INNOVATIVE ONLINE WATER QUALITY MONITORING IN DRINKING WATER NETWORKS

Drinking water is a primary nutrient. Thus, not only the transport in the drinking water network, but also the excellent quality for the consumers must be ensured. Currently, the quality of drinking water is ensured by means of laboratory samples, which have to be carried out according to the authorities / law (drinking water regulations) by the water companies at specified intervals. The actual drinking water regulation intends for improvements by moving away from regular sampling to a risk assessment-based adaptation of sampling planning.

On the one hand, this approach is costly, because across large parts of the drinking water network samples need to be taken, transported and analysed weekly to monthly and on the other hand, however, owing to their slow dynamics, problems such as contamination events can often barely or not be detected at all.

In order not to be dependent on the prescribed frequency of examinations and to increase transparency, many water suppliers worldwide require online sensors so that responding to issues related to the water quality in their drinking water distribution network is possible in real time.

Criteria for using sensors in the drinking water network

Online sensors that are used in the drinking water network are supposed to continuously monitor and provide quantitative, high resolution and validated measurements for assessing the water quality.

The environmental conditions in man holes and pipelines are not trivial. Therefore protection class requirements of minimum IP67 and drinking water certification criteria for materials which are in contact with water must be fulfilled.

If sensors are supposed to make measurements in the pressured pipe, such systems must be very robust in order to be able to deliver good results regardless of pressure fluctuations and pressure bursts. The susceptibility, maintenance and power

requirements of this "online analytics" must be reduced to an absolute minimum.

The prerequisite of every online measurement is not just robust sensors but also a real-time data transmission into a data base / SCADA system in order to be able to react to alarms and changes in the measured data.

The pipe::scan

The pipe::scan (Figure 8) is a sensor system for monitoring the drinking water quality in pipes under pressure. Up to 10 parameters are measured in one system: Organic parameters (TOC, DOC, UV254/UVT), turbidity, colour, chlorine, pH/redox, conductivity, temperature and pressure.

The installation is carried out on the pipe under pressure by means of Hawle pipe saddles (DN100 - DN 600). Via a "straw", the water from the pressure pipe is pushed into the pipe::scan flow cell. A nano pump ensures that the water is pumped through the flow cell and back into the pipe without water loss, refer to Figure 2. Functional principle.

The sensors in the pipe::scan are well known, reliable s::can sensors which have been on the market for many years: the i::scan - an optical miniature spectrophotometer with LED technology and automatic brush cleaning for the measurement of organics (TOC, DOC, UV254, UVT), turbidity and colour, the chlori::lyser - a pressure-resistant amperometric sensor for detection of free
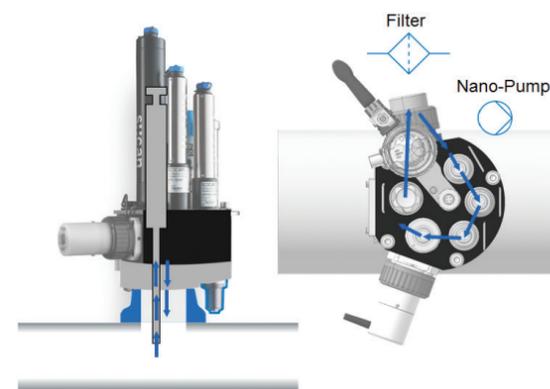

Figure 2: Functional principle of the pipe::scan

chlorine, the pH::lyser - a very robust pH sensor without salt bridge with a polymer reference electrode, the condu::lyser - a 4-electrode conductivity sensor with an integrated temperature sensor suitable for industrial use, and a miniature pressure sensor. All these sensors need extremely low maintenance and have been used for several years in drinking water applications worldwide.

A filter in the inlet ensures that no large particles penetrate into the flow cell and a ventilation valve ensures an air free measuring environment inside the cell.

