

UV600TPTN

Online Water Analyser



Specialist Of UV Spectroscopy

> UV600TPTN Online Water Analyser

The UV600TPTN is an on-line water analyser to simultaneously measure total phosphorus and total nitrogen based on a wet-chemical oxidation in compliance with EN ISO 6878 and Standard Methods 4500-P, 4500-N and 4500-NO₃. It belongs to a family of analysers for total parameters: TP (Total Phosphorus), TN (Total Nitrogen) and TOC (Total Organic Carbon).

Tethys Instruments UV600TPTN provides a simple and fast way to measure total phosphorus and total nitrogen for surface water or industrial / municipal waste water treatment plants with accuracy, stability and low operating cost.

A digestion set up enables to oxidize both organic and inorganic phosphorus and nitrogen compounds into orthophosphates and nitrates, respectively, using potassium persulfate under alkaline conditions at 95 °C and UV light irradiation. Total amount of orthophosphates is then quantified by a colorimetric module while total amount of nitrates is determined by direct UV absorbance measurement.

Phosphorus compounds such as trimethyl phosphate or polyphosphate (sodium hexametaphosphate) can be recovered up to 98% yield.

External probes can be added for physicochemical parameters like pH, ORP, dissolved oxygen, conductivity and total suspended solids.

Thanks to its automatic cleaning system, the maintenance is roughly limited to the periodic refill of the inexpensive cleaning solution and reagents.



> UV600TPTN Measurement Principle

Wet-Chemical Oxidation Followed by Colorimetry

The water sample is mixed with an alkaline decomposition solution made of potassium peroxodisulfate. The solution is heated at 95 °C and irradiated with UV light. Phosphorous compounds are converted to orthophosphates while nitrogen-based compounds are transformed to nitrates. Two different methods are used to quantify orthophosphates and nitrates.

Nitrates are quantified by direct UV absorbance at 220 nm. The absorption is proportional to their concentration, based on the Beer-Lambert law.

Orthophosphates are quantified by two colorimetric methods, depending on the concentration ranges: the molybdenum blue and the vanadomolybdophosphoric methods.

In the molybdenum blue method (EN ISO 6878 and Standard Methods 4500-P), the orthophosphate ions react with ammonium molybdate and potassium antimonyl tartate under acidic conditions to afford phosphomolybdic acid. This acid is then reduced by ascorbic acid to give a colored molybdenum blue, which intensity is measured by a LED at 630 nm.

In the vanadomolybdophosphoric method (Standard Method 4500-P), orthophosphates react with ammonium molybdate under acidic conditions to afford molybdophosphoric acid. The molybdophosphoric acid reacts with ammonium monovanadate to give vanadomolybdophosphoric acid. This acid is yellow. The absorption of the solution is measured by a blue LED. In this method, the reagent has a longer lifetime than the reagents of the molybdenum blue method.

In both methods, the absorption is proportional to the phosphate concentration, based on the Beer-Lambert law. The colorimetric module has been specially developed to reach a very small volume flow cell that reduces the quantity of reagent to preserve the environment and to reduce the operating cost. The multi-wavelength LED source assumes a colour and turbidity compensation with an unlimited life time.

