Turbidity Sensor TurbiMax W CUS 31

Installation and immersion sensor for drinking water and industrial water according to the 90° scattered light method





















Application

- All phases of drinking water processing
- Coagulation and flocculation
- Filter rupture monitoring
- Filter backwash
- Control of clear rinsing cycles • Monitoring of phase separation processes
- Boiler feedwater
- Monitoring of cooling water
- Monitoring of surface waters
- Outlet monitoring of sewage treatment plants
- Monitoring of industrial water discharge
- Recycling of industrial water

Your benefits

- Suitable as a drinking water sensor for every installation with a wall distance greater than 10 cm
- Commissioning without formazine, factory calibration ("plug and play")
- Measurement according to EN / ISO
- Measurement under pressure to avoid degassing
- Direct installation in water pipes • Wiper unit can be retrofitted
- Self-monitoring and plausibility check Integrated temperature measurement
- Inclined plain sensor surface uses medium flow to increase the selfcleaning effect and repels air bubbles
- Scratch-resistant sapphire glass measuring window
- Permissible distance between sensor and transmitter 200 m







Function and system design

Measuring principle

Nephelometric measuring principle 90° NIR scattered light according to EN 27027

The 90° scattered light method with a wavelength in the near-infrared range (880 nm) according to ISO 7027 / EN 27027 records turbidity values under standardised, comparable conditions. A temperature signal is also recorded and transmitted in addition to the turbidity signal. The excitation radiation of an infrared transmitter (Fig., Item 1) strikes the medium at a defined angle of beam. The different refractions of light between the entrance window and the medium (water) are taken into account.

Particles in the medium (Item 5) create a scattered radiation which strikes the scattered light receivers (Items 3, 4) at a defined angle of beam. The measurement in the medium is constantly compared with the values of a reference receiver (Item 2). Digital filter functions with excellent interference signal suppression and sensor self-monitoring ensure additional measurement reliability.



- A Side view of the sensor (cutaway scheme)
- 1 Infrared transmitter
- 2 Reference diode
- 3 Scattered light receiver 1
- 4 Scattered light receiver 2
- 5 Particles in the medium
- B Top view of the sensor surface with optical windows

Turbidity measurement according to ISO 7027 / EN 27027

Wavelength	880 nm	
Radiation compensation	Using reference photodiodes	
Factory calibration	Traceable to formazine standard and SiO ₂	

Measuring system	A measuring system consists of:
	 Turbidity sensor CUS 31 in an assembly Transmitter, e.g. Liquisys M CUM 223/253
	Optional:
	 CYH 101 universal suspended assembly holder for immersion operation DipFit W CYA 611 immersion assembly or FlowFit W CUA 250 flow assembly

- or ProbFit W CUA 461 retractable assembly
- VBM junction box
- ChemoClean automatic spray cleaning system





Flow measurement

- 1 Transmitter, e.g. Liquisys M CUM 253
- 2 Sensor cable
- 3 TurbiMax W CUS 31
- 4 Flow assembly S, (see Page 6)



- 2 CYH 101 assembly holder
 - (with CYY 101 weather protection cover)
- 3 TurbiMax W CUS 31
- 4 DipFit W CYA 611 immersion assembly

Input

Measured variable	rbidity	
Measuring range	0.000 9999 FNU / 0.00 3000 ppm / 0.0 3.0 g/l / 0.0 200.0 %	

Electrical connection

Cable connection



207-CUS31xxx-14-05-00-xx-001.EPS

CUS 31 cable assignment, for sensor and transmitter

CYK 81, four-core, screened fixed cable (2x2 cores twisted) with free cable ends

Operating conditions (installation)

Installation instructions

- Each sensor is calibrated in the factory according to standard procedures (ISO 7027 / EN 27027).
- The calibration data are stored in the sensor.
- Customer-specific or material-specific calibrations can also be stored.
- The calibration values are listed in a quality certificate which is enclosed individually in the packaging with each sensor.
- Sensor systems with assemblies are available to meet the requirements of the drinking water sector. The sensor is already installed in the assembly and is calibrated with the assembly.
- Various assemblies are available for the industrial water sector.
- Installing the sensor in piping or very close to a wall can cause backscatter which results in a higher signal.

To compensate for this factor, an installation adjustment may have to be performed by means of the transmitter, (see Operating Instructions for Liquisys M CUM 2x3, BA 200C/07/en).



Effect of the distance from the wall or bottom

Installation in immersion assemblies

When installing the CUS 31 in immersion assemblies, such as CYA 611 with pendulum frame, please ensure that a sufficient wall distance is observed during operation. For this reason, select an installation location in which **a minimum wall distance of 15 cm** is observed even with varying levels or altered flow profiles. Mounting in a suspended assembly with chain must therefore be avoided.

The sensor must immerse at least 4 cm into the medium.





CUS 31 in CYA 611 assembly with pendulum frame

CYH 101 assembly holder with CYA 611 assembly

Pipe installation

The following diagram illustrates various installation positions in piping and indicates whether they are permitted or not.







Parallel sensor orientation

Sensor orientation against the medium flow

Medium flow direction

Use in the drinking water sector with specific calibration

When the CUS 31 sensor is ordered with assembly E or S, the sensor is **individually calibrated** in the factory with the assembly ordered.

Therefore, no initial calibration on site is necessary.





Flow assembly E (without gas bubble trap)

Flow assembly S (with gas bubble trap)

- In-flow and out-flow is vertical if **assembly E** is installed, (flow direction from bottom to top, see left-hand diagram), and horizontal if **assembly S** is installed (right-hand diagram).
- The inlet and outlet pipes (nominal diameter DN 20) are each glued into the PVC adhesive threaded joints. A wall support can be mounted if necessary.
- The minimum flow for assembly S is 50 l/h.



