

Operating Manual

Digital Field Display PA 440 for IS-areas



READ THOROUGHLY BEFORE USING THE DEVICE
KEEP FOR FUTURE REFERENCE

ID: BA_PA440_EX_E | Version: 10.2021.10

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/or EN 60079-14) as well as the occupational safety provisions.

The device was designed by applying the following standards:

- EN IEC 60079-0:2018
- EN 60079-11:2012
- IEC 60079-0:2017 Edition:7.0
- IEC 60079-11:2011 Edition:6.0

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. It has been issued to our best knowledge. BD SENSORS is not liable for any incorrect statements and their effects.

– 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 field display PA 440 is supplied by the analogue current loop and shows the measured value on the display. For monitoring the limit values optionally up to two PNP open collector-contacts are available. As standard the PA 440 is equipped with a LC-display, optionally a LED-display is deliverable.
- The configuration is menu-driven via two push buttons located in the front. Following parameters could be configured: decimal point, zero point, end point, switch-on and switch-off points, etc. Those parameters are being stored in an EEPROM and, thus, are being kept also in case of power breakdown. Limit exceeding in both directions can be displayed as a message. Furthermore an access protection is provided.
- 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!
- The technical data listed in the current data sheet are engaging and must be complied with. If the data sheet is not available, please order or download it from our homepage. (<http://www.bdsensors.de/products/download/datasheets>)

WARNING! Danger through improper usage!

1.6 Safety technical maximum values

AX15-PA440

IBExU08ATEX1126 X / IECEx IBE21.0023X

zone 1: II 2G Ex ia IIB T4 Gb

permissible temperatures for environment: -20 ... 70 °C

U_i = 28 V, I_i = 93 mA, P_i = 660 mW, C_i = 0 nF, L_i = 0 µH

1.7 Package contents

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

- field display PA 440
- sheet of unit labels
- this operating manual

1.8 UL-Approval

The UL – Approval was done with respect to U.S. standards norms which also correspond with the applicable Canadian standards norms for safety.

Note the following points, so that devices fulfils the demands of UL approval:

- only indoor use
- maximum operating voltage: see technical data
- The transmitter shall be supplied by Limited Energy Source (per UL 61010) or NEC Class 2 Power Source.

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. The programme version of the firmware, (e. g. P06) will appear for about 1 second in the display after starting up the device. Please hold it ready for inquiry calls.

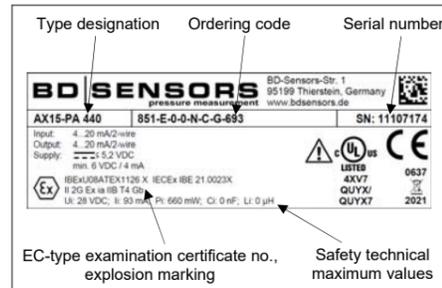


Fig. 1 example of manufacturing label

! 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 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. If the certificate is not available, please order or download it from our homepage: <http://www.bdsensors.de/products/download/certificates>
 - 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).
 - The external circuit must prevent an external power-inflow to the contacts. Suitable signal separating devices which fulfil this demand have to be used.

! 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!

! Remove packaging only directly before starting up the device to avoid any damage!

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

3.2 General installation steps

- Carefully remove the pressure measuring device from the package and dispose of the package properly.
- Next the field display has to be mount stationary on a suitable fixing location via two appropriate fastening screws.

3.3 Lead in the transmitter cable

- Lead in the connecting cable of the transmitter through the cable gland on the left side. The cable length inside the terminal box has to be long enough for connecting the cords with the terminal clamps on the left (SENSOR).
- Then tighten the cable gland by hand. Take care that the cable is strain-relieved.
- Pay attention that the PTFE-filter on the gauge reference of BD SENSORS-transmitters may not be damaged or removed.

3.4 Lead in the supply line

- Lead the supply line through the cable gland on the right side. The cable length inside the terminal box has to be long enough for connecting the cords with the terminal clamps on the right (SUPPLY).
- Then tighten the cable gland by hand. Take care that the cable is strain-relieved.

4. Special regulations for IS-Areas

4.1 Protection against electrostatic charge hazards

Different types of devices partially consist of chargeable plastic components. These are, in particular, the carrying and connection cables, terminal boxes as well as housing enclosures. 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.

The following warning sign is, if applicable, attached to the transmitter. It points once more to the hazard of electrostatic charging.



Fig. 2 warning sign

! The warning sign must not be removed from the device!

4.2 Overvoltage protection

If the device is used as electrical equipment of category 2 G, a suitable overvoltage protection device must be connected in series (attend the valid regulations for operating safety as well as EN60079-14).

