

**Operating Manual**

Pressure Transmitter with simplified i<sup>2</sup>C-Interface



**READ THOROUGHLY BEFORE USING THE DEVICE**  
**KEEP FOR FUTURE REFERENCE**

ID: BA\_DCT532-I2C\_E | Version: 01.2025.0

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**1. General and safety-related information on this operating manual**

This operating manual enables safe and proper handling of the product, and forms part of the device. It should be kept in close proximity to the place of use, accessible for staff members at any time.

All persons entrusted with the mounting, installation, putting into service, operation, maintenance, removal from service, and disposal of the device must have read and understood the operating manual and in particular the safety-related information.

**Complementary to this operating manual the current data sheet has to be adhered to.**

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In addition, the applicable accident prevention regulations, safety requirements, and country-specific installation standards as well as the accepted engineering standards must be observed.

**1.1 Symbols Used**

	- Type and source of danger - Measures to avoid the danger
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Warning word	Meaning
	- Imminent danger! - Non-compliance <b>will result in</b> death or serious injury.
	- Possible danger! - Non-compliance <b>may result in</b> death or serious injury.
	- Hazardous situation! - Non-compliance <b>may result in</b> minor or moderate injury.

**NOTE** - draws attention to a possibly hazardous situation that may result in property damage in case of non-compliance.

✓ Precondition of an action

**1.2 Staff qualification**

**Qualified persons** are persons that are familiar with the mounting, installation, putting into service, operation, maintenance, removal from service, and disposal of the product and have the appropriate qualification for their activity.

This includes persons that meet at least one of the following three requirements:

- They know the safety concepts of metrology and automation technology and are familiar therewith as project staff.
- They are operating staff of the measuring and automation systems and have been instructed in the handling of the systems. They are familiar with the operation of the devices and technologies described in this documentation.
- They are commissioning specialists or are employed in the service department and have completed training that qualifies them for the repair of the system. In addition, they are authorized to put into operation, to ground, and to mark circuits and devices according to the safety engineering standards.

All work with this product must be carried out by qualified persons!

**1.3 Intended use**

The device is intended for converting the physical parameter of pressure into an electric signal. It has to be used only for this purpose, considering the following information.

Devices with 3-A and / or EHEDG certified process connection have been developed especially for applications in food and pharmaceutical industry. The process connection is hygienic and can be sterilized.

Permissible measuring and cleaning media are gases or liquids, which are compatible with the media wetted parts of the device (according to data sheet) and your system. This must be ensured for the application.

The user must check whether the device is suited for the selected use. In case of doubt, please contact our sales department: [info@bdsensors.de](mailto:info@bdsensors.de) | phone: +49 (0) 92 35 98 11 0  
BDSENSORS assumes no liability for any wrong selection and the consequences thereof!

The technical data listed in the current data sheet are engaging and must absolutely be complied with. If the data sheet is not available, please order or download it from our homepage: <http://www.bdsensors.de>

**1.4 Incorrect use**

	<b>Danger through incorrect use</b> - Only use the device in permissible media and in accordance with its intended use. - Do not use the device as a ladder or climbing aid. - The device must not be altered or modified in any way. - BDSENSORS is not liable for damage caused by improper or incorrect use.
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**1.5 Limitation of liability and warranty**

Failure to observe the instructions or technical regulations, improper use and use not as intended, and alteration of or

damage to the device will result in the forfeiture of warranty and liability claims.

**1.6 Safe handling**

**NOTE** - Do not use any force when installing the device to prevent damage of the device and the plant!

**NOTE** - Treat the device with care both in the packed and unpacked condition!

**NOTE** - Do not throw or drop the device!

**NOTE** - Excessive dust accumulation and complete coverage with dust must be prevented!

**NOTE** - The device is state-of-the-art and is operationally reliable. Residual hazards may originate from the device if it is used or operated improperly.

**1.7 Scope of delivery**

Check that all parts listed in the scope of delivery are included free of damage, and have been delivered according to your purchase order:

- pressure transmitters
- for DIN 3852 mech. connectors: O-ring (pre-fitted)
- this operating manual

**1.8 UL approval (for devices with UL marking)**

The UL approval was effected by applying the US standards, which also conform to the applicable Canadian standards on safety.

Observe the following points so that the device meets the requirements of the UL approval:

- only indoor usage
- maximum operating voltage: according to data sheet
- The device must be operated via a supply with energy limitation (acc. to UL 61010) or an NEC Class 2 energy supply.

