Operating Instructions
Digital Pressure Gauge Reference Model D2

Contents

1. Information on This Operating Instruction

- The manual is aimed at specialists and semi-skilled personnel.
- Please read the instructions carefully before carrying out any operation and keep the specified order.
- Thoroughly read and understand the information in chapter 2 “Safety Instructions”.

If you have any problems or questions, please contact your supplier or contact us directly at:

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1.1 Pictographs Used in This Manual

In this manual, pictographs are used as hazard warnings.

Particular information, instructions and restrictions designed for the prevention of personal or substantial property damage:

WARNING! Is used to warn you against an imminent danger that may result in personal injury or death.

IMPORTANT! Is used to warn you against a possibly hazardous situation that may result in personal, property or environmental damage.

CAUTION! Is used to draw your attention to important recommendations to be observed. Disregarding them may result in property damage.

Passages in the text containing **explanations, information or advice** are highlighted with this pictograph.

The following symbol highlights
actions you have to conduct
or
instructions that have to be strictly observed.

1.2 Exclusion of Liability

We accept no liability for any damage or malfunction resulting from incorrect installation, inappropriate use of the device or failure to follow the instructions in this manual.

2. Safety Instructions

Please read this operating instruction thoroughly before installing the D2.
Disregarding the containing warnings, especially the safety instructions, may result in danger for people, the environment, and the device and the system it is connected to.
The D2 corresponds with the state of engineering at the time of printing. This concerns the accuracy, the operating mode and the safe operation of the device.
In order to guarantee that the device operates safely, the operator must act competently and be conscious of safety issues.
The ARMATURENBAU GmbH provides support for the use of its products either personally or via relevant literature. The customer verifies that our product is fit for purpose based on our technical information. The customer performs customer and application specific tests to ensure that the product is suitable for the intended use. With this verification, all hazards and risks are transferred to our customers. Our warranty expires in case of inappropriate use.

Qualified personnel:

- The personnel that is charged for the installation, operation and maintenance of the D2 must hold a relevant qualification. This can be based on training or relevant tuition. The personnel must be aware of this manual and have access to it at all times.
- The electrical connection shall be carried out by a fully qualified electrician only.

General safety instructions:

- In all work, the existing national regulations for accident prevention and safety at the workplace must be complied with. Any internal regulations of the operator must also be complied with, even if these are not mentioned in this manual.
- Degree of protection according to DIN EN 60 529: Ensure that the ambient conditions at the installation location do not exceed the requirements of the specified degree of protection (⇨ chapter 4 “Technical Data”).
- Use the D2 in its perfect technical condition only. Damaged or defective instruments need to be checked immediately and replaced if necessary.

- Only use appropriate tools for mounting, connecting and dismounting the D2.
- Nameplates or other information on the device shall neither be removed nor obliterated, since otherwise any warranty and manufacturer responsibility expires.

Special safety instructions:
Warnings, which are specifically relevant to individual operating procedures or activities, are to be found at the beginning of the relevant sections of this operating instruction.

3. Device Description

The reference D2 is a digital pressure gauge with display of actual and MIN/MAX values. It is used for stationary or mobile pressure measurement.

It is equipped with a robust case made of zinc casting with rubber protection cap ❶. The electronic unit, the 4½ digit LC display ❷, the control panel ❸ and the replaceable batteries are housed inside the device.
The reference has an accuracy of ±0.1 %, referring to the respective full scale value (FS).
The application as pressure reference allows for easy checking, adjustment and calibration of other pressure measuring equipment.

Components:
The most important components of the D2 are
❶ Zinc casting case with rubber protection cap
❷ LC display with background lighting
❸ Control panel with buttons
❹ Male process connection G¼"
❺ Pressure port gasket

Version:
The reference D2 is available for the pressure ranges given in table 1.

Nameplate and label:
The nameplate is placed on the back of the digital pressure gauge. It contains the most important technical data and information.

Scope of delivery:
Check the delivered items before operating the device:
- 1 x D2 according to the ordering information
- 1 x operating instruction
- Packaging or transport protection if necessary

Pressure Range	Reference D2	
	Accuracy (FS)	Resolution
–1 / +3 bar	±0.1 %	1 mbar
–1 / +40 bar	±0.1 %	10 mbar
–1 / +60 bar	±0.1 %	10 mbar
0 – 400 bar	±0.1 %	100 mbar
0 – 700 bar	±0.1 %	100 mbar
0 – 1000 bar	±0.1 %	100 mbar

Table 1

3.1 Intended Use

The digital pressure gauge D2 shall only be used for checking, adjustment and calibration of pressure measuring equipment.
Do not use the reference D2 beyond its specification or contrary to the operating instructions.

