Technical
Information
TI 228C/07/en
51504289

Turbidity and Solids Content Sensor
TurbiMax P CUS 61 / CUS 61H

Turbidity and Solids Content Sensor for Average Concentrations in High-Temperature and Hazardous Areas Using the Light Absorption Method

The TurbiMax P CUS 61 / CUS 61H sensor is used for optical solid matter content measurement in turbid water for up to 12g solid matter/l in high-temperature and hazardous applications.

Applications
- Solid matter content measurement in suspensions
- Separation zone detection in sedimentation processes
- Industrial quality control

Features and benefits
- Reliable concentration measurement using optical measurement process
- Four-beam pulsed light method for compensation of sensor soiling and ageing of optical components
- Stainless steel sensor body
- No mechanically moving parts
- Measured value preprocessing in sensor resulting in low signal transmission sensitivity

Quality made by
Endress+Hauser

ISO 9001

Endress+Hauser

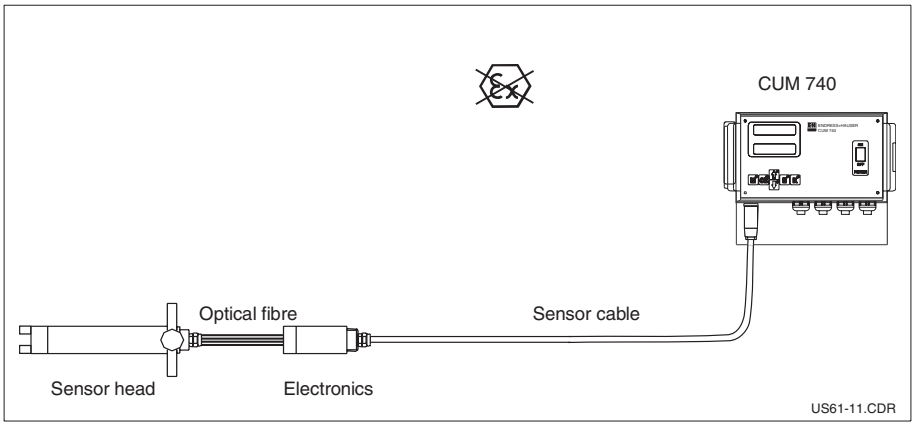
The Power of Know How

Measuring system

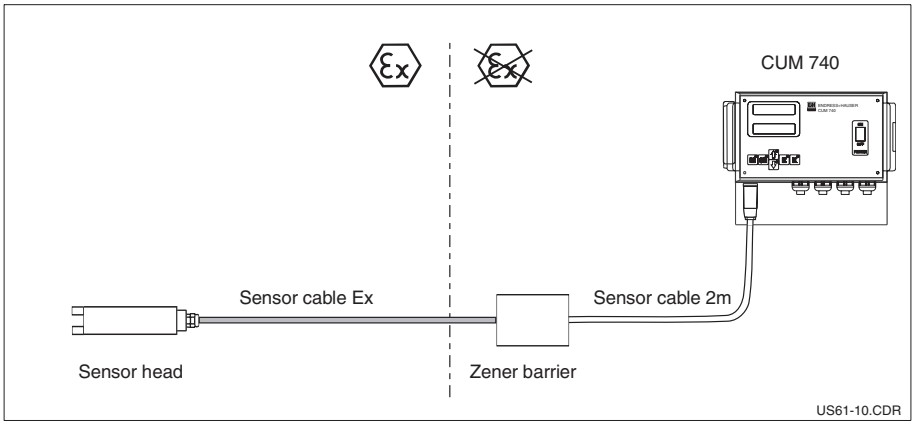
The complete measuring system consists of:
- Turbidity transmitter CUM 740
- Turbidity sensor TurbiMax P
  CUS 61/61H with the components:
  - Sensor head
  - Zener barrier 7900 ZB
    (for hazardous applications)
  - Optical fibre and sensor electronics
    (fo high temperature applications)
- Assembly for installation or immersion