**2. Product identification**

The device can be identified by means of the manufacturing label with ordering code. The most important data can be gathered therefrom.

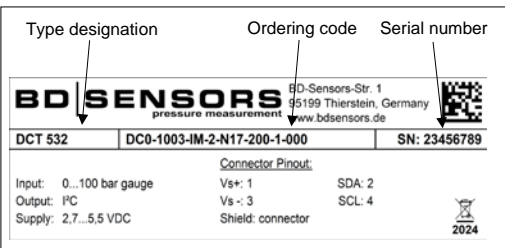


Fig. 1: Example of manufacturing label

**NOTE** - The manufacturing label must not be removed!

**3. Mounting**

**3.1 Mounting and safety instructions**

	<b>Danger of death from airborne parts, leaking fluid, electric shock</b> - Improper installation may result in electric shock! - Always mount the device in a depressurized and de-energized condition!
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**NOTE** - Do not remove the packaging or protective caps of the device until shortly before the mounting procedure, in order to exclude any damage to the diaphragm and the threads! Protective caps must be kept! Dispose of the packaging properly!

**NOTE** - If there is increased risk of damage to the device by lightning strike or overvoltage, increased lightning protection must additionally be provided!

**NOTE** - Treat any unprotected diaphragm with utmost care; this can be damaged very easily.

**NOTE** - Provide a cooling line when using the device in steam piping and clarify the material compatibility.

**NOTE** - The measuring point must be designed in such a way that cavitation and pressure surges are avoided.

**NOTE** - When installing the device, avoid high mechanical stresses on the pressure port! This will result in a shift of the characteristic curve or to damage, in particular in case of very small pressure ranges and devices with a pressure port made of plastic.

**NOTE** - In hydraulic systems, position the device in such a way that the pressure port points upward (ventilation).

**NOTE** - If the device is installed with the pressure port pointing upwards, ensure that no liquid drains off on the device. This could result in humidity and dirt blocking the gauge reference in the housing and could lead to malfunctions. If necessary, dust and dirt must be removed from the edge of the screwed joint of the electrical connection.

**NOTE** - The permissible tightening torque depends on the conditions on site (material and geometry of the mounting point). The specified tightening torques for the pressure transmitter must not be exceeded!

**NOTES - for mounting outdoors or in a moist environment:**

- Please note that your application does not show a dew point, which causes condensation and can damage the pressure transmitter. There are specially protected pressure transmitters for these operating conditions. Please contact us in such case.
- Connect the device electrically straightaway after mounting or prevent moisture penetration, e.g. by a suitable protective cap. (The ingress protection specified in the data sheet applies to the connected device.)
- Select the mounting position such that splashed and condensed water can drain off. Stationary liquid on sealing surfaces must be excluded!
- If the device has a cable outlet, the outgoing cable must be routed downwards. If the cable needs to be routed upwards, this must be done in an initially downward curve.
- Mount the device such that it is protected from direct solar radiation. In the most unfavourable case, direct solar radiation leads to the exceeding of the permissible operating temperature.
- For devices with gauge reference in the housing (small hole next to the electrical connection), install the device in such a way, that the gauge reference is protected from dirt and moisture. Should the device be exposed to fluid admission, the functionality will be blocked by the gauge reference. An exact measurement in this condition is not possible. Furthermore, this can lead to damages on the device.

**3.2 Conditions for devices with 3-A symbol**

The device or its connecting piece must be installed in such a way that the surfaces are self-draining (permissible installation position 273° ... 87°).

Make sure that the welding socket is mounted flush inside the tank.

The user is responsible for:

- the correct size of the seal and the choice of an elastomeric sealing material that complies with the 3-A standard
- an easy to clean installation position of the pressure transmitter with little dead space, as well as definition / verification / validation of a suitable cleaning process
- defining adequate service intervals

**3.3 Conditions for devices, with EHEDG certificate**

Install the device according to the requirements given in EHEDG Guidelines 8, 10 and 37. That is to mount the device in a self-draining orientation. The device should be installed flush to the process area. If mounting in a T-piece, the ratio between the depth of the upstand (L) and the diameter (D) of the upstand shall be L/D < 1. If welded adapters are used, the food contact surface must be smooth, and the welding has to be done according to EHEDG Guideline 9 and 35. Suitable pipe couplings and process connections must be applied according to the EHEDG Position Paper. (List the available ones.)

