

UV500

Online Water Analyser



TETHYS
INSTRUMENTS

Specialist Of UV Spectroscopy



> UV500 Online Water Analyser

The UV500 is an on-line water analyser based on a high resolution UV-visible spectrograph.

It allows to monitor simultaneously many different parameters for waste water treatment plants or river monitoring stations with an excellent stability and low operating cost.

The same spectrograph can measure organic matter, nitrate, colour, turbidity, phosphate, ammonia and hydrogen sulphide. A complementary UV-visible fluorescence module allows the measurement of aromatics hydrocarbons (PAH). Nephelometric turbidity by visible or infra-red laser diode is also available.

The full UV-visible spectrum can also be used to monitor specific chemical process making the UV500 an ideal instrument for chemical plants. Different materials are available for the flow cell and hydraulic parts depending on the matrix chemical compatibility.

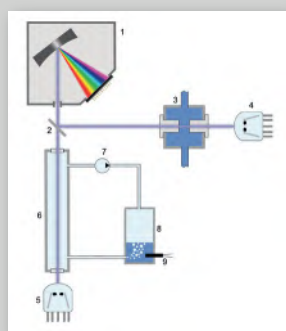
External probes can be added for physicochemical parameters like pH, ORP, dissolved oxygen, conductivity and turbidity.

Thanks to its automatic cleaning system and its extremely long life time lamp, the maintenance is roughly limited to the periodic refill of the inexpensive cleaning solution and eventually reagents depending on the parameters.



UV-Visible Spectroscopy on Liquid and Gas Phase : a Unique Method

- A 2048 pixels high resolution spectrograph scanning wavelengths from 180 nm to 750 nm is the master part of the UV500. Direct absorbance measurement for UV254, COD, BOD, TOC, NO₃, Colour PO₄ and Cr VI brings fast and stable measurements with a simple hydraulic circuit. Factory predefined or local multi-point calibration allows to get readings of COD, BOD and TOC under the UV alternative method for compatible applications. UV spectroscopy brings faster results than conventional methods like COD, BOD, TOC with much less maintenance once the correlation is determined.
- An additional circuit allows the measurement of ammonia and hydrogen sulfide on the gas phase after a stripping step. This unique method allows measurements on extremely turbid or coloured samples like activated sludge as the gas phase is not affected. A fast Fourier transform (FFT) brings an exceptional selectivity and no interference has never been reported after years of operation on many different applications.
- The patented flow cell allows very high level of suspended solid without clogging. The turbidity is automatically compensated by a dual-wavelength method.
- The UV source is a xenon flash lamp specified for 10⁹ flashes that correspond to more than 10 years of life time with one measurement every minute.
- Physico-chemical measurements like pH, ORP, dissolved oxygen, conductivity can be added to the internal measurements by using external probes. The dissolved oxygen probe is based on fluorescence method for a lower maintenance and higher stability.

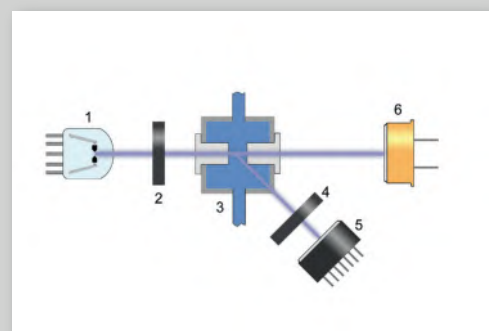


1 : spectrograph
2 : beam splitter
3 : patented water flow cell
4 & 5 : xenon lamps
6 : gas flow cell
7 : gas pump
8 : stripping pot
9 : temperature probe

Measuring principle by absorbance
(liquid and gas phase)

1 : xenon lamp
2 : excitation filter
3 : flow cell
4 : emission filter
5 : photomultiplier
6 : reference photo detector

UV fluorescence principle



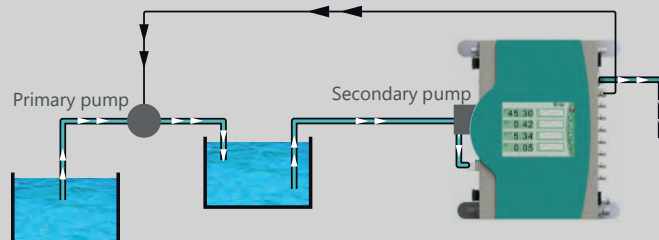
Sampling System

The UV500 can adapt to many different kind of sampling depending of the application : surface water, drinking water, process water or wastewater.

If the water is already pressurized, the sample can be directly admitted 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 UV500 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.

