Part number: 1 987 721 076

Part number: 1 987 721 021

Part number: 1 987 721 540

Part number: 1 987 721 074

Part number: 1 987 721 029

The Bosch Program for industrial applications

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This edition supersedes all previous editions.

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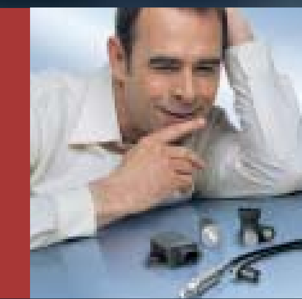
Sensors for angles, rotation rate, speed, pressure, air-mass flow rate, oxygen, temperature, structure-borne sound

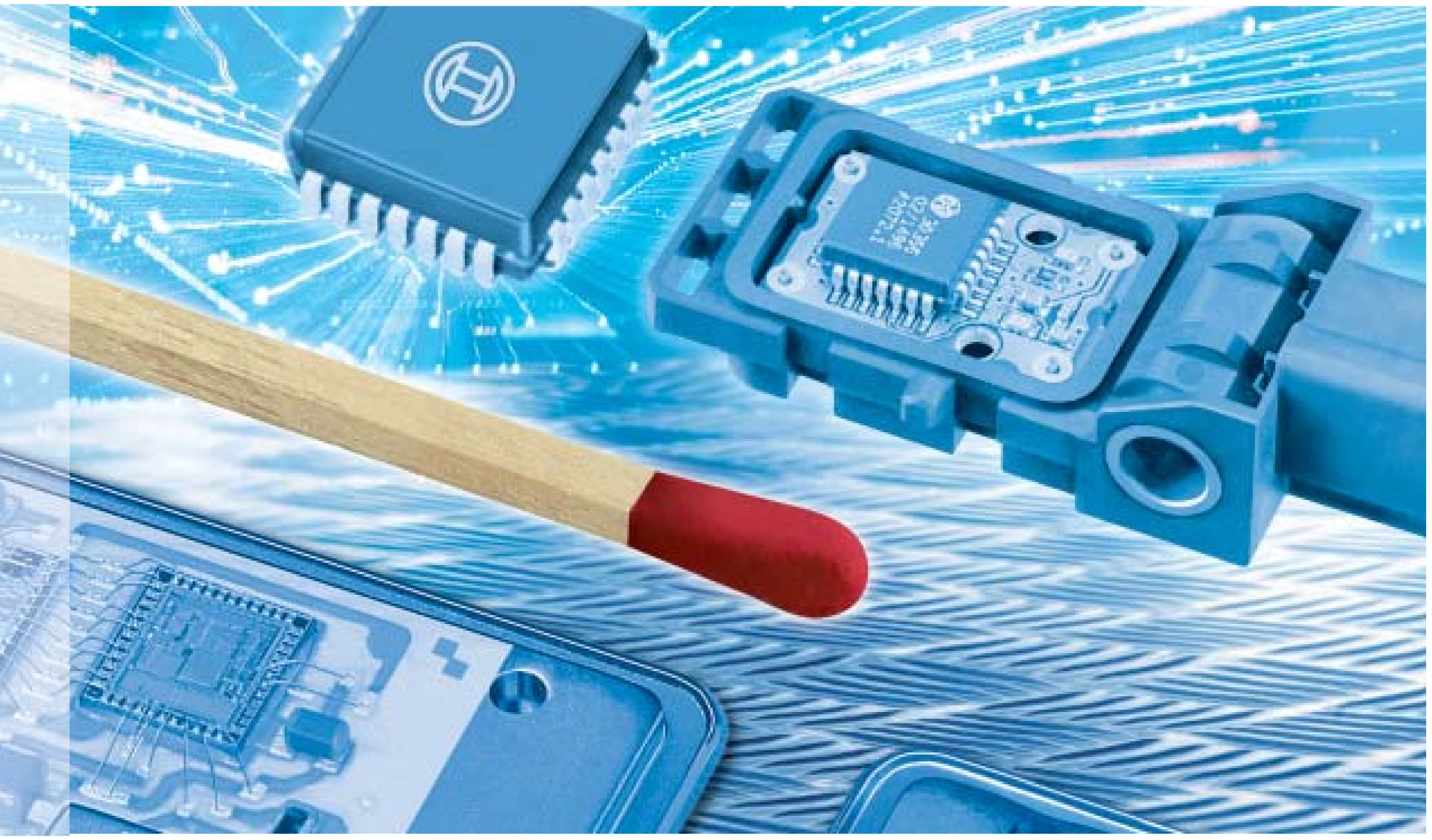


Sensors

2006 | 2007

BOSCH

Sensors – the vehicle's "Sensory System"



Vehicle electronics are constantly gaining in significance. Here, sensors are the vehicle's "sensory system" for travel, angle, speed, velocity, acceleration, vibration, pressure, flow rate, gas concentration, temperature and other influencing variables. Their signals have, in the meantime, become indispensable for many control and regulating functions of the various management systems for engine and vehicle control, safety and comfort. Electronic data processing has ultimately made it possible to evaluate the stated influencing variables faster, and to condition them for the required vehicle functions.

These sensors, which have demonstrated their value in millions of vehicles covering numerous kilometers under rough vehicle service conditions, also harbor a tremendous potential for **industrial applications**. Particularly in those areas dependent on high reliability, and where low prices can be achieved through high-volume production.

The areas in which they can be used are almost limitless: wherever tests, closed and open-loop controls, and monitoring are required; wherever computers have to be "fed" with physical data, or even simply wherever automatic switch-on of the heating is required in the cold or of the air conditioner when temperatures climb. Constant further development and refinement of the sensors by Bosch, including their **miniaturization**, means that Bosch is well equipped for tomorrow's challenges and is able to actively participate in shaping state-of-the-art technology.

Our philosophy

Our philosophy
With the quality, value for money and function of our products, we wish to set standards and capture a peak position in the market. By working towards economical solutions, we reinforce our innovative strength and thus our future. For our customers, we are an active, receptive partner who is aware of their goals and gives complete satisfaction. We react rapidly and flexibly to the requirements of our customers and colleagues. We accomplish our agreed tasks creatively, with the emphasis on quality and on the protection of the environment.

Our staff
We prefer target-oriented team-work, and treat problems as an opportunity for continual improvement. All management personnel delegate responsibility and support their workers by stipulating clear targets and by the appropriate control of resources. They set an example in putting our philosophy into practice.

Our organization
Bosch is never far from its clients. We are close to vehicle manufacturers, working in close cooperation with them in the development of new solutions. But we are also close to the users of sensors, who can enjoy competent service all over the world from nearly 10,000 Bosch Service Agents. Bosch has agents in 130 countries. In our international alliance, we develop and produce sensors in Europe, the USA and Asia.

Our technology
From drafting through design to production, we use the latest techniques and facilities, such as
- Finite-element calculations,
- Fully automated production lines,
- Quality assurance by computer-aided, statistical closed-loop process control and 100 % testing of all parameters which are relevant for correct function.

Our contribution to environmental protection
Our sensors are made from materials which can be recycled, which, thanks to thermal and magnetic separation processes, can be reintroduced into the material cycle. We use re-cyclable cardboard packaging containing a high proportion of recycled paper, or, on request, reusable packaging.

Sensors

Techniques and applications

This catalog features the most important technical data required for selecting a given sensor. To date, the sensors listed have all been used in automotive applications, but their universal and highly versatile characteristics also make them ideally suitable for industrial applications. For instance in:

- Manufacturing engineering
- Mechanical engineering
- Automation
- Materials handling and conveying
- Heating and air-conditioning
- Chemical and process engineering
- Environmental and conservation technology
- Installation and plant engineering

Brief descriptions and examples of application are to be found in the Table below.

For the applications listed below, prior clarification of the technical suitability is imperative. This Catalog only lists those products which are available from series manufacture.
If your problem cannot be solved with this range of products, please inform of us of your requirements using the Enquiry Data Sheet.

Sensors	Automotive application	Examples of non-automotive applications
Angular position sensors measure simple angular settings and changes in angle.	Throttle-valve-angle measurement for engine management on gasoline (SI) engines.	Door/window opening angle, setting-lever angles in monitoring and control installations.
Rotational-speed sensors measure rotational speeds, positions and angles in excess of 360°.	Wheel-speed measurement for ABS/TCS, engine speeds, positioning angle for engine management, measurement of steering-wheel angle, distance covered, and curves/bends for vehicle navigation systems.	Proximity or non-contact measurement of rotational speed, displacement and angular measurement, definition of end and limit settings for industrial machines, robots, and installations of all types.
Spring-mass acceleration sensors measure changes in speed, such as are common in road traffic.	Registration of vehicular acceleration and deceleration. Used for the Antilock Braking System (ABS) and the Traction Control System (TCS).	Acceleration and deceleration measurement for safety, control, protective systems in lifts, cable railways, fork-lift trucks, conveyor belts, machines, wind power stations.
Bending-beam acceleration sensors register shocks and vibration which are caused by impacts on rough/unpaved road surfaces or contact with kerbstones.	For engine management, detection of vibration on rough/unpaved road surfaces.	Forced switch-off for machines, industrial robots, manufacturing plant, and gaming machines in case of sudden acceleration or deceleration caused by shock or impact.
Piezoelectric acceleration sensors measure shocks and vibration which occur when vehicles and bodies impact against an obstacle.	Impact detection used for triggering airbags and belt tighteners.	Detection of impact in monitoring/surveillance installations, detection of foreign bodies in combine harvesters, filling machines, and sorting plants. Registration of score during rifleman competitions.
Yaw sensors measure skidding movements, such as occur in vehicles under road traffic conditions.	Used on the vehicle dynamics control (Electronic Stability Program, ESP) for measuring yaw rate and lateral acceleration, and for vehicle navigation sensors.	Stabilization of model vehicles and airplanes, safety circuits in carousels and other entertainment devices on fairgrounds etc.
Piezoelectric vibration sensors measure structure-borne vibrations which occur at engines, machines, and pivot bearings.	Engine-knock detection for anti-knock control in engine-management systems.	Machine-tool safety, cavitation detection, pivot-bearing monitoring, structure-borne-noise detection in measurement systems.
Absolute-pressure sensors measure the pressure ranges from about 50 % to 500 % of the earth's atmospheric pressure.	Manifold vacuum measurement for engine management. Charge-air-pressure measurement for charge-air pressure control, altitude-pressure-dependent fuel injection for diesel engines.	Pressure control in electronic vacuum cleaners, monitoring of pneumatic production lines, meters for air-pressure, altitude, blood pressure, manometers, storm-warning devices.
Differential-pressure sensors measure differential gas pressures, e.g. for pressure-compensation purposes.	Pressure measurement in the fuel tank, evaporative-emissions control systems.	Monitoring of over and underpressure. Pressure limiters, filled-level measurement.
Temperature sensors measure the temperature of gaseous materials and, inside a suitable housing, the temperatures of liquids in the temparature range of the earth's atmosphere and of water.	Display of outside and inside temperature, control of air conditioners and inside temperature, control of radiators and thermostats, measurement of lube-oil, coolant, and engine temperatures.	Thermometers, thermostats, thermal protection, frost detectors, air-conditioner control, temperature and central heating, refrigerant-temperature monitoring, regulation of hot-water and heat pumps.
Lambda oxygen sensors determine the residual oxygen content in the exhaust gas.	Control of A/F mixture for minimization of pollutant emissions on gasoline and gas engines.	Pollutants reduction during combustion, smoke measurement, gas analysis.
Air-mass meters measure the flow rate of gases.	Measurement of the mass of the air drawn in by the engine.	Flow-rate measurement for gases on test benches and in combustion plant.

IP degres of protection
Valid for the electrical equipment of road vehicles as per DIN 40050 (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

IP 2 □[1] 3 □[2] C M

Code letters — IP
First characteristic numeral 0...6 or letter X — 2
Second characteristic numeral 0...9 or letter X — 3
Additional letter (optional) A, B, C, D — C
Supplementary letter (optional) M, S — M
K[1] — □

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.

Comments IP code

1st characteristic numeral and supplementary 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				
			8	Protection against continuous immersion				
			9K	Protection against high-pressure/steam-jet cleaners				

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 real-time 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
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 condense status information so as to minimize driver distraction.
Data transmission rates are generally below 125 kbit/s; whereby direct transmission of audio or video data is not possible.

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

Bus configuration
CAN operates according to the multimaster 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 transmission, and the nodes are not involved in administering system configuration. This facilitates adaptation to variations in equipment levels.

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

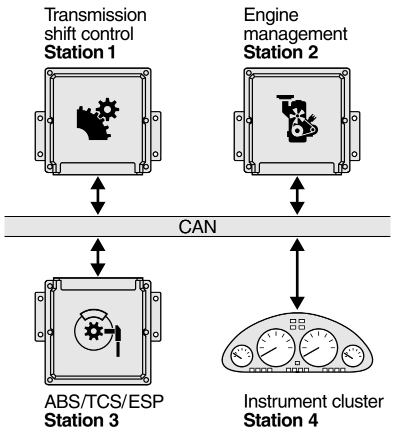
Priority assignments
The identifier labels both the data content and the priority of the message being sent. Identifiers corresponding to low binary numbers enjoy a high priority and vice versa.

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

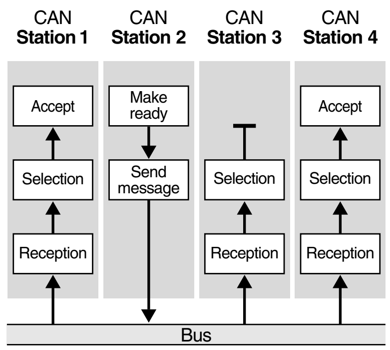
Message format
CAN supports two different data-frame formats, with the sole distinction being in the length of the identifier (ID). The standard-format ID is 11 bits, while the extended version consists of 29 bits. Thus the transmission data frame contains a maximum of 130 bits in standard format, or 150 bits in the extended format. This ensures miminal 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"
enthält den Code für die Anzahl der Datenbytes im „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.

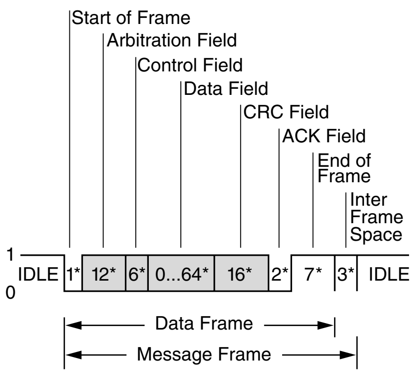
① **Linear bus structure**



② **Message fittering**



③ **Message format**



Transmitter initiative
The transmitter will usually initiate a data transfer by sending a data frame. However, the receiver can also request data from the transmitter. 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. The transmitter follows up a sequence of 5 bits of the same polarity by inserting a bit of the opposite polarity in the bit stream; the receivers eliminate these bits as the messages arrive.
- Frame check: The CAN protocol contains several bit fields with a fixed format for verification by all stations.

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

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

Implementations
In order to provide the proper CPU support for a wide range of different requirements, the semiconductor manufacturers have introduced implementations representing a broad range of performance levels. The various implementations differ neither in the message they produce, nor in their arrangements for responding to errors. The difference lies solely in the type of CPU support required for message administration.
As the demands placed on the ECU's processing capacity are extensive, the interface controller should be able to administer a large number of messages and expedite data communications with, as far as possible, no demands on the CPU's computational resources. 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.

Source: Texts and illustrations on the subject of CAN-Bus are taken from the Bosch Automotive Handbook, 6th Edition, 2004. The Automotive Handbook contains a very wide variety of information covering the whole range of modern-day automotive engineering.

Further information on sensors in the vehicle can be taken from the Bosch Yellow Jacket publication "Automotive Sensors".

Steering-angle sensor

Measurement of angles from -780° to +780°

φ / CAN

- "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.

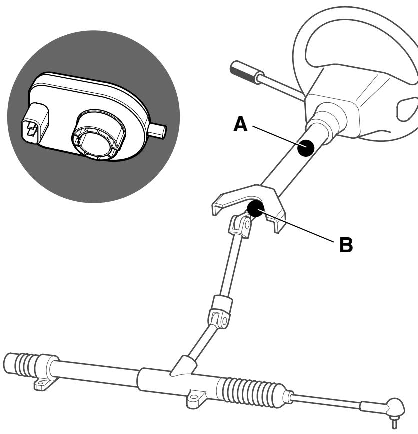
Design and operation

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

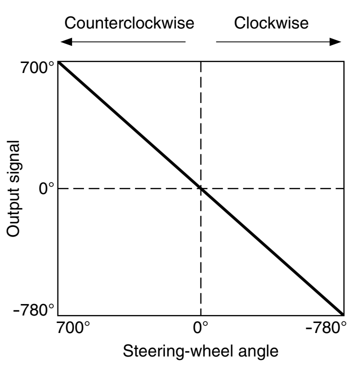
By way of the standardised CAN bus, the steering-wheel angle information can be utilised for example for running-gear control, navigation and electrical power-steering systems. Different types of mechanical connection and electrical interface versions are available on request.

Attachment options

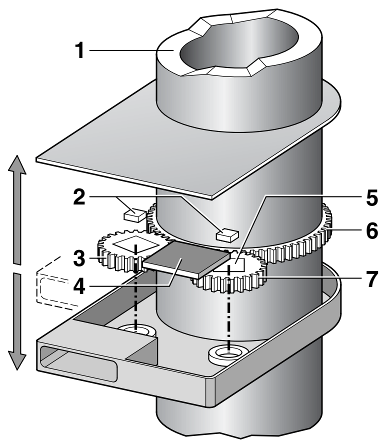


A Steering-column switch
B Steering column

Characteristic curve



Design and operation



1 Steering column
2 AMR measurement cells
3 Gear wheel with m teeth
4 Evaluation electronics
5 Magnets
6 Gear wheel with n>m teeth
7 Gear wheel with m+1 teeth

Part number 0 265 005 411

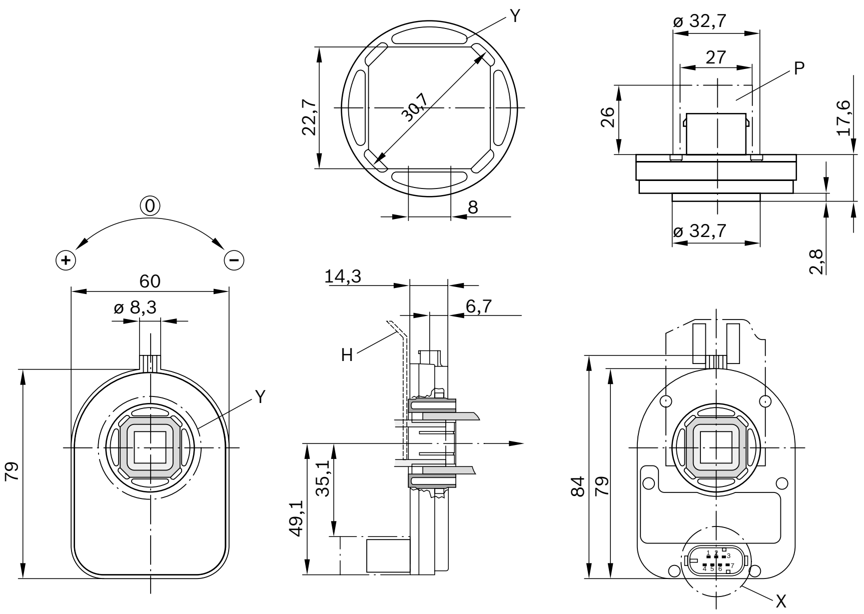
Technical data

Measuring range, angle	- 780 ...+ 780 °
Measuring range, steering-angle velocity	0 ... 1016 °/s
Sensitivity and resolution over measuring range, angle	0,1°
Sensitivity and resolution over measuring range, steering-angle velocity	4°/s
Non-linearity over measuring range, steering-angle velocity	- 2,5 ...+ 2,5 °
Hysteresis over measuring range	0 ... 5 °
Steering-wheel angle velocity, maximum	± 2000 °/s
Steering-wheel angle velocity, displayed	0 ... 1016 °/s
Operating temperature	- 40 ...+ 85 °C
Storage temperature	- 40 ...+ 50 °C
Supply voltage	12V nominal
Supply-voltage range U_V	8 ... 16 V
Current consumption at 12 V	< 150 mA

Other designs on request.

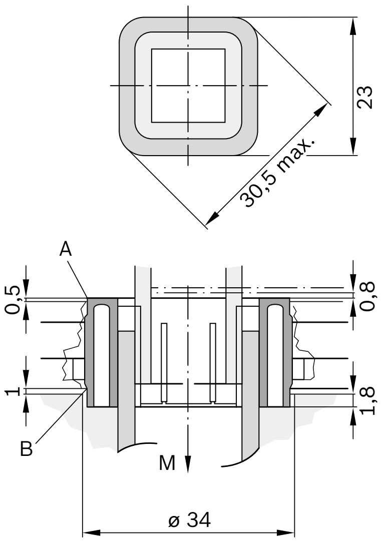
Illustration

Dimension drawings



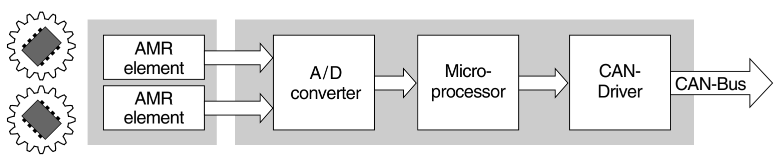
H Retaining plate
P Space for mating connector and wiring harness
X Pin assignment

Steering-column installation dimensions

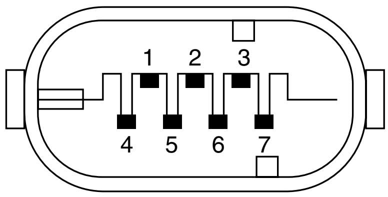


A Distance between hub and holder
B Distance between steering-angle sensor and steering-column assembly flange
M Fitting direction

Block diagram



Pin assignment



Pin 1	Ground	Pin 5	-
Pin 2	12 V	Pin 6	-
Pin 3	CAN High	Pin 7	-
Pin 4	CAN Low		

Accessories

Accessories		Part number
Connector housing	7-pin	1 928 404 025
Contact pins	for Ø 0.5 - 0.7 mm²; Contents: 100 x	1 928 498 001

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

Angle sensor

Measurement of angles up to 88°

φ / R

- 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 register 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 an industrial atmosphere.

Design and operation

The throttle-valve angular-position sensor is a potentiometric angular-position 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.

Version

The throttle-valve angular-position sensor 0 280 122 001 has one linear characteristic curve. The throttle-valve angular-position sensor 0 280 122 201 has two linear characteristic curves. This permits a particularly high resolution in the angle range 0°...23°.

Explanation of characteristic quantities

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 3

Technical data		
Operating voltage U_V	V	5

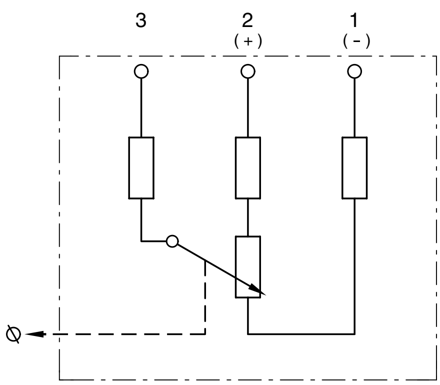
Part number 0 280 122 001

Technical data

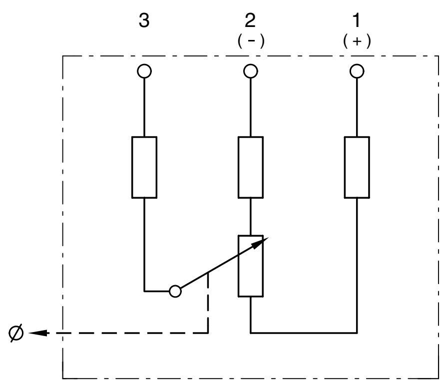
Useful electrical angle range	degrees	≤ 86
Useful mechanical angle range	degrees	≤ 86
Angle between internal stops (must not be reached when fitted)	degrees	≥ 95
Direction of rotation		Any
Total resistance (term. 1-2)	kΩ	2 ± 20 %
Wiper protective resistor (wiper in zero position, term. 2-3)	Ω	710 ... 1380
Permissible wiper current	µA	≤ 18
Voltage ratio from stop to stop - characteristic curve 1		$0{,}04 \le U_A/U_V \le 0{,}96$
Slope of nominal characteristic curve	deg^{-1}	0,00927
Operating temperature		- 40 ...+ 130
Approximate value for permissible vibration acceleration	m/s^2	≤ 700
Service life (rotary cycles)	Mill.	2

Illustration

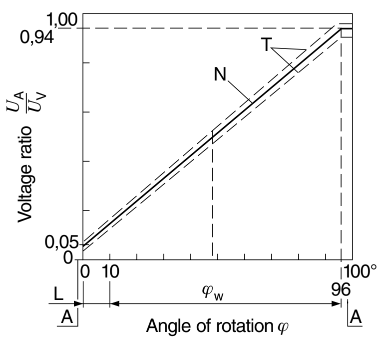
Circuit diagram 1



Circuit diagram 2



Characteristic curve

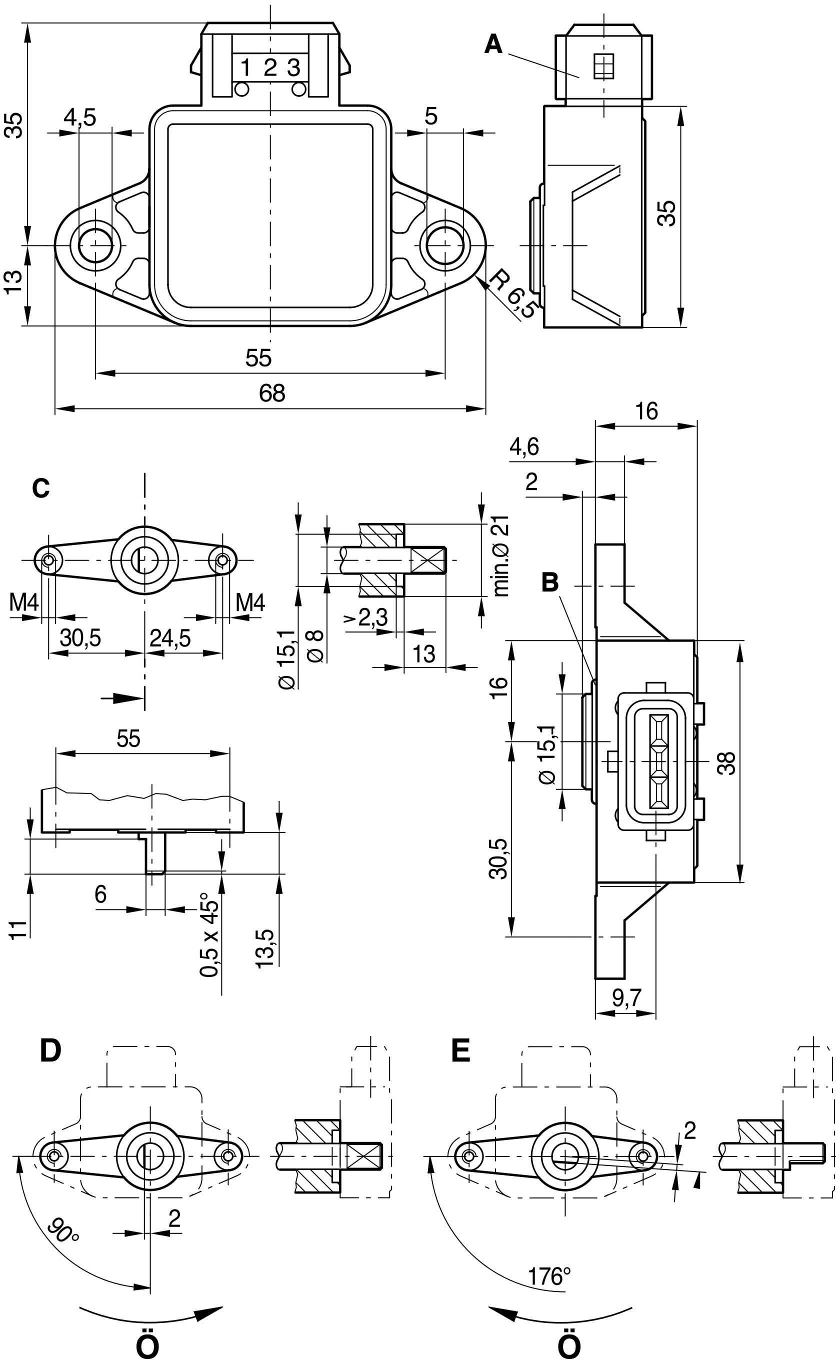


A Internal stop
L Positional tolerance of wiper when attached
N Nominal characteristic curve
T Tolerance limits
φ_w Useful electrical angle range

Accessories	Part number
Connector	1 237 000 039

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

Dimension drawings



A Plug connection
B O-ring 14.65 x 2 mm
C Attachment dimensions for throttle-valve housing
D Clockwise
E Anti-clockwise
Ö Throttle-valve opening direction

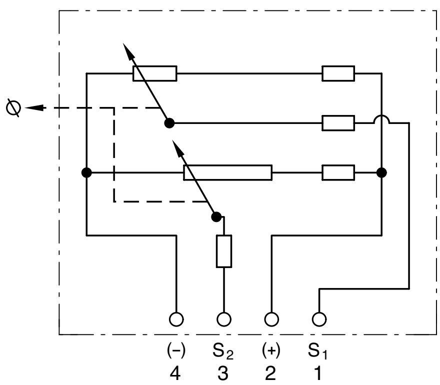
Part number 0 280 122 201

Technical data

Useful electrical angle range	degrees	≤ 88
Useful mechanical angle range	degrees	≤ 92
Direction of rotation		Anti-clockwise
Permissible wiper current	µA	≤ 20
Voltage ratio in range 0...88 °C - characteristic curve 2		$0{,}05 \leq U_{A1} / U_V \leq 0{,}985$
Voltage ratio in range 0...88 °C - characteristic curve 3		$0{,}05 \leq U_{A2} / U_V \leq 0{,}970$
Operating temperature		- 40 ...+ 85
Approximate value for permissible vibration acceleration	m/s^2	≤ 300
Service life (rotary cycles)	Mill.	1,2

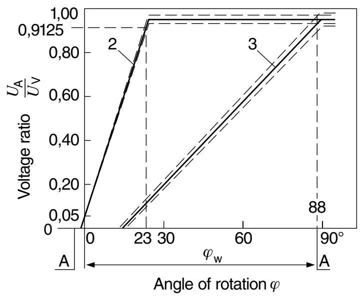
Illustration

Circuit diagram



Throttle valve in idle position

Characteristic curve 1 and 2

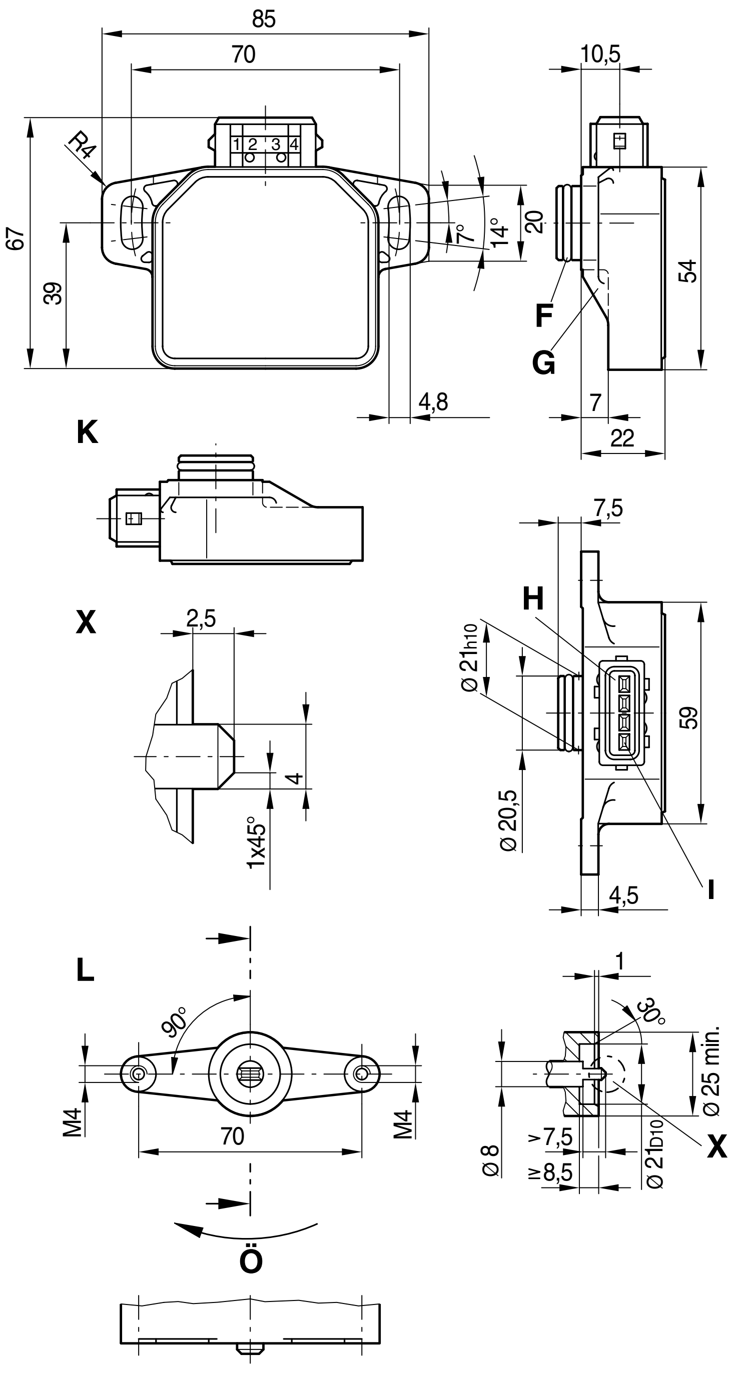


A Internal stop
φ_w Useful electrical angle range

Accessories		Part number
Plug housing		1 284 485 118
Connector housing	Quantity required: 4 x; Contents: 5 x	1 284 477 121
Protective cap	Quantity required: 1 x; Contents: 5 x	1 280 703 023

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

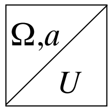
Dimension drawings



F O-ring 16.5 x 2.5 mm
G 2 ribs, 2.5 mm thick
H Plug connection
I Blade terminal
K This installation position is only permissible if throttle-valve shaft is sealed against oil, gasoline etc.
Ö Throttle-valve opening direction
L Attachment dimensions for throttle-valve potentiometer

Yaw sensor

with micromechanical acceleration sensor



- Flexible and cost-effective sensor cluster with highly integrated electronics.
- Modular concept for different integration stages.
- Multiple use of sensor signals for future highly dynamic safety and convenience systems.
- Optimised monitoring and safety concept.

Design

The unit consists of a yaw sensor and an acceleration sensor, as well as evaluation electronics. The components are mounted on a hybrid and hermetically sealed in a metal housing.

Application

The sensor is used in the electronic stability program (ESP) of motor vehicles to measure the vehicle rotation about its vertical axis whilst at the same time determining the acceleration at right angles to the direction of travel. Electronic evaluation of the measured values thus enables the ESP system to distinguish between cornering and
skidding.

Principle of operation

Two oscillatory masses are provided with printed conductors carrying an alternating current. As the two masses are in a constant magnetic field, they are subject to a (Lorentz) force which causes the masses to oscillate. Additional Coriolis forces act on the masses if rotary motion is applied. The resultant Coriolis acceleration is a measure of the yaw rate. The linear acceleration values are recorded by a separate sensor element.

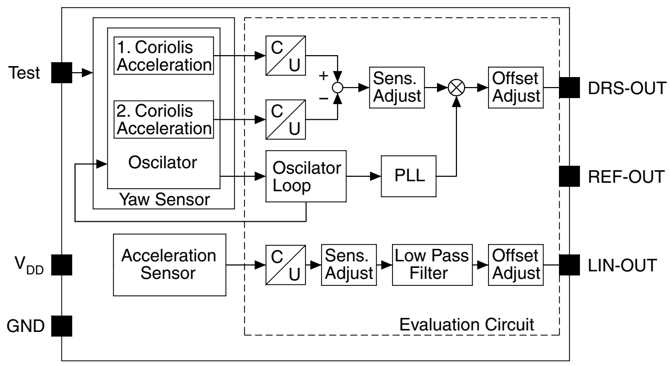
Installation instructions

The sensor is used in the electronic stability program (ESP) of motor vehicles to measure the vehicle rotation about its vertical axis whilst at the same time determining the acceleration at right angles to the direction of travel. Electronic evaluation of the measured values thus enables the ESP system to distinguish between cornering and
skidding.

Explanation of characteristic quantities

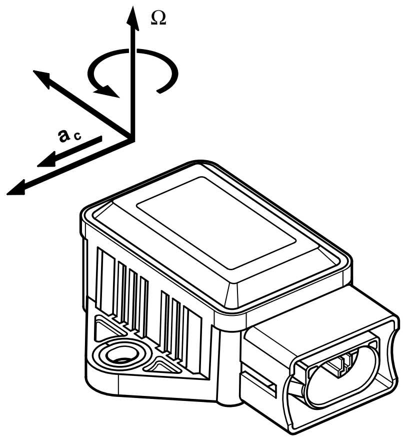
Ω Yaw rate
g Acceleration due to gravity 9.8065 m/s^2
a_q Linear (lateral) acceleration

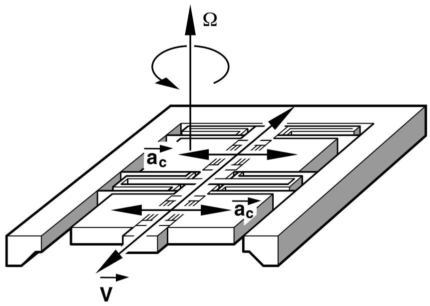
Block diagram

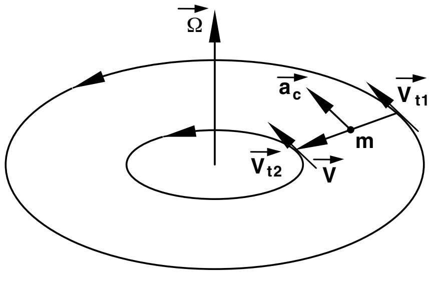


Principle of operation

$\vec{a}_c$ Coriolis acceleration
$\vec{v}$ Oscillation rate
$\vec{\Omega}$ Angular velocity
$= 2\vec{v} \times \vec{\Omega}$
Deviation between $\vec{\Omega}$ axis and reference surface ±3°







Part number 0 265 005 258

Technical data

Yaw sensor/type	DRS-MM 1.0R
Maximum yaw rate Ω_{max} about axis of rotation (Z-axis)	± 100 °/s
Minimum resolution $\Delta\Omega_{max}$	± 0,2 °/s
Sensitivity	18 mV/°/s
Change in sensitivity	≤ 5 %
Yaw-rate offset	2 °/s[1])
Change in offset	≤ 4 °/s
Non-linearity, max. deviation from optimum linear approximation	≤ 1 % FSO
Start-up time	≤ 1 s
Dynamics	≥ 30 Hz
Electrical noise (measured with 100 Hz bandwidth)	≤ 5 mV_{rms}
Maximum acceleration a_{qmax}	± 1,8 *g*
Sensitivity	1000 mV/*g*
Change in sensitivity	≤ 5 %
Offset	0 *g*[1])
Change in offset	≤ 0,06 *g*
Non-linearity, max. deviation from optimum linear approximation	≤ 3 % FSO
Start-up time	≤ 1,0 s
Dynamics	≥ 30 Hz
Electrical noise (measured with 100 Hz bandwidth)	≤ 5 V_{rms}

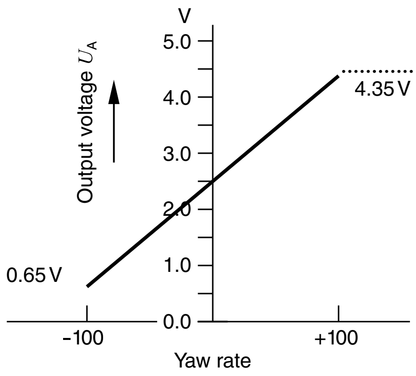
General information

Operating-temperature range	- 30 ...+ 85 °C
Storage-temperature range	- 20 ...+ 50 °C
Supply voltage	12V nominal
Supply-voltage range	8,2 ... 16 V
Current consumption at 12 V	< 70 mA
Reference voltage	2,5 V ± 50 mV[1])

[1]) Zero point at 2.5 V (reference).

Illustration

Characteristic curve

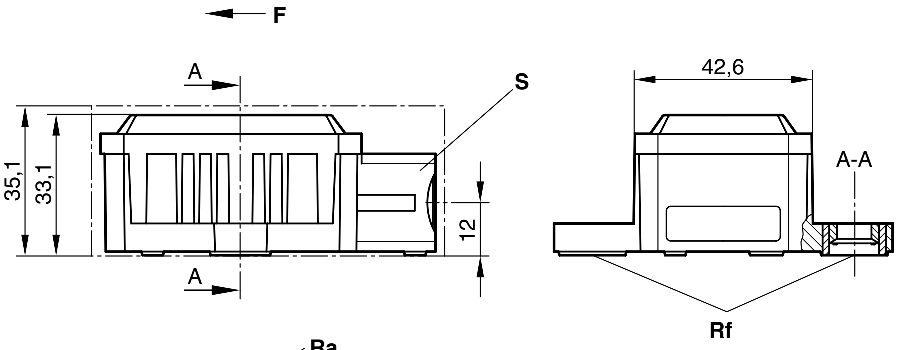


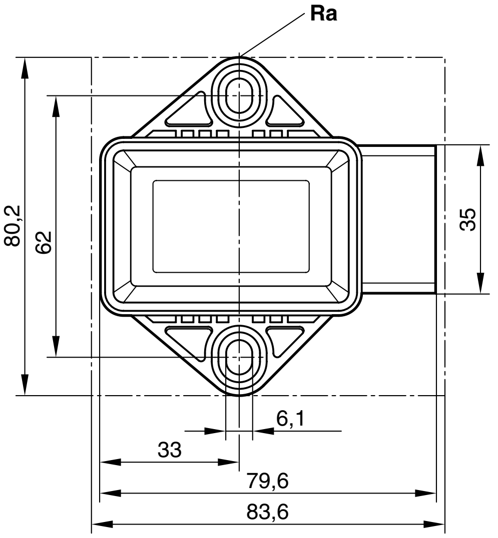
Accessories | Part number

Connector housing	Quantity required: 1 x	Tyco number	1-967 616-1[1])
Contact pins	for Ø 0.75 mm²; Quantity required: 6 x	Tyco number	965 907-1[1])
Seals	for Ø 1.4...1.9 mm²; Quantity required: 6 x	Tyco number	965 907-1[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

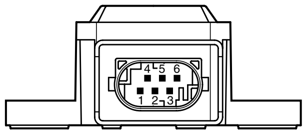
Dimension drawings





F Direction of travel
S 6-pin connector
Ra Reference axis
Rf Reference surface
a_c Acceleration direction

Pin assignment



Pin 1 Reference
Pin 2 BITE
Pin 3 12 V
Pin 4 Out DRS
Pin 5 Out BS
Pin 6 Ground

Yaw sensor with CAN interface

with micromechanical acceleration sensor

Ω,a / U

- Flexible and cost-effective sensor cluster with highly integrated electronics.
- Modular concept for different integration stages.
- Multiple use of sensor signals for future highly dynamic safety and convenience systems.
- Optimised monitoring and safety concept.

Design

Use is made in the sensor cluster of a new generation of micromechanical elements for the measurement and digital processing of angular velocity and acceleration. Based on PCB technology, they form a modular hardware and software concept with many new safety features providing a versatile and reliable unit for a wide variety of automotive applications.

Application

The introduction of the ESP system, the link with other chassis convenience systems and the development of advanced vehicle-stabilisation 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 measurement axes with a high degree of reliability. Bosch therefore developed a third generation, the versatile and inexpensive sensor cluster DRS MM3.x to meet the requirements of functions such as the hill-starting assistant, automatic parking brake, adaptive cruise and distance control, four-wheel drive, rollover intervention, electronic active steering, and control systems for springs and dampers.
DRS-MM3.7k is the basic version of the MM3 generation for ESP applications. It comprises a yaw sensor and an integrated lateral-acceleration module.

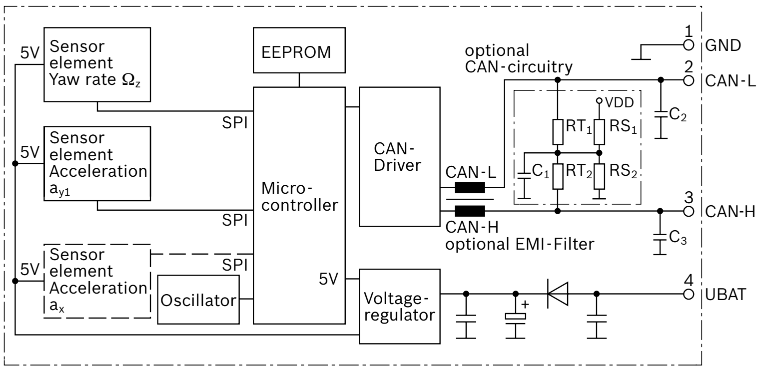
Principle of operation

The new micromechanical element for yaw-rate measurement is a member of the established group of vibrating gyrometers operating on the Coriolis principle (CVG = Coriolis Vibrating Gyros).
It consists of an inverse tuning fork with two mutually perpendicular linear vibration modes, drive circuit and evaluation circuit. A comb-like structure provides electrostatic drive and evaluation. The Coriolis acceleration is measured electrostatically by way of engaging electrodes. The measurement element is made up of two masses connected by way of a spring with the same resonance frequency for both vibration modes. This is typically 15 kHz and thus outside the normal vehicle interference spectrum, making it resistant to disturbance acceleration.
The evaluation circuit ASIC and the micromechanical measurement element are located in a prefabricated housing with 20 connections (Premold 20). The design of the acceleration module is comparable to that of the yaw sensor module and consists of a micromechanical measurement element, an electronic evaluation circuit and a housing with 12 connections (Premold 12). The sensitive element of the spring mass structure is deflected by external acceleration and evaluation is performed with a differential capacitor in the form of a comb structure.

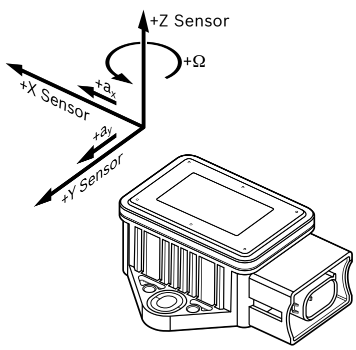
Explanation of characteristic quantities

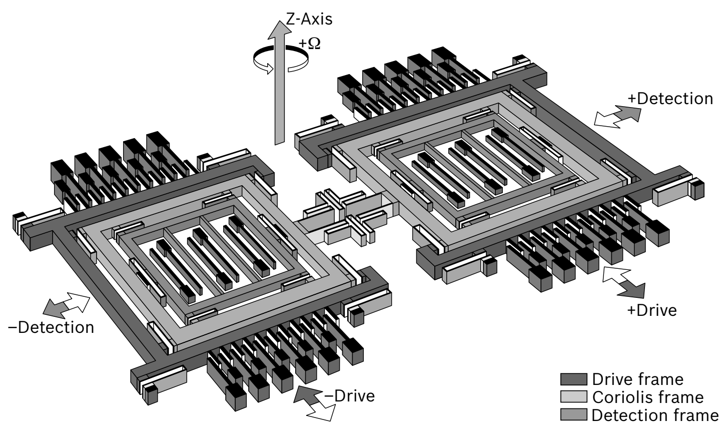
Ω Yaw rate
g Acceleration due to gravity 9.8065 m/s^2

Block diagram



Principle of operation





Ω Angular velocity (to be measured)
a_y, a_x and Ω are the signals supplied by the (illustrated) sensor, where:
Ω Angular velocity
a_y Acceleration in y-direction = Lateral acceleration
a_x Acceleration in x-direction = Longitudinal acceleration

Part number 0 265 005 642

Technical data

Yaw sensor/type	DRS-MM 3.7K
Maximum yaw rate Ω_{max} about axis of rotation (Z-axis)	± 100 °/s
Minimum resolution $\Delta\Omega_{max}$	± 0,1 °/s
Sensitivity	200 LSB/°/s
Sensitivity tolerance over service life[1])	≤ 5 %
Yaw-rate offset	≤ 1,5 °/s
Offset error over service life[1])	≤ 2 °/s
Non-linearity, max. deviation from optimum linear approximation	≤ 1 °/s
Start-up time	≤ 1 s
Dynamics	15Hz
Electrical noise (measured with 100 Hz bandwidth)	≤ 0,2 °/s_{rms}

Linear acceleration sensor

Maximum acceleration a_{qmax}	± 1,8 g
Sensitivity	800LSB/m/s^2
Sensitivity	7845LSB/g
Sensitivity tolerance over service life[1])	≤ 5 %
Offset	≤ 0,03 g
Offset error over service life[1])	≤ 0,1 g
Non-linearity, max. deviation from optimum linear approximation	≤ 4 % FSO
Start-up time	≤ 0,25 s
Dynamics	15 Hz
Electrical noise (measured with 100 Hz bandwidth)	≤ 0,01 g_{rms}

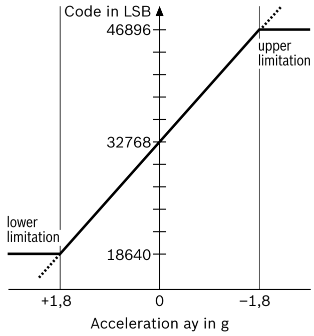
General information

Operating-temperature range	-40 ... 85 °C
Storage-temperature range	-40 ... 50 °C
Supply voltage	12V nominal
Supply-voltage range	7 ... 18 V
Current consumption at 12	< 130 mA

[1]) Service life: 6,000 h, over 15 years.

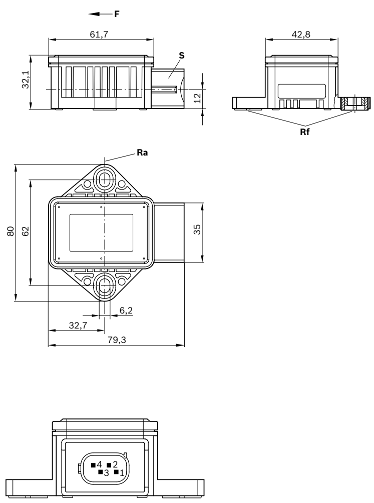
Illustration

Yaw-rate characteristic curve

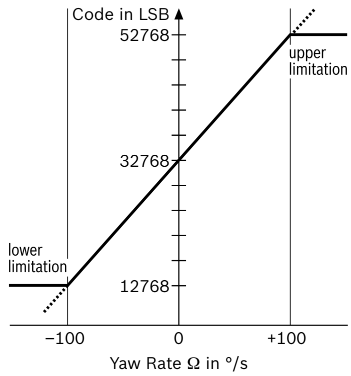


Dimension drawings

F	Direction of travel
S	4-pin connector
Ra	Reference axis
Rf	Reference surface
Pin 1	GND
Pin 2	CANL
Pin 3	CANH
Pin 4	12 V



Acceleration characteristic curve



Accessories

Accessories		Part number
Plug housing	Tyco number	114-18063-076[1])
Contact pins	Tyco number	114-18063[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

Inductive rotational-speed sensor

Incremental measurement of rotational speeds and angles.

- Non-contacting and thus wear-free rotational-speed measurement.
- Sturdy design for exacting demands.
- Strong output signal.
- Measurement dependent on specific direction of rotation.

Application

Inductive speed sensors of this type are suitable for a wide range of rotational-speed measurement applications. Depending on design, they measure engine speeds or wheel speeds for ABS systems in a completely non-contacting and wear-free manner and convert the rotational speeds into electrical signals.

Design and operation

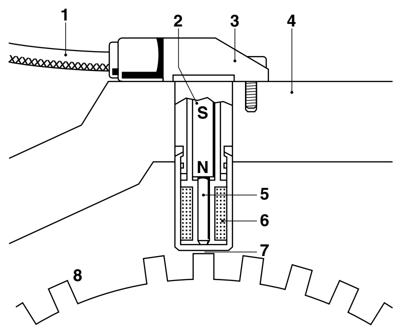
The soft-iron core of the speed sensor is surrounded by a winding and is located directly opposite a rotating trigger wheel with only a narrow air gap in between. The soft-iron core is connected to a permanent magnet, the magnetic field of which extends into the ferromagnetic trigger wheel and is influenced by this. If there is a tooth directly opposite the sensor, this concentrates the magnetic field and thus intensifies the magnetic flux in the coil. A gap, on the other hand, weakens the flux in the coil. These two situations alternate constantly as the ring gear rotates. Changes in magnetic flux occur at the gap-to-tooth transitions (leading tooth edge) and at the tooth-to-gap transitions (trailing tooth edge). In accordance with Faraday's law, these changes induce an AC voltage in the coil. The frequency of this can be used for rotational-speed measurement.

The sensor generates one output pulse per tooth. The pulse amplitude is a function of the air gap, together ring's rotational speed, the shape of its teeth, and the materials used in its manufacture. Not only the output-signal amplitude increases with speed, but also its frequency. This means that a minumum rotational speed is required for reliable evaluation of even the smallest voltages. A reference mark on the pulse ring in the form of a large "tooth space" makes it possible not only to perform rotational-speed measurenemt, but also to determine the pulse ring's position. Since the toothed pulse ring is an important component of the rotational-speed measuring system, exacting technical demands are made upon it to ensure that reliable, precise information is obtained. Pulse-ring specifications are available on request.

