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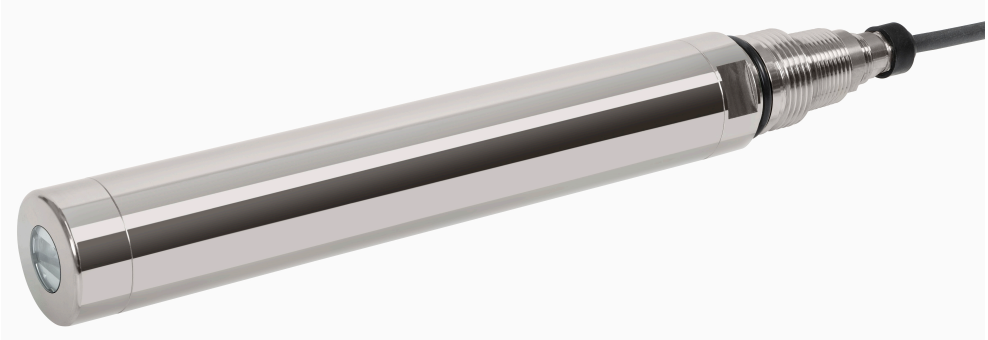
2022-05-18

Operating Instructions
Memosens CFS51

Sensor for fluorescence measurement



Endress+Hauser
People for Process Automation

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1 About this document

1.1 Warnings

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 used

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

1.2.1 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.
- Optical radiation warning

1.3 Documentation

The following manuals which complement these Operating Instructions can be found on the product pages on the Internet:
- Technical Information of the sensor
- Operating Instructions for the transmitter used

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

The sensor is used to measure polycyclic aromatic hydrocarbons PAHs (PAH) using fluorescence measurement.

The device is suitable for the following field of application:
Monitoring of scrubber washwater on ships

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

WARNING

UV radiation from this product

Can cause damage to the eyes and skin!

- ▶ Avoid any exposure of the eyes and skin to the unshielded product.
- ▶ When the sensor is switched on, avoid looking directly into the sensor window without appropriate eye protection. The exposure limits according to IEC 62471:2008 are not exceeded within the first 100 seconds.
- ▶ Appropriate protective goggles must be worn to protect against UV radiation.
- ▶ Cover the light source when performing maintenance tasks that do not need UV light.

- The risk to the observer depends on how the user installs and uses the sensor.
- The sensor's lamp radiates light in the 254 nm wavelength range (UV radiation). The sensor's lamp is categorized as Risk Group 3 according to EN/IEC 62471.

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations

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

During operation:

- If faults cannot be rectified:
  products must be taken out of service and protected against unintentional operation.

2.5 Product safety

2.5.1 State-of-the-art technology

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.

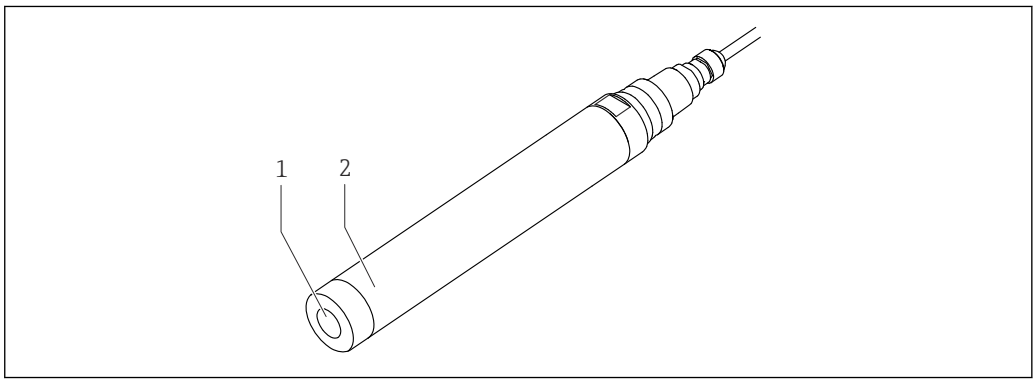
3 Product description

3.1 Product design

The device can be operated directly in the process, without any additional sampling (in-line).

The device consists of the following assemblies:
- Power supply
- Light source
- Detectors
  Detectors detect the measuring signals, digitize them and process them to form a measured value.
- Sensor microcontroller
  This is responsible for controlling internal processes and transmitting data.

All the data - including the calibration data - are stored in the device. The device can be used at a measuring point and is either precalibrated or externally calibrated. The device can also be used for several measuring points with different calibrations.



1 Sensor

1 Optical window
2 Sensor

3.1.1 Measuring principle

Fluorescence measurement is used to demonstrate the presence of polycyclic aromatic hydrocarbons PAHs (PAH) in water. The device stimulates the PAHs with UV light and detects the fluorescent radiation emitted by the PAHs as a result. The PAH concentration is measured in units of phenanthrene equivalents (PAH_{phe}) according to MEPC.259(68) and MEPC.340(77) [1)]. The measurement is performed in the excitation wavelength range of 254 nm and in the reception wavelength range up to 360 nm.

1) Marine Environment Protection Committee

4 Incoming acceptance and product identification

4.1 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.

4.2 Product identification

4.2.1 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.

4.2.2 Product identification

Product page

www.endress.com/cfs51

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 fill information pertaining to your device, including the product documentation.

4.2.3 Manufacturer address

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

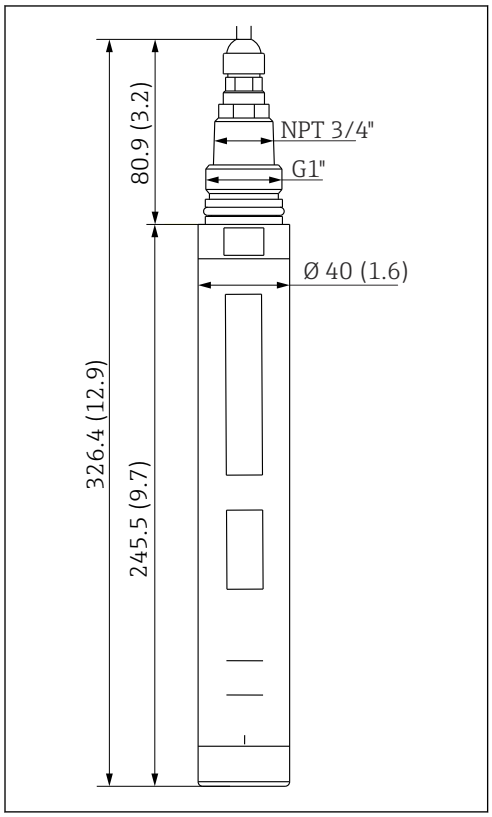
4.3 Scope of delivery

The scope of delivery comprises:
- Sensor, version as ordered
- Operating Instructions

