

Pressure transmitter with RS485 Modbus RTU / iPC interface

DCT 531, DCT 532



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1. General Information





1.1 Information concerning the user manual


Follow the safety and handling instructions that are set out in this user manual. Compliance with the applicable accident prevention regulations and safety regulations as well as with national installation standards and recognized codes of practice must also be ensured.

This user manual is part of the device and should be kept accessible to personnel at all times in the immediate vicinity of the installation location of the device.

– Subject to technical alteration –

1.2 Symbols used

	- Nature and source of danger - Measures to prevent danger
Warning term	
	Immediate danger! Failure to observe will result in death or serious injury.
DANGER	
	Possible danger! Failure to observe may result in death or serious injury.
WARNING	
	Dangerous situation! Failure to observe may result in slight or moderate injury.
CAUTION	

 NOTE – Tips and information for the user in order to ensure trouble-free operation.

1.3 Qualification of personnel

Installation, commissioning, operation, maintenance, de-commissioning and disposal may be carried out only by appropriately qualified specialist personnel.


Work on electrical components must be performed only by a qualified electrician and in accordance with the applicable regulations and guidelines.

1.4 Limitation of liability and warranty

Failure to follow the instructions or observe technical regulations, improper use or use of the device in a manner other than that intended, or alteration or damage to the device will void the warranty and invalidate claims for liability.

1.5 Intended use

- The **Pressure transmitters DCT 531 with Modbus RTU communication interface 485** respectively the **pressure transmitters DCT 532 with iPC 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 sensor is intended for installation in a machine or system. It is the responsibility of the user to check whether the device is suitable for the chosen application. If in doubt, please contact our sales office. BD SENSORS cannot, however, assume any liability for an incorrect choice or any consequences arising from this!
- Media that can be measured are gases or liquids that are compatible with the materials that contact the medium. These are described in the data sheet. Furthermore, it must be ensured in each individual case that the medium is compatible with the parts that come in contact with it.
- The technical data as set out in the current data sheet are authoritative. If you do not have the data sheet, please request it from us or download it from our website.

	Danger of death through incorrect use
	- In order to avoid accidents, use the device only in accordance with its intended use.

1.6 Package contents

Check that all of the listed parts are included in the delivered package and have been supplied in accordance with your order:

- Pressure transmitters from the DCT 531 / DCT 532 series
- For DIN 3852 mech. connectors: O-ring (pre-fitted)
- User manual

2. Product Identification

The type plate serves to identify the device. The most important data can be taken from this. The order code is used for unique identification of your product.

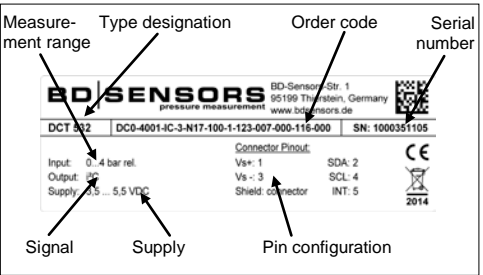





Fig. 1 Type plate


 The type plate must not be removed from the device!

3. Installation

3.1 Installation and safety instructions









	DANGER	Danger of death from electric shock - Install the device only when the machine is depressurized and the power supply has been switched off!
	WARNING	Danger of death from improper installation - Installation must be performed only by appropriately qualified specialist personnel who have read and understood the user manual.

Oxygen






	DANGER	Danger of death from explosion through improper use of devices intended for use with oxygen - The following points must be observed in order to ensure safe handling:
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- Make sure that a special version of your device has been ordered for use with oxygen and that the expected device has been delivered. The easiest way for you to verify this is by checking the type plate (see Fig. 1 regarding this). If your order code ends with the digits "007", then your device is suitable for oxygen applications.