Explanation of characteristic quantities

U_A Output voltage
n Rotational speed
s Air gap

Rotational-speed sensor (block diagram)



1 Cable
2 Permanent magnet
3 Sensor housing
4 Housing block
5 Soft-iron core
6 Coil
7 Air gap
8 Trigger wheel with reference mark

Technical data

Rotational-speed measuring range[1]) n	min^{-1}	≈ 20 ... 7000
Sustained ambient temperature/coil zone	°C	- 40 ...+ 150
Max. vibration	m/s^2	1200
Number of turns		4300 ± 10
Winding resistance at 20 °C[2])	Ω	860 ± 10 %
Inductance at 1 kHz	mH	370 ± 15 %
Degree of protection		IP 67
Output voltage[2]) U_A	V	0 ... 200
Signal frequency		1 ... 2500 Hz

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

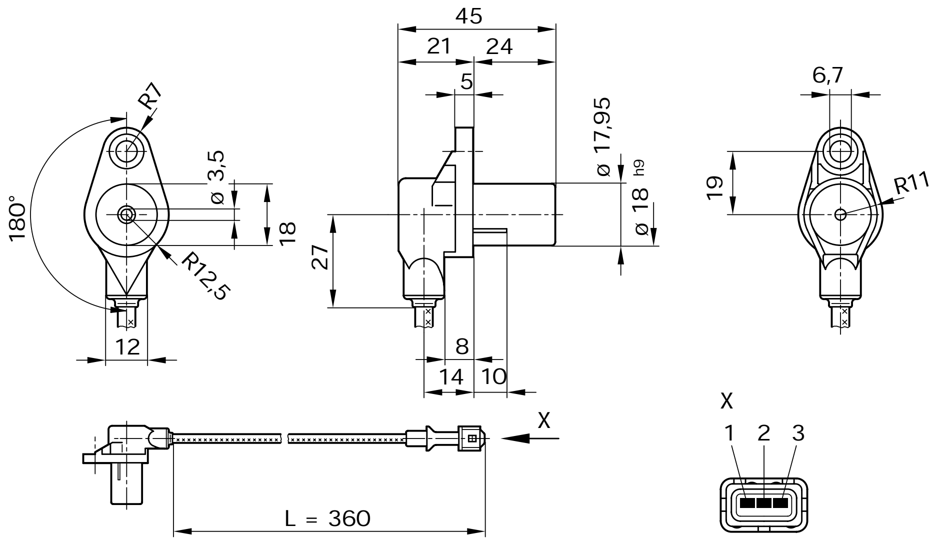
Part number 0 261 210 104

Technical data

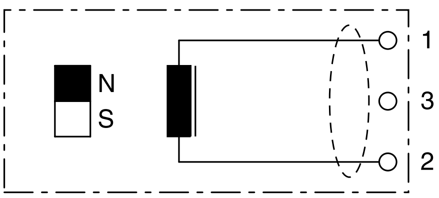
Cable length with connector	mm	360 ± 15
Sustained ambient temperature/cable zone	°C	- 40 ...+ 120

Illustration

Dimension drawings



Circuit diagram



Connections:
1 Output voltage
2 Ground
3 Screen

Accessories		Part number
Connector	with clip fastener	1 928 402 412
Connector	without clip fastener	1 928 402 579

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

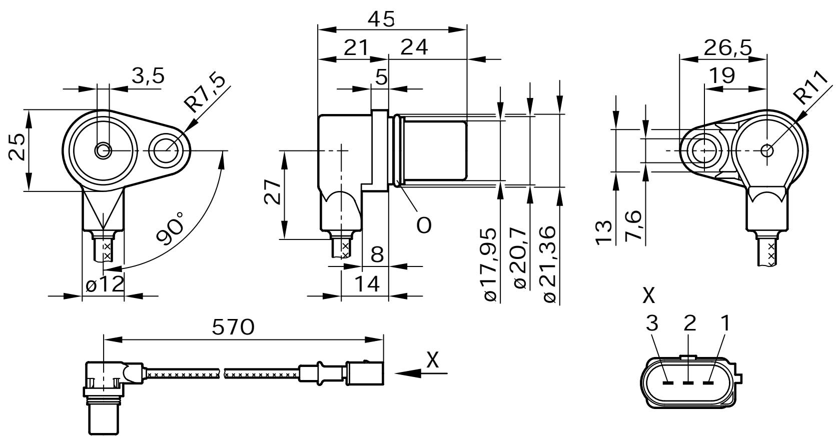
Part number 0 261 210 147

Technical data

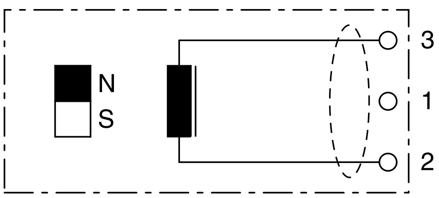
Cable length with connector	mm	553 ± 10
Sustained ambient temperature/cable zone	°C	- 40 ...+ 130

Illustration

Dimension drawings



Circuit diagram



Connections:
1 Output voltage
2 Ground
3 Screen

Accessories	Part number
Connector	Available from Tyco Electronics

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

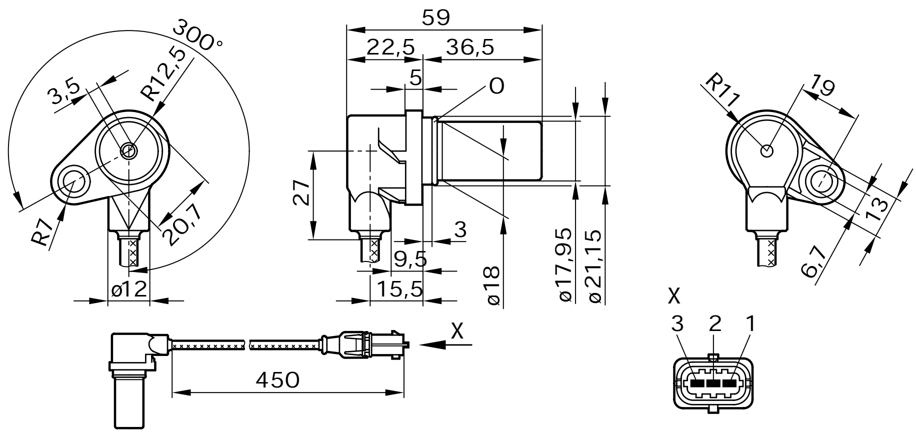
Part number 0 281 002 214

Technical data

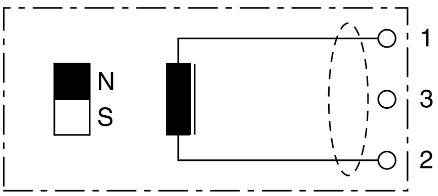
Cable length with connector	mm	450 ± 15
Sustained ambient temperature/cable zone	°C	- 40 ...+ 120

Illustration

Dimension drawings



Circuit diagram



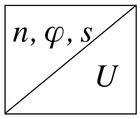
Connections:
1 Output voltage
2 Ground
3 Screen

Accessories	Part number
Connector	1 928 402 966

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

Hall speed sensor

Digital measurement of rotational speeds



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

Design

Hall sensors consist of a semiconductor wafer with integrated driver circuits (e.g. Schmitt trigger) for signal conditioning, a transistor as output driver and a permanent magnet. These are hermetically sealed in a plastic connector housing. In an active rotational-speed sensor, magnets assume the function of the sensor-ring teeth. The magnets are integrated into a multiple rotor for example and are arranged with alternating polarity around its periphery. The measuring cell of the active rotational-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 measuring cell as the multiple rotor turns.

Application

Hall speed sensors are suitable for non-contacting and thus wear-free rotational-speed measurement. Thanks to its compact design and low weight, the active rotational-speed sensor can be installed at or in a wheel bearing.

Principle of operation

The principal sensor components are either Hall elements or magnetoresistive elements. Both elements generate a voltage which is governed by the magnetic flux through the measurement 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 the wheel speed. Wheel speed measurement is therefore possible almost until the wheel is no longer turning. A typical feature of the active speed sensor is the local amplifier, integrated together with the measurement cell in the sensor housing. A two-wire cable provides the control unit link. The speed information is transmitted as a load-independent current. As with the inductive speed sensor, the frequency of the current is proportional to the wheel speed. As opposed to the method of transmission with an inductive speed sensor, inductive disturbance voltages have no influence with this type of transmission employing conditioned digital signals.

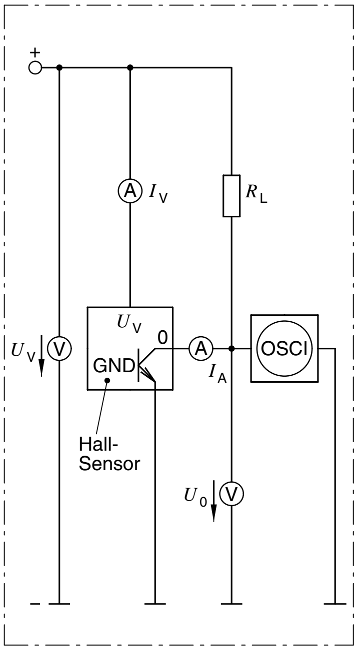
Installation instructions

- Standard installation conditions ensure full sensor operating capacity.
- Route connecting leads in parallel to minimise interference.
- Protect sensor against the destructive effect of static discharge (CMOS elements).

Explanation of characteristic quantities

$n_{min.}$=0 Static operation possible. $n_{min.}$>0 Only dynamic operation possible.
U_V Max. LOW output voltage 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).

Block diagram



Technical data

Minimum working air gap	0,1 mm
Output current I_A	0 ... 20 mA
Output voltage U_A	0 ... U_V
Output saturation voltage U_s	≤ 0,5 V
Switching time t_f[2]	≤ 1 µs
Switching time t_r[3]	≤ 15 µs

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 %.

Part number 0 232 103 021

The trigger wheel must be designed as a 2-track wheel. The phase sensor must be installed in central position. Permissible centre offset: ±0.5 mm.
Segment shape:

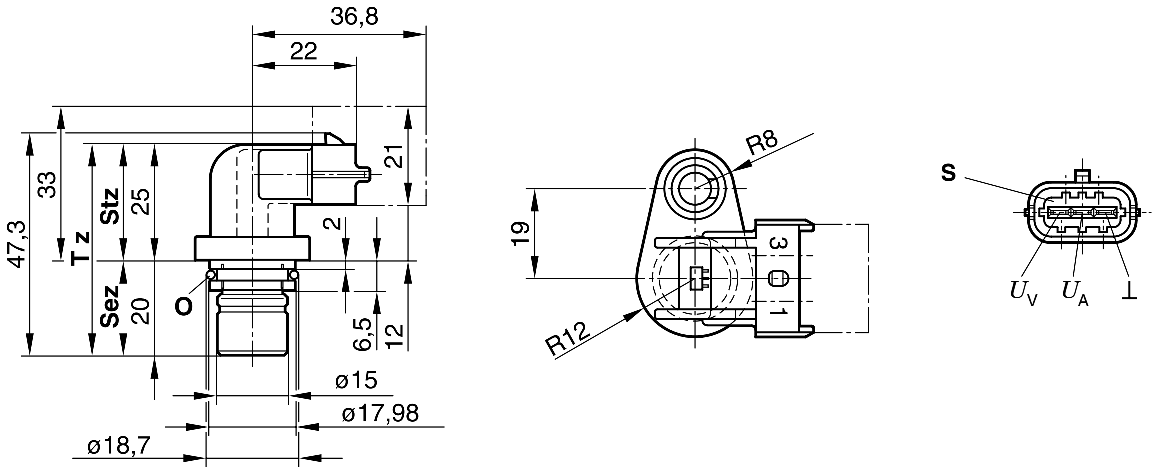
Average diameter	≥ 45 mm
Segment width	≥ 5 mm
Segment length	≥ 10 mm
Segment height	≥ 3.5 mm

Technical data

Minimum trigger-wheel speed	$n_{min.}$	0min^{-1}
Maximum trigger-wheel speed	$n_{max.}$	4000min^{-1}
Maximum working air gap		1,8mm
Rated supply voltage	U_N	5V
Supply-voltage range	U_V	4,75 ... 5,25 V[1])
Supply current	I_V	Typically 5.5 mA
Sustained temperature in sensor and transition zone		- 40 ...+ 150 °C[1])
Sustained temperature in connector zone		- 40 ...+ 130 °C[2])

Illustration

Dimension drawings



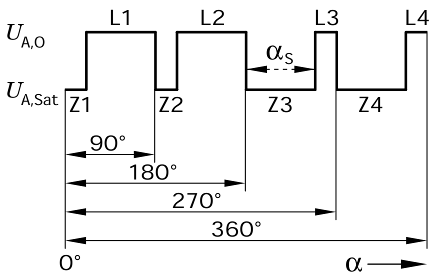
S 3-pin plug connection
Sez Sensor zone
Stz Connector zone a
Tz Temperature zone
O O-ring

Accessories

Accessories		Part number
Connector housing	for Ø 0.5...1.0 mm^2	1 928 403 110
Contact pins	for Ø 0.5...1.0 mm^2; Contents: 20 x	1 987 280 103
Contact pins	for Ø 1.5...2.5 mm^2; Contents: 20 x	1 987 280 105
Individual seals	for Ø 0.5...1.0 mm^2; Contents: 50 x	1 987 280 106
Individual seals	for Ø 1.5...2.5 mm^2; Contents: 20 x	1 987 280 107

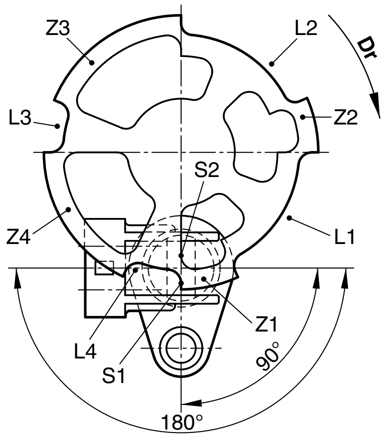
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.

Ouput-signal profile



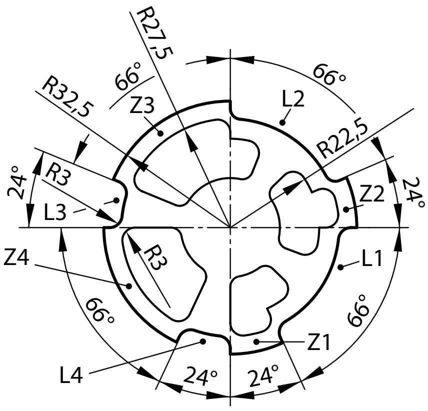
$U_{A,O}$	Output voltage
$U_{A,SAT}$	Output saturation voltage
α	Angle of rotation
α_s	Signal width

Installation requirements



Dr Direction of rotation

Test wheel



Part number 0 232 103 022

The trigger wheel is scanned radially.
Segment shape:

Diameter	≥ 30 mm
Tooth height	≥ 4.5 mm
Tooth width	≥ 10 mm
Material thickness	≥ 3.5 mm

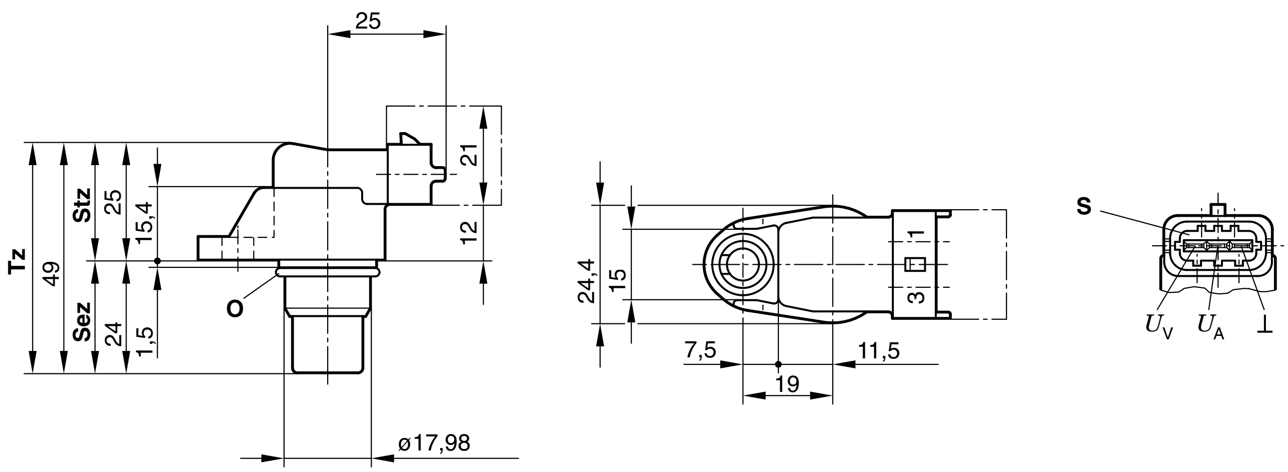
Technical data

Minimum trigger-wheel speed	$n_{min.}$	10 min^{-1}
Maximum trigger-wheel speed	$n_{max.}$	4500 min^{-1}
Maximum working air gap		1,5 mm
Rated supply voltage	U_N	12 V
Supply-voltage range	U_V	4,5 ... 24 V
Supply current	I_V	10 mA
Sustained temperature in sensor and transition zone		- 30 ...+ 130 °C[1])
Sustained temperature in connector zone		- 30 ...+ 120 °C[2])

[1]) -40...+150 °C permissible for brief periods.
[2]) -40...+130 °C permissible for brief periods.

Illustration

Dimension drawings



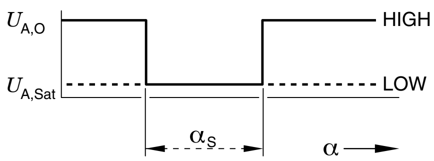
Accessories

Accessories		Part number
Connector housing	for Ø 0.5...1.0 mm^2	1 928 403 110
Contact pins	for Ø 0.5...1.0 mm^2; Contents: 20 x	1 987 280 103
Contact pins	for Ø 1.5...2.5 mm^2; Contents: 20 x	1 987 280 105
Individual seals	for Ø 0.5...1.0 mm^2; Content: 50 x	1 987 280 106
Individual seals	for Ø 1.5...2.5 mm^2; Content: 20 x	1 987 280 107

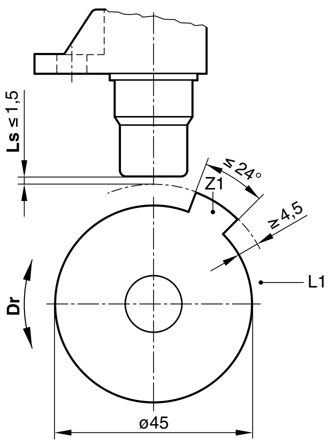
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.

Ouput-signal profile

$U_{A,O}$ Output voltage
$U_{A,SAT}$ Output saturation voltage
Angle of rotation
α_s Signal width

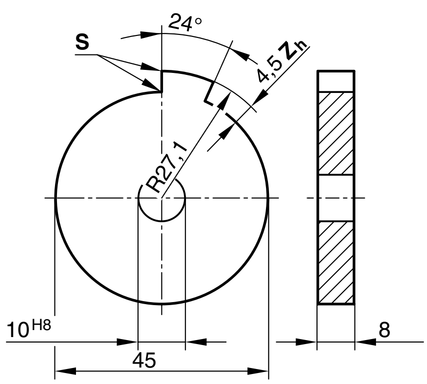


Installation requirements



Dr Direction of rotation

Test wheel

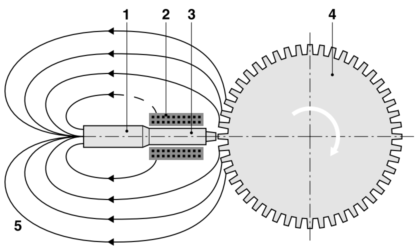


Passive rotational-speed sensor

Application

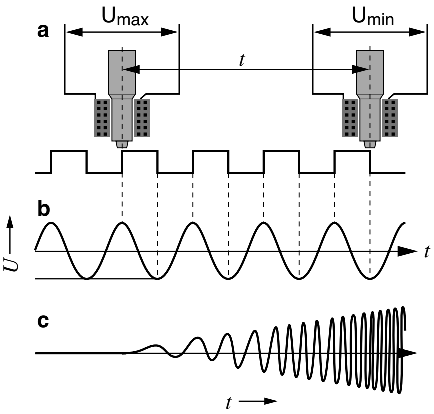
A passive (inductive) rotational-speed sensor consists of a permanent magnet. Connected to this is a soft magnetic pole piece within a coil with several thousand wire turns. A constant magnetic field is generated in this manner. The pole piece is located directly above the sensor ring, which is a toothed wheel permanently connected to the wheel hub. As the sensor ring turns, the constant magnetic field is “disturbed” by the constant alternation between tooth and gap.
This alters the magnetic flux through the pole piece and thus also the magnetic flux through the coil winding. The change in magnetic field induces an AC voltage in the winding, which is tapped at the ends of the winding. Both the frequency and the amplitude of the AC voltage are proportional to the wheel speed. This means that if a wheel is not moving, the induced voltage is equal to zero. The tooth shape, air gap, rate of voltage rise and input sensitivity of the electronic control unit determine the lowest vehicle speed which can still be measured and thus the minimum response sensitivity and switching rate which can be attained for ABS applications.
There are different pole-piece designs and different methods of installation to suit the different conditions encountered at the wheel. The most commonly used types are the flat pole piece and the diamond-shaped pole piece. Both versions must be precisely aligned with the sensor ring on installation.

Block diagram



1 Permanent magnet
2 Solenoid
3 Pole piece
4 Steel sensor ring
5 Magnetic lines of force

Signal output voltage



a Passive wheel-speed sensor with sensor ring
b Sensor signal at constant wheel speed
c Sensor signal with increasing wheel speed

Technical data

Sustained ambient temperature/cable zone	°C	- 40 ...+ 115
Max. vibration loading	m/s^2	1000
Number of turns		6000 ± 40
Output voltage U_A	V	0,0001 ... 1
Signal frequency		1 ... 2000 Hz
Limited-time temperature for coil zone up to 150 °C		200 h
Limited-time temperature for coil zone up to 160 °C		50 x 30 min
Limited-time temperature for coil zone up to 175 °C		10 x 10 min

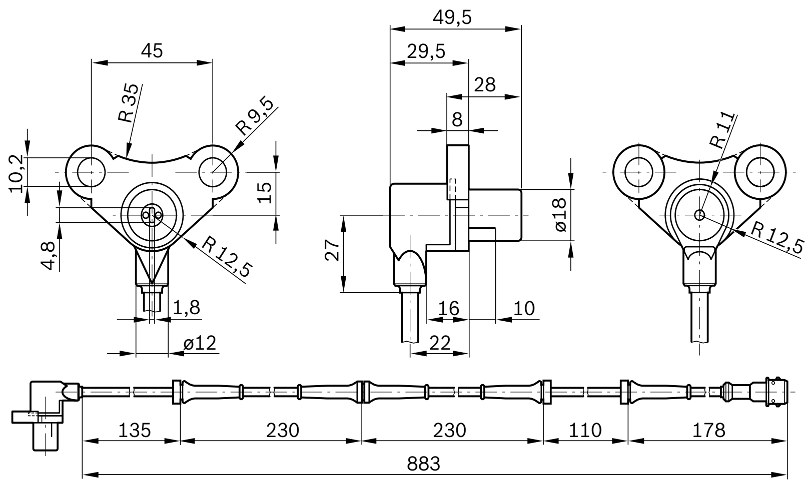
Part number 0 265 006 366

Technical data

Cable length with connector	mm	883 ± 20
Sustained ambient temperature/coil zone	°C	-40 ...+ 115

Illustration

Dimension drawings



Accessories — Part number

Pin housing	2-pin	2 264 420 424
Contact pins	for Ø 0.5...2.5 mm ^{2}	2 263 1245 303

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
If another plug connector is to be used, then the cable must be sealed against ingress of moisture.

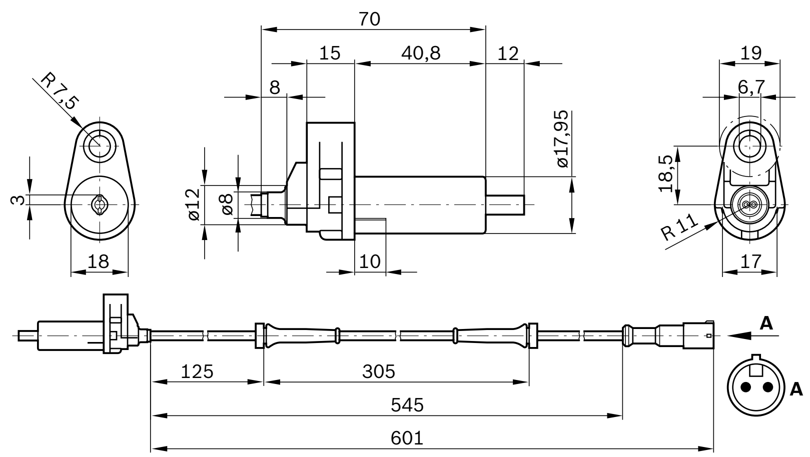
Part number 0 265 006 833

Technical data

Cable length with connector	mm	601 ± 10
Sustained ambient temperature/coil zone	°C	-40 ...+ 115

Illustration

Dimension drawing



Accessories	Part number
Pin housing	-
Contact pins	-

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
If another plug connector is to be used, then the cable must be sealed against ingress of moisture.

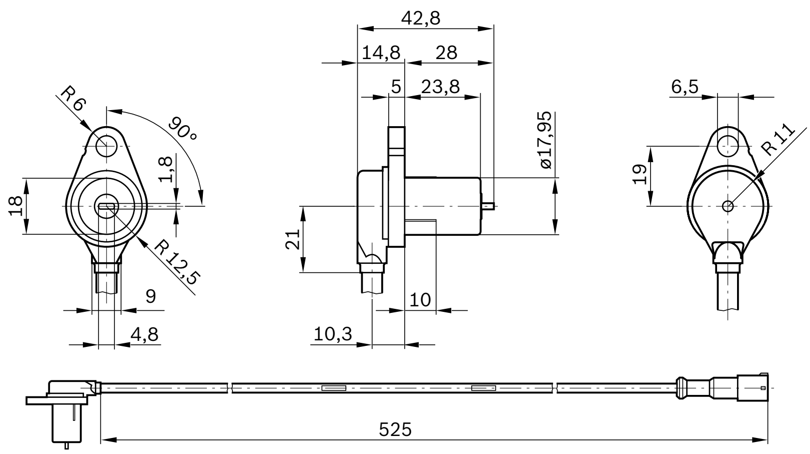
Part number 0 265 006 487

Technical data

Cable length with connector	mm	525 ± 10
Sustained ambient temperature/coil zone	°C	-40 ...+ 120

Illustration

Dimension drawing



Accessories	Part number
Pin housing	-
Contact pins	-

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
If another plug connector is to be used, then the cable must be sealed against ingress of moisture.

Active rotational-speed sensor

Design

Most modern braking systems these days only make use of active rotational-speed sensors. These usually consist of a silicon IC, hermetically sealed in plastic and located in the sensor head. In addition to magnetoresistive ICs (resistance changes in response to changes in magnetic field), Bosch predominantly employs Hall sensor elements which react to even the slightest changes in the magnetic field and thus permit larger air gaps than passive rotational-speed sensors.

Sensor rings

A multiple rotor acts as sensor ring in the active rotational-speed sensor. This takes the form of alternately magnetised plastic elements in annular arrangement on a non-magnetic metallic substrate. These North and South poles assume the function of the sensor ring teeth. The IC of the sensor is exposed to the constantly changing magnetic field of these magnets. There is thus a constant change in the magnetic flux through the IC as the multiple rotor turns. A steel sensor ring can also be used as an alternative to the multiple rotor. In this case, the Hall IC is provided with a magnet which generates a constant magnetic field. As the sensor ring turns, the constant magnetic field is “disturbed” by the constant alternation between tooth and gap. The measurement principle, signal processing method and the IC are otherwise identical to the sensor with no magnet.

Features

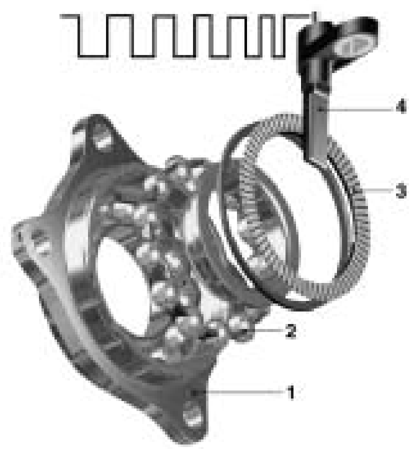
A typical feature of the active speed sensor is the integration of the Hall measurement element, the signal amplifier and the signal conditioning stage into an IC. The speed information is transmitted as a load-independent current in the form of square-wave pulses. The frequency of the current pulses is proportional to the wheel speed and detection is still possible even with the wheel virtually stopped (0.1 km/h). The supply voltage is between 4.5 and 12 volts. The square-wave output signal level is 7 mA (low) and 14 mA (high).
In contrast to passive inductive sensors, inductive disturbance voltages for example have no influence on this type of transmission employing digital signals. A two-wire cable is used for the control unit link. The compact design and the low weight permit installation of the active speed sensor at or in the wheel bearing. Various standard sensor head designs are suitable for this purpose.

Technical data

Rated supply voltage U_N	12V
Supply-voltage range U_V	4,5 ... 12 V
Output current I_A	5,9 ... 16,8 mA
Sustained temperature in sensor and transition zone[1])	-40 ...+ 150 °C
Sustained temperature in connector zone	-40 ...+ 115 °C
Signal frequency	1 ... 2500 Hz

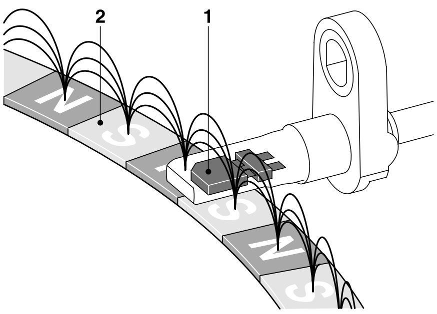
[1]) Short-time -40...+170 °C permissible.

Exploded view



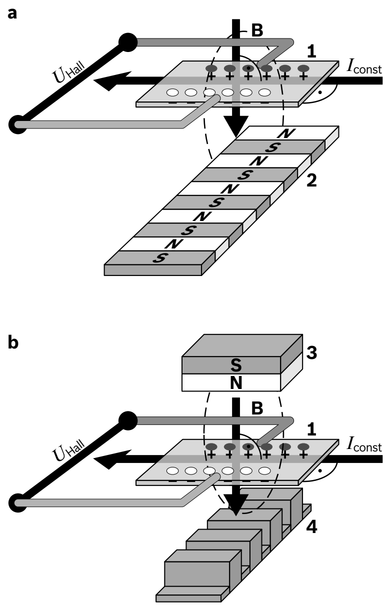
1 Wheel hub
2 Ball bearing
3 Multiple rotor
4 Wheel-speed sensor

Sectional view through active rotational-speed sensor



1 Sensor element
2 Multiple rotor with alternating North and South magnetisation

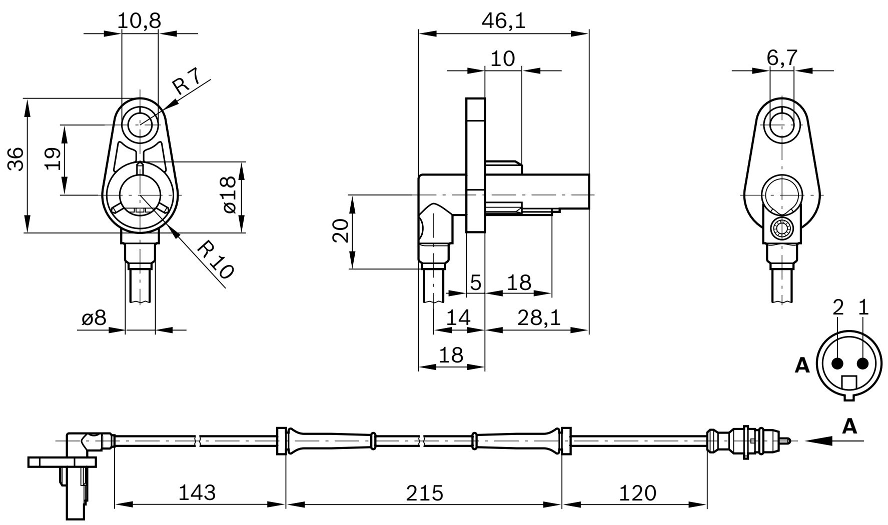
Diagrammatic figure for rotational-speed sensing



U_{Hall} Generated Hall voltage (in Volt)
I_{const} Constant current (in amps)
B Magnetic flux density (in Tesla)
N North pole
S South pole
aU_{Hall} Generated Hall voltage (in Volt)
b Constant current (in amps)
Magnetic flux density (in Tesla)
1 Sensor element
2 Multiple rotor
3 Magnet
4 Steel sensor ring

Part number 0 265 007 527

Dimension drawings



Pin 1 Supply voltage (white wire)
Pin 2 Signal (black wire)

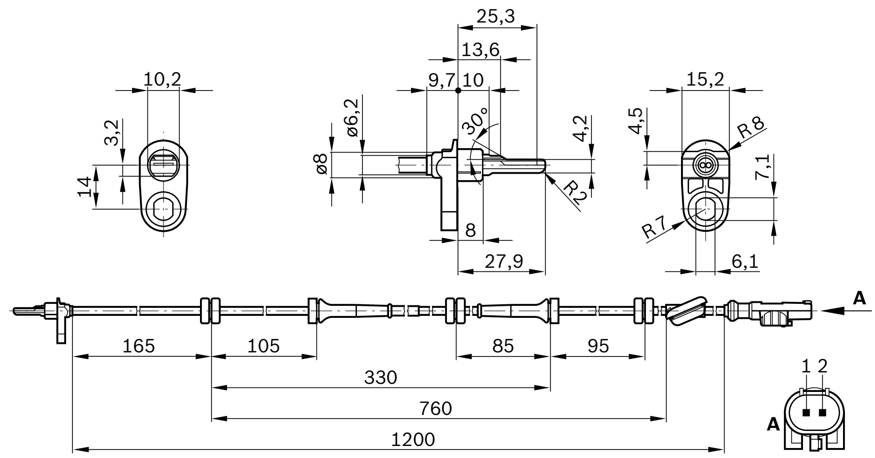
Illustration

Accessories		Part number
Pin housing	2-pin	3 334 420 082
Contact pins	for Ø 0.5...2.5 mm^2	2 260 326 302

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
If another plug connector is to be used, then the cable must be sealed against ingress of moisture.

Part number 0 265 007 544

Dimension drawings



Pin 1 Supply voltage (white wire)
Pin 2 Signal (black wire)

Illustration

Accessories

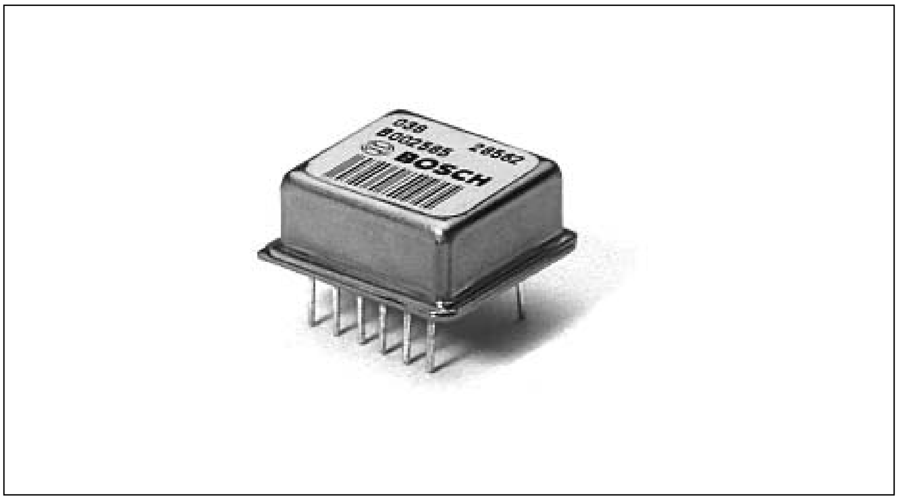
Accessories			Part number
Connector housing	2-pin	Tyco number	1-967 644-1[1])
Contact pins	for Ø 0.5...2.5 mm²	Tyco number	962 885-1[1])
Single-wire seal	for Ø 0.5...1.0 mm²	Tyco number	967 067-2[1])
Single-wire seal	for Ø 1.5...2.5 mm²	Tyco number	967 067-1[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
If another plug connector is to be used, then the cable must be sealed against ingress of moisture.
[1]) Available from Tyco Electronics.

Piezoelectric acceleration sensor

Measurement of acceleration up to 35 g

- Acceleration measurement using piezoelectric bending element (bimorph strips)
- Micromechanical acceleration sensor (available on request)
- Little dependence on temperature
- High sensitivity
- Large measuring range



Application

Sensors of this type are used in motor-vehicle occupant protection systems for triggering airbags, belt tensioners, the roll-over bar or belt locking systems. They are also used as impact sensors for monitoring jolts during transportation. As the lower cut-off frequency is 0.9 Hz, the sensor is only able to detect changes in acceleration.

Design and operation

The heart of the acceleration sensor is a piezoceramic strip made of a polycrystalline sintered material. Following electric polarisation, this material exhibits the piezoelectric effect: When pressure is exerted, the mechanical strain results in charge separation or a voltage which can be tapped by way of electrodes. The piezoelectric bending element is a emented assembly formed of two piezoelectric strips, the so-called bimorph strips, of opposite polarity. They are provided with electrodes and bonded to a centre electrode. The advantage of this configuration is that the pyroelectric signals arising from changes in temperature are mutually compensated. If acceleration occurs, the piezoceramic element bends by up to 10^{-7} m on account of its mass inertia.

For signal conditioning, the sensor is provided with a hybrid circuit consisting of an impedance transformer, a filter and an amplifier. The sensitivity and useful frequency range are thus specified. The filter blanks out high-frequency signal components. A lower cut-off frequency of 0.6 Hz is defined by the actual piezoelectric element. An additional test input permits monitoring of the electronic functions of the sensor and the integrity of the piezoelectric strip.

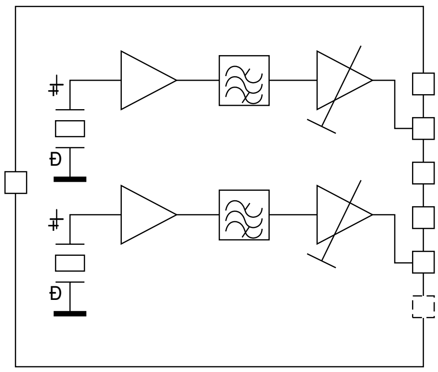
Test signal

On applying +5 V very briefly to the test input, a functional sensor supplies a positive output pulse. If there is a break in the signal path there will be no pulse and if the bimorph strip has broken off the magnitude of the pulse will increase. The pulses must be applied to both outputs in the case of versions with two bimorph strips.

Installation instructions

Acceleration sensors must be installed such that the base plate is either perpendicular or parallel to the direction of acceleration or deceleration.

Block diagram of two-channel sensor



Technical data

Parameter		min	type	max
Measuring range at U_V = 5 V	g[1])	- 35		+ 35
Frequency range (-3dB)	Hz	0,9		
Calibrated sensitivity at room temperature	$mV \cdot g^{-1}$	57,5	60	62,5
Operating temperature range	°C	-45		+95

[1]) Acceleration due to gravity g = 9.81 m/s².

Part number 0 273 101 150

With two 90° offset sensing directions. Suitable for PCB mounting.

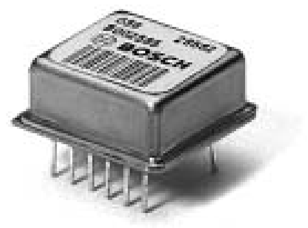
Technical data

Parameter		min	type	max
Frequency range (-3dB)	Hz			340
Supply voltage U_V	V	4,00	5,00	5,25
Supply current I_V	mA			15
No-load voltage with zero acceleration	mV		U_V /2±60 mV	

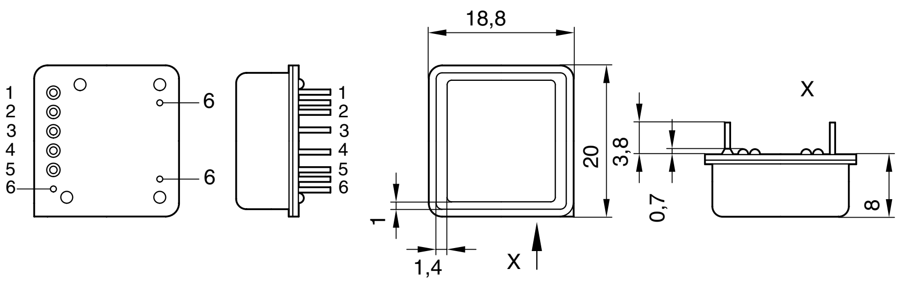
Electrical output

Connection assignment Pin 1	Output B
Connection assignment Pin 2	U_V = +5 V
Connection assignment Pin 3	Data
Connection assignment Pin 4	Test input
Connection assignment Pin 5	Output A
Connection assignment Pin 6	Housing, ground

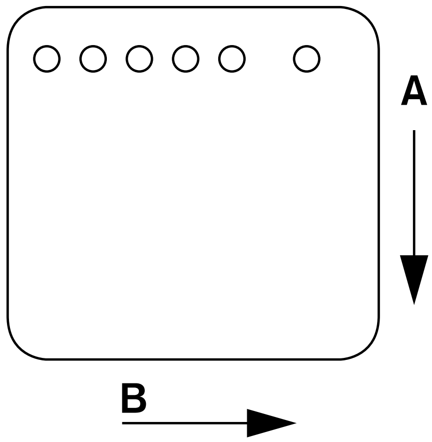
Illustration



Dimension drawings



Installation position

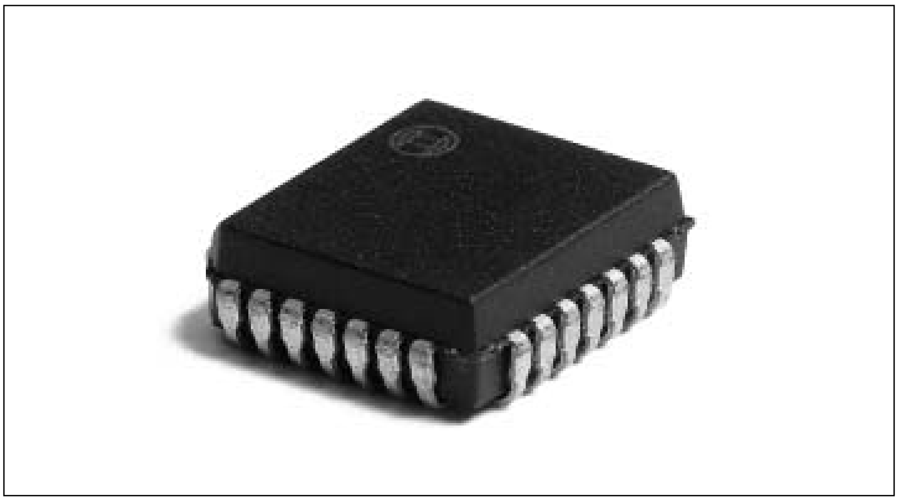


A, B Measurement direction
Base plate parallel to measurement direction
Acceleration direction A,
Output voltage Channel A
$U_{AA} > U_V/2$
Acceleration in direction B,
Output voltage Channel B
$U_{AB} > U_V/2$

Surface micromechanical acceleration sensor

Measurement of ±35 g or ±50 g acceleration

- Complete ±35 g or ±50 g measuring range.
- Few external components.
- Integrated self-diagnosis.
- Integrated offset compensation.
- Integrated 2nd-order Bessel filter.
- Ratiometric output signal.
- Standard SMD PLCC28 housing.
- Temperature range for automotive applications.



Application

This type of acceleration sensor is used in motor vehicles as part of the airbag system. Depending on the installation position, the sensor can detect longitudinal or lateral acceleration in the passenger compartment (referenced to the direction of travel).

Design and operation

The acceleration sensors operate on the capacitive measurement principle. Lateral sensing direction (in component plane): Acceleration causes deflection of the seismic element in x-direction. This is suspended from wave-shaped bending springs. A set of electrodes connected to the seismic element (comb structure) moves in accordance with the given acceleration. These moving electrodes are designed as capacitor plates and are provided with fixed counter electrodes separated by a narrow air gap. The use of a capacitive differential circuit with two capacitors reduces the non-linearity of the signal evaluation. Integrated overload stops are designed to guard against direct contact between the electrodes (combs) in the event of excessively high acceleration. The mechanical sensitivity is governed by the geometrical shape of the springs. Changes in C1 and C2 are detected and converted into a corresponding voltage by a capacitance/voltage converter.

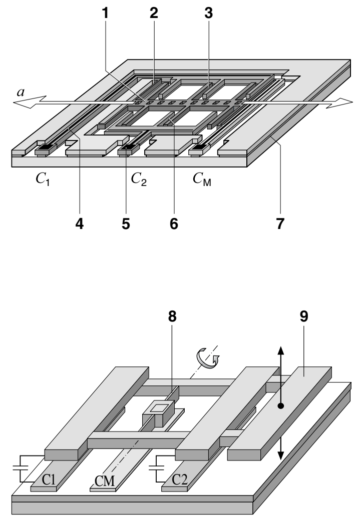
Installation instructions

A deviation of ±1° of the installation position from the horizontal causes an acceleration measurement error of 0.02 g. The sensor is protected against reverse polarity.

Explanation of characteristic quantities

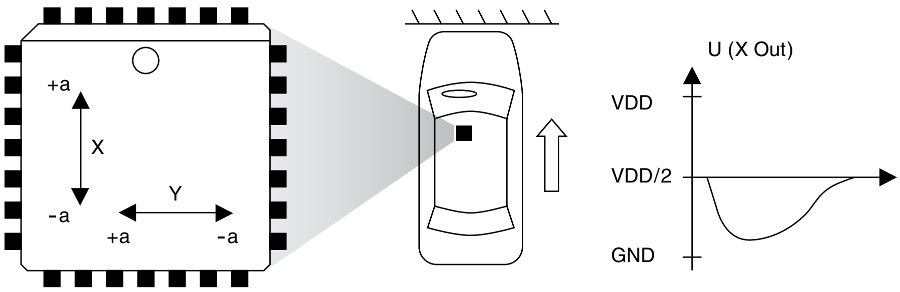
a Acceleration (g_n = 9.81 m/s^2)
V_{DD} Supply voltage
V_{off} Offset voltage
S Sensitivity
V_{out} Output voltage
V_{out} $=(V_{DD}/2) + (V_{off} + S \cdot \alpha) \cdot (V_{DD}/5V)$

Principle of operation

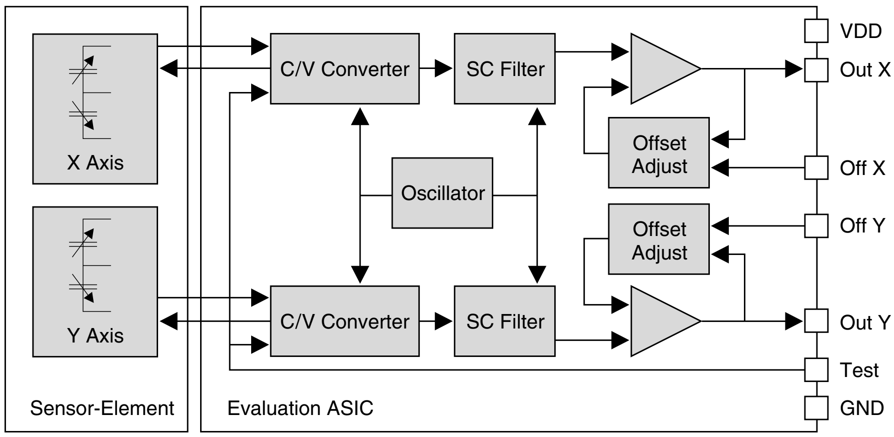


1 Horizontally sprung seismic element with electrodes
2 Spring
3 Fixed electrodes with capacitance C_1
4 Al printed conductor
5 Bond pad
6 Fixed electrodes with capacitance C_2
7 Silicon oxide
8 Torsion spring
9 Vertically sprung seismic element with electrodes. a Acceleration in sensing direction, C_M Measurement capacitance. $a \sim (C_1 - C_2) / (C_1 + C_2)$

Sensing direction



Design and operation

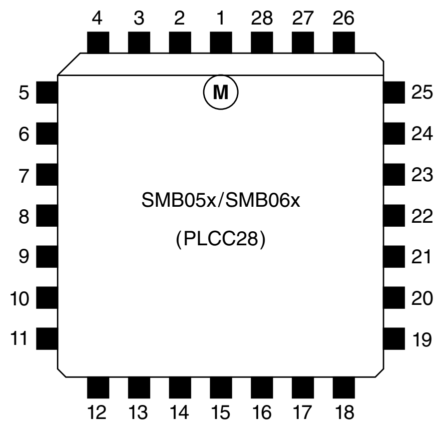


Pin assignment

M marking Pin 1

PIN	Part No. 1 273 202 ... ...138 ...155	...143 ...154	...144 ...157
1 - 11	N.C. (*)	N.C. (*)	N.C.(*)
12	Offset X	Offset X	Offset X
13	Out X	Out X	Out X
14	Test	Test	Test
15	GND	GND	GND
16	VDD	VDD	VDD
17	N.C.	Offset Y	Offset X
18	N.C.	Out Y	Out X
19 - 28	N.C.	N.C.	N.C.

* Pin has no bond connection



Technical data

Parameter		min	normal	max
Limit values				
Supply voltage U_V	V	-0,3		6
Storage temperature	°C	-55		+105
Mechanical impact when deenergised[2])	g			2000
Mechanical impact when energised	g			1000
ESD (each pin)	kV	1,5		
Temperature rise	K/min			20
Operating conditions				
Supply voltage U_V	V	4,75	5	5,25
Supply current I_V 1-channel unit	mA		6	7
Supply current I_V 2-channel unit	mA		10	14
Operating temperature	°C	-40		+85
Measurement and operating features				
Sensitivity	mV/g		55	
Sensitivity	mV/g		38,5	
Sensitivity tolerance[3])	%		5	9
Non-linearity of sensitivity	%		0,8	2
Transverse-axis sensitivity[4])	%			5
Output with zero acceleration			VDD/2	
Offset with zero acceleration after offset adjustment	mV			± 150
Offset with zero acceleration without offset adjustment	V			±Vdd/4
Offset adjustment	s			1,65
Offset / test input voltage (X/Y) low	V			0,25 · VDD
Offset / test input voltage (X/Y) high	V			0,75 · VDD
Self-test ±35*g*, at 5 V	mV	250	385	866
Self-test ±50*g*, at 5 V	mV	200	336	610
Output voltage range U_A I_{AUS} = ±50 µA	V	0,25		VDD -0,25
Output current I_A	µA	± 50		
Capacitive output load	pF			1000
3 dB cut-off frequency 2nd-order Bessel filter	Hz	320	400	480
Output noise 10 to 1000 Hz[5])	mg/√ Hz		2,5	4,5

[2]) Excessive shock can cause permanent damage to the unit. Sensor malfunctioning due to mechanical impact or excessive *g* levels is detected by the on-chip self-test.
[3]) As a percentage of nominal sensitivity over service life and temperature range.
[4]) Output signal resulting from acceleration in any axis perpendicular to the sensing axis.
[5]) Output noise with offset adjustment not in operation. With offset adjustment in operation, the noise level is roughly twice as high.

Part number 0 273 101 138

Technical data	
Acceleration[1])	± 35 *g*
Sensing axis	X
Sensor type	SMB 050

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Part number 0 273 101 143

Technical data	
Acceleration[1])	± 35 *g*
Sensing axis	X/Y
Sensor type	SMB 060

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Part number 0 273 101 144

Technical data	
Acceleration[1])	± 35 *g*
Sensing axis	X/-X
Sensor type	SMB 065

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Part number 0 273 101 155

Technical data	
Acceleration[1])	± 50 *g*
Sensing axis	X
Sensor type	SMB 052

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Part number 0 273 101 154

Technical data

Acceleration[1])	± 50 *g*
Sensing axis	X/Y
Sensor type	SMB 062

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Part number 0 273 101 157

Technical data

Acceleration[1])	± 50 *g*
Sensing axis	X/-X
Sensor type	SMB 067

[1]) Measuring range for full-load deflection is guaranteed after setting offset to VDD/2.

Illustration

Piezoelectric vibration sensor

Measurement of structure-borne sound and acceleration

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

Application

Vibration sensors of 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 piezoceramic 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.

Note

Note: 1 connector housing, 3 contact pins and 3 individual seals are required for a 3-pin connector. Genuine Tyco crimping tools must be used for automotive applications.

Measurement sensitivity

Each vibration sensor has individual transmission characteristics closely related to the measurement 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.

Evaluation

The signals of these sensors can be evaluated with an electronic module.

Installation instructions

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

Explanation of characteristic quantities

E Sensitivity
f Frequency
g Acceleration due to gravity

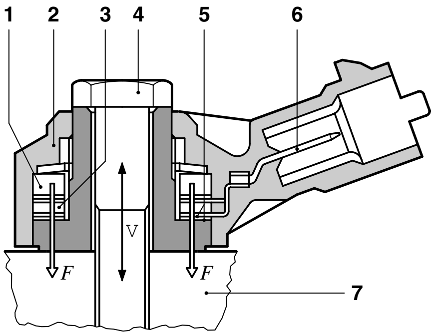
Pin assignment

Pin 1, 2 Measurement signal
Pin 3 Screen, dummy

Technical data

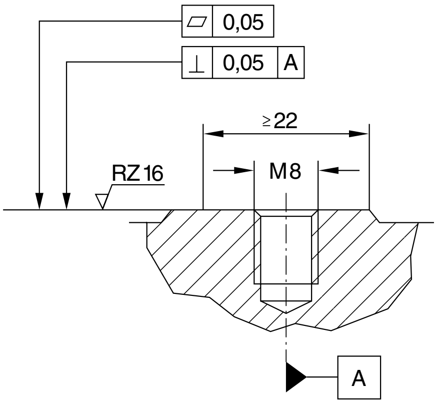
Permissible short-term vibration	≤ 400 g
Installation	
Grey cast iron bolt	M 8 x 25 ; Quality 8.8
Aluminium bolt	M 8 x 30 ; Quality 8.8
Tightening torque (possible with lubrication)	20 ± 5 Nm

Vibration sensor (design)

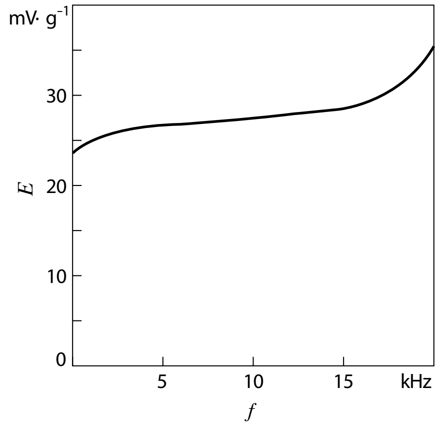


1 Seismic element with compressive forces F
2 Housing
3 Piezoceramic element
4 Screw
5 Contact
6 Electrical connection
7 Machine block, V Vibration.

