

Operating Instructions

Memosens CFS51

Sensor for fluorescence measurement



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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

	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

1.2.1 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

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

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.

The operator is responsible for ensuring compliance with the following safety regulations:

- 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.

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

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:

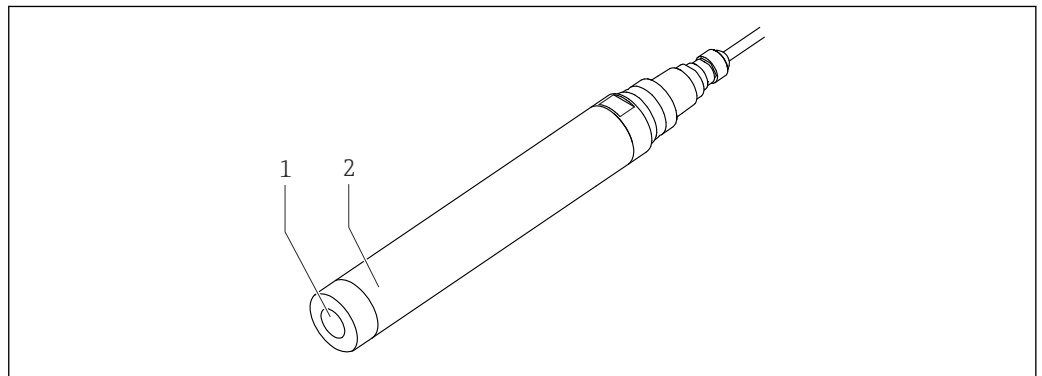
- Power supply
- Light source
- Detectors

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.



A0046290

1 Sensor

1 Optical window

2 Sensor

3.1.1 Measuring principle

The fluorescence measurement method determines the PAH¹⁾ content in water and PAH concentrations.

The measuring instrument irradiates the PAHs with ultraviolet light and detects the resulting fluorescence radiation. Resolutions MEPC.259(68) and MEPC.340(77)²⁾ require the indication of PAH concentration in phenanthrene equivalents.

Mathematical functions from Liquiline can display measurement results in a customer-specific format.

The excitation wavelength during measurement is 254 nm; the maximum emission wavelength is 360 nm.

1) polycyclic aromatic hydrocarbons

2) 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 following information on the device can be found on the nameplate:

- Manufacturer identification
 - Extended order code
 - Serial number
 - Safety information and warnings
- Compare the information on the nameplate with the order.

4.2.2 Identifying the product

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 will find information pertaining to your device, including the product documentation.

4.2.3 Manufacturer address

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

4.3 Scope of delivery

The scope of delivery comprises:

- Sensor, version as ordered
- Operating Instructions
- If you have any queries:
Please contact your supplier or local sales center.

4.4 Certificates and approvals

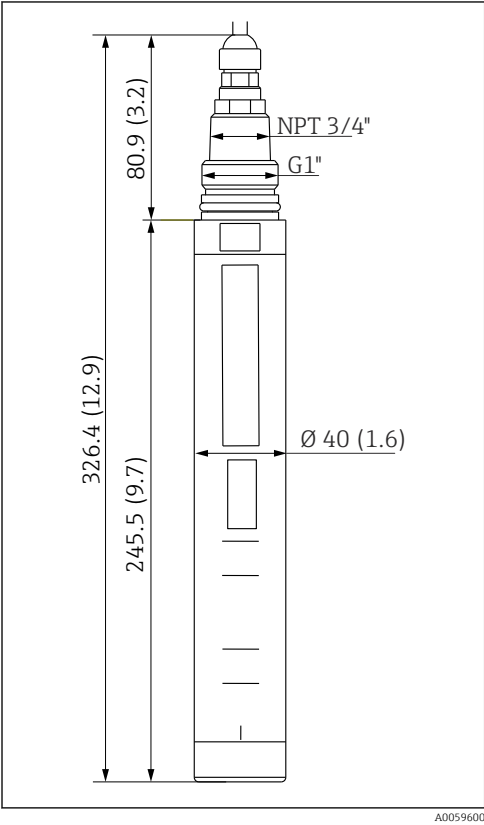
Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

