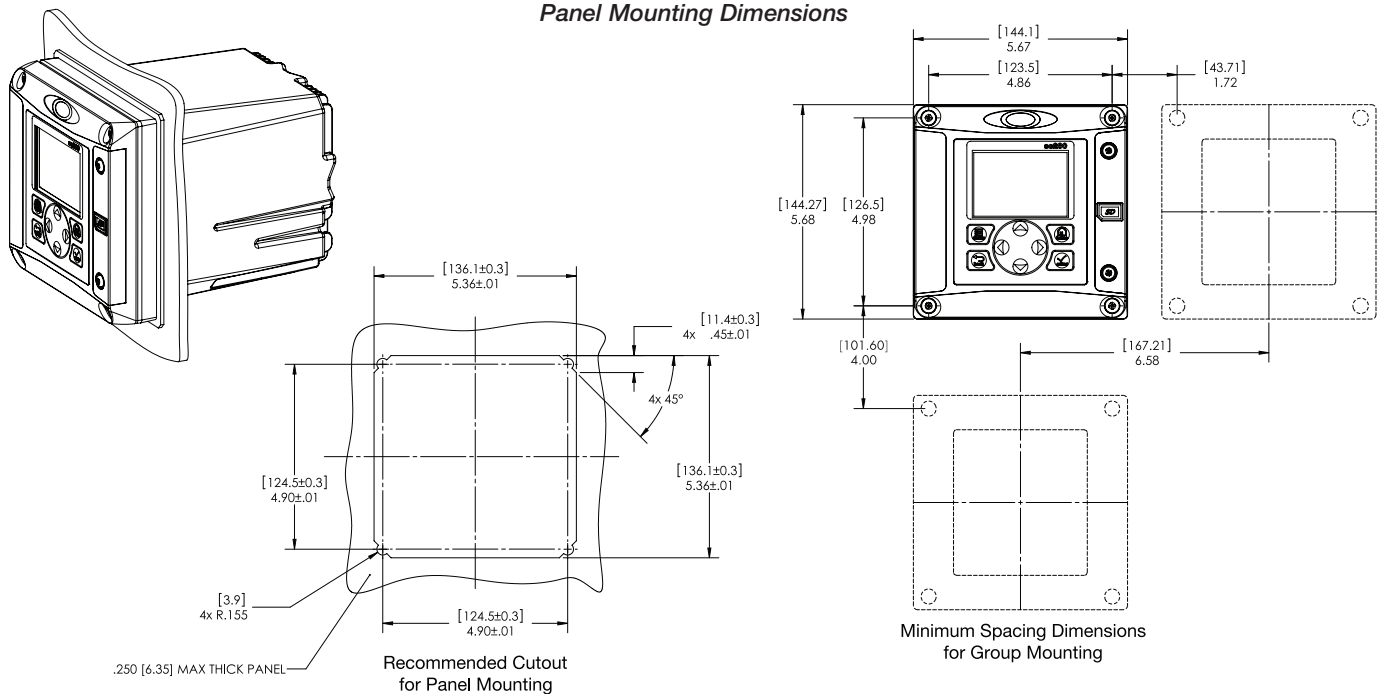
**Subject to change without notice.*

Dimensions

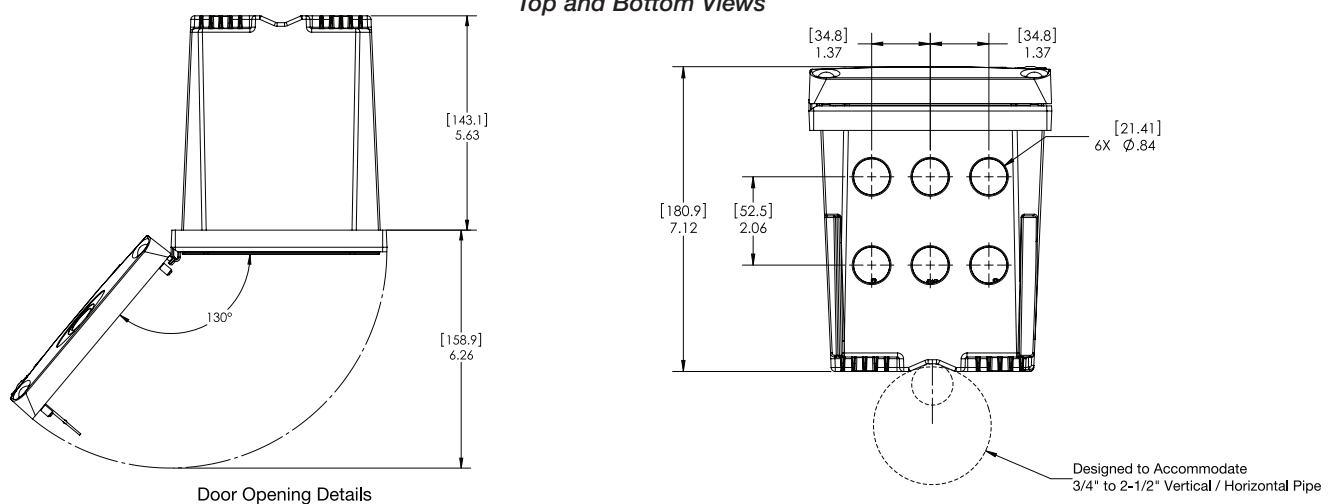
Surface Mounting Dimensions



Panel Mounting Dimensions



Top and Bottom Views



Ordering Information

sc200 for Hach Digital and Analog Sensors

LXV404.99.00552	sc200 controller, 2 channels, digital
LXV404.99.00502	sc200 controller, 1 channel, digital
LXV404.99.00102	sc200 controller, 1 channel, pH/DO
LXV404.99.00202	sc200 controller, 1 channel, Conductivity
LXV404.99.01552	sc200 controller, 2 channels, digital, Modbus RS232/RS485
LXV404.99.00112	sc200 controller, 2 channel, pH/DO

Note: Other Sensor combinations are available. Please contact Hach Technical Support or your Hach representative.

Note: Communication options (MODBUS, Profibus DPV1, and HART) are available. Please contact Hach Technical Support or your Hach representative.

sc200 for Ultrapure Sensors

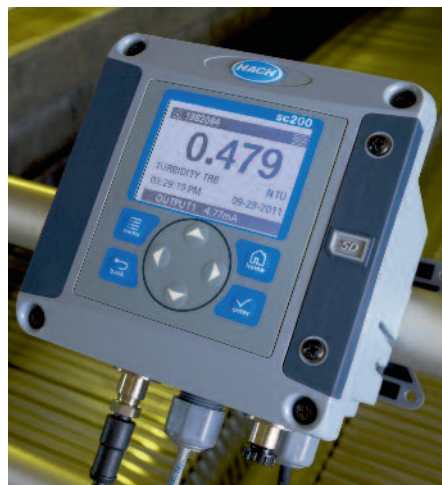
9500.99.00602	sc200 controller, 1 channel, ultrapure conductivity
9500.99.00702	sc200 controller, 1 channel, ultrapure pH
9500.99.00662	sc200 controller, 2 channel, ultrapure conductivity
9500.99.00772	sc200 controller, 2 channel, ultrapure pH

Sensor and Communication Modules

9012900	Analog pH/ORP and DO module for GLI Sensors
9013000	Analog Conductivity module for GLI Sensors
9012700	Flow module
9012800	4-20 mA Input Module
9525700	Analog pH/ORP Module for Polymetron Sensors
9525800	Analog Conductivity Module for Polymetron Sensors
9013200	Modbus 232/485 Module
9173900	Profibus DP Module
9328100	HART Module
9334600	4-20 mA Output Module (Provides 3 additional mA Outputs)

Accessories

9220600	sc200 Weather and Sun Shield with UV Protection Screen
8809200	sc200 UV Protection Screen
9218200	SD card reader (USB) for connection to PC
9218100	4 GB SD card



HACH COMPANY World Headquarters: Loveland, Colorado USA

United States:	800-227-4224 tel	970-669-2932 fax	orders@hach.com
Outside United States:	970-669-3050 tel	970-461-3939 fax	int@hach.com
hach.com			

LIT2665 Rev 7

K13 Printed in U.S.A.

©Hach Company, 2013. All rights reserved.

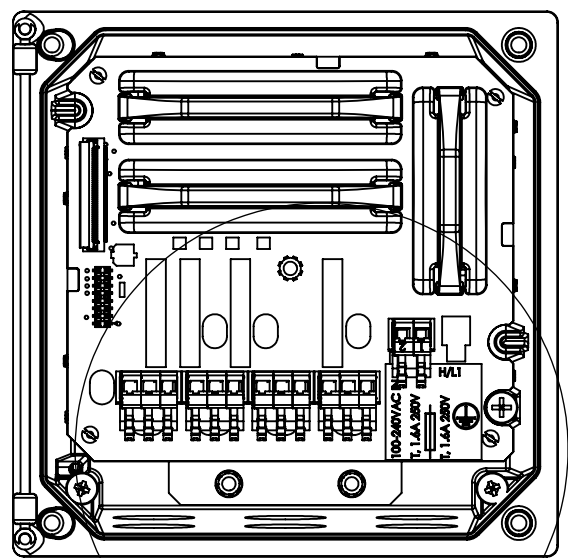
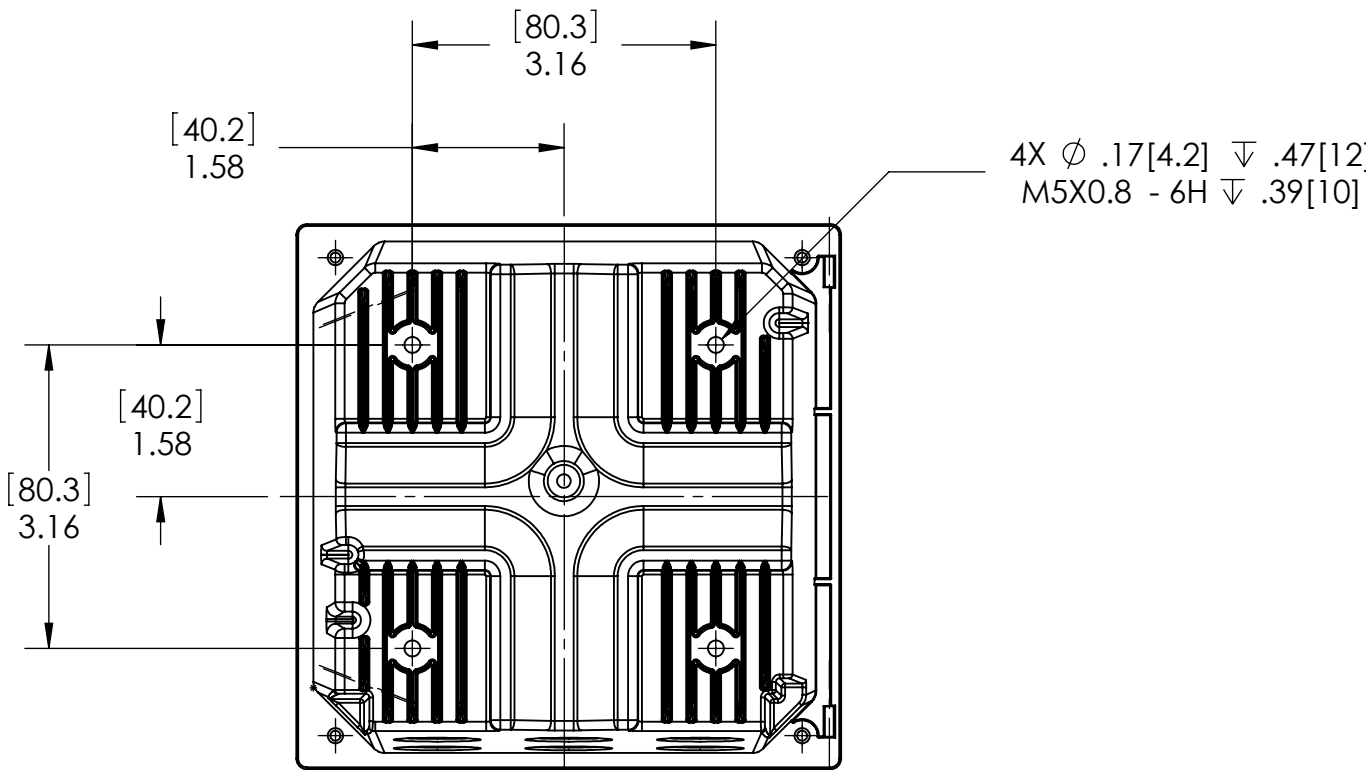
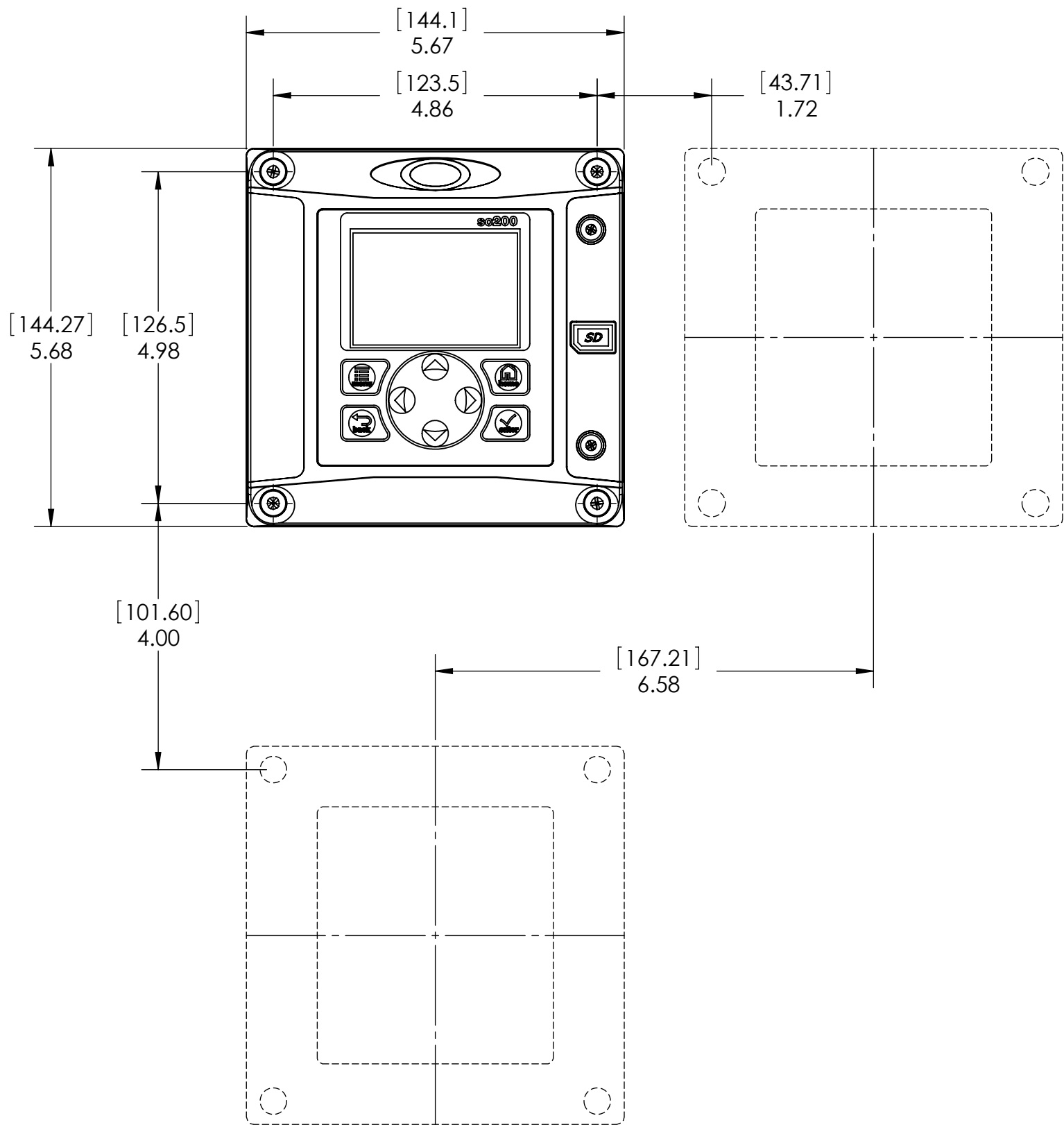
In the interest of improving and updating its equipment,

Hach Company reserves the right to alter specifications to equipment at any time.



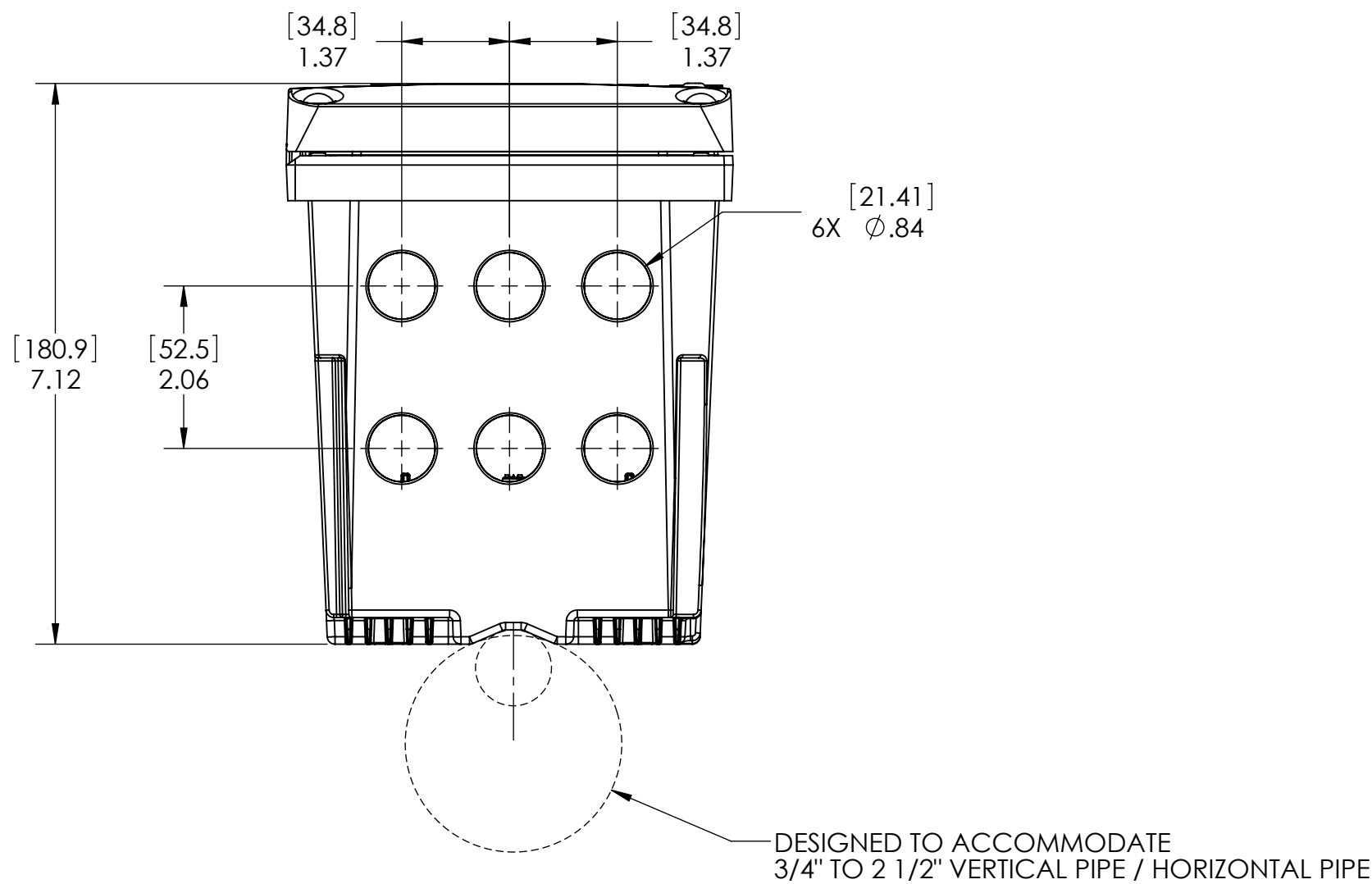
SC200 OVERALL DIMENSIONS

REVISION		
REV	DESCRIPTION	APPROVED
B	REVISED PER 11-842	WHITE, STEVE

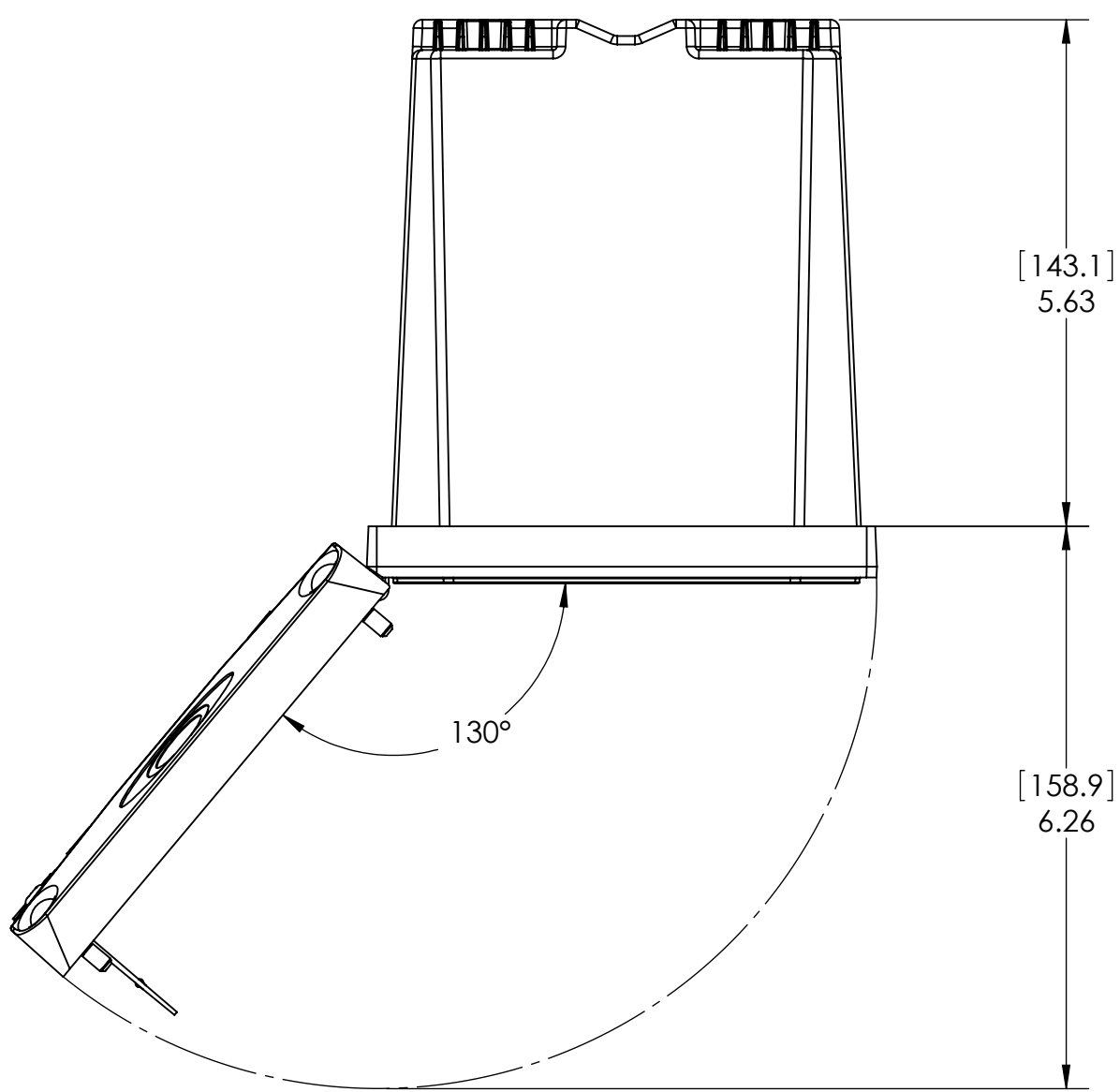


CUSTOMER CONNECTIONS
ITEMS REMOVED FOR CLARITY

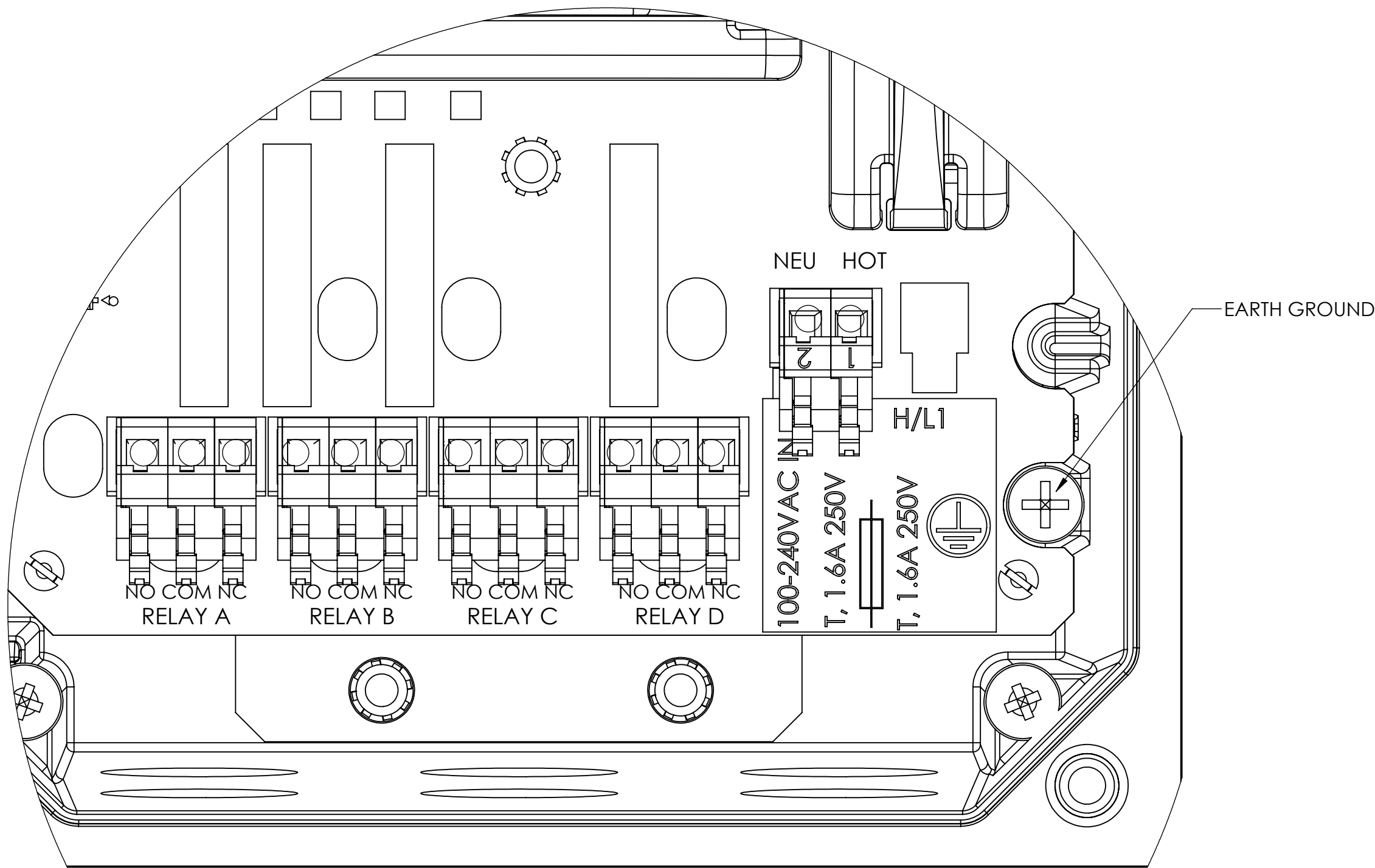
MINIMUM SPACING DIMENSIONS
FOR GROUP MOUNTING



MOUNTING DIMENSIONS



DOOR OPENING DETAILS

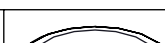



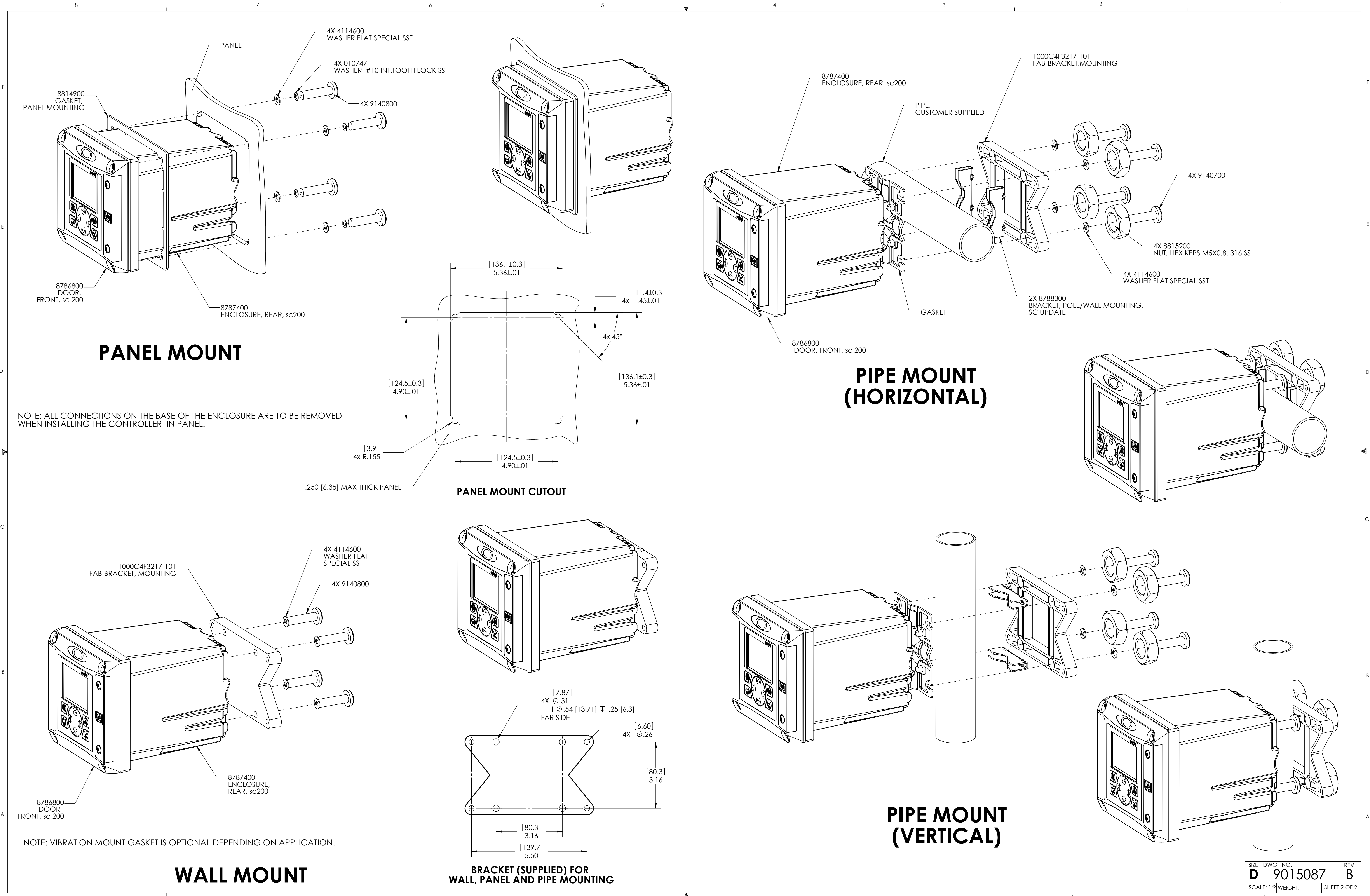
DETAIL B
SCALE 2 : 1

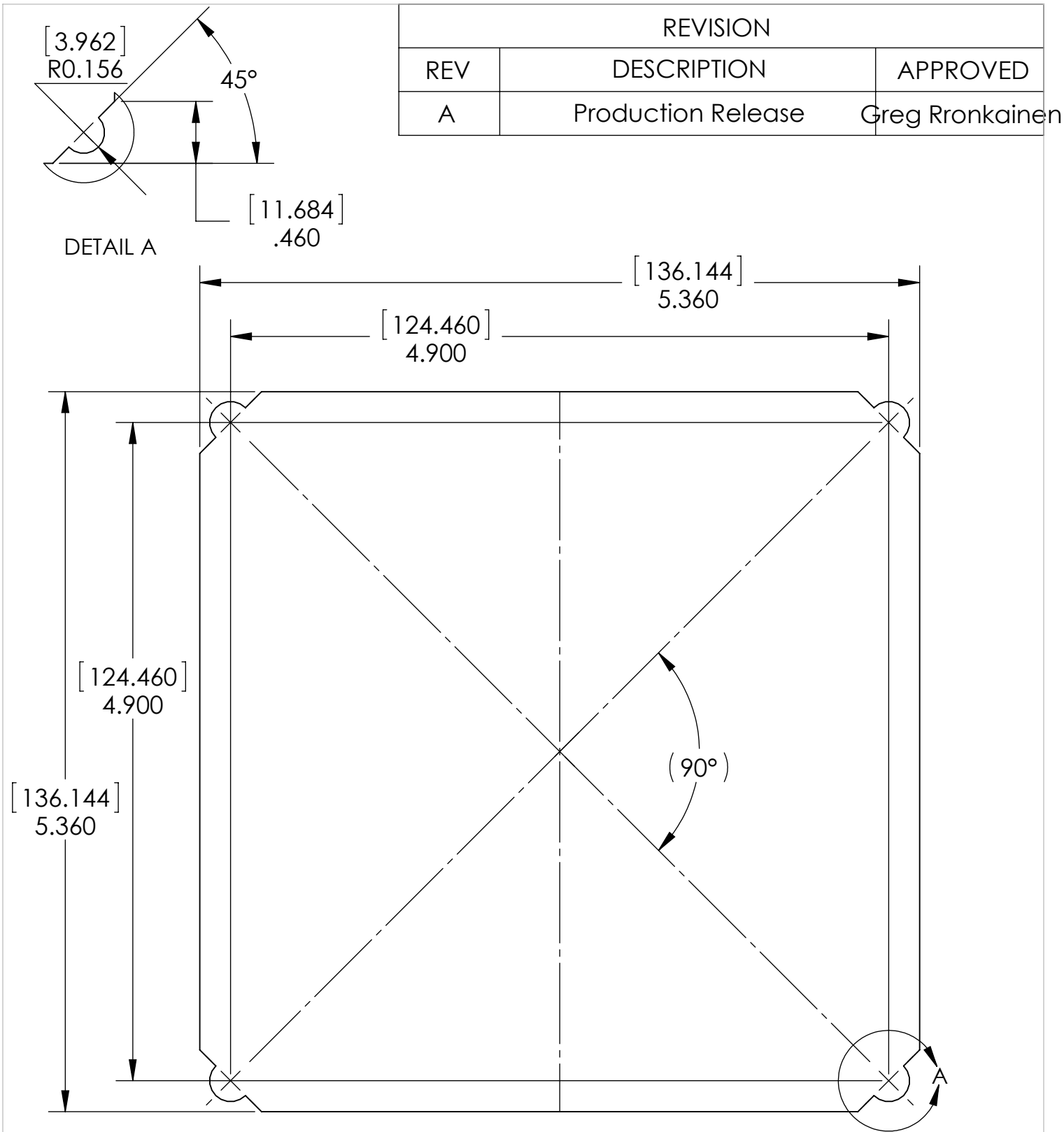
- NOTES:
1. ALL THE DIMENSION ARE IN INCHES [MILLIMETERS].

GENERAL INFORMATION:

1. CONTROLLER OPERATING TEMPERATURE : -20 TO 60°C (-4 TO 140°F); 95% HUMIDITY, NON CONDENSING.
2. CONTROLLER STARAGE TEMPERATURE: -20 TO 70°C (-4 TO 158°F); 95% RELATIVE HUMIDITY, NON CONDENSING.
3. ENCLOSURE: NEMA 4X / IP66 METAL ENCLOSURE WITH A CORROSION RESISTANT FINISH.
4. CONTROLLER WEIGHT: 1.6 Kg (3.5 lb).

NOTICE-HACH COMPANY CLAIMS PROPRIETARY RIGHTS IN THE INFORMATION DISCLOSED ON THIS DRAWING. IT IS ISSUED IN CONFIDENCE FOR ENGINEERING INFORMATION ONLY AND MAY NOT, IN WHOLE OR IN PART, BE USED TO MANUFACTURE ANYTHING, WHETHER OR NOT SHOWN HEREON, REPRODUCED OR DISCLOSED TO ANYONE WITHOUT DIRECT PERMISSION FROM HACH COMPANY.					
MATERIAL	UNLESS OTHERWISE SPECIFIED:	DRAWN	NAME	DATE	 HACH COMPANY 5600 LINDBERH DR. LOVELAND, CO. 80539
	DIMENSIONS ARE IN INCHES TOLERANCES: .X = ±.03 .XX = ±.01 .XXX = ±.005 ANGLES = ±.25°	ENGINEER			
		THIRD ANGLE PROJECTION	TITLE:		
		TRANSMITTAL, sc200			
		INTERPRET GEOMETRIC TOLERANCING PER: ANSI Y14.5M 1994			
DO NOT SCALE THIS SHEET	SIZE	DWG. NO.	REV		
	D	9015087	B		
	SCALE: 1:2	WEIGHT:	SHEET 1 OF 2		





For a document that prints with the correct measurements, choose PAGE SCALING: NONE in the print dialog.

NOTICE-HACH COMPANY CLAIMS PROPRIETARY RIGHTS IN THE INFORMATION DISCLOSED ON THE DRAWING. IT IS ISSUED IN CONFIDENCE FOR ENGINEERING INFORMATION ONLY AND MAY NOT, IN WHOLE OR IN PART, BE USED TO MANUFACTURE ANYTHING, WHETHER OR NOT SHOWN HEREON/REPRODUCED OR DISCLOSED TO ANYONE WITHOUT DIRECT PERMISSION FROM HACH COMPANY.	MATERIAL	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM] TOLERANCES: .X = ±.03 .XX = ±.01 .XXX = ±.005 ANGLES = ±.25°	DRAWN ENGINEER	NAME DATE	<div style="text-align: center;"> HACH COMPANY 5600 LINDBERGH DR. LOVELAND, CO. 80539 </div>
			THIRD ANGLE PROJECTION <div style="text-align: center;"> </div>		
INTERPRET GEOMETRIC TOLERANCING PER: ANSI Y14.5 1994		TITLE: <div style="text-align: center; font-size: 1.2em;"> Panel Cutout Template </div>		SIZE DWG. NO. A sc200SymetricPanelCutOut SCALE: 1:1 WEIGHT: SHEET 1 OF 1	

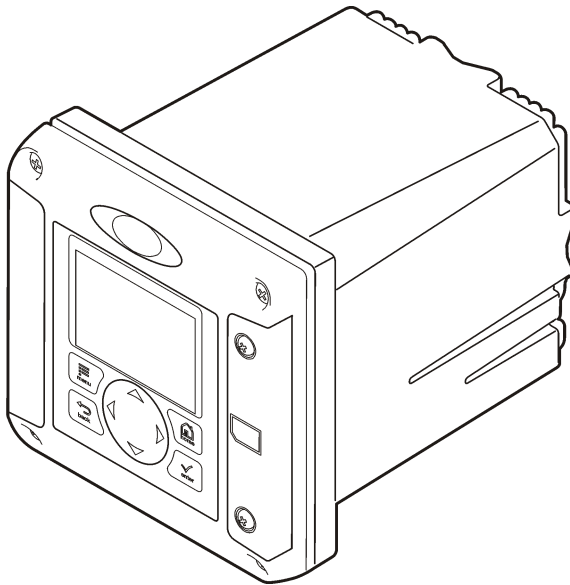


DOC023.53.80040

SC200 Controller

12/2019, Edition 10

User Manual



Section 1 Specifications	3
Section 2 General information	3
2.1 Safety information	4
2.1.1 Use of hazard information	4
2.1.2 Precautionary labels	4
2.1.3 Certification	5
2.2 Product overview	5
2.2.1 Sensors and sensor modules	6
2.2.2 Relays outputs and signals	6
2.2.3 Device scans	6
2.2.4 Controller enclosure	6
2.2.5 Controller mounting options	6
Section 3 Installation	7
3.1 Mounting components and dimensions	7
3.2 Controller mounting	8
3.3 High-voltage barrier	11
3.4 Electrostatic discharge (ESD) considerations	11
3.5 Wiring overview	12
3.6 Wiring for power	12
3.7 Alarms and relays	15
3.8 Wiring for relays	15
3.9 Analog output connections	17
3.10 Discrete input wiring connections	18
3.11 Connect a digital sc sensor	20
3.12 Connect the optional digital communication output	20
3.13 Install a Secure Digital (SD) memory card	20
Section 4 User interface and navigation	21
4.1 User interface	21
4.2 Display	22
4.2.1 Additional display formats	23
4.2.2 Graphical display	23
Section 5 System startup	24
5.1 Set the language, date and time for the first time	24
5.2 Controller configuration information	24
Section 6 Advanced operation	25
6.1 Security setup	25
6.1.1 Enable or disable the passcode	25
6.1.2 Edit the passcode	25
6.1.3 Protect features	26
6.2 Configure a 4-20 mA input module	26
6.3 Configure a 4-20 mA output module	27
6.4 Configure the controller analog outputs	27
6.4.1 Logarithmic output mode	29
6.4.2 Bilinear output mode	29
6.5 Configure relays	30

Table of Contents

6.6 Display setup	39
6.7 Update the date and time	40
6.8 Set the datalog mode and interval	40
6.9 Set up a calculation	40
6.10 Set up the discrete inputs	41
6.11 Update the display language	42
6.12 Using the secure digital memory (SD) card	42
6.12.1 Updating software	42
6.12.2 Saving data and event logs with SD cards	43
6.12.3 Access data and event log files on the SD card	43
6.12.4 Firmware updates with SD cards	44
6.12.5 Backup settings to an SD card	44
6.12.6 Restore settings to the controller	44
6.12.7 Transfer settings to another device	45
6.13 Using the service port	45
6.14 Using DataCom	45
Section 7 Maintenance	46
7.1 Cleaning the controller	46
7.2 Fuse replacement	46
7.3 Battery replacement	46
Section 8 Troubleshooting	46
8.1 Test and Maintenance menu	48
8.2 Warning and error conditions	49
Section 9 Device scan information	50
Section 10 Replacement parts and accessories	50

Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Component description	Microprocessor-controlled and menu-driven controller that operates the sensor and displays measured values.
Operating temperature	-20 to 60 °C (-4 to 140 °F); 95% relative humidity, non-condensing with sensor load <7 W; -20 to 50 °C (-4 to 104 °F) with sensor load <28 W
Storage temperature	-20 to 70 °C (-4 to 158 °F); 95% relative humidity, non-condensing
Enclosure ¹	NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish
Power requirements	<p>AC powered controller: 100-240 VAC ±10%, 50/60 Hz; Power 50 VA with 7 W sensor/network module load, 100 VA with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).</p> <p>24 VDC powered controller: 24 VDC—15%, + 20%; Power 15 W with 7 W sensor/network module load, 40 W with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).</p>
Altitude requirements	Standard 2000 m (6562 ft) ASL (Above Sea Level)
Pollution degree/Installation category	Pollution Degree 2; Installation Category II
Outputs	Two analog (0-20 mA or 4-20 mA) outputs. Each analog output can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values. Optional module supplies three additional analog outputs (5 total).
Relays	Four SPDT, user-configured contacts, rated 250 VAC, 5 Amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. Relays are designed for connection to AC Mains circuits (i.e., whenever the controller is operated with 115 - 240 VAC power) or DC circuits (i.e., whenever the controller is operated with 24 VDC power).
Dimensions	½ DIN—144 x 144 x 180.9 mm (5.7 x 5.7 x 7.12 in.)
Weight	1.7 kg (3.75 lb)
Compliance information ²	<p>CE approved (with all sensor types). Listed for use in general locations to UL and CSA safety standards by ETL (with all sensor types).</p> <p>Certain AC mains powered models are listed for use in general safety locations to UL and CSA safety standards by Underwriters Laboratories (with all sensor types).</p>
Digital communication	Optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection for data transmission
Data logging	Secure Digital Card (32 GB maximum) or special RS232 cable connector for data logging and performing software updates. The controller will keep approximately 20,000 data points per sensor.
Warranty	2 years

Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to

¹ Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.

² DC powered units are not listed by UL.

make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

▲ DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

▲ WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

▲ CAUTION





Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates that a risk of electrical shock and/or electrocution exists.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.

2.1.3 Certification

⚠ CAUTION

This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

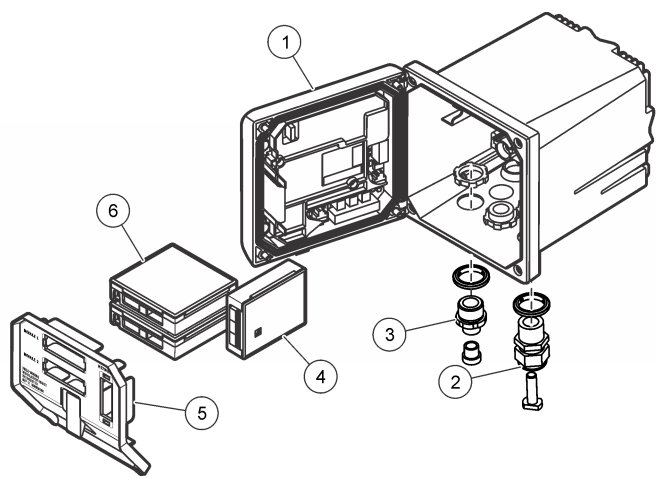
1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

2.2 Product overview

The controller displays sensor measurements and other data, can transmit analog and digital signals, and can interact with and control other devices through outputs and relays. Outputs, relays, sensors and sensor modules are configured and calibrated through the user interface on the front of the controller.

Figure 1 shows the product components. Components may vary according to controller configuration. Contact the manufacturer if parts are damaged or missing.

Figure 1 System components



1 Controller	4 Network module (optional)
2 Strain relief assembly (optional depending on controller version)	5 High-voltage barrier
3 Digital connection fitting (optional depending on controller version)	6 Sensor modules (optional)

2.2.1 Sensors and sensor modules

The controller accepts up to a maximum of two sensor modules or two digital sensors (depending on the controller configuration), along with one communication module. A single digital sensor and a single sensor module can be installed in combination. A variety of sensors can be wired to the sensor modules. Sensor wiring information is given in the specific sensor manuals and in the user instructions for specific modules.

2.2.2 Relays outputs and signals

The controller has four configurable relay switches and two analog outputs. An optional analog output module can increase the number of analog outputs to five.

2.2.3 Device scans

With two exceptions, the controller automatically scans for connected devices without user input when it is powered on. The first exception is when the controller is powered on for the first time before initial use. The second exception is after the controller configuration settings have been set to their default values and the controller is powered on. In both cases, the controller first displays the language, date and time edit screens. After the language, date and time entries are accepted, the controller performs a device scan. Refer to [Connect a digital sc sensor](#) on page 20 for instructions about how to scan for devices when the controller is already powered on.

2.2.4 Controller enclosure

The controller enclosure is NEMA 4X/IP66-rated and has a corrosion-resistant finish designed to withstand corrosive environmental constituents such as salt spray and hydrogen sulfide. Protection against environmental damage is strongly recommended for outdoor use.

Note: Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.

2.2.5 Controller mounting options

The controller can be mounted to a panel, to a wall or to a vertical or horizontal pipe. A neoprene sealing gasket is included and can be used to reduce vibration. The gasket can be used as a template for panel mounting before the inner gasket component is separated.

Section 3 Installation

3.1 Mounting components and dimensions

⚠ CAUTION

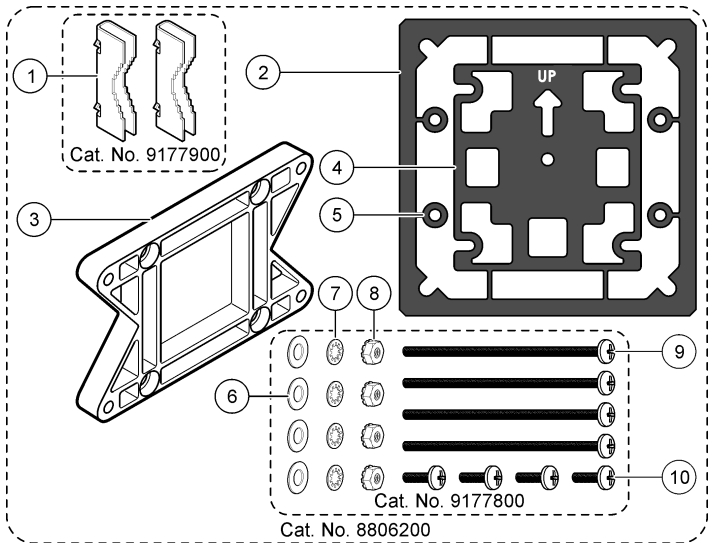
Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

The controller can be installed on a surface, panel or pipe (horizontal or vertical). For mounting options and instructions, refer to [Figure 2](#), [Figure 3](#) on page 8, [Figure 4](#) on page 9, [Figure 5](#) on page 10 and [Figure 6](#) on page 11.

For horizontal pipe mounts, the mounting feet ([Figure 2](#)) must be attached to the mounting bracket in a vertical position.

For both horizontal and vertical pipe mounts, attach the mounting bracket to the controller as shown in [Figure 5](#) on page 10.

Figure 2 Mounting components



1 Mounting foot (2x)	6 Flat washer, ¼-inch ID (4x)
2 Sealing gasket for panel mount, Neoprene	7 Lock washer, ¼-inch ID (4x)
3 Bracket for wall and pipe mounting	8 M5 x 0.8 Keps hexnut (4x)
4 Vibration isolation gasket for pipe mount	9 Pan head screws, M5 x 0.8 x 100mm (4x) (Used for variable diameter pipe mount installations)
5 Vibration isolation washer for pipe mount (4x)	10 Pan head screws, M5 x 0.8 x 15 mm (4x)

Note: A bracket for panel mounting is available as an optional accessory.

3.2 Controller mounting

Figure 3 Surface mounting dimensions

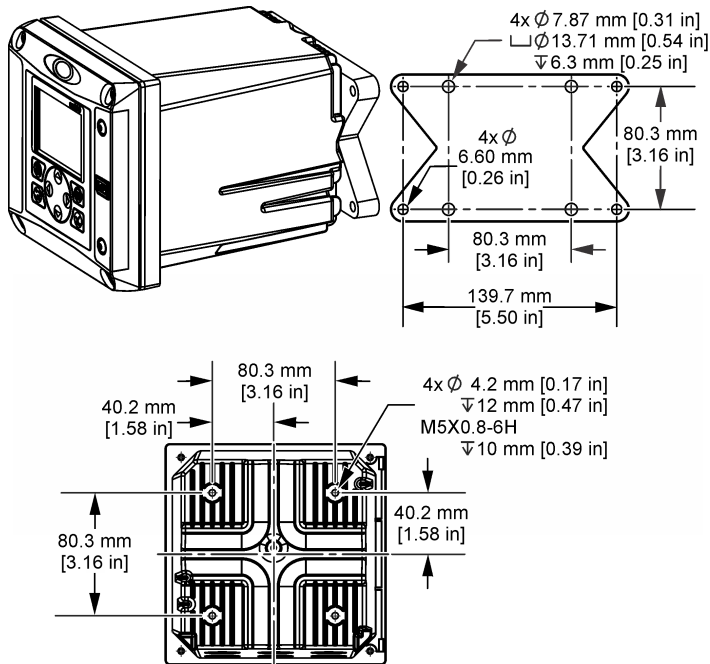
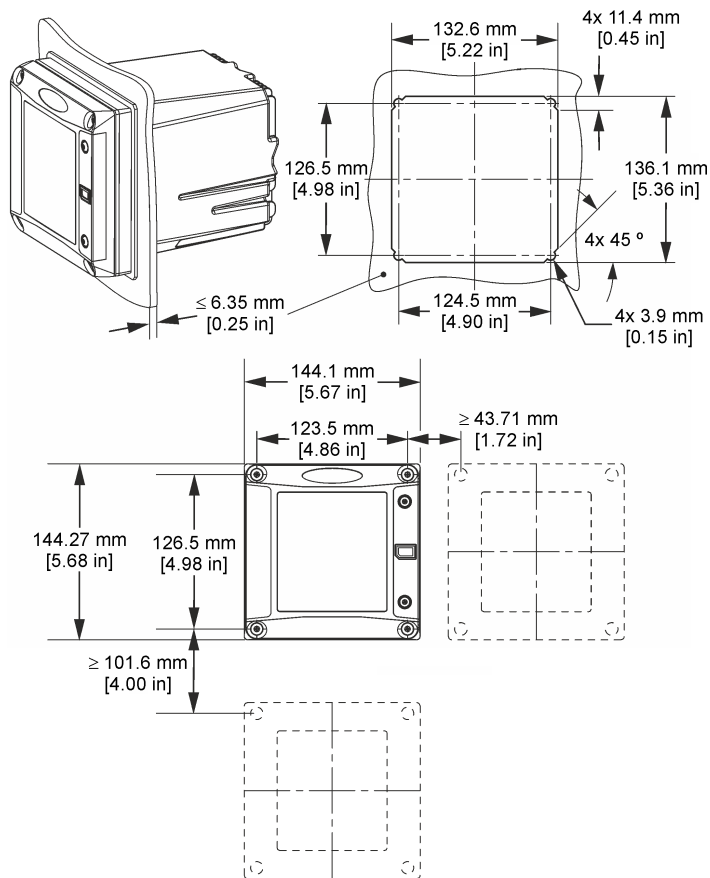


Figure 4 Panel mounting dimensions



Note: If using the bracket (optional) for panel mounting, push the controller through the hole in the panel and then slide the bracket over the controller on the back side of the panel. Use the four 15 mm pan head screws (supplied) to attach the bracket to the controller and secure the controller to the panel.

Figure 5 Pipe mounting (vertical pipe)

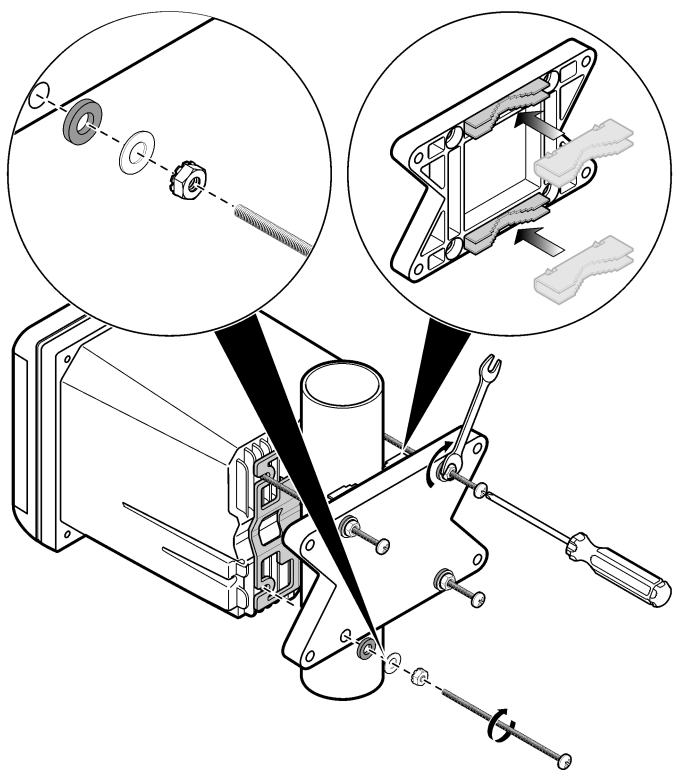
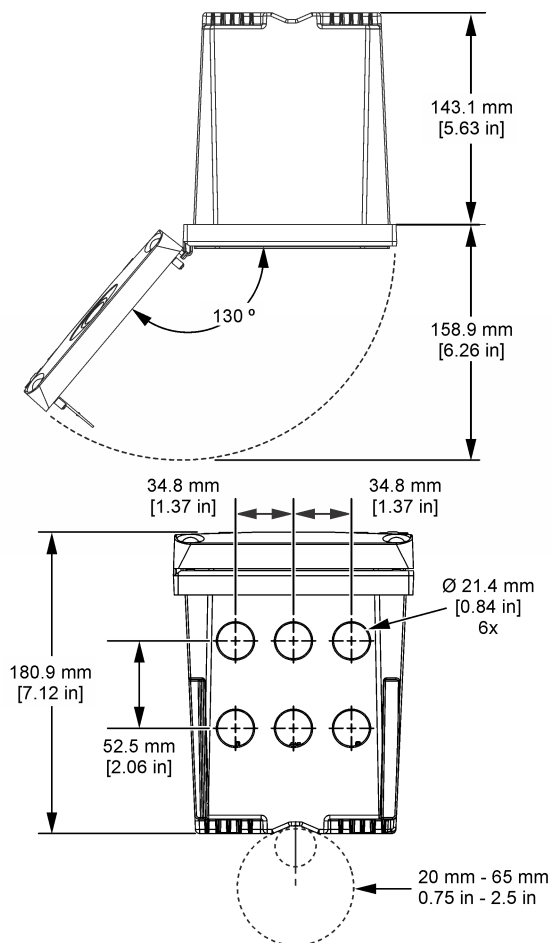


Figure 6 Top and bottom views



3.3 High-voltage barrier

High-voltage wiring for the controller is located behind the high-voltage barrier in the controller enclosure. The barrier must remain in place except when installing modules or when a qualified installation technician is wiring for power, alarms, outputs or relays. Do not remove the barrier while power is applied to the controller.

3.4 Electrostatic discharge (ESD) considerations

NOTICE



Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.

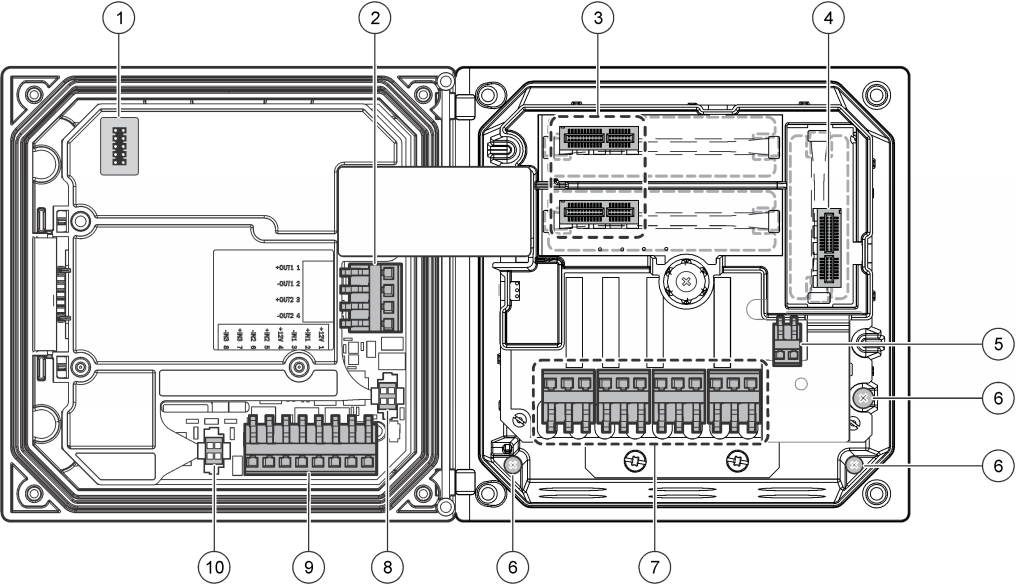
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

3.5 Wiring overview

Figure 7 shows an overview of the wiring connections inside the controller with the high voltage barrier removed. The left side of the figure shows the back side of the controller cover.

Note: Remove connector caps from the connectors before module installation.

Figure 7 Wiring connections overview



1 Service cable connection	5 AC and DC power connector ³	9 Discrete input wiring connector ³
2 4-20 mA output ³	6 Ground terminals	10 Digital sensor connector ³
3 Sensor module connector	7 Relay connections ³	
4 Communication module connector (e.g., Modbus, Profibus, HART, optional 4-20 mA module, etc.)	8 Digital sensor connector ³	

3.6 Wiring for power

⚠ WARNING
 Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

³ Terminals can be removed for improved access.

⚠ WARNING



Potential Electrocution Hazard. If this equipment is used outdoors or in potentially wet locations, a **Ground Fault Interrupt** device must be used for connecting the equipment to its mains power source.

⚠ DANGER



Electrocution Hazard. Do not connect AC power to a 24 VDC powered model.

⚠ WARNING



Potential Electrocution Hazard. A protective earth (PE) ground connection is required for both 100-240 VAC and 24 VDC wiring applications. Failure to connect a good PE ground connection can result in shock hazards and poor performance due to electromagnetic interferences. ALWAYS connect a good PE ground to the controller terminal.

NOTICE

Install the device in a location and position that gives easy access to the disconnect device and its operation.

The controller can be purchased as either a 100-240 VAC powered model or a 24 VDC powered model. Follow the appropriate wiring instructions for the purchased model.

The controller can be wired for line power by hard-wiring in conduit or wiring to a power cord. Regardless of the wire used, the connections are made at the same terminals. A local disconnect designed to meet local electrical code is required and must be identified for all types of installation. In hard-wired applications, the power and safety ground service drops for the instrument must be 0.82 to 1.31 mm² (18 to 16 AWG). Make sure that the field wiring insulation is rated 80 °C (176 °F) minimum.

Notes:

- The voltage barrier must be removed before making any electrical connections. After making all connections, replace the voltage barrier before closing the controller cover.
- A sealing type strain relief and a power cord less than 3 meters (10 feet) in length with three 18-gauge conductors (including a safety ground wire) can be used to maintain the NEMA 4X/IP66 environmental rating.
- Controllers can be ordered with AC power cords pre-installed. Additional power cords may also be ordered.
- The DC power source that supplies power to the 24 VDC powered controller must maintain voltage regulation within the specified 24 VDC-15% +20% voltage limits. The DC power source must also provide adequate protection against surges and line transients.

Wiring procedure

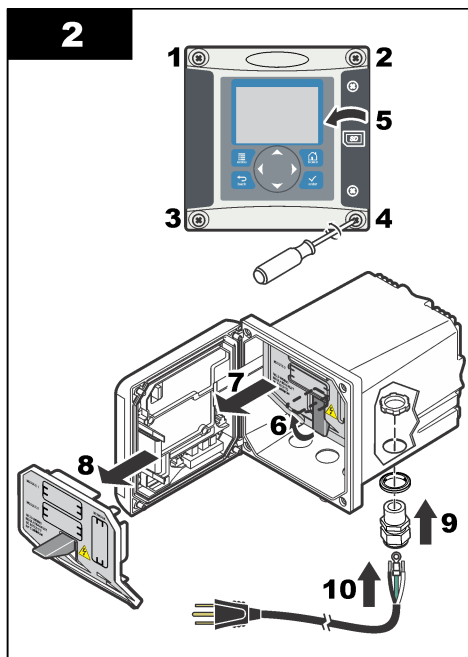
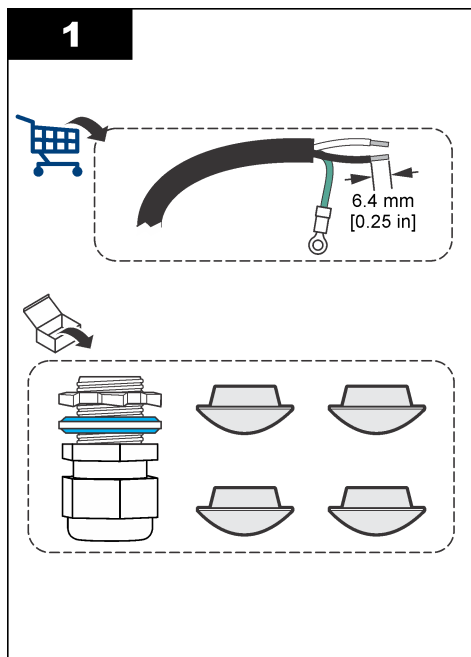
Refer to the illustrated steps that follow and [Table 1](#) or [Table 2](#) to wire the controller for power. Insert each wire into the appropriate terminal until the insulation is seated against the connector with no bare wire exposed. Tug gently after insertion to make sure that there is a secure connection. Seal any unused openings in the controller box with conduit opening sealing plugs.

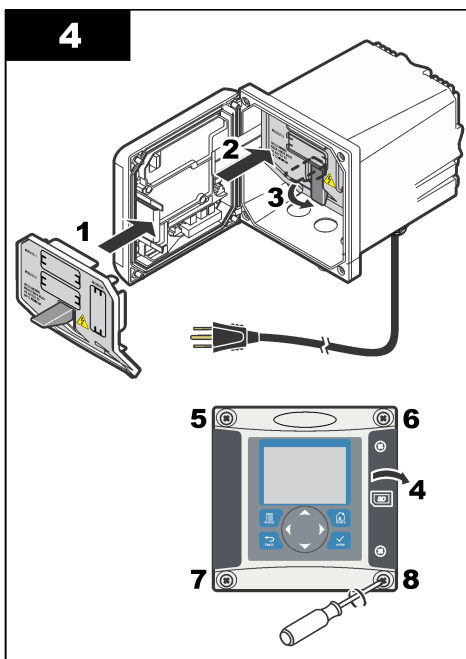
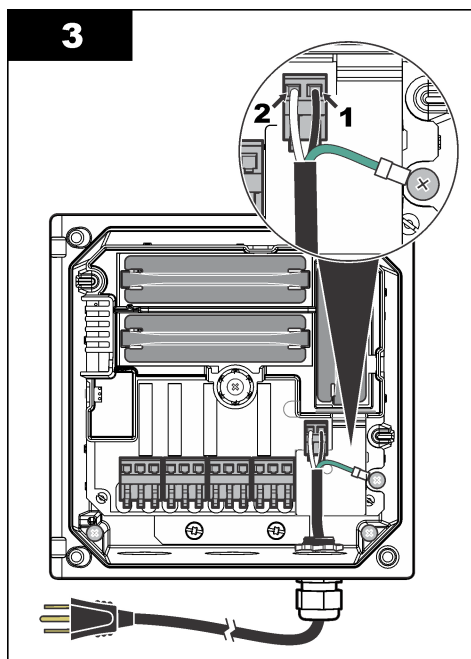
Table 1 AC power wiring information (AC powered models only)

Terminal	Description	Color—North America	Color—EU
1	Hot (L1)	Black	Brown
2	Neutral (N)	White	Blue
—	Protective Earth (PE) Ground lug	Green	Green with yellow stripe

Table 2 DC power wiring information (DC powered models only)

Terminal	Description	Color—North America	Color—EU
1	+24 VDC	Red	Red
2	24 VDC return	Black	Black
—	Protective Earth (PE) Ground lug	Green	Green with yellow stripe





3.7 Alarms and relays

The controller is equipped with four unpowered, single pole relays rated 100-250 VAC, 50/60 Hz, 5 amp resistive maximum. Contacts are rated 250 VAC, 5 amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. The relays are not rated for inductive loads.

3.8 Wiring for relays

⚠ WARNING



Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING



Potential fire hazard. The relay contacts are rated 5A and are not fused. External loads connected to the relays must have current limiting devices provided to limit current to < 5 A.

⚠ WARNING



Potential fire hazard. Do not daisy-chain the common relay connections or jumper wire from the mains power connection inside the instrument.

⚠ WARNING



Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

AC line (100—250 V) powered controllers

⚠ WARNING



Potential electrocution hazard. AC mains powered controllers (115 V–230 V) are designed for relay connections to AC mains circuits (i.e., voltages greater than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

The wiring compartment is not designed for voltage connections in excess of 250 VAC.

24 VDC powered controllers

⚠ WARNING



Potential electrocution hazard. 24 V powered controllers are designed for relay connections to low voltage circuits (i.e., voltages less than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

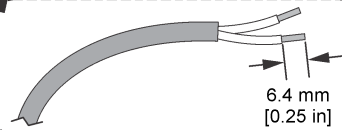
The 24 VDC controller relays are designed for the connection to low voltage circuits (i.e., voltages less than 30 V-RMS, 42.2 V-PEAK or 60 VDC). The wiring compartment is not designed for voltage connections above these levels.

The relay connector accepts 0.82 to 1.31 mm² (18 to 16 AWG) wire (as determined by load application). Wire gauge less than 18 AWG is not recommended. Make sure that the field wiring insulation is rated 80 °C (176 °F) minimum.

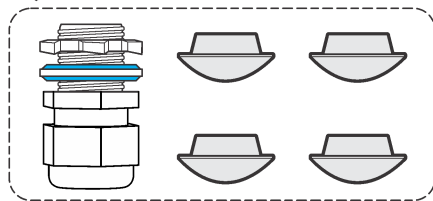
The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes) or when power is removed from the controller.

Most relay connections use either the NO and COM terminals or the NC and COM terminals. The numbered installation steps show connection to the NO and COM terminals.

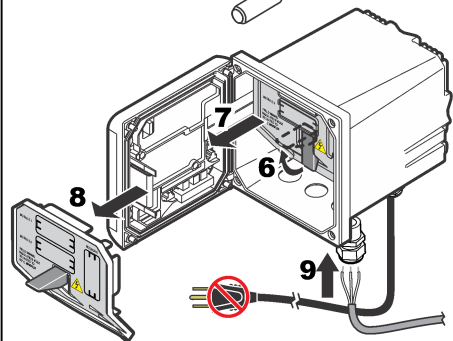
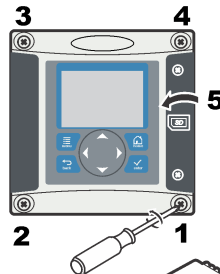
1

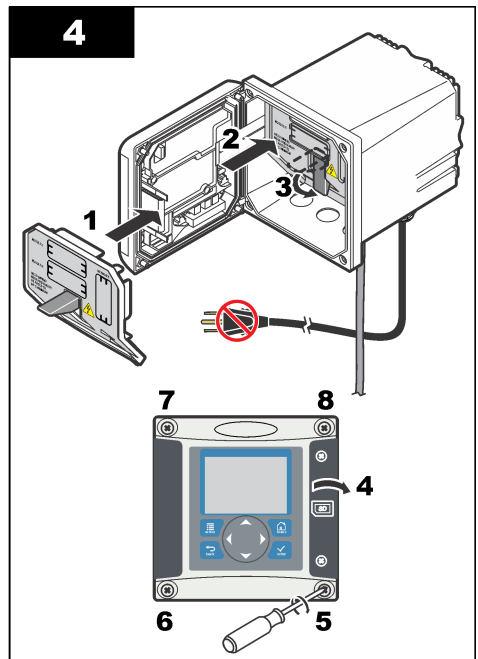
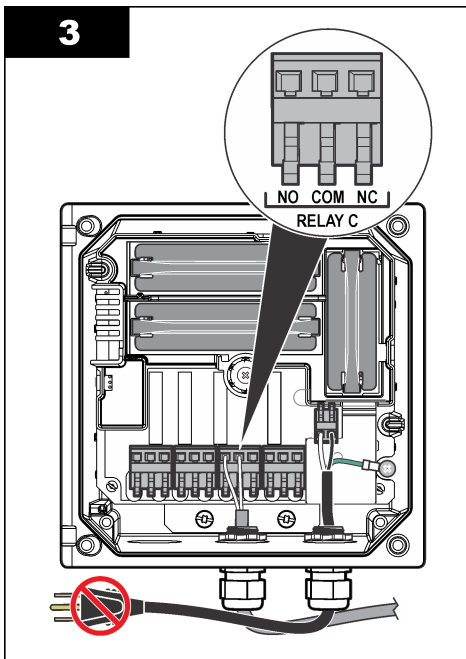


6.4 mm
[0.25 in]



2





3.9 Analog output connections

⚠ WARNING

Potential Electrocutation Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING

Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

Two isolated analog outputs (1 and 2) are provided (Figure 8). Such outputs are commonly used for analog signaling or to control other external devices.

Make wiring connections to the controller as shown in Figure 8 and Table 3.

Note: Figure 8 shows the back of the controller cover and not the inside of the main controller compartment.

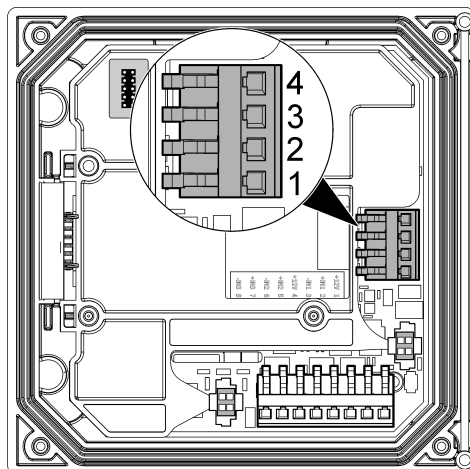
Table 3 Output connections

Recorder wires	Circuit board position
Output 2–	4
Output 2+	3
Output 1–	2
Output 1+	1

1. Open the controller cover.
2. Feed the wires through the strain relief.
3. Adjust the wire as necessary and tighten the strain relief.

4. Make connections with twisted-pair shielded wire and connect the shield at the controlled component end or at the control loop end.
 - Do not connect the shield at both ends of the cable.
 - Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed.
 - Maximum loop resistance is 500 ohm.
5. Close the controller cover and tighten the cover screws.
6. Configure outputs in the controller.

Figure 8 Analog output connections



3.10 Discrete input wiring connections

⚠ WARNING



Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

⚠ WARNING



Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

Three discrete inputs are provided for switch closure inputs or logic level voltage inputs. Make wiring connections and configure jumper settings to the controller as shown in [Figure 9](#), [Table 4](#) and [Figure 10](#).

Note: [Figure 9](#) shows the back of the controller cover and not the inside of the main controller compartment.

Figure 9 Discrete input wiring connections

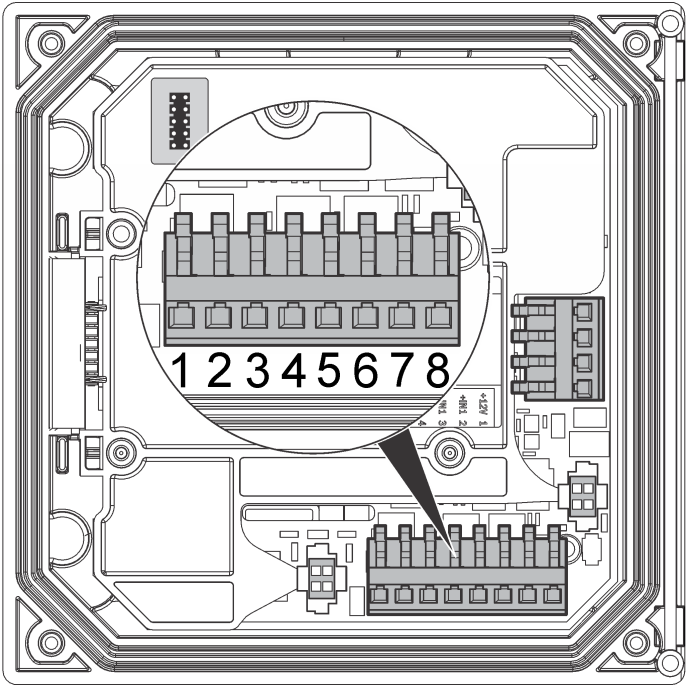
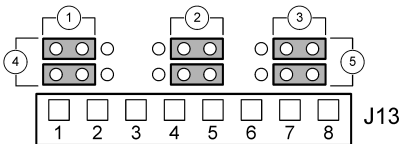


Table 4 Input connections

Discrete inputs	Connector position - Switch input	Connector position - Voltage input
Input 1+	3	2
Input 1-	2	3
Input 2+	6	5
Input 2-	5	6
Input 3+	8	7
Input 3-	7	8

Figure 10 Jumper settings



1 Input 1 configuration jumpers	4 Jumpers positioned to the left for switch inputs
2 Input 2 configuration jumpers	5 Jumpers positioned to the right for voltage inputs
3 Input 3 configuration jumpers	

1. Open the controller cover.
2. Feed the wires through the cable gland.
3. Adjust the wire as necessary and tighten the cable gland.
4. The jumpers are positioned immediately behind the connector. Remove the connector for improved access to the jumpers and configure the jumper settings according to the type of input as shown in [Figure 10](#).
5. Close the controller cover and tighten the cover screws.
6. Configure inputs in the controller.

Note: In **switch input** mode the controller supplies 12 volts to the switch and is not isolated from the controller. In **voltage input** mode the inputs are isolated from the controller (user input voltage from 0 to 30 volts).

3.11 Connect a digital sc sensor

Note: To connect an analog sensor, refer to the instructions supplied in the module or sensor manual.

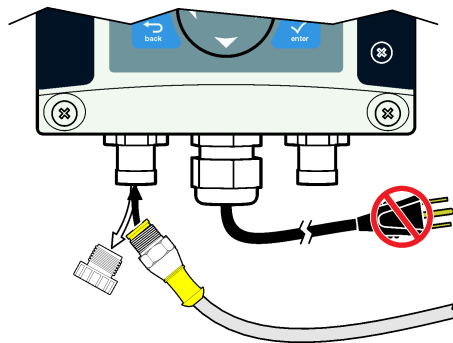
A digital sc sensor can be connected to the controller using the keyed quick-connect fitting ([Figure 11](#)). A digital sensor can be connected with the controller powered on or off.

When a sensor is connected with the controller powered on, the controller does not automatically perform a device scan. To make the controller perform a device scan, navigate to the Test/Maintenance menu and select Scan Devices. If a new device is found, the controller performs the installation process without further user action.

When a sensor is connected with the controller powered off, the controller will perform a device scan when it is powered on again. If a new device is found, the controller performs the installation process without further user action.

Retain the connector cap to seal the connector opening in case the sensor must be removed.

Figure 11 Digital sensor quick connect



3.12 Connect the optional digital communication output

The manufacturer supports Modbus RS485, Modbus RS232, Profibus DPV1 and HART communication protocols. The optional digital output module is installed in the location indicated by item 4 in [Figure 7](#) on page 12. Refer to the instructions supplied with the network module for more details.

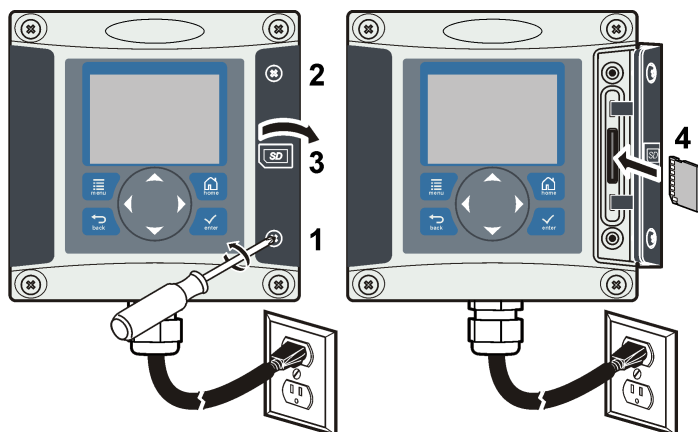
For information about Modbus registers, go to <http://www.de.hach.com> or <http://www.hach.com> and search *Modbus registers* or go to any sc200 product page.

