Customer reference

Intelligent remote control solution for piping networks

Reliable water supply without any losses

Customer profile

The Albstadtwerke energy and water utility supplies its customers with electricity, natural gas, water, and heat. In order that the piping network necessary for the power supply always functions perfectly, it must be monitored continuously. To this end, a modern remote control solution based on the license-free Radioline wireless system from Phoenix Contact ensures the reliable connection of the widely distributed and branched measuring stations to the control center.

Albstadtwerke is a service and supply company operating in the fields of electricity, natural gas, heat, water, and swimming pools. It supplies up to 2.2 billion liters of drinking water annually via a 960 km piping network. It has 14 decentralized combined heat and power plants that generate local heat. The electrical energy generated flows into the local distribution grid, while the thermal energy can be used for heating and hot water.

The challenge

Distribution of measuring points across the entire urban area

Piping is among the most important components of technical infrastructure. It is required for the transportation of liquid or gaseous substances. The requirements for safety technology and process data acquisition are as varied as the areas of application. Leaks can lead to environmental damage or economic losses, for example, which is why appropriate monitoring systems are required. At the same time, the trouble-free operation of piping is based on precise knowledge of the operating parameters.

The measuring points that Albstadtwerke has set up for leakage monitoring, for recording the temperature and heat output of the combined heat and power plants, and for recording the water and heat quantities are spread across the entire urban area. “The options for connecting the measuring points to the control center in our operations building were limited,” explains Thomas Haas, responsible for investment and maintenance planning at Albstadtwerke. “The available budget and local conditions meant that it was not possible to lay new underground cables. A cellular communication solution was also out of the question, as the Albstadtwerke must have network sovereignty in order to be able to exert influence in the event of a fault.” In addition, the power provider has to meet the requirements of the IT Security Act for Critical Infrastructures (KRITIS), which did not make the selection any easier.

The solution

Determining the optimum position of wireless devices and antennas

With this in mind, the individual outstations were to be connected to the control center via radio relay connections. Those responsible chose the Radioline wireless system from Phoenix Contact. The advantage of the license-free and provider-independent solution is that there are no running costs. In addition, private wireless networks are not overloaded compared to cellular networks and are therefore failsafe. The universal Radioline wireless system can also be used to exchange sensor and actuator information as well as serial data in spatially extended systems.

Once the technical support staff from Phoenix Contact had completed the initial route planning, the ideal position of the wireless devices and antennas was determined on site. In this context, it became apparent that the measuring points located in the urban area were obscured by trees and buildings. In such cases, the modular Radioline system allows the use of different radio frequencies. The wireless experts therefore suggested that the employees of Albstadtwerke conduct a test with devices operating in the 868 MHz frequency band. Compared to the 2.4 GHz band, the 868 MHz frequency band is characterized by a better penetration of obstacles. This is due to the lower frequency range and the higher transmission power this permits.

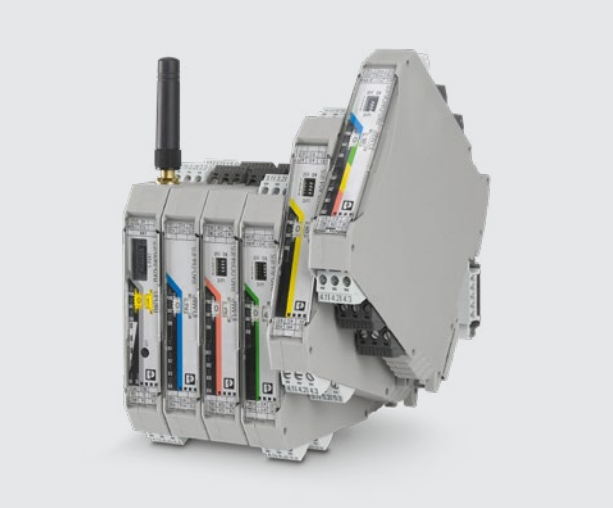
> “Through the use of Radioline, all measured values can now be recorded continuously.”
>
> *Thomas Haas,*
> *responsible for investment and maintenance planning at Albstadtwerke*

