Datasheet $H_2$-Sensor System NEO972A for Leak Detection in Automobiles

Product Description:
Ambient Hydrogen measuring system for automobile applications, the signal is compensated for the effects of temperature, pressure, and humidity.

Typical Application:
- Detection of hydrogen gas in the cabin of automobiles
- Determination of hydrogen gas concentration under atmospheric conditions

Features:
- Compatible with automobiles
- Large measurement range
- Negligible cross sensitivity with oxygen
- Function not influenced by pressure or humidity
- Determination and reporting of the Lower Explosive Limit (LEL)
- Outputs humidity compensated H2 reading. Prevents exceeding the LEL by condensing any existing humidity.
- Error controls including explosion risk warning
- Signal output via CAN 2.0 and optional USB connection

Picture 1: $H_2$-Sensor system Version NEO972A
Sensor System Characteristics:

Supply Voltage: 9 – 16 V DC
Processor: ATSAMD21G18, 48 MHz
Energy Requirements: < 1.4 W
H₂-Sensitivity: 0 – 4.4 Vol.-% H₂
Tolerance: ± 0.3 Vol.-% H₂
Detection Limits: < 0.2 Vol.-% H₂ in air at 50% r.h, RT, atmospheric pressure
Response Time $t_{90}$: < 3s
Decay Time $t_{10}$: < 3s
Startup Time from Cold Start: < 45s for first valid measurement, < 120s for final status

Ambient Temperature Range: -40°C – 100°C
Functional Temperature Range: -40°C – 80°C
Pressure Range: 60 - 120 kPa absolute
Air Humidity: 0 – 100 % r.h. (also condensing)
Carrier Gas: Air
Cross sensitivities: Helium and negligible Oxygen gas¹

Signal: CAN 2.0 (500kbit) through CAN-Controller MCP2515
CAN-Lines are not terminated!
first CAN Message 5s after system start
CAN-ID: Standard 0x640²
USB-Communication (upon request)

Measurement Interval: 100 ms
Resolution: < 8 bit, 0.02 Vol.-% H₂
Housing: Dimensions: 108 x 79 x 45 mm³, AL6082 alloy, M5 screws fastened with 3Nm torque
Leakage rate: $10^5$ mbar l / s³

¹ Sensor signal decreased by 0.1 Vol.-% H₂ with a decrease of 5 Vol.-% O₂, calibrated at 20.9 Vol.-% O₂
² CAN-ID individually adjustable, see section "Setting CAN-ID"
³ Measured with forming gas 90/10, 1.5bar absolute, room temperature
IP Code: IP6K9 (dustproof & protected against water in factory!

Weight: < 375 g

ASIL: Developed for SIL2 (IEC 61508)

ATEX: Developed for ATEX 100a Zone

Lifetime: IP6K9-Housing certified with a life expectancy of 10 years

Installation:
NEO972 is either for a sealed installation against a wall (with seal) [Variant 1] or for an open air installation [Variant 2].

Variante 1

Variante 2

Picture 2: Installation options $H_2$-Sensor system

4 Measuring components purely inorganic and do not degrade during functioning
**Dimensions:**

![Dimensions Diagram]

*Picture 3a: Dimensions of H₂-Sensor system from below*

**Drilling Template:**

![Drilling Template Diagram]

*Picture 3b: Drilling Template*

During installation be sure that the opening free of obstruction, for example water condensation. We suggest to install the sensor system on its side, the retaining pins or screws used may have a maximum diameter of 5.5 mm or 6.5 mm. We recommend a tightening torque of 3 Nm and a maximum of 10 Nm.
Conditions:
Please note that in addition to pressing the plug into the socket, it must also be screwed through the attached thread in order to guarantee permanent trouble-free contact with the sensor. The sensor must be operated via the 4-pin socket. The 3-pin socket is used for programming and maintenance.

4 pin socket for CAN Communication

Lumberg Automation, Typ.Nr.: RSMCK 4, part No. 28045

Picture 4: Installation H₂-Sensor system
Resolution and Reaction Time:

Test of a sensor system with 0.2, 1.5, 2.5 and 3.5 Vol.-% H₂ in 21 Vol.-% O₂. Measured with a total flow of 1.000 sccm.

$t_{90}$-time determination of a Sensor system through a change of 0 Vol.-% H₂ to 3.5 Vol.-% H₂. Measured with a total flow of 1.000 sccm.
Comparison of set hydrogen concentrations values and measured ones with an error bar of three standard deviations of the measuring signal.

**CAN Matrix Message Layout NEO972A:**

**Byte 0:** Hydrogen gas concentration[%] \( H_2 = \frac{(\text{Byte}1-20)}{50} \)

*Total Hydrogen gas after the condensation of water*

**Byte 1:** Lower Explosion Limit[%] \( LEL = \frac{(\text{Byte}2-20)}{50} \)

Output the calculated explosive limit

**Byte 3:** Raw value: Output of the raw value for error evaluation. At 21% O2 in N2, without humidity, atmospheric pressure, and with the absence of H2 returns a raw value of 100+-1

**Byte 4:** CRC 1

**Byte 5:** Continuous Message-Counter

**Byte 6:** Statusbyte:

- 80: Hydrogen gas concentration above the explosive range
- 48: Hydrogen gas concentration in the explosive range
- 32: More that 50% of the lower explosive limit exceeded.
- 16: Hydrogen gas present
- +0: Sensor fully functional
- +2: A parameter is outside the defined range
- +4: Error: Sensor defective

**Byte 7:** CRC 0
Setting CAN-ID:

A 16-fold rotary switch is installed for setting the CAN-ID, 8 different CAN-ID’s can be chosen:

Rotary switch: 0 → ID: 0x640
Rotary switch: 1 → ID: 0x648
Rotary switch: 2 → ID: 0x650
Rotary switch: 3 → ID: 0x658
Rotary switch: 4 → ID: 0x660
Rotary switch: 5 → ID: 0x668
Rotary switch: 6 → ID: 0x670
Rotary switch: 7 → ID: 0x678
Rotary switch: 8 → ID: 0x640
Rotary switch: 9 → ID: 0x648
Rotary switch: A → ID: 0x650
Rotary switch: B → ID: 0x658
Rotary switch: C → ID: 0x660
Rotary switch: D → ID: 0x668
Rotary switch: E → ID: 0x670
Rotary switch: F → ID: 0x678

The switch can be reached by removing the 1/8” plug using a 5mm Allen key on the back of the housing.

Picture 5: Setting CAN-ID H₂-Sensor system