# $H_2$ REFUELLING STATIONS: A KEY TECHNOLOGY FOR EMISSION-FREE MOBILITY

## TC90 HIGH-PRESSURE THERMOCOUPLE FROM WIKA IN THE MAX DISPENSER 1.5 ENSURES SAFE REFUELLING

Image source: Maximator Hydrogen GmbH

Hydrogen is regarded as a key technology for sustainable and emission-free mobility – especially in heavy goods transport, where alternative drive systems have so far only offered a limited range. However, for hydrogen vehicles to reach their full potential, the nationwide expansion of an efficient infrastructure with $H_2$ refuelling stations is essential. With the MAX Dispenser 1.5, Maximator Hydrogen has developed an innovative solution that enables fast, safe and cost-effective hydrogen refuelling thanks to precise temperature monitoring with the WIKA TC90 high-pressure thermocouple.

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# Challenge

### Politics forces a change of course

Hydrogen is the smallest and lightest chemical molecule, but its role in the energy transition is huge. In the transport sector, hydrogen is seen as a promising alternative to fossil fuels – especially for heavy goods transport, which is one of the largest sources of $CO_2$ emissions. In order to reduce these emissions, politicians are planning a change of course: in accordance with EU guidelines, one -third of newly registered trucks should be equipped with electric drives or fuel cells by 2030.

### The expansion of the hydrogen infrastructure as a key challenge

In accordance with the EU regulation on the deployment of alternative fuels infrastructure (AFIR), there must be at least one publicly accessible hydrogen refuelling station every 200 kilometres along the trans-European transport network (TEN-T) and at every urban node from 2030. The EU is currently providing 422 million euros in funding for projects that promote the refuelling and charging infrastructure for alternative fuels, including 35 hydrogen refuelling stations for trucks, buses and cars.

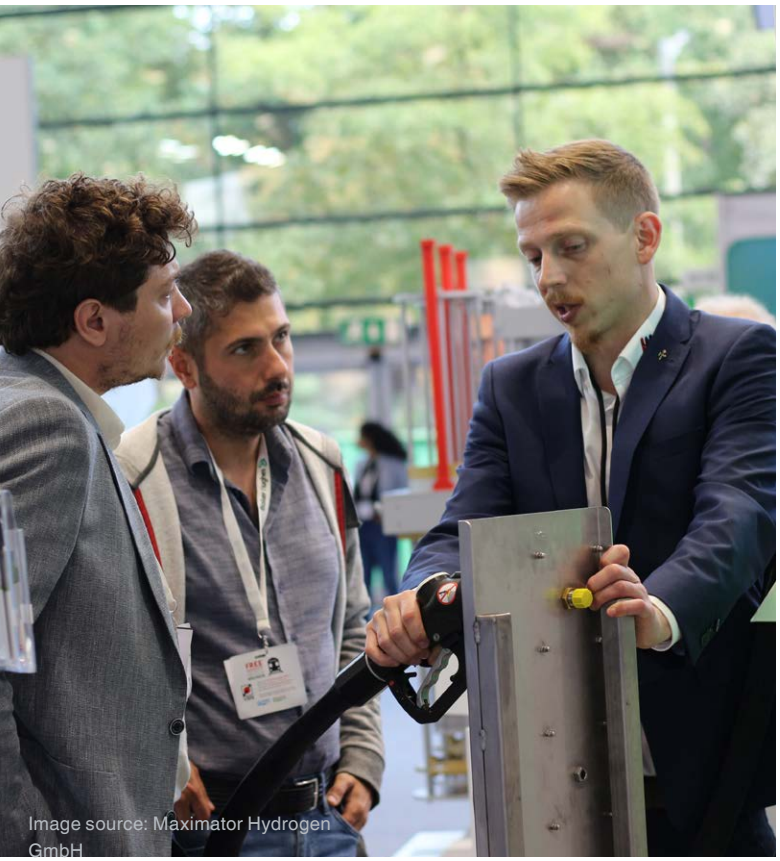

Image source: Maximator Hydrogen GmbH

### Safe hydrogen refuelling – requirements and standards

- **High-pressure systems**
  Current fuel cell vehicles use tanks with an operating pressure of 350 or 700 bar.
- **Safety requirements**
  Refuelling under high pressure demands the highest standards of safety.
- **User-friendliness**
  The refuelling must be as easy as for petrol or diesel, in order to achieve wide acceptance.
- **SAE J2601 standard**
  This standard regulates the highest pressure and maximum hydrogen temperature during the refuelling process.
- **Thermal control**
  Precise pressure and temperature control prevents material damage and ensures safe processes.

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The creation of a reliable infrastructure is crucial to accelerate the introduction of hydrogen-powered vehicles. We are working on this expansion and are also relying on cooperation with partners such as WIKA.

**Lukas Rainer**
Executive Development Lead,
Maximator Hydrogen

# Solution

### Hydrogen refuelling – a business for experts

For its solutions, Maximator Hydrogen utilises the knowledge and experience of WIKA, the world's leading supplier of sensor solutions in pressure and temperature measurement. One example of the close cooperation is the use of the TC90 high-pressure thermocouple from WIKA in the MAX Dispenser 1.5, a technically sophisticated "dispenser" for filling hydrogen vehicles in accordance with the SAE J2601 refuelling standard.

