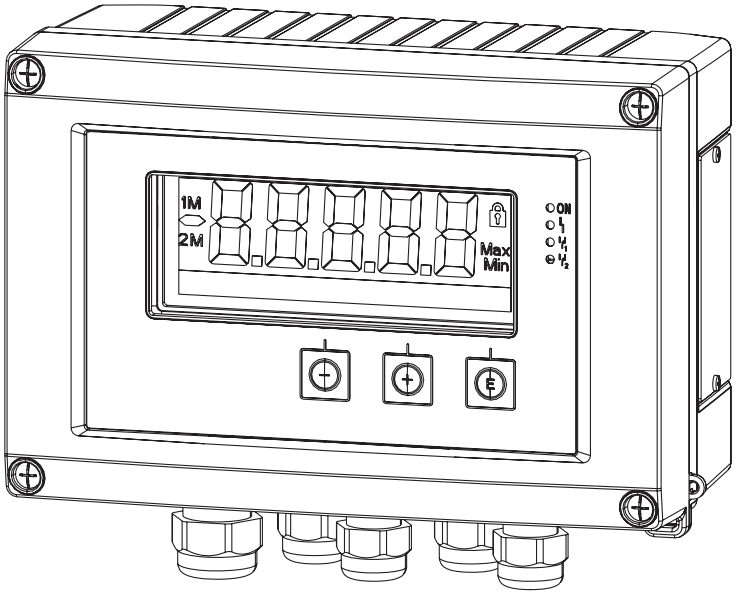
BA00274R/09/EN/02.13
71234733

SW Version
1.03.xx

Operating Instructions
RIA46
Field meter



Endress+Hauser
People for Process Automation

Brief overview

For quick and easy commissioning:

Safety instructions	→ 4
▼	
Installation	→ 7
▼	
Wiring	→ 10
▼	
Display and operating elements	→ 13
▼	
Commissioning	→ 21
Device configuration - explanation and use of all configurable device functions with the associated value ranges and settings.	

Block circuit diagram

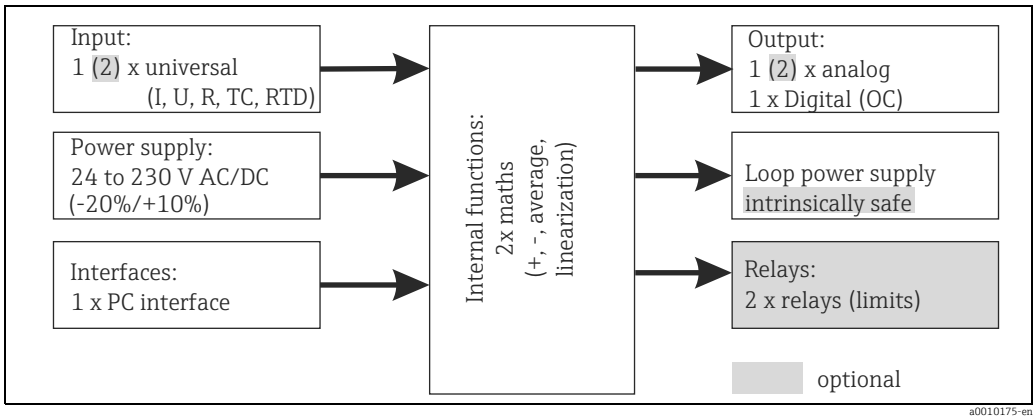


Fig. 1: Block circuit diagram

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1 Safety instructions

Safe operation of the device is only guaranteed if these Operating Instructions have been read and the safety instructions they contain have been observed.

1.1 Designated use

The device evaluates analog process variables and shows them on its multicolored display. Using the unit's outputs and limit relays, processes can be monitored and controlled. The device is equipped with a wide range of software functions for this purpose.
Power can be supplied to 2-wire sensors with the integrated loop power supply.

- The device is designed for installation in the field.
- The manufacturer accepts no liability for damages resulting from incorrect use or use other than that designated. The device may not be converted or modified in any way.

1.2 Installation, commissioning and operation

This device is designed to meet state-of-the-art safety requirements and complies with applicable standards and EU regulations. The device can be a source of application-related danger if used improperly or other than intended.
Installation, wiring, commissioning and maintenance of the device must only be carried out by trained technical personnel. The technical personnel must have read and understood these Operating Instructions and must strictly follow the instructions they contain. The information in the electrical wiring diagrams (see Operating Instructions, Section 4 'Wiring') must be observed closely.

1.3 Operational safety

Technical improvement
The manufacturer reserves the right to adapt technical details to the most up-to-date technical developments without prior notice. Contact your sales center for current information and updates to these Operating Instructions.

1.4 Return

For a return, e.g. in case of repair, the device must be sent in protective packaging. The original packaging offers the best protection. Repairs must only be carried out by your supplier's service organization.

Please enclose a note describing the fault and the application when sending the unit in for repair.

1.5 Notes on safety conventions and icons

Always refer to the safety instructions in these Operating Instructions labelled with the following symbols:

Symbol	Meaning
WARNING A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE A0011192-EN	NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury.
	ESD - Electrostatic discharge Protect the terminals against electrostatic discharge. Failure to comply with this instruction can result in the destruction of parts or malfunction of the electronics.
 A0011193	Indicates additional information, Tip

1.6 Other symbols used

Cross-references

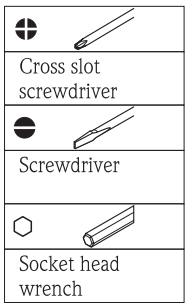


Reference to "see page"



Reference to "see figure"

Identification of tools



a0010735-en

2 Identification

2.1 Device designation

2.1.1 Nameplate

Compare the nameplate on the device with the following diagram:

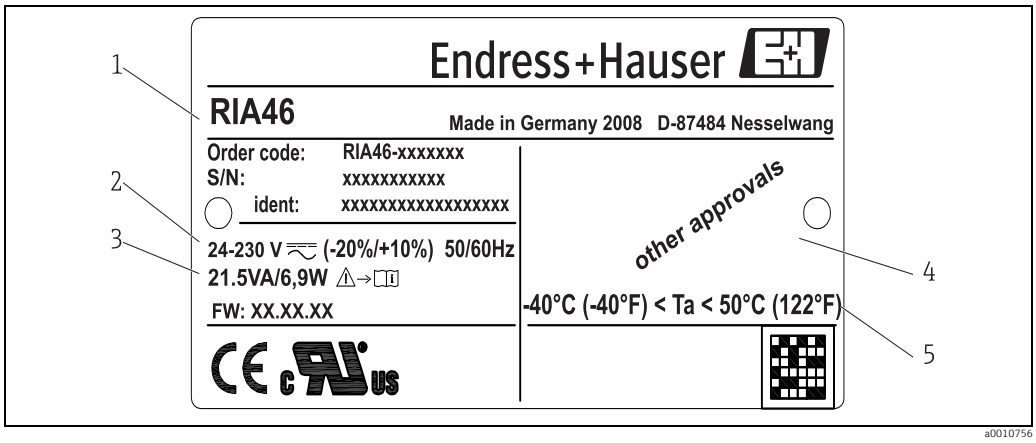


Fig. 2: Nameplate of the device (sample)

1 *Order code, serial number and ID number of the device*
2 *Power supply*
3 *Power consumption*
4 *Approval (if applicable)*
5 *Temperature range (if applicable)*

2.2 Scope of delivery

The scope of delivery of the device comprises:

- Field meter
- Hard copy of Brief Operating Instructions and Ex documentation (XA)
- Operating Instructions and additional documentation on CD
- Mounting plate (optional)
- Clamps and screws for pipe mounting (optional)

Please note the device accessories in Section 8 ’Accessories’ of the Operating Instructions.

2.3 Certificates and approvals

CE mark, Declaration of Conformity
The device is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. The device meets the relevant standards and directives as per EN 61 010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use".
Thus, the device described in these Operating Instructions meets the legal requirements of the EU directives. The manufacturer confirms successful testing of the device by affixing to it the CE mark.
An overview of all the certificates and approvals available can be found in Section 10 "Technical data".

3 Installation

3.1 Incoming acceptance, transport, storage

The permitted ambient and storage conditions must be observed. The precise specifications can be found in Section 10 "Technical data".

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- Are the packaging or contents damaged?
- Is anything missing from the delivery? Compare the scope of delivery with the information you specified in the order. See also section 2.2 "Scope of delivery".

3.1.2 Transportation and storage

Note the following points:
- Pack the device so that is protected against impact for storage and transportation. The original packaging provides optimum protection.
- The permitted storage temperature range is -40 to +85 °C (-40 to +185 °F); it is possible to store the device in the limit temperature ranges for a limited period (maximum 48 hours).

3.2 Installation conditions

The device is designed to be used in the field[1)].
The orientation is determined by the readability of the display. Cable entries are located on the bottom of the device.
Operational temperature range:
-40 to 50 °C (-40 to 122 °F)

⚠ WARNING

Loss of Ex approval if device is not properly installed

▶ When using the field meter in explosion hazardous area observe the installation conditions given in the corresponding safety notes.

NOTICE

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

▶ Do not operate the device in the upper temperature range over a longer period of time.

Readability of the display cannot be guaranteed at temperatures below -30 °C (-22 °F).

1) According to UL approval panel or surface mounting only.

3.3 Installation procedure

The device can be mounted directly to the wall with 4 screws ∅5 mm (0.2 in) or the optional mounting plate can be used for wall or pipe mounting.

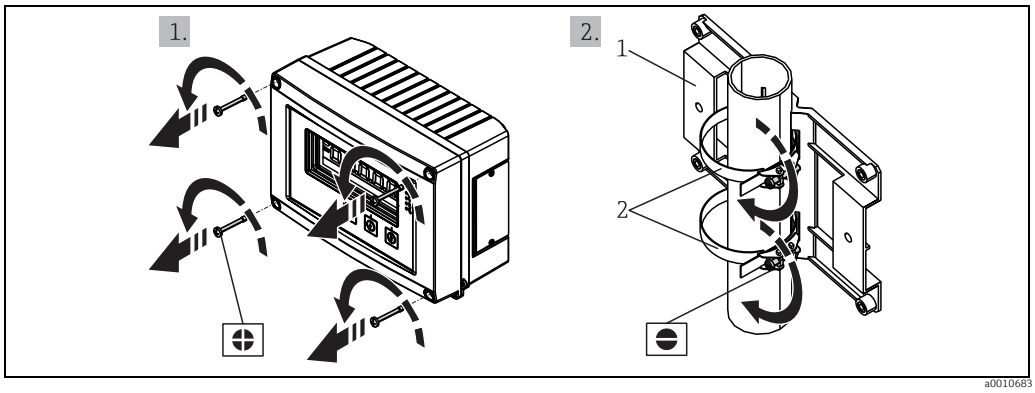


Fig. 3: Pipe mounting of the device

1: Mounting plate
2: Clamp for pipe mounting

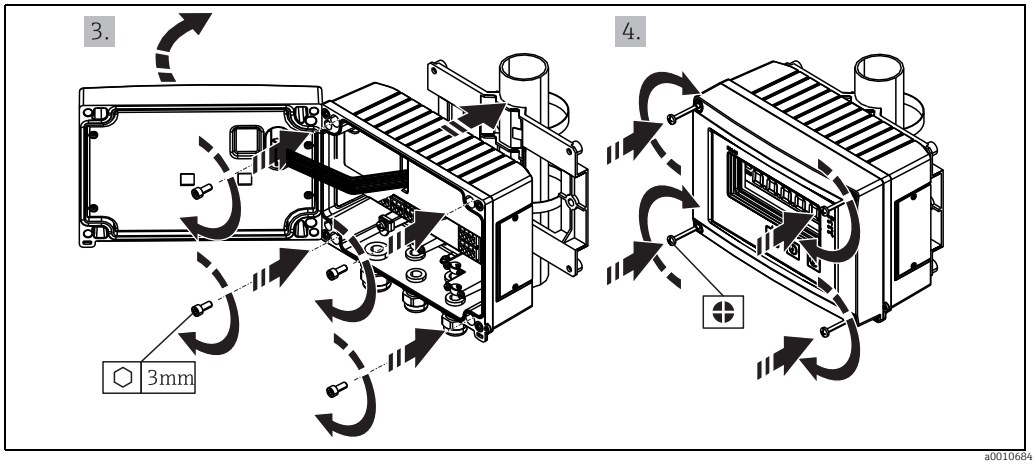


Fig. 4: Pipe Mounting of the device

3.4 Dimensions

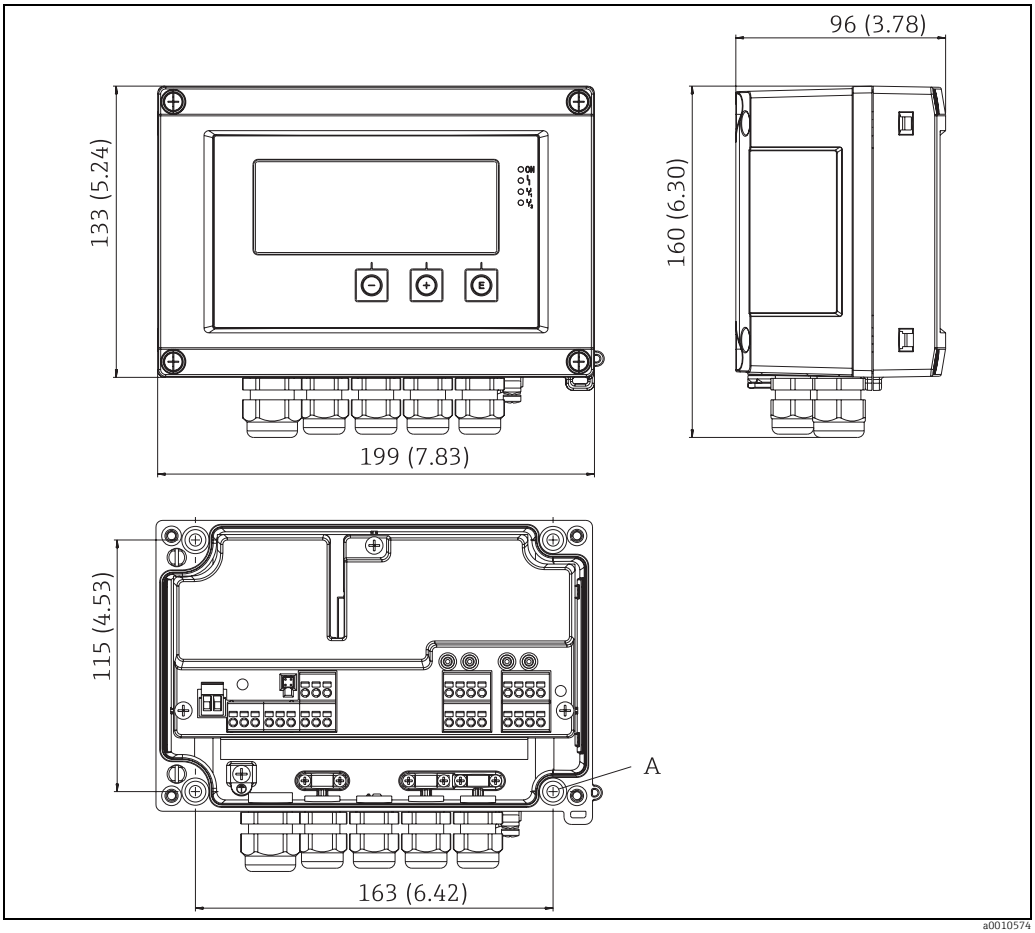


Fig. 5: Dimensions of the device in mm (in)

A: Drill-hole for direct wall mounting or on optional mounting plate with 4 screws ∅5 mm (0.2 in)

3.5 Post-installation check

- Is the sealing ring undamaged?
- Is the device firmly screwed to the mounting plate or the wall?
- Are the housing frame screws closed tightly?

