PROTEUS INSTRUMENTS

Proteus Water Quality Sensor

An award-winning, patented, multi-parameter, real-time sensor platform to accurately and reliably measure BOD, COD, TOC and Total Coliforms in permanent and temporary applications.

The Proteus is the world's first scientifically proven real-time sensor for measuring BOD that can measure a wide range of water quality, environmental and industrial applications. A multiprobe that measures your choice of parameter, all in one package, that can deliver data in the toughest field conditions. The Proteus has been designed for its ease of use, reliable data and economical operation.

Applications

- BOD/COD/TOC Loading to Wastewater Treatment Works
- Combined Sewage Overflow event monitoring
- Point Source Pollution monitoring
- Total Coliform monitoring
- Efficiencies of Wastewater Treatment Works
- Diffuse Pollution Montioring
- Groundwater Water Quality Monitoring
- Survey tool combined with Bluetooth ®

Parameters include:

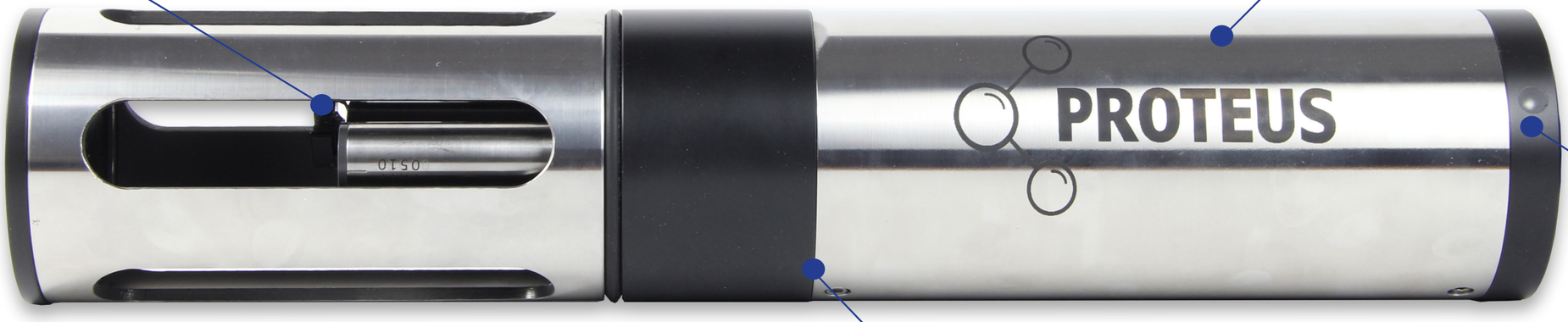
- BOD, COD, TOC, DOC
- Dissolved Oxygen
- Pressure
- Chloride
- pH
- Temperature
- Optical Brighteners
- Nitrate
- Total Coliforms
- ORP / REDOX
- Tryptophan
- Refined Oils
- Ammonium
- EC / Salinity / TDS
- Turbidity
- Crude Oils CDOM

Self cleaning: As it is essential that optical sensors have a cleaning mechanism, the Proteus is also supplied with an integral wiper which cleans all of the Proteus' sensors before every measurement cycle.

Ultra-low maintenance: The system is fully serviceable in the field and requires almost no maintenance. Logs data unattended minimizing manpower requirements and safety issues.

Multiple power options: Power can be provided by an optional internal lithium battery pack for unattended logging, or an external power source (battery, mains or solar). External ON/OFF switch for logging without need for PC connection.

Process control: Let the Proteus monitor multiple process parameters 24/7.



Coliforms: The Proteus is the first instrument globally that has the potential to measure bacteria/coliforms in drinking water in real time.

Simple to use & intuitive software

Status LED

Scalable: The patent-pending and award-winning Proteus breaks the boundaries of water quality meters. The Proteus offers a unique platform to add additional sensors such as pH, REDOX, electrical conductivity, dissolved oxygen, turbidity and many others.

Robust build quality with stainless steel and Delrin outer casing

Easy integration: The Proteus can be effortlessly integrated with telemetry/SCADA systems and other datalogging devices with external RS232/Modbus/SDI12 or simply by using its internal datalogger. The integrated datalogger can log 1,000,000 readings and it can be used with Tablets/Mobile Phones.

