ONLINE PARTICLE COUNTER PAMAS WATERVIEWER

By PAMAS GmbH

Figure 1: PAMAS WaterViewer

THE PAMAS WATERVIEWER IS APPLIED FOR PARTICLE COUNTING OF PROCESS WATER, POOL WATER, RAW WATER, TREATED WATER AND MAINLY FOR DRINKING WATER.

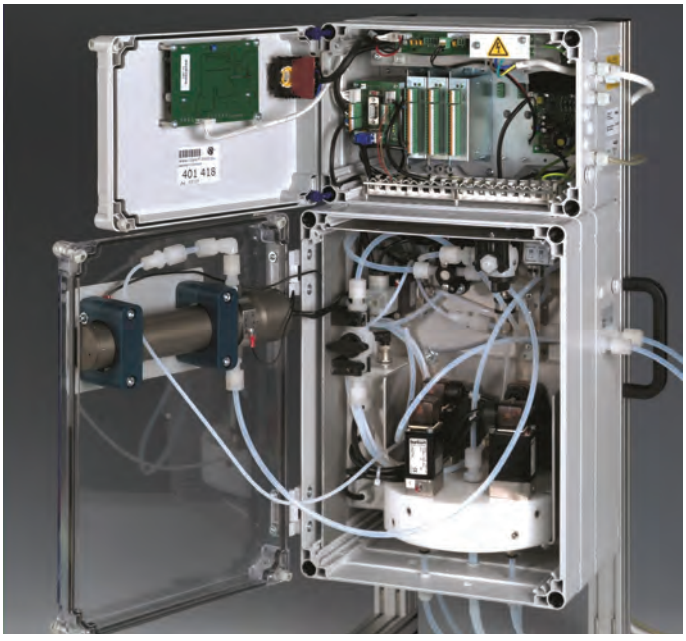

Figure 2: PAMAS WaterViewer with Multiplexer - The Optional Multiplexer Unit (Bottom Cabinet) for Simultaneous Measurement at Multiple Measuring Points

Introduction

The particle counter PAMAS WaterViewer is an online particle counting system for the control of water quality. The system can be designed for continuous online condition monitoring of multiple measuring points. With the aid of an optional Multiplexer Unit, the system may be connected to up to 32 measuring points. The PAMAS WaterViewer may be fitted with the automatic Sensor Flushing Unit PAMAS SFU which avoids the deposition of chemical components (manganese, chalk, iron, etc.) on the optical window of the measurement cell, which could diminish the laser light beam. So, the instrument stays in action round the clock without anyone having to care of it. The standard software, which is delivered along with the instrument, helps to program the measurement procedures and to handle the data and displays. This makes events and trends in the particle size distribution of the sample fluid easily visible over time. The PAMAS WaterViewer works in online mode and may be operated with or without PC and software.

The measuring data are down-loaded to the PC via plug and play interface. Alternatively, the PAMAS WaterViewer can read in digital data from other sensors and transmit measurement data as analogue signal to external PLC (Programmable Logic Controller). The PAMAS WaterViewer can also be controlled bi-directional by Modbus Interface. ☞ **www.pamas.de**

Turbidity vs. Particle Counting

Quite often we are asked about the difference between turbidity measurements and particle counting. Turbidity is an optical measurement where the measuring signal depends on the complete particle population. It is proven by many users that particle counting makes much more events visible: It is the result of an optical method where the measurement result depends on each single particle of that population, as the particles are counted and sized individually.

Beta Ratio Analysis with PAMAS WVBeta Software

Another special application is the use of two PAMAS WaterViewer units connected to the PAMAS WVBeta software for PAMAS WaterViewer. This is more and more of interest to measure the Beta Ratio of a drinking water filtration application. Examples are there in proving the log-reduction of particles at membrane filtration units.

In which specific fields of application is the PAMAS WaterViewer a tried and trusted measuring instrument? Who is using the instrument in real life? Potential customers and users of PAMAS instruments often ask for references and for actual application examples already in progress. To give an idea, the following report summarizes application examples of the PAMAS WaterViewer. All application reports described below have been tested and experienced by users in practice. The use of the PAMAS WaterViewer is a tried and trusted measuring instrument for these applications.