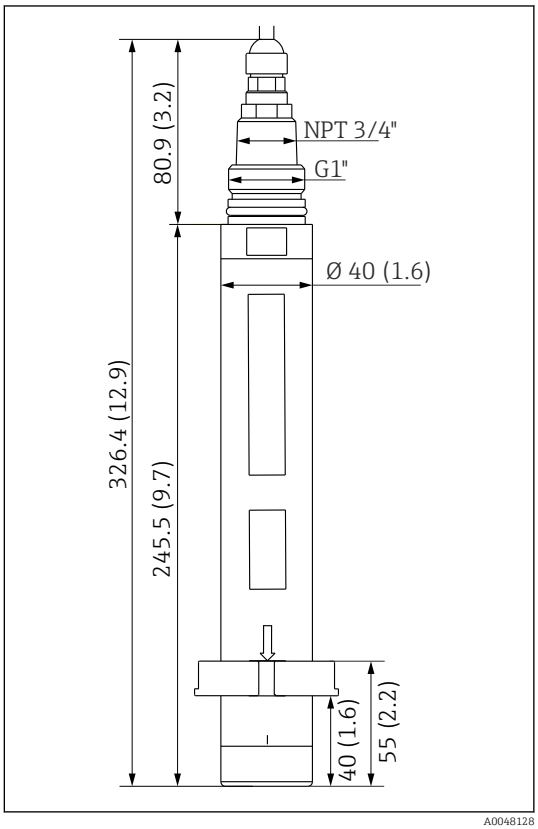
5 Mounting

5.1 Mounting requirements

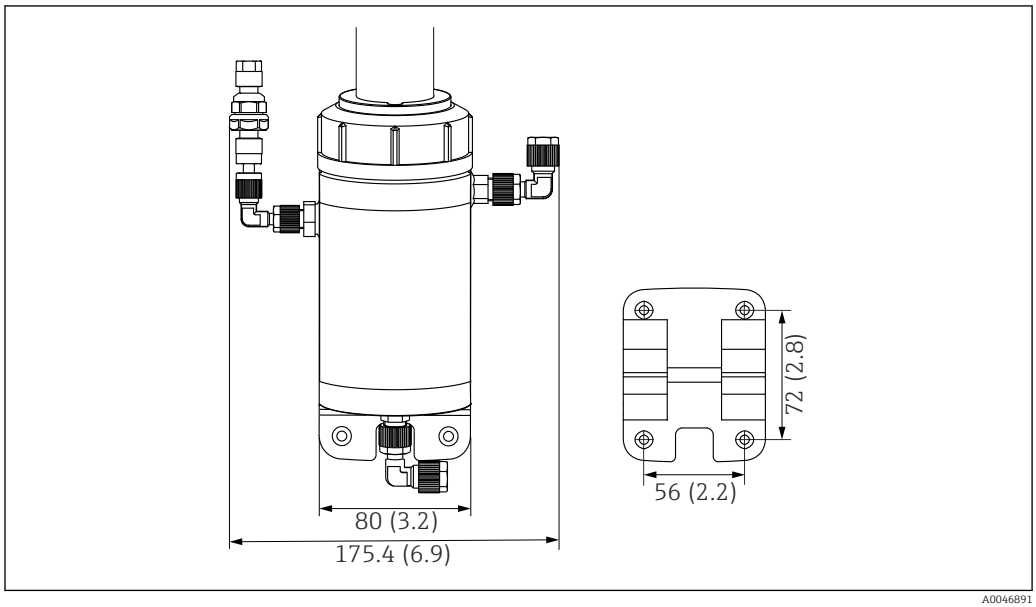
5.1.1 Dimensions



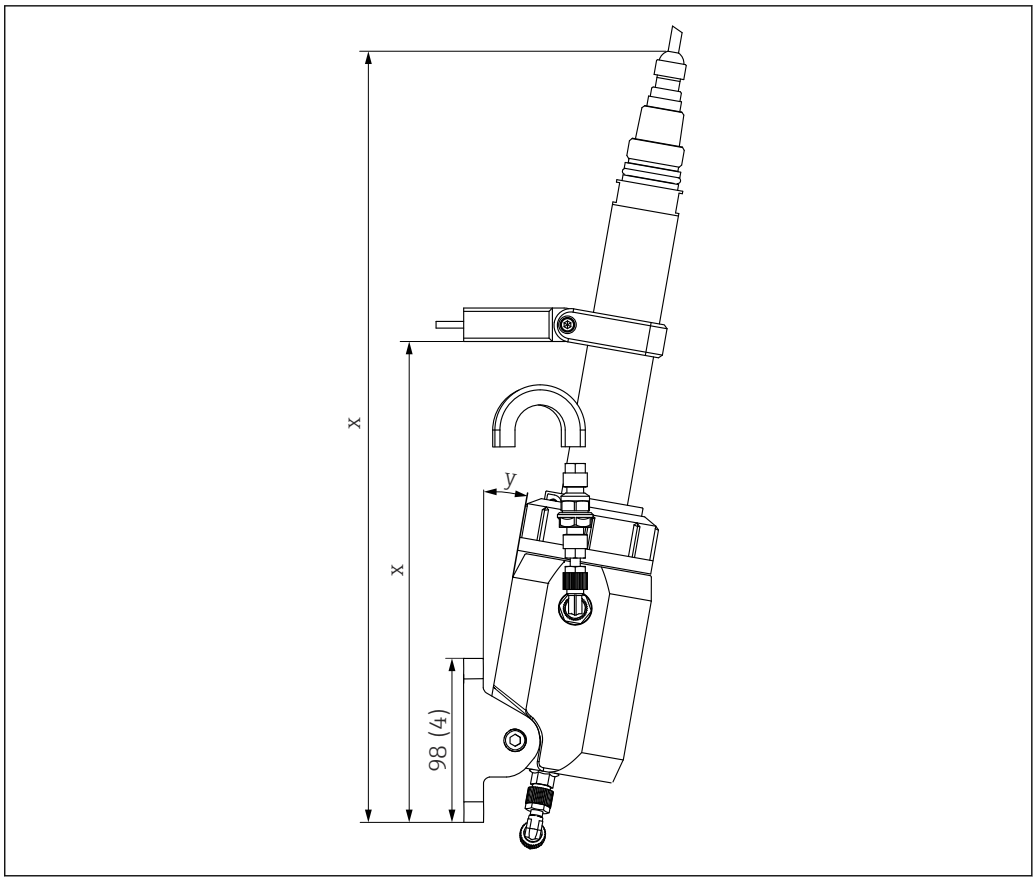
2 Dimensions of sensor. Engineering unit: mm (in)



3 Dimensions of sensor with clamping ring. Engineering unit: mm (in)



4 Dimensions of assembly with securing plate (right). Engineering unit: mm (in)



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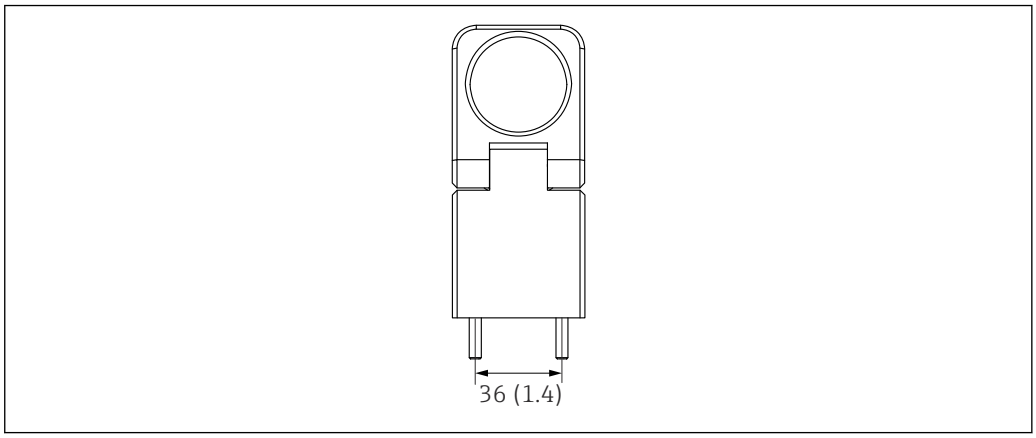
5 Dimensions of mounted sensor with assembly. Engineering unit: mm (in)

x Variable length (depending on mounting)
y Variable angle (depending on mounting)



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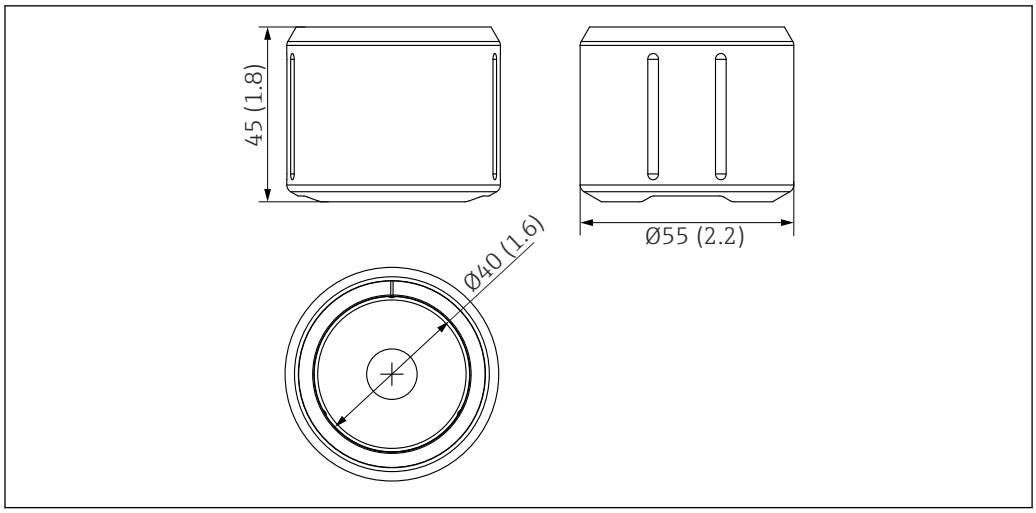
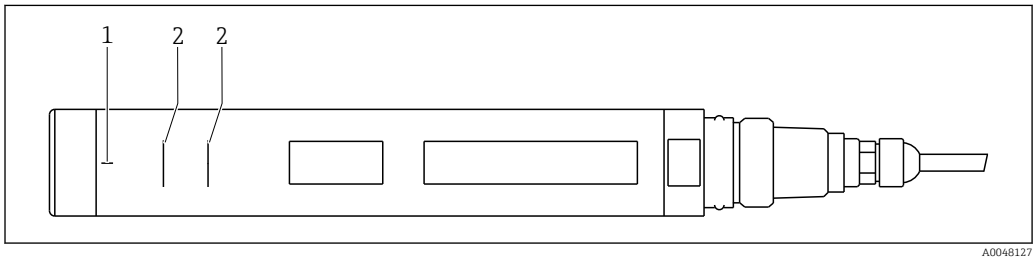
6 Dimensions of ring clip with spacer. Engineering unit: mm (in)



7 Dimensions of solid state reference. Engineering unit: mm (in)

5.1.2 Installation instructions

Installation in flow assembly



8 Installation markings for clamping ring

1 Vertical alignment line for solid state reference
2 Horizontal alignment lines for clamping ring

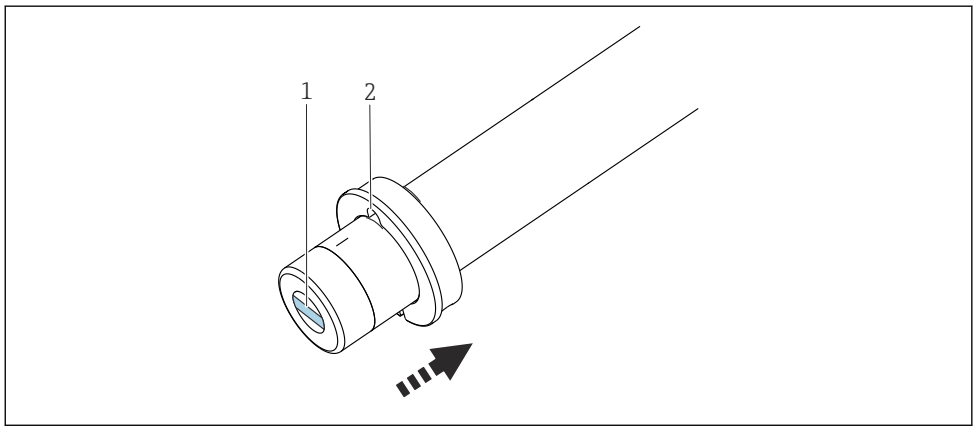
The vertical alignment line on the sensor is used to align the solid state reference. The horizontal alignment lines on the sensor indicate the exact positions where the upper and lower end of the clamping ring must be located.

Securing the clamping ring on the sensor

Proceed as follows if the clamping ring is not pre-installed on the sensor or if the clamping ring needs to be reassembled after disassembly:

1. Clean the surfaces on the sensor and clamping ring and remove any grease.

2.

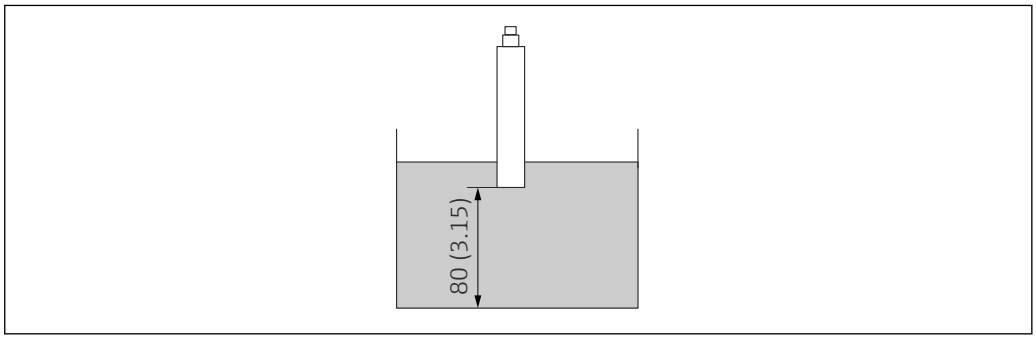


1 Optical window
2 Joint of the clamping ring

Slide the clamping ring through the sensor from below.

3. Align the joint of the clamping ring perpendicularly to the optical window of the sensor.
4. Slide the clamping ring exactly onto the horizontal alignment lines.
5. Using the enclosed M5 screw, secure the clamping ring with a torque of 5 Nm.

Installation without flow assembly



9 Positioning the sensor. Dimensions: mm (in)

Please note the following when installing the sensor without a flow assembly:
- The immersion depth of the sensor must be selected in such a way that the optical window of the sensor is always fully immersed in the medium.
- The distance to the bottom of the vessel must be at least 80 mm (3.15 in).

5.1.3 Orientation

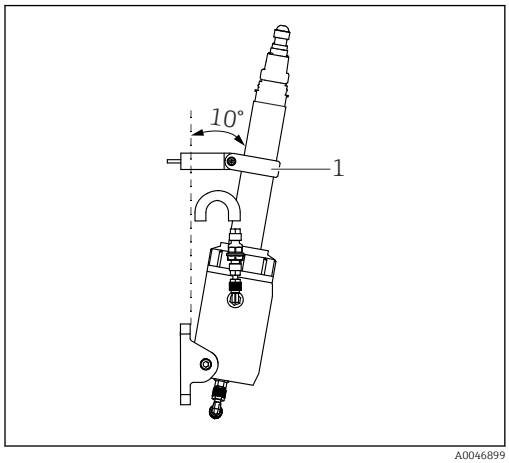
The angle of inclination of the sensor can affect the formation of air bubbles below the sensor. The greater the angle of inclination of the sensor, the more insensitive the measurement is to air bubbles.

