

Technical Information

Memosens CFS51

Sensor for fluorescence measurement



Field of application

The Memosens CFS51 fluorescence sensor is used for continuous monitoring of polycyclic aromatic hydrocarbons (PAHs) and oil contamination in the following applications:

- Monitoring of PAHs in washing water from marine exhaust gas cleaning systems (EGCS)
- Outlet monitoring for detection of pollutant loads
- Detection of oil contamination in cooling water systems
- Early identification of oil leaks in the steam condensate of heat exchangers
- Oil monitoring at seawater intake points of desalination plants
- Continuous monitoring of environmental and surface waters

Benefits

- The exceptionally long factory-set maintenance interval saves significant costs and organizational effort.
- The optionally available flow assembly keeps the sensor at an ideal installation angle to minimize interfering effects caused by air bubbles. In addition, it can be tilted for quick installation and removal of the sensor.
- Integrated turbidity compensation in the range from 0 to 50 FNU
- High IACS E10 conformity of the sensor and flow assembly materials (low flammability)
- The solid-state reference considerably simplifies calibration for the user and eliminates the need to use toxic phenanthrene, thereby increasing safety for personnel and the environment.
- The suitability of the solid-state reference for calibration and readjustment of the PAH sensor on board has been confirmed by DNV.
- Early warning for limiting contamination and initiation of suitable measures, as well as real-time monitoring to ensure reliable documentation and compliance with legal requirements

Function and system design

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.

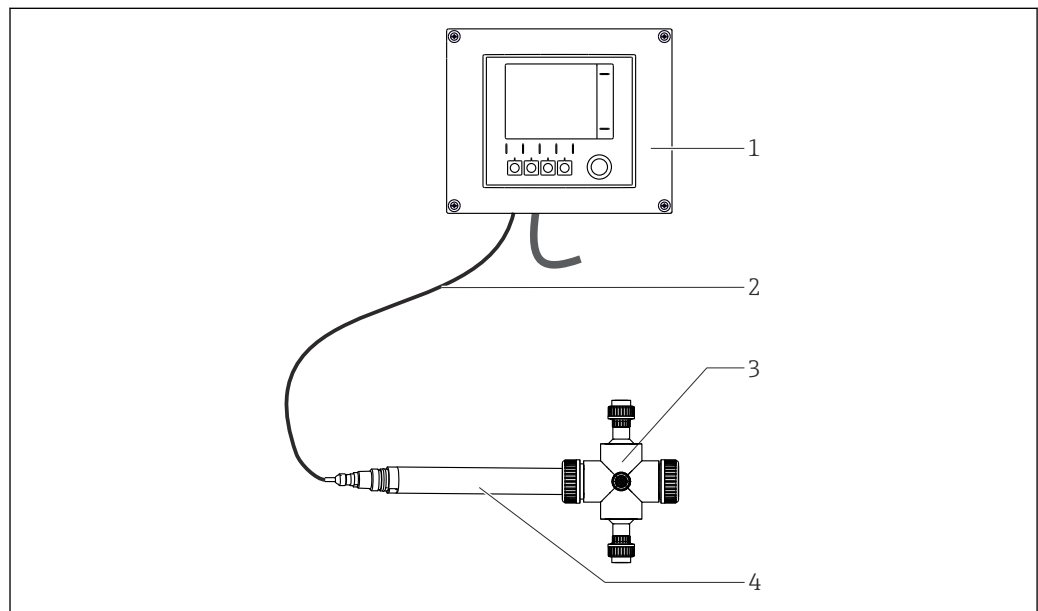
The excitation wavelength during measurement is 254 nm; the maximum emission wavelength is 360 nm.

Measuring system

Sensor on Flowfit CYA251

A complete measuring system comprises:

- Sensor
- Liquiline CM44x transmitter
- Flowfit CYA251 flow assembly



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1 Example of a measuring system

