20S Series

Piezoresistive OEM pressure transducers with very high stability

Features

- Very high long-term stability
- Robust stainless-steel housing
- High proof pressure
- Optimised thermal behaviour

Technology

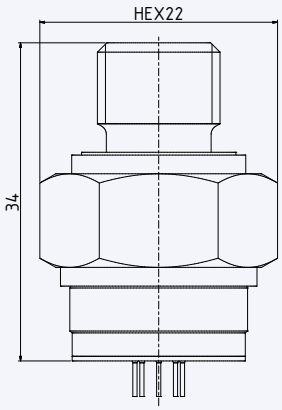
- Insulated piezoresistive pressure sensor encapsulated in an oil-filled metal housing
- Fully welded design with no internal seals
- Typical range of output signal of 160 mV / mA

Typical applications

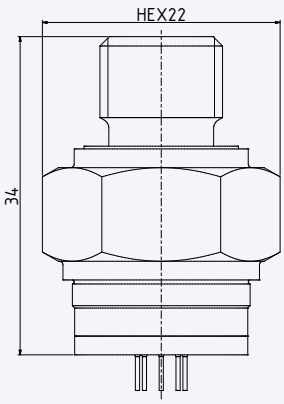
- OEM
- Industry
- Oil and gas

Accuracy
± 0,25 %FS
Long-term stability
± 0,2 %FS / year
Pressure ranges
0…0,3 bar to 0…1000 bar

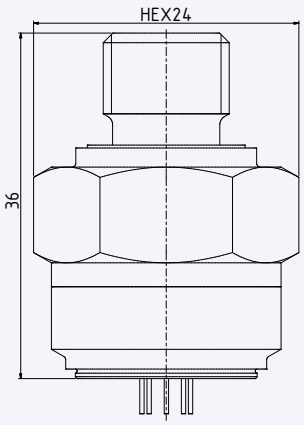
20S Series: 0…0,3 to 0…50 bar



20S Series: 0…50 to 0…200 bar



20S Series: 0…200 to 0…1000 bar



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20S Series – Specifications

Standard pressure ranges

Relative pressure PR		Absolute pressure PAA	Absolute pressure PA	Proof pressure	Sensitivity		
					min.	typ.	max.
-0,3…0,3	0…0,3			3	98	130	163
-1…0	0…1	0…1	0…1	6	60	80	100
-1…2	0…3	0…3	0…3	9	40	53,3	66,7
	0…10	0…10	0…10	30	12	16	20
	0…30	0…30	0…30	90	4	5,3	6,7
		0…100	0…100	300	1,2	1,6	2
		0…200	0…200		0,48	0,64	0,80
		0…400	0…400	800	0,30	0,40	0,50
		0…1000	0…1000	1200	0,12	0,16	0,20
bar rel.		bar abs.	bar abs.	bar	mV / (mA × bar)		
Reference pressure at ambient pressure		Reference pressure at 0 bar abs. (vacuum)	Reference pressure at 1 bar abs.	based on reference pressure	Note: 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 fitted 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 within -40…125 °C possible as an option
Long-term stability	≤ ± 0,2 %FS	Per year under reference conditions
Degree of dependency on location	≤ 2 mbar	Calibrated in vertical installation position with pressure connection facing downwards
Temperature coefficient zero (TCzero) pre-compensated with R1 or R2	≤ ± 0,02 %FS / K	For pressure ranges ≥ 2 bar
	< ± 4 mbar / K	For pressure ranges < 2 bar
Temperature coefficient sensitivity (TCsens)	≤ ± 0,06 % / K	For pressure ranges ≥ 3 bar
	≤ ± 0,12 % / K	For pressure ranges < 3 bar
Temperature coefficient total bridge resistance (TCresistance)	1800…3000 ppm / K	