**3.4 Conditions for oxygen applications**

	<b>Danger of death from explosion</b> - when used improperly
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Make sure that your device was ordered for oxygen applications and delivered accordingly. (see manufacturing label - ordering code ends with the numbers "007")

Unpack the device directly prior to the installation.

Skin contact during unpacking and installation must be avoided to prevent fatty residues remaining on the device. Wear safety gloves!

The entire system must meet the requirements of BAM (DIN 19247)!

For oxygen applications > 25 bar, devices without seals are recommended.

Transmitters with o-rings of FKM (Vi 567): permissible maximum values: 25 bar / 150° C (BAM approval)

**3.5 Mounting steps for connections according to DIN 3852**

**NOTE** - Do not use any additional sealing material such as yarn, hemp, or Teflon tape!

- ✓ The O-ring is undamaged and seated in the designated groove.
  - ✓ The sealing face of the mating component has a flawless surface. (R<sub>z</sub> 3.2)
- 1 Screw the device into the corresponding thread by hand.
  - 2 Devices equipped with a knurled ring: only tighten by hand
  - 3 Devices with a spanner flat must be tightened using a suitable open-end wrench. Permissible tightening torques for pressure transmitter:
    - Wrench flat made of steel:  
G1/4": approx. 5 Nm      G1/2": approx. 10 Nm  
G3/4": approx. 15 Nm      G1": approx. 20 Nm
    - Wrench flat made of plastic: max. 3 Nm

**3.6 Mounting steps for connections according to EN 837**

- ✓ A suitable seal for the medium and the pressure to be measured is available. (e.g. a copper seal)
  - ✓ The sealing face of the mating component has a flawless surface. (R<sub>z</sub> 6.3)
- 1 Screw the device into the corresponding thread by hand.
  - 2 Then tighten it using an open-end wrench. Permissible tightening torques for pressure transmitter:  
G1/4": approx. 20 Nm; G1/2": approx. 50 Nm

**3.7 Mounting steps for NPT connections**

- ✓ Suitable fluid-compatible sealing material, e.g. PTFE tape, is available.
- 1 Screw the device into the corresponding thread by hand
  - 2 Then tighten it using an open-end wrench. Permissible tightening torques for pressure transmitter:  
1/4" NPT: approx. 30 Nm; 1/2" NPT: approx. 70 Nm

**3.8 Mounting steps for G1" cone connection**

- 1 Screw the device into the mating thread by hand (seal produced metallically)
- 2 Then tighten it using an open-end wrench. Permissible tightening torques for pressure transmitter:  
p<sub>N</sub> < 10 bar: 30 Nm  
p<sub>N</sub> ≥ 10 bar: 60 Nm

**3.9 Mounting steps for Clamp and Varivent® connections**

- ✓ A suitable seal for the measured fluid and the pressure to be measured is available.
- ✓ Chapter "3.2 and/or 3.3" have been noticed. EHEDG conformity is only ensured in combination with an approved seal. This is e.g.:  
for Clamp connections - codes C61, C62, C63: T-ring seal from Combit International B.V.  
for Varivent® connections - codes P40, P41: EPDM-O-ring which is FDA-listed  
Note, that P40 can only be used for tank flanges.

- 1 Place the seal onto the corresponding mounting part.
- 2 Centre the clamp connection or Varivent® connection above the counterpart with seal.
- 3 Then fit the device with a suitable fastening element (e. g. semi-ring or retractable ring clamp) according to the supplier's instructions.

**4. Electrical connection**

**4.1 Connection and safety instructions**

	<b>Danger of death from electric shock</b> - Always mount the device in a depressurized and de-energized condition!
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- ✓ The supply corresponds to protection class III (protective insulation).

**NOTE** - Use a shielded and twisted multicore cable for the electrical connection.

**NOTE** - for devices with cable outlet

- When routing the cable, following bending radii have to be complied with:

<b>cable without ventilation tube:</b>	static installation: 8-fold cable diameter dynamic application: 12-fold cable diameter
<b>cable with ventilation tube:</b>	static installation: 10-fold cable diameter dynamic application: 20-fold cable diameter

- In case of devices with cable outlet and integrated ventilation tube, the PTFE filter located at the cable end on the air tube must neither be damaged nor removed! Route the end of the cable into an area or suitable connection box which is as dry as possible and free from aggressive gases, in order to prevent any damage.