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

Sensor on standard assembly CFS51

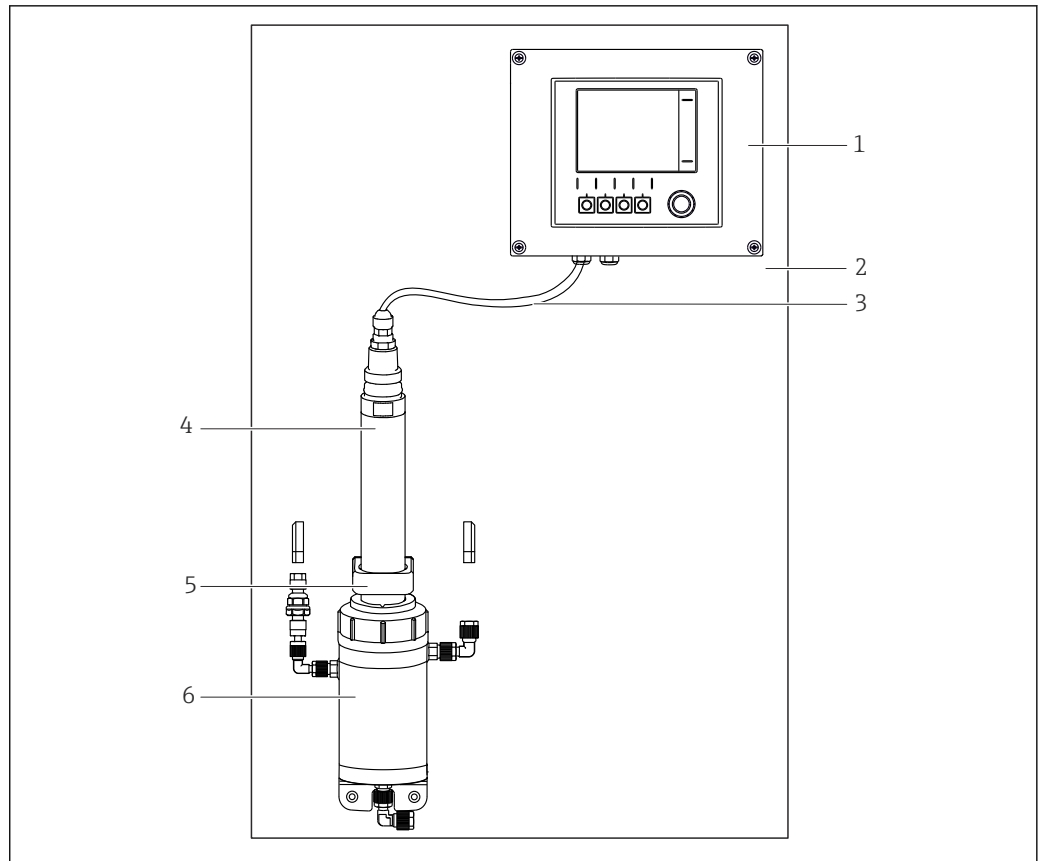
The sensor is secured to a panel with the assembly.

A complete measuring system comprises:

- Sensor
- Liquiline CM44x multichannel transmitter
- CFS51 standard assembly

1) polycyclic aromatic hydrocarbons

2) Marine Environment Protection Committee

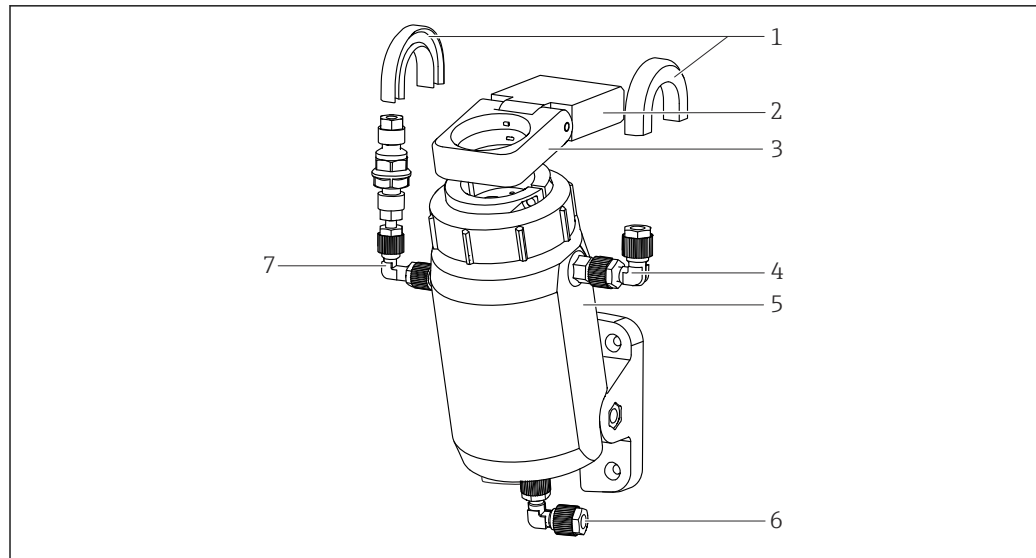


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2 Measuring system

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

The CFS51 standard assembly is structured as follows:



3 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).

