

# Technical Information

## Turbimax CUS50D

Absorption sensor for turbidity and solids measurements



### Application

Turbimax CUS50D ensures reliable measurements and efficient process monitoring, even in aggressive media:

- Industrial wastewater and utilities:
  - Measurement of solids content in process sludges and wastewater sludges
  - Flocculant dosing
  - Measurement of concentration of dairy products in wastewater
- Process media:  
Concentration measurement in the product, e.g. in titanium dioxide
- Highly absorptive media:  
Concentration measurement in very dark media, e.g. activated carbon concentration in fourth cleaning stage in WWTPs

### Your benefits

- Turbidity measurement according to the principle of light attenuation as per ISO7027.
- Standardized communication (Memosens technology) enables "plug and play".
- Sensor head made of a dirt-repellent Teflon derivative is easy to keep clean using the air cleaning unit.
- Long service life of sensor thanks to resistant materials used in sensor shaft and head.
- Sensor is precalibrated ex works and includes different application models.
- Automatic sludge model independently selects the optimum signal characteristics for each type of sludge.
- Single-point calibration sufficient in most applications.

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## Function and system design

### Measuring principle

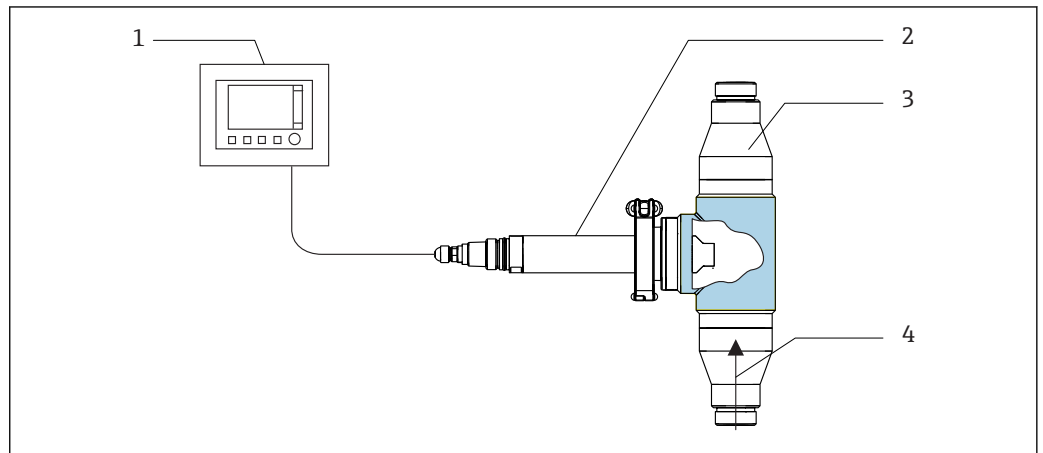
The sensor operates on the principle of light attenuation and meets the requirements of turbidity measurement according to the principle of light attenuation as per ISO 7027. The measurement is performed with a wavelength of 860 nm.

Suitable for average to high turbidity.

### Measuring system

A complete measuring system comprises:

- Turbimax CUS50D turbidity sensor
- Liquiline CM44x multi-channel transmitter
- Direct installation in a pipe connection (Clamp 2" ) or
- Assembly:
  - CUA252 flow assembly or
  - CUA262 flow assembly or
  - Flexdip CYA112 assembly and Flexdip CYH112 holder or
  - Retractable assembly, e.g. Cleanfit CUA451



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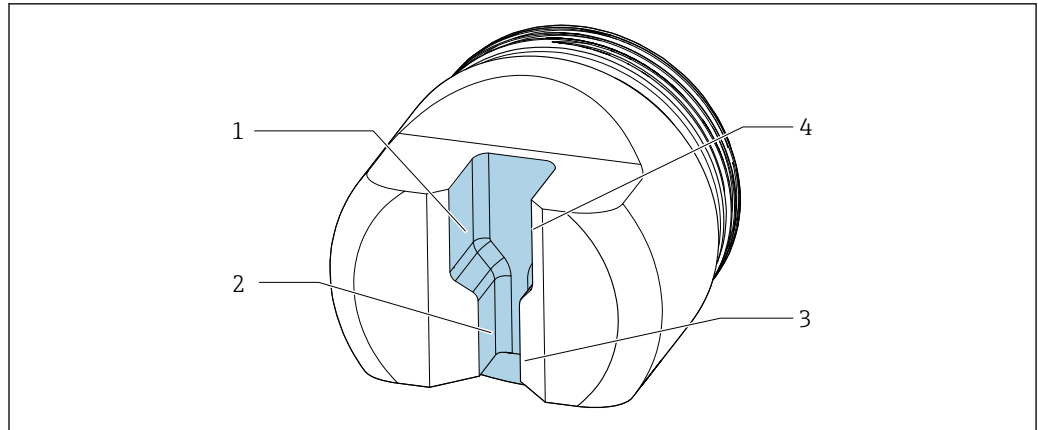
1 Measuring system with CUA252 flow assembly

- 1 Liquiline CM44x multi-channel transmitter
- 2 Turbimax CUS50D turbidity sensor
- 3 CUA252 flow assembly
- 4 Direction of flow

### Sensor structure

CUS50D is an absorption sensor for measuring turbidity and solids content. It features a glass, non-adhesive sensor head with 2 path lengths (5 mm and 10 mm). Stainless steel and plastic housing options are available.