### TC90 high-pressure thermocouple

Precise monitoring of the hydrogen temperature prevents the tank from overheating and protects the system from damage. The MAX Dispenser 1.5 uses the TC90 high-pressure thermocouple from WIKA for this purpose. The temperature of the incoming hydrogen is recorded on the inlet side of the dispenser and the filling temperature is monitored redundantly with two TC90 sensors in the outlet assembly. Thus it is ensured that this remains between -40 °C and -17.5 °C in accordance with SAE J2601.


Image source: Maximator Hydrogen GmbH

**Maximator Hydrogen – Infrastructure for hydrogen mobility**

- **Company foundation**
  Founded 2019, headquarters in Nordhausen, Germany.
- **Core focus**
  Development and expansion of hydrogen refuelling stations worldwide.
- **International presence**
  Over 80 systems in use by the end of 2025 – in Switzerland, 17 out of 18 are from Maximator Hydrogen.
- **Goal**
  Contributing to the mobility transition by building a reliable $H_2$ infrastructure.

"Three decisive factors spoke in favour of choosing the TC90 from WIKA: its pressure containment up to at least 1034 bar, the short response time and the ATEX certificate, which enables it to be used in hazardous areas.

**Maik Wenderott**
Strategic Buyer, Maximator Hydrogen

# Solution

**Indispensable: Short response time**

The temperature of the hydrogen is closely monitored to ensure that the refuelling process is safe and efficient. The TC90 is so robust that additional protection by a thermowell / protection tube is not necessary. The probe's direct contact with the media ensures short response times in the low second range, which enables rapid readjustment of the hydrogen cooling.

**Cooperation on an equal footing: Customised solution**

In addition to the technical quality of the TC90, WIKA impressed with its close and reliable cooperation. WIKA captured Maximator Hydrogen's requirements precisely and translated them into customised solutions. One example of the close collaboration is the specific adaptation of the probe length of the thermocouple to Maximator Hydrogen's specifications.

**Precise temperature data: Lowers costs for operators**

The temperature measurement enables the exact calculation of hydrogen losses in the hose line after refuelling. By knowing the pressure, temperature and volume of the pipework, the exact amount of hydrogen actually released is calculated. This prevents unnecessary additional costs for the operator of the hydrogen refuelling station. The temperature control also improves refuelling performance – if the hydrogen is cold enough, refuelling is faster. This saves time, increases efficiency and enhances convenience for end users.

**Leak-tight and well thought out: Adapter-free solution for greater safety**

Maximator Hydrogen was particularly keen to avoid potential leakage points when using the thermocouple. For this reason, a connection technology was chosen that does not require any adapter. WIKA's solution is a perfect match for Maximator Hydrogen's requirements and is fully compatible with the existing system – a decisive advantage for the safe and reliable operation of hydrogen refuelling stations.

**Reliability counts: WIKA impresses with high delivery capability**

High-performance components alone are not enough – reliability and consistent quality are just as important. With Maximator Hydrogen, WIKA scored highly, not only with the technically mature TC90, but also with its high delivery capability. Time-critical availability and a competitive price tipped the scales in favour of the thermocouple.

**The product: TC90**

- The TC90 is compact and designed for measuring tasks in small nominal pipe widths.
- Its probe tip can withstand pressures of up to 1034 bar that occur at hydrogen refuelling stations, even when it is unprotected.
- The version with high-pressure threaded connection, gives the TC90 the necessary strength and keeps the measuring location reliably leak-tight.
- All wetted components are made of $H_2$-compatible materials.
- ATEX certification, which allows the TC90 to be used in hazardous areas.

## Benefits

- **Collective contribution to the mobility transition**
  Expansion of a hydrogen infrastructure with minimal impact on the climate through a key technology for emission-free heavy goods transport.
- **Safe and efficient refuelling**
  Precise temperature and pressure monitoring ensures a safe refuelling process in accordance with international standards.
- **Optimised refuelling performance**
  Precise temperature control allows rapid refuelling, comparable to conventional refuelling.
- **Increased cost-effectiveness**
  The precise temperature measurement enables an exact calculation of the hydrogen losses, which increases the profitability for the refuelling station operators.
- **Reducing potential leaks**
  Adapter-free connection technology from WIKA reduces the risk of gas leakage and increases plant safety.
- **Certified safety**
  ATEX-certified sensors can be used in sensitive areas and fulfil the highest safety standards.
- **High system availability**
  WIKA delivers reliably and enables the rapid construction of new refuelling stations worldwide.

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Hydrogen is a key building block for the sustainable future of heavy goods transport.

**Christian Wirl**
Portfolio Manager Hydrogen, WIKA

### Hydrogen becomes a real alternative to diesel

Short refuelling times and a competitive price are crucial for acceptance by end customers. Thanks to innovative systems such as the MAX Dispenser 1.5, fast refuelling is already a reality. The price of hydrogen was also on a par with diesel before the pandemic. In the medium term, the technology can become competitive and make a significant contribution to emission-free mobility.

### Contact

If you would also like to optimise your $H_2$ infrastructure with the TC90 high-pressure thermocouple from WIKA, please contact us:

**info@wika.com**