Mounting hole



Characteristic curve



Transmission characteristics as a function of frequency

Part number 0 261 231 148

Technical data

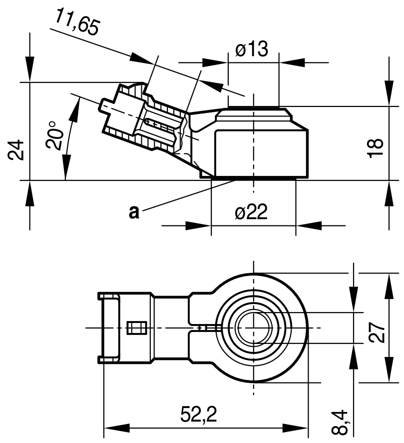
Vibration sensors	2-pole, without cable
Frequency range	3 ... 22 kHz
Sensitivity at 5 kHz	26 ± 8 mV/*g*
Linearity between 5...20 kHz with resonance	15 %
Main resonance frequency	> 25 kHz
Self-impedance	> 1 MΩ
Capacitance range	800 ... 1400 pF
Temperature dependence of sensitivity	≤ 0,06 mV/*g* · K
Operating temperature range	- 40 ...+ 150 °C
Permissible sustained vibration	≤ 80 *g*

Installation

Installation position	any

Illustration

Dimension drawings



a Contact surface

Accessories

Accessories		Part number
Connector housing	for Ø 0.5...1.0 mm²	1 928 403 137
Contact pins	for Ø 0.5...1.0 mm²; Content: 20 x	1 987 280 103
Contact pins	for Ø 1.5...2.5 mm²; Content: 20 x	1 987 280 105
Individual seal	for Ø 0.5...1.0 mm²; Content 50: x	1 987 280 106
Individual seal	for Ø 1.5...2.5 mm²; Content: 20 x	1 987 280 107

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

Part number 0 261 231 153

Technical data

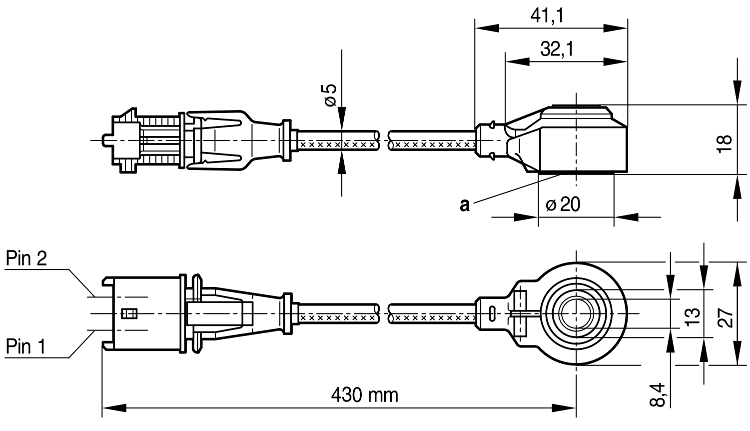
Vibration sensors	2-pole, with cable, up to 130 °C
Frequency range	3 ... 22 kHz
Sensitivity at 5 kHz	26 ± 8 mV/*g*
Linearity between 5...20 kHz with resonance	15 %
Main resonance frequency	> 25 kHz
Self-impedance	> 1 MΩ
Capacitance range	800 ... 1400 pF
Temperature dependence of sensitivity	≤ 0,06 mV/*g* · K
Operating temperature range	- 40 ...+ 130 °C
Permissible sustained vibration	≤ 80 *g*

Installation

Installation position	any

Illustration

Dimension drawings



a Contact surface

Accessories		Part number
Connector housing	for Ø 0.5...1.0 mm²	1 928 403 826
Contact pins	for Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 060
Contact pins	for Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 061
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; Content: 10 x	1 928 300 600

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

Part number 0 261 231 118

Technical data

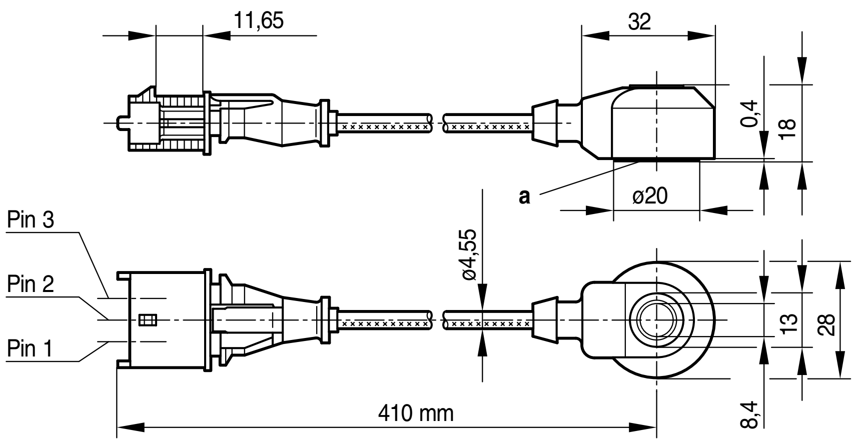
Vibration sensors	3-pole, with cable, up to 150 °C
Frequency range	3 ... 22 kHz
Sensitivity at 5 kHz	26 ± 8 mV/*g*
Linearity between 5...20 kHz with resonance	15 %
Main resonance frequency	> 25 kHz
Self-impedance	> 1 MΩ
Capacitance range	800 ... 1400 pF
Temperature dependence of sensitivity	≤ 0,06 mV/*g* · K
Operating temperature range	- 40 ...+ 150 °C
Permissible sustained vibration	≤ 80 *g*

Installation

Installation position	any

Illustration

Dimension drawings



a Contact surface

Accessories		Part number
Connector housing	for Ø 0.5...1.0 mm²	1 928 403 110
Contact pins	for Ø 0.5...1.0 mm²; Contents: 20 x	1 987 280 103
Contact pins	for Ø 1.5...2.5 mm²; Contents: 20 x	1 987 280 105
Individual seal	for Ø 0.5...1.0 mm²; Contents: 50 x	1 987 280 106
Individual seal	for Ø 1.5...2.5 mm²; Contents: 20 x	1 987 280 107

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

Part number 0 261 231 173

Technical data

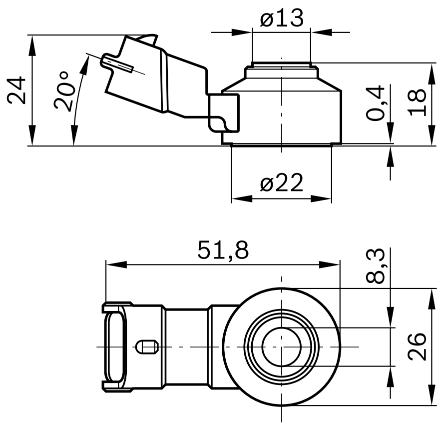
Vibration sensors	2-pole, without cable
Frequency range	3 ... 22 kHz
Sensitivity at 5 kHz	30 ± 6 mV/*g*
Linearity between 5...20 kHz with resonance	10 %
Main resonance frequency	> 30 kHz
Self-impedance	> 1 MΩ
Capacitance range	950 ... 1350 pF
Temperature dependence of sensitivity	≤ 0,04 mV/*g* · K
Operating temperature range	- 40 ...+ 150 °C
Permissible sustained vibration	≤ 80 *g*

Installation

Installation position	any

Illustration

Dimension drawings



Accessories		Part number
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	1 987 300 599
Individual seal	for Ø 1.5...2.5 mm²; Contents: 10 x	1 987 300 600
Dummy plug		1 928 300 601

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

Part number 0 261 231 176

Technical data

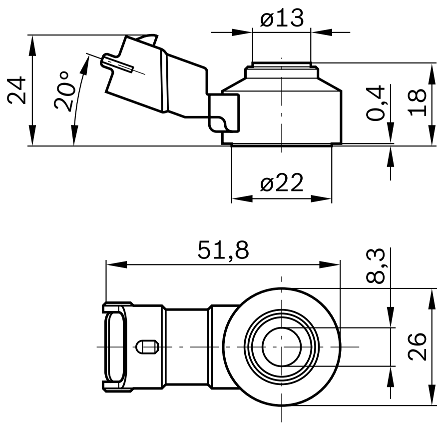
Vibration sensors	2-pole, without cable
Frequency range	3 ... 22 kHz
Sensitivity at 5 kHz	30 ± 6 mV/g
Linearity between 5...20 kHz with resonance	10 %
Main resonance frequency	> 30 kHz
Self-impedance	> 30 MΩ
Capacitance range	950 ... 1350 pF
Temperature dependence of sensitivity	≤ 0,04 mV/g · K
Operating temperature range	- 40 ...+ 130 °C
Permissible sustained vibration	≤ 50 g

Installation

Installation position	any

Illustration

Dimension drawings



Accessories

Accessories		Part number
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	1 987 300 599
Individual seal	for Ø 1.5...2.5 mm²; Contents: 10 x	1 987 300 600
Dummy plug		1 928 300 601

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

Part number 0 261 231 196

Technical data

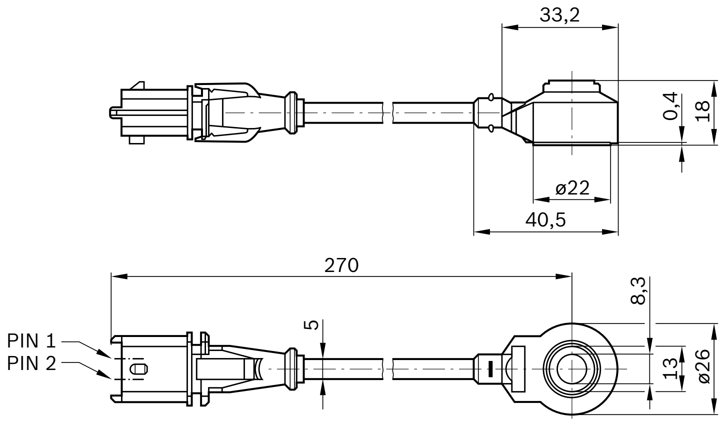
Vibration sensors	2-pole, with cable, up to 130 °C
Frequency range	0 ... 24 kHz
Sensitivity at 5 kHz	30 ± 6 mV/*g*
Linearity between 5...20 kHz with resonance	10 %
Main resonance frequency	> 30 kHz
Self-impedance	> 1 MΩ
Capacitance range	950 ... 1350 pF
Temperature dependence of sensitivity	≤ 0,04 mV/*g* · K
Operating temperature range	- 40 ...+ 130 °C
Permissible sustained vibration	≤ 80 *g*

Installation

Installation position	any

Illustration

Dimension drawings



Accessories

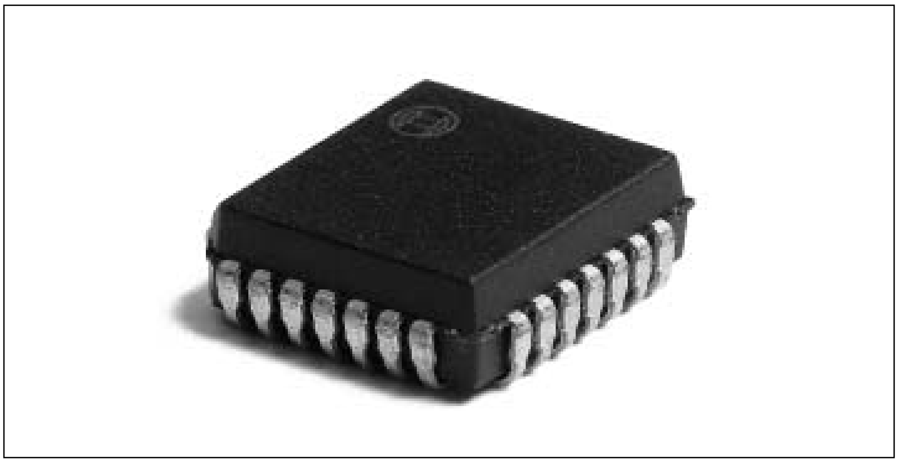
Accessories		Part number
Connector housing	2-pin	1 928 403 874
Contact pins	for Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 054
Contact pins	for Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 055
Individual seal	for Ø 0.5...1.0 mm²; Contents: 10 x	1 987 300 599
Individual seal	for Ø 1.5...2.5 mm²; Contents: 10 x	1 987 300 600
Dummy plug		1 928 300 601

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

Signal evaluation for vibration sensors

Signal-evaluation module

- Option of 4 selectable sensor inputs or 2 symmetrical inputs.
- Programmable amplification.
- Programmable band pass filter.
- No external calibration required.
- Integrated programmable frequency divider.
- Analog stage with signal test.
- Suitable for a wide range of microcontrollers.
- PLCC28 housing.



Application

Evaluation of the analog signals from piezoelectric sensors (vibration sensors).

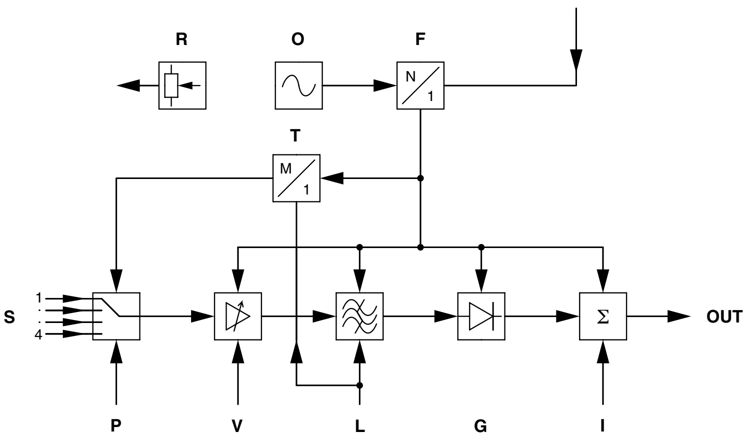
Design and operation

A circuit integrated into the module evaluates the analog signals. The circuit contains a programmable amplifier, a band pass filter, a rectifier, an integrator and control logic. The use of "SC" circuitry ensures reliable operation without the need for external calibration. The fully programmable circuit can be readily employed for a variety of applications. The start and end of integration are controlled by the "Measurement window" input. A frequency divider programmed by way of three inputs generates the system clock of the analog stage for various externally applied clock frequencies (8 stages from 1...16 MHz) and the test frequencies (9 centre frequencies of 5...16 kHz) depending on the setting of the filter. By altering the frequency, the internal clock frequency can be set from a nominal level of 100 kHz to values between 50 kHz and 150 kHz. The band-filter centre frequencies, the test frequencies and the integration time constant are shifted in parallel with this.

Note

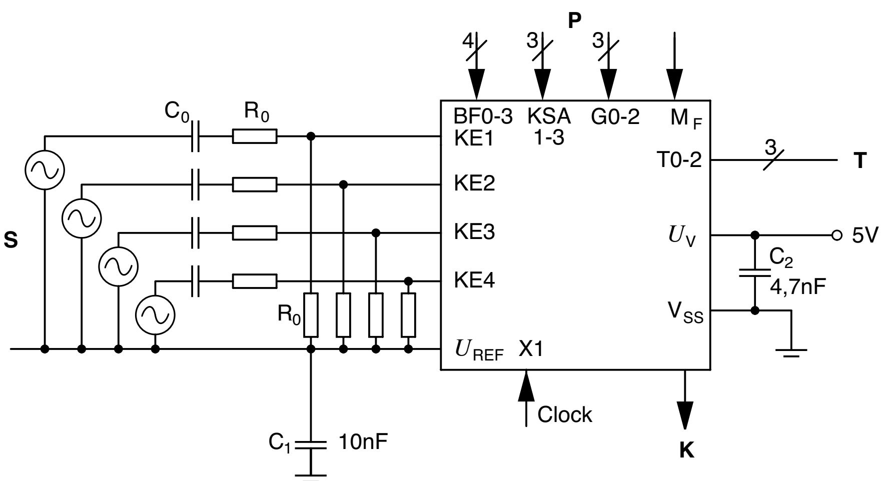
On account of the MOS inputs, the electronic module is to be handled with extreme care. Avoid direct contact and make use of MOS workplace. On switch-on, the rate of rise of the operating voltage should be < 1 V · μs^{-1}!

Design and operation



F	Frequency divider	R	Reference signals
G	Rectifier	S	Sensor inputs
L	Filter	T	Test pulse divider
I	Integrator	V	Amplifier
O	Oscillator	OUT	Output.
P	Multiplexer		

Application circuit (example)



K	Signal integral output	T	Quartz clock
P	From microcomputer port driver	C1/C2	Capacitors as close as possible to housing pins
S	Sensors T		

Part number 0 272 230 424

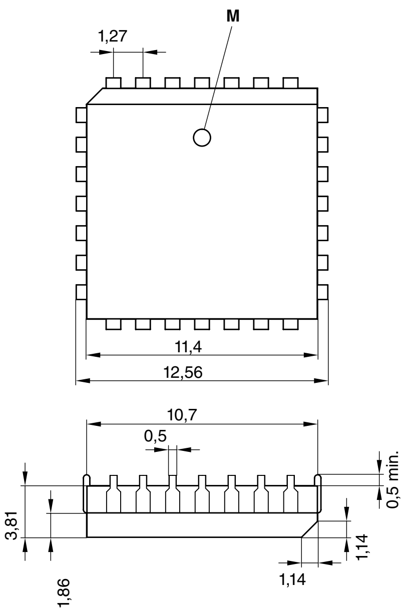
Technical data

Parameter			Conditions	min	max
Supply voltage	U_V	V	-	4,75	5,25
Supply current	I_V	mA	$U_V/2$		30
Input voltage, analog	U_{KE}	V	-	0	2
Input current, analog	I_{KE}	µA	U_{KE} = 2 V		10
Signal amplification	V		-	2	128
Signal amplification, tolerance	d_v	%	-	-3	+3
Clock frequency	f_x	MHz	-	0,5	27
Input signal frequency	f_{KE}	kHz	-		30
Band-pass filter centre frequency	f_M	kHz	-	5	16
Filter quality	Q		-	3	
Filter quality, tolerance	d_α		-	-0,5	+0,3
Integrator stroke, useful	d_{VKU}	V	-	3,8	4,5
Integrator offset t_{MF}=10ms	mV		> 0 °C	-300	+300
Integrator offset t_{MF}=10ms	mV		< 0 °C	-400	+400
Integration time constant	t_I	µs	-	148	152
Integrator output impedance	Z_{KL}	kΩ	-		2
Operating temperature	ϑ	°C	-	-40	+125

Limit values

Parameter			min	type	max
Max. supply voltage	V	-	-0,5		6,7
Max. rate of rise of supply voltage	µs	-		1	
Max. current in all inputs and outputs	mA	-	-2,5		+2,5
Protection of inputs and outputs against destruction by electrostatic charging	kV	-	-2		+2
Storage temperature	°C	-	-55		+135
Ambient temperature during operation	°C	-	-40		+125

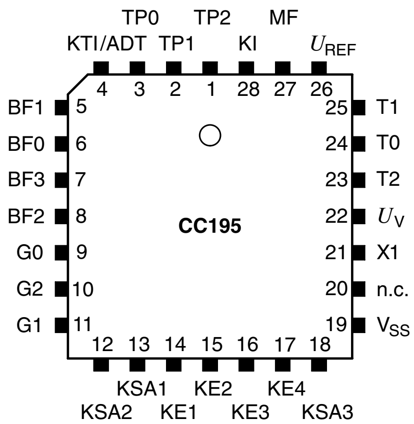
Dimension drawings



M Marking Pin 1

Illustration

Pin assignment



Pin assignment.

U_{REF} $U_V/2$	Reference voltage (output ±0.5mA load capacity)
U_V	Supply voltage 5 V
V_{ss}	Earth
BF0/BF1/BF2/BF3*)	Band pass centre frequency setting
G0/G1/G2*)	Amplification factor setting
KI1/2/3/4	Sensor inputs KI Signal integral output
KSA1/2/3*)	Sensor selection
KTI/ADT	Controlled input/test
output FM*)	Measurement window
N.C.	Not connected
T0/T1/T2	Clock frequency selection
TP0/TP1/TP2	For clock purposes
X1	Clock input

*) TTL-compatible static inputs of microcomputer port driver

Differential-pressure sensor

Micromechanical hybrid design

- High level of accuracy
- EMC protection better than 100 Vm^{-1}
- With temperature compensation

Application

This sensor is used to measure the difference between the intake-manifold pressure of the intake air flow of internal-combustion engines and a reference pressure applied by way of a hose.

Design and operation

The piezoresistive pressure-sensor element and appropriate signal amplification and temperature-compensation electronics are integrated on a silicon chip. The pressure measured acts on the back of the silicon diaphragm. The reference pressure acts from above on the active side of the silicon diaphragm.

Thanks to the coating process employed, both sides are resistant to the gases and liquids occurring in the intake manifold.

Installation instructions

The sensor is designed for attachment to a flat surface at the intake manifold of motor vehicles. The pressure connection projects into the intake manifold and is sealed off from the atmosphere by an O-ring. The sensor should be installed such that condensate cannot accumulate 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 will lead to malfunctioning.

Recommendation for signal evaluation

The design of the electrical output of the pressure sensor is such that appropriate circuitry in the downstream electronics can detect malfunctioning caused by breaks in the cable or short circuits. The diagnosis ranges beyond the characteristic curve limits are intended for fault diagnosis. Specimen circuit for detection of all fault situations by way of signal beyond the characteristic-curve limits.

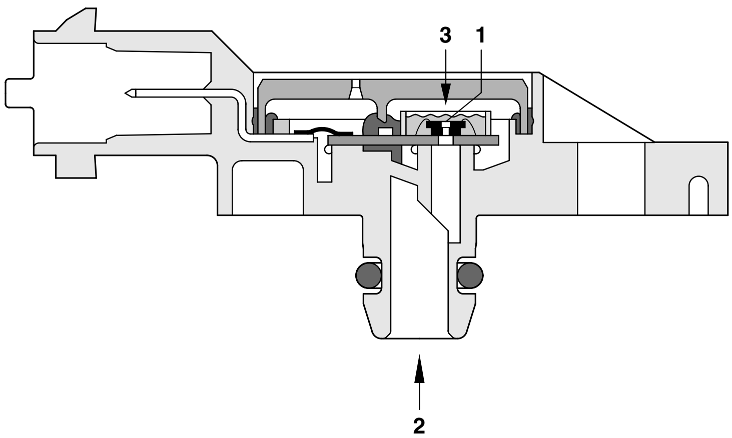
Technical data

Parameter			min	type	max
Supply voltage	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	$R_{pull\text{-}down}$	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

Sectional view of pressure sensor (entire system)



1 Sensor cell
2 Measurement pressure
3 Reference pressure

Part number 0 261 230 121

Technical data

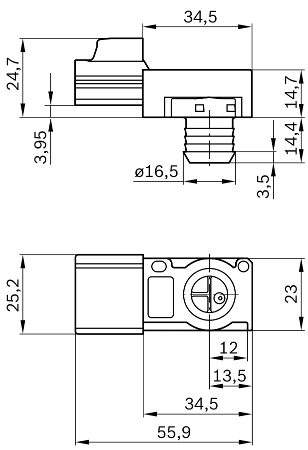
Pressure measuring range (p_1...p_2)	p_e	kPa	-100	0
Operating temperature	ϑ_B	°C	-40	+130
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	

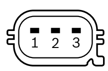
Limit data

Pressure	p_e	kPa	-500	+500
Storage temperature		°C	-40	+130

Illustration

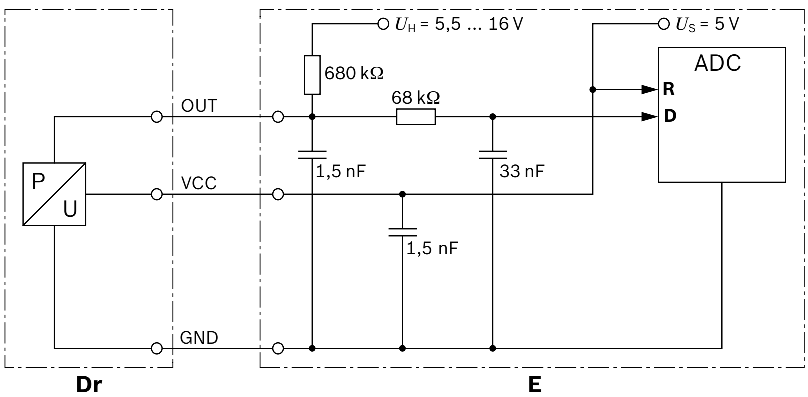
Dimension drawings





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

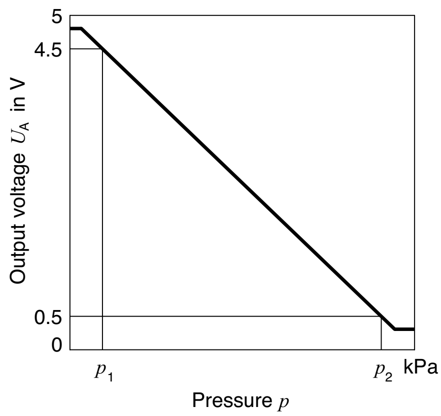
Signal evaluation recommendation



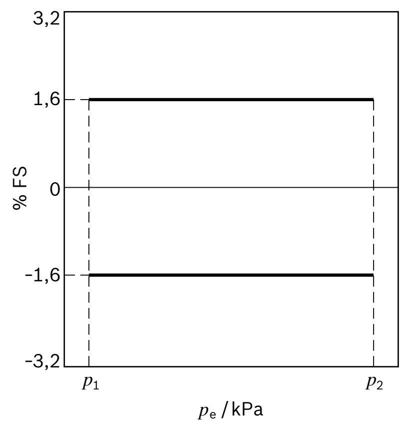
D Pressure signal
R Reference

Dr Pressure sensor
E Electronic control unit

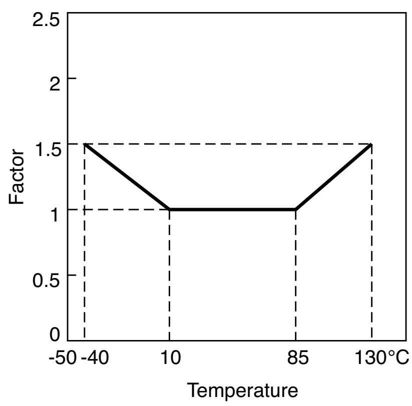
Characteristic curve



Characteristic-curve tolerance



Tolerance extension factor



Accessories

Accessories			Part number
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	7116-4103-02 [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 are therefore to be ordered separately as required. [1]) Available from Yazaki Europe LTD.

Part number 0 281 002 772

Technical data

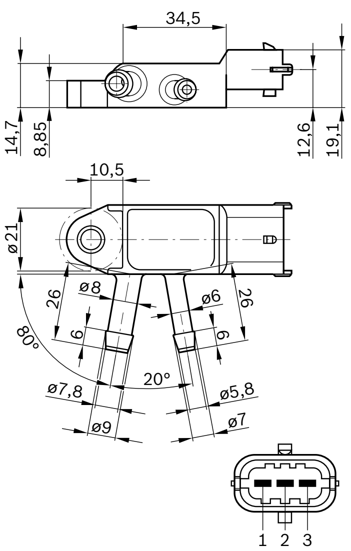
Pressure measuring range (p_1...p_2)	p_e	kPa	0	100
Operating temperature	ϑ_B	°C	-40	+130
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	

Limit data

Pressure	p_e	kPa	-350	+350
Storage temperature		°C	-40	+130

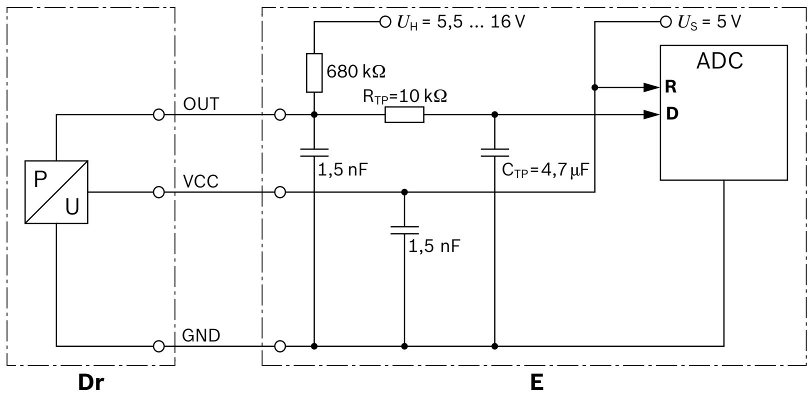
Illustration

Dimension drawings



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

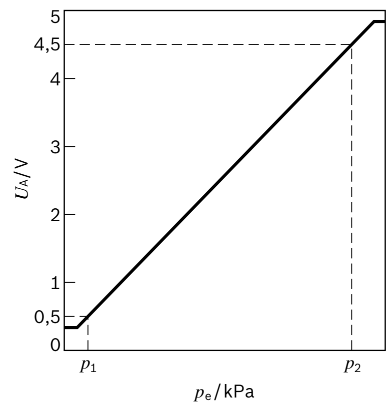
Recommendation for signal evaluation



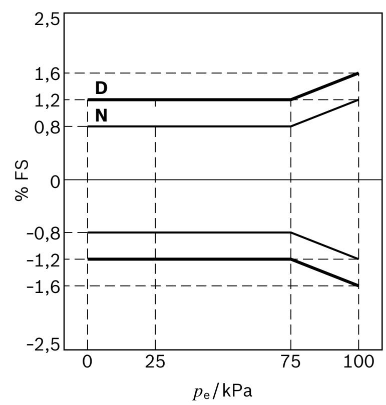
D Pressure signal
R Reference

Dr Pressure sensor
E Electronic control unit

Characteristic curve

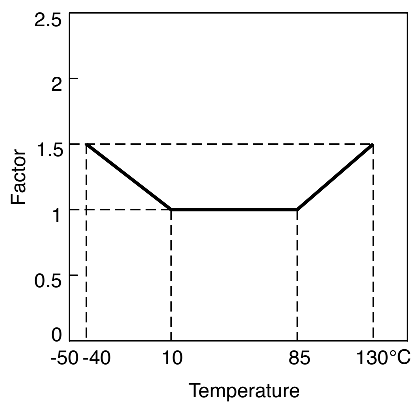


Characteristic-curve tolerance



D After endurance test
N As-new condition

Tolerance extension factor



Accessories

Accessories		Part number
Connector housing	3-pin	1 928 403 966
Contact pins	for Ø 0.5...1.0 mm^2; Contents: 100 x	1 928 498 056
Contact pins	for Ø 1.5...2.5 mm^2; Contents: 100 x	1 928 498 057
Single-wire seal	for Ø 0.5...1.0 mm^2; Contents: 10 x	1 928 300 599
Single-wire seal	for Ø 0.5...2.5 mm^2; 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 are therefore to be ordered separately as required.

Part number 0 261 230 093

Technical data

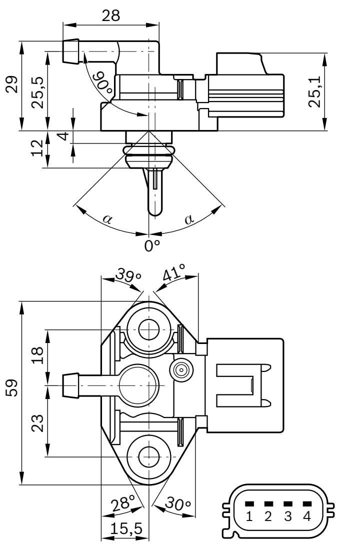
Pressure measuring range (p_1...p_2)	p_e	kPa	0	500
Operating temperature	ϑ_B	°C	-40	+125
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	4,7	

Limit data

Pressure	p_e	kPa		+3000
Storage temperature		°C		+130

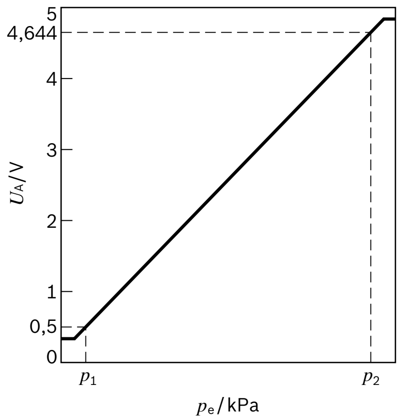
Illustration

Dimension drawings

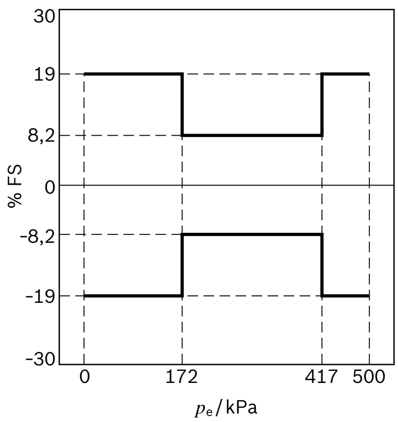


Pin 1	Ground
Pin 2	NTC
Pin 3	+5 V
Pin 4	Output signal

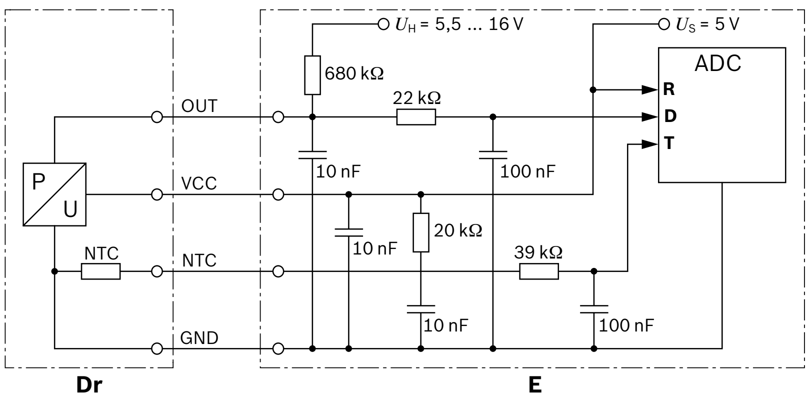
Characteristic curve



Characteristic-curve tolerance



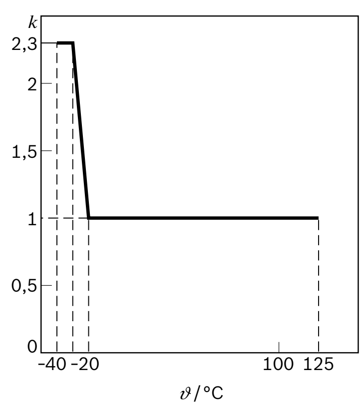
Recommendation for signal evaluation



D Pressure signal
R Reference

Dr Pressure sensor
E Electronic control unit

Tolerance-extension factor



Accessories

Accessories		Part number
Connector housing	4-pin	Yazaki number 7283-5886-30¹)
Contact pins	for Ø 0.35...0.5 mm²	Yazaki number 7116-4102-08¹)
Contact pins	for Ø 0.75...1.0 mm²	Yazaki number 7116-4103-08¹)
Single-wire seal	for Ø 0.35...0.5 mm²	Yazaki number 7158-3030-50¹)
Single-wire seal	for Ø 0.75...1.0 mm²	Yazaki number 7158-3031-90¹)
Dummy plug		Yazaki number 7158-3032-60¹)

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. ¹) Available from Yazaki Europe LTD.

Differential-pressure sensor

Micromechanical TO design

- Resistant to measurement medium.
- Piezoresistive sensor element.
- Integral moisture protection.

Application

Pressure sensors of this type are used in motor vehicles to measure the pressure in the fuel tank. The measurement principle involves determining the difference in pressure with respect to ambient pressure.

Design and operation

The main component of the differential-pressure sensor is a micromechanical sensor element with diaphragm and pressure connection. The diaphragm is resistant to the measurement medium. For measurement purposes, the measurement medium is routed through the pressure connection onto the diaphragm, which transmits the pressure applied to the piezoresistive sensor element. This is integrated together with appropriate signal amplification and temperature-compensation electronics on a silicon chip. The silicon chip is provided with a TO-type enclosure which forms the inner sensor cell. The active surface is exposed to the ambient pressure by way of an opening in the cap and a reference connection and is protected against moisture by a silicone gel. The pressure sensor supplies an analog output signal which has a ratiometric relationship with the supply voltage.

Installation instructions

The sensor is designed for horizontal attachment to a horizontal surface. Suitability for other installation angles is to be checked on a case-to-case basis. 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 will lead to malfunctioning.

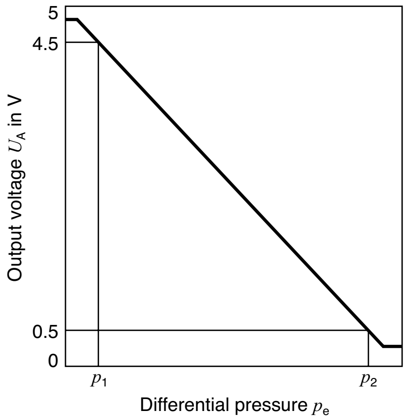
Explanation of characteristic quantities

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

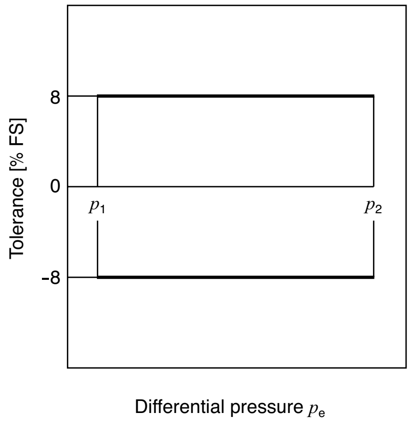
Technical data

Parameter			min	type	max
Operating temperature	ϑ_B	°C	-40		+80
Supply voltage (1 min)	U_V	V	4,75	5,0	5,25
Current input at U_V = 5 V	I_V	mA		9,0	12,5
Load current at output	I_L	mA	-0,1		+0,1
Load resistance to U_V or ground	R_L	kΩ	50		
Response time	$\tau_{10/90}$	ms		0,2	
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
Load resistance to U_H = 5.5...16V	$R_{L.H}$	kΩ		680	
Limit data					
Supply voltage (1 min)	$U_{V\,max}$	V			16
Pressure measurement	I_N	kPa	-30		+30
Storage temperature		°C	-40		+80

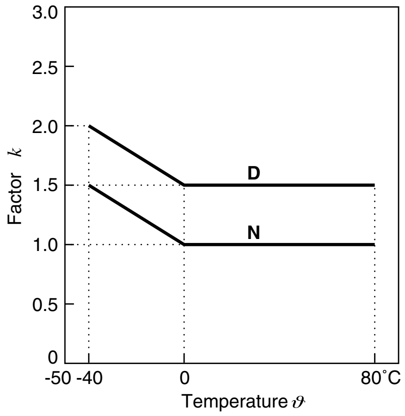
Characteristic curve



Characteristic-curve tolerance

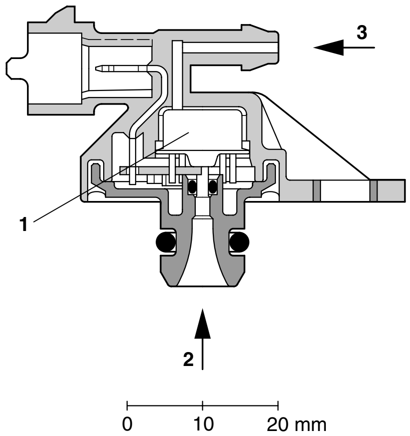


Temperature-error multiplier



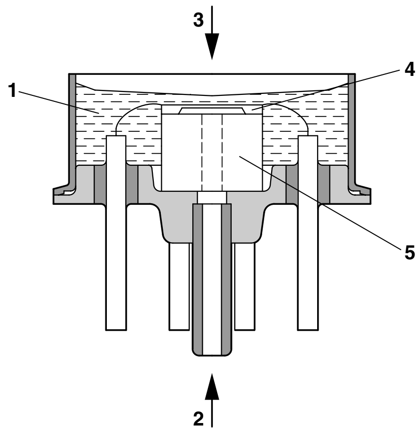
D After endurance test
N As-new condition

Sectional view of pressure sensor (entire system)



1 Sensor cell
2 Pressure applied
3 Reference pressure

Sectional view of sensor cell



1 Gel
2 Pressure applied
3 Reference pressure
4 Sensor chip
5 Glass base

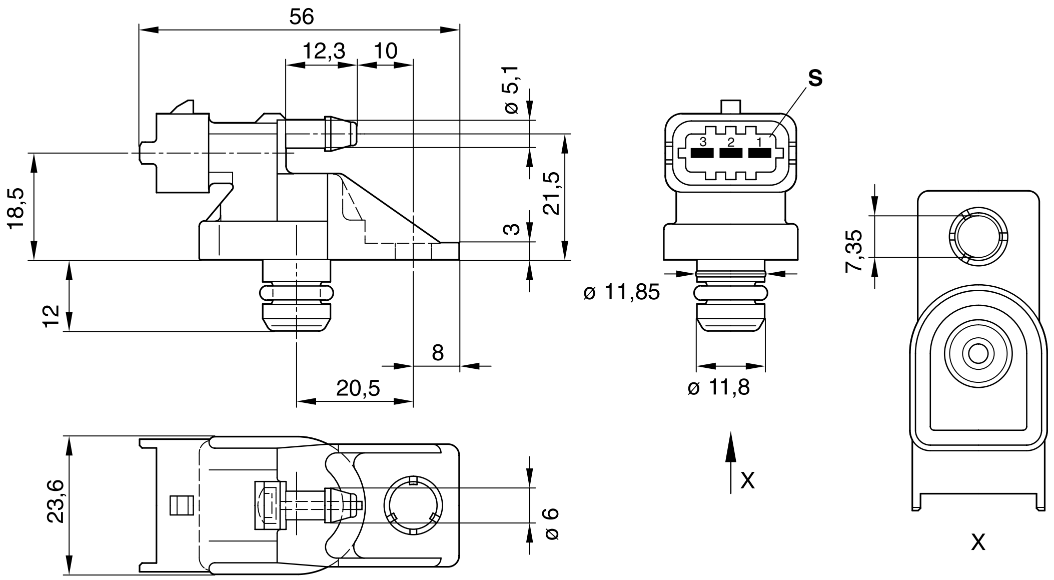
Part number 0 261 230 015

Technical data

Parameter			min	max
Pressure measuring range ($p_1 ... p_2$)	p_e	kPa	2,5	+2,5

Illustration

Dimension drawings



S 3-pin connector
Pin 1 +5 V
Pin 2 Ground
Pin 3 Output signal

Accessories			Part number
Connector housing	Quantity required: 1 x		1 928 403 110
Contact pins	Quantity required: 3 x	Tyco number	2-929 939-1[1])
Individual seal	Quantity required: 3 x	Tyco number	828 904[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

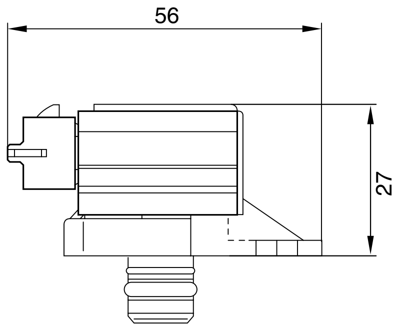
Part number 0 261 230 026

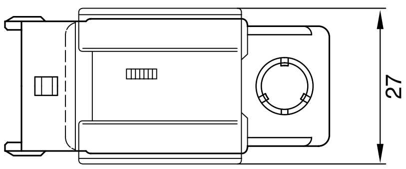
Technical data

Parameter			min	max
Pressure measuring range ($p_1 \ldots p_2$)	p_e	kPa	-2,5	+2,5

Illustration

Dimension drawings





Accessories

Accessories			Part number
Connector housing	Quantity required: 1 x		1 928 403 110
Contact pins	Quantity required: 3 x	Tyco number	929 939-3[1])
Individual seal	Quantity required: 3 x	Tyco number	828 904[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

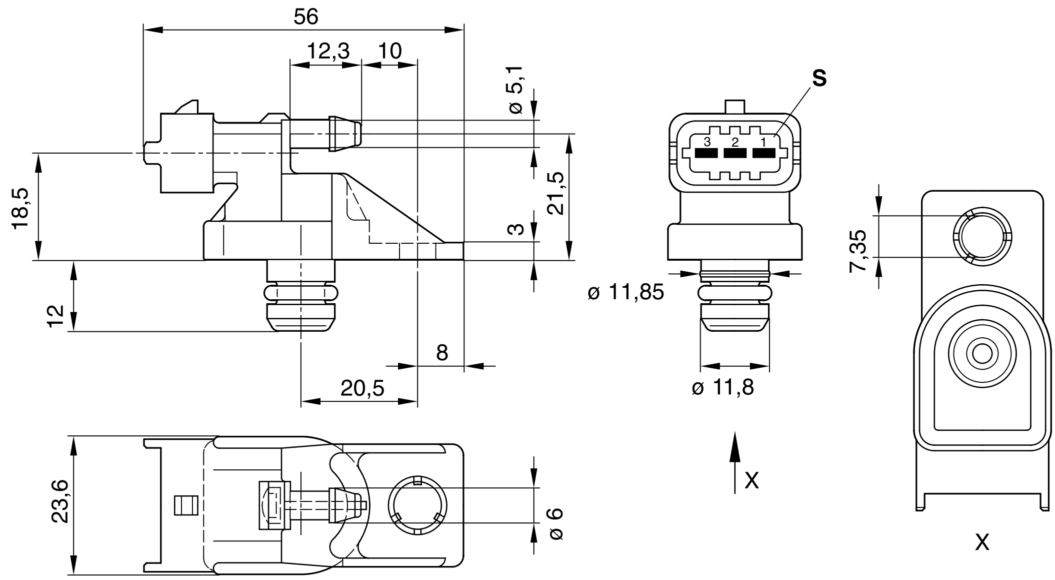
Part number 0 261 230 086

Technical data

Parameter			min	max
Pressure measuring range (p_1...p_2)	p_e	kPa	-3,75	+1,25

Illustration

Dimension drawings



S 3-pin connector
Pin 1 +5 V
Pin 2 Ground
Pin 3 Output signal

Accessories			Part number
Connector housing	Quantity required: 1 x		1 928 403 110
Contact pins	Quantity required: 3 x	Tyco number	2-929 939-1¹)
Individual seal	Quantity required: 3 x	Tyco number	828 904¹)

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
¹) Available from Tyco Electronics.

Absolute-pressure sensors

Piezoresistive, with moulded cable

- Pressure-measuring element with silicon diaphragm for extremely high accuracy and long-term stability.
- Integrated evaluation circuit for signal amplification, temperature compensation and characteristic-curve setting.
- Extremely sturdy design.

Application

This type of absolute-pressure sensor is suitable for measuring the boost pressure in the intake manifold of turbocharged diesel engines. With such engines, the sensors are required for boost-pressure control and smoke limitation.

Design and operation

The sensors are provided with a pressure-connection fitting with O-ring so that they can be fitted directly at the measurement point without the complication and costs of installing special hoses. They are extremely robust and insensitive to agressive media such as oils, fuels, brake fluids, saline fog, and industrial climate. In the measuring process, pressure is applied to a silicon diaphragm to which to which are attached piezoresistive resistors. Using their integrated electronic circuitry, the sensors provide an output signal the voltage of which is proportional to the applied pressure.

Tolerances

The sensors are provided with a pressure-connection fitting with O-ring so that they can be fitted directly at the measurement point without the complication and costs of installing special hoses. They are extremely robust and insensitive to agressive media such as oils, fuels, brake fluids, saline fog, and industrial climate. In the measuring process, pressure is applied to a silicon diaphragm to which to which are attached piezoresistive resistors. Using their integrated electronic circuitry, the sensors provide an output signal the voltage of which is proportional to the applied pressure.

Installation instructions

The metal bushes of the attachment holes are designed for a tightening torque of max. 10 N · m. On installation the pressure connection should face downwards. The angle between the pressure connection and the perpendicular may be up to 60°.

Explanation of characteristic quantities

U_V	Supply voltage
U_A	Output voltage
k	Temperature error multiplier
p_{abs}	Absolute pressure
g	Acceleration due to gravity 9.81 m/s^2
D	After endurance test
N	As-new condition

Part number 0 281 002 655

Technical data

Measuring range	50 ... 400 kPa
Core measuring range with increased accuracy	70 ... 360 kPa
Pressure resistance	600 kPa
Ambient/sustained operating temperature range	- 40 ...+ 120 °C
Core range with increased accuracy	+ 20 ...+ 110 °C
Short-term temperature limit range	≤ 140 °C
Supply voltage U_V	5 V ± 10 %
Current input I_V	≤ 12 mA
Reverse-polarity protection at I_V ≤ 100 mA	$-U_V$
Output short-circuit strength	To ground and to U_V
Permissible pull-down load	≥ 100 kΩ
Permissible pull-down load	≤ 100 nF
Response time $\tau_{10/90}$	≤ 5 ms
Max. vibration loading	20 g
Water protection powerful spray with increased pressure	IPX6K
Water protection High-pressure and steam cleaning	IPX9K
Dust protection	IP6KX

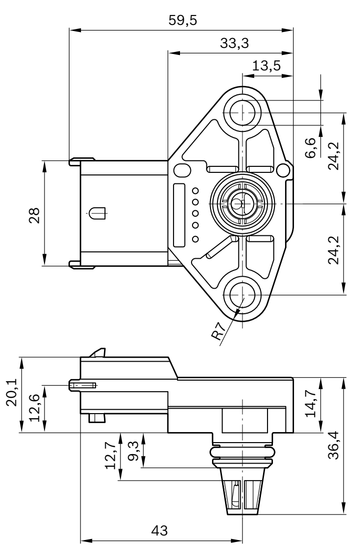
The permissible temperature error is obtained over the entire temperature range by multiplying the maximum permissible pressure measurement error by the temperature error multiplier corresponding to the temperature:

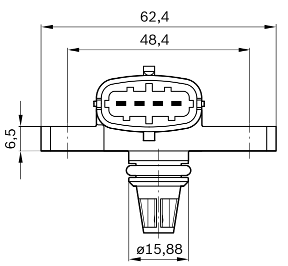
Temperature core range	+20...+110 °C	1,0[1])
	+20...+40 °C	3,0[1])
	+110...+120 °C	1,6[1])
	+120...+140 °C	2,0[1])

[1]) Linear increase to stated value in each case.

Dimension drawings

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





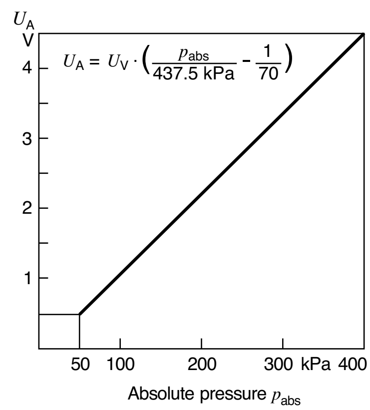
Accessories

Accessories		Part number
Connector	3-pin	1 237 000 039
Connecting cable	Length: 180 mm	F 00C 3G1 900

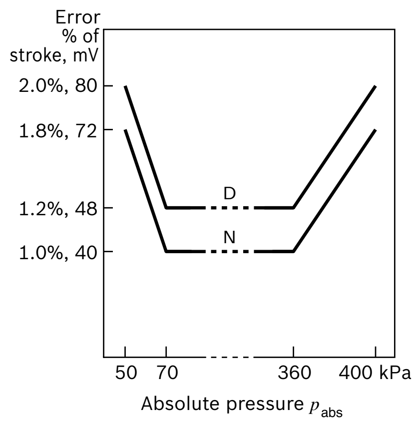
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.

Illustration

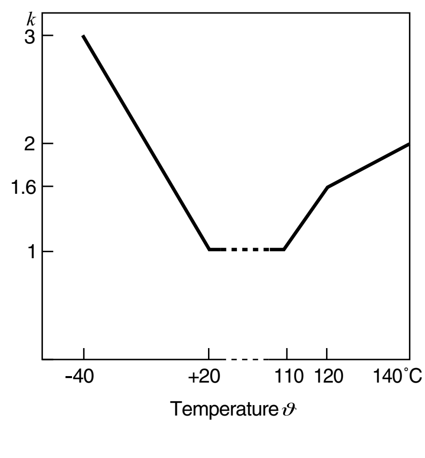
Characteristic curve



Maximum permissible pressure-measurement error



Temperature-error multiplier



Absolute-pressure sensors

Micromechanical hybrid design

p / U

- High level of accuracy
- EMC protection better than 100 V m^{-1}.
- With temperature compensation.
- Version with additional integrated temperature sensor.

Application

This sensor is used to measure the absolute intake-manifold pressure. The version with integrated temperature sensor additionally measures the temperature of the intake-air flow.

Design and operation

The piezoresistive pressure-sensor element and suitable electronic circuitry for signal-amplification and temperature compensation are mounted on a silicon chip. The measured pressure is applied from above to the diaphragm´s active surface. A reference vacuum is enclosed between the rear side and the glass base. Thanks to a special coating, both pressure sensor and temperature sensor are insensitive to the gases and liquids which are present in the intake manifold.

Tolerances

The piezoresistive pressure-sensor element and suitable electronic circuitry for signal-amplification and temperature compensation are mounted on a silicon chip. The measured pressure is applied from above to the diaphragm´s active surface. A reference vacuum is enclosed between the rear side and the glass base. Thanks to a special coating, both pressure sensor and temperature sensor are insensitive to the gases and liquids which are present in the intake manifold.

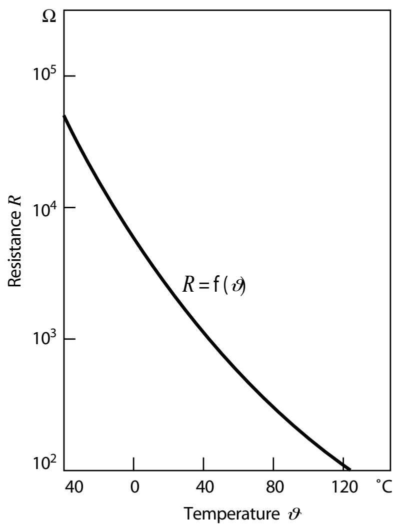
Installation instructions

The sensor is designed for attachment to a flat surface at the intake manifold of motor vehicles. The pressure connection and the temperature sensor jointly project into the intake manifold and are sealed off from the atmosphere by an O-ring. The sensor should be installed in the vehicle such that condensate cannot accumulate in the pressure cell (pressure sampling point at top of intake manifold, pressure connection angled downwards etc.).