Communication and data processing

Communication with the transmitter

 Always connect digital sensors with Memosens technology to a transmitter with Memosens technology. Data transmission to a transmitter for analog sensors is not possible.

Digital sensors can store measuring system data in the sensor. These include the following:

- Manufacturer data
 - Serial number
 - Order code
 - Date of manufacture
- Calibration data
 - Calibration date
 - Number of calibrations
 - Serial number of the transmitter used to perform the last calibration or adjustment
- Operating data
 - Temperature application range
 - Date of initial commissioning

Dependability

Reliability

Easy handling

Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total hours of operation or hours of operating under extreme measuring conditions). Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the current measured value. As the calibration data are stored in the sensor, the sensor can be calibrated and adjusted independently of the measuring point. The result:

- Pre-calibrated sensors can be replaced quickly and easily, resulting in a dramatic increase in the availability of the measuring point.
- The sensor history can be documented on external data carriers and evaluation programs.

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)

Power supply

Electrical connection



Device is live!

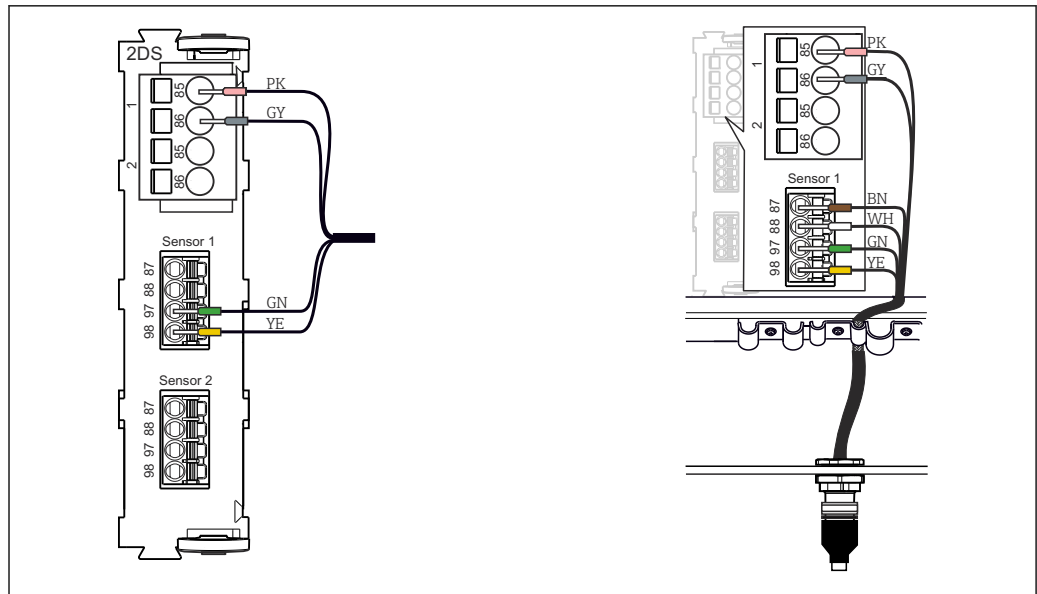
Incorrect connection may result in injury or death!

- ▶ 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.

Connecting the sensor

The following connection options are available:

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



4 Spectrometer connection to input (left) or via M12 plug (right)

The maximum cable length is 100 m (328.1 ft).

Cable specification

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)

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	<ul style="list-style-type: none"> ■ 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

Installation

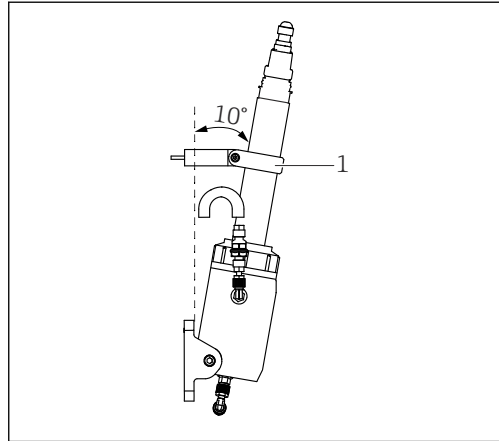
Orientation

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 → 7.

