Sensors



Angular-position, battery sensing, inertial, rotational-speed, structure-borne sound, pressure, temperature, air-mass, lambda

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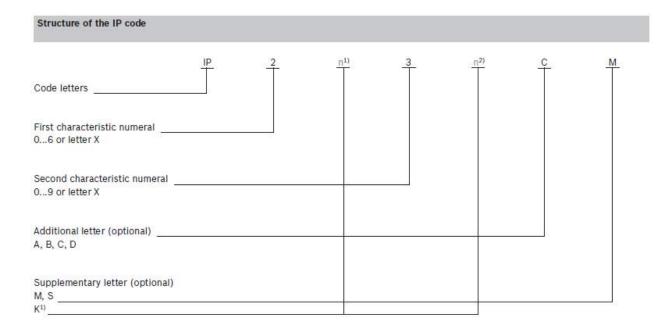
Sensor IP degrees



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 effects 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.



If a characteristic numeral is not given, it must be superseded by the letter "X" (i. e. "XX" if both characteristic numerals are not given). The supplementary and/or additional letters can be omitted at will, and need not be superseded by other letters.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



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	Α	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	В	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°)	С	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		•	Product groups

CAN-Bus - Controller Area Network

Present-day motor vehicles are equipped with a large number of electronic control units (ECUs) which have to exchange large volumes of data with one another in order to perform their various functions. The conventional method of doing so by using dedicated data lines for each link is now reaching the limits of its capabilities. On the one hand, it makes the wiring harnesses so complex that they become unmanageable, and on the other the finite number of pins on the connectors becomes the limiting factor for ECU development. The solution is to be found in the use of specialized, vehicle-compatible serial bus systems among which the CAN has established itself as the standard.

Applications

There are four areas of application for CAN in the motor vehicle, each with its own individual requirements:

Real-time applications

Real-time applications, in which electrical Systems such as Motronic, transmission-shift control, electronic stability-control systems are networked with one another, are used to control vehicle dynamics. Typical data transmission rates range from 125 kbit/s to 1 Mbit/s (high-speed CAN) in order to be able to guarantee the realtime characteristics demanded.

Multiplex applications

Multiplex applications are suitable for situations requiring control and regulation of body-component and luxury/convenience systems such as air conditioning, central locking and seat adjustment. Typical data transmission rates are between 10 kbits and 125 kbit/s (low-speed CAN).

Mobile-communications applications

Connect components such as the navigation system, cellular phone or audio system with central displays and controls. The basic aim is to standardize control operations and to con-dense status information so as to minimize driver distraction. Data transmission rates are generally below 125 kbit/s; whereby direct transmission of audio or video data is not possible.

Diagnostic applications

Diagnostic applications for CAN aim to make use of existing networking for the diagnosis of the ECUs incorporated in the network. The use of the "K" line (ISO 9141), which is currently the normal practice, is then no longer necessary. The data rate envisaged is 500 kbit/s.

Bus configuration

CAN operates according to the multi-master principle, in which a linear bus structure connects several ECUs of equal priority rating (Fig. 1). The advantage of this type of structure lies in the fact that a malfunction at one node does not impair bus-system access for the remaining devices. Thus the probability of a total system failure is substantially lower than with other logical architectures (such as ring or active star structures). When a ring or active star structure is employed, failure at a single node or at the CPU is sufficient to cause a total failure.

Content-based addressing

Addressing is message-based when using CAN. This involves assigning a fixed identifier to each message. The identifier classifies the content of the message (e.g., engine speed). Each station processes only those messages whose identifiers are stored in its acceptance list (message

filtering, Fig. 2). Thus CAN requires no station addresses for data trans-mission, and the nodes are not involved in administering system configuration. This facilitates adaptation to variations in equipment levels.

Logical bus states

The CAN protocol is based on two logical states: The bits are either "recessive" (logical 1) or "dominant" (logical 0). When at least one station transmits a dominant bit, then the recessive bits simultaneously sent from other stations are overwritten.

Priority assignments

The identifier labels both the data content and the priority of the message being sent. Identifiers corresponding to low binary numbers enjoy a high priority and vice versa.

Bus access

Each station can begin transmitting its most important data as soon as the bus is unoccupied. When several stations start to transmit simultaneously, the system responds by employing "Wired-AND" arbitration to sort out the resulting contentions over bus access. The message with the highest priority is assigned first access, without any bit loss or delay. Transmitters respond to failure to gain bus access by automatically switching to receive mode; they then repeat the transmission attempt as soon as the bus is free again.

Message format

CAN supports two different data-frame formats, with the sole distinction being in the length of the identifier (ID).

The standard-format ID is 11 bits, while the extended version consists of 29 bits. Thus the transmission data frame contains a maximum of 130 bits in standard format, or 150 bits in the extended format. This 150 bits



in the extended format. This ensures minimal waiting time until the subsequent transmission (which could be urgent). The data frame consists of seven consecutive bit fields (Fig. 3):

"Start of frame"

indicates the beginning of a message and synchronizes all stations.

"Arbitration field"

consists of the message's identifier and an additional control bit. While this field is being transmitted, the transmitter accompanies the transmission of each bit with a check to ensure that no higher-priority message is being transmitted (which would cancel the access authorization). The control bit determines whether the message is classified under "data frame" or "remote frame".

"Control field"

contains the code for number of data bytes in "Data Field".

"Data field's"

information content comprises between 0 and 8 bytes. A message of data length 0 can be used to synchronize distributed processes.

"CRC field"

(Cyclic Redundancy Check) contains the check word for detecting possible transmission interference.

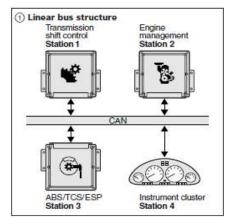
"Ack field"

contains the acknowledgement signals with which all receivers indicate receipt of noncorrupted messages.

"End of frame"

marks the end of the message.

CAN-Bus - Controller Area Network



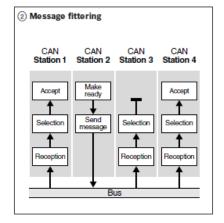
Transmitter initiative

The transmitter will usually initiate a data transfer by sending a data frame. However, the receiver can also request data from the trans-mitter. This involves the receiver sending out a "remote frame". The "data frame" and the corresponding "remote frame" have the same identifier. They are distinguished from one another by means of the bit that follows the identifier.

Error detection

CAN incorporates a number of monitoring features for detecting errors. These include:

- ► 15 Bit CRC (Cyclic Redundancy Check): Each receiver compares the CRC sequence which it receives with the calculated sequence.
- ► Monitoring: Each transmitter compares transmitted and scanned bit.
- ▶ Bit stuffing: Between "start of frame" and the end of the "CRC field", each "data frame" or "remote frame" may contain a maximum of 5 consecutive bits of the same polarity.
- ► Frame check: The CAN protocol contains several bit fields with a fixed format for verification by all stations.



Error handling

When a CAN controller detects an error, it aborts the current transmission by sending an "error flag". An error flag consists of 6 dominant bits; it functions by deliberately violating the conventions governing stuffing and/or formats.

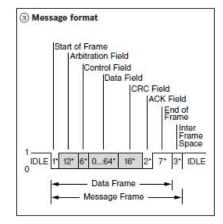
Fault confinement with local failure

Defective stations can severely impair the ability to process bus traffic. Therefore, the CAN controllers incorporate mechanisms which can distinguish between intermittent and permanent errors and local station failures. This process is based on statistical evaluation of error conditions.

Implementations

In order to provide the proper CPU support for a wide range of different requirements, the semiconductor manufacturers have introduced implementations representing a broad range of performance levels. The various implementations differ neither in the message they produce, nor in their arrangements for responding to errors. The difference lies solely in the type of CPU support required for message administration. As the demands placed on the ECU's processing capacity are extensive, the interface controller should be able to administer a large number of messages and expedite data communications





with, as far as possible, no demands on the CPU's computational re-sources. Powerful CAN controllers are generally used in this type of application. The demands placed on the controllers by multiplex systems and present-day mobile communications are more modest. For that reason, more basic and less expensive chips are preferred for such uses.

Standardization

CANs for data exchange in automotive applications have been standardized both by the ISO and the SAE – in ISO 11519-2 for low-speed applications ≤ 125 kbit/s and in ISO 11898 and SAE J 22584 (cars) and SAE J 1939 (trucks and busses) for high-speed applications >125 kbit/s. There is also an ISO standard for diagnosis via CAN (ISO 15765 – Draft) in the course of preparation.



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 previouslymentioned 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.



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 contact.i.business@de.bosch.com.





1.1 Angular-position sensors

Steering angle sensor



- ▶ "True Power on" function
- ► Multiturn capability
- ► CAN interface



Application

The steering-angle sensor was developed for use in electronic stability programs (ESP). Integrated plausibility checks and special self-diagnosis functions make the steering-wheel angle sensor suitable for use in safety systems.

Design and operation

The steering column drives two measurement gears by way of a gear wheel. Magnets are incorporated into the measurement gears. AMR elements, the resistance of which changes as a function of the magnetic field direction, detect the angular position of the magnets. The analog measured values are supplied to the microprocessor via an A/D converter. The measurement gears have different numbers of teeth and their rotational position thus changes at different rates. The total steering angle can be calculated by combining the two current angles. After several turns of the steering wheel, the two measurement gears have returned to their original positions. This measurement principle can therefore be used to cover a measuring range of several turns of the steering wheel without the need for a revolution counter.

The steering angle is output as an absolute value over the total angle range (turning range) of the steering column. A special feature of the sensor is the correct angle output immediately after switching on the ignition without moving the steering wheel (True Power On). Steering angle and velocity are output via CAN.

Further areas of application

Using the standardized CAN bus, the steering wheel angle information can be utilized, for example for chassis control, navigation and electrical power-steering systems.

Different types of mechanical connection and electrical interface versions are available on request.

1.1 Angular-position sensors

Steering angle sensor



Product type

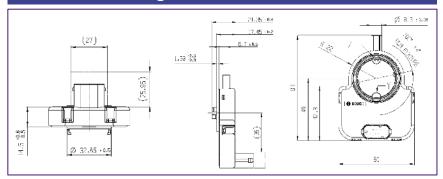
LWS 7.3.6

Part number

0 265 019 136



Dimensional drawings

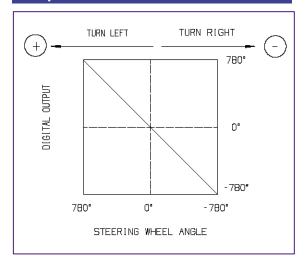


Pinning

PIN	NING	PINNING 2———
PIN NO.	SIGNAL	
1	GND	
2	12V	(DD
3	CAN HIGH	
4	CAN LOW	4

at 6/11/10au resistance of 12	100 1117 (
CAN specification	ISO 11898	500 kbps
Nominal angle measuring range and resolution	±780°	0,1°
Nominal velocity measuring range and resolution	0 to 1016°/s	4°/s
Mating connector	Robert Bosch	1 928 404 025
Ingress protection	IP5K0	
Operating temperature	-40 to + 85° C	_

Output definition



1.2 Angular-position sensors

Throttle valve angle sensor

BOSCH

- Potentiometric angular-position sensors with linear characteristic curve
- Sturdy design for exacting demands
- ► Compact size



Application

Sensors of this type are used in motor vehicles to record the angle of rotation of the throttle valve. They are exposed to extreme operating conditions, being attached directly to the throttle valve housing by means of an extended throttle valve shaft in the engine compartment. To maintain reliable operation under such conditions, the sensors are resistant to fuels, oils, saline fog and industrial atmospheres.

Design and operation

The throttle-valve angular-position sensor is a potentiometric sensor with a linear characteristic curve. It is used with fuel-injection engines to convert the angle of rotation of the throttle valve into a proportional voltage ratio. To do so, the rotor with its special wipers connected to the throttle-valve shaft travels along corresponding resistance tracks, with the position of the throttle valve being converted into the above-mentioned voltage ratio. The throttle-valve angular-position sensors have no return spring.

Explanation of characteristic data

 U_{Δ} Output voltage

 $U_{\rm V}$ Supply voltage

 φ Angle of rotation

*U*_{A1} Output –voltage characteristic curve 2

*U*_{A2} Output -voltage characteristic

curve 2

1.2 Angular-position sensors

Throttle valve angle sensor



Product type

DKG

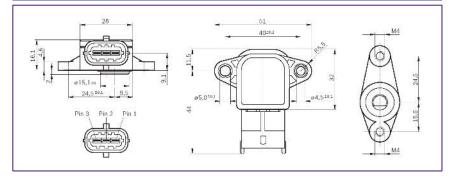
Part number

0 280 122 024

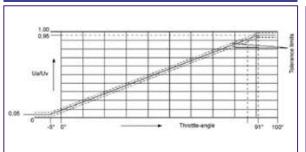


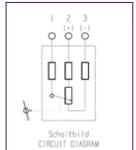
Dimensional drawings

Characteristic curve



Circuit diagram





Technical data Useful electrical angle range degrees ≤ 86 Useful mechanical angle range degrees ≤ 96 Angle between internal stops (must not be reached when fitted) degrees ≥ 96 Direction of rotation Any Total resistance (term. 1-2) kΩ 2 ± 20 % Wiper protective resistor (wiper in zero position, term. 2-3) 710 ... 1380 V 5 Operating voltage U_V Load 5 Ohmic res. Permissible wiper current ≤ 10 μΑ Voltage ratio from stop to stop - characteristic curve 1 0,05 = UA / UV = 0,95 Slope of nominal characteristic curve deg-1 0,009375 - 40 °C ...+ 130 °C Operating temperature Approximate value for permissible vibration acceleration m/s² ≤ 800 Service life (rotary cycles) Mill. 2

2 Battery sensing

Electronic battery sensor

BOSCH

- Measures current, voltage and temperature via ASIC
- ► Robust, protected housing
- ► Battery state detection algorithm



Application

Equipping a vehicle/machine with EBS from Bosch is a precondition to increase vehicle reliability, lengthen battery life and provide intelligent energy management features like load reduction or alternator recuperation. These features help reducing equipment downtime and promote user comfort as well as fuel saving and reduced emission.

Design and operation

The electronic battery sensor supplies information about the vehicle's battery state: current, voltage and temperature are measured on the batteries negative pole niche. This creates the basis for numerous functions that prevent battery problems or optimize energy consumption and battery charging. When using lead-acid batteries with a capacity up to 120Ah, the EBS can also supply advanced battery state signals to predict battery behavior.

The EBS measures physical variables of the battery, such as U,I and T with high accuracy. An internal Battery State Detection (BSD) software provides information about the current battery states as well as the predicted future electrical behavior to a master Electronic Control Unit (ECU). An Electric Energy Management (EEM) run on this ECU can decide if actions are needed to protect the vehicle against power loss and a low battery, hence preventing equipment breakdown.

