OPTISENS TUR 2000 Technical Datasheet

Sensor for turbidity measurement in water and wastewater

- Rugged design for harsh applications
- Integrated transmitter with direct 4...20 mA output
- Near infrared light source and 90° measurement according ISO 7027

The documentation is only complete when used in combination with the relevant documentation for the signal converter.

KROHNE

1.1 Turbidity sensor for water and waste water application

Turbidity measurement is widely used in drinking water and wastewater applications. The turbidity measurement is used for filter monitoring and quality control of water in waste water plants.

The turbidity sensor OPTISENS TUR 2000 from KROHNE has a standardized robust design for open channel measurement and a long lifespan. Therefore the sensor is especially designed for small and medium-sized wastewater treatment plants. The integrated spray cleaning nozzle minimize the need for manual cleaning, which means longer intervals between maintenance and calibration.

Figure 1-1: OPTISENS TUR 2000

① Process connection 2" NPT
② Cleaning nozzle
③ Measuring windows

Highlights

- Precise turbidity measurement <40 FNU/NTU through the 90° scattered light method
- Measurement according to ISO 7027
- Short response time for all applications
- Long-term stability due to reduced clogging by integrated spray cleaning nozzle
- Low cost of ownership due to an integrated transmitter
- Suitable for installation with telescopic rod SENSOFIT IMM 2000

Industries

- Waste water industry

Applications

- Water quality control in the outlet
- Filter monitoring

1.2 Design and options

This submersible turbidity sensor provides a 4...20 mA current loop or a RS485 output.

The serial interface allows commands entered via the hyperterminal of a personal computer, the transmission of the measurement and check signal, the scale selection, the analog or digital operating mode selection, the zero and sensitivity calibration. The sensor is suitable for connection to a signal converter.

The cleaning of the sensing element is performed by the injection of pressurised clean air, provided by the user.

It can be easily adapted to various application requirements and can be installed directly into a basin with a telescopic rod.

1.3 Measuring principle

Turbidity is the cloudiness of a fluid caused by the presence of suspended and colloidal matter. In waterworks, a turbidity measurement is used to indicate the clarity of water. Technically, turbidity is an optical property of water based on the amount of light reflected by colloidal and suspended particles. The measuring unit for the turbidity is Nephelometric Turbidity Unit (NTU) or Formazine Nephelometric Unit (FNU).

According to ISO 7027, turbidity values below 40 NTU / FNU have to be measured with the 90° scattered light method. The light source and receiver are positioned in a 90° angle to each other. The light transmitted from the source is directed in equal strength to the reference receiver and into the medium. Light is now reflected from the particles and fractions of the scattered light are received by the detector, positioned at a 90° angle.

The meter now compares the light from the reference receiver and scattered light receiver and calculates the turbidity value.

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Parameter	Turbidity
Measuring principle	90° scattered light

Design

Measuring principle	Nephelometric
Measuring scale	0...4.000 NTU / FNU
	0...40.00 NTU / FNU
	0...400.0 NTU / FNU (default)
Sensitivity NTU	70...130% NTU
Zero NTU	± 0.400 NTU all scales
Sensor type	Installation with MAC 100 signal converter or directly to control system via 4...20 mA
Shaft diameter	60 mm / 2.36"
Shaft length	166 mm / 6.5"
Sensor thread	2" NPT
Hose diameter	6.3...9.5 mm / 1/4...3/8"

Operating conditions

Temperature range	-5...50°C / +23...122°F
Pressure range	Max. 1 bar at 25°C / 14.5 psi at 77°F
Measuring range	< 1% of end of measurement scale
Response time	t_{90} < 120 seconds (small signal < 3%fs), < 40 seconds (high signal > 3%fs)
Measuring cycle	2 seconds
Relative humidity	0...95% non condensing
Air pressure cleaning	max. 3 bar / 43.51 psi
Units displayed sensor	NTU (= FNU)

Installation conditions

Ingress conditions	IP68
Weight	Body 420 g / 0.93 lb 10 meter cable 640 g / 1.41 lb

