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Operating Instructions
Indumax CLS54

Conductivity sensor

Endress+Hauser
People for Process Automation

Table of contents

1 About this document

1.1 Safety information

Structure of information	Meaning
DANGER **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **will** result in a fatal or serious injury.
WARNING **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **can** result in a fatal or serious injury.
CAUTION **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** If necessary, Consequences of non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2 Symbols

- Additional information, tips
- Permitted
- Recommended
- Not permitted or not recommended
- Reference to device documentation
- Reference to page
- Reference to graphic
- Result of an individual step

1.3 Symbols on the device

- Reference to device documentation
- Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

1.4 Documentation

The following manuals, which complement these Operating Instructions, can be found on the product pages on the Internet:

Technical Information Indumax CLS54, TI00400C

In addition to the Operating Instructions and depending on the relevant approval, XA "Safety instructions" are supplied with sensors for the hazardous area.

► Please follow the XA instructions when using the device in the hazardous area.

2 Basic safety instructions

2.1 Requirements for the personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Intended use

Indumax CLS54 is designed for the inductive measurement of the conductivity of liquids. The sensor is particularly suitable for use in hygienic applications in the food, beverage, pharmaceutical and biotech industry.

Use with Liquiline CM42, and Liquisys CLM223/253 transmitters; part of the Smartec CLD134 measuring system.

Any use other than that intended puts the safety of people and the measuring system at risk. Therefore, any other use is not permitted.

The manufacturer is not liable for harm caused by improper or unintended use.

2.3 Workplace safety

The operator is responsible for ensuring compliance with the following safety regulations:
- Installation guidelines
- Local standards and regulations
- Regulations for explosion protection

Electromagnetic compatibility
- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.

Procedure for damaged products:

1. Do not operate damaged products, and protect them against unintentional operation.
2. Label damaged products as defective.

During operation:

▶ If errors cannot be rectified,
take products out of service and protect them against unintentional operation.

2.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify the supplier of any damage to the packaging.
   Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged.
   ↳ Notify the supplier of any damage to the delivery contents.
   Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing.
   ↳ Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
   Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.

3.2 Product identification

3.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Extended order code
- Serial number
- Safety information and warnings

► Compare the information on the nameplate with the order.

3.2.2 Identifying the product

Product page

www.endress.com/cls54

Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Go to www.endress.com.
2. Page search (magnifying glass symbol): Enter valid serial number.
3. Search (magnifying glass).
   ↳ The product structure is displayed in a popup window.
4. Click the product overview.
   ↳ A new window opens. Here you will find information pertaining to your device, including the product documentation.

Manufacturer address

Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24
70839 Gerlingen
Germany

3.3 Scope of delivery

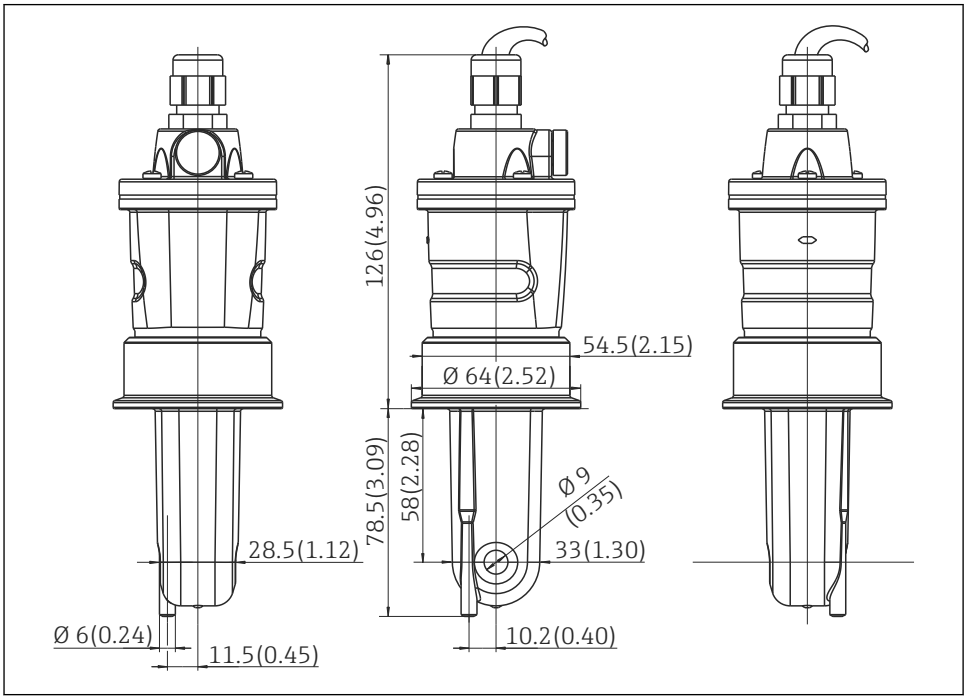
The scope of delivery includes:
- Sensor (version as ordered)
- Operating instructions