Setting the sensor angle of inclination on the standard assembly CFS51

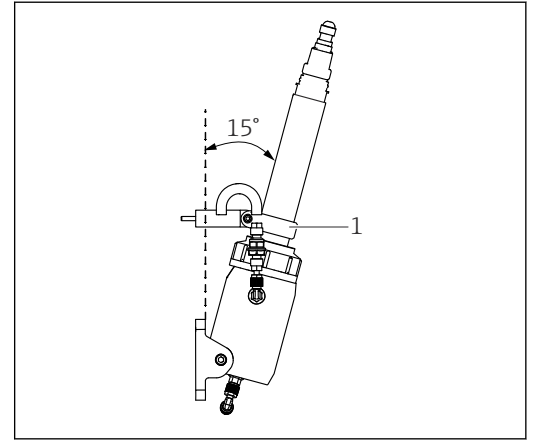
Depending on the measuring point, the angle of inclination for the sensor can be set individually. The angle of inclination is determined by the location of the spacer on the panel.



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

1 Ring clip with spacer



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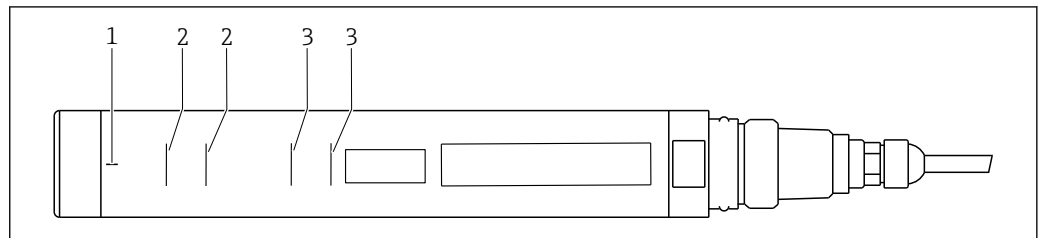
6 Example with spacer mounted at bottom, 15° angle in relation to panel

1 Ring clip with spacer

For detailed information on setting the angle of inclination of the sensor, see BA02165C

Installation instructions

Installation in flow assembly



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7 Installation markings for clamping ring

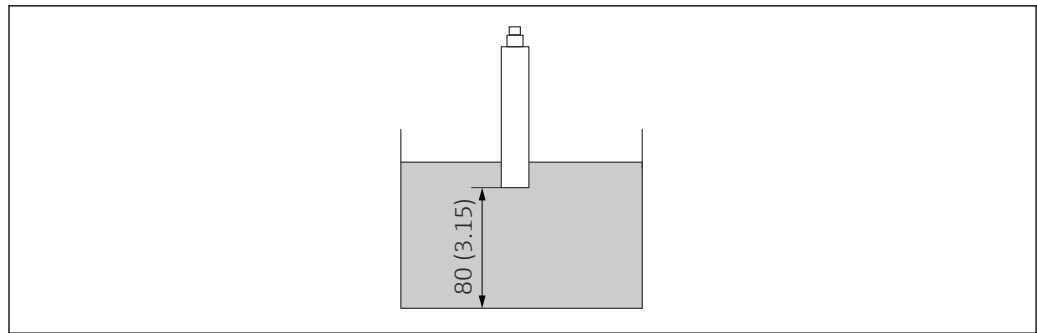
1 Vertical alignment line for the solid state reference

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.

Installation without flow assembly



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8 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).