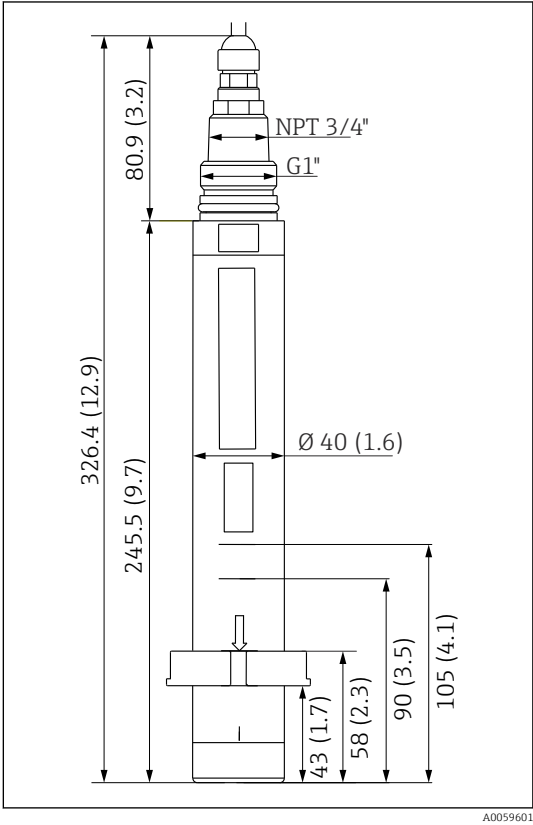
5 Installation

5.1 Installation requirements

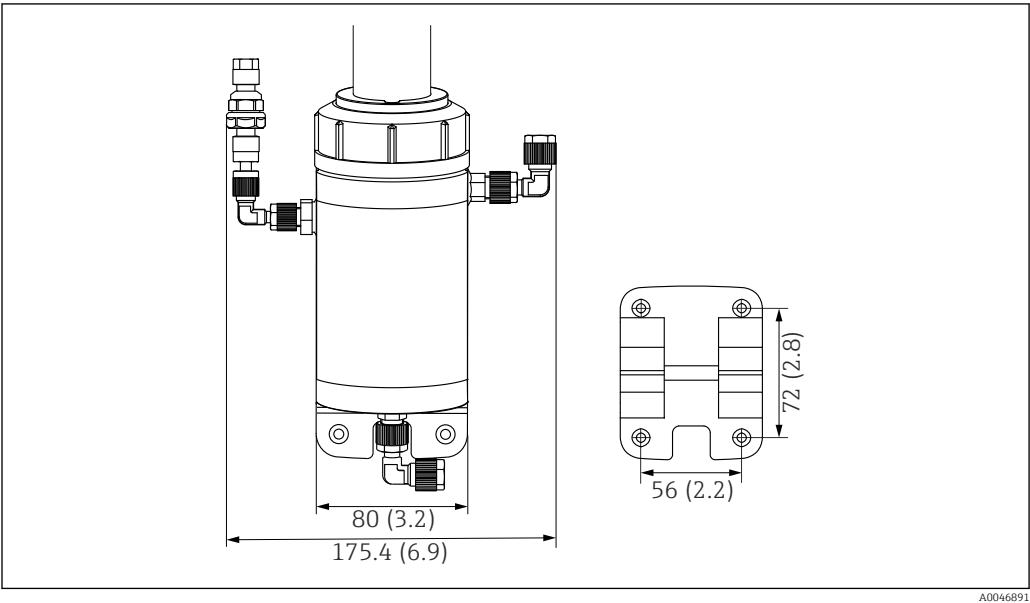
5.1.1 Dimensions



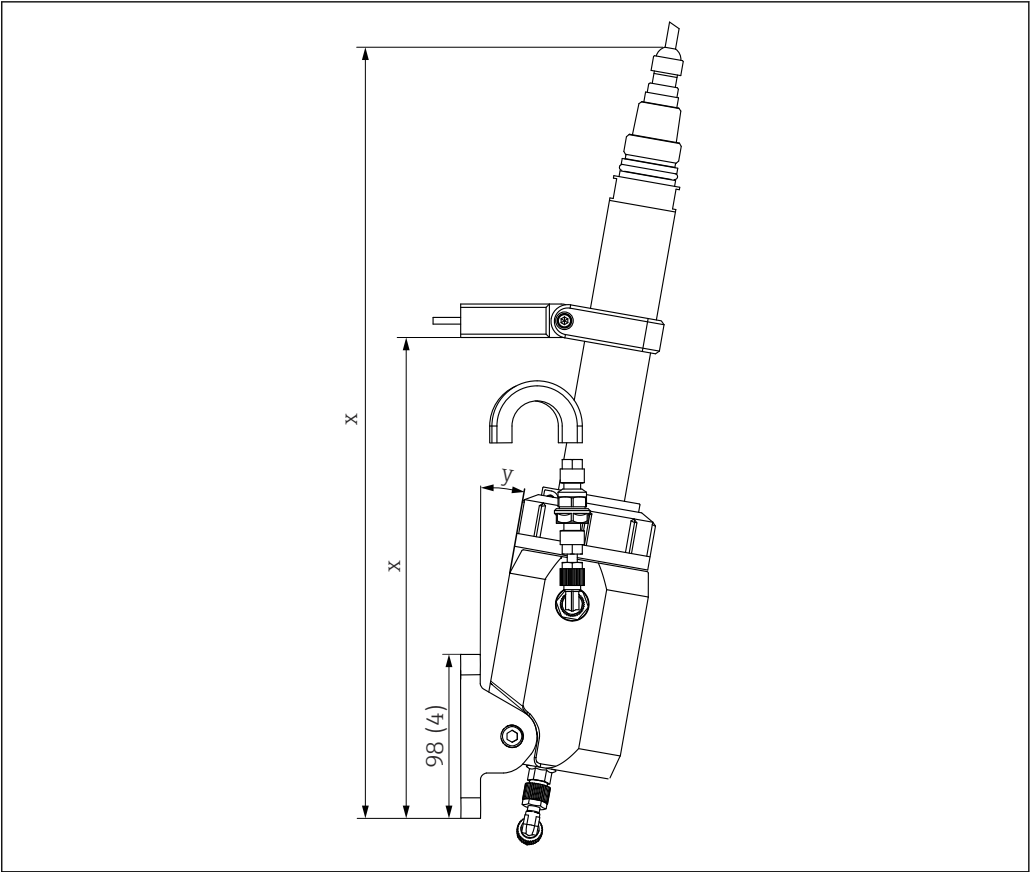
2 Sensor dimensions. Unit: mm (in)



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

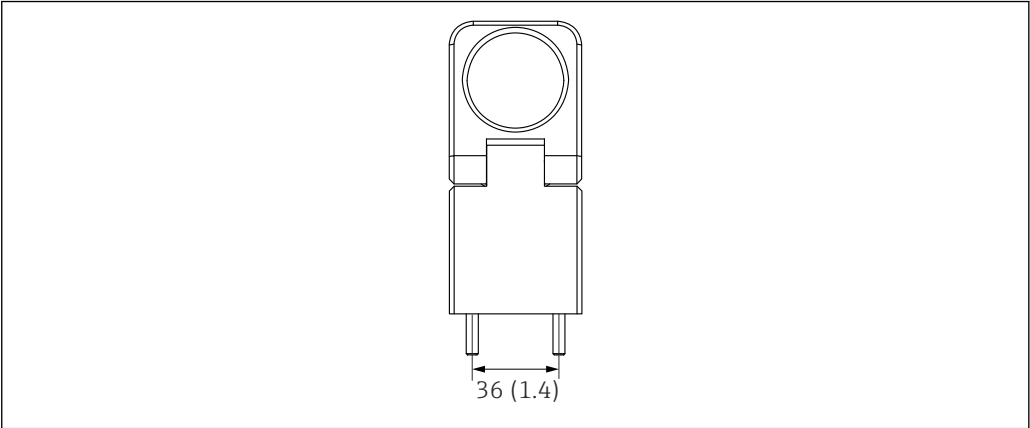


4 Dimensions of standard assembly CFS51 with mounting plate (right). Unit: mm (in)



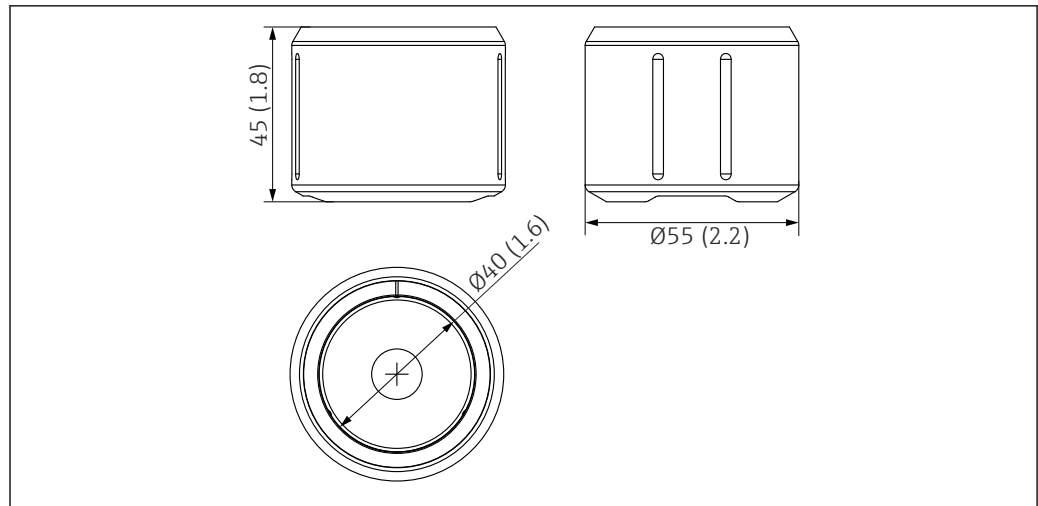
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5 Dimensions of mounted sensor with standard assembly CFS51 . Unit: mm (in)
x Variable length (depending on mounting)
y Variable angle (depending on mounting)



A0047395

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

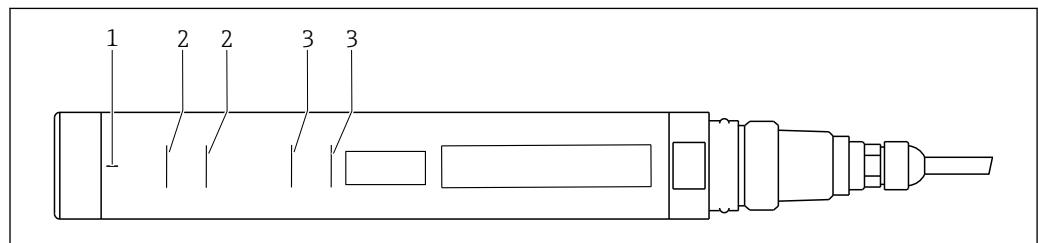


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7 Dimensions of solid state reference. Engineering unit: mm (in)

5.1.2 Installation instructions

Installation in flow assembly



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8 Installation markings for clamping ring

- 1 Vertical alignment line for the solid state reference
- 2 Horizontal alignment lines for clamping ring (standard assembly CFS51)
- 3 Horizontal alignment lines for clamping ring (Flowfit CYA251)

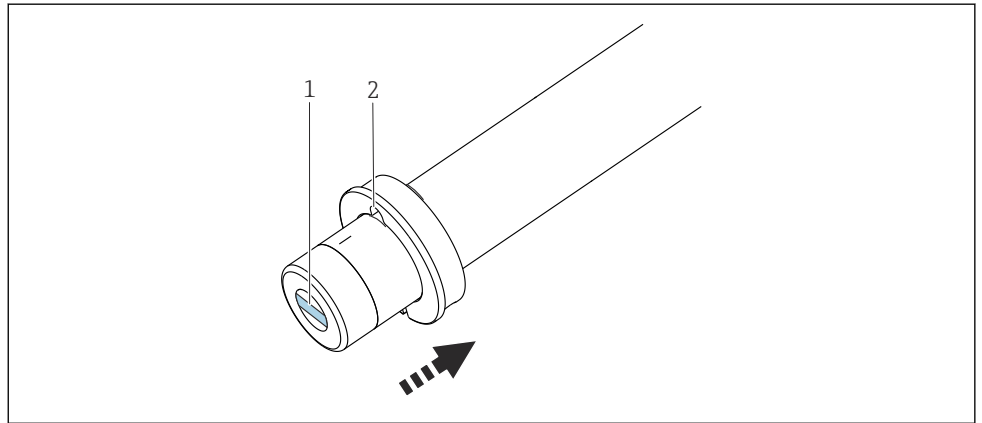
The vertical alignment line on the sensor is used to align the solid state reference. The horizontal alignment lines on the sensor indicate the exact positions where the lower and upper end of the clamping ring must be located.

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.



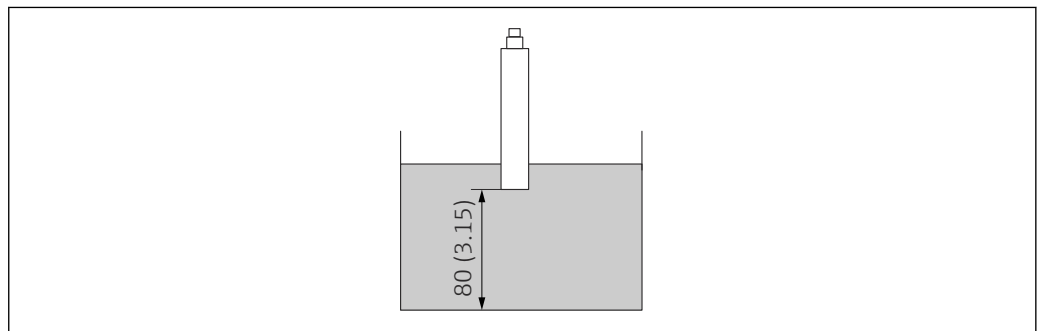
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- 1 Optical window
2 Gap in the clamping ring

Slide the clamping ring through the sensor from below.

