BD SENSORS®
pressure measurement
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Operating Manual

Digital Gauge DM01, DM01-500, DM01-500HD

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READ THOROUGHLY BE FORE USING THE DEVICE
KEEP FOR FUTURE REFERENCE

ID: BA_DMXX_E_SRO | Version: 11.2018.0

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

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

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

Complementary to this operating manual the current data sheet has to be adhered to.

Download the data sheet by accessing www.bdsensors.cz or request it: sale@bdsensors.cz | Phone: +420 572 411 011

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 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.

All work with this product must be carried out by qualified persons!

1.3 Intended use

The battery powered digital gauge has been designed for extremely high demands in the sector of calibration and test technology. It can be easily and quickly installed in situ.

The user must check whether the device is suited for the selected use. In case of doubt, please contact our sales department (sale@bdsensors.cz | Phone: +420 572 411 011). BD|SENSORS assumes no liability for any wrong selection and the consequences thereof!

The fluids that can be measured are gases and liquids that are compatible with the materials in contact with the fluids, described in the data sheet. For application, it must additionally be ensured that the fluid is compatible with the parts in contact with the fluid.

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 - 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 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:

- digital gauge (display / pressure sensor module)
- this operating manual
- accessories (option)

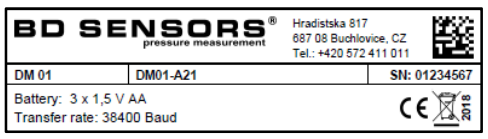
1.7 UL approval (for devices with UL marking)

The UL approval was effected by applying the US standards, which also conform to the applicable Canadian standards on safety.

2. Product identification

The device can be identified by means of the manufacturing label with order code. The most important data can be gathered there from.

manufacturing label of display



manufacturing label of pressure sensor module

Fig. 1 Manufacturing labels

NOTE - The manufacturing labels must not be removed!

3. Mounting

3.1 Mounting and safety instructions

WARNING	- Mount the device (pressure transmitter module) always in the state without pressure and apart from the display!
WARNING	- This device may only be installed by qualified technical personnel who has read and understood the operating manual!
WARNING	- Do not use the display to tighten or solve to the mechanical connection of the pressure transmitter module!

NOTE - Handle this electronic precision measuring device carefully in packed as well as in unpacked condition!

NOTE - Handle the unprotected diaphragm very carefully - it is very sensitive and may be easily damaged.

NOTE - The device may not be thrown!

NOTE - To avoid damaging the diaphragm, remove packaging and protective cap only directly before starting up the device. A delivered protective cap must be stored!

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

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

NOTE - Take note that no inadmissibly high mechanical stresses occur at the pressure port as a result of the installation, since this may cause a shifting of the characteristic curve or to the demage.

NOTE - In hydraulic systems, position the device in such a way that the pressure port points upward (venting).

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

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 specified tightening torques must not be exceeded!

NOTES - for mounting outdoors or in a moist environment:

- Connect the device electrically straightaway after mounting or prevent moisture penetration, e.g. by a suitable protective cap. (The protection rating specified on 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!
- 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 explosion-hazardous area!
- A device with gauge reference in the housing (small hole next to the electrical connection) must be mounted such that the gauge reference is protected against dirt and humidity. If the transducer is exposed to liquid admission, the gauge reference will be blocked, and the equalization of air pressure will be prevented. In this condition, a precise measurement is impossible and damage to the transducer may occur.

3.2 Conditions for oxygen applications

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 the German Federal Agency for Material Testing [BAM] (DIN19247)!

For oxygen applications > 25 bar, transducer types without seals are recommended.

Transmitters with o-rings of FKM Vi 567: permissible maximum values: 25 bar / 150° C (BAM approval)

3.3 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 mating thread by hand.

