

Piezoresistive Absolute Pressure Sensors

Type 4043A..., 4045A...,
4073A..., 4075A...

Universal Precision Pressure Sensors

Universal sensor suitable for measuring absolute pressures in ranges from 0 ... 2 bar to 0 ... 500 bar.

- Designs for compensated operating temperature ranges: -20 ... 50 °C and 20 ... 120 °C
- Available as basic or PiezoSmart® design with TEDS functionality
- Ideal for gas exchange analysis in internal combustion engines
- Isolated from medium with steel diaphragm
- Small dimensions
- Frontflush diaphragms, suitable for rapid changes in pressure

Description

The pressure is applied to the silicon load via a thin steel diaphragm and the transmission medium of silicone oil. This silicon load cell has a micromechanically produced diaphragm structure. It contains implanted piezoresistive resistors connected in a Wheatstone bridge. The applied pressure unbalances the bridge and produces a proportional output signal.

Individually tuned resistors built into the sensor compensate most of the thermal effects.

This series of sensors is consequently suitable for precise measurement of static and dynamic pressure variations. The sensors measure the absolute pressure, i.e. the pressure relative to a vacuum. Fluctuations in barometric pressure (approx. 30 mbar) are therefore included. Medium isolation is achieved using a steel diaphragm, which ensures universality of application.

Application

Main area of application is the acquisition of intake and outlet pressures (mounted in cooling adapters) for the purpose of gas exchange optimization in combustion engines. Other applications include the measurement of injection pressures in GDI engines, measurement of hydraulic pressures, etc., where small mounting dimensions, a front-flush diaphragm (for rapid changes in pressure) and good thermal compensation are important.



PiezoSmart® version
Type 4045A...V200S



PiezoSmart® version
Type 4075A...V200S

Basic model (connector on sensor housing)

This is suitable for connection to amplifier Type 4603B and 4618A...

The sensor is supplied with a constant current I_{cal} , whose magnitude is determined by factory calibration. The calibration current I_{cal} and the zero-point offset are shown for each individual sensor that is set on amplifier Type 4603B. The calibration current I_{cal} and the zero point are set such that a sensor output signal of 500 mV is generated at a pressure of 100 %FS.

PiezoSmart version with TEDS (V200S)

This version has an integral cable and a data chip for storing the calibration values. When it is connected to amplifier Type 4665... they are read and adjusted.

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Technical Data (at $T_{ref} = 25\text{ °C}$)

Sensor versions

| Sensor Type | | 4043A... | 4073A... | 4045A... | 4075A... |
|---|----|------------|----------|------------|----------|
| Process connection | | M14x1,25 | M12x1 | M14x1,25 | M12x1 |
| Compensated operating temperature range | °C | -20 ... 50 | | 25 ... 120 | |
| Min./Max. temperature | °C | -40/70 | | 0/140 | |

Technical Data Type 4043A.../4045A...

| Sensor Type | | A2 | A5 | A10 | A20 | A50 | A100 | A200 | A500 | |
|-----------------------------|-----------|-----------------|---------|----------|----------|----------|-----------------|-----------|-----------|--|
| Measuring ranges | bar | 0 ... 2 | 0 ... 5 | 0 ... 10 | 0 ... 20 | 0 ... 50 | 0 ... 100 | 0 ... 200 | 0 ... 500 | |
| Overload | bar | 5 | 12,5 | 25 | 50 | 125 | 250 | 500 | 750 | |
| Nominal sensitivity | mV/bar/mA | 62,5 | 25 | 11,5 | 6,25 | 2,5 | 1,25 | 0,625 | 0,25 | |
| Natural frequency | kHz | ≈30 | ≈80 | ≈120 | ≈150 | ≈180 | >200 | >200 | >200 | |
| Linearity (LSQ) | ±%FSO | ≤0,2 | ≤0,1 | | | | | ≤0,3 | | |
| Thermal zero point shift* | ±%/FSO | ≤0,7 | ≤0,5 | ≤0,5 | ≤0,5 | ≤0,5 | ≤0,5 | ≤0,5 | ≤±0,5 | |
| Thermal sensitivity change* | ±% | ≤1,5 (4043A...) | | | | | ≤1,0 (4045A...) | | | |
| Tightening torque | N·m | 12 ... 20 | | | | | | | | |
| Weight (without cable) | g | 33 | | | | | | | | |