3. Align the gap in the clamping ring at a right angle to the optical window of the sensor.
4. Push the clamping ring precisely 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



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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

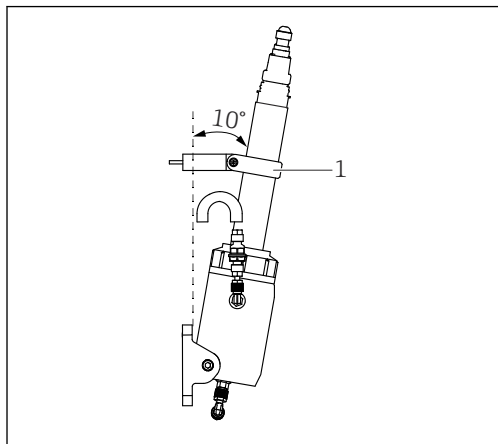
The angle of inclination of the sensor can affect the formation of air bubbles below the sensor. The greater the angle of inclination of the sensor, the more insensitive the measurement is to air bubbles.

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

Setting the sensor angle of inclination on the standard assembly CFS51

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.

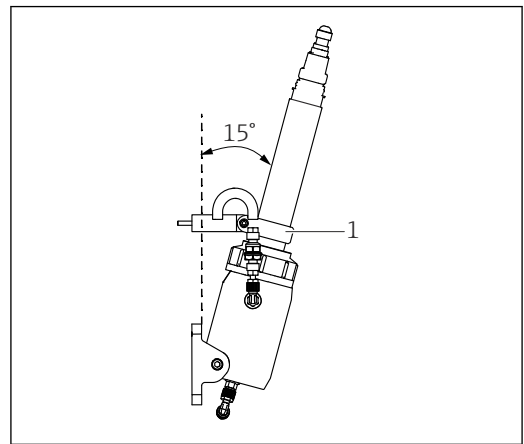
1. Put the spacer in the desired location.
↳ The angle of inclination of the sensor changes.
2. Fix the spacer on the panel →  18.



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

1 Ring clip with spacer



A0046900

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

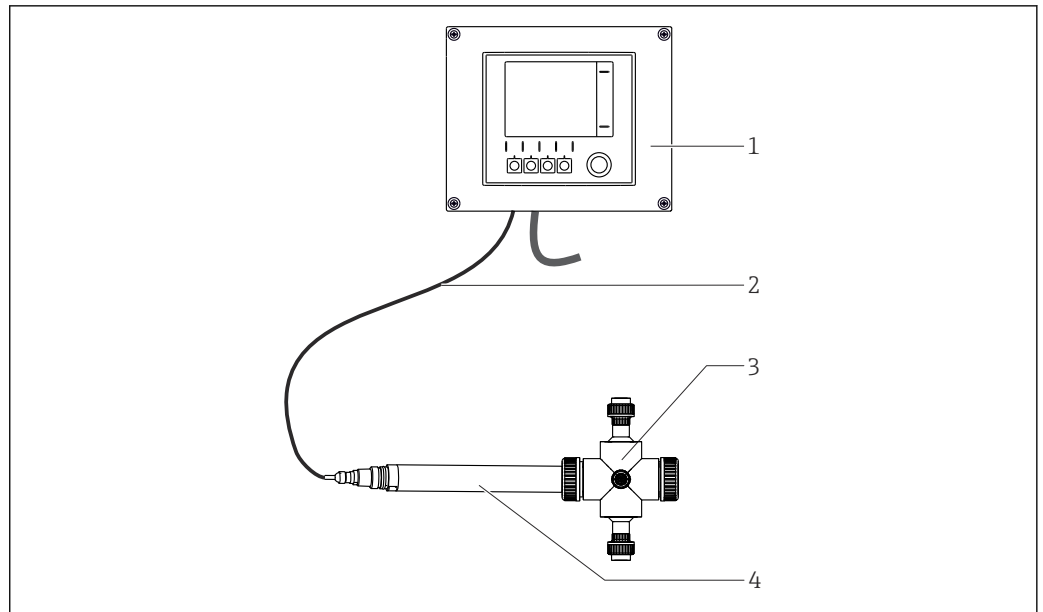
1 Ring clip with spacer

5.2 Installing the sensor on Flowfit CYA251

5.2.1 Measuring system

A complete measuring system comprises:

- Sensor
- Liquiline CM44x transmitter
- Flowfit CYA251 flow assembly



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12 Example of a measuring system

- 1 Transmitter
- 2 Fixed cable
- 3 CYA251 assembly
- 4 Sensor



For detailed information on installing the Flowfit CYA251: BA00495C

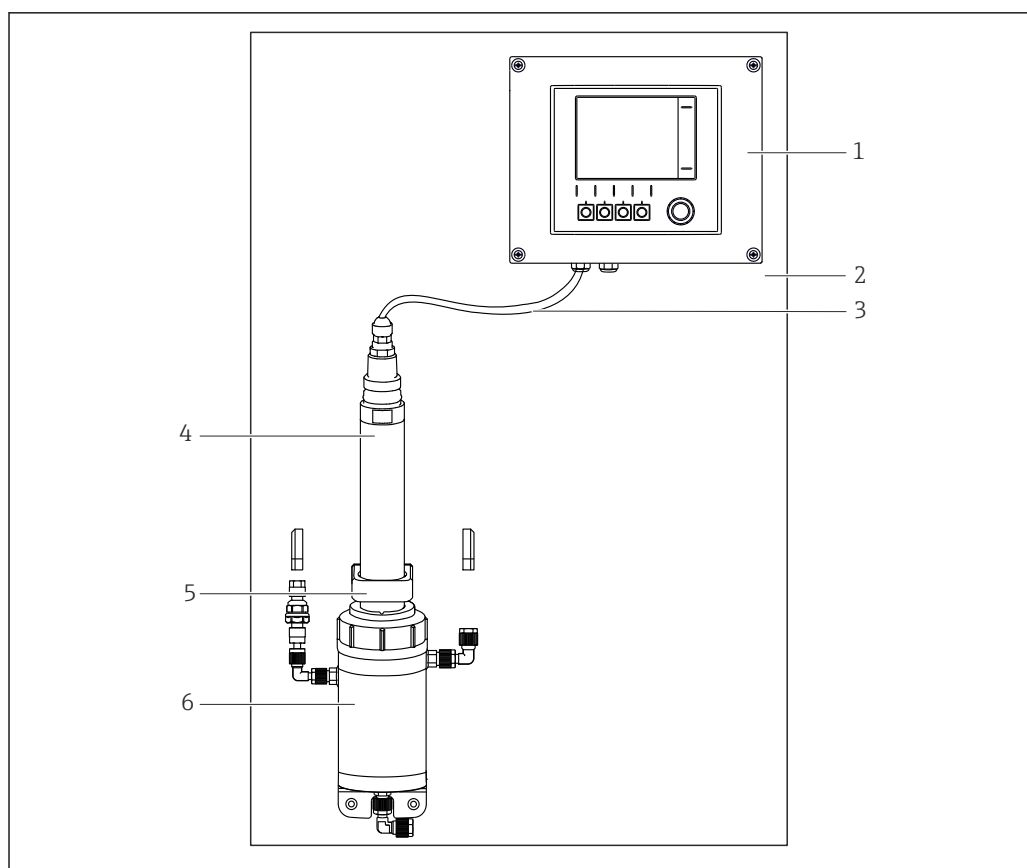
5.3 Installing the sensor on the CFS51 standard assembly

5.3.1 Measuring system

The sensor is secured to a panel with the assembly.

A complete measuring system comprises:

- Sensor
- Liquiline CM44x multichannel transmitter
- CFS51 standard assembly



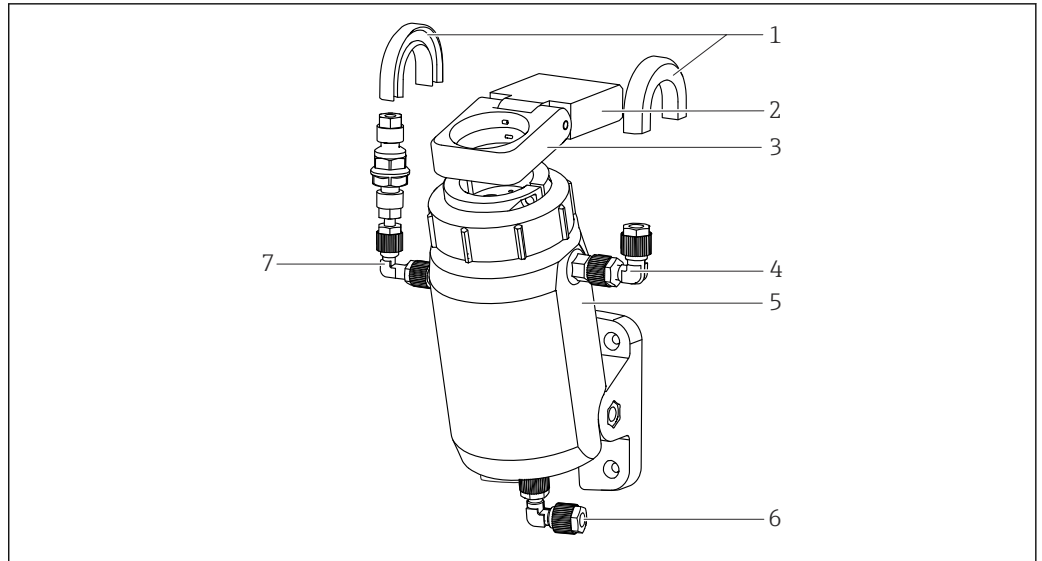
A0046358

13 Measuring system

- 1 Transmitter
- 2 Panel
- 3 Fixed cable
- 4 Sensor
- 5 Ring clip/spacer
- 6 CFS51 standard assembly

