Sensors

Air-mass, lambda, pressure, rotational-speed, structure-borne sound, temperature



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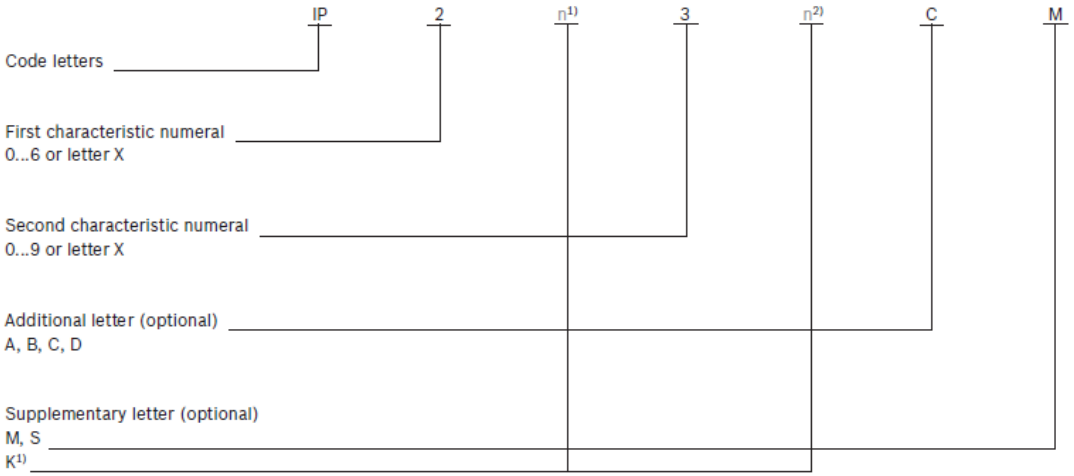
0 General information
Sensor IP degrees

IP degrees of protection

Valid for the electrical equipment of road vehicles as per DIN 40 050 (Part 9).

- Protection of the electrical equipment inside the enclosure against the effect of solid foreign objects including dust.
- Protection of the electrical equipment inside the enclosure against the ingress of water.
- Protection of persons against contact with dangerous parts, and rotating parts, inside the enclosure.

Structure of the IP code



If a characteristic numeral is not given, it must be superseded by the letter “X” (i.e. “XX” if both characteristic numerals are not given). The supplementary and/or additional letters can be omitted at will and need not be superseded by other letters.

1)The supplementary letter “K” is located either directly after the first characteristic numerals 5 and 6, or directly after the second characteristic numerals 4, 6 and 9.

2) During the water test. Example: IP16KB protection against the ingress of solid foreign bodies with diameter ≥ 50 mm, protection against high-pressure hose water, protection against access with a finger.

General remark: Please note that this catalogue is for information only. The listed products do not constitute binding purchase offers. We reserve the right to update the products and the information given herein. Please feel free to contact our sales department in case of any questions, or if you would like to receive an individual offer.

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0 General information

Sensor IP codes

1st characteristic numeral and sup-plementary letter K	Protection of electrical equipment against ingress of solid foreign objects	Persons	2nd characteristic numeral and supplementary letter K	Protection of electrical equipment against the ingress of water	Additional letter (optional)	Protection of persons against contact with hazardous parts	Additional letter (optional)
0	Non-protected	Non-protected	0	Non-protected	A	Protection against contact with back of hand	M Movable parts of the equipment are in motion [2)]
1	Protection against foreign bodies Ø ≥ 50 mm	Protection against contact with back of hand	1	Protection against vertically dripping water	B	Protection against contact with finger	S Movable parts of the equipment are stationary [2)]
2	Protection against foreign bodies Ø ≥ 12.5 mm	Protection against contact with finger	2	Protection against dripping water (at an angle of 15°)	C	Protection against contact with tool	K For the electrical equipment of road vehicles
3	Protection against foreign bodies Ø ≥ 2.5 mm	Protection against contact with tool	3	Protection against splash water	D	Protection against contact with wire	
4	Protection against foreign bodies Ø ≥ 1.0 mm	Protection against contact with wire	4	Protection against spray water			
5K	Dust-protected	Protection against contact with wire	4K	Protection against high- pressure spray water			
6K	Dust-proof	Protection against contact with wire	5	Protection against jets of water			
			6	Protection against powerful jets of water			
			6K	Protection against high-pressure jets of water			
			7	Protection against temporary immersion			
			9	Protection against continuous immersion			
			9K	Protection against high-pressure/steam-jet cleaners			

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0 General information

CE-Identification and manufacturer declaration with EU directive

As under the EU Directive all electrically-powered machines, devices and systems, which are manufactured, imported and sold within the borders of the European Union must have a CE-label attached to them. The EU Directive also includes the following individual guidelines, which are of significance for sensor users.

1. Machine Directive
It is valid for self-contained operational machines or any interlinking of machines to form integral systems. It is not valid for machine components however, such as, for example, electrical control systems or sensors which have no independent function. The entire machine or system must always comply with the Directive.

2. EMC Directive
This Directive is valid for all electrical and electronic devices, installations and systems. However, this Directive is also valid for complex components such as, e.g. sensors, although this only applies were they are openly available for purchase by the public. The sensors listed in this catalogue are solely shipped as supplied parts or replacement parts and are not subject to § 5 paragraph 5 of the EMC Act regarding a mandatory CE label. The limits for the relaying and the radiation of high-frequency interference are specified in EN 55014 of the EMC Act. Because of the previously-mentioned reasons, Bosch sensors are on no account subject to mandatory CE labeling. We will gladly assist you with information in all matters relating to the acceptance of your application.



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0 General information
Liability disclaimer

For applications listed in the catalogue, prior clarification of the technical suitability is imperative. All listed products are designed for automotive vehicles in its intended use. If you use these products within specification, but outside its intended use, you are responsible for establishing the suitability of our products for your intended purpose, if other than for its approved application (in particular, if subjected to different loads or under different technical conditions) by taking suitable action (especially testing). We would like to point out to you that the responsibility for the overall system also lies solely with you.

If your application cannot be solved with this range of products or in case you need our consultancy, please inform us about your requirements and contact us via e-mail address:
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1 Air-mass sensors
HFM with analog interface

- Nominal air-flow up to 1.050 kg/h
- Analog interface
- Compact design
- Low weight
- Fast response time
- Low power input
- Pulsation flow detection



Application

The air-mass sensor (HFM) is designed to measure the air mass and temperature of the intake air in motor vehicles with diesel and gasoline applications. The sensor measures the actual air mass flow rate for an optimized air-fuel mixture, supporting an efficient fuel combustion and powerful engine performance.

Design and operation

The standard HFM consists of a plug-in sensor and cylinder housing. The electronic module, with the evaluation circuit and the sensor element, is located in the plug-in sensor. The sensor element is positioned on the electronic module and extends into the metering duct (bypass channel) of the connector housing. The location of the temperature sensor (NTC) is on the backside of the connector housing.

The HFM is a thermal flowmeter. From the intake air flow within the cylinder housing, a portion of the total mass air flow will pass across the sensor element in the bypass channel.

In the center exists a heating zone which is controlled to a certain temperature, depending on the temperature of the intake air. With-out air flow, the temperature from the heating zone to the edges decreases linearly, and the temperature sensors up- and downstream of the heating zone indicate the same value. With air flow, the sensor area upstream will be cooled by the heat transfer in the boundary layer.

The downstream temperature sensor will keep its temperature because the air is heated as it passes over the heating zone. The temperature sensors show a temperature difference which depends on amount and direction of the air flow.

The difference between the signals of the temperature sensors is evaluated in a bridge circuit.

Explanation of characteristic data

$\dot{m}_N$ Nominal airflow
$\Delta\dot{m}/\dot{m}$ Relative accuracy
$\tau\Delta$ Time until measurement error ≤5%
τ_{63} Time until change in measured value 63%

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1.1 Air-mass sensors
HFM with analog interface

Product type

HFM7-R5

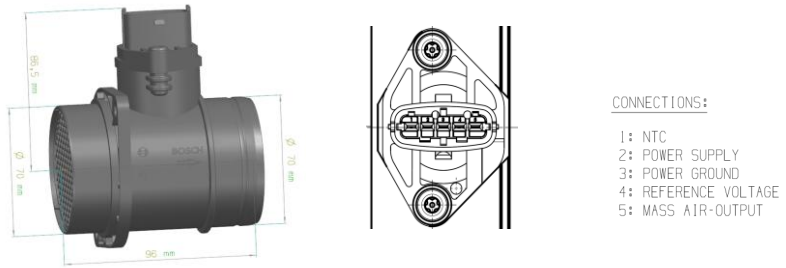
Part number

0 280 218 120
(successor of 0 280 218 037/116)

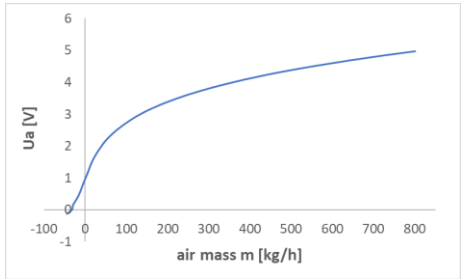
Picture



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

Features	With intake air temperature sensor	
Interface	analog	
Nominal airflow	$\dot{m}_N$	480 kg/h
Measuring range	$\dot{m}$	-30 ... +640 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Compact connector	5-pin	1 928 403 738
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seals	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seals	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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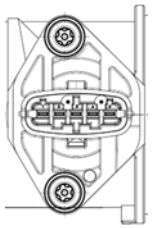
1.1 Air-mass sensors
HFM with analog interface

Product type
HFM7-R5

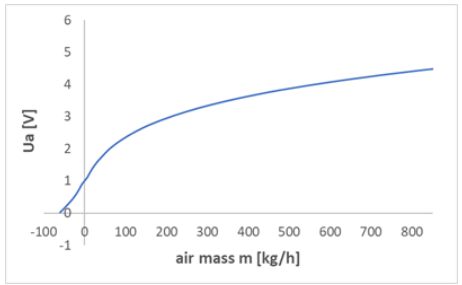
Part number
0 280 218 446

Picture


Dimensional drawings

CONNECTIONS:
1: NTC
2: POWER SUPPLY
3: POWER GROUND
4: REFERENCE VOLTAGE
5: MASS AIR-OUTPUT

Air-mass characteristic curve at ambient temperature


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Technical data

Features		With intake air temperature sensor
Interface		analog
Nominal airflow	$\dot{m}_N$	850 kg/h
Measuring range	$\dot{m}$	-50 ... +1100 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seals	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seals	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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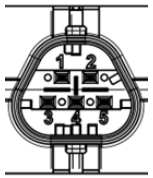
1.1 Air-mass sensors
HFM with analog interface

Product type
HFM-7

Part number
0 280 218 218

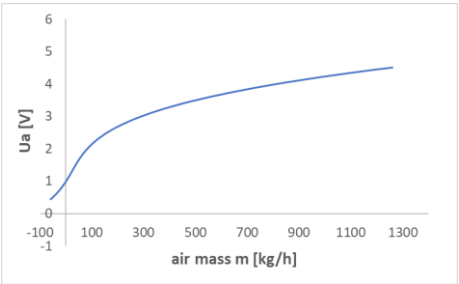
Picture


Dimensional drawings

CONNECTIONS:

1: POWER GROUND
2: REFERENCE VOLTAGE
3: POWER SUPPLY
4: NTC
5: MASS AIR-OUTPUT

Air-mass characteristic curve at ambient temperature


Technical data

Features		With intake air temperature sensor
Interface		analog
Nominal airflow	$\dot{m}_N$	1050 kg/h
Measuring range	$\dot{m}$	-90 ... +1150 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 ... 17 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	± 2 %
Temperature range [2]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 10 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Compact connector	5-pin	1 928 405 159
Contact pins	For Ø 0.35...0.5 mm²	1 928 498 143
Contact pins	For Ø 0.75...1.0 mm²	1 928 498 144
Single-wire seals	For Ø 1.2...1.6 mm²	1 928 300 934
Single-wire seals	For Ø 1.7...2.1 mm²	1 928 300 936
Dummy plug		1 928 300 935

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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1.2 Air-mass sensors
HFM with digital interface

- Nominal air-flow up to 2.300 kg/h
- Digital interface (frequency/SENT)
- Compact design
- Low weight
- Fast response time
- Low power input
- Pulsation flow detection



Explanation of characteristic data

$\dot{m}_N$ Nominal airflow
$\Delta\dot{m}/\dot{m}$ Relative accuracy
$\tau\Delta$ Time until measurement error ≤ 5 %
τ_{63} Time until change in measured value 63%

Application

The air-mass sensor (HFM) is designed to measure the air mass and temperature of the intake air in motor vehicles with diesel and gasoline applications. The sensor measures the actual air mass flow rate for an optimized air-fuel mixture, supporting an efficient fuel combustion and powerful engine performance.

Design and operation

The standard HFM consists of a plug-in sensor and cylinder housing. The electronic module, with the evaluation circuit and the sensor element, is located in the plug-in sensor. The sensor element is positioned on the electronic module and extends into the metering duct (bypass channel) of the connector housing. The location of the temperature sensor (NTC) is on the backside of the connector housing.

The HFM is a thermal flowmeter. From the intake air flow within the cylinder housing, a portion of the total mass air flow will pass across the sensor element in the bypass channel. In the center exists a heating zone which is controlled to a certain temperature, depending on the temperature of the intake air. With-out air flow, the temperature from the heating zone to the edges decreases linearly, and the temperature sensors up- and downstream of the heating zone indicate the same value.

With air flow, the sensor area upstream will be cooled by the heat transfer in the boundary layer.

The downstream temperature sensor will keep its temperature because the air is heated as it passes over the heating zone. The temperature sensors show a temperature difference which depends on amount and direction of the air flow. The difference between the signals of the temperature sensors is evaluated in a bridge circuit.

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1.2 Air-mass sensors
HFM with digital interface – SENT interface

SENT interface

The SENT interface is a one-way asynchronous voltage interface which requires three wires: supply voltage, signal voltage and ground.

For HFM8 the transmission takes place in accordance with the following figure (SENT transmissions).

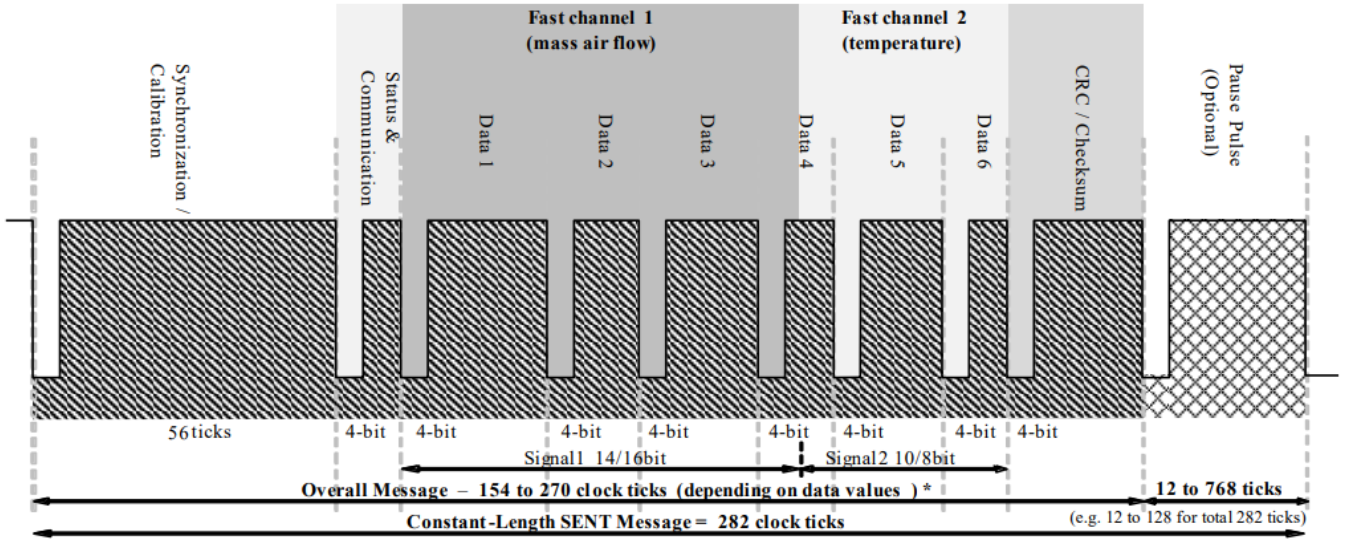
The air mass signal is read from Fast Channel 1 in 14-bit data format. The pressure signal is read from Fast Channel 2 in 10-bit data format.

The temperature signal and the signals of the humidity sensor are transmitted via the Slow Channel in 12-bit data format.

In addition, further signals and status information are transmitted in the Slow Channel.

Specified descriptions are to be inferred from the SAE SENT standard J2716 APR 2016.





SENT message format for HFM8

* Maximum possible message length is 270 clock ticks, minimum length is 154 ticks, since CRC value depends on message data.

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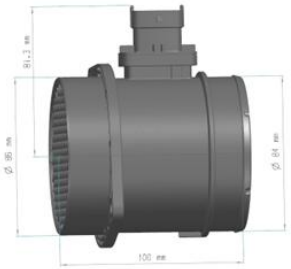
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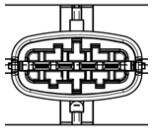
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7

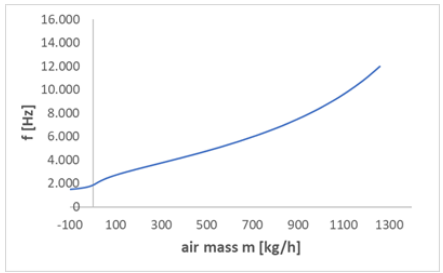
Part number
0 280 218 416

Picture


Dimensional drawings




CONNECTIONS:
1: POWER SUPPLY
2: POWER GROUND
3: NTC
4: MASS AIR-OUTPUT

Air-mass characteristic curve at ambient temperature


Technical data

Features		With intake air temperature sensor
Interface		FAS (frequency analog signal)
Nominal airflow	$\dot{m}_N$	850 kg/h
Measuring range	$\dot{m}$	-90 ... +1150 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 12 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Compact connector	4-pin	1 928 405 745
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seals	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seals	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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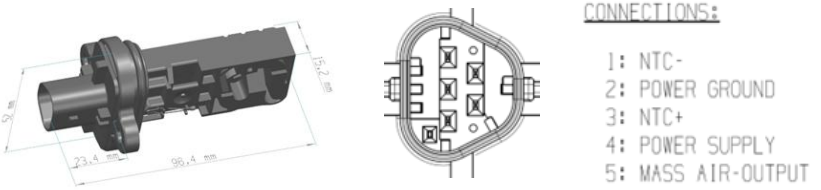
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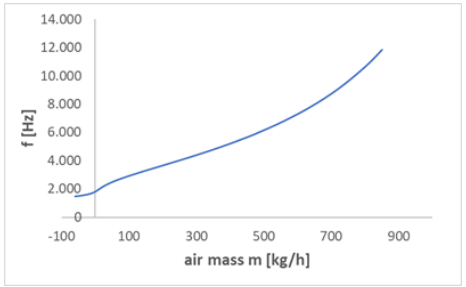
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7

Part number
0 280 218 429

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


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Technical data

Features		With intake air temperature sensor
Interface		FAS (frequency analog signal)
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range	$\dot{m}$	-60 ... +800 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 2 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 25 ms
Time constant	$\tau\Delta$ [4)]	≤ 80 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Compact connector	5-pin	1 928 405 138
Contact pins	For Ø 0.35...0.5 mm²	1 928 498 143
Contact pins	For Ø 0.75...1.0 mm²	1 928 498 144
Single-wire seals	For Ø 1.2...1.6 mm²	1 928 300 934
Single-wire seals	For Ø 1.7...2.1 mm²	1 928 300 936
Dummy plug		1 928 300 935

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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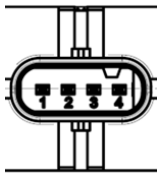
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7

Part number
0 281 002 956

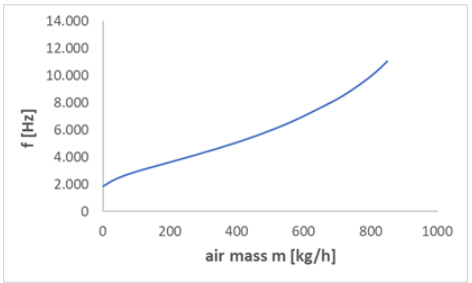
Picture


Dimensional drawings

CONNECTIONS:

1: POWER SUPPLY
2: POWER GROUND
3: REFERENCE_FREQUENCY
4: MASS AIR-OUTPUT

Air-mass characteristic curve at ambient temperature


Technical data

Features	With intake air temperature sensor	
Interface	FAS (frequency analog signal)	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range	$\dot{m}$	-60 ... +800 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 2 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 12 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for 0,04 ≤ Δ $\dot{m}$ / $\dot{m}N$ ≤ 1,3
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | Δ $\dot{m}$ / $\dot{m}$ | ≤ 5 %.