Connection to the controller via RS-485 interface

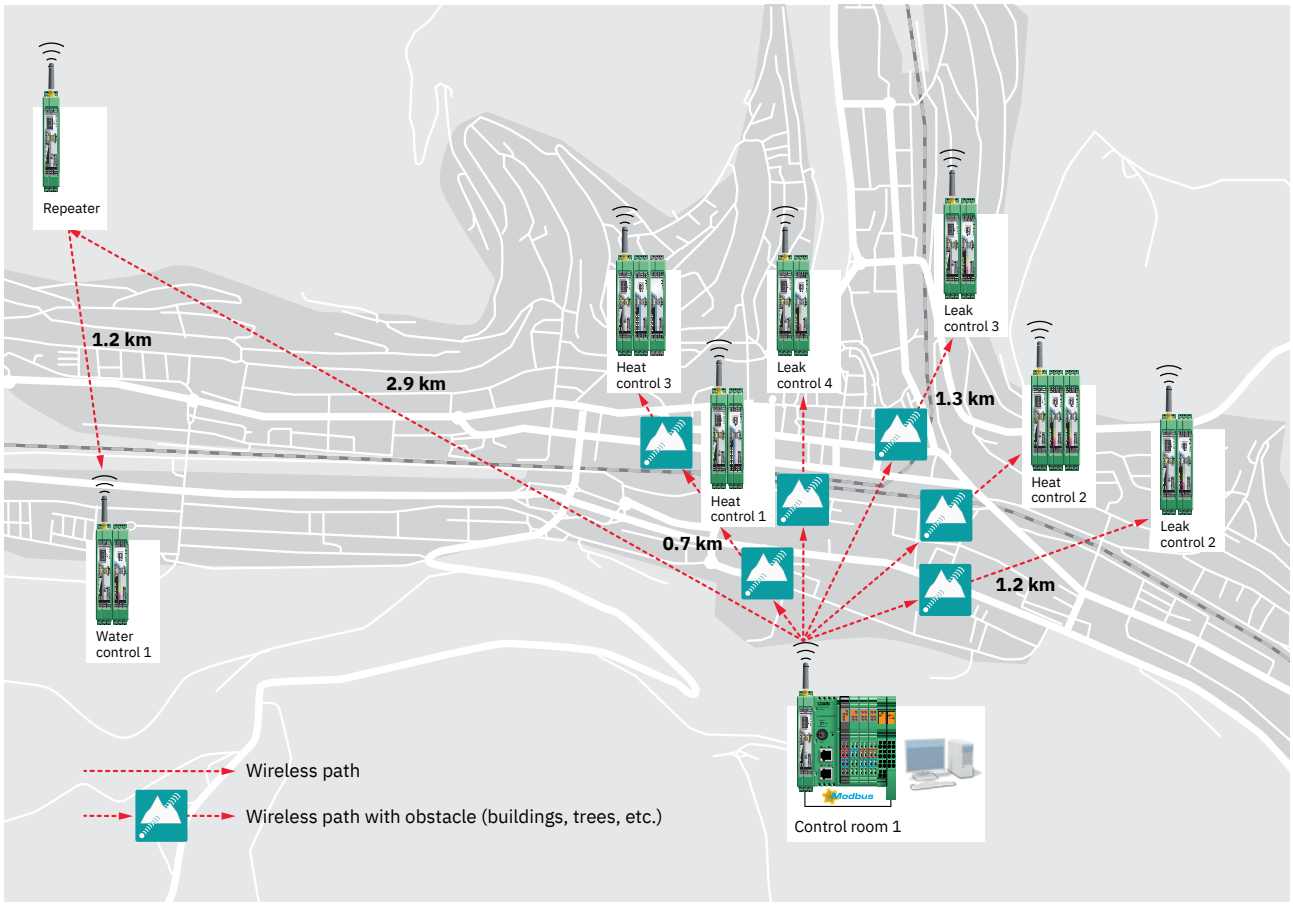
Due to the local conditions, the measuring points had to be distributed across two wireless networks. Eight measuring points have been connected to the base station installed in an elevated tank and two further measuring points to a base station installed in the Albstadtwerke company building. “Aligning the antennas was easy, thanks to a bar graph display integrated into the wireless module,” reports Thomas Haas.

An ILC 191 Inline controller from Phoenix Contact, which communicates directly with the control center, is mounted next to each of the two base stations.