4.3 Exemplary circuit description

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

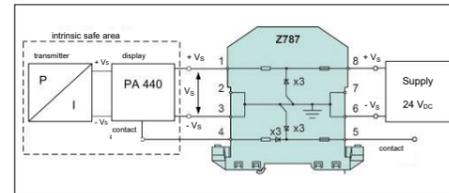


Fig. 3 Circuit diagram

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 Zener diodes as protective components. Subsequently, the operating voltage is applied to the device and, depending on the pressure, a particular signal current will flow.

4.5 Functional selection criteria for Zener barriers and galvanic power supply

The minimum supply voltage V_{Smin} of the device 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 a linear bonding, please attend that the terminal voltage of the device will decrease like it does with a Zener barrier. Furthermore, it has to be attended that the supply of the device will also 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_{Smin} it is important to verify which minimum supply voltage is available at full level control of the device.

The technical data of the barrier will usually provide you with the information needed for the selection of the Zener barrier. However, the value can also be calculated. If a minimum supply of 16 V is assumed, then – according to Ohm's law – a particular voltage drop will result on the series resistance of the Zener barrier. If, for a device with PNP contact, the contact is also activated, the additional current flowing from the contact to the load resistor will also flow through the Zener barrier or the output of a transmitter repeater. The higher the load current, the lower the available minimum operating voltage. In the diagram shown, the maximum current can be calculated from the voltage difference (V_{as Barriers max.}) between input and output of the Zener barrier divided by the series resistance of the Zener barrier.

The maximum signal current must be subtracted from this value. If the available residual current is smaller than the current required at the contact, either a different barrier or a higher supply voltage before the barrier should be chosen.

When selecting the power supply, the maximum operating conditions according to the EC type-examination certificate must be observed. When assessing the power supply, please refer to their current data sheets to ensure that the entire interconnection of intrinsically safe components will remain intrinsically safe.

5. Electrical Installation

- WARNING!** Install the device only when currentless!
- The supply must correspond to the safety class II (protective insulation)!
- The transmitter shall be supplied by Limited Energy Source (per UL 61010) or NEC Class 2 Power Source!

Open the top cover; establish the electrical connection of the device according to the following table and the wiring diagram. Screw the top cover onto the box again.

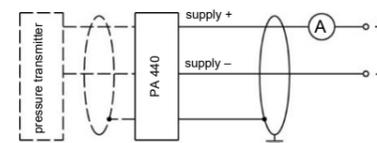
Pin configuration:

De-signation	Terminal block	Electrical connection (cable colours of BD SENSORS transmitters)	has to be connected with
GND	SENSOR	Potential reference clamp (yellow/green)	cable shield of transmitter
VS-	SENSOR	Supply - (brown)	neg. connecting cable of transmitter
VS+	SENSOR	Supply + (white)	pos. connecting cable of transmitter
SP2	SP	Contact 1	connecting cable of transmitter for contact 1
SP1	SP	Contact 2	connecting cable of transmitter for contact 2
VS+	SUPPLY	Supply +	pos. connecting cable for pressure signal
VS-	SUPPLY	Supply -	neg. connecting cable for pressure signal
GND	SUPPLY	Potential reference clamp	cable shield of supply line

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

The ground wires of all components have to be connected when installing!

Pin configuration:



Supply:

The supply created by the electronics of the device is approx. 5.5 V_{DC}. Please take this into consideration when planning your power supply. The tolerances for the power supply can be calculated as follows:

Minimum supply: V_{Smin} = V_{minTR} + 6.5V

Maximum supply: V_{Smax} = V_{maxTR} + 6.5V

V_{minTR} = minimum supply of the used 2-wire transmitter

V_{maxTR} = maximum supply of the used 2-wire transmitter

6. Initial start-up

- WARNING!** Before the initial start-up, the user has to check that the device has been properly installed and make sure that it does not have any visible defects.
- WARNING!** The device must only be started up by qualified technical personnel that has read and understand the operating manual!
- WARNING!** The device must only be used within the technical specifications (compare the data in the data sheet and the EC type-examination certificate)!

7. Operation

7.1 Configuration

The menu system is a closed system allowing you to scroll both forward and backward through the individual set-up menus to navigate to the desired setting item. All settings are permanently stored in an EEPROM and therefore available again even after disconnecting from the supply voltage. The structure of the menu system is the same for all types of devices, regardless of the number of contacts. However, they only differ by the number of menus. Following figure and the menu list shows all possible menus.

Please follow the manual meticulously and remember that changes of the adjustable parameters (switch-on point, switch-off point, etc.) become only effective after pushing both buttons simultaneously and leaving the menu item.

