

# Operating Instructions

## RMA42

Process transmitter with control unit



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# 1 About this document

## 1.1 Symbols

### 1.1.1 Safety symbols

|                                                                                                                                                                                                                             |                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>DANGER</b><br>This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury. |  <b>WARNING</b><br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. |
|  <b>CAUTION</b><br>This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.  |  <b>NOTICE</b><br>This symbol contains information on procedures and other facts which do not result in personal injury.                   |

### 1.1.2 Symbols for certain types of information

| Symbol                                                                              | Meaning                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
|    | <b>Permitted</b><br>Procedures, processes or actions that are permitted. |
|   | <b>Preferred</b><br>Procedures, processes or actions that are preferred. |
|  | <b>Forbidden</b><br>Procedures, processes or actions that are forbidden. |
|  | <b>Tip</b><br>Indicates additional information.                          |
|  | Reference to documentation                                               |
|  | Reference to page                                                        |
|  | Reference to graphic                                                     |
|  | Notice or individual step to be observed                                 |
|  | Series of steps                                                          |
|  | Result of a step                                                         |
|  | Help in the event of a problem                                           |
|  | Visual inspection                                                        |

### 1.1.3 Electrical symbols

|                                                                                     |                                        |                                                                                       |                                                                                                                                 |
|-------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|  | Direct current                         |  | Alternating current                                                                                                             |
|  | Direct current and alternating current |  | <b>Ground connection</b><br>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |

### 1.1.4 Symbols in graphics

|             |              |              |       |
|-------------|--------------|--------------|-------|
| 1, 2, 3,... | Item numbers | A, B, C, ... | Views |
|-------------|--------------|--------------|-------|

## 1.2 Documentation

 For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

The following document types are available in the Downloads area of the Endress+Hauser website ([www.endress.com/downloads](http://www.endress.com/downloads)), depending on the device version:

| Document type                                        | Purpose and content of the document                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technical Information (TI)                           | <b>Planning aid for your device</b><br>The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.                                                                                                                                                       |
| Brief Operating Instructions (KA)                    | <b>Guide that takes you quickly to the 1st measured value</b><br>The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.                                                                                                                                                                 |
| Operating Instructions (BA)                          | <b>Your reference document</b><br>The Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.                      |
| Description of Device Parameters (GP)                | <b>Reference for your parameters</b><br>The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.                                                                                                              |
| Safety instructions (XA)                             | Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions.<br> The nameplate indicates which Safety Instructions (XA) apply to the device. |
| Supplementary device-dependent documentation (SD/FY) | Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.                                                                                                                                                                               |

## 2 Safety instructions

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Are authorized by the plant owner/operator.
- ▶ Are familiar with federal/national regulations.
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).

- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- ▶ Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

## 2.2 Intended use

The process transmitter evaluates analog process variables and displays them on its multicolored screen. Processes can be monitored and controlled with the device's outputs and limit relays. The device is equipped with a wide array of software functions for this purpose. Power can be supplied to 2-wire sensors with the integrated loop power supply.

- The device is an associated apparatus and may not be installed in the hazardous area.
- The manufacturer accepts no liability for damages resulting from improper or non-intended use. The device must not be converted or modified in any way.
- The device is designed for use in industrial environments and may only be operated in an installed state.

## 2.3 Product liability

The manufacturer does not accept any responsibility for damage that results from non-designated use and from failure to comply with the instructions in this manual.

## 2.4 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

## 2.5 Operational safety

Damage to the device!

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for the interference-free operation of the device.

### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers!

- ▶ If modifications are nevertheless required, consult with the manufacturer.

### Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories.

## 2.6 Product safety

This state-of-the-art device is designed and tested in accordance with good engineering practice to meet operational safety standards. It left the factory in a condition in which it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU declaration of conformity. The manufacturer confirms this by affixing the CE mark.

## 2.7 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

## 2.8 Device-specific IT security

The device was developed in accordance with the requirements of the IEC 62443-4-1 "Secure product development lifecycle management" standard.

Link to the cybersecurity website: <https://www.endress.com/cybersecurity>



Further information on cybersecurity: see product-specific security manual (SD).

# 3 Incoming acceptance and product identification

## 3.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
  - ↳ Report all damage immediately to the manufacturer.  
Do not install damaged components.
2. Check the scope of delivery using the delivery note.
3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.



If one of the conditions is not satisfied, contact the manufacturer.

## 3.2 Product identification

The device can be identified in the following ways:

- Nameplate specifications
- Enter the serial number from the nameplate into *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number from the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.

### 3.2.1 Nameplate

#### Do you have the correct device?

The nameplate provides you with the following information on the device:

- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

- Compare the information on the nameplate with the order.

### 3.2.2 Name and address of manufacturer

|                                 |                                                                                          |
|---------------------------------|------------------------------------------------------------------------------------------|
| <b>Name of manufacturer:</b>    | Endress+Hauser Wetzer GmbH + Co. KG                                                      |
| <b>Address of manufacturer:</b> | Obere Wank 1, D-87484 Nesselwang or <a href="http://www.endress.com">www.endress.com</a> |

## 3.3 Storage and transport

Note the following points:

The permitted storage temperature is –40 to 85 °C (–40 to 185 °F); it is possible to store the device at borderline temperatures for a limited period (48 hours maximum).

-  Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

Avoid the following environmental influences during storage:

- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

## 4 Installation

### 4.1 Installation requirements

#### NOTICE

#### High temperatures reduce the life-time of the display

- To avoid heat accumulation, ensure the device is sufficiently cooled.
- Do not operate the device in the upper temperature range over a longer period of time.

The process transmitter is designed for use on the DIN rail (IEC 60715 TH35). Connections and outputs are provided on the top and underside of the device. Inputs are located on the top, while outputs and the power supply connection are located on the underside of the device. The cables are connected via labeled terminals.

Operating temperature range:

Non-Ex/Ex devices: –20 to 60 °C (–4 to 140 °F)

UL devices: –20 to 50 °C (–4 to 122 °F)

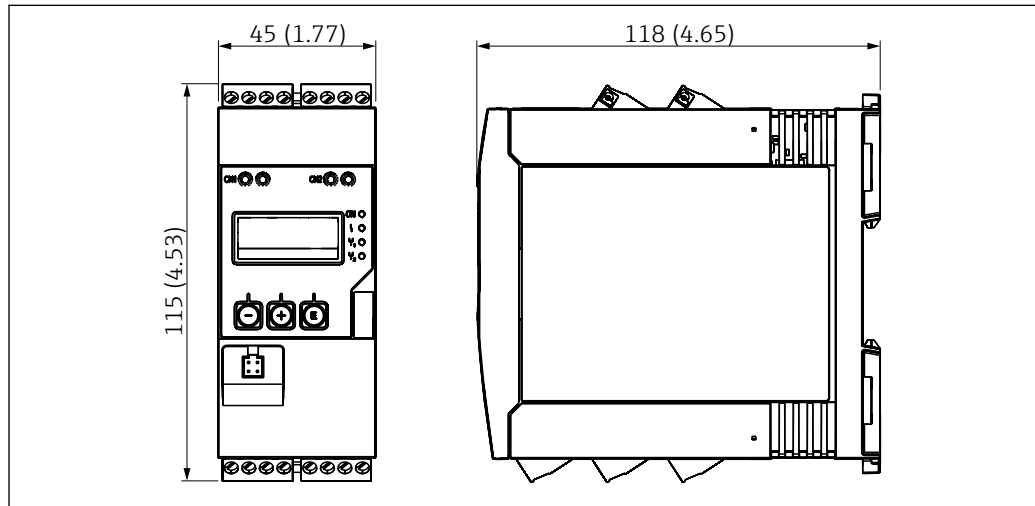
### 4.1.1 Orientation

Vertical or horizontal.

## 4.2 Dimensions

Note the width of the device: 45 mm (1.77 in).

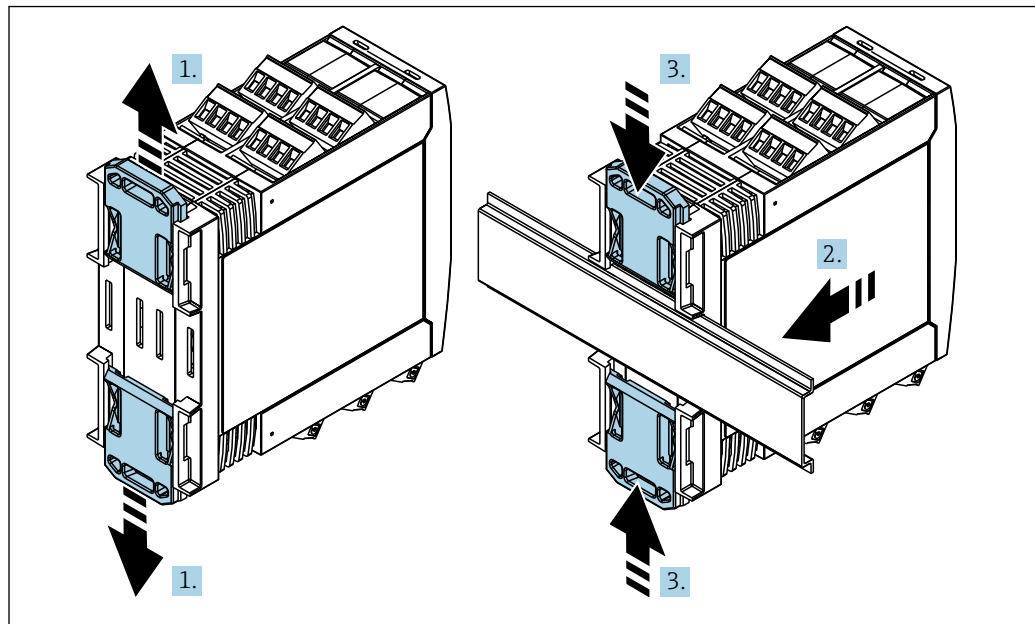
- Maximum depth incl. DIN rail clip 118 mm (4.65 in).
- Maximum height incl. terminals 115 mm (4.53 in).
- Housing width 45 mm (1.77 in).



A0011792

1 Dimensions of the process transmitter in mm (in)

## 4.3 Installing the device



A0011766

1. Slide the upper DIN rail clip upwards and the lower clip downwards until they click into place.
2. Fit the device on the DIN rail from the front.
- 3.

3. Slide the two DIN rail clips back together until they click into place.

To disassemble the device, push the DIN rail clips up or down (see 1.) and remove the device from the rail. It also suffices to open just one of the DIN rail clips and then tilt the device to remove it from the rail.

## 4.4 Post-installation check

- Is the DIN rail clip clicked into place?
- Is the device securely seated on the DIN rail?
- Are all plug-in terminals securely engaged?
- Are the temperature limits observed at the mounting location →  7?

# 5 Electrical connection

### WARNING

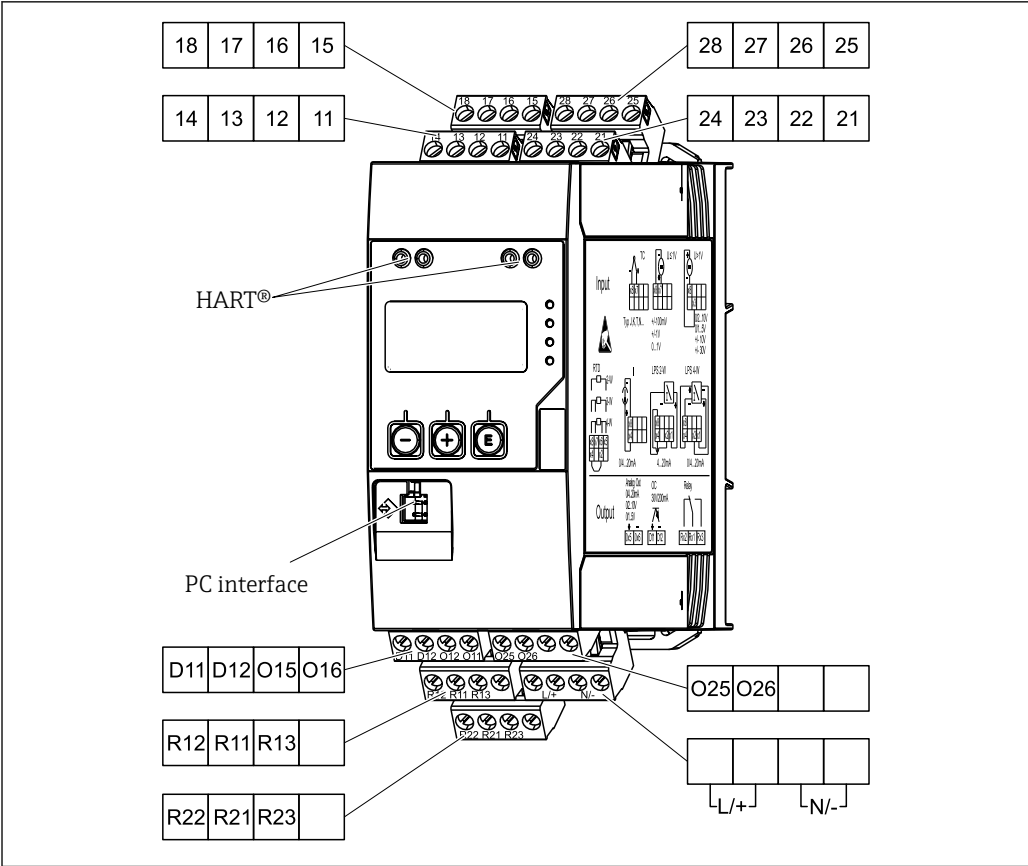
#### **Danger! Electric voltage**

- ▶ The entire connection of the device must take place while the device is de-energized.
- ▶ Before commissioning the device, make sure that the supply voltage matches the voltage specifications on the nameplate.
- ▶ Provide suitable switch or circuit breaker in building installation. This switch must be provided close to the device (within easy reach) and marked as a circuit breaker.
- ▶ An overcurrent protection element (rated current  $\leq 10\text{ A}$ ) is required for the power cable.

-  ■ Observe the terminal designation on the side of the device.
- The mixed connection of safety extra-low voltage and dangerous contact voltage to the relay is permitted.

## 5.1 Connecting the device

A loop power supply (LPS) is provided for every input. The loop power supply is primarily designed to supply power to 2-wire sensors and is galvanically isolated from the system and the outputs.

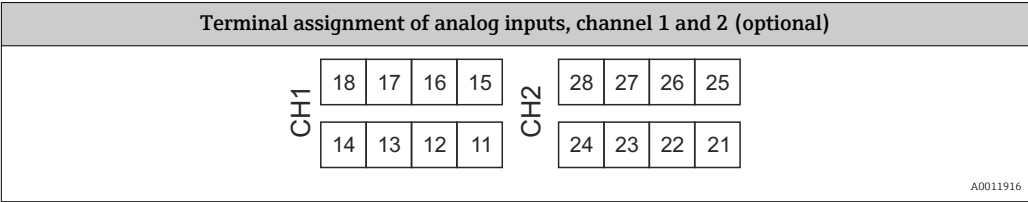


A0011800-EN

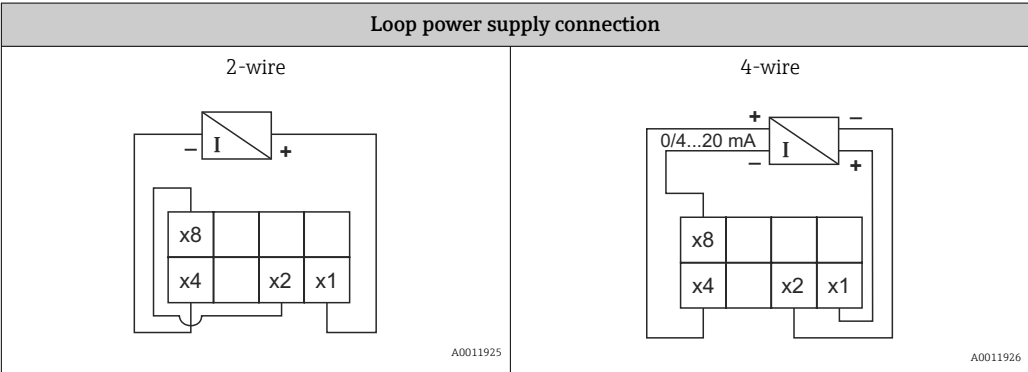
2 Terminal assignment of process transmitter (channel 2 and relay optional)

**i** We recommend you connect a suitable surge arrester upstream if high-energy transients can be expected on long signal cables.

5.1.1 Overview of possible connections on the process indicator

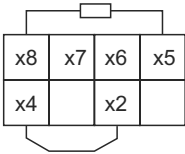
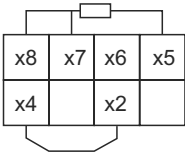
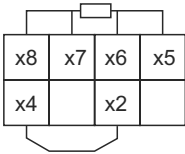
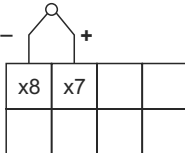
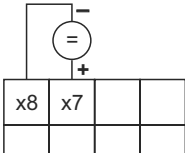
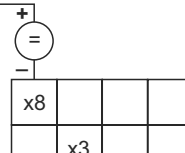
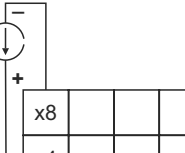


A0011916

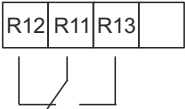
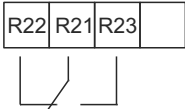


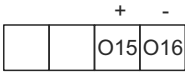
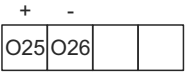
A0011925

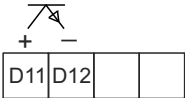
A0011926

| Analog input connection                                                                                                                          |                                                                                                                                                             |                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>RTD/resistor, 2-wire</div> <div></div> <div>A0011917</div> | <div>RTD/resistor, 3-wire</div> <div></div> <div>A0011918</div>           | <div>RTD/resistor, 4-wire</div> <div></div> <div>A0011919</div>           |
| <div>Thermocouple</div> <div></div> <div>A0011920</div>         | <div><math>U \leq 1\text{ V}</math></div> <div></div> <div>A0011921</div> | <div><math>U &gt; 1\text{ V}</math></div> <div></div> <div>A0011922</div> |
| <div>Current</div> <div></div> <div>A0011923</div>              |                                                                                                                                                             |                                                                                                                                                              |

Illustrated contact position of the relays if the power supply fails:

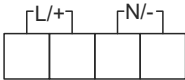
| (Optional) relay connection                                                                                                           |                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <div>Relay 1</div> <div></div> <div>A0011801</div> | <div>Relay 2</div> <div></div> <div>A0011802</div> |

| Analog output connection                                                                                                                      |                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Analog output 1</div> <div></div> <div>A0011803</div> | <div>Analog output 2 (optional)</div> <div></div> <div>A0011804</div> |

| Digital output connection                                                                                                                                      |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <div>Digital output / open collector</div> <div></div> <div>A0011806</div> |  |

Power supply connection

24 to 230 V AC/DC (-20 % / +10 %) 50/60 Hz



A0011805

Interfaces

Interface for configuring with PC software



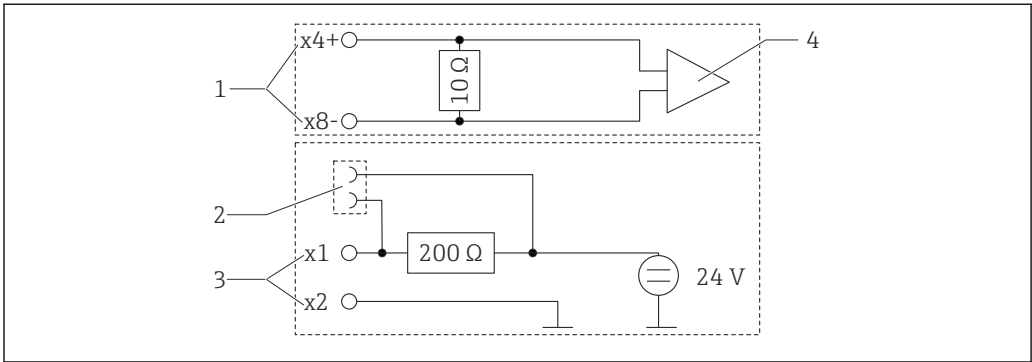
A0012418

HART® connection sockets

CH1 / CH2 

A0012403

 The HART® terminals are connected to the internal resistor of the loop power supply. There is no internal connection to the current input. If the loop power supply of the device is not used, an external HART® resistor must be used in the 4 to 20 mA current loop.



