

OPUS

Spectrometer

Online measurement of nitrogen and carbon compounds



Applications

- Processing control of wastewater treatment
- Resource Water Monitoring
- Drinking water control
- Industrial applications

Advantages

- Accuracy and reliability by measurement of attenuation and full spectrum analysis of UV absorption 200 - 360 nm
- In situ and continuous measurements
- Optical window coated to minimize clogging
- Pre-installed application calibrations
- Automatic turbidity compensation

Water absorption spectrum analysis

OPUS is a high-end miniature spectrometer for on-line measurements of nitrogen and carbon compounds. By analyzing the water absorption spectrum, the sensor provides reliable measurements of $\text{NO}_3\text{-N}$ and $\text{NO}_2\text{-N}$ concentrations and organic parameters such as COD_{eq} , BOD_{eq} , DOC_{eq} and TOC_{eq} .

The spectral absorption analysis from 200 to 360 nm is refined by a calibration adapted to your application. 6 families of calibrations are proposed :

- Wastewater treatment plant inlet
- Wastewater treatment plant outlet
- Anammox process
- River water
- Sea water
- Drinking water

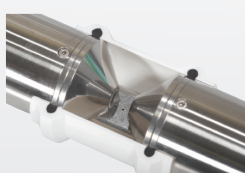
The instrument can be calibrated to measure one parameter or several simultaneously.

Integrated into your facilities

The OPUS features the new G2 interface that allows quick access to sensor data and configurations using a web browser on computer, tablet and smartphone.

The sensor could be dived directly in the field, even in very heavy water, but also in bypass measuring cell (panel and measuring station).

The OPUS probe has many accessories to optimize its integration into the processes, automate its cleaning and facilitate the use of measurement data. Measurement campaigns and mobile applications are also possible with an optional battery system.



A xenon flash lamp emits broad spectrum light directed in a beam of parallel wavelengths towards the optical path through the sample. Compounds in water absorb light at specific wavelengths.

The light thus received is then diffracted and measured by a 256-channel photo-diode.

The probe then measures the attenuation of light to define the absorption spectrum of the water from 200 to 360 nm.

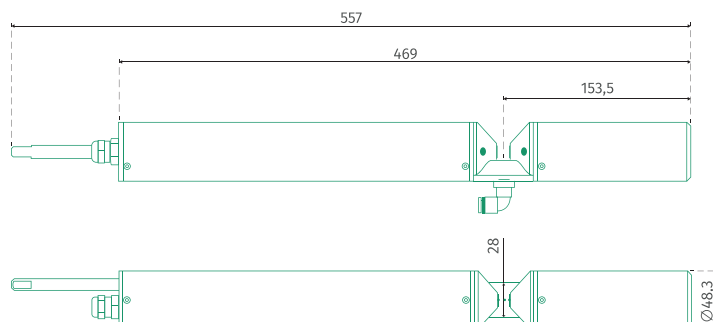
On the basis of a large number of absorption spectra records related to the application, the sensor performs a combination between the absorption spectrum obtained and the nearest water profile to refine the concentration calculations (LSA calculation rules).

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Technical specifications

Measuring technology	Light source	Xenon Flash Lamp
	Detector	High quality miniature spectrometer
Principle of measurement		256 channels
Optical path		200 to 360 nm
		0,8 nm/pixel
		Attenuation measurement and absorption spectrum analysis
		0,3 mm, 1 mm, 2mm, 5 mm, 10 mm, 50 mm
Parameters		see list of parameters p.3
Measurement ranges		see list of parameters p.3
Measuring accuracy		see list of parameters p.3
Turbidity compensation		Automatic
Internal memory		2 GB
T100 response time		2 min
Measuring interval		> 1 min
Materials		Stainless steel (1.4571 / 1.4404) or titanium (3.7035)
Dimensions (L x d)		470 mm x 45 mm (with 10 mm optical path)
Weight		3 kg stainless steel - 2 kg titanium
Interface	Digital	Ethernet (TCP/IP)
Power supply		RS-232 ou RS-485 (Modbus RTU)
Consumption		12 ... 24 VDC (+/- 10%)
		< 8W
Maintenance		<0.5 h / month (standard use)
Calibration interval		24 month
Warranty		24 months in the European Union
Maximum pressure	SubConn connector	30 bar.
	Fixed connector	3 bar.
Protection	FlowCell	1 bar. , 2 ... 4 L / min
		IP 68
Temperature of the medium / sample		+ 2 ... + 40 °C
Ambient temperature		- 5 ... + 55 °C
Storage temperature		- 20 ... + 80 °C
Inflow velocity		0,1 ... 10 m/s