Environment

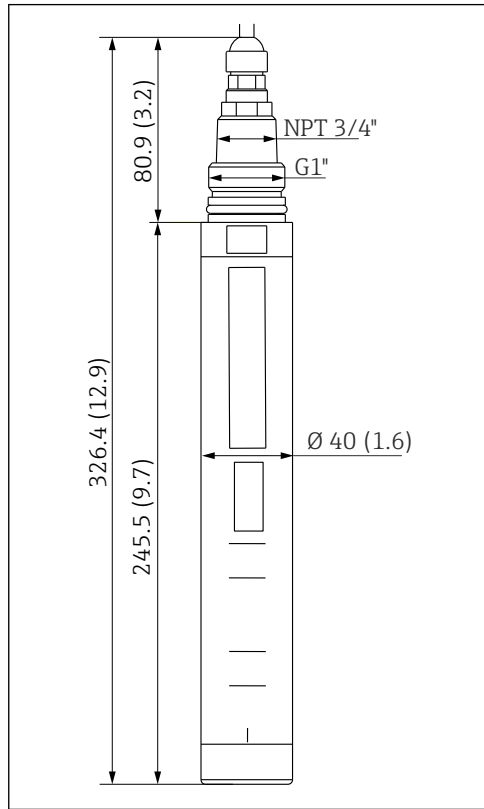
Ambient temperature range	<p>Sensor</p> <p>-20 to 60 °C (-4 to 140 °F)</p> <p>Solid state reference</p> <p>-5 to 60 °C (23 to 140 °F), without condensation</p>
Storage temperature	-20 to 70 °C (-4 to 158 °F)
Degree of protection	<ul style="list-style-type: none"> ■ IP 68 (1.83 m (6 ft) water column over 24 hours) ■ IP 66 ■ Type 6P

Process

Process temperature range	-5 to 55 °C (20 to 130 °F)
Process pressure range	<ul style="list-style-type: none"> ■ 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	<p>Minimum flow</p> <p>No minimum flow required.</p>

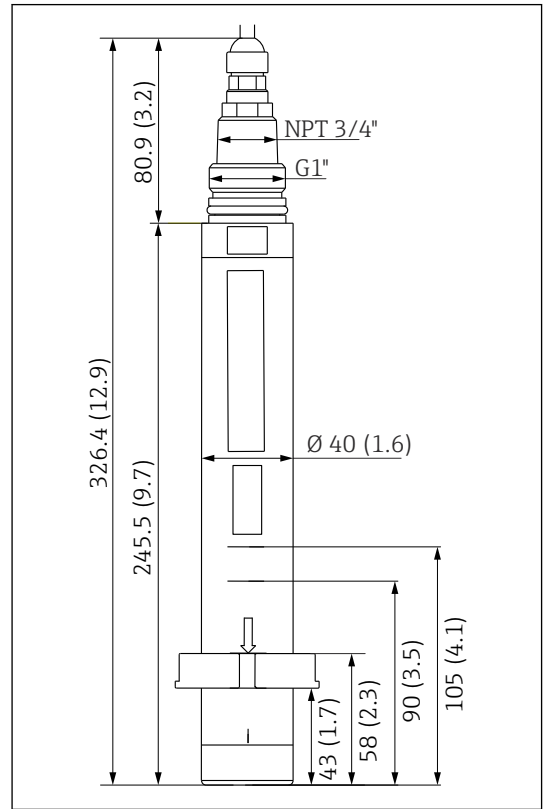
Mechanical construction

Dimensions



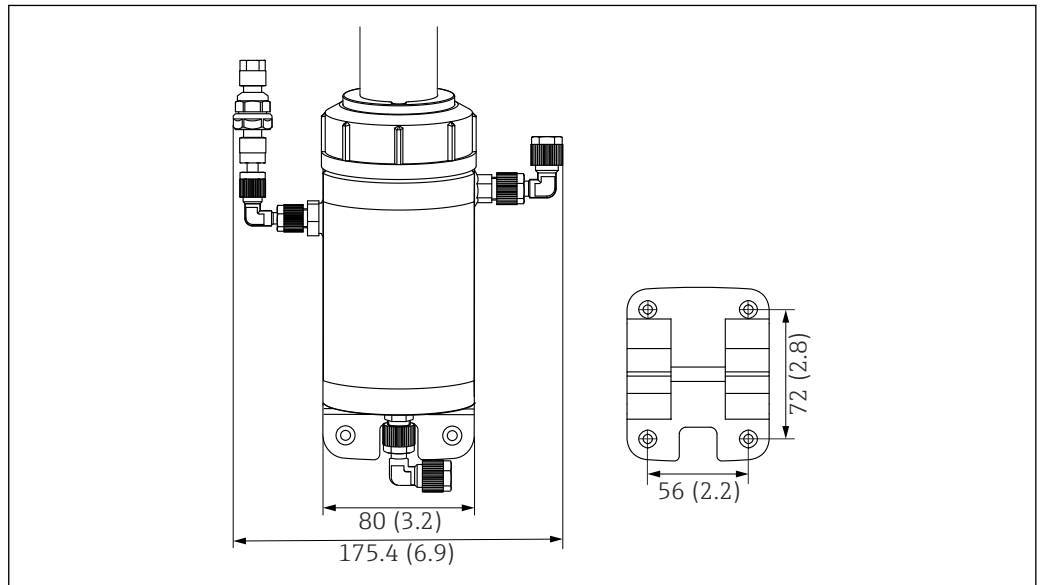
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9 Sensor dimensions. Unit: mm (in)