2 Battery sensing

Electronic battery sensor



Product type

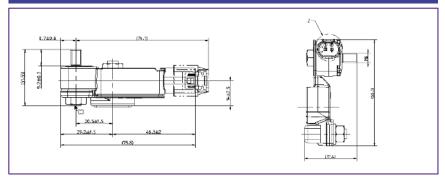
EBS3.AA

Part number

0 199 300 057



Dimensional drawings



Measuring range	V	6 to 18
Resolution	V	0,03
Date Rate	Hz	1000
Relative error		± 0,3 %
Noise	mV	± 1
Cranking current		1500 A < 0,5 s
Nominal current	А	200
Resolution (nominal A)	mA	0,5
Relative error		± 1 %
Temperature		
Measuring range		- 40 °C+ 125 °C
Update rate	S	60
Tolerance	К	< ± 3
Battery State Detection		
Max battery size	Ah	120
Battery types		AGM, Flooded, EFB
Operating temperature range		- 40 °C + 105 °C
Supply voltage range	V	6 to 18
Current consumption at 12 V	mA	10
LIN interface		LIN 2.2
Weight	g	130
Dust and water protection		IP6K9K (needs protection against corrosive substance

3 Inertial sensor

Inertial sensor with CAN interface

BOSCH

- ► Flexible and cost-effective sensor cluster with highly integrated electronics
- ► Modular concept for different integration stages
- ► Optimized performance



Application

The introduction of the ESP system, the link with other chassis convenience systems and the development of advanced vehicle stabilization systems gave rise to the need for inertial signals to meet with exacting demands, particularly in terms of signal quality and stability, as well as additional measure-ment axes with a high degree of reliability. Bosch therefore developed many generations of inertial sensors. The versatile and inexpensive sensor cluster MM7.zC meets the requirements of simpler functions using only accelerations on two axis and one angular rate. For applications with higher complexity, Bosch can also deliver the MM5.10 to provide 3 accelerations and 2 angular rates. Both share the same housing.

Design

Bosch inertial sensors a new generation of micromechanical elements for the measurement and digital processing of angular velocity and acceleration.

Measuring angular rate

The angular rate sensor is based on the Coriolis vibratory gyroscope principle: High-frequency electrostatic forces generate an oscillation of two seismic masses controlled by a closed loop drive system. When rotating around the axis, the Coriolis forces acting on the oscillators can be measured by capacity changes in the detection system.

Measuring acceleration

The acceleration sensor consists of movable comb-like seismic masses suspended from silicon spring bars and fixed counter electrodes.

As a result of external forces acting on the sensor, deflections of the seismic masses along the sensitive axis generate changes in the capacity of the system.

Explanation of characteristic data

- Ω Yaw rate
- g Acceleration in relation to gravity 9.8065 m/s²

3 Inertial sensor

3-dimensional sensor with CAN interface



Product type

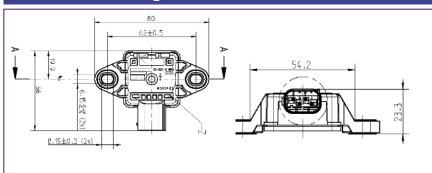
MM7.zC

Part number

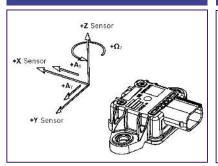
0 265 005 955



Dimensional drawings



Available axis



Pin connection

	PIN CONFIGURATION Steckerbelegung	
PIN 1	1 GND	
PIN 2	C ANL	
PIN 3	CANH	
PIN 4	PIN 4 UBAT	

Technical data

CAN Interface

Sensing axes		
	(Ωz), min/max values	Longitudinal acceleration sensor (ax, ay)
Measuring range	± 100 °/s	± 1,8 g
Resolution	± 0,1 °/s	
Digital resolution	200 LSB/°/s	
Sensitivity errors	≤ ±4 % (typically ±2.5 %)	≤ ±3 % (typically ±2.0 %)
Offset	≤ ±3 % (typically ±2.0 °/s)	≤ ±0,06 % (typically ±0,03 °/s)
Non-linearity	≤ ±1 % (typically ±0.5 °/s)	≤ ±0,04 % (typically ±0,02 °/s)
Technical characteristics		
Operating temperature range		-40°C +85°C
Supply voltage range	V	7 to 16
Current consumption at 12 V	mA	65

in acc. with ISO 11898

3 Inertial sensor

5-dimensional sensor with CAN interface



Product type

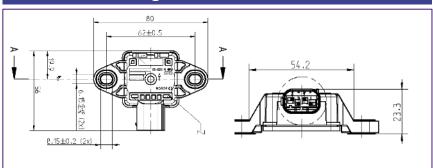
MM5.10

Part number

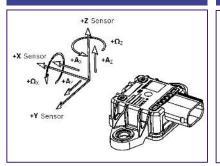
F 037 000 002



Dimensional drawings



Available axis



Pin connection

	PIN CONFIGURATION Steckerbelegung		
PIN 1	I 1 GND		
PIN 2	C ANL		
PIN 3	CANH		
PIN 4	UBAT		

Technical data

	(Ωz), min/max values	Longitudinal acceleration senso (ax, ay, az)
Measuring range	± 163 °/s	± 4,2 g
Resolution	± 0.1 °/s	
Digital resolution	200 LSB/°/s	
Sensitivity errors	≤ ±4 % (typically ±2.5 %)	≤ ±3 % (typically ±2.0 %)
Offset	≤ ±3 °/s (typically ±1.5 °/s)	≤ ±0.1 g (typically ±0.05 °/s)
Non-linearity	$\leq \pm 1$ °/s (typically ± 0.5 °/s)	≤ ±0.072 g (typically ±0.036 g)

Technical characteristics

Operating temperature range		-40°C +85°C
Supply voltage range	V	7 to 16
Current consumption at 12 V	mA	65
CAN Interface		in acc. With ISO 11898

Hall speed sensor

BOSCH

- Precise and reliable digital measurement of speeds and angles
- ► Non-contacting measurement
- ► Hall IC in sensor with open collector output
- ► Not susceptible to dirt
- ► Resistant to mineral oil products (fuel, engine oil)
- ► Transmission of information on sensor signal quality



Application

Hall speed sensors are suitable for noncontacting and thus wear-free speed measurement of crank speed, cam speed or wheel speed.

Design and operation

Hall sensors consist of a semiconductor chip with integrated driver circuits (e.g. Schmitt trigger) for signal conditioning and a transistor as output driver as well as a permanent magnet. These are hermetically sealed into a plastic connector housing. With an active speed sensor, magnets assume the function of the sensor ring teeth. The magnets are integrated for example into a multi-pole ring and are arranged with alternating polarity around its circumference. The measurement cell of the active speed sensor is exposed to the constantly changing magnetic field of these magnets. There is thus a constant change in the magnetic flux through the measurement cell as the multi-pole ring rotates.

The principal sensor components are either Hall elements or magneto resistive elements. Both elements generate a voltage which is governed by the magnetic flux through the measuring element. The voltage is conditioned in the active speed range. In contrast to an inductive sensor, the voltage to be evaluated is not a function of wheel speed. The wheel speed can thus be measured almost down to zero. A typical feature of the active speed sensor is the local amplifier. This is integrated into the sensor housing together with the measurement cell. A two-core cable forms the connection to the control unit. The speed information is transmitted in the form of a loadindependent current. As with an inductive speed sensor, the frequency of the current is proportional to the wheel speed. This form of transmission employing conditioned digital signals is not susceptible to inductive disturbance voltages as is the case with the type of transmission with inductive speed sensors.

Explanation of characteristic data

 n_{\min} =0 Static operation possible.

 n_{\min} >0 Dynamic operation only.

 $U_{\rm V}$ Max. output voltage at LOW with

I_A output current = 20 mA.

 $I_{\rm V}$ Supply current for Hall sensor.

 $t_{\rm f}$ Fall time (trailing signal edge).

 $T_{\rm r}$ Rise time (leading signal edge).

Installation instructions

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



Hall speed sensor



Product type

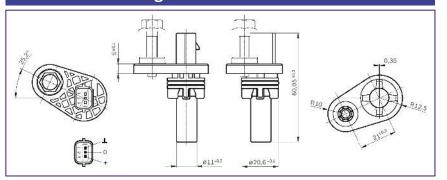
DG-23

Part number

0 261 210 303



Dimensional drawings



Technical data

1 0 0 11111 0 011 010100		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	8000 min. ⁻¹
Maximum working air gap		1,5 mm
Minimum working air gap		0,3 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U_{V}	4,518V
Supply current	I _V	Typically 6.7
Output current	I _A	0 20 mA
Output saturation voltage	U_{s}	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1,3 µs
Switching time	t _f ²)	≤ 20 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C
·		· · · · · · · · · · · · · · · · · · ·

 μ A) At ambient temperature 23 ± 5 °C.

- $^{1)}$ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Hall speed sensor



Product type

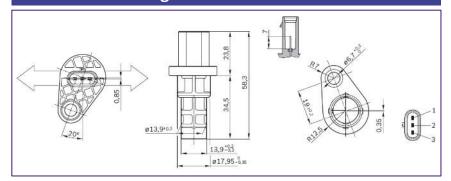
DG-23-I

Part number

0 261 210 318



Dimensional drawings



Technical data

1 Commedia data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed, forwards	n _{max.}	8000 1/min
Maximum trigger-wheel speed, reverse	n _{max.}	4000 1/min
Maximum working air gap		1,5 mm
Minimum working air gap		0,5 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U _v	4,55,5 V
Supply current	I _V	Typically 5.0 mA
Output current	I _A	0 20 mA
Output saturation voltage	U_{s}	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1,3 µs
Switching time	t _f ²)	≤ 17 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

 $^{^{1)}}$ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.

²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.

^{3) -40...+150 °}C permissible for brief period.

^{4) -40...+130 °}C permissible for brief period.

Hall speed sensor



Product type

DG-23-I

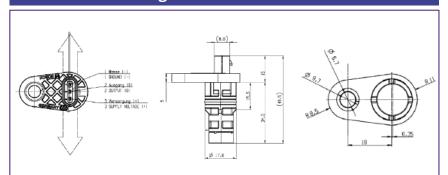
Part number

0 261 210 325





Dimensional drawings



Technical data

recilincal data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed, forwards	n _{max.}	8000 1/min
Maximum trigger-wheel speed, reverse	n _{max.}	1200 1/min
Maximum working air gap		1,5 mm
Minimum working air gap		0,5 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U_{V}	4,755,25 V
Supply current	I _V	Typically 5.0 mA
Output current	I _A	4 15 mA
Output saturation voltage	U_{s}	≤ 0,5 V
Switching time	$t_{\rm f}^{\ 1})$	≤ 1,3 µs
Switching time	t _f ²)	≤ 17 µs
Steady-state temperature in sensor and transition zone	·	-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

¹⁾ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.

21

²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.

^{3) -40...+150 °}C permissible for brief period.

^{4) -40...+130 °}C permissible for brief period.

Hall speed sensor



≤ 17 μs -40°C...+150°C

-40°C...+130°C

Product type

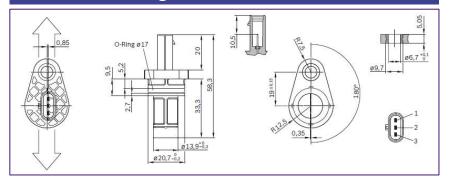
DG-23-I

Part number

0 261 210 385



Dimensional drawings



Technical data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	5000 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U_{V}	4,518V
Supply current	I_{V}	Typically 10 mA
Output current	I_{A}	0 20 mA
Output saturation voltage	U_{s}	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1,3 µs

 t_f^2

Steady-state temperature in connector zone

Steady-state temperature in sensor and transition zone

Switching time

¹⁾ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.

²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.

^{3) -40...+150 °}C permissible for brief period.

^{4) -40...+130 °}C permissible for brief period.

Hall speed sensor



≤ 1,3 µs

≤ 17 µs -40°C...+150°C

-40°C...+130°C

Product type

DG-23-I

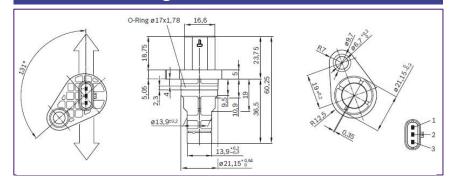
Part number

0 281 006 101





Dimensional drawings



recinical data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed, forwards	n _{max.}	8000 1/min
Maximum trigger-wheel speed, reverse	n _{max.}	4000 1/min
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U_{V}	4,518 V
Supply current	I _V	Typically 10 mA
Output current	I _A	0 20 mA
Output saturation voltage	$U_{\rm s}$	≤ 0,5 V

 t_f^1

 t_f^2

Steady-state temperature in connector zone

Steady-state temperature in sensor and transition zone

Technical data

Switching time

Switching time

 $^{^{1)}}$ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.

²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.

^{3) -40...+150 °}C permissible for brief period.

^{4) -40...+130 °}C permissible for brief period.

Hall speed sensor

BOSCH

Product group

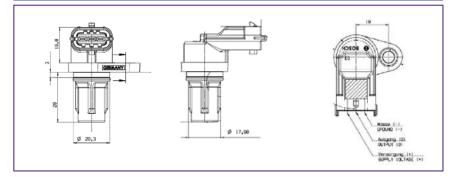
PG-3-8

Part number

0 232 103 048



Dimensional drawings



Technical data

recimical data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U _v	4,516V
Supply current	I _V	Typically 5.6
Output current	I _A	0 20 mA
Output saturation voltage	$U_{\rm s}$	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1 µs
Switching time	t _f ²)	≤ 15 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

- 1) Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (gold plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Hall speed sensor

BOSCH

Product group

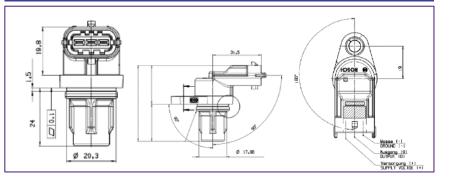
PG-3-8

Part number

0 232 103 063



Dimensional drawings



Technical data

recimical data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U _v	4,516V
Supply current	I _V	Typically 5.6 mA
Output current	I _A	0 20 mA
Output saturation voltage	U _s	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1 µs
Switching time	t _f ²)	≤ 15 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

- 1) Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (tin plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Hall speed sensor

BOSCH

Product group

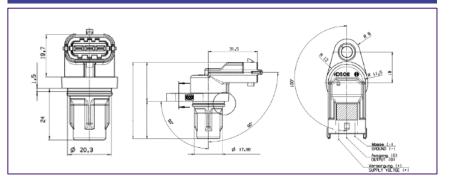
PG-3-8

Part number

0 232 103 067



Dimensional drawings



Technical data

recimical data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U _v	4,516V
Supply current	I _V	Typically 5.6 mA
Output current	I _A	0 20 mA
Output saturation voltage	U _s	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1 µs
Switching time	t _f ²)	≤ 15 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

- 1) Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Accessories Connector housing 3-pin

Connector housing	3-pin	1 928 403 966
Contact pins (tin plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Hall speed sensor

BOSCH

0 ... 20 mA ≤ 0.5 V

≤ 1 µs

≤ 15 μs -40°C...+150°C

-40°C...+130°C

 t_f^1

 t_f^2

Product group

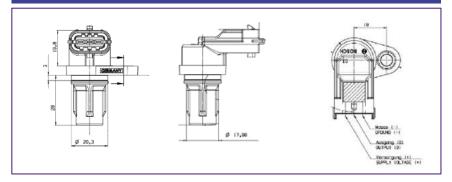
PG-3-8

Part number

0 232 103 097



Dimensional drawings



Technical data 0 min.-1 Minimum trigger-wheel speed n_{\min} 4500 min.-1 Maximum trigger-wheel speed $n_{\text{max.}}$ Maximum working air gap 1,8 mm Minimum working air gap 0.2 mm Rated supply voltage U_{N} 5 V Supply voltage range $U_{\rm v}$ 4,5 ...16V Supply current Typically 5.6 mA

- ¹⁾ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.