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Measuring ranges

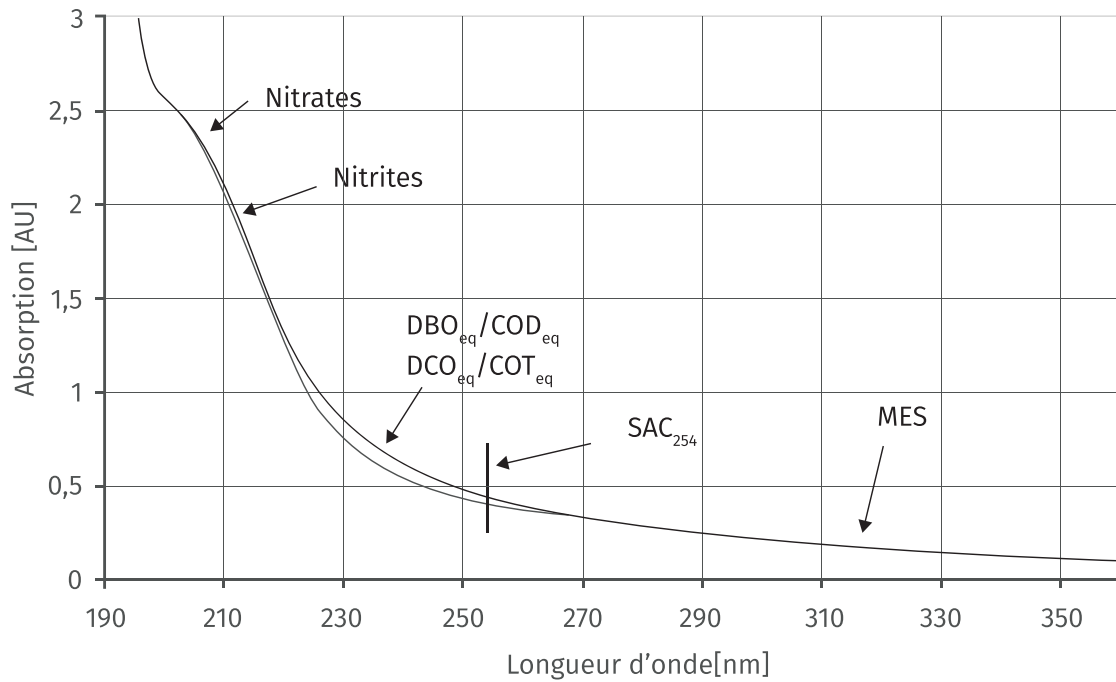
Single parameter under optimum laboratory conditions