 3 Internal circuitry of the HART® connection sockets

- 1 Current input
- 2 HART® connection sockets
- 3 Loop power supply
- 4 A/D converter

## 5.2 Post-connection check

| Device condition and specifications                                                                        | Notes                                      |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Are cables or the device damaged?                                                                          | Visual inspection                          |
| Electrical connection                                                                                      | Notes                                      |
| Does the supply voltage match the specifications on the nameplate?                                         | 24 to 230 V AC/DC (-20 % / +10 %) 50/60 Hz |
| Are all terminals firmly engaged in their correct slot? Is the coding on the individual terminals correct? | -                                          |

|                                                             |                                        |
|-------------------------------------------------------------|----------------------------------------|
| Are the mounted cables strain-relieved?                     | -                                      |
| Are the power supply and signal cables correctly connected? | See the wiring diagram on the housing. |

## 6 Operation options

Thanks to the device's simple operating concept, it is possible to commission the device for many applications without a printed set of Operating Instructions.

The FieldCare operating software is a quick and convenient way of configuring the device. It contains brief explanatory (help) texts that provide additional information on individual parameters.

### 6.1 Operating elements

#### 6.1.1 Local operation at the device

The device is operated by means of the three keys integrated in the front part of the device



|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <ul style="list-style-type: none"> <li>▪ Open the Configuration menu</li> <li>▪ Confirm an entry</li> <li>▪ Select a parameter or submenu offered in the menu</li> </ul>                                                                                                                                                                                                                         |
|  | <p>Within the Configuration menu:</p> <ul style="list-style-type: none"> <li>▪ Scroll step-by-step through the parameters/menu items/characters offered</li> <li>▪ Change the value of the selected parameter (increase or decrease)</li> </ul> <p>Outside the Configuration menu:<br/>Display enabled and calculated channels, as well as min. and max. values for all the active channels.</p> |

You can always exit menu items / submenus by selecting "x Back" at the end of the menu.

Leave the setup directly without saving the changes by pressing the '-' and '+' keys simultaneously for longer (> 3 s).

#### 6.1.2 Configuration via interface & PC configuration software

##### CAUTION

**Undefined states and switching of outputs and relays while configuring with the configuration software**

- Do not configure the device when the process is running.

To configure the device using the FieldCare Device Setup software, connect the device to your PC. You need a special interface adapter for this purpose, e.g. the Commubox FXA291.

##### **Installing the communication DTM in FieldCare**

Before the indicator can be configured, FieldCare Device Setup must be installed on your PC. The installation instructions can be found in the FieldCare instructions.

Install FieldCare device drivers according to the following instructions:

1. First install the device driver "CDI DTMLibrary" in FieldCare. It can be found in FieldCare under "Endress+Hauser Device DTMs → Service / Specific → CDI".
2. The DTM catalog in FieldCare must then be updated. Add the new installed DTMs to the DTM catalog.

### Installation of the Windows driver for TXU10/FXA291

Administrator rights are required to install the driver in Windows. Proceed as follows:

1. Connect the device to the PC using the TXU10/FXA291 interface adapter.
  - ↳ A new device is detected and the Windows installation wizard opens.
2. In the installation wizard, do not allow the device to automatically search for software. For this, select "No, not this time" and click "Next".
3. In the next window, select "Install software from a list or specific location" and click "Next".
4. In the next window, click "Browse" and select the directory where the driver for the TXU10/FXA291 adapter is saved.
  - ↳ The driver is installed.
5. Click "Finish" to finish the installation.
6. Another device is detected and the Windows installation wizard starts again. Again, choose "No, not this time" and click "Next".
7. In the next window, select "Install software from a list or specific location" and click "Next".
8. In the next window, click "Browse" and select the directory where the driver for the TXU10/FXA291 adapter is saved.
  - ↳ The driver is installed.
9. Click "Finish" to finish the installation.

This completes the driver installation for the interface adapter. The COM port that has been assigned can be seen in the Windows device manager.

### Connecting the device

Proceed as follows to establish a connection with FieldCare:

1. Firstly, edit the connection macro. For this, start a new project and in the window that is displayed, right-click the symbol for "Service (CDI) FXA291" and select "Edit".
2. In the next window, to the right of "Serial interface", select the COM port which was assigned during the installation of the Windows driver for the TXU10/FXA291 adapter.
  - ↳ The macro is now configured. Select "Finish".
3. Start the "Service (CDI) FXA291" macro by double-clicking it and confirm the subsequent query with "Yes".
  - ↳ A search for a connected device is performed and the suitable DTM is opened. Online configuration is started.

Continue with device configuration in accordance with the Operating Instructions for the device. The complete Setup menu, i.e. all of the parameters listed can be found in FieldCare Device Setup.



In general, it is possible to overwrite parameters with the FieldCare PC software and the appropriate device DTM even if access protection is active.

If access protection by means of a code should be extended to the software, this function should be activated in the extended device setup.

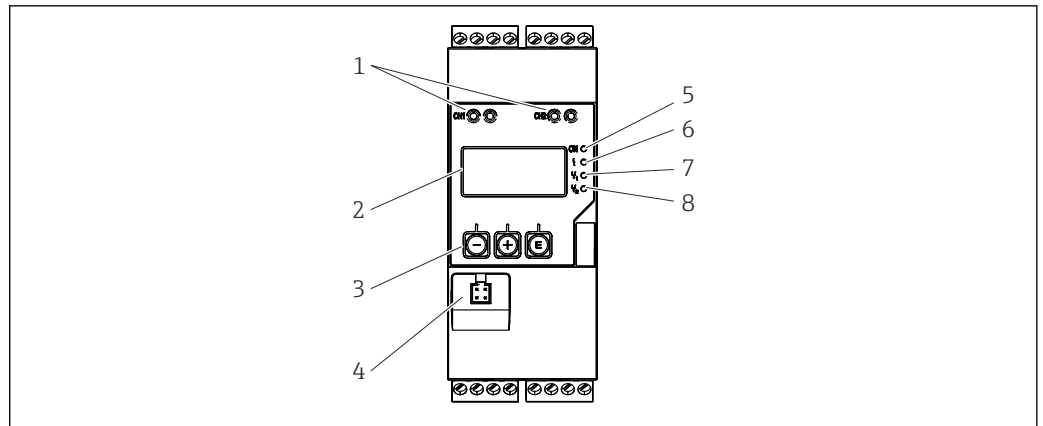
For this, select Menu → Setup / Expert → System → Overfill protect → German WHG and confirm.

## 6.2 Display and device status indicator / LED

The process indicator provides an illuminated LC display which is split into two sections. The segment section displays the value of the channel and additional information and alarms.

In the dot matrix section, additional channel information, such as the TAG, unit or bar graph, is displayed in the display mode. Operating text in English is displayed here during operation.

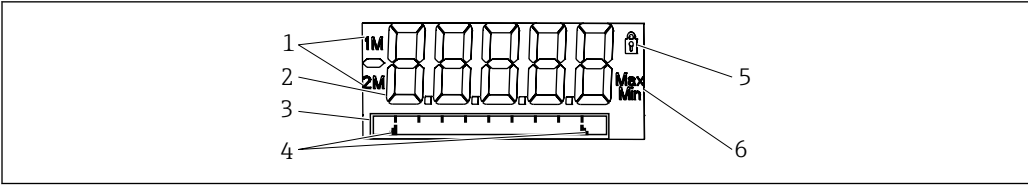
The parameters for configuring the display are described in detail in the "Configuring the device" section.



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4 Display and operating elements of the process transmitter

- 1 HART® connection sockets
- 2 Display
- 3 Operating keys
- 4 PC interface connection socket
- 5 Green LED; on = supply voltage applied
- 6 Red LED; on = fault/alarm
- 7 Yellow LED; on = relay 1 energized
- 8 Yellow LED; on = relay 2 energized



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-  5    *Display of the process transmitter*
- 1    *Channel indicator: 1: analog input 1; 2: analog input 2; 1M: calculated value 1; 2M: calculated value 2*
  - 2    *Measured value display*
  - 3    *Dot matrix display for TAG, bar graph, unit*
  - 4    *Limit value indicators in the bar graph*
  - 5    *"Operation locked" indicator*
  - 6    *Minimum/maximum value indicator*

In the event of an error, the device switches automatically between displaying the error and displaying the channel, →  34 and →  36.

6.3        Symbols

6.3.1     Display symbols

|                                                                                    |                                                                                                                       |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|  | The device is locked/operator lock; the device setup is locked for changes to parameters; the display can be changed. |
| 1                                                                                  | Channel one (Analog in 1)                                                                                             |
| 2                                                                                  | Channel two (Analog in 2)                                                                                             |
| 1M                                                                                 | First calculated value (Calc value 1)                                                                                 |
| 2M                                                                                 | Second calculated value (Calc value 2)                                                                                |
| Max                                                                                | Maximum value/value of the maximum indicator of the channel displayed                                                 |
| Min                                                                                | Minimum value/value of the minimum indicator of the channel displayed                                                 |

**In the event of an error:**

The display shows: -----, the measured value is not displayed

Underrange/overrange: -----

 The error and the channel identifier (TAG) are specified in the dot matrix section.

6.3.2     Icons in the editing mode

The following characters are available for entering customized text:

‘0-9’, ‘a-z’, ‘A-Z’, ‘+’, ‘-’, ‘\*’, ‘/’, ‘\’, ‘%’, ‘°’, ‘2’, ‘3’, ‘m’, ‘.’, ‘:’, ‘;’, ‘!’, ‘?’, ‘\_’, ‘#’, ‘\$’, ‘”’, ‘’’, ‘(’, ‘)’, ‘~’

For numerical entries, the numbers ‘0-9’ and the decimal point are available.

Furthermore, the following icons are used in the editing mode:

|                                                                                     |                         |
|-------------------------------------------------------------------------------------|-------------------------|
|  | Symbol for setup        |
|  | Symbol for expert setup |
|  | Symbol for diagnostics  |

|   |                                                                                                                                     |
|---|-------------------------------------------------------------------------------------------------------------------------------------|
| ✓ | Accept entry.<br>If this symbol is selected, the entry is applied at the position specified by the user, and you quit editing mode. |
| ✗ | Reject entry.<br>If this symbol is selected, the entry is rejected and you quit editing mode. The previously set text remains.      |
| ← | Jump one position to the left.<br>If this symbol is selected, the cursor jumps one position to the left.                            |
| ⌫ | Delete backwards.<br>If this symbol is selected, the character to the left of the cursor position is deleted.                       |
| ⌫ | Delete all.<br>If this symbol is selected, the entire entry is deleted.                                                             |

## 6.4 Quick guide to the operating matrix

The following tables list all the menus and the operating functions.

| Display menu |                   | Description                                           |
|--------------|-------------------|-------------------------------------------------------|
| Ⓔ            | AI1 Reset minmax* | Reset the min/max values for Analog in 1              |
| ⊕            | AI2 Reset minmax* | Reset the min/max values for Analog in 2              |
| ⊕            | CV1 Reset minmax* | Reset the min/max values for Calc value 1             |
| ⊕            | CV2 Reset minmax* | Reset the min/max values for Calc value 2             |
| ⊕            | Analog in 1       | Display setting for analog input 1                    |
| ⊕            | Analog in 2       | Display setting for analog input 2                    |
| ⊕            | Calc value 1      | Display setting for calculated value 1                |
| ⊕            | Calc value 2      | Display setting for calculated value 2                |
| ⊕            | Contrast          | Display contrast                                      |
| ⊕            | Brightness        | Display brightness                                    |
| ⊕            | Alternating time  | Switchover time between values chosen to be displayed |
| ⊕            | Back              | Return to the main menu                               |

\*) Is only displayed if "Allow reset" = "Yes" is set in the "Expert" menu for the corresponding channel.

| Setup menu |                  | Description                                 |
|------------|------------------|---------------------------------------------|
| Ⓔ          | Application      | Application selection                       |
|            | 1-channel        | 1-channel application                       |
|            | 2-channel        | 2-channel application                       |
|            | Diff-pressure    | Differential pressure application           |
| ⊕          | AI1 Lower range* | Lower measuring range limit for Analog in 1 |
| ⊕          | AI1 Upper range* | Upper measuring range limit for Analog in 1 |
| ⊕          | AI2 Lower range* | Lower measuring range limit for Analog in 2 |
| ⊕          | AI2 Upper range* | Upper measuring range limit for Analog in 2 |
| ⊕          | CV Factor*       | Factor for calculated value                 |
| ⊕          | CV Unit*         | Unit for calculated value                   |
| ⊕          | CV Bar 0%*       | Bar graph lower limit for calculated value  |
| ⊕          | CV Bar 100%*     | Bar graph upper limit for calculated value  |

\*) Is only displayed if "Application" = "Diff pressure".

| Setup menu |                  | Description                                                    |
|------------|------------------|----------------------------------------------------------------|
| ⊕          | Linearization*   | Linearization for calculated value                             |
|            | No lin points    | Number of linearization points                                 |
|            | X-value          | X-values for linearization points                              |
|            | Y-value          | Y-values for linearization points                              |
| ⊕          | Analog in 1      | Analog input 1                                                 |
|            | Signal type      | Signal type                                                    |
|            | Signal range     | Signal range                                                   |
|            | Connection       | Connection type (only for Signal type = RTD)                   |
|            | Lower range      | Measuring range lower limit                                    |
|            | Upper range      | Measuring range upper limit                                    |
|            | Tag              | Designation of analog input                                    |
|            | Unit             | Unit for analog input                                          |
|            | Temperature unit | Unit of temperature, only visible if "Signal type" = RTD or TC |
|            | Offset           | Offset for analog input                                        |
|            | Ref junction     | Reference junction (only for Signal type = TC)                 |
|            | Reset min/max    | Reset min/max values for analog input                          |
| ⊕          | Analog in 2      | Analog input 2                                                 |
|            | See Analog in 1  |                                                                |
| ⊕          | Calc value 1     | Calculated value 1                                             |
|            | Calculation      | Type of calculation                                            |
|            | Tag              | Designation of calculated value                                |
|            | Unit             | Unit for calculated value                                      |
|            | Bar 0%           | Bar graph lower limit for calculated value                     |
|            | Bar 100%         | Bar graph upper limit for calculated value                     |
|            | Factor           | Factor for calculated value                                    |
|            | Offset           | Offset for calculated value                                    |
|            | No lin points    | Number of points for linearization                             |
|            | X-value          | X-values for linearization points                              |
|            | Y-value          | Y-values for linearization points                              |
|            | Reset min/max    | Reset min/max values                                           |
|            | Calc value 2     | Calculated value 2                                             |
|            | See Calc value 1 |                                                                |
| ⊕          | Analog out 1     | Analog output 1                                                |
|            | Assignment       | Analog output assignment                                       |
|            | Signal type      | Signal type, analog output                                     |
|            | Lower range      | Lower range limit of analog output                             |
|            | Upper range      | Upper range limit of analog output                             |
| ⊕          | Analog out 2     | Analog output 2                                                |
|            | See Analog out 1 |                                                                |
| ⊕          | Relay 1          | Relay 1                                                        |
|            | Assignment       | Assignment of value to be monitored with relay                 |
|            | Function         | Operating mode of the relay                                    |

\*) Is only displayed if "Application" = "Diff pressure".

| Setup menu |               | Description                                                         |
|------------|---------------|---------------------------------------------------------------------|
|            | Set point     | Limit value for relay                                               |
|            | Set point 1/2 | Limit values 1 and 2 for relay (only if Function = Inband, Outband) |
|            | Time base     | Time base for gradient evaluation (only if Function = Gradient)     |
|            | Hysteresis    | Hysteresis for relay                                                |
| +          | Relay 2       | Relay 2                                                             |
|            | See Relay 1   |                                                                     |
| +          | Back          | Return to the main menu                                             |

\*) Is only displayed if "Application" = "Diff pressure".

| Diagnostics menu |                    | Description                  |
|------------------|--------------------|------------------------------|
| ⌂                | Current diagn      | Current diagnostic message   |
| +                | Last diagn         | Last diagnostic message      |
| +                | Operating time     | Operating time of the device |
| +                | Diagnost logbook   | Diagnostics logbook          |
| +                | Device information | Device information           |
| +                | Back               | Return to the main menu      |

| Expert menu |                                                                                           | Description                                                               |
|-------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| ⌂           | Direct access                                                                             | Direct access to an operating item                                        |
| +           | System                                                                                    | System settings                                                           |
|             | Access code                                                                               | Protection of operation by an access code                                 |
|             | Overfill protect                                                                          | Overfill protection system                                                |
|             | Reset                                                                                     | Device reset                                                              |
|             | Save user setup                                                                           | Save setup settings                                                       |
| +           | Input                                                                                     | Inputs                                                                    |
|             | The following parameters are available in addition to the parameters from the Setup menu: |                                                                           |
|             | Analog in 1 / 2                                                                           | Analog input 1 / 2                                                        |
|             | Bar 0%                                                                                    | Lower limit for bar graph of analog input                                 |
|             | Bar 100%                                                                                  | Upper limit for bar graph of analog input                                 |
|             | Decimal places                                                                            | Decimal places for analog input                                           |
|             | Damping                                                                                   | Damping                                                                   |
|             | Failure mode                                                                              | Failure mode                                                              |
|             | Fixed fail value                                                                          | Fixed value in the event of an error (only if Failure mode = Fixed value) |
|             | NAMUR NE43                                                                                | Maximum permissible error according to NAMUR                              |
|             | Allow reset                                                                               | Reset the min/max values via the Display menu                             |
| +           | Output                                                                                    | Outputs                                                                   |
|             | The following parameters are available in addition to the parameters from the Setup menu: |                                                                           |
|             | Analog out 1 / 2                                                                          | Analog output 1 / 2                                                       |
|             | Fail mode                                                                                 | Failure mode                                                              |
|             | Fixed fail value                                                                          | Fixed value in the event of an error (only if Fail mode = Fixed value)    |

| Expert menu |                | Description                       |
|-------------|----------------|-----------------------------------|
|             | Relay 1 / 2    | Relay 1/2                         |
|             | Time delay     | Switching delay                   |
|             | Operating mode | Mode of operation                 |
|             | Failure mode   | Behavior in the event of an error |

## 7 Commissioning

### 7.1 Post-installation check and switching on the device

Make sure that all post-connection checks have been carried out before putting your device into operation:

- Checklist for "post-installation check" →  9
- Checklist for "post-connection check" →  12

After the operating voltage is applied, the green LED lights up and the display indicates the device is ready for operation.

If you are commissioning the device for the first time, program the setup as described in the following sections of the Operating Instructions.

