Sensors

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

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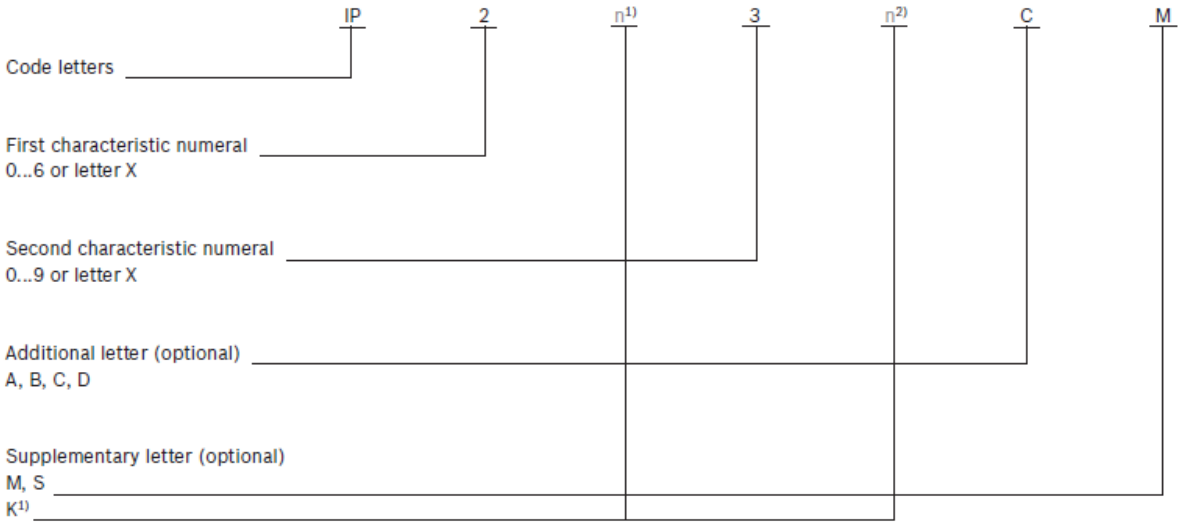
Content
(Press buttons for more information)

Sensor IP degrees

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

- ► Protection of the electrical equipment inside the enclosure against the 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.

Structure of the IP code



If a characteristic numeral is not given, it must be superseded by the letter “X” (i. e. “XX” if both characteristic numerals are not given).
The supplementary and/or additional letters can be omitted at will, and need not be superseded by other letters.

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

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

► Product groups

0 General Information

Sensor IP codes

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

► 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 transmis-sion 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 unoccu-pied. 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 transmis-sion 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.

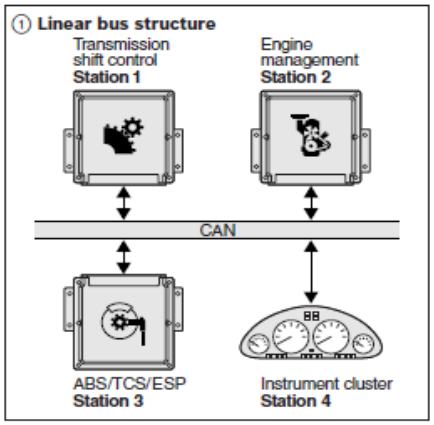
“CRC field”
(Cyclic Redundancy Check) contains the check word for detecting possible transmission interference.

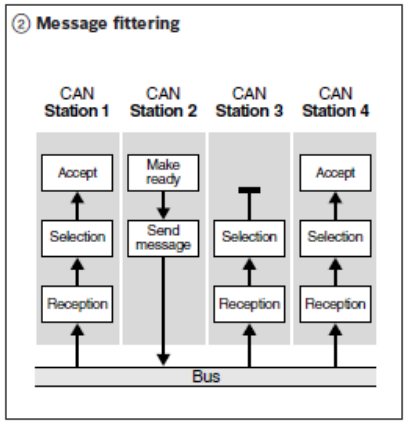
“Ack field”
contains the acknowledgement signals with which all receivers indicate receipt of non-corrupted messages.

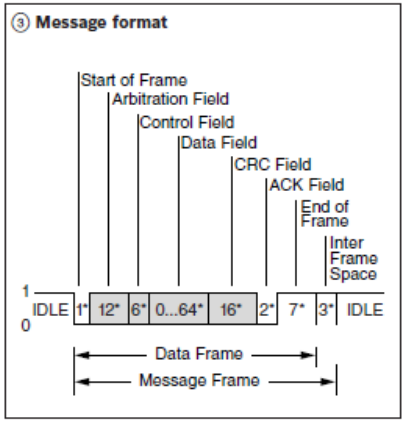
“End of frame”
marks the end of the message.

► Product groups

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 imple-mentations 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 de-mands placed on the ECU’s pro-cessing 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.

► Product groups

CE-Identification and manufacturer declaration with EU directive

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

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

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

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.

► Product groups

1.1 Angular-position sensors

Steering angle sensor

Product type

LWS 7.3.6

Part number

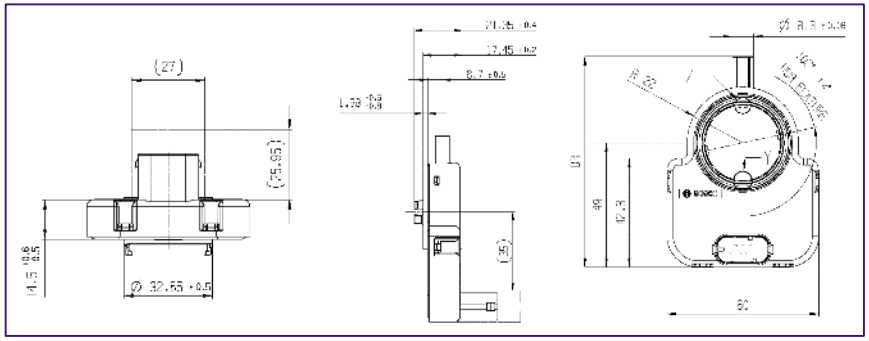
0 265 019 136

Picture

Technical data

Operating voltage	7 to 16 V	
Reverse voltage protection	up to -13,5 V	
Current consumption at 12V at CAN load resistance 60 Ω	< 150 mA	
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	

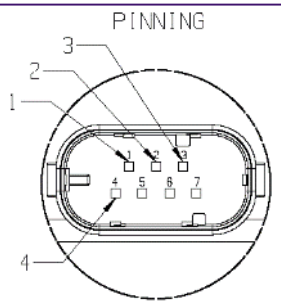
Dimensional drawings



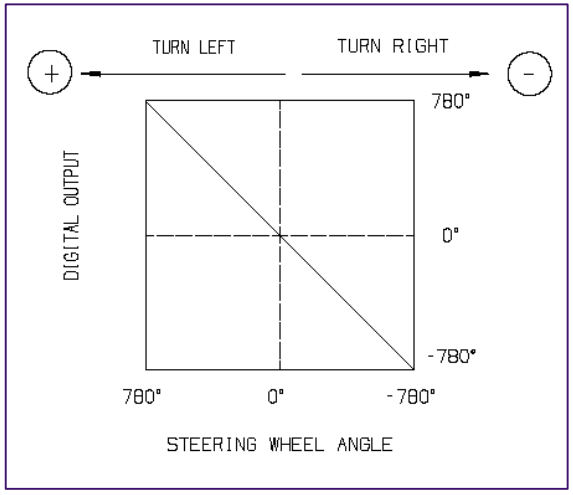
Pinning

PINNING

PIN NO.	SIGNAL
1	GND
2	12V
3	CAN HIGH
4	CAN LOW



Output definition

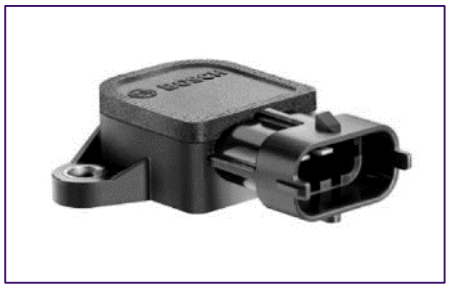


► Product groups

1.2 Angular-position sensors

Throttle valve angle sensor

- ► 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_A	Output voltage
U_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

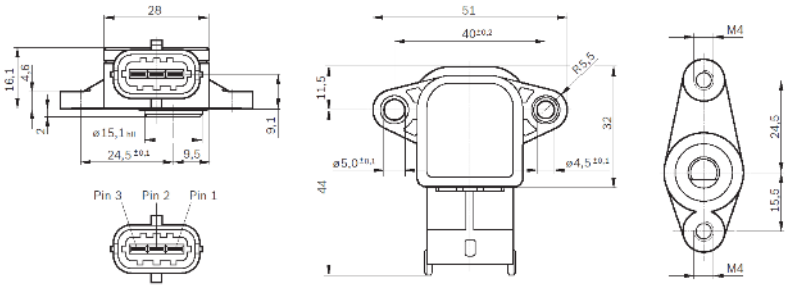
0 280 122 024

Picture

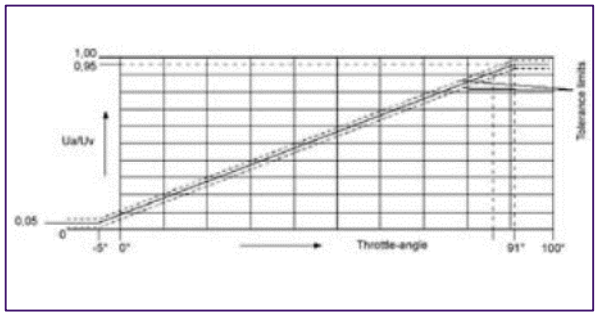
Technical data

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)	Ω	710 ... 1380
Operating voltage U_V	V	5
Load		5 Ohmic res.
Permissible wiper current	µA	≤ 10
Voltage ratio from stop to stop – characteristic curve 1		0,05 = UA / UV = 0,95
Slope of nominal characteristic curve	deg^{-1}	0,009375
Operating temperature		- 40 °C ...+ 130 °C
Approximate value for permissible vibration acceleration	m/s^2	≤ 800
Service life (rotary cycles)	Mill.	2

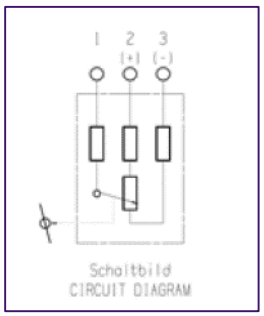
Dimensional drawings



Characteristic curve



Circuit diagram



► Product groups

2 Battery sensing

Electronic battery sensor

- ► 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

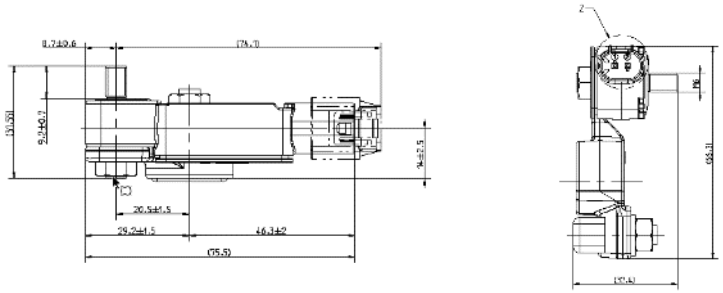
EBS3.AA

Part number

0 199 300 057

Picture

Dimensional drawings



Technical data

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	A	200
Resolution (nominal A)	mA	0,5
Relative error		± 1 %
Temperature		
Measuring range		- 40 °C ...+ 125 °C
Update rate	s	60
Tolerance	K	< ± 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 substances)

► Product groups

3 Inertial sensor

Inertial sensor with CAN interface

- ► 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

► Product groups

3 Inertial sensor

3-dimensional sensor with CAN interface

Product type

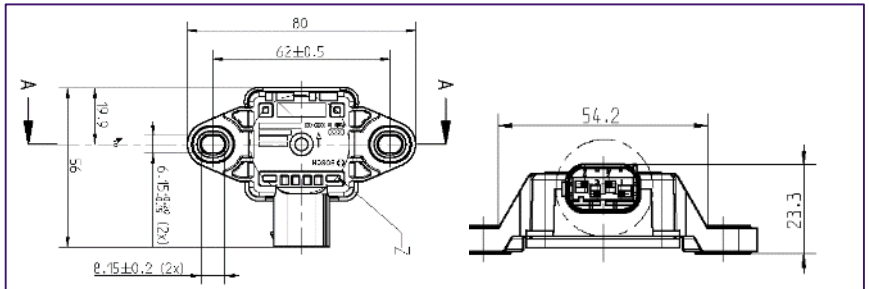
MM7.zC

Part number

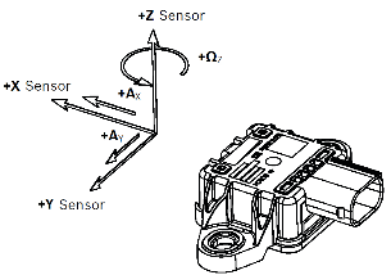
0 265 005 955

Picture

Dimensional drawings



Available axis



Pin connection

PIN CONFIGURATION Steckerbelegung	
PIN 1	GND
PIN 2	CANL
PIN 3	CANH
PIN 4	UBAT

Technical data

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
CAN Interface		in acc. with ISO 11898

► Product groups

3 Inertial sensor

5-dimensional sensor with CAN interface

Product type

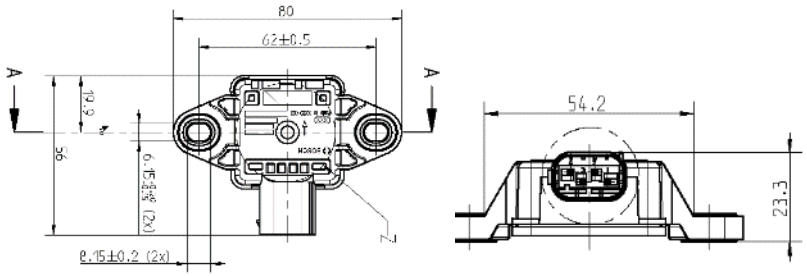
MM5.10

Part number

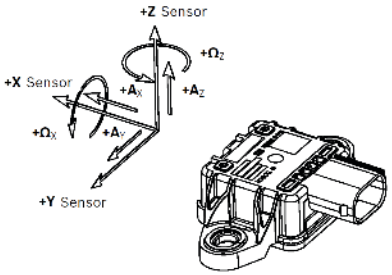
F 037 000 002

Picture

Dimensional drawings



Available axis



Pin connection

PIN CONFIGURATION Steckerbelegung	
PIN 1	GND
PIN 2	CANL
PIN 3	CANH
PIN 4	UBAT

Technical data

Sensing axes		
	(Ωz), min/max values	Longitudinal acceleration sensor (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	≤ ±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

► Product groups

4.1 Rotational-speed sensors

Hall speed sensor

- ► 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 non-contacting 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 load-independent 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_V	Max. output voltage at LOW with
I_A	output current = 20 mA.
I_V	Supply current for Hall sensor.
t_f	Fall time (trailing signal edge).
T_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).

► Product groups

4 Rotational-speed sensors

Hall speed sensor

Product type

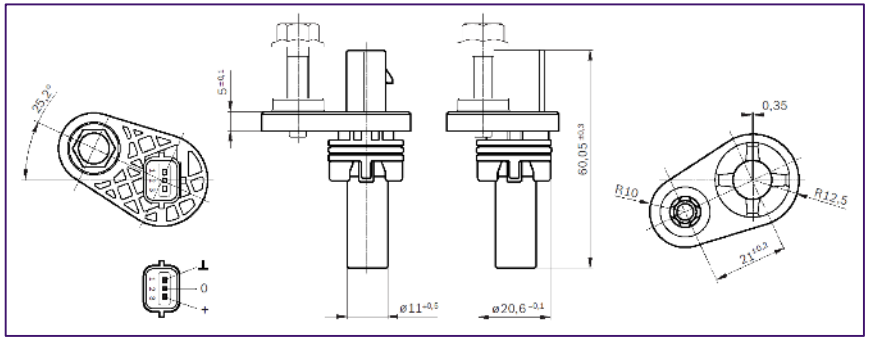
DG-23

Part number

0 261 210 303

Picture

Dimensional drawings



Technical data

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	4,5 ...18V
Supply current	I_V	Typically 6.7
Output current	I_A	0 ... 20 mA
Output saturation voltage	U_s	≤ 0,5 V
Switching time	t_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

µA) 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.

► Product groups

Hall speed sensor

Product type

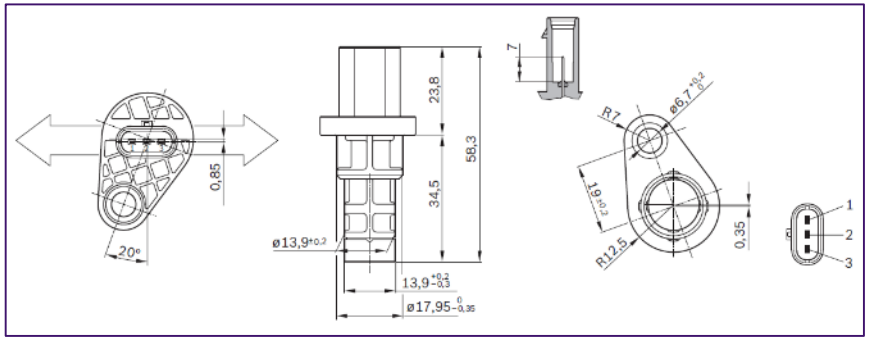
DG-23-I

Part number

0 261 210 318

Picture

Dimensional drawings



Technical 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	4,5...5,5 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	t_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.