Steady-state temperature in connector zone

Steady-state temperature in sensor and transition zone

4) -40...+130 °C permissible for brief period.

Output current

Switching time

Switching time

Output saturation voltage

Accessories		
Connector housing	3-pin	1 928 403 966
Contact pins (gold plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Hall speed sensor

BOSCH

-40°C...+130°C

Product type

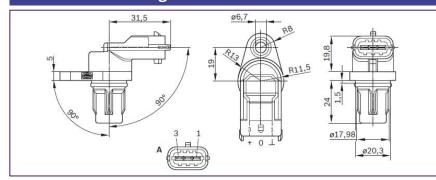
PG-3-8

Part number

0 281 002 667



Dimensional drawings



Technical data		
Minimum trigger-wheel speed	n _{min.}	0 min1
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap	•	0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U _V	4,7518V
Supply current	I _V	Typically 5.0 mA
Output current	I _A	0 20 mA
Output saturation voltage	$U_{\rm s}$	≤ 0,5 V
Switching time	<i>t</i> _f ¹)	≤ 1 µs
Switching time	t _f ²)	≤ 15 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C

- 1) Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- 3) -40...+150 °C permissible for brief period.

Steady-state temperature in connector zone

4) -40...+130 °C permissible for brief period.

Accessories		
Connector housing	3-pin	1 928 403 966
Contact pins (tin plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Hall speed sensor



Product group

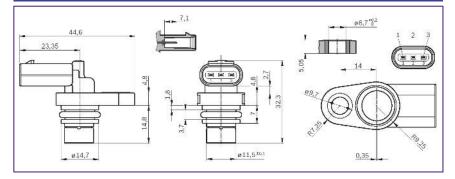
PG-3-9

Part number

0 232 103 099



Dimensional drawings



Technical data

1 Common data		
Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	U_{v}	4,7518V
Supply current	I_{V}	Typically 5,6 mA
Output current	I _A	0 20 mA
Output saturation voltage	U_{s}	≤ 0,52 V
Switching time	$t_{\rm f}^{\ 1})$	≤ 1 µs
Switching time	t _f ²)	≤ 17 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+150°C

 μ A) At ambient temperature 23 ± 5 °C.

- $^{1)}$ Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- ³⁾ -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Hall speed sensor

BOSCH

Product group

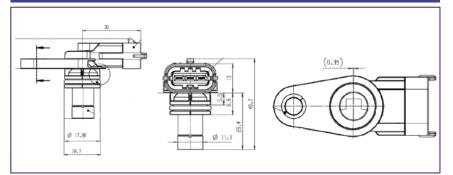
PG-3-9

Part number

0 232 103 122



Dimensional drawings



Technical data

Minimum trigger-wheel speed	n _{min.}	0 min. ⁻¹
Maximum trigger-wheel speed	n _{max.}	4500 min. ⁻¹
Maximum working air gap		1,8 mm
Minimum working air gap		0,2 mm
Rated supply voltage	U_{N}	5 V
Supply voltage range	$U_{\rm v}$	4,7518V
Supply current	I_{V}	Typically 5,6 mA
Output current	I _A	0 20 mA
Output saturation voltage	U_{s}	≤ 0,52 V
Switching time	$t_{\rm f}^{\ 1})$	≤ 1 µs
Switching time	<i>t</i> _f ²)	≤ 17 µs
Steady-state temperature in sensor and transition zone		-40°C+150°C
Steady-state temperature in connector zone		-40°C+130°C

 μ A) At ambient temperature 23 ± 5 °C.

- 1) Time from HIGH to LOW, measured between connections (0) and (-) from 90% to 10%.
- ²⁾ Time from LOW to HIGH, measured between connections (0) and (-) from 10% to 90%.
- ³⁾ -40...+150 °C permissible for brief period.
- 4) -40...+130 °C permissible for brief period.

Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (silver plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 058
Contact pins (silver plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 059
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Inductive speed sensor

BOSCH

- 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 noncontacting and wear-free methods to measure engine speeds or wheel speeds for the ABS system 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.

Explanation of characteristic data

U Output voltage

n Speed

s Air gap

Installation instructions

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

4 Rotational-speed sensors Inductive speed sensor



7000 (for 60-2 type wheel)

Product group

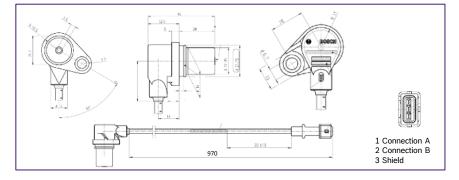
DG-6-K

Part number

0 261 210 128



Dimensional drawings



Technical data Rotational-speed measuring range 1) n min⁻¹ 20 ... 7000 Sustained ambient temperature/coil zone °C - 40 ... + 150 °C Sustained ambient temperature/cable zone - 40 ... + 130 m/s² 300 Max. vibration Number of turns 4300 turns/windings Winding resistance at 20 °C 2) U_A Ω 860 ±10% 370 ±60 Inductance at 1 kHz mΗ ΙP IPx9K Degree of protection 210 V (0.3mm air-gap, 7000 RPM) Output voltage 2) U V/mV 170 mV (1.5mm air-gap, 50 RPM)

Hz

Signal frequency

Accessories		
Connector housing	3-pin	1 280 703 022
Contact pins	For Ø 0.51.0 mm ²	AMP 925 590 2
Contact pins	For Ø 1.52.5 mm ²	AMP 925 595 2

¹⁾ Referenced to corresponding trigger wheel.

²⁾ Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

4 Rotational-speed sensors Inductive speed sensor



Product group

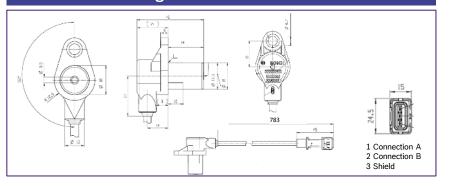
DG-6-K

Part number

0 261 210 361



Dimensional drawings



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
Max. vibration	m/s²	300
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.

Accessories Connector housing 3-pin 1 928 402 412 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 AMP 828 922 Dummy plug

²⁾ Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

4 Rotational-speed sensors Inductive speed sensor



Product group

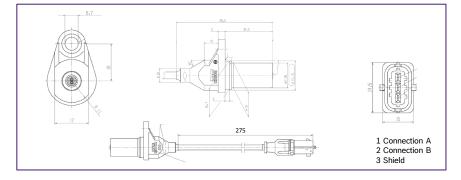
DG-6-K

Part number

0 281 002 629



Dimensional drawings



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
Max. vibration	m/s²	300
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 0.51.0 mm²	1 928 498 056
Contact pins	For Ø 1.52.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

4 Rotational-speed sensors Inductive speed sensor



Product group

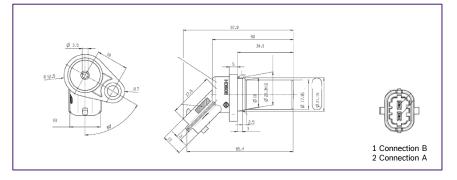
DG-6-S

Part number

0 281 002 315



Dimensional drawings



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
Max. vibration	m/s ²	300
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.

Accessories		
Connector housing	2-pin	1 928 404 072
Contact pins (tin-plated)	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.52.5 mm ²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600
Dummy plug		1 928 300 601

²⁾ Change factor k= 1+0.004 (v_w -20°C); v_w Winding temperature.

5 Structure-borne sound

Piezoelectric vibration sensor

BOSCH

- Reliable detection of structureborne 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.

Explanation of characteristic data

E Sensitivity

F Frequency

g Acceleration due to gravity

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.

Piezoelectric vibration sensor



Product type

KS-4-K

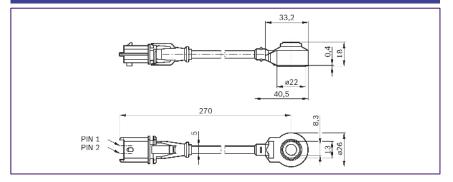
Part number

0 261 231 196



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

Dimensional drawings



Accessories		
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 054
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 055
Individual seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600
Dummy plug	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 601

Piezoelectric vibration sensor



Product type

KS-4-K

Part number

0 261 231 218



Technical data Vibration sensors 2-pole, with cable Frequency range $0 \dots 24 \text{ kHz}$ Self-impedance > $1 \text{ M}\Omega$ Operating temperature range $-40 \dots + 130 \text{ °C}$ (sensor head 150 °C) Permissible sustained vibration $\leq 80 \text{ g}$ Pin coating Gold-plated

Dimensional drawings 530

Accessories		
Connector housing	2-pin	1 928 403 137

Piezoelectric vibration sensor



Product type

KS-4-S

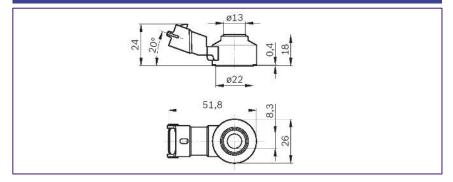
Part number

0 261 231 173



Technical data Vibration sensors 2-pole, without cable Frequency range 3 ... 22 kHz Self-impedance > 1 MΩ Operating temperature range - 40 ... + 150 °C Permissible sustained vibration ≤ 80 g Pin coating Gold-plated

Dimensional drawings



Accessories		
Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Individual seal	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600
Dummy plug	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 601

Piezoelectric vibration sensor



Product type

KS-4-S

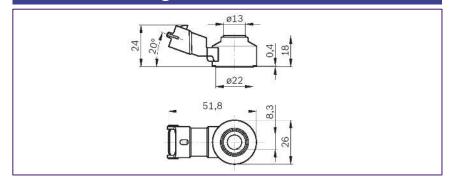
Part number

0 261 231 176



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

Dimensional drawings



Accessories				
Connector housing	2-pin	1 928 403 874		
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056		
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057		
Individual seal	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599		
Individual seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600		
Dummy plug	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 601		

Piezoelectric vibration sensor



Product type

KS-4-S

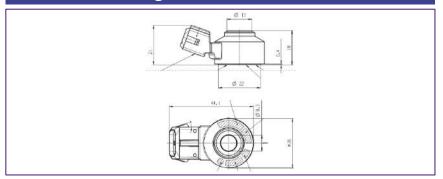
Part number

0 261 231 208



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

Dimensional drawings



Accessories		
Connector housing	2-pin	1 284 485 070

Piezoelectric vibration sensor



Product type

KS-4-S

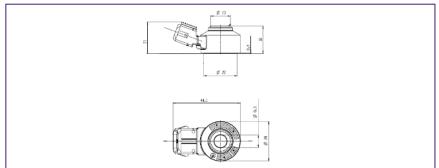
Part number

0 261 231 300



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	Gold-plated	

Dimensional drawings



Accessories		
Connector housing	2-pin	1 928 402 070

Differential pressure sensor



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



Application

This sensor is used for measurement of the differential pressure at the diesel particulate filter to determine its load condition.

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

Differential pressure $p_{\rm e}$ U_{Δ} Output voltage (signal voltage)

Supply voltage U_{v}

Ν

k Tolerance multiplier

D After endurance test 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.

Differential pressure sensor



Product type

DS-D2

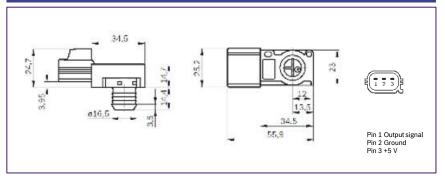
Part number

0 261 230 121





Dimensional drawings



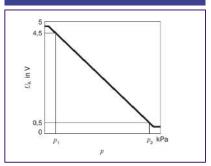
Technical data

Parameter			min.	type	Max.
Pressure measuring range (p_1p_2)	ρ_{e}	kPa	-100		0
Operating temperature	ϑ_{B}	°C	-40		+130
Supply voltage $U_{\rm V}$	U_{V}	V	4,75	5	5,25
Current input at $U_V = 5 \text{ V}$	I _V	mA	6,0	9,0	12,5
Load current at output	I_{L}	mA	-1,0		0,5
Load resistance to U_{V} or ground	$R_{\text{pull-up}}$	kΩ	5		
Load resistance to U_{V} or ground	$R_{\text{pull-down}}$	kΩ	10		
Response time	$\tau_{10/90}$	ms			1
Voltage limitation at $U_V = 5 \text{ V} - \text{lower limit}$	$U_{\rm Amin}$	V	0,25	0,3	0,35
Voltage limitation at U_V = 5 V – upper limit	U _{A max}	٧	4,75	4,8	4,85

Limit data

Supply voltage	U_{V}	٧		16
Pressure	$p_{\rm e}$	kPa	-500	+500
Storage temperature	v_{L}	°C	-40	+130

Characteristic curve



Accessories

Connector housing	3-pin	Yazaki number	7283-5880-101)
Contact pins	For Ø 0.350.5 mm ²	Yazaki number	7116-4102-021)
Contact pins	For Ø 0.751.0 mm ²	Yazaki number	7116-4102-031)
Single-wire seal	For Ø 0.350.5 mm ²	Yazaki number	7158-3030-50 ¹⁾
Single-wire seal	For Ø 0.751.0 mm ²	Yazaki number	7158-3031-901)
Dummy plug		Yazaki number	7158-3032-60 ¹⁾

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

1) Available from Yazaki Europe LTD.

Differential pressure sensor



-40

+130

Product type

DS-D2

Part number

0 281 002 772

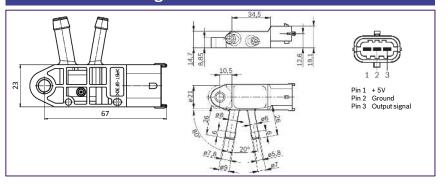


Storage temperature

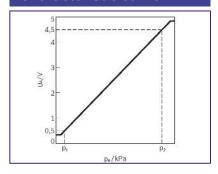
Technical data Parameter min max 0 Pressure measuring range $(U_{AA}...p_2)$ kPa 100 p_{e} °C -40 +130 Operating temperature Load resistance to $U_{\rm V}$ or ground $R_{\text{pull-up}}$ kΩ 5 680 Limit data Pressure p_{e} kPa -350 +350 °C

V_I

Dimensional drawings



Characteristic curve



Accessories		
Connector housing	3-pin	1 928 403 966
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Differential pressure sensor



Product type

DS-D2

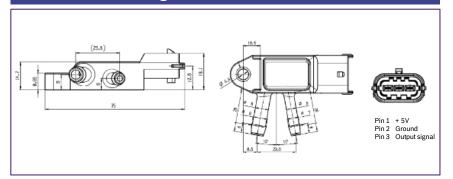
Part number

0 281 006 207

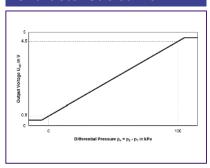


Technical data Parameter min max Pressure measuring range $(U_{AA}...p_2)$ kPa 0 100 °C -40 Operating temperature +130 Load resistance to $U_{\rm V}$ or ground kΩ 5 68 Limit data Pressure p_{e} kPa -350 +350 °C -40 +130 Storage temperature V_I

Dimensional drawings



Characteristic curve



Accessories		
Connector housing	3-pin	1 928 403 966
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Differential pressure sensor



Product type

DS-K-TF

Part number

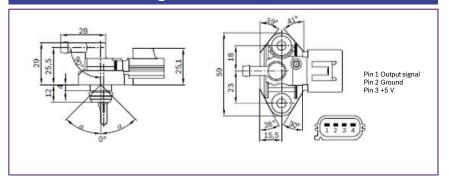
0 261 230 093



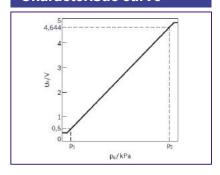
Picture Technical data

Parameter			min	max
Features			Integrated te	mperature sensor
Pressure measuring range $(U_{AA}p_2)$	$p_{\rm e}$	kPa	0	500
Operating temperature	ϑ _B	°C	-40	+125
Load resistance to $U_{\rm V}$ or ground	$R_{\text{pull-up}}$	kΩ	4,7	
Limit data				
Pressure	p _e	kPa	+3000	
Storage temperature	V ₁	°C	+130	

Dimensional drawings



Characteristic curve



Accessories			
Connector housing	4-pin	Yazaki number	7283-5886-301)
Contact pins	For Ø 0.350.5 mm ²	Yazaki number	7116-4102-08 ¹⁾
Contact pins	For Ø 0.751.0 mm ²	Yazaki number	7116-4103-081)
Single-wire seal	For Ø 0.350.5 mm ²	Yazaki number	7158-3030-50 ¹⁾
Single-wire seal	For Ø 0.751.0 mm ²	Yazaki number	7158-3031-90 ¹⁾
Dummy plug		Yazaki number	7158-3032-60 ¹⁾

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

1) Available from Yazaki Europe LTD.