3.13 Install a Secure Digital (SD) memory card

For instructions on how to install an SD card in the controller, refer to [Figure 12](#). Information on how to use the SD memory card can be found in [Using the secure digital memory \(SD\) card](#) on page 42.

To remove an SD card, push down on the edge of the card and release, then pull the card up and out of the slot. After the card is removed, close the slot cover and tighten the cover screws.

Figure 12 SD card installation

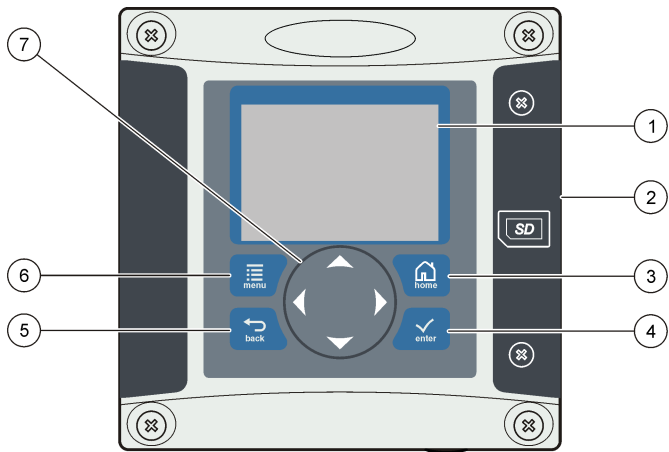


Section 4 User interface and navigation

4.1 User interface

The keypad has four menu keys and four directional keys as shown in [Figure 13](#).

Figure 13 Keypad and front panel overview



1 Instrument display	5 BACK key. Moves back one level in the menu structure.
2 Cover for secure digital memory card slot	6 MENU key. Moves to the Settings Menu from other screens and submenus.
3 HOME key. Moves to the Main Measurement screen from other screens and submenus.	7 Directional keys. Used to navigate through the menus, change settings, and increment or decrement digits.
4 ENTER key. Accepts input values, updates, or displayed menu options.	

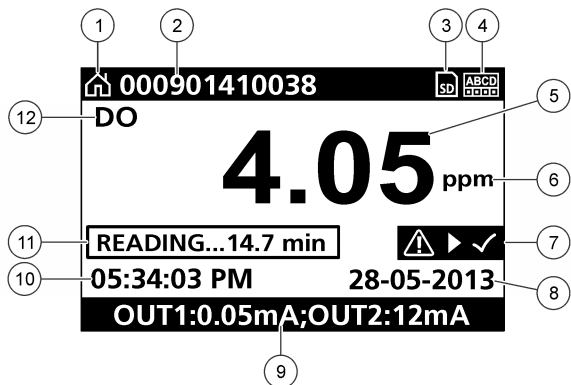
Inputs and outputs are set up and configured through the front panel using the keypad and display screen. This user interface is used to set up and configure inputs and outputs, create log information and calculated values, and calibrate sensors. The SD interface can be used to save logs and update software.

4.2 Display

Figure 14 shows an example of the main measurement screen with a DO sensor connected to the controller.

The front panel display screen shows sensor measurement data, calibration and configuration settings, errors, warnings and other information.

Figure 14 Example of Main Measurement screen



1 Home screen icon	7 Warning status bar
2 Sensor name	8 Date
3 SD Memory card icon	9 Analog output values
4 Relay status indicator	10 Time
5 Measurement value	11 Progress bar
6 Measurement unit	12 Measurement parameter

Table 5 Icon descriptions

Icon	Description
Home screen	The icon may vary depending on the screen or menu being displayed. For example, if an SD card is installed, an SD card icon appears here when the user is in the SD Card Setup menu.
SD memory card	This icon appears only if an SD card is in the reader slot. When a user is in the SD Card Setup menu, this icon appears in the upper left corner.
Warning	A warning icon consists of an exclamation point within a triangle. Warning icons appear on the right of the main display below the measurement value. Push the ENTER key then select the device to view any problems associated with that device. The warning icon will no longer be displayed once all problems have been corrected or acknowledged.
Error	An error icon consists of an exclamation point within a circle. When an error occurs, the error icon and the measurement screen flash alternately in the main display. To view errors, push the MENU key and select Diagnostics . Then select the device to view any problems associated with that device.

4.2.1 Additional display formats

- From the Main Measurement screen push the **UP** and **DOWN** arrow keys to switch between measurement parameters
- From the Main Measurement screen push the **RIGHT** arrow key to switch to a split display of up to 4 measurement parameters. Push the **RIGHT** arrow key to include additional measurements. Push the **LEFT** arrow key as needed to return to the Main Measurement screen
- From the Main Measurement screen push the **LEFT** arrow key to switch to the graphical display (see [Graphical display](#) on page 23 to define the parameters). Push the **UP** and **DOWN** arrow keys to switch measurement graphs

4.2.2 Graphical display

The graph shows concentration and temperature measurements for each channel in use. The graph supplies easy monitoring of trends and shows changes in the process.

1. From the graphical display screen use the up and down arrow keys to select a graph and push the **HOME** key.
2. Select an option:

Option	Description
MEASUREMENT VALUE	Set the measurement value for the selected channel. Select between Auto Scale and Manually Scale. For manual scaling enter the minimum and maximum measurement values
DATE & TIME RANGE	Select the date and time range from the available options

Section 5 System startup

When initially powered up, the Language, Date Format and Date/Time screens appear in order. After these options are set, the controller performs a device scan and displays the message **Scanning for devices. Please wait...** If a new device is found, the controller performs an installation process before displaying a main measurement screen.

If the scan finds previously installed devices without configuration changes, the main measurement screen of the device in the number one position appears immediately after the scan is complete.

If a device has been removed from the controller or is not found during the next power-cycled or menu-driven scan, the controller displays a **Device missing** message and prompts to delete the missing device.

If no sensor is connected to an installed analog module, the controller will indicate an error. If devices are connected but not found by the controller, refer to [Troubleshooting](#) on page 46.

5.1 Set the language, date and time for the first time

The controller displays the language, date and time edit screens when the controller is powered on for the first time, and when it is powered on after the configuration settings have been set to their default values.

After the language, date and time options are set for the first time, update the options as necessary through the sc200 setup menu.

1. In the Language screen, highlight a language in the options list and push the **ENTER** key. English is the default language for the controller.
The selected language is saved. The Date Format screen appears.
2. In the Date Format screen, highlight a format and push the **ENTER** key.
The date and time format is saved. Next, the Date /Time screen appears.
3. In the Date/Time screen, push the **RIGHT** or **LEFT** arrow keys to highlight a field, then push the **UP** and **DOWN** arrow keys to update the value in the field. Update the other fields as necessary.
4. Push the **ENTER** key.
The changes are saved and the controller performs a start-up scan for devices. If connected devices are found, the controller displays the main measurement screen for the device in the number one position. If the controller fails to find connected devices, refer to [Troubleshooting](#) on page 46.

5.2 Controller configuration information

General information about configuration options is listed in the table.

1. To navigate to the menu options, from the Settings Menu, select sc200 Setup.

Option	Description
Security setup	Sets the passcode preferences (refer to Security setup on page 25)
Output setup	Configures the controller analog outputs (refer to Configure the controller analog outputs on page 27)

Option	Description
Relay setup	Configures the controller relays (refer to Configure relays on page 30)
Display setup	Configures the controller display (refer to Display setup on page 39)
Set Date/Time	Sets the controller time and date (refer to Update the date and time on page 40)
Datalog setup	Configures data logging options. Available only if Calculation has been setup. At least one sensor must be attached to enter a calculation (refer to Set the datalog mode and interval on page 40)
Manage Data	Select the device from the list of installed components to view the data or event log
Error Hold Mode	<p>Hold Outputs—Holds outputs at last known value when controller loses communication with the sensor.</p> <p>Transfer Outputs—Switches to transfer mode when controller loses communication with the sensor. Outputs transfer to a pre-defined value.</p>
Calculation	Configures the controller math function (refer to Set up a calculation on page 40)
sc200 Information	<p>S/W VER:—Displays the current version of controller software</p> <p>Bootloader VER:—Displays the current Bootloader version. The Bootloader is a file that loads the main operating system for the controller</p> <p>S/N:—Displays the controller serial number</p> <p>Version:—Displays the current version of controller hardware</p>
Discrete Input Setup	Configures three discrete input channels (refer to Set up the discrete inputs on page 41)
Language	Assigns the language used in the controller (refer to Update the display language on page 42)

2. Select an option and push **ENTER** to activate the menu item.

Section 6 Advanced operation

6.1 Security setup

6.1.1 Enable or disable the passcode

By default the passcode option is disabled and all configuration settings and calibrations can be changed. When the passcode function is enabled, access to Sensor calibration and Test/Maint menus requires a passcode.

To enable the passcode:

1. From the Settings Menu, select sc200 Setup and push the **ENTER** key.
2. Select Security Setup and push the **ENTER** key.
3. Select Set Passcode and push the **ENTER** key.
4. Select Disabled or Enabled and push the **ENTER** key.
The passcode is enabled.
5. Push the **BACK** key to return to the sc200 Setup Menu, or push the **MENU** key to return to the Settings Menu.

6.1.2 Edit the passcode

The passcode is factory set to SC200. The Edit Passcode menu option appears in the Security Setup menu only after the passcode feature is enabled and a valid passcode has been entered.

A passcode consists of up to six upper or lower-case alpha, numeric and special characters. Passcodes are case-sensitive.

To edit the passcode:

1. Make sure the passcode is enabled. Refer to [Enable or disable the passcode](#) on page 25 for information on how to enable the passcode.
2. From the Settings menu, select Security Setup and push **ENTER**.
3. Use the arrow keys to enter the current valid passcode and push **ENTER**.
The Edit Passcode option appears in the Security Setup menu.
4. Select Edit Pass Code and push **ENTER**.
The Edit Pass Code screen appears.
5. Use the arrow keys to edit the passcode and push **ENTER**.
The new passcode is saved and the Security Setup menu appears.
Note: All menus stay accessible until the **HOME** key is pushed or the controller is restarted.
6. Push the **HOME** key or perform a controller restart.
The new passcode settings are saved, and the new passcode is required to enter the Security Setup, Datalog Setup and Test/Maint menus.

6.1.3 Protect features

This option is only displayed if an analyzer or sensor that supports this feature is connected to the controller. Security categories are displayed that are defined by the connected analyzer or sensor. The user can then enable or disable password protection against individual menu options within these categories.

6.2 Configure a 4-20 mA input module

An analog module must be installed in the controller.

1. Determine what output the connected device is using (0-20 mA or 4-20 mA). This information will be used to set the scale.
2. Determine what the 20 mA value is equal to (e.g., 100 psi).
3. Determine what the low end (0 or 4 mA) value is equal to (e.g., 10 psi). This information will be used to set the display range.
4. From the Settings Menu, select Sensor Setup.
5. Select Configure.
6. Update the options.
 - a. Highlight an option and push **ENTER**.
 - b. Make a selection or update the entries.
 - c. Push **ENTER** to save the changes.

Option	Description
Edit name	Edits the module name
Edit units	Edits the measurement units
Edit parameter	Edits the parameter name
Display range	Sets the values used for the selected scale (0-20 mA or 4-20 mA)
For the 0-20 mA scale:	
• Set the 20 mA value	
• Set the 0 mA value	
For the 4-20 mA scale:	
• Set the 20 mA value	
• Set the 4 mA value	

Option	Description
Signal average	Sets how often signals are averaged. Higher values produce a smoother signal but increase the time it takes for a signal to respond to a change in the process value.
Set resolution— X.XXX, XX.XX, XXX.X, XXXX	Sets the number of decimal places used in the display.
Select scale— 4-20 mA or 0-20 mA	Sets scale used for the 4-20 mA input
Data log interval—5 sec, 30 sec, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min, 60 min	Sets how often data is logged to the internal controller memory.
Reset defaults—Push ENTER to reset configuration settings or push the BACK key to cancel.	Resets configuration settings to the default values.

For additional information, refer to the *sc200 4–20 Analog Input Module User Manual*.

6.3 Configure a 4-20 mA output module

The Network Setup option appears in the Settings Menu only if an analog output module or other network module such as Modbus or Profibus is installed in the controller.

Outputs for analog output modules are set at 4-20 mA. Outputs can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values.

1. From the Settings menu, select Network Setup.
2. Select Edit Name and enter a name for the module. Push **ENTER** to save the name.
3. Select an output (A, B, C, D) and push **ENTER**.
 - a. Highlight an option and push **ENTER**.
 - b. Make a selection from the list or update the entries.
 - c. Push **ENTER** to save the changes.

Option	Description
Select Source	Selects the output to configure—None, sensor 1 name, sensor 2 name, calculation (if set up). For sensor output, Select Parameter sets the measurement options. When the measurement is autorange, Set Range sets the range.
Set Low Value	Sets the 4 mA value (default: 0.000). (Range and units depend on sensor)
Set High Value	Sets the 20 mA value (default: 1.000). (Range and units depend on sensor)
Set Transfer	Sets the transfer value. Range 3.0 to 25.0 mA (default 4.000).
Set Filter	Sets a time-average filter value of 0 (default) to 120 seconds.

For additional information, refer to the *sc200 4-20 Output Module User Manual*.

6.4 Configure the controller analog outputs

The controller analog outputs can be assigned to represent the measured parameter or secondary measurements such as temperature and calculations. To configure the options, highlight a menu option, push **ENTER** and select an option or update the entries. Push **ENTER** after an option is selected or the entries are updated.

1. From the Settings menu, select sc200 Setup.
2. Select Output Setup.
3. Select Output 1 or Output 2.

4. Choose Select Source and select a source from the list. Typically the source is one of the sensors attached to the system. If an analog input card is installed, the analog input may be used as a source.
5. From the Output Setup menu, choose Select Parameter and choose an option from the list. Parameters will vary depending on the type of sensors installed.
6. From the Output Setup menu, select Set Function and choose a function. Further setup options will vary depending on which function is chosen.

Option	Description
Linear	Signal is linearly dependent on the process value
PID	Signal works as a PID (Proportional, Integral, Derivative) controller
Logarithmic	Signal is represented logarithmically within the process variable range
Bilinear	Signal is represented as two linear segments within the process variable range

7. From the Output Setup menu, select Activation. Use the information in the table below the chosen function to configure the options.
8. If Transfer is or will be selected as the Error Hold Mode, or if the Transfer will be used during calibration or other functions within the sensor menu, select Set Transfer from the Output Setup menu and enter the transfer value.
9. From the Output Setup menu, select Set Filter and enter the filter value.
10. From the Output Setup menu, select Scale and choose the scale (0-20 mA or 4-20 mA).

- **Linear**

Option	Description
Set low value	Sets the low endpoint of the process variable range
Set high value	Sets the high endpoint of the process variable range

- **PID**

Option	Description
Set mode (Auto or Manual)	Auto—the signal is automatically controlled by the algorithm within the analyzer using proportional, integral, and derivative inputs. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase (Direct or Reverse)	The direction in which the signal responds to process change. Direct—signal increases as the process increases. Reverse—signal increases as process decreases.
Set setpoint	Creates a desired control point of process
Prop band	A function of the difference between the measured signal and the desired setpoint.
Integral	The period of time from the injection point of a reagent to contact with the measuring device.
Derivative	Used to compensate for the 2 nd order effects of the process. The majority of applications can be controlled without the use of the derivative setting.
Transit time	Stops all PID control for a selected period of time as the sample travels from the control pump to the measurement sensor.

• **Logarithmic**

Option	Description
Set 50% value	Sets the value corresponding to 50% of the process variable range.
Set high value	Sets the upper value of the process variable range.

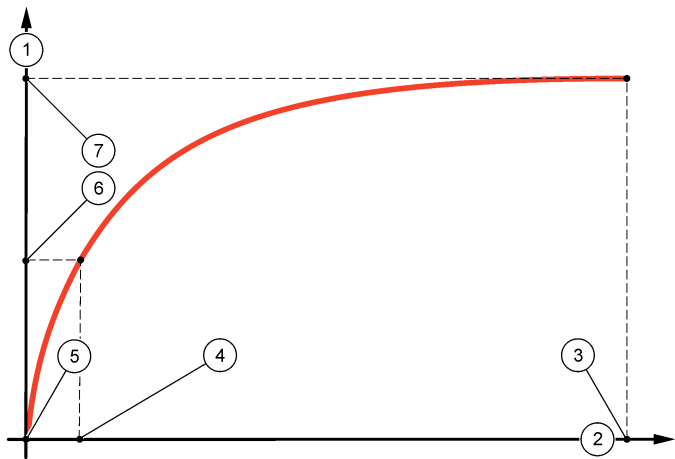
• **Bilinear**

Option	Description
Set low value	Sets the low endpoint value of the process variable range.
Set high value	Sets the high endpoint value of the process variable range.
Set knee point value	Sets the value at which the process variable range divides into another linear segment.
Set knee point current	Sets the value of the current at the knee point value.

6.4.1 Logarithmic output mode

Figure 15 shows in graph form the operation of the logarithmic output mode.

Figure 15 Logarithmic output

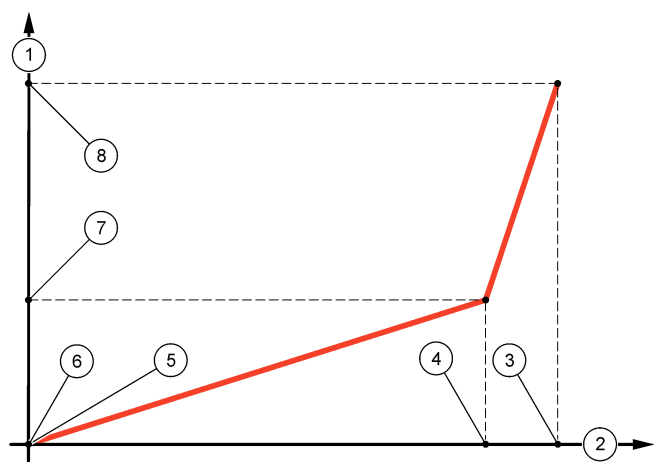


1 Output current axis	5 Minimum output current (0-4 mA)
2 Source value axis	6 50% output current
3 High value	7 Maximum output current (20 mA)
4 50% value	

6.4.2 Bilinear output mode

Figure 16 shows in graph form the operation of the bilinear output mode.

Figure 16 Bilinear output



1 Output current axis	5 Low value
2 Source value axis	6 Minimum output current (0-4 mA)
3 High value	7 Knee point current
4 Knee point value	8 Maximum output current (20 mA)

6.5 Configure relays

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes), or when power is removed from the controller. To select a menu option, highlight the option and push **ENTER**.

1. From the sc200 Setup menu, select Relay Setup.
2. Select a relay from the list.
3. From the Relay Setup menu, choose Select Source and push **ENTER**. Normally, a source is one of the sensors attached to the system, but the controller can also function as a source. If an analog input module is installed, the source may be the analog input.
4. From the Relay Setup menu, select Set Parameter and choose from the list of parameters. The list of parameter options will vary with the type of attached sensor.
5. From the Relay Setup menu, select Set Function and choose from the list. Further setup will depend on the function chosen.

Option	Description
Scheduler Function (available if the controller is selected as the relay source)	Relay switches at certain times independently of any process value
Alarm Function	Relay activates when upper or lower alarm value is exceeded
Feeder Control Function	Relay indicates if a process value exceeds or falls below a setpoint
Event Control Function	Relay toggles if a process value reaches an upper or lower limit
Pulse Width Modulation (PWM) Control Function	Relay uses a Pulse Width Modulation control depending on a process value

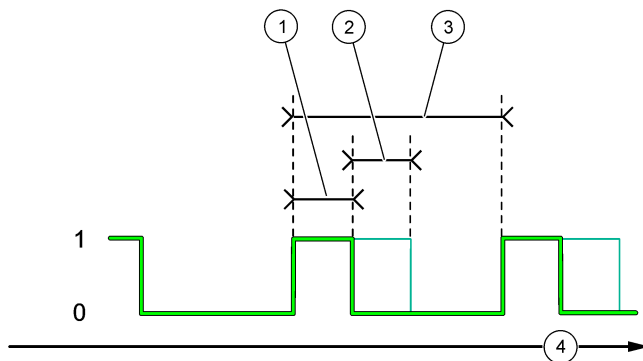
Option	Description
Frequency control	Relay switches with a frequency depending on a process value
Warning	Relay indicates warning and error conditions in probes

6. From the Relay Setup menu, select Set Transfer and choose Active or Inactive.
7. From the Relay Setup menu, select Fail Safe and choose Yes or No.
8. From the Relay Setup menu, select Activation.
The activation options for the selected function appear. Use the information in the table below each function to update the options.
9. Test the relay function to make sure it is properly energizing the connected device. To do relay testing, go to the Setting menu, then select **Test/Maint>Test Relay**.

• **Scheduler Function** (refer to [Figure 17](#))

Option	Description
Hold outputs	Holds outputs in the present ON or OFF state
Run days	Sets the weekday(s) that the relay operates. Options: Sunday, Monday, Tuesday., Wednesday, Thursday, Friday, Saturday
Start time	Sets the start time.
Interval	Sets the time between activation cycles (Default value: 5 min).
Duration	Sets the period of time the relay is energized (Default value: 30 sec).
Off delay	Sets the time for additional hold/output time after the relay has been turned off.

Figure 17 Scheduler function



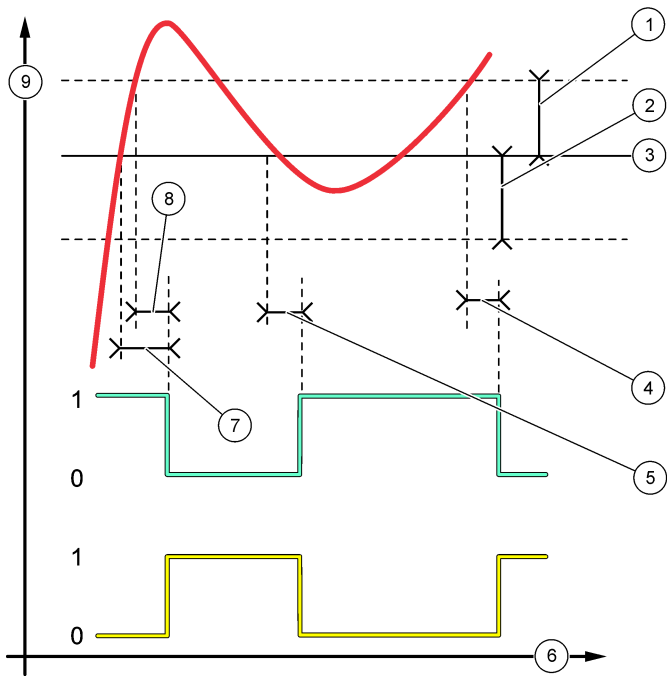
1 Duration	3 Interval
2 OFF delay	4 Time (x-axis)

• **Alarm Function** (refer to [Figure 18](#))

Option	Description
Low alarm	Sets the value where the relay will turn on in response to decreasing measured value. For example, if the low alarm is set for 1.0 and the measured value drops to 0.9, the relay activates.
High alarm	Sets the value where the relay will turn on in response to increasing measured value. For example, if the high alarm is set for 1.0 and the measured value increases to 1.1, the relay activates.

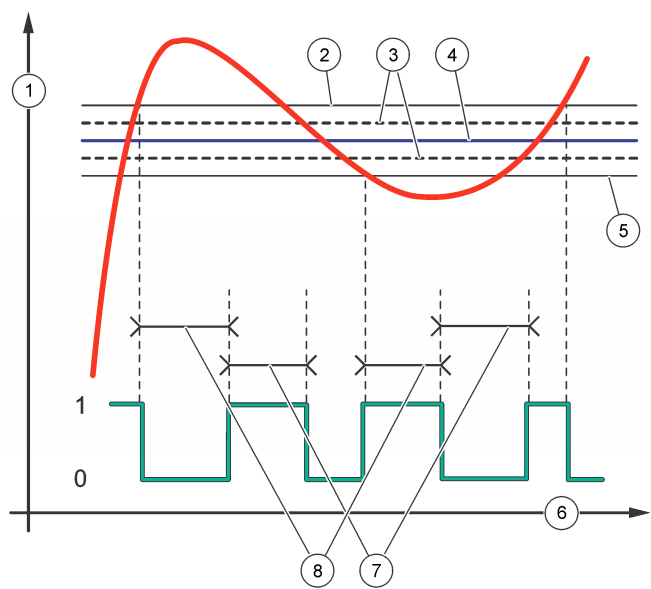
Option	Description
Overfeed timer	Sets a time period for de-activating an active relay if the process setpoint cannot be reached. Once an overfeed alarm is present, it must be manually reset.
Off delay	Sets a delay time for the relay to turn off (default: 0 seconds).
On delay	Sets a delay time for the relay to turn on (default: 0 seconds).

Figure 19 Feeder control function



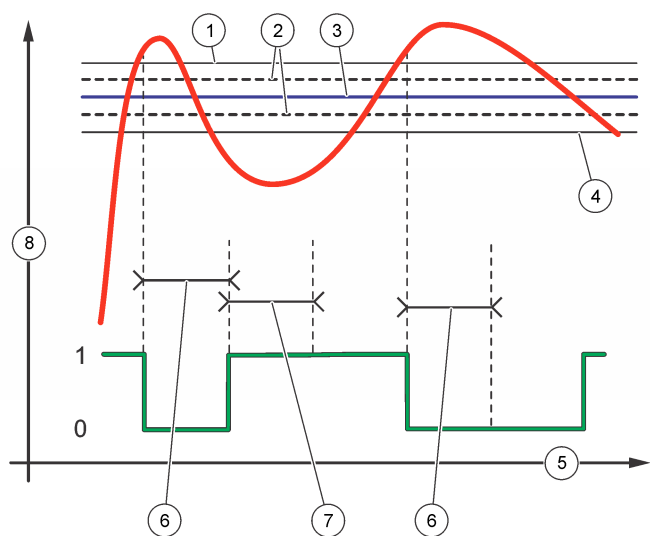
1 Deadband (Phase = Low)	6 Time (x-axis)
2 Deadband (Phase = High)	7 ON delay (phase set high)
3 Setpoint	8 OFF delay (phase set low)
4 OFF delay (phase set high)	9 Source (y-axis)
5 ON delay (phase set low)	

Figure 21 Event control function (no delay)



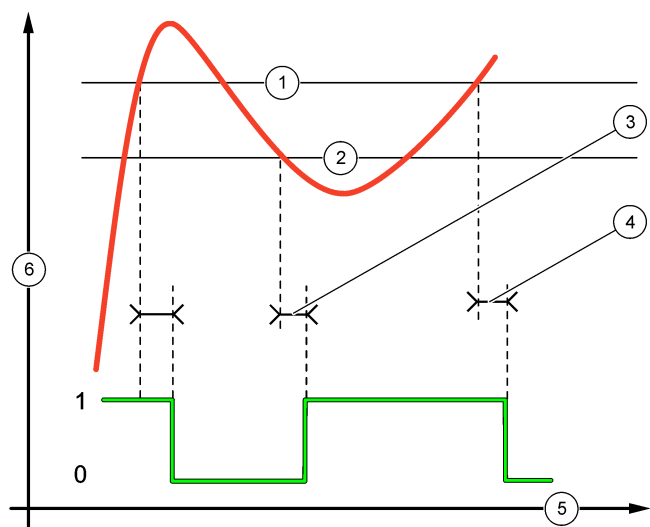
1 Source (y-axis)	5 Low alarm
2 High alarm	6 Time (x-axis)
3 Deadband	7 OnMax-time
4 Setpoint	8 OffMax-time

Figure 22 Event control function (OnMin timer, OffMin timer)



1 High alarm	5 Time (x-axis)
2 Deadband	6 OffMin timer
3 Setpoint	7 OnMin timer
4 Low alarm	8 Source (y-axis)

Figure 23 Event control function (ON/OFF delay)

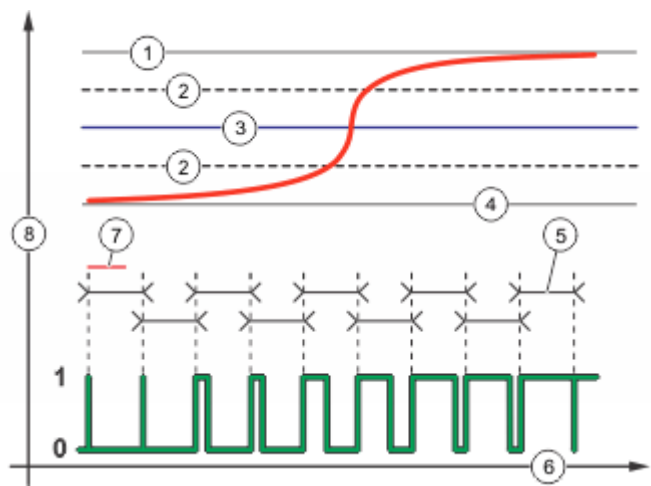


1 High alarm	4 OFF delay
2 Low alarm	5 Time (x-axis)
3 ON delay	6 Source (y-axis)

• **Pulse Width Modulation Control Function** (refer to [Figure 24](#))

Option	Description
Set mode	Auto—the relay output works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Creates a setpoint value.
Dead zone	The range above and below the setpoint. In this set range, the PID controller does not take action to change the Pulse Width Modulation On/Off Ratio output signal until the limits of the dead zone are reached.
Period	Sets the cycle duration of the PWM output signal (default: 5 seconds).
Min width	Sets the minimum PWM ratio (default: 1.0 second).
Max width	Sets the maximum PWM ratio (default: 4.0 seconds).
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot completely compensate for disturbances.
Integral	Sets the integral part of the PID controller (default: 000 minutes). The integration part of the controller supplies an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can completely compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.

Figure 24 Pulse Width Modulation function (linear mode)

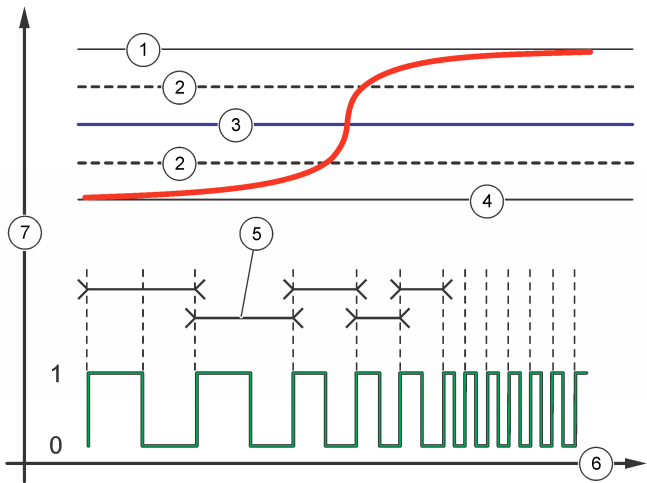


1 High alarm	5 Period
2 Deadband	6 Time (x-axis)
3 Setpoint	7 Phase
4 Low alarm	8 Selected source (y-axis)

- **Frequency Control Function (refer to [Figure 25](#))**

Option	Description
Set mode	Auto—The relay works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Sets the process value which is controlled by the PID controller.
Dead zone	In this set range, the PID controller does not take action to change the output frequency until within the limits of the dead zone.
Pulse width	Sets the cycle duration (0-600 seconds) of the PWM output signal. (default: 0.5 seconds) The cycle duration is equal to the duty cycle of the output signal.
Minimum pulses	Sets the minimum number of pulses per minute at which the relay can operate. Range: 0.001–4.000 (default: 1.000)
Maximum pulses	Sets the maximum number of pulses per minute at which the relay can operate. Range: 0.001–60.000 (default: 04.000). This value cannot be set lower than Minimum Pulses value.
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot fully compensate for disturbances.
Integral	Sets the derivative part of the PID controller (default: 000 minutes). The integration part of the controller generates an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can fully compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.

Figure 25 Frequency control function



1 High limit	5 Cycle duration
2 Deadband	6 Time (x-axis)
3 Setpoint	7 Selected source (y-axis)
4 Low limit	

• **Warning Function**

Option	Description
Warning	Sets the level for warning activation. Refer to the sensor manual for the numbers for individual warning messages.

6.6 Display setup

Configures the controller display.

1. From the Settings menu, select **sc200 Setup** and push **ENTER**.
2. Select **Display Setup** and push **ENTER**.

Option	Description
Adjust Order	<p>View and modify the measurement display order.</p> <ul style="list-style-type: none">• See Current Order—View the current display order• Add Measurements—Add selected measurements to the display• Remove Measurements—Remove selected measurements from the display• Reorder List—Select one or more measurements and change their order in the display• See Default Order—View the default display order• Set to Default—Set the display order to the default configuration <p><i>Note: Some of the above will not be available if no adjustment is possible for that option (e.g. Reorder List and Remove Measurements will not be available if only one measurement is selected for display).</i></p>
Display Contrast	Adjust the contrast to a value between the minimum of +1 and the maximum of +9
Edit Name	Assigns a name to the controller

6.7 Update the date and time

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Set Date/Time and push **ENTER**.
3. Select Date Format from the Set Date/Time screen and push **ENTER**.
4. Select a format and push **ENTER**.
5. Select Date/Time from the Set Date/Time screen and push **ENTER**.
6. Update the entries.
 - a. Use the right and left arrow keys to highlight a field.
 - b. Use the up and down arrow keys to change the values in the field and push **ENTER**.
 - c. At the end of the date field, push the right arrow to wrap down to the time fields.
 - d. Use the up and down and arrow keys to update the time fields.
7. Push **ENTER** to save the changes.

The controller returns to the Set Date/Time menu.

6.8 Set the datalog mode and interval

Datalog Setup is available if a calculation has been set up.

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Datalog Setup and push **ENTER**.
3. Select Set Mode and push **ENTER**.
4. Select an option (Snap Shot, Average, Maximum, Minimum) and push **ENTER**.
5. From the Datalog Setup menu, select Set Interval and push **ENTER**.
6. Select an interval from the list and push **ENTER**.

6.9 Set up a calculation

1. From the Settings menu, select sc200 Setup and push **ENTER**.
2. Select Calculation and push **ENTER**. Select a menu option and choose from the displayed list or update the entry. Refer to the table below for more information about each option.

Option	Description
Set variable X	Selects the sensor for the x variable
Set parameter X	Selects the sensor measurement for the x variable
Set variable Y	Selects the sensor for the y variable
Set parameter Y	Selects the sensor measurement for the y variable
Set formula	Select the math function to implement: <ul style="list-style-type: none">• None—Disables the math function• X-Y—Subtraction function• X+Y—Addition function• X/Y—Division function• [X/Y]%—Percentage function• [X+Y]/2—Average function• [X*Y]—Multiplication function• [X-Y]%X—Difference function
Display format	Selects the number of digits and decimal points

Option	Description
Set units	Selects the units for the calculated reading
Set parameter	Selects the parameter for the calculated reading

3. Push **ENTER** to save the selection or setting and return to the Calculation menu.

6.10 Set up the discrete inputs

Use these inputs to switch closure inputs or logic level voltage inputs.

1. Press the **MENU** key.
2. Select sc200 Setup and push **ENTER**.
3. Select Discrete Input Setup and push **ENTER**.
4. Select the desired channel (Input 1, Input 2 or Input 3) and push **ENTER**.
5. Select a control logic option and push **ENTER**.

Option	Description
Disable	This channel is disabled and not used.
On/High	This channel is active when either the switch input is On (or closed), or the logic level voltage input is at a High level.
Off/Low	This channel is active when either the switch input is Off (or opened), or the logic level voltage input is at a Low level.

6. Select a warning option and push **ENTER**.

Option	Description
Off	An active discrete input does not trigger a device warning.
On	An active discrete input triggers a device warning.

7. Select an output mode option and push **ENTER**.

Option	Description
Active	Output level continues to represent operating conditions.
Hold	Output level is held static.
Transfer	Output level moves to a pre-configured value.

8. Select the sensors that will have their outputs (analog and relay) affected when one of the discrete inputs becomes active. Push **ENTER**.
9. Use the arrows to select the On Delay value (the duration time delay between the discrete input activation and the configured response of the controller). Push **ENTER**.
10. Use the arrows to select the Off Delay value (the duration time delay between the discrete input de-activation and the configured response of the controller). Push **ENTER**.
11. Repeat steps 4–10 for each desired channel.
12. If a discrete input needs to be changed after initially set up:
 - a. Repeat steps 1–4 and an Input Settings menu appears with the following options:
 - Control Logic
 - Set Warning
 - Output Mode
 - On Delay
 - Off Delay
 - b. Select the desired option and push **ENTER**.

- c. Make the desired changes and push **ENTER** to save the changes and return to the Inputs Setting menu.

6.11 Update the display language

The display language can be changed through the Setup menu.

1. From the Settings Menu, select sc200 Setup and push **ENTER**.
2. Select Language and push **ENTER**.
The list of language options appears. English is the default language for the controller.
3. Highlight the language to be used for the controller and push **ENTER**.
The selected language is saved and is used for the controller display. The display returns to the sc200 Setup menu.

6.12 Using the secure digital memory (SD) card

An SD card must be installed in the controller.

- The SD card can be used to update software and firmware and to download event and data logs. If the SD card is installed while the controller is in the Settings Menu, push the **HOME** key and then the **MENU** key to verify the option is visible. The SD icon will also be visible in the upper status bar of the main measurement screen when a card is installed.
- Data log files on the SD card are available in XML and binary formats.
- DataCom is used to convert files from binary to CSV format. Refer to the DataCom manual for more information on how to use the application. For a copy of the DataCom manual, software updates or other downloadable resources, go to <http://www.de.hach.com> or <http://www.hach.com>. Search *DataCom* or go to any sc200 product page.

6.12.1 Updating software

Notes:

- The controller does not automatically transfer information to or from an SD card.
- When the SD card is put in multiple controllers, each controller has a separate set of folders in the SD card memory. To make sure software updates are in the correct folder for the controller in use, it is best to use a separate dedicated SD card for each controller.

1. From the Settings Menu, select SD Card Setup and push the **ENTER** key.
2. Select Upgrade Software and push the **ENTER** key.

Note: If the Upgrade Software option does not appear, do the steps in [Firmware updates with SD cards](#) on page 44.

3. Select a device from the list and push the **ENTER** key. The list of options includes the controller and all connected devices that have software placed in the appropriate folder on the SD card.
4. If more than one version of the upgrade software is available, select the version with the highest number and push the **ENTER** key.
5. Push the **ENTER** key to begin the software transfer.
The display will show "Transferring files. Please wait..." The percentage of completion appears in the bottom left corner of the display. The upgrade cannot be halted once it has begun.
 - When the transfer is successful, the display will show "Transfer complete" along with a prompt to push **ENTER** to restart the controller or to push the **BACK** key and exit to the SD Card Setup menu. Controller updates take effect when the controller is restarted. A restart is not necessary for sensor updates.
 - If the transfer is unsuccessful, the display will show "Transfer failed" and an error message. Press the **ENTER** key to acknowledge the warning and exit out of the menu. Error messages are different for each sensor. Refer to the applicable sensor manual.

6.12.2 Saving data and event logs with SD cards

Notes:

- Data and event logs can be downloaded to an SD card and viewed with any device capable of reading an SD card.
- Data logs store the measurement data at selected intervals in a packed binary format (.flg file).
- Event logs store a variety of events that occur on the devices such as configuration changes, alarms and warning conditions. Event logs are set up during the sensor or module configuration process. Event logs are stored in a CSV format.

1. From the Settings Menu, select SD Card Setup and push the **ENTER** key.
2. Select Save Logs and push the **ENTER** key.
3. If more than one device appears on the screen, all devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Select the devices from which logs will be saved and push the **ENTER** key.
4. Select the time period from which logs are to be saved.

Option	Description
Last Day	All logs from the last full 24 hours, starting from 12:00 a.m., and any additional time remaining on the current day
Last Week	All logs from the last full week (7 days) starting from 12:00 a.m., and any additional time remaining on the current day
Last Month	All logs from the last full month (30 days) starting from 12:00 a.m., and any additional time remaining on the current day
All	Save all logs in memory
New	All logs that are new since the last time logs were saved to the SD card

5. Push the **ENTER** key to confirm the choice, and push the **ENTER** key again to begin the file transfers.
6. Allow time for the files to transfer. The display will show Transferring files. Please wait... and the percentage of files transferred.
If the transfer is successful, the display will show "Transfer complete." If the transfer is not successful, the display will show "Transfer failed."
7. Do one of the following:
 - a. Push the **ENTER** key to exit back to the SD Card Setup menu.
 - b. Push the **HOME** key to return to the measurement screen.
 - c. Push the **BACK** keys to return to the Settings Menu.

6.12.3 Access data and event log files on the SD card

A PC with an SD Card reader device or USB adapter is necessary to view the event and data logs kept on the SD Card. Excel 2003 or higher (for XML files) or the Data Com application (for binary flg files) is necessary to open the event and data logs.

Data logs have the following structure: Device Name, Device Serial Number, Device Identification, Data Log, Time Stamp.

Event logs have the following structure: Device Name, Device Serial Number, Device Identification, Event Log, Time Stamp.

To view data or event log files stored on the SD card:

1. Attach the card reader device to the PC (if necessary) and install the SD card that contains the files in the reader device.
2. In the SD card directory, open the HACH folder.
3. Select the Logs folder.
4. Select a device folder.

The event and data log files in the folder are shown.

5. To view XML data log files:

- a. Make sure the HachDatalog.xsl style sheet exists in the device folder.
- b. Open the Excel application.
- c. Go to File, Open.
- d. Select the data log file.
- e. In the Import XML dialog box, select **Open the file with the following style sheet applied** and select **HachDatalog.xml**.
- f. Click OK to view the data.

6. To view binary data log (.flg) files:

- a. Make sure the device driver (.flg.drv) file exists in the device folder.
- b. Open Data Com.
- c. In the File Viewer section, click Open.
- d. Select the data log file.
The data log file is shown in the box and a comma separated values (csv) file with the same file name is created. This csv file can be opened in Excel.

6.12.4 Firmware updates with SD cards

The latest firmware updates can be placed on an SD card. The SD card can then be used to update the controller or device firmware.

A PC and a USB card reader or other device capable of reading an SD card are necessary.

1. Find the zip file at <http://www.hach.com> and copy it to the PC.
2. Extract file(s) from the zip folder and save them to the SD card.
3. Remove the SD card and update the controller and device firmware. Refer to [Updating software](#) on page 42.

6.12.5 Backup settings to an SD card

Saves the configuration of a device to the SD card.

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Backup Settings and push **ENTER**.
5. Select the devices to be backed up. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers. If backup files already exist on the SD card, a confirmation window appears. Select the devices again and push **ENTER**. Wait for the "Transfer complete" message.
6. Push **ENTER** again to return to the Manage Configuration menu.

6.12.6 Restore settings to the controller

This menu selection only appears if a (serial number-specific) backup file for the controller or one of the sensors connected to it exists on the SD Card. This menu selection loads the configuration of a specific device from the SD card to the same device (serial number-controlled function).

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Restore Settings and push **ENTER**.
5. Select the device that will be restored. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers.

6. When the transfer is complete, push **ENTER**.
7. To have the settings take effect immediately, restart the controller. Push the **BACK** key to exit the Manage Configuration menu.

6.12.7 Transfer settings to another device

All device settings including calibration, sensor name, selected temperature and measurement units and data logging settings are transferred.

1. Push the **MENU** key.
2. Select SD Card Setup and push **ENTER**.
3. Select Manage Configuration and push **ENTER**.
4. Select Transfer Settings and push **ENTER**. Two options appear:
 - Retrieve Settings
 - Copy Settings
5. To retrieve settings from the controller (or a device connected to it) and put the settings on the SD card:
 - a. Select Retrieve Settings and push **ENTER**.
 - b. Select the devices that contain the information to be transferred. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers. Wait for the "Transfer complete" message.
 - c. If files already exist on the SD card, a confirmation window appears. Select the devices again and push **ENTER**. Wait for the "Transfer complete" message.
 - d. Push **ENTER** to return to the Manage Configuration menu.
6. To copy settings from the SD card to a controller (or a device connected to it):
 - a. Select Transfer Settings and push **ENTER**.
 - b. Select Copy Settings and push **ENTER**.
 - c. Select the devices on the SD card. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push **ENTER** to begin the file transfers.
7. When the transfer is complete, push **ENTER** to restart the connected devices.
8. Push **ENTER** to restart the controller or push **BACK** to return to the Manage Configuration menu.

6.13 Using the service port


The service port is used to download data files from the controller and install new versions of controller and sensor firmware. To download data and update software, use the service port in combination with DataCom and a service cable (LZX887).


6.14 Using DataCom

When using the service port, it is necessary to use DataCom. DataCom is a PC Application Utility that downloads data log and event log files from the controller and installed sensors. Files are downloaded from the controller through the controller service port or they can be placed on a Secure Digital Memory (SD) card installed in the controller. In addition, DataCom is used to upload software for the controller and sensors. The DataCom application must be installed on a PC to read the files.

Refer to the DataCom manual for more information on how to use the application. The DataCom manual, software updates and other downloadable resources are available at <http://www.de.hach.com> or <http://www.hach.com> on any sc200 product page.


Section 7 Maintenance




 **DANGER**

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

7.1 Cleaning the controller



 **DANGER**

Electrocution hazard. Remove power from the instrument before doing maintenance or service activities.

Note: *Never use flammable or corrosive solvents to clean any part of the controller. Use of these solvents may degrade the environmental protection of the unit and may void the warranty.*

1. Make sure the controller cover is securely closed.
2. Wipe the controller exterior with a cloth dampened with water, or with a mixture of water and mild detergent.

7.2 Fuse replacement

Fuses are not user-serviceable items. The need for fuse replacement in controllers indicates severe technical failure and is therefore considered to be a service activity. If a blown fuse is suspected, contact Technical Support.

7.3 Battery replacement

The lithium ion backup battery is not user replaceable. Contact technical support for replacement.

Section 8 Troubleshooting

Problem	Resolution
No current output	Verify current output configuration.
	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections.
	Contact Technical Support.
Incorrect current output	Verify current output configuration.
	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections. If the output is incorrect, perform an output calibration.

Problem	Resolution
No relay activation	Make sure relay connections are secure.
	If using an external power source, make sure the relay wiring is correct.
	Make sure the relay configuration is correct.
	Test the relay activation through the Test/Maintenance menu. The relay should energize and de-energize as selected.
	Make sure the controller is not in calibration mode and that the relay is not being held.
	Reset the Overfeed Timer to make sure the timer has not expired.
Secure Digital Memory (SD) card not recognized by the controller	Make sure the SD card is properly oriented. The copper traces should face toward the controller display.
	Make sure the SD card is fully seated in the slot and the spring lock is engaged.
	Make sure the SD card is properly formatted with a Fat 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.
	Make sure the card is not larger than 32 GB.
	Make sure an SD card is being used. Other types of cards (such as xSD, micro SD, mini SD) will not work properly.
Information not saving, or not saving properly to the SD card.	Make sure the SD card is properly formatted with the FAT 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.
	If the SD card has previously been in use, format the card with the Fat 32 format, install the card in the controller, and try downloading files.
	Try a different SD card.
SD card full	Read the SD card with a PC or other card reader device. Save important files and then delete some or all of the files on the SD card.
Controller cannot find software updates on the SD card.	Make sure an appropriate folder is created by installing the SD card in the controller. An update folder will automatically be created.
	Install the SD card on a PC and make sure the software files are located in the appropriate update folder.
	If the same SD card is used with multiple controllers, each controller will have a separate folder on the system. Make sure the software updates are in the folder dedicated to the controller in use.
Display is lit but shows no characters or characters are faint or blurry.	Adjust the display contrast
	Make sure protective film has been removed from display.
	Clean the outside of the controller, including the display screen.

Problem	Resolution
Controller will not power up, or powers up intermittently	Make sure the AC power connections are properly terminated in the controller.
	Make sure the power strip, line power, wall plug are all properly plugged in.
	Contact Technical Support
Network or sensor module not recognized	Make sure the module is properly installed.
	Make sure the module selector switch is set to the proper number.
	Remove sensor module and install the module into the second analog slot. Apply power to the controller and allow the controller to perform a device scan.
	Contact Technical Support.
Sensor not recognized <i>Note: Example of possible display message: ****</i>	If the sensor is an analog sensor and a corresponding module is installed in the controller, refer to the instructions supplied with the Network or Sensor Module.
	Make sure the digital connector wiring harness is seated on the inside of the door assembly and that the wiring harness is not damaged.
	If the digital sensor is connected to the controller with a digital termination box, user supplied junction box, digital extension cables, or a user-supplied extension cable, connect the sensor directly to the controller and perform a device scan. If the controller recognizes the sensor, check that all the wiring in the junction boxes or extension cables is correct.
	Make sure that only two sensors are installed in the controller. Although two analog module ports are available, if a digital sensor and two analog modules are installed, only two of the three devices will be seen by the controller.
	Contact Technical Support
Device Missing error message appears	Perform a Device Scan from the Test/Maintenance menu.
	Power cycle the controller

8.1 Test and Maintenance menu

- From the Settings Menu, select Test/Maint and push **ENTER**.

Option	Description
Scan devices	Performs a scan for active and missing devices.
Output cal	Lets the user calibrate the 4–20 mA outputs with a 250 ohm resistor in series to the mA output terminals. The settings for each output are adjusted until the correct value (4 mA or 20 mA) is supplied.
• Output 1	
• Output 2	Calibrate 4 mA output (Min: 0 Max: 25000) Calibrate 20 mA output (Min: 35000 Max: 65533)
Hold outputs	Sets the value the controller sends to an external system for a defined period of time. After the time period, the instrument goes back to reporting real time values. Set activation—Launch or release Set Outmode—Hold Outputs (default) or Transfer Outputs Set Channels—All (default) or select from hardware list

Option	Description
Test output	Lets the user select a mA value that is sent by the controller for verification.
• Output 1	Min: 0 mA (default +04.00)
• Output 2	Max: 25.00 mA
Status	View status of all modules, sensors and relays.
Test relay—A, B, C, D	Energize or De-energize the selected relay
Overfeed reset	Resets the Overfeed Timer.
Reset default config	Resets the controller configuration settings to the default values (language, date and time, relay function and data output function).
Restart sc200	Performs a controller restart
Simulation (only displays if sensors or modules are connected)	<p>After the sim value is entered, the controller outputs this value as if it was the value sent from the sensor. The simulation stops after the user exits the screen.</p> <p>Source-</p> <ul style="list-style-type: none"> • <Module 1> • <Module 2> <p>(Footer displays current source selection)</p> <p>Parameter—Source measurement type (footer displays current source selection)</p> <p>Sim value—Use arrow keys to change value (footer displays current source selection)</p>
Modbus stats	<p>Displays Error and Good count stats for selected port.</p> <ul style="list-style-type: none"> • Sensor port 1, 2, 3 or 4 • Network port • Service port • Clear stats
System data	Displays the current system current, temperature and voltage data.

8.2 Warning and error conditions

Follow the steps below to acknowledge controller warnings.

1. From the Settings menu, select Diagnostics and push **ENTER**.
2. Select the device (controller, sensor, network card) with the warning or error and push **ENTER**.
3. Select the warning, error or event list and push **ENTER**.
4. Select Yes and push **ENTER** to acknowledge the warning.
Note: Errors cannot be acknowledged.
5. For more information on a specific warning, error or event, refer to the device manual.

Section 9 Device scan information

Display message	Action
Installing device...please wait	The controller has found a new device. No action is necessary. The controller automatically performs an installation process for the new device and displays the main measurement screen of the device installed in the number one position.
Device missing <device id>	<p>A previously installed device has been removed from the controller or is not detected.</p> <ul style="list-style-type: none"> • Push the Enter key to continue. • Push the left arrow key to select or de-select a missing device. • Push the Enter key to delete the missing device. <p>The controller will display the main measurement screen for the device in the number one position.</p> <p>Note: This message also displays when a device is missing and a new device has been installed. After the missing device is deleted, the controller automatically installs the new device and displays Installing device...please wait. The controller then displays the main measurement screen for the device installed in the number one position.</p>

Section 10 Replacement parts and accessories

Note: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Description	Item number
4 GB Secure Digital Memory (SD) card	9218100
Connector kit for digital sensor	9201000
Controller installation kit	8806200
DataCom cable	LZX887
Mounting bracket inserts	9177900
Plug, conduit opening (set of 3)	5868700
Power cord kit, with strain relief, 125 VAC, U.S.-style plug	9202900
Power cord kit, with strain relief, 230 VAC, European-style plug	9203000
Screw driver	6134300
SD card reader	9218200
SD card cover kit for sc200 controller	9200900
Screws for controller installation kit	9177800
Cord grip kit (1)	9178000
Sealing washer for cord grip assembly	1033814
UV protection screen	8809200
Weather and sun shield w/ UV protection screen	9220600
Sensor and communication modules	
Conductivity module	9013000

Description	Item number
Flow module	9012700
4-20 mA input module	9012800
pH and DO module	9012900
4-20 mA output module	9334600
HART network module kit	9328100
Modbus network module	9013200
Profibus network module	9173900
Profibus M12 connector kit	9178500
Profibus M12 socket (hard wire to quick connector adapter)	9178200
Profibus M12 T-splitter	9178400

**HACH COMPANY World Headquarters**

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.

Tel. (970) 669-3050

(800) 227-4224 (U.S.A. only)

Fax (970) 669-2932

orders@hach.com

www.hach.com

HACH LANGE GMBH

Willstätterstraße 11

D-40549 Düsseldorf, Germany

Tel. +49 (0) 2 11 52 88-320

Fax +49 (0) 2 11 52 88-210

info-de@hach.com

www.de.hach.com

HACH LANGE Sàrl

6, route de Compois

1222 Vérenaz

SWITZERLAND

Tel. +41 22 594 6400

Fax +41 22 594 6499

TU5 Series Turbidimeters

Applications

- Drinking Water
- Power
- Beverage
- Pharmaceutical



The next standard in the evolution of turbidity

Only the new TU5 Series Lab & Process Turbidimeters with 360° x 90° Detection™ deliver unprecedented confidence that a change in your reading is a change in your water.

Groundbreaking 360° x 90° Detection™ Technology

The TU5 Series employs a patented optical design that sees more of your sample than any other turbidimeter, delivering the best low level precision and sensitivity while minimizing variability from test to test.

Matching lab and online results

For the first time you will be able to remove the uncertainty of which measurement to trust, thanks to identical 360° x 90° Detection™ Technology in both instruments.

Everything about turbidity – faster

The TU5 Series dramatically reduces the time needed to get a turbidity measurement you can rely on, with 98% less online sample surface area to clean, sealed vials for calibration, and the elimination of the need for indexing and silicone oil in the lab. Not to mention, a smaller online sample volume means you will detect events almost immediately.

No surprises

Prognosys™ monitors your TU5 Series online instrument, proactively alerting you to maintenance needs before your measurement becomes questionable. And a Hach Service Agreement protects your investment and helps ensure that you stay in compliance and on budget.

USEPA and ISO 7027 reporting: The TU5 Series Turbidimeters apply the instrument design and meet performance criteria established by EPA Approved Hach Method 10258 and ISO 7027-1:2016, making them suitable for regulatory reporting.



Technical Data*

TU5200

Light Source	Class 2 laser product, with embedded 650 nm (EPA 0.43 mW) or Class 1 laser product, with embedded 850 nm (ISO), max. 0.55 mW (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 - 700 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 175 EBC ISO: 0 - 1000 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 250 EBC
Accuracy	±2 % plus 0.01 NTU from 0 - 40 NTU; ±10 % of reading from 40 - 1000 NTU based on Formazin primary standard (at 25 °C)
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC / mg/L
Repeatability	<40 NTU: Better than 1% of reading or ±0.002 NTU on Formazin at 25 °C, whichever is greater >40 NTU: Better than 3.5% of reading on Formazin at 25 °C
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC; mg/L if calibrated with Degrees calibration curve
Operating Temperature Range	10 - 40 °C (50 - 104 °F)
Operating Humidity	80% at 30 °C (non condensing)
Sample Temperature	4 - 70 °C (39 - 158 °F)
Storage Conditions	-30 - 60 °C (-22 - 140 °F)
Power Requirements (Voltage)	100 - 240 VAC
Power Requirements (Hz)	50/60 Hz
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50) Australian ACMA Marking
Dimensions (H x W x D)	195 mm x 409 mm x 278 mm
Weight	2.4 kg (5.29 lbs.)
Warranty	1 year

TU5300sc / TU5400sc

Light Source	Class 2 laser product, with embedded 650 nm (EPA 0.43 mW) or Class 1 laser product, with embedded 850 nm (ISO), max. 0.55 mW (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 - 700 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 175 EBC ISO: 0 - 1000 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 250 EBC
Accuracy	±2% or 0.01 NTU from 0 - 40 NTU ±10% of reading from 40 - 1000 NTU based on Formazin primary standard
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC
Repeatability	Better than 1% of reading or ±0.002 NTU (TU5300) or ±0.0006 NTU (TU5400) on Formazin at 25 °C (77 °F), whichever is greater
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC
Signal Average Time	TU5300sc: 30 - 90 seconds TU5400sc: 1 - 90 seconds
Response Time	TU5300sc: T90 <45 seconds at 100 mL/min TU5400sc: T90 <30 seconds at 100 mL/min
Sample Temperature	2 - 60 °C (35 - 140 °F)
Sample Pressure	6 bar (87 psi) maximum, compared to air at sample temperature range from 2 - 40 °C (35.6 - 104 °F)
Sample Flow Rate	100 - 1000 mL/min; optimal flow rate: 200 - 500 mL/min
Operating Temperature Range	0 - 50 °C (32 - 122 °F)
Operating Humidity	Relative humidity: 5 - 95% at different temperatures, non-condensing
Storage Conditions	-40 - 60 °C (-40 - 140 °F)
Enclosure Rating	Electronic compartment IP55; all other functional units IP65 with process head/ACM attached to the TU5300sc/TU5400sc instrument
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Australian ACMA Marking
Dimensions (H x W x D)	249 mm x 268 mm x 190 mm
Weight	5.95 lbs. (2.7 kg); 11 lbs. (5.0 kg) with all accessories
Warranty	1 year

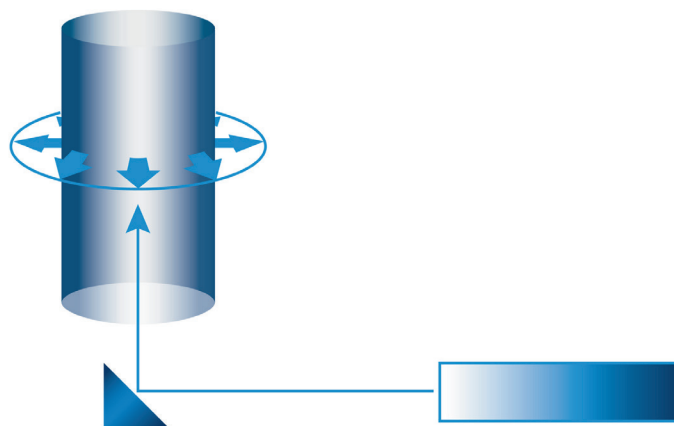
*Subject to change without notice.

Principle of Operation

The TU5 Series turbidimeters measure turbidity by directing a laser into a sample to scatter off suspended particles. The light that is scattered at a 90° angle from the incident beam is reflected through a conical mirror in a 360° ring around the sample before it is captured by a detector.

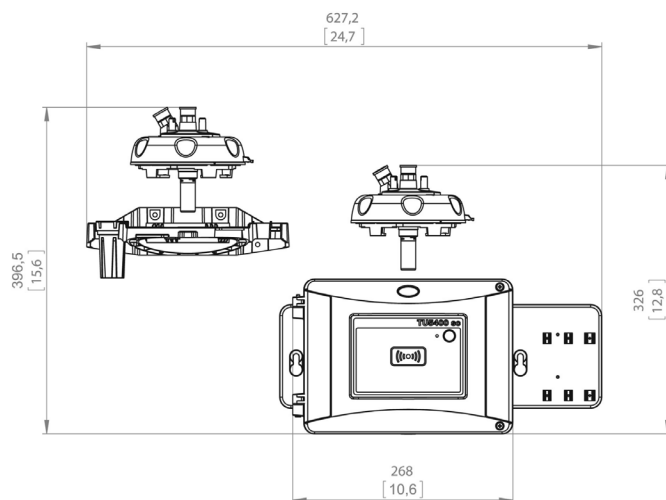
The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

The 360° x 90° optics of the TU5 series were optimized for high accuracy at low turbidity ranges and therefore the TU5 does not include ratio technology. Ratio technology is only applicable for high turbidity applications which have interference from color and large particles.

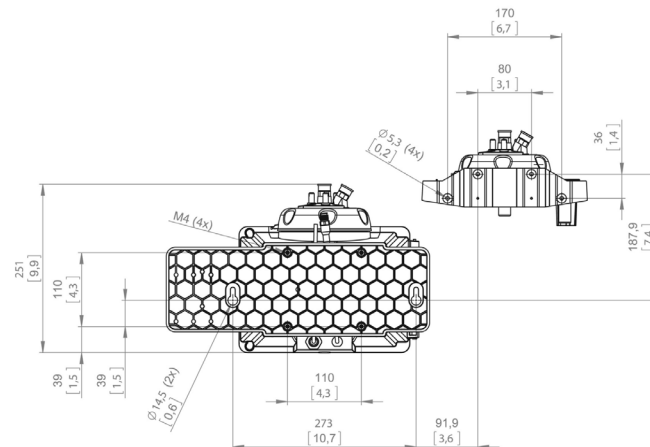


Dimensions

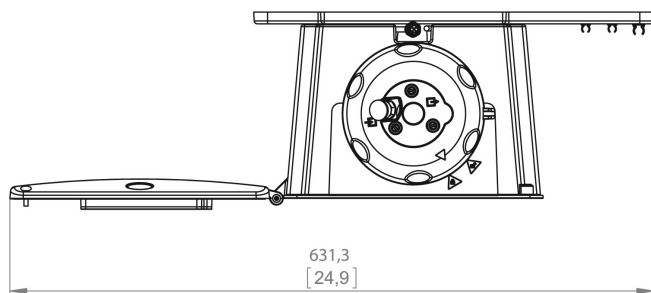
TU5300sc and TU5400sc front view



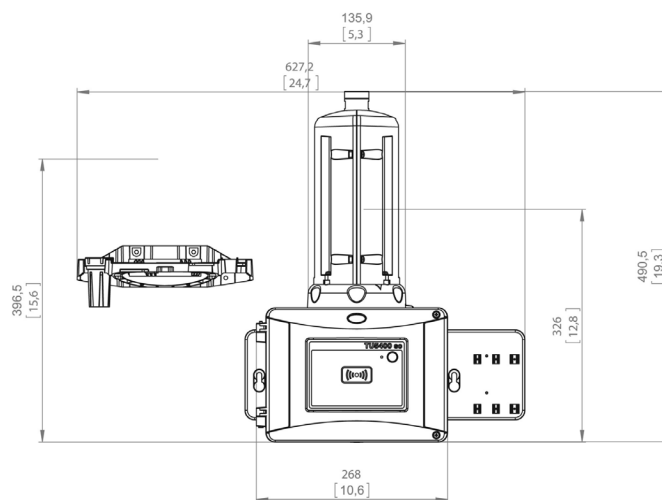
TU5300sc and TU5400sc rear view



TU5300sc and TU5400sc top view



TU5300sc and TU5400sc with automatic cleaning module



Order Information

TU5200 Benchtop Laser Turbidimeters

LPV442.99.03012	TU5200 Benchtop Laser Turbidimeter with RFID, EPA Version
LPV442.99.01012	TU5200 Benchtop Laser Turbidimeter without RFID, EPA Version
LPV442.99.03022	TU5200 Benchtop Laser Turbidimeter with RFID, ISO Version
LPV442.99.01022	TU5200 Benchtop Laser Turbidimeter without RFID, ISO Version

TU5300sc/TU5400sc Online Laser Turbidimeters

LXV445.99.10112	TU5300sc Low Range Laser Turbidimeter, EPA Version
LXV445.99.10212	TU5400sc Ultra-High Precision Low Range Laser Turbidimeter, EPA Version
LXV445.99.53112	TU5300sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version
LXV445.99.53212	TU5400sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version

Please note: Other turbidimeter configurations are available and RFID may not be available in all areas. Please contact your local Hach representative.

Please note: An SC controller is required for operation of the TU5300sc or TU5400sc.

Calibration and Verification

LZY835	Stabcal® Calibration Set with RFID
LZY898	Stabcal® Calibration Set without RFID
LZY901	Glass Rod Secondary Turbidity Standard <0.1 NTU/FNU
LZY834	Replacement Vial for TU5300sc and TU5400sc
LZV946	Sample Vials for TU5200

TU5 Series Accessories

LQV159.97.00002	Automatic Cleaning Module for TU5300sc and TU5400sc
LQV160.99.00002	Flow Sensor for TU5300sc and TU5400sc
LZY876	Desiccant Cartridge for TU5300sc and TU5400sc
LZY907.97.00002	Maintenance Kit for TU5300sc and TU5400sc
LQV157.99.50002	SIP10 Sipper Unit for TU5200
LZY903	Manual Vial Wiper for TU5200, TU5300sc, and TU5400sc



With Hach Service, you have a global partner who understands your needs and cares about delivering timely, high-quality service you can trust. Our Service Team brings unique expertise to help you maximise instrument uptime, ensure data integrity, maintain operational stability, and reduce compliance risk.

HACH COMPANY World Headquarters: Loveland, Colorado USA

United States: 800-227-4224 tel 970-669-2932 fax orders@hach.com
 Outside United States: 970-669-3050 tel 970-461-3939 fax int@hach.com
hach.com

Printed in U.S.A.

©Hach Company, 2019. All rights reserved.

In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.



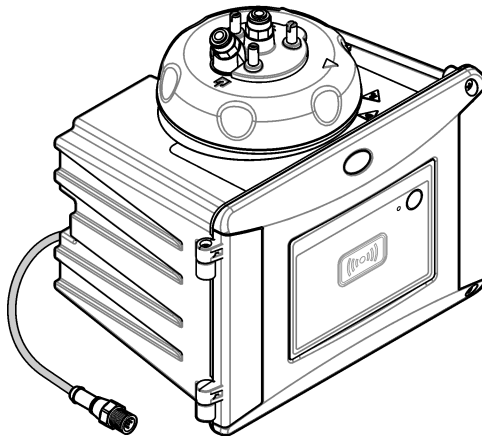


DOC343.52.90477

TU5300 sc/TU5400 sc

09/2019, Edition 5

User Manual



Section 1 Specifications	3
Section 2 General information	4
2.1 Safety information	4
2.1.1 Use of hazard information	5
2.1.2 Precautionary labels	5
2.1.3 Class 1 laser product	6
2.1.4 RFID module	6
2.1.4.1 Safety information for RFID modules	6
2.1.4.2 FCC conformance for RFID	7
2.1.5 Certification	7
2.2 Product overview	8
2.3 Status indicator light	9
2.4 Product components	10
Section 3 Installation	11
3.1 Installation guidelines	11
3.2 Installation overview	11
3.3 Wall mount	13
3.3.1 Install with the wall mount bracket	13
3.3.2 Install directly on a wall	14
3.4 Install the desiccant cartridge	15
3.5 Replace the cleaning lid screws	17
3.6 Install the service bracket	17
3.7 Install the flow sensor (optional)	18
3.8 Install the automatic cleaning module (optional)	18
3.9 Connect to an SC controller	18
3.10 Plumbing	19
3.10.1 Plumb the instrument	19
3.10.2 Set the flow rate	22
Section 4 User navigation	22
Section 5 Operation	22
5.1 Configure the instrument	22
5.2 Show instrument information	23
5.3 Compare process and laboratory measurements	24
5.3.1 Collect a grab sample	24
5.3.2 Compare measurements with RFID	24
5.3.3 Compare measurements with Link2SC	25
5.3.3.1 Configure the Link2SC settings	26
Section 6 Calibration	27
6.1 Configure the calibration settings	27
6.2 Calibrate with a syringe	28
6.2.1 Make 4000-NTU Formazin stock solution	31
6.2.2 Prepare Formazin standards	31
6.3 1-point calibration without verification	32
6.3.1 Troubleshooting	33
6.3.1.1 Status indicator light	33

Table of Contents

6.3.2 Prevent vial contamination	33
6.4 Calibrate with vials without RFID	34
6.4.1 Make 4000-NTU Formazin stock solution	34
6.4.2 Prepare the standard vial(s)	34
6.4.2.1 Prepare Formazin standards	36
6.4.3 Calibration procedure—vials without RFID	36
Section 7 Verification	38
7.1 Configure the verification settings	38
7.2 Do a calibration verification with a syringe	39
7.3 Do a calibration verification with a sealed vial or glass rod	42
7.4 Show the calibration or verification history	43
Section 8 Maintenance	43
8.1 Maintenance schedule	44
8.2 Clean spills	44
8.3 Clean the instrument	44
8.4 Clean the vial	45
8.4.1 Do a chemical vial cleaning	45
8.5 Clean the vial compartment	47
8.6 Replace the vial	47
8.7 Replace the desiccant cartridge	50
8.8 Replace the tubing	50
Section 9 Troubleshooting	50
9.1 Reminders	50
9.2 Warnings	50
9.3 Errors	51
9.4 Fix water ingress	52
9.4.1 Setup after water ingress error	53
Section 10 Replacement parts and accessories	54

Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Measurement method	Nephelometry with scattered light collected at a 90-degree angle to the incident light and 360 degrees around the sample vial
Primary compliance method	DIN EN ISO 7027
Enclosure	Material: ASA Luran S 777K / RAL7000, TPE RESIN Elastocon® STK40, Thermoplastic Elastomer TPS-SEBS (60 Shore) and stainless steel
IP rating	Electronic compartment IP55; process head/Automatic Cleaning Module attached to the instrument and all of the other functional units IP65 ¹
Dimensions (W x D x H)	268 x 249 x 190 mm (10.6 x 9.8 x 7.5 in.)
Weight	Instrument with the process head: 2.7 kg (6.0 lb); Instrument with the optional automatic cleaning module: 5.0 kg (11.0 lb)
Power requirements	12 VDC, 14 VA supplied by the SC controller
Protection class	III
Pollution degree	2
Installation category	II
Mounting	Indoor on a wall
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage temperature	–40 to 60 °C (–40 to 140 °F)
Humidity	5 to 95% relative humidity, non-condensing
Sensor cable length	TU5x00 sc without Automatic Cleaning Module or flow sensor: 50 m (164 ft); TU5x00 sc with Automatic Cleaning Module: 10 m (33 ft)
Laser	Class 1 laser product: Contains a non user-serviceable class 1 laser.
Optical light source	850 nm, maximum 0.55 mW
Fittings	Sample inlet and outlet: ¼-in. OD tubing (optional tubing adapter, ¼ in. to 6 mm)
Tubing requirements	Polyethylene, polyamide or polyurethane tubing. Calibrated ¼ in. OD, +0.03 or –0.1 mm (+0.001 or –0.004 in.)
Measurement units	TU5300 sc: NTU, FNU, TE/F, EBC or FTU; TU5400 sc: NTU, mNTU ² , FNU, mFNU, TE/F, EBC, FTU or mFTU.
Range	0 to 1000 NTU, FNU, TE/F and FTU; 0 to 250 EBC
Method detection limit	0.0001 FNU at 25 °C (77 °F)
Response time	T90 < 30 seconds at 100 mL/min
Signal averaging	TU5300 sc: 30–90 seconds TU5400 sc: 1–90 seconds
Accuracy	± 2% or ± 0.01 FNU (the larger value) from 0 to 40 FNU ± 10% of reading from 40 to 1000 FNU based on Formazin primary standard at 25 °C (77 °F)

¹ Water drops, puddles or runlets that will not damage the instrument may be in the inner of the enclosure.

² 1 mNTU = 0.001 NTU

Specification	Details
Linearity	Better than 1% for 0 to 40 NTU based on Formazin primary standard at 25 °C (77 °F).
Repeatability	TU5300 sc: 0.002 FNU or 1% (the larger value) at 25 °C (77 °F) (> 0.025 FNU range); TU5400 sc: 0.0006 FNU or 1% (the larger value) at 25 °C (77 °F) (> 0.025 FNU range)
Stray light	< 0.01 FNU
Resolution	0.0001 FNU (0.0001 to 0.9999/1.000 to 9.999/10.00 to 99.99/100.0 to 1000 FNU) Default: TU5300 sc: 0.001 FNU and TU5400 sc: 0.0001 FNU
Air bubble compensation	Physical, mathematical
Sample requirements	Temperature: 2 to 60 °C (35.6 to 140 °F) Conductivity: 3000 µS/cm maximum at 25 °C (77 °F) Flow rate ³ : 100 to 1000 mL/min; optimal flow rate: 200 to 500 mL/min Pressure: 6 bar (87 psi) maximum compared to air, 2 to 40 °C (35.6 to 104 °F) sample; 3 bar (43.5 psi) maximum compared to air, 40 to 60 °C (104 to 140 °F) sample
Calibration options	StablCal® or Formazin: 1-point calibration (20 FNU) for 0 to 40 FNU measurement range, 2-point calibration (20 and 600 FNU) for 0 to 1000 FNU (full) measurement range or 2- to 6-point custom calibration for a measurement range of 0 FNU to the highest calibration point.
Verification options	Glass verification rod (solid secondary standard) ≤ 0.1 NTU, StablCal or Formazin
Verification (RFID or Link2SC®)	Verification of the measurement value by comparison of the process and lab measurements with RFID or Link2SC.
Certifications	CE compliant; US FDA accession number: 1420492-xxx. This product complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50. Australian RCM.
Warranty	1 year (EU: 2 years)

Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.








³ For the best results, operate the instrument at a flow rate of 200 mL/min when the maximum particle size is 20 µm. For larger particles (150 µm maximum), the best flow rate is 350 to 500 mL/min.

2.1.1 Use of hazard information



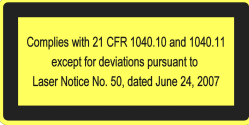
⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.
NOTICE
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates the need for protective eye wear.
	This symbol indicates a laser device is used in the equipment.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates radio waves.

2.1.3 Class 1 laser product

⚠ DANGER	
	Personal injury hazard. Never remove covers from the instrument. This is a laser-based instrument and the user risks injury if exposed to the laser.
	Class 1 laser product, IEC60825-1:2014, 850 nm, maximum 0.55 mW Location: Rear of the instrument.
	Conforms to U.S. regulations 21 CFR 1040.10 and 1040.11 in accordance with Laser Notice No. 50. Location: Rear of the instrument.

This instrument is a Class 1 Laser product. There is invisible laser radiation when the instrument is defective and when the instrument lid is open. This product complies with EN 61010-1, "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use" and with IEC/EN 60825-1, "Safety of Laser Products" and with 21 CFR 1040.10 in accordance with Laser Notice No. 50. Refer to the labels on the instrument that supply laser information.

2.1.4 RFID module



Instruments with the optional RFID module receive and transmit information and data. The RFID module operates with a frequency of 13.56 MHz.

RFID technology is a radio application. Radio applications are subject to national conditions of authorization. The use of instruments with the optional RFID module is currently permitted in the regions that follow:

EU (European Union) countries, EFTA (European Free Trade Association) countries, Turkey, Serbia, Macedonia, Australia, Canada, US, Chile, Ecuador, Venezuela, Mexico, Brazil, South Africa, India, Singapore, Argentina, Columbia, Peru and Panama

The use of instruments with the optional RFID module outside of the above-mentioned regions can violate national laws. The manufacturer reserves the right also to get authorization in other countries. In case of doubt, contact the manufacturer.

2.1.4.1 Safety information for RFID modules

⚠ WARNING	
	Multiple hazards. Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.
⚠ WARNING	
	Electromagnetic radiation hazard. Do not use the instrument in dangerous environments.
NOTICE	
This instrument is sensitive to electromagnetic and electromechanical interference. These interferences can have an effect on the analysis performance of this instrument. Do not put this instrument near equipment that can cause interference.	

Obey the safety information that follows to operate the instrument in accordance with local, regional and national requirements.

- Do not operate the instrument in hospitals and equivalent establishments or near medical equipment, such as pace makers or hearing aids.
- Do not operate the instrument near highly flammable substances, such as fuels, highly flammable chemicals and explosives.
- Do not operate the instrument near combustible gases, vapors or dust.
- Keep the instrument away from strong vibration or shock.
- The instrument can cause interference in immediate proximity to televisions, radios and computers.
- The warranty does not cover improper use or wear.

2.1.4.2 FCC conformance for RFID

This instrument may contain a registered radio frequency identification device (RFID). Refer to [Table 1](#) for the Federal Communications Commission (FCC) registration information.

Table 1 Registration information

Parameter	Value
FCC identification number (FCC ID)	YCB-ZBA987
IC	5879A-ZBA987
Frequency	13.56 MHz

2.1.5 Certification

⚠ CAUTION
This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits


Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

2.2 Product overview

⚠ DANGER	
	<p>Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.</p>

The TU5300 sc and the TU5400 sc turbidimeters are used with an SC controller to measure low-range turbidity mostly in finished drinking water applications. Refer to [Figure 1](#).

The TU5300 sc and the TU5400 sc turbidimeters measure scattered light at an angle of 90° in a 360° radius around the axis of the incident light beam.

An optional RFID module and an automatic system check option are available⁴. The RFID module is shown in [Figure 1](#). The RFID module lets process and laboratory turbidity measurements be easily compared. A description of the automatic system check option is given in [Configure the instrument](#) on page 22.

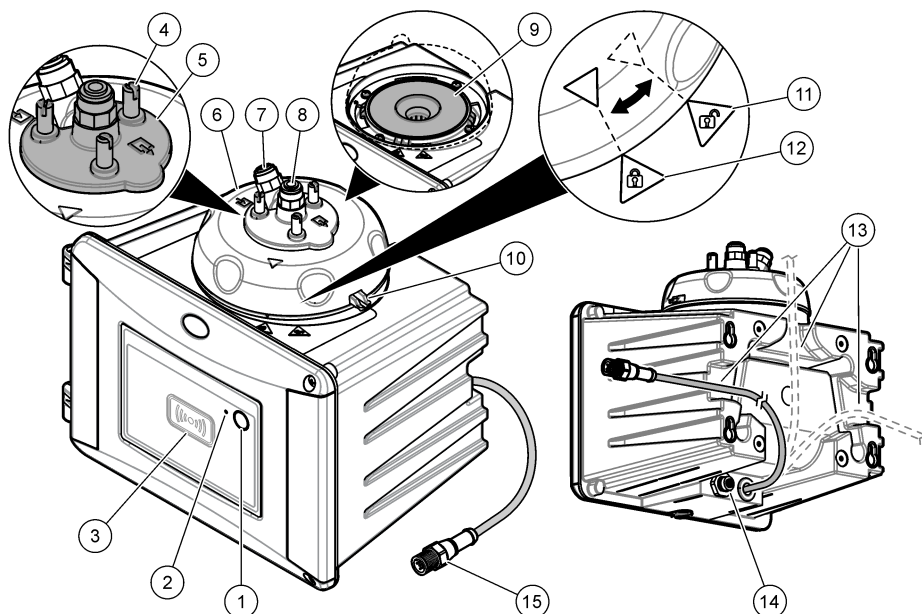
PROGNOSYS predictive diagnostic software is available for the TU5300 sc and TU5400 sc turbidimeters. To use PROGNOSYS, connect the turbidimeter to an SC controller with PROGNOSYS.