CFS51 standard assembly

The CFS51 standard assembly is structured as follows:



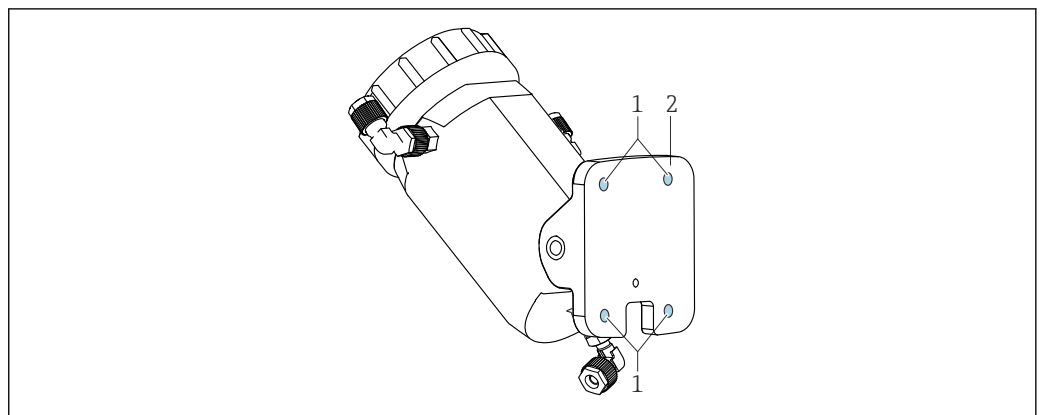
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14 Structure

- 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. 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).

5.3.2 Installing the CFS51 standard assembly on the panel



A0047708

15 Rear view of assembly

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

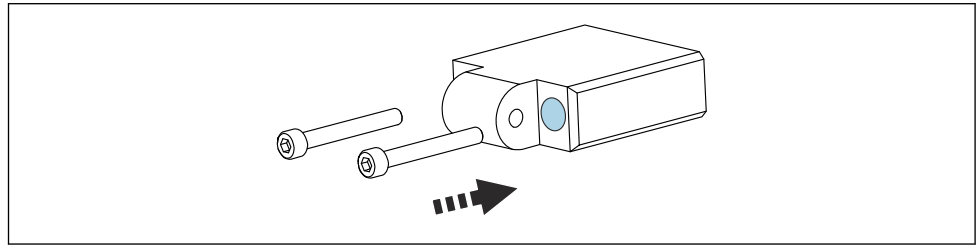
1. Hold the securing plate of the assembly up at the point where the assembly is to be fixed.
2. If necessary, release the assembly from the securing plate before mounting.
3. Mark the 4 boreholes on the panel. In doing so, pay attention to the dimensions → 10.
4. Drill the holes.

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

5.3.3 Installing 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.



A0048147

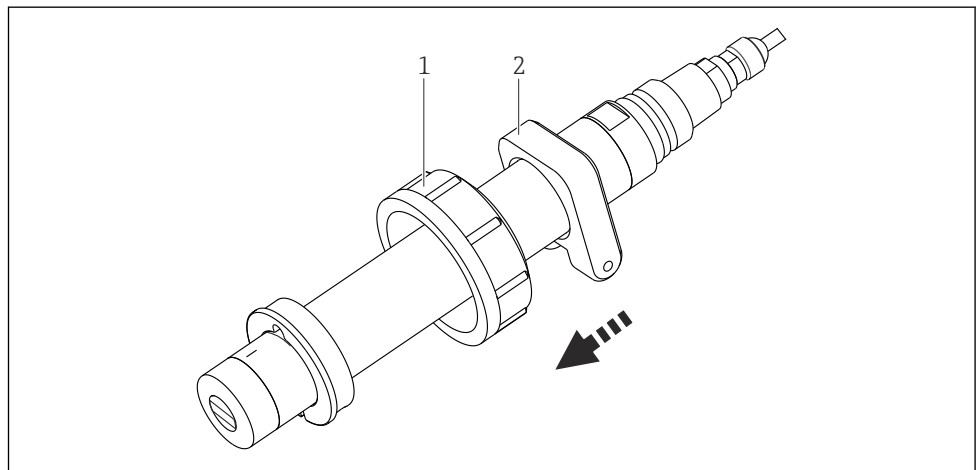
Fix the spacer on the panel with 2 M5 screws.

5.3.4 Installing the sensor with the CFS51 standard assembly

The sensor can be installed in the CFS51 standard assembly either with the clamping ring pre-assembled or without the clamping ring mounted.

Preparations for the sensor with mounted clamping ring:

- 1.



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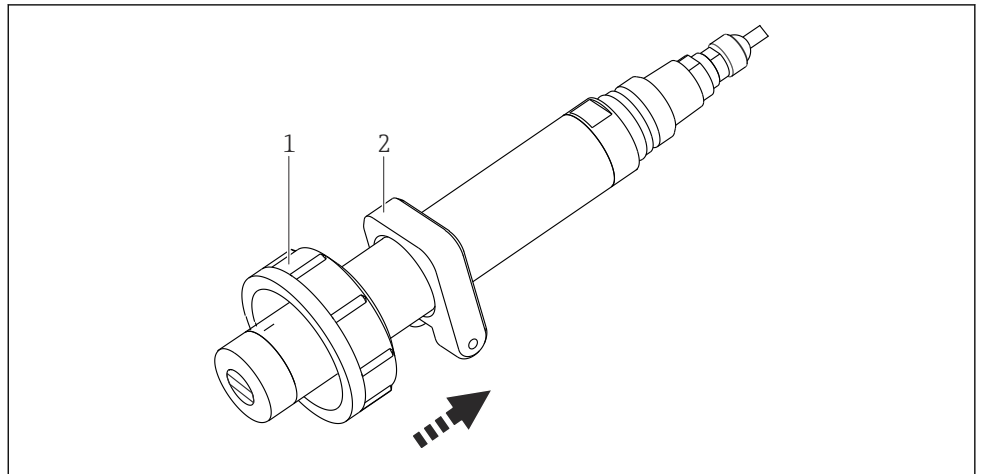
- 1 Union nut
- 2 Ring clip

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).

Preparations for the sensor without mounted clamping ring:

1.



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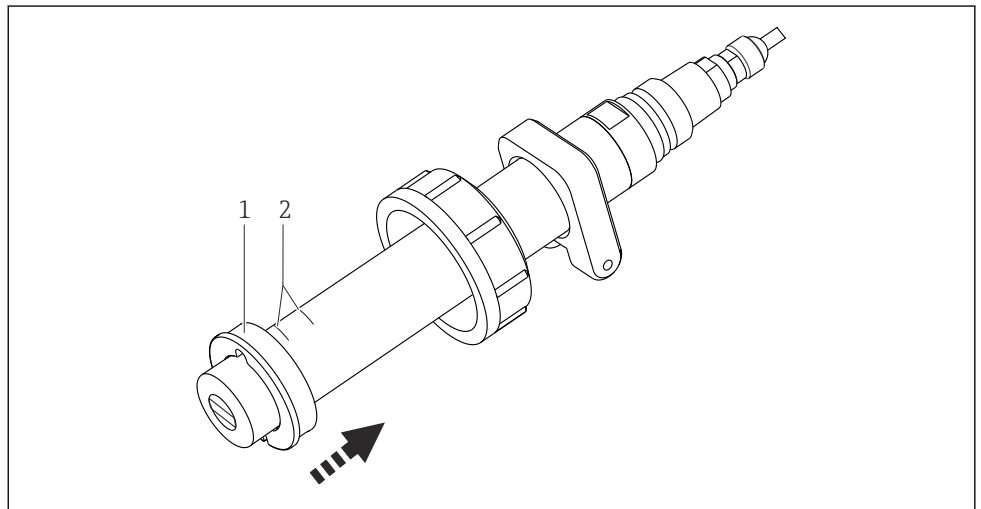
- 1 Union nut
- 2 Ring clip

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.

