KA00293K/09/EN/05.24-00
71680019
2024-02-19

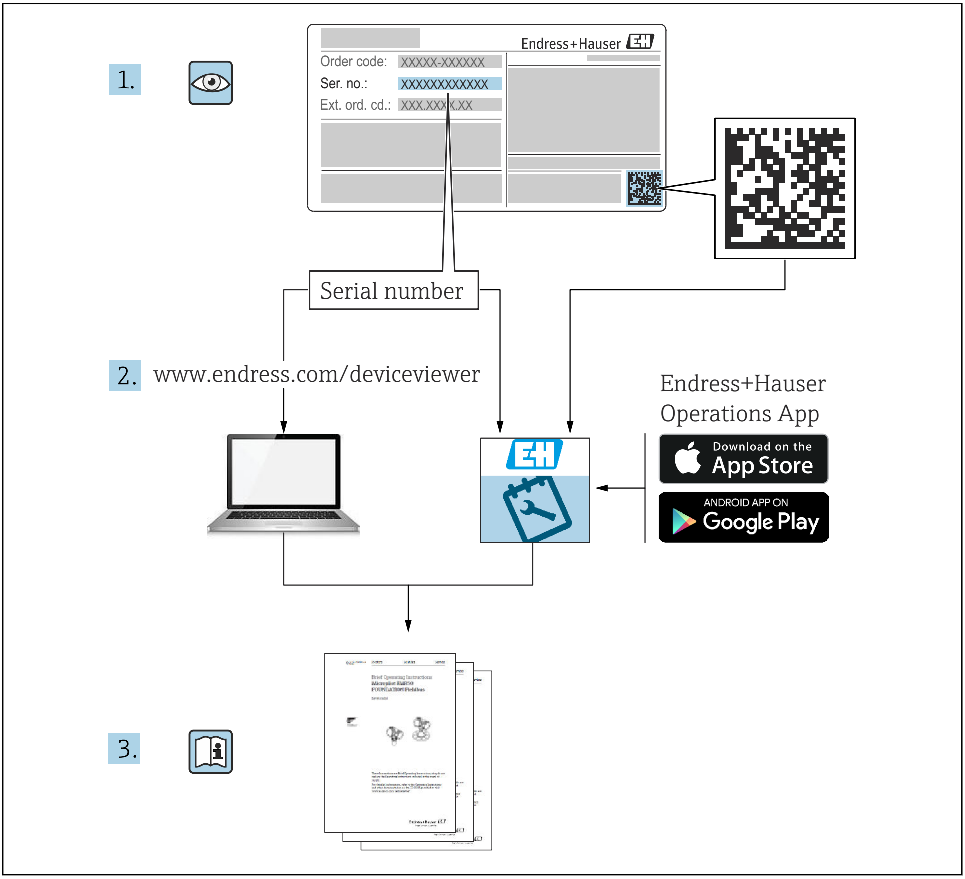
Brief Operating Instructions
EngyCal RS33

Steam calculator for a measuring point with one pulse/analog input for flow and two RTD/analog inputs for temperature/pressure

These Brief Operating Instructions are not a substitute for the Operating Instructions pertaining to the device.
Detailed information can be found in the Operating Instructions and the additional documentation.

Available for all device versions via:
- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: Endress+Hauser Operations app

Endress+Hauser
People for Process Automation


1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXXX.XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the
App Store
ANDROID APP ON
Google Play
3.

A0023555

Table of contents

1 About this document

1.1 Document function

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.2 Symbols

1.2.1 Safety symbols

DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION
This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Symbols for certain types of information

Symbol	Meaning	Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.		**Preferred** Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.		**Tip** Indicates additional information.
	Reference to documentation		Reference to page
	Reference to graphic	1., 2., 3....	Series of steps
	Result of a step		Visual inspection

1.2.3 Electrical symbols

⎓	Direct current	∼	Alternating current
≂	Direct current and alternating current	⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

1.2.4 Symbols in graphics

Symbol	Meaning	Symbol	Meaning
1, 2, 3,...	Item numbers	1., 2., 3....	Series of steps
A, B, C, ...	Views	**A-A, B-B, C-C, ...**	Sections
EX	Hazardous area	~~EX~~	Safe area (non-hazardous area)

2 Basic safety instructions

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

2.1 Requirements for the personnel

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

2.2 Intended use

The steam calculator is a flow computer for calculating the mass and energy flow of steam. The mains-powered device is designed for use in industrial environments.

- The manufacturer accepts no liability for damages resulting from improper or non-intended use. The device must not be converted or modified in any way.
- The device may only be operated when installed.

2.3 Workplace safety

When working on and with the device:
- ▶ Wear the required personal protective equipment as per national regulations.

2.4 Operational safety

Damage to the device!

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

2.5 Product safety

This product is designed in accordance with good engineering practice to meet state-of-the-art safety requirements and has been tested and left the factory in a condition in which it is safe to operate.

2.6 IT security

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

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

3 Product description

3.1 Product design

The steam calculator is used for recording and billing steam mass and energy flow in systems with saturated or superheated steam. The calculation is based on the process values measured for volume flow, temperature and/or pressure. The calculator is suitable for connecting and supplying all common flow transmitters, temperature sensors and pressure sensors.

The device uses the IAPWS IF97 standard to calculate the mass flow and energy flow of steam. Here, the input variables pressure and temperature are used to calculate the density and enthalpy of steam. The compensation of the differential pressure flow measurement and the electronic adjustment of the temperature sensor (sensor-transmitter matching) with the calculator enable highly accurate and reliable measurements even under dynamic process conditions. Remote reading of the stored data is possible via Ethernet IP, Modbus or M-Bus.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

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

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

4.1.1 Product identification

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

Nameplate

Do you have the correct device?

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

▶ Compare the information on the nameplate with the order.

Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang or www.endress.com

4.1.2 Storage and transport

Storage temperature: −30 to +70 °C (−22 to +158 °F)

Maximum relative humidity 80 % for temperatures up to 31 °C (87.8 °F), decreasing linearly to 50 % relative humidity at 40 °C (104 °F).

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

Avoid the following environmental influences during storage:
- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

5 Mounting

5.1 Mounting requirements

With the appropriate accessories, the device with field housing is suitable for wall mounting, pipe mounting, panel mounting and DIN rail installation.

Its orientation is determined by the readability of the display. Connections and outputs are fed out of the bottom of the device. The cables are connected via coded terminals.

