



OPTISENS TSS 2000 **Technical Datasheet**

Sensor for total suspended solids measurement in water and wastewater

- NIR technology not affected by colouring
- Suitable for turbulent water
- Scratch resistant sapphire windows

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

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1.1 Turbidity sensor for water and waste water applications

The OPTISENS TSS 2000 sensor is manufactured using stainless steel 1.4404 material. It features one optical path length of 10 mm between NIR light source and detector.

Its scratch resistant sapphire windows for light source and detector make it ideally suited for waste water applications. The rugged stainless steel housing allows installations in turbulent water. The absorption measurement is not influenced by colouring due to the near infrared light source of 855 nm.

The sensor is suitable for immersion installation in the standard SENSOFIT IMM 2000 telescopic rod assembly. It comes factory calibrated and can be adjusted to the non-linear behavior of the process medium by a multi-point calibration (linearisation with up to 6 point measuring points).

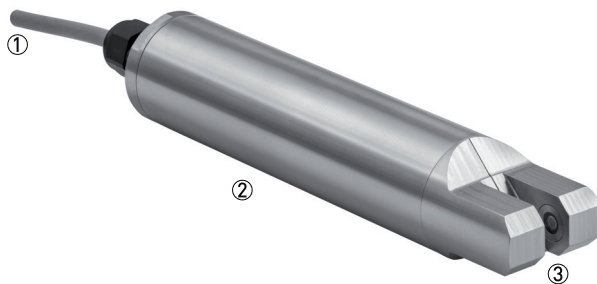


Figure 1-1: OPTISENS TSS 2000

- ① Cable gland
- ② Stainless steel body
- ③ Measuring head with one ermitter and one detector

Highlights

- Robust stainless steel body
- NIR technology not affected by colouring
- Scratch resistant sapphire windows
- Factory calibrated
- Up to 6 points linearisation

Industries

- Waste water industry
- Metal and mining industry
- Pulp and paper industry

Applications

- Quality control in industrial and municipal wastewater applications
- De-sludging of primary sedimentation (clarifier) tanks
- Monitoring biological treatment in wastewater aeration basins

1.2 Measuring principle

The measurement principle follows the transmitted light absorption principle with pulsed NIR 855 nm. In this case it utilises one emitter and one detector for absorption measurement of light on suspended solids and particles. The light passes the measured particles between the emitter and the detector. Depending on industry and application the absorption measurement principle is used for the parameters extinction (optical density) or total suspended solids. Immersion sensors are most often used to measure the absorption as Total Suspended Solids (TSS).

TSS is a key measurement for water, wastewater and certain industrial processes. Typically, TSS is monitored through periodic grab samples and a filter test performed by a skilled technician. TSS is the gravimetric dry-weight of particles trapped by a filter. TSS is typically expressed in mg/l, g/l, and %. $\text{Total Suspended Solids (mg/l)} = (\text{filter weight after filtering} - \text{filter weight before filtering}) / \text{sample volume in litres}$. Quantitative online TSS measurement is often done with absorption sensors. The TSS sensors also provide immediate results for process control and reduce the need for the time-consuming suspended solids lab analysis. Online sensors are best used after calibration or correlation to the gravimetric TSS procedure.

The advantage of using NIR as light source is that this sensor is not affected by the colour of the medium measured.

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

Measuring principle	180° Transmitted light absorption principle; pulsed NIR 855 nm. Absorption and scattering of light on suspended solids and colloidal particles in water. The light passes the measuring medium with the measured particles between the measuring windows.
Application	Total suspended solids or optical density (extinction) in fluids in the near infrared range (855 nm wavelength)

Design

Measuring range	0...4 AU
Light method specifications	Wavelength: 855 nm
	Light source: LED

Measuring accuracy

Measurement uncertainty	2.5% at reference conditions [DIN EN ISO 15839 [2007-02]]
Repeatability	0.5% at reference conditions [DIN EN ISO 15839 [2007-02]]
Response time	< 1 second

Temperatures and pressure

Process temperature	0...+70°C / +32...+158°F
Storage temperature	-40...+70°C / -40...+158°F
Max. pressure	1 bar / 14.5 psi
Protection category	IP 68

Installation conditions

Installation position	The installation position of the sensor should be 25°...75° from vertical position (sensor head pointing downwards).
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Materials

Sensor	Enclosures: Stainless steel (1.4404 / 316L)
	Optical windows: Sapphire
	Cable gland: PA
	Cable gland sealing: FPM / FKM
	O-Ring: EPDM
Sensor cable	PUR

Electrical connections

Cable connection	Core end sleeves
Cable length	11 meter / 36.08 feet

Approvals and certifications

CE
The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the European Union legislation applying to the product and providing for CE marking.
For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the website of the manufacturer.

