

Customer reference

Wireless-based valve monitoring in a Spanish refinery

No costly errors within the process

Customer profile

A refinery processes hundreds of thousands of barrels of oil every day. Liquids and gases are produced between the individual process steps and are constantly pumped back and forth between the process plants and storage tanks via piping. If a valve is set incorrectly, raw products may be mixed unintentionally. At the Petronor refinery in Muskiz, Spain, the Radioline wireless system is therefore

used for the remote monitoring of valve positions, pumping stations, and plant pressure levels.

Petronor S.A. was founded in Muskiz, near the Basque city of Bilbao, in 1968. Today, the company operates the largest refinery in Spain, processing around 11 million metric tons of hydrocarbons every year. During the production process, crude oil is heated several times, causing its various components to separate according to their density in distillation columns. The most important components include



butane, propane, naphtha, kerosene, gasoline, diesel, petroleum, heating oil, coke, and asphalt.

To ensure that the fuels at every service station are of the same quality, these substances are then refined at another refinery in Muskiz and harmonized to standardized values. The refining process includes the removal of sulfur and the addition of additives.

The challenge

Due to the surrounding mountains and the village of Muskiz, the refinery cannot expand any further. As a result, there are fewer storage tanks on the site than in most refineries of a similar size. In order to achieve corresponding production capacities even with the limited number of tanks, the raw materials have to be transported many times. Around 100 transfers take place daily between the tanks, which have a capacity of up to 30,000 m³.

The solution

Installation effort significantly reduced

Petronor started by implementing a new SCADA system and simultaneously modernizing its field infrastructure. These improvements focused on monitoring internal material transport, as this has a significant impact on the throughput and efficiency of a plant. In addition, an incorrect valve position can result in reworking costs running into millions.

The concept that was originally developed envisaged networking the relevant process elements – such as pumps, valves, and pressure sensors – via Modbus/RTU using an RS-485 bus system. When the economic crisis hit Spain, the planned budgets were significantly reduced, which meant that this solution could no longer be implemented.

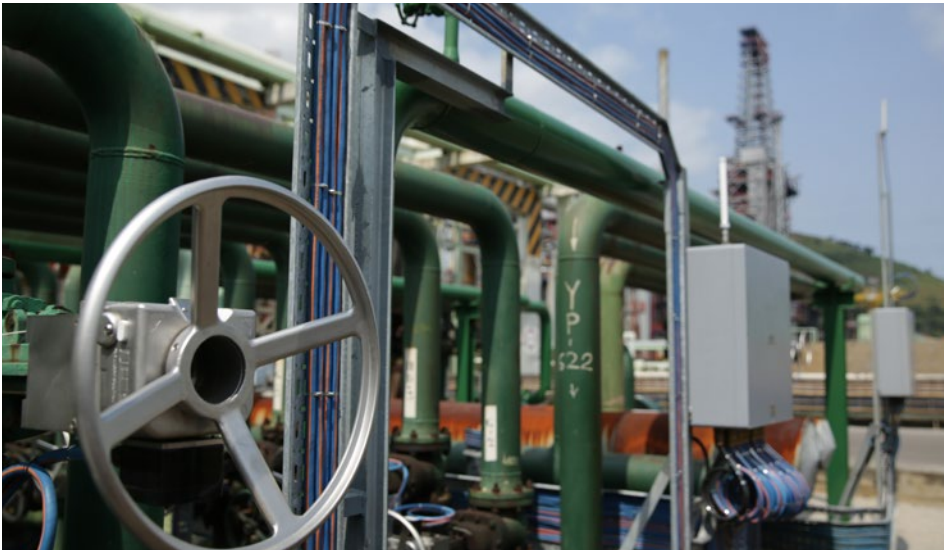
Under considerable cost pressure, company managers were now looking for alternatives. “During our research, we came across the Radioline wireless system from Phoenix Contact,” reports José Maria Elexpe Rovira, the Lead Project Engineer in the Optimization and Control Technology department.

Proven reliability

However, the Radioline wireless system first had to demonstrate its reliability and immunity to interference in a test application under real conditions. To do this, measured values were transmitted both via the existing lines and in parallel via wireless communication, and recorded in the control room. The Trusted Wireless technology, on which the Radioline system is based, demonstrated its high availability here. The same was true when it came to coexistence with other nearby wireless systems, as Petronor uses WLAN in some areas of the refinery. After two years of successful testing of this wireless communication method, work began on converting the infrastructure in the field. To this end, more than 2,000 valves have been equipped with

“The wireless solution allowed us to replace the RS-485 cabling with wireless data transmission and therefore significantly reduce the installation effort involved. In addition to the cost savings, we were also impressed by Radioline’s high level of flexibility and security, as well as the user experiences from other areas of industry.”

