

BODAS Pressure sensor PR4

RE 95156

Edition: 02.2017

Replaces: 12.2015



- ▶ Thin-film measurement principle
- ▶ Measurement range
 - 0 ... 280 bar
 - 0 ... 420 bar and
 - 0 ... 600 bar
- ▶ Ratiometric output signal 0.5 ... 4.5 V at 5 V supply voltage
- ▶ Type of protection IP67 and IP69K

Features

- ▶ Tightening torque 45 Nm
- ▶ Shock and vibration resistant
- ▶ High resistance to pressure spikes
- ▶ Very good resistance to temperature shock
- ▶ High accuracy over the complete measuring range
- ▶ Compact dimensions for all pressure ranges

Inhalt

| | |
|--|----|
| Ordering code | 2 |
| Description | 2 |
| Technical data | 3 |
| Characteristics | 4 |
| Dimensions | 4 |
| Connector Bosch Compact | 5 |
| Manufacturer confirmation of PR4 MTTF _d -values | 6 |
| Installation instructions | 7 |
| Wiring and error diagnostic of the sensor | 8 |
| Error diagnosis | 9 |
| Safety instructions | 11 |

Ordering code

| | | | | | | |
|--------------|------------|----|----|----|----|-----------|
| | 01 | 02 | 03 | 04 | 05 | 06 |
| BODAS | PR4 | | | | / | 10 |

Type

| | | |
|----|-----------------|------------|
| 01 | Pressure sensor | PR4 |
|----|-----------------|------------|

Measurement range

| | | |
|----|---------------|------------|
| 02 | 0 ... 280 bar | 280 |
| | 0 ... 420 bar | 420 |
| | 0 ... 600 bar | 600 |

Mechanical connection

| | | | | | |
|----|---------------------------------------|------------|------------|------------|----------|
| | | 280 | 420 | 600 | |
| 03 | G1/4 A according to DIN EN ISO 1179-2 | ● | ● | - | G |
| | M14 x 1.5 according to ISO 6149-2 | - | - | ● | M |

Electrical connection

| | | |
|----|---------------|----------|
| 04 | Bosch Compact | B |
|----|---------------|----------|

Supply

| | | | |
|----|-----------|---|-----------|
| 05 | 5 ±0.25 V | 0.5 ... 4.5 V ratiometric (at 5 V supply) | 05 |
|----|-----------|---|-----------|

Output signal

Series

| | | |
|----|--|-----------|
| 06 | | 10 |
|----|--|-----------|

● = Available - = Not available

Available variants

| Type | Material number | | | | | |
|---------------------|------------------------|--|--|-------------|--|--|
| | Bulk pack (136 pieces) | | | Single pack | | |
| PR4 280 G B 05 / 10 | R917C05562 | | | R917A05562 | | |
| PR4 420 G B 05 / 10 | R917C09842 | | | R917A09842 | | |
| PR4 600 M B 05 / 10 | R917C10105 | | | R917A10105 | | |

Description

This sensor is used for measuring pressure in hydraulic circuits. Due to its outstanding characteristics, it is also ideally suited for use in mobile hydraulics: shock and vibration resistance, type of protection, resistance to pressure spikes, resistance to temperature shock, EMC characteristics better than 150 V/m. The measurement principle uses a hermetically welded thin-film measurement cell, which ensures long-term leak resistance. The sensor signal can be directly evaluated by a BODAS controller RC.