4 Wiring

⚠ WARNING

Danger through electric tension

- Make sure that no voltage is supplied when wiring the device.
- The protective ground connection must be established before any other connection is made. A source of danger could arise if the protective ground connection is disconnected.
- Provide a suitable switch or power-circuit breaker in the building installation. This switch must be provided within easy reach of the device and be labelled as a disconnector.

NOTICE

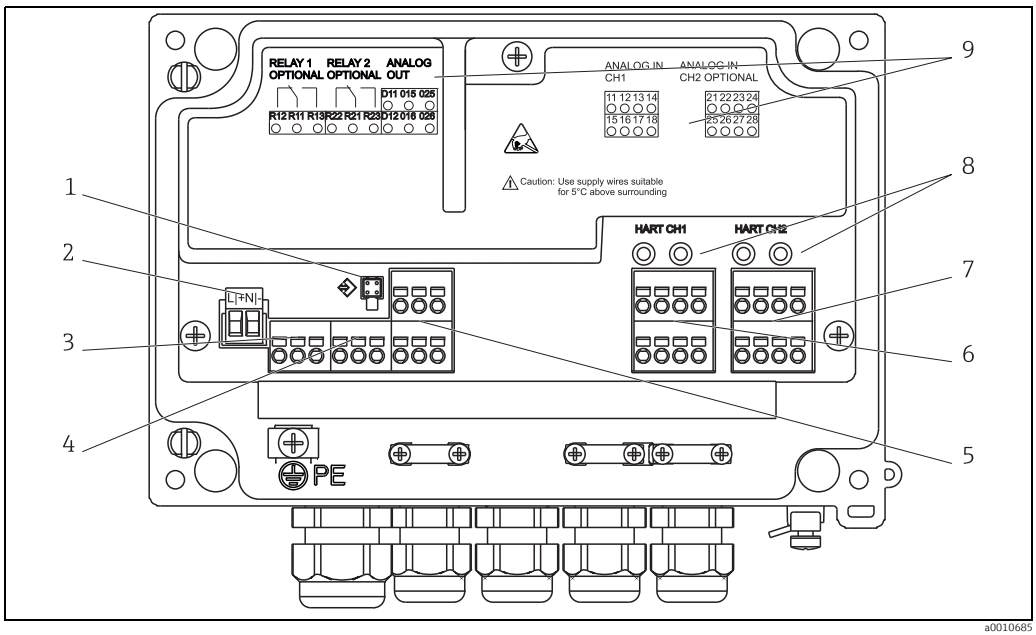
Damage of the device through incorrect wiring or overvoltage

- Use wires suitable for 5 °C (9 °F) above surrounding.
- Prior to commissioning, make sure the supply voltage matches the specifications on the nameplate (left side of the housing).
- An overcurrent protection unit (nominal current = 10 A) is required for the power cable.
- Observe the terminal designation inside the device.

It is permitted to connect a mixture of safety extra low voltage and voltage which poses a shock hazard to the relays.

4.1 Connecting the device

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



a0010685

Fig. 6: Inside view and terminal assignment of the device

1: Connection socket for interface cable
2: Connection supply voltage
3: Connection relay 1 (optional)
4: Connection relay 2 (optional)
5: Connection analog and status output
6: Connection analog input 1
7: Connection analog input 2 (optional)
8: HART® connection sockets
9: Laser labelling of terminal assignment

Overview of possible connection options at the device

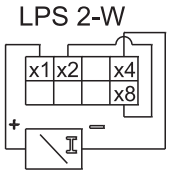
Terminal assignment of analog inputs, channel 1 and 2



a0010406

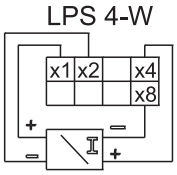
Connection of the loop power supply

2-wire



a0010407

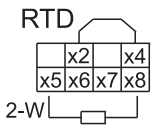
4-wire



a0010408

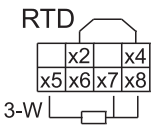
Connection of the analog input

RTD/resistance 2-wire



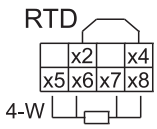
a0010581

RTD/resistance 3-wire



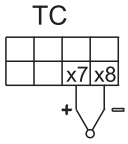
a0010582

RTD/resistance 4-wire



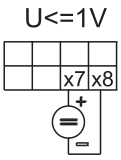
a0010583

Thermocouple



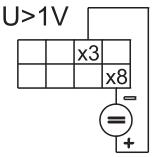
a0010409

U ≤ 1 V



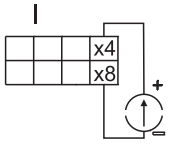
a0010410

U > 1 V



a0010411

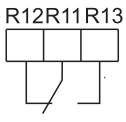
Current



a0011934

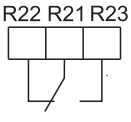
Connection of the relays

Relay 1



a0010740

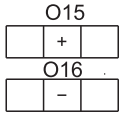
Relay 2



a0010741

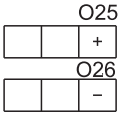
Connection of the analog output

Analog output 1

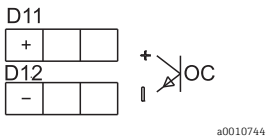
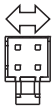


a0010742

Analog output 2



a0010743

Connection of the digital output
Digital output/open collector  a0010744
Connection of the power supply
24 to 230 V (-20%/+10%) 50/60 V AC/DC  a0010746 No grounding conductor is connected for the plastic housing. For the aluminum housing, a grounding conductor can be connected at the grounding connection inside the housing.
Interface for configuring with the FieldCare PC software
 a0010417

NOTICE

High-energy transients can damage the device

▶ For long signal lines fit a suitable surge arrester upstream.

4.2 Post-connection check

Device condition and specifications	Notes
Are the device or cables damaged?	Visual inspection
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	24 to 230 V (-20%/+10%) 50/60 Hz AC/DC, 50/60 Hz
Are the power supply terminals firmly engaged in their correct slot?	-
Are the mounted cables strain-relieved?	-
Are the supply voltage and signal cables connected correctly?	See connection diagram on the housing.

5 Operating elements and display

The easy operating concept of the device makes it possible for users 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.
Brief explanatory (help) texts provide additional information on individual parameters.

5.1 Operating elements

5.1.1 Local operation at the device

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



	▪ Open the configuration menu ▪ Confirm an entry ▪ Select a parameter or submenu offered in the menu
	Within the configuration menu: ▪ Scroll step-by-step through the parameters/menu items/characters offered ▪ Change the value of the selected parameter (increase or decrease) Outside the configuration menu: ▪ Display enabled and calculated channels, as well as min. and max. values for all the active channels.

You can always exit items/submenus at the end of the menu by selecting "x Back".
Leave the setup directly without saving the changes by pressing the '-' and '+' keys simultaneously for over 3 seconds.

5.1.2 Configuration via interface & FieldCare Device Setup PC configuration software

⚠ CAUTION

Undefined switching of outputs and relays possible while configuring with FieldCare

▶ Do not configure during running process.

To configure the device with 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.
The 4-pin connector of the interface cable must be plugged into the corresponding socket on the rear of the device and the USB connector must be plugged into a free USB slot on the PC.

Installing the Windows driver for the TXU10/FXA291

To install the Windows driver Administrator rights are required. 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 assistant opens.
2. In the installation assistant, do not carry out the automatic search for a driver. For this, choose "No, not this time" and click "Next".
3. In the subsequent window, choose "Install 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 located.
5. The driver is installed. Finish the installation by clicking "Finish".
6. A further device is detected and the Windows installation assistant opens once more. Again, choose "No, not this time" and click "Next".
7. In the subsequent window, choose "Instal 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 located.
9. The driver is installed. Finish the installation by clicking "Finish".

The installation of the Windows driver for the interface adapter is now complete. Which COM-Port has been assigned for the adapter can be seen in the Windows device manager.

Installing the communication DTM in FieldCare

Before the configuration of the device can be done, FieldCare Device Setup must be installed on your PC. The installation instructions can be found in the FieldCare instructions. Subsequently, install the FieldCare device driver according to the following instructions:

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

Establishing the connection

To establish the connection with FieldCare, proceed as follows:

1. Firstly, edit the connection macro. For this, start a new project and in the window displayed, click with the right mouse button on the symbol for "Service (CDI) FXA291" and choose "Edit".
2. In the following window, next to "Serial interface", select the COM port which has been assigned during the installation of the Windows driver for the TXU10/FXA291 adapter.
3. The macro is now configured. Complete configuration by clicking "Finish".
4. Start the macro "Service (CDI) FXA291" by double-clicking it and confirm the subsequent query with "Yes".
5. A connected device is searched and the suitable DTM is automatically opened. The configuration starts.

To then configure the device itself, follow these Operating Instructions for the device. The entire Setup menu, i.e. all the parameters listed in these Operating Instructions, can also be found in the 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 purpose, select:
Menu → **Setup / Expert** → **System** → **Overfill protect** → **German WHG** and confirm.

5.2 Display and device status indicator/LED

The device 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 explained in detail in Section 6.4.

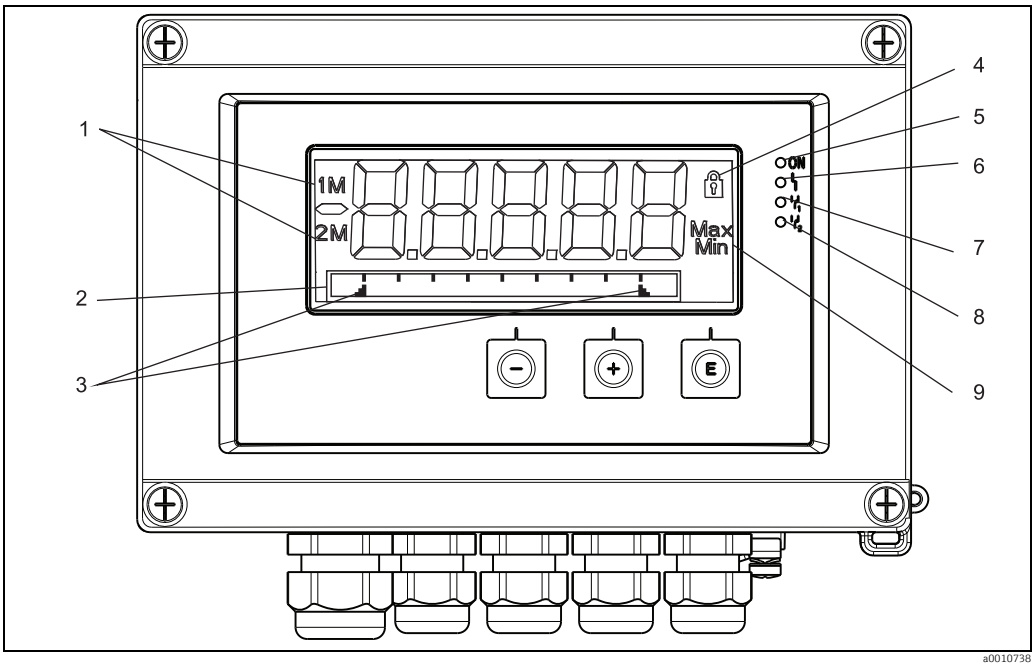


Fig. 7: Display of the device

1: Channel display: 1: analog input 1; 2: analog input 2; 1M: calculated value 1; 2M: calculated value 2
2: Dot matrix display for TAG, bar graph and unit
3: Limit value indicators in the bar graph
4: "Operation locked" indicator
5: Green LED; on - supply voltage applied
6: Red LED; on - error/alarm
7: Yellow LED; on - relay 1 energized
8: Yellow LED; on - relay 2 energized
9: Minimum/maximum value indicator

In the event of an error, the device switches automatically between displaying the error and displaying the channel, see Section 6.5.3 and Section 9 ‘Troubleshooting’.

5.3 Icons

5.3.1 Display icons

	Device is locked/operating lock; the device setup is locked against changes to parameters, the display can be modified.
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 display shows: – – – – –

In the dot matrix section, the error and channel name (TAG) are specified.

5.3.2 Icons in the editing mode

The following characters can be used to enter user-defined text:
‘0-9’, ‘a-z’, ‘A-Z’, ‘+’, ‘-’, ‘*’, ‘/’, ‘\’, ‘%’, ‘°’, ‘²’, ‘³’, ‘µ’, ‘.’, ‘,’, ‘;’, ‘:’, ‘!’, ‘?’, ‘_’, ‘#’, ‘$’, ‘“”, ‘ ´ ’, ‘(’, ‘)’, ‘~’
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 the setup
	Symbol for the Expert setup
	Symbol for diagnostics
	Accept entry. If this icon is selected, the information entered is accepted at the position and the user exits the editing mode.
	Reject entry. If this icon is selected, the information entered is rejected and the user exits the editing mode. The text configured beforehand remains unchanged.
	Move one position to the left. If this icon is selected, the cursor moves one position to the left.
	Delete back. If this icon is selected, the character to the left of the cursor is deleted.
	Delete all. If this icon is selected, all the information entered is deleted.

5.4 Quick guide to the operating matrix

The following tables show all menus and the operating functions.