- When it is delivered, the device is packaged in a plastic bag to protect it from contamination. Take note of the advice sticker with the text "Device for oxygen; unpack immediately before installation"! Also note that contact with skin should be avoided when unpacking and installing the device so as to avoid leaving grease residues on the device.
- The relevant provisions concerning explosion protection must be met during installation. Also check whether approval as intrinsically safe equipment is required in addition to suitability for oxygen. (This is not the case for the device as supplied!)
- Please note that the entire system must comply with the requirements of the BAM (German Federal Institute for Materials Research and Testing, DIN 19247).
- Pressure transmitters designed for use without seals are recommended for oxygen applications > 25 bar.
- Pressure transmitters with 70 EPDM 281 sealing rings: Maximum permitted values: 15 bar / 60° C and 10 bar / 60° C to 90° C (BAM approval).
- Pressure transmitters with FKM (Vi 567) sealing rings: Maximum permitted values: 25 bar / 150° C (BAM approval).

-  Please treat this highly sensitive electronic measuring instrument carefully, both when packed and when unpacked!
-  No modifications or alterations may be made to the device.
-  Do not throw or drop the device!
-  Only remove the packaging and, if applicable, the protective cap from the device shortly before its installation, so as to avoid damaging the diaphragm. Be sure to retain the supplied protective cap!
-  Fit the protective cap back over the diaphragm immediately after dismounting the device.
-  Treat the unprotected diaphragm with extreme care; it can be damaged very easily.
-  Do not apply any force to install the device so as to avoid damaging the device and the system!
-  When installing outdoors or in humid environments, the following points should be noted:

- The device should be electrically connected immediately after installation to ensure that no moisture is able to penetrate into the plug connector. If this is not possible, the ingress of moisture must be prevented by using a suitable protective cap. (The protection class specified in the data sheet applies to the connected device.)
- Select an installation position that allows splashed water and condensation to drain away. Ensure that sealing surfaces are not exposed to standing liquid!
- Install the device such that it is protected from direct sunlight. In the worst case, direct sunlight may result in the maximum permissible operating temperature being exceeded, 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.

-  Take care that the pressure connector is not subjected to any mechanical stresses higher than that permitted, since this could cause the characteristic to shift or result in damage. This applies especially to very small pressure ranges, as well as to devices with a pressure connector made of plastic.
-  In the case of hydraulic systems, orient the device such that the pressure connector faces upwards (for venting).
-  Provide a cooling section when using the device in steam lines.
-  If there is a risk that a device installed outdoors might be damaged by lightning strike or overvoltage, we recommend the provision of overvoltage protection between the power supply unit or control cabinet and the device.
-  If the device is installed with the pressure connector facing upwards, make sure that no liquid runs down the housing. This could result in moisture and dirt blocking the gauge reference in the housing and cause malfunctions. If necessary, remove any dust and dirt from the edge of the screw joint of the electrical connector.

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-  If there is a risk that a device installed outdoors might be damaged by lightning strike or overvoltage, we recommend the provision of overvoltage protection between the power supply unit or control cabinet and the device.
-  If the device is installed with the pressure connector facing upwards, make sure that no liquid runs down the housing. This could result in moisture and dirt blocking the gauge reference in the housing and cause malfunctions. If necessary, remove any dust and dirt from the edge of the screw joint of the electrical connector.

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-  If the device is installed with the pressure connector facing upwards, make sure that no liquid runs down the housing. This could result in moisture and dirt blocking the gauge reference in the housing and cause malfunctions. If necessary, remove any dust and dirt from the edge of the screw joint of the electrical connector.

3.2 General installation instructions

- Carefully remove the device from its packaging and dispose of the packaging properly.
- Then proceed as described in the following installation instructions.