Videos on how to install, operate and do maintenance and troubleshooting on the TU5300 sc and the TU5400 sc turbidimeters are available on the *TU5 Series Turbidimeters* playlist at <http://www.youtube.com/user/hachcompany>.

The accessories are shown in [Installation overview](#) on page 11.

⁴ The RFID module and automatic system check option is only available at the time of purchase.

Figure 1 Product overview



1 Programmable button	9 Vial compartment
2 Status indicator light (refer to Status indicator light on page 9)	10 Overflow drain
3 RFID module indicator (optional)	11 Process head (open)
4 Cleaning lid screws (3x)	12 Process head (closed)
5 Cleaning lid	13 Channels for cables
6 Process head	14 Extension connector for accessories
7 Sample inlet	15 Sensor cable
8 Sample outlet	

2.3 Status indicator light

The status indicator light shows the instrument status. Refer to [Table 2](#) for status descriptions.

Note: The status indicator light is only on when the SC controller power is set to on and the sensor cable is connected to the sc controller.

Table 2 Status indicator light

Color	Status
Green (stable)	The instrument is in operation. The instrument status is ok—no warnings, errors or reminders.
Green (flashes)	Calibration is complete. The instrument status is ok.
	Verification is complete. The instrument status is ok.
Yellow (stable)	Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.

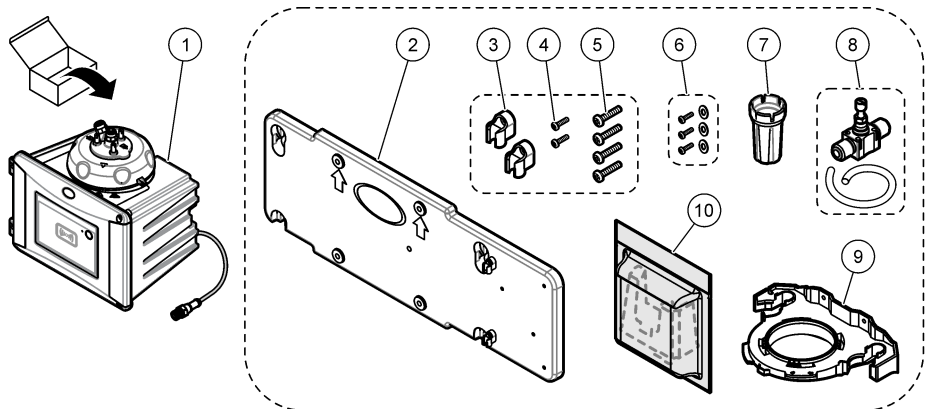
Table 2 Status indicator light (continued)

Color	Status
Yellow (flashes)	The instrument is in Service Mode.
	An automatic cleaning is in progress.
Yellow (flashes slow)	The optional flow sensor has identified that there is no sample flow or the sample flow is lower than the limit. Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.
Yellow (flashes fast)	The optional flow sensor has identified that the sample flow rate is higher than the limit. Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.
Red (stable)	Read the error that shows on the controller display. Refer to Errors on page 51 for the error description and solution.
Red (flashes)	Calibration or verification was not completed.
	The instrument cannot start calibration or verification for one or more reason that follows. <ul style="list-style-type: none">• The standard expired.• The first measurement of the verification standard was done with a different method (EPA/ISO).• The first measurement value of the verification standard is missing.
Blue (stable)	A calibration or verification is started.
Blue (flashes)	A calibration or verification measurement is started.
Blue (flashes fast)	A calibration or verification is started with RFID.

2.4 Product components

Make sure that all components have been received. Refer to [Figure 2](#). If any items are missing or damaged, contact the manufacturer or a sales representative immediately.


Figure 2 Product components



1 TU5300 sc or TU5400 sc	6 Cleaning lid screws and washers for hot water applications
2 Wall mount bracket (two tubing clips on bracket)	7 Vial replacement tool
3 Tubing clips	8 Flow regulator
4 Tubing clip screws, 2.2 x 6 mm	9 Service bracket
5 Mounting screws, 4 x 16 mm	10 Desiccant cartridge

Section 3 Installation

⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

3.1 Installation guidelines

NOTICE

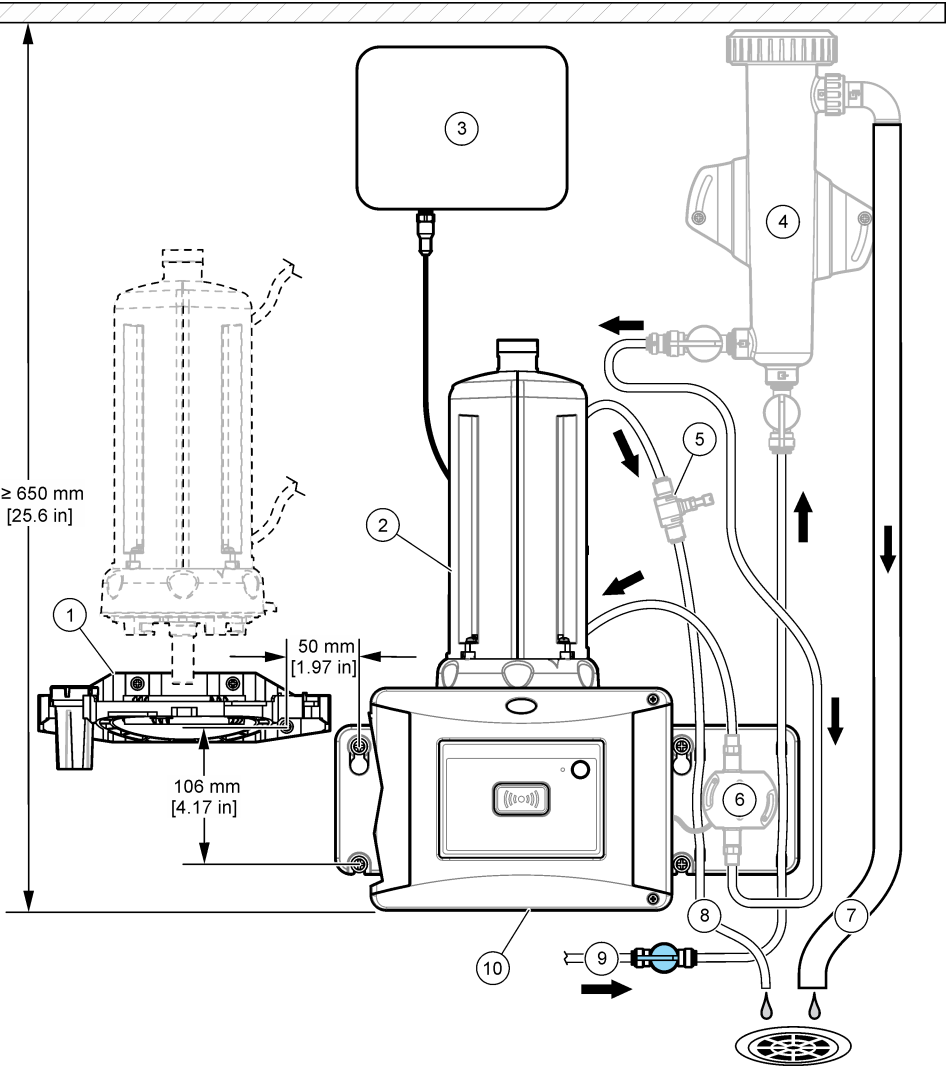
Make sure that there is a floor drain near the instrument. Examine the instrument daily for leaks.

This instrument is rated for an altitude of 3100 m (10,710 ft) maximum. Use of this instrument at an altitude higher than 3100 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

3.2 Installation overview

Figure 3 shows the installation overview with all of the accessories and the clearances necessary.

Figure 3 Installation overview with accessories



1 Service bracket	6 Flow sensor (accessory)
2 Automatic cleaning module (accessory)	7 Bubble trap overflow
3 SC controller	8 Sample outlet
4 Bubble trap (accessory)	9 Sample inlet
5 Flow regulator ⁵	10 TU5300 sc or TU5400 sc

⁵ Not used with the bubble trap.

3.3 Wall mount

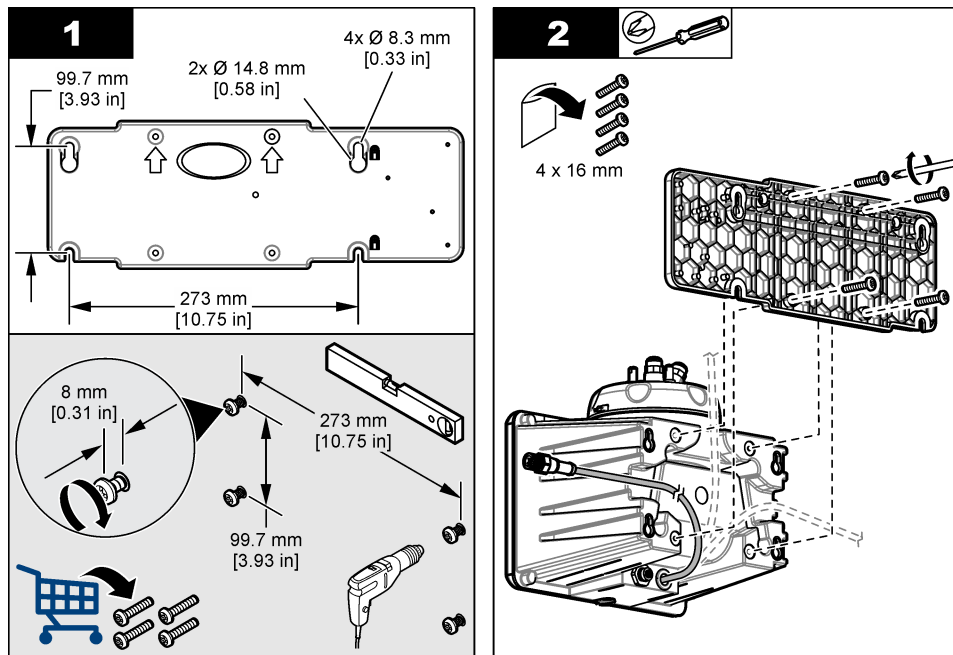
Install the instrument on a wall in a vertical position. Install the instrument so that it is level.

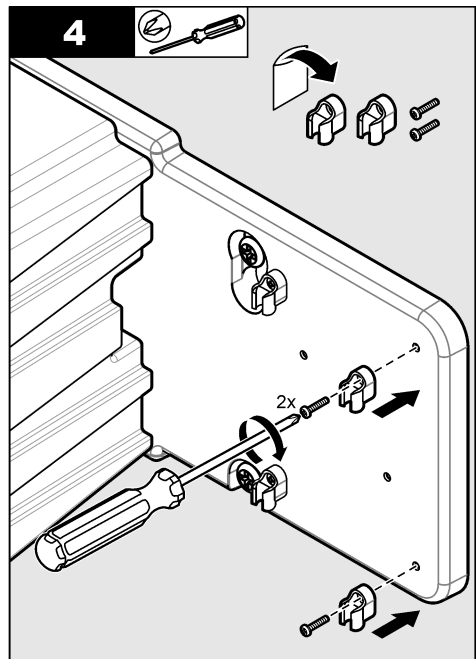
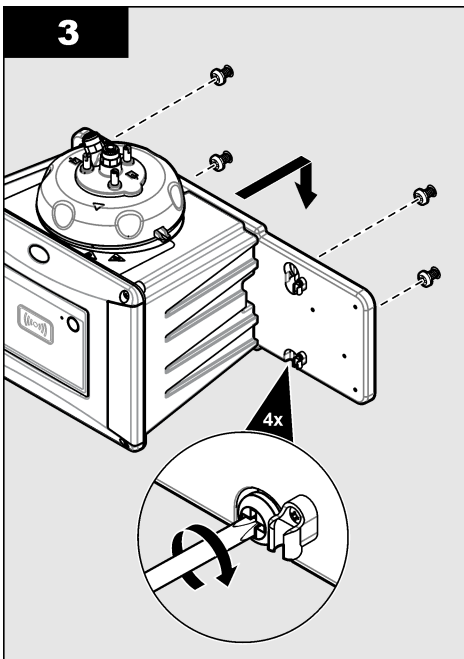
3.3.1 Install with the wall mount bracket

Refer to the illustrated steps that follow to install the instrument on a wall with the wall mount bracket. The mounting hardware to install the wall mount bracket on a wall is supplied by the user.

If a 1720D, 1720E, or FT660 instrument is replaced, remove the instrument from the wall. Then do steps 2 to 4 of the illustrated steps that follow to install the instrument on the existing hardware.

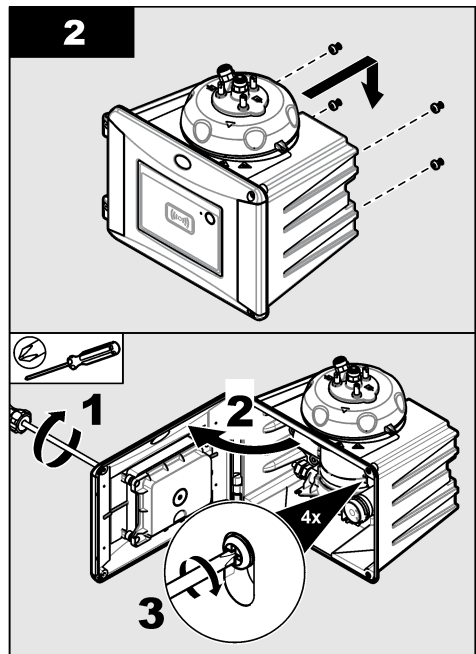
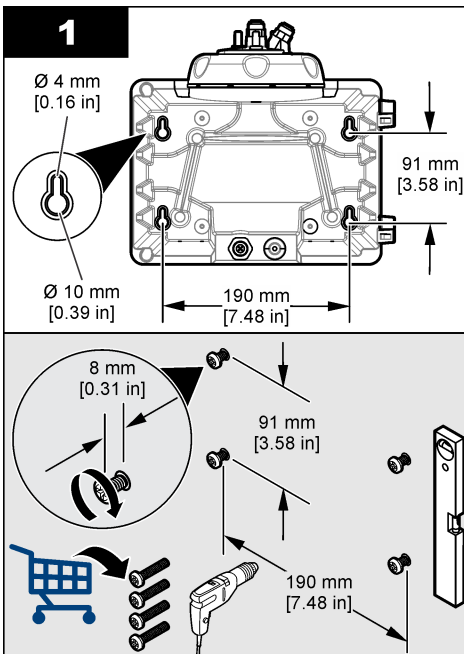
Note: When the accessories are used, the installation location of the tubing clips is different. Refer to the documentation supplied with the accessories for tubing clip installation.





3.3.2 Install directly on a wall

As an alternative, refer to the illustrated steps that follow to install the instrument directly on a wall. The mounting hardware is supplied by the user. Remove the thin, plastic film from the mounting holes on the back of the instrument.



3.4 Install the desiccant cartridge

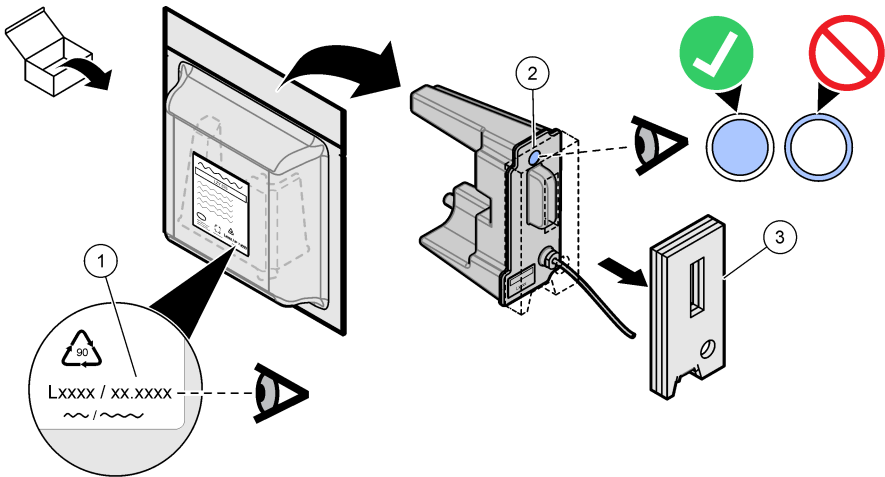
NOTICE

Make sure that the desiccant cartridge is installed or damage to the instrument will occur.

For initial installation, complete the steps below. For replacement, refer to the documentation supplied with the desiccant cartridge.

1. Look at the install by date on the packaging. Refer to [Figure 4](#). Do not use if the current date is past the install by date.
2. Make sure that the indicator on the new desiccant cartridge is light blue. Refer to [Figure 4](#).
3. Install the new desiccant cartridge. Refer to the illustrated steps that follow.

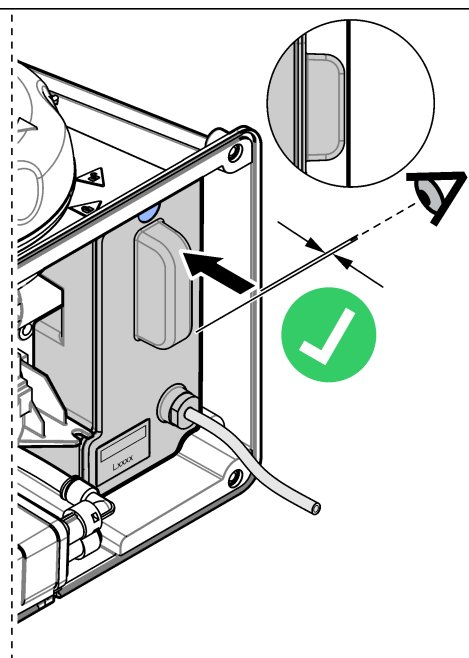
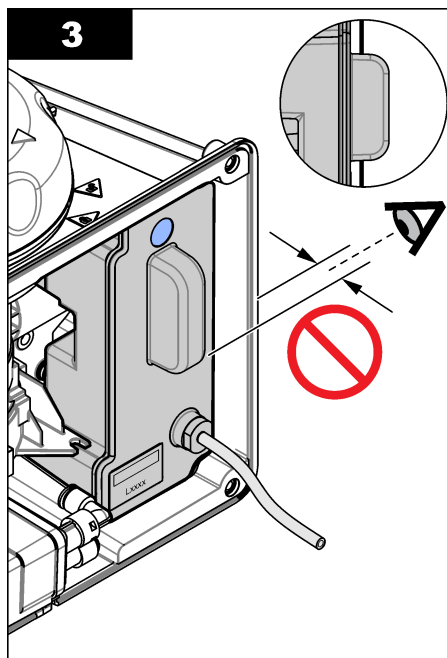
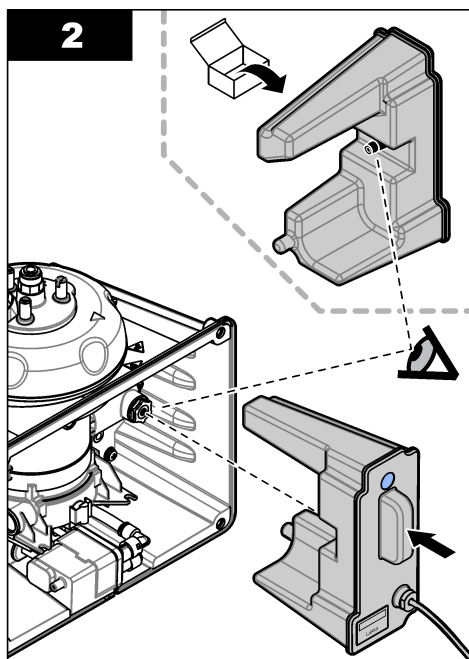
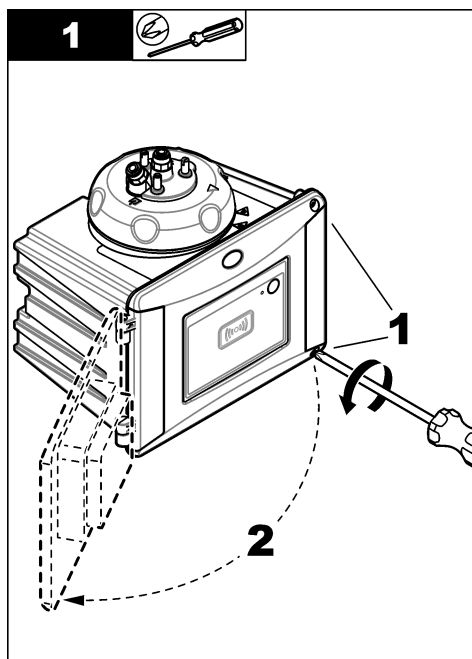
Figure 4 Examine the desiccant cartridge

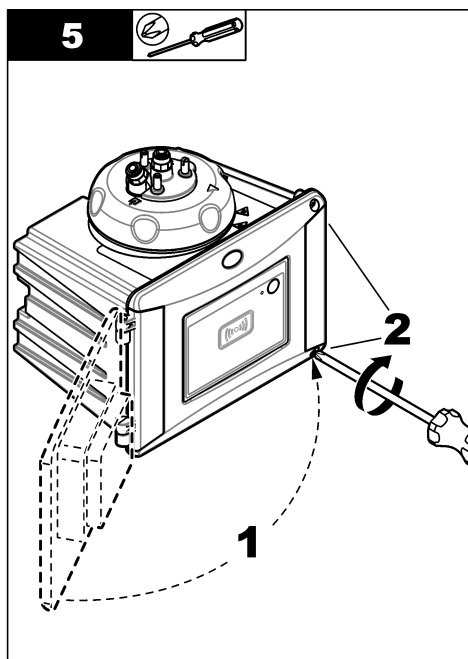
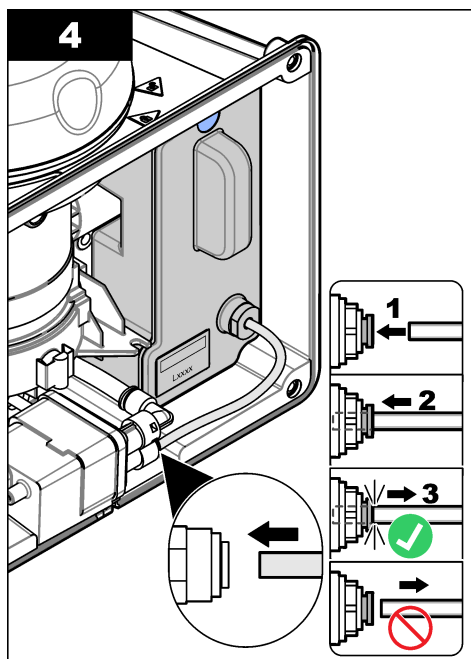


1 Install by date (mm.yyyy = month and year)

2 Indicator (light blue = not expired, white = expired)

3 Transport safety protection





3.5 Replace the cleaning lid screws

NOTICE

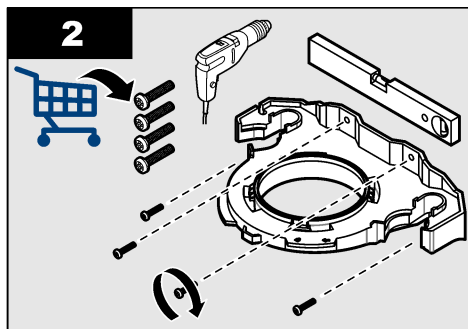
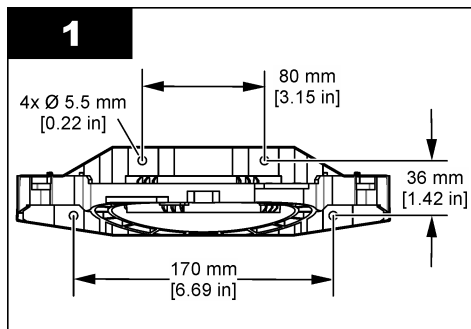
Do not overtighten the screws or breakage will occur. Hand tighten the screws.

If the sample temperature is 40 to 60 °C (104 to 140 °F), the cleaning lid screws will become hot. To prevent burns, replace the standard cleaning lid screws with the cleaning lid screws and washers for hot water. Refer to [Figure 1](#) on page 9 for the location of the cleaning lid screws.

3.6 Install the service bracket

The service bracket holds the process head (or the optional automatic cleaning module) when it is not installed on the instrument.

Refer to [Installation overview](#) on page 11 to install the service bracket the correct distance from the instrument. Refer to the illustrated steps that follow to install the service bracket.



3.7 Install the flow sensor (optional)


The optional flow sensor identifies if the sample flow is within specifications. A warning shows on the controller display and the status indicator light when a no flow, low flow or high flow warning occurs.

Install the optional flow sensor. Refer to the documentation supplied with the optional flow sensor.

3.8 Install the automatic cleaning module (optional)

The automatic cleaning module cleans the inside of the process vial at a selected time interval. Install the optional automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module.

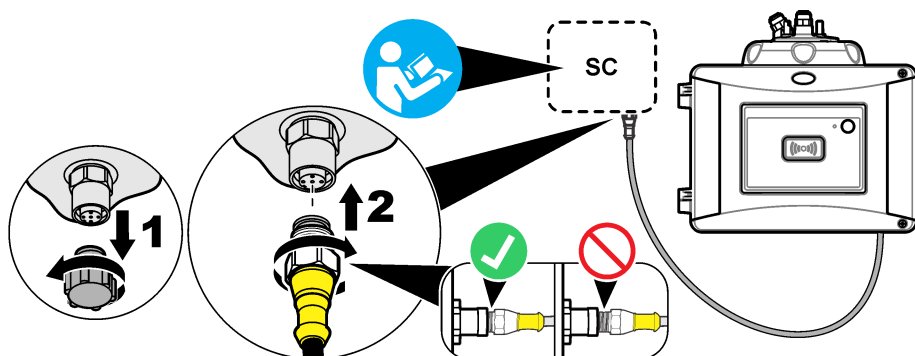
3.9 Connect to an SC controller

⚠ CAUTION	
	Personal injury hazard. Do not look into the vial compartment when the instrument is connected to power.



1. Get the latest software version from www.hach.com. Install the latest software version on the SC controller before the instrument is connected to the SC controller.
Refer to the software installation instructions supplied in the box or supplied in the software download for the SC controller.
2. Remove power to the SC controller.
3. Connect the sensor cable to the quick-connect fitting of the SC controller. Refer to [Figure 5](#). Keep the connector cap for later use.
4. Supply power to the SC controller.
The SC controller looks for the instrument.
5. When the SC controller finds the instrument, push **enter**.
On the main screen, the controller shows the turbidity value measured by the turbidimeter.

Figure 5 Connect the sensor cable to the SC controller



3.10 Plumbing

3.10.1 Plumb the instrument

⚠ WARNING



Explosion hazard. Make sure that the drain tube is free of all obstructions. If the drain tube has a blockage or is pinched or bent, high pressure can build up in the instrument.

⚠ WARNING



Personal injury hazard. The sample line contains water under high water pressure that can burn skin if hot. Qualified personnel must remove the water pressure and wear personal protective equipment during this procedure.

NOTICE

Do not let water get in the vial compartment or instrument damage will occur. Before the process head is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the vial nut is tight. The full water pressure should be on the system, the water flow is on and no water leak on the glass vial is seen.

NOTICE

Hold the automatic cleaning module vertically when it is installed on the instrument or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Before the instrument is plumbed, make sure that the desiccant cartridge and vial are installed.

NOTICE

Based on the environmental conditions, is necessary to wait a minimum of 15 minutes to let the system become stable.

Items supplied by the user:

- Flow shutoff valve

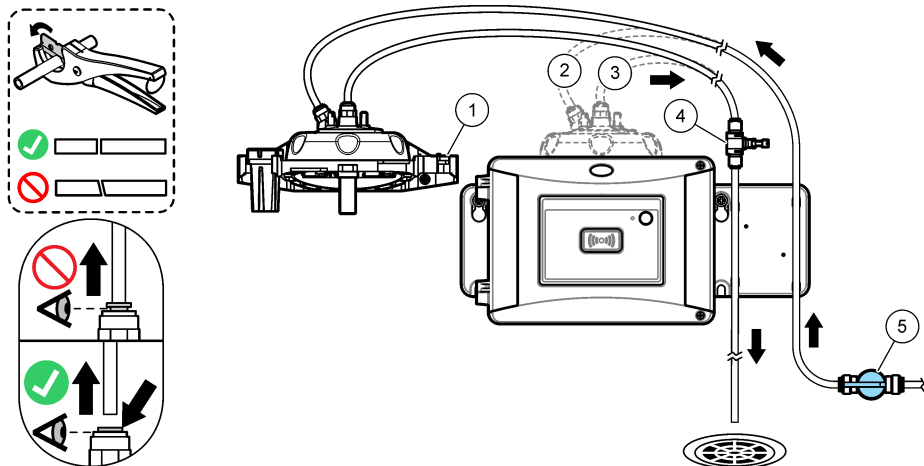
- Tubing⁶
- Tubing cutter

1. Plumb the instrument. Refer to the illustrated steps that follow and [Figure 6](#).

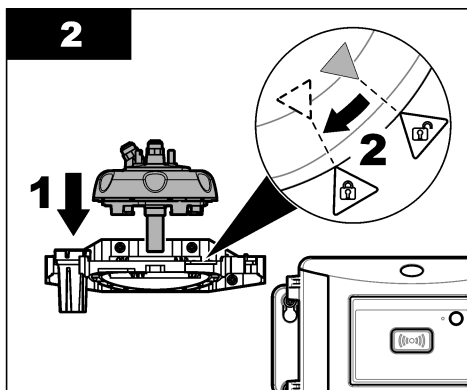
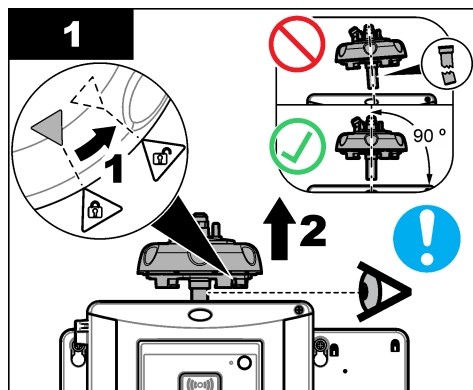
Note: To plumb the instrument with accessories, refer to the documentation supplied with the accessories.

Note: Use the opaque tubing accessory supplied from HACH accessory to prevent the bacteria growth.

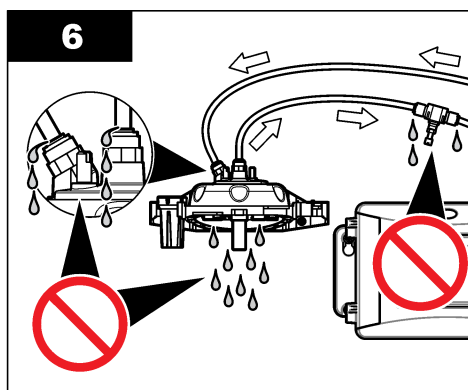
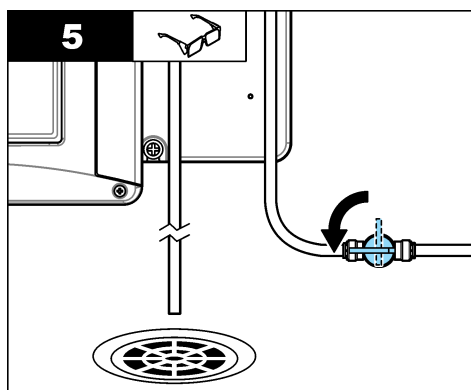
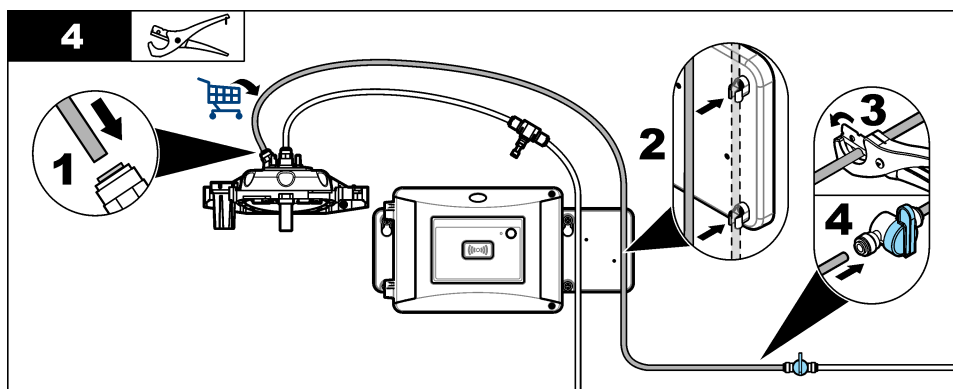
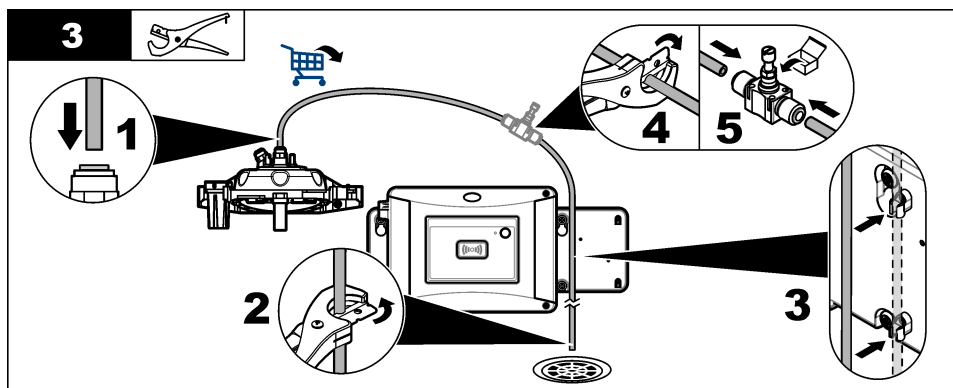
Figure 6 Plumbing overview – no accessories

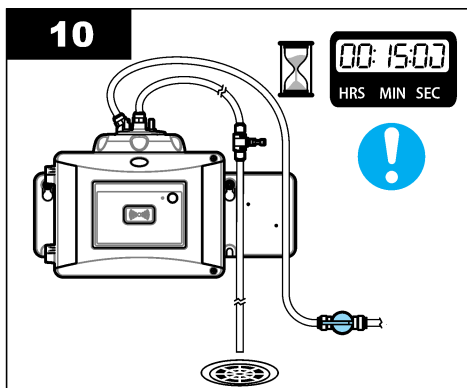
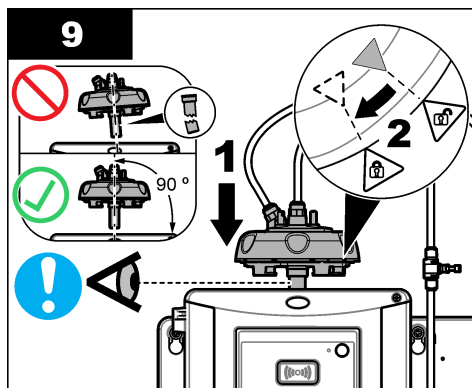
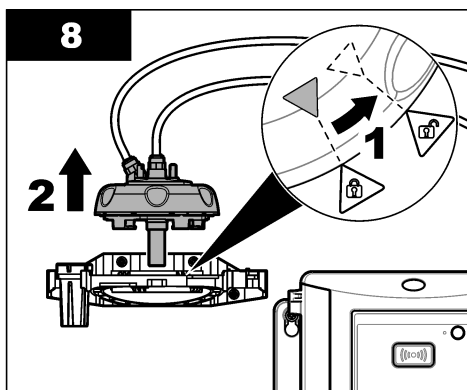
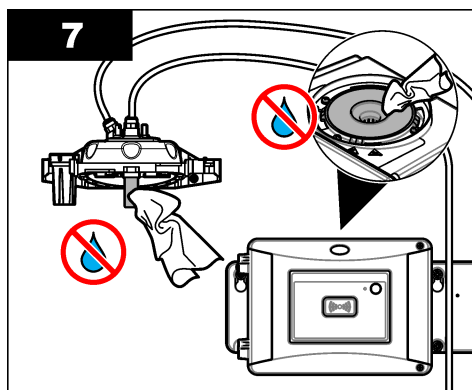


1 Service bracket	4 Flow regulator
2 Sample inlet	5 Flow shutoff valve
3 Sample outlet	



⁶ Refer to [Specifications](#) on page 3 for the tubing requirements.





3.10.2 Set the flow rate

1. Measure the flow with the flow regulator fully open. Make sure that the flow is in the middle of the flow specification. Refer to [Specifications](#) on page 3.
2. Slowly close the flow regulator until the flow decreases by 20 to 30%.
Note: The flow regulator causes back pressure in the tubing and decreases the quantity of bubbles that can form in the vial.

Section 4 User navigation

Refer to the controller documentation for keypad description and navigation information.

Push the **RIGHT** arrow key on the controller multiple times to show more information on the home screen and to show a graphical display.

Section 5 Operation

5.1 Configure the instrument

Select the location name, signal averaging, measurement units, resolution, bubble reject, logger interval, programmable button function and more.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>CONFIGURE**.
3. Select an option.

Option	Description
LOCATION	Sets the name or location of the sample source. The name or location entered shows on the measurement screen (16 characters maximum, default: serial number).
SIGNAL AVG	When enabled, the turbidity reading that shows on the controller display is an average of the values measured during the time interval selected. TU5300 sc options: 30–90 seconds; TU5400 sc options: 1–90 seconds (default: 30 seconds). Note: <i>The manufacturer recommends that the Signal Average setting be set to 30 seconds or less because of the fast response of the instrument.</i>
MEAS UNITS	Selects the measurement units that show on the controller display and that are recorded to the data log. TU5300 sc options: NTU, FNU, TE/F, EBC or FTU. TU5400 sc options: NTU, mNTU, FNU, mFNU, TE/F, EBC, FTU or mFTU. Default: FNU for TU5300 sc or mFNU for TU5400 sc.
RESOLUTION	Selects the number of decimal places that show on the controller display. Options: 0.001 or 0.0001. TU5300 sc default: 0.001. TU5400 sc default: 0.0001.
BUBBLE REJECT	Sets the bubble reject to on (default) or off. When set to on, high turbidity readings caused by bubbles in the sample are not shown or saved to the data log.
LOGGER INTERVAL	Sets the frequency that the turbidity reading is saved to the data log. Options: 5 or 30 seconds or 1, 2, 5, 10 (default), 15 or 30 minutes.
CLEANING	Configures the optional automatic cleaning module settings. Refer to the documentation supplied with the automatic cleaning module to configure the CLEANING setting. This option only shows when CLEANING MODULE is set to ON.
SET DEFAULTS	Sets the instrument settings to the factory defaults.
BUTTON FUNCTION	Sets the function of the programmable button. Refer to Figure 1 on page 9. SERVICE —When the button is pushed, changes the output mode to HOLD if the output mode is currently ACTIVE and changes the output mode to ACTIVE if the output mode is currently HOLD. LINK2SC —When the button is pushed, makes a Link2SC job file. Refer to Compare measurements with Link2SC on page 25. OFF (default)—Disables the button. In addition, when CLEANING MODULE is set to ON, the options that follow show. START WIPE —When the button is pushed, start a wiper cleaning cycle. WIPER REPLACE —When the button is pushed, puts the wiper in the position for wiper replacement.
FLOW SENSOR	Enables or disables the flow signal to show on the measurement screen and the DIAG/TEST>SIGNALS screen. Enables or disables flow signal warnings and errors to occur. When the optional flow sensor is installed, set to ON (default: OFF).
CLEANING MODULE	Enables or disables the automatic cleaning module menu options. When the optional automatic cleaning module is installed, set to ON (default: OFF). When this option is set to ON, the START WIPE option shows in the main SENSOR SETUP menu.
AUTO-CHECK	Sets the time interval and sensitivity of the automatic system check. This option only shows when the instrument has the automatic system check option. CHECK INTERVAL —Sets the time interval between automatic system checks. The automatic system check examines the condition of the vial. If the condition of the vial is bad, a warning message shows on the controller display. Options: OFF, 1, 2 (default), 3, 6, 12 hours or 1 day. SENSITIVITY —Sets the sensitivity of the automatic system check to the condition of the vial. Options: HIGH or LOW (default).

5.2 Show instrument information

Show instrument information and the instrument status to get diagnostic information.

1. Push **menu**.
2. Select SENSOR SETUP>TU5x00 sc>DIAG/TEST.

3. Select an option.

Option	Description
SENSOR INFO	Shows the sensor name, location, serial number, type (EPA or ISO), model number, software version and measurement device version.
SIGNALS	Shows real-time values for turbidity, flow rate ⁷ , the humidity set point and the air system humidity and temperature. Shows the vial condition (condensation and clarity) and the vial status (installed or not installed). Shows the lid type installed (calibration lid or process head).
COUNTERS	Shows the total operational time of the instrument, remaining number of wiper cycles, date the vial was installed/replaced, date the vial was cleaned, date of calibration, date of verification, operational time of the desiccant, remaining desiccant life, operational time of the air pump and date factory service was done. Note: <i>The counters are reset when menu-guided maintenance is done. Refer to the MAINTENANCE option that follows.</i>
MAINTENANCE	Starts menu-guided maintenance to replace or clean the vial, replace the wiper or replace the desiccant cartridge. START WIPE —Starts a wiper cleaning when the optional automatic cleaning module is installed. OUTPUT MODE —Selects the output behaviour during maintenance (default: HOLD). FACTORY SERVICE —For service use only.

5.3 Compare process and laboratory measurements

Compare process and laboratory measurements with RFID or Link2SC. Make sure that the process and lab instrument are calibrated with the same number of calibration points and with the same standards. Make sure that the calibrations are not expired.

5.3.1 Collect a grab sample

Collect a 100-mL sample (minimum) from the sample outlet tubing of the process instrument. Collect the sample in a clean glass bottle with a tight-fitting cap. Do not collect samples directly into a sample vial.

1. Rinse the glass bottle a minimum of three times with water from the sample outlet tubing of the process instrument. Let the bottle overflow with the sample.
2. Collect a 100-mL sample (minimum) in the glass bottle from the sample outlet tubing of the process instrument.
3. Put the cap on the sample bottle.
4. Analyze the grab sample immediately with the laboratory instrument to prevent settling, bacteria growth and temperature changes.

5.3.2 Compare measurements with RFID

When the process instrument and laboratory instrument have the optional RFID module, compare process and laboratory measurements with RFID.

Items to collect:

- TU5300 sc or TU5400 sc with the optional RFID module
 - TU5200 with the optional RFID module
 - TU5200 sample vials
 - Glass sample bottle with a sample RFID sticker
 - Operator RFID tag (optional)
1. At the process instrument, put the operator RFID tag (if available) near the RFID module. Refer to [Figure 1](#) on page 9 for the location of the RFID module.
 2. Put a sample RFID sticker on the sample bottle.
 3. Collect a grab sample. Refer to [Collect a grab sample](#) on page 24.

⁷ A value less than 0.1 shows if the optional flow sensor is not installed.

4. At the process instrument, put the RFID sticker that is on the sample bottle near the RFID module.
The instrument gives a sound signal. The status indicator light changes to blue.
The turbidity reading, operator ID (if available), location of the process instrument and the date and time are recorded on the RFID sticker.
5. Move the grab sample bottle to the laboratory instrument.
6. On the TU5200, push **Options>Reading Setup**.
7. Push **Bubble Reject**, then set bubble reject to on.
8. If the grab sample is 1 NTU or less, push **Reading>Minimum Mode**, then select 60 seconds.
Note: In minimum mode, readings are done continuously for 60 seconds when a measurement is done. The smallest reading within 60 seconds is saved to the data log.
9. At the laboratory instrument, put the operator RFID tag (if available) near the RFID module to log in.
10. Put the RFID sticker that is on the sample bottle near the RFID module.
The instrument gives a sound signal. The turbidity reading from the process instrument shows on the display.
11. Prepare a grab sample vial. Refer to *Prepare a sample vial* in the TU5200 documentation.
12. Measure the turbidity of the grab sample with the laboratory instrument. Refer to the TU5200 documentation.
If the difference between the process and laboratory measurements is not more than the selected acceptance range, "Measurement values match." shows on the display. Refer to the TU5200 documentation to select the acceptance range.
If "Measurement values do not match." shows on the display, click the link to show the troubleshooting steps.
13. To show the compare log, push **Options>Compare Log**. Refer to the TU5200 documentation for more options.
14. To send the verification data to external devices that are connected to the instrument, push **Options>Send Data**. Refer to the TU5200 documentation for more options.

5.3.3 Compare measurements with Link2SC

When the process instrument and laboratory instrument do not have the optional RFID module, compare the process and laboratory measurements with Link2SC.

Items to collect:

- TU5300 sc or TU5400 sc
 - TU5200
 - TU5200 sample vials
 - SD card⁸ (or a LAN connection at the SC controller⁹ and the laboratory instrument¹⁰)
 - USB adapter for the SD card (if used)
1. Collect a grab sample. Refer to [Collect a grab sample](#) on page 24.
 2. If the SC controller and laboratory instrument do not have a LAN connection, install the SD card in the SC controller. Refer to the SC controller documentation to install the SD card.
 3. At the SC controller, make a Link2SC job file as follows:
 - a. Push **menu**.
 - b. Select **LINK2SC>CREATE A NEW JOB>TU5x00 sc**.
The SC controller makes a Link2SC job file. The turbidity reading, operator ID (if available), location of the process instrument and the date and time are recorded to the job file.

⁸ Refer to the SC controller documentation for the SD card requirements.

⁹ Refer to the SC controller documentation to set up a LAN connection at the SC controller.

¹⁰ Refer to the TU5200 documentation to set up a LAN connection at the laboratory instrument.

In addition, the temperature, calibration settings, bubble reject setting, vial clarity and desiccant cartridge life are recorded to the Link2SC job file.

4. Push **OK**, then **YES**.
5. Select **JOB>LAB**.
The Link2SC job file is saved to the SD card (if available) or sent to the laboratory instrument (when the SC controller and laboratory instrument have a LAN connection).
To see the Link2SC job files on the SD card, select **JOBS FROM CARD**.
6. If the SC controller and laboratory instrument do not have a LAN connection, complete the steps that follow.
 - a. Remove the SD card from the SC controller.
 - b. At the laboratory instrument, put the SD card in the USB adapter. Then put the USB adapter in a USB port type A on the laboratory instrument.
7. Move the grab sample bottle to the laboratory instrument.
8. On the TU5200, push **Options>Reading Setup**.
9. Push **Bubble Reject**, then set bubble reject to on.
10. If the grab sample is 1 NTU or less, push **Reading>Minimum Mode**, then select 60 seconds.
Note: In minimum mode, readings are done continuously for 60 seconds when a measurement is done. The smallest reading within 60 seconds is saved to the data log.
11. At the laboratory instrument, push the **LINK2SC** to show the job list.
12. Select the latest Link2SC job file.
The turbidity measurement from the process instrument shows on the right side of the display.
13. Prepare a grab sample vial. Refer to *Prepare a sample vial* in the TU5200 documentation.
14. Measure the turbidity of the grab sample with the laboratory instrument. Refer to the TU5200 documentation.
If the difference between the process and laboratory measurements is not more than the selected acceptance range, "Measurement values match." shows on the display. Refer to to select the acceptance range.
If "Measurement values do not match." shows on the display, click the link to show the troubleshooting steps.
15. To show the compare log, push **Options>Compare Log**. Refer to the TU5200 documentation for more options.
16. To send the verification data to external devices that are connected to the instrument, push **Options>Send Data**. Refer to the TU5200 documentation for more options.

5.3.3.1 Configure the Link2SC settings

Select the acceptance range permitted when process and laboratory measurements are compared with Link2SC.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>LINK2SC**.
3. Select an option.

Option	Description
ACCEPT. UNIT	Sets the units used to compare the process and laboratory measurements. Options: %, NTU or LAB. Select LAB when the acceptance range is supplied by the laboratory instrument.
ACCEPT. RANGE	Sets the maximum difference permitted between the process and laboratory measurements. Options: 1 to 50% (default: 10%). This option only shows when ACCEPT. UNIT is set to % or NTU.

Section 6 Calibration

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

The instrument is factory calibrated and the laser light source is stable. The manufacturer recommends that a calibration verification be done periodically to make sure that the system operates as intended. The manufacturer recommends calibration as local regulations require and after repairs or comprehensive maintenance work.

Use the optional calibration lid and a vial(s) with a StablCal standard or Formazin standard to calibrate the instrument. Refer to the Calibration lid documentation for more calibration procedures with and without RFID vials, 1-point and 2-point calibrations. As an alternative, use a syringe and StablCal standard or Formazin standard to calibrate the instrument.

6.1 Configure the calibration settings

Select the calibration curve, calibration interval, output behavior during calibration and more.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>CALIBRATION>SETUP**.
3. Select an option.

Option	Description
MENU GUIDED	Sets menu-guided calibration to SEALED VIAL, SYRINGE or OFF (default). Calibration instructions show on the controller display ¹¹ during calibration when set to SEALED VIAL or SYRINGE. Note: The MENU GUIDED option does not show when sealed vials with RFID are used.
CAL CURVE¹²	Selects the type of standard and the calibration curve (range). STABLCAL 0–40 FNU (default)—1-point calibration (20 FNU) with StablCal. STABLCAL 0–1000 FNU —2-point calibration (20 FNU and 600 FNU) with StablCal. FORMAZIN 0–40 FNU —2-point calibration (20 FNU and dilution water) with Formazin. FORMAZIN 0–1000 FNU —3-point calibration (20 FNU and 600 FNU and dilution water) with Formazin. CUSTOM —2- to 6-point calibration (0.02 to 1000 FNU) with StablCal or Formazin. The user selects the number of calibration points and the value of each calibration point.
VER AFTER CAL	Sets the instrument to start a verification immediately after the instrument is calibrated. When set to on, the verification standard is measured immediately after a calibration is done. Default: ON. Refer to Configure the verification settings on page 38.
CAL REMINDER	Sets the time interval between calibrations. The controller will show a reminder when a calibration is due. When a calibration is done, the calibration time is set to zero. Options: OFF(default), 1 day, 7 days, 30 days or 90 days.



¹¹ Or the Claros user interface for Claros controllers without a display.

¹² Select the correct setting for the calibration with StablCal vials with RFID procedure. Refer to the applicable section of this manual.

Option	Description
OUTPUT MODE	Selects the output behavior during calibration. ACTIVE —The outputs continues to give the measurement values during calibration. HOLD (default)—Keeps the outputs at the last measurement value before calibration. The outputs give the measurement values again when the calibration procedure is complete. SET TRANSFER —Sets the outputs to the SET TRANSFER value selected in the controller settings. Refer to the controller setting for more information.
CAL POINTS	When the CAL CURVE setting is set to CUSTOM, this option sets the number of calibration points (2 to 6). This option only shows when the CAL CURVE setting is set to CUSTOM.
OFFSET	Enables the offset function when set to on (default: OFF). When enabled, the selected offset value is added to each reading. To enter an offset value, set to ON then push back to exit the SETUP menu. Select SET OFFSET and enter an offset value (default: 0.0).
FACTOR¹³	Enables the factor function when set to on (default: OFF). When enabled, the selected factor value is used as a slope to the turbidity reading. To enter a factor value, set to ON then push back to exit the SETUP menu. Select SET FACTOR and enter a factor value (default: 1.0).
SET FACT CAL	Sets the calibration settings to the factory defaults.

6.2 Calibrate with a syringe

Pre-requisite: Configure the calibration settings. Refer to [Configure the calibration settings](#) on page 27.

⚠ WARNING	
 	<p>Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.</p>

Items to collect:

- StablCal standard or prepared Formazin standard at the same ambient temperature as the sensor
- Calibration syringe and tubing

To prepare a Formazin standard(s), refer to [Prepare Formazin standards](#) on page 31. To make 4000-NTU Formazin stock solution, refer to [Make 4000-NTU Formazin stock solution](#) on page 31.

1. Push **menu**.
2. Select SENSOR SETUP>TU5x00 sc>CALIBRATION>SETUP>MENU GUIDED>SYRINGE.
3. Select SENSOR SETUP>TU5x00 sc>CALIBRATION>START.

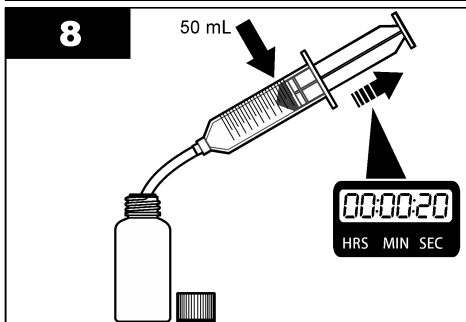
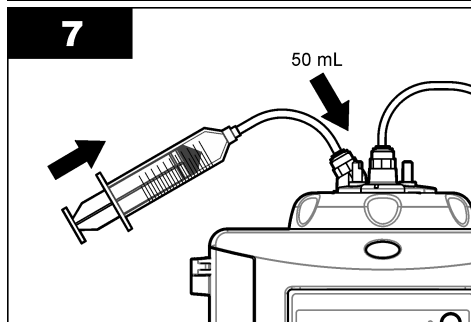
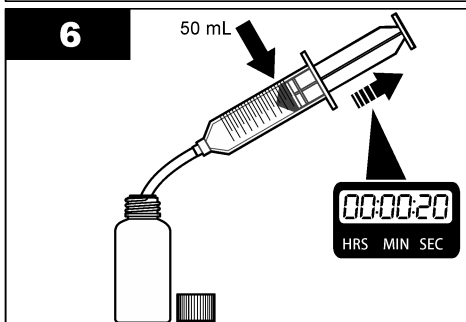
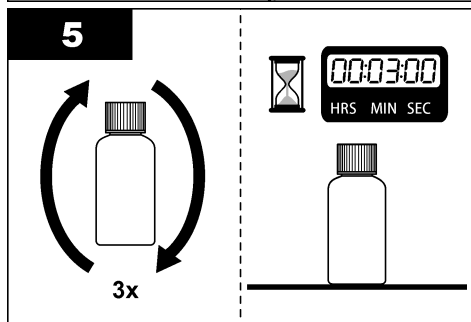
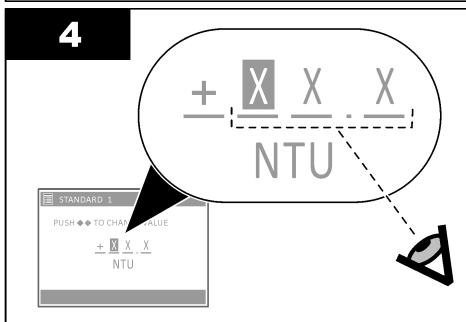
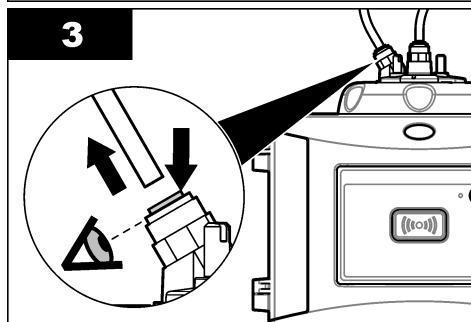
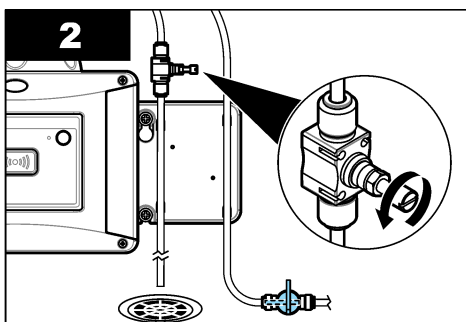
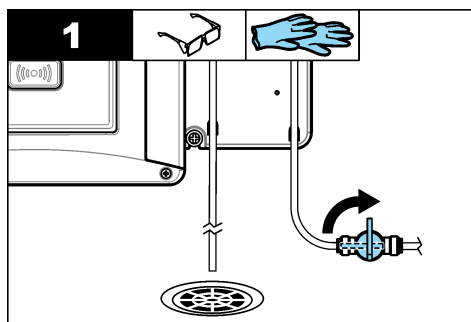
4. Complete the steps shown on the display.

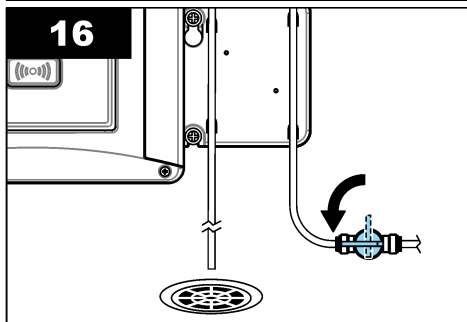
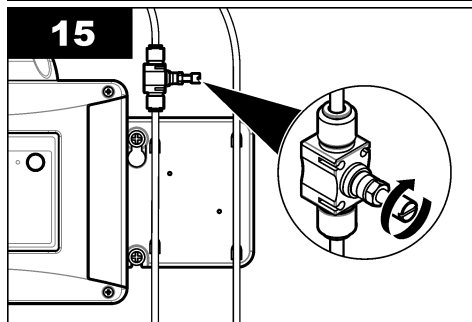
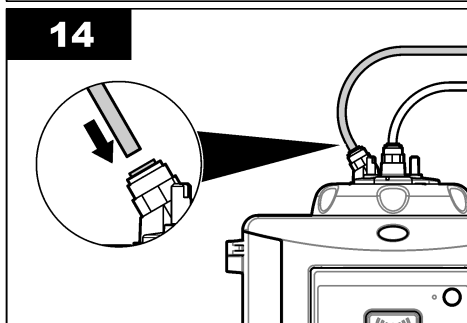
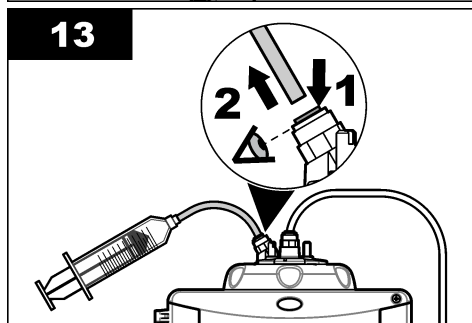
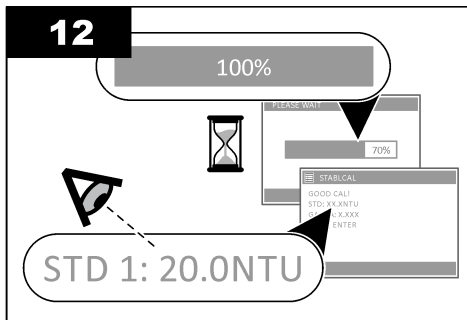
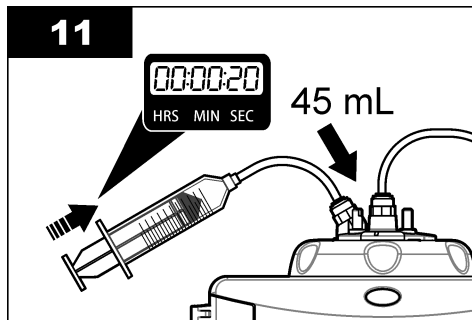
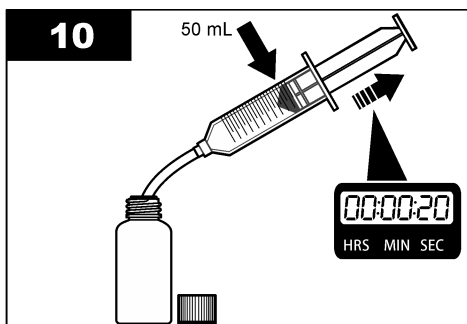
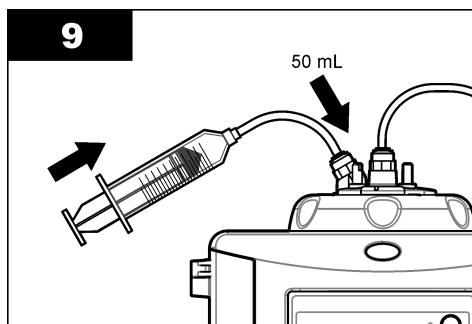
Refer to the illustrated steps that follow to complete the steps shown on the display.

At illustrated step 4, enter the measured turbidity value of the standard. If the standard value that shows on the display is correct, push confirm. The status indicator light changes to blue.

At illustrated step 15, fully open the flow regulator. Then slowly close the flow regulator until the flow decreases by 20 to 30%.

¹³ This option is only available on ISO models of the instrument. This option only shows when the CAL CURVE setting is set to STABLCAL or FORMAZIN.





6.2.1 Make 4000-NTU Formazin stock solution

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Note: The manufacturer recommends that Formazin stock solution is not made from raw materials. Preparation of Formazin stock solution is temperature and technique sensitive. Use Hach Formazin stock solution to get the best instrument performance and analytical standard accuracy.

1. Dissolve 5.000 grams of reagent grade hydrazine sulfate ($(\text{NH}_2)_2\text{--H}_2\text{SO}_4$) in about 400 mL of demineralized water.
2. Dissolve 50.000 grams of reagent grade hexamethylenetetramine in approximately 400 mL of demineralized water.
3. Quantitatively, pour the two solutions in a 1-liter volumetric flask, and dilute to volume with demineralized water. Mix fully.
4. Let the solution stand for 48 hours at $25 \pm 1^\circ\text{C}$ ($77 \pm 1^\circ\text{F}$).

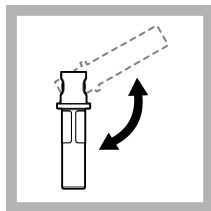
6.2.2 Prepare Formazin standards

Prepare Formazin standards immediately before a calibration and discard after use.

1. Prepare a 20 NTU Formazin standard as follows:
 - a. Use a pipet to add 5.0 mL of 4000 NTU Formazin standard solution in a 1-L volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.
2. When the sample turbidity range is 40 to 700 NTU¹⁴, prepare a 600 NTU Formazin standard as follows:
 - a. Use a pipet to add 15.0 mL of 4000 NTU Formazin standard solution in a 100-mL volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.

¹⁴ 1 mNTU = 0.001 NTU

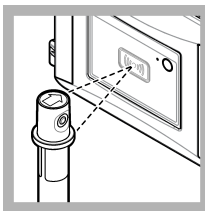
6.3 1-point calibration without verification



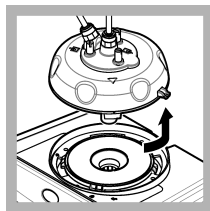
1. Invert the 20 NTU StablCal vial for 2 to 3 minutes. Refer to the documentation supplied with the StablCal vials.



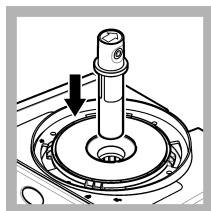
2. Clean and dry the vial with a no-lint cloth. Refer to [Prevent vial contamination](#) on page 33.



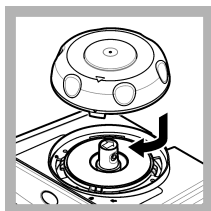
3. Put the 20 NTU vial in front of the RFID module. A beep sound is heard and the status indicator light flashes blue. If the status indicator light does not flash blue refer to [Troubleshooting](#) on page 33. The instrument records the value, the lot number, the expiration date and the Certificate of Analysis information from the RFID vial to the data log.



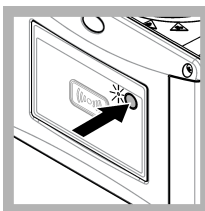
4. Remove the process head (or the automatic cleaning module).



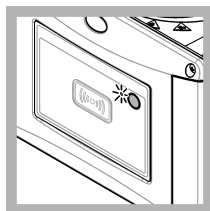
5. Put the 20 NTU vial in the vial compartment.



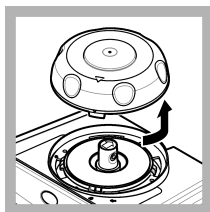
6. Install the calibration lid. Make sure that the calibration lid is in the closed position.



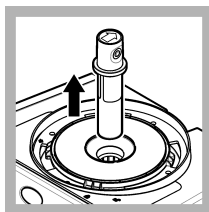
7. Push the button on the front of the instrument.



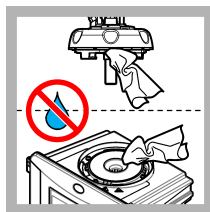
8. Wait 30 to 60 seconds for the measurement to complete. The status indicator light slowly flashes blue during the measurement.



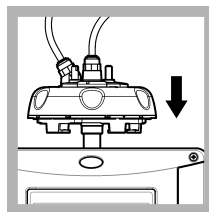
9. When the status indicator light flashes green, remove the calibration lid.



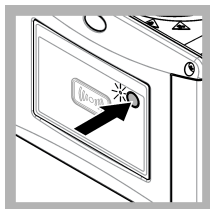
10. Remove the vial.



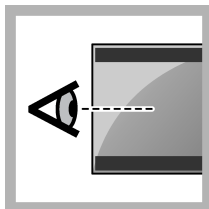
11. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



12. Hold the process head (or automatic cleaning module) vertically when it is installed on the instrument or the vial can break.



13. Push the button on the front of the instrument to save the calibration value. The status indicator light stays green.



14. Examine the calibration data on the controller menu or the Claros user interface.

6.3.1 Troubleshooting

6.3.1.1 Status indicator light

Problem	Possible cause	Solution
The status indicator light does not change.	RFID communication failure	Make sure that the TU5x00 has an RFID reader.
		Make sure that the StablCal vial is an RFID cuvette.
		The RFID tag of the cuvette is defective.
The status indicator light flashes red.	The calibration setting is not correct.	Make sure that the calibration setting is configured with STABL CAL.
	The cuvette has expired.	Use a new cuvette.

6.3.2 Prevent vial contamination

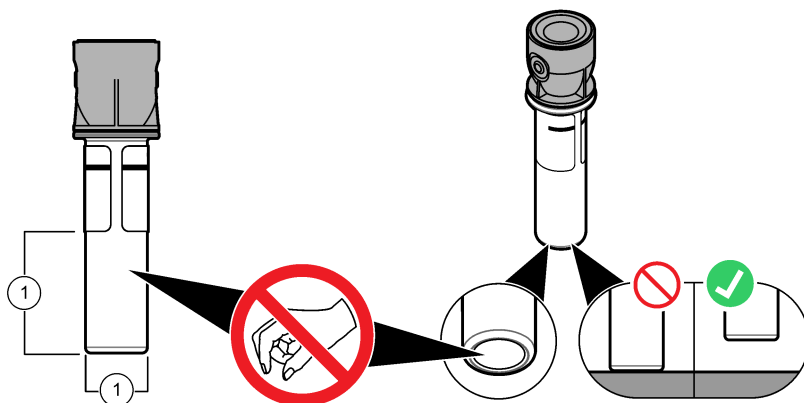
NOTICE

Do not touch or scratch the glass of the sample vial. Contamination or scratches on the glass can cause measurement errors.

The glass must stay clean and have no scratches. Use a no-lint cloth to remove dirt, fingerprints or particles from the glass. Replace the sample vial when the glass has scratches.

Refer to [Figure 7](#) to identify where not to touch the sample vial. Always keep the sample vials in the vial stand to prevent contamination on the bottom of the vial.

Figure 7 Sample vial overview



1 Measurement surface—Do not touch.

6.4 Calibrate with vials without RFID

6.4.1 Make 4000-NTU Formazin stock solution

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Note: The manufacturer recommends that Formazin stock solution is not made from raw materials. Preparation of Formazin stock solution is temperature and technique sensitive. Use Hach Formazin stock solution to get the best instrument performance and analytical standard accuracy.

1. Dissolve 5.000 grams of reagent grade hydrazine sulfate ($(\text{NH}_2)_2\text{H}_2\text{SO}_4$) in about 400 mL of demineralized water.
2. Dissolve 50.000 grams of reagent grade hexamethylenetetramine in approximately 400 mL of demineralized water.
3. Quantitatively, pour the two solutions in a 1-liter volumetric flask, and dilute to volume with demineralized water. Mix fully.
4. Let the solution stand for 48 hours at $25 \pm 1^\circ\text{C}$ ($77 \pm 1^\circ\text{F}$).

6.4.2 Prepare the standard vial(s)

⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

NOTICE

Always put a cap on the sample vial to prevent spills in the vial compartment.

To use sealed vials for calibration, immediately go to [Calibration procedure—vials without RFID](#) on page 36. To use unsealed vials for calibration, prepare the standard vial(s) as follows:

- For formazin calibration, prepare the formazin standards with 4000-NTU formazin stock solution. Refer to [Prepare Formazin standards](#) on page 31.

Note: To make 4000-NTU formazin stock solution, refer to [Make 4000-NTU Formazin stock solution](#) on page 31.

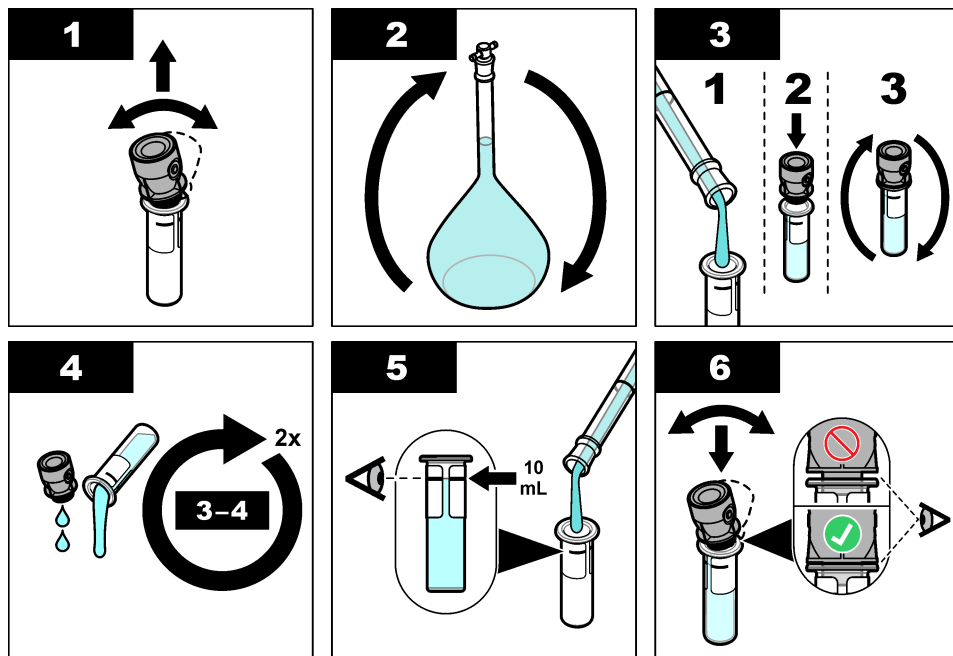
- Prepare the standard vial(s). Refer to the illustrated steps that follow.

- FORMAZIN 0–40 NTU (or 0–40 FNU) calibration**—Two vials: formazin 20 NTU and dilution water¹⁵ used to prepare the formazin standard.
- FORMAZIN 0–700 NTU (or 0–1000 FNU) calibration**—Three vials: formazin 20 NTU, formazin 600 NTU and the dilution water¹⁵ used to prepare the formazin standards
- STABLCAL 0–40 NTU (or 0–40 FNU) calibration**—One vial: StablCal 20 NTU
- STABLCAL 0–700 NTU (or 0–1000 FNU) calibration**—Two vials: StablCal 20 NTU and StablCal 600 NTU

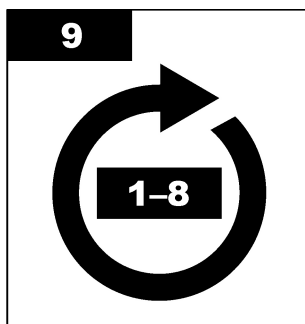
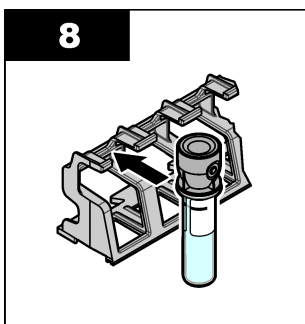
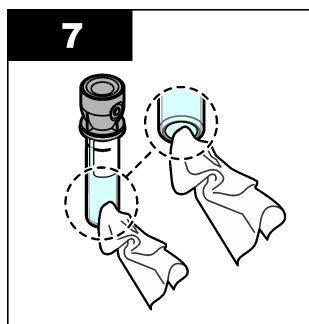
Make sure that the standard is at the same ambient temperature as the sensor.

If there is contamination in the sample vial after it is rinsed with the sample, clean the sample vial. Refer to the TU5200 documentation for vial cleaning instructions.

If calibration with verification is used, make sure to measure the verification standard with the menu item **Define Std Val**. Refer to [Configure the verification settings](#) on page 38.



¹⁵ Make sure that the vial contains dilution water for a minimum of 12 hours before the procedure.



6.4.2.1 Prepare Formazin standards

Prepare Formazin standards immediately before a calibration and discard after use.

1. Prepare a 20 NTU Formazin standard as follows:
 - a. Use a pipet to add 5.0 mL of 4000 NTU Formazin standard solution in a 1-L volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.
2. When the sample turbidity range is 40 to 700 NTU¹⁶, prepare a 600 NTU Formazin standard as follows:
 - a. Use a pipet to add 15.0 mL of 4000 NTU Formazin standard solution in a 100-mL volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.

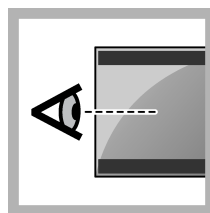
6.4.3 Calibration procedure—vials without RFID



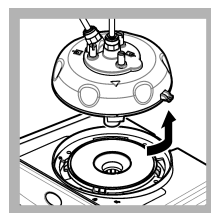
1. Push **menu**. Select
SENSOR SETUP>
TU5x00 sc>
CALIBRATION>
SETUP> MENU
GUIDED> SEALED
VIAL.



2. Select SENSOR
SETUP> TU5x00 sc>
CALIBRATION>
START.
The status indicator
light changes to blue.



3. Follow the
instructions on the
controller display.



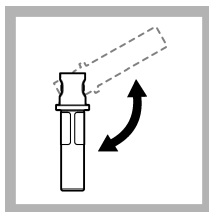
4. Remove the process
head (or the automatic
cleaning module).

¹⁶ 1 mNTU = 0.001 NTU



5. Enter the value of the vial and push ENTER.

The status indicator light changes to blue.

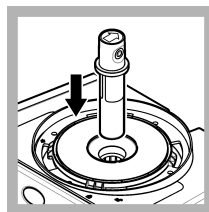


6. Carefully invert the vial a minimum of three times.

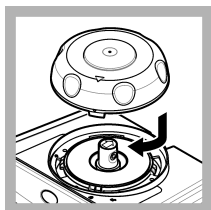
For StablCal vials, invert the 20 NTU StablCal vial for 2 to 3 minutes. Refer to the documentation supplied with the StablCal vials.



7. Clean and dry the vial with a no-lint cloth. Refer to [Prevent vial contamination](#) on page 33.



8. Put the vial in the vial compartment.

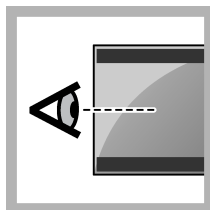


9. Install the calibration lid. Make sure that the calibration lid is in the closed position.

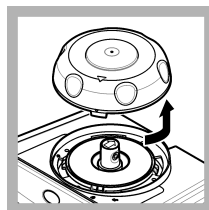


10. If the standard value that shows on the display is not correct, enter the accurate turbidity value of the standard from the certificate of analysis.

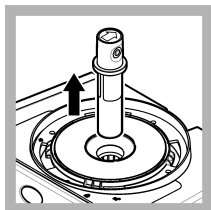
If the standard value that shows on the display is correct, push **enter**.



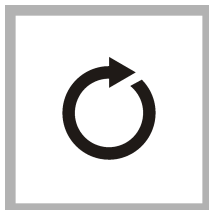
11. Complete the steps that show on the controller display.



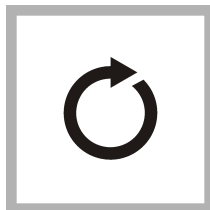
12. When the status indicator light changes to green, remove the calibration lid.



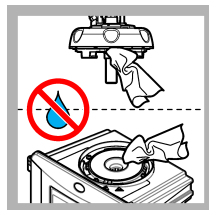
13. Remove the vial.



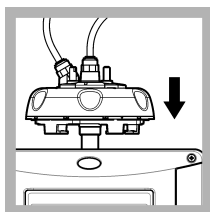
14. Do steps 4 to 12 again until all of the standard vials are measured.



15. If the value of the verification standard shows on the display, do steps 6 to 12 again to measure the verification standard.



16. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



17. Install the process head (or the automatic cleaning module).



18. Push ENTER to save the calibration value. The status indicator light stays green.

Section 7 Verification

Use the optional calibration lid and a sealed-vial 10-NTU StablCal standard (or a StablCal 10 NTU standard and a syringe) to do a primary calibration verification. As an alternative, use the optional calibration lid and the optional glass verification rod (< 0.1 NTU) to do a secondary calibration verification in the lower range of turbidity.

7.1 Configure the verification settings

Measure the value of the verification standard. Set the acceptance range and measurement units for verification. Set the verification reminder and type of menu guided verification. Set the output behavior during verification.

1. Push **menu**.
2. Select **SENSOR SETUP>VERIFICATION>SETUP**.
3. Select an option.

Option	Description
MENU GUIDED	Sets menu-guided verification to SEALED VIAL , SYRINGE or OFF (default). Verification instructions show on the controller display during verification when set to SEALED VIAL or SYRINGE . Select SEALED VIAL for verification with the glass verification rod.
DEFINE STD VAL	Measures the verification standard for later use during the verification. The instrument records the results to the data log. For the best results, measure the verification standard immediately after calibration.
ACCEPT. UNIT	Sets the acceptance range for verification to a percentage (1 to 99%) or an NTU value (0.015 to 100.00 NTU). Options: % or NTU (or mNTU).
ACCEPT. RANGE	Sets the maximum difference permitted between the recorded value of the verification standard and the measured value of the verification standard during verification. Options: 1 to 99% or 0.015 to 100.00 NTU.
VERIF REMINDER	Sets the time interval between calibration verifications. The display will show a reminder when a verification is due. Options: OFF (default), 1 day, 7 days, 30 days or 90 days. When a verification is done, the verification time is set to zero.
OUTPUT MODE	Sets the output behavior during verification. ACTIVE -The outputs continues to agree with the operating conditions. HOLD (default)-Keeps the outputs at the last known value when communication is lost. SET TRANSFER -Sets the outputs to the Set Transfer value selected in the controller settings.

7.2 Do a calibration verification with a syringe

Pre-requisite: Configure the verification settings. Refer to [Configure the verification settings](#) on page 38.