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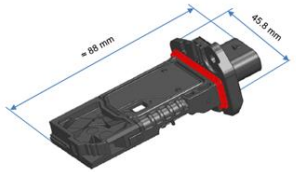
1.2 Air-mass sensors
HFM with digital interface

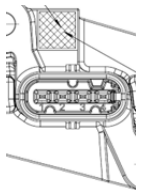
Product type	Part number
HFM-8-PTH SF	**0 281 218 03X**

Picture



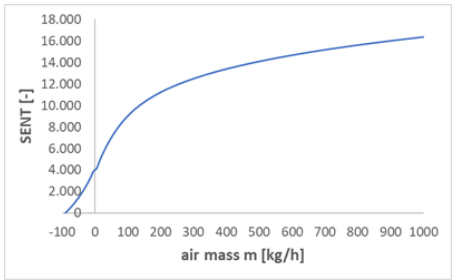
Dimensional drawings





CONNECTIONS:
1: POWER SUPPLY 5V
2: GROUND
3: SENT
4: ---

Air-mass characteristic curve at ambient temperature



Technical data

Features	With integrated pressure, humidity and intake air temperature sensor	
Interface	SENT	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-90 ... +1000 kg/h
Measuring range pressure	kPA	10 ... 120
Measuring range humidity	%rH	0 ... 100
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 1,5 %
Temperature range [2)]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_V	< 0,03 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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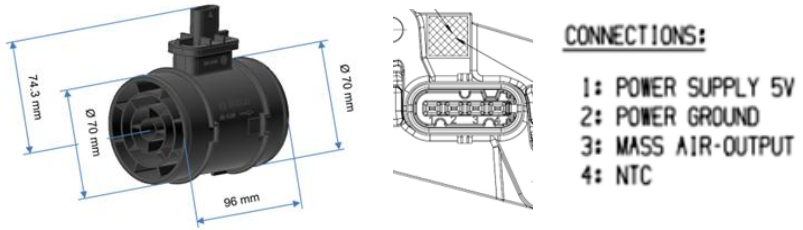
1.2 Air-mass sensors
HFM with digital interface

Product type	Part number
HFM-8-T	**0 281 218 04B**

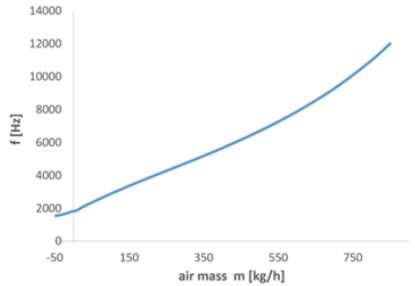
Picture



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

Features		With intake air temperature sensor
Interface		FAS (frequency analog signal)
Nominal airflow	$\dot{m}_N$	480 kg/h
Measuring range airflow	$\dot{m}$	-60 ... +850 kg/h
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 1,5 %
Temperature range [2)]	°C	-40 ... +140
Pressure drop at $\dot{m}_N$	Δp	≤ 7 hPa
Current input	I_V	< 0,03 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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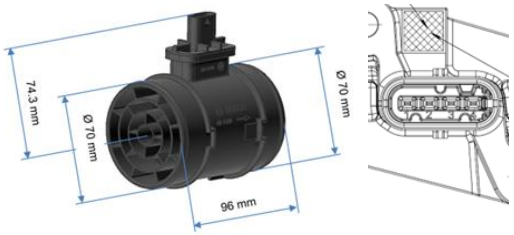
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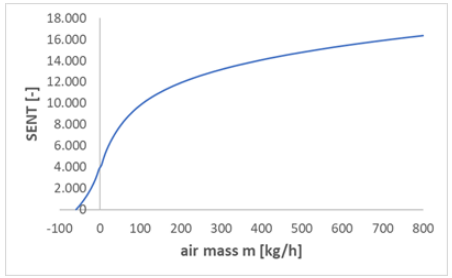
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-PTH

Part number
0 280 218 07T

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


Technical data

Features	With intake air temperature sensor	
Interface	FAS (frequency analog signal)	
Nominal airflow	$\dot{m}_N$	480 kg/h
Measuring range airflow	$\dot{m}$	-60 ... +850 kg/h
Measuring range pressure	kPa	10 ... 120
Measuring range humidity	%rH	0 ... 100
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 1,5 %
Temperature range [2)]	°C	-40 ... +140
Pressure drop at $\dot{m}_N$	Δp	≤ 7 hPa
Current input	I_V	< 0,03 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

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1.2 Air-mass sensors
HFM with digital interface

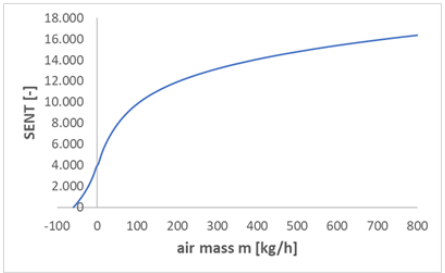
Product type
HFM-8-PTH

Part number
0 280 218 07U

Picture


Dimensional drawings


CONNECTIONS:
1: POWER SUPPLY 5V
2: GROUND
3: SENT
4: ---

Air-mass characteristic curve at ambient temperature


Technical data

Features	With integrated pressure, humidity and intake air temperature sensor	
Interface	SENT	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-90 ... +1000 kg/h
Measuring range pressure	kPa	10 ... 120
Measuring range humidity	%rH	0 ... 100
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	± 1,5 %
Temperature range [2]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	≤ 5 hPa
Current input	I_V	< 0,03 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

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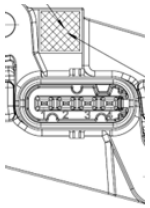
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-T SF

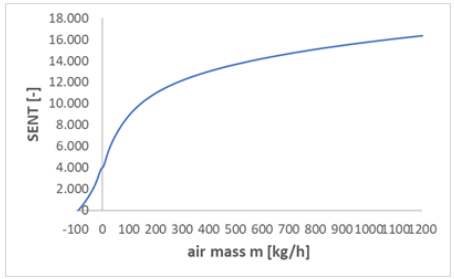
Part number
0 281 006 597

Picture


Dimensional drawings

CONNECTIONS:
1: POWER SUPPLY 5V
2: GROUND
3: SENT
4: ---

Air-mass characteristic curve at ambient temperature


Technical data

Features	With intake air temperature sensor	
Interface	SENT	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-60 ... +1200 kg/h
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 2,0 %
Temperature range [2)]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_V	< 0,02 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

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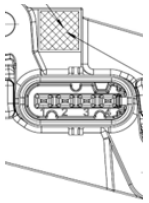
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-T SF

Part number
0 280 218 07K

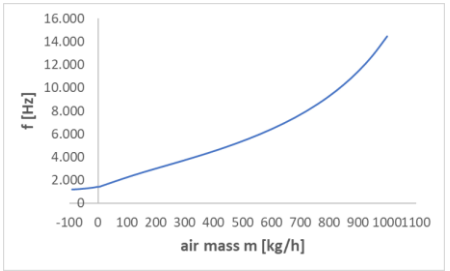
Picture


Dimensional drawings

CONNECTIONS:

1: POWER SUPPLY 5V
2: POWER GROUND
3: MASS AIR-OUTPUT
4: NTC

Air-mass characteristic curve at ambient temperature


Technical data

Features		With intake air temperature sensor
Interface		FAS (frequency analog signal)
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-90 ... +1000 kg/h
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 2,0 %
Temperature range [2)]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_V	< 0,02 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation | $\Delta \dot{m} / \dot{m}$ | ≤ 5 %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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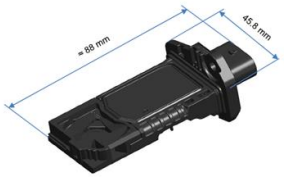
1.2 Air-mass sensors
HFM with digital interface

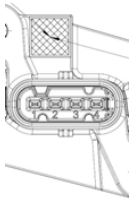
Product type	Part number
HFM-8-TH SF	**0 281 006 812**

Picture



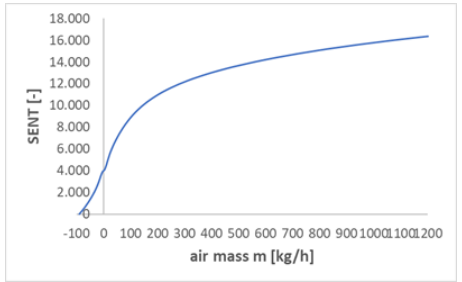
Dimensional drawings





CONNECTIONS:
1: POWER SUPPLY 5V
2: GROUND
3: SENT
4: ---

Air-mass characteristic curve at ambient temperature



Technical data

Features	With integrated humidity and intake Air temperature sensor	
Interface	SENT	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-60 ... +1200 kg/h
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	± 2,0 %
Temperature range [2]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_V	< 0,02 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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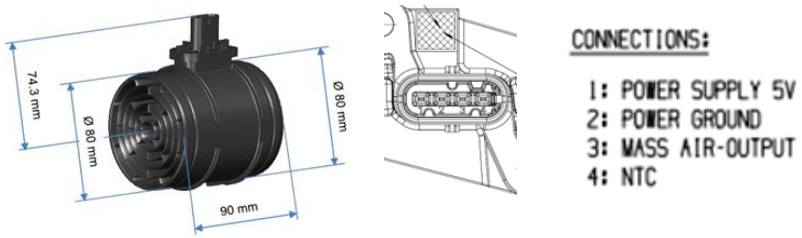
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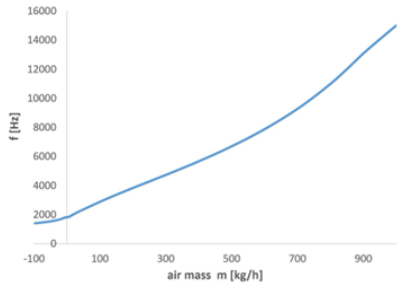
1.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-T

Part number
0 281 007 740

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


Technical data

Features	With intake air temperature sensor	
Interface	SENT	
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}$	-60 ... +1200 kg/h
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,75 ... 5,25 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	± 1,5 %
Temperature range [2]	°C	-40 ... +140
Pressure drop at $\dot{m}_N$	Δp	≤ 12 hPa
Current input	I_V	< 0,02 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

1) for $0{,}04 \le \Delta \dot{m} / \dot{m}N \le 1{,}3$
2) short-time (≤ 3 min.) to 130 °C
3) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h
4) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation $|\Delta \dot{m} / \dot{m}| \le 5$ %.

Accessories

Connector	4-pin	Hirschmann 872-975-...02 Option 1. Spec. 2, Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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1.3 Air-mass sensors
PFM pressure based flow meter

- Pressure range up to 4,5 bar
- Digital interface (SENT, 2 channels)
- Compact design
- Low weight
- Fast response time
- Efficient, robust & dynamic mass flow measurement
- High level of robustness & accuracy



Explanation of characteristic data

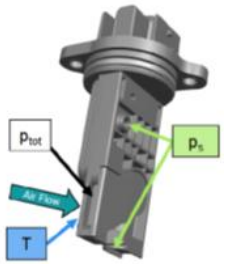
$$\dot{m} = \sqrt{\frac{2 \cdot p_{diff} \cdot p_s}{R_s \cdot T}} \cdot A_{eff}$$

$\dot{m}$ = Air mass flow

Signals of the 3 integrated sensors:
- p_{diff} = Differential pressure ($p_{diff}=p_{tot}-p_s$)
- p_s = Static pressure
- T = Temperature

R_s = gas-constant for air

A_{eff} = Effective area at mounting position



Application

The pressure based air mass flow meter PFM is a sensor to measure the fresh air mass (without exhaust gas recirculation) within air ducts of CV-engines. It is usually mounted downstream of the charge air intercooler.

With the air mass flow measurement the fuel injection quantities can be optimized, which helps to minimize the exhaust gas emissions. The PFM detects the single values, which are used for the air mass flow calculation.

The single values are:
- Differential pressure (difference of total pressure and static pressure)
- Absolute pressure (static pressure)
- Temperature

Design and operation

The PFM measurement technique is based on the pitot-static tube concept, whereby two pressure sensors and one temperature sensor are installed in the sensor for the determination of the air mass flow. The differential pressure sensor is placed in the lower part of the sensor housing and its pressure taps are exposed to the air flow.

Similarly, the temperature sensor is placed in the lower housing part to be directly immersed in the flow. The absolute pressure sensor is positioned in the upper part of the sensor housing, since its membrane does not have to be exposed to the flow.

The PFM is designed as a plug-in sensor, which is mounted in a measuring tube with three main parts: a nozzle, a measurement section and a diffusor. The design of the measurement tube uses engine specific data and conditions the flow for an optimal air mass flow measurement with the PFM.

The two analog pressure sensor signals are AD converted, the signal of the temperature sensor is digitized via the absolute pressure sensor. Finally, the sensor signals are transmitted to the ECU via the SENT communication protocol.

The sensor signals of
- the differential pressure sensor
- the absolute pressure sensor
- the temperature sensor

are the input for the air mass flow calculation on the ECU.

The PFM is mounted downstream of the charge air intercooler and upstream of the throttle valve. Thereby, the PFM static pressure measurement can be used as boost pressure signal at this position.

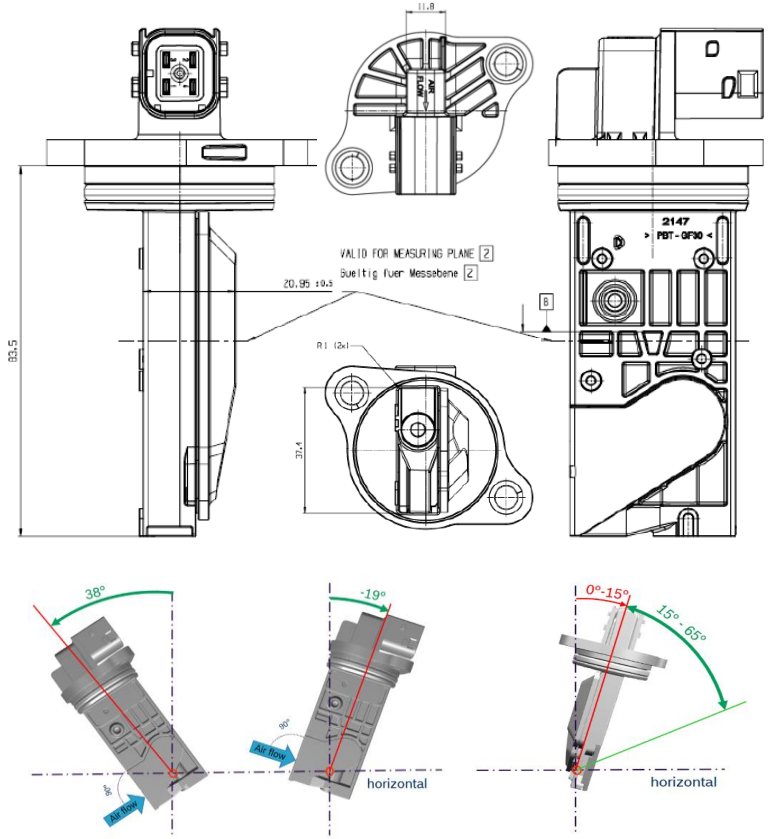
The temperature signal of the PFM can not only be used for the calculation of the air mass flow, but also as an additional temperature signal at the PFM position between the charge air intercooler and the throttle valve.

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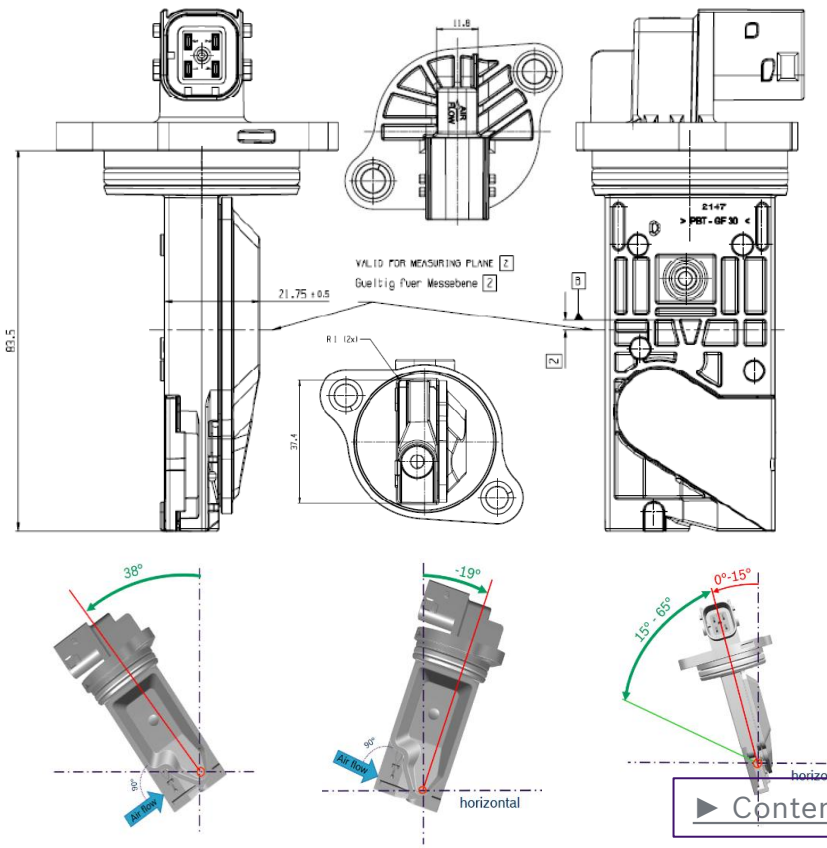
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1.3 Air-mass sensors
PFM pressure based flow meter

Dimensional drawings for VarA with positioning angles



Dimensional drawings for VarB with positioning angles



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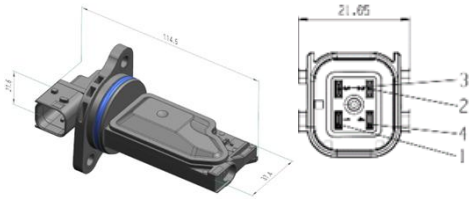
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1.3 Air-mass sensors
HFM with digital interface

Product type
PFM VarA

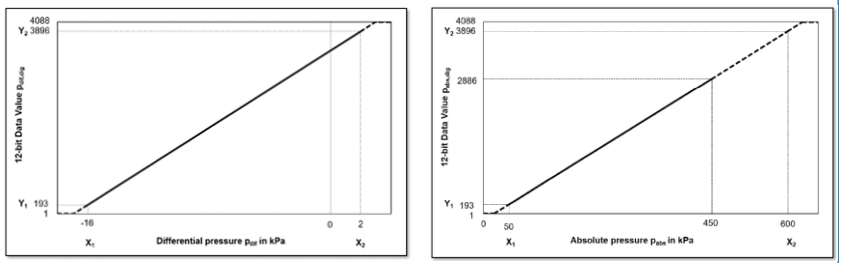
Part number
0 280 218 902

Picture


Dimensional drawings


PIN ASSIGNMENT

1: VDD (5V)	Source
2: SENT 1	Differential pressure p_{diff}
3: GND	Ground
4: SENT 2	Absolute pressure p_{abs} & air temperature T