Figure 1: Multiple pipe::scans monitor the drinking water network
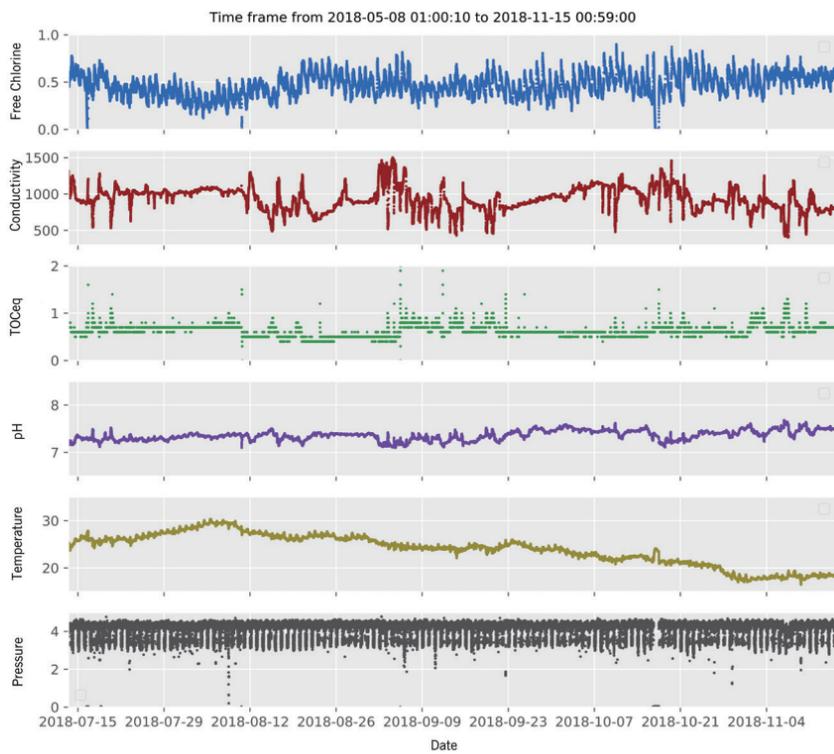

Figure 3: con::cube terminal

Figure 4: Drift-free long-term measurement in the drinking water distribution network of a major European city and high-resolution results showing pressure fluctuations and changes in conductivity
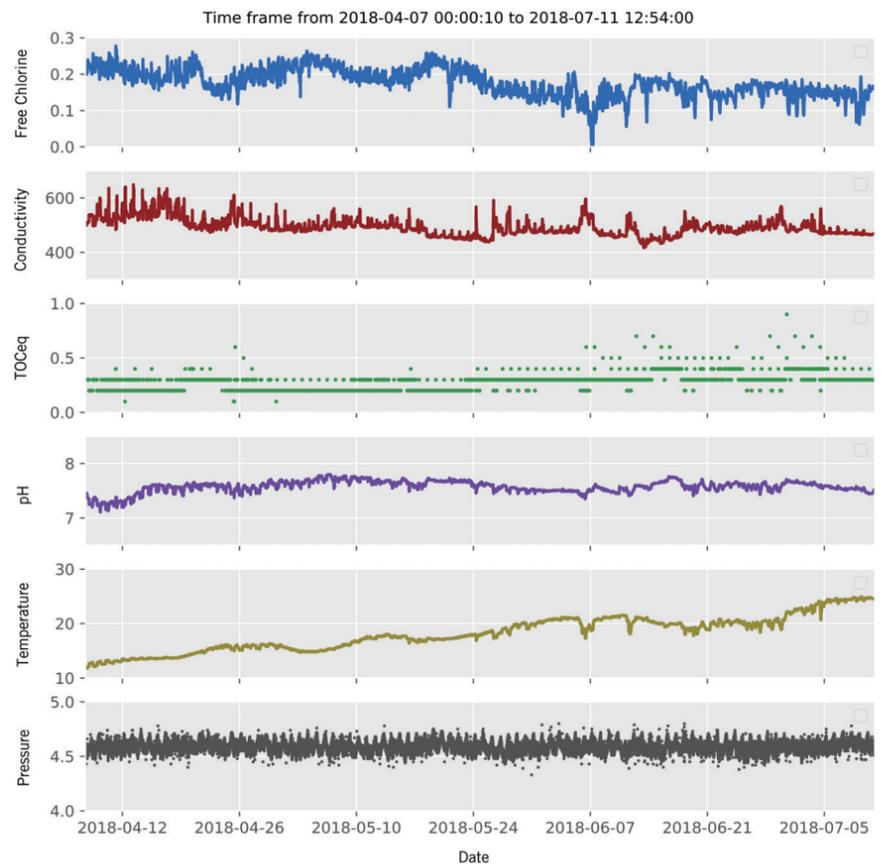