Examples for measuring systems

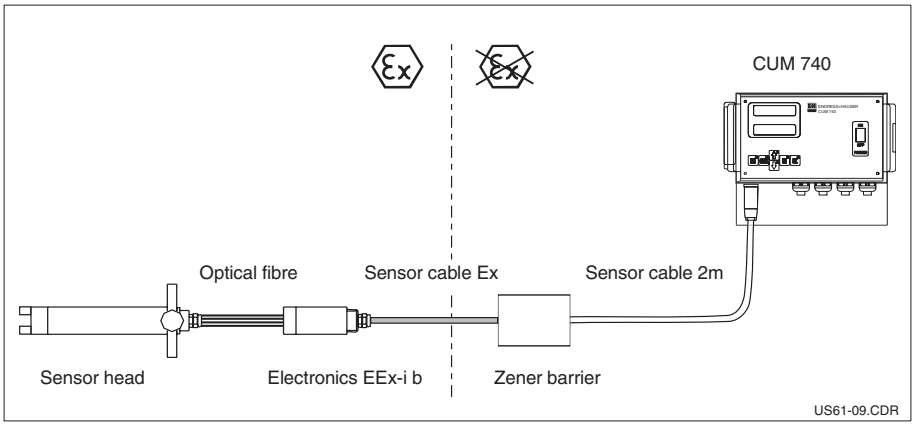
CUM 740
with CUS 61H-A2



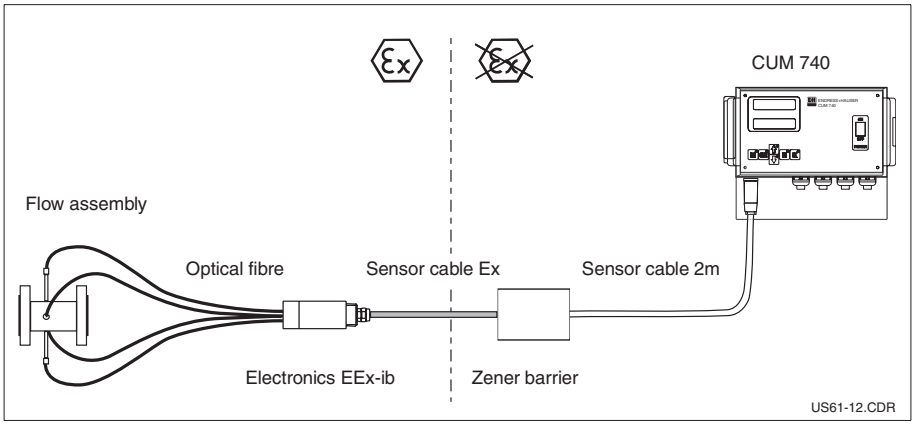
Measuring system
CUM 740
with CUS 61-G1



Measuring system
CUM 740
with CUS 61H-G2



Measuring system
CUM 740
with CUS 61H-G3



Measuring principle

Turbidity measurement
By turbidity we mean the scattered component of a light beam which is diverted away from its original course by optically denser particles in the medium e.g. solid matter particles.

Four-beam pulsed light method
This method is based on two light sources and two photoreceivers. Long-life LEDs (at least 20,000 operation hours) are used as mono-chromatic light sources.

To eliminate interference from extraneous light sources, the LEDs are pulsed at a rate of several kHz.

Two measuring signals are detected at the two photoreceivers with every light pulse. The four measuring signals are compared logarithmically with each other and converted into a ratio. This compensates for detector soiling and the ageing of optical modules.

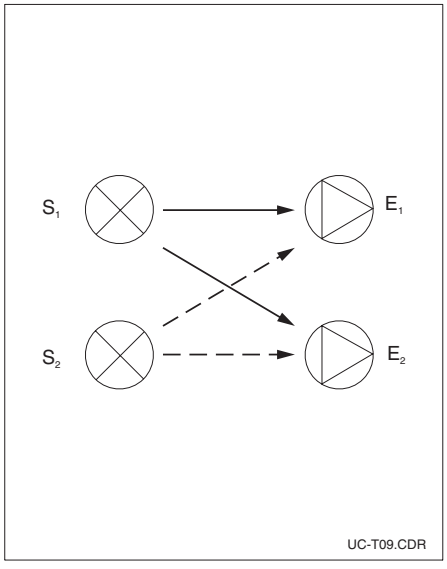
Light absorption method
This measuring method is based on the Lambert-Beer law. Turbidity is measured by light attenuation.

