

# Water Cooled Absolute Pressure Sensor Type 4049A...

## High Temperature Gas Pressure Measurement

Patent pending

The water cooled piezoresistive absolute pressure sensor Type 4049A... is a small, rugged sensor suitable for exposure to hot gaseous media. It is particularly well suited for exhaust pressure measurement in internal combustion engines.

- Rugged design for exhaust pressure measurement for temperatures in excess of 1 100 °C
- Compact size
- Digital temperature compensation
- Media separated measuring element

### Description

The piezoresistive pressure sensor Type 4049A... with integrated water cooling is capable of continuous high temperature operation. Available in absolute pressure range 0 ... 5 and 0 ... 10 bar it is designed for use in varied applications but specifically for exhaust pressure measurement without the use of additional water cooled adapters.

Sensor Type 4049A... utilizes a Wheatstone bridge implanted in a silicon measuring element to generate an electrical signal which is proportional to the applied pressure. The measuring element is situated behind a thin steel isolation diaphragm and an oil fill providing excellent media compatibility. This core element is placed within a cooling jacket whereby the internal temperature can be suitably managed and is somewhat independent of the applied hot gases.

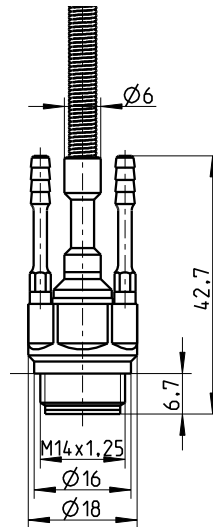
This approach allows the sensor to be exposed to gas temperatures in excess of 1 100 °C. Due to the constant water cooling and stable temperature, thermal effects are minimized therefore improving overall accuracy.

Further performance improvements are made using analog and digital characterization techniques whereby, the effects of zero and sensitivity changes due to temperature can be further reduced without sacrificing signal bandwidth.

### Application

The sensor can be used wherever the pressure of high temperature gaseous media has to be measured and limitations are set by conventional uncooled sensors. Applications such as:

- Exhaust manifold pressure
- Turbine pressure measurement (e.g. exhaust turbo charger)
- Measurement in combustion systems



### Technical Data

#### Type 4049A..., General

Measuring range	bar	0 ... 5	0 ... 10
Overload	bar	15	25
Excitation	mA	1 ... 5	
Output signal (FSO@1mA)	mV	100 (nominal)	
Linearity at T <sub>ref</sub> (BSL)	% FSO	≤±0,1	
Reference temperature (T <sub>ref</sub> )	°C	60	
Sensor temperature, min./max.	°C	0/120	
Natural frequency	kHz	>60	
Required flow cooling fluid	l/min	≥0,3	
Sensor mounting torque	N·m	20	
Screen mounting torque	N·m	3	
Weight (without connector and cable)	g	30	

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**Type 4049A...S, with Amplifier Type 4665  
(Digital Temperature Compensation)**

Output signal	V	0 ... 10
Temperature compensation range	°C	0 ... 80
Max. deviation <sup>1)</sup> at T <sub>ref</sub>	%FSO	≤0,2
Max. deviation <sup>1)</sup> bei 0 ... 80 °C	%FSO	≤0,5
Frequency range (-3 dB, measuring range)	kHz	0 ... 90
Filter settings		selectable
Excitation		integrated
Electrical connection		Fischer connector S103A054

**Type 4049A...S, with Analog Temperature Compensation<sup>2)</sup>**

Temperature compensation range	°C	0 ... 80
Max. deviation <sup>1)</sup> at T <sub>ref</sub>	%FSO	≤0,2
Max. deviation <sup>1)</sup> at 0 ... 80 °C	%FSO	≤1,5

**Type 4049A...SP..., with Amplifier Type 4622A...  
(Measurement Chain with Digital Temperature Compensation)**

Output signal pressure 4622A2	V	0 ... 10
Output signal temperature 4622A2	mV/°C	10
Temperature compensation range	°C	0 ... 80
Max. deviation <sup>1)</sup> at T <sub>ref</sub>	%FSO	≤0,2
Max. deviation <sup>1)</sup> at 0 ... 80 °C	%FSO	≤0,5
Frequency range (-3 dB, measuring range)	kHz	0 ... 40
Operating temperature range amplifier Type 4622A...	°C	-40 ... 85
Excitation	V DC	11 ... 30
Electrical connection		see Fig. 5

<sup>1)</sup> Maximum deviation from calibration reference within stated temperature range.