► Product groups

4 Rotational-speed sensors

Hall speed sensor

Product type

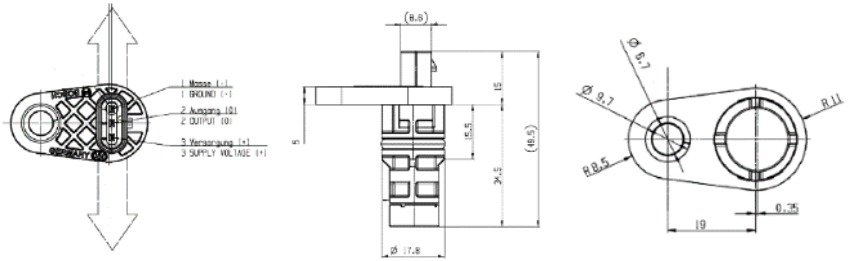
DG-23-I

Part number

0 261 210 325

Picture

Dimensional drawings



Technical 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	4,75...5,25 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_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.

► Product groups

Hall speed sensor

Product type

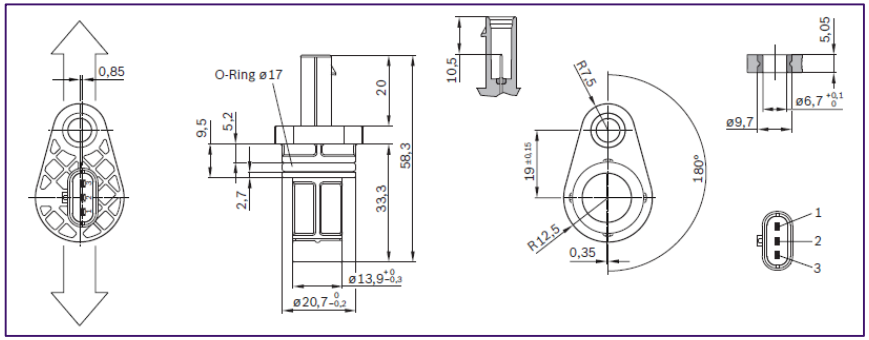
DG-23-I

Part number

0 261 210 385

Picture

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	4,5...18V
Supply current	I_V	Typically 10 mA
Output current	I_A	0 ... 20 mA
Output saturation voltage	U_s	≤ 0,5 V
Switching time	t_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.

► Product groups

Hall speed sensor

Product type

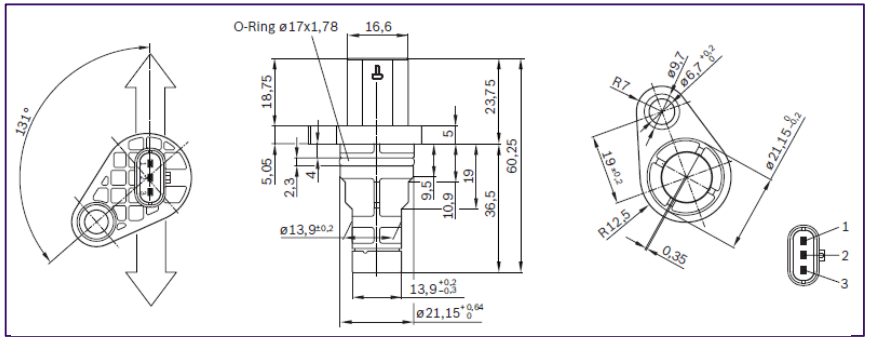
DG-23-I

Part number

0 281 006 101

Picture

Dimensional drawings



Technical 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	4,5...18 V
Supply current	I_V	Typically 10 mA
Output current	I_A	0 ... 20 mA
Output saturation voltage	U_s	≤ 0,5 V
Switching time	t_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.

► Product groups

4 Rotational-speed sensors

Hall speed sensor

Product group

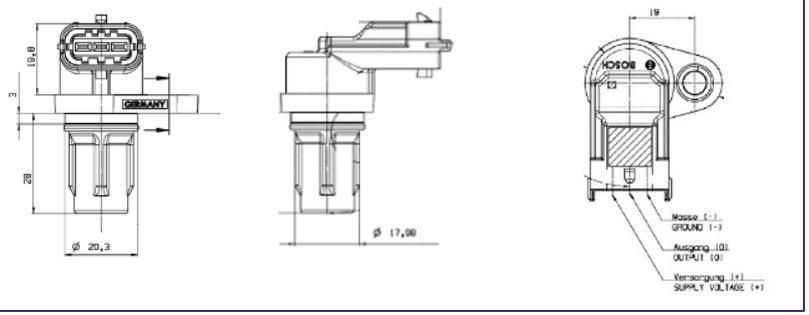
PG-3-8

Part number

0 232 103 048

Picture

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_V	4,5 ...16V
Supply current	I_V	Typically 5.6
Output current	I_A	0 ... 20 mA
Output saturation voltage	U_s	≤ 0,5 V
Switching time	t_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 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

Hall speed sensor

Product group

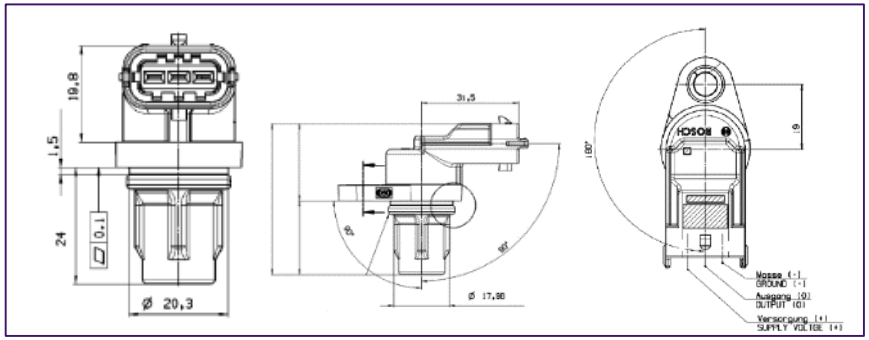
PG-3-8

Part number

0 232 103 063

Picture

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_V	4,5 ...16V
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	t_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 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

Hall speed sensor

Product group

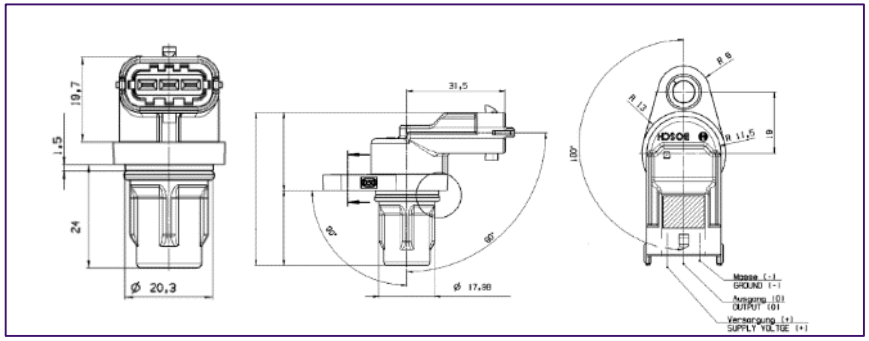
PG-3-8

Part number

0 232 103 067

Picture

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_V	4,5 ...16V
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	t_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 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

Hall speed sensor

Product group

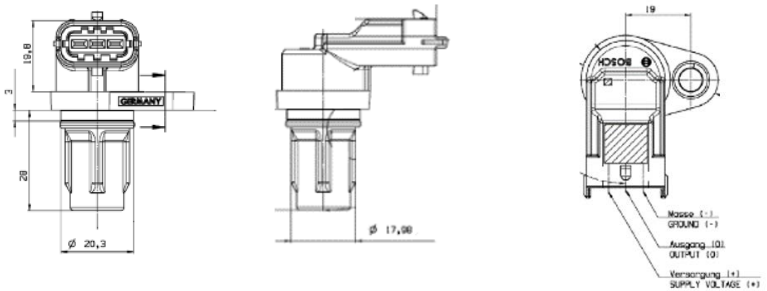
PG-3-8

Part number

0 232 103 097

Picture

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_V	4,5 ...16V
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	t_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 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins (gold plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

Hall speed sensor

Product type

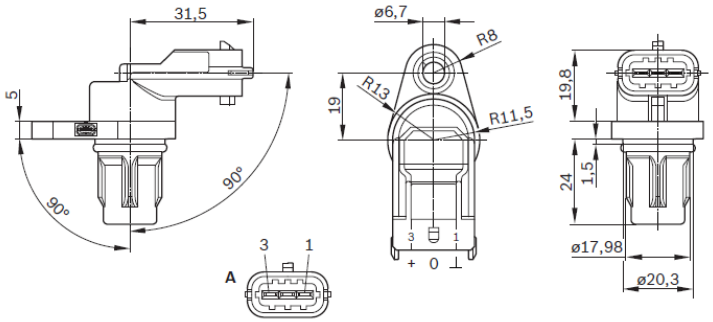
PG-3-8

Part number

0 281 002 667

Picture

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_V	4,75 ...18V
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	t_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 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

Hall speed sensor

Product group

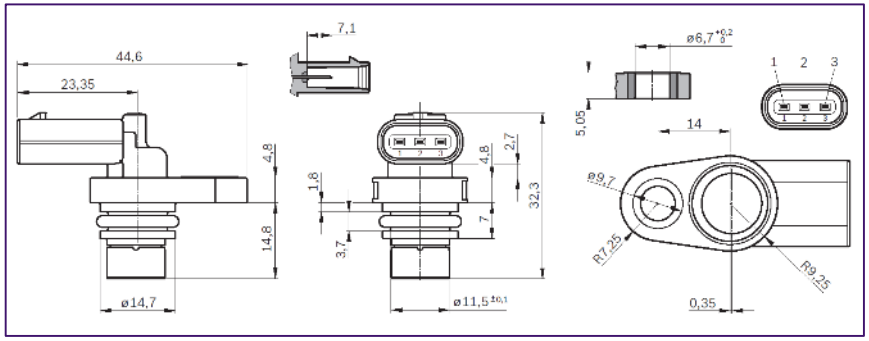
PG-3-9

Part number

0 232 103 099

Picture

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_V	4,75 ...18V
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_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

µA) 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.

► Product groups

Hall speed sensor

Product group

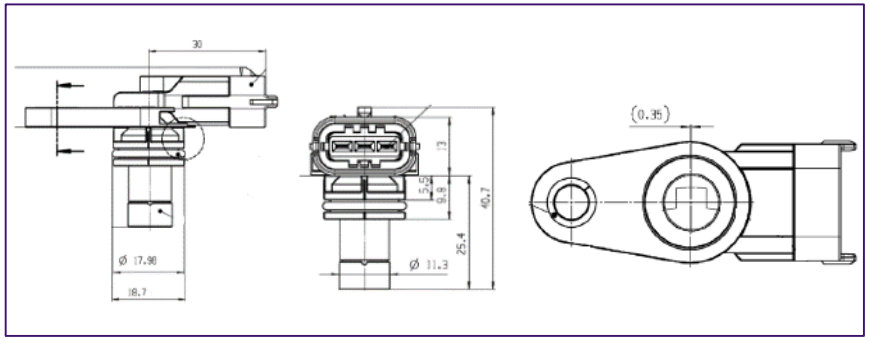
PG-3-9

Part number

0 232 103 122

Picture

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_V	4,75 ...18V
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_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...+130°C

µA) 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 0.5...1.0 mm²; Contents: 100 x	1 928 498 058
Contact pins (silver plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 059
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

4.2 Rotational-speed sensors

Inductive speed sensor

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

Application

Inductive speed sensors of this type are suitable for a variety of speed recording applications. Depending on design, they use completely non-contacting and wear-free methods to measure engine speeds 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).

► Product groups

Inductive speed sensor

Product group

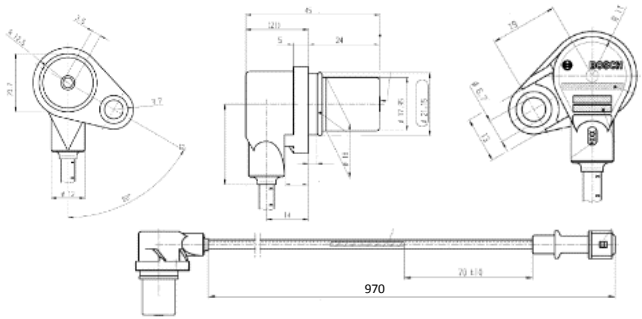
DG-6-K

Part number

0 261 210 128

Picture

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

Accessories

Connector housing	3-pin	1 280 703 022
Contact pins	For Ø 0.5...1.0 mm²	AMP 925 590 2
Contact pins	For Ø 1.5...2.5 mm²	AMP 925 595 2

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

► Product groups

4 Rotational-speed sensors

Inductive speed sensor

Product group

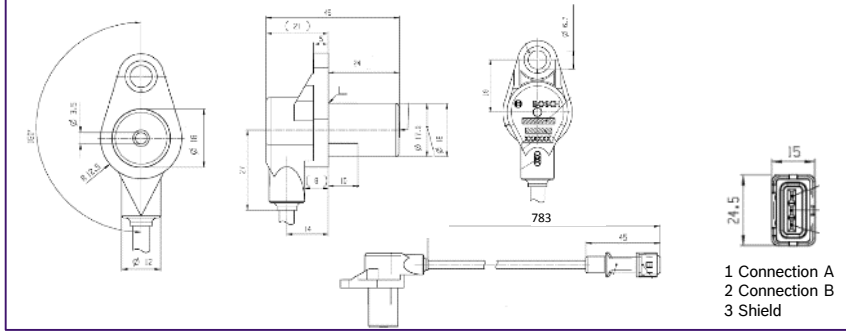
DG-6-K

Part number

0 261 210 361

Picture

Dimensional drawings



1 Connection A
2 Connection B
3 Shield

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

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
Dummy plug		AMP 828 922

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

► Product groups

Inductive speed sensor

Product group

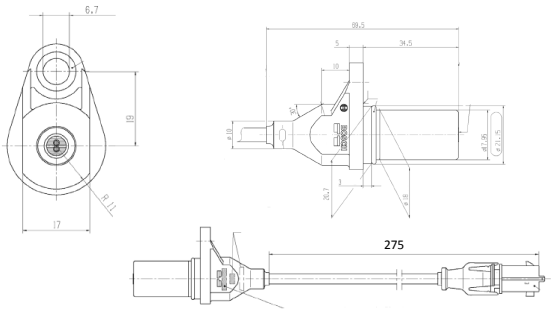
DG-6-K

Part number

0 281 002 629

Picture

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

Accessories

Connector housing	3-pin	1 928 404 073
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
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.

► Product groups

Inductive speed sensor

Product group

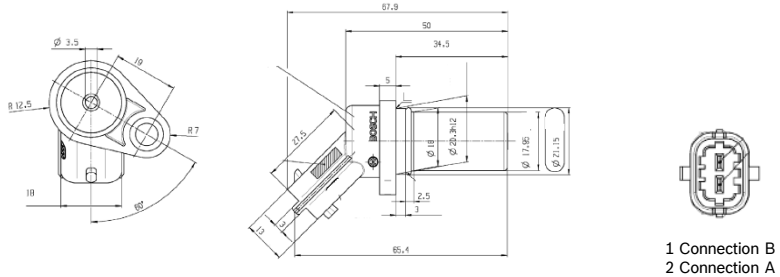
DG-6-S

Part number

0 281 002 315

Picture

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

Accessories

Connector housing	2-pin	1 928 404 072
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

5 Structure-borne sound

Piezoelectric vibration sensor

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

Application

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

Areas of application

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

Design and operation

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

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.