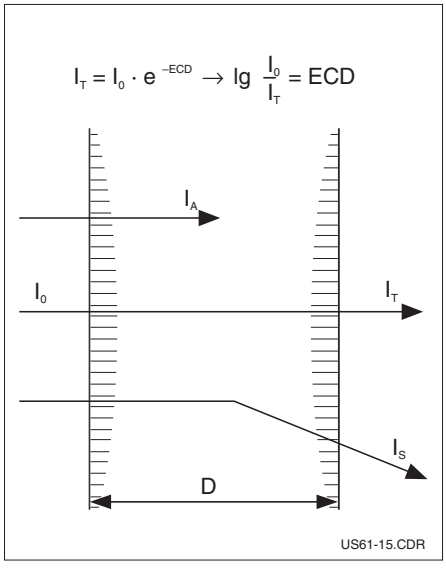
The LEDs on the sensor send a directed light beam to the photoreceivers. The intensity of the beam is attenuated by the solid matter particles in the medium. The photoreceivers measure the absoprtion signal and convert it into a frequency signal. The frequency signals are assigned to corresponding turbidity units and solid matter concentrations, and appear in the display.

left:
Principle of measured light diffusion
S = Transmitter
E = Receiver

right:
Principle of measured light attenuation analogue to Lambert-Beer's law

I_0 = Intensity of transmitted light
I_A = Intensity of absorbed light
I_T = Intensity of light transmitted
I_S = Intensity of scattered light
E = Extinction coefficient
C = Concentration
D = Optical path length



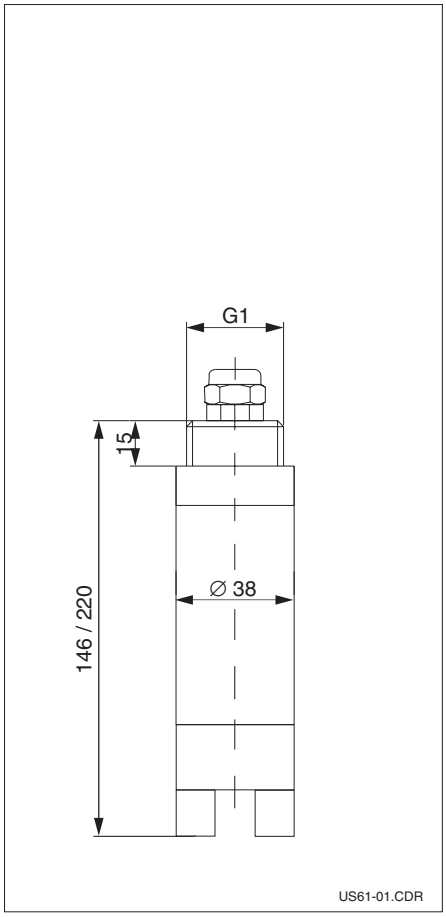


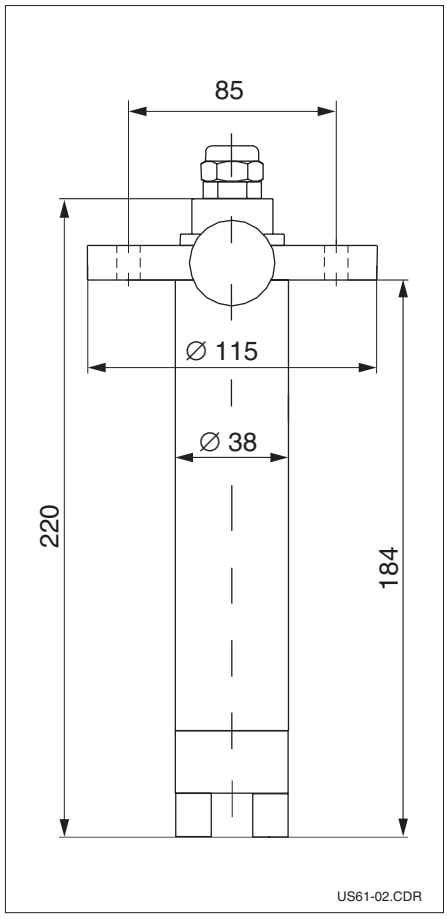
Calibration

Each sensor is subjected to a careful calibration at the factory. One customer calibration can also be saved.

For the calibration of solids content measurement, such as sludge, refer to the concentration determined by a reference method (dry substance).