▶ If you have any queries:
Please contact your supplier or local sales center.

4 Installation

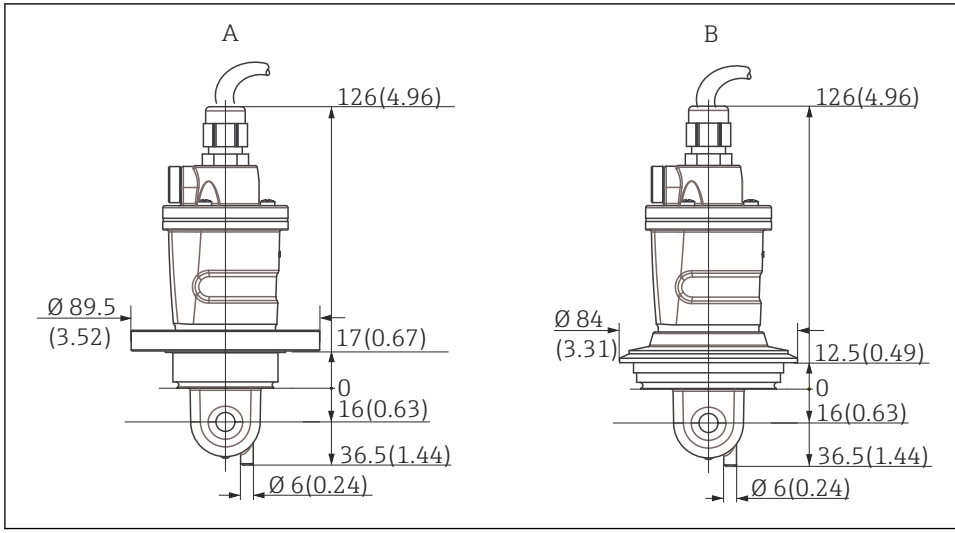
4.1 Installation requirements

4.1.1 Dimensions



1 Dimensions in mm(inch) (long version)

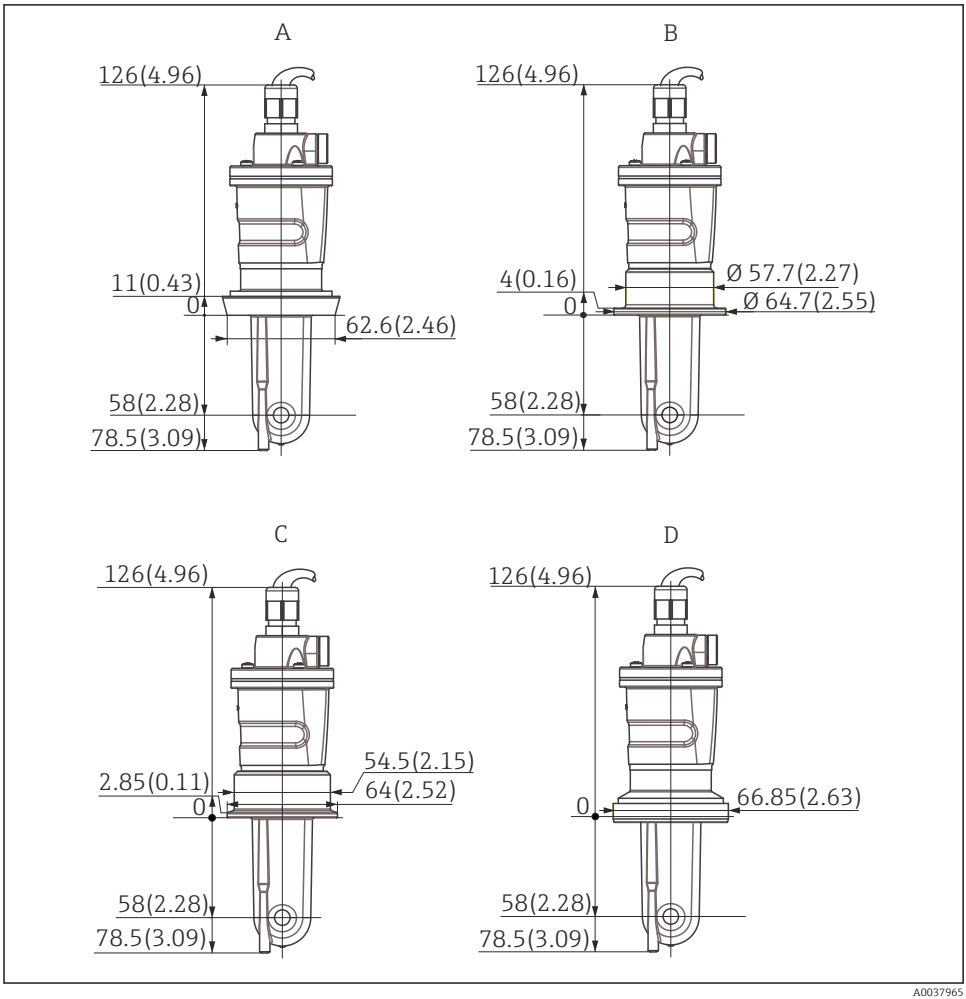
Process connections



2 *Process connections for CLS54 (short version), dimensions in mm (inch)*

A NEUMO BioControl D50 for pipe connection: DN 40 (DIN 11866 series A, DIN 11850); DN 42.4 (DIN 11866 series B, DIN EN ISO 1127); 2" (DIN 11866 series C, ASME-BPE)

B Varivent N DN 40 to 125



