# Monitoring the Full Range of Water Quality Parameters - On-line, Easy and Cost-efficient

WATER WASTEWATER

**Dr. Joep van den Broeke, Solutions - Senior Scientist, DI Franz Hofstädter, Director International Sales**
s::can Messtechnik GmbH, Vienna, Brigittagasses 22 - 24, 1200 Vienna - Austria
Tel: +43 1 2197393 - 0 Fax: +43 1 2197393 - 12 Email: office@s-can.at Website: www.s-can.at

Whether your application is waste water monitoring, control of water treatment processes, monitoring of waters in environmental applications or monitoring and protection of drinking water quality, in-situ & on-line UV/Vis spectrometry can provide the solution. On-line spectrometry, in the form of the s::can spectrometer probes, has found its way into these and many more water monitoring and management applications. Furthermore, the range of approved standardised applications available is continuously being expanded upon by development of new spectral algorithms especially for industrial applications and is supplemented by the handsome integration of additional sensors – e.g. for monitoring of $NH_4$+, DO, pH or EC - into the s::can monitoring system.

## The Spectrometer Family

The well proven core of the s::can monitoring systems are the submersible UV/Vis spectrometer probes, the spectro::lyser™, nitro::lyser™, carbo::lyser™ and multi::lyser™. These instruments are suitable for monitoring of a wide range of waters, from the cleanest drinking waters to industrial process-streams. Since its introduction on the market over 6 years ago, the technology has proven to be accurate and reliable, with over 900 instruments already in place.

The parameters that can be monitored by the spectrometer probes include COD, COD-filtrated, BOD, TOC, DOC, UV-254, $NO_3$-, $NO_2$-, TSS, Turbidity, Benzene, Toluene, many pesticides and other chromophores, all based on the spectro-photometric principle and multiple parameters can be implemented in one single spectrometer probe. The unit can run off a battery pack and has a built in data logger capable of recording many months of information. There are no moving parts in contact with the water and it is built to run without ever leaving the water, using compressed air for automated cleaning. This makes the s::can spectrometer probes highly reliable, robust and, at almost zero operating costs highly cost-efficient.

All s::can spectrometer probes can be operated without initial calibration; the instrument can be used in a very simple yet robust “plug-and-play” modus (“Global Calibration”). Next to this, it also allows the full exploration of the potential of UV-Vis by adjusting the instrument to local conditions:

- The unique concept of “Global Calibration” allows the measurement of chemical parameters like turbidity, COD and $NO_3$- directly after initial operation of the system without necessity for calibration. The principle of Global Calibrations was developed using the spectra of thousands of real-life samples.
- If local calibration should be needed, it is done automatically while the instrument remains submersed in the water.
- Pre-settings for many different applications and situations have been prepared, examples being: WWTP influent, effluent and aeration basin, river water, drinking water, paper mill, brewery, dairy, petrochemical industry, ....

