Piezoresistive OEM Pressure Transmitters

With the D-line, Keller introduces a unique combination consisting of an exceedingly robust industrial pressure transducer and the popular I2C microcontroller interface. Pressure transmitters with this interface are commonly available only in consumer market housings made of plastic or ceramic, where merely the parameters for compensation are stored in an integrated memory. The D-line OEM transmitters however have an unprecedented embedded digital signal processing (DSP) core for the compensation and normalization of the output values.

Technology

The Series 4 LD…9 LD is based on KELLER’s famous Chip-In-Oil (CIO) technology. The “L” stands for the laser welded stainless steel housing and could equally be representative for low-power (typ. 0.1 µA in idle/sleep mode) and low-voltage (Supply: 1.8…3.6 VDC). The housing is hermetically-sealed, oil-filled and builds a Faraday cage with feed-through capacitors around the entire electronics. The digital interface of the electronics with dual information of pressure and temperature is indicated by the “D”.

Interfaces

The easiest way to couple an OEM pressure transmitter to a microcontroller based system is a digital I/O-compatible interface; no amplification, no analog to digital conversion, no calibration, no temperature coefficients. In short: no problems.

I2C (Inter-Integrated Circuit) is designed for a direct connection between devices on a printed circuit board. It is a BUS-system because it allows the connection of multiple transmitters (slaves) to the same communication lines, but it is not a fieldbus with the classic long distance inter-connectability. So the D-Line combines an industrial pressure interface for harsh environment with an electrical interface for OEM applications.

The values are in 16 Bit unsigned integer format and the scaling is given by constants or by the memory content of the transmitter (two floating point values IEEE 754 for the pressure scaling).

Performance features

- Ultra low power consumption, optimised for battery powered applications
- Hermetically protected sensor electronics – extremely resistant to environmental influences
- Ultra-compact, robust housing made from stainless steel (optional Hastelloy C-276)
- No external electronics for compensation or signal processing
- Extremely accurate, outstanding long-term stability, no hysteresis
- Pressure ranges of 1 bar to 200 bar
- Easy to integrate into microcontroller based systems
- Internal two-chip solution with pressure sensor and signal processing separation provides a high degree of flexibility

Subject to alterations

02/2013
Specifications

Pressure ranges rel.

<table>
<thead>
<tr>
<th>Type/Version</th>
<th>Dimensions [mm] (4)</th>
<th>Pressure Range</th>
<th>Operating Temperature</th>
<th>Comp. Temp. Range</th>
<th>TEB (3) [%FS]</th>
</tr>
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<tbody>
<tr>
<td>4 LD</td>
<td>ø 11 x 4,2</td>
<td>3...200 bar abs. (2)</td>
<td>-10...+80 °C</td>
<td>0...50 °C</td>
<td>± 0,7 %FS</td>
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<tr>
<td>7 LD</td>
<td>ø 15 x 5</td>
<td>3...200 bar abs.</td>
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<td>9 LD</td>
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Accuracy

max. ± 0,15 %FS (Linearity best straight line @RT, hysteresis, repeatability)

Overpressure

4 x pressure range (max. 350 bar)

Stability

typ. ± 0,1 %FS, max. ± 0,2 %FS

Communication Protocol

D-Line OEM-transmitter samples only on request.
The idle state is the sleep mode to save power.
Sequence for data acquisition:

1. Request measurement
   2 bytes from master
   ADDR H DDA0000

2. Await the end of conversion (three ways)
   - Simple delay of 10 ms
   - Polling of the “Busy?” flag [5] in the status byte (only one byte reading needed)
   - Event triggering by the additional “EOC” handshake pin (goes to VDD)

3. Read out measurement results
   1 byte from master, 3...5 bytes from slave
   ADDR H STATUS P MSB P LSB ... T MSB T LSB

4. Interpretation of new data
   P [bar] = P min...P max ★ 16384...49152
   T [°C] = -50...150 °C ★ 384...64384

The complete communication protocol can be provided upon request.

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Interface

digital I²C (serial synchronous)

Signal Output

P [bar], T [°C]; normalised to 16 Bit unsigned integer
typ. ± 10 %FS, min. ± 5 %FS

Supply

1,8...3,6 V
typ. 1,5 mA during conversion
typ. 100 nA in idle mode

Bit Rate

≤ 3,4 MHz

Start-up Time (Supply ON)
< 2,5 ms

Conversion Time
< 4 ms (for P and T)

Noise Floor
max. ± 0,015 %FS (temperature 4 Bit)

typ. ± 2 °C (≥ 30 bar: additional ±0,01 °C/bar)

Temperature Accuracy

none

Supply Voltage Dependency

> 100 MO @ 500 VDC

Material in Contact with Media

- Stainless Steel AISI 316L (DIN 1.4404 / 1.4435)
- O-Ring: Viton® 70 Shore A (exchangeable)
- Pressure connection (i.e. G 1/4”)
- Housing made of Hastelloy C-276
- Extended temperature range within -40...110 °C

Remarks

- Other pressure ranges for high volume projects only
- This series is not available in transmitter housings with plugs or cable (I²C is not a fieldbus)