<sup>2)</sup> For example with amplifier Type 4663, 4643, 4603.

**Installation**

Sensor Type 4049A... can be installed directly into a measuring port. To reduce the influence of heat, it is recommended to use the sensor with the integrated screen (heat protector) Type 1189A1 (Fig. 3). Machining of the bore (Fig. 1) or the sensor fitting (Fig. 2) must be according the bore specifications. It is essential to comply with the tightening torque of 20 N·m when installing the sensor. The use of the correct installation tools is mandatory, such as mounting tool Type 1300A19 and torque wrench Type 1300A39. The connection to SCP- and measurement chain amplifier is shown in Fig. 4 and Fig. 5.

The sensor requires cooling to avoid damage!

By using Kistler conditioning unit Type 2621E optimal sensor cooling can be assured and the best performance achieved.

**Maintenance**

When using the sensor in exhaust gas application soot particles may build up on the protector screen of the sensor. For the best sensor performance it may be necessary to clean or replace the protector screen. For further information please contact Kistler.

**Operating Instruction for Amplifier Type 4622A...**

The amplifier Type 4622A... includes easy-to-use push buttons to adjust the zero-point of the sensor signal.



The zero-point is adjusted by holding push button "Offset Adjust" and pushing "Up" or "Down" button at the same time. The increment of zero-point adjustment can be seen in the table below.

	Type 4049A5...	Type 4049A10...
Increment in mV of signal output	≈1 mV	
Increment in mbar	≈0,5 mbar	≈1 mbar

Keep holding push buttons "Up" or "Down" to increase the speed of the adjustment. The adjusted zero-point is memorized in the amplifier and does not get lost when power supply is intermitted.

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Sensor Type 4049A...S with PiezoSmart®