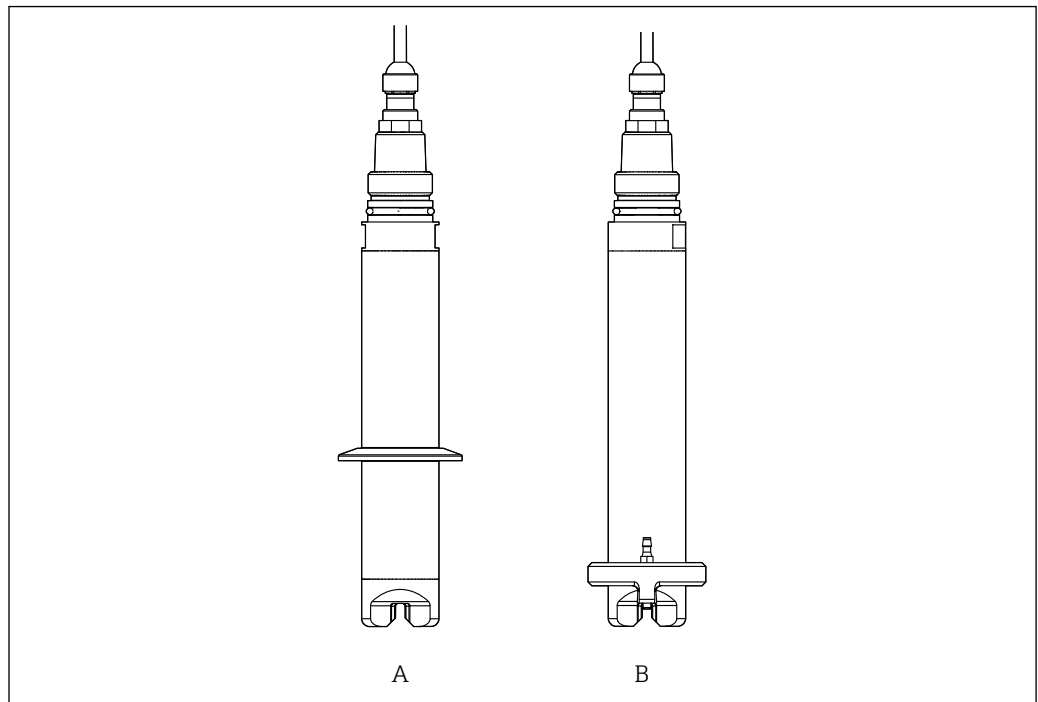
CM44 transmitter for sensor operation.



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2 CUS50D sensor head

- 1 Light sources 10 mm (0.4 in)
- 2 Light sources 5 mm (0.2 in)
- 3 Light receiver 10 mm (0.4 in)
- 4 Light receiver 5 mm (0.2 in)



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3 Versions

- A Clamp
- B Air cleaning

**Sensor monitoring**

The optical signals are continuously monitored and analyzed for plausibility. If inconsistencies occur, an error message is output via the transmitter. The function is disabled by default.

**Applications**

The "Absorption" and "Formazine" applications are calibrated at the factory. The absorption factory calibration is used as the basis for precalibrating additional applications and optimizing them for the different media characteristics.

Application	Specified operating range
Factory calibration for absorption	0.000 to 5.000 AU or 0.000 to 10.000 OD
Factory calibration for formazine	40 to 4,000 FAU
Application: Kaolin	0 to 60 g/l
Application: Sludge	0 to 25 g/l
Application: Auto sludge	0 to 25 g/l
Product loss	0 to 100%

To adapt to a specific application, customer calibrations can be carried out with up to 10 points.

**Application: Formazine**

Factory calibration for the formazine application is carried out with the formazine turbidity standard. Sensor measured values in the unit [FAU] are only comparable to the measured values of any other sensor e.g. scattered light sensor with the unit [FNU] or [NTU] in this standard medium. In any other media, the measured values will be different than when measurement is carried out with a scattered light sensor.

