



Piezoresistive OEM Pressure Transmitters

WITH I2C INTERFACE AND EMBEDDED SIGNAL CONDITIONING

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 4LD...9LD 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. $0.1~\mu$ A 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».

Interface

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.

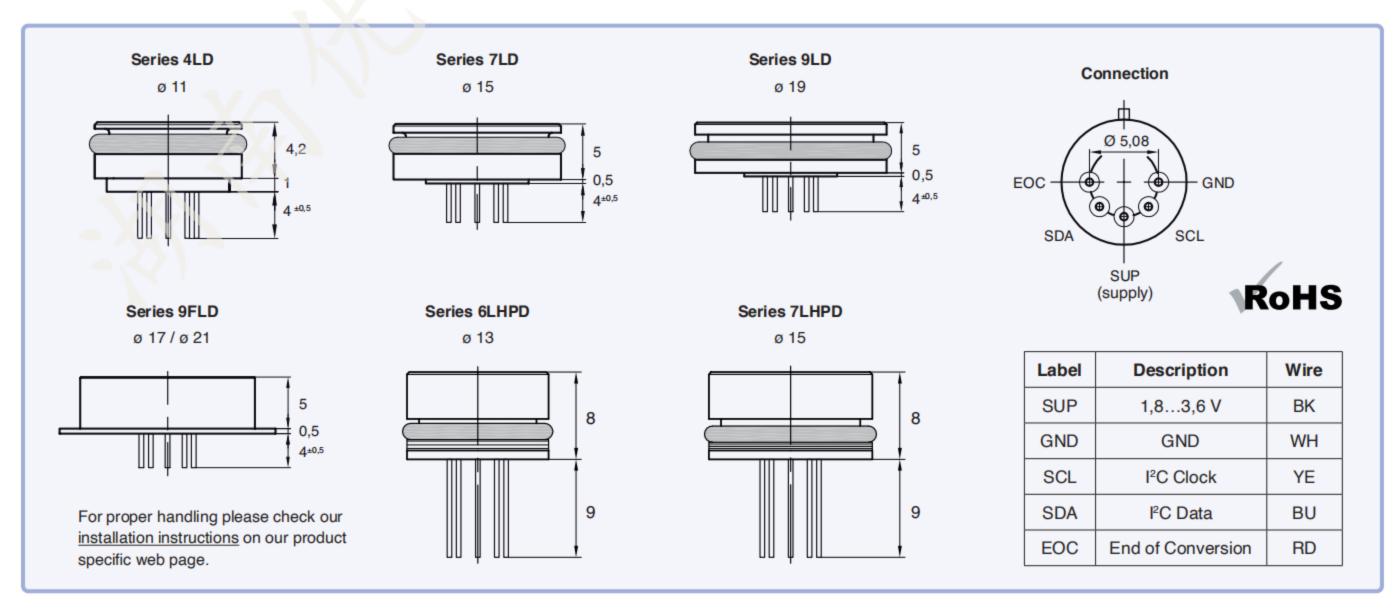
The values are in 16 Bit unsigned integer format and the scaling is given by constants or by the memory content of the transmitter (two floating point values IEEE 754 for the pressure scaling).

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 1000 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

SERIES 4LD...9LD









Specifications

Pressure Ranges rel. PR	01	-0,50,5	-13	-110	-130						bar
Pressure Ranges abs. PA PAA	01	0,51,5	03 03	010 010	030	0100	0200	0400	0600	01000	bar bar

Accuracy (1) Overpressure Long Term Stability max. ± 0.15 %FS (600 bar: ± 0.25 %FS / 1000 bar: ± 0.35 %FS) 4 x pressure range (max. 350 bar resp. 1200 bar for 6LHPD, 7LHPD) typ. ± 0.1 %FS, max. ± 0.2 %FS (limited to max. ± 3 mbar)

Type/ Version	Dimensions [mm] ⁽⁵⁾	Pressure Range	Operating Temperature	Comp. Temp. Range	TEB (2) [%FS]
4LD	ø 11 x 4,2	3200 bar abs. ⁽³⁾	-10+80 °C	050 °C	± 0,7 %FS
7LD	ø 15 x 5	3200 bar abs. 330 bar rel. (4)	-40+110 °C	050 °C -1080 °C	± 0,5 %FS ± 0,7 %FS
9LD	ø 19 x 5	1200 bar abs. 130 bar rel.	-40+110 °C	050 °C -1080 °C	± 0,5 %FS
9FLD	ø 17 x 5,5 Flange ø 21	130 bar abs. 130 bar rel.	-40+110 *C		± 0,7 %FS
6LHPD	ø 13 x 8				0.7.4.50
7LHPD	Ø 15 x 8	4001000 bar abs.	-40+110 °C	050 °C -1080 °C	± 0,7 %FS ± 1,0 %FS

