



Wastewater treatment plant modernizes rain overflow basins with PLCnext Technology Ideally equipped for future requirements as well

Highlights

- The Warendorf wastewater treatment system is updated frequently to include the latest automation technology.
- The latest retrofit increased efficiency, reduced support resources, and upgraded the communications network for a rain overflow basin.
- The PLCnext Technology ecosystem is the foundation for a more reliable, future-proof operation.

Customer profile

Warendorf is a town in western Germany, and the capital of the Warendorf District. The town is best known today for its well-preserved medieval town center, horse-riding, and the opportunities provided for cycling. The Warendorf wastewater treatment system includes two wastewater treatment plants, several pumping stations, and special facilities, such as rain overflow basins and rainwater spillways.

Challenge: “Stagnation is regression”

The Warendorf wastewater treatment plant operator updates the technology in its systems on an ongoing basis.

To increase system efficiency and reduce the necessary resources, the operator regularly modernizes and equips the system with the latest technologies. As a part of the latest retrofit measures, the decentralized rain overflow basins in the Hoetmar district of Warendorf were coupled directly to the network, the local emergency power generators were replaced, and the automation level was updated. The utility has two augers with a maximum conveying capacity of 1.7 million gallons (6,500 cubic meters) and a basin volume of around 264,000 gallons (1,000 cubic meters). The rain overflow basin is located upstream of a small, decentralized wastewater treatment plant.

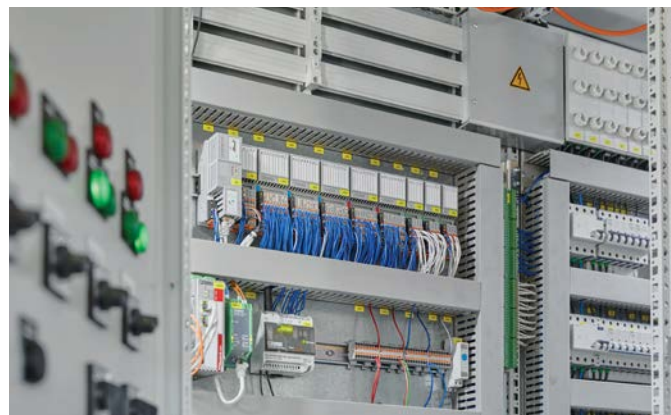


Figure 1: As the central link, the AXC F 2152 PLCnext Control device supports a variety of protocols.

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Frank Linning, manager of the wastewater treatment plants and special facilities at the Warendorf wastewater operation

Solution: PLCnext supports a variety of interfaces

As a part of the modernization program, a programmable logic controller based on PLCnext Technology from Phoenix Contact was installed in the automation level. The protocols supported by the AXC F 2152 device, such as OPC UA, and the integrated security functions were significant reasons for selecting this controller. The controller is now the core element of the local automation concept for the rain overflow basins in Hoetmar. As the central link, it needs to support a variety of protocols. For example, classic fieldbus systems, such as Modbus/RTU and Modbus/TCP, can read and process the data from the frequency converter, the various measuring devices, and the new generator. Additional interfaces, such as PROFINET and OPC UA, will make it easy to integrate sensors and actuators in the future. Furthermore, various signals from the field can be recorded via the local bus participants, processed by the controller, and then issued (Figure 1).

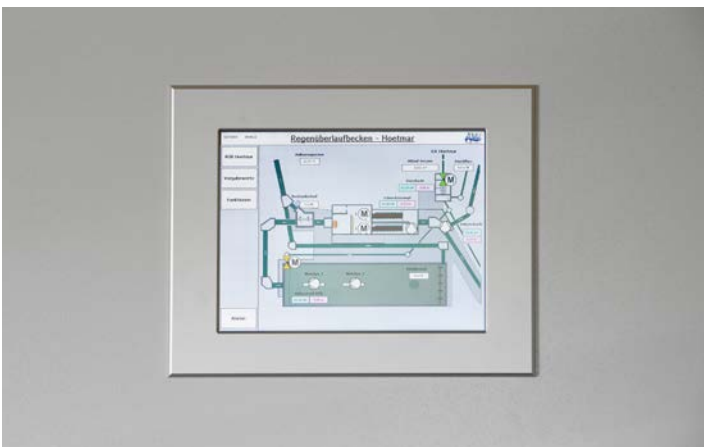


Figure 2: All relevant information is made available to the employees on the local user interface.