If you are commissioning a device that is already configured or preset, the device starts measuring immediately as defined in the settings. The values of the channels currently activated are shown on the display. Changes to the display can be made in the Display menu item →  30.

 Remove the protective film from the display as this would otherwise affect the readability of the display.

### 7.2 General information about configuring the device

Configure your device onsite or put it into operation using the three integrated keys or via the PC. The Commubox FXA291/TXU10 is required (see the 'Accessories' section) to connect the device to a PC.

Advantages of configuring via FieldCare Device Setup:

- The device data are saved in FieldCare Device Setup and can be retrieved at any time.
- Data entry is faster with the keyboard.

### 7.3 Notes on setup access protection

Access to the setup is enabled by default (factory setting) and can be locked via the setup settings.

Proceed as follows to lock the device:

1. Press **E** to enter the configuration menu.
2. Press **+**, **Setup** is displayed.
3. Press **E** to open the **Setup** menu.
4. Repeatedly press **+** until **System** is displayed.
5. Press **E** to open the **System** menu.
6. **Access code** is displayed.
7. Press **E** to open the setting for access protection.

8. Set the code: press the + and - buttons to set the desired code. The access code is a four-digit number. The corresponding position of the number is displayed in plain text. Press **E** to confirm the value entered and go to the next position.
  9. Confirm the last position of the code in order to exit the menu. The full code is displayed. Press + to scroll back to the last item of the **x Back** submenu and confirm this item. By confirming the point, the value is adopted and the display returns to the **Setup** level. Again select the last parameter **x Back** to also exit this submenu and return to the measured value/channel display level.
-  The **x Back** item at the end of every picklist/menu item takes the user from the submenu to the next menu level up.

## 7.4 Configuration of the device

Configuration steps:

1. Selection of the application conditions (only for 2-channel device) →  21
2. Configuration of the universal input/inputs →  23
3. Configuration of calculations →  24
4. Configuration of the analog output/outputs →  25
5. Configuration of the relays (if option selected); assignment and monitoring of limit values →  25
6. Advanced device configuration (access protection/operating code; backup of current setup/user setup) →  29
7. Configuration of display functionalities →  30

The following section describes in detail how to set up the two-channel device and the differential pressure application package (brief overview of the configuration →  22, only available in the two-channel version). If you want to configure a single-channel device, please proceed as described in step 2 →  23.

### 7.4.1 Step 1: Selecting the application conditions/number of active input channels

#### Application conditions for two-channel device

Call up the Setup menu after performing the post-installation check.

Press **E** → press + → **Setup** is displayed → press **E**.

Select your application conditions in the first item of the setup. You have a choice of the following settings:

- Differential pressure (Diff pressure): application package; parameters are automatically preselected for you.
- One-channel (1-channel): universal input 2 (Analog in 2) is deactivated (off) in the software. The second channel can be enabled any time via **Setup** → **Analog in 2** →  23.
- Two-channel (2-channel): universal input 1 (Analog in 1) and universal input 2 (Analog in 2) are preconfigured with the following values:
  - Signal type: **Current**
  - Signal range: **4-20mA**

The following section describes the "Differential pressure" application package.

To set up the device in single-channel/two-channel applications, please proceed as explained in step 2 → 23.

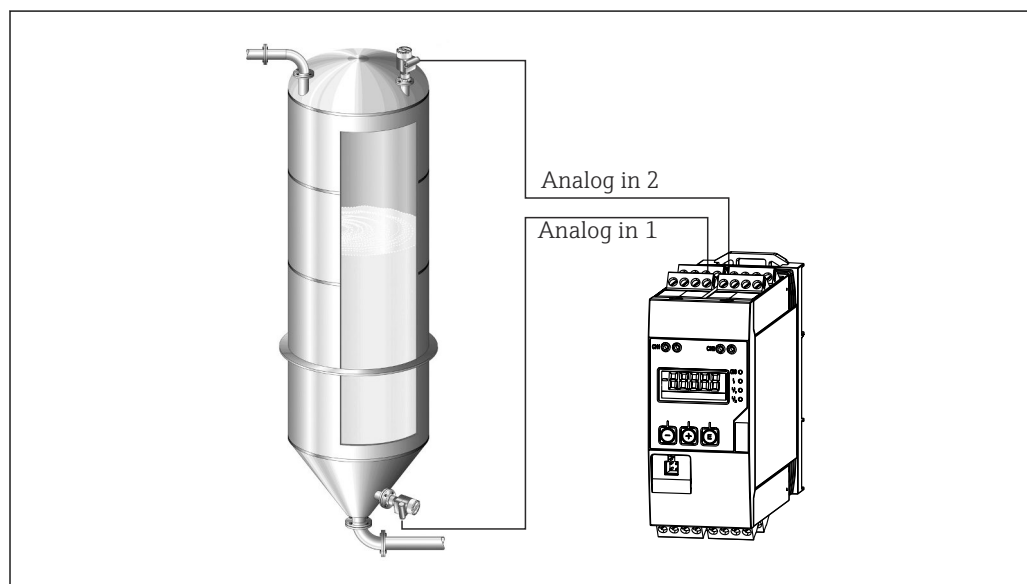
- i** If the application or the selected parameter are subsequently changed, parameters already configured are retained (e.g. if the differential pressure application is changed to two-channel, **Calc value 1** remains set to Difference).

### Differential pressure application

A concise setup is available for differential pressure applications.

Once the differential pressure application setup has been completed successfully, the difference between the two inputs is automatically calculated and the signal linearized using the configured parameters of the analog inputs and the linearization points. The volume is shown on the display (= calculated value 2).

- i** Prerequisites for correct value calculation and a functioning setup:
- Sensor 1 returns the higher pressure: connected to analog input 1 (Analog in 1)
  - Sensor 2 returns the lower pressure: connected to analog input 2 (Analog in 2)



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**6** Differential pressure application

### Setup → Application → Diff pressure

Once the differential pressure application has been selected by confirming the **Diff pressure** parameter, the editable parameters are displayed in succession and must be configured individually for your application.

Some parameters are already configured for you due to the selection of the application setup → 23.

The **CV Factor** parameter is used to take the density of the medium into account during level measurement, i.e. it corresponds to the mathematic formula  $1/(\text{density} \cdot \text{gravitational acceleration})$ . The default value for the factor is 1.

The density must be given in  $\text{kg/m}^3$  and the pressure in Pascal (Pa) or  $\text{N/m}^2$ . The gravitational acceleration is defined by the constant on the earth's surface.

This is  $g = 9.81 \text{ m/s}^2$ . Tables and examples for converting application-related units into the defined values  $\text{kg/m}^3$  and Pa and  $\text{N/m}^2$  can be found in the Appendix → 51.

- i** Other parameters can be enabled in the setup for the corresponding parameter (see Steps 4, 5, 6 and 7 or offset for analog inputs, display original values of analog channels, etc.).

**‘Setup’ menu item**

| Setup → Application → ‘Diff pressure’                                                                                                                                                                                                                       |                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preconfigured by application package                                                                                                                                                                                                                        | Submenu                                                                                                                                                                                                                         |
| Setup analog inputs<br>Signal: <b>Current</b><br>Range: <b>4-20 mA</b><br>→  21 and →  23 | <b>AI1 Lower range:</b> start of measuring range, analog input 1 (corresponds to 4 mA for example)                                                                                                                              |
|                                                                                                                                                                                                                                                             | <b>AI1 Upper range:</b> end of measuring range, analog input 1 (corresponds to 20 mA for example)                                                                                                                               |
|                                                                                                                                                                                                                                                             | <b>AI2 Lower range:</b> start of measuring range, analog input 2 (corresponds to 4 mA for example)                                                                                                                              |
|                                                                                                                                                                                                                                                             | <b>AI2 Upper range:</b> end of measuring range, analog input 2 (corresponds to 20 mA for example)                                                                                                                               |
| Setup display<br>Display: calculated value and bar graph for <b>Calc Value 2:</b><br>Active; all other values inactive<br>→  30                                            | <b>CV Unit:</b> unit of the calculated volume value (e.g.liters)                                                                                                                                                                |
|                                                                                                                                                                                                                                                             | <b>CV Bar 0%:</b> start of measuring range for bar graph display                                                                                                                                                                |
|                                                                                                                                                                                                                                                             | <b>CV Bar 100%:</b> end of measuring range for bar graph display                                                                                                                                                                |
| <b>CV Factor</b>                                                                                                                                                                                                                                            | <b>CV Factor:</b> factor to take the density of the medium into account during level measurement, i.e. it corresponds to the mathematic formula $1/(\text{density} \cdot \text{gravitational acceleration})$ ; default value: 1 |
| Setup calculation of the volume:<br>Calc value 1: <b>Difference</b><br>Calc value 2: <b>Lineariz. CV1</b><br>→  24                                                        | Create the linearization table:<br>If the volume value should be calculated - i.e. a linearization of the difference is output - the X and Y coordinates must be specified as the basis for performing the calculation.         |
|                                                                                                                                                                                                                                                             | <b>No lin points:</b> number of linearization points required (max. 32)                                                                                                                                                         |
|                                                                                                                                                                                                                                                             | <b>X-value:</b> X-coordinate for linearization point X1, 2, etc.                                                                                                                                                                |
|                                                                                                                                                                                                                                                             | <b>X-value:</b> Y-coordinate for linearization point X1, 2, etc.                                                                                                                                                                |
|                                                                                                                                                                                                                                                             | End differential pressure setup                                                                                                                                                                                                 |

**7.4.2 Step 2: Configuring the universal input(s) (Analog in 1/2)**

The device has one universal input, and optionally an additional universal input for current, voltage, resistance thermometers (RTD) or thermocouples (TC).

The input is monitored for a cable open circuit (see the 'Measuring range limits' table →  34 and the 'Troubleshooting' section →  36).

**Minimum/maximum values at the inputs:**

 The current min./max. value is saved every 15 minutes. If the power supply is disconnected (power off/power on), there may be a gap in the recording sequence. The measuring interval starts when the device is switched on. It is not possible to synchronize the measuring cycles to full hours.

Limit values and relays are available for monitoring the measured values. They must be configured as described in step 5 →  25.

Each universal input saves the smallest and largest measured value that is measured. These values can be reset individually for every channel. In the setup, the administrator can specify that a user can reset the minimum and maximum values of the individual channels directly in the main menu without the need for a release code. The min./max. value is reset if a reset is performed and if channel scaling is changed.

| Setup                                    |
|------------------------------------------|
| <b>Analog in 1</b><br><b>Analog in 2</b> |

|                                                                                                                         |                |                                                                                |                                                                             |                                   |
|-------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------|
| <b>Current</b>                                                                                                          | <b>Voltage</b> | <b>RTD</b> (resistance temperature detector)                                   | <b>TC</b> (thermocouple)                                                    | <b>Off</b> (deactivate the input) |
| <b>Signal range</b><br>Signal range (see Technical data); start and end of measuring range defined by the type selected |                |                                                                                |                                                                             |                                   |
| <b>Lower range</b><br>Start of measuring range; also enter the decimal point                                            |                | <b>Connection</b> (RTD only)<br>Type of connection (2-, 3-, 4-wire connection) |                                                                             |                                   |
| <b>Upper range</b><br>End of measuring range; also enter the decimal point                                              |                |                                                                                |                                                                             |                                   |
| <b>TAG</b><br>Channel identifier                                                                                        |                |                                                                                |                                                                             |                                   |
| <b>Unit</b><br>Unit                                                                                                     |                |                                                                                |                                                                             |                                   |
| <b>Offset</b><br>Constant value that is added to the current measured value                                             |                |                                                                                | <b>Ref junction</b> (TC only)<br>Internal/fixed + entry of "Fixed ref junc" |                                   |
| <b>Res minmax:</b> (yes/no)<br>Reset minimum/maximum values?                                                            |                |                                                                                |                                                                             |                                   |

### 7.4.3 Step 3: Configuring the calculations

One channel or two channels (optional) with the following functions are available for calculations:

| Setup                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Calc value 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Calc value 2</b>                                                                                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>■ Switched off</li> <li>■ Sum (AI1+AI2)</li> <li>■ Difference (AI1-AI2)</li> <li>■ Average ( (AI1+AI2)/2 )</li> <li>■ Linearization AI1</li> <li>■ Multiplication (AI1*AI2)</li> </ul>                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>■ Switched off</li> <li>■ Sum (AI1+AI2)</li> <li>■ Difference (AI1-AI2)</li> <li>■ Average ( (AI1+AI2)/2 )</li> <li>■ Linearization AI2</li> <li>■ Linearization CV1</li> <li>■ Multiplication (AI1*AI2)</li> </ul> |
| <b>TAG</b><br><b>Unit</b><br><b>Bar 0%</b><br><b>Bar 100%</b><br><b>Factor</b><br><b>Offset</b>                                                                                                                                                                                                                                                                                                                                                                                                              | To be configured like the universal input, see step 2 → 23                                                                                                                                                                                                 |
| <b>No. lin points</b> → X/Y coordinates<br>The device has two linearization tables, each with a maximum of 32 linearization points. They are permanently assigned to the 'Calc value 1' and 'Calc value 2' channels. If linearization is selected as the calculation, the number of linearization points needed is specified in the 'No. lin points' parameter. An X-coordinate and a Y-coordinate must be specified for each linearization point. The linearization tables can be deactivated individually. |                                                                                                                                                                                                                                                            |
| <b>Reset min/max</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | To be configured like the universal input, see Step 2 → 23                                                                                                                                                                                                 |

#### 7.4.4 Step 4: Configuring the analog output(s)

The device has one analog output (optionally two analog outputs). These outputs can be freely assigned to the inputs and channels available in the device.

| Setup                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Analog out 1</b><br><b>Analog out 2</b>                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Assignment:</b> assignment of the output <ul style="list-style-type: none"> <li>▪ <b>Off:</b> switched off</li> <li>▪ <b>Analog input 1:</b> universal input 1</li> <li>▪ <b>Analog input 2:</b> universal input 2</li> <li>▪ <b>Calc value 1:</b> calculated value 1</li> <li>▪ <b>Calc value 2:</b> calculated value 2</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Signal type:</b> select active signal range of the output                                                                                                                                                                                                                                                                           | The output range for the current output corresponds to NAMUR NE43, i.e. a range to 3.8 mA or 20.5 mA is used. If the value continues to increase (or continues to drop), the current remains at the limits 3.8 mA or 20.5 mA.<br>0-20 mA output: only the overrange is available. An overrange is also only available for the voltage output. The limit of the overrange is 10% here. |
| <b>Lower range</b><br><b>Upper range</b>                                                                                                                                                                                                                                                                                               | To be configured like the universal input, see step 2 → 23                                                                                                                                                                                                                                                                                                                            |

#### 7.4.5 Step 5: Configuring the relays, assigning and monitoring limit values

As an option, the device has two relays with limit values, which are either switched off, or can be assigned to the input signal or the linearized value of analog input 1 or 2 or the calculated values. The limit value is entered as a numerical value including the decimal position. Limit values are always assigned to a relay. Each relay can be assigned to a channel or a calculated value. In the "Error" mode, the relay functions as an alarm relay and switches each time a fault or alarm occurs.

The following settings can be made for each of the two limit values: assignment, function, set point, hysteresis, switching behavior<sup>1)</sup>, delay<sup>1)</sup> and failure mode<sup>1)</sup>.

| Setup                                                                                           |                                                                                                                       |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Relay 1</b><br><b>Relay 2</b>                                                                |                                                                                                                       |
| <b>Assignment:</b><br>Which value should be monitored?                                          | <b>Off,</b> Analog input 1, Analog input 2, Calc value 1, Calc value 2, Error                                         |
| <b>Function:</b><br>Operating mode of the relay (for a description, see "Operating modes" → 26) | Min, Max, Gradient, Out-band, In-band                                                                                 |
| <b>Set point:</b><br><b>Set point 2:</b><br>Limit value                                         | Enter the limit value with the position of the decimal point. Set point 2 is only displayed for out-band and in-band. |

1) Can only be set via the Expert menu, Expert/Output/Relay

|                                                                                                             |                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Time base:</b><br>Time base for calculating the gradient                                                 | Enter the time base in seconds. Only for the Gradient operating mode.                                                                                                                                             |
| <b>Hysteresis:</b><br>Hysteresis. For every set point, the switch point can be controlled via a hysteresis. | The hysteresis is configured as an absolute value (only positive values) in the unit of the particular channel (e.g. upper limit value = 100 m, hysteresis = 1 m: limit value on = 100 m, limit value off = 99 m) |



- Please note special situations where both the hysteresis and the delay time should be activated simultaneously (see the following description in the "Operating modes" section).
- Following a power failure, the limit value monitoring system behaves as if the limit value had not been active before the power failure, i.e. the hysteresis and any delay are reset.

### Relay specification

|                                            |                                                             |
|--------------------------------------------|-------------------------------------------------------------|
| Relay contact                              | Change-over contact                                         |
| Maximum contact load DC                    | 30 V / 3 A (permanent state, without destroying the input)  |
| Maximum contact load AC                    | 250 V / 3 A (permanent state, without destroying the input) |
| Minimum contact load                       | 500 mW (12 V / 10 mA)                                       |
| Galv. isolation towards all other circuits | Test voltage 1 500 V <sub>AC</sub>                          |
| Switching cycles                           | > 1 million                                                 |
| Default setting                            | Normally closed: NC contact Rx1/Rx2                         |

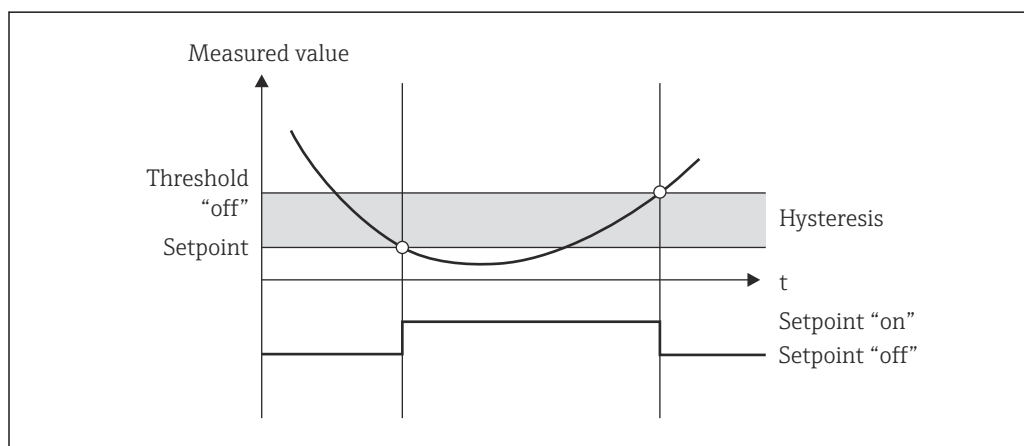
### Operating modes

#### Off

No action is triggered. The assigned output is always in the normal operating state.

#### Min (lower limit value)

The limit is active if the value drops below the configured value. The limit value is switched off if the limit value, including hysteresis, is exceeded.