3 Process connections for CLS54 (long version), dimensions in mm (inch)

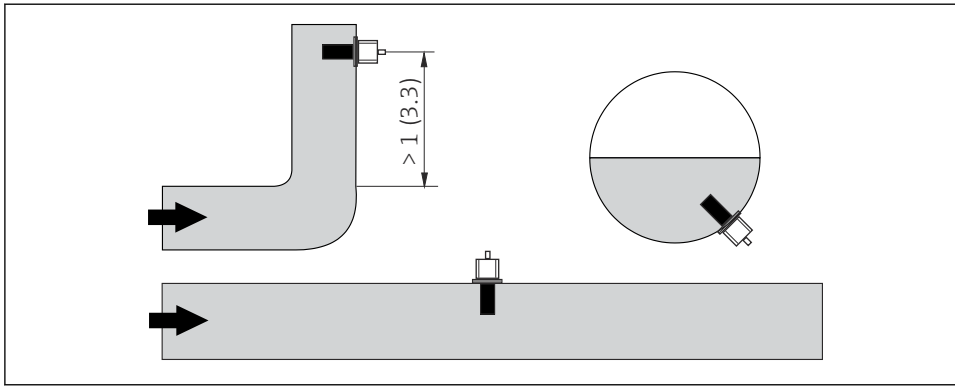
A Sanitary connection DIN 11851, DN 50
B SMS coupling 2"
C Clamp ISO 2852 , 2"
D Aseptic coupling DIN 11864-1 form A, for pipe according to DIN 11850, DN 50

4.1.2 Hygienic requirements

For 3-A-compliant installation, please observe the following:
- ► After the device has been mounted, hygienic integrity must be guaranteed.
- ► 3-A-compliant process connections must be used.

4.1.3 Orientation

The sensor must be completely immersed in the medium. Avoid air bubbles in the area of the sensor.