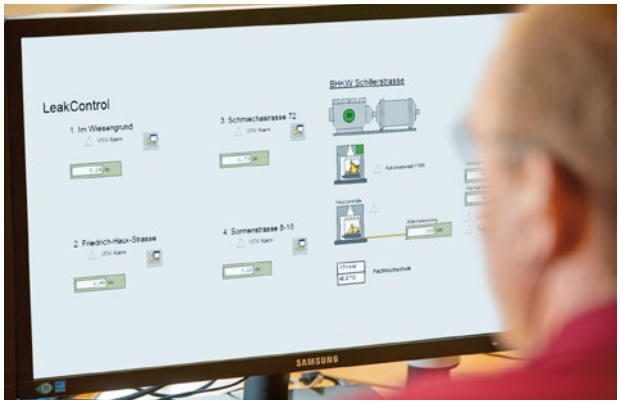
The remote stations transmit their measured values via digital and analog I/O extension modules to the base station, where they are stored in internal Modbus tables. The tables also include diagnostic information about the wireless path, such as the RSSI (Receiver Signal Strength Indicator). Based on this value, the reception quality of each individual wireless station can be continuously recorded and monitored. Via built-in RS-485 interfaces, the base stations are connected to the ILC 191 controller, which stores the Modbus-coded data and sends them to the higher-level supervisory control system. Computers located in the control center document the inflows and outflows. They also statistically evaluate the water, heat, and gas supply. In the event of a fault in the substations, the system notifies the on-call team.



Radioline wireless system



The large network comprises eight measuring stations that send their data to the control center. There is another smaller network to the north in Truchtelfingen.



Everything at a glance: All data converge in the control center and are constantly monitored and logged

Security mechanisms to protect against attacks

The Radioline modules with transmission based on the robust Trusted Wireless technology have been developed for forwarding data over long distances. In addition to I/O signals, serial data can also be transmitted – without requiring a license, so there are no extra costs. The mesh network capability of the Radioline system enables up to 99 devices to communicate with each other via repeater/remote stations. As soon as the data exchange between two stations is interrupted, a new transmission path to another station nearby is automatically searched for. This ensures permanent communication between the decentralized stations and the control center.

With proprietary technology such as Trusted Wireless, the protocol is not publicly accessible, which means fundamentally better protection against attacks. Phoenix Contact has also implemented security mechanisms in the technology: 128-bit AES encryption ensures that data packets that could be intercepted in theory cannot be understood, while the integrity check verifies the authenticity of the sender and discards messages that have been altered. The so-called frequency hopping spread spectrum (FHSS) increases the robustness of the transmission. Due to these mechanisms and the fact that the wireless system does not have an Ethernet interface and therefore only forwards Modbus-coded I/O signals, Trusted Wireless is particularly suitable for use in critical infrastructure applications.

Measuring station for recording the amount of heat at the Albstadt-Sigmaringen University of Applied Sciences

Covering long distances

The wireless technology, which operates in the 2.4 GHz, 868 MHz, and 900 MHz frequency bands, is characterized by high robustness and reliability as well as the ability to cover long distances. For this purpose, the data rate of the wireless interface can be set individually so that the receiver sensitivity can be increased. Much longer distances can be covered with a low data rate than with a high transmission speed. Therefore, the users can perfectly tailor the Radioline devices to the corresponding application. Trusted Wireless also features good diagnostic

options and coexists with other systems transmitting in the same frequency band.

"Through the use of Radioline, all measured values can now be recorded continuously," concludes Thomas Haas. "This means that faults are detected early on and we can take countermeasures immediately. Based on the positive experience with the wireless technology and the good service we have received, we are planning to integrate further measuring points into the wireless networks."

Assessment of feasibility with radio frequency site survey

The feasibility of a wireless path can be evaluated using special software. For this purpose, the tool provides a terrain section with height profile based on the substation coordinates provided. In this way, obstacles such as mountains, hills, trees, or buildings can be determined. Furthermore, the software enables the precise determination of the antenna positioning and height, as well as the location of the necessary repeater stations. With this information, users can make an assessment of the feasibility of the wireless connection.

For more information, simply enter the web code into the search field on our website.

Web code: #1927

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