Operating temperature range: −20 to 60 °C (−4 to 140 °F)

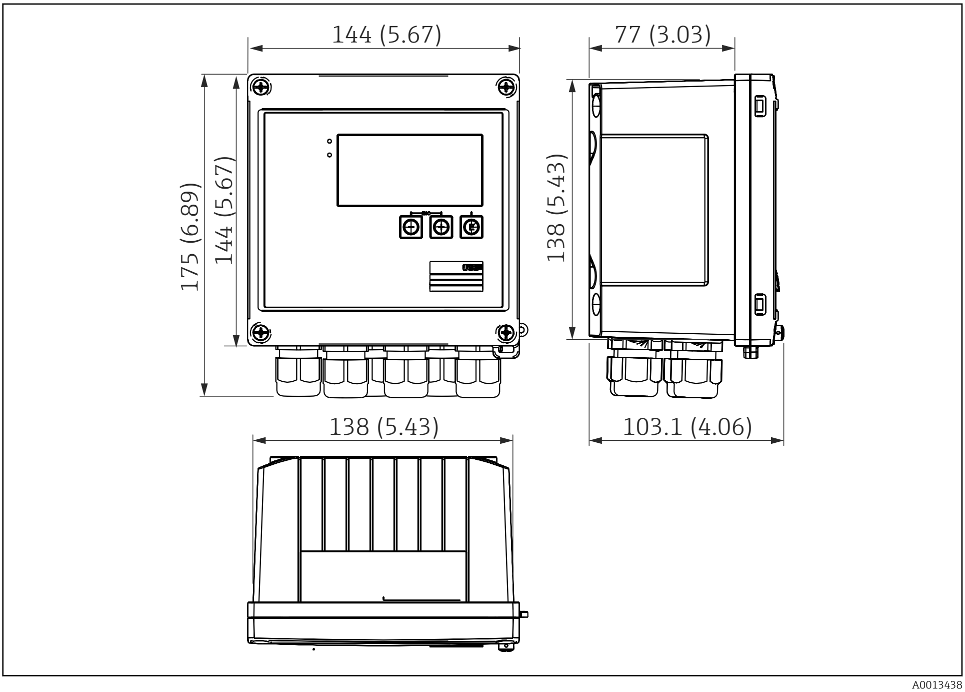
You can find more information in the "Technical data" section.

NOTICE

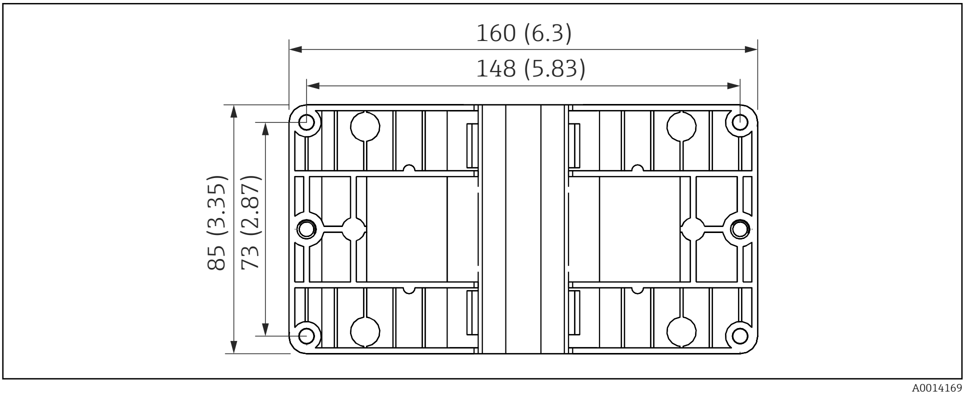
Overheating of the device due to insufficient cooling

▶ To avoid heat buildup, please always ensure that the device is sufficiently cooled. Operating the device in the upper temperature limit range decreases the operating life of the display.

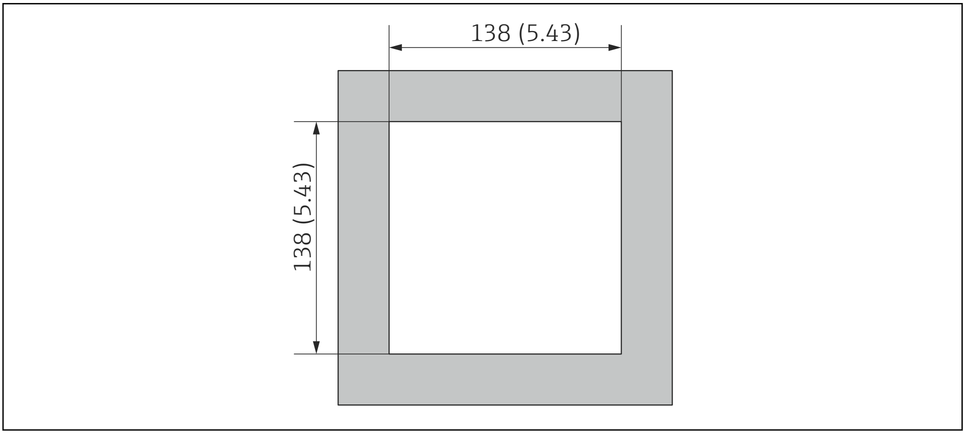
5.2 Dimensions



1 Dimensions of the device in mm (in)



2 Dimensions of the mounting plate for wall, pipe and panel mounting in mm (in)



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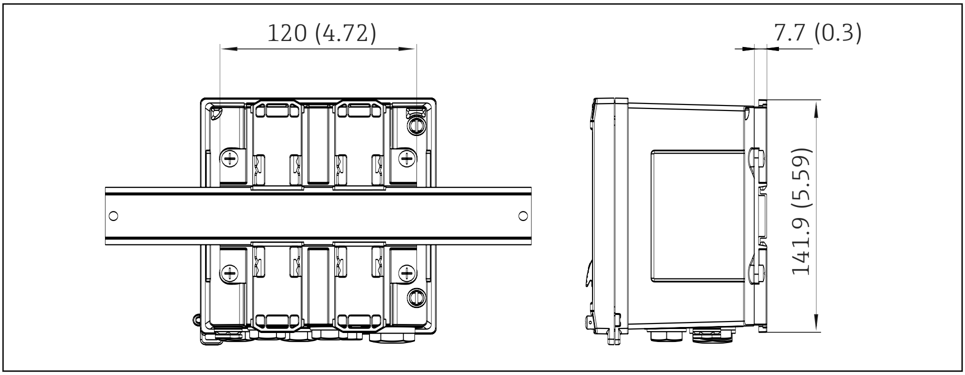
3 *Dimensions of the panel cutout in mm (in)*



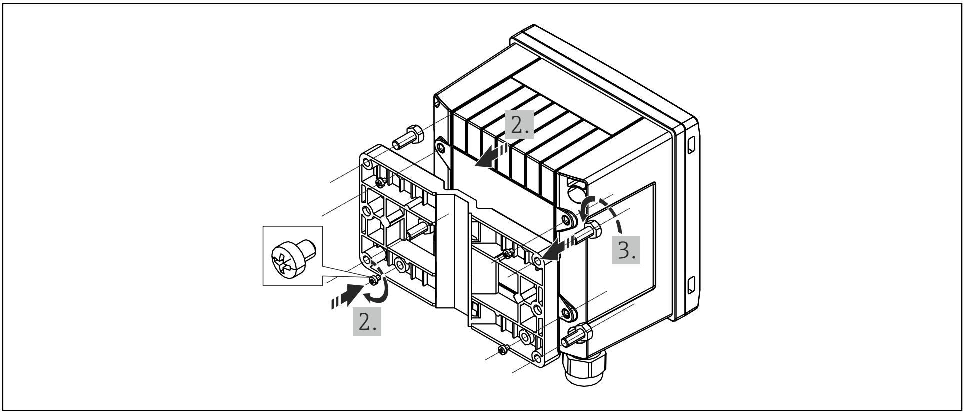
A0014610

4 *Dimensions of DIN rail adapter in mm (in)*

5.3 Mounting the device

5.3.1 Wall mounting

1. Use the mounting plate as the template for drilled holes, dimensions → 2, 9
2. Attach the device to the mounting plate and fasten it in place from the rear using 4 screws.
3. Fasten the mounting plate to the wall using 4 screws.