Absolute pressure sensors



Product type

DS-T3

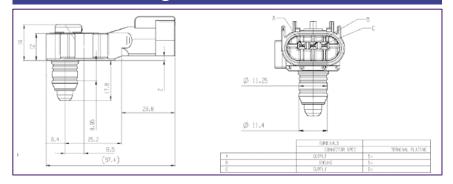
Part number

0 261 230 162

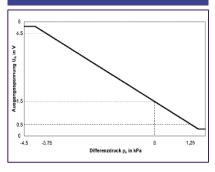


Technical data min. Max. Parameter type kPa -3,75 +1,25 Pressure range $(p_1...p_2)$ ٧ 4,75 5 5,25 Supply voltage U_V 0,5 Load current I_1 at output mΑ -1,0 Response time $\tau_{10/90}$ 5,0 ms °C 0 +80 Operating temperature Limit data Operating temperature °C -50 +90

Dimensional drawings



Characteristic curve



Absolute pressure sensors

BOSCH

- ► 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. In addition it 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 vapours and fluids existing in the intakemanifold, exhaust gas or exhaust gas condensate, however, may affect the sensor lifetime.

Explanation of characteristic data

 $egin{array}{ll} U_{\mathrm{A}} & & \mathrm{Output\ voltage} \\ U_{\mathrm{V}} & & \mathrm{Supply\ voltage} \\ k & & \mathrm{Tolerance\ multiplier} \\ \mathrm{D} & & \mathrm{After\ endurance\ test} \\ \mathrm{N} & & \mathrm{As-new\ condition} \\ \end{array}$

Installation instruction

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.).

Absolute pressure sensors



Product type

DS-S1-TF

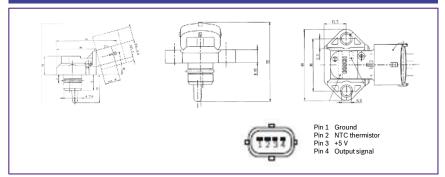
Part number

0 261 230 022

Picture



Dimensional drawings



Technical data

Parameter		min.	type	Max.
Features		Integrated	l temperature se	nsor
Pressure range (p ₁ p ₂)	kPa	10		115
Supply voltage $U_{\rm V}$	V	4,5	5	5,5
Load current I _L at output	mA	-0,1		0,1
Response time $\tau_{10/90}$	ms			0,2
Operating temperature	°C	-40		+125

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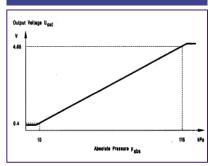
Operating temperature	°C	-40	+130

Temperature sensor

Measuring range	°C	-40		+125
Measurement current ¹)	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	

¹⁾ Operation with 1 $k\Omega$ series resistance.

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 112
Contact pins	For Ø 0.51.0 mm²	AMP 2-929 939-1
Contact pins	For Ø 1.52.5 mm²	AMP 2-929 937-1
Individual seal	For Ø 0.51.0 mm ²	AMP 828 904
Individual seal	For Ø 1.52.5 mm ² ;	AMP 828 905

Absolute pressure sensors



Product type

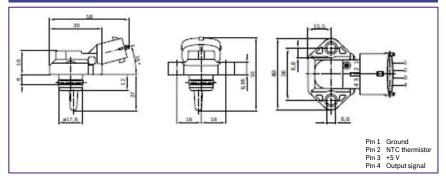
DS-S1-TF

Part number

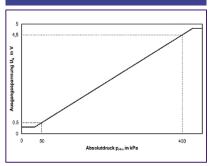
0 281 002 316



Dimensional drawings



Characteristic curve



100mmour data				
Parameter		min.	type	max.
Features		Integrated	l temperature se	nsor
Pressure range (p_1p_2)	kPa	50		400
Supply voltage $U_{\rm V}$	٧	4,5	5	5,5
Load current I _L at output	mA	-0,1		0,1
Load resistance to ground or $U_{\rm V}$	kΩ	50		
Response time $ au_{10/90}$	ms		0,2	
Operating temperature	°C	-40		+125
Limit data				
Operating temperature	°C	-40		+130
Recommendation for signal evaluation				
Load resistance to ground	kΩ		100	

kΩ

nF

°C

mΑ

kΩ

s

-40

Temperature/time constant $\tau_{63}^{2)}$

Rated resistance at +20°C

Low-pass resistance

Low-pass capacitance
Temperature sensor

Measuring range

Measurement current¹)

Technical data

Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Individual seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Individual seal	For Ø 1.52.5 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.

21,5

100

2,5 ± 5 %

+125

1

45

 $^{^{1)}}$ Operation with 1 k Ω series resistance.

²⁾ In air with flow velocity 6 m/s.

Absolute pressure sensors



type

max.

min.

10

Product type

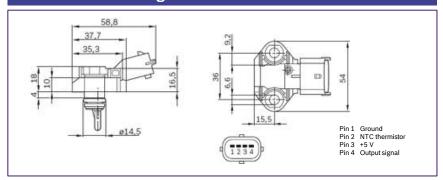
DS-S1-TF

Part number

0 281 002 693



Dimensional drawings



Picture



Feature	Integrated temperature sensor				re sensor
Pressure range kPa (p_1p_2)			50		1000
Operating temperature	ϑ_{B}	°C	-40		+125
Supply voltage (1 min)	U _V	V	4,75	5	5,25
Load resistance to U _V or ground	$R_{\text{pull-up}}$	kΩ	5		

kΩ

ms

 $R_{\text{pull-down}}$

 $\tau_{10/90}$

Limit data				
Storage temperature	ϑ_{L}	°C	-40	+130
Temperature sensor				
Measuring range	ϑ_{M}	°C	-40	+125
Measurement current	I _M	mA		1 1)
Rated resistance at +20°C	kΩ		2,5 ± 6%	-
Temperature/time constant	τ ₆₃	S		45 ²⁾

 $^{^{1)}}$ Operation at 5 V with 1Ω series resistance.

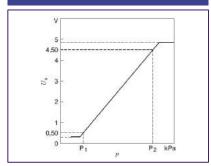
Technical data

Load resistance to U_{V} or ground

Parameter

Response time

Characteristic curve



Accessories		
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

²⁾ In air with flow velocity 6 m/s.

TO cell

Absolute pressure sensors



Product type

DS-S2

Part number

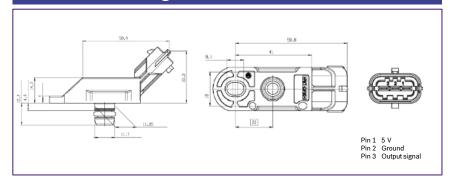
0 261 230 061



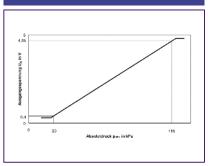
Technical data Max. Parameter min. type 20 Pressure range $(p_1...p_2)$ kPa 115 ٧ 5 5,25 4,75 Supply voltage U_V Load current I_1 at output mΑ -1 0,1 Response time $\tau_{10/90}$ 1 ms °C -40 +130 Operating temperature Limit data °C -40 +130

Operating temperature

Dimensional drawings



Characteristic curve



Accessories		
Connector housing	3-pin	1 928 403 110
Contact pins (gold-plated)	For Ø 0.51.0 mm ²	AMP 2 929 939 1
Contact pins (gold-plated)	For Ø 1.52.5 mm ²	AMP 2 929 937 1
Single-wire seal	For Ø 0.51.0 mm ²	AMP 828 905
Single-wire seal	For Ø 1.52.5 mm ²	AMP 828 905
Dummy plug		AMP 828 922

Absolute pressure sensors



Product type

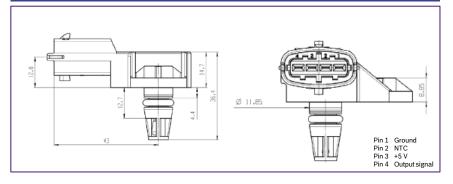
DS-S2-TF

Part number

0 261 230 133

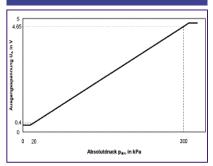


Dimensional drawings



Technical data Max. Parameter min. type Features Integrated temperature sensor Pressure range $(p_1...p_2)$ kPa 300 ٧ 5 Supply voltage U_V 4,75 5,25 0,5 Load current I_1 at output mΑ -1 Response time $\tau_{10/90}$ ms 1 °C -40 +130 Operating temperature Limit data °C -40 +130 Operating temperature

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Absolute pressure sensors



Product type

DS-S2

Part number

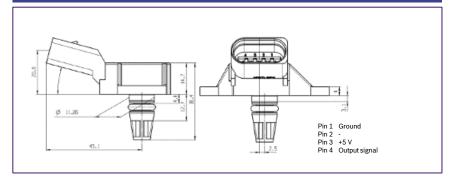
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Picture

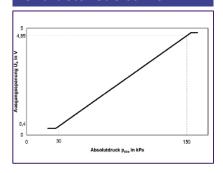


Parameter		min.	type	Max.
Pressure range (p_1p_2)	kPa	30		150
Supply voltage $U_{\rm V}$	V	4,75	5	5,25
Load current I _L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130

Dimensional drawings



Characteristic curve



Absolute pressure sensors



type

Integrated temperature sensor

Max.

Product type

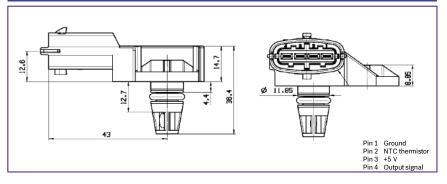
DS-S2-TF

Part number

0 281 002 437



Dimensional drawings



Picture

· outuree		tog.atot	. tomporataro como	·.
Pressure range (p_1p_2)	kPa	20		300
Supply voltage $U_{\rm V}$	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
Temperature sensor				
Measuring range	°C	-40		+130
Measurement current ¹⁾	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	
Temperature/time constant $ au_{63}$ ²⁾	S			10

min.

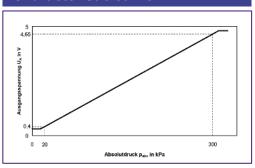
- ¹⁾ Operation with 1 $k\Omega$ series resistance.
- 2) In air with flow velocity 6 m/s.

Technical data

Parameter

Features

Characteristic curve



Accessories						
Connector housing	4-pin	1 928 403 736				
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056				
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057				
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599				
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600				
Dummy nlug		1 928 300 601				

Absolute pressure sensors



Product type

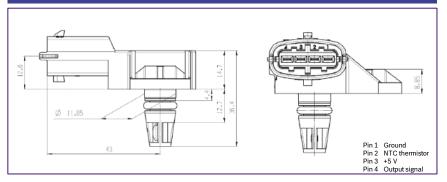
DS-S2-TF

Part number

0 281 002 456



Dimensional drawings



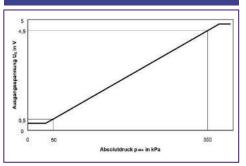
Picture

1 Par		
1	31	

i echnicai data				
Parameter		min.	type	Max.
Features		Integrated	l temperature ser	nsor
Pressure range (p_1p_2)	kPa	50		350
Supply voltage $U_{\rm V}$	V	4,5	5	5,5
Load current I _L at output	mA	-1		0,5
Response time $ au_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130
Temperature sensor				
Measuring range	°C	-40		+130
Measurement current ¹⁾	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	
Temperature/time constant $\tau_{63}^{\ 2)}$	S		-	10

¹⁾ Operation with 1 $k\Omega$ series resistance.

Characteristic curve



Accessories				
Connector housing	4-pin	1 928 403 736		
Contact pins (tin-plated)	For Ø 0.51.0 mm²; Contents:	1 928 498 060		
Contact pins (tin-plated)	For Ø 1.52.5 mm ² ; Contents:	1 928 498 061		
Single-wire seal	For Ø 0.51.0 mm ² ; Contents:	1 928 300 599		
Single-wire seal	For Ø 1.52.5 mm ² ; Contents:	1 928 300 600		
Dummy plug		1 928 300 601		

²⁾ In air with flow velocity 6 m/s.

Absolute pressure sensors



Product type

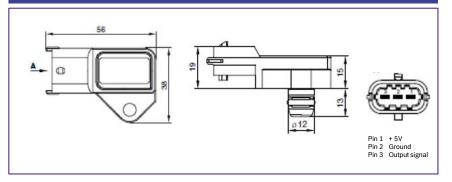
DS-S2

Part number

0 281 002 487



Dimensional drawings



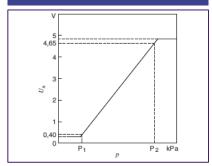
Technical data

				• •	
Parameter		min.	type	Max.	Para meter
Pressure range (p_1p_2)			20		250
Operating temperature	ϑ_{B}	°C	-40		+130
Supply voltage (1 min)	U_{V}	٧	4,5	5	5,5
Load resistance to $U_{\rm V}$ or ground	R _{pull-up}	kΩ	5	680	
Load resistance to $U_{\rm V}$ or ground	$R_{\mathrm{pull-down}}$	kΩ	10	100	
Response time	τ _{10/90}	ms		1	

Limit data

Storage temperature v_L °C -40 +130

Characteristic curve



Accessories	Accessories					
Connector housing	Quantity required: 1 x	1 928 403 966				
Contact pins	Quantity required: 3 x; Contents: 100 x	1 928 498 060				
Individual seals	Quantity required: 3 x; Contents: 10 x	1 928 300 599				

Absolute pressure sensors



Product type

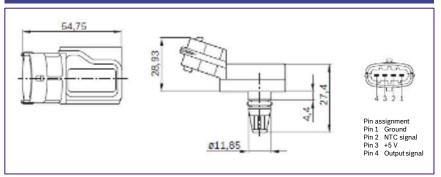
DS-S2-TF

Part number

0 281 002 573



Dimensional drawings



Picture



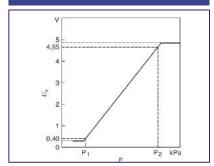
Parameter			min.	туре	max.
Feature			Integrated to	ntegrated temperature sensor	
Pressure range kPa (p_1p_2)			20		250
Operating temperature	ϑ_{B}	°C	-40		+130
Supply voltage (1 min)	U_{V}	V	4,75	5	5,25
Load resistance to $U_{\rm V}$ or ground	$R_{\text{pull-up}}$	kΩ	5	680	
Load resistance to $U_{\rm V}$ or ground	$R_{\mathrm{pull-down}}$	kΩ	10	100	
Response time	τ _{10/90}	ms			1

Limit data				
Storage temperature	ϑ_{L}	°C	-40	
Temperature sensor				
Measuring range	ϑ_{M}	°C	-40	+130
Measurement current	I _M	mA		1 1)
Rated resistance at +20°C	kΩ		2,5 ± 5%	
Temperature/time constant	τ ₆₃	S		10 ²⁾

¹⁾ Operation with 5 V series resistance.