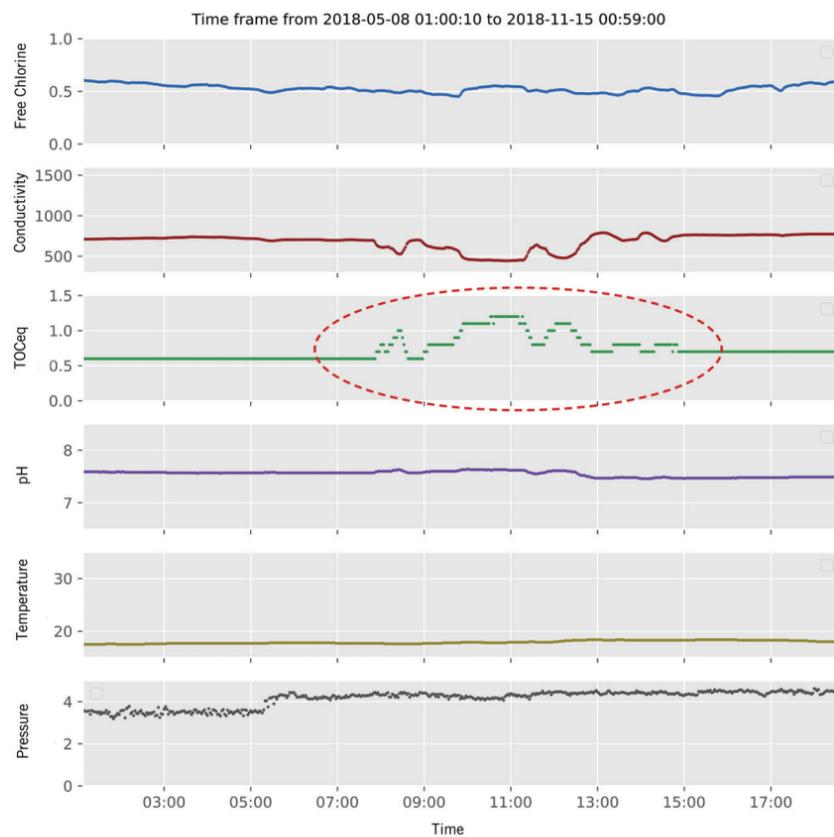
Figure 6: 3 months online data seemingly without an alarm

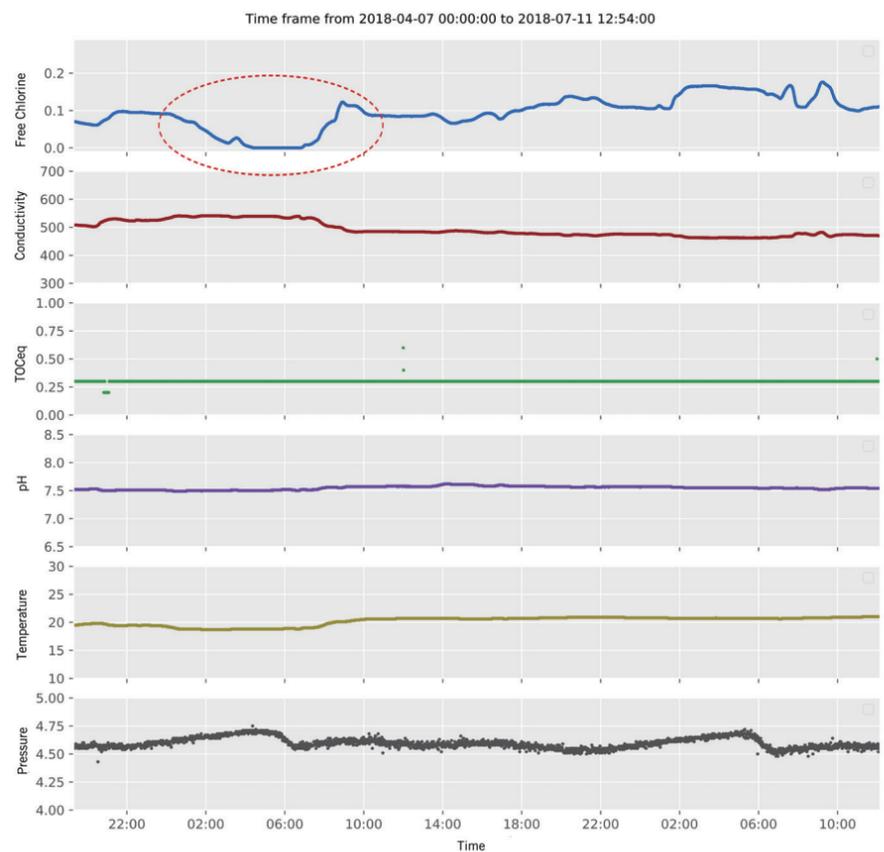*Figure 5: Event detection via the organic parameter TOC*