Materials

Sensor body	PVC

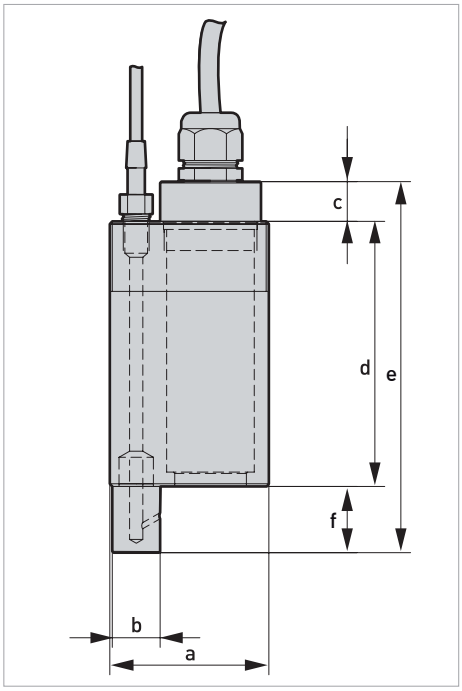
Electrical connection

Cable	10 meter / 32.8 ft. 20 meter / 65.62 ft. 30 meter / 98.43 ft.
Voltage	9...36 VDC
Analog output	4...20 mA loop powered isolated
Load	600 Ohm max. at 24 VDC
Digital output	RS485

Approvals and certifications

CE	This device fulfils the statutory requirements of the EC directive. The manufacturer certifies successful testing of the product by applying the CE mark.
Electromagnetic compatibility	EMC Directive 2004/108/EC (valid until 2016/04/19) or EMC Directive 2014/30/EU (valid from 2016/04/20) EN 61326-2-3:2013 EN 55011:2009+A1:2010

2.2 Dimensions and weight



	Dimensions [mm]	Dimensions [inch]
a	60	2,4
b	18	0,71
c	15	0,6
d	100	3,94
e	140	5,51
f	25	0,98

3.1 Installation procedure

The device is factory calibrated and the analog signals are set to the measurement range 0...400 NTU. To install the device in the correct way, follow the order and the following sections and their instructions.

1. Connect the sensor to the signal converter or directly to the control system.
2. Configure the measurement range. Verify or calibrate sensor if required.
3. Mount the sensor into the immersion assembly. (For further information refer to the manual of the assembly)
4. Install the sensor into its final measuring location.

3.2 Sensor use with cleaning function

Most applications do not require the cleaning function if the sensor is installed correctly in a correct angle.

When the automatic cleaning is required the device can be equipped with a cleaning hose for air cleaning.

Before the device is installed into its final measuring location the following points must be observed

- provide hose (Ø 6.3...9.5 mm / 1/4...3/8") in suitable length
- prepare a connection for the cleaning hose
- push the hose onto the cleaning connector
- put the sensor cable and cleaning hose through the adequate extension pipe of the mounting assembly

The pressurised air is to be provided and must be clean with a max of 3 bar.

The typical cleaning time is 15 seconds and the typical cleaning fequency is 2 times/day, but this will differ from application to application.

3.3 Sensor use without cleaning function

Without a cap on the air line connector the sample might block the cleaning drilling for later use or water might flow into a closed assembly and damage the probe due to later handling.

Before installation and immersion the sensor check the following order:

- Do not install any flexible tubing.
- Install a cap on the air line connector in order to avoid the cleaning drilling to be blocked for later use or water to flow through it into a closed assembly.

3.4 Mounting the sensor into an assembly

All work on the electrical connections may only be carried out with the power disconnected.

Do not turn the cable gland on the sensor this might cause a sensor leak and damage the electronics inside. While mounting or dismounting the sensor, the senor cable must not be fixed or trapped as this might loosen the water tight gland connection from the sensor.

Recalibrate the sensor after each manual cleaning procedure.

For further instructions on installation into an immersion assembly refer to the assembly manual.

Use an assembly that does not fix the sensor cable or require the sensor to be screwed into the assembly. If the sensor needs to be screwed for mounting or dismounting make sure that the sensor cable is turned into the same direction.

Installing procedure

- Insert the sensor cable through the immersion assembly.
- Fasten the sensor to the tip of the telescopic rod by tighteninng the 6 screws of the 2 holding plates.
- Connect the wires either to the control system directly (only 4...20 mA) or to the MAC 100 signal converter.

For removing the sensor, repeat the steps above in reverse order.

Calibrate the sensor before installing it into the assembly.

4.1 Connecting the sensor cable to the signal converter

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Look at the device nameplate to ensure that the device is delivered according to your order.

