

# BODAS Pressure sensor PR4



- ▶ Thin-film measurement principle
- ▶ Measuring ranges 0 to 50 bar, 0 to 100 bar, 0 to 280 bar, 0 to 400 bar, 0 to 420 bar, 0 to 480 bar, 0 to 600 bar
- ▶ Output signal 0.5 to 4.5 V ratiometric at supply voltage 5 V or SENT according to SAE J2716 JAN 2010
- ▶ Protection class IP67 / IP69K

## Features

- ▶ Tightening torque up to 55 Nm
- ▶ High shock and vibration resistance
- ▶ High resistance to pressure peaks
- ▶ Very good temperature shock resistance
- ▶ High accuracy over the complete measuring range
- ▶ Compact robust construction
- ▶ Available electrical connections:
  - AMP Superseal 1.5
  - Bosch Kompakt 1.1a
  - Deutsch DT04-3P
  - Trapez
- ▶ CE conformity

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### Type code

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

#### Type

|    |                 |            |
|----|-----------------|------------|
| 01 | Pressure sensor | <b>PR4</b> |
|----|-----------------|------------|

#### Measuring range

|    |               |            |
|----|---------------|------------|
| 02 | 0 ... 50 bar  | <b>050</b> |
|    | 0 ... 100 bar | <b>100</b> |
|    | 0 ... 280 bar | <b>280</b> |
|    | 0 ... 400 bar | <b>400</b> |
|    | 0 ... 420 bar | <b>420</b> |
|    | 0 ... 480 bar | <b>480</b> |
|    | 0 ... 600 bar | <b>600</b> |

#### Mechanical connection

|    |                                           | 050 | 100 | 280 | 400 | 420 | 480 | 600 |           |
|----|-------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----------|
| 03 | G 1/4 A in according to DIN EN ISO 1179-2 | ●   | ●   | ●   | –   | ●   | –   | ●   | <b>G</b>  |
|    | M14 x 1.5 according to ISO 6149-2         | –   | –   | –   | ●   | –   | ●   | ●   | <b>M</b>  |
|    | 7/16-20 UNF according to SAE J 1926-1     | –   | –   | ●   | –   | ●   | –   | ●   | <b>U7</b> |
|    | 9/16-18 UNF according to SAE J 1926-1     | –   | –   | ●   | –   | ●   | –   | ●   | <b>U9</b> |

#### Electrical connection

|    |                                                           | 050 | 100 | 280 | 400 | 420 | 480 | 600 |           |
|----|-----------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----------|
| 04 | AMP Superseal 1.5                                         | ●   | –   | ●   | –   | ●   | –   | ●   | <b>A</b>  |
|    | Bosch Compact 1.1a; <b>code 1</b>                         | ●   | ●   | ●   | ●   | ●   | ●   | ●   | <b>B</b>  |
|    | Bosch Compact 1.1a; <b>code 2</b> (potted connector base) | –   | –   | –   | –   | –   | –   | ●   | <b>SB</b> |
|    | DEUTSCH DT04-3P                                           | ●   | –   | ●   | –   | ●   | –   | ●   | <b>D</b>  |
|    | Trapeze                                                   | –   | –   | –   | –   | –   | –   | ●   | <b>T</b>  |

#### Output signal

|    |                                             | 050 | 100 | 280 | 400 | 420 | 480 | 600 |           |
|----|---------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----------|
| 05 | 0.5 ... 4.5 V ratiometric (at 5±0 V supply) | ●   | ●   | ●   | ●   | ●   | –   | ●   | <b>05</b> |
|    | SENT according to SAE J2716 JAN 2010        | ●   | –   | ●   | –   | ●   | ●   | ●   | <b>SE</b> |

#### Series

|    |  |           |
|----|--|-----------|
| 06 |  | <b>10</b> |
|----|--|-----------|

● = Available    – = Not available

Available variants<sup>1)</sup>

| Type (with AMP Superseal 1.5 connection <sup>3)</sup> ) | Material number<br>Bulk pack (136 pieces) | Single pack |
|---------------------------------------------------------|-------------------------------------------|-------------|
| PR4 050 G A 05/10                                       | R917C13938                                | R917A13938  |
| PR4 050 G A SE/10                                       | R917C13939                                | R917A13939  |
| PR4 280 G A 05/10                                       | R917C13940                                | R917A13940  |
| PR4 280 G A SE/10                                       | R917C13941                                | R917A13941  |
| PR4 420 G A 05/10                                       | R917C13942                                | R917A13942  |
| PR4 420 G A SE/10                                       | R917C13943                                | R917A13943  |
| PR4 600 M A 05/10                                       | R917C13944                                | R917A13944  |
| PR4 600 M A SE/10                                       | R917C13945                                | R917A13945  |

| Type (with Bosch Compact 1.1a; code 1 connection) | Material number<br>Bulk pack (136 pieces) | Single pack |
|---------------------------------------------------|-------------------------------------------|-------------|
| PR4 050 G B 05/10 <sup>2)</sup>                   | R917C11189                                | R917A11189  |
| PR4 050 G B SE/10                                 | R917C11574                                | R917A11574  |
| PR4 100 G B 05/10 <sup>2)</sup>                   | R917C12392                                | R917A12392  |
| PR4 280 G B 05/10 <sup>2)</sup>                   | R917C05562                                | R917A05562  |
| PR4 280 G B SE/10                                 | R917C10997                                | R917A10997  |
| PR4 280 U7 B 05/10                                | R917C12991                                | R917A12991  |
| PR4 280 U7 B SE/10                                | R917C12997                                | R917A12997  |
| PR4 280 U9 B 05/10                                | R917C12990                                | R917A12990  |
| PR4 280 U9 B SE/10                                | R917C12994                                | R917A12994  |
| PR4 400 M B 05/10 <sup>2)</sup>                   | R917C12355                                | R917A12355  |
| PR4 420 G B 05/10 <sup>2)</sup>                   | R917C09842                                | R917A09842  |
| PR4 420 G B SE/10 <sup>2)</sup>                   | R917C11558                                | R917A11558  |
| PR4 420 U7 B 05/10                                | R917C12842                                | R917A12842  |
| PR4 420 U7 B SE/10                                | R917C12996                                | R917A12996  |
| PR4 420 U9 B 05/10                                | R917C12843                                | R917A12843  |
| PR4 420 U9 B SE/10                                | R917C12993                                | R917A12993  |
| PR4 480 M B SE/10 <sup>2)</sup>                   | R917C11816                                | R917A11816  |
| PR4 600 G B SE/10                                 | R917C16709                                | R917A16709  |
| PR4 600 M B 05/10 <sup>2)</sup>                   | R917C10105                                | R917A10105  |
| PR4 600 M B SE/10 <sup>2)</sup>                   | R917C11550                                | R917A11550  |
| PR4 600 U7 B 05/10                                | R917C12844                                | R917A12844  |
| PR4 600 U7 B SE/10                                | R917C12995                                | R917A12995  |
| PR4 600 U9 B 05/10 <sup>2)</sup>                  | R917C12845                                | R917A12845  |
| PR4 600 U9 B SE/10 <sup>2)</sup>                  | R917C12992                                | R917A12992  |

| Type (with Bosch Compact 1.1a; code 2 connection) | Material number<br>Bulk pack (136 pieces) | Single pack |
|---------------------------------------------------|-------------------------------------------|-------------|
| PR4 600 M SB 05/10                                | R917C11817                                | R917A11817  |

1) Further variants (incl. different electric connectors AK 3-pole code B, AK-Kostal 3-pole code A, Delphi Packard 3-pole code B, MLK 3-pole code B) on request

2) Preferred program for axial piston units

3) SOP 03 to 09 / 2025

| Type (with DEUTSCH DT04-3P connection) <sup>1)</sup> | Material number<br>Bulk pack (136 pieces) | Single pack |
|------------------------------------------------------|-------------------------------------------|-------------|
| PR4 050 G D 05 / 10                                  | R917C13930                                | R917A13930  |
| PR4 050 G D SE / 10                                  | R917C13931                                | R917A13931  |
| PR4 280 G D 05 / 10                                  | R917C13932                                | R917A13932  |
| PR4 280 G D SE / 10                                  | R917C13933                                | R917A13933  |
| PR4 280 U7 D 05 / 10                                 | R917C13917                                | R917A13917  |
| PR4 280 U7 D SE / 10                                 | R917C13920                                | R917A13920  |
| PR4 280 U9 D 05 / 10                                 | R917C13923                                | R917A13923  |
| PR4 280 U9 D SE / 10                                 | R917C13927                                | R917A13927  |
| PR4 420 G D 05 / 10                                  | R917C13934                                | R917A13934  |
| PR4 420 G D SE / 10                                  | R917C13935                                | R917A13935  |
| PR4 420 U7 D 05 / 10                                 | R917C13918                                | R917A13918  |
| PR4 420 U7 D SE / 10                                 | R917C13921                                | R917A13921  |
| PR4 420 U9 D 05 / 10                                 | R917C13924                                | R917A13924  |
| PR4 420 U9 D SE / 10                                 | R917C13928                                | R917A13928  |
| PR4 600 G D 05 / 10                                  | R917C16708                                | R917A16708  |
| PR4 600 M D 05 / 10                                  | R917C13936                                | R917A13936  |
| PR4 600 M D SE / 10                                  | R917C13937                                | R917A13937  |
| PR4 600 U7 D 05 / 10                                 | R917C13919                                | R917A13919  |
| PR4 600 U7 D SE / 10                                 | R917C13922                                | R917A13922  |
| PR4 600 U9 D 05 / 10                                 | R917C13925                                | R917A13925  |
| PR4 600 U9 D SE / 10                                 | R917C13929                                | R917A13929  |

| Type (with trapeze connection) | Material number<br>Bulk pack (136 pieces) | Single pack |
|--------------------------------|-------------------------------------------|-------------|
| PR4 600 M T 05 / 10            | R917C12804                                | R917A12804  |

1) SOP between August 2024 and September 2025 depending on material number

Product description PR4 xxx xx 05/10

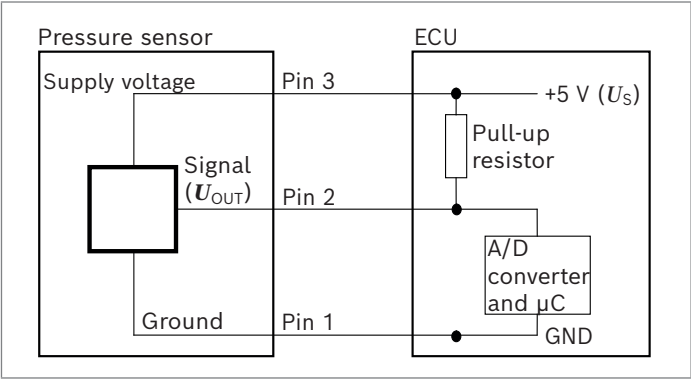
This sensor is used for measuring pressure in hydraulic circuits. Due to its outstanding characteristics, it is also ideally suited for use in mobile hydraulics: Shock and vibration resistance, type of protection, resistance to pressure spikes, resistance to temperature shock, EMC characteristics better than 150 V/m. A resistance bridge is applied on a steel membrane using thin-film technology. 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.

Wiring of the sensor PR4 xxx xx 05/10

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



The allocation of the pins of the high-pressure sensor can be found in the chapter “Pin assignment”. The pressure sensor either delivers an analog output signal, which has a radiometric relation to the supply voltage, or a digital output signal.

Specification recommendation:

In the signal path of the control unit, a pull-up resistor of 4.64 kΩ± 5% against  $U_s$  as well as a low-pass filter with a time constant of max. 0.7 ms should be provided. The electric output of the sensor is designed in such a way that any malfunction due to cable breaks or short-circuits in the displayed wiring can be detected. Other circuitries are possible, the diagnosis function may, however, be limited

Resistor information

| Designation                                    | Value   |         |         |
|------------------------------------------------|---------|---------|---------|
|                                                | Minimum | Typical | Maximum |
| Pull-up resistor to $U_s$ $R_{\text{Pull-up}}$ | 4.41 kΩ | 4.64 kΩ | 4.87 kΩ |

Characteristics of the sensor PR4 xxx xx 05/10

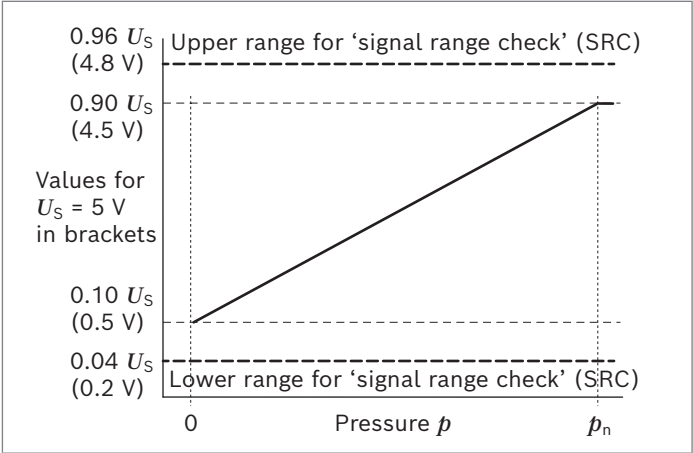
Output voltage as function of the pressure

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

$$U_{\text{OUT}} = (c_1 \times p + c_0) \times U_s$$

- Key
- $U_{\text{OUT}}$  Signal output voltage
  - $U_s$  Supply voltage (typical 5 V)
  - $p$  Pressure [MPa]
  - $c_0$  = 0.1
  - $c_1$  = 0.8/ $p_n$
  - $p_n$  Nominal pressure [MPa]

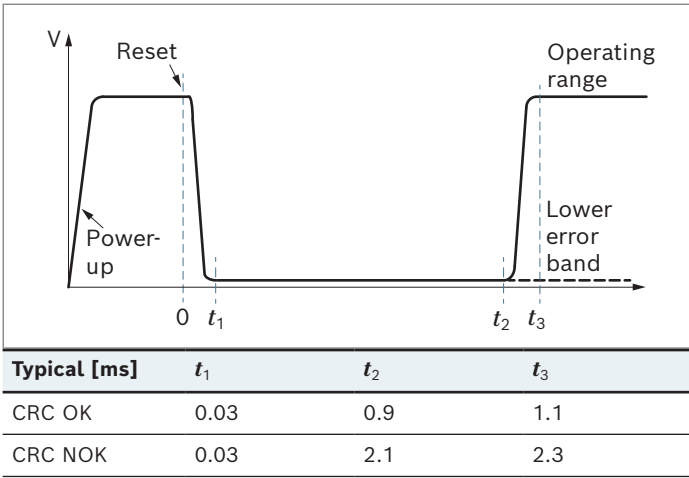
▼ Signal output voltage  $U_{\text{OUT}}$



Behavior after reset and initialization for the sensor PR4 xxx xx 05/10

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



Behavior after undervoltage and overvoltage of the sensor PR4 xxx xx 05/10

In case of undervoltage or overvoltage detection, the output is drawn to ground.