Air-mass characteristic curve at ambient temperature


Technical data

Features	With integrated ambient-temperature sensor	
Interface	SENT	
Measuring range differential pressure	p_{diff}	-16 ... 2 kPa
Measuring range absolute pressure	p_{abs}	50 ... 450 kPa
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	*approx. 2 ... 4 % Calculation for each engine*
Temperature range [2]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_{DD}	0,018 A ... 0,045 A
Time constant	τ_{IDD} [1]	≤ 7 ms
Time constant	$\tau_{up,p,SENT}$ [2]	≤ 5 ms

1) Transient time until supply current settled
2) Time until 1st valid pressure value transfer

Accessories

Connector	4-pin	Tyco HDSCS Code A

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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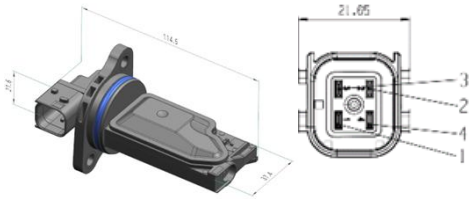
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1.3 Air-mass sensors
HFM with digital interface

Product type
PFM VarB

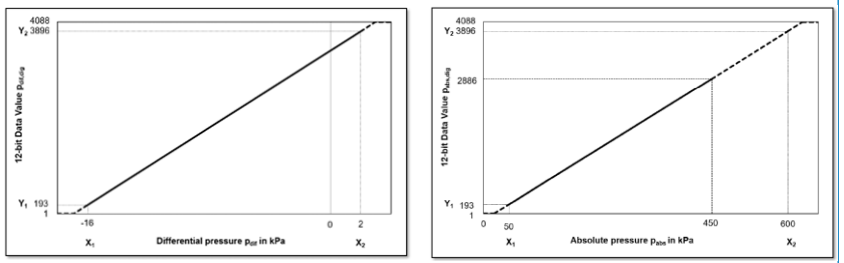
Part number
0 280 218 900

Picture


Dimensional drawings


PIN ASSIGNMENT

1: VDD (5V)	Source
2: SENT 1	Differential pressure p_{diff}
3: GND	Ground
4: SENT 2	Absolute pressure p_{abs} & air temperature T

Air-mass characteristic curve at ambient temperature


Technical data

Features	With integrated ambient-temperature sensor	
Interface	SENT	
Measuring range differential pressure	p_{diff}	-16 ... 2 kPa
Measuring range absolute pressure	p_{abs}	50 ... 450 kPa
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	*approx. 2 ... 4 % Calculation for each engine*
Temperature range [2]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size & design of cross section area
Current input	I_{DD}	0,018 A ... 0,045 A
Time constant	τ_{IDD} [1]	≤ 7 ms
Time constant	$\tau_{up,p,SENT}$ [2]	≤ 5 ms

1) Transient time until supply current settled
2) Time until 1st valid pressure value transfer

Accessories

Connector	4-pin	Tyco HDSCS Code B

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2.1 Lambda sensors
Type LSF-4.2 (Switching type)

- compared to the wideband lambda sensor LSU4.9 the switching type LSF4.2 type is limited to applications in the near operation vicinity of lambda=1



Application

Engine management
- Gas engines
- Combined heat and thermal power
- units (CHP)
- Gasoline engines

Industrial processes
- Tempering furnaces
- Chemical industry
- Packaging equipment
- Process engineering
- Drying plants
- Metallurgy

Measurement and analysis processes
- Flue gas measurement
- Gas analysis
- Determination of Wobbe index

Design and application

The LSF4.2 lambda sensor operates according to the principle of a galvanic oxygen concentration cell with solid electrolyte. The sensor element is in the form of a long wafer with rectangular cross section. The measuring cell and the heater are integrated in this planar ceramic. The measuring cell's surfaces are coated with microporous layers of noble metal. On the one side, due to their catalytic activity, these layers define the sensor's characteristic curve, while on the other they serve as contact elements. On the surface of the ceramic exposed to the exhaust gas, the noble-metal electrode is protected by a porous ceramic layer which, across the whole operating-temperature range, prevents erosion damage due to the deposits in the exhaust gas. This protective layer is applied using sintering techniques and, due among other things to its perfect adhesion and structure, it guarantees a long service life and compliance with the high functional demands made upon the sensor. The heater is a wave-shaped element and contains noble metals. It is insulated, and integrated in the ceramic wafer. Even at low heater inputs it ensures that the sensor heats up quickly. The Lambda sensor operates as a reference-gas sensor, and compares the residual oxygen in the exhaust gas with the oxygen in the reference atmosphere (air circulating inside the sensor). In the stoichiometric region of the air/fuel mixture (lambda = 1), there is a sudden jump in the sensor output voltage. The system is closed-loop controlled to lambda = 1 (two-state controller), and this voltage jump is evaluated in the 450...500 mV area of the system's characteristic curve. The following approximate values apply as guidelines for sensor voltage:
- rich mixture (lambda < 1) 800...1000 mV,
- lean mixture (lambda > 1)
- in the area around 100 mV.

A prerequisite for efficient and reliable functioning is that the active sensor ceramic has a temperature of 350 °C. The integrated heater ensures that the sensor functions at exhaust-gas temperatures. In addition, the direct sensor heating ensures that the sensor element heats up so rapidly that lambda closed loop control can come into operation within 10 secs. after engine start. These advantages make an important contribution towards achieving low, stable exhaust-gas emission values. There are product variants with an additional “Thermal Shock Protection” (TSP). TSP increases robustness, especially against cold water droplets in cold start case of motor engines. An additional ceramic layer reduces the heat transition by distributing the drops to a larger area in case a water droplet hits the already heated sensor

Characteristics

- Field-proven,
- robust and compact,
- reliable,
- high-temperature-resistant up to 1000 °C exhaust-gas temperature
- resistant to stone impact,
- resistant to corrosion,
- isolated ground sensor signal circuit,
- low heater rating,
- stable control characteristic,
- short switch-on time.

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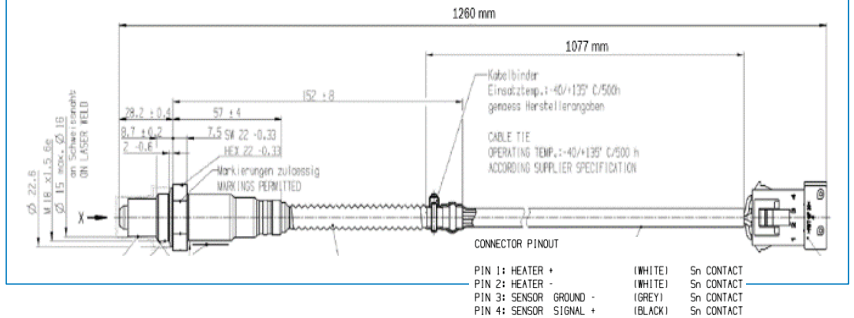
2.1 Lambda sensors
Type LSF-4.2 (Switching type)

Product type	Part number
LSF-4.2	**Several available**

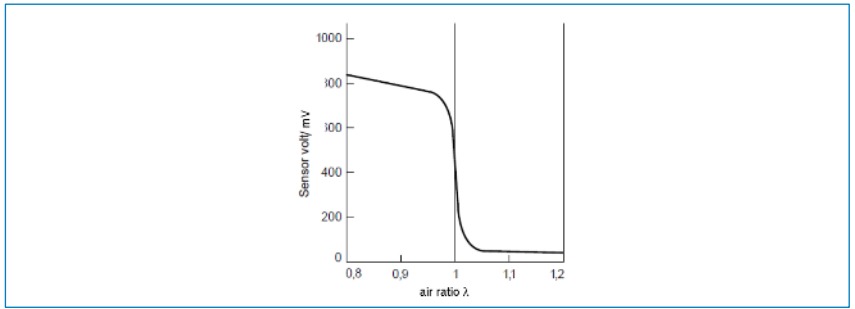
Picture



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

Measuring range of lambda 1,10	0,97 ...
Sensor voltage at lambda = 0,97 mV	800 ± 55
Sensor voltage at lambda = 1,10 mV	50 ± 30
Internal resistance	≤ 0,5 kΩ
Response time (600mV ... 300mV)	< 125 ms
Response time (300mV ... 600mV)	< 60 ms
Heater current	0,48 ± 0,1 A
Heater power (with 13V heater voltage)	7 W
Heater nominal voltage supply	12 V
Exhaust gas temperature	350°C .... 930°C

Part number	TSP	Voltage	Cable length L1
0 258 006 956	No	12 V	460 mm
0 258 986 784	Yes	12 V	1135 mm

Accessories

Connector housing	4-pin	Tyco 185 001-61
Contact pins	Sn	Tyco 1-962915-1
Single-wire seal		Tyco 828 904-1
Single-wire seal		Tyco 1 251 039 001

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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2.2 Lambda sensors
Type LSF-4.9 (wideband)

Explanation of characteristics quantities
λ Air fuel ratio
U_N Nernst voltage
U_P Variable pump voltage

- The wideband Lambda sensor LSU is a planar ZrO_2 dual-cell limit current sensor with integrated heater.
- It is used for measuring the oxygen content and the λ value of exhaust gases in vehicle engines.
- Thanks to a steady characteristic curve in the range λ = 0.65 to air, it is universally applicable for λ = 1 and for other λ ranges.

Application

Engine management
- Gas engines
- Combined heat and thermal power units (CHP)
- Diesel engines
- Gasoline engines
- Lean combustion engines
  Industrial processes
- Tempering furnaces
- Chemical industry
- Packaging equipment
- Process engineering
- Drying plants
- Metallurgy

Measurement and analysis processes
- Flue gas measurement
- Gas analysis
- Determination of Wobbe index
- Incineration plants
- Wood
- Biomass



Design and operation

The LSU broadband Lambda sensor is a planar ZrO_2 dual-cell limit current sensor with integrated heater. It is suitable for measuring the oxygen content and the λ value of exhaust gases in vehicle engines (gasoline and diesel). A constant characteristic curve in the range from λ = 0.65 to air makes it suitable for universal use for λ =1 and for other λ ranges. The connector module includes a trimming resistor, which determines the characteristics of the sensor and is necessary for the sensor to function. To function, the LSU requires special operating electronics (e.g. ETAS LA4 or IC CJ125 evaluation circuit) and may only be operated in conjunction with these.The Lambda sensor consists of two cells.

It is made up of a Nernst type potentiometric oxygen concentration cell and an amperometric oxygen pump cell. Nernst cells have the property that oxygen ions diffuse through their ceramic at high temperatures, as soon as there are differences in the partial oxygen pressure at both ends of the ceramic. The transport of ions results in an electrical voltage between them, which is measured using electrodes. The components of the exhaust gas diffuse through the diffusion duct to the electrodes for the pump and Nernst cell, where they are brought to thermodynamic equilibrium.Control electronics record the Nernst voltage U_N the concentration cell and supply the pump cell with a variable pump voltage U_P. If U_N takes on a value of less than 450 mV, the exhaust gas is lean and the pump cell is supplied with a current that causes oxygen to be pumped out of the duct. By contrast, if the exhaust gas is rich, U_N> 450 mV and the flow direction is reversed, causing the cell to pump oxygen into the duct. An integrated module (CJ125) can be used for signal evaluation. As well as the controller for the pump flow and the controller that keeps the Nernst cell at 450 mV, this module includes an amplifier.

The sensor element is manufactured using thick-film techniques, which results in production distribution. This means that the characteristic curves for different sensors will vary. At an oxygen concentration of 0%, the output voltage is a uniform 0 V, as when using the evaluation circuit. However, at air the voltage scatters between approx. 6 and 8 V. This means that each sensor has to be individually calibrated so that a clear relationship between the measured oxygen concentration and the output voltage can be created. Calibration can be carried out on air in which the oxygen content is 20.9%. Calibration is recommended at each maintenance. There are product variants with an additional “Thermal Shock Protection” (TSP). TSP increases robustness, especially against cold water droplets in cold start case of motor engines. An additional ceramic layer reduces the heat transition by distributing the drops to a larger area in case a water droplet hits the already heated sensor. This allows an earlier signal readiness in the vehicle since it is possible to heat sensor already with engine start.

Installation instructions

- Installation in exhaust gas pipes at a location exhibiting a representtative exhaust gas composition given compliance with the specified temperature limits.
- The ceramic sensor element warms up rapidly after switching on the sensor heating. Once the ceramic element has warmed up, the occurrence of condensate, which could damage the hot ceramic sensor element, must be avoided.
- If possible, the installation position should be vertically upwards, however at least at an angle of 10 ° with respect to the horizontal. This prevents the accumulation of liquid between the sensor housing and sensor element. An angle of 90 ° is desirable, however no greater than 90 ° + 15 ° gas inlet hole with respect to the exhaust gas flow or 90 ° - 30 °. Other angular positions are to be assessed separately if applicable.
- Tightening torque: 40 - 60 Nm, the material properties and strength of the thread must be designed accordingly.

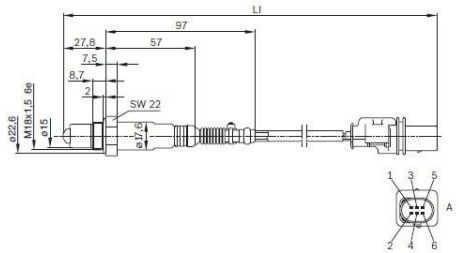
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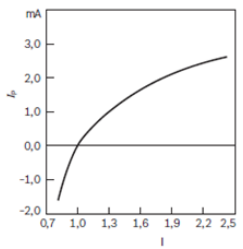
2.2 Lambda sensors
Type LSU-4.9 (wideband)

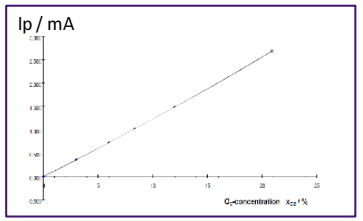
Product type	Part number
LSF-4.9	**Several available**

Dimensional drawings



Air-mass characteristic curve at ambient temperature





Picture



Technical data

Measuring range of lambda	0,65 ... ∞
Heater power (with 7,5V heater voltage)	7,5 W
Heater nominal voltage supply	7,5 V
Exhaust gas temperature	≤ 930°C

Part number	TSP	Voltage	Cable length L1
0 281 004 805	Yes	12/24 V 2)	1000 mm
0 258 017 594	Yes	12 V 1) 2)	450 mm
0 258 017 025	No	12 V	1000 mm

1) Heater voltage need to be PWM (Pulse-width modulation) controlled
2) Possible to use with CNG applications

Accessories

Mating connector parts set	Connector housing, contacts, grommet	1 987 280 016

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2.3 Lambda sensors
Type LSF-5.2 (wideband)

- The wideband Lambda sensor LSU is a planar ZrO_2 dual-cell limit current sensor with integrated heater.
- It is used for measuring the oxygen content and the λ value of exhaust gases in vehicle engines.
- Thanks to a steady characteristic curve in the range λ = 0.65 to air, it is universally applicable for λ = 1 and for other λ ranges.

Application

Engine management
- Gas engines
- Gasoline engines
- Lean combustion engines

Industrial processes
- Tempering furnaces
- Chemical industry
- Packaging equipment
- Process engineering
- Drying plants
- Metallurgy
- Baking oven application

Measurement and analysis processes
- Flue gas measurement
- Gas analysis
- Determination of Wobbe index
- Incineration plants



Design and operation

The LSU broadband Lambda sensor is a planar ZrO_2 dual-cell limit current sensor with integrated heater. It is suitable for measuring the oxygen content and the λ value of exhaust gases in vehicle engines (gasoline). A constant characteristic curve in the range from λ = 0.65 to air makes it suitable for universal use for λ =1 and for other λ ranges. The connector module includes a trimming resistor, which determines the characteristics of the sensor and is necessary for the sensor to function. To function, the LSU requires special operating electronics (e.g. ETAS LA4 or IC CJ125 evaluation circuit) and may only be operated in conjunction with these. The Lambda sensor consists of two cells.

It is made up of a Nernst type potentiometric oxygen concentration cell and an amperometric oxygen pump cell. Nernst cells have the property that oxygen ions diffuse through their ceramic at high temperatures, as soon as there are differences in the partial oxygen pressure at both ends of the ceramic. The transport of ions results in an electrical voltage between them, which is measured using electrodes. The components of the exhaust gas diffuse through the diffusion duct to the electrodes for the pump and Nernst cell, where they are brought to thermodynamic equilibrium. Control electronics record the Nernst voltage U_N at the concentration cell and supply the pump cell with a variable pump voltage U_P. If U_N takes on a value of less than 450 mV, the exhaust gas is lean and the pump cell is supplied with a current that causes oxygen to be pumped out of the duct. By contrast, if the exhaust gas is rich, U_N> 450 mV and the flow direction is reversed, causing the cell to pump oxygen into the duct. An integrated module (CJ125) can be used for signal evaluation. As well as the controller for the pump flow and the controller that keeps the Nernst cell at 450 mV, this module includes an amplifier. The sensor element is manufactured using thick-film techniques, which results in production distribution. This means that the characteristic curves for different sensors will vary. At an oxygen concentration of 0%, the output signal is 0, as when using the evaluation circuit. However, at air the signal scatters ±12%. This means that each sensor has to be individually calibrated so that a clear relationship between the measured oxygen concentration and the output voltage can be created. Calibration can be carried out on air in which the oxygen content is 20.9%. Calibration is recommended at each maintenance. The LSU5.2 has a “Thermal Shock Protection” (TSP). TSP increases robustness, especially against cold water droplets in cold start case of motor engines. An additional ceramic layer reduces the heat transition by distributing the drops to a larger area in case a water droplet hits the already heated sensor. This allows an earlier signal readiness in the vehicle since it is possible to heat sensor already with engine start.

Installation instructions

- Installation in exhaust gas pipes at a location exhibiting a representative exhaust gas composition given compliance with the specified temperature limits.
- The ceramic sensor element warms up rapidly after switching on the sensor heating. Once the ceramic element has warmed up, the occurrence of condensate, which could damage the hot ceramic sensor element, should be limited (max. 60 µl droplet size and max. 25 µl/sec liquid flow)
- If possible, the installation position should be vertically upwards, however at least at an angle of 10° with respect to the horizontal. This prevents the accumulation of liquid between the sensor housing and sensor element. An angle of 90° is desirable, however no greater than 90° + 15° gas inlet hole with respect to the exhaust gas flow or 90° - 30°. Other angular positions are to be assessed separately if applicable.
- Tightening torque: 40 - 60 Nm, the material properties and strength of the thread must be designed accordingly.

Explanation of characteristics quantities

λ Air fuel ratio
U_N Nernst voltage
U_P Variable pump voltage

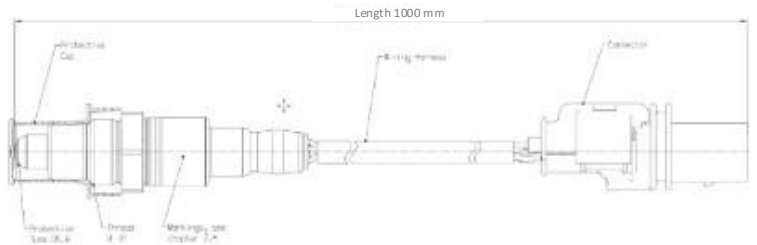
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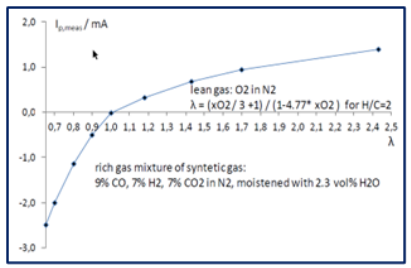
2.3 Lambda sensors
Type LSU-5.2 (wideband)

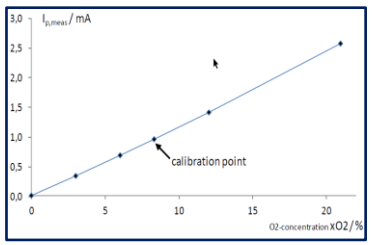
Product type	Part number
LSU-5.2	**Several available**

Dimensional drawings



Air-mass characteristic curve at ambient temperature





Picture



Technical data

Measuring range of lambda	0,65 ... ∞
Heater power (with 7,5V heater voltage)	8,1 W
Heater nominal voltage supply	6,8 V
Exhaust gas temperature	≤ 980°C

Part number	Remark	Cable length L1
0 258 037 056		1000 mm

LSU 5.2 sensors using a 2nd Gen. TSP

Accessories

Mating connector parts set	Connector housing, contacts, grommet	1 987 280 016

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2.4 Nitrogen-Oxide sensors
Gen 3 12/24 Volt

Precise measurement of the nitrogen oxide concentration in the exhaust gas

- Nitrogen oxide sensors ensure a reliable monitoring and control of the exhaust gas cleaning components in diesel engines.
- They precisely measure the nitrogen oxide concentration in the exhaust gas and support an efficient exhaust gas aftertreatment.
- In this way, Bosch nitrogen oxide sensors make a significant contribution to nitrogen-oxide reduction and compliance with applicable emission standards.