▶ Adjust the angle of inclination if many air bubbles form → 13.

Setting the angle of inclination of the sensor

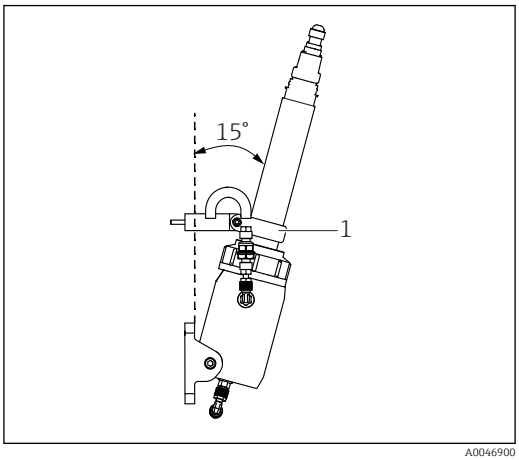
Depending on the measuring point, the angle of inclination for the sensor can be set individually. The angle of inclination is determined by the location of the spacer on the panel → 5, 11.

1. Put the spacer in the desired location.
   ↳ The angle of inclination of the sensor changes.
2. Fix the spacer on the panel → 17.



10 *Example with spacer mounted at top, 10° angle in relation to panel*

1 *Ring clip with spacer*



11 *Example with spacer mounted at bottom, 15° angle in relation to panel*

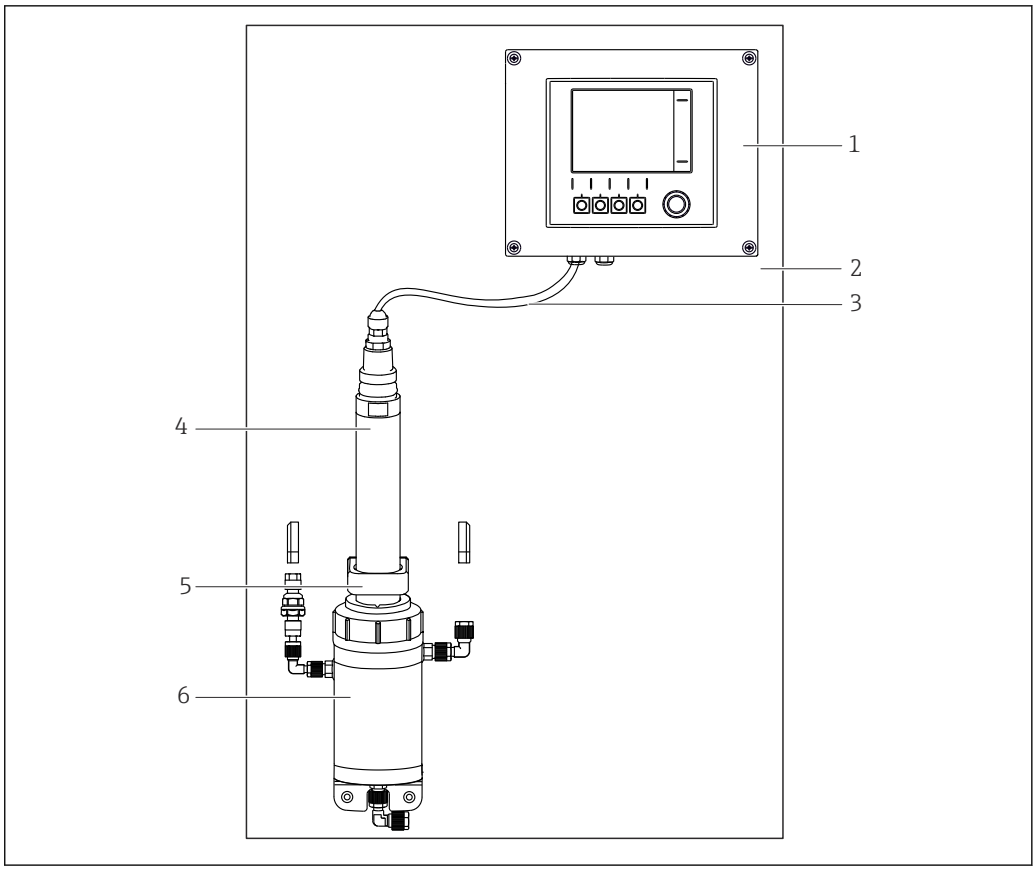
1 *Ring clip with spacer*

5.2 Mounting the device

5.2.1 Measuring system

The sensor is secured to a panel with the assembly.

A complete measuring system comprises:
- Sensor
- Liquiline CM44x multi-channel transmitter
- Flow assembly

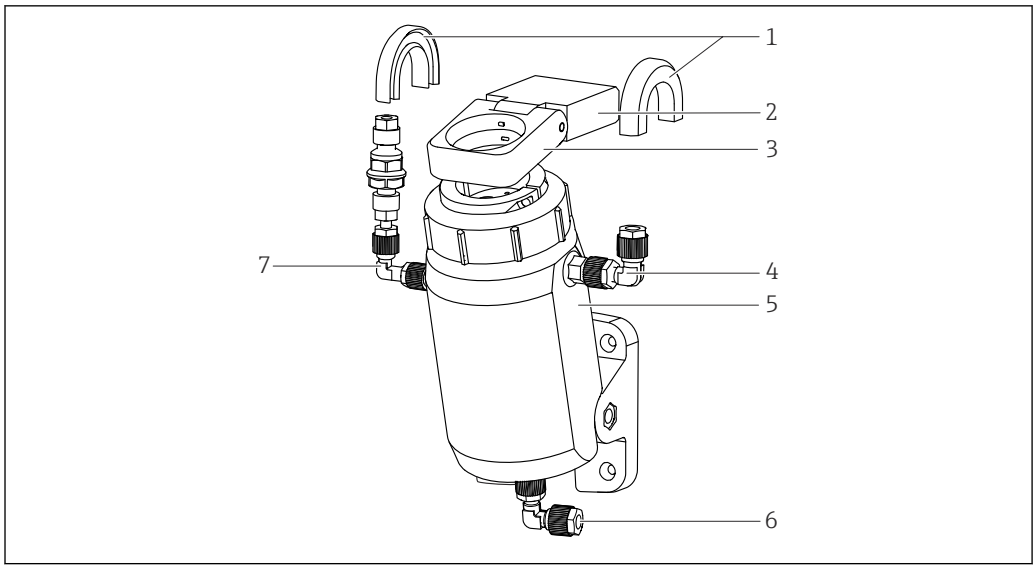


12 *Measuring system*

1 Transmitter
2 Panel
3 Fixed cable
4 Sensor
5 Ring clip/spacer
6 Assembly

Assembly

The assembly has the following structure:

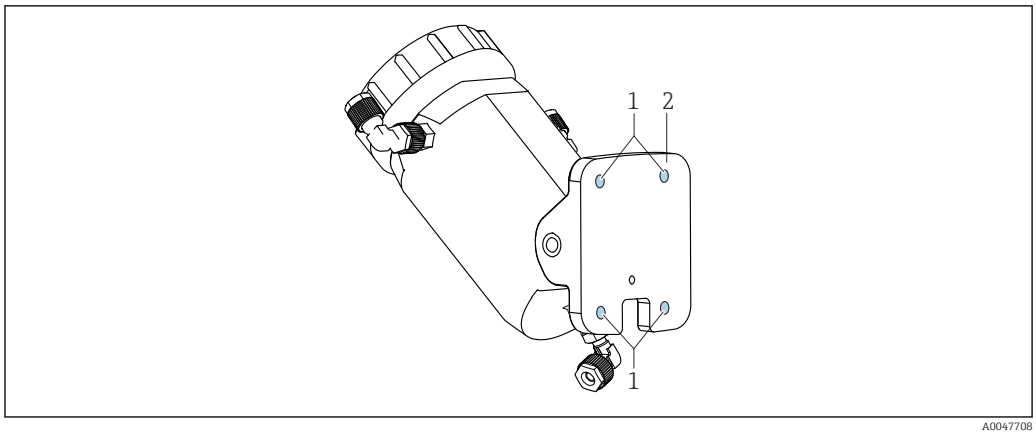


13 *Flow assembly*

1 *Hose bracket (anti-bend protection)*
2 *Spacer*
3 *Ring clip*
4 *Hose connection, outlet*
5 *Flow assembly*
6 *Hose connection, inlet*
7 *Connection for cleaning (optional)*

If possible, the measuring system setup should be free of air bubbles → 13. The assembly offers an integrated bubble trap for assistance. This works best at flow rates of at least 100 l/h (26.4 gal/h).

5.2.2 Mounting the assembly on the panel



14 *Rear view of assembly*

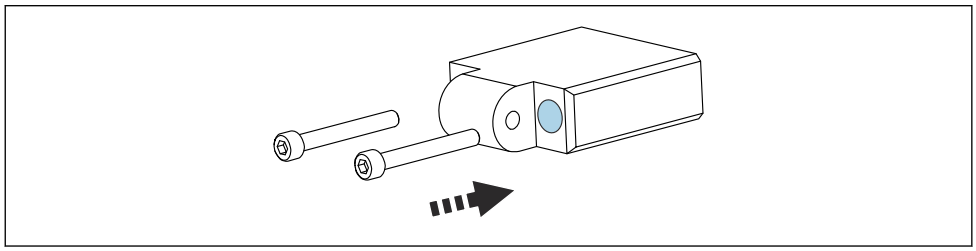
1 *Boreholes for M5 screws (not included in the scope of delivery)*
2 *Securing plate*

1. Hold the securing plate of the assembly up at the point where the assembly is to be fixed.
2. If necessary, release the assembly from the securing plate before mounting.
3. Mark the 4 boreholes on the panel. In doing so, pay attention to the dimensions → 10.
4. Drill the holes.

5. Fix the securing plate with the 4 M5 screws in a cross-wise sequence.

5.2.3 Mounting the spacer on the panel

The spacer, together with the ring clip, are used to secure the sensor. The spacer must be mounted at the level of the sensor housing.

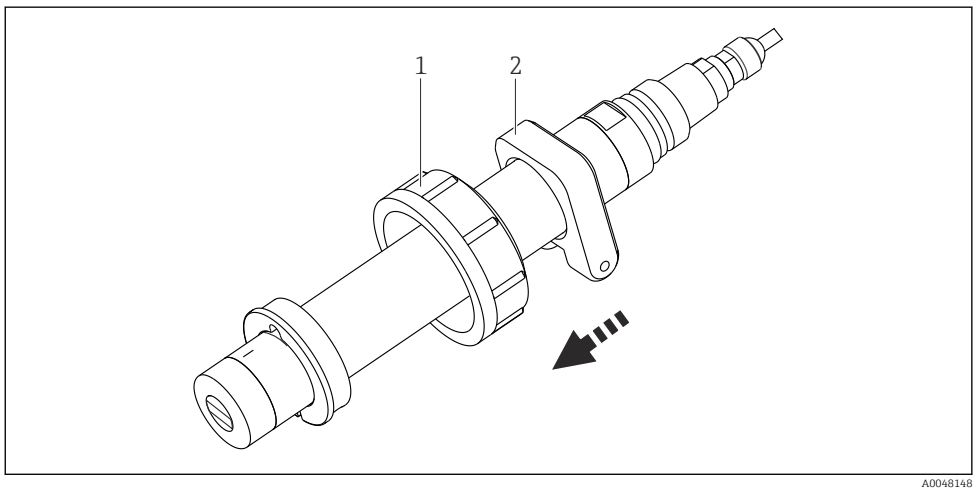
1. Hold the spacer up at the mounting point above the assembly. In doing so, pay attention to the dimensions → 5, 11.
2. Mark the 2 boreholes on the panel. In doing so, pay attention to the dimensions → 11.
3. Drill the holes.
4. 