WARNING! No safety component!
The reference D2 is no safety component in compliance with the directive 2006/42/EC (Machinery Directive).
→ Never use the reference D2 as safety component.

The operational safety of the device supplied is only guaranteed by intended use. The specified limit values (⇨ chapter 4 “Technical Data”) must not be exceeded. This particularly applies for the adherence to the permissible full scale value and the permissible temperature range.

IMPORTANT! Risk of injury or material damage due to overpressure!
Exceeding the maximum overload values may lead to material failure of the digital pressure gauge. This may also cause serious damage to health.
→ Ensure that the overload values are never exceeded.

Please check if the reference is suitable for your application before ordering and installation.

4. Technical Data

Measuring range input • Piezoresistive pressure measuring cell • DMS pressure measuring cell	 –1 / +3 bar –1 / +40 bar –1 / +60 bar 0 – 400 bar 0 – 700 bar 0 – 1000 bar
Accuracy	0.1 % FS ±1 digit
Sample rate	10 ms
Internal resolution AD converter	12 bit = 4,096 steps
Temperature influence	0.05 % FS / 10 K
LC display • Actual value • MIN/MAX or FullScale (FS) • Bargraph → Sample rate • Background lighting	 4½ digit (15 mm / 0.59") 4½ digit (8 mm / 0.41") 33 segments (drag indicator function) 50 ms (20 measurements/s) 50 x 34 mm (1.97 x 1.34")
Pressure units	bar, psi, kPa, MPa, kg/cm², mH_2O
Electrical Characteristics	
Power supply	battery 2x1.5 V DC AA (LR6-AA)
Battery life	1,500 h (without lighting)
Degree of protection (DIN EN 60 529)	IP 67
Ambient Conditions and Process Factors	
Operating temperature	0 °C to +50 °C (+32 °F to +122 °F)
Fluid temperature	–20 °C to +80 °C (–4 °F to +176 °F)
Storage temperature	–20 °C to +60 °C (–4 °F to +140 °F)
Relative humidity	< 85 %
Vibration	IEC 60068-2-6 10…500 Hz/5 g
Shock	IEC 60068-2-29 11 ms./25 g
Pressure connection • Material • Connection thread • Sealing	 stainless steel 1.4404 G¼" (ISO 1179-2) NBR
Case • Material • Dimensions	 zinc casting (rubber protection cap: TPE) d = 79 mm (3.11"), T = 33 mm (1.3")
Weight	540 g (1.19 lb)

5. Display, Functions and Measuring Process

For inspection, adjustment or calibration, the digital pressure gauge D2 must be connected to a pressure generator and the pressure measuring equipment, which is to be tested.
The paragraph “Measuring process” is an exemplary description of the calibration with the hand test pump BHP 700 or BHP 40 as pressure generator and a mechanical pressure gauge as test item.

Display and control panel

❶ Indication of the measured value
❷ Control panel with buttons
❸ Bargraph indication with drag indicator function
❹ Unit indication
❺ Status line

The digital pressure gauge D2 is equipped with an LC display with additional elements and a graphic bargraph indication.
The measured values are indicated as numbers in the 4½ digit display ❶. The set measuring unit ❹ (bar, psi, kPa, MPa, kg/cm^2, mH_2O) is indicated next to the measured value.
The bargraph indication ❸ represents the pressure range of 0–100 % in graphic blocks. The drag indicator function shows pressure peaks with a single line.
In the status line ❺ , the battery symbol indicates the current battery level. Next to that, depending on the default setting, MIN, MAX or FS value is indicated.
The measuring mode (⇨ chapter 8.1) and the menu for device settings (⇨ chapter 8.1.1) are operated via the four buttons of the control panel ❷.

Function of the reference:
The signals of the pressure measuring cell are recorded with a sample rate of 10 ms (100 measurements/s), converted into pressure values and indicated. With the high sample rate, dynamic pressure peaks can also be measured. These are saved in the MIN/MAX memory, which is permanently updated.
The reference D2 supports the daily pressure measurement due to useful features like MIN/MAX indication, display filter, zero function, adjustment of the pressure unit, lighting, battery level indication and programmable automatic switch-off function.