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Items to collect:

- StablCal 10 NTU standard at the same ambient temperature as the sensor
- Calibration syringe and tubing

1. Push **menu**.

2. Select SENSOR SETUP>TU5x00 sc>VERIFICATION>SETUP>MENU GUIDED>SYRINGE.

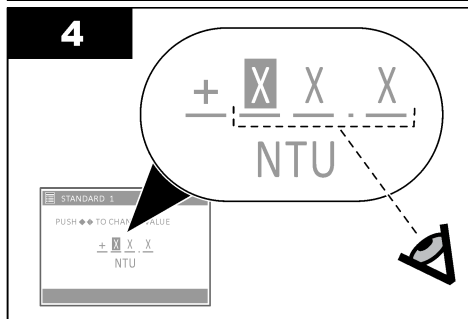
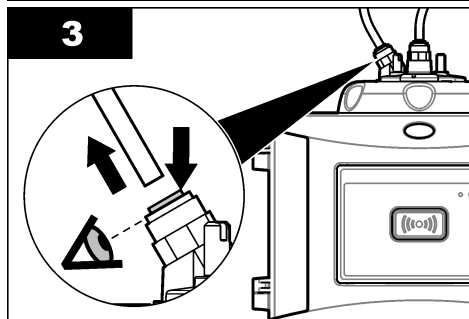
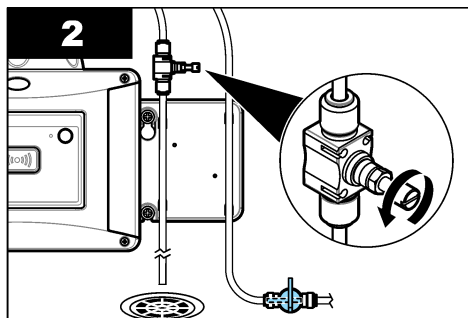
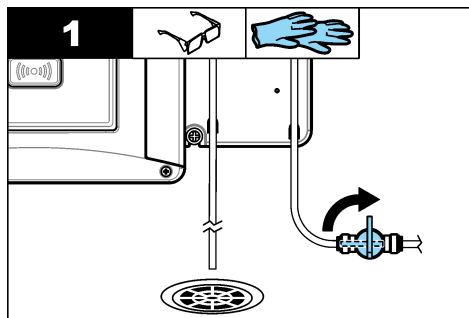
3. Select SENSOR SETUP>TU5x00 sc>VERIFICATION>START.

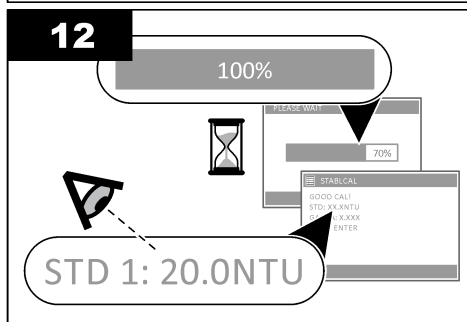
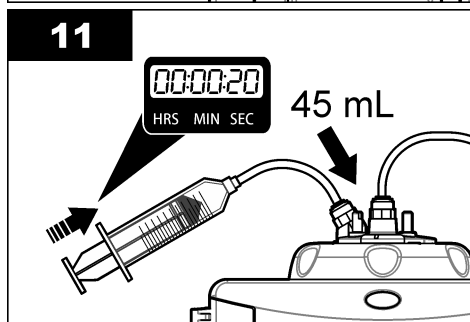
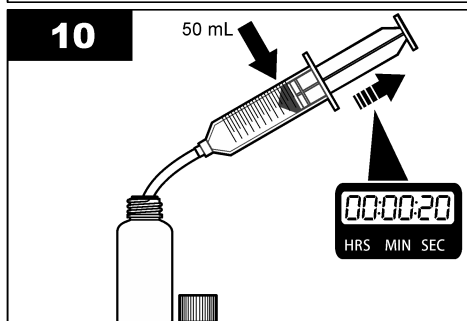
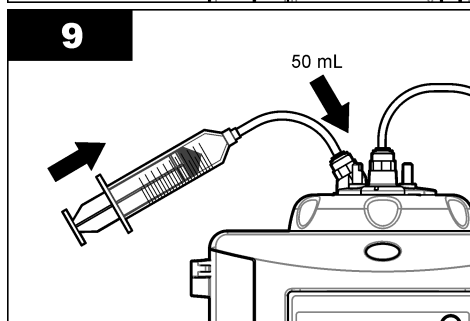
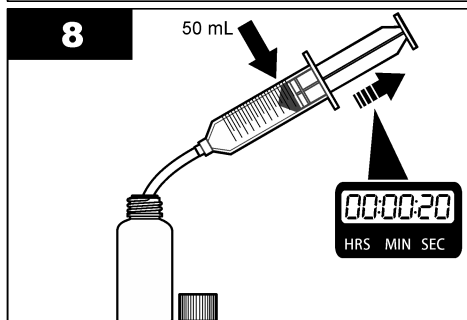
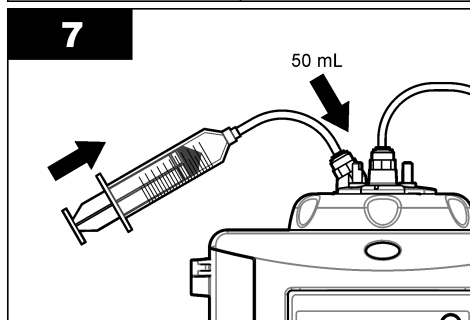
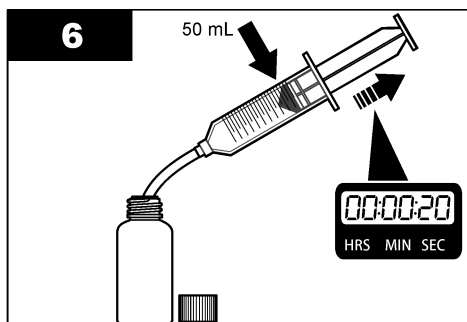
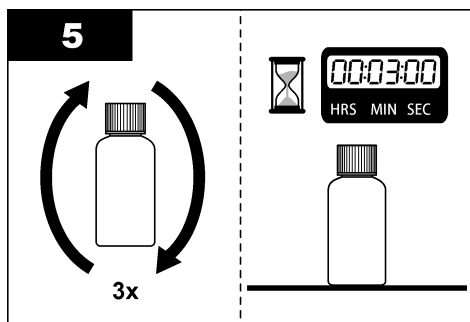
4. Complete the steps shown on the display.

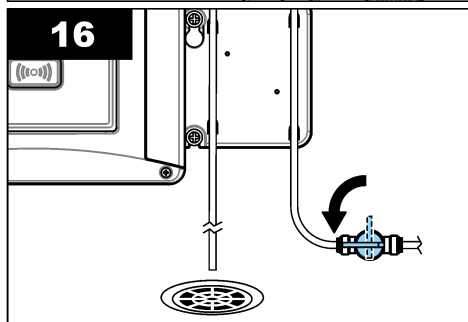
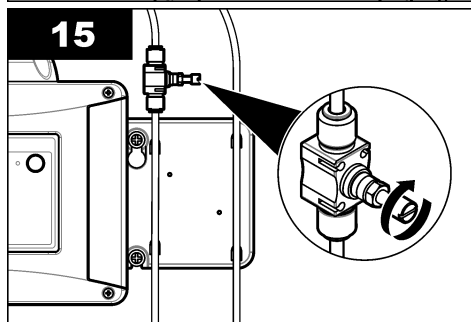
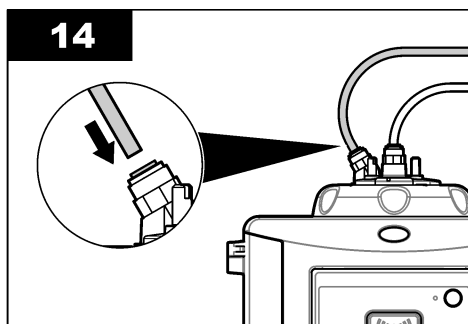
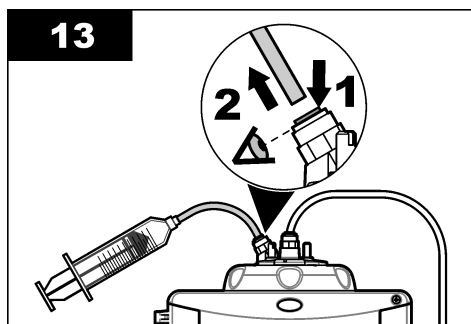
Refer to the illustrated steps that follow to complete the steps shown on the display.

At illustrated step 4, enter the measured turbidity value of the verification standard. If the verification standard value that shows on the display is correct, push confirm. The status indicator light changes to blue.

At illustrated step 15, fully open the flow regulator. Then slowly close the flow regulator until the flow decreases by 20 to 30%.







7.3 Do a calibration verification with a sealed vial or glass rod

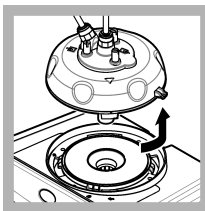
Use the optional calibration lid and a sealed-vial 10-NTU StablCal standard to do a primary calibration verification. As an alternative, use the optional calibration lid and the optional glass verification rod (< 0.1 NTU) to do a secondary calibration verification.



1. Push **menu**. Select
SENSOR SETUP>
TU5x00 sc>
VERIFICATION>
SETUP>MENU
GUIDED> SEALED
VIAL.



2. Select SENSOR
SETUP> TU5x00 sc>
VERIFICATION>
START.



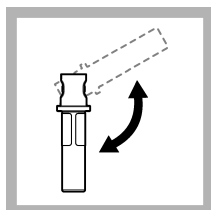
3. Remove the process
head (or the automatic
cleaning module).
Press ENTER.



4. If the verification
standard value that
shows on the display is
not correct, enter the
accurate turbidity value
of the verification
standard from the
certificate of analysis
for the sealed-vial
StablCal standard or
from the last recorded
value from the
 < 0.1 NTU glass rod.

If the verification
standard value that
shows on the display is
correct, push **confirm**.

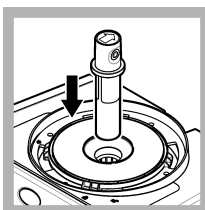
The status indicator
light flashes blue.



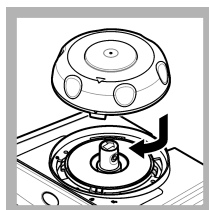
5. If the verification
standard is a liquid
standard, carefully
invert the verification
standard vial a
minimum of three times.



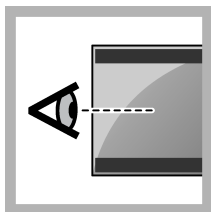
6. Clean and dry the
verification standard
vial with a no-lint cloth.
Refer to [Prevent vial
contamination](#)
on page 33.



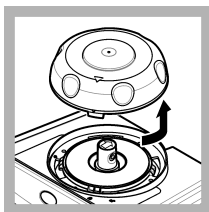
7. Put the vial in the
vial compartment.



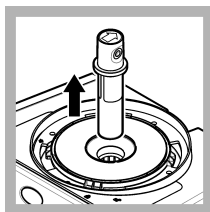
8. Install the calibration
lid. Make sure that the
calibration lid is in the
closed position.



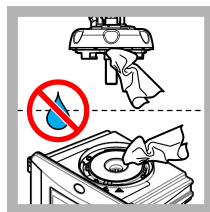
9. Complete the steps that show on the controller display.



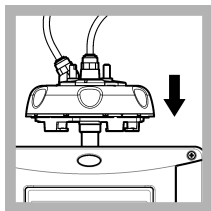
10. When the status indicator light flashes green, remove the calibration lid.



11. Remove the vial.



12. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



13. Install the process head (or the automatic cleaning module).



14. Push ENTER to save the calibration value. The status indicator light stays green.

7.4 Show the calibration or verification history

To show the historical data for the last four calibrations, push menu and select SENSOR SETUP>TU5x00 sc>CALIBRATION>CAL LOG.

To show the historical data for the last four verifications, push menu and select SENSOR SETUP>TU5x00 sc>VERIFICATION>VERIF LOG.

Section 8 Maintenance

⚠ WARNING



Burn hazard. Obey safe handling protocols during contact with hot liquids.

⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠ CAUTION



Personal injury hazard. Never remove covers from the instrument. This is a laser-based instrument and the user risks injury if exposed to the laser.

⚠ CAUTION



Personal injury hazard. Glass components can break. Handle with care to prevent cuts.

NOTICE

Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.

NOTICE

Stop the sample flow to the instrument and let the instrument become cool before maintenance is done.

To set the output behavior during maintenance, push **menu** and select SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>OUTPUT MODE.

8.1 Maintenance schedule

Table 3 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 3 Maintenance schedule

Task	1 to 3 months	1 to 2 years	As necessary
Clean the vial on page 45 <i>Note: The cleaning interval is dependent on the water quality.</i>	X		
Clean the vial compartment on page 47			X
Replace the vial on page 47		X	
Replace the desiccant cartridge on page 50 <i>Note: The replacement interval is dependent on the ambient humidity, ambient temperature and sample temperature.</i>		X ¹⁷	
Replace the tubing on page 50			X

8.2 Clean spills

⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Obey all facility safety protocols for spill control.
2. Discard the waste according to applicable regulations.

8.3 Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry as necessary.

¹⁷ Two years or as identified by instrument notification.

8.4 Clean the vial

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

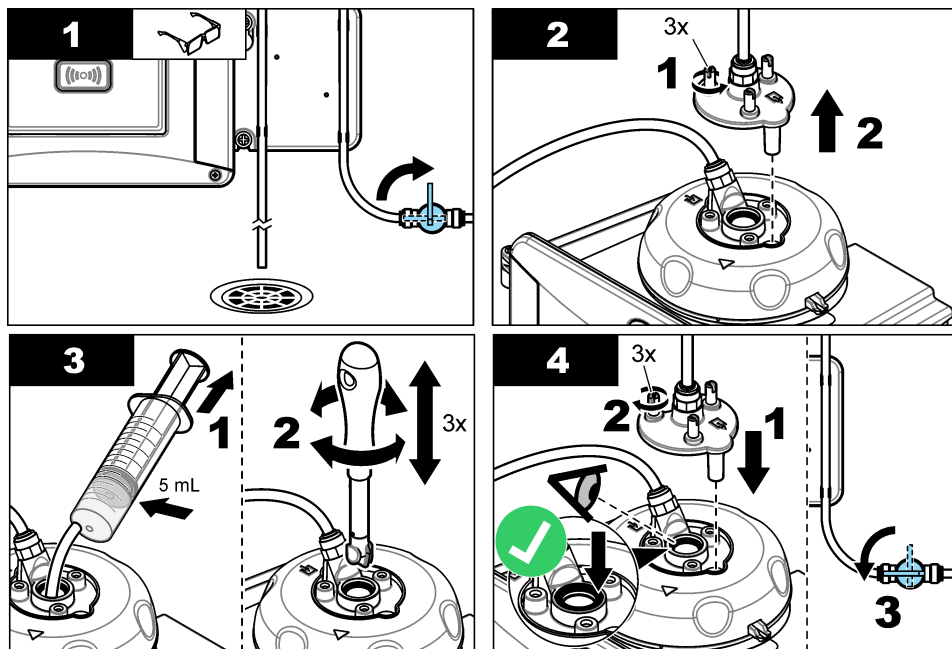
When the turbidity reading shows that there is contamination in the process vial or "VIAL CLARITY" shows on the controller display, clean the vial.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>VIAL CLEANING**.
3. Complete the steps that show on the controller display. The instrument automatically saves the cleaning process date after the last screen shows.
4. If the optional automatic cleaning module is installed, push **menu** and select **SETUP>TU5x00 sc>START WIPE** to start the automatic cleaning process.
5. If the optional automatic cleaning module is not installed, clean the vial with the manual vial wiper.

NOTICE

Carefully remove most of the water in the vial. Carefully put the vial wiper into the process vial so that no water spills out.

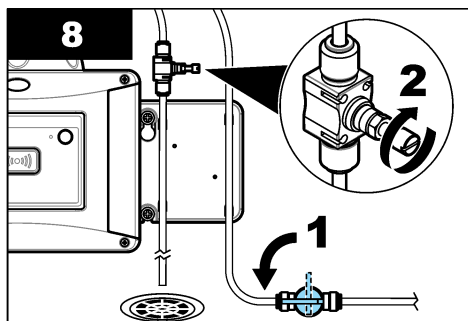
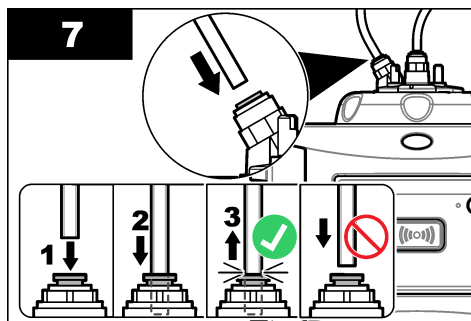
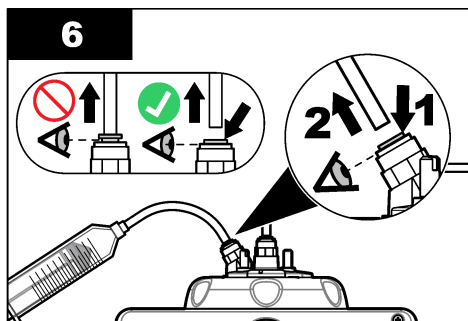
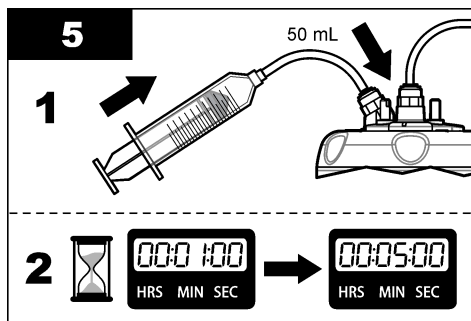
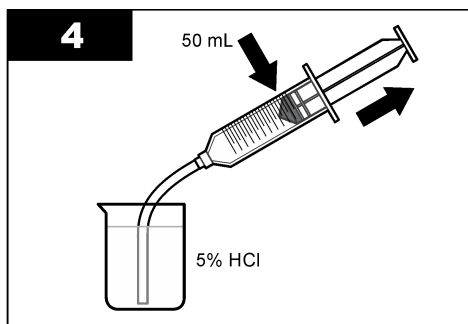
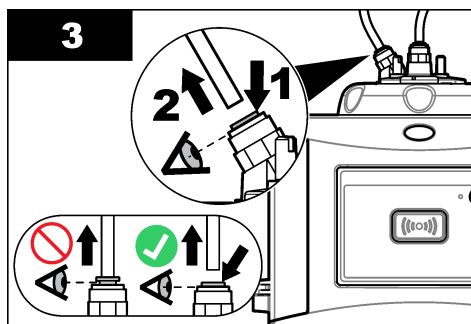
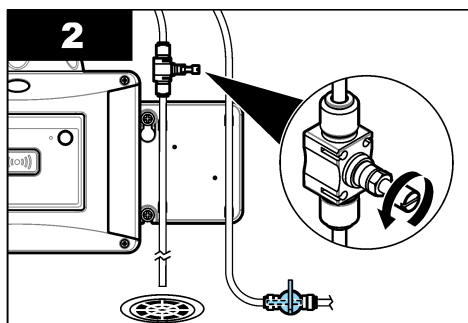
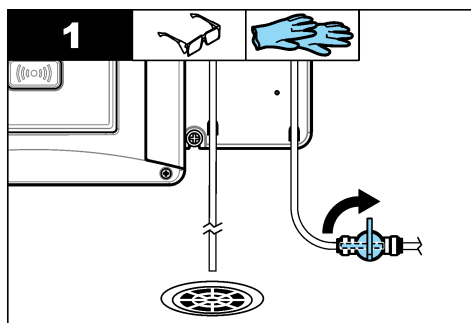
Clean the process vial with the manual vial wiper as shown in the illustrated steps that follow.



8.4.1 Do a chemical vial cleaning

If the turbidity readings do not go back to the original values, do the illustrated steps that follow to clean the vial.

Note: Hold the output values of the SC controller as necessary before the illustrated steps are done. Refer to the SC controller documentation to hold the outputs.



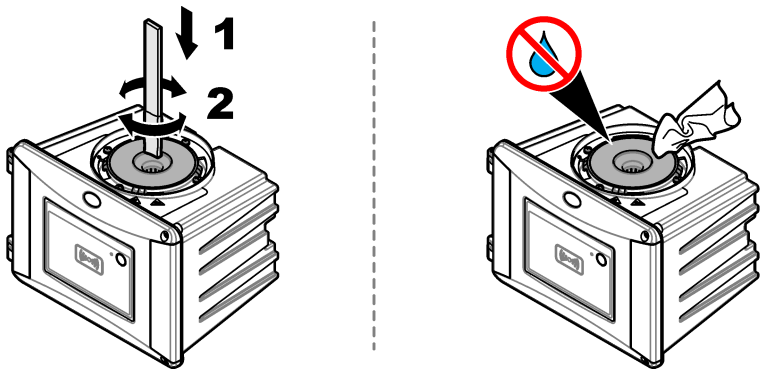
8.5 Clean the vial compartment

Clean the vial compartment only when the compartment has contamination. Make sure that the tool to clean the vial compartment has a soft surface and does not damage the instrument. [Table 4](#) and [Figure 8](#) show the options on how to clean the vial compartment.

Table 4 Cleaning options

Contaminant	Options
Dust	Vial compartment wiper, micro fiber cloth, lint-free cloth
Liquid, oil	Cloth, water and cleaning agent

Figure 8 Cleaning options



8.6 Replace the vial

NOTICE

Keep water out of the vial compartment or instrument damage will occur. Before the automatic cleaning module is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the green O-ring is in place to seal the vial. Make sure that the vial nut is tight.

NOTICE



Hold the automatic cleaning module vertically when it is installed on the instrument or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Do not touch or scratch the glass of the process vial. Contamination or scratches on the glass can cause measurement errors.

NOTICE



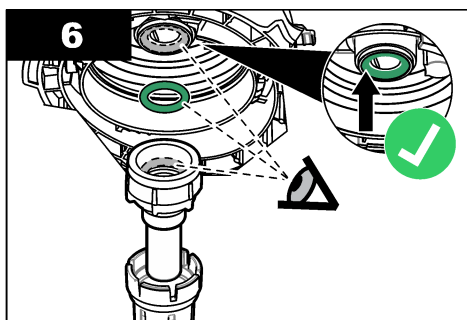
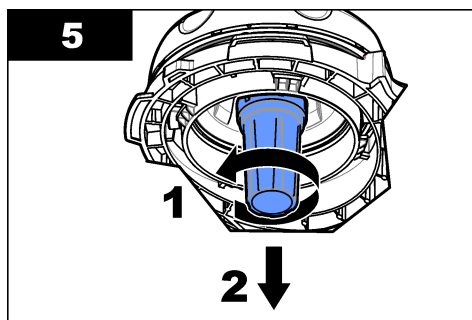
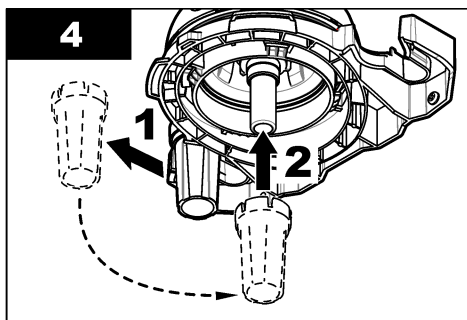
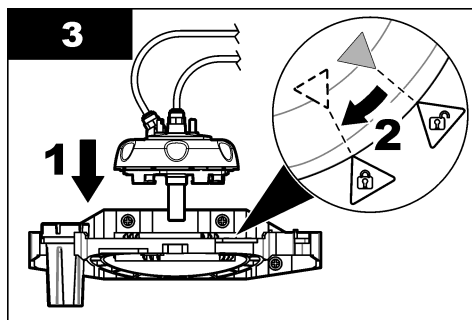
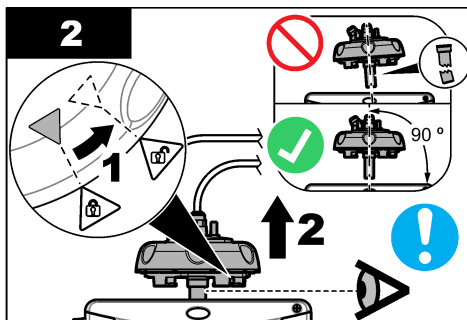
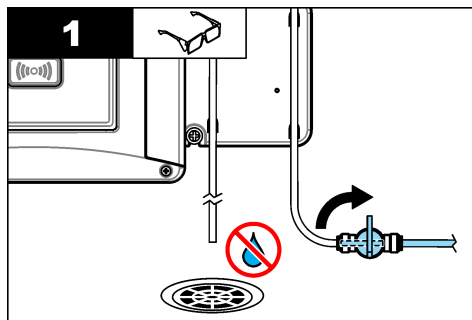
Based on the environmental conditions, is necessary to wait a minimum of 15 minutes to let the system become stable.

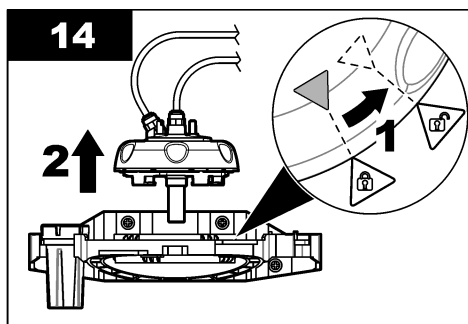
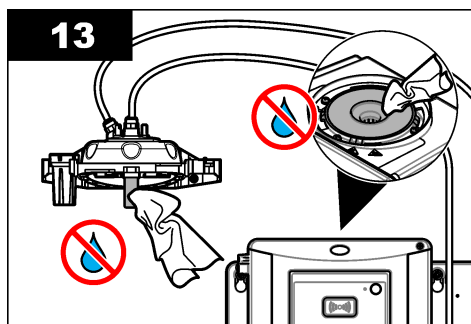
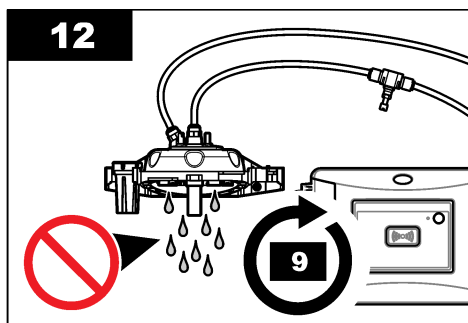
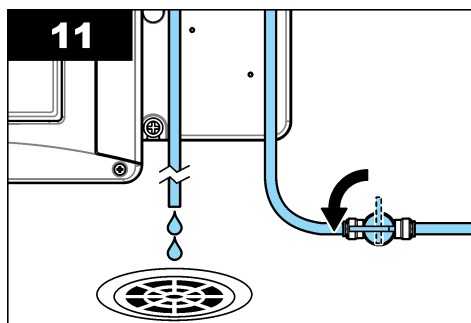
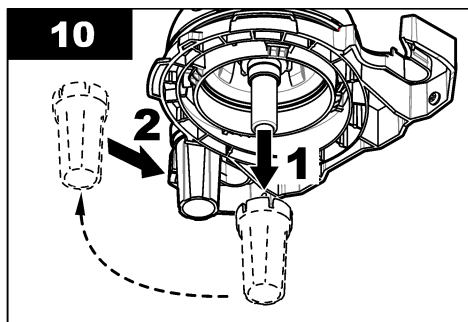
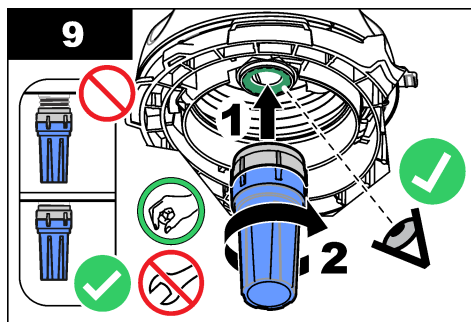
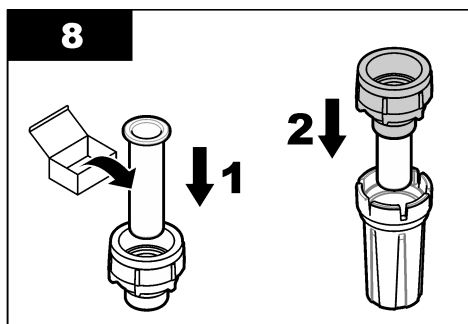
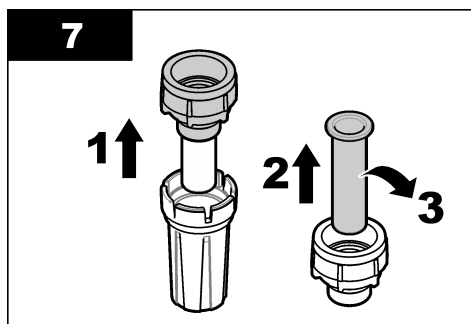
Note: Make sure that no particles fall into the vial compartment.

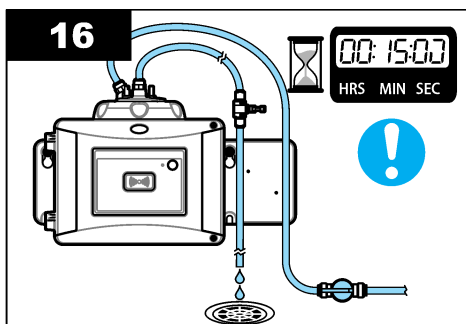
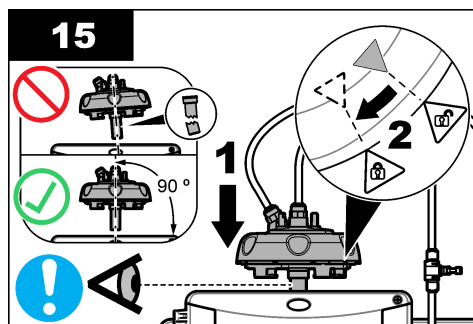
1. Push **menu**.
2. Select **SENSOR SETUP>[select analyzer]>DIAG/TEST>MAINTENANCE>VIAL REPLACEMENT**.
3. Complete the steps that show on the controller display. The date the vial was replaced is automatically saved after the last screen shows.

Refer to the illustrated steps that follow to replace the vial. To protect the new vial from contamination, use the vial replacement tool to install the vial.

At illustrated step 3, put the process head on its side on a flat surface if a service bracket is not installed near the instrument.







8.7 Replace the desiccant cartridge

The controller display will show when a desiccant cartridge replacement is due. Refer to the documentation included in the desiccant cartridge bag to replace the desiccant cartridge.

8.8 Replace the tubing

Replace the tubing when the tubing has a blockage or has damage.

Turn the flow shutoff valve to stop flow to the instrument. Then refer to [Plumb the instrument](#) on page 19 to replace the tubing.

Section 9 Troubleshooting

More troubleshooting information is available online. Go to www.hach.com, then click Support to go to Hach Support Online.

9.1 Reminders

Reminders show on the controller display. To see all of the reminders, push **menu** then select **DIAGNOSTICS>TU5x00 sc>REMINDER**.

Message	Description	Solution
DRYER RANGE	The desiccant cartridge capacity is low.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.
PERFORM CAL	A calibration is due.	Do a calibration. Refer to Calibration on page 27.
PERFORM VER	A verification is due.	Do a verification. Refer to Verification on page 38.
WIPER REPLACE	A wiper replacement is due in the automatic cleaning module.	Replace the wiper in the automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module to replace the wiper.

9.2 Warnings

Warnings show on the controller display. To see all of the active warnings, push **menu** then select **DIAGNOSTICS>TU5x00 sc>WARNING LIST**.

Warning	Description	Solution
CLEANING MODULE	The automatic cleaning module does not operate correctly.	Make sure that the wiper head is installed correctly and the wiper arm can move up and down.
DESICCANT OLD	The desiccant cartridge is more than 2 years old.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.

Warning	Description	Solution
DRYER EXHAUST'D	The desiccant cartridge life is zero.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.
HIGH FLOW	The flow rate is higher than the limit (more than 1250 mL/min).	Adjust the flow regulator as necessary. Make sure that the flow regulator does not have a malfunction.
HUM PCB SC	There is humidity on the interior electronics of the instrument.	Contact technical support. Measurements with limited validity are still available.
LASER-TEMP HIGH	The laser temperature is higher than the limit.	Decrease the environmental temperature of the instrument.
LASER-TEMP SENS	The laser temperature sensor has a malfunction.	Contact technical support. Measurements with limited validity are still available.
LOW FLOW	The flow rate is lower than the limit (less than 75 mL/min).	Examine the tubing for blockages that decrease the flow rate. Remove the blockages. Adjust the flow regulator as necessary. Make sure that the flow regulator does not have a malfunction.
NO FLOW	The flow rate is less than 10 mL/min.	Examine the tubing for blockages stop the flow. Remove the blockages.
NOT DRYING	The instrument cannot regulate the internal humidity.	Replace the desiccant cartridge. Refer to Replace the desiccant cartridge on page 50. If the error continues, contact technical support. Measurements with limited validity are still available.
PUMP	The air pump for the drying circuit has a malfunction.	Contact technical support. Measurements with limited validity are still available.
SENS.DRY: FUNC	The air system of the drying system has a malfunction.	Contact technical support. Measurements are still available, but the life of the desiccant cartridge is decreases.
TURB TOO HIGH	The turbidity reading is not within the calibration range.	Make sure that the calibration range selected is applicable to the turbidity value of the sample.
WIPER REPLACE	A wiper replacement is due in the automatic cleaning module.	Replace the wiper in the automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module to replace the wiper.
VIAL CLARITY	The vial or vial compartment is dirty.	Clean or dry the vial and the vial compartment.

9.3 Errors

Errors show on the controller display. To see all of the active errors, push **menu** then select **DIAGNOSTICS>TU5x00 sc>ERROR LIST**.

Error	Description	Solution
AUTOCHK. NO FUNC	The automatic system check does not complete.	Contact technical support.
CLEANING MODULE	The automatic cleaning module has a malfunction.	Contact technical support.
EE RSRVD ERR	There is a problem with the internal memory.	Contact technical support.
FLASH FAIL	The internal calibration memory is corrupted.	Contact technical support.
HUMIDITY PCB	There is humidity or water in the instrument.	Contact technical support.
LASER TOO LOW	The laser has a malfunction.	Contact technical support.
MEAS ELECTRONIC	There is a measurement error. There is a problem in the electronics unit.	Contact technical support.

Error	Description	Solution
PROC HEAD OPEN	The process head is in the open position or the process head detector has a malfunction.	Turn the process head to the closed position.
TURB TOO HIGH	The turbidity reading is higher than the measurement range of the instrument (1000 FNU maximum).	Make sure that the turbidity value of the sample is within the measurement range of the instrument.
VIAL PRESENT	There is no vial in the vial compartment.	Install a vial in the vial compartment.
VIAL CLARITY	The vial or vial compartment is dirty.	Clean or dry the vial and the vial compartment.
WATER INGRESS ¹⁸	There is water in the instrument.	Immediately stop flow to the instrument. Disconnect the sensor cable. The desiccant cartridge can become hot. Only touch and remove the desiccant cartridge when it is at room temperature.

9.4 Fix water ingress

The device has a drying system to prevent condensation on the vial. If water goes into the drying system the device shows the error message "Water Ingress". The desiccant cartridge starts an irreversible water stop procedure to make sure that no water goes into the measuring unit. Make sure to use always a new desiccant cartridge, even though the desiccant cartridge has a blue indicator, to fix the water ingress.

Items to collect:

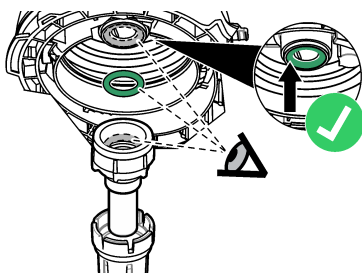
- LZY945—Microfiber cloth, vial cleaning
- LZY906—Vial replacement tool
- LZY876—Desiccant cartridge
- optional LZY918—Seal, process vial
- optional LZY917—Nut, process vial
- optional LZY834—Vial, process
- optional LZY910—Vial compartment wiper

Causes of water ingress

Note: Make sure to do a visual inspection and a leak test before the device is put back into operation.

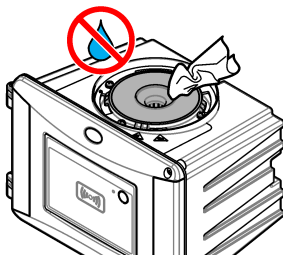
1. The vial is broken or there is a crack on the vial.
 - a. Replace the vial.
 - b. Clean the contact surface of the vial on the O-ring and the vial nut.
 - c. Clean the contact surface of the O-ring on the vial.
 - d. Make sure that the edge of the vial and the seal are clean and with no dust.
 - e. Tighten the vial nut by hand.

¹⁸ Water drops, puddles or runlets that will not damage the instrument may be in the inner of the enclosure.



2. The green O-ring between vial and process head is missing or the position is not correct.

- a. Make sure that the O-ring of the process head or cleaning unit is in the correct position. Use the tool LZY906 to install the vial.
- b. Clean the contact surface of the vial on the O-ring and the vial nut.
- c. Clean the contact surface of the O-ring on the vial.
- d. Make sure that the edge of the vial and the seal are clean and with no dust.
- e. Tighten the vial nut by hand.



3. Water in or on the top of the vial compartment.

- a. Clean the vial compartment and the top of the vial compartment with a clean and dust-free cleaning cloth.
 - b. Make sure that there is no water on the process head (or automatic cleaning module).
 - c. Dry all possible spills to prevent water ingress on the vial compartment.
4. There is a strong condensation on the inner side of the process head or on the vial compartment.
- a. Dry the water with a clean and dust-free cleaning cloth.

9.4.1 Setup after water ingress error

NOTICE

Keep water out of the vial compartment or instrument damage will occur. Before the process head (or automatic cleaning module) is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the vial nut is tight.

NOTICE

Hold the process head (or automatic cleaning module) vertically when it is removed from the instrument or condensation water can fall into the instrument. If condensation water gets into the vial compartment instrument damage will occur.

NOTICE

Make sure to lift the process head (or automatic cleaning module) the sufficient distance to release the vial (approximately 10 cm (3.94 in.)) or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Do not touch or scratch the glass of the process vial. Contamination or scratches on the glass can cause measurement errors.

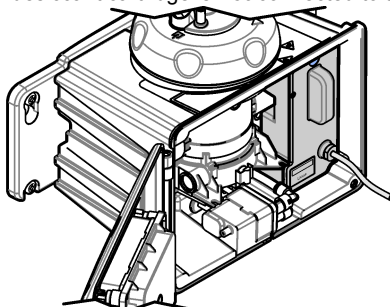
NOTICE

Although the indicator on the desiccant cartridge is blue, the cartridge is wasted after a water ingress. The water stop procedure in the desiccant cartridge can not be reset. It is necessary to use a new cartridge during the procedure FIX WATER INGRESS.

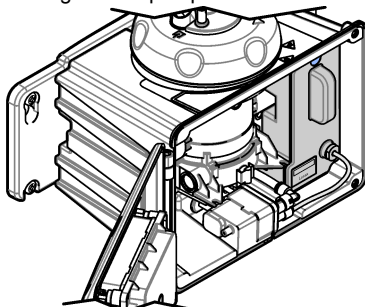
NOTICE

After completing the procedure FIX WATER INGRESS, the pump will operate for a maximum of 6 hours. Subsequently, more frequent and longer pump cycles can occur.

1. Push **Menu**.
2. Select **SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>FIX WATER INGRESS**.
3. Follow the steps that show on the controller.
4. Install a new desiccant cartridge during the water ingress procedure.
Make sure that the new desiccant cartridge is **not** connected to the pump.



5. The pump starts for 25 minutes to dry the pump and tubes.
6. After the drying time, dry water drips at the outlet of the pump with a dust-free cleaning cloth.
7. Connect the desiccant cartridge to the pump.



Section 10 Replacement parts and accessories

⚠ WARNING



Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Recommended standards

Description	Quantity	Item no.
Verification standard, < 0.1 NTU, glass verification rod (solid secondary standard)	each	LZY901
StabiCal 800 mNTU Standard	1 L	2788453
StabiCal 10 NTU Standard	500 mL	2659949
StabiCal 20 NTU Standard	1 L	2660153
StabiCal 20-NTU sealed vial with RFID	each	LZY837
StabiCal 20-NTU sealed vial without RFID	each	LZY899
StabiCal kit, sealed vials with RFID, includes: 10, 20 and 600 NTU vials	each	LZY835
StabiCal kit, sealed vials without RFID, includes: 10, 20 and 600 NTU vials	each	LZY898

Replacement parts

Description	Quantity	Item no.
Cleaning lid screws and washers, hot water, includes: Cleaning lid screws (3x) and washers (3x)	3	LZY905
Desiccant cartridge	each	LZY876
Mounting set, includes: Mounting screws (4x), tubing clip screws (2x) and tubing clips (2x)	each	LZY870
Nut, process vial	each	LZY917
Seal, automatic cleaning module	each	LZY914
Seal, process head	each	LZY969
Seal, process vial	each	LZY918
Service bracket	each	LZY873
Flow regulator kit, includes: flow regulator and tube ¼-in. OD × 0.13 m (5.11 in.)	each	LZY963
Vial with seal, process	each	LZY834
Vial replacement tool	each	LZY906
Wall mount bracket kit, includes: Wall mount bracket (two tubing clips on bracket), mounting screws (4x), tubing clips (2x) and tubing clip screws (2x)	each	LZY871

Accessories

Description	Quantity	Item no.
Automatic cleaning module	each	LQV159.99.00002
Bubble trap	each	LZY828.99.00002
Calibration lid	each	LZY904.98.00002

Accessories (continued)

Description	Quantity	Item no.
Extension cable, sensor cable, 1 m (3.3 ft)	each	6122400
Extension cable, sensor cable, 5 m (16.40 ft)	each	LZX848
Extension cable, sensor cable, 10 m (32.81 ft)	each	LZX849
Flow sensor kit, includes: flow sensor, flow sensor cap, mounting screws and 1 m (3.3 ft) of ¼ in. OD tubing	each	LQV160.99.00002
Maintenance kit for post-filter applications, includes: Case, calibration lid, micro fiber cloth, 20 NTU StablCal sealed vial, verification glass rod, vial wiper, vial compartment wiper, mobile service bracket, glass verification rod (≤ 0.1 NTU) and vial replacement tool	each	LZY907
Micro fiber cloth, vial cleaning	each	LZY945
Process head holder	each	LZY946
RFID tags, operator	2/pkg	LZQ066
RFID stickers, black ¹⁹	3/pkg	LZQ067
Syringe with tubing, calibration and verification	each	LZY953
Tubing adapter, ¼ in. to 6 mm	each	LZY954
Tubing, bubble trap to TU5x00 sc, ¼ in. OD	1 m	LZQ134
Tubing set, ULTRATURB replacement	each	LZY912
Tubing, inlet of bubble trap, 3/8 in. OD	4 m	LZY947
Tubing, inlet and outlet of TU5x00 sc, ¼ in. OD	4 m	LZY911
Vial wiper	each	LZY903
Vial compartment wiper	each	LZY910

¹⁹ Other colors are available.

**HACH COMPANY World Headquarters**

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.

Tel. (970) 669-3050

(800) 227-4224 (U.S.A. only)

Fax (970) 669-2932

orders@hach.com

www.hach.com

HACH LANGE GMBH

Willstätterstraße 11

D-40549 Düsseldorf, Germany

Tel. +49 (0) 2 11 52 88-320

Fax +49 (0) 2 11 52 88-210

info-de@hach.com

www.de.hach.com

HACH LANGE Sàrl

6, route de Compois

1222 Vézenaz

SWITZERLAND

Tel. +41 22 594 6400

Fax +41 22 594 6499

DISSOLVED OXYGEN: HACH LDO® PROBE, MODEL 2

Applications

- Wastewater
- Industrial Water
- Drinking Water



Take “No” for an answer when measuring dissolved oxygen with the next generation Hach LDO probe.

No Calibration Required

The Hach LDO probe is ready to work in your process right out of the box with no calibration required for the entire 2-year life of the sensor cap.

No Membranes to Replace

There is virtually no maintenance with Hach's breakthrough luminescent technology. There are no membranes to replace, no electrolyte solution to replenish, and no anode or cathode to clean.

No Missed Cleaning Cycles

Customizable service indicators trigger a service message so that a cleaning cycle is never missed.

No Drift

A cutting-edge, 3D calibration procedure at the factory makes oxygen measurement with the Hach LDO probe more accurate than ever before.

No Complications

A robust new design gives the Hach LDO enhanced durability and reduced size for easier handling.

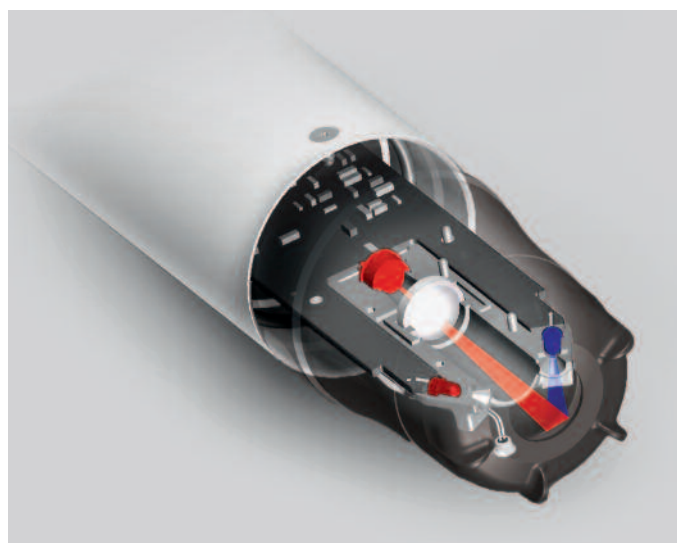
Specifications*

Range	0 to 20.00 ppm	Flow Rate	None required
	0 to 20.0 mg/L (or ppm)	Sensor Immersion Depth	Down to 345 kPa 345 kPa (50 psi), maximum; accuracy may not be maintained at this depth
	0 to 200 % air saturation	Transmission Distance	1000 m (3280 ft.) maximum when used with a termination box
Accuracy	± 0.05 ppm below 1 ppm	Cable Length	10 m (options with 30m, 60m, 100m)
	± 0.1 ppm below 5 ppm	Dimensions (D x L)	1.9 in x 10 in (48.25 mm x 254 mm)
	± 0.2 ppm above 5 ppm	Weight	2.2 lbs. (1 kg), probe only
Response Time	$T_{95} < 60$ s	<i>*Subject to change without notice.</i>	
	$T_{90} < 40$ s		
Resolution	0.01 ppm DO		
	0.1% saturation		
Repeatability	± 0.1 (mg/L) ppm		

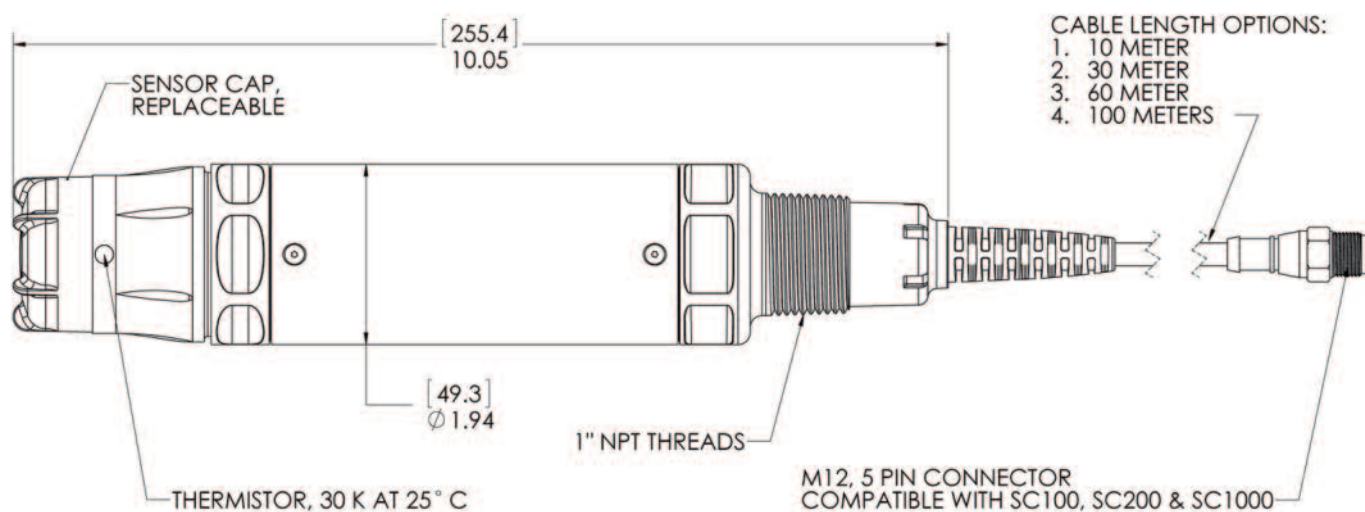
Principle of Operation

The HACH LDO sensor is coated with a luminescent material. Blue light from an LED is transmitted to the sensor surface. The blue light excites the luminescent material. As the material relaxes it emits red light. The time it takes for the red light to be emitted is measured. Between the flashes of blue light, a red LED is flashed on the sensor and used as an internal reference.

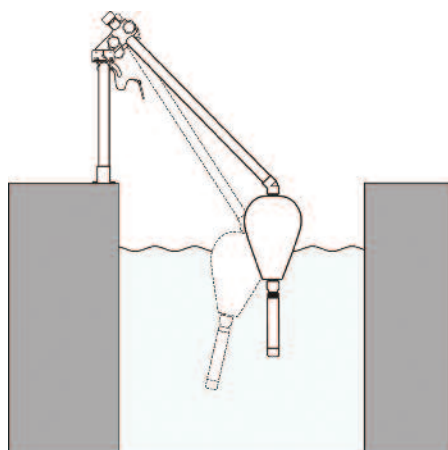
Increased oxygen in the sample decreases the time it takes for the red light to be emitted. The time measurements correlate to the oxygen concentration.



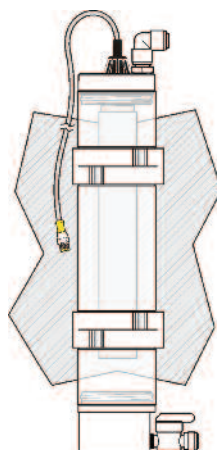
Dimensions



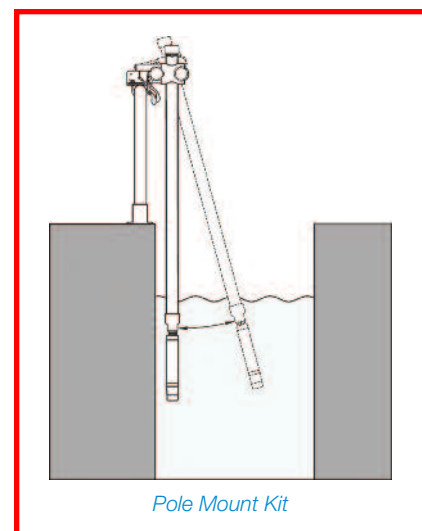
Installation / Mounting



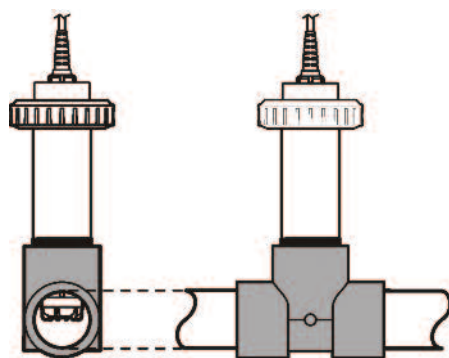
Float Mount Kit



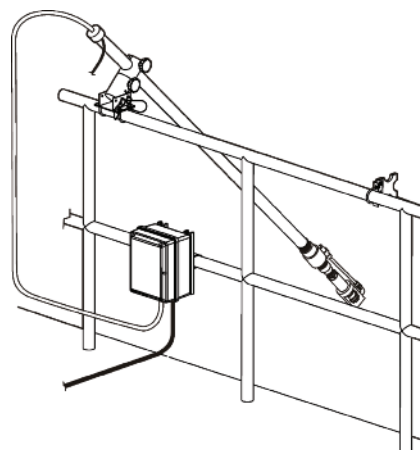
Flow Cell



Pole Mount Kit



Union Mount Kit



Air Blast Cleaning System

Distance from main floor to water level is about 2.1m. Pole to be about 2.5m. Provide Flange connection instead of swivel and rail mount bracket.

Ordering Information

9020000	Hach LDO Model 2 Probe
9020000-UPGRADE	LDO Probe, Mounting Conversion Adapter
9020000-SC200	LDO Probe, Mounting Conversion Adapter, sc200 controller with 2 channels

Accessories

5867000	Digital Termination Box
5796000	Digital Extension Cable, 7.7 m (25 ft.)
5796100	Digital Extension Cable, 15 m (50 ft.)
5796200	Digital Extension Cable, 31 m (100 ft.)
6860000	High Output Air Blast Cleaning System, 115 Vac
6860100	High Output Air Blast Cleaning System, 230 Vac
9253500	Air Blast Hardware Components

Replacement Parts

9021100	LDO Model 2 Sensor Cap Replacement Kit
----------------	--

Mounting Kits

9253000	Pole Mount Kit, PVC
9253100	Ball Float Mount Kit, PVC
9257000	Union Mount Kit, PVC
9253400	Mounting Conversion Adapter, LDO Model 1 to LDO Model 2
7300800	1 NPT sc Sensors Flow Cell

Controllers

sc200 Digital Controllers

LXV404.99.00552	sc200 controller, 2 channel, digital
LXV404.99.00542	sc200 controller, 2 channel, digital & mA input
LXV404.99.00502	sc200 controller, 1 channel, digital
LXV404.99.00512	sc200 controller, 2 channel, digital & pH/DO
LXV404.99.00522	sc200 controller, 2 channel, digital & Conductivity
LXV404.99.00532	sc200 controller, 2 channel, digital & Flow

sc1000 Digital Controllers

LXV402.99.00002	sc1000 Display Module
LXV400.99.1R572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V
LXV400.99.1B572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, Modbus RS485, 110-230V
LXV400.99.1F572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, PROFIBUS DP, 110-230V
LXV400.99.1R582	sc1000 Probe Module, 6 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V



HACH COMPANY World Headquarters: Loveland, Colorado USA

United States:	800-227-4224 tel	970-669-2932 fax	orders@hach.com
Outside United States:	970-669-3050 tel	970-461-3939 fax	int@hach.com
hach.com			

LIT2455 Rev 3

A14 Printed in U.S.A.

©Hach Company, 2014. All rights reserved.

In the interest of improving and updating its equipment,

Hach Company reserves the right to alter specifications to equipment at any time.



Be Right™

PROGNOSYS FOR LDO sc

Eliminate last-minute maintenance emergencies.

PROGNOSYS is a predictive diagnostic system that allows you to be proactive in your maintenance, by alerting you to upcoming instrument issues. Know with confidence whether changes in your measurements are due to changes in your instrument or your water.



Measurement Indicator

The measurement indicator monitors the instrument's components and uses that information to alert the user to upcoming instrument needs before measurements become questionable.



Service Indicator

The service indicator tracks the number of days until the instrument will require maintenance or service.

Time to plan your maintenance *before* your measurements are affected.

MAINTENANCE REQUIRED



Measurement Indicator

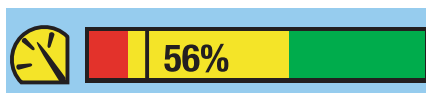
Temperature is out of specified range
An LED is not functioning
No sensor cap is installed
Factory calibration for cap is incomplete
Any instrument error



Service Indicator

1 day or less remaining until the next recommended maintenance task

MAINTENANCE PENDING



Measurement Indicator

LED amplitude is out of specified range;
sensor cap may be damaged
Sensor cap life has expired
Calibration in progress
Any instrument warning



Service Indicator

2–14 days remaining until the next maintenance task (user adjustable)

MAINTENANCE PERFORMANCE



Measurement Indicator

Temperature is within the specified range
LEDs are functioning as expected
Reference and measurement calculations are within the expected range
Sensor is clean (100 %) or a sensor cleaning is overdue (76–99 %)



Service Indicator

7–14 days remaining until the next maintenance task (user adjustable)

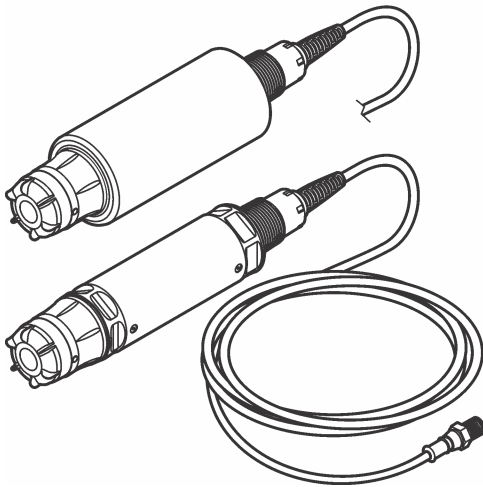
Many of the parameters and tasks considered for the maintenance indicator will also be displayed through the service indicator if the related instrument components require maintenance soon.



DOC023.97.80170

LDO Sensor

12/2012, Edition 4



USER MANUAL
MANUEL D'UTILISATION
MANUAL DEL USUARIO
MANUAL DO USUÁRIO

用戶手冊
ユーザーマニュアル
사용 설명서
តួអង្គប្រើ

English 3

Français 19

Español 37

Português 56

中文 74

日本語 90

한글 107

ไทย 123

Table of Contents

[Specifications](#) on page 3

[General information](#) on page 4

[Product overview](#) on page 6

[Installation](#) on page 7

[Calibration for measurements](#) on page 12

[Operation](#) on page 9

[Maintenance](#) on page 14

[Troubleshooting](#) on page 16

[Replacement parts and accessories](#) on page 17

Specifications

Specifications are subject to change without notice.

Specification	Details
Wetted materials	Standard Probe, Standard Class 1-Div 2 Probe <ul style="list-style-type: none"> • CPVC, sensor end and cable end • Polyurethane, over-molding on cable end and cable jacket • 316 stainless steel body and screws • Viton, O-ring • Noryl, nut on the cable end
	Standard Seawater Probe, Seawater Class 1-Div 2 Probe <ul style="list-style-type: none"> • CPVC, sensor end and cable end • Polyurethane, over-molding on cable end and cable jacket • PVC seawater body • Seawater epoxy sealant • Noryl, nut on the cable end
IP classification	IP68
Wetted materials (sensor cap)	Acrylic
Measurement range (dissolved oxygen)	0 to 20 ppm (0 to 20 mg/L)
	0 to 200% saturation
Measurement accuracy (dissolved oxygen)	Below 5 ppm: ± 0.1 ppm
	Above 5 ppm: ± 0.2 ppm
Repeatability (dissolved oxygen)	0.1 ppm (mg/L)
Response time (dissolved oxygen)	$T_{90} < 40$ seconds
	$T_{95} < 60$ seconds
Resolution, sensor (dissolved oxygen)	0.01 ppm (mg/L); 0.1% saturation.
Measurement range (temperature)	0 to 50 °C (32 to 122 °F)
Measurement accuracy (temperature)	± 0.2 °C (± 0.36 °F)
Interferences	No interferences from the following: H_2S , pH, K^+ , Na^+ , Mg^{2+} , Ca^{2+} , NH_4^+ , Al^{3+} , Pb^{2+} , Cd^{2+} , Zn^{2+} , Cr (total), Fe^{2+} , Fe^{3+} , Mn^{2+} , Cu^{2+} , Ni^{2+} , Co^{2+} , CN^- , NO_3^- , SO_4^{2-} , S^{2-} , PO_4^{3-} , Cl^- , Anion Active Tensides, Crude Oils, $Cl_2 < 4$ ppm
Storage temperature	-20 to 70 °C (-4 to 158 °F)
Maximum temperature	0 to 50 °C (32 to 122 °F)

Specification	Details
Hazardous location classification (9020000-C1D2 sensor only)	Class I Division 2, Groups A–D, T4 / Class I, Zone 2 Group 2C, T4 Note: This product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).
Certifications (9020000-C1D2 sensor only)	ETL listed to ANSI/ISA, CSA and FM standards for use in hazardous location. Note: This product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).
Minimum flow rate	Not required
Calibration/verification	Air calibration: One point, 100% water-saturated air
	Sample calibration: Comparison with standard instrument
Probe immersion depth and pressure limits	Pressure Limits at 34 m (112 ft.), 345 kPa (50 psi) maximum; accuracy may not be maintained at this depth
Sensor cable	10 m (30 ft) integral cable with quick disconnect plug (all sensor types) Up to 100 m possible with extension cables (non-Class I, Division 2 sensor types only) Up to 1000 m with junction box (non-Class I, Division 2 sensor types only)
Probe weight	1.0 kg (2 lb, 3 oz)
Probe dimensions	Standard probe (diameter x length): 49.53 x 255.27 mm (1.95 x 10.05 in.)
	Seawater probe (diameter x length): 60.45 x 255.27 mm (2.38 x 10.05 in.)
Power requirements	12 VDC, 0.25 A, 3 W
Warranty	Probe: 3 years against manufacturing defects
	Sensor cap: 2 years against manufacturing defects

General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information





DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING	
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.	
⚠ CAUTION	
Indicates a potentially hazardous situation that may result in minor or moderate injury.	
NOTICE	
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.	

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates the presence of a light source that may have the potential to cause minor eye injury. Obey all messages that follow this symbol to avoid potential eye injury.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.

Certification

Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction

manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

- 1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
- 2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
- 3. Move the equipment away from the device receiving the interference.
- 4. Reposition the receiving antenna for the device receiving the interference.
- 5. Try combinations of the above.

Product overview

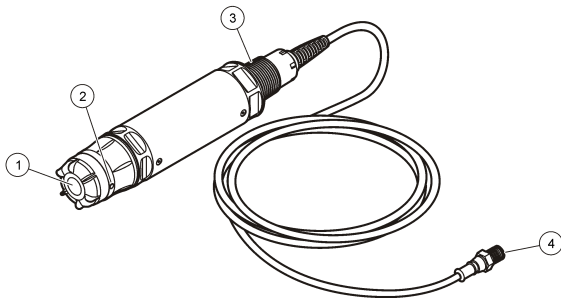
⚠ DANGER

Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

This sensor is designed to work with a controller for data collection and operation. The sensor can be used with several controllers. Refer to the controller-specific user manual for more information.

The primary applications for this sensor are municipal and industrial wastewater applications. LDO sensor technology does not consume oxygen, and can measure DO concentration in low or no-flow applications. Refer to [Figure 1](#).

Figure 1 LDO sensor

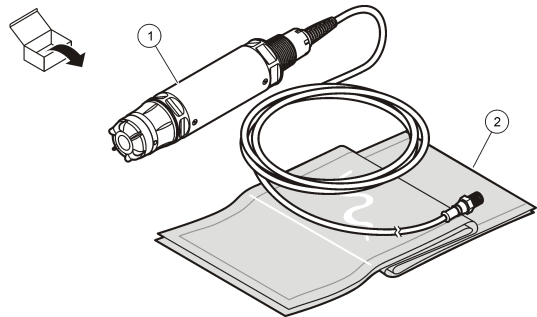


1 Sensor cap	3 1-inch NPT
2 Temperature sensor	4 Connector, quick-connect (standard)

LDO Sensor component list

Make sure that all components shown in [Figure 2](#) have been received. If any items are missing or damaged, contact the manufacturer or a sales representative immediately. Refer to [Figure 2](#).

Figure 2 Sensor component list



1 LDO sensor ¹	2 Calibration bags (2x)
---------------------------	-------------------------

Installation

⚠ WARNING

Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

Validate the sensor type

⚠ DANGER

Explosion hazard. Connect only peripheral components that are clearly marked as certified for Class 1, Division 2 Hazardous Locations.



NOTICE

The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).

- Go to the connector end of the cable.
- Read the label on the connector end of the cable. For hazardous location certified sensors, the label will show "Rated: Class 1 Division 2".
- Examine the connector.
 - Hazardous location certified sensors have a safety lock connector. Refer to [Figure 3](#) on page 8.
 - Sensors that are not certified for hazardous locations have a quick-connect connector, without a safety lock.

¹ Included user manual is not shown.

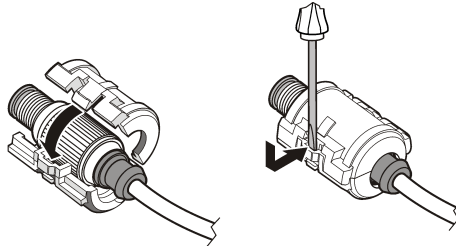
Connect the sensor in a hazardous location

⚠ DANGER	
	Explosion hazard. This equipment is suitable for use in non-hazardous locations or Class 1, Division 2, Groups A, B, C, D Hazardous Locations with specified sensors and options when installed per the Hazardous Location Installation Control Drawing. Always refer to the Control Drawing and applicable electrical code regulations for proper installation instructions.
⚠ DANGER	
	Explosion hazard. Do not connect or disconnect electrical components or circuits to the equipment unless power has been removed or the area is known to be non-hazardous.
NOTICE	
Use only a hazardous location certified sensor and cable lock in hazardous locations. The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).	

For more information, refer to [Validate the sensor type](#) on page 7 .

1. Remove the connector cap from the controller. Keep the connector cap to seal the connector opening when the sensor is removed.
2. Connect the sensor to the controller. Refer to the controller manual for more information.
3. Close the safety lock over the connector.
4. To remove the connector safety lock, use a small flat screwdriver. Refer to [Figure 3](#).

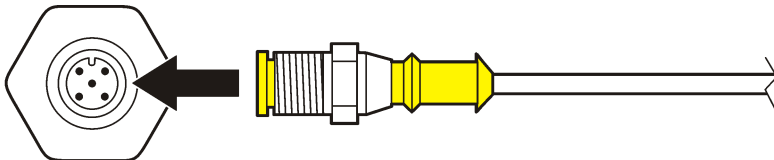
Figure 3 Connector safety lock



Connect the sensor in a non-hazardous location

Refer to [Figure 4](#) to connect an LDO sensor to an sc controller. Refer to the specific sc controller manual for hard-wiring instructions.

Figure 4 Connect the LDO sensor (non-hazardous location sensor shown)



After the sensor is attached, scan for the sensor. Refer to [Install the sensor](#) on page 8.

Install the sensor

There are two options to install the sensor:

- Connect the sensor while power to the controller is off. The controller will look for and install new sensors when it is turned on.
- Connect the sensor while power to the controller is on. Use the Scan Devices command to install the new sensor:

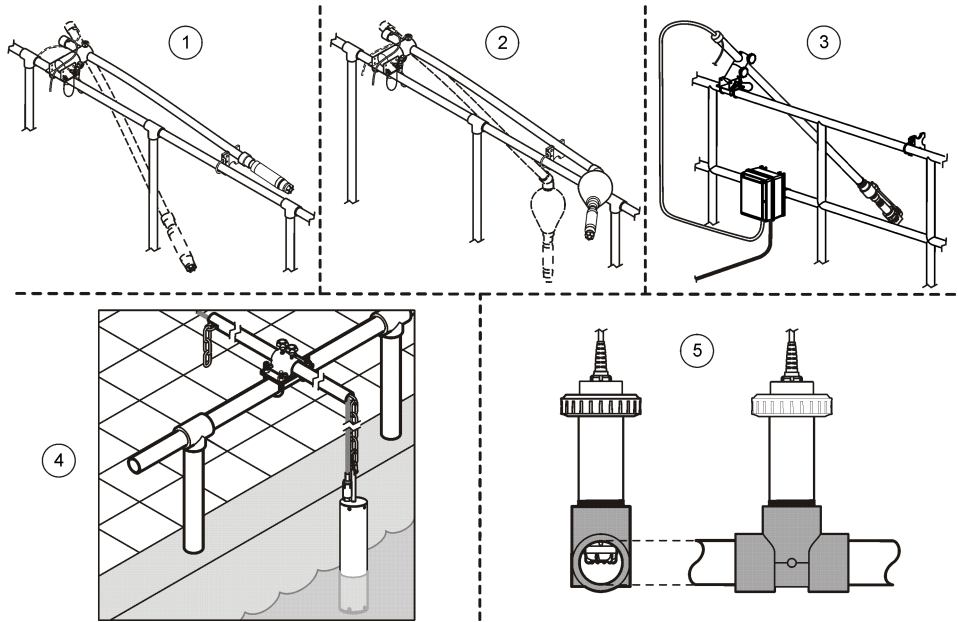
Option	Description
sc200 controller	Go to MENU>TEST/MAINT>SCAN DEVICE
sc100 controller	Go to MENU>TEST/MAINT>SCAN SENSORS
sc1000 controller	Go to MENU>SYSTEM SETUP>DEVICE MANAGEMENT>SCANNING FOR NEW DEVICES

Refer to [Connect the sensor in a non-hazardous location](#) on page 8 for digital sensor connection.

Sensor installation options

The installation and accessory options available for the LDO sensor are supplied with installation instructions in the hardware kit. [Figure 5](#) shows several installation options. To order installation hardware, refer to [Replacement parts and accessories](#) on page 17.

Figure 5 Installation options



1 Rail mount	4 Chain mount
2 Float mount	5 Union mount (not seawater probe compatible)
3 Air blast system mount (not seawater probe compatible)	

Operation

User navigation

Refer to the controller documentation for keypad description and navigation information.

Configure the sensor

Use the Configure menu to enter identification information for the sensor and to change options for data handling and storage.

For information about sensor installation, refer to [Install the sensor](#) on page 8.

Make sure that all of the Configuration menu values are correct for the application.

1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE.
2. Select an option, ENTER. The list of available options is shown in the table below.

Option	Description
EDIT NAME	Changes the name that corresponds to the sensor on the top of the measure screen. The name is limited to 10 characters in any combination of letters, numbers, spaces or punctuation.
SET UNITS	TEMP—Sets the temperature units to °C (default) or °F.
	MEASURE—Set the measurement units in mg/L, ppm or % .
	ALT/PRESS—Set the altitude in m or ft, or set the atmospheric pressure units in mmHg or torr. (Default value = 0 ft)
ALT/PRESS	Enter the value of the altitude or atmospheric pressure. This value must be accurate to complete % saturation measurements and calibration in air. (Default = 0 ft).
SALINITY	Enter the salinity value. Salinity range: 0.00 to 250.00 parts per thousand (‰). Refer to Enter a salinity correction value on page 11 for more information. (Default value = 0)
SIGNAL AVERAGE	Set the time interval to average signal in seconds
CLEAN INTRVL	Set the time interval for manual sensor cleaning in days (Default value = 0 days. A value of 0 days disables the clean interval.)
RESET CLN INTRVL	Set the time interval to the last saved clean interval
LOG SETUP	Sets the time interval for data storage in the data log—0.5, 1, 2, 5, 10, 15 (default), 30, 60 minutes.
SET DEFAULTS	Restores the configurable default values for the sensor. Does not change the setting for slope or offset.

Enter the atmospheric pressure value

The factory setting for atmospheric (air) pressure is 0 ft, or sea level. To change the default value, use the steps in this procedure. The adjustment for air pressure is entered as either elevation or as pressure units (preferred).

Note: Accurate air pressure is critical for saturated air calibration ([Calibration with air](#) on page 12). Use only absolute pressure, not adjusted. If the absolute air pressure is not known, use the correct elevation for the location.

1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SET UNITS>AIR PRESS/ALT UNITS.
2. Select **one** of the unit options listed:

Option	Description
ft	Feet—unit of measure for elevation
m	Meters—metric unit of measure for elevation
mmHg	Millimeters of mercury—metric unit of measure for absolute air pressure
torr	Unit of measure for absolute air pressure

3. Confirm the selection. The value entry screen will show the selected units.
4. Enter the value, then confirm.

Enter a salinity correction value

Dissolved oxygen measurements in saline samples can show an apparent DO value that is very different from the actual DO value. To correct for the influence of dissolved salts in a sample, enter a salinity correction factor.

Note: If the presence or amount of salinity in the process is unknown, consult with the treatment facility engineering staff.

1. Use a conductivity meter to measure the conductivity of the sample in mS/cm at a reference temperature of 20 °C (68 °F).

2. Use [Table 1](#) to estimate the salinity correction factor in parts per thousand (‰) saturation.

Note: The chloride ion concentration, in g/kg is equal to the chlorinity of the sample. Salinity is calculated with the formula: $\text{Salinity} = 1.80655 \times \text{chlorinity}$.

Salinity can be calculated with the relationship in section 2520 B of *Standard Methods for the Examination of Water and Wastewater*.²,

3. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SALINITY.

4. Enter the salinity correction factor and confirm.

Table 1 Salinity saturation (‰) per conductivity value (mS/cm)

mS/cm	‰	mS/cm	‰	mS/cm	‰	mS/cm	‰
5	3	16	10	27	18	38	27
6	4	17	11	28	19	39	28
7	4	18	12	29	20	40	29
8	5	19	13	30	21	42	30
9	6	20	13	31	22	44	32
10	6	21	14	32	22	46	33
11	7	22	15	33	23	48	35
12	8	23	15	34	24	50	37
13	8	24	17	35	25	52	38
14	9	25	17	36	25	54	40
15	10	26	18	37	26		

Configure linear output on the controller

Linear outputs send probe data back to the facility PLC, SCADA or other data collection system.

1. Go to the controller output setup menu.

Option	Description
--------	-------------

sc200	Go to MENU>SETTINGS>sc200 SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.
-------	--

² *Standard Methods for the Examination of Water and Wastewater*, 20th Edition. Editors Lenore S. Clesceri, Arnold E. Greenberg and Andrew D. Eaton, p. 2-48-2-29 (1998). The relationship between Chlorinity and Oxygen Solubility is provided in the same reference in 4500-O:1 p. 4-131.

Option	Description
sc100	Go to MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.
sc1000	Go to MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.

2. Set the function for the controller.

Option	Description
sc200	LINEAR
sc100	LINEAR CONTROL (Default value)
sc1000	LINEAR CONTROL (Default value)

Modbus registers

A list of Modbus registers is available for network communication. Refer to www.hach.com or www.hach-lange.com for more information.

Calibration for measurements

The sensor is calibrated to specification at the factory. The manufacturer does not recommend calibration unless periodically required by regulatory agencies. If calibration is required, let the sensor come to equilibrium with the process before calibration. Do not calibrate the sensor at setup.

Table 2 shows options for calibration.

Table 2 Calibration options

Option	Description
AIR CAL	Recommended calibration method. This calibration modifies the slope.
SAMPLE CAL	Calibration by comparison with a hand-held DO meter . This calibration modifies the offset.
RESET DFLT CAL	Resets the calibration gain (slope) and offset to the factory default: default gain=1.0; default offset=0.0

Calibration with air

User notes:

- Make sure that calibration bag has water inside.
- Make sure that the seal between the calibration bag and the sensor body is tight.
- Make sure that the sensor is dry when it is calibrated.
- Make sure the air pressure/elevation setting is accurate for the calibration location.
- Allow enough time for the sensor temperature to stabilize to the temperature of the calibration bag location. A large difference in temperature between the process and the calibration location can take up to 15 minutes to stabilize.

1. Remove the sensor from the process. Use a wet cloth to clean the sensor.
2. Put the entire sensor in a calibration bag with 25-50 mL of water. Make sure that the sensor cap is not in contact with the water inside the calibration bag and that no water drops are on the sensor cap (Figure 6).
3. Use a rubber band, tie or hand to create a tight seal around the sensor body.
4. Let the instrument stabilize for 15 minutes before calibration. Keep the calibration bag out of direct sunlight during stabilization.
5. Make sure that the current absolute air pressure or elevation is configured correctly. Refer to [Enter the atmospheric pressure value](#) on page 10.

Note: The manufacturer recommends the use of absolute or actual air pressure as a best practice.

6. Go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>AIR CAL.

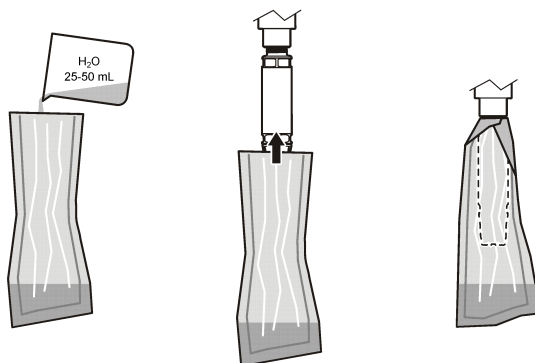
7. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration procedure.
Hold	The sensor output value is held at the current measured value during the calibration procedure.
Transfer	A preset value is sent during calibration. Refer to the controller user manual to change the preset value.

8. The controller will show "Move the probe to bag". Allow the value to stabilize. Push ENTER to accept the stable value. Alternately, let the calibration continue until the display shows "Complete".

9. When the sensor is calibrated, put the sensor into the process. Push ENTER.

Figure 6 Air calibration procedure



If the value does not stabilize, the display will show "Unable to Calibrate" followed by an error message. [Table 3](#) shows the error message and resolution for calibration problems.

Table 3 Air calibration error messages

Message	Description	Resolution
Cal fail, gain high	The calculated gain value is too high.	Repeat the calibration.
Cal fail, gain low	The calculated gain value is too low.	Repeat the calibration.
Cal fail, unstable	The value did not stabilize in the maximum allowed calibration time.	Repeat the calibration.

Sample CAL - calibration by comparison

This calibration method uses an alternate sensor attached to a hand-held meter.

1. Put the alternate sensor into the process. Put the second sensor as close as possible to the first sensor.
2. Wait for the DO value to stabilize .
3. On the controller for the first sensor, go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>SAMPLE CAL.
4. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration procedure.

Option	Description
Hold	The sensor output value is held at the current measured value during the calibration procedure.
Transfer	A preset value is sent during calibration. Refer to the controller user manual to change the preset value.

- The controller will show:
 - "Press ENTER when stabilized"
 - The current dissolved oxygen measurement
 - The current temperature measurement
- When the measurement is stable, push ENTER. The display will show an entry screen.
Note: The measurement will usually stabilize in 2 to 3 minutes.

If the value does not stabilize, the display will show "Unable to Calibrate" followed by an error message. [Table 4](#) shows the error message and resolution for calibration problems.

Table 4 Sample cal error messages

Message	Description	Resolution
Cal fail, offset high	The calculated offset value is too high.	Repeat the calibration.
Cal fail, offset low	The calculated offset value is too low.	Repeat the calibration.
Cal fail, unstable	The value did not stabilize in the maximum allowed calibration time.	Repeat the calibration.

Exit the calibration procedure

- During calibration, push the BACK key. Three options are shown:

Option	Description
ABORT	Stop the calibration. A new calibration must start from the beginning.
BACK TO CAL	Return to the current calibration.
LEAVE	Exit the calibration temporarily. Access to other menus is allowed while the calibration continues in the background. A calibration for a second sensor (if present) can be started. To return to the calibration, push the MENU key and select Sensor Setup, [Select Sensor].

- Select one of the options. Confirm.

Reset calibration defaults

Calibration settings can be reset to the factory defaults. Gain and offset values are set to 1.0 and 0.0, respectively.

- Go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>RESET CAL DEFLT.
- The display will show a confirmation message. Confirm to reset the sensor to the factory default calibration curve.

Maintenance

⚠ DANGER	
	Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠ DANGER



Explosion hazard. Do not connect or disconnect electrical components or circuits to the equipment unless power has been switched off or the area is known to be non-hazardous.