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20S Series – Specifications

Electrical data

Half-bridge configuration

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 = version-dependent	See Dimensions and options Optional: 28AWG silicone wires, L = 70 mm, other lengths on request Optional: Circuit board with JST female connector
Insulation	> 100 MΩ @ 500 VDC	

Mechanical data

Materials in contact with fluid

Housing and separating diaphragm	Stainless steel AISI 316L	
Pressure connection seal	FKM (75 Shore) -20…200 °C	Others on request

Other materials

Pressure transducer oil filling	Silicone oil	Others on request

Further details

Pressure connection	G1/4 male	See Dimensions and options
	1/4-18NPT male	
Diameter × height	Depends on pressure range	
Connection for capillary for reference pressure compensation	ø 1,2 mm × 3 mm	Optional: Capillary (silicone)
Weight (approx.)	approx. 65 g	For pressure ranges ≤ 200 bar
	approx. 85 g	For pressure ranges > 200 bar

Ambient conditions

Media temperature range	-40…125 °C	Icing not permitted Optional: Temperature ranges within -55…150 °C possible	
Ambient temperature range	-40…125 °C		
Storage temperature range	-20…70 °C		
Vibration endurance	10 g, 10…2000 Hz, ± 10 mm	IEC 60068-2-6	
Shock endurance	50 g, 6 ms	IEC 60068-2-27	
Natural frequency (resonance)	> 20 kHz		
Pressure endurance @ RT (20…25 °C)	> 10 million pressure cycles	0…100 %FS	Restricted for pressure > 600 bar

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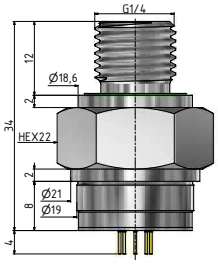
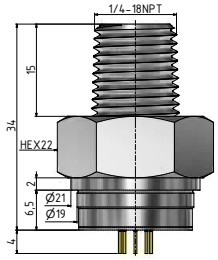
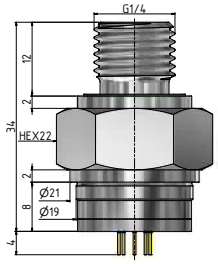
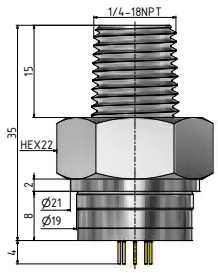
Series 20S – Dimensions and options

Available pressure connections

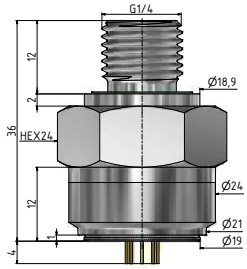
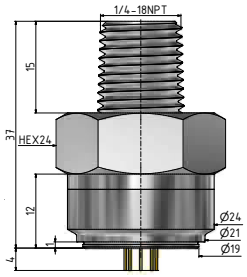
For pressure ranges ≤ 50 bar

G1/4	1/4-18NPT
	
DIN EN ISO 1179-2	ASME/ANSI B 120.1

For pressure ranges of > 50 to ≤ 200 bar

G1/4	1/4-18NPT
	
DIN EN ISO 1179-2	ASME/ANSI B 120.1

For pressure ranges > 200 bar

G1/4	1/4-18NPT
	
DIN EN ISO 1179-2	ASME/ANSI B 120.1

Other pressure connections available on request.

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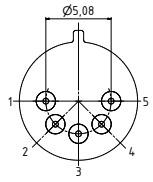
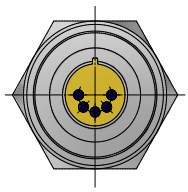
Series 20S – Dimensions and options

