

Operating Manual



Differential pressure transmitter for IS-areas

DX3A DMD 331, DX3A DMD 331_54X



DX3A DMD 331

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1. General information

1.1 Information on the operating manual

This operating manual contains important information on proper usage of the device. Read this operating manual carefully before installing and starting up the pressure measuring device.

Adhere to the safety notes and operating instructions which are given in the operating manual. Additionally applicable regulations regarding occupational safety, accident prevention as well as national installation standards and engineering rules must be complied with!

For the installation, maintenance and cleaning of the device, you must absolutely observe the relevant regulations and stipulations on explosion protection (VDE 0160, VDE 0165 and EN IEC 60079-0:2018, EN 60079-11:2012 and EN 60079-26:2015) as well as the occupational safety provisions.

This operating manual is part of the device, must be kept nearest its location, always accessible to all employees.

This operating manual is copyrighted. The contents of this operating manual reflect the version available at the time of printing.

– Technical modifications reserved –

1.2 Symbols used

- DANGER!** – dangerous situation, which may result in death or serious injuries
- WARNING!** – potentially dangerous situation, which may result in death or serious injuries
- CAUTION!** – potentially dangerous situation, which may result in minor injuries
- CAUTION!** – potentially dangerous situation, which may result in physical damage
- NOTE** – tips and information to ensure a failure-free operation

1.3 Target group

- WARNING!** To avoid operator hazards and damages of the device, the following instructions have to be worked out by qualified technical personnel.

1.4 Limitation of liability

By non-observance of the operating manual, inappropriate use, modification or damage, no liability is assumed and warranty claims will be excluded.

1.5 Intended use

- The differential pressure transmitter DMD 331 is intended for industrial applications. For both sided pressure admission, the difference of the pressure between positive and negative side is established and converted into a proportional electrical signal. The DMD 331 is intended e.g. in engineering and plant construction for filter controlling and flow measurement as well as in hydraulic applications.
- This operating manual applies to devices with explosion protection approval and is intended for the use in IS-areas. A device has an explosion protection approval if this has been specified in the purchase order and confirmed in our order confirmation. In addition, the manufacturing label contains the -symbol.
- It is the operator's responsibility to check and verify the suitability of the device for the intended application. If any doubts remain, please contact our sales department in order to ensure proper usage. BD SENSORS is not liable for any incorrect selections and their effects!
- Permissible media are gases or liquids, which are compatible with the media wetted parts described in the data sheet. In addition it has to be ensured, that this medium is compatible with the media wetted parts.
- The technical data listed in the current data sheet are engaging. If the data sheet is not available, please order or download it from our homepage. (<http://www.bdsensors.com>)

- WARNING!** Danger through improper usage!

1.6 Safety technical maximum values

EC-Type Examination Certificate Number:
IBExU08ATEX1124 X

designation:

DX3A DMD 331
zone 1:
DX3A DMD 331_54X:
zone 0:

permissible temperatures for environment:

application in zone 0 (p_{atm} 0.8 bar up to 1.1 bar):

-20 ... 60 °C

application in zone 1:

-25 ... 60 °C

safety technical maximum values

$U_i = 28 \text{ V}$; $I_i = 93 \text{ mA}$; $P_i = 660 \text{ mW}$; $C_i \leq 1 \text{ nF}$; $L_i \leq 10 \mu\text{H}$;
effective internal capacitance to earth $\leq 27 \text{ nF}$

1.6.1. Specific conditions of use

- The safety and assembly notes contained in the operating instructions are the ambient temperature range $-25 \text{ °C} \leq T_a \leq +60 \text{ °C}$ have to be observed.
- The device may only operate in explosive atmosphere which requires equipment of Category 1, if there are atmospheric conditions (temperature from -20 °C to $+60 \text{ °C}$ pressure from 0.8 bar to 1.1 bar).
- The type label must be protected against electrostatic charge. It can only be cleaned with a damp cloth.
- The device must not be operated near processes that generate strong charges.

1.7 Package contents

Please verify that all listed parts are undamaged included in the delivery and check for consistency specified in your order:

- differential pressure transmitter
- this operating manual

2. Product identification

The device can be identified by its manufacturing label. It provides the most important data. By the ordering code the product can be clearly identified.