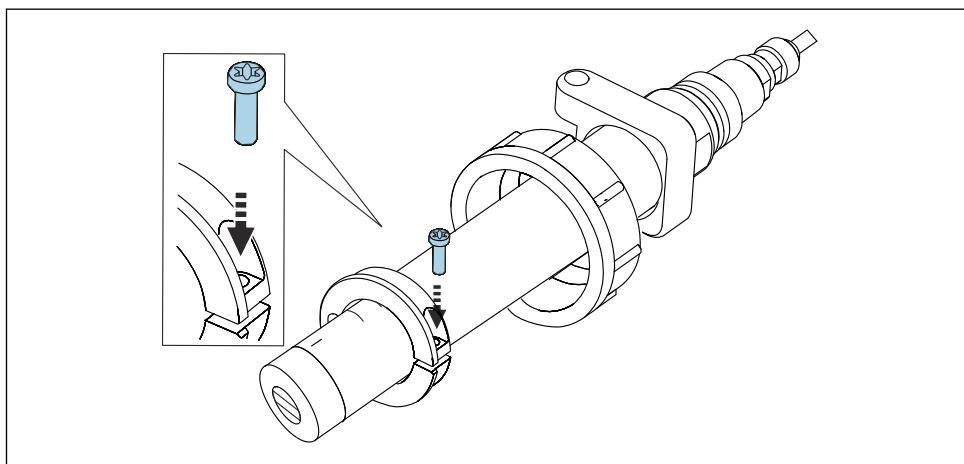
4.

Make sure that the gap in the clamping ring is aligned at a right angle to the optical window.

5.

Position the clamping ring on the horizontal alignment lines of the sensor (item 2)
→  8,  12.

6.

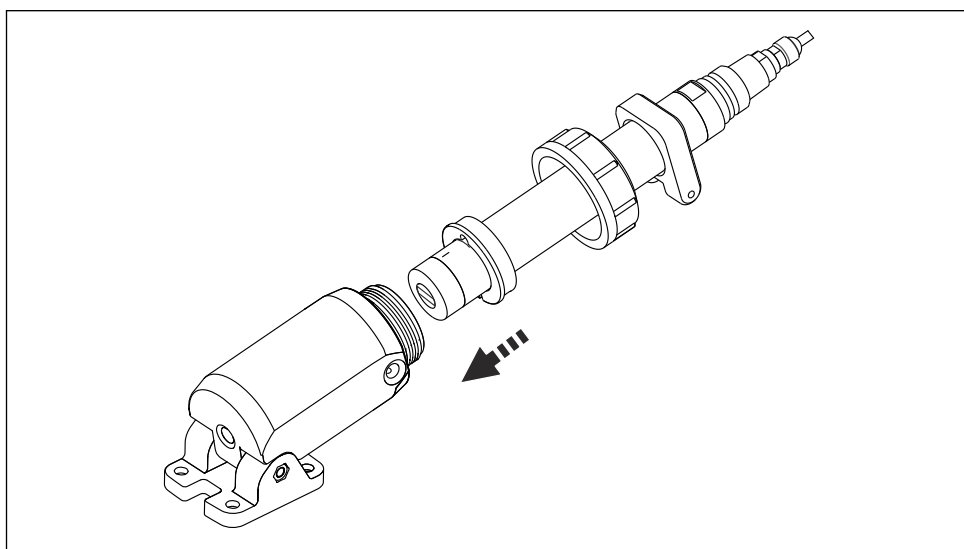


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Using the M5 screw, secure the clamping ring with a torque of 5 Nm.

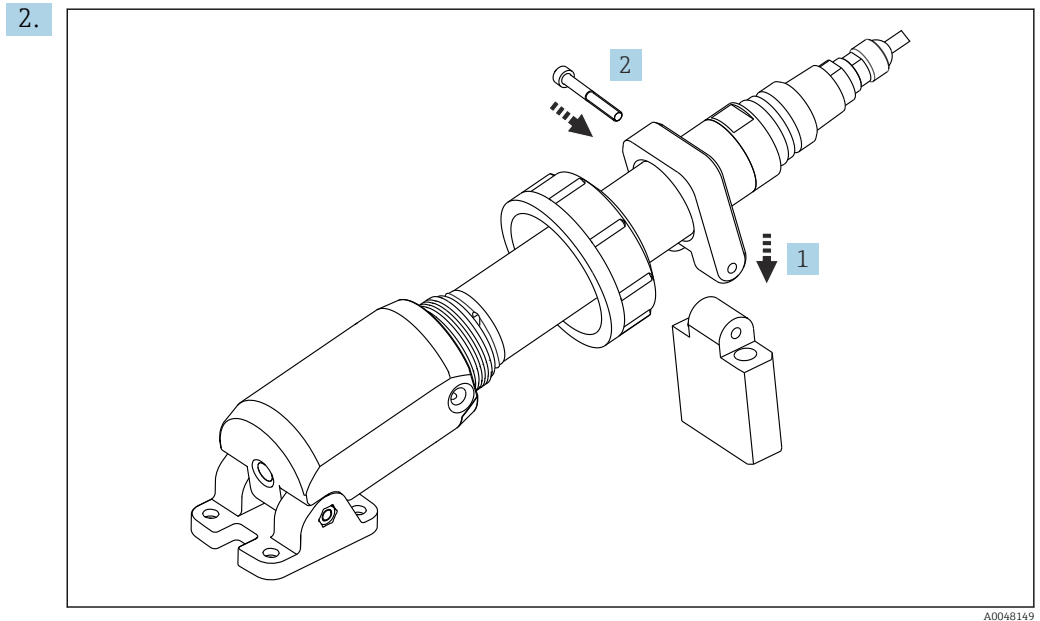
Mounting the sensor with the assembly

1.



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Push the sensor into the assembly up to the clamping ring.

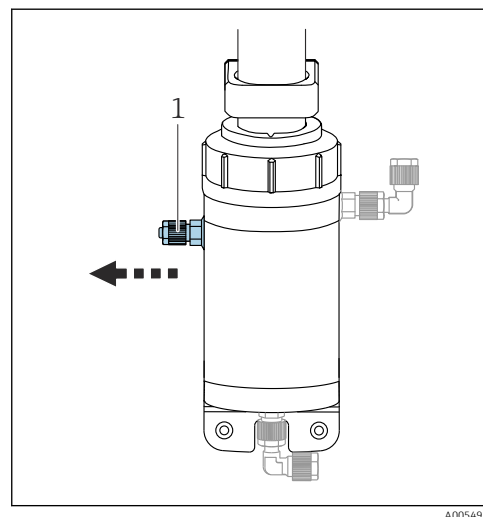


Connect the ring clip with the mounted spacer.

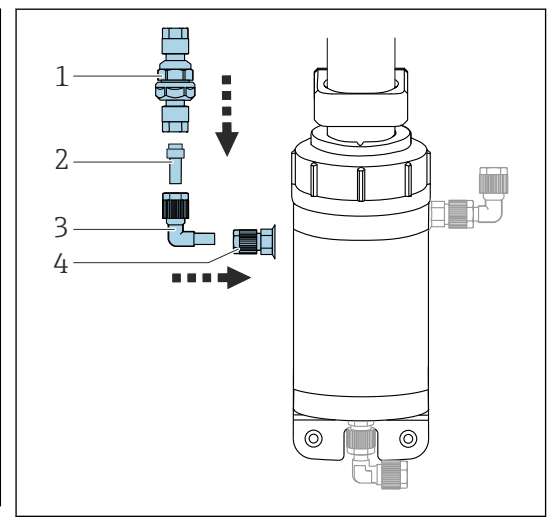
3. Use the M5 screw supplied to secure the ring clip and the spacer.
4. Slide the union nut downward to the edge of the assembly.
5. Tighten the union nut.

5.3.5 Installing the cleaning connection to the CFS51 standard assembly

 The use of the cleaning connection is optional.



 16 Preparing the cleaning connection
1 Hose connection with sealing plug



 17 Mounting the cleaning connection
1 Check valve
2 Nipple
3 Angle connection
4 Hose connection

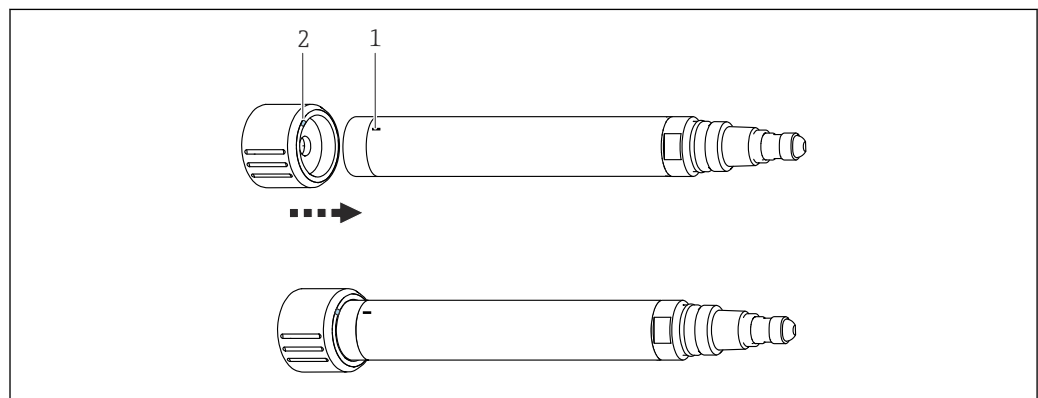
If the sensor was ordered without a cleaning kit, a hose connection with a sealing plug is mounted →  16,  21. The hose connection must be replaced if a cleaning kit is to be mounted. Although both hose connections look identical, they differ in their construction.