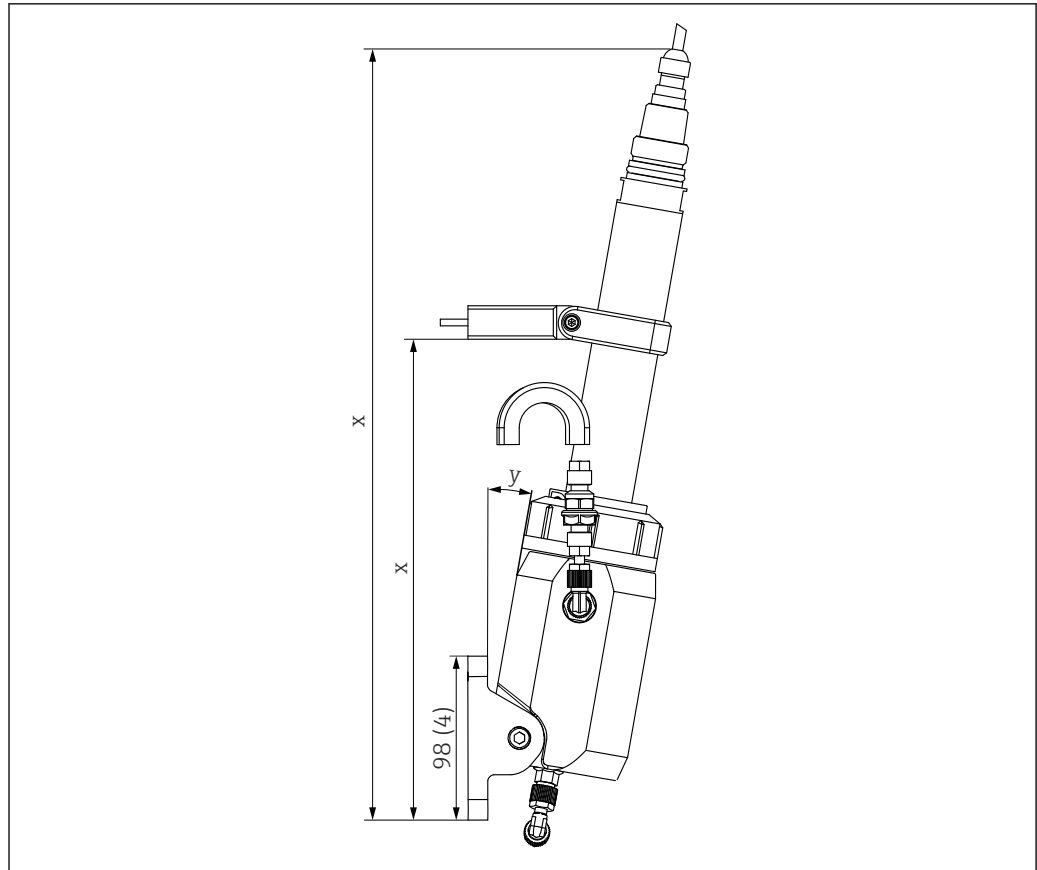
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10 Dimensions of sensor with clamping ring. Unit: mm (in)



