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Operating Manual

Pressure transmitter with IO Link interface

DCT 123, DCT 133, DCT 143, DCT 163,
DCT 533, DCT 533P, DCT 543, DCT 553P, DCT 563

DCT 533

DCT 533P:

74-07

READ THOROUGHLY BEFORE USING THE DEVICE
KEEP FOR FUTURE REFERENCE

ID: BA_DCT-IO-Link_E | Version: 07.2021.0

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 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

Warning word	- Type and source of danger - Measures to avoid the danger

Warning word	Meaning
DANGER	- Imminent danger! - Non-compliance **will result in** death or serious injury.
WARNING	- Possible danger! - Non-compliance **may result in** death or serious injury.
CAUTION	- Hazardous situation! - Non-compliance **may result in** 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 pressure transmitters DCT XX3 with-IO_Link interface have been developed for pressure measuring applications depending on the particular model. Depending on the particular device and mechanical connection, they are suitable for a wide range of applications. The pressure transmitter is intended for installation in a machine or system, which is equipped with a digital interface (IO-Link).

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 | phone: +49 (0) 92 35 / 98 11 0

BD|SENSORS 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

WARNING	**Danger through incorrect use** - 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.
WARNING	**Danger through incorrect use** - 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

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 transmitter DCT XX3
- for DIN 3852: O-Ring (pre-mounted)
- 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.

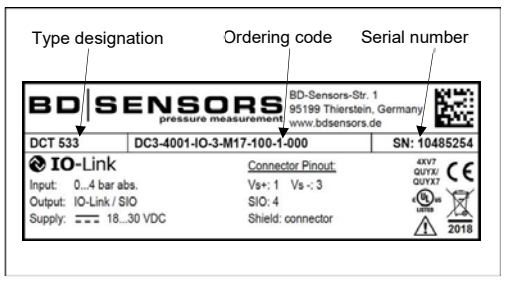


Fig. 1: Example of manufacturing label

NOTE - The manufacturing label must not be removed!

3. Mounting

3.1 Mounting and safety instructions

DANGER	**Danger of death from airborne parts, leaking fluid, electric shock** - Always mount the device in a depressurized and de-energized condition!
DANGER	**Danger of death from improper installation** - Installation must be performed only by appropriately qualified persons who have read and understood the user manual.

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

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 - 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 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 at 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. 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 / in a humid environment and for cleaning:

- 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, which can then damage the device or affect its ability to function correctly. If the internal pressure in the device rises, this could also cause temporary measurement errors.
- 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

DANGER	**Danger of death from explosion** - when used improperly

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_Z 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 an 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
  G1 1/2": approx. 25 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_Z 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 dairy pipe connections

✓ The O-ring is undamaged and seated in the designated groove.

✓ Chapter "3.2 and/or 3.3" have been noticed.
EHEDG conformity is only ensured in combination with an approved seal for codes M73, M75, M76. This is e.g.:
ASEPTO-STAR k-flex upgrade seal by Kieselmann GmbH

1 Centre the dairy pipe connection in the counterpart.

2 Screw the cup nut onto the mounting part.

3 Then tighten it using a hook wrench.

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 Combifit 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.

3.10 Mounting steps for flange connections

✓ A suitable seal for the measured fluid and the pressure to be measured is available. (e.g. a fiber seal)

1 Put the seal between connecting flange and counter flange

2 Install the device with 4 resp. 8 screws (depending on flange version) on the counter flange.

4. Electrical connection

4.1 Connection and safety instructions

DANGER	**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
- 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

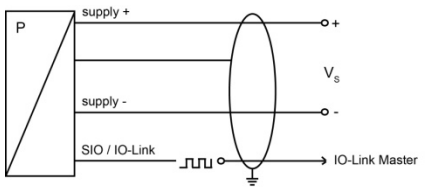
Establish the electrical connection of the device according to the technical data shown on the manufacturing label, the following table and the wiring diagram.

Pin configuration:

Electrical connections	M12x1 (4-pin) metal	Binder 723 (5-pin)	cable colours (IEC 60757)
Supply +	1	1	WH (white)
Supply –	3	3	BN (brown)
SIO / IO Link +	4	4	GN (green)
Shielding	housing	housing	GNYE (green-green)

Wiring diagram:

3-wire system (SIO / IO-Link)



5. Commissioning

DANGER	**Danger of death from airborne parts, leaking fluid, electric shock** - 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. IO-Link interface

6.1 General device information

Baud rate	COM 2 (38.4 kbaud)
Input process data length	2 bytes
Minimum cycle time	5 msec
IO-Link version	V 1.1
SIO mode	yes

6.2 SIO mode (standard IO mode)

In this mode the transmitter operates like a normal pressure transmitter with standard output signals. The digital output is always on Pin 4 of the M12 connector plug or with cable via the green wire.