Technical data

Characteristic curve



Accessories		
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

²⁾ In air with flow velocity 6 m/s.

Absolute pressure sensors



2,5 ± 5 %

10

Product type

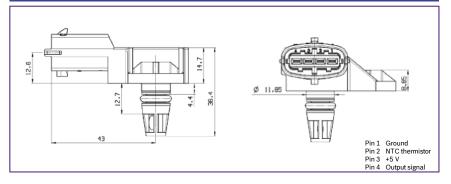
DS-S2-TF

Part number

0 281 002 576



Dimensional drawings



Picture Technical data

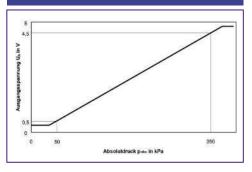
Parameter		min.	type	Max.
Features		Integrated	temperature se	nsor
Pressure range (p ₁ p ₂)	kPa	50		400
Supply voltage $U_{\rm V}$	V	4,75	5	5,25
Load current I _L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130
Temperature sensor				
Measuring range	°C	-40		+130
Measurement current ¹⁾	mA			1

kΩ

Rated resistance at +20°C

Temperature/time constant τ_{63} ²⁾

Characteristic curve



Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.51.0 mm ² ; Contents:	1 928 498 060
Contact pins (tin-plated)	For Ø 1.52.5 mm²; Contents:	1 928 498 061
Single-wire seal	For Ø 0.51.0 mm²; Contents:	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents:	1 928 300 600
Dummy plug		1 928 300 601

¹⁾ Operation with 1 $k\Omega$ series resistance.

²⁾ In air with flow velocity 6 m/s.

Absolute pressure sensors



Product type

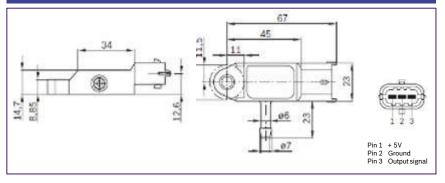
DS-S2

Part number

0 281 002 593



Dimensional drawings

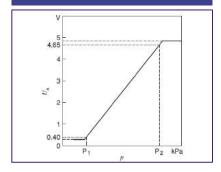


Picture

reciiiicai data					
Parameter			min.	type	max.
Pressure range kPa (p_1p_2)			20		250
Operating temperature	θ _B	°C	-40		+130
Supply voltage (1 min)	U _V	V	4,75	5	5,25
Load resistance to $U_{\rm V}$ or ground	$R_{\text{pull-up}}$	kΩ	5		
Load resistance to $U_{\rm V}$ or ground	$R_{ m pull-down}$	kΩ	10		
Response time	τ _{10/90}	ms			1
Limit data					
Storage temperature	ϑ_{L}	°C	-40		+130

Technical data

Characteristic curve



Quantity required: 1 x	1 928 403 966
Quantity required: 3 x; Contents: 100 x	1 928 498 060
Quantity required: 3 x; Contents: 10 x	1 928 300 599
	Quantity required: 3 x; Contents: 100 x

Absolute pressure sensors



Product type

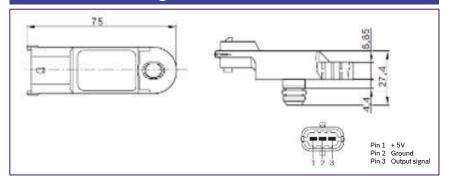
DS-S2

Part number

0 281 002 616



Dimensional drawings



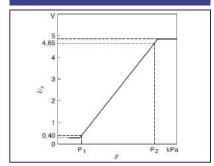
Storage temperature

Parameter			min.	type	max.
Pressure range kPa (p ₁ p ₂)			20		250
Operating temperature	ϑ_{B}	°C	-40		+130
Supply voltage (1 min)	U _v	V	4,75	5	5,25
Load resistance to $U_{\rm V}$ or ground	$R_{\mathrm{pull-up}}$	kΩ	5		
Load resistance to U_{V} or ground	$R_{ m pull-down}$	kΩ	10		
Response time	τ _{10/90}	ms			1

°C

-40

Characteristic curve



Accessories		
Connector housing	Quantity required: 1 x	1 928 403 966
Contact pins	Quantity required: 3 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 3 x; Contents: 10 x	1 928 300 599

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

+130

Absolute pressure sensors



Product type

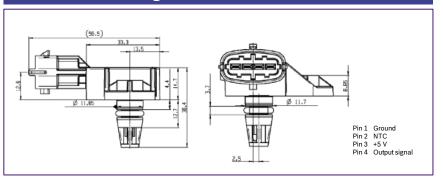
DS-S3-TF

Part number

0 261 230 217

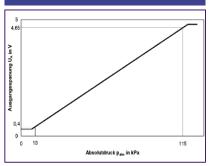


Dimensional drawings



Technical data Max. Parameter min. type Features Integrated temperature sensor Pressure range $(p_1...p_2)$ kPa 10 115 ٧ 5 Supply voltage U_V 4,75 5,25 0,5 Load current I at output mΑ -1 Response time $\tau_{10/90}$ ms 1 °C -40 +130 Operating temperature Limit data °C -40 +130 Operating temperature

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Absolute pressure sensors



Product type

DS-S3-TF

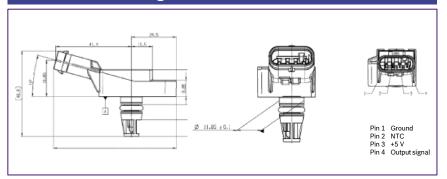
Part number

0 261 230 416

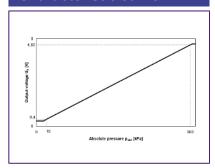


Technical data Max. Parameter type Features Integrated temperature sensor Pressure range $(p_1...p_2)$ kPa 300 ٧ 4,75 5 5,25 Supply voltage U_V Response time $\tau_{10/90}$ 1 ms °C -40 +130 Operating temperature Limit data Operating temperature °C -40 +130

Dimensional drawings



Characteristic curve



Absolute pressure sensors



Product type

DS-S3-TF

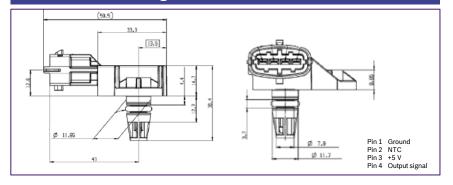
Part number

0 281 006 028

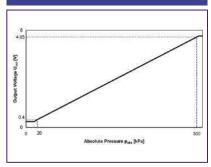


Technical data Max. Parameter min. type Features Integrated temperature sensor Pressure range $(p_1...p_2)$ kPa 300 ٧ 5 5,25 Supply voltage U_V 4,75 Response time $\tau_{10/90}$ 1 ms °C -40 +130 Operating temperature Limit data Operating temperature °C -40 +130

Dimensional drawings



Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Absolute pressure sensors



+130

Product type

DS-S3-TF

Part number

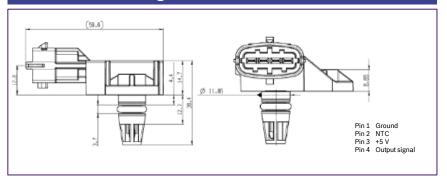
0 281 006 102



Limit data

Operating temperature

Dimensional drawings

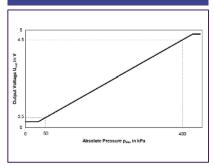


Technical data Max. Parameter type Features Integrated temperature sensor Pressure range $(p_1...p_2)$ kPa 400 ٧ 5 Supply voltage U_V 4,75 5,25 0,5 Load current I_1 at output mΑ -1 Response time $\tau_{10/90}$ ms 1 °C -40 +130 Operating temperature

°C

-40

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Absolute pressure sensors



Product type

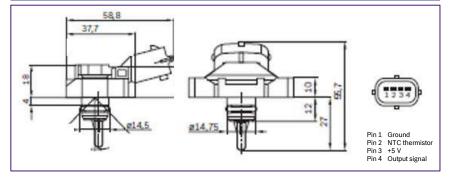
DS-K-TF (fuel)

Part number

0 261 230 112



Dimensional drawings



Picture

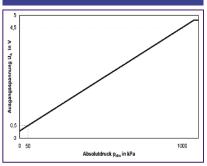
Parameter		min.	type	Max.	
Features	Integrated	Integrated temperature sensor			
Application/medium		fuel			
Pressure range (p_1p_2)	kPa	50		1000	
Supply voltage $U_{\rm V}$	٧	4,75	5	5,25	
Load current I _L at output	mA	-1		0,5	
Response time $\tau_{10/90}$	ms			1	
Operating temperature	°C	-40		+125	
Limit data					
Operating temperature	°C	-40		+130	
Temperature sensor					
Measuring range	°C	-40		+125	
Measurement current ¹⁾	mA			1	
Rated resistance at +20°C	kΩ		2,5 ± 6 %		
Temperature/time constant $\tau_{63}^{2)}$	S			45	

 $^{^{1)}}$ Operation with 1 k Ω series resistance.

Dummy plug

Technical data

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600

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

1 928 300 601

²⁾ In air with flow velocity 6 m/s.

Absolute pressure sensors



Product type

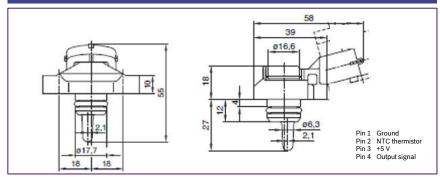
DS-O-TF (oil)

Part number

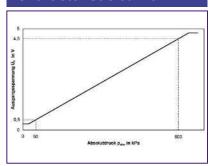
0 281 006 282



Dimensional drawings



Characteristic curve



Technical data					
Parameter		min.	type	max.	
Features		Integrated	Integrated temperature sensor		
Application/medium		oil			
Pressure range (p_1p_2)	kPa	50		600	
Supply voltage $U_{\rm V}$	V	4,5	5	5,5	
Load current I_{L} at output	mA	-0,1		0,1	
Load resistance to ground or U_V	kΩ	50			
Response time $\tau_{10/90}$	ms		0,2		
Operating temperature	°C	-40		+125	
Limit data					
Operating temperature	°C	-40		+130	
Recommendation for signal evaluation					
Load resistance to ground	kΩ		100		
Low-pass resistance	kΩ		21,5		
Low-pass capacitance	nF		100		
Temperature sensor					
Measuring range	°C	-40		+125	
Measurement current ¹)	mA			1	
Rated resistance at +20°C	kΩ		2,5 ± 5 %		
Temperature/time constant $\tau_{63}^{2)}$	s			45	

 $^{^{1)}}$ Operation with 1 k Ω series resistance.

²⁾ In air with flow velocity 6 m/s.

Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

Absolute pressure sensors



Product type

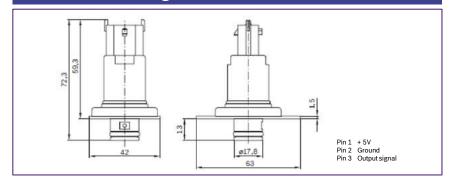
DS-AM5

Part number

0 281 002 668

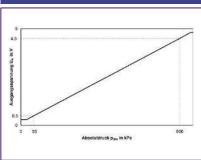


Dimensional drawings



Technical data				
Parameter		min.	type	max.
Pressure range (p ₁ p ₂)	kPa	50		600
Supply voltage $U_{\rm V}$	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		+125
Limit data				
Operating temperature	°C	-40		+130

Characteristic curve



Accessories		
Connector housing	3-pin	1 928 403 966
Contact pins (tin plated)	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

High pressure sensors

BOSCH

- ▶ Pressure range 1 260 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 a braking system or in the fuel rail of direct-injection gasoline or common-rail diesel engines.

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 · p / P _N
P_N	Rated pressure [MPa]

Installation instruction

The pressure sensor is designed for attachment to the fuel rail. The pressure port has the conical sealing surface to ensure the sealing to the fuel rail and to ensure that no water can collect at the diaphragm.

The pressure sensor consists of a pressure port of metal and a housing of plastic. The pressure port has a conical sealing 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, have to be applied only at the hexagon. After the pressure sensor has been screwed in at its installation position in this way, it is tightened at the hexagon. A gap remains between the hexagon of the pressure sensor and the fuel rail.

6.3 Pressure sensors High pressure sensor



Product type

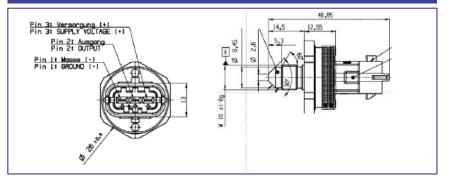
DS-HD-KV4.2

Part number

0 261 545 030



Dimensional drawings

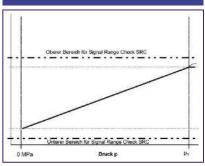


Technical data

recillical data			
Pressure range	P_{N}	bar (Mpa)	260 (26)
Thread	·		M 10 x 1
Connector			Compact 1.1
Application/medium			CNG
Max. feed voltage	$U_{\rm s}$	V	16
Supply voltage	U_{V}	V	5 ± 0,25
Supply current	I_{V}	mA	1215
Load capacitance to ground		nF	13
Temperature range		°C	- 40+ 130
Max. overpressure	p_{max}	bar	320
Rupture pressure	p_{max}	bar	250
Response time	$\tau_{10/90}$	ms	2

¹⁾ FS = Full Scale

Characteristic curve



Accessories

Connector housing	4-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.51.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.52.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²	1 928 300 600
Dummy plug		1 928 300 601



6.3 Pressure sensors High pressure sensor



Product type

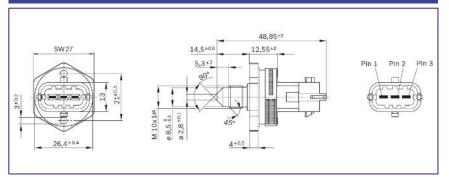
DS-HD-KV4.2

Part number

0 261 545 053



Dimensional drawings



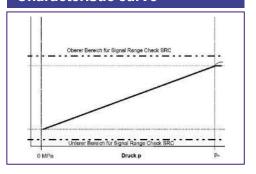
Picture

h	

1) FS = Full Scale

Technical data			
Pressure range	P_{N}	bar (Mpa)	140 (14)
Thread			M 10 x 1
Connector			Compact 1.1
Application/medium			Unleaded fuel
Max. feed voltage	U _s	V	16
Supply voltage	U _V	V	5 ± 0,25
Supply current	I _V	mA	1215
Load capacitance to ground		nF	13
Temperature range		°C	- 40+ 130
Max. overpressure	p_{max}	bar	180
Rupture pressure	p_{max}	bar	>150
Response time	T 10/90	ms	2