Connect the turbidity sensor to the MAC100 for optimal configurability and process control due to following features:

- scale selection flexibility
- digital input to hold signals during cleaning process
- easy calibration via zero and sensitivity adjustment
- set minimum and maximum for alarm relays
- galvanic isolated 4...20 mA outputs
- error current

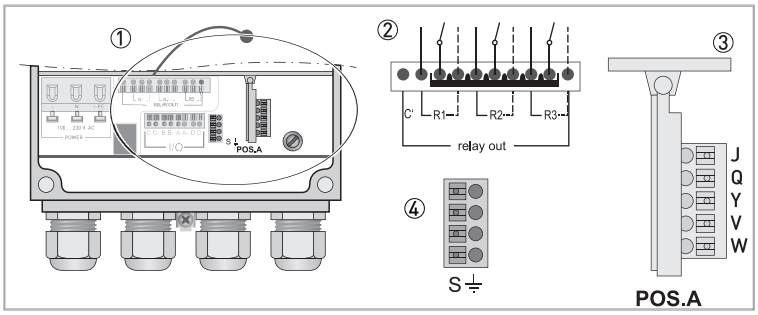


Figure 4-1: Sensor connection terminals on the signal converter

① Sensor connection terminal
② Relays
③ Terminal block A: terminals for sensors
④ Terminal block S (protective earth)

Wire	Terminal block Pos.A
White	J
Green	Q
Yellow	Y
Grey	V
None	W

Wire	Terminal S
Metal (non isolated cable)	S

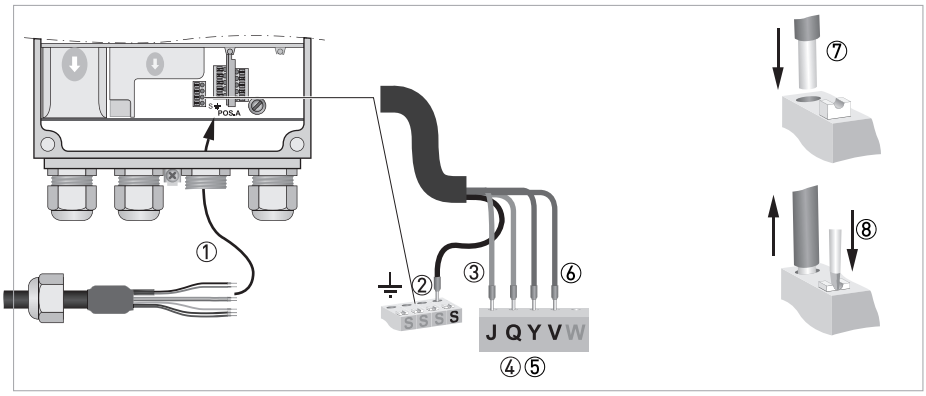


Figure 4-2: Connecting the sensor cable

The following instructions describe the connection of the sensor cable.

Connecting the sensor cable to the signal converter

- Remove the terminal cover.
- Thread the sensor cable through the middle right cable gland ①.
- Push the wires ⑦ into terminal J ③, Q ④, Y⑤, V ⑥ and S ②.
- To remove a wire, press down the white clip ⑧ on the corresponding terminal and pull the wire out.

4.2 Connecting the sensor directly to the control system

Avoid cable interruptions. If necessary use adequate junction box. Keep the cable far away from power cables inside of the switch board.

The device is loop powered and can be connected directly onto the control system via any junction box.

Wire	Function
Green	+ current loop
White	- current loop
Metal	shield

The normal operation needs just the connection of the green and white wires, which are protected against accidental inversion. The shield is not connected to the probe but it must be connected to the ground.

4.3 Connecting the sensor to PC

Avoid cable interruptions. If necessary use adequate junction box. Keep the cable far away from power cables inside of the switch board.

Connect the device to the converter or directly to the control system as stated in above chapters. The shield is not connected to the probe but it must be connected to the ground.

Wire	Function
Shield	not connected
Yellow	A (+) RS485
Grey	B (-) RS485
Brown	not connected
Green	+ current loop
White	- current loop / COM RS485

4.4 Connecting the power supply to the signal converter

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

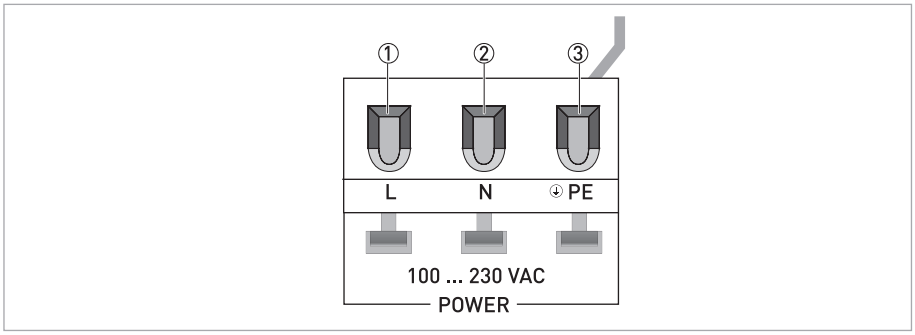
Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries!