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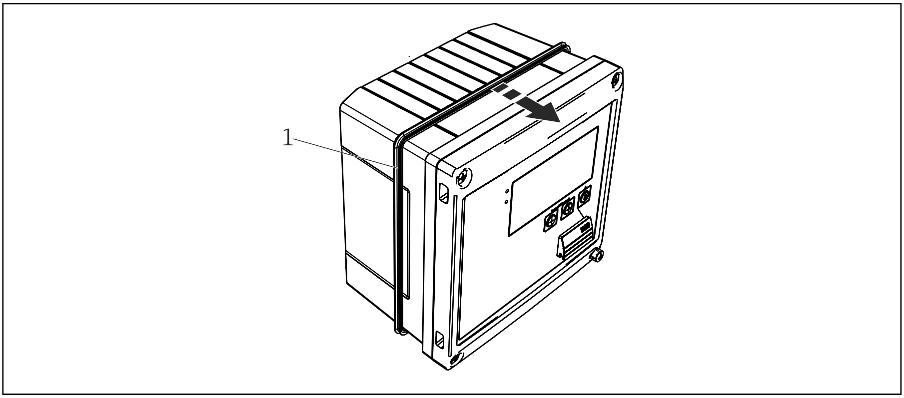
5 *Wall mounting*

5.3.2 Panel mounting

1. Make the panel cutout in the required size, dimensions → 3, 10
2. 

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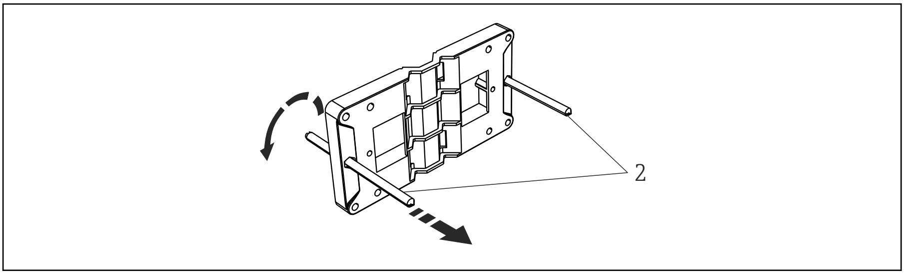
6 *Panel mounting*

Attach the seal (item 1) to the housing.

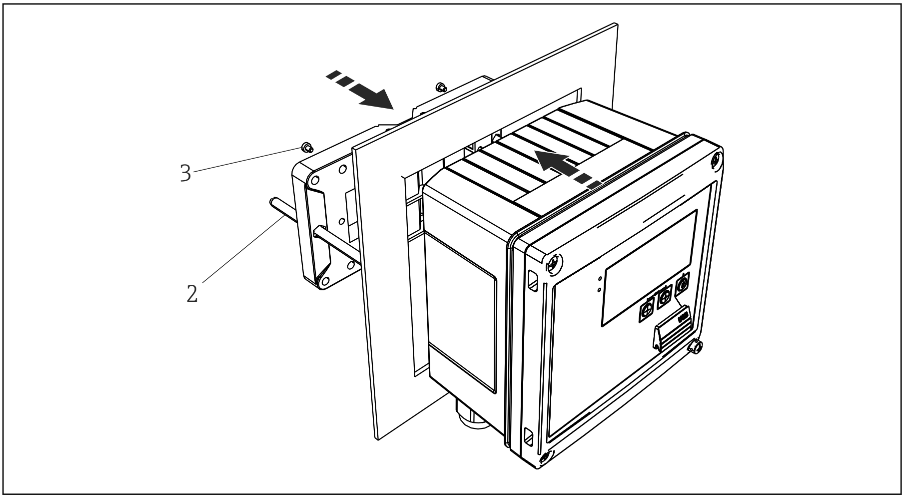
3.



7 *Preparing the mounting plate for panel mounting*

Screw the threaded rods (item 2) into the mounting plate (dimensions → 2, 9).

4.



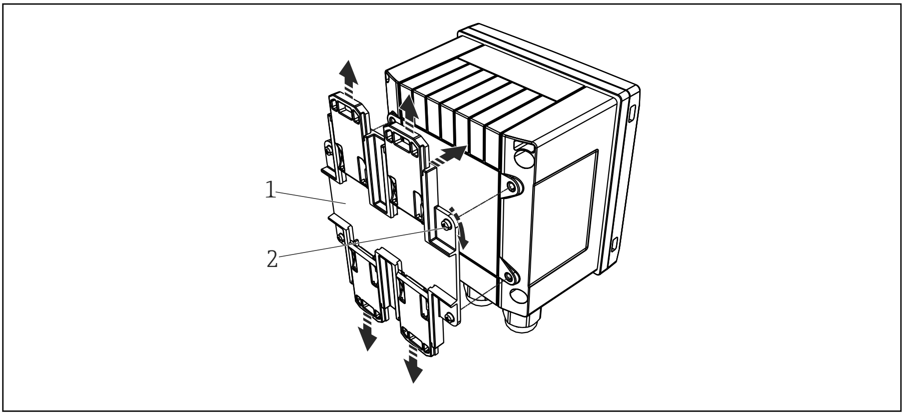
8 *Panel mounting*

Push the device into the panel cutout from the front and attach the mounting plate to the device from the rear using the 4 screws provided (item 3).

5. Fasten the device in place by tightening the threaded rods.

5.3.3 Support rail/DIN rail (to EN 50 022)

1.

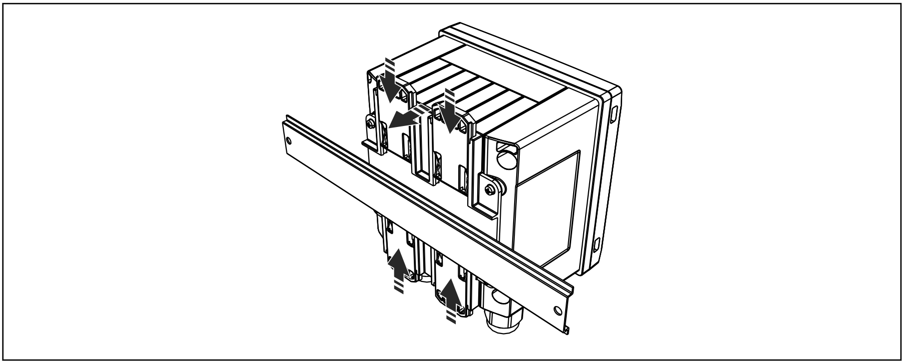


A0014176

9 Preparing for DIN rail mounting

Fasten the DIN rail adapter (item 1) to the device using the screws provided (item 2) and open the DIN rail clips.