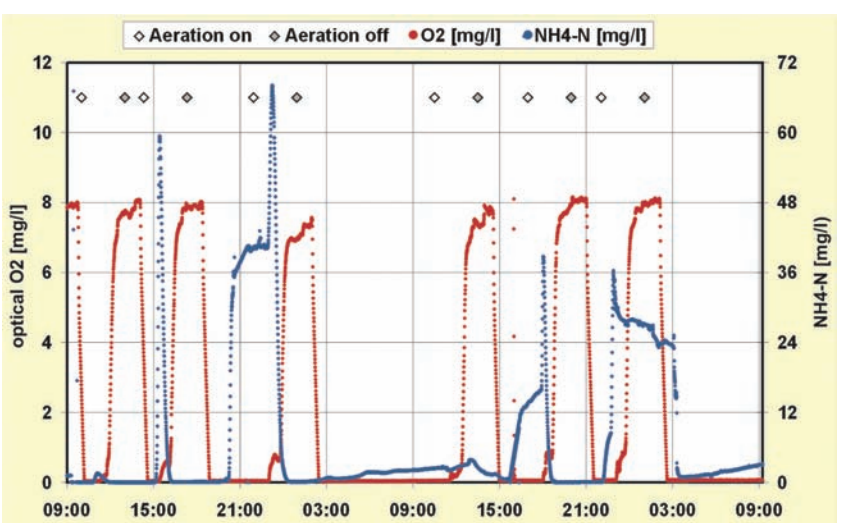


*Figure 1: Simultaneous measurement of ammonium and dissolved oxygen in an SBR.*

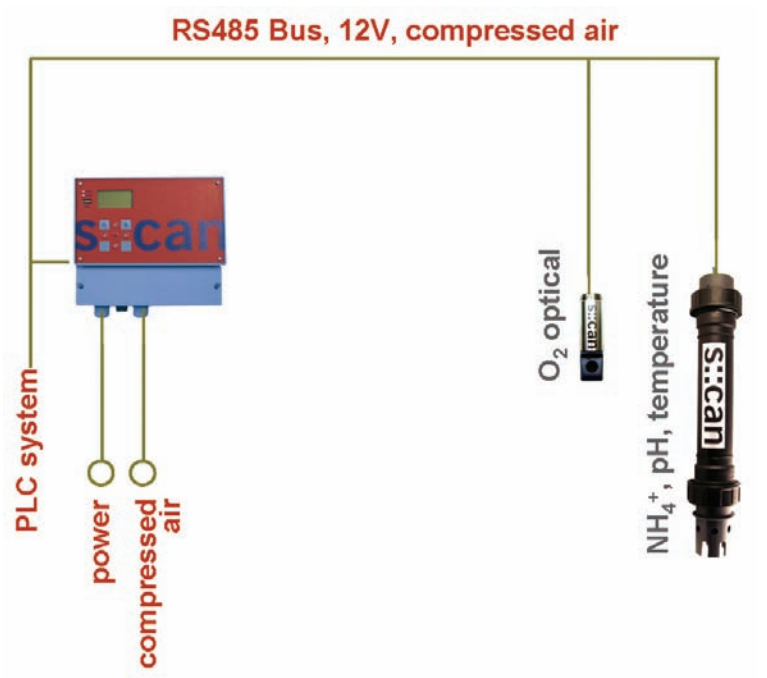


*Figure 2: s::can Monitoring System for **ammonium, pH, DO and temperature**.*

## A Full Suite of Sensors for Online Monitoring

With the optical dissolved oxygen sensor – oxi::lyser™ – and the ion selective ammonium probe – ammo::lyser™ – s::can completes its range of intelligent, low maintenance sensors, and integrates them in an easy-to-use and cost-efficient digital environment.

ammo::lyser™ – this instrument is based on a new, potassium, pH and temperature-compensated, ion-selective sensor. This sensor has proven superior to all other ion selective $NH_4$+-sensors during 3 years of continuous measurements in various applications and was evaluated positively by several European Universities. Calibration is recommended twice per month, although applications where calibration only once every 6 months was necessary have been demonstrated. Like all other s::can instruments, the ammo:lyser™ runs on 12V, uses compressed air for automatic cleaning and is fully integrated into the validated s::can software and s::can terminal via an RS485 protocol.

oxi::lyser™ – this sensor determines the concentration of dissolved oxygen (DO) using a temperature compensated optical measuring principle; quenching of a fluorescing complex in a sol-gel matrix. In contrast to other equipment available on the market, the sensor works accurately even at $O_2$ levels below 0.1mg/L and is not affected by exposure to sunlight. Neither regular calibration nor replacement of the sensing element is necessary, reducing operational costs to almost zero. For cases where cleaning of the sensor is necessary, the instrument has the provisions for using the compressed air system common to all s::can sensors.

## Operation, Communication and Process Control

User interfaces for sensor operation and control are available on several performance levels:

- the stainless steel “con::stat-III” is an industrial process control terminal that sets a new standard with its large colour display and a touch panel allowing menu-driven, user-friendly operation and displaying time series of the monitored results. It can control all s::can sensors and any other digital (RS485) or analogue (4-20 mA) sensor connected to it. Furthermore, provisions for operation of distributed monitoring systems, either via telephone, radio, GSM, or GPRS telemetry are available in this terminal.
- for less demanding applications and smaller budgets, the compact “con::lyte” terminal is available, which can control up to 4 sensors. This system is designed to transmit the parameter readings of these probes, recorded with a measuring interval down to 15 seconds, via 4-20 mA or RS485 interface to a PLC system.

## Proof of Performance in Real Case Applications

**Monitoring and control in a Sequencing Batch Reactor (SBR)**

Ammonium and dissolved oxygen are monitored simultaneously in an SBR reactor in Vienna, Austria. Using the oxi::lyser™ and ammo::lyser™ directly in the reactor, several characteristic points of an SBR cycle can be monitored (see Figure 1). This shows that in comparison with a SBR operated via fixed time schedule, the times for settling, denitrification and nitrification can be minimised using these online measurements. During this operation, the oxi::lyser™ did not require any cleaning or maintenance, whereas the ammo::lyser™ was cleaned on an hourly basis by the compressed air system. The calibration of ammonium was verified on a weekly basis, and required adjustment every 2 weeks. The correlation coefficients of the on-line measurements with laboratory results were close to 1, with measurements working well at all solids concentrations.

An s::can Monitoring System consisting of the terminal con::lyte, one ammo::lyser™ and one oxi::lyser™ will be able to provide the readings for ammonium, pH, DO and temperature to the PLC-System. This Monitoring System allows the controlling of the complete treatment process of an SBR at very competitive pricing. With the optimisation of the operating cycles of an SBR facilitated by this online Monitoring System, the efficiency of the reactor can be increased, the volumes of treated water can be maximised and the air usage can be minimised. As a result, the quality of the treated water will be better and the operating costs will be reduced.