Display menu		Description
E	AI1 Min-max-reset*	Reset the min/max values for Analog in 1
+	AI2 Min-max-reset*	Reset the min/max values for Analog in 2
+	CV1 Min-max-reset*	Reset the min/max values for Calc value 1
+	CV2 Min-max-reset*	Reset the min/max values for Calc value 2
+	Analog in 1	Display setting for Analog in 1
+	Analog in 2	Display setting for Analog in 2
+	Calc value 1	Display setting for Calc value 1
+	Calc value 2	Display setting for Calc value 2
+	Contrast	Display contrast
+	Brightness	Display brightness
+	Alternating time	Switchover time between values chosen to be displayed
+	Back	Return to main menu
*) Is only displayed if "Allow reset" = "Yes" is set in the "Expert" menu for the corresponding channel.		

Setup menu			Description
E	Application		Application selection
		1-channel	1-channel application
		2-channel	2-channel application
		Diff-pressure	Difference 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%*		Lower limit for bargraph of calculated value
+	CV Bar 100%*		Upper limit for bargraph of calculated value
+	Linearization*		Linearization of calculated value
		No lin points	Number of linearization points
		X-value	X-values for linearization points
		Y-value	Y-values for linearization points

Setup menu		Description
+	Analog in 1	Analog input 1
	Signal type	Signal type
	Signal range	Signal range
	Connection	Connection type (only for Signal type = RTD)
	Lower range	Lower limit of measuring range
	Upper range	Upper limit of measuring range
	Tag	Designation of analog input
	Unit	Unit of analog input
	Offset	Offset of analog input
	Ref junction	Reference junction (only for Signal type = TC)
	Reset min/max	Reset min/max value 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 of calculated value
	Bar 0%	Lower limit for bargraph of calculated value
	Bar 100%	Upper limit for bargraph of calculated value
	Factor	Factor for calculated value
	Offset	Offset for calculated value
	No lin points	Number of linearization points
	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	Assignment for analog output
	Signal type	Signal type of 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 function for relay
	Set point	Set point for relay
	Set point 1/2	Set points 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

Setup menu		Description
+	Back	Return to main menu
*) Is only displayed if "Application" = "Diff pressure" is configured.		

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

Expert menu				Description
E	Direct access			Direct access to an operting function
+	System			System settings
		Access code		Protection of operating menu by means of access code
		Overfill protect		Overfill protection
		Reset		Device reset
		Save user setup		Save settings made in the setup
+	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 bargraph of analog input
			Bar 100%	Upper limit for bargraph of analog input
			Decimal places	Decimal place 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	Error limits according Namur
			Open circ detect	Activate open circuit detection (1-5 V)
			Failure delay	Delay time for failure
			Allow reset	Allow reset of min/max values via Display menu

Expert menu			Description
+	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)
	Relay 1 / 2		Relay 1/2
		Time delay	Switching delay time
		Operating mode	Operating mode
		Failure mode	Behavior in the event of an error

6 Commissioning

6.1 Post-installation check and switching on the device

Make sure that all post-connection checks have been carried out before you commission your device:
- 'Post-installation check' checklist in Section 3.5
- 'Post-connection check' checklist in Section 4.2

Once the operating voltage is applied, the display lights up and the green LED indicates that the device is operational.
When you commission the device for the first time, you program the setup in accordance with the descriptions provided in these Operating Instructions in the following sections. When commissioning a device already configured or preset, measuring is immediately started as per the settings. The values of the channels currently activated appear on the display. Changes to the display can be made in the Display menu item (→ 31 'Step 7: Configuring the display functions').

Remove the protective foil from the display as this restricts display legibility otherwise.

6.2 General information on the device configuration

You can commission/configure your device locally using the three integrated keys, or by PC. You require the Commubox FXA291 to connect the device to a PC (see 'Accessories' section).

Advantages of configuring the device using FieldCare Device Setup:
- The device data are saved in the FieldCare Device Setup and can be called up at any time.
- Entries can be made more quickly using the keyboard.

6.3 Notes on setup access protection

Access to the setup is enabled when the device leaves the factory. Access can be locked via the setup.

Proceed as follows to lock the device:

1. Press '**E**' to get to the configuration menu
2. Press '**+**' , '**Setup**' is displayed → press '**E**'
3. Press '**+**' again until '**System**' is displayed, press → '**E**'
4. '**Access code**' is displayed, press → '**E**'
5. Set the code: the desired numerical value is configured by pressing the '**+**' and '**-**' keys. The access code is a four-digit number. The corresponding position of the number is displayed in plain text.
   To confirm the value entered and to go to the next position, press '**E**'.
6. Confirm the last position of the code to exit the menu. The code is displayed in full. Press '**+**' to scroll to the last point of the '**x Back**' submenu and confirm this point. As a result, the value is accepted and the user returns to the level of the '**Setup**' item. Also exit this submenu via the last '**x Back**' parameter to get back to the measured value/channel display.

The '**x Back**' point can be found at the end of every picklist/menu item. If you confirm this parameter, you go from the submenu to the higher-order menu, or you exit the setup.

6.4 Configuring the device

Configuration steps:

1. Select the application conditions (only for 2-channel devices) (→ 22)
2. Configure the universal input(s) (→ 24)
3. Configure the calculations (→ 26)
4. Configure the analog output(s) (→ 26)
5. Configure relays (if option selected); assign and monitor limit values (→ 27)
6. Advanced device configuration (access protection/operating code; saving the current setup/user setup) (→ 31)
7. Configure the display functions (→ 31)

The following section provides a detailed account of how to set up the two-channel device and the differential pressure application package (brief overview of the configuration → 24, only available in the two-channel version). If you want to configure a single-channel device, please proceed as explained in Section 6.4.2.

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

Application conditions of a 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 point of the setup. The following options are available:

1. Differential pressure ('**Diff pressure**'): application package; parameters are automatically preconfigured for you.
2. Single channel ('**1-channel**'): universal input 2 ('**Analog in 2**') is deactivated ('**off**') from the software side. The second channel can always be activated at a later stage via '**Setup**' → **'Analog in 2'** (→ 24).
3. Two channels ('**2-channel**'): universal input 1 ('**Analog in 1**') and universal input 2 ('**Analog in 2**') are preconfigured with the following values:
   – Signal type ('**Signal type**'): '**Current**'
   – Signal range ('**Signal range**'): '**4-20mA**'

The following section provides a detailed description of the "Differential pressure" application package.
To set up the device in single-channel/two-channel applications, please proceed with the device setup as explained in Section 6.4.2 (analog input 1 ('**Analog in 1**')).

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

Differential pressure application

A concise setup is available for differential pressure applications.
Once the differential pressure application setup has been successfully completed, the configured parameters of the analog inputs and the linearization points are used to automatically form the difference between the two inputs and linearize the signal. As a result, the volume is already shown on the display (= calculated value 2).

NOTICE

The following is essential to ensure values are calculated correctly and that the setup functions properly:

- Sensor 1 returning the higher pressure: connected to analog input 1 ('**Analog in 1**')
- Sensor 2 returning the lower pressure: connected to analog input 2 ('**Analog in 2**')

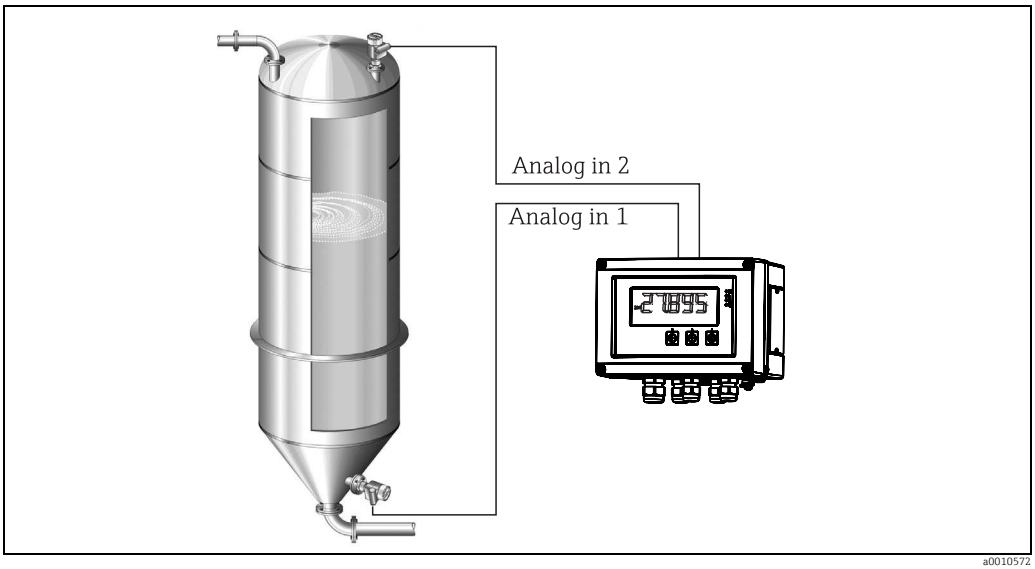


Fig. 8: Differential pressure application

Setup → Application → Diff pressure

After selecting the differential pressure application by confirming the "Diff pressure" parameter, the parameters, which are displayed in succession and can be edited, must be configured individually for your application.
Some parameters are already configured for you by selecting the application setup (→ 24).
The parameter "CV Factor" serves for the regard of the density of the medium at level measurement, i.e. it equates the mathematic formula 1/(density*gravitational acceleration). The standard value of the factor is 1.
At this the density is to be named in kg/m^3 and the pressure in Pascal (Pa) or N/m^2. The gravitational acceleration is defined by the constant on the earth's surface.
It amounts $g=9.81 m/s^2$.
Tables and examples for the conversion of application related units into the defined values kg/m^3 and Pa respectively N/m^2 can be found in the appendix, → 53.

If you want to activate other parameters (see Step 4, 5, 6 and 7 or offset for analog inputs, display original values of analog channels, etc.), you can do so afterwards in the setup of the corresponding parameter.

'Setup' menu item

Setup → **Application** → '**Diff pressure**'	
Preconfigured by application package	Submenu
Setup analog inputs → Signal: '**Current**' → Range: '**4-20 mA**' (→ 🖹 22 Step 1 and 2)	'**AI1 Lower range**': start of measuring range, analog input 1 (corresponds to 4 mA for example)
	'**AI1 Upper range**': end of measuring range, analog input 1 (corresponds to 20 mA for example)
	'**AI2 Lower range**': start of measuring range, analog input 2 (corresponds to 4 mA for example)
	'**AI2 Upper range**': end of measuring range, analog input 2 (corresponds to 20 mA for example)
→ **CV Factor**	Factor for the regard of the density of the medium at level measurement, i.e. it equates the formula 1/(density*gravitational acceleration); Standard value: 1
Setup display → Display: calculated value and bar graph for Calc Value 2: Active; all other values inactive (→ 🖹 22 Step 7)	'**CV Unit**': unit of the calculated volume value (e.g.liters)
	'**CV Bar 0%**': start of measuring range for bar graph display
	'**CV Bar 100%**': end of measuring range for bar graph display
Setup calculation of the volume: → '**Calc value 1**': '**Difference**' → '**Calc value 2**': '**Lineariz. CV1**' (→ 🖹 22 Step 3)	Create the linearization table: If the volume value should be calculated - i.e. a linearization of the difference is output - the X and Y coordinates have to be specified as the basis for performing the calculation.
	'**No lin points**': number of linearization points required (max. 32)
	'**X-value**': X-coordinate for linearization point X1, 2, ...
	'**Y-value**': Y-coordinate for linearization point X1, 2, ...
	End differential pressure setup

6.4.2 Step 2: Configuring the universal input(s) ('AnalogIn 1/2')

The device has one universal input, and optionally another universal input for current ('**Current**'), voltage ('**Voltage**'), resistance thermometer ('**RTD**') or thermocouples ('**TC**'). The input is monitored for a cable open circuit (see "Measuring range limits" table (→ 🖹 37) and "Troubleshooting" section (→ 🖹 40).

Minimum/maximum values at the inputs:

The current min./max. value is saved every 15 minutes. If the power supply is disconnected (mains off/mains on), a gap in the recording may result. 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 should be configured as described in Step 5 (→ 🖹 27).

Each universal input saves the smallest and biggest measured value measured. These values can be reset individually for every channel. In the setup, the administrator can decide whether 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. It is reset in the event of a Reset and if the scaling of the channel is changed.

<table>
<tr><td colspan="5">Setup</td></tr>
<tr><td colspan="5">Analog in 1
Analog in 2</td></tr>
<tr><td>Current</td><td>Voltage</td><td>RTD (resistance thermometer)</td><td>TC (thermocouple)</td><td rowspan="10">Off
Deactivate the input</td></tr>
<tr><td colspan="4">Signal range
Signal range (see Technical data); start and end of measuring range defined by type selected</td></tr>
<tr><td colspan="2">Lower range
Start of measuring range; also enter decimal point</td><td rowspan="2">Connection only RTD
Type of connection (2-, 3-, 4-wire connection)</td><td rowspan="2"></td></tr>
<tr><td colspan="2">Upper range
End of measuring range; also enter decimal point</td></tr>
<tr><td colspan="4">TAG
Channel identifier</td></tr>
<tr><td colspan="4">Unit
Unit</td></tr>
<tr><td colspan="4">Offset
Constant value that is added to the current measured value</td></tr>
<tr><td colspan="3"></td><td>Ref junction (TC only)
intern / fixed + entering "Fixed ref junc" value</td></tr>
<tr><td colspan="4">Res minmax: (yes/no)
Reset minimum/maximum values?</td></tr>
</table>

6.4.3 Step 3: Configuring the calculations

One or two channels with the following functions are available for calculations:

Setup	
Calc value 1	**Calc value 2**
▪ Switched off ▪ Sum (AI1+AI2) ▪ Difference (AI1-AI2) ▪ Average ((AI1+AI2)/2) ▪ Linearization AI1 ▪ Multiplication	▪ Switched off ▪ Sum (AI1+AI2) ▪ Difference (AI1-AI2) ▪ Average ((AI1+AI2)/2) ▪ Linearization AI2 ▪ Linearization CV1 ▪ Multiplication
TAG **Unit** **Bar 0%** **Bar 100%** **Factor** **Offset**	To be configured like universal input (see Step 2 → 24)
No. lin points → X/Y coordinates 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 has to be specified for each linearization point. The linearization tables can be deactivated individually.	
Res minmax	To be configured like universal input (see Step 2 → 24)

6.4.4 Step 4: Configuring the analog output(s)

The device is fitted with an analog output (optionally with two analog outputs).
These outputs can be freely assigned to the inputs and channels available in the device.