Dimensions

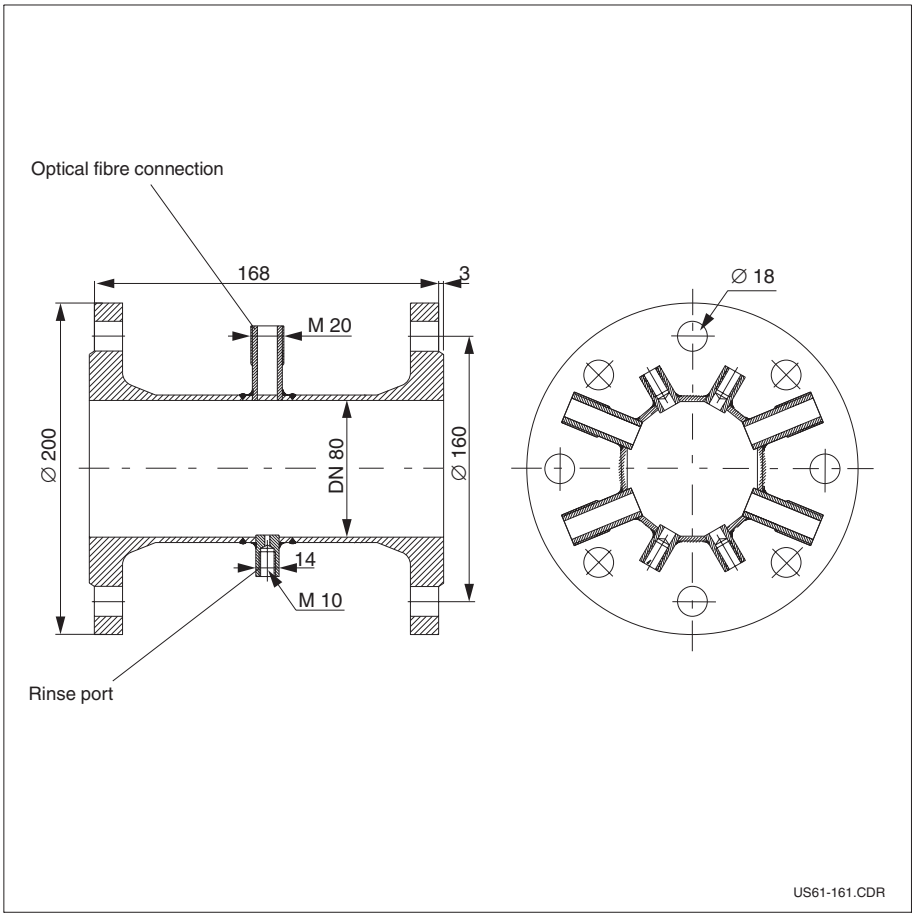




Dimensions

left:
Immersion type
CUS 61 (length 146 mm)
CUS 61H (length 220 mm)

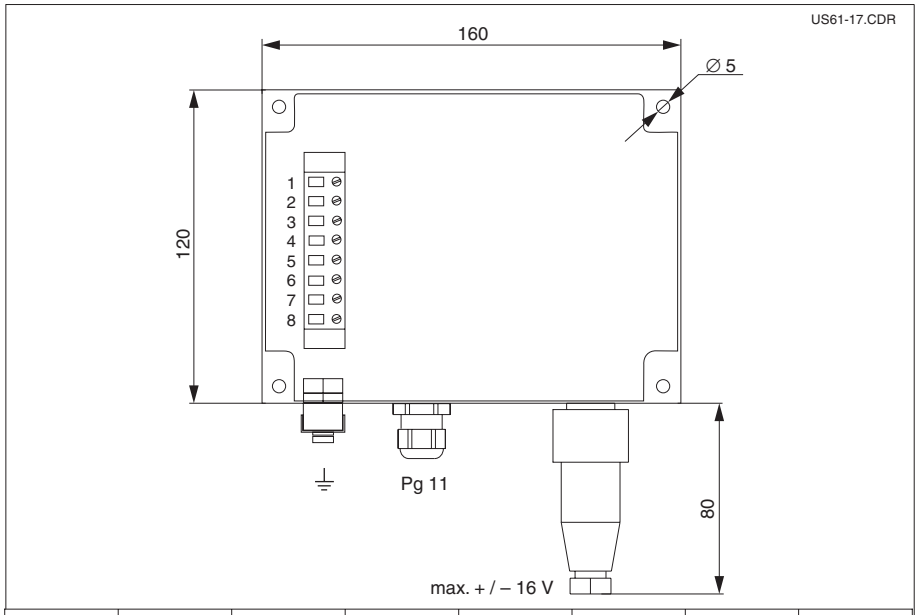
right:
Installation type
CUS 61 / CUS 61H