   Fix the spacer on the panel with 2 M5 screws.

5.2.4 Mounting the sensor with the assembly

The sensor can be installed in the assembly both with the pre-installed clamping ring and without the installed clamping ring.

Preparatory steps for the sensor with the installed clamping ring:

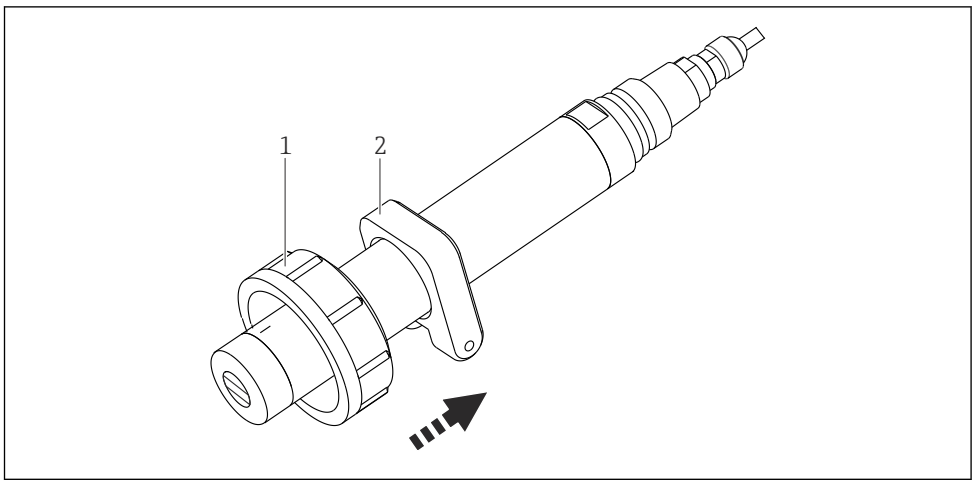
1. 

   1 Union nut
   2 Ring clip

   Slide the union nut onto the sensor from above (over the fixed cable).
2. Slide the ring clip onto the sensor from above (over the fixed cable).

Preparatory steps for the sensor without an installed clamping ring:

1.



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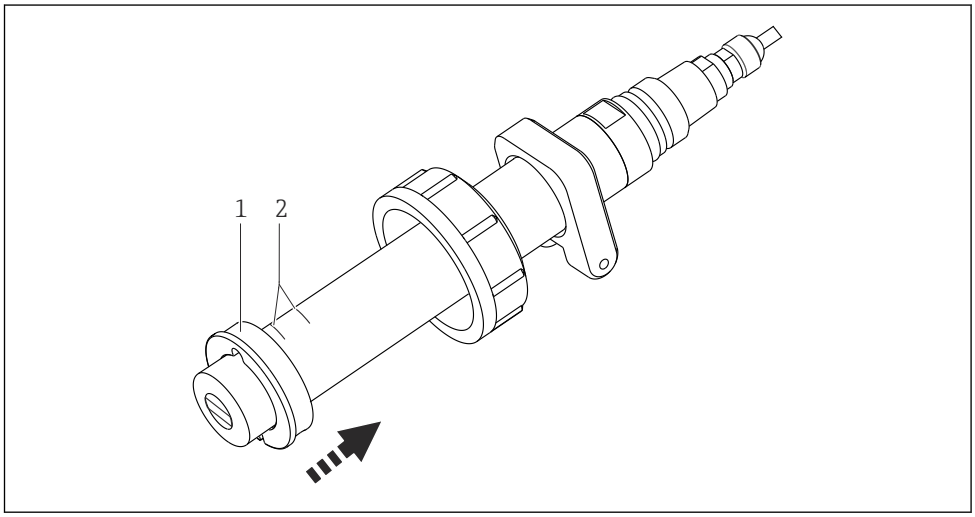
1 Union nut
2 Ring clip

Slide the ring clip onto the sensor from below.

2. Slide the union nut onto the sensor from below.

3.



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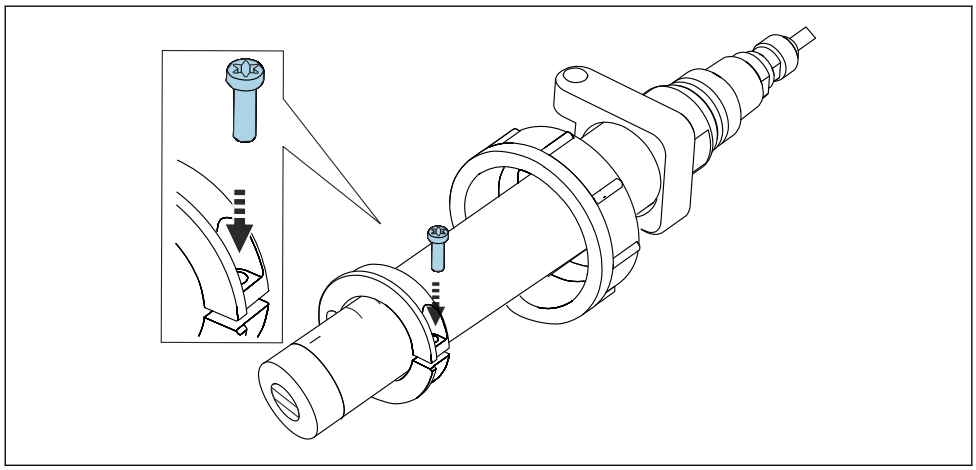
1 Clamping ring
2 Alignment lines

Slide the clamping ring onto the sensor.

4. Make sure that the joint of the clamping ring is perpendicular to the optical window.
5. Position the clamping ring on the alignment lines of the sensor → 10.

6.



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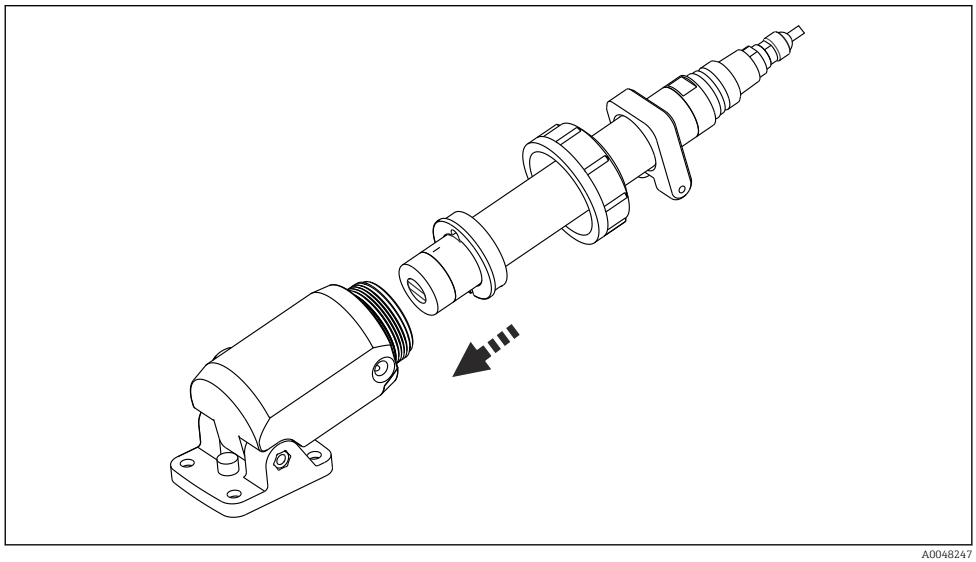
Using the M5 screw, tighten the clamping ring with a torque of 5 Nm.

Mounting the sensor with the assembly

1.



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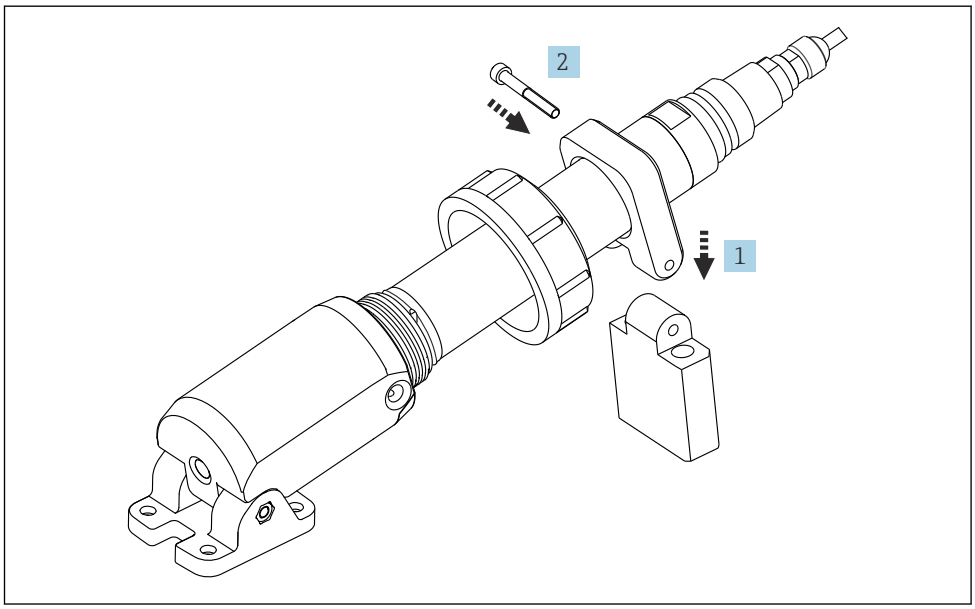
Slide the sensor into the assembly as far as the clamping ring.

2.



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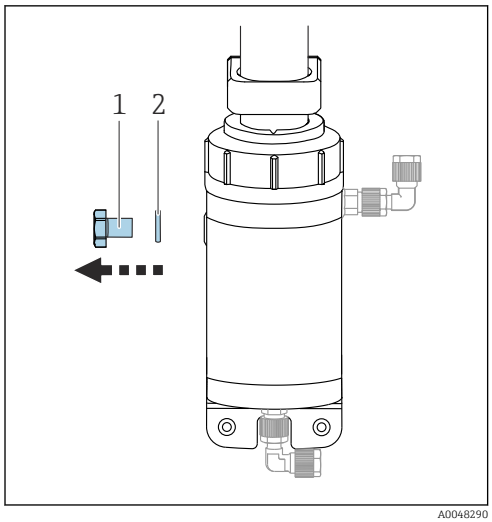
Connect the ring clip to the mounted spacer.