Setup	
Analog out 1 **Analog out 2**	
Assignment: assignment of the output ▪ **Off**: switched off ▪ **Analog input 1**: universal input 1 ▪ **Analog input 2**: universal input 2 ▪ **Calc value 1**: calculated value 1 ▪ **Calc value 2**: calculated value 2	
Signal type: 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 if it continues to drop), the current remains at the limits 3.8mA or 20.5 mA. 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.
Lower range **Upper range**	To be configured like universal input (see Step 2 → 24)

6.4.5 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 position of the decimal point. 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 a fault indicator relay and switches for every fault or alarm.
The following settings can be made for each of the two limit values: assignment, function, set point, hysteresis, operating mode[2)], time delay[2)] and failure mode[2)].

Please configure the following parameters to activate the function of the limit value monitoring system or the relays:

Setup	
Relay 1 **Relay 2**	
Assignment: Which value should be monitored?	**Off**, Analog input 1, Analog input 2, Calc value 1, Calc value 2, Error
Function: Operating mode of the relay (for a description, see "Operating modes")	**Min.**, Max., Gradient, Out-band, In-band
Set point: **Set point 2:** Limit value	Enter the limit value with the position of the decimal point. Set point 2 is only displayed for outband and inband.
Time base: Time base of gradient calculation	Enter the time base in seconds. Only for operating mode Gradient.
Hysteresis Hysteresis. The switch point can be controlled by means of a hysteresis for every limit value.	The hysteresis is configured as an absolute value (only positive values) in the unit of the channel in question (e.g. upper limit value = 100m, hysteresis = 1m: limit value on = 100m, limit value off = 99m)

- Please note special situations if 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	Changeover
Maximum contact burden DC	30 V / 3 A (permanent state, without destruction of the input)
Maximum contact burden AC	250 V / 3 A (permanent state, without destruction of the input)
Minimum contact load	500 mW (12 V / 10 mA)
Galvanic isolation towards all other circuits	Test voltage 1500V AC
Switching cycles	> 1 million

2) can only be set in the menu Expert/Output/Relay

Default setting	Normally closed: Rest contact Rx1/Rx2

Operating modes

Off

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

Min (lower limit value)

The limit value is active if the value configured is undershot. The limit value is switched off again if the limit value incl. hysteresis is overshot.

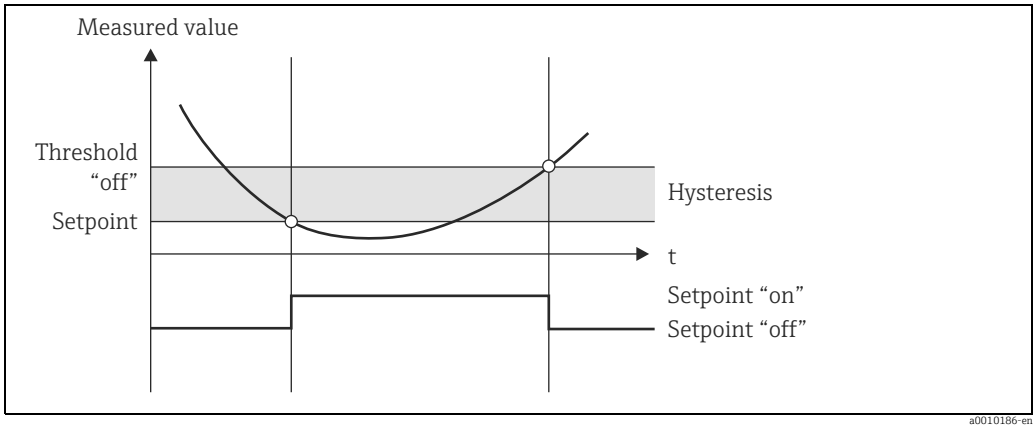


Fig. 9: Min operating mode

Max (upper limit value)

The limit value is active if the value configured is overshot. The limit value is switched off again if the limit value incl. hysteresis is undershot.

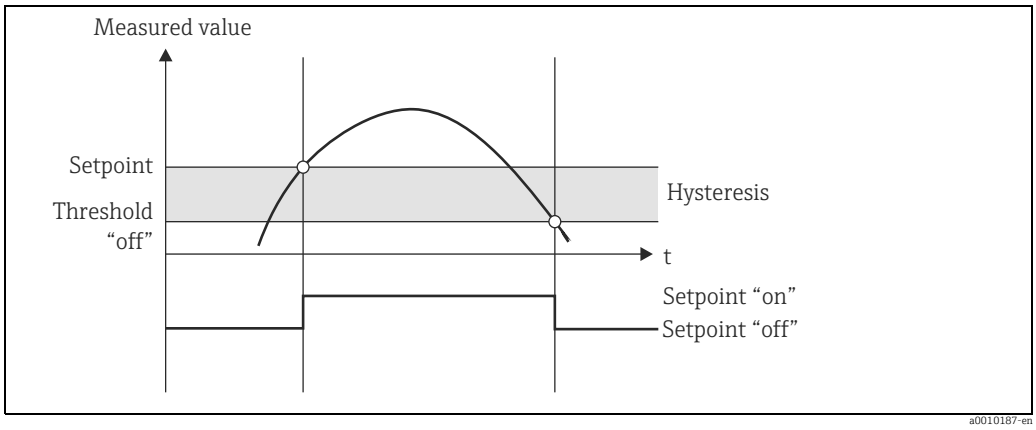


Fig. 10: Max operating mode

Gradient

The "Gradient" operating mode is used to monitor the change in the input signal over time. The alarm is triggered if the measured value reaches or overshoots the set value. If the user configures a positive value, the limit value is monitored for rising gradients.
In the event of negative values, the falling gradient is monitored.
The alarm ends if the gradient drops below the set value again. A hysteresis is not possible for the Gradient operating mode. The alarm can be damped by means of the delay time function (second (s) unit) to reduce the sensitivity.

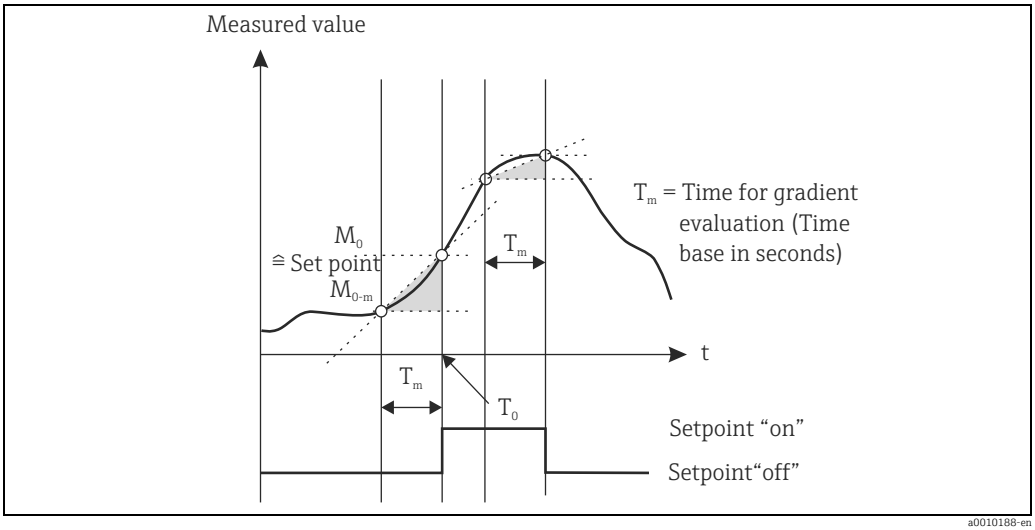


Fig. 11: Gradient operating mode

Outband

The limit value is violated as soon as the measured value to be checked drifts into a band specified beforehand by minimum and maximum values. The hysteresis is located at the outsides of the band.

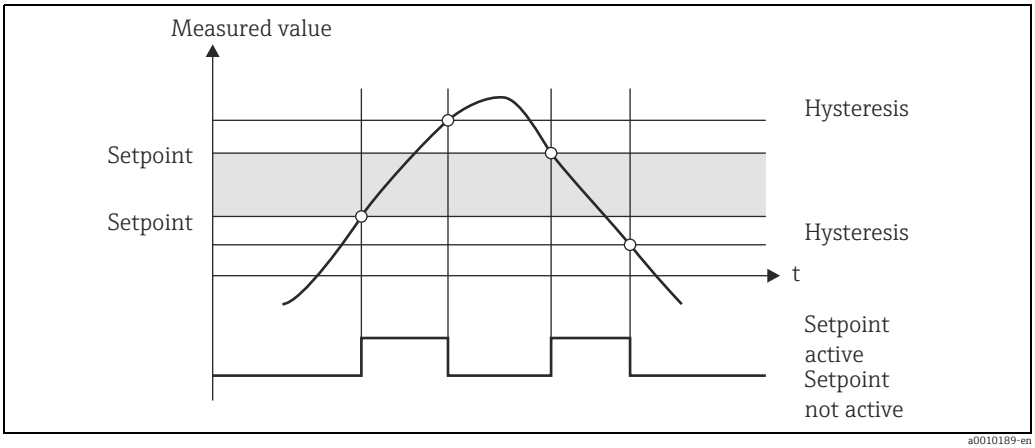


Fig. 12: Outband operating mode

Inband

The limit value is violated as soon as the measured value to be checked drops below or exceeds a minimum or maximum value specified beforehand. The hysteresis is located at the insides of the band.

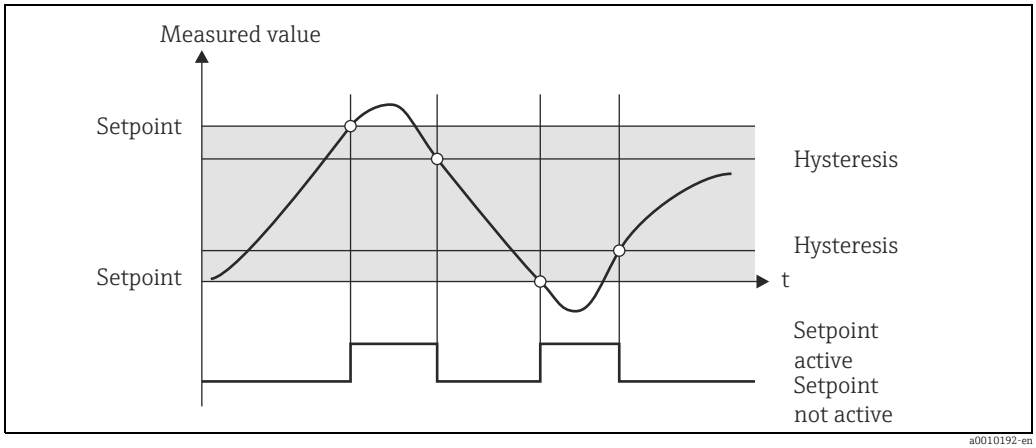


Fig. 13: Inband operating mode

Special situation: hysteresis and delay at one limit value

In special cases when the hysteresis and limit value display are activated, a limit value is switched based on the following principle.
If the hysteresis and limit value delay are activated, the delay is activated when a limit value is overshot and measures the time since the value overshoot began. If the measured value drops back below the limit value, the delay is reset again. This also happens if the measured value falls under the limit value but is still above the specified value of the hysteresis. The next time the limit value is exceeded, the delay time becomes active and starts measuring from 0.

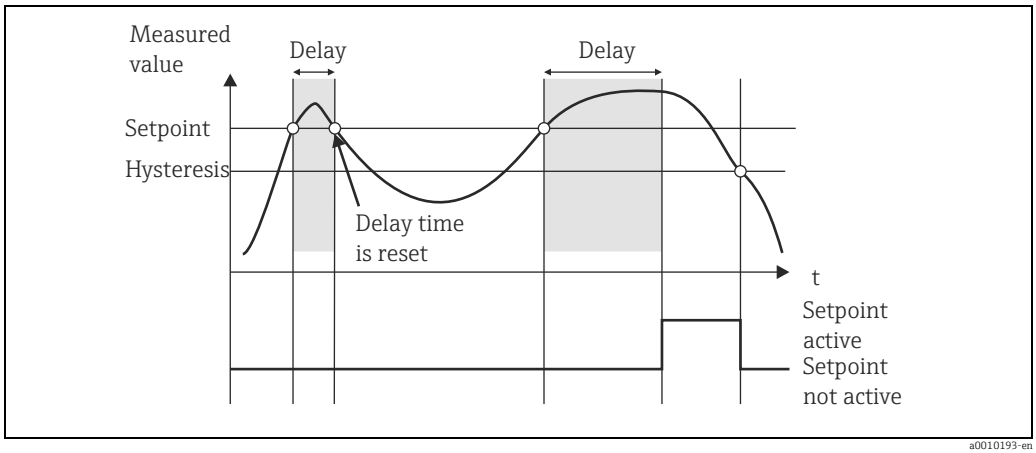


Fig. 14: Hysteresis and delay active

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

Access protection

The access protection locks all the editable parameters, i.e. 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 up the menu '**Setup**' → '**System**' → '**Access code**'
2. To enter the code with the '**+**' and '**-**' keys, select the desired character and confirm with '**E**'. The cursor goes to the next position. Once the fourth position has been confirmed, the entry is accepted and the user exits the **'Access code**' submenu.

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

If access protection is enabled, the device locks automatically after 600 seconds if it has not been operated in 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 confirm with 'E'.

Saving the current setup/user setup

The current configuration of the device can be saved and is thus available as a specific setup for a device reset or for a device restart. If you ordered the device with customized settings which you specified, the preconfigured setup is also saved in the user setup.
Saving the setup:
Call up the menu '**Expert**' → '**System**' → '**Save User Setup**'. Confirm by configuring 'Yes'. See also → 38, Device reset.

6.4.7 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.
All the active channels (analog inputs and calculated values) are offered for selection.
To configure the display: press '**E**' and select '**Display**'.
Select → channel / calculated value and configure one of the following parameters.

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 stages 1 to 7)
→ **Brightness**: select brightness (can be configured in stages 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 higher-order menu.

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.

6.4.8 Overfill protection

In accordance with Annex 2, Section 2(3) and Section 4 of TRbF 510 (Regulation/ construction and inspection guidelines for overfill protection units), and in accordance with the approval guidelines for overfill protection units (ZG-ÜS), the device can be used as a limit signal transmitter for overfill protection units with continuous level measurement for storing combustible and noncombustible liquids which are hazardous to water.
Reason:
The device meets the requirement that plant units without an inspection label have to comply with the general and special construction and inspection principles for overfill protection in accordance with Annex 2, Section 4, in the following situations:

a. in the event of power supply failure and
b. if limit values are overshot or undershot and
c. if the connection wires between the upstream isolating transmitter and the meter are disconnected, the safety-oriented message "Maximum level" appears (the limit relay deenergizes).