3.3 Installation instructions for DIN 3852 connectors

 **DO NOT USE ANY ADDITIONAL SEALING MATERIALS SUCH AS TOW, HEMP OR TEFLON TAPE!**

- Check that the O-ring is undamaged and is seated in the groove provided for it.
- Make sure that the sealing surface of the receiving part is perfectly clean and smooth. (R_z 6.3)
- Screw the device into the mounting thread by hand.
- If you have a device with a knurled ring, the device need only be screwed in by hand.
- Devices with wrench flats must be tightened with an open-end wrench (with steel wrench flats: G1/4": approx. 5 Nm; G1/2": approx. 10 Nm; G3/4": approx. 15 Nm; G1": approx. 20 Nm; with plastic wrench flats: max. 3 Nm).
- **The specified tightening torques must not be exceeded!**

3.4 Installation instructions for EN 837 connectors

- Use a suitable seal that is compatible with the process medium and the pressure to be measured (e.g. a copper seal).
- Make sure that the sealing surface of the receiving part is perfectly clean and smooth. (R_z 6.3)
- Screw the device into the mounting thread by hand.
- Then tighten it with the open-end wrench (for G1/4": approx. 20 Nm; for G1/2": approx. 50 Nm).
- **The specified tightening torques must not be exceeded!**


3.5 Installation instructions for NPT connectors

- Additional seal materials, e.g. PTFE tape, may be used to provide sealing.
- Screw the device into the mounting thread by hand.
- Then tighten it with the open-end wrench (for 1/4" NPT: approx. 30 Nm; for 1/2" NPT: approx. 70 Nm).
- **The specified tightening torques must not be exceeded!**


3.6 Installation instructions for dairy pipe connectors

- Check that the O-ring is undamaged and is seated in the groove provided for it in the receiving fitting.
- Center the dairy pipe connector in the corresponding receiving fitting.
- Screw the union nut on to the receiving fitting.
- Then pull it tight with a hook wrench.

3.7 Installation instructions for clamp and Varivent® connectors

- Use a suitable seal that is compatible with the process medium and the pressure to be measured.
- Place the seal on the corresponding receiving fitting.
- Center the clamp or Varivent® connector above the corresponding receiving fitting with its seal.
- Then attach the device using a suitable fastening element (e.g. semi-ring or retractable ring clamp) in accordance with the manufacturer's instructions.
-  The sensor must not be exposed to high temperatures or rapid pressure increases that exceed the specified limits (see data sheet for limit values). The sensitive diaphragm of the flush-mounted sensor must not be touched since it may deform or tear.

4. Electrical Installation

	Danger of death from electric shock - Switch off the power supply before installing the device.
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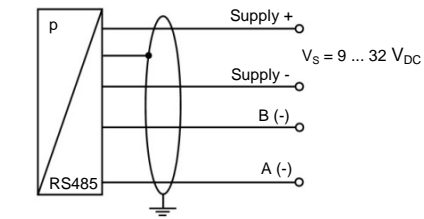
Electrically connect the device in accordance with the specifications given on the type plate, the following pin assignment table and the connection diagram.

Interface	Electrical connections	M12x1 (4-pin) metal	Binder 723 (5-pin)	Cable colours (DIN 47100)
RS 485 Modbus RTU	Supply +	1	1	wh (white)
	Supply -	3	3	bn (brown)
	Not inverted B+ inverted A-	2 4	2 4	gn (green) ye (yellow)
	Shielding	Pressure port	5	ye/gn (yellow / green)
iPC	Supply+	1	1	wh (white)
	Supply -	3	3	bn (brown)
	SDA	2	2	ye (yellow)
	SCL	4	4	gn (green)
	INT	5	5	pk (pink)
	Shielding	housing	housing	ye/gn (yellow / green)

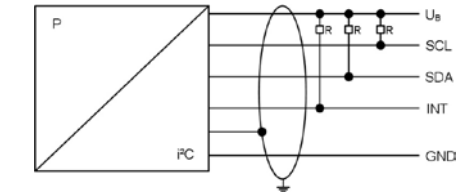
Pin assignment table:


Connection diagrams:

RS 485 / Modbus RTU




iPC





 For the installation of a device with cable outlet following bending radii have to be complied with:

cable without ventilation tube:
static installation : 5-fold cable diameter
dynamic application: 10-fold cable diameter


cable with ventilation tube:
static installation : 10-fold cable diameter
dynamic application: 20-fold cable diameter


 the damage or removal of the PTFE filter which is fixed over the end of the air tube on devices with cable outlet and integrated air tube.