2.



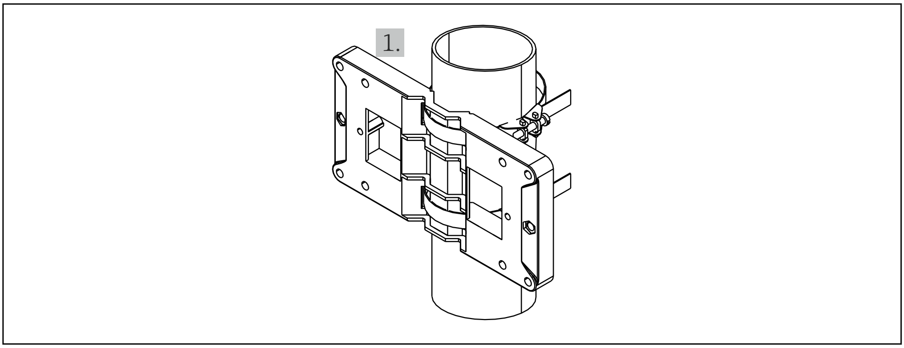
A0014177

10 DIN rail mounting

Attach the device to the DIN rail from the front and close the DIN rail clips.

5.3.4 Pipe mounting

1.

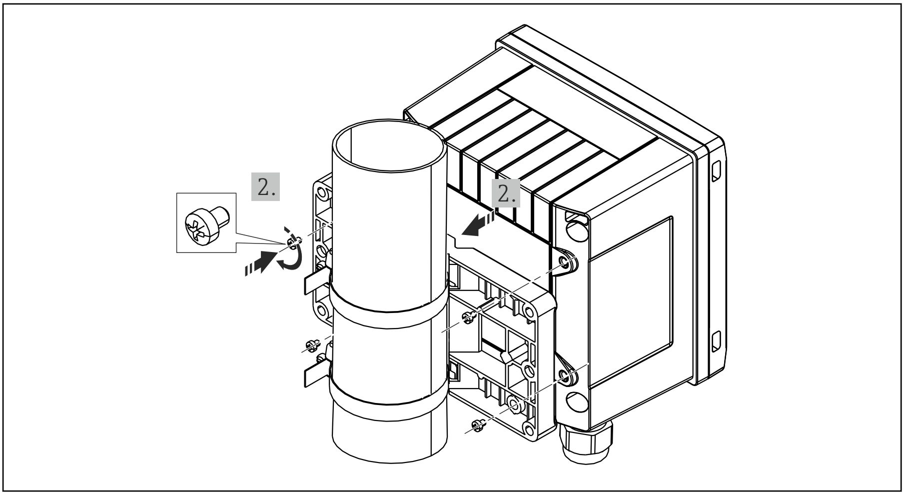


A0014178

11 *Preparing for pipe mounting*

Pull the steel belts through the mounting plate (dimensions → 2, 9) and fasten them to the pipe.

2.

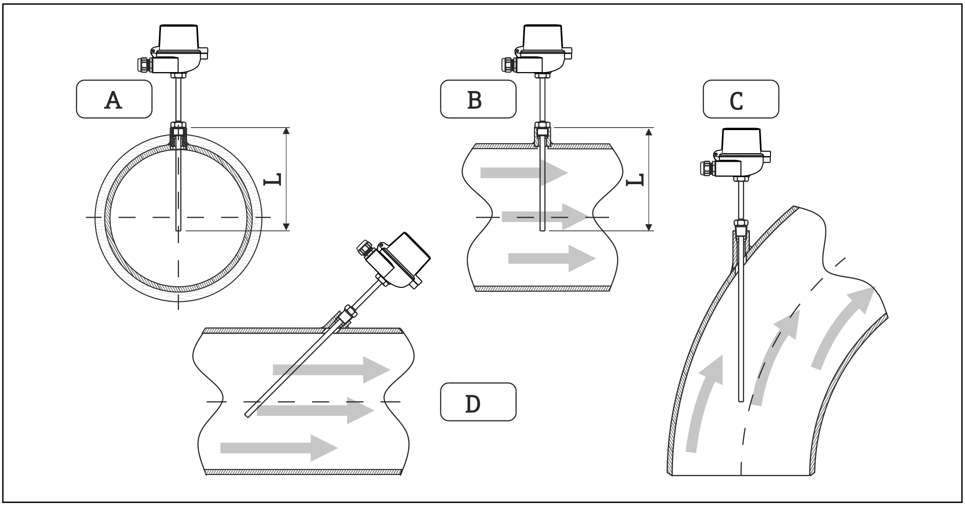


A0014179

12 *Pipe mounting*

Attach the device to the mounting plate and fasten it in place using the 4 screws provided.

5.4 Installation instructions for temperature sensor(s)



13 *Installation types for temperature sensors*

A - B For pipelines with a small cross-section, the sensor tip must reach as far as the piping axis or a little farther (=L).
C - D Slanted orientation.

The installation depth of the thermometer influences the measurement accuracy. If the installation depth is insufficient, errors in the measurement are caused by heat conduction via the process connection and the container wall. For installation in a pipe, therefore, the recommended installation depth ideally corresponds to half of the pipe diameter.

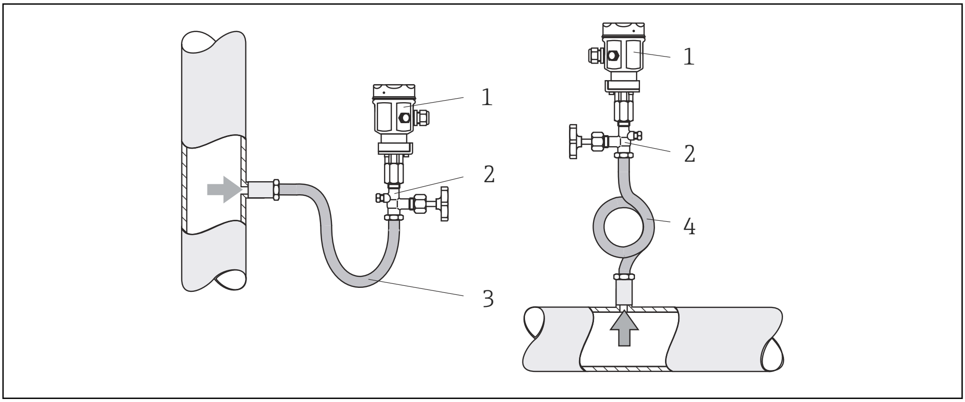
- Installation possibilities: Pipes, tanks or other plant components
- Minimum immersion depth = 80 to 100 mm (3.15 to 3.94 in)
  The immersion depth should correspond to at least 8 times the thermowell diameter. Example: Thermowell diameter 12 mm (0.47 in) x 8 = 96 mm (3.8 in). We recommend a standard immersion depth of 120 mm (4.72 in).

For pipes with small nominal diameters, ensure that the tip of the thermowell extends far enough into the process so that it also protrudes past the axis of the pipe (→ 13, 15, item A and B). Another solution may be diagonal installation (→ 13, 15, item C and D). When determining the immersion length or installation depth all the parameters of the thermometer and of the process to be measured must be taken into account (e.g. flow velocity, process pressure).