⚠ DANGER



Explosion hazard. Substitution of components may impair suitability for Class 1, Division 2. Do not replace any component unless power has been switched off and the area is known to be non-hazardous.

NOTICE

The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).

Maintenance schedule

The maintenance schedule shows minimum intervals for regular maintenance tasks. Perform maintenance tasks more frequently for applications that cause electrode fouling.

Note: Do not disassemble the probe for maintenance or cleaning.

Maintenance task	Recommended minimum frequency
Clean the sensor	90 days
Inspect the sensor for damage	90 days
Calibrate the sensor	As recommended by regulatory agencies

Clean the sensor

Clean the exterior of the sensor with a soft, wet cloth.

Note: If the sensor cap must be removed for cleaning, do not expose the interior of the cap to direct sunlight for extended periods of time.

Set or change the clean interval

Application conditions may need shorter or longer durations between manual sensor cleanings. The default clean interval is 0 days. To change the interval, refer to the steps in this procedure.

1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>CLEAN INTRVL.
2. Change the shown value as needed. Confirm the change.
 - To turn off the clean interval, set the value to '0'.

Change the sensor cap

⚠ WARNING



Potential explosion hazard. The sensor setup cap is not rated for hazardous location use.

Replacement sensor caps and setup caps are shipped with installation instructions. Refer to the included instructions to change the cap.

For best performance and accuracy, replace the sensor cap:

- Every two years
- When routine inspection shows significant erosion of the sensor cap

Troubleshooting

Diagnostic and test menu

The diagnostic and test menu shows current and historical information about the LDO sensor. To access the diagnostic and test menu, go to MENU>SENSOR SETUP>[Select Sensor]>DIAG/TEST.

Refer to [Table 5](#).

Table 5 DIAG/TEST menu

Option	Description
SENSOR INFO	SOFTWARE VERS—Shows the installed software version
	BOOT VERSION—Shows the installed boot version
	DRIVER VERS—Shows the installed software driver version
LOT CODE	Shows the sensor cap manufacturing lot
SERIAL NUMBER	Sensor serial number
GAIN CORR	Adjust the calibration gain value.
	Range: 0.50 to 2.00
OFFSET CORR	Adjust the calibration offset value (mg/L or ppm).
	Range: -3.00 to +3.00
PHASE DIAG	Shows the phase for total, red and blue wavelengths. Updates once per second.
AMPL DIAG	Shows the amplitude for red and blue wavelengths. Updates once per second.
DAYS TO CLEAN	Shows the number of days until the next scheduled manual cleaning.
SENSOR LIFE	Shows the number of days until the next scheduled sensor cap replacement

Error list

If an error occurs, the reading on the measurement screen flashes. Output behavior is determined by controller settings. Refer to the controller manual for details.

To show the current sensor errors, go to MENU>DIAGNOSTICS>[Select Sensor]>ERROR LIST.

Refer to [Table 6](#).

Table 6 Error list for the LDO sensor

Error	Possible cause	Resolution
RED AMPL LOW (Value is below 0.01) OR BLUE AMPL LOW (Value is below 0.01)	The sensor cap is not installed, or is not installed correctly.	Remove the sensor cap and install it again.
	The light path is blocked in the sensor cap.	Inspect the inside of the sensor cap and lens.
	The sensor is not operating correctly.	Make sure that the LED is flashing. Contact the manufacturer.

Warning list

When the warning icon flashes (sc100 and sc200) or when the screen turns yellow (sc1000), a message is shown on the bottom of the measurement screen. On the sc1000, the screen turns

yellow to show a warning. To show the current sensor warnings, go to MENU>DIAGNOSTICS>[Select Sensor]>WARNING LIST. Refer to [Table 7](#).

Table 7 Sensor warning list

Warning	Definition	Resolution
EE SETUP ERR	Storage is corrupt. The values have been set to the factory default.	Contact technical support.
EE RSRVD ERR		
TEMP < 0 °C	The process temperature is below 0 °C (32 °F)	Increase the process temperature or stop use until the process temperature is in the sensor specification range.
TEMP > 50 °C	The process temperature is above 50 °C (120 °F)	Decrease the process temperature or stop use until the process temperature is in the sensor specification range.
RED AMPL LOW	Value falls below 0.03	Refer to Table 6 on page 16 .
RED AMPL HIGH	Value is greater than 0.35	Call technical support.
BLUE AMPL LOW	Value is below 0.03	Refer to Table 6 on page 16.
BLUE AMPL HIGH	Value is greater than 0.35	Call technical support.
CAP CODE FAULT	The sensor cap code has become corrupt. The code has been reset automatically to the default cap and lot codes.	Complete the sensor setup cap procedure. If no setup cap is available for the sensor cap, call technical support.

Event list

The Event list keeps a log of changes to how data is recorded by the sensor. To show sensor events, go to MENU>DIAGNOSTICS>[Select Sensor]>EVENT LIST.

Refer to [Table 8](#).

Table 8 Event list for the sensor

Event	Description
ALT/PRESSURE UNIT CHANGE	Atmospheric pressure or altitude units have changed.
ALT/PRESSURE CHANGE	The value for altitude or atmospheric pressure has changed.
TEMP UNIT CHANGE	The units for temperature have changed.
MEAS UNIT CHANGE	A new unit of measurement has changed.
SALINITY CHANGE	The value for salinity has changed.
SET DEFAULT	Sensor settings have been reset to the default values.
SENSOR SETUP CHANGE	The sensor setup has changed.
CLEAN INTERVAL TIMER CHANGE	The time between sensor cleaning has changed.
SENSOR CAP LIFE TIMER CHANGE	The time between sensor cap replacements has changed.

Replacement parts and accessories

Use only replacement parts approved by the manufacturer. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction.

Replacement items

Description	Item no. (US / EU)
LDO Probe, with one sensor cap and 2 calibration bags	9020000 / LXV416.99.20001
LDO Probe for seawater, with one sensor cap and two calibration bags	9020000-SW / —
LDO Probe for seawater hazardous locations, with one sensor cap and two calibration bags	9020000-C1D2-SW / —
LDO Probe for hazardous locations, with one sensor cap and 2 calibration bags	9020000-C1D2 / —
Sensor cap, replacement (includes the sensor setup cap, which is not rated for use in Class 1, Division 2 hazardous locations)	9021100 / 9021150

Accessories

Description	Item no. (US / EU)
Sensor cable lock for hazardous locations	6139900 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 1 m (3.3 ft)	6122402 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 7m (23 ft)	5796002 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 15 m (49.21 ft)	5796102 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 31 m (101.71 ft)	5796202 / —
High output air blast cleaning system, 115 V (not rated for use in hazardous locations)	6860000 / 6860003.99.0001
High output air blast cleaning system, 230 V (not ATEX rated for use in hazardous locations)	6860100 / 6860103.99.0001
Calibration bag (1x)	5796600 / 5796600
Cable, sensor extension, non-hazardous location, 7.7 m (25 ft) ³	US: 5796000, 7.7 m (25 ft)
	EU: LZX849, 10 m (33 ft)
Hardware kit for pipe mount (PVC)	9253000 / LZY714.99.21810
Hardware kit for float mount (PVC)	9253100 / LZX914.99.42200
Hardware kit for air blast mount	9253500 / LZY812
Hardware kit for chain mount (stainless steel)	— / LZX914.99.11200
Hardware kit for union mount	9257000 / 9257000
HQd meter with LDO rugged probe (not rated for use in hazardous locations)	8505200 / HQ40D.99.310.000

³ 15 m (49 ft) and 30 m (98 ft) also available

Table des matières

[Caractéristiques](#) à la page 19

[Généralités](#) à la page 20

[Présentation du produit](#) à la page 22

[Installation](#) à la page 23

[Etalonnage](#) à la page 28

[Fonctionnement](#) à la page 26

[Maintenance](#) à la page 31

[Dépannage](#) à la page 32

[Pièces de rechange et accessoires](#) à la page 35

Caractéristiques

Les caractéristiques techniques peuvent être modifiées sans préavis.

Caractéristique	Détails
Matériaux immergés	<p>Sonde standard, sonde standard classe 1 division 2</p> <ul style="list-style-type: none"> • CPVC, extrémité du capteur et extrémité du câble • Polyuréthane, surmoulage de l'extrémité du câble et de la gaine de câble • Corps et vis en acier inoxydable 316 • Viton, joint torique • Noryl, écrou sur l'extrémité du câble <p>Sonde standard pour eau de mer, sonde pour eau de mer classe 1 division 2</p> <ul style="list-style-type: none"> • CPVC, extrémité du capteur et extrémité du câble • Polyuréthane, surmoulage de l'extrémité du câble et de la gaine de câble • Corps en PVC pour eau de mer • Matériau d'étanchéité époxy pour eau de mer • Noryl, écrou sur l'extrémité du câble
Classification IP	IP68
Matériaux immergés (Capsule de sonde)	Acrylique
Plage de mesure (oxygène dissous)	<p>0 à 20 ppm (0 à 20 mg/l)</p> <p>0 à 200 % de saturation</p>
Précision des mesures (oxygène dissous)	<p>En dessous de 5 ppm : $\pm 0,1$ ppm</p> <p>Au-dessus de 5 ppm : $\pm 0,2$ ppm</p>
Répétabilité (oxygène dissous)	0,1 ppm (mg/l)
Temps de réponse (oxygène dissous)	<p>T₉₀ < 40 secondes</p> <p>T₉₅ < 60 secondes</p>
Résolution, capteur (oxygène dissous)	0,01 ppm (mg/l) ; 0,1 % de saturation
Plage de mesure (température)	0 à 50 °C
Précision des mesures (température)	$\pm 0,2$ °C
Interférences	Les éléments suivants ne causent aucune interférence : H ₂ S, pH, K ⁺ , Na ⁺ , Mg ²⁺ , Ca ²⁺ , NH ₄ ⁺ , Al ³⁺ , Pb ²⁺ , Cd ²⁺ , Zn ²⁺ , Cr (total), Fe ²⁺ , Fe ³⁺ , Mn ²⁺ , Cu ²⁺ , Ni ²⁺ , Co ²⁺ , CN ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , S ²⁻ , PO ₄ ³⁻ , Cl ⁻ , surfactants anioniques actifs, pétrole, Cl ₂ < 4 ppm

Caractéristique	Détails
Température de stockage	-20 à 70 °C
Température maximale	0 à 50 °C
Classification pour zone dangereuse (capteur 9020000-C1D2 uniquement)	Classe I Division 2, Groupes A–D, T4 / Classe I, Zone 2 Groupe 2C, T4 Remarque : ce produit n'est pas conforme à la norme 94/9/EC (norme ATEX).
Certifications (capteur 9020000-C1D2 uniquement)	Certifié conforme aux normes ANSI/ISA, CSA et FM par l'ETL pour une utilisation en environnement dangereux. Remarque : ce produit n'est pas conforme à la norme 94/9/EC (norme ATEX).
Débit minimal	Non requis
Etalonnage/vérification	Etalonnage à l'air : un point, air saturé d'eau à 100 %
	Etalonnage par échantillon : comparaison avec un instrument de référence (2)
Profondeur d'immersion et limites de pression de la sonde	Limites de pression à 34 m, 345 kPa maximum ; il est possible que la précision ne soit plus assurée à cette profondeur
Câble du capteur	Câble intégral de 10 m avec connecteur rapide (tous les types de capteur) Extension possible jusqu'à 100 m à l'aide de câbles supplémentaires (uniquement les types de capteur non-classe I, Division 2) Extension possible jusqu'à 1 000 m à l'aide d'une boîte de raccordement (uniquement les types de capteur non-classe I, Division 2)
Poids de la sonde	1 kg
Dimensions de la sonde	Sonde standard (diamètre x longueur) : 49,53 x 255,27 mm
	Sonde pour eau de mer (diamètre x longueur) : 60,45 x 255,27 mm
Alimentation requise	12 V CC, 0,25 A, 3 W
Garantie	Sonde : 3 ans de couverture des défauts de fabrication
	Capsule (2) du capteur : 2 ans de couverture des défauts de fabrication

Généralités

En aucun cas le constructeur ne saurait être responsable des dommages directs, indirects, spéciaux, accessoires ou consécutifs résultant d'un défaut ou d'une omission dans ce manuel. Le constructeur se réserve le droit d'apporter des modifications à ce manuel et aux produits décrits à tout moment, sans avertissement ni obligation. Les éditions révisées se trouvent sur le site Internet du fabricant.


Consignes de sécurité

AVIS

Le fabricant décline toute responsabilité quant aux dégâts liés à une application ou un usage inappropriés de ce produit, y compris, sans toutefois s'y limiter, des dommages directs ou indirects, ainsi que des dommages consécutifs, et rejette toute responsabilité quant à ces dommages dans la mesure où la loi applicable le permet. L'utilisateur est seul responsable de la vérification des risques d'application critiques et de la mise en place de mécanismes de protection des processus en cas de défaillance de l'équipement.





Veuillez lire l'ensemble du manuel avant le déballage, la configuration ou la mise en fonctionnement de cet appareil. Respectez toutes les déclarations de prudence et d'attention. Le non-respect de cette procédure peut conduire à des blessures graves de l'opérateur ou à des dégâts sur le matériel. Assurez-vous que la protection fournie avec cet appareil n'est pas défaillante. N'utilisez ni n'installez cet appareil d'une façon différente de celle décrite dans ce manuel.

Interprétation des indications de risques

▲ DANGER	
	Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, entraîne des blessures graves, voire mortelles.
▲ AVERTISSEMENT	
	Indique une situation de danger potentiel ou imminent qui, si elle n'est pas évitée, peut entraîner des blessures graves, voire mortelles.
▲ ATTENTION	
	Indique une situation de danger potentiel qui peut entraîner des blessures mineures ou légères.
AVIS	
	Indique une situation qui, si elle n'est pas évitée, peut occasionner l'endommagement du matériel. Informations nécessitant une attention particulière.

Étiquettes de mise en garde

Lisez toutes les informations et toutes les étiquettes apposées sur l'appareil. Des personnes peuvent se blesser et le matériel peut être endommagé si ces instructions ne sont pas respectées. Un symbole sur l'appareil est référencé dans le manuel et accompagné d'une déclaration de mise en garde.

	Ceci est le symbole d'alerte de sécurité. Se conformer à tous les messages de sécurité qui suivent ce symbole afin d'éviter tout risque de blessure. S'ils sont apposés sur l'appareil, se référer au manuel d'utilisation pour connaître le fonctionnement ou les informations de sécurité.
	Ce symbole signale la présence d'une source lumineuse entraînant un risque de détérioration légère de la vue. Veillez à vous conformer à tous les messages de sécurité qui suivent ce symbole afin d'éviter une potentielle détérioration de votre vue.
	Ce symbole indique la présence de dispositifs sensibles aux décharges électrostatiques (ESD) et indique que des précautions doivent être prises pour éviter les dommages avec l'équipement.
	En Europe, depuis le 12 août 2005, les appareils électriques comportant ce symbole ne doivent pas être jetés avec les autres déchets. Conformément à la réglementation nationale et européenne (Directive 2002/96/CE), les appareils électriques doivent désormais être, à la fin de leur service, renvoyés par les utilisateurs au fabricant, qui se chargera de les éliminer à ses frais. Remarque : Pour le retour à des fins de recyclage, veuillez contacter le fabricant ou le fournisseur d'équipement pour obtenir les instructions sur la façon de renvoyer l'équipement usagé, les accessoires électriques fournis par le fabricant, et tous les articles auxiliaires pour une mise au rebut appropriée.

Certification

Règlement canadien sur les équipements causant des interférences radio, IECS-003, Classe A:

Les données d'essai correspondantes sont conservées chez le constructeur.

Cet appareil numérique de classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC part 15, limites de classe A :

Les données d'essai correspondantes sont conservées chez le constructeur. L'appareil est conforme à la partie 15 de la réglementation FCC. Le fonctionnement est soumis aux conditions suivantes :

- 1. Cet équipement ne peut pas causer d'interférence nuisible.
- 2. Cet équipement doit accepter toutes les interférences reçues, y compris celles qui pourraient entraîner un fonctionnement inattendu.

Les modifications de cet équipement qui n'ont pas été expressément approuvées par le responsable de la conformité aux limites pourraient annuler l'autorité dont l'utilisateur dispose pour utiliser cet équipement. Cet équipement a été testé et déclaré conforme aux limites définies pour les appareils numériques de classe A, conformément à la section 15 de la réglementation FCC. Ces limites ont pour but de fournir une protection raisonnable contre les interférences néfastes lorsque l'équipement fonctionne dans un environnement commercial. Cet équipement génère, utilise et peut irradier l'énergie des fréquences radio et, s'il n'est pas installé ou utilisé conformément au mode d'emploi, il peut entraîner des interférences dangereuses pour les communications radio. Le fonctionnement de cet équipement dans une zone résidentielle risque de causer des interférences nuisibles, dans ce cas l'utilisateur doit corriger les interférences à ses frais Les techniques ci-dessous peuvent permettre de réduire les problèmes d'interférences :

- 1. Débrancher l'équipement de la prise de courant pour vérifier s'il est ou non la source des perturbations
- 2. Si l'équipement est branché sur le même circuit de prises que l'appareil qui subit des interférences, branchez l'équipement sur un circuit différent.
- 3. Éloigner l'équipement du dispositif qui reçoit l'interférence.
- 4. Repositionner l'antenne de réception du périphérique qui reçoit les interférences.
- 5. Essayer plusieurs des techniques ci-dessus à la fois.

Présentation du produit

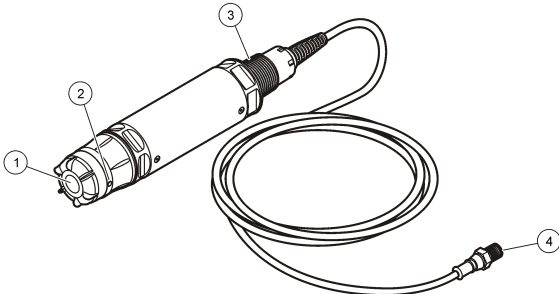
▲ DANGER

Dangers chimiques ou biologiques. Si cet instrument est utilisé pour la surveillance d'un procédé de traitement et/ou d'un système de dosage de réactifs chimiques auxquels s'appliquent des limites réglementaires et des normes de surveillance motivées par des préoccupations de santé et de sécurité publiques ou de fabrication et de transformation d'aliments ou de boissons, il est de la responsabilité de l'utilisateur de cet instrument qu'il connaisse et applique les normes en vigueur et qu'il ait à sa disposition suffisamment de mécanismes pour s'assurer du bon respect de ces normes dans l'éventualité d'un dysfonctionnement de l'appareil.

Ce capteur est conçu pour fonctionner avec un contrôleur assurant la collecte de données et le fonctionnement. Il est possible d'utiliser le capteur avec plusieurs transmetteurs. Pour plus d'informations, reportez-vous au manuel d'utilisation du transmetteur.

Ce capteur est essentiellement conçu pour le traitement municipal ou industriel des eaux usées. La technologie de capteur LDO ne consomme pas d'oxygène et permet de mesurer la concentration d'oxygène dissous pour un débit faible ou nul. Voir la [Figure 1](#).

Figure 1 Capteur LDO

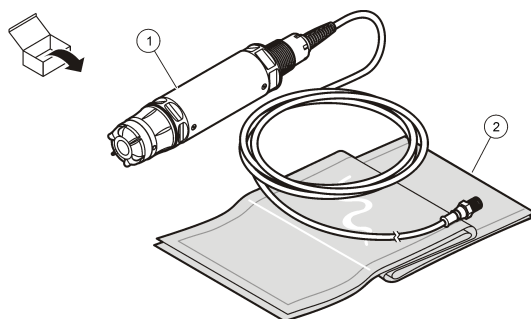


1 Capsule de sonde	3 Filetage 1 pouce NPT (2)
2 Capteur de température	4 Connecteur, connexion rapide (standard)

Liste des composants du capteur LDO

Assurez-vous d'avoir bien reçu tous les composants illustrés dans la [Figure 2](#). Si des éléments manquent ou sont endommagés, contactez immédiatement le fabricant ou un représentant commercial. Voir la [Figure 2](#).

Figure 2 Liste des composants du capteur



1 Capteur LDO ¹	2 Sachets d'étalonnage (2)
----------------------------	----------------------------

Installation

⚠ AVERTISSEMENT

Risque de blessures corporelles. Seul le personnel qualifié est autorisé à entreprendre les opérations décrites dans cette section du manuel.

Validation du type de capteur

⚠ DANGER



Risque d'explosion. Ne branchez que des composants périphériques clairement indiqués comme certifiés pour usage en endroits dangereux de Classe 1, Division 2.

AVIS

La version de ce produit certifiée pour les environnements dangereux n'est pas conforme à la norme 94/9/EC (norme ATEX).

1. Saisissez l'extrémité du câble comportant le connecteur.
2. Lisez l'étiquette placée à cette extrémité du câble. Sur les capteurs certifiés pour une utilisation en environnement dangereux, l'étiquette affiche « Certifié : Classe 1 Division 2 ».
3. Examinez le connecteur.
 - Les capteurs certifiés pour une utilisation en environnement dangereux comportent un connecteur avec verrouillage de sécurité. Voir la [Figure 3](#) à la page 24.
 - Les capteurs non certifiés pour une utilisation en environnement dangereux comportent une prise de déconnexion rapide, sans verrouillage de sécurité.

¹ Le manuel fourni n'est pas représenté.

Connexion du capteur dans un environnement dangereux

⚠ DANGER



Risque d'explosion. Cet équipement convient à une utilisation au sein d'environnements non dangereux ou au sein d'environnements dangereux Classe 1, Division 2, Groupes A, B, C et D avec capteurs et options spécifiées installées selon la fiche technique relative à l'installation au sein d'environnements dangereux. Reportez-vous toujours aux instructions de la fiche technique et des réglementations en vigueur en matière de normes électriques pour une installation conforme.

⚠ DANGER



Risque d'explosion Ne branchez ni ne débranchez aucun composant électrique ou circuit sur l'équipement avant de vous être assuré que l'alimentation a été coupée et que l'emplacement est sécurisé.

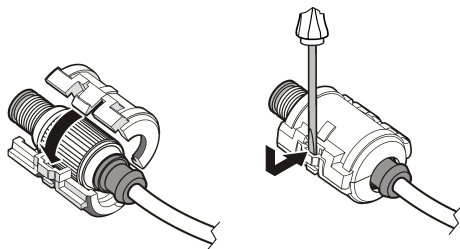
AVIS

Dans un environnement dangereux, utilisez uniquement un capteur certifié pour ce type d'environnement et un verrou de câble. La version de ce produit certifiée pour les environnements dangereux n'est pas conforme à la norme 94/9/EC (norme ATEX).

Pour plus de renseignements, référez-vous à la section [Validation du type de capteur](#) à la page 23 .

1. Retirez le bouchon (2) du connecteur du transmetteur. Conservez le bouchon (2) du connecteur afin de protéger l'ouverture du connecteur une fois le capteur retiré.
2. Connectez le capteur au transmetteur. Pour plus d'informations, reportez-vous au manuel du transmetteur.
3. Verrouillez le dispositif de sécurité du connecteur.
4. Pour retirer le verrouillage de sécurité du connecteur, utilisez un petit tournevis plat. Voir la [Figure 3](#).

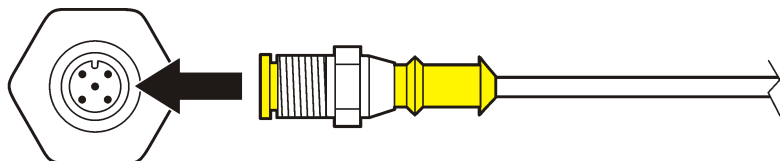
Figure 3 Verrouillage de sécurité du connecteur



Connexion du capteur dans un environnement non dangereux

Voir la [Figure 4](#) pour la connexion d'un capteur LDO à un transmetteur sc. Pour les instructions relatives au câblage, reportez-vous au manuel du transmetteur sc.

Figure 4 Connexion du capteur LDO (illustration correspondant à un capteur pour environnement non dangereux)



Une fois le capteur fixé, détectez-le à l'aide du logiciel. Voir la section [Installation du capteur](#) à la page 25.

Installation du capteur

Deux méthodes permettent d'installer le capteur :

- Connectez le capteur lorsque le transmetteur est hors tension. Une fois sous tension, le transmetteur recherche et installe tout nouveau capteur.
- Connectez le capteur lorsque le transmetteur est sous tension. Installez le nouveau capteur à l'aide de la commande Scan Devices (Rechercher les périphériques) :

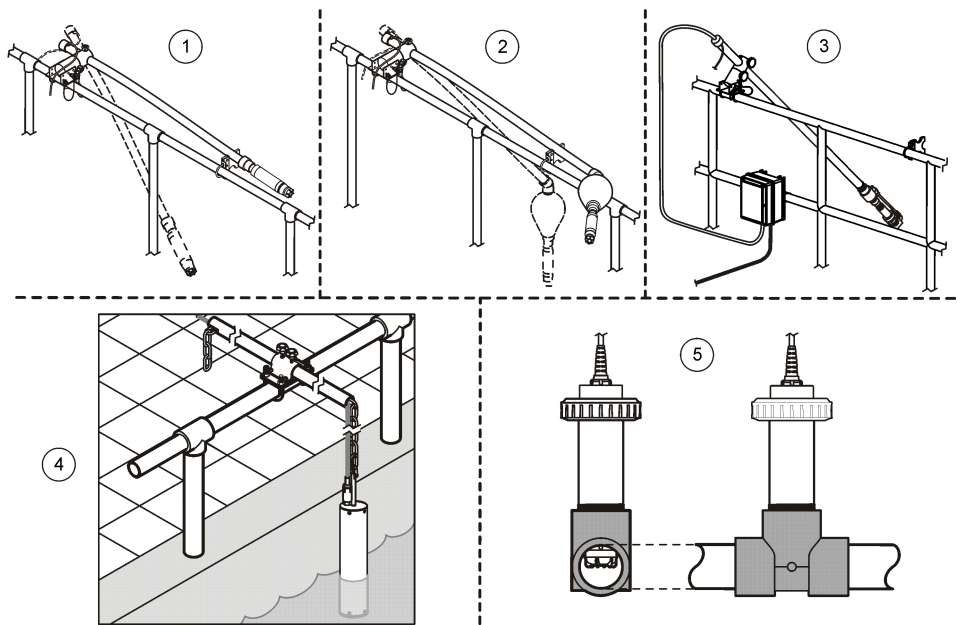
Option	Description
Transmetteur sc200	Sélectionnez MENU>TEST/MAINT>RECHERCHE CAPTEUR
Transmetteur sc100	Sélectionnez MENU>TEST/MAINT>RECHERCHE CAPTEUR
Transmetteur sc1000	Sélectionnez MENU>SYSTEM SETUP (CONFIG SYSTEME)>CONTROLE APPAREILS>RECHERCHE NOUVEAUX APPAREILS

Pour plus d'informations sur la connexion d'un capteur numérique, voir la section [Connexion du capteur dans un environnement non dangereux](#) à la page 24.

Options d'installation du capteur

Les options d'installation et les accessoires du capteur LDO sont fournies avec les instructions nécessaires dans le kit de fixation. La [Figure 5](#) présente plusieurs options d'installation. Pour commander du matériel d'installation, voir la section [Pièces de rechange et accessoires](#) à la page 35.

Figure 5 Options d'installation



1 Montage sur rail	4 Montage sur chaîne
2 Montage sur flotteur	5 Montage raccord union (non compatible avec sonde pour eau de mer)
3 Montage sur système de soufflage d'air (non compatible avec sonde pour eau de mer)	

Fonctionnement

Navigation utilisateur

Consultez la documentation du transmetteur pour une description du clavier et des informations de navigation.

Configuration du capteur

Utiliser le menu Configurer pour entrer les informations d'identification du capteur et modifier les options de gestion et stockage de données.

Pour plus d'informations sur l'installation du capteur, voir [Installation du capteur](#) à la page 25.

Assurez-vous que toutes les valeurs du menu de configuration sont appropriées à l'utilisation de l'appareil.

1. Sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>CONFIGURE (CONFIGURER).
2. Sélectionnez une option, puis appuyez sur ENTER (ENTREE). Le tableau ci-dessous présente les options disponibles.

Option	Description
EDITER NOM	Modifie le nom correspondant au capteur en haut de l'écran de mesure. Le nom est limité à 10 caractères avec n'importe quelle combinaison de lettres, chiffres, espaces ou ponctuation.
DEFINITION UNITES	TEMP : règle les unités de température en °C (par défaut) ou °F.
	MEASURE (MESURE) : règle les unités de mesure en mg/l, ppm ou %.
	ALT/PRESS : règle l'altitude en mètres ou en pieds ou les unités de pression atmosphérique en mmHg ou torr. (Valeur par défaut = 0 pied.)
ALT/PRESS	Saisissez la valeur d'altitude ou de pression atmosphérique. Il est nécessaire que cette valeur soit précise afin d'effectuer les mesures de saturation en pourcentage et l'étalonnage dans l'air. (Valeur par défaut = 0 pied.)
SALINITE	Saisissez la valeur de salinité. Plage de salinité : 0 à 250 parties par milliers (‰). Pour en savoir plus, reportez-vous à la section Saisie d'une valeur de correction de la salinité à la page 27. (Valeur par défaut = 0 pied.)
MOYENNE SIGNAL	Définissez l'intervalle de temps pour la moyenne du signal en secondes.
INTERVALLE NETTOYAGE	Définissez l'intervalle de temps pour le nettoyage manuel du capteur en jours. (Valeur par défaut = 0 jour. Une valeur de 0 jour désactive l'intervalle de nettoyage.)
RAZ INT NETTOY	Définissez le dernier intervalle de nettoyage enregistré comme intervalle de temps.
PROGRAMMATION HISTORIQUE	Définit l'intervalle de temps pour l'enregistrement des données dans le journal des données ; 0,5, 1, 2, 5, 10, 15 (par défaut), 30, 60 minutes.
VALEURS PAR DEFAUT	Restaure les valeurs par défaut des options de configuration du capteur. Les réglages de pente et de décalage ne sont pas affectés.

Saisie de la valeur de pression atmosphérique

Le réglage par défaut pour la pression atmosphérique (de l'air) est 0 pied, soit le niveau de la mer. Pour modifier la valeur par défaut, procédez comme suit. Il est possible d'ajuster la pression d'air à l'aide d'une valeur d'altitude ou d'unités de pression (recommandée).

Remarque : la précision de la valeur de pression d'air est essentielle à l'étalonnage de la saturation de l'air ([Étalonnage à l'air](#) à la page 29). Utilisez toujours la valeur de pression absolue, et non la valeur ajustée. Si vous ne connaissez pas la valeur de pression d'air absolue, utilisez l'altitude exacte de l'endroit où se trouve le capteur.

1. Sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>CONFIGURE (CONFIGURER)>SET UNITS (DEF UNITES)>AIR PRESS (PRESSION)/ALT UNITS (UNIT ALT).
2. Sélectionnez **une** des unités suivantes :

Option	Description
ft	Pied (foot) : unité de mesure anglo-saxonne de l'altitude
m	Mètre : unité de mesure de l'altitude
mmHg	Millimètres de mercure : unité de mesure de la pression d'air absolue
torr	Unité de mesure de pression d'air absolue

3. Confirmez la sélection. L'écran de saisie de valeur affiche les unités sélectionnées.
4. Saisissez la valeur et confirmez.

Saisie d'une valeur de correction de la salinité

Il est possible que la valeur DO affichée par les mesures d'oxygène dissous des échantillons salins soit très différente de la valeur DO réelle. Pour compenser l'effet des sels dissous dans un échantillon, saisissez un facteur de correction de la salinité.

Remarque : Si vous n'êtes pas certain du taux de salinité du fluide, renseignez-vous auprès des ingénieurs du site de traitement.

1. A l'aide d'un conductimètre, mesurez la conductivité de l'échantillon en mS/cm à la température de référence de 20 °C.
2. Aidez-vous du [Tableau 1](#) pour estimer le facteur de correction de la salinité en fonction de la saturation en parties par millier (‰).

Remarque : La concentration en ion chlorure, exprimée en g/kg, indique la chlorinité de l'échantillon. Le taux de salinité est calculé selon la formule suivante : $\text{salinité} = 1,80655 \times \text{chlorinité}$.

Il est possible de calculer le taux de salinité à l'aide de la relation établie dans la section 2520 B du document *Standard Methods for the Examination of Water and Wastewater*.²,

3. Sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>CONFIGURE (CONFIGURER)>SALINITY (SALINITE).
4. Saisissez le facteur de salinité et confirmez votre saisie.

² *Standard Methods for the Examination of Water and Wastewater*, 20e édition. Editeurs : Lenore S. Clesceri, Arnold E. Greenberg et Andrew D. Eaton, p. 2-48-2-29 (1998). Le rapport entre chlorinité et solubilité de l'oxygène est fourni dans ce même document à la section 4500-O:1 p. 4-131.

Tableau 1 Saturation de salinité (‰) en fonction de la valeur de conductivité (mS/cm)

mS/cm	‰		mS/cm	‰		mS/cm	‰		mS/cm	‰
5	3		16	10		27	18		38	27
6	4		17	11		28	19		39	28
7	4		18	12		29	20		40	29
8	5		19	13		30	21		42	30
9	6		20	13		31	22		44	32
10	6		21	14		32	22		46	33
11	7		22	15		33	23		48	35
12	8		23	15		34	24		50	37
13	8		24	17		35	25		52	38
14	9		25	17		36	25		54	40
15	10		26	18		37	26			

Configuration de la sortie courant (2) du transmetteur

Les sorties linéaires envoient les données de la sonde au système centralisé (automate, supervision ou autre) de l'installation.

1. Ouvrez le menu de configuration de sortie du transmetteur.

Option Description

- sc200** Sélectionnez MENU>SETTINGS (REGLAGES)>sc200 SETUP (CONFIG sc200)>PROGRAMMATION SORTIE>[Sélectionnez la sortie]>MODE.
- sc100** Sélectionnez MENU>SYSTEM SETUP (CONFIG SYSTEME)>PROGRAMMATION SORTIE>[Sélectionnez la sortie]>MODE.
- sc1000** Sélectionnez MENU>SYSTEM SETUP (CONFIG SYSTEME)>PROGRAMMATION SORTIE>[Sélectionnez la sortie]>MODE.

2. Définissez la fonction du transmetteur.

Option Description

- sc200** LINEAIRE
- sc100** LINEAIRE (valeur par défaut)
- sc1000** LINEAIRE (valeur par défaut)

Registres Modbus

Une liste de registres Modbus est disponible pour la communication réseau. Consulter www.hach.com ou www.hach-lange.com pour plus d'informations.

Étalonnage

Le capteur est étalonné en usine conformément aux spécifications. Le fabricant recommande de procéder à l'étalonnage à la fréquence préconisée par les organismes de contrôle. Si l'étalonnage est nécessaire, assurez-vous du fonctionnement stabilisé (2) du capteur avant de procéder à l'étalonnage. Ne procédez pas à l'étalonnage du capteur lors de son installation.

Le [Tableau 2](#) présente les options d'étalonnage.

Tableau 2 Options d'étalonnage

Option	Description
ETALONNAGE A L'AIR	Méthode d'étalonnage recommandée. Cet étalonnage modifie la pente.
ETALONNAGE PROCESS	Etalonnage par comparaison avec un appareil de mesure d'oxygène dissous portable. Cet étalonnage modifie le décalage.
RAZ DEF ETAL	Rétablit les valeurs de gain d'étalonnage (pente) et de décalage par défaut ; gain par défaut = 1,0, décalage par défaut = 0,0

Étalonnage à l'air

Remarques à l'intention de l'utilisateur :

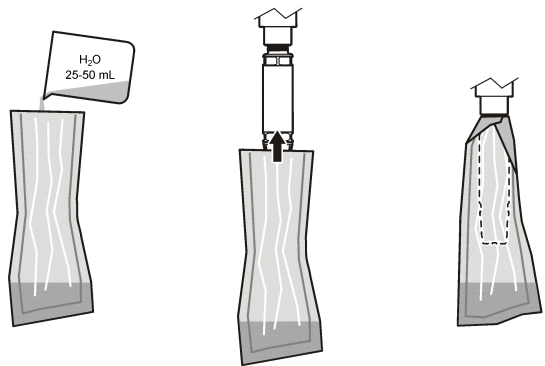
- Assurez-vous que le sachet utilisé pour l'étalonnage contient bien de l'eau.
- Assurez-vous que le joint placé entre le sachet d'étalonnage et le corps du capteur est bien serré.
- Avant de procéder à l'étalonnage, assurez-vous que le capteur est bien sec.
- Assurez-vous que le réglage de pression d'air et d'altitude est approprié à l'emplacement choisi pour effectuer l'étalonnage.
- Attendez que la température du capteur corresponde à la température de l'emplacement du sachet d'étalonnage. Jusqu'à 15 minutes peuvent être nécessaires pour réduire un écart de température important entre le fluide traité et l'emplacement choisi pour l'étalonnage.

1. Sortez le capteur du fluide traité. Nettoyez le capteur à l'aide d'un chiffon humide.
2. Placez l'intégralité du capteur dans un sachet d'étalonnage contenant 25 à 50 ml d'eau. Veillez à ce que la capsule du capteur n'entre pas en contact avec l'eau du sachet d'étalonnage et ne comporte aucune goutte d'eau ([Figure 6](#)).
3. Resserrez le sac autour du corps du capteur à l'aide d'un ruban adhésif, d'une ficelle ou de votre main.
4. Avant de procéder à l'étalonnage, laissez le capteur se stabiliser pendant 15 minutes. Pendant la stabilisation, conservez le sachet d'étalonnage à l'abri du soleil.
5. Assurez-vous que le réglage actuel absolu de pression d'air ou d'altitude est correctement configuré. Voir [Saisie de la valeur de pression atmosphérique](#) à la page 26.
Remarque : le fabricant recommande l'utilisation de la valeur de pression d'air réelle ou absolue.
6. Sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>CALIBRATE (ETALONNER)>AIR CAL (ETAL AIR).
7. Sélectionnez l'option de sortie du signal pendant l'étalonnage :

Option	Description
Actif	L'instrument envoie la valeur de sortie mesurée pendant la procédure d'étalonnage.
Mémorisation	La valeur de sortie du capteur est maintenue à la dernière valeur mesurée pendant la procédure d'étalonnage.
Transfert	Une valeur prédéfinie est fournie pendant l'étalonnage. Consultez le manuel d'utilisation du transmetteur pour changer la valeur prédéfinie.

8. Le transmetteur affiche le message « Placer le capteur dans l'air ». Attendez que la valeur se stabilise. Appuyez sur ENTER (ENTREE) pour accepter la valeur stable. Vous pouvez également attendre que l'écran affiche « Complete » (Terminé).
9. Une fois le capteur étalonné, placez-le dans le fluide traité. Appuyez sur ENTER (ENTREE).

Figure 6 Procédure d'étalonnage à l'air



Si la valeur ne se stabilise pas, l'écran affiche un message d'erreur précédé de la mention « Unable to Calibrate » (Etalonnage impossible). Le [Tableau 3](#) présente les messages d'erreur et les résolutions des problèmes d'étalonnage.

Tableau 3 Messages relatifs à l'étalonnage à l'air

Message	Description	Résolution
Cal fail, gain high (Echec étal., gain élevé)	La valeur de gain calculée est trop élevée.	Procédez à nouveau à l'étalonnage.
Cal fail, gain low (Echec étal., gain faible)	La valeur de gain calculée est trop faible.	Procédez à nouveau à l'étalonnage.
Cal fail, unstable (Echec étal., instable)	La valeur ne s'est pas stabilisée dans le délai maximal d'étalonnage.	Procédez à nouveau à l'étalonnage.

Etalonnage Process : étalonnage par comparaison

Cette méthode d'étalonnage nécessite un autre capteur connecté à un appareil de mesure portable.

1. Plongez cet autre capteur dans le fluide. Placez le second capteur aussi près que possible du premier.
2. Attendez la stabilisation de la valeur O2 dissous (1).
3. Sur le transmetteur du capteur à calibrer, sélectionnez MENU>CONFIG CAPTEUR>[Sélectionnez le capteur]>ETALONNAGE>PROCESS.
4. Sélectionnez l'option de sortie du signal pendant l'étalonnage :

Option	Description
Actif	L'instrument envoie la valeur de sortie mesurée pendant la procédure d'étalonnage.
Mémorisation	La valeur de sortie du capteur est maintenue à la dernière valeur mesurée pendant la procédure d'étalonnage.
Transfert	Une valeur prédéfinie est fournie pendant l'étalonnage. Consultez le manuel d'utilisation du transmetteur pour changer la valeur prédéfinie.

5. Le transmetteur affiche les éléments suivants :
 - « Press ENTER when stabilized » (Appuyez sur ENTREE une fois la valeur stabilisée)
 - La mesure d'oxygène dissous actuelle
 - La mesure de température actuelle

6. Une fois la mesure stable, appuyez sur ENTER (ENTREE). Un écran de saisie s'affiche.

Remarque : la mesure se stabilise en général au bout de 2 ou 3 minutes.

Si la valeur ne se stabilise pas, l'écran affiche un message d'erreur précédé de la mention « Unable to Calibrate » (Étalonnage impossible). Le [Tableau 4](#) présente les messages d'erreur et les résolutions des problèmes d'étalonnage.

Tableau 4 Messages d'erreur d'étalonnage par échantillon

Message	Description	Résolution
Cal fail, offset high (Echec étal., décalage élevé)	La valeur de décalage calculée est trop élevée.	Procédez à nouveau à l'étalonnage.
Cal fail, offset low (Echec étal., décalage faible)	La valeur de décalage calculée est trop faible.	Procédez à nouveau à l'étalonnage.
Cal fail, unstable (Echec étal., instable)	La valeur ne s'est pas stabilisée dans le délai maximal d'étalonnage.	Procédez à nouveau à l'étalonnage.

Quitter la procédure d'étalonnage

1. Pendant l'étalonnage, appuyez sur la touche BACK (RETOUR). Trois options apparaissent :

Option	Description
ANNULER	Arrête l'étalonnage. Un nouvel étalonnage devra repartir du début.
RETOUR ETALON.	Permet de reprendre l'étalonnage en cours.
ECHAPPER	Quitte temporairement l'étalonnage. L'étalonnage se poursuit en arrière-plan, permettant l'accès à d'autres menus. Il est possible de démarrer un étalonnage pour un deuxième capteur (le cas échéant). Pour revenir à l'étalonnage, appuyez sur la touche MENU et sélectionnez Sensor Setup (Config capteur), [Sélectionnez le capteur].




2. Sélectionnez une des options. Validez.

Réinitialisation des valeurs d'étalonnage par défaut

Il est possible de réinitialiser les réglages d'étalonnage à l'aide des valeurs par défaut. Les valeurs de gain et de décalage sont alors définies sur 1 et 0, respectivement.

- Sélectionnez MENU>CONFIG CAPTEUR>CONFIGURATION
- Un message de confirmation s'affiche. Confirmez la réinitialisation du capteur à l'aide de la courbe d'étalonnage par défaut.

Maintenance

⚠ DANGER	
	Dangers multiples. Seul le personnel qualifié doit effectuer les tâches détaillées dans cette section du document.
⚠ DANGER	
	Risque d'explosion Ne branchez ni ne débranchez aucun composant électrique ou circuit sur l'équipement avant de vous être assuré que l'alimentation a été coupée et que l'emplacement est sécurisé.
⚠ DANGER	
	Risque d'explosion Tout changement de composant est susceptible d'avoir une incidence sur la conformité Classe 1, Division 2. Ne remplacez jamais un composant avant de vous être assuré que l'alimentation a été coupée et que l'emplacement est sécurisé.

La version de ce produit certifiée pour les environnements dangereux n'est pas conforme à la norme 94/9/EC (norme ATEX).

Calendrier de maintenance

Le calendrier de maintenance indique la fréquence minimum des tâches de maintenance régulières. Effectuer les opérations d'entretien plus fréquemment avec des applications entraînant une contamination de l'électrode.

Remarque : ne démontez pas la sonde pour la maintenance ou le nettoyage.

Tâche de maintenance	Fréquence minimum recommandée
Nettoyage du capteur	90 jours
Inspection du capteur	90 jours
Etalonnage du capteur	Conformément aux recommandations des organismes de contrôle

Nettoyage du capteur

Nettoyez la surface du capteur à l'aide d'un chiffon doux humide.

Remarque : S'il est nécessaire de retirer la capsule du capteur lors du nettoyage, évitez d'exposer l'intérieur de la capsule aux rayons du soleil pendant une période prolongée.

Définition ou modification de l'intervalle de nettoyage

L'intervalle adéquat entre les nettoyages manuels du capteur peut varier en fonction des conditions d'utilisation. L'intervalle de nettoyage par défaut est de 0 jour. Pour modifier l'intervalle, procédez comme suit.

1. Sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>CONFIGURE (CONFIGURER)>INT NETTOYAGE.
2. Modifiez la valeur affichée. Confirmez la modification.
 - Pour désactiver l'intervalle de nettoyage, définissez 0 comme valeur.

Remplacement du capuchon du capteur

▲ AVERTISSEMENT



Risque d'explosion. Le capuchon de configuration du capteur n'est pas certifié pour une utilisation en environnement dangereux.

Des instructions d'installation sont fournies avec les capuchons de configuration et les capuchons de capteur de rechange. Pour remplacer le capuchon, reportez-vous aux instructions fournies.

Pour bénéficier de performances et d'une précision optimales, remplacez le capuchon du capteur :

- Tous les deux ans ;
- Lorsque l'inspection de routine révèle une forte érosion du capuchon du capteur.

Dépannage

Menu de diagnostic et test

Le menu de diagnostic et de test affiche les informations actuelles et consignées relatives au capteur LDO.

Pour accéder au menu de diagnostic et de test, sélectionnez MENU>SENSOR SETUP (CONFIG CAPTEUR)>[Sélectionnez le capteur]>DIAG/TEST.

Voir le [Tableau 5](#).

Tableau 5 Menu DIAG/TEST

Option	Description
INFO CAPTEUR	VER LOGICIEL : affiche la version du logiciel installé.
	VER CODE DEM : affiche la version du code de démarrage installé.
	DRIVER VERSION (VER PILOTE) : affiche la version du pilote logiciel installé.
LOT CODE (CODE LOT)	Affiche le lot de fabrication du capuchon du capteur
SERIAL NUMBER (NUMERO DE SERIE)	Numéro de série du capteur
GAIN CORR (COEF GAIN)	Permet d'ajuster la valeur de gain d'étalonnage.
	Plage : 0,5 à 2
OFFSET CORR (CORR DECALAGE)	Permet d'ajuster la valeur de décalage d'étalonnage (mg/l ou ppm).
	Plage : -3 à 3
PHASE DIAG (DIAG PHASE)	Affiche la phase des longueurs d'onde bleue, rouge et totale. Mise à jour chaque seconde.
AMPL DIAG (DIAG AMPL)	Affiche l'amplitude des longueurs d'onde bleue et rouge. Mise à jour chaque seconde.
JRS AV NETTOY	Affiche le nombre de jours avant le prochain nettoyage manuel programmé.
DUREE CAPTEUR	Affiche le nombre de jours avant le prochain remplacement de capuchon du capteur programmé.

Liste d'erreurs

En cas d'erreur, la mesure affichée clignote. Le comportement de sortie est déterminé par les réglages du transmetteur. Pour plus d'informations, reportez-vous au manuel du transmetteur. Pour afficher les erreurs actuellement détectées sur le capteur, sélectionnez MENU>DIAGNOSTICS>[Sélectionnez le capteur]>ERROR LIST (LISTE ERREURS) Voir le [Tableau 6](#).

Tableau 6 Liste d'erreurs du capteur LDO

Erreur	Cause possible	Résolution
RED AMPL LOW (AMPL RGE FAIB) (Valeur inférieure à 0,01) OU BLUE AMPL LOW (AMPL BL FAIB) (Valeur inférieure à 0,01)	Le capuchon du capteur n'est pas installé ou ne l'est pas correctement.	Retirez le capuchon du capteur, puis remplacez-le.
	La trajectoire de la lumière est bloquée dans le capuchon du capteur.	Inspectez la lentille et l'intérieur du capuchon du capteur.
	Le capteur ne fonctionne pas correctement.	Assurez-vous que le voyant clignote. Contactez le fabricant.

Liste d'avertissements

Lorsque l'icône d'avertissement clignote (sc100 et sc200) ou lorsque l'écran devient jaune (sc1000), un message s'affiche en bas de l'écran. Sur le transmetteur sc1000, l'écran devient jaune lorsqu'un avertissement est affiché. Pour afficher les avertissements actuellement émis par le capteur,

sélectionnez MENU>DIAGNOSTICS>[Sélectionnez le capteur]>WARNING LIST (LISTE AVERTISSEMENTS) Voir le [Tableau 7](#).

Tableau 7 Liste d'avertissements du capteur

Avertissement	Définition	Résolution
EE SETUP ERR (ERR CONFIG EE)	Le stockage est corrompu. Les valeurs par défaut ont été rétablies.	Contactez l'assistance technique.
EE RSRVD ERR (ERR ENR EE)		
TEMP < 0 °C (TEMP < 0 °C)	La température du fluide est inférieure à 0 °C	Augmentez la température du fluide ou cessez son utilisation jusqu'à ce que sa température soit comprise dans la plage des spécifications du capteur.
TEMP > 50 °C (TEMP > 50 °C)	La température du fluide est supérieure à 50 °C	Diminuez la température du fluide ou cessez son utilisation jusqu'à ce que sa température soit comprise dans la plage des spécifications du capteur.
RED AMPL LOW (AMPL RGE FAIB)	La valeur est inférieure à 0,03	Voir le Tableau 6 à la page 33.
RED AMPL HIGH (AMPL RGE ELEV)	La valeur est supérieure à 0,35	Appelez l'assistance technique.
BLUE AMPL LOW (AMPL BL FAIB)	La valeur est inférieure à 0,03	Voir le Tableau 6 à la page 33.
BLUE AMPL HIGH (AMPL BL ELEV)	La valeur est supérieure à 0,35	Appelez l'assistance technique.
CAP CODE FAULT (ERR CODE CAP)	Le code du capuchon du capteur est corrompu. Le code a été automatiquement réinitialisé à l'aide des codes de lot et de capuchon par défaut.	Suivez les instructions relatives au capuchon de configuration du capteur. Si aucun capuchon de configuration n'est disponible pour le capuchon du capteur, contactez l'assistance technique.

Liste d'événements

La liste d'événements consigne les modifications apportées au mode d'enregistrement des données par le capteur. Pour afficher les événements relatifs au capteur, sélectionnez MENU>DIAGNOSTICS>[Sélectionnez le capteur]>EVENT LIST (LISTE EVENEMENTS). Voir le [Tableau 8](#).

Tableau 8 Liste d'événements du capteur

Événement	Description
ALT/PRESSURE UNIT CHANGE (MODIF UNIT PRESSION/ALT)	Les unités de pression atmosphérique ou d'altitude ont été modifiées.
ALT/PRESSURE CHANGE (MODIF PRESSION/ALT)	La valeur de pression atmosphérique ou d'altitude a été modifiée.
TEMP UNIT CHANGE (MODIF UNIT TEMP)	Les unités de température ont été modifiées.
MEAS UNIT CHANGE (MODIF UNIT MES)	Une nouvelle unité de mesure a été introduite.
SALINITY CHANGE (MODIF SALINITE)	La valeur de salinité a été modifiée.
SET DEFAULT (DEF VAL PR DFT)	Les valeurs par défaut des réglages du capteur ont été rétablies.

Tableau 8 Liste d'événements du capteur (suite)

Événement	Description
SENSOR SETUP CHANGE (MODIF CONFIG CAPTEUR)	La configuration du capteur a été modifiée.
CLEAN INTERVAL TIMER CHANGE (MODIF INT NETTOYAGE)	L'intervalle entre deux nettoyages du capteur a été modifié.
SENSOR CAP LIFE TIMER CHANGE (MODIF DUREE CAP)	L'intervalle entre deux remplacements du capuchon du capteur a été modifié.

Pièces de rechange et accessoires

Utiliser uniquement des pièces de rechange approuvées par le fabricant. L'utilisation de pièces non approuvées comporte un risque de blessure, d'endommagement de l'appareil ou de panne d'équipement.

Éléments de rechange

Description	Référence article (U.S.A. / U.E.)
Sonde LDO avec capsule de capteur et 2 sachets d'étalonnage	9020000 / LXV416.99.20001
Sonde LDO pour eau de mer avec capsule de capteur et deux sachets d'étalonnage	9020000-SW / —
Sonde LDO pour zone dangereuse avec eau de mer, avec capsule de capteur et deux sachets d'étalonnage	9020000-C1D2-SW / —
Sonde LDO pour zone dangereuse avec capsule de capteur et 2 sachets d'étalonnage	9020000-C1D2 / —
Capsule du capteur de rechange (inclut la capsule de configuration du capteur non certifié pour zone dangereuse de classe 1, division 2)	9021100 / 9021150

Accessoires

Description	Référence article (U.S.A. / U.E.)
Verrou de câble du capteur pour environnements dangereux	6139900 / —
Câble, extension de capteur, zone dangereuse de classe 1, division 2, 1 m	6122402 / —
Câble, extension de capteur, zone dangereuse de classe 1, division 2, 7 m	5796002 / —
Câble, extension de capteur, zone dangereuse de classe 1, division 2, 15 m	5796102 / —
Câble, extension de capteur, zone dangereuse de classe 1, division 2, 31 m	5796202 / —
Système de nettoyage par soufflage d'air haut rendement, 115 V (non certifié pour utilisation en environnement dangereux)	6860000 / 6860003.99.0001
Système de nettoyage par soufflage d'air haut rendement, 230 V (non certifié ATEX pour utilisation en environnement dangereux)	6860100 / 6860103.99.0001
Sachet d'étalonnage (1)	5796600 / 5796600
Câble, extension du capteur, environnement non dangereux, 7,7 m ³	U.S.A. : 5796000, 7,7 m
	U.E. : LZX849, 10 m
Kit de montage tube d'immersion (PVC)	9253000 / LZY714.99.21810
Kit de montage sur flotteur (PVC)	9253100 / LZX914.99.42200

³ Câbles de 15 m et 30 m également disponibles.

Description	Référence article (U.S.A. / U.E.)
Kit de montage pour soufflage d'air	9253500 / LZY812
Kit de montage chaîne d'immersion (acier inoxydable)	— / LZX914.99.11200
Kit de montage raccord union	9257000 / 9257000
Appareil de mesure HQd avec sonde LDO terrain (non certifiée pour utilisation en environnement dangereux)	8505200 / HQ40D.99.310.000

Contenido

Especificaciones en la página 37	Funcionamiento en la página 44
Información general en la página 38	Mantenimiento en la página 50
Descripción general del producto en la página 40	Solución de problemas en la página 52
Instalación en la página 41	Piezas de repuesto y accesorios en la página 54
Calibración de las mediciones en la página 47	

Especificaciones

Las especificaciones están sujetas a cambios sin previo aviso.

Especificación	Detalles
Materiales impregnados	Sonda estándar, sonda estándar Clase 1-Div 2 <ul style="list-style-type: none">• CPVC, extremo del sensor y extremo del cable• Poliuretano, doble moldura en el extremo y el revestimiento del cable• Cuerpo y tornillos de acero inoxidable 316• Viton, junta tórica• Noryl, tuerca en el extremo del cable
	Sonda estándar para agua de mar, sonda para agua de mar Clase 1-Div 2 <ul style="list-style-type: none">• CPVC, extremo del sensor y extremo del cable• Poliuretano, doble moldura en el extremo y el revestimiento del cable• Cuerpo de PVC para agua de mar• Sellado de epoxi para agua de mar• Noryl, tuerca en el extremo del cable
Clasificación IP	IP68
Materiales húmedos (Tapa del sensor)	Acrílico
Intervalo de medición (oxígeno disuelto)	De 0 a 20 ppm (de 0 a 20 mg/l)
	Del 0 al 200% de saturación
Precisión de la medición (oxígeno disuelto)	Por debajo de 5 ppm: $\pm 0,1$ ppm
	Por encima de 5 ppm: $\pm 0,2$ ppm
Repetibilidad (oxígeno disuelto)	0,1 ppm (mg/l)
Tiempo de respuesta (oxígeno disuelto)	T ₉₀ <40 segundos
	T ₉₅ <60 segundos
Resolución, sensor (oxígeno disuelto)	0,01 ppm (mg/l); 0,1% de saturación.
Intervalo de medición (temperatura)	0 a 50 °C (32 a 122 °F)
Precisión de la medición (temperatura)	$\pm 0,2$ °C ($\pm 0,36$ °F)
Interferencias	No existen interferencias de los siguientes elementos: H ₂ S, pH, K ⁺ , Na ⁺ , Mg ²⁺ , Ca ²⁺ , NH ₄ ⁺ , Al ³⁺ , Pb ²⁺ , Cd ²⁺ , Zn ²⁺ , Cr (total), Fe ²⁺ , Fe ³⁺ , Mn ²⁺ , Cu ²⁺ , Ni ²⁺ , Co ²⁺ , CN ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , S ²⁻ , PO ₄ ³⁻ , Cl ⁻ , tensioactivos de aniones, aceites crudos, Cl ₂ < 4 ppm
Temperatura de almacenamiento	De -20 a 70 °C (de -4 a 158 °F)

Especificación	Detalles
Temperatura máxima	0 a 50 °C (32 a 122 °F)
Clasificación de ubicaciones peligrosas (solo sensor 9020000-C1D2)	Clase I, División 2, Grupos A–D, T4/Clase I, Zona 2 Grupo 2C, T4 Nota: Este producto no cumple los requisitos de la Directiva 94/9/EC (Directiva ATEX).
Certificaciones (solo sensor 9020000-C1D2)	ETL se recoge en las normativas ANSI/ISA, CSA y FM para su uso en entornos peligrosos. Nota: Este producto no cumple los requisitos de la Directiva 94/9/EC (Directiva ATEX).
Caudal mínimo	No se requiere.
Calibración/verificación	Calibración del aire: un punto, aire con una saturación de agua del 100%
	Calibración de la muestra: comparación con el instrumento estándar
Profundidad de inmersión y límites de presión de la sonda	Límites de presión a 34 m (112 pies), 345 kPa (50 psi) como máximo; es posible que no se mantenga la precisión a esta profundidad.
Cable del sensor	Cable integral de 10 m (30 pies) con interruptor de desconexión rápida (todos los tipos de sensores) Hasta 100 m mediante cables de extensión (sólo los tipos de sensores que no pertenecen a la Clase I, División 2) Hasta 1.000 m con caja de empalmes (sólo los tipos de sensores que no pertenecen a la Clase I, División 2)
Peso de la sonda	1,0 kg (2 libras, 3 onzas)
Dimensiones de la sonda	Sonda estándar (diámetro x longitud): 49,53 x 255,27 mm (1,95 x 10,05 pulg)
	Sonda para agua de mar (diámetro x longitud): 60,45 x 255,27 mm (2,38 x 10,05 pulg)
Requisitos de alimentación	12 VDC, 0,25 A, 3 W
Garantía	Sonda: 3 años por defectos de fabricación
	Cápsula del sensor: 2 años por defectos de fabricación

Información general

En ningún caso el fabricante será responsable de ningún daño directo, indirecto, especial, accidental o resultante de un defecto u omisión en este manual. El fabricante se reserva el derecho a modificar este manual y los productos que describen en cualquier momento, sin aviso ni obligación. Las ediciones revisadas se encuentran en la página web del fabricante.

Información de seguridad

AVISO

El fabricante no es responsable de los daños provocados por un mal uso o aplicación incorrecta del producto. Entre estos daños se incluyen, sin limitación, los daños directos y accidentales. El usuario sólo es responsable de identificar los riesgos críticos de aplicación y de instalar adecuadamente los mecanismos para proteger los procesos en caso de que el equipo no funcione correctamente.

Lea todo el manual antes de desembalar, instalar o trabajar con este equipo. Ponga atención a todas las advertencias y avisos de peligro. El no hacerlo puede provocar heridas graves al usuario o daños al equipo.





Asegúrese de que la protección proporcionada por el equipo no está dañada. No utilice ni instale este equipo de manera distinta a lo especificado en este manual.

Uso de la información sobre riesgos

⚠ PELIGRO
Indica una situación potencial o de riesgo inminente que, de no evitarse, provocará la muerte o lesiones graves.
⚠ ADVERTENCIA
Indica una situación potencial o inminentemente peligrosa que, de no evitarse, podría provocar la muerte o lesiones graves.
⚠ PRECAUCIÓN
Indica una situación potencialmente peligrosa que podría provocar una lesión menor o moderada.
AVISO
Indica una situación que, si no se evita, puede provocar daños en el instrumento. Información que requiere especial énfasis.

Etiquetas de precaución

Lea todas las etiquetas y rótulos adheridos al instrumento. En caso contrario, podrían producirse heridas personales o daños en el instrumento. El símbolo que aparezca en el instrumento se comentará en el manual con una declaración de precaución.

	Este es un símbolo de alerta de seguridad. Obedezca todos los mensajes de seguridad que se muestran junto con este símbolo para evitar posibles lesiones. Si se encuentran sobre el instrumento, consulte el manual de instrucciones para obtener información de funcionamiento o seguridad.
	Este símbolo indica la presencia de una fuente de luz que podría provocar lesiones oculares leves. Obedezca todos los mensajes que se muestran a continuación de este símbolo para evitar posibles lesiones oculares.
	Este símbolo indica la presencia de dispositivos susceptibles a descargas electrostáticas. Asimismo, indica que se debe tener cuidado para evitar que el equipo sufra daño.
	<p>El equipo eléctrico marcado con este símbolo no se podrá desechar por medio de los sistemas europeos públicos de eliminación después del 12 de agosto de 2005. De acuerdo con las regulaciones locales y nacionales europeas (Directiva UE 2002/96/EC), ahora los usuarios de equipos eléctricos en Europa deben devolver los equipos viejos o que hayan alcanzado el término de su vida útil al fabricante para su eliminación sin cargo para el usuario.</p> <p>Nota: Para devolver equipos para su reciclaje, póngase en contacto con el fabricante o distribuidor para así obtener instrucciones acerca de cómo devolverlos y desecharlos correctamente. Esto es aplicable a equipos que hayan alcanzado el término de su vida útil, accesorios eléctricos suministrados por el fabricante o distribuidor y todo elemento auxiliar.</p>

Certificación

Reglamentación canadiense sobre equipos que provocan interferencia, IECS-003, Clase A

Registros de pruebas de control del fabricante.

Este aparato digital de clase A cumple con todos los requerimientos de las reglamentaciones canadienses para equipos que producen interferencias.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Parte 15, Límites Clase "A"

Registros de pruebas de control del fabricante. Este dispositivo cumple con la Parte 15 de las normas de la FCC estadounidense. Su operación está sujeta a las siguientes dos condiciones:

1. El equipo no puede causar interferencias perjudiciales.

2. Este equipo debe aceptar cualquier interferencia recibida, incluyendo las interferencias que pueden causar un funcionamiento no deseado.
- Los cambios o modificaciones a este equipo que no hayan sido aprobados por la parte responsable podrían anular el permiso del usuario para operar el equipo. Este equipo ha sido probado y encontrado que cumple con los límites para un dispositivo digital Clase A, de acuerdo con la Parte 15 de las Reglas FCC. Estos límites están diseñados para proporcionar una protección razonable contra las interferencias perjudiciales cuando el equipo está operando en un entorno comercial. Este equipo genera, utiliza y puede irradiar energía de radio frecuencia, y si no es instalado y utilizado de acuerdo con el manual de instrucciones, puede causar una interferencia dañina a las radio comunicaciones. La operación de este equipo en un área residencial es probable que produzca interferencia dañina, en cuyo caso el usuario será requerido para corregir la interferencia bajo su propio cargo. Pueden utilizarse las siguientes técnicas para reducir los problemas de interferencia:
1. Desconecte el equipo de su fuente de alimentación para verificar si éste es o no la fuente de la interferencia.

2. Si el equipo está conectado a la misma toma eléctrica que el dispositivo que experimenta la interferencia, conecte el equipo a otra toma eléctrica.

3. Aleje el equipo del dispositivo que está recibiendo la interferencia.

4. Cambie la posición de la antena del dispositivo que recibe la interferencia.

5. Trate combinaciones de las opciones descritas.

Descripción general del producto

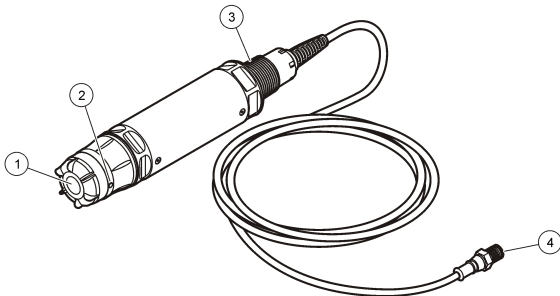
⚠ PELIGRO

Peligro químico o biológico. Si este instrumento se usa para controlar un proceso de tratamiento y/o un sistema de suministro químico para el que existan límites normativos y requisitos de control relacionados con la salud pública, la seguridad pública, la fabricación o procesamiento de alimentos o bebidas, es responsabilidad del usuario de este instrumento conocer y cumplir toda normativa aplicable y disponer de mecanismos adecuados y suficientes que satisfagan las normativas vigentes en caso de mal funcionamiento del equipo.

Este sensor está diseñado para trabajar con un controlador para la recolección de datos y operación. El sensor puede utilizarse con varios controladores. Para obtener más información, consulte el manual de usuario específico del sensor.

Las aplicaciones principales de este sensor son aplicaciones de aguas residuales industriales y municipales. La tecnología del sensor LDO no consume oxígeno y puede medir la concentración de oxígeno disuelto en aplicaciones sin flujo o con flujo bajo. Consulte la [Figura 1](#).

Figura 1 Sensor LDO

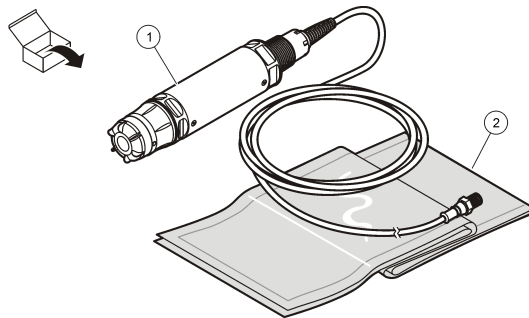


1 Tapa del sensor	3 NPT de 1 pulgada
2 Sensor de temperatura	4 Conector, conexión rápida (estándar)

Lista de componentes del sensor LDO

Asegúrese de haber recibido todos los componentes que se muestran en la [Figura 2](#). Si faltan elementos o están dañados, póngase en contacto con el fabricante o el representante de ventas inmediatamente. Consulte la [Figura 2](#).

Figura 2 Lista de componentes del sensor



1 Sensor LDO ¹	2 Bolsas de calibración (2x)
---------------------------	------------------------------


Instalación

⚠ **ADVERTENCIA**

Peligro de lesión personal. Las tareas descritas en esta sección del manual solo deben ser realizadas por personal cualificado.

Validación del tipo de sensor

⚠ **PELIGRO**

 Peligro de explosión. Sólo debe conectar componentes periféricos que estén claramente etiquetados con el certificado para ubicaciones peligrosas de Clase 1, División 2.


AVISO


La versión con certificación para ubicaciones peligrosas de este producto no cumple los requisitos de la Directiva 94/9/EC (Directiva ATEX).

1. Vaya al extremo del conector del cable.
2. Lea la etiqueta del extremo del conector del cable. En las etiquetas de los sensores con certificación para ubicaciones peligrosas, se leerá: "Rated: Class 1 Division 2" (Evaluado: Clase 1, División 2).
3. Examine el conector.
 - Los sensores con certificados para ubicaciones peligrosas disponen de un conector de bloqueo de seguridad. Consulte la [Figura 3](#) en la página 42.
 - Los sensores que no cuentan con certificados para ubicaciones peligrosas tienen un conector de conexión rápida sin un bloqueo de seguridad.

¹ El manual del usuario incluido no se muestra.

Conexión del sensor en una ubicación peligrosa

▲ PELIGRO	
	Peligro de explosión. Este equipo se puede usar en lugares no peligrosos o en los lugares peligrosos de los grupos A, B, C y D de Clase 1, División 2 si se utiliza con sensores y equipos opcionales específicos instalados de acuerdo a los planos de control para la instalación en lugares peligrosos. Consulte siempre los planos de control y las regulaciones del código eléctrico para llevar a cabo una instalación apropiada.

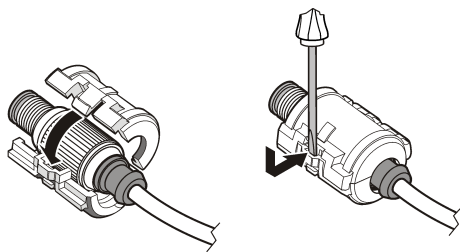
▲ PELIGRO	
	Peligro de explosión. Evite conectar o desconectar componentes o circuitos eléctricos sin antes desconectar la alimentación eléctrica, a menos que se sepa que esa parte del equipo no presenta riesgos.

A V I S O	
En ubicaciones peligrosas, utilice únicamente un sensor y un conector de cables que cuenten con una certificación para ubicaciones peligrosas. La versión con certificación para ubicaciones peligrosas de este producto no cumple los requisitos de la Directiva 94/9/EC (Directiva ATEX).	

Para disponer de más información, consulte [Validación del tipo de sensor](#) en la página 41.

1. Retire la cápsula del conector del controlador. Conserve la cápsula del conector para sellar la apertura del conector cuando se retire el sensor.
2. Conecte el sensor al controlador. Para obtener más información, consulte el manual del controlador.
3. Cierre la cerradura de seguridad en el conector.
4. Para retirar la cerradura de seguridad del conector, utilice un destornillador plano pequeño. Consulte la [Figura 3](#).

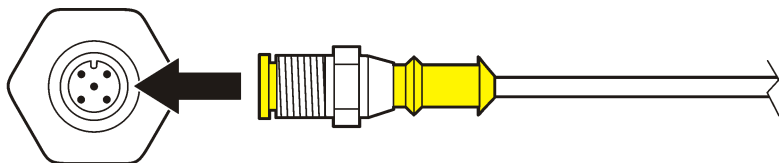
Figura 3 Cerradura de seguridad del conector



Conexión del sensor en una ubicación no peligrosa

Consulte [Figura 4](#) para conectar un sensor LDO a un controlador sc. Para obtener las instrucciones de conexión, consulte el manual específico del controlador sc.

Figura 4 Conexión del sensor LDO (se muestra un sensor para ubicaciones no peligrosas)



Cuando haya conectado el sensor, realice una exploración del sensor. Consulte la [Instalación del sensor](#) en la página 43.

Instalación del sensor

Existen dos opciones para instalar el sensor:

- Conectar el sensor mientras la alimentación eléctrica del controlador está desactivada. El controlador buscará e instalará los sensores nuevos cuando se active.
- Conectar el sensor mientras la alimentación eléctrica del controlador está activada. Utilice el comando Scan Devices (Dispositivos de exploración) para instalar el sensor nuevo:

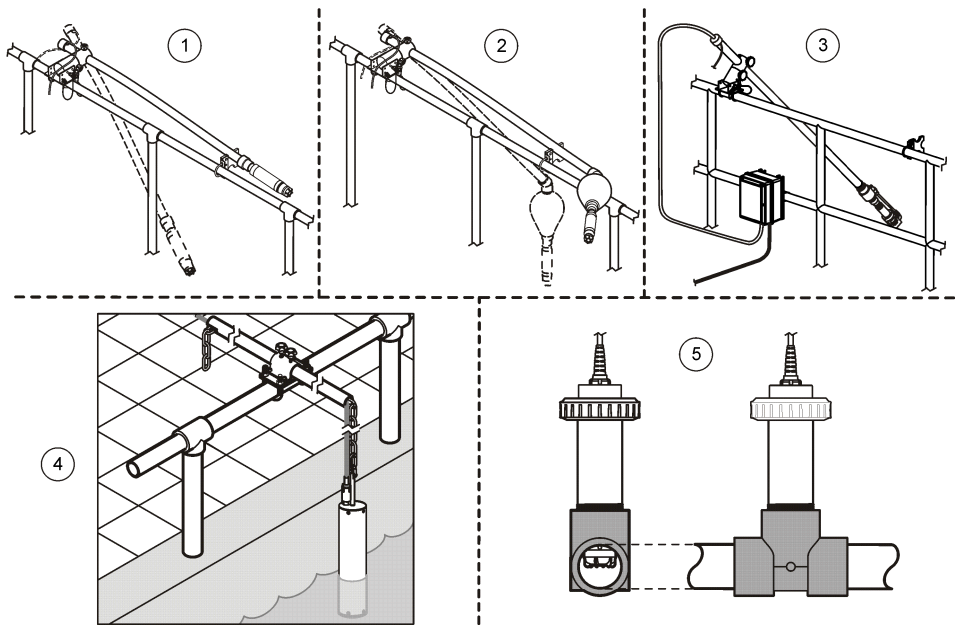
Opción	Descripción
Controlador sc200	Vaya a MENU>TEST/MAINT>SCAN DEVICE (MENÚ>PRUEBA/MANTENIMIENTO>DISPOSITIVO DE EXPLORACIÓN).
Controlador sc100	Vaya a MENU>TEST/MAINT>SCAN SENSORS (MENÚ>PRUEBA/MANTENIMIENTO>SENSORES DE EXPLORACIÓN).
Controlador sc1000	Vaya a MENU>SYSTEM SETUP>DEVICE MANAGEMENT>SCANNING FOR NEW DEVICES (MENÚ>CONFIGURACIÓN DEL SISTEMA>GESTIÓN DE DISPOSITIVOS>EXPLORACIÓN DE DISPOSITIVOS NUEVOS).

Para obtener información sobre la conexión del sensor digital, consulte [Conexión del sensor en una ubicación no peligrosa](#) en la página 42 .

Opciones de instalación del sensor

Las opciones de instalación y de accesorios disponibles para el sensor LDO se suministran con las instrucciones de instalación del kit de hardware. En la [Figura 5](#) se muestran varias opciones de instalación. Para pedir hardware de instalación, consulte [Piezas de repuesto y accesorios](#) en la página 54.

Figura 5 Opciones de instalación



1 Montaje en barra	4 Montaje con cadenas
2 Montaje flotante	5 Montaje de unión (no compatible con la sonda para agua de mar)
3 Montaje con el sistema de ráfagas de aire (no compatible con la sonda para agua de mar)	

Funcionamiento

Desplazamiento del usuario

Consulte la documentación del controlador para ver la descripción del teclado e información sobre cómo desplazarse.

Configuración del sensor

Utilice el menú Configurar para introducir la información de identificación del sensor y para cambiar las opciones para el manejo y almacenamiento de datos.

Para obtener más información sobre la instalación del sensor, consulte [Instalación del sensor](#) en la página 43.

Asegúrese de que todos los valores del menú Configuration (Configuración) son correctos para la aplicación.

- 1. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CONFIGURAR).
- 2. Seleccione una opción y, a continuación, pulse ENTER (Intro). A continuación, se enumeran las opciones disponibles en una tabla.

Opción	Descripción
EDIT NAME (EDITAR NOMBRE)	Cambia el nombre que corresponde al sensor en la parte superior de la pantalla de medición. El nombre puede contener hasta 10 caracteres en cualquier combinación de letras, números, espacios o signos de puntuación.
SET UNITS (ESTABLECER UNIDADES)	TEMP (TEMPERATURA): establece las unidades de temperatura en °C (predeterminado) o en °F.
	MEASURE (MEDIR): establece las unidades de las mediciones en mg/l, ppm o %.
	ALT/PRESS (ALTITUD/PRESIÓN): establezca la altitud en m o pies y las unidades de presión atmosférica en mmHg o torr. (Valor predeterminado = 0 pies)
ALT/PRESS (ALTITUD/PRESIÓN)	Introduzca el valor de la altitud o presión atmosférica. Este valor debe ser preciso para completar la calibración y las mediciones de la saturación en % del aire. (Predeterminado = 0 pies).
SALINITY (SALINIDAD)	Introduzca el valor de salinidad. Intervalo de salinidad: de 0,00 a 250,000 partes por mil (‰). Consulte Introducción de un valor de corrección de salinidad en la página 46 para obtener más información. (Valor predeterminado = 0).
SIGNAL AVERAGE (PROMEDIO SEÑAL)	Configure el intervalo de tiempo al promedio de señal en segundos.
CLEAN INTRVL (INTERV. LIMPIEZA)	Establezca el intervalo de tiempo para la limpieza manual del sensor en días. (Valor predeterminado = 0 días. Un valor de 0 días desactiva el intervalo de limpieza).
RESET CLN INTRVL (RESTABLECER INTERV. LIMPIEZA)	Establezca el intervalo de tiempo al último intervalo de limpieza guardado.
LOG SETUP (CONFIG. REGISTRO)	Establece el intervalo de tiempo del almacenamiento de datos en el registro de datos: 0,5, 1, 2, 5, 10, 15 (predeterminado), 30 y 60 minutos.
SET DEFAULTS (ESTABLECER VAL. PREDET.)	Restablece los valores predeterminados configurables para el sensor. No modifique los ajustes para la pendiente o el desvío.

Introducción de la unidad de presión atmosférica

La configuración de fábrica de la presión atmosférica (aire) es de 0 pies o del nivel del mar. Para cambiar el valor predeterminado, siga los pasos de este procedimiento. El ajuste de la presión del aire se introduce como unidades de elevación o de presión (preferido).

Nota: La precisión de la presión del aire es fundamental para calibrar el aire saturado ([Calibración con aire](#) en la página 48). Utilice únicamente presión absoluta, no ajustada. Si se desconoce la presión absoluta del aire, utilice la elevación correcta para la ubicación.

1. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SET UNITS>AIR PRESS/ALT UNITS (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CONFIGURAR>CONFIGURAR UNIDADES>UNIDADES ALTITUD/PRESIÓN DEL AIRE).
2. Seleccione **una** de las opciones de unidades que se enumeran:

Opción	Descripción
pies	Pie: unidad de medida para la elevación
m	Metros: unidad métrica de medición de la elevación
mmHg	Milímetros de mercurio: unidad métrica de medición de la presión absoluta del aire
torr	Unidad de medición de la presión absoluta del aire

3. Confirme la selección. La pantalla de introducción del valor le mostrará las unidades seleccionadas.
4. Introduzca el valor y, a continuación, confírmelo.

Introducción de un valor de corrección de salinidad

Las mediciones de oxígeno disuelto en muestras de salino pueden mostrar un valor aparente del oxígeno disuelto muy diferente del valor actual de oxígeno disuelto. Para corregir la influencia de sales disueltas en una muestra, introduzca un factor de corrección de salinidad.

Nota: Si se desconoce la presencia o la cantidad de salinidad del proceso, póngase en contacto con el personal de ingeniería del centro de tratamiento.

1. Utilice un medidor de conductividad para medir la conductividad de la muestra en mS/cm a una temperatura de referencia de 20 °C (68 °F).
2. Utilice la [Tabla 1](#) para calcular el factor de corrección de salinidad en una saturación en partes por mil (‰).