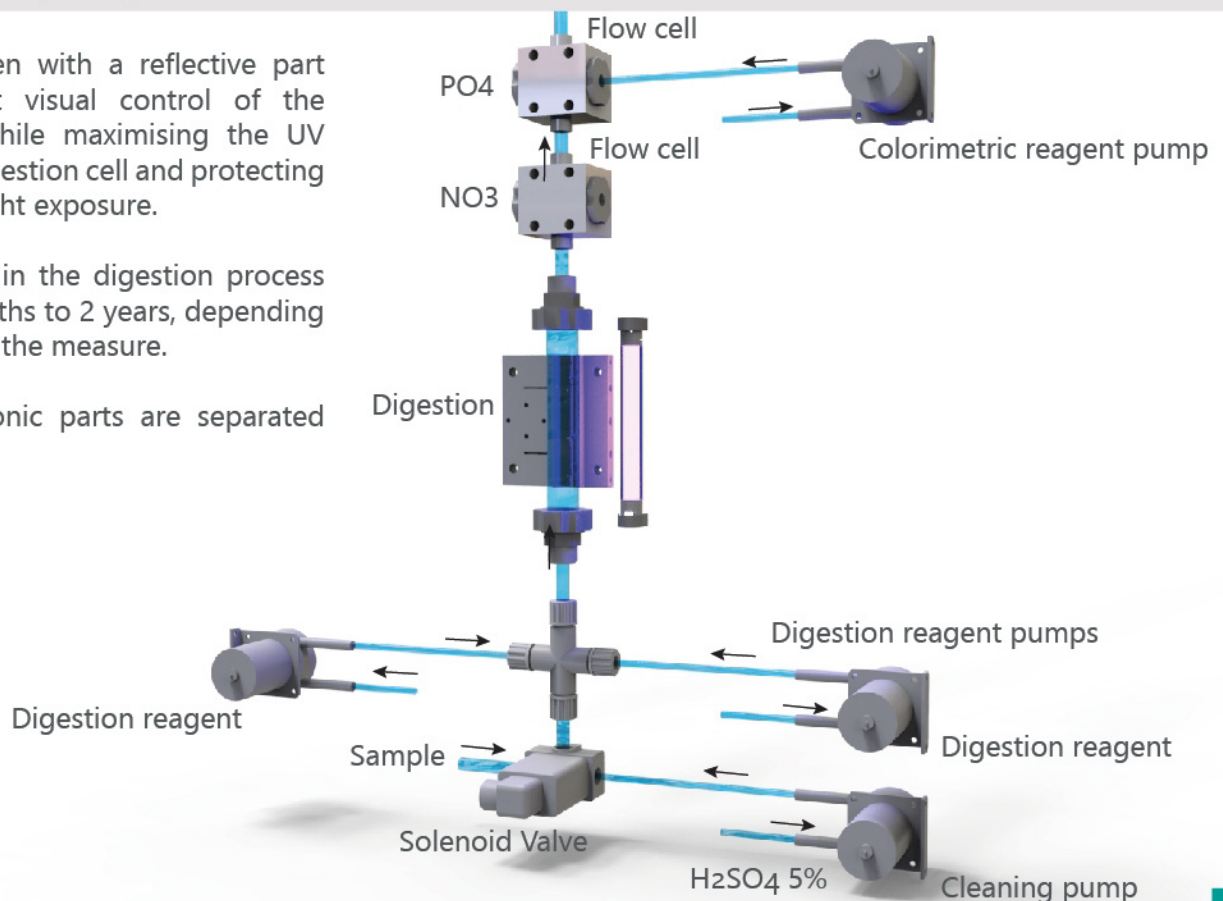
The overall measurement typically takes 14 minutes. It can be extended up to 20 minutes for more complex samples (longer digestion time needed). The oxidation yield was tested on different phosphorus compounds such as trimethyl phosphate and sodium hexametaphosphate (polyphosphate).

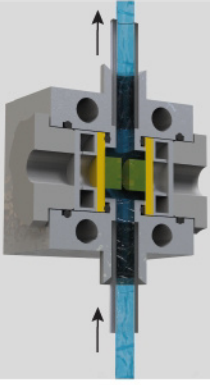
Phosphorus compound	UV600TP recovery yield (%)	Nitrogen compounds	TN recovery (%)
Trimethyl phosphate (CH ₃) ₃ PO ₄	98	Urea	
Sodium hexametaphosphate (NaPO ₃) ₆	99		

A transparent screen with a reflective part enables an instant visual control of the digestion set-up while maximising the UV irradiation of the digestion cell and protecting the user from UV light exposure.