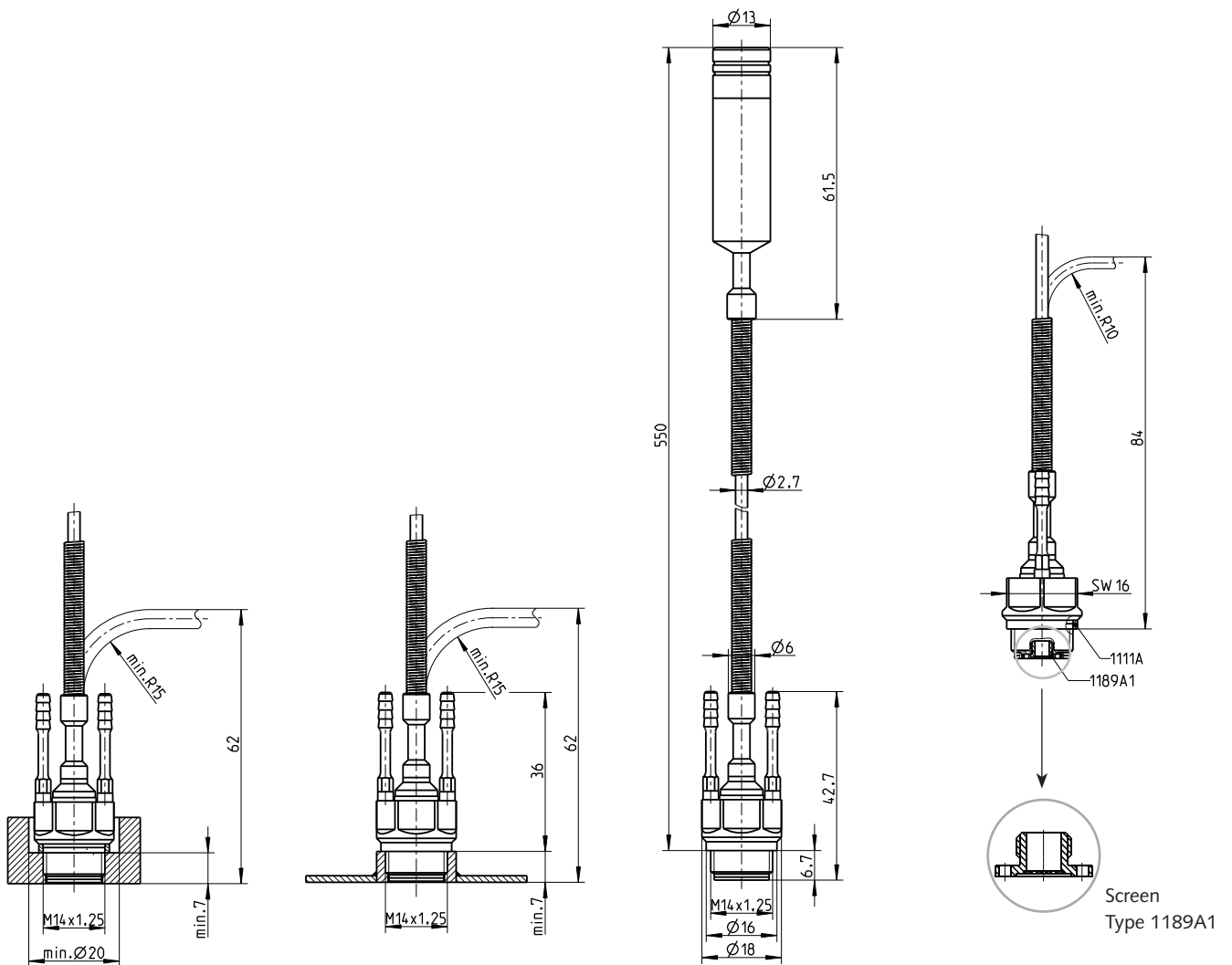


Fig. 1: Bore dimension

Fig. 2: Sensor installed in fitting (e.g. exhaust application)

Fig. 3: Sensor Type 4049A...S with Fischer connector

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This information corresponds to the current state of knowledge. Kistler reserves the right to make technical changes. Liability for consequential damage resulting from the use of Kistler products is excluded.

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**Type 4049A...S, with Amplifier Type 4665 (with PiezoSmart® Sensor Identification)**