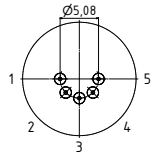
Electrical connection

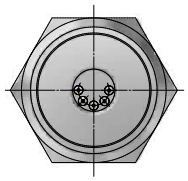
Glass feedthrough connection





For pressure ranges ≤ 200 bar



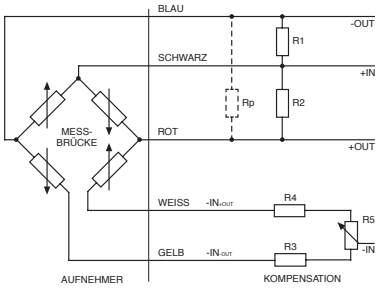


For pressure ranges > 200 bar

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

Electrical diagram of compensation resistors



Overview of customer-specific options

- Custom pressure ranges
- Custom temperature ranges
- Custom mathematical modeling
- Housing and separating diaphragm made from Hastelloy C-276, Iconel 718 or titanium
- Electrical connection with silicone wires
- 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

- 20SX Series: Pressure transducer 20S with digital compensation electronics
- 20SY Series: Pressure transducer 20S with analog compensation electronics
- 20SC Series: Pressure transducer 20S with chip-in-oil technology and analog ratiometric output signal
- 20SD Series: Pressure transducer 20S with chip-in-oil technology and I²C interface
- 20 Series: Pressure transducer with high stability in a compact design

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20S Series – Analysis and characteristic curves

Standard analysis

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 bar
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.A03D1K (20)

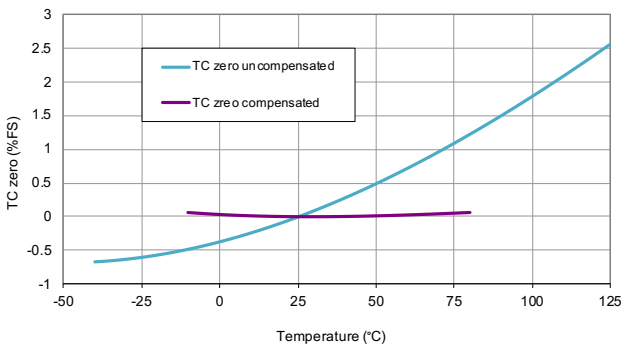
Key	
1.	Type (PA-10L) and measuring range (10 bar) of pressure sensor
2.	Serial number of pressure sensor
3.	Actual test temperatures
4.	Uncompensated zero offset
5.	Zero offset values with compensation resistor R1 (+) or R2 (-) connected
6.	Zero offset with calculated compensation resistors connected
7.	Temperature zero error with compensation resistors connected
8.	Calculated compensation resistor values R1 or R2 (TCzero) and R3 or R4 (offset) connected
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
12.	Pressure test points
13.	Signal at pressure test points
14.	Nonlinearity (best straight line through zero)
15.	Nonlinearity (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

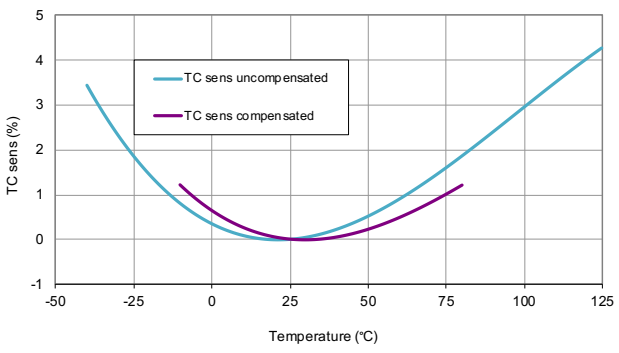
Notes
- The indicated specifications apply only for constant current supply of 1 mA. The sensor must not be supplied with more than 3 mA. The output voltage is proportional to the supply current. If the supply deviates from the calibration, signal shifts may occur.
- The compensation resistors described in this data sheet are not part of the pressure transducer and are not included in the scope of delivery.
- Compensation resistors with a temperature coefficient of < 50 ppm/°C must be used in extreme temperatures. 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 compensation resistors” on page 5.

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)





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20S Series – Analysis and characteristic curves

Mathematical compensation model

KELLER's 20S Series pressure transducers 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 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.

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