Technical data

| Type PR4 | 280 GB05 | 420 GB05 | 600 MB05 |
|--|---|---------------|---------------|
| Measurement range | 0 ... 280 bar | 0 ... 420 bar | 0 ... 600 bar |
| Overload limit ¹⁾ | 400 bar | 560 bar | 800 bar |
| Bursting pressure ²⁾⁴⁾ | 2500 bar | 3750 bar | 5250 bar |
| Output signal | 0.5 V ... 4.5 V, ratiometric (at 5 V supply) | | |
| Supply voltage U_s | 5 V \pm 0.25 V | | |
| Maximum supply voltage | 18 V (maximum 1 h) | | |
| Short circuit signal output to GND or supply voltage | $U_{S, short} = 0 \dots 18$ V, (max. 8 h) in case of simultaneous supply of U_s with $U_{S, short}$ | | |
| Sensor output impedance $R_{\text{differential}}$ at $0.1 U_s < U_{\text{out}} < 0.9 U_s$ | typical: 5 Ω maximum: 10 Ω | | |
| Current consumption | | | |
| Typical at 5V supply voltage | 12 mA | | |
| Maximum without load | ≤ 15 mA | | |
| Maximum at reverse connection | 260 mA | | |
| Connector | Bosch Compact 1.1a | | |
| Parts contacting measuring materials | X5CrNiCuNb16-4 | | |
| Housing material | PBT-GF30/CrNi steel | | |
| Response time (10 ... 90 %) | ≤ 1.0 ms | | |
| Overall accuracy | ≤ 1.5 %, refer to table "tolerance over temperature, pressure and life time" | | |
| Medium temperature range ³⁾ | -40 °C ... $+140$ °C | | |
| Ambient temperature range | -40 °C ... $+100$ °C | | |
| Storage temperature range | -30 °C ... $+60$ °C at 0 ... 80 % relative humidity and 5 years | | |
| Transportation conditions, Conditions deviating from the storage conditions are allowed for the transport: | | | |
| Duration, max. 48 h temperature | -40 °C ... $+80$ °C | | |
| Relative humidity | 0 % ... 80 % | | |
| Service life | 10000 operating hours or 15 years Different values, depending on operational conditions on request | | |
| Pressure cycles over service life | 10 million cycles | | |
| Shock resistance | 50 g (DIN EN 60068-2-27, 11 ms), 500 g (DIN EN 60068-2-27, 1 ms) | | |
| Vibration resistance | | | |
| Amplitude of the deflection | $s = 0.25$ mm in the range 70 Hz ... 147 Hz | | |
| Amplitude of the acceleration | $a = 210$ m/s ² in the range 147 Hz ... 1350 Hz $a = 175$ m/s ² in the range 1350 Hz ... 2000 Hz | | |
| Frequency change | 0.5 octave/min | | |
| Duration of excitation | 100 h in each spatial direction with the same test specimen | | |
| Drop test | Controlled drop from 1 m height onto concrete in accordance with ISO 16750-3. One drop event per axial direction. The component must then be fully functional or visually damaged | | |
| CE conformity | According to EMC directive 2014/30/EU (EN ISO 14982 and EN 13309) | | |
| E1 Type approval | UN ECE 10 Rev4 | | |
| Electromagnetic compatibility EMC | ISO 11452-2, -4, -5 as well as according to IEC 61000 | | |
| BCI up ... 200 mA | open and closed loop according ISO 11452-4 up ... 400 MHz. | | |
| Antenna > 150 V/m | according ISO 11452-2 from 200 MHz - 3.2 GHz | | |
| Electrical protection | Protection from voltage reversal, short circuits and undervoltage; protection from overvoltage in the defined supply voltage range | | |
| Type of protection with installed mating connector | IP67 and IPX9K according to ISO 20653 (2006-08-15) | | |
| Weight approx. | G 1/4: 48 g, M14: 52 g | | |

1) maximum 15 minutes at P_n to P_{max}

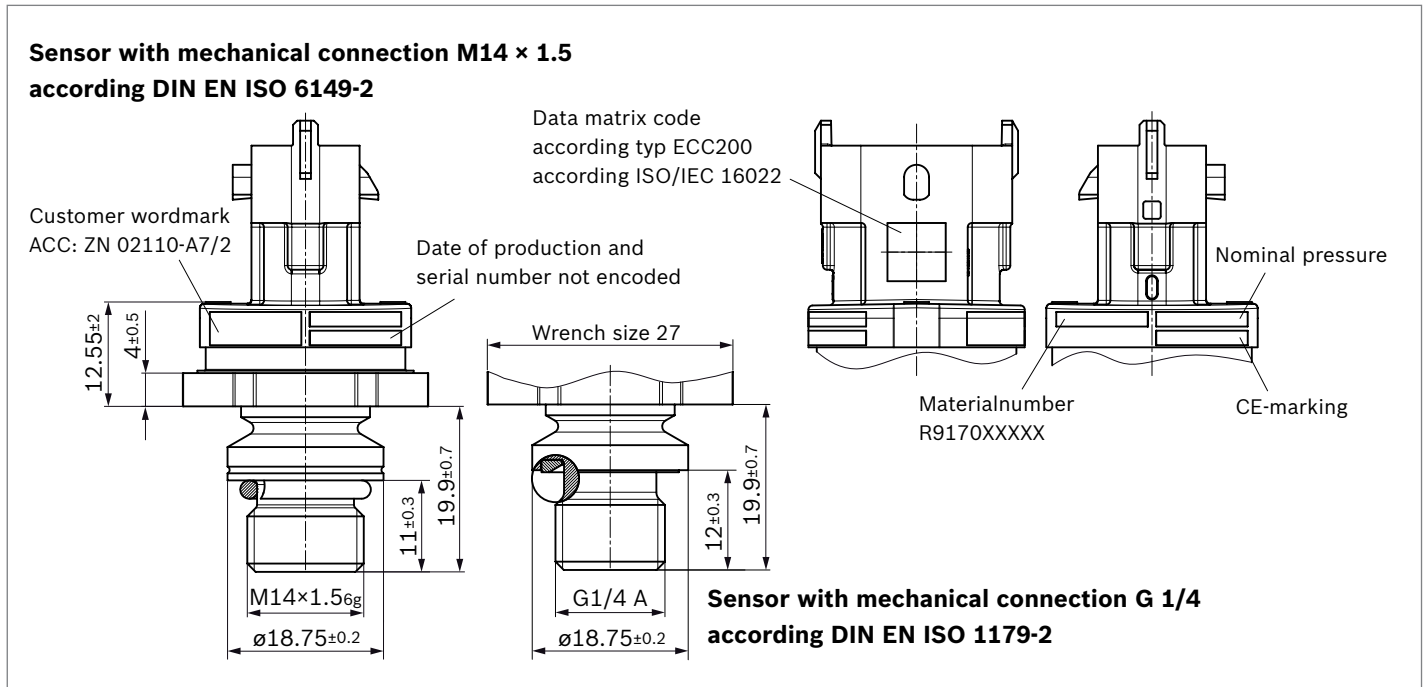
2) maximum 15 minutes at P_n to P_{berst}

