Mono/Multi-Parameter Analysers

Series 300 & UVpcx

- COD
- Nitrate
- Ammonia
- Hydrocarbons
- Phenol / BTEX
- Chlorophyll A
- Rhodamine
- Turbidity
- Colour
- pH
- Conductivity
- Dissolved oxygen
- Temperature
- Level / flow

- Multi-language with touch screen technology
- Compact size
- 10-years lamp lifetime
- Measuring time within 10 seconds for most parameters
- No reagent (except NaOH for ammonia)
- Accept unfiltered waste water
- Built-in automatic cleaning system
- Datalogging with optional RS232 download

http://www.awa-instruments.com

awa instruments

Introduction

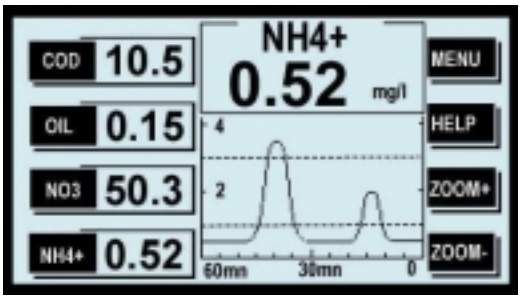
Based on a 10-years experience, the UVpcx is a state-of-the-art water monitoring system specially designed for high reliability, low operating cost and small size.

Ultra-Violet spectroscopy, the most reliable and stable method, is used to analyse the specific parameters: ammonia, COD, hydrocarbons, nitrate, chlorophyll A and fluorescent tracers.

Optical methods are also used for turbidity and colour while electrodes are used for pH, dissolved oxygen and conductivity.

Based on a modular design, the UVpcx can be configured as

- **Mono-parameter** system: on many process control applications, only one parameter is critical. In that case, the UVpcx offers a cost-competitive solution.



- **Multi-parameter** system: water chemistry is complex and to meet the regulations for drinking water or wastewater, many parameters have to be taken in account.

Designed in compliance with CE electromagnetic standards and using a watertight IP64/Nema4x box, the UVpcx is the ideal instrument for industrial applications such as:

- Water treatment plants
- Industrial effluents monitoring
- River monitoring
- Chemical, oil and food industries

Standard methods and on-line analysis

The standard methods are based on traditional and well-known chemical methods that are convenient for laboratory use but **not applicable for on-line analysis**.

The automation of such methods lead to complex system requiring a high maintenance and having a poor reliability. Moreover, the cost of reagent is prohibitive and some of them are dangerous pollutants.

Also, the measuring time is generally not compatible with process control.

It's the reasons for which the UVpcx use optical methods for the specific parameters (ammonia, COD, hydrocarbons, nitrate, chlorophyll A, fluorescent tracers, color and turbidity) for stable, fast and reliable measurements.

No drift or limited lifetime is to be feared as with electrode-based systems, that avoids the need of costly standard solutions.

On some applications, the results on UVpcx can be more accurate than those obtained by standard colorimetric methods that are subject to many interferences, for example chloride for nitrate and COD analysis.

Multi-Language

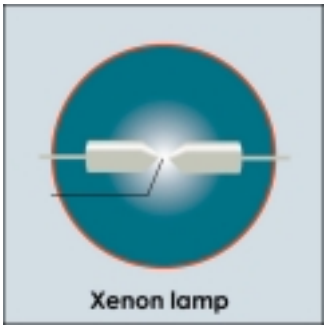
The touch screen human interface brings an incomparable facility for setting the parameters, calibrating or testing the instrument, in anyone of the available languages that are:
English, Spanish, French, German, Dutch, Italian, Portuguese

Simplified Chinese, traditional Chinese, Malay, Korean, Japanese, Thai

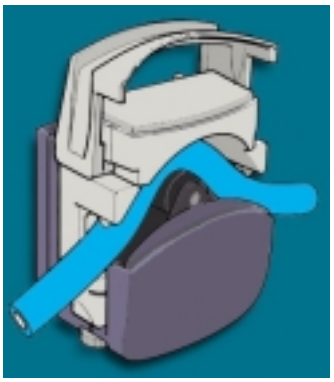
10-years lamp lifetime

The UV xenon lamp is specified for 10^9 flashes that give more than 10 years of lifetime with a measurement every minute.

This reduces considerably the maintenance and the risk of wrong measurement due to age lamps or replacement itself.



Sampling pump



An optional built-in peristaltic pump can be added to take sample directly on river, reservoir or open pipe with a maximum pumping height of 6 meters.

A strainer prevents large suspended solid to enter into the analyser.

A discontinuous pumping is assumed to increase the tubing lifetime.

The easy-to-load pump head facilitates the tubing replacement.

No filtering with river water or waste water

Thanks to large bore tubing and a German-patented inlet electric-valve with pivoting armature, unfiltered water can be admitted into the UVpcx analyser with very low risk of clogging.