Dimensions

Flow assembly for
CUS 61H (DN 80)

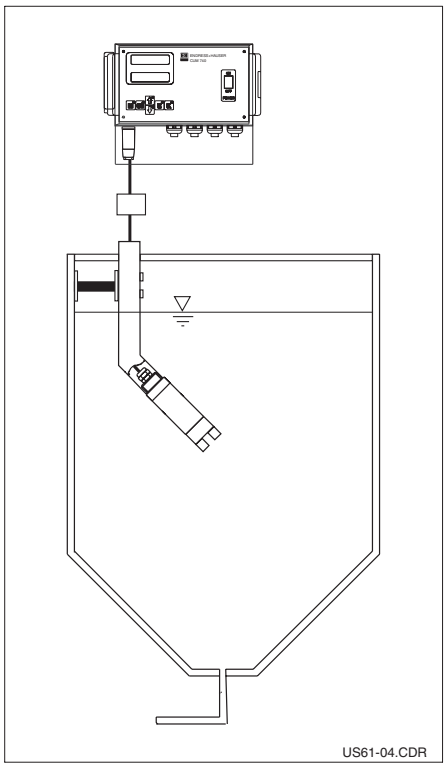
Dimensions

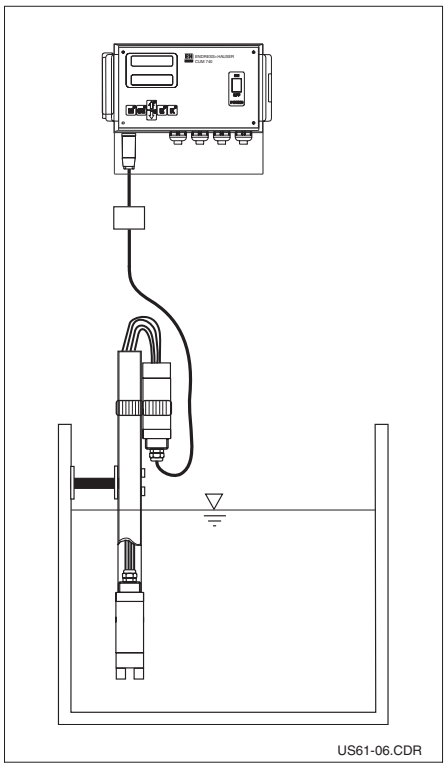


1	2	3	4	5	6	7	8
bl	pk	wt	bn	gn	ye	gn	bk
+dig	0Vdig	+at	0V at	Status	AV	screen	PAL

Dimensions of the Zener barrier 7900 ZB

Installation





Installation examples for sensor, immersion type

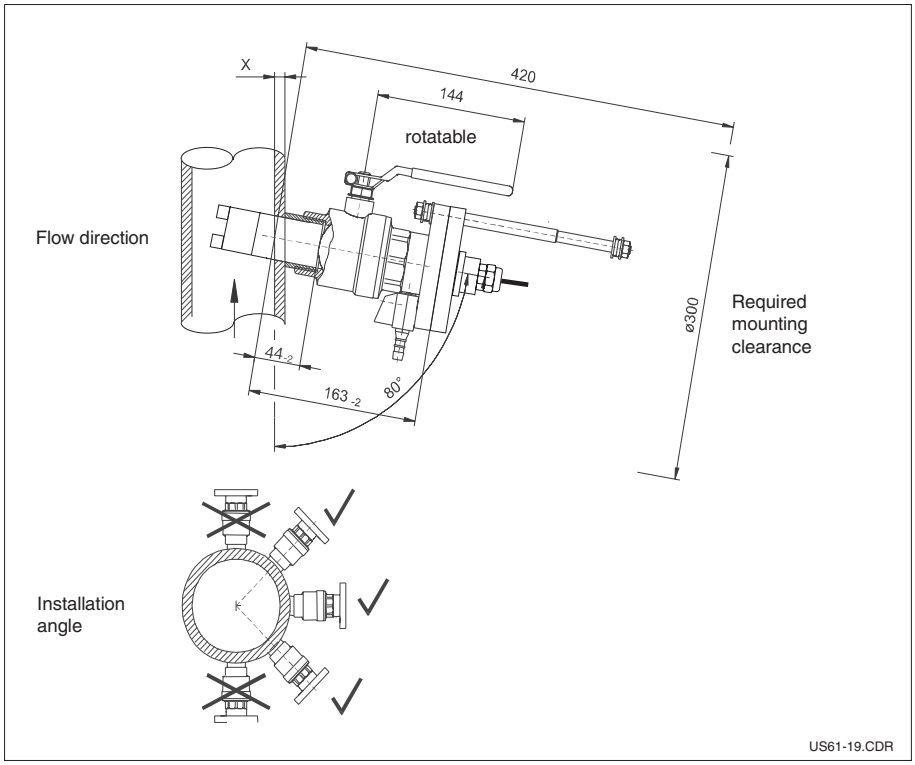
left:
Tank installation of CUS 61 with immersion tube 45°