Technical Data Type 4073A.../4075A...

| Sensor Type | | A10 | A20 | A50 | A100 | A200 | A500 | |
|-----------------------------|-----------|-----------------|----------|----------|-----------|-----------|-----------------|--|
| Measuring ranges | bar | 0 ... 10 | 0 ... 20 | 0 ... 50 | 0 ... 100 | 0 ... 200 | 0 ... 500 | |
| Overload | bar | 25 | 50 | 125 | 250 | 500 | 750 | |
| Nominal sensitivity | mV/bar/mA | 12,5 | 6,25 | 2,5 | 1,25 | 0,625 | 0,25 | |
| Natural frequency | kHz | ≈120 | ≈150 | ≈180 | >200 | >200 | >200 | |
| Linearity (LSQ) | ±%FSO | ≤0,1 | | | | | ≤0,3 | |
| Thermal zero-point shift* | %FSO | ≤±0,5 | | | | | | |
| Thermal sensitivity change* | ±% | ≤1,5 (4073A...) | | | | | ≤1,0 (4075A...) | |
| Tightening torque | N·m | 12 ... 20 | | | | | | |
| Weight (without cable) | g | 28 | | | | | | |

General Technical Data, Type 4043A.../4045A.../4073A.../4075A...

| | | |
|---|--------|------------------------|
| Calibration current range (basic version) I_{cal} | mA | 1 ... 5 |
| Full-scale output (FSO) with I_{cal} | mV | 500 |
| Reference current (V200S versions) I_{ref} | mA | 1 |
| Input/output impedance | kΩ | ≈3 |
| Stability: * | | |
| of sensitivity type. | %/a | <0,3 (for 2 bar <0,5%) |
| of zero point type. | %FSO/a | <0,3 |
| Acceleration sensitivity | mbar/g | <0,3 |
| Shock resistance | g | 1 000 |
| Degree of protection | | IP65 |
| Zero point (ZMO at 0 bar abs) | mV/mA | ≤±5 |

Material

| | | |
|---------------|-----------------|--------|
| Diaphragm | mat. no. | 1.4435 |
| Sensorgehäuse | mat. no. | 1.4301 |
| Cable (V200S) | Fluoroelastomer | |

* In a compensated temperature range

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Basic model, Types 4043A... and 4045A...

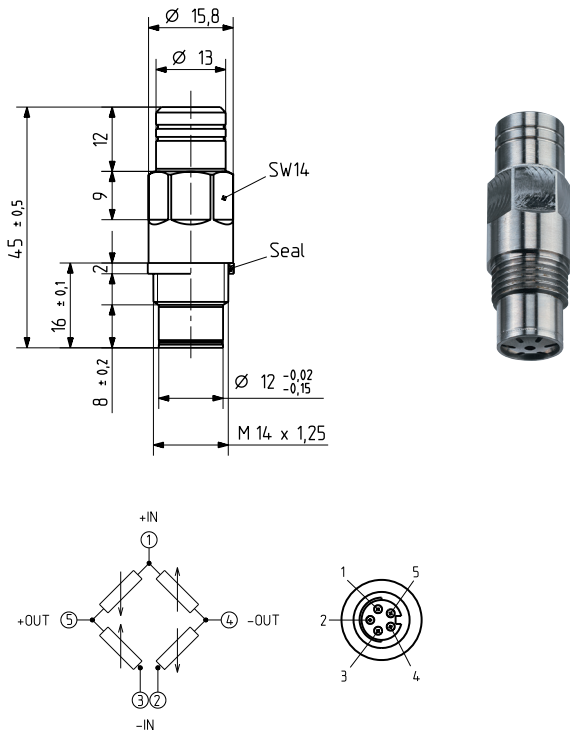


Fig. 1a: Sensor measuring bridge and pin allocation

Basic model, Types 4073A... and 4075A...