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

KS-4-K

Part number

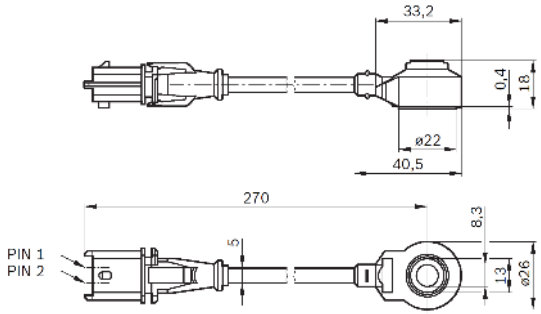
0 261 231 196

Picture

Technical data

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

Dimensional drawings



Accessories

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

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

► Product groups

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

KS-4-K

Part number

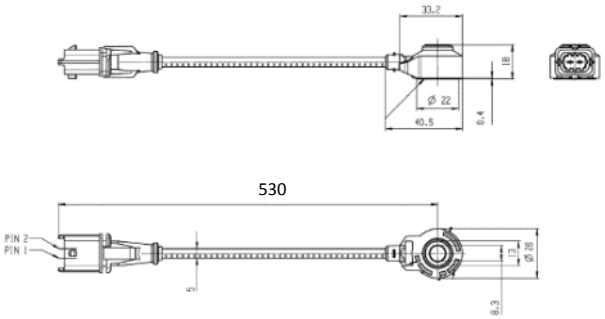
0 261 231 218

Picture

Technical data

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

Dimensional drawings



Accessories

Connector housing	2-pin	1 928 403 137

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

► Product groups

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

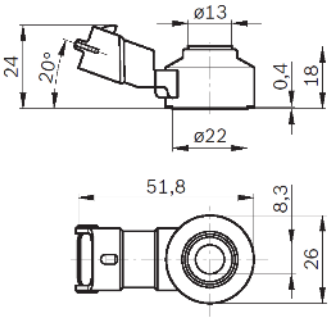
KS-4-S

Part number

0 261 231 173

Picture

Dimensional drawings



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

Accessories

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

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

► Product groups

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

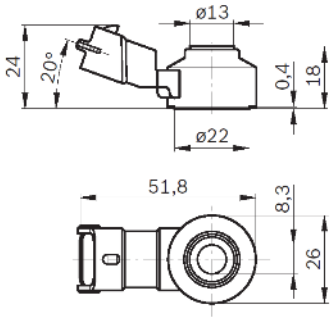
KS-4-S

Part number

0 261 231 176

Picture

Dimensional drawings



Technical data

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

Accessories

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

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

► Product groups

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

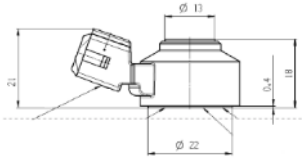
KS-4-S

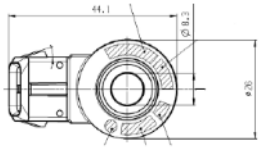
Part number

0 261 231 208

Picture

Dimensional drawings





Technical data

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

Accessories

Connector housing	2-pin	1 284 485 070

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

► Product groups

5 Acceleration sensors

Piezoelectric vibration sensor

Product type

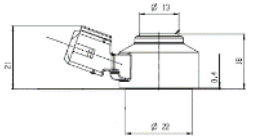
KS-4-S

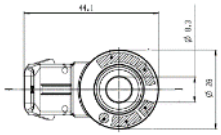
Part number

0 261 231 300

Picture

Dimensional drawings





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

Accessories

Connector housing	2-pin	1 928 402 070

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

► Product groups

6.1 Pressure sensors

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

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

Installation instructions

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

6.1 Pressure sensors

Differential pressure sensor

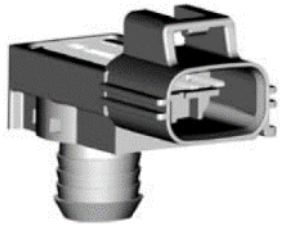
Product type

DS-D2

Part number

0 261 230 121

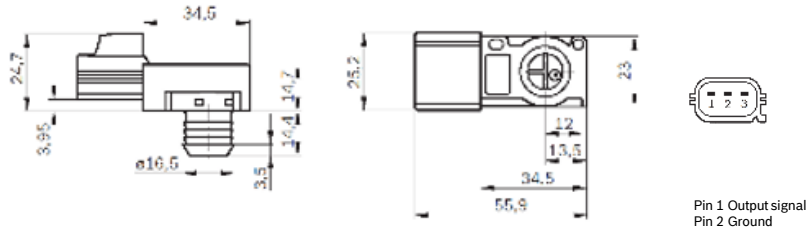
Picture



Technical data

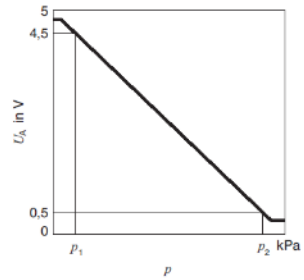
Parameter			min.	type	Max.
Pressure measuring range (p_1...p_2)	p_e	kPa	-100		0
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage U_V	U_V	V	4,75	5	5,25
Current input at U_V = 5 V	I_V	mA	6,0	9,0	12,5
Load current at output	I_L	mA	-1,0		0,5
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10		
Response time	$\tau_{10/90}$	ms			1
Voltage limitation at U_V = 5 V – lower limit	$U_{A\,min}$	V	0,25	0,3	0,35
Voltage limitation at U_V = 5 V – upper limit	$U_{A\,max}$	V	4,75	4,8	4,85
Limit data					
Supply voltage	U_V	V			16
Pressure	p_e	kPa	-500		+500
Storage temperature	v_L	°C	-40		+130

Dimensional drawings



Pin 1 Output signal
Pin 2 Ground
Pin 3 +5 V

Characteristic curve



Accessories

Connector housing	3-pin	Yazaki number	7283-5880-10[1)]
Contact pins	For Ø 0.35...0.5 mm²	Yazaki number	7116-4102-02[1)]
Contact pins	For Ø 0.75...1.0 mm²	Yazaki number	7116-4102-03[1)]
Single-wire seal	For Ø 0.35...0.5 mm²	Yazaki number	7158-3030-50[1)]
Single-wire seal	For Ø 0.75...1.0 mm²	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.

► Product groups

6.1 Pressure sensors

Differential pressure sensor

Product type

DS-D2

Part number

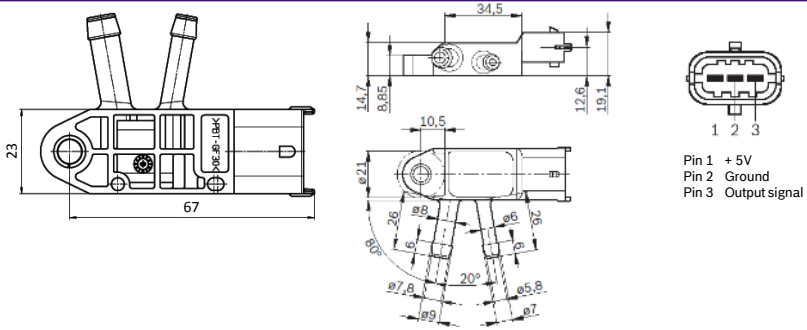
0 281 002 772

Picture

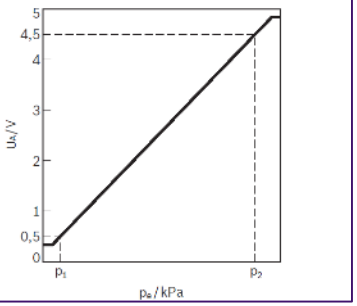
Technical data

Parameter			min	max
Pressure measuring range (U_{AA}...p_2)	p_e	kPa	0	100
Operating temperature	ϑ_B	°C	-40	+130
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5	680
Limit data				
Pressure	p_e	kPa	-350	+350
Storage temperature	v_L	°C	-40	+130

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 966
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

6.1 Pressure sensors

Differential pressure sensor

Product type

DS-D2

Part number

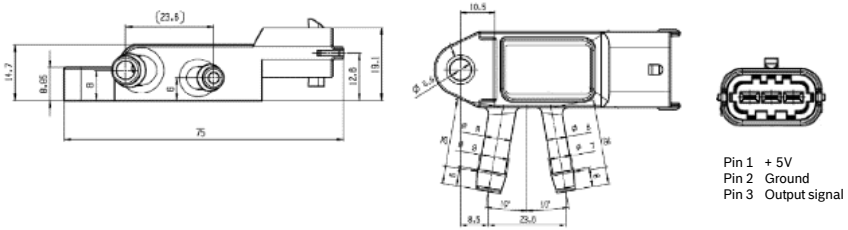
0 281 006 207

Picture

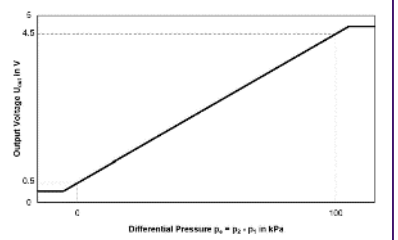
Technical data

Parameter			min	max
Pressure measuring range (U_{AA}...p_2)	p_e	kPa	0	100
Operating temperature	ϑ_B	°C	-40	+130
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5	68
Limit data				
Pressure	p_e	kPa	-350	+350
Storage temperature	v_L	°C	-40	+130

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 966
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

6.1 Pressure sensors

Differential pressure sensor

Product type

DS-K-TF

Part number

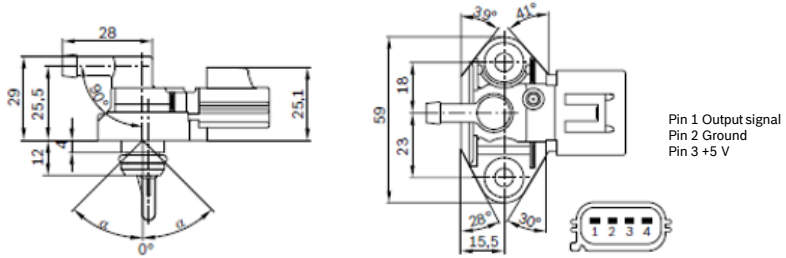
0 261 230 093

Picture

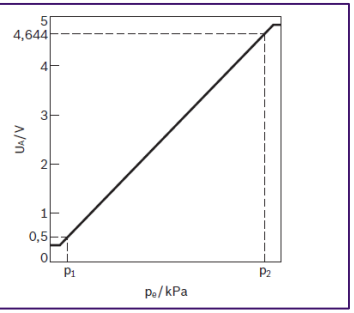
Technical data

Parameter			min	max
Features			Integrated temperature sensor	
Pressure measuring range (U_{AA}...p_2)	p_e	kPa	0	500
Operating temperature	ϑ_B	°C	-40	+125
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	4,7	
Limit data				
Pressure	p_e	kPa	+3000	
Storage temperature	v_L	°C	+130	

Dimensional drawings



Characteristic curve



Accessories

Connector housing	4-pin	Yazaki number	7283-5886-30[1)]
Contact pins	For Ø 0.35...0.5 mm²	Yazaki number	7116-4102-08[1)]
Contact pins	For Ø 0.75...1.0 mm²	Yazaki number	7116-4103-08[1)]
Single-wire seal	For Ø 0.35...0.5 mm²	Yazaki number	7158-3030-50[1)]
Single-wire seal	For Ø 0.75...1.0 mm²	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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-T3

Part number

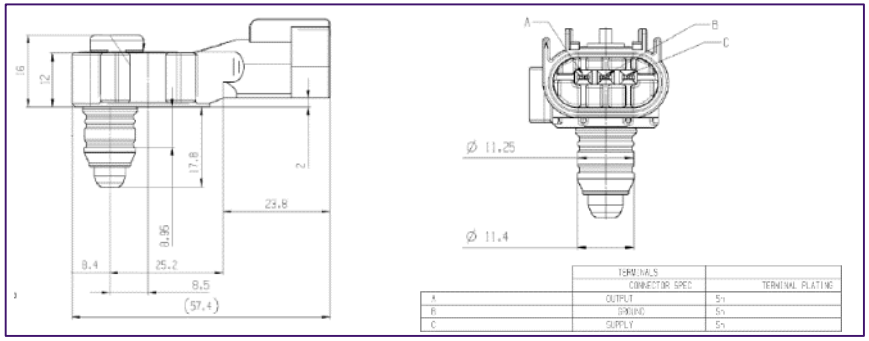
0 261 230 162

Picture

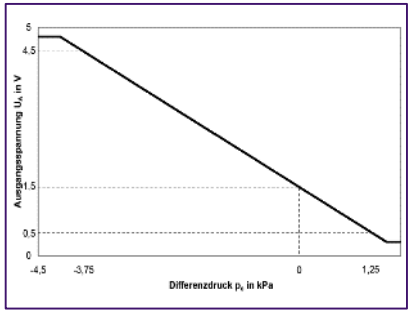
Technical data

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

Dimensional drawings



Characteristic curve



► Product groups

6.2 Pressure sensors

Absolute pressure sensors

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

Application

The sensor is used to measure the absolute intake-manifold or boost pressure. 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 intake-manifold, exhaust gas or exhaust gas condensate, however, may affect the sensor lifetime.

Explanation of characteristic data

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

Installation 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.).

6.2 Pressure sensors

Absolute pressure sensors

Product type

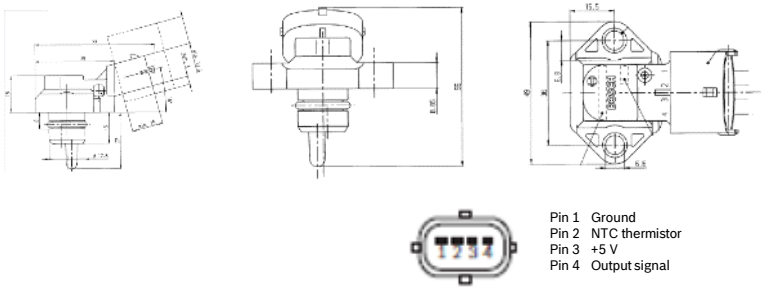
DS-S1-TF

Part number

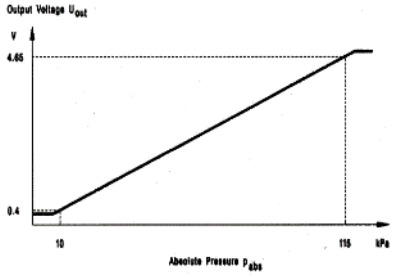
0 261 230 022

Picture

Dimensional drawings



Characteristic curve



Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	10		115
Supply voltage U_V	V	4,5	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
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 ± 5 %	

[1] Operation with 1 kΩ series resistance.

Accessories

Connector housing	4-pin	1 928 403 112
Contact pins	For Ø 0.5...1.0 mm²	AMP 2-929 939-1
Contact pins	For Ø 1.5...2.5 mm²	AMP 2-929 937-1
Individual seal	For Ø 0.5...1.0 mm²	AMP 828 904
Individual seal	For Ø 1.5...2.5 mm²;	AMP 828 905

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

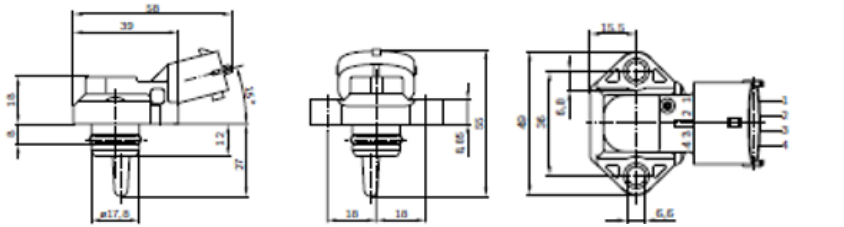
DS-S1-TF

Part number

0 281 002 316

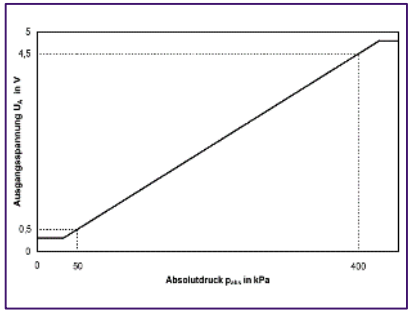
Picture

Dimensional drawings



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

Characteristic curve



Technical data

Parameter		min.	type	max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	50		400
Supply voltage U_V	V	4,5	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 τ_{63}[2)]	s			45

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

Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

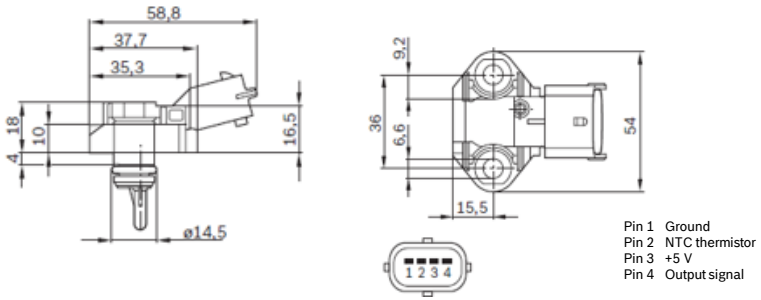
DS-S1-TF

Part number

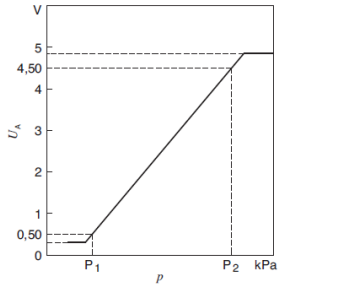
0 281 002 693

Picture

Dimensional drawings



Characteristic curve



Technical data

Parameter			min.	type	max.
Feature			Integrated temperature sensor		
Pressure range kPa (p_1...p_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	$R_{pull-up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10		
Response time	$\tau_{10/90}$	ms			1
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.
[2] In air with flow velocity 6 m/s.
TO cell

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

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

▶ Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S2

Part number

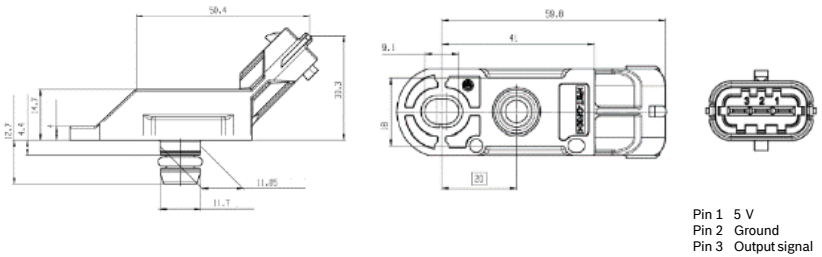
0 261 230 061

Picture

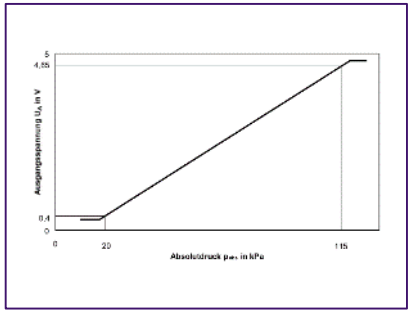
Technical data

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

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 110
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	AMP 2 929 939 1
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	AMP 2 929 937 1
Single-wire seal	For Ø 0.5...1.0 mm²	AMP 828 905
Single-wire seal	For Ø 1.5...2.5 mm²	AMP 828 905
Dummy plug		AMP 828 922