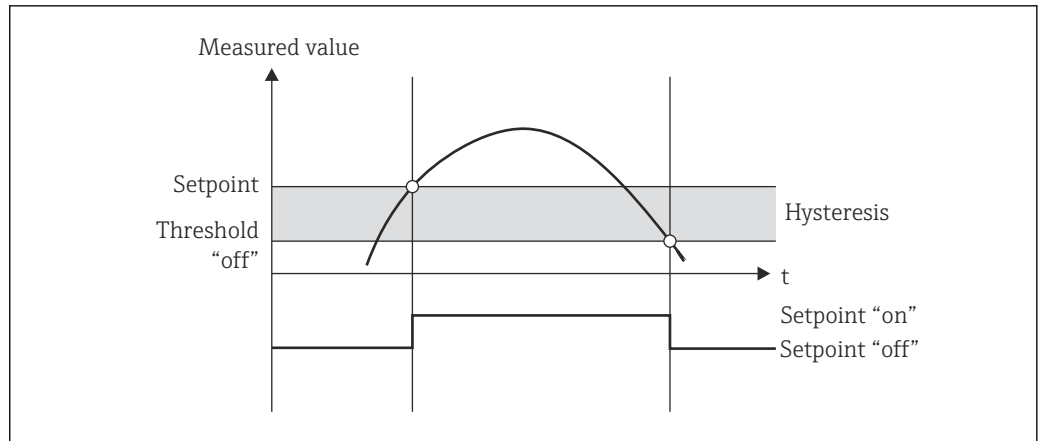


A0048460

7 Min operating mode

#### Max (upper limit value)

The limit value is active if the value exceeds the configured value. The limit value is switched off if the limit value, including hysteresis, is undershot.



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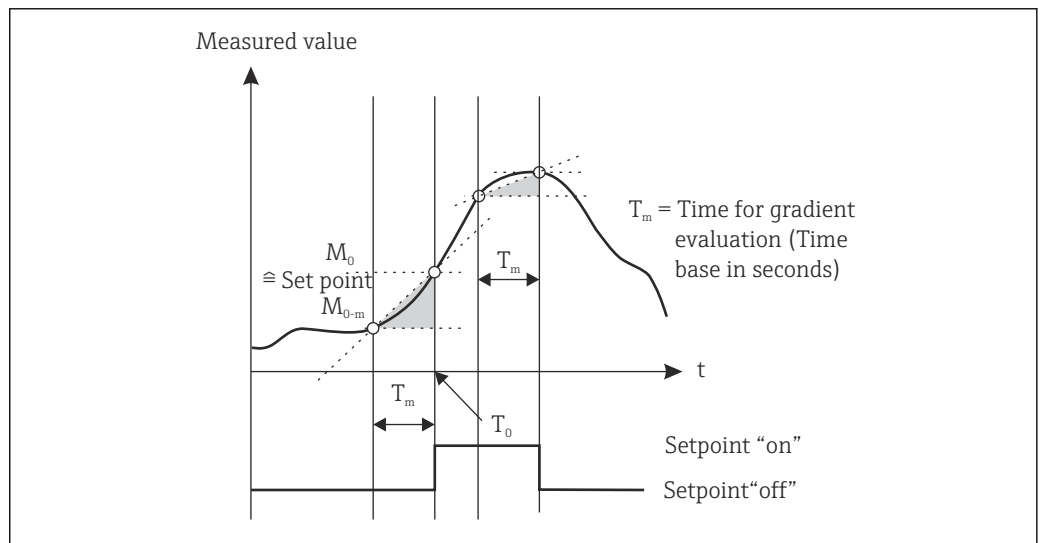
8 Max operating mode

### Gradient

The "Gradient" operating mode is used to monitor the change of the input signal over time. The alarm is triggered if the measured value reaches or exceeds the preset value. If the user configures a positive value, the limit value is monitored for increasing gradients.

In the case of negative values the decreasing gradient is monitored.

The alarm is canceled when the gradient drops below the preset value. A hysteresis is not possible in the Gradient operating mode. The alarm can be suppressed for the set time delay (unit: seconds s) in order to decrease the sensitivity.

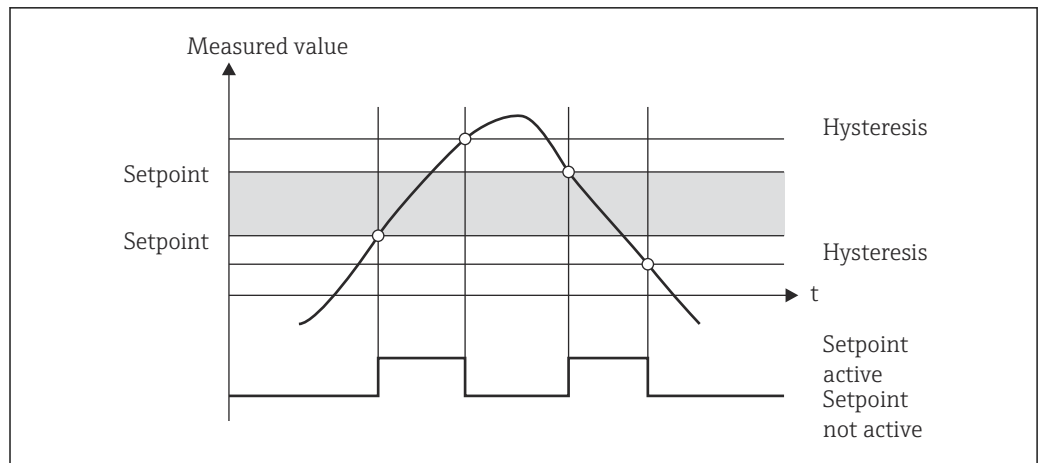


A0048462

9 Gradient operating mode

### OutBand

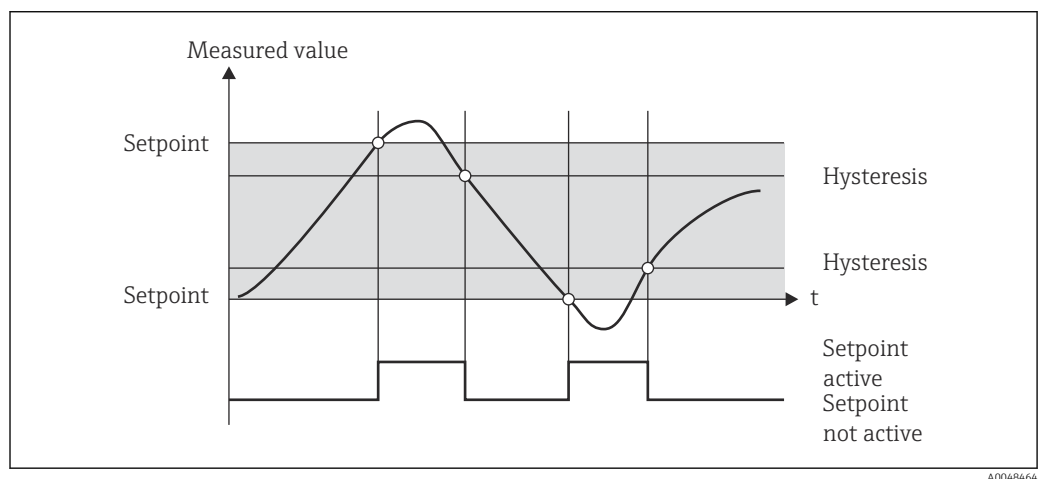
The limit value is violated as soon as the measured value to be checked lies within a preset band between minimum and maximum. The hysteresis must be monitored on the outside of the band.



10 OutBand operating mode

### InBand

The limit value is violated as soon as the measured value to be checked exceeds or drops below a preset maximum or minimum. The hysteresis must be monitored on the inside of the band.

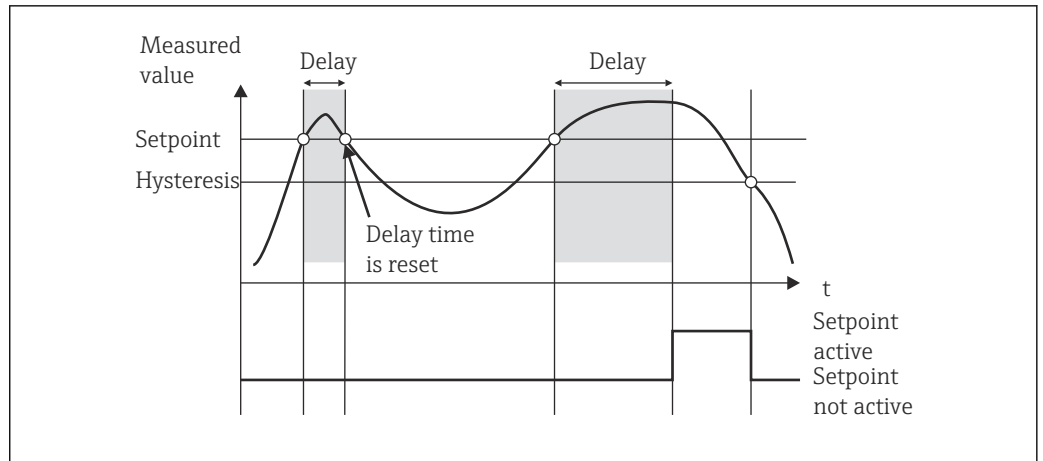


11 InBand operating mode

### Special case: Hysteresis and delay for one limit value

In the special scenario where the hysteresis and limit value delay are activated, a limit value is switched according to the following principle.

If the hysteresis and the limit value delay are activated, the delay becomes active when a limit value is exceeded and measures the time since the start of limit value overshoot. If the measured value falls below the limit value, the delay is reset. This also occurs if the measured value falls below the limit value, but continues to be higher than the set hysteresis value. When the limit value is exceeded again, the delay time becomes active again and starts measuring from 0.



12 Hysteresis and delay active

### 7.4.6 Step 6: Advanced device configuration (access protection/operating code, saving the current setup)

#### Access protection

Access protection locks all the editable parameters, i.e. the setup can only be accessed once the 4-digit user code has been entered.

Access protection is not activated at the factory. However, the configuration of the device can be protected by a four-digit code.

Activating access protection

1. Call the menu 'Setup' → 'System' → 'Access code'
2. To enter the code with the '+' and '-' keys, select the desired character and press 'E' to confirm. The cursor goes to the next position.
  - ↳ After confirming the fourth position, the entry is accepted and the user exits the 'Access code' submenu.

Once access protection has been successfully activated, the lock symbol appears on the display.

**i** If access protection is enabled, the device locks automatically after 600 seconds if the device has not been operated during this time. The display switches back to the operating display. To delete the code completely, use the '+' and '-' keys to select the "c" character and press 'E' to confirm.

#### Saving the current setup/user setup

The current device configuration can be saved and is therefore available as a specific setup for a device reset or for a device restart. If you ordered the device with customized settings, the preconfigured setup is also saved in the user setup.

Saving the setup

1. Call the menu 'Expert' → 'System' → 'Save User Setup'.
2. Confirm by selecting 'yes'.

**i** See also "Device reset" → 35.

### 7.4.7 Step 7: Configuring the display functions

The display is split into a 7-segment display section and a color section. The dot matrix section can be configured separately for each channel.

Users can choose from all the active channels (analog inputs and calculated values).

Configuration of the display

1. Press 'E'
2. Select 'Display'.
3. Select channel/calculated value and configure one of the parameters that follow.

|                                                       |                                                                            |                                                                                                     |
|-------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| off                                                   | Channel is not displayed.                                                  |                                                                                                     |
| Activate the display by configuring the color section |                                                                            |                                                                                                     |
|                                                       | Value/measured value of the channel is displayed on the 7-segment display. |                                                                                                     |
|                                                       | Unit                                                                       | The unit of the channel is displayed                                                                |
|                                                       | Bar graph                                                                  | The value of the channel is displayed as a bar graph over the entire width.                         |
|                                                       | Bargr+unit                                                                 | Division of the color section, displays value of the channel as a bar graph and unit of the channel |
|                                                       | TAG+unit                                                                   | Division of the color section, displays channel name and unit of the channel                        |

- **Contrast**: select contrast (can be configured in steps of 1 to 7)
- **Brightness**: select brightness (can be configured in steps of 1 to 7)
- **Alternating time**: select the time between automatic switchover between the channels and calculated values (in seconds: 3, 5, or 10)
- **x Back** takes you back to the menu one level up

 If several channels are active, the device switches automatically between the channels configured.

Non-activated channels, calculated values and minimum and maximum values are called up manually by pressing the '+' and '-' keys and appear for 5 seconds on the display.

### 7.4.8 Overfill protection system

The German Water Resources Act (WHG) requires the use of overfill protection units on vessels for water-polluting liquids. These units monitor the level and trigger an alarm in time before the permitted fill level is reached. According to the approval guidelines for overfill protection units (ZG-ÜS), suitable plant units must be used for this.

In accordance with these guidelines, the device can be used as a level switch for overfill protection systems with continuous level measurement for storing liquids which are hazardous to water (water-polluting liquids).

As a prerequisite the device must comply with the general and special construction principles (chapters 3 and 4) of the approval guidelines for overfill protection units. This means that the safety-oriented message "Maximum level" is displayed (the limit relay de-energizes) in the following situations:

- in the event of power supply failure and
- if limit values are exceeded or undershot and
- if the connection cables between the upstream transmitter and the level switch are disconnected.

In addition, the configured limit values for the overfill protection system must be secured against unintentional modification.



The following function must be activated if additional access protection should be provided for the configuration software:

Select **Setup / Expert** → **System** → **Overfill protect: German WHG**

#### Configuration when operating the device in accordance with the approval guidelines for overfill protection units:

The device must be set up and operated in accordance with these Operating Instructions pertaining to the device.

- Universal inputs must be configured (like in step 1 - step 3 → 21).
- Limit values must be configured as follows (like step 5 → 25):

**Function:** MAX

**Assignment:** which input signal should be monitored?

**Set point:** maximum limit value to be monitored; value for the switching threshold

**Hysteresis:** no hysteresis (=0)

**Time delay**<sup>1)</sup>: no switching delay (=0) or the set time must be taken into account for the tail quantity

- The device must be locked for unauthorized persons;

**User Code** protects the configured parameters (like Step 6 → 29):

Enter the 4-digit code: select digit with '+' or '-' and press 'E' to confirm the individual digit; once the digit has been confirmed, the cursor moves to the next position, or skips back to the 'System' menu item once the fourth digit has been entered

The lock symbol appears on the display.

- Select **Setup** → **System** → **Overfill protect: German WHG**.

It is absolutely essential to assign the device to a WHG application. Confirming the 'Overfill protect: German WHG' parameter provides additional safety. The device status must be changed if the device is being configured using the FieldCare operating software, i.e. WHG must be disabled to be able to change parameters.

1) Can only be configured in the "Expert" menu

## 7.4.9 Expert menu

Activate the Expert mode by pressing **E** → **Expert**.

The Expert menu offers advanced device settings to adapt the device optimally to the application conditions.

Access to the Expert menu requires an access code. The factory default code is "0000". If a new access code is defined by the user, it replaces the access code assigned at the factory.

The Expert menu is enabled as soon as the correct access code has been entered.

The configuration options which the Expert mode also offers in addition to the normal setup parameters are described in the following section.

### Input → Analog input 1/2

*Bar 0%, Bar 100%*

Change the scaling of the bar graph; default value: channel scaling

*Decimal places*

Specify the desired number of decimal places; default value: 2 decimal places

*Damping*

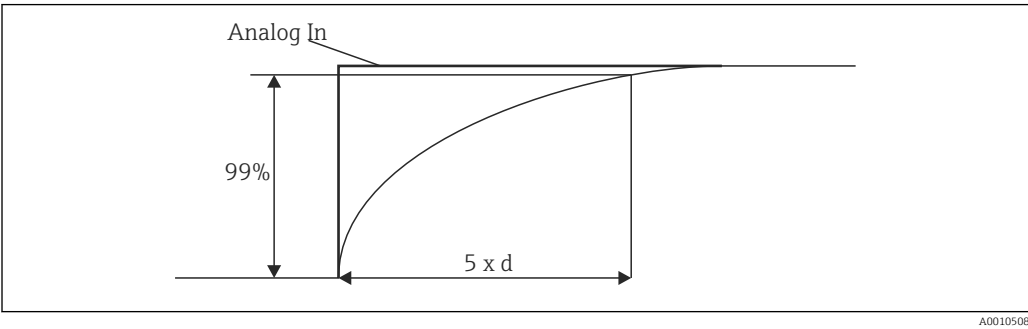
The input signal can be dampened by a low-pass filter.

The damping is specified in seconds (can be configured in steps of 0.1 s , max. 999.9 s).

Default values

| Input type                 | Default value |
|----------------------------|---------------|
| Current and voltage inputs | 0.0 s         |
| Temperature inputs         | 1.0 s         |

Once 5 times the filter time has elapsed, 99% of the actual measured value is reached.



13 Signal damping  
Analog In: Analog input signal  
d: Set damping

Failure mode

If an error is detected at one of the two inputs, the internal status of the input is set to error. The behavior of the measured value in the event of an error can be defined here.

- Invalid = invalid value:  
The value is not calculated further as it is passed on as an invalid value.
- Fixed value = constant value:  
A constant value can be entered. This value is used if the device should perform further calculations. The input continues to be in the "error" state.

NAMUR NE43

Only for 4 to 20 mA. The measured value and the cables are monitored in accordance with NAMUR NE43 recommendations. See → 34. Default value: enabled

Open circ detect

Only for 1 to 5 V. Input monitored for cable open circuit.

Failure delay

Delay time for failures, 0 to 99 s

Allow reset

If this function is activated, the min. and/or max. values can be reset outside the setup in the Display menu. Active access protection does not apply when this memory is reset.

Output → Analog output 1/2

Failure mode

- Min = stored minimum value:  
The stored minimum value is output.
- Max = stored maximum value:  
The stored maximum value is output.
- Fixed value = constant value:  
It is possible to enter a constant value that is output in the event of an error.

**Output → Relay 1/2***Time delay*

Sets the time delay for switching the relay

*Operating mode*

Operating mode of the relay.

- norm opened
- norm closed

*Failure mode*

- norm opened
- norm closed

**NOTICE****Setting the limit relay failure mode**

- ▶ The failure mode of the limit relay is configured in the setup. If an error occurs at an input to which a limit value is assigned, the limit relay adopts the configured status. The effect of the limit relay in the event of an error (energizes or de-energizes) must be specified in the setup. If a failure mode with a fixed error substitute value is configured in the assigned input, the corresponding relay does not react to the error at the input. Instead it checks the substitute value for limit value violation and switches depending on the limit value violation. The default value for the relay is "energized".

**Application → Calc value 1/2***Failure mode*

- Invalid:  
The calculated value is not valid and is not output.
- Fixed value:  
It is possible to enter a constant value that is output in the event of an error.

**Diagnostics***Verify HW set*

Following a hardware upgrade (e.g. additional relays, universal inputs etc.), it is necessary to perform hardware verification, i.e. the hardware is checked by the firmware in the device.

The "Verify HW set" function must be enabled in this case.

*Simulation*

The output value of the analog outputs and the switching state of the relays can be specified in the simulation mode. Simulation remains active until it is set to "off". The start and end of the simulation are saved in the diagnostic events.

Expert → Diagnostics → Simulation:

- Select the output to be simulated with the simulation value
- Select the relay to be simulated with the status

## 7.5 In operation

### 7.5.1 + and - quick pick keys

You can use the '+' and '-' quick pick keys to switch through all the active channels (universal inputs and calculated values) in the display mode. The measured value or the calculated value is then displayed for 5 seconds. The channel name pertaining to the value

displayed appears in the color section of the display. The maximum and minimum value are provided for each active channel.

Press the '+' and '-' simultaneously to exit a menu at any time. Any changes made are not saved.

### 7.5.2 Min/Max memory

The device records the highest and lowest values of the inputs and calculated values and saves them cyclically every 15 minutes in the nonvolatile memory.

#### Display:

Select the corresponding channel using the '+' and '-' quick pick keys.

#### Reset the min. and max. values:

Reset in the setup: select the channel (Analog in 1/2, Calc value 1/2), 'Reset min/max', min./max. values of the corresponding channel are reset.