3) 150 °C: 250 h over live time

4) The specified bursting pressure is valid for the device only.

This value does not include the mechanical interface - the thread between the sensor and the hydraulic component

Dimensions and labeling



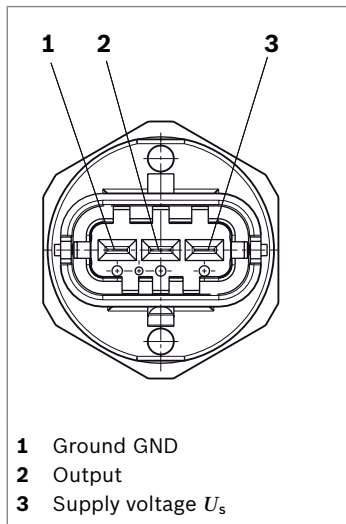
Data matrix code content

| Content | Digits | Count |
|---|--------|-------|
| Start digit | 1 | 1 |
| Customer content material number R917010105 | 2-11 | 10 |
| Year of production | 12-13 | 2 |
| Day of the year | 14-16 | 3 |
| Serial number | 17-21 | 5 |
| Number of production-line | 22 | 1 |

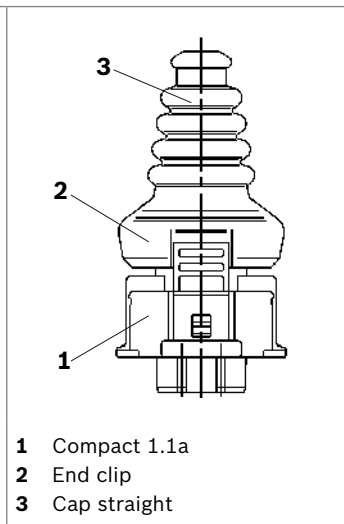
| Content | Digits | Count |
|--------------------------------------|--------|-------|
| Bosch plant number | 23-25 | 3 |
| Last 4 digits from Bosch part-number | 26-30 | 5 |
| Bosch change index | 31-32 | 2 |
| Bosch drawing index | 33-35 | 3 |
| Empty place for CD-free sensor | 36 | 1 |

Connector Bosch Compact

Pin assignment



Assembly example



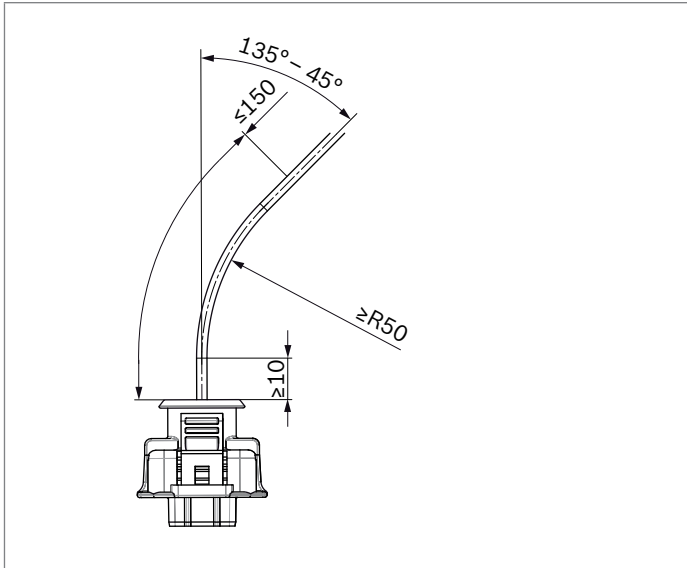
Mating connector¹⁾

Mating connector sets with the following content are available under Rexroth part number R917009890 for the manual assembly of wiring harness connectors for laboratory or small-series requirements:

| Designation | Number | Material number |
|--|--------|-----------------|
| Bosch Compact 1.1a Connector | 1 | 1928403966 |
| BDK Terminal Gold for 18-20 AWG, 0.5-1.0 mm ² | 3 | 1928498054 |
| Bosch compact cap straight | 1 | 1928300527 |
| Single seal, BDK, blue, ROHS | 3 | 1928300599 |
| End clip | 1 | 1928403423 |

¹⁾ The mating connectors are not included in the scope of supply. These are available from Bosch Rexroth under the corresponding material numbers.