Refer also to the installation recommendations EN1434-2 (D), Figure 8.

Detailed information: BA01915T

5.5 Pressure measuring cell installation instructions



14 *Measuring arrangement for pressure measurement in steams*

1 *Pressure measuring cell*
2 *Shutoff device*
3 *U-shaped water pocket*
4 *O-shaped water pocket*

- Mount the pressure measuring cell with the siphon above the tapping point.
  The siphon reduces the temperature to almost ambient temperature.
- Fill the siphon with liquid before commissioning.

6 Electrical connection

6.1 Connecting requirements

WARNING

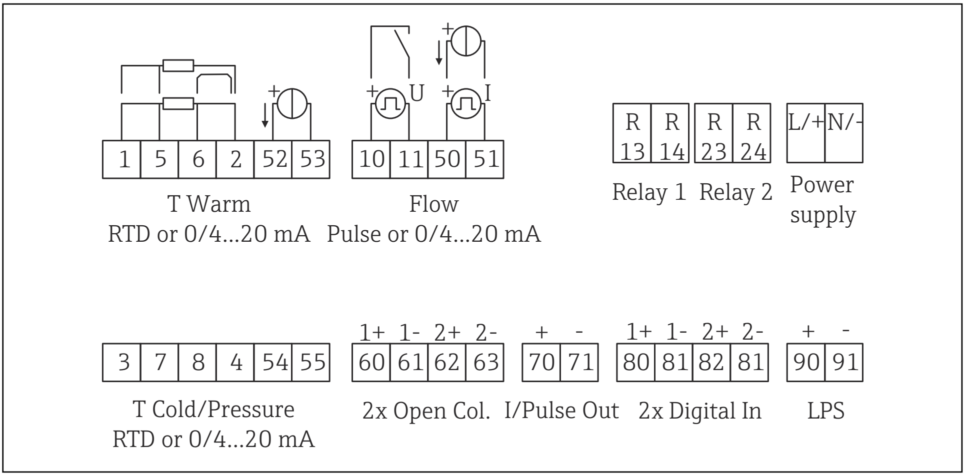
Danger! Electric voltage!
▶ The entire connection of the device must take place while the device is de-energized.

CAUTION

Pay attention to additional information provided
▶ Before commissioning, ensure that the supply voltage corresponds to the specification on the nameplate.
▶ Provide a suitable switch or power-circuit breaker in the building installation. This switch must be provided close to the device (within easy reach) and marked as a circuit breaker.
▶ An overload protection element (rated current ≤ 10 A) is required for the power cable.

To install the steam calculator and the associated components, observe the general installation instructions according to EN1434 Part 6.

6.2 Connecting the device



15 Connection diagram of the device

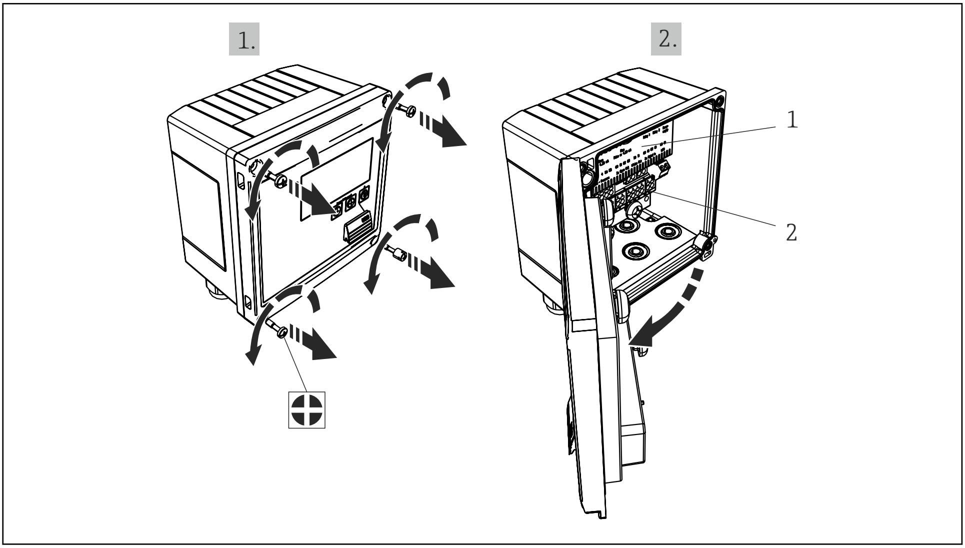
Terminal assignment

- In the case of heat differential /T, the temperature sensor for T condensate must be connected to the T Warm terminals and the temperature sensor for T steam to the T Cold terminals.
- In the case of heat differential /p, the temperature sensor for T condensate must be connected to the T Warm terminals.

Terminal	Terminal assignment	Inputs
1	+ RTD power supply	Temperature steam (Optionally RTD or current input)
2	- RTD power supply	
5	+ RTD sensor	
6	- RTD sensor	
52	+ 0/4 to 20 mA input	
53	Signal ground for 0/4 to 20 mA input	
3	+ RTD power supply	Pressure (steam)
4	- RTD power supply	
7	+ RTD sensor	
8	- RTD sensor	
54	+ 0/4 to 20 mA input	
55	Signal ground for 0/4 to 20 mA input	

10	+ pulse input (voltage)	Flow (Optionally pulse or current input)
11	- pulse input (voltage)	
50	+ 0/4 to 20 mA or current pulse (PFM)	
51	Signal ground for 0/4 to 20 mA input flow	
80	+ digital input 1 (switch input)	▪ Start tariff counter 1 ▪ Time synchronization ▪ Lock device
81	- digital input (terminal 1)	
82	+ digital input 2 (switch input)	▪ Start tariff counter 2 ▪ Time synchronization ▪ Lock device
81	- digital input (terminal 2)	
		Outputs
60	+ pulse output 1 (open collector)	Energy, volume or tariff counter. Alternative: limits/alarms
61	- pulse output 1 (open collector)	
62	+ pulse output 2 (open collector)	
63	- pulse output 2 (open collector)	
70	+ 0/4 to 20 mA/pulse output	Current values (e.g. power) or counter values (e.g. energy)
71	- 0/4 to 20 mA/pulse output	
13	Relay normally open (NO)	Limits, alarms
14	Relay normally open (NO)	
23	Relay normally open (NO)	
24	Relay normally open (NO)	
90	24V sensor power supply (LPS)	24 V power supply (e.g. for sensor power supply)
91	Power supply ground	
		Power supply
L/+	L for AC + for DC	
N/-	N for AC - for DC	