2 Devices with a wrench flat must be tightened using a suitable open-end wrench.
G1/4": approx. 5 Nm; G1/2": approx. 10 Nm;
G3/4":approx. 15 Nm; G1": approx. 20 Nm

3.4 Mounting steps for connections according to EN 837

✓ A suitable seal for the measured fluid 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 mating thread by hand.

2 Then tighten it using an open-end wrench:
G1/4": approx. 20 Nm; G1/2": approx. 50 Nm

3.5 Mounting steps for NPT connections

✓ Suitable fluid-compatible sealing material, e.g. PTFE tape, is available.

1 Screw the device into the mating thread by hand

2 Then tighten it using an open-end wrench:
1/4" NPT: approx. 30 Nm; 1/2" NPT: approx. 70 Nm

3.6 Installation steps for internal threads M20x1.5 and 9/16" UNF (for DM01-500 HD)

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)

4. Connecting display / pressure sensor module

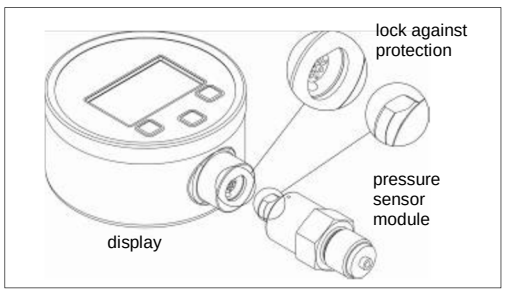


Fig. 2 Lock against protection

Connect display with pressure transmitter module as follows:

- Bring together carefully the display with pressure transmitter module.
- Press the display sturdy pressure transmitter module to this engages.

NOTE - Make sure the device is switched off before disconnecting display and pressure sensor module.

NOTE - While the data logger is active, the display and pressure sensor module may not be disconnected!

5. Supply / changing the batteries

Before initial start-up, remove the insulating foil in the battery case. Perform steps 1 - 3 and 5 in this regard.

As soon as in the display the announcement of "battery" is shown, a battery change is necessary. Perform steps 1, 2, 4, and 5 in this regard.

1 Unscrew three fixing screws with a suitable screwdriver.
2 Take the battery case cap.
3 Remove the insulation foil before initial start-up.
4 Exchange the batteries (3 x 1.5 V AA).
5 Lock the device after that properly.

NOTE - An incorrect usage may cause a leak out of batteries and so a damage the device!

NOTE - Only use batteries of type 1.5 V AA.

NOTE - Never combine batteries of different types or old with new ones!

NOTE - Make sure that the batteries are connected correctly with the corresponding contacts in the battery tray.

NOTE - Never try to charge batteries, demount them, or short-circuit them.

NOTE - use only batteries with UL certification

NOTE - Keep the batteries away from heat and unshielded flame.

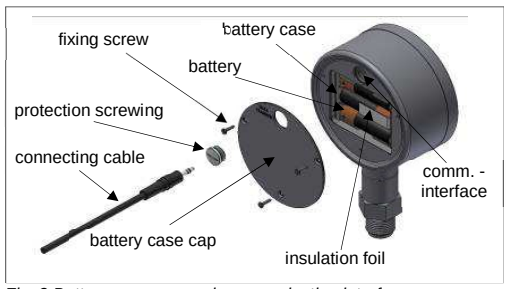


Fig. 3 Battery case cap and communication interface

6. Commissioning

✓ The device has been installed properly.

✓ The device does not have any visible defect.

✓ The device is operated within the specification (according to the data sheet).

✓ The insulation foil in the battery case has been removed.

6.1 Data logger

The battery powered digital gauge disposes of an integrated data logger. The measuring values stored away in the device can be selected above the communication interface by means of software BD|DAQ (optionally included in delivery). Free version BD|DAQ software is available via homepage https://www.bdsensors.cz.