Explanation of characteristic quantities

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

Characteristic curve for temperature sensor

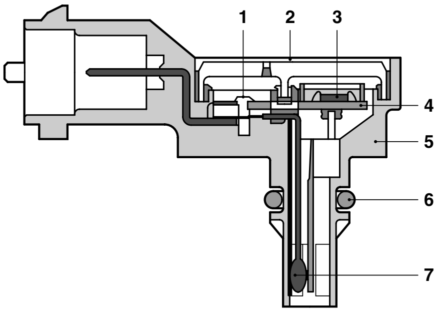


Applies to products with integrated temperature sensor.

Technical data

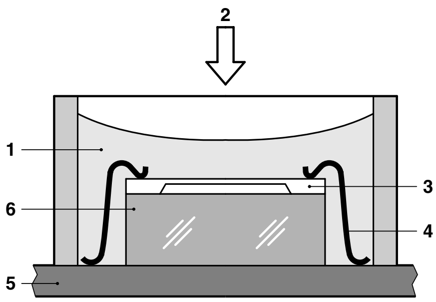
Parameter			min	type	max
Current input at U_V = 5 V	I_V	mA	6	9	12,5
Voltage limitation at U_V = 5 V - lower limit	$U_{A\,min}$	V	0,25	0,3	0,35
Voltage limitation at U_V = 5 V - upper limit	$U_{A\,max}$	V	4,75	4,8	4,85
Limit data					
Supply voltage	$U_{V\,max}$	V			16
Storage temperature		°C	-40		+130

Section through pressure sensor



1 Bond
2 Cover
3 Sensor chip
4 Ceramic substrate
5 Housing with pressure-sensor connection
6 Seal
7 NTC element.

Selection through sensor cell



1 Protective gel
2 Pressure
3 Sensor chip
4 Bond connection
5 Ceramic substrate
6 Glass base

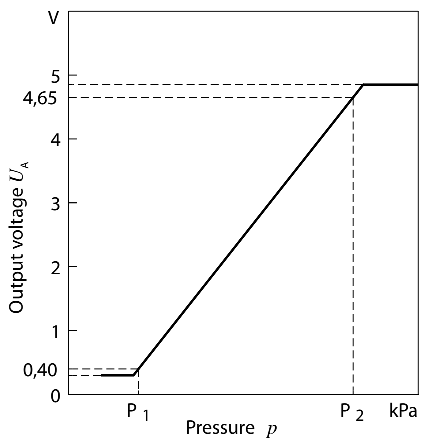
Part number 0 261 230 052

Technical data

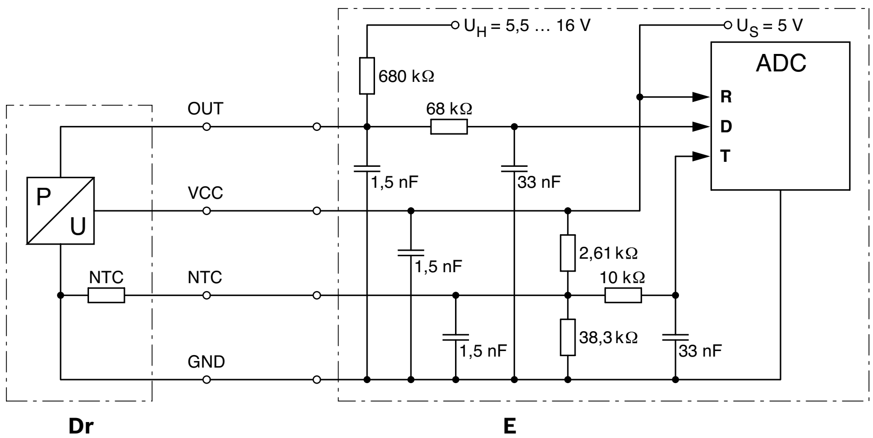
Parameter			min	type	max
Pressure range kPa (p_1...p_2)			10		115
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m		1	

Illustration

Characteristic curve

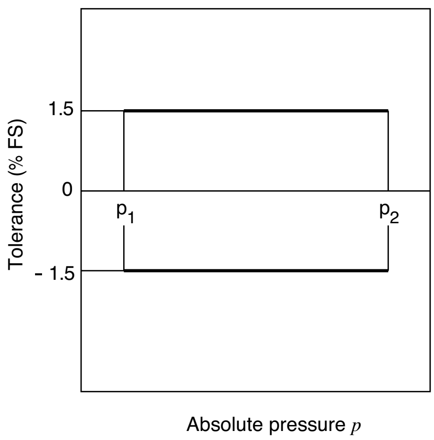


Recommendation for signal evaluation

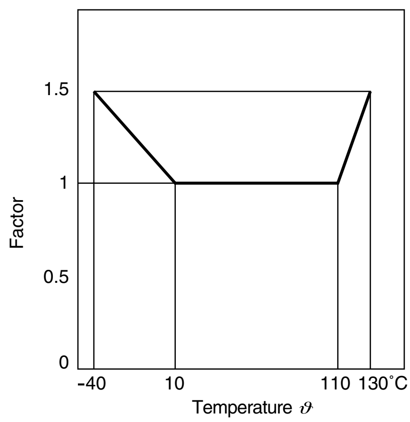


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

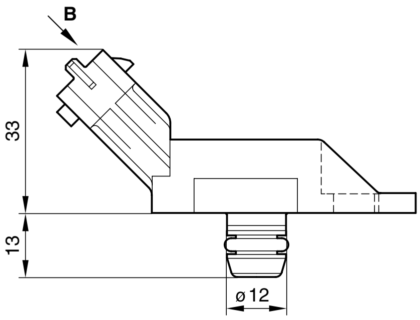


Accessories

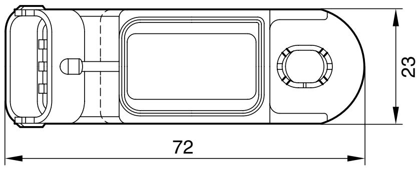
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 966
Contact pins	Quantity required: 3 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 3 x; Contents: 10 x	1 928 300 599

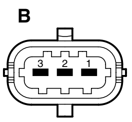
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.

Dimension drawings



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





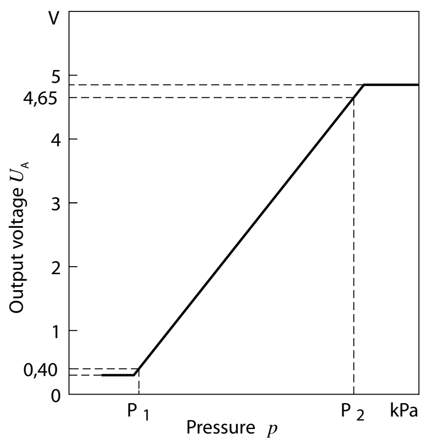
Part number 0 281 002 487

Technical data

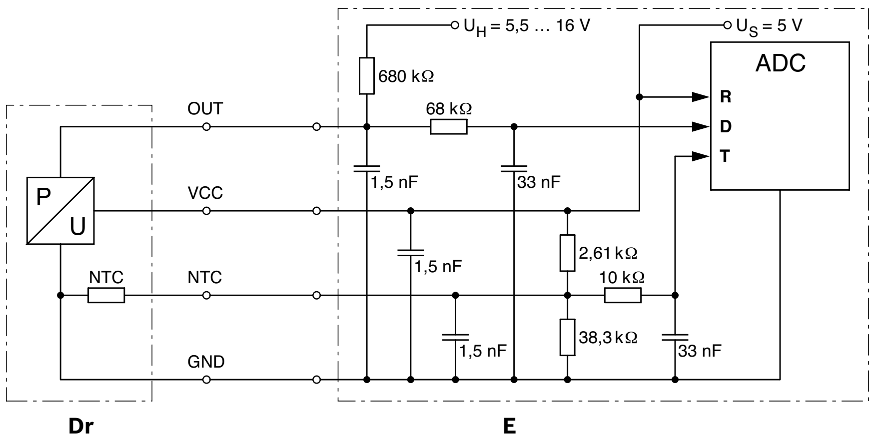
Parameter			min	type	max
Pressure range kPa (p_1...p_2)			20		250
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$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

Illustration

Characteristic curve

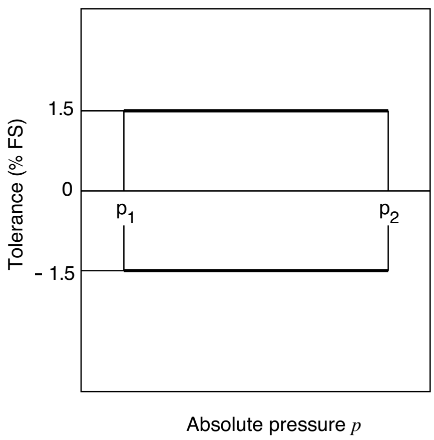


Recommendation for signal evaluation

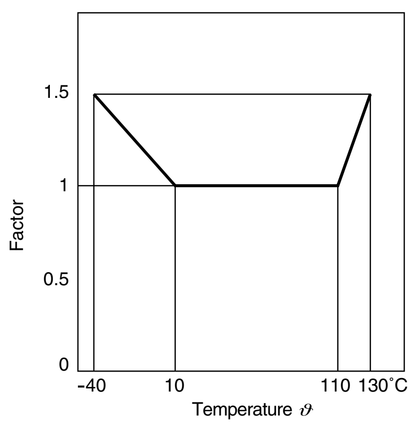


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

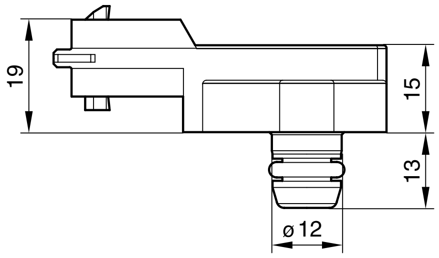


Accessories

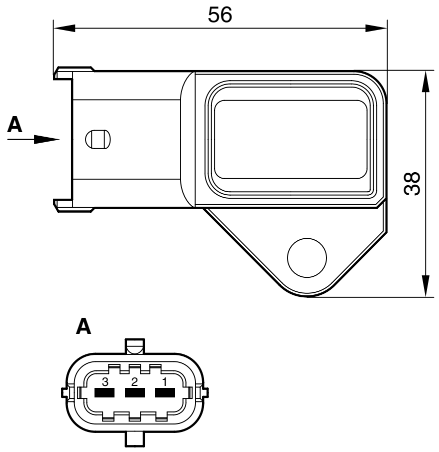
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 966
Contact pins	Quantity required: 3 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 3 x; Contents: 10 x	1 928 300 599

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

Dimension drawings



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



Part number 0 261 230 030

Technical data

Parameter			min	type	max
Feature				Integrated temperature sensor	
Pressure range kPa (p_1...p_2)			10		115
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m		1	

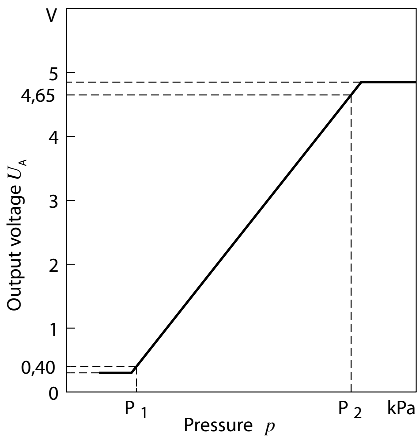
Temperature sensor

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])

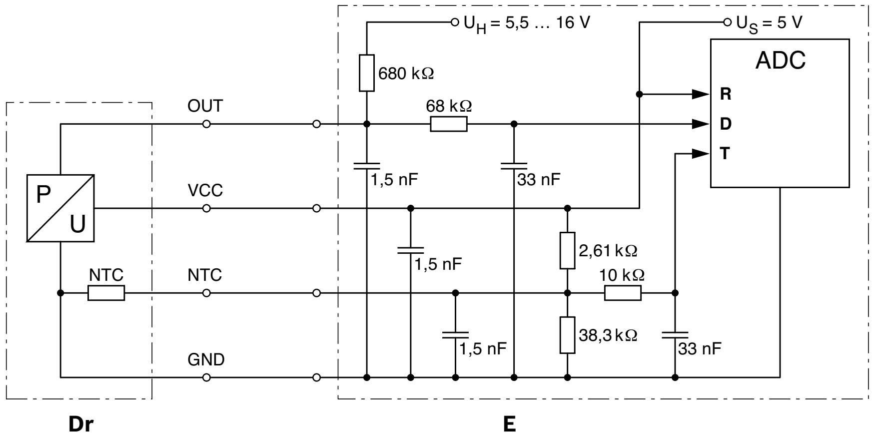
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

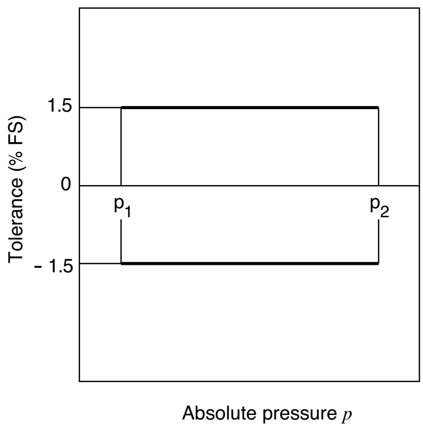


Recommendation for signal evaluation

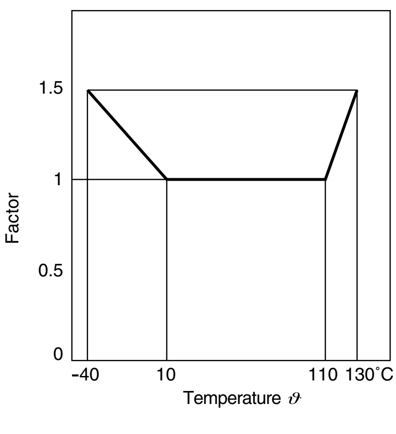


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

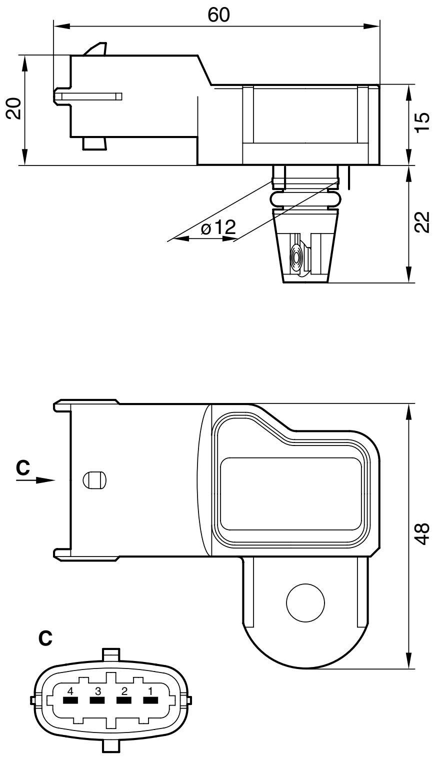


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

Part number 0 261 230 042

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	4,5	5	5,5
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m		1	

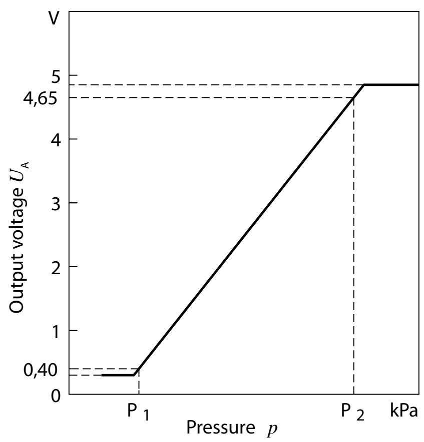
Temperature sensor

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])

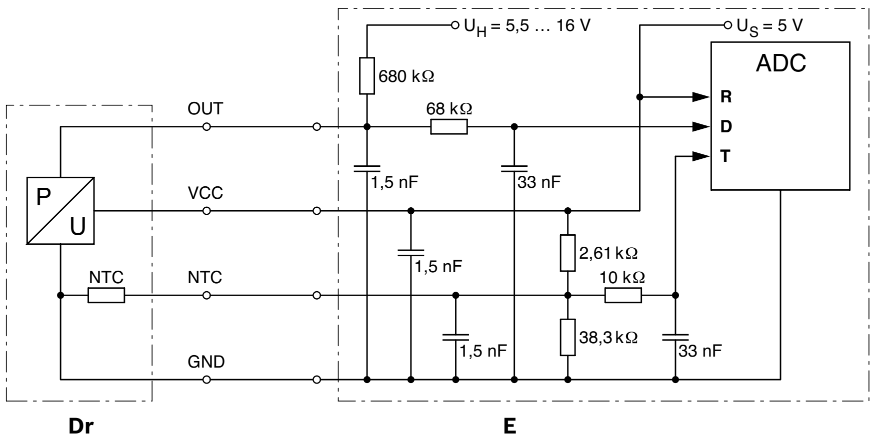
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

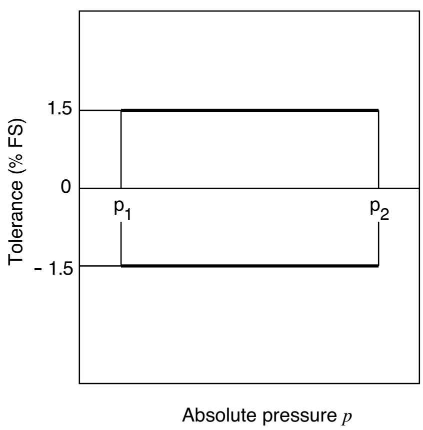


Recommendation for signal evaluation

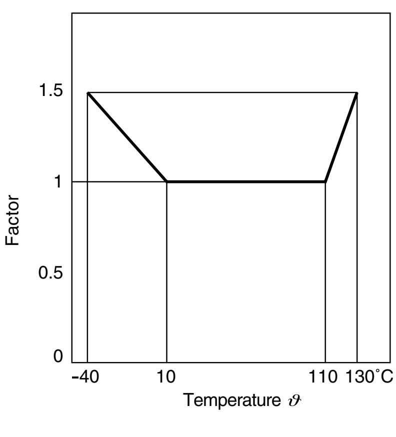


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

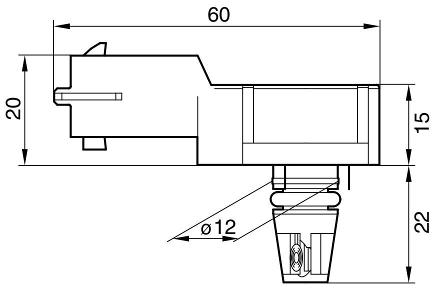


Accessories

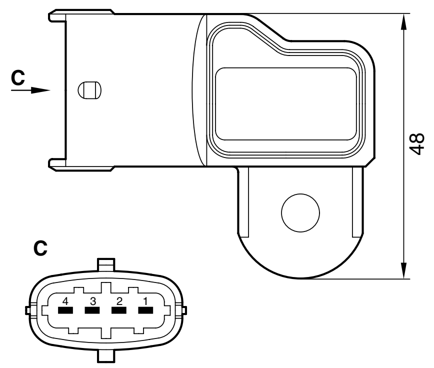
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

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

Dimension drawings



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



Part number 0 281 002 437

Technical data

Parameter			min	type	max
Feature			Integrated temperature sensor		
Pressure range kPa (p_1...p_2)			20		300
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load current at output	I_L	mA	-1		0,5
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	

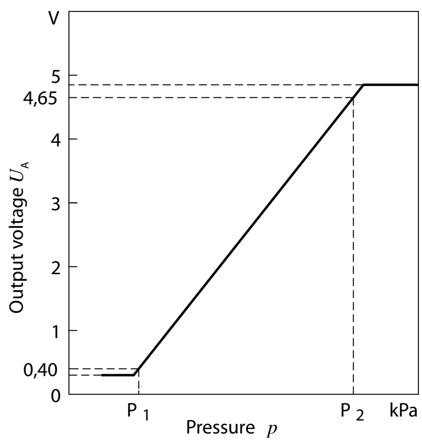
Temperature sensor

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])

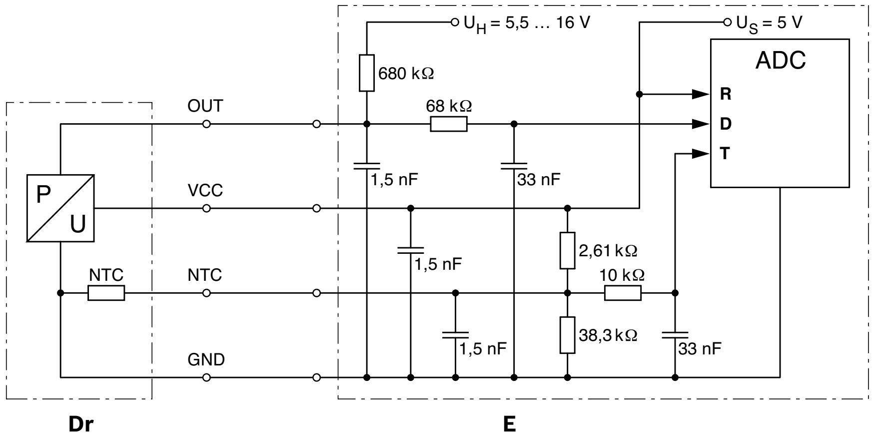
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

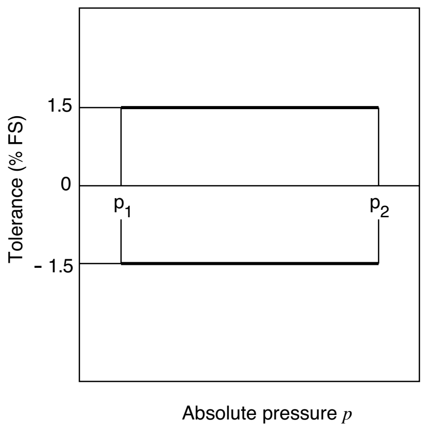


Recommendation for signal evaluation

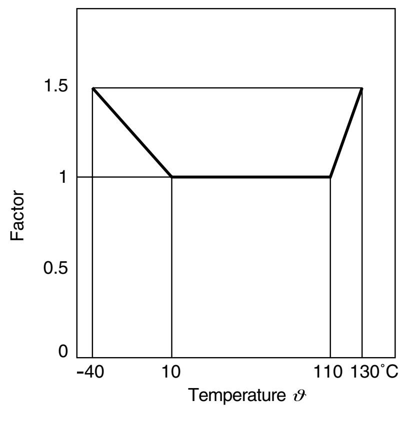


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

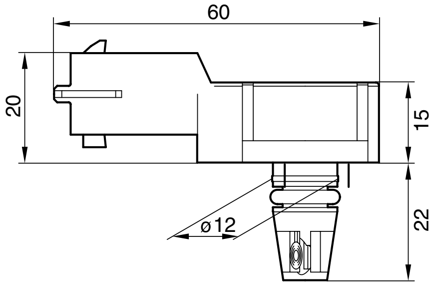


Accessories

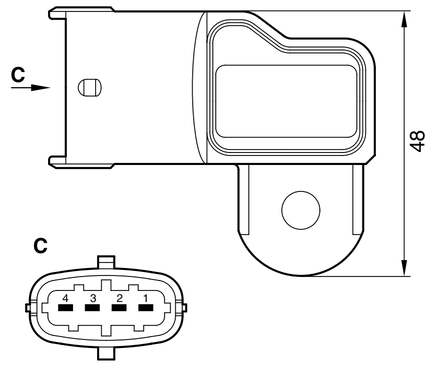
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

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

Dimension drawings



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



Part number 0 281 002 456

Technical data

Parameter			min	type	max
Feature			Integrated temperature sensor		
Pressure range kPa (p_1...p_2)			50		350
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load current at output	I_L	mA	-1		0,5
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	$\tau_{10/90}$	m		1	

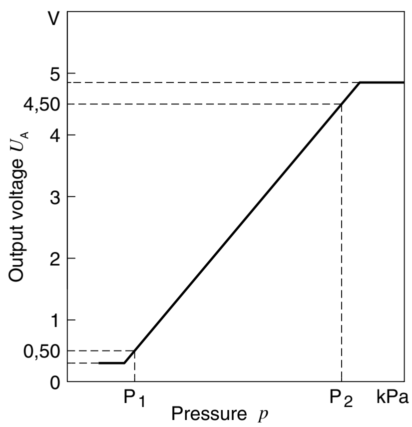
Temperature sensor

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])

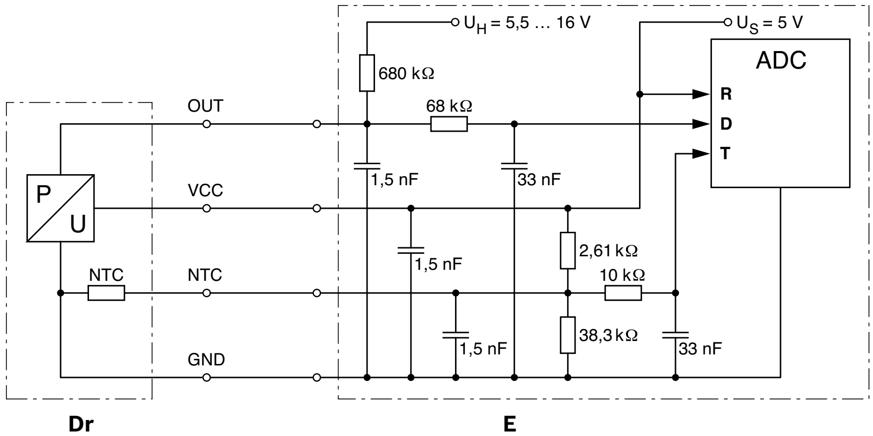
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

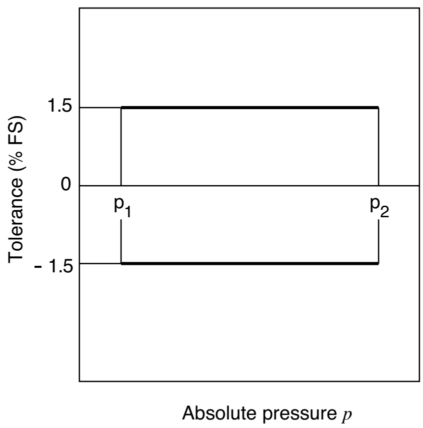


Recommendation for signal evaluation

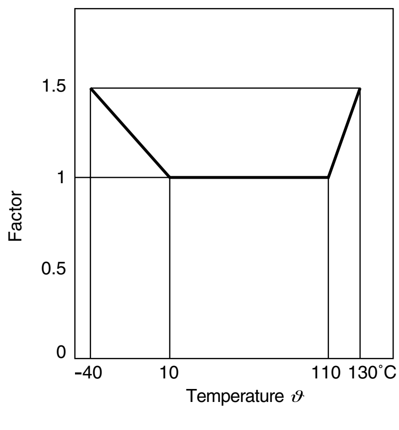


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

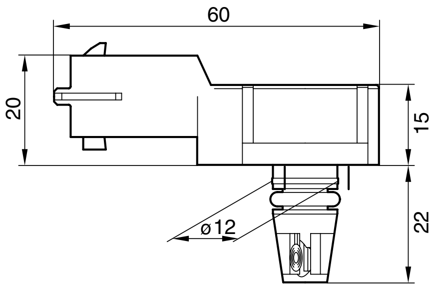


Accessories

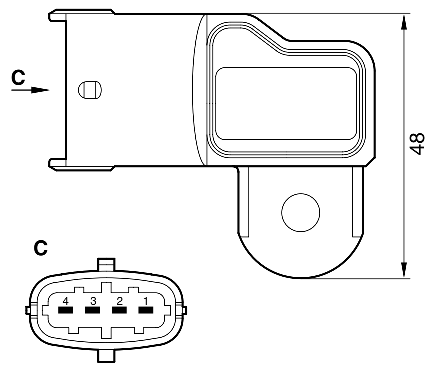
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

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

Dimension drawings



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



Part number 0 281 002 573

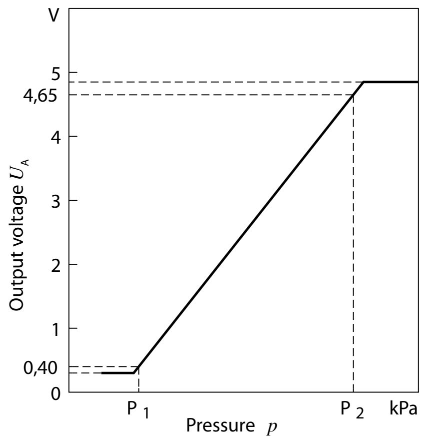
Technical data

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 current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m		1	
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])

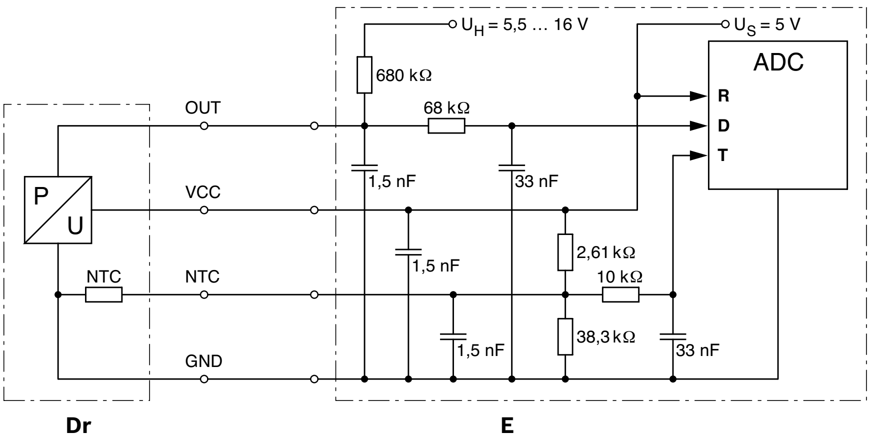
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

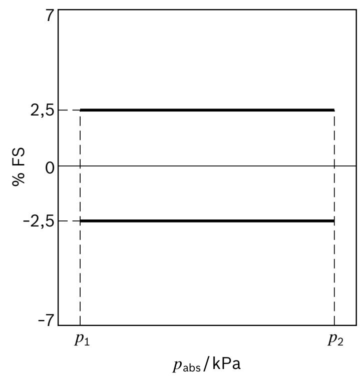


Recommendation for signal evaluation

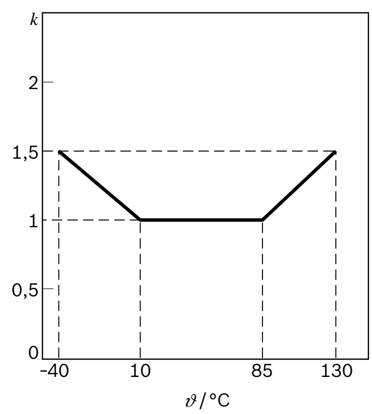


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

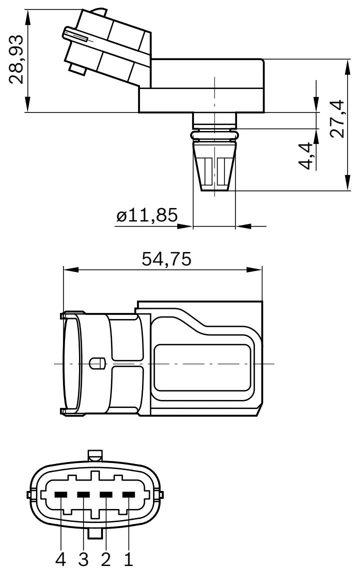


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

Part number 0 281 002 576

Technical data

Parameter			min	type	max
Feature			Integrated temperature sensor		
Pressure range kPa (p_1...p_2)			50		400
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,5	5	5,5
Load current at output	I_L	mA	-1		0,5
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	$\tau_{10/90}$	m		1	

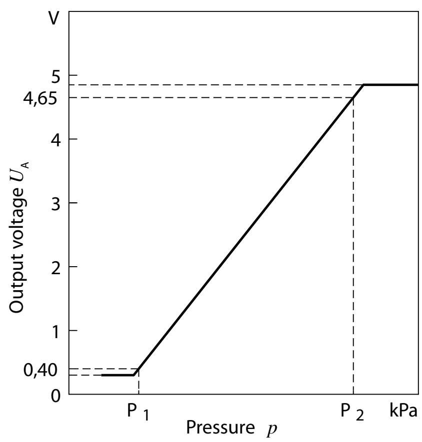
Temperature sensor

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])

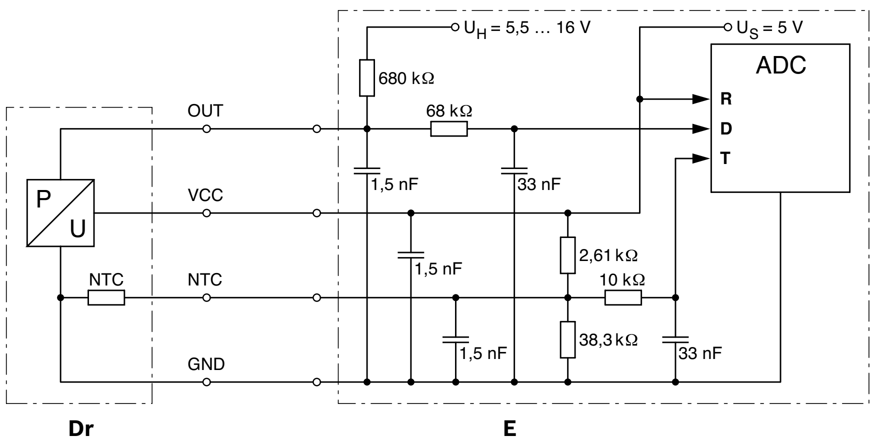
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

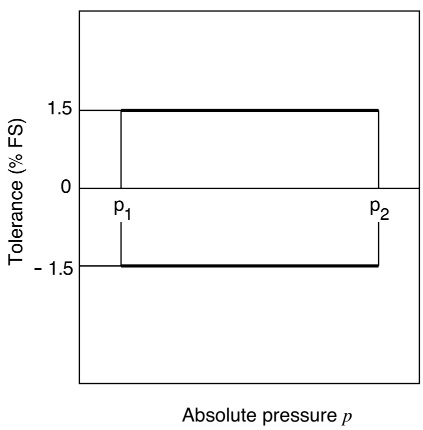


Recommendation for signal evaluation

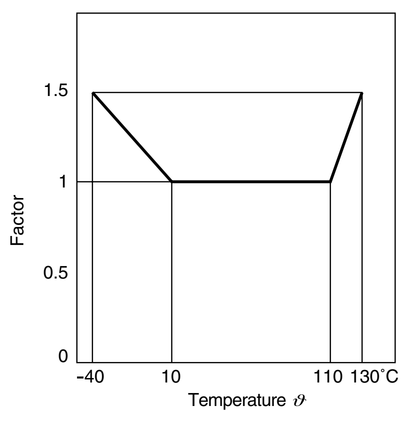


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance extension factor

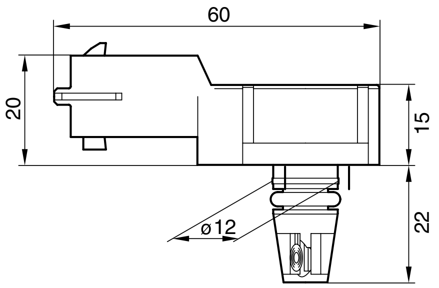


Accessories

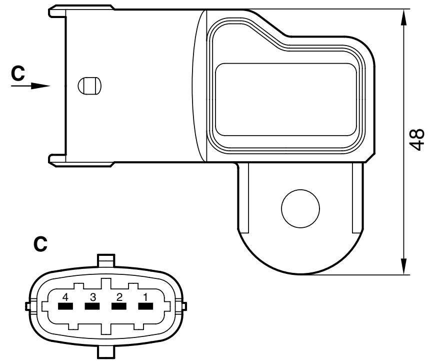
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 736
Contact pins	Quantity required: 4 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 4 x; Contents: 10 x	1 928 300 599

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

Dimension drawings



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



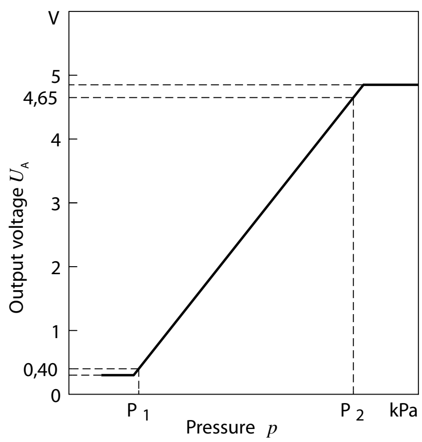
Part number 0 281 002 566

Technical data

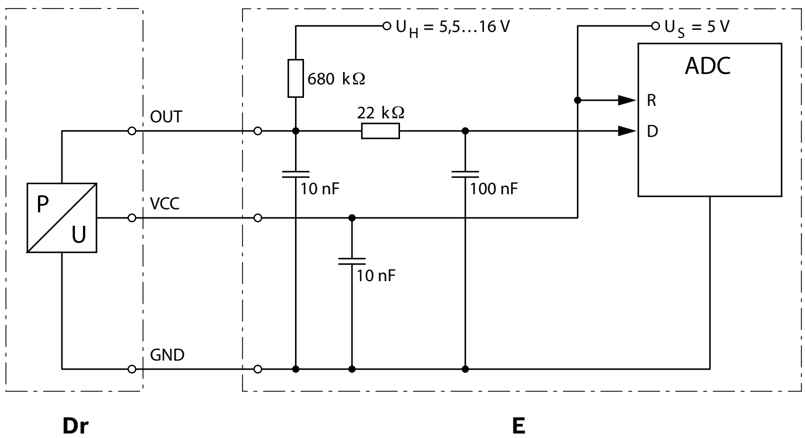
Parameter			min	type	max
Pressure range kPa (p_1...p_2)			20		300
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,75	5	5,25
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10		
Response time	$\tau_{10/90}$	m			1

Illustration

Characteristic curve

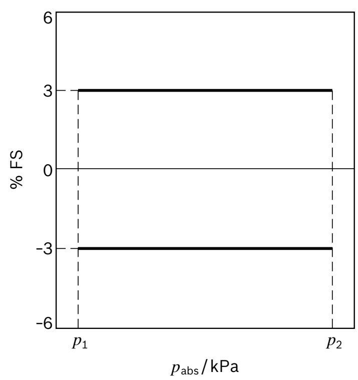


Recommendation for signal evaluation

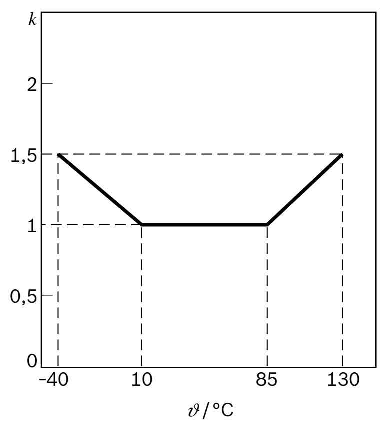


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

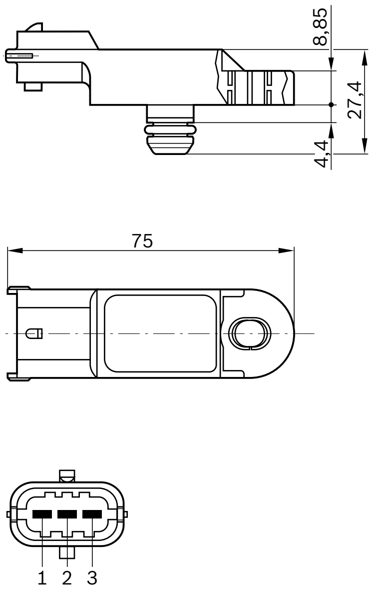


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



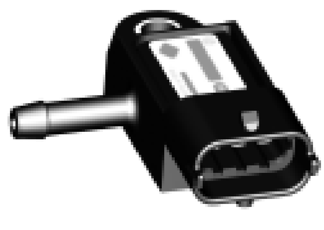
Pin 1 +5 V
Pin 2 Ground
Pin 3 Output signal

Part number 0 281 002 593

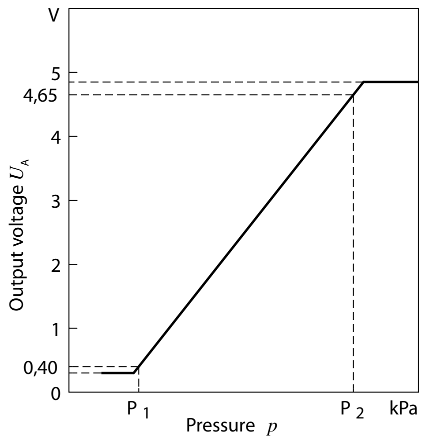
Technical data

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 current at output	I_L	mA	-1		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	$\tau_{10/90}$	m			1

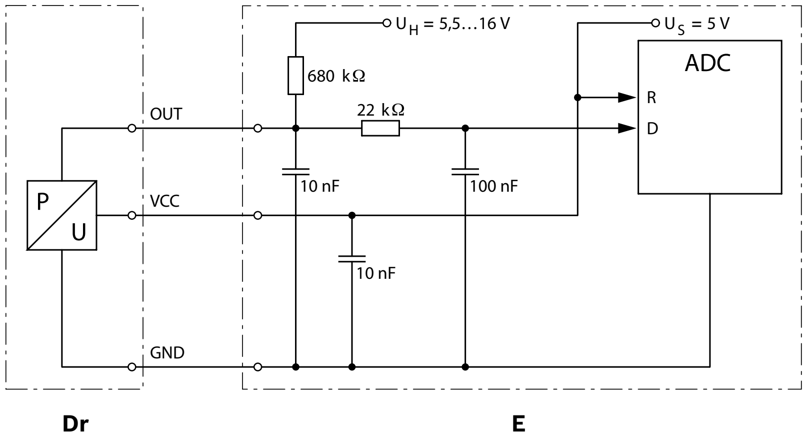
Illustration



Characteristic curve

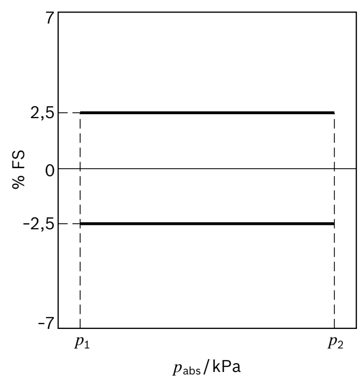


Recommendation for signal evaluation

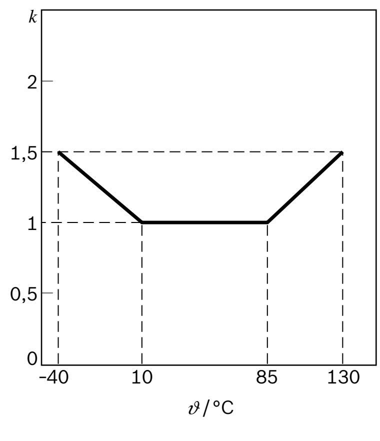


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

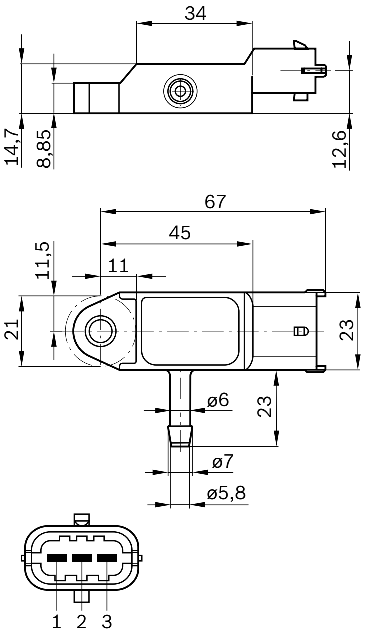


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

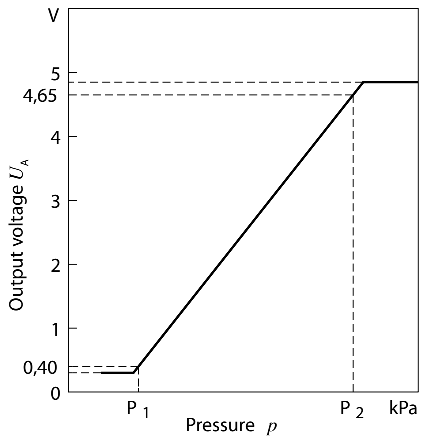
Part number 0 281 002 616

Technical data

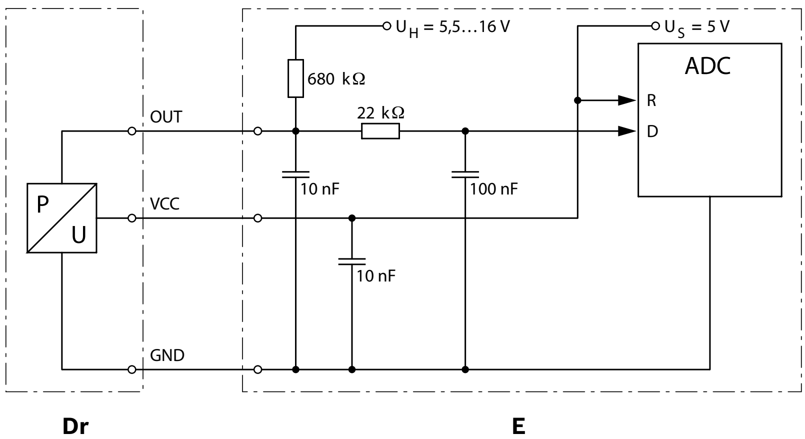
Parameter			min	type	max
Pressure range kPa (p_1...p_2)			20		250
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,75	5	5,25
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10		
Response time	$\tau_{10/90}$	m			1

Illustration

Characteristic curve

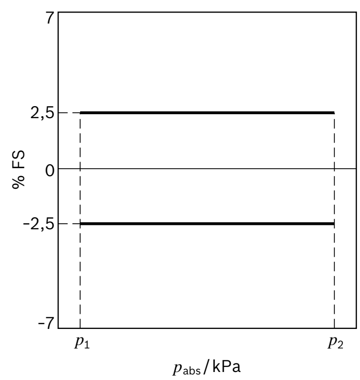


Recommendation for signal evaluation

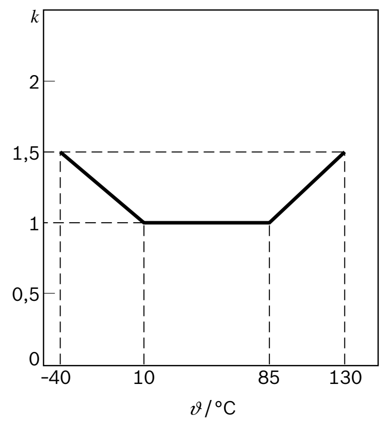


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

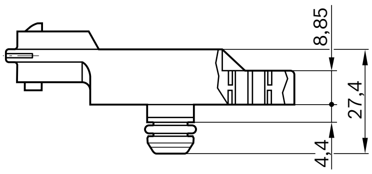


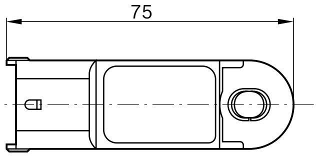
Accessories

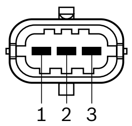
Accessories		Part number
Connector housing	Quantity required: 1 x	1 928 403 966
Contact pins	Quantity required: 3 x; Contents: 100 x	1 928 498 060
Individual seals	Quantity required: 3 x; Contents: 10 x	1 928 300 599

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

Dimension drawings







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

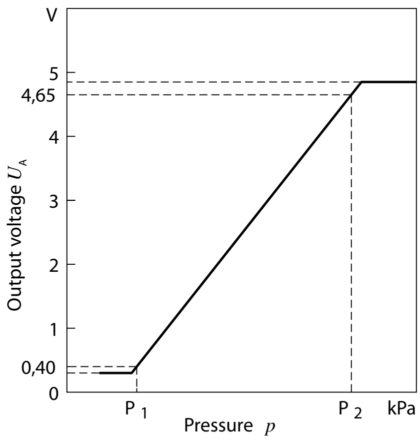
Part number 0 261 230 083

Technical data

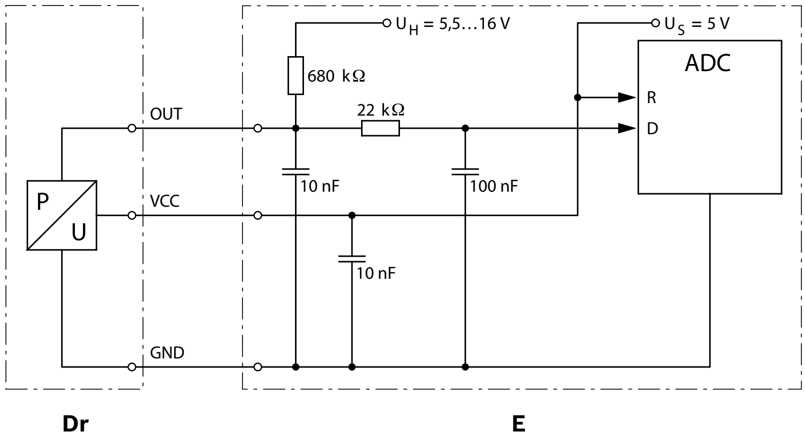
Parameter			min	type	max
Pressure range kPa (p_1...p_2)			10		115
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,75	5	5,25
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m			1

Illustration

Characteristic curve

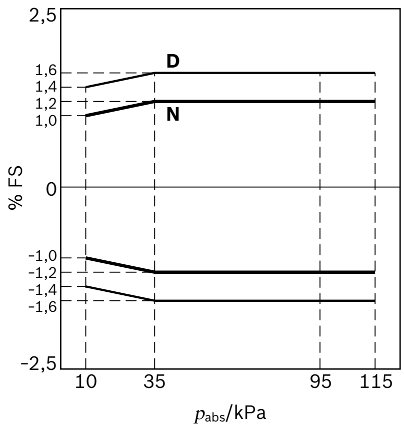


Recommendation for signal evaluation

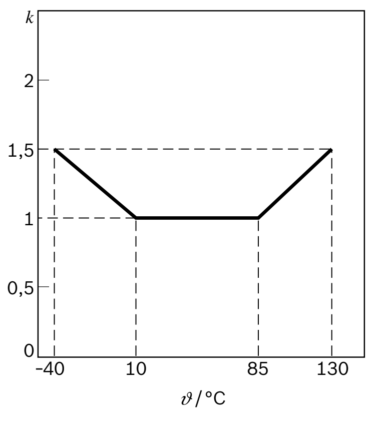


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

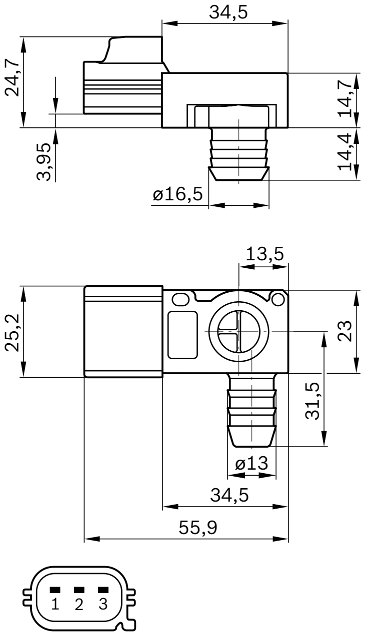


Accessories

		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

Part number 0 281 002 693

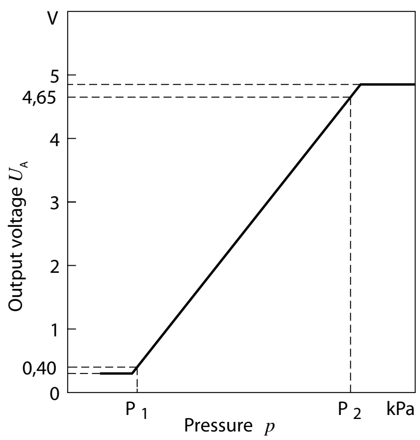
Technical data

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 current at output	I_L	mA	-1		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	$\tau_{10/90}$	m			1
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])

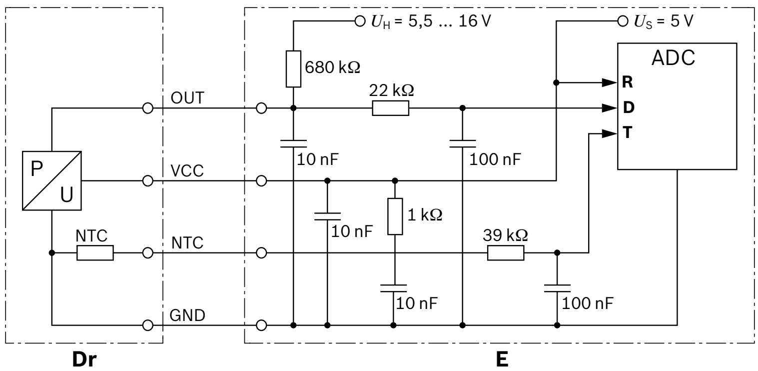
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

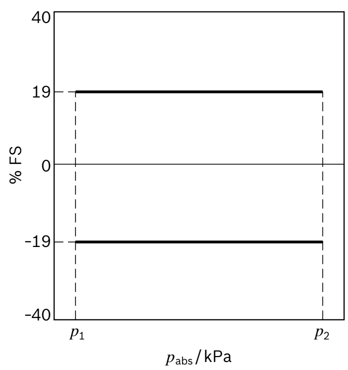


Recommendation for signal evaluation

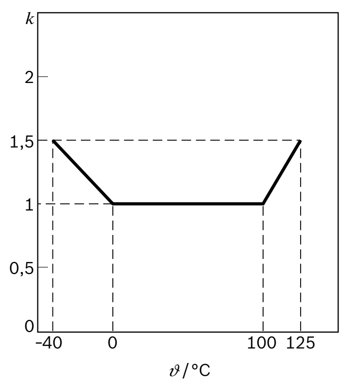


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

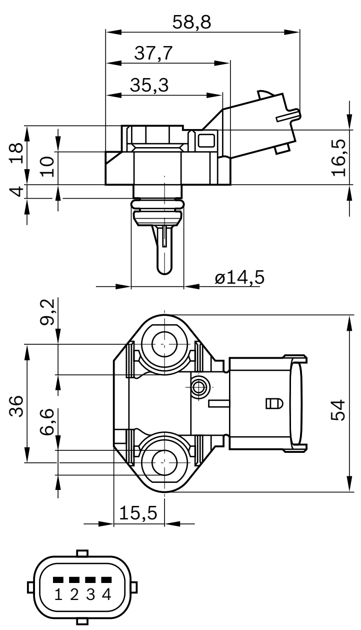


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

Part number 0 261 230 090

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 current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10	100	
Response time	$\tau_{10/90}$	m			1