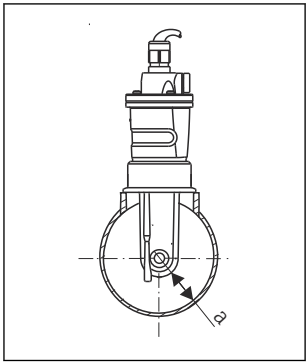
4 *Installation positions of the conductivity sensor*

Changes in the flow direction (after pipe bends) can cause turbulence in the medium. Install the sensor at a distance of at least 1 m (3.3 ft) downstream from a pipe bend.

The product should flow along the hole of the sensor (see the arrows on the housing). The symmetrical measuring channel allows flow in both directions.

4.1.4 Installation factor

The ionic current in the liquid is affected by the walls in confined installation conditions. This effect is compensated by what is referred to as the installation factor. The installation factor can be entered in the transmitter for the measurement or the cell constant is corrected by multiplying by the installation factor.
The value of the installation factor depends on the diameter and the conductivity of the pipe nozzle as well as the distance a between the sensor and the wall.
The installation factor f (f = 1.00) can be disregarded if the distance to the wall is sufficient (a > 15 mm, from DN 65).
If the distance to the wall is smaller, the installation factor increases for electrically insulating pipes (f > 1), and decreases for electrically conductive pipes (f < 1).
It can be measured using calibration solutions, or a close approximation can be determined from the diagram below.



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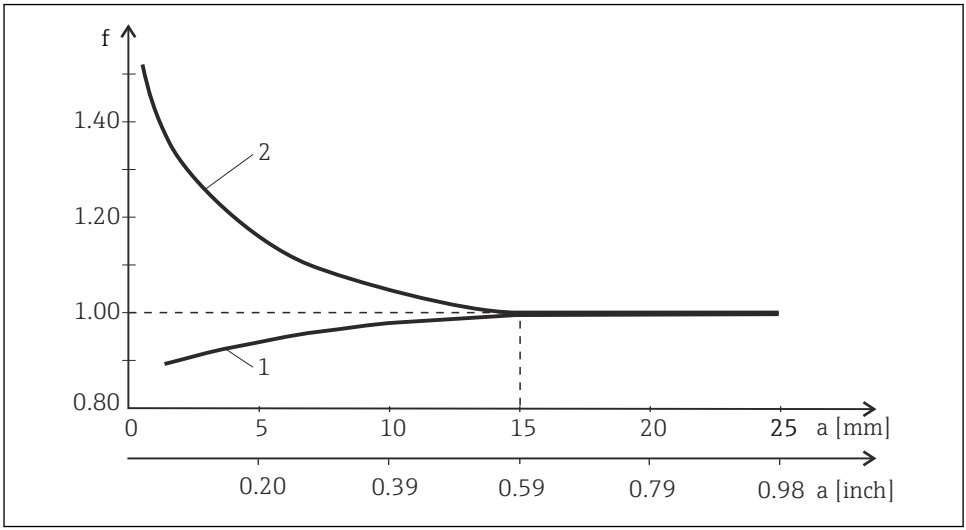
5 Installation CLS54

a Wall distance



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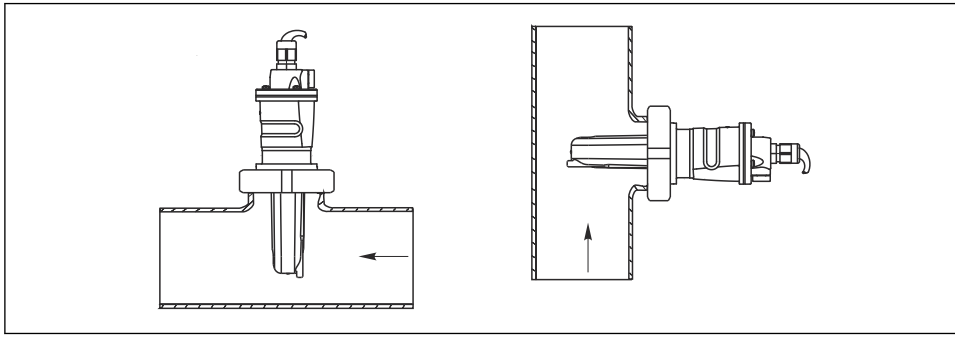
6 Relationship between installation factor f and wall distance a

1 Electrically conductive pipe wall
2 Electrically insulating pipe wall

4.1.5 Air set

To compensate residual coupling in the cable and between the two sensor coils, zero adjustment in air ("air set") must be performed before installing the sensor. Follow the instructions provided in the Operating Instructions of the transmitter used.

