Series 7L

Piezoresistive OEM pressure transducers with high stability in a compact design

Features

- High long-term stability
- Robust, compact stainless-steel housing
- Front-flush, crevice-free welded diaphragm
- Very high proof pressure
- Optimised thermal behaviour

Technology

- Insulated piezoresistive pressure sensor encapsulated in an oil-filled metal housing
- Ideal for mounting with O-ring
- Typical range of output signal of 160 mV / mA

Typical Applications

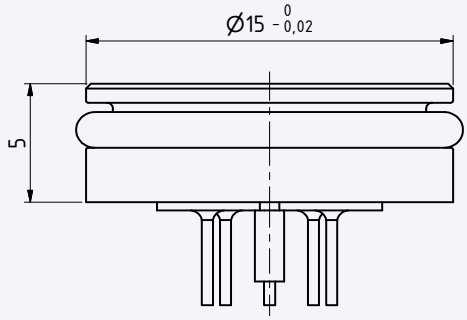
- OEM
- Industry
- Laboratory

Accuracy
± 0,50 %FS

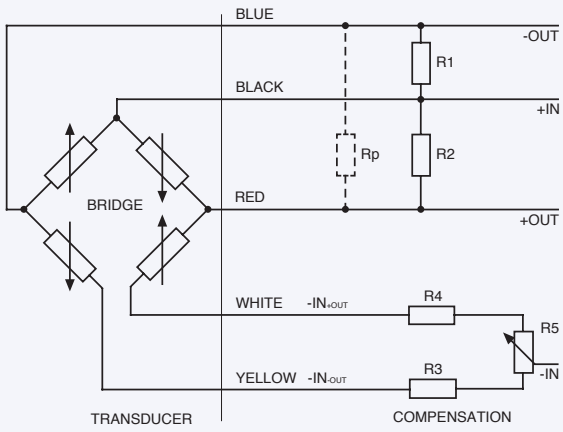
Long-term Stability
± 0,25 %FS/year

Pressure Ranges
0…5 bar to 0…200 bar

Series 7L



Electrical Diagram of a 7L with compensation resistors



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Edition 02/2022
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Series 7L – Specifications

Standard Pressure Ranges

Relative pressure	Absolute pressure	Absolute pressure	Proof pressure	Sensitivity		
PR	PAA	PA		min.	typ.	max.
0…5	0…5	0…5	15	24	32	40
0…10	0…10	0…10	30	12	16	20
0…20	0…20	0…20	60	6	8	10
0…30	0…30	0…30	90	4	5,3	6,7
0…50	0…50	0…50	150	2,4	3,2	4
	0…100	0…100	300	1,2	1,6	2
	0…160	0…160		0,75	1,0	1,25
	0…200	0…200				
bar rel.	bar abs.	bar	bar	mV / (mA × bar)		
Zero at atmospheric pressure	Zero at 0 bar abs. (vacuum)	Zero at 1 bar abs.	With reference to zero			

Performance

Accuracy @ RT (20…25 °C)	± 0,25 %FS typ.	Non-linearity (BFSL), pressure hysteresis, non-repeatability
	± 0,50 %FS max.	
Offset @ RT (20…25 °C)	< ± 25 mV/mA	Uncompensated, the sensitivity value must be added for PA
	< ± 2 mV/mA	Compensated with R3 or R4
Long-term stability	≤ ± 0,25 %FS	Per year under reference conditions
Position dependency	≤ 2 mbar	Calibrated in vertical installation position with metal diaphragm facing downwards
Temperature coefficient TCzero pre-compensated with R1 or R2	≤ ± 0,025 %FS/K	
Temperature coefficient sensitivity TCsens	≤ ± 0,06 %/K	
Temperature coefficient total bridge resistance TC-resistance	1800…3000 ppm/K	

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Series 7L – Specifications

Temperature Ranges

Compensated temperature range	-10…80 °C	Optional: Temperature ranges within -40…125 °C possible
Media temperature range	-20…100 °C	
Ambient temperature range	-20…100 °C	
Storage temperature range	-20…100 °C	

Electrical Data

Half-bridge configuration

Constant current supply	1 mA nominal 3 mA max.	
Bridge resistance @ RT (20…25 °C)	3,5 kΩ ± 20 %	
Electrical connection	Gold-plated pins ø 0,45 mm L = 4 mm ± 0,5 mm	Optional: Silicone wires AWG22, L = 70 mm, other lengths on request
Insulation	> 100 MΩ @ 500 VDC	