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S2-TF

Part number

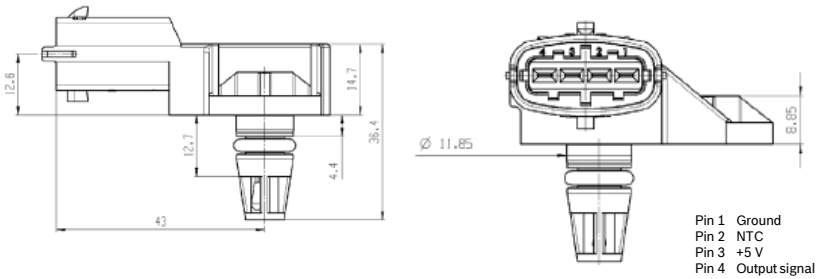
0 261 230 133

Picture

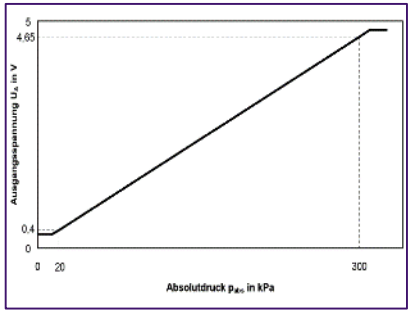
Technical data

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

Dimensional drawings



Characteristic curve



Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S2

Part number

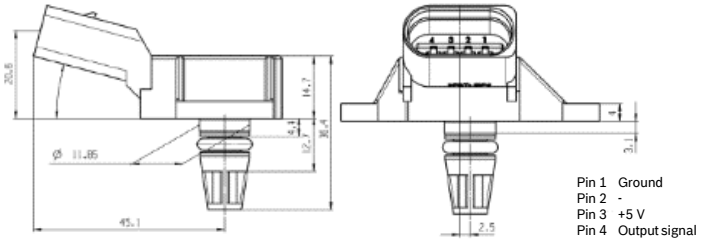
0 261 230 167

Picture

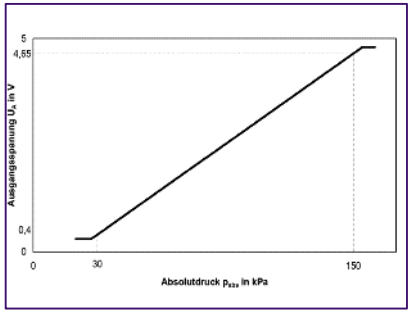
Technical data

Parameter		min.	type	Max.
Pressure range (p_1...p_2)	kPa	30		150
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130

Dimensional drawings



Characteristic curve



► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

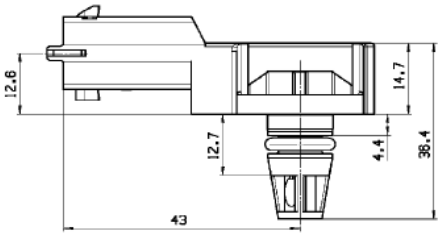
DS-S2-TF

Part number

0 281 002 437

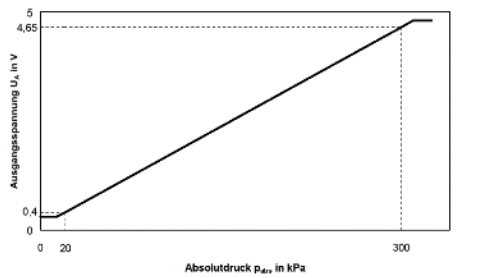
Picture

Dimensional drawings



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

Characteristic curve



Technical data

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

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

Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

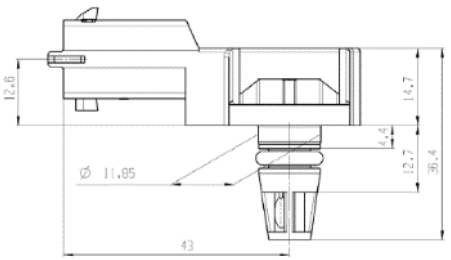
DS-S2-TF

Part number

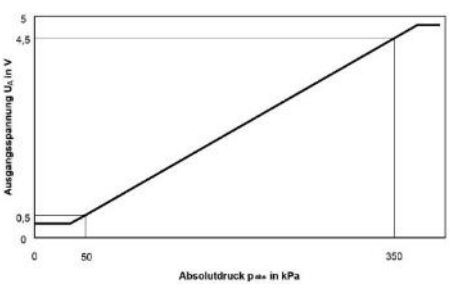
0 281 002 456

Picture

Dimensional drawings



Characteristic curve



Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	50		350
Supply voltage U_V	V	4,5	5	5,5
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 τ_{63} [2)]	s			10

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

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²; Contents:	1 928 498 060
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²; Contents:	1 928 498 061
Single-wire seal	For Ø 0.5...1.0 mm²; Contents:	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents:	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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S2

Part number

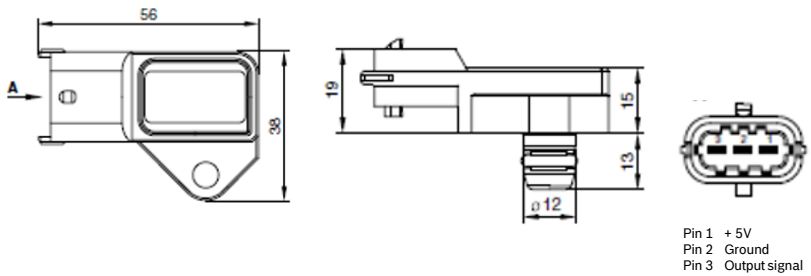
0 281 002 487

Picture

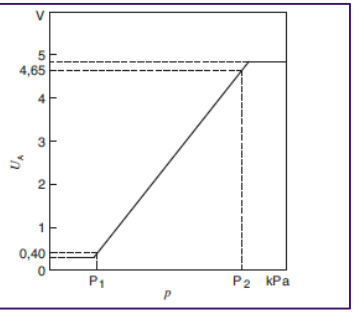
Technical data

Parameter		min.	type	Max.	Para meter
Pressure range (p_1...p_2)			20		250
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	ms		1	
Limit data					
Storage temperature	v_L	°C	-40		+130

Dimensional drawings



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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

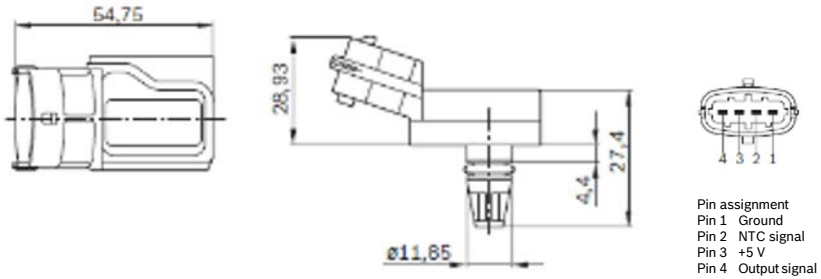
DS-S2-TF

Part number

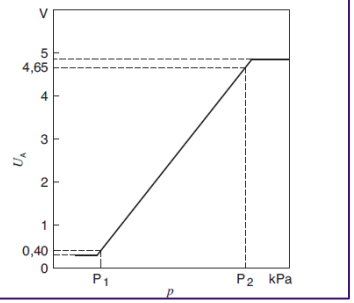
0 281 002 573

Picture

Dimensional drawings



Characteristic curve



Technical data

Parameter			min.	type	max.
Feature			Integrated temperature sensor		
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_V or ground	$R_{pull-up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	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.
[2] In air with flow velocity 6 m/s.

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

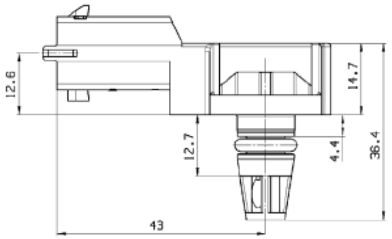
DS-S2-TF

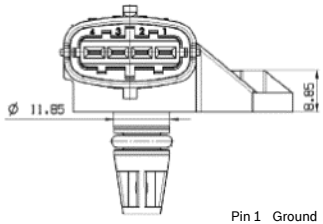
Part number

0 281 002 576

Picture

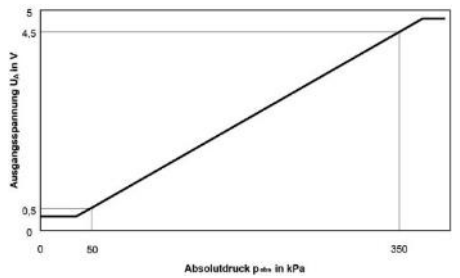
Dimensional drawings





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

Characteristic curve



Technical data

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

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

Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²; Contents:	1 928 498 060
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²; Contents:	1 928 498 061
Single-wire seal	For Ø 0.5...1.0 mm²; Contents:	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents:	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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S2

Part number

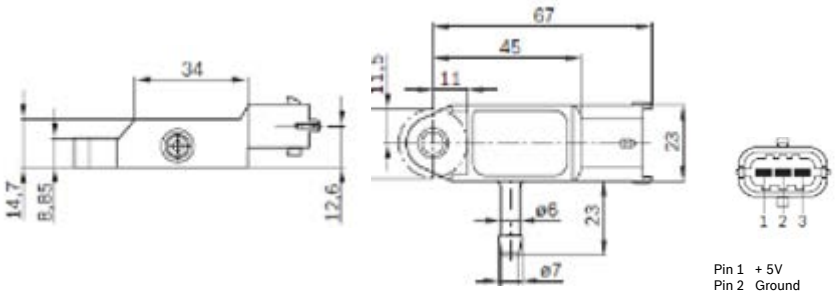
0 281 002 593

Picture

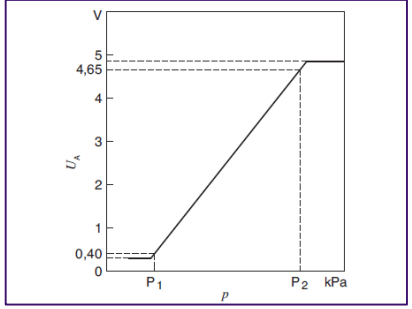
Technical data

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_V or ground	$R_{pull-up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10		
Response time	$\tau_{10/90}$	ms			1
Limit data					
Storage temperature	ϑ_L	°C	-40		+130

Dimensional drawings



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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

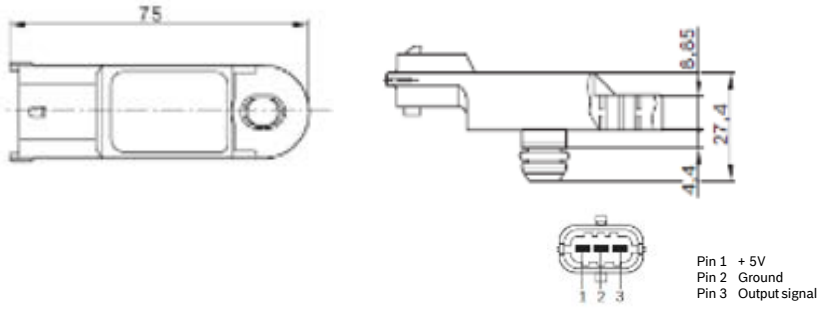
DS-S2

Part number

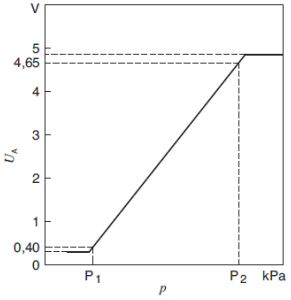
0 281 002 616

Picture

Dimensional drawings



Characteristic curve



Technical data

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_V or ground	$R_{pull-up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10		
Response time	$\tau_{10/90}$	ms			1
Limit data					
Storage temperature	ϑ_L	°C	-40		+130

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.

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S3-TF

Part number

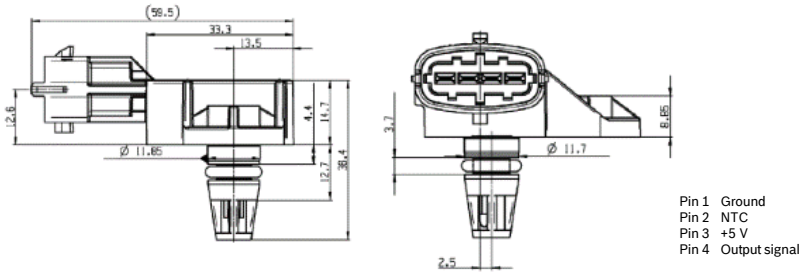
0 261 230 217

Picture

Technical data

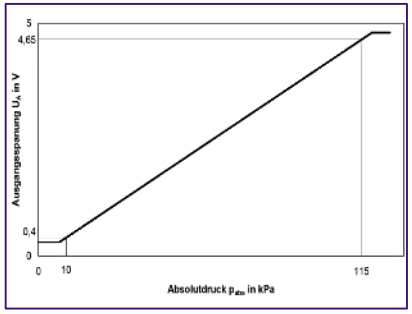
Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	10		115
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130

Dimensional drawings



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

Characteristic curve



Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S3-TF

Part number

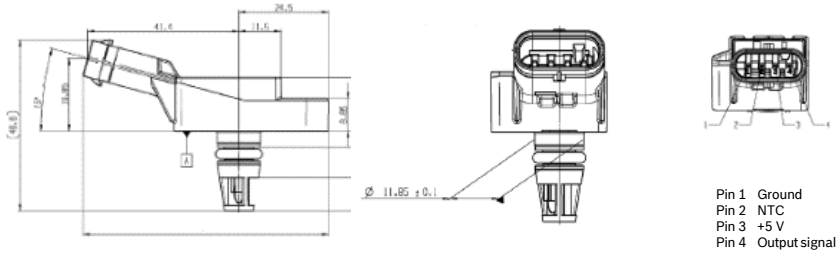
0 261 230 416

Picture

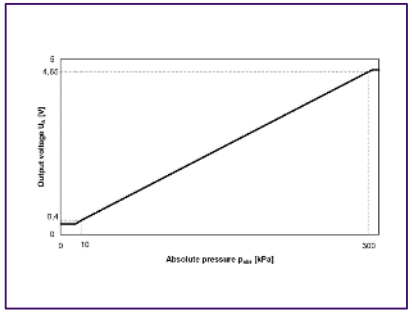
Technical data

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

Dimensional drawings



Characteristic curve



► Product groups

Absolute pressure sensors

Product type

DS-S3-TF

Part number

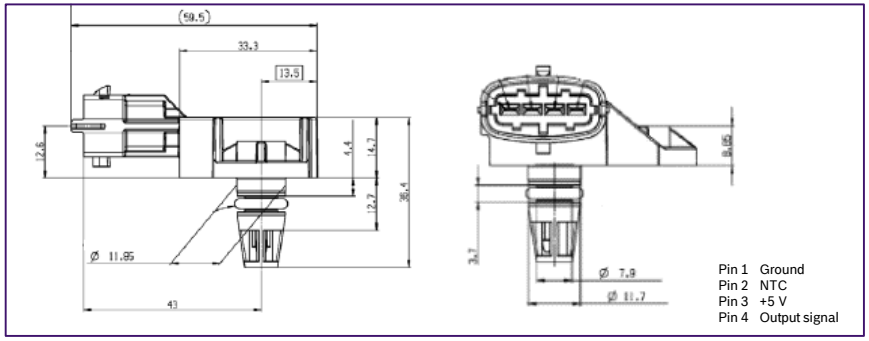
0 281 006 028

Picture

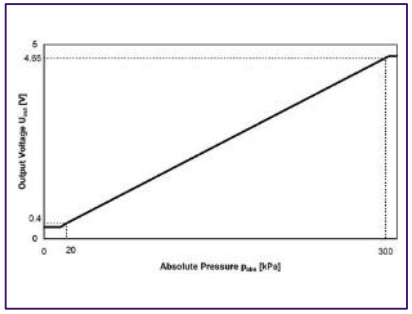
Technical data

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

Dimensional drawings



Characteristic curve



Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-S3-TF

Part number

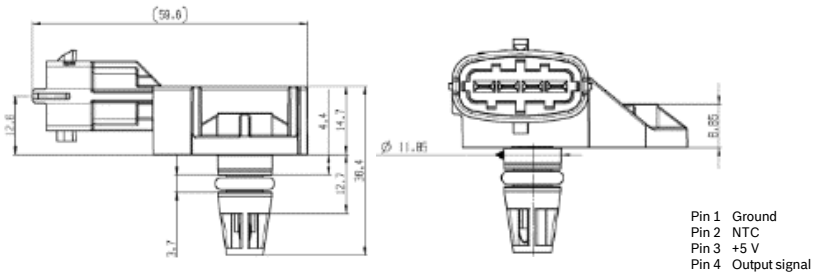
0 281 006 102

Picture

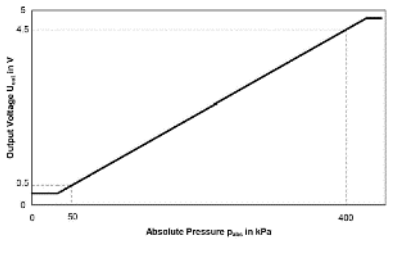
Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Pressure range (p_1...p_2)	kPa	50		400
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+130
Limit data				
Operating temperature	°C	-40		+130

Dimensional drawings



Characteristic curve



Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

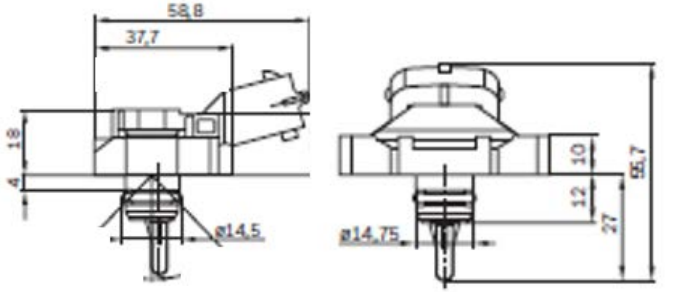
DS-K-TF (fuel)