3. Use the enclosed M5 screw to fix the ring clip and the spacer.
4. Slide the union nut down as far as the edge of the assembly.
5. Tighten the union nut.

5.2.5 Mounting the cleaning connection

The use of the cleaning connection is optional.



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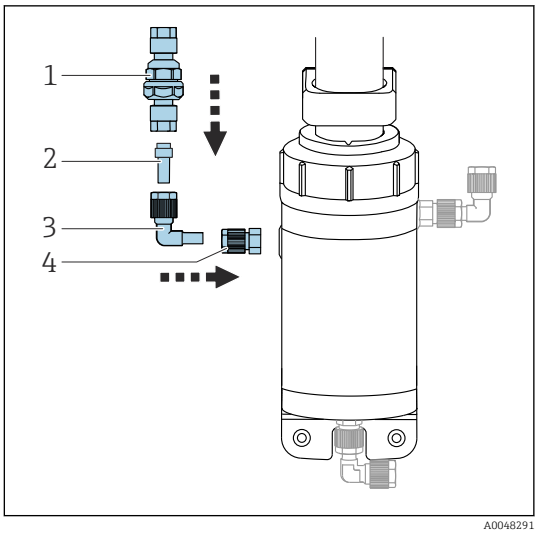
15 Preparing the cleaning connection

1 Screw plug
2 O-ring



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16 Mounting the cleaning connection

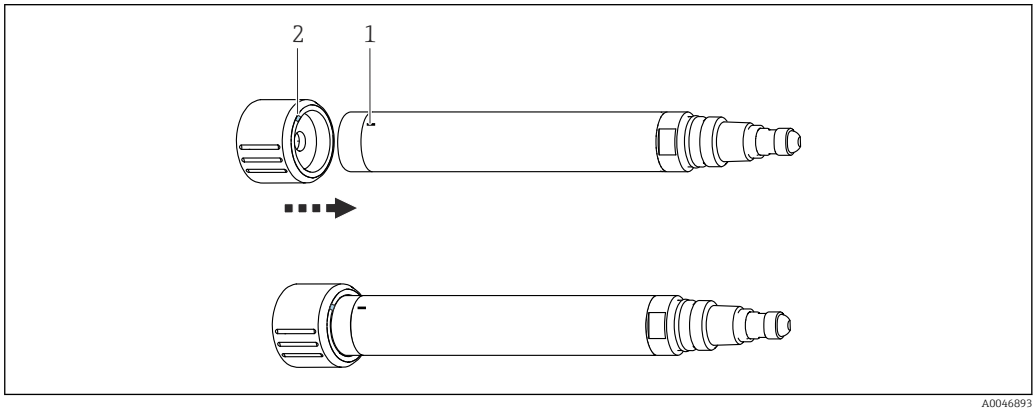
1 Check valve
2 Nipple
3 Angle connection
4 Hose connection

1. Loosen the lock screw.
2. Remove the lock screw and O-ring → 15, 20.
3. Fit the hose connection on the opening of the cleaning connection and secure it → 16, 20.

4. Fit the angle connection, nipple and check valve on the hose connection → 16, 20.
5. Screw on the check valve and tighten by hand.
6. Connect the hose for cleaning.
7. Before commissioning the cleaning, check again to ensure that all connections are firmly seated.

5.2.6 Positioning the solid state reference

▶ Ensure that the serial number of the solid state reference matches your sensor.



17 *Fitting the sensor on the solid state reference*

1 Installation marking on the sensor
2 Installation marking on the solid state reference

1. Remove the sensor from the assembly → 35.
2. Clean the sensor.
3. Remove the protective cap of the solid state reference.
4. Align the sensor in such a way that the installation marking on the sensor is located above the installation marking on the solid state reference.
5. Fit the solid state reference onto the sensor until the end stop.

5.3 Post-mounting check

Put the sensor into operation only if the following questions can be answered with "yes":
- Are the sensor and cable undamaged?
- Is the orientation correct?
- Is the sensor installed in the assembly and not suspended from the cable?

6 Electrical connection

⚠ WARNING

Device is live!

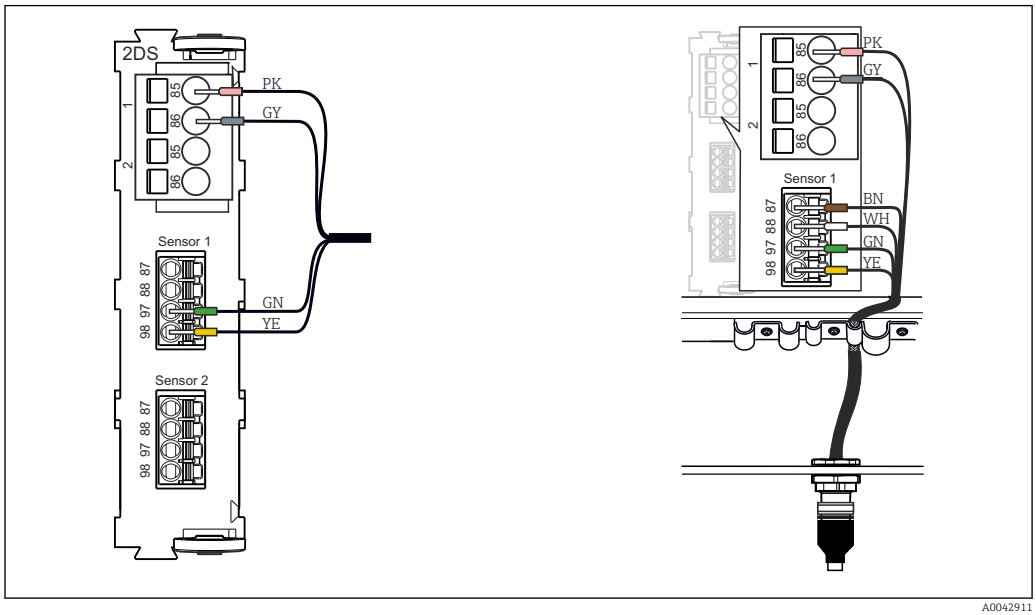
Incorrect connection may result in injury or death!

- ▶ 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.

6.1 Connecting the sensor

The following connection options are available:

- Via M12 plug (version: fixed cable, M12 plug)
- Via the cable of the device to the plug-in terminals of the input of the transmitter (version: fixed cable, wire end ferrules)



18 *Device connection to input (left) or with M12 plug (right)*

The device is available with the following fixed cable lengths:

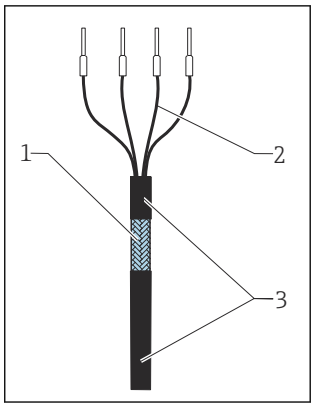
- 3 m (9.84 ft)
- 7 m (22.97 ft)
- 15 m (49.22 ft)

6.1.1 Connecting the cable shield

The device cable must be shielded cables.

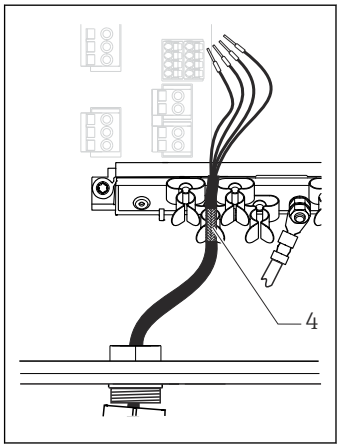
Only use terminated original cables where possible.

Sample cable (does not necessarily correspond to the original cable supplied)



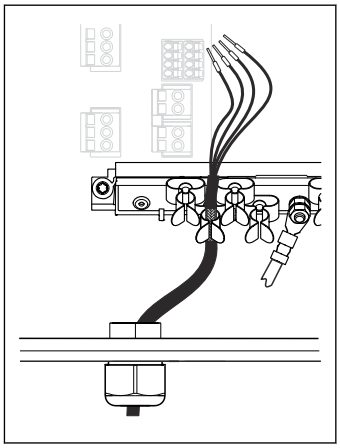
19 *Terminated cable*

1 Outer shield (exposed)
2 Cable cores with ferrules
3 Cable sheath (insulation)



20 *Connect the cable to the grounding clamp*

4 Grounding clamp



21 *Press the cable into the grounding clamp*

The cable shield is grounded using the grounding clamp [1)]

1) Observe the instructions in the "Ensuring the degree of protection" section

1. Loosen a suitable cable gland on the bottom of the housing.
2. Remove the dummy plug.
3. Attach the gland to the cable end, making sure the gland is facing the right direction.
4. Pull the cable through the gland and into the housing.
5. Route the cable in the housing in such a way that the **exposed** cable shield fits into one of the cable clamps and the cable cores can be easily routed as far as the connection plug on the electronics module.
6. Connect the cable to the cable clamp.
7. Clamp the cable.
8. Connect cable cores as per the wiring diagram.
9. Tighten the cable gland from outside.

6.2 Ensuring the degree of protection

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

▶ Exercise care when carrying out the work.

Individual types of protection permitted for this product (impermeability (IP), electrical safety, EMC interference immunity) can no longer be guaranteed if, for example :
- Covers are left off
- Different power units to the ones supplied are used
- Cable glands are not sufficiently tightened (must be tightened with 2 Nm (1.5 lbf ft) for the permitted level of IP protection)
- Unsuitable cable diameters are used for the cable glands
- Modules are not fully secured
- The display is not fully secured (risk of moisture entering due to inadequate sealing)
- Loose or insufficiently tightened cables/cable ends
- Conductive cable strands are left in the device

6.3 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 all screw terminals tightened?	▶ Tighten the screw terminals.
Are all cable entries mounted, firmly tightened and leak-tight?	▶ Perform a visual inspection. In the case of lateral cable entries:
Are all cable entries mounted on the side or pointing downwards?	▶ Point cable loops downward so that water can drip off.

7 Commissioning

7.1 Preliminaries

Prior to initial commissioning, ensure that:
- The sensor is correctly installed
- The electrical connection is correct

▶ Before commissioning, check the chemical material compatibility, the temperature range and the pressure range.

7.1.1 Assembly adjustment

The material of the flow assembly used affects the autofluorescence. Depending on the customer's requirements, the value of the autofluorescence can be adjusted in the clean and dry assembly before commissioning or recommissioning.

Offset calibration → 32

1. Ensure that the assembly is clean and dry.
2. Measure the value in the clean and dry assembly.
3. Select **Calibration** in the transmitter.
4. Select the fluorescence sensor.
5. Under **Fluorescence**, enter the value previously measured as a negative offset.