**River Water Monitoring**

In an intensive research programme (IMW, Lit*), the spectro::lyser™ and the ammo::lyser™ have been in use for monitoring the water quality of the Danube river near Vienna for several years now. Mounted on a kind of trolley for easy adjustment of the installation to the changing water level, all the sensors were operated free of drift using the automatic cleaning system operated by compressed air. The ammo::lyser™ was calibrated every two weeks using a simple single point off-set calibration. The s::can Monitoring System registers many fluctuations in the quality of the water, originating from both natural and human influences. For example a daily period in organics and ammonium concentrations could be identified (Figure 3) most likely as a result of daily cycles in the composition of the final effluent of waste water treatment plants located upstream from the measuring site.

The results of this s::can Monitoring System are transmitted via GSM to a central database collecting results of several monitoring stations. This central database also provides the visualisation of the collected results over the internet and therefore accessible worldwide. In this configuration an s::can Monitoring System, consisting of a con::stat terminal, one ammo::lyser™ and one spectro::lyser™, is able to provide worldwide accessible readings for ammonium, pH, $NO_3$-N, TOC, DOC, turbidity and temperature at a very competitive pricing.

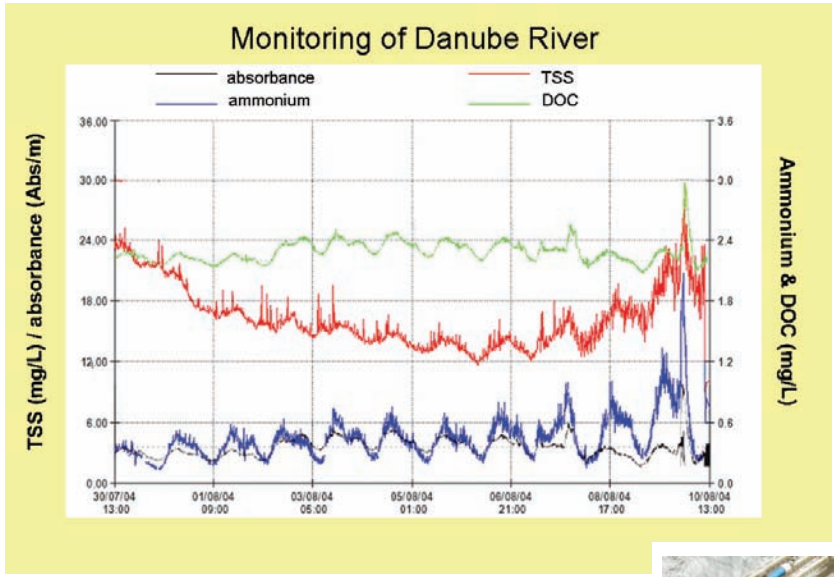


*Figure 3: Simultaneous results for ammonium, suspended solids and dissolved organics.*

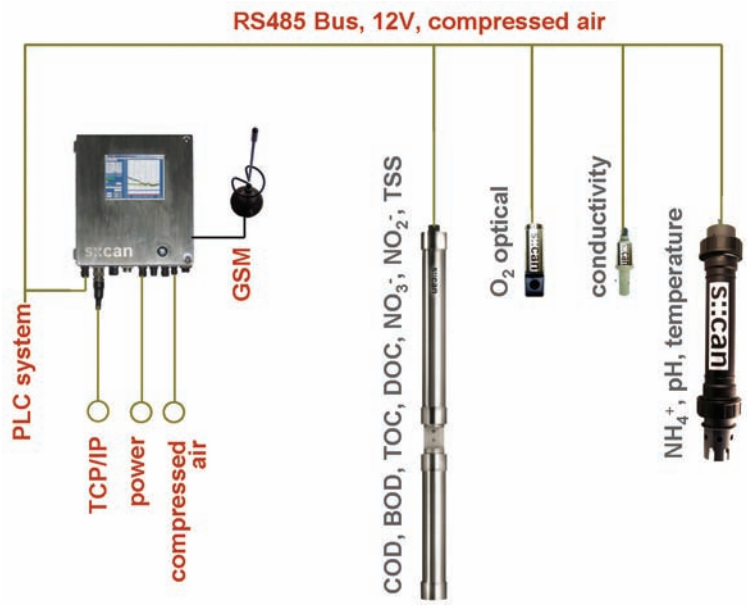


*Figure 4: s::can Monitoring System providing readings for **ammonium, pH, EC, DO, $NO_3$-N, TOC, DOC, FTU and Temperature** and worldwide access via internet*

(Lit*) .... Please ask for our literature and reference lists on CD !