Application examples for the PAMAS WaterViewer

- Ahlstrom Glassfibre Oy, Karhula: Particle analysis in filtration system for process water in Finland
- Electrabel GDF Suez, Tihange: Filter control in secondary water cooling circuit of the Nuclear Power Station of Tihange 3 in Belgium
- Fachklinik Bad Bentheim: Particle counting in Pool Water Treatment Plant in Germany
- Het Waterlaboratorium (HWL), Haarlem: Particle analysis of self purification and disinfection capacity of wetlands in the Netherlands
- Polska Grupa Energetyczna (PGE) in Belchatow: Use of PAMAS WaterViewer for power generation in Poland
- PWN Water Company North-Holland: Particle analysis to determine the ideal distribution network design in potable water supply system in the Netherlands
- Sam Bo Scientific Co. Ltd., Seoul: Use of PAMAS WaterViewer in potable water filtration plant in South Korea
- SFC Umwelttechnik GmbH, Salzburg: Application in water treatment plant in Austria
- KTL Kansanterveyslaitos (Finnish National Public Health Institute): Finnish studies on particle analysis of bacteria in water distribution systems in Finland
- KWR Watercycle Research Institute (formerly Kiwa Water Research), Nieuwegein: For water treatment research, the KWR institute mainly uses the PAMAS WaterViewer as standard measuring instrument.
- Technical University Delft: Studies on drinking water production at the Technical University of Delft in the Netherlands
- THL Finnish National Institute for Health and Welfare, Kuopio: Use of PAMAS WaterViewer and PAMAS SVSS for drinking water quality control
- Université de Lorraine, Nancy: Quality control in water treatment plant of Nancy in France

Figure 3: Water Treatment Plant of the City of Nancy in France

- Vitens B.V., Spannenburg: Particle counting after rapid sand filters in the Netherlands and applications about early warning system and counting in the distribution network
- Waternet, Amsterdam and Haarlem: Water condition monitoring in water treatment plant of Amsterdam and Haarlem in the Netherlands

Case Examples

Ahlstrom Glassfibre Oy, Karhula/Finnland - PAMAS WaterViewer Used in a Process Water Filtration Plant in Finland

The PAMAS WaterViewer proved useful in a Process Water Filtration Plant in Finland: Back-flushing and normal operation can be identified by the particle concentration pattern for the different particle sizes. It can be used as an easy-to-handle tool for permanent monitoring of the filtration process. The analyzing results provided by the PAMAS WaterViewer helped to optimize the filtration process, saving energy, time and money.

Electrabel GDF Suez, Tihange/Belgium - Particle Counting for Filter Control in Power Generation

The Belgian power producer Electrabel GDF Suez uses the PAMAS WaterViewer to measure and control the filters in the secondary water cooling circuit of the Nuclear Power Station of Tihange 3 in Belgium.

Fachklinik (Hospital) Bad Bentheim, Germany - PAMAS WaterViewer as Control Instrument for Pool Water Treatment in Germany

With the aid of a PAMAS WaterViewer, three engineers one each of the Paul Niederberghaus & Partner GmbH at Ibbenbüren, of the IWW water centre at Mülheim an der Ruhr and of the IWT engineering firm for Water Technology at Hanover had proved that a filtration flow rate of 30 m/h suffices to filter and treat the pool water in the hospital's swimming pool in Bad Bentheim. The analysis had been commissioned due to a prior change in regulations of pool water treatment. According to this modification, the hospital bath management was compelled to reduce the filtration speed to 20 m/h. The legal regulations had been modified because of the assumption that particles could not be removed effectively at higher flow rates during filtration and that the pool water hence could not be purified from contaminants to the required level at a higher flow rate. Filtration speed reduction however would have resulted in severe economic disadvantages.

The hospital bath management therefore decided to verify the need of a reduced filtration speed and asked external experts to analyze the particle concentration at different filtration flow rates. The analysis showed that the pool water was sufficiently filtered at a flow rate of 30 m/h. A speed reduction to 20 m/h hence was not necessary.

The measuring results of the PAMAS WaterViewer attested a good filtrate quality: After filtration, the mean measuring value was at 50 particles per milliliter for particle sizes above 1 micron. In this application, the PAMAS WaterViewer had considerably contributed in the reduction of cost of pool water treatment.