Part number

0 261 230 112

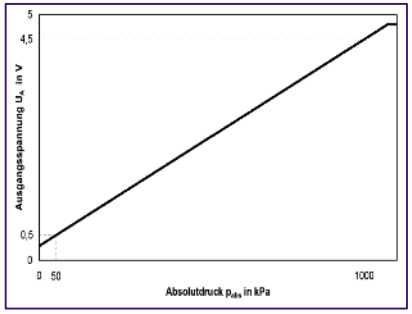
Picture

Dimensional drawings



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

Characteristic curve



Technical data

Parameter		min.	type	Max.
Features		Integrated temperature sensor		
Application/medium		fuel		
Pressure range (p_1...p_2)	kPa	50		1000
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms			1
Operating temperature	°C	-40		+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 τ_{63} [2)]	s			45

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

Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

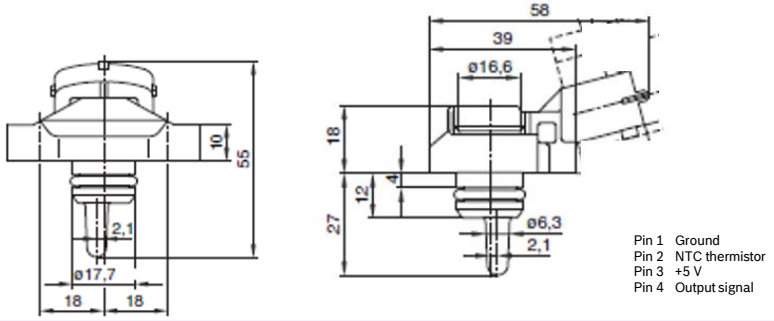
DS-O-TF (oil)

Part number

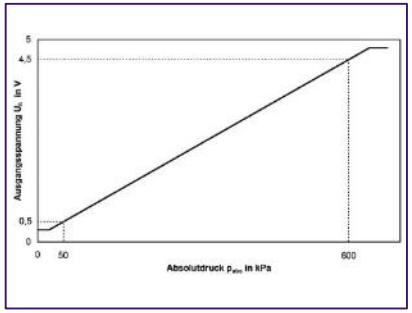
0 281 006 282

Picture

Dimensional drawings



Characteristic curve



Technical data

Parameter		min.	type	max.
Features		Integrated temperature sensor		
Application/medium		oil		
Pressure range (p_1...p_2)	kPa	50		600
Supply voltage U_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				
Measurement range	°C	-40		+125
Measurement current[1])	mA			1
Rated resistance at +20°C	kΩ		2,5 ± 5 %	
Temperature/time constant τ_{63}[2)]	s			45

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

Accessories

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

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

► Product groups

6.2 Pressure sensors

Absolute pressure sensors

Product type

DS-AM5

Part number

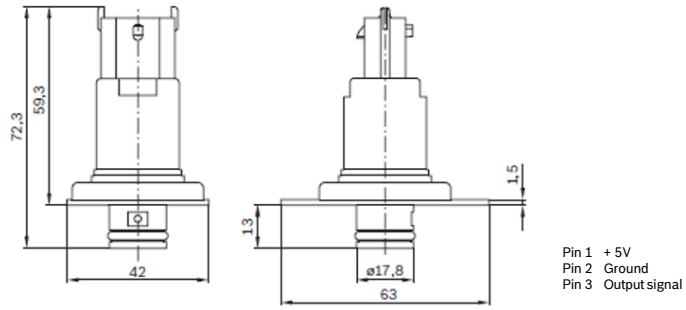
0 281 002 668

Picture

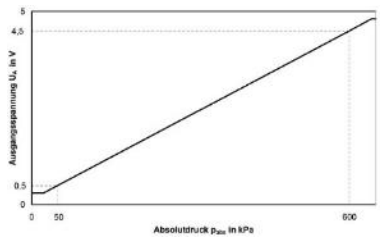
Technical data

Parameter		min.	type	max.
Pressure range (p_1...p_2)	kPa	**50**		**600**
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		+125
Limit data				
Operating temperature	°C	-40		+130

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 966
Contact pins (tin plated)	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins (tin plated)	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

6.3 Pressure sensors

High pressure sensors

- 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	$0.8 \cdot p / P_N$
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.

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

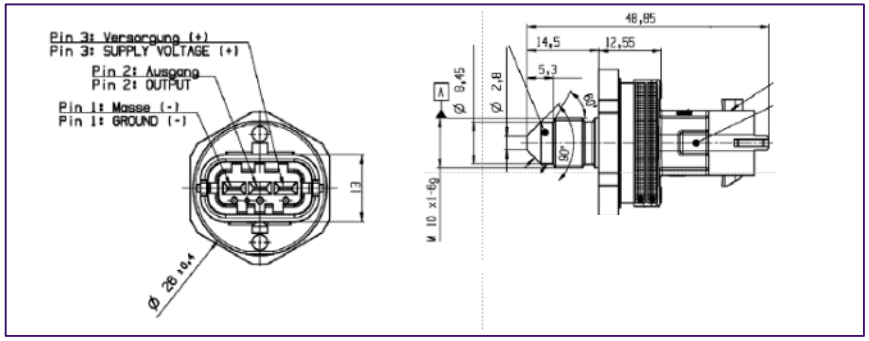
DS-HD-KV4.2

Part number

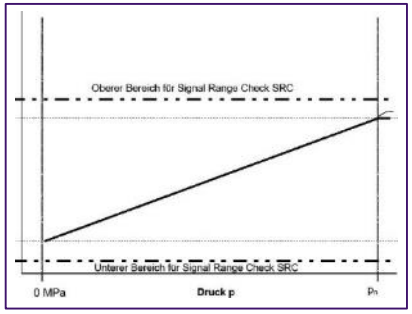
0 261 545 030

Picture

Dimensional drawings



Characteristic curve



Technical 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_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Supply current	I_V	mA	12...15
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

Accessories

Connector housing	4-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-HD-KV4.2

Part number

0 261 545 053

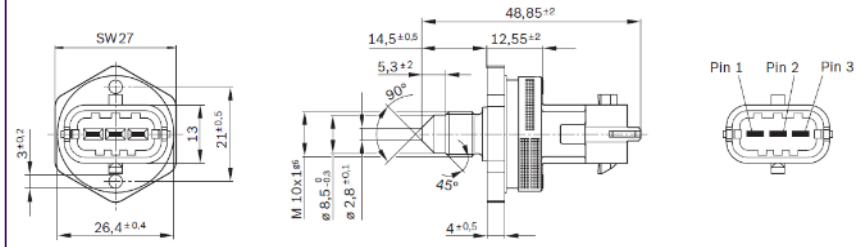
Picture

Technical data

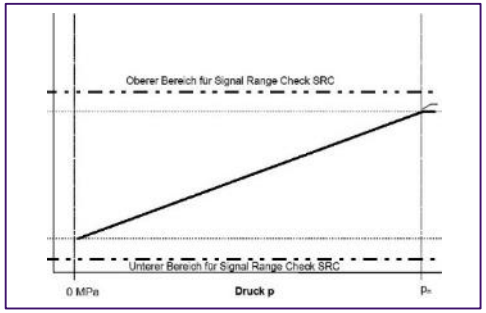
Pressure range	P_N	bar (Mpa)	140 (14)
Thread			M 10 x 1
Connector			Compact 1.1
Application/medium			Unleaded fuel
Max. feed voltage	U_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Supply current	I_V	mA	12...15
Load capacitance to ground		nF	13
Temperature range		°C	- 40 ...+ 130
Max. overpressure	p_{max}	bar	180
Rupture pressure	p_{max}	bar	>150
Response time	$\tau_{10/90}$	ms	2

[1] FS = Full Scale

Dimensional drawings



Characteristic curve



Accessories

Connector housing	4-pin	1 928 403 966
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-HD-KV4.2

Part number

0 281 006 650

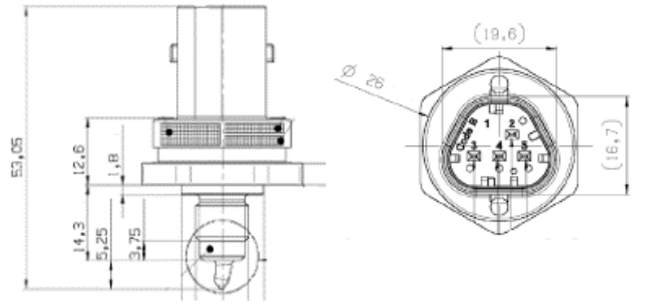
Picture

Technical data

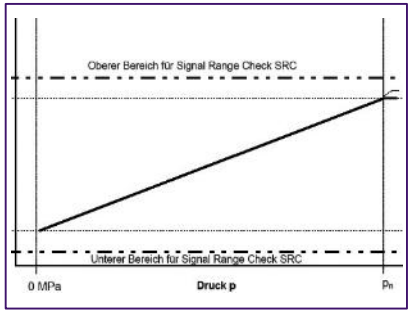
Pressure range	P_N	bar (Mpa)	260 (26)
Thread			M 10 x 1
Connector			Trapez
Application/medium			Unleaded fuel
Max. feed voltage	U_s	V	18
Supply voltage	U_V	V	5 ± 0,25
Supply current	I_V	mA	9...15
Load capacitance to ground		nF	15,1
Temperature range		°C	- 40 ...+ 140
Max. overpressure	p_{max}	bar	400
Rupture pressure	p_{max}	bar	375
Response time	$\tau_{10/90}$	s	9

[1] FS = Full Scale

Dimensional drawings



Characteristic curve



Accessories

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

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

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-RPS4-18

Part number

0 281 002 907

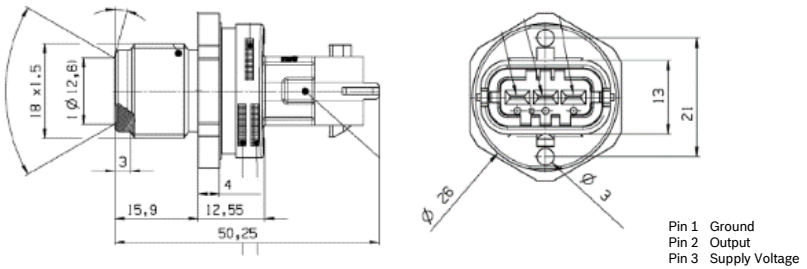
Picture

Technical data

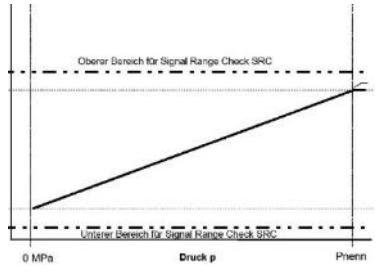
Pressure range	P_N	bar (MPa)	1500 (150)
Max. feed voltage	U_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Load capacitance to ground		nF	10
Thread			M 18 x 1,5
Application/medium			Diesel or biodiesel [2]
Temperature range		°C	- 40 ...+ 130
Max. overpressure	p_{max}	bar	2300
Rupture pressure	p_{berst}	bar	4000
Response time	$\tau_{10/90}$	ms	2

[2] RME rapeseed methyl ester.

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
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.

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-RPS4-18

Part number

0 281 002 930

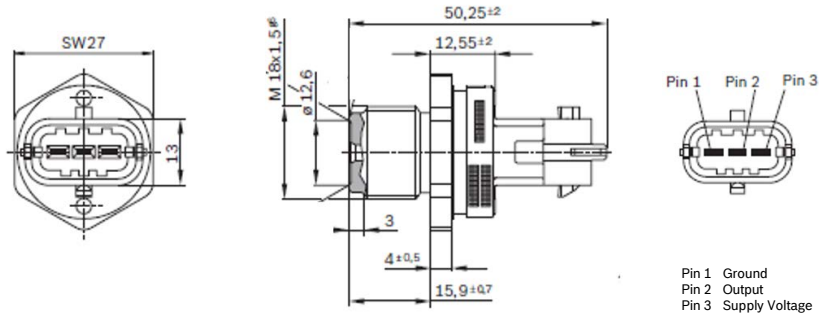
Picture

Technical data

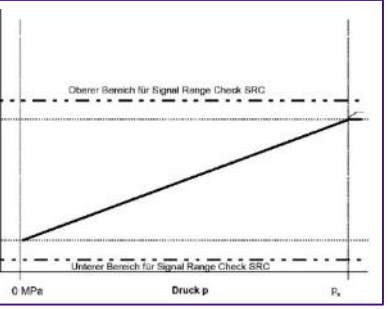
Pressure range	P_N	bar (MPa)	2000 (200)
Max. feed voltage	U_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Load capacitance to ground		nF	10
Thread			M 18 x 1,5
Application/medium			Diesel or biodiesel [2]
Temperature range			- 40 ...+ 130
Max. overpressure	p_{max}	bar	2300
Rupture pressure	p_{berst}	bar	4000
Response time	$\tau_{10/90}$	ms	2

[1] FS = Full Scale.
[2] RME rapeseed methyl ester.
[4] Output current with pull-up resistor.
[5] +140°C for max. 250 h.

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
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.

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-RPS4-2

Part number

0 281 002 937

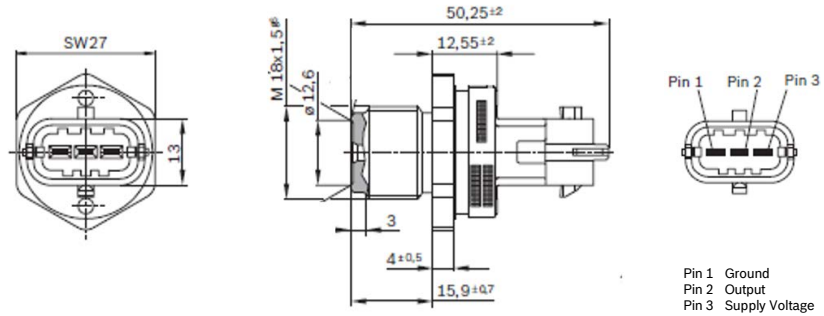
Picture

Technical data

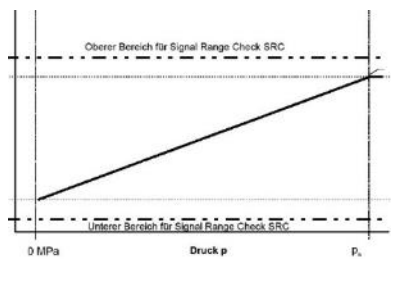
Pressure range	P_N	bar (MPa)	1800 (180)
Max. feed voltage	U_s	V	16
Supply voltage	U_V	V	5 ± 0,25
Load capacitance to ground		nF	10
Thread			M 18 x 1,5
Application/medium			Diesel or biodiesel [2]
Temperature range		°C	- 40 ...+ 130
Max. overpressure	p_{max}	bar	2300
Rupture pressure	p_{berst}	bar	4000
Response time	$\tau_{10/90}$	ms	2

[1] FS = Full Scale.
[2] RME rapeseed methyl ester.
[4] Output current with pull-up resistor.
[5] +140°C for max. 250 h.

Dimensional drawings



Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
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.

► Product groups

6.3 Pressure sensors

High pressure sensor

Product type

DS-RPS4-22

Part number

0 281 006 117

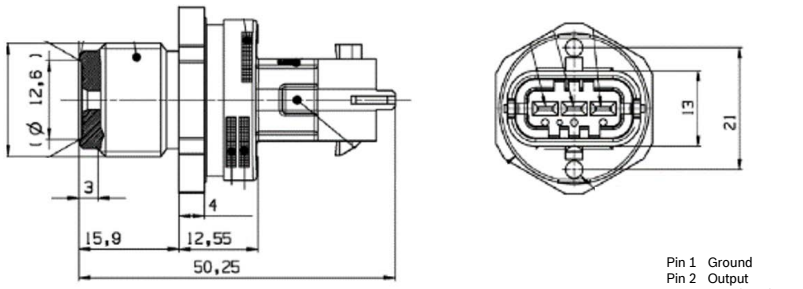
Picture

Technical data

Pressure range	P_N	bar (MPa)	2400 (240)
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			- 40 ...+ 130
Max. overpressure	p_{max}	bar	2800
Rupture pressure	p_{berst}	bar	4000
Response time	$\tau_{10/90}$	ms	2

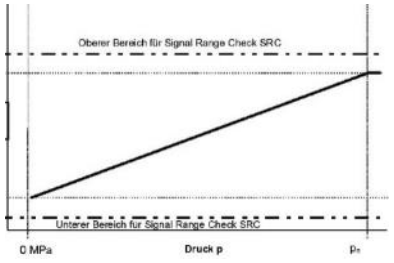
[1] FS = Full Scale.
[2] RME rapeseed methyl ester.
[4] Output current with pull-up resistor.
[5] +140°C for max. 250 h.

Dimensional drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply Voltage

Characteristic curve



Accessories

Connector housing	3-pin	1 928 403 968
Contact pins (gold plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Dummy plug		1 928 300 601

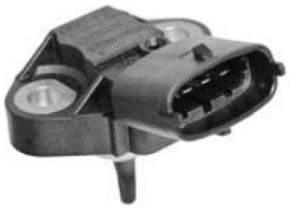
Accessories are not included in the scope of delivery of the sensor and therefore to be ordered separately as required.