 A reset outside the setup (resetting without a user code) is only possible if this has been enabled for the channel in the setup (Allow reset →  23). Press 'E' and select 'Display'. All the channels for which resetting outside the setup is permitted are displayed in succession. Select the corresponding channel and set to 'Yes'. The channel is reset.

### 7.5.3 Device self-diagnosis, failure mode and cable open circuit detection/measuring range limits

The device monitors its inputs for a cable open circuit, as well as its own internal functions, by comprehensive monitoring mechanisms in the device software (e.g. cyclic memory test).

If the device self-diagnosis function detects an error, the device reacts as follows:

- Open collector output switches
- Red LED is lit
- Relay switches (if active and assigned as a fault/alarm relay)
- Display goes to error mode → color of channel affected changes to red and an error is displayed
- Display switches automatically between the active channels and the error

Troubleshooting instructions and a list of all the error messages can be found in the 'Troubleshooting' section →  36.

#### Measuring range limits

| Display                    |                                                      |                      |                                        |                      |                       |                        |                                                                        |
|----------------------------|------------------------------------------------------|----------------------|----------------------------------------|----------------------|-----------------------|------------------------|------------------------------------------------------------------------|
| Display                    | -----                                                | -----                | Measured value                         | -----                | -----                 | -----                  | Points to note                                                         |
| Status                     | F                                                    | F                    | Displayed and processed measured value | F                    | F                     | F                      |                                                                        |
| Range                      |                                                      | Under range          |                                        | Over range           |                       | Invalid measured value |                                                                        |
| 0 to 20 mA                 |                                                      |                      | 0 to 22 mA                             | > 22 mA              |                       | Not calibrated         | Negative currents are not displayed or calculated (value remains at 0) |
| 4 to 20 mA (without NAMUR) |                                                      | ≤ 2 mA               | > 2 mA < 22 mA                         | ≥ 22 mA              |                       | Not calibrated         |                                                                        |
| 4 to 20 mA (as per NAMUR)  | ≤ 2 mA <sup>1)</sup><br>2 < x ≤ 3.6 mA <sup>2)</sup> | > 3.6 mA to ≤ 3.8 mA | > 3.8 mA to < 20.5 mA                  | ≥ 20.5 mA to < 21 mA | ≥ 21 mA <sup>2)</sup> | Not calibrated         | As per NAMUR 43                                                        |
| +/- voltage ranges         |                                                      | < -110%              | -110% to 110%                          | > 110%               |                       | Not calibrated         |                                                                        |

| Display                                                                        |                                                                      |                           |                                                                |                                                                      |                                              |                                         |                                                                        |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------|----------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------|-----------------------------------------|------------------------------------------------------------------------|
| Display<br>Status<br>Range                                                     | -----<br>F                                                           | -----<br>F<br>Under range | Measured value<br>Displayed and<br>processed<br>measured value | -----<br>F<br>Over range                                             | -----<br>F                                   | -----<br>F<br>Invalid<br>measured value | Points to note                                                         |
| Voltage ranges<br>from 0 V                                                     |                                                                      | < -10%                    | -10% to 110%                                                   | > 110%                                                               |                                              | Not calibrated                          |                                                                        |
|                                                                                | No further calculation/further<br>calculation with fixed error value |                           | Further<br>calculation in<br>math and as<br>min./max.          |                                                                      |                                              |                                         |                                                                        |
| Voltage range<br>1 to 5 V with<br>activated cable<br>open circuit<br>detection | ≤ 0.8 V                                                              |                           | 1 to 5 V                                                       |                                                                      | ≥ 5.2 V                                      | Not calibrated                          |                                                                        |
| Thermocouples                                                                  | Below the lower<br>range limit <sup>2)</sup>                         |                           | 0 to 100%                                                      |                                                                      | Above the upper<br>range limit <sup>2)</sup> |                                         | Cable open<br>circuit detection<br>from approx.<br>50 kΩ <sup>1)</sup> |
| Resistance                                                                     | Below the lower<br>range limit <sup>1)</sup>                         |                           | 0 to 100%                                                      |                                                                      | Above the upper<br>range limit <sup>1)</sup> |                                         |                                                                        |
|                                                                                | No further calculation/further<br>calculation with fixed error value |                           | Further<br>calculation in<br>math and as<br>min./max.          | No further calculation/further calculation with fixed<br>error value |                                              |                                         |                                                                        |

1) Cable open circuit

2) Error at sensor

### 7.5.4 Saving diagnostic events/alarms and errors

Diagnostic events such as alarms and fault conditions are saved in the device as soon as a new error occurs or the status of the device changes. The events saved are written to the nonvolatile device memory every 30 minutes.

The device lists the following values in the 'Diagnostics' menu:

- Current device diagnostics
- Last device diagnostics
- Last 5 diagnostic messages

List of error codes, see Troubleshooting → 36.



It is possible that events saved over the past 30 minutes might be lost.

### 7.5.5 Operating hours counter

The device has an internal operating hours counter which also acts as the reference for diagnostic events.

The operating hours are indicated in the 'Diagnostics' → 'Operating time' menu item. This information cannot be reset or changed.

### 7.5.6 Device reset

Various reset levels are available for a device reset.

**'Expert' → 'System' → 'Reset' → 'Factory reset':** reset all the parameters to the as-delivered state; all the configured parameters are overwritten.

 If a user code has been defined, it is overwritten!!! When operation is locked by a user code, this is indicated by a lock symbol on the display.

**'Expert' → 'System' → 'Reset' → 'User reset':** parameters are loaded and configured in accordance with the user setup that is saved; the current configuration and factory settings are overwritten by the user setup.

 If a user code has been defined, it is overwritten by the user code defined in the user setup! If no user code was saved in the user setup, the device is no longer locked. When operation is locked by a user code, this is indicated by a lock symbol on the display.

## 8 Diagnostics and troubleshooting

### NOTICE

#### Device malfunction possible when retrofitting with untested hardware

- ▶ When retrofitting the device with additional hardware (relay, additional universal input and additional analog output), the device software must perform an internal hardware test). To do so, call up the "Verify HW set" function in the Expert→Diagnostics menu.

### 8.1 General troubleshooting

#### WARNING

#### Danger! Electric voltage

- ▶ Do not operate the device in an open condition for device troubleshooting.

 Error codes that appear on the display are described in the next section →  36. Further information on the failure mode is also provided in the "Commissioning" section →  34.

### 8.2 Overview of diagnostic information

 Faults have the highest priority. The corresponding error code is displayed.

### 8.3 Diagnostic list

*The errors are defined as:*

| Error code | Meaning                         | Remedial action                         |
|------------|---------------------------------|-----------------------------------------|
| F041       | Sensor/cable open circuit       | Check wiring                            |
| F045       | Sensor error                    | Check sensor                            |
| F101       | Below range                     | Check measurement, limit value violated |
| F102       | Above range                     |                                         |
| F221       | Error: Reference junction       | Contact your service organization       |
| F261       | Error: Flash                    | Contact your service organization       |
| F261       | Error: RAM                      | Contact your service organization       |
| F261       | Error: EEPROM                   | Contact your service organization       |
| F261       | Error: A/D converter, channel 1 | Contact your service organization       |

| Error code | Meaning                                     | Remedial action                                            |
|------------|---------------------------------------------|------------------------------------------------------------|
| F261       | Error: A/D converter, channel 2             | Contact your service organization                          |
| F261       | Error: invalid device ID                    | Contact your service organization                          |
| F281       | Initialization phase                        | Contact your service organization                          |
| F282       | Error: parameter data could not be saved    | Contact your service organization                          |
| F283       | Error: incorrect parameter data             | Contact your service organization                          |
| F431       | Error: incorrect calibration values         | Contact your service organization                          |
| C411       | Info: upload/download active                | For information purposes only. Device is working properly. |
| C432       | Info: calibration/test mode                 | For information purposes only. Device is working properly. |
| C482       | Info: simulation mode, relay/open collector | For information purposes only. Device is working properly. |
| C483       | Info: simulation mode, analog output        | For information purposes only. Device is working properly. |
| C561       | Display overrun                             | For information purposes only. Device is working properly. |

## 8.4 Firmware history

### Release

The firmware version on the nameplate and in the Operating Instructions indicates the device release: XX.YY.ZZ (example 1.02.01).

|    |                                                                                                |
|----|------------------------------------------------------------------------------------------------|
| XX | Change to main version.<br>No longer compatible. The device and Operating Instructions change. |
| YY | Change to functions and operation.<br>Compatible. The Operating Instructions change.           |
| ZZ | Bug fixes and internal changes.<br>No changes to the Operating Instructions.                   |

| Date    | Firmware version | Software changes                              | Documentation     |
|---------|------------------|-----------------------------------------------|-------------------|
| 04.2009 | V01.01.zz        | Original software                             | BA00287R/09/09.09 |
| 11.2009 | V01.01.zz        | No change to functions and operation          | BA00287R/09/11.09 |
| 06.2011 | V01.02.zz        | Multiplication of two channels                | BA00287R/09/01.11 |
| 01.2014 | V01.03.zz        | Delay of failure in the event of NAMUR errors | BA00287R/09/03.13 |
| 11.2015 | V01.03.zz        | No change to functions and operation          | BA00287R/09/04.15 |
| 03.2016 | V01.03.zz        | No change to functions and operation          | BA00287R/09/05.16 |
| 06.2022 | V01.03.zz        | No change to functions and operation          | BA00287R/09/07.22 |
| 01.2025 | V01.03.zz        | No change to functions and operation          | BA00287R/09/08.25 |

## 9 Maintenance and cleaning

No special maintenance work is required for the device.

### 9.1 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

 The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

## 10 Repair

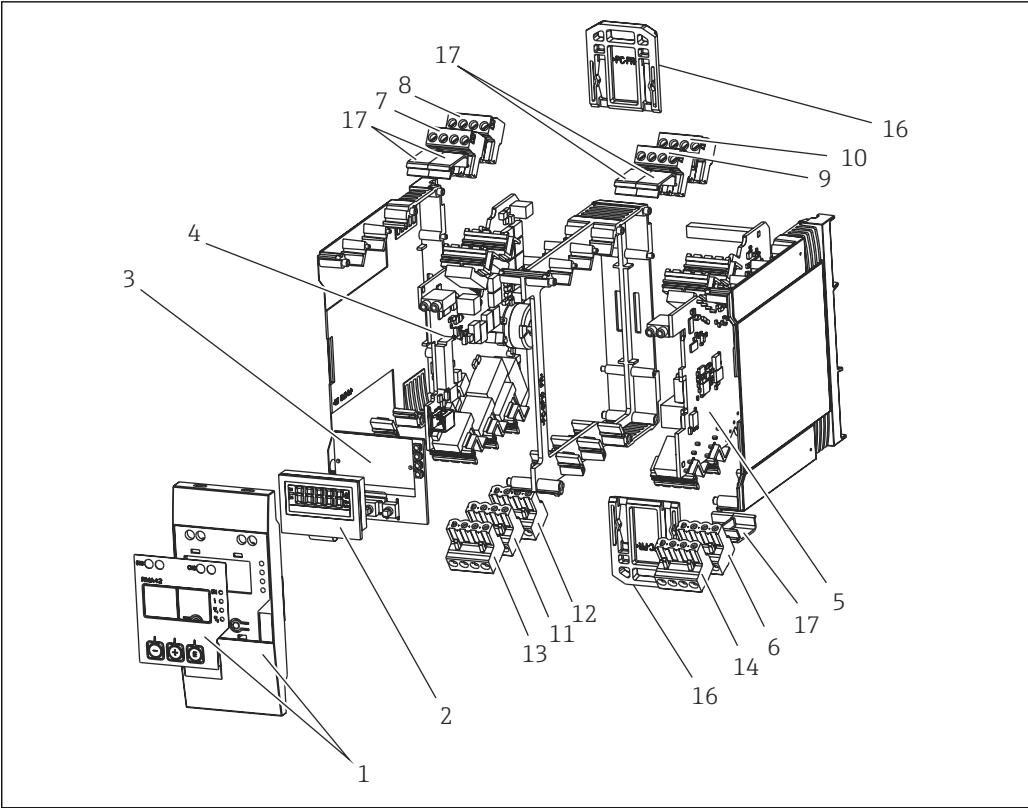
### 10.1 General information

 Repairs that are not described in these Operating Instructions must only be carried out directly by the manufacturer or by the service department.

When ordering spare parts, specify the serial number of the device. Where necessary, installation instructions are supplied with the spare part.

### 10.2 Spare parts

Device spare parts that are currently available can be found online at:  
<https://www.endress.com/en/instrumentation-services>.



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14 Spare parts

| Item No. | Name                                                      |
|----------|-----------------------------------------------------------|
| 1        | Front incl. foil                                          |
| 2        | Display                                                   |
| 3        | CPU board (without display)                               |
| 4        | Mainboard 1-channel without relay, non-Ex                 |
|          | Mainboard 1-channel without relay, Ex                     |
|          | Mainboard 1-channel with relay, non-Ex                    |
|          | Mainboard 1-channel with relay, Ex                        |
| 5        | Powerboard without channel 2, non-Ex 24-230 V (-20% +10%) |
|          | Powerboard without channel 2, Ex 24-230 V (-20% +10%)     |
|          | Powerboard with channel 2, non-Ex 24-230 V (-20% +10%)    |
|          | Powerboard with channel 2, Ex 24-230 V (-20% +10%)        |
| 6        | 4-pin terminals for supply voltage "N/- \ L/+"            |
| 7        | Terminals, input 1 Ex, "11 12 13 14" blue                 |
|          | Terminals, input 1 non-Ex, "11 12 13 14" gray             |
| 8        | Terminals, input 1 Ex, "15 16 17 18" blue                 |
|          | Terminals, input 1 non-Ex, "15 16 17 18" gray             |
| 9        | Terminals, input 2 Ex, " 21 22 23 24" blue                |
|          | Terminals, input 2 non-Ex, " 21 22 23 24" gray            |
| 10       | Terminals, input 2 Ex, "25 26 27 28" blue                 |
|          | Terminals, input 2 non-Ex, "25 26 27 28" gray             |
| 11       | Terminals, relay output 1 (R13, R11, R12)                 |

| Item No. | Name                                                           |
|----------|----------------------------------------------------------------|
| 12       | Terminals, relay output 2 (R23, R21, R22)                      |
| 13       | Terminals, analog output 1 and status output (O16 O15 D12 D11) |
| 14       | Terminals, analog output 2 (O25, O26)                          |
| 16       | Fix slide (2 pcs)                                              |
| 17       | Terminal cover set (5 pcs)                                     |

## 10.3 Return

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:  
<https://www.endress.com/support/return-material>  
↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging offers the best protection.

## 10.4 Disposal

### 10.4.1 IT security

Observe the following instructions before disposal:

1. Delete the data
2. Reset the device

### 10.4.2 Removing the measuring instrument

1. Switch off the device
2. Carry out the mounting and connection steps from the "Installing the measuring instrument" and "Connecting the measuring instrument" sections in reverse order. Observe the safety instructions.

### 10.4.3 Disposing of the measuring instrument



If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

## 11 Accessories

The accessories currently available for the product can be selected at [www.endress.com](https://www.endress.com):

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

## 11.1 Communication-specific accessories

### Commubox FXA291

Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.

For more information, please refer to: [www.endress.com](http://www.endress.com)

### Configuration kit TXU10

Configuration kit for PC-programmable transmitter - FDT/DTM-based plant asset management tool, FieldCare/DeviceCare, and interface cable (4-pin connector) for PC with USB port.

For more information, please refer to: [www.endress.com](http://www.endress.com)

## 11.2 Online tools

Product information over the entire life cycle of the device: [www.endress.com/onlinetools](http://www.endress.com/onlinetools)

# 12 Technical data

## 12.1 Input

### 12.1.1 Measured variable

Current, voltage, resistance, resistance thermometer, thermocouples

### 12.1.2 Measuring range

Current:

- 0/4 to 20 mA +10% overrange
- Short-circuit current: max. 150 mA
- Load: 10  $\Omega$

Voltage:

- 0 to 10 V, 2 to 10 V, 0 to 5 V, 0 to 1 V, 1 to 5 V,  $\pm 1$  V,  $\pm 10$  V,  $\pm 30$  V,  $\pm 100$  mV
- Max. permitted input voltage:
  - Voltage  $\geq 1$  V:  $\pm 35$  V
  - Voltage  $< 1$  V:  $\pm 12$  V
- Input impedance:  $> 1\,000\text{ k}\Omega$

Resistance:

30 to 3 000  $\Omega$

RTD assembly:

- Pt100 as per IEC60751, GOST, JIS1604
- Pt500 and Pt1000 as per IEC60751
- Cu100, Cu50, Pt50, Pt46, Cu53 as per GOST
- Ni100, Ni1000 as per DIN 43760

Thermocouple types:

- Type J, K, T, N, B, S, R as per IEC60584
- Type U as per DIN 43710
- Type L as per DIN 43710, GOST
- Type C, D as per ASTM E998

12.1.3    **Number of inputs**

One or two universal inputs

12.1.4    **Measuring cycle**

200 ms

12.1.5    **Galvanic isolation**

Towards all other circuits

12.2      **Output**

12.2.1    **Output signal**

One or two analog outputs, galvanically isolated

**Current/voltage output**

Current output:

- 0/4 to 20 mA
- Overrange up to 22 mA

Voltage:

- 0 to 10 V, 2 to 10 V, 0 to 5 V, 1 to 5 V
- Overrange: up to 11 V, short-circuit proof,  $I_{\max} < 25 \text{ mA}$

**HART®**

HART® signals are not affected

12.2.2    **Loop power supply**

- Open-circuit voltage: 24 V<sub>DC</sub> (+15% /-5%)
- Hazardous area version: > 14 V at 22 mA
- Non-hazardous area version without SIL: > 16 V at 22 mA
- Non-hazardous area version with SIL: > 14 V at 22 mA
- Maximum 30 mA short-circuit-proof and overload-resistant
- Galvanically isolated from system and outputs

12.2.3    **Switching output**

Open collector for monitoring the device state as well as open circuit and alarm notification. The OC output is closed in the fault-free operating state. In error state, the OC output is opened.