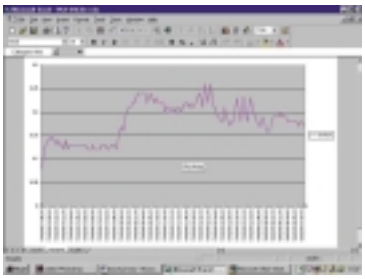
This reduces significantly the initial cost of the measuring system and especially the maintenance.

A double wavelength measuring system compensates the effect of turbidity and suspended solid for COD, nitrate, hydrocarbons, chlorophyll, fluorescent tracers and colour measurement.

The ammonia being measured in the gaseous phase is completely insensible to turbidity, colour or suspended solid in the sample.

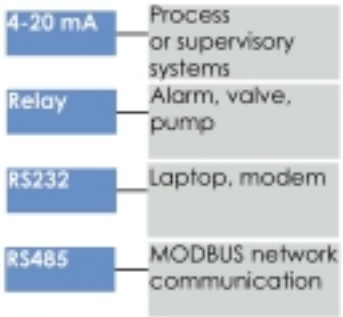
Data logging with RS232 download

All the measurements over a few weeks can be downloaded with the RS232 module using Hyperterminal® of Windows® on any laptop (no specific software is required). The data are compatible with standard worksheets as Excel® for graph, printing or archiving.

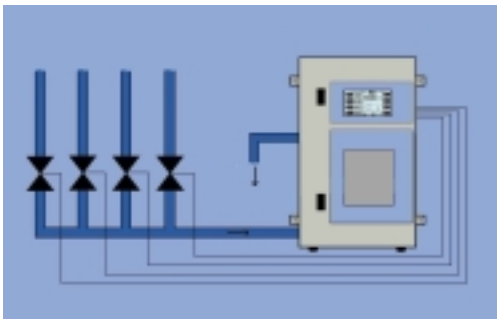


Connectivity

A variety of data links are available to easily interconnect the UVpcx to the other process control elements:
dozing pumps, valves, alarm, PLC, SCADA, laptop, modem and phone systems.



Multiplexing configuration



In the multiplexing configuration, the 4 relays can be use to switch external electric-valves or pumps (not provided) to measure 2, 3 or 4 water streams, for example inlet and outlet of a treatment plant.

In this case, the high threshold relays are no more available and external relays on 4-20mA outputs may be used if necessary.

Explosion proof option

When used in explosion proof areas, an air purge system can be added externally. No additional enclosure is needed.

With such air purge option, the UVpcx can meet the CENELEC EN50016 specification EEx p II T6 to T1.

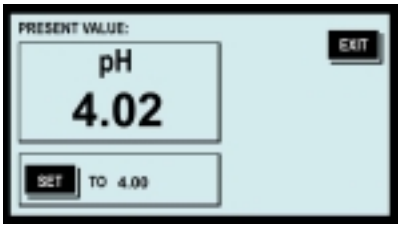
E: European
Ex: Explosion proof
P : pressurized apparatus
II : Zone 2 : potential danger of explosion
Tx: Temperature code (T1: 450ºC, T2: 300ºC, T3:200ºC, T4:135ºC, T5:100ºC, T6:85ºC)

Or NFPA 496, 1993, X, Y or Z type, Class I & II, Group A to G

Class I: Flammable gases or vapors are present in the air in quantities sufficient to produce explosive or ignitable mixture

Class II: Combustible or conductive dust are present
Group A: Acetylene
Group B: Hydrogen (or equivalent hazard)
Group C: Ethylene (or equivalent hazard)
Group D: Gasoline (or equivalent hazard)
Group E: Metal dust
Group F: Coal dust
Group G: Grain dust

pH, Dissolved oxygen and Conductivity inputs



The UVpcx can be configured with specific inputs for the connexion of standard electrodes for pH, dissolved oxygen and conductivity with 100 Ohm or 1000 Ohm Pt RTD for the automatic temperature compensation.

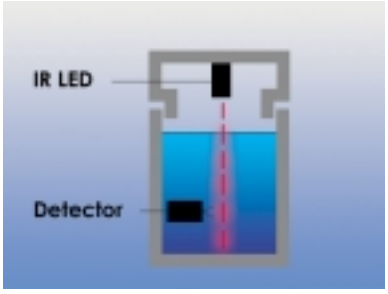
A range of 3/4" NPT industrial electrodes can also be provided with the UVpcx controller. The self-cleaning flat pH electrode prevents building of solids reducing the maintenance.

The operator is fully assisted by menu-driven functions for the calibration.

Low and high range turbidity

Using a high power infra-red light-emitting diode (LED) for sensitivity and stability, the low range probe is specially designed for a range from 0.01 to 100 NTU.