6.2.1 Opening the housing



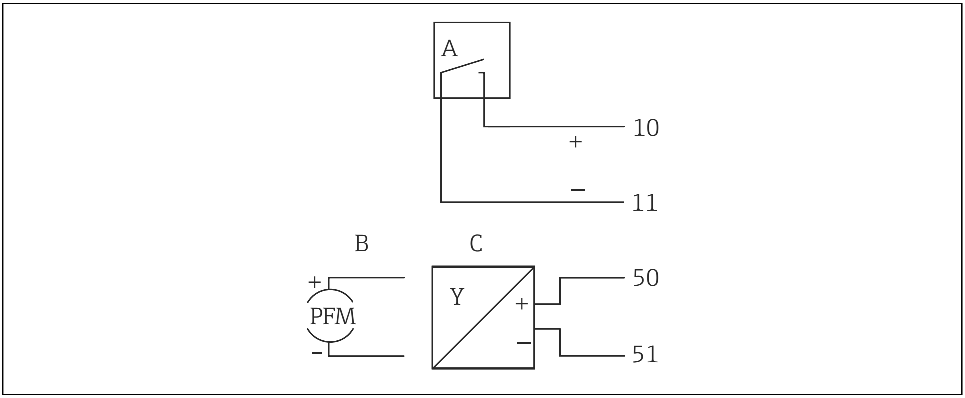
16 *Opening the housing of the device*

1 *Terminal assignment labeling*
2 *Terminals*

6.3 Connecting the sensors

6.3.1 Flow

Flow sensors with external power supply

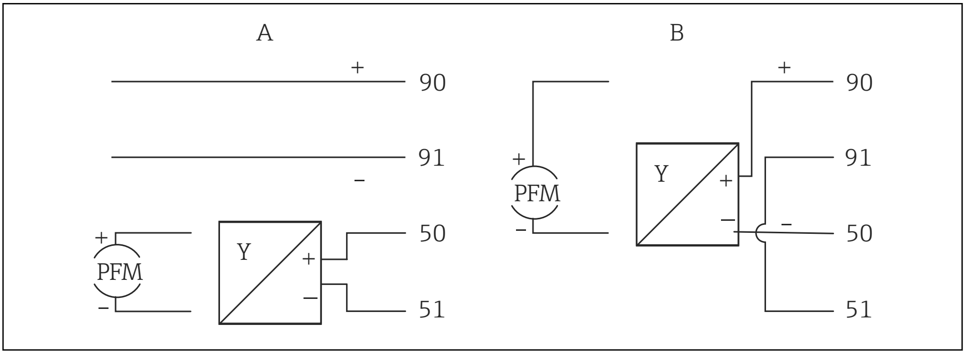


A0013521

17 *Connecting a flow sensor*

A *Voltage pulses or contact sensors including EN 1434 Type IB, IC, ID, IE*
B *Current pulses*
C *0/4 to 20 mA signal*

Flow sensors with power supply via the steam calculator



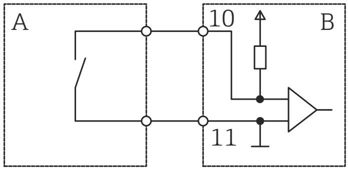
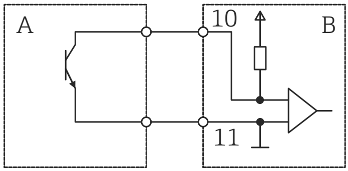
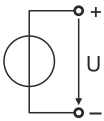
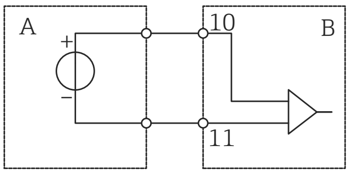
A0014180

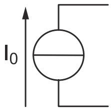
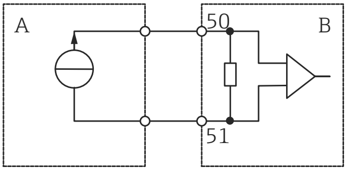
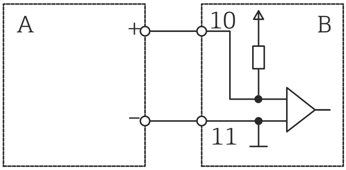
18 *Connecting active flow sensors*

A *4-wire sensor*
B *2-wire sensor*

Settings for flow sensors with pulse output

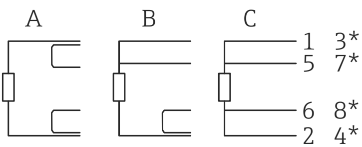
The input for voltage pulses and contact sensors is divided into different types according to EN1434 and provides a power supply for switching contacts.

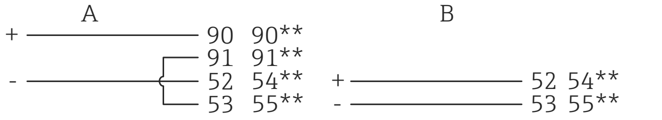
Pulse output of the flow sensor	Setting at the Rx33	Electrical connection	Note
Mechanical contact  A0015360	Pulse ID/IE up to 25 Hz	 A0015354 *A Sensor* *B Rx33*	As an alternative, it is possible to choose "Pulse IB/IC+U" up to 25 Hz. The current flow via the contact is then lower (approx. 0.05 mA instead of approx. 9 mA). Advantage: lower power consumption, disadvantage: less immunity to interference.
Open collector (NPN)  A0015361	Pulse ID/IE up to 25 Hz or up to 12.5 kHz	 A0015355 *A Sensor* *B Rx33*	As an alternative, it is possible to choose "Pulse IB/IC+U". The current flow via the transistor is then lower (approx. 0.05 mA instead of approx. 9 mA). Advantage: lower power consumption, disadvantage: less immunity to interference.
Active voltage  A0015362	Pulse IB/IC+U	 A0015356 *A Sensor* *B Rx33*	The switching threshold is between 1 V and 2 V

Pulse output of the flow sensor	Setting at the Rx33	Electrical connection	Note
Active current  A0015363	Pulse I	 A0015357 *A Sensor* *B Rx33*	The switching threshold is between 8 mA and 13 mA
NAMUR sensor (as per EN60947-5-6)	Pulse ID/IE up to 25 Hz or up to 12.5 kHz	 A0015359 *A Sensor* *B Rx33*	No monitoring for short circuit or line break takes place.

Voltage pulses and transmitters according to Class IB and IC (low switching thresholds, small currents)	≤ 1 V corresponds to Low level ≥ 2 V corresponds to High level U max 30 V, U no-load: 3 to 6 V	Floating contacts, reed transmitters
Transmitters to Class ID and IE for higher currents and power supplies	≤ 1.2 mA corresponds to Low level ≥ 2.1 mA corresponds to High level U no-load: 7 to 9 V	

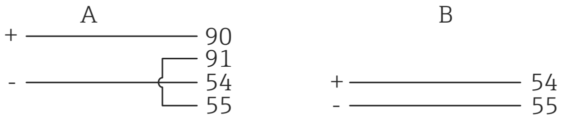
6.3.2 Temperature

Connecting the RTD sensors	 A0014529 A = 2-wire connection B = 3-wire connection C = 4-wire connection * only use in event of energy calculation with heat differential /T, temperature sensor in steam Terminals 1, 2, 5, 6: temperature Terminals 3, 4, 7, 8: temperature

iTEMP temperature transmitter connection	 A0014528 A = without external power supply of the transmitter, B = with external power supply of the transmitter ** only use in event of energy calculation with heat differential /T, temperature sensor in steam Terminals 90, 91: transmitter power supply Terminals 52, 53: temperature input

To ensure the highest level of accuracy, we recommend using the RTD 4-wire connection, as this compensates for measurement errors caused by the mounting location of the sensors or the line length of the connecting cables.