- $I_{\max} = 200 \text{ mA}$
- $U_{\max} = 28 \text{ V}$
- $U_{\text{on}/\max} = 2 \text{ V}$  at 200 mA

Galvanic isolation to all circuits, test voltage 500 V

12.2.4    **Relay output**

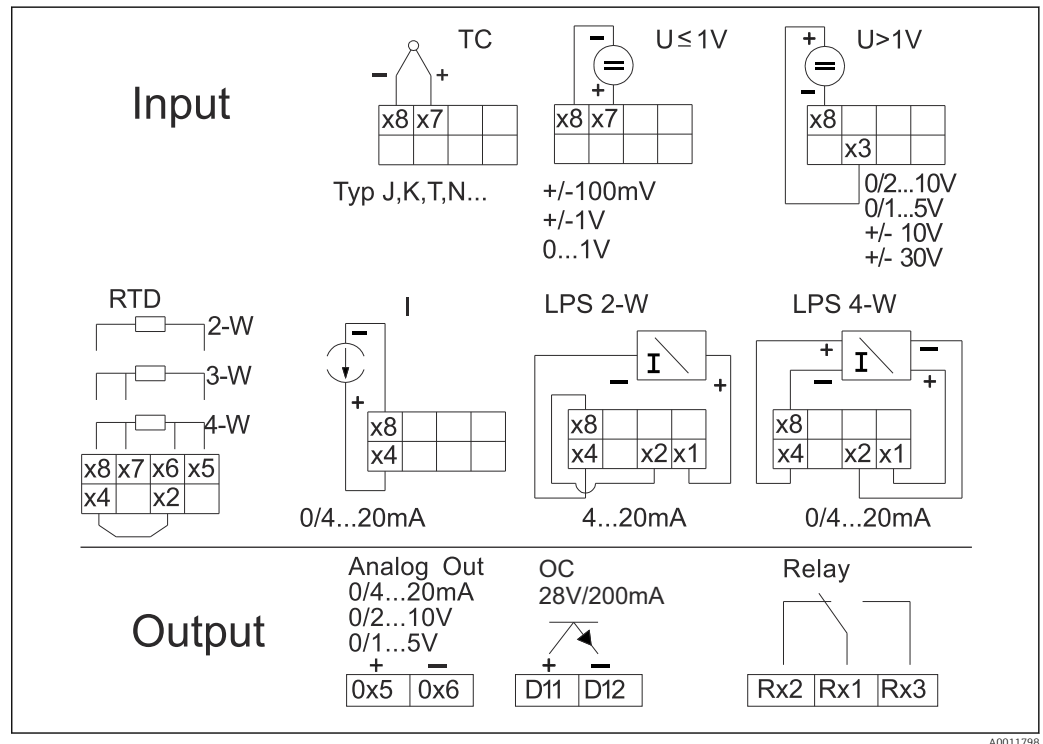
Relay output for limit monitoring

|                         |                                                                |
|-------------------------|----------------------------------------------------------------|
| Relay contact           | Change-over contact                                            |
| Maximum contact load DC | 30 V / 3 A (permanent state, without destruction of the input) |

|                                            |                                                                 |
|--------------------------------------------|-----------------------------------------------------------------|
| Maximum contact load AC                    | 250 V / 3 A (permanent state, without destruction of the input) |
| Minimum contact load                       | 500 mW (12 V/10 mA)                                             |
| Galv. isolation towards all other circuits | Test voltage 1500 V <sub>AC</sub>                               |
| Switching cycles                           | > 1 million                                                     |

## 12.3 Power supply

### 12.3.1 Terminal assignment



15 Terminal assignment of the process transmitter (relay (terminals Rx1-Rx3) and channel 2 (terminals 21-28 and 025/026) optional). Note: Illustrated contact position of the relays if the power supply fails.

### 12.3.2 Supply voltage

Wide range power supply 24 to 230 V AC/DC (-20 % / +10 %) 50/60 Hz

### 12.3.3 Power consumption

Max. 21.5 VA / 6.9 W

### 12.3.4 Interface connection data

#### Commubox FXA291 PC USB interface

- Connection: 4-pin socket
- Transmission protocol: FieldCare
- Transmission rate: 38,400 baud

**Interface cable TXU10-AC PC USB interface**

- Connection: 4-pin socket
- Transmission protocol: FieldCare
- Order configuration: interface cable with FieldCare Device Setup DVD incl. all Comm DTMs and Device DTMs

**12.4 Performance characteristics****12.4.1 Reference operating conditions**

Power supply: 230 V<sub>AC</sub>, 50/60 Hz

Ambient temperature: 25 °C (77 °F) ± 5 °C (9 °F)

Humidity: 20 %...60 % rel. humidity

**12.4.2 Maximum measured error****Universal input:**

| Accuracy | Input:                 | Range:                                                                                                                                                                                                                                                                                                                                                               | Maximum measured error of measuring range (oMR):                                                                             |
|----------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
|          | Current                | 0 to 20 mA, 0 to 5 mA, 4 to 20 mA; Overrange: up to 22 mA                                                                                                                                                                                                                                                                                                            | ±0.05%                                                                                                                       |
|          | Voltage ≥ 1 V          | 0 to 10 V, 2 to 10 V, 0 to 5 V, 1 to 5 V, 0 to 1 V, ±1 V, ±10 V, ±30 V                                                                                                                                                                                                                                                                                               | ±0.1%                                                                                                                        |
|          | Voltage < 1 V          | ±100 mV                                                                                                                                                                                                                                                                                                                                                              | ±0.05%                                                                                                                       |
|          | Resistance measurement | 30 to 3 000 Ω                                                                                                                                                                                                                                                                                                                                                        | 4-wire: ± (0.10% oMR + 0.8 Ω)<br>3-wire: ± (0.10% oMR + 1.6 Ω)<br>2-wire: ± (0.10% oMR + 3 Ω)                                |
|          | RTD                    | Pt100, -200 to 850 °C (-328 to 1 562 °F) (IEC60751, α=0.00385)<br>Pt100, -200 to 850 °C (-328 to 1 562 °F) (JIS1604, w=1.391)<br>Pt100, -200 to 649 °C (-328 to 1 200 °F) (GOST, α=0.003916)<br>Pt500, -200 to 850 °C (-328 to 1 562 °F) (IEC60751, α=0.00385)<br>Pt1000, -200 to 600 °C (-328 to 1 112 °F) (IEC60751, α=0.00385)                                    | 4-wire: ± (0.10% oMR + 0.3 K (0.54 °F))<br>3-wire: ± (0.10% oMR + 0.8 K (1.44 °F))<br>2-wire: ± (0.10% oMR + 1.5 K (2.7 °F)) |
|          |                        | Cu100, -200 to 200 °C (-328 to 392 °F) (GOST, w=1.428)<br>Cu50, -200 to 200 °C (-328 to 392 °F) (GOST, w=1.428)<br>Pt50, -200 to 1 100 °C (-328 to 2 012 °F) (GOST, w=1.391)<br>Pt46, -200 to 850 °C (-328 to 1 562 °F) (GOST, w=1.391)<br>Ni100, -60 to 250 °C (-76 to 482 °F) (DIN43760, α=0.00617)<br>Ni1000, -60 to 250 °C (-76 to 482 °F) (DIN43760, α=0.00617) | 4-wire: ± (0.10% oMR + 0.3 K (0.54 °F))<br>3-wire: ± (0.10% oMR + 0.8 K (1.44 °F))<br>2-wire: ± (0.10% oMR + 1.5 K (2.7 °F)) |
|          |                        | Cu53, -50 to 200 °C (-58 to 392 °F) (GOST, w=1.426)                                                                                                                                                                                                                                                                                                                  | 4-wire: ± (0.10% oMR + 0.3 K (0.54 °F))<br>3-wire: ± (0.10% oMR + 0.8 K (1.44 °F))<br>2-wire: ± (0.10% oMR + 1.5 K (2.7 °F)) |
|          | Thermocouples          | Typ J (Fe-CuNi), -210 to 1 200 °C (-346 to 2 192 °F) (IEC60584)                                                                                                                                                                                                                                                                                                      | ± (0.10% oMR + 0.5 K (0.9 °F))<br>from -100 °C (-148 °F)                                                                     |
|          |                        | Typ K (NiCr-Ni), -200 to 1 372 °C (-328 to 2 502 °F) (IEC60584)                                                                                                                                                                                                                                                                                                      | ± (0.10% oMR + 0.5 K (0.9 °F))<br>from -130 °C (-202 °F)                                                                     |

| Accuracy                | Input: | Range:                                                                                                            | Maximum measured error of measuring range (oMR):                                                                            |
|-------------------------|--------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|                         |        | Typ T (Cu-CuNi), -270 to 400 °C (-454 to 752 °F) (IEC60584)                                                       | ± (0.10% oMR +0.5 K (0.9 °F))<br>from -200 °C (-328 °F)                                                                     |
|                         |        | Typ N (NiCrSi-NiSi),<br>-270 to 1 300 °C (-454 to 2 372 °F) (IEC60584)                                            | ± (0.10% oMR +0.5 K (0.9 °F))<br>from -100 °C (-148 °F)                                                                     |
|                         |        | Typ L (Fe-CuNi),<br>-200 to 900 °C (-328 to 1 652 °F) (DIN43710, GOST)                                            | ± (0.10% oMR +0.5 K (0.9 °F))<br>from -100 °C (-148 °F)                                                                     |
|                         |        | Typ D (W3Re/W25Re),<br>0 to 2 495 °C (32 to 4 523 °F)(ASTME998)                                                   | ± (0.15% oMR +1.5 K (2.7 °F))<br>from 500 °C (932 °F)                                                                       |
|                         |        | Typ C (W5Re/W26Re),<br>0 to 2 320 °C (32 to 4 208 °F) (ASTME998)                                                  | ± (0.15% oMR +1.5 K (2.7 °F))<br>from 500 °C (932 °F)                                                                       |
|                         |        | Typ B (Pt30Rh-Pt6Rh),<br>0 to 1 820 °C (32 to 3 308 °F) (IEC60584)                                                | ± (0.15% oMR +1.5 K (2.7 °F))<br>from 600 °C (1 112 °F)                                                                     |
|                         |        | Typ S (Pt10Rh-Pt),<br>-50 to 1 768 °C (-58 to 3 214 °F) (IEC60584)                                                | ± (0.15% oMR +3.5 K (6.3 °F))<br>for -50 to 100 °C (-58 to 212 °F)<br>± (0.15% oMR +1.5 K (2.7 °F))<br>from 100 °C (212 °F) |
|                         |        | Typ U (Cu-CuNi),<br>-200 to 600 °C (-328 to 1 112 °F) (DIN 43710)                                                 | ± (0.15% oMR +1.5 K (2.7 °F))<br>from 100 °C (212 °F)                                                                       |
| AD converter resolution |        | 16 bit                                                                                                            |                                                                                                                             |
| Temperature drift       |        | Temperature drift: ≤ 0.01%/K (0.1%/18 °F) oMR<br>≤ 0.02%/ K (0.2%/18 °F) oMR for Cu100, Cu50, Cu53, Pt50 and Pt46 |                                                                                                                             |

### Analog output:

|                    |                                                                                                             |                                                        |
|--------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Current            | 0/4 to 20 mA, overrange up to 22 mA                                                                         | ±0.05% of measuring range                              |
|                    | Max. load                                                                                                   | 500 Ω                                                  |
|                    | Max. inductivity                                                                                            | 10 mH                                                  |
|                    | Max. capacity                                                                                               | 10 µF                                                  |
|                    | Max. ripple                                                                                                 | 10 mVpp at 500 Ω, frequency < 50 kHz                   |
| Voltage            | 0 to 10 V, 2 to 10 V<br>0 to 5 V, 1 to 5 V<br>Overrange: up to 11 V, shortcircuit proof, $I_{\max} < 25$ mA | ±0.05% of measuring range<br>±0.1 % of measuring range |
|                    | Max. ripple                                                                                                 | 10 mVpp at 1000 Ω, frequency < 50 kHz                  |
| Resolution         | 13 bit                                                                                                      |                                                        |
| Temperature drift  | ≤ 0.01%/K (0.1%/18 °F) of measuring range                                                                   |                                                        |
| Galvanic isolation | Testing voltage of 500 V towards all other circuits                                                         |                                                        |

## 12.5 Installation

### 12.5.1 Mounting location

Mounting on top-hat rail as per IEC 60715.

### 12.5.2 Orientation

Vertical or horizontal.

**NOTICE**

**Heat accumulation when installing several devices on a vertically mounted top-hat rail**

- Keep sufficient gaps between the individual devices.

## 12.6 Environment

### 12.6.1 Ambient temperature range

**NOTICE**

**The life-time of the display is shortened when operated in the upper temperature range.**

- To avoid heat accumulation, always make sure the device is sufficiently cooled.

Non-Ex/Ex devices: -20 to 60 °C (-4 to 140 °F)

UL devices: -20 to 50 °C (-4 to 122 °F)

### 12.6.2 Storage temperature

-40 to 85 °C (-40 to 185 °F)

### 12.6.3 Altitude

< 2 000 m (6 560 ft) above MSL

### 12.6.4 Climate class

As per IEC 60654-1, Class B2

### 12.6.5 Degree of protection

DIN rail housing IP 20

### 12.6.6 Electrical safety

Protection class II, overvoltage category II, pollution degree 2

### 12.6.7 Condensation

Not permitted

### 12.6.8 Electromagnetic compatibility (EMC)

#### CE compliance

Electromagnetic compatibility in accordance with all the relevant requirements of the IEC/EN 61326 series and NAMUR Recommendation EMC (NE21). For details refer to the EU Declaration of Conformity.

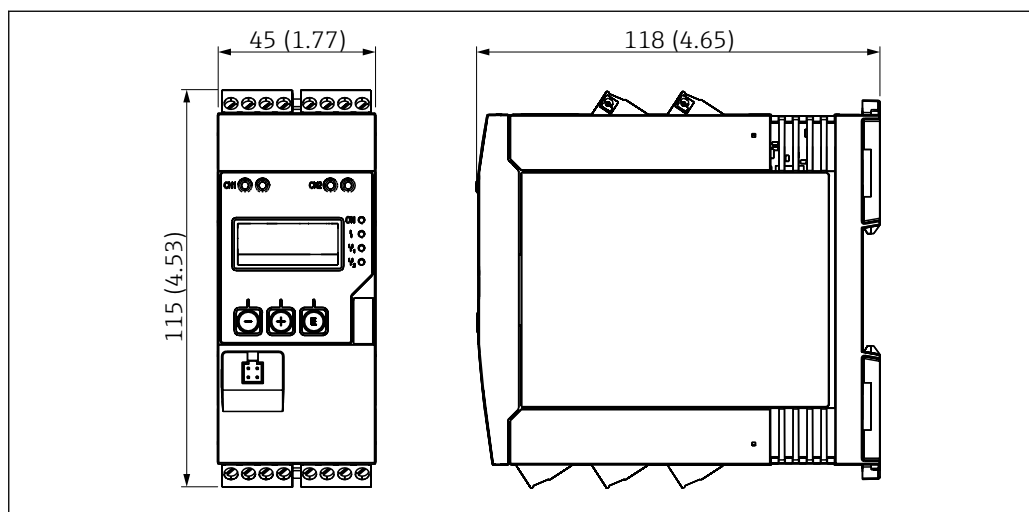
- Maximum measured error < 1% of measuring range
- Interference immunity as per IEC/EN 61326 series, industrial requirements
- Interference emission as per IEC/EN 61326 series (CISPR 11) Group 1 Class A



This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

## 12.7 Mechanical construction

### 12.7.1 Design, dimensions



16 Dimensions of the process transmitter in mm (in)

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### 12.7.2 Weight

Approximately 300 g (10.6 oz)

### 12.7.3 Material

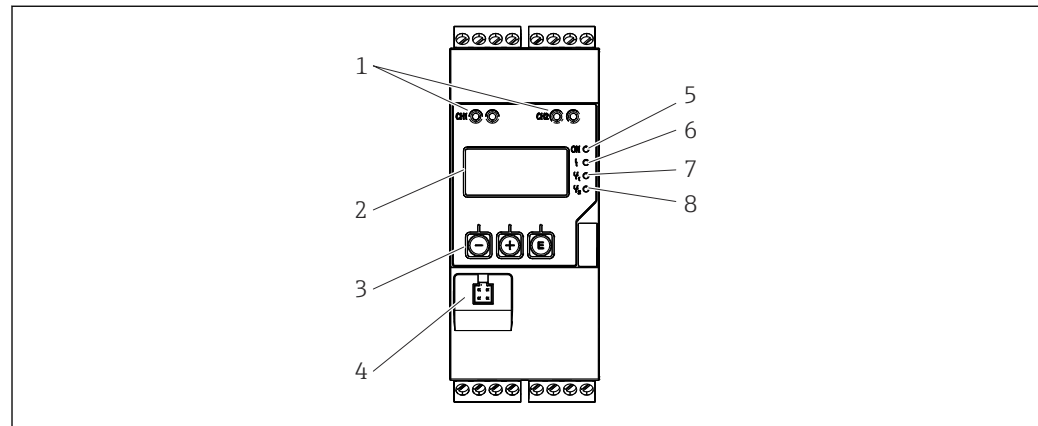
Housing: plastic PC-GF10

### 12.7.4 Terminals

Screw terminals, plug-in, 2.5 mm<sup>2</sup> (14 AWG), 0.1 to 4 mm<sup>2</sup> (30 to 12 AWG), torque 0.5 to 0.6 Nm (0.37 to 0.44 lbf ft)

## 12.8 Operability

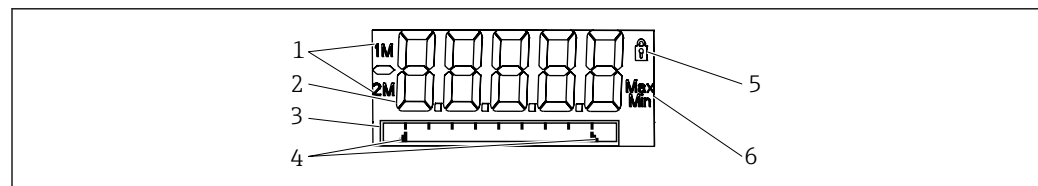
### 12.8.1 On-site operation



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17 Display and operating elements of the process transmitter

- 1 HART® connection sockets
- 2 Display
- 3 Operating keys
- 4 PC interface connection socket
- 5 Green LED; on = supply voltage applied
- 6 Red LED; on = fault/alarm
- 7 Yellow LED; on = relay 1 energized
- 8 Yellow LED; on = relay 2 energized



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18 Display of the process transmitter

- 1 Channel indicator: 1: analog input 1; 2: analog input 2; 1M: calculated value 1; 2M: calculated value 2
- 2 Measured value display
- 3 Dot matrix display for TAG, bar graph, unit
- 4 Limit value indicators in the bar graph
- 5 "Operation locked" indicator
- 6 Minimum/maximum value indicator

### 12.8.2 Local display

- Display
  - 5-digit, 7-segment backlit LC display
  - Dot matrix for text/bar graph
- Display area
  - 99999 to +99999 for measured values
- Signaling
  - Setup security locking (lock)
  - Measuring range overshoot/undershoot
  - 2 x status relay (only if the relay option was selected)

#### Operating elements

3 keys: -, +, E

### 12.8.3 Remote operation

#### Configuration

The device can be configured with the FieldCare PC software. FieldCare Device Setup is included in the Commubox FXA291 and TXU10-AC scope of delivery (see 'Accessories') or can be downloaded free of charge at [www.endress.com](http://www.endress.com).

#### Interface

4-pin socket for the connection with a PC via Commubox FXA291 and TXU10-AC interface cable (see 'Accessories').

## 12.9 Certificates and approvals

Current certificates and approvals for the product are available at [www.endress.com](http://www.endress.com) on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

## 12.10 Ordering information

Detailed ordering information is available from your nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator at [www.endress.com](http://www.endress.com):

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.



#### **Product Configurator - the tool for individual product configuration**

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

## 12.11 Accessories

The accessories currently available for the product can be selected at [www.endress.com](http://www.endress.com):

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

### 12.11.1 Communication-specific accessories

#### Commubox FXA291

Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.

For more information, please refer to: [www.endress.com](http://www.endress.com)

#### Configuration kit TXU10

Configuration kit for PC-programmable transmitter - FDT/DTM-based plant asset management tool, FieldCare/DeviceCare, and interface cable (4-pin connector) for PC with USB port.

For more information, please refer to: [www.endress.com](http://www.endress.com)

### **12.11.2 Online tools**

Product information over the entire life cycle of the device: [www.endress.com/onlinetools](http://www.endress.com/onlinetools)

## 13 Appendix

All the parameters available in the configuration menu are listed in the following tables. The values preconfigured at the factory are marked in bold.

### 13.1 Further explanations regarding the differential pressure application in level measurement

Pressure measuring cells are connected at both universal inputs. The volume in the CV channels is ultimately calculated with the following calculation steps.