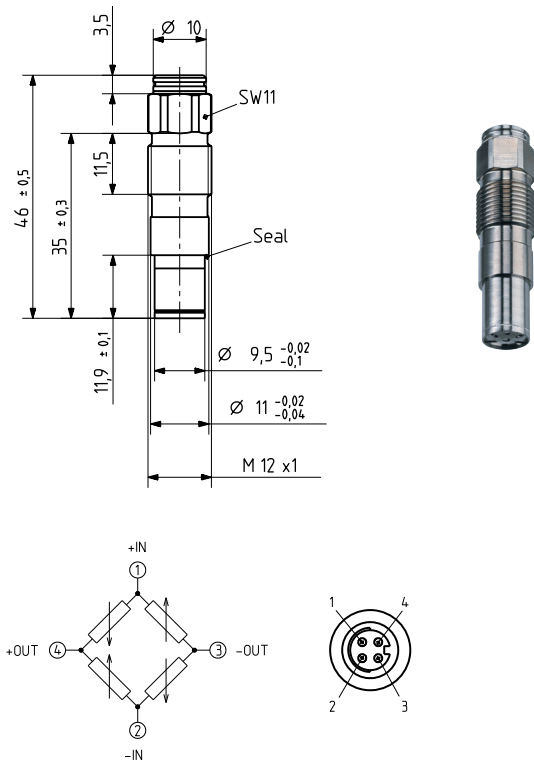


Fig. 1b: Sensor measuring bridge and pin allocation

Measuring chains

The sensors can be used with several amplifiers:

- Laboratory amplifiers, e.g. Type 4603B...
- Plug-in amplifier for multichannel signal conditioning, e.g. Type 4643 and 4665
- Measuring chain amplifiers, e.g. Type 4618A...

Please contact your local Kistler distributor for detailed advice.

**PiezoSmart® versions with TEDS functionality
Type 4045/4075A...V200S; for use with amplifier Type 4665...**

PiezoSmart is an automatic sensor identification system based on the standard IEEE 1451.4. Kistler supplies piezoelectric and piezoresistive sensors for the SCP (Signal Conditioning Platform). These designs of sensor are characterized by TEDS functionality (sensor identification) and the associated automatic configuration (plug & play) for maximum process reliability.

Detailed information on PiezoSmart can be found in brochure doc. no. 100-421.

For the oil-filled series, Types 4045/75A... are available in the form of an SCP design with TEDS functionality and may be identified by their type extension: _V200S. These versions should be chosen as standard for engine application with intake and exhaust measurement, and are ideally operated with the two-channel amplifier Type 4665.

Detailed information on the amplifier Type 4665 can be found in the data sheet, doc.no. 2854A_000-409.

PiezoSmart® Type 4045A...V200S

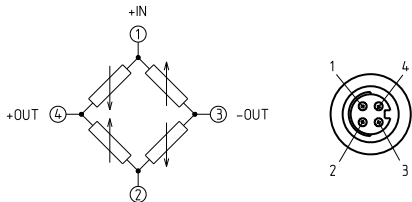
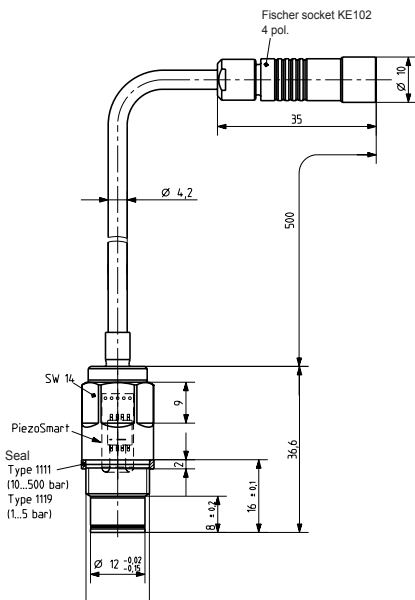