► Product groups

6.4 Pressure sensors

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

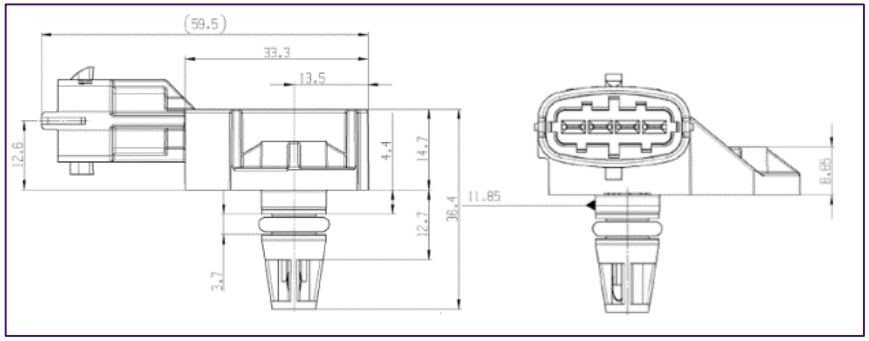
DS-G3-TF

Part number

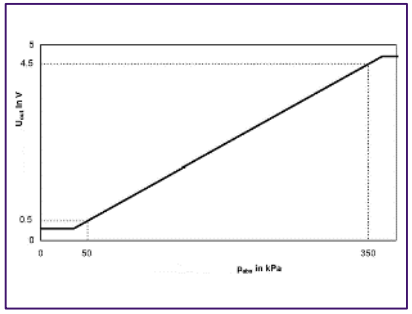
0 261 230 373

Picture

Dimensional drawings



Characteristic curve



Technical data

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

Accessories

Connector housing	4-pin	1 928 403 734
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

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

▶ Product groups

Pressure sensors for CNG and LPG

Product type

DS-K-TF

Part number

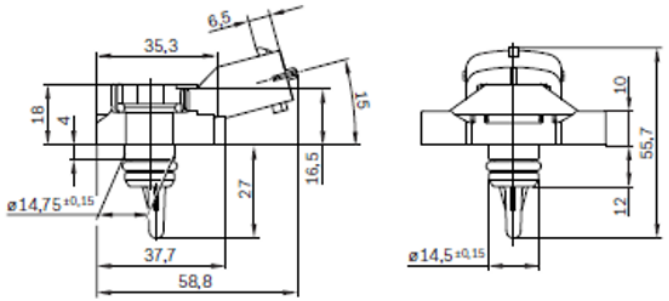
0 261 230 145

Picture

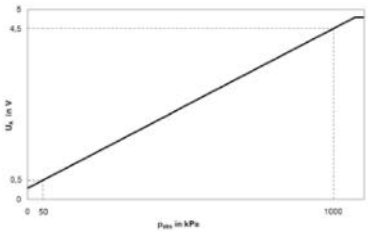
Technical data

Parameter		min.	type	Max.
Features		integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_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_V, ground open	kΩ			
Response time	$\tau_{10/90}$	ms	1	
Operating temperature	°C	-40	130	

Dimensional drawings



Characteristic curve



Accessories

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

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

▶ Product groups

6.4 Pressure sensors

Pressure sensors for CNG and LPG

Product type

DS-K-TF

Part number

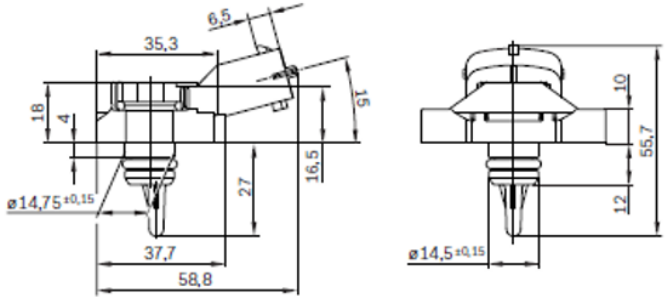
0 261 230 255

Picture

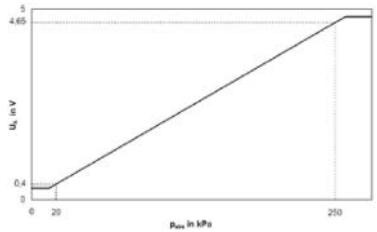
Technical data

Parameter		min.	type	Max.
Features		integrated temperature sensor		
Application/medium		approved for CNG and LPG		
Pressure range (p_1...p_2)	kPa	20		250
Supply voltage U_V	V	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		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_V, ground open	kΩ			
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		130

Dimensional drawings



Characteristic curve



Accessories

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

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

▶ Product groups

6.4 Pressure sensors

Pressure sensors for CNG and LPG

Product type

DS-K-TF

Part number

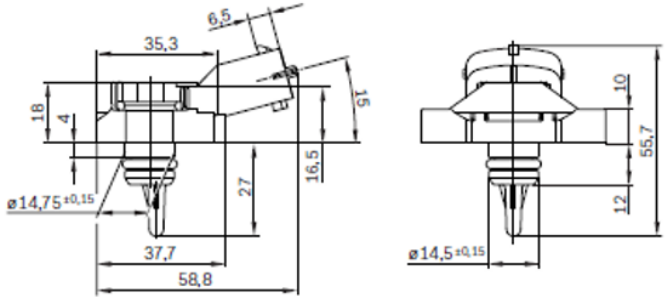
0 261 230 275

Picture

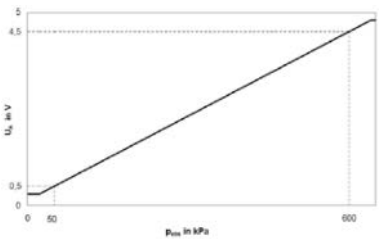
Technical data

Parameter		min.	type	Max.
Features		integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	50		600
Supply voltage U_V	V	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 V	V	4,75	4,8	4,85
Output resistance to ground, U_v open	kΩ			
Output resistance to U_V, ground open	kΩ			
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		130

Dimensional drawings



Characteristic curve



Accessories

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

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

► Product groups

Pressure sensors for CNG and LPG

Product type

DS-K-TF

Part number

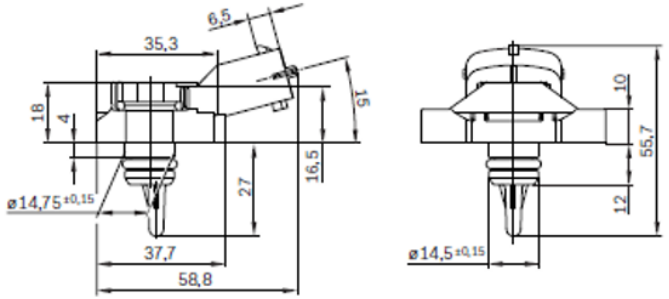
0 281 006 243

Picture

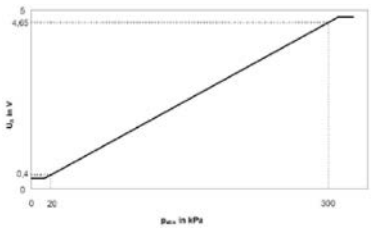
Technical data

Parameter		min.	type	max.
Features		integrated temperature sensor		
Application/medium		approved for CNG		
Pressure range (p_1...p_2)	kPa	20		300
Supply voltage U_V	V	4,75	5	5,25
Current input I_V at U_V = 5V	mA	6	9	12,5
Load current I_L at output	mA	-1		0,5
Load resistance to ground or U_V	kΩ	5		10
Lower limit at U_v = 5 V	V	0,25	0,3	0,35
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_V, ground open	kΩ			
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		130

Dimensional drawings



Characteristic curve



Accessories

Connector housing	4-pin	1 928 403 736
Contact pins (gold-plated)	For Ø 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600
Dummy plug		1 928 300 601

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

▶ Product groups

7 Temperature sensors

Measurement of air/liquid temperatures

- ► 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
ϑ	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

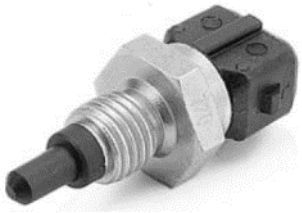
Product type

TF-L

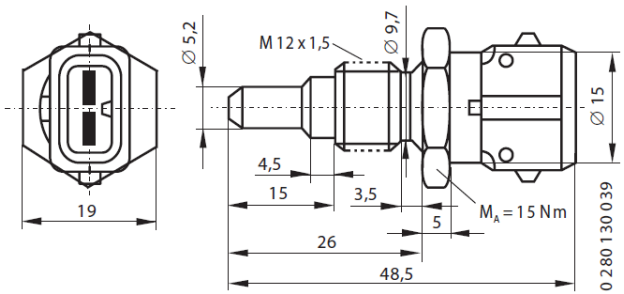
Part number

0 280 130 039

Picture



Dimensional drawings



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 P = 2 mW and still air (23 °C)	K	≤ 2
Temperature/time constant τ_{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 0.5...1.0 mm²	AMP 929 939-3
Contact pins	For Ø 1.5...2.5 mm²	AMP 929 937-3
Individual seal	For Ø 0.5...1.0 mm²	1 987 280 106
Individual seal	For Ø 1.5...2.5 mm²	1 987 280 107

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

► Product groups

Measurement of air/liquid temperatures

Product type

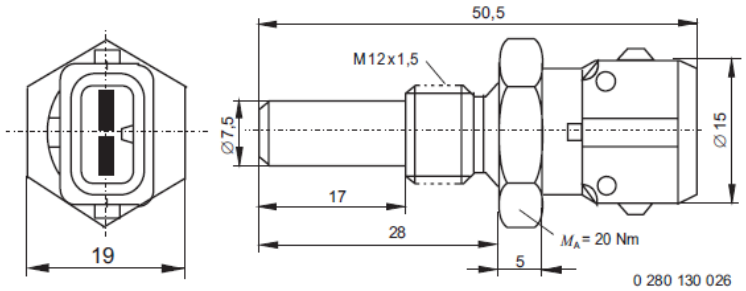
TF-W

Part number

0 280 130 026

Picture

Dimensional drawings



Technical data

Measuring range	°C	-40 ... +130
Features		Sensor in brass housing.
Application/medium		Oil/water
Rated resistance at 100 °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
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 5K9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	20
Rated voltage	V	5 ± 0,15

[1)] With individual seal.

Accessories

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

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

► Product groups

Measurement of air/liquid temperatures

Product type

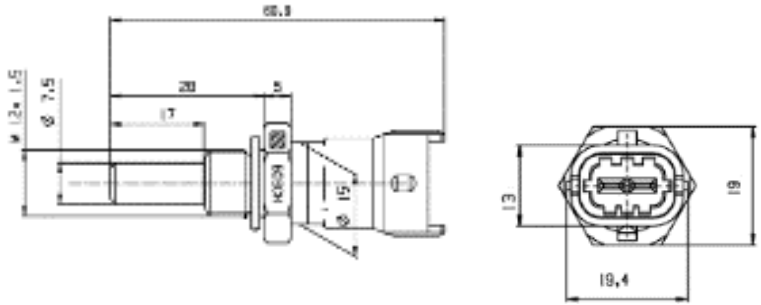
TF-W

Part number

0 280 130 093

Picture

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 ± 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
Temperature/time constant τ_{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	1 928 403 137
Contact pins (tin-plated)	For Ø 0.5...1.0 mm²	AMP 929 939 3
Contact pins (tin-plated)	For Ø 1.5...2.5 mm²	AMP 929 937 3
Single-wire seal	For Ø 0.5...1.0 mm²	AMP 828 904
Single-wire seal	For Ø 1.5...2.5 mm²	AMP 828 905
Dummy plug		AMP 828 922

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

► Product groups

Product type

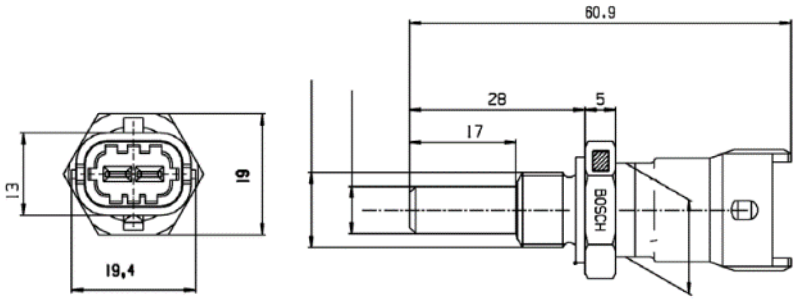
TF-W

Part number

0 281 002 170

Picture

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 τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 5K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 38 52-1
Tightening torque	Nm	25
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

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

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

▶ Product groups

Measurement of air/liquid temperatures

Product type

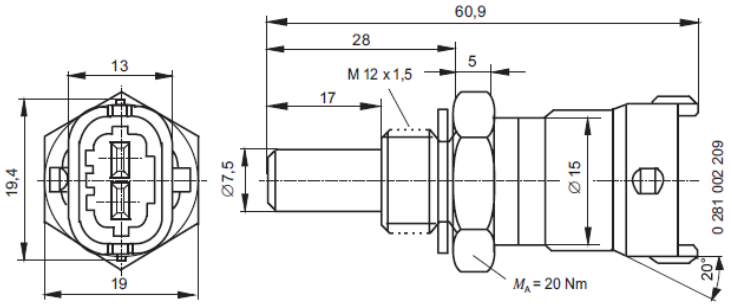
TF-W

Part number

0 281 002 209

Picture

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 τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 5K 9K
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	25
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

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

► Product groups

Measurement of air/liquid temperatures

Product type

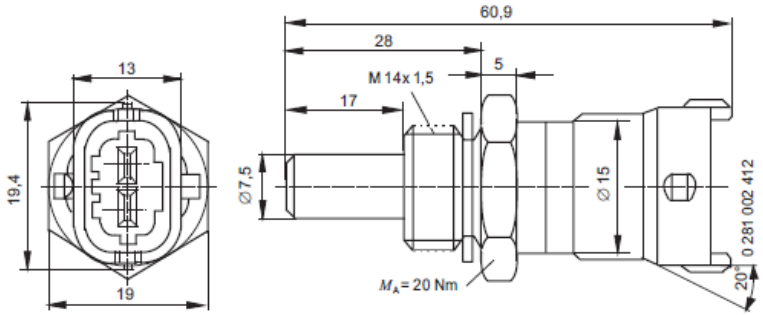
TF-W

Part number

0 281 002 412

Picture

Dimensional drawings



Technical data

Temperature range	°C	-40 ... +130
Features		Sensor in brass housing.
Application/medium		Oil/water
Tolerance at +100 °C	K	0,1886 ± 2%
Rated resistance at 100 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,640 ... 10,149
Resistance at +20 °C	kΩ	2,351 ... 2,648
Resistance at +80 °C	kΩ	0,313 ... 0,332
Temperature/time constant τ_{63} [1)]	s	≤ 15
Degree of protection [1)]		IP 5K 9K
Thread		M 14 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	20
Rated voltage	V	5 ± 0,15

[1)] With single-wire seal.

Accessories

Connector housing	2-pin	1 928 403 874
Contact pins	For Ø 0.5...1.0 mm²	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

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

► Product groups

Measurement of air/liquid temperatures

Product type

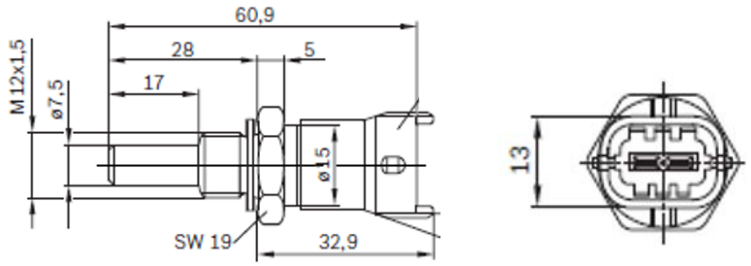
TF-W

Part number

0 281 002 704

Picture

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 τ_{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 0.5...1.0 mm²	1 928 498 054
Contact pins (gold-plated)	For Ø 1.5...2.5 mm²	1 928 498 055
Single-wire seal	For Ø 0.5...1.0 mm²	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²	1 928 300 600

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

► Product groups

8.1 Air-mass sensors

HFM with analog interface

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

Application

The air-mass sensor (HFM) is designed to 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 layer.

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

Explanation of characteristic data

$\dot{m}_N$	Air mass throughput
$\Delta\dot{m}$	Absolute accuracy
$\Delta\dot{m}/\dot{m}$	Relative accuracy
$\tau\Delta$	Time until measurement error
τ_{63}	Time until change in measured value 63%

► Product groups

8.1 Air-mass sensors

HFM with analog interface

Product type

HFM-5

Part number

0 280 217 123

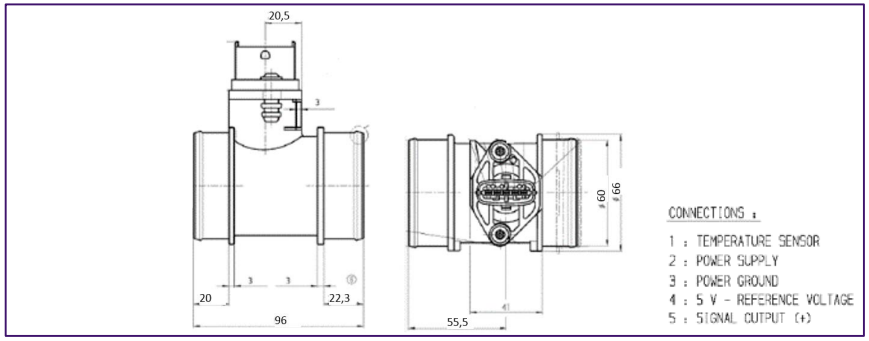
Picture

Technical data

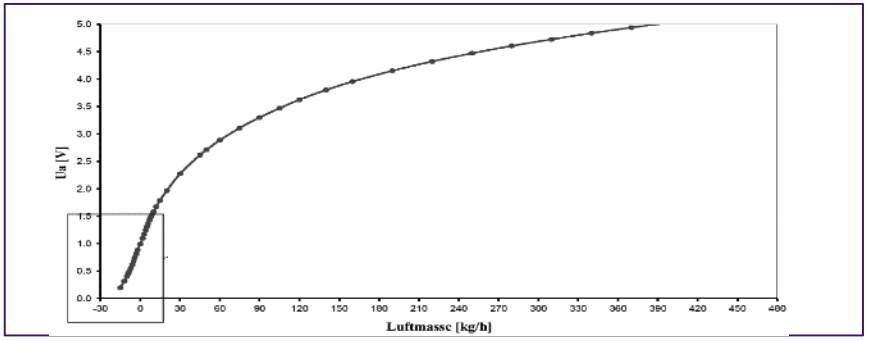
Features		With ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	370 kg/h
Measuring range	$\dot{m}_N$	-15 ... 480 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Dimensional drawings



Air-mass characteristic curve at ambient temperature



Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.5...1.0 mm²; 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.