Operating at 880 nm and detecting the scattered light at 90º, the probe meets the ISO7027 criteria.



The high range is obtained by using the reference photodiode of COD measurement.

Colour, Chromate, Chlorine and specific parameters

The Uvpcx can be adapted for the measurement of any UV or visible absorbent chemical by selecting the appropriate optical filters.

The most common are the yellow colour of water in platinum unit, hexavalent chromium or chromate, and chlorine for high concentration.

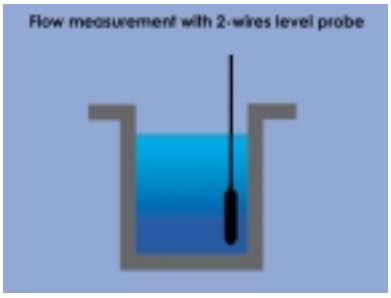
Ranges:

Colour: Low range: 0 – 100 Pt-Co unit
High range: 0 – 1000 Pt-Co unit

Chromate: Low range: 0 – 25 mg/l
High range: 0 – 250 mg/l

Chlorine: Low range: 0 – 500 mg/l
High range: 0 – 5000 mg/l

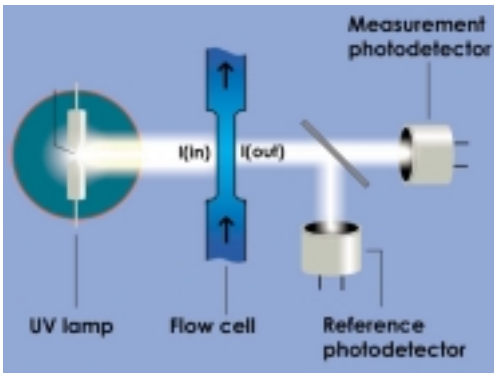
Level and flow



A 4-20mA 2-wires submerged level probe can be connected directly on the 4-20 mA input.
The level can be converted in flow on a calibrated open channel using the formula $F=k1\ L^{k2}$.
K1 and K2 must be entered in the UVpcx to display the flow F given by a level L.

Other probes can also be connected using the 4-20mA input: ultrasonic, bubbler or area velocity.

Measuring principle



The measuring principle is based on the UV light absorption by unsaturated organic molecules at 254nm according to the Beer-Lambert law:

[C]= k log (Iin/Iout)

With
[C]: sample concentration
k: absorption coefficient (specific to each molecule)
Iin: light intensity at the input of the sample
Iout: light intensity at the output of the sample

Turbidity, suspended solid or dirty on the flow cell is automatically compensated by a differential measurement with a second detector at a reference wavelength.

The approximate ratio COD/UV (ppm.abs^{-1}.m) is given bellow for a few chemicals:

Acrolein	3
Benzene	5
Chlorobenzene	5
Dimethyldisulfide	3.5
Hydrogen peroxide	1.5
Nitro benzene	0.15
Phenol	5
Styrene	0.25
Tetrachloroethylene	0.5
Toluene	5
Triethylamine	1
Xylene	7

Generally, the sample is a mixture of many different molecules giving an average absorption coefficient.
That means that the instrument must be calibrated according to a COD laboratory measurement before using.

Also, the ratio of the different molecules must remains approximately constant to assume a good correlation with laboratory COD.

The UV absorption can be considered as an alternative method for COD (Chemical Oxygen Demand) when fast, reliable and inexpensive measurements with very low maintenance are required.

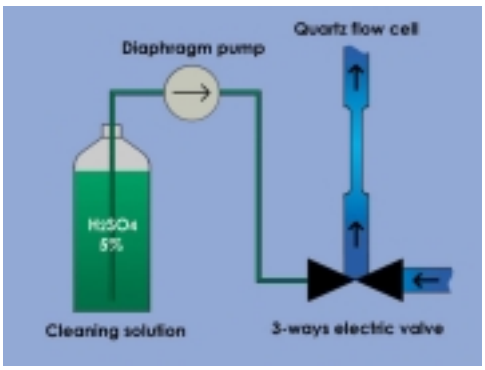
The correlation for industrial wastewater may need an experimentation to be validated while results are guaranteed on river water or urban wastewater.

This method is in accordance with DIN38404-C3 standard and can be considerate as an alternative method referring to AFNOR XPT90-210 standard.

Automatic cleaning system

One time a day, a low cost cleaning solution (5% sulphuric acid) is automatically injected into the flow cell to clean it. An auto-zero is performed at the same time.

The autonomy is about 2 weeks with the built-in 2-litres tank. An alarm is generated on low level of the cleaning solution tank.



Ranges and calibration

Two ranges are available on the UVpcx according to the flow cell:
- Low range with 10 mm flow cell for drinking or river water: 0 – 100 mg/l KMnO4 COD
- High range with 1 mm flow cell for effluents: 0 – 20,000 mg/l COD (depends of the effluent)

The instrument is pre-calibrated for river water on the low range and for urban wastewater on the high range.