 If possible, use a shielded and twisted multicore cable for the electrical connection.

 If a transition is desired from a transmitter cable with gauge tube to a cable without gauge tube, we recommend our terminal box KL 1 or KL 2.

5. Commissioning

 Before using the device for the first time, check that it has been properly installed, and make sure that it does not show any visible defects.

 The device may be commissioned only by appropriately qualified specialist personnel who have read and understood the user manual.

6. Modbus RTU Communication

6.1 Configuration of Modbus RTU

Factory setting	1	1	1
address	1 ... 247		
Baud-Rate			
4800		0	
9600		1	
19200		2	
38400		3	
Paritate			
none			0
odd			1
even			2

6.2 Explicit register description

Map of Input registers (read only, function #4 - Read Input Registers)		
Address	Register	Data type
0x0000	Serial Number	UInt32
0x0001		
0x0002	Date of last calibration	Date
0x0003		
0x0004	Upper range of pressure channel	Float, IEEE754
0x0005		
0x0006	Lower range of pressure channel	Float, IEEE754
0x0007		
0x0008	Actual pressure	Float, IEEE754
0x0009		
0x000A	Maximal Pressure	Float, IEEE754
0x000B		
0x000C	Minimal Pressure	Float, IEEE754
0x000D		
0x000E	Upper range of temperature channel	Float, IEEE754
0x000F		
0x0010	Lower range of temperature channel	Float, IEEE754
0x0011		
0x0012	Actual temperature	Float, IEEE754
0x0013		
0x0014	Maximal temperature	Float, IEEE754
0x0015		
0x0016	Minimal temperature	Float, IEEE754
0x0017		

Map of Holding registers (read, write, fce #3 - Read Holding Registers, fce #6 - Write Single Register)		
Address	Register (description)	Data type
0x0000	Unit of pressure channel	UInt16
0x0001	Unit of temperature channel	UInt16
0x0002	Device address	UInt16
0x0003	Baud rate	UInt16
0x0004	Parity	UInt16

Pressure unit enumeration		
Code (UInt16)	Unit	
0x0003		mmH ₂ O
0x0004		mmHG
0x0005		psi
0x0006		bar
0x0007		mbar
0x0008		g/cm ²
0x0009		kg/cm ²
0x000A		Pa
0x000B		kPa
0x000C		torr
0x000D		atm
0x000E		mH ₂ O
0x000F		MPa

Temperature unit enumeration		
Code (UInt16)	Unit	
0x0000		°C
0x0001		°K
0x0002		°F

Baud rate enumeration		
Code (UInt16)	Baud rate [Bd]	
0x0004		4800
0x0005		9600
0x0006		19200
0x0007		38400

Parity enumeration		
Code (UInt16)	Parity	
0x0000		none
0x0001		odd
0x0002		even

7. I²C-Interface

7.1 Configuration of I²C-Interface

Standard	050	0	0	0	0	0	00001
Slave address							
address	1						
	...						
	127						
Type of result register							
32bit IEEE float		0					
16bit integer		1					
Byte order of values							
Low byte first			0				
High byte first			1				
Mode of result register							
Value				0			
Percent of nominal				1			
Restore of address pointer							
no restore					0		
to last set address on next start						1	
Digital meaning							
Count of result							00001 ... 10000

7.3 Register overview

Nr.	Re-gister	Type 0 (Float)	Mode 1 (Int 16)
1	0x00	Status	Status
2	0x01	Pressure	Pressure
3	0x02		
4	0x03		Temperature
5	0x04		
6	0x05	Temperature	
7	0x06		
8	0x07		
9	0x08		