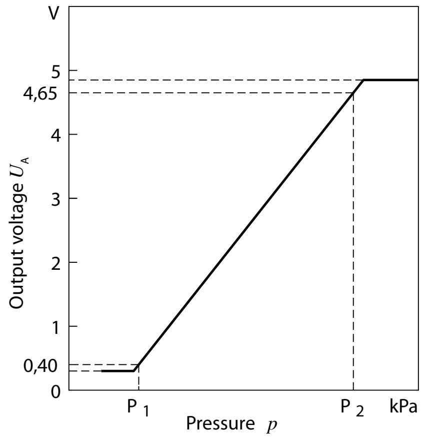
Temperature sensor

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])

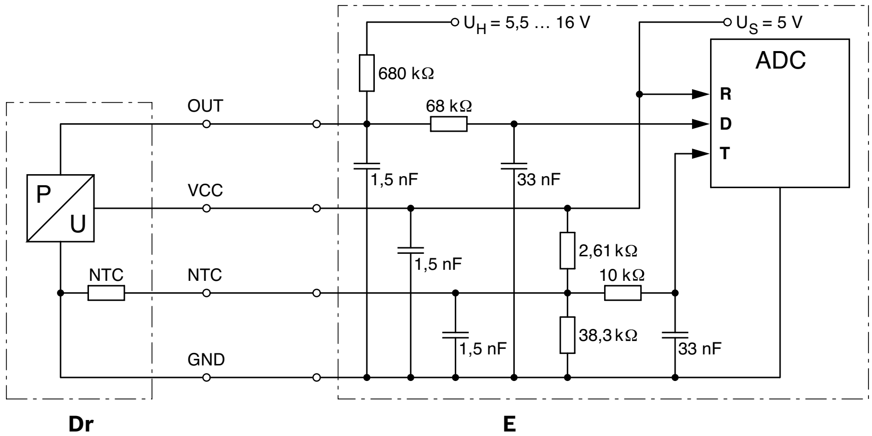
[1]) Operation at 5 V with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

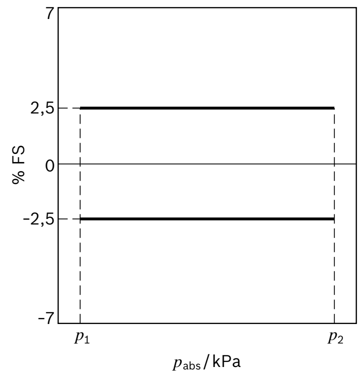


Recommendation for signal evaluation

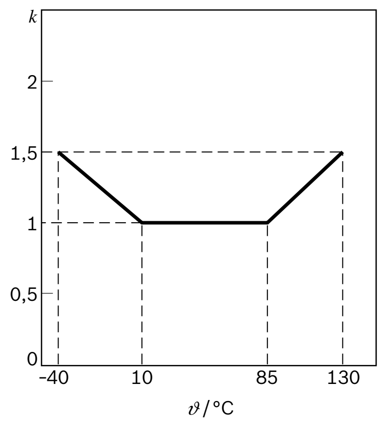


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

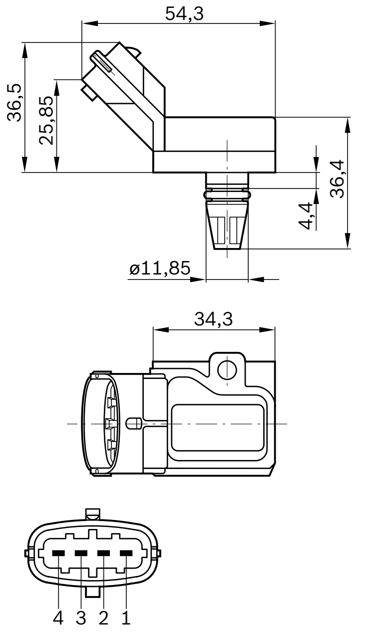


Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Dimension drawings



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

Part number 0 261 230 105

Technical data

Parameter			min	type	max
Feature			Integrated temperature sensor		
Pressure range kPa (p_1...p_2)			20		300
Operating temperature	ϑ_B	°C	-40		+130
Supply voltage (1 min)	U_V	V	4,75	5	5,25
Load current at output	I_L	mA	-1		0,5
Load resistance to U_V or ground	$R_{pull\text{-}up}$	kΩ	5		
Load resistance to U_V or ground	$R_{pull\text{-}down}$	kΩ	10		
Response time	$\tau_{10/90}$	m			1

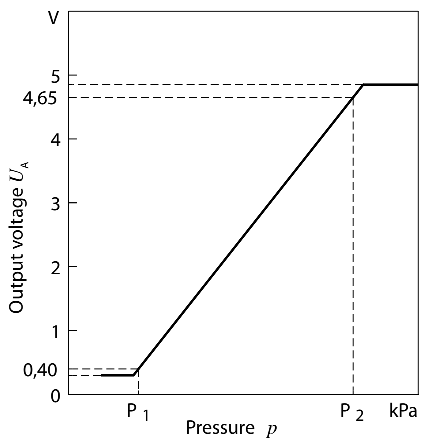
Temperature sensor

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])

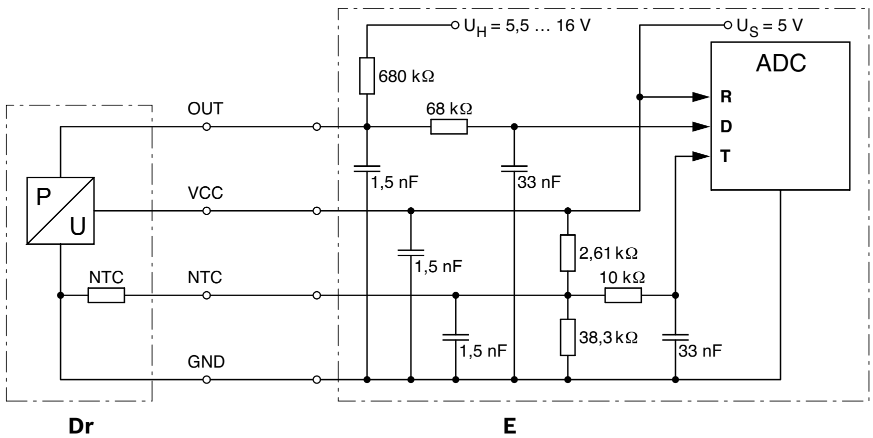
[1]) Operation at 5 V with 1 kΩ series resistance.
[1]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

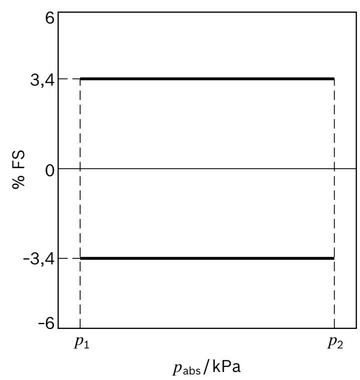


Recommendation for signal evaluation

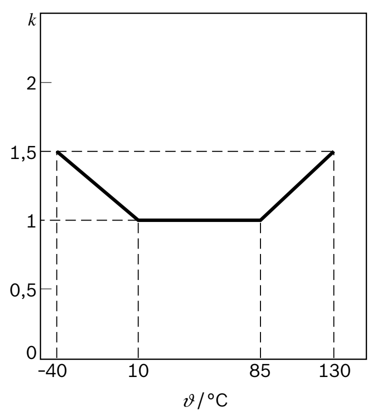


R Reference
D Pressure signal
T Temperature signal
Dr Pressure sensor
E Electronic control unit

Characteristic-curve tolerance



Tolerance-extension factor

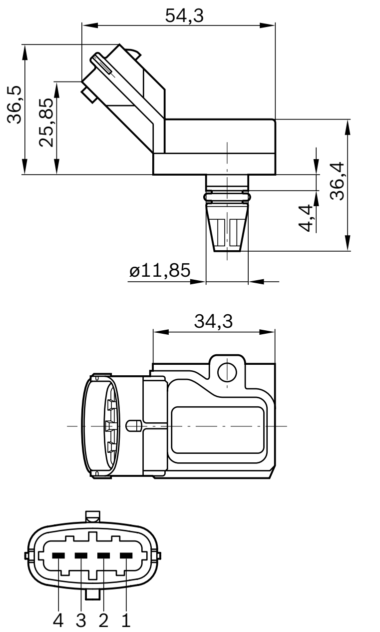


Accessories Part number

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

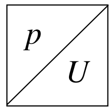
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.

Dimension drawings



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

Absolute-pressure sensors



Media-resistant, micromechanical

- Available as separate component or fitted in an extremely robust housing.
- EMC protection up to 100 Vm^{-1}
- With temperature compensation
- Ratiometric output signal
- All sensors and sensor cells are resistant to fuels (including diesel) and oils such as engine oil.

Application

Monolithically integrated silicon pressure sensors are extremely precise measuring elements for determining absolute pressure. They are particularly suitable for use under harsh ambient conditions, such as the measurement of the absolute intake-manifold pressure in internal-combustion engines.

Design and operation

The sensor contains a silicon chip with etched pressure diaphragm. A change in pressure causes elongation of the diaphragm and this is recorded by an evaluation circuit on the basis of changes in resistance. The circuit is integrated on the silicon chip together with electronic calibration elements. When manufacturing the silicon chip, a silicon wafer containing a number of sensor elements is attached to a glass plate. Once sawn into individual chips, each chip is soldered onto a metal base with pressure connection. The pressure is routed via the connection and the base to the back of the pressure diaphragm. A reference vacuum permitting measurement of the absolute pressure and at the same time protecting the front of the pressure diaphragm is enclosed beneath the cap, which is welded to the base. The programming logic on the chip performs calibration. The calibration parameters are permanently stored by means of thyristors (zener zapping) and etched conductive paths. The calibrated and tested sensors are fitted in a special housing for attachment to the intake manifold (refer to product range).

Signal evaluation

The pressure sensor supplies an analog output signal which has a ratiometric relationship with the supply voltage. It is advisable to fit the input stage of the downstream electronics with an RC low-pass filter (e.g. t = 2 ms) to suppress any interference due to harmonics. In the version with integrated temperature sensor, this consists of an NTC thermistor (to be used in conjunction with a series resistor) for measurement of the ambient temperature.

Installation instructions

On installation, the pressure connection should face downwards to stop condensate accumulating in the pressure cell.

Version

Sensors with housing:
This version features a sturdy housing. On the version with temperature sensor, the sensor is located in the housing. Sensors without housing:
Enclosure similar to TO, pressure is supplied through a central pressure connection. The pin assignment is as follows:
Pin 6 Output voltage UA,
Pin 7 Ground,
Pin 8 +5 V.

Note

1 connector housing, 3 contact pins and 3 individual seals are required for a 3-pin connector.
1 connector housing, 4 contact pins and 4 individual seals are required for a 4-pin connector.

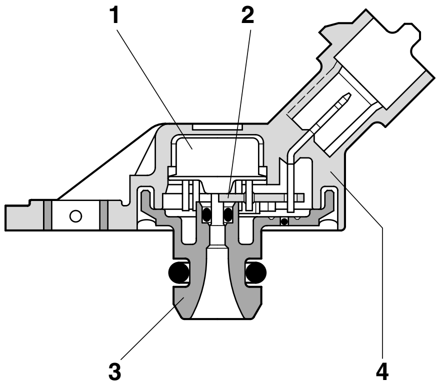
Explanation of characteristic quantities

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

Technical data

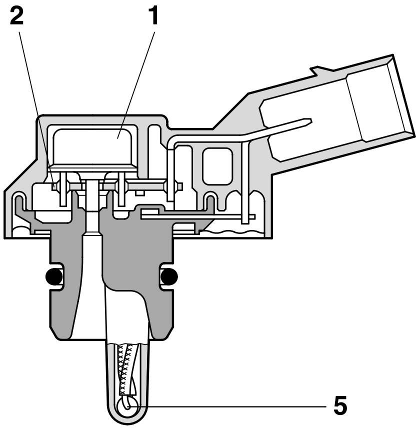
Parameter		min	type	max
Current input I_V at U_V = 5 V	mA	6	9	12,5
Lower limit at U_V = 5 V	V	0,25	0,3	0,35
Upper limit at U_V = 5 V	V	4,75	4,8	4,85
Output resistance to ground, U_V open	kΩ	2,4	4,7	8,2
Output resistance to U_V, ground open	kΩ	3,4	5,3	8,2
Limit data				
Supply voltage U_V	V			16
Recommendation for signal evaluation				
Load resistance to U_H = 5.5...16 V	kΩ		680	

Section through installed pressure sensor



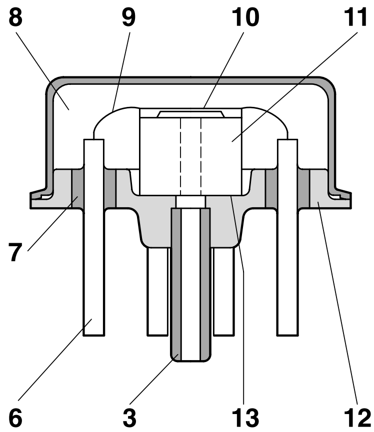
1 Pressure sensor
2 PCB
3 Pressure connection
4 Housing

Pressure sensor installed



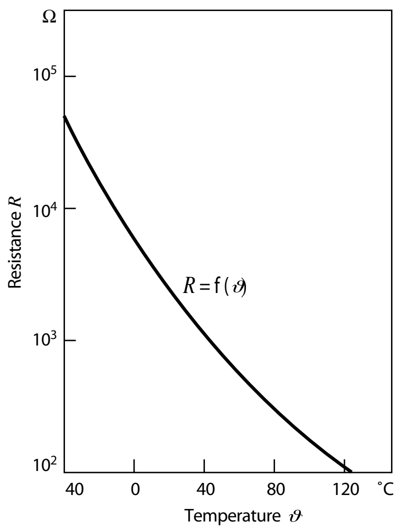
Version with temperature sensor
1 Pressure sensor
2 PCB
5 Temperature sensor Version with temperature sensor

Pressure sensor in housing



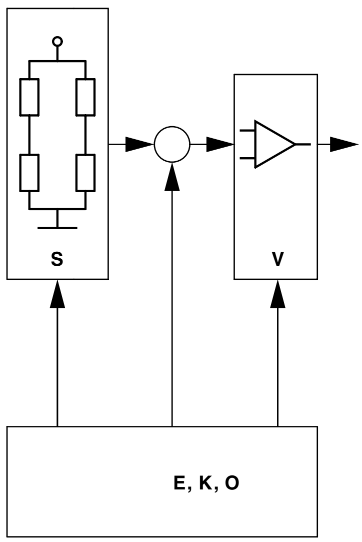
3 Pressure connection
6 Gland
7 Glass coating
8 Reference vacuum
9 Aluminium bond (bonding wire)
10 Sensor chip
11 Glass base
12 Welded joint
13 Soldered joint

Characteristic curve for temperature sensor



Applies to products with integrated temperature sensor.

Recommendation for signal evaluation



E Sensitivity
O Offset
K Compensation circuit
S Sensor bridge
V Amplifier
E Sensitivity

Part number 0 261 230 020

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	20		115
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

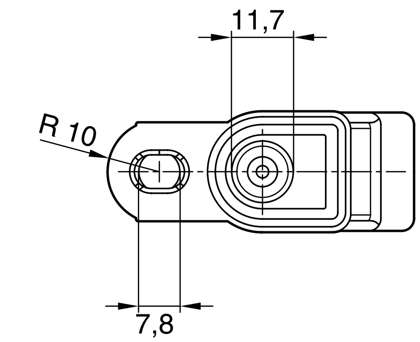
Limit data

Operating temperature	°C	-40		+130

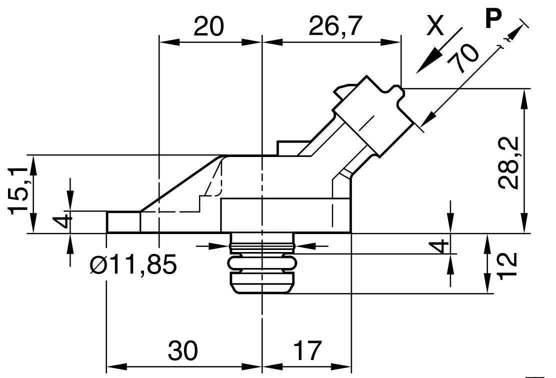
Recommendation for signal evaluation

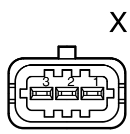
Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

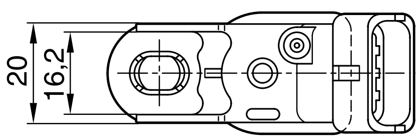
Dimension drawings



P Space required for connector and cable
Pin 1 +5 V
Pin 2 Ground
Pin 3 Output signal







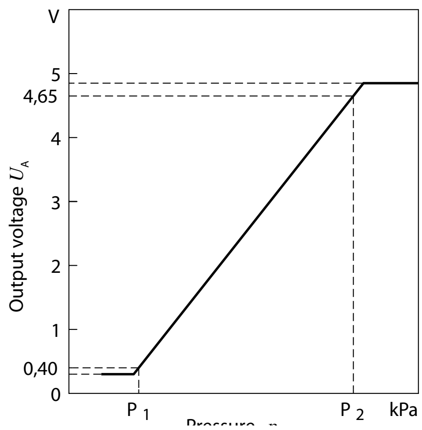
Accessories

Accessories		Part number
Plug housing		1 928 403 870
Contact pin	Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x	1 987 280 106

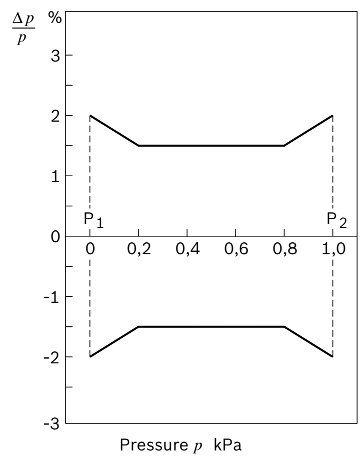
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Illustration

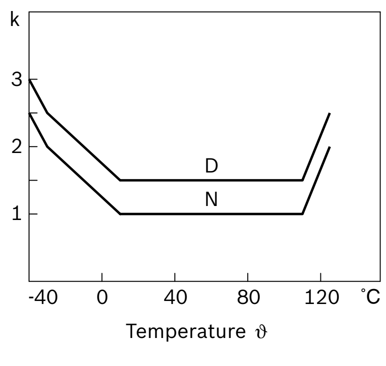
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 281 002 137

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	20		115
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

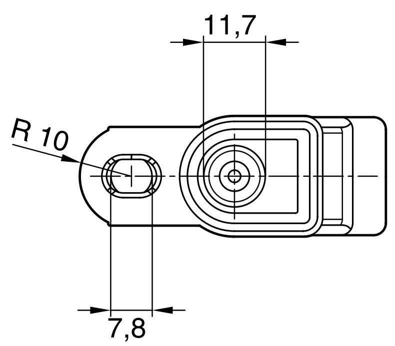
Limit data

Operating temperature	°C	-40		+130

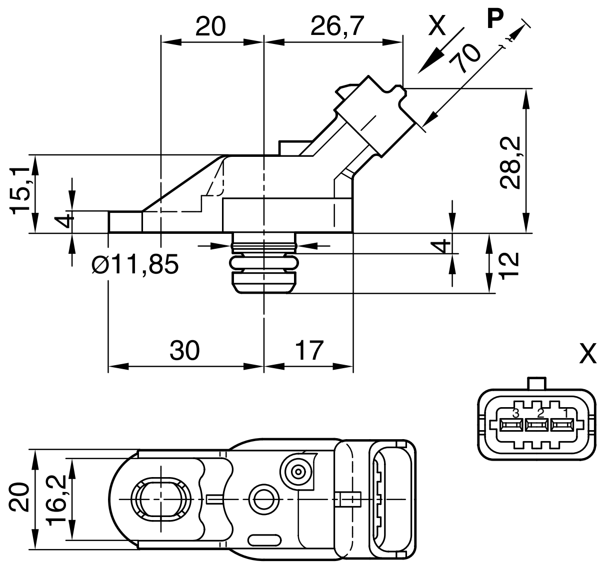
Recommendation for signal evaluation

Load resistance to ground	kΩ	100
Low-pass resistance	kΩ	21,5
Low-pass capacitance	nF	100

Dimension drawings

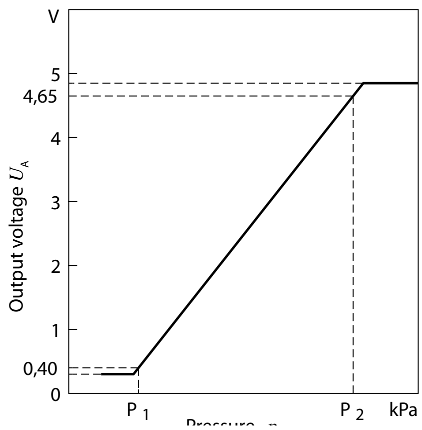


P Space required for connector and cable
Pin 1 +5 V
Pin 2 Ground
Pin 3 Output signal

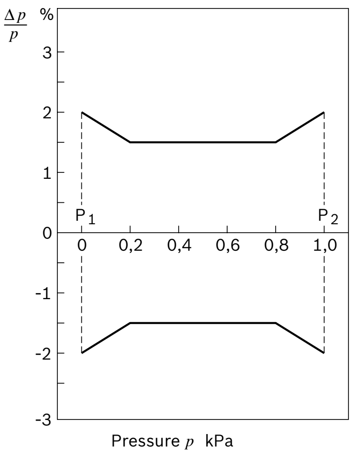


Illustration

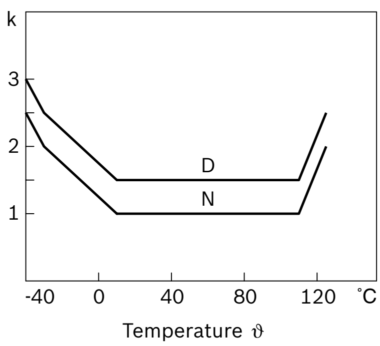
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Accessories

Accessories			Part number
Plug housing			1 928 403 870
Contact pin		Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Part number 0 261 230 022

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
Load resistance to ground or U_V	kΩ	50		
Response time $\tau_{10/90}$	ms		0,2	
Operating temperature	°C	-40		+125

Limit data

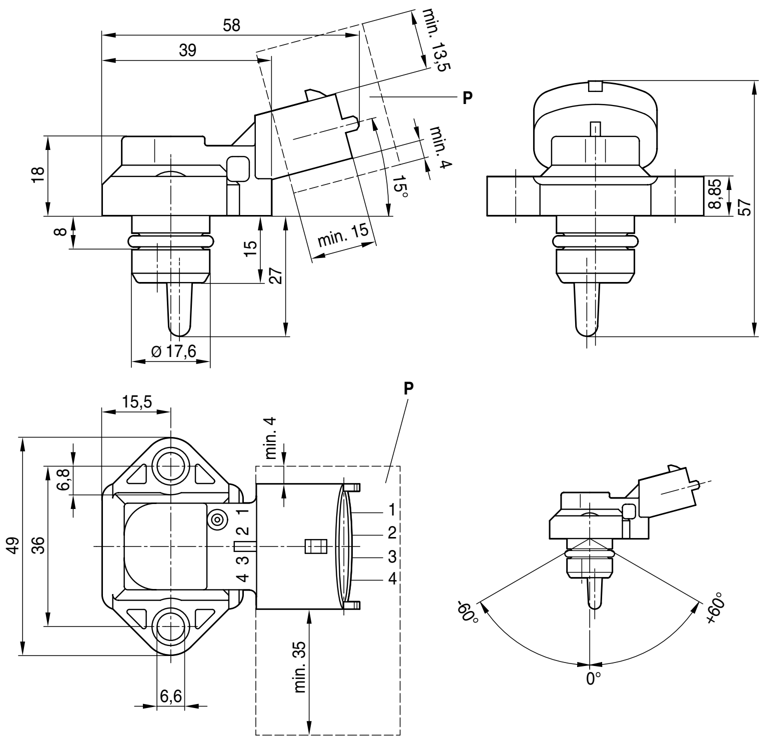
Operating temperature	°C	-40		+130

Recommendation for signal evaluation

Load resistance to ground	kΩ	100
Low-pass resistance	kΩ	21,5
Low-pass capacitance	nF	100

Dimension drawings

P	Space required for connector and cable.
Pin 1	Ground
Pin 2	NTC thermistor
Pin 3	+5 V
Pin 4	Output signal



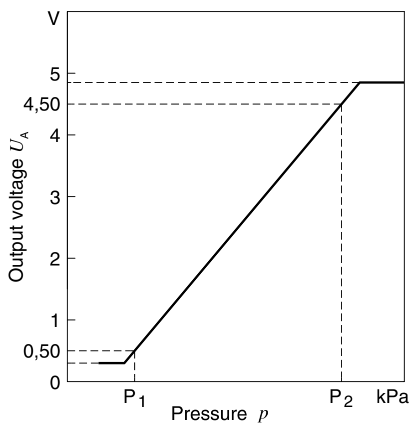
Accessories

Accessories			Part number
Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x		1 987 280 106

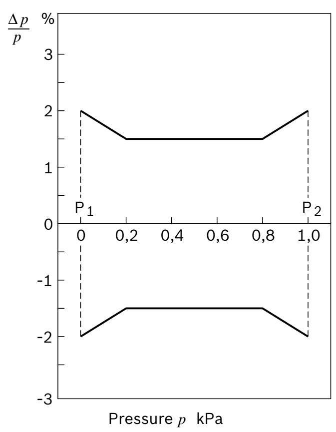
Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Illustration

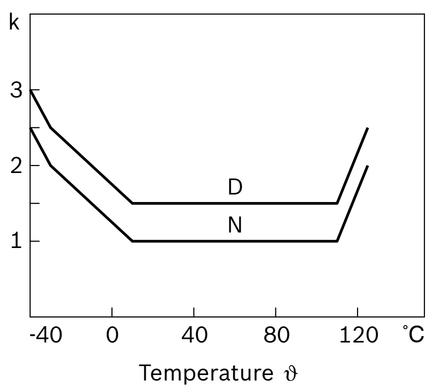
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 261 230 013

Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
Pressure range ($p_1 ... p_2$)	kPa	20		115
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	

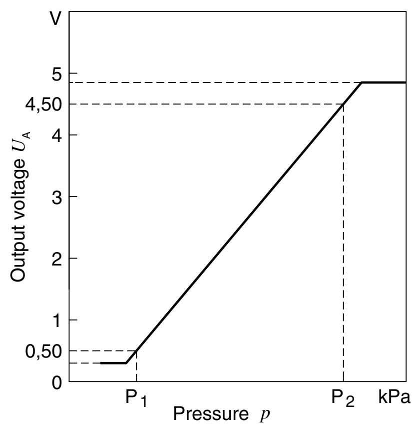
Temperature sensor

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

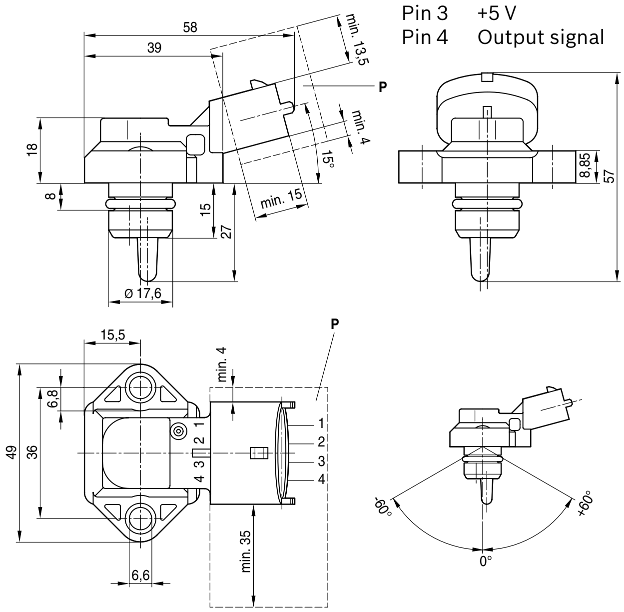
[1]) Operation with 1 kΩ series resistance. [2]) In air with flow velocity 6 m/s.

Illustration

Characteristic curve

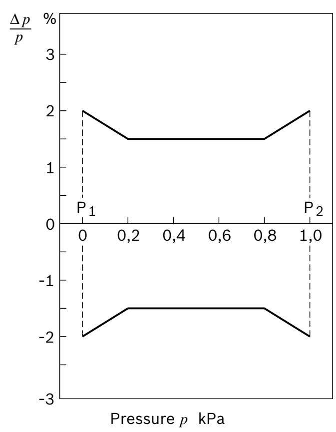


Dimension drawings

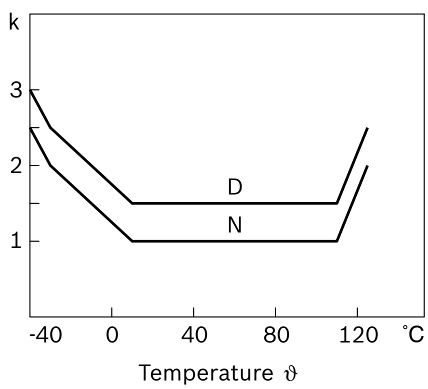


P	Space required for connector and cable.
Pin 1	Ground
Pin 2	NTC thermistor
Pin 3	+5 V
Pin 4	Output signal

Characteristic-curve tolerance



Tolerance-extension factor



Accessories

			Part number
Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Part number 0 281 002 205

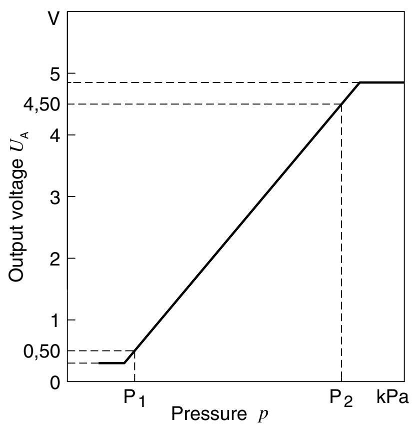
Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
Pressure range ($p_1 \dots p_2$)	kPa	20		250
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.

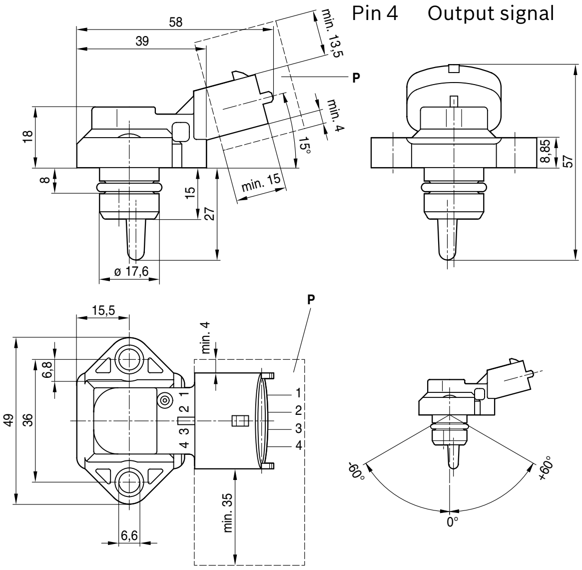
Illustration

Characteristic curve

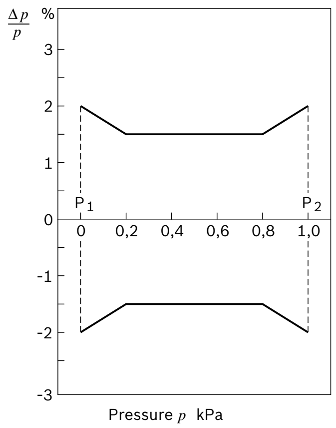


Dimension drawings

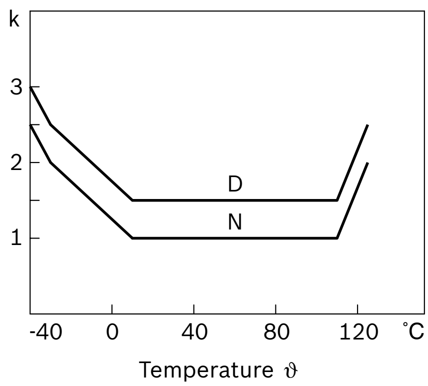
P Space required for connector and cable.
Pin 1 Ground
Pin 2 NTC thermistor
Pin 3 +5 V
Pin 4 Output signal



Characteristic-curve tolerance



Tolerance-extension factor



Accessories

Accessories			Part number
Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Part number 0 281 002 244

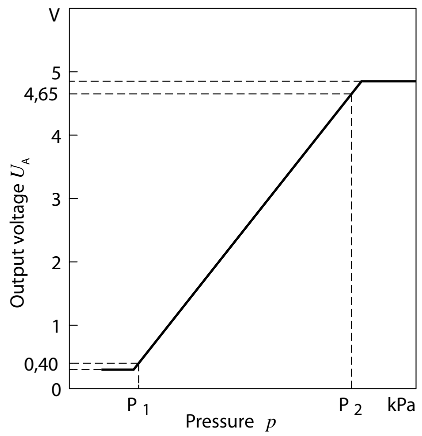
Technical data

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	-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.

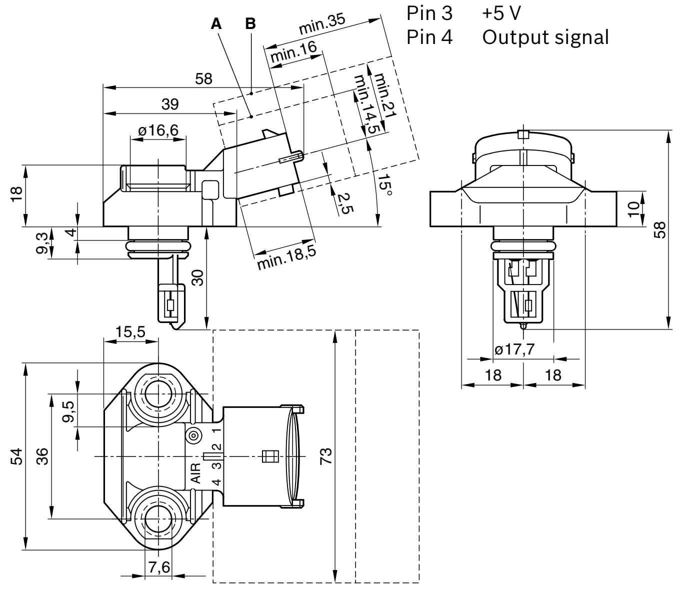
Illustration

Characteristic curve

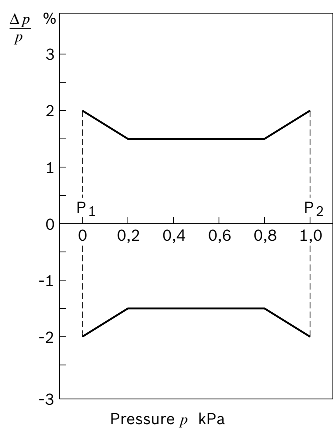


Dimension drawings

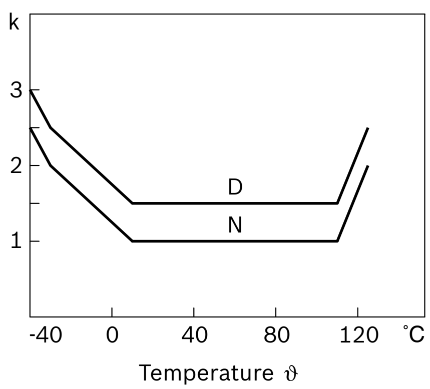
A Space required for connector.
B Space required for connection.
Pin 1 Ground
Pin 2 NTC
Pin 3 +5 V
Pin 4 Output signal



Characteristic-curve tolerance



Tolerance-extension factor



Accessories — Part number

Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-6[1])
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

Part number 0 281 002 316

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	

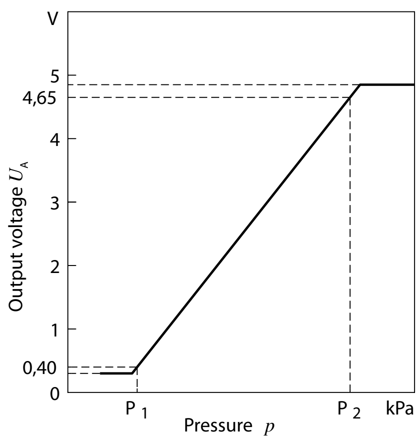
Temperature sensor

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

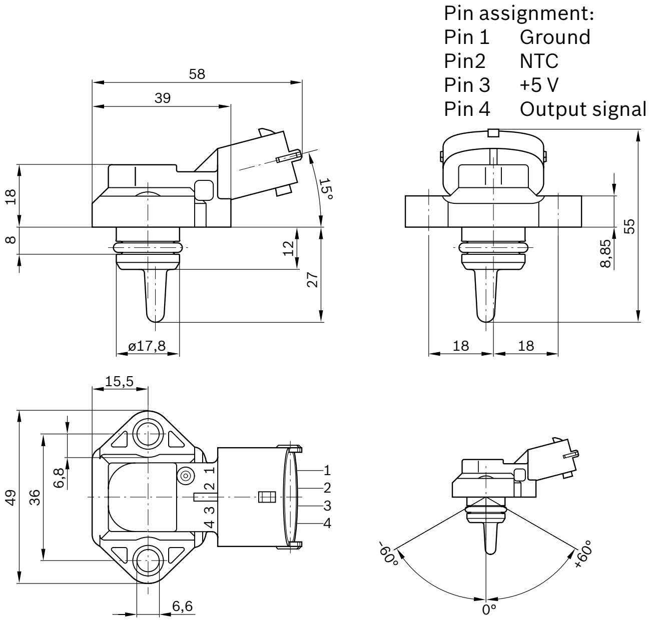
[1]) Operation with 1 kΩ series resistance. [2]) In air with flow velocity 6 m/s.

Illustration

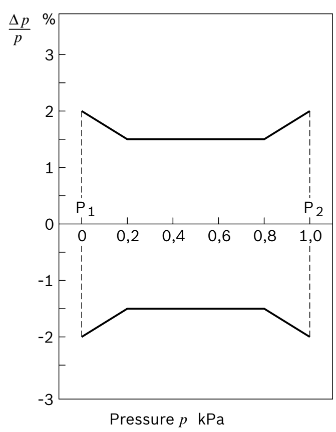
Characteristic curve



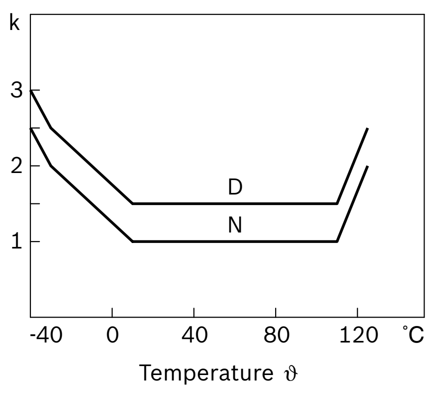
Dimension drawings



Characteristic-curve tolerance



Tolerance-extension factor



Accessories

Accessories		Part number
Connector housing	4-pin	1 928 403 966
Contact pins	for Ø 0.5...1.0 mm^2; Contents: 100 x	1 928 498 056
Contact pins	for Ø 1.5...2.5 mm^2; Contents: 100 x	1 928 498 057
Individual seal	for Ø 0.5...1.0 mm2^2; Contents: 10 x	1 928 300 599
Individual seal	for Ø 1.5...2.5 mm^2; 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 are therefore to be ordered separately as required.

Part number 0 281 002 420

Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
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	

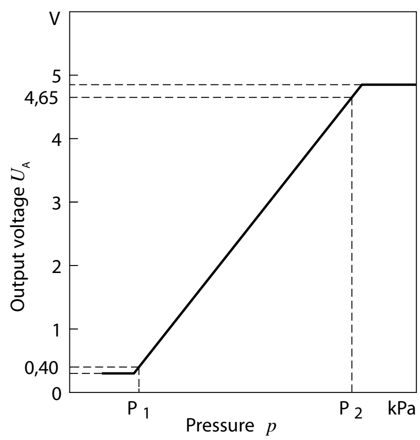
Temperature sensor

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.

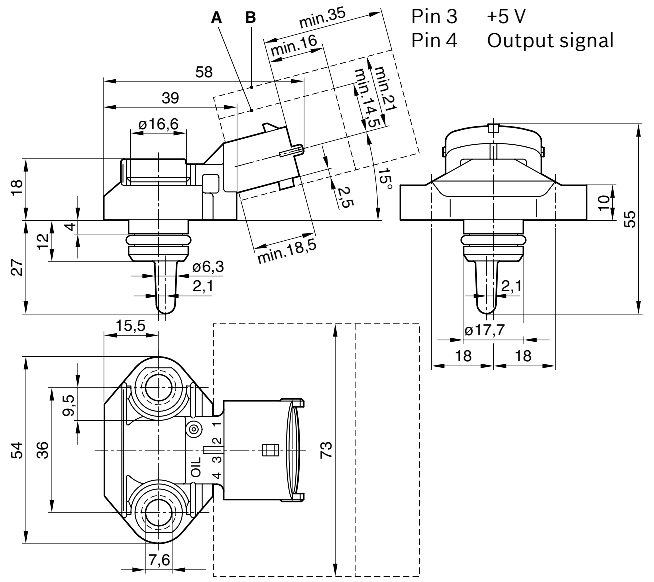
Illustration

Characteristic curve

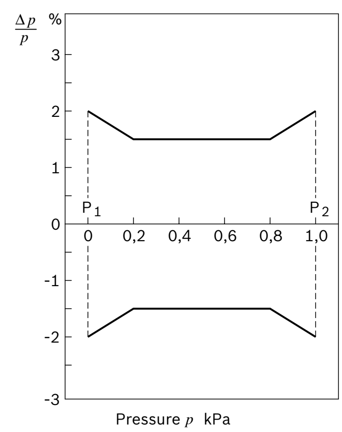


Dimension drawings

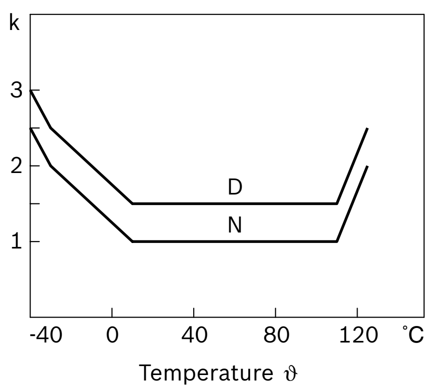
A	Space required for connector.
B	Space required for connection.
Pin 1	Ground
Pin 2	NTC
Pin 3	+5 V
Pin 4	Output signal



Characteristic-curve tolerance



Tolerance-extension factor



Accessories

Accessories			Part number
Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-1[1])
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. [1]) Available from Tyco Electronics.

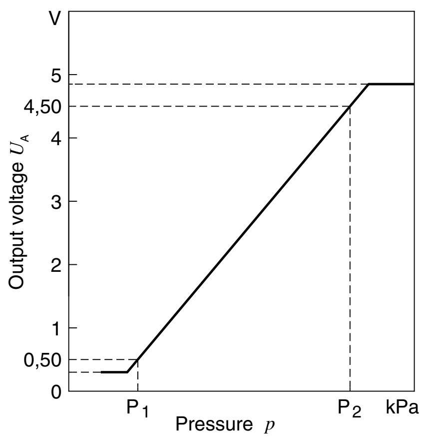
Part number 0 261 230 009

Technical data

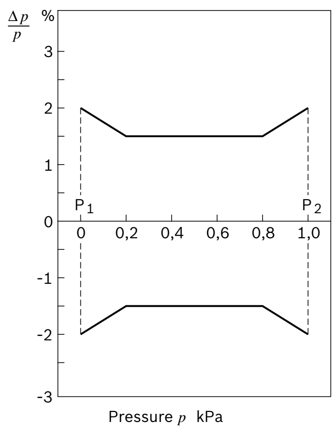
Parameter		min	type	max
Features				Hose connection
Pressure range (p_1...p_2)	kPa	10		115
Supply voltage U_V	V	4,5	5	5,5
Load current I_L at output	mA	-0,1		0,1
Load resistance to ground or U_V	kΩ	50		
Response time $\tau_{10/90}$	ms		0,2	
Operating temperature	°C	-40		+125
Limit data				
Operating 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	

Illustration

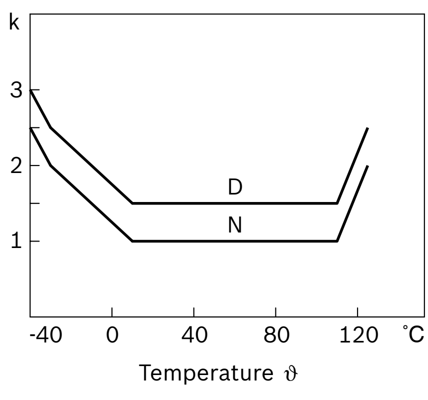
Characteristic curve



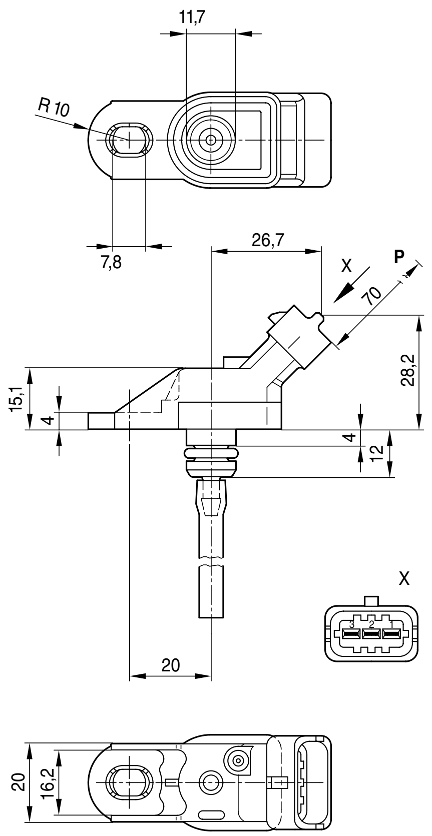
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



P	Space required for connector and cable.
Pin 1	+5 V
Pin 2	Ground
Pin 3	Output signal

Accessories

Accessories			Part number
Plug housing			1 928 403 913
Contact pin		Tyco number	2-929 939-1¹)
Individual seal	Contents: 50 x		1 987 280 106

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required. ¹) Available from Tyco Electronics.

