

## PIEZORESISTIVE OEM PRESSURE TRANSDUCERS

WITH LASER WELDED MEDIA ISOLATION DIAPHRAGM

Series 3L...10L, a new range of transducers that benefit from smaller capsule dimensions and crevice free diaphragms. KELLER has developed a new technique for laser welding very thin stainless steel media isolation diaphragms. The smaller crevice free transducers still retain all the traditional performance, stability, and quality, for which KELLER is renowned.

Each transducer is supplied with a calibration sheet indicating sensitivity, linearity, zero offset, temperature errors and the compensation resistors to substantially reduce zero offset and zero temperature errors.

The transducers are designed for floating O-ring seal mounting, this avoids housing induced stress, and guarantees the performance over pressure and temperature as tested in our automatic test chambers. Each transducer comprises of a piezoresistive silicon chip mounted on a glass-metal feed-through header welded into a stainless steel housing and filled with silicone oil, the very thin laser welded stainless steel isolation diaphragm completes the front side. Media pressure is transferred from the stainless steel isolation diaphragm, via the oil inside the cell, to the silicon measuring chip.

With the laser welded technology, transducers having diameters as low as 9,5 mm can be realised. Diameter is to some extent dependent upon the pressure range measured, low pressures require larger diameters, higher pressures can be achieved with smaller diameters. This is due to the expansion of the oil under temperature that creates an internal pressure due to the resistance of the diaphragm. The smaller the diameter, the higher the internal pressure and the more difficult is the zero compensation.

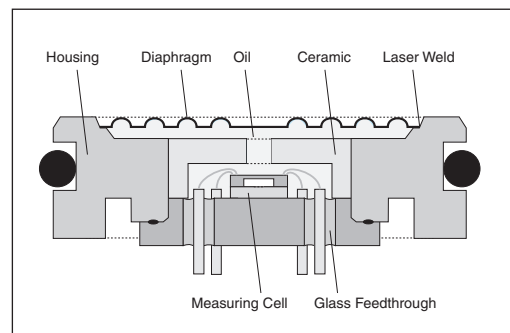
The list below shows the dimensions of the standard types of the Series L transducers and the pressure ranges, in which they meet the specifications on the reverse of this leaflet.

The higher length for high pressure transducers is given by the required thickness of the glass feedthrough to withstand the pressures.

## SERIES 3 L TO 10 L



Typ	Dimensions (mm)	Ranges (bar)	Version
3 L	Ø 9,5 x 4,2	20...200	abs.
4 L	Ø 11 x 4,2	10...200	abs.
5 L	Ø 12 x 4,5	10...200	abs.
6 L	Ø 13 x 4,5	50...200	abs.
6 L HP	Ø 13 x 8	200...1200	abs.
7 L	Ø 15 x 5	10...200	abs. / gauge (<50 bar)
7 L HP	Ø 15 x 8	200...1000	abs.
8 L	Ø 17 x 7	0,2...200	abs. / gauge (<50 bar)
9 L	Ø 19 x 5	0,2...200	abs. / gauge (<50 bar)
PD-9 L	Ø 19 x 15	0,1...50	diff. / wet wet
10 L	Ø 19 x 15	0,1...100	abs. / gauge
10 L HP	Ø 19 x 15	200...1000	abs.
PD-10 L	Ø 19 x 26	0,1...50	diff. / wet wet





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## Specifications. Excitation I = 1 mA

Series 3 L ... 10 L	Standard Pressure Ranges (FS) in bar														
PR	-1	-0,5	-0,2	-0,1	0,1	0,2	0,5	1	2	5	10	20			
PD					0,1	0,2	0,5	1	2	5	10	20	50		
PAA					0,1	0,2	0,5	1	2	5	10	20			
PA								1	2	5	10	20	50	100	200
Signal Output nominal [mV]	100	60	35	20	20	35	60	100	150	175	175	175	175	175	175
Overpressure	-1	-1	-1	-1	2,5	2,5	2,5	3	4	10	20	40	100	200	300
PD, neg. Overpressure [-]					1	1	1	2	3	5	7	10	10		
PD-9 L, max. Line Pressure													50		
PD-10 L, max. Line Pressure													200 <sup>(1)</sup>		

PAA: Absolute. Zero at vacuum    PA: Sealed Gauge. Zero at atmospheric pressure (at calibration day)    PR: Vented Gauge. Zero at atmospheric pressure    PD: Differential

Bridge Resistance @ 25 °C	Ω	3500	± 20%
Constant Supply	mA	1 nominal	1,5 max.
Insulation @ 500 VCC	MΩ	100	
Operating Temperature	°C	-30...100	-55...150 (optional, Ø≥15 mm)
Compensated Range	°C	0...50 <sup>(1)</sup>	-10...80 (optional)
Storage Temperature	°C	-40...100	-60...150 (optional)
Vibration (20...5000 Hz)	g	20	
Endurance (FS @ 25 °C)	Cycles	>100 x 10 <sup>6</sup>	FS

Housing and Diaphragm	Stainless steel, type 316 L
Seal Ring	Viton®
Oil Filling	Silicone oil <sup>(1)</sup>
Dead Volume Change @ 25 °C	<0,1mm <sup>3</sup> / FS
Electrical Connection Wires <sup>*</sup>	0,09 mm <sup>2</sup> , 12 x Ø 0,1 mm, silicone sheathed, Ø 1,2 mm, length 7 cm <sup>(1)</sup>