right:
Channel installation of CUS 61H with basin mounting and straight immersion tube

Note:

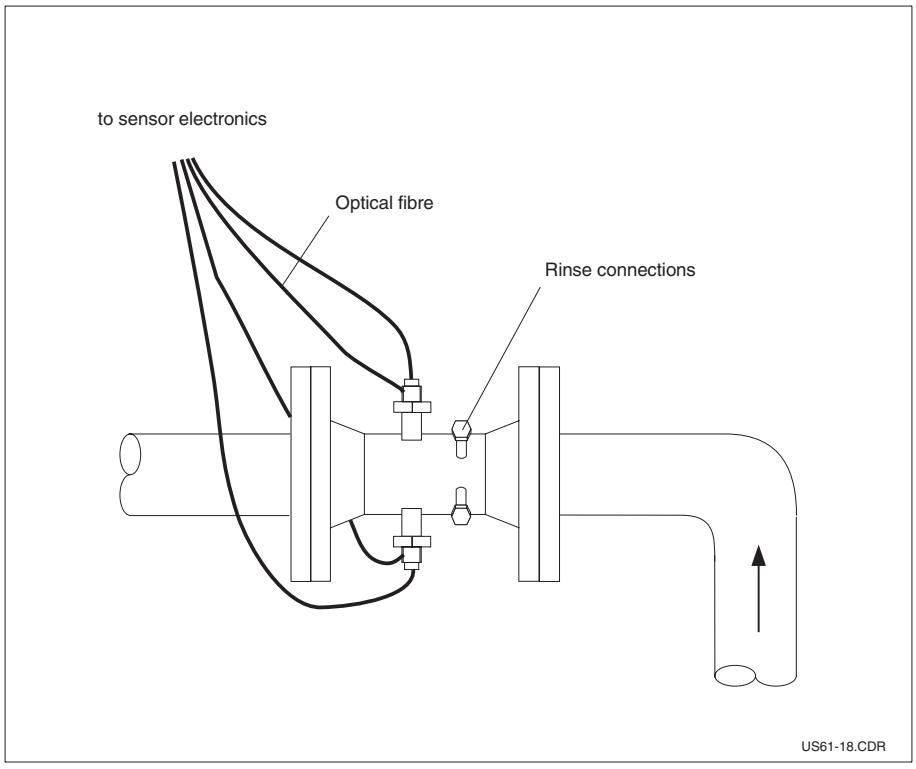
- We recommend the use of an immersion tube (with 45° angle) for the CUS 61 immersion type.
- The immersed version of the CUS 61H may only be fitted with a straight immersion tube to prevent the optical fibre from breaking (immersion tube contained in scope of supply).
- Do not immerse the separate sensor electronics! Attach the sensor electronics with the mounting kit included in the scope of supply.
- Installing the sensor in pipelines or close to a wall can lead to back-scattering and therefore to signal increase.

Installation



Installation example of CUS 61 sensor
Installation version

Tube installation with ball valve built-in assembly (accessories)



Installation examples for CUS 61H sensor
Flow version

Pipe installation

Accessories

- ❏ Ball valve built-in assembly for sensor extension under process conditions,
  DN 40 with security locking
  Material: stainless steel SS 316Ti,
  O-rings made of Viton®
  Order No.: 51503588
- ❏ Sensor fixing bracket for basin mounting
  Material: stainless steel SS 316Ti,
  Order No.: 51503626
- ❏ Immersion tube 1m
  Material: stainless steel SS 316Ti
  Order No. 51506000
- ❏ Immersion tube 2m
  Material: stainless steel SS 316Ti
  Order No. 51503628
- ❏ Immersion tube 2m, 45° angle
  Material: stainless steel SS 316Ti
  Order No.: 51505998