2.2 Dimensions and weight

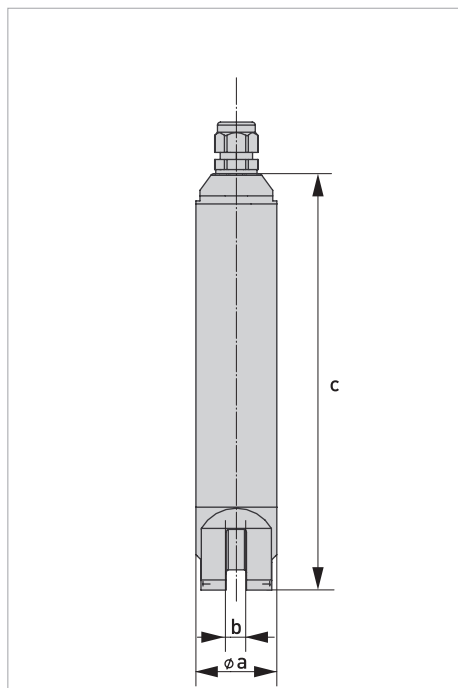


Figure 2-1: Dimensions of the device

	Dimensions [mm]	Dimensions [inch]
a	Ø 40	1.57
b	10	0.39
c	205.5	8.09
Weight	approx. 1.5 kg	approx. 3.31 lb.

3.1 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The intended use of OPTISENS TSS 2000 sensors is the measurement of the total suspended solid content in water and wastewater applications. The sensor is suitable for connection to the MAC 100 signal converter.

3.3 General installation instructions

The sensor head must always have full contact with water. The mounting position of the sensor should be 25°...75° from vertical position (sensor head pointing downwards). Non-observance might cause air bubbles or dirt/sludge to stick to the sensor head.

For optimal positioning use an immersion assembly as shown in the following image.

Ensure that the oblique surface is always in vertical position and that the medium can flow through the measuring window area without restriction.

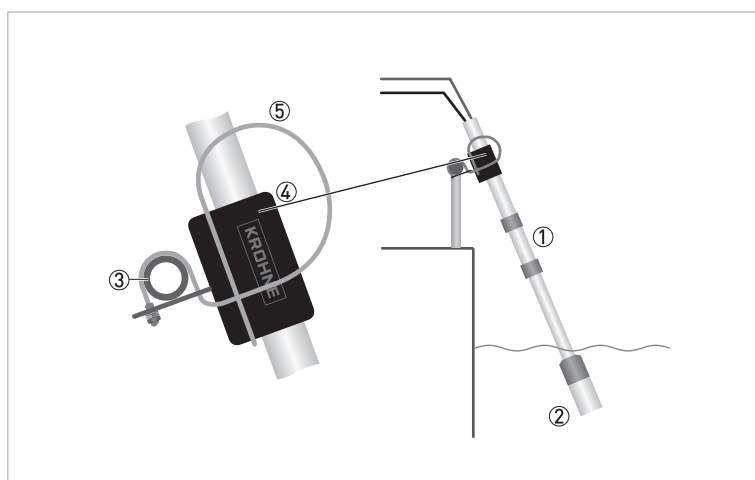


Figure 3-1: Optimal mounting position

- ① Immersion assembly
- ② Sensor holder
- ③ Handrail
- ④ Rod holder
- ⑤ Mounting bracket

This is a “portable” device that has to be secured during operation. It is designed to be immersed in a water or waste water basin. A breakage of the immersion fitting should not lead to a hazard. However, use suitable immersion fittings.

3.4 Installation procedure

- *Never touch or scratch the measurement windows of the sensor.*
- *Make sure that the measurement windows are clean and dust-free. If necessary, clean the measurement windows as described in the manual of the sensor.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to a electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*

The sensor is factory calibrated and ready to use. However, it is recommended to calibrate the sensor with one or more process samples before it is installed into its final measuring location. To install the device in the correct way, follow the order of the following sections and their instructions.

1. Connect the sensor to the signal converter.
2. Calibrate the sensor.
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.

3.5 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 dismantling the sensor, the sensor cable must not be fixed or trapped as this might loosen the water tight gland connection from the sensor.

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 dismantling make sure that the sensor cable is turned into the same direction.

