Reliable pressure measurement in hydrogen production

How Messer Industriegase obtains a high plant availability

Plant manager Guido Kniepper.

The hydrogen plant from Messer Industriegase.

MESSER Gases for Life

Messer is the world's largest family-run specialist for industrial, medical and specialty gases. Messer Industriegase GmbH, the German sales company, has been operating a hydrogen production facility in Castrop-Rauxel, Germany since 2020. The hydrogen is produced by means of the steam reforming process, using natural gas as the feedstock. This produces 2,700 standard cubic meters of hydrogen per hour, or approximately 10 tankers per day.

"The differential and gauge pressure measuring devices from Endress+Hauser are accurate and reliable even for very small pressure measuring ranges. The devices are intuitive and safe to operate thanks to the digital assistants. As a result, we achieve a high level of plant availability and can produce high-quality hydrogen."

Guido Kniepper, plant manager at Messer Industriegase GmbH

Messer produces hydrogen in a steam reformer. The facility has a large number of protection and safety devices where pressure values play an important role. Endress+Hauser measuring devices meet all the challenges of hydrogen production due to the gold-coated membrane among other things.

The results

- High plant availability
- Accurate and reliable measurement even in very small pressure ranges
- Time savings as the devices are easy to operate
- Minimum training required
- Extended maintenance intervals

Customer challenge Pressure measurement is very demanding in the steam reforming process. Requirements include temperatures up to 900 °C during production and pressures up to 200 bar during filling. At the same time, the pressure in the reformer furnace is often in the millibar range. Hydrogen diffusion poses a particularly difficult challenge. The tiny hydrogen atoms can penetrate the thin metallic membrane of the oil-filled sensors. Bubbles then form in the fill fluid. This causes a zero point shift in the short term and eventually leads to a malfunction.

Our solution Endress+Hauser installed pressure measuring devices in the steam reformer at Messer, which meet the specific requirements of hydrogen production:

- A 25µ-thick gold coating reliably prevents hydrogen diffusion through the membrane into the pressure cell.
- The devices monitor themselves automatically without interrupting plant operation.
- A wizard guides users through commissioning, maintenance and SIL proof testing step by step.
- The Bluetooth connection facilitates convenient access to the device.

Endress+Hauser
People for Process Automation

An Endress+Hauser employee shows production manager Florian Wagner the gold-coated membrane.

The right decision A mixture of steam and natural gas reacts to form hydrogen in the reformer furnace at the Messer plant. This is subsequently purified during a pressure swing adsorption process and compressed. After Messer put the facility in Castrop-Rauxel into operation, errors occurred repeatedly during pressure measurement in the furnace. How did those responsible resolve this problem? *Production Manager, Florian Wagner, explains „We replaced the instruments originally installed with Endress+Hauser devices, where the membrane is protected by a gold coating“. „Pressure measurement has been operating reliably and trouble-free since then.“*

The latest generation of Cerabar and Deltabar pressure and differential pressure sensors are used in Messer's hydrogen production facility.

- Cerabar PMP71B
- Deltabar PMD75B

Numerous helpful functions Messer has placed its trust in Endress+Hauser pressure measuring devices at many of the measuring points in its hydrogen facility; in the steam boiler, heat exchanger, natural gas compressor and in the filling stage, for example. The latest generation of Cerabar instruments is installed in the reformer furnace. They offer various functions that make operation intuitive. *Production Manager, Florian Wagner says „Commissioning was very easy, our team was guided through the process step by step by the device's assistant program.“*

Out of the control room, Florian Wagner can check the verification of the pressure gauges.

The digital assistants are called wizards. In addition to commissioning, they also make verification easier, for example. *Production Manager, Florian Wagner says „Using the wizard, we can check the verification from our control room without interrupting the process. This leads to increased plant availability and substantial time savings“.*

You do not need a ladder or scaffolding to reach devices in difficult-to-access areas. They can be easily configured by Bluetooth. *„This is very convenient and saves roughly 1,500 Euro per measuring point. In this way, we can complete safety-related tasks much faster and yet without compromising safety“ explains Florian Wagner.*

The plant produces 2,700 standard cubic meters of hydrogen per hour.

Advantages of digitalization In addition to the pressure values, the devices provide useful additional information. This is possible thanks to Endress+Hauser's Heartbeat Technology. The concept is based on intelligent sensor technology, which enables data to be read from process applications and used in a targeted manner. For example, Heartbeat Technology uses the detected pressure shocks to draw conclusions in relation to the mechanical stress on surrounding plant components. In practical terms, broken welding seams can thus be prevented – predictive maintenance in short.
Heartbeat Technology – and thus the digitalization of the process industry in general – is supported and optimized by Ethernet-APL. Endress+Hauser pressure measuring devices are equipped with an additional physical layer (APL, „Advanced Physical Layer"), which supports numerous protocols, including PROFINET, EtherNet/IP, HART IP and more. Increased bandwidth and faster data transmission times are thus possible, as well as digital communication and power supply via the same cable.

Thanks to the intelligent sensor technology of the pressure gauges additional data from the from the process can be used.

The displays of the devices are backlit.

Enlightened optimization One simple, yet very practical function is the illuminated display on the pressure measuring devices. *„You can easily read the display even in the dark, which is a real improvement", says Florian Wagner.* And if something goes wrong with the pressure measurement, the lighting is also helpful: The display switches from green to red and thus makes it easier to identify devices issuing an alarm signal.

Plant manager Guido Kniepper with an Endress+Hauser employee in the hydrogen production plant.

Always available Messer can count not only on the software wizards, but also on the Endress+Hauser Service Team. *Guido Kniepper emphasizes „Endress+Hauser sales engineers provide us with exceptional support, they are always available and respond very quickly.“*
Because Endress+Hauser store all device data in a database, those responsible at Messer are spared the administrative effort.

Minimum training required Thanks to the Endress+Hauser spare parts database, we have access to all replaceable spare parts including the installation instructions at all times. The pressure transmitters are modular in design. *Guido Kniepper says „This means that potential mistakes when replacing components practically do not exist. Even staff members who do not work with the pressure measuring devices on a daily basis can take action“.*

Summary
„We can rely fully on Endress+Hauser‘s devices and their team. This is vital in ensuring that hydrogen production runs smoothly in our facility and yields the desired results.“

Plant manager Guido Kniepper on the cooperation with Endress+Hauser.

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