Mechanical Data

Materials in contact with media

Housing and diaphragm	Stainless steel AISI 316L	Optional: Hastelloy C-276
Seal ring	FKM (75 Shore) ø 12 mm × 1,5 mm -20...200 °C	Optional: Other materials on request

Other materials

Pressure transducer oil filling	Silicone oil	Optional: Other oil fillings on request

Further details

Diameter × height	ø 15 mm × 5 mm	See Dimensions and Options
Reference tube connection	ø 1,2 mm × 3 mm	Optional: Silicone reference tube for reference offset
Weight	approx. 4,5 g	

Dynamics

Vibration resistance	20 g, 10…2000 Hz, ± 10 mm	IEC 60068-2-6
Shock resistance	50 g, 11 ms	IEC 60068-2-27
Natural frequency (resonance)	> 30 kHz	
Endurance @ RT (20...25 °C)	> 10 million pressure cycles	0…100 %FS
Dead volume change @ RT (20...25 °C)	< 2 mm^3	

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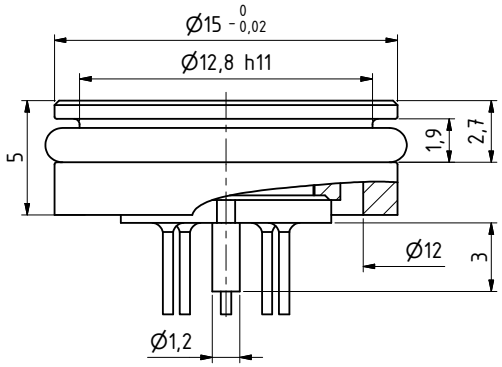
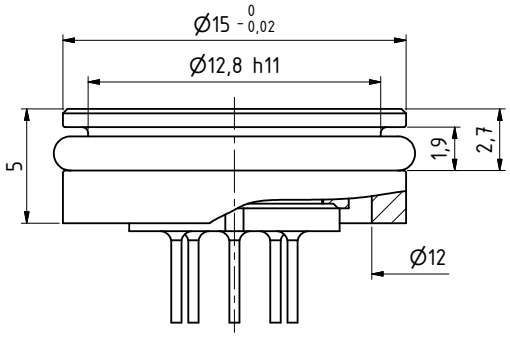
Series 7L – Dimensions and Options

Overview of Versions

PR

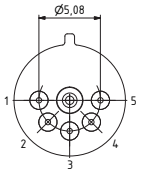


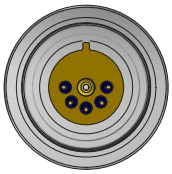
PAA / PA



Electrical Connection

Glass feedthrough connection





Half-open measurement bridge pin assignment

PIN	Label	Designation	Wire colour
1	+OUT	Positive Output	red
2	+IN	Positive Supply	black
3	-OUT	Negative Output	blue
4	$-IN_{-OUT}$	Negative Supply (half bridge -OUT)	yellow
5	$-IN_{+OUT}$	Negative Supply (half bridge +OUT)	white

Overview of Customer-specific Options

- Custom pressure ranges
- Custom temperature ranges
- Custom mathematical modeling
- Electrical connection with silicone wires
- Housing and diaphragm made of Hastelloy C-276
- O-Rings made of other materials
- Other oil filling types for pressure transducers: e.g. special oils for oxygen applications
- Modifications to customer-specific applications

Examples of Related Products

- Series 7FL: Version with flange
- Series 7LX: Pressure transducer 7L with digital compensation electronics
- Series 10L: Low-pressure transducer with maximum long-term stability
- Series PD-10L: Differential pressure version

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Series 7L – Analysis and Characteristic Lines

Standard Analysis

The 7L are intended for o-ring mounting and depend on the stress isolation provided by o-rings for performance within stated specifications. This installation enables the values measured during factory testing to remain valid. If the transducers are not installed free from stress, the mechanical forces may change the measured values and the stability of the pressure transducers.

Calibration sheet: Example type PA-10L

```
------------------------------------------------------------------------ 449
PA-10L / 10 bar / 10-1005-118 (1)        Sn I107547 (2)
------------------------------------------------------------------- 29/01
(3) Temp   (4) Zero    (5) +510    (6) Comp    (7) dZero
   [°C]      [mV]        [mV]        [mV]        [mV]
   -9,5      18,5        13,3        -0,6        0,2
    0,1      18,7        13,3        -0,6        0,2
   25,0      19,1        13,1        -0,8        0,0
   50,2      19,8        13,0        -0,9        -0,1
   79,9      20,8        12,9        -1,1        -0,2
------------------------------------------------------------------------ L1
COMP   R1     510 kOhm (8)      R3      56.0 Ohm (8)
RB          3482 Ohm (9)
ZERO          -0,8 mV (10)      P_atm     964 bar
SENS        16,41 mV/bar (11)

LIN                                  (14) Lnorm   (15) Lbfsl
  (12) [bar]      (13) [mV]           [%Fs]        [%Fs]
      0,000           0,0             0,00        -0,01
      2,500          41,1             0,02         0,01
      5,000          82,1             0,00         0,00
      7,500         123,1            -0,02        -0,01
     10,000         164,1            -0,01        -0,01
------------------------------------------------------------------------
Long Term Stability Ok (16)
Lot 72114-2 (17)
Test 500 Volt Ok (18)
Supply 1.000 mA (19)
01.09.17 (20) ---------------------------------- GOL3.A03D1K (20)
```