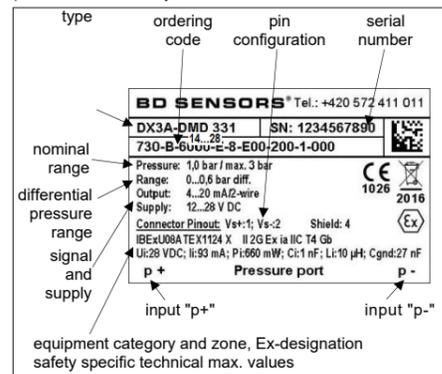


Fig. 1 manufacturing label DMD 331- example

- The manufacturing label must not be removed from the device!

3. Mechanical installation

3.1 Mounting and safety instructions

- WARNING!** Install the device only when depressurized and currentless!

- WARNING!** This device may only be installed by qualified technical personnel who has read and understood the operating manual!

- DANGER!** Caused by the explosion hazard following instructions have to be complied with:

- The technical data listed in the EC type-examination certificate are engaging. If the certificate is not available, please order or download it from our homepage: <http://www.bdsensors.com>
- Working on supplied (active) parts, except for intrinsically safe circuits, is principally prohibited during an explosion hazard.
- Make sure that an equipotential bonding is in place for the entire course of the line, both inside and outside the intrinsic area.
- In case of increased danger of lightning strike or damage by overvoltage, a stronger lightning protection should be planned.
- Observe the limiting values specified in the EC type-examination certificate. (Capacitance and inductance of the connection cable are not included in the values.)
- Make sure that the entire interconnection of intrinsically safe components remains intrinsically safe. The operator is responsible for the intrinsic safety of the overall system (installation of intrinsic parts).
- Do not mount the device in a pneumatic flow rate!
- Excessive dust deposits (over 5 mm) and a complete dust covering must be avoided!

- Handle this high-sensitive electronic precision measuring device with care, both in packed and unpacked condition!

- There are no modifications/changes to be made on the device.

- Do not throw the package/device!

- To avoid damaging the diaphragm, remove packaging and protective cap directly before starting assembly. The delivered protective cap has to be stored!

- Place the protective cap on the pressure port again immediately after disassembling.

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

- Make sure that no mechanical stresses occur at the pressure port with low pressure ranges during installation, as this may cause a shifting of the characteristic curve.

- For the connection of the pressure lines, a sealing has to be installed by the operator.

- For the pipe assembly, a stress free installation must be observed.

- Consider for the installation that the pressure ports must not be turned against the housing!

- For installations outdoor and in damp areas following these instructions:

- To prevent moisture admission in the plug the device should be installed electrically after mounting, at once. Otherwise a moisture admission has to be blocked e.g. by using a suitable protection cap. (The ingress protection in the data sheet is valid for the connected device.)
- Choose an assembly position, which allows the flow-off of splashed water and condensation. Avoid permanent fluid at sealing surfaces!
- When using a cable gland and outlet device, turn the outgoing cable downwards. If the cable has to be turned upwards, then point it downward so the moisture can drain.
- Install the device in such a way that it is protected from direct solar irradiation. Direct solar irradiation can lead to the permissible operating temperature being overstepped in the worst case. This is prohibited for applications in IS-areas!

- Take note that no inadmissibly high mechanical stresses occur at the pressure port as a result of the characteristic curve or to the damage.

- Provide a cooling line when using the device in steam piping.

- If installing the device outdoor and there is any danger of lightning or overpressure we suggest putting a overpressure protection unit between the supply/switch cabinet and the device to prevent damage.

3.2 General installation steps

- Carefully remove the pressure measuring device from the package and dispose of the package properly.
- Connect the reference pressures according to the following installation steps. Therefore, keep in mind that the higher pressure has to be connected with input "p+"; lower pressure has to be connected with input "p-".
- Fix the device according to your demands on the holder or holding angle intended for it. For mounting the device, mounting threads are provided. (DMD 331: four threads M4 - 10 deep. The exact position is defined in the data sheet.)