Characteristic curve



Accessories

Connector housing	4-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.51.0 mm ²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.52.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600
Dummy plug		1 928 300 601

High pressure sensor



375

Product type

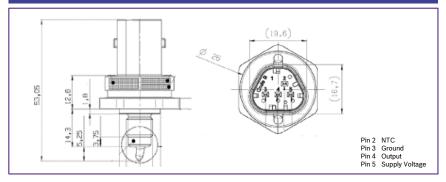
DS-HD-KV4.2

Part number

0 281 006 650



Dimensional drawings



Picture

	- 6	_	5
749			P

P_{N}	bar (Mpa)	260 (26)
		M 10 x 1
		Trapez
		Unleaded fuel
U_{s}	V	18
U _V	V	5 ± 0,25
I _V	mA	915
	nF	15,1
	°C	- 40+ 140
p_{max}	bar	400
	U _s U _V	U _s V U _V V I _V mA nF °C

 $\tau_{10/90}$

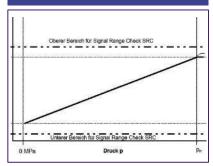
bar

s

Rupture pressure

Technical data

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 405 159
Matrix-Hv Terminal	For Ø 0.350.5 mm ² ; Contents: 4 x	1 928 498 810
Mating single wire seal	For Ø 0.350.5 mm ² ; Contents: 4 x	1 928 300 934
Cavity Plug	For Ø 0.35 0.5 mm²; Contents: 1 x	1 928 300 935

Response time 1) FS = Full Scale

High pressure sensor



Product type

DS-RPS4-18

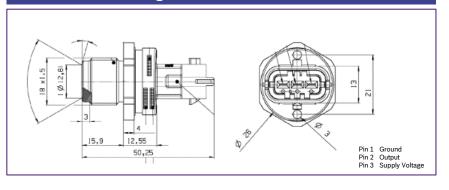
Part number

0 281 002 907

Picture



Dimensional drawings

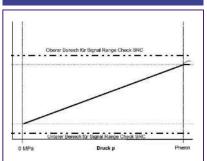


Technical data

i ecililicai data			
Pressure range	P_{N}	bar (MPa)	1500 (150)
Max. feed voltage	U _s	V	16
Supply voltage	U _v	V	5 ± 0,25
Load capacitance to ground		nF	10
Thread			M 18 x 1,5
Application/medium			Diesel or biodiesel 2)
Temperature range		°C	- 40+ 130
Max. overpressure	p_{max}	bar	2300
Rupture pressure	p_{berst}	bar	4000
Response time	τ _{10/90}	ms	2

2) RME rapeseed methyl ester.

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.51.0 mm ²	1 928 498 054
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Dummy plug		1 928 300 601

High pressure sensor



2000 (200)

 $5 \pm 0,25$

M 18 x 1,5

- 40 ...+ 130

Diesel or biodiesel 2)

10

2300

4000

2

Product type

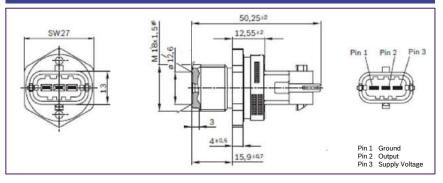
DS-RPS4-18

Part number

0 281 002 930



Dimensional drawings



Picture



1) FS = Full Scale.

Technical data

Load capacitance to ground

Pressure range

Supply voltage

Thread

Max. feed voltage

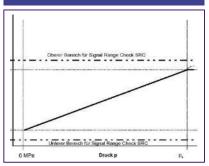
Application/medium

Temperature range Max. overpressure

Rupture pressure

Response time

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.51.0 mm²	1 928 498 054
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Dummy plug		1 928 300 601

 P_{N}

U,

 U_{V}

 p_{max}

 p_{berst}

 $\tau_{10/90}$

bar (MPa)

٧

٧

nF

bar

bar

²⁾ RME rapeseed methyl ester.

⁴⁾ Output current with pull-up resistor.

^{5) +140°}C for max, 250 h.

High pressure sensor



1800 (180)

16

 5 ± 0.25

 $M 18 \times 1.5$

- 40 ...+ 130

2300

4000

Diesel or biodiesel 2)

Product type

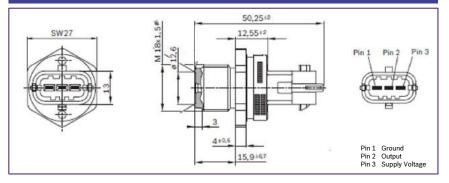
DS-RPS4-2

Part number

0 281 002 937



Dimensional drawings



Picture



Response time 1) FS = Full Scale.

Technical data

Load capacitance to ground

Pressure range

Supply voltage

Thread

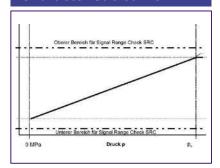
Max. feed voltage

Application/medium

Temperature range Max. overpressure

Rupture pressure

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.51.0 mm ²	1 928 498 054
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Dummy plug		1 928 300 601

 P_{N}

 $U_{\rm s}$

 U_{v}

 p_{max}

 p_{berst}

 $\tau_{10/90}$

bar (MPa)

٧

٧

nF

°C

bar

bar

ms

²⁾ RME rapeseed methyl ester.

⁴⁾ Output current with pull-up resistor.

^{5) +140°}C for max. 250 h.

High pressure sensor



2400 (240)

 $5 \pm 0,25$

M 18 x 1,5

- 40 ...+ 130

Diesel or biodiesel 2)

10

2800

4000

2

bar (MPa)

٧

٧

nF

bar

bar

ms

U,

 U_{V}

 p_{max}

 p_{berst}

 $\tau_{10/90}$

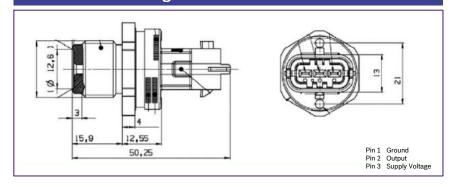
Product type

DS-RPS4-22

Part number

0 281 006 117

Dimensional drawings



Picture

© Sch
3.34

1) FS = Full Scale.

Technical data

Load capacitance to ground

Pressure range

Supply voltage

Thread

Max. feed voltage

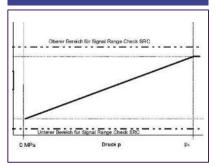
Application/medium

Temperature range Max. overpressure

Rupture pressure

Response time

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.51.0 mm ²	1 928 498 054
Single-wire seal	For Ø 0.51.0 mm²	1 928 300 599
Dummy plug		1 928 300 601

²⁾ RME rapeseed methyl ester.

⁴⁾ Output current with pull-up resistor.

^{5) +140°}C for max, 250 h.

Pressure sensors for CNG and LPG



- ▶ Pressure range 20 1000 kPa
- ► High level of accuracy
- ► EMC protection up to 100 Vm⁻¹
- ▶ With temperature compensation
- ► Ratiometric output signal
- All sensors and sensor cells are resistant against natural gas (CNG) and partly against gaseous liquefied petroleum gas (LPG).



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) and partly against gaseous liquefied petroleum gas (LPG).

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 attachment 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.

Pressure sensors for CNG and LPG



Product type

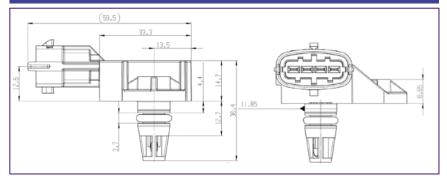
DS-G3-TF

Part number

0 261 230 373



Dimensional drawings



Technical data min. type Max. Parameter Features integrated temperature sensor Application/medium approved for CNG and LPG 50 350 Pressure range $(p_1...p_2)$ kPa ٧ 5 5,25 Supply voltage U_V 4,75 9 Current input I_v at $U_v = 5 \text{ V}$ mΑ 6 12,5 Load current I_i at output mΑ -1 0,5 Load resistance to ground or U_{ν} kΩ 5 10 V Lower limit at $U_V = 5 \text{ V}$ 0,25 0,3 0,35 Upper limit at $U_V = 5 \text{ V}$ ٧ 4,65 4,7 4,75 Output resistance to ground, U_V open kΩ

kΩ

ms °C

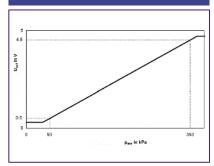
-40

Output resistance to U_{ν} ground open

Response time $\tau_{10/90}$

Operating temperature

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 734
Contact pins (tin-plated)	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.52.5 mm ²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 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.

1

120

Pressure sensors for CNG and LPG



Product type

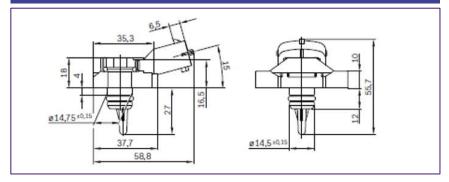
DS-K-TF

Part number

0 261 230 145



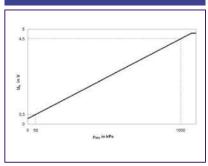
Dimensional drawings



Picture

Technical data				
Parameter		min.	type	Max.
Features		integrated	temperature ser	nsor
Application/medium		approved	for CNG	
Pressure range (p_1p_2)	kPa	50		1000
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
Upper limit at $U_{V=}$ 5 V	V	4,75	4,8	4,85
Output resistance to ground, U _V open	kΩ			
Output resistance to U_{ν_i} ground open	kΩ			
Response time	τ _{10/90}	ms	1	
Operating temperature	°C	-40	130	•

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.52.5 mm ²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600
Dummy plug		1 928 300 601

Pressure sensors for CNG and LPG



Product type

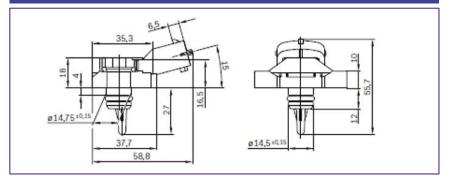
DS-K-TF

Part number

0 261 230 255

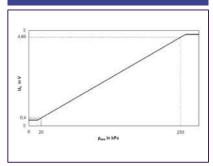


Dimensional drawings



Technical data Max. Parameter min. type Features integrated temperature sensor Application/medium approved for CNG and LPG Pressure range $(p_1...p_2)$ kPa 20 250 ٧ Supply voltage U_V 4,75 5 5,25 Current input I_v at $U_v = 5 \text{ V}$ 6 9 12.5 mΑ -1 0,5 Load current I_i at output mΑ kΩ 5 10 Load resistance to ground or U_{ν} Lower limit at $U_V = 5 \text{ V}$ V 0.25 0.3 0.35 ٧ Upper limit at $U_V = 5 \text{ V}$ 4,75 4.8 4.85 Output resistance to ground, U_V open kΩ kΩ Output resistance to U_{V} ground open 1 Response time $\tau_{10/90}$ ms °C -40 130 Operating temperature

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.52.5 mm ²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600
Dummy plug		1 928 300 601

Pressure sensors for CNG and LPG



Product type

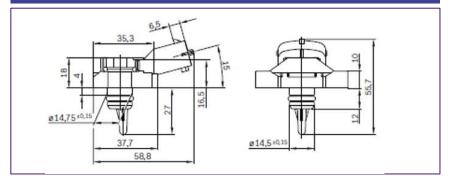
DS-K-TF

Part number

0 261 230 275



Dimensional drawings

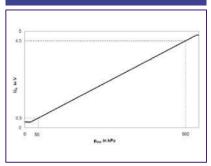


Picture

Technical data				
Parameter		min.	type	Max.
Features		integrated	l temperature se	nsor
Application/medium		approved	for CNG	
Pressure range (p ₁ p ₂)	kPa	50		600
Supply voltage U_{V}	٧	4,75	5	5,25
Current input I_v 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		
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Upper limit at $U_v = 5 \text{ V}$	V	4,75	4,8	4,85
Output resistance to ground, U_{ν} open	kΩ			
Output resistance to U_V , ground open	kΩ			
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		130

Technical data

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.52.5 mm ²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600
Dummy plug		1 928 300 601

Pressure sensors for CNG and LPG



Product type

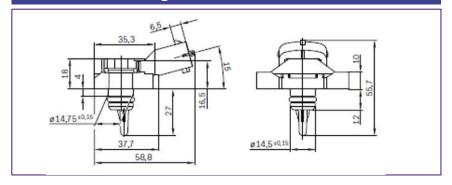
DS-K-TF

Part number

0 281 006 243



Dimensional drawings



Picture

Technical data Parameter min. type max. Features integrated temperature sensor Application/medium approved for CNG kPa 20 Pressure range $(p_1...p_2)$ 300 ٧ Supply voltage U_V 4,75 5 5,25 Current input I_V at $U_V = 5V$ 6 9 12.5 mΑ -1 0,5 Load current I_i at output mΑ kΩ 5 10 Load resistance to ground or U_V Lower limit at $U_v = 5 \text{ V}$ ٧ 0,25 0.3 0.35 ٧ Upper limit at $U_V = 5 \text{ V}$ 4,75 4,8 4.85 Output resistance to ground, U_V open kΩ

kΩ

ms

°C

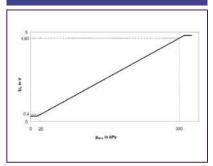
-40

Output resistance to U_{ν} , ground open

Response time $\tau_{10/90}$

Operating temperature

Characteristic curve



Accessories		
Connector housing	4-pin	1 928 403 736
Contact pins (gold-plated)	For Ø 0.51.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.52.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.52.5 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.

1

130

Measurement of air/liquid temperatures

BOSCH

- ► 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. Temperature sensors are negative temperature coefficient thermistors, i.e. they reduce their resistance with increasing temperature. The temperature sensor described in this TKU is suitable for the measurement of liquid media, e.g. coolant, fuel and oil.

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

Explanation of characteristic data

R Resistance

Temperature

Installation instructions

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

Measurement of air/liquid temperatures



Product type

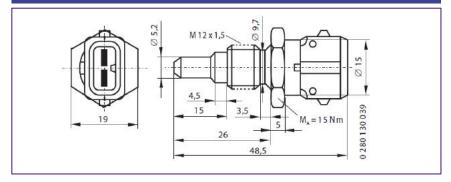
TF-L

Part number

0 280 130 039



Dimensional drawings



Technical data

Technical data	
Temperature range	°C -40 + 130
Features	Sensor in steel housing with threaded connection
Application/medium	air
Rated resistance at 20 °C	kΩ 2,5 ± 5 %
Resistance at -10 °C	kΩ 8,325 10,572
Resistance at +20 °C	kΩ 2,280 2,736
Resistance at +80 °C	kΩ 0,288 0,359
Nominal voltage	V 5 ± 0,15
Max. measurement current	mA 1
Self-heating with max. perm. Power loss of <i>P</i> = 2 mW and still air (23 °	°C) K ≤ 2
Temperature/time constant $ au_{63}^{1)}$	s ≤ 38
Approximate value for permissible Vibration acceleration a _{sin} (sinusoidal vibration)	m/s² 300
Corrosion-tested as per	DIN 50 018

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 80°C; flow velocity of air 6 m/s.