For a specific effluent, the ratio COD/UV can be entered in the instrument according to laboratory COD measurements.

Operating cost

The operating cost is limited to the refilling of the 2-litres tank of cleaning solution every 2 weeks with 5% sulphuric acid on distilled water.

For effluent measurements, tap water instead of distilled water can be tolerate after checking.

It can be estimated to about US$ 100 per year including labour.

Application on river water

Many studies have been conducted on river water to demonstrate the relation between UV absorption and COD such as:

American Public Health Association- "Standards methods for the determination of water and Wastewater – UV Absorbing organic constituents, p5-60", 1995.

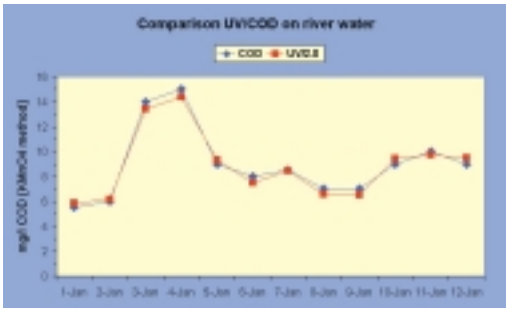
J.C. ROSTANG, C.MOUVET-"Contribution of UV spectrometry and dissolved organic matter to the studies of the functioning of freshwater ecosystems". Science de l'Eau, 5(1986) 9-28.

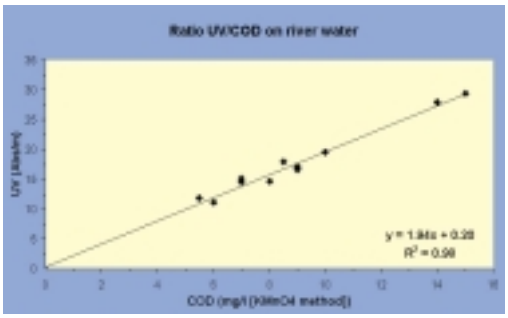
V.LEMAUVIEL-"Utilisation de la spectrometrie U.V. dans l'analyse des eaux naturelles". Rapport DIREN-SEMA Basse Normandie, 1994.

The applications concern mainly river monitoring for environmental studies and drinking water treatment plants.

Successful and cost-efficient applications are also reported on automatic coagulant dozing.

The graph below shows a typical relation between UV absorption and COD on river water.





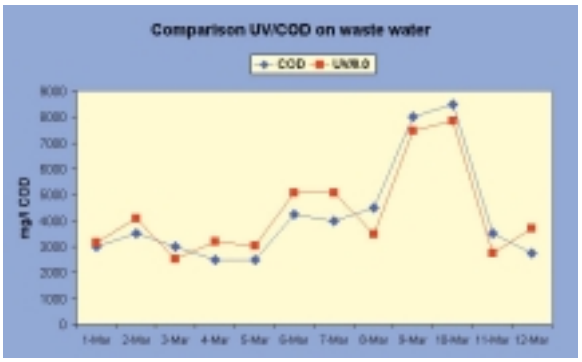
Application on wastewater

The COD of the final effluent is a critical parameter for environmental requirements on many chemical and food industries. A fast and reliable on-line measuring system is needed.

If the correlation with COD is assumed, UV absorption appears to be the most adapted and cost-effective method (no filtering, no reagents, no consumable, no dilution).

The graph below shows a typical comparison between UV absorption and COD on wastewater.

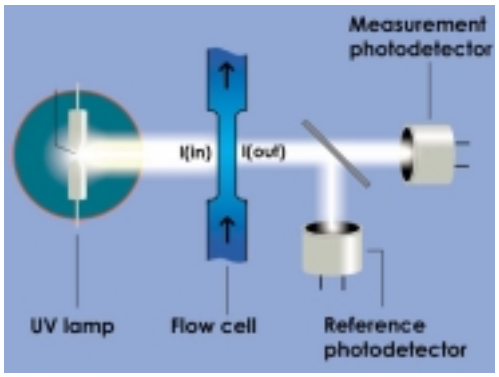
The UVpcx can drive a sampler using the high alarm relay if a standard method is required to meet the regulations.
The samples are taken only above a critical value to limit the number of laboratory analysis.