Nota: La concentración de iones cloruro, en g/kg, equivale a la clorinidad de la muestra. La salinidad se calcula con la fórmula: $\text{Salinidad} = 1,80655 \times \text{clorinidad}$.

La salinidad puede calcularse con la relación de la sección 2520 B de *Standard Methods for the Examination of Water and Wastewater* (Métodos estándar para la evaluación de las aguas y las aguas residuales).²,

3. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SALINITY (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CONFIGURAR>SALINIDAD).
4. Introduzca el factor de corrección de salinidad y confírmelo.

Tabla 1 Saturación de la salinidad (‰) por valor de conductividad (mS/cm)

mS/cm	‰		mS/cm	‰		mS/cm	‰		mS/cm	‰
5	3		16	10		27	18		38	27
6	4		17	11		28	19		39	28
7	4		18	12		29	20		40	29
8	5		19	13		30	21		42	30
9	6		20	13		31	22		44	32
10	6		21	14		32	22		46	33
11	7		22	15		33	23		48	35
12	8		23	15		34	24		50	37
13	8		24	17		35	25		52	38
14	9		25	17		36	25		54	40
15	10		26	18		37	26			

² *Standard Methods for the Examination of Water and Wastewater*, Edición 20.º. Editores: Lenore S. Clesceri, Arnold E. Greenberg y Andrew D. Eaton, pág. 2-48-2-29 (1998). La relación entre la clorinidad y la solubilidad del oxígeno se proporciona en la misma obra de referencia, en 4500-O:1, pág. 4-131.

Configure la salida lineal en el controlador.

Las salidas lineales devuelven los datos de la sonda a los sistemas PLC y SCADA o a otros sistemas de recopilación de datos.

1. Vaya al menú de configuración de salidas del controlador.

Opción	Descripción
sc200	Vaya a MENU>SETTINGS>sc200 SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>AJUSTES<CONFIGURACIÓN DE sc200>CONFIGURACIÓN DE SALIDA>[Seleccione la salida]>CONFIGURAR FUNCIÓN).
sc100	Vaya a MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>CONFIGURACIÓN DEL SISTEMA>CONFIGURACIÓN DE SALIDA>[Seleccione la salida]>CONFIGURAR FUNCIÓN).
sc1000	Vaya a MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>CONFIGURACIÓN DEL SISTEMA>CONFIGURACIÓN DE SALIDA>[Seleccione la salida]>CONFIGURAR FUNCIÓN).

2. Configure la función para el controlador.

Opción	Descripción
sc200	LINEAL
sc100	LINEAR CONTROL (CONTROL LINEAL) (valor predeterminado)
sc1000	LINEAR CONTROL (CONTROL LINEAL) (valor predeterminado)

Registros de Modbus

Está disponible una lista de registros Modbus para comunicación en red. Consulte www.hach.com o www.hach-lange.com para obtener más información.

Calibración de las mediciones

El sensor se calibra en fábrica de acuerdo con las especificaciones. El fabricante no recomienda que se calibre a menos que las agencias de regulación soliciten calibraciones periódicas. En caso que se requiera una calibración, deje que el sensor se equilibre con el proceso antes de calibrarlo. No calibre el sensor durante la configuración.

En la [Tabla 2](#) se muestran las opciones de calibración.

Tabla 2 Opciones de calibración

Opción	Descripción
AIR CAL (CAL. AIRE)	Método de calibración recomendado. Esta calibración modifica la pendiente.
SAMPLE CAL (CAL. MUESTRA)	Calibración por comparación con un medidor manual de oxígeno disuelto. Esta calibración modifica el desvío.
RESET DFLT CAL (RESTABLECER CAL. PREDET.)	Restablece la ganancia (pendiente) y el desvío de la calibración a los valores predeterminados de fábrica: ganancia predeterminada = 1,0; desvío predeterminado = 0,0

Calibración con aire

Notas para el usuario:

- Asegúrese de que la bolsa de calibración contiene agua en el interior.
- Asegúrese de que el sellado entre la bolsa de calibración y el cuerpo del sensor es hermético.
- Asegúrese de que el sensor está seco cuando lo vaya a calibrar.
- Asegúrese de que los ajustes de la elevación y la presión del aire son adecuados para el lugar de calibración.
- Deje tiempo suficiente para que la temperatura del sensor se estabilice con la temperatura del lugar de la bolsa de calibración. Si existe una gran diferencia entre la temperatura del proceso y la temperatura del lugar de calibración, es posible que el sensor tarde en estabilizarse hasta 15 minutos.

1. Retire el sensor del proceso. Utilice un paño húmedo para limpiar el sensor.
2. Ponga el sensor en su conjunto en una bolsa de calibración con unos 25 o 50 ml de agua. Asegúrese de que la cápsula del sensor no entra en contacto con el agua del interior de la bolsa de calibración y que no caen gotas de agua en la cápsula del sensor (Figura 6).
3. Utilice una correa o lazo de goma o la mano para crear un sellado hermético alrededor del cuerpo del sensor.
4. Deje que el instrumento se estabilice durante 15 minutos antes de calibrarlo. Evite que la bolsa de calibración entre en contacto directo con la luz solar durante la calibración.
5. Asegúrese de que la elevación o la presión absoluta del aire actual estén configuradas correctamente. Consulte la [Introducción de la unidad de presión atmosférica](#) en la página 45.

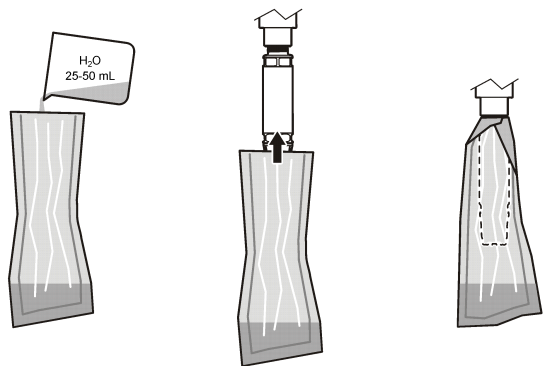
Nota: El fabricante recomienda el uso de una presión real o absoluta del aire como buena práctica.

6. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>AIR CAL (MENU>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CALIBRAR>CAL. AIRE).
7. Seleccione la opción de la señal de salida durante la calibración:

Opción	Descripción
Activa	Durante el proceso de calibración el instrumento envía el valor de medición actual de salida.
Hold (Retenido)	Durante el proceso de calibración el valor de salida del sensor se mantiene en el valor de medición actual.
Transfer (Transferencia)	Durante el proceso de calibración se envía un valor predeterminado. Consulte el manual del usuario del controlador para cambiar el valor predeterminado.

8. El controlador mostrará el mensaje "Move the probe to bag" (Mover sonda). Deje que el valor se estabilice. Pulse ENTER (Intro) para aceptar el valor estable. A su vez, deje que la calibración continúe hasta que se muestre el mensaje "Complete" (Finalizado).
9. Cuando se haya calibrado el sensor, póngalo en proceso. Pulse ENTER (Intro).

Figura 6 Procedimiento de calibración del aire



Si el valor no se estabiliza, en la pantalla se mostrará el mensaje "Unable to Calibrate" (No se puede calibrar), seguido de un mensaje de error. En la [Tabla 3](#) se muestran los mensajes de error y las soluciones para los problemas de calibración.

Tabla 3 Mensajes de error de la calibración del aire

Mensaje	Descripción	Resolución
Cal fail, gain high (Error de calibración, ganancia elevada)	El valor de ganancia calculado es demasiado elevado.	Repita la calibración.
Cal fail, gain low (Error de calibración, ganancia baja)	El valor de ganancia calculado es demasiado bajo.	Repita la calibración.
Cal fail, unstable (Error de calibración, inestable)	El valor no se estabilizó en el tiempo máximo de calibración permitido.	Repita la calibración.

Calibración de la muestra: calibración por comparación

El método de calibración utiliza un sensor alternativo conectado a un medidor manual.

- 1. Ponga en funcionamiento el sensor alternativo. Coloque el segundo sensor lo más próximo posible al primer sensor.
- 2. Espere a que el valor de oxígeno disuelto se estabilice.
- 3. En el controlador del primer sensor, vaya a MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>SAMPLE CAL (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CALIBRAR>CAL. MUESTRA).
- 4. Seleccione la opción de la señal de salida durante la calibración:

Opción	Descripción
Activa	Durante el proceso de calibración el instrumento envía el valor de medición actual de salida.
Hold (Retenido)	Durante el proceso de calibración el valor de salida del sensor se mantiene en el valor de medición actual.
Transfer (Transferencia)	Durante el proceso de calibración se envía un valor predeterminado. Consulte el manual del usuario del controlador para cambiar el valor predeterminado.

- 5. En el controlador se mostrará:
 - "Press ENTER when stabilized" (Pulse INTRO cuando se estabilice)
 - La medición actual de oxígeno disuelto

- La medición actual de la temperatura

6. Cuando la medición sea estable, pulse INTRO. Se visualizará una pantalla de entrada.

Nota: Normalmente, la medición se tarda en estabilizarse entre 2 y 3 minutos.

Si el valor no se estabiliza, en la pantalla se mostrará el mensaje "Unable to Calibrate" (No se puede calibrar), seguido de un mensaje de error. En la [Tabla 4](#) se muestran los mensajes de error y las soluciones para los problemas de calibración.

Tabla 4 Mensajes de error de la calibración de muestra

Mensaje	Descripción	Resolución
Cal fail, offset high (Error de calibración, desvío elevado)	El valor calculado de desvío es demasiado elevado.	Repita la calibración.
Cal fail, offset low (Error de calibración, desvío bajo)	El valor calculado de desvío es demasiado bajo.	Repita la calibración.
Cal fail, unstable (Error de calibración, inestable)	El valor no se estabilizó en el tiempo máximo de calibración permitido.	Repita la calibración.

Salida del proceso de calibración

1. Durante la calibración, pulse la tecla BACK (Atrás). Aparecerán tres opciones:

Opción	Descripción
ABORT (ABORTAR)	Detiene el proceso de calibración. Se deberá comenzar con una nueva calibración desde el principio.
VOLVER A CAL	Vuelve a la calibración actual.
LEAVE (ABANDONAR)	Sale del proceso de calibración provisoriamente. Se puede acceder a otros menús mientras continúa la calibración. Se puede iniciar la calibración de un segundo sensor (en caso que lo hubiera). Para volver al proceso de calibración, pulse la tecla MENU (MENÚ) y seleccione Sensor Setup (Configuración del sensor), [seleccione el sensor].

2. Seleccione una de las opciones. Confirme.

Restablecimiento de los valores predeterminados de la calibración

La configuración de la calibración puede restablecerse con los valores predeterminados de fábrica. Los valores de ganancia y desvío se establecen al 1,0 y al 0,0, respectivamente.

1. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>RESET CAL DEFLT (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CALIBRAR>RESTABLECER CONFIGURACIÓN PREDETERMINADA DE LA CALIBRACIÓN).
2. En la pantalla se mostrará un mensaje de confirmación. Confirme que desea restablecer el sensor con la curva de calibración predeterminada de fábrica.

Mantenimiento

⚠ PELIGRO	
	Peligros diversos. Sólo el personal cualificado debe realizar las tareas descritas en esta sección del documento.
⚠ PELIGRO	
	Peligro de explosión. Evite conectar o desconectar componentes o circuitos eléctricos sin antes desconectar la alimentación eléctrica, a menos que se sepa que esa porción del equipo no presenta riesgos.

⚠ PELIGRO



Riesgo de explosión. Es posible que la sustitución de algún componente perjudique a la conformidad con la Clase 1, División 2. Evite conectar o desconectar ningún componente sin antes desconectar la alimentación eléctrica, a menos que se sepa que esa zona no presenta riesgos.

AVISO

La versión con certificación para ubicaciones peligrosas de este producto no cumple los requisitos de la Directiva 94/9/EC (Directiva ATEX).

Cronograma de mantenimiento

En el cronograma de mantenimiento se muestran los intervalos mínimos de las tareas periódicas de mantenimiento. En las aplicaciones donde el electrodo se ensucia, realice las tareas de mantenimiento con mayor frecuencia.

Nota: No desmonte la sonda para su mantenimiento o limpieza.

Tarea de mantenimiento	Frecuencia mínima recomendada
Limpiar el sensor	90 días
Inspección del sensor en busca de daños	90 días
Calibración del sensor	Según lo recomendado por su sistema de control de calidad o entes regulatorios locales

Limpiar el sensor

Limpie la parte exterior del sensor con un paño suave y húmedo.

Nota: Si debe retirar la cápsula del sensor para limpiarla, no exponga directamente la parte interior de la cápsula a la luz solar durante un período de tiempo prolongado.

Configuración y cambio del intervalo de limpieza

En función de las condiciones de la aplicación del sensor, los intervalos de tiempo que transcurren entre las limpiezas del sensor manual pueden ser menores o mayores. El intervalo de limpieza predeterminado es de 0 días. Para cambiar el intervalo, consulte los pasos de este procedimiento.

1. Vaya a MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>CLEAN INTRVL (MENÚ>CONFIGURACIÓN DEL SENSOR>[Seleccione el sensor]>CONFIGURAR>INTERV. LIMPIEZA).
2. Cambie el valor mostrado según sea necesario. Confirme el cambio.
 - Para desactivar el intervalo de limpieza, establezca el valor en "0".

Sustitución de la cápsula del sensor

⚠ ADVERTENCIA



Posible riesgo de explosión. La cápsula de configuración del sensor no se ha evaluado para ser utilizada en ubicaciones peligrosas.

Junto con las instrucciones de instalación se suministran cápsulas para el sensor y cápsulas de configuración de repuesto. Para cambiar la cápsula, consulte las instrucciones suministradas.

Para obtener un rendimiento y una precisión mejores, sustituya la cápsula del sensor:

- Cada dos años
- Cuando en las inspecciones periódicas se detecte una erosión importante en la cápsula del sensor.

Solución de problemas

Menú de prueba y diagnóstico

En el menú de prueba y diagnóstico se muestra la información actual e histórica relativa al sensor LDO.

Para acceder al menú de prueba y diagnóstico, vaya a MENU>SENSOR SETUP>[Select Sensor]>DIAG/TEST (MENÚ>CONFIGURACIÓN DEL SENSOR>[Selecione el sensor]>DIAGNÓSTICO/PRUEBA).

Consulte la [Tabla 5](#).

Tabla 5 Menú DIAG/PRUEBA

Opción	Descripción
SENSOR INFO (INFORMACIÓN SENSOR)	SOFTWARE VERS (VERSIÓN SOFTWARE): muestra la versión del software instalada.
	BOOT VERSION (VERSIÓN ARRANQUE): muestra la versión del arranque instalada.
	DRIVER VERS (VERSIÓN CONTROLADOR): muestra la versión del controlador instalada.
LOT CODE (CÓDIGO LOTE)	Muestra el lote de fabricación de la cápsula del sensor.
SERIAL NUMBER (NÚMERO DE SERIE)	Número de serie del sensor
GAIN CORR (CORR. GANANCIA)	Ajusta el valor de ganancia de la calibración.
	Intervalo: de 0,50 a 2,00
OFFSET CORR (CORR. NIVELACIÓN)	Ajusta el valor de desvío de la calibración (mg/l o ppm).
	Intervalo: de -3,00 a +3,00
PHASE DIAG (FASE DEL DIAGNÓSTICO)	Muestra la fase de las longitudes de onda totales, rojas y azules. Actualiza una por segundo.
AMPL DIAG (AMPLITUD DEL DIAGNÓSTICO)	Muestra la amplitud de las longitudes de onda rojas y azules. Actualiza una por segundo.
DAYS TO CLEAN (DÍAS PARA LA LIMPIEZA)	Muestra el número de días que quedan hasta la próxima limpieza manual programada.
SENSOR LIFE (DURACIÓN DEL SENSOR)	Muestra el número de días que quedan hasta la próxima sustitución programada de la cápsula del sensor.

Lista de errores

Si se produce un error, la lectura de la pantalla de medición se iluminará. Los ajustes del controlador determinan la conducta de la salida. Para obtener información detallada, consulte el manual del controlador.

Para mostrar los errores actuales del sensor, vaya a MENU>DIAGNOSTICS>[Select Sensor]>ERROR LIST (MENÚ>DIAGNÓSTICO>[Seleccione el sensor]>LISTA DE ERRORES). Consulte la [Tabla 6](#).

Tabla 6 Lista de errores del sensor LDO

Error	Posible causa	Resolución
RED AMPL LOW (Value is below 0.01) (AMPLITUD ROJA BAJA [El valor se encuentra por debajo de 0,01])	La cápsula del sensor no está instalada o no se ha instalado correctamente.	Retire la cápsula del sensor y vuélvala a instalar.
O BIEN BLUE AMPL LOW (Value is below 0.01) (AMPLITUD AZUL BAJA [El valor se encuentra por debajo de 0,01])	El recorrido de la luz se ha bloqueado en la cápsula del sensor.	Inspeccione el interior de la cápsula y de la lente del sensor.
	El sensor no funciona correctamente.	Asegúrese de que el LED se ilumina. Póngase en contacto con el fabricante.

Lista de advertencias

Cuando el icono de advertencia se ilumina (sc100 y sc200) o cuando el color de la pantalla cambia a amarillo (sc1000), aparece un mensaje en la parte inferior de la pantalla de medición. En el sc1000, el color de la pantalla se cambia a amarillo para mostrar una advertencia. Para mostrar las advertencias actuales del sensor, vaya a MENU>DIAGNOSTICS>[Select Sensor]>ERROR LIST (MENÚ>DIAGNÓSTICO>[Seleccione el sensor]>LISTA DE ERRORES). Consulte la [Tabla 7](#).

Tabla 7 Lista de advertencias del sensor

Advertencia	Definición	Resolución
EE SETUP ERR (ERR. CONFIG. EE)	El almacenamiento se ha dañado. Los valores se han establecido a los valores predeterminados de fábrica.	Póngase en contacto con la asistencia técnica.
EE RSRVD ERR (ERR. RSRVD EE)		
TEMP < 0 C	La temperatura del proceso se encuentra por debajo de 0 °C (32 °F).	Aumente la temperatura del proceso o deténgalo hasta que la temperatura se encuentre dentro del intervalo del sensor indicado en las especificaciones.
TEMP < 50 C	La temperatura del proceso se encuentra por encima de 50 °C (120 °F).	Disminuya la temperatura del proceso o deténgalo hasta que la temperatura se encuentre dentro del intervalo del sensor indicado en las especificaciones.
RED AMPL LOW (AMPLITUD ROJA BAJA)	El valor cae por debajo de 0,03.	Consulte Tabla 6 en la página 53 .
RED AMPL HIGH (AMPLITUD ROJA ELEVADA)	El valor es superior a 0,35.	Póngase en contacto con la asistencia técnica.
BLUE AMPL LOW (AMPLITUD AZUL BAJA)	El valor se encuentra por debajo de 0,03.	Consulte la Tabla 6 en la página 53.
BLUE AMPL HIGH (AMPLITUD AZUL ELEVADA)	El valor es superior a 0,35.	Póngase en contacto con la asistencia técnica.
CAP CODE FAULT (ERROR DE CÓDIGO DE LA CÁPSULA)	El código de la cápsula del sensor se ha dañado. Se ha restablecido automáticamente el código con los códigos predeterminados del lote y la cápsula.	Finalice el procedimiento de la cápsula de configuración del sensor. Si no hay ninguna cápsula de configuración disponible para la cápsula del sensor, póngase en contacto con la asistencia técnica.

Lista de eventos

La lista de eventos guarda un registro de los cambios en la forma en la que el sensor registra los datos. Para mostrar los eventos del sensor, vaya a MENU>DIAGNOSTICS>[Select Sensor]>EVENT LIST (MENÚ>DIAGNÓSTICO>[Seleccione el sensor]>LISTA DE EVENTOS).

Consulte la [Tabla 8](#).

Tabla 8 Lista de eventos del sensor

Evento	Descripción
ALT/PRESSURE UNIT CHANGE (CAMBIO UNIDAD ALTITUD/PRESIÓN)	Se han modificado las unidades de la presión atmosférica o de la altitud.
ALT/PRESSURE CHANGE (CAMBIO EN LA ALTITUD/PRESIÓN)	Se ha modificado el valor de la altitud o de la presión atmosférica.
TEMP UNIT CHANGE (CAMBIO EN LA UNIDAD DE TEMPERATURA)	Se han modificado las unidades de la temperatura.
MEAS UNIT CHANGE (CAMBIO EN LAS UNIDADES DE MEDICIÓN)	Se ha modificado una unidad nueva de medición.
SALINITY CHANGE (CAMBIO EN LA SALINIDAD)	Se ha modificado el valor de salinidad.
SET DEFAULT (ESTABLECER VAL. PREDET.)	Se ha restablecido la configuración del sensor a los valores predeterminados.
SENSOR SETUP CHANGE (CAMBIO EN LA CONFIGURACIÓN DEL SENSOR)	Se ha modificado la configuración del sensor.
CLEAN INTERVAL TIMER CHANGE (CAMBIO EN EL TEMPORIZADOR DEL INTERVALO DE LIMPIEZA)	Se ha modificado el intervalo de tiempo que transcurre entre las limpiezas del sensor.
SENSOR CAP LIFE TIMER CHANGE (CAMBIO EN EL TEMPORIZADOR DE LA DURACIÓN DE LA CÁPSULA DEL SENSOR)	Se ha modificado el intervalo de tiempo que transcurre entre las sustituciones de la cápsula del sensor.

Piezas de repuesto y accesorios

Utilice únicamente piezas de repuesto aprobadas por el fabricante. El uso de piezas no aprobadas puede causar lesiones personales, daños al instrumento o un mal funcionamiento del equipo.

Repuestos

Descripción	Referencia (EE. UU./UE)
Sonda LDO, con una cápsula para el sensor y 2 bolsas de calibración	9020000 / LXV416.99.20001
Sonda LDO para agua de mar, con una cápsula para el sensor y dos bolsas de calibración	9020000-SW / —
Sonda LDO para agua de mar en ubicaciones peligrosas, con una cápsula para el sensor y dos bolsas de calibración	9020000-C1D2-SW / —
Sonda LDO para ubicaciones peligrosas, con una cápsula para el sensor y 2 bolsas de calibración	9020000-C1D2 / —
Cápsula para el sensor, repuesto (incluye la cápsula de configuración del sensor que no se ha evaluado para su uso en ubicaciones peligrosas de Clase 1, División 2)	9021100 / 9021150

Accesorios

Descripción	Referencia (EE. UU./UE)
Bloqueo del cable del sensor para ubicaciones peligrosas	6139900 / —
Cable, extensión del sensor, Clase 1, División 2, ubicaciones peligrosas, 1 m (3,3 pies)	6122402 / —
Cable, extensión del sensor, Clase 1, División 2, ubicaciones peligrosas, 7 m (23 pies)	5796002 / —
Cable, extensión del sensor, Clase 1, División 2, ubicaciones peligrosas, 15 m (49,21 pies)	5796102 / —
Cable, extensión del sensor, Clase 1, División 2, ubicaciones peligrosas, 31 m (101,71 pies)	5796202 / —
Sistema de limpieza con ráfagas de aire de la salida elevada, 115 V (no se ha evaluado para su uso en ubicaciones peligrosas)	6860000 / 6860003.99.0001
Sistema de limpieza con ráfagas de aire de la salida elevada, 230 V (no se ha evaluado según la Directiva ATEX para su uso en ubicaciones peligrosas)	6860100 / 6860103.99.0001
Bolsa de calibración (1x)	5796600 / 5796600
Cable, extensión del sensor, ubicación no peligrosa, 7,7 m (25 pies) ³	EE. UU.: 5796000, 7,7 m (25 pies)
	UE: LZX849, 10 m (33 pies)
Kit de hardware para montaje con conducto (PVC)	9253000 / LZY714.99.21810
Kit de hardware para montaje flotante (PVC)	9253100 / LZX914.99.42200
Kit de hardware para montaje con ráfagas de aire	9253500 / LZY812
Kit de hardware para montaje con cadenas (acero inoxidable)	— / LZX914.99.11200
Kit de hardware para montaje de empalme	9257000 / 9257000
Medidor HQd con sonda reforzada LDO (no se ha evaluado su uso en ubicaciones peligrosas)	8505200 / HQ40D.99.310.000

³ También disponible con 15 m (49 pies) y 30 m (98 pies)

Índice

Especificações	na página 56	Operação	na página 63
Informações gerais	na página 57	Manutenção	na página 68
Visão geral do produto	na página 59	Solução de problemas	na página 70
Instalação	na página 60	Peças e acessórios de reposição	na página 72
Calibração para medições	na página 65		

Especificações

As especificações estão sujeitas a alterações sem aviso prévio.

Especificação	Detalhes
Materiais molhados	Sonda padrão, Sonda de Classe padrão 1, Divisão 2 <ul style="list-style-type: none">• CPVC, extremidade do sensor e extremidade do cabo• Poliuretano, supermoldagem na extremidade do cabo e suporte do cabo• 316 parafusos e corpo em aço inoxidável• Viton, O-ring• Porca noryl na extremidade do cabo
	Sonda padrão para água do mar, Sonda para água do mar, Classe 1, Divisão 2 <ul style="list-style-type: none">• CPVC, extremidade do sensor e extremidade do cabo• Poliuretano, supermoldagem na extremidade do cabo e suporte do cabo• Corpo em PVC para água do mar• Selador epóxi para água do mar• Porca noryl na extremidade do cabo
Classificação de IP	IP68
Materiais em contato com líquido (Cap do Sensor)	Acrílico
Intervalo de medição (oxigênio dissolvido)	0 a 22 ppm (0 a 20 mg/L)
	Saturação de 0 a 200%
Precisão de medição (oxigênio dissolvido)	Abaixo de 5 ppm: ± 0,1 ppm
	Acima de 5 ppm: ± 0,2 ppm
Repetibilidade (oxigênio dissolvido)	0,1 ppm (mg/L)
Tempo de resposta (oxigênio dissolvido)	T ₉₀ <40 segundos
	T ₉₅ <60 segundos
Resolução, sensor (oxigênio dissolvido)	0,01 ppm (mg/L); 0,1% de saturação.
Faixa de medição (temperatura)	0 a 50°C (32 a 122°F)
Precisão de medida (temperatura)	± 0,2 °C (±0,36 °F)
Interferente	Nenhuma interferência de: H ₂ S, pH, K ⁺ , Na ⁺ , Mg ²⁺ , Ca ²⁺ , NH ₄ ⁺ , Al ³⁺ , Pb ²⁺ , Cd ²⁺ , Zn ²⁺ , Cr (total), Fe ²⁺ , Fe ³⁺ , Mn ²⁺ , Cu ²⁺ , Ni ²⁺ , Co ²⁺ , CN ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , S ²⁻ , PO ₄ ³⁻ , Cl ⁻ , Ânion tenso-ativo, Petróleo bruto, Cl ₂ < 4 ppm

Especificação	Detalhes
Temperatura de armazenamento	-20 a 70°C (-4 a 158°F)
Temperatura máxima	0 a 50°C (32°F a 122°F)
Classificação para local perigoso (apenas para sensor 9020000-C1D2)	Classe I, Divisão 2, Grupos A-D, T4 / Classe I, Zona 2 Grupo 2C, T4 Observação: Este produto não preenche os requisitos da Diretiva 94/9/EC (Diretiva ATEX).
Certificações (apenas para sensor 9020000-C1D2)	ETL listado em padrões ANSI/ISA, CSA e FM para uso em local perigoso. Observação: Este produto não preenche os requisitos da Diretiva 94/9/EC (Diretiva ATEX).
Taxa de vazão mínima	Não obrigatória
Calibração/verificação	Calibração do ar: um ponto, 100% de ar saturado por água
	Exemplo de calibração: comparação com instrumento padrão
Profundidade de imersão da sonda e limites de pressão	Limites de pressão em 34 m (112 pés), 345 kPa (50 psi) - máximo; a precisão pode não ser mantida nesta profundidade
Cabo do sensor	Cabo integral com 10 m (30 pés) e plugue de desconexão rápida (todos os tipos de sensor) Possibilidade de até 100 m com cabos de extensão (somente tipos de sensores que não sejam Classe I, Divisão 2) Até 1.000 m com caixa de junção (somente tipos sensores que não sejam Classe I, Divisão 2)
Peso da sonda	1.0 kg (2 lb, 3 oz)
Dimensões da sonda	Sonda padrão (diâmetro x comprimento): 49,53 x 255,27 mm (1,95 x 10,05 pol.)
	Sonda para água do mar (diâmetro x comprimento): 60,45 x 255,27 mm (2,38 x 10,05 pol.)
Alimentação elétrica	12 VDC, 0,25 A, 3 W
Garantia	Sonda: 3 anos para defeitos de fabricação
	Cap do Sensor: 2 anos para defeitos de fabricação

Informações gerais

Em hipótese alguma o fabricante será responsável por danos diretos, indiretos, especiais, incidentais ou consequenciais resultantes de qualquer defeito ou omissão neste manual. O fabricante reserva-se o direito de fazer alterações neste manual e nos produtos aqui descritos a qualquer momento, sem aviso ou obrigação. As edições revisadas podem ser encontradas no site do fabricante.

Informações de segurança

AVISO

O fabricante não é responsável por quaisquer danos devido ao uso ou aplicação incorreta deste produto, incluindo, sem limitação, danos diretos, acidentais ou consequenciais, e se isenta desses danos à extensão total permitida pela lei aplicável. O usuário é unicamente responsável por identificar riscos críticos de aplicação e por instalar os mecanismos apropriados para proteger os processos durante um possível mau funcionamento do equipamento.

Leia todo o manual antes de tirar da embalagem, montar ou operar esse equipamento. Preste atenção a todas as declarações de perigo e cuidado. Caso contrário, o operador poderá sofrer ferimentos graves ou o equipamento poderá ser danificado.





Certifique-se de que a proteção oferecida por este equipamento não seja afetada. Não use nem instale este equipamento de nenhuma outra forma além da especificada neste manual.

Uso de informações de risco

▲ PERIGO
Indica uma situação potencial ou iminentemente perigosa que, se não for evitada, resultará em morte ou lesão grave.
▲ ADVERTÊNCIA
Indica uma situação potencialmente perigosa que, se não for evitada, pode resultar em morte ou ferimento grave.
▲ CUIDADO
Indica uma situação potencialmente perigosa que pode resultar em ferimento leve a moderado.
AVISO
Indica uma situação que, se não evitada, pode causar danos ao instrumento. Informações que necessitam de uma ênfase especial.

Avisos de precaução

Leia todas as etiquetas e rótulos fixados no instrumento. Caso não sejam observadas, podem ocorrer lesões pessoais ou danos ao instrumento. Um símbolo no instrumento tem sua referência no manual com uma medida preventiva.

	Este é o símbolo de alerta de segurança. Acate todas as mensagens de segurança que seguem este símbolo a fim de evitar lesões potenciais. Se o símbolo estiver no instrumento, consulte o manual de instruções para obter informações sobre a operação ou segurança.
	Este símbolo indica a presença de uma fonte de luz com potencial de causar lesões oculares leves. Acate todas as mensagens de segurança que seguem este símbolo a fim de evitar possíveis lesões.
	Este símbolo identifica a presença de dispositivos sensíveis a Descargas eletrostáticas (ESD) e indica que deve-se tomar cuidado para evitar dano ao equipamento.
	Os equipamentos elétricos marcados com este símbolo não podem ser descartados em sistemas de descarte (lixo) públicos europeus após 12 de agosto de 2005. Em conformidade com as regulamentações nacionais e locais europeias (Diretiva UE 2002/96/EC), os usuários de equipamentos elétricos devem devolver seus equipamentos usados para o fabricante para descarte, sem ônus para o usuário. Observação: Para o envio de equipamento para reciclagem, entre em contato com o fabricante ou fornecedor do equipamento para obter instruções sobre o envio de sucata de equipamento, acessórios elétricos fornecidos pelo fabricante e todos os itens auxiliares para um descarte adequado.

Certificação

Canadian Radio Interference-Causing Equipment Regulation (Regulamentação para equipamentos de rádio causadores de interferência do Canadá), IECs-003, Classe A:

Os registros de testes de comprovação encontram-se com o fabricante.

Este aparelho digital Classe A atende a todos os requisitos de regulamentações canadenses sobre equipamentos que causam interferências.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC parte 15, limites Classe "A"

Os registros de testes de comprovação encontram-se com o fabricante. O dispositivo está em conformidade com a Parte 15 das Regras da FCC. A operação está sujeita às seguintes condições:

- 1. O equipamento não deve causar interferência prejudicial.
- 2. O equipamento deve aceitar todas as interferências recebidas, inclusive interferências que podem causar funcionamento indesejado.

Alterações ou modificações a este equipamento não aprovadas expressamente pela parte responsável pela conformidade podem anular a autoridade do usuário de operar o equipamento. Este equipamento foi testado e está em conformidade com os limites de dispositivo digital Classe A, de acordo com a Parte 15 das Regras da FCC. Esses limites foram estabelecidos para proporcionar uma razoável proteção contra interferências nocivas quando o equipamento for operado em ambientes comerciais. Este equipamento gera, utiliza e pode irradiar energia de rádiofrequência e, se não instalado e usado de acordo com o manual de instruções, pode causar interferências prejudiciais às comunicações de rádio. É provável que o funcionamento deste equipamento em área residencial possa causar interferência indesejada, caso em que o usuário será solicitado a corrigir a interferência por conta própria. As seguintes técnicas podem ser usadas para reduzir problemas de interferência:

- 1. Desconecte o equipamento de sua fonte de alimentação para verificar se ele é ou não a origem da interferência.
- 2. Se o equipamento está conectado à mesma tomada do dispositivo que está sofrendo interferência, conecte o equipamento a uma tomada diferente.
- 3. Afaste o equipamento do dispositivo que estiver recebendo a interferência.
- 4. Reposicione a antena de recebimento do dispositivo que está sofrendo interferência.
- 5. Tente algumas combinações das opções acima.

Visão geral do produto

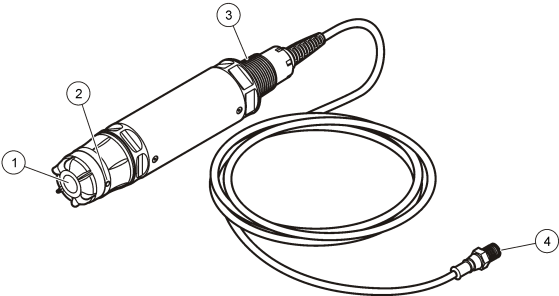
PERIGO

Riscos químicos ou biológicos. Se esse instrumento for usado para monitorar um processo de tratamento e/ou sistema de alimentação química para o qual existam limites de regulamentação e requisitos de monitoramento relacionados à saúde pública, à produção ou ao processamento de alimentos ou bebidas, é responsabilidade do usuário deste instrumento conhecer e cumprir as regulamentações aplicáveis e ter mecanismos suficientes e apropriados para obter conformidade com as regulamentações aplicáveis no caso de mau funcionamento do instrumento.

Este sensor foi projetado para funcionar com um controlador para a operação e armazenamento de dados. O sensor pode ser usado com vários controladores. Consulte o manual do usuário do sensor para obter mais informações.

As principais aplicações deste sensor são Estações de Tratamento de Efluentes Industriais e Companhias de Saneamento. A tecnologia do sensor LDO não consome oxigênio e pode medir a concentração de DO em aplicações com baixas vazões ou sem vazão. Consulte a [Figura 1](#).

Figura 1 LDO

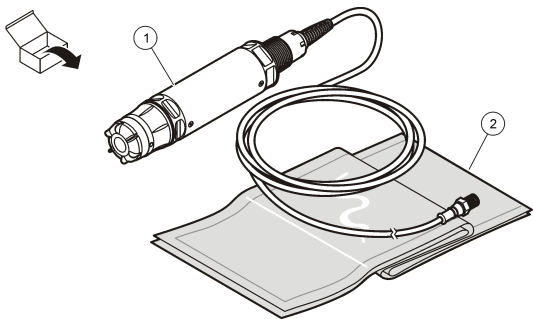


1 Cap do Sensor	3 NPT de 1 polegada
2 Sensor de temperatura	4 Conector, conexão rápida (padrão)

Lista de componentes do sensor LDO

Certifique-se de que todos os componentes foram recebidos. [Figura 2](#) Se houver itens ausentes ou danificados, entre em contato imediatamente com o fabricante ou com um representante de vendas. Consulte a [Figura 2](#).

Figura 2 Lista de componentes do sensor



1 LDO ¹	2 Bolsas de calibração (2x)
--------------------	-----------------------------

Instalação

⚠ ADVERTÊNCIA

Risco de lesão corporal. Somente pessoal qualificado deve realizar as tarefas descritas nesta seção do manual.

Validar o tipo de sensor

⚠ PERIGO



Risco de explosão. Conecte apenas componentes periféricos claramente marcados como certificados como Locais de Perigo Classe 1, Divisão 2.


AVISO

A versão certificada deste produto para locais perigosos não corresponde aos requisitos da Diretiva 94/9/EC (Diretiva ATEX).

1. Vá até a extremidade do conector do cabo.
2. Leia o rótulo da extremidade do conector do cabo. Para sensores certificados para locais perigosos, a etiqueta deve ter o texto "Classificação: Classe 1, Divisão 2".
3. Examine o conector.
 - Sensores certificados para locais perigosos têm um conector com trava de segurança. Consulte a [Figura 3](#) na página 61.
 - Os sensores que não são certificados para locais perigosos têm conector com conexão rápida, sem trava de segurança.

¹ O manual do usuário incluído não é exibido.

Conecte o sensor em um local não perigoso

⚠ PERIGO	
	Perigo de explosão. Este equipamento é adequado para uso em locais seguros ou de Classe 1, Divisão 2, Grupos A, B, C e D com sensores e opções especificados quando instalado em locais perigosos de Classe 1, Divisão 2, Grupos A, B, C e D. Consulte sempre o desenho de controle e os códigos de normas elétricas para instruções de instalação apropriadas.

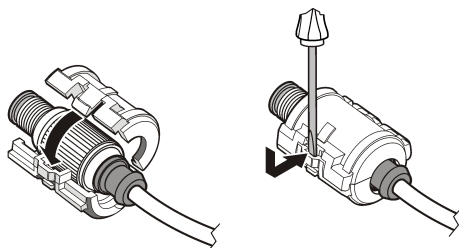
⚠ PERIGO	
	Risco de explosão. Não conecte nem desconecte componentes ou circuitos elétricos para e do equipamento, ao menos que a energia tenha sido desligada ou a área esteja completamente segura.

AVISO	
Use apenas sensores e trava do cabo certificados para locais perigosos. A versão certificada deste produto para locais perigosos não corresponde aos requisitos da Diretiva 94/9/EC (Diretiva ATEX).	

Para obter mais informações, consulte [Validar o tipo de sensor](#) na página 60 .

1. Remova a cap do conector do controlador. Mantenha a cap do conector para vedar a abertura do conector quando o sensor for removido.
2. Conecte o do sensor ao controlador. Consulte o manual do controlador para obter mais informações.
3. Alinhe a trava de segurança no conector.
4. Para remover a trava de segurança do conector, Consulte a [Figura 3](#).

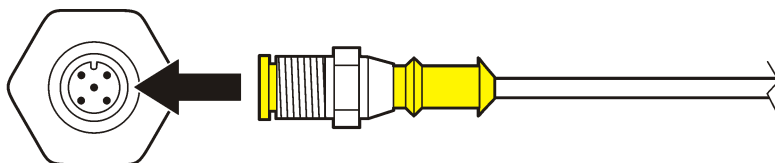
Figura 3 Trava de segurança do conector.



Conecte o sensor em um local não perigoso

Consulte a [Figura 4](#) para conectar um sensor LDO a um controlador sc. Consulte o manual específico do controlador sc para obter instruções sobre cabeamento.

Figura 4 Conecte o sensor LDO (sensor para local não perigoso)



Depois que o sensor for encaixado, procure o sensor. Consulte a [Instalar o sensor](#) na página 61.

Instalar o sensor

Há duas opções para instalar o sensor:

- Conecte o sensor enquanto a energia para o controlador estiver desligada. O controlador procurará e instalará novos sensores quando for ligado.
- Conecte o sensor enquanto a energia para o controlador estiver ligada. Use o comando Scan Devices (Procurar dispositivos) para instalar o novo sensor:

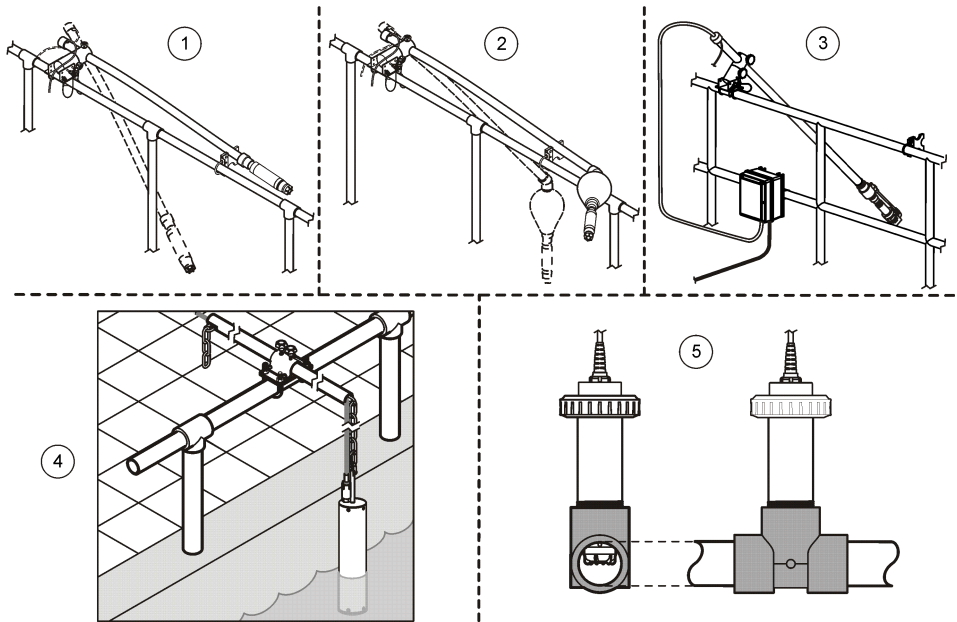
Opção	Descrição
Controlador sc200	Vá para MENU>TEST/MAINT>SCAN DEVICE (MENU>TESTE/MANUT>PROCURAR DISPOSITIVO)
Controlador sc100	Vá para MENU>TEST/MAINT>SCAN DEVICE (MENU>TESTE/MANUT>PROCURAR SENSORES)
Controlador sc1000	Vá para MENU>SYSTEM SETUP>DEVICE MANAGEMENT>SCANNING FOR NEW DEVICES (MENU>CONFIGURAÇÃO DO SISTEMA>GERENCIAMENTO DE DISPOSITIVOS>PROCURANDO NOVOS DISPOSITIVOS)

Consulte [Conecte o sensor em um local não perigoso](#) na página 61 para obter a conexão do sensor digital.

Opções de instalação do sensor

As opções de instalação e acessórios disponíveis para o sensor LDO são fornecidas com as instruções de instalação no kit de montagens. O [Figura 5](#) mostra diversas opções de instalação. Para solicitar as peças do kit de montagens, consulte o [Peças e acessórios de reposição](#) na página 72.

Figura 5 Opções de instalação



1 de montagem em trilho	4 de montagem em corrente
2 Montagem flutuante	5 Montagem por união (incompatível com sondas para água do mar)
3 Montagem do sistema de jato de ar (incompatível com sondas para água do mar)	

Operação

Navegação do usuário

Consulte a documentação do controlador para obter uma descrição do teclado e informações de navegação.

Configurar o sensor

Use o menu Configure (Configurar) para digitar as informações de identificação do sensor, e para alterar as opções de armazenamento e manuseio dos dados.

Para obter informações sobre a instalação do sensor, consulte [Instalar o sensor](#) na página 61.

Confira se todos os valores do menu Configuração estão corretos para a aplicação.

1. Vá para MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione Sensor]>CONFIGURAR).
2. Selecione uma opção, pressione ENTER. A lista de opções disponíveis é mostrada na tabela abaixo.

Opção	Descrição
EDIT NAME (Editar nome)	Altera o nome que corresponde ao sensor no topo da tela de medição. O nome é limitado a 10 caracteres com qualquer combinação de letras, números, espaços ou pontuação.
SET UNITS (DEFINIR UNIDADES)	Define a unidade de temperatura para °C (padrão) ou °F.
	MEASURE (MEDIDA) - Define as unidades de medida em mg/L, ppm ou %.
	ALT/PRESS - Define a altitude em m ou pés, ou defina as unidades de pressão atmosférica em mmHg ou torr. (Valor padrão = 0 pé)
ALT/PRESS (Altitude/pressão)	Insira o valor da altitude ou pressão atmosférica. Este valor deve ser preciso para completar as medidas de saturação em % e a calibração no ar. (Padrão = 0 pé).
SALINITY (Salinidade)	Insira o valor de salinidade. Intervalo de salinidade: 0,00 a 250,00 partes por milhar (‰). Consulte a seção Inserir valor de correção de salinidade na página 64 para obter mais informações. (Valor padrão= 0)
Média de sinal	Ajuste o intervalo de tempo para a média de sinal em segundos
CLEAN INTRVL (INTERVALO DE LIMPEZA)	Ajuste o intervalo de tempo para a limpeza manual do sensor em dias (Valor padrão = 0 dia. Um valor de 0 dia desativa o intervalo de limpeza).
RESET CLN INTRVL (REDEFINIR INTERVALO DE LIMPEZA)	Ajuste o intervalo de tempo ao último intervalo de limpeza salvo
LOG SETUP (Configuração do registrador)	Define o intervalo de tempo para armazenamento de dados no registros dos dados—0.5, segundos, 1, 2, 5, 10, 15 (padrão), 30, 60 minutos.
SET DEFAULTS	Restaura os valores padrão configuráveis do sensor. Não altera o ajuste de inclinação ou deslocamento.

Insira o valor de pressão atmosférica

A configuração de fábrica para pressão (de ar) atmosférica é O pés ou no nível do mar. Para alterar o valor padrão, utilize as etapas nesse procedimento. O ajuste para pressão de ar é inserido como elevação ou como unidades de pressão (preferido).

Observação: A pressão de ar precisa é essencial para calibração de ar saturado ([Calibração com ar](#) na página 66). Utilize apenas pressão absoluta, não ajustada. Se a pressão absoluta do ar for desconhecida, utilize a elevação correta para o local.

1. Vá para MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SET UNITS>AIR PRESS/ALT UNITS (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione Sensor]>CONFIGURAR>DEFINIR UNIDADES>PRESSÃO AR/UNIDADES ALT.
2. Selecione **um** das opções de unidade listadas:

Opção	Descrição
ft	Pés - unidade de medida para elevação
m	Metros - unidade métrica para medir elevação
mmHg	Milímetros de mercúrio - unidade métrica para medir pressão absoluta do ar
torr	Unidade de medida para pressão absoluta do ar

3. Confirme a seleção. A tela de entrada de valor exibirá as unidades selecionadas.
4. Insira o valor de e confirme.

Inserir valor de correção de salinidade.

As medidas de oxigênio dissolvido em amostras salinas podem exibir um valor aparente de DO que é bem diferente do valor real do DO. Para corrigir a influência de sais dissolvidos na amostra, insira o fator de correção de salinidade.

Observação: Se a presença ou a quantidade de salinidade no processo for desconhecido, consulte a equipe de engenharia da unidade de tratamento.

1. Utilize o medidor de condutividade para medir a condutividade da amostra em mS/cm na temperatura de referência de 20 °C (68 °F).
2. Utilize [Tabela 1](#) para estimar o fator de correção de salinidade em partes por milhar (‰) de saturação.

Observação: A concentração de íon cloreto em g/kg é igual à clorinidade da amostra. A salinidade é calculada com a seguinte fórmula: $\text{Salinidade} = 1.80655 \times \text{clorinidade}$.

A salinidade pode ser calculada por meio da relação na seção 2520 B de *Método Padrão para Análise de Água e Água servida*.²,

3. Vá para MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SALINITY (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione Sensor]>CONFIGURAR>SALINIDADE.
4. Insira o fator de correção de salinidade e confirme.

² *Standard Methods for the Examination of Water and Wastewater*, 20th Edition. Editors Lenore S. Clesceri, Arnold E. Greenberg and Andrew D. Eaton, p. 2-48-2-29 (1998). A relação entre Clorinidade e Solubilidade do oxigênio é fornecida na mesma referência em 4500-O:1 p. 4-131.

Tabela 1 Saturação de salinidade (‰) por valor de condutividade (mS/cm)

mS/cm	‰	mS/cm	‰	mS/cm	‰	mS/cm	‰
5	3	16	10	27	18	38	27
6	4	17	11	28	19	39	28
7	4	18	12	29	20	40	29
8	5	19	13	30	21	42	30
9	6	20	13	31	22	44	32
10	6	21	14	32	22	46	33
11	7	22	15	33	23	48	35
12	8	23	15	34	24	50	37
13	8	24	17	35	25	52	38
14	9	25	17	36	25	54	40
15	10	26	18	37	26		

Configurar a saída linear do controlador

As saídas lineares enviam dados da sonda para o PLC, SCADA ou outro sistema de coleta de dados da instalação.

1. Vá até o menu de configuração de saída do controlador.

Opção	Descrição
sc200	Vá para MENU>SETTINGS>sc200 SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>CONFIGURAÇÕES>CONFIGURAÇÃO de sc200>CONFIGURAÇÃO DA SAÍDA>[Selecione a Saída]>DEFINIR FUNÇÃO).
sc100	Vá para MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>CONFIGURAÇÃO DO SISTEMA>CONFIGURAÇÃO DA SAÍDA>[Selecione a Saída]>DEFINIR FUNÇÃO).
sc1000	Vá para MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION (MENU>CONFIGURAÇÃO DO SISTEMA>CONFIGURAÇÃO DA SAÍDA>[Selecione a Saída]>DEFINIR FUNÇÃO).

2. Ajuste a função do controlador.

Opção	Descrição
sc200	LINEAR
sc100	CONTROLE LINEAR (valor padrão)
sc1000	CONTROLE LINEAR (valor padrão)

Registradores Modbus

Uma lista de registradores Modbus está disponível para comunicação em rede. Visite www.hach.com ou www.hach-lange.com para obter mais informações.

Calibração para medições

O sensor está calibrado com as especificações de fábrica. O fabricante não recomenda a calibração a não ser que seja periodicamente solicitada pelas agências de regulamentação. Se a calibração for necessária, permita que o sensor chegue ao ponto de equilíbrio com o processo antes da calibração. Não faça a calibração do sensor na configuração.

Tabela 2 mostra opções para calibração.

Tabela 2 Opções de calibração

Opção	Descrição
AIR CAL (CALIBRAÇÃO DE AR)	Método de calibração recomendado. Essa calibração modifica a inclinação.
SAMPLE CAL (1 CAL. AMOSTRA)	Calibração por comparação com um medidor de DO portátil. Essa calibração modifica o deslocamento.
RESET DFLT CAL (RECONFIGURAR CALIBRAÇÃO PADRÃO)	Reconfigura o ganho de calibração (inclinação) e o deslocamento aos padrões de fábrica: ganho padrão=1,0; deslocamento padrão=0,0

Calibração com ar

Notas para o usuário:

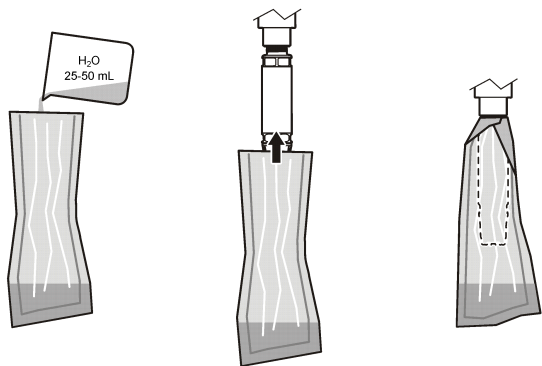
- Confira se a bolsa de calibração contém água.
- Confira se a vedação entre a bolsa de calibração e o corpo do sensor está firme.
- Confira se o sensor fica seco quando calibrado.
- Confira se a configuração de pressão/elevação do ar é precisa para o local de calibração.
- Aguarde o tempo suficiente para que a temperatura do sensor se estabilize à temperatura do local da bolsa de calibração. Uma diferença grande de temperatura entre o processo e o local da calibração pode determinar um tempo de estabilização de até 15 minutos.

1. Remova o sensor do processo. Use um pano molhado para limpar o sensor.
 2. Coloque todo o sensor em uma bolsa de calibração com 25 a 50 ml de água. Confira se a cap do sensor não está em contato com a água da bolsa de calibração e se não há gotas de água na cap do sensor ([Figura 6](#)).
 3. Utilize uma faixa de borracha, abraçadeira ou a mão para criar uma vedação firme ao redor do corpo do sensor.
 4. Antes da calibração, aguarde 15 minutos para a estabilização do instrumento. Mantenha a bolsa de calibração longe da luz solar direta durante a estabilização.
 5. Confira se a pressão absoluta ou elevação do ar está configurada corretamente. Consulte a [Insira o valor de pressão atmosférica](#) na página 63.
- Observação:** O fabricante recomenda o uso de pressão do ar absoluta ou real como melhor prática.
6. Vá para MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>AIR CAL (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione o sensor]>CALIBRAR>CALIBRAÇÃO NO AR).
 7. Selecione a opção para o sinal de saída durante a calibração:

Opção	Descrição
Ativo	O instrumento envia para a saída o valor medido atual durante o procedimento de calibração.
Espera	O valor de saída é mantido no valor medido no início do processo de calibração.
Transferir	Um valor de saída pré-definido é enviado para a saída durante a calibração. Consulte o manual do usuário para alterar o valor pré-definido

8. O controlador mostrará "Move the probe to bag" ("Mover a sonda para bolsa"). Aguarde o valor se estabilizar. Pressione ENTER para aceitar o valor estável. Como alternativa, aguarde a calibração continuar até a exibição de "Complete" ("Completo").
9. Quando o sensor for calibrado, coloque-o no processo. Pressione ENTER.

Figura 6 Procedimento de calibração por ar



Se o valor não for estabilizado, o visor mostrará "Unable to Calibrate" ("Não é possível calibrar") e uma mensagem de erro. [Tabela 3](#) mostra a mensagem de erro e a resolução para os problemas de calibração.

Tabela 3 Mensagens de erro de calibração de ar

Mensagem	Descrição	Resolução
Cal fail, gain high (Falha na calibração, ganho alto)	O valor de ganho calculado é muito alto.	Repita a calibração.
Cal fail, gain low (Falha na calibração, ganho baixo)	O valor de ganho calculado é muito baixo.	Repita a calibração.
Cal fail, unstable (Falha na calibração, instável)	O valor não foi estabilizado no tempo máximo de calibração permitido.	Repita a calibração.

Sample CAL (CAL de amostra) - calibração por comparação

Esse método de calibração usa um sensor opcional anexado a um medidor portátil.

1. Coloque o sensor opcional no processo. Coloque o segundo sensor o mais próximo possível do primeiro.
2. Aguarde até que o valor estabilize.
3. No controlador do primeiro sensor, vá para MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>SAMPLE CAL (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione o sensor]>CALIBRAR>CAL. DE AMOSTRA).
4. Selecione a opção para o sinal de saída durante a calibração:

Opção	Descrição
Ativo	O instrumento envia para a saída o valor medido atual durante o procedimento de calibração.
Espera	O valor de saída é mantido no valor medido no início do processo de calibração.
Transferir	Um valor de saída pré-definido é enviado para a saída durante a calibração. Consulte o manual do usuário par alterar o valor pré-definido

5. O mostrador exibirá:
 - Pressione ENTER quando estabilizado
 - A medição atual de oxigênio dissolvido
 - A medição atual da temperatura

6. Quando a medição estiver estável, pressione ENTER. O visor mostrará uma tela de entrada.

Observação: A medição normalmente se estabiliza dentro de 2 a 3 minutos.

Se o valor não for estabilizado, o visor mostrará "Unable to Calibrate" ("Não é possível calibrar") e uma mensagem de erro. [Tabela 4](#) mostra a mensagem de erro e a resolução para os problemas de calibração.

Tabela 4 Mensagens de erro de calibração de amostra

Mensagem	Descrição	Resolução
Cal fail, offset high (Falha na calibração, deslocamento alto)	O valor de deslocamento calculado é muito alto.	Repita a calibração.
Cal fail, offset low (Falha na calibração, deslocamento baixo)	O valor de deslocamento calculado é muito baixo.	Repita a calibração.
Cal fail, unstable (Falha na calibração, instável)	O valor não foi estabilizado no tempo máximo de calibração permitido.	Repita a calibração.

Sair temporariamente da calibração

1. Durante a calibração pressione a tecla BACK (VOLTAR). São exibidas três opções:

Opção	Descrição
ABORT (ANULAR)	Interrompe a calibração. Uma nova calibração precisa ser reiniciada.
BACK TO CAL (Voltar à calibração)	Retornar à calibração.
LEAVE (Deixar a calibragem)	Sair temporariamente da calibração. O acesso a outros menus é permitido enquanto a calibração prossegue em segundo plano. Uma calibração para um segundo sensor (se presente) pode ser iniciada. Para retornar à calibração, pressione a tecla MENU e selecione Sensor Setup (Configuração do sensor), [Select Sensor] (Selecionar sensor).



2. Selecionar uma das opções de saída. Confirme.

Restaurar a calibração para os valores padrão

As configurações de calibração podem ser restauradas aos padrões de fábrica. Os valores de ganho e deslocamento são definidos como 1,0 e 0,0, respectivamente.

1. Vá para MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>RESET CAL DEFLT (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione o sensor]>CALIBRAR>REDEFINIR CALIBRAÇÃO PADRÃO).
2. O visor mostrará uma mensagem de confirmação. Confirme para redefinir a curva de calibração do sensor ao padrão de fábrica.

Manutenção

⚠ PERIGO	
	Vários perigos. Somente pessoal qualificado deve realizar as tarefas descritas nesta seção do manual.
⚠ PERIGO	
	Perigo de explosão. Não conecte nem desconecte componentes ou circuitos elétricos para e do equipamento, ao menos que a energia tenha sido desligada ou a área esteja completamente segura.

⚠ PERIGO



Perigo de explosão. A substituição de componentes pode prejudicar a compatibilidade da Classe 1, Divisão 2. Não substitua nenhum componente, ao menos que esse tenha sido desligado ou que a área esteja completamente segura.

AVISO

A versão certificada deste produto para locais perigosos não corresponde aos requisitos da Diretiva 94/9/EC (Diretiva ATEX).

Rotina de manutenção

O programa de manutenção mostra os tempos mínimos para as tarefas de manutenção regulares. Efetue as tarefas de manutenção com mais frequência para aplicações que causam sujeira no eletrodo.

Observação: Não desmonte o instrumento para manutenção ou serviço.

Tarefa de manutenção	Frequência mínima recomendada
Limpar o sensor	90 dias
Verificar se há danos no sensor	90 dias
Calibrar o sensor	Conforme recomendação do órgão regulamentar

Limpar o sensor

Limpe a parte externa do sensor com um pano macio e úmido.

Observação: Se a cap do sensor precisar ser removida para limpeza, não exponha o interior da cap à luz direta do sol por um longo período de tempo.

Definir ou alterar o intervalo de limpeza

As condições da aplicação podem exigir intervalos mais curtos ou mais longos entre as limpezas manuais do sensor. O intervalo de limpeza padrão é de 0 dias. Para alterar o intervalo, consulte as etapas neste procedimento.

1. Vá para MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>CLEAN INTRVL (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione o sensor]>CONFIGURAR>INTERVALO DE LIMPEZA).
2. Altere o valor mostrado, conforme necessário. Confirme a alteração.
 - Para desativar o intervalo de limpeza, defina o valor como '0'.

Troque a cap do sensor

⚠ ADVERTÊNCIA



Risco potencial de explosão. A cap de configuração do sensor não está classificada para uso em locais perigosos.

Caps sobressalentes e de configuração são enviadas juntamente com as instruções de instalação. Consulte as instruções incluídas para trocar a cap.

Para um melhor desempenho e precisão, substitua a cap do sensor:

- A cada dois anos
- Quando a inspeção de rotina mostra erosão significativa na cap do sensor

Solução de problemas

Menu de teste e diagnóstico

O menu de teste e diagnóstico mostra as informações atuais e históricas sobre o analisador de cloro.

Para acessar o menu de diagnóstico e de teste, vá para MENU>SENSOR SETUP>[Select Sensor]>DIAG/TEST (MENU>CONFIGURAÇÃO DO SENSOR>[Selecione o sensor]>DIAG/TESTE).

Consulte a [Tabela 5](#).

Tabela 5 Menu DIAG/TEST (Diagnóstico/teste)

Opção	Descrição
INFORMAÇÕES DO SENSOR	VERSÃO DO SOFTWARE - Exibe a versão instalada do software
	VERSÃO DE INICIALIZAÇÃO - Exibe a versão de inicialização instalada
	VERSÃO DO DRIVER - Exibe a versão do driver instalada
LOT CODE (CÓDIGO DO LOTE)	Exibe o lote de fabricação na cap do sensor
SERIAL NUMBER (NÚMERO DE SÉRIE):	Número de série do sensor
GAIN CORR (CORREÇÃO DO GANHO)	Ajustar o valor de ganho da calibração.
	Intervalo de 0.50 a 2.00
OFFSET CORR	Ajustar o valor de deslocamento da calibração (mg/L ou ppm).
	Intervalo de 3.00 a 3.00
PHASE DIAG (DIAG DA FASE)	Exibe a fase para comprimento de onda total, vermelho e azul. Atualiza uma vez por segundo
AMPL DIAG (DIAG AMPL)	Exibe a amplitude para comprimento de onda vermelho e azul. Atualiza uma vez por segundo
DAYS TO CLEAN (DIAS PARA LIMPEZA)	Exibe os dias até a próxima programação de limpeza manual.
SENSOR LIFE (VIDA ÚTIL DO SENSOR)	Exibe os dias até a próxima programação de reposição da cap do sensor.

Lista de erro

Se ocorrer um erro, a leitura na tela de medidas piscará. O comportamento da saída é determinado pelas configurações do controlador. Consulte o manual do controlador para obter mais informações. Para mostrar os erros atuais do sensor, vá para MENU>DIAGNOSTICS>[Select Sensor]>ERROR LIST (MENU>DIAGNÓSTICOS>[Selecione o sensor]>LISTA DE ERROS). Consulte a [Tabela 6](#).

Tabela 6 Lista de erros do sensor

Error (Erro)	Causa possível	Resolução
RED AMPL LOW (AMPL VERM BAIXO - Valor abaixo de 0,01) Ou BLUE AMPL LOW (AMPL AZUL BAIXO - Valor abaixo de 0,01)	The sensor cap is not installed, or is not installed correctly.	Remova a cap do sensor e instale-a novamente.
	O percurso da luz está bloqueado na cap do sensor.	Inspecione a parte interna da cap do sensor e a lente.
	O sensor não está funcionando corretamente.	Verifique se o LED está piscando. Entre em contato com o fabricante.

Lista de aviso

Quando o ícone de advertência piscar (sc100 e sc200) ou a tela ficar amarela (sc1000), uma mensagem será mostrada na parte inferior da tela de medição. Para sc1000, a tela ficará amarela para mostrar a advertência. Para mostrar as advertências atuais do sensor, vá para MENU>DIAGNOSTICS>[Select Sensor]>WARNING LIST (MENU>DIAGNOSTICOS>[Selecione o sensor]>LISTA DE ADVERTÊNCIAS). Consulte a [Tabela 7](#).

Tabela 7 Lista de advertências do sensor

Advertência	Definição	Resolução
EE SETUP ERR (ERRO DE CONFIGURAÇÃO DE EE)	O armazenamento está corrompido. Os valores foram definidos para o padrão de fábrica.	Entre em contato com o suporte técnico.
ERRO EE RSRVD		
TEMP < 0 °C (TEMPERATURA < 0 °C)	A temperatura de processamento está abaixo de 0 °C (32 °F)	Aumente a temperatura de processamento ou interrompa o uso até que a temperatura de processamento esteja dentro do intervalo de especificação do sensor.
TEMP > 50 °C (TEMPERATURA > 50 °C)	A temperatura de processamento está acima de 50 °C (120 °F)	Diminua a temperatura de processamento ou interrompa o uso até que a temperatura de processamento esteja dentro do intervalo de especificação do sensor.
RED AMPL LOW (AMPL VERM BAIXO)	Valor fica abaixo de 0,03	Consulte a Tabela 6 na página 70.
RED AMPL HIGH (AMPL VERM ALTO)	Valor é maior que 0,35	Contate o suporte técnico.
BLUE AMPL LOW (AMPL AZUL BAIXO)	Valor abaixo de 0,03	Consulte a Tabela 6 na página 70.
BLUE AMPL HIGH (AMPL AZUL ALTO)	Valor é maior que 0,35	Contate o suporte técnico.
CAP CODE FAULT (FALHA DO CÓDIGO DA CAP)	O código da cap do sensor foi corrompido. O código foi redefinido automaticamente para os códigos padrão da cap e do lote.	Conclua o procedimento da cap de configuração do sensor. Se nenhuma cap de configuração estiver disponível para a cap do sensor, contate o suporte técnico.

Lista de eventos

A Lista de eventos mantém um registro das alterações na forma como os dados são registrados pelo sensor. Para mostrar os eventos do sensor, vá para (MENU>DIAGNOSTICOS>[Selecione o sensor]>LISTA DE EVENTOS). Consulte a [Tabela 8](#).

Tabela 8 Lista de eventos do sensor

Evento	Descrição
ALT/PRESSURE UNIT CHANGE (ALTERAÇÃO DA UNIDADE DE ALTITUDE/PRESSÃO)	As unidades de pressão atmosférica ou de altitude foram alteradas.
ALT/PRESSURE CHANGE (ALTERAÇÃO DA ALTITUDE/PRESSÃO)	O valor da altitude ou da pressão atmosférica foi alterado.
TEMP UNIT CHANGE (ALTERAÇÃO DE UNIDADE DE TEMPERATURA)	As unidades de temperatura foram alteradas.
MEAS UNIT CHANGE (ALTERAÇÃO DA UNIDADE DE MEDIDA)	Uma nova unidade de medida foi alterada.

Tabela 8 Lista de eventos do sensor (continuação)

Evento	Descrição
SALINITY CHANGE (ALTERAÇÃO DE SALINIDADE)	O valor de salinidade foi alterado.
SET DEFAULT (DEFINIR PARA PADRÃO)	As configurações do sensor foram redefinidas para os valores padrão.
SENSOR SETUP CHANGE (ALTERAÇÃO DA CONFIGURAÇÃO DO SENSOR)	A configuração do sensor foi alterada.
CLEAN INTERVAL TIMER CHANGE (ALTERAÇÃO DO TEMPORIZADOR DO INTERVALO DE LIMPEZA)	O tempo entre as limpezas do sensor foi alterado.
SENSOR CAP LIFE TIMER CHANGE (ALTERAÇÃO NO TEMPORIZADOR DE VIDA ÚTIL DA CAP DO SENSOR)	O tempo entre as substituições da cap do sensor foi alterado.

Peças e acessórios de reposição

Utilize apenas as peças de substituição aprovadas pelo fabricante. O uso de peças não aprovadas pode causar lesões pessoais, danos ao instrumento ou mau funcionamento do equipamento.

Itens de reposição

Descrição	Nº de item (EUA / UE)
Sonda LDO, com cap de sensor e 2 bolsas de calibração	LXV416.99.20001416.99.20001
Sonda LDO para água do mar, com cap de sensor e duas bolsas de calibração	9020000-SW / —
Sonda LDO para locais perigosos com água do mar, com cap de sensor e duas bolsas de calibração	9020000-C1D2-SW / —
Sonda LDO para locais perigosos, com cap de sensor e 2 bolsas de calibração	9020000-C1D2 / —
Cap do Sensor, substituição (inclui a cap de configuração do sensor, que não é classificada para uso em locais perigosos de Classe 1, Divisão 2)	9021100 / 9021150

Acessórios

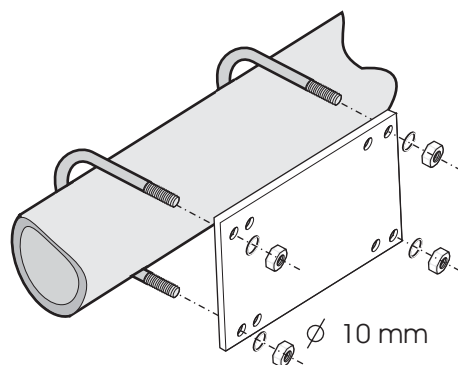
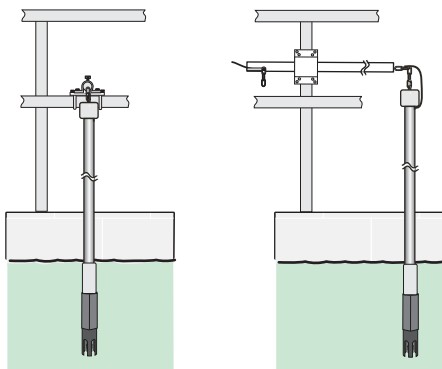
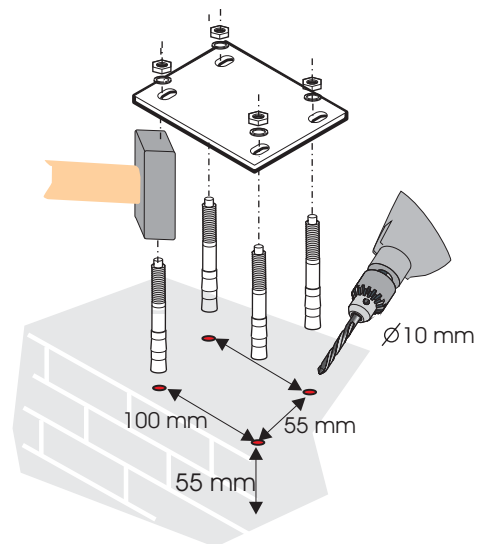
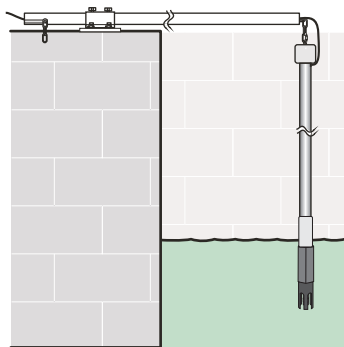
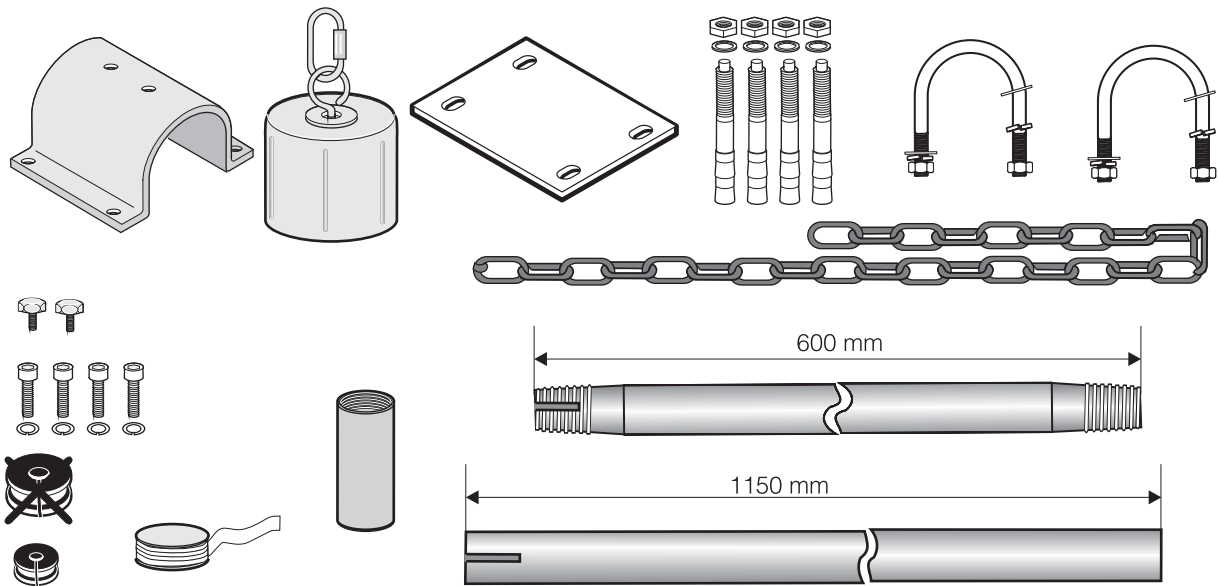
Descrição	Nº de item (EUA / UE)
Trava do cabo do sensor para locais perigosos	6139900 / —
Cabo, extensão do sensor, Classe 1, Locais perigosos da Divisão 2, 1 m (3,3 pés)	6122402 / —
Cabo, extensão do sensor, Classe 1, Locais perigosos da Divisão 2, 7 m (23 pés)	5796002 / —
Cabo, extensão do sensor, Classe 1, Locais perigosos da Divisão 2, 15 m (49,21 pés)	5796102 / —
Cabo, extensão do sensor, Classe 1, Locais perigosos da Divisão 2, 31 m (101,71 pés)	5796202 / —
Sistema de limpeza jato de ar de alto rendimento, 115 volts (não classificado para uso em locais perigosos)	6860000 / 6860003.99.0001
Sistema de limpeza com jato de ar de alto rendimento, 230 volts (não classificado pela ATEX para uso em locais perigosos)	6860100 / 6860103.99.0001
Bolsa de calibração (1x)	5796600 / 5796600

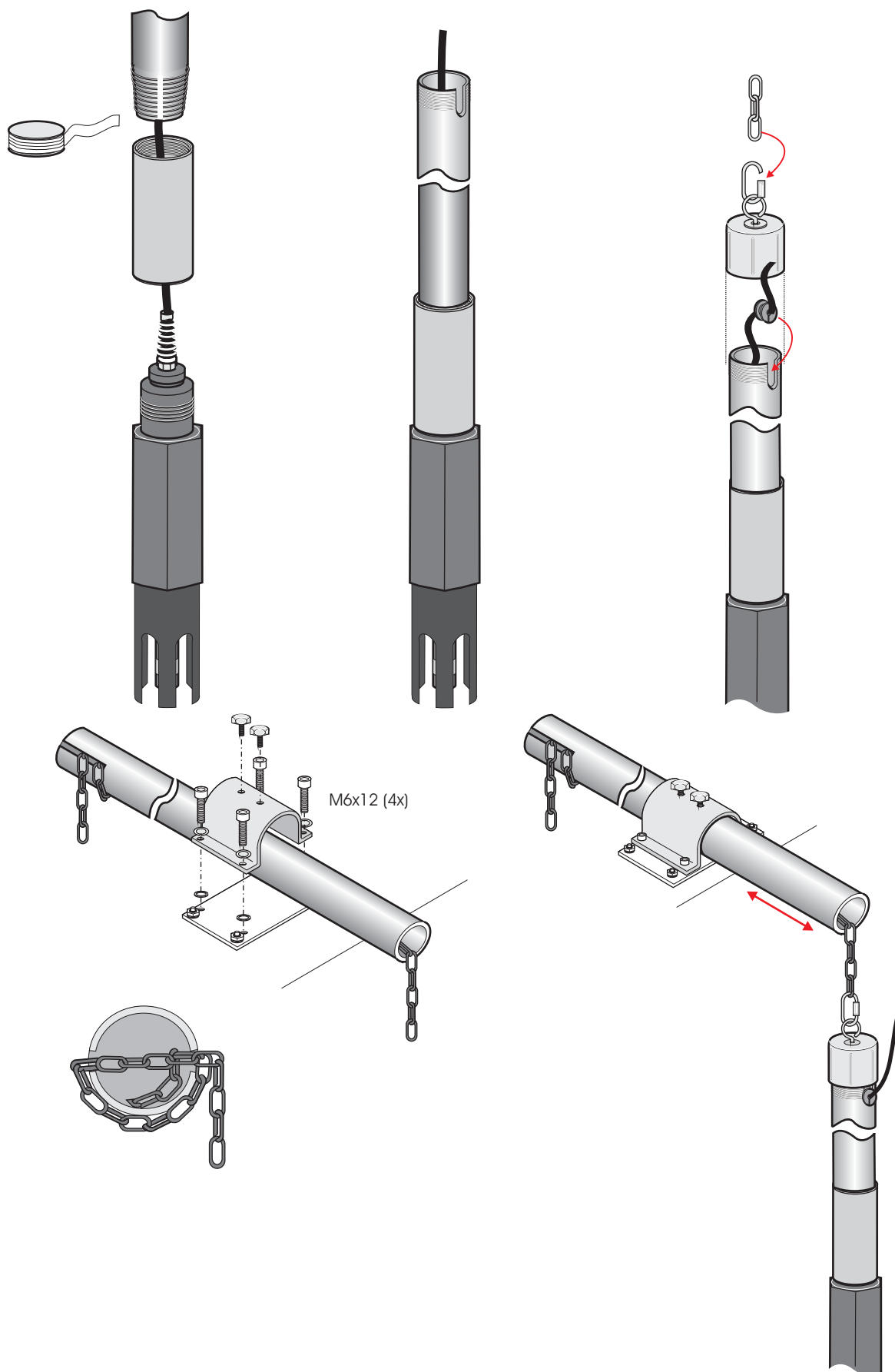
Descrição	Nº de item (EUA / UE)
Cabo, extensão do sensor, local não perigoso, 7,7 m (25 pés) ³	EUA: 5796000, 7,7 metros (25 pés)
	UE: LZX849, 10 m (33 pés)
Kit de hardware para montagem de tubulação (PVC)	LZY714.99.21810714.99.21810
Kit de hardware para montagem de flutuante (PVC)	LZX914.99.42200914.99.42200
Kit de hardware para montagem do jato de ar	9253500 / LZY812
Kit de hardware para montagem em corrente (aço inoxidável)	— / LZX914.99.11200
Kit de hardware para montagem por união	9257000 / 9257000
Medidor HQd com sonda resistente LDO (não classificada para uso em locais perigosos)	8505200 / HQ40D.99.310.000

³ 15 metros (49 pés) e 30 metros (98 pés) também disponíveis

Mounting Instruction

LZX914.99.11200





TU5 Series Turbidimeters

Applications

- Drinking Water
- Power
- Beverage
- Pharmaceutical



The next standard in the evolution of turbidity

Only the new TU5 Series Lab & Process Turbidimeters with 360° x 90° Detection™ deliver unprecedented confidence that a change in your reading is a change in your water.

Groundbreaking 360° x 90° Detection™ Technology

The TU5 Series employs a patented optical design that sees more of your sample than any other turbidimeter, delivering the best low level precision and sensitivity while minimizing variability from test to test.

Matching lab and online results

For the first time you will be able to remove the uncertainty of which measurement to trust, thanks to identical 360° x 90° Detection™ Technology in both instruments.

Everything about turbidity – faster

The TU5 Series dramatically reduces the time needed to get a turbidity measurement you can rely on, with 98% less online sample surface area to clean, sealed vials for calibration, and the elimination of the need for indexing and silicone oil in the lab. Not to mention, a smaller online sample volume means you will detect events almost immediately.