Behavior after connection failures PR4 xxx xx 05/10

| Error description                                 | Sensor output $U_{out}$        |
|---------------------------------------------------|--------------------------------|
| Short circuit of $U_{out}$ and $U_s$              | Upper error band <sup>1)</sup> |
| Short circuit of $U_{out}$ and GND                | Lower error band <sup>1)</sup> |
| Short circuit of $U_s$ and GND                    | Upper error band <sup>1)</sup> |
| Connector/ wire break of $U_s$ , GND or $U_{out}$ | Upper error band <sup>1)</sup> |

Error diagnosis for the sensor PR4 xxx xx 05/10

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 “Response of the sensor in case of error” 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

1) Result with a pull up resistor as suggested in the circuit diagram “Sensor wiring in the ECU” page 2

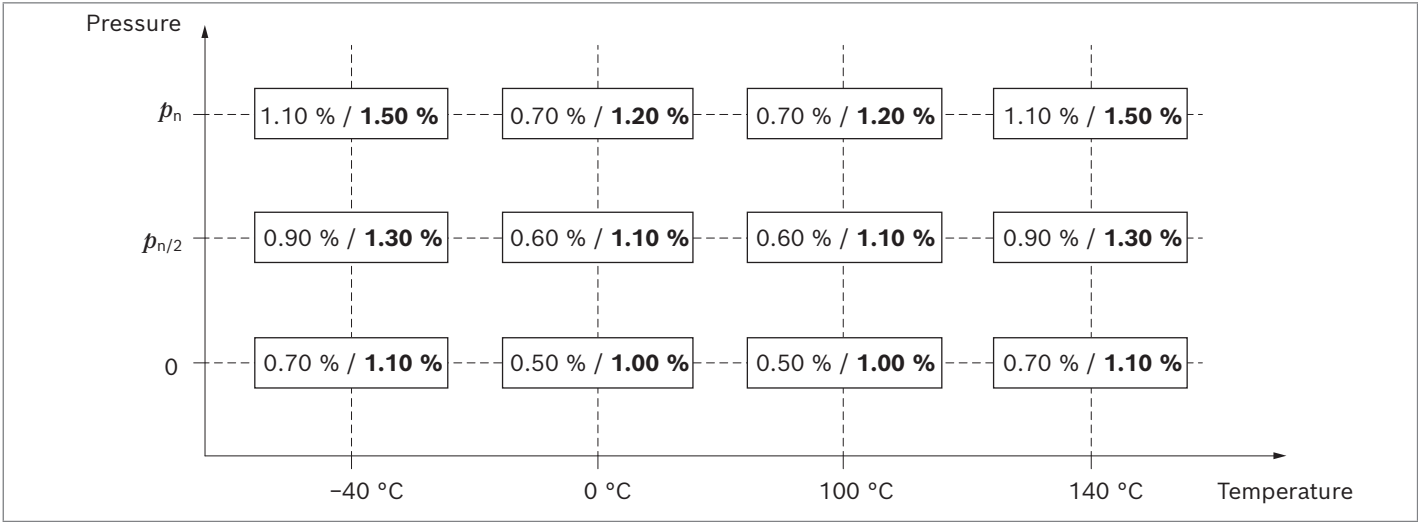
## Response of the sensor in case of error

| Error description                                                                                                                                                                                                   | Debounce characteristics                           | Error mode |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------|
| Initialization, $p$ (pressure) and $T$ (temperature) 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,<br>No reset is triggered | -1         |
| 1) Power-on<br>Complete RAM check (Read/Write)<br>Beginning of continuous ROM check                                                                                                                                 |                                                    |            |
| 2) Normal operation<br>Continuous ROM check<br>Continuous RAM check<br>RAM/ROM checks DSP by Parity during each Access<br>HW-Check of Signal Processor (Question/Answer)<br>Signature monitoring of program counter | Error is set immediately,<br>Reset is triggered    | -2         |
| 1) OTP CRC check of boot loading failed 4 times (consecutive)                                                                                                                                                       | 1) Error is set immediately,<br>Reset is triggered | -2         |
| 2) Sum-check on trim data. Test carried out during boot loading and continuous normal cycle                                                                                                                         | 2) Error is set immediately,<br>Reset is triggered |            |
| Test on Acquisition Chain Pressure by injection of test signal before ADC on power-up<br>Thresholds are defined during EoL programming at Bosch for each sensor individually.                                       | Error is set immediately,<br>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)                                                                                                                                                                  |                                                    |            |
| 1) Power-On<br>Common Mode at Power-On                                                                                                                                                                              | 1) Error is set immediately,<br>Reset is triggered | -2         |
| 2) Normal operation<br>Common Mode<br>Current Modulation                                                                                                                                                            | 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 temperature sensor --> HW Defects of ADC or PTAT itself                                                                                                                                         | No reset                                           | -1         |
| Supply voltage too low Below the programmed threshold                                                                                                                                                               | No reset, debouncing next frame                    | -1         |
| Supply voltage too high Above the programmed threshold                                                                                                                                                              | No reset, debouncing next frame                    | -1         |

Tolerances of the PR4 xxx xx 05/10 sensor

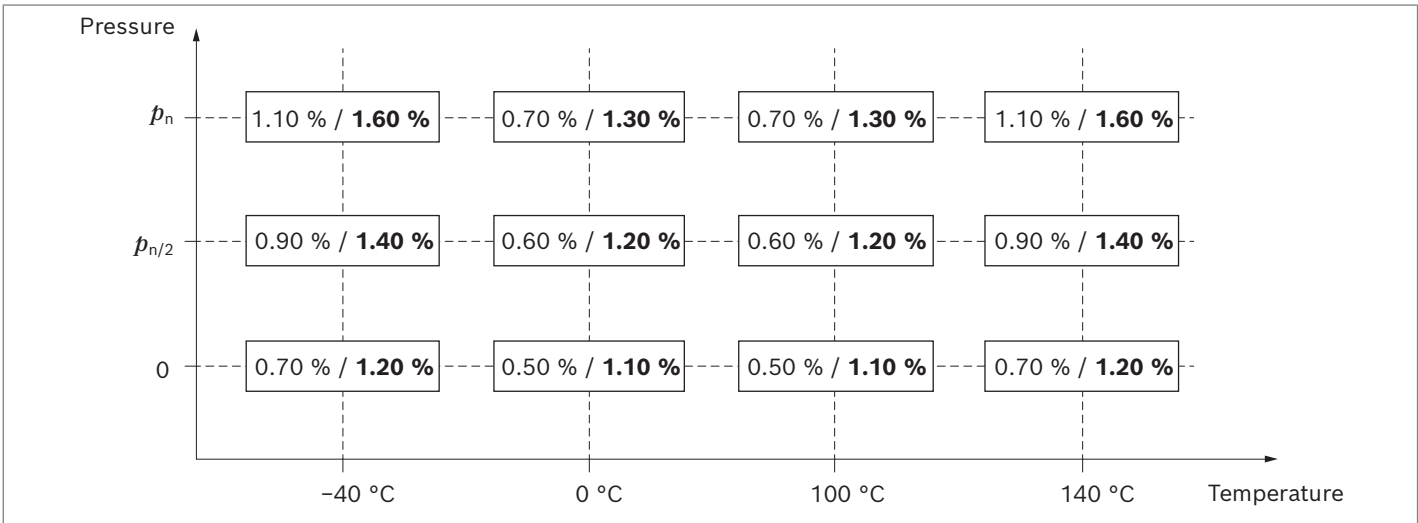
The tolerance of the pressure measurement is specified in % FS. FS = “full scale” refers to the nominal sensor pressure  $p_n$  usable range (4 V). The relative tolerance is pressure- and temperature-dependent and increases over the service life. In this connection, the service life comprises the entire specified service life respectively all specified tests. Statistically, the tolerances for new parts are observed with  $\pm 3\sigma$  per production lot. 100% sorted products may be delivered. After the service life, the tolerance range of the new parts may expand to the values highlighted in the diagram; here, the  $3\sigma$  limit is in turn located maximally at the indicated tolerance limit.

▼ Version 050 bar / 280 bar / 420 bar / 480 bar / 600 bar



New condition unmounted / after life time

▼ Version 100 bar / 400 bar



New condition unmounted / after life time



## Product description PR4 xxx xx SE/10

### Wiring of sensor PR4 xxx xx SE/10

The sensor is to be switched by the control unit according to the SENT specification SAE J2716 JAN 2010 and supplied with a supply voltage of 5 V.

The assignment of the sensor connector pins of the high-pressure sensor deviates from the SENT standard as described in chapter “Pin Assignment”.

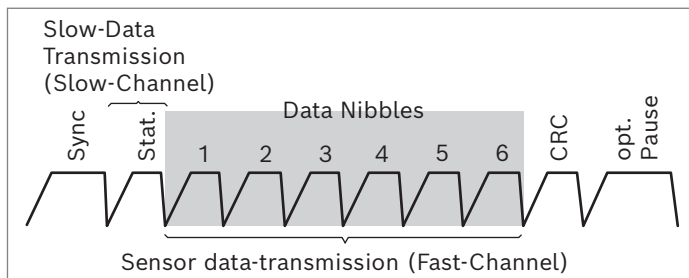
### Sensor characteristics PR4 xxx xx SE/10 and SENT protocol description

#### SENT configuration for PR4 sensor

The PR4 xxx xx SE/10 output setting, according to the SAE J2716 JAN 2010 standard is:  $p/T$ .

With the data nibbles 1-3 the SENT signal transmits a 12-bit data value “Fast-Channel 1” (pressure).

With the data nibbles 4-6 the SENT signal transmits a 12-bit data value “Fast-Channel 2” (temperature).



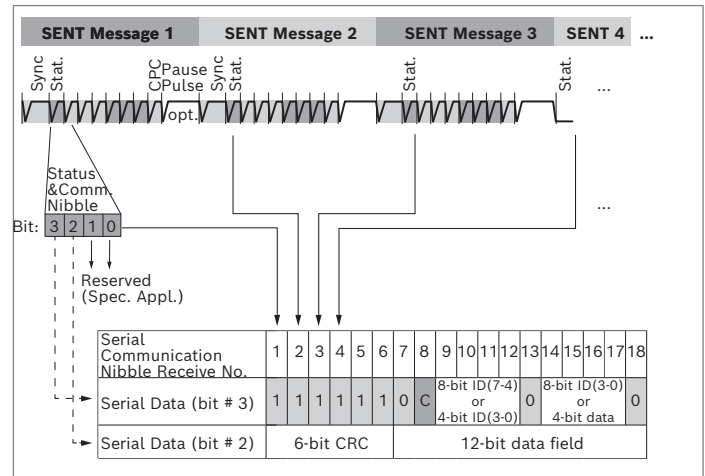
#### Serial communication/Slow-Channel/Slow-Data

PR4 uses the “Enhanced Serial Message” format with 8-bit MsgID and 12-bit Data (config bit C=0).

In order to compose serial messages in enhanced format, two bit of each SENT message are beeing used. 18

consecutive error-free SENT messages are required to compose one serial message.

#### ▼ Set-up of the extended serial message from 18 sent messages



In the “slow-channel/slow-data”, characteristic sensor data like coefficients, parameters, error information messages, OEM data, and so on are transmitted.

**The sensor is delivered with the following settings:**

("Configuration Shorthand" according to J2716 JAN 2010)

|                                                               | <b>050</b><br><b>PR4 xxx xx SE/10</b>                                         | <b>280</b><br><b>PR4 xxx xx SE/10</b>               | <b>420</b><br><b>PR4 xxx xx SE/10</b>               | <b>480</b><br><b>PR4 xxx xx SE/10</b>               | <b>600</b><br><b>PR4 xxx xx SE/10</b>               |
|---------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Pressure offset (P2) /<br>Nominal pressure (P3) <sup>1)</sup> | 0 bar in the mode<br>relative pressure /<br>050 bar                           | 0 bar in the mode<br>relative pressure /<br>280 bar | 0 bar in the mode<br>relative pressure /<br>420 bar | 0 bar in the mode<br>relative pressure /<br>480 bar | 0 bar in the mode<br>relative pressure /<br>600 bar |
| Maximal pressure for error - flag                             | 62.5 bar±5%                                                                   | 350 bar±5%                                          | 525 bar±5%                                          | 600 bar±5 %                                         | 750bar±5%                                           |
| Sensor type                                                   | <i>p / T</i>                                                                  |                                                     |                                                     |                                                     |                                                     |
| Tick length                                                   | 3 µs                                                                          |                                                     |                                                     |                                                     |                                                     |
| Bandwidth                                                     | Minimum: 470 Hz<br>Nominal: 523 Hz<br>Maximum: 575 Hz                         |                                                     |                                                     |                                                     |                                                     |
| Latency                                                       | Minimum: 1.13 ms<br>Nominal: 1.25 ms<br>Maximum: 1.4 ms                       |                                                     |                                                     |                                                     |                                                     |
| Variable frame length                                         | No                                                                            |                                                     |                                                     |                                                     |                                                     |
| Maximal temperature for error - flag                          | 160 °C typically ±20 Kelvin (full functionality only guaranteed up to 140 °C) |                                                     |                                                     |                                                     |                                                     |
| Number of data nibbles                                        | 6                                                                             |                                                     |                                                     |                                                     |                                                     |
| Pause pulse                                                   | Yes ("constant frame length")                                                 |                                                     |                                                     |                                                     |                                                     |
| Serial protocol                                               | "Enhanced Serial Protocol" with 8 bit ID and 12 bit data                      |                                                     |                                                     |                                                     |                                                     |
| Fast-Channel 1                                                | Pressure 12 bit                                                               |                                                     |                                                     |                                                     |                                                     |
| Fast-Channel 2                                                | Temperature 12 bit                                                            |                                                     |                                                     |                                                     |                                                     |
| Length of one Fast-Data Message                               | 0.846 ms±10%                                                                  |                                                     |                                                     |                                                     |                                                     |
| Length of one Slow-Data Message<br>(18 Fast-Data Messages)    | 15.2 ms±10%                                                                   |                                                     |                                                     |                                                     |                                                     |
| 8 Slow-Data Messages (Diag)                                   | 121.6 ms±10%                                                                  |                                                     |                                                     |                                                     |                                                     |
| All 32 Slow-Data Messages                                     | 486.4 ms±10%                                                                  |                                                     |                                                     |                                                     |                                                     |

**Transfer function of the signals of the sensor**

**PR4 xxx xx SE/10**

**Transfer function pressure measurement signal**

The measured pressure is transmitted as a digital value according to the SENT specification SAE J2716 JAN 2010 according to the following function in Fast-Channel 1 (measured values are contained in the Fast-Channel). The coefficients and other values are transmitted in the Slow-Channel, refer to the see "SENT-Slow-Channel Messages Order, meaning and values" chapter.