Instruction for cable guide



Required tooling²⁾

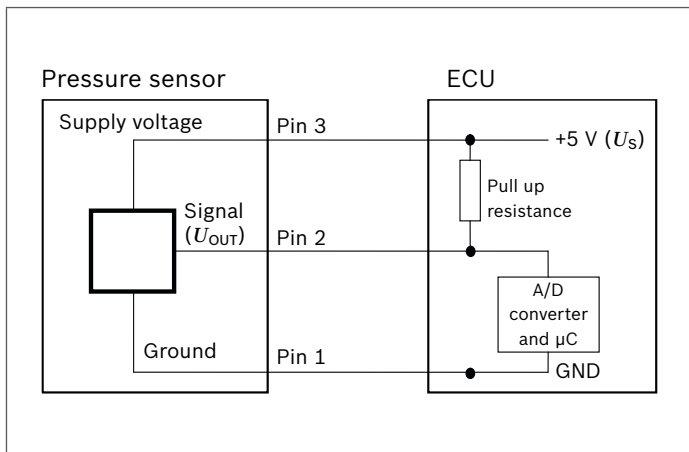
| Designation | Number | Material number |
|---|--------|-----------------|
| Bosch crimping tool for BDK 2.8 terminal 0.5, 0.75, 1.0 sq mm wire | 1 | 1928498161 |
| Bosch terminal extraction tool for BDK 2.8 terminals | 1 | 1928498167 |

Wiring and error diagnostic of the sensor

Recommended wiring of the sensor

The sensor is to be connected to the ECU according to the following wiring diagram and provided with a supply voltage of 5 V.

▼ Sensor wiring in the ECU



Notes regarding assembly

In the assembly of the connectors, respect the assembly instructions for plug connections (Y 928 P00 222) and BDK 2.8 contacts (1 928 F00 025).

These assembly instructions are available on request from Rexroth.

Caution:

In the installation of the connector in the vehicle, observe the following:

The fixation of the cable harness must be done at a distance ≤ 150 mm after the outgoing cable unit at the same vibration level of the sensor.

Electrical connection

- ▶ The device may only be installed by a trained electrician.
- ▶ The national and international specifications regarding the installation of electro-technical systems must be followed.
- ▶ Voltage supply according to SELV, PELV.
- ▶ De-energize the system.

The assignment of the connector pins of the high-pressure sensor is depicted on previous page.

The pressure sensor delivers an analog output signal that has a ratiometric relationship with the supply voltage.

Specification of the pull-up resistor:

| Quantity | Symbol | Value | | | Unit |
|-------------------------------|----------------------|-------|------|------|------------|
| | | min | typ | max | |
| Pull-up resistor as per U_S | $R_{\text{pull-up}}$ | 4.41 | 4.64 | 4.87 | k Ω |

In addition to this, a low-pass filter with a time constant of maximum 0.7 ms is to be provided in the signal path.

The electrical output of the sensor is designed such that malfunctions through cable breaks or short-circuits can be detected with the wiring shown in the representation with a pull-up resistor of 4.64 k Ω $\pm 5\%$ against supply voltage.

²⁾ The tools may be purchased from Bosch dealers or Bosch Service (www.bosch-service.com)

Drawings and further information about Bosch connectors and tools can be found on the internet: www.bosch-connectors.com

Error diagnosis

Diagnostic ranges outside the operating range are provided for the error diagnosis (also see characteristic on page 8).

Since the sensor characteristic of the upper operating range is limited, overpressure conditions can be distinguished from errors.

The coding of the response to an error in the following table is as follows:

0 = no error band and no reset

-1 = lower error band and no reset

-2 = lower error band and reset is triggered

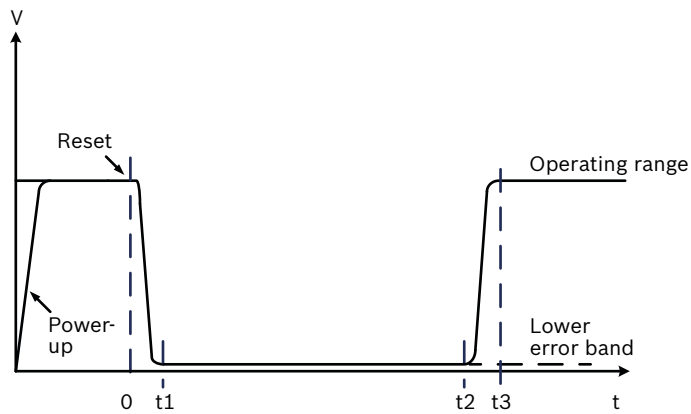
Response of the sensor in case of error

| Error description | Debounce characteristics | Error mode |
|---|--|------------|
| Initialization, P and T not yet available | | -1 |
| Indicates that OTP Bit for final programming at Bosch of OTP Master is not set (lock-bit not set) | error is set immediately, no Reset is triggered | -1 |
| 1) Power-on complete RAM check (Read/Write) beginning of continuous ROM check 2) Online continuous ROM check continuous RAM check RAM/ROM checks DSP by Parity during each Access HW-Check of SignalProcessor (Question/Answer) signature monitoring of program counter | error is set immediately, Reset is triggered | -2 |
| 1) OTP CRC check of boot loading failed 4 times (consecutive) 2) Sum-check on trim data. Test carried out during boot loading and continuous cycle | 1) error is set immediately, Reset is triggered 2) error is set immediately, Reset is triggered | -2 |
| Test on Aquisition Chain Pressure by injection of test signal before ADC on power-up Thresholds are defined during EoL programming at Bosch for each sensor individually | error is set immediately, Reset is triggered | -2 |
| Decimation interval error (Only possible in case of severe hardware malfunction) | no Reset, debouncing next frame | -1 |
| Pressure Sensor element failure (Wiring Detection) | | -2 |
| 1) Power-On Common Mode at Power-On 2) Online Common Mode Current Modulation | 1) error is set immediately, Reset is triggered 2) Reset, debouncing next frame | |
| Signal Input ADC too high, also for Sensor Element Error | no Reset, debouncing next frame | -1 |
| Signal Input ADC too low, also for Sensor Element Error | no Reset, debouncing next frame | -1 |
| Reference temperature input too high or low | no Reset | -1 |
| Failure of internal temperatur sensor --> HW Defects of ADC_T or PTAT itself | no Reset | -1 |
| Low Voltage Supply detection, programmable threshold | no Reset, debouncing next frame | -1 |
| High Voltage Supply detection, programmable threshold | no Reset, debouncing next frame | -1 |

Behavior after reset and initialization

In case of certain errors, a reset is triggered in the sensor. These are then generated every 400 ms. After a reset, and during the subsequent initialization of the sensor, the output is pulled to ground. If the error is still present, the output signal remains in the lower error band. In case, the error is no longer present, the output signal controls its value into the applicable operating range. The course of the output signal and the related typical time at room temperature, after the reset, are shown in diagram below.

▼ **Representation of the time after reset and initialization**



| Typicals [ms] | t1 | t2 | t3 |
|---------------|------|-----|-----|
| CRC OK | 0.03 | 0.9 | 1.1 |
| CRC NOK | 0.03 | 2.1 | 2.3 |

Behavior after undervoltage and overvoltage

In case of undervoltage < 4.75 V or overvoltage > 5.25 V detection, the output is pulled to ground.

Characteristics

Output voltage as function of the pressure

The signal output voltage is (up to the nominal pressure) calculated from the actual pressure as follows:

$$U_{OUT} = (c_1 \cdot p + c_0) \cdot U_S$$

where

U_{OUT} = Signal output voltage

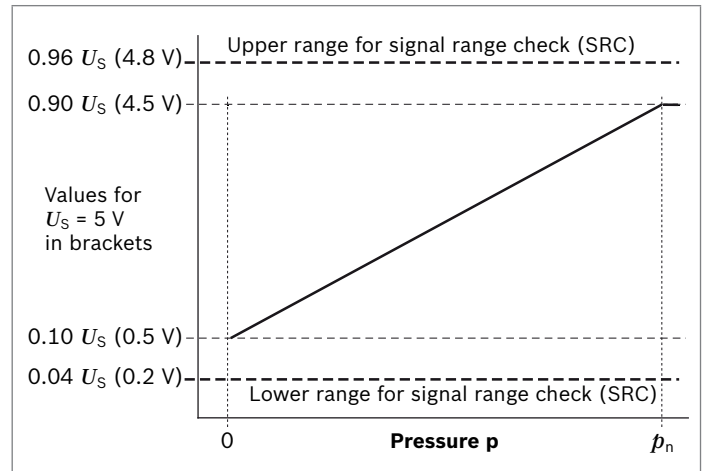
U_S = Supply voltage (typ. 5 V)

p = Pressure [MPa]