3.3 Installation steps for G 1/2" acc. to EN 837

- Use suitable cooper gaskets for each pressure port, corresponding to the diameter of the threads which should be screwed in. (seals are not included in the scope of delivery)
- Ensure that the sealing surfaces are perfectly smooth and clean. ($R_2 6.3$)
- Screw your fittings by hand onto the threads.
- To tighten the fittings properly, hold the DMD 331 on the spanner flat SW 22 of the respective pressure port with one hand and then tighten it (max. 50 Nm).
- The indicated tightening torques must not be exceeded!**

3.4 Installation steps for G 1/4" internal thread

- Check to ensure that the o-rings fit properly into the grooves. (o-rings are included in the scope of delivery)
- Make sure that the sealing surfaces of the fittings are perfectly smooth and clean. ($R_2 6.3$)
- Screw the fittings into the threads by hand.
- To tighten the fittings properly, hold the DMD 331 on the spanner flat SW 22 of the respective pressure port with one hand and then tighten it (max. 20 Nm).
- The indicated tightening torques must not be exceeded!**

3.5 Installation steps for G 7/16" UNF

- Seal the pressure ports of the differential pressure transmitter in a way that is suitable for your application. (seals are not included in the scope of delivery)
- Screw your fittings by hand onto the threads.
- To tighten the fittings properly, hold the DMD 331 on the spanner flat SW 22 of the respective pressure port with one hand and then tighten it (max. 30 Nm).
- The indicated tightening torques must not be exceeded!**

4. Special regulations for IS-Areas

4.1 Protection against electrostatic charge hazards

Different types of the device partially consist of chargeable plastic components. These are, in particular, the carrying and

connection cables. A potential electrostatic charge presents the danger of spark generation and ignition. An electrostatic charge must therefore be absolutely prevented.

- Generally, a shielded cable must be used.

- Avoid friction on the plastic surfaces!

- Do not clean the device dry! Use, for example, a damp cloth.

4.2 Overvoltage protection

If the pressure transmitter is used as electrical equipment of category 1 G, then a suitable overvoltage protection device must be connected in series (attend the valid regulations for operating safety as well as EN60079-14 as amended).

4.3 Schematic circuit

The operation of an intrinsically safe transmitter in intrinsic safe areas requires special care when selecting the necessary Zener barrier or transmitter repeater devices to allow the utilization of the device's properties to the full extent. The following diagram shows a typical arrangement of power supply, Zener barrier and transmitter.

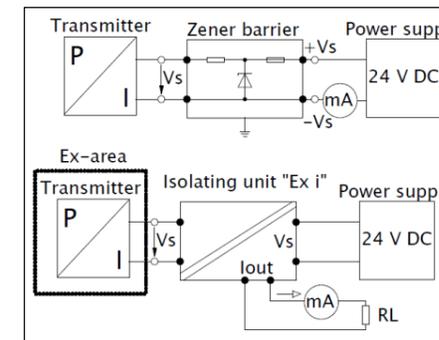


Fig. 2 circuit diagrams

- Please pay attention to item (17) of the type examination certificate, which stipulates special conditions for intrinsically safe operation.

4.4 Exemplary circuit description

The supply voltage of e.g. 24 V_{DC} provided by the power supply is led across the Zener barrier. The Zener barrier contains series resistances and breakdown diodes as protective components. Subsequently, the operating voltage is applied to the transmitter and, depending on the pressure, a particular signal current flows.

- DANGER!** When installing the intrinsically safe device as zone-0-equipment, the supplying must be carried out by a power supply which must be galvanically insulated and which must not be grounded.

4.5 Functional selection criteria for Zener barriers and galvanic power supply

The minimum supply voltage V_{S min} of the transmitter must not fall short since a correct function of the device can otherwise not be guaranteed. The minimum supply voltage has been defined in the respective product-specific data sheet under "Output signal / supply".

When using a galvanically insulated amplifier with linear bonding, note that the terminal voltage of the transmitter will decrease like it does with a Zener barrier. Furthermore, you have to note that the supply will additionally decrease with an optionally used signal amplifier.