## Input

**Measured values**

- Turbidity
- Absorption
- Solids content
- Product loss
- Temperature

**Measuring range**

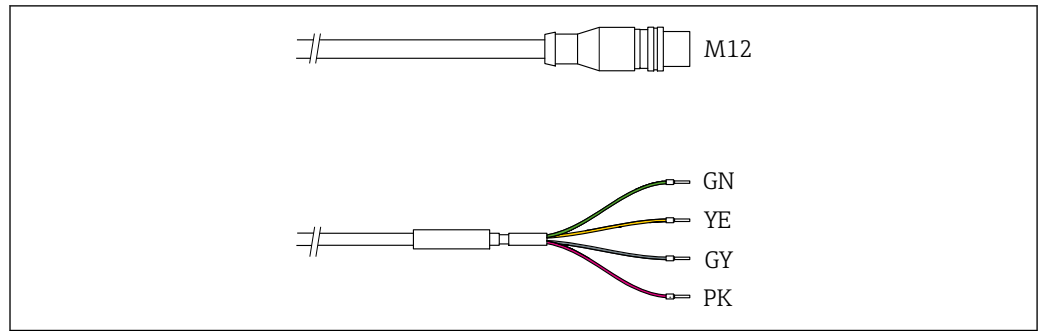
Application	Specified operating range	Max. operating range
Factory calibration for absorption	0.000 to 5.000 AU or 0.000 to 10.000 OD	
Factory calibration for formazine	40 to 4000 FAU	10000 FAU
Application: Kaolin	0 to 60 g/l	500 g/l
Application: Sludge	0 to 25 g/l	500 g/l
Application: Auto sludge	0 to 25 g/l	500 g/l
Product loss	0 to 100 %	1000 %



**Measuring range with solids content:**

For solids, the achievable ranges depend very much on the media that are actually present and may differ from the recommended operating ranges. Extremely inhomogeneous media may cause fluctuations in measured values, thus narrowing the measuring range.

## Power supply

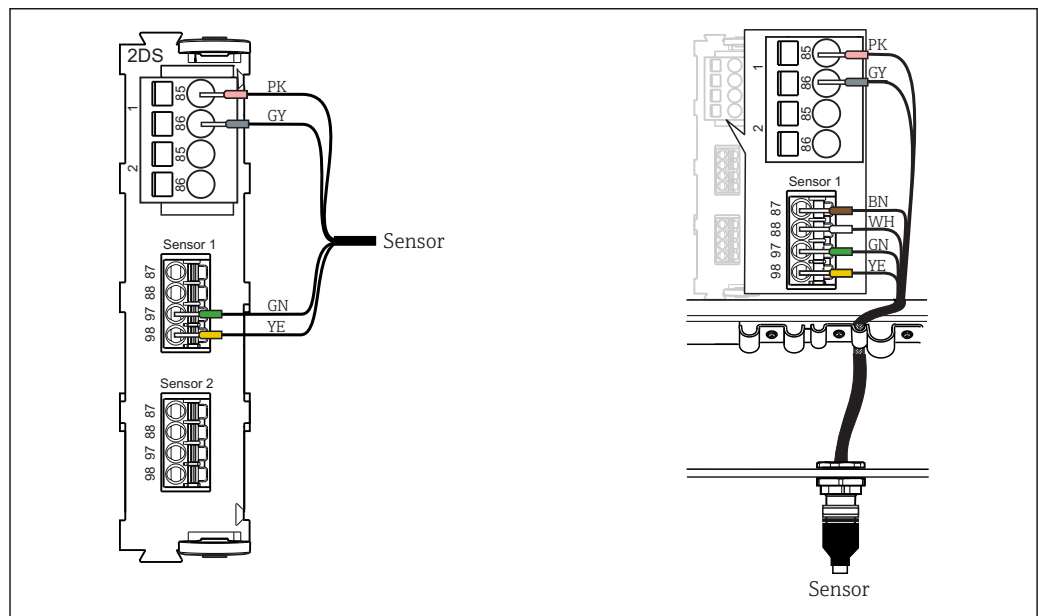


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4 Connection options

You have the following connection options:

- via M12 connector (version: fixed cable, M12 connector)
- via sensor cable to the plug-in terminals of a sensor input on the transmitter (version: fixed cable, end sleeves)

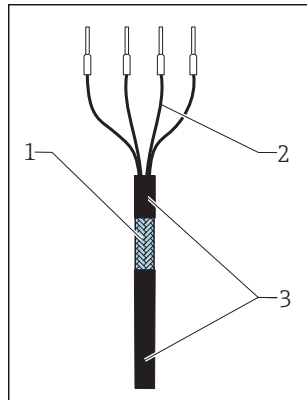


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5 Sensor connection to sensor input (left) or via M12 connector (right)

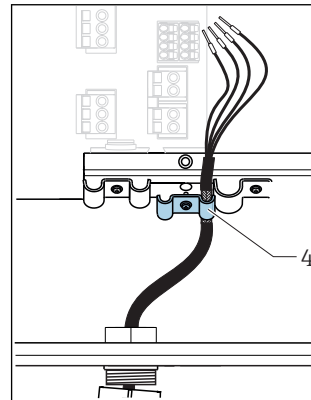
Connecting the cable shield

Cable sample (does not necessarily correspond to the original cable supplied)



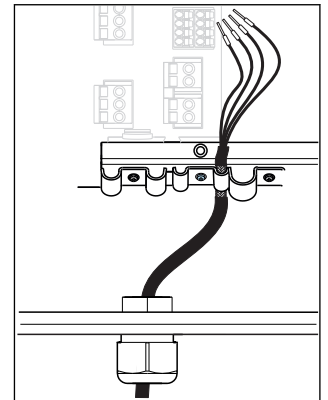
6 Terminated cable

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



7 Inserting the cable

- 4 Grounding clip



8 Tighten screw (2 Nm)


The cable shield is grounded by the grounding clip


The maximum cable length is 100 m (328 ft).