\* Series PD-9 L, PD-10 L, 10 L

(the values indicate the max. error @ 1 mA supply)	Compensated Range 0...50 °C		Compensated Range (optional) -10...80 °C	
	TC (Zero) <sup>(4)</sup> [mV/°C]	Stability [mV]	TC (Zero) [mV/°C]	Stability [mV]
Series 3 L / 4 L	0,0375	0,75	0,075	1,00
Series 5 L / 6 L	0,025	0,50	0,050	0,75
Series 7 L / 8 L	0,025	0,50	0,050	0,75
Series 9 L	0,0175	0,50	0,0375	0,75
Series 10 L	0,0125	0,25	0,025	0,50

Accuracy <sup>(2)</sup>	%FS	0,25 typ. <sup>(1)</sup>	0,5 max.
Offset at 25 °C	mV	< 20 mV (compensated with R5 of 22 Ω <sup>(3)</sup> )	
Temperature Error Sensitivity	% / °C	< 0,01 (0...50 °C)	< 0,02 (-10...80 °C)
Line Pressure Influence	mV/bar	< 0,0125 (PD-9 L, PD-10 L)	
Natural Frequency (Resonance)	kHz	> 30	

- (1) Others on request.  
 (2) Including linearity, hysteresis and repeatability. Linearity calculated as best straight line through zero.  
 Note: Generally, accuracy and overload is improved by factor of 2 to 4 if the sensor is used in the range of 0...50 %FS  
 (3) External compensation, potentiometer not supplied.  
 (4) Temperature-Coefficients of Zero

## Options

- Diaphragm/Housing: Hastelloy C-276
- Oil for low temperatures. Fluorinated oil. Olive oil
- Integrated temperature sensor (version PA, PAA, PR)
- Special characteristics: Linearity, overpressure, lower TC-zero
- Special tests
- Compensation PCB fitted
- Mathematical modelling: See data sheet Series 30 X
- 4 mA current supply

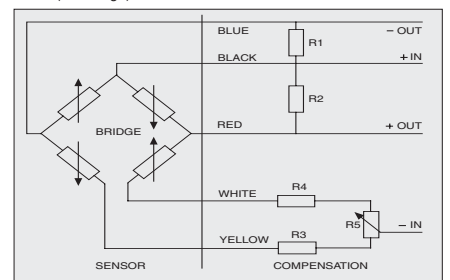
PR-10 L-0.5 <sup>(a)</sup> SN EQ925 <sup>(b)</sup>				
(c) Temp [°C]	(d) Zero [mV]	(e) +270 [mV]	(f) Comp [mV]	(g) dZero [mV]
-8.6	-5.5	-50.6	-60.8	-2.6
1.0	-2.6	-49.1	-59.7	-1.4
25.8	4.6	-46.6	-58.2	0.0
50.6	11.3	-45.6	-58.6	-0.3
80.7	19.0	-46.4	-61.3	-3.0
COMP R1 = 220kOhm <sup>(h)</sup> R4 = 56.0 Ohm <sup>(h)</sup>				
ZERO -2.2 mV <sup>(i)</sup> P_atm 962 mbar <sup>(i)</sup>				
SENS 112.5 mV/bar at 1.000 mA <sup>(k)</sup>				
SENS 450 mV/bar at 4.000 mA <sup>(k)</sup>				
(l) [bar]	(m) [mV]	(n) Lnorm [%FS]	(o) Lbfsl [%FS]	
0.000	0.0	0.00	0.06	
0.250	112.2	-0.07	-0.06	
0.500	224.9	0.08	0.06	
Long Term Stability Ok <sup>(p)</sup>				
Lot 649 <sup>(q)</sup>				
Test 500 Volt ok <sup>(r)</sup>				
Supply 1.000 mA <sup>(s)</sup>				
31.01.06 <sup>(t)</sup> ----- GOLI.D03DqK <sup>(t)</sup>				

Each sensor is delivered with a calibration sheet with the following data:

- (a) Type (PR-10) and range (0,5 bar) of pressure sensor  
 (b) Serial number of pressure sensor (not standard)  
 (c) Test temperatures  
 (d) Uncompensated zero offset in mV  
 (e) Zero offset values, in mV, with test resistance (270 kΩ) (for factory computation only)  
 (f) Zero offset, in mV, with calculated compensation resistor R1 or R2  
 (g) Temp. zero error, in mV, with compensation resistor R1 or R2  
 (h) Compensation resistor values R1 / R2 and R3 / R4  
 (i) Offset with compensation resistors R1/ R2 and R3 / R4 fitted (fine adjustment of zero with R5 potentiometer)  
 (j) Ambient pressure, zero reference for absolute sensors < 20 bar  
 (k) Sensitivity of pressure sensor  
 (l) Pressure test points  
 (m) Signal at pressure test points  
 (n) Linearity (best straight line through zero)  
 (o) Linearity (best straight line)  
 (p) Results of long term stability  
 (q) Lot-type (on request, identification of silicon chip)  
 (r) Voltage insulation test  
 (s) Excitation (constant current)  
 (t) Date of test ----- Test equipment

## Remarks:

- The indicated specifications only apply for constant current supply; the sensor should not be excited higher than 1,5 mA. The sensor signal is proportional to the current. When exciting with constant voltage, the zero offset values remain the same, the sensitivity decreases approx. 1% per +5°C.
- If exposed to extreme temperatures, the compensation resistors should have a temperature coefficient of < 50 ppm/°C. Sensor and resistors can be exposed to different temperatures.
- The sensors may be ordered with integrated compensation resistors (surcharge).



Subject to alterations

04/06

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