BD|SENSORS pressure measurement

APPLIED MEASUREMENTS LTD.

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Operating Manual

Industrial pressure transmitter DMK / DMP,
screw-in transmitter LMK / LMP and
OEM pressure transmitter

DMK 331, DMK 331 P, DMK 351, DMK 351 P, DMK 387, DMP 311, DMP 320, DMP 320P, DMP 321, DMP 331, DMP 331i, DMP 331 P, DMP 331 Pi, DMP 333, DMP 333i, DMP 334, DMP 334i, DMP 335, DMP 335P, DMP 336, DMP 339, DMP 339P, DMP 343, LMK 331, LMK 351, LMP 331, LMP 331i, 17.6XX, 17.6XX G, 18.6XX, 18.6XX G, 26.6XX, 26.6XX G, 30.6XX, 30.6XX G

DMP 331

DMP 331P / DMP 331Pi:

74-07

READ THOROUGHLY BEFORE USING THE DEVICE KEEP FOR FUTURE REFERENCE

ID: BA_DMU-ES-OEM_E | Version: 07.2021.0

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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.

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 device is intended for converting the physical parameter of pressure into an electric signal. It has to be used only for this purpose, considering the following information.

The above listed pressure transmitters have, according to the type, been developed for applications in overpressure and vacuum as well as for absolute pressure measurement.

The screw-in transmitters are intended for level and process measurement.

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. - 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 or screw-in transmitter
- for mechanical pressure ports DIN 3852: O-ring (pre-mounted)
- mounting instructions or operating manual
- for SIL2 version: safety data sheet

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

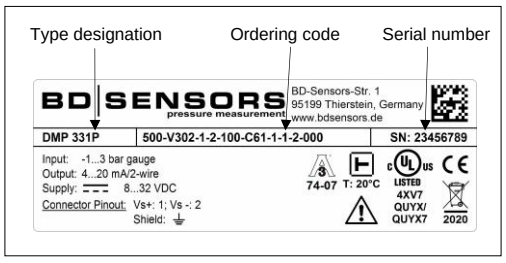


Fig. 1: Example of manufacturing label

NOTE - The manufacturing label 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 operating manual.

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

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 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 in case of 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. If necessary, 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 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!
- If the device has a cable outlet or cable gland, 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.
- 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

NOTE – note the permitted pressure according to EN 837:

G1/4" EN 837	p ≤ 600 bar	Counterpart has to be of steel according to DIN 17440 with strength R_p 0.2 ≥ 190 N/mm²
G1/2" EN 837	p ≤ 1000 bar	
G1/4" EN 837	p > 600 bar, p ≤ 1000 bar	Counterpart has to be of steel according to DIN 17440 with strength R_p 0.2 ≥ 260 N/mm²
G1/2" EN 837	p > 1000 bar, p ≤ 1600 bar	

NOTE - Please refer to data sheet or contact sales department at BD|SENSORS regarding max. permitted pressure of device.

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 G1″ cone connection

1 Screw the device into the mating thread by hand (seal produced metallically)

2 Then tighten it using an open-end wrench. Permissible tightening torques for pressure transmitter:

p_N < 10 bar: 30 Nm
p_N ≥ 10 bar: 60 Nm

3.9 Installation steps for flare

1 Cut the end at right angle to the piping and remove all internal and external burrs.

2 Make the flare; depending on the usage, the device has to be tightened with max. 10 Nm.

3.10 Mounting steps for internal threads M20x1.5 and 9/16" UNF (for high-pressure devices)

WARNING	**Danger of injury** - Due to wrong installation - Do not use any seal!

NOTE - The high-pressure tube will seal metal-to-metal in the chamfer of the pressure port. (sealing cone 60°)

1 Screw the high-pressure fitting into the internal thread of the pressure transmitter.

2 Then tighten it using an open-end wrench. The required tightening torque depends on the manufacturer's specifications for the high-pressure pipe you are using. (permissible tightening torque for pressure transmitter: max 120 Nm)

3.11 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.

3.12 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.

3.13 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 - For the electrical connection a shielded and twisted multicore cable is recommended.

NOTE - If the device is equipped with **plug ISO 4400 or field housing,** it must be ensured that the external diameter of the used cable is within the permissible clamping range:
cable socket ISO 4400: Ø 4 … 6 mm
field housing code 850: Ø 2 … 8 mm
field housing code 880: Ø 5 … 14 mm
Moreover you have to ensure that it lies in the cable gland firmly and cleftlessly!

NOTE - When devices with **ISO 4400 or Buccaneer connector** are used, the cable socket must be properly mounted so that the ingress protection specified in the data sheet is ensured! Ensure that 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.