Fig. 2a: Sensor measuring bridge and pin allocation

PiezoSmart® Type 4075A...V200S

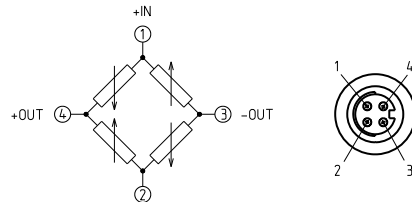
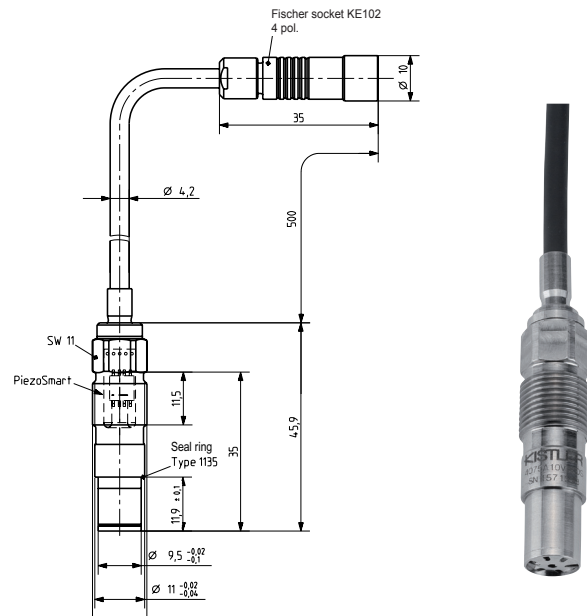


Fig. 2b: Sensor measuring bridge and pin allocation

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Installation

In the case of direct mounting the dimensions shown in Figures 3a and 3b must be achieved. For measurements of a compressible medium under highly dynamic flow conditions (such as

those encountered during measurement of intake pressure on combustion engines) the sensor must be flush-mounted. The sensor must be tightened to a torque of 12 ... 20 Nm

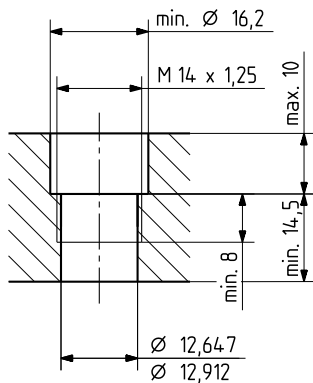


Fig. 3a: Mounting bore for Type 4043A.../4045A...

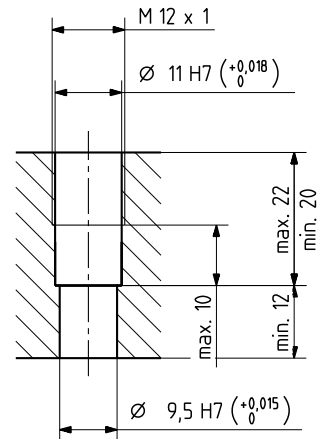


Fig. 3b: Mounting bore for Type 4073A.../4075A...

Cooled switching adapter Type 7533B... for measuring intake and exhaust pressure

For high-precision measurements the cooled switching adapter in the intake and exhaust is recommended.

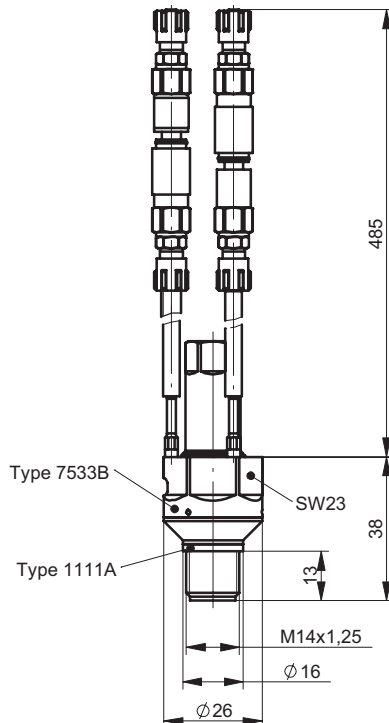


Fig. 4: Cooled switching adapter Type 7533B...