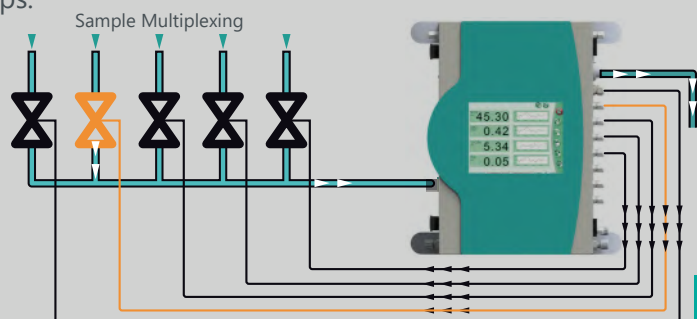


Multiplexing System

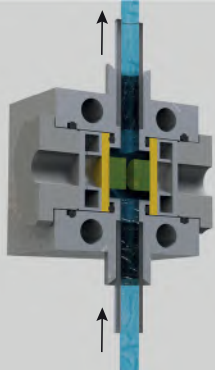
When different streams need to be analysed, for example inlet and outlet of a plant, an optional multiplexing system delivers relay contacts to control external electric-valves or external pumps.

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 sequentially measured to fit with the maximum of 16 measuring channels (a MODBUS register tells which stream is currently being measured).



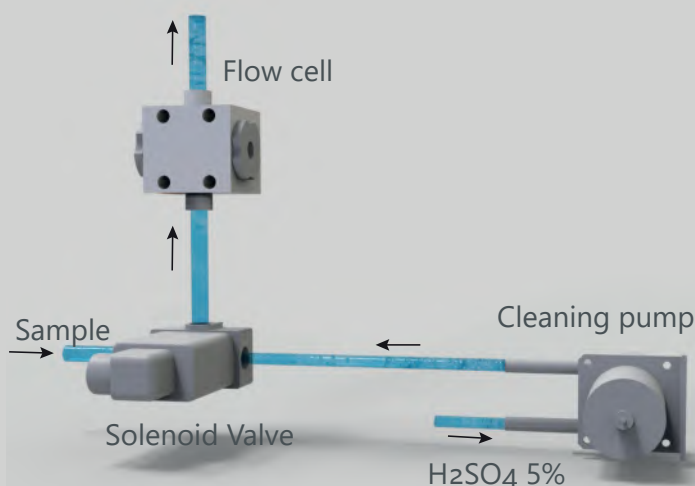
Patented Flow Cell



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 acid 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

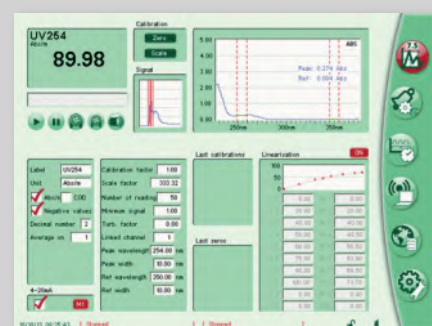
Sulfuric acid has no absorbance in the UV-visible, making it an ideal component to measure the zero. At the end of each autocleaning cycle, the zero is performed on the sulfuric acid 5%. This frequency of zeroing is the key for successful measurements as it prevents any drift in the zero to occur.

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 assumes 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.

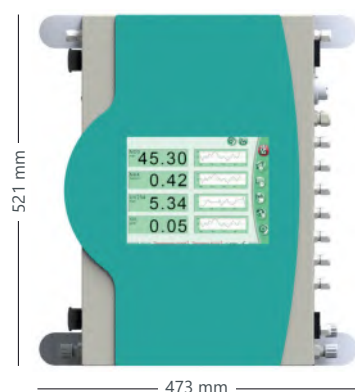
Basic 4 – 20 mA output modules can be plugged on the main board for each measuring channel, in the limit of 12 modules. A USB port enables to download on any USB key the last 5000 lines of recorded measurements as well as a diagnostic file containing the configuration and useful information for remote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



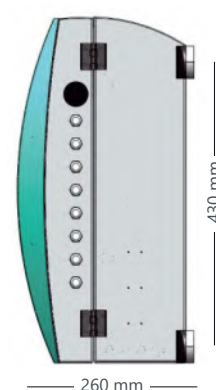
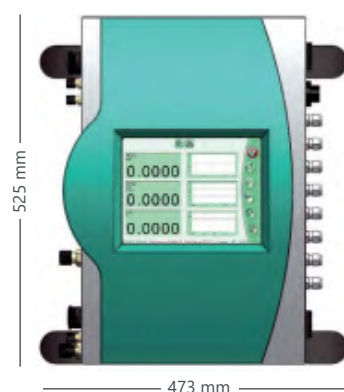
The recorded measurements file can be imported to Excel for graphs or other treatments. The software of the analyser can be upgraded by connecting a USB key.