Het Waterlaboratorium (HWL), Haarlem/ The Netherlands - Self-Cleaning Effect and Disinfection Capacity of Constructed Wetlands

On behalf of Waternet, the HWL laboratory analyzed the decrease of pathogens in constructed wetlands. With the aid of the PAMAS WaterViewer, the laboratory could test and verify that the number of contaminants gradually decreases in wetland water. Due to processes such as sedimentation, natural mortality, grazing, biofilm trapping and UV-disinfection, wetlands are able to clean and purify their water reservoirs themselves.

For this specific application, the PAMAS WaterViewer had been equipped with the light extinction sensor PAMAS HCB-LD-100. The particle sizes of 2 to 500 µm were measured.

Polska Grupa Energetyczna (PGE) in Belchatow, Poland - Use of PAMAS WaterViewer for Power Generation

PGE is the largest power producer in Poland and operates Europe's biggest thermal power plant in Belchatow. In the turbines of the power plant, hot steam is used for power generation. Only very clean, filtered water free of particles can be used to produce the hot steam. For water cleanliness

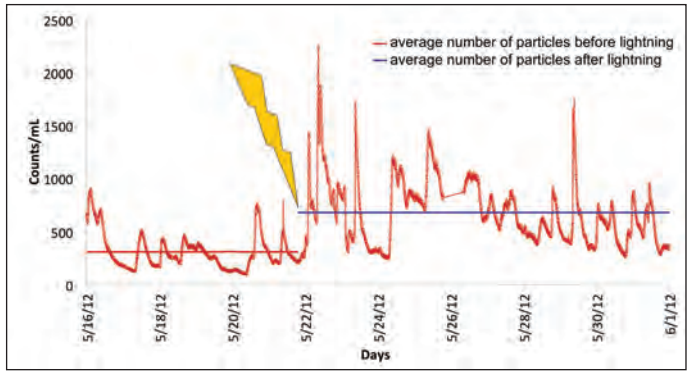

Figure 4: The Measuring Results of PAMAS WaterViewer Clearly Showed that the Average Number of Particles Per Milliliter was Seriously Increased Due to the Lightning Event and the Changes in Water Production and Distribution.

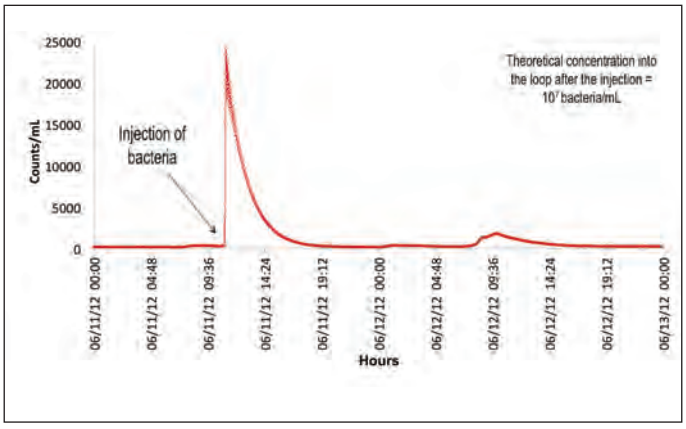

Figure 5: The Injected Bacteria Suspension was Visible in the Particle Counts Only During the First Hour After Injection. Due to Sedimentation and Dilution, the Particle Concentration Decreased Very Soon.

control, PGE has been installing six instruments of the PAMAS WaterViewer since 2008.

PWN Water Company North-Holland in the Netherlands - Identification of Ideal Structure and Design of Water Distribution Systems

On behalf of the Dutch waterworks PWN, Loet Rosenthal analyzed the requirements for pipe construction in water distribution systems. With the aid of the PAMAS WaterViewer, Rosenthal analyzed the particle concentration in water pipelines of different diameters. His analysis showed that pipelines with a smaller diameter generally contain less particles than pipelines with a larger diameter.

After flushing, the rinsing fluid of pipelines with a smaller diameter contains less particles than that of pipelines with a larger diameter. Loet Rosenthal concluded from his analysis that water pipelines with a smaller diameter have a self-cleaning effect. Thus pipelines with a smaller diameter are ideal for water distribution systems.