No surprises

Prognosys™ monitors your TU5 Series online instrument, proactively alerting you to maintenance needs before your measurement becomes questionable. And a Hach Service Agreement protects your investment and helps ensure that you stay in compliance and on budget.

USEPA and ISO 7027 reporting: The TU5 Series Turbidimeters apply the instrument design and meet performance criteria established by EPA Approved Hach Method 10258 and ISO 7027-1:2016, making them suitable for regulatory reporting.



Technical Data***TU5200**

Light Source	Class 2 laser product, with embedded 650 nm (EPA 0.43 mW) or Class 1 laser product, with embedded 850 nm (ISO), max. 0.55 mW (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 - 700 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 175 EBC ISO: 0 - 1000 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 250 EBC
Accuracy	±2 % plus 0.01 NTU from 0 - 40 NTU; ±10 % of reading from 40 - 1000 NTU based on Formazin primary standard (at 25 °C)
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC / mg/L
Repeatability	<40 NTU: Better than 1% of reading or ±0.002 NTU on Formazin at 25 °C, whichever is greater >40 NTU: Better than 3.5% of reading on Formazin at 25 °C
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC; mg/L if calibrated with Degrees calibration curve
Operating Temperature Range	10 - 40 °C (50 - 104 °F)
Operating Humidity	80% at 30 °C (non condensing)
Sample Temperature	4 - 70 °C (39 - 158 °F)
Storage Conditions	-30 - 60 °C (-22 - 140 °F)
Power Requirements (Voltage)	100 - 240 VAC
Power Requirements (Hz)	50/60 Hz
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50) Australian ACMA Marking
Dimensions (H x W x D)	195 mm x 409 mm x 278 mm
Weight	2.4 kg (5.29 lbs.)
Warranty	1 year

TU5300sc / TU5400sc

Light Source	Class 2 laser product, with embedded 650 nm (EPA 0.43 mW) or Class 1 laser product, with embedded 850 nm (ISO), max. 0.55 mW (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 - 700 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 175 EBC ISO: 0 - 1000 NTU / FNU / TE/F / FTU 0 - 100 mg/L 0 - 250 EBC
Accuracy	±2% or 0.01 NTU from 0 - 40 NTU ±10% of reading from 40 - 1000 NTU based on Formazin primary standard
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC
Repeatability	Better than 1% of reading or ±0.002 NTU (TU5300) or ±0.0006 NTU (TU5400) on Formazin at 25 °C (77 °F), whichever is greater
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC
Signal Average Time	TU5300sc: 30 - 90 seconds TU5400sc: 1 - 90 seconds
Response Time	TU5300sc: T90 <45 seconds at 100 mL/min TU5400sc: T90 <30 seconds at 100 mL/min
Sample Temperature	2 - 60 °C (35 - 140 °F)
Sample Pressure	6 bar (87 psi) maximum, compared to air at sample temperature range from 2 - 40 °C (35.6 - 104 °F)
Sample Flow Rate	100 - 1000 mL/min; optimal flow rate: 200 - 500 mL/min
Operating Temperature Range	0 - 50 °C (32 - 122 °F)
Operating Humidity	Relative humidity: 5 - 95% at different temperatures, non-condensing
Storage Conditions	-40 - 60 °C (-40 - 140 °F)
Enclosure Rating	Electronic compartment IP55; all other functional units IP65 with process head/ACM attached to the TU5300sc/TU5400sc instrument
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Australian ACMA Marking
Dimensions (H x W x D)	249 mm x 268 mm x 190 mm
Weight	5.95 lbs. (2.7 kg); 11 lbs. (5.0 kg) with all accessories
Warranty	1 year

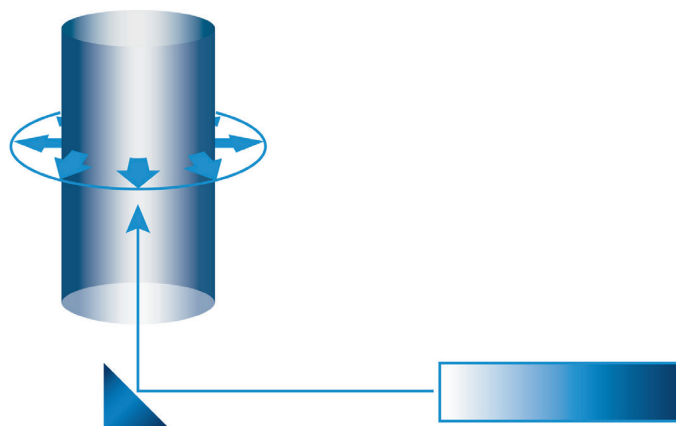
*Subject to change without notice.

Principle of Operation

The TU5 Series turbidimeters measure turbidity by directing a laser into a sample to scatter off suspended particles. The light that is scattered at a 90° angle from the incident beam is reflected through a conical mirror in a 360° ring around the sample before it is captured by a detector.

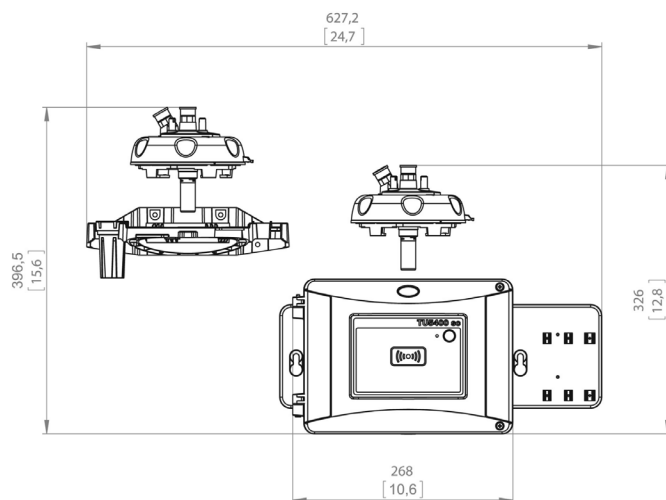
The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

The 360° x 90° optics of the TU5 series were optimized for high accuracy at low turbidity ranges and therefore the TU5 does not include ratio technology. Ratio technology is only applicable for high turbidity applications which have interference from color and large particles.

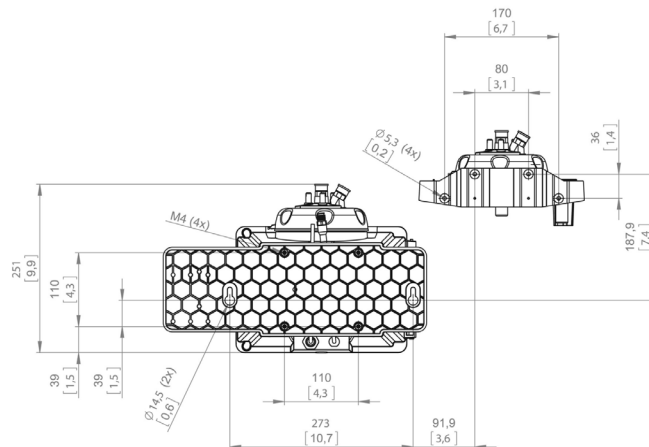


Dimensions

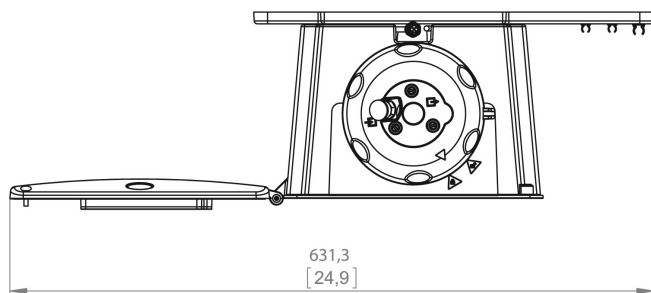
TU5300sc and TU5400sc front view



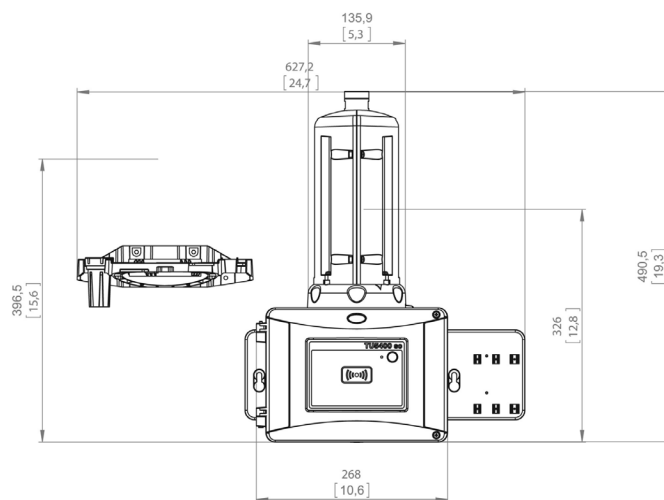
TU5300sc and TU5400sc rear view



TU5300sc and TU5400sc top view



TU5300sc and TU5400sc with automatic cleaning module



Order Information

TU5200 Benchtop Laser Turbidimeters

LPV442.99.03012	TU5200 Benchtop Laser Turbidimeter with RFID, EPA Version
LPV442.99.01012	TU5200 Benchtop Laser Turbidimeter without RFID, EPA Version
LPV442.99.03022	TU5200 Benchtop Laser Turbidimeter with RFID, ISO Version
LPV442.99.01022	TU5200 Benchtop Laser Turbidimeter without RFID, ISO Version

TU5300sc/TU5400sc Online Laser Turbidimeters

LXV445.99.10112	TU5300sc Low Range Laser Turbidimeter, EPA Version
LXV445.99.10212	TU5400sc Ultra-High Precision Low Range Laser Turbidimeter, EPA Version
LXV445.99.53112	TU5300sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version
LXV445.99.53212	TU5400sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version

Please note: Other turbidimeter configurations are available and RFID may not be available in all areas. Please contact your local Hach representative.

Please note: An SC controller is required for operation of the TU5300sc or TU5400sc.

Calibration and Verification

LZY835	Stabcal® Calibration Set with RFID
LZY898	Stabcal® Calibration Set without RFID
LZY901	Glass Rod Secondary Turbidity Standard <0.1 NTU/FNU
LZY834	Replacement Vial for TU5300sc and TU5400sc
LZV946	Sample Vials for TU5200

TU5 Series Accessories

LQV159.97.00002	Automatic Cleaning Module for TU5300sc and TU5400sc
LQV160.99.00002	Flow Sensor for TU5300sc and TU5400sc
LZY876	Desiccant Cartridge for TU5300sc and TU5400sc
LZY907.97.00002	Maintenance Kit for TU5300sc and TU5400sc
LQV157.99.50002	SIP10 Sipper Unit for TU5200
LZY903	Manual Vial Wiper for TU5200, TU5300sc, and TU5400sc



With Hach Service, you have a global partner who understands your needs and cares about delivering timely, high-quality service you can trust. Our Service Team brings unique expertise to help you maximise instrument uptime, ensure data integrity, maintain operational stability, and reduce compliance risk.

HACH COMPANY World Headquarters: Loveland, Colorado USA

United States: 800-227-4224 tel 970-669-2932 fax orders@hach.com
 Outside United States: 970-669-3050 tel 970-461-3939 fax int@hach.com
hach.com

Printed in U.S.A.

©Hach Company, 2019. All rights reserved.

In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.



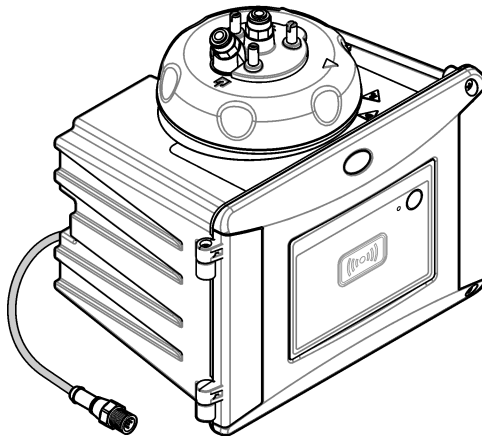


DOC343.52.90477

TU5300 sc/TU5400 sc

09/2019, Edition 5

User Manual



Section 1 Specifications	3
Section 2 General information	4
2.1 Safety information	4
2.1.1 Use of hazard information	5
2.1.2 Precautionary labels	5
2.1.3 Class 1 laser product	6
2.1.4 RFID module	6
2.1.4.1 Safety information for RFID modules	6
2.1.4.2 FCC conformance for RFID	7
2.1.5 Certification	7
2.2 Product overview	8
2.3 Status indicator light	9
2.4 Product components	10
Section 3 Installation	11
3.1 Installation guidelines	11
3.2 Installation overview	11
3.3 Wall mount	13
3.3.1 Install with the wall mount bracket	13
3.3.2 Install directly on a wall	14
3.4 Install the desiccant cartridge	15
3.5 Replace the cleaning lid screws	17
3.6 Install the service bracket	17
3.7 Install the flow sensor (optional)	18
3.8 Install the automatic cleaning module (optional)	18
3.9 Connect to an SC controller	18
3.10 Plumbing	19
3.10.1 Plumb the instrument	19
3.10.2 Set the flow rate	22
Section 4 User navigation	22
Section 5 Operation	22
5.1 Configure the instrument	22
5.2 Show instrument information	23
5.3 Compare process and laboratory measurements	24
5.3.1 Collect a grab sample	24
5.3.2 Compare measurements with RFID	24
5.3.3 Compare measurements with Link2SC	25
5.3.3.1 Configure the Link2SC settings	26
Section 6 Calibration	27
6.1 Configure the calibration settings	27
6.2 Calibrate with a syringe	28
6.2.1 Make 4000-NTU Formazin stock solution	31
6.2.2 Prepare Formazin standards	31
6.3 1-point calibration without verification	32
6.3.1 Troubleshooting	33
6.3.1.1 Status indicator light	33

Table of Contents

6.3.2 Prevent vial contamination	33
6.4 Calibrate with vials without RFID	34
6.4.1 Make 4000-NTU Formazin stock solution	34
6.4.2 Prepare the standard vial(s)	34
6.4.2.1 Prepare Formazin standards	36
6.4.3 Calibration procedure—vials without RFID	36
Section 7 Verification	38
7.1 Configure the verification settings	38
7.2 Do a calibration verification with a syringe	39
7.3 Do a calibration verification with a sealed vial or glass rod	42
7.4 Show the calibration or verification history	43
Section 8 Maintenance	43
8.1 Maintenance schedule	44
8.2 Clean spills	44
8.3 Clean the instrument	44
8.4 Clean the vial	45
8.4.1 Do a chemical vial cleaning	45
8.5 Clean the vial compartment	47
8.6 Replace the vial	47
8.7 Replace the desiccant cartridge	50
8.8 Replace the tubing	50
Section 9 Troubleshooting	50
9.1 Reminders	50
9.2 Warnings	50
9.3 Errors	51
9.4 Fix water ingress	52
9.4.1 Setup after water ingress error	53
Section 10 Replacement parts and accessories	54

Section 1 Specifications

Specifications are subject to change without notice.

Specification	Details
Measurement method	Nephelometry with scattered light collected at a 90-degree angle to the incident light and 360 degrees around the sample vial
Primary compliance method	DIN EN ISO 7027
Enclosure	Material: ASA Luran S 777K / RAL7000, TPE RESIN Elastocon® STK40, Thermoplastic Elastomer TPS-SEBS (60 Shore) and stainless steel
IP rating	Electronic compartment IP55; process head/Automatic Cleaning Module attached to the instrument and all of the other functional units IP65 ¹
Dimensions (W x D x H)	268 x 249 x 190 mm (10.6 x 9.8 x 7.5 in.)
Weight	Instrument with the process head: 2.7 kg (6.0 lb); Instrument with the optional automatic cleaning module: 5.0 kg (11.0 lb)
Power requirements	12 VDC, 14 VA supplied by the SC controller
Protection class	III
Pollution degree	2
Installation category	II
Mounting	Indoor on a wall
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage temperature	–40 to 60 °C (–40 to 140 °F)
Humidity	5 to 95% relative humidity, non-condensing
Sensor cable length	TU5x00 sc without Automatic Cleaning Module or flow sensor: 50 m (164 ft); TU5x00 sc with Automatic Cleaning Module: 10 m (33 ft)
Laser	Class 1 laser product: Contains a non user-serviceable class 1 laser.
Optical light source	850 nm, maximum 0.55 mW
Fittings	Sample inlet and outlet: ¼-in. OD tubing (optional tubing adapter, ¼ in. to 6 mm)
Tubing requirements	Polyethylene, polyamide or polyurethane tubing. Calibrated ¼ in. OD, +0.03 or –0.1 mm (+0.001 or –0.004 in.)
Measurement units	TU5300 sc: NTU, FNU, TE/F, EBC or FTU; TU5400 sc: NTU, mNTU ² , FNU, mFNU, TE/F, EBC, FTU or mFTU.
Range	0 to 1000 NTU, FNU, TE/F and FTU; 0 to 250 EBC
Method detection limit	0.0001 FNU at 25 °C (77 °F)
Response time	T90 < 30 seconds at 100 mL/min
Signal averaging	TU5300 sc: 30–90 seconds TU5400 sc: 1–90 seconds
Accuracy	± 2% or ± 0.01 FNU (the larger value) from 0 to 40 FNU ± 10% of reading from 40 to 1000 FNU based on Formazin primary standard at 25 °C (77 °F)

¹ Water drops, puddles or runlets that will not damage the instrument may be in the inner of the enclosure.

² 1 mNTU = 0.001 NTU

Specification	Details
Linearity	Better than 1% for 0 to 40 NTU based on Formazin primary standard at 25 °C (77 °F).
Repeatability	TU5300 sc: 0.002 FNU or 1% (the larger value) at 25 °C (77 °F) (> 0.025 FNU range); TU5400 sc: 0.0006 FNU or 1% (the larger value) at 25 °C (77 °F) (> 0.025 FNU range)
Stray light	< 0.01 FNU
Resolution	0.0001 FNU (0.0001 to 0.9999/1.000 to 9.999/10.00 to 99.99/100.0 to 1000 FNU) Default: TU5300 sc: 0.001 FNU and TU5400 sc: 0.0001 FNU
Air bubble compensation	Physical, mathematical
Sample requirements	Temperature: 2 to 60 °C (35.6 to 140 °F) Conductivity: 3000 µS/cm maximum at 25 °C (77 °F) Flow rate ³ : 100 to 1000 mL/min; optimal flow rate: 200 to 500 mL/min Pressure: 6 bar (87 psi) maximum compared to air, 2 to 40 °C (35.6 to 104 °F) sample; 3 bar (43.5 psi) maximum compared to air, 40 to 60 °C (104 to 140 °F) sample
Calibration options	StablCal® or Formazin: 1-point calibration (20 FNU) for 0 to 40 FNU measurement range, 2-point calibration (20 and 600 FNU) for 0 to 1000 FNU (full) measurement range or 2- to 6-point custom calibration for a measurement range of 0 FNU to the highest calibration point.
Verification options	Glass verification rod (solid secondary standard) ≤ 0.1 NTU, StablCal or Formazin
Verification (RFID or Link2SC®)	Verification of the measurement value by comparison of the process and lab measurements with RFID or Link2SC.
Certifications	CE compliant; US FDA accession number: 1420492-xxx. This product complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50. Australian RCM.
Warranty	1 year (EU: 2 years)

Section 2 General information

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

2.1 Safety information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.








³ For the best results, operate the instrument at a flow rate of 200 mL/min when the maximum particle size is 20 µm. For larger particles (150 µm maximum), the best flow rate is 350 to 500 mL/min.

2.1.1 Use of hazard information



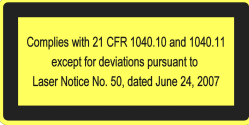
⚠ DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.
NOTICE
Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems. Return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol indicates the need for protective eye wear.
	This symbol indicates a laser device is used in the equipment.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates radio waves.

2.1.3 Class 1 laser product

⚠ DANGER	
	Personal injury hazard. Never remove covers from the instrument. This is a laser-based instrument and the user risks injury if exposed to the laser.
	Class 1 laser product, IEC60825-1:2014, 850 nm, maximum 0.55 mW Location: Rear of the instrument.
	Conforms to U.S. regulations 21 CFR 1040.10 and 1040.11 in accordance with Laser Notice No. 50. Location: Rear of the instrument.

This instrument is a Class 1 Laser product. There is invisible laser radiation when the instrument is defective and when the instrument lid is open. This product complies with EN 61010-1, "Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use" and with IEC/EN 60825-1, "Safety of Laser Products" and with 21 CFR 1040.10 in accordance with Laser Notice No. 50. Refer to the labels on the instrument that supply laser information.

2.1.4 RFID module



Instruments with the optional RFID module receive and transmit information and data. The RFID module operates with a frequency of 13.56 MHz.

RFID technology is a radio application. Radio applications are subject to national conditions of authorization. The use of instruments with the optional RFID module is currently permitted in the regions that follow:

EU (European Union) countries, EFTA (European Free Trade Association) countries, Turkey, Serbia, Macedonia, Australia, Canada, US, Chile, Ecuador, Venezuela, Mexico, Brazil, South Africa, India, Singapore, Argentina, Columbia, Peru and Panama

The use of instruments with the optional RFID module outside of the above-mentioned regions can violate national laws. The manufacturer reserves the right also to get authorization in other countries. In case of doubt, contact the manufacturer.

2.1.4.1 Safety information for RFID modules

⚠ WARNING	
	Multiple hazards. Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.
⚠ WARNING	
	Electromagnetic radiation hazard. Do not use the instrument in dangerous environments.
NOTICE	
This instrument is sensitive to electromagnetic and electromechanical interference. These interferences can have an effect on the analysis performance of this instrument. Do not put this instrument near equipment that can cause interference.	

Obey the safety information that follows to operate the instrument in accordance with local, regional and national requirements.

- Do not operate the instrument in hospitals and equivalent establishments or near medical equipment, such as pace makers or hearing aids.
- Do not operate the instrument near highly flammable substances, such as fuels, highly flammable chemicals and explosives.
- Do not operate the instrument near combustible gases, vapors or dust.
- Keep the instrument away from strong vibration or shock.
- The instrument can cause interference in immediate proximity to televisions, radios and computers.
- The warranty does not cover improper use or wear.

2.1.4.2 FCC conformance for RFID

This instrument may contain a registered radio frequency identification device (RFID). Refer to [Table 1](#) for the Federal Communications Commission (FCC) registration information.

Table 1 Registration information

Parameter	Value
FCC identification number (FCC ID)	YCB-ZBA987
IC	5879A-ZBA987
Frequency	13.56 MHz

2.1.5 Certification

⚠ CAUTION
This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Canadian Radio Interference-Causing Equipment Regulation, ICES-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

FCC Part 15, Class "A" Limits


Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

1. The equipment may not cause harmful interference.
2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

2.2 Product overview

⚠ DANGER	
	Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

The TU5300 sc and the TU5400 sc turbidimeters are used with an SC controller to measure low-range turbidity mostly in finished drinking water applications. Refer to [Figure 1](#).

The TU5300 sc and the TU5400 sc turbidimeters measure scattered light at an angle of 90° in a 360° radius around the axis of the incident light beam.

An optional RFID module and an automatic system check option are available⁴. The RFID module is shown in [Figure 1](#). The RFID module lets process and laboratory turbidity measurements be easily compared. A description of the automatic system check option is given in [Configure the instrument](#) on page 22.

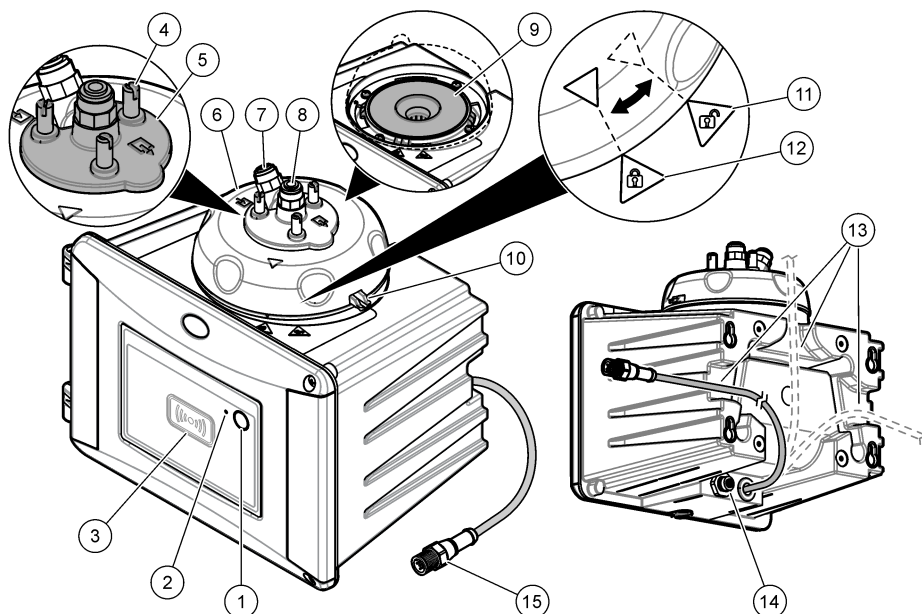
PROGNOSYS predictive diagnostic software is available for the TU5300 sc and TU5400 sc turbidimeters. To use PROGNOSYS, connect the turbidimeter to an SC controller with PROGNOSYS.

Videos on how to install, operate and do maintenance and troubleshooting on the TU5300 sc and the TU5400 sc turbidimeters are available on the *TU5 Series Turbidimeters* playlist at <http://www.youtube.com/user/hachcompany>.

The accessories are shown in [Installation overview](#) on page 11.

⁴ The RFID module and automatic system check option is only available at the time of purchase.

Figure 1 Product overview



1 Programmable button	9 Vial compartment
2 Status indicator light (refer to Status indicator light on page 9)	10 Overflow drain
3 RFID module indicator (optional)	11 Process head (open)
4 Cleaning lid screws (3x)	12 Process head (closed)
5 Cleaning lid	13 Channels for cables
6 Process head	14 Extension connector for accessories
7 Sample inlet	15 Sensor cable
8 Sample outlet	

2.3 Status indicator light

The status indicator light shows the instrument status. Refer to [Table 2](#) for status descriptions.

Note: The status indicator light is only on when the SC controller power is set to on and the sensor cable is connected to the sc controller.

Table 2 Status indicator light

Color	Status
Green (stable)	The instrument is in operation. The instrument status is ok—no warnings, errors or reminders.
Green (flashes)	Calibration is complete. The instrument status is ok.
	Verification is complete. The instrument status is ok.
Yellow (stable)	Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.

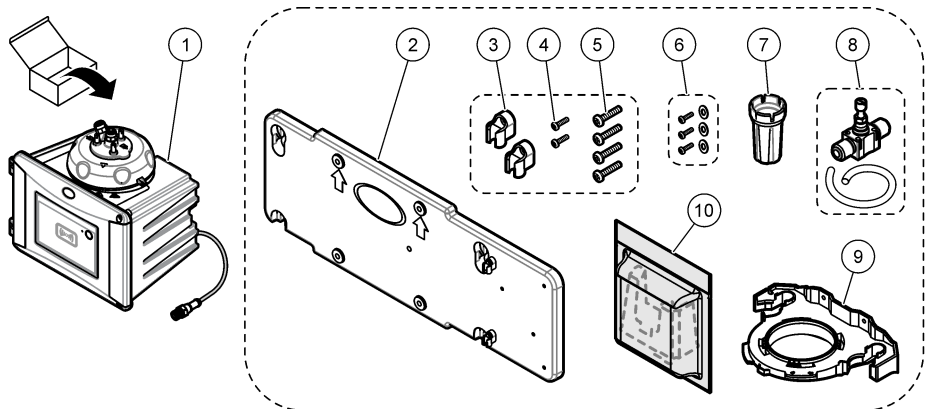
Table 2 Status indicator light (continued)

Color	Status
Yellow (flashes)	The instrument is in Service Mode.
	An automatic cleaning is in progress.
Yellow (flashes slow)	The optional flow sensor has identified that there is no sample flow or the sample flow is lower than the limit. Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.
Yellow (flashes fast)	The optional flow sensor has identified that the sample flow rate is higher than the limit. Read the warning that shows on the controller display. Refer to Warnings on page 50 for the warning description and solution.
Red (stable)	Read the error that shows on the controller display. Refer to Errors on page 51 for the error description and solution.
Red (flashes)	Calibration or verification was not completed.
	The instrument cannot start calibration or verification for one or more reason that follows. <ul style="list-style-type: none">• The standard expired.• The first measurement of the verification standard was done with a different method (EPA/ISO).• The first measurement value of the verification standard is missing.
Blue (stable)	A calibration or verification is started.
Blue (flashes)	A calibration or verification measurement is started.
Blue (flashes fast)	A calibration or verification is started with RFID.

2.4 Product components

Make sure that all components have been received. Refer to [Figure 2](#). If any items are missing or damaged, contact the manufacturer or a sales representative immediately.


Figure 2 Product components



1 TU5300 sc or TU5400 sc	6 Cleaning lid screws and washers for hot water applications
2 Wall mount bracket (two tubing clips on bracket)	7 Vial replacement tool
3 Tubing clips	8 Flow regulator
4 Tubing clip screws, 2.2 x 6 mm	9 Service bracket
5 Mounting screws, 4 x 16 mm	10 Desiccant cartridge

Section 3 Installation

⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

3.1 Installation guidelines

NOTICE

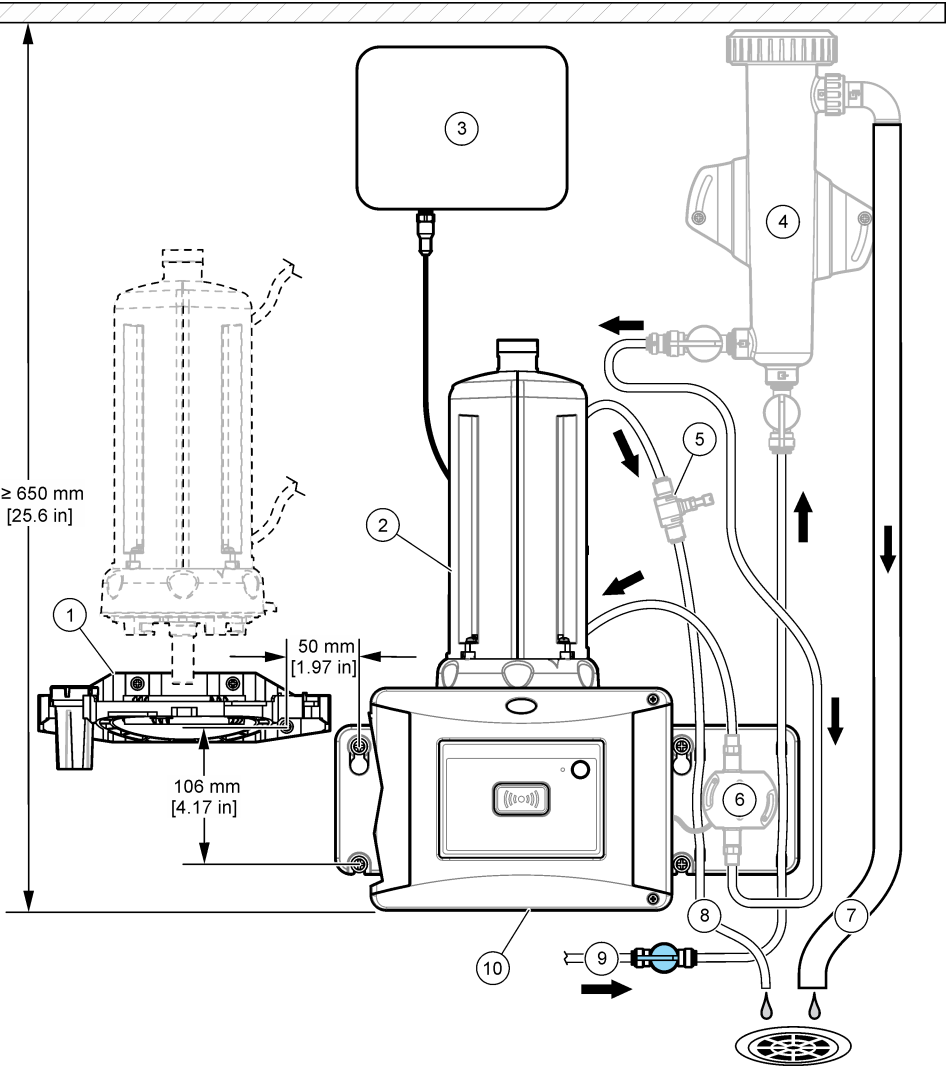
Make sure that there is a floor drain near the instrument. Examine the instrument daily for leaks.

This instrument is rated for an altitude of 3100 m (10,710 ft) maximum. Use of this instrument at an altitude higher than 3100 m can slightly increase the potential for the electrical insulation to break down, which can result in an electric shock hazard. The manufacturer recommends that users with concerns contact technical support.

3.2 Installation overview

Figure 3 shows the installation overview with all of the accessories and the clearances necessary.

Figure 3 Installation overview with accessories



⁵ Not used with the bubble trap.

3.3 Wall mount

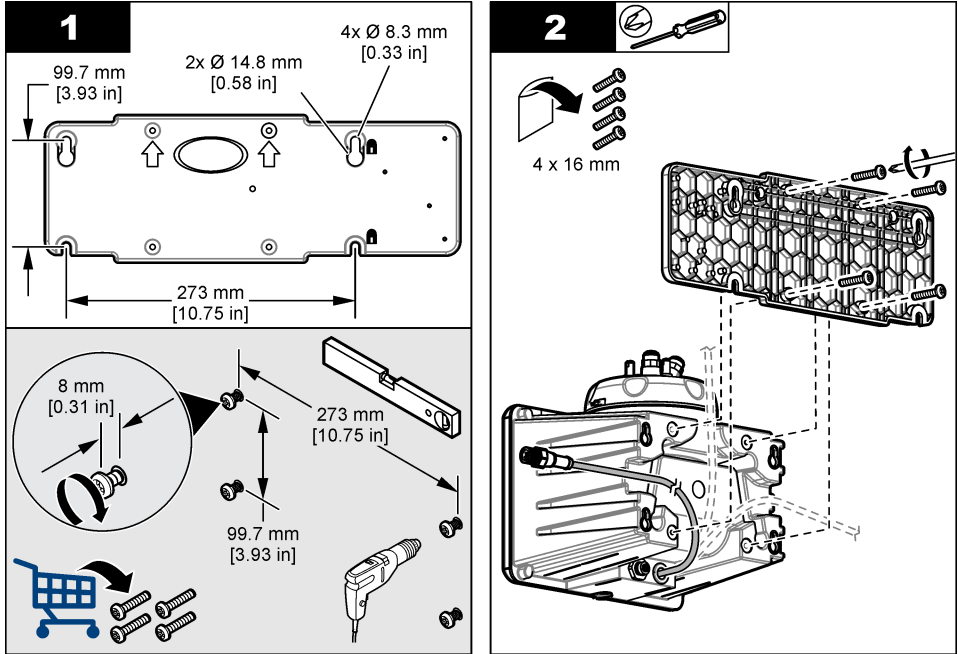
Install the instrument on a wall in a vertical position. Install the instrument so that it is level.

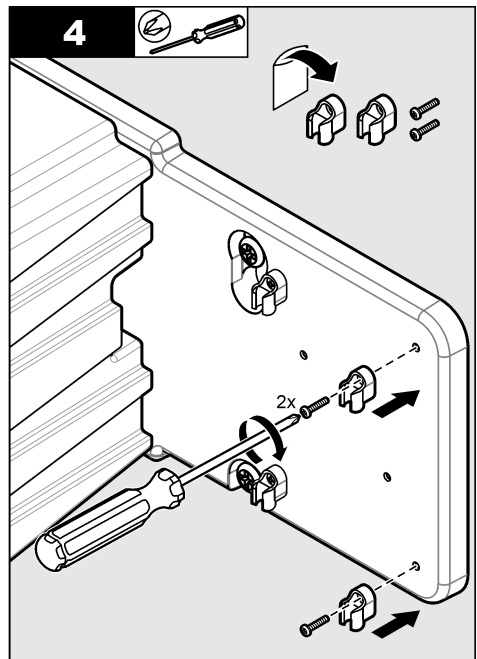
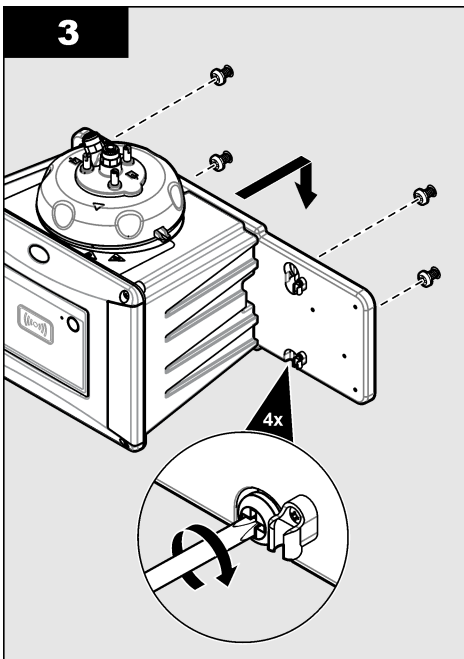
3.3.1 Install with the wall mount bracket

Refer to the illustrated steps that follow to install the instrument on a wall with the wall mount bracket. The mounting hardware to install the wall mount bracket on a wall is supplied by the user.

If a 1720D, 1720E, or FT660 instrument is replaced, remove the instrument from the wall. Then do steps 2 to 4 of the illustrated steps that follow to install the instrument on the existing hardware.

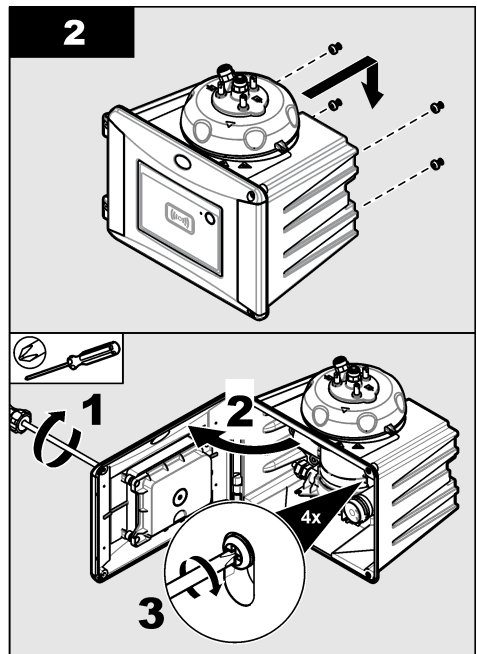
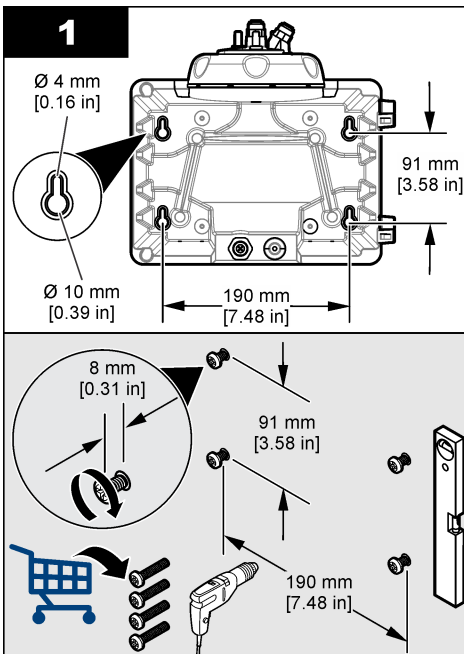
Note: When the accessories are used, the installation location of the tubing clips is different. Refer to the documentation supplied with the accessories for tubing clip installation.





3.3.2 Install directly on a wall

As an alternative, refer to the illustrated steps that follow to install the instrument directly on a wall. The mounting hardware is supplied by the user. Remove the thin, plastic film from the mounting holes on the back of the instrument.



3.4 Install the desiccant cartridge

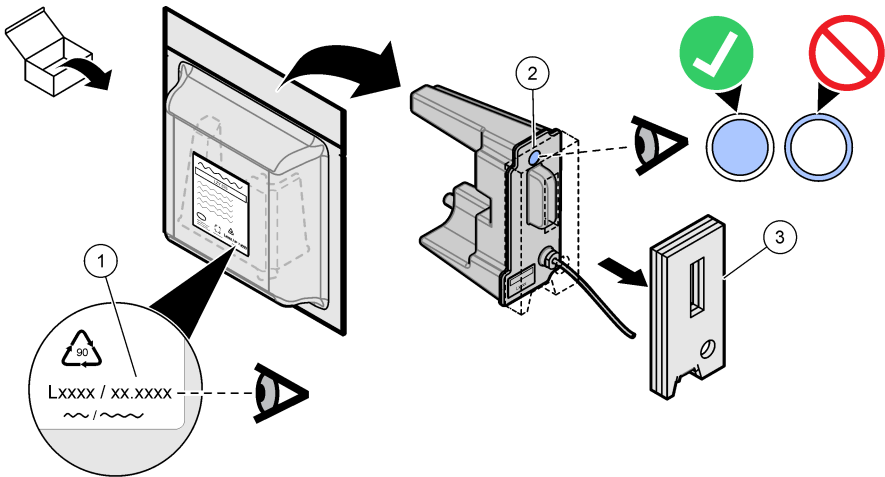
NOTICE

Make sure that the desiccant cartridge is installed or damage to the instrument will occur.

For initial installation, complete the steps below. For replacement, refer to the documentation supplied with the desiccant cartridge.

1. Look at the install by date on the packaging. Refer to [Figure 4](#). Do not use if the current date is past the install by date.
2. Make sure that the indicator on the new desiccant cartridge is light blue. Refer to [Figure 4](#).
3. Install the new desiccant cartridge. Refer to the illustrated steps that follow.

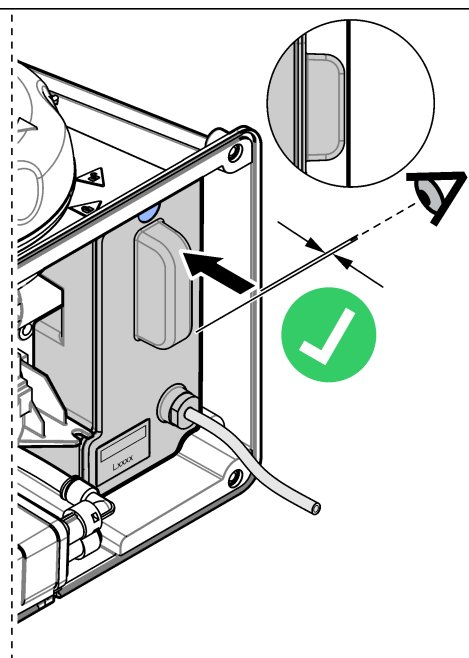
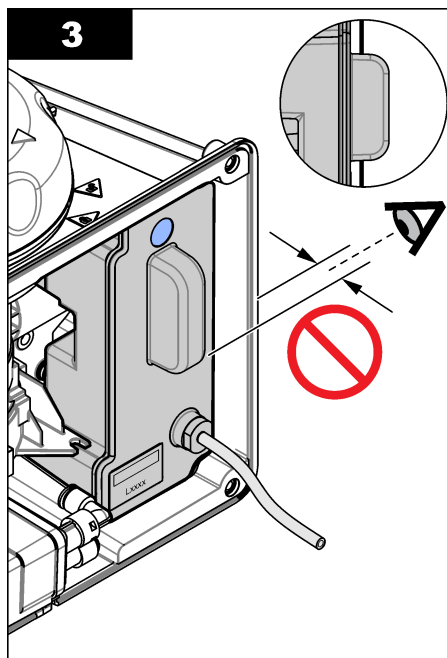
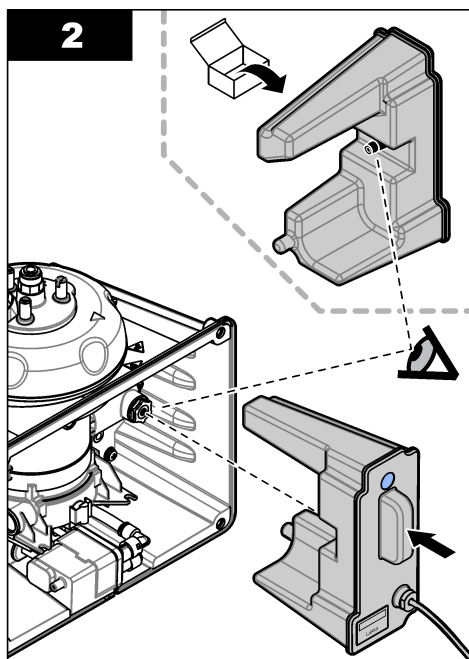
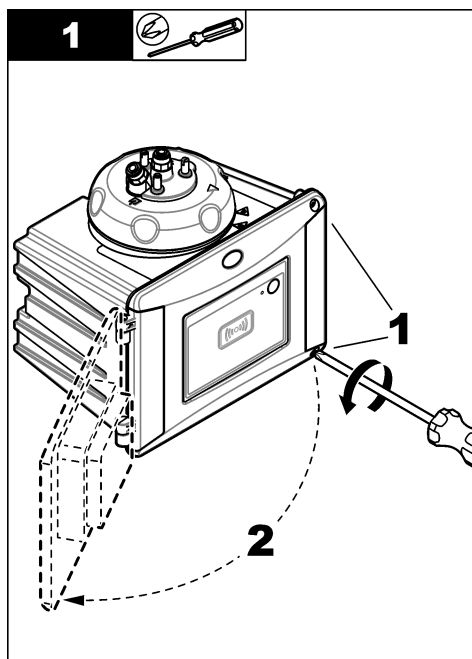
Figure 4 Examine the desiccant cartridge

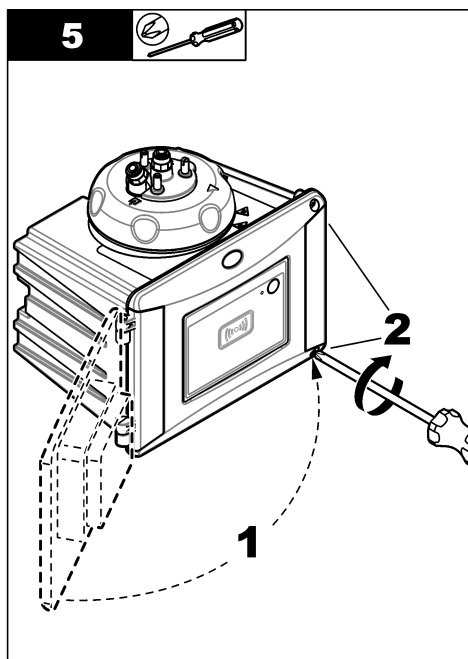
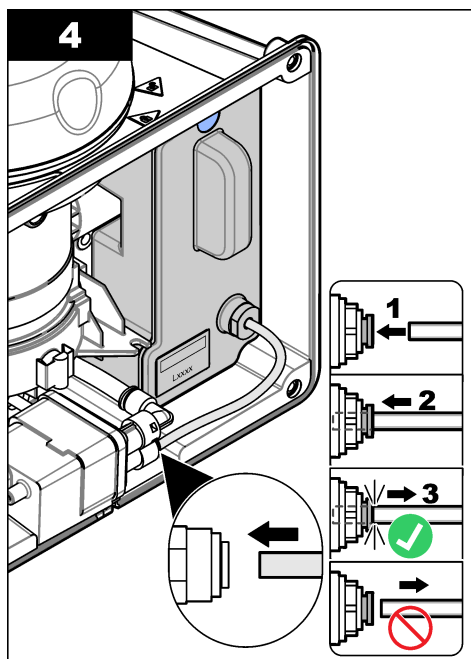


1 Install by date (mm.yyyy = month and year)

2 Indicator (light blue = not expired, white = expired)

3 Transport safety protection





3.5 Replace the cleaning lid screws

NOTICE

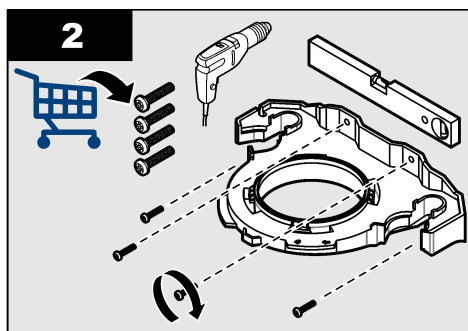
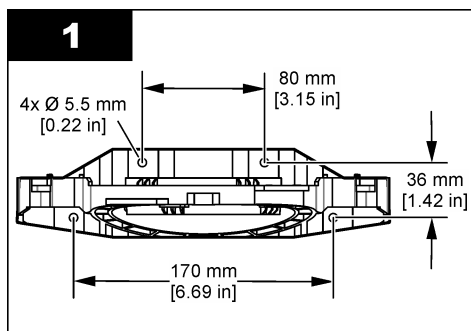
Do not overtighten the screws or breakage will occur. Hand tighten the screws.

If the sample temperature is 40 to 60 °C (104 to 140 °F), the cleaning lid screws will become hot. To prevent burns, replace the standard cleaning lid screws with the cleaning lid screws and washers for hot water. Refer to [Figure 1](#) on page 9 for the location of the cleaning lid screws.

3.6 Install the service bracket

The service bracket holds the process head (or the optional automatic cleaning module) when it is not installed on the instrument.

Refer to [Installation overview](#) on page 11 to install the service bracket the correct distance from the instrument. Refer to the illustrated steps that follow to install the service bracket.



3.7 Install the flow sensor (optional)


The optional flow sensor identifies if the sample flow is within specifications. A warning shows on the controller display and the status indicator light when a no flow, low flow or high flow warning occurs.

Install the optional flow sensor. Refer to the documentation supplied with the optional flow sensor.

3.8 Install the automatic cleaning module (optional)

The automatic cleaning module cleans the inside of the process vial at a selected time interval. Install the optional automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module.

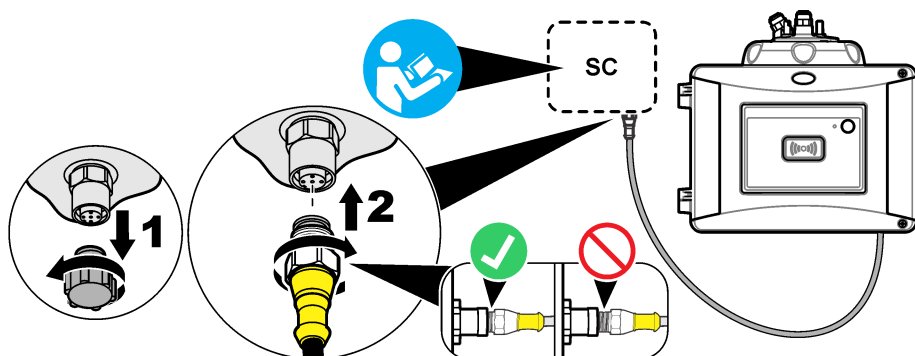
3.9 Connect to an SC controller

⚠ CAUTION	
	Personal injury hazard. Do not look into the vial compartment when the instrument is connected to power.



1. Get the latest software version from www.hach.com. Install the latest software version on the SC controller before the instrument is connected to the SC controller.
Refer to the software installation instructions supplied in the box or supplied in the software download for the SC controller.
2. Remove power to the SC controller.
3. Connect the sensor cable to the quick-connect fitting of the SC controller. Refer to [Figure 5](#). Keep the connector cap for later use.
4. Supply power to the SC controller.
The SC controller looks for the instrument.
5. When the SC controller finds the instrument, push **enter**.
On the main screen, the controller shows the turbidity value measured by the turbidimeter.

Figure 5 Connect the sensor cable to the SC controller



3.10 Plumbing

3.10.1 Plumb the instrument

⚠ WARNING



Explosion hazard. Make sure that the drain tube is free of all obstructions. If the drain tube has a blockage or is pinched or bent, high pressure can build up in the instrument.

⚠ WARNING



Personal injury hazard. The sample line contains water under high water pressure that can burn skin if hot. Qualified personnel must remove the water pressure and wear personal protective equipment during this procedure.

NOTICE

Do not let water get in the vial compartment or instrument damage will occur. Before the process head is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the vial nut is tight. The full water pressure should be on the system, the water flow is on and no water leak on the glass vial is seen.

NOTICE

Hold the automatic cleaning module vertically when it is installed on the instrument or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Before the instrument is plumbed, make sure that the desiccant cartridge and vial are installed.

NOTICE

Based on the environmental conditions, is necessary to wait a minimum of 15 minutes to let the system become stable.

Items supplied by the user:

- Flow shutoff valve

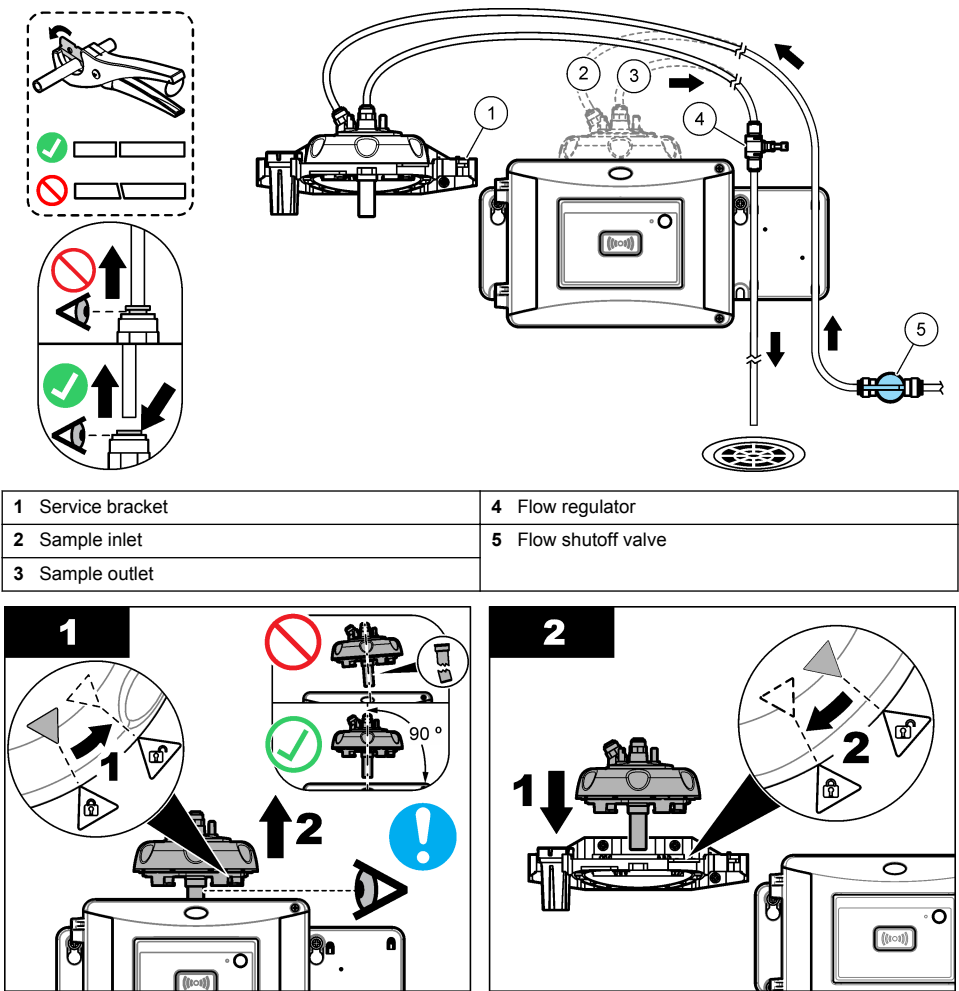
- Tubing⁶
- Tubing cutter

1. Plumb the instrument. Refer to the illustrated steps that follow and [Figure 6](#).

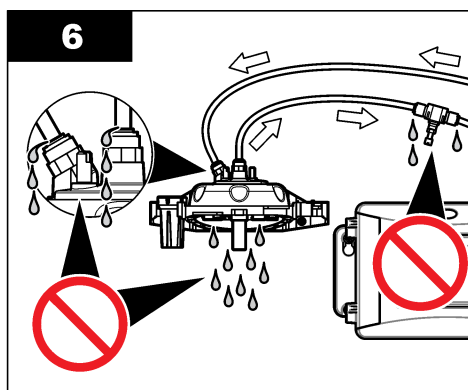
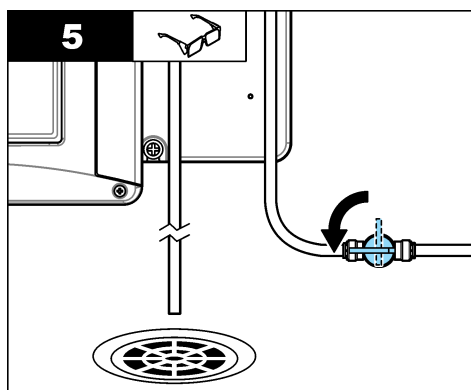
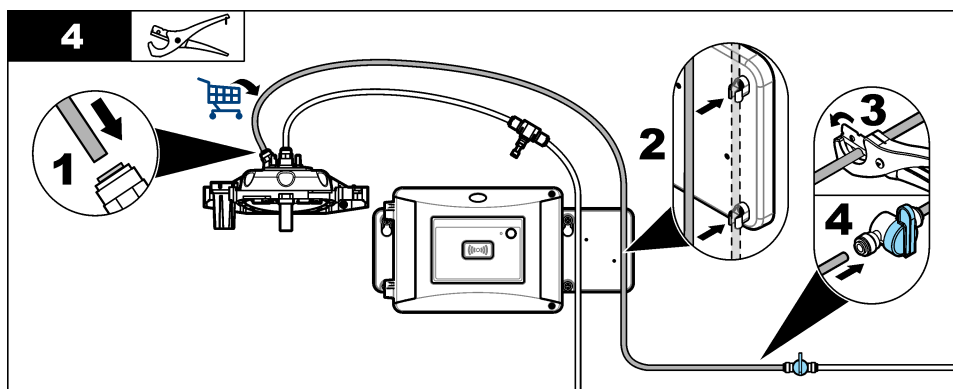
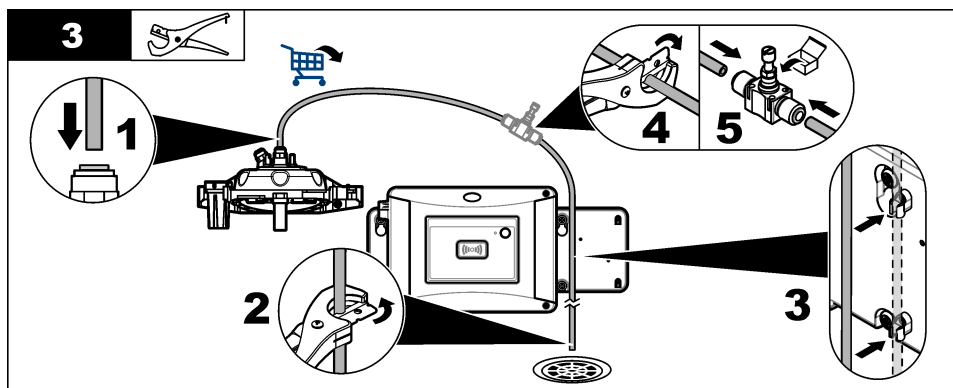
Note: To plumb the instrument with accessories, refer to the documentation supplied with the accessories.

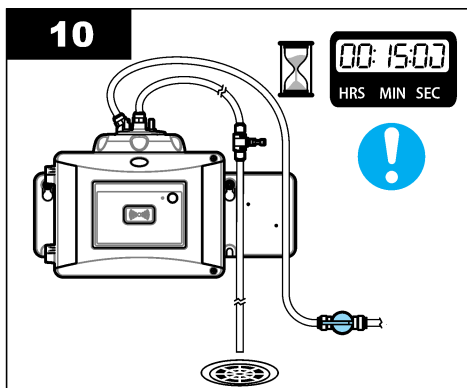
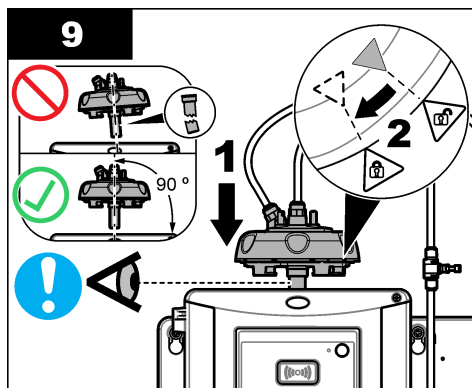
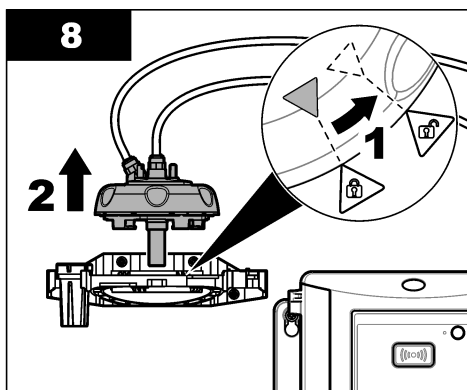
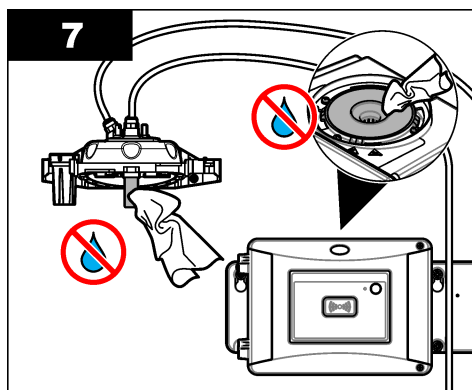
Note: Use the opaque tubing accessory supplied from HACH accessory to prevent the bacteria growth.

Figure 6 Plumbing overview – no accessories



⁶ Refer to [Specifications](#) on page 3 for the tubing requirements.





3.10.2 Set the flow rate

1. Measure the flow with the flow regulator fully open. Make sure that the flow is in the middle of the flow specification. Refer to [Specifications](#) on page 3.
2. Slowly close the flow regulator until the flow decreases by 20 to 30%.
Note: The flow regulator causes back pressure in the tubing and decreases the quantity of bubbles that can form in the vial.

Section 4 User navigation

Refer to the controller documentation for keypad description and navigation information.

Push the **RIGHT** arrow key on the controller multiple times to show more information on the home screen and to show a graphical display.

Section 5 Operation

5.1 Configure the instrument

Select the location name, signal averaging, measurement units, resolution, bubble reject, logger interval, programmable button function and more.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>CONFIGURE**.
3. Select an option.

Option	Description
LOCATION	Sets the name or location of the sample source. The name or location entered shows on the measurement screen (16 characters maximum, default: serial number).
SIGNAL AVG	When enabled, the turbidity reading that shows on the controller display is an average of the values measured during the time interval selected. TU5300 sc options: 30–90 seconds; TU5400 sc options: 1–90 seconds (default: 30 seconds). Note: <i>The manufacturer recommends that the Signal Average setting be set to 30 seconds or less because of the fast response of the instrument.</i>
MEAS UNITS	Selects the measurement units that show on the controller display and that are recorded to the data log. TU5300 sc options: NTU, FNU, TE/F, EBC or FTU. TU5400 sc options: NTU, mNTU, FNU, mFNU, TE/F, EBC, FTU or mFTU. Default: FNU for TU5300 sc or mFNU for TU5400 sc.
RESOLUTION	Selects the number of decimal places that show on the controller display. Options: 0.001 or 0.0001. TU5300 sc default: 0.001. TU5400 sc default: 0.0001.
BUBBLE REJECT	Sets the bubble reject to on (default) or off. When set to on, high turbidity readings caused by bubbles in the sample are not shown or saved to the data log.
LOGGER INTERVAL	Sets the frequency that the turbidity reading is saved to the data log. Options: 5 or 30 seconds or 1, 2, 5, 10 (default), 15 or 30 minutes.
CLEANING	Configures the optional automatic cleaning module settings. Refer to the documentation supplied with the automatic cleaning module to configure the CLEANING setting. This option only shows when CLEANING MODULE is set to ON.
SET DEFAULTS	Sets the instrument settings to the factory defaults.
BUTTON FUNCTION	Sets the function of the programmable button. Refer to Figure 1 on page 9. SERVICE —When the button is pushed, changes the output mode to HOLD if the output mode is currently ACTIVE and changes the output mode to ACTIVE if the output mode is currently HOLD. LINK2SC —When the button is pushed, makes a Link2SC job file. Refer to Compare measurements with Link2SC on page 25. OFF (default)—Disables the button. In addition, when CLEANING MODULE is set to ON, the options that follow show. START WIPE —When the button is pushed, start a wiper cleaning cycle. WIPER REPLACE —When the button is pushed, puts the wiper in the position for wiper replacement.
FLOW SENSOR	Enables or disables the flow signal to show on the measurement screen and the DIAG/TEST>SIGNALS screen. Enables or disables flow signal warnings and errors to occur. When the optional flow sensor is installed, set to ON (default: OFF).
CLEANING MODULE	Enables or disables the automatic cleaning module menu options. When the optional automatic cleaning module is installed, set to ON (default: OFF). When this option is set to ON, the START WIPE option shows in the main SENSOR SETUP menu.
AUTO-CHECK	Sets the time interval and sensitivity of the automatic system check. This option only shows when the instrument has the automatic system check option. CHECK INTERVAL —Sets the time interval between automatic system checks. The automatic system check examines the condition of the vial. If the condition of the vial is bad, a warning message shows on the controller display. Options: OFF, 1, 2 (default), 3, 6, 12 hours or 1 day. SENSITIVITY —Sets the sensitivity of the automatic system check to the condition of the vial. Options: HIGH or LOW (default).

5.2 Show instrument information

Show instrument information and the instrument status to get diagnostic information.

1. Push **menu**.
2. Select SENSOR SETUP>TU5x00 sc>DIAG/TEST.

3. Select an option.

Option	Description
SENSOR INFO	Shows the sensor name, location, serial number, type (EPA or ISO), model number, software version and measurement device version.
SIGNALS	Shows real-time values for turbidity, flow rate ⁷ , the humidity set point and the air system humidity and temperature. Shows the vial condition (condensation and clarity) and the vial status (installed or not installed). Shows the lid type installed (calibration lid or process head).
COUNTERS	Shows the total operational time of the instrument, remaining number of wiper cycles, date the vial was installed/replaced, date the vial was cleaned, date of calibration, date of verification, operational time of the desiccant, remaining desiccant life, operational time of the air pump and date factory service was done. Note: <i>The counters are reset when menu-guided maintenance is done. Refer to the MAINTENANCE option that follows.</i>
MAINTENANCE	Starts menu-guided maintenance to replace or clean the vial, replace the wiper or replace the desiccant cartridge. START WIPE —Starts a wiper cleaning when the optional automatic cleaning module is installed. OUTPUT MODE —Selects the output behaviour during maintenance (default: HOLD). FACTORY SERVICE —For service use only.

5.3 Compare process and laboratory measurements

Compare process and laboratory measurements with RFID or Link2SC. Make sure that the process and lab instrument are calibrated with the same number of calibration points and with the same standards. Make sure that the calibrations are not expired.

5.3.1 Collect a grab sample

Collect a 100-mL sample (minimum) from the sample outlet tubing of the process instrument. Collect the sample in a clean glass bottle with a tight-fitting cap. Do not collect samples directly into a sample vial.

1. Rinse the glass bottle a minimum of three times with water from the sample outlet tubing of the process instrument. Let the bottle overflow with the sample.
2. Collect a 100-mL sample (minimum) in the glass bottle from the sample outlet tubing of the process instrument.
3. Put the cap on the sample bottle.
4. Analyze the grab sample immediately with the laboratory instrument to prevent settling, bacteria growth and temperature changes.

5.3.2 Compare measurements with RFID

When the process instrument and laboratory instrument have the optional RFID module, compare process and laboratory measurements with RFID.

Items to collect:

- TU5300 sc or TU5400 sc with the optional RFID module
 - TU5200 with the optional RFID module
 - TU5200 sample vials
 - Glass sample bottle with a sample RFID sticker
 - Operator RFID tag (optional)
1. At the process instrument, put the operator RFID tag (if available) near the RFID module. Refer to [Figure 1](#) on page 9 for the location of the RFID module.
 2. Put a sample RFID sticker on the sample bottle.
 3. Collect a grab sample. Refer to [Collect a grab sample](#) on page 24.

⁷ A value less than 0.1 shows if the optional flow sensor is not installed.

4. At the process instrument, put the RFID sticker that is on the sample bottle near the RFID module.
The instrument gives a sound signal. The status indicator light changes to blue.
The turbidity reading, operator ID (if available), location of the process instrument and the date and time are recorded on the RFID sticker.
5. Move the grab sample bottle to the laboratory instrument.
6. On the TU5200, push **Options>Reading Setup**.
7. Push **Bubble Reject**, then set bubble reject to on.
8. If the grab sample is 1 NTU or less, push **Reading>Minimum Mode**, then select 60 seconds.
Note: In minimum mode, readings are done continuously for 60 seconds when a measurement is done. The smallest reading within 60 seconds is saved to the data log.
9. At the laboratory instrument, put the operator RFID tag (if available) near the RFID module to log in.
10. Put the RFID sticker that is on the sample bottle near the RFID module.
The instrument gives a sound signal. The turbidity reading from the process instrument shows on the display.
11. Prepare a grab sample vial. Refer to *Prepare a sample vial* in the TU5200 documentation.
12. Measure the turbidity of the grab sample with the laboratory instrument. Refer to the TU5200 documentation.
If the difference between the process and laboratory measurements is not more than the selected acceptance range, "Measurement values match." shows on the display. Refer to the TU5200 documentation to select the acceptance range.
If "Measurement values do not match." shows on the display, click the link to show the troubleshooting steps.
13. To show the compare log, push **Options>Compare Log**. Refer to the TU5200 documentation for more options.
14. To send the verification data to external devices that are connected to the instrument, push **Options>Send Data**. Refer to the TU5200 documentation for more options.

5.3.3 Compare measurements with Link2SC

When the process instrument and laboratory instrument do not have the optional RFID module, compare the process and laboratory measurements with Link2SC.

Items to collect:

- TU5300 sc or TU5400 sc
 - TU5200
 - TU5200 sample vials
 - SD card⁸ (or a LAN connection at the SC controller⁹ and the laboratory instrument¹⁰)
 - USB adapter for the SD card (if used)
1. Collect a grab sample. Refer to [Collect a grab sample](#) on page 24.
 2. If the SC controller and laboratory instrument do not have a LAN connection, install the SD card in the SC controller. Refer to the SC controller documentation to install the SD card.
 3. At the SC controller, make a Link2SC job file as follows:
 - a. Push **menu**.
 - b. Select **LINK2SC>CREATE A NEW JOB>TU5x00 sc**.
The SC controller makes a Link2SC job file. The turbidity reading, operator ID (if available), location of the process instrument and the date and time are recorded to the job file.

⁸ Refer to the SC controller documentation for the SD card requirements.

⁹ Refer to the SC controller documentation to set up a LAN connection at the SC controller.

¹⁰ Refer to the TU5200 documentation to set up a LAN connection at the laboratory instrument.

In addition, the temperature, calibration settings, bubble reject setting, vial clarity and desiccant cartridge life are recorded to the Link2SC job file.

4. Push **OK**, then **YES**.
5. Select **JOB>LAB**.
The Link2SC job file is saved to the SD card (if available) or sent to the laboratory instrument (when the SC controller and laboratory instrument have a LAN connection).
To see the Link2SC job files on the SD card, select **JOBS FROM CARD**.
6. If the SC controller and laboratory instrument do not have a LAN connection, complete the steps that follow.
 - a. Remove the SD card from the SC controller.
 - b. At the laboratory instrument, put the SD card in the USB adapter. Then put the USB adapter in a USB port type A on the laboratory instrument.
7. Move the grab sample bottle to the laboratory instrument.
8. On the TU5200, push **Options>Reading Setup**.
9. Push **Bubble Reject**, then set bubble reject to on.
10. If the grab sample is 1 NTU or less, push **Reading>Minimum Mode**, then select 60 seconds.
Note: In minimum mode, readings are done continuously for 60 seconds when a measurement is done. The smallest reading within 60 seconds is saved to the data log.
11. At the laboratory instrument, push the **LINK2SC** to show the job list.
12. Select the latest Link2SC job file.
The turbidity measurement from the process instrument shows on the right side of the display.
13. Prepare a grab sample vial. Refer to *Prepare a sample vial* in the TU5200 documentation.
14. Measure the turbidity of the grab sample with the laboratory instrument. Refer to the TU5200 documentation.
If the difference between the process and laboratory measurements is not more than the selected acceptance range, "Measurement values match." shows on the display. Refer to to select the acceptance range.
If "Measurement values do not match." shows on the display, click the link to show the troubleshooting steps.
15. To show the compare log, push **Options>Compare Log**. Refer to the TU5200 documentation for more options.
16. To send the verification data to external devices that are connected to the instrument, push **Options>Send Data**. Refer to the TU5200 documentation for more options.

5.3.3.1 Configure the Link2SC settings

Select the acceptance range permitted when process and laboratory measurements are compared with Link2SC.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>LINK2SC**.
3. Select an option.

Option	Description
ACCEPT. UNIT	Sets the units used to compare the process and laboratory measurements. Options: %, NTU or LAB. Select LAB when the acceptance range is supplied by the laboratory instrument.
ACCEPT. RANGE	Sets the maximum difference permitted between the process and laboratory measurements. Options: 1 to 50% (default: 10%). This option only shows when ACCEPT. UNIT is set to % or NTU.

Section 6 Calibration

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

The instrument is factory calibrated and the laser light source is stable. The manufacturer recommends that a calibration verification be done periodically to make sure that the system operates as intended. The manufacturer recommends calibration as local regulations require and after repairs or comprehensive maintenance work.

Use the optional calibration lid and a vial(s) with a StablCal standard or Formazin standard to calibrate the instrument. Refer to the Calibration lid documentation for more calibration procedures with and without RFID vials, 1-point and 2-point calibrations. As an alternative, use a syringe and StablCal standard or Formazin standard to calibrate the instrument.

6.1 Configure the calibration settings

Select the calibration curve, calibration interval, output behavior during calibration and more.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>CALIBRATION>SETUP**.
3. Select an option.

Option	Description
MENU GUIDED	Sets menu-guided calibration to SEALED VIAL, SYRINGE or OFF (default). Calibration instructions show on the controller display ¹¹ during calibration when set to SEALED VIAL or SYRINGE. Note: The MENU GUIDED option does not show when sealed vials with RFID are used.
CAL CURVE¹²	Selects the type of standard and the calibration curve (range). STABLCAL 0–40 FNU (default)—1-point calibration (20 FNU) with StablCal. STABLCAL 0–1000 FNU —2-point calibration (20 FNU and 600 FNU) with StablCal. FORMAZIN 0–40 FNU —2-point calibration (20 FNU and dilution water) with Formazin. FORMAZIN 0–1000 FNU —3-point calibration (20 FNU and 600 FNU and dilution water) with Formazin. CUSTOM —2- to 6-point calibration (0.02 to 1000 FNU) with StablCal or Formazin. The user selects the number of calibration points and the value of each calibration point.
VER AFTER CAL	Sets the instrument to start a verification immediately after the instrument is calibrated. When set to on, the verification standard is measured immediately after a calibration is done. Default: ON. Refer to Configure the verification settings on page 38.
CAL REMINDER	Sets the time interval between calibrations. The controller will show a reminder when a calibration is due. When a calibration is done, the calibration time is set to zero. Options: OFF(default), 1 day, 7 days, 30 days or 90 days.



¹¹ Or the Claros user interface for Claros controllers without a display.

¹² Select the correct setting for the calibration with StablCal vials with RFID procedure. Refer to the applicable section of this manual.

Option	Description
OUTPUT MODE	Selects the output behavior during calibration. ACTIVE —The outputs continues to give the measurement values during calibration. HOLD (default)—Keeps the outputs at the last measurement value before calibration. The outputs give the measurement values again when the calibration procedure is complete. SET TRANSFER —Sets the outputs to the SET TRANSFER value selected in the controller settings. Refer to the controller setting for more information.
CAL POINTS	When the CAL CURVE setting is set to CUSTOM, this option sets the number of calibration points (2 to 6). This option only shows when the CAL CURVE setting is set to CUSTOM.
OFFSET	Enables the offset function when set to on (default: OFF). When enabled, the selected offset value is added to each reading. To enter an offset value, set to ON then push back to exit the SETUP menu. Select SET OFFSET and enter an offset value (default: 0.0).
FACTOR¹³	Enables the factor function when set to on (default: OFF). When enabled, the selected factor value is used as a slope to the turbidity reading. To enter a factor value, set to ON then push back to exit the SETUP menu. Select SET FACTOR and enter a factor value (default: 1.0).
SET FACT CAL	Sets the calibration settings to the factory defaults.

6.2 Calibrate with a syringe

Pre-requisite: Configure the calibration settings. Refer to [Configure the calibration settings](#) on page 27.

⚠ WARNING	
	 <p>Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.</p>

Items to collect:

- StablCal standard or prepared Formazin standard at the same ambient temperature as the sensor
- Calibration syringe and tubing

To prepare a Formazin standard(s), refer to [Prepare Formazin standards](#) on page 31. To make 4000-NTU Formazin stock solution, refer to [Make 4000-NTU Formazin stock solution](#) on page 31.

1. Push **menu**.
2. Select SENSOR SETUP>TU5x00 sc>CALIBRATION>SETUP>MENU GUIDED>SYRINGE.
3. Select SENSOR SETUP>TU5x00 sc>CALIBRATION>START.