Application

Engine management
- Diesel engines
- Combined heat and thermal power units (CHP)
- H2 application
- CNG application
- Marine application

Industrial processes
- Tempering furnaces
- Chemical industry
- Packaging equipment
- Process engineering
- Drying plants

Design and operation

The NOx Gen3 is a technology designed to reduce nitrogen oxide (NOx) emissions from diesel engines, particularly in heavy-duty vehicles. This system utilizes advanced aftertreatment processes, including selective catalytic reduction (SCR) and diesel particulate filters (DPF), to effectively lower harmful emissions. The design focuses on optimizing the chemical reactions that convert NOx into harmless nitrogen and water vapor, thereby meeting stringent environmental regulations.

Advantages at a glance

- Reliable monitoring for compliance with applicable emission standards
- Long service life up to 250,000 km
- Especially robust and resistant sensor element thanks to a ceramic protective layer
- Simple and fast assembly thanks to the union screw
- Individually tested according to original equipment standards

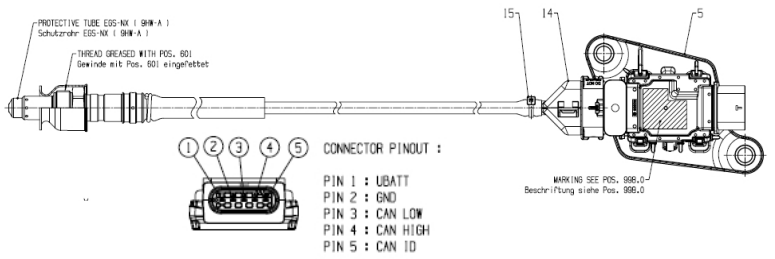
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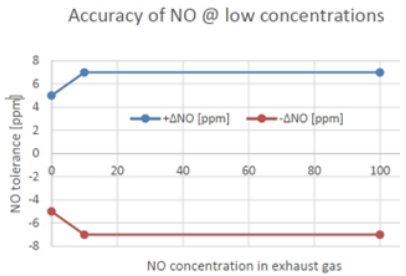
2.4 Lambda sensors
Gen 3 12/24 Volt

Product type	Part number
EGS-NX3	**0 281 050 074**

Dimensional drawings



Air-mass characteristic curve at ambient temperature



0 ppm	± 5 ppm
10 ppm	± 7 ppm
100 ppm	± 7 %
500 ppm	± 8 %
1500 ppm	± 10 %

Picture



Technical data

- High NOx & NH3 accuracy
- NO ≤±5* ppm @ 0 ppm
- NO ≤±8 %* @ 100 – 500 ppm
- Fast heat up
- Light off time <60 s
- Response time <1000 ms @12 m/s
- Operation before dew point end - high water robustness
- Robust against poisoning & soot
- Communication interface: J1939

Part number	Remark	Cable length L1
0 281 050 074	12/24 V	1040 mm

Accessories

Connector housing	5-pin	Hirschmann 872-978-..00
Contact pins (silver plated)		

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.1 Pressure sensors
Differential pressure sensors

- Pressure range -100 to 500 kPa
- High level of accuracy
- With temperature compensation



Application

This sensor is used for either measurement of the differential pressure at the diesel particulate filter to determine its load condition, or fuel tank vapor pressure.

Design and operation

The piezo-resistive pressure sensor element and a suitable circuitry for signal amplification and temperature compensation are integrated on a silicon chip. The pressure measured operates to the back side of the silicon diaphragm, which is resistant to corrosive media and protected by a gel film against diaphragm cracks. The reference pressure operates from above to the active side of the silicon diaphragm. The upper chip surface and the wire-bonding onto the ceramic substrate are protected from corrosion by a anti-corrosive gel.

Explanation of characteristic data

p_e	Differential pressure
U_A	Output voltage (signal voltage)
U_V	Supply voltage
k	Tolerance multiplier
D	After endurance test
N	As-new condition

Installation instructions

The sensor is designed for attachment to the bodywork or to the engine of motor vehicles. The sensor should be installed to avoid condensate accumulating in the pressure cell or the reference opening (pressure sampling point at top of intake manifold, pressure connection angled downwards etc.). As a general rule, the installation position should ensure that liquids cannot accumulate in the sensor and pressure hose. If it freezes, water in the sensor can lead to malfunction.

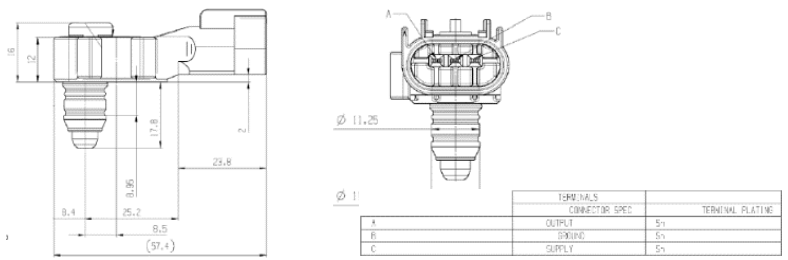
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3.1 Pressure sensors
Differential pressure sensors

Product type	Part number
DS-T3	**0 261 230 161**

Dimensional drawings



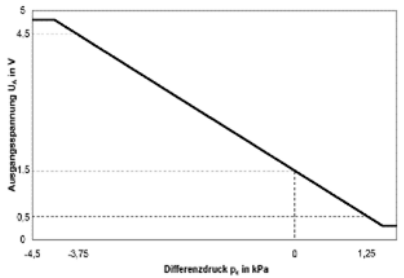
Picture



Technical data

		min.	type	Max.
Pressure range (p_1...p_2)	kPa	-3,75		+1,25
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1,0		0,5
Response time $\tau_{10/90}$	ms			5,0
Operating temperature	°C	0		+80
Limit data				
Operating temperature	°C	-50		+90

Characteristic curve



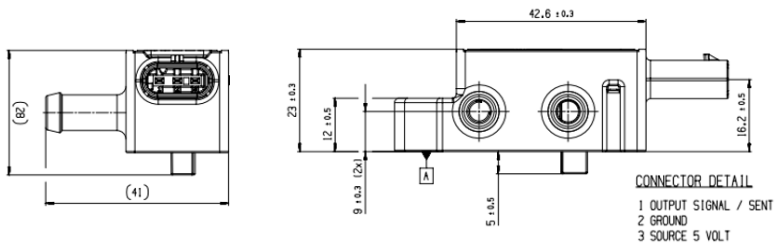
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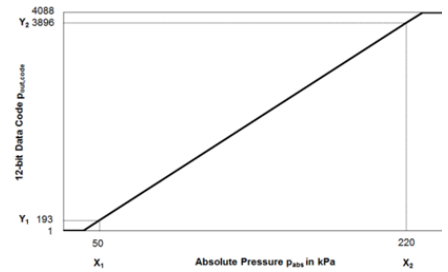
3.1 Pressure sensors
Differential pressure sensors

Product type	Part number
LPS4-2DUO	**0 261 232 0HD**

Dimensional drawings



Characteristic curve



Picture



Technical data

		min.	type	Max.
Pressure range (p_1...p_2)	kPa	-3,75		+1,25
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	15	20	30
Response time $\tau_{10/90}$	ms		1/2	4,7/3.4
Operating temperature	°C	-40		+140
Limit data				
Operating temperature	°C	-40		+150

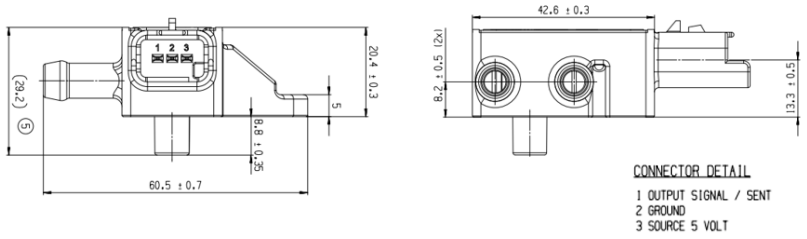
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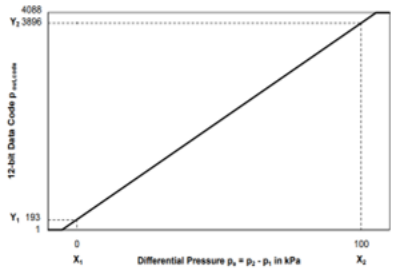
3.1 Pressure sensors
Differential pressure sensors

Product type	Part number
PS-4-DPF	**0 281 006 300**

Dimensional drawings



Characteristic curve



Picture



Technical data

		min.	type	Max.
Pressure range (p_1...p_2)	kPa	0		+100
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	+10	17	20
Response time $\tau_{10/90}$	ms			2,4
Operating temperature	°C	-40		+140
Limit data				
Operating temperature	°C	-40		+150

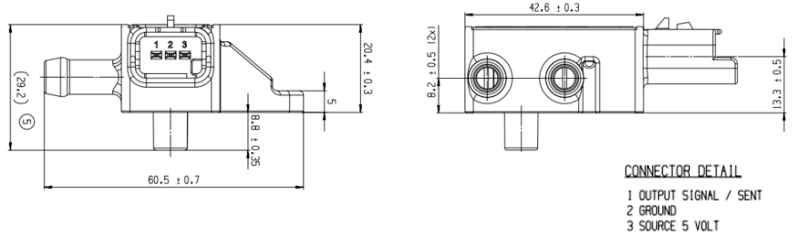
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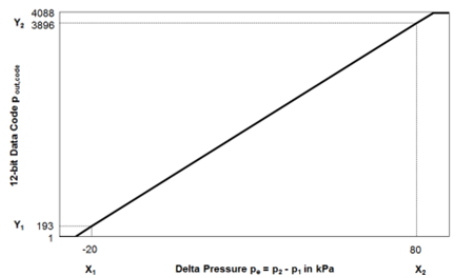
3.1 Pressure sensors
Differential pressure sensors

Product type	Part number
PS-4-GPF	**0 261 232 051**

Dimensional drawings



Characteristic curve



Picture



Technical data

		min.	type	Max.
Pressure range (p_1...p_2)	kPa	-20		+80
Supply voltage U_V	V	4,5	5	5,5
Load current I_L at output	mA	-1,0		0,5
Response time $\tau_{10/90}$	ms			2,4
Operating temperature	°C	-40		+150
Limit data				
Operating temperature	°C	-40		+150

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3.2 Pressure sensors
Absolute pressure sensors

- Pressure range 0 – 1000 kPa
- High level of accuracy
- EMC protection better than 100 V m-1
- With temperature compensation
- Version with additional integrated temperature sensor



Application

The sensor is used to measure the absolute intake-manifold or boost pressure. Some variants can be used to measure the absolute fuel or oil pressure. The version with integrated temperature sensor additionally measures the temperature of the detected medium.

Design and operation

The piezo-resistive pressure sensor element and a suitable circuitry for signal amplification and temperature compensation are integrated on a silicon chip. The measured pressure operates from above to the active side of the silicon diaphragm. Between the backside and a glass socket a reference vacuum is enclosed. The temperature sensor element is an NTC-resistor. By a suitable coating process the pressure and temperature sensor are protected against vapors and fluids existing in the intake-manifold, exhaust gas or exhaust gas condensate, however, may affect the sensor lifetime.

Explanation of characteristic data

U_A	*Output voltage*
U_V	*Supply voltage*
k	*Tolerance multiplier*
D	*After endurance test*
N	*As-new condition*

Installation instructions

The sensor is designed for attachment to a flat surface at the intake manifold of motor vehicles. The pressure connection and the temperature sensor jointly project into the intake manifold and are sealed off from the atmosphere by an O-ring. The sensor should be installed to avoid condensate accumulating in the pressure cell (pressure sampling point at top of intake manifold, pressure connection angled downwards etc.).

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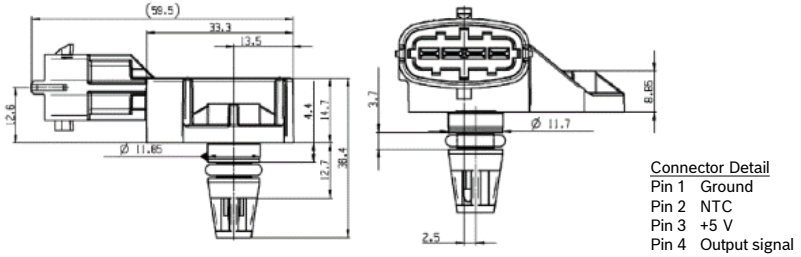
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3.2 Pressure sensors
Absolute pressure sensors

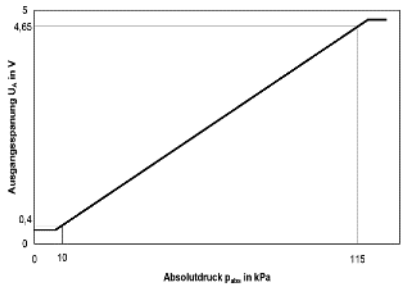
Product type
DS-S3-TF

Part number
0 261 230 217

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features	interface	Integrated temperature sensor with bushing for usage with metal		
Pressure range (p_1...p_2)	kPa	10		115
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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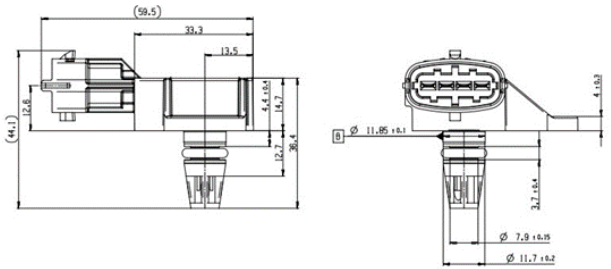
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3.2 Pressure sensors
Absolute pressure sensors

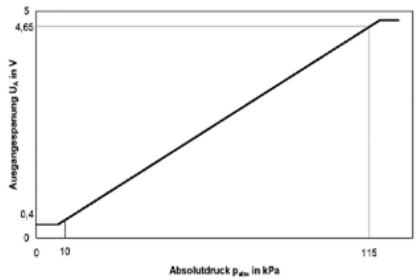
Product type
DS-S3-TF

Part number
0 261 230 245

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2	kPa	10		115
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1.0
Operating temperature	°C	-40		+130
Load resistance to Us or ground *R pull up*	kΩ	5	68	
Load resistance to Us or ground *R pull down*	kΩ	10	100	
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Accessories

Connector housing	4-pin	1 928 404 745
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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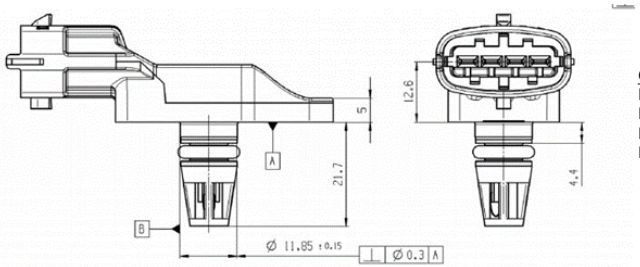
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3.2 Pressure sensors
Absolute pressure sensors

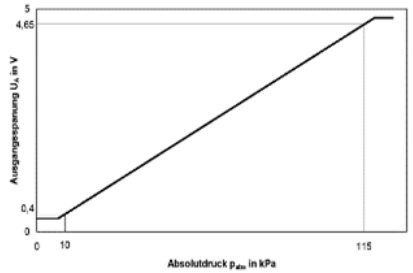
Product type
DS-S3-TF

Part number
0 261 230 247

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	20		250
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Accessories

Connector housing	4-pin	1 928 404 745
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

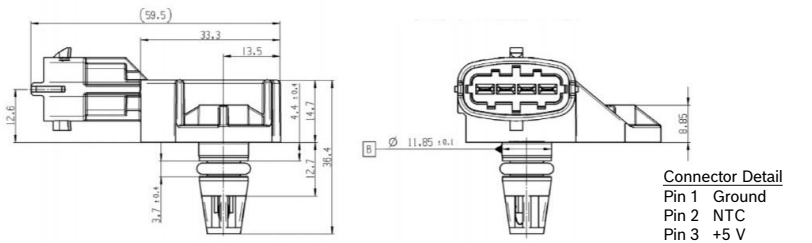
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3.2 Pressure sensors
Absolute pressure sensors

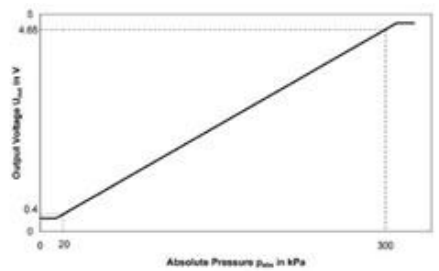
Product type	Part number
DS-S3-TF	**0 261 230 280**

Dimensional drawings



Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve



Picture



Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	20		300
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Accessories

Connector housing	4-pin	1 928 404 745
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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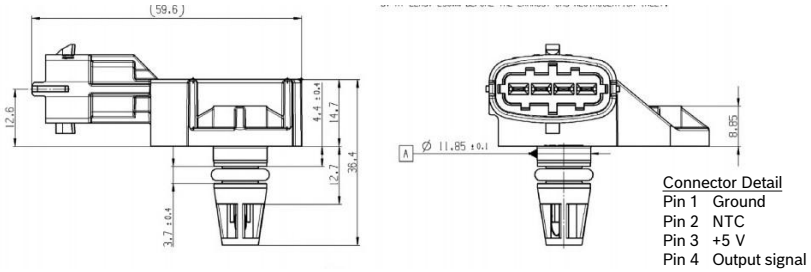
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3.2 Pressure sensors
Absolute pressure sensors

Product type
DS-S3-TF

Part number
0 261 230 283

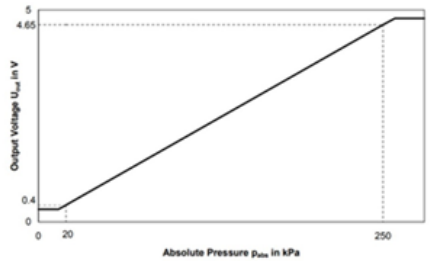
Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	20		250
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Characteristic curve


Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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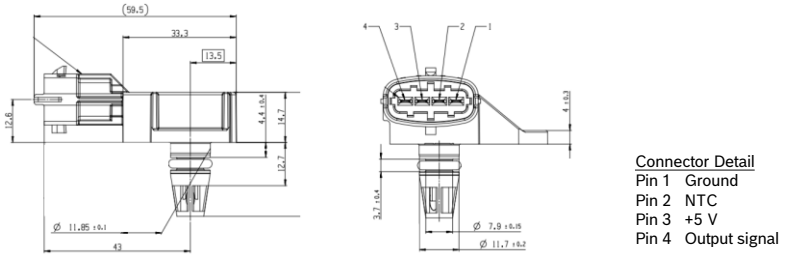
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3.2 Pressure sensors
Absolute pressure sensors