Measuring process:

❶ Reference D2
❷ Hand test pump
❸ Test item
❹ Pressure hose
❺ LC display with background lighting
❻ Control panel with buttons
❼ Male process connection G ¼"

Connect the reference D2 ❶ and the test item ❸ to the hand pump ❷ .
It is important for the measuring process that the same pressure is applied to reference and test item. This is guaranteed with the hand test pump BHP 700 and BHP 40.
The reference D2 is screwed directly to the hand pump via the male process connection ❼. Connect the test unit with a flexible pressure hose ❹.
Then, use the hand pump to generate pressure and set the required test points.
Measuring values and additional information are indicated in the LC display ❺ of the reference D2.
Operate and set the functions via the membrane buttons of the control panel ❻.
As soon as the pressure stabilised at the test points, the current measuring values are read. The measuring values of test item and reference are recorded and evaluated.

6. Connection and Battery Replacement

The digital pressure gauge D2 has a G ¼" (BSPP) male thread and is supplied including batteries. The device is ready for operation after switching on (⇨ chapter 7.2).

IMPORTANT! Material damage and risk of injury!
Pay attention to the nominal pressure specifications of measuring connection and adapters!
The connection (WAF 27) is approved up to a nominal pressure of 1,000 bar.
→ Observe the nominal pressure specifications of the integrated measuring connections and the specified safety factors.
→ Comply with the instructions in this operating manual! Especially an improper installation of the pressure gauges and the appropriate adapters might cause the tearing of the pressure gauges.

Adhere to the following instructions when using the D2:
- Operation and control shall only be carried out by authorised personnel.
- The installation location should be sufficiently bright and easy to operate.
- Take appropriate precautions to protect the device from damage.
- Pay attention to adequate protection against weather. Note the degree of protection according to DIN EN 60 529 (⇨ chapter 4 “Technical Data”).

6.1 Connection

1. Prepare the measurement setup for connection to the G ¼" male process connection.
   ☞ Use adapters with corresponding nominal pressure specifications only!
2. Ensure that the sealing is correctly seated in the male process connection.
3. Carefully turn the reference by hand into the measurement setup thread.
4. Tighten the male process connection with an open-end wrench (WAF 27).
   ☞ The assembling must be executed with a torque of 25 Nm.
5. Align the reference for your application.

☞ **Ensure rotatability!**
The case of the D2 can be rotated on the male process connection. During direct assembly, make sure that no attachment parts impede the rotatability.

6.2 Battery Replacement

The battery capacity is constantly monitored by the electronics of the D2 and indicated by the number of bars (0 – 5 bars) within the battery symbol.
The batteries should be replaced if no bar is visible anymore and the battery symbol flashes. The D2 is still completely functional.
The batteries must be replaced as soon as the additional notification “Lo bAtt” appears. The D2 is no longer operational.

CAUTION! Observe battery type and polarity!
Using different types of batteries or inserting the batteries incorrectly during replacement may damage the device.
→ Only use new batteries of the same type (LR6-AA) when replacing.
→ When inserting the batteries, make sure that the poles are connected correctly.

Adhere to the following instructions when replacing the batteries:
1. Switch off the device.
2. Press the top section of the rubber protection cap backwards over the case and remove it in the downward direction over the male process connection.
3. Open the case by removing the screws from the rear cover. Put the rear cover and the screws aside.
4. Remove the old batteries.
   ☞ No domestic waste! The batteries need to be disposed of.
5. Insert the new batteries.
   Pay attention to the POLARITY!

6. Check the seating of the seal in the back of the case and inspect for signs of damage.
7. Carefully attach the rear cover with the screws to the case.
8. Tighten the screws on the back of the case.
9. Pull the rubber protection cap over the case again. Hereby, ensure that the recess of the rubber bulge on the front is underneath the button panel.

7. Commissioning, Switching On and Off

The digital pressure gauge D2 is supplied including batteries. The device is ready for operation after switching on (⇨ chapter 7.2).

7.1 Commissioning

Before switching on the D2 for the first time and when changing the measurement setup, please follow the instructions below. Check if

- all components of the measurement setup are connected to each other.
- all connections are carried out properly and pressure-tight.

7.2 Switching On and Off

The D2 can be switched on and off with the **ON/OFF** button.

Switching on:
First, the device performs a self-test and afterwards, it is in the measured value indication mode.
→ Briefly press the **ON/OFF** button.