Comparative table for COD

METHOD	UV absorption (UVpcx)	Automated laboratory COD	COD by ozone or –OH electrode	TOC with UV oxidation	TOC with high temperature oxidation
Measuring time	< 10 seconds	2 hours	tens of minutes	tens of minutes	tens of minutes
Correlation with COD on river water	very good	very good	very good	very good	very good
Correlation with COD on industrial effluent	variable	very good	good	variable	variable
Detection of unsaturated organic molecules	yes	yes	yes	yes	yes
Detection of alcohol and linear hydrocarbons	no	yes	yes	no	yes
Reagents	no	yes, pollutant	yes	yes	yes
Consumable, gas cartridge	no	no	yes	yes	yes
Distilled water for dilution	no	yes	yes, >10litres/day	no	no
Periodic change of electrode or lamp or parts	no	yes	yes	yes	yes
Maintenance	very low	high	high	high	high + waiting time
Filtering	no need	inevitable	inevitable	inevitable	inevitable
Operating cost	low	high	high	high	high
Size	compact	big	big	big	big
Weight	15 kg approx.	> 30 kg	>30 kg	> 30 kg	> 40 kg
Transportable by car or passenger plane	yes	no	no	no	no
Installation time	few minutes	hours	hours	hours	hours

Measuring principle



The measuring principle is based on the strong UV light absorption by chromophore N-O at 210 – 220nm according to the Beer-Lambert law:

[C]= k log (Iin/Iout)
With
[C]: sample concentration
k: absorption coefficient
Iin: light intensity at the sample input
Iout: light intensity at the sample output

An automatic internal linearisation compensates the inherent non-linearity of Beer-Lambert law for high concentrations.

The measurement is the weighted sum of NO2 and NO3 concentration, but in most applications, the NO2 concentration is negligible regarding NO3 concentration.

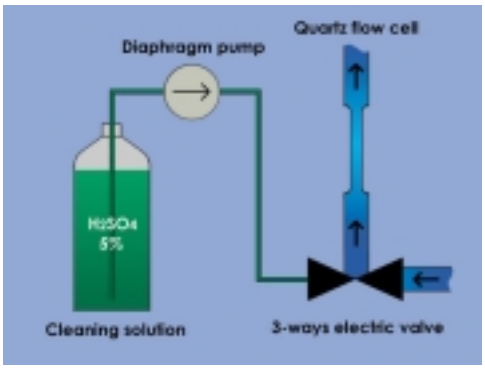
Turbidity, organic matter, suspended solid or dirty on the flow cell is automatically compensated by a differential measurement with a second detector at a reference wavelength.

Chlorates and chlorites at high concentration are the only inorganic cause of interference but hopefully they are not encountered on drinking water or urban wastewater.

Automatic cleaning system

One time a day, a low cost cleaning solution (5% sulphuric acid) is automatically injected on the flow cell to clean it. An auto-zero is performed at the same time.

The autonomy is about 2 weeks with the built-in 2-litres tank.
An alarm is generated on low level of the cleaning solution tank.



Operating cost

The operating cost is limited to the refilling of the 2-litres tank of cleaning solution every 2 weeks with 5% sulphuric acid on distilled water.

It can be estimated to about US$ 100 per year including labour.

Application on river water

Rivers monitoring for environmental studies and nitrate flow evaluation are the main applications on river.

Stability, reliability and low maintenance are the major concern for these remote measurements that only UV spectroscopy method can achieve.

The optional built-in peristaltic pump can take water directly on the river.

Application on drinking water

The major water companies and municipalities now largely use the UV method for on-line measurements on drinking water, especially to control automatically the mixing of several waters or for nitrate removal plants.

Laboratory measurements according to standard methods are still done periodically to follow the local regulations and they show very close results with UV measurements.

Application on waste water

Nitrate removal plants need a fast and reliable nitrate measurement to control the process that only UV spectroscopy method can really achieve. No drift as with electrode-base system are to be feared. The absence of reagent assumes the lower operating cost.

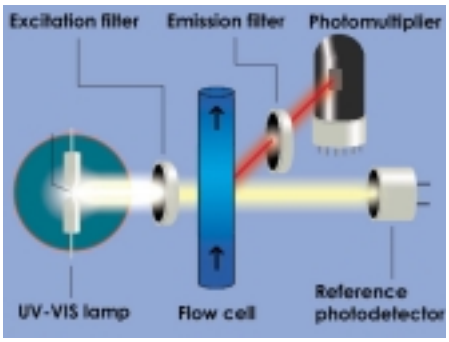
The turbidity compensation and large bore tubing of UVpcx avoid any filtering system reducing significantly the initial cost and maintenance. The automatic cleaning system maintain the flow cell clean.