1. Release the hose connection with the sealing plug (AF 13) →  16,  21.

2. Remove the hose connection with the sealing plug.
3. Screw the hose connection of the cleaning kit into the opening of the cleaning connection →  17,  21.
4. Fit the angle connection, nipple and check valve onto the hose connection →  17,  21.
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.

5.4 Positioning the solid state reference

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



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 18 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 →  36.
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.

5.5 Post-installation 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!

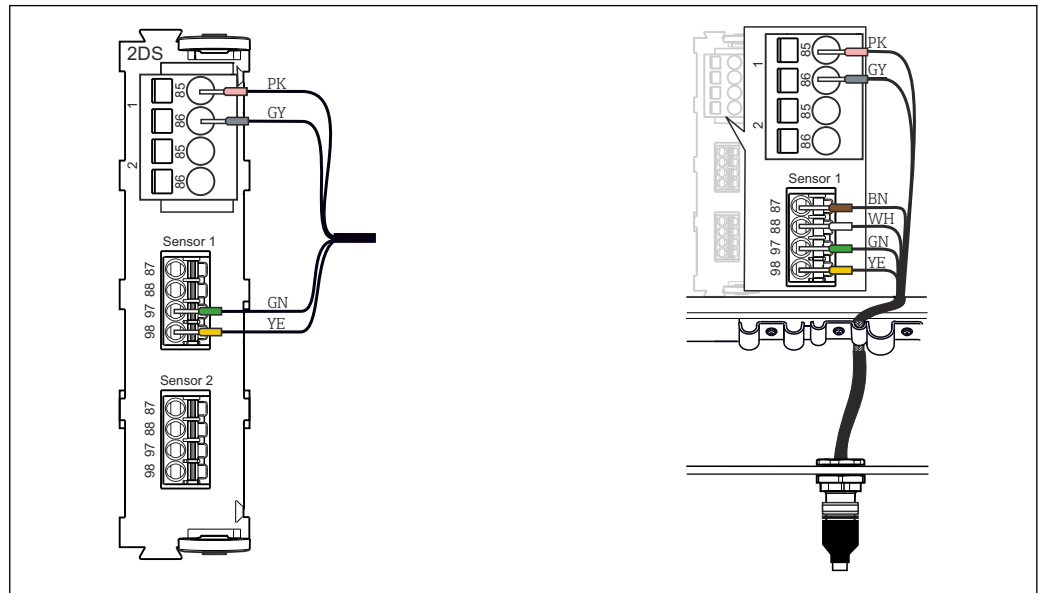
Incorrect connection may result in injury or death!

- ▶ 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)



19 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)

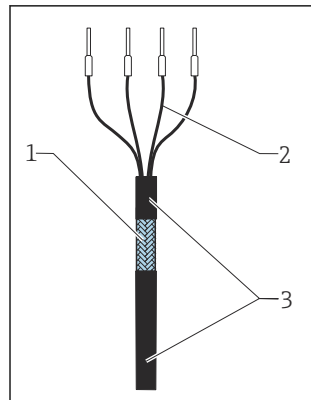
6.1.1 Connecting the cable shield

The device cable must be shielded cables.

- i** Only use terminated original cables where possible.

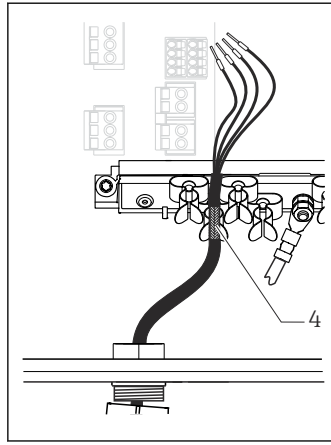
Clamping range of cable clamps: 4 to 11 mm (0.16 to 0.43 in)

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



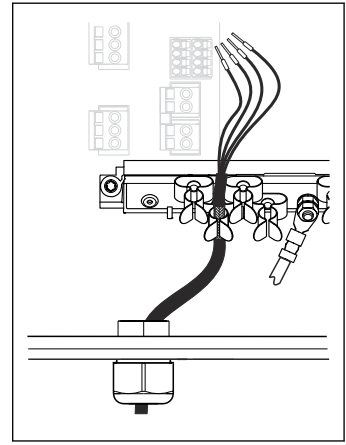
20 Terminated cable

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



21 Connect the cable to the grounding clamp

- 4 Grounding clamp



22 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 at 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 intended use, may be established 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)
- Cables/cable ends are loose or insufficiently tightened
- 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 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.
Are all the cable entries installed, tightened and leak-tight?	► Perform a visual inspection. In the case of lateral cable entries: ► Point cable loops downward so that water can drip off.
Are all cable entries mounted on the side or pointing downwards?	

7 Commissioning

7.1 Preparatory steps

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

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

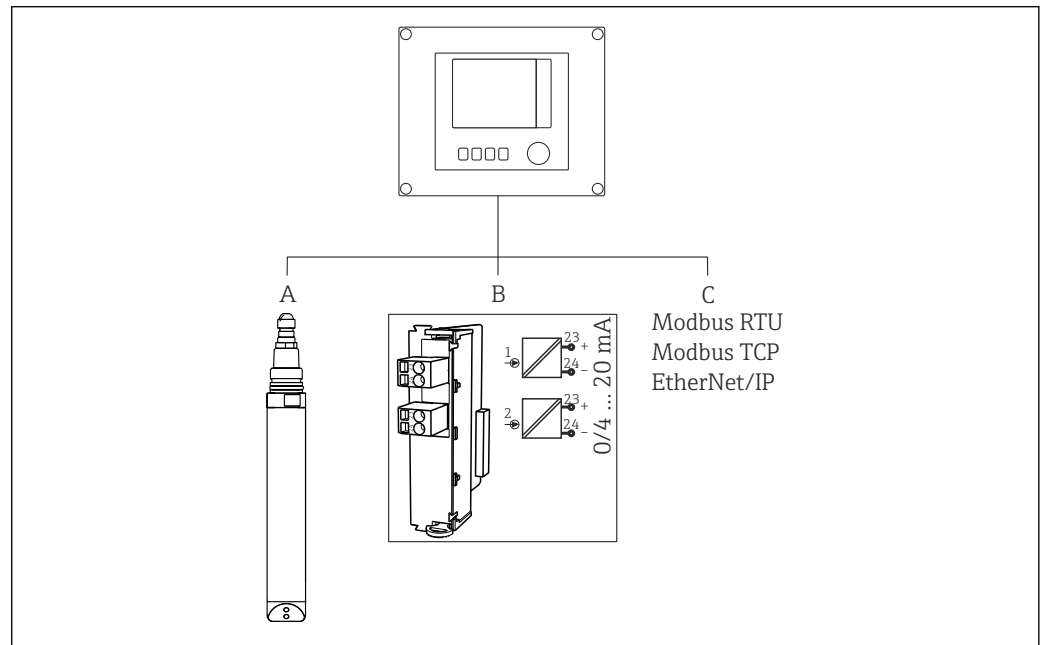
8.1 Adapting the measuring instrument to the process conditions

8.1.1 Turbidity compensation

The measured value of the sensor is affected by turbidity that may occur. When turbidity compensation is activated, turbidity effects are automatically compensated in real time.



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



A0048479

23 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).

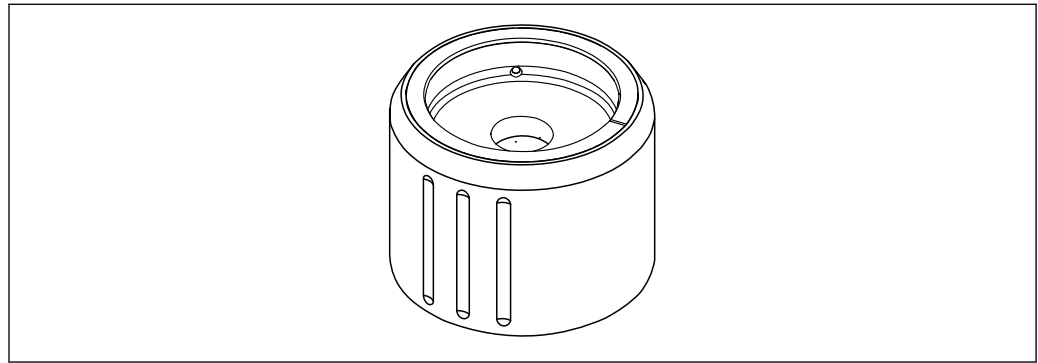
1. To comply with the MEPC.259(68) and MEPC.340(77) criteria, calibrate the sensor at least once a year using the solid state reference.
2. If necessary, adjust the sensor with the solid state reference.

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.