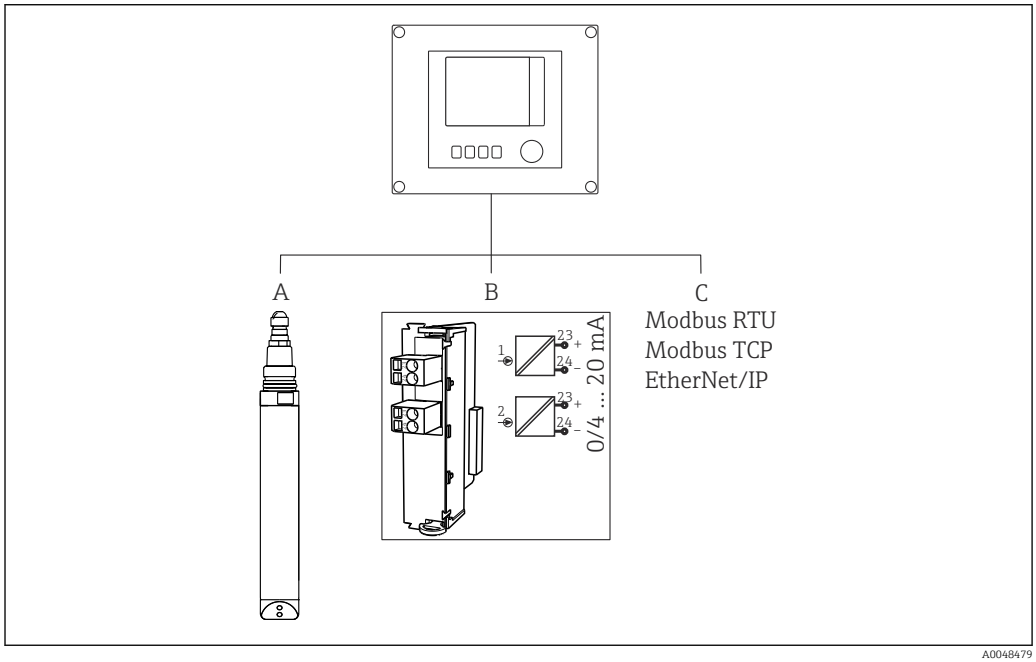
8 Operation

8.1 Adapting the measuring device to the process conditions

8.1.1 Turbidity compensation

The measured value of the sensor is affected by turbidity that may occur. The device compensates for the turbidity effects automatically and in real-time when turbidity compensation is switched on.

For detailed information on turbidity compensation, see the Operating Instructions for the transmitter



22 Turbidity compensation options

A Memosens sensor, e.g. CUS52D
B Analog input
C Fieldbus systems

Turbidity compensation can be performed in the following 3 ways:
- Via the Memosens sensor, CUS52D
- Via the analog input of the transmitter
- Via fieldbus system

► Switch on turbidity compensation at the transmitter.

8.1.2 Calibration

The sensor is adjusted on leaving the factory. It can be used directly without the need for additional calibration.

The following calibrations are possible:
- Calibration
  - In-situ calibration with the certified solid state reference
  - Recalibration by the manufacturer
- Application adjustment
  - Calibration or adjustment using reference samples via a value table (1-6 points)
  - Entry of a factor (multiplication of the measured values by a constant factor)
  - Entry of an offset (addition/subtraction of a constant value to/from the measured values)

► Before a calibration, clean the device so that there is no dirt on the optical window.

Solid state reference

The sensor is adjusted ex-works in compliance with Resolution MEPC.259(68) and MEPC.340(77).

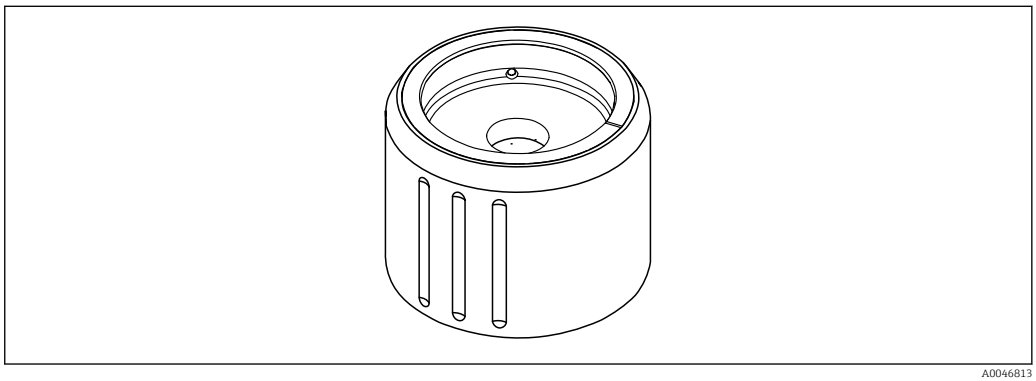
1. To comply with the MEPC.259(68) and MEPC.340(77) criteria, calibrate the sensor at least once a year using the solid state reference.
2. If necessary, adjust the sensor with the solid state reference.

The solid state reference is qualified for calibration and adjustment in the entire sensor measuring range according to the requirements of the relevant MEPC resolutions.

We recommend you send in the sensor and solid state reference to the manufacturer every 4 years for inspection and recalibration.

During factory calibration, the solid state reference is adapted to the sensor. The solid state reference can only be used with this sensor. The solid state reference and the sensor are therefore permanently assigned to one another.

The functional integrity of the sensor can be checked using the solid state reference. The sensor can be calibrated and adjusted. Adjustment is performed automatically by the transmitter following calibration.



A0046813

23 Solid state reference

Calibration with solid state reference

⚠ CAUTION

High pressure and high temperatures when removing the sensor

Risk of injury!

► Pay attention to the process pressure and process temperature.

► If the process pressure is elevated, reduce the process pressure before removing the sensor. Use the manual valve mounted onsite for this purpose.

⚠ CAUTION

Medium leaking

Risk of injury, damage to clothing and the system!

- ▶ Make sure that the inlet and outlet of the assembly are shut off.
- ▶ Make sure that automatic cleaning is switched off before performing the calibration.

NOTICE

Condensation and fouling cause incorrect calibration results!

- ▶ Clean the sensor, and particularly the sensor's optical window, thoroughly beforehand.
- ▶ Avoid condensation on the sensor.

For detailed information on transmitter settings, see the Operating Instructions for the transmitter

Pay attention to the following conditions for the calibration:

- No condensation on the sensor or the solid state reference
- Stable temperature of the sensor and the solid state reference
- Compliance with ambient temperature ranges
- Clean optical sensor window

Start calibration

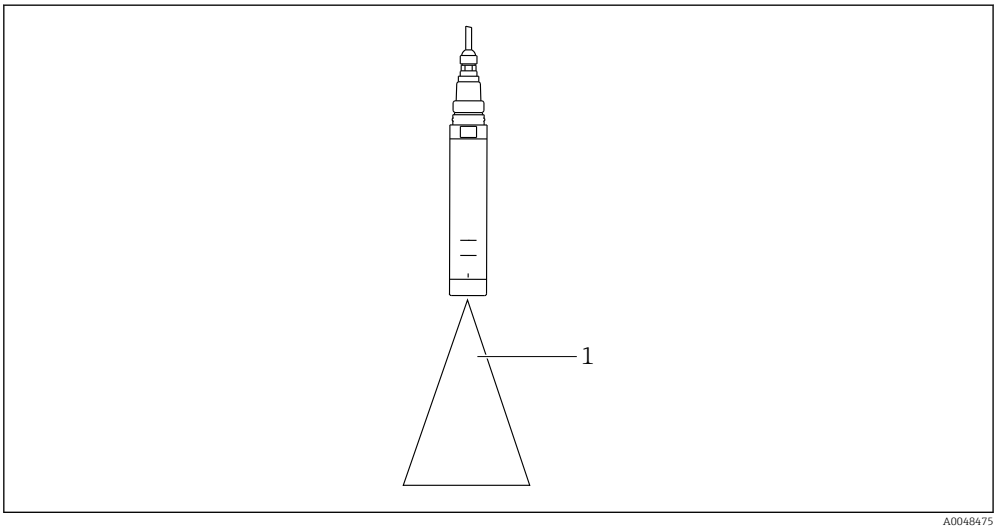
1. Select **Calibration** on the transmitter.
2. Select the fluorescence sensor.
3. Select **Fluorescence**.
4. Select **Solid state reference**.
5. Follow the instructions of the transmitter.

Function check in air:

- ▶ **NOTICE**

  Objects and items of clothing in front of the optical window result in incorrect measured values!

  - ▶ Remove any objects below the sensor (at least 0.5 m (1.64 ft)).



1 Free space

Hold the sensor in the free space.

Failed function check in air:

1. Clean the optical sensor window again.
2. Repeat the measurement procedure.

3. If the measurement is still outside the specified limits after multiple rounds of cleaning, send the sensor to your local Endress+Hauser sales organization.

Once the process of calibrating with the solid state reference is completed, the following statuses are possible:
- Calibration completed successfully
  The measured value is within the limit values indicated and therefore an automatic adjustment was not necessary
- Calibration completely successfully and automatic adjustment performed
  The measured value has exceeded the limit values and has been successfully corrected by the automatic adjustment
- Calibration has failed, no automatic adjustment has been performed
  The measured value is outside the limit values and an automatic adjustment was not possible. The device no longer measures using the specification of the MEPC.

The sensor can continue measuring following a failed adjustment. It continues measuring based on the last adjustment to be completed successfully.

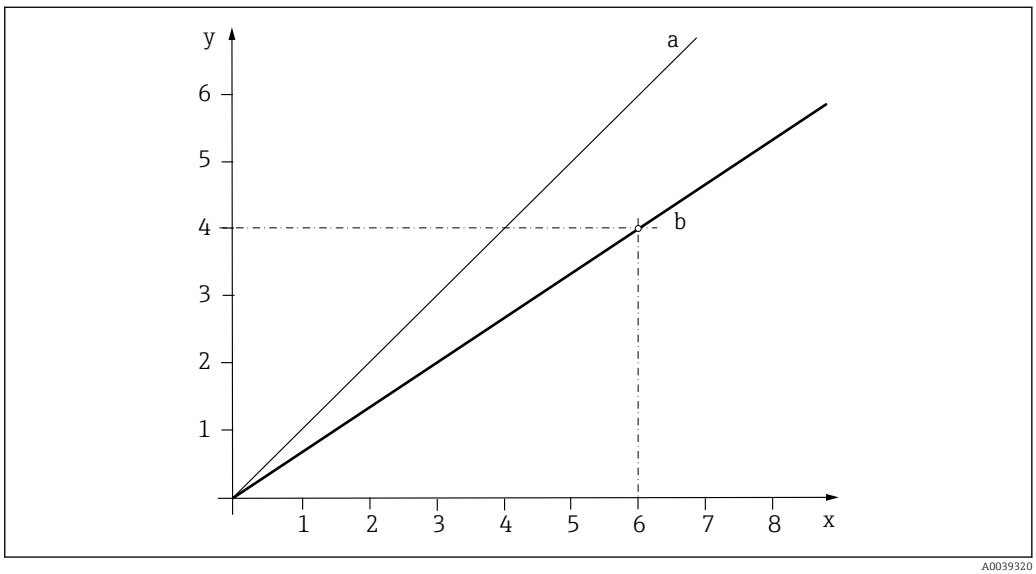
Failed calibration with solid state reference:

1. Clean the optical sensor window again.
2. Repeat the calibration procedure.
3. If the calibration still fails after multiple rounds of cleaning, send the sensor to your local Endress+Hauser sales organization.