7.2 Password system

To avoid a configuration by unauthorized persons, the possibility is given to lock the device by an access protection. More information is given in menu 1 of the menu list.

7.3 Unit

The unit of the values to be measured is determined on ordering. But it is also possible to change the unit later by using one of the enclosed unit labels.

7.4 Description of hysteresis and compare mode

To invert the respective modes, you have to exchange the values for the switch-on and switch-off points.

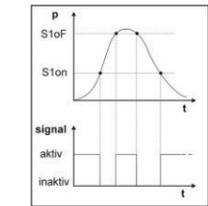


Fig. 4 compare mode

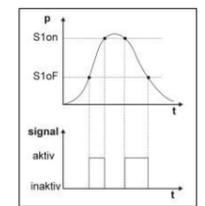


Fig. 5 compare mode inverted

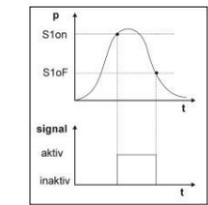


Fig. 6 hysteresis mode

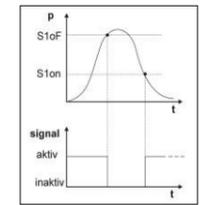
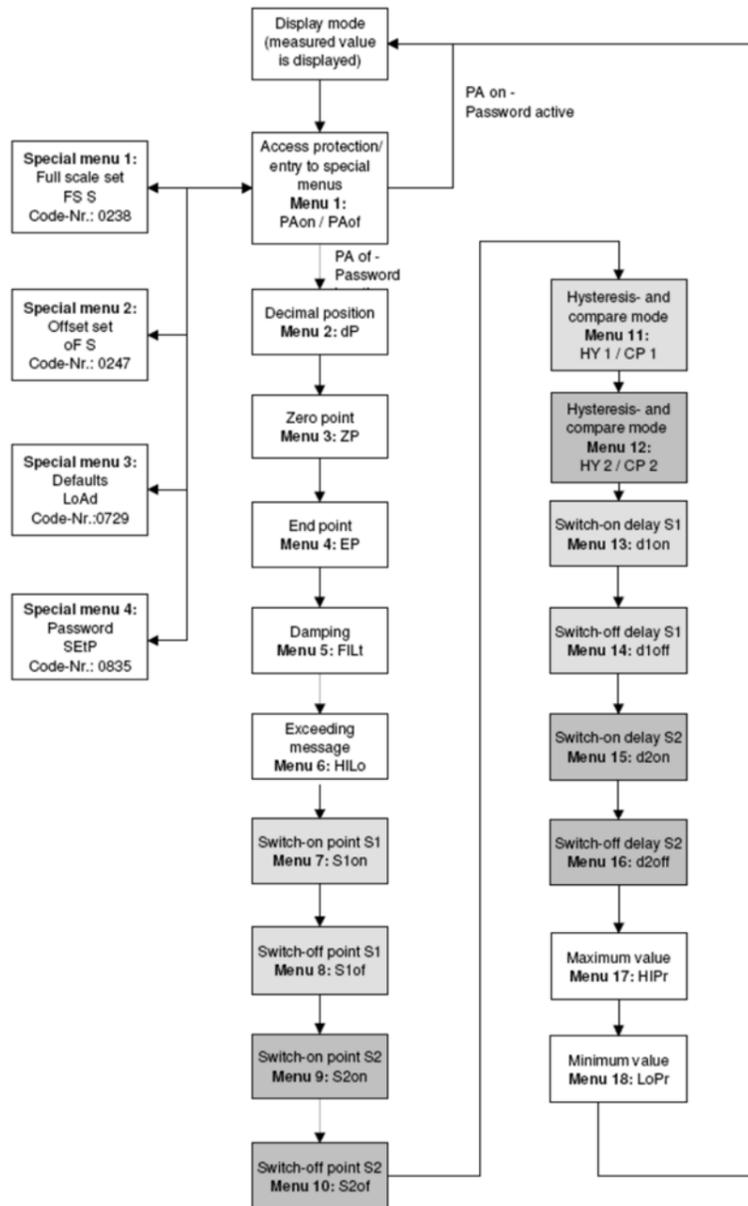


Fig. 7 hysteresis mode inverted

7.5. Structure of the menu system



7.6 Menu list

- ▲-button: move in the menu system (forward) or increase the displayed value
- ▼-button: move in the menu system (backward) or decrease the displayed value
- both buttons simultaneously: confirm the menu items and set values or change between display and configuration mode

☰ to increase the counting speed, when setting the values: keeping the respective button pushed for more than 5 seconds

Execution of configuration:

- set the desired menu item by pushing the ▲- or ▼-button
- activate the set menu item by pushing both buttons simultaneously
- set the desired value or select one of the offered settings by using the ▲- or ▼-button
- store the set value / selected setting and exit the menu by pushing both buttons simultaneously

PAon PAof	menu 1 – access protection PAon → password active → to deactivate: set password PAof → password inactive → to activate: set password ☰ default setting for the password is "0005"; modification of the password is described in special menu 4
dP	menu 2 – set decimal point position For devices with LC display – in case no decimal point shall be displayed – the colon between digit 3 +4 is displayed in the selection menu "dP".
ZP EP	menus 3 and 4 – set zero point / end point the device has been configured correctly before delivery, so a later setting of a 2-wire device is only necessary, if a differing displayed value is desired (e. g. 0 ... 100 %)
FILt	menu 5 – set damping this function allows getting a constant display value although the measuring values may vary considerably; the time constant for a simulated low-pass filter can be set (0.3 up to 30 sec permissible)
HILO	menu 6 – exceeding message set "on" or "off"
S1on	menus 7 and 9 – set switch-on points set the particular values, for the activation of contact 1 (S1on) up to 2 (S2on)
S1of	menus 8 and 10 – set switch-off points set the particular values, for the deactivation of contact 1 (S1of) up to 2 (S2of)
HY 1 CP 1	menus 11 and 12 – select hysteresis or compare mode select the hysteresis mode (HY 1 up to HY 2) or compare mode (CP 1 up to CP 2) for the contacts 1 up to 2 (no. corresponds to the contact) ☰ compare "7.4. Description of hysteresis and compare mode"
d1on	menus 13 and 15 – set switch-on delay set the particular value of the switch-on delay after reaching contact 1 (d1on) up to 2 (d2on) (0 up to 100 sec permissible)
d1of	menus 14 and 16 – set switch-off delay set the particular value of the delay after reaching the switch-off point 1 (d1of) up to 2 (d2of) (0 up to 100 sec permissible)
HIPr LoPr	menus 17 and 18 – maximum / minimum pressure display view high pressure (HIPr) or low pressure (LoPr) during the measurement process (the value will not remain stored if the power supply is interrupted) ☰ to erase: push both buttons again within one second
special menus (to access a special menu, select the menu item "PAof" with the ▲- or ▼-button and confirm it; "1" appears in the display)	
FS S	special menu 1 – full scale compensation for full scale compensation, which is necessary if the indicated value for full scale differs from the real full scale value in the application (a compensation is only possible with a respective reference source, if the deviation of the measured value is within defined limits); set "0238"; confirm with both buttons; "FS S" will appear in the display; now it is necessary to place the device under pressure (the pressure must correspond to the end point of the pressure measuring range); push both buttons, to store the signal being emitted from the device as full scale; in the display the set end point will appear although the full scale sensor signal is displaced ☰ the analogue output signal (for devices with analogue output) is not affected by this change
oF S	special menu 2 – offset compensation / position correction set "0247";
LoAd	special menu 3 – load defaults set "0729"
SEtP	special menu 4 – set password set "0835"; confirm with both buttons; "SEtP" appears in the display; set the password using the ▲- or ▼-button (0 ... 9999 are permissible, the code numbers 0238, 0247, 0729, 0835 are exempt); confirm the password by pushing both buttons simultaneously

8. Placing out of service

⚠ WARNING! Disassemble the device only in current and pressure less condition!

9. 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.

10. 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.de. 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!

11. Disposal

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!

Dispose of the device properly!



12. 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.

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

EU-Konformitätserklärung

EU Declaration of Conformity

BD|SENSORS GmbH erklärt hiermit in alleiniger Verantwortung, dass die Produkte
BD|SENSORS GmbH declares on its own responsibility that the products

PA 440

mit den aufgeführten Richtlinien und Normen übereinstimmt.
fulfil the below mentioned requirements and standards.

2014/30/EU (EMC)	EN 61326-1:2013
2011/65/EU (RoHS)	

Für Geräte mit Ex-Zulassung:
For devices with IS approval:

2014/34/EU (ATEX)	AX15-PA 440
IBExU08ATEX1126 X	EN IEC 60079-0:2018, EN 60079-11:2012
Benannte Stelle / Kennnummer Notified Body / identification number:	IBExU Institut für Sicherheitstechnik GmbH / 0637
IBExU19ATEXQ013	EN ISO/IEC 80079-34:2012
Benannte Stelle / Kennnummer Notified Body / identification number	IBExU Institut für Sicherheitstechnik GmbH / 0637

Thierstein, 2021-10-01

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