4.2 Installing the sensor



7 *Installation of CLS54, arrow indicates direction of flow*

When installing, align the sensor in such a way that the medium flows through the flow opening of the sensor in the direction of medium flow. The sensor head must be completely immersed in the medium.

The symmetrical measuring channel allows flow in both directions.

4.3 Post-installation check

Put the sensor into operation only if you can answer yes to the following questions:

1. Are the sensor and cable undamaged?
2. Is the orientation correct?
3. Has the sensor been installed in the process connection, and does not suspend freely from the cable?

5 Electrical connection

⚠ WARNING

Device is live!

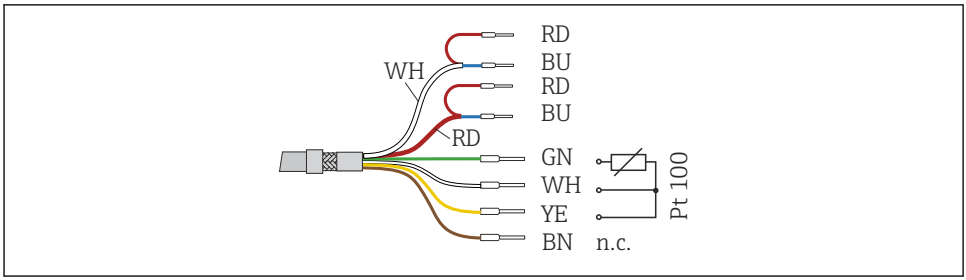
Incorrect connection may result in injury or death!

- The electrical connection may be performed only by an electrical technician.
- The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- **Prior** to commencing connection work, ensure that no voltage is present on any cable.

5.1 Connecting the sensor

The sensor is supplied with a fixed cable. The wiring diagram is provided in the Operating Instructions of the transmitter used.

Connection via a VBM junction box is necessary for a cable connection. The extension to the transmitter is via the CLK6 cable.



8 *Fixed cable / measuring cable CLK6*

Cable length: maximum 55 m (180 ft) total length (non-Ex versions)
maximum 50 m (180 ft) total length (Ex versions)

5.2 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions, and which are necessary for the required intended use, may be established on the device delivered.

▶ Exercise care when carrying out the work.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example, to covers being left off or cable (ends) that are loose or insufficiently secured.

5.3 Post-connection check

Device health and specifications	**Action**
Is the outside of the sensor, assembly or cable free from damage?	▶ Perform a visual inspection.
Electrical connection	**Action**
Are the mounted cables strain-relieved and not twisted?	▶ Perform a visual inspection. ▶ Untwist the cables.
Is a sufficient length of the cable cores stripped, and are the cores positioned in the terminal correctly?	▶ Perform a visual inspection. ▶ Pull gently to check they are seated correctly.
Are the power supply and signal lines correctly connected?	▶ Refer to the wiring diagram for the transmitter.
Are all screw terminals tightened?	▶ Tighten the screw terminals.

Device health and specifications	Action
Are all the cable entries installed, tightened and leak-tight?	▶ Perform a visual inspection.
Are all cable entries mounted on the side or pointing downwards?	In the case of lateral cable entries: ▶ Point cable loops downward so that water can drip off.

6 Maintenance

⚠ WARNING

Thiocarbamide

Harmful if swallowed! Limited evidence of carcinogenicity! Possible risk of harm to the unborn child! Dangerous for the environment with long-term effects!

- ▶ Wear protective goggles, protective gloves and appropriate protective clothing.
- ▶ Avoid all contact with the eyes, mouth and skin.
- ▶ Avoid discharge into the environment.

⚠ CAUTION

Corrosive chemicals

Risk of chemical burns to the eyes and skin and risk of damage to clothing and equipment!