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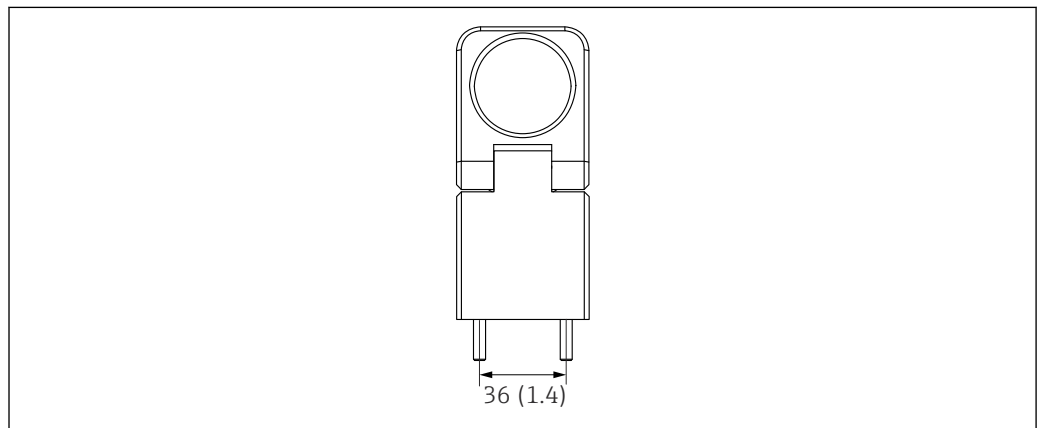
11 Dimensions of standard assembly CFS51 with mounting plate (right). Unit: mm (in)



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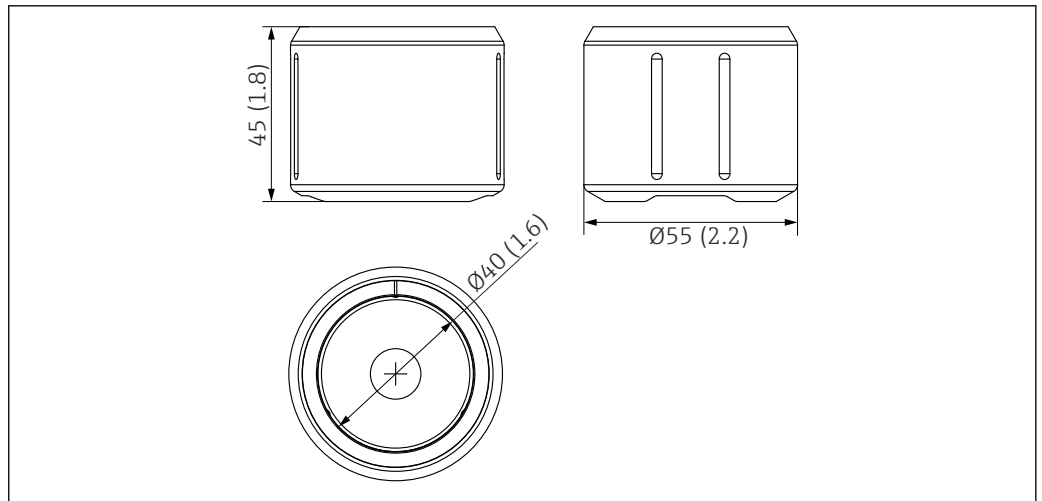
12 Dimensions of mounted sensor with standard assembly CFS51 . Unit: mm (in)

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



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



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

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:	Black PEHD, UL94: HB
	O-rings:	FKM
	Clamping ring:	Titanium 3.7035

Process connections	<ul style="list-style-type: none"> ■ Sensor: G1" and NPT 3/4" ■ Assembly: G1/4" DN 4/6 (cleaning connection), G1/4" DN6/8 (process connection)
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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**.

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Marine certifications	The product has certificates for marine applications, issued by the following classification societies: ABS (American Bureau of Shipping), BV (Bureau Veritas), DNV (Det Norske Veritas) and LR (Lloyd's Register).
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Ordering information

Scope of delivery	The scope of delivery comprises: <ul style="list-style-type: none"> ■ Sensor, version as ordered ■ Operating Instructions
Product page	www.endress.com/cfs51
Product Configurator	<ol style="list-style-type: none"> 1. Configure: Click this button on the product page. Select Extended selection. <ul style="list-style-type: none"> ↳ The Configurator opens in a separate window. Configure the device according to your requirements by selecting the desired option for each feature. <ul style="list-style-type: none"> ↳ In this way, you receive a valid and complete order code for the device. 4. Accept: Add the configured product to the shopping cart. <p> For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.</p> <ol style="list-style-type: none"> 5. CAD: Open this tab. <ul style="list-style-type: none"> ↳ The drawing window is displayed. You have a choice between different views. You can download these in selectable formats.

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.

Device-specific accessories	CFS51 standard assembly <ul style="list-style-type: none"> ■ 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
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