6.2 PC-connection

Connect device with a computer as follows:

- unscrew the protective screwing of the communication interface with a suitable slit screwdriver.
- connect the handle plug of the connecting cable (included in delivery) with the interface socket of the device. Connect the side with the USB plug with a free USB connection on the computer.
- install the COM driver and data logger software BD|DAQ, receive available on CD (optionally included in delivery). Free version BD|DAQ software is available via homepage https://www.bdsensors.cz).
- after the use, disconnect the connection and lock the protection screwing again properly.

7. Operation

7.1 Operating- and display elements (display)

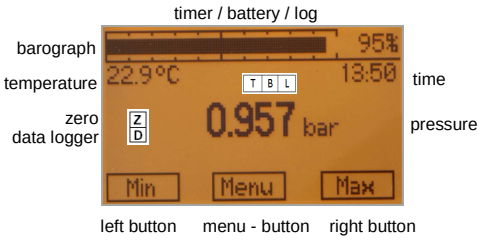
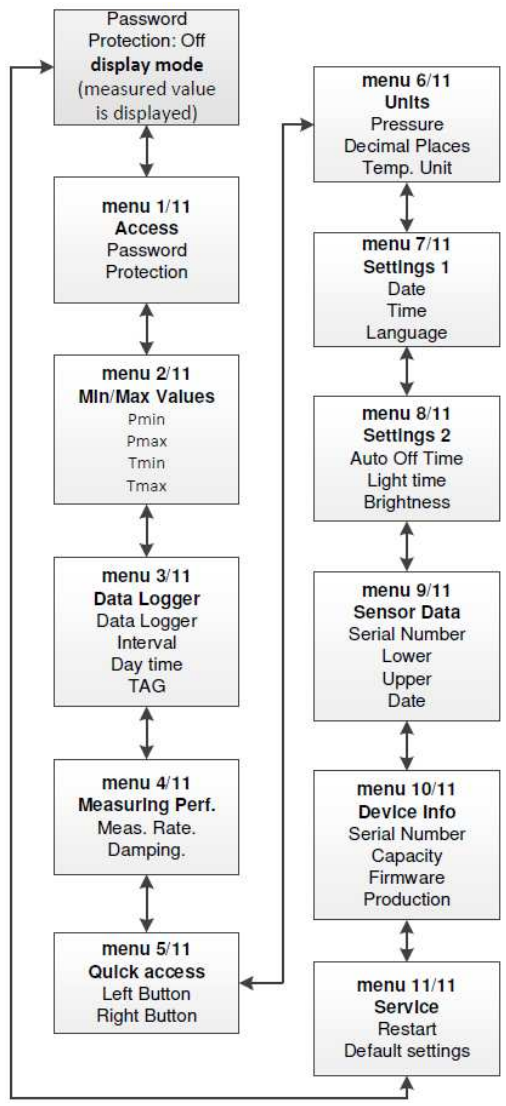


Fig.4 Display and operating foil

The display of the measuring value as well as configuring the single parameters occurs menu-steered about a LC display capable of graphic arts. The single functions are regulated on the basis of three-front-sided arranged push buttons.

The menu system is closed, thereby one can "browse" forward as well as backward by the single setting menus to reach to the desired setting point.