Calibrate the sensor before installing it into the assembly.

Installing procedure

- Insert the sensor cable through the immersion assembly.
- Fasten the sensor to the tip of the telescopic rod by tightening the screws of the 2 holding plates.
- Connect the wires to the MAC 100 signal converter. For further information refer to *Connecting the sensor cable to the signal converter* on page 12.

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

4.1 Safety instructions

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

Observe the national regulations for electrical installations!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Connecting the power supply to the signal converter MAC 100

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 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% or 24 VAC/DC and 7VA with a tolerance of AC -15%/+10%; and DC: -25%/+30%. 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:

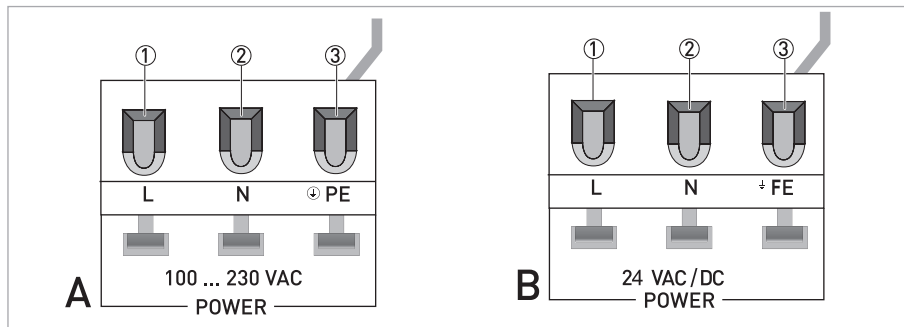
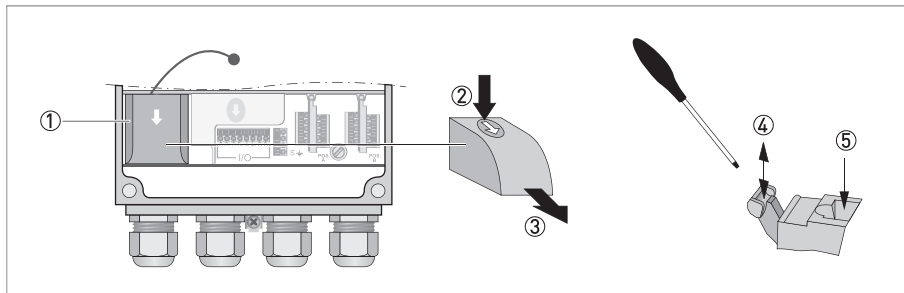


Figure 4-1: **A** - 100...230 VAC / **B**- 24 VAC/DC

- ① Live (L)
- ② Neutral (N)
- ③ Protective Earth (PE) or Functional Earth (FE)

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 and protect from restarting!
- 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.

4.3 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.

The following features are available when using the MAC 100:

- Scale selection flexibility
- Digital input to hold signals during cleaning process
- Easy calibration
- Set minimum and maximum for alarm relays
- Galvanic isolated 4...20 mA outputs
- Error current

