Series 10LHP

Piezoresistive OEM high-pressure transducer with optimum long-term stability

Features

- Optimum long-term stability
- Robust housing made from stainless steel, Hastelloy or titanium
- Front-flush diaphragm welded with no gaps
- 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 and support ring
- Typical output signal range of 160 mV/mA

Typical applications

- OEM
- Industry
- Laboratory
- Oil and gas
- Oceanology

Accuracy
± 0,25 %FS
Long-term stability
± 0,15 %FS/year
Pressure ranges
0…100 bar to 0…1000 bar

Series 10LHP

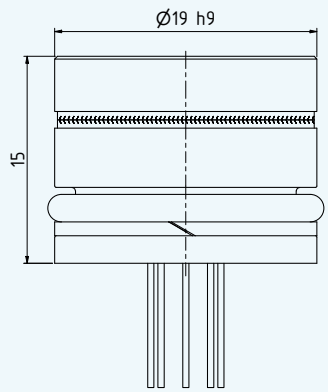
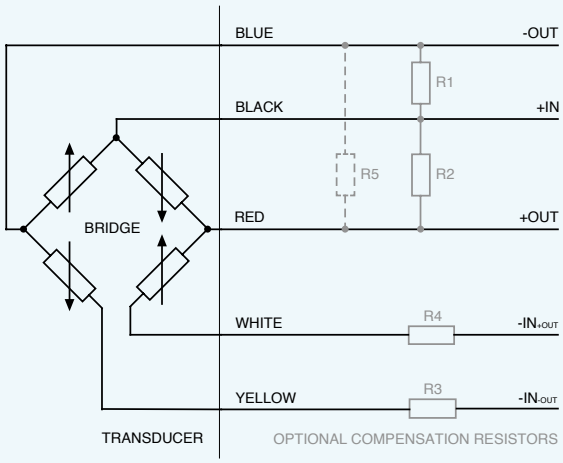


Diagram of a measurement bridge with compensation



Version 03/2025
Subject to change
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Series 10LHP – Specifications

Standard pressure ranges

Absolute pressure PAA	Absolute pressure PA	Proof pressure	Sensitivity		
			min.	type	max.
0…100	0…100	250	1,20	1,60	2,00
0…160	0…160	400	0,75	1,00	1,25
0…250	0…250	625	0,48	0,64	0,80
0…400	0…400	1000	0,30	0,40	0,50
0…600	0…600	1500	0,20	0,267	0,333
0…1000	0…1000	1500	0,12	0,16	0,20
bar abs.	bar	bar	mV/(mA × bar)		
Reference pressure at 0 bar abs. (vacuum)	Reference pressure at 1 bar abs.	Based on reference pressure	The standard pressure ranges are available from the warehouse. Additional calibrations to intermediate pressure ranges can also be made.		

Performance

Accuracy @ RT (20…25 °C)	± 0,25 %FS typ.	Non-linearity (best fit straight line, 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
Compensated temperature range	-10…80 °C	Other temperature ranges between -55…150 °C are possible as an option
Long-term stability	≤ ± 0,15 %FS	Per year under reference conditions.
Position dependency	≤ 2 mbar	Calibrated in vertical installation position with metal diaphragm facing downwards.
Temperature coefficient	≤ ± 0,015 %FS/K	Zero (TCzero) pre-compensated with R1 or R2
	≤ ± 0,06 %/K	Sensitivity (TCsens)
	1800…3000 ppm/K	Total bridge resistance (TCres)

Electrical data

Half-open measurement bridge

Constant current supply	1 mA nominal 3 mA maximum	
Bridge resistance @ RT (20…25 °C)	3,5 kΩ ± 20 %	
Electrical connection	Gold-plated pins ø 0,45 mm L = 9 mm ± 0,5 mm	Optional: Silicone wires AWG28 (0,09 mm²), L = 70 mm, other lengths on request
Insulation	> 100 MΩ @ 500 VDC	