Permissible and impermissible sensor installation positions in flow assembly E or S

Gas bubble elimination	Conventional turbidity measurements are carried out in an unpressurised sample. When the pressure on a sample (which was pressurised beforehand) is released, fine bubbles are produced which distort the turbidity measurement. There are several methods of eliminating these gas bubbles:				
	 Pressurised measurement in the bypass (pressure is not released until after the measurement). For measurements without overpressure or with slight overpressure: Free medium flow above the assembly level. The mounting location should be as low as possible to take advantage of the maximum possible pressure. Unpressurised measurement and gas bubble elimination using wiper cleaning. The wiping duration and interval can be programmed for optimum results. Reduction of the flow to the lowest possible value (50 l/h, CUS 31-xxS). Slight flow prolongs the period in which the medium is in the assembly. This means that gas bubbles have more time to rise to the top. The sensor response time increases slightly due to the lower flow. Flow assembly S with integrated gas bubble trap (Figure below) Most of the gas bubbles are sent directly to the assembly outlet in the upper half of the separated inlet (7). The other half of the medium flows into a ring channel (1) by means of the central pipe. The remaining bubbles rise here and are conveyed out of the measuring chamber by means of holes in the outlet (2) located in the centre of the assembly. Bubble-free medium (3) is pushed down into the measuring chamber (5). This also leads to a high flow which results in a quick response time. In addition, this almost completely prevents dirt particles settling. 				
	Image: space of the space of				
	Performance characteristics				
Maximum measured error	< 5 % (min. 0.02 FNU) of the measured value (system measured error related to the primary formazine standard / tracing according to ISO 5725 and ISO 7027 / EN 27027)				
Repeatability	< 1 % (min. 0.01 FNU) of the measured value				

Operating conditions (environment)

Storage temperature	−20 +60 °C
Ingress protection	IP 68

Process temperature range	−5 +50 °C
Process pressure range (temperature-dependent)	1 bar (50 °C) 6 bar (25 °C)
Process connection	G1 and NPT ¾"

Operating conditions (process)

Mechanical construction

Design, dimensions



Sapphire

PVC

Sensor carrier plate, shaft

Flow assemblies E and S

Optical windows

Cable

Endress+Hauser

PVC / PPS GF 40 (polyphenylene sulfide with 40 % glass-fibre)

TPEO -40 ... 130 °C (elastomer on polyolefine base)

Materials

Certificates and approvals

Quality certificate

Each sensor has an individual quality certificate with information on the sensor identification and calibration according to ISO 7027 / EN 27027.

The quality certificate is enclosed with each sensor in the packaging.

Ordering information

Product structure TurbiMax W CUS 31

	Sensor			
	A Sensor in standard version			
	W	Ser	nsor	with integrated wiper
		Ca	ble	length
		2	Co	nnecting cable 7 m
		4	Со	nnecting cable 15 m
		9 Connecting cable to customer's specifications		
			٨c	sembly
			A3.	
			А	Without assembly
			Е	Assembly for bubble-free media
			S	Assembly with integrated gas bubble elimination
CUS 31-				Complete order code
				·

Accessories





FlowFit W CUA 250 flow assembly

	Ver	Version		
	А	Installation in DN 25 - threaded joint		
	В	Installation in DN 63 pipe segments (adhesion)		
	Υ	Special version to customer's specifications		
CUA250-		Complete order code		



Welding rinse socket DN 65 For automatic spray cleaning of CUS 31 in pipelines and containers; Order no. 51500912

CUA 120 installation assembly



CUA 120-B adapter with welding socket DN 50 / ANSI 2" with lap joint flange

	Version		
	А	Adapter for welding neck flange (flange height = 47 mm)	
	В	Adapter for installation socket (socket height = 93 mm)	
	Υ	Special version to customer's specifications	
CUA120-		Complete order code	

Welding socket	Version	Order number			
DN 50 / ANSI 2"	Stainless steel 1.4571 (AISI 316Ti)	50080249			
	Polyvinyl chloride (PVC)	50080250			
	Polypropylene (PP)	50080251			
CUY 22 check unit	Check unit for CUS 31 and CUS 41 for checking the stability of the sensor; Order no. 51504477				
CUR 3 spray head	Spray head for cleaning turbidity sensors in flow assemblies; Order code: CUR 3 - 1				
CUR 4 spray head	Spray head for cleaning turbidity sensors in immersion assemblies; Order code: CUR 4 - A				
Recalibration	CUS 31 recalibration according to ISO 7027 / EN 27027; Order no. 50081264				
CUY 31 service kit	3 spare wiper arms for CUS 31-Wxx; Order no. 50089252				
CYK 81 extension cable	Unterminated cable for extending VBM junction box to transmitter, four-core, screened measuring cable (2x2 cores twisted); Order no. 51500830				
RM shunt resistance	Order no. 51500836				
RM junction box	Order no. 51500832				
RM sensor holder	Order no. 51500734				

Documentation

- □ Technical Information Liquisys M CUM 223/253, TI 200C/07/en; Order no. 51500283
- D Technical Information ProbFit CUA 461, TI 134C/07/en; Order no. 50073613
- Technical Information DipFit W CYA 611, TI 166C/07/en; Order no. 50085985
- Technical Information CUA 120 / CUA 250, TI 096C/07/en; Order no. 50077051
- □ Technical Information CYH 101, TI 092C/07/en; Order no. 50061228
- Depending Instructions CUY 22, BA 226C/07/en; Order no. 51503818

Subject to modifications

Endress + Hauser GmbH+Co. Instruments International P.O. Box 2222 D-79574 Weil am Rhein Germany

Tel. +49 (0)7621 975-02 Fax +49 (0)7621 975-345 http://www.endress.com info@ii.endress.com