When connecting the power supply, always note the safety regulations of the current state of the art. Also note the following items to avoid fatal injuries, destruction or damage of the device or measuring errors:

- *De-energise the cables of the power supply before you start any installation works!*
- *Always keep the housing of the device well closed if you do not perform any installation works. The function of the housing is to protect the electronic equipment from dust and moisture.*
- *Assure that there is a fuse protection for the infeed power circuit ($I_{nom} \leq 16$ A) and a disconnecting device (switch, circuit breaker) to isolate the signal converter.*
- *Check the nameplate and assure that the power supply meets the voltage and frequency of the device. You can operate the device in the range of 100...230 VAC and 8 VA with a tolerance of -15/+10% while 240 VAC +5% is included in the tolerance range (a version with a power supply of 24 VAC/DC is in preparation). A power supply outside these specifications may destroy the device!*
- *Assure that the protective earth conductor (PE) is longer than the L- and N-conductor.*

The manufacturer has designed all creepage distances and clearances according to VDE 0110 and IEC 664 for pollution degree 2. The power supply circuits fulfil the overvoltage category III and the output circuits fulfil the overvoltage category II.

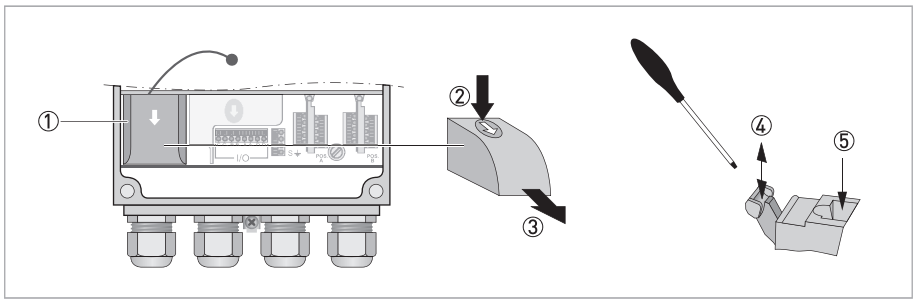
Before you start to connect the power supply cables, note the following drawing with the function of the terminals:



① L1...L3 (live)
② Neutral
③ Protective Earth (PE)

Afterwards connect the power supply cables accordingly:

The manufacturer strongly recommends to use a slotted screwdriver with a tip of 3.5 x 0.5 mm / 0.14 x 0.02" to push down the lever! Otherwise you could damage the lever.



- De-energise the power supply cables with the help of a disconnecting device (switch, circuit breaker)!
- Remove the cover of the power supply terminal (①) by pressing it down and pulling forwards at the same time (② and ③), be careful and do not disrupt the retaining band (it prevents the cover from getting lost)!
- Use a slotted screwdriver with a tip of 3.5 x 0.5 mm / 0.14 x 0.02" to push down the lever, connect the wires to the terminals and pull up the levers again (④ and ⑤).
- Refasten the cover of the power supply terminal, close the converter housing and tighten all screws of the housing.

5.1 Order code

The characters of the order code highlighted in light grey describe the standard.

VGA W	**4**	**Sensor type**													
		A	OPTISENS TUR 2000												
			Measuring range												
			4	0...4, 40, 400 NTU / FNU											
				Sensor features											
				A	1x 4...20 mA / RS 485										
					Process conditions										
					1	-5...+50°C, 1 bar / +23...+122°F, 14.5 psi									
						Enclosure type									
						B	Submersible with spray cleaning nozzle								
							Body material								
							1	PVC							
								Process connection							
								A	Submersible, 2" NPT male threat for mounting on SENSOFIT IMM 2000 telescopic rod						
									Power supply						
									1	9...36 VDC loop powered					
										Cable					
										B	Cable-TUR-W 2000				
											Cable features				
											A	Attached cable			
												Cable length			
												3	10 m / 33 ft.		
												4	20 m / 65.6 ft.		
												5	30 m / 98.4 ft.		
													Cable options		
													1	Wire end ferrule	
														Sensor options	
														1	Spray cleaning nozzle
															Documentation
															0 none
															1 English
															2 German
															3 French
															4 Spanish
VGA W	**4**														

KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

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