► Product groups

8.1 Air-mass sensors
HFM with analog interface

Product type
HFM-5

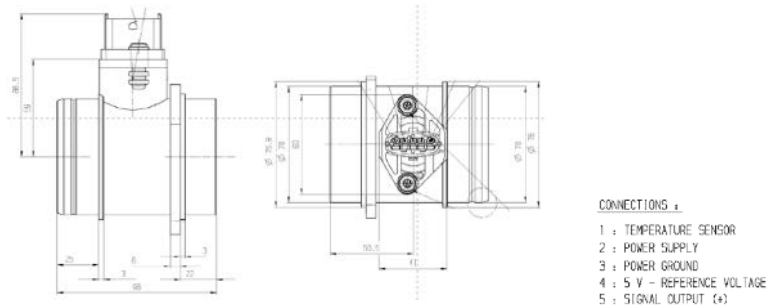
Part number
0 280 218 037

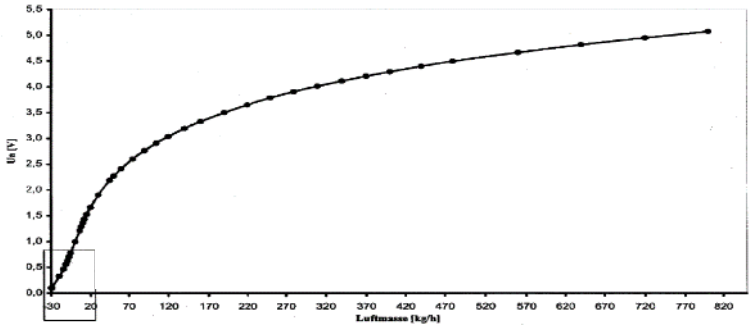
Picture


Technical data

Features		With ambient-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)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Dimensional drawings


Air-mass characteristic curve at ambient temperature


Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

8.1 Air-mass sensors

HFM with analog interface

Product type

HFM-5

Part number

0 280 218 089

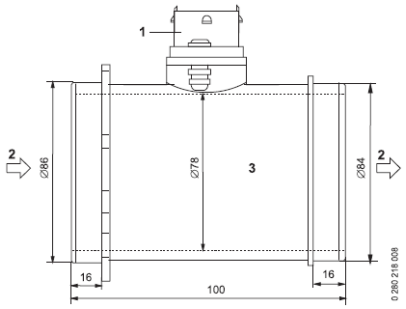
Picture

Technical data

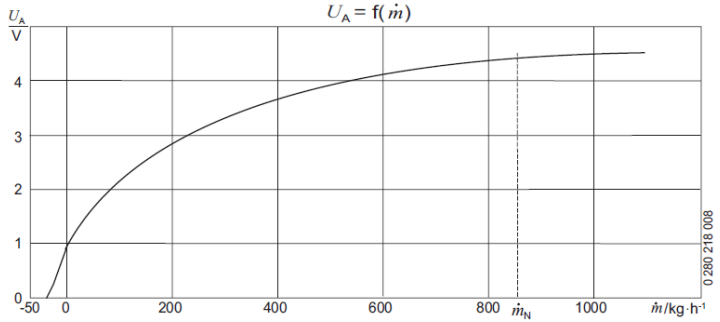
Features		Without ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	850 kg/h
Measuring range	$\dot{m}_N$	-50 ... +1100 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

1) for 0,04 ≤ Δ *ṁ* / *ṁN* ≤ 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 *ṁ* / *ṁ* | ≤ 5 %.

Dimensional drawings



Air-mass characteristic curve at ambient temperature



Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.5...1.0 mm²; 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.

► Product groups

8.1 Air-mass sensors

HFM with analog interface

Product type

HFM-5

Part number

0 280 218 116

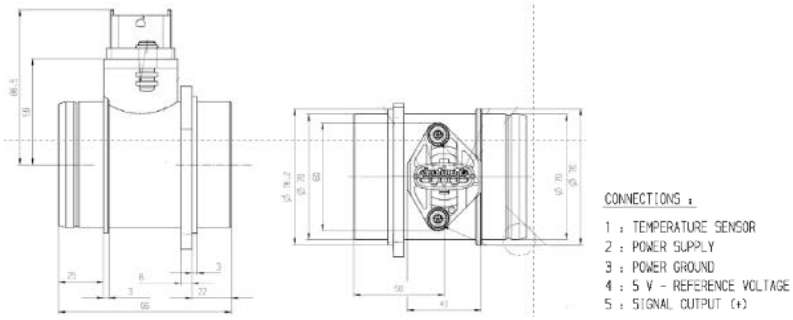
Picture

Technical data

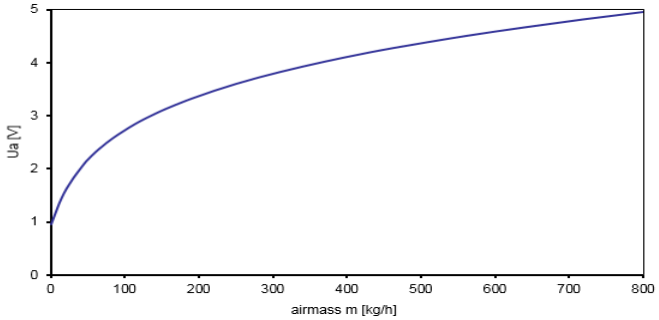
Features		With ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	480 kg/h
Measuring range	$\dot{m}_N$	-40 ... +640 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	8 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Dimensional drawings



Air-mass characteristic curve at ambient temperature



Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

8.1 Air-mass sensors

HFM with analog interface

Product type

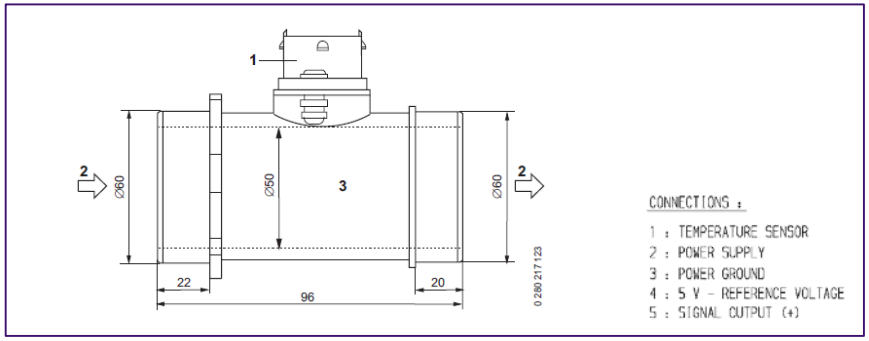
HFM-5

Part number

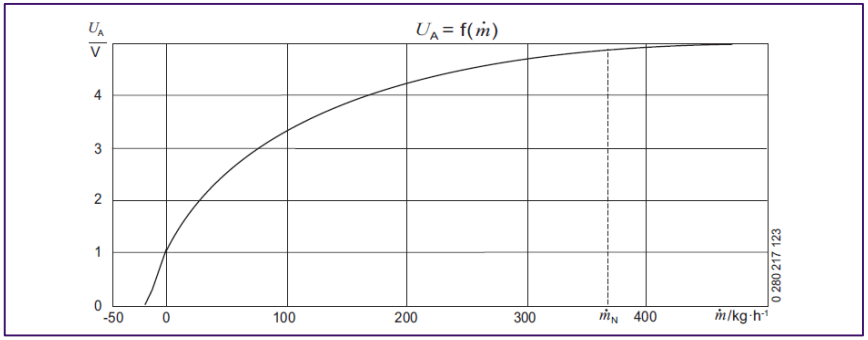
0 280 218 119

Picture

Dimensional drawings



Air-mass characteristic curve at ambient temperature



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	6 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 15 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Accessories

Compact connector	5-pin	1 928 403 836
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seals	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seals	For Ø 0.5...1.0 mm²; 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.

► Product groups

8.1 Air-mass sensors
HFM with analog interface

Product type
HFM-5

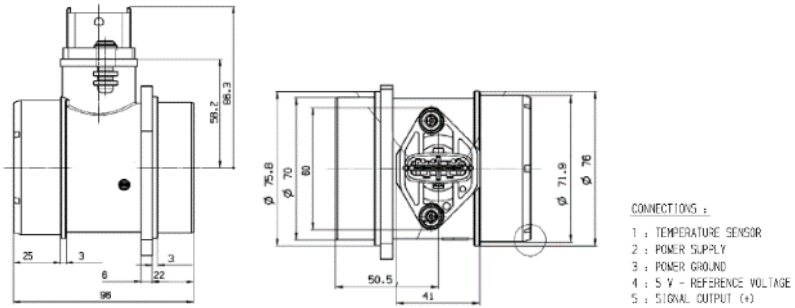
Part number
0 281 002 571

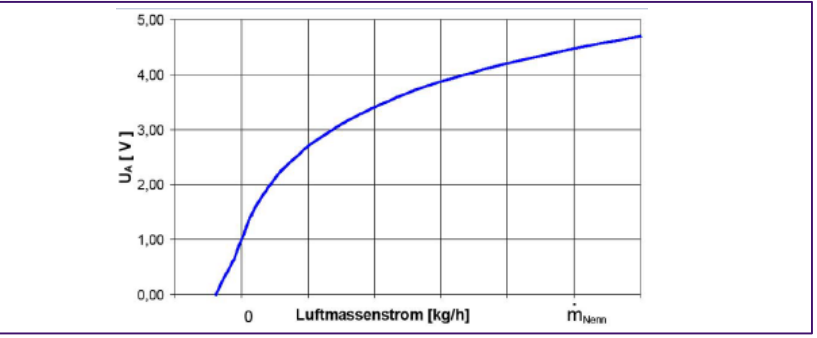
Picture


Technical data

Features		With ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	480 kg/h
Measuring range	$\dot{m}_N$	+8 ... 480 kg/h
Rated supply voltage	U_N	14 V
Supply-voltage range	U_V	6 ... 17 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 3 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 18 hPa
Current input	I_V	< 0,1 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Dimensional drawings


Air-mass characteristic curve at ambient temperature


Accessories

Connector housing	5-pin	1 928 403 738
Contact pins	For Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	For Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	For Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	For Ø 1.5...2.5 mm²; Contents: 10 x	1 928 300 600
Dummy plug		1 928 300 601

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

► Product groups

8.1 Air-mass sensors

HFM with analog interface

Product type

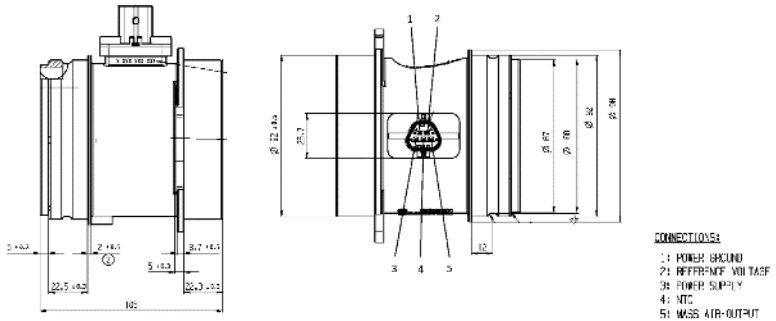
HFM-7 (analog)

Part number

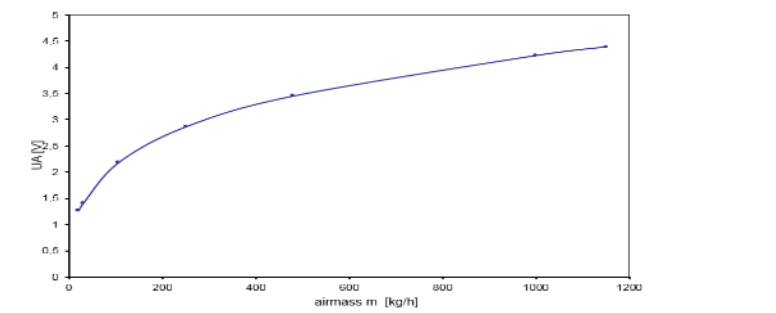
0 280 218 218

Picture

Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

Features		With ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	1050 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]	$\Delta \dot{m} / \dot{m}$	± 2 %
Temperature range [2]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 10 hPa
Current input	I_V	< 0,06 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

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

► Product groups

8.2 Air-mass sensors

HFM with digital interface

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

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 layer.

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

Explanation of characteristic data

$\dot{m}_N$	Air mass throughput
$\Delta\dot{m}$	Absolute accuracy
$\Delta\dot{m}/\dot{m}$	Relative accuracy
$\tau\Delta$	Time until measurement error
τ_{63}	Time until change in measured value 63%

8.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7

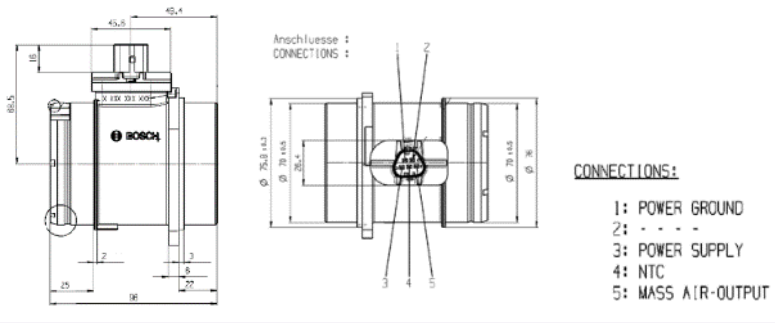
Part number
0 280 218 225

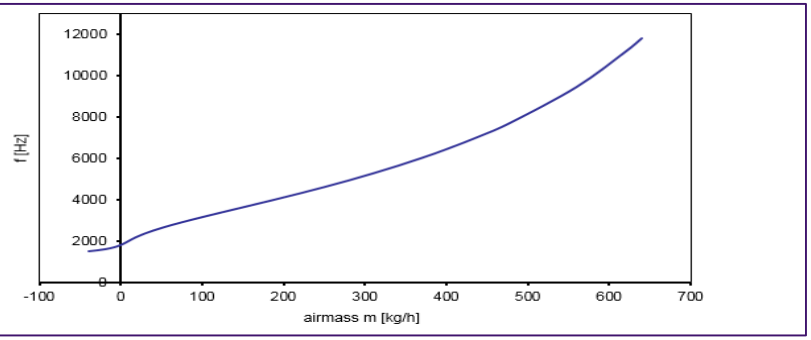
Picture


Technical data

Features		With ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	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)]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 12 hPa
Current input	I_V	< 0,06 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

Dimensional drawings


Air-mass characteristic curve at ambient temperature


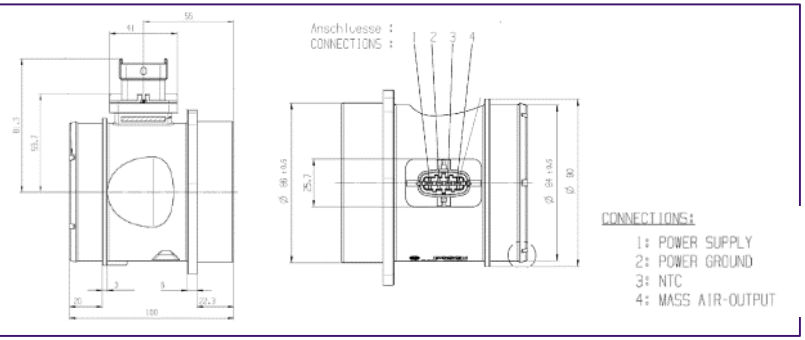
► Product groups

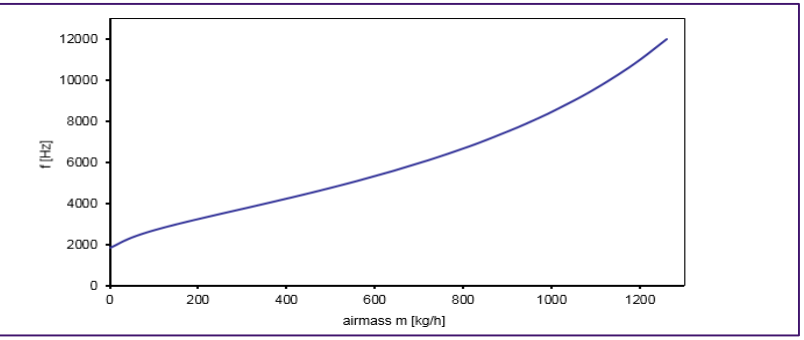
8.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7

Part number
0 280 218 416

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


Technical data

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)	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range 2)	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 12 hPa
Current input	I_V	< 0,06 A
Time constant	τ_{63} 3)	≤ 10 ms
Time constant	$\tau\Delta$ 4)	≤ 30 ms