Series 10LHP – Specifications

Mechanical data

Materials in contact with media

Housing and diaphragm	Stainless steel AISI 316L	Series 10LHP
	Hastelloy C-276	Series 10LHPH
	Titanium	Series 10LHPTi
O-ring	ø 15 mm × 2 mm FKM (90 Shore) -20…200 °C	For media temperatures < -20 °C, FVMQ is used. Others available on request
Support ring	≥ 60...600 bar: PTFE	
	> 600…1000 bar: PEEK	
	ø 19 mm / ø 16 mm × 1 mm	

Other materials

Pressure transducer oil filling	Silicone oil	Others available on request

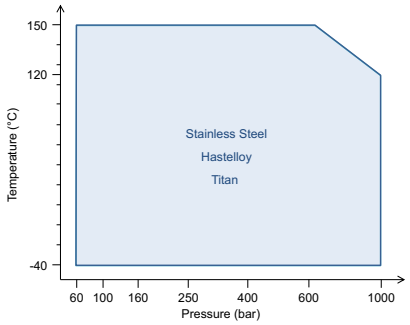
Further details

Diameter × height	ø 19 x 15 mm	See dimensions and options
Weight	approx. 30 g	Series 10LHP
		Series 10LHPH
	approx. 16 g	Series 10LHPTi

Environmental conditions

Medium temperature range	-40…150 °C	Optional: -55…150 °C	Observe the o-ring operating temperature. Icing not permitted
Ambient temperature range	-40…150 °C		
Storage temperature range	-40…150 °C		
Vibration resistance	10 g, 10…2000 Hz, ±10 mm		IEC 60068-2-6
Shock resistance	50 g, 6 ms		IEC 60068-2-27
Natural frequency (resonance)	> 30 kHz		
Load cycles @ RT (20…25 °C)	> 10 m. pressure cycles		0…100 %FS
Dead volume change @ RT (20…25 °C)	< 2 mm^3		

Recommended material selection according to pressure and temperature

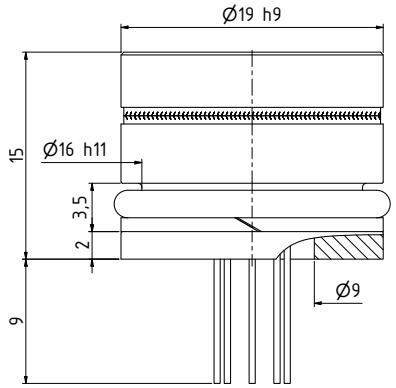


KELLER 10LHP series high-pressure transducers are available in various material options. Stainless steel, Hastelloy or titanium can be selected depending on the relevant requirements (see “Mechanical data”).

The diagram opposite shows the material options available based on pressure and temperature. All the materials mentioned are compatible with pressure ranges up to 1000 bar.

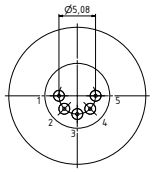
Series 10LHP – Dimensions and options

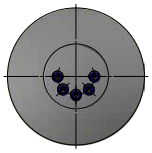
Dimensions



Electrical connection

Glass feedthrough connection





Half-open measurement bridge pin assignment

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

Overview of customer-specific options

- Calibration to customer-specific pressure ranges
- Calibration to customer-specific temperature ranges
- Calibration with a mathematic model
- Electrical connection via silicone wires
- O-rings made of other materials
- Other oil filling for pressure transducers
- Modifications to customer-specific applications

Examples of similar products

- Series 10L: Low-pressure version for pressure ranges < 200 bar
- Series 10LX/10LHPX: with digital compensation electronics
- Series 6LHP/7LPH: high-pressure version in more compact designs

Series 10LHP – Analysis and characteristic lines

Standard analysis

The pressure transducers are intended for O-ring mounting and are therefore designed for low force transmission. This method of installation enables the values measured in the test equipment to remain unchanged. If the transducers are not de-energised when they are installed, the mechanical forces may change the measured values and the stability of the pressure transducers.