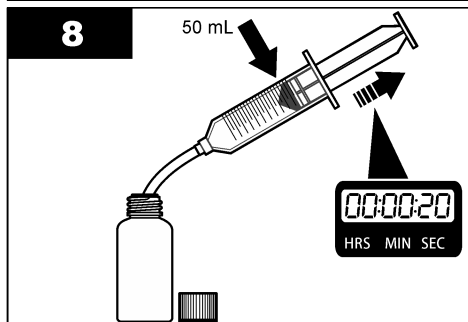
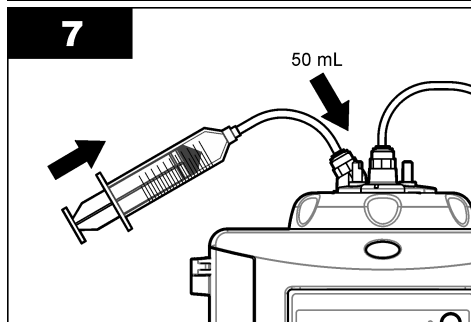
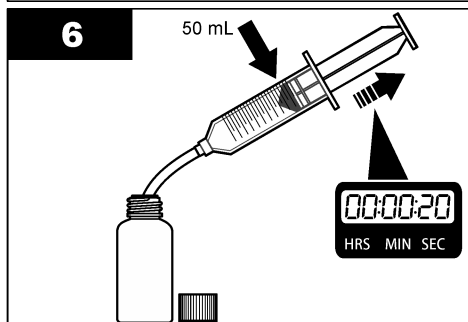
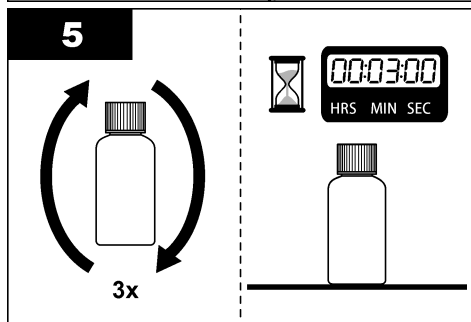
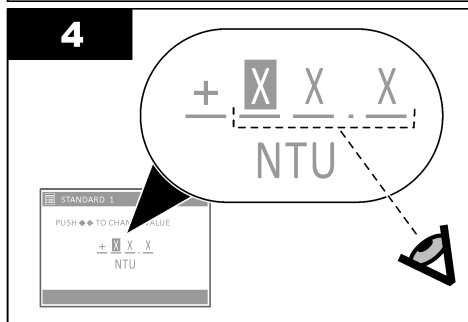
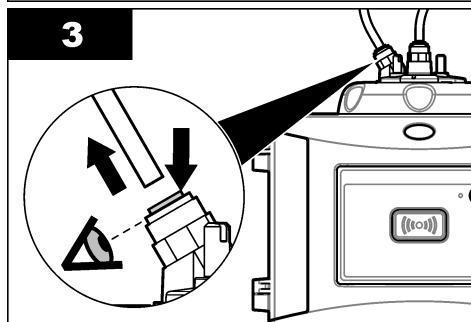
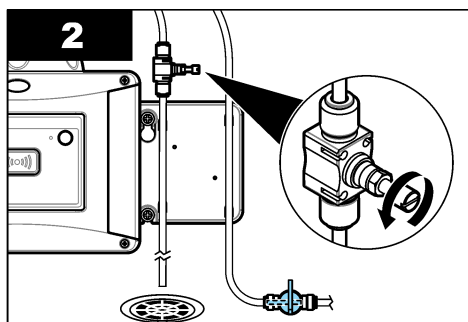
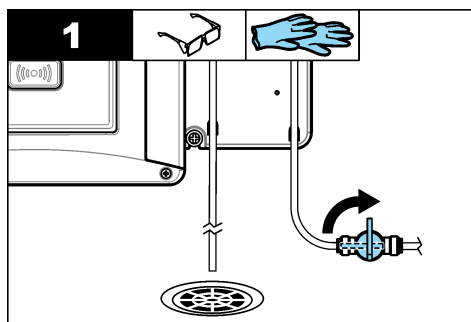
4. Complete the steps shown on the display.

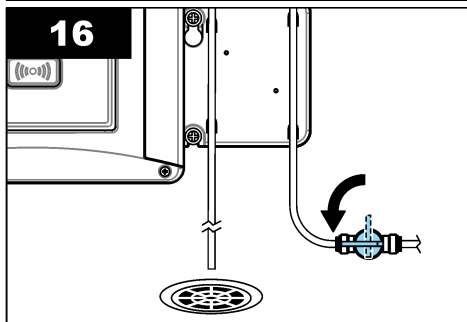
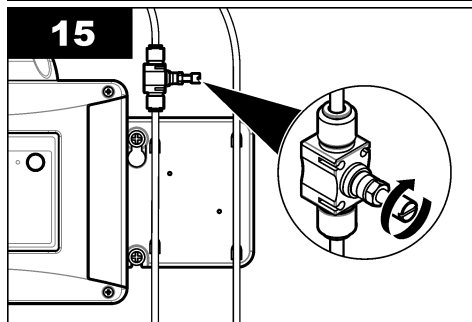
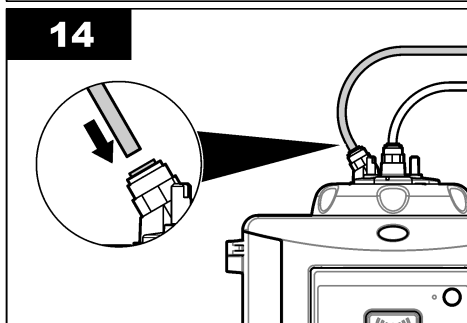
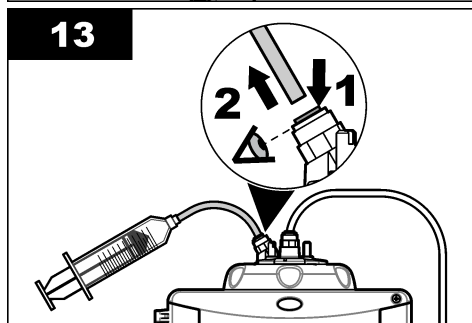
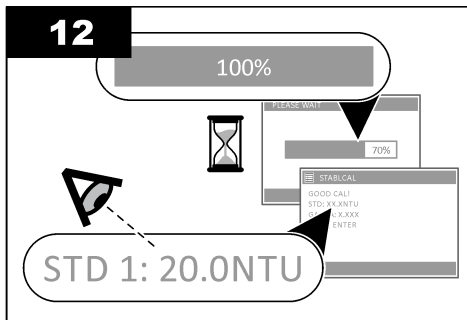
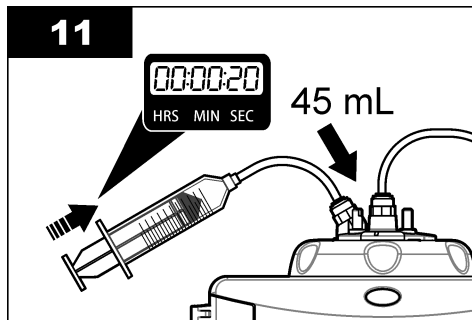
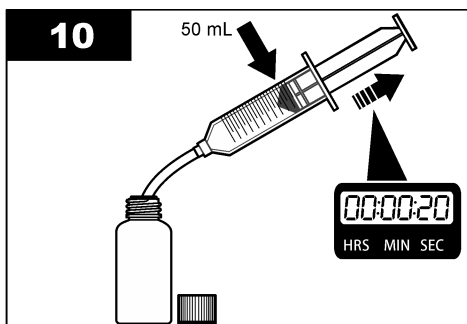
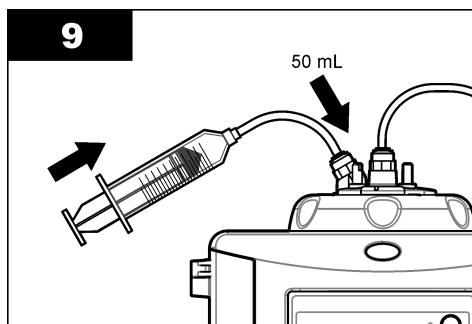
Refer to the illustrated steps that follow to complete the steps shown on the display.

At illustrated step 4, enter the measured turbidity value of the standard. If the standard value that shows on the display is correct, push confirm. The status indicator light changes to blue.

At illustrated step 15, fully open the flow regulator. Then slowly close the flow regulator until the flow decreases by 20 to 30%.

¹³ This option is only available on ISO models of the instrument. This option only shows when the CAL CURVE setting is set to STABLCAL or FORMAZIN.





6.2.1 Make 4000-NTU Formazin stock solution

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Note: The manufacturer recommends that Formazin stock solution is not made from raw materials. Preparation of Formazin stock solution is temperature and technique sensitive. Use Hach Formazin stock solution to get the best instrument performance and analytical standard accuracy.

1. Dissolve 5.000 grams of reagent grade hydrazine sulfate ($(\text{NH}_2)_2\text{--H}_2\text{SO}_4$) in about 400 mL of demineralized water.
2. Dissolve 50.000 grams of reagent grade hexamethylenetetramine in approximately 400 mL of demineralized water.
3. Quantitatively, pour the two solutions in a 1-liter volumetric flask, and dilute to volume with demineralized water. Mix fully.
4. Let the solution stand for 48 hours at $25 \pm 1^\circ\text{C}$ ($77 \pm 1^\circ\text{F}$).

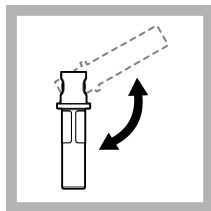
6.2.2 Prepare Formazin standards

Prepare Formazin standards immediately before a calibration and discard after use.

1. Prepare a 20 NTU Formazin standard as follows:
 - a. Use a pipet to add 5.0 mL of 4000 NTU Formazin standard solution in a 1-L volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.
2. When the sample turbidity range is 40 to 700 NTU¹⁴, prepare a 600 NTU Formazin standard as follows:
 - a. Use a pipet to add 15.0 mL of 4000 NTU Formazin standard solution in a 100-mL volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.

¹⁴ 1 mNTU = 0.001 NTU

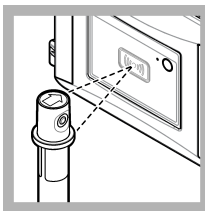
6.3 1-point calibration without verification



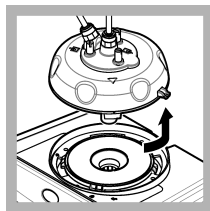
1. Invert the 20 NTU StablCal vial for 2 to 3 minutes. Refer to the documentation supplied with the StablCal vials.



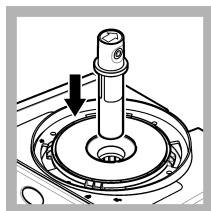
2. Clean and dry the vial with a no-lint cloth. Refer to [Prevent vial contamination](#) on page 33.



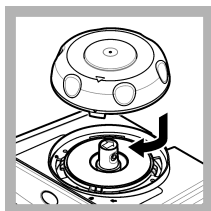
3. Put the 20 NTU vial in front of the RFID module. A beep sound is heard and the status indicator light flashes blue. If the status indicator light does not flash blue refer to [Troubleshooting](#) on page 33. The instrument records the value, the lot number, the expiration date and the Certificate of Analysis information from the RFID vial to the data log.



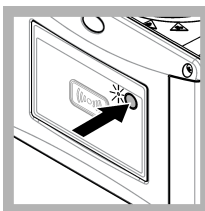
4. Remove the process head (or the automatic cleaning module).



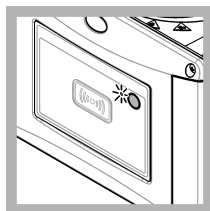
5. Put the 20 NTU vial in the vial compartment.



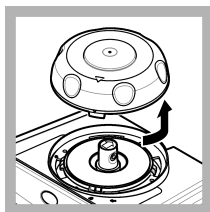
6. Install the calibration lid. Make sure that the calibration lid is in the closed position.



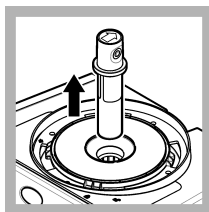
7. Push the button on the front of the instrument.



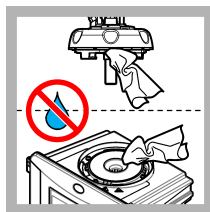
8. Wait 30 to 60 seconds for the measurement to complete. The status indicator light slowly flashes blue during the measurement.



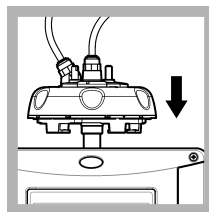
9. When the status indicator light flashes green, remove the calibration lid.



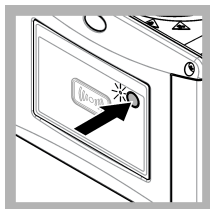
10. Remove the vial.



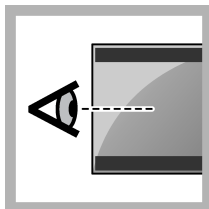
11. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



12. Hold the process head (or automatic cleaning module) vertically when it is installed on the instrument or the vial can break.



13. Push the button on the front of the instrument to save the calibration value. The status indicator light stays green.



14. Examine the calibration data on the controller menu or the Claros user interface.

6.3.1 Troubleshooting

6.3.1.1 Status indicator light

Problem	Possible cause	Solution
The status indicator light does not change.	RFID communication failure	Make sure that the TU5x00 has an RFID reader.
		Make sure that the StablCal vial is an RFID cuvette.
		The RFID tag of the cuvette is defective.
The status indicator light flashes red.	The calibration setting is not correct.	Make sure that the calibration setting is configured with STABL CAL.
	The cuvette has expired.	Use a new cuvette.

6.3.2 Prevent vial contamination

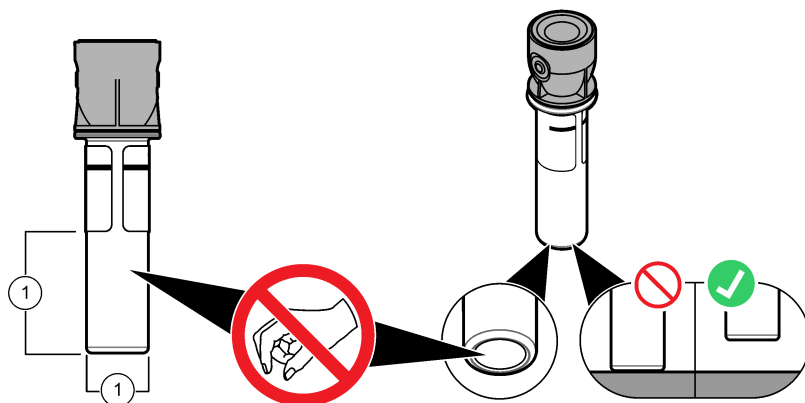
NOTICE

Do not touch or scratch the glass of the sample vial. Contamination or scratches on the glass can cause measurement errors.

The glass must stay clean and have no scratches. Use a no-lint cloth to remove dirt, fingerprints or particles from the glass. Replace the sample vial when the glass has scratches.

Refer to [Figure 7](#) to identify where not to touch the sample vial. Always keep the sample vials in the vial stand to prevent contamination on the bottom of the vial.

Figure 7 Sample vial overview



1 Measurement surface—Do not touch.

6.4 Calibrate with vials without RFID

6.4.1 Make 4000-NTU Formazin stock solution

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Note: The manufacturer recommends that Formazin stock solution is not made from raw materials. Preparation of Formazin stock solution is temperature and technique sensitive. Use Hach Formazin stock solution to get the best instrument performance and analytical standard accuracy.

1. Dissolve 5.000 grams of reagent grade hydrazine sulfate ($(\text{NH}_2)_2\text{H}_2\text{SO}_4$) in about 400 mL of demineralized water.
2. Dissolve 50.000 grams of reagent grade hexamethylenetetramine in approximately 400 mL of demineralized water.
3. Quantitatively, pour the two solutions in a 1-liter volumetric flask, and dilute to volume with demineralized water. Mix fully.
4. Let the solution stand for 48 hours at $25 \pm 1^\circ\text{C}$ ($77 \pm 1^\circ\text{F}$).

6.4.2 Prepare the standard vial(s)

⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

NOTICE

Always put a cap on the sample vial to prevent spills in the vial compartment.

To use sealed vials for calibration, immediately go to [Calibration procedure—vials without RFID](#) on page 36. To use unsealed vials for calibration, prepare the standard vial(s) as follows:

- For formazin calibration, prepare the formazin standards with 4000-NTU formazin stock solution. Refer to [Prepare Formazin standards](#) on page 31.

Note: To make 4000-NTU formazin stock solution, refer to [Make 4000-NTU Formazin stock solution](#) on page 31.

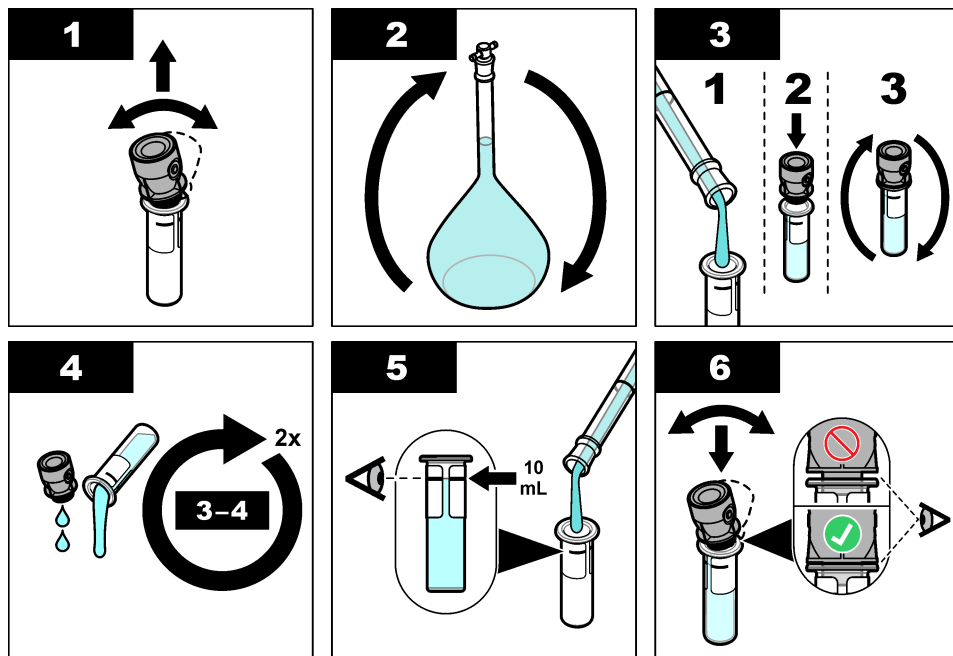
- Prepare the standard vial(s). Refer to the illustrated steps that follow.

- FORMAZIN 0–40 NTU (or 0–40 FNU) calibration**—Two vials: formazin 20 NTU and dilution water¹⁵ used to prepare the formazin standard.
- FORMAZIN 0–700 NTU (or 0–1000 FNU) calibration**—Three vials: formazin 20 NTU, formazin 600 NTU and the dilution water¹⁵ used to prepare the formazin standards
- STABLCAL 0–40 NTU (or 0–40 FNU) calibration**—One vial: StablCal 20 NTU
- STABLCAL 0–700 NTU (or 0–1000 FNU) calibration**—Two vials: StablCal 20 NTU and StablCal 600 NTU

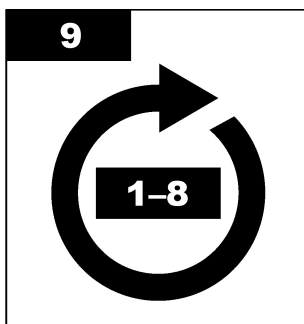
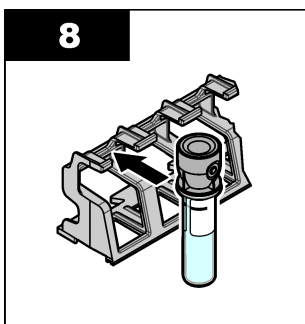
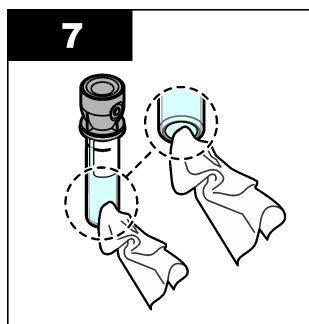
Make sure that the standard is at the same ambient temperature as the sensor.

If there is contamination in the sample vial after it is rinsed with the sample, clean the sample vial. Refer to the TU5200 documentation for vial cleaning instructions.

If calibration with verification is used, make sure to measure the verification standard with the menu item **Define Std Val**. Refer to [Configure the verification settings](#) on page 38.



¹⁵ Make sure that the vial contains dilution water for a minimum of 12 hours before the procedure.



6.4.2.1 Prepare Formazin standards

Prepare Formazin standards immediately before a calibration and discard after use.

1. Prepare a 20 NTU Formazin standard as follows:
 - a. Use a pipet to add 5.0 mL of 4000 NTU Formazin standard solution in a 1-L volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.
2. When the sample turbidity range is 40 to 700 NTU¹⁶, prepare a 600 NTU Formazin standard as follows:
 - a. Use a pipet to add 15.0 mL of 4000 NTU Formazin standard solution in a 100-mL volumetric flask.
 - b. Dilute to the mark with deionized water or distilled water with a turbidity of less than 0.5 NTU. Put in the stopper and mix well.

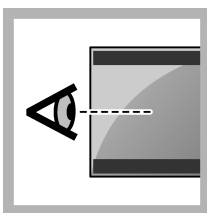
6.4.3 Calibration procedure—vials without RFID



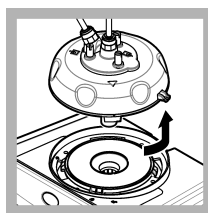
1. Push **menu**. Select
SENSOR SETUP>
TU5x00 sc>
CALIBRATION>
SETUP> MENU
GUIDED> SEALED
VIAL.



2. Select SENSOR
SETUP> TU5x00 sc>
CALIBRATION>
START.
The status indicator
light changes to blue.



3. Follow the
instructions on the
controller display.



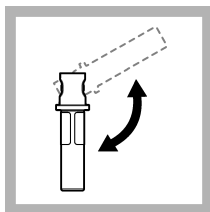
4. Remove the process
head (or the automatic
cleaning module).

¹⁶ 1 mNTU = 0.001 NTU



5. Enter the value of the vial and push ENTER.

The status indicator light changes to blue.

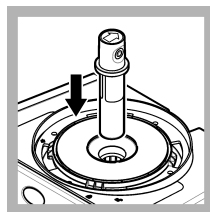


6. Carefully invert the vial a minimum of three times.

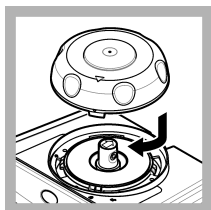
For StablCal vials, invert the 20 NTU StablCal vial for 2 to 3 minutes. Refer to the documentation supplied with the StablCal vials.



7. Clean and dry the vial with a no-lint cloth. Refer to [Prevent vial contamination](#) on page 33.



8. Put the vial in the vial compartment.

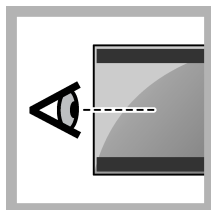


9. Install the calibration lid. Make sure that the calibration lid is in the closed position.

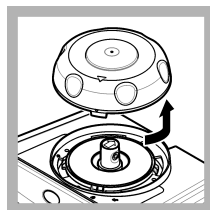


10. If the standard value that shows on the display is not correct, enter the accurate turbidity value of the standard from the certificate of analysis.

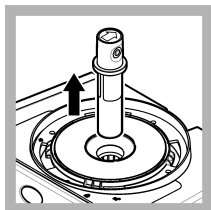
If the standard value that shows on the display is correct, push **enter**.



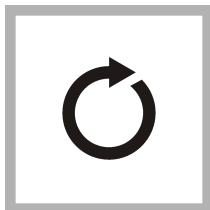
11. Complete the steps that show on the controller display.



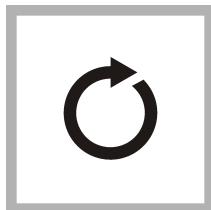
12. When the status indicator light changes to green, remove the calibration lid.



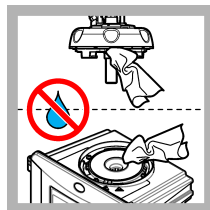
13. Remove the vial.



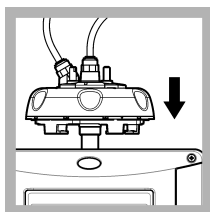
14. Do steps 4 to 12 again until all of the standard vials are measured.



15. If the value of the verification standard shows on the display, do steps 6 to 12 again to measure the verification standard.



16. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



17. Install the process head (or the automatic cleaning module).



18. Push ENTER to save the calibration value. The status indicator light stays green.

Section 7 Verification

Use the optional calibration lid and a sealed-vial 10-NTU StablCal standard (or a StablCal 10 NTU standard and a syringe) to do a primary calibration verification. As an alternative, use the optional calibration lid and the optional glass verification rod (< 0.1 NTU) to do a secondary calibration verification in the lower range of turbidity.

7.1 Configure the verification settings

Measure the value of the verification standard. Set the acceptance range and measurement units for verification. Set the verification reminder and type of menu guided verification. Set the output behavior during verification.

1. Push **menu**.
2. Select **SENSOR SETUP>VERIFICATION>SETUP**.
3. Select an option.

Option	Description
MENU GUIDED	Sets menu-guided verification to SEALED VIAL , SYRINGE or OFF (default). Verification instructions show on the controller display during verification when set to SEALED VIAL or SYRINGE . Select SEALED VIAL for verification with the glass verification rod.
DEFINE STD VAL	Measures the verification standard for later use during the verification. The instrument records the results to the data log. For the best results, measure the verification standard immediately after calibration.
ACCEPT. UNIT	Sets the acceptance range for verification to a percentage (1 to 99%) or an NTU value (0.015 to 100.00 NTU). Options: % or NTU (or mNTU).
ACCEPT. RANGE	Sets the maximum difference permitted between the recorded value of the verification standard and the measured value of the verification standard during verification. Options: 1 to 99% or 0.015 to 100.00 NTU.
VERIF REMINDER	Sets the time interval between calibration verifications. The display will show a reminder when a verification is due. Options: OFF (default), 1 day, 7 days, 30 days or 90 days. When a verification is done, the verification time is set to zero.
OUTPUT MODE	Sets the output behavior during verification. ACTIVE -The outputs continues to agree with the operating conditions. HOLD (default)-Keeps the outputs at the last known value when communication is lost. SET TRANSFER -Sets the outputs to the Set Transfer value selected in the controller settings.

7.2 Do a calibration verification with a syringe

Pre-requisite: Configure the verification settings. Refer to [Configure the verification settings](#) on page 38.

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

Items to collect:

- StablCal 10 NTU standard at the same ambient temperature as the sensor
- Calibration syringe and tubing

1. Push **menu**.

2. Select SENSOR SETUP>TU5x00 sc>VERIFICATION>SETUP>MENU GUIDED>SYRINGE.

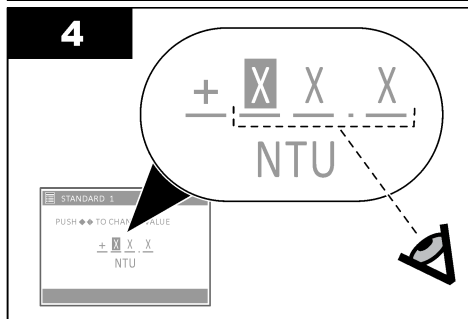
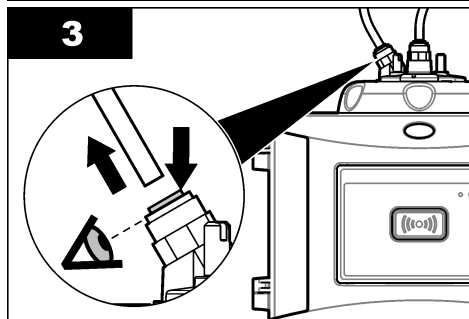
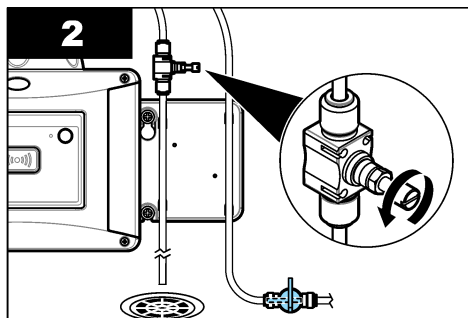
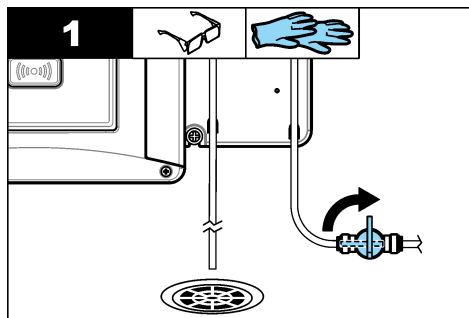
3. Select SENSOR SETUP>TU5x00 sc>VERIFICATION>START.

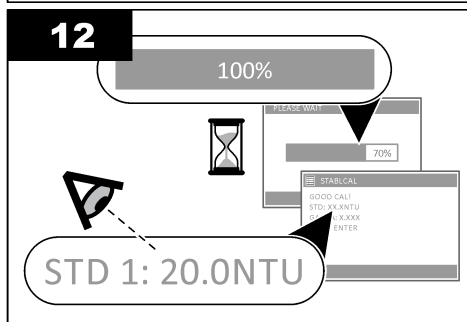
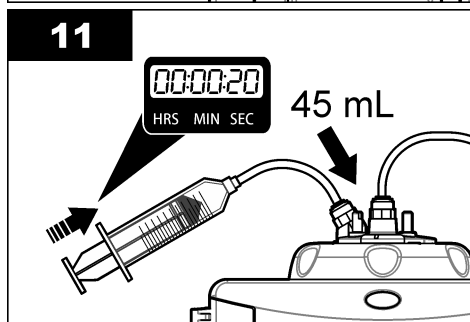
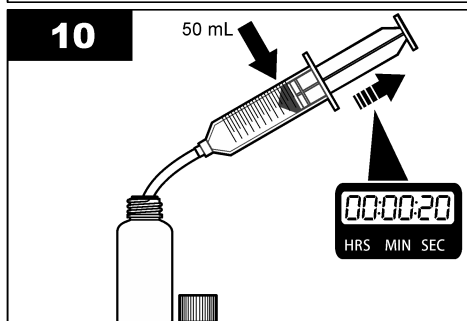
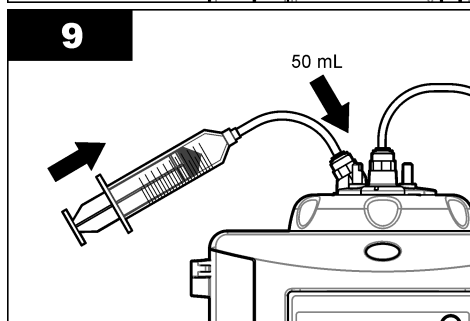
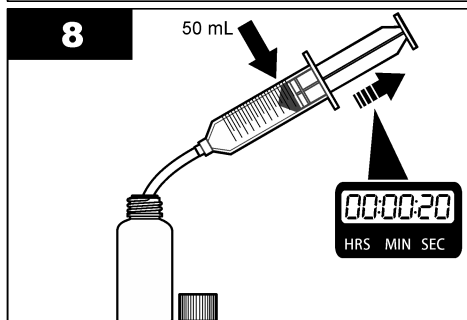
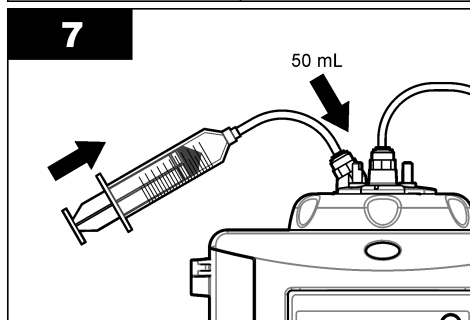
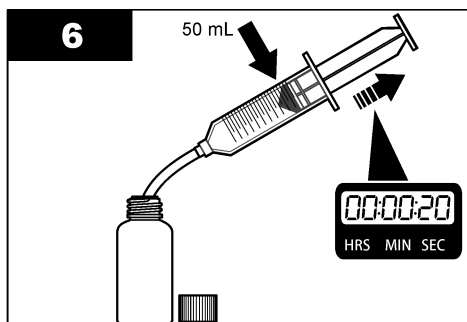
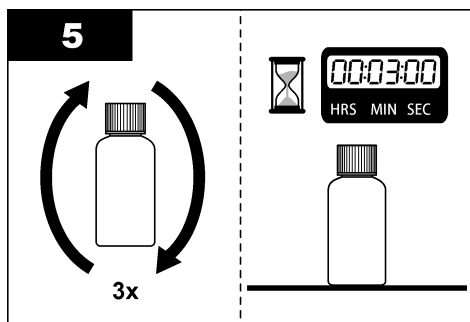
4. Complete the steps shown on the display.

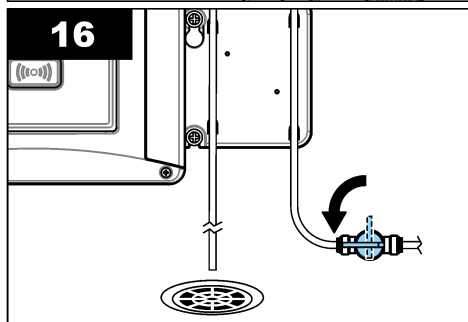
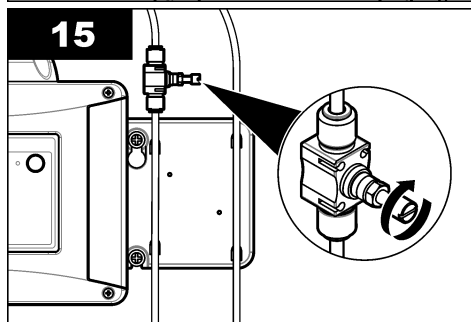
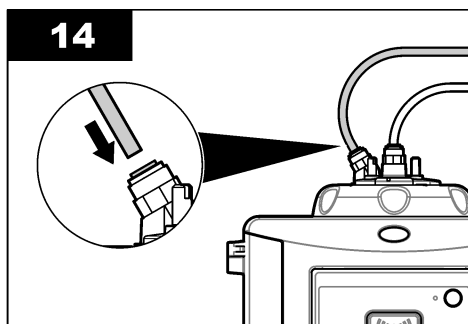
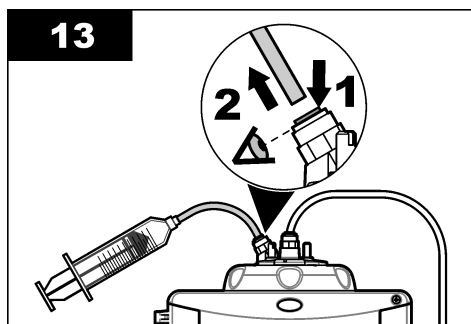
Refer to the illustrated steps that follow to complete the steps shown on the display.

At illustrated step 4, enter the measured turbidity value of the verification standard. If the verification standard value that shows on the display is correct, push confirm. The status indicator light changes to blue.

At illustrated step 15, fully open the flow regulator. Then slowly close the flow regulator until the flow decreases by 20 to 30%.







7.3 Do a calibration verification with a sealed vial or glass rod

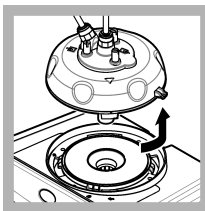
Use the optional calibration lid and a sealed-vial 10-NTU StablCal standard to do a primary calibration verification. As an alternative, use the optional calibration lid and the optional glass verification rod (< 0.1 NTU) to do a secondary calibration verification.



1. Push **menu**. Select
SENSOR SETUP>
TU5x00 sc>
VERIFICATION>
SETUP>MENU
GUIDED> SEALED
VIAL.



2. Select SENSOR
SETUP> TU5x00 sc>
VERIFICATION>
START.



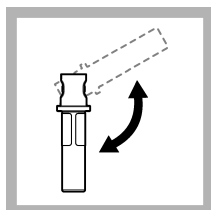
3. Remove the process
head (or the automatic
cleaning module).
Press ENTER.



4. If the verification
standard value that
shows on the display is
not correct, enter the
accurate turbidity value
of the verification
standard from the
certificate of analysis
for the sealed-vial
StablCal standard or
from the last recorded
value from the
 < 0.1 NTU glass rod.

If the verification
standard value that
shows on the display is
correct, push **confirm**.

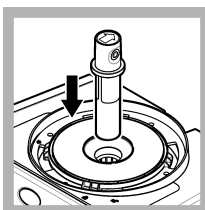
The status indicator
light flashes blue.



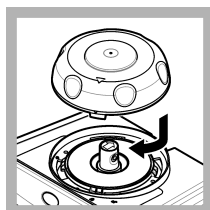
5. If the verification
standard is a liquid
standard, carefully
invert the verification
standard vial a
minimum of three times.



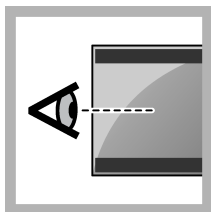
6. Clean and dry the
verification standard
vial with a no-lint cloth.
Refer to [Prevent vial
contamination](#)
on page 33.



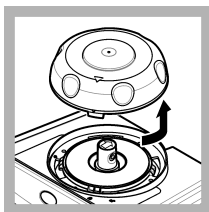
7. Put the vial in the
vial compartment.



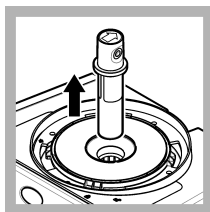
8. Install the calibration
lid. Make sure that the
calibration lid is in the
closed position.



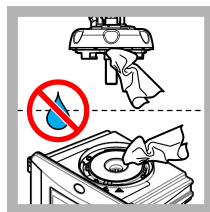
9. Complete the steps that show on the controller display.



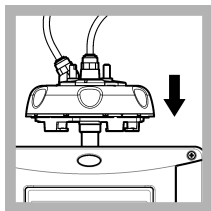
10. When the status indicator light flashes green, remove the calibration lid.



11. Remove the vial.



12. Make sure that there is no water on the process head (or the automatic cleaning module). Dry all possible spills to prevent water ingress on the vial compartment.



13. Install the process head (or the automatic cleaning module).



14. Push ENTER to save the calibration value. The status indicator light stays green.

7.4 Show the calibration or verification history

To show the historical data for the last four calibrations, push menu and select SENSOR SETUP>TU5x00 sc>CALIBRATION>CAL LOG.

To show the historical data for the last four verifications, push menu and select SENSOR SETUP>TU5x00 sc>VERIFICATION>VERIF LOG.

Section 8 Maintenance

⚠ WARNING



Burn hazard. Obey safe handling protocols during contact with hot liquids.

⚠ CAUTION



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

⚠ CAUTION



Personal injury hazard. Never remove covers from the instrument. This is a laser-based instrument and the user risks injury if exposed to the laser.

⚠ CAUTION



Personal injury hazard. Glass components can break. Handle with care to prevent cuts.

NOTICE

Do not disassemble the instrument for maintenance. If the internal components must be cleaned or repaired, contact the manufacturer.

NOTICE

Stop the sample flow to the instrument and let the instrument become cool before maintenance is done.

To set the output behavior during maintenance, push **menu** and select SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>OUTPUT MODE.

8.1 Maintenance schedule

Table 3 shows the recommended schedule of maintenance tasks. Facility requirements and operating conditions may increase the frequency of some tasks.

Table 3 Maintenance schedule

Task	1 to 3 months	1 to 2 years	As necessary
Clean the vial on page 45 <i>Note: The cleaning interval is dependent on the water quality.</i>	X		
Clean the vial compartment on page 47			X
Replace the vial on page 47		X	
Replace the desiccant cartridge on page 50 <i>Note: The replacement interval is dependent on the ambient humidity, ambient temperature and sample temperature.</i>		X ¹⁷	
Replace the tubing on page 50			X

8.2 Clean spills

⚠ CAUTION



Chemical exposure hazard. Dispose of chemicals and wastes in accordance with local, regional and national regulations.

1. Obey all facility safety protocols for spill control.
2. Discard the waste according to applicable regulations.

8.3 Clean the instrument

Clean the exterior of the instrument with a moist cloth and a mild soap solution and then wipe the instrument dry as necessary.

¹⁷ Two years or as identified by instrument notification.

8.4 Clean the vial

⚠ WARNING



Chemical exposure hazard. Obey laboratory safety procedures and wear all of the personal protective equipment appropriate to the chemicals that are handled. Refer to the current safety data sheets (MSDS/SDS) for safety protocols.

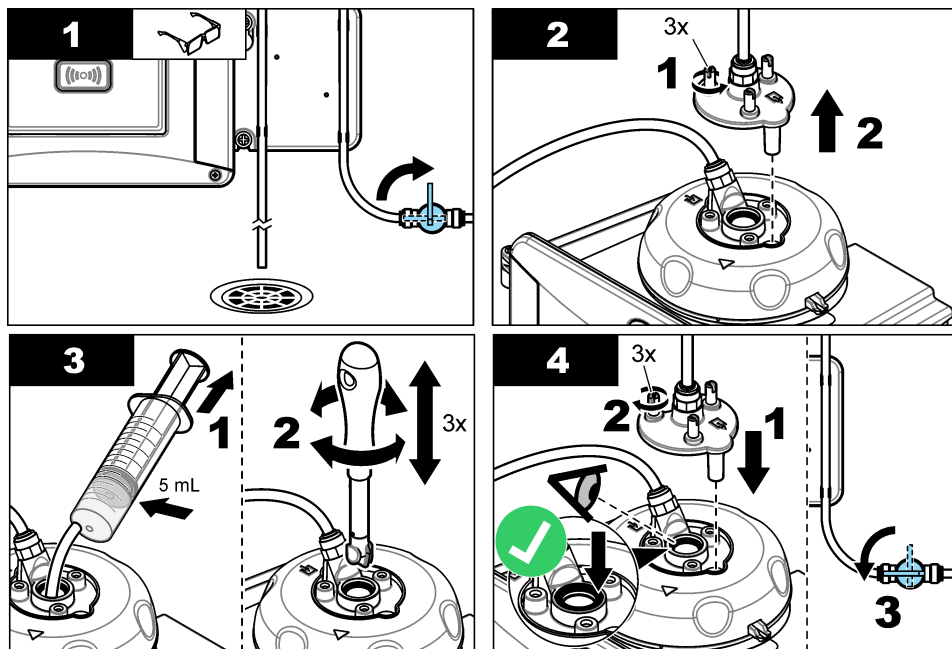
When the turbidity reading shows that there is contamination in the process vial or "VIAL CLARITY" shows on the controller display, clean the vial.

1. Push **menu**.
2. Select **SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>VIAL CLEANING**.
3. Complete the steps that show on the controller display. The instrument automatically saves the cleaning process date after the last screen shows.
4. If the optional automatic cleaning module is installed, push **menu** and select **SETUP>TU5x00 sc>START WIPE** to start the automatic cleaning process.
5. If the optional automatic cleaning module is not installed, clean the vial with the manual vial wiper.

NOTICE

Carefully remove most of the water in the vial. Carefully put the vial wiper into the process vial so that no water spills out.

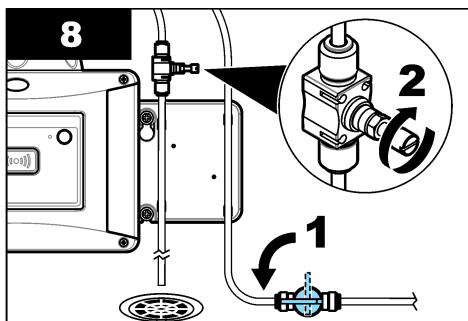
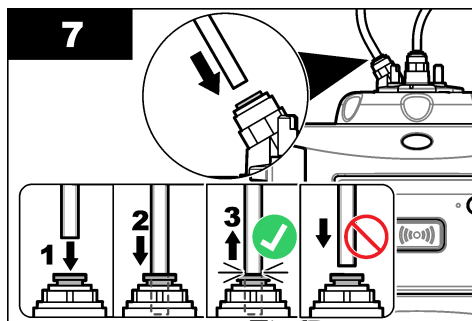
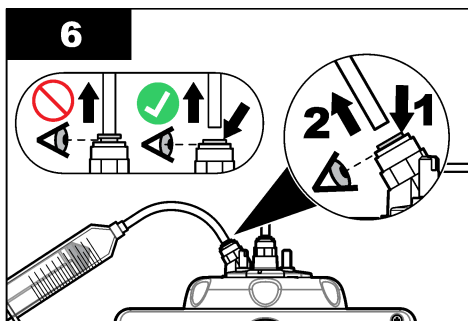
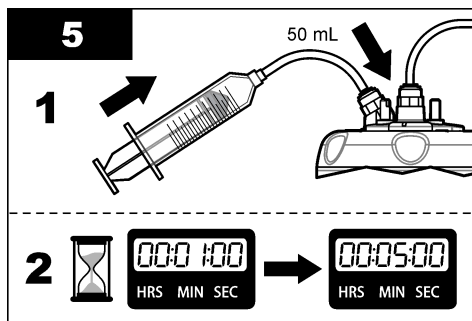
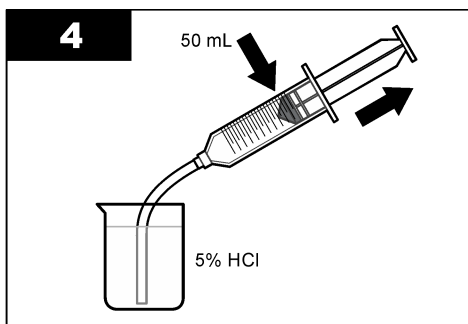
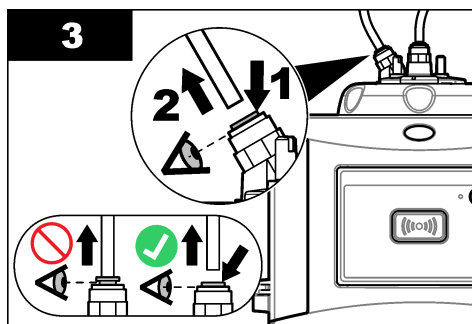
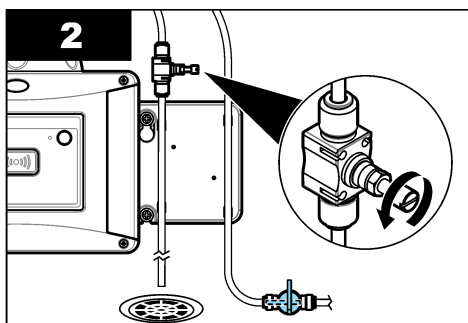
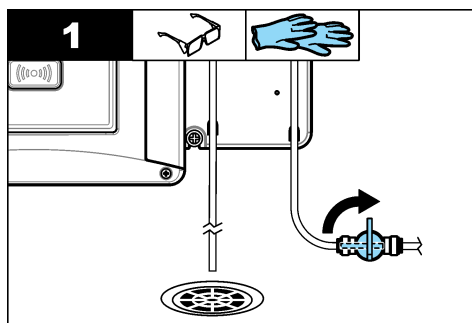
Clean the process vial with the manual vial wiper as shown in the illustrated steps that follow.



8.4.1 Do a chemical vial cleaning

If the turbidity readings do not go back to the original values, do the illustrated steps that follow to clean the vial.

Note: Hold the output values of the SC controller as necessary before the illustrated steps are done. Refer to the SC controller documentation to hold the outputs.



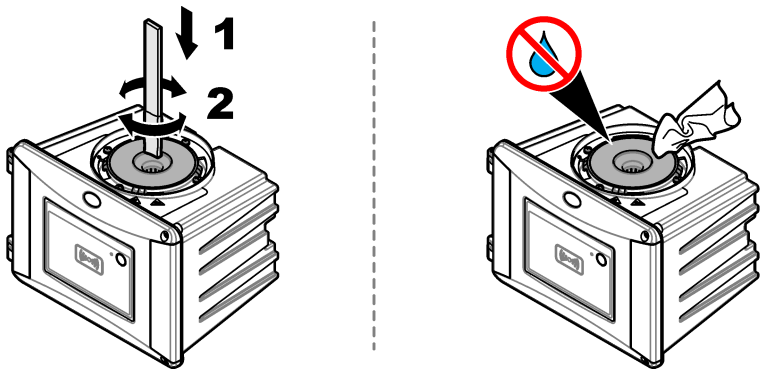
8.5 Clean the vial compartment

Clean the vial compartment only when the compartment has contamination. Make sure that the tool to clean the vial compartment has a soft surface and does not damage the instrument. [Table 4](#) and [Figure 8](#) show the options on how to clean the vial compartment.

Table 4 Cleaning options

Contaminant	Options
Dust	Vial compartment wiper, micro fiber cloth, lint-free cloth
Liquid, oil	Cloth, water and cleaning agent

Figure 8 Cleaning options



8.6 Replace the vial

NOTICE

Keep water out of the vial compartment or instrument damage will occur. Before the automatic cleaning module is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the green O-ring is in place to seal the vial. Make sure that the vial nut is tight.

NOTICE



Hold the automatic cleaning module vertically when it is installed on the instrument or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Do not touch or scratch the glass of the process vial. Contamination or scratches on the glass can cause measurement errors.

NOTICE



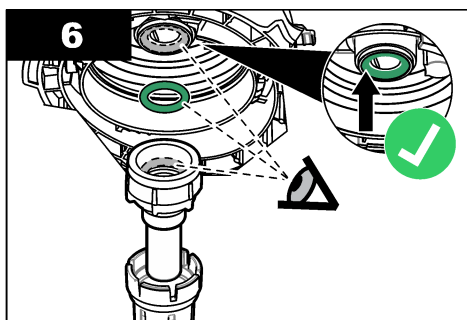
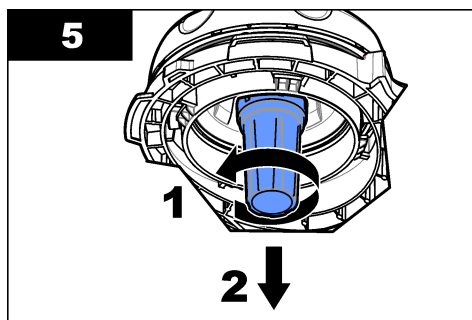
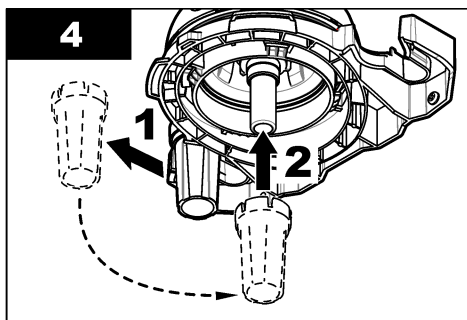
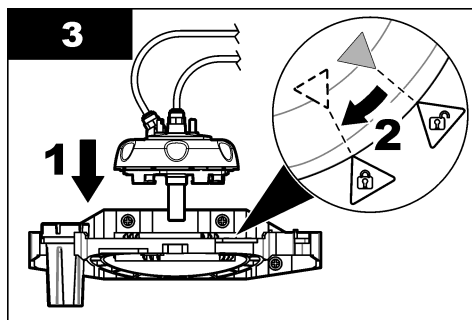
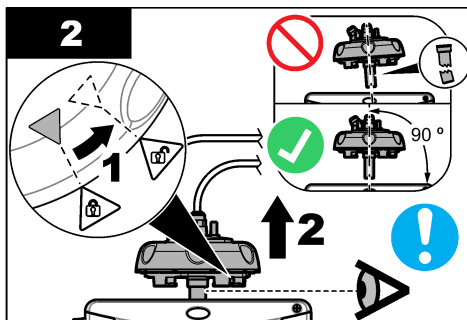
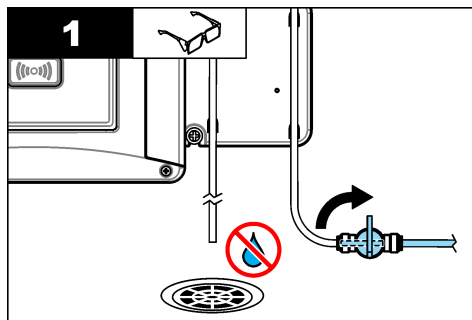
Based on the environmental conditions, is necessary to wait a minimum of 15 minutes to let the system become stable.

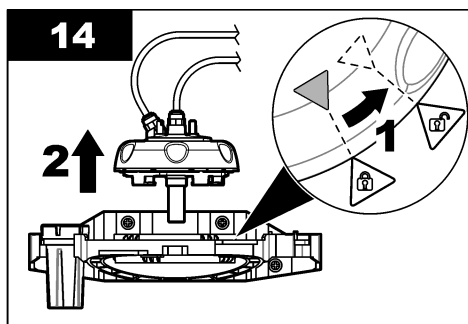
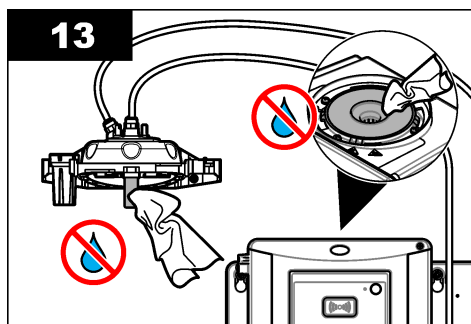
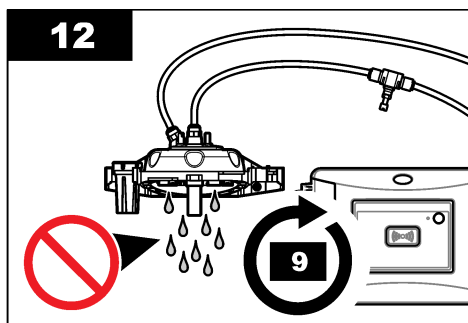
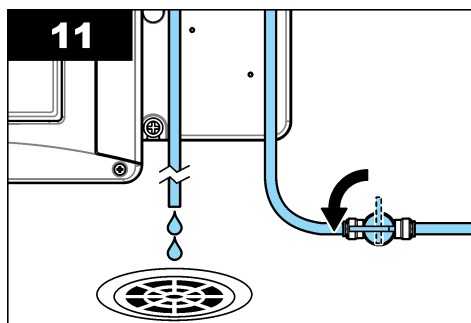
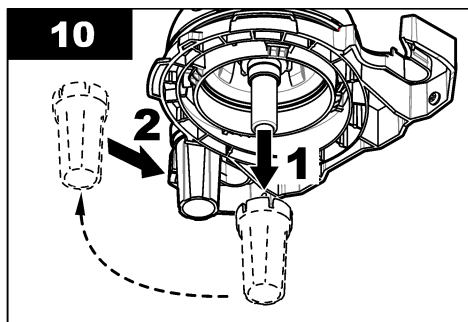
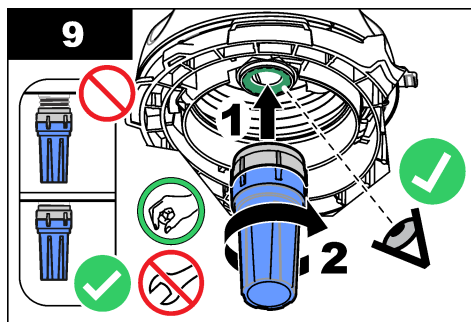
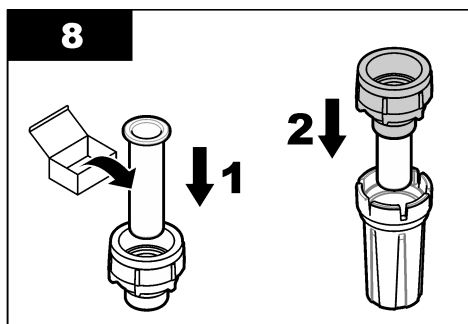
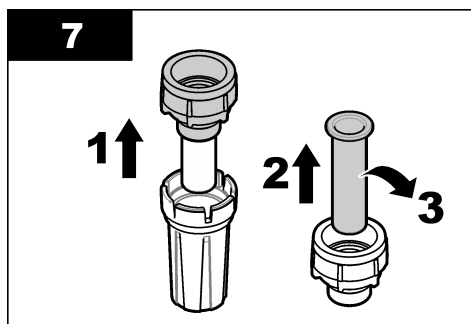
Note: Make sure that no particles fall into the vial compartment.

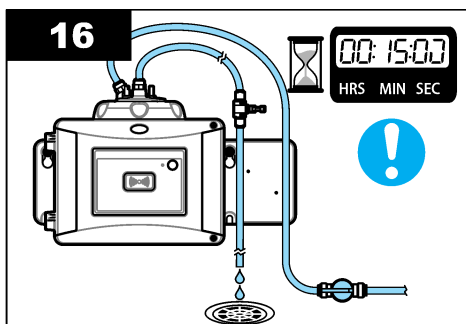
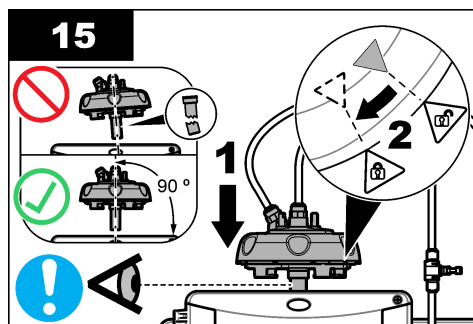
1. Push **menu**.
2. Select **SENSOR SETUP>[select analyzer]>DIAG/TEST>MAINTENANCE>VIAL REPLACEMENT**.
3. Complete the steps that show on the controller display. The date the vial was replaced is automatically saved after the last screen shows.

Refer to the illustrated steps that follow to replace the vial. To protect the new vial from contamination, use the vial replacement tool to install the vial.

At illustrated step 3, put the process head on its side on a flat surface if a service bracket is not installed near the instrument.







8.7 Replace the desiccant cartridge

The controller display will show when a desiccant cartridge replacement is due. Refer to the documentation included in the desiccant cartridge bag to replace the desiccant cartridge.

8.8 Replace the tubing

Replace the tubing when the tubing has a blockage or has damage.

Turn the flow shutoff valve to stop flow to the instrument. Then refer to [Plumb the instrument](#) on page 19 to replace the tubing.

Section 9 Troubleshooting

More troubleshooting information is available online. Go to www.hach.com, then click Support to go to Hach Support Online.

9.1 Reminders

Reminders show on the controller display. To see all of the reminders, push **menu** then select **DIAGNOSTICS>TU5x00 sc>REMINDER**.

Message	Description	Solution
DRYER RANGE	The desiccant cartridge capacity is low.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.
PERFORM CAL	A calibration is due.	Do a calibration. Refer to Calibration on page 27.
PERFORM VER	A verification is due.	Do a verification. Refer to Verification on page 38.
WIPER REPLACE	A wiper replacement is due in the automatic cleaning module.	Replace the wiper in the automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module to replace the wiper.

9.2 Warnings

Warnings show on the controller display. To see all of the active warnings, push **menu** then select **DIAGNOSTICS>TU5x00 sc>WARNING LIST**.

Warning	Description	Solution
CLEANING MODULE	The automatic cleaning module does not operate correctly.	Make sure that the wiper head is installed correctly and the wiper arm can move up and down.
DESICCANT OLD	The desiccant cartridge is more than 2 years old.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.

Warning	Description	Solution
DRYER EXHAUST'D	The desiccant cartridge life is zero.	Replace the desiccant cartridge. Refer to the documentation supplied with the desiccant cartridge.
HIGH FLOW	The flow rate is higher than the limit (more than 1250 mL/min).	Adjust the flow regulator as necessary. Make sure that the flow regulator does not have a malfunction.
HUM PCB SC	There is humidity on the interior electronics of the instrument.	Contact technical support. Measurements with limited validity are still available.
LASER-TEMP HIGH	The laser temperature is higher than the limit.	Decrease the environmental temperature of the instrument.
LASER-TEMP SENS	The laser temperature sensor has a malfunction.	Contact technical support. Measurements with limited validity are still available.
LOW FLOW	The flow rate is lower than the limit (less than 75 mL/min).	Examine the tubing for blockages that decrease the flow rate. Remove the blockages. Adjust the flow regulator as necessary. Make sure that the flow regulator does not have a malfunction.
NO FLOW	The flow rate is less than 10 mL/min.	Examine the tubing for blockages stop the flow. Remove the blockages.
NOT DRYING	The instrument cannot regulate the internal humidity.	Replace the desiccant cartridge. Refer to Replace the desiccant cartridge on page 50. If the error continues, contact technical support. Measurements with limited validity are still available.
PUMP	The air pump for the drying circuit has a malfunction.	Contact technical support. Measurements with limited validity are still available.
SENS.DRY: FUNC	The air system of the drying system has a malfunction.	Contact technical support. Measurements are still available, but the life of the desiccant cartridge is decreases.
TURB TOO HIGH	The turbidity reading is not within the calibration range.	Make sure that the calibration range selected is applicable to the turbidity value of the sample.
WIPER REPLACE	A wiper replacement is due in the automatic cleaning module.	Replace the wiper in the automatic cleaning module. Refer to the documentation supplied with the automatic cleaning module to replace the wiper.
VIAL CLARITY	The vial or vial compartment is dirty.	Clean or dry the vial and the vial compartment.

9.3 Errors

Errors show on the controller display. To see all of the active errors, push **menu** then select **DIAGNOSTICS>TU5x00 sc>ERROR LIST**.

Error	Description	Solution
AUTOCHK. NO FUNC	The automatic system check does not complete.	Contact technical support.
CLEANING MODULE	The automatic cleaning module has a malfunction.	Contact technical support.
EE RSRVD ERR	There is a problem with the internal memory.	Contact technical support.
FLASH FAIL	The internal calibration memory is corrupted.	Contact technical support.
HUMIDITY PCB	There is humidity or water in the instrument.	Contact technical support.
LASER TOO LOW	The laser has a malfunction.	Contact technical support.
MEAS ELECTRONIC	There is a measurement error. There is a problem in the electronics unit.	Contact technical support.

Error	Description	Solution
PROC HEAD OPEN	The process head is in the open position or the process head detector has a malfunction.	Turn the process head to the closed position.
TURB TOO HIGH	The turbidity reading is higher than the measurement range of the instrument (1000 FNU maximum).	Make sure that the turbidity value of the sample is within the measurement range of the instrument.
VIAL PRESENT	There is no vial in the vial compartment.	Install a vial in the vial compartment.
VIAL CLARITY	The vial or vial compartment is dirty.	Clean or dry the vial and the vial compartment.
WATER INGRESS ¹⁸	There is water in the instrument.	Immediately stop flow to the instrument. Disconnect the sensor cable. The desiccant cartridge can become hot. Only touch and remove the desiccant cartridge when it is at room temperature.

9.4 Fix water ingress

The device has a drying system to prevent condensation on the vial. If water goes into the drying system the device shows the error message "Water Ingress". The desiccant cartridge starts an irreversible water stop procedure to make sure that no water goes into the measuring unit. Make sure to use always a new desiccant cartridge, even though the desiccant cartridge has a blue indicator, to fix the water ingress.

Items to collect:

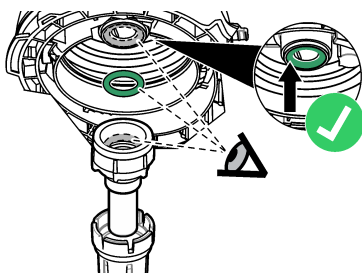
- LZY945—Microfiber cloth, vial cleaning
- LZY906—Vial replacement tool
- LZY876—Desiccant cartridge
- optional LZY918—Seal, process vial
- optional LZY917—Nut, process vial
- optional LZY834—Vial, process
- optional LZY910—Vial compartment wiper

Causes of water ingress

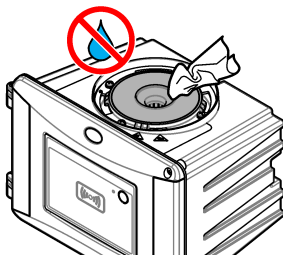
Note: Make sure to do a visual inspection and a leak test before the device is put back into operation.

1. The vial is broken or there is a crack on the vial.
 - a. Replace the vial.
 - b. Clean the contact surface of the vial on the O-ring and the vial nut.
 - c. Clean the contact surface of the O-ring on the vial.
 - d. Make sure that the edge of the vial and the seal are clean and with no dust.
 - e. Tighten the vial nut by hand.

¹⁸ Water drops, puddles or runlets that will not damage the instrument may be in the inner of the enclosure.



2. The green O-ring between vial and process head is missing or the position is not correct.
 - a. Make sure that the O-ring of the process head or cleaning unit is in the correct position. Use the tool LZY906 to install the vial.
 - b. Clean the contact surface of the vial on the O-ring and the vial nut.
 - c. Clean the contact surface of the O-ring on the vial.
 - d. Make sure that the edge of the vial and the seal are clean and with no dust.
 - e. Tighten the vial nut by hand.



3. Water in or on the top of the vial compartment.
 - a. Clean the vial compartment and the top of the vial compartment with a clean and dust-free cleaning cloth.
 - b. Make sure that there is no water on the process head (or automatic cleaning module).
 - c. Dry all possible spills to prevent water ingress on the vial compartment.
4. There is a strong condensation on the inner side of the process head or on the vial compartment.
 - a. Dry the water with a clean and dust-free cleaning cloth.

9.4.1 Setup after water ingress error

NOTICE

Keep water out of the vial compartment or instrument damage will occur. Before the process head (or automatic cleaning module) is installed on the instrument, make sure that there are no water leaks. Make sure that all tubing is fully seated. Make sure that the vial nut is tight.

NOTICE

Hold the process head (or automatic cleaning module) vertically when it is removed from the instrument or condensation water can fall into the instrument. If condensation water gets into the vial compartment instrument damage will occur.

NOTICE

Make sure to lift the process head (or automatic cleaning module) the sufficient distance to release the vial (approximately 10 cm (3.94 in.)) or the vial can break. If the vial breaks, water will get in the vial compartment and instrument damage will occur.

NOTICE

Do not touch or scratch the glass of the process vial. Contamination or scratches on the glass can cause measurement errors.

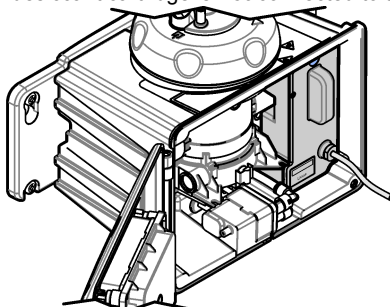
NOTICE

Although the indicator on the desiccant cartridge is blue, the cartridge is wasted after a water ingress. The water stop procedure in the desiccant cartridge can not be reset. It is necessary to use a new cartridge during the procedure FIX WATER INGRESS.

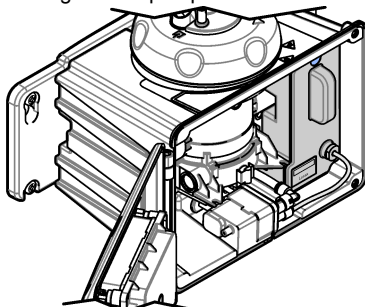
NOTICE

After completing the procedure FIX WATER INGRESS, the pump will operate for a maximum of 6 hours. Subsequently, more frequent and longer pump cycles can occur.

1. Push **Menu**.
2. Select **SENSOR SETUP>TU5x00 sc>DIAG/TEST>MAINTENANCE>FIX WATER INGRESS**.
3. Follow the steps that show on the controller.
4. Install a new desiccant cartridge during the water ingress procedure.
Make sure that the new desiccant cartridge is **not** connected to the pump.



5. The pump starts for 25 minutes to dry the pump and tubes.
6. After the drying time, dry water drips at the outlet of the pump with a dust-free cleaning cloth.
7. Connect the desiccant cartridge to the pump.



Section 10 Replacement parts and accessories

⚠ WARNING



Personal injury hazard. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction. The replacement parts in this section are approved by the manufacturer.

Note: Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Recommended standards

Description	Quantity	Item no.
Verification standard, < 0.1 NTU, glass verification rod (solid secondary standard)	each	LZY901
StabiCal 800 mNTU Standard	1 L	2788453
StabiCal 10 NTU Standard	500 mL	2659949
StabiCal 20 NTU Standard	1 L	2660153
StabiCal 20-NTU sealed vial with RFID	each	LZY837
StabiCal 20-NTU sealed vial without RFID	each	LZY899
StabiCal kit, sealed vials with RFID, includes: 10, 20 and 600 NTU vials	each	LZY835
StabiCal kit, sealed vials without RFID, includes: 10, 20 and 600 NTU vials	each	LZY898

Replacement parts

Description	Quantity	Item no.
Cleaning lid screws and washers, hot water, includes: Cleaning lid screws (3x) and washers (3x)	3	LZY905
Desiccant cartridge	each	LZY876
Mounting set, includes: Mounting screws (4x), tubing clip screws (2x) and tubing clips (2x)	each	LZY870
Nut, process vial	each	LZY917
Seal, automatic cleaning module	each	LZY914
Seal, process head	each	LZY969
Seal, process vial	each	LZY918
Service bracket	each	LZY873
Flow regulator kit, includes: flow regulator and tube ¼-in. OD × 0.13 m (5.11 in.)	each	LZY963
Vial with seal, process	each	LZY834
Vial replacement tool	each	LZY906
Wall mount bracket kit, includes: Wall mount bracket (two tubing clips on bracket), mounting screws (4x), tubing clips (2x) and tubing clip screws (2x)	each	LZY871

Accessories

Description	Quantity	Item no.
Automatic cleaning module	each	LQV159.99.00002
Bubble trap	each	LZY828.99.00002
Calibration lid	each	LZY904.98.00002

Accessories (continued)

Description	Quantity	Item no.
Extension cable, sensor cable, 1 m (3.3 ft)	each	6122400
Extension cable, sensor cable, 5 m (16.40 ft)	each	LZX848
Extension cable, sensor cable, 10 m (32.81 ft)	each	LZX849
Flow sensor kit, includes: flow sensor, flow sensor cap, mounting screws and 1 m (3.3 ft) of ¼ in. OD tubing	each	LQV160.99.00002
Maintenance kit for post-filter applications, includes: Case, calibration lid, micro fiber cloth, 20 NTU StablCal sealed vial, verification glass rod, vial wiper, vial compartment wiper, mobile service bracket, glass verification rod (≤ 0.1 NTU) and vial replacement tool	each	LZY907
Micro fiber cloth, vial cleaning	each	LZY945
Process head holder	each	LZY946
RFID tags, operator	2/pkg	LZQ066
RFID stickers, black ¹⁹	3/pkg	LZQ067
Syringe with tubing, calibration and verification	each	LZY953
Tubing adapter, ¼ in. to 6 mm	each	LZY954
Tubing, bubble trap to TU5x00 sc, ¼ in. OD	1 m	LZQ134
Tubing set, ULTRATURB replacement	each	LZY912
Tubing, inlet of bubble trap, 3/8 in. OD	4 m	LZY947
Tubing, inlet and outlet of TU5x00 sc, ¼ in. OD	4 m	LZY911
Vial wiper	each	LZY903
Vial compartment wiper	each	LZY910

¹⁹ Other colors are available.

**HACH COMPANY World Headquarters**

P.O. Box 389, Loveland, CO 80539-0389 U.S.A.

Tel. (970) 669-3050

(800) 227-4224 (U.S.A. only)

Fax (970) 669-2932

orders@hach.com

www.hach.com

HACH LANGE GMBH

Willstätterstraße 11

D-40549 Düsseldorf, Germany

Tel. +49 (0) 2 11 52 88-320

Fax +49 (0) 2 11 52 88-210

info-de@hach.com

www.de.hach.com

HACH LANGE Sàrl

6, route de Compois

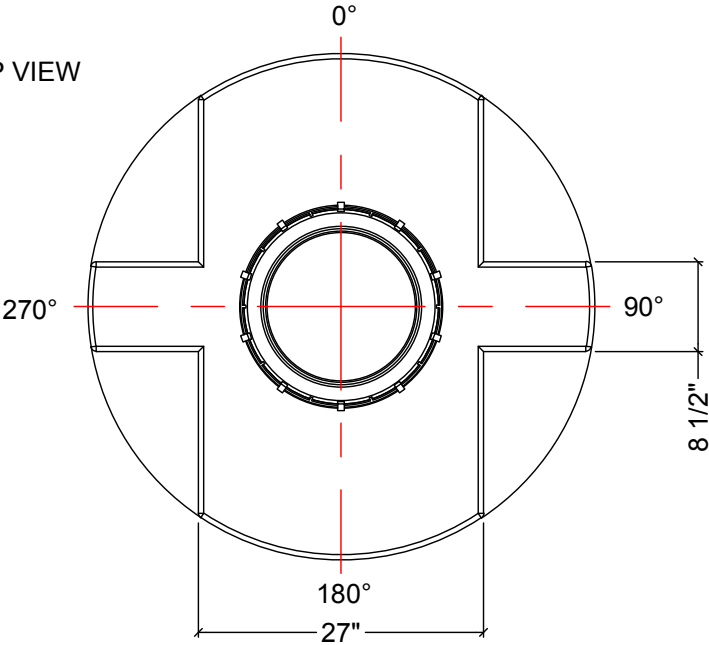
1222 Vézenaz

SWITZERLAND

Tel. +41 22 594 6400

Fax +41 22 594 6499

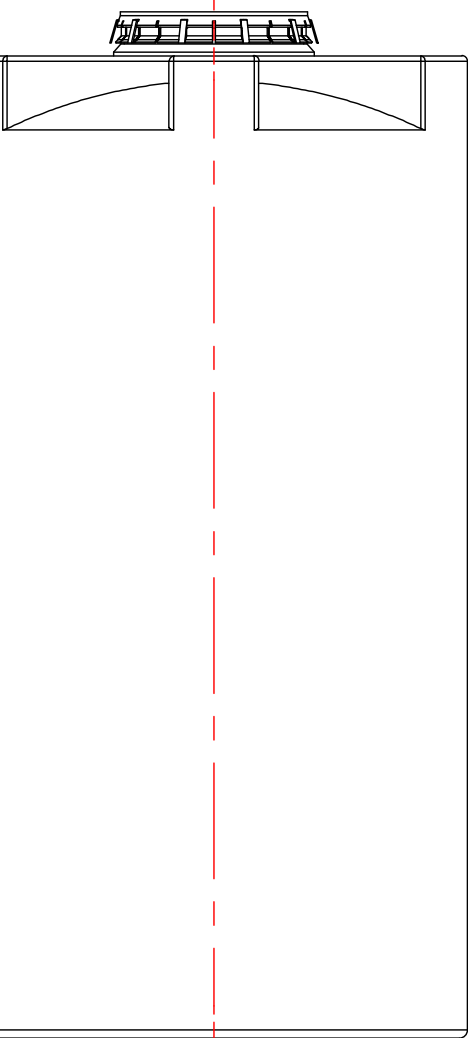
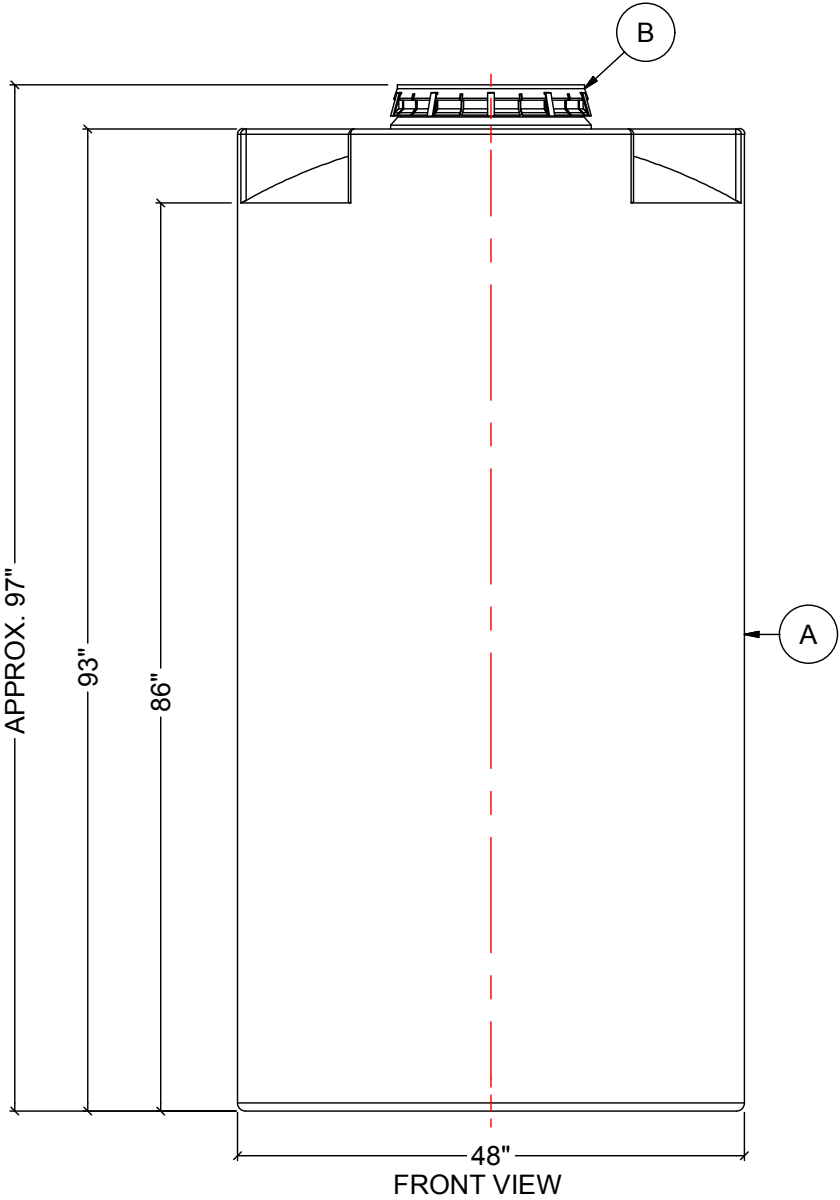
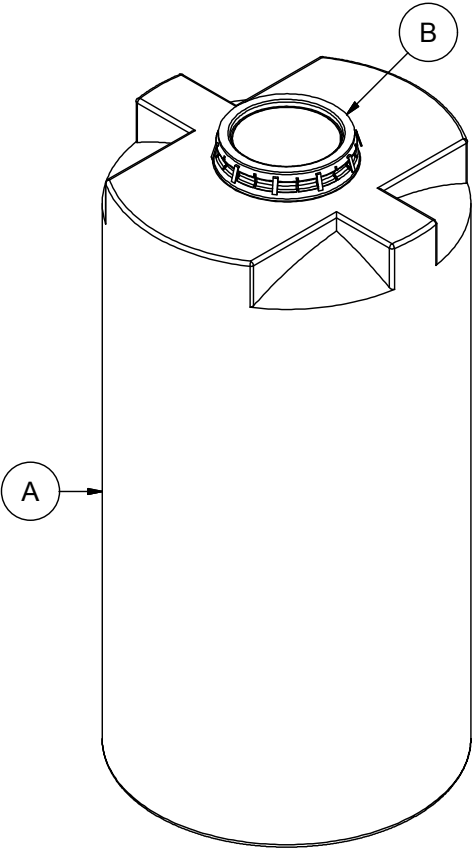
TOP VIEW



NOTES:

- 1. TANK IS MANUFACTURED TO ASTM-D-1998 STANDARD.
- 2. ALL DIMENSIONS ARE APPROXIMATE.

MATERIALS LIST		
ITEMS	DESCRIPTION	NOTES
A	CT-500-CH TANK	
B	16" LID WITH LOCKING STRAP	



SIDE VIEW

REV	DATE	DESCRIPTION	BY	APPD	REVD
REVISIONS					
CUSTOMER					
TITLE		ACO JOB NO:			
500 IG CLOSED TOP TANK		PURCHASE ORDER NO:			
		PURCHASER'S EQUIP. NO:			
THIS DRAWING IS THE PROPERTY OF ROTOPLAST INC. AND SHALL NOT BE COPIED OR TRANSFERRED WITHOUT THE WRITTEN CONSENT OF ROTOPLAST INC.					
ENGINEERS SEAL		ACO CONTAINER SYSTEMS			
		DIVISION OF ROTOPLAST INC.			
		PICKERING - ONTARIO - CANADA			
		ACO CONTAINER SYSTEMS		DESIGNED	
		DIVISION OF ROTOPLAST INC.		DRAWN	WM
		794 MCKAY RD.		CHECKED	
		PICKERING, ONTARIO, CANADA		APPROVED	
		TEL. 905-683-8222		SCALE	N.T.S.
FAX 905-683-2969		DATE	02-03-16		
DWG No		CT-500-CH			REV 0