4.6 Test criteria for the selection of the Zener barrier

In order not to fall below V_{S min}, it is important to verify which minimum supply voltage is available at full level control of the transmitter. The full level control, i.e. a maximum or nominal output signal (20 mA), can be reached by applying the maximum physical input signal (pressure).

The technical data of the barrier will usually provide the information needed for the selection of the Zener barrier. However, the value can also be calculated. If a maximum signal current of 0.02 A is assumed, then – according to Ohm's law – a particular voltage drop will result from the series resistance of the Zener barrier.

This voltage drop is subtracted by the voltage of the power supply and as a result, the terminal voltage is obtained which is applied on the transmitter at full level control. If this voltage is smaller than the minimum supply voltage, another barrier or a higher supply voltage should be chosen.

- When selecting the supplied devices / Zener barrier, the maximum operating conditions according to the EC type-examination certificate must be observed. When assessing these, refer to their current data sheets to ensure that the entire interconnection of intrinsically safe components remains intrinsically safe.

4.7 Calculation example for the selection of the Zener barrier

The nominal voltage of the power supply in front of the Zener barrier is 24 V_{DC} ± 5 %. This results in:

- greatest supply voltage: $V_{S \text{ up max}} = 24 \text{ V} * 1.05 = 25.2 \text{ V}$

- smallest supply voltage: $V_{S \text{ up min}} = 24 \text{ V} * 0.95 = 22.8 \text{ V}$

The series resistance of the Zener barrier is listed with 295 ohm. The following values must still be calculated:

- voltage drop at the barrier (with full conduction):

$$V_{\text{ab barrier}} = 295 \Omega * 0.02 \text{ A} = 5.9 \text{ V}$$

- terminal voltage at the transmitter with Zener barrier:

$$V_{\text{kl}} = V_{S \text{ up min}} - V_{\text{ab barrier}} = 22.8 \text{ V} - 5.9 \text{ V} = 16.9 \text{ V}$$

- minimum supply voltage of the transmitter, (according to data sheet):

$$V_{\text{kl min}} = 12 \text{ V}_{\text{DC}} \text{ (corresponding to } V_{S \text{ min}})$$

Condition:

$$V_{\text{kl}} \geq V_{\text{kl min}}$$

Result:

The terminal voltage of the transmitter with Zener barrier lies at 16.9 V and is therefore higher than the minimum supply voltage of the transmitter which lies at 12 V_{DC}. This means, the Zener barrier has been selected correctly regarding the supply voltage.

- Note that no line resistances have been listed in this calculation. However, these will lead to an additional voltage drop that must be taken into account.

5. Electrical Installation

- WARNING!** Install the device only when depressurized and currentless!

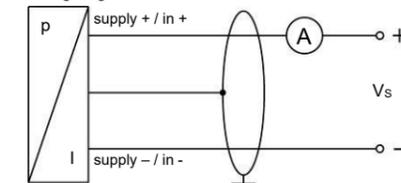
- DANGER!** Danger of explosion when surpassing the maximum supply of 28 V_{DC}!

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	con-	ISO 4400	Brad Harrison [®]	M12x1 (4-pin)
Supply +	1	A	1	
Supply -	2	B	2	
Shield	ground pin	C	4	

Wiring diagram:



- For devices with cable socket, you have to make sure that the external diameter of the used cable is within the allowed clamping ($\varnothing 4 \dots 6 \text{ mm}$) range. Moreover you have to ensure that it lies in the cable gland firmly and cleftlessly!

- Please note for devices with ISO 4400 plug and cable socket, that the socket has to be mounted properly to ensure the ingress protection mentioned in the data sheet. Please check if the delivered seal is placed between plug and cable socket. After connecting the cable fasten the cable socket on the device by using the screw.

- For the electrical connection a shielded and twisted multicore cable has to be used.

6. Initial start-up

- WARNING!** Before start-up, the user has to check for proper installation and for any visible defects.

- WARNING!** The device can be started and operated by authorized personnel only, who have read and understood the operating manual!