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 24 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

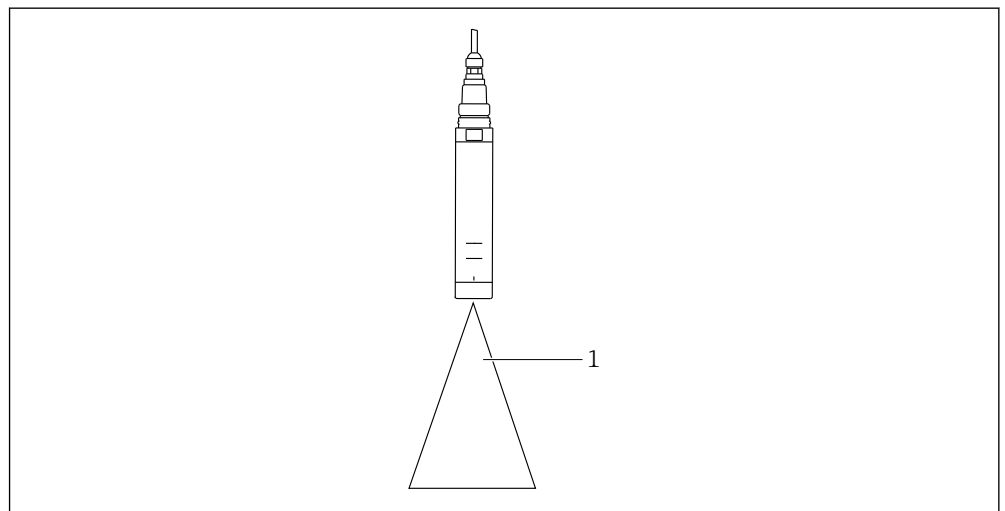
1. Select **Calibration** on the transmitter.
2. Select the fluorescence sensor.
3. Select **Fluorescence**.
4. Select **Solid state reference**.
5. Follow the instructions of the transmitter.

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.

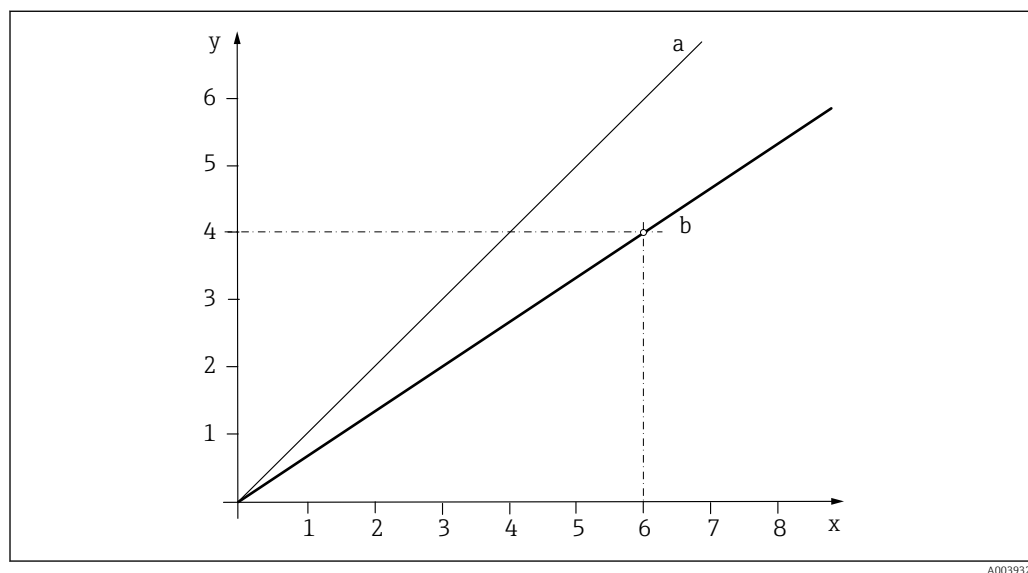
Failed calibration with solid state reference:

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

One-point calibration

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



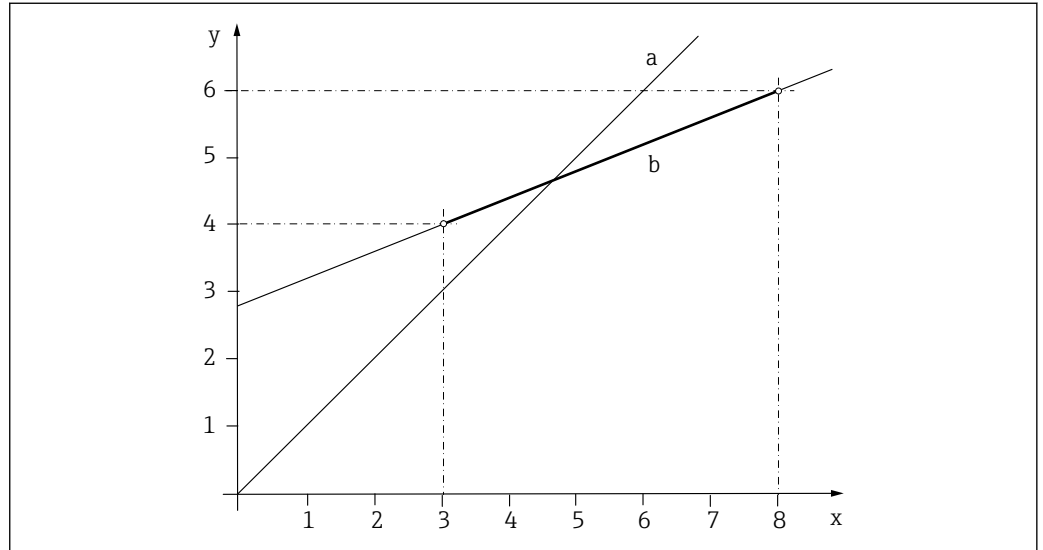
25 Principle of a one-point calibration

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

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

Two-point calibration

Measured value deviations are to be compensated at 2 different points in an application (e.g. maximum and minimum value of the application). In this way, maximum measurement accuracy is ensured between these two extreme values.



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26 Principle of a two-point calibration

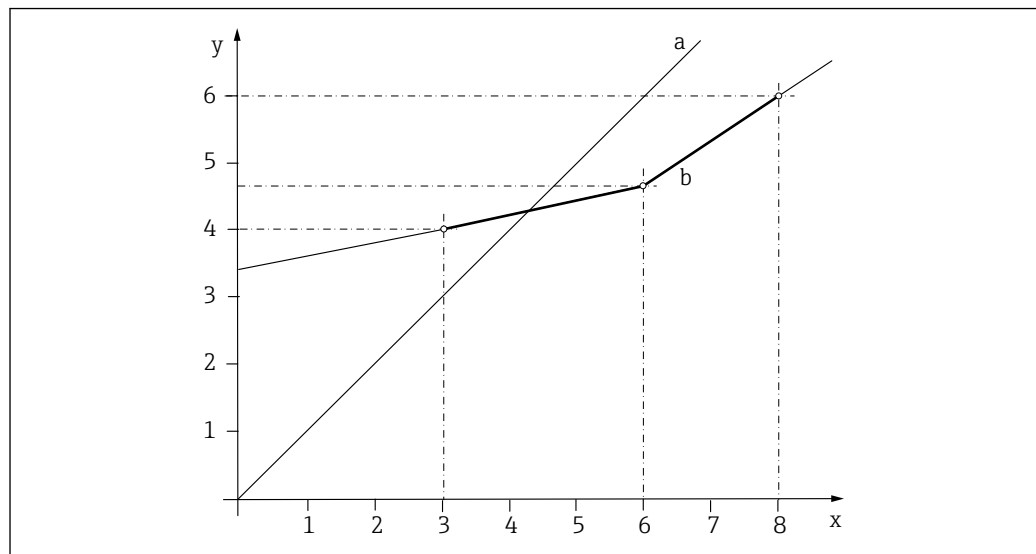
- x Measured value
- y Target sample value
- a Factory calibration
- b Application calibration

1. Select a data set.
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.
The calibration curve must be monotonically increasing.

Three-point calibration



A0039322

27 Principle of multipoint calibration (3 points)

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

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

i A linear extrapolation is performed outside the calibrated operational range.
 The calibration curve must be monotonically increasing.

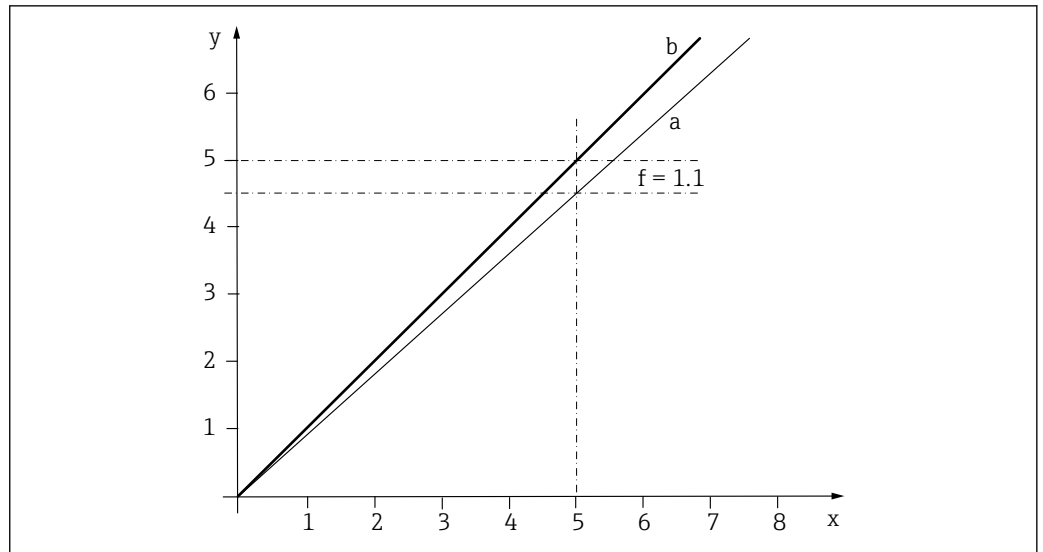
Factor

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

Example:

This type of adjustment can be selected when the measured values are compared with the laboratory values over an extended period and all measured values deviate from the laboratory value (target sample value) e.g. are 10 % too low, by a constant factor.

