

Operating Manual

Differential pressure transmitter for IS-areas

DX13A-DMD331, DX13A-DMD331_54X



READ THOROUGHLY BEFORE USING THE DEVICE KEEP FOR FUTURE REFERENCE

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

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

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

The following documents are an important part of the operating manual:

- Data sheet
- Type-examination certificate

For specific data on the individual transmitter, please refer to the respective data sheet.

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

The IS versions of our products are variants of the standard products.

Example:

Standard: DMD 331 → IS-version: DX13A-DMD 331

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

For the installation, maintenance and cleaning of the device, the relevant regulations and provisions on explosion protection (VDE0160, VDE 0165 and/or EN 60079-14) as well as the accident prevention regulations must absolutely be observed. The device was designed by applying the following standards:

DX13A: EN60079-0:2012+A11:2013
EN60079-11:2012

1.1 Symbols used

	- Type and source of danger - Measures to avoid the danger
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Warning word	Meaning
	- Imminent danger! - Non-compliance will result in death or serious injury.
	- Possible danger! - Non-compliance may result in death or serious injury.
	- 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 measuring 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 devices are used to convert the physical parameter of pressure into an electric signal.

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 was specified in the purchase order and confirmed in our order acknowledgement. In addition, the manufacturing label includes a sign.

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!

Permissible media are gases or liquids, which are compatible with the media wetted parts described in the data sheet.

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>

	Danger through incorrect use - In order to avoid accidents, use the device only in accordance with its intended use.
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1.4 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.

1.5 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 - The device must not be altered or modified in any way.

NOTE - Do not throw or drop the device!

NOTE - Excessive dust accumulation (over 5 mm) 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.

1.6 Safety-related maximum values

U_i = 28 V; I_i = 93 mA; P_i = 660 mW; C_i ≤ 1 nF; L_i ≤ 10 µH; with respect to the housing, the supply connections have an interior capacity of max. 27 nF

Range of ambient temperature

DX13A-DMD 331:

Use in zone 1: -25 ... 65 °C

DX13A-DMD 331_54X:

Use in zone 0 (p_{atm} 0.8 bar to 1.1 bar): -20 ... 60 °C

Use in zone 1: -25 ... 65 °C

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:

- 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.

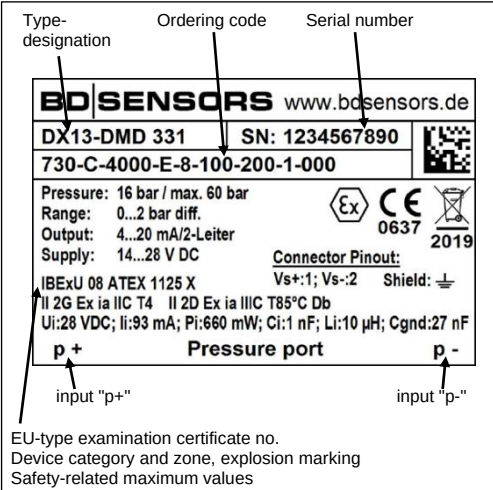


Fig. 1 Example of manufacturing label

NOTE - The manufacturing label may not be removed!

The marking of equipment with an IS approval has to include the following:

EU-type examination certificate: IBExU08ATEX1125 X

Designation:
DX13A-DMD 331:
II 2G Ex ia IIC T4 Gb
II 2D Ex ia IIIC T85°C Db

DX13A-DMD 331_54x:
II 1G Ex ia IIC T4 Ga
II 1D Ex ia IIIC T85°C Da

3. Mounting

3.1 Mounting and safety instructions

	Danger of death from explosion, airborne parts, leaking fluid, electric shock - Always mount the device in a depressurized and de-energized condition! - Do not install the device while there is a risk of explosion.
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NOTE - The technical data listed in the EU-type examination certificate are binding. Download these by accessing www.bdsensors.de or request them: info@bdsensors.de | Tel.: +49 (0) 92 35 / 98 11 0

NOTE - Make sure that the entire interconnection of intrinsically safe components remains intrinsically safe. The owner-operator is responsible for the intrinsic safety of the overall system (entire circuitry).

NOTE - Make sure that an equipotential bonding is in place for the entire course of the line, both inside and outside the intrinsic area.

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

NOTE - Provide for a cooling section if the device is used in a steam line.

NOTE - Do not mount the device in a pneumatic flow rate!

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

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

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

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

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

NOTES - for mounting outdoors or in a moist environment:

- Please note that your application does not show a dew point, which causes condensation and can damage the pressure transmitter. There are specially protected pressure transmitters for these operating conditions. Please contact us in such case.
- Connect the device electrically straightaway after mounting or prevent moisture penetration, e.g. by a suitable protective cap. (The ingress protection specified in the data sheet applies to the connected device.)
- Select the mounting position such that splashed and condensed water can drain off. Stationary liquid on sealing surfaces must be excluded!
- For devices with cable socket, 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. This must be excluded if the device is used in any IS area!
- If installing the device outdoor and there is any danger of lightning or overpressure, we suggest putting an overpressure protection unit between the supply / switch cabinet and the device to prevent damage.