Accessories

Connector housing	2-pin	1 928 402 078
Protective cap	Temperature-resistant	1 280 703 031
Contact pins	For Ø 0.51.0 mm²	AMP 929 939-3
Contact pins	For Ø 1.52.5 mm²	AMP 929 937-3
Individual seal	For Ø 0.51.0 mm²	1 987 280 106
Individual seal	For Ø 1.52.5 mm²	1 987 280 107

Measurement of air/liquid temperatures



Product type

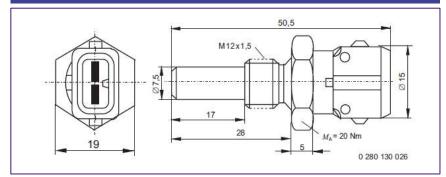
TF-W

Part number

0 280 130 026



Dimensional drawings



°C	-40 +130
	Sensor in brass housing.
	Oil/water
kΩ	2,5 ± 5 %
kΩ	8,325 10,572
kΩ	2,280 2,736
kΩ	0,288 0,359
S	≤ 15
	IP 5K9K
	M 12 x 1,5
	DIN 50 021
Nm	20
V	5 ± 0,15
	kΩ kΩ kΩ s

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 0.51.0 mm²	AMP 929 939-3
Contact pins	For Ø 1.52.5 mm²	AMP 929 937-3
Individual seal	For Ø 0.51.0 mm²	1 987 280 106
Individual seal	For Ø 1.52.5 mm²	1 987 280 107

Measurement of air/liquid temperatures



Product type

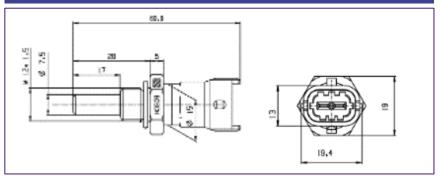
TF-W

Part number

0 280 130 093



Dimensional drawings



Technical data		
Temperature range	°C	-40 +130
Features		Sensor in brass housing.
Application/medium		Coolants, fuel, oil
Folerance at +100 °C	kΩ	0,1886 ± 2%
Rated resistance at 100 °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	0,323 0,349
emperature/time constant $ au_{63}^{1)}$	S	= 15 s
egree of protection 1)		IP 5K 9K
nread		M12 x 1,5
orrosion-tested as per		DIN EN 60068-2-11
ightening torque	Nm	20
Rated voltage	V	5 ± 1,5

Accessories		
Connector housing	2-pin	1 928 403 137
Contact pins (tin-plated)	For Ø 0.51.0 mm²	AMP 929 939 3
Contact pins (tin-plated)	For Ø 1.52.5 mm²	AMP 929 937 3
Single-wire seal	For Ø 0.51.0 mm²	AMP 828 904
Single-wire seal	For Ø 1.52.5 mm ²	AMP 828 905
Dummy plug		AMP 828 922

Measurement of air/liquid temperatures



DIN 38 52-1

 $5 \pm 0,15$

Nm

Product type

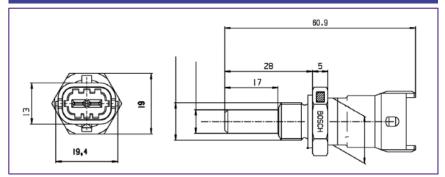
TF-W

Part number

0 281 002 170



Dimensional drawings



Technical data		
Temperature range	°C	-40 +130
Features		Sensor in brass housing.
Application/medium		Oil/water
Rated resistance at 100 °C	kΩ	0,19 ± 2 %
Resistance at -10 °C	kΩ	8,64 10,15
Resistance at +20 °C	kΩ	2,35 2,65
Resistance at +80 °C	kΩ	0,31 0,33
Temperature/time constant $\tau_{63}^{1)}$	S	≤ 15
Degree of protection 1)		IP 5K 9K
Thread		M 12 x 1,5

Corrosion-tested as per

Tightening torque

Rated voltage

Accessories 2-pin 1 928 403 137 Contact pins (gold-plated) For Ø 0.5...1.0 mm² AMP 2 929 933 Contact pins (gold-plated) For Ø 1.5...2.5 mm² AMP 2 929 933

Contact pins (gold-plated)	For Ø 0.51.0 mm ²	AMP 2 929 939 1
Contact pins (gold-plated)	For Ø 1.52.5 mm²	AMP 2 929 937 1
Single-wire seal	For Ø 0.51.0 mm²	AMP 828 904
Single-wire seal	For Ø 1.52.5 mm²	AMP 828 905
Dummy plug		AMP 828 922

¹⁾ With single-wire seal.

Measurement of air/liquid temperatures



5 ± 0.15

Product type

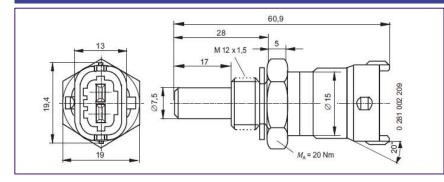
TF-W

Part number

0 281 002 209



Dimensional drawings



Technical data		
Temperature range	°C	-40 + 130
Features		Sensor in brass housing.
Application/medium		Oil/water
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 $\tau_{63}^{1)}$	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	25

٧

Rated voltage

Accessories

Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.51.0 mm ²	1 928 498 056
Contact pins	For Ø 1.52.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600

¹⁾ With single-wire seal.

Measurement of air/liquid temperatures



Product type

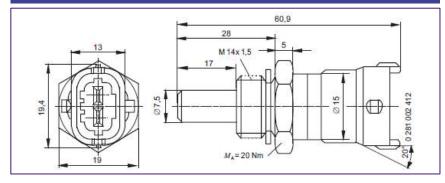
TF-W

Part number

0 281 002 412



Dimensional drawings



Technical data °C -40 ... +130 Temperature range Features Sensor in brass housing. Application/medium Oil/water Tolerance at +100 °C 0,1886 ± 2% K kΩ 2,5 ± 6 % Rated resistance at 100 °C 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

s

Nm

≤ 15

20

IP 5K 9K

M 14 x 1,5

DIN 50 021

5 ± 0.15

1) With single-wire seal.

Rated voltage

Degree of protection 1)

Corrosion-tested as per Tightening torque

Thread

Temperature/time constant $\tau_{63}^{1)}$

Accessories

Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.51.0 mm²	1 928 498 056
Contact pins	For Ø 1.52.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ²	1 928 300 600

Measurement of air/liquid temperatures



Product type

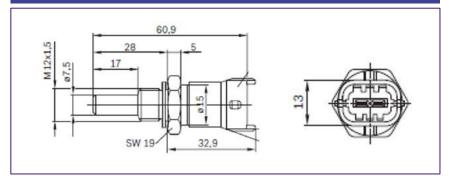
TF-W

Part number

0 281 002 704



Dimensional drawings



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 100 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,640 9,395
Resistance at +20 °C	kΩ	2,351 2,648
Resistance at +80 °C	kΩ	0,313 0,332
Temperature/time constant $\tau_{63}^{\ 1)}$	S	= 15 s
Degree of protection 1)		IP 5K 9K
Thread		M12 x 1,5
Corrosion-tested as per		DIN EN 60068-2-11
Tightening torque	Nm	20
Rated voltage	V	5 ± 1,5

Accessories

Connector housing	2-pin	1 928 403 874
Contact pins (gold-plated)	For Ø 0.51.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.52.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.51.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²	1 928 300 600

HFM with analog interface

BOSCH

- ▶ 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 meter the mass air and temperature of the intake air in motor vehicles with diesel and gasoline applications. The sensor is used to measure the air-mass flow for precise adaption of the injected fuel quantity to the current power requirement, atmospheric pressure and air temperatures

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. Without 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 laver.

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

Air mass throughput

Absolute accuracy

 $\Delta \dot{m} / \dot{m}$ Relative accuracy

Time until measurement error

Time until change in measured value 63%

HFM with analog interface



Product type

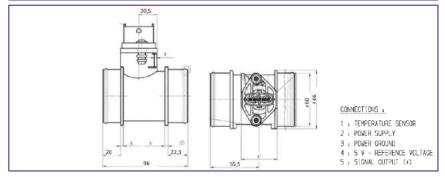
HFM-5

Part number

0 280 217 123



Dimensional drawings



Picture



Technical data

Features	With ambient-temperature sensor.	
Nominal airflow	\dot{m}_{N}	370 kg/h
Measuring range	\dot{m}_N	-15 480 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 17 V
Relative accuracy 1)	Δṁ/ṁ	± 3 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	$ au_{63}^{\ 3)}$	≤ 15 ms
Time constant	τΔ 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 | ∆ m / m | ≤ 5 %.

Air-mass characteristic curve at ambient temperature

5.0 4.5 4.0 -			 						
3.5 • 3.0 • A 2.5 • 2.0 •									
1.0									
-30 0	30 60	90 120	210 240 Luftmasse [kg	270 300	330 360	390	420 4	50 480	

Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599

HFM with analog interface



Product type

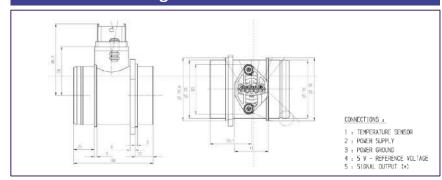
HFM-5

Part number

0 280 218 037



Dimensional drawings



Picture

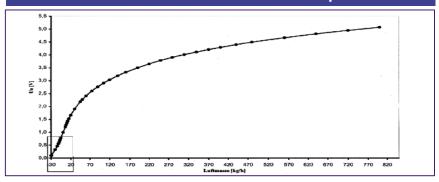
0	

Technical data

Features	With ambi	ent-temperature sensor.
Nominal airflow	\dot{m}_{N}	480 kg/h
Measuring range	\dot{m}_N	5 480 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_{V}	8 17 V
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 3 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{\rm N}$	Δρ	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	$ au_{63}^{3)}$	≤ 15 ms
Time constant	τΔ 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 | ∆ m / m | ≤ 5 %.

Air-mass characteristic curve at ambient temperature



Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

HFM with analog interface



Product type

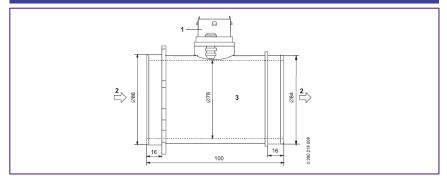
HFM-5

Part number

0 280 218 089



Dimensional drawings



Picture

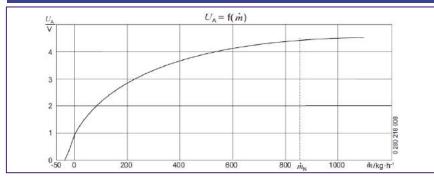


Technical data

Features	Without a	mbient-temperature sensor.
Nominal airflow	\dot{m}_{N}	850 kg/h
Measuring range	\dot{m}_N	-50 +1100 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_{V}	8 17 V
Relative accuracy ¹)	Δ <i>ṁ / ṁ</i>	± 3 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	$ au_{63}^{\ 3)}$	≤ 15 ms
Time constant	τΔ 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 | ∆ m / m | ≤ 5 %.

Air-mass characteristic curve at ambient temperature



Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599

HFM with analog interface



Product type

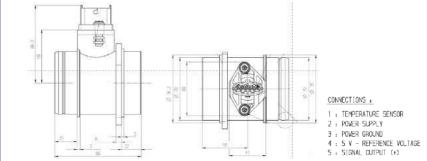
HFM-5

Part number

0 280 218 116



Dimensional drawings



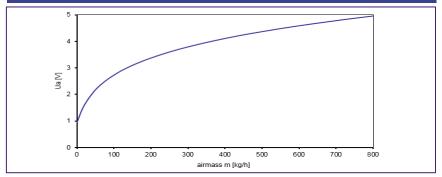
Picture

Technical data

Features	With ambi	ent-temperature sensor.
Nominal airflow	ṁ _N	480 kg/h
Measuring range	\dot{m}_N	-40 +640 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 17 V
Relative accuracy ¹)	Δ <i>ṁ / ṁ</i>	± 3 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	$ au_{63}$ 3)	≤ 15 ms
Time constant	$ au\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 | ∆ m / m | ≤ 5 %.

Air-mass characteristic curve at ambient temperature



Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

HFM with analog interface



Product type

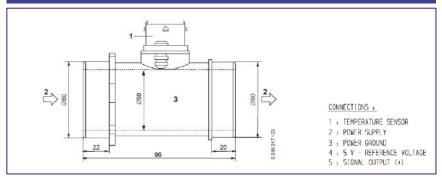
HFM-5

Part number

0 280 218 119



Dimensional drawings



Picture

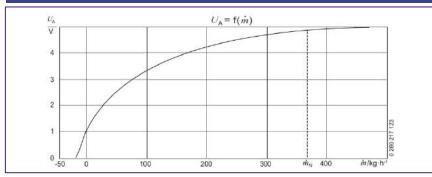


Technical data

Features	With ambi	With ambient-temperature sensor.	
Nominal airflow	$\dot{m}_{ m N}$	370 kg/h	
Measuring range	\dot{m}_N	-15 +480 kg/h	
Rated supply voltage	U _N	14 V	
Supply-voltage range	U_V	6 17 V	
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 3 %	
Temperature range ²⁾	°C	-40 +120	
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 15 hPa	
Current input	I_V	< 0,1 A	
Time constant	τ ₆₃ ³⁾	≤ 15 ms	
Time constant	τΔ 4)	≤ 30 ms	

¹⁾ for $0.04 \le \Delta \dot{m} / \dot{m} N \le 1.3$

Air-mass characteristic curve at ambient temperature



Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.51.0 mm ² ; Contents: 10 x	1 928 300 599

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 | ∆ m / m | ≤ 5 %.

HFM with analog interface



Product type

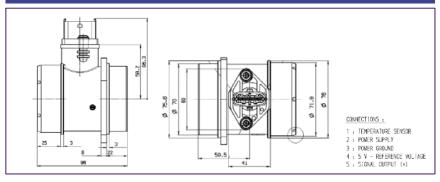
HFM-5

Part number

0 281 002 571



Dimensional drawings



Picture

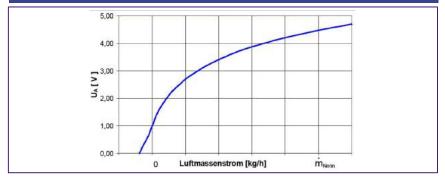


Technical data

Features	With amb	With ambient-temperature sensor.	
Nominal airflow	\dot{m}_{N}	480 kg/h	
Measuring range	ṁ _N	+8 480 kg/h	
Rated supply voltage	U_N	14 V	
Supply-voltage range	U_V	6 17 V	
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 3 %	
Temperature range ²⁾	°C	-40 +120	
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 18 hPa	
Current input	I_V	< 0,1 A	
Time constant	$\tau_{63}^{3)}$	≤ 10 ms	
Time constant	τΔ 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 | ∆ m / m | ≤ 5 %.

Air-mass characteristic curve at ambient temperature



Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

HFM with analog interface



Product type

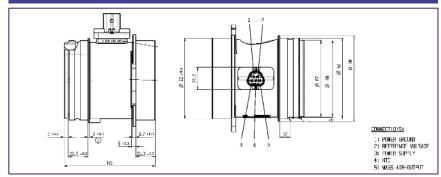
HFM-7 (analog)

Part number

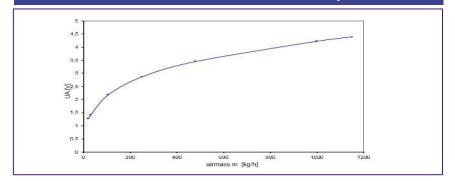
0 280 218 218



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

1 Common data		
Features	With amb	ient-temperature sensor.
Nominal airflow	\dot{m}_{N}	1050 kg/h
Measuring range	ṁ _Ν	-90 1150 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 17 V
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 2 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 10 hPa
Current input	I_V	< 0,06 A
Time constant	τ ₆₃ ³⁾	≤ 10 ms
Time constant	τΔ 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 | \(\Delay \text{ if } \text

HFM with digital interface

BOSCH

- ▶ 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



Application

The air-mass sensor (HFM) is designed to meter the mass air and temperature of the intake air in motor vehicles with diesel and gasoline applications. The sensor is used to measure the air-mass flow for precise adaption of the injected fuel quantity to the current power requirement, atmospheric pressure and air temperatures

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. Without 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 laver.