THL Finnish National Institute for Health and Welfare, Kuopio/ Finland - PAMAS WaterViewer and PAMAS SVSS for Drinking Water Quality Control

In October 2013, three scientists of the Finnish National Institute for Health and Welfare investigated suitable methods to detect changes in bacterial drinking water quality. Among other parameters, the water quality was determined through particle analysis. The particle contamination was analyzed with the aid of particle counters and turbidimeters. For particle counting, the scientists used the online instrument PAMAS WaterViewer with an integrated PAMAS HCB-LD sensor and the laboratory instrument PAMAS SVSS with an integrated PAMAS SLS-25/25 sensor.

In their study, Jenni Ikonen, Tarja Pitkänen and Ilkka T. Miettinen found out that particle counters are able to give immediate alert in case of deterioration of the water quality: "The comparison of total counts and particle fractions, during and after the contamination event highlighted the ability of particle counting to function as an early warning tool."

Furthermore, the study gave evidence on the fact the Automatic Particle Counters provide more precise and differentiated measuring results than turbidimeters: "The results confirmed that although turbidity is a good basic measurement for detecting changes in drinking water quality, the particle count gives more precise information. Particle counting was also found to work as a feasible indicator of bacterial counts in a real water contamination incident."

Université de Lorraine, Nancy/France - PAMAS WaterViewer for Quality Control of Potable Water in France

In collaboration with two scientists of the University of Lorraine, the PAMAS sales directors Paul Pollmann and Eric Colon presented a poster on "Particle counting for early detection of contaminants in drinking water" at the WCEC5 conference (Water Contamination Emergencies - Managing the Threats) in Mülheim an der Ruhr in Germany in November 2012. Based on measurements of a real application at the city waterworks of Nancy in France, the poster explained the use of the PAMAS WaterViewer for the quality control of drinking water.

Case Study

Use of PAMAS WaterViewer at the Water Treatment Plant of the City of Nancy in France

Particles were counted in three different online measurements: Under stable and normal conditions, the PAMAS WaterViewer measured a mean number of 310 P/ml in the specific interval of particle sizes between 1 to 15 µm (Figure 3).

In a second step, the particle concentration was analyzed after a major raining event. During a thunderstorm, a lightning stroke into the water treatment plant of the city of Nance and seriously affected the plant operation. The water production was stopped for several hours and water had to be taken out of highly chlorinated security reservoirs. When analyzing the water coming out of these reservoirs, the PAMAS WaterViewer counted between 801 P/ml and up to 2300 P/ml for the particle size range between 1 and 15 µm.

During the third experimental step of analysis, the water was contaminated by injecting a bacteria suspension into an isolated loop circuit, in order to examine the effects on water quality. During the first hours after injection, more than 20.000 P/ml were counted. The graph of online measurements however shows that the particle concentration decreased within few hours after injection. The authors of this study attribute this fast decrease of particles to sedimentation and dilution processes.

The analysis in the water treatment plant of Nancy gave evidence on the fact that the PAMAS WaterViewer is an ideal instrument for the early detection and warning of contaminants in drinking water. The online particle counter instantaneously gives alert in case of drastic changes in the measuring results