> UV500 Parameters Specifications

UV500



UV500-Premium



Parameter

Standard range

Other ranges on request

Typical Repeatability

for low values <10% FS

Accuracy

On standard solution

UV254

0-200 Abs/m
0-600 Abs/m
0-2000 Abs/m

± 0.05 Abs/m
± 0.15 Abs/m
± 0.5 Abs/m

± 2%

COD by UV correlation

0-100 mg/L COD
0-2000 mg/L COD
0-20000 mg/L COD

± 0.05 mg/L COD
± 1 mg/L COD
± 10 mg/L COD

± 2%

BOD by UV correlation

0-100 mg/L BOD
0-1000 mg/L BOD
0-10000 mg/L BOD

± 0.05 mg/L BOD
± 0.5 mg/L BOD
± 5 mg/L BOD

± 2%

TOC by UV correlation

0-100 mg/L TOC
0-1000 mg/L TOC
0-10000 mg/L TOC

± 0.05 mg/L TOC
± 0.5 mg/L TOC
± 5 mg/L TOC

± 2%

Ammonia

0-100 mg/L NH₄

± 0.2 mg/L NH₄

± 5%

Nitrate

0-100 mg/L NO₃

± 0.1 mg/L NO₃

± 2%

Colour

0-100 Pt-Co
0-1000 Pt-Co

± 0.2 Pt-Co
± 2 Pt-Co

± 2%

PAH (aromatics)

0-10 mg/L C₆H₆

± 0.01 mg/L C₆H₆

± 2%

Oil in water

0-100 ppm OIW
0-1000 ppm OIW

± 0.1 ppm OIW
± 1 ppm OIW

± 2%

Phosphate

0-2 mg/L P-PO₄
0-20 mg/L P-PO₄

± 0.01 mg/L P-PO₄
± 0.1 mg/L P-PO₄

± 2%

Hydrogen sulphide

0-20 mg/L H₂S

± 1 mg/L H₂S

± 2%

Chromium VI

0-2 mg/L Cr VI

± 0.04 mg/L Cr VI

± 2%

Turbidity
(TSS by correlation)

0-10 NTU
0-100 NTU
0-1000 NTU

± 0.01 NTU
± 0.1 NTU
± 1 NTU

± 2%

pH

0-14

± 0.01 pH

± 2%

ORP

± 2000 mV

± 1 mV

± 2%

Dissolved oxygen

0-25 mg/L O₂

± 0.1 mg/L O₂

± 2%

Conductivity

0-2000 µS

± 1 µS

± 2%

External turbidity
(TSS by correlation)

0-4 NTU
0-40 NTU
0-400 NTU

± 2%
± 2%
± 2%

External TSS

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

Temperature

0-80 °C

± 0.1 °C

± 2%

> UV500 General Specifications

Sample flow	Recommended: 0 - 5 L/min 0 - 0.5 L/min for NH ₄ or H ₂ S
Sample pressure	0 - 4 Bar (0 - 1 Bar with sampling peristaltic pump) 0 - 0.5 Bar for NH ₄ or H ₂ S
Sample temperature	0 - 80 °C 0 - 30 °C for NH ₄ or H ₂ S
Wet parts materials	Quartz, Polypropylene, Polyethylene, FPM (viton), PMMA (+ Pharmed and glass for NH ₄ or H ₂ S)
Measuring time	5 sec (except PO ₄ , NH ₄ , H ₂ S : 3 min)
Measurement interval	1 min to 720 min Physicochemical parameters may be continuous
Memory	5000 lines of measurements (up to 16 channels) with date and time
Consumption	Cleaning solution (5% sulfuric acid): 220 mL/day Reagent for PO ₄ : 2 mL per measurement NaOH 10% for NH ₄ : 2 mL per measurement HCl 10% for H ₂ S : 2 mL per measurement
Maintenance interval	Recommended: 6 months to 1 year (except for refilling)
Power supply	90 - 264 VAC / maxi 100 VA : 50 - 60 Hz
Screen	Colour TFT LCD 640x480 pixels with LED backlight
Communication	RS232 with MODBUS protocol RS485 for external probes (DO, TSS)
Certifications	CE, EN 61010-1, EN 61326 / A1 / A2 / A3
Enclosure	Stainless steel with epoxy coating, IP65, wall mounting brackets
Dimensions	521x473x250 mm for UV500 525x473x260 mm for UV500-Premium
Weight	20 to 30 kg depending on the configuration

> UV500 Parts References

Basic unit

UV500	Basic unit (no measurement included) Color graphic display 640x320 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 MODBUS protocol USB port included for USB key connection Automatic cleaning system with 2 liters tank Power supply 90 - 264 VAC / maxi 100 VA : 50 - 60 Hz with power cord 2 meters Enclosure IP65/Nema4x stainless steel 316 521x473x250 mm (HxWxD) / 20 to 30 kg Mounting lugs for wall
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UV500-P (Premium)	Basic unit (no measurement included) Same specifications as UV500 except dimensions : 525x473x260 mm
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Sampling pump