▼ **Measured pressure**

$$p_{\text{ist}} = \frac{p_{\text{OUT,code}} - c_0}{k}$$

▼ **Transfer function pressure**

$$p_{\text{OUT,code}} = k \times p + c_0$$

$$k = \frac{(Y_2 - Y_1)}{(X_2 - X_1)} = \frac{(C_3 - C_2)}{(P_3 - P_2)}$$

$$c_0 = Y_1 - \frac{(Y_2 - Y_1)}{(X_2 - X_1)} \times X_1 = C_2 - \frac{(C_3 - C_2)}{(P_3 - P_2)} \times P_2 = C_2$$

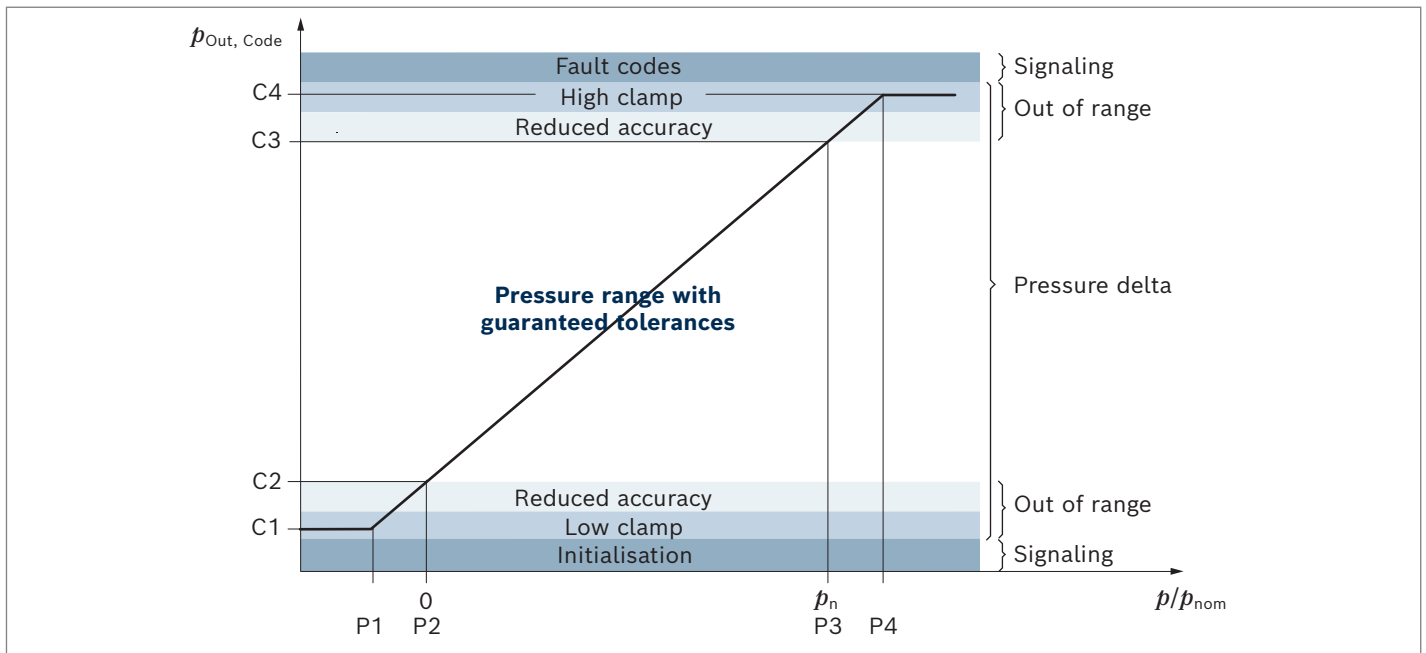
Key

|                       |                                            |
|-----------------------|--------------------------------------------|
| $p_{\text{OUT,code}}$ | Digital 12 bit data value                  |
| $p$                   | Pressure [kPa] (Hinweis: 1 kPa = 0.01 bar) |
| $k$                   | Slope                                      |
| $c_0$                 | Offset                                     |

1) The specific calculation rule for the nominal pressure P3 results from the 12-bit value X2 from the Slow-Channel data as follows: The least significant 3 bits as power of ten, the higher-order (9) bits as the mantissa.

Example for X2 = 0x156: The nominal pressure corresponds to 42e6 Pa = 420 bar.

▼ **Transfer characteristic for the pressure as 12-bit data values**



The assignment of digital value to pressure is shown in table "Characteristic parameters pressure", the accuracy of the sensor is defined in the section Tolerances on temperature, pressure and life of the sensor  
PR4 xxx xx SE/10.

**Characteristic parameters pressure**

| Parameter       | 050<br>HPS5 50 bar | 280<br>HPS5 280 bar | 420<br>HPS5 420 bar | 480<br>HPS5 480 bar | 600<br>HPS5 600 bar |
|-----------------|--------------------|---------------------|---------------------|---------------------|---------------------|
| P1              | -259249 Pa         | -1451796 Pa         | -2177694 Pa         | -2488793 Pa         | -3110991 Pa         |
| P2 (X1)         | 0 Pa (0x0)         | 0 Pa (0x0)          | 0 Pa (0x0)          | 0 Pa (0x0)          | 0 Pa (0x0)          |
| P3 (X2)         | 5000000 Pa (0x195) | 28000000 Pa (0xE6)  | 42000000 Pa (0x156) | 48000000 Pa (0x186) | 60000000 Pa (0x1E6) |
| P4              | 5259249 Pa         | 29451796 Pa         | 44177694 Pa         | 50488793 Pa         | 63110991 Pa         |
| C1 (Low clamp)  | 1 LSB              | 1 LSB               | 1 LSB               | 1 LSB               | 1 LSB               |
| C2 (Y1, $c_0$ ) | 193 LSB            | 193 LSB             | 193 LSB             | 193 LSB             | 193 LSB             |
| C3 (Y2)         | 3896 LSB           | 3896 LSB            | 3896 LSB            | 3896 LSB            | 3896 LSB            |
| C4 (High clamp) | 4088 LSB           | 4088 LSB            | 4088 LSB            | 4088 LSB            | 4088 LSB            |
| $k$             | 74.06 LSB/bar      | 13.225 LSB/bar      | 8.8167 LSB/bar      | 7.7146 LSB/bar      | 6.1717 LSB/bar      |
| $c_0$           | 193 LSB            | 193 LSB             | 193 LSB             | 193 LSB             | 193 LSB             |

Temperature measurement transfer function

The sensor measures the temperature in the ASIC (application-specific integrated circuit). According to the SENT specification SAE J2716 JAN 2010, the temperature characteristic is encoded as a 12-bit signal for Slow- and Fast-Channel:

Measured temperature

$$T_{ist}^* = \frac{T_{OUT,code}}{8} \text{ K} + 200 \text{ K}$$

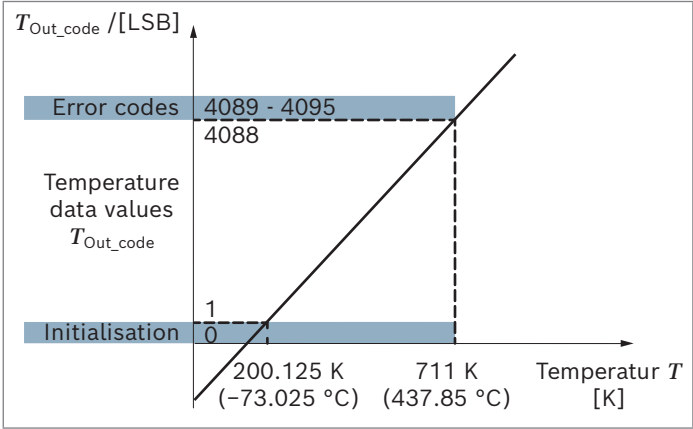
Transfer function temperature

$$T_{OUT,code} = round\left(8 \times \frac{T_{ist} - 200 \text{ K}}{\text{K}}\right)$$

Key

|                |                              |
|----------------|------------------------------|
| $T_{OUT,code}$ | Digital 12 bit data value    |
| $T_{ist}$      | Measurand in Kelvin [K]      |
| $T_{ist}^*$    | Measured value in Kelvin [K] |

Transfer characteristic of the temperature values [K] into 12-bit data values



Maximum temperature until sending an error message:  
160 °C typical ±20 Kelvin

Supply voltage measurement transfer function

According to the SENT specification SAE J2716 JAN 2010, the supply voltage is encoded as a 12-bit signal for Slow-Channel:

Measured supply voltage

$$U_{ist}^* = \frac{U_{Val}}{100} \text{ V}$$

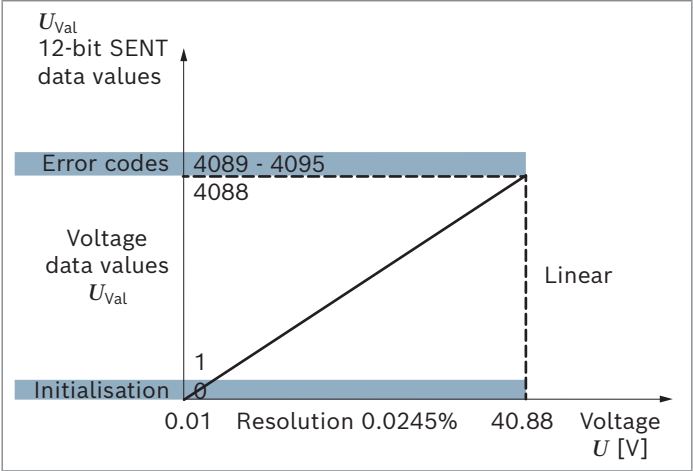
Supply voltage

$$U_{Val} = round\left(100 \times \frac{U_{ist}}{\text{V}}\right)$$

Key

|             |                            |
|-------------|----------------------------|
| $U_{Val}$   | Digital 12 bit data value  |
| $U_{ist}$   | Measurand in Volt [V]      |
| $U_{ist}^*$ | Measured value in Volt [V] |

Transmission characteristics of voltage supply [V] to 12-bit data values



Threshold for the overvoltage error message:  
5.65±0.15 V  
Threshold for the undervoltage error message:  
4.35±0.15 V

**SENT-Slow-Channel Messages Order, meaning and values**

In the Slow-Channel, this information is submitted in the order given as a continuous (repeating) sequence.

| Message ID | Message order | Meaning                                                                                                                                                                  | Hexadecimal value (decimal value)     |
|------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 0x01       | 1             | Diagnostic Error Codes/Error and Status Codes                                                                                                                            | See table "Error Codes" <sup>1)</sup> |
| 0x03       | 2             | Channel 1/2 Sensor type<br>Data values for the sensor types are defined in Table D.4 in SAE J2716 JAN 2010                                                               | 0x7 (7)                               |
| 0x04       | 3             | Configuration Code<br>Detailed specification of sensor type defined in Message 03 (Material number)                                                                      | <sup>2)</sup>                         |
| 0x05       | 4             | Manufacturer Code<br>Specific codes are assigned by the SAE SENT Task Force (B for Bosch)                                                                                | 0x42 (66)                             |
| 0x06       | 5             | SENT Standard Revision<br>SENT SAE J2716 JAN 2010                                                                                                                        | 0x3 (3)                               |
| 0x23       | 6             | Supplementary Data-Channel<br>Bosch Codes: Internal Reference Temperature (PTAT/Diode) (TIC)                                                                             | <sup>1)</sup>                         |
| 0x1C       | 7             | Supplementary Data-Channel<br>Supply Voltage                                                                                                                             | <sup>1)</sup>                         |
| 0x82       | 8             | Bosch-specific Information                                                                                                                                               | <sup>1)</sup>                         |
| 0x01       | 9             | Diagnostic Error Codes/Error and Status Codes                                                                                                                            | See table "Error Codes" <sup>1)</sup> |
| 0x07       | 10            | Fast-Channel 1 Characteristic X1 [Pa]<br>Physical unit and encoding defined in application-specific appendices:<br>Pressure transfer characteristic function (Channel 1) | 0x0 (0)                               |
| 0x08       | 11            | Fast-Channel 1 Characteristic X2 [Pa]<br>(Exponent + Mantisse = nominal measurement range)                                                                               | <sup>2)</sup>                         |
| 0x09       | 12            | Fast-Channel 1 Characteristic Y1 [LSB]                                                                                                                                   | 193 LSB                               |
| 0x0A       | 13            | Fast-Channel 1 Characteristic Y2 [LSB]                                                                                                                                   | 3896 LSB                              |
| 0x83       | 14            | Configurable Message 1                                                                                                                                                   | 0x1 (1)                               |
| 0x84       | 15            | Configurable Message 2                                                                                                                                                   | 0x2 (2)                               |
| 0x85       | 16            | Configurable Message 3                                                                                                                                                   | 0x3 (3)                               |
| 0x01       | 17            | Diagnostic Error Codes/Error and Status Codes                                                                                                                            | See table "Error Codes" <sup>1)</sup> |
| 0x29       | 18            | Sensor ID #1<br>12-bit for 48-Bit Serial Number                                                                                                                          | <sup>3)</sup>                         |
| 0x2A       | 19            | Sensor ID #2<br>12-bit for 48-Bit Serial Number                                                                                                                          | <sup>3)</sup>                         |
| 0x2B       | 20            | Sensor ID #3<br>12-bit for 48-Bit Serial Number                                                                                                                          | <sup>3)</sup>                         |
| 0x2C       | 21            | Sensor ID #4<br>12-bit for 48-Bit Serial Number                                                                                                                          | <sup>3)</sup>                         |
| 0x80       | 22            | IIR Lowpass Filter Setting                                                                                                                                               | (0)                                   |
| 0x81       | 23            | Supplier Info #2<br>Bosch Rexroth part number, coded (part1)                                                                                                             | <sup>3)</sup>                         |
| 0x90       | 24            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x01       | 25            | Diagnostic Error Codes/Error and Status Codes                                                                                                                            | See table "Error Codes" <sup>1)</sup> |
| 0x91       | 26            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x92       | 27            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x93       | 28            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x94       | 29            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x95       | 30            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x96       | 31            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |
| 0x97       | 32            | Bosch Rexroth-specific Information                                                                                                                                       | 0x0 (0)                               |

Default = 0

<sup>1)</sup> Variable values

<sup>2)</sup> Depending on the pressure range and sensor type, this means the data changes for each material number.

