








# Innovative water treatment

## Fast and secure UMTS router enables convenient remote access to mobile, distributed wastewater treatment plants

A fast UMTS router is installed in an innovative wastewater treatment plant for the widely distributed deployment of keys for secure remote access. This means that container facilities, which are usually installed far away from any IT infrastructure, can be conveniently monitored and maintained via radio control. This enables larger amounts of data to be transmitted quickly and securely for process and wastewater analysis.

Remote villages, resorts, hotels (especially on islands), temporary housing on large construction sites and decentralized industrial facilities have one thing in common: The problem of legally compliant and environmentally responsible disposal, i.e. treatment, of their wastewater. When distances are great and the quantity of waste water is relatively small, connection to the nearest sewage treatment plant is often too difficult and costly, and building a new conventional plant locally is out of the question.

One very interesting solution to this problem that is technically innovative and economical has been developed by ItN Nanovation AG (see box) of Saarbrücken, Germany, over the last four years and is now ready for the market. A tailor-made plant for distributed wastewater treatment in a compact, turn-key container design. This is an application of the "Ceramic Flat Membrane (CFM)" system from ItN Nanovation – here in conjunction with the three-stage "Moving Bed Bio Reactor (MBBR)" process specifically optimized for decentralized treatment. The essential components for reliable, trouble-free, long-term operation and convenient remote control and maintenance are provided by the portfolio of automation technology from Siemens.



A guarantee for consistently reliable, unmanned operation is the integrated, industry-proven control, drive and communication technology from Siemens. Similar to SCALANCE M875 UMTS router, it is designed for operation in an extended temperature range of -30 to +75 °C and therefore ideal for use in the containers that are usually located outdoors.

### Compactly packaged in containers

The company builds the entire process and automation technology in standard ISO containers (20 and 40 feet) ready for transport and operation. The capacity is 50 and 100 cubic meters of wastewater per day, respectively. Multiple containers are simply strung together for larger quantities.

The principle is simple and effective. Solids in pre-filtered inflowing wastewater are first minced by a grinding pump. This is followed by biological degradation using bacteria on so-called chips (which float free in the tanks) in three identical stages that alternate between oxygen-rich and oxygen-poor environments. The last step after sedimentation is filtration, in which the water is injected under pressure through the nano-coated ceramic membrane filter. The final result is clean, germ-free water, which can be safely drained into rivers, used for irrigation of crops or for cleaning purposes. Compared to other methods, the process is characterized (due to the internal recirculation) by a very small amount of residual material (sediment), which ideally can be completely decomposed biologically using only plant growth on a bed of reeds.

### Reliable automation from a single mold

The decomposition process is started and continually monitored using modern Siemens automation technology: An IM151 8 PN/DP CPU interface module configured within a SIMATIC ET 200S distributed I/O system is used for controlling the process. The system is distinguished by its integrated controller, as well as reduced wiring and space requirements. Converters from the SINAMICS G120 series are connected for speed-controlled operation of the inflow and circulation pumps. The various measurements and signals from the process are processed by means of analog and digital input and output modules. A SIMATIC Microbox PC (IPC427C) with a thin-client operating terminal is installed as a data collection and visualization computer on the shown test system. A SIMATIC Multi Panel or Comfort Panel will be preferred in the future to efficiently handle an increasing number of process parameters and the resulting larger amounts of data.

### Fast and secure remote access

To reliably operate even the most remote plants "unmanned", you need sufficiently fast access from a distance. Because an existing IT infrastructure can/may rarely be used (as is the case in industrial plants that are "shielded" from the outside), the focus from the start has been on an autonomous, wireless solution. The latest technology in this regard is the fast and secure SCALANCE M875 UMTS router from Siemens: The device supports the transmission modes HSDPA (High Speed Downlink Packet Access) and HSUPA (High Speed Uplink Packet Access), which provide high transmission rates of up to 14.4 Mbps in the downlink and 5.76 Mbps in the uplink (depending on the provider). When no UMTS network is available, data can be sent on the GSM cellular network using EGPRS ("Edge") and GPRS (General Packet Radio Service).



Fast and secure (thanks to the firewall and VPN with IPSec) WAN communication is an essential feature of the new SCALANCE M875 UMTS router from Siemens.

“With a fast UMTS connection, the image refresh times (of half a second) are significantly shorter than with the fastest access previously possible via GPRS,” says Dr. Martin Kaschek, Head of Process Engineering CFM Systems at ItN, who developed and optimized the method and process engineering. “This means you can operate and monitor the system well from a distance.” The service technician sees all screen content and information (pressures, temperatures, flow rates and even plain-text error messages) on the remote system, allowing him to intervene in the process as needed.

Secure “Virtual Private Network (VPN)” connections are used in any case to send data in accordance with the IPSec standard (Internet Protocol Security). This enables IP packets to be sent cryptographically secure (through encryption and authentication mechanisms) over “unsafe” public networks. Additional protection against undesired access is also provided by a “stateful inspection firewall”. This firewall filters data packets based on the state and enables or disables communication connections according to a filter list. The firewall can be used as an alternative or in addition to the VPN.

The company plans to hand over responsibility for service and maintenance to a (company-owned) service provider in the U.S., the potentially largest market, when plant sales increase. This service provider will log into the various plants at regular intervals and look after things remotely. The plants themselves will regularly send an e-mail at midnight (or immediately if a problem occurs in the process) to the head office or a designated recipient, who can then immediately take appropriate measures. As a side note: A convenient Web interface is provided for configuration and management of the router.

The hardware of the secure SCALANCE M875 UMTS router is designed for an extended temperature range of -30 to +75 °C and is therefore ideal for use in containers that are normally located outdoors. Unlike previous devices, there is a second (unused) RJ45 port through which a programmer or on-site service technician can log onto the local network of the treatment plant during operation and directly intervene in the process.

The new SCALANCE router also makes it feasible and possible to send live Webcam images from the containers, which may be useful from a remote location especially before and after maintenance work (e.g. automatic cleaning). ItN is also working on a container version requiring even less energy for deployment in specific regions; one which uses only solar energy. The company from Saarbrücken is working together with Siemens in this regard.



Thanks to the fast wireless transmission via secure UMTS router, the treatment plants can be operated and maintained both locally and remotely.



The „moving bed“ of the bioreactor is formed by so-called chips, which float freely in the containers and are used for the bacteria biology.

### Proven in practice

The plant described here was installed specifically for advanced testing and optimization purposes at the nearby sewage treatment plant of the Entsorgungsverband Saar (EVS) in Saarbrücken-Burbach. Their developers have fast “remote access” via UMTS and can also immediately test all feature enhancements to continuously improve the hardware and software of the system in addition to the process itself.

Several of these compact systems have proven to be successful at various locations in the United States, Saudi Arabia and Germany. One such installation is the sewage treatment for remote Indian pueblos in the desert of New Mexico.

### Innovative nanotechnology for the world market

ItN Nanovation (Saarbrücken) is one of the world’s leading nanotechnology companies. It develops innovative ceramic products such as filter systems and coatings for large industrial customers. The so-called nanoscale powder required for this purpose is manufactured by the company itself.

The filter products for drinking water treatment and water purification can be used as filters in the beverage industry and for the separation of oil and water. Ceramic coatings based on nanotechnology are used as protective and catalytic coatings in a wide range of applications and in a variety of industries from baking ovens and aluminum foundries to coal-fired plants.

The company was founded in 2000 and currently has around 50 employees. The company’s success is based on an extensive patent portfolio, combined with comprehensive development and application know-how.

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