Product type
DS-S3-TF

Part number
0 261 230 302

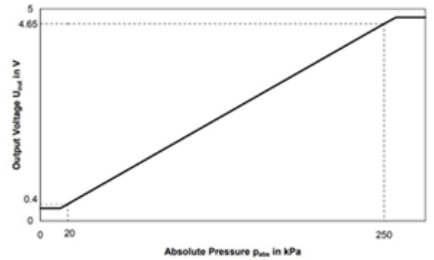
Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	20		250
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Characteristic curve


Accessories

Connector housing	4-pin	1 928 404 745
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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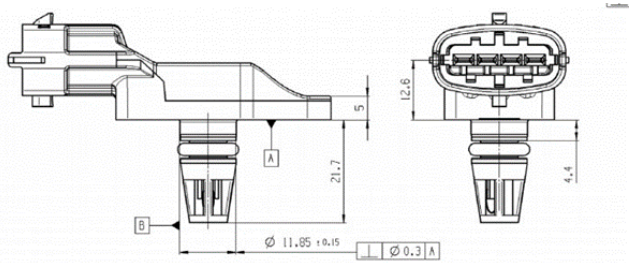
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3.2 Pressure sensors
Absolute pressure sensors

Product type
DS-S3-TF

Part number
0 261 230 310

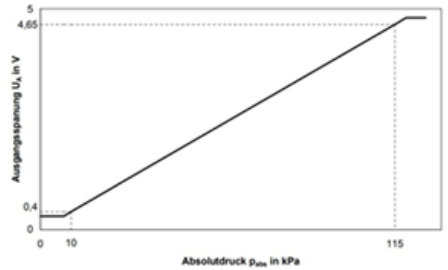
Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	10		115
Supply voltage U_V	V	4,75	5	5,25
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Load current I_L at output		-1		0,5
Lower limit at US = 5 V Upper limit at US = 5 V	V	0.25 4.65	0,3 4,7	0,35 4,75

Characteristic curve


Accessories

Connector housing	4-pin	1 928 404 745
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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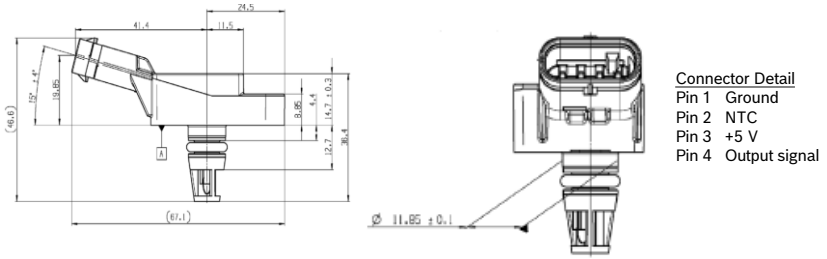
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3.2 Pressure sensors
Absolute pressure sensors

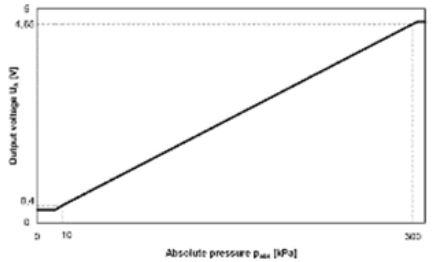
Product type
DS-S3-TF

Part number
0 261 230 416

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	10		300
Supply voltage U_V	V	4,75	5	5,25
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				

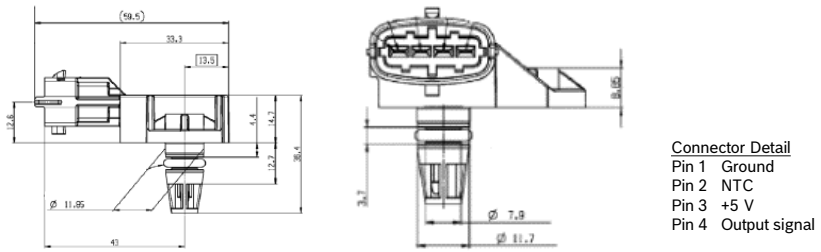
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3.2 Pressure sensors
Absolute pressure sensors

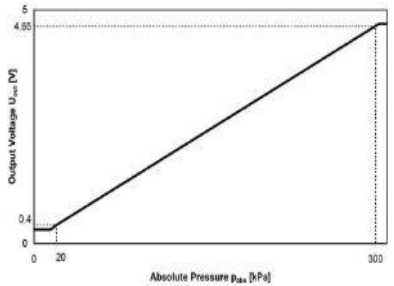
Product type	Part number
DS-S3-TF	**0 261 006 028**

Dimensional drawings



Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve



Picture



Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	20		300
Supply voltage U_V	V	4,75	5	5,25
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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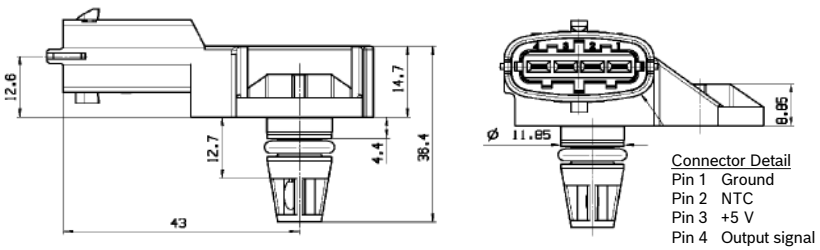
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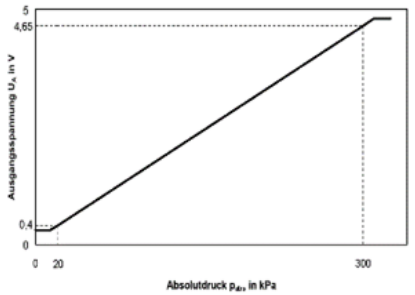
3.2 Pressure sensors
Absolute pressure sensors

Product type
DS-S3-TF

Part number
0 261 006 076

Picture


Dimensional drawings


Characteristic curve


Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	20		300
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Temperature sensor				
Measuring range	°C	-40		+130
Measurement current[1)]	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	
Temperature/time constant τ_{63} [2)]	s			10

[1)] Operation with 1 kΩ series resistance.
[2)] In air with flow velocity 6 m/s.

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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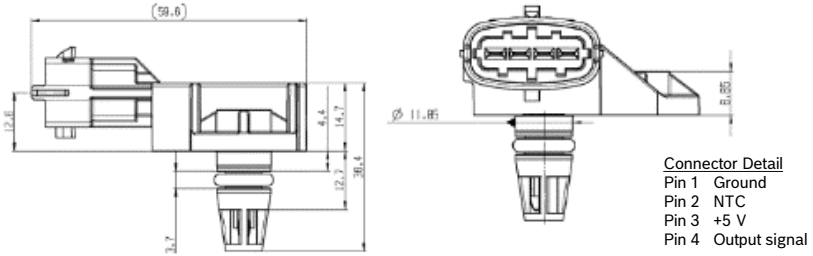
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3.2 Pressure sensors
Absolute pressure sensors

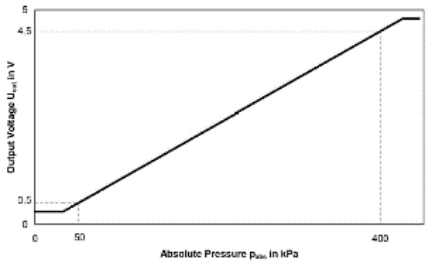
Product type
DS-S3-TF

Part number
0 261 006 102

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features			Integrated temperature sensor	
Pressure range (p_1...p_2)	kPa	50		400
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Temperature sensor				
Measuring range	°C	-40		+130
Measurement current[1)]	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	
Temperature/time constant τ_{63} [2)]	s			10

[1)] Operation with 1 kΩ series resistance.
[2)] In air with flow velocity 6 m/s.

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.3 Pressure sensors
Pressure sensors for CNG

- Pressure range 20 – 1000 kPa
- High level of accuracy
- EMC protection up to 100 Vm-
- With temperature compensation
- Ratiometric output signal
- All sensors and sensor cells are resistant against natural gas (CNG)



Application

The sensor is used to measure and regulate the absolute pressure and the temperature in the fuel rail pipe of natural-gas systems that are operated with CNG. The fuel pressure sensor is resistant against natural gas (CNG).

Design and operation

The piezo-resistive pressure sensor element and a suitable circuitry for signal amplification and temperature compensation are integrated on a silicon chip. The measured pressure operates from above to the active side of the silicon diaphragm. The temperature sensor element is an NTC-resistor.

Explanation of characteristic data

U_A	*Output voltage*
U_V	*Supply voltage*
k	*Tolerance multiplier*
D	*After endurance test*
N	*As-new condition*

Installation instructions

The sensor has been designed for attach-ment to a flat surface. Both pressure port piece and temperature sensor project into the line, and sealing from the atmosphere is by means of an 0-ring. The hole on the customer side for holding and fastening the sensor in place shall be such that a permanently tight sit at the pressure port as well as stability towards the measuring medium will be assured. The installed position in the vehicle shall be only on the side of medium purity. Neither substances that can freeze nor any condensates at the pressure port are allowed, and neither shall be introduced during transportation of assembly.

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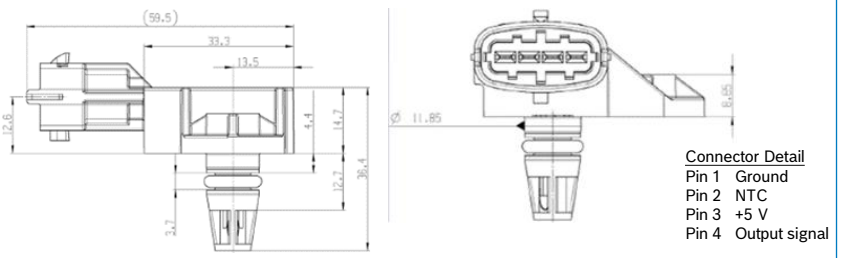
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3.3 Pressure sensors
Pressure sensors for CNG

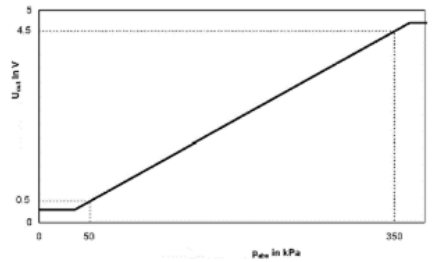
Product type
DS-G3-TF

Part number
0 261 230 373

Picture


Dimensional drawings


Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve


Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	50		350
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Load resistance to ground or U_v	kΩ	5		10
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Lower limit at U_V = 5 V	V	4,65	4,7	4,75
Output resistance to ground, U_V oben	kΩ	1	1,6	2
Output resistance to U_V, ground open	kΩ	1	1,6	2
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		+120

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.3 Pressure sensors

Pressure sensors for CNG

Product type

DS-G3-TF

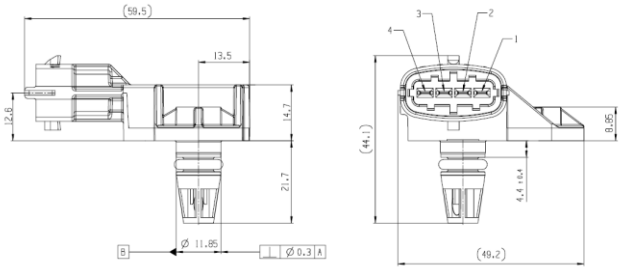
Part number

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Picture

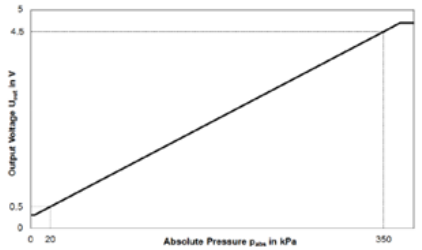


Dimensional drawings



Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve



Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	20		350
Supply voltage U_V	V	4,75	5	5,25
Current input Iv at U_V = 5 V	mA	6	9	12,5
Load current I_L at output	mA	-1		0,5
Load resistance to ground or U_v	kΩ	5		10
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Lower limit at U_V = 5 V	V	4,65	4,7	4,75
Output resistance to ground, U_V oben	kΩ	1	1,6	2
Output resistance to U_V, ground open	kΩ	1	1,6	2
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+120

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.3 Pressure sensors

Pressure sensors for CNG

Product type

DS-G3-TF

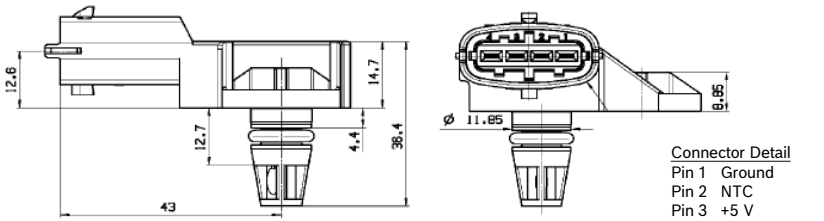
Part number

0 261 230 00J

Picture

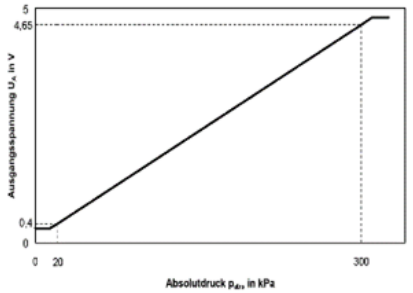


Dimensional drawings



Connector Detail
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal

Characteristic curve



Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	20		300
Supply voltage U_V	V	4,75	5	5,25
Current input Iv at U_V = 5 V	mA	6	9	12,5
Load current I_L at output	mA	-1		0,5
Load resistance to ground or U_v	kΩ	5		10
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Lower limit at U_V = 5 V	V	4,65	4,7	4,75
Output resistance to ground, U_V oben	kΩ	1	1,6	2
Output resistance to U_V, ground open	kΩ	1	1,6	2
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+120

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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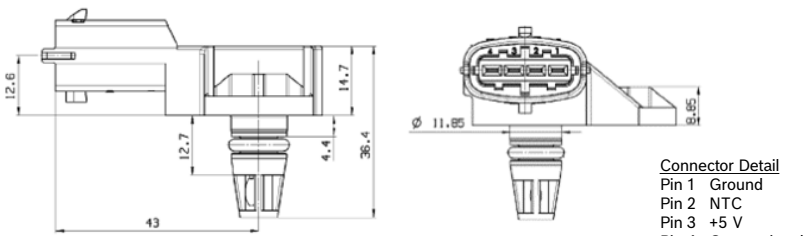
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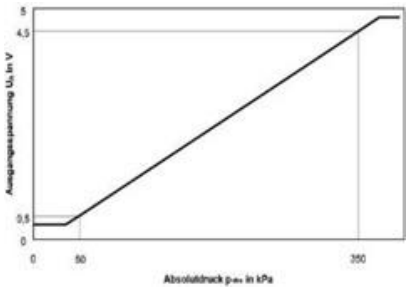
3.3 Pressure sensors
Pressure sensors for CNG

Product type
DS-G3-TF

Part number
0 261 230 01G

Picture


Dimensional drawings


Characteristic curve


Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	50		400
Supply voltage U_V	V	4,75	5	5,25
Current input Iv at U_V = 5 V	mA	6	9	12,5
Load current I_L at output	mA	-1		0,5
Load resistance to ground or U_v	kΩ	5		10
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Lower limit at U_V = 5 V	V	4,65	4,7	4,75
Output resistance to ground, U_V oben	kΩ	1	1,6	2
Output resistance to U_V, ground open	kΩ	1	1,6	2
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+120

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.4 Pressure sensors
Medium pressure sensor

- Pressure range 5 to 50 bar (absolute or relative)
- Highly precise measurement of fuel and oil pressure
- Integrated temperature sensor optional



Application

The medium-pressure sensor ensures rapid and highly precise measurement of fuel and oil pressure in every kind of combustion engine (gasoline, diesel, CNG, LPG) and transmission. The measurement is used to control the amount of fuel or oil supplied by the pump.

Design and operation

The sensor measures pressure by using a resistance bridge to evaluate the distortion of a silicon membrane. An integrated temperature sensor is optional. The pressure sensor can be equipped with a range of hydraulic interfaces and connectors. An optional temperature sensor can be integrated into the medium-pressure sensor. It measures temperature using an NTC (negative temperature coefficient) resistor connected to the evaluation element in the sensor. The pressure sensor can transmit the pressure and temperature readings as analog or digital signals (SENT).

Explanation of characteristic data

U_A	*Output voltage*
U_V	*Supply voltage*
bar	*Pressure*
U_S	*Input voltage*
p	*Pressure [MPa]*
C_O	*0,1*
C_1	$0{,}8 \cdot p / P_N$
P_N	*Rated pressure [MPa]*

Installation instructions

A suitable installation in the vehicle should be used to ensure that water cannot collect on the membrane.
The pressure sensor may only be handled at the hexagon while screwing. While mounting, a socket or ring wrench has to be used. This wrench may only be put at the hexagon and must cover it safely. Tilting or tipping of the socket or ring wrench with the device connector must be avoided. Open-end wrenches are no permitted for the assembly. While assembling the sensor, the device connector should not be rotated against the pressure port, else the sensor will be damaged. After the pressure sensor has been screwed into its installation position, it is tightened at the hexagon.

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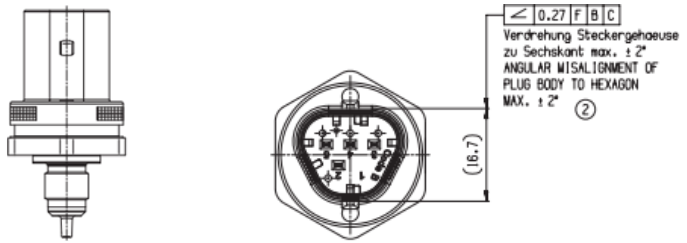
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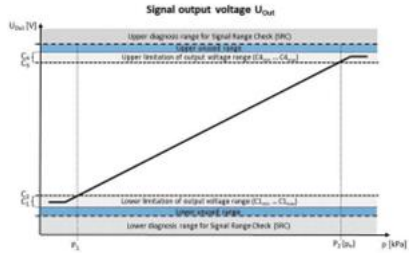
3.4 Pressure sensors
Medium pressure sensors

Product type
MPS1-TF

Part number
0 261 544 01F

Picture


Dimensional drawings


Characteristic curve


Technical data

Features	Integrated temperature sensor		
Pressure range (p_1...p_2)	bar	0	10
Max. overpressure	bar		20
Supply voltage U_V	V	4,75	5,25
Supply current I_s	mA		16,5
Thread			M 10 x 1
Application		Diesel and gasoline	
Max. Supply voltage U_s	V		18
Load capacitance to ground	nF		13
Response time $\tau_{10/90}$	ms		2,0
Operating temperature	°C	-40	+150
Measurement current[1)]	mA		1

1) Operation with 1 kΩ series resistance

Accessories

Wire size range	For Ø 0,35...0,5 mm²	
Connector housing (1x)		1 928 405 159
Matrix terminal (4x)		1 928 498 143
Mating single wire seal (4x)		1 928 300 934
Cavity Plug (1x)		1 928 300 935

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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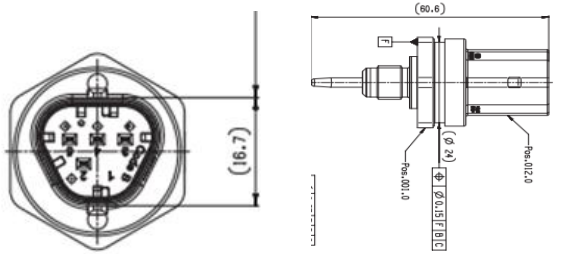
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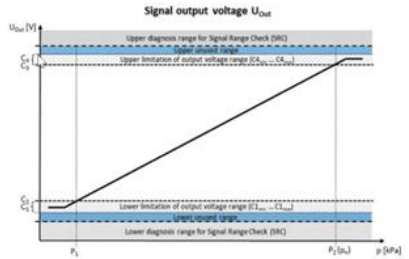
3.4 Pressure sensors
Medium pressure sensors

Product type
MPS1-TF-CNG

Part number
0 261 544 00K

Picture


Dimensional drawings


Characteristic curve


Technical data

Features	Integrated temperature sensor		
Pressure range (p_1...p_2)	bar	0	10
Max. overpressure	bar		20
Supply voltage U_V	V	4,75	5,25
Supply current I_s	mA		16,5
Thread			M 10 x 1
Application		Diesel and gasoline	
Max. Supply voltage U_s	*V*		18
Load capacitance to ground	nF		13
Response time $\tau_{10/90}$	ms		2,0
Operating temperature	°C	-40	+150
Measurement current[1)]	mA		1

1) Operation with 1 kΩ series resistance

Accessories

Connector housing		1 928 405 159
Contact pins (silver-plated)	For Ø 0,35...0,5 mm²	1 928 498 143
Single-wire seal		1 928 300 934
Dummy plug		1 928 300 935

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

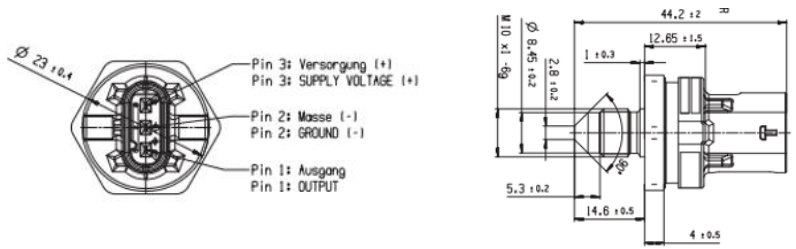
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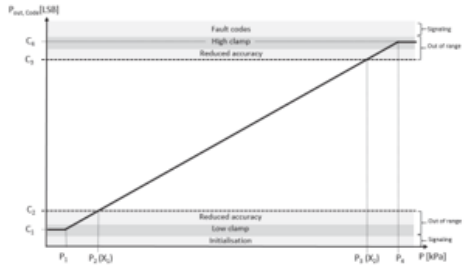
3.4 Pressure sensors
Medium pressure sensors

Product type	Part number
MPS1-D	**0 261 544 018**

Dimensional drawings



Characteristic curve



Picture



Technical data

Pressure range	P_N	bar	0,48-11
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Thread			M 10 x 1
Application/medium		Diesel and gasoline	
Temperature range		°C	-40 ... +80
Max. overpressure	p_{max}	bar	22

*RME rapeseed methyl ester.

