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Operating Manual

Probe with simplified i2C-Interface







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

ID: BA DCL532-I2C E | Version: 08.2025.0

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

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. Download this by accessing www.bdsensors.de or request it: info@bdsensors.de | phone.: +49 (0) 92 35 / 98 11 0

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

1.1 Symbols Used



Warning word

Type and source of danger asures to avoid the danger

Non-compliance will result in

- **DANGER** WARNING
- death or serious injury. Possible danger!

Imminent danger!

Non-compliance may result in death or serious injury Hazardous situation!

Non-compliance may result in minor or moderate injury. CAUTION NOTE - draws attention to a possibly hazardous situation that

Meaning

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

1.3 Intended use

The stainless steel probes DCL are only suitable for continuous hydrostatic level and level measurement.

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

Suitable measuring media are liquids which are compatible with the media wetted materials described in the data sheet.

The specifications listed in the current data sheet are binding and must absolutely be complied with. If you do not have the data sheet to hand, please request it or download it from our homepage. (http://www.bdsensors.de)

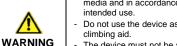


Danger through incorrect use

- In order to avoid accidents, use the device only in accordance with its intended use

1.4 Incorrect use

Danger through incorrect use



- Only use the device in permissible media and in accordance with its
- Do not use the device as a ladder or
- The device must not be altered or modified in any way.
- BD|SENSORS is not liable for damage caused by improper or incorrect use.

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

 $\ensuremath{\text{NOTE}}$ - Do not use any force when installing the device to prevent damage of the device and the plant!

 $\ensuremath{\mathbf{NOTE}}$ - Treat the device with care both in the packed and

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:

- stainless steel probe
- 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

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

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

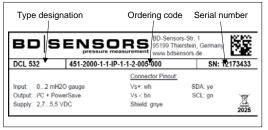


Fig. 1: Example of manufacturing label

NOTE - The manufacturing label must not be removed!

3. Mounting

3.1 Mounting and safety instructions



Danger of death from airborne parts, leaking fluid, electric shock

- Improper installation may result in electric shock!

- Always mount the device in a depressurized and de-energized condition!

As standard, the probe is supplied without fastening material. Clamp fixing and anchor clamp are available as accessories, for different mounting variants.

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

NOTE - Install the probe such that any rubbing or bumping of the sensor head (sensor element), e.g. against a container wall, is excluded. Observe the operating conditions such as, for example, flow conditions. This applies in particular to probes equipped with cable outlet and to devices with tube extensions of a length over 2.8 m.

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

 $\label{NOTE-Treat} \textbf{NOTE-Treat} \ \ \text{any unprotected diaphragm with utmost care};$ this can be damaged very easily

NOTE - Always immerse the device slowly into the fluid to be measured! If the probe strikes the liquid surface, the diaphragm could be damaged or destroyed.

NOTE - Fasten the probe properly according to your

NOTE - Free-hanging probes with FEP cables should not be used if effects of highly charging processes can be expected.

3.2 Removal of protective cap (if necessary)

For the protection of the diaphragm, some of the probes have a plugged-on protection cap. If the device shall be used in highscosity media such as sludge, a removal of the cap before sta up is necessary. Thus, the sensor becomes flush and the medium will attain quickly to the diaphragm.

- Hold the probe in a way that the protection cap points
- Hold the probe with one hand on the sensor section (1).
- Remove the protection cap (2) with the other hand.

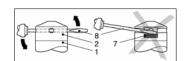


Fig.2 Removal of protection cap

- 1. Hold the probe in a way that the protection cap points upwards
- Slide a small tool such as a screwdriver (8) straight through two opposite drill holes in the protective cap (2).
- Lever it off by moving up the handle of the screwdriver

NOTE - Make sure that the sensor (7) under the protection cap will not be damaged!

4. Electrical connection

4.1 Connection and safety instructions



Danger of death from electric shock Always mount the device in a depressurized and de-energized condition!

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 radiuses have to be complied with:

cable without ventilation tube:

static installation: 8-fold cable diameter dynamic application: 12-fold cable diameter cable with ventilation tube:

static installation: 10-fold cable diameter dynamic application: 20-fold cable diameter NOTE - Use a shielded and twisted multicore cable for the

NOTE - In case of integrated ventilation hose, the PTFE filter located at the cable end on the relative pressure hose 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 NOTE - If a transition is desired from a cable with relative

pressure hose to a cable without relative pressure hose, we recommend using the terminal box KL 1 or KL 2.

4.2 Electrical installation

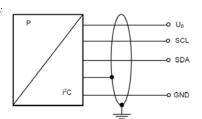
Establish the electrical connection of the device according to the technical data shown on the manufacturing label, the following table and the wiring diagram.