65	0x40	Configuration	Configuration
66	0x41	Oversampling	Oversampling
67	0x42		
68	0x43	Slave Address	Slave Address
69	0x44	Pressure unit	Pressure unit
70	0x45	Nominal pressure lower	Nominal pressure lower
71	0x46		Decimal places
72	0x47		
73	0x48	Nominal pressure upper	Nominal pressure upper
74	0x49		
75	0x4A		
76	0x4B		
77	0x4C	Temperature unit	Temperature unit
78	0x4D		
79	0x4E	Nominal temperature lower	Nominal temperature lower
80	0x4F		Decimal places
81	0x50	Nominal temperature upper	Nominal temperature upper
82	0x51		
83	0x52		
84	0x53		
85	0x54		
86	0x55		

7.3 Explicit register description

Explanation:

r = only readable

r/w = read and write capable

d = don't care

0x00 – Status register:

7	6	5	4	3	2	1	0
ABS			ERR	SAT	OVER	UNDER	READY
r	d	d	r	r	r	r	r

bit 0	Result registers is READY	
0 b =	Outdated values will be read	
1 b =	Registers contain new values	
Note:	This bit has same behaviour as hardware ready connector. Logic level is inverted because of open collector at output stage.	
Note:	It is possible to poll update without using hard wiring, or to check wick sensor has updated if more than one is used on bus.	
bit 2	Value is out of UNDER nominal range	
0 b =	Pressure value is in nominal range	
1 b =	Pressure is to low	
Note:	OVER and UNDER flags are stored until state register is read.	
bit 3	Value SAT urated	
0 b =	No saturation	
1 b =	Output value or ADC is out of range	
bit 4	Internal ERR or, transmitter does not work	
0 b =	Transmitter is in normal operation	
1 b =	Internal error or wrong setting is active	
bit 7	Transmitter is ABS olute	
0 b =	Pressure type of transmitter is relative	
1 b =	Pressure type of transmitter is absolute	

0x40 – Configuration register

7	6	5	4	3	2	1	0
ADD			RESTORE	MODE	ORDER	TYPE	
r/w	d	d	r/w	r/w	r/w	r/w	r/w

bit 0	TYPE of result register	
0 b =	32bit IEEE float	
1 b =	16bit integer	
bit 1	Byte ORDER of values	
0 b =	Low byte first	
1 b =	High byte first	
bit 2...3	MODE of result register	
00b=	Value	
01b=	Percent of nominal	
10b=	reserved	
11b=	reserved	
bit 4	RESTORE address pointer	
0 b =	No restore	
1 b =	Restore to last set address on restart	
Note:	Using this setting causes reset of register pointer to last written after each stop condition of readout.	
bit 7	Set new I2C slave ADDRESS	
0 b =	Slave address stays as it is	
1 b =	Set this bit to apply previously set slave address	

0x43 – Slave address register

7	6	5	4	3	2	1	0
SLAVE_ADDRESS							
r/w							d

bit 1...7	SLAVE ADDRESS which this transmitter acknowledges	
Note:	To apply new address, it is necessary to set ADD bit in configuration register after new address is written.	

0x44 – Pressure unit register

7	6	5	4	3	2	1	0
UNIT							
r/w							

bit 0...7	Pressure UNIT (according to units in HART protocol)	
0x01	inH2O @ 68°F	
0x02	inHg @ 0°C	
0x03	ftH2O @ 68°F	
0x04	mmH2O @ 68°F	
0x05	mmHG @ 0°C	
0x06	psi	
0x07	bar	
0x08	mbar	
0x09	g/cm ²	
0x0A	kg/cm ²	
0x0B	Pa	
0x0C	kPa	
0x0D	Torr	
0x0E	atm	
0x91	inH2O @ 60°F	
0xAA	cmH2O @ 4°C	
0xAB	mH2O @ 4°C	
0xAC	cmHg @ 0°C	
0xAD	lb/ft ²	
0xAE	hPa	
0xB0	kg/m ²	
0xB1	ftH2O @ 4°C	
0xB2	ftH2O @ 60°F	
0xB3	mHg @ 0°C	
0xED	Mpa	
0xEE	inH2O @ 4°C	
0xEF	mmH2O @ 4°C	