*José Maria Elexpe Rovira,
Project Engineer in the Optimization and Control Technology department*



Solid steel pipes are no obstacle to wireless transmission

valve position indicators (VPI), which enable remote monitoring of the valve position via limit switches.

Parallel to this, the Oil & Gas System Management specialists from Phoenix Contact developed the control cabinet concepts for recording the approximately 4,000 field signals from Ex zone 1. The solution is based on the modular I/O system Inline, where communication heads for Modbus/RTU and Ex modules are used. The extensive Inline portfolio flexibly covers the various requirements of different areas of industry, e.g., in terms of the number of channels, ambient temperature, and approvals.

Flexible expansion of the wireless network supported

The Radioline modules act as a wireless replacement for cables for Modbus/RTU transmission to the control room. They operate in the 2.4 GHz ISM band and can therefore be used worldwide. At the Petronor refinery, the 340 stations were distributed across seven logical wireless networks, which are based on the individual parts of the plant. Within the wireless network, each wireless station also serves as a repeater for stations located further away. The mesh network set up in this way allows the wireless network to repair itself if a station fails. This ensures reliable communication between the other wireless devices. Furthermore, each of the seven

subnetworks can be expanded to up to 250 wireless stations in the future, providing a generous reserve for the further digitalization of the refinery.

The control room now has continuous access to data on valve positions, line pressure levels, and pumping stations. This allows material transport through the pipeline networks to be monitored centrally and liquids and gases to be transported from one of the defined sources to the specified destination. The costly contamination of various products can therefore be safely avoided. In addition, the workload of field operators is significantly reduced because the routes for material transport can be configured, controlled, and monitored.



The routes for material transport can be configured, controlled, and monitored in the control room



To ensure that system faults can be detected at an early stage, valve operation will still be manual in the future

The operator wants valve operation to still be manual in the future so that employees retain an understanding of the overall process. The regular presence of employees on site also means that any necessary repairs to valves, screw connections, and other equipment can be identified at an early stage and carried out immediately.

Protection against any data manipulation

The project at Petronor shows that considerable cost savings can be achieved, especially when retrofitting existing process plants. To do this, classic cabling or a battery-powered wireless system is simply replaced by Radioline. At Petronor, this led to savings on around 40 km of data cables that would have

had to be laid through the Ex area during operation. The Radioline system can also be flexibly adapted to different plant sizes and architectures as well as individual requirements. This significantly reduces the time and costs involved in engineering.

The first stations of the wireless network were put into operation on the Muskiz site almost three years ago. The Radioline modules have been working smoothly and reliably since then. The functions integrated into the wireless system – such as packet authentication, the proprietary protocol, and optional AES data encryption – protect communication against any data manipulation. This means that nothing stands in the way of the wireless solution being used even in critical applications in the fields of process technology or power generation and distribution.

Easy commissioning via thumbwheel

A maximum of 250 stations can be networked wirelessly with the Radioline system. Depending on the selected frequency, distances of up to 10 km can be bridged between two devices. Since each module also functions as a repeater for downstream stations, the total extent of the network is significantly larger. The portfolio includes communication heads for the 2.4 GHz, 868 MHz, and 900 MHz frequency bands as well as RS-485 transmission. Integrated blacklisting allows two WLAN channels to be hidden, ensuring that Radioline and WLAN components do not influence each other. From point-to-point and star networks to self-healing mesh networks – a wide range of structures are possible.

Users can flexibly add I/O modules to any Radioline device in order to exchange sensor/actuator information. For commissioning, the I/O information is distributed to corresponding

modules in the network via the built-in thumbwheel. Alternatively, the data can be stored centrally in a Modbus register so that it can be read and written directly via Modbus by corresponding controllers. In addition, Radioline replaces serial RS-232/RS-485 cabling with wireless transmission. The wireless solution also features an extended operating temperature range from -40 to +70°C. In combination with worldwide Ex approvals, it is therefore ideal for use in infrastructure and process applications.

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

 **Web code:** #3240

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