Optical path (mm)	Parameters	Principle of measurement	Unit.	Range measurement	Detection limit	Limit of determination	Min. resolution	Accuracy
1	NO ₃ -N	Spectral	mg/L	0...100	0,3	0,5	0,05	+/- (5%+0,1)
	NO ₂ -N	Spectral	mg/L	0...150	0,5	1,2	0,12	+/- (5%+0,1)
	COD _{eq}	Spectral	mg/L	0...2200	30	100	10	
	BOD _{eq}	Spectral	mg/L	0...2200	30	100	10	
	DOC _{eq}	Spectral	mg/L	0...1000	5	10	1	
	TOC _{eq}	Spectral	mg/L	0...1000	5	10	1	
	TSS _{eq}	Spectral	mg/L	0...1500	60	200	20	
	KHP	Spectral	mg/L	0...4000	5	10	1	+/- (5%+2)
	SAC ₂₅₄	1 single wavelength	1/m	0...2200	15	50	5	
	COD-SAC _{eq}	1 single wavelength	mg/L	0...3200	22	73	7,3	
BOD-SAC _{eq}	1 single wavelength	mg/L	0...1500	7,2	24	2,4		
10	NO ₃ -N	Spectral	mg/L	0...10	0,03	0,05	0,005	+/- (5%+0,01)
	NO ₂ -N	Spectral	mg/L	0...15	0,05	0,12	0,012	+/- (5%+0,01)
	COD _{eq}	Spectral	mg/L	0...220	3	10	1	
	BOD _{eq}	Spectral	mg/L	0...220	3	10	1	
	DOC _{eq}	Spectral	mg/L	0...100	0,5	1	0,1	
	TOC _{eq}	Spectral	mg/L	0...100	0,5	1	0,1	
	TSS _{eq}	Spectral	mg/L	0...150	6	20	2	
	KHP	Spectral	mg/L	0...400	0,5	1	0,1	+/- (5%+0,2)
	SAC ₂₅₄	1 single wavelength	1/m	0...220	1,5	5	0,5	
	COD-SAC _{eq}	1 single wavelength	mg/L	0...320	2,2	7,3	0,73	
BOD-SAC _{eq}	1 single wavelength	mg/L	0...150	0,72	2,4	0,24		

Parameters	Principle	Unit	Factor	Optical path (mm)						
				0,3	1	2	5	10	20	50
Absorbance	spectral	UA	-	0,01...2,2	0,01...2,2	0,01...2,2	0,01...2,2	0,01...2,2	0,01...2,2	0,01...2,2
Absorbance	spectral	1/m	-	50...7300	15...2200	7,5...1100	3...440	1,5...220	0,75...110	0,3...44
Nitrate N-NO ₃	spectral	mg/l	-	1,0...330	0,3...100	0,15...50	0,06...20	0,03...10	0,015...5	0,006...2
Nitrate NO ₃	spectral	mg/l	-	4,43...1460	1,33...440	0,67...220	0,27...88	0,13...44	0,067...22	0,030...9
Nitrite N-NO ₂	spectral	mg/l	-	1,7...500	0,5...150	0,25...75	0,1...30	0,05...15	0,025...7,5	0,01...3
Nitrite NO ₂	spectral	mg/l	-	5,6...1650	1,65...500	0,82...250	0,33...100	0,17...50	0,083...25	0,033...10
DOC _{eq}	spectral	mg/l	-	17...3300	5,0...1000	2,5...500	1,0...200	0,5...100	0,25...50	0,1...20
TOC _{eq}	spectral	mg/l	-	17...3300	5,0...1000	2,5...500	1,0...200	0,5...100	0,25...50	0,1...20
COD _{eq}	spectral	mg/l	-	100...7300	30...2200	15...1100	6,0...440	3,0...220	1,5...110	0,6...44
BOD _{eq}	spectral	mg/l	-	100...7300	30...2200	15...1100	6,0...440	3,0...220	1,5...110	0,6...44
KHP	spectral	mg/l	-	17...13300	5,0...4000	2,5...2000	1,0...800	0,5...400	0,25...200	0,1...80
SAC ₂₅₄	254nm	1/m	-	50...7300	15...2200	7,5...1100	3,0...440	1,5...220	0,75...110	0,3...44
COD-SAC _{eq}	Spec wavele.	mg/l	1,46	75...10600	22...3200	11...1600	4,4...640	2,2...320	1,1...160	0,44...64
BOD-SAC _{eq}	Spec wavele.	mg/l	0,48	24...3500	7,2...1050	3,6...525	1,44...210	0,72...105	0,36...52,5	0,15...21
TSS _{eq}	Spec wavele.	mg/l	2,6	130...4300	40...1300	20...650	8,0...260	4,0...130	2,0...65	0,8...26

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Example of absorption spectrum



OPUS integration



Measurement of nitrates and nitrites in a treatment station, mounting OPUS probe on a float with automatic cleaning by injection of compressed air