- ▶ It is absolutely essential to protect the eyes and hands properly when working with acids, alkalis and organic solvents!
- ▶ Wear protective goggles and safety gloves.
- ▶ Clean away splashes on clothes and other objects to prevent any damage.
- ▶ Comply with instructions in the safety data sheets for the chemicals used.

Clean away fouling on the sensor as follows depending on the type of fouling:

1. Oily and greasy films:
   Clean with grease remover, e.g. alcohol, or hot water with an alkaline agent.
2. Lime and metal hydroxide buildup and low solubility (lyophobic) organic buildup:
   Dissolve buildup with diluted hydrochloric acid (3 %) and then rinse thoroughly with plenty of clear water.
3. Sulfidic buildup (from flue gas desulfurization or wastewater treatment plants):
   Use a mixture of hydrochloric acid (3 %) and thiocarbamide (commercially available) and then rinse thoroughly with plenty of clear water.
4. Buildup containing protein (e.g. in the food industry):
   Use a mixture of hydrochloric acid (0.5 %) and pepsin (commercially available) and then rinse thoroughly with plenty of clear water.
5. Readily soluble biological buildup:
   Rinse with pressurized water.

After cleaning, rinse the sensor thoroughly with plenty of water.

7 Repair

7.1 General information

The repair and conversion concept provides for the following:
- The product has a modular design
- Spare parts are grouped into kits which include the associated kit instructions
- Only use original spare parts from the manufacturer
- Repairs are carried out by the manufacturer's Service Department or by trained users
- Certified devices can only be converted to other certified device versions by the manufacturer's Service Department or at the factory
- Observe applicable standards, national regulations, Ex documentation (XA) and certificates

1. Carry out the repair according to the kit instructions.
2. Document the repair and conversion and enter, or have entered, in the Life Cycle Management tool (W@M).

7.2 Spare parts

Spare parts currently available for the device can be found at: www.endress.com/onlinetools

▶ Quote the serial number of the device when ordering spare parts.

7.3 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

www.endress.com/support/return-material

7.4 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

8 Accessories

The following are the most important accessories available at the time this documentation was issued.

Listed accessories are technically compatible with the product in the instructions.

1. Application-specific restrictions of the product combination are possible.
   Ensure conformity of the measuring point to the application. This is the responsibility of the operator of the measuring point.
2. Pay attention to the information in the instructions for all products, particularly the technical data.
3. For accessories not listed here, please contact your Service or Sales Center.

8.1 Cable extension

8.1.1 Measuring cable

Measuring cable CLK6
- Extension cable for inductive conductivity sensors, for extension via VBM junction box
- Sold by the meter, order number: 71183688

8.1.2 Junction box

VBM
- Junction box for cable extension
- 10 terminal strips
- Cable entries: 2 x Pg 13.5 or 2 x NPT ½"
- Material: aluminum
- Degree of protection: IP 65
- Order numbers
  - Cable entries Pg 13.5 : 50003987
  - Cable entries NPT ½": 51500177

Desiccant pouch
- Desiccant pouch with color indicator for VBM junction box
- Order No. 50000671

8.2 Calibration solutions

Conductivity calibration solutions CLY11
Precision solutions referenced to SRM (Standard Reference Material) by NIST for qualified calibration of conductivity measuring systems in accordance with ISO 9000
- CLY11-B, 149.6 µS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081903
- CLY11-C, 1.406 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081904
- CLY11-D, 12.64 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081905
- CLY11-E, 107.00 mS/cm (reference temperature 25 °C (77 °F)), 500 ml (16.9 fl.oz)
  Order No. 50081906

Technical Information TI00162C

9 Technical data

9.1 Input

9.1.1 Measured variables

- Conductivity
- Temperature

9.1.2 Measuring range

Conductivity	Recommended range: 100 µS/cm to 2000 mS/cm (uncompensated)
Temperature	–10 to +150 °C (+14 to +302 °F)

9.1.3 Cell constant

$k = 6.3\ cm^{-1}$

9.1.4 Temperature measurement

Pt1000 (according to DIN EN 60751)

9.2 Performance characteristics

9.2.1 Temperature response time

$t_{90} \leq 26$ s

9.2.2 Measurement error

± (0.5 % of reading + 10 µS/cm) after calibration

(plus uncertainty of the conductivity of the calibration solution)