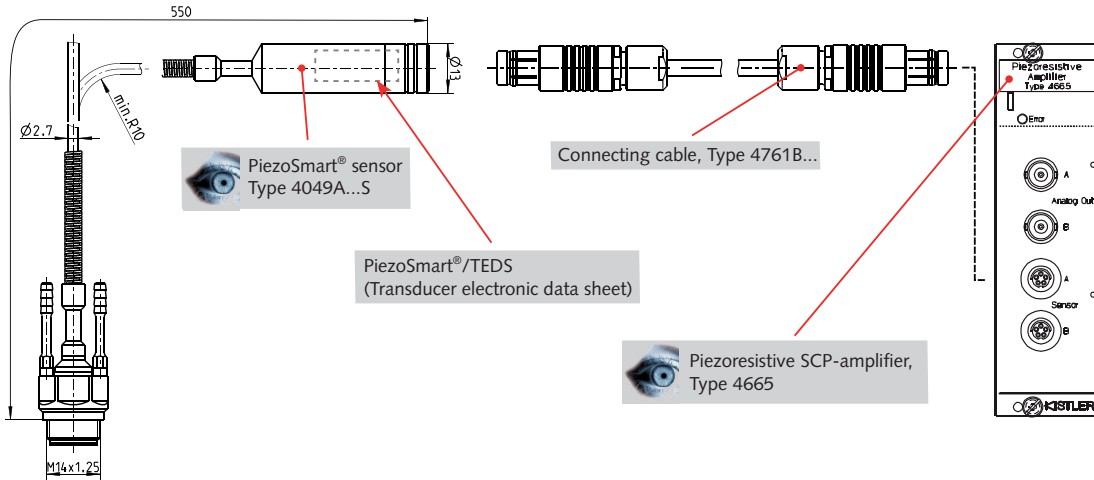
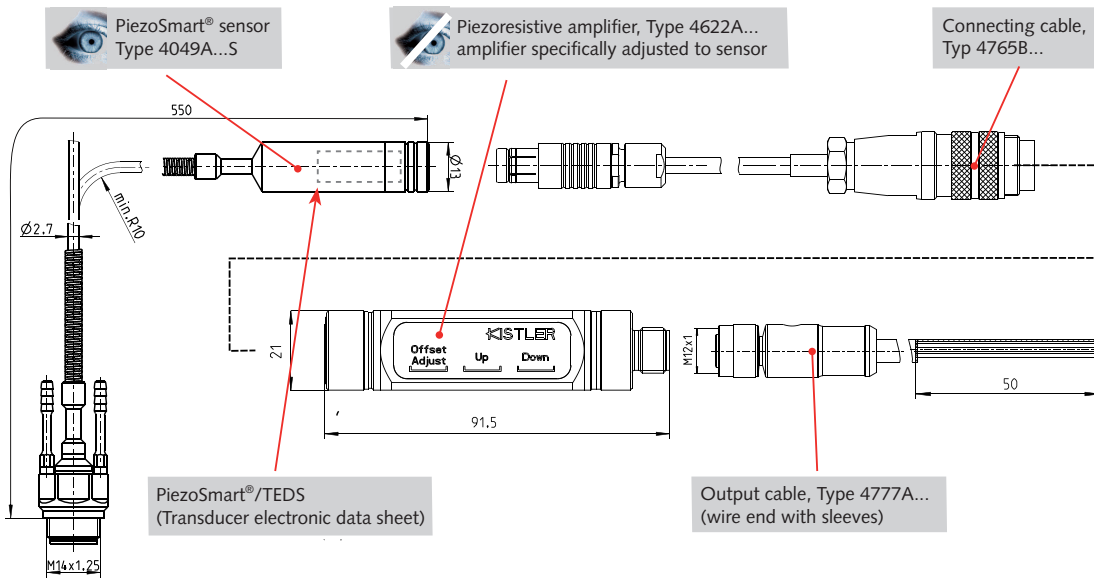
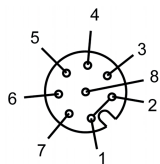


Fig. 4: Sensor Type 4049A...S with connecting cable and amplifier Type 4665

**Type 4049A...SP..., with Amplifier Type 4622A... (Amplifier without Sensor Identification)**



**Pin Allocation at Amplifier Type 4622A... (Lumberg 8-pol, M12x1)**



Pos.	Signal
1	Excitation GND
2	Signal GND
8	Excitation (+11 ... 30 V DC)
4	Pressure output
5	Temperature output (10mV/°C)

Wire colors cable Type 4777A...
brown
white
gray
blue
black

Fig. 5: Measurement chain Type 4049A...SP... with amplifier Type 4622A... and connecting and output cables

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**Included Accessory**

- Seal
- Screen

**Type/Art. No.**

1111A  
1189A1

**Optional Accessories**

- Screen mounting tool
- Sensor mounting tool
- Open ended insert tool 16 mm
- Open ended insert tool 18 mm
- Torque wrench 4 ... 20 N·m
- Torque wrench 1 ... 6 N·m

**Type/Art. No.**

1300A127  
1300A19  
1300A33  
1300A15  
1300A39  
1300A17

**Adapter**

- Adapter G1/2"
- Sensor dummy M14x1,25

7543A1  
4189

**Connecting cable**

- L = 2 m
- L = 5 m
- L = 10 m
- L = ... m (L<sub>min</sub> = 0,5/L<sub>max</sub> = 10 m)

4761B2  
4761B5  
4761B10  
4761Bsp

**Connecting cable for amplifier Type 4622A...**

- L = 2 m
- L = 5 m
- L = 10 m
- L = ... m (L<sub>min</sub> = 0,5/L<sub>max</sub> = 10 m)