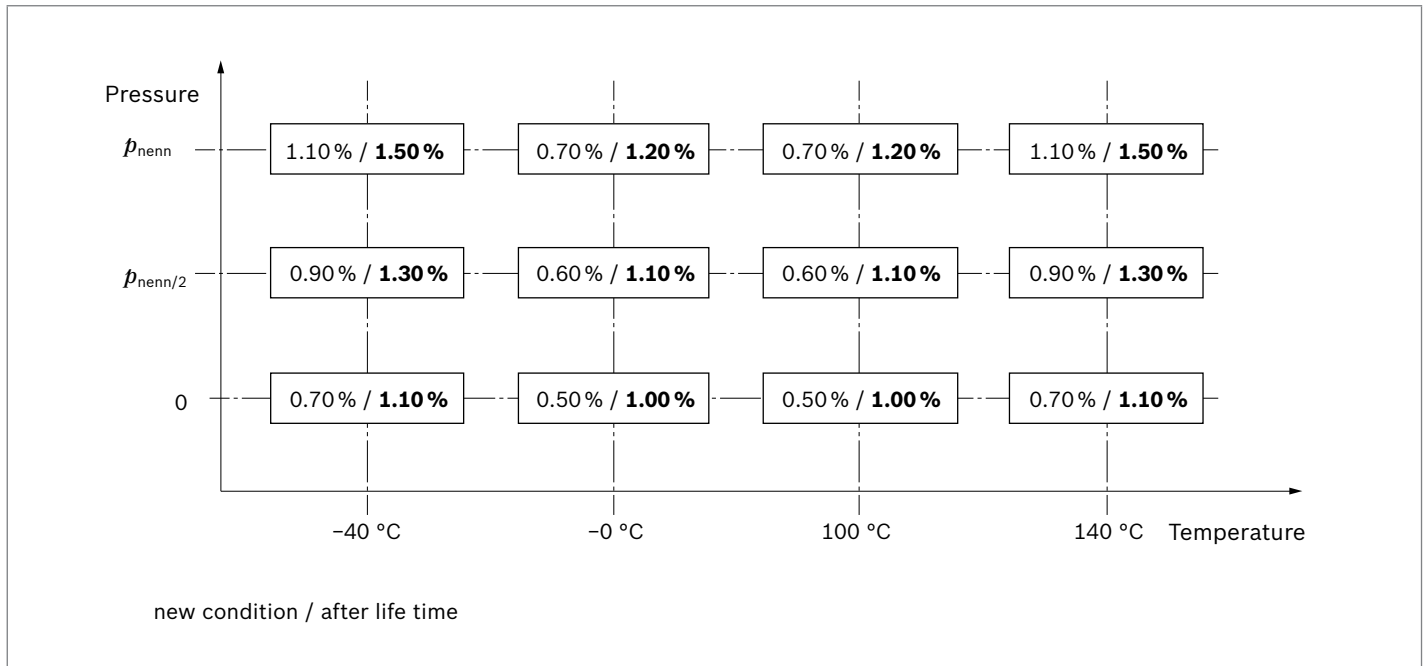
$c_0 = 0.1$

$c_1 = 0.8 : p_n$

p_n = Nominal pressure [MPa]



Tolerance over temperature, pressure and life time



The tolerance for the pressure measurement is given in % FS = "full scale". FS denotes the sensor nominal pressure p_{nenn} or the usable range. The relative tolerance is dependent on the pressure and temperature, and increases over the service lifetime. Here, the service lifetime encompasses the entire lifetime. The tolerances for new parts are statistically observed with 3 s per manufacturing batch. Delivery of 100 % sorted products is permitted. After lifetime the tolerance for new parts can broaden to the values given in the diagram. Here the given tolerances also represent the 3 s limit.

Installation instructions

Mounting

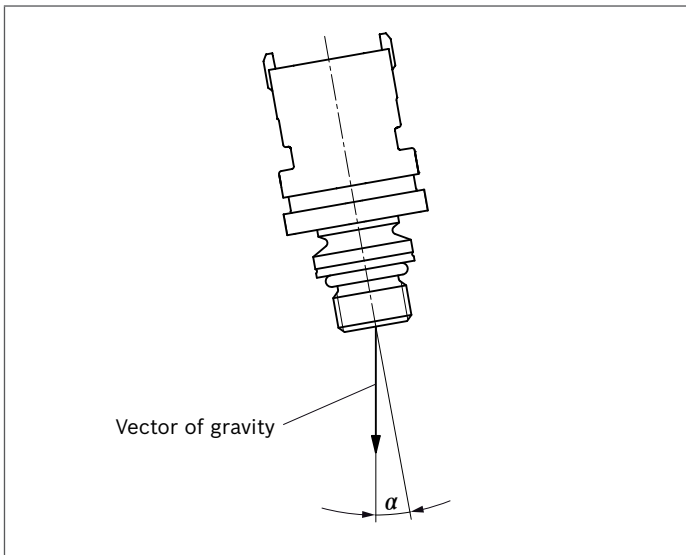
Mounting process of sensor must be ensured by customer by adequate validation.

Rexroth recommends to wet the surface of thread and tightening plane of pressure sensor completely with Oil or Molykote WI5 prior to mounting.

To prevent accumulation of lubricant in the pressure port application of lubricant by spraying while pressure port facing downwards is recommended.

Recommended position $\alpha = \pm 0 \dots 90^\circ$ in all direction from vertical position.

Tightening only permitted with hexagonal socket wrench or with box wrench $\alpha > 90^\circ$.



Mechanical connection

- Before installing and removing the device, make certain that the system is not pressurized.

Tightening torque

Before mounting the PR4 pressure sensor, check the specified tightening torque of the hydraulic pump, motor or valve block.