0x4d – Temperature unit register

7	6	5	4	3	2	1	0
UNIT							
r/w							


bit 0...7	Temperature UNIT (according to units in HART protocol)	
0x20	°C	
0x21	°F	
0x22	°R	
0x23	K	
Note:	If pressure or temperature unit is set to an invalid value, slave will not acknowledge.	
Note:	If 16bit integer mode is selected and nominal values can not be displayed with 0...5 decimal places, ERROR flag is set and DECIMAL_PLACES will be 0xff.	

0x47 / 0x50 – Decimal places register

7	6	5	4	3	2	1	0
DECIMAL_PLACES							
r							

bit 0...7	Count of DECIMAL_PLACES	
Note:	Available only when 16bit integer type is selected.	
Note:	Value will be calculated automatically according to nominal range.	

8. Decommissioning

 WARNING	Danger of injury from media escaping under pressure - Dismount in an orderly fashion when the machine is depressurized and the power supply has been switched off. - Check whether the medium needs to be drained before dismounting!
	Danger of injury from the measured medium - Depending on the measured medium, suitable precautions should be taken, e.g. protective gloves, goggles.

9. Maintenance

The device is, in principle, maintenance free. If necessary, the housing of the device may be cleaned with a damp cloth and a non-aggressive cleaning solution while it is switched off.

With certain media may, however, deposits or contamination may accumulate on the diaphragm. The specification of appropriate maintenance intervals for inspection is recommended in this case. Once the device has been properly decommissioned, the diaphragm can normally be cleaned with a non-aggressive cleaning solution and a soft brush or sponge. Care should be taken while doing so. If the diaphragm is covered in limescale, decalcification by BD SENSORS is recommended. See the Servicing/Repair section with regard to this.

Incorrect cleaning can result in irreparable damage to the measuring cell. For this reason, you should never use sharp objects or compressed air to clean the diaphragm.


10. Servicing/Repair

10.1 Recalibration

It is possible that the offset value or the scaling value may shift during the lifetime of the device. This is indicated by a deviation in the output signal value with reference to the set measurement range start or end values respectively. If either of these two phenomena should occur after a prolonged period of use, recalibration is recommended in order to ensure a continued high level of accuracy.

10.2 Return

Whenever the device is returned, no matter whether for recalibration, decalcification, modification or repair, it must be carefully cleaned and packed such that there is no risk of breakage. The device must be accompanied by a notice of return giving a detailed description of the fault. If your device has come into contact with pollutants, then a notice of decontamination will also be needed. You can find the relevant templates on our website at www.bdsensors.de. Should you send in your device without a notice of decontamination and doubts with regard to the medium used should arise in our service department, repair work will commence only once an appropriate notice has been received.

 Caution	Danger of injury from pollutants - If the device has come into contact with pollutants, wear suitable protective clothing, e.g. gloves, goggles, when cleaning it.
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11. Disposal

The device must be disposed of in accordance with European Directives 2002/96/EC and 2003/108/EC (Waste Electrical and Electronic Equipment). Waste electrical products may not be disposed of with household waste!

Depending on the medium used, residues on the device may constitute a hazard to the environment. You should therefore take appropriate precautions if necessary and dispose of the device properly.

12. Guarantee Conditions

The guarantee conditions are subject to the statutory warranty period of 24 months, starting from the date of dispatch. No warranty claims will be accepted if the device has been used improperly, modified or damaged. The warranty does not cover damaged diaphragms. Warranty cover also excludes any claims for defects that have arisen as a result of normal wear.

13. Declaration of Conformity / CE

The supplied device fulfills the statutory requirements. The relevant directives, harmonized standards and documents are listed in the EU Declaration of Conformity applicable to the product. This can be found at <http://www.bdsensors.de>. In addition, the operational safety of the device is confirmed by the CE mark on the type plate.