6.3.3 Pressure

Pressure measuring cell connection	 A0015152 A = 2-wire sensor with power supply via the steam calculator B = 4-wire sensor with external power supply Terminals 90, 91: transmitter power supply Terminals 54, 55: pressure

6.4 Outputs

6.4.1 Analog output (active)

This output can be used either as a 0/4 to 20 mA current output or as a voltage pulse output. The output is galvanically isolated. Terminal assignment, → 🖹 17.

6.4.2 Relays

The two relays can be switched in case of fault messages or a limit violation.

Relay 1 or 2 can be selected under **Setup** → **Advanced setup** → **System** → **Fault switching**.

Limit values are assigned under **Setup** → **Advanced setup** → **Application** → **Limits**. Possible settings for limit values are described in the "Limits" section of the Operating Instructions.

6.4.3 Pulse output (active)

Voltage level:
- 0 to 2 V corresponds to Low level
- 15 to 20 V corresponds to High level

Maximum output current: 22 mA

6.4.4 Open collector output

The two digital outputs can be used as status or pulse outputs. Make the selection in the following menus **Setup** → **Advanced setup** or **Expert** → **Outputs** → **Open collector**

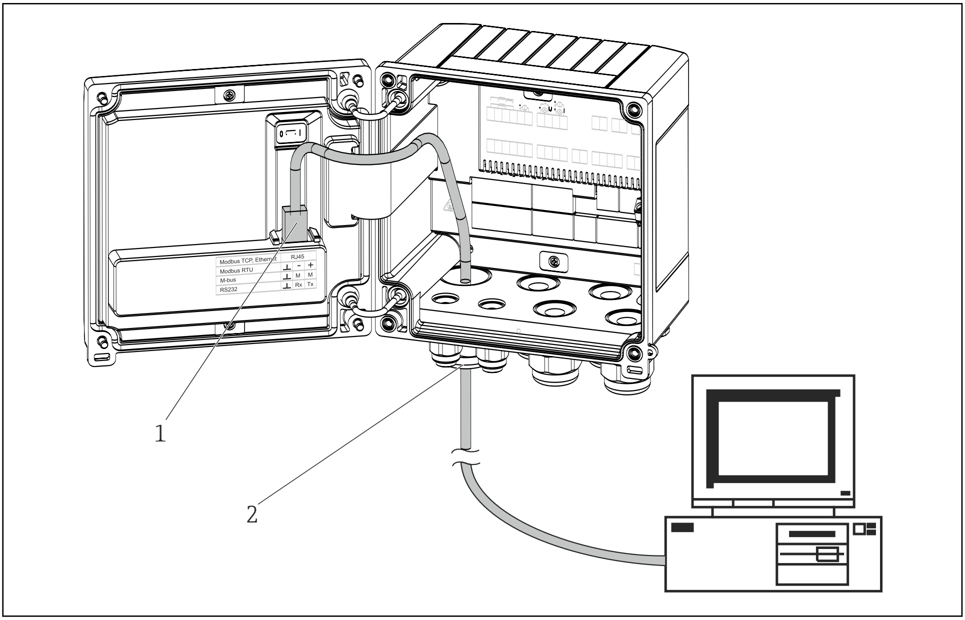
6.5 Communication

The USB interface is always active and can be used independently of other interfaces. Parallel operation of multiple optional interfaces, e.g. fieldbus and Ethernet, is not possible.

6.5.1 Ethernet TCP/IP (optional)

The Ethernet interface is galvanically isolated (testing voltage: 500 V). A standard patch cable (e.g. CAT5E) can be used to connect the Ethernet interface. A special cable gland is available for this purpose which allows users to guide pre-terminated cables through the housing. Via the Ethernet interface, the device can be connected using a hub or a switch or directly to office equipment.

- Standard: 10/100 Base T/TX (IEEE 802.3)
- Socket: RJ-45
- Max. cable length: 100 m



A0014600

19 Connection of Ethernet TCP/IP, Modbus TCP

1 *Ethernet, RJ45*
2 *Cable entry for Ethernet cable*

6.5.2 Modbus TCP (optional)

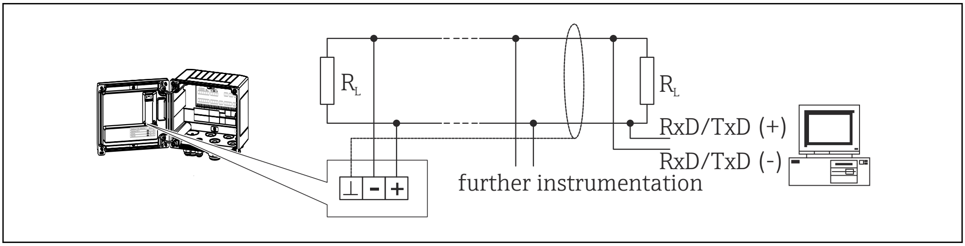
The Modbus TCP interface is used to connect the device to higher-order systems to transmit all measured values and process values. The Modbus TCP interface is physically identical to the Ethernet interface → 19, 25

The device can only be read from a Modbus master.

Detailed information for the Modbus register map: www.endress.com

6.5.3 Modbus RTU (optional)

The Modbus RTU (RS-485) interface is galvanically isolated (testing voltage: 500 V) and used to connect the device to higher-level systems to transmit all measured values and process values. It is connected via a 3-pin plug-in terminal in the housing cover.

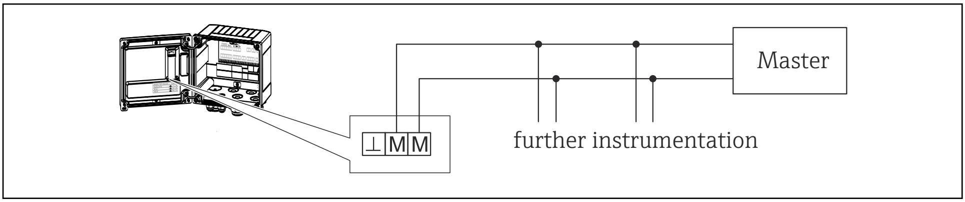


A0047099

20 *Connection of Modbus RTU*

6.5.4 M-Bus (optional)

The M-Bus (Meter Bus) interface is galvanically isolated (testing voltage: 500 V) and used to connect the device to higher-level systems to transmit all measured values and process values. It is connected via a 3-pin plug-in terminal in the housing cover.