If the torque for mounting the sensor in the respective hydraulic component is not specified use a torque of 35 ± 5 Nm.

Do not exceed the maximum tightening torque of: 45 Nm.

Operating conditions - temperatures

The sensor is designed for use in hydraulic components (direct motor attachment) and the corresponding ambient temperatures with a typical temperature distribution:

| Temperature | |
|-------------|------|
| -40 °C | 6 % |
| 23 °C | 20 % |
| 85 °C | 65 % |
| 135 °C | 8 % |
| 140 °C | 1 % |

Storage conditions

The pressure sensor is to be stored under the following conditions:

| | |
|---|-------------------|
| Temperature range | -30 °C ... +60 °C |
| Rel. humidity | 0 ... 80 % r. h. |
| Maximum storage duration after the delivery by the Bosch production plant | 5 years |

The sensor has to be kept under dry and dust-free storage conditions. It is important to ensure that there is no contamination due to liquid or solid media in the connector area or on the threaded fitting. Sulfurous atmospheres have to be avoided for silver-plated connector pins.

These storage conditions do not lead to any change in the properties and the functioning of the high-pressure sensor. After the maximum storage duration is exceeded, the sensors must be sent back to Bosch Rexroth AG for inspection or testing.

Transportation conditions

Conditions deviating from the storage conditions are allowed for the transport:

| | |
|-------------------|-------------------|
| Duration | max. 48 h |
| Temperature | -40 °C ... +80 °C |
| Relative humidity | 0 % ... 80 % |

Manufacturer confirmation of PR4 MTTFd-values

The MTTFd-values were determined in accordance with ISO 13849-1:2008-12, Appendix D, Parts Count Method, and the specified temperature profiles below.

| Ambient temperature Control unit [°C] | Self-heating [°C] | Temperature profile, Operating time share [%] | | | | | | |
|--|----------------------|---|-------|------|------|------|------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10 | 10 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 10 | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| 30 | 10 | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 40 | 10 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 50 | 10 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| 60 | 10 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| 70 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 80 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 110 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 120 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 130 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 140 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MTTFd-value [years] with | 4h use per day | 594 | 592 | 589 | 585 | 578 | 569 | 556 |
| | 8h use per day | 371 | 370 | 368 | 365 | 361 | 356 | 347 |
| | 16h use per day | 212 | 212 | 211 | 209 | 207 | 203 | 199 |
| | 24h use per day | 149 | 148 | 147 | 146 | 145 | 142 | 139 |
| MTTFd-value of the printed circuit board | | 15712 | 11362 | 8117 | 5738 | 4010 | 2767 | 1881 |

| Ambient temperature Control unit [°C] | Self-heating [°C] | Temperature profile, Operating time share [%] | | | | | | | |
|--|----------------------|---|-----|-----|-----|-----|-----|-----|-----|
| | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| -40 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 30 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 10 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| 90 | 10 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 | 10 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| 110 | 10 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 120 | 10 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |
| 130 | 10 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| 135 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 140 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 1 |
| MTTFd-value [years] with | 4h use per day | 536 | 508 | 468 | 416 | 351 | 280 | 209 | 486 |
| | 8h use per day | 335 | 317 | 293 | 260 | 220 | 175 | 131 | 304 |
| | 16h use per day | 192 | 182 | 167 | 149 | 126 | 100 | 75 | 174 |
| | 24h use per day | 134 | 127 | 117 | 104 | 88 | 70 | 52 | 122 |
| MTTFd-value of the printed circuit board | | 1258 | 826 | 534 | 339 | 212 | 131 | 80 | 641 |

Safety instructions

General instructions

- ▶ Before finalizing your design, request a binding installation drawing.
- ▶ The proposed circuits do not imply any technical liability for the system on the part of Bosch Rexroth.
- ▶ It is not permissible to open the sensor or to modify or repair the sensor. Modifications or repairs to the wiring could result in dangerous malfunctions.
- ▶ Only allow pressure measurement devices to be installed by trained and specialist personnel who are authorized by the system owner.
- ▶ Connections must only be opened while in a depressurized state!
- ▶ System developments, installation and commissioning of electronic systems for controlling hydraulic drives must only be carried out by trained and experienced specialists who are sufficiently familiar with both the components used and with the complete system.
- ▶ While commissioning the sensor, the machine may pose unforeseen dangers. Before commissioning the system, you must therefore ensure that the vehicle and the hydraulic system are in a safe condition.
- ▶ Make sure that nobody is in the machine's danger zone.
- ▶ No defective or incorrectly functioning components may be used. If the sensor should fail or demonstrate faulty operation, it must be replaced.
- ▶ Residual measurement materials in unmounted pressure measurement devices could endanger people, the environment and equipment. Take appropriate precautionary measures.
- ▶ In spite of taking great care in preparing this document, all conceivable application cases could not be taken into account. If information is lacking for your specific application, please contact Bosch Rexroth.