Part number 1 267 030 835

Technical data

Parameter		min	type	max
Features	Clip-type module with connecting cable			
Pressure range ($p_1 ... p_2$)	kPa	15		380
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

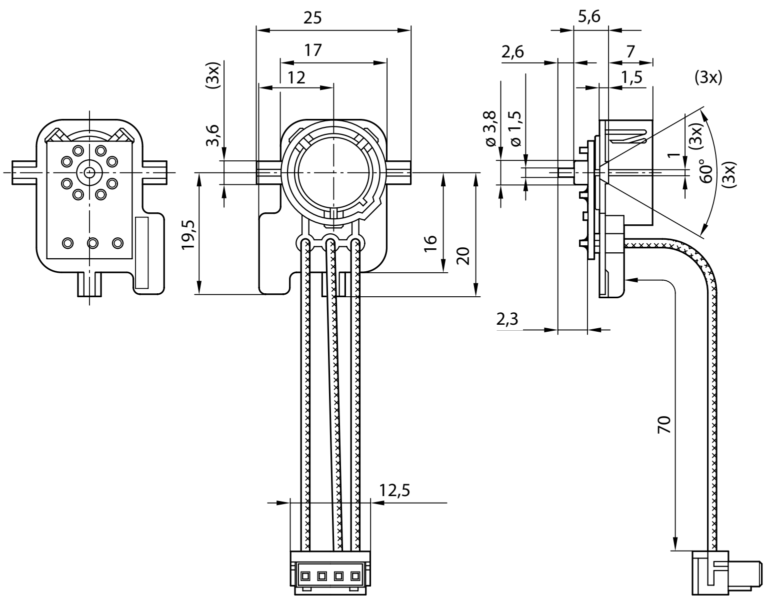
Operating temperature	°C	-40		+130

Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

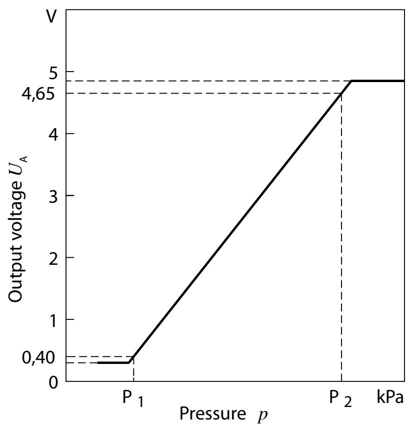
Dimension drawings

Pin assignment:
Pin 1 Ground
Pin 2 +5 V
Pin 3 Not used
Pin 4 Output signal

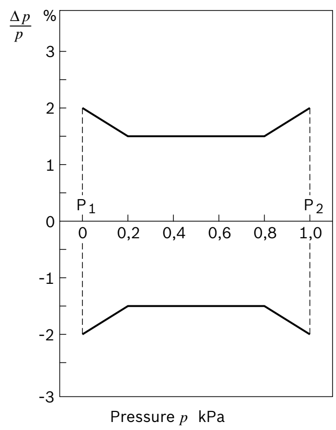


Illustration

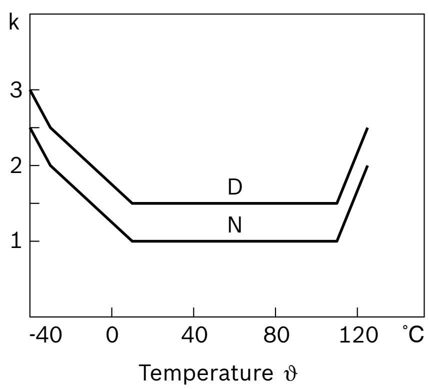
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 273 300 006

Technical data

Parameter		min	type	max
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
Load resistance to ground or U_V	kΩ	50		
Response time $\tau_{10/90}$	ms		0,2	
Operating temperature	°C	-40		+125

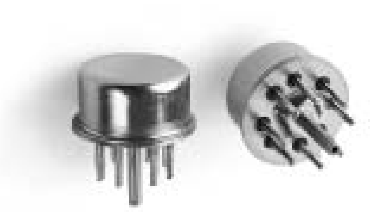
Limit data

Operating temperature	°C	-40		+130

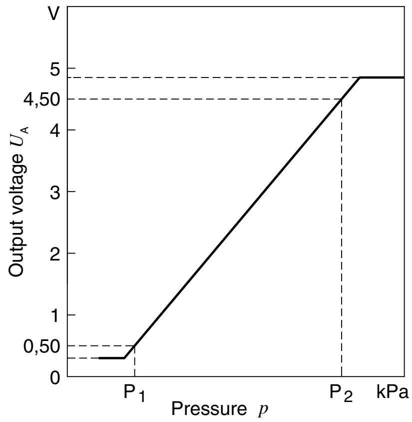
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

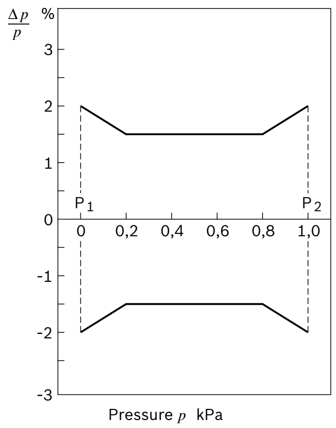
Illustration



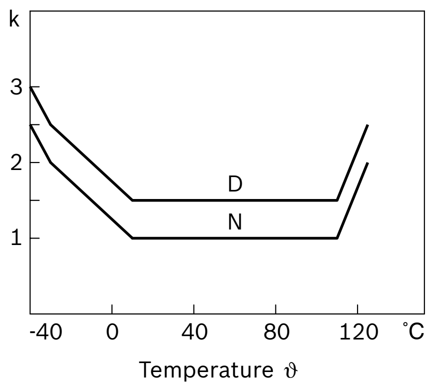
Characteristic curve



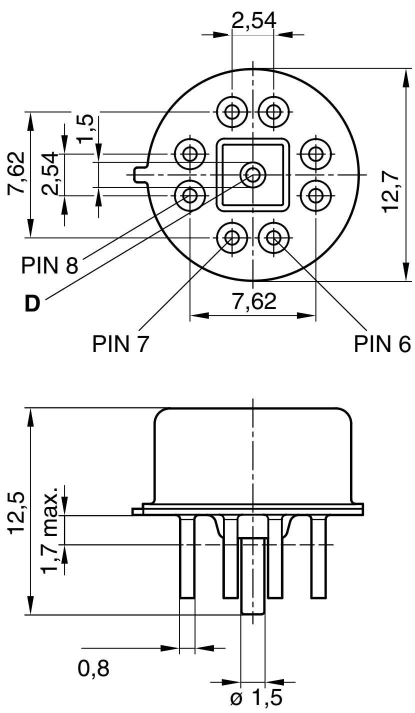
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



Sensor without housing

D	Pressure connection
Pin 6	Output signal
Pin 7	Soldered in

Part number 0 273 300 017

Technical data

Parameter		min	type	max
Pressure range ($p_1 ... p_2$)	kPa	15		380
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

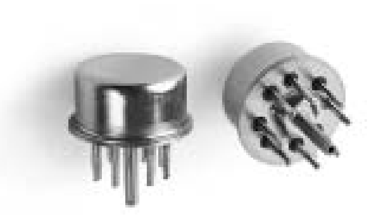
Limit data

Operating temperature	°C	-40		+130

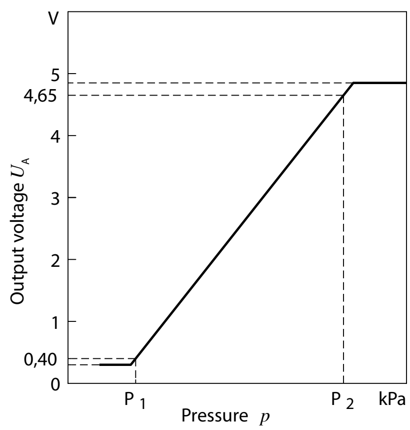
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

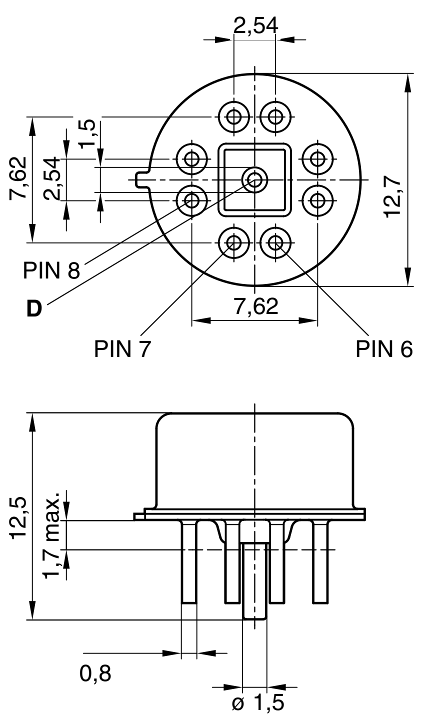
Illustration



Characteristic curve

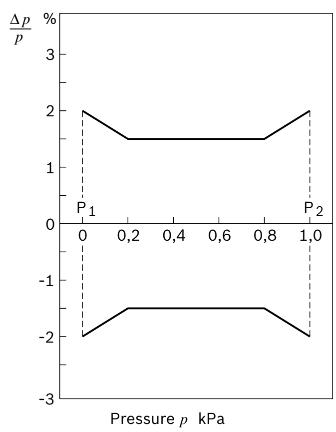


Dimension drawings

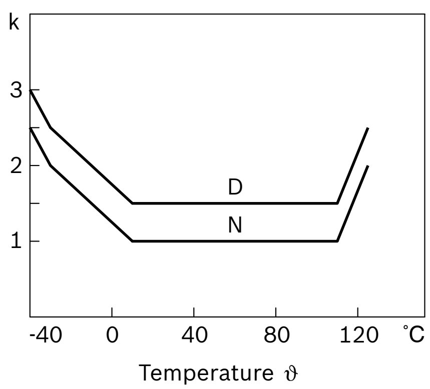


Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 261 230 036

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	15		380
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

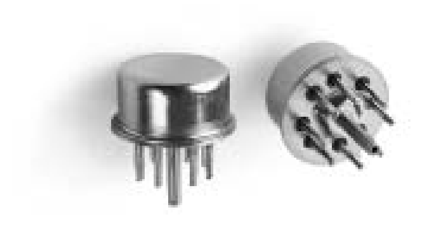
Limit data

Operating temperature	°C	-40		+130

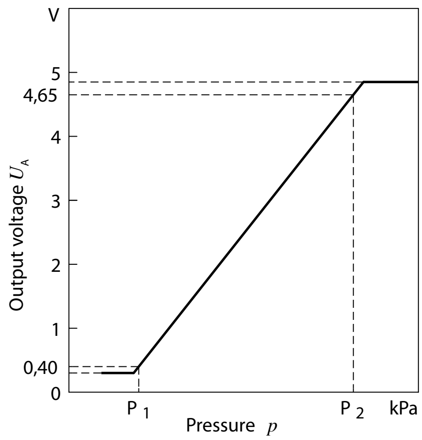
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

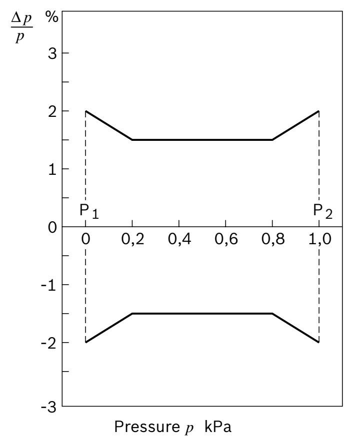
Illustration



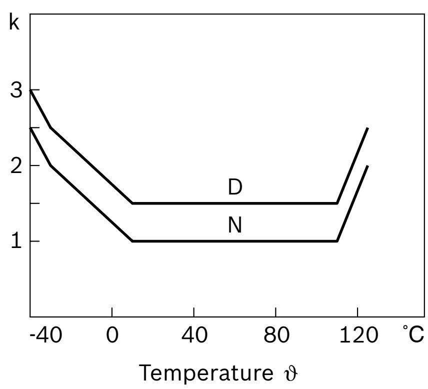
Characteristic curve



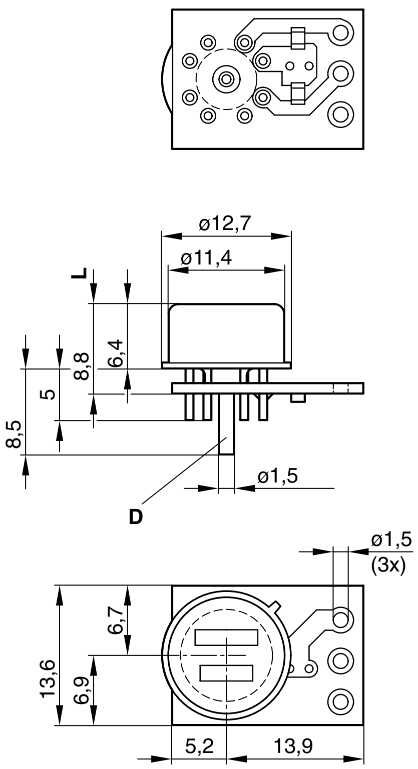
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



D Pressure connection
L in area of measurement surface

Part number 0 273 300 001

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	20		105
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

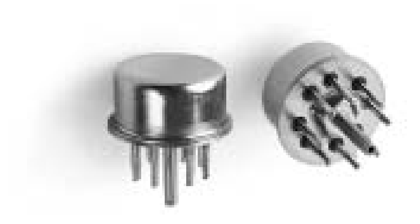
Limit data

Operating temperature	°C	-40		+130

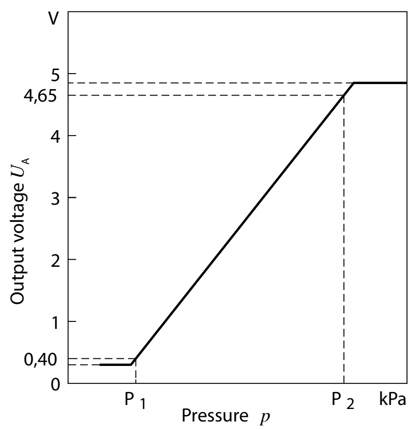
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

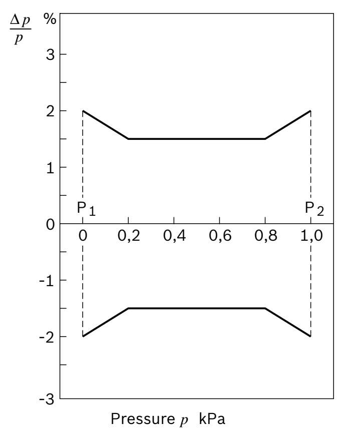
Illustration



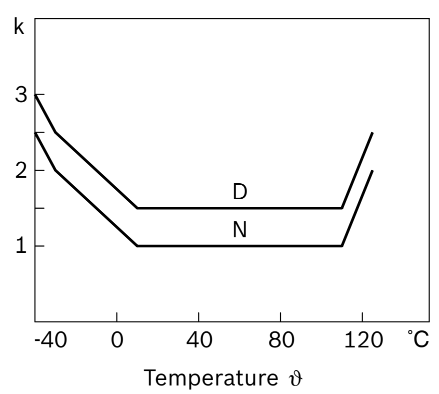
Characteristic curve



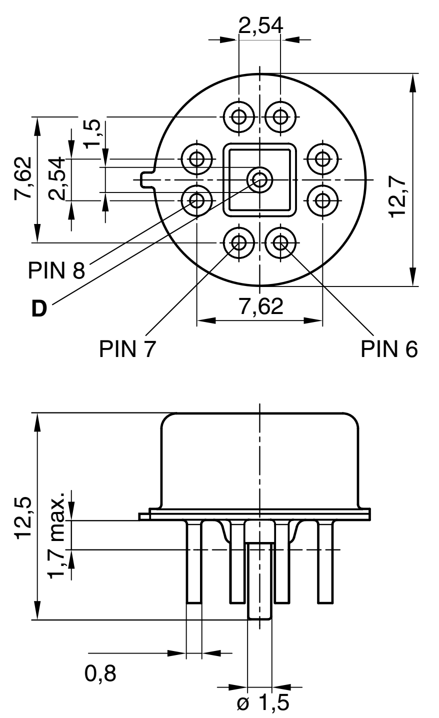
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

Part number 0 273 300 002

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	20		115
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

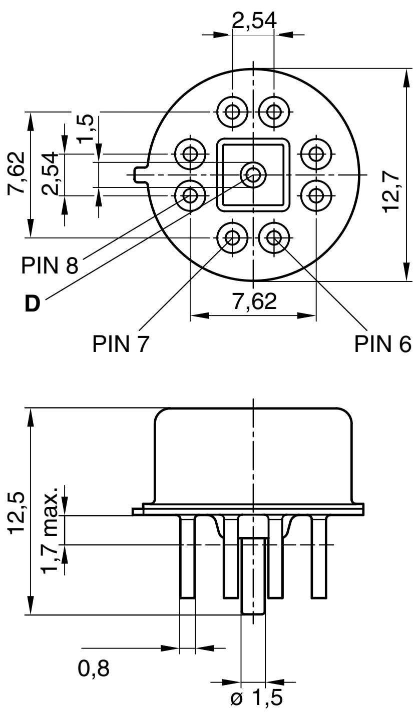
Limit data

Operating temperature	°C	-40		+130

Recommendation for signal evaluation

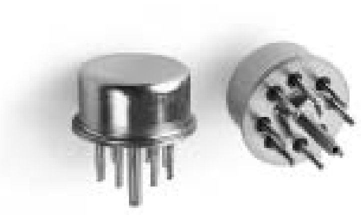
Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

Dimension drawings

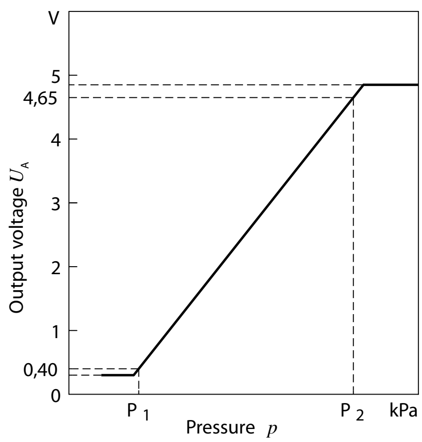


Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

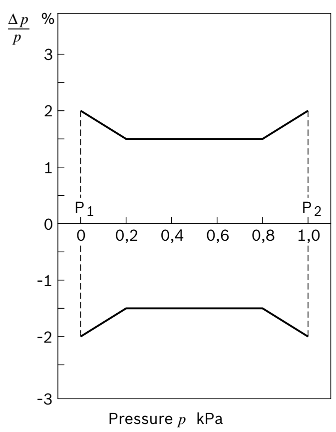
Illustration



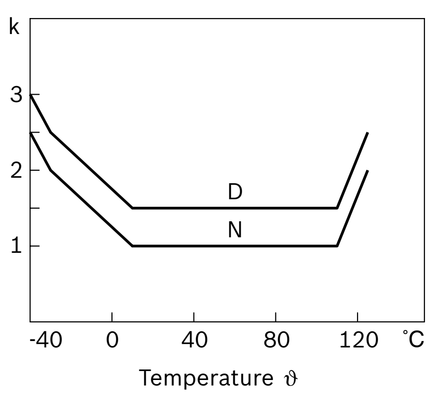
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 273 300 004

Technical data

Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	20		250
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

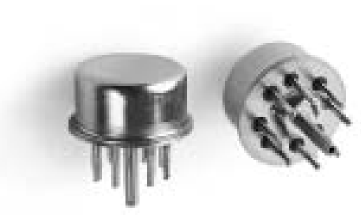
Limit data

Operating temperature	°C	-40		+130

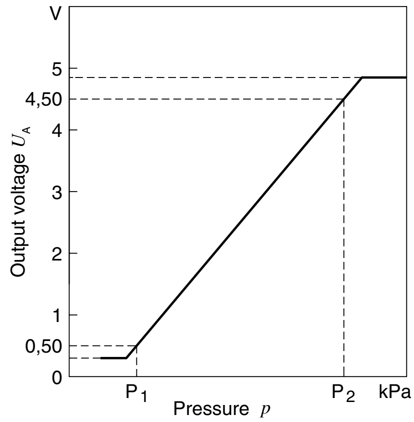
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

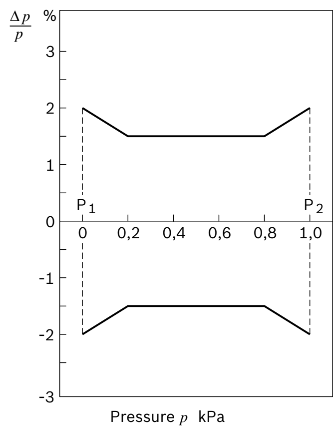
Illustration



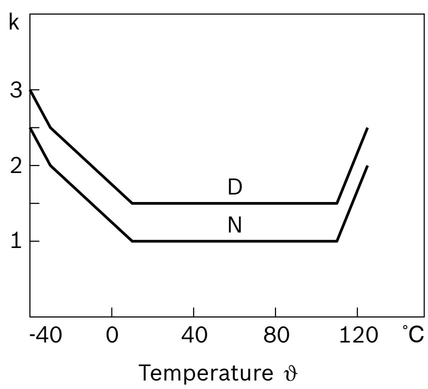
Characteristic curve



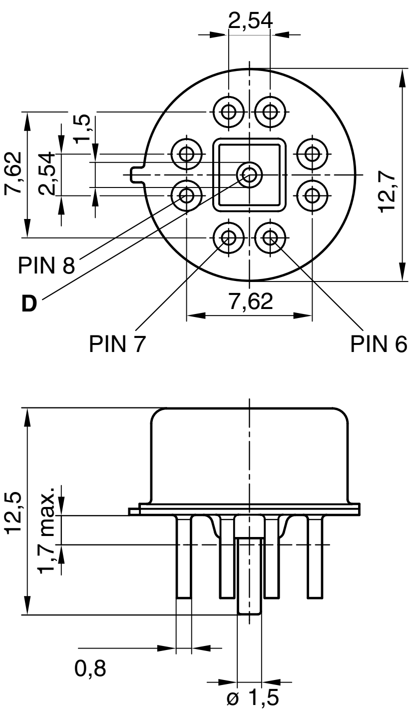
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

Part number 0 273 300 010

Technical data

Parameter		min	type	max
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	-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

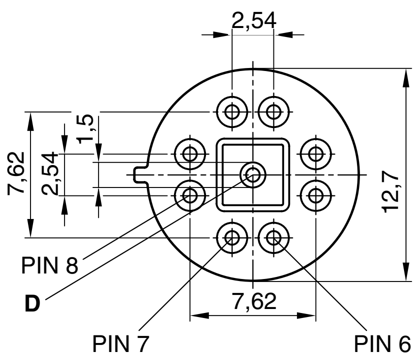
Limit data

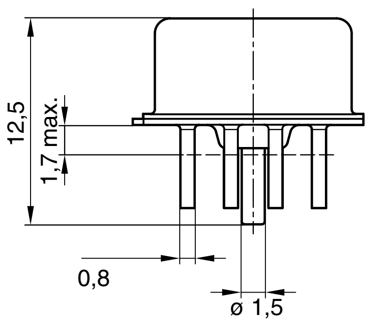
Operating temperature	°C	-40		+130

Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

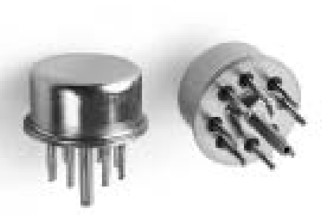
Dimension drawings



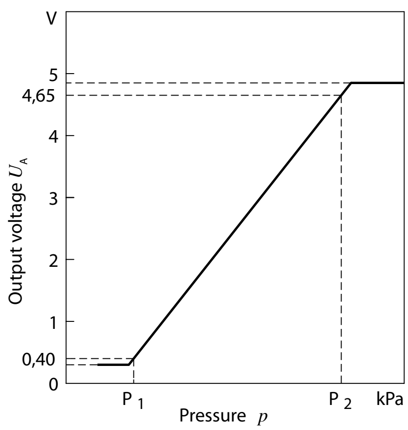


Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

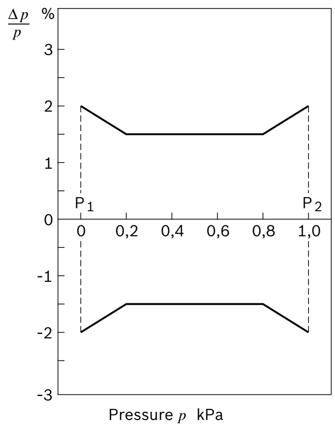
Illustration



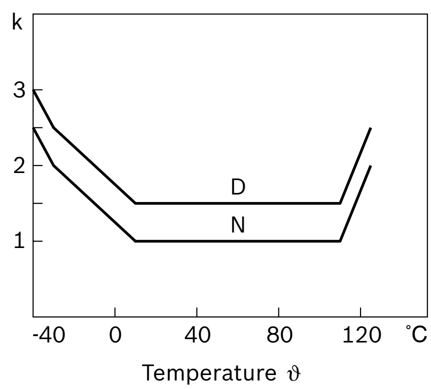
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 273 300 019

Technical data

Parameter		min	type	max
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

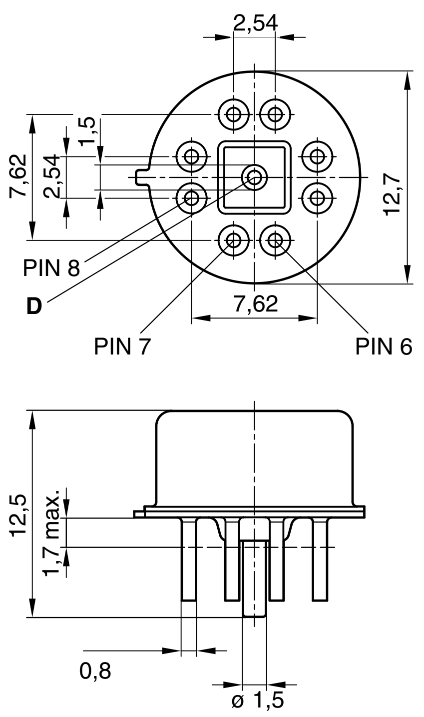
Limit data

Operating temperature	°C	-40		+130

Recommendation for signal evaluation

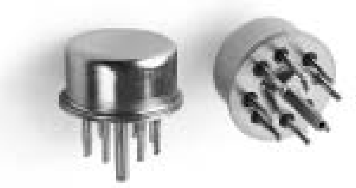
Load resistance to ground	kΩ		100
Low-pass resistance	kΩ		21,5
Low-pass capacitance	nF		100

Dimension drawings

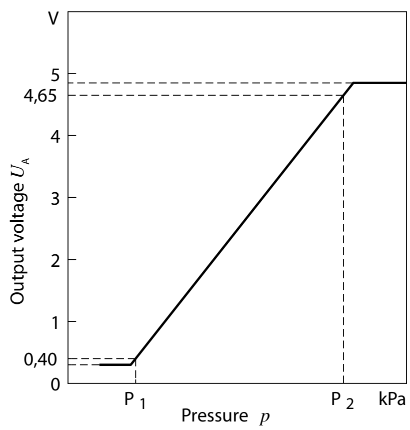


Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

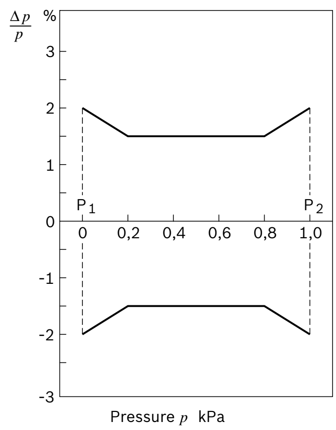
Illustration



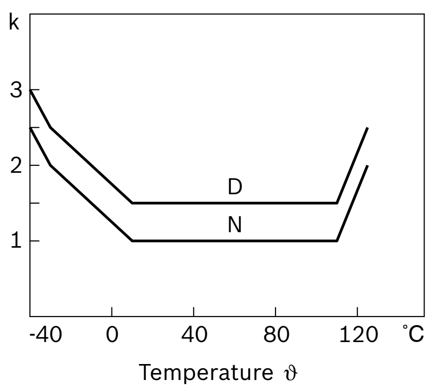
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 261 230 033

Technical data

Parameter		min	type	max
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

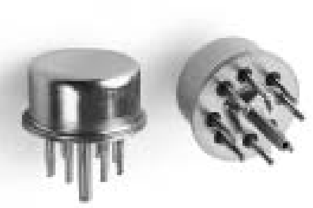
Limit data

Operating temperature	°C	-40		+130

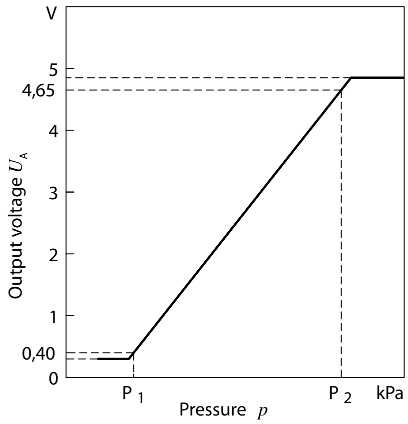
Recommendation for signal evaluation

Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

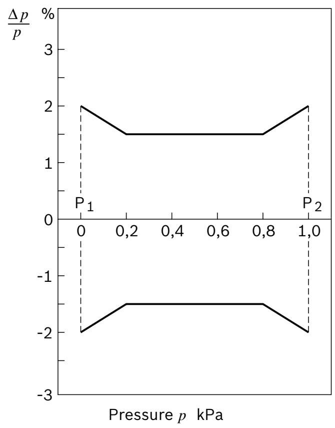
Illustration



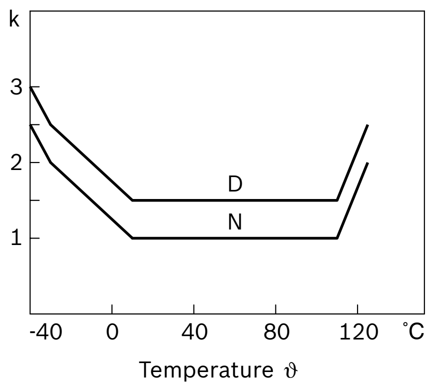
Characteristic curve



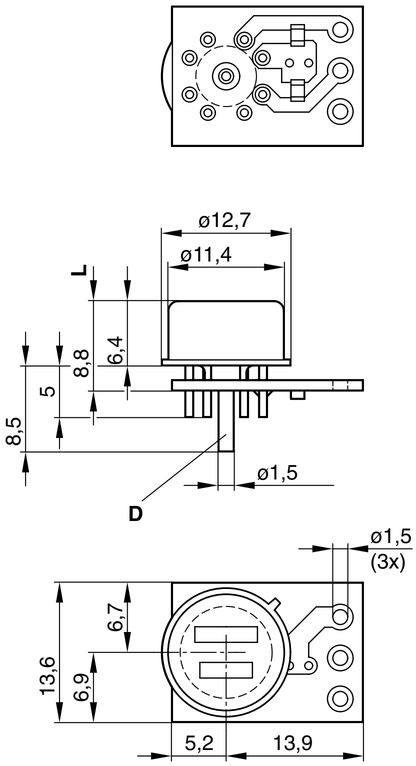
Characteristic-curve tolerance



Tolerance-extension factor



Dimension drawings



D Pressure connection
L in area of measurement surface

Part number 0 273 300 012

Technical data

Parameter		min	type	max
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

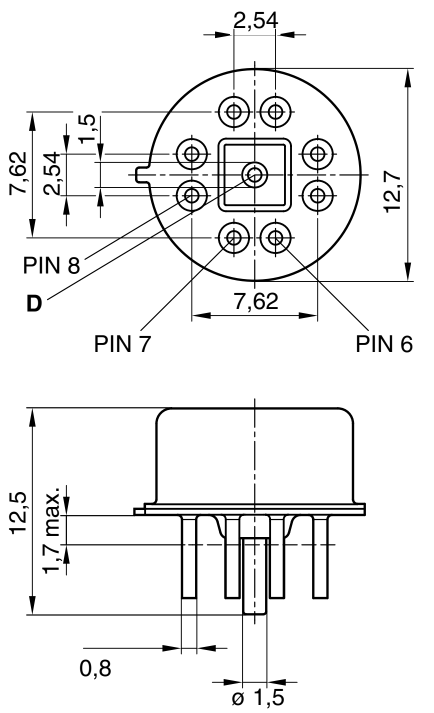
Limit data

Operating temperature	°C	-40		+130

Recommendation for signal evaluation

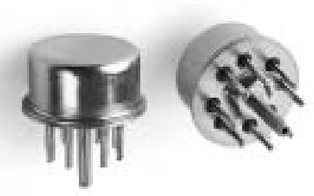
Load resistance to ground	kΩ		100	
Low-pass resistance	kΩ		21,5	
Low-pass capacitance	nF		100	

Dimension drawings

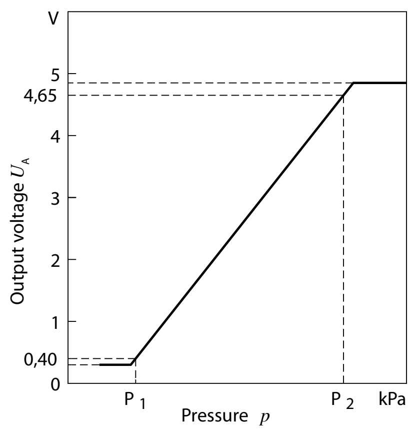


Sensor without housing
D Pressure connection
Pin 6 Output signal
Pin 7 Soldered in

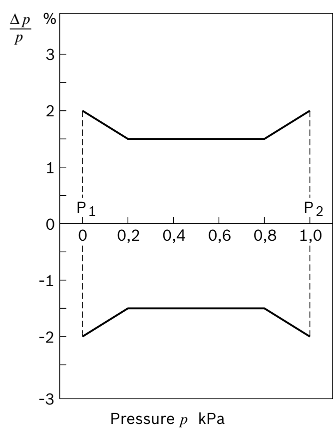
Illustration



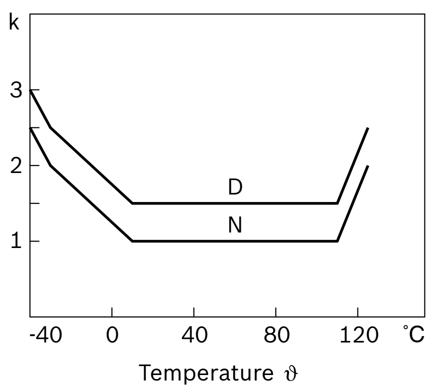
Characteristic curve



Characteristic-curve tolerance



Tolerance-extension factor



Part number 0 261 230 112

Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
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

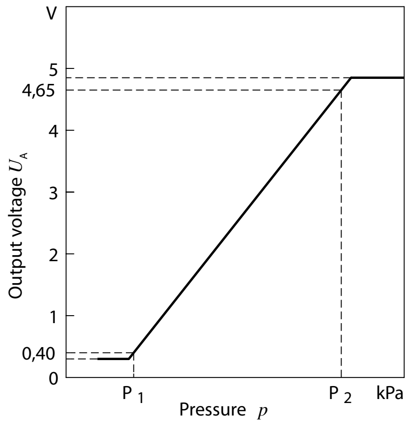
Temperature sensor

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

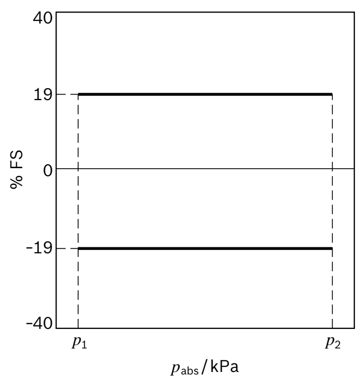
[1]) Operation with 1 kΩ series resistance.
[2]) In air with flow velocity 6 m/s.

Illustration

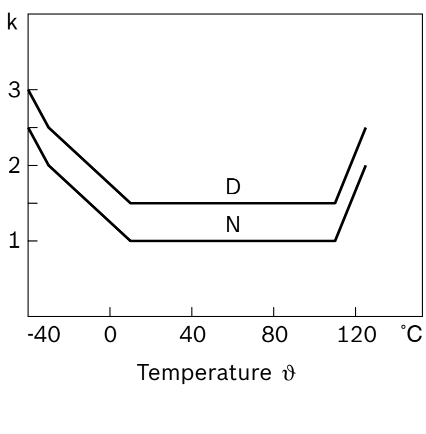
Characteristic curve



Characteristic-curve tolerance

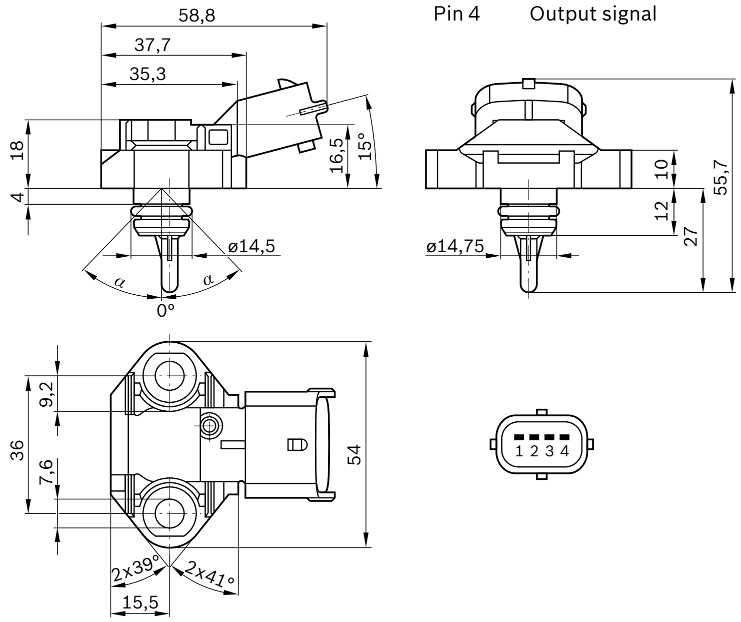


Tolerance-extension factor



Dimension drawings

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



Accessories

Accessories		Part number
Connector housing	4-pin	1 928 403 736
Contact pins	for Ø 0.5...1.0 mm^2; Contents: 100 x	1 928 498 056
Contact pins	for Ø 1.5...2.5 mm^2; Contents: 100 x	1 928 498 057
Single-wire seal	for Ø 0.5...1.0 mm^2; Contents: 10 x	1 928 300 599
Single-wire seal	for Ø 1.5...2.5 mm^2; 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 are therefore to be ordered separately as required.

Part number 0 261 230 110

Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
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		130

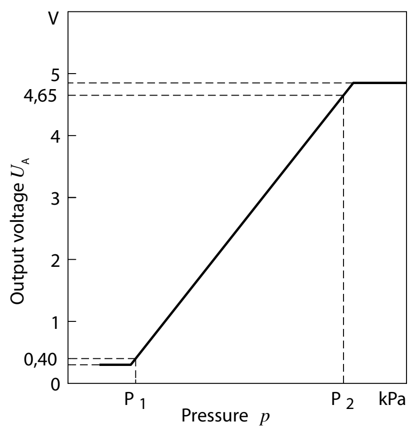
Temperature sensor

Measuring range	°C	-40		+130
Measurement current[1])	mA			1
Rated resistance at +20 °C	kΩ		2,5 ± 3,5 %	

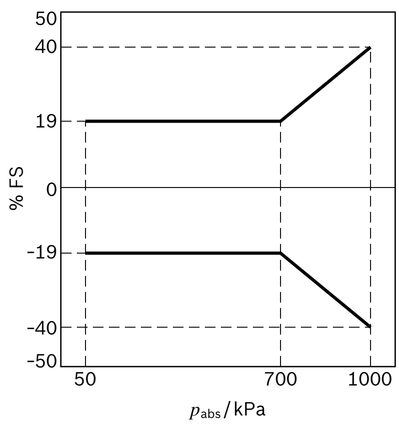
[1]) Operation with 1 kΩ series resistance.

Illustration

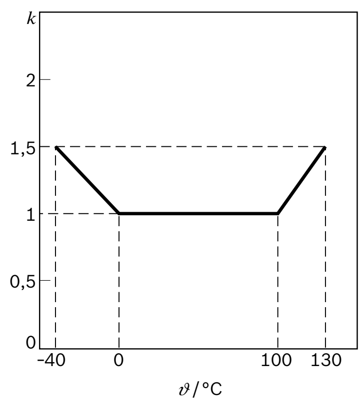
Characteristic curve



Characteristic-curve tolerance

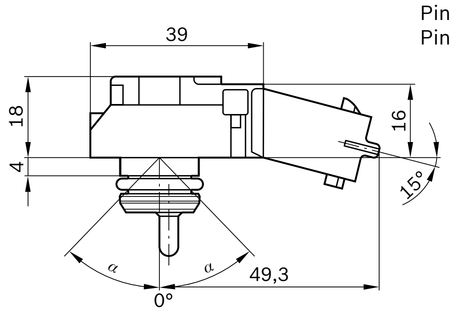


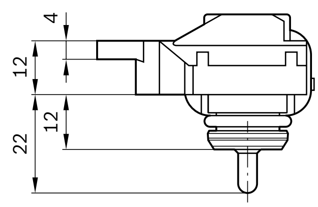
Tolerance-extension factor

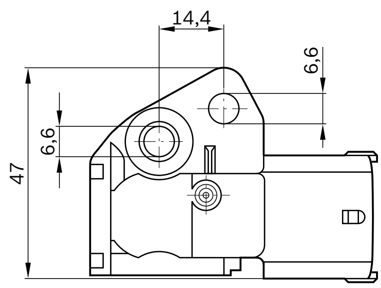


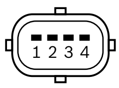
Dimension drawings

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









Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Part number 0 261 230 109

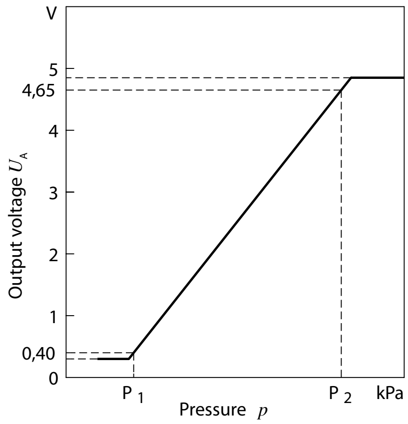
Technical data

Parameter		min	type	max
Features		Integrated temperature sensor		
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		+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 ± 3,5 %	

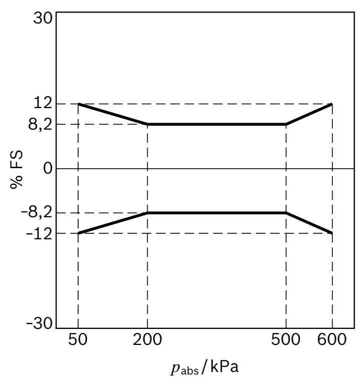
[1]) Operation with 1 kΩ series resistance.

Illustration

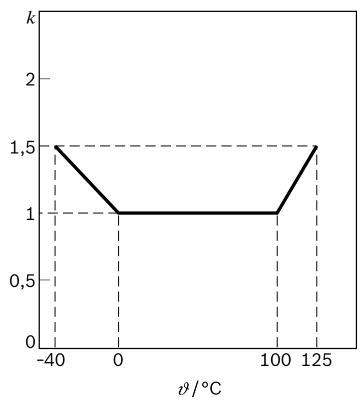
Characteristic curve



Characteristic-curve tolerance

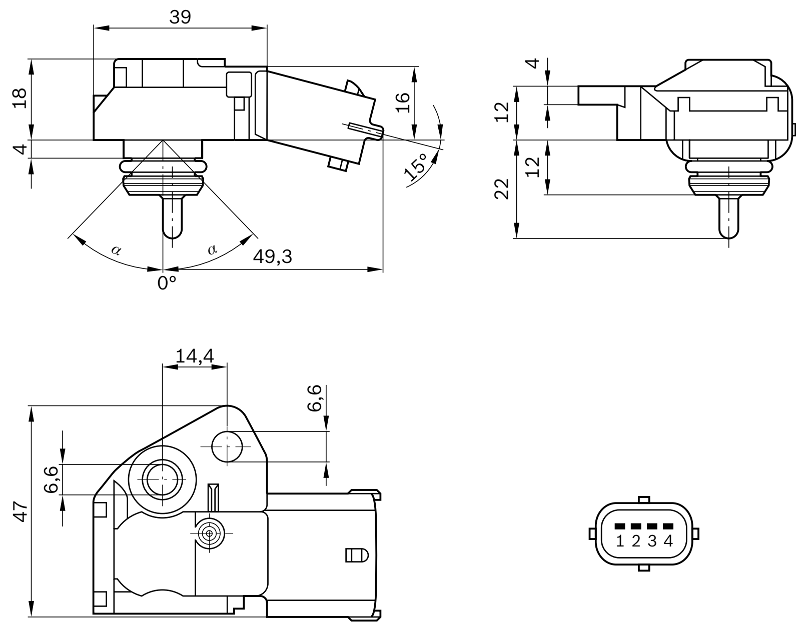


Tolerance-extension factor



Dimension drawings

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



Accessories

Accessories		Part number
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 are therefore to be ordered separately as required.

Part number 0 281 002 668

Technical data

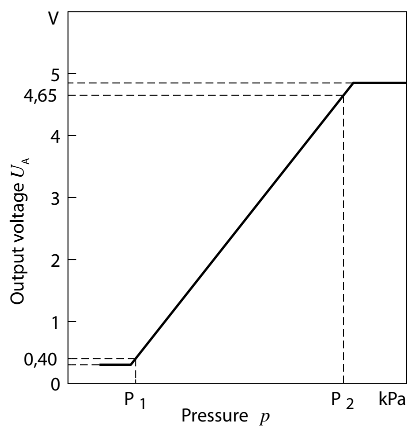
Parameter		min	type	max
Pressure range (p_1...p_2)	kPa	50		600
Supply voltage U_V	V	4,75	5	5,25
Load current I_L at output	mA	-1		0,5
Response time $\tau_{10/90}$	ms		1	
Operating temperature	°C	-40		+125

Limit data

Operating temperature	°C	-40		+125

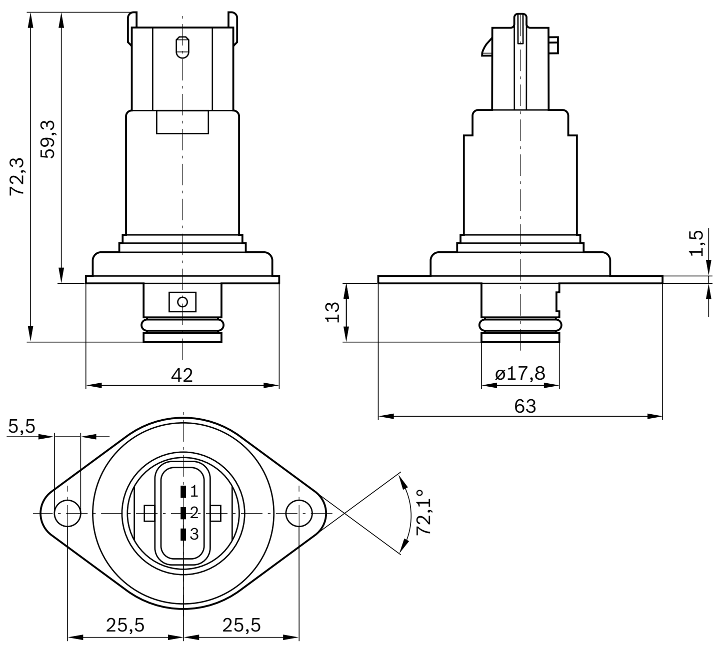
Illustration

Characteristic curve

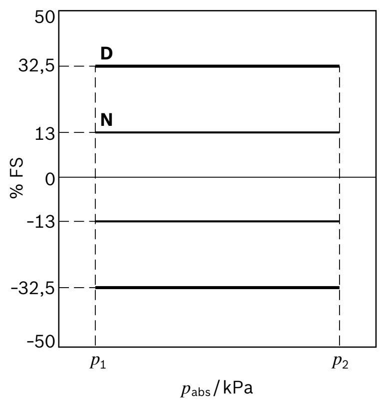


Dimension drawings

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

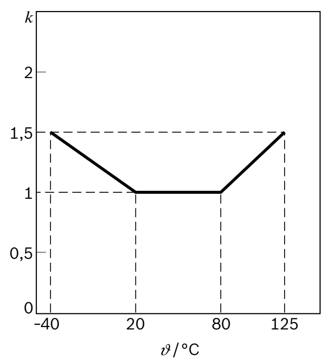


Characteristic-curve tolerance



D After endurance test
N As-new condition

Tolerance-extension factor



Accessories

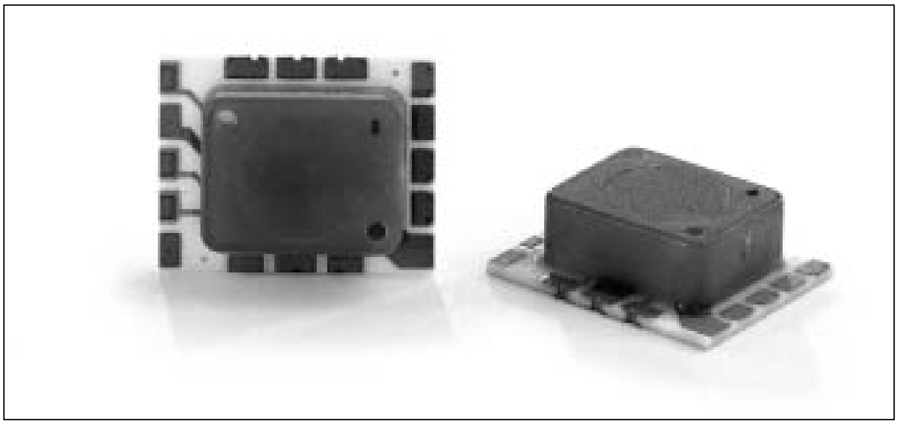
Accessories		Part number
Connector housing	3-pin	1 928 403 966
Contact pins	for Ø 0.5...1.0 mm²; Contents: 100 x	1 928 498 056
Contact pins	for Ø 1.5...2.5 mm²; Contents: 100 x	1 928 498 057
Single-wire seal	for Ø 0.5...1.0 mm²; Contents: 10 x	1 928 300 599
Single-wire seal	for Ø 1.5...2.5 mm²; Contents: 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 are therefore to be ordered separately as required.

Absolute-pressure sensor in atmosphere

For atmospheric-pressure measurement

- SMD assembly.
- Compact micromechanical design.
- With temperature compensation.
- Integrated signal amplification.



Design and operation

The sensor consists of a measuring element with temperature compensation for barometric absolute-pressure determination. With this monolithically integrated silicon pressure sensor, the sensor element and the corresponding evaluation circuit are combined with the calibration elements on a single silicon chip. For automatic SMD assembly, the silicon chip is bonded onto a hybrid substrate.

Explanation of characteristic quantities

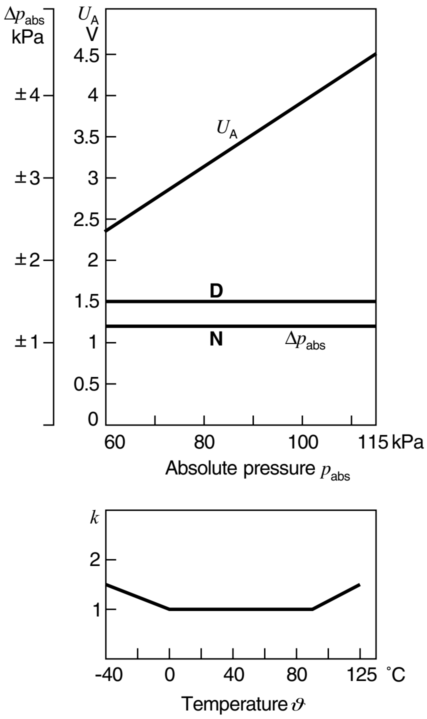
U_V	Supply voltage
U_A	Output voltage (signal voltage)
k	Temperature error multiplier
ϑ	Temperature
p_{abs}	Absolute pressure
D	After endurance test
N	Nominal status

Transmission function

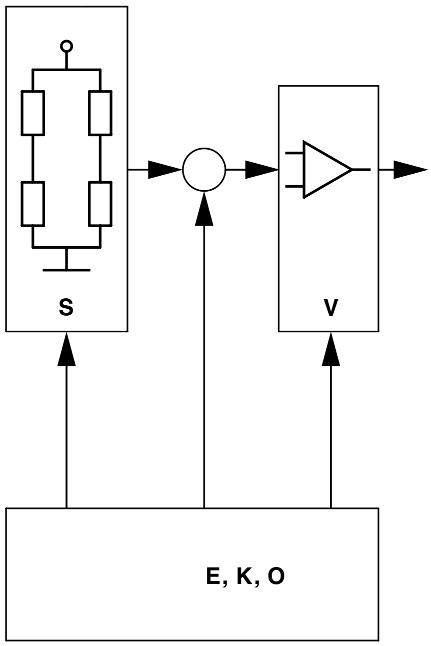
$U_A = (C_1 \cdot p_{abs} + C_0) \cdot U_V$

U_A	Output voltage (signal voltage)
p_{abs}	Absolute pressure
C_0	0
C_1	0,8 / 101,33 kPa^{-1}

Characteristic curve



Block diagram



E	Sensitivity
O	Offset
K	Compensation circuit
S	Sensor bridge
V	Amplifier

Technical data

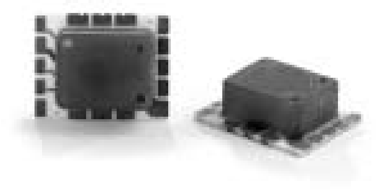
Parameter			min	type	max
Pressure measuring range	p_{abs}	kPa	60		115
Supply voltage	U_V	V	4,75	5,00	5,25
Current input at U_V = 5 V	I_V	mA	6,0	9,0	12,5
Load current at output	I_L	mA	-1,0		0,5
Voltage limitation at U_V = 5 V - lower limit	$U_{A\,min}$	V	0,25	0,3	0,35
Voltage limitation at U_V = 5 V - upper limit	$U_{A\,max}$	V	4,75	4,8	4,85
Response time	$\tau_{10/90}$	ms			1
Load capacitance	C_L	nF			12
Limit data					
Supply voltage, 1 min	$U_{V\,max}$	V			16
Pressure	p_{max}	kPa			160
Storage temperature		°C	-40		130

Part number 0 273 300 030

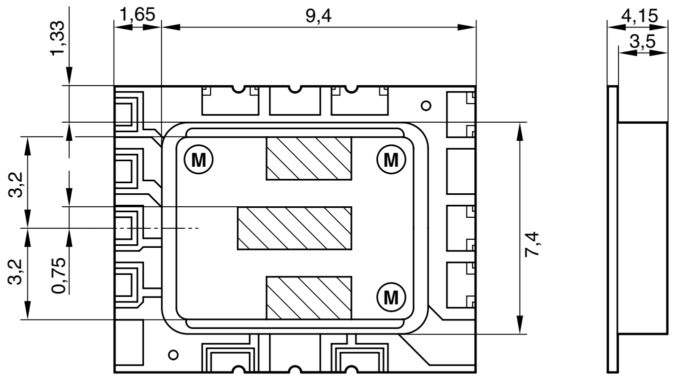
Technical data

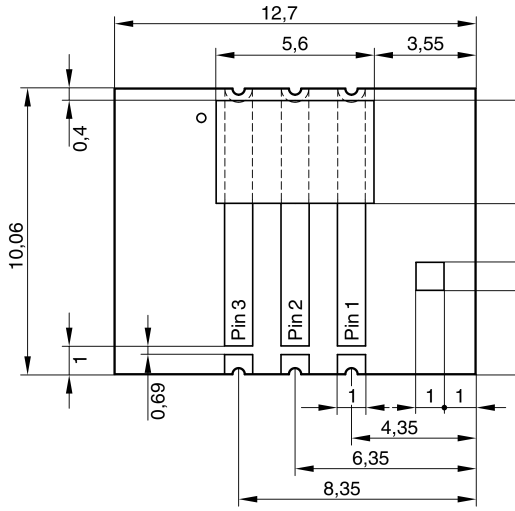
Operating temperature	ϑ_B	°C	-40		+125
Signal voltage	U_A	V	2,37		4,54
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5	680	
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10	100	

Illustration



Dimension drawings





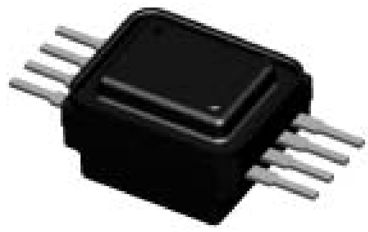
The following pins are required for operation:
Pin 1 OUT Output signal
Pin 2 GND Ground
Pin 3 U_V Supply voltage

Part number 0 273 300 041

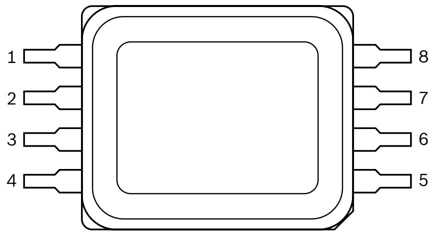
Technical data

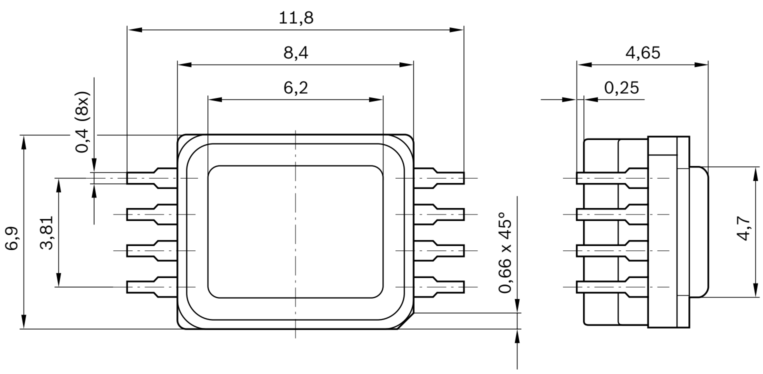
Operating temperature	ϑ_B	°C	-40	+130
Load resistance to U_V or ground	$R_{pull-up}$	kΩ	5	
Load resistance to U_V or ground	$R_{pull-down}$	kΩ	10	

Illustration



Dimension drawings





Pin 1 DNC/GND
Pin 2 NC/GND
Pin 3 NC/GND
Pin 4 DNC/GND
Pin 5 +5 V
Pin 6 Ground
Pin 7 Output signal
Pin 8 DNC/GND

High-pressure sensors

For pressures up to 14 MPa

- Ratiometric signal evaluation (referred to supply voltage)
- Self-monitoring of offset and sensitivity
- Protection against polarity reversal, over voltage, and short circuit of output to supply voltage or ground.
- High level of compatibility with media since this only comes into contact with stainless steel.
- Resistant to break fluids, mineral oils, water, and air.

Application

Pressure sensors of this type are used in motor vehicles to measure the pressure in a braking system or in the fuel rail of direct-injection gasoline engines or common-rail system 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 utilisation 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.

Only for 0 265 005 303
The following additional diagnosis function distinguishes this sensor from conventional sensors: The comparison of two signal paths in the sensor permits detection of
- Offset error
- Amplification error.

Storage conditions

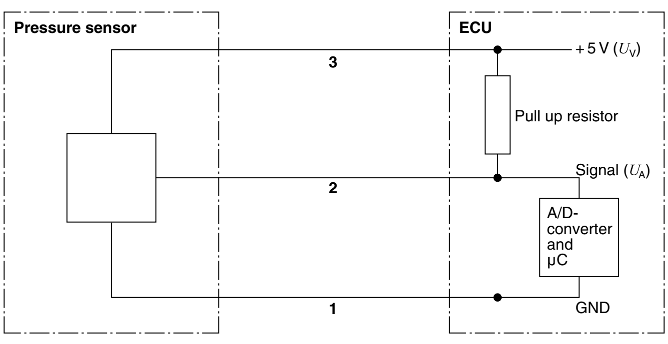
Temperature range	-30...+60 °C
Rel. humidity	0...80 % rH
Maximum storage time	5 years

There will be no changes to functions if stored under the specified conditions. The sensors are no longer to be used once the maximum storage time has expired.