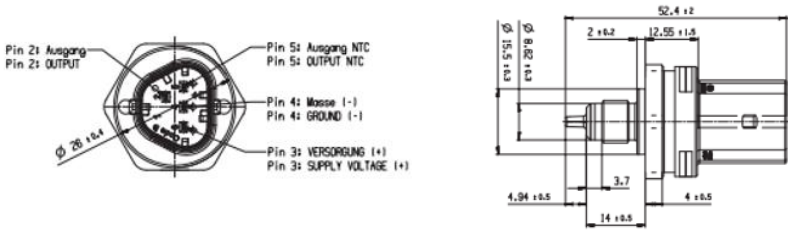
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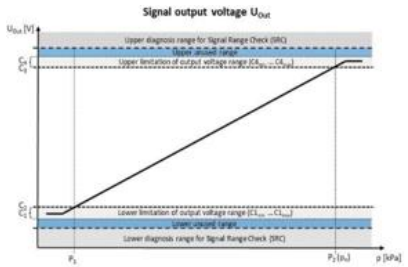
3.4 Pressure sensors
Medium pressure sensors

Product type	Part number
MPS1-TF	**0 261 544 02G**

Dimensional drawings



Characteristic curve



Picture



Technical data

Pressure range	P_N	bar	10
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Thread			M 10 x 1
Application/medium		Oil, Diesel, gasoline	
Temperature range		°C	-40 ... +80
Max. overpressure	p_{max}	bar	20
Response time	τ_{ini}	ms	2.0

*RME rapeseed methyl ester.

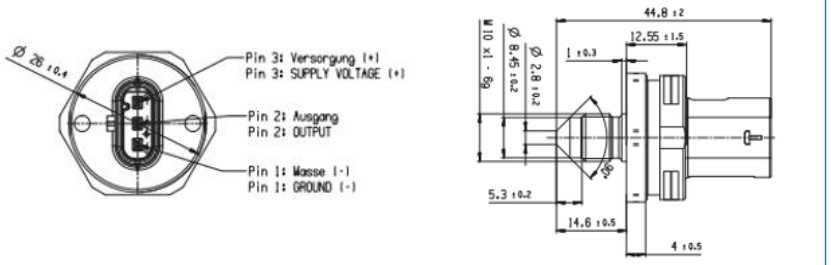
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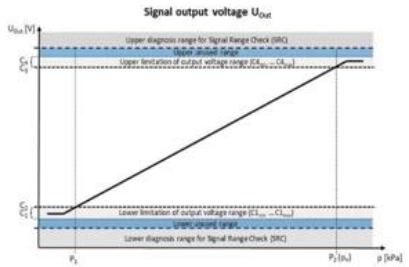
3.4 Pressure sensors
Medium pressure sensors

Product type	Part number
MPS1-A	**0 261 232 02X**

Dimensional drawings



Characteristic curve



Picture



Technical data

Pressure range	P_N	bar	10
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Thread			M 10 x 1
Application/medium		Diesel, gasoline	
Temperature range		°C	-40 ... +80
Max. overpressure	p_{max}	bar	20
Response time	τ_{ini}	ms	2.0

*RME rapeseed methyl ester.

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3.5 Pressure sensors
High pressure sensor

- Pressure range 5 – 340 Mpa
- Ratiometric signal evaluation (relative to supply voltage)
- Self-monitoring offset and sensitivity.
- Excellent media resistance (stainless steel)
- Resistant to brake fluids, mineral oils, fuel, water and air
- Protection against reverse polarity, overvoltage and short circuit of the output to supply voltage or ground

Application

High pressure sensors are used in motor vehicles to measure the pressure in the fuel rail of direct-injection gasoline and common-rail diesel engines or further hydraulic applications.



Design and operation

Use is made of polysilicon metal thin-film strain gauge elements. These are connected to form a Wheatstone bridge. This permits good signal utilization and temperature compensation. The measurement signal is amplified in an evaluation IC and corrected with regard to offset and sensitivity. Further temperature compensation is then implemented, so that the calibrated measurement cell and ASIC unit exhibits only a low degree of dependence on temperature. The evaluation IC also incorporates a diagnosis function for detection of the following possible faults:

- Break in bonding wire to measurement cell.
- Break in any signal wire at any point.
- Break in supply and ground wire at any point.

Explanation of characteristic data

U_A	*Output voltage*
U_V	*Supply voltage*
bar	*Pressure*
U_S	*Input voltage*
p	*Pressure [MPa]*
C_O	*0,1*
C_1	$0{,}8 \cdot p / P_N$
P_N	*Rated pressure [MPa]*

Installation instructions

The pressure sensor is designed for different use cases, which have different sealing concepts. Water must not be allowed to collect on the membrane.

The pressure sensor consists of a pressure port of metal and a housing of plastic. The pressure port has a sealing surface and a hexagon. The housing must not be twisted against the pressure port during installation. The pressure sensor has to be handled during screwing-in only at the hexagon. Tools for installation, e. g. socket wrench, must be applied only at the hexagon. After the pressure sensor has been correctly tightened to its installation position, a gap remains between the hexagon of the pressure sensor and the fuel rail or similar interface.

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3.5 Pressure sensors
High pressure sensor (hydraulic applications)

Hydraulic sensor program



Nominal Pressure	series number	electrical Interface	mechanical interface
50 bar	0 261 546 003	analog	G1/4 acc. ISO1179-1 w. form gasket
260 bar	0 261 545 108	analog	M 10 x 1 acc. ISO 14405-1
300 bar	0 261 545 115	analog	M 10 x 1 acc. ISO 14405-1
400 bar	0 261 546 00A	analog	M14x1,5 acc. ISO 6149-1 w. O-Ring
500 bar	0 261 547 012	digital (SENT)	ISO 16750.3
1800 bar	0 281 007 302	analog	M 18 x 1.5 acc. ISO 14405-1
2000 bar	0 281 006 372	analog	ISO 26262

Attention: program is regularly adjusted based on market requirements.

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3.5 Pressure sensors

High pressure sensors (hydraulic applications)

Product type

HPS4

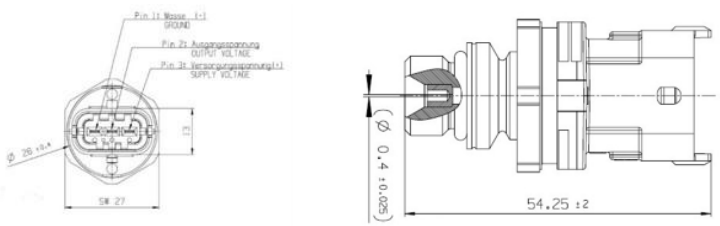
Part number

0 261 545 188

Picture



Dimensional drawings

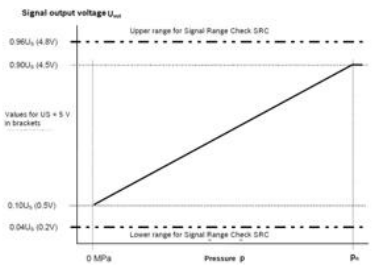


Technical data

Pressure range	P_N	bar (Mpa)	260 (26)
Thread			M10 x1
Connector			Compact 1.1
Application/medium			CNG
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Supply current	I_s	mA	15
Load capacitance to ground		nF	13
Temperature range		°C	- 40 ...+ 140
Max. overpressure	p_{max}	bar	400
Rupture pressure	p_{max}	bar	2500
Response time	$\tau_{10/90}$	ms	1.0

[1] FS = Full Scale

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.5 Pressure sensors

High pressure sensors (hydraulic applications)

Product type

HPS4

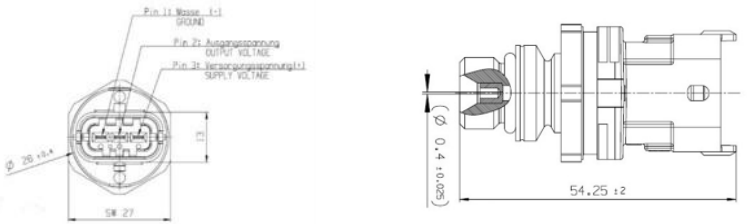
Part number

0 261 546 00A

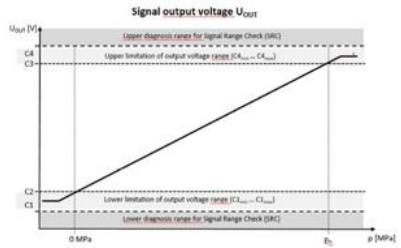
Picture



Dimensional drawings



Characteristic curve



Technical data

Pressure range	P_N	bar (Mpa)	400 (40)
Thread			M 14 x 1,5
Connector			Compact 1.1
Application/medium			Hydraulic applications with oil or hydraulic fluids
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Supply current	I_s	mA	15
Load capacitance to ground		nF	13
Temperature range		°C	- 40 ...+ 130
Max. overpressure	p_{max}	bar	840
Rupture pressure	p_{max}	bar	4500
Response time	$\tau_{10/90}$	ms	0.2 ... 0.8

[1] FS = Full Scale

Attention: product also available with other pressure ranges, such as 600 bar. For details, please approach us via contact page.

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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3.5 Pressure sensors

High pressure sensors (hydraulic applications)

Product type

RPS4.2

Part number

0 281 007 302

Picture

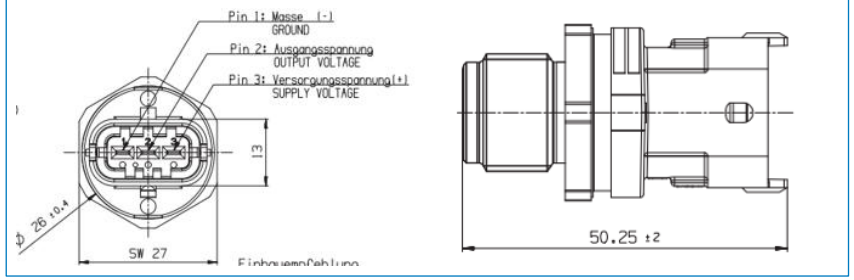


Technical data

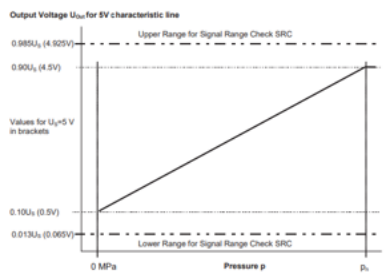
Pressure range	P_N	bar (MPa)	1800 (180)
Max. feed voltage	U_s	V	15
Supply voltage	U_V	V	5 ± 0,25
Load capacitance to ground		nF	13
Thread			M 18 x 1.5
Application/medium			diesel
Temperature range		°C	-40 ... +130
Max. overpressure	p_{max}	bar	
Rupture pressure	p_{berst}	bar	
Response time	τ_{ini}	ms	2,0

*RME rapeseed methyl ester.

Dimensional drawings



Characteristic curve



Accessories

Connector housing		1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Single-wire seal		1 928 300 599

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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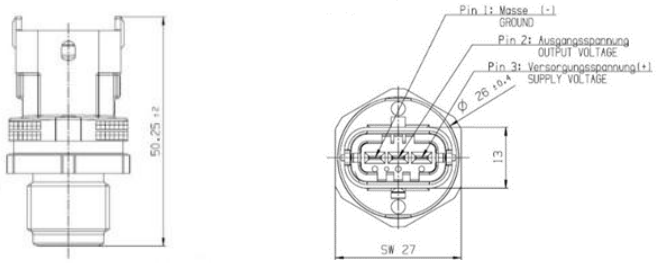
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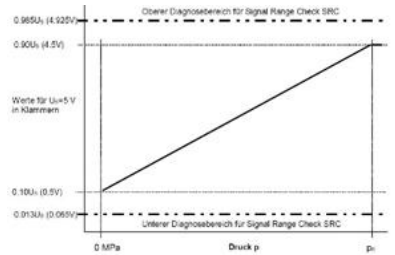
3.5 Pressure sensors
High pressure sensors (diesel)

Product type
RPS4.2

Part number
0 281 002 930

Picture


Dimensional drawings


Characteristic curve


Technical data

Pressure range	P_N	bar (MPa)	2000 (200)
Max. feed voltage	U_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Load capacitance to ground		nF	13
Thread			M 18 x 1,5
Application/medium			Diesel or biodiesel*
Temperature range		°C	- 40 ...+ 130
Max. overpressure	p_{max}	bar	2300
Rupture pressure	p_{berst}	bar	4000
Response time	τ_{ini}	ms	2

*RME rapeseed methyl ester.

Attention: product also available with other pressure ranges, such as 1500 or 1800 bar. For details, please approach us via contact page.

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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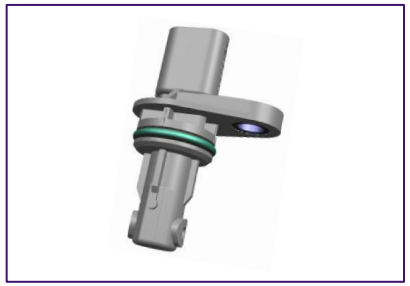
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4.1 Rotational - Speed sensors
Sensors for Camshaft and Crankshaft Applications

- Precise and reliable digital measurement of rotation speed, angle position and rotation direction (crankshaft sensors)
- Non-contact measurement
- Hall IC sensor with open collector output
- Not susceptible to dirt
- Resistant to mineral oil products (fuel, engine oil)
- High robustness against electromagnetic interference (EMC)

Application

Hall speed sensors are ideal for non-contact, wear-free measurement of crankshaft speed, camshaft speed and similar applications.



Design and operation

Speed sensors are integral components of the engine management system in motor vehicles, typically installed in the engine or similar compartment. These sensors provide signals used to determine the position and rotational speed of the wheels, which are then processed by the ECU (Engine Control Unit). By detecting the teeth of a ferromagnetic target wheel, the sensor performs signal processing through an ASIC (Application-Specific Integrated Circuit) and transmits the processed signal to the ECU.

Crankshaft sensors identify additionally the rotation direction of the crankshaft wheel, enabling the detection of both forward and backward rotations during engine operation.This information allows the ECU to calculate the absolute position of the crankshaft after the engine stops, facilitating the implementation of a Start-Stop function in the engine control unit.

These speed sensors are equipped with a permanent magnet and a Hall IC (Integrated Circuit). As the ferromagnetic target wheel rotates in front of the sensor, the magnetic field of the internal magnet is modulated at the sensor's Hall probe(s). The sensor detects changes in the magnetic field at the transition between the tooth and slot of the ferromagnetic target wheel.

Installation instructions

- Please refer to installation conditions given in the offer drawing and Technical Customer Documentation (TCD)
- Route the connecting cables away from interference sources like ignition cables.
- Connect the ground connection of the sensor to the ECU ground pin to prevent issues arising from trigger level shifting and ground offsets.
- Protect the sensor against the destructive action of static discharge during installation.

Explanation of characteristic data

n	Rotation Speed
U_S	Sensor supply voltage
U_{S_OUT}	Voltage on Rpull_up Resistor
I_S	Sensor supply current
t_f	Fall time (trailing signal edge).
t_r	Rise time (leading signal edge).