NOTE - On devices with **field housing**, the terminal clamps are situated under the metal cap. To install the device electrically, the cap must be screwed off. Before the cap is screwed on again, the O-ring and the sealing surface on the housing have to be checked for damages and if necessary to be changed! Afterwards screw the metal cap on by hand and make sure that the field housing is firmly locked again.

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 ventilation 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.

NOTE - 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.

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 connection	ISO 4400	Binder 723 (5-pin)
Supply +	1	3
Supply –	2	4
Signal + (for 3-wire)	3	1
Shield	ground pin ⏚	5

Electrical connection		Binder 723 (7-pin)
Supply +		3
Supply –		1
Signal + (for 3-wire)		6
Shield		2
Communication - interface	RxD	4
	TxD	5
	GND	7

NOTE - The communication interface RS232 may not be connected directly to the PC. A suitable adapter is available as an accessory.

Electrical connection	M12x1 metal (4-pin)	
Code	**M10 / M20**	**M13** (17.620G)
Supply +	1	1
Supply –	2	3
Signal + (for 3-wire))	3	2
Shield	4	plug housing

Electrical connection	Micro	
Code	**C10**	**CB0** (17.620G)
Supply +	1	1
Supply –	2	3
Signal + (for 3-wire)	3	2
Shield	ground pin ⏚	ground pin ⏚

Electrical connection	field housing	cable colours (IEC 60757)
Supply +	IN +	WH (white)
Supply –	IN –	BN (brown)
Signal + (for 3-wire)	OUT +	GN (green)
Shield	⏚	GNYE (green-yellow)

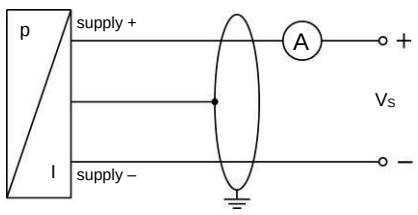
Electrical connection	Buccaneer (4-pin)	TRIM TRIO® (4-pin)
Supply +	1	1
Supply –	2	2
Signal + (for 3-wire)	3	3
Shield	4	4

Electrical connection	Bayonet MIL-C-26482 (10-6)	
	2-wire	3-wire
Supply +	A	A
Supply –	B	D
Signal + (for 3-wire)	-	B
Shield	pressure port	

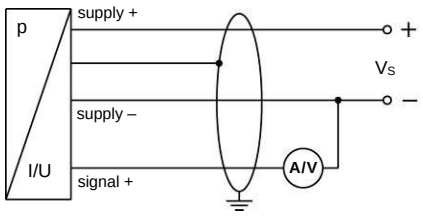
NOTE – The pin configuration for different electrical connections can be found on the manufacturing label.

Wiring diagrams:

2-wire-system (current)



3-wire-system (current/voltage)



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.

In case of highly precise devices with an accuracy of 0.1 % FSO, a microcontroller-controlled electronic system is used for signal processing. This electronic system is used for signal improvement. Due to the principle, the processing of measured values requires a longer time than with purely analogue sensors, which only comprise amplification circuitry. Due to the longer processing time, the output signal follows the measured value not continuously but in jumps. In case of relatively stable and slowly changing measured values, this property plays a minor role. Compare this with the information on the adjusting time in the data sheet.

In the case of i-devices with optional communication interfaces can also be configured by these electronics. Offset, span and damping are programmable within the limits given in the data sheet. For configuring the device, the programming kit CIS 510 consisting of Adapt 1, Windows® compatible programming software P-Scale 510, power supply and connecting cable is necessary. This can be ordered additionally from BD|SENSORS.

6. 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.

7. Troubleshooting

⚠ **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)

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

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

Fault: analogue output signal too low	
Possible cause	**Fault detection / remedy**
Load resistance too high	Checking of load resistance (value)
Supply voltage too low	Checking of power supply output voltage
Defective energy supply	Checking of the power supply and the supply voltage being applied to the device

Fault: slight shift of the output signal	
Possible cause	**Fault detection / remedy**
Diaphragm of senor is severely contaminated, calcified or crusted	Checking of diaphragm; if necessary, send the device to BD|SENSORS for cleaning

Fault: large shift of the output signal	
Possible cause	**Fault detection / remedy**
Diaphragm of sensor is damaged (caused by overpressure or mechanically)	Checking of diaphragm; when damaged, send the device to BD|SENSORS for repair

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

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:

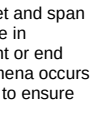
info@bdsensors.de | phone: +49 (0) 92 35 / 98 11 0

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:

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