<sup>3)</sup> Changes for each sensor

**Response after a reset and following initialization of the Sensor PR4 xxx xx SE/10**

For certain faults (see “Fault diagnosis for sensor PR4 xxx xx SE/10”) a reset is triggered in the sensor. After a reset and during the subsequent initialization of the sensor, the SENT message “Initialization 0” is sent exactly once as soon as the transmission is possible. As soon as pressure values and temperature values are available, they are sent.

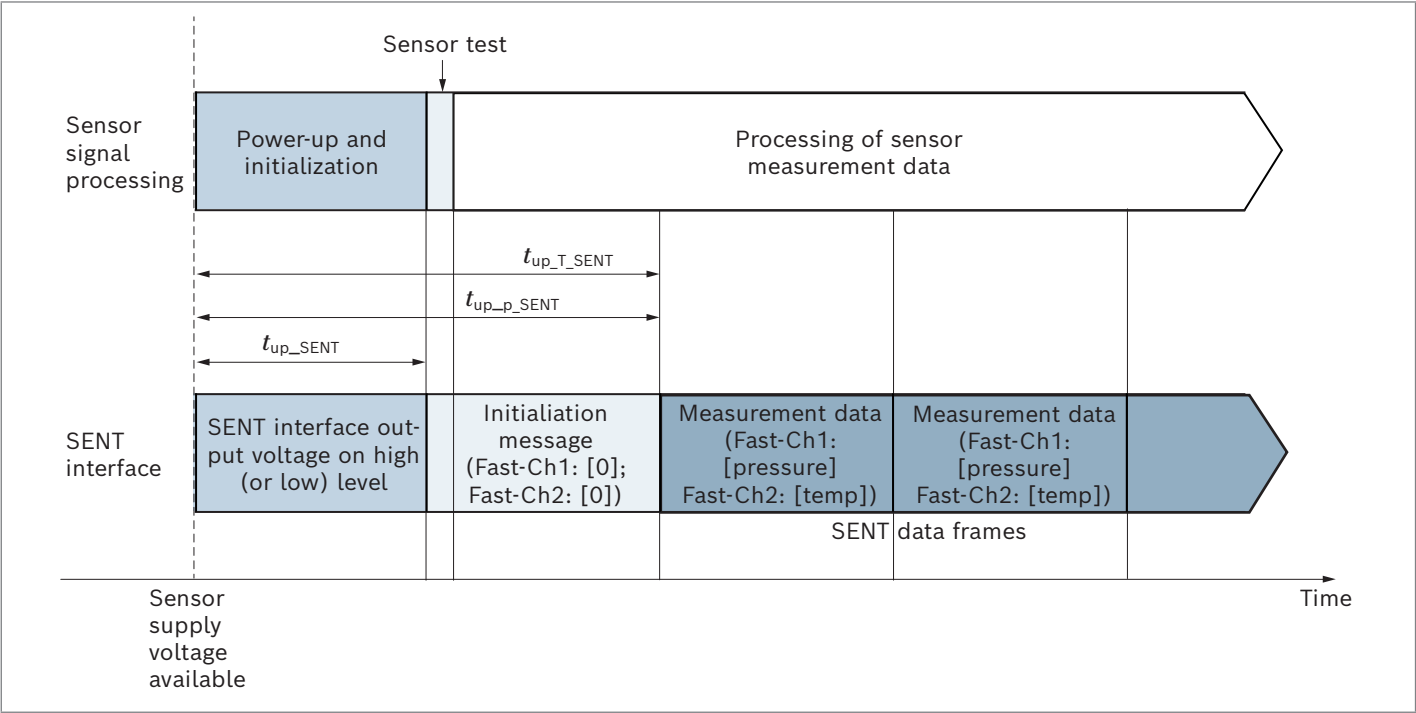
There are two types of resets:

**Hard-Resets:** are executed immediately on request.

**Soft-Resets:** are not executed until error conditions are still present after approx. 400 ms after power-on and the cause of the error could be reported under ID1 in the Slow-Channel.

The attempt to initiate a reset within 400 ms after power-on results in a continuous transmission of ID1 until the error condition is omitted or the reset is triggered after 400 ms.

▼ **Response after a reset of the Sensor PR4 xxx xx SE/10**



Values for the indicated times are available on request and are made available by Bosch Rexroth

**Behavior after undervoltage and overvoltage of the sensor PR4 xxx xx SE/10**

The sensor PR4 xxx xx SE/10 can detect an undervoltage or overvoltage in the supply line. An undervoltage is detected when the supply voltage drops below a measured voltage threshold ( $U_{\text{mess under}}$ ). Overvoltage is detected when the supply voltage is above a voltage threshold ( $U_{\text{mess over}}$ ).

The undervoltage/overvoltage detection is designed in such a way that continuous undervoltage/overvoltage (e.g. due to damaged cables or plug-in connections) and temporary undervoltage/overvoltage are detected.

**Behavior after connection failures PR4 xxx xx SE/10**

| Error description                                                  | Sensor output $U_{\text{out}}$ |
|--------------------------------------------------------------------|--------------------------------|
| Short circuit of $U_{\text{out}}$ and $U_{\text{s}}$               | SENT signal not available      |
| Short circuit of $U_{\text{out}}$ and GND                          | SENT signal not available      |
| Short circuit of $U_{\text{s}}$ and GND                            | SENT signal not available      |
| Connector/ wire break of $U_{\text{s}}$ , GND, or $U_{\text{out}}$ | SENT signal not available      |

**Error diagnosis for Sensor PR4 xxx xx SE/10**

For fault diagnosis, fault codes are transmitted in the Fast-Channel instead of data values (pressure or temperature), these are shown in the “Transmitted error codes on the Fast-Channel” table.

**Transmitted error codes on the Fast-Channel**

| Transmission | Description PR4 xxx xx SE/10                                                                                                                                 |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4095         | Used for the production stage (e.g. if errors occurred during the manufacturing process)                                                                     |
| 4094         | Unused                                                                                                                                                       |
| 4093         | Unused                                                                                                                                                       |
| 4092         | Unused                                                                                                                                                       |
| 4091         | Error indication sensor element and front-end pressure measuring of sensor element and front-end error                                                       |
| 4090         | Error signal processing and signal perimeter                                                                                                                 |
| 4089         | Error message is sent due to reduced accuracy or reliability of the pressure signal                                                                          |
| 0            | The initialization message is transmitted during the sensor initialization phase until valid measurement values are available (minimum one time after reset) |

**Note**

Error indicator bits and serial message data (Message ID 01) carry additional information.

A further error detailing is described via information sent in the Slow-Channel. The assignment of the errors between Fast-Channel and Slow-Channel as well as the associated priorities are shown in the “Error codes” table.

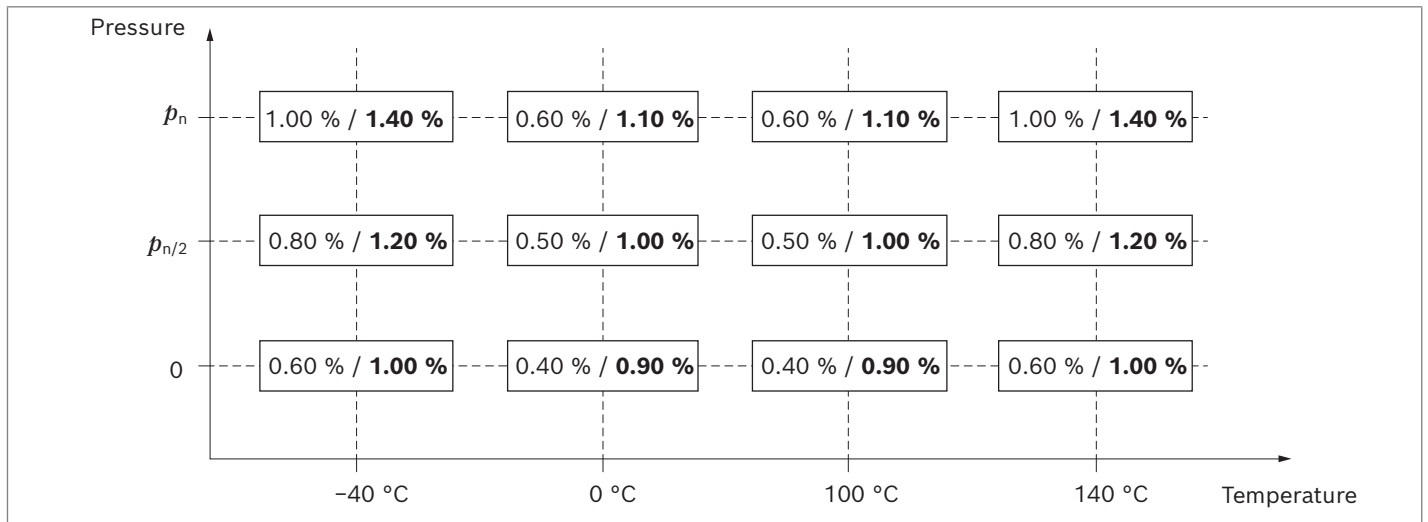
## Error codes

| Error description                                                                         | Slow-Channel error codes [dec] | SENT Fast-Channel 1 error codes [dec] | SENT Fast-Channel 2 error codes [dec] | Channel 1 error bit 0 of status nibble | Channel 2 error bit 0 of status nibble | Internal reference temperature (PTAT/Diode) Supplementary Data-Channel #4.1 error codes | Sensor supply voltage Supplementary Data-Channel #3.1 error codes [dec] | Reset after Slow-Channel error message if set to 1 [bin] | Fast-Channel 1 measurement data priority (measured value is transmitted at FC rather than error) | Fast-Channel 2 measurement data priority (measured value is transmitted at FC rather than error) |
|-------------------------------------------------------------------------------------------|--------------------------------|---------------------------------------|---------------------------------------|----------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Initialization ( $p$ and $T$ not yet available)                                           | 0                              | 0                                     | 0                                     | 0                                      |                                        |                                                                                         |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |
| Factory use only (OTP bits not set)                                                       | 0                              | 4095                                  | 4095                                  | 1                                      | 1                                      | 4095                                                                                    | 4095                                                                    | 0                                                        |                                                                                                  |                                                                                                  |
| Error during initial or cycling HW check (RAM/ROM)                                        | 2070                           | 4090                                  | 4090                                  | 1                                      | 1                                      | 4090                                                                                    | 4090                                                                    | 1                                                        |                                                                                                  |                                                                                                  |
| Error during initial CRC or cyclic trim data check                                        | 3                              | 4090                                  | 4090                                  | 1                                      | 1                                      | 4090                                                                                    | 4090                                                                    | 1                                                        |                                                                                                  |                                                                                                  |
| Error during injection self test on power-up                                              | 2049                           | 4091                                  |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 1                                                        |                                                                                                  |                                                                                                  |
| Internal timing error (buffer overflow)                                                   | 2076                           | 4089                                  |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |
| Sensor element error (FC1, pressure)                                                      | 2064                           | 4091                                  |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 1                                                        |                                                                                                  |                                                                                                  |
| Signal input ADC too high (FC1, pressure)                                                 | 1                              | 4091                                  |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 1                                                        |                                                                                                  |                                                                                                  |
| Signal input ADC too low (FC1, pressure)                                                  | 2                              | 4091                                  |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 1                                                        |                                                                                                  |                                                                                                  |
| Reference temperature input to high or low                                                | 2067                           | 4091                                  | 4091                                  | 1                                      | 1                                      | 4091                                                                                    |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |
| Failure of internal temperature sensor                                                    | 2067                           | 4091                                  |                                       | 1                                      | 0                                      | 4091                                                                                    |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |
| Low voltage supply (threshold exceeded)                                                   | 32                             | 4089                                  | 4089                                  | 1                                      | 1                                      | 4089                                                                                    |                                                                         | 0                                                        | 1                                                                                                | 1                                                                                                |
| High voltage supply (threshold exceeded)                                                  | 33                             | 4089                                  | 4089                                  | 1                                      | 1                                      | 4089                                                                                    |                                                                         | 0                                                        | 1                                                                                                | 1                                                                                                |
| ASIC temperature high (threshold exceeded)                                                | 34                             | 4089                                  | 4089                                  | 1                                      | 1                                      |                                                                                         | 4089                                                                    | 0                                                        | 1                                                                                                | 1                                                                                                |
| Pressure above or below limit for error flag                                              | 2056                           |                                       |                                       | 1                                      | 0                                      |                                                                                         |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |
| Overflows or saturation in supply voltage path (measurement possibly unreliable or wrong) | 2079                           |                                       |                                       | 0                                      | 0                                      |                                                                                         | 4089                                                                    | 0                                                        |                                                                                                  |                                                                                                  |
| Overflows or saturation in signal paths (pressure, temperature, supply voltage)           | 2075                           |                                       |                                       | 1                                      | 1                                      |                                                                                         |                                                                         | 0                                                        |                                                                                                  |                                                                                                  |



### Tolerances of the PR4 xxx xx SE/10 sensor

The tolerance of the pressure measurement is specified in % FS. FS = "full scale" refers to the nominal sensor pressure  $p_n$ . The relative tolerance is pressure- and temperature-dependent and increases over the service life. Here, the service life comprises the entire specified service life. Statistically, the tolerances for new parts are observed with  $\pm 3$  s per production lot. 100% sorted products may be delivered. After the service life, the tolerance range of the new parts may expand to the values highlighted in the diagram; here, the 3 s limit is in turn located maximally at the indicated tolerance limit.



New condition unmounted/after service life

### Tolerances of the PR4 xxx xx SE/10 temperature measurement

The relative tolerance is temperature-dependent. Statistically, the tolerances are observed with  $\pm 3$  s per production lot. 100% sorted products may be delivered.

The following tolerances apply to SENT 280 bar, SENT 420 bar, SENT 480 bar and SENT 600 bar

| Temperature  | Tolerance                                                |
|--------------|----------------------------------------------------------|
| < 25 °C      | $\pm 12$ K over service life<br>$\pm 10$ K for new parts |
| 25 ... 90 °C | $\pm 7$ K over service life<br>$\pm 5$ K for new parts   |
| > 90 °C      | $\pm 12$ K over service life<br>$\pm 10$ K for new parts |

The following tolerances apply for all other pressures

| Temperature | Tolerance  |
|-------------|------------|
| -40 °C      | $\pm 12$ K |
| 30 °C       | $\pm 12$ K |
| 140 °C      | $\pm 12$ K |

### Tolerances of the supply voltage measurement PR4 xxx xx SE/10

The high-pressure sensor transmits the level of the power supply with a tolerance of  $\pm 150$  mV.