The UV lamp used in the digestion process can last from 6 months to 2 years, depending on the frequency of the measure.

All wet and electronic parts are separated within the analyser.

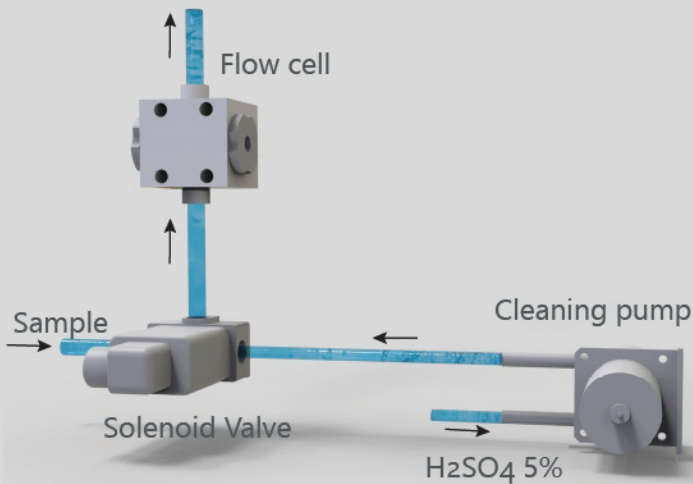




The patented flow cell allows to analyse very high level of suspended solids without clogging, making it suitable for industrial and municipal waste water applications. The wetted parts of the flow cell make it also suitable for most corrosive samples. The design with two cylinders enables the water to go around them, avoiding suspended particles to agglomerate and interfere with the optical measurements. The turbidity is automatically compensated by a dual-wavelength method.

Autocleaning

The analyser is designed to automatically clean itself with an adjustable time range, typically 24 hours, using sulfuric acid 5%. This autocleaning with sulfuric acid 5% proves to be more efficient than water or air autocleaning for dirty and oily samples. It prevents any clogging in the hydraulic circuit from heavily charged water samples. This autocleaning design enables uninterrupted measurements and low maintenance.



Autozeroing

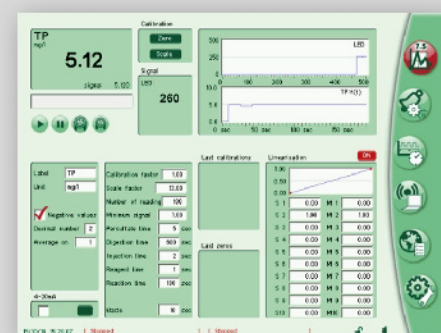
Sulfuric acid has no absorbance in the UV-visible, making it an ideal component to measure the zero. At the end of each autocleaning cycle, the zero is performed on the sulfuric acid 5%. This frequency of zeroing is the key for successful measurements as it prevents any drift in the zero to occur.

User-Friendly Interface

The large colour touch screen (10.4") and intuitive interface available in 9 different languages (Chinese, English, French, German, Hungarian, Italian, Portuguese, Spanish, Turkish) makes very easy to test or configure the analyser.

Many test functions allow to test and troubleshoot each element of the analysers (light signal, pump, solenoid valves, etc...) to set up quickly a maintenance diagnostic.

An acid resistant protection film on the screen assures an efficient long-term protection.



Communication

The RS232 port supports the MODBUS protocol to transmit each measuring channel value to a SCADA system.

Additional parameters are available like status code, error code, calibration values and pumps run time.

Basic 4 – 20 mA output modules can be plugged on the main board for each measuring channel, in the limit of 12 modules. A USB port enables to download on any USB key the last 5000 recorded measurements as well as a diagnostic file containing the configuration and useful information for remote troubleshooting.