Figure 7: Detail of stable and precise online data: no chlorine disinfection for hours

The water quality data can be sent to any central database via almost any protocol using the s::can terminal con::cube.

The con::cube is a compact, powerful and versatile terminal for data acquisition and control. By integrating the latest processor technology, the flexible interfaces of the con::cube for connecting sensors to a SCADA or any central database system are ideal for remote monitoring. Thanks to the integrated modem and the low energy consumption, this data logger fulfils all requirements for the operation in decentralised installation locations.

Application examples

Multiple pipe::scans are the ideal solution to monitor drinking water in the drinking water network at any accessible point. Some of these systems have been installed in distribution networks of major European cities for a long period of time already.

It can be seen from the data how well the continuous measurement of several parameters is performed in high resolution and without drift under fluctuating pressure conditions over many months, refer to Figure 4.

In detail you can see day and night pressure fluctuations in the drinking water network between 3 and 4 bar. Distinctive changes in the conductivity indicate different water sources, in this case, for example, ground water or processed surface water.

Furthermore, with the pipe::scan, organic parameters such as TOC, DOC or UV254 can be measured very precisely. These parameters are essential for determining contamination events in drinking water and for detecting water mixing from different sources, refer to Figure 5.

In the drinking water network of another city, it can be seen that although the concentrations of some parameters change continuously (Figure 6), no alarm limits are reached. Whereas, with the help of the extremely stable and accurate pipe::scan measurement, refer to Figure 7, you can see in detail that there is a strong decrease in free chlorine for a few hours and thus, no adequate disinfection took place in the drinking water network at this point at that time - an unwanted condition.

Figure 8: The pipe::scan is a sensor system for monitoring drinking water quality in pipes under pressure.

Conclusion

The pipe::scan is currently the only sensor system on the market with the following unique features:

- Accurate measurement in perfect agreement with standardised laboratory references, not just "trending"
- Up to 10 parameters in one system
- Continuous monitoring of organics (TOC, DOC, UV254, UVT), turbidity, colour, pH/Redox, EC, Pressure and temperature
- Totally flow-independent, even works under stagnant conditions in the drinking water network
- "Hot-maintenance" under pressure: Without interrupting the flow/pressure and individually possible for each sensor

- Full-scale event detection with real-time alarms
- 6 months maintenance interval: Efficient, reliable, stand alone operation with minimal maintenance

The innovative approach of measuring the water quality directly in the drinking water network with online sensors provides very valuable and comprehensive information, for example when a pipe breaks, or problems in chlorine dosing stations occur and these events then might lead to risks for the drinking water.

Drinking water safety is of great importance worldwide and by making extremely stable, accurate and robust sensor technology available, with the pipe::scan this is no longer a topic of the future but already reality.

References, bibliography:

[1] Directive of the Federal Minister for Social Security and Generations relating to the quality of water for human consumption (Drinking Water Regulation - TWV) original version: Federal Law Gazette II No. 304/2001 [CELEX-No.: 398L0083]

Author Contact Details
Robert Wurm, s::can Messtechnik GmbH,
Brigittagasse 22-24, 1200 Vienna, Austria,
• Tel: +43 1219 73930 • Email: rwurn@s-can.at • www.s-can.at

Author Contact Details
Andreas Weingartner, s::can Messtechnik GmbH
Brigittagasse 22-24, 1200 Vienna, Austria
• Tel: +43 1219 73930 • Email: aweingartner@s-can.at • www.s-can.at

Read, Print, Share or **Comment** on this Article at: **envirotech-online.com/article**