- All segments of the digital display appear briefly.
- After that, the pressure range (FS) of the device and the recently used pressure unit are displayed.
- The current setting of the automatic switch-off follows `(Po)`:
  "`on`" = activated;
  "`off`" = deactivated.
- Finally, the serial number and the installed software version of the device is displayed.
- Now, the device is ready for operation and indicates the current measured values.

Switching off:
→ Briefly press the **ON/OFF** button.

- The device is switched off and the display is blank.

Automatic switch-off:
With activated "`Po`" function `(on)`, the device switches off after 5 minutes (⇨ chapter 8.3).

8. Measuring Mode and Operation of the Functions

After switching on and completion of the starting procedure, the D2 is in the measuring mode. The current measured value is indicated.

8.1 Measuring Mode

Figure 1 illustrates the operation and functions in the measuring mode.

In the measuring mode, you can activate the different functions (⇨ chapter 8.2) or access the menu for device settings (⇨ chapter 8.1.1) of the D2.

ON/OFF button:

The **ON/OFF** button is used to switch the device on and off (⇨ chapter 7.2).
Additionally, the **ON/OFF** button can be used to switch on the background lighting for 20 s (⇨ chapter 8.2).

MIN/MAX/FS button:

Use the **MIN/MAX/FS** button to switch between minimum value (MIN), maximum value (MAX) and pressure range (FS) in the status line (⇨ chapter 8.2).
The selected range is again displayed the next time the device is switched on.

MENU/ZERO button:

The **MENU** button is used to access the menu for device settings.
Use the **ZERO** button to perform a zero point adjustment.

RESET/OK button:

With the **RESET** button, the current MIN and MAX values can be deleted.
The **OK** button is used to confirm the selection in the menu.

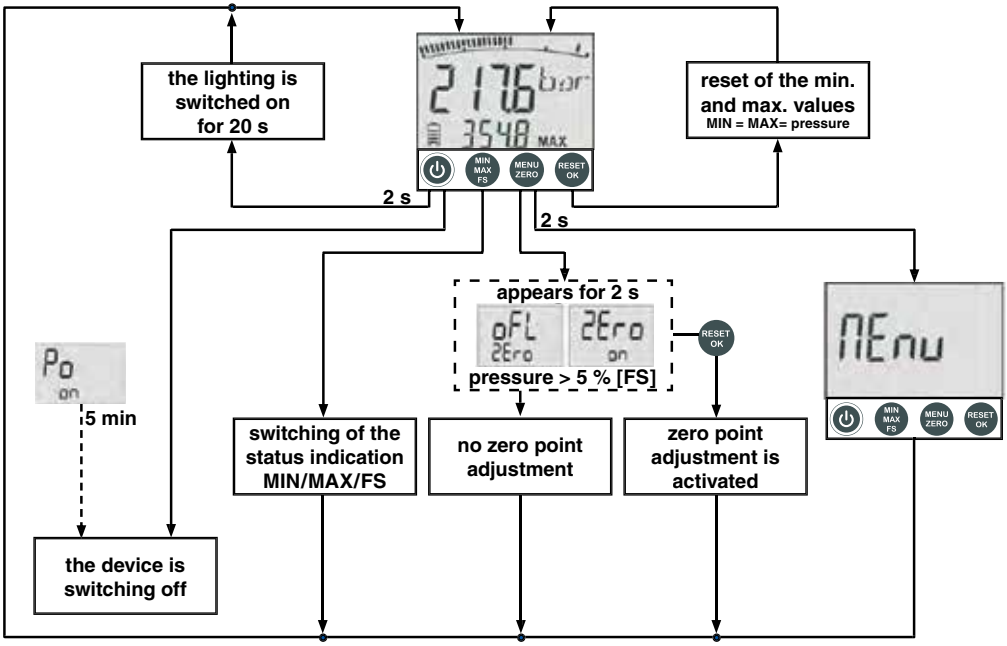

Fig. 1

8.1.1 Menu for Device Settings

The device functions “automatic switch-off”, “units” and “display filter” are set in the menu for device settings. Figure 2 illustrates the procedure for the device settings.

Access the menu for device settings via MENU button.
→ Press the MENU button for 2 s.
- “Menu” appears in the display.

The individual functions and the available settings are controlled with the MENU button.
→ Press the MENU button repeatedly until the function with the desired setting appears.
→ Press the OK button to save the setting of the function.
- The selection is saved and the device switches back to the measuring mode.

Automatic return!
If no button is pressed, the device switches back to the measuring mode after 10 s.

8.2 Operation of the Functions

The operation of the functions in the measuring mode and in the menu for device settings are described in the following paragraphs.

Background lighting:
→ Press the ON/OFF button for 2 s.
- The display lighting is switched on.
- The lighting automatically switches off after 20 s.

FS (FullScale) indication:
The indication of the full scale value (FS) is used for better readability of the bargraph indication. The full scale value of the pressure range is displayed numerically in the status line.
→ Press the MIN/MAX/FS button to switch between MIN, MAX and FS indication.
- In sequence, MIN, MAX and FS are displayed with their corresponding values in the status line.

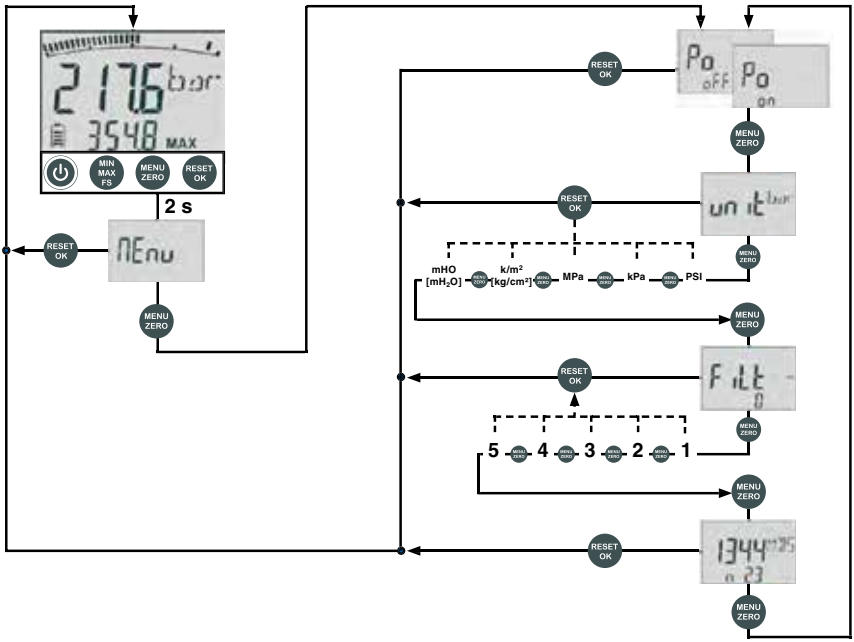

Fig. 2

MIN/MAX indication: (MIN MAX FS)
The MIN/MAX function is used to measure pressure peaks. In the MIN/MAX memory, the lowest (MIN) and highest (MAX) measured values are saved.
→ Press the MIN/MAX/FS button to switch between MIN, MAX and FS indication.
- In sequence, MIN, MAX and FS are displayed with their corresponding values in the status line.

The MIN/MAX memory is deleted when the device is switched off. If different pressure tests shall be performed successively, the MIN/MAX memory needs to be deleted after each measurement.

Deletion of the MIN/MAX values: (RESET OK)
→ Press the RESET/OK button to delete the MIN/MAX values and the drag indicator of the bargraph indication.
- The MIN/MAX values are set to the current measured value.

Pressure range overstepping/ "oFL" indication:
The "oFL" indication appears when the current pressure is exceeding the pressure range (≥110 % FS) of the D2. As soon as the pressure falls within the pressure range, the current measured value is indicated again.

The MAX value continues to indicate "oFL" and needs to be reset.

If the indication "oFL" appears in an unpressurised state, a malfunction occurred.
→ Please contact the ARMATURENBAU GmbH.

Zero point adjustment (ZERO): (MENU ZERO)
In case of undesired deviations in the unpressurised state (atmospheric pressure), the zero point can be corrected manually.

Measuring errors!
The zero point adjustment sets the current ACTUAL value to zero. If the ZERO function is activated when pressure is applied, the pressure measurement is no longer carried out against ambient pressure and measuring errors occur.
→ Only activate the ZERO function in an unpressurised state.

→ Press the MENU/ZERO button.
- "2Ero on" appears in the display for 2 s. The ZERO function can be activated.
  → Press the RESET/OK button to perform the zero point adjustment.

- The indication and the MIN/MAX values are reset to zero.
Or
- "oFL 2Ero" appears in the display for 2 s. The measured pressure (0 bar) is higher than 5 % of the pressure range. The ZERO function cannot be performed.

- The device switches back to the measuring mode.
  → Restore an unpressurised state and press the MENU/ZERO button again.