The set limit values for overfill protection must be protected against unintentional modification.

The following function must be activated if additional access protection should be provided for the configuration software:
Select **Expert / Setup** → **System** → **Overfill protect**: German WHG.

Configuration when operating the device in accordance with TRbF510:
The device must be set up and operated in accordance with these Operating Instructions which belong to the device.

- Universal inputs have to be configured (as described in Step 1 - Step 3 (→ 22 ff.)).
- Limit values have to be configured as follows (as described in Step 5, → 27):
  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*: no switching delay (=0) or the set time must be taken into account for the tail quantity
  Operating mode*: norm closed (relay is de-energized if the limit value is violated; set at the factory)
  Failure mode*: norm closed (relay is de-energized in the event of an error; set at the factory)
  *) Only in the Expert menu.
- The device must be locked against access from non-authorized persons;
  User code protects the parameters configured (as Step 6, → 31):
  Enter the 4-digit code: select digit with '+' or '-' and confirm the individual digit with 'E'; 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 has to be changed if configuring the device by means of the FieldCare operating software, i.e. WHG must be disabled to be able to change parameters.

6.4.9 Expert menu

You activate the Expert mode by pressing '**E**' → '**Expert**'
The Expert menu offers advanced device settings to be able to adapt the device optimally to the application conditions.
An access code is needed to access the Expert menu. This code is preset at the factory as "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 parameters of the normal setup are explained 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 damped by means of a low-pass filter.
The damping is specified in seconds (can be configured in steps of 0.1 seconds, max. 999.9s).

Default values:

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

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

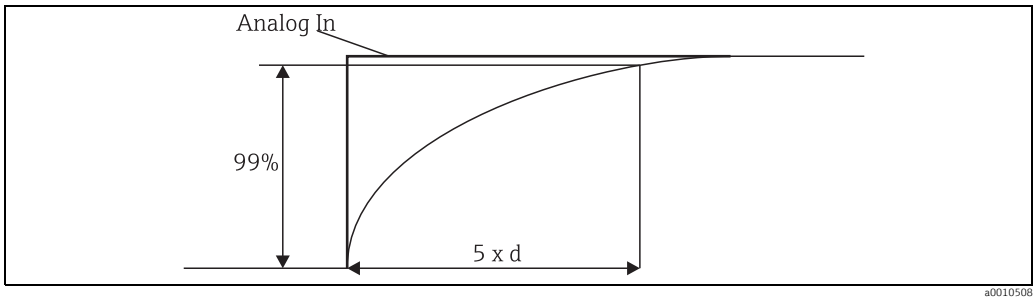


Fig. 15: Signal damping

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 since 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 a fault state. The error flag is also transmitted if the signal is processed further.

Namur NE43

Only for 4...20 mA. The measured value and the cables are monitored in accordance with NAMUR NE43 recommendations. See → 37 for this purpose. Default value: enabled

Open circ detect

Only for 1-5 V. Open circuit monitoring of the input.

Failure delay

Delay time for failure, 0-9999 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 lock resetting of this memory.

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:
  A constant value for output in the event of an error can be entered.

Output → Relay 1/2

Time delay

Setting the time delay for relay switching.

Operating mode

Operating mode of the relay:

- norm opened
- norm closed

Failure mode

- norm opened
- norm closed

NOTICE

Setting the limit relay failsafe mode

▶ The failsafe mode of the limit relay is configured in the setup. If an input to which a limit value is assigned experiences an error, the limit relay assumes the configured status. The effect of the limit relay in the event of an error must be specified in the setup (energizes or de-energizes). If a failsafe mode with a fixed error substitute value is configured in the input assigned, 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 specifies that the relay is energized.

Application → Calc value 1/2

Failure mode:
- Invalid:
  The calculated value is not valid and is not output.
- Fixed value:
  A constant value for output in the event of an error can be entered.

Diagnostics

Verify HW set

If the hardware has been upgraded (e.g. contains additional relays, universal inputs etc.), hardware verification has to be performed, i.e. the hardware is checked by the device-internal firmware.
The Verify HW set function has to be activated in such situations.

Simulation

The output value of the analog outputs and the switching condition 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

6.5 In operation

6.5.1 '+' 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 offered for each active channel.

You can exit a menu at any time by pressing the '+' and '-' keys simultaneously. Any changes made are rejected.

6.5.2 Min./max. memory

The device writes 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 was enabled for the channel in the setup (Allow reset, → 24). 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.

6.5.3 Device self-diagnosis, failsafe 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 means of comprehensive monitoring mechanisms in the device software (e.g. cyclic memory test).

If the self-diagnosis of the device detects an error, the device reacts as follows:
- Open collector output switches
- Red LED lights up
- Relay switches (if active and assigned as a fault/alarm relay)
- Display goes to the error mode → color of channel affected changes to red and an error is displayed
- The unit switches automatically between the active channels and the error display

Troubleshooting instructions and a list of all the error messages can be found in Section 9 'Troubleshooting'.

Measuring range limits

	Display						
Range Status Display	- - - - - **F**	- - - - - **F** Underrange	Measured value Measured value displayed and processed	- - - - - **F** Overrange	- - - - - **F**	- - - - - **F** Invalid measured value	Special points to note
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 to < 22 mA	≥ 22 mA		Not calibrated	
4 to 20 mA (as per Namur)	≤ 2 mA 2 < x ≤ 3.6 mA	> 3.6 mA to ≤ 3.8mA	> 3.8 mA to < 20.5 mA	≥ 20.5 mA to < 21 mA	≥ 21 mA	Not calibrated	As per NAMUR 43
+/- voltage ranges		< -110 %	-110 % to 110 %	> 110 %		Not calibrated	
Voltage ranges as of 0 V		< -10 %	-10 % to 110 %	> 110%		Not calibrated	
	No further calculation/further calculation with fixed error value		Further calculation in math and as min./max.				
1-5 V voltage range with activated cable open circuit detection	≤ 0.8 V		1-5 V		≥ 5.2 V	Not calibrated	
Thermocouples	Below the lower range limit		0 to 100 %		Above the upper range limit	Not calibrated	Cable open circuit detection as of approx. 50 kΩ
Resistance	Below the lower range limit		0 to 100 %		Above the upper range limit	Not calibrated	
	No further calculation/further calculation with fixed error value		Further calculation in math and as min./max.	No further calculation/further calculation with fixed error value			

= cable open circuit

= error at sensor

6.5.4 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 saved every 30 minutes to the nonvolatile device memory.
The device lists the following values in the 'Diagnostics' menu:
- Current device diagnosis
- Last device diagnosis
- Previous 5 diagnosis messages

List of error codes, see Section 9.2.1

Under certain conditions events saved over the past 30 minutes might be lost.

6.5.5 Operating hours counter

The device has an internal operating hours counter which also acts as the reference for diagnostic events.
The operating hours can be found in the '**Diagnostics**' → '**Operating time**' menu item. This information cannot be reset or changed.

6.5.6 Device reset

The following reset categories 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.

Any user code already defined 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 saved; configuration currently configured or factory settings are overwritten by the user setup.

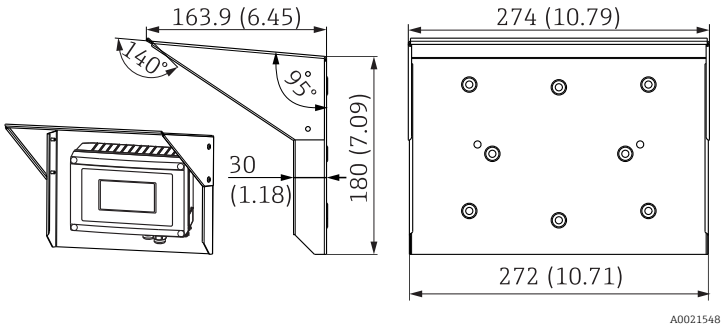
Any user code already defined is overwritten by the user code defined in the user setup!!! If no user code was saved in the user setup, the device is no longer locked. When operation is locked by a user code, this is indicated by a lock symbol on the display.

7 Maintenance

No special maintenance work is required on the device.

8 Accessories

8.1 Device-specific accessories

Designation	Description
Mounting set wall/pipe (for pipes ∅1-5")	
Weather protection cover	 *Fig. 16: Dimensions in mm (in)*

8.2 Communication-specific accessories

Designation
Interface cable
Commubox TXU10 incl. FieldCare Device Setup and DTM Library
Commubox FXA291 incl. FieldCare Device Setup and DTM Library

9 Troubleshooting

The following section provides you with an overview of possible causes of errors to provide you with an initial troubleshooting aid.

NOTICE

Device malfunction possible when retrofitting with untested hardware

- When upgrading/retrofitting the device with additional hardware at a later date (relay, additional universal input and additional analog output), an internal hardware test must be performed by the device software. To do so use the **Verify HW set** function in the **Expert→Diagnostics** menu.

9.1 Troubleshooting instructions

⚠ WARNING

Danger through electric tension

- The device cannot be operated in an open state for error diagnosis!

Display	Cause	Remedy
No measured value display	No power supply connected	Check the power supply of the device.
	Power supply applied, device defective	The device must be replaced.
The red marking for overrange/ underrange is flashing on the bar graph.	Analog output is > 10% above or below the scaled range.	Check the scaling of the analog output (Out 100% or Out 0%).

Error codes that are shown on the display are described in Section 9.2.
Further information on the failsafe mode is also provided in Section 6.5.3.

9.2 Process error messages

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

9.2.1 Device malfunction

The errors are defined as:

Error code	Meaning	Remedy
F041	Sensor/cable open circuit	Check wiring.
F045	Sensor error	Check sensor.
F101	Range undershoot	Check measurement, limit violated.
F102	Range overshoot	Check measurement, limit violated.
F221	Error: comparison measurement point	Contact your local service organization.
F261	Error: flash	Contact your local service organization.
F261	Error: RAM	Contact your local service organization.

Error code	Meaning	Remedy
F261	Error: EEPROM	Contact your local service organization.
F261	Error: D/A converter channel 1	Contact your local service organization.
F261	Error: D/A converter channel 2	Contact your local service organization.
F261	Error: invalid device ID	Contact your local service organization.
F281	Initialization phase	Contact your local service organization.
F282	Error: parameter data could not be saved	Contact your local service organization.
F283	Error: incorrect parameter data	Contact your local service organization.
F431	Error: incorrect calibration values	Contact your local service organization.
C411	Info: upload/download active	Only for information, device properly working.
C432	Info: calibration/testing mode	Only for information, device properly working.
C482	Info: simulation mode, relay/open collector	Only for information, device properly working.
C483	Info: analog output simulation mode	Only for information, device properly working.
C561	Display overflow	Only for information, device properly working.

9.3 Spare parts

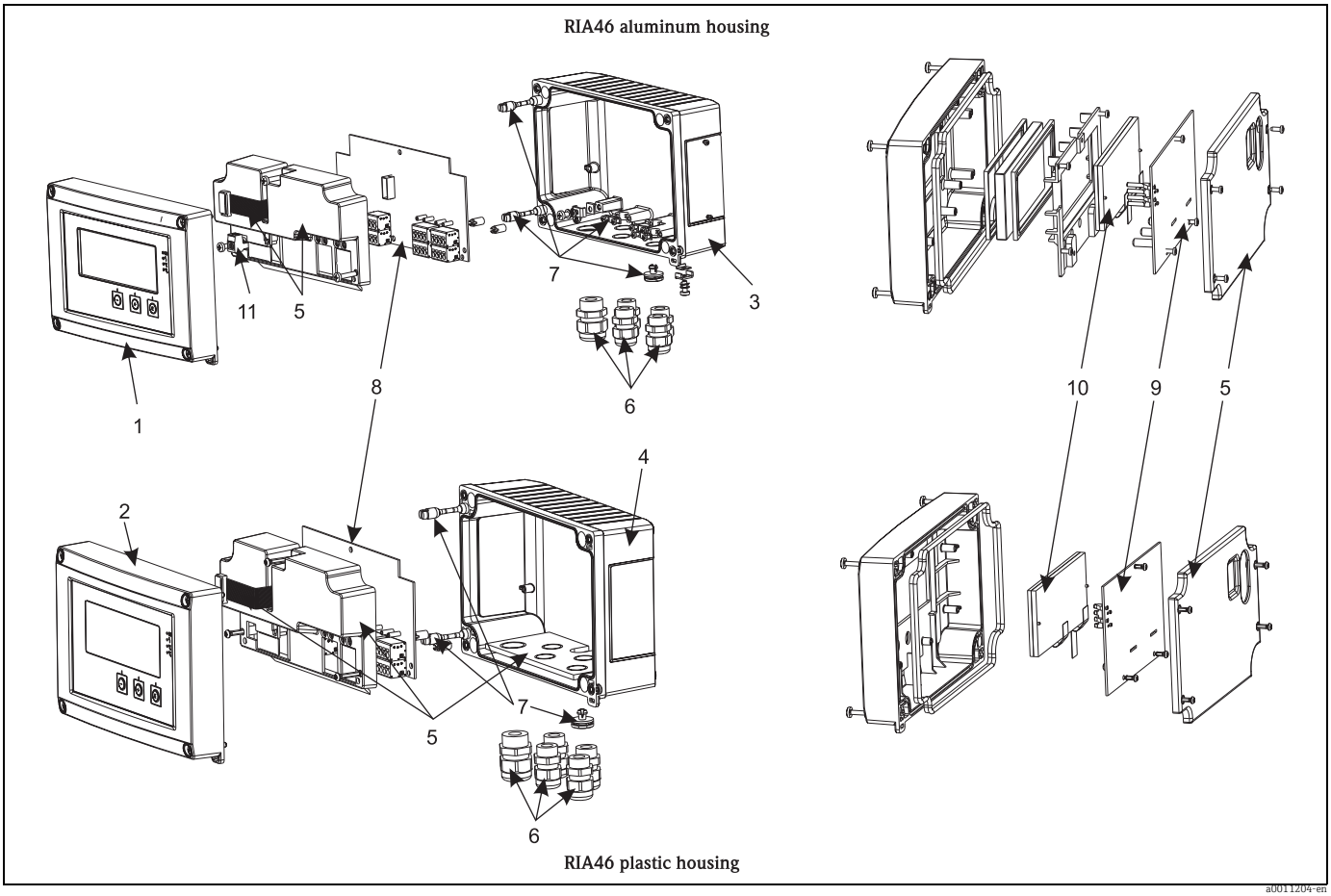


Fig. 17: Spare parts of the device

Item no.	Designation	Order no.
1	Front metal incl. front foil and glass	RIA46X-GB
2	Front plastic incl. front foil	RIA46X-GA
3	Housing bottom part aluminum (metric threads)	RIA46X-GD
	Housing bottom part aluminium (NPT1/2" threads)	RIA46X-GE
4	Housing bottom part plastic (lasered)	RIA46X-GC
5	Spare parts kit cover and connection parts ▪ cover plate for front + bottom part ▪ counter plate for cable glands (plastic housing) ▪ ribbon cable main board -> display board	RIA46X-GF
6	Cable gland kit (plastic) ▪ 4x M16x1,5 + 1x M20x1,5	RIA46X-GH
	Adapter kit NPT ▪ 4x adapter M20x1,5 (external threat) -> NTP1/2" (inside thread) ▪ 1x adapter M16x1,5 (external thread) -> NTP1/2" (inside thread)	RIA46X-GI
	Cable gland NPT1/2"	51006845
7	Spare part kit sundries ▪ Goretex filter ▪ Hinge pin (2 pieces) ▪ Cable shield grounding clamp (metal kit 5 screws/washer + clamp)	RIA46X-GG