Comparative table for nitrate

METHOD	UV absorption with close flow cell and xenon lamp (UVpcx)	UV absorption with open flow cell and deuterium lamp	Specific electrode	Colorimetry	Amperometry
Measuring time	< 10 seconds	>30 seconds	> 5 minutes	> 5 minutes	> 5 minutes
Interference with chlorides	no	no	yes	yes, high	yes
Reagents or consumable	no	no	yes	yes	yes
Periodic change of electrode or lamp or parts	no	yes	yes	yes	yes
Maintenance	very low	medium	high	high	high
Filtering	no need	inevitable to avoid clogging of the calibrated hole	inevitable on waste water	inevitable on waste water	inevitable on waste water
Automatic cleaning system	yes	no, impossible Require manufacturer's specialist for cleaning			
Operating cost	low	high	high	high	high
Size	compact	big	big	big	big
Weight	12 kg approx.	> 30 kg	> 30 kg	>30 kg	> 30 kg
Transportable by car or passenger plane	yes	no	no	no	no
Installation time	few minutes	tens of minutes	hours	hours	hours

Note: The immersed probes don't figure in this table as they don't match the reliability and lifetime criteria (leakage problem) required for on-line monitoring.

Measuring principle



The measuring principle is based on fluorescence: when lighted at a specific wavelength (excitation), some chemicals re-emit light (emission) at another longer wavelength.

Very few chemicals are fluorescent giving a highly selective measurement.

The emission light is detected by a high sensitivity photo multiplier to detect very low concentrations from a few ppb.

The excitation light is controlled by a detector to compensate any variation of the source.

The table below give the relative intensity of some aromatic hydrocarbons.

Anthracene	42
Benzene	10
Biphenyl	20
Chlorobenzene	7
Fluorobenzene	10
Naphtalene	35
Phenanthrene	25
Phenol	18
Propybenzene	17
Styrene	10
Toluene	17

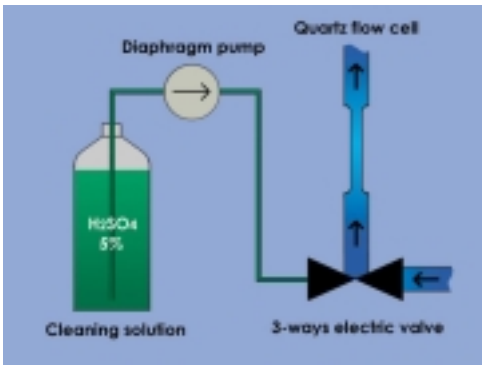
The application (aromatic hydrocarbons, Chlorophyll A, Rhodamine or fluorescein) needs to be specified when ordering the instruments. It can be changed by the user by changing the optical filters.

A higher sensitivity than falling stream flow cell is obtained due to the absence of parasite light reflections. The flow and pressure of the sample may vary in a wide range at the opposite of falling stream flow cells that need a complex hydraulic system to control the flow.

Automatic cleaning system

One time a day, a low cost cleaning solution (5% sulphuric acid) is automatically injected on the flow cell to clean it. An auto-zero is performed at the same time.

The autonomy is about 2 weeks with the built-in 2-litres tank.
An alarm is generated on low level of the cleaning solution tank.



Operating cost

The operating cost is limited to the refilling of the 2-litres tank of cleaning solution every 2 weeks with 5% sulphuric acid on distilled water.

It can be estimated to about US$ 100 per year including labour.

Application on lake, reservoir and river water

Hydrocarbons are dangerous pollutants that have to be detected very early on reservoir or river for producing drinking water. **Fast and reliable** measuring system is necessary and the UV fluorescence is the only method matching these requirements.

Alga growing is becoming a major environmental concern on more and more lakes and reservoirs due to the excess of nutriments coming from fertilisants or urban wastewater.

Fast and reproducible on-line measurement of chlorophyll A can be done by fluorescence for environmental studies.

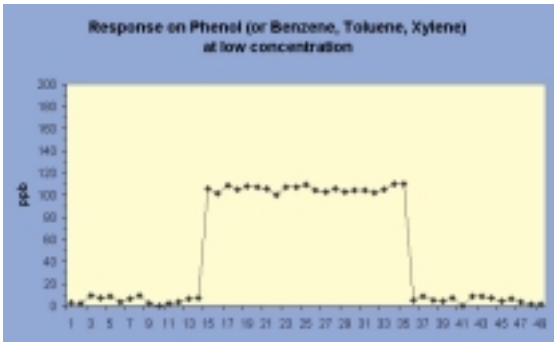
Rhodamine and fluorescein are the major tracers used for environmental studies (for example underground water contamination or transit time of pollutants in a river).
Very low concentrations (below ppb) are to be detected and fluorescence is the only fast and selective method applicable.

The optional built-in peristaltic pump can take water directly on the river or reservoir.

Application for cooling water

The level of hydrocarbons in cooling water is a critical parameter on refineries.

A fast and reliable on-line measuring system is necessary and the UV fluorescence is the only method matching these requirements.



Application on wastewater

The effluents of refineries and chemical plants have to stay below limits to meet the environmental regulations.

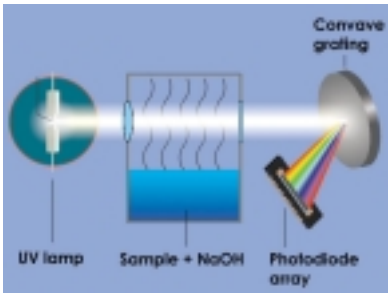
A reliable and low maintenance measuring system is required that only UV fluorescence can achieve.