## Technical data

| Type PR4                                                                                                          | 050                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100           | 280           | 400           | 420           | 480           | 600           |             |              |        |    |       |     |       |     |        |    |        |    |
|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|--------------|--------|----|-------|-----|-------|-----|--------|----|--------|----|
| Measuring range $p_n$                                                                                             | 0 ... 50 bar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0 ... 100 bar | 0 ... 280 bar | 0 ... 400 bar | 0 ... 420 bar | 0 ... 480 bar | 0 ... 600 bar |             |              |        |    |       |     |       |     |        |    |        |    |
| Maximum overpressure <sup>1)</sup> $p_{\max}$                                                                     | 100 bar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 200 bar       | 400 bar       | 840 bar       | 560 bar       | 840 bar       | 840 bar       |             |              |        |    |       |     |       |     |        |    |        |    |
| Burst pressure (static) <sup>2)3)</sup> $p_{\text{Burst}}$                                                        | 500 bar                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2000 bar      | 2500 bar      | 4500 bar      | 3750 bar      | 4500 bar      | 4500 bar      |             |              |        |    |       |     |       |     |        |    |        |    |
| Output signal                                                                                                     | PR4 xxx xx 05/10: 0.5 ... 4.5 V, ratiometric (at 5 V supply)<br>PR4 xxx xx SE/10: SENT according to SAE J2716 JAN 2010                                                                                                                                                                                                                                                                                                                                                                                                              |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Supply voltage $U_s$                                                                                              | 5±0.25 V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Maximum supply voltage                                                                                            | 18 V (max. 1 h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Short circuit signal output to GND or supply voltage                                                              | $U_{\text{S, short}}$ = 0 ... 18 V, (max. 8 h) in case of simultaneous supply of $U_{\text{S}}$ with $U_{\text{S, short}}$                                                                                                                                                                                                                                                                                                                                                                                                          |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Sensor output impedance<br>$R_{\text{differential}}$ at<br>$0.1 U_{\text{S}} < U_{\text{out}} < 0.9 U_{\text{S}}$ | Typical: 5 Ω<br>Maximum: 10 Ω                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Current consumption typical                                                                                       | 12 mA (at 5 V supply voltage)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Maximum current consumption                                                                                       | ≤ 15 mA (at 5 V supply voltage)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Reverse polarity protection of the supply voltage                                                                 | yes ( $U_{\text{S}} \leq 11 \text{ V}$ )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Maximum current consumption in case of reverse polarity                                                           | 260 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Sensor connector                                                                                                  | AMP Superseal 1.5<br>Bosch Compact 1.1a, 3 pin, code 1<br>Bosch Compact 1.1a, 3 pin, code 2<br>DEUTSCH DT04-3P<br>Trapeze                                                                                                                                                                                                                                                                                                                                                                                                           |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Parts contacting with measuring medium                                                                            | X5CrNiCuNb16-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Housing material                                                                                                  | PBT-GF30/CrNi steel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| PR4 xxx xx 05/10:<br>Response time (10 ... 90 %)                                                                  | ≤ 1 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| PR4 xxx xx SE/10:<br>SENT data transfer                                                                           | Time till the first SENT Data transmission min.: 1.8 ms, max.: 2.2 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Overall accuracy                                                                                                  | ≤1.5%, refer to table “Tolerance of the sensor PR4 xxx xx 05/10” or “Tolerance of the sensor PR4 xxx xx SE/10”                                                                                                                                                                                                                                                                                                                                                                                                                      |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Ambient temperature range                                                                                         | -40 ... +125 °C for AMP Superseal 1.5, DEUTSCH DT04-3P and UNF variants<br>-40 ... +140 °C for others<br><br>The sensor is designed for use in engine compartment (direct motor attachment) and the corresponding ambient temperatures with a typical temperature Distribution:<br><table><tr><th>Temperature</th><th>Distribution</th></tr><tr><td>-40 °C</td><td>6%</td></tr><tr><td>23 °C</td><td>20%</td></tr><tr><td>85 °C</td><td>65%</td></tr><tr><td>135 °C</td><td>8%</td></tr><tr><td>140 °C</td><td>1%</td></tr></table> |               |               |               |               |               |               | Temperature | Distribution | -40 °C | 6% | 23 °C | 20% | 85 °C | 65% | 135 °C | 8% | 140 °C | 1% |
| Temperature                                                                                                       | Distribution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| -40 °C                                                                                                            | 6%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| 23 °C                                                                                                             | 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| 85 °C                                                                                                             | 65%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| 135 °C                                                                                                            | 8%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| 140 °C                                                                                                            | 1%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Storage time and storage temperature                                                                              | Maximum storage period from manufacturing date: 5 years at -30 ... +60 °C and 0 ... 80% relative humidity                                                                                                                                                                                                                                                                                                                                                                                                                           |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Transportation conditions                                                                                         | -40 ... +80 °C at 0 ...80% relative humidity, for the duration of max. 48h                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Service life                                                                                                      | 20000 operating hours or 20 years.<br>Different values, depending on operational conditions on request                                                                                                                                                                                                                                                                                                                                                                                                                              |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Pressure cycles against service life                                                                              | 10 million cycles                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |
| Shock resistance                                                                                                  | 50 g (DIN EN 60068-2-27, 11 ms)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |               |               |               |               |               |             |              |        |    |       |     |       |     |        |    |        |    |

1) Maximum 15 minutes at  $p_{\max}$

2) Maximum 15 minutes at  $p_{\text{Burst}}$

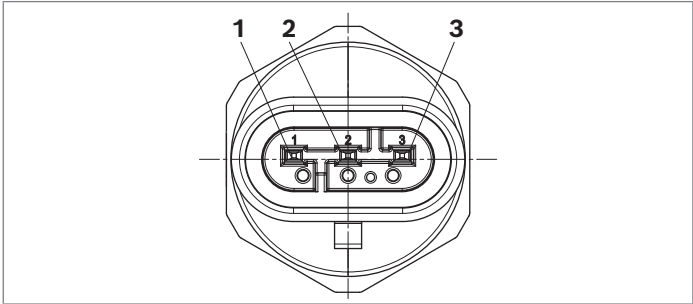
3) The specified bursting pressure is valid for the device only. This value does not include the mechanical interface - the thread between the sensor and the hydraulic component.

|                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                        |                                                              |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Vibration resistance                               | Amplitude of the deflection                                                                                                                                                                                                                                                                       | for Connectors:<br>Bosch Compact 1.1a; code 1,<br>Bosch Compact 1.1a; code 2,<br>trapeze                               | s = 0.25 mm in the range 70 ... 147 Hz                       |
|                                                    |                                                                                                                                                                                                                                                                                                   | for Connectors:<br>AMP Superseal 1.5,<br>DEUTSCH DT04-3P                                                               | s = 1.4 mm in the range 5 ... 70 Hz                          |
|                                                    | Amplitude of the acceleration                                                                                                                                                                                                                                                                     | for Connectors:<br>AMP Superseal 1.5,<br>Bosch Compact 1.1a; code 1,<br>Bosch Compact 1.1a; code 2,<br>DEUTSCH DT04-3P | a = 210 m/s <sup>2</sup> in the range 147 ... 1350 Hz        |
|                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                        | a = 175 m/s <sup>2</sup> in the range 1350 ... 2000 Hz       |
|                                                    |                                                                                                                                                                                                                                                                                                   | for Connector:<br>Trapeze                                                                                              | a = 140 m/s2 at 100 Hz                                       |
|                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                        | a = 420 m/s2 in the range 300 ... 1200 Hz                    |
|                                                    |                                                                                                                                                                                                                                                                                                   |                                                                                                                        | a = 290 m/s2 in the range 1200 ... 2000 Hz                   |
|                                                    | Frequency change                                                                                                                                                                                                                                                                                  | 1 octave/min                                                                                                           |                                                              |
|                                                    | Duration of excitation                                                                                                                                                                                                                                                                            | 100 h in each spatial direction with the same test specimen                                                            |                                                              |
|                                                    | Fulfills ISO 19014-3                                                                                                                                                                                                                                                                              |                                                                                                                        |                                                              |
| Drop test                                          | Controlled drop from 1 m height onto concrete in accordance with ISO 16750-3: 2023-07<br>One drop event per axial direction. The component must then be fully functional or visually damaged                                                                                                      |                                                                                                                        |                                                              |
| Salt spray test                                    | According to DIN EN 60068-2-11 (Feb. 2000)                                                                                                                                                                                                                                                        | Test duration 240 h, without electrical operation                                                                      |                                                              |
| Electromagnetic compatibility (EMC)                |                                                                                                                                                                                                                                                                                                   | ISO 11452-2, -4, -5 as well as according to IEC 61000-4-2                                                              |                                                              |
|                                                    | BCI 100 mA                                                                                                                                                                                                                                                                                        |                                                                                                                        | according to ISO 11452-4; 2 ... 400 MHz (closed loop; CBCI ) |
|                                                    | Antenna > 150 V/m                                                                                                                                                                                                                                                                                 |                                                                                                                        | according to ISO 11452-2 from 200 MHz... 3.2 GHz             |
| Electrostatic discharge (ESD)                      | According to ISO 10605: 2023-06                                                                                                                                                                                                                                                                   | contact discharge                                                                                                      | ±8 kV (powered up and unpowered)                             |
|                                                    |                                                                                                                                                                                                                                                                                                   | air discharge                                                                                                          | ±15 kV (powered up and unpowered)                            |
| Applied standards                                  | EN 12895:2015 + A1:2019, EN ISO 13766-1:2018, EN ISO 14982:2009                                                                                                                                                                                                                                   |                                                                                                                        |                                                              |
| RoHS directive 2011/65/EU                          | RoHS 2 with the exception of 7(c)-I and RoHS 3 with the exception of 7(c)-I                                                                                                                                                                                                                       |                                                                                                                        |                                                              |
| E1 type approval                                   | UN ECE 10 - Rev. 4                                                                                                                                                                                                                                                                                |                                                                                                                        |                                                              |
| Electrical protection                              | Protection against reverse voltage, short circuit and undervoltage; protection against overvoltage in the defined supply voltage range                                                                                                                                                            |                                                                                                                        |                                                              |
| Type of protection with installed mating connector | AMP Superseal 1.5                                                                                                                                                                                                                                                                                 |                                                                                                                        | IP67, IPX6K, IPX9K according to ISO 20653:2013               |
|                                                    | Bosch Compact 1.1a; code 1                                                                                                                                                                                                                                                                        |                                                                                                                        | IP67 and IPX9K according to ISO 20653:2006-08-15             |
|                                                    | Bosch Compact 1.1a; code 2                                                                                                                                                                                                                                                                        |                                                                                                                        | IP67 und IPX9K nach ISO 20653:2006-08-15                     |
|                                                    | DEUTSCH DT04-3P                                                                                                                                                                                                                                                                                   |                                                                                                                        | IP67 according to ISO 20653:2013                             |
|                                                    | Trapeze                                                                                                                                                                                                                                                                                           |                                                                                                                        | IP67 and IPX9K according to ISO 20653:2006-08-15             |
| Weight approximately                               | G 1/4 A                                                                                                                                                                                                                                                                                           |                                                                                                                        | 48 g                                                         |
|                                                    | M14 × 1.5 mm                                                                                                                                                                                                                                                                                      |                                                                                                                        | 52 g                                                         |
| Permissible hydraulic fluids                       | Mineral oil, HETG, HEPG, HEES, HFE, HFB, HFD (other hydraulic fluids on request)                                                                                                                                                                                                                  |                                                                                                                        |                                                              |
| Cable length                                       | The maximum cable length with SENT has been defined according to SAE J2716 JAN 2010. Under certain conditions, this length may also be extended to up to 20 m. If cable lengths which exceed the applicable SENT standard SAE J2716 JAN 2010 are required, please contact the product management. |                                                                                                                        |                                                              |

1) When used in an oil environment, the subsection „Note for use in oil environment“ in the section „Notices on the installation location and position“ (see page 31) must be observed.

Electrical connection (Pin assignment)

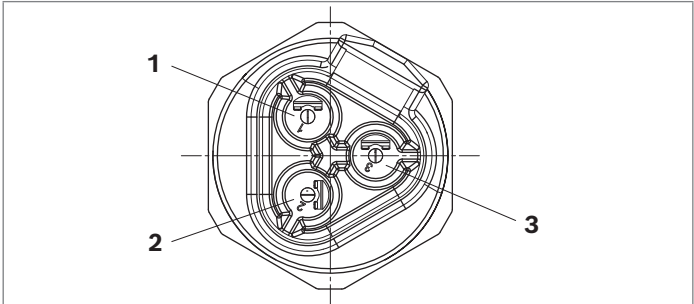
▼ Sensor connector: AMP Superseal 1.5



| Pin | Connection     |           |
|-----|----------------|-----------|
| 1   | Ground         | GND       |
| 2   | Output signal  | $U_{sig}$ |
| 3   | Supply voltage | $U_s$     |

Contact coating: Tin

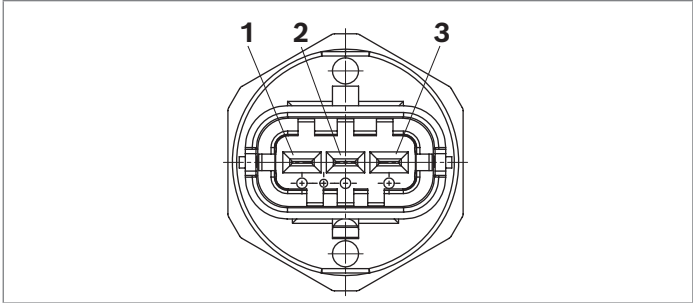
▼ Sensor connector: DEUTSCH DT04-3P



| Pin | Connection     |           |
|-----|----------------|-----------|
| 1   | Ground         | GND       |
| 2   | Output signal  | $U_{sig}$ |
| 3   | Supply voltage | $U_s$     |