Technical data

Sensor CUS 61

General specifications

Manufacturer	Endress+Hauser
Product designation	TurbiMax P CUS 61

Mechanical data

Dimensions (l x Ø)	Installation type Immersion type	220 × Ø 38mm 146 x Ø 38mm
Weight	Installation type Immersion type	approx. 3kg approx. 1kg

Material

Sensor body	Stainless steel SS 316 Ti
Sight glass	Epoxy resin
O-rings	Viton®

Turbidity measurement

Measuring principle	Light absorption method
Optical components	Light source: 2 LEDs, Detector: 2 photodiodes
Measuring light	Infrared light at 880nm (absorption maximum)
Measuring range	0 ... 12g solid matter/l, dependent on sludge type
Accuracy	< 1% of measuring range end value
Reference	using four-beam pulsed light method
Factory calibration	SiO_2
Cable lengths	13m, 25m, 25 ... 100m

Operating conditions

Operating temperature	0 ... +50°C
Operating pressure	max. 6 bar
Ingress protection	IP 68
Explosion protection CUS 61-G	EEx ib IIC T4

Supplementary documentation

Technical Information CUM 740	Order No.: 51504297

Sensor CUS 61H

General specifications

Manufacturer	Endress+Hauser
Product designation	TurbiMax P CUS 61H

Mechanical data

Dimensions (L x Ø)	Installation type Immersion type Flow assembly	220 × Ø 38mm 220 x Ø 38mm 174 × Ø 165mm
Weight	Instalation type Immersion type Flow assembly	approx. 3kg approx. 1kg approx. 8kg

Material

Sensor body	Stainless steel SS 316 Ti
Sight glass	Silica glass
O-rings	Viton®, Simeritz®
Optical fibre	Optical fibre
Optical fibre sheath	Silicon (up to 160°C), stainless steel (up to 230°C)

Turbidity measurement

Measuring principle	Light absorption method
Optical components	Light source: 2 LEDs, Detector: 2 photodiodes
Measuring light	Infrared light at 880nm (absorption maximum)
Measuring range	0 ... 12g solid matter/l , dependent on sludge type
Accuracy	< 1% of measuring range end value
Reference	Using four-beam pulsed light method
Factory calibration	SiO_2
Cable lengths	13m, 25m, 25 ... 100m
Connecting cable length of Zener barrier to transmitter	2m

Operating conditions

Operating temperature	sensor head sensor electronics	0 ... 160°C , 0 ... 230°C 0 ... 50 °C
Operating pressure		max. 6 bar
Ingress protection	sensor head sensor electronics	IP 68 IP 65
Explosion protection CUS 61H-G		EEx ib IIC T4

Supplementary documentation

Technical Information CUM 740	Order No.: 51504297

Product structure

Turbidity sensor TurbiMax P CUS 61

Certificate
- G ATEX II 2G EEx ib IIC T4
- Y Special version

Version
- 1 Immersion type
- 2 Installation type
- 9 Special version

Cable length
- D Connecting cable 13m
- F Connecting cable 25m
- H Connecting cable 25 ... 100m (price per metre)
- Z Special version

Additional equipment
- A Standard version
- Y Special version

CUS 61- [ ][ ][ ][ ] **Complete order code**

Turbidity sensor TurbiMax P CUS 61H

Certificate
- A Version for hazard-free zones
- G ATEX II 1/2G EEx ib IIC T4
- Y Special version

Version
- 1 Immersion type
- 2 Installation version
- 3 With flow assembly DN 50
- 4 With flow assembly DN 80
- 9 Special version

Cable length
- D Connecting cable 13m
- F Connecting cable 25m
- H Connecting cable 25 ... 100m
- Y Special version

Optical fibre length
- 1 Optical fibre length 1200mm (for version 2, 3, 4)
- 2 Optical fibre length 2400mm (for version 2, 3, 4)
- 3 Optical fibre length 1200mm, immersion tube 1m (only version 1)
- 4 Optical fibre length 2400mm, immersion tube 2m (only version 1)
- 9 Special version

Temperature range
- 1 Temperature range to 160°C
- 2 Temperature range to 230°C
- 9 Special version

Additional equipment
- A Standard version
- Y Special version

CUS 61H- [ ][ ][ ][ ][ ][ ] **Complete order code**

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TI 228C/07/en/05.01
Printed in Germany / DT / CV5 (51504289)