

# Piezoresistive OEM Pressure Transmitters

With I<sup>2</sup>C interface for hazardous areas

Introducing the Keller Intrinsically safe D-line; a unique combination of robust industrial pressure transducers and the popular I<sup>2</sup>C microcontroller interface for use in hazardous industrial applications (Gas Group II). Pressure transmitters with this interface are typically available only in consumer-grade plastic or ceramic housings, where only compensation parameters are stored in integrated memory. The Keller intrinsically safe D-Line, however, have unprecedented embedded digital signal conditioning core for both the compensation and normalization of the output values.

### 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.

I<sup>2</sup>C (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 intrinsically safe 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

### Ex-Classification

EPS 14 ATEX 1 661 X EPS 22 UKEX 1190 X IECEx EPS 14.0027 X

Temperature class	Ambient temperature	U <sub>i max</sub> ≤ 7 V
T4	-40...+110 °C	I <sub>i max</sub> ≤ 200 mA
T5	-40...+ 80 °C	P <sub>i max</sub> ≤ 250 mW
T6	-40...+ 65 °C	C <sub>i</sub> 220 nF
		L <sub>i</sub> 0 mH



*I<sup>2</sup>C is a trademark of NXP*



**Series 4LD-Ei**  
ø 11

**Series 7LD-Ei**  
ø 15

**Series 9LD-Ei**  
ø 19

**Connection**

**Series 9FLD-Ei**  
ø 17 / ø 21

**Series 6LHPD-Ei**  
ø 13 / high pressure

**Series 7LHPD-Ei**  
ø 15 / high pressure

For proper handling please check our [installation instructions](#) on our product specific web page.

**RoHS**

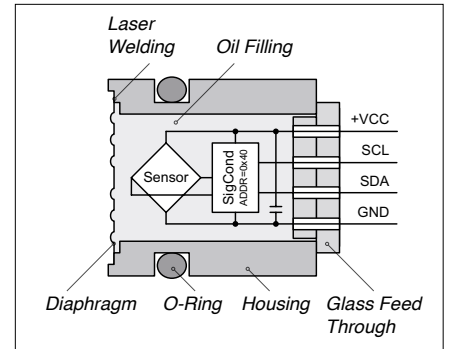
Label	Description	Wire
SUP	1,8...3,6 V	BK
GND	GND	WH
SCL	I <sup>2</sup> C Clock	YE
SDA	I <sup>2</sup> C Data	BU
EOC	End of Conversion	RD

## Specifications

Pressure Ranges rel.													
PR	0...1	-0,5...0,5	-1...3	-1...10	-1...30								bar
Pressure Ranges abs.													
PA			0...3	0...10	0...30	0...100	0...200	0...400	0...600	0...1000			bar
PAA	0...1	0,5...1,5	0...3	0...10									bar

Accuracy	max. $\pm 0,15$ %FS (600 bar: $\pm 0,25$ %FS / 1000 bar: $\pm 0,35$ %FS)
Overpressure	4 x pressure range (max. 350 bar resp. 1200 bar for 6LHPD-Ei / 7LHPD-Ei (high pressure))
Long Term Stability	typ. $\pm 0,1$ %FS, max. $\pm 0,2$ %FS (limited to max. $\pm 3$ mbar)

Type/ Version	Dimensions [mm] <sup>(5)</sup>	Pressure Range	Operating Temperature	Comp. Temp. Range	TEB <sup>(2)</sup> [%FS]
4LD-Ei	$\phi 11 \times 4,2$	3...200 bar abs. <sup>(3)</sup>	-10...+80 °C	0...50 °C	$\pm 0,7$ %FS
7LD-Ei	$\phi 15 \times 5$	3...200 bar abs. 3...30 bar rel. <sup>(4)</sup>	-40...+110 °C	0...50 °C -10...80 °C	$\pm 0,5$ %FS $\pm 0,7$ %FS
9LD-Ei	$\phi 19 \times 5$	1...200 bar abs. 1...30 bar rel.	-40...+110 °C	0...50 °C	$\pm 0,5$ %FS
9FLD-Ei	$\phi 17 \times 5,5$ Flange $\phi 21$	1...30 bar abs. 1...30 bar rel.		-10...80 °C	$\pm 0,7$ %FS
6LHPD-Ei	$\phi 13 \times 8$	400...1000 bar abs.	-40...+110 °C	0...50 °C	$\pm 0,7$ %FS
7LHPD-Ei	$\phi 15 \times 8$			-10...80 °C	$\pm 1,0$ %FS



- (1) Linearity best straight line@RT, hysteresis, repeatability  
(2) TEB (Total Error Band): Maximum deviation within specified pressure and compensated temperature range  
(3) abs: Absolute Pressure Measurement (PAA: Absolute. Zero at vacuum PA: Sealed Gauge. Zero at 1,0 bar abs.)  
(4) rel: Referential version (PR: Vented Gauge. Zero at atmospheric pressure)  
(5) Dimensions without glass feed through

Interface	digital I <sup>2</sup> C (serial synchronous)
Signal Output	P [bar], T [°C]: normalised to 16 Bit unsigned integer
Pressure Range Reserve	typ. $\pm 10$ %FS, min. $\pm 5$ %FS
Supply	1,8...3,6 V
Power Consumption	typ. 1,5 mA during conversion typ. 100 nA in idle mode
Bit Rate	$\leq 400$ kHz
Start-up Time (Supply ON)	< 1 ms
Conversion Time	typ. 6 ms, max. 8 ms (for P and T)
Logic Levels	LOW: max. 15 %V <sub>SUP</sub> , HIGH: min. 85 %V <sub>SUP</sub>
Noise Floor	max. $\pm 0,015$ %FS (temperature 4 Bit)
Temperature Accuracy	typ. $\pm 2$ °C
Supply Voltage Dependency	none
Isolation	> 100 M $\Omega$ @ 500 VDC
ESD – Human Body Model	4 kV (HBM: C = 100 pF / R = 1,5 k $\Omega$ )
Material in Contact with Media	– Stainless Steel AISI 316L (DIN 1.4404 / 1.4435) – O-Ring: Viton® Shore A (-20...200 °C, exchangeable)
Oil Filling	Silicone oil, others on request
Pressure Endurance	0...100 %FS @ 25 °C: > 10 million pressure cycles with appropriate installation
Vibration Endurance	20 g, 5...2000 Hz, X/Y/Z-Achse
Shock	75 g sine 11 ms
Electrical Connection	– Glass feed through pins $\phi 0,45$ mm, L = $4 \pm 0,5$ mm – Adapter print with plug JST – Adapter print with flexible wires or cable
Options	– Hastelloy housing (depending on version also Inconel)
Other possible versions	– OEM, IP54, and IP68 versions available. See Illustrations. – Level Probe 26D-Ei (300 mbar rel. = approx. 3 mH <sub>2</sub> O)
Remarks	– Intermediate pressure range on request. – 21D-Ei / 23D-Ei / 26D-Ei: Shielded cable 0,5 to 3 m – Cable capacitance < 200 pF/m – Series 21D-Ei / 23D-Ei is not available with plug – The complete communication protocol is available on the KELLER homepage.
Recommended Zener barrier	Z042 from Pepperl + Fuchs