7.2 Structure of the menu system



7.3 Menu description

Switching on	**Switching on without status message**, with "Left button" and "Right button" key possible. **Switching on with status message**, only possible with button "Menu key" (middle button). Status message (appears in the display for approx. 2 seconds): -Memory usage: in percent -TAG: Measuring point designation in text form -Battery: Status of the battery charge -Firmware: installed version
Menu 1/11 **Access**	**Password**: **** (a four-digit, freely combinable statement consisting of numbers, letters and special characters) -Protection [Off]: unrestricted operation -Protection [On]: operation only possible after password input (Select menu item "Password" with "Edit" → Press "<<" or ">>" → Set value → continue with "Next". Set password and remember! → Press "Next" to "Protection" sub-item → Press "<<" or ">>" → Activate protection [On] or deactivate protection [Select] → confirm with "Next" and continue to menu bar.) **NOTE** - no connection to the evaluation software BD|DAQ, if password is active! If you have forgotten your password, contact the manufacturer!
Menu 2/11 **Min/Max Values**	**Display of min / max values** P_{min} - Minimum pressure display: The minimum pressure applied during measuring is shown in the display. P_{max} - Maximum pressure display: The maximum pressure applied during measuring is shown in the display. T_{min} - Minimum temperature display: The minimum temperature during measuring is shown in the display. T_{max} - Maximum temperature display: The maximum pressure applied during measuring is shown in the display. Possible options: reset value [Reset ?, Sure?] (Resetting of a value: select the menu point with "Edit" → button ">>" operate. There appears the question "Reset?" → once more operate the button ">>". It seems "Sure?" additional confirmation whether the value should be put back → repeated confirming with the button ">>" takes over topically adjoining pressure as a minimum value.)
Menu 3/11 **Data Logger**	**Data Logger configuration** the following settings are possible: linearly [Linear] (value admission to the counter level 600798 is reached), cyclically ([Loop] (after the value is reached in 600798, the data logger automatically begins the values once more to grasp and, besides, headlines the old values) or [Off] (in the display appears "**D**", if the data logger is activated and goes out if the data logger is off). Intervals to the memory of the measuring values (pressure / temperature): Interval: second [1-99 sec.]; minute [1-99 min]; hour [1-99 h]; or day [1-99 days], the time of day is to be set additionally; Milliseconds [20 msec.], only possible if the sampling rate is set to 50 / sec. in menu 4/11 (measuring performance). Time of day: Measured value recording: at what time the value should be recorded (only effective for the interval setting "day"). TAG: Measuring point inscription, factory set BD|Sensors. The setting can be changed by the user. **NOTE** - While the data logger is active, the display and pressure sensor module may not be disconnected!
Menu 4/11 **Measuring Perf.**	Sample rate: Possible settings [1 / sec.], [2 / sec.] or [50 / sec.] only if the interval is set to [20 msec.] in menu 3/11 (Data Logger). Damping: Damping can be set in one-second increments between [1 sec.] and [10 sec.], or disabled by selecting [Off].
Menu 5/11 **Quick access**	Button configuration: Left button / Right button Left / Right button: configuration of functions: [Min], [Max], [Light], [Zero], [Reset], [Single], [Off] Description of the functions: - [Min] / [Max] minimum / maximum pressure value is shown in the display - [Light] The backlight will turn on only when the illumination time in the 8/11 menu is set to 1-10 s. - [Zero] the zero point is set automatically, the display shows "**Z**" - [Reset] the set zero point is reset, goes out - [Single] the measured values are recorded individually after pressing the button - [Off] switches off the display (standby), provided the data logger is deactivated.
Menu 6/11 **Units**	**Adjustment of pressure unit** adjustable units: [bar], [PSI], [mbar], [mH2O], [inHg], [cmHg], [mmHg], [hPa], [kPa], [MPa], [kg/cm2], [inH2O], [mmH2O] or [User] (the user-defined unit [User] can only be programmed using the software BD | DAQ), all pressure-related parameters are converted **Setting the decimal places** settable decimal places: standard [Std], one decimal place [+1] or two decimal places [+2] **Setting the temperature unit** adjustable units: degrees Celsius [°C], degrees Fahrenheit [°F] or Kelvin [K] set (factory setting [°C])
Menu 7/11 **Settings 1**	**Setting the date, time and language** Adjustable options: The date in the format [T.M.JJJJ], the time in the format [hh: mm] and the language [German] or [English].
Menu 8/11 **Settings 2**	**Setting the switch-off time, the lighting and the brightness** Off time: Setting the automatic switch-off in minutes. The automatic shut-off can be configured in increments of [1 min], [2 min], [3 min], [4 min] or [5 min] (the timer is activated 30 sec. before switching it off) or disabled by the [Off] option. After deactivation, the precision digital pressure gauge is in continuous operation. Illumination: the illumination duration can be set in one-second increments between [1 s] and [10 s] and in ten-second increments between [20 s] and [120 s], or disabled by selecting [Off] and enabling [On]. Note: For continuous lighting [On] increased consumption of the battery charge. Brightness: The brightness can be adjusted in 10% increments between [0%] and [100%].
Menu 9/11 **Sensor Data**	**Overview of sensor data (pressure sensor module)** [SN:] Serial number (ten-digit number) [Lower:] Start of measuring range (value and unit) [Upper:] Measuring range end (value and unit) [Date:] Date of manufacture (dd.mm.yyyy) The values are set by the factory and cannot be changed. Automatic detection after connecting the sensor to the display
Menu 10/11 **Device Info**	**Overview of device information (display)** [SN:] Serial number (eight-digit number) [Cap:] Data logger capacity (occupied range 0-600798 / maximum acceptance 600798) [Firmware:] The installed firmware version is displayed. [Production:] Date of Manufacture (TT.MM.JJJJ) Note: The values are set by the factory and cannot be changed. The recorded value in the data logger can be reset. (Reset counter reading: menu point [Cap:] with "Edit" select → button "<<" or ">>" press. There appears the question "Reset?" → once more operate the button "<<" or ">>". It seems "Sure?" additional confirmation whether the value should be reset → repeated confirming with the button "<<" or ">>" reset the grasped measuring values. Display announcement "Counter: 0/600798")
Menu 11/11 **Service**	**Setting the service options** Device restart: [No] or [Yes] Switching off and switching on the device is carried out automatically. Required before firmware upgrade. Presets: Reset [No] or [Yes] to factory defaults
Error	Display "No sensor": Display and pressure sensor modules are disconnected. Indication "Inappropriate sensor": Sensor is not suitable for the sampling rate 50 / s and the interval of 20 ms.
Firmware update	Download current firmware (https://www.bdsensors.cz), switch on the device, connect the display to the computer (see 5.2), start the firmware update tool. Device (display) restart (automatic detection), select update file with Select File, press Start Update button and execute update. Important: the update may not be interrupted!