9.3 Environment

9.3.1 Ambient temperature

–20 to 60 °C (–4 to 140 °F)

9.3.2 Storage temperature

-25 to +80 °C (-13 to +176 °F)

9.3.3 Relative humidity

5 to 95 %

9.3.4 Degree of protection

IP 68 / NEMA type 6 (1 m (3.3 ft) water column, 50 °C (122 °F), 168 h)

9.4 Process

9.4.1 Process temperature

-10 to +125 °C (+14 to +257 °F)

9.4.2 Sterilization

150 °C (302 °F) / 6 bar (87 psi) absolute, (max. 60 min.)

9.4.3 Process pressure (absolute)

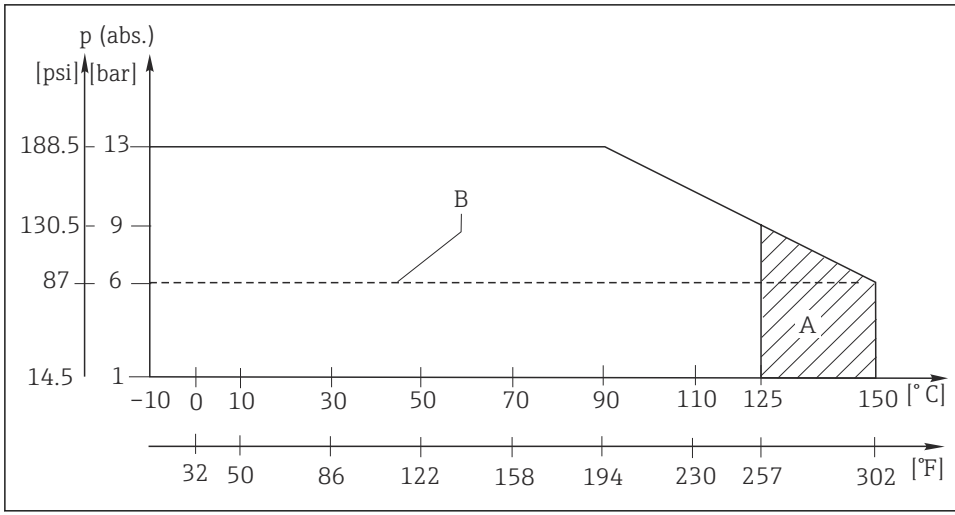
13 bar (188.5 psi) up to 90 °C (194 °F)

9 bar (130.5 psi) at 125 °C (257 °F)

1 to 6 bar (14.5 to 87 psi) in CRN environment tested with 50 bar (725 psi)

Underpressure down to 0.1 bar (1.45 psi)

9.4.4 Temperature/pressure curves



9 Pressure/temperature ratings

A Temporarily for sterilization (max. 60 min.)

B MAWP (maximum allowable working pressure) according to ASME-BPVC Sec. VIII, Div 1 UG101 for CRN registration

9.5 Mechanical construction

9.5.1 Dimensions

→ Section "Installation"

9.5.2 Weight

0.3 to 0.5 kg (0.66 to 1.1 lb.) depending on version plus cable

9.5.3 Materials

In contact with medium	Virgin PEEK
Not in contact with medium	PPS-GF40 Stainless steel 1.4404 (AISI 316L) Screws: 1.4301 (AISI 304) Cable gland: PVDF Seals: FKM, EPDM Cable: TPE

9.5.4 Surface roughness

Ra ≤ 0.8 µm (smooth, injection-molded PEEK surface) at surfaces in contact with medium

9.5.5 Chemical resistance

Medium	Concentration	PEEK
Caustic soda NaOH	0 to 15 %	20 to 90 °C (68 to 194 °F)
Nitric acid HNO_3	0 to 10 %	20 to 90 °C (68 to 194 °F)
Phosphoric acid H_3PO_4	0 to 15 %	20 to 80 °C (68 to 176 °F)
Sulfuric acid H_2SO_4	0 to 30 %	20 °C (68 °F)
Peracetic acid H_3C-CO-OOH	0.2 %	20 °C (68 °F)

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