Sensor Specifications

Parameter		Range	Resolution	Accuracy	Comments
BOD	BOD mg/l	0-300 mg/l	0.01 mg/l $^{-1}$	±5 % of reading*	Local site calibration can improve accuracy. * providing adequate field calibration
Coliform Counts	per 100ml^{-1}	>1 count/100ml^{-1}	1 count/100ml^{-1}	±10 Coliforms*	Local site calibration can improve accuracy. * providing adequate field calibration
COD	COD mg/l	0-600 mg/l	0.01 mg/l	±5 % of reading*	Local site calibration can improve accuracy. * providing adequate field calibration
DOC	DOC mg/l	0 - 400 mg/l^{-1}	0.01 mg/l	±5 % of reading*	Local site calibration can improve accuracy. * providing adequate field calibration
TOC	TOC mg/l	0 - 400 mg/l^{-1}	0.01 mg/l	±5 % of reading*	Local site calibration can improve accuracy. * providing adequate field calibration
Temperature	Water Temperature	-5 to 50°C	0.01	±0.1	Never needs calibration
pH/ORP	pH	0 to 14 units	0.1	±0.1 within 10°C of calibration, 0.2 °C otherwise	Refillable reference electrode; corrected for temperature; typical sensor life > 4 years
	ORP	-999 to 999 mV	1	±20 mV	Platinum ORP sensor is combined with pH sensor
Turbidity	TSS Turbidity	0 to 500 mg/l	4 digits with maximum of two decimals	±2% of reading or 0.2	Compensated for temperature; filtered for non-turbidity spikes; includes wiper to clean the optics
		0-500 FNU		±2% of reading or 0.2	
		400-5000 FNU		±2% of range	
	Transmissivity	0 to 100% transmission	4 digits	Linearity of 0.99R²	Mounts alongside the Manta
Optical Dissolved Oxygen	Concentration	0 to 20 mg/l	0.01	±0.1	Compensated for temperature and salinity; EPA approved "lifetime" luminescence method; typical sensor cap life > 4 years
		20 to 30 mg/l	0.01	±0.15	
		30 to 50 mg/l	0.1	±5%	
	% saturation	0 to 500% saturation	0.1%	Corresponds with the accuracy of the concentration reading	
Conductivity	Specific conductance, µS/cm	0 to 5000 µS/cm	4 digits max one decimal	±0.5% of reading ±0.001	Corrected for temperature; four easy-to-clean graphite electrodes; optional sensor provides ±0.5% of reading accuracy to 100 mS/cm.
	Specific conductance, mS/cm	0 to 10 mS/cm		±1% of reading ±0.001	
		10 to 100 mS/cm		±1% of reading	
		100 to 275 mS/cm		±2% of reading	
	Salinity	0 to 70 PSS	0.01	±0.2	Calculated from specific conductance; PSS = Practical Salinity Scale which is roughly equivalent to ppt
	Total dissolved solids (TDS)	0 to 65 g/	0.1	±5% of reading	Calculated from specific conductance

Sensor Specifications

Parameter		Range	Resolution	Accuracy	Comments
Pressure	Depth	0 to 25 m	0.01	±0.05	Compensated for temperature and salinity; 0.05 m out of 25 m is 2" out of 100 feet; 0.4 m out of 200 m is a football length out of two football felds
		0 to 200 m		±0.4	
	Vented depth (level)	0 to 10 m	0.001	±0.003 m	Compensated for temp, salinity, barometric pressure
	Barometric pressure	400 to 900 mm Hg	0.1	±1.5	Included with (non-vented) depth sensor
Fluorometers	Chlorophyll a - blue	0 to 500 µg/l	6 digits with maximum of two decimals	Linearity of 0.99R²	Highest-quality Turner Designs fluorometric sensors; fluorometers often require non-trivial calibration; custom optics available upon request
	Chlorophyll a - red	0 to 500 µg/l			
	Rhodamine dye	0 to 1000 ppb			
	Phycocyanin (freshwater BGA)	0 to 40,000 ppb			
	Phycoerythrin (marine BGA)	0 to 750 ppb			
	CDOM/fDOM	0 to 1250 or 0 to 5000 ppb			
	CDOM/fDOM custom	0 to 1250 or 0 to 5000 ppb			
	Optical brighteners	0 to 15,000 ppb			
	Tryptophan	0 to 20,000 ppb			
	Fluorescein dye	0 to 500 ppb			
	Refined oil	0 to 10,000pb			
	Crude oil	0 to 1500 ppb			
Ion-selective electrodes (ISE's)	Ammonium	0 to 100 mg/l as nitrogen	0.1	±5% or 2 mg/l	Corrected for ionic strength (via conductivity readings); the accuracy specification relies on non-trivial maintenance practice and frequent calibration near the temperature of measurement; ammonium and nitrate require tip replacement every 3 - 6 months
	Nitrate	0 to 100 mg/l as nitrogen			
	Chloride	0 to 18,000 mg/l			
	Sodium	0 to 20,000 mg/l			
	Calcium	0 to 40,000 mg/l			
	Bromide	0 to 80,000 mg/l			
TDG	Total Dissolved Gas	600-800 mmHg	0.1 mmHg	±0.1 mmHg	Pressure sensor with gas permeable membrane, max depth 15m
PAR	Photometric PAR	10,000 µmol/sm2	4 digits	±5% of reading	LiCor spherical sensor