#### 13.1.1 1st calculation step: calculation of the filling level

Both pressure measuring cells provide the actual pressure at the installation point. A pressure difference ( $\Delta p$ ) is determined from both pressures (adjusted by an offset where applicable; this offset must be set in AI1 or AI2). The measured height is calculated by dividing the pressure difference by the density of the medium and multiplying by the gravitational acceleration.

$$\text{Height } h = \Delta p / (\rho * g)$$

The calculation is based on the following units:

- Density  $\rho$  [kg/m<sup>3</sup>]
- Pressure  $p$ : [Pa] or [N/m<sup>2</sup>]

The gravitational acceleration is defined by a constant:

Gravitational acceleration  $g = 9.81 \text{ m/s}^2$

#### NOTICE

##### Wrong calculation results due to the use of incorrect units

- To obtain a correct calculation, a measured signal (e.g. in mbar) may need to be converted to the correct unit. This is done using a conversion factor. Conversion factors are indicated in the table → 52.

##### Examples of conversion:

Water: density  $\rho = 1\,000 \text{ kg/m}^3$

Pressure measurement: pressure 1 (bottom): scale 0 to 800 mbar (0 to 80000 Pa);

Present value: 500 mbar (50000 Pa)

Pressure measurement: pressure 2 (head): scale 0 to 800 mbar (0 to 80000 Pa);

Present value: 150 mbar (15000 Pa)

If using Pascal:

$$h = \frac{1}{1\,000 \text{ kg/m}^3 * 9.81 \text{ m/s}^2} * (50000 - 15000 \text{ Pa}) = 3.57 \text{ m}$$

If using mbar:

$$h = \frac{1}{1\,000 \text{ kg/m}^3 * 9.81 \text{ m/s}^2} * ((500 - 150 \text{ mbar})) * (1.0000 * 10^2) = 3.57 \text{ m}$$

$$h = b * \Delta p$$

Calculation of the correction factor  $b$ :

$$b = 1 / (\rho * g)$$

$$\text{for water: } b = 1 / (1000 * 9.81) = 0.00010194$$

Tables and examples for the conversion of application-related units into the defined values kg/m<sup>3</sup> and Pa and N/m<sup>2</sup>:

- 1 bar = 0.1 N/mm<sup>2</sup> = 10<sup>5</sup> N/m<sup>2</sup> = 10<sup>5</sup> Pa
- 1 mbar = 1 hPa = 100 Pa

*Conversion factors for various pressure engineering units*

|          | Pascal                   | Bar                       | Technical atmosphere      | Physical atmosphere       | Torr                      | Pounds per square inch    |
|----------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|          | [Pa]                     | [bar]                     | [at]                      | [atm]                     | [torr]                    | [psi]                     |
|          | = 1 N/m <sup>2</sup>     | = 1 Mdyn/cm <sup>2</sup>  | = 1 kp/cm <sup>2</sup>    | = 1 pSTP                  | = 1 mmHg                  | = 1 lbf/in <sup>2</sup>   |
| 1 Pa =   | 1                        | 1.000 · 10 <sup>-4</sup>  | 1.0197 · 10 <sup>-5</sup> | 9.8692 · 10 <sup>-6</sup> | 7.5006 · 10 <sup>-3</sup> | 1.4504 · 10 <sup>-4</sup> |
| 1 bar =  | 1.000 · 10 <sup>5</sup>  | 1                         | 1.0197 · 10 <sup>0</sup>  | 9.8692 · 10 <sup>-1</sup> | 7.5006 · 10 <sup>2</sup>  | 1.4504 · 10 <sup>1</sup>  |
| 1 mbar = | 1.000 · 10 <sup>2</sup>  | 1.000 · 10 <sup>-3</sup>  | 1.0197 · 10 <sup>3</sup>  | 9.8692 · 10 <sup>-4</sup> | 7.5006 · 10 <sup>-1</sup> | 1.4504 · 10 <sup>-2</sup> |
| 1 at =   | 9.8067 · 10 <sup>4</sup> | 9.8067 · 10 <sup>-1</sup> | 1                         | 9.6784 · 10 <sup>-1</sup> | 7.3556 · 10 <sup>2</sup>  | 1.4223 · 10 <sup>1</sup>  |
| 1 atm =  | 1.0133 · 10 <sup>5</sup> | 1.0133 · 10 <sup>0</sup>  | 1.0332 · 10 <sup>0</sup>  | 1                         | 7.6000 · 10 <sup>2</sup>  | 1.4696 · 10 <sup>1</sup>  |
| 1 torr = | 1.3332 · 10 <sup>2</sup> | 1.3332 · 1 <sup>-3</sup>  | 1.3595 · 10 <sup>-3</sup> | 1.3158 · 10 <sup>-3</sup> | 1                         | 1.9337 · 10 <sup>-2</sup> |
| 1 psi =  | 6.8948 · 10 <sup>3</sup> | 6.8948 · 1 <sup>-3</sup>  |                           |                           |                           |                           |

### Density:

Refer to the specifications of the medium in the tank for the density.

The table below lists standard approximate values, which provide initial orientation.

| Medium                                 | Density in [kg/m <sup>3</sup> ] |
|----------------------------------------|---------------------------------|
| Water (at 3.98 °C (39.164 °F))         | 999.975                         |
| Mercury                                | 13 595                          |
| Bromine                                | 3 119                           |
| Sulfuric acid                          | 1834                            |
| Nitric acid                            | 1512                            |
| Glycerine                              | 1260                            |
| Nitrobenzene                           | 1220                            |
| Deuterium oxide                        | 1105                            |
| Acetic acid                            | 1049                            |
| Milk                                   | 1030                            |
| Seawater                               | 1025                            |
| Aniline                                | 1022                            |
| Olive oil                              | 910                             |
| Benzene                                | 879                             |
| Toluene                                | 872                             |
| Essence of turpentine                  | 855                             |
| Methylated spirit                      | 830                             |
| Diesel fuel                            | 830                             |
| Petroleum                              | 800                             |
| Methanol                               | 790                             |
| Ethanol                                | 789                             |
| Gasoline (standardized, average value) | 750                             |
| Acetone                                | 721                             |

| Medium           | Density in [kg/m <sup>3</sup> ] |
|------------------|---------------------------------|
| Carbon disulfide | 713                             |
| Diethyl ether    | 713                             |

### 13.1.2 2nd calculation step: calculation of the volumetric content from the height

The volume can be calculated using the linearization of the calculated height value.

This is done by assigning a certain volume value to every height value, depending on the tank shape.

This linearization is mapped over up to 32 linearization points (support points). However, 2-3 linearization points suffice if the dependency between the filling level and volume is very linear.

The tank linearization module integrated in FieldCare provides support here.

## 13.2 Display menu

### AI1/AI2 Reset minmax

|                               |                                                                                                                                |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Display → AI1 Reset minmax/AI2 Reset minmax |
| <b>Description</b>            | Resets the saved minimum and maximum values of analog input 1 or analog input 2.                                               |
| <b>Selection</b>              | Yes<br>No                                                                                                                      |
| <b>Factory setting</b>        | No                                                                                                                             |
| <b>Additional information</b> | Only available if "Allow reset = Yes" has been configured in the menu Expert<br>→ Analog in 1/Analog in 2.                     |

### Cv1/Cv2 Reset minmax

|                               |                                                                                                                                 |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Display → Cv1 Reset minmax/Cv2 Reset minmax |
| <b>Description</b>            | Resets the saved minimum and maximum values of math 1 or math 2.                                                                |
| <b>Selection</b>              | Yes<br>No                                                                                                                       |
| <b>Factory setting</b>        | No                                                                                                                              |
| <b>Additional information</b> | Only available if "Allow reset = Yes" has been configured in the menu Expert<br>→ Calc val 1/Calc val 2.                        |

### Analog in 1/2

|                        |                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Display → Analog in 1/Analog in 2              |
| <b>Description</b>     | Configuration of the display for analog input 1 or analog input 2. If the parameter is set to 'Off', the channel is not displayed. |
| <b>Selection</b>       | off<br>Unit<br>Bar graph<br>Bar + unit<br>Tag + unit                                                                               |
| <b>Factory setting</b> | Tag + unit                                                                                                                         |

---

Calc value 1/2

---

|                        |                                                                                                                       |
|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Display → Calc value 1/Calc value 1 |
| <b>Description</b>     | Configuration of the display for math 1 or math 2. If the parameter is set to 'Off', the channel is not displayed.    |
| <b>Selection</b>       | off<br>Unit<br>Bar graph<br>Bar + unit<br>Tag + unit                                                                  |
| <b>Factory setting</b> | off                                                                                                                   |

---

Contrast

---

|                        |                                                                                                      |
|------------------------|------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Display → Contrast |
| <b>Description</b>     | Sets the display contrast                                                                            |
| <b>Selection</b>       | 1 to 7                                                                                               |
| <b>Factory setting</b> | 6                                                                                                    |

---

Brightness

---

|                        |                                                                                                          |
|------------------------|----------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Display → Brightness |
| <b>Description</b>     | Sets the brightness                                                                                      |
| <b>Selection</b>       | 1 to 7                                                                                                   |
| <b>Factory setting</b> | 6                                                                                                        |

---

Alternating time

---

|                        |                                                                                                                |
|------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Display → Alternating time |
| <b>Description</b>     | Setting for the time for toggling between the displayed channels.                                              |
| <b>Selection</b>       | 3 seconds<br>5 seconds<br>10 seconds                                                                           |
| <b>Factory setting</b> | 5 seconds                                                                                                      |

## 13.3 Setup menu

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Application

---

|                               |                                                                                                         |
|-------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Application |
| <b>Description</b>            | Configuration of the application for the process indicator.                                             |
| <b>Selection</b>              | 1-channel<br>2-channel<br>Diff pressure                                                                 |
| <b>Factory setting</b>        | 1- / 2-channel                                                                                          |
| <b>Additional information</b> | 2-channel is the default setting for two-channel devices, 1-channel for single-channel devices.         |

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AI1/AI2 Lower range

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|                               |                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → AI1 Lower range/AI2 Lower range |
| <b>Description</b>            | Setting for the measuring range lower limit.                                                                              |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                             |
| <b>Factory setting</b>        | 0.0000                                                                                                                    |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured.                                                                |

---

AI1/AI2 Upper range

---

|                               |                                                                                                                           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → AI1 Upper range/AI2 Upper range |
| <b>Description</b>            | Setting for measuring range upper limit.                                                                                  |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                             |
| <b>Factory setting</b>        | 100.00                                                                                                                    |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured.                                                                |

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CV factor

---

|                               |                                                                                                      |
|-------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → CV factor |
| <b>Description</b>            | Factor by which the calculated value is multiplied.                                                  |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                        |
| <b>Factory setting</b>        | 1.0                                                                                                  |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured.                                           |

---

CV unit

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|                               |                                                                                                     |
|-------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → CV unit |
| <b>Description</b>            | Unit of the calculated value                                                                        |
| <b>Selection</b>              | Customized text, max. 5 characters                                                                  |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured.                                          |

---

CV Bar 0%

---

|                               |                                                                                                       |
|-------------------------------|-------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → CV Bar 0% |
| <b>Description</b>            | Setting for the 0% value for the bar graph                                                            |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                         |
| <b>Factory setting</b>        | 0.0000                                                                                                |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured.                                            |

---

CV Bar 100%

---

|                    |                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → CV Bar 100% |
| <b>Description</b> | Setting for the 0% value for the bar graph                                                              |
| <b>User entry</b>  | Numerical value <sup>1)</sup>                                                                           |

|                               |                                                            |
|-------------------------------|------------------------------------------------------------|
| <b>Factory setting</b>        | 100.00                                                     |
| <b>Additional information</b> | Only visible if Application → Diff pressure is configured. |

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#### "Linearization" submenu

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|                    |                                                                                                         |
|--------------------|---------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Linearization |
| <b>Description</b> | Only visible if Application → Diff pressure is configured.                                              |

---

#### No lin points

---

|                        |                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Linearization → No lin points |
| <b>Description</b>     | Number of linearization points                                                                                          |
| <b>User entry</b>      | 2 to 32                                                                                                                 |
| <b>Factory setting</b> | 2                                                                                                                       |

---

#### X-value 1 to X-value 32

---

|                        |                                                                                                                                  |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Linearization → X-value 1...X-value 32 |
| <b>Description</b>     | X-value for the linearization point                                                                                              |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                    |
| <b>Factory setting</b> | 0.0000                                                                                                                           |

---

#### Y-value 1 to Y-value 32

---

|                        |                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Linearization → Y-value 1...Y-value 32 |
| <b>Description</b>     | Y-value for the linearization point                                                                                                |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                      |
| <b>Factory setting</b> | 0.0000                                                                                                                             |

---

#### Submenu "Analog in 1"/"Analog in 2"

---

|                               |                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 |
| <b>Additional information</b> | Settings for analog input 1 or analog input 2                                                                       |

---

#### Signal type

---

|                               |                                                                                                                                   |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Signal type |
| <b>Description</b>            | Setting for the input type.                                                                                                       |
| <b>Selection</b>              | off<br>Current<br>Voltage<br>RTD<br>TC                                                                                            |
| <b>Factory setting</b>        | Current                                                                                                                           |
| <b>Additional information</b> | If the Signal type is set to 'off', all the parameters under it are hidden.                                                       |

## Signal range

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog in 1/Analog in 2 → Signal range                                                                                                                                                                                                                                                                               |
| <b>Description</b>     | Setting for the input signal. The options that are available for selection depend on the "Signal type" that is set.                                                                                                                                                                                                                                                                                            |
| <b>Selection</b>       | 4-20mA, 4-20mA squar, 0-20mA, 0-20mA squar<br>0-10V, 0-10V squar, 0-5V, 2-10V, 1-5V, 1-5V squar, 0-1V, 0-1V squar,<br>+/- 1V, +/- 10V, +/- 30V, +/- 100mV<br>Pt46GOST, Pt50GOST, Pt100IEC, Pt100JIS, Pt100GOST, Pt500IEC,<br>Pt1000IEC, Ni100DIN, Ni1000DIN, Cu50GOST, Cu53GOST, Cu100GOST,<br>3000 Ohm<br>Type B, Type J, Type K, Type N, Type R, Type S, Type T, Type C, Type D, Type L, Type L GOST, Type U |
| <b>Factory setting</b> | 4-20mA, 0-10V, Pt100IEC, Type J; depending on the selected input signal                                                                                                                                                                                                                                                                                                                                        |

## Lower range

|                               |                                                                                                                                 |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Lower range |
| <b>Description</b>            | Setting for the measuring range lower limit.                                                                                    |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                                   |
| <b>Factory setting</b>        | 0                                                                                                                               |
| <b>Additional information</b> | Only visible for "Signal type" = "Current" or "Voltage"                                                                         |

## Upper range

|                               |                                                                                                                                   |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Upper range |
| <b>Description</b>            | Setting for measuring range upper limit.                                                                                          |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                                     |
| <b>Factory setting</b>        | 100                                                                                                                               |
| <b>Additional information</b> | Only visible for "Signal type" = "Current" or "Voltage"                                                                           |

## Connection

|                               |                                                                                                                                  |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Connection |
| <b>Description</b>            | Setting for the connection type for the resistance thermometer.                                                                  |
| <b>Selection</b>              | 2-wire<br>3-wire<br>4-wire                                                                                                       |
| <b>Factory setting</b>        | 2-wire                                                                                                                           |
| <b>Additional information</b> | Only visible for "Signal type" = "RTD"                                                                                           |

## Tag

|                    |                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Analog in 1/Analog in 2 → Tag |
| <b>Description</b> | Channel name; TAG is the device designation for channel 1                                                                 |
| <b>User entry</b>  | Customized text, max. 12 characters                                                                                       |

---

Unit

---

|                               |                                                                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Unit |
| <b>Description</b>            | Unit of the channel.                                                                                                     |
| <b>User entry</b>             | Customized text, max. 5 characters                                                                                       |
| <b>Additional information</b> | Only visible for "Signal type" = "Current" or "Voltage"                                                                  |

---

Temperature unit

---

|                               |                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Temperature unit |
| <b>Description</b>            | Setting for the temperature unit.                                                                                                    |
| <b>Selection</b>              | °C<br>°F<br>K                                                                                                                        |
| <b>Factory setting</b>        | °C                                                                                                                                   |
| <b>Additional information</b> | Only visible for "Signal type" = "RTD" or "TC"                                                                                       |

---

Offset

---

|                        |                                                                                                                              |
|------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog in 1/Analog in 2 → Offset |
| <b>Description</b>     | Setting for an offset                                                                                                        |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                |
| <b>Factory setting</b> | 0                                                                                                                            |

---

Ref junction

---

|                               |                                                                                                                                    |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Ref junction |
| <b>Description</b>            | Setting for reference temperature.                                                                                                 |
| <b>Selection</b>              | Internal<br>Fixed                                                                                                                  |
| <b>Factory setting</b>        | Internal                                                                                                                           |
| <b>Additional information</b> | Only visible for "Signal type" = "TC"                                                                                              |

---

Fixed ref junc

---

|                               |                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog in 1/Analog in 2 → Fixed ref junc |
| <b>Description</b>            | Setting for constant reference temperature.                                                                                          |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                                        |
| <b>Additional information</b> | Only visible if "Ref junction" = "Fixed".                                                                                            |

---

Reset min/max

---

|                   |                                                                                                                                     |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Analog in 1/Analog in 2 → Reset min/max |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------|

|                        |                                 |
|------------------------|---------------------------------|
| <b>Description</b>     | Reset the saved min/max values. |
| <b>Selection</b>       | No<br>Yes                       |
| <b>Factory setting</b> | No                              |

---

 Submenu "Calc value 1"/"Calc value 2"
 

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|                               |                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Calc value 1/Calc value 2 |
| <b>Additional information</b> | Settings for math 1 or math 2                                                                                       |

---

 Calculation
 

---

|                               |                                                                                                                                   |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Calc value 1/Calc value 2 → Calculation |
| <b>Description</b>            | Selection of calculation method.                                                                                                  |
| <b>Selection</b>              | off<br>Sum<br>Difference<br>Average<br>Lineariz. AI1 / Lineariz. AI2<br>Lineariz. CV1 (only Calc value 2)<br>Multiplication       |
| <b>Factory setting</b>        | off                                                                                                                               |
| <b>Additional information</b> | If Calculation is set to 'off', all the parameters under it are hidden.                                                           |

---

 Tag
 

---

|                    |                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Calc value 1/Calc value 2 → Tag |
| <b>Description</b> | Channel name                                                                                                                |
| <b>User entry</b>  | Customized text, max. 12 characters                                                                                         |

---

 Unit
 

---

|                    |                                                                                                                              |
|--------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Setup → Calc value 1/Calc value 2 → Unit |
| <b>Description</b> | Unit of the channel                                                                                                          |
| <b>User entry</b>  | Customized text, max. 5 characters                                                                                           |

---

 Bar 0%
 

---

|                        |                                                                                                                                |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Calc value 1/Calc value 2 → Bar 0% |
| <b>Description</b>     | Setting for the 0% value for the bar graph                                                                                     |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                  |
| <b>Factory setting</b> | 0                                                                                                                              |

---

 Bar 100%
 

---

|                   |                                                                                                                                  |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → Bar 100% |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------|

|                        |                                              |
|------------------------|----------------------------------------------|
| <b>Description</b>     | Setting for the 100% value for the bar graph |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                |
| <b>Factory setting</b> | 100                                          |

---

Factor

---

|                   |                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → Factor |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|

|                        |                                                 |
|------------------------|-------------------------------------------------|
| <b>Description</b>     | Setting for the factor for the calculated value |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                   |
| <b>Factory setting</b> | 1.0                                             |

