

## Successful level measurement in liquid hydrogen at -253 °C

Linde Engineering and Endress+Hauser develop a solution to meet the highest demands of hydrogen refueling



With the construction of more than 200 hydrogen refueling stations worldwide, Linde is the most experienced supplier of infrastructure for hydrogen mobility. Linde offers powerful fueling technology with low operating costs per kg hydrogen and the highest safety standards. Linde is the one-stop provider for hydrogen solutions, from reliable H<sub>2</sub> supply (compressed, gaseous or liquid) through state-of-the-art filling stations and customized services.

"Filling the pump tank correctly is essential for controlled pump operation. The collaboration with Endress+Hauser was very goal-oriented right from the start."

Michael Westermeier,  
Cryo Applications Senior Expert



Linde Hydrogen Centre, Unterschleißheim

**The special capacitive solution for Liquicap FMI51 enables continuous level measurement in liquid hydrogen in small containers with a measurable range of 3 m.**

**The challenge** Hydrogen as a energy carrier is one of the central issues of sustainability and is directly linked to achieving global climate targets. Liquid hydrogen (LH<sub>2</sub>) has an extremely low boiling temperature of around -253 degrees Celsius. This requires special tanks and transport containers, as well as appropriate level monitoring, capable of meeting these extreme conditions. Storing and transporting LH<sub>2</sub> is therefore technically very demanding. The requirements for continuous level measurement in liquid hydrogen are therefore as follows:

- Extreme temperature resistance
- Suitable insulation in consideration of enormous (low) temperature changes
- International Ex approvals

- Very fast detection of filling level changes
- High reliability

**Our solution** Together with Linde Engineering, Endress+Hauser developed the capacitive probe Liquicap FMI51 which meets these huge requirements.

A bare stainless steel (316Ti) is used here as the probe rod. The liquid hydrogen serves as an insulator between the container and the probe. For space-related reasons in the cryogenic pump, a bypass is used as both a measuring vessel and mass tube. Due to the extremely low boiling point of hydrogen (-253 °C), a gas phase takes place in the area immediately upstream of the process connection of the probe. This gas phase combined with the excellent properties of ceramic insulation creates near ambient temperatures at the process connection. The rapid reaction time (0.3 s) of capacitive measuring technology is ideal for this application. Even in several years of operation,

the measurement runs without failures. The low installation effort rounds off the solution.

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### The solution components

- Capacitive rod probe Liquicap FMI51 with separate electronics 4 to 20 mA HART
- Ceramic insulation of the 11961Z probe due to the expansion coefficient
- International Ex certifications in accordance with: IECEx, ATEX, US-Ex, Korea-Ex



<https://www.de.endress.com/Liquicap-FMI51>

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