Technical Information TI 230C/07/en 51504293

Turbidity and Solids Content Sensor TurbiMax P CUS 63 / CUS 63H

Turbidity and Solids Content Sensor for Low Concentrations in High-Temperature and Hazardous Areas Using the 90 Scattered Light Method





















The TurbiMax P CUS 63 / CUS 63H sensor is used for optical solid matter content measurement in pure and process water for up to 1000 FNU in high-temperature and hazardous applications.

Applications

- Filtrate monitoring
- Purity contol of boiler feed water
- Condensate monitoring
- In-process monitoring of industrial water
- Industrial quality control

Features and benefits

- Reliable concentration measurement using optical measuring 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



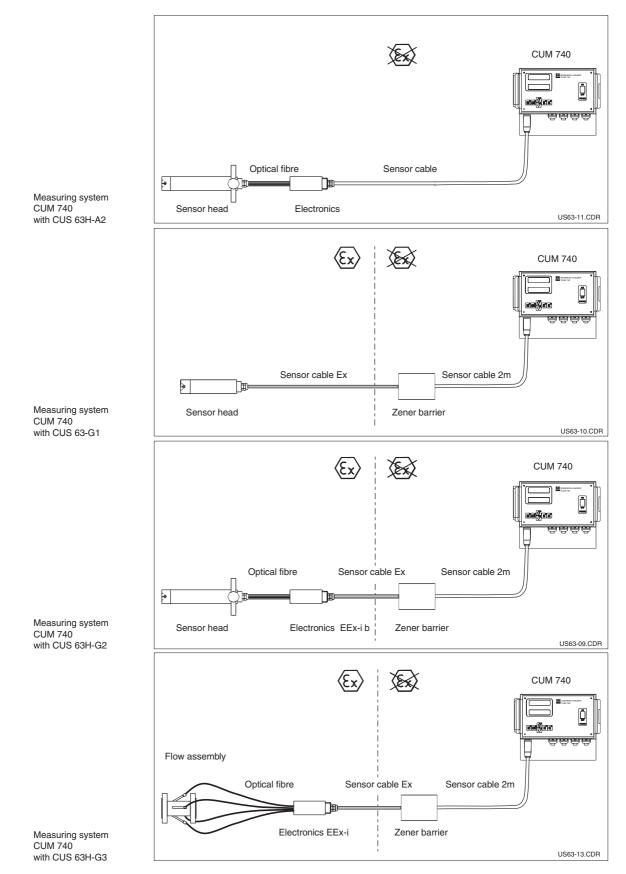
Quality made by Endress+Hauser



Measuring system

The complete measuring system consists of:

- Turbidity transmitter CUM 740
- Turbidity sensor TurbiMax P CUS 63 / 63H with the components:
 - Sensor head
 - Zener barrier 7900 ZB
 - (for hazardous applications)
 - Optical fibre and sensor electronics
 - (for high temperature applications)
- Assembly for installation or immersion



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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. Longlife LEDs (at least 20,000 operating hours) are used as monochromatic 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.

90 scattered light method

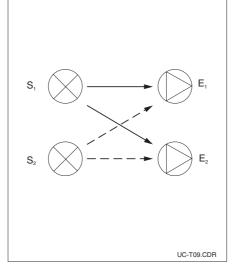
Measurements are made using the standardised 90 scattered light method in accordance with ISO 7027 / EN 27027. The measuring method is based on the Tyndall effect.

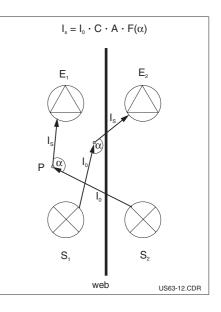
The turbidity of the medium is determined from the amount of scattered light. The transmitted infra-red light beam is scattered by the particles in the medium. The scattered beams are measured by scattered light receivers which are fixed at an angle of 90 to the transmitted light. The measured scattered light signals are converted to frequency signals. The frequency signals are assigned to corresponding turbidity units and solid matter concentrations, and appear in the display.

left: Principle of measured liaht transmission S = Transmitter E = Receiver

riaht[.] Principle of 90 scattered beam measurement

- Intensity of $I_0 =$
- transmitted light Intensity of $I_{S} =$
- scattered light
- Geometrical factor
- C = Concentration $f(\alpha)$ = Angle correlation
- P = Particle



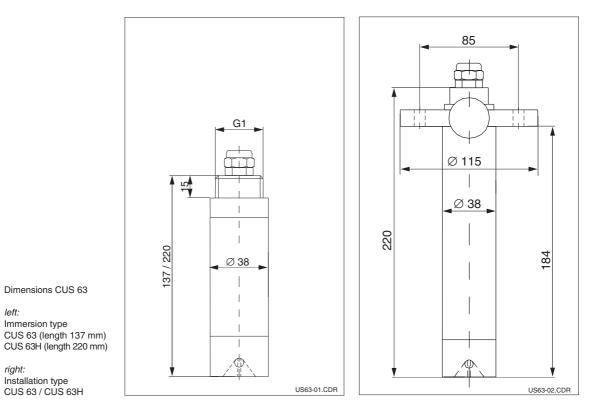


Calibration

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

Dimensions

left:

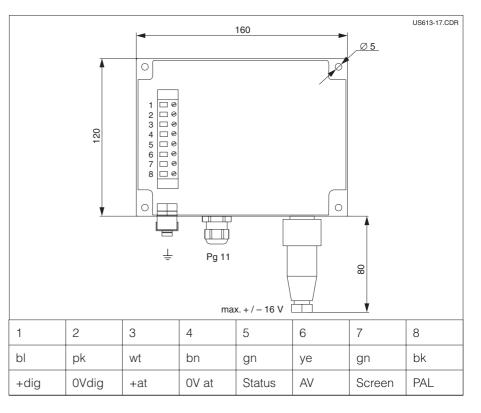


Optical fibre connection Rinse port Ø 18 35 M 10 \otimes ax. Ø 165/200 DN50/DN80 Ø 125/160 Ø 168 3 US63-161.CDR

Dimensions

Flow assembly for CUS 63H (DN 50/DN 80)

Dimensions



Dimensions and connections of the Zener barrier 7900 ZB

Installation examples for the sensor, immersion

type

left:

tube right:

tube

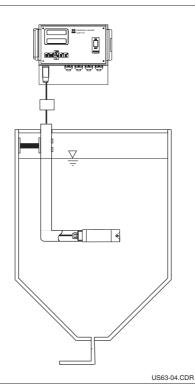
CUS 63H with basin mounting

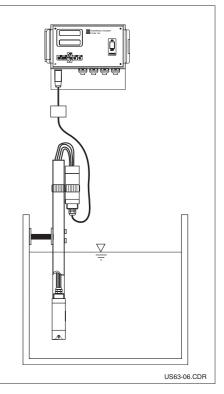
Tank installation CUS 63 with immersion

Channel installation

and straight immersion

Installation







Note:

- We recommend the use of an immersion tube (with 90° angle) for the CUS 63 immersion type.
- The immersed version of the CUS 63H 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.

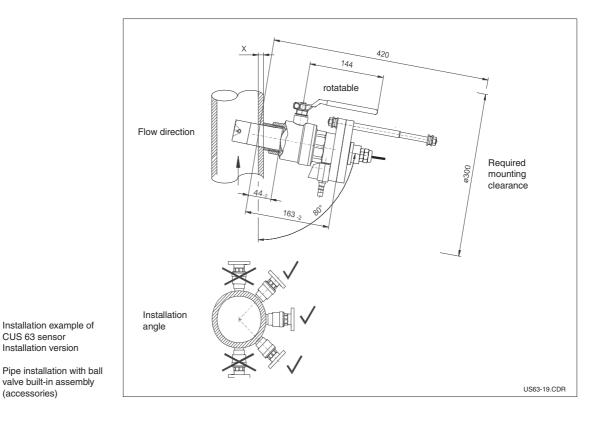
Installation

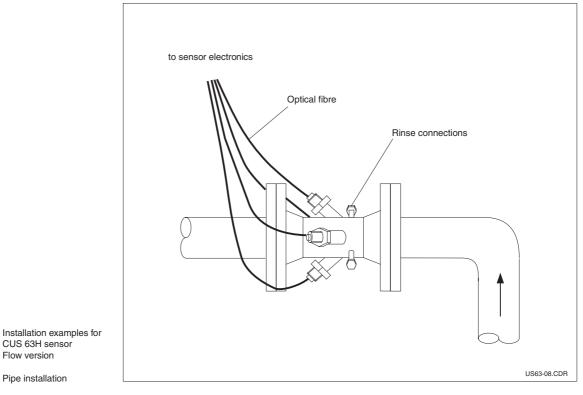
CUS 63 sensor

(accessories)

CUS 63H sensor Flow version

Pipe installation





Accessories

- □ Ball valve built-in assembly for sensor extension under process conditions DN 40 with safety lock Material: stainless steel SS 316 Ti, O-rings made of Viton® Order No.: 51503588
- □ Sensor fixing bracket for basin mounting Material: stainless steel SS 316 Ti, Order No.: 51503626
- □ Immersion tube 1m Material: stainless steel SS 316 Ti Order No. 51506000
- □ Immersion tube 2m Material: stainless steel SS 316 Ti Order No. 51505994
- □ Immersion tube 2m, 90° Material: stainless steel SS 316 Ti Order No. 51505996