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Type 4043A.../4045A...

| Accessories included | Type/Mat. No. |
|--|---------------|
| • Thermoplastic seal (0 ... 5 bar) | 1119 |
| • Cu-seal (10 ... 500 bar) | 1111 |
| Accessories (optional) | Type/Mat. No. |
| • Seals | |
| – Ni-seal | 1111A |
| • Connection cable for basic version | |
| – for amplifier Type 4603B... (<70 °C) | 4751A... |
| – for amplifier Type 4603B... (<180 °C) | 4761B... |
| – for amplifier Type 4618A... | 4765B... |
| • Connection cable for PiezoSmart version | |
| (see also PiezoSmart brochure doc. no. 100-421) | |
| – for amplifier Type 4665 (<70 °C) | 4753A... |
| – for amplifier Type 4665 (<180 °C) | 4763B... |
| • Cooling adapters | |
| – Cooling adapter, damped M14x1,25 | 7511 |
| – Cooled switching adapter M14x1,25 | 7533B11 |

Type 4073A.../4075A...

| Accessories included | Type/Mat. No. |
|--|---------------|
| • Cu sea | 1135 |
| Accessories (optional) | Type/Mat. No. |
| • Seals | |
| – Ni seal | 1135A |
| – Fluoropolymer seal | 1137 |
| • Connection cable for the basic version | |
| – for amplifier Type 4603B... (<70 °C) | 4753A... |
| – for amplifier Type 4603B... (<180 °C) | 4763B... |
| – for amplifier Type 4618A... | 4767B... |
| • Connection cable for PiezoSmart version | |
| (see also PiezoSmart brochure doc. no. 100-421) | |
| – for amplifier Type 4665 (<70 °C) | 4753A... |
| – for amplifier Type 4665 (<180 °C) | 4763B... |
| • Cooling adapters | |
| – Cooling adapter M18x1,25 | 7505B |
| – Cooling adapter M14x1,25 | 7507 |
| – Cooled switching adapter M14x1,25 | 7533B12 |

Ordering Key Sensor M14x1,25

| | | Type 404 | A | | |
|---------------------------------|-------|----------|---|---|---|
| Temperature range –20 ... 50 °C | 3 | ↑ | ↑ | ↑ | ↑ |
| Temperature range 20 ... 120 °C | 5 | | | | |
| Pressure range | | ↑ | ↑ | ↑ | ↑ |
| 0 ... 2 bar | 2 | | | | |
| 0 ... 5 bar | 5 | | | | |
| 0 ... 10 bar | 10 | | | | |
| 0 ... 20 bar | 20 | | | | |
| 0 ... 50 bar | 50 | | | | |
| 0 ... 100 bar | 100 | | | | |
| 0 ... 200 bar | 200 | | | | |
| 0 ... 500 bar | 500 | | | | |
| Basic Type | – | ↑ | ↑ | ↑ | ↑ |
| With PiezoSmart ¹⁾ | V200S | | | | |

¹⁾ Cable length l = 500 mm. Not available as Type 4043A...

Ordering Key Sensor M12x1

| | | Type 407 | A | | |
|---------------------------------|-------|----------|---|---|---|
| Temperature range –20 ... 50 °C | 3 | ↑ | ↑ | ↑ | ↑ |
| Temperature range 20 ... 120 °C | 5 | | | | |
| Pressure range | | ↑ | ↑ | ↑ | ↑ |
| 0 ... 10 bar | 10 | | | | |
| 0 ... 20 bar | 20 | | | | |
| 0 ... 50 bar | 50 | | | | |
| 0 ... 100 bar | 100 | | | | |
| 0 ... 200 bar | 200 | | | | |
| 0 ... 500 bar | 500 | | | | |
| Basic Type | – | ↑ | ↑ | ↑ | ↑ |
| With PiezoSmart ¹⁾ | V200S | | | | |

¹⁾ Cable length l = 500 mm. Not available as Type 4073A....

Details on PiezoSmart sensor identification can be found in PiezoSmart brochure, doc. no. 100-421d.