Contact coating: Tin

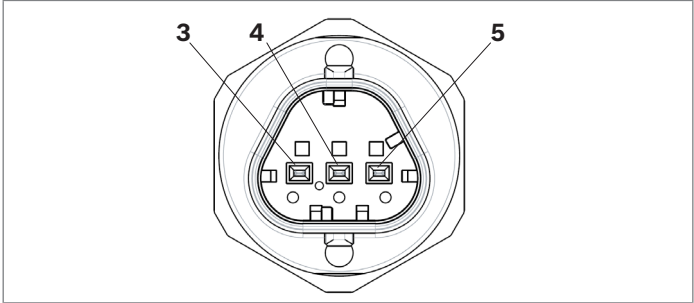
▼ Sensor connector: Bosch Compact 1.1a; code 1



| Pin | Connection     |           |
|-----|----------------|-----------|
| 1   | Ground         | GND       |
| 2   | Output signal  | $U_{sig}$ |
| 3   | Supply voltage | $U_s$     |

Contact coating: Gold

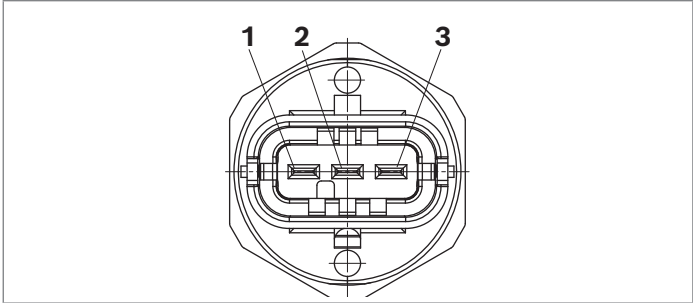
▼ Sensor connector: Trapeze



| Pin | Connection     |           |
|-----|----------------|-----------|
| 3   | Ground         | GND       |
| 4   | Output signal  | $U_{sig}$ |
| 5   | Supply voltage | $U_s$     |

Contact coating: Gold

▼ Sensor connector: Bosch Compact 1.1a; code 2

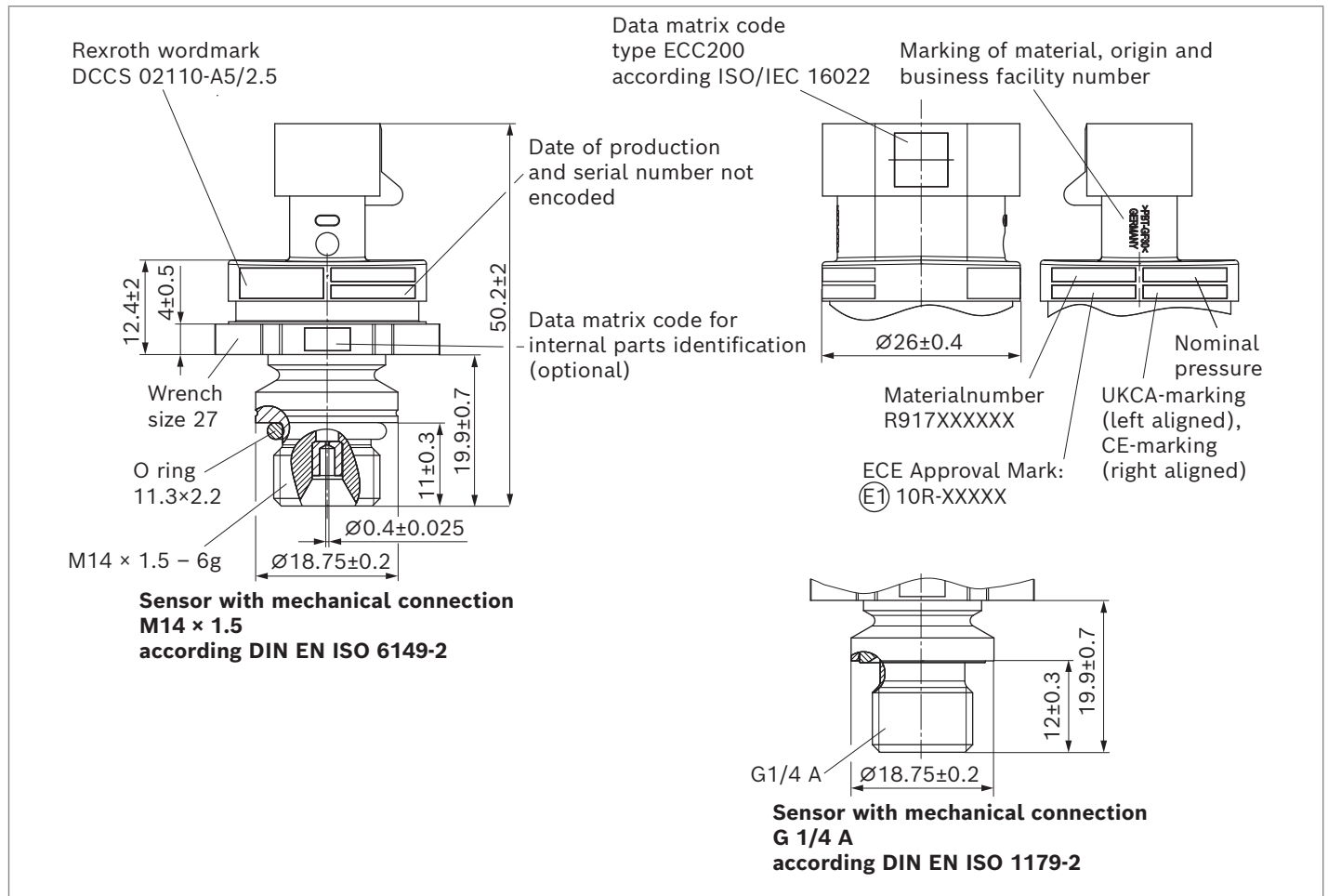


| Pin | Connection     |           |
|-----|----------------|-----------|
| 1   | Ground         | GND       |
| 2   | Output signal  | $U_{sig}$ |
| 3   | Supply voltage | $U_s$     |

Contact coating: Gold

## Dimensions

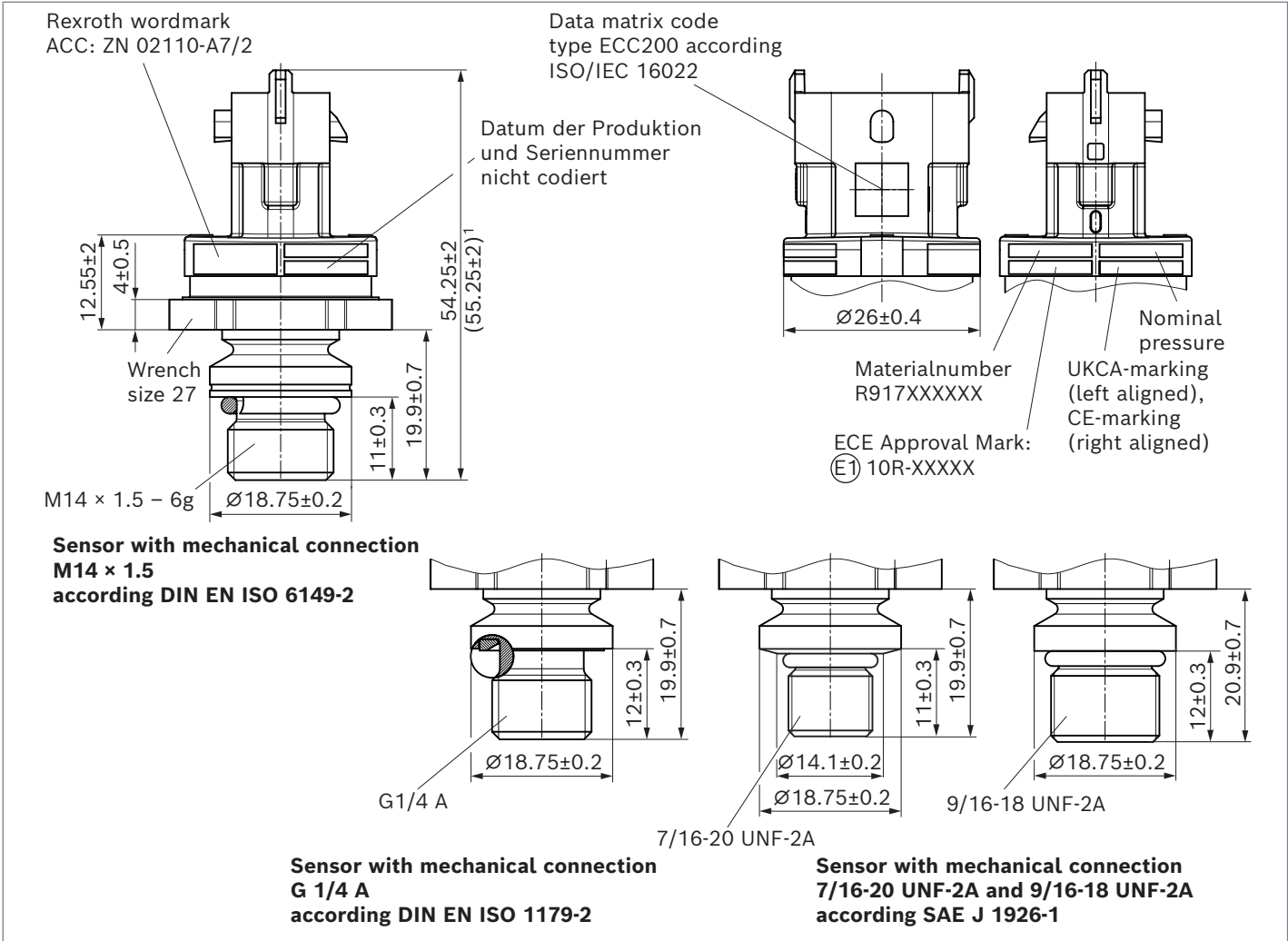
### ▼ Sensor connector AMP Superseal 1.5 dimensions and labeling



### Data matrix code content

| Content                                   | Digits    | Number |
|-------------------------------------------|-----------|--------|
| Material type: finished product           | 1         | 1      |
| Material number R917XXXXXX                | 2 ... 11  | 10     |
| Year of production                        | 12 ... 13 | 2      |
| Production day related to production year | 14 ... 16 | 3      |
| Serial number related to production day   | 17 ... 21 | 5      |
| Number of production-line                 | 22        | 1      |
| Number of the manufacturing plant         | 23 ... 25 | 3      |
| Internal Bosch Rexroth number             | 26 ... 30 | 5      |
| Bosch Rexroth change index                | 31 ... 32 | 2      |
| Bosch Rexroth drawing index               | 33 ... 35 | 3      |
| Empty place for CD-free sensor            | 36        | 1      |

▼ **Sensor connector Bosch Compact 1.1a; code 1 and Bosch Compact 1.1a; code 2**  
**dimensions and labelings**

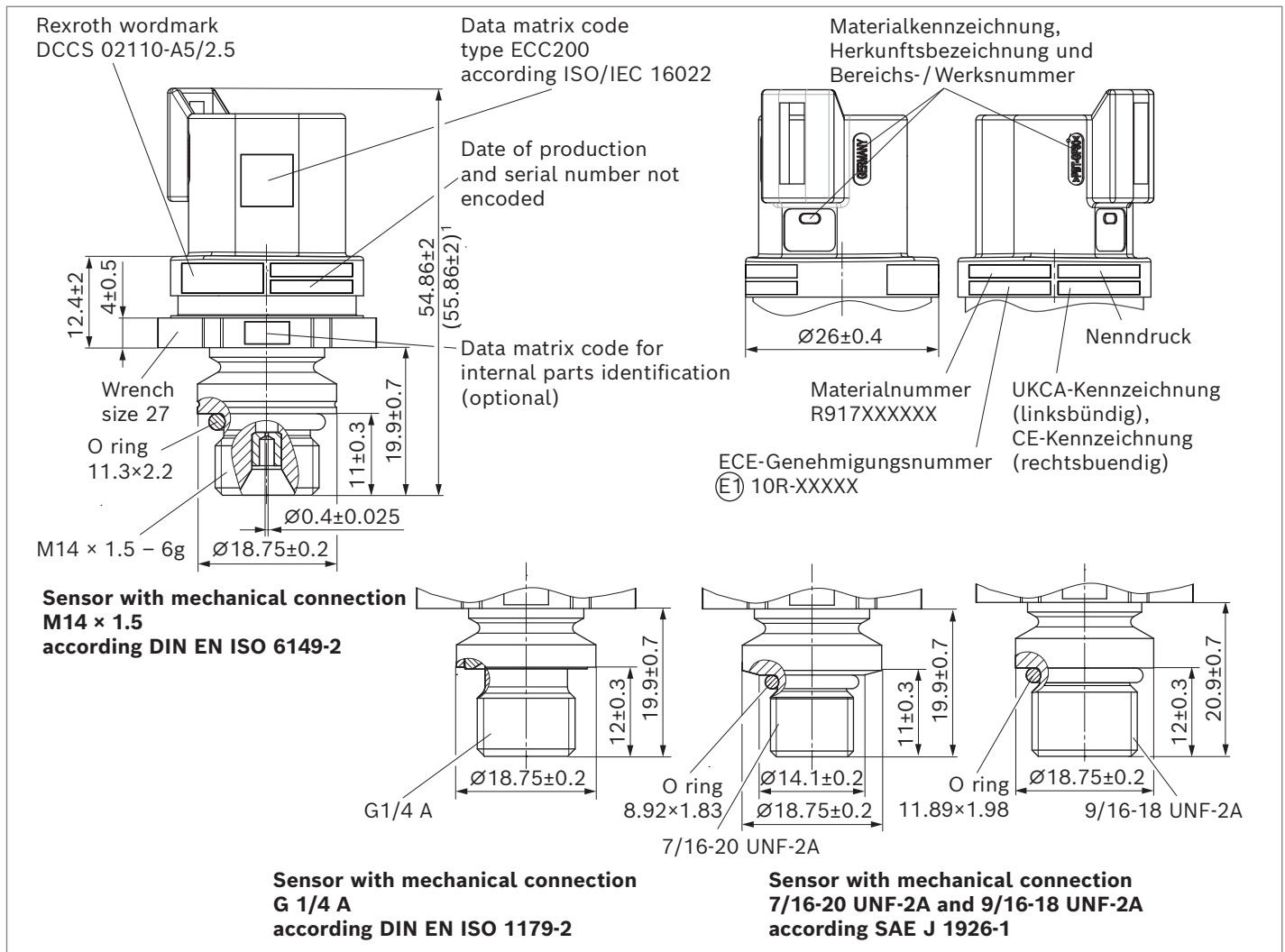


**Data matrix code content**

| Content                                   | Digits    | Number |
|-------------------------------------------|-----------|--------|
| Material type: finished product           | 1         | 1      |
| Material number R917XXXXXX                | 2 ... 11  | 10     |
| Year of production                        | 12 ... 13 | 2      |
| Production day related to production year | 14 ... 16 | 3      |
| Serial number related to production day   | 17 ... 21 | 5      |
| Number of production-line                 | 22        | 1      |
| Number of the manufacturing plant         | 23 ... 25 | 3      |
| Internal Bosch Rexroth number             | 26 ... 30 | 5      |
| Bosch Rexroth change index                | 31 ... 32 | 2      |
| Bosch Rexroth drawing index               | 33 ... 35 | 3      |
| Empty place for CD-free sensor            | 36        | 1      |