Key

1. Type (PA-10L) and measuring range (10 bar) of pressure sensor
2. Serial number of pressure sensor
3. Actual test temperatures
4. Uncompensated zero offset
5. Zero offset values with compensation resistor R1 (+) or R2 (-) connected
6. Zero offset with calculated compensation resistors connected
7. Temperature zero error with compensation resistors connected
8. Calculated compensation resistor values R1 or R2 (TCzero) and R3 or R4 (offset)
9. RB: Bridge resistance at room temperature
10. Calculated offset with compensation resistors R1 or R2 and R3 or R4 connected
11. Sensitivity of pressure sensor at room temperature
12. Pressure test points
13. Signal at pressure test points
14. Non-linearity (best straight line through zero)
15. Non-linearity (best straight line)
16. Results of long-term test
17. Sensor traceability information
18. Insulation test
19. Excitation (constant current)
20. Date of test -------- Test equipment

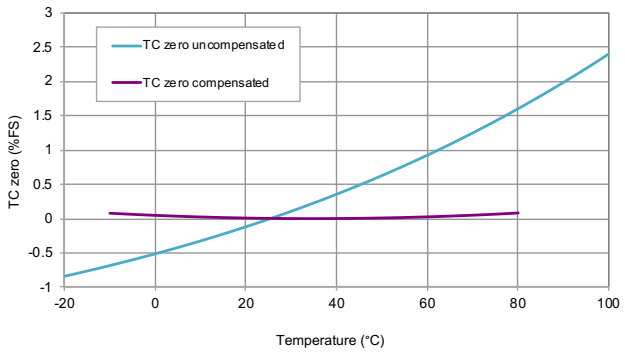
Notes

- The indicated specifications apply only for constant current supply of 1 mA. The sensor must not be supplied more than 3 mA. The output voltage is proportional to the current supply (excitation). If excitation other than 1mA used, the output signal will deviate from the calibrated values.
- 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.
- Fine adjustment of zero with R5 potentiometer (20 Ω) is possible. In addition, a maximum TC-sensitivity can be guaranteed on request or the value for the compensation resistor (Rp) can be indicated. See Electrical Diagram of a 7L with Compensation on page 1.

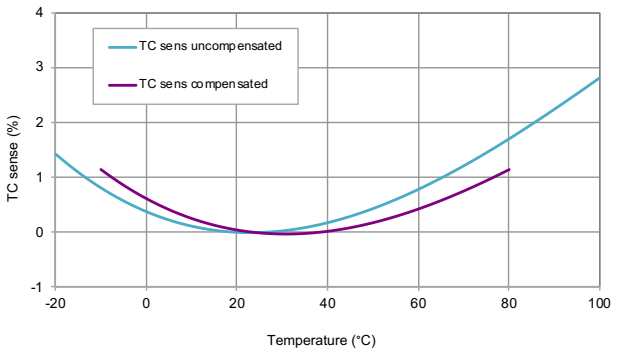
Characteristic Lines

Examples of typical characteristic curves of the temperature coefficients, normalised at 25 °C, uncompensated vs. compensated

Temperature coefficient zero, TCzero



Temperature coefficient sensitivity, TCsens



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Series 7L – Analysis and Characteristic Lines

Mathematical Compensation Model

The KELLER pressure transducers of series 7L can be ordered with an optional mathematical compensation model.

The compensation model is a mathematical formula that helps to calculate the compensated pressure value of the pressure transducer.
Both the pressure signal and the temperature signal of the pressure transducer are incorporated into the calculation. Polynomial functions are used as the basis for this mathematical model.

The pressure transducers are characterised in the factory in order to produce the compensation model. This involves measuring pressure and temperature signals at various pressure and temperature levels. Comparing the measured values with the known pressure and temperature values enables the calculation of the compensation coefficients of the pressure transducer. These compensation coefficients are made available to the customer along with the respective pressure transducer.

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