---

Offset

---

|                   |                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → Offset |
|-------------------|------------------------------------------------------------------------------------------------------------------------------|

|                        |                               |
|------------------------|-------------------------------|
| <b>Description</b>     | Setting for an offset         |
| <b>User entry</b>      | Numerical value <sup>1)</sup> |
| <b>Factory setting</b> | 0                             |

---

No. lin points

---

|                   |                                                                                                                                        |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → No. lin points |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                  |
|-------------------------------|--------------------------------------------------|
| <b>Description</b>            | Number of linearization points                   |
| <b>User entry</b>             | 2 to 32                                          |
| <b>Factory setting</b>        | 2                                                |
| <b>Additional information</b> | Only visible if "Calculation" = "Linearization". |

---

X-value

---

|                   |                                                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → X-value |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                              |
|-------------------------------|------------------------------------------------------------------------------|
| <b>Description</b>            | Enter the support points (linearization points) for linearization (max. 32). |
| <b>User entry</b>             | X-value 1 to X-value 32, a numerical value in each case <sup>1)</sup>        |
| <b>Factory setting</b>        | 0                                                                            |
| <b>Additional information</b> | Only visible if "Calculation" = "Linearization".                             |

---

Y-value

---

|                   |                                                                                                                                 |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → Y-value |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                              |
|-------------------------------|------------------------------------------------------------------------------|
| <b>Description</b>            | Enter the support points (linearization points) for linearization (max. 32). |
| <b>User entry</b>             | Y-value 1 to Y-value 32, a numerical value in each case <sup>1)</sup>        |
| <b>Factory setting</b>        | 0                                                                            |
| <b>Additional information</b> | Only visible if "Calculation" = "Linearization".                             |

---

Reset min/max

---

|                   |                                                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Calc value 1/Calc value 2 → Reset min/max |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|

|                        |                                 |
|------------------------|---------------------------------|
| <b>Description</b>     | Reset the saved min/max values. |
| <b>Selection</b>       | No<br>Yes                       |
| <b>Factory setting</b> | No                              |

---

#### Submenu "Analog Out 1"/"Analog Out 2"

---

|                               |                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Analog Out 1/Analog Out 2 |
| <b>Additional information</b> | Settings for analog output 1 or analog output 2                                                                     |

---

#### Assignment

---

|                        |                                                                                                                                  |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog Out 1/Analog Out 2 → Assignment |
| <b>Description</b>     | For selecting the source for the output signal                                                                                   |
| <b>Selection</b>       | off<br>Analog 1<br>Analog 2<br>Calc Val 1<br>Calc Val 2                                                                          |
| <b>Factory setting</b> | off                                                                                                                              |

---

#### Signal type

---

|                        |                                                                                                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog Out 1/Analog Out 2 → Signal type |
| <b>Description</b>     | For selecting the signal type for the output signal                                                                                 |
| <b>Selection</b>       | 4-20mA<br>0-20mA<br>0-10V<br>2-10V<br>0-5V<br>1-5V                                                                                  |
| <b>Factory setting</b> | 4-20mA                                                                                                                              |

---

#### Lower range

---

|                        |                                                                                                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog Out 1/Analog Out 2 → Lower range |
| <b>Description</b>     | Setting for the measuring range lower limit                                                                                         |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                       |
| <b>Factory setting</b> | 0                                                                                                                                   |

---

#### Upper range

---

|                        |                                                                                                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Analog Out 1/Analog Out 2 → Upper range |
| <b>Description</b>     | Setting for measuring range upper limit                                                                                             |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                       |
| <b>Factory setting</b> | 100                                                                                                                                 |

---

 Submenu "Relay 1"/"Relay 2"
 

---

|                               |                                                                                                           |
|-------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Relay 1/Relay 2 |
| <b>Additional information</b> | Settings for relay 1 or relay 2                                                                           |

---

 Source
 

---

|                        |                                                                                                                    |
|------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Relay 1/Relay 2 → Source |
| <b>Description</b>     | For selecting the source for the relay                                                                             |
| <b>Selection</b>       | off<br>Analog input 1<br>Analog input 2<br>Calc value 1<br>Calc value 2<br>Error                                   |
| <b>Factory setting</b> | off                                                                                                                |

---

 Function
 

---

|                        |                                                                                                                       |
|------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Relay 1/Relay 2 → Function |
| <b>Description</b>     | Function of the relay                                                                                                 |
| <b>Selection</b>       | Min<br>Max<br>Gradient<br>Inband<br>Outband                                                                           |
| <b>Factory setting</b> | Min                                                                                                                   |

---

 Setpoint
 

---

|                        |                                                                                                                        |
|------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Relay 1/Relay 2 → Setpoint |
| <b>Description</b>     | Switching threshold for relay                                                                                          |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                          |
| <b>Factory setting</b> | 0                                                                                                                      |

---

 Setpoint 2
 

---

|                               |                                                                                                                          |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → Relay 1/Relay 2 → Setpoint 2 |
| <b>Description</b>            | Second switching threshold for relay.                                                                                    |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                            |
| <b>Factory setting</b>        | 0                                                                                                                        |
| <b>Additional information</b> | Only for the Inband and Outband functions.                                                                               |

---

 Time base
 

---

|                   |                                                                                                                         |
|-------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → Relay 1/Relay 2 → Time base |
|-------------------|-------------------------------------------------------------------------------------------------------------------------|

|                               |                                               |
|-------------------------------|-----------------------------------------------|
| <b>Description</b>            | Time base for gradient evaluation in seconds. |
| <b>User entry</b>             | 0-60                                          |
| <b>Factory setting</b>        | 0                                             |
| <b>Additional information</b> | Only visible if "Function" = "Gradient".      |

---

Hysteresis

---

|                        |                                                                                                                        |
|------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → Relay 1/Relay 2 → Hysteresis |
| <b>Description</b>     | Hysteresis for switching threshold(s)                                                                                  |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                          |
| <b>Factory setting</b> | 0                                                                                                                      |

---

"System" submenu

---

|                   |                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Setup → System |
|-------------------|--------------------------------------------------------------------------------------------------|

---

Access code

---

|                               |                                                                                                                |
|-------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Setup → System → Access code |
| <b>Description</b>            | User code to protect the device configuration.                                                                 |
| <b>User entry</b>             | 0000 to 9999                                                                                                   |
| <b>Factory setting</b>        | 0000                                                                                                           |
| <b>Additional information</b> | 0000 = protection disabled by user code                                                                        |

---

Overfill protect

---

|                        |                                                                                                                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → System → Overfill protect                                                       |
| <b>Description</b>     | If the device is used for overfill protection →  30, Overfill protect = Yes must be set. |
| <b>Selection</b>       | No<br>Yes                                                                                                                                                                   |
| <b>Factory setting</b> | No                                                                                                                                                                          |

---

Reset

---

|                        |                                                                                                            |
|------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Setup → System → Reset |
| <b>Description</b>     | Reset the device to the as-delivered state                                                                 |
| <b>Selection</b>       | No<br>Yes                                                                                                  |
| <b>Factory setting</b> | No                                                                                                         |

1) Numerical values consist of 6 digits, wherein the decimal point counts as a digit, e.g. +99.999

## 13.4 Diagnostics menu

---

Current diagn

---

|                    |                                                                                                               |
|--------------------|---------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Current diagn |
| <b>Description</b> | Displays the error code currently active                                                                      |

---

 Last diagn
 

---

|                    |                                                                                                            |
|--------------------|------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Last diagn |
| <b>Description</b> | Displays the last error code                                                                               |

---

 Operating time
 

---

|                    |                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Operating time |
| <b>Description</b> | Displays the operating hours up until now                                                                      |

---

 Submenu "Diagnost logbook"
 

---

|                    |                                                                                                                  |
|--------------------|------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Diagnost logbook |
| <b>Description</b> | Displays the last 5 error codes                                                                                  |

---

 Diagnostics x
 

---

|                    |                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Diagnost logbook → Diagnostics x |
| <b>Description</b> | Displays a message from the Diagnostics logbook.                                                                                   |

---

 Submenu "Device information"
 

---

|                   |                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Diagnostics → Device information |
|-------------------|----------------------------------------------------------------------------------------------------------------------|

---

 Device tag
 

---

|                    |                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Device information → Device tag |
| <b>Description</b> | Display the device name, TAG, channel 1                                                                                           |

---

 Serial number
 

---

|                    |                                                                                                                                      |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Device information → Serial number |
| <b>Description</b> | Displays the serial number                                                                                                           |

---

 Order code
 

---

|                    |                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>  |  Diagnostics → Device information → Order code |
| <b>Description</b> | Displays the order code                                                                                                           |

---

Order identifier

---

**Navigation**  Diagnostics → Device information → Order identifier

**Description** Displays the order code

---

Firmware version

---

**Navigation**  Diagnostics → Device information → Firmware version

**Description** Displays the firmware version

---

ENP version

---

**Navigation**  Diagnostics → Device information → ENP Version

**Description** Displays the ENP version

## 13.5 Expert menu

In addition to all the parameters from the Setup menu, the following parameters are also available in the Expert Mode.

---

Direct access

---

**Navigation**  Expert → Direct access

**Description** Code to go directly to an operating item

**User entry** 4-digit code

---

"System" submenu

---

**Navigation**  Expert → System

---

Save user setup

---

**Navigation**  Expert → System → Save user setup

**Description** Select 'Yes' to save the current device settings. The device can be reset to the saved settings via 'Reset'-'>'User reset'.

**Selection** No  
Yes

**Factory setting** No

---

Submenu "Input"

---

**Navigation**  Expert → Input

---

 Submenu "Analog in 1"/"Analog in 2"
 

---

|                               |                                                                                                                            |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Expert → Input → Analog in 1/Analog in 2 |
| <b>Description</b>            | Settings for the analog inputs.                                                                                            |
| <b>Additional information</b> | The following parameters are available for analog input 1 and for analog input 2.                                          |

---

 Bar 0%
 

---

|                        |                                                                                                                                     |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Bar 0% |
| <b>Description</b>     | Setting for the 0% value for the bar graph                                                                                          |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                       |
| <b>Factory setting</b> | 0                                                                                                                                   |

---

 Bar 100%
 

---

|                        |                                                                                                                                       |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Bar 100% |
| <b>Description</b>     | Setting for the 100% value for the bar graph                                                                                          |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                         |
| <b>Factory setting</b> | 100                                                                                                                                   |

---

 Decimal places
 

---

|                        |                                                                                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Decimal places |
| <b>Description</b>     | Setting for the number of decimal places for the display                                                                                      |
| <b>Selection</b>       | XXXXX<br>XXXX.X<br>XXX.XX<br>XX.XXX<br>X.XXXX                                                                                                 |
| <b>Factory setting</b> | XXX.XX                                                                                                                                        |

---

 Damping
 

---

|                        |                                                                                                                                        |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Damping |
| <b>Description</b>     | Setting for the damping of the input signal. Enter value in 0.1 s increments from 0.0 s to 999.9 s.                                    |
| <b>User entry</b>      | Numerical value <sup>1)</sup>                                                                                                          |
| <b>Factory setting</b> | 0.0 for current / voltage<br>1.0 for temperature inputs                                                                                |

---

 Failure mode
 

---

|                   |                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Expert → Input → Analog in 1/Analog in 2 → Failure mode |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|

|                               |                                                                                                                                 |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>            | Setting for the failure mode.                                                                                                   |
| <b>Selection</b>              | Invalid<br>Fixed value                                                                                                          |
| <b>Factory setting</b>        | Invalid                                                                                                                         |
| <b>Additional information</b> | Invalid: An invalid value is output in the event of an error.<br>Fixed value: A fixed value is output in the event of an error. |

---

Fixed fail value

---

|                               |                                                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Expert → Input → Analog in 1/Analog in 2 → Fixed fail value |
| <b>Description</b>            | The value set here is output in the event of an error.                                                                                        |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                                                 |
| <b>Factory setting</b>        | 0                                                                                                                                             |
| <b>Additional information</b> | Only visible if Failure mode = Fixed value.                                                                                                   |

---

NAMUR NE 43

---

|                        |                                                                                                                                          |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → NAMUR NE 43 |
| <b>Description</b>     | Setting whether the failure mode should be according to NAMUR NE 43.                                                                     |
| <b>Selection</b>       | On<br>Off                                                                                                                                |
| <b>Factory setting</b> | On                                                                                                                                       |

---

Open circ detect

---

|                               |                                                                                                                                                 |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Expert → Input → Analog in 1/Analog in 2 → Open circ detect |
| <b>Description</b>            | Setting for cable open circuit detection.                                                                                                       |
| <b>Selection</b>              | On<br>Off                                                                                                                                       |
| <b>Factory setting</b>        | On                                                                                                                                              |
| <b>Additional information</b> | Only visible if 1-5 V is set for the signal range.                                                                                              |

---

Failure delay

---

|                        |                                                                                                                                              |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Failure delay |
| <b>Description</b>     | Delay time for fault in seconds                                                                                                              |
| <b>User entry</b>      | Integer (0-99)                                                                                                                               |
| <b>Factory setting</b> | 0                                                                                                                                            |

---

Allow reset

---

|                        |                                                                                                                                            |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Input → Analog in 1/Analog in 2 → Allow reset |
| <b>Description</b>     | Setting specifying whether saved min/max values in the Display menu can be reset without entering a (configured) user code.                |
| <b>Selection</b>       | No<br>Yes                                                                                                                                  |
| <b>Factory setting</b> | No                                                                                                                                         |

---

 Submenu "Output"
 

---

**Navigation**  Expert → Output

---

 Submenu "Analog Out 1"/"Analog Out 2"
 

---

**Navigation**  Expert → Output → Analog Out 1/Analog Out 2

**Description** Settings for the analog outputs.

**Additional information** The following parameters are available for analog output 1 and analog output 2.

---

 Failure mode
 

---

**Navigation**  Expert → Output → Analog Out 1/Analog Out 2 → Failure mode

**Description** Setting for the failure mode.

**Selection** Min  
Max  
Fixed value

**Factory setting** Min

**Additional information** Min: The saved minimum value is output in the event of an error.  
Max: The saved maximum value is output in the event of an error.  
Fixed value: A fixed value is output in the event of an error.

---

 Fixed fail value
 

---

**Navigation**  Expert → Output → Analog Out 1/Analog Out 2 → Fixed fail value

**Description** The value set here is output in the event of an error.

**User entry** Numerical value<sup>1)</sup>

**Factory setting** 0

**Additional information** Only visible if Failure mode = Fixed value.

---

 Submenu "Relay 1"/"Relay 2"
 

---

**Navigation**  Expert → Output → Relay 1/Relay 2

**Description** Settings for the relays.

**Additional information** The following parameters are available for relay 1 and relay 2.

---

 Time delay
 

---

**Navigation**  Expert → Output → Relay 1/Relay 2 → Time delay

**Description** Delay to switch the relay in seconds.

**User entry** 0-9999

**Factory setting** 0

---

 Operating mode
 

---

|                        |                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Output → Relay 1/Relay 2 → Operating mode |
| <b>Description</b>     | Normally closed = NC contact<br>Normally opened = NO contact                                                                         |
| <b>Selection</b>       | Normally closed<br>Normally opened                                                                                                   |
| <b>Factory setting</b> | Normally closed                                                                                                                      |

---

#### Failure mode

---

|                        |                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Output → Relay 1/Relay 2 → Failure mode |
| <b>Description</b>     | Normally closed = NC contact<br>Normally opened = NO contact                                                                       |
| <b>Selection</b>       | Normally closed<br>Normally opened                                                                                                 |
| <b>Factory setting</b> | Normally closed                                                                                                                    |

---

#### Submenu "Application"

---

|                   |                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Expert → Application |
|-------------------|--------------------------------------------------------------------------------------------------------|

---

#### Submenu "Calc value 1"/"Calc value 2"

---

|                               |                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Expert → Application → Calc value 1/Calc value 2 |
| <b>Description</b>            | Settings for the math channels.                                                                                                      |
| <b>Additional information</b> | The following parameters are available for math 1 and math 2.                                                                        |

---

#### Decimal places

---

|                        |                                                                                                                                                       |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Application → Calc value 1/Calc value 2 → Decimal places |
| <b>Description</b>     | Setting for the number of decimal places for the display                                                                                              |
| <b>Selection</b>       | XXXXX<br>XXXX.X<br>XXX.XX<br>XX.XXX<br>X.XXXX                                                                                                         |
| <b>Factory setting</b> | XXX.XX                                                                                                                                                |

---

#### Failure mode

---

|                        |                                                                                                                                                     |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Application → Calc value 1/Calc value 2 → Failure mode |
| <b>Description</b>     | Setting for failure mode                                                                                                                            |
| <b>Selection</b>       | Invalid<br>Fixed value                                                                                                                              |
| <b>Factory setting</b> | Invalid                                                                                                                                             |

---

#### Fixed fail value

---

|                               |                                                                                                                                                       |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>             |  Expert → Application → Calc value 1/Calc value 2 → Fixed fail value |
| <b>Description</b>            | The value set here is output in the event of an error.                                                                                                |
| <b>User entry</b>             | Numerical value <sup>1)</sup>                                                                                                                         |
| <b>Factory setting</b>        | 0                                                                                                                                                     |
| <b>Additional information</b> | Only visible if Failure mode = Fixed value.                                                                                                           |

---

#### Allow reset

---

|                        |                                                                                                                                                  |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Application → Calc value 1/Calc value 2 → Allow reset |
| <b>Description</b>     | Setting specifying whether saved min/max values in the Display menu can be reset without entering a (configured) user code.                      |
| <b>Selection</b>       | No<br>Yes                                                                                                                                        |
| <b>Factory setting</b> | No                                                                                                                                               |

---

#### Submenu "Diagnostics"

---

|                   |                                                                                                        |
|-------------------|--------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Expert → Diagnostics |
|-------------------|--------------------------------------------------------------------------------------------------------|

---

#### Verify HW set

---

|                        |                                                                                                                          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Diagnostics → Verify HW set |
| <b>Description</b>     | Verification of the device hardware.                                                                                     |
| <b>Selection</b>       | Yes<br>No                                                                                                                |
| <b>Factory setting</b> | No                                                                                                                       |

---

#### "Simulation" submenu

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|                   |                                                                                                         |
|-------------------|---------------------------------------------------------------------------------------------------------|
| <b>Navigation</b> |  Expert → Simulation |
|-------------------|---------------------------------------------------------------------------------------------------------|

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#### Simulation AO1/AO2

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|                        |                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Navigation</b>      |  Expert → Simulation → Simulation AO1/Simulation AO1 |
| <b>Description</b>     | Simulation of analog output 1 or analog output 2.<br>The value set in the simulation is output at analog output 1 or analog output 2.   |
| <b>Selection</b>       | Off<br>0mA<br>3.6mA<br>4mA<br>10mA<br>12mA<br>20mA<br>21mA<br>0V<br>5 V<br>10V                                                          |
| <b>Factory setting</b> | Off                                                                                                                                     |

---

|                 |                                                                                                                                   |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Simu relay 1/2  |                                                                                                                                   |
| <hr/>           |                                                                                                                                   |
| Navigation      |  Expert → Simulation → Simu relay 1/Simu relay 2 |
| Description     | Simulation of relay 1 or relay 2.                                                                                                 |
| Selection       | off<br>Closed<br>Opened                                                                                                           |
| Factory setting | off                                                                                                                               |

1) Numerical values consist of 6 digits, wherein the decimal point counts as a digit, e.g. +99.999



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