The automatic cleaning system of UVpcx maintains clean the flow cell avoiding any manual operation to clean a calibrated hole as with open flow cell systems.

Comparative table for hydrocarbons

METHOD	UV fluorescence with close flow cell and xenon lamp (UVpcx)	UV fluorescence with open flow cell and mercury lamp	Extraction and IR absorption	Stripping and FID
Measuring time	< 10 seconds	<10 seconds	> 5 minutes	> 5 minutes
Sensitivity	High	Medium	High	Medium
Use of dangerous solvent (CCL4, freon)	No	No	Yes	No
Use of flammable gas	No	No	No	Yes
Air supply	No	Yes	No	No
Influence of molecular weight	No	No	No	Yes
Detection of total hydrocarbons	No, aromatics only	No, aromatics only	Yes	Yes
Periodic change of lamp or parts	no	yes	Yes	yes
Simple hydraulic system	Yes	No, Flow control	No, Extraction	No, Stripping
Maintenance	Very low	Medium	High	High
Filtering	No need	Inevitable to avoid clogging of the calibrated hole	Inevitable on waste water	Inevitable on waste water
Automatic cleaning system	Yes	No, impossible Require manufacturer's specialist for cleaning		
Operating cost	Low	Medium	High	High
Size	Compact	Big	Big	Big
Weight	12 kg approx.	> 30 kg	> 30 kg	>30 kg
Transportable by car or passenger plane	Yes	No	No	No
Installation time	Few minutes	Tens of minutes	Hours	Hours

Measuring principle



The measuring principle is based on UV light absorption spectrum of ammoniac gas NH3 in equilibrium with dissolved ammoniac gas in the water sample.

A small quantity of sodium hydroxide (NaOH) is added to the sample to increase the pH for transforming NH4+ to NH3.

A Fast Fourier Transform (FFT) is applied on the spectrum to extract the absorption signal typical to ammoniac gas.

This method is very selective and no interference is known on river or waste water.

Moreover, turbidity or colour of the water has no influence as the measurement is performed in the gaseous phase.
Wastewater with suspended solids (as activated sludge) can be admitted without filtering.

This method is known since 1956* but requires a strong mathematical signal processing that only powerful-microprocessor-based instruments can handle.

*"Quantitative Microdetermination of Gaseous Ammonia by Its Absorption at 204.3 nm"
by Gunther, Barkley, Kolbezen, Blinn, Staggs - University of California, Vol28, no12, 1956.

The stability of the measurement (at the opposite of the electrodes) avoids the use of costly standard solution. An auto-zero is performed at each measuring cycle.

The detecting system is in a separate enclosure for a good accessibility.

Automatic cleaning system

One time a day, a low cost cleaning solution (5% sulphuric acid) is automatically flowing in the stripping pot.

The autonomy is about 1 week with the built-in 2-litres tank.

An alarm is generated on low level of the cleaning solution tank.

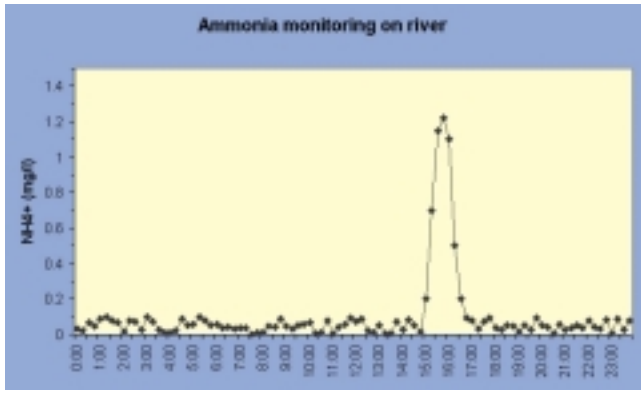
Operating cost

The operating cost is limited to the refilling of the 2-litres tank of cleaning solution every week with 5% sulphuric acid on distilled water.

It can be estimated to about US$ 200 per year including labour.

Application on river water

The concentration of ammonia in river water is an important parameter for drinking water treatment plants. Stability, reliability and low maintenance are the major concerns for these applications that only UV spectroscopy method can achieve. The graph bellow shows typical measurements on river water.



Application on waste water

Waste water treatments plants need a fast and reliable ammonia measurement to control the nitrogen removal process that only UV spectroscopy method can really achieve.

The measurement on the gaseous phase avoids any interference with turbidity or suspended solid and the use of large bore tubing make possible the measurement on activated sludge.

The automatic cleaning system maintains the tubing clean.