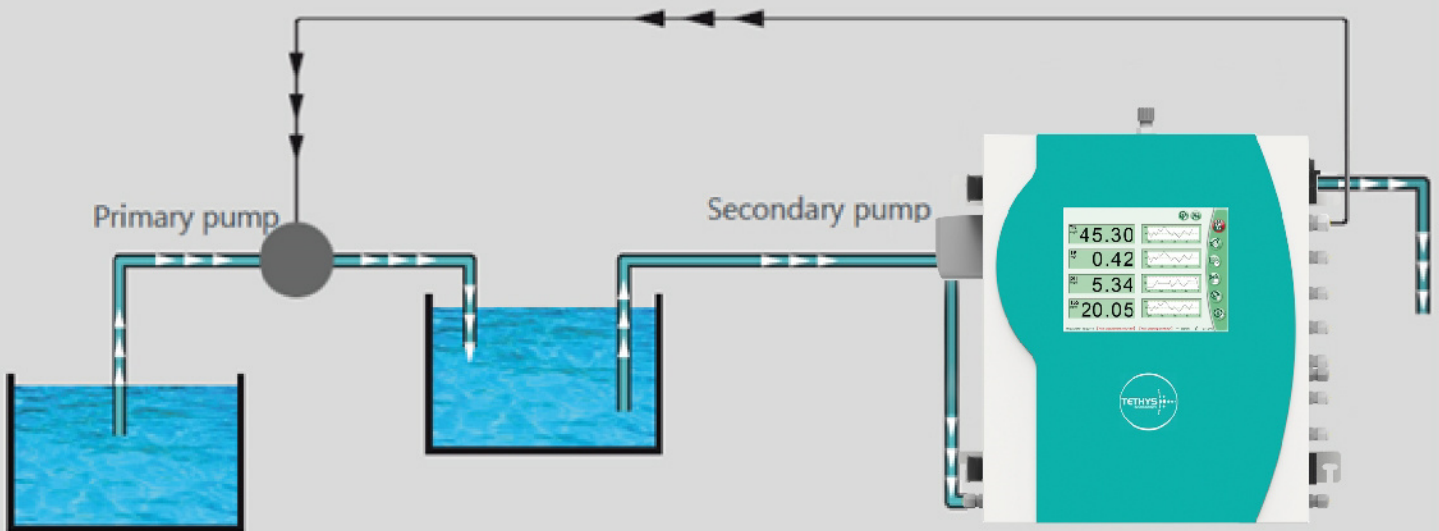
The recorded measurements file can be imported to Excel for graphs or other treatments. The software of the analyser can be upgraded by connecting a USB key.



The UV600TPTN can adapt to many different kinds of sampling depending on the application: surface water, drinking water, process water or wastewater.

A built-in peristaltic pump, synchronised with the measurement, the sample can be admitted directly inside the analyser with a maximal pressure of 4 bars. Otherwise an optional built-in peristaltic pump, synchronised with the measurement to extend the tubing life time, allows to take the sample directly from a tank located up to 6 meters below the analyser. For demanding applications with long distances, another peristaltic pump in a separate enclosure is proposed as an option.

For some applications on river water or wastewater where two sampling pumps are necessary, the UV600TPTN delivers a relay contact to synchronise the primary pump. The delay and running time of each pump can be adjusted easily in the parameters menu of the analyser.