6.3 IO-Link mode (communication mode)

The pressure transmitter switches to the IO-Link communication mode, when it operates under an IO-Link master. IO-Link communication is only possible over Pin 4 of the M12 connector plug or with cable via the green wire.

6.4 Process data

The process data length of the sensor is 16 bits. The switching state (BCD1) as well as the current measured values are transmitted. The 14 bits of the measured value are scaled according to the measuring range.

15 bit	14…2	1	0
Signed bit	Measured value	0	BDC1 / Output 1

6.5 Error codes

Error code	Description
0x8011	Index not available
0x8012	Subindex not available
0x8023	Access denied
0x8030	Parameter value out of range
0x8033	Parameter length overrun
0x8034	Parameter length underrun

6.6 Event codes

	Event codes for IO-Link 1.1	Event codes for IO-Link 1.0	Device status	Type
No malfunction	0x0000	0x0000	0	Notification
General malfunction Unknown error	0x1000	0x1000	4	Error
Process variable range overrun Process data uncertain	0x8C10	0x8C10	2	Warning
Process variable range underrun Process data uncertain	0x8C30	0x8C10	2	Warning

6.7 Parameter data

The parameter data for the pressure sensor correspond to the Smart Sensor profile (V1.0).

Index hex	Subindex hex	Object name	Single value	Default	Comment
0x02	0x00	System Commands	0x81 = Delete min/max value 0x82 = res 0xA0 = Set0		The action is executed by writing in the subindex.
0x03	0x00	Data Storage Index	0x01: Upload Start 0x02: Upload End 0x03: Download Start 0x04: Download End 0x05: Data Storage Break		
0x0C	0x00	Device Access Lock	0x00: Unlocked 0x01: IO-Link Lock 0x02: Data Storage Lock 0x04: Parameterization Lock 0x08: User Interface Lock 0x03: IO-Link Lock + Data Storage Lock 0x05: IO-Link Lock + Parameterization Lock 0x09: IO-Link Lock + User Interface Lock 0x06: Data Storage Lock + Parameterization Lock 0x0A: Data Storage Lock + User Interface Lock 0x07: Data Storage Lock + IO-Link Lock + Parameterization Lock 0x0B: Data Storage Lock + IO-Link Lock + User Interface Lock	0x00: Unlocked	
0x24	0x00	Device Status	0x00 Device is operating properly 0x02 Out-of-Specification 0x04 Failure		
0x3D	0x02	Switch Point Mode	0x80: Hysteresis NO 0x81: Hysteresis NC 0x82: Window NO 0x83: Window NC	0x80: HNo	

Index hex	Subindex hex	Object name	Access	Length	Value range	Gradient	Unit	Default
0x3C	0x01	SetPoint 1 = SP1	R/W	2 bytes	Process Data			100%
0x3C	0x02	SetPoint 2 = rP1	R/W	2 bytes	Process Data			0%
0xD0	0x00	Switching Delay Time	R/W	2 bytes	0 ... 500	0.1	sec	0
0xD1	0x00	Resetting Delay Time	R/W	2 bytes	0 ... 500	0.1	sec	0
0xD5	0x00	Min Pressure Value	R	2 bytes	Process Data			
0xD6	0x00	Max Pressure Value	R	2 bytes	Process Data			
0xD7	0x00	Measurement Damping	R/W	2 bytes	0 …1000 in 10 ms steps	1	ms	0

7. Maintenance

DANGER	**Danger of death from airborne parts, leaking fluids, electric shock** - Always service the device in a depressurized and de-energized condition!
WARNING	**Danger of injury from aggressive fluids or pollutants** - Depending on the measured medium, this may constitute a danger to the operator. - 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.

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. Removal from service

DANGER	**Danger of death from airborne parts, leaking fluids, electric shock** - Disassemble the device in a depressurized and de-energized condition!
WARNING	**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.

9. Service / repair

Information on service / repair:

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

9.1 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 occurs after prolonged use, a recalibration is recommended to ensure furthermore high accuracy

9.2 Return

WARNING	**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!

10. Disposal

WARNING	**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!

11. Warranty terms

The 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.

12. 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.

Notes: