

Translation of the
Original Operating Manual

Lindenstraße 20
74363 Güglingen
Fon: +49 7135 102-0
Service: +49 7135 102-211
info@afriso.com
www.afriso.com

Plug-on display

DA 06 EX

EX II 2G Ex ia IIC T4 Gb



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
- EC-type-examination certificate

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

Download these by accessing www.afriso.com or request them by e-mail or phone: info@afriso.com | Fon: +49 7135 102-211

The explosion-proof versions of our products are variants of the standard products.

Example:

Standard: DA 06 → IS version: DA 06 EX

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:

EN 60079-0:2012+A11:2013, EN 60079-11:2012

1.1 Symbols Used

	<ul style="list-style-type: none">- Type and source of danger- Measures to avoid the danger
Warning word	

Warning word	Meaning
	<ul style="list-style-type: none">- Imminent danger!- Non-compliance will result in death or serious injury.
	<ul style="list-style-type: none">- Possible danger!- Non-compliance may result in death or serious injury.
	<ul style="list-style-type: none">- 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 **DA 06 EX plug-on display** is used for measured value display and optionally for limit point monitoring (with PNP open collector output) for a large variety of transmitters (pressure, temperature, etc.) with 4 ... 20 mA / 2-wire analog output.

A device has an explosion-protection approval if this was specified in the purchase order and confirmed in our order acknowledgement. In addition, the type plate 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@afriso.com | Fon: +49 7135 102-211). AFRISO assumes no liability for any wrong selection and the consequences thereof!

The specifications listed in the current data sheet are binding and must absolutely be complied with. If you do not have the data sheet to hand, please request it or download it from our homepage. (<http://www.afriso.com>)

1.4 Foreseeable Misuse

The digital plug-on display DA 06 EX must not be used particularly in the following cases:

In areas for which the device has no approval. When the DA 06 EX is used in combination with other devices, the approval of the device with the lowest approved area applies.

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 – 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!

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 Safety-Related Maximum Values

U_i = 28 V, I_i = 93 mA, P_i = 660 mW; C_i; L_i = negligible plus line inductance of 1µH/m and line capacities of 100 pF/m

Permissible ambient temperature:
-25 ... 70 °C

1.8 Product Description

The digital plug-on display DA 06 EX may be used with all transmitters if the following requirements are met:

• Output signal of the transducer: 4–20 mA / 2-wire

• Refer to “Electrical Connections” for the plug connection system

The digital plug-on display DA 06 EX can be mounted between the connector and transducer and is ready for immediate operation. No additional auxiliary energy is required since the display is supplied from the 4–20-mA circuit. A preferred application is on-site process monitoring, for example.

Programming is performed via two buttons on the front side. The following parameters can be set: scaling, decimal point, damping, switch point, and delay. Moreover, a min./max. value memory is available. The settings will be retained even in case of a power failure. Incidences of range exceedance in both directions can be displayed as messages.

The integrated diagnostic system constantly monitors all functions of the display. The housing can be turned by 300° in an infinitely variable manner, the display by 330°.

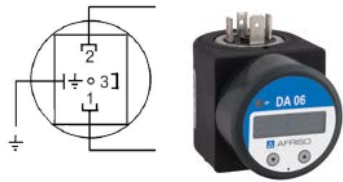


Fig. 1: view

1.9 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:

- Plug-on Display DA 06 EX
- fastening screw M3x84
- profiled gasket
- Units decal sheet
- Operating manual

2. Product Identification

The device can be identified by means of the type plate with order code. The most important data can be gathered therefrom.



1	EC-type examination certificate	6	Order code
2	Safety-Related Maximum Values	7	Serial number
3	Output	8	Terminal assignment
4	Input	9	IS marking
5	Type designation		

Fig. 2: Type plate

NOTE – The type plate must not be removed!

The marking of the equipment shall include the following:

EC-type examination certificate **IBExU12ATEX1084 X**

Marking: **EX II 2G Ex ia IIC T4 Gb**

3. Mounting

3.1 Mounting and Safety Instructions

	<ul style="list-style-type: none">- Explosion hazard, airborne parts, leaking fluid, electric shock- Always mount the device in a de-energized condition!
DANGER	

NOTE – The technical data listed in the EC type-examination certificate are binding. Download these by accessing www.afriso.com or request them by e-mail or phone: info@afriso.com | Fon: +49 7135 102-211

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

NOTE – Do not remove the packaging of the device until shortly before the mounting procedure in order to exclude any damage!

NOTE – The display and the plastic housing are equipped with a turning limiter. Avoid overturning the display or housing by exerting increased force.

3.2 Mounting Steps for ISO-4400 Connectors

- Loosen and carefully pull off the cable box from the transducer
- Plug the plug-on display onto the transducer. When doing so, ensure that the profiled gasket premounted on the bottom side is seated correctly.
- Remove the fastening screw from the cable box.
- Replace the profiled gasket premounted on the cable box by the supplied profiled gasket to ensure the IP 65 protection rating.
- Plug the cable box onto the plug-on display.
- Insert the supplied stainless steel screw through the cable box and plug-on display and tighten the screw hand-tight on the transducer using a screwdriver.

3.3 Alignment of the Display Module

The display may be turned to the desired position in order to enable perfect reading even in case of unusual mounting positions.

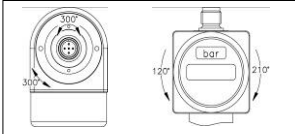


Fig. 3: Display module

4. Electrical Connection

4.1 Connection and Safety Instructions

	<ul style="list-style-type: none">- Improper installation may result in electric shock- Always mount the device in a de-energized condition!
WARNING	
	<ul style="list-style-type: none">- Explosion hazard if the operating voltage is too high (max. 28VDC)!- Operate the device only within the specification! (data sheet)
DANGER	

- ✓ The limit values listed in the EC type-examination certificate are observed. (Capacity and inductance of the connection cable are not included in the values.)
- ✓ The supply corresponds to protection class II. (protective insulation)

NOTE – If the device is equipped with a **cable box**, it must be ensured that the outer diameter of the line used is within the permissible clamping range. Additionally it must be ensured that this is seated firmly and gaplessly in the cable fitting!

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

NOTE – Ensure that potential equalization exists in the entire routing of the line, both inside and outside the explosion-hazardous area.

NOTE – It must be ensured by the external wiring that no energy can flow from the outside into the switch output. Suitable signal separation devices must be used that satisfy this requirement.

4.2 Conditions for the Explosion-Hazardous Area

Danger generated by electrostatic charging

	<ul style="list-style-type: none">- Explosion hazard due to spark formation from electrostatic charging of plastic components.- If devices are equipped with a cable outlet, the connection cable routing must be fixed.- Do not clean the device and, if applicable, the connection cable, in a dry state! Use a moist cloth, for example.
DANGER	

Overvoltage protection

If the pressure transducer is used as a Category 1 G piece of equipment, a suitable overvoltage protector must be installed upstream (refer to the German Ordinance on Industrial Health [BetrSichV] and EN60079-14).

Schematic circuit design

The operation of an intrinsically safe device in the explosion-hazardous area requires special care when selecting the required Zener barrier or transmitter repeater devices so that the device properties can be utilized to the full extent. The following diagram shows a typical arrangement consisting of power pack, Zener barrier and plug-on display.

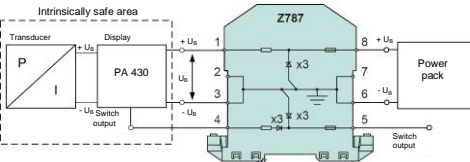


Fig. 3: Wiring diagrams

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 pack is led through the Zener barrier. The Zener barrier contains series resistors and Zener diodes as protective components. Then the operating voltage is applied to the device and, depending on the pressure, a particular signal current will flow.

Selection criteria for Zener barriers and power supplies

The minimum supply voltage U_{B min} of the device must not be undercut.

When using a galvanically isolated power supply with linear limitation, it must be taken into account that the terminal voltage of the device will decrease because of the linear limitation, as with a Zener barrier. Furthermore, account must be taken of the fact that a certain voltage drop will also occur on an optionally used signal isolation amplifier, whereby the operating voltage of the device will decrease additionally.

Test criteria for the selection of the Zener barrier

In order not to undercut U_{B min} it is important to check which minimum supply voltage is available at full-level modulation of the device.

Usually the specifications of the Zener barrier will provide an answer as to the selection of the barrier. However, the value can also be determined by calculation. If a minimum supply voltage of e.g. 16 V is assumed, a certain voltage drop on the series resistor of the Zener barrier follows in accordance with Ohm's law. If the switch output is additionally activated on a device with PNP switch output, the additional current flowing from the switch output to the load resistor will also flow through the Zener barrier or from the output of a power supply. The higher the load current, the lower the available minimum operating voltage. In the circuit shown, the maximum current can be calculated from the maximum voltage difference (U_{ab barrier 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 less than the current needed at the switch output, either another barrier or a higher supply voltage upstream of the barrier should be selected.

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

Calculation example for the selection of the Zener barrier

The nominal voltage of the power pack (supply) upstream of the Zener barrier is 24 V_{DC} ± 2 %. From this follows:

- maximum supply voltage:
U_{Sup max} = 24 V * 1.02 = 24.48 V
- minimum supply voltage:
U_{Sup min} = 24 V * 0.98 = 23.52 V

First, the minimum supply voltage of the combination of plug-on display and transducer must be determined. This results from the minimum supply voltage of the transducer plus the voltage drop of the plug-on display which is nominally 6 V. For example, U_{B transducer min} = 10 V results in a minimum supply voltage U_{B min} = 16 V.

The series resistor of the Zener barrier is specified with 295 Ω. The maximum voltage drop at the Zener barrier may reach the following value:

$$U_{ab barrier max} = 23.52 V - 16 V = 7.52 V$$

In order for this condition to be adhered to, the maximum current must not exceed the following value:

$$I_{max} = 7.52 V : 295 \Omega = 25.49 mA$$

The maximum current of the combination of plug-on display and transducer is made up of the sum of signal current and switching current. There are two approaches:

- The measuring range is to be utilized in the range of 0 ... 100 %. A maximum signal current of 20 mA is generated thereby. Based on the facts above, the available residual current through the switch output is calculated as follows:
I_{Resid 1} = 25.49 mA – 20 mA = 5.49 mA

- With an analog output of 4 ... 20 mA, the measuring range is to be utilized only in a specific range, e.g. 0 ... 70 %. This results in a maximum signal current:

$$I_{Signal max} = \Delta i * 0.7 + i_{offset} = 16 mA * 0.7 + 4 mA = 15.2 mA$$

(with $\Delta i = 20 mA - 4 mA$ and $i_{offset} = 4 mA$)

Here, the available residual current through the switch output is:

$$I_{Resid 2} = 25.49 mA - 15.2 mA = 10.29 mA$$

Condition: I_{Resid} ≥ I_{Switch output}

The switching current (current through the switch output) must not exceed the determined residual current since this will impair the functionality of the device.

NOTE – The switching current must be determined separately by the user as it depends on the particular case of application. The switching current can be calculated or measured at the switch output.

NOTE – Please note that no line resistances have been listed in this calculation. These lead additionally to a voltage drop that must be taken into account.

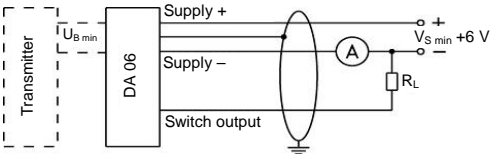
4.3 Electrical Installation

Connect the device electrically according to the information specified on the type plate, the following table, and the connection circuit diagram.

Terminal assignment table:

Electrical connections		
	ISO 4400	
Supply +	1	
Supply -	2	
Switch output 1	3	
Shield	ground pin	

Connection circuit diagram:



Voltage supply

The voltage drop generated by the device electronics is approx. 6 V_{DC}. Consider this when designing your system supply. The limit values of the voltage supply are calculated as follows:

minimum operating voltage: $V_{S \min} = V_{\text{transmitter min}} + 6 \text{ V}$

maximum operating voltage: $V_{S \max} = V_{\text{transmitter max}} + 6 \text{ V}$

$V_{\text{transmitter min}}$ = minimum operating voltage of the 2-wire transmitter used

$V_{\text{transmitter max}}$ = maximum operating voltage of the 2-wire transmitter used

5. Commissioning

- ✓ The device has been installed properly
- ✓ The device does not have any visible defect
- ✓ The device is operated within the specification. (see data sheet and EC type-examination certificate)

6. Operation

Control and display elements

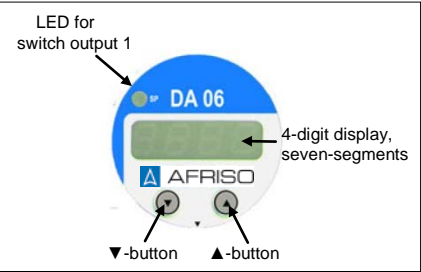


Fig. 4: Control panel

Depending on how it is equipped, the device has max. one LED which is allocated to the switch output. If this LED is lit, the switching point has been reached, and the switch output is active. The display of the measured value and the configuration of the individual parameters is performed through the menu, via the seven-segment display.

Configuration

The menu system is a closed system allowing you to scroll both forth and back through the individual set-up menus to navigate to the desired setting item. All settings are permanently stored in an EEPROM and are therefore available again even after a disconnection from the supply voltage. The structure of the menu system is the same for all device variants, regardless of the number of switching points. The structure only differs by the absence of the superfluous menu items. The following illustrations and menu description show all possible menu items.

NOTE – Please adhere to the description exactly and remember that changes to the adjustable parameters (switch-on point, switch-off point, etc.) only become effective after pushing both buttons simultaneously and leaving the menu item.

Password system

The device can be locked in order to prevent configuration by unauthorized persons. Refer to menu 1 of the menu list for more information.

Unit

The unit of the measured value is already determined at the time of ordering by the desired measuring range. However, the device may also be labeled with another unit at a later time by attaching one of the supplied unit decals.

Explanation of hysteresis mode and compare mode

In order to invert the respective mode, the values for switch-on and switch-off points must be interchanged.

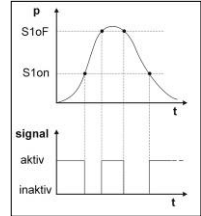


Fig. 5: Compare mode inverted

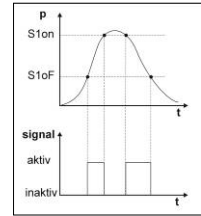


Fig. 6: Compare mode

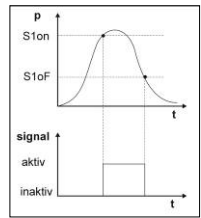


Fig. 7: Hysteresis mode

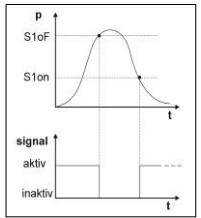
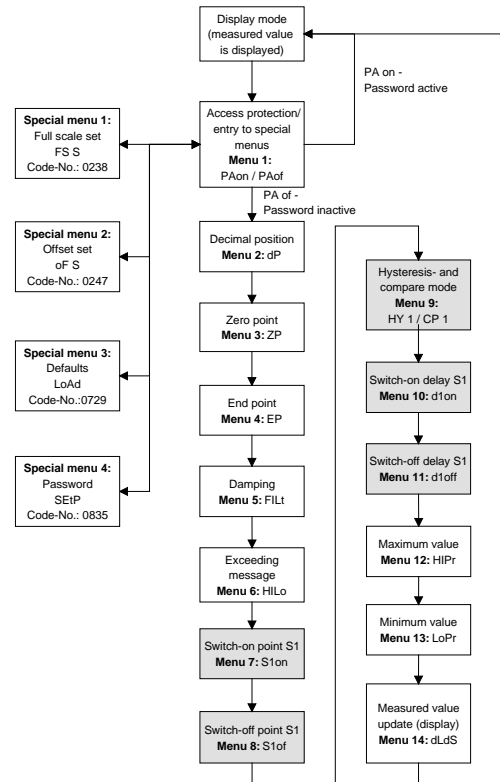


Fig. 8: Hysteresis mode inverted

Menu system structure



Menu list

- ▲-button: to scroll forward through the menu system or to increase the indicated value; additionally, the control (operator) mode (starting with menu 1) can be accessed by pressing the button
- ▼-button: to scroll back through the menu system or to decrease the indicated value; additionally, the control (operator) mode (starting with the last menu) can be accessed by pressing the button
- Pressing both buttons simultaneously: to acknowledge the menu items and the values set

NOTE – To increase the counting speed when setting the values: press and hold the respective button for more than 5 seconds

Configuration procedure:

- Select the desired menu item using the button ▲ or ▼
- Activate the selected menu item by pressing both buttons simultaneously
- Set the desired value or select a default value by pressing the button ▲ or ▼
- Store or acknowledge an adjusted or default value and exit a menu item by pressing both buttons simultaneously

PRon	Menu 1 – Access protection PAon → Password active → To deactivate: set/adjust the password PAof → Password inactive → To activate: set/adjust the password NOTE – The password is factory-set to "0005"; Adjusting the password – Special menu 4
dP	Menu 2 – Setting of decimal point position
ZP EP	Menus 3 and 4 – Setting of zero point / end point The correct values were already set during manufacturing; a subsequent configuration for 2-wire devices is only required when deviating display values (e.g. 0 ... 100 %) are desired
FILt	Menu 5 – Setting of damping (filter) To achieve a stable indication when measured values fluctuate considerably: setting the time constant of a simulated analog low-pass filter (adjustable from 0.3 to 30 s)
HILO	Menu 6 – Activation of range-exceeding message Set to "on" or "off"
S1on	Menu 7 – Setting of switch-on point Set the value for the activation of the switch output 1 (S1on)
S1oF	Menu 8 – Setting of switch-off point Set the value for the deactivation of the switch output 1 (S1oF)
HY 1 CP 1	Menu 9 – Selection of hysteresis mode or compare mode Set the hysteresis mode (HY 1) or compare mode (CP 1) for switch output 1 NOTE – see "7.4 Explanation of hysteresis mode and compare mode"
d1on	Menu 10 – Setting of switch-on delay Set the value of the switch-on delay after reaching the switch-on point 1 (d1on) (adjustable from 0 to 100 s)
d1oF	Menu 11 – Setting of switch-off delay Set the value of the switch-off delay after reaching the switch-off point 1 (d1of) (adjustable from 0 to 100 s)
HI Pr LoPr	Menus 12 and 13 – Maximum / Minimum value display Display of the maximum pressure (HIPr) or minimum pressure (LoPr) applied during the measurement (the value will be lost if the voltage supply is interrupted) NOTE – To delete: press both buttons again within one second
dLdS	Menu 14 – Measured-value update (display) Set the duration of cycles after which the measured value is updated in the display (adjustable from 0.0 to 10 s)

Special menus

(To access the special menus, use the button ▲ or ▼ to select the menu item "PAof". Acknowledge this, and "1" will appear in the display)

FS S	Special menu 1 – Full scale compensation For full scale compensation (correction of the display) if the indicated value for full scale differs from the applied pressure value: a compensation is only possible if respective reference sources are available, provided that the measured value deviation is within defined limits; set "0238", acknowledge with both buttons, and "FS S" will appear in the display. Now the device must be pressurized using a pressure reference (the pressure must correspond to the measuring range end point). Push both buttons in order to store the signal being output by the pressure switch as full scale (range span) signal; the set end point will appear in the display, although the full scale sensor signal is offset. NOTE – The analog output signal (in case of devices with analog output) remains unaffected by this change.
oF S	Special menu 2 – Offset alignment / position correction Set "0247", acknowledge the menu item "POS!". If offset ≠ ambient pressure, pressurization is necessary (pressure reference must correspond to the lower measuring range value). Push both buttons to store the signal currently being output as offset; the set lower measuring range value (zero point) will appear in the display, although the sensor signal is shifted in the offset NOTE – A position correction is required if the installation position differs from the factory calibration (otherwise this can cause minor signal shifts resulting in wrong indicated values) NOTE – The analog output signal (in case of devices with analog output) remains unaffected by this change. Moreover, a shift of the range value (full scale) occurs simultaneously with the shift of the offset.
LoAd	Special menu 3 – Loading of factory default settings Set "0729". To load the factory default settings, push both buttons again simultaneously NOTE – All changes made will be reset (password will be reset to "0005")
SEtP	Special menu 4 – Setting of password Set "0835" and acknowledge with both buttons. "SEtP" will appear in the display. Press the button ▲ or ▼ to set / change the password (adjustment range 0 ... 9999; the code numbers 0238, 0247, 0729, 0835 are excluded). Acknowledge the password by pressing both buttons simultaneously

7. Maintenance

	<ul style="list-style-type: none">- Airborne parts, leaking fluids, electric shock- Always service the device in a depressurized and de-energized condition!
	<ul style="list-style-type: none">- due to aggressive fluids- Wear suitable protective clothing, e.g. gloves, safety goggles.

In principle, the device requires no maintenance. If necessary, clean the housing of the device using a moist cloth and a non-aggressive cleaning solution.

8. Removal from Service

	<ul style="list-style-type: none">- Airborne parts, leaking fluids, electric shock- Always dismount the device in a depressurized and de-energized condition!
	<ul style="list-style-type: none">- due to aggressive fluids.- Wear suitable protective clothing, e.g. gloves, safety goggles.

9. Service/Repair

Information on service / repair:

- www.afriso.com
- info@afriso.com
- Service phone: +49 7135 102-211

9.1 Return

	<ul style="list-style-type: none">- due to pollutants- Wear suitable protective clothing, e.g. gloves, safety goggles
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For every return shipment, whether for recalibration, decalcification, alteration or repair, the device must be cleaned thoroughly and packed in a break-proof manner. A return declaration with a detailed fault description must be added to the defective device. If your device has come into contact with pollutants, a declaration of decontamination is additionally required. Appropriate templates can be found on our homepage. Download these by accessing www.afriso.com or request them by e-mail or phone: info@afriso.com | Fon: +49 7135 102-211

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

	<ul style="list-style-type: none">- due to pollutants- Wear suitable protective clothing, e.g. gloves, safety goggles
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The device must be disposed of according to the European Directive 2012/19/EU (waste of 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

AFRISO-EURO-INDEX GmbH hereby declares its sole responsibility that the products mentioned above comply with the Directives and standards listed.

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

2014/34/EU (ATEX)
IBExU12ATEX1084 X
EN 60079-0:2012+A11:2013, EN 60079-11:2012

Notified body / ID number:
IBExU Institut für Sicherheit GmbH / 0637

EX2 16 01 15639 015
EN 80079-34:2012
Notified body / ID number:
TÜV SÜD Produkt Service GmbH / 0123

12.10.2016

Dr. Aldinger
Manager engineering