- WARNING!** The device has to be used within the technical specifications, only! (compare the data in the data sheet and the EC type-examination certificate)

7. Placing out of service

- WARNING!** Disassemble the device only in current and pressure less condition! Check before disassembling, if it is necessary to drained off the media before dismantling!

- WARNING!** Depending on the medium, it may cause danger for the user. Comply therefore with adequate precautions for purification.

8. Maintenance

- DANGER!** The operator is obligated to observe the information concerning operation and maintenance work on the warning signs possibly affixed to the device.

In principle, this device is maintenance-free. If desired, the housing of the device can be cleaned using a damp cloth and non-aggressive cleaning solutions, in switched-off state.

With certain media, however, the diaphragm may be polluted or coated with deposit. It is recommended to define corresponding service intervals for control. After placing the device out of service correctly, the diaphragm can usually be cleaned carefully with a non-aggressive cleaning solution and a soft

brush or sponge. If the diaphragm is calcified, it is recommended to send the device to BD SENSORS for decalcification. Please note the chapter "Service/Repair" below.

! A false cleaning of the device can cause irreparable damages on the diaphragm. Therefore never use pointed objects or pressured air for cleaning the diaphragm.

9. Service / Repair

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

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 www.bdsensors.com. Should you dispatch a device without a declaration of decontamination and if there are any doubts in our service department regarding the used medium, repair will not be started until an acceptable declaration is sent.

⚠ **If the device came in contact with hazardous substances, certain precautions have to be complied with for purification!**

10. Disposal

The device has to be disposed of according to the European Directives 2012/19/EU and 16/2022 coll. (on waste electrical and electronic equipment). It is prohibited to place electrical and electronic equipment in domestic refuse!



⚠ WARNING! Depending on the used medium, deposit on the device may cause danger for the user and the environment. Comply with adequate precautions for purification and dispose of it properly.

11. Warranty conditions

The warranty conditions are subject to the legal warranty period of 24 months from the date of delivery. In case of improper use, modifications of or damages to the device, we do not accept warranty claims. Damaged diaphragms will also not be accepted. Furthermore, defects due to normal wear are not subject to warranty services.

12. Explanation for the certificate

To item [12] of the EC type-examination "The marking of the equipment mentioned in [4] must include one of the following details:"

Equipment group	II				
Explosion protection					
Equipment category					
Zone 0 – Gas, vapor, mist	1G				
Zone 1 – Gas, vapor, mist	2G				
Zone 20 - Dust	1D				
Zone 21 - Dust	2D				
Designation according to EN and ignition protection type					
Intrinsically safe design	Ex ia				
Explosion group ¹					
II B		II B			
II C		II C			
Ingress protection					
IP 6X			IP 6X		
Temperature class					
max. environmental temperature 85 °C (1G, 2G)					T4
max. environmental temperature 135 °C (1G, 2G)					T6
max. surface temperature 85 °C (1D, 2D)					T 85°C

¹Exact specifications regarding limiting gap width and minimum ignition current ratio can be taken from the corresponding standard or the VDE publication.

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

14. Error handling

Malfunction	Possible cause	Error detection / corrective
no output signal	wrong connected	inspect the connection
	line break	inspect all line connections necessary to supply the device (including the connector plugs)
	defective ampere meter (signal input)	inspect the ampere meter (fine-wire fuse) or the analog input of the PLC
analog output signal too low	load resistance too high	verify the value of the load resistance
	supply voltage too low	verify the output voltage of the power supply
	defective energy supply	inspect the power supply and the applied supply voltage at the device
shift of output signal	diaphragm is contaminated or damaged	please send the device to BD SENSORS for repair
wrong or no output signal	electrical connection is damaged	check the connections
	reverse polarity of the pressure ranges	check if the higher pressure is connected with the input "p+"

If you detect an error, please try to eliminate it by using this table or send the device to our service address for repair.

⚠ DANGER! Working on supplied (active) parts, except for intrinsically safe circuits, is principally prohibited during an explosion hazard. Additionally, the operator is obligated to observe the information concerning operation and maintenance work on the warning signs possibly affixed to the device.

! Improper action and opening can damage the device. Therefore repairs on the device may only be executed by the manufacturer!