Item no.	Designation	Order no.
8	Mainboard 24-230V (-20% +10%) 1 channel w/o relay, non Ex	RIA46X-NA
	Mainboard 24-230V (-20% +10%) 1 channel w/o relay, EX	RIA46X-NB
	Mainboard 24-230V (-20% +10%) 1 channel with relay, non EX	RIA46X-NC
	Mainboard 24-230V (-20% +10%) 1 channel with relay, EX	RIA46X-ND
	Mainboard 24-230V (-20% +10%) 2 channel w/o relay, non EX	RIA46X-NE
	Mainboard 24-230V (-20% +10%) 2 channel w/o relay, EX	RIA46X-NF
	Mainboard 24-230V (-20% +10%) 2 channel with relay, non EX	RIA46X-NG
	Mainboard 24-230V (-20% +10%) 2 channel with relay, EX	RIA46X-NH
9	CPU board, standard + LC display	RIA46T-
	Version:	
	A Standard + LC display	
	Device software:	
	1 Standard	
10	LC display (incl. ribbon cable)	RIA46X-DA
11	Power supply terminal 2 pole	71084277
w/o. item no.	Pipe mounting kit (with plastic mounting plate) Pipe mounting kit (with stainless steel mounting plate)	RK01-AH RK01-AU

9.4 Return

For a return, e.g. in case of repair, the device must be sent in protective packaging. The original packaging offers the best protection. Repairs must only be carried out by your supplier's service organization.

Please enclose a note describing the fault and the application when sending the unit in for repair.

9.5 Disposal

The device contains electronic components and must, therefore, be disposed of as electronic waste in the event of disposal. Please observe in particular the local waste disposal regulations of your country.

10 Technical data

10.0.1 Input

Inputs

One or two universal inputs

Measured variable

Current, voltage, resistance, resistance thermometer, thermocouples

Measuring ranges

Current:
- 0/4 to 20 mA +10% overrange
- Short-circuit current: max. 150 mA
- Load: 10 Ω

Voltage:
- 0 to 10 V, 2 to 10 V, 0 to 5 V, 0 to 1 V, 1 to 5 V, ± 1 V ± 10 V, ± 30 V, ± 100 mV
- Max. permitted input voltage:
  Voltage ≥ 1 V: ± 35 V
  Voltage < 1 V: ± 12 V
- Input impedance: > 1 MΩ

Resistance:
- 30 to 3000 Ω

Resistance thermometer:
- Pt 100 as per IEC60751, GOST, JIS1604
- Pt 500 and Pt 1000 as per IEC60751
- Cu 100, Cu 50, Pt 50, Pt 46, Cu 53 as per GOST
- Ni 100, Ni 1000 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

Update time

200 ms

Linearization

Linearization of input signals and calculated values possible over a maximum of 32 points.

Galvanic isolation

Towards all other circuits

Output

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...5 V
- Overrange: up to 11 V, short-circuit proof, I_{max} < 25 mA

Loop power supply

- Open-circuit voltage: 24 V DC (+15% /-5%)
  Ex version: > 14 V at 22 mA
  Non-hazardous operation: > 16 V at 22 mA
- Maximum 30 mA short-circuit-proof and overload-proof
- Galvanically isolated from system and outputs

HART®:
HART® signals are not affected

Status output

Open Collector for monitoring of the device state and alarm notification. The OC output is closed in normal state. In error state, the OC output is opened.
- I_{max} = 200 mA
- U_{max} = 28 V
- $U_{on/max}$ = 2 V at 200 mA

Limit function

Relay contact	Changeover
Maximum contact burden DC	30 V / 3 A (permanent state, without destruction of the input)
Maximum contact burden AC	250 V / 3 A (permanent state, without destruction of the input)
Minimum contact load	500 mW (12 V/10 mA)
Galvanic isolation towards all other circuits	Test voltage 1500V AC
Switching cycles	> 1 million

10.0.2 Terminal assignment

Electrical connection

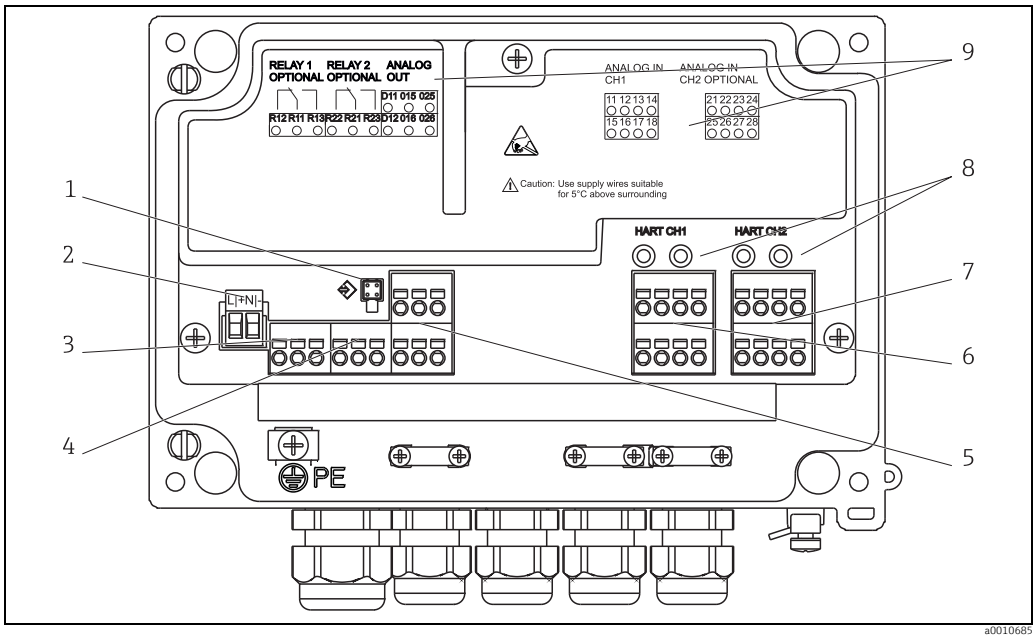


Fig. 18: Terminal assignment of the field meter

1: Connection socket for interface cable
2: Connection supply voltage
3: Connection relay 1 (optional)
4: Connection relay 2 (optional)
5: Connection analog and status output
6: Connection analog input 1
7: Connection analog input 2 (optional)
8: HART® connection sockets
9: Laser labelling of terminal assignment

Supply voltage

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

Power consumption

Max. 21.5 VA / 6.9 W

Connection data interface

Commubox FXA291 PC USB interface
- Connection: 4-pin connector
- Transmission protocol: FieldCare
- Transmission rate: 38,400 Baud

Interface cable TXU10-AC PC USB interface
- Connection: 4-pin connection
- Transmission protocol: FieldCare
- Delivery scope: Interface cable incl. FieldCare Device Setup DVD with all Comm DTMs and Device DTMs

Performance characteristics

Reference operating conditions

Power supply: 230 V AC, 50/60 Hz
Ambient temperature: 25 °C ± 5 °C (77 °F ± 9 °F)
Humidity: 20 % to 60 % rel. humidity

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: 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 3000 Ω	4-wire: ± (0.10% oMR + 0.8 Ω) 3-wire: ± (0.10% oMR + 1.6 Ω) 2-wire: ± (0.10% oMR + 3 Ω)
	Resistance thermometer	Pt100, -200 to 850 °C (-328 to 1562 °F) (IEC60751, α=0.00385) Pt100, -200 to 850 °C (-328 to 1562 °F) (JIS1604, w=1.391) Pt100, -200 to 649 °C (-328 to 1200 °F) (GOST, α=0.003916) Pt500, -200 to 850 °C (-328 to 1562 °F) (IEC60751, α=0.00385) Pt1000, -200 to 600 °C (-328 to 1112 °F) (IEC60751, α=0.00385)	4-wire: ± (0.10% oMR + 0.3 K (0.54 °F)) 3-wire: ± (0.10% oMR + 0.8 K (1.44 °F)) 2-wire: ± (0.10% oMR + 1.5 K (2.7 °F))
		Cu100, -200 to 200 °C (-328 to 392 °F) (GOST, w=1.428) Cu50, -200 to 200 °C (-328 to 392 °F) (GOST, w=1.428) Pt50, -200 to 1100 °C (-328 to 2012 °F) (GOST, w=1.391) Pt46, -200 to 850 °C (-328 to 1562 °F) (GOST, w=1.391) Ni100, -60 to 250 °C (-76 to 482 °F) (DIN43760, α=0.00617) Ni1000, -60 to 250 °C (-76 to 482 °F) (DIN43760, α=0.00617)	4-wire: ± (0.20% oMR + 0.3 K (0.54 °F)) 3-wire: ± (0.20% oMR + 0.8 K (1.44 °F)) 2-wire: ± (0.20% oMR + 1.5 K (2.7 °F))
		Cu53, -50 to 200 °C (-58 to 392 °F) (GOST, w=1.426)	4-wire: ± (0.30% oMR + 0.3 K (0.54 °F)) 3-wire: ± (0.30% oMR + 0.8 K (1.44 °F)) 2-wire: ± (0.30% oMR + 1.5 K (2.7 °F))
	Thermocouples	Type J (Fe-CuNi), -210 to 1200 °C (-346 to 2192 °F) (IEC60584)	± (0.1% oMR +0.5 K (0.9 °F)) from -100 °C (-148 °F)
		Type K (NiCr-Ni), -200 to 1372 °C (-328 to 2502 °F) (IEC60584)	± (0.1% oMR +0.5 K (0.9 °F)) from -130 °C (-202 °F)
		Type T (Cu-CuNi), -270 to 400 °C (-454 to 752 °F) (IEC60584)	± (0.1% oMR +0.5 K (0.9 °F)) from -200 °C (-328 °F)
		Type N (NiCrSi-NiSi), -270 to 1300 °C (-454 to 2372 °F) (IEC60584)	± (0.1% oMR +0.5 K (0.9 °F)) from -100 °C (-148 °F)
		Type L (Fe-CuNi), -200 to 900 °C (-328 to 1652 °F) (DIN43710, GOST)	± (0.1% oMR +0.5 K (0.9 °F)) from -100 °C (-148 °F)
		Type D (W3Re/W25Re), 0 to 2495 °C (32 to 4523 °F)(ASTME998)	± (0.15% oMR +1.5 K (2.7 °F)) from 500 °C (from 932 °F)
		Type C (W5Re/W26Re), 0 to 2320 °C (32 to 4208 °F)(ASTME998)	± (0.15% oMR +1.5 K (2.7 °F)) from 500 °C (932 °F)
		Type B (Pt30Rh-Pt6Rh), 0 to 1820 °C (32 to 3308 °F) (IEC60584)	± (0.15% oMR +1.5 K (2.7 °F)) from 600 °C (1112 °F)
		Type S (Pt10Rh-Pt), -50 to 1768 °C (-58 to 3214 °F) (IEC60584)	± (0.15% oMR +3.5 K (6.3 °F)) for -50 to 100 °C (-58 to 212 °F) ± (0.15% oMR +1.5 K (2.7 °F)) for 100 to 1768 °C (212 to 3214 °F)

		Type R (Pt13Rh-Pt), -50 to 1768 °C (-58 to 3214 °F) (IEC60584)	± (0.15% oMR +3.5 K (6.3 °F)) for -50 to 100 °C (-58 to 212 °F) ± (0.15% oMR +1.5 K (2.7 °F)) for 100 to 1768 °C (212 to 3214 °F)
		Type U (Cu-CuNi), -200 to 600 °C (-328 to 1112 °F) (DIN 43710)	± (0.15% oMR +0.5 K (0.9 °F)) from -100 °C (-148 °F)
AD converter resolution		16 bit	
Temperature drift		Temperature drift: ≤ 0.01%/ K (0.1%/18 °F) oMR ≤ 0.02%/ K (0.2%/18 °F) oMR for Cu100, Cu50, Cu53, Pt50 and Pt46	

Analog output:

Current	0/4 to 20 mA, overrange to 22 mA	± 0.05% of measuring range
	Max. load	500 Ω
	Max. inductance	10 mH
	Max. capacitance	10 µF
	Max. ripple	10 mVpp at 500 Ω, frequency < 50 kHz
Voltage	0 to 10 V, 2 to 10 V 0 to 5 V Overrange: up to 11 V, short-circuit proof, I_{max} < 25 mA	± 0.05% of measuring range ± 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 of measuring range	
Galvanic isolation	Testing voltage of 500 V towards all other circuits	

10.0.3 Installation

Installation instructions

Mounting location
Field, direct wall mounting and wall or pipe mounting[3)] using the optional mounting plate.
Orientation
The orientation is determined by the readability of the display.
Max. viewing angle range +/- 45° from the central display axis in every direction.

Environment

Ambient temperature range

-40 to +50 °C (-40 to 122 °F)

Readability of the display cannot be guaranteed at temperatures below -30 °C (-22 °F).

Storage temperature

-40 to +85 °C (-40 to 185 °F)

3) According to UL approval panel or surface mounting only.