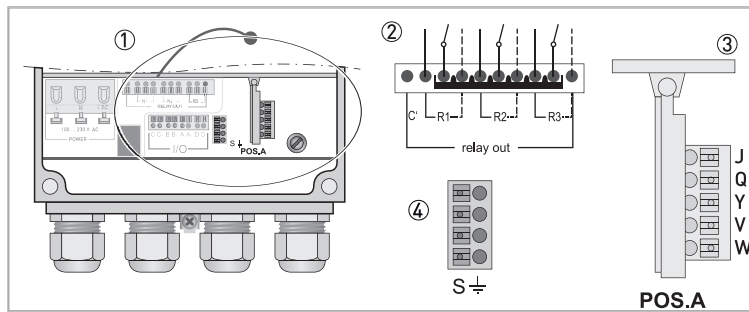


Figure 4-2: Sensor connection terminals on the signal converter MAC 100

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

Wire	Terminal block Pos.A
Blue	J
Brown	Q
Green	Y
Yellow	V
None	W

Wire	Terminal S
Black (isolated cable)	S

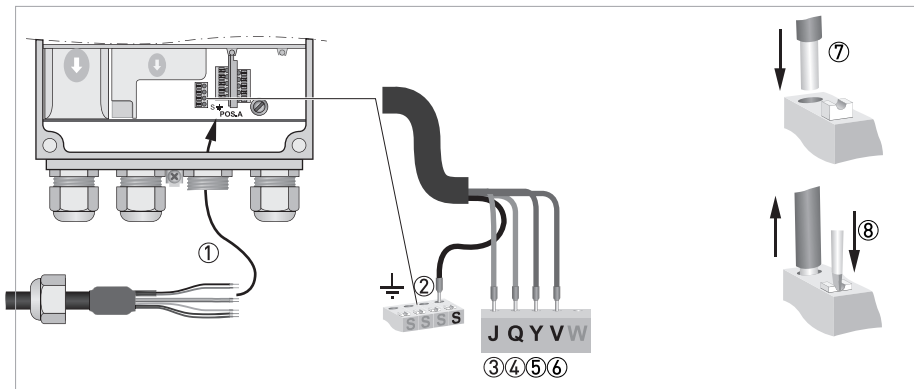


Figure 4-3: Connecting the sensor cable

The following instructions describe the connection of the sensor cable.

Connecting the sensor cable to the signal converter

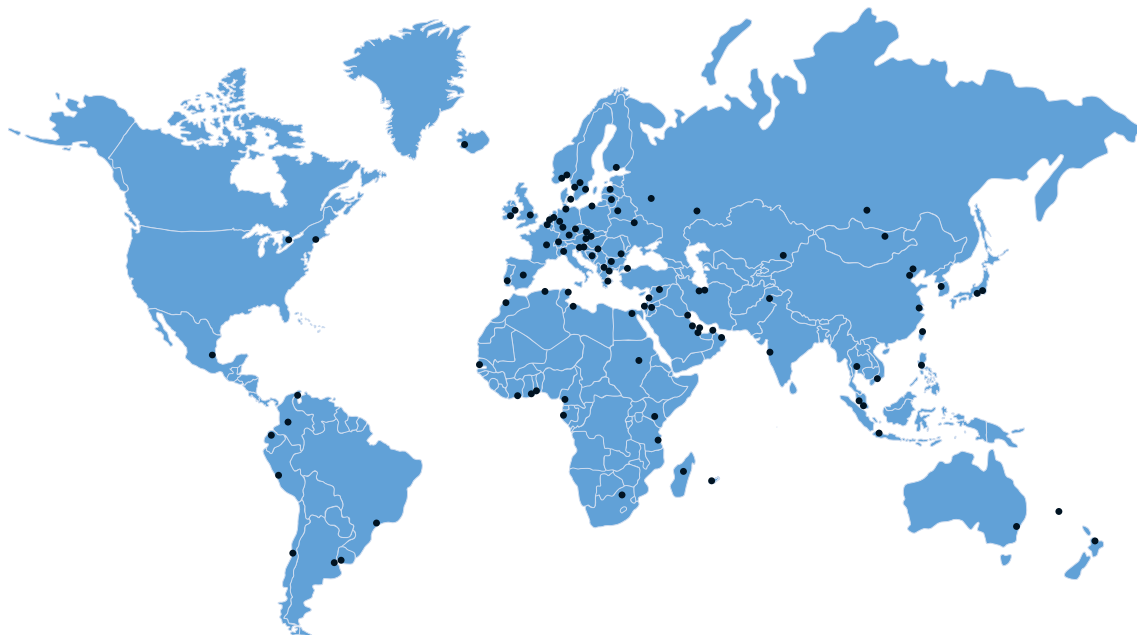
- Remove the terminal cover.
- Thread the sensor cable through one cable gland ①.
- Push the wires ⑦ into terminal J ③, Q ④, Y ⑤, V ⑥ and S ②.
- To remove a wire, press down the white clip ⑧ on the corresponding terminal and pull the wire out.

5.1 Order code

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

VGA Y	4	Sensor type																						
		2	OPTISENS TSS 2000																					
			Wave length																					
			1	855 nm																				
				Optical path length / Measurement range																				
				1	10 mm / 0...18 g/l																			
					Process conditions																			
					1	0...70°C, 1 bar / 32 ... 158°F, 14.5 psi																		
						Body material																		
						1	Stainless steel AISI 316L (1.4404)																	
							Optical windows																	
							1	Sapphire glass																
								Process connection																
								1	Immersion installation															
									Wetted sealing material															
									1	EPDM, adhesive, glue, FPM, PA, PUR														
										Cable length / connection														
										3	11 m hard wired core sleeve ends													
											Hygienic certificates													
											0	None												
												Approvals												
												0	None											
													Documentation											
													0	None										
														1	English									
															2	German								
VGA Y	4																							





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