Resetting the zero point adjustment: (⏻)
The zero point adjustment is activated until the device is switched off. After switching on again, the zero point adjustment is no longer activated.

8.3 Functions in the Menu for Device Settings

The following functions can be changed within the "menu for device settings" (⇨ chapter 8.1.1).
→ To do this, press the MENU button for 2 s.
- "Menu" appears in the display.

→ Press the MENU button repeatedly until the desired function appears.

Automatic switch-off:
The automatic switch-off serves to extend the battery life.
If the function is activated, the device is switched off automatically after 5 minutes.
If the function is deactivated, the device is in the continuous mode and needs to be switched off manually via the ON/OFF button.

The current setting is displayed when switching on the D2:

- "Po on" = activated (automatic switch-off);
- "Po oFF" = deactivated (continuous mode).

→ Press the MENU button again.
- The new value of the function is displayed. If the function was already activated, "Po oFF" appears, otherwise "Po on" appears.

→ Press the OK button to save the new value.
- The selection is saved and the device switches back to the measuring mode.

Setting retains when switching off!
The settings "Po on" or "Po oFF" remain saved and are active again when switching on the device.

Change units:
With the menu item "Unit", you can specify the physical unit for the pressure.

→ Press the MENU button repeatedly until the menu item "Unit" appears.
- "Unit" and the first selectable unit (bar) appears. By pressing the MENU button again, the next selectable unit is indicated. Selectable units are: bar, psi, mbar, kPa, MPa, kg/cm^2, mH_2O (depending on the pressure range).

→ Select the desired unit with the MENU button and save your selection with the OK button.
- The selection is saved and the device switches back to the measuring mode.

Filter setting (damping):
The menu item "FiLt" is used to dampen the indication.

→ Press the MENU button repeatedly until the menu item "FiLt" appears.
- "FiLt 0" appears, and to the right of this the current value is indicated (--). Value selection: 0–5 (0 = no damping).

→ Select the desired value with the MENU button and save your selection with the OK button.
- The selection is saved and the device switches back to the measuring mode.

Indicating the serial number:
The menu item displays the serial number and the software version of the device. These details are necessary for queries in case of service.
Furthermore, you can exit the "menu for device settings" via this item without making any changes.

→ Press the MENU button repeatedly until the menu item appears.
- The serial number and the software version appears:
  1st line: indication of the serial number.
  2nd line: indication of the software version.

→ Press the MENU button to remain in the "menu for device settings".

Or

→ Press the OK button to return to the measuring mode.

9. Maintenance/Cleaning, Storage and Transport

CAUTION! Material damage and loss of warranty!
Any modifications or interventions in the device, made by the customer, might damage important parts or components. Such intervention leads to the loss of any warranty and manufacturer's responsibility!
→ Never modify the device or perform any repairs yourself.

Maintenance:
The digital pressure gauge D2 is maintenance-free and cannot be repaired by the operator. In case of a defect, the device needs to be replaced or returned to the manufacturer for repair.
Only the batteries are to be replaced regularly. We recommend replacing them with new ones after 1½ years at the latest (⇨ chapter 6.2).

Cleaning:
- Clean the D2 with a dry or slightly dampened lint-free cloth.
- Do not use any sharp objects or aggressive agents for cleaning.

Storage and transport:
HANDLE WITH CARE!
Electronic components!
The device is equipped with sensitive electronic components.
- Use the original packaging or comparable packaging for transport.
- Avoid impacts or strong vibrations.
- Protect the device against moisture.

☞ **Remove batteries!**
If the device is not in use for extended periods, the batteries should be removed from the device to preclude any leaking damage.

10. Dismounting and Disposal

WARNING! Risk of injury!
Never remove the device from a system in operation.
Make sure that the system is switched off professionally.

Before dismounting:
Check before dismounting, whether the system
- is switched off,
- is in a safe and currentless state,
- is unpressurised and cooled down.

Dismounting:
→ Pay attention to potentially leaking media. Take appropriate precautions to collect them.
→ Loosen the male process connection with an open-end wrench (WAF 27).
→ Manually turn the D2 out of the measurement setup.

Disposal:
In compliance with the directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE), the device must be disposed separately as electrical and electronic waste. Please regard legal regulations of the country of distribution.

NO DOMESTIC WASTE!
The D2 comprises various materials. It shall not be disposed together with domestic waste.

→ Bring the D2 to your local recycling plant

or

→ send the D2 back to your supplier or to the ARMATURENBAU GmbH.