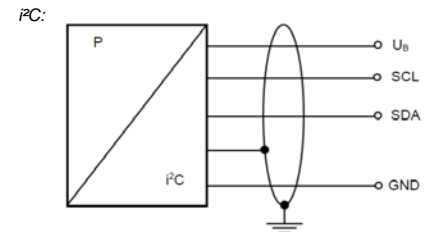
**4.2 Electrical installation**

Establish the electrical connection of the device according to the technical data shown on the manufacturing label, the following table and the wiring diagram.

**Pin configuration**

Electrical connections	M12x1, metal (5-pin)	Binder 723 (5-pin)	cable colours (IEC 60757)
Supply+	1	1	WH (white)
Supply-	3	3	BN (brown)
SDA	2	2	YE (yellow)
SCL	4	4	GN (green)
Not connected	5	5	PK (pink)
Shield	plug housing	plug housing	GNYE (green-yellow)

**Wiring diagram**



\* max. I/O current 3 mA

**5. Commissioning**

	<b>Danger of death from airborne parts, leaking fluid, electric shock</b> - Operate the device only within the specification! (according to data sheet)
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- ✓ The device has been installed properly.
- ✓ The device does not have any visible defect.

**6. i<sup>2</sup>C-Interface**

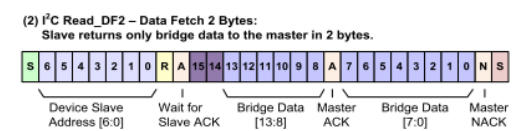
**6.1 Readout of devices with i<sup>2</sup>C output**

The i<sup>2</sup>C address is 0x28 (HEX). The i<sup>2</sup>C frequency must be at least 100 kHz and a maximum of 400 kHz. Pull-up resistors with 4.7 kΩ are used as standard. The exact value of the pull-up resistors depends on the communication structure and its electrical properties (cable length, cable capacitances, etc.).

To read out the recorded measured values, a request must be sent to the device consisting of the slave address and the read bit. The NACK of the master is then used to control how many bytes are read. For the pressure measurement (bridge), 2 bytes must be read. For pressure and temperature, 4 bytes must be read.

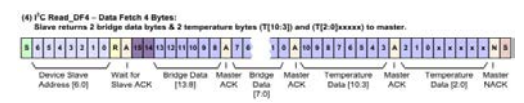
Example 1:

i<sup>2</sup>C Read\_DF2 (2 bytes for pressure measurement):



Example 2:

i<sup>2</sup>C Read\_DF4 (pressure and temperature measurement):



As the temperature value is output in only 11 bits, the last 5 bits of the last byte are undefined and should be truncated in the application (shown with x in the example).

**6.2 Data interpretation**

The binary values read must first be converted into decimal format.

The pressure measurement works with a resolution of 14 bits. The raw value D read out is between 0 and 16383. The measuring span of the pressure measurement is adjusted to 10 - 90 % of the available resolution (raw v alue D = 1638 ... 14744). The range below 10 % or above 90% is used to be able to detect an overshoot or undershoot of the adjusted measuring range.

The temperature measurement works with a resolution of 11 bits. The raw value D read out is between 0 and 2048. The measuring span of the temperature measurement is adjusted from 0-100% of the available resolution, which means that no overshoots or undershoots of the adjusted measuring range can be detected. The temperature output of the module used is adjusted directly by the manufacturer to -40 to 125°C. Note: The temperature value is measured inside the device and can therefore deviate from the media temperature.

Calculation:

Scaled measured value pressure = (((D-1638)/13106)\*measuring span) + start of measuring range

Scaled measured value temperature = ((D/2048)\*165°C)-40°C

Example 1:

Measuring range: 0 ... 10 bar, measuring span: 10 bar, start of measuring range: 0 bar

Read out measured value pressure: 8191

Calculation of scaled measured value pressure: (((8191-1638)/13106)\*10 bar) = 5.00 bar

Example 2:

Measuring range: -1 ... 10 bar, measuring span: 11 bar, start of measuring range: -1 bar

Read out measured value pressure: 8191

Calculation of scaled measured value pressure: (((8191-1638)/13106)\*11 bar) + (-1 bar) = 4.50 bar

Example 3:

Read out measured value temperature: 800

Calculation of scaled measured value temperature: ((800/2048)\*165°C)-40°C = 24.45 °C

**6.3 Writing at devices with i<sup>2</sup>C interface**

For a detailed explanation, please refer to the documentation of the component used (Renesas ZSC31014).