## Performance characteristics

**Reference operating conditions** 20°C (68 °F), 1013 hPa (15 psi)

<b>Maximum measured error</b>	Absorption	0.5% of the upper range value (corresponds to +/- 50 mOD).
	Formazine	10% of measured value or 10 FAU (the greater value applies in each case).
	Kaolin	5% of the upper range value; applies to sensors that are calibrated for the observed measuring range.
	Sludge/Auto sludge	10% of the measured value or 5% of the upper range value (the greater value applies in each case); applies to sensors that are calibrated for the observed measuring range.
	Product loss	Not specified. Very much depends on the condition of the measuring medium used.

 For solids, the achievable measured error depends very much on the media that are actually present and may differ from the specified values. Extremely inhomogeneous media may cause fluctuations in measured values, thus increasing the measured error.


 The measured error encompasses all inaccuracies of the measuring chain (sensor and transmitter). However, it does not include the inaccuracy of the reference material used for calibration.

**Drift** Working on the basis of electronic controls, the sensor is largely free of drifts.

Formazine:	Drift 0.04% per day (for 2,000 FAU)
Absorption:	Drift 0.015% per day (for 5 OD)


**Detection limits**

Application	Detection limit
Absorption	0.004 OD for 0.5 OD
Formazine	10 FAU

 For kaolin, sludge/auto sludge and product loss, the detection limit depends very much on the media that are actually present. It is therefore not possible to specify general values.

**Repeatability**

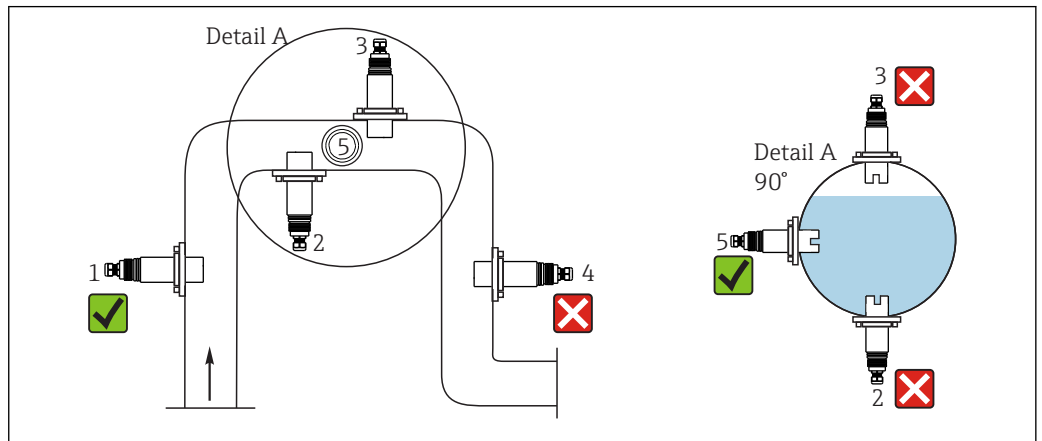
Application	Repeatability
Absorption	0.001 OD or 0.2% of measured value (the greater value applies in each case)
Formazine	10 FAU for 800 FAU

 For kaolin, sludge/auto sludge and product loss, the detection limit depends very much on the media that are actually present. It is therefore not possible to specify general values.



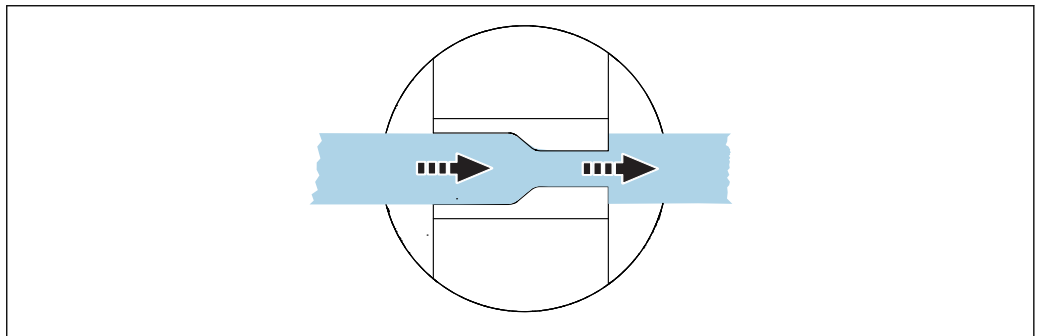
## Installation

### Pipes



9 Permitted and unacceptable installation positions in pipes

1. The diameter of the pipe must be at least 50 mm (2").
2. Install the sensor in places with consistent flow conditions.
3. The best installation location is in the ascending pipe (item 1).