Application adjustments

1-point calibration

The measured error between the measured value of the device and the laboratory measured value is too large. This is corrected by a 1-point calibration.



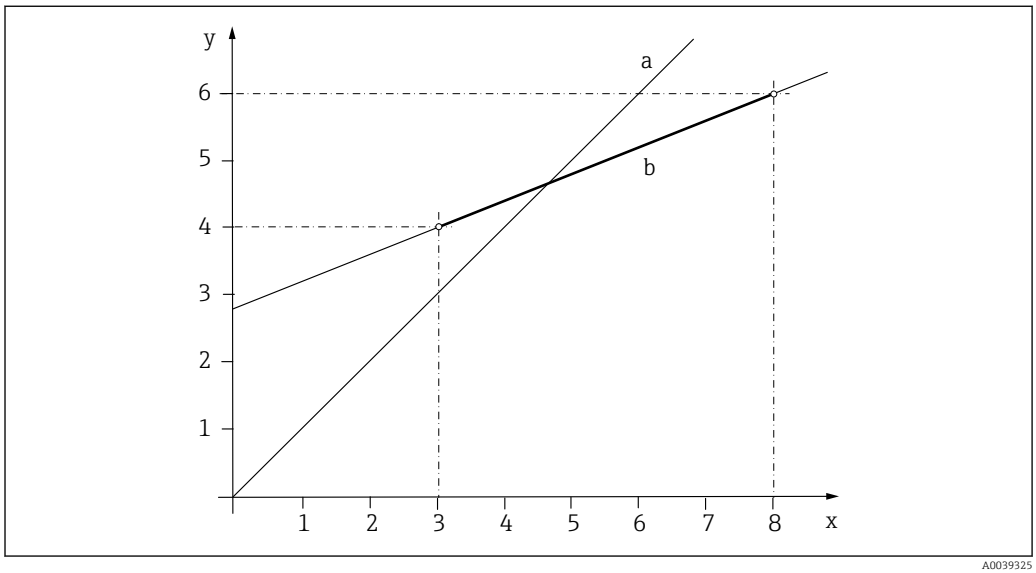
24 Principle of a 1-point calibration

x Measured value
y Target sample value
a Factory calibration
b Application calibration

1. Select data record.
2. Set the calibration point in the medium and enter the target sample value (laboratory value).

2-point calibration

Measured value deviations are to be compensated for at 2 different points in an application (e.g. the maximum and minimum value of the application). This aims to ensure a maximum level of accuracy between these two extreme values.



25 *Principle of a 2-point calibration*

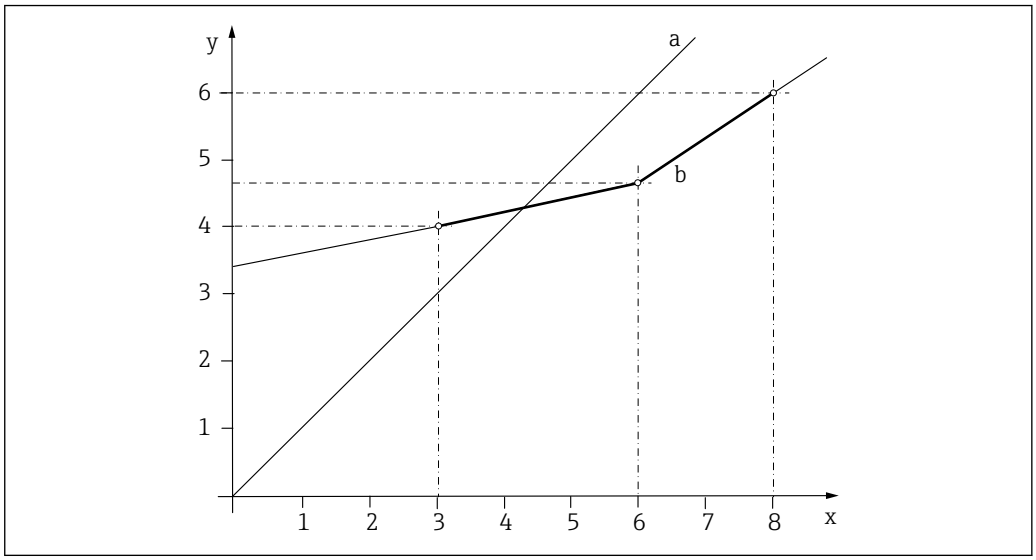
x *Measured value*
y *Target sample value*
a *Factory calibration*
b *Application calibration*

1. Select a data record.
2. Set 2 different calibration points in the medium and enter the corresponding set points.

A linear extrapolation is performed outside the calibrated operational range (gray line).

The calibration curve must be monotonically increasing.

3-point calibration



26 Principle of multipoint calibration (3 points)

x Measured value
y Target sample value
a Factory calibration
b Application calibration

1. Select data record.
2. Set 3 different calibration points in the medium and specify the corresponding set points.

A linear extrapolation is performed outside the calibrated operational range (gray line).

The calibration curve must be monotonically increasing.

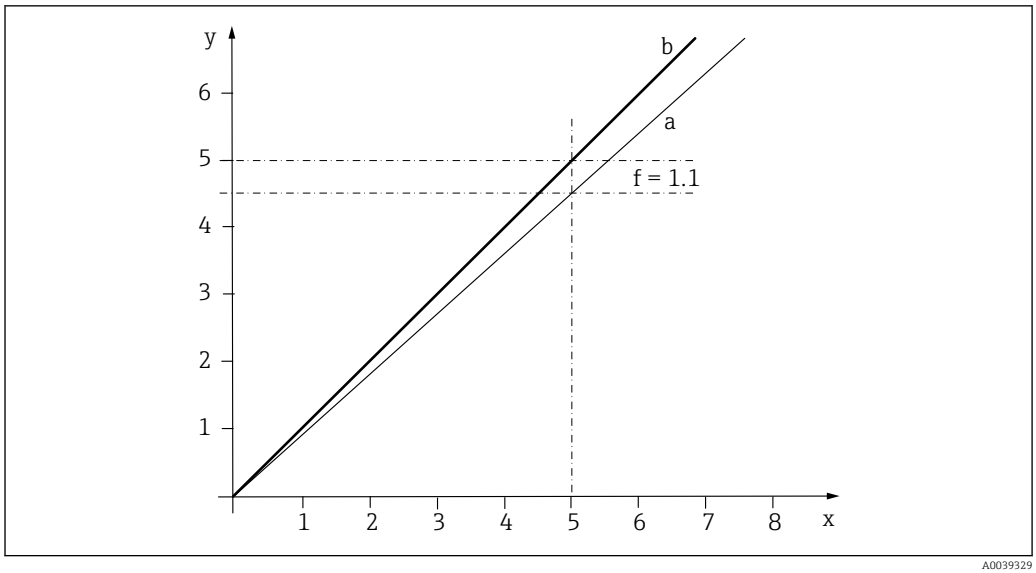
Factor

With the "Factor" function, the measured values are multiplied by a constant factor. The functionality corresponds to that of a 1-point calibration.

Example:

This type of adjustment can be selected if the measured values are compared to the laboratory values over a longer period of time and all values are too low by a constant factor, e.g. 10%, in relation to the laboratory value (target sample value).

In the example, the adjustment is made by entering the factor 1.1.

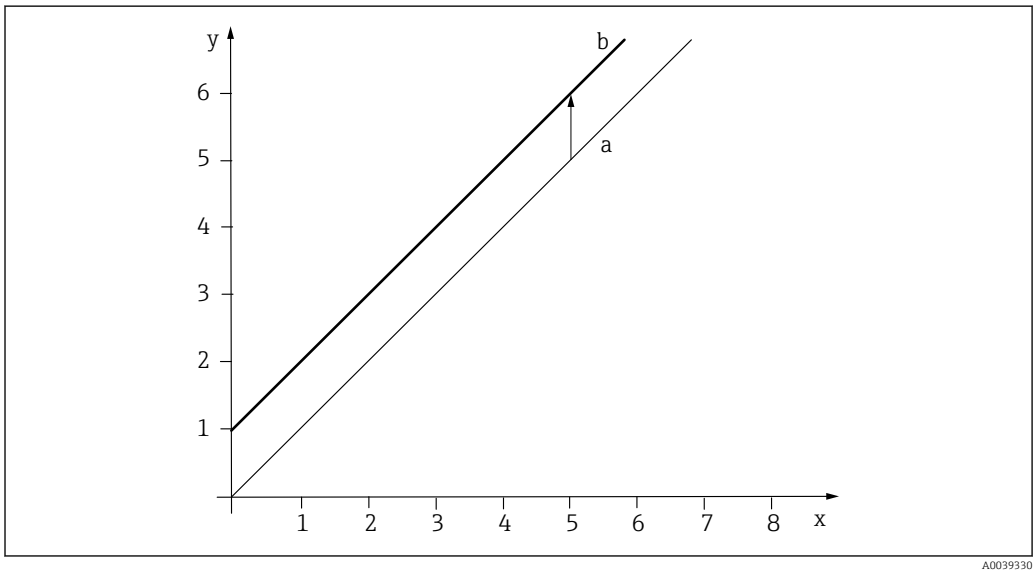


27 Principle of factor calibration

x Measured value
y Target sample value
a Factory calibration
b Factor calibration

Offset

With the "Offset" function, the measured values are offset by a constant amount (added or subtracted).



28 Principle of an offset

x Measured value
y Target sample value
a Factory calibration
b Offset calibration

8.1.3 Signal filter

The sensor is fitted with an internal signal filter function in order to adapt the measurement flexibly to different measuring requirements. Fluorescence measurements may have a low signal-to-noise ratio. In addition, there may be disturbances from air bubbles or contamination for example.

However, a high level of damping affects the sensitivity of the measured value required in applications.

Measurement filter

The following filter settings are available:

Measurement filter	Description
Weak	Low filtering, high sensitivity, fast response to changes (2 seconds)
Normal (default)	Medium filtering, 10-second response time
Strong	Strong filtering, low sensitivity, slow response to changes (25 seconds)
Specialist	This menu is designed for the Endress+Hauser Service Department.

If the desired signal quality cannot be achieved due to disturbance factors, e.g. air bubbles, we recommend setting the measurement filter to the "Strong" setting.

9 Diagnostics and troubleshooting

9.1 General troubleshooting

When troubleshooting, the entire measuring point must be taken into account:
- Transmitter
- Electrical connections and cables
- Sensor

The possible causes of error in the following table refer primarily to the sensor.

Problem	Check	Remedial action
Blank display, no sensor reaction	▪ Line voltage at transmitter? ▪ Sensor connected correctly? ▪ Buildup on optical windows?	▶ Connect mains voltage. ▶ Establish correct connection. ▶ Clean sensor.
Display value too high or too low	▪ Buildup on optical windows? ▪ Sensor calibrated?	▶ Clean device. ▶ Calibrate device.
Display value fluctuating greatly	Is the mounting location correct? Disturbance from gas bubbles?	▶ Select a different mounting location. ▶ Eliminate gas bubbles at the installation location, e.g. using a gas bubble trap or by throttling the assembly outlet. ▶ Adjust measured value filter.

Pay attention to the troubleshooting information in the Operating Instructions for the transmitter. Check the transmitter if necessary.