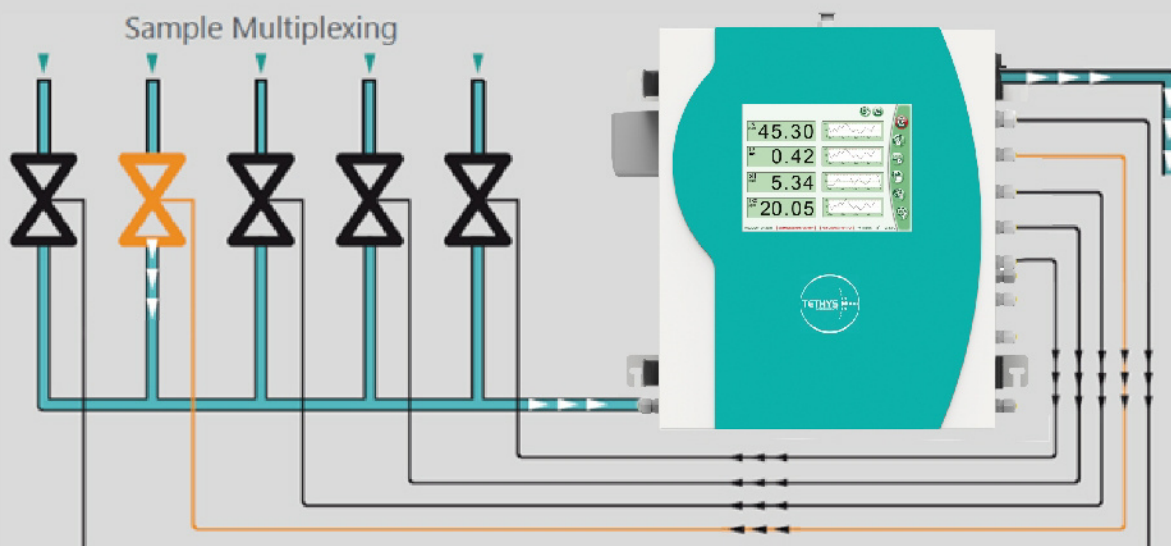


Multiplexing System

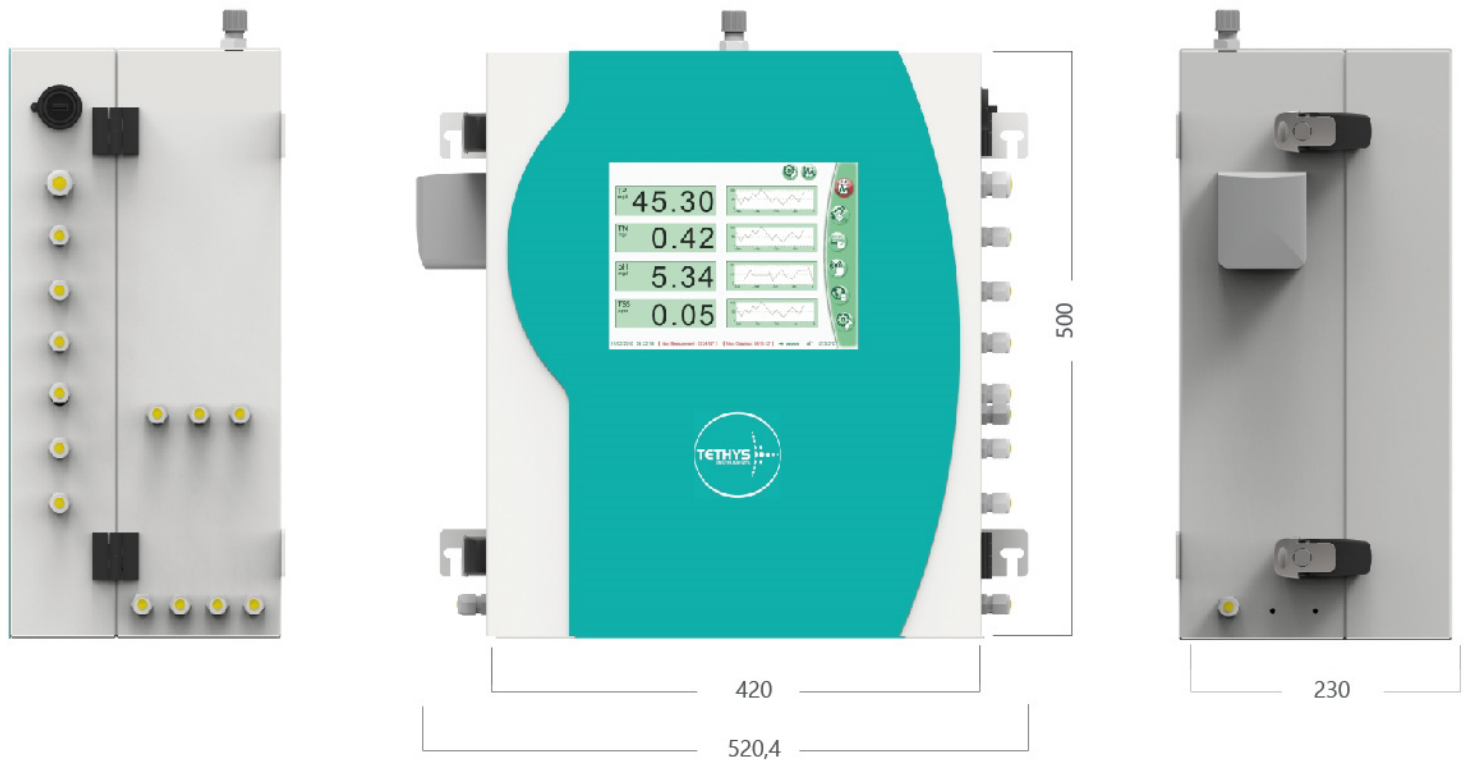
When different streams need to be analysed, an optional multiplexing system delivers relay contacts to control external electric-valves or external pumps.