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

Air mass throughput

Absolute accuracy

 $\Delta \dot{m} / \dot{m}$ Relative accuracy

Time until measurement error

Time until change in measured value 63%

HFM with digital interface



Product type

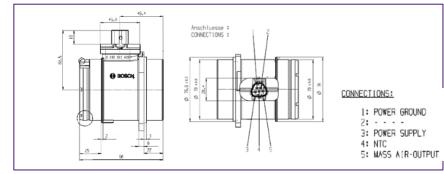
HFM-7

Part number

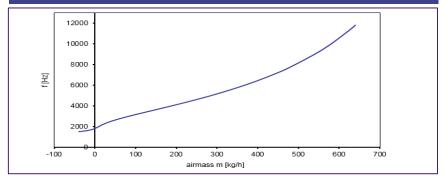
0 280 218 225



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data			
Features	With amb	With ambient-temperature sensor.	
Nominal airflow	ṁ _N	480 kg/h	
Measuring range	\dot{m}_N	-40 620 kg/h	
Rated supply voltage	U_N	14 V	
Supply-voltage range	U_{V}	6 17 V	
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 5 %	
Temperature range ²⁾	°C	-40 +120	
Pressure drop at $\dot{m}_{\rm N}$	Δρ	< 12 hPa	
Current input	I_V	< 0,06 A	
Time constant	τ ₆₃ ³⁾	≤ 10 ms	
Time constant	τΔ 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 | Δ m / m | ≤ 5 %.

HFM with digital interface



Product type

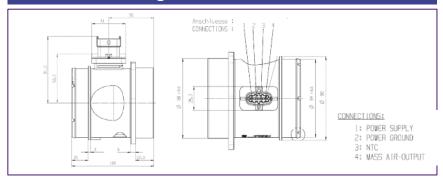
HFM-7

Part number

0 280 218 416



Dimensional drawings

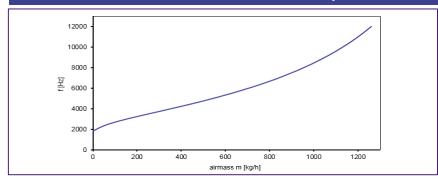


Technical data

1 0 0 11111 0 011 0 131 0 0 1		
Features	With ambient-temperature sensor.	
Nominal airflow	\dot{m}_{N}	850 kg/h
Measuring range	\dot{m}_N	-90 1150 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_{v}	6 17 V
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 5 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{\rm N}$	Δρ	< 12 hPa
Current input	I_V	< 0,06 A
Time constant	$ au_{63}$ 3)	≤ 10 ms
Time constant	$ au\Delta$ 4)	≤ 30 ms

¹⁾ for $0.04 \le \Delta \dot{m} / \dot{m} N \le 1.3$

Air-mass characteristic curve at ambient temperature



Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm ² ; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm ² ; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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 | ∆ m / m | ≤ 5 %.

HFM with digital interface



Product type

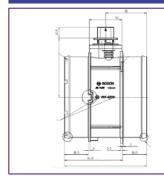
HFM-7

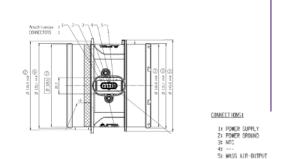
Part number

0 281 006 275



Dimensional drawings





Technical data

Features	With amb	With ambient-temperature sensor.	
Nominal airflow	\dot{m}_{N}	2300 kg/h	
Measuring range	\dot{m}_N	-140 2900 kg/h	
Rated supply voltage	U_N	14 V	
Supply-voltage range	U_V	6 17 V	
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 5 %	
Temperature range ²⁾	°C	-40 +120	
Pressure drop at $\dot{m}_{ m N}$	Δρ	< 15 hPa	
Current input	I_V	< 0,08 A	
Time constant	$ au_{63}^{\ 3)}$	≤ 10 ms	
Time constant	τΔ 4)	≤ 30 ms	

¹⁾ for $0.04 \le \Delta \dot{m} / \dot{m} N \le 1.3$

Air-mass characteristic curve at ambient temperature

Due to the replacement concept of the HFM plug-in, it has to be calibrated individually, w/o cylinder housing. Since these characteristic curves depend on the specific layout of the air intake system, no characteristic curves of the assembly can be given here.

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins	For Ø 0.51.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.52.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.51.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.52.5 mm ² ; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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 | ∆ m / m | ≤ 5 %.

HFM with digital interface



Product type

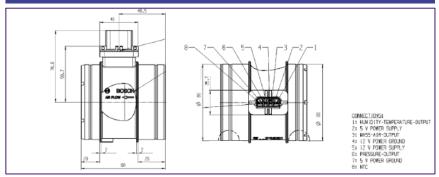
HFM-7-IPH

Part number

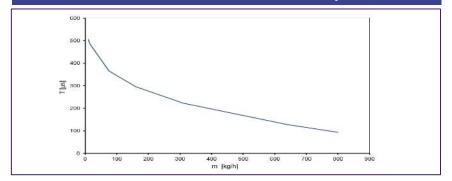
0 281 006 426



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data			
Features		With integrated pressure, humidity and ambient-temperature sensor.	
Nominal airflow	$\dot{m}_{ m N}$	640 kg/h	
Measuring range airflow	\dot{m}_N	-40 800 kg/h	
Measuring range pressure	kPa	12,5 115	
Measuring range humidity	%rH	10 90	
Rated supply voltage	U_N	14 V	
Supply-voltage range	U_{V}	6 17 V	
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 5 %	
Temperature range ²⁾	°C	-40 +120	
Pressure drop at $\dot{m}_{\rm N}$	Δρ	< 12 hPa	
Current input	I_V	< 0,06 A	
Time constant	$ au_{63}^{3)}$	≤ 25 ms	
Time constant	τ Δ 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 | ∆ m / m | ≤ 5 %.

HFM with digital interface



Product type

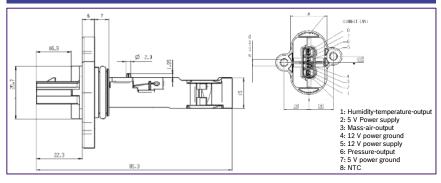
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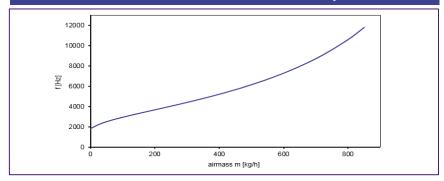
0 280 218 419



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data With integrated pressure, humidity and Features ambient-temperature sensor. Nominal airflow 640 kg/h $\dot{m}_{\rm N}$ Measuring range airflow \dot{m}_N -60 ... 800 kg/h kPa 12,5 ... 115 Measuring range pressure Measuring range humidity %rH 10 ... 90 Rated supply voltage U_N 14 V Supply-voltage range U_{ν} 6 ... 17 V Relative accuracy 1) $\Delta \dot{m} / \dot{m}$ ±5% Temperature range 2) °C -40 ... +120 Pressure drop at $\dot{m}_{\rm N}$ Δp depending on size and design of cross section area

Current input

Time constant

Time constant

< 0,06 A

≤ 25 ms

≤ 80 ms

I_V τ₆₃ 3)

τΔ 4)

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 | ∆ m / m | ≤ 5 %.

HFM with digital interface



Product type

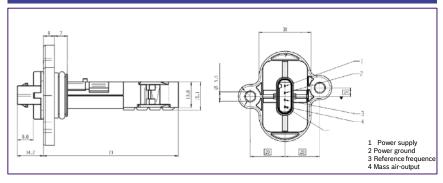
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Part number

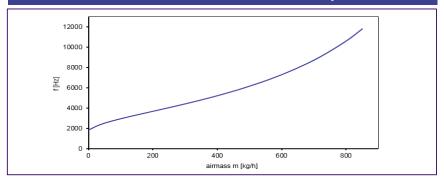
0 281 006 069



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

recinical data		
Features	With ambient-temperature sensor.	
Nominal airflow	\dot{m}_{N}	640 kg/h
Measuring range	\dot{m}_N	-60 800 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_{V}	6 17 V
Relative accuracy 1)	Δ <i>ṁ / ṁ</i>	± 5 %
Temperature range ²⁾	°C	-40 +120
Pressure drop at $\dot{m}_{\rm N}$	Δρ	depending on size and design of cross section area
Current input	I_V	< 0,06 A
Time constant	τ ₆₃ ³⁾	≤ 25 ms
Time constant	$ au\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 | \(\Delay \) in / in | \(\leq 5 \) %.

HFM with digital interface



Product type

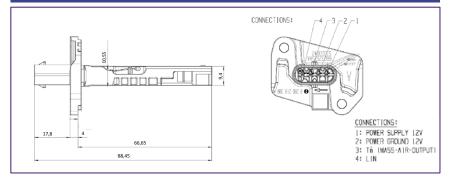
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Part number

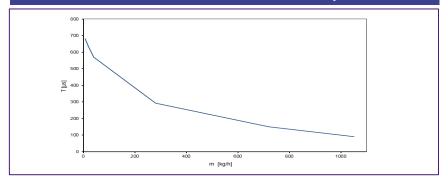
0 280 218 399



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data With integrated pressure, humidity and **Features** ambient-temperature sensor. Nominal airflow 640 kg/h $\dot{m}_{\rm N}$ Measuring range airflow \dot{m}_N -60 ... 1150 kg/h kPa 10 ... 125 Measuring range pressure Measuring range humidity %rH 0 ... 100 Rated supply voltage U_N 5 V Supply-voltage range U_{ν} 4,85 ... 5,15 V Relative accuracy 1) $\Delta \dot{m} / \dot{m}$ ±5% Temperature range 2) °C -40 ... +140 depending on size and Pressure drop at $\dot{m}_{\rm N}$ Δp design of cross section area < 0,06 A Current input I_V $au_{63}^{3)}$ Time constant ≤ 10 ms

Time constant

τΔ 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 | ∆ m / m | ≤ 5 %.

HFM with digital interface



Product type

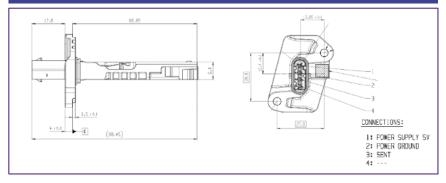
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Part number

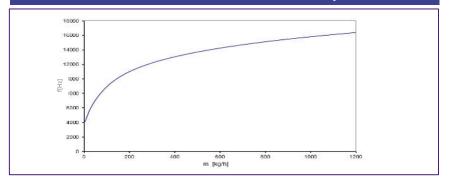
0 281 006 812



Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data With integrated humidity and ambient-**Features** temperature sensor. Nominal airflow 640 kg/h $\dot{m}_{\rm N}$ Measuring range airflow \dot{m}_N -60 ... 1200 kg/h Measuring range humidity %rH 0 ... 100 Rated supply voltage U_N 5 V Supply-voltage range U_{ν} 4,85 ... 5,15 V Relative accuracy 1) $\Delta \dot{m} / \dot{m}$ ±5% Temperature range 2) °C -40 ... +130 depending on size and Pressure drop at $\dot{m}_{\rm N}$ Δp design of cross section area

 I_V

 $\tau_{63}^{3)}$

τΔ 4)

< 0,06 A

≤ 10 ms

≤ 30 ms

1) for $0.04 \le \Delta \dot{m} / \dot{m} N \le 1.3$

Current input

Time constant

Time constant

- 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 | ∆ m / m | ≤ 5 %.

9.1 Lambda sensors

Type LSU 4.9 (wideband)



- The wideband Lambda sensor LSU is a planar ZrO₂ 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 $\lambda = 0.65$ to air, it is universally applicable for $\lambda = 1$ and for other λ ranges.



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 ZrO₂ 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. AWS. 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.

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, 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.

Explanation of characteristics quantities

λ Air ratio

U_N Nernst voltage

U_p Variable pump voltage



9.1 Lambda sensors

Type LSU 4.9 (wideband)



Product type

LSU-4.9

Part number

0 258 017 025

Picture

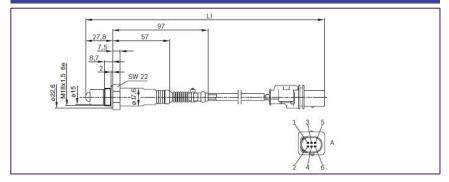


Technical data

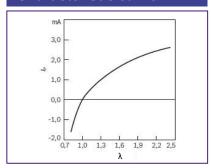
Due to the complexity of this product a detailed technical product Description is available. Please request it at:

bosch.lambdasonde@de.bosch.com

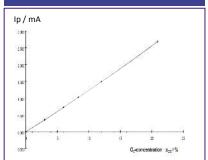
Dimensional drawings



Characteristic curve



Characteristic curve



Accessories

Mating connector parts set Connector housing, contacts, grommet 1 986 280 016

9.2 Lambda sensors

Type LSF4 (narrow band)

BOSCH

compared to the wideband lambda sensor LSU4.9 the narrow band LSF4 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
- Lean combustion engines

Industrial processes

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

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

Design and Application

The LSF4 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 Measurement and analysis processes 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 ³ 350 °C. The integrated heater ensures that the sensor functions at exhaust-gas temperatures as low as 150 °C. Since this sensor's ceramic temperature is determined by the electrical heating at low engine loads (i.e. low exhaust-gas temperatures), this means that it can also be installed in the exhaust system at a point remote from the engine.

The electrical sensor heating means that the exhaust-gas temperature's influence on the sensor-ceramic temperature, and therefore upon the temperature-dependent sensor functions, are considerably reduced. 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.

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,
- submersible.
- low heater rating.
- resistant to coating and poisoning,
- stable control characteristic,
- short switch-on time.

9.2 Lambda sensors

Type LSF4 (narrow band)



Product type

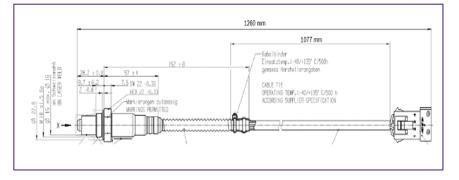
LSF-4

Part number

0 258 006 026

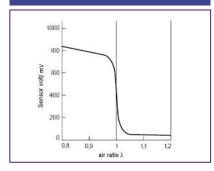


Dimensional drawing



Technical data Measuring range of lambda 0,97 ... 1,10 Sensor voltage at lambda = 0,97 800 ± 55 mV Sensor voltage at lambda = 1,10 50 ± 30 mV Internal resistance ≤ 0,5 kΩ Response time (600mV ... 300mV) < 125 ms Response time (300mV ... 600mV) < 60 ms $0.48 \pm 0.1 \text{ A}$ Heater current Heater power (with 13V heater voltage) 7 W Heater nominal voltage supply 12 V 350°C 930°C Exhaust gas temperature

Characteristic curve



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