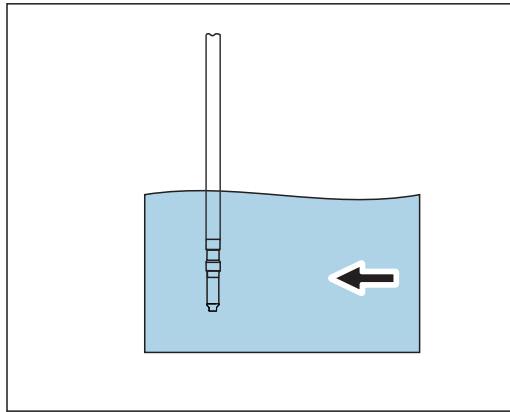
10 Direction of flow

- ▶ Align the sensor in such a way that the medium flows through the measuring gap (self-cleaning effect). The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path.

### Installation options

Installation options:

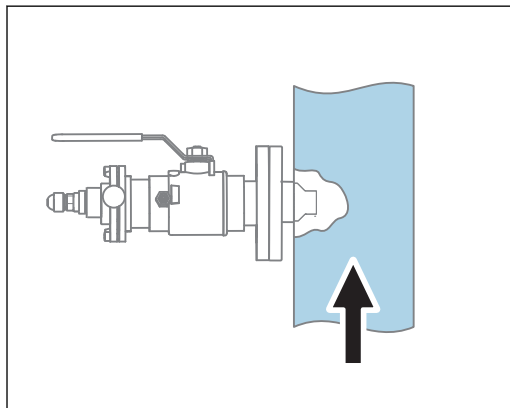
- with Flowfit CUA252 flow assembly
- with Flowfit CUA262 flow assembly
- with Cleanfit CUA451 retractable assembly
- with Flexdip CYA112 immersion assembly and Flexdip CYH112 holder



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11 Installing with immersion assembly

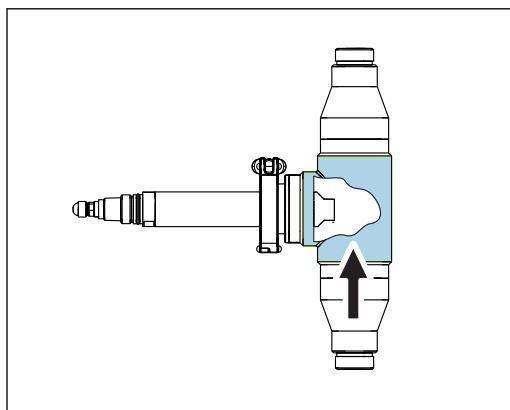
The installation angle is 0°. The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path. If you are using the sensor in open basins, install the sensor in such a way that bubbles cannot accumulate on it.



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12 Installing with CUA451 flow assembly

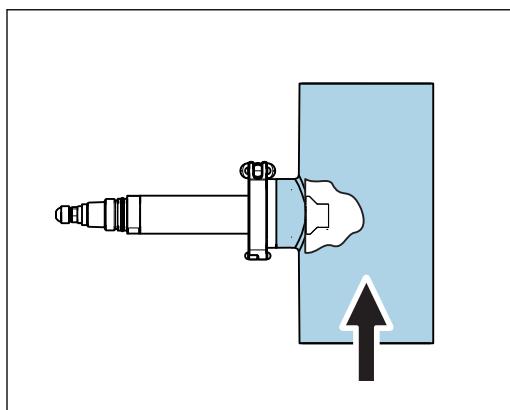
The installation angle is 90°. The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path. For manual insertion/retraction of the assembly, the medium pressure must not exceed 2 bar (29 psi).



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13 Installing with CUA252 flow assembly

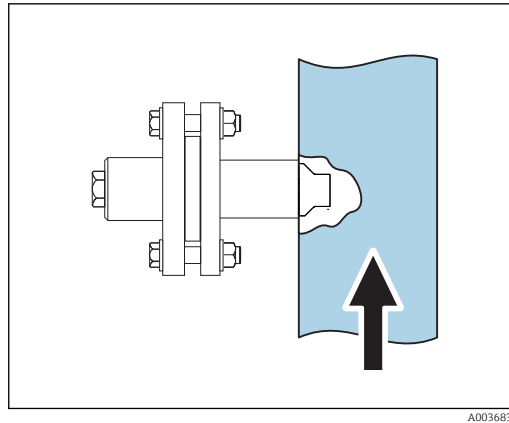
The installation angle is 90°. The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path.



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14 Installing with CUA262 flow assembly

The installation angle is 90°. The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path.



The installation angle is 90°. The arrow shows the flow direction; it runs from the 10 mm path to the 5 mm path.