Calibration sheet: example type PA-10L	Key

---------- 449

PA-10L / 10 bar / 10-1005-118 (1) **Sn I107547** (2)

---------- 29/01

(3) Temp [°C]	(4) Zero [mV]	(5) +510 [mV]	(6) Comp [mV]	(7) dZero [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 mbar
SENS 16.41 mV/bar (11)

LIN (12) [bar]	(13) [mV]	(14) Lnorm [%Fs]	(15) Lbfsl [%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.A03DIK (20)

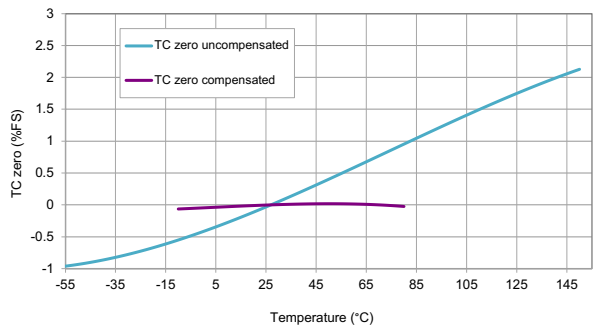
1. Type (PA-10L) and measuring range (10 bar) of pressure sensor
2. Serial number of pressure sensor
3. Actual test temperatures
4. Uncompensated zero offset
5. Zero offset values with calculated compensation resistor R1 (+) or R2 (-)
6. Zero offset values with calculated compensation resistors R1 or R2 and R3 or R4
7. Temperature zero error with calculated compensation resistors
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
11. Sensitivity of pressure sensor at room temperature 25 °C
12. Pressure test points
13. Signal change at pressure test points at room temperature 25 °C
14. Nonlinearity (best straight line through zero)
15. Nonlinearity (best straight line)
16. Result of the long-term stability test
17. Lot number and identification of silicon wafer
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 with more than 3 mA. The output voltage is proportional to the supply current. If the supply deviates from the calibration, this will cause signal shifts.
- The compensation resistors described in this data sheet are not part of the pressure transducer and are not included in the scope of delivery.
- It is recommended to use compensation resistors with temperature coefficients of < 50 ppm/°C for large temperature ranges. 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 Diagram “Measurement bridge with compensation” on page 1.

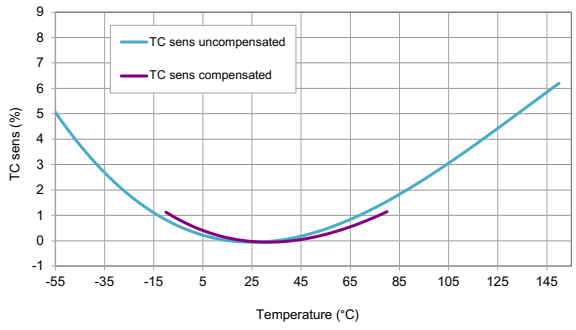
Characteristic lines

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

Temperature coefficient zero (TCzero)



Temperature coefficient sensitivity (TCsens)



Series 10LHP – Analysis and characteristic lines

Mathematic model

KELLER's Series 10LHP pressure transducers can be ordered with an optional 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 makes it possible to calculate the compensation coefficients of the pressure transducer. These compensation coefficients are made available to the customer along with the respective pressure transducer.

KELLER
myCalibration

KELLER myCalibration

Content
myCalibration is a digital data platform provided free of charge to KELLER customers. It provides an easy option for transferring and providing sensor calibration data.

Format
The calibration data is available in the standard JSON file format, which facilitates smooth integration into the customer's software. The file structure is clearly defined in a publicly accessible JSON schema. This means that the customer is able to integrate the data seamlessly into their software.

Access
The platform can be accessed either via a standard web browser (web view) or directly within the customer's linked software using an API. The calibration data remains available in myCalibration for 24 months.

Web app
Customers can access the calibration data for their sensors via a user-friendly interface. The system ensures secure authentication by asking users to enter their personal login details, thereby preventing unauthorised access to the data by third parties.
The user has the option to use various search and filter functions to download calibration data for specific sensors or mass export multiple datasets simultaneously.

API
Customers have the option to use the REST API for automated access and to integrate it into their processes. This means that calibration data for new sensors can be called up automatically and then processed, for example.

Documentation
Comprehensive technical documentation including example software is available at the following link: https://mycalibration.github.io/