A0047100

21 *Connection of M-Bus*

6.6 Post-connection check

After completing the device's electrical installation, carry out the following checks:

Device condition and specifications	Notes
Is the device or cable damaged (visual inspection)?	-
Electrical connection	**Notes**
Does the supply voltage match the information on the nameplate?	100 to 230 V AC/DC (±10 %) (50/60 Hz) 24 V DC (−50 % / +75 %) 24 V AC (±50 %) 50/60 Hz
Are the mounted cables relieved of tension?	-
Are the power supply and signal cables connected correctly?	See wiring diagram on the housing

7 Operation options

7.1 Overview of operation options

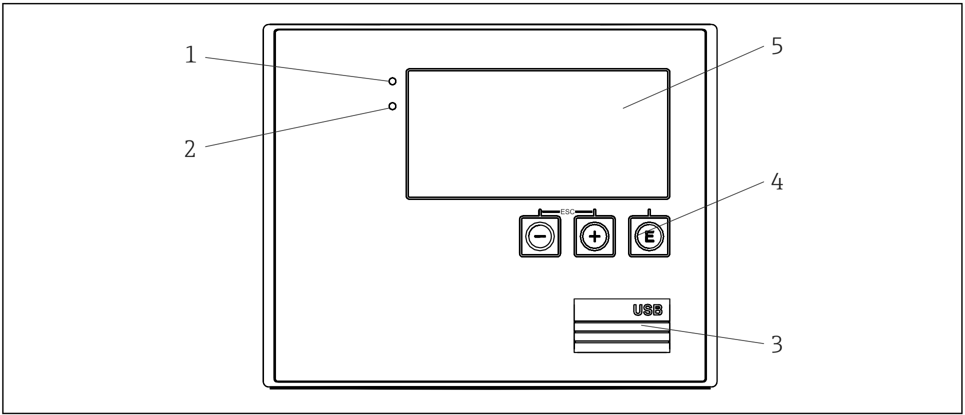
The steam calculator can be configured using operating keys or with the help of the "FieldCare" operating software.

The operating software, including the interface cable, is available as an order option, i.e. it is not included in the basic scope of delivery.

Parameter configuration is locked if the device is locked by the write protection switch → 28, the user code or digital input.

For details, see "Access protection" section in the Operating Instructions.

7.2 Display and operating elements



A0013444

22 Display and operating elements of the device

1 *Green LED, "Operation"*
2 *Red LED, "Fault message"*
3 *USB connection for configuration*
4 *Operating keys: -, +, E*
5 *160x80 dot-matrix display*

Green LED if voltage present, red LED in the event of an alarm/error. Green LED is always lit once the device is supplied with power.

Red LED flashing slowly (approx. 0.5 Hz): The device has been set to the bootloader mode.

Red LED flashing quickly (approx. 2 Hz): In normal operation: maintenance required. During firmware update: data transmission in progress.

Red LED remains lit: Device error.

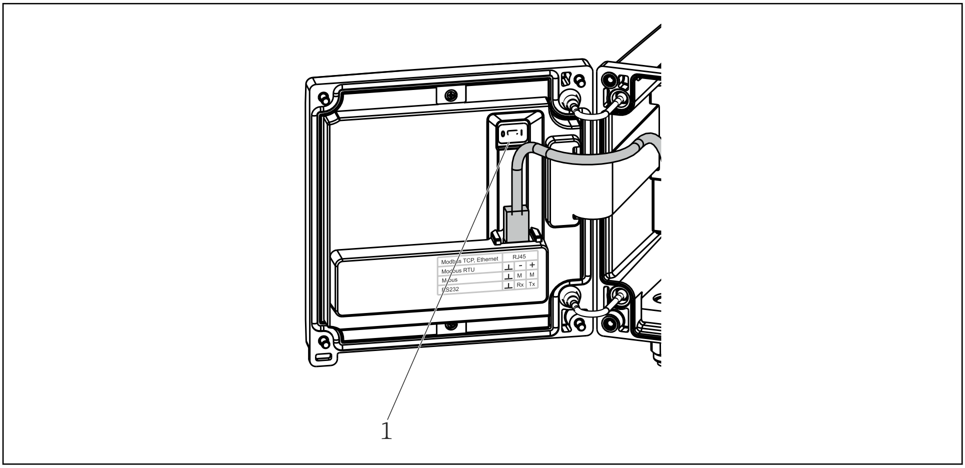
7.2.1 Operating elements

3 operating keys, "-", "+", "E"

Esc/Back function: Press "-" and "+" simultaneously.

Enter/Confirm entry function: Press "E"

Write protection switch

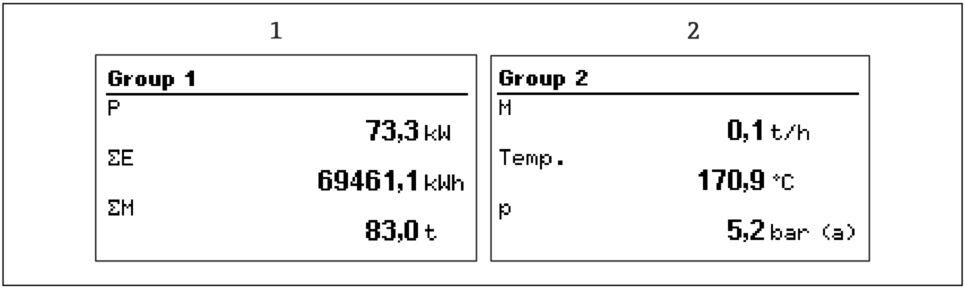


A0015168

23 Write protection switch

1 Write protection switch on rear of housing cover

7.2.2 Display



A0014533

24 Steam calculator display (example)

1 Group 1 display
2 Group 2 display

7.2.3 "FieldCare Device Setup" operating software

To configure the device using the FieldCare Device Setup software, connect the device to your PC via the USB interface.

Connecting the device

1. Start FieldCare.
2. Connect the device to the PC via USB.
3. Create project in File/New menu.
4. Select Communication DTM (CDI Communication USB).
5. Add device EngyCal RS33.
6. Click Connect.
7. Start parameter configuration.

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

NOTICE

Undefined switching of outputs and relays

▶ During configuration with FieldCare, the device may assume undefined statuses! This may result in the undefined switching of outputs and relays.

7.3 Structure and function of the operating menu

A complete overview of the operating matrix, incl. all of the configurable parameters, can be found in the appendix of the Operating Instructions.

Language	Picklist with all available operating languages. Select the language of the device.

Display/operation menu	▪ Select the group for display (alternate automatically or fixed display group) ▪ Configure brightness and contrast of display ▪ Display saved analyses (day, month, year, billing date, totalizer)

Setup menu	The parameters for quick commissioning of the device can be configured in this setup. The advanced setup contains all of the essential parameters for configuring the device function.

	▪ Units ▪ Pulse value, value ▪ Date and time ▪ Pressure	Parameters for quick commissioning
	Advanced setup (settings that are not essential for the basic operation of the device) Special settings can also be configured via the "Expert" menu.	

Diagnostics menu	Device information and service functions for a quick device check. ▪ Diagnostic messages and list ▪ Event logbook ▪ Device information ▪ Simulation ▪ Measured values, outputs

Expert menu	The Expert menu provides access to all of the operating positions of the device, including fine-tuning and service functions. ▪ Skip directly to the parameter via Direct Access (on device only) ▪ Service code to display service parameters (via PC operating software only) ▪ System (settings) ▪ Inputs ▪ Outputs ▪ Application ▪ Diagnostics

8 Maintenance

No special maintenance work is required for the device.

8.1 Cleaning

A clean, dry cloth can be used to clean the device.

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