15 Installing with CUA120 flow assembly

## Environment

<b>Ambient temperature range</b>	-20 to +60 °C (-4 to 140 °F)
<b>Storage temperature</b>	-20 to +70 °C (0 to 160 °F)
<b>Degree of protection</b>	IP 68 (1.8 m (5.91 ft) water column over 20 days, 1 mol/l KCl)

## Process

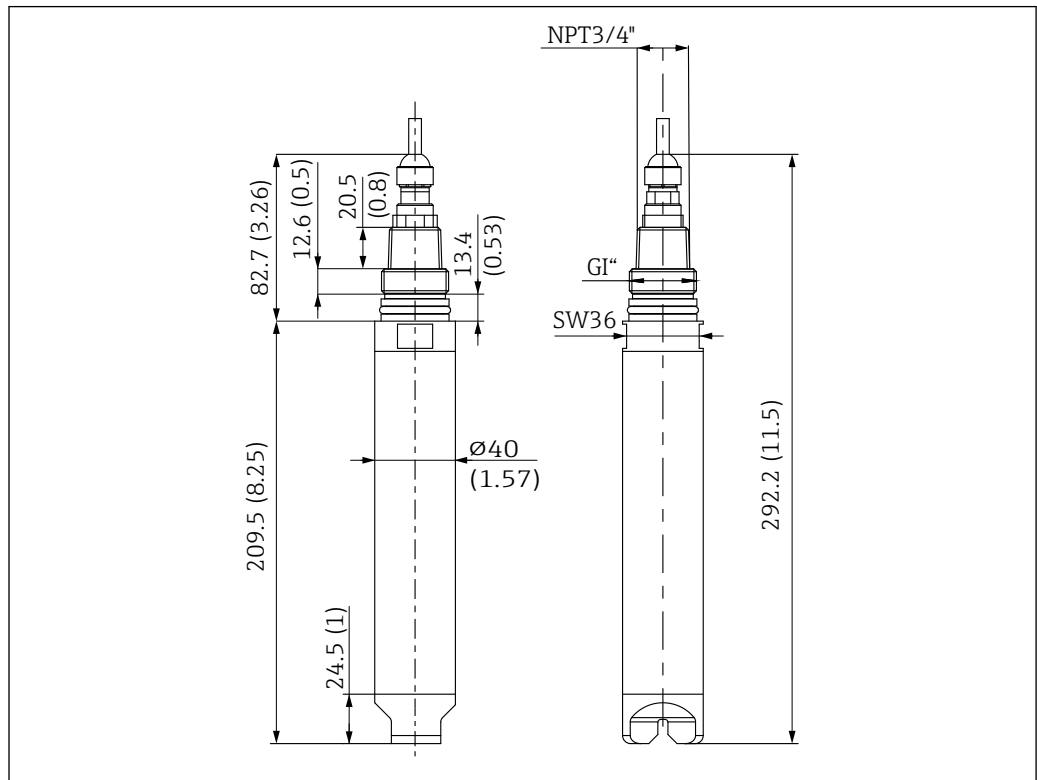
<b>Process temperature</b>	-20 to +85 °C (0 to 185 °F)
<b>Process pressure</b>	0.5 to 4.5 bar (7.3 to 65.3 psi) absolute
<b>Minimum flow</b>	No minimum flow required.



For solids which have a tendency to form deposits, ensure that sufficient mixing is performed.