Technical data

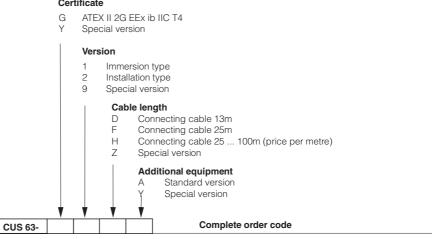
Sensor CUS 63

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Flow assembly 174 × Ø 165mm Weight Installation type Immersion type Flow assembly approx. 3kg approx. 8kg Materials Sensor body Stainless steel SS 316 Ti Sight glass Silica glass Silica glass Orrings Viton®, Simeritz® Optical fibre Optical fibre Optical fibre Optical fibre Optical fibre sheath Optical fibre Optical fibre Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring range 2.0 1000 FNU Measuring range 2.0 1000 FNU Reference Using four-beam pulsed light method Cable lengths 13m, 25m, 25 100m Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating temperature sensor head sensor electronics 0 50 °C	Mechanical data		
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Immersion type Flow assembly approx. 1kg approx. 8kg Alaterials Sensor body Stainless steel SS 316 Ti Sight glass Silica glass O-rings Viton®, Simerita® Optical fibre Optical fibre Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Turbidity measurement Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C 0 50°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68			
Materials Sensor body Stainless steel SS 316 Ti Sight glass Silica glass O-rings Vitor®, Simeritz® Optical fibre Optical fibre Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68		Immersion type	approx. 1kg
Sight glass Silica glass O-rings Viton®, Simeritz® Optical fibre Optical fibre Optical fibre sheath Silico (up to 160°C), stainless steel (up to 230°C) Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Reference Using four-beam pulsed light method Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating temperature sensor head sensor electronics P 68 Ingress protection sensor electronics Ingress protection sensor head sensor electronics IP 68		Flow assembly	approx. 8kg
Sight glass Silica glass O-rings Vitor®, Simeritz® Optical fibre Optical fibre Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor electronics Ingress protection sensor head sensor electronics IP 68 IP 65	Materials	Sensor body	Stainless steel SS 316 Ti
O-rings Viton®, Simeritz® Optical fibre Optical fibre Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C 0 50 °C Operating pressure max. 6 bar Ingress protection sensor electronics IP 68 IP 65 IP 65 IP 68		,	
Optical fibre Optical fibre Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating pressure max. 6 bar Ingress protection sensor head sensor electronics 0 120°C, 0 230°C Ingress protection sensor head sensor electronics 1P 68 IP 65			
Optical fibre sheath Silicon (up to 160°C), stainless steel (up to 230°C) Furbidity measurement Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics			
Furbidity measurement Measuring principle 90° scattered light method Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65			
Optical components Light source: 2 LEDs, Detector: 2 photodiodes Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 68			
Measuring light Infrared light at 880nm (absorption maximum) Measuring range 2.0 1000 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor electronics IP 68 IP 68 IP 65	Turbidity measurement	Measuring principle	90° scattered light method
Measuring range 2.0 100 FNU Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics		Optical components	Light source: 2 LEDs, Detector: 2 photodiodes
Accuracy < 1% of measuring range end value Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65		Measuring light	Infrared light at 880nm (absorption maximum)
Reference Using four-beam pulsed light method Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor electronics IP 68 IP 65		Measuring range	2.0 1000 FNU
Factory calibration Formazine standard Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65		Accuracy	< 1% of measuring range end value
Cable lengths 13m, 25m, 25 100m Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65 IP 65		Reference	Using four-beam pulsed light method
Connecting cable length of Zener barrier to transmitter 2m Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65 IP 65		Factory calibration	Formazine standard
Operating conditions Operating temperature sensor head sensor electronics 0 120°C, 0 230°C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65 IP 65		Cable lengths	13m, 25m, 25 100m
sensor electronics 0 50 °C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65		Connecting cable length of Zener barrier to transmitter	2m
sensor electronics 0 50 °C Operating pressure max. 6 bar Ingress protection sensor head sensor electronics IP 68 IP 65	Operating conditions	Operating temperature, consor back	0 120°C 0 230°C
Ingress protection sensor head IP 68 sensor electronics IP 65	operating conditions		0 50 °C
sensor electronics IP 65		Operating pressure	max. 6 bar
Explosion protection CUS 63H-G EEx ib IIC T4			
		Explosion protection CUS 63H-G	EEx ib IIC T4

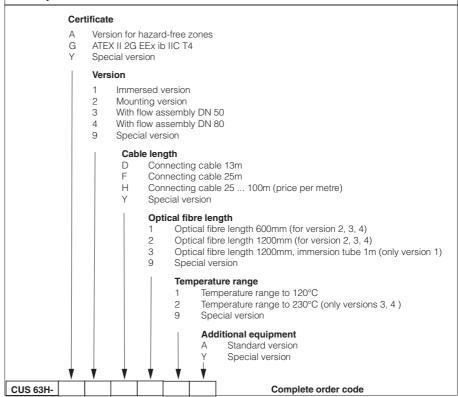
Technical Information CUM 740

Product structure

Turbidity sensor TurbiMax P CUS 63 Certificate ATEX II 2G EEx ib IIC T4 G Special version



Turbidity sensor TurbiMax P CUS 63H



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