Operating height

< 2000 m above MSL (6561 ft)

Shock and vibration

3g at 2...150 Hz as per IEC 60068-2-6

Climate class

As per IEC 60654-1, Class B2

Degree of protection

Front IP 67 / NEMA 4x (not evaluated by UL)

Condensation

permitted

Electromagnetic compatibility (EMC)

- Interference immunity:
  To IEC 61326 industrial environments / NAMUR NE 21
- Interference emissions:
  To IEC 61326 Class A

10.0.4 Mechanical construction

Design, dimensions

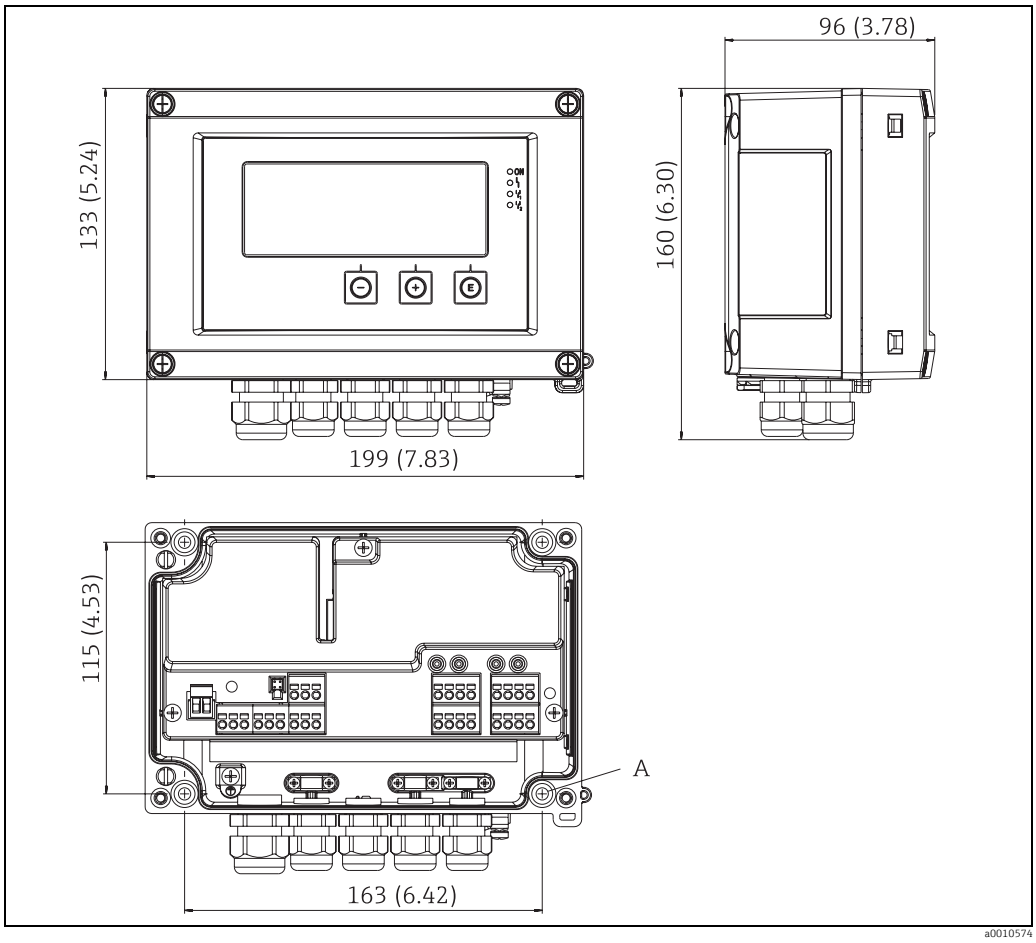


Fig. 19: Dimensions of the field meter

A: Drill-hole for direct wall mounting or on optional mounting plate with 4 screws ∅5 mm (0.2 in)

Weight

- Plastic housing: approx. 600 g (1.32 lbs)
- Aluminum housing: approx. 1700 g (3.75 lbs)

Material

Housing	Nameplate
Fiber-glass reinforced plastic PBT-GF30	Laser marking
Aluminum AlSi12 (as an option)	Laser-writable foil, polyester

Terminals

Plug-in spring terminals, 2.5 mm^2 (14 AWG); auxiliary voltage with screw terminals (AWG 30-12; torque 0.5-0.6 Nm (4.4-5.3 lb in)).

10.0.5 Human interface

Display elements

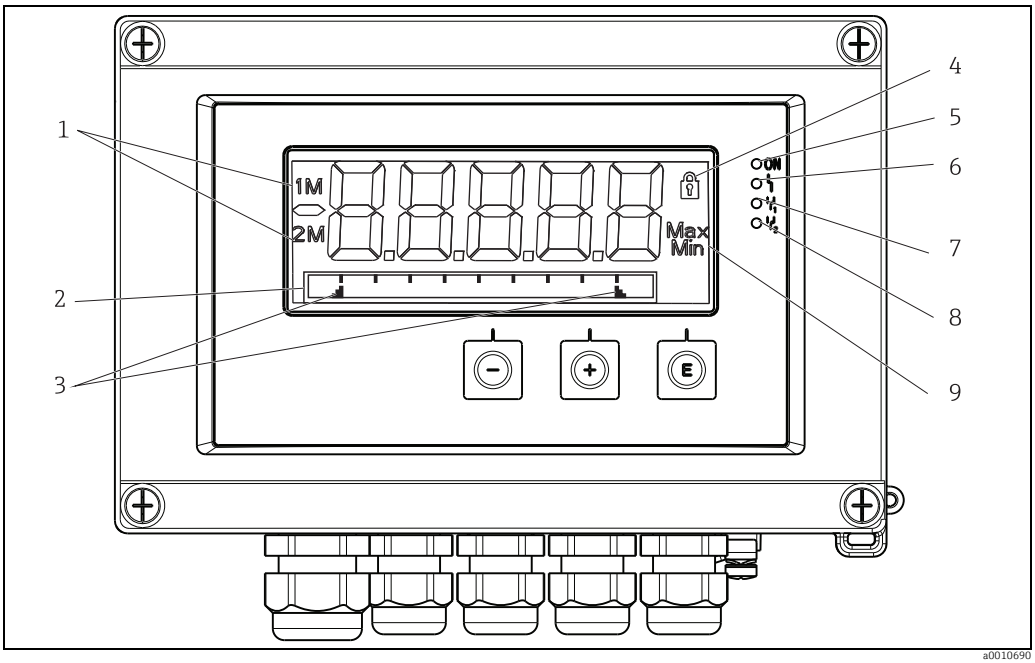


Fig. 20: Display of the field meter

1: Channel display: 1: analog input 1; 2: analog input 2; 1M: calculated value 1; 2M: calculated value 2
2: Dot matrix display for TAG, bar graph and unit
3: Limit value indicators in the bar graph
4: "Operation locked" indicator
5: Green LED; measuring device operational
6: Red LED; error/alarm
7: Yellow LED; status of relay 1
8: Yellow LED; status of relay 2
9: Minimum/maximum value indicator

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

Operating elements

3 keys: -, +, E

Remote operation

Configuration

The device can be configured with the PC software or on site using the operating keys. FieldCare Device Setup is delivered together with the Commubox FXA291 or TXU10-AC (see 'Accessories') or can be downloaded free of charge from www.endress.com.

Interface

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

10.0.6 Certificates and approvals

CE mark

The device meets the legal requirements of the EU directives. Endress+Hauser confirms that the device has been tested successfully by affixing the CE mark.

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Other standards and guidelines

- IEC 60529:
  Degrees of protection by housing (IP code)
- IEC 61010-1: 2001 Cor 2003
  Safety requirements for electrical equipment for measurement, control and laboratory use
- EN 60079-11
  Explosive atmospheres - Part 11: equipment protection by intrinsic safety "I"

11 Appendix

The following tables show all the parameters available in the configuration menu. The values configured at the factory are marked in bold.

11.1 Further explanations on the differential pressure application at level measurement

At both universal inputs pressure sensors are connected.
With the following calculation steps the volume in the CV channels is finally calculated:

1st Calculation Step: Calculation of the filling level

Both pressure sensors provide the actual pressure at the installation point.From both pressures (possibly adjusted for an offset; this has to be set in AI1 respectively AI2) a pressure difference (Δp) is determined. If the pressure difference is divided through the density of the medium multiplied with the gravitational acceleration the measured height is gained..
Level h= Δp/(ρ*g)

The following units form the basis of the calculation:
Density ρ: [kg/m]
Pressure p: [Pa] or [N/m^2]

The gravitational acceleration is defined by a constant:
Gravitational acceleration g=9.81m/s^2

NOTICE

Wrong calculation results through use of incorrect engineering units

- If the calculation is to be carried through correctly the measured signal (e.g. in mbar) has to be converted into the according unit Pascal (Pa). This is achieved by a conversion factor. Conversion factors can be found in the table → 54.

Examples for the conversion:
Water: density ρ=1000 kg/m^3
Pressure measurement: pressure1 (bottom): Scale 0 to 800 mbar (0 to 80000 Pa);
Present value: 500 mbar (50000 Pa)
Pressure measurement: pressure2 (top): Scale 0 to 800 mbar (0 to 80000 Pa);
Present value: 150 mbar (15000 Pa)

When using Pascal:

$$h = \frac{1}{1000\ kg/m^3 * 9.81\ m/s^2} * (50000\text{-}15000\ Pa) = 3.57\ m$$

When using mbar:

$$h = \frac{1}{1000\ kg/m^3 * 9.81\ m/s^2} * ((500\text{-}150\ mbar) * (1{,}0000 * 10^2)) = 3.57\ m$$

h = b * Δp
Calculation of the correction factor b:
b = 1/(ρ*g)
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^3 and Pa or N/m^2:

- 1 bar = 0.1 N/mm^2 = 10^5 N/m^2 = 10^5 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^2	**≡ 1 $Mdyn/cm^2$**	**≡ 1 kp/cm^2**	**≡ 1 pSTP**	**≡ 1 mmHg**	**≡ 1 lbf/in^2**
1 Pa	1	$1.0000 * 10^{-5}$	$1.0197 * 10^{-5}$	$9.8692 * 10^{-6}$	$7.5006 * 10^{-3}$	$1.4504 * 10^{-4}$
1 bar	$1.0000 * 10^{5}$	1	$1.0197 * 10^{0}$	$9.8692 * 10^{-1}$	$7.5006 * 10^{2}$	$1.4504 * 10^{1}$
1 at	$9.8067 * 10^{4}$	$9.8067 * 10^{-1}$	1	$9.6784 * 10^{-1}$	$7.3556 * 10^{2}$	$1.4223 * 10^{1}$
1 atm	$1.0133 * 10^{5}$	$1.0133 * 10^{0}$	$1.0332 * 10^{0}$	1	$7.6000 * 10^{2}$	$1.4696 * 10^{1}$
1 torr	$1.3332 * 10^{2}$	$1.3332 * 10^{-3}$	$1.3595 * 10^{-3}$	$1.3158 * 10^{-3}$	1	$1.9337 * 10^{-2}$
1 psi	$6.8948 * 10^{3}$	$6.8948 * 10^{-3}$				

Density:
The density has to be taken from the specifications of the medium that the tank contains. In the given table standard approximate values that can help for a first orientation are listed

Medium	**Density**
	in kg/m^3
Water (at 3.98 °C)	999.975
Mercury	13595
Bromine	3119
Sulfuric acid	1834
Nitric acid	1512
Glycerin	1260
Nitrobenzene	1220
Deuterium oxide	1105
Acetic Acid	1049
Milk	1030
Seawater	1025
Aniline	1022
Olive oil	910
Benzene	879
Toluene	872
Spirits of turpentine	855
Spirit	830
Diesel fuel	830
Paraffin	800
Methanol	790
Ethyl alcohol	789
Automotive gas (standardized, average value)	750
Acetone	721
Disulfide	713
Diethyl ether	713

2nd Calculation step: Calculation of the volume out of the height

By means of the linearization of the calculated height value the volume can be calculated. This is done by assigning a certain volume value to every height value in dependency of the tank shape.
This linearization is mapped over up to 32 supporting points. However, at a straight-linear dependency of filling height and volume are sufficient.
The integrated tank-linearization module in FieldCare provides support here.

11.2 Display menu

Display menu		
AI1 Minmax-reset *Only available if "Yes" was configured in the Setup>Analog in 1>Allow reset menu.*	Yes **No**	Resets the minimum and maximum values saved for analog input 1.
AI2 Minmax-reset *Only available if "Yes" was configured in the Setup>Analog in 2>Allow reset menu.*	Yes **No**	Resets the minimum and maximum values saved for analog input 2.
Cv1 Minmax-reset *Only available if "Yes" was configured in the Setup > Calc value 1 > Allow reset menu.*	Yes **No**	Resets the minimum and maximum values saved for math 1.
Cv2 Minmax-reset *Only available if "Yes" was configured in the Setup > Calc value 2 > Allow reset menu.*	Yes **No**	Resets the minimum and maximum values saved for math 2.
Analog in 1	Off Unit Bar graph Bargr + unit **Tag + unit**	Configures the display for analog input 1. If the parameter is set to 'Off', the channel is not displayed.
Analog in 2	Off Unit Bar graph Bargr + unit **Tag + unit**	Configures the display for analog input 2. If the parameter is set to 'Off', the channel is not displayed.
Calc value 1	**Off** Unit Bar graph Bargr + unit Tag + unit	Configures the display for math 1. If the parameter is set to 'Off', the channel is not displayed.
Calc value 2	**Off** Unit Bar graph Bargr + unit Tag + unit	Configures the display for math 2. If the parameter is set to 'Off', the channel is not displayed.
Contrast	1 to 7 **6**	Configures the contrast
Brightness	1 to 7 **6**	Configures the brightness
Alternating time	3 seconds **5 seconds** 10 seconds	Configures the time for toggling between the channels displayed.