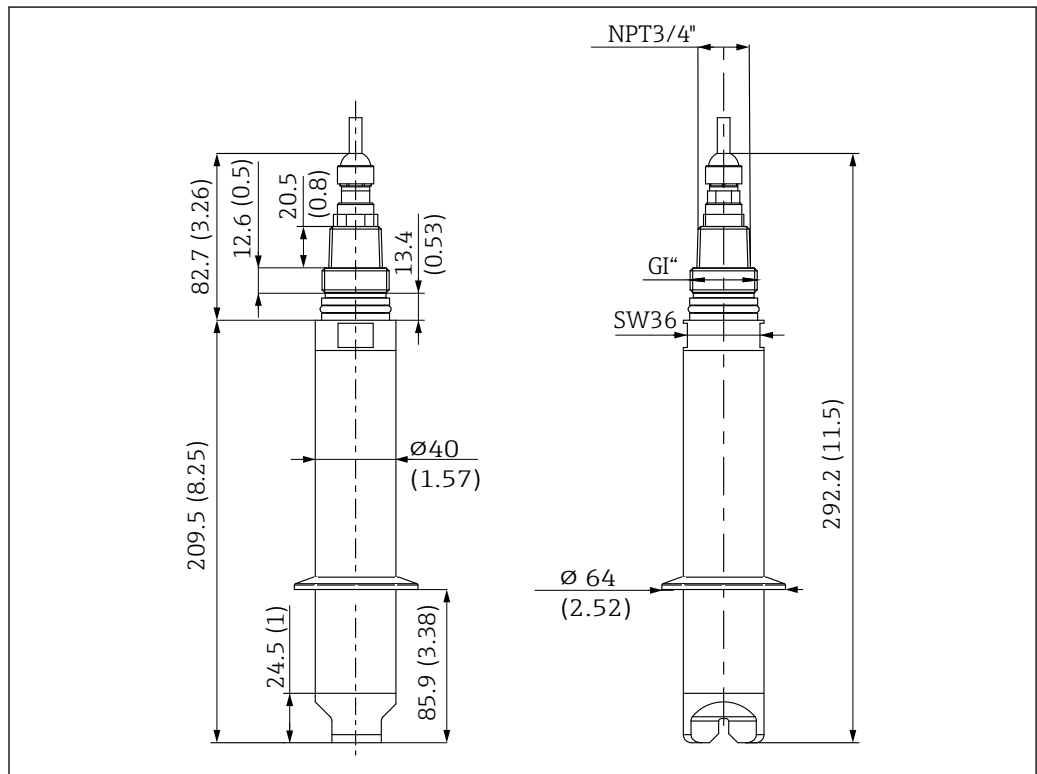
## Mechanical construction

### Dimensions



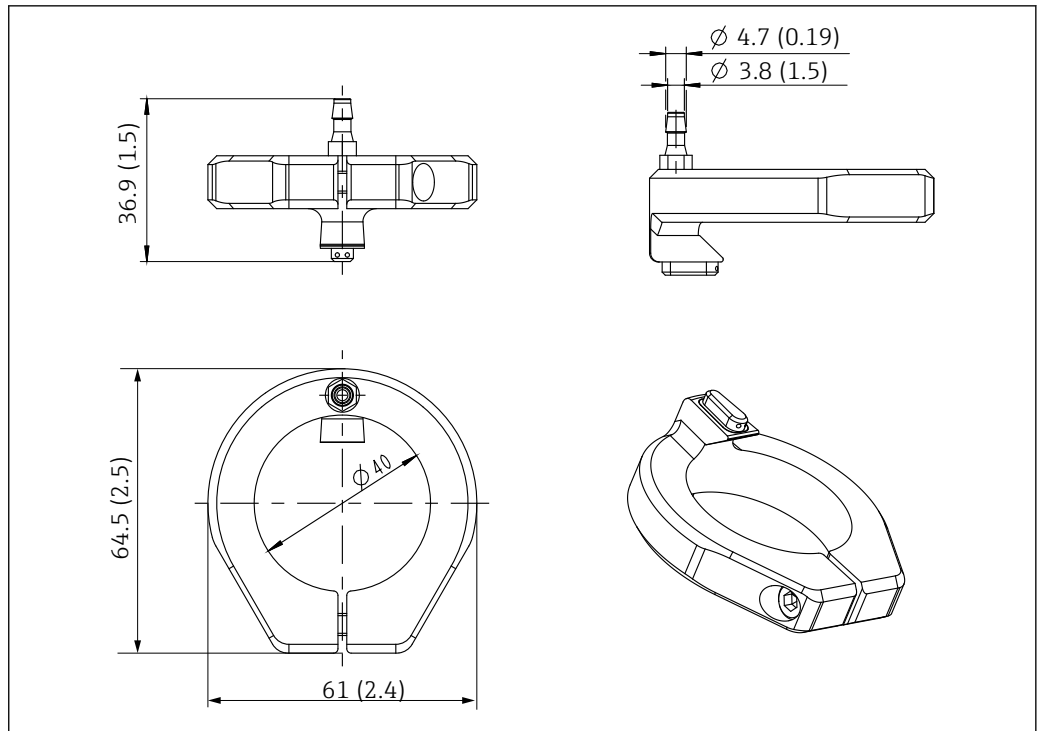
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16 Dimensions in mm (in)



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17 Dimensions with clamp in mm (in)



18 Air cleaning, dimensions in mm (in)

For air cleaning: Max. pressure 2 bar

**i** Slide the air cleaning unit onto the sensor head until it can go no further. The nozzle of the air cleaning unit must be located on the side of the wider 10 mm gap.

**Weight**

Cable length	Plastic sensor	Metal sensor	Metal sensor with clamp
3 m (9.84 ft)	0.46 kg (1.5 lbs)	1.15 kg (2.54 lbs)	1.21 kg (2.67 lbs)
7 m (23 ft)	0.68 kg (1.5 lbs)	1.37 kg (3.81 lbs)	1.43 kg (3.15 lbs)
15 m (49.2 ft)	1.15 kg (2.54 lbs)	1.83 kg (4.03 lbs)	1.9 Kg (4.19 lbs)

**Materials**

	Plastic sensor	Metal sensor
Sensor head:	PCTFE	PCTFE
Sensor housing:	PPS/GF40%	1.4571/AISI 316Ti
Sensor threaded connection:	PPS/GF40%	1.4404/AISI 316L
O-rings:	EPDM	EPDM

The data refer to the materials in contact with the medium when the sensor is properly installed in Endress+Hauser valves.

**Process connections**

G1 and NPT 3/4"

Clamp 2" (depending on sensor version)/DIN 32676

## Certificates and approvals

### Electromagnetic compatibility

Interference emission and interference immunity as per

- EN 61326-1:2013
- EN 61326-2-3:2013
- NAMUR NE21: 2012

### CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the **CE** mark.

### ISO 7027


The measuring method used with the sensor complies with the ISO 7027-1:2016 standard.