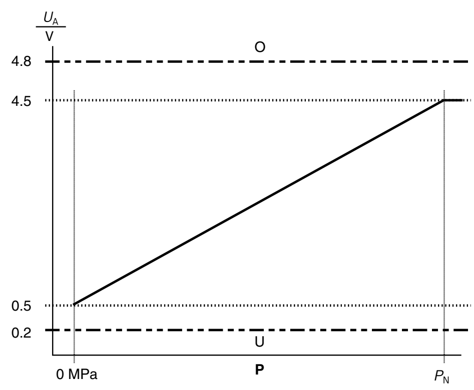
Explanation of characteristic quantities

U_A	Output voltage
U_V	Supply voltage
bar	Pressure
U_S	Input voltage
p	Pressure [MPa]
C_0	0.1
C_1	$0.8 \cdot p/P_N$
P_N	Nominal pressure [MPa]

Measurement circuit



Characteristic curve



$U_A = (C_1 + C_0) \cdot U_V$
O Upper range for signal range check SRC
U Lower range for signal range check SRC

Part number 0 261 545 006

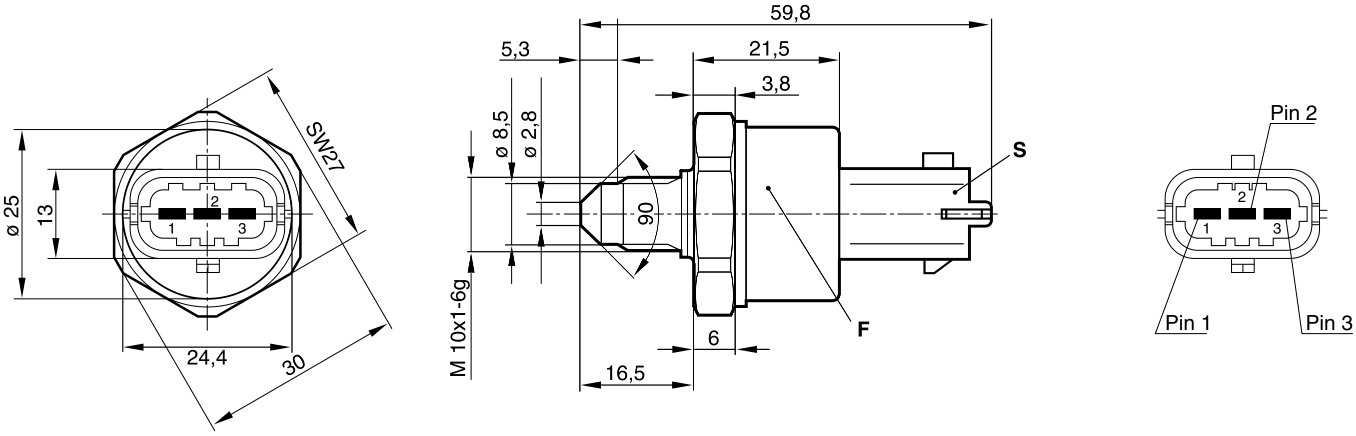
Technical data

Pressure range P_N		140 (14)
Pressure-sensor type		KV2 BDE
Thread		M 10 x 1
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Unleaded fuel
Accuracy of offset U_V		0,7 % FS
Accuracy of sensitivity at 5 V - in range 35...140 bar	FS[2]) of measured value	1,5 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Load capacitance to ground		13
Temperature range		- 40 ...+ 130
Max. overpressure p_{max}		180
Rupture pressure I_A		> 300
Tightening torque M_a		22 ± 2
Response time $\tau_{10/90}$		2

[1]) FS = Full Scale.

Illustration

Dimension drawings



Space required for connector, approx. 25 mm
Space required for connection, approx. 50 mm

SW	Width across flats
Pin 1	GND ground
Pin 2	Output voltage
Pin 3	Supply voltage

Accessories

Accessories		Part number
Connector housing	3-pin	1 928 403 966
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

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

For pressures up 25 MPa

Part number 0 265 005 303

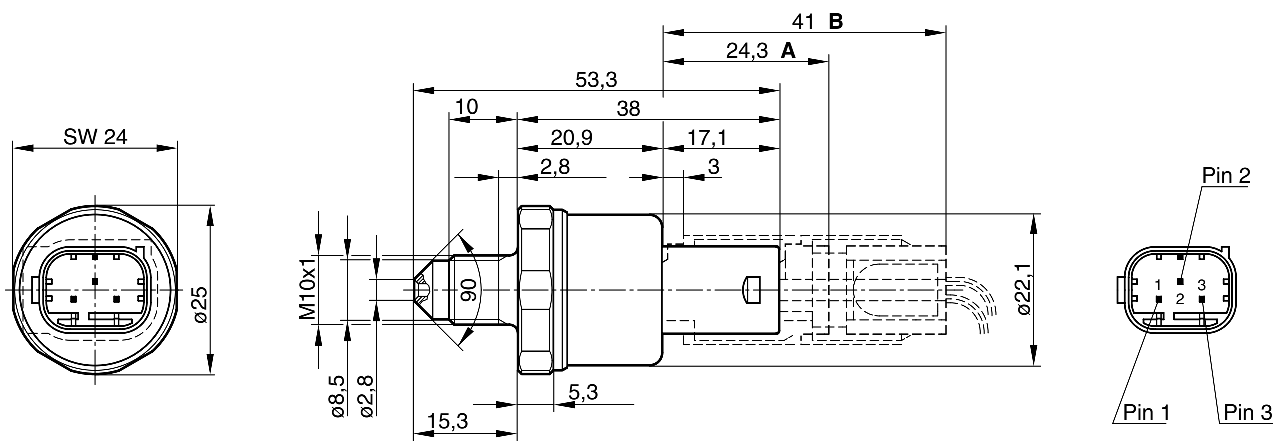
Technical data

Pressure range P_N		250 (25)
Thread		M 10 x 1
Connector		PSA
Application/medium		Brake fluid
Accuracy of offset U_V		2,0 %
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	≤ 0,7 %
Accuracy of sensitivity at 5 V - in range 35...250 bar	FS[1]) of measured value	≤ 5,0 %[3])
Supply voltage U_V		5 ± 0,25
Supply current I_V		≤ 20
Output current I_A		-100...3
Temperature range		- 40 ...+ 120
Max. overpressure p_{max}		350
Rupture pressure I_A		> 500
Tightening torque M_a		20 ± 2

[1]) FS = Full Scale.
[3]) of measured value.

Illustration

Dimension drawings



A Space required for connector, approx. 25 mm
B Space required for connector, approx. 50 mm
SW Width across flats

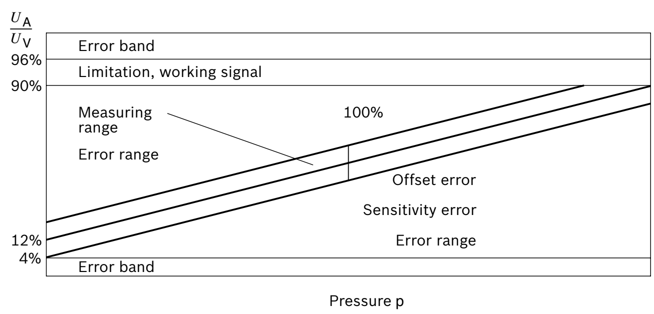
Pin 1 GND ground
Pin 2 Output voltage U_A
Pin 3 Supply voltage U_V

Accessories

Accessories		Part number
Connector housing	Tyco number	2-967 642-1[1])
Contact pins	Tyco number	965 907-1[1])
Individual seal	Tyco number	967 067-1[1])

Accessories are not included in the scope of delivery and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

Self-monitoring



Offset and sensitivity.

For pressures up 150 MPa

Part number 0 281 002 238

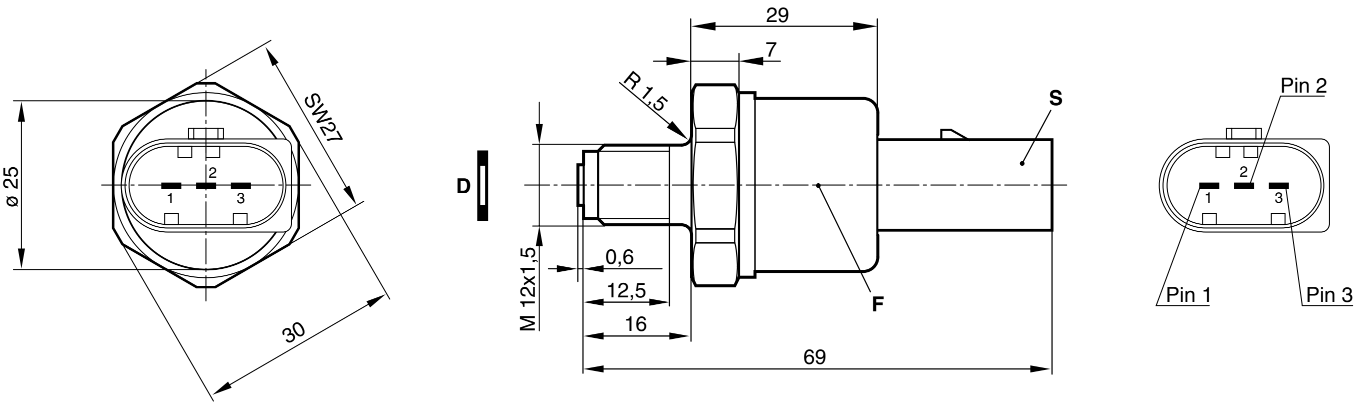
Technical data

Pressure range P_N		1500 (150)
Pressure-sensor type		RDS2
Thread		M 12 x 1,5
Connector		Make circuit
Pin		Silver-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		1,0 % FS
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	1,0 %
Accuracy of sensitivity at 5 V - in range 35...1500 bar	FS[1]) of measured value	2,0 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Output current I_A		2,5 mA[4])
Load capacitance to ground		10
Temperature range		- 40 ...+ 120[5])
Max. overpressure p_{max}		1800
Rupture pressure I_A		3000
Tightening torque M_a		35 ± 5
Response time $\tau_{10/90}$		5

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

Illustration

Dimension drawings



D	Sealing washer
F	Date of manufacture
SW	Width across flats
S	3-pin connector

Pin 1	GND ground
Pin 2	Output voltage U_A
Pin 3	Supply voltage U_V

Accessories

		Part number
Connector housing	Kostal number	9 441 391[1])
Contact pins	Kostal number	22 124 492 060[1])
Single-wire seal	Kostal number	10 800 444 522[1])

[1]) Available from Kostal Deutschland.

Part number 0 281 002 405

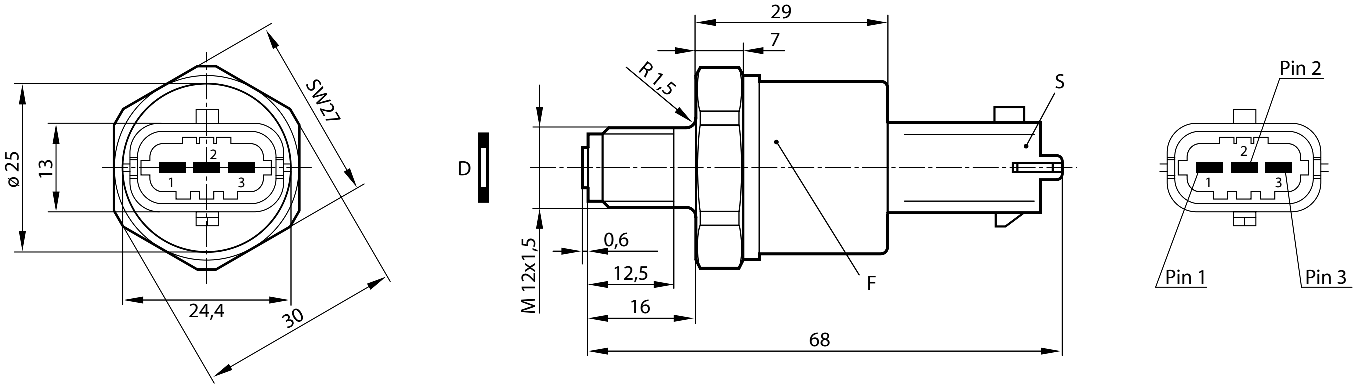
Technical data

Pressure range P_N		1500 (150)
Pressure-sensor type		RDS2
Thread		M 12 x 1,5
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Diesel fuel or biodiesel²)
Accuracy of offset U_V		1,5 % FS
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS¹) of measured value	1,5 %
Accuracy of sensitivity at 5 V - in range 35...1500 bar	FS¹) of measured value	2,5 %
Max. input voltage U_s		16
Supply current I_V		9...15
Output current I_A		2,5 mA⁴)
Load capacitance to ground		10
Temperature range		- 40 ...+ 120⁵)
Max. overpressure p_{max}		1800
Rupture pressure I_A		3000
Tightening torque M_a		35 ± 5
Response time $\tau_{10/90}$		5

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

Illustration

Dimension drawings



D Sealing washer
F Date of manufacture
S 3-pin connector
SW Width across flats

Pin 1 GND Ground
Pin 2 Output voltage U_A
Pin 3 Supply voltage U_V

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 498

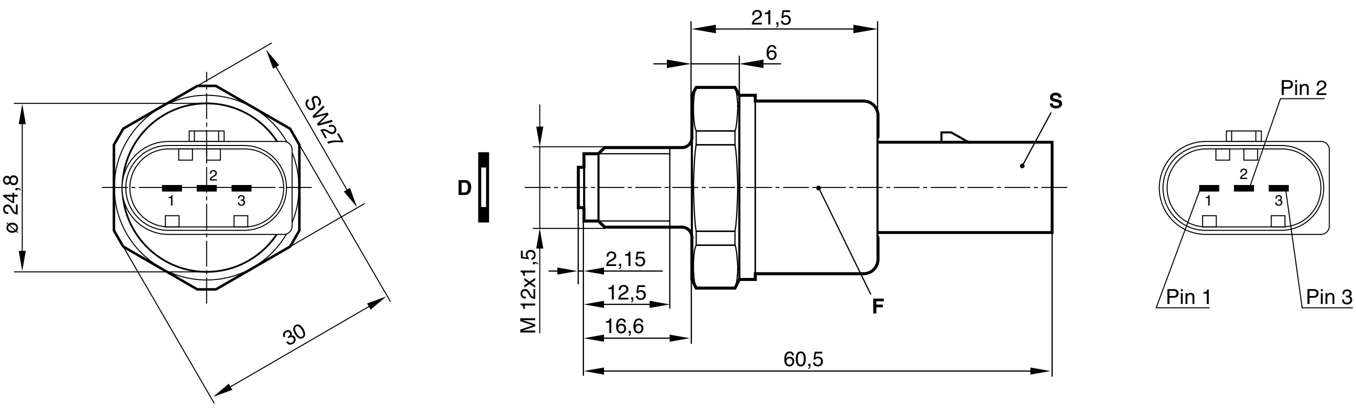
Technical data

Pressure range P_N		1500 (150)
Pressure-sensor type		RDS3
Thread		M 12 x 1,5
Connector		Make circuit
Pin		Silver-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		0,7 % FS
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	0,7 %
Accuracy of sensitivity at 5 V - in range 35...1500 bar	FS[1]) of measured value	1,5 %
Accuracy of sensitivity at 5 V - in range 35...1800 bar	FS[1]) of measured value	2,3
Max. input voltage U_s		16
Supply current K		9...15
Supply voltage u		5 ± 0,25
Load capacitance to ground		13
Temperature range		- 40 ...+ 120
Max. overpressure p_{max}		2200
Rupture pressure I_A		4000
Tightening torque M_a		35 ± 5
Response time $\tau_{10/90}$		2

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



D	Sealing washer
F	Date of manufacture
SW	Width across flats
S	3-pin connector

Pin 1	GND ground
Pin 2	Output voltage U_A
Pin 3	Supply voltage U_V

Accessories

Accessories		Part number
Connector housing	Kostal number	9 441 391[1])
Contact pins	Kostal number	22 124 492 060[1])
Single-wire seal	Kostal number	10 800 444 522[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Kostal Deutschland

Part number 0 281 002 522

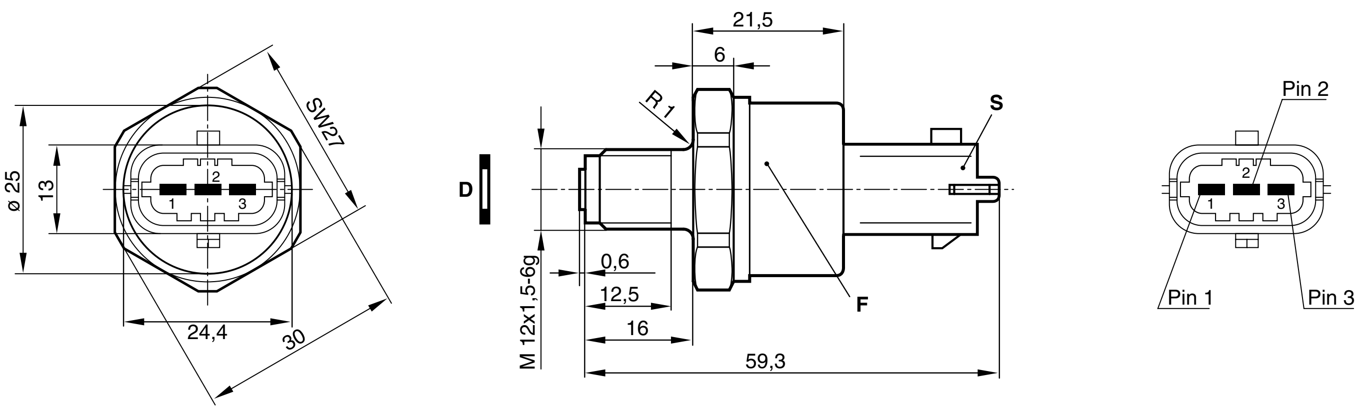
Technical data

Pressure range P_N		1500 (150)
Pressure-sensor type		RDS3
Thread		M 12 x 1,5
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		0,7 % FS
Accuracy of sensitivity at 5 V - in range 35...1500 bar	FS[1]) of measured value	1,5 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Load capacitance to ground		13
Temperature range		- 40 ...+ 130
Max. overpressure p_{max}		2200
Rupture pressure I_A		4000
Tightening torque M_a		35 ± 5
Response time $\tau_{10/90}$		2

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



D	Sealing washer
F	Date of manufacture
SW	Width across flats
S	3-pin connector

Pin 1	GND ground
Pin 2	Output voltage U_A
Pin 3	Supply voltage U_V

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 788

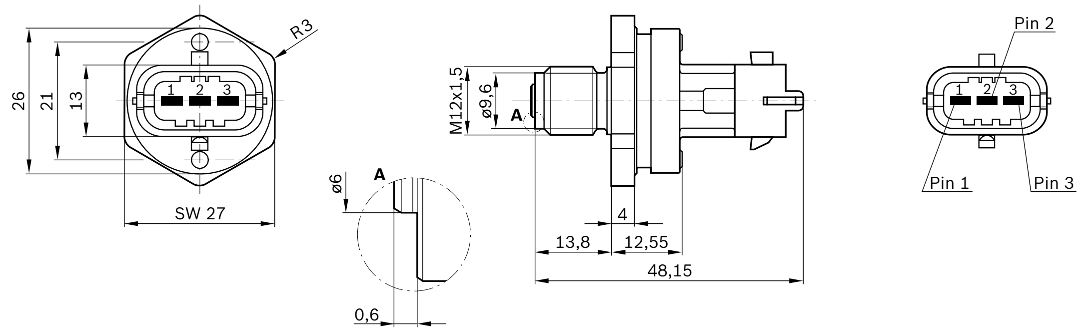
Technical data

Pressure range P_N	1500 (150)
Pressure-sensor type	RDS4.1
Thread	M 12 x 1,5
Connector	Compact 1.1
Pin	Gold-plated
Application/medium	Diesel fuel and biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	2300
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



SW Width across flats
Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 734

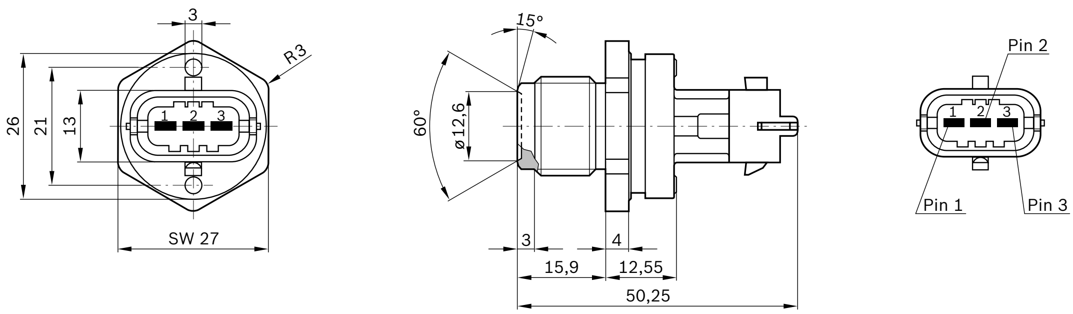
Technical data

Pressure range P_N	1500 (150)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Connector	Compact 1.1
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

For pressures up 180 MPa

Part number 0 281 002 398

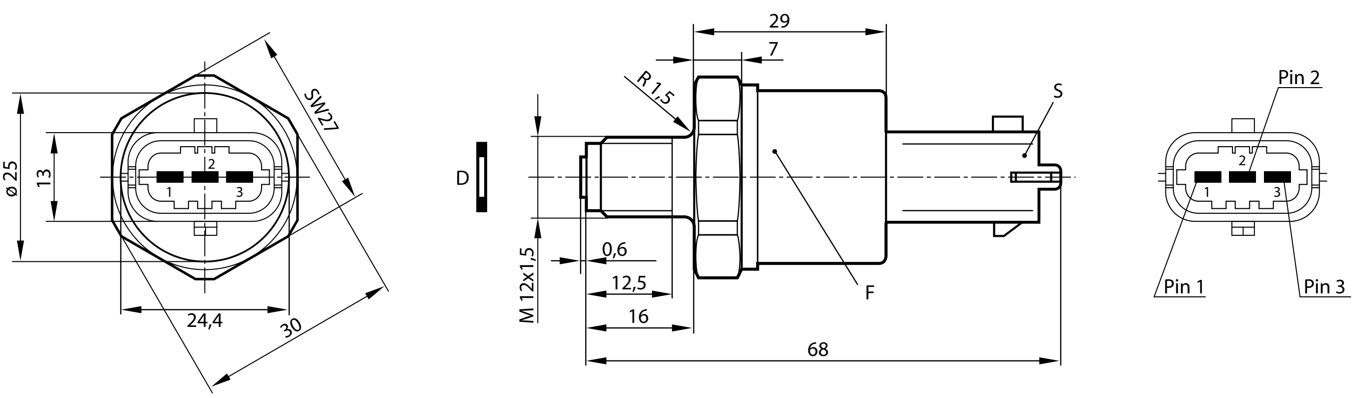
Technical data

Pressure range P_N		1800 (180)
Pressure-sensor type		RDS2
Thread		M 12 x 1,5
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		1,0 % FS
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	1,0 %
Accuracy of sensitivity at 5 V - in range 35...1800 bar	FS[1]) of measured value	2,3 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Output current I_A		2,5[4])
Load capacitance to ground		10
Temperature range		- 40 ...+ 120
Max. overpressure p_{max}		2100
Rupture pressure I_A		3500
Tightening torque M_a		70 ± 2
Response time $\tau_{10/90}$		5

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



D Sealing washer
F Date of manufacture
S 3-pin connector
SW Width across flats

Pin 1 GND Ground
Pin 2 Output voltage U_A
Pin 3 Supply voltage U_V

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 472

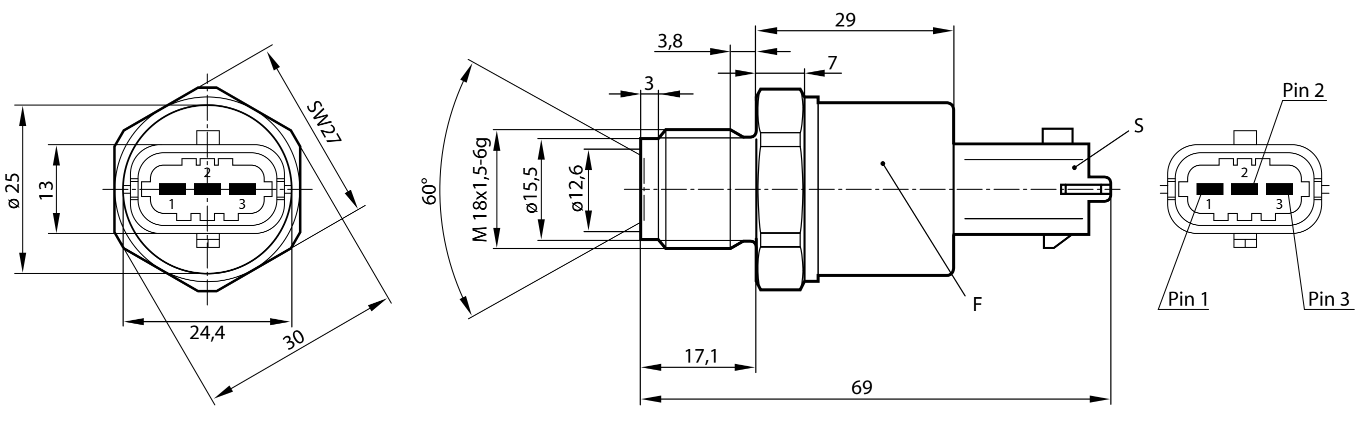
Technical data

Pressure range P_N		1800 (180)
Pressure-sensor type		RDS2
Thread		M 18 x 1,5
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	1% FS
Accuracy of sensitivity at 5 V - in range 35...1800 bar	FS[1]) of measured value	2,3 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Output current I_A		2,5[4])
Load capacitance to ground		10
Temperature range		- 40 ...+ 120
Max. overpressure p_{max}		2100
Rupture pressure I_A		3500
Tightening torque M_a		70 ± 2
Response time $\tau_{10/90}$		5

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.
[4]) Output current with pull-up resistor.

Illustration

Dimension drawings



F Date of manufacture
SW Width across flats
S 3-pin connector

Pin 1 GND ground
Pin 2 Output voltage U_A
Pin 3 Supply voltage U_V

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 534

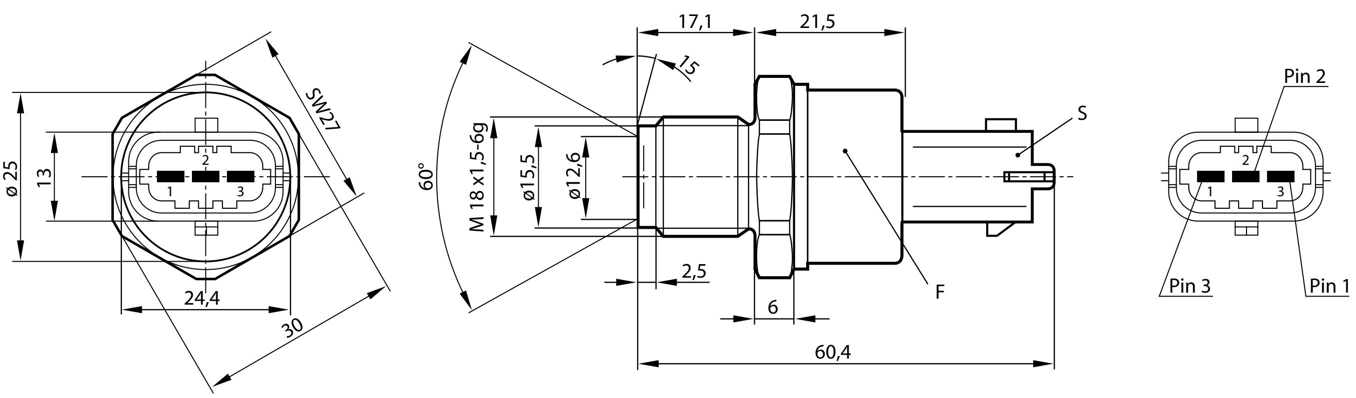
Technical data

Pressure range P_N		1800 (180)
Pressure-sensor type		RDS3
Thread		M 18 x 1,5
Connector		Compact 1.1
Pin		Gold-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		0,7 % FS
Accuracy of sensitivity at 5 V - in range 0...35 bar	FS[1]) of measured value	0,7 %
Accuracy of sensitivity at 5 V - in range 35...1800 bar	FS[1]) of measured value	1,5 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Load capacitance to ground		13
Temperature range		- 40 ...+ 130
Max. overpressure p_{max}		2200
Rupture pressure I_A		4000
Tightening torque M_a		70 ± 2
Response time $\tau_{10/90}$		2

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



F	Date of manufacture
SW	Width across flats
S	3-pin connector

Pin 1	GND ground
Pin 2	Output voltage U_A
Pin 3	Supply voltage U_V

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 504

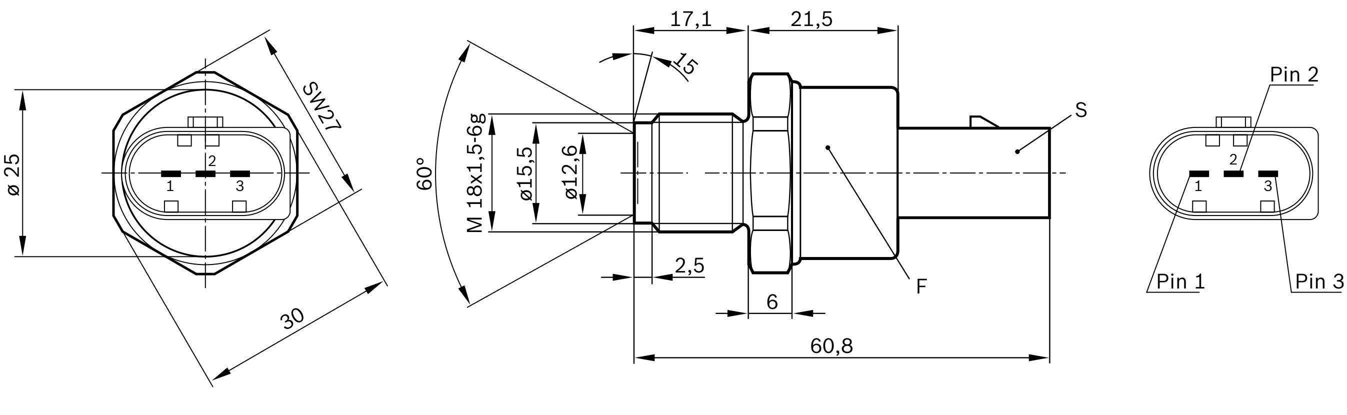
Technical data

Pressure range P_N		1800 (180)
Pressure-sensor type		RDS3
Thread		M 18 x 1,5
Connector		Make circuit
Pin		Silver-plated
Application/medium		Diesel fuel or biodiesel[2])
Accuracy of offset U_V		0,7 % FS
Accuracy of sensitivity at 5 V - in range 35...1800 bar	FS[1]) of measured value	1,5 %
Max. input voltage U_s		16
Supply voltage U_V		5 ± 0,25
Supply current I_V		9...15
Load capacitance to ground		13
Temperature range		- 40 ...+ 130
Max. overpressure p_{max}		2200
Rupture pressure I_A		4000
Tightening torque M_a		70 ± 2
Response time $\tau_{10/90}$		2

[1]) FS = Full Scale.
[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



F Date of manufacture
SW Width across flats
S 3-pin connector

Pin 1 GND ground
Pin 2 Output voltage U_A
Pin 3 Supply voltage U_V

Accessories		Part number
Connector housing	Kostal number	9 441 391[1])
Contact pins	Kostal number	22 124 492 060[1])
Single-wire seal	Kostal number	10 800 444 522[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Kostal Deutschland.

Part number 0 281 002 767

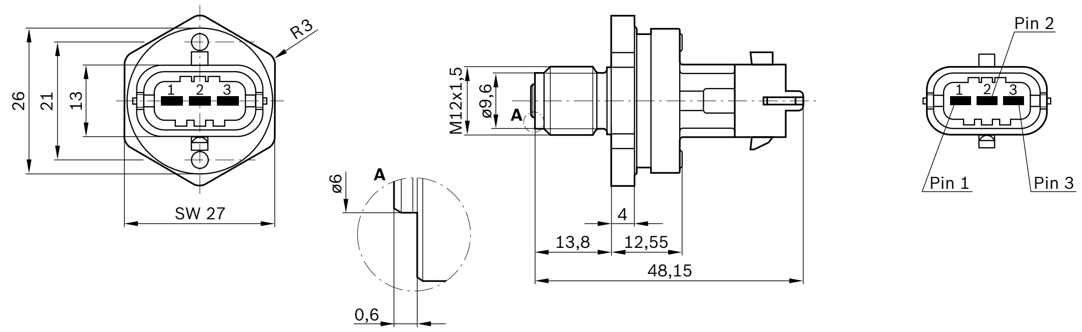
Technical data

Pressure range P_N	1800 (180)
Pressure-sensor type	RDS4.1
Thread	M 12 x 1,5
Connector	Compact 1.1
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



SW Width across flats
Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 671

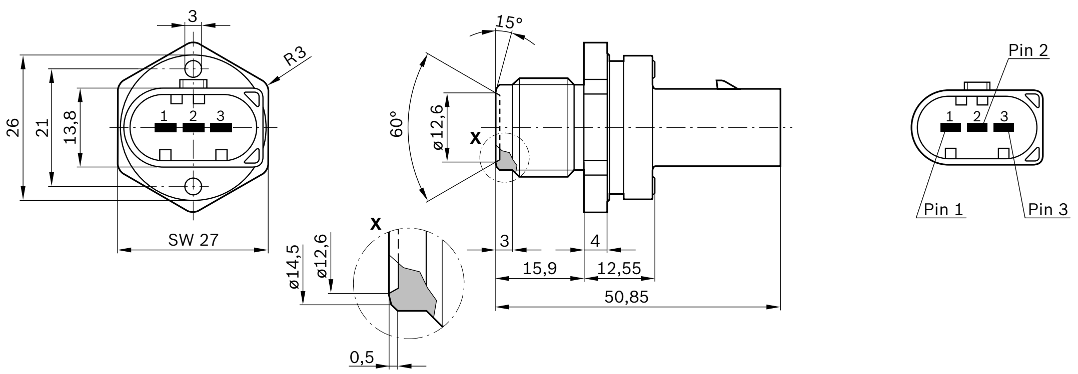
Technical data

Pressure range P_N	1800 (180)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Pin	Silver-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories

Accessories		Part number
Connector housing	Kostal number	9 441 391[1])
Contact pins	Kostal number	22 124 492 060[1])
Single-wire seal	Kostal number	10 800 444 522[1])

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Kostal Deutschland.

Part number 0 281 002 706

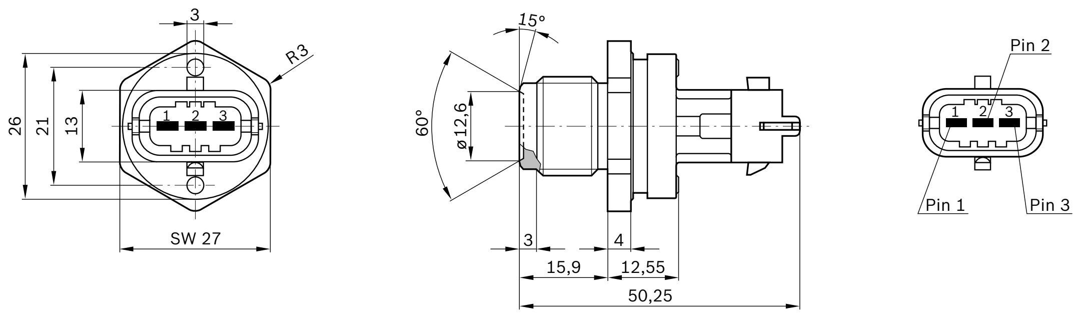
Technical data

Pressure range P_N	1800 (180)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Connector	Compact 1.1
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 841

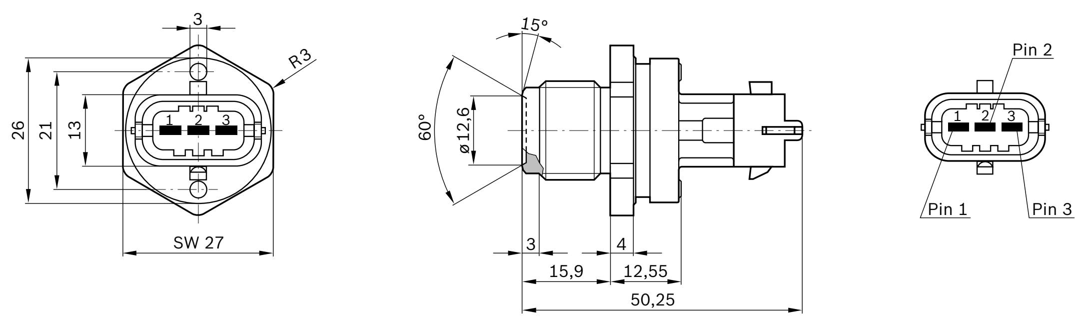
Technical data

Pressure range P_N	1800 (180)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Connector	Compact 1.1
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

For pressures up 200 MPa

Part number 0 281 002 755

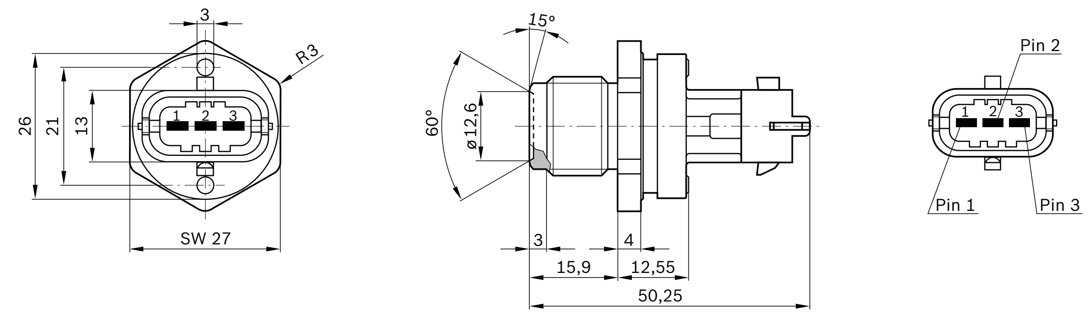
Technical data

Pressure range P_N	2000 (200)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

Part number 0 281 002 787

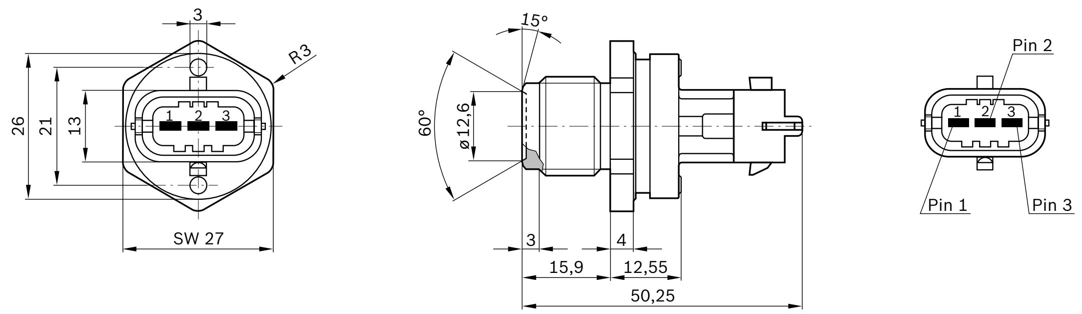
Technical data

Pressure range P_N	2000 (200)
Pressure-sensor type	RDS4.1
Thread	M 18 x 1,5
Pin	Gold-plated
Application/medium	Diesel fuel or biodiesel[2])
Max. input voltage U_s	16
Supply voltage U_V	5 ± 0,25
Supply current I_V	9...15
Load capacitance to ground	10
Temperature range	- 40 ...+ 130
Max. overpressure p_{max}	230
Rupture pressure I_A	400
Response time $\tau_{10/90}$	2

[2]) RME rapeseed methyl ester.

Illustration

Dimension drawings



Pin 1 Ground
Pin 2 Output
Pin 3 Supply

Accessories		Part number
Plug housing		1 928 403 968
Contact pins	Contents: 100 x	1 928 498 054
Single-wire seal	Contents: 10 x	1 928 300 599

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

NTC temperature sensors: -40 °C to 150 °C

Measurement of air temperatures

- Measurement with temperature-sensitive resistors.
- Broad temperature range.

NTC temperature sensor

Plastic-sheathed NTC thermistor

Design and operation

NTC thermistors have a negative temperature coefficient, i.e. their electrical conductivity increases with increasing temperature: Their resistance decreases. The conductive element of the temperature sensor consists of semiconducting heavy metal oxides and oxidised mixed crystals, pressed or sintered into wafer or bead form with the aid of binding agents and provided with a protective enclosure. In combination with suitable evaluation circuits, such thermistors 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 engine oil, coolant, fuel and intake air, i.e. in the range -40...150 °C.

Note

1 connector housing, 2 contact pins and 2 individual seals are required for a 2-pin connector. Genuine Tyco crimping tools must be used for automotive applications.

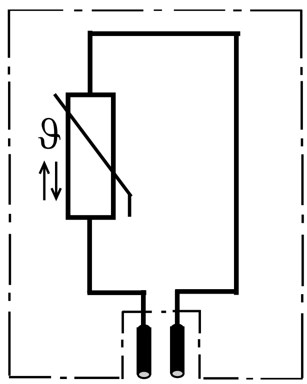
Explanation of characteristic quantities

R Resistance
ϑ Temperature

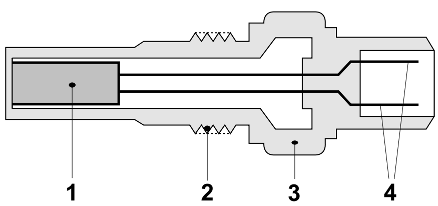
Installation instructions

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

Circuit diagram



Temperature sensor (block diagram)



1 Electrical connection
2 Housing
3 NTC thermistor

Technical data

Rated voltage	V	≤ 5
Max. measurement current	mA	1
Corrosion-tested as per		DIN 50 018

Part number 0 280 130 039

Sensor in steel housing with threaded connection.

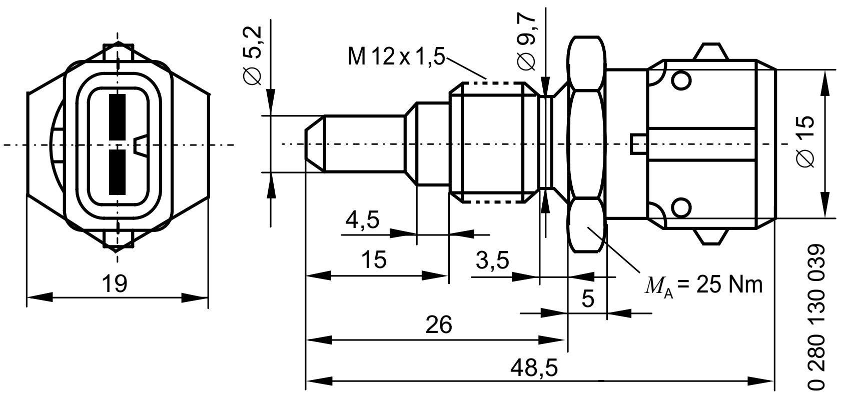
Technical data

Perm. temperature max.	°C	130
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,304 ... 0,342
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	≤ 10 s
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	600

[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 .

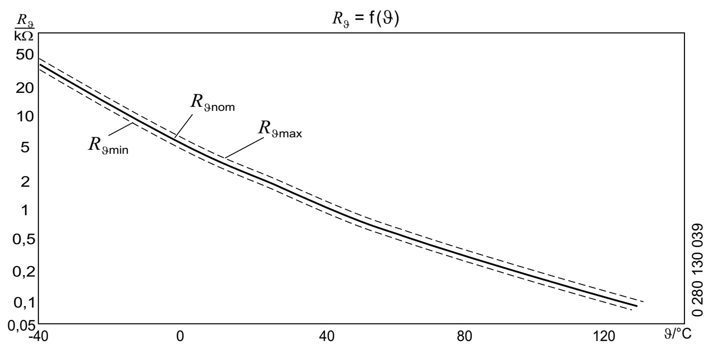
Illustration

Dimension drawings



M_A Tightening torque

Resistance profile of temperature sensor



Accessories

Accessories			Part number
Jetronic connector	2-pin		1 928 402 078
Protective cap	Temperature-resistant; Contents: 1 x		1 280 703 031
Contact pins	for Ø 0.5...1.0 mm²	Tyco number	929 939-3[1])
Contact pins	for Ø 1.5...2.5 mm²	Tyco number	929 937-3[1])
Individual seal	for Ø 0.5...1.0 mm²; Contents: 50 x		1 987 280 106
Individual seal	for Ø 1.5...2.5 mm²; Contents: 20 x		1 987 280 107

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

Part number 0 280 130 085

Plug-in sensor in polyamide housing.

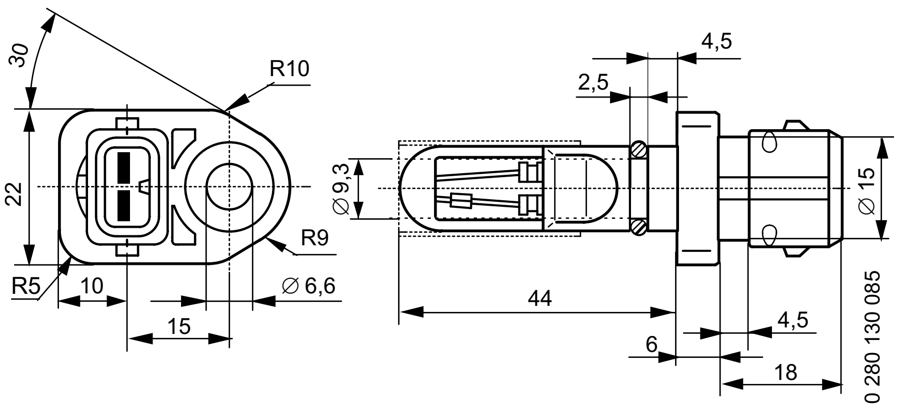
Technical data

Perm. temperature max.	°C	130
Rated resistance at 20 °C	kΩ	2,4 ± 5,4 %
Resistance at +20 °C	kΩ	2,290 ... 2,551
Temperature/time constant τ_{63}[1])	s	≤ 5
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	100

[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 .

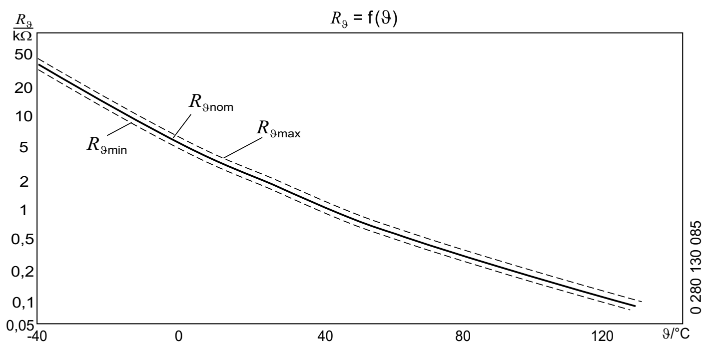
Illustration

Dimension drawings



B Bolt Thread in contact area
L Air flow

Resistance profile of temperature sensor



Accessories

Accessories			Part number
Jetronic connector	2-pin		1 928 402 078
Protective cap	Temperature-resistant; Contents: 1 x		1 280 703 031
Contact pins	for Ø 0.5...1.0 mm²	Tyco number	929 939-3[1])
Contact pins	for Ø 1.5...2.5 mm²	Tyco number	929 937-3[1])
Individual seal	for Ø 0.5...1.0 mm²; Contents: 50 x		1 987 280 106
Individual seal	for Ø 1.5...2.5 mm²; Contents: 20 x		1 987 280 107

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

Part number 0 280 130 123

Plug-in sensor in polyamide housing.

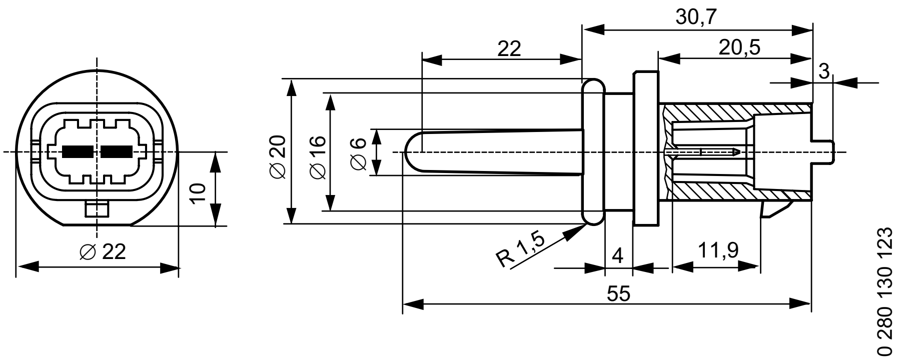
Technical data

Perm. temperature max.	°C	150
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,304 ... 0,342
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	≤10
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	300

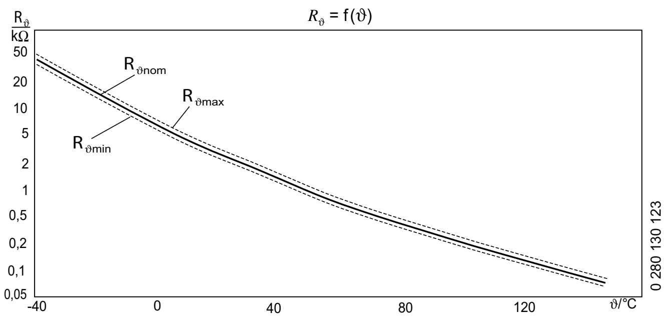
[1]) Time required to attain a difference in resistance of 63 % of the final value given an abrupt change in measurement temperature from 20 °C to 80 °C; flow velocity of air 6 m/s .

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories

Accessories			Part number
Compact connector 1	2-pin		1 928 403 137
Contact pins	for Ø 0.5...1.0 mm²	Tyco number	2-929 939-3[1])
Contact pins	for Ø 1.5...2.5 mm²	Tyco number	2-929 937-3[1])
Single-wire seal	for Ø 0.5...1.0 mm²; Contents: 50 x		1 987 280 106
Single-wire seal	for Ø 1.5...2.5 mm²; Contents: 20 x		1 987 280 107

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

NTC temperature sensors: -40 °C to 150 °C

Measurement of liquid temperatures

- Wide range of liquid temperature measurements with temperature-sensitive resistors.

NTC temperature sensor

Plastic-sheathed NTC thermistor in a brass housing.

Design and operation

NTC thermistors have a negative temperature coefficient, i.e. their electrical conductivity increases with increasing temperature: Their resistance decreases. The conductive element of the temperature sensor consists of semiconducting heavy metal oxides and oxidised mixed crystals, pressed or sintered into wafer or bead form with the aid of binding agents and provided with a protective enclosure. In combination with suitable evaluation circuits, such thermistors 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 engine oil, coolant, fuel and intake air, i.e. in the range -40...150 °C.

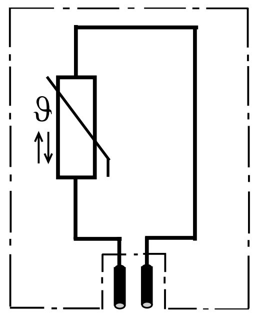
Note

1 connector housing, 2 contact pins and 2 individual seals are required for a 2-pin connector. Genuine AMP crimping tools must be used for automotive applications.

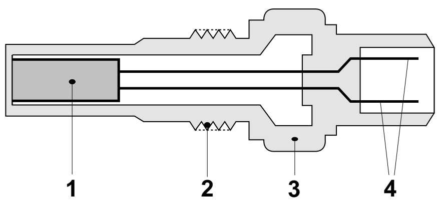
Explanation of characteristic quantities

R Resistance
ϑ Temperature

Circuit diagram



Temperature sensor (block diagram)



1 Electrical connection
2 Housing
3 NTC thermistor

Technical data

Degree of protection[1])		IP 64K
Corrosion-tested as per		DIN 50 021
Rated voltage	V	≤ 5
Max. measurement current	mA	1

[1]) With individual seal.

Part number 0 280 130 026

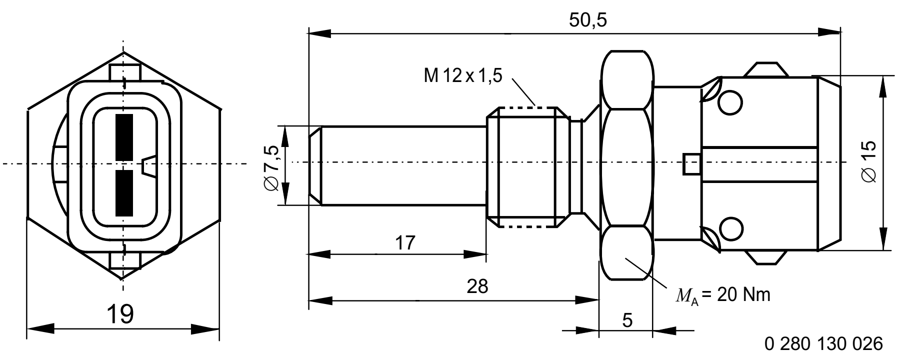
Sensor in brass housing.

Technical data

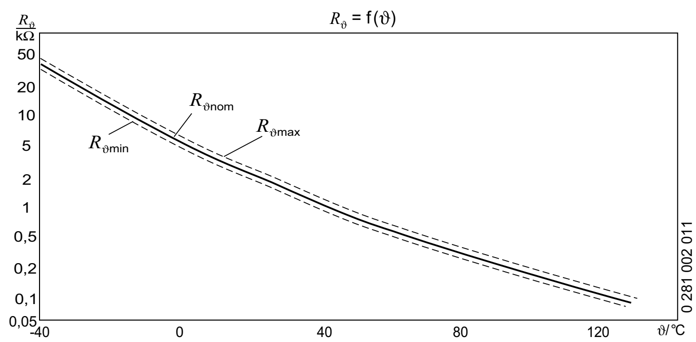
Application/medium		Oil/water/natural gas
Measuring range	°C	- 40 ...+ 130
Tolerance at +20 °C	K	1,2
Tolerance at +100 °C	K	3,4
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,304 ... 0,342
Temperature/time constant τ_{63}[1])	s	≤ 15
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	600
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Connector		Jetronic, tinned pins
Tightening torque	Nm	20

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories

Accessories			Part number
Jetronic connector	2-pin		1 928 402 078
Protective cap	Temperature-resistant; Contents: 1 x		1 280 703 031
Contact pins	for Ø 0.5...1.0 mm²	Tyco number	929 939-3[1])
Contact pins	for Ø 1.5...2.5 mm²	Tyco number	929 937-3[1])
Single-wire seal	for Ø 0.5...1.0 mm²; Contents: 50 x		1 928 498 106
Single-wire seal	for Ø 1.5...2.5 mm²; Contents: 20 x		1 987 280 107

Accessories are not included in the scope of delivery of the sensor and are therefore to be ordered separately as required.
[1]) Available from Tyco Electronics.