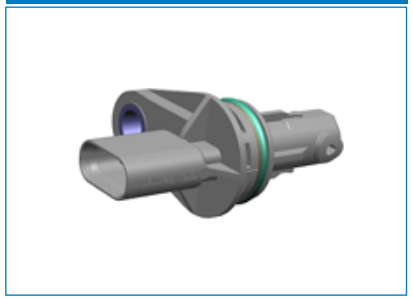
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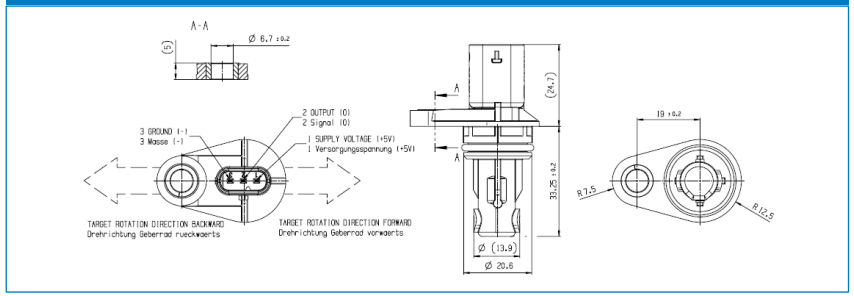
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type
RSC-D5

Part number
0 261 210 389

Picture


Dimensional drawings


Key features
- Differential Hall Sensor
- Rotation Direction Detection
- Open Collector Interface (3-wire)
- Utilizes the Latest ASIC Generation for Optimal Accuracy and Repeatability
- Suitable for High-Speed Applications (up to 10,000 rpm with a 60-2 target wheel)

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed, forward	$n_{max.}$	10 000 min.$^{-1}$
Maximum trigger-wheel speed, reverse	$n_{max.}$	4 000 min.$^{-1}$
Sensor switching position		Near tooth centre
Rotation Direction Detection		Yes
Working air gap range		0.2 mm ... 1.8 mm
Rated supply voltage	$U_{S, nom}$	5 V
Supply voltage range	U_S	4.5...5.5V
Supply current	I_V	≤ 15 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 3 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1])	≤ 1 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2])	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+160°C
Steady-state temperature in connector zone		-40°C...+150°C

[1, 2]) Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin, coding B	Hirschmann 872-978-...00
Contact pins (gold-plated)		

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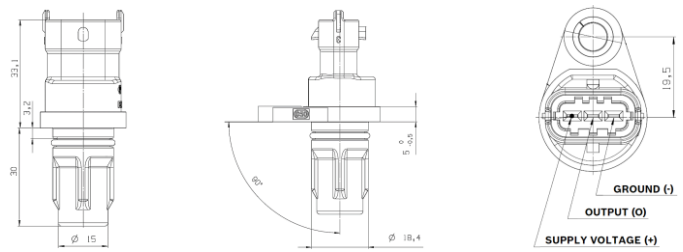
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type
PG-3-8

Part number
0 232 103 10K

Picture


Dimensional drawings


Key features
- Single Hall Sensor
- Twist Insensitive Mounting (TIM) Capability
- True Power On (TPO) for Quick Engine Start
- Open Collector Interface (3-wire) Robust Design

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	4500 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Near tooth edge
Rated supply voltage	$U_{S,\ nom}$	5 V
Supply voltage range	U_S	4.5 V ...5.5 V
Supply current	I_S	< 9 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 10 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 4 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+160°C
Steady-state temperature in connector zone [3)]		-40°C...+130°C
Programming Option		50TL05/12-88

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)
[3)] -40...+150 °C permissible in connector zone for short time

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold plated)	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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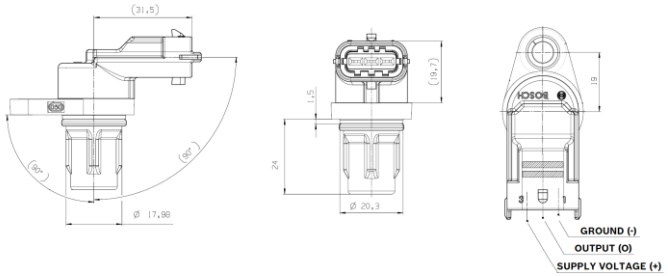
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type
PG-3-8

Part number
0 232 103 10W

Picture


Dimensional drawings


Key features
- Single Hall Sensor
- Twist Insensitive Mounting (TIM) Capability
- True Power On (TPO) for Quick Engine Start
- Open Collector Interface (3-wire)
- Using Best-in-Class Plastic Material (PPS) with High Resistance to Media and Humidity

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	4500 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Near tooth edge
Rated supply voltage	$U_{S, nom}$	5 V
Supply voltage range	U_S	4.5 V ...5.5 V
Supply current	I_S	< 9 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 10 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 4 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone [3)]		-40°C...+130°C
Programming Option		50TL05/12-88

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)
[3)] -40...+150 °C permissible in connector zone for short time

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold plated)	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

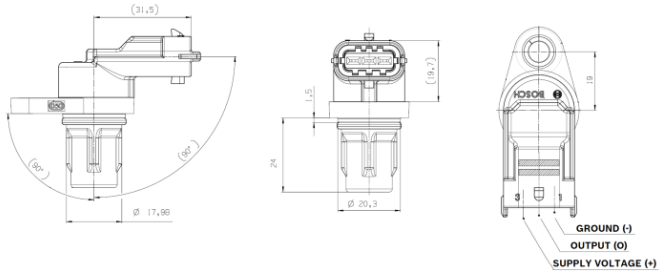
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type	Part number
CPS-4	**0 232 103 502**

Dimensional drawings



Picture



Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	4500 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Near tooth edge
Rated supply voltage	$U_{S, nom}$	5 V or 12 V
Supply voltage range	U_S	4.75 V ...16 V
Supply current	I_S	< 10 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 10 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 4 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone [3)]		-40°C...+150°C
Programming Option		50TL05/12-86

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin	Hirschmann 872-978-...00
		Coding B, Silver plated

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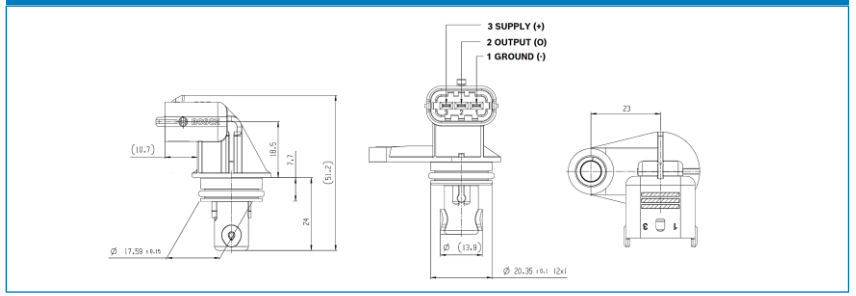
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type
CPS-4

Part number
0 232 103 506

Picture


Dimensional drawings


Key features
- Single Hall Sensor
- Newest sensor platform
- Twist Insensitive Mounting (TIM) Capability
- True Power On (TPO) for Quick Engine Start
- Open Collector Interface (3-wire)
- Connector acc. 1 928 A00 75S, Code 1, Silver plated contacts
- Using Best-in-Class Plastic Material (PPS) with High Resistance to Media and Humidity

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	4500 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Near tooth edge
Rated supply voltage	$U_{S, nom}$	5 V or 12 V
Supply voltage range	U_S	4.75 V ...16 V
Supply current	I_S	< 10 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 10 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 4 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone [3)]		-40°C...+150°C
Programming Option		50TL05-86

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin	1 928 405 524
Contact pins (silver plated)	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (silver plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

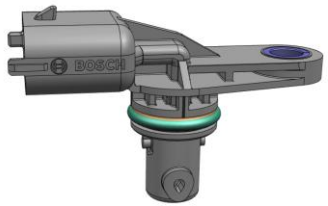
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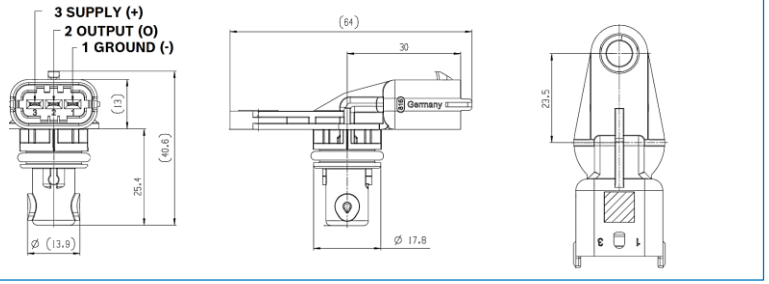
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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type
CPS-4

Part number
0 232 103 510

Picture


Dimensional drawings


Key features
- Single Hall Sensor
- Newest sensor platform
- Twist Insensitive Mounting (TIM) Capability
- True Power On (TPO) for Quick Engine Start
- Bosch plug connector acc. A 928 000 453, Code 2, Tin plated contacts
- Open Collector Interface (3-wire)
- Robust Design

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	4500 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Near tooth edge
Rated supply voltage	$U_{S,\ nom}$	5 V or 12V
Supply voltage range	U_S	4.75 V ...16 V
Supply current	I_S	< 10mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm...10 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 4 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone		-40°C...+150°C
Programming Option		70TL05-86

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin	1 928 403 734
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.35...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

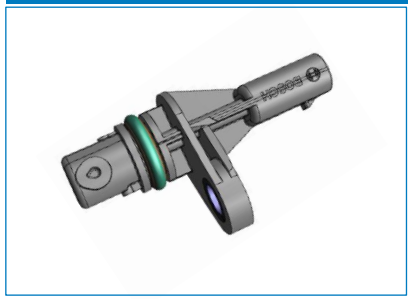
Product type

CPS-4 HA
(HA = High Accuracy)

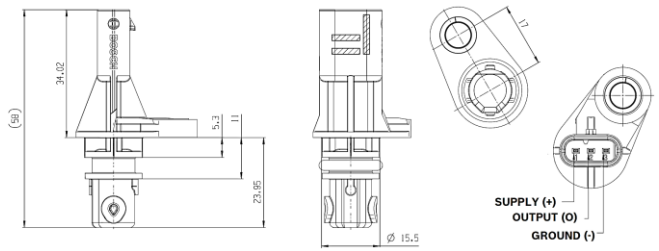
Part number

0 232 103 50C

Picture



Dimensional drawings



Key features

- Differential Hall Sensor
- High Accuracy Sensor Version
- Newest sensor platform
- Open Collector Interface (3-wire)

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	5000 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Tooth centre
Rated supply voltage	$U_{S, nom}$	5 V
Supply voltage range	U_S	4.5 V ...5.5 V
Supply current	I_S	< 15 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 5 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 1.5 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone		-40°C...+150°C
Programming Option		96-SO

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin	Hirschmann 872-975-...00
		Coding B, Silver plated

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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4.1 Rotational - Speed sensors
Sensor for Crankshaft Applications

Product type

CPS-4 HA
(HA = High Accuracy)

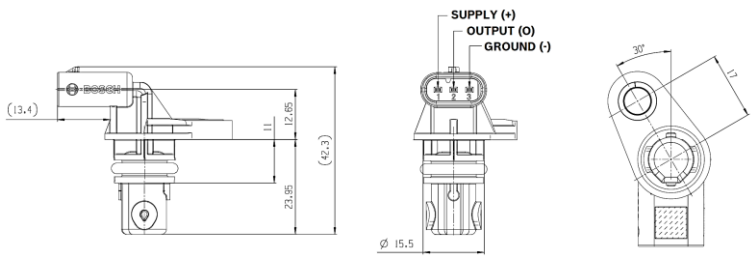
Part number

0 232 103 50F

Picture



Dimensional drawings



Key features

- Differential Hall Sensor
- High Accuracy Sensor Version
- Newest sensor platform
- Open Collector Interface (3-wire)

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min.$^{-1}$
Maximum trigger-wheel speed	$n_{max.}$	5000 min.$^{-1}$
Working air gap range		0.2 mm ... 1.8 mm
Sensor switching position		Tooth centre
Rated supply voltage	$U_{S, nom}$	5 V
Supply voltage range	U_S	4.5 V ...5.5 V
Supply current	I_S	< 15 mA
Pull-Up Resistor in ECU	$R_{PULL-UP}$	1 kOhm ... 5 kOhm
Sensor Output voltage LOW	U_{OUT_LOW}	≤ 0.5 V
Sensor Output voltage HIGN	U_{OUT_HIGH}	≥ 0.9 x U_{S_OUT}
Output fall time (high – low) 90 % ... 10 %, $U_{S,O}$ = 5.0 V	t_f [1)]	≤ 1.5 µs
Output rise time (low – high) 10 % ... 90 %, $U_{S,O}$ = 5.0 V	t_f [2)]	≤ 10 µs
Steady-state temperature in sensor and transition zone		-40°C...+150°C
Steady-state temperature in connector zone		-40°C...+150°C
Programming Option		96-SO

[1, 2)] Depends on ECU input circuit (e.g. Rpull_up value)

Accessories

Connector housing	3-pin	Hirschmann 872-975-...00
		Coding B, Silver plated

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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4.2 Rotational - Speed sensors
Sensors for Transmission Applications (TDR)

- Precise and reliable digital measurement of rotation speed and rotation direction
- Two-wire interface
- Non-contact measurement
- Not susceptible to dirt
- Resistant to mineral oil products (fuel, engine oil)
- High robustness against electromagnetic interference (EMC)



Application

Hall speed sensors are ideal for non-contact, wear-free measurement of speed and direction in transmission applications.

Design and operation

The TRD sensor signal is used for the detection of the rotation speed and rotation direction in transmission applications. The sensor detects the teeth of a ferromagnetic target wheel and the rotation direction, performs signal processing in the ASIC and transmits the processed signal to the control unit (CU).TRD transmission rotation sensor with rotation direction detection contains a permanent magnet and a Hall IC. Due to the rotation of a magnetically soft target wheel in front of TRD the magnetic field is modulated at the place of the differential hall probe.

The sensor detects magnetic differential fields at the transition between tooth and slot of the ferromagnetic target wheel. This modulation results in changes of the output signal. The magnetic field is evaluated by the differential hall probes in the ASIC.

Explanation of characteristic data

n	Rotation Speed
U_S	Sensor supply voltage
U_{S_OUT}	Voltage on Rpull_up Resistor
I_S	Sensor supply current
t_f	Fall time (trailing signal edge).
t_r	Rise time (leading signal edge).

Installation instructions

- Please refer to installation conditions given in the offer drawing and Technical Customer Documentation (TCD)
- Route the connecting cables away from interference sources like ignition cables.
- Connect the ground connection of the sensor to the ECU ground pin to prevent issues arising from trigger level shifting and ground offsets.
- Protect the sensor against the destructive action of static discharge during installation.

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4.2 Rotational - Speed sensors

Sensors for Transmission Applications

(TDR)

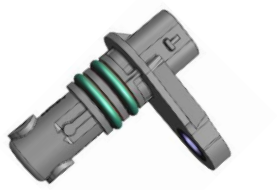
Product type

TRD

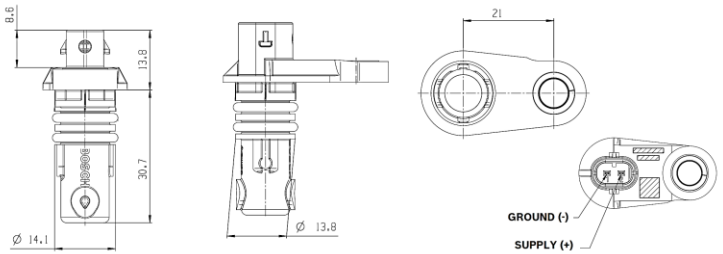
Part number

0 261 210 32Y

Picture



Dimensional drawings



Key features

- Differential Hall Sensor
- Rotation Direction Detection
- Newest sensor platform
- Current Interface (7 mA/14mA) - 2 – wire interface
- Wire break and wire short detection
- Target wheel vibration Suppression
- Using Best-in-Class Plastic Material (PPS) with High Resistance to Media and Humidity

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0 min^{-1}
Maximum trigger-wheel speed (60 teeth)	$n_{max.}$	12000 min^{-1}
Working air gap range	AG	0.2 mm ... 2.0 mm
Rated sensor supply voltage	U_N	5 V
Sensor supply voltage range	U_S	4.5 V ... 5.5 V
Sensor supply current	I_{S_max}	< 20mA
Output signal LOW level	I_{s_low}	7 mA
Output signal HIGH level	I_{s_high}	14 mA
Steady-state temperature in sensor and transition zone		-40 °C...+140 °C
Steady-state temperature in connector zone		-40 °C...+140 °C
Minimum trigger-wheel speed	$n_{min.}$	0 min^{-1}
Maximum trigger-wheel speed (60 teeth)	$n_{max.}$	12000 min^{-1}
Working air gap range	AG	0.2 mm ... 2.0 mm
Rated sensor supply voltage	U_N	5 V
Sensor supply voltage range	U_S	4.5 V ... 5.5 V
Sensor supply current	I_{S_max}	< 20mA

Accessories

Connector housing	3-pin	Hirschmann 872-975-...00
		Coding B, Silver plated

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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4.3 Rotational - Speed sensors
Inductive speed sensor

- Precise and reliable measurement of speeds
- Non-contacting measurement
- Not susceptible to dirt
- Resistant to mineral oil products (fuel, engine oil)



Application

Inductive speed sensors of this type are suitable for a variety of speed recording applications. Depending on design, they use completely non-contacting and wear-free methods to measure engine speeds (cam or crank) and convert these speeds into electrical signals.

Design and operation

The soft iron core of the speed sensor, surrounded by a winding, is positioned directly opposite a rotating trigger wheel and only separated from this by a narrow air gap. The soft iron core is connected to a permanent magnet, the magnetic field of which extends into the ferromagnetic trigger wheel, by which it is influenced. A tooth directly opposite the sensor concentrates the magnetic field and thus intensifies the magnetic flux in the coil. A gap on the other hand attenuates the flux in the coil. These two states alternate constantly due to the rotation of the ring gear. The transition from gap to tooth (leading tooth edge) and from tooth to gap (trailing tooth edge) produces changes in the magnetic flux which induce an alternating voltage in the coil in line with Faraday's law.

The frequency of this voltage can be used for speed determination. Per tooth the sensor supplies an output pulse, the magnitude of which is governed by the speed, the size of the air gap, the tooth shape and the rotor materials used. Together with the frequency, the amplitude of the output signal also increases with the speed. A minimum speed is therefore necessary to permit reliable evaluation of even very low voltages. A reference mark on the trigger wheel in the form of a large "tooth gap" permits determination of the position of the trigger wheel in addition to the actual speed measurement. The trigger wheel sensor ring forms part of the speed detection system. Sensor rings must be of a high technical standard to provide reliable speed information. Trigger wheel sensor ring specifications are available on request.

Installation instructions

- Standard Installation conditions guaran-tee full sensor functioning.
- Route the connecting cables in parallel to minimize interference.
- Protect the sensor against the destructive action of static discharge (CMOS components).

Explanation of characteristic data

U	Output voltage
n	Speed
s	Air gap

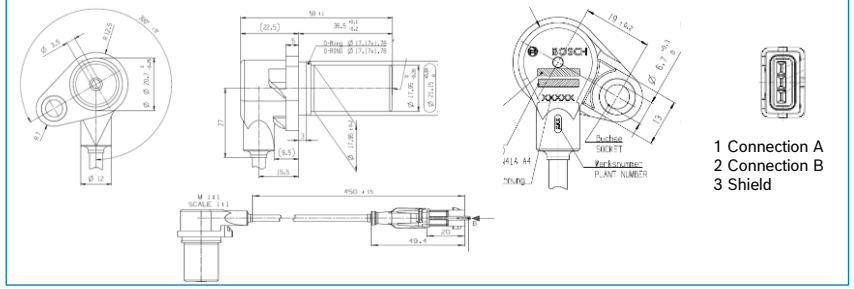
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4.3 Rotational - Speed sensors
Inductive speed sensor

Product type	Part number
DG-6-K	**0 281 002 214**

Dimensional drawings



Picture



Technical data

Rotational-speed measuring range [1] n	min^{-1}	20 ... 7000
Sustained ambient temperature/coil zone	°C	- 40 ... + 130
Sustained ambient temperature/cable zone	°C	- 40 ... + 130
Operating principle		EMI
Maximum working air gap		1.8 mm
Minimum working air gap		0.3 mm
Number of turns		4300 turns / windings
Winding resistance at 20 °C [2] U_A	Ω	860 ±10%
Inductance at 1 kHz	mH	370 ±60
Degree of protection	IP	IPx9K
Output voltage [2] U_A	V/mV	210 V (0.3mm air-gap, 7000 RPM) 170 mV (1.5mm air-gap, 50 RPM)
Signal frequency	Hz	7000 (for 60-2 type wheel)

[1] Referenced to corresponding trigger wheel.
[2] Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

Accessories

Connector housing	3-pin	1 928 403 734
Contact pins (tin plated)	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

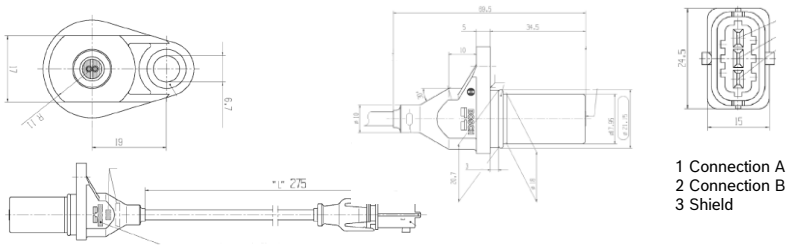
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4.3 Rotational - Speed sensors
Inductive speed sensor

Product type	Part number
DG-6-K	**0 281 002 629**

Dimensional drawings



Picture



Technical data

Rotational-speed measuring range [1] n	min^{-1}	20 ... 7000
Sustained ambient temperature/coil zone	°C	- 40 ... + 150
Sustained ambient temperature/cable zone	°C	- 40 ... + 130
Operating principle		EMI
Maximum working air gap		1.8 mm
Minimum working air gap		0.3 mm
Number of turns		4300 turns / windings
Winding resistance at 20 °C [2] U_A	Ω	860 ±10%
Inductance at 1 kHz	mH	370 ±60
Degree of protection	IP	IPx9K
Output voltage [2] U_A	V/mV	210 V (0.3mm air-gap, 7000 RPM) 170 mV (1.5mm air-gap, 50 RPM)
Signal frequency	Hz	7000 (for 60-2 type wheel)

[1] Referenced to corresponding trigger wheel.
[2] Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

Accessories

Connector housing	3-pin	1 928 404 073
Contact pins	For Ø 0.5...1.0 mm^2	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm^2	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm^2	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm^2	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

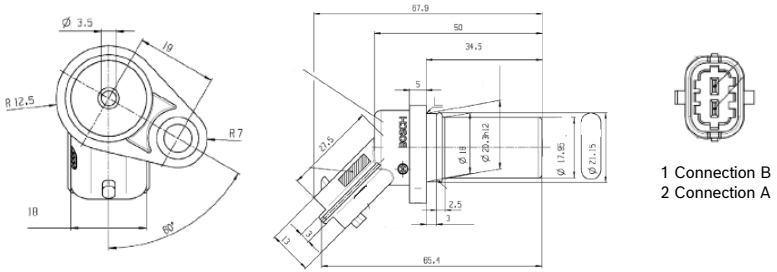
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4.3 Rotational - Speed sensors
Inductive speed sensor

Product type	Part number
DG-6-S	**0 281 002 315**

Dimensional drawings



Picture



Technical data

Rotational-speed measuring range [1] n	min^{-1}	20 ... 7000
Sustained ambient temperature/coil zone	°C	- 40 ... + 150
Sustained ambient temperature/cable zone	°C	- 40 ... + 130
Operating principle		EMI
Maximum working air gap		1.8 mm
Minimum working air gap		0.3 mm
Number of turns		4300 turns / windings
Winding resistance at 20 °C [2] U_A	Ω	860 ±10%
Inductance at 1 kHz	mH	370 ±60
Degree of protection	IP	IPx9K
Output voltage [2] U_A	V/mV	210 V (0.3mm air-gap, 7000 RPM) 170 mV (1.5mm air-gap, 50 RPM)
Signal frequency	Hz	7000 (for 60-2 type wheel)

[1] Referenced to corresponding trigger wheel.
[2] Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

Accessories

Connector housing	2-pin	1 928 404 072
Contact pins (tin-plated)	For Ø 0.5...1.0 mm^2	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm^2	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm^2	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm^2	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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5 Structure-borne sound
Piezoelectric vibration sensor

- Reliable detection of structure-borne sound to protect machines and motors
- Piezo-ceramic element with high measurement sensitivity
- Sturdy compact design



Application

Vibration sensors of this this type are suitable for detecting structure-borne vibration occurring for example in motor-vehicle engines due to irregular combustion and in machines. Thanks to their robust design, these vibration sensors can withstand even the most severe operating conditions.