<sup>1)</sup> Clamp value valid for sensor version with mechanical connection 9/16-20 UNF

▼ **Sensor connector DEUTSCH DT04-3P**  
**dimensions and labelings**

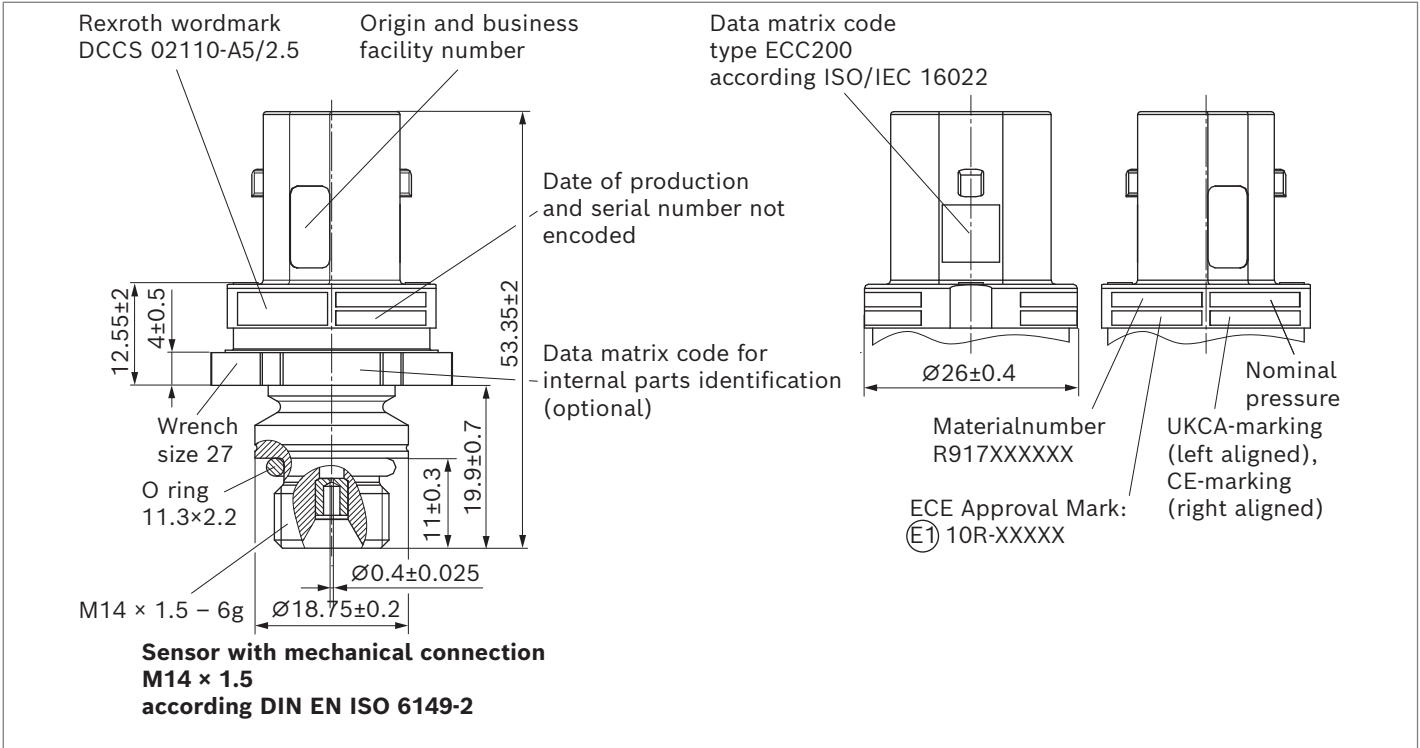


**Data matrix code content**

| Content                                   | Digits    | Number |
|-------------------------------------------|-----------|--------|
| Material type: finished product           | 1         | 1      |
| Material number R917XXXXXX                | 2 ... 11  | 10     |
| Year of production                        | 12 ... 13 | 2      |
| Production day related to production year | 14 ... 16 | 3      |
| Serial number related to production day   | 17 ... 21 | 5      |
| Number of production-line                 | 22        | 1      |
| Number of the manufacturing plant         | 23 ... 25 | 3      |
| Internal Bosch Rexroth number             | 26 ... 30 | 5      |
| Bosch Rexroth change index                | 31 ... 32 | 2      |
| Bosch Rexroth drawing index               | 33 ... 35 | 3      |
| Empty place for CD-free sensor            | 36        | 1      |

<sup>1)</sup> Clamp value valid for sensor version with mechanical connection 9/16-20 UNF

▼ **Sensor connector trapeze  
dimensions and labelings**



**Data matrix code content**

| Content                                   | Digits    | Number |
|-------------------------------------------|-----------|--------|
| Material type: finished product           | 1         | 1      |
| Material number R917XXXXXX                | 2 ... 11  | 10     |
| Year of production                        | 12 ... 13 | 2      |
| Production day related to production year | 14 ... 16 | 3      |
| Serial number related to production day   | 17 ... 21 | 5      |
| Number of production-line                 | 22        | 1      |
| Number of the manufacturing plant         | 23 ... 25 | 3      |
| Internal Bosch Rexroth number             | 26 ... 30 | 5      |
| Bosch Rexroth change index                | 31 ... 32 | 2      |
| Bosch Rexroth drawing index               | 33 ... 35 | 3      |
| Empty place for CD-free sensor            | 36        | 1      |



Mounting

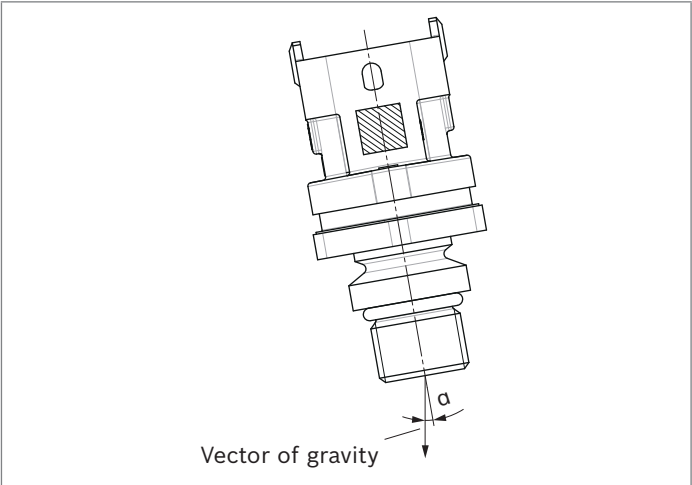
Mounting process of sensor must be ensured by customer by adequate validation.

Bosch 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.

The recommended installation position is with the nozzle facing downwards ( $\alpha = [- 90 \text{ }^{\circ}; + 90 \text{ }^{\circ}]$  to the acceleration due to gravity). This prevents water from collecting on the diaphragm (risk of measuring bridge detuning or diaphragm rupture in the case of frost). If the recommended installation position is not adhered to, suitable measures must be taken to prevent water from collecting in the threaded connection.

▼ Installation position



Mechanical connection

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

Tightening torque

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

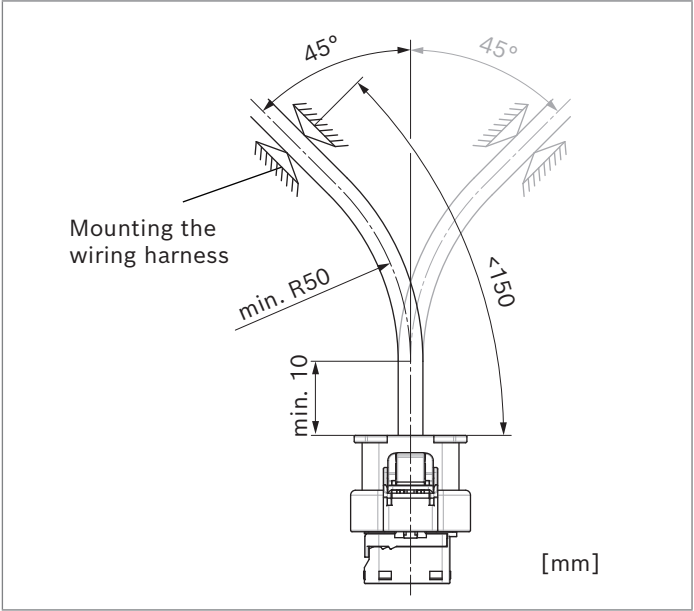
If the torque for mounting the sensor in the respective hydraulic component is not specified, the following torques apply.

| Mechanical connection | Torque [Nm] |
|-----------------------|-------------|
| G 1/4 A               | 50±5        |
| 7/16 UNF-2A           | 35±3.5      |
| 9/16 UNF-2A           | 45±4.5      |
| M14 × 1.5 mm          | 45±4.5      |

The maximum tightening torque must not exceed the following values.

| Mechanical connection | Torque [Nm] |
|-----------------------|-------------|
| G 1/4 A               | 55          |
| 7/16 UNF-2A           | 40          |
| 9/16 UNF-2A           | 50          |
| M14 × 1.5 mm          | 55          |

▼ Instruction for cable guide



Required tooling<sup>1)</sup>

| Designation                                                        | Number | Ordering No. |
|--------------------------------------------------------------------|--------|--------------|
| Bosch crimping pliers for BDK 2.8 terminal 0.5, 0.75, 1.0 mm² wire | 1      | 1928498161   |
| Bosch terminal dismantling tool for BDK 2.8 terminals              | 1      | 1928498167   |

1) The tools may be purchased from Bosch dealers or Bosch Service ([www.bosch-service.com](http://www.bosch-service.com)).

### **Assembly information**

For assembly of connectors, please observe the assembly instructions for plug-in connections (Y 928 P00 222) and BDK 2.8 contacts (1 928 F00 025).

These assembly instructions are available on request from Bosch Rexroth.

### **Attention:**

For assembly of the sensor connector in the vehicle, the following must be observed:

- ▶ The wiring harness must be mechanically fastened within a distance of  $\leq 150$  mm from the sensor connector.
- ▶ The wiring harness has to be secured in such a way that in-phase excitation with the sensor occurs.
- ▶ Use wiring harness connectors to protect the sensor against ingress of water.
- ▶ The sensor has an air bleed bore and is leaky if the mating connector is not plugged in! During processing and/or assembly, you must therefore use suitable protection against the ingress of humidity.

### **Electrical connection**

- ▶ The sensor may only be installed by qualified personnel (electrician).
- ▶ National and international specifications for installation of electrotechnical systems must be observed.
- ▶ Voltage supply according to SELV, PELV.
- ▶ The contacts in the connector of the sensor must not be touched during assembly.
- ▶ When connecting the mating connector, “hot plugging” must be prevented (= connection of the mating connector with live voltage).

## Safety-related characteristics in accordance with ISO 13849, ISO 25119

The safety function of the sensor is defined as system integrity (temperature and pressure). This means that the sensor must correctly detect and process the pressure, and convert it into the corresponding output signals with a deviation of less than the values specified in the paragraph “Tolerances of the PR4 xxx xx 05 / 10 sensor” (chapter “Product description PR4 xxx xx 05 / 10”) or “Tolerances of the PR4 xxx xx SE / 10 sensor” (chapter “Product description PR4 xxx xx SE / 10”).

- ▶ The sensor has a single channel architecture with monitoring equipment (category 2). All required diagnostic measures shall be provided by the ECU to

reach the specified DC values can be found in the table “Diagnostic functions to be implemented by the machine control unit” in this chapter.

- ▶ The sensor meets the requirements of the basic and well-tried safety principles.
- ▶ The sensor meets the requirements of the common cause failures rating according to ISO 13849 > 65 points.
- ▶ The used components of the sensor meet the requirements of well-tried components.
- ▶ The sensor contains no safety-related software.

### MTTF<sub>D</sub> and diagnostic coverage (DC<sub>avg</sub>) of the PR4 pressure sensor with analog output signals

| Ambient temperature [°C] | Operating time [%] | MTTF <sub>D</sub> [years] |           |          |          | DC <sub>avg</sub> [%] |
|--------------------------|--------------------|---------------------------|-----------|----------|----------|-----------------------|
|                          |                    | 24h / day                 | 16h / day | 8h / day | 4h / day |                       |
| -40                      | 6                  | 1160                      | 1657      | 2900     | 4640     | 65.4                  |
| 23                       | 20                 |                           |           |          |          |                       |
| 85                       | 65                 |                           |           |          |          |                       |
| 135                      | 8                  |                           |           |          |          |                       |
| 140                      | 1                  |                           |           |          |          |                       |

### MTTF<sub>D</sub> and diagnostic coverage (DC<sub>avg</sub>) of the PR4 pressure sensor with SENT output signals

| Ambient temperature [°C] | Operating time [%] | MTTF <sub>D</sub> [years] |           |          |          | DC <sub>avg</sub> [%] |
|--------------------------|--------------------|---------------------------|-----------|----------|----------|-----------------------|
|                          |                    | 24h / day                 | 16h / day | 8h / day | 4h / day |                       |
| -40                      | 6                  | 1181                      | 1687      | 2952     | 4724     | 66.5                  |
| 23                       | 20                 |                           |           |          |          |                       |
| 85                       | 65                 |                           |           |          |          |                       |
| 135                      | 8                  |                           |           |          |          |                       |
| 140                      | 1                  |                           |           |          |          |                       |

Diagnostic functions to be implemented by the machine control unit

Following diagnostic functions shall be implemented by the machine control unit, in order to prevent damages to the sensor and to enable the sensor to reach the specified functional safety features.