Part number 0 281 002 170

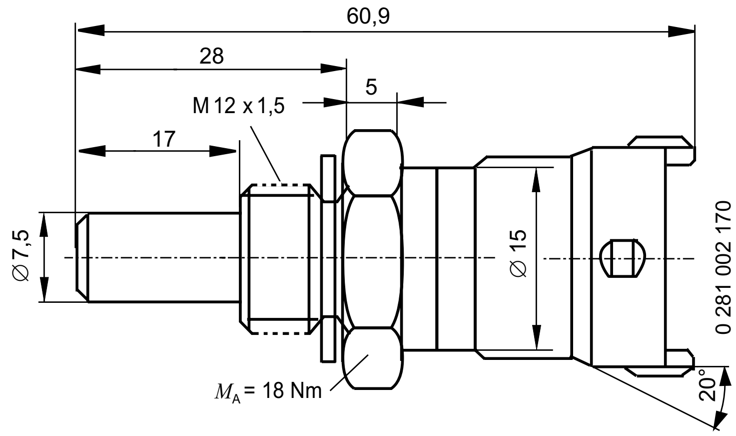
Sensor in brass housing.

Technical data

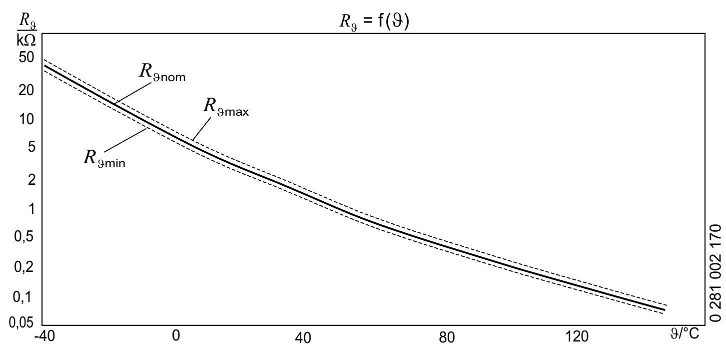
Application/medium		Oil/water
Measuring range	°C	- 40 ...+ 150
Tolerance at +20 °C	K	± 1,5
Tolerance at +100 °C	K	± 0,8
Rated resistance at 20 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,244 ... 10,661
Resistance at +20 °C	kΩ	2,262 ... 2,760
Resistance at +80 °C	kΩ	0,304 ... 0,342
Temperature/time constant τ_{63}[1])	s	≤ 15
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	≤ 300
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Connector		Compact 1.1a, gold-plated pins
Tightening torque	Nm	18

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories

Accessories		Part number
Compact connector 1.1a	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
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

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

Part number 0 281 002 209

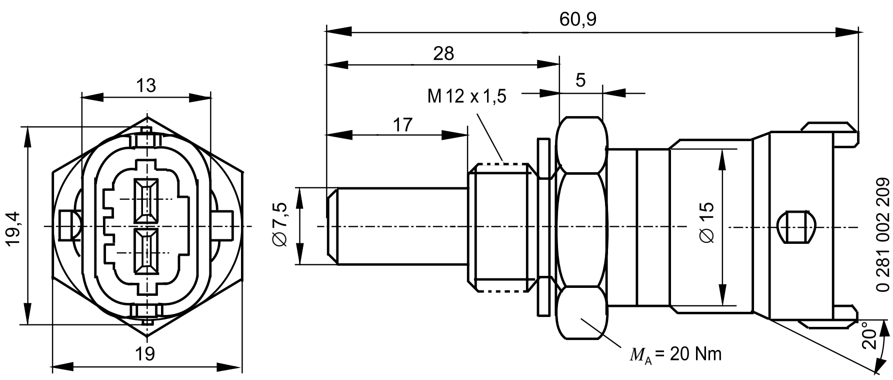
Sensor in brass housing.

Technical data

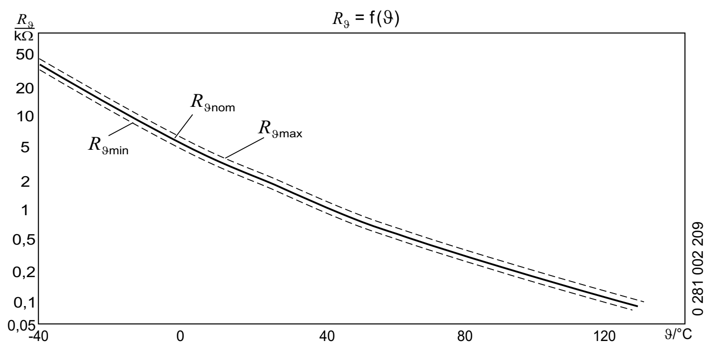
Application/medium		Oil/water
Measuring range	°C	- 40 ...+ 130
Tolerance at +20 °C	K	± 1,5
Tolerance at +100 °C	K	± 0,8
Rated resistance at 20 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,244 ... 10,661
Resistance at +20 °C	kΩ	2,262 ... 2,760
Resistance at +80 °C	kΩ	0,304 ... 0,342
Temperature/time constant τ_{63}[1])	s	≤ 15
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	300
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Connector		Compact 1.1, tinned pins
Tightening torque	Nm	25

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories

Accessories		Part number
Compact connector 1.1a	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
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

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

Part number 0 281 002 412

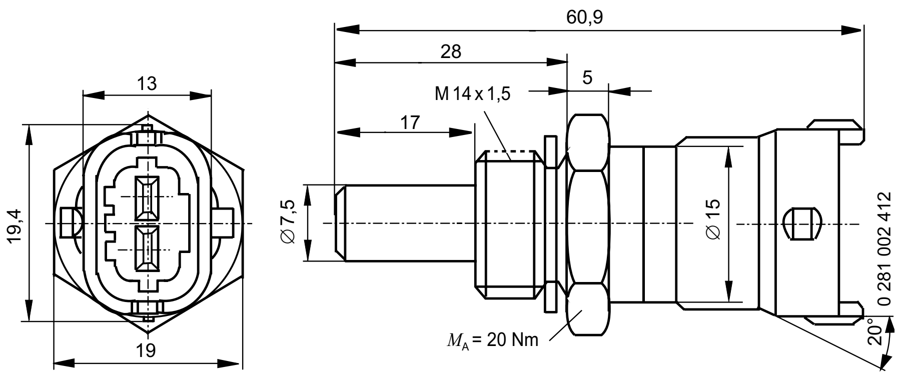
Sensor in brass housing.

Technical data

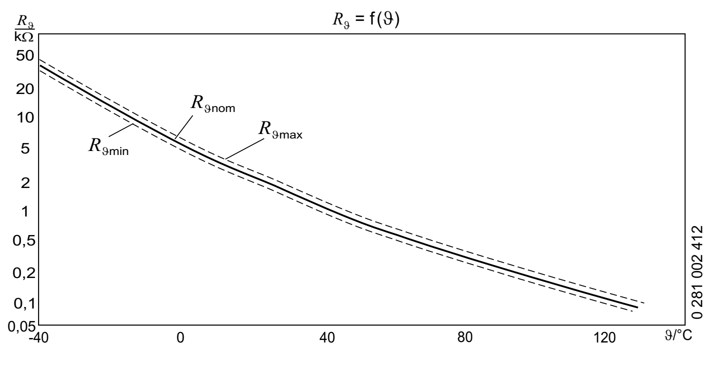
Application/medium		Oil/water
Measuring range	°C	- 40 ...+ 130
Tolerance at +20 °C	K	± 1,5
Tolerance at +100 °C	K	± 0,8
Rated resistance at 20 °C	kΩ	2,5 ± 6 %
Resistance at -10 °C	kΩ	8,244 ... 10,661
Resistance at +20 °C	kΩ	2,262 ... 2,760
Resistance at +80 °C	kΩ	0,304 ... 0,342
Temperature/time constant τ_{63}[1])	s	≤ 15
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s^2	300
Thread		M 14 x 1,5
Corrosion-tested as per		DIN 50 021
Connector		Compact 1.1, tinned pins
Tightening torque	Nm	20

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories

		Part number
Compact connector 1.1a	2-pin	1 928 403 874
Contact pins	for Ø 0.5 ... 1.0 mm^2; Contents: 100 x	1 928 498 056
Contact pins	for Ø 1.5 ... 2.5 mm^2; Contents: 100 x	1 928 498 057
Single-wire seal	for Ø 0.5 ... 1.0 mm^2; Contents: 10 x	1 928 300 599
Single-wire seal	for Ø 1.5 ... 2.5 mm^2; Contents: 10 x	1 928 300 600

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

Part number 0 281 002 011

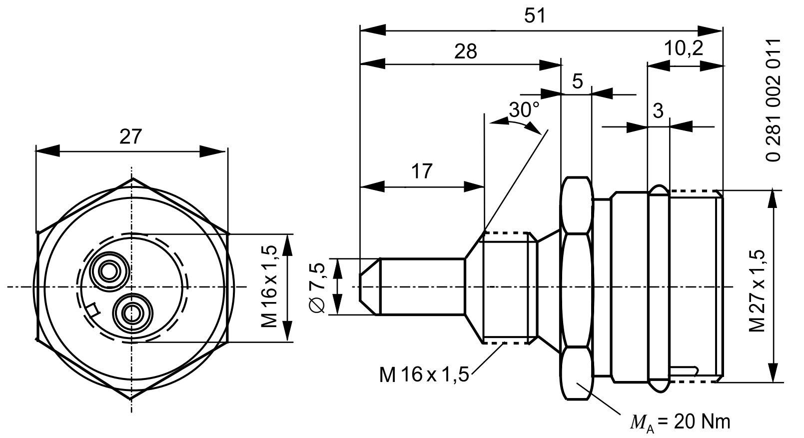
Sensor in brass housing.

Technical data

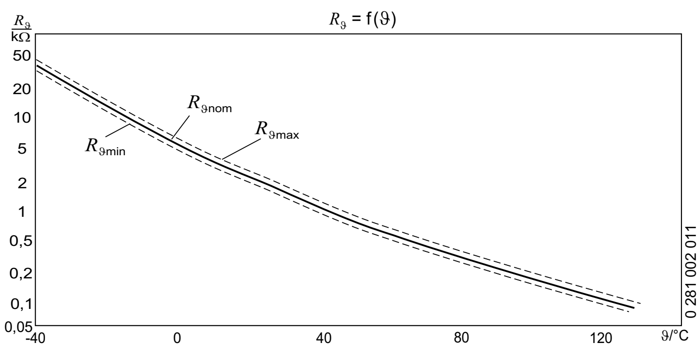
Application/medium		Oil/water/natural gas
Measuring range	°C	- 40 ...+ 130
Tolerance at +20 °C	K	1,2
Tolerance at +100 °C	K	3,4
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
Resistance at -10 °C	kΩ	8,727 ... 10,067
Resistance at +20 °C	kΩ	2,375 ... 2,625
Resistance at +80 °C	kΩ	0,304 ... 0,342
Temperature/time constant τ_{63}[1])	s	≤ 20
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	500
Thread		M 16 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	20

Illustration

Dimension drawings



Resistance profile of temperature sensor



Accessories		Part number
Coupler plug	2-pin	0 281 002 050

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

Part number 0 281 002 623

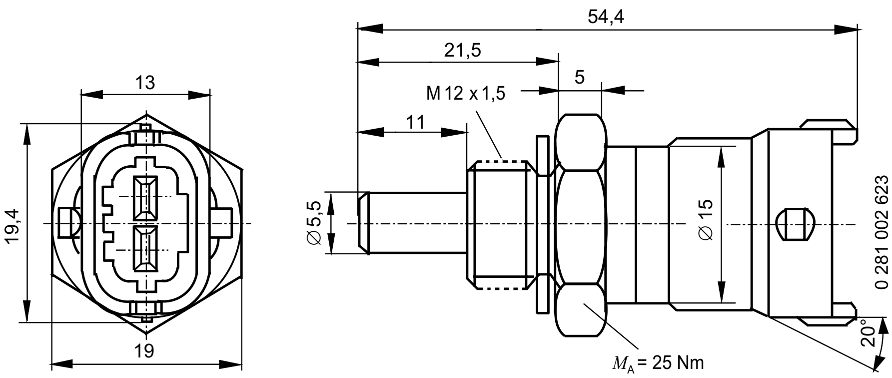
Sensor in brass housing.

Technical data

Application/medium		Oil/water
Measuring range	°C	- 40 ...+ 150
Tolerance at +20 °C	K	1,5
Tolerance at +100 °C	K	2,0
Rated resistance at 20 °C	kΩ	2,5 ± 5 %
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 ... 0,331
Temperature/time constant τ_{63}[1])	s	≤ 13
Approximate value for permissible vibration acceleration a_{sin} (sinusoidal vibration)	m/s²	300
Thread		M 12 x 1,5
Corrosion-tested as per		DIN 50 021
Tightening torque	Nm	25

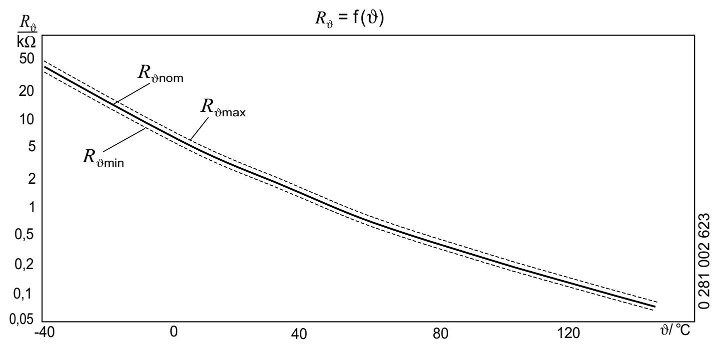
Illustration

Dimension drawings



M_A Tightening torque

Resistance profile of temperature sensor

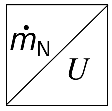


Accessories

Accessories		Part number
Compact connector 1.1a	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
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

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

Hot-film air-mass meter, type HFM 5



Measurement of air-mass flow up to 1200 kg/h

- Compact design.
- Low weight.
- Rapid response.
- Low power input.
- Backflow detection.

Application

To comply with the legally specified emission limits for motor vehicles, a specific air-fuel ratio must be precisely maintained. This requires the use of sensors which accurately record the actual air-mass flow and output this in the form of an electrical signal to the control electronics. The sensor is used to measure the air-mass flow in internal-combustion engines for precise adaption of the injected fuel quantity to the current power requirement, atmospheric pressure and air temperatures.

Design

The micromechanical sensor element is located in the flow duct of the plug-in sensor. The plug-in sensor is suitable for installation in air filters or, together with a measurement tube, in the air duct. Measurement tubes of various sizes are available to suit the required air throughput. A micromechanical measurement system with a hybrid circuit permits evaluation of the measurement data to also detect backflow in a pulsating air-mass flow.

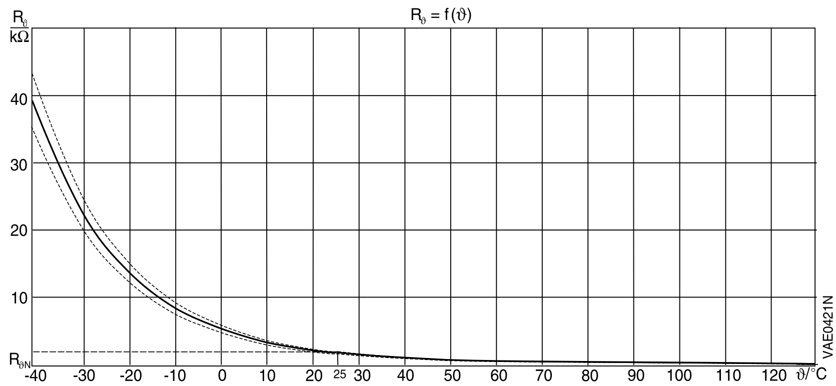
Principle of operation

In the air-mass meter, the amount of heat extracted from a heated sensor element by way of heat transfer from the heating element to the air flow increases with increasing air mass. The resultant difference in temperature is a measure of the air-mass flow. An electronic hybrid circuit evaluates the measurement data and thus permits precise recording of the air volume, including the direction of flow. The sensor element only detects part of the air-mass flow. The total air mass flowing through the measurement tube is determined by way of calibration (characteristic-curve definition).

Explanatory notes on characteristic quantities

$\dot{m}_N$	Air mass throughput
$\Delta\dot{m}$	Absolute accuracy
$\Delta\dot{m}/\dot{m}$	Relative accuracy
$\tau\Delta$	Time until measurement error <5 %
τ_{63}	Time for 63 % measured value change

Resistance profile of temperature sensor

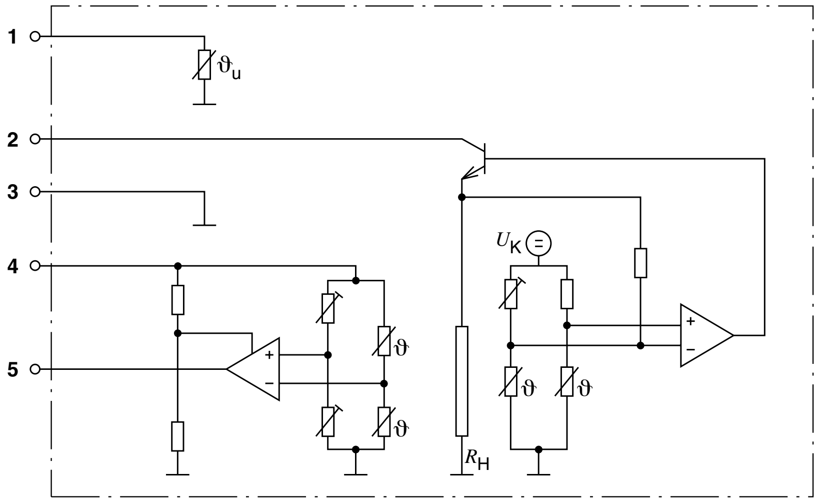


Technical data

Rated supply voltage	U_N	14V
Supply-voltage range	U_V	8 ... 17 V
Accuracy	$\Delta\dot{m}/\dot{m}$	≤ 3 %
Pressure drop at $\dot{m}_N$[1])	Δp	< 15 hPa
Output voltage	U_A	0 ... 5 V
Current input	I_V	< 0,1 A
Permissible vibration acceleration	a_v	≤ 150 m/s^2
Time constant τ_{63}[2])		≤ 15 ms
Time constant $\tau\Delta$[3])		≤ 30 ms
Temperature range[4])		-40 ...+ 120 °C

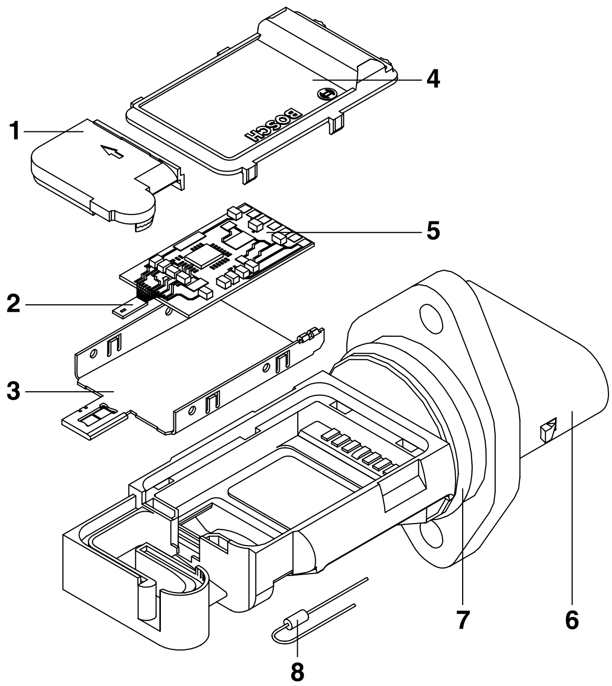
[1]) Measured between input and output.
[2]) Time required for step response of output voltage to 63 % of final value given an abrupt change in air mass from 10 kg/h to 310 kg/h.
[3]) Delay on switch-on and after any change in flow rate until the output voltage has attained the relative measurement deviation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

Block diagram with pin assignment



1 Additional temperature sensor ϑ_u (not for version 4, part no. 0 280 218 008)
2 Supply voltage U_V
3 Signal ground
4 Reference voltage 5 V
5 Measurement signal U_A.
ϑ Temperature-sensitivity of resistor
R_H Heating resistor
U_K Constant voltage

Design of HFM 5 plug-in sensor



1 Measurement-channel cover
2 Sensor
3 Mounting plate
4 Hybrid cover
5 Hybrid
6 Plug-in sensor
7 O-ring
8 Additional temperature sensor

Part number 0 280 218 119

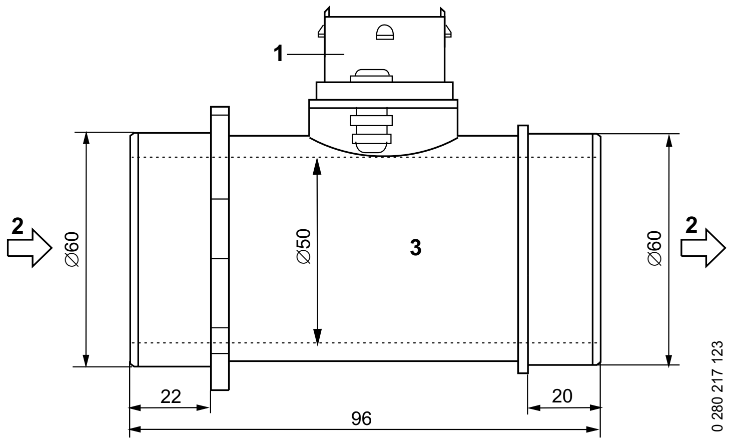
With ambient-temperature sensor.

Technical data

Measuring range	$\dot{m}_N$	-15 ... 480 kg/h

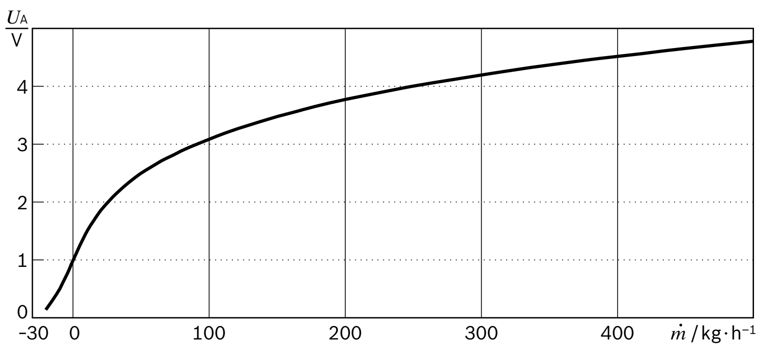
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories		Part number
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	1 928 300 600

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

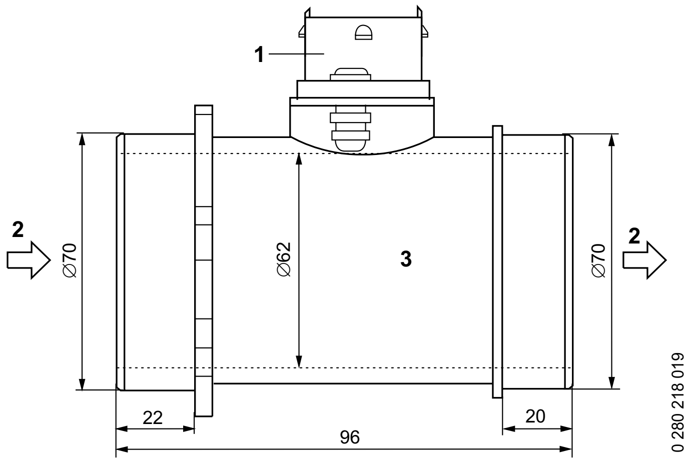
Part number 0 280 218 113

Technical data

Measuring range	$\dot{m}_N$	10 ... 480 kg/h

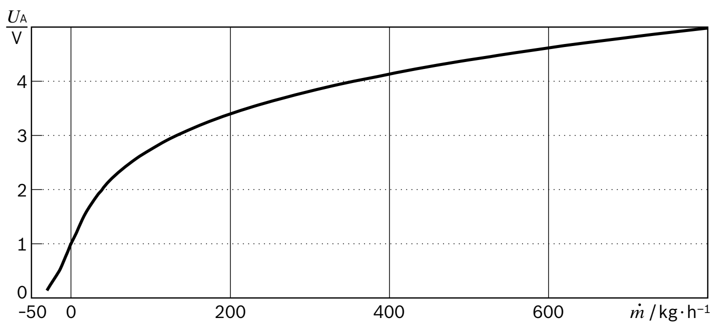
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories

Accessories		Part number
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	1 928 300 600

Part number 0 280 218 087

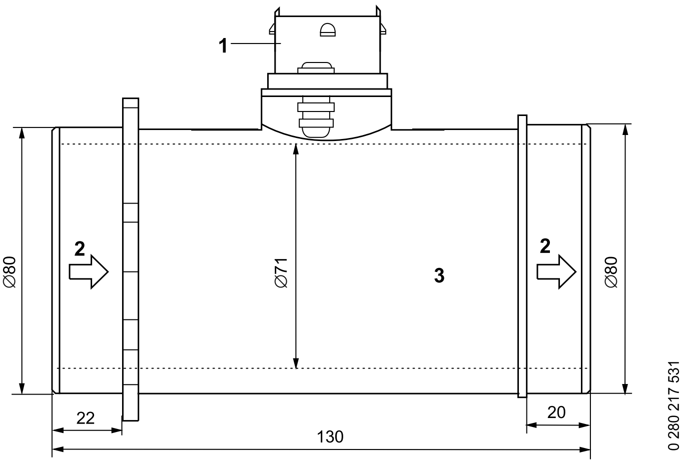
With ambient-temperature sensor.

Technical data

Measuring range	$\dot{m}_N$	-30 ... 850 kg/h

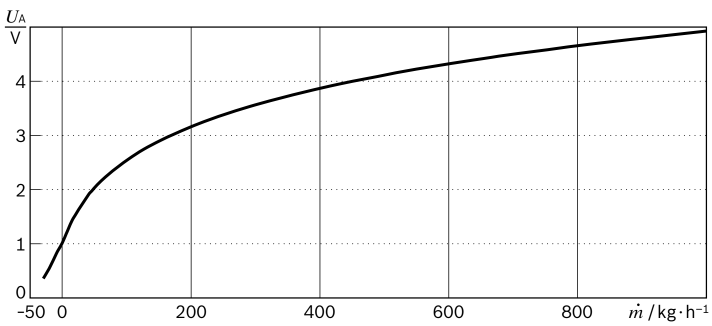
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories

Accessories		Part number
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	1 928 300 600

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

Part number 0 280 218 089

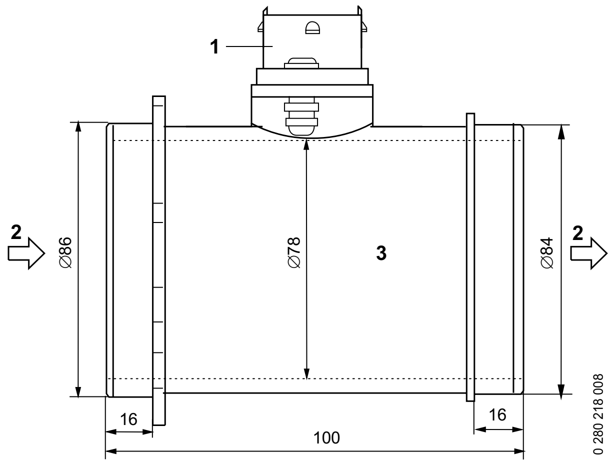
With ambient-temperature sensor.

Technical data

Measuring range	$\dot{m}_N$	-50 ... 1100 kg/h

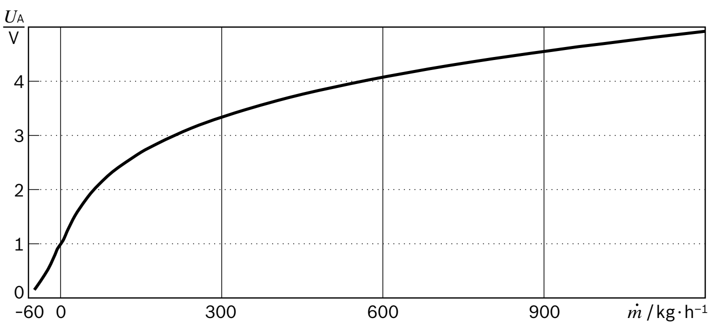
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories

Accessories		Part number
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	1 928 300 600

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

Part number 0 281 002 421

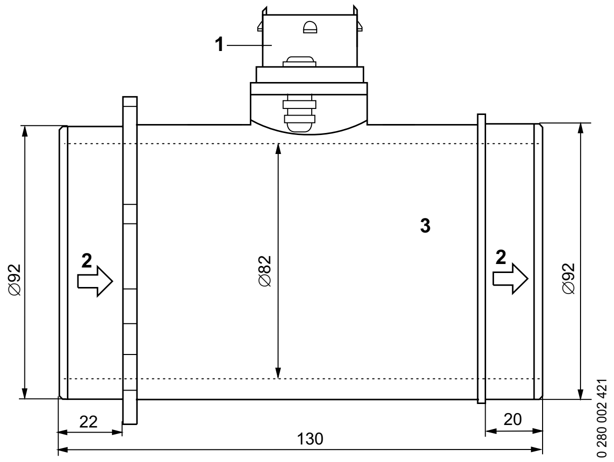
With ambient-temperature sensor.

Technical data

Measuring range	$\dot{m}_N$	-50 ... 1200 kg/h

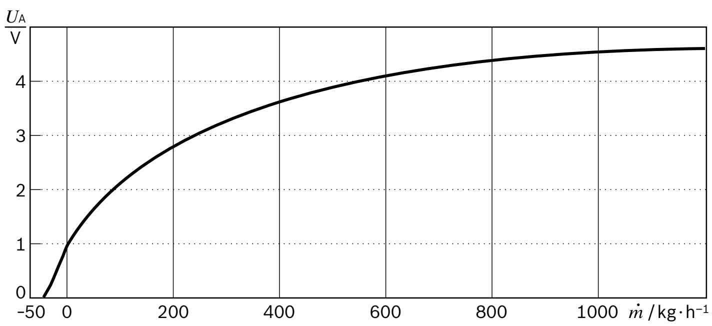
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories

Accessories		Part number
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	1 928 300 600

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

Hot-film air-mass meter, type HFM 6

$\dot{m}_N$ / U

Measurement of air-mass flow up to 800 kg/h

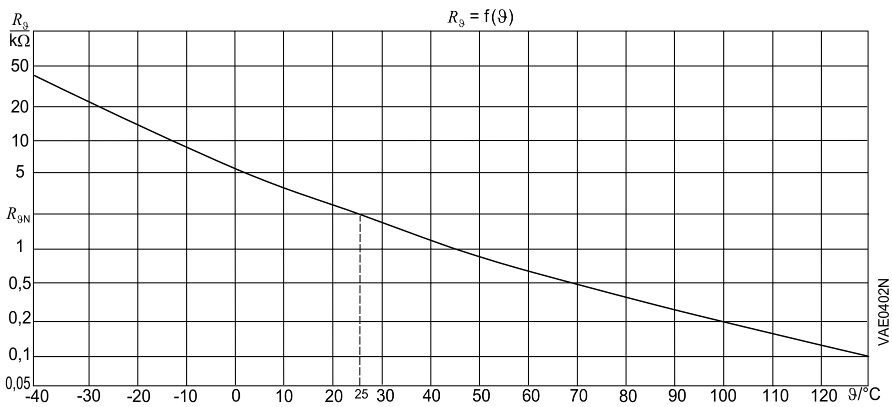
Application

To comply with the pertinent legislation, the pollutant levels in the exhaust gas of internal-combustion engines must be minimised and the combustion process optimised. This involves mixing the air and fuel in a precisely defined ratio. It is therefore necessary to exactly record the air-mass flow and transmit this in the form of an electrical signal to the control electronics. Further applications include measurement, test and control units for all types of combustion system and special gas engines, as air-mass meters can be accordingly calibrated to record the mass flow of virtually all non-corrosive gases.

Design

Air-mass meters consist of a measurement tube into which the plug-in sensor with the sensor element is inserted. The dimensions of the measurement tube vary depending on the measuring-range requirements. There are measurement tubes of different sizes and design to suit the required air throughput. It is basically also possible to integrate the plug-in sensor directly in the intake tract, for example in the air-filter housing or intake connection. The sensor element is located in the air flow (measurement duct) of the plug-in sensor and forms part of a Wheatstone bridge. The configuration is such that the inevitable contamination does not affect the flow of air around the sensor. This obviates the need for a self-cleaning process as always used to be necessary with earlier hot-wire air-mass meters prior to starting.

Resistance of temperature sensor



Technical data

Rated supply voltage	U_N	14V
Supply-voltage range	U_V	7,5 ... 17 V
Relative accuracy[1]	$\Delta\dot{m}/\dot{m}$	± 2 %
Temperature range[2]		-40 ... 120 °C
Pressure drop at $\dot{m}_N$	Δp	< 18 hPa
Current input	I_V	< 0,06 A
Vibration acceleration	a_v	≤ 180 m/s²
Time constant τ_{63}[3]		≤ 10 ms
Time constant $\tau\Delta$[4]		≤ 30 ms

1) For $0.04 \leq \dot{m}/\dot{m}_N \leq 1.3$
2) Up to 130 °C for brief periods (≤ 3 min.).
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 $|\Delta\dot{m}/\dot{m}| \leq 5$ %

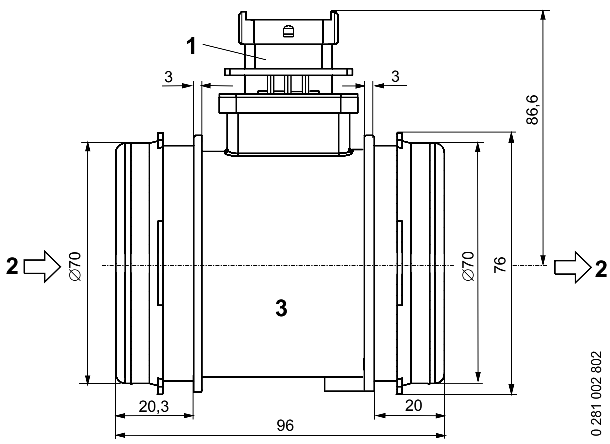
Part number 0 281 002 802

Technical data

Measuring range	$\dot{m}_N$	-40 ... 620 kg/h

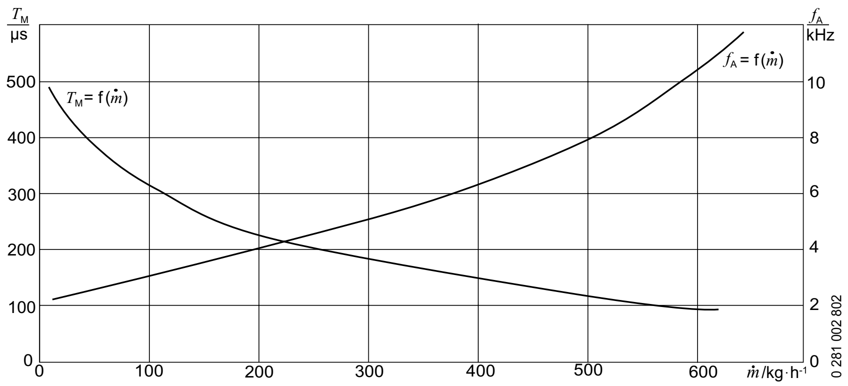
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories		Part number
Compact connector	4-pin	1 928 403 736
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 1.5...2.5 mm²; Contents: 10 x	1 928 300 600

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

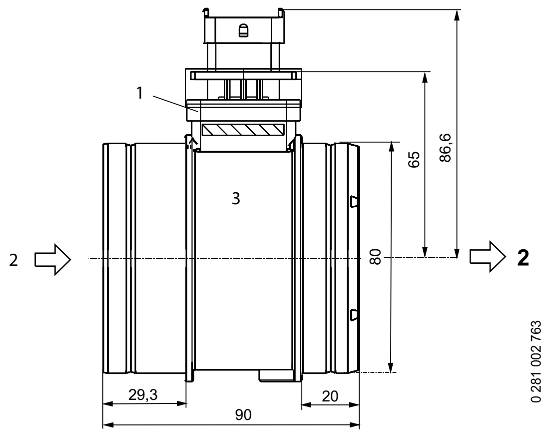
Part number 0 281 002 764

Technical data

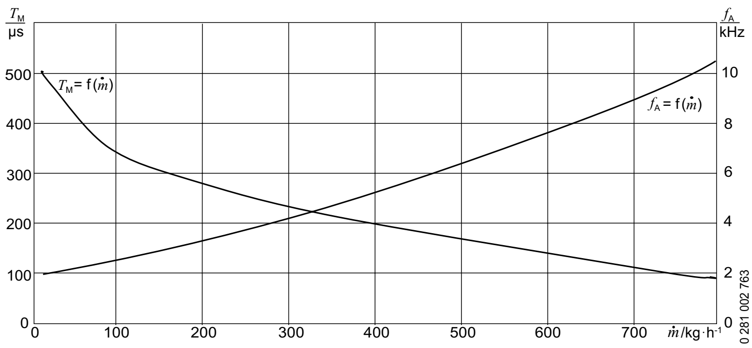
Measuring range	$\dot{m}_N$	-60 ... 800 kg/h

Illustration

Dimension drawing



Air-mass characteristic curve at ambient temperature



Accessories		Part number
Compact connector	4-pin	1 928 403 736
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 1.5...2.5 mm²; Contents: 10 x	1 928 300 600

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

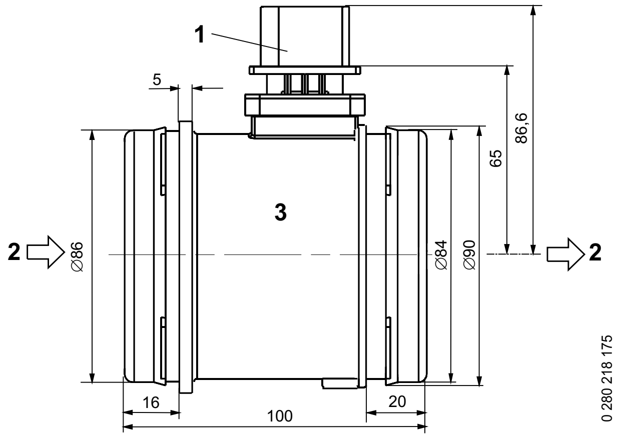
Part number 0 280 218 176

Technical data

Measuring range	$\dot{m}_N$	-40 ... 620 kg/h

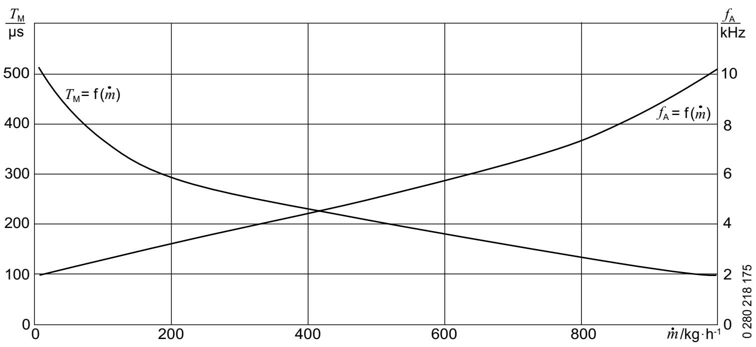
Illustration

Dimension drawing



1 Plug-in sensor
2 Flow direction
3 Measurement tube

Air-mass characteristic curve at ambient temperature



Accessories		Part number
Compact connector	4-pin	1 928 403 736
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 1.5...2.5 mm²; Contents: 10 x	1 928 300 600

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

Lambda oxygen sensor, type LSM 11

λ / U

Measurement of oxygen content

- Principle of galvanic oxygen concentration cell with solid electrolyte permits measurement of oxygen concentration, for example in an exhaust-gas mixture.
- Sensor with stable and interference-immune output signal for extreme operating conditions.

Application

Comustion processes
- Oil burners
- Gas burners
- Coal-fired systems
- Wood-fired systems
- Bio refused and waste
- Industrial furnaces

Engine-management systems
- Lean-burn engines
- Gas engines
- Block-type thermal power stations

Industrial processing
- Packaging machinery and installations
- Process engineering
- Drying plants
- Hardening furnaces
- Metallurgy (steel melting)
- Chemical industry (class melting)

Measuring and analysis processing
- Smoke measurement
- Gas analysis
- Determining the Wobb index

Design and operation

The ceramic part of the Lambda sensor (solid electrolyte) is in the form of a tube closed at one end. The inside and outside surfaces of the sensor ceramic have a microporous platinum layer (electrode) which, on the one hand, has a decisive influence on the sensor characteristic, and on the other, is used for contacting purposes. The platinum layer on that part of the sensor ceramic which is in contact with the exhaust gas is covered with a firmly bonded, highly porous protective ceramic layer which prevents the residues in the exhaust gas from eroding the catalytic platinum layer. The sensor thus features good long-term stability.
The sensor protrudes into the flow of exhaust gas and is designed such that the exhaust gas flows around one electrode, whilst the other electrode is in contact with the outside air (atmosphere). Measurements are taken of the residual oxygen content in the exhaust gas. The catalytic effect of the electrode surface at the sensor´s exhaust-gas end produces a step-type sensor-voltage profile in the area around λ = 1.

The active sensor ceramic (ZrO2) is heated from inside by means of ceramic Wolfram heater so that the temperature of the sensor ceramic remains above the 350 °C function limit irrespective of the exhaust-gas temperature. The ceramic heater features a PTC characteristic, which results in rapid warm-up and restricts the power requirements when the exhaust gas is hot.
The heater-element connections are completely decoupled from the sensor signal voltage (R> 30 MΩ). Additional design measures serve to stabilize the lean characteristic-curve profile of the type LSM11 Lambda sensor at λ > 1.0 ... 1.5 (for special applicationsup to λ= 2.0):
– Use of powerful heater (16 W)
– Special design of the protective tube
– Modified electrode/protective-layer system.

The special design permits:
- Reliable control even with low exhaust-gas temperatures (e.g. with engine at idle),
- Flexible installation unaffected by external heating,
- Function parameters practically independent of exhaust-gas temperature,
- Low exhaust-gas values due to the sensor´s rapid dynamic response,
- Little danger of contamination and thus long service life,
- Waterproof sensor housing.

Explanation of characteristic quantities

U_s Sensor voltage
U_H Heater voltage
ϑ_a Exhaust-gas temperature
λ Excess-air factor
O_2 Oxygen concentration in %

Special accessories

Evaluation unit LA2 on request. This calculates the Lambda values from the signals of the Lambda sensors listed here and displays these in digital form. The values are simultaneously output via an analog output and a multislave V 24 interface.

Installation instructions

The Lambda sensor is to be installed at a location where the exhaust-gas composition is representative whilst complying with the specified temperature limits. The sensor is screwed into a mating thread and tightened to a torque of 50...60 Nm.
- Choose an installation location where the gas is as hot as possible.
- Observe upper temperature limits.
- Fit sensor in as upright a position as possible with the electrical connections facing upwards.
- Do not position sensor too close to the end of the exhaust pipe to preclude ambient-air influences. Upstream of the installed sensor, there must be no external leaks in the exhaust system to prevent the influence of unmetered air.
- Protect the sensor against condensate.
- To avoid overheating, the sensor body must be externally ventilated.
- The sensor is not to be painted, waxed or subjected to any similar treatment. Always use the recommended special grease for lubricating the thread.
- The sensor is supplied with reference air via the connecting cables. The connectors must therefore be clean and dry. The use of contact spray, anti-corrosion agents or the like is not permitted.
- Connecting cables are not to be soldered, but rather use is to be made of crimp, clamp or screw connections.

Warranty claims

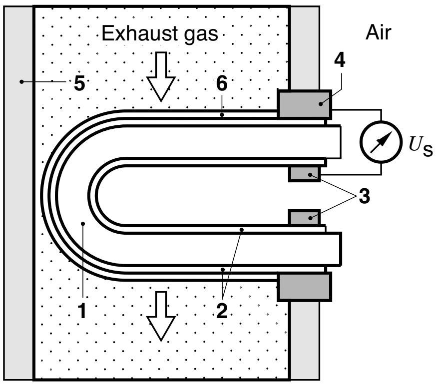
as per the general terms of delivery A 17 can only be accepted if use is made of residue-free gaseous hydrocarbons and light fuel oil in accordance with DIN 51 603 as permissible fuels.

Technical data

Usage conditions	
Passive temperature range (storage temperature range)	-40 ... 100 °C
Sustained exhaust-gas temperature with heating on	+ 150 °C ...+ 600 °C
Maximum permissible exhaust-gas temperature with heating on (200 h cumulative)	+ 800 °C
Operating temperature at hexagon end of sensor housing	≤ 500 °C
Operating temperature at cable gland	≤ 200 °C
Operating temperature at connecting cable	≤ 150 °C
Operating temperature at connector	≤ 120 °C
Temperature gradient on front side of sensor ceramic element	≤ 100 K/s
Temperature gradient at hexagon end of sensor housing	≤ 150 K/s
Permissible vibration at hexagon end - stochastic vibration - max. acceleration	≤ 800 m/s^2
Permissible vibration at hexagon end - sinusoidal vibration - amplitude	≤ 0,3 mm
Permissible vibration at hexagon end - sinusoidal vibration - acceleration	≤ 300 m/s^2
Max. load current	± 20 µA
Heating element	
Rated supply voltage (preferably AC voltage) U_N	12 V_{eff}
Operating voltage U_V	12 ... 13 V
Heat output for ϑ_{Gas} = 350 °C and exhaust-gas flow velocity of ≈ 0.7 m/s at 12 V heating voltage in steady state	≈ 16 W
Heating current at 12 V in steady state	≈ 1,25 A
Insulation resistance between heating and sensor connection	> 30 MΩ
Values for burner applications	
Lambda control range λ	1 ... 2
Sensor output voltage for λ = 1.025...2.00 at ϑ_{Gas} = 220 °C and a flow velocity of 0.4...0.9 m/s	68 mV ... 3,5 mV
Sensor internal resistance R_i~ in air at 20 °C and 12 V heating voltage	≤ 250 Ω
Sensor voltage in air at 20 °C in as-new condition and 13 V heating voltage	- 12 ...- 15 mV[2])
Manufacturing tolerance $\Delta\lambda$ in as-new condition (standard deviation 1 s) at ϑ_{Gas} = 220 °C and approx. 0.7 m/s flow velocity - at ϑ_{Gas} = 1.30	≤ ± 0,013
Manufacturing tolerance $\Delta\lambda$ in as-new condition (standard deviation 1 s) at ϑ_{Gas} = 220 °C and approx. 0.7 m/s flow velocity - at ϑ_{Gas} = 1.80	≤ ± 0,050
Relative sensitivity $\Delta U_S/\Delta\lambda$ at λ = 1.30	0,65 mV / 0,01
Influence of exhaust-gas temperature on sensor signal with temperature increase from 130 °C to 230 °C and flow velocity ≤ 0.7 m/s at λ = 1.30; $\Delta\lambda$	≤ ± 0,01
Influence of change in heating voltage ±10 % from 12 V at ϑ_{Gas} = 220 °C - at λ = 1.30; $\Delta\lambda$	≤ ± 0,009
Influence of change in heating voltage ±10 % from 12 V at ϑ_{Gas} = 220 °C - at λ = 1.80; $\Delta\lambda$	≤ ± 0,035
Response time at ϑ_{Gas} = 220 °C and approx. 0.7 m/s flow velocity new values for 66 % switching point; λ step change = 1.10 ... 1.30 for step change direction “lean”	2,0 s
Response time at ϑ_{Gas} = 220 °C and approx. 0.7 m/s flow velocity new values for 66 % switching point; λ step change = 1.10 ... 1.30 for step change direction “rich”	1,5 s
Approximate value for sensor control condition after switching on oil burners and sensor heating; ϑ_{Gas} ≈ 220 °C; flow velocity approx. 1.8 m/s; λ = 1.45; sensor in exhaust pipe Ø 170 mm	70 s
Sensor ageing $\Delta\lambda$ in fuel-oil waste gas after 1000 h continuous burner operation with fuel oil EL; measurement at ϑ_{Gas} = 220 °C and at λ = 1.30	≤ ± 0,012
Sensor ageing $\Delta\lambda$ in fuel-oil waste gas after 1000 h continuous burner operation with fuel oil EL; measurement at ϑ_{Gas} = 220 °C and at λ = 1.80	≤ ± 0,052
Service life at ϑ_{Gas} < 300 °C to be tried out by customer on a case to case basis;	Approximate value > 10 000 h

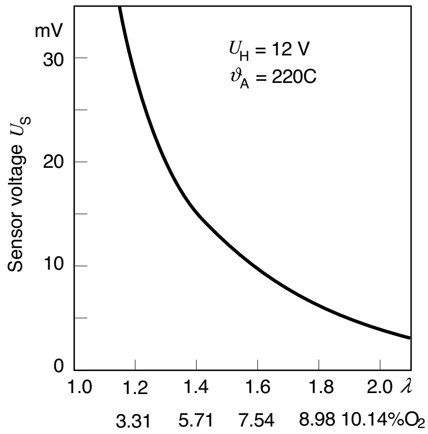
[1]) Refer to characteristic curve.
[2]) On request -8.5...-12 mV.

Lambda oxygen sensor in exhaust pipe (block diagram)

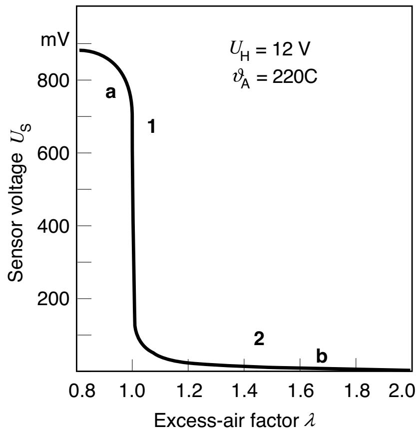


1 Sensor ceramic, 2 Electrodes, 3 Contact, 4 Housing contacts, 5 Exhaust pipe,
6 Ceramic protective layer (porous)

Characteristic curve for propane-gas operation (lean range)



Characteristic curve for full range



1 Control λ = 1; 2 Lean control
a Rich mixture, b Lean mixture.

Part number 0 258 104 002

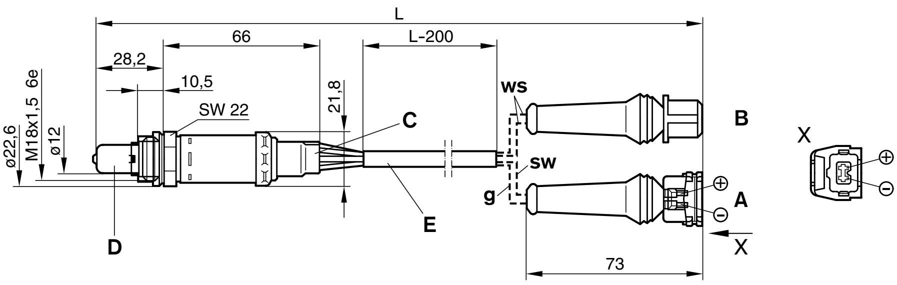
Technical data

Usage conditions

Total length	2500 mm

Illustration

Dimension drawing



A Signal voltage
B Heating voltage
C Cable grommet and seals
D Conduit
E Sheath
ws White
sw Black
g Grey
L Total length

Accessories		Part number
Connector housing	Connector for heating element	1 284 485 110
Receptacles	Connector for heating element; Contents 5: x	1 284 477 121
Protective cap	Connector for heating element; Contents: 1 x	1 250 703 001
Coupler plug	Connector for sensor; Contents: 1 x	1 224 485 018
Blade terminal	Connector for sensor; Contents: 5 x	1 234 477 014
Protective cap	Connector for sensor; Contents: 1 x	1 250 703 001
Special grease for connecting thread	Tin 120 g	1 987 123 020

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

Part number 0 258 104 004

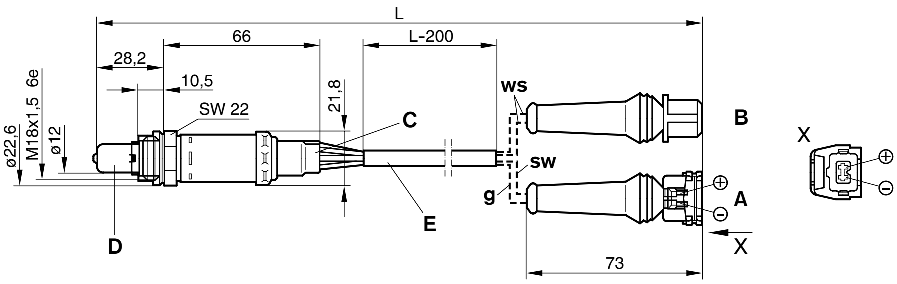
Technical data

Usage conditions

Total length	650 mm

Illustration

Dimension drawing



A Signal voltage
B Heating voltage
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D Conduit
E Sheath
ws White
sw Black
g Grey
L Total length

Accessories		Part number
Connector housing	Connector for heating element	1 284 485 110
Receptacles	Connector for heating element; Contents: 5 x	1 284 477 121
Protective cap	Connector for heating element; Contents: 1 x	1 250 703 001
Coupler plug	Connector for sensor; Contents: 1 x	1 224 485 018
Blade terminal	Connector for sensor; Contents: 5 x	1 234 477 014
Protective cap	Connector for heating element; Content: 1 x	1 250 703 001
Special grease for connecting thread	Tin 120 g	1 987 123 020

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

List of Part numbers

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Tel.: +01 630-530-1154
Fax: +01 630-530-1224
Internet: www.chiefent.com

If your requirements go beyond our sensor range, please indicate this on the following data sheet. In the case of modifications, please state the product with which you are familiar in the box below.

Bosch Part No.: ☐ ☐☐☐ ☐☐☐ ☐☐☐

Please use the data sheet printed here as a copy and return the copy to us after filling it in appropriately.

Address:

Robert Bosch GmbH
Abt. AA/MKC
Postfach 41 09 60

D-76225 Karlsruhe
Fax: 07 11/81 15 07-25 20

Customer address:

Your ref.	Our department/person to contact	Telephone (extension)	Date

Project, application:

Sensor requirements

Measured variable:

Secondary conditions:

Remarks:

Usage conditions

Brief description:

Specifications available Yes ☐ No ☐

Quantity required

☐ Once-only Qty.

Envisaged delivery date

☐ Following quantity on following dates

Date						
Quantity						

☐ Yearly Qty. Monthly Qty.

☐ Advice required