Up to 6 different streams can be selected.

The measuring channels can be either duplicated (each one having its own 4 – 20 mA output or MODBUS register) or measured sequentially to fit with the maximum of 16 measuring channels (a MODBUS register tells which stream is currently being measured).



> UV600TPTN Parameters Specifications



Parameter	Standard range Other ranges on request	Typical Repeatability for low values <10% FS	Accuracy On standard solution
Total Phosphorus	0 - 2 mg/L 0 - 20 mg/L	± 0.02 mg/L ± 0.2 mg/L	± 2%
Total Nitrogen	0 - 50 mg/L	± 0.1 mg/L	± 2%
pH	0 - 14	± 0.01 pH	± 2%
ORP	± 2000 mV	± 1 mV	± 2%
Dissolved oxygen	0 - 25 mg/L O ₂	± 0.1 mg/L O ₂	± 2%
Conductivity	0 - 2000 µS	± 1 µS	± 2%
Total Suspended Solids	0 - 1500 mg/L TSS 0 - 30000 mg/L TSS	± 1 % of reading or ± 2 % mg/L TSS ± 1 % of reading or ± 2 % mg/L TSS	± 2% ± 2%
Temperature	0 - 80 °C	± 0.1 °C	± 2%

> UV600TPTN General Specifications

Sample flow	0,6 L/min (only during sampling time)
Sample pressure	0 – 1 bar with sampling peristaltic pump
Sample temperature	0 - 80 °C
Wet parts materials	Polypropylene, Polyethylene, PMMA, PEEK, FPM (Viton), Quartz
UV generation	UV Lamp
Digestion temperature	95 °C
Measuring time	14 to 30 minutes for complex samples
Measurement interval	15 min to 720 min (if measuring time compatible) Physicochemical parameters may be continuous
Memory	5000 lines of measurements (up to 16 channels) with date and time
Consumption	Cleaning solution (sulfuric acid 5%): 220 mL/day Digestion reagents per measurement: 11.3 mL up to XX mL for TN Colorimetric reagent per measurement: 1.2 mL
Maintenance interval	Recommended: 6 months to 1 year (except for refilling)
Power supply	90 - 264 V / Maxi 500 VA / 50 – 60 Hz
Screen	10.4" Colour TFT LCD 640x480 pixels with LED backlight
Communication	RS232 with MODBUS protocol RS485 for external probes USB
Certifications	CE, EN 61010-1, EN 61326
Enclosure	Stainless steel with epoxy coating, IP65, wall mounting brackets
Ambient Temperature	-20 °C to 60 °C
Dimensions	715x450x242 mm (HxLxD)
Weight	25 kg