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

Accessories

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

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

► Product groups

8.2 Air-mass sensors
HFM with digital interface

Product type

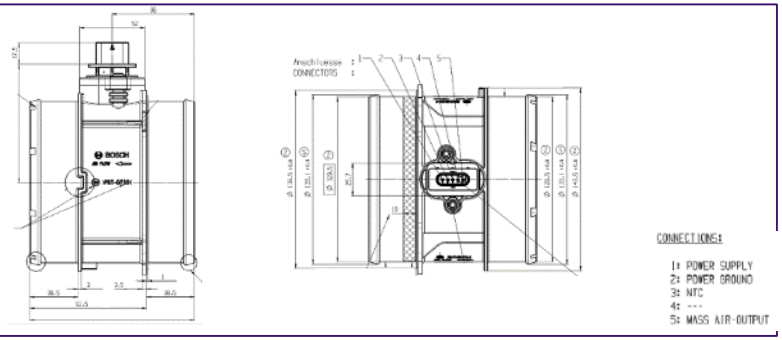
HFM-7

Part number

0 281 006 275

Picture

Dimensional drawings



Technical data

Features		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)]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 15 hPa
Current input	I_V	< 0,08 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

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

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

▶ Product groups

8.2 Air-mass sensors

HFM with digital interface

Product type

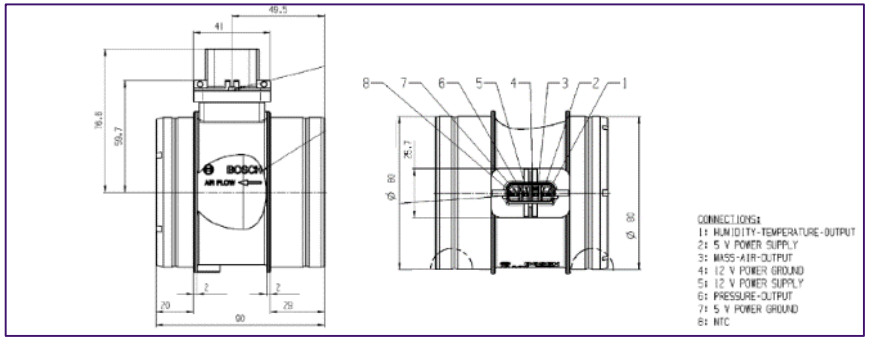
HFM-7-IPH

Part number

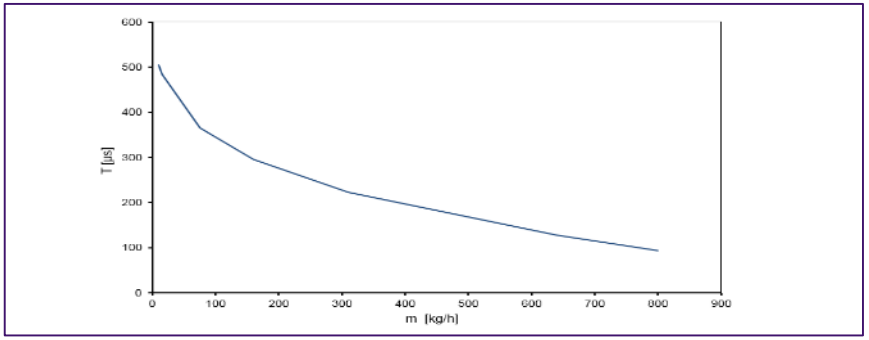
0 281 006 426

Picture

Dimensional drawings



Air-mass characteristic curve at ambient temperature



Technical data

Features		With integrated pressure, humidity and ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	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]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	< 12 hPa
Current input	I_V	< 0,06 A
Time constant	τ_{63} [3]	≤ 25 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

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

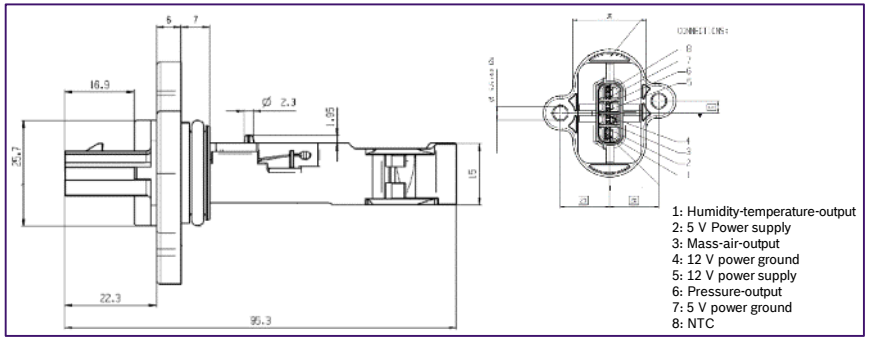
► Product groups

8.2 Air-mass sensors
HFM with digital interface

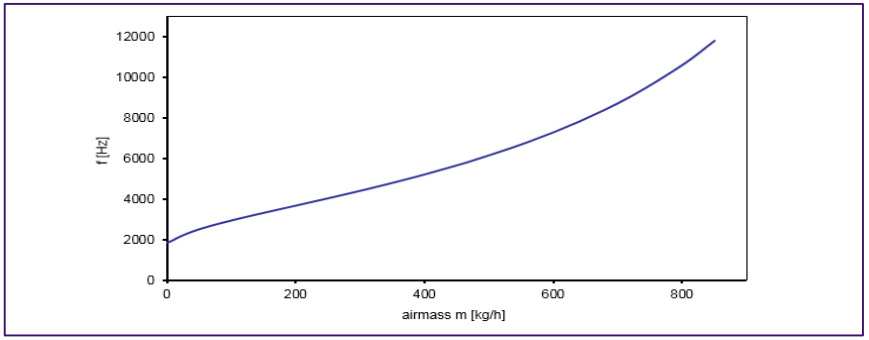
Product type
HFM-7-SF-IPH

Part number
0 280 218 419

Picture


Dimensional drawings


1: Humidity-temperature-output
2: 5 V Power supply
3: Mass-air-output
4: 12 V power ground
5: 12 V power supply
6: Pressure-output
7: 5 V power ground
8: NTC

Air-mass characteristic curve at ambient temperature


Technical data

Features		With integrated pressure, humidity and ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}_N$	-60 ... 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]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	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	$\tau\Delta$ [4]	≤ 80 ms

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

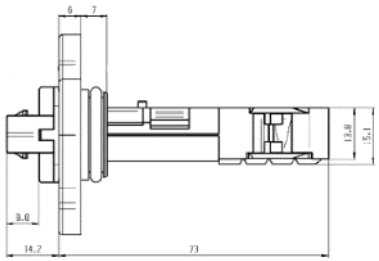
► Product groups

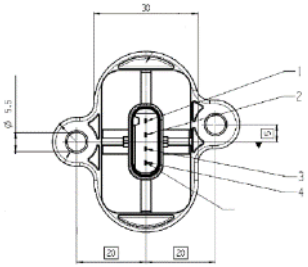
8.2 Air-mass sensors
HFM with digital interface

Product type
HFM-7-SF

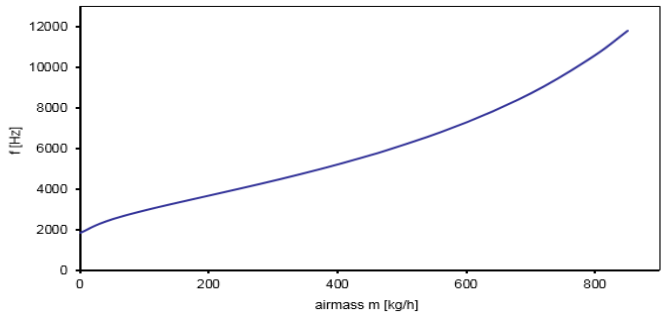
Part number
0 281 006 069

Picture


Dimensional drawings




1 Power supply
2 Power ground
3 Reference frequence
4 Mass air-output

Air-mass characteristic curve at ambient temperature


Technical 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)]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2)]	°C	-40 ... +120
Pressure drop at $\dot{m}_N$	Δp	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	$\tau\Delta$ [4)]	≤ 80 ms

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

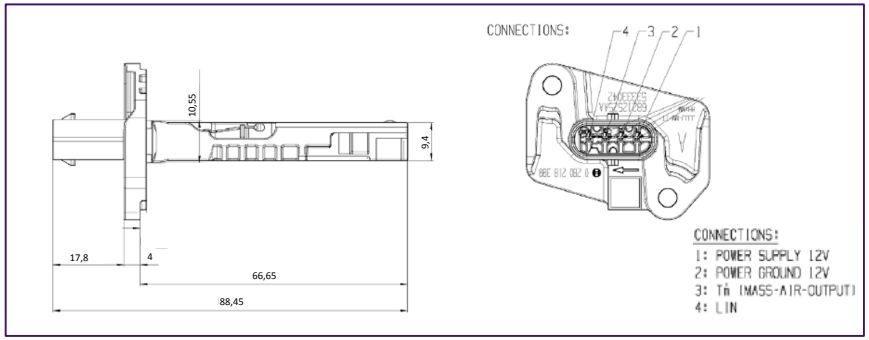
► Product groups

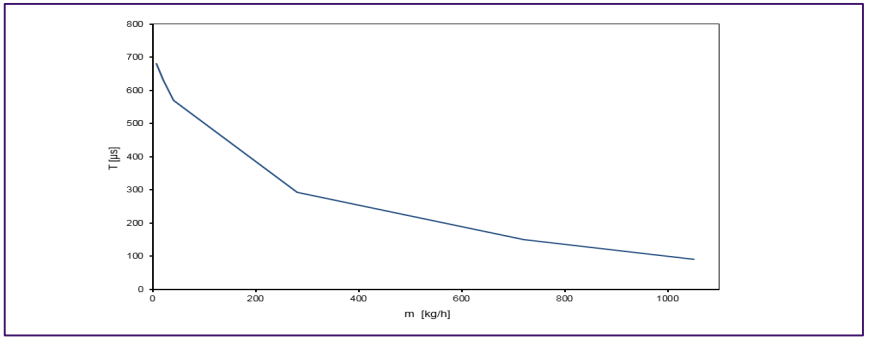
8.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-SF-PTH

Part number
0 280 218 399

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


Technical data

Features		With integrated pressure, humidity and ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	640 kg/h
Measuring range airflow	$\dot{m}_N$	-60 ... 1150 kg/h
Measuring range pressure	kPa	10 ... 125
Measuring range humidity	%rH	0 ... 100
Rated supply voltage	U_N	5 V
Supply-voltage range	U_V	4,85 ... 5,15 V
Relative accuracy [1)]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2)]	°C	-40 ... +140
Pressure drop at $\dot{m}_N$	Δp	depending on size and design of cross section area
Current input	I_V	< 0,06 A
Time constant	τ_{63} [3)]	≤ 10 ms
Time constant	$\tau\Delta$ [4)]	≤ 30 ms

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

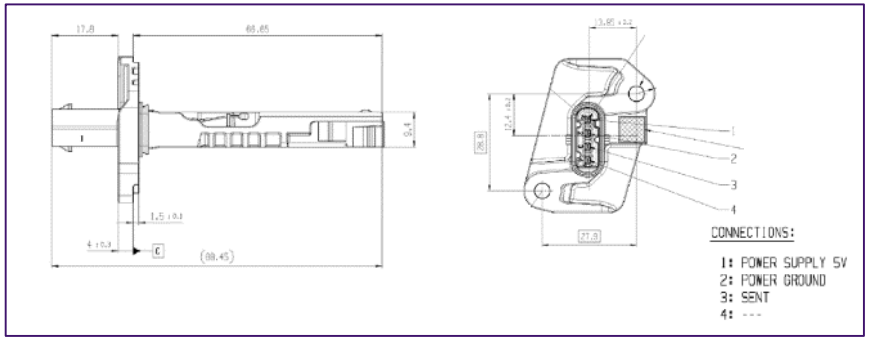
► Product groups

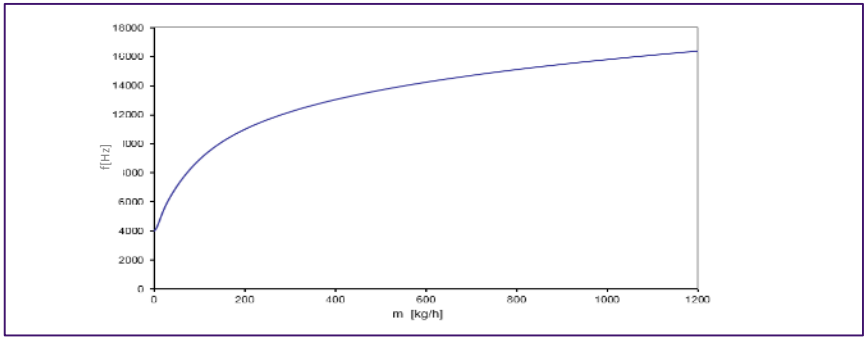
8.2 Air-mass sensors
HFM with digital interface

Product type
HFM-8-SF-TH

Part number
0 281 006 812

Picture


Dimensional drawings


Air-mass characteristic curve at ambient temperature


Technical data

Features		With integrated humidity and ambient-temperature sensor.
Nominal airflow	$\dot{m}_N$	640 kg/h
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_V	4,85 ... 5,15 V
Relative accuracy [1]	$\Delta \dot{m} / \dot{m}$	± 5 %
Temperature range [2]	°C	-40 ... +130
Pressure drop at $\dot{m}_N$	Δp	depending on size and design of cross section area
Current input	I_V	< 0,06 A
Time constant	τ_{63} [3]	≤ 10 ms
Time constant	$\tau\Delta$ [4]	≤ 30 ms

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

► Product groups

9.1 Lambda sensors

Type LSU 4.9 (wideband)

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

Application

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

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

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

Design and operation

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

► Product groups

9.1 Lambda sensors

Type LSU 4.9 (wideband)

Product type

LSU-4.9

Part number

0 258 017 025

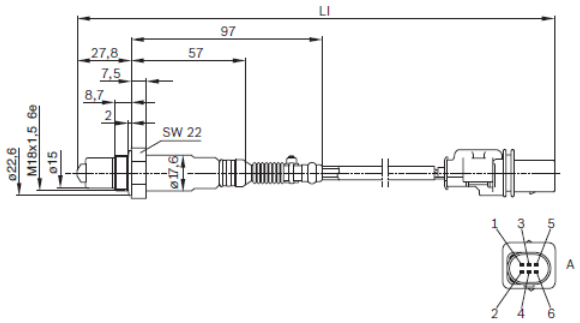
Picture

Technical data

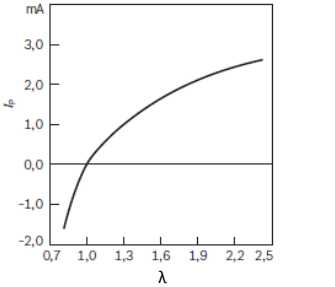
Due to the complexity of this product a detailed technical product Description is available. Please request it at:

bosch.lambdasonde@de.bosch.com

Dimensional drawings

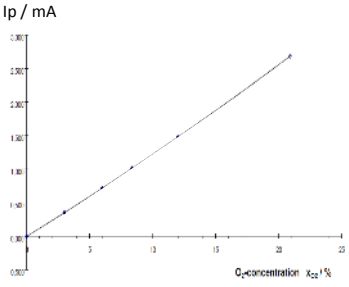


Characteristic curve



I_P = Pump current
λ = Air ratio

Characteristic curve



Accessories

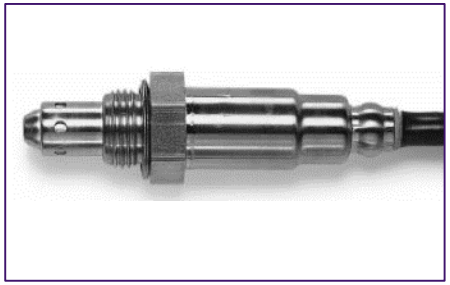
Mating connector parts set	Connector housing, contacts, grommet	1 986 280 016

► Product groups

9.2 Lambda sensors

Type LSF4 (narrow band)

► 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

Measurement and analysis processes
– 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 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

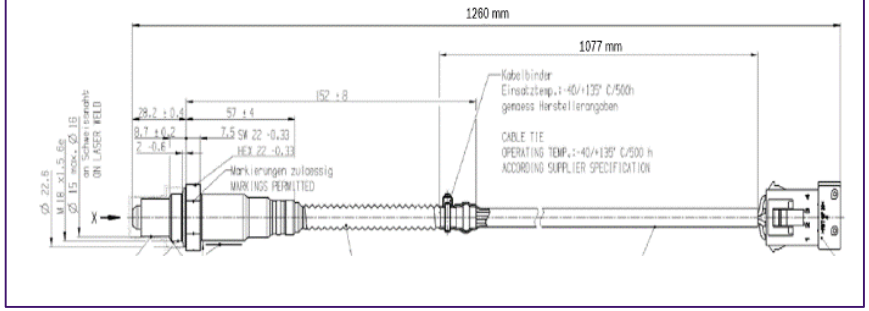
0 258 006 026

Picture

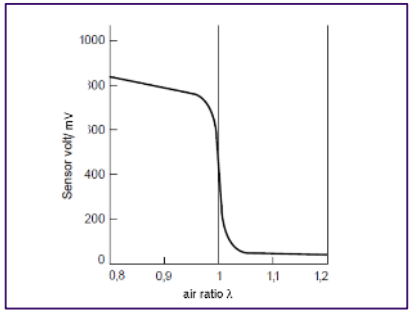
Technical data

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
Heater current	0,48 ± 0,1 A
Heater power (with 13V heater voltage)	7 W
Heater nominal voltage supply	12 V
Exhaust gas temperature	350°C .... 930°C

Dimensional drawing



Characteristic curve



► Product groups

List of part numbers

► Product groups