- Linearity best straight line@RT, hysteresis, repeatability
- TEB (Total Error Band): Maximum deviation within specified pressure and compensated temperature range
- abs: Absolute Pressure Measurement (PAA: Absolute. Zero at vacuum PA: Sealed Gauge. Zero at 1,0 bar abs.)
- rel: Referential version (PR: Vented Gauge. Zero at atmospheric pressure)

Dimensions without glass feed through

Interface Signal Output

Pressure Range Reserve

Supply

Power Consumption

Bit Rate Start-up Time (Supply ON) Conversion Time Logic Levels Noise Floor

Temperature Accuracy Supply Voltage Dependency

Isolation

ESD - Human Body Model

Material in Contact with Media

Oil Filling

Pressure Endurance

Vibration Endurance Shock

Electrical Connection

Options

Other possible versions

Remarks

digital I²C (serial synchronus)

P [bar], T [°C]: normalised to 16 Bit unsigned integer

typ. ± 10 %FS, min. ± 5 %FS

1,8...3,6 V

typ. 1,5 mA during conversion typ. 100 nA in idle mode

≤ 400 kHz

< 1 ms

typ. 6 ms, max. 8 ms (for P and T) LOW: max. 15 %V_{SUP}, HIGH: min. 85 %V_{SUP} max. ± 0,015 %FS (temperature 4 Bit)

typ. ± 2 °C

none

> 100 MΩ @ 500 VDC

 $4 \text{ kV (HBM: C} = 100 \text{ pF / R} = 1.5 \text{ k}\Omega)$

- Stainless Steel AISI 316L (DIN 1.4404 / 1.4435)
- O-Ring: Viton® Shore A (-20...200 °C, exchangeable)

Silicone oil, others on request

0...100 %FS @ 25 °C: > 10 million pressure cycles with appropriate installation

20 g, 5...2000 Hz, X/Y/Z-Achse 75 g sine 11 ms

- Glass feed through pins \emptyset 0,45 mm, L = 4 ± 0,5 mm
- Plug JST 1 mm, 5-pole. Type: BM05B-SRSS-TB. Only for -20...85 °C and not for 4LD & 6LD As counterpart: Crimp-socket with wires AWG 28. Type: SHR-05V-S-(B), Crimp-contact: SSH-003T-P0.2
- Electrical connection: 7 cm silicone wires 0,09 mm² on the glass feed through pins
- Hastelloy housing (dep. on version also Inconel, Titanium)
- Extended temperature range within -50...125 °C
- Series 9LD: With pressure range 300 mbar rel.
- Series 10LD: Type 10L (ø 19 x 15), spec. same as 9LD - Series 20D: With pressure connection G1/4", G1/8" etc.
- Series 21D: With screened cable (0,5 to 3 m)
- Intermediate press. ranges only for high-volume projects
- Series 21D is not available with plug (I2C is not a fieldbus)

Communication Protocol

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

Sequence for data acquisition:

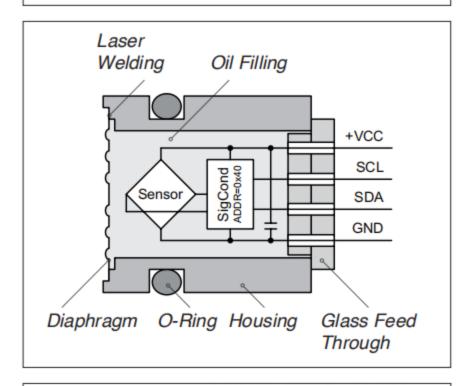
- Request measurement 2 bytes from master ADDR 0 0xAC
- 2. Await the end of conversion (three ways)
 - Simple delay of 8 ms
 - Polling of the «Busy?» flag [5] in the status byte (only one byte reading needed)
 - Event triggering by the additional «EOC» handshake pin (goes to VDD)
- 3. Read out measurement results 1 byte from master, 3...5 bytes from slave ADDR 1 STATUS P MSB P LSB

... T MSB

TLSB

4. Interpretation of new data $P [bar] = P min...P max \triangleq 16384...49152$

The complete communication protocol is available on the KELLER homepage.







Tel: 0731-85228841 /15084819131 Mail: 17708479931@163.com