Pin configuration



Electrical connections	cable colours (IEC 60757)
Supply+	WH (white)
Supply –	BN (brown)
SDA	YE (yellow)
SCL	GN (green)
Not connected	PK (pink)
Shield	GNYE (green-yellow)

Wiring diagram



* max. I/O current 3 mA

5. Commissioning **DANGER**

Note

Danger of death from airborne parts,

Operate the device only within the specification! (according to data sheet)

- The device has been installed properly.
- The device does not have any visible defect.

6. i²C-Interface

6.1 Readout of devices with i2C output

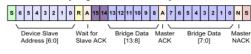
The i2C address is 0x28 (HEX). The I2C frequency must be at least 100 kHz and a maximum of 400 kHz. Pull-up resistors with 4.7 k Ω are used as standard. The exact value of the pull-up resistors depends on the communication structure and its electrical properties (cable length, cable capacitances, etc.).

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

Example 1:

i²C Read_DF2 (2 bytes for pressure measurement):

(2) I²C Read_DF2 - Data Fetch 2 Bytes: Slave returns only bridge data to the master in 2 bytes.



Example 2:

 i^2C Read_DF4 (pressure and temperature measurement):

(4) I²C Read_DF4 – Data Fetch 4 Bytes: Slave returns 2 bridge data bytes & 2 te 5 6 5 4 3 2 1 6 R A (5 (4 1) (2 (1) (6) 8 A 7 6 1 0 A (6) 8 7 6 5 4 3 A 2 1 6 x x x x x x 8 5 Device Stave Walt for Bridge Data Master Bridge Meter Temperature Master Temperature Master Address (8.0) Slave ACK [13.8] ACK Data ACK Data (10.3) ACK Data (2.0) NACK (7.0)

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

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 = $1638 \dots 14744$). 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.

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 barExample 3:

Read out measured value temperature: 800 Calculation of scaled measured value temperature:

6.3 Writing at devices with i2C interface For a detailed explanation, please refer to the documentation of the component used (Renesas ZSC31014).

6.4 Standard settings of devices with output IM Devices with the output code "IM" are supplied with a high update rate for the module used. After the supply voltage is applied, the device is permanently switched on and constantly supplies new measured values. The update rate is 1.5 msec.

 $((800/2048)*165°C)-40°C \approx 24.45°C$

6.5 Devices with output IP Devices with output code "IP" are optimized to offer the lowest possible power consumption. This is achieved by operating the devices in sleep mode. After the supply voltage is applied, the device calculates the first measured value and then goes into inactive sleep mode. No further measured values are initially

A read command always transmits the last recorded (possibly old) measured values - not the current measured values. The request to read the measured values should therefore be sent twice. The first read command transmits the last measured values recorded and activates the recording of new measured values. The new measured values are then transferred with the second read command.

recorded in sleep mode.

Note Enlargement of Section 6.1, Example 1 0 e Data :0] Bridge [7:0 m 9 bridge data to the master in 2 bytes 4 Master Š ۷ 00 Data (8) 6 9 Bridge 12 11 Fetch 2 Bytes Š ρ ave Wait œ Data only 0 $\overline{}$ Device Slave Address [6:0] DF2 returns 8 3 I'C Read Slave retu 4 w 9 2 S Enlargement of Section 6.1, Example 2 ŝ × Femperature Data [2:0] × × 0 Master 8 master ⋖ eo 4 2 Temperature [10:3] bytes (T[10:3]) and (T[2:0]xxxxx) S 9 Data œ 6 9 ۷ 0 9 7 Mast 2 temperature Bridge Data [13:8] 9 14 13 12 11 Data Fetch 4 Bytes:
2 bridge data bytes & Wait for Slave ACK ⋖ œ -N Device Slave Address [6:0] (4) I'C Read DF4 Slave returns 8 3 4 w 9 ŝ

Note

7. Maintenance



Danger of death from airborne parts, leaking fluids, electric shock

Always service the device in a depressurized and de-energized condition!



Danger of injury from aggressive fluids or pollutants

- Depending on the measured medium, this may constitute a danger to the
- Wear suitable protective clothing e.g. gloves, safety goggles.

If necessary, clean the housing of the device using a moist cloth and a non-aggressive cleaning solution.

During the cleaning processes, note the compatibility of the cleaning media used in combination with the media-wetted materials of the pressure measuring devices. Permissible concentrations and temperatures must be observed. Verification/ validation by the user is essential.

operator.