Notes on the installation location and position

- ▶ Do not install the sensor close to parts that generate considerable heat (e.g. exhaust).
- ▶ Wires are to be routed with sufficient distance from hot or moving vehicle parts.
- ▶ A sufficiently large distance to radio systems must be maintained.
- ▶ The connector of the sensor is to be unplugged during electrical welding and painting operations.
- ▶ Electrostatic painting of the sensor is not allowed (hazard: ESD damage).

- ▶ Cables/wires must be sealed individually to prevent water from entering the device.
- ▶ Make sure, by appropriate installation of the sensor, that no water is gathering the sensor measuring element. This might result to a malfunction of the measuring signal (freezing condition, in worst case: crack of measuring element).

Notes on transport and storage

- ▶ Please inspect the device for any damages which may have occurred during transport. If there are obvious signs of damage, please immediately inform the transport company and Bosch Rexroth.
- ▶ If it is dropped, the sensor must not be used any longer as invisible damage could have a negative impact on reliability.

Notes on wiring and circuitry

- ▶ Use twisted pair wires to connect the pressure sensor.
- ▶ Use short wires to avoid voltage drop along the lines and choose wires with bigger gauge in case of longer distances between the sensor and the electronic.
- ▶ We recommend to use shielded wire to increase the signal quality. Connect the shield on one side, either to the machine or the vehicle ground or to the electronic via a short low resistance connection.
- ▶ The mating connector of the sensor must not be plugged or unplugged, if the electrical system of the machine is energized.
- ▶ The sensor wires are sensitive to radiation interference. For this reason, the following measures should be taken when operating the sensor:
 - Sensor wires should be attached as far away as possible from large electric machines.
 - If the signal requirements are satisfied, it is possible to extend the sensor cable.
- ▶ Wires from the sensor to the electronics must not be routed close to other power-conducting lines in the machine or vehicle.
- ▶ The wiring harness should be fixated mechanically in the area in which the sensor is installed (spacing < 150 mm). The wiring harness should be fixated so that in-phase excitation with the sensor occurs (e.g. at the sensor mounting points).
- ▶ If possible, wires should be routed in the vehicle interior. If the wires are routed outside the vehicle, make sure that they are securely fixed.

- ▶ Wires must not rub against edges and must not be routed through sharp-edged ducts without protection.
- ▶ Bosch Rexroth warranty will cover the function of the connector system only in the case of combination with harness connector system parts according to this data sheet.
- ▶ Use only the appropriate tooling to crimp and mount the mating connector.

Attention:

Use harness connector for protection against water ingress.

- ▶ First cable mounting point max. 150 mm after the plug (straight cable length). It must be located on the sensor carrier.
- ▶ Angle of bending the cable (deviation from straight line) between cable exit at sensor and first mounting point, 20° ... 90°.
- ▶ Admissible bending radius of the cable up to the first cable mounting point: $R \geq 50$ mm.
- ▶ Installation instructions see also corresponding offer drawing.

Intended use

- ▶ The sensor is designed for use in mobile working machines provided no limitations/restrictions are made to certain application areas in this data sheet.
- ▶ Prior to installation, commissioning and operation, make certain that the correct pressure measurement device was selected with respect to measurement range, design and – based on the specific measurement conditions – parts which are in contact with measuring materials (corrosion). Furthermore, the respective national safety regulations are to be observed.
- ▶ Operation of the sensor must generally occur within the operating ranges specified and released in this data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- ▶ If required, install a throttle, that limit possible pressure peaks. Attention should be also paid to side effects e.g. cavitation. Ensure that there will be no cavitation in any point of operation.

- ▶ Use outside of the specified and released boundary conditions may result in danger to life and/or cause damage to components which could result in consequential damage to the mobile working machine.
- ▶ Failure to observe the respective specifications may result in serious bodily injury and/or property damage.

Improper use

- ▶ Any use of the sensor other than that described in chapter “Intended use” is considered to be improper.
- ▶ Use in explosive areas is not permissible.
- ▶ Damages which result from improper use and/or from unauthorized, interference in the component not described in this data sheet render all warranty and liability claims with respect to the manufacturer void.

Use in safety-related functions

- ▶ The customer is responsible for performing a risk analysis of the mobile working machine and determining the possible safety-related functions.
- ▶ In safety-related applications, the customer is responsible for taking suitable measures for ensuring safety (sensor redundancy, plausibility check, emergency switch, etc.).
- ▶ Product data that is necessary to assess the safety of the machine can be provided on request or are listed in this data sheet.

Further information

- ▶ Further information about the sensor can be found at www.boschrexroth.com/mobile-electronics.
- ▶ The sensor must be disposed according the national regulations of your country.

Bosch Rexroth AG
Mobile Applications
Robert-Bosch-Straße 2
71701 Schwieberdingen, Germany
Tel. +49 93 52 40 50 60
info.bodas@boschrexroth.de
www.boschrexroth.com

© Bosch Rexroth AG 2017. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights. The data specified within only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.