Areas of application

- Knock control for internal-combustion engines
- Machine-tool protection
- Cavitation detection
- Monitoring of pivot bearings
- Anti-theft systems

Design and operation

On account of its inertia, a mass exerts compressive forces on an annular piezo-ceramic element in the same rhythm as the vibrations causing them. As a result of these forces, charge transfer occurs within the ceramic element and a voltage is generated between the upper and lower sides of the ceramic element. The voltage is tapped via contact washers - often filtered and integrated - and is available for use as a measurement signal. Vibration sensors are bolted to the object to be measured so as to relay the vibrations at the measurement location directly to the sensors.

Measurement sensitivity

Each vibration sensor has individual transmission characteristics closely related to the measuring sensitivity. The sensitivity is defined as the output voltage per unit of acceleration due to gravity (refer to characteristic curve). The production-related sensitivity scatter is acceptable for applications in which the main emphasis is on recording the occurrence of vibrations rather than on their amplitude. The low voltages supplied by the sensor can be evaluated using a high-impedance AC voltage amplifier.

Installation instructions

The sensors must rest directly on their metal surfaces. Use must not be made of packing plates, spring or toothed lock washers for support. The contact surface of the mounting hole must be of high quality to ensure low-resonance coupling of the sensors to the measurement location. The sensor cable is to be laid such that no resonance vibration can occur. The sensor must not be allowed to have contact with liquids for lengthy periods.

Explanation of characteristic data

E	Sensitivity
F	Frequency
g	Acceleration due to gravity

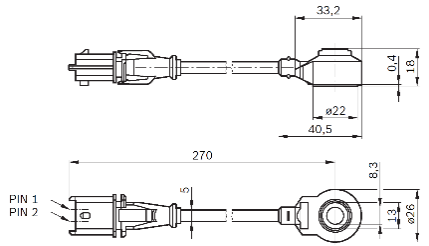
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-K	**0 261 231 196**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, with cable
Frequency range	0 ... 24 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 130 °C (sensor head +150 °C)
Permissible sustained vibration	≤ 80 g
Pin coating	Gold-plated

Accessories

Connector housing	2-pin RB compact connector code-1, tin plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Individual seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

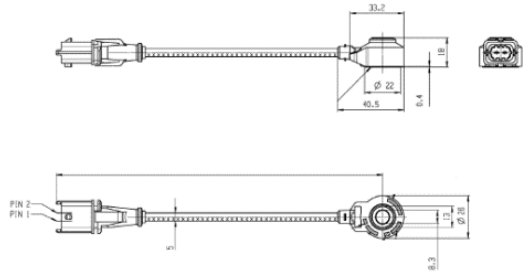
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-K	**0 261 231 218**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, with cable
Frequency range	0 ... 24 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 130 °C (sensor head 150 °C)
Permissible sustained vibration	≤ 80 g
Pin coating	Gold-plated

Accessories

Connector housing	2-pin RB compact connector code-1, gold plated terminals	
Connector housing	2-pin	1 928 403 137

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

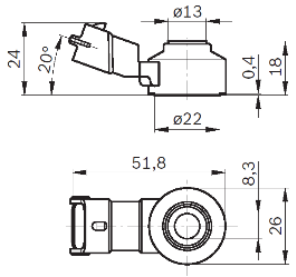
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-S	**0 261 231 173**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, with cable
Frequency range	0 ... 24 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 130 °C (sensor head 150 °C)
Permissible sustained vibration	≤ 80 g
Pin coating	Gold-plated

Accessories

Connector housing	2-pin RB compact connector code-1, gold plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Individual seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

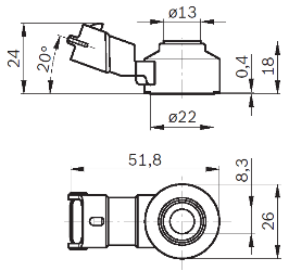
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-S	**0 261 231 176**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, without cable
Frequency range	3 ... 22 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 130 °C
Permissible sustained vibration	≤ 50 g
Pin coating	Tin-plated

Accessories

Connector housing	2-pin RB compact connector code-1, gold plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Individual seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

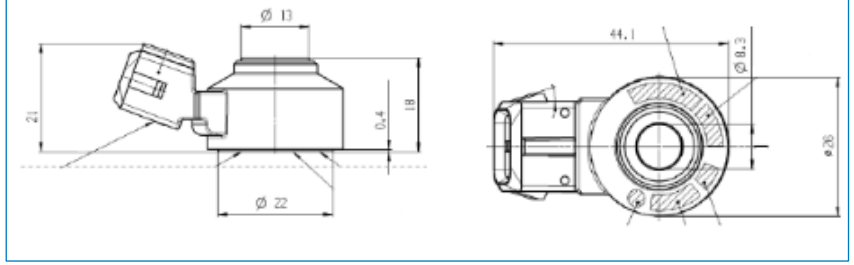
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-S	**0 261 231 208**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, without cable
Frequency range	0 ... 24 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 130 °C
Permissible sustained vibration	≤ 80 g
Pin coating	Tin-plated

Accessories

Connector housing	2-pin Jetronics connector code-1, gold plated terminals

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

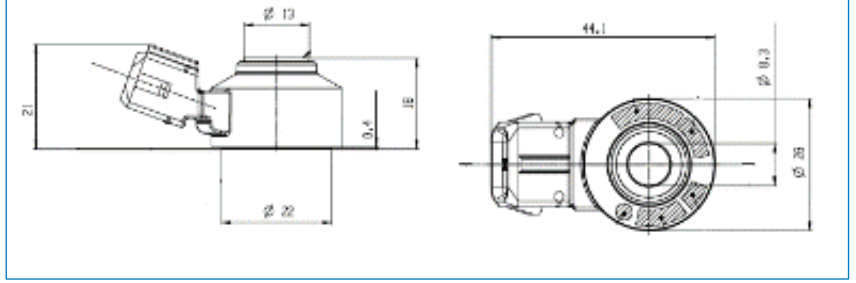
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5 Structure-borne sound
Piezoelectric vibration sensor

Product type	Part number
KS-4-S	**0 261 231 300**

Dimensional drawings



Picture



Technical data

Vibration sensors	2-pole, without cable
Frequency range	0 ... 24 kHz
Self-impedance	> 1 MΩ
Operating temperature range	- 40 ...+ 150 °C
Permissible sustained vibration	≤ 80 g
Pin coating	Tin-plated

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6 Temperature sensors
Temperature sensor for air/liquid

- Temperature range -40C - 130C
- Measurement of air, coolant, fuel and oil
- Measurement with temperature sensitive resistors
- Broad temperature range



Application

The temperature sensor is a sensor, converting a temperature into an electrical signal. Available for air, coolant, fuel and oil temperature measurement.

In motor vehicles they are used to measure the temperature of the intake air in the range -40...130 °C.

Design and operation

NTC thermistors have a negative temperature coefficient, i. e. their conductivity increases with increasing temperature; their resistance decreases. The conductive element of the temperature sensor consists of semi-conducting heavy metal oxides and oxidized mixed crystals pressed or sintered into wafers or beads with the aid of binding agents and provided with a protective casing. In combination with a suitable evaluation circuit, such resistors permit precise temperature determination. Depending on the housing design, the sensors are suitable for measuring temperatures in liquids and gases.

Explanation of characteristic data

R	Resistance
ϑ	Temperature

Installation instructions

The sensor is installed such that the front section with the sensing element is directly exposed to the fluid flow.

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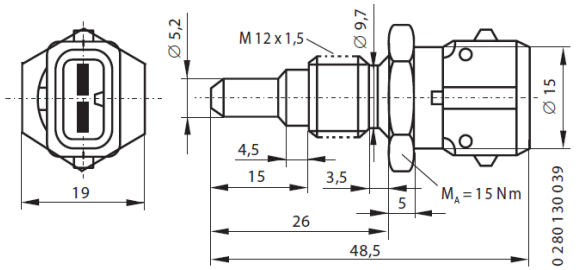
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6 Temperature sensors

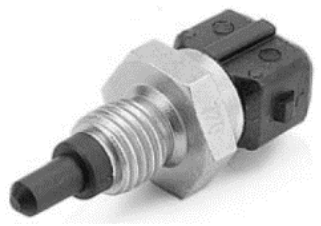
Temperature sensor for air/liquid

Product type	Part number
TF-L	**0 280 130 039**

Dimensional drawings



Picture



Technical data

Temperature range 130	°C	-40 ... +
Features threaded connection.	Sensor in steel housing with	
Application/medium		air
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,296 ... 0,349
Nominal voltage	V	5 ± 0,15
Max. measurement current	mA	1
Self-heating with max. perm. Power loss of P = 2 mW and still air (23 °C)	K	≤ 2
Temperature/time constant τ_{63} [1)]	s	≤ 45
Approximate value for permissible Vibration acceleration a_{sin} (sinusoidal vibration)	m/s^2	300
Corrosion-tested as per		DIN 50 018
Degree of protection		IP6K9K
Tightening torque	Nm	15 ± 2
Thread		M12 x 1.5

[1)] Time required to attain a difference in resistance of 63% of the final value given an abrupt change in measurement temperature from 20°C to 75°C; flow velocity of air 6 m/s.

Accessories

Connector housing	2-pin Jetronics connector, tin plated terminals	
Connector housing	2-pin	1 928 402 078
Protective cap	Temperature-resistant	1 280 703 031
Contact pins	For Ø 0.5...1.0 mm^2	AMP 929 939-3
Contact pins	For Ø 1.5...2.5 mm^2	AMP 929 937-3
Individual seal	For Ø 0.5...1.0 mm^2	1 987 280 106
Individual seal	For Ø 1.5...2.5 mm^2	1 987 280 107

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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6 Temperature sensors

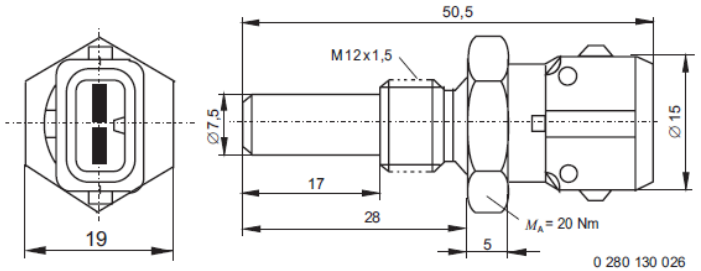
Temperature sensor for air/liquid

Product type	Part number
TF-W	**0 280 130 026**

Picture



Dimensional drawings



Technical data

Measuring range	°C	-40 ... +130
Features		Sensor in brass housing.
Application/medium		Oil/water
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,296 ... 0,349
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 5K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

[1)] With individual seal.

Accessories

Connector housing	2-pin	1 928 402 078
Protective cap	Temperature-resistant	1 280 703 031
Contact pins	For Ø 0.5...1.0 mm²	AMP 929 939-3
Contact pins	For Ø 1.5...2.5 mm²	AMP 929 937-3
Individual seal	For Ø 0.5...1.0 mm²	1 987 280 106
Individual seal	For Ø 1.5...2.5 mm²	1 987 280 107

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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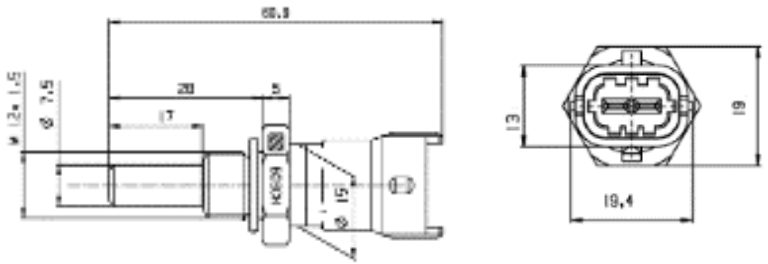
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6 Temperature sensors

Temperature sensor for air/liquid

Product type	Part number
TF-W	**0 280 130 093**

Dimensional drawings



Picture



Technical data

Temperature range	°C	-40 ... +130
Features	Sensor in brass housing.	
Application/medium		Coolants, fuel, oil
Tolerance at +100 °C	kΩ	0,1886 ± 2%
Rated resistance at 20 °C	kΩ	2,5 ± 5%
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,296 ... 0,349
Temperature/time constant τ_{63} [1)]	s	= 15 s
Degree of protection [1)]		IP 6K 9K
Thread		M12 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

Accessories

Connector housing	2-pin RB compact connector code-1, tin plated terminals	
Connector housing	2-pin	1 928 403 137
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	AMP 929 939-3
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	AMP 929 937-3
Single-wire seal	For Ø 0.5...1.0 mm²	AMP 828 904
Single-wire seal	For Ø 1.5...2.5 mm²	AMP 828 905
Dummy plug		AMP 828 922

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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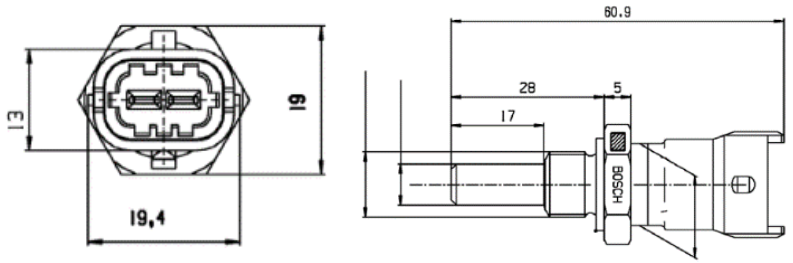
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6 Temperature sensors

Temperature sensor for air/liquid

Product type	Part number
TF-W	**0 281 002 170**

Dimensional drawings



Picture



Technical data

Temperature range	°C	-40 ... +150
Features		Sensor in brass housing.
Application/medium		Oil/water
Rated resistance at 100 °C	kΩ	0,1866 ± 2 %
Resistance at -10 °C	kΩ	8,640 ... 10,149
Resistance at +20 °C	kΩ	2,351 ... 2,648
Resistance at +80 °C	kΩ	0,313 ... 0,332
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 6K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin RB compact connector code-1, gold plated terminals	
Connector housing	2-pin	1 928 403 137
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	AMP 2 929 939-1
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	AMP 2 929 937-1
Single-wire seal	For Ø 0.5...1.0 mm²	AMP 828 904
Single-wire seal	For Ø 1.5...2.5 mm²	AMP 828 905
Dummy plug		AMP 828 922

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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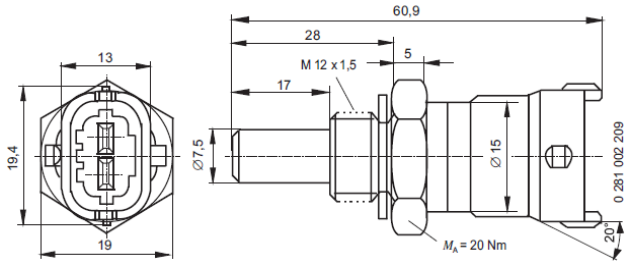
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6 Temperature sensors

Temperature sensor for air/liquid

Product type	Part number
TF-W	**0 281 002 209**

Dimensional drawings



Picture



Technical data

Temperature range	°C	-40 ... + 130
Features		Sensor in brass housing.
Application/medium		Oil/water
Rated resistance at 100 °C	kΩ	0,1866 ± 2 %
Resistance at -10 °C	kΩ	8,640 ... 10,149
Resistance at +20 °C	kΩ	2,351 ... 2,648
Resistance at +80 °C	kΩ	0,313 ... 0,332
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 6K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin RB compact connector code-1, Tin plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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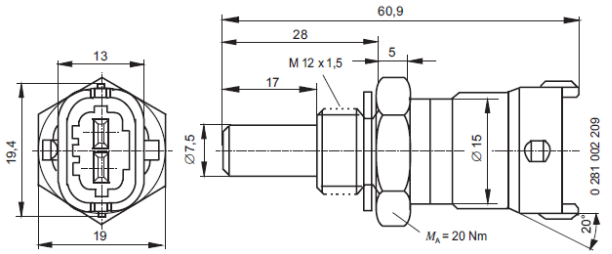
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6 Temperature sensors

Temperature sensor for air/liquid

Product type	Part number
TF-W Alu	**0 280 130 01F**

Dimensional drawings



Picture



Technical data

Temperature range	°C	-40 ... + 140
Features		Sensor with aluminum (Al-6082) housing.
Application/medium		Oil/water/fuel
Rated resistance at 100 °C	kΩ	0,1866 ± 2 %
Resistance at -10 °C	kΩ	8,640 ... 10,149
Resistance at +20 °C	kΩ	2,351 ... 2,648
Resistance at +80 °C	kΩ	0,313 ... 0,332
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 6K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin RB compact connector code-1, Tin plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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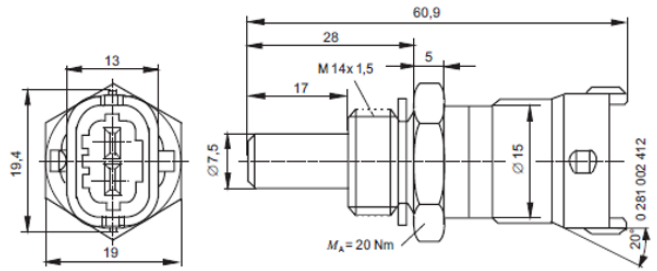
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6 Temperature sensors

Temperature sensor for air/liquid

Product type	Part number
TF-W	**0 281 002 412**

Dimensional drawings



Picture



Technical data

Temperature range	°C	-40 ... +130
Features		Sensor in brass housing.
Application/medium		Oil/water
Tolerance at +100 °C	K	0,1886 ± 2%
Rated resistance at 100 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,640 ... 10,149
Resistance at +20 °C	kΩ	2,351 ... 2,648
Resistance at +80 °C	kΩ	0,313 ... 0,332
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 6K 9K
Thread		M 14 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20 ± 5
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin RB compact connector code-1, Tin plated terminals	
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

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