For EHEDG certified devices in tanks, the cleaning device must be positioned in such a way that the sensor is directly assessed and wetted for cleaning. The device has been developed for Cleaning in Place (CIP) applications and must not be dismantled for cleaning.

Deposits or contamination may occur on the diaphragm/ pressure port in case of certain media. Depending on kind and quality of the process, suitable cyclical maintenance intervals must be specified by the operator. As part of this, regular checks must be carried out regarding corrosion, damage of diaphragm/seal(s) and signal shift. A periodical replacement of the seal(s) may be necessary.

If the diaphragm is calcified, it is recommended to send the device to BD|SENSORS for decalcification. Please note the chapter "Service / repair" below.

NOTE - Wrong cleaning or improper touch may cause an irreparable damage on the diaphragm. Therefore, never use pointed objects or pressured air for cleaning the diaphragm.

8. Troubleshooting



Danger of death from airborne parts, leaking fluids, electric shock

If malfunctions cannot be resolved, put the device out of service (proceed according to chapter 10 up to 12)

In case of malfunction, it must be checked whether the device has been correctly installed mechanically and electrically. Use the following table to analyse the cause and resolve the malfunction, if possible.

Fault: no output signal			
Possible cause	Fault detection / remedy		
Connected incorrectly	Checking of connections		
Conductor/wire breakage	Checking of <u>all</u> line connections.		
Defective measuring device (signal input)	Checking of ammeter (miniature fuse) or of analogue input of your signal processing unit		

Fault: incorrect signal behaviour			
Possible cause	Fault detection / remedy		
Load resistance too high	Checking of load resistance (value)		
Supply voltage too low	Checking of power supply output voltage		
Defective energy supply	Checking of the power supply and the supply voltage being applied to the device		
Diaphragm of senor is severely contaminated or damaged	Checking of diaphragm; if necessary, send the device to BD SENSORS for repair		

Fault: wrong or no output signal		
Possible cause	Fault detection / remedy	
Cable damaged mechanically, thermally or chemically	Checking of cable; pitting corrosion on the stainless-steel housing as a result of damage on cable; when damaged, send the device to BD SENSORS for repair	

9. Removal from service



Danger of death from airborne parts, leaking fluids, electric shock

 Disassemble the device in a depressurized and de-energized condition!



Danger of injury from aggressive media or pollutants

Depending on the measured medium, this may constitute a danger to the operator.

 Wear suitable protective clothing e.g. gloves, goggles.

NOTE - After dismounting, mechanical connections must be fitted with protective caps.

10. Service / repair

- Information on service / repair:
 - www.bdsensors.de
 - info@bdsensors.de
 - Service phone: +49 (0) 92 35 98 11 0

10.1 Recalibration

During the life-time of a transmitter, the value of offset and span may shift. As a consequence, a deviating signal value in reference to the nominal pressure range starting point or end point may be transmitted. If one of these two phenomena occur fter prolonged use, a recalibration is recommended to ensure furthermore high accuracy.

10.2 Return



Danger of injury from aggressive media or pollutants

- Depending on the measured medium, this may constitute a danger to the operator.
- Wear suitable protective clothing e.g. gloves, goggles.

Before every return of your device, whether for recalibration, decalcification, modifications or repair, it has to be cleaned carefully and packed shatter-proofed. You have to enclose a notice of return with detailed defect description when sending the device. If your device came in contact with harmful substances, a declaration of decontamination is additionally required.

Appropriate forms can be downloaded from our homepage. Download these by accessing www.bdsensors.de or request them:

info@bdsensors.de | phone: +49 (0) 92 35 / 98 11 0

In case of doubt regarding the fluid used, devices without a declaration of decontamination will only be examined after receipt of an appropriate declaration!

11. Disposal



Danger of injury from aggressive media or pollutants

- Depending on the measured medium, this may constitute a danger to the operator.
- Wear suitable protective clothing
- e.g. gloves, goggles.

The device must be disposed of according to the European Directive 2012/19/EU (waste electrical and electronic equipment). Waste equipment must not be disposed of in household waste!



NOTE - Dispose of the device properly!

12. Warranty termsThe warranty terms are subject to the legal warranty period of

24 months, valid from the date of delivery. If the device is used improperly, modified or damaged, we will rule out any warranty claim. A damaged diaphragm will not be accepted as a warranty case. Likewise, there shall be no entitlement to services or parts provided under warranty if the defects have arisen due to normal wear and tear.

13. EU declaration of conformity / CE

The delivered device fulfils all legal requirements. The applied directives, harmonised standards and documents are listed in the EC declaration of conformity, which is available online at: http://www.bdsensors.de.

Additionally, the operational safety is confirmed by the CE sign on the manufacturing label.

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