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



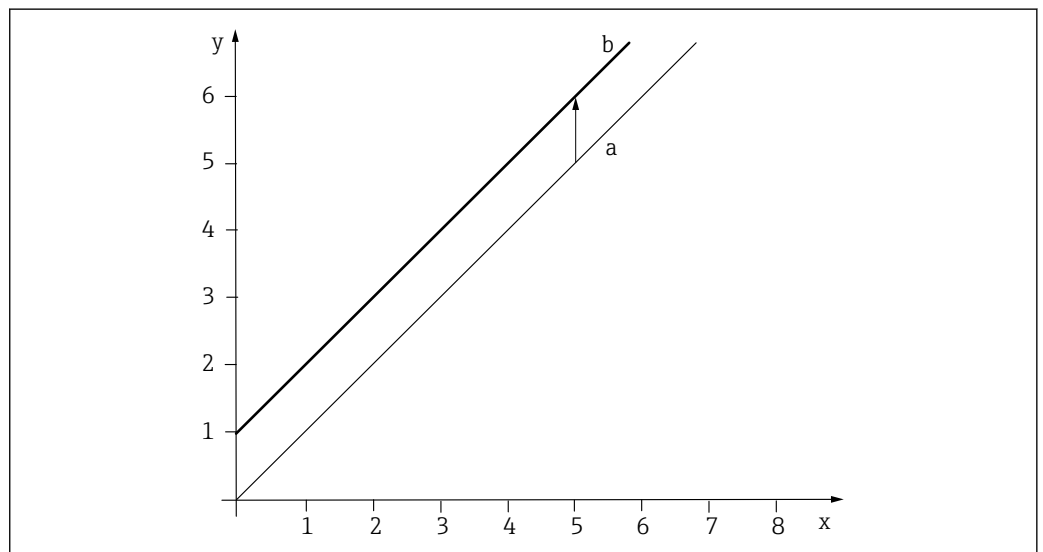
A0039329

28 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).



A0039330

29 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 work

⚠ 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!

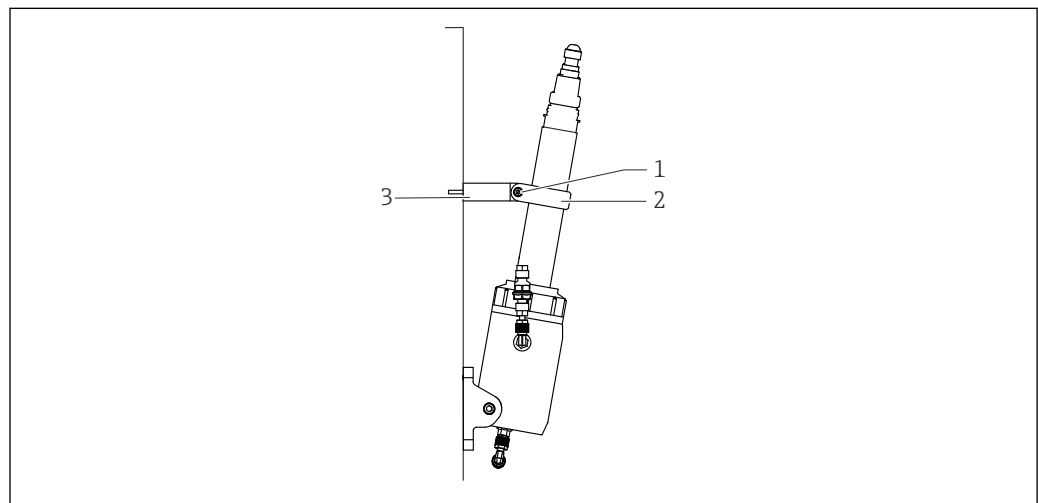
- ▶ Switch off cleaning before the sensor is removed from the medium.
- ▶ Wear protective goggles and safety gloves.
- ▶ Clean away splashes on clothes and other objects.
- ▶ You must perform maintenance tasks at regular intervals.

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 the sensor from the CFS51 standard assembly



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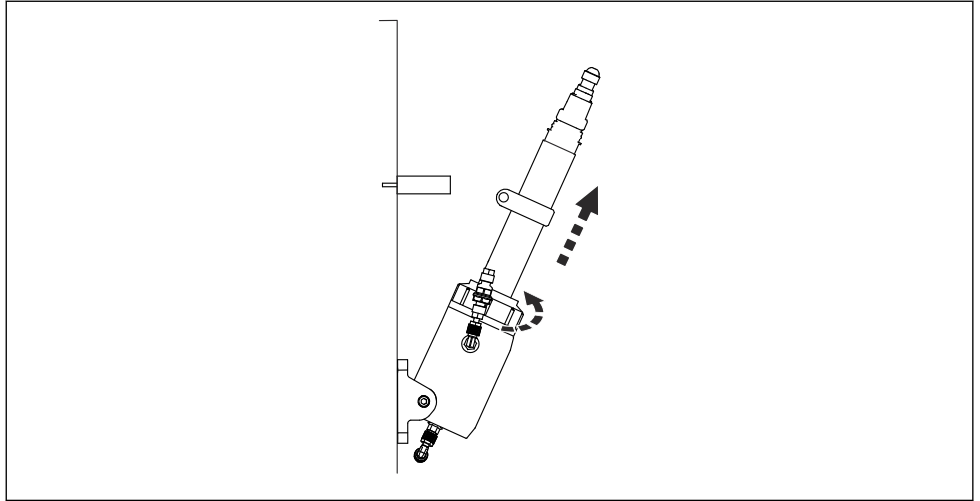
 30 Sensor with assembly

- 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 .

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.

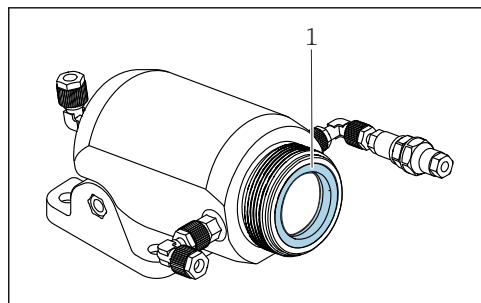


A0048273

Push up the union nut.

7. Remove the entire sensor from the assembly.

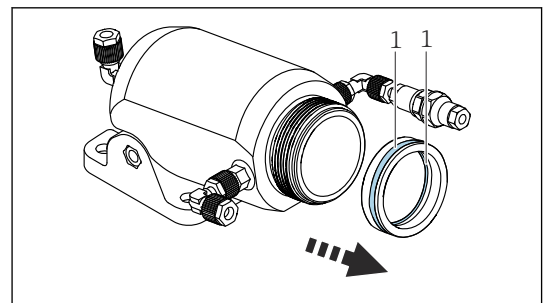
10.1.2 Replacing O-rings on the double sealing ring of the CFS51 standard assembly



A0049182

 31 Assembly

1 Double sealing ring



A0049184

1 O-rings

The double sealing ring contains 2 O-rings.

Replace the O-rings:

1. Remove the double sealing ring from the assembly →  37.
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

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.

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.

www.endress.com/support/return-material

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.

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 for 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.

12.1 Device-specific accessories

CFS51 standard assembly

- Material: PE-HD, black
- 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

Flowfit CYA251

- Connection: See product structure
- Material: PVC-U
- Product Configurator on the product page: www.endress.com/cya251



Technical Information TI00495C

13 Technical data

13.1 Input

Measured variable	■ PAH concentration in phenanthrene equivalents PAH_{phe} ■ Temperature ■ Concentration of PAH-containing oils
-------------------	--

Measuring range	■ 0 to 5 000 µg/l PAH_{phe} ■ 0 to 6 000 ppm Oil (depending on the oil sample)
-----------------	---

13.2 Performance characteristics

Maximum measurement 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)
---------------------------	--

Measurement stability across 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 within two years: < 5 %
-----------------------	--

Response time	< 10 seconds adjustable
---------------	-------------------------

Detection limit	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 ■ EN 61326-2-3 ■ NAMUR NE21
-------------------------------------	--

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) CFS51 standard assembly Flow cell: Black PEHD, UL94: HB 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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