## Ordering information

### Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
  - ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
  - ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

 For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

### Scope of delivery

The delivery comprises:

- 1 CUS50D outlet turbidity sensor, version as ordered
- 1 Operating Instructions BA01846C

## 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.

### Assemblies

#### FlowFit CUA120

- Flange adapter for mounting turbidity sensors CUS
- Product Configurator on the product page: [www.endress.com/cua120](http://www.endress.com/cua120)



Technical Information TI096C

#### Flowfit CUA252

- Flow assembly
- Product Configurator on the product page: [www.endress.com/cua252](http://www.endress.com/cua252)



Technical Information TI01139C

#### Flowfit CUA262

- Weld-in flow assembly
- Product Configurator on the product page: [www.endress.com/cua262](http://www.endress.com/cua262)



Technical Information TI01152C

**FlexdipCYA112**

- Immersion assembly for water and wastewater
- Modular assembly system for sensors in open basins, channels and tanks
- Material: PVC or stainless steel
- Product Configurator on the product page: [www.endress.com/cya112](http://www.endress.com/cya112)



Technical Information TI00432C

**Cleanfit CUA451**

- Manual retractable assembly made of stainless steel with ball valve shut-off for turbidity sensors
- Product Configurator on the product page: [www.endress.com/cua451](http://www.endress.com/cua451)



Technical Information TI00369C

**Flowfit CYA251**

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



Technical Information TI00495C

**Holder**

**Flexdip CYH112**

- Modular holder system for sensors and assemblies in open basins, channels and tanks
- For Flexdip CYA112 water and wastewater assemblies
- Can be affixed anywhere: on the ground, on the capstone, on the wall or directly onto railings.
- Stainless steel version
- Product Configurator on the product page: [www.endress.com/cyh112](http://www.endress.com/cyh112)

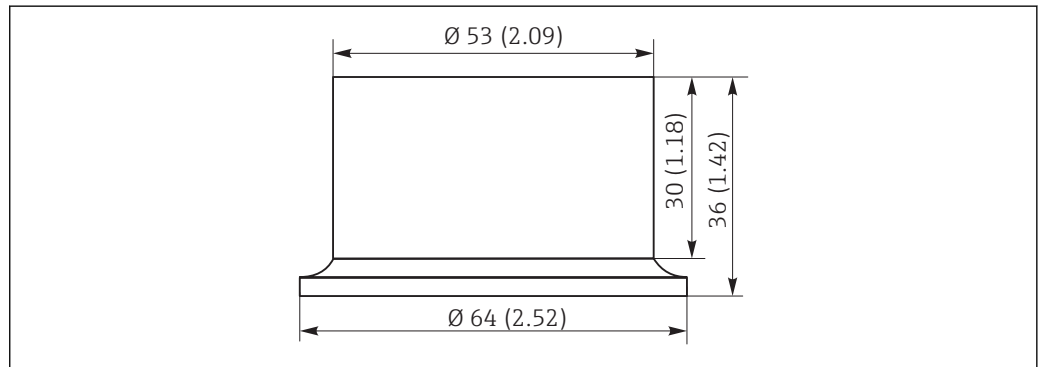


Technical Information TI00430C

**Mounting material**

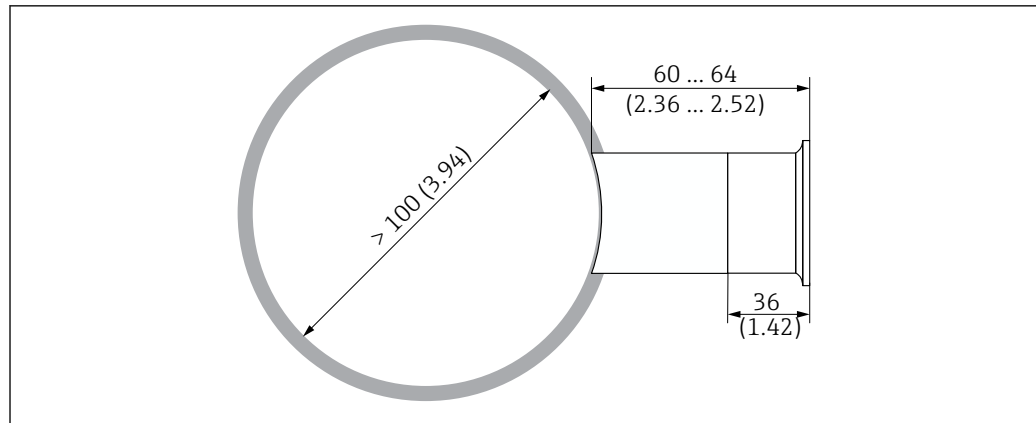
**Weld-in adapter for clamp connection DN 50**

- Material: 1.4404 (AISI 316 L)
- Wall thickness 1.5 mm
- Order number: 71242201



19 Dimensions in mm (inch)

A0030841



A0030819

20 Pipe connection with weld-in adapter, dimensions in mm (in)

### Compressed air cleaning

#### Compressed air cleaning for CUS50D

- Connection: 6 mm
- Pressure: 1.5 to 2 bar (22 to 30 psi)
- Materials: POM, PE, PA 6.6 30% glass fiber
- Order No.: 71395617

#### Compressor

- For compressed air cleaning
- 230 V AC order no. 71072583
- 115 V AC order no. 71194623

### Calibration kit

#### CUS50D kit, solid state reference

- Calibration tool for CUS50D turbidity sensor
- Easy and reliable inspection of CUS50D turbidity sensors.
- Order No.: 71400898

[www.addresses.endress.com](http://www.addresses.endress.com)