11.3 Setup menu

Setup menu			
Application	**1-channel** **2-channel** Diff pressure		Configures the application for the process display unit. 2-channel is the default setting for two-channel devices, 1-channel for single-channel devices.
AI1 Lower range *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **0.0000**		Configures the measuring range lower limit
AI1 Upper range *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **100.00**		Configures the measuring range upper limit
AI2 Lower range *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **0.0000**		Configures the measuring range lower limit
AI2 Upper range *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **100.00**		Configures the measuring range upper limit
CV factor *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **1.0**		Factor by which the calculated value is multiplied.
CV unit *Only visible if → Diff pressure is configured as the application.*	Customized text, max. 5 digits		Unit of the calculated value
CV Bar 0% *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **0.0000**		Configures the 0%-value for the bar graph
CV Bar 100% *Only visible if → Diff pressure is configured as the application.*	Numerical value[1)] **100.00**		Configures the 100%-value for the bar graph
Linearization *Only visible if → Diff pressure is configured as the application.*	No lin points	2 to 32 **2**	Number of points needed for linearization.
	X-value 1 to X-value 32	Numerical value[1)] **0.0000**	X-value for the linearization point in question
	Y-value 1 to Y-value 32	Numerical value[1)] **0.0000**	Y-value for the linearization point in question
Analog in 1	Signal type	Off **Current** Voltage RTD TC	Configures the input type *If "Signal type" is set to "Off", all the parameters under it are hidden.*
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

Setup menu			
	Signal range	**4-20mA**, 4-20mA squar, 0-20mA, 0-20mA squar, **0-10V**, 0-10V squar, 0-5V, 2-10V, 1-5V, 1-5V squar, 0-1V, 0-1V squar, +/- 1V, +/- 10V, +/- 30V, +/- 100mV Pt46GOST, Pt50GOST, **Pt100IEC**, Pt100JIS, Pt100GOST, Pt500IEC, Pt1000IEC, Ni100DIN, Ni1000DIN, Cu50GOST, Cu53GOST, Cu100GOST 3000 Ohm 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	Configures the input signal
	Lower range *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Numerical value[1)] **0**	Configures the measuring range lower limit
	Upper range *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Numerical value[1)] **100**	Configures the measuring range upper limit
	Connection *Only displayed if "Signal type" = "RTD" is set.*	**2-wire** 3-wire 4-wire	Configures the connection type for RTD thermometers
	Tag	Customized text, max. 12 digits	Channel name; TAG i the device designation for channel 1
	Unit *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Customized text, max. 5 digits	Unit of the channel
	Temperature unit *Only displayed if "Signal type" = "RTD" or "TC" is set.*	**°C** °F K	Configures the temperature unit
	Offset	Numerical value[1)] **0**	Configures an offset
	Ref junction *Only displayed if "Signal type" = "TC" is set.*	**intern** fixed	Configures the reference temperature
	Fixed ref junc *Only visible if "fixed" was selected for the "Ref junction".*	Numerical value[1)]	Configures the constant reference temperature
	Res minmax	**No** Yes	Resets the min./max. values saved.
Analog in 2	Signal type	Off **Current** Voltage RTD TC	Configures the input type. *If "Signal type" is set to "Off", all the parameters under it are hidden.*
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

Setup menu			
	Signal range	**4-20mA**, 4-20mA squar, 0-20mA, 0-20mA squar, **0-10V**, 0-10V squar, 0-5V, 2-10V, 1-5V, 1-5V squar, 0-1V, 0-1V squar, +/- 1V, +/- 10V, +/- 30V, +/- 100mV Pt46GOST, Pt50GOST, **Pt100IEC**, Pt100JIS, Pt100GOST, Pt500IEC, Pt1000IEC, Ni100DIN, Ni1000DIN, Cu50GOST, Cu53GOST, Cu100GOST 3000 Ohm 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	Configures the input signal
	Lower range *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Numerical value[1)] **0**	Configures the measuring range lower limit
	Upper range *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Numerical value[1)] **100**	Configures the measuring range upper limit
	Connection *Only displayed if "Signal type" = "RTD" is set.*	**2-wire** 3-wire 4-wire	Configures the connection type for RTD thermometers
	Tag	Customized text, max. 12 digits	Channel name
	Unit *Only displayed if "Signal type" = "Current" or "Voltage" is set.*	Customized text, max. 5 digits	Unit of the channel
	Temperature unit *Only displayed if "Signal type" = "RTD" or "TC" is set.*	**°C** °F K	Configures the temperature unit
	Offset	Numerical value[1)] **0**	Configures an offset
	Ref junction *Only displayed if "Signal type" = "TC" is set.*	**intern** fixed	Configures the reference temperature
	Fixed ref junc *Only displayed if "fixed" was selected for the "Ref junction".*	Numerical value[1)]	Configures the constant reference temperature
	Res minmax	**No** Yes	Resets the min./max. values saved.
Calc value 1	Calculation	**Off** Sum Difference Average Lineariz. AI1 Multiplication	Selects the calculation method *If "Calculation" is set to "Off", all the parameters under it are hidden.*
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

Setup menu			
	Tag	Customized text, max. 12 digits	Channel name
	Unit	Customized text, max. 5 digits	Unit of the channel
	Bar 0%	Numerical value[1)] **0**	Configures the 0%-value for the bar graph
	Bar 100%	Numerical value[1)] **100**	Configures the 100%-value for the bar graph
	Factor	Numerical value[1)]	Setting of factor for calculated value
	Offset	Numerical value[1)] **0**	Configures an offset
	No. lin points *Only visible if "Calculation" = "Linearization" was set.*	2 to 32 **2**	Number of points for linearization.
	X-value *Only visible if "Calculation" = "Linearization" was set.*	X-value 1 to X-value 32, numerical value[1)]	For entering the points for linearization (max. 32)
	Y-value *Only visible if "Calculation" = "Linearization" was set.*	Y-value 1 to Y-value 2, numerical value[1)]	For entering the points for linearization (max. 32)
	Res minmax	**No** Yes	Resets the min./max. values saved.
Calc value 2	Calculation	**Off** Sum Difference Average Lineariz. AI2 Lineariz. CV1 Multiplication	Selects the calculation method *If "Calculation" is set to "Off", all the parameters under it are hidden.*
	Tag	Customized text, max. 12 digits	Channel name
	Unit	Customized text, max. 5 digits	Unit of the channel
	Bar 0%	Numerical value[1)] **0**	Configures the 0%-value for the bar graph
	Bar 100%	Numerical value[1)] **100**	Configures the 100%-value for the bar graph
	Factor	Numerical value[1)]	Setting of factor for calculated value
	Offset	Numerical value[1)] **0**	Configures an offset
	No. lin points *Only visible if "Calculation" = "Linearization" was set.*	2 to 32 **2**	Number of points for linearization.
	X-value *Only visible if "Calculation" = "Linearization" was set.*	X-value 1 to X-value 32, numerical value[1)]	For entering the points for linearization (max. 32)
	Y-value *Only visible if "Calculation" = "Linearization" was set.*	Y-value 1 to Y-value 32, numerical value[1)]	For entering the points for linearization (max. 32)
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

Setup menu			
	Res minmax	No Yes	Resets the min./max. values saved.
Analog Out 1	Assignment	**Off** Analog 1 Analog 2 Calc value 1 Calc value 2	Selects the source for the output signal
	Signal type	**4-20mA** 0-20mA 0-10V 2-10V 0-5V 1-5V	Selects the type of signal for the output signal
	Lower range	Numerical value[1)] **0**	Configures the measuring range lower limit
	Upper range	Numerical value[1)] **100**	Configures the measuring range upper limit
Analog Out 2	Assignment	**Off** Analog 1 Analog 2 Calc value 1 Calc value 2	Selects the source for the output signal
	Signal type	**4-20mA** 0-20mA 0-10V 2-10V 0-5V 1-5V	Selects the type of signal for the output signal
	Lower range	Numerical value[1)] **0**	Configures the measuring range lower limit
	Upper range	Numerical value[1)] **100**	Configures the measuring range upper limit
Relay 1	Source	**Off** Analog input 1 Analog input 2 Calc value 1 Calc value 2 Error	Selects the source for the relay
	Function	**Min** Max Gradient Inband Outband	Function of the relay
	Setpoint	Numerical value[1)] **0**	Switching threshold for relay
	Setpoint 2	Numerical value[1)] **0**	Second switching threshold for relay *Only for the inband and outband functions.*
	Time base *Only visible if "Function" = "Gradient" was set*	0-60 **0**	Time base for gradient calculation in seconds
	Hysteresis	Numerical value[1)] **0**	Hysteresis for switching threshold(s)
Relay 2	Source	**Off** Analog input 1 Analog input 2 Calc value 1 Calc value 2 Error	Selects the source for the relay
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

Setup menu			
	Function	**Min** Max Gradient Inband Outband	Function of the relay
	Setpoint	Numerical value[1)] **0**	Switching threshold for relay
	Setpoint 2	Numerical value[1)] **0**	Second switching threshold for relay *Only for the inband and outband functions.*
	Time base *Only visible if "Function" = "Gradient" was set*	0-60 **0**	Time base for gradient calculation in seconds
	Hysteresis	Numerical value[1)] **0**	Hysteresis for switching threshold(s)
System	Access code	0000 to 9999 **0000**	User code to protect the device configuration. 0000 = protection through user code disabled
	Overfill protect	**No** Yes	If the device is used for overfill protection (see Section 6.4.8), "Yes" must be selected for "Overfill protect".
	Reset	**No** Yes	Resets the device to the order configuration
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999			

11.4 Diagnostics menu

Diagnostics menu		
Current diagn	Error code	Displays the error code currently present
Last diagn	Error code	Displays the last error code
Operating time	Numerical value	Displays the hours operated up until now
Diagnost logbook	Diagnostics x	Displays the last 5 error codes
Device information	Device tag	Displays the device name i TAG channel 1
	Serial number	Displays the serial number
	Order code	Displays the order code
	Order identifier	Displays the order number
	Firmware version	Displays the firmware version
	ENP version	Displays the ENP version

11.5 Expert menu

In addition to all the parameters in the Setup menu, the following parameters are also available in the Expert mode:

Expert menu				
Direct access	4-digit code			
System	Save user setup	**No** Yes	Select 'Yes' to save the current device settings. The device can be reset to the saved settings by means of 'Reset'->'User reset'.	
Input	Analog in 1	Bar 0%	Numerical value[1)] **0**	Configures the 0%-value for the bar graph
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999				

Expert menu				
		Bar 100%	Numerical value[1)] **100**	Configures the 100%-value for the bar graph
		Decimal places	XXXXX XXXX.X **XXX.XX** XX.XXX X.XXXX	Configures the number of decimal places for the display
		Damping	Numerical value[1)] **0.0** *for current/voltage* **1.0** *for temperature inputs*	Configures the damping for the input signal. Entry in steps of 0.1 seconds from 0.0 to 999.9 s.
		Failure mode	**Invalid** Fixed value	Configures the failsafe mode. Invalid: an invalid 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 *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)] **0**	The value configured here is output in the event of an error.
		Namur NE 43	**On** Off	Setting as to whether the failsafe mode is in accordance with NAMUR NE 43.
		Open circ detect *Only visible if "1-5 V" is configured as the signal range.*	**On** Off	Sets cable open circuit detection.
		Failure delay	Integer value (0-9999)	Delay time for failure in s
		Allow reset	**No** Yes	Setting as to whether saved min./ max. values can be reset in the Display menu without having to enter a user code which may already have been configured.
	Analog in 2	Bar 0%	Numerical value[1)] **0**	Configures the 0%-value for the bar graph
		Bar 100%	Numerical value[1)] **100**	Configures the 100%-value for the bar graph
		Decimal places	XXXXX XXXX.X **XXX.XX** XX.XXX X.XXXX	Configures the number of decimal places for the display
		Damping	Numerical value[1)] **0.0** *for current/voltage* **1.0** *for temperature inputs*	Configures the damping for the input signal. Entry in steps of 0.1 seconds from 0.0 to 999.9 s.
		Failure mode	**Invalid** Fixed value	Configures the failsafe mode. Invalid: an invalid 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 *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)] **0**	The value configured here is output in the event of an error.
		Namur NE 43	**On** Off	Setting as to whether the failsafe mode is in accordance with NAMUR NE 43.
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999				

Expert menu				
		Open circ detect *Only visible if "1-5 V" is configured as the signal range.*	**On** Off	Sets cable open circuit detection.
		Failure delay	Integer value (0-9999)	Delay time for failure in s
		Allow reset	**No** Yes	Setting as to whether saved min./ max. values can be reset in the Display menu without having to enter a user code which may already have been configured.
Output	Analog Out 1	Failure mode	**Min** Max Fixed value	Configures the failsafe mode. 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 *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)] **0**	The value configured here is output in the event of an error.
	Analog Out 2	Failure mode	**Min** Max Fixed value	Configures the failsafe mode. 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 *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)]	The value configured here is output in the event of an error.
	Relay 1	Time delay	Numerical value[1)] **0**	Delay for switching the relay.
		Operating mode	**Normally closed** Normally opened	Normally closed = breaker contact Normally opened = maker contact
		Failure mode	**Normally closed** Normally opened	Normally closed = breaker contact Normally opened = maker contact
	Relay 2	Time delay	Numerical value[1)] **0**	Delay for switching the relay.
		Operating mode	**Normally closed** Normally opened	Normally closed = breaker contact Normally opened = maker contact
		Failure mode	**Normally closed** Normally opened	Normally closed = breaker contact Normally opened = maker contact
Application	Calc value 1	Decimal places	XXXXX XXXX.X **XXX.XX** XX.XXX X.XXXX	Configures the number of decimal places for the display
		Failure mode	**Invalid** Fixed value	Configures the failsafe mode
		Fixed fail value *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)] **0**	The value configured here is output in the event of an error.
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999				

Expert menu				
		Allow reset	**No** Yes	Setting as to whether saved min./ max. values can be reset in the Display menu without having to enter a user code which may already have been configured.
	Calc value 2	Decimal places	XXXXX XXXX.X **XXX.XX** XX.XXX X.XXXX	Configures the number of decimal places for the display
		Failure mode	**Invalid** Fixed value	Configures the failsafe mode
		Fixed fail value *Only visible if "Fixed value" was selected for the "Failure mode".*	Numerical value[1)] **0**	The value configured here is output in the event of an error.
		Allow reset	**No** Yes	Setting as to whether saved min./ max. values can be reset in the Display menu without having to enter a user code which may already have been configured.
Diagnostics	Verify HW set	Yes **No**	Device hardware check.	
	Simulation	Simulation AO1	**Off** 0mA 3.6mA 4mA 10mA 12mA 20mA 21mA 0V 5V 10V	Simulation of analog output 1. The value configured in the simulation is output at analog output 1.
		Simulation AO2	**Off** 0mA 3.6mA 4mA 10mA 12mA 20mA 21mA 0V 5V 10V	Simulation of analog output 2. The value configured in the simulation is output at analog output 1.
		Simu relay 1	**Off** Closed Opened	Simulation of relay 1.
		Simu relay 2	**Off** Closed Opened	Simulation of relay 2.
1) Numerical values consist of 6 digits where the decimal point counts as a digit, e.g. +99.999				

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