The OPC UA server installed in the AXC F 2152 controller provides the local user interface with information, so wastewater treatment plant employees have all the relevant data available at a glance. The local visualization system is based on the Visu+ SCADA system from Phoenix Contact. It displays the plant's current status and allows the employees to control the plants manually. (Figure 2)

Adoption of existing functions and program parts

The key system data is transmitted to the control system via the OPC UA protocol. The wastewater treatment plant operators can then regulate, control, and monitor the plants and processes from the control room. If the connection is interrupted, the historical data will be sent with a timestamp to the control room once the connection is re-established. This ensures that the data is not lost.

In the past, the data was transmitted to the control system via the classic IEC 60870-5-104 remote control protocol. The OPC UA

protocol offers simple implementation and flexibility, opening up significant advantages for the operator. Because of this and the protocol's user-friendliness, the Warendorf wastewater operation has standardized on OPC UA.

The application is programmed based on the IEC 61131 standard. Functions and program parts already in use could be adopted from the existing system and quickly adapted to the rain overflow basin's special requirements. The PLCnext Engineer software from Phoenix

Contact was used for the programming. The operator can also configure, diagnose, and visualize the entire system with this software. The wastewater treatment plant employees only have to be familiar with one tool to perform all tasks. This reduces the complexity of their work.

PLCnext Technology is highly scalable, as demonstrated by the fact that the open control platform can be used on multiple PLC performance classes while still behaving and operating in the same way. This allows the operator to use a lower-performance controller for small, decentralized facilities, and equip complex processes with a powerful controller. Should the complexity of the processes increase in the future, the PLCs in existing applications can be replaced very easily with a more powerful version (Figure 3).

Protection against unauthorized access

IT security is becoming ever more important in the age of digitalization. Against this backdrop, the Warendorf wastewater treatment operation has developed and put into practice a system-wide IT security concept. For example, the individual system parts are already segmented and protected by an upstream firewall — the FL mGuard security router from Phoenix Contact. The AXC F 2152 PLCnext Control device fits into this IT security concept perfectly, because it is already equipped with such key functions as an integrated firewall and user administration function.



Figure 3: Along with the PLCnext Control device, other Phoenix Contact components, such as a security appliance, switch, and power supplies, are also installed in the rain overflow basin control cabinets.



Figure 4: The individual system parts are segmented and protected by an upstream firewall — the FL mGuard security router from Phoenix Contact.

“Modernizing the rain overflow basin and the associated new automation technology has created the perfect foundation for solving future challenges,” says Frank Linning, manager of the wastewater treatment plants and special facilities at the Warendorf wastewater operation, summarizing the retrofit activities. “In particular, the IT security functions available in PLCnext Technology and its support for OPC UA communications make it a perfect fit for our automation philosophy.” (Figure 4).

Store for software applications

Along with the PLCnext Control devices and PLCnext Engineer software, the PLCnext Technology ecosystem also includes the PLCnext Community and the PLCnext Store. The store features software applications (apps) that can easily extend the functions of the PLCnext Control devices. The store has software libraries — such as Waterworx — for faster programming, as well as fully programmed apps that can be used without any prior programming knowledge.

For example, the “Pump Station Control” app makes it possible to continuously monitor and control decentralized pumping stations. The app collects the relevant measurement and operating data to diagnose the operating states of the pumps. When necessary, it can initiate predictive maintenance. Moreover, an intelligent level-control function can also prevent the pumps from running dry. The intelligent web visualization system allows the app, which simply needs to be configured, to be commissioned quickly. Standardized interfaces are also available for integrating application-specific analog measurement technology.

The firewall installed in the controller limits and monitors the controller connections based on specific rules. Employees can use a configuration page in the browser to make the appropriate settings. As already mentioned, along with the firewall, the new control technology also includes a user administration function, which allows all user rights to be adapted and changed individually. This is also configured directly on the controller via the web-based management system. In addition to the firewall and the user administration function, the VPN function installed in the AXC F 2152 represents added value for the Warendorf wastewater operation. The PLCnext Control device can be connected directly and securely to the central infrastructure via the Virtual Private Network tunnel.



Figure 5: The rain overflow basin in Hoetmar has a volume of 1,000 cubic meters.

Results: Easy optimization — now and into the future

The demands and framework conditions in water management systems are changing faster than ever. To optimize their processes, wastewater systems need to record and process more data and information than ever before. The foundation for this is a flexible and open automation technology that also supports future standards, is easy for employees to use, and truly supports them in their everyday work. PLCnext Technology meets these demands.

More information:

www.phoenixcontact.com/water