> UV600TPTN Parts references

Basic unit

UV600 TPTN Common characteristics:

Color graphic display 640x480 pixels with touch screen
 Built-in data logger, memory 5000 measurements for each parameter,
 12 sockets for input and output modules (not included, refer to options),
 7 available glands for inputs / outputs, RS232 included (Sub-D 9 ways female connector) with 2 meters cable for PC,
 RS485 included for communication with RS485 probes, USB port integrated for USB key connection,
 Automatic cleaning system with 2-litres tank, Power supply 90-260 VAC 47-63 Hz with power cord 2 meters,
 Enclosure IP65 / Nema3 715x450x242 mm (HxLxD) / 20 to 30 kg
 Mounting lugs for wall,
 Sampling peristaltic pump with a flow of about 600 mL/min .

Measurement module by oxidative digestion and colorimetry

Complete unit

TP-H: Total phosphorus high range

0 – 20 mg/L

TP-L: Total phosphorus low range

0 – 2 mg/L

Measurement module by oxidative digestion and UV absorption

TN: Total nitrogen Range

0 – 50 mg/L

Measurements by electrode (external)

PH500 **pH/ORP module**
 pH Range: 0 – 14
 ATC input for platinum RTD 100 Ohm or 1000 Ohm
 ORP Range: -2000 mV to +2000 mV

ELPH **pH on-line electrode**
 Range: 0 – 14
 5 meters of cable (10 meters in option)
 Built-in ATC RTD 100 Ohm

COND500 **Conductivity module**
 Range: 0 – 100 µS to 0 - 100 mS
 ATC input for platinum RTD 100 Ohm

ICOND **Inductive conductivity online probe**
 Range: 0 – 100 mS
 3 meters of cable
 Built-in temperature compensation at 2.2%/°C
 Requires an IN4-20-500 module instead of COND500 module

ELORP **ORP on-line electrode**
 Range: -2000 mV to +2000 mV
 5 meters of cable (10 meters in option)
 Built-in ATC RTD 100 Ohm

ELCOND **Conductivity on-line electrode**
 Range: 0 – 10 mS
 Cell constant k=1.0 cm⁻¹ (medium range)
 5 meters of cable (10 meters in option)
 Built-in ATC RTD 100 Ohm

EXT - TURBNEPH-H **Nephelometric turbidity probes high range**
 Range: 0 – 400 NTU
 10 meters cable

EXT - TURBNEPH-M **Nephelometric turbidity probes medium range**
 Range: 0 – 40 NTU
 10 meters cable

Measurements by optical method

DO-F **Dissolved oxygen probe by fluorescence**
 Range: 0 - 25mg/L O₂

DO-F-AC **Dissolved oxygen probe by fluorescence with automatic cleaning**
 Range: 0 – 25 mg/L O₂
 7 meters of cable

Input modules

IN4-20-500 **4 – 20 mA input module**
 Isolated 4 – 20 mA input
 Impedance: 100 Ohm

LOGIC500 **Double logical inputs module**
 Input no 1 : external pulse command for measurement
 Input no 2 : measurements inhibition
 Isolated 0 – 48 V DC inputs
 Impedance: >10 Kohm

Output modules

OUT4-20-500 **4 – 20 mA output module**
 Isolated 4-20 mA output
 Active output, Max load 500 Ohm

RELAY500 **Relay module**
 Contact rating: 2A/220 V

Recommended consumables for 2 years :

L-UV-1 : UV lamp

P-ACI-HD1 : Head of cleaning pump (x1)

T-PHAR-1 : Tubing 6.4x9.6 mm for sampling pump (x2 to x8 depending on sampling pump use)

Cleaning solution and reagents are not provided

The manufacturer reserves the right to modify and/or change any specifications, dimensions, design or drawing at any time without prior notice

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