P	Sampling peristaltic pump for unpressurized water Built-in on the left side of the enclosure Flow of about 600 mL/min Discontinuous operating to increase tube lifetime	P-EXT	External Peristaltic sampling pump for unpressurized water Flow of about 940 mL/min Heavy duty brushless motor Discontinuous operating to increase tube lifetime
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Spectrograph (required for UV254, COD, BOD, TOC, NO₃, Colour, PO₄, Cr VI, NH₄ and H₂S measurements)

SPECTRO500 UV-Visible spectrograph

Range: 180 – 750 nm
 Resolution 0.29 nm
 2048 pixels

Absorbance flow cell and xenon lamp (required for UV254, COD, BOD, TOC, NO₃, Colour, PO₄, Cr VI measurements)

ABS500 Flow cell and xenon lamp for absorbance measurements

Optical path: 1, 3 or 10 mm
 Lamp life time: 10⁹ flashes
 Wet materials: PMMA, Viton, Quartz

Configuration and calibration for measurements by absorbance (require SPECTRO500 and ABS500 modules)

COD-H-500	Organic matter high range high range: 0 – 2000 Abs/m (equivalent to approx. 20000 mg/L COD on municipal waste water)	NO3-500	Nitrate Range: 0 – 100 mg/L NO ₃ (0 – 25 mg/L N of NO ₃) Measurement possible until 250 mg/L NO ₃ (60 mg/L N-NO ₃)
COD-M-500	Organic matter Medium range medium range: 0 – 600 Abs/m (equivalent to 2000 mg/L COD)	CO-H-500	Colour high range Range: 0 – 1000 Pt-Co unit
COD-L-500	Organic matter low range low range: 0 – 200 Abs/m (equivalent to 100 mg/L COD on river water)	CO-L-500	Colour low range Range: 0 – 100 Pt-Co unit

Measurement by UV fluorescence (required for PAH and OIW measurements)

PAH-500	Poly-aromatic hydrocarbons Range: 0 – 10 ppm phenol Range: 0 – 100 ppm OIW (equivalent to approx. 0 – 100 ppm oil with 10% aromatic ratio)
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Measurement module by colorimetric method (require SPECTRO500 and ABS500 module)

PO4-H-500	Phosphate high range High range: 0 – 20 mg/L P (60 mg/L PO ₄) Sampling peristaltic pump included	PO4-L-500	Phosphate low range Low range: 0 – 2 mg/L P (6 mg/L PO ₄) Sampling peristaltic pump included
CR6-500	Hexavalent chromium (VI) Range: 0 – 2 mg/L Cr VI Measurement possible up to 5 mg/L Cr VI		

Measurement by nephelometry

IRTURB-H-500	Internal turbidity sensor high range High range: 0 – 1000 NTU Nephelometric method by laser diode at 650 nm (850 nm on request)	IRTURB-L-500	Internal turbidity sensor low range Low range: 0 – 10 NTU Nephelometric method by laser diode at 650 nm (850 nm on request)
IRTURB-M-500	Internal turbidity sensor medium range Low range: 0 – 100 NTU Nephelometric method by laser diode at 650 nm (850 nm on request)		

> UV500 Parts References

Measurements by optical method

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

EXT-TURB-H **Turbidity probes high range**
High range: 0 – 30000 mg/L TSS
7 meters cable

EXT-TURB-L **Turbidity probes low range**
Low range: 0 – 1500 mg/L TSS
7 meters cable

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

EXT-TURBNEPH-L **Nephelometric turbidity probes low range**
Range: 0 – 4 NTU
10 meters cable

Measurement by UV absorption in gas phase



The spectrograph option SPECTRO must be included

STRIP500 **Stripping system**
Include xenon lamp, flow cell, glassware, air pump, air filter and solenoid valve

NH4-500 **Ammonia**
Range: 0 – 100 ppm NH₄⁺

H2S-500 **Hydrogen sulfide**
Range: 0 – 20 ppm H₂S

Measurements by electrode (external)

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

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/cm
Cell constant k=1.0 cm⁻¹ (medium range)
5 meters of cable (10 meters in option)
Built-in ATC RTD 100 Ohm

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

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

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

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

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/220V

Recommended consumables for 2 years :

P-ACI-HD1 : Head of cleaning pump (x1)
P-RGT-HD1 : Head of reagent pump (x1) (only for NH₄ or H₂S)
T-PHAR-1 : Tubing 6.4x9.6 mm (if optional sampling pump)
(x2 to x8 depending on sampling pump use)

Cleaning solution and reagents (if any) 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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