Comparative table for ammonia

METHOD	UV absorption on NH3 (Uvpcx)	Specific electrode	Colorimetric
Measuring time	5 minutes	> 5 minutes	> 5 minutes
Interference with color or turbidity	no	no	yes
Standard solution	no need	inevitable (drift)	yes
Expensive or specific reagents	no	yes	yes
Periodic change of electrode or lamp or parts	no	yes	yes
Maintenance	low	high	high
Filtering	no need	inevitable on waste water	inevitable on waste water
Automatic cleaning system	yes		
Operating cost	low	medium	high
Size	compact	big	big
Weight	25 kg approx.	> 30 kg	>30 kg
Transportable by car or passenger plane	yes	no	no
Installation time	few minutes	hours	hours

Mono/Multi-Parameter Analysers

Series 300 &UVpcx

Mono-parameter:
AM300: Ammonia
CT300: -L: COD low range, -H: COD high range
FL300: -H: Hydrocarbons, -A: Chlorophyll A, -R: Rhodamine, -F: Fluorescein
NT300: Nitrate

Multi-parameter:
UVpcx / XXXXX / XXXXX / XXXXX / XXXXX / XXXXX

Absorption
COD-H: COD high range
or **COD-L**: COD low range
or **NO3**: nitrate
or **COD-H-NO3**: COD high range + nitrate
or **CO**: colour

External system
NH4: ammonia

Fluorescence
PAH: hydrocarbons, BTEX, phenol
or **CHLOA**: chlorophyll
or **RHOD**: rhodamine
or **FLUO**: fluorescein

Electrodes - Inputs
pH-DO: pH + diss. oxygen
(+) **COND**: conductivity
(+) **IN4-20**: dual input 4-20mA

Outputs - Communication
XOUT4-20: dual 4-20 mA
or **RS232** X=1,2,3 or 4
or **RS485**

	Range	Typical repeatability
COD	Low range: 0 - 100 mg/l [KMnO4] COD	+/- 0.05 mg/l [KMnO4]
	High range: 0 - 20,000 mg/l COD(approx.)	+/- 10 mg/l (approx.)
Turbidity	Coupled with COD low range: 0 - 150 NTU	+/- 0.5 NTU
	Coupled with COD high range: 0 - 1500 NTU	+/- 5 NTU
Phenol, BTEX	0 - 10 ppm (0 - 100 ppm on request)	+/- 0.01 ppm
Oil with 10% aromatics	0 - 100 ppm (0 - 1000 ppm on request)	+/- 0.1 ppm
Chlorophyll A	0 - 300 ppb	+/- 0.5 ppb
Rhodamine	0 - 200 ppb	+/- 0.1 ppb
Nitrate	0 - 100 mg/l NO3 (0 - 1000 mg/l on request)	+/- 0.1 mg/l NO3
Ammonia	0 - 10 mg/l to 0 - 500 mg/l NH4	+/- 0.05 mg/l NH4

Sample temperature	0 - 80 °C, avoid frozen absolutely 5 °C to ambient temperature max. for ammonia only (absolutely)
Sample pressure	0 - 5 bar 0 - 1 bar only with peristaltic pump
Sample flow	0 - 5 l/min, typical 0.5 l/min
Analog output	4-20 mA opto-isolated, 12-bit resolution, 500 Ohm max (option)
Alarm output	4 relay contacts NO programmable with hysteresis band and delay
Communication	RS232 - No specific software, compatible with Excel® (option) RS485 - MODBUS protocol (option)
Display	240 x 128 pixels LCD with backlight
Power supply	110-130 V or 220-240 V / 30 VA / 50-60Hz - Internal voltage selector 12 V to 15 V DC, 3 A
Operating limits	0 to 50°C
CE standards	Electromagnetic compatibility EN50081-2, EN50082-2, EN55011
Enclosure	IP65 / Nema 4X, coated steel
Dimensions	500 x 300 x 200 mm (HxWxD)
Weight	14 kg (+14 kg for ammonia compartment)

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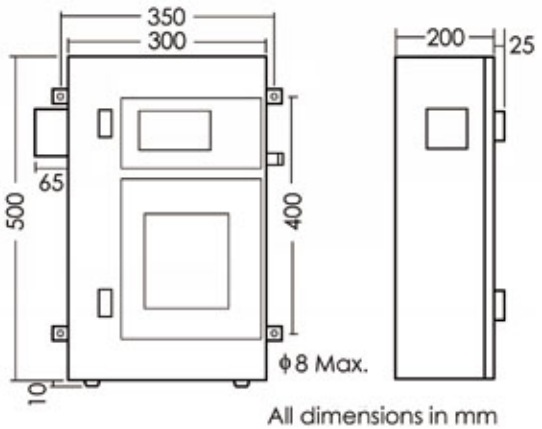

All dimensions in mm

Some characteristics refer to optional parts
All specifications are subject to change without notice