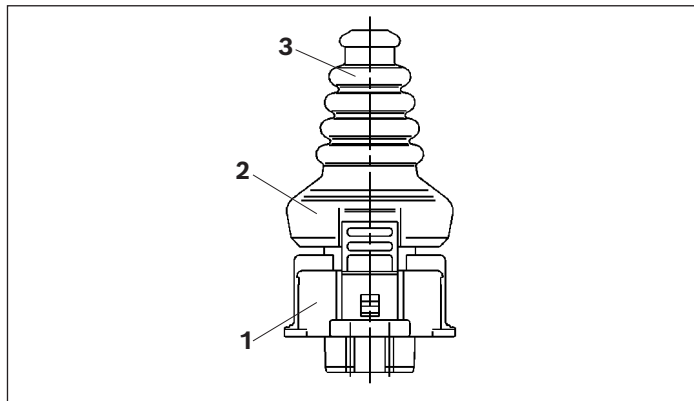
| Diagnostic functions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Frequency of monitoring                                                  | Failure reaction                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------|
| Monitor the sensor operating conditions, among others the supply voltage and applied pressure, and make sure the sensor only works within the specified boundary conditions.                                                                                                                                                                                                                                                                                                                                                                               | Periodically<br>The exact frequency depends on the target reaction time. | Bring the system into a safe state. |
| React to the abnormal sensor output signals (see chapter “Product description PR4 xxx xx 05/10”, paragraphs “Behavior after undervoltage and overvoltage of the sensor PR4 xxx xx 05/10”, “Behavior after connection failures PR4 xxx xx 05/10” and “Error diagnosis for the sensor PR4 xxx xx 05/10” or chapter “Product description PR4 xxx xx SE/10”, paragraphs “Behavior after undervoltage and overvoltage of the sensor PR4 xxx xx SE/10”, “Behavior after connection failures PR4 xxx xx SE/10” and “Error diagnosis for Sensor PR4 xxx xx SE/10”) | Periodically<br>The exact frequency depends on the target reaction time. | Bring the system into a safe state. |

## Accessories

### AMP connector set R902602132<sup>1)</sup>

| Designation              | Number | Ordering No.           |
|--------------------------|--------|------------------------|
| Socket housing 3-pin     | 1      | 282087-1 <sup>2)</sup> |
| Single-wire seal, yellow | 3      | 281934-2 <sup>2)</sup> |
| Socket contact           | 3      | 183025-1 <sup>2)</sup> |

### Mating connector Bosch Compact 1.1a; code 1



| Position | Designation                 |
|----------|-----------------------------|
| 1        | Compact 1.1a/Plug 3P/Code 1 |
| 2        | End clip                    |
| 3        | Cap straight                |

The suitable connector set is available under Rexroth material number R917009890 for manual assembly of wiring harness connectors for laboratory or small series requirements with the following contents:

### Mating connector set Bosch Compact 1.1a; code 1 R917009890<sup>1)</sup>

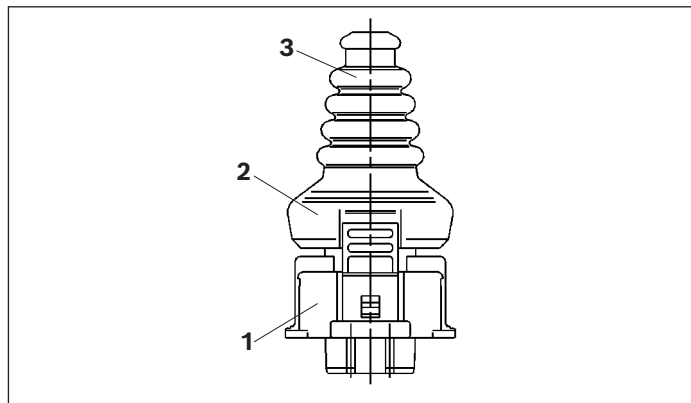
| Designation                                                                      | Number | Ordering No. |
|----------------------------------------------------------------------------------|--------|--------------|
| Bosch Compact 1.1a connector                                                     | 1      | 1928403966   |
| BDK 2.8 Terminal Gold for 18 ... 20 AWG, 0.5 ... 1.0 mm <sup>2</sup>             | 3      | 1928498054   |
| Bosch compact cap straight                                                       | 1      | 1928300527   |
| BDK 2.8/Single seal/ Ø1.2 ... 2.1 mm/blue for insulation diameter 1.2 ... 2.1 mm | 3      | 1928300599   |
| End clip                                                                         | 1      | 1928403423   |

Further variants of the mating connector are available from Robert Bosch GmbH as well as via distribution.

See also the list in the drawing:

A 928 000 453 - Offer drawing compact plug 1.1<sup>3)</sup>

### Mating connector Bosch Compact 1.1a; code 2



| Position | Designation                 |
|----------|-----------------------------|
| 1        | Compact 1.1a/Plug 3P/Code 2 |
| 2        | End clip                    |
| 3        | Cap straight                |

### Mating connector set Bosch Compact 1.1a; code 2

| Designation                                                                      | Number | Ordering No. |
|----------------------------------------------------------------------------------|--------|--------------|
| Bosch Compact 1.1a connector                                                     | 1      | 1928403968   |
| BDK 2.8 Terminal Gold for 18 ... 20 AWG, 0.5 ... 1.0 mm <sup>2</sup>             | 3      | 1928498054   |
| Bosch compact cap straight                                                       | 1      | 1928300527   |
| BDK 2.8/Single seal/ Ø1.2 ... 2.1 mm/blue for insulation diameter 1.2 ... 2.1 mm | 3      | 1928300599   |
| End clip                                                                         | 1      | 1928403423   |

Further variants of the mating connector are available from Robert Bosch GmbH as well as via distribution.

See also the list in the drawing:

A 928 000 453 - Offer drawing compact plug 1.1<sup>3)</sup>

<sup>1)</sup> The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request.

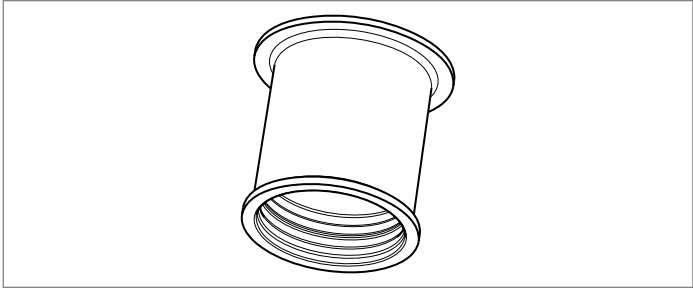
<sup>2)</sup> Available from AMP

<sup>3)</sup> Drawings and further information about Bosch connectors and tools can be found on the internet:

[www.bosch-connectors.com](http://www.bosch-connectors.com)

Mating connector set R917012805<sup>1)</sup>

Protective cap (for PR4 with sensor connector AMP, Bosch Compact 1.1a; code 1, Bosch Compact 1.1a; code 2 or trapeze)



The protective cap is used to protect against moisture or fluids which can enter the sensor via the sensor connector as long as the cable wiring harness connector / mating connector is not plugged in.

In addition, it can also be used as transport protection for the sensor connector.

The protective cap can be ordered at Bosch Rexroth Elchingen.

| Designation    | Material number |
|----------------|-----------------|
| Protective cap | R913078779      |

Mating connector set DEUTSCH DT04-3P

| Designation   | Number | Ordering No.                                                                                                                                    |
|---------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Housing 3-pin | 1      | DT06-3S <sup>2)</sup>                                                                                                                           |
| Wedge         | 1      | W3S <sup>2)</sup>                                                                                                                               |
| Sockets       | 3      | 1062-16-0677 <sup>2)</sup> (cable cross-section wire size AWG 16-20) or<br>1062-16-0177 <sup>2)</sup> (cable cross-section wire size AWG 14-18) |

▼ Pin assignment DEUTSCH DT04-3P

| Mating connector socket | PR4 assignment |
|-------------------------|----------------|
| GND                     | 1              |
| $U_{sig}$               | 2              |
| $U_s$                   | 3              |

1) The mating connector is not included in the scope of delivery.  
This can be supplied by Bosch Rexroth on request.

2) Available from TE Connectivity

## Safety Instructions

### General instructions

- ▶ Request a binding installation drawing before completing your design.
  - ▶ The proposed circuits do not imply any technical liability for the system or the machine on the part of Bosch Rexroth.
  - ▶ Opening the sensor or carrying out modifications to or repairs on the sensor is prohibited. Modifications to or repairs on the wiring can lead to dangerous malfunctions.
  - ▶ Pressure gages may only be installed by trained personnel authorized by the system operator.
  - ▶ Ports may only be opened in a depressurized state.
  - ▶ The sensor may only be assembled / disassembled in a depressurized and de-energized state.
  - ▶ When reassembling a sensor, the O-ring must be replaced.
  - ▶ In order to prevent damage to the sensor and maintain its impeccable function, a professional air bleed of the hydraulic system is required.
  - ▶ Only trained and experienced specialists who are adequately familiar with both the components used and the complete system should implement system developments or install and commission electronic systems for controlling hydraulic drives.
  - ▶ When 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.
  - ▶ Do not use defective components or components which are not in a proper working order. If the sensor fails or demonstrates a faulty operation, it must be replaced.
  - ▶ Residual measurement media in dismantled pressure gages may cause hazards to people, the environment and equipment. Adequate precautions must be taken.
  - ▶ Despite the greatest care being taken when compiling this document, it is not possible to consider all feasible applications. If notices for your specific application are missing, please contact Bosch Rexroth.
- ▶ Before electric welding and painting operations, the sensor must be disconnected from the power supply and the sensor connector must be removed.
  - ▶ Painting the sensor with electrostatic charge is not permitted (danger: ESD damage).
  - ▶ Suitable measures, e.g. individual wire sealing of the cables/wires, must be taken to ensure that no liquids can enter the sensor.
  - ▶ Notice for use in oil environment
    - If it cannot be ruled out that oil can get into the connector chamber, a sensor with a “Bosch Compact 1.1a; code 2” connector to be used. Only the following non-electrically conductive oils<sup>1)</sup> may be used with this sensor:
      - Petronas Akcela Hy Tran Ultra
      - Shell Spirax S4TXM
      - Total Dynatrans MPV
      - John Deere Hy-Gard
    - When used in safety functions, suitable measures must be taken to ensure that no oil can get into the sensor.
  - ▶ With a suitable installation in the vehicle, it is to be ensured that there is no water accumulation in the diaphragm (danger: measuring bridge detuning or diaphragm fracture in case of frost).

### Notices on transport and storage

- ▶ Please examine the sensor for any damage which may have occurred during transport. If there are obvious signs of damage, please inform the transport company and Bosch Rexroth immediately.
- ▶ If the sensor is dropped, it is not permissible to use it any longer, as invisible damage could have a negative impact on reliability.
- ▶ Store the sensor in a dry and dust-free place. Ensure that any contamination with fluid or solid media in the area of the connector or on the thread can be excluded.
- ▶ Sulfur-containing atmospheres should be avoided when using silver-plated mating connector contacts. For this application, we recommend using gold-plated contacts.
- ▶ The storage conditions described in the chapter “Technical data” do not lead to any change in the characteristics and the function of the high-pressure sensor.

### Notices on the installation location and position

- ▶ Do not install the sensor close to parts that generate considerable heat (e.g., exhaust).
- ▶ The connection lines are to be routed with sufficient distance from hot or moving vehicle parts.
- ▶ A sufficient distance to radio systems must be maintained.

<sup>1)</sup> Further oils will only be released after a positive test at Bosch Rexroth.

### Notices on wiring and circuitry

- ▶ Use twisted lines for the connection of the sensor.
- ▶ To minimize voltage drop in the line, the lines used must be as short as possible and, if applicable, have a larger cross section between the sensor and the electronic control unit.
- ▶ We recommend using twisted and shielded lines as well as connecting one side of the shield to the vehicle ground or the housing ground of the electronics.
- ▶ The sensor mating connector must only be plugged and unplugged when it is in a deenergized state.
- ▶ The sensor lines are sensitive to spurious interference. For this reason, the following measure should be taken when operating the sensor:  
Sensor lines should be attached as far away as possible from large electric machines (e.g. alternator, motor-generator) and not in the near of other power-conducting lines in the device or vehicle.
- ▶ The wiring harness should be fixated mechanically in the area in which the sensor is installed (distance < 150 mm). The wiring harness should be secured so that in-phase excitation with the sensor occurs (e.g. at the sensor mounting point).
- ▶ If possible, lines should be routed in the vehicle interior. If the lines are routed outside of the vehicle, their secure mounting is to be ensured.
- ▶ Lines must not be kinked or twisted, must not rub against edges and must not be routed through sharp-edged ducts without protection.
- ▶ The Bosch Rexroth warranty only covers the function of the plug-in system in combination with wiring harness connector system parts according to this data sheet.
- ▶ Only use appropriate tools for crimping and installing the mating connector.
- ▶ Bending of the cable (deviation from the straight line) between cable outlet at the sensor and first assembly point, 20 ... 90°.
- ▶ Permissible bending radius of the cable until the first cable diameter:  $R \geq 50 \text{ mm}$ .

### Intended use

- ▶ The sensor is designed for use in mobile working machines provided that no limitations/restrictions are made to certain application areas in this data sheet.
- ▶ Before installation, commissioning and operation, you must always ensure that the correct pressure gage has been selected with regard to measurement range, version and specific measurement conditions, and that the gage is suitable for wetted material (corrosion). National safety regulations must also be observed.

- ▶ Generally, the sensor must be operated within the operating ranges specified and approved in this data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- ▶ If necessary, a throttle in the hydraulic system which limits possible pressure peaks and pulses must be installed. Please also observe any specific operating conditions which could cause cavitation, for example. Make sure to avoid any stress exceeding the specified values. Cavitation must be prevented in any operation or standby mode.
- ▶ Its use outside of these specified and approved boundary conditions may result in danger to life and/or cause damage to components which could result in sequential damage to the mobile working machine.
- ▶ Severe personal injury and/or damage to property may occur in case of non-compliance with the corresponding specifications.

### Improper use

- ▶ Any use of the sensor other than that described in the chapter "Intended use" is considered to be improper use.
- ▶ Its use in explosive areas is not permitted.
- ▶ Damage resulting from its improper use and/or from an unauthorized intervention which is not specified in this data sheet voids all warranty and liability claims against the manufacturer.

### Use in safety-related functions

- ▶ Detailed information about functional safety metrics can be found in chapter "Safety-related characteristics in accordance with ISO 13849, ISO 25119".
- ▶ It is the responsibility of the customer to perform a risk analysis of the entire safety-relevant system on machine level and validate the suitability of the sensor for any determined safety functions of the mobile machine.
- ▶ An efficient field monitoring process must be setup by the customer. All field failures of the sensor must be reported to Bosch Rexroth immediately, even if they are not covered by the warranty.

### Disposal

The sensor and its packaging must be disposed of according to the national environmental regulations of the country in which the sensor is used.



### **Further information**

Further information about the sensor can be found at  
[www.boschrexroth.com/mobile-electronics](http://www.boschrexroth.com/mobile-electronics).

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