Internal Power Battery Life	1 to 24 month depending on sensors / logging rates	**Sample Rate**	1 Hz
External Power	5-15 vdc	**Data Memory**	>1,000,000 logged readings
Operating Temperature	-5 to 50 °C	**Logging Rates**	1 second to 1 day
Depth Rating	200 m	**Warranty**	2 years* *** All sensors included except ISE's (Ammonia/nitrate/chloride)**
Communications	RS-232, SDI-12, USB or Bluetooth		

General Specifications	Proteus 30	Proteus 35	Proteus 40
Diameter	75 mm (2.95")	89 mm (3.5")	102 mm (4.00")
Length - w/o Battery Pack	483 mm (19")	483 mm (19")	483 mm (19")
Weight - with IBP	2.3 kg (5.0 lbs)	4.1 kg (9.0 lbs)	4.5 kg (10.0 lbs)
Number of sensors	Up to 7	Up to 11	Up to 13
Battery Pack	8 "C" cells	8 "C" cells	8 "C" cells

	Parameter Information
Ammonia (NH3)	Ammonia is normally found in very low concentrations in natural waters. It is a result of microbiological activity breaking down nitrogen-containing material. Elevated levels of ammonia can be very harmful to aquatic life and fish in particular.
Biochemical Oxygen Demand (BOD)	Biochemical oxygen demand is a measure of the amount of oxygen used by micro-organisms (e.g.,aerobic bacteria) in the oxidation of organic matter. High levels of BOD (due to excess organic matter) indicate greater consumption of oxygen by micro-organisms, meaning less is available to fish and other aquatic life.
Chemical Oxygen Demand (COD)	Chemical Oxygen Demand (COD) measures the amount of oxygen required to chemically oxidize the organic material and inorganic nutrients, such as Ammonia or Nitrate, present in water. It is widely used as an indicator of organic pollution and many industrial and wastewater effluents have strict permits associated with COD concentration.
Coliform Counts	Coliforms (coliform bacteria) are rod-shaped gram-negative bacteria that are commonly used as an indicator of the sanitary quality of water.
Colour	Colour has historically been used as an indicator for Dissolved Organic Matter (DOM). CDOM (Chromomorphic Dissolved Organic Matter) sensors can accurately measure DOM. It is therefore possible to use CDOM to indicate colour and DOM with a local site calibration.
Conductivity	Conductivity is a measure of the ability of water to pass an electric current; it is affected by the presence of dissolved solids such as chloride, nitrate and phosphate. Conductivity can be a very useful indicator that a discharge of some sort has entered a stream, or some other change has occurred.
Dissolved Oxygen	Oxygen is essential for the survival of aquatic life and is incorporated into surface waters by direct absorption from the atmosphere, more so in turbulent streams. It is then consumed by organisms and decaying organic matter. An excess of decaying organic matter leads to a shortage of oxygen, which can prove fatal for fish.
Dissolved Organic Carbon (DOC)	Dissolved Organic Carbon is operationally defined as the amount of organic carbon based compounds that can pass through a 0.45 µm filter
Nitrate (NO3)	Nitrate is a naturally occurring by-product of the breakdown of organic waste. In low concentrations it stimulates the growth of aquatic plants. At higher concentrations it can be directly harmful and can also lead to excess algae growth and eutrophication. The primary source of excess nitrate is surface runoff from agricultural land.
pH	pH is related to the concentration of hydrogen ions in a solution and is a measure of acidity or alkalinity. In natural ecosystems it can vary from around 4.5, for acid peaty upland waters, to over 10.0 where there is intense photosynthetic activity.
Redox (ORP)	Redox (Reduction-oxidation) or ORP (Oxidation Reduction Potential) is a measure of the oxidising or reducing potential of a water body. Many important biochemical processes are oxidation or reduction reactions (e.g. ammonia>nitrite>nitrate). The ORP level in a river or treatment plant will govern (along with DO and pH levels) which reactions are prevalent.
Temperature	Physical temperature of the watercourse. Largely dictated by climate, but also of interest around thermal discharges. Temperature extremes can be harmful to aquatic organisms, and also have an effect on other parameters, e.g. pH and dissolved oxygen.
Total Organic Carbon (TOC)	Total Organic Carbon is a measure of the total amount of carbon in organic compounds in water.
TSS (Total Suspended Solids)	TSS (Total Suspended Solids) can beerived by using a turbidity (NTU) sensor to measure backscatter caused by suspended sediment in the water. As suspended sediment can be in the form of clay, silt, organic or organic matter there is no single relationship between turbidity and TSS. However, the relationship is typically near perfect ($R^{2>}$>0.95) and can easily be derived by undertaking regression analysis between the two parameters and entering that factor into the Proteus software.
Turbidity	Turbidity is a measure of the clarity of water. Silts and soils that are suspended within rivers and lakes cause high levels of turbidity, especially during storm and run-off events.

Proteus Instruments, Leask House, Hanbury Road, Stoke Prior, Bromsgrove, B60 4JZ
www.proteus-instruments.com - info@proteus-instruments.com - +44 (0) 1527 882060