- **Left button**: is a function button and can be configured in menu 5. Off, Min, Max, Light, Zero, Reset or Single function can be assigned to the button. The configured function is active in display mode. Hold the button for about 2 seconds to activate the preset function. In operating mode, move backwards in the menu system "<<" or reduce the setting value.

- **Right button:** is a function key and can be configured in menu 5. Off, Min, Max, Light, Zero, Reset or Single functions can be assigned to the key. Hold the button for about 2 seconds to activate the preset function. In operating mode, move forward in the menu system ">>" or increase the setting.

- **Menu-button:** pressing this "Menu" button will enter the operating mode; It also serves to select the individual menu items "Edit" or to confirm the set values "Next". When pressing the button for approx. 4 seconds, the operating mode is exited.

To configure the individual menu items, the desired menu item must be set with the help of the left key "<<" or the right key ">>". Then confirm this with the menu button "Edit". Menu item is highlighted and configuration can begin.
To save a set value the menu key "Next" must be pressed. To exit the menu, press the menu button for approx. 4 seconds. The operating mode is also left automatically after approx. 1 min.

☞ Changes are only effective after pressing the menu button "Next" and after leaving the menu item. When leaving the entire menu system, the set parameters are checked again in relation to each other and in relation to the characteristics of the device. When configuring the unit, the measuring range is converted into the new unit only after leaving the menu system. Depending on the pressure range, not all units may be used.

Notes

8. Placing out of service

DANGER	**Danger of death from airborne parts, leaking fluids** - Disassemble the device in a depressurized and switched-off 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.

9. Service / repair

- Information on service / repair:
- www.bdsensors.cz
- servis@bdsensors.cz
- Service phone: +420 572 411 011

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.com or request them:

sale@bdsensors.cz | phone: +420 572 411 011

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