3.2 General mounting steps

1. 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-".
2. 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

- ✓ The sealing surfaces are perfectly smooth and clean. (R_z 6.3)
- ✓ For each pressure port a suitable cooper gaskets, corresponding to the diameter of the threads which should be screwed in, is used. (seals are not included in the scope of delivery)

1. Screw the fittings into the threads by hand.
2. 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 (permissible tightening torque for device: max. 50 Nm).

3.4 Installation steps for G 1/4" internal thread

- ✓ Suitable seals for the measured fluid and the pressure to be measured are available.
- ✓ The sealing surfaces of the fittings are perfectly smooth and clean. (R_z 6.3)

1. Screw the fittings into the threads by hand.
2. 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. The torque depends on the counterpart (permissible tightening torque for the device: max. 20 Nm).

3.5 Installation steps for G 7/16" UNF

- ✓ The pressure ports of the differential pressure transmitter are sealed in a way that is suitable for your application. (seals are not included in the scope of delivery)

1. Screw your fittings by hand onto the threads.
2. 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 (permissible tightening torque for device: max. 30 Nm).

4. Electrical connection

4.1 Connection and safety instructions

	Danger of death from electric shock or explosion - Explosion hazard if the operating voltage is too high (max. 28 V_{DC}). - Always mount the device in a depressurized and de-energized condition! - Do not install the device while there is a risk of explosion. - Operate the device only within the specification! (data sheet) - Improper installation may result in electric shock.
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- ✓ The limit values listed in the
- ✓ certificate are observed. (Capacity and inductance of the connection cable are not included in the values.)
- ✓ The supply corresponds to protection class III (protective insulation).

NOTE - for device with ISO 4400 plug and socket

- Please note 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.
- It must be ensured that the external diameter of the used cable is within the allowed clamping range (Ø 4 ... 6 mm). Moreover you have to ensure that it lies in the cable gland firmly and cleflessly!

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

4.2 Conditions for the IS-area

Danger generated by electrostatic charging

	Danger of death from explosion - Explosion hazard due to spark formation from electrostatic charging of plastic components. - Generally, a shielded cable must be used. - For devices with cable outlet, the cable must be installed tightly. - Avoid friction on the plastic surfaces - Do not clean the device and, if applicable, the connection cable, in a dry state! Use a moist cloth, for example.
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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).

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.

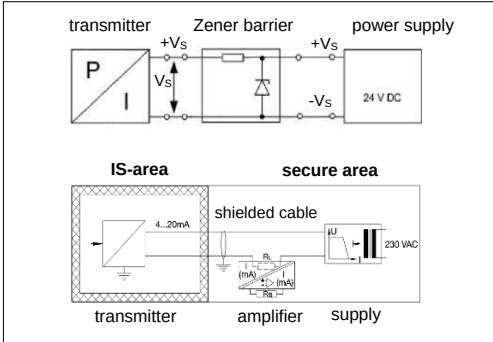


Fig. 2 circuit diagrams

NOTE - Observe item (17) of the type-examination certificate which specifies special conditions for intrinsically safe operation.

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 of death from explosion - Operation of intrinsically safe devices as zone-0 equipment only with ungrounded and galvanically isolated power supply.
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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.

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.

NOTE - When selecting the supplied devices / Zener barrier, the maximum operating conditions according to the EU-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.

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:

- maximum supply voltage:

$$V_{Sup \max} = 24 \text{ V} * 1.05 = 25.2 \text{ V}$$

- minimum supply voltage:

$$V_{Sup \min} = 24 \text{ V} * 0.95 = 22.8 \text{ V}$$

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):

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

- terminal voltage at the transmitter with Zener barrier:

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

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

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

Condition:

$$V_{KI} \geq V_{KI \min}$$

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 - 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.

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

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

 DANGER	Danger of death from explosion, airborne parts, leaking fluid, electric shock - Explosion hazard if the operating voltage is too high (max. 28 V_{DC})! - Operate the device only within the specification! (according to data sheet)
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- Please note that for starting up, the device has to be stressed by pressure simultaneously at both pressure ports. Otherwise the sensor could be damaged. For one-sided pressure admission, the permissible static pressure (one-sided) must be attended. Please take this out of the current data sheet.

 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.

Deposits or contamination may occur on the diaphragm / pressure port in case of certain media. Depending on the quality of the process, suitable maintenance intervals must be specified by the operator. As part of this, regular checks must be carried out regarding corrosion, damage to the diaphragm and signal shift.

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.

 DANGER	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 8 up to 10)
 DANGER	Danger of death from explosion - As a matter of principle, work on energized parts, except for intrinsically safe circuits, is prohibited while there is an explosion hazard.

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	inspect the connection
line break	inspect of all line connections
defective ampere meter (signal input)	inspect the ampere meter (fine-wire fuse) or the analogue input of the PLC

Fault: analogue output signal too low	
Possible cause	Fault detection / remedy
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

Fault: shift of output signal	
Possible cause	Fault detection / remedy
diaphragm is contaminated or damaged	recommendation: send the device to BD SENSORS for service / repair

Fault: wrong or no output signal	
Possible cause	Fault detection / remedy
electrical connection is damaged	check the connections
reverse polarity of the pressure ranges	check if the higher pressure is connected with the input "p+"

 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.

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

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.

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

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.
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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.

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:

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