10 Maintenance

10.1 Maintenance tasks

⚠ WARNING

UV radiation from this product

Can cause damage to the eyes and skin!

- ▶ Avoid any exposure of the eyes and skin to the unshielded product.
- ▶ When the sensor is switched on, avoid looking directly into the sensor window without appropriate eye protection. The exposure limits according to IEC 62471:2008 are not exceeded within the first 100 seconds.
- ▶ Appropriate protective goggles must be worn to protect against UV radiation.
- ▶ Cover the light source when performing maintenance tasks that do not need UV light.

⚠ CAUTION

Acid or medium

Risk of injury, damage to clothing and the system!

- ▶ Switch off cleaning before the sensor is removed from the medium.
- ▶ Wear protective goggles and safety gloves.
- ▶ Clean away splashes on clothes and other objects.

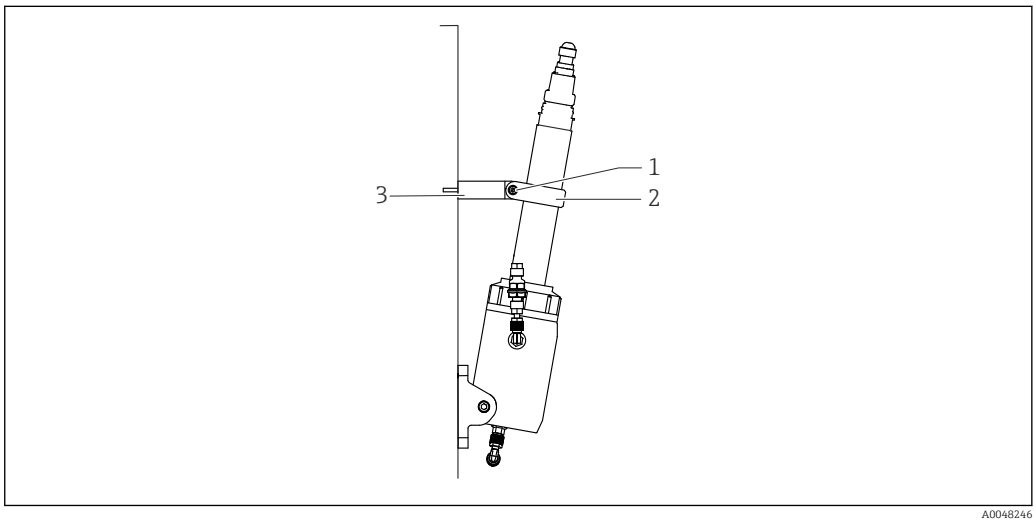
- ▶ You must perform maintenance tasks at regular intervals.

We recommend setting the maintenance times in advance in an operations journal or log.

The maintenance cycle primarily depends on the following:

- The system
- The installation conditions
- The medium in which measurement takes place

10.1.1 Removing sensor from assembly

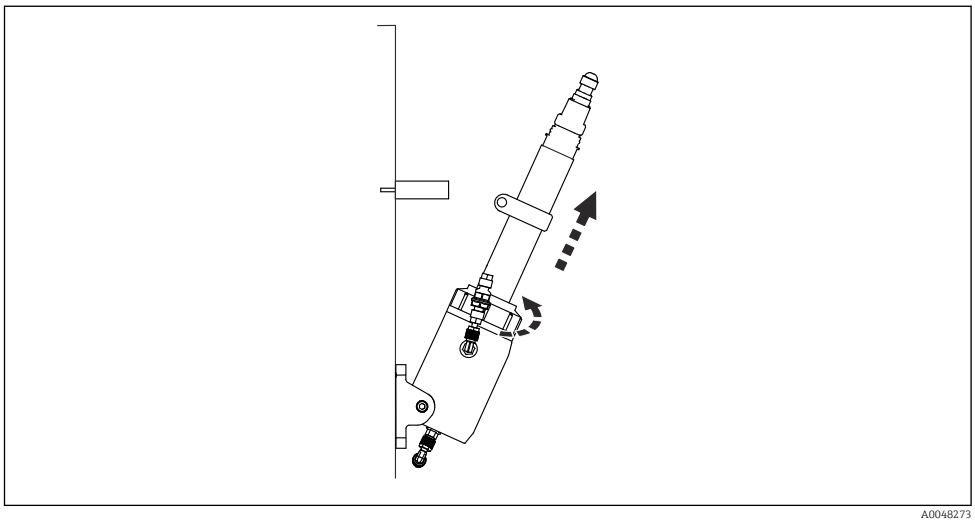


29 *Sensor with assembly*

1 M5 screw
2 Ring clip
3 Spacer

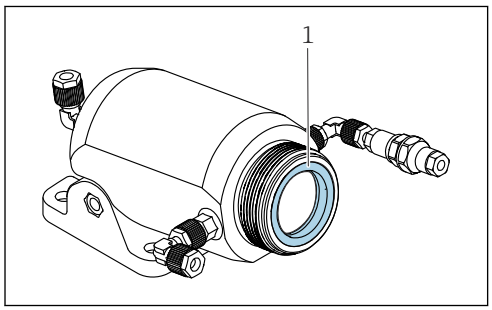
To clean or calibrate the sensor, move the sensor to the service position:

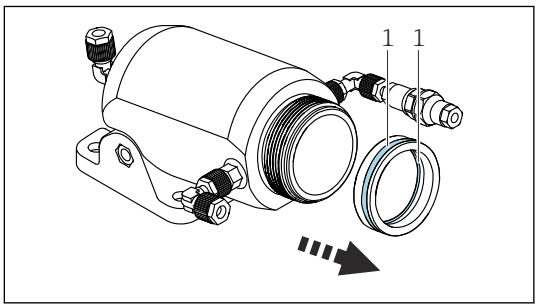
1. Shut off the inlet for the process medium before the maintenance tasks.
2. Pay attention to the process pressure and temperature of the medium → 40.

3. Slacken the M5 screw that connects the ring clip and the spacer. Make sure that the screw is not lost during removal.
4. Tilt the sensor slightly towards the front.
5. Turn the union nut to release the sensor.
6. 

   Push up the union nut.
7. Remove the entire sensor from the assembly.

10.1.2 Replacing O-rings on the double sealing ring of the assembly





30 Assembly

1 Double sealing ring

1 O-rings

The double sealing ring contains 2 O-rings.

Replace the O-rings:

1. Remove the double sealing ring from the assembly → 36.
2. Replace the double sealing ring if necessary or if it is damaged.
3. Remove both O-rings from the double sealing ring. Use a tweezers if necessary.
4. Fit freshly greased O-rings on the double sealing ring.

Insert the double sealing ring in the assembly:

1. Place the double sealing ring back into the opening of the assembly.
2. Push down the double sealing ring firmly so that it is located completely in the assembly.
3. If necessary, push down the double sealing ring e.g. with a screwdriver.
4. Ensure the double sealing ring is securely fitted.

10.1.3 Cleaning the sensor

Sensor fouling can affect the measurement results and even cause a malfunction.

- ▶ To ensure reliable measurements, clean the sensor at regular intervals. The frequency and intensity of the cleaning process depend on the medium.

Clean the sensor:
- As specified in the maintenance schedule
- Before every calibration
- Before returning it for repair

Type of contamination	Cleaning measure
Dirt particles on the sensor window	▶ Wipe the sensor window with a soft cleaning cloth.
Deposit buildup on the sensor window	There may be deposit buildup in the non-visible range (UV). Therefore, always clean the optics. ▶ Clean away oily substances with a suitable solution, e.g. isopropyl alcohol.

After cleaning:

- ▶ Rinse the sensor thoroughly with water.

10.1.4 Cleaning the assembly

- ▶ To ensure reliable measurement, clean and rinse the assembly regularly. The frequency and intensity of the cleaning process depend on the medium.

11 Repair

11.1 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).

11.2 Spare parts

Device spare parts that are currently available for delivery can be found on the website:

www.endress.com/device-viewer

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

11.3 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.

To ensure the swift, safe and professional return of the device:

▶ Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

11.4 Disposal

The device contains electronic components. The product must be disposed of as electronic waste.

▶ Observe the local regulations.

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.

12 Accessories

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

▶ For accessories not listed here, please contact your Service or Sales Center.

12.1 Device-specific accessories

Flow assembly 71546713
- Material: PVDF V0
- Process pressure range: 6 bar (87 psi) (20 °C (68 °F))
- Process temperature range: –5 to 55 °C (23 to 131 °F)
- Flow rate: 40 to 120 l/h (10.6 to 31.7 gal/h)
- Order No. 71546713

13 Technical data

13.1 Input

Measured variable	▪ PAH concentration in phenanthrene equivalents PAH_{phe} ▪ Temperature
Measuring range	0 to 5 000 µg/l PAH_{phe}

13.2 Performance characteristics

Maximum measured error	< 5 % of reading or 6.7 µg/l, at 20 °C (68 °F) according to DIN EN ISO 15839 and MEPC.259(68) and MEPC.340(77)
Reading stability over temperature	Measured with solid state reference at 100 µg/l in the temperature range from −5 to 55 °C (23 to 131 °F) < 5 % of reading
Repeatability	< 1 % of reading or 1 µg/l PAH_{phe}, the larger value applies in each case
Long-term reliability	Relative measured value deviation per year: < 5%
Response time	< 10 seconds adjustable
Limit of detection	Limit of detection in accordance with ISO 15839 in ultrapure water: 2 µg/l PAH_{phe}
Turbidity compensation	▪ Measured error with turbidity compensation switched off: 0 to 5 FNU, < 5 % of measured value ▪ Measured error with turbidity compensation switched on: 0 to 50 FNU, < 5 % of measured value

13.3 Environment

Ambient temperature range	**Sensor** −20 to 60 °C (−4 to 140 °F) **Solid state reference** −5 to 60 °C (23 to 140 °F), without condensation
Storage temperature	−20 to 70 °C (−4 to 158 °F)

Degree of protection	▪ IP 68 ▪ NEMA 6P
Electromagnetic compatibility (EMC)	Interference emission and interference immunity according to: ▪ EN 61326-1:2013 ▪ EN 61326-2-3:2013 ▪ NAMUR NE21: 2012

13.4 Process

Process temperature range	−5 to 55 °C (20 to 130 °F)
Process pressure range	▪ Sensor: 0.5 to 10 bar (7.3 to 145 psi) ▪ Sensor with assembly: 0.5 to 6 bar (7.3 to 87 psi)
Flow limit	**Minimum flow** No minimum flow required.

13.5 Mechanical construction

Dimensions	→ Section "Installation"

Weight	Sensor without clamping ring:	0.69 kg (1.52 lb)
	Sensor with clamping ring:	0.78 kg (1.72 lb)

Materials	**Sensor**	
	Housing:	Titanium 3.7035
	Optical window:	Sapphire
	O-rings:	FKM, EPDM (seal of cable assembly)
	Assembly	
	Flow cell:	PVDF V0, PA6FR (low flammability)
	O-rings:	FKM
	Clamping ring:	Titanium 3.7035

Process connections	▪ Sensor: G1" and NPT ¾" ▪ Assembly: G1/4" DN 4/6 (cleaning connection), G1/4" DN6/8 (process connection)

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