4765B2  
4765B5  
4765B10  
4765Bsp

**Output cable for amplifier Type 4622A...**

- L = 5 m

4777A5

**Signal Conditioning Platform (SCP)**

- SCP (Slim-) for 2 measuring modules
- SCP for 8 measuring modules
- SCP compact for 4/6 measuring modules
- Piezoresistive SCP-amplifier

2852A...  
2853A...  
2854A...  
4665

**Water cooling equipment**

- Water connecting hose
- Water connecting tube with quick coupling
- Temperature conditioning unit
- Flow monitor

1203Csp  
1233A1  
2621E  
2625A

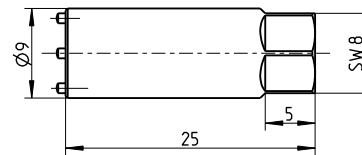


Fig. 6: Screen mounting tool Type 1300A127

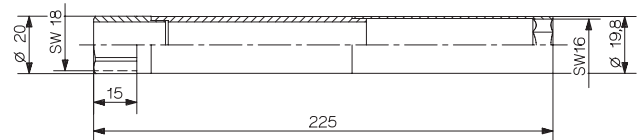


Fig. 7: Sensor mounting tool Type 1300A19



Fig. 8: G 1/2" Adapter Type 7543A1

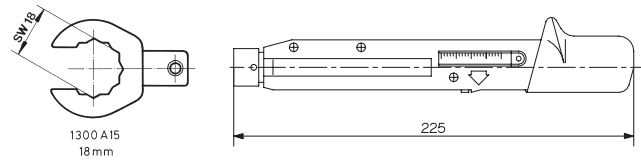


Fig. 9: Torque wrench 4 ... 20 N·m Type 1300A39 and open ended insert tool Type 1300A15 (18 mm) or 1300A33 (16 mm)

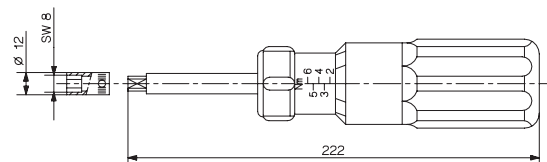


Fig. 10: Torque wrench 1 ... 6 N·m Typ 1300A17

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Fig. 11: Temperature conditioning unit Type 2621E

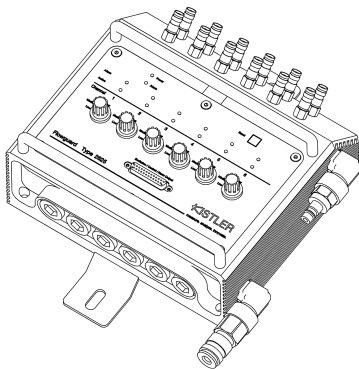


Fig. 12: Flow monitor Type 2625A

**Ordering Key**

Type 4049A  S

**Pressure**

Measuring range 0 ... 5 bar	5
Measuring range 0 ... 10 bar	10

PiezoSmart® sensor	S
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**Amplifier**

for use with amplifier Type 4665 <sup>1)</sup>	-
with measurement chain amplifier <sup>2)</sup> Type 4622A2, output signal pressure 0 ... 10 V	P2

**Connecting and output cable  
amplifier Type 4622A...**

without connecting cable Type 4765B...	-
without output cable Type 4777A...	-
with connecting cable Type 4765B2 (2m)	2
with output cable Type 4777A5 (5m)	2

<sup>1)</sup> With amplifier Type 4663, 4643, 4603 operating with analog temperature compensation and without PiezoSmart® identification.

<sup>2)</sup> Amplifier Type 4622A... is specifically adjusted to the sensor (Measurement chain).

**Ordering Example: Type 4049A...**

- Version with measuring range 0 ... 5 bar, with PiezoSmart®, for amplifier Type 4665 Type 4049A5S
- Version with measuring range 0 ... 5 bar, with amplifier Type 4622A2 (output signal 0 ... 10 V) and necessary connecting and output cables Type 4049A5SP22

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