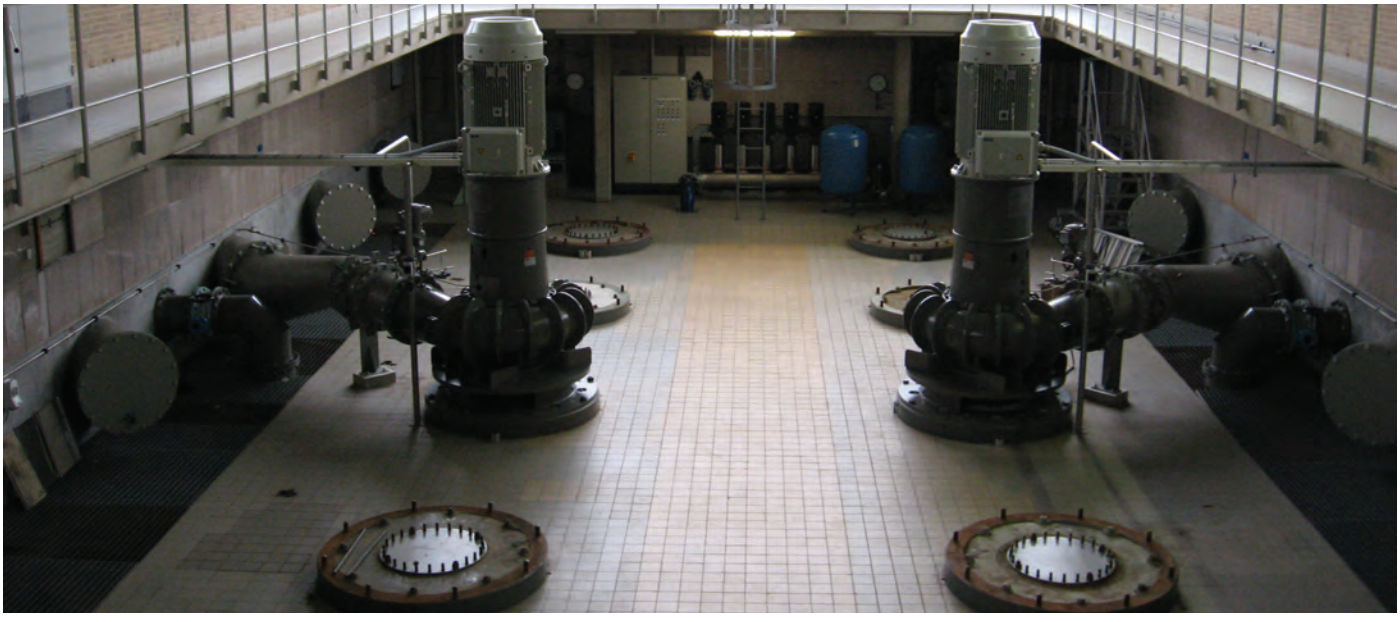

Figure 6: Pumps in Water Treatment Plant of the City of Amsterdam

and immediately informs about exceeding particle contamination (Figure 4 & 5).

Vitens B.V., Spannenburg, The Netherlands - PAMAS WaterViewer for Rapid Sand Filtration Control and Applications About Early Warning System and Counting in Distribution Network in the Netherlands

Rapid sand filters are very commonly used in many Northern European Countries. Water highly contaminated with particles is filtered to remove most of the particle load. Depending on the water source the filters are re-flushed every few hours or once after some days. Again the automated sensor flushing unit of the PAMAS WaterViewer proved to keep the system running unattended - also in presence of solved iron which tends to build up oxide layers, typically blocking optical instruments.

Waternet, Amsterdam and Haarlem, The Netherlands - PAMAS WaterViewer for Drinking Water Analysis in Water Treatment Plants of Amsterdam and Haarlem

In 2008, the Dutch company Waternet installed the PAMAS WaterViewer in two drinking water production plants in Amsterdam and Haarlem. At both locations, the online particle counters are continuously measuring the drinking water where it is pumped into the distribution network. As soon as prior defined limits are exceeding, the PAMAS WaterViewer gives instantaneous alert.

Figure 6 shows the pump cellar in the water treatment plant of Amsterdam. The pumped water is permanently monitored through online analysis.

Conclusion

The water application examples of the years 2004 to 2013, which are described in this article, show how and for what purpose the PAMAS WaterViewer is used in today's application practice. The PAMAS WaterViewer online particle counter proved to be the ideal instrument for water quality verification and water cleanliness control. Numerous users appreciate the particle counter's measuring accuracy and reliability. In real world practice, the PAMAS WaterViewer is applied for particle counting of process water, pool water, raw water, treated water and mainly for drinking water.

Furthermore, the PAMAS WaterViewer is also tried and trusted as measuring instrument for scientific research, since it was used for the studies on drinking water treatment at the Finnish University of Kuopio, at the French University of Lorraine and at the Dutch Technical University Delft.

About the Contributor

PAMAS GmbH (founded in 1992), located near Stuttgart in Germany, is active throughout the world as a company focused on high-quality particle measuring systems. Whenever it comes to particle counting and particle sizing, PAMAS answers your needs for most applications. We at PAMAS have a continuing commitment to learn from our customers. This drives the design quality of our products, now regarded as the most reliable and accurate particle measuring instruments in the world. Furthermore, our experience over many years in this field enables us to provide individual support to every user of PAMAS equipment, including a wide variety of special applications. Our statement is to solve our customers' problems, not just to sell a particle counting system.

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