BA00300K/09/EN/06.21-00
71557772
2021-10-25

Operating Instructions
RA33

Batch Controller

Endress+Hauser
People for Process Automation

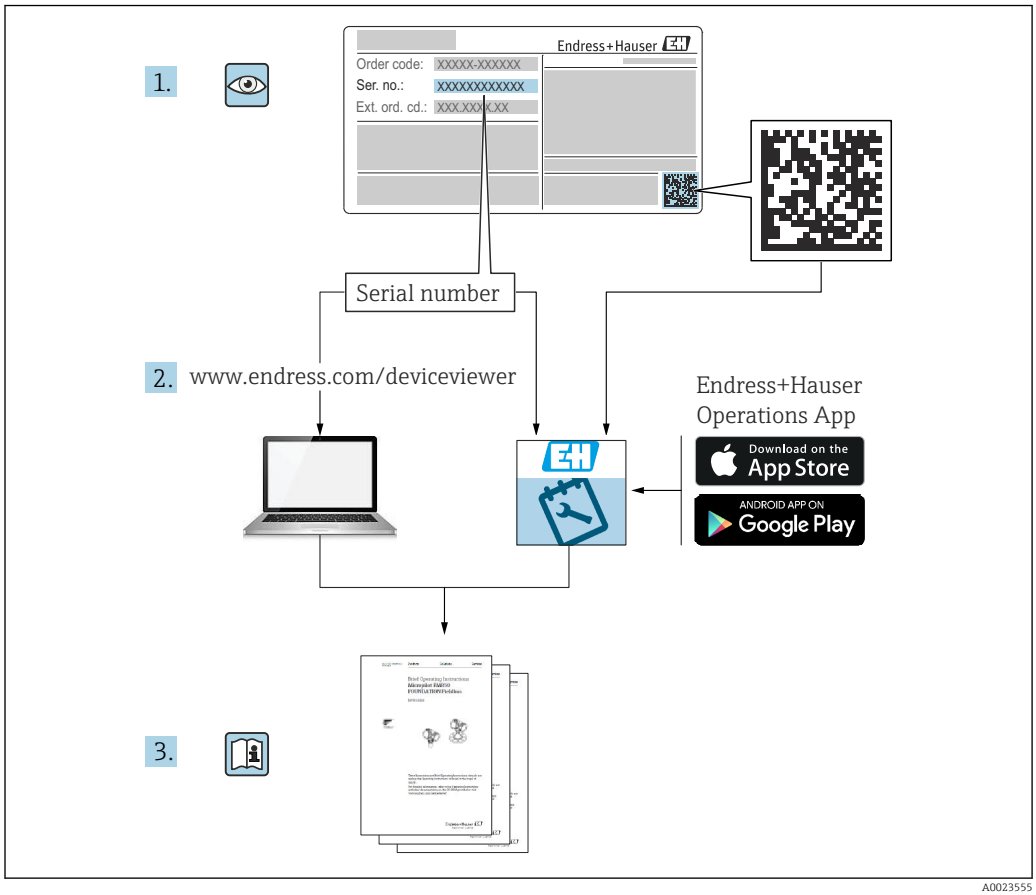

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
A0023555

Table of contents

1 About this document

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Document conventions

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 dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

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

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.
 A0012751	**ESD - electrostatic discharge** Protect the terminals from electrostatic discharge. Failure to observe this may result in the destruction of parts of the electronics.

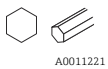
1.2.3 Symbols for certain types of information

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
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

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
	Hazardous area		Safe area (non-hazardous area)

1.2.5 Tool symbols

Symbol	Meaning
 A0011220	Flat-blade screwdriver
 A0011219	Phillips screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench
 A0013442	Torx screwdriver

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

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

The Batch Controller is a batching and dosing manager for metering any kind of fluid or mineral oil.

- The manufacturer accepts no liability for damages resulting from incorrect use or use other than that for which the device is intended. It is not permitted to convert or modify the device in any way.
- The device may only be operated when installed.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to national regulations.

If working on and with the device with wet hands:
- Due to the increased risk of electric shock, wear suitable gloves.

2.4 Operational safety

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

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,
- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice 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.

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

2.6 IT security

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

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

3 Incoming acceptance and product identification

3.1 Incoming acceptance

Proceed as follows on receipt of the device:

1. Check whether the packaging is intact.
2. If damage is discovered:
   Report all damage immediately to the manufacturer.
3. Do not install damaged material, as the manufacturer cannot otherwise guarantee compliance with the safety requirements and cannot be held responsible for the consequences that may result.
4. Compare the scope of delivery to the contents of the order.
5. Remove all the packaging material used for transportation.

3.2 Product identification

The device can be identified in the following ways:
- Nameplate specifications
- Enter the serial number from the nameplate in the *W@M Device Viewer*www.endress.com/deviceviewer: All data relating to the device and an overview of the Technical Documentation supplied with the device are displayed.

3.3 Nameplate

The nameplate is located on the side of the housing.

The nameplate provides you with the following information on the device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Firmware version
- Ambient and process conditions
- Input and output values
- Measuring range
- Activation codes
- Safety information and warnings
- Certificate information
- Approvals as per order version

▶ Compare the information on the nameplate with the order.

3.4 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang
Model/type reference:	RA33

3.5 Certificates and approvals

3.5.1 Certificates and approvals

For certificates and approvals valid for the device: see the data on the nameplate

Approval-related data and documents: www.endress.com/deviceviewer → (enter the serial number)

4 Mounting

4.1 Incoming acceptance, transport, storage

Compliance with the permitted environmental and storage conditions is mandatory. The exact specifications for this are provided in the "Technical Information" section → 63.

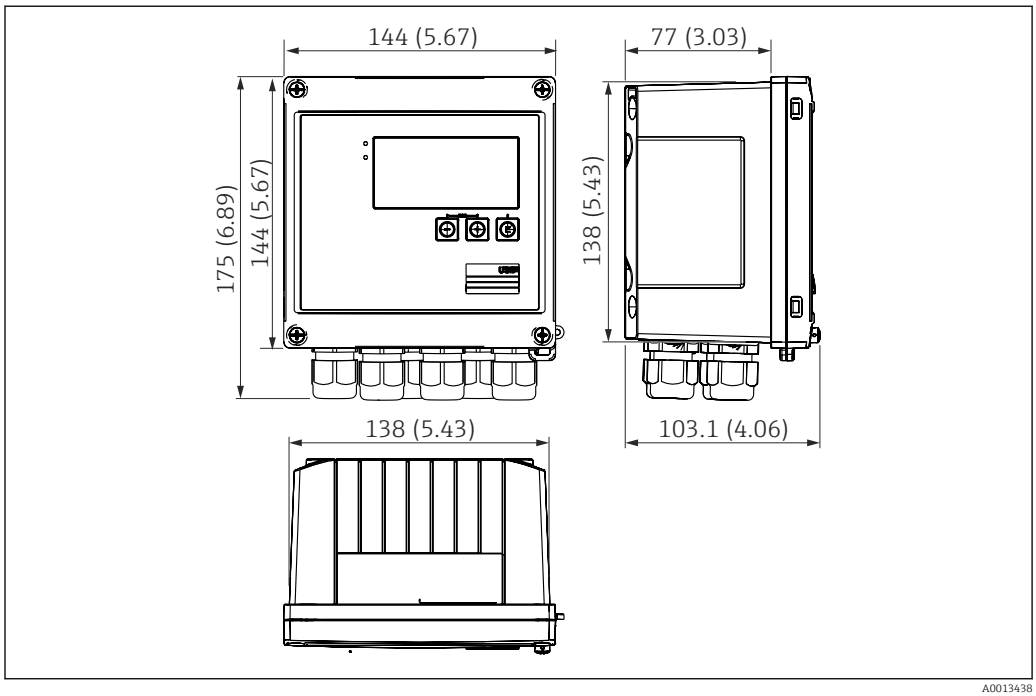
4.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- Is the packaging or the content damaged?
- Is the delivery complete? Compare the scope of delivery against the information on your order form.

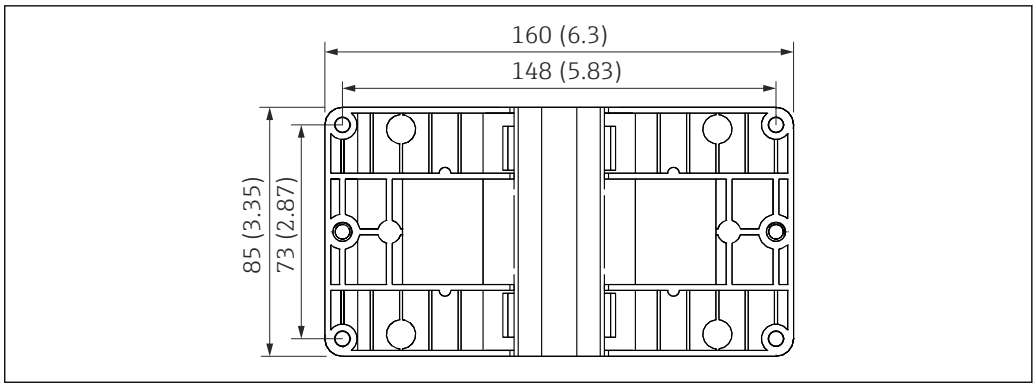
4.1.2 Transport and storage

Please note the following:
- Pack the device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permitted storage temperature is −40 to +85 °C (−40 to +185 °F); it is possible to store the device at borderline temperatures for a limited period (48 hours maximum).

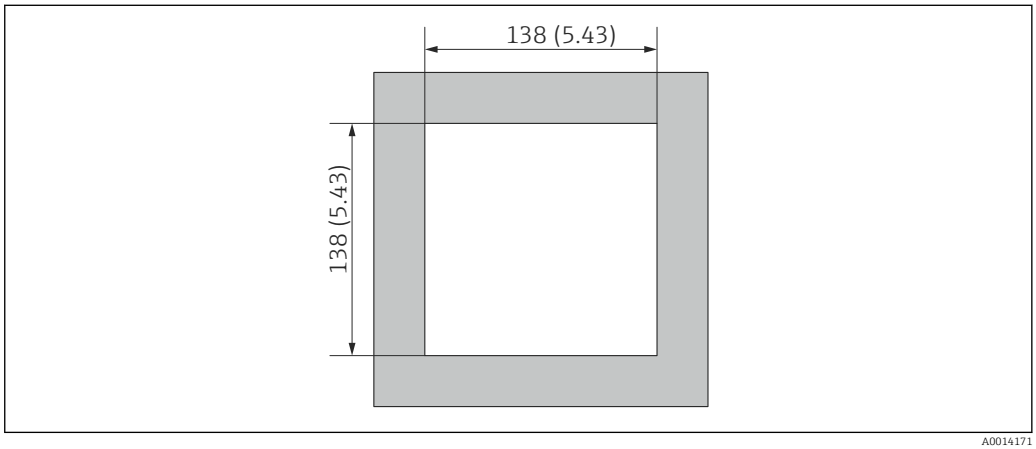
4.2 Dimensions



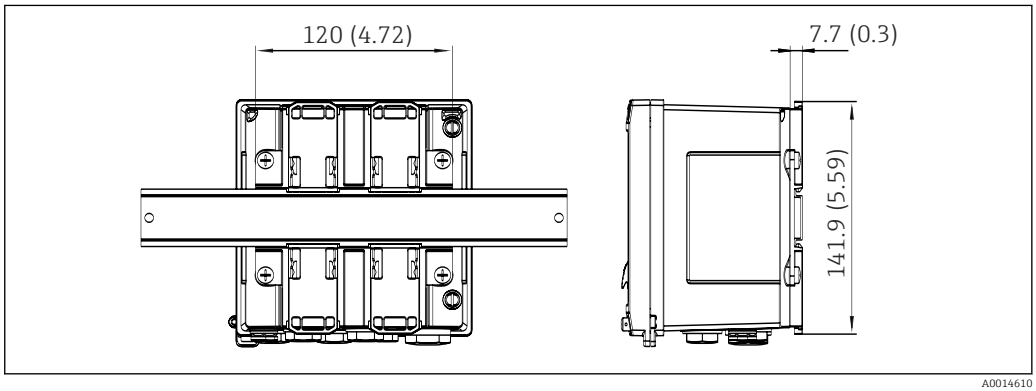
1 *Dimensions of the device in mm (in)*



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



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



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

4.3 Mounting requirements

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

The orientation is determined by the legibility 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

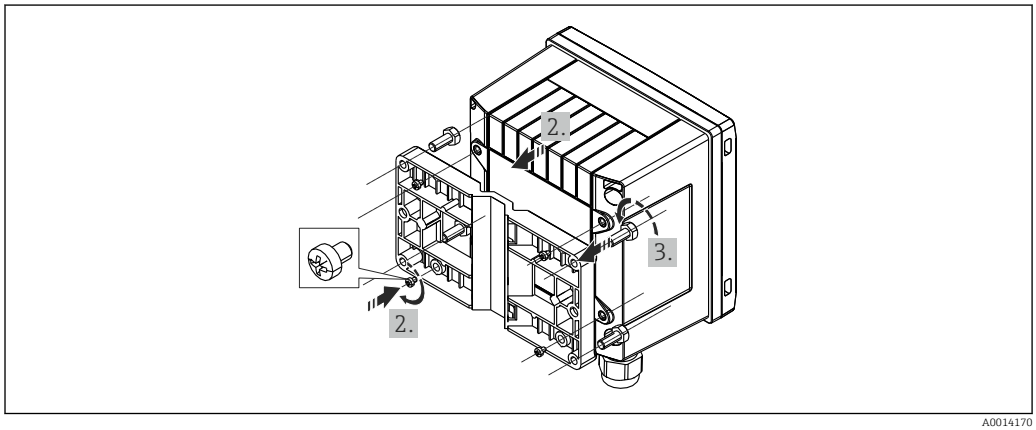
Overheating of the device due to insufficient cooling

- 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.

4.4 Mounting

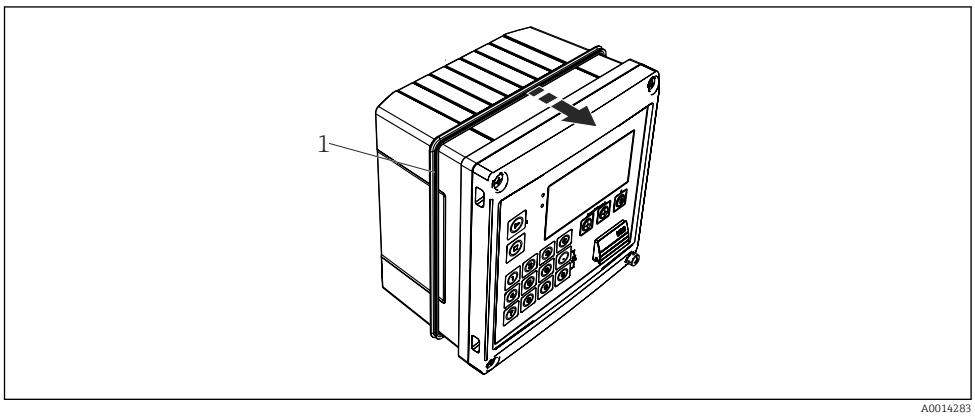
4.4.1 Wall mounting

1. Use the mounting plate as the template for drilled holes, dimensions → 2, 11
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.



5 *Wall mounting*

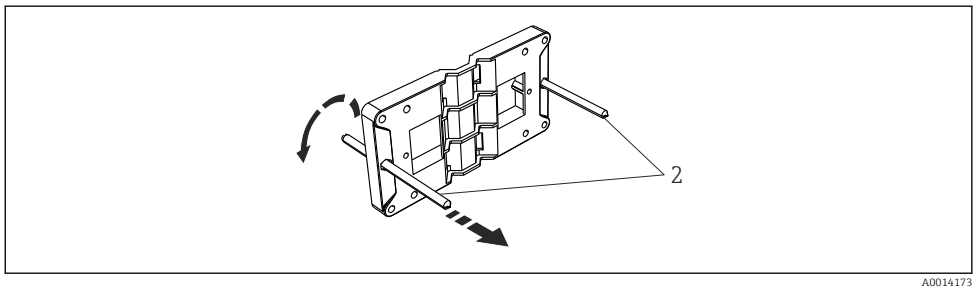
4.4.2 Panel mounting

1. Make the panel cutout in the required size, dimensions → 3, 11
2. 

6 *Panel mounting*

Attach the seal (item 1) to the housing.

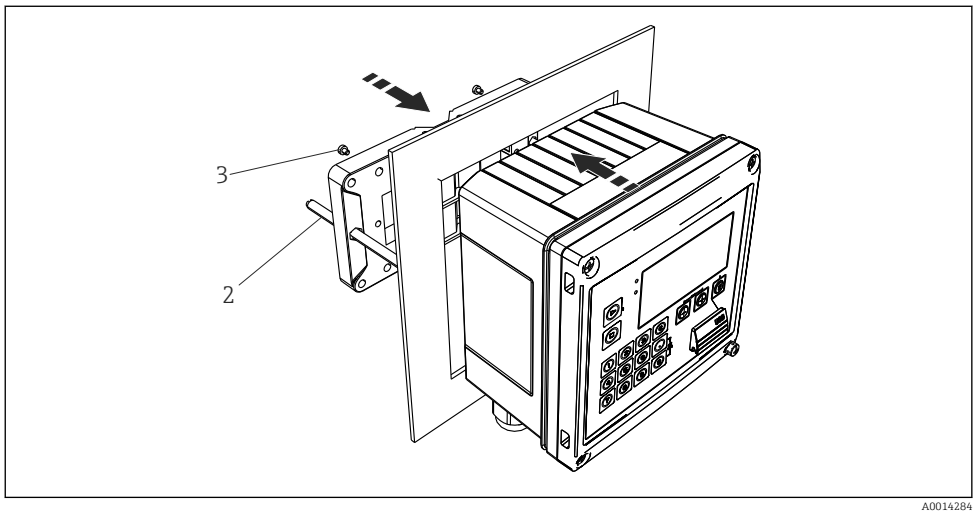
3.



7 *Preparing the mounting plate for panel mounting*

Screw the threaded rods (item 2) into the mounting plate (dimensions → 2, 11).

4.



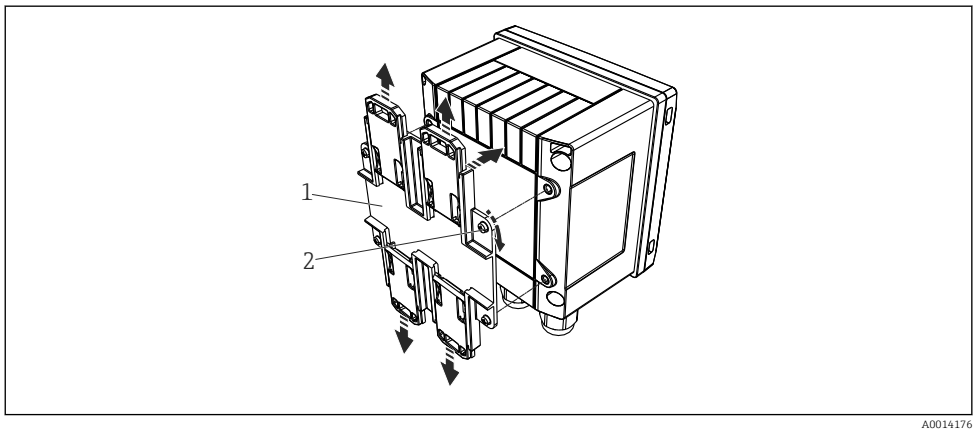
8 *Panel mounting*

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.

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

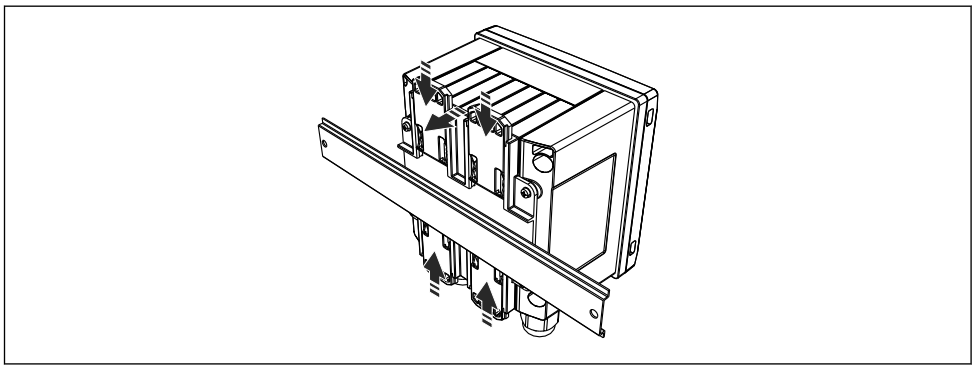
1.



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.



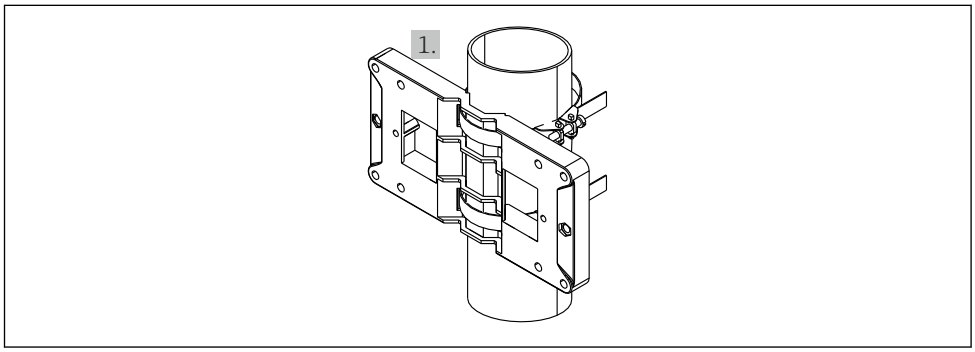
A0014177

10 DIN rail mounting

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

4.4.4 Pipe mounting

1.

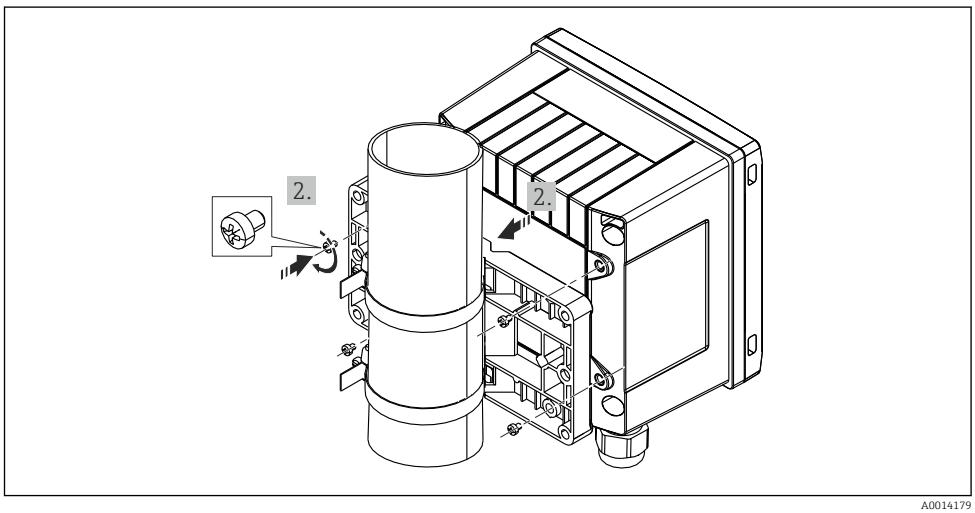


A0014178

11 Preparing for pipe mounting

Pull the steel belts through the mounting plate (dimensions → 2, 11) 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.

4.5 Post-mounting check

To install the Batch Controller and the associated temperature sensors, observe the general installation instructions according to EN 1434 Part 6.

5 Electrical connection

5.1 Connection instructions

⚠ WARNING

Danger! Electric voltage!

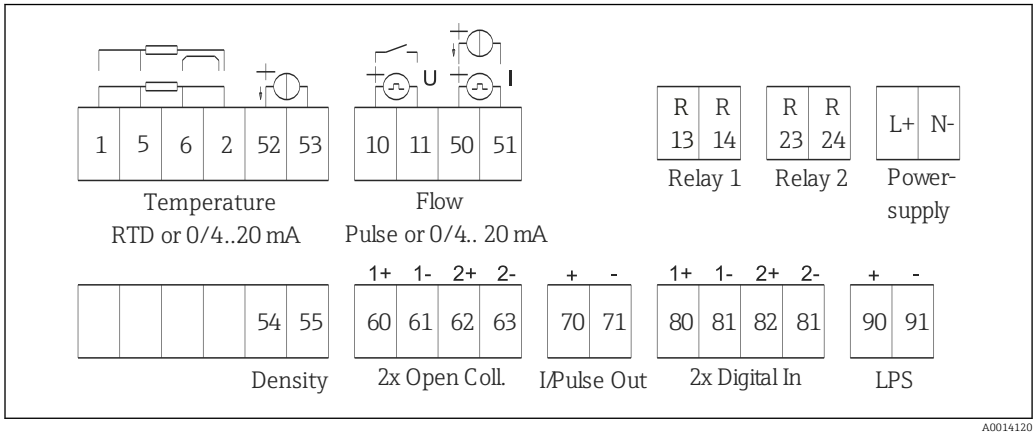
- The entire connection of the device must take place while the device is de-energized.

⚠ 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.

5.2 Quick wiring guide



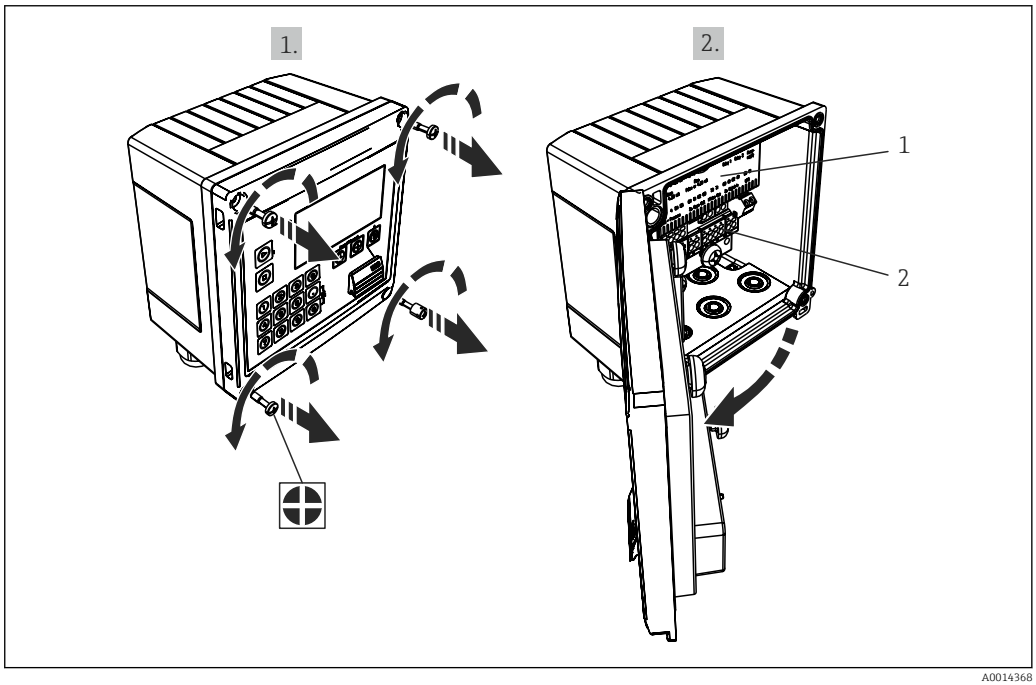
13 *Connection diagram of the device*

Terminal assignment

Terminal	Terminal assignment	Inputs
1	+ RTD power supply	Temperature (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	
54	+ 0/4 to 20 mA input	Density (current input)
55	Signal ground for 0/4 to 20 mA input	
10	+ pulse input (voltage or contact)	Flow (Optionally pulse or current input)
11	- pulse input (voltage or contact)	
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)	▪ Time synchronization ▪ Start batch ▪ Stop batch ▪ Reset batch
81	- digital input (terminal 1)	
82	+ digital input 2 (switch input)	Time synchronization
81	- digital input (terminal 2)	
		Outputs
60	+ status/pulse output 1 (open collector)	Batch control: pump/valve, volume counter, signal batch ended, fault
61	- status/pulse output 1 (open collector)	
62	+ status/pulse output 2 (open collector)	
63	- status/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 1 normally open (NO)	Batch control: pump/valve, fault
14	Relay 1 normally open (NO)	
23	Relay 2 normally open (NO)	
24	Relay 2 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	

5.2.1 Opening the housing



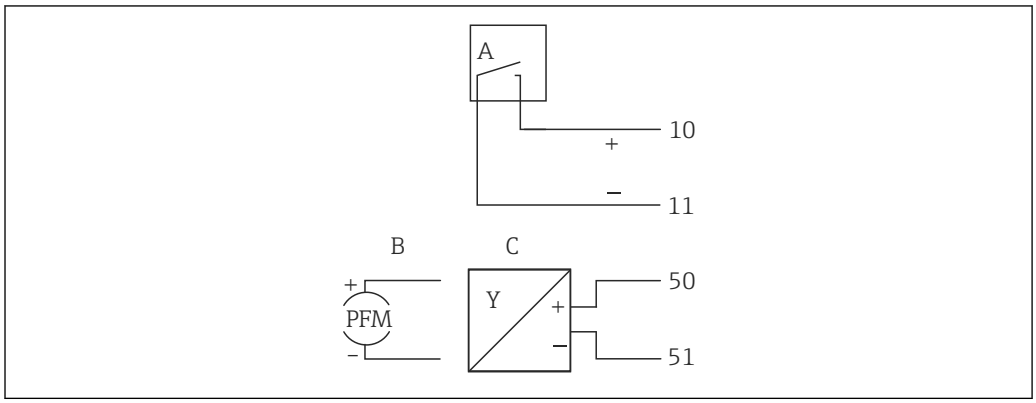
14 Opening the housing of the device

1 Terminal assignment labeling
2 Terminals

5.3 Connecting the sensors

5.3.1 Flow

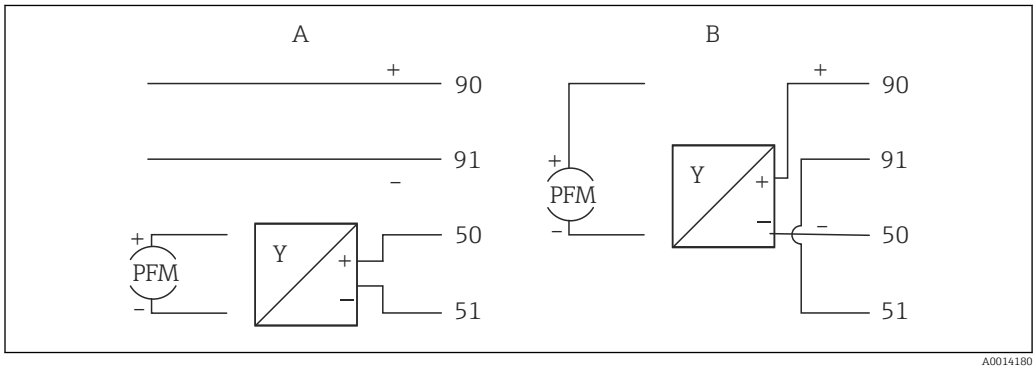
Flow sensors with external power supply



15 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 Batch Controller

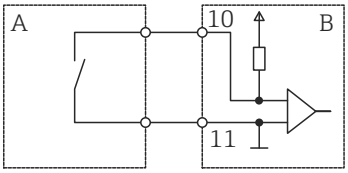
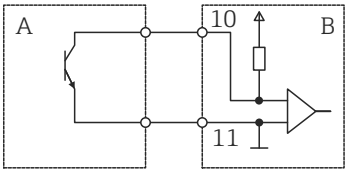
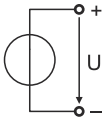
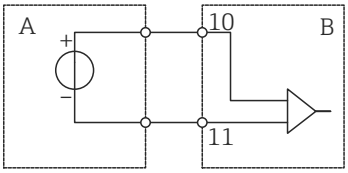
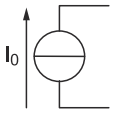
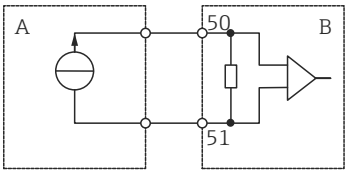
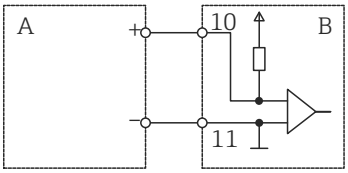


16 Connecting active flow sensors

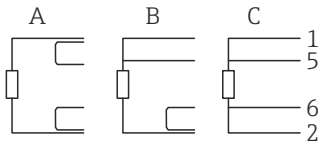
A 4-wire sensor
B 2-wire sensor

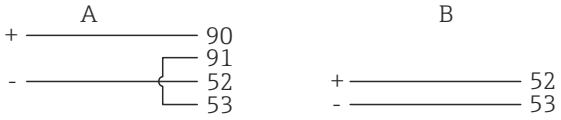
Settings for flow sensors with pulse output

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	Comment
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
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.

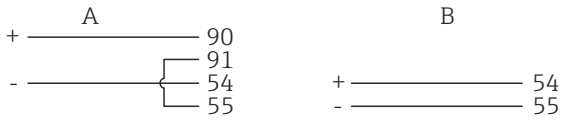
5.3.2 Temperature

Connecting the RTD sensors	 A0047841 A = 2-wire connection B = 3-wire connection C = 4-wire connection Terminals 1, 2, 5, 6: temperature

Temperature transmitter connection	 A0047822 A = without external power supply of the transmitter, B = with external power supply of the transmitter 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 inaccuracies caused by the mounting location of the sensors or the line length of the connecting cables.

5.3.3 Density

Density sensor connection	 A0015152 A = without external power supply of the density sensor B = with external power supply of the density sensor

5.4 Outputs

5.4.1 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, → 16.

5.4.2 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

5.4.3 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**

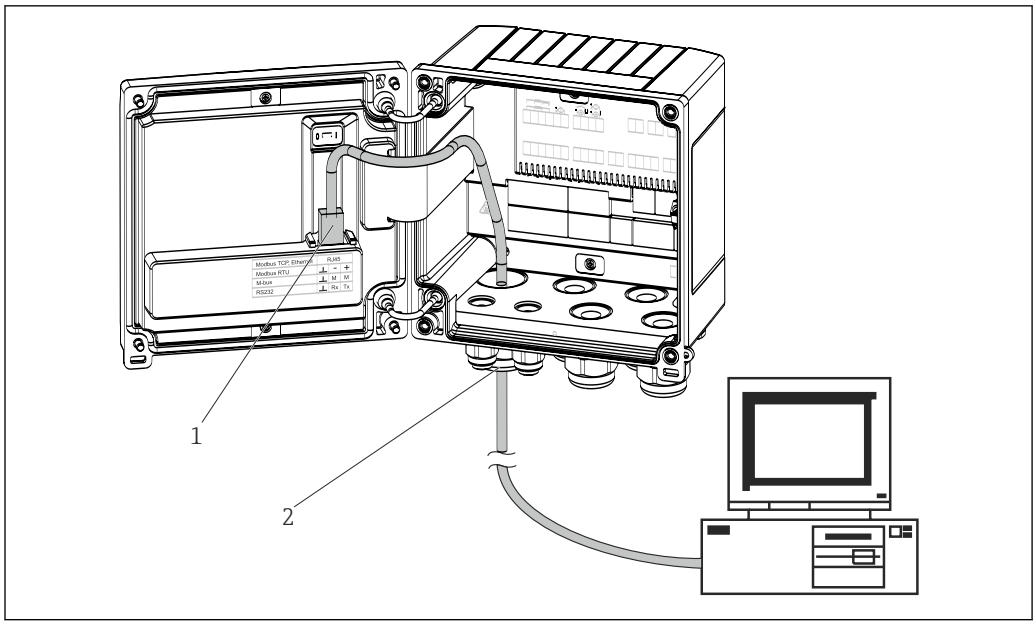
5.5 Communication

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.

5.5.1 Ethernet TCP/IP (optional)

The Ethernet interface is galvanically isolated (test 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

17 Connection of Ethernet TCP/IP, Modbus TCP

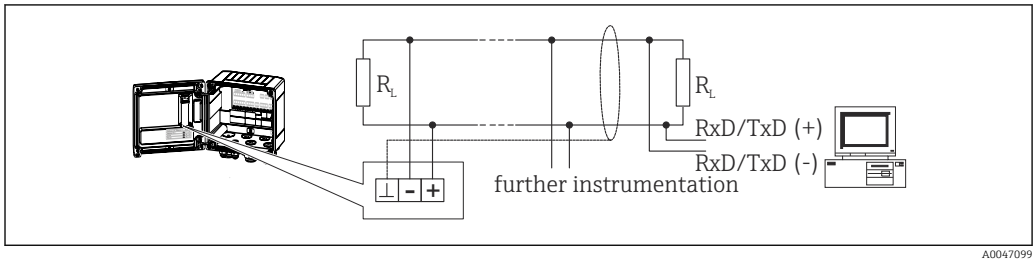
1 Ethernet, RJ45
2 Cable entry for Ethernet cable

5.5.2 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 → 17, 22

5.5.3 Modbus RTU (optional)

The Modbus RTU (RS-485) interface is galvanically isolated (test 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.

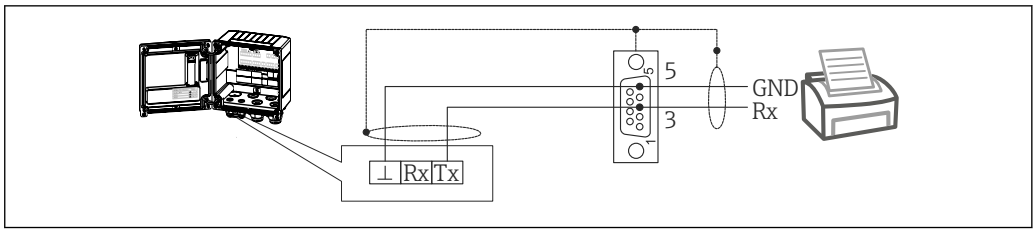


A0047099

18 Connection of Modbus RTU

5.5.4 Printer interface / RS232 (optional)

The printer/RS232 interface is galvanically isolated (test voltage: 500 V) and is used to connect a printer. It is connected via a 3-pin plug-in terminal in the housing cover.



19 Printer connection via RS232

The following printers have been tested with the Batch Controller:

GeBE MULDE Mini thermal printer

5.6 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 specifications 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
Do the mounted cables have adequate strain relief?	-
Are the power supply and signal cables correctly connected?	See wiring diagram on the housing

6 Operation options

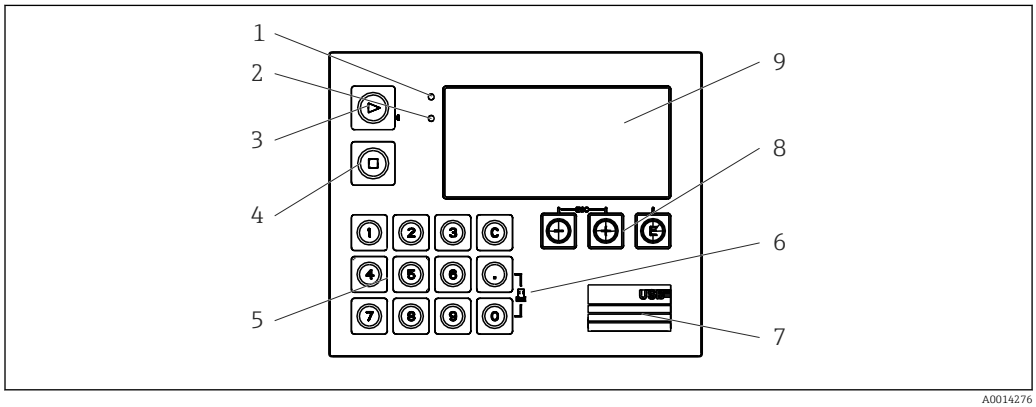
6.1 General information regarding operation

The Batch Controller 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 → 25 or the user code.

6.2 Display and operating elements



20 *Display and operating elements of the device*

1 *Green LED, "Operation"*
2 *Red LED, "Fault message"*
3 *Start (function key)*
4 *Stop (function key)*
5 *Numeric keyboard (function key)*
6 *Start printout (function key)*
7 *USB connection for configuration (interface)*
8 *-, +, E (operating keys)*
9 *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.

6.2.1 Operating elements

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

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

Enter/Confirm entry function: Press "E"

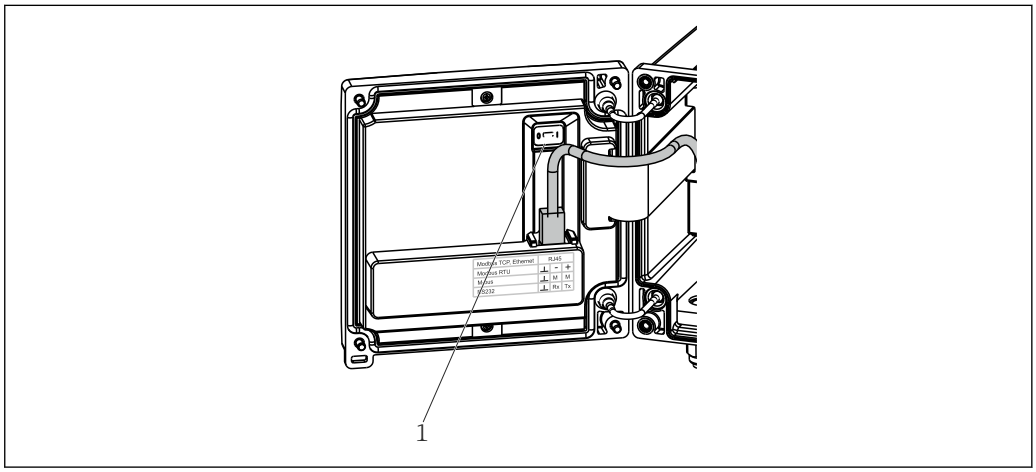
14 function keys

Start / stop function: Press "Start" to start a batching process. Press "Stop" to pause the batch that is currently running. Press "Stop" again to cancel the batch, press "Start" again to resume the batch run.

Function C: Press "C" when a batch is stopped to reset the counters on the display to their initial values.

Print function: Press "0" and "." simultaneously to initiate a printout for the last batch run. To avail of this functionality, the "RS232 printer interface" option must be purchased.

Write protection switch



21 Write protection switch

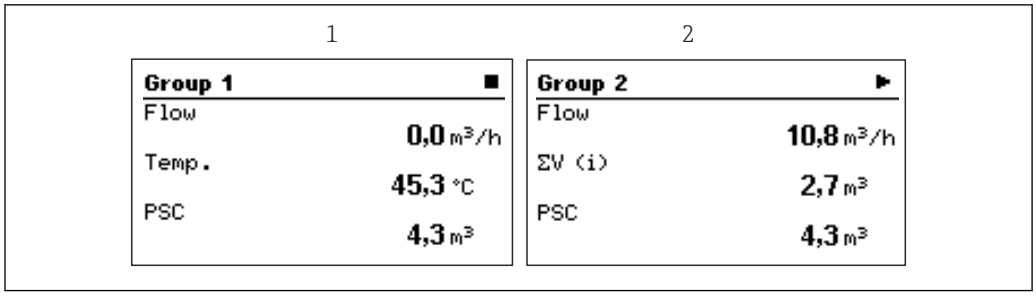
1 Write protection switch on rear of housing cover

6.2.2 Preset counter entry function

A value for the preset counter can be entered any time. This value can be entered either in the **Display** menu or by pressing one of the keys 0-9 or period. It does not matter whether a batching process is currently active when you enter the value. The new preset counter value is used when the next batching process is started.

If the preset counter is part of a display group, the preset counter value which is valid for the current batch is always displayed. If the value is changed when the batching process is stopped, the new value appears immediately on the display. However, if the value is changed during an active batching operation, the old value of the preset counter, which still applies for the current batch run, is displayed until this batching operation is finished. The new value, which is valid for the next batching operation, is displayed directly afterwards.

6.2.3 Display



22 *Display of the Batch Controller (example)*

1 Display group 1, no batch active. Flow, temperature, preset counter
2 Display group 2, batch active. Flow, volume counter, preset counter

6.2.4 "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.

Establishing a connection

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 RA33.
6. Click Connect.
7. Start parameter configuration.

Continue with device configuration in accordance with these 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 FieldCareDevice 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.

6.3 Operating matrix

A complete overview of the operating matrix, incl. all of the configurable parameters, can be found in the appendix, → 74.

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 and batch reports ▪ Enter a value for the preset counter ▪ Recipe selection

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 ▪ Signal type ▪ Pulse value, value (for pulse signal type) or ▪ Start of measuring range (for current signal type) ▪ End of measuring range (for current signal type) ▪ Unit ▪ Counter unit ▪ Date and time 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-turning 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

7 Commissioning

Make sure that all post-connection checks have been carried out before putting your device into operation:
- See 'Post-mounting check' section, → 📄 15.
- Checklist, 'Post-connection check' section, → 📄 23.

After the operating voltage is applied, the display and the green LED are illuminated. The device is now operational and can be configured via the keys or the "FieldCare" parameterization software → 📄 26.

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

7.1 Quick commissioning

For quick commissioning of the "standard" Batch Controller application, only a few operating parameters must be entered in the **Setup** menu.

Prerequisites for quick commissioning:

RTD temperature sensor, 4-wire direct connection

Menu/setup
- **Units**: Select unit type (SI/US)
- **Signal type**: Select the signal type for the flow (pulse or current)
- **Unit**: Select the flow unit
- **Unit counter**: Define the unit for the flow counter, e.g. m^3, kg
- **Pulse value, value**: Enter the unit and value of the pulse value for the flow transmitter (for the pulse signal type)
- **Start of measuring range** and **end of measuring range** (for the current signal type)
- **Date/time**: Set the date and time

The device is now operational and ready to control batches.

You can configure device functions, such as data logging, tariff function, bus connection and the scaling of current inputs for flow or temperature, in the **Advanced setup** menu → 📄 36 or in the **Expert** menu.

7.2 Applications

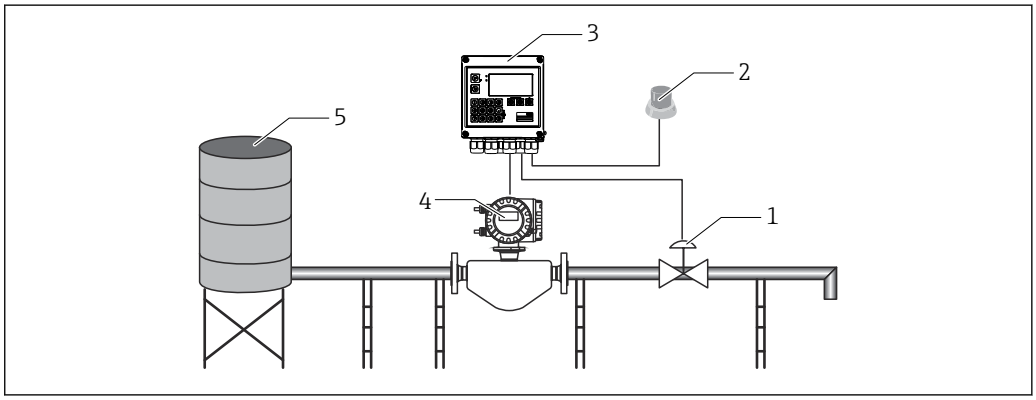
The device is suitable for the automatic control of slow batch processes that last longer than 10 seconds.

The following is an explanation of the application possibilities, including brief operating instructions for the respective device settings.

The device can be used for the following applications:
- Batch Controller with flow measurement and 1-stage batching, → 29
- Batch Controller with flow measurement and 2-stage batching, → 30
- Batch Controller with API temperature compensation, → 31
- Batch Controller with API temperature/density compensation, → 32
- Batch Controller with mass calculation, → 34
- Batch Controller with volume calculation, → 35
- Manual batching, → 36

7.2.1 Batch Controller with flow measurement and 1-stage batching

This application describes the standard application of the Batch Controller RA33. It is presented as a metering instrument in this application. The flow is measured and the valve is controlled in a way that ensures that precisely the desired volume is batched.



23 Batch Controller with flow measurement and 1-stage batching

1 Valve
2 Start button
3 Batch Controller
4 Flowmeter
5 Supply tank

Input signals:

Flow (pulse input or current input)

Output signals:

Valve control (relay or open collector)

Required settings:

1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Valve control:
   Set the choice of filling stages to 1-stage. Assign the selected output to control the filling stage.

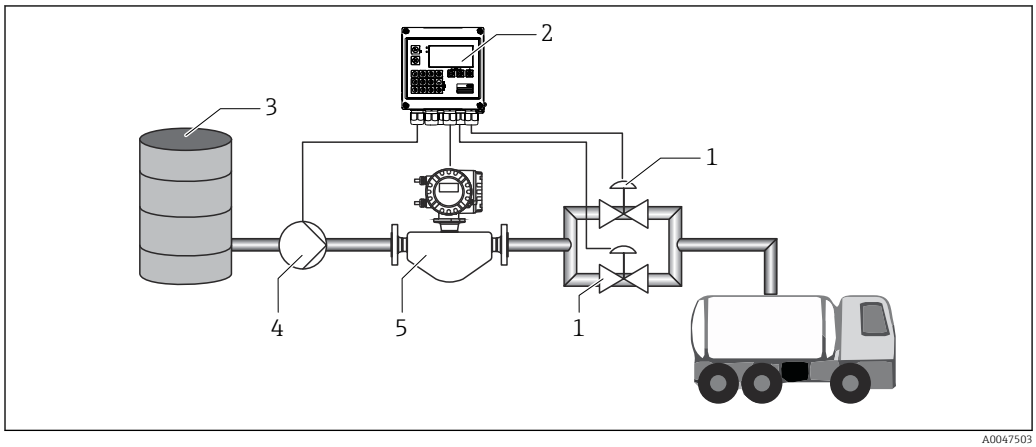
3. Preset counter:
   Before starting a batch for the first time, a value must be entered for the preset counter → 📄 25, as otherwise batching cannot commence. The preset counter defines the quantity of medium which the Batch Controller RA33 batches as precisely as possible. The last preset counter value that was used is stored in the device and applied for new batching operations until the value is changed.
4. After-run correction:
   The first time the automatic after-run correction function of the Batch Controller RA33 is used, the user must first teach the Controller what the after-run quantity is. The after-run quantity refers to the volume of medium that still flows between the time the control output switches and the time no more flow is recorded. The after-run quantity therefore encompasses the switching delay and the valve closing time, for example. The Batch Controller tries to correct the switch output by this amount in order to achieve a batching result that is as accurate as possible. To keep excess amounts to a minimum during these initial runs, it is advisable to enter a value for the manual after-run quantity and to teach the device gradually with smaller test quantities as medium overflow can be expected.

Display variables:

Preset counter, batch counter, flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

7.2.2 Batch Controller with flow measurement and 2-stage batching

This application describes the standard application of the Batch Controller. It describes two-stage batching with two valves. This application uses one valve with a higher rate of flow and another valve with a lower rate of flow to dose the medium. The valve with the higher rate of flow is used for faster filling and is closed earlier so that the device can then dose more precisely with the second valve.



24 Batch Controller with flow measurement and 2-stage batching

1 Valves
2 Batch Controller
3 Supply tank
4 Pump
5 Flowmeter

Input signals:

Flow (pulse input or current input)

Output signals:

Valve control (relay or open collector)

Pump control (analog output, relay or open collector)

Required settings:

1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Valve control:
   Set the choice of filling stages to 2-stage. Assign the selected outputs to control the filling stages.

Display variables:

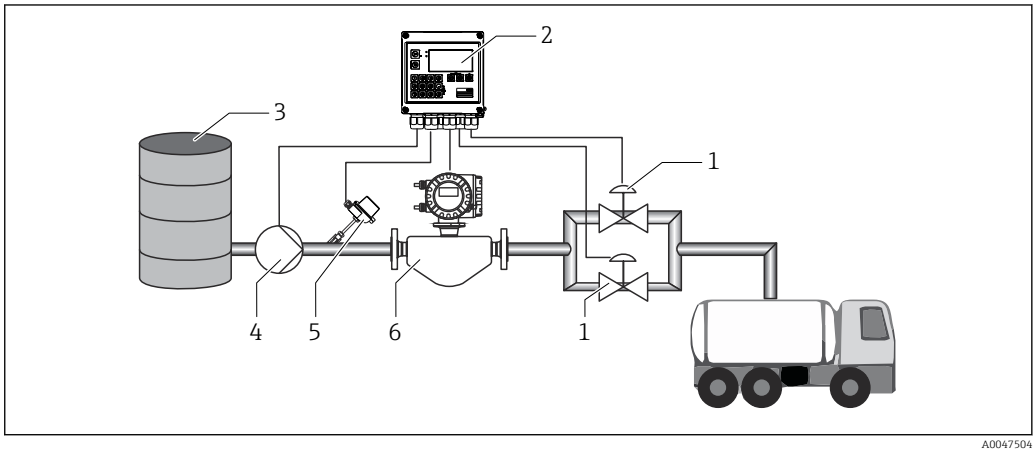
Preset counter, batch counter, flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

Miscellaneous notes:

- Before starting a batch for the first time, a value must be entered for the preset counter → 25, as otherwise batching cannot commence. Afterwards, the last preset counter value to be used is stored in the device.
- To ensure that the after-run quantity is kept to a minimum during the first run even if the automatic after-run correction function is activated (this function requires an initial measurement), it is advisable to enter a measured value as the manual after-run correction value, or to teach the device gradually with a small test quantity.

7.2.3 Batch Controller with API temperature compensation

This application describes the use of the Batch Controller with mineral oils and volume correction. The volume can be corrected by simply measuring the temperature, or by measuring the temperature and the density. The first application example describes the measurement using temperature compensation only. The volume can be corrected with any flow unit (volume flow or mass flow).



25 *Batch Controller with flow measurement, temperature compensation and 2-stage batching*

1 *Valves*
2 *Batch Controller*
3 *Supply tank*
4 *Pump*
5 *Temperature sensor*
6 *Flowmeter*

Input signals:

Flow (pulse input or current input)

Temperature (RTD or current input)

Output signals:

Valve control (relay or open collector)

Pump control (analog output, relay or open collector)

Required settings:

1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Temperature input:
   Select the RTD type and temperature range or enter the temperature measuring range for the 4 to 20 mA input.
3. Select the product group of the mineral oil.
4. Select the type of density measurement:
   As the density is not measured, the "Operating density" parameter must be set to "Calculated".
5. Select the reference density:
   The reference conditions of the corrected volume must be determined for the reference density. Here, the volumes at 15 °C, 20 °C and 60°F can be selected.
6. Reference density value:
   In addition to the reference operating conditions, the actual density value of the medium under the selected reference operating conditions must be specified here.
7. Pressure:
   If the event of gauge pressure deviation, you must enter a pressure at which the flow is measured.
8. Valve control:
   Set the choice of filling stages to 2-stage. Assign the selected output to control the filling stage.

Display variables:

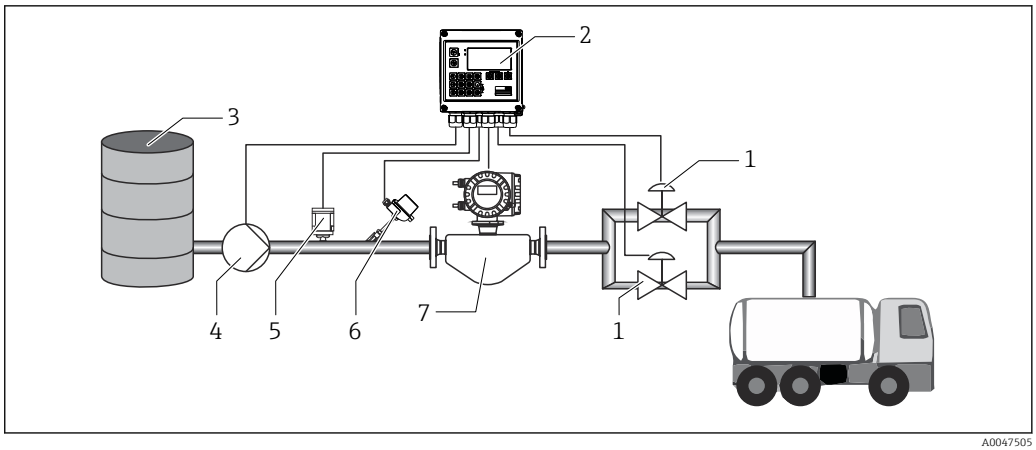
Preset counter (corrected volume), batch counter (corrected volume), volume flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

Miscellaneous notes:

The pressure is entered relative to the environment. As the pressure only has a marginal effect on liquids, for the sake of efficiency it suffices to specify a value instead of measuring the pressure.

7.2.4 Batch Controller with API temperature/density compensation

This application describes the use of the Batch Controller with mineral oils and volume correction. The second volume correction application describes the process for correcting the volume by measuring both the temperature and the density. The volume can be corrected with any flow unit (volume flow or mass flow).



26 *Batch Controller with flow measurement, temperature compensation, density compensation and 2-stage batching*

1 *Valves*
2 *Batch Controller*
3 *Supply tank*
4 *Pump*
5 *Density sensor*
6 *Temperature sensor*
7 *Flowmeter*

Input signals:

Flow (pulse input or current input)

Temperature (RTD or current input)

Density (current input)

Output signals:

Valve control (relay or open collector)

Pump control (analog output, relay or open collector)

Required settings:

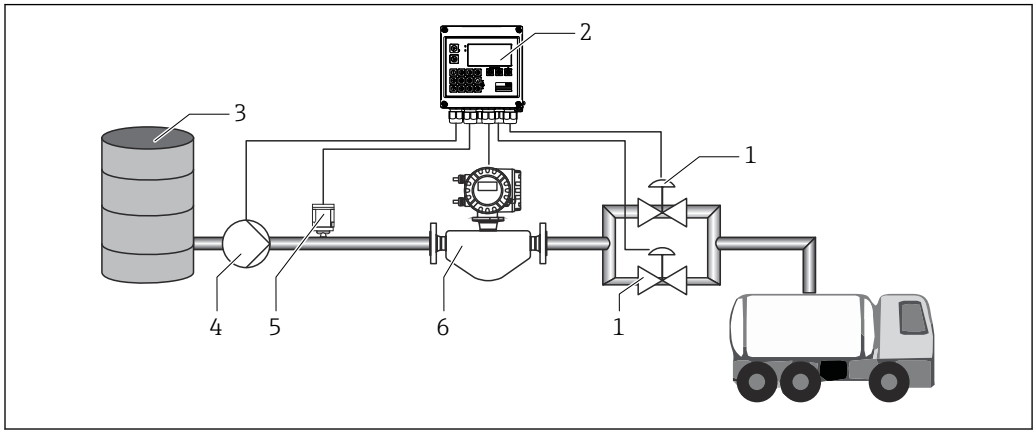
1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Temperature input:
   Select the RTD type and temperature range or enter the temperature measuring range for the 4 to 20 mA input.
3. Select the product group of the mineral oil.
4. Select the type of density measurement:
   The "Operating density" is set to "Measured" since a density meter is used in this application example.
5. Select the reference density:
   The reference conditions of the corrected volume must be determined for the reference density. Here, the volumes at 15 °C, 20 °C and 60°F can be selected.
6. Valve control:
   Set the choice of filling stages to 2-stage. Assign the selected output to control the filling stage.

Display variables:

Preset counter (corrected volume), batch counter (corrected volume), volume flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

7.2.5 Batch Controller with mass calculation

In addition to performing volume correction for mineral oils, the mass of any medium can also be calculated. If this function is activated, the volume is converted to mass and the counter and preset counter are also available in the selected mass units.



27 *Batch Controller with mass calculation*

1 *Valves*
2 *Batch Controller*
3 *Supply tank*
4 *Pump*
5 *Density sensor*
6 *Flowmeter*

Input signals:

Flow (pulse input or current input)

Density (current input)

Output signals:

Valve control (relay or open collector)

Pump control (analog output, relay or open collector)

Required settings:

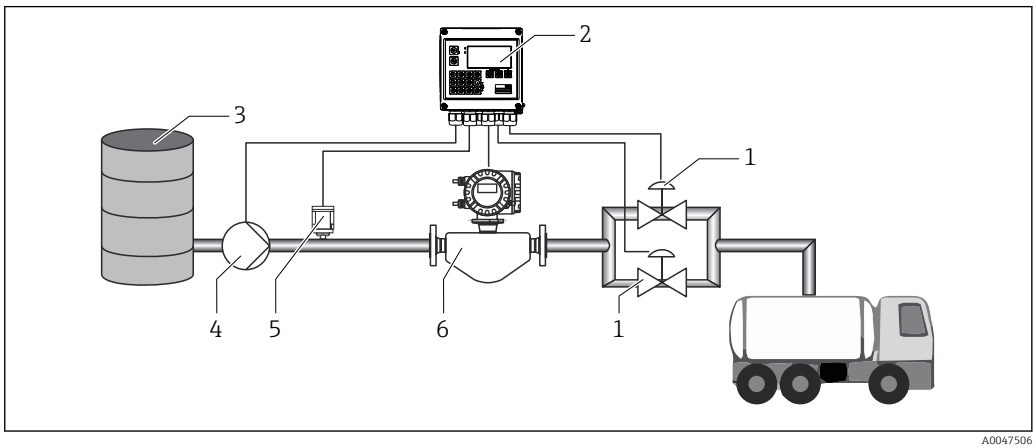
1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Set the product group to "User-defined".
3. Select the type of density measurement:
   The "Operating density" is set to "Measured" since a density meter is used in this application example.
4. Set the "The result is" parameter to "Mass" to enable the calculation of the mass.
5. Valve control:
   Set the choice of filling stages to 2-stage. Assign the selected output to control the filling stage.

Display variables:

Preset counter (mass), batch counter (mass), volume flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

7.2.6 Batch Controller with volume calculation

If a flow sensor is used for mass flow measurement, it is possible to calculate the batched volume. This requires a density measurement (alternatively: a fixed density value is specified or the temperature is measured and this information is used to calculate the operating density internally on the basis of the reference conditions, reference density and expansion coefficient). If this function is enabled, then the mass is converted to volume and the counter and preset counter are also available in the selected volume units.



28 *Batch Controller with mass calculation*

1 *Valves*
2 *Batch Controller*
3 *Supply tank*
4 *Pump*
5 *Density sensor*
6 *Flowmeter*

Input signals:

Flow (pulse input or current input)

Density (current input)

Output signals:

Valve control (relay or open collector)

Pump control (analog output, relay or open collector)

Required settings:

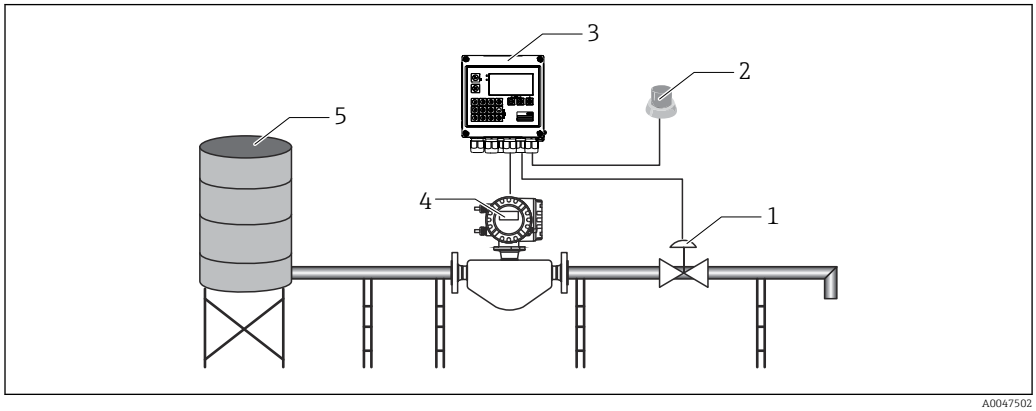
1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Set the product group to "User-defined".
3. Select the type of density measurement:
   The "Operating density" is set to "Measured" since a density meter is used in this application example.
4. Set the "The result is" parameter to "Volume" to enable the calculation of the volume.
5. Valve control:
   Set the choice of filling stages to 2-stage. Assign the selected output to control the filling stage.

Display variables:

Preset counter (volume), batch counter (volume), mass flow, daily, monthly and annual counters and totalizer for batched quantity, number of batches.

7.2.7 Manual batching

In addition to batching based on a preset counter selected beforehand, it is also possible to use the device as a volume counter or mass counter (depending on the type of flow sensor) with manual control. This enables batching on the basis of visual control, for example, or via the stop signal of an external signal transmitter.



29 *Manual batching with the Batch Controller*

1 *Valve*
2 *Start button*
3 *Batch Controller*
4 *Flowmeter*
5 *Supply tank*

Input signals:

Flow (pulse input or current input)

Remote control (digital input)

Output signals:

Valve control (relay or open collector)

Required settings:

1. Flow input:
   Enter the pulse value or measuring range of the 0/4 to 20 mA input.
2. Set the Batch Controller to "Manual" mode.
3. The digital inputs must be assigned a Start/stop function for remote control.
4. Valve control:
   Set the choice of filling stages to 1-stage. Assign the selected output to control the filling stage.

Display variables:

Preset counter, batch counter, flow, daily, monthly and annual counters and totalizer for batched quantity/mass, number of batches.

7.3 Configuring the basic parameters/general device functions

- Inputs, → 37
- Outputs, → 38
- Application, → 40
- Data logging, → 41

- Access protection, → 42
- Logbooks, → 42
- Communication/fieldbus systems, → 43

7.3.1 Inputs

Flow pulse transmitter

The pulse input can process different current and voltage pulses. The software can switch to different frequency ranges:
- Pulses and frequencies up to 12.5 kHz
- Pulses and frequencies up to 25 Hz (for bounce contacts, max. bounce time: 5 ms)

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

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 High level ≥ 2.1 mA corresponds to Low level U no-load: 7 to 9 V	

Pulse value and K-factor

For all signal types, the pulse value of the flow transmitter has to be entered.

The calculation of the current value for the volume flow is floating; therefore, it decreases continuously with slow pulses. After 100 seconds or if the value is less than the low flow cut off, the flow value becomes 0.

The batching and statistics counters are totaled from the individual pulse values. The current flow can also be calculated from the counters so that it can be shown on the display. The desired flow unit must first be selected in the flow settings.

Flow current signal

For flow transmitters with a current signal output, the flow measuring range is scaled in the Advanced setup → 75.

Adjustment/calibration of the current input

To adjust the current inputs, a two-point calibration can be carried out in the **Expert** menu, for example to correct the long-term drift of the analog input.

Example: flow signal 4 mA (0 m^3/h), but the device displays 4.01 mA (0.2 m^3/h). If you enter the set point 0 m^3/h, actual value: 0.2 m^3/h the device "learns" a new 4 mA value. The set point must always be within the measuring range.

Low flow cut off

Volume flows below the configured low flow cut off value are evaluated as zero (not measured on the counter). This is used to suppress measured values, for example at the lower limit of the measuring range.

For the pulse input, the minimum permitted frequency can be determined from the low flow cut off. Example: low flow cutoff 3.6 m^3/h (1 l/s), pulse value of the transmitter: 0.1 l.

1/0.1 = 10 Hz. This means that after 10 s the value "0" is displayed for volume flow and power.

For analog signals, two variants of low flow cut off exist:
- Positive flow measuring range, e.g. 0 to 100 m^3/h: values less than the low flow cut off value are valued at zero.
- Negative start of measuring range (bidirectional measurement), e.g. −50 to 50 m^3/h: Values around the zero point (+/- low flow cut off value) are valued at zero.

Temperature inputs

To measure the temperature, RTD sensors can be connected directly or via transmitter (4 to 20 mA). For the direct connection, sensors of types PT 100/500/1000 can be used. For PT 100 sensors, users can choose from different measuring ranges for high and low temperature differences to ensure maximum accuracy:

Menu **Setup** → **Advanced setup** → **Inputs** → **Temperature** → **Range**.

The measuring range can be scaled individually if a current signal is used:

Menu **Setup** → **Advanced setup** → **Inputs** → **Temperature**. → 📄 49

Density (optional)

To measure the density, a density sensor can be connected to the current input marked "Density" via 0/4 to 20 mA. In addition a fixed density value can be also be saved. This is suitable for media whose composition is known. → 📄 49

Digital inputs

Two digital inputs are available: Depending on the options of the device, the following functions can be controlled via the digital inputs:

Function	Description
Batch active (high)	A batch is started when there is a switch from low → high. It runs until either the value on the preset counter is reached or the signal drops from high → low. An active batch is aborted and ended if the signal drops. If the value on the preset counter is reached and a new batch should start, a switch must first take place from high → low so that another change from low → high can start the new batch run.
Batch start (edge)	A batch is started when the edge changes from low → high. The function has exactly the same effect as pressing the button locally.
Batch stop (edge)	A batch is paused when the edge changes from low → high and aborted and then stopped with the next change from low → high. The function has exactly the same effect as pressing the button locally.
Reset batch number	The batch number, which is automatically increased, is reset to the start value defined in the Setup when the edge changes from low → high.
Time synchronization	Time synchronization is triggered by an edge change from low → high.
Status	The device remains operational as long as there is a high signal (status=OK). Once the signal drops to low, any batching operation that is currently active is stopped and the device is locked so that it cannot restart. The device remains locked until there is a high signal again, which indicates that the system is operational.

7.3.2 Outputs

Relay

The two relays can be switched to control the filling stages and to signal fault messages.

They can be assigned to the relevant filling stages of the batch under **Setup** → **Advanced setup** → **Application** → **Batch settings** → **Switches fill stage 1/2**.

The minimum service life of the relays is specified as 105 switching cycles. In the event of more intensive use, it is recommended to use the open collector outputs for batch control.

Open collector outputs (optional)

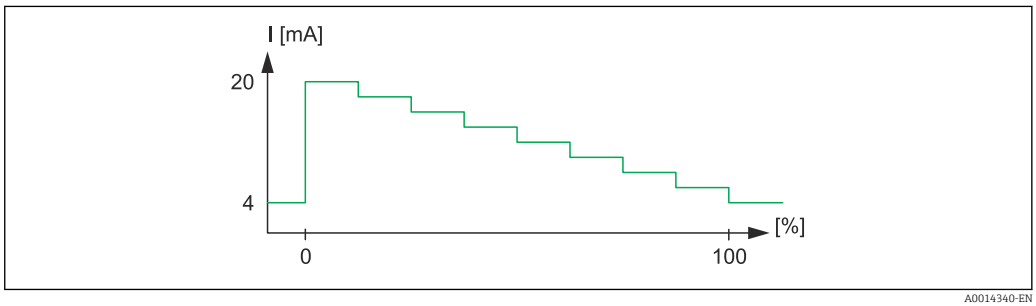
The open collector outputs can be used as status and pulse outputs. If used as status outputs, they can be used to control the filling stages of the batches and to signal fault messages. Counters and to signal the end of a batch

Universal output - current and active pulse output (optional)

The universal output can be used as a pulse output or analog output. It can output the volume flow or the volume/mass counter. In addition, the progress of the batch can be output in linear or curve form.

Batch progress

When the progress of the batch is displayed, the output value starts at 20 mA at the beginning of the batch and moves down linearly until it reaches the lower limit of the current output 0/4 mA at the end of the batch. The output's lower range limit is output at the current output if a batch is not active.

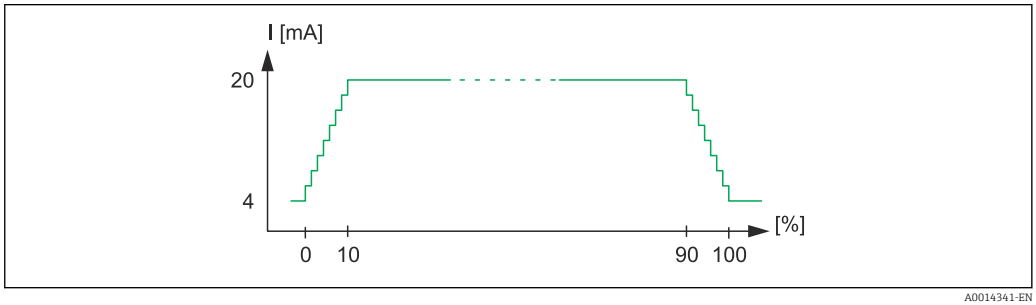


30 Chart displaying batch progress

0 Batch starts at 0 %
100 Quantity reached at 100 %

Curve

If batching has stopped, the current value at the output is 0/4 mA. The output adopts the current defined in "Current start value" directly after a batching operation starts. The current value then moves upwards linearly and reaches the 20 mA current value at a percentage value of the entire batch quantity, "Start max.", that is specified in the Setup. The current value at the current output then remains at 20 mA until the percentage value of the batch quantity specified in "Stop max." is reached. The current value is then adjusted downwards linearly to the output value. The output's lower range limit is output at the current output if a batch is not active.



31 Chart displaying a curve

0 Batch start
10 Start max
90 Stop max
100 Quantity reached

7.3.3 Batch settings

All batching and control-related settings for batch operation must be made in the "Batch settings".

Batch mode

The main setting of the batching functionality is to select the batch mode, which comprises the following modes: "Standard", "Automatic restart" and "Manual"

Function	Description
Standard	In the "Standard mode", a value must be entered for the preset counter after commissioning. This value is then used for all batch cycles until it is changed again. The value for the preset counter can be changed during an active batch or when batching has stopped. This preset counter value is then used when the new batch is started. A batch can be started via the control input or by pressing a button. It continues until the value on the preset counter is reached, or the batch is paused beforehand via a stop command (button or control input). From this paused state, the batch can either be resumed by means of a start command or aborted entirely by means of another stop command.
Automatic restart	The "Automatic restart" mode works like the "Standard" mode but with the addition that a batch sequence is started which is restarted after a configurable restart delay time. This continues until the batch sequence is paused and finished.
Manual	A preset counter is not required in the Manual mode. The batch is started and stopped by operating keys on the device or via the control input.

Counting direction

The counting direction is another basic setting. It is only relevant for showing values on the display and refers to the counting direction in which the preset counter is displayed. The options are forwards, in which case a totalizer is displayed, or backwards, whereby the remaining quantity of the current batch is displayed.

Filling stages

With this device, the user has the option of 1-stage and 2-stage batching. The main valve is for the first stage. It supplies a lower flow rate and is opened at the start of the batch. It is used for precision dosing at the end of the batch. The second filling stage, with a higher flow rate, is also opened after a specified delay time so that the required batching quantity is reached more quickly, and is closed when a remaining pre-stop quantity is reached. The delay time and pre-stop quantity must also be specified in the batch settings.

Fixed and automatic after-run correction

It is advisable to use after-run correction due to system response times. The command to close the valves is thus given early enough to compensate for the response time and to achieve maximum batching accuracy.

Fixed after-run correction value serves as the basis. Here, a fixed value can be specified and flow is stopped earlier by this value.

Automatic after-run correction can be activated in addition to fixed after-run correction. It calculates the new correction value based on the actual measured error of the last batch runs. In this way, consistent batching accuracy can be achieved.

To ensure that the after-run quantity is kept to a minimum during the first run even if the automatic after-run correction function is activated (this function requires an initial measurement), it is advisable to enter a measured value as the manual after-run correction value, or to teach the device gradually with a small test quantity.

Maximum preset counter

Entering the maximum permitted preset counter value reduces the risk of incorrect entries. If a preset counter value is entered during operation that is greater than the maximum permitted value, the batch is not started and a message is displayed.

7.3.4 Batch information

All parameters for displaying and identifying stored batches are saved in the batch information. Batches are identified by a user-defined name and a batch number, which is automatically incremented after each batch cycle. The start value of the batch number can also be preset and the current number can also be reset to this value.

7.3.5 Display settings and units

Display settings

In the **Application/Grouping** menu in Setup, you can select which process values are shown on the display. For this purpose, 6 display groups are available. A group can be assigned up to 3 values. For a three-line display, the values are displayed in a smaller font size. A user-defined name can be assigned to each group (max. 10 characters). This name is displayed in the header. When the device is delivered, the display groups are preconfigured according to the following table.

Display mode

The display mode is selected in the Display/operation menu. You can configure the brightness, contrast and the switching mode of the display, i.e. whether switching between the display groups takes place automatically or by pressing a button. In this menu, you can also call up the current values for data recording (batch reports, day, month and annual counter and totalizer) under "stored values". (For details, see "Data logging" → 📄 41)

No. of Sums/counter overflow

Counters are limited to max. 8 digits before the decimal point (for counters that require signs, to 7 characters). If the counter reading exceeds this value (overflows), it is reset to zero. The number of overflows for each counter is recorded on overflow counters. A counter overflow is shown on the display with the "^" icon. The number of overflows can be called up in the **Display/operation** → **Stored values** menu.

Units

The units for scaling and displaying the process variables are configured in the respective submenus (e.g. the unit for displaying the temperature is configured under Inputs/ Temperature).

To make the device setting easier, the unit system is selected at the beginning of device commissioning.

- EU: SI units
- USA: imperial units

This setting sets the units in the individual submenus to a certain value (default), e.g. SI: m^3/h, °C, kWh.

If a unit is converted subsequently, no automatic conversion of the associated (scaled) value takes place!

For information on the conversion of units, see the appendix → 📄 92.

7.3.6 Data logging

The device stores relevant measured values and counter data at defined times. An analysis is stored daily, monthly and annually with the number of batch cycles, error-free batch cycles and the batched volume for this time period.

The individual batch cycles are stored with the following details: date, time, batch name, batch number, preset counter and volume counter. The device offers consistent and reliable data logging, which guarantees the security of data even after a power failure.

Current day, monthly and billing date counters can be called up in the **Display/operation** → **Stored values** menu. In addition, all counters can be shown as a display value (can be allocated to a display group).

The entire data archive, i.e. all stored values, can be read out using the "Field Data Manager Software" only.

Specifically, the following data are stored in the device:

Analysis	Calculation
Batch	▪ Date, time ▪ Batch name ▪ Batch number ▪ Preset counter ▪ Volume counter
Daily, monthly and annual analysis	▪ Volume counter for the time period ▪ Number of batches completed ▪ Number of batches completed without error

General notes for data logging

The time of data logging (start time of the logging intervals) can be configured and/or synchronized via the time of day.

The current counter can be reset to zero via the setup. The archived values (completed evaluations) can no longer be changed! To delete these, the entire measured value memory must be cleared.

Storage capacity

The device should be read out regularly using the "Field Data Manager Software" to ensure seamless data logging. Depending on the storage depth, the counters are overwritten after a certain time, see the table below.

Data	Number
Batches	Min. 1000
Events	Min. 1500 (messages with an average of 40 characters)
Statistics day/month/year	Min. 800/750/50

7.3.7 Access protection

To prevent tampering, the device can be locked by an operating code or by a hardware switch in the device → 📄 25.

Protection by code

The entire local operation can be protected by a 4-digit operating code (default value is 0000, i.e. no protection). After 600 s without operation, the device is locked again automatically.

It is still possible to enter the preset counter value.

7.3.8 Logbooks

Changes to the setup are recorded in entries in the event logbook.

Event logbook

The event logbook stores events such as alarms, off-limit conditions, setup changes, etc. with the date and time specified. The memory is sufficient for at least 1600 messages

(however, depending on the text length, it is possible for more messages to be stored). If the memory is full, the oldest messages are overwritten. The logbook can be read out via the Field Data Manager software or on the device. To exit the logbook quickly, press the +/- keys simultaneously.

7.3.9 Communication/fieldbus systems

General notes

The device has (optional) fieldbus interfaces for reading out all process values. Values can be written to the device only in the context of device configuration (via the FieldCare operating software and USB or Ethernet interface). Process values such as flow cannot be transmitted to the device via the bus interfaces.

Batch commands can be sent to the device via Modbus, for details refer to the "Modbus RTU" section.

Depending on the bus system, alarms or faults occurring during data transmission are displayed (e.g. status byte).

The process values are transmitted in the same units that are used to display the values on the device.

Only the counter readings of the most recently completed storage period (day, month, year, billing date) can be read out of the memory.

If counter readings are large, the number of decimal places is truncated (e.g. 1234567.1234 → 1234567 or 234567.1234 → 234567.1).

The device can be read out via the following interfaces:
- Modbus RTU
- Ethernet/Modbus TCP

Modbus RTU/(TCP/IP)

The device can be connected to a Modbus system via RS485 or Ethernet interface. The general settings for the Ethernet connection are made in the **Setup** → **Advanced setup** → **System** → **Ethernet** menu or the **Expert** → **System** → **Ethernet**, menu → 🖹 46. Modbus communication is configured in the **Setup** → **Advanced setup** → **System** → **Modbus** menu or the **Expert** → **System** → **Modbus** menu.

Menu position	RTU	Ethernet
Device address:	**1** to 247	IP address manual or automatic
Baud rate:	2400/4800/9600/**19200**/38400	-
Parity:	**Even**/Odd/None	-
Port	-	502
Reg	Register	Register
Value	Value to be transmitted	Value to be transmitted

Transfer of values

The actual Modbus TCP protocol is located between layer 5 to 6 in the ISO/OSI model.

To transmit a value, 3 registers of 2 bytes each are used (2 bytes status + 4-byte float). In the setup, you can configure which register is to be written with which value. The most important/most common values are already preconfigured.

Register 000	Status of first measured value (16-bit integer, high byte first)
Register 001 to 002	First measured value (32-bit float, high byte first)

Validity and limit value information are encoded in the status byte.

16		6	5	4	3	2	1	
	Not used			0	0	0	0	ok
				0	0	0	1	Open circuit
				0	0	1	0	Over range
				0	0	1	1	Under range
				0	1	0	0	Invalid measured value
				0	1	1	0	Replacement value
				0	1	1	1	Sensor error
			1					Lower limit value violated
		1						Upper limit value violated
1								Counter overflow

During the request from the master, the desired start register and the number of registers to be read are sent to the device. Because a measured value always requires three registers, the start register and the number must be divisible by 3.

From the master to the Batch Controller:

ga fk r1 r0 a1 a0 c1 c2

ga	Slave address (1..247)
fk	Function, always 03
r1 r0	Start register (high byte first)
a1 a0	Number of registers (high byte first)
c0 c1	CRC checksum (low byte first)

Response from Batch Controller in event of successful request:

ga fk az s1 s0 w3 w2 w1 w0 s1 s0 w3 w2 w1 w0 . . . . . s1 s0 w3 w2 w1 w0 c1 c0

ga	Device address
fk	Function, always 03
az	Number of bytes of all subsequent measured values
s1 s0	Status of first measured value (16-bit integer, high byte first)
w3 w2 w1 w0	First measured value in 32-bit float format, high byte first
s1 s0	Status of second measured value (16-bit integer, high byte first)
w3 w2 w1 w0	Second measured value (32-bit float, high byte first)
s1 s0	Status of last measured value (16-bit integer, high byte first)
w3 w2 w1 w0	Last measured value (32-bit float, high byte first)
c0 c1	CRC checksum, 16-bit (low byte first)

Response from Batch Controller in event of unsuccessful request:

ga fk fc c0 c1

ga	Slave address (1..247)
fk	Requested function + 80hex
fc	Error code
c0 c1	CRC checksum, 16-bit (low byte first)

Error code:

01 : Function unknown
02 : Start register invalid
03 : Number of registers to be read invalid

In the event of checksum or parity errors in the request from the master, the Batch Controller does not respond.

For large counter readings, the decimal points are truncated.

Additional information on the Modbus is provided in BA01029K.

Transmission of batch commands to the Batch Controller/reading the batch status

Batch commands can be transmitted to the Batch Controller and the batch status read via Modbus. The following registers are available for this purpose:

Protocol address (base 0)	PLC address (base 1)	Function	Data type	Description
5000	5001	Set preset counter	FLOAT	A new preset counter is set when these registers are written to. **Modbus function 16 (Write Registers)**
5002	5003	Set start/stop	UINT16	If a 1 is written, a batch is started. If a 0 is written, a batch is stopped. **Modbus functions 16 (Write Registers), 06 (Write Single Register).**
5200	5201	Read batch status	UINT16	This register provides the status of the batch: 0: Batch stopped 1: Batch active 2: Batch paused **Modbus functions 03 (Read Holding Register), 04 (Read Input Register)**

The byte order must be followed according to the setting in the Batch Controller.

Set the batch name via Modbus:

Protocol address (base 0)	PLC address (base 1)	Function	Data type	Description
5010-5019	5011-5020	Write batch name	STRING (ASCII)	The batch name is written from register 5010 onwards, Modbus function 16 (Write Registers)

The batch name can only be set before the start of the batch. Register 5200 -> 0x0000.

A maximum of 20 characters are accepted.

This functionality is only available if recipe management is switched off, or if no recipe or the first recipe was selected if recipe management is active. Otherwise the device returns Error 04: SLAVE_DEVICE_FAILURE.

2 characters are transferred in each register. Must start from register 5010 (base 0). The end of the text is recognized as follows:

- Register number (maximum 10 -> 20 characters)
- Must end with 0x00 in the event of an uneven number of characters
- Character 0x00

Request from master (byte sequence):

6 characters, register filled	
"ABCDEF" -> 5010-5012	0x41, 0x42, 0x43, 0x44, 0x45, 0x46
6 characters, 2 additional registers, ends with 0x00	
"ABCDEF" -> 5010-5014	0x41, 0x42, 0x43, 0x44, 0x45, 0x46, 0x00, 0x00, 0x00, 0x00

5 characters, last register only 1 character -> ends with 0x00	
"ABCDE"-> 5010-5012	0x41, 0x42, 0x43, 0x44, 0x45, 0x00
4 characters, starting from the 2nd register	
"BCDE" ->5011-5012	0x42, 0x43, 0x44, 0x45 -> Error message 02: Invalid Start Register
22 characters	
"ABCDEFGHIJKLMNOPQRST12" > 5010-5020	0x41, 0x42, ... 0x53, 0x54, 0x31, 0x32 -> The first 20 characters are accepted ("ABCDEFGHIJKLMNIOQRST"), additional characters are ignored. No error message!

Process messages via Modbus:

Protocol address (base 0)	PLC address (base 1)	Function	Data type	Description
5300	5301	Number of active process messages	UINT16	This register provides the number of active process messages: Modbus functions 03 (Read Holding Register), 04 (Read Input Register). e.g. 0x0003
5301	5302	Read out the error code of the process message currently displayed	UINT16	The value has the following structure. Bit 15: "F" Bit 14: "C" Bit 13: "M" Bit 12: "S" Bit 0-11 Error code, Modbus functions 03 (Read Holding Register), 04 (Read Input Register). e.g. “F903” -> 0x8387 -> binary 1000 0011 1000 0111
5302	5303	Acknowledge process messages	UINT16	1: Acknowledge process message currently displayed 2: Acknowledge all process messages, Modbus function 06 (Write Register)

The byte sequence must follow the setting.

Ethernet/Web server (TCP/IP)

Setup → **Advanced setup** → **System** → **Ethernet** or **Expert** → **System** → **Ethernet**

The IP address can be entered manually (fixed IP address) or assigned automatically using DHCP.

The port for the data communication is set by default to 8000. The port can be changed in the **Expert** menu.

The following functions are implemented:
- Data communication to PC software (Field Data Manager Software, FieldCare, OPC server)
- Web server
- Modbus TCP → 📄 43

Up to 4 connections can be opened simultaneously, e.g. Field Data Manager software, Modbus TCP and 2x Web server.

However, only one data connection via Port 8000 is possible.

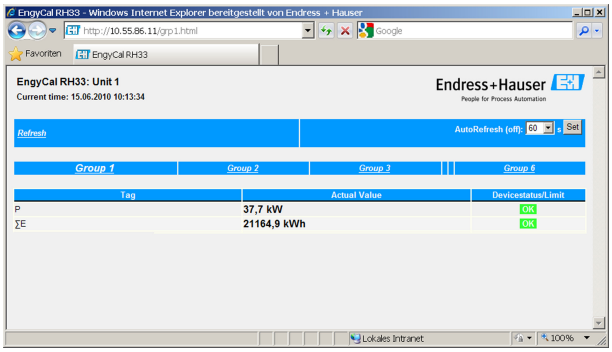
As soon as the max. number of connections is reached, new connection attempts are blocked until an existing connection is terminated.

Web server

If the device is connected via Ethernet, it is possible to export the display values via the Internet using a Web server.

The Web server port is preset to 80. The port can be changed in the **Expert** → **System** → **Ethernet** menu.

If the network is protected by a firewall, the port may need to be activated.



32 *Display values shown in the Web browser (using the example of the EngyCal RH33)*

As in the case of the display, you can alternate between the display groups in the Web server. The measured values are updated automatically (directly via "link": off/5s/15s/30s/60s). In addition to the measured values, status and limit value flags are displayed.

Data can be exported via the Web server in HTML or XML format.

When using an Internet browser, it suffices to enter the address http://<IP address> to display the information as HTML in the browser. In addition, two versions of the XML format are available. These versions can be integrated into additional systems as required. The two XML versions contain all the measured values which are assigned to any group.

The decimal separator is always displayed as a period in the XML file. All times are given in UTC. The time difference in minutes is noted in the following entry.

Version 1:

The XML file is available in ISO-8859-1 (Latin-1) encoding at the address http://<IP address>/index.xml (alternatively: http://<IP address>/xml). However, this encoding cannot display some special characters such as the sum sign. Texts such as digital statuses are not transmitted.

Version 2:

A UTF-8 encoded XML file can be retrieved at the address http://<IP address>/main.xml All the measured values and the special characters can be found in this file.

The structure of the channel values for the XML file is explained as follows:

```
<device      id="ID0104" tag="Flow" type="INTRN">
             <v1>12.38</v1>
             <u1>m3/h</u1>
             <vstslv1>2</vstslv1>
             <hlsts1>ErS</hlsts1>
             <vtime>20120105-004158</vtime>
             <man>Endress+Hauser</man>
             <param />
</device>
```

Tag	Description
tag	Channel identifier
v1	Measured value of channel as a decimal value
u1	Unit of measured value
vstslv1	Status of the measured value 0 = OK, 1 = warning, 2 = error
hlsts1	Error description OK, OC = cable open circuit, Inv = invalid, ErV = error value, OR = over range, UR = under range, ErS = error sensor
vtime	Date and time
MAN	Manufacturer

Web server settings

Menu **Setup** → **Advanced setup** → **System** → **Ethernet** → **Web server** → **Yes** or menu **Expert** → **System** → **Ethernet** → **Web server** → **Yes**

If default port 80 is not available in your network you can change the port in the **Expert** menu.

Enter the address for retrieval in the Web browser: http://<IP address>

The following Web browsers are supported:
- MS Internet Explorer 6 and higher
- Mozilla Firefox 2.0 and higher
- Opera 9.x and higher

The operating language for the Web server is English. No other languages are offered.

The device makes the data available in HTML or XML format (for the Fieldgate Viewer).

No provision is made for authentication via ID/password.

Printer interface

The device can print a batch report directly to a connected ASCII printer via RS232.

Menu position	Description
Printout	You can initiate printing manually on-site if the setting is set to "Manual". If the setting is set to "Automatic", the configured number of printouts is additionally printed after every batch cycle.
Baud rate	Select the baud rate that is compatible with the printer here.
Number of copies	Use this option to specify the number of printouts for automatic printing at the end of the batch.
Characters/line	Use this option to enter the possible number of characters per line supported by the printer.
Number of headers	Use this option to select the required number of lines for user-defined text at the start of the printout.
Header 1-4	Use this option to enter the user-defined text.
Number of footers	Use this option to select the required number of lines for user-defined text at the end of the printout.
Footer 1-4	Use this option to enter the user-defined text.
Blank rows at the end	Use this option to enter the required blank rows at the end of a printout, e.g. to allow sufficient space to tear off the printout.
Print direction	Use this option to select whether printing should start at the first line or the last line.
Test print	Use this option to initiate a test printout directly.

```
self definable header information
Company XYZZGSAZGSAZSGZAGSZAGSZGAZSGAZSG
Street ASASOKAOSKAOSOAKSOAKSOK
----------------------------------------

17:07                          03.08.2010
Unit 1                          BatchSimu

No.                                     9
Batch 1                         4.0 m³


----------------------------------------
self definable footer information
Company XYZZGSAZGSAZSGZAGSZAGSZGAZSGAZSG
Street ASASOKAOSKAOSOAKSOAKSOK
```

33 *Batch Controller test printout*

7.4 Optional device settings/special functions

- Compensation → 49
- Batch printout → 50

7.4.1 Compensation

Measured volumes can be corrected or converted to mass, or measured mass can be converted to volume, using the additional compensation function. Depending on the type of compensation, temperature and density sensors are required for this purpose.

The use of the temperature and density inputs is shown in the table below using the measured product group (mineral oils or other), as are the expected results.

Volume flowmeter (conversion to mass / volume correction)

Product group	Expected result	"Operating density" setting	Temperature sensor	Density sensor
User-defined	Mass	Measured	Not required	Required
	Corrected volume	Calculated	Required	Not required
		Measured	Not required	Required
Mineral oil	Corrected volume	Calculated	Required	Not required
		Measured	Required	Required

Volume correction via temperature measurement and/or density measurement is possible for both product groups. The advantage of an additional density measurement is that the system reacts to fluctuations in the medium independently. If the correction is based on temperature measurement alone, the density value of the medium must be checked at reference operating conditions where necessary and adjusted.

Product group

The choice of product group determines the calculation standard at the same time. In the case of user-defined media, a volume can be corrected or converted to mass using other parameters. The volume is corrected in accordance with the API MPMS (Chapter 11) standard for the following mineral oil product groups: crude oil, refined products and lubricating oils.

Reference data

The reference condition specifies the ambient conditions at which the correction must be calculated. The user can choose from 15 °C, 20 °C or 60 °F. The value that must be entered in the reference density parameter is the density of the medium under the selected

reference operating conditions. When the API° and Gravity (G) density unit is used, 60 °F is automatically selected as the reference condition.

An expansion coefficient must be specified depending on the calculation and if density measurement does not take place. It must be entered in the unit 1/°C or 1/°F, depending on the reference conditions. Consequently, a reference condition in °C also produces an expansion coefficient in 1/°C. In this case, the expansion coefficient is a factor by which the volume increases if the temperature of the medium is one degree higher than the reference condition.

Pressure specifications

The pressure must be taken into account for a complete correction of the volume. In the Setup, you must enter the gauge pressure in relation to the ambient pressure at which the flow of the medium is measured. Direct measurement is not required as the influence of pressure is relatively low. It suffices to enter the approximate pressure for the required level of accuracy. Pressure compensation can be disabled by entering a pressure value of 0.

7.4.2 Batch printout

See the "Printer interface" section, → 🖹 48

7.5 Data analysis and visualization with the Field Data Manager software (accessories)

FDM is a software application which offers central data administration with visualization for recorded data.

This enables the data of a measuring point to be fully archived, e.g.:
- Measured values
- Diagnostic events
- Protocols

FDM saves the data in an SQL database. The database can be operated locally or in a network (client / server).

The following databases are supported:
- PostgreSQL [1)]
  You can install and use the free PostgreSQL database which is supplied with the FDM-CD.
- Oracle [1)]
  Version 8i or higher. To set up user login, please contact your database administrator.
- Microsoft SQL server [1)]
  Version 2005 or higher. To set up user login, please contact your database administrator.

7.5.1 Installation of the Field Data Manager software

Insert the Field Data Manager software CD into your CD/DVD drive. Installation starts automatically.

An installation assistant guides you through the necessary installation steps.

Details on installing and operating the Field Data Manager software are provided in the Getting Started Guide supplied with the software and in the Operating Instructions which are available online at www.products.endress.com/ms20.

You can import data from the device using the software's user interface. Use the USB cable, which is available as an accessory, or the Ethernet port of the device, → 🖹 46.

1) The product names are registered trademarks of the individual manufacturers.

8 Maintenance

No special maintenance work is required for the device.

8.1 Cleaning

The front of the housing can be cleaned with a soft, dry cloth.

9 Accessories

Various accessories, which can be ordered with the device or subsequently from Endress +Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

9.1 Device-specific accessories

9.1.1 For the transmitter

Accessories	Description
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight or extreme cold in winter. For details, see Installation Instructions SD00333F
Pipe mounting set	Mounting plate for pipe mounting For dimensions → 2, 11 and installation instructions, → 14 see the "Mounting" section
DIN rail mounting set	DIN rail adapter for DIN rail mounting For dimensions → 4, 11 and installation instructions → 13, see the "Mounting" section
Panel mounting set	Mounting plate for panel mounting For dimensions → 3, 11 and installation instructions → 12, see the "Mounting" section

9.2 Communication-specific accessories

FDM software	Visualization software and SQL-based database "Field Data Manager software (FDM)" MS20 For details, see "Technical Information" TI01022R
RXU10-G1	USB cable and FieldCare Device Setup configuration software incl. DTM library
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. For details, see Operating Instructions BA061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S

Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

9.3 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. For details, see Operating Instructions BA00027S and BA00059S

9.4 System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on an SD card or USB stick. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
Overvoltage protection HAW562 DIN rail	To protect against overvoltage in the power supply and signal/communication cables, Endress+Hauser provides a surge arrester HAW562 for DIN rail mounting. For details, see "Technical Information" TI01012K

Overvoltage protection HAW569 field housing	To protect against overvoltage in the power supply and signal/communication cables, Endress+Hauser provides a surge arrester HAW562 for field mounting. For details, see "Technical Information" TI01013K
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R

10 Diagnostics and troubleshooting

10.1 Instrument diagnostics and troubleshooting

The Diagnostics menu is used for the analysis of the device functions and offers comprehensive assistance during troubleshooting. To find the causes for device errors or alarm messages, follow these basic procedures.

General troubleshooting procedure

1. Open diagnosis list: Lists the 10 most recent diagnostic messages. This can be used to determine which errors are currently present and whether an error has repeatedly occurred.
2. Open measured value display diagnostics: Verify the input signals by displaying the raw values (mA, Hz, Ohm) or the scaled measuring ranges. To verify calculations, call up calculated auxiliary variables if necessary.
3. Most errors can be rectified by performing steps 1 and 2. If the error persists, observe the troubleshooting instructions for the error types from Chapter 9.2 of the Operating Instructions.
4. If this does not rectify the problem, contact the Service Department. The contact details of your Endress+Hauser representative can be found on the Internet at www.endress.com/worldwide. For service inquiries, please always have the error number and the information from the Device information/ENP (program name, Serial Number etc.) available.

The contact details of your Endress+Hauser representative can be found on the Internet at **www.endress.com/worldwide**.

10.1.1 Troubleshooting for MODBUS

- Do the device and master have the same baudrate and parity?
- Is the interface correctly wired?
- Does the device address sent by the master match the configured address of the device?
- Do all slaves on the MODBUS have different device addresses?

10.1.2 Device error/alarm relay

There is a global "alarm relay" (the user can either assign the relay or one of the open collectors in the setup).

This "alarm relay" switches if "F"-type errors occur (F = failure), i.e. "M"-type errors (M= Maintenance required) do not switch the alarm relay.

For errors of type F, the color of the backlighting of the display additionally switches from white to red.

10.2 Error messages

Fault	Description	Remedy
F041	Cable open circuit: Input current ≤ 2 mA ▪ Incorrect wiring ▪ Full scale value of the measuring range configured incorrectly ▪ Sensor defective	▪ Check wiring ▪ Enlarge measuring range (change scaling) ▪ Replace sensor

F104	Sensor error Input current > 2 to ≤ 3.6 mA or ≥ 21 mA (or 22 mA for 0 to 20 mA signal) ▪ Incorrect wiring ▪ Full scale value of the measuring range configured incorrectly ▪ Sensor defective Pulse input > 12.5 kHz or > 25 Hz	▪ Check wiring ▪ Enlarge measuring range (change scaling) ▪ Replace sensor ▪ Select a larger value for pulse value
F201	Device error (operating system error)	Contact the Service Department
F261	System error (miscellaneous hardware errors)	Contact the Service Department
F301	Setup defective	Reconfigure the device. If the error recurs, contact service.
F303	Device data defective	Contact the Service Department
F305	Counters defective	Counter value is reset automatically to 0
F307	Customer preset value defective	Save configuration parameters.
F309	Invalid date/time (e.g. GoldCap was empty)	Device was switched off too long. The date/time must be set again.
F310	The setup could not be saved	Contact the Service Department
F311	Device data could not be stored	Contact the Service Department
F312	Calibration data could not be stored	Contact the Service Department
F314	Activation code is no longer correct (incorrect serial number/program name).	Enter new code
F431	Calibration data missing	Contact the Service Department
F501	Invalid configuration	Check setup
F900	Input variable(s) outside the calculation limits (see Technical data, → 🖹 63)	▪ Check plausibility of the measured input values ▪ Check scaling of device inputs/sensor outputs ▪ Check system/process
F910	Firmware for this device not released.	Install correct firmware.
F919	Flow rate greater than low flow cut off!	Check sensors, valves or pumps.
F921	Fill deviation exceeded!	
F922	Fill deviation undershot!	
M102	Over range Input current ≥ 3.6 mA to < 3.8 mA	Enlarge measuring range (change scaling)

M103	Under range Input current > 20.5 mA to ≤ 21 mA	Enlarge measuring range (change scaling)
M302	Setup has been loaded from backup.	No effect on operation. To be safe, check setup (configuration) and adjust if necessary
M304	Device data defective. The system continues working with backup data.	No action required.
M306	Counter defective, but system could continue working with backup.	Check plausibility of the counter reading (compare to last stored counter reading)
M313	FRAM has been defragmented	No action required.
M315	No IP address could be obtained from the DHCP server!	Check network cable, contact network administrator.
M316	No or incorrect MAC address	Contact the Service Department
M502	Device is locked! - e.g. for firmware update attempt	Check hardware switch in device
M908	Analog/pulse output error	Check process values and scaling of the output, select larger full scale value (or pulse value) if necessary.
M918	Preset counter may not be 0!	Enter value for preset counter.
M920	Batch aborted. No flow!	Check sensors, valves or pumps.

10.3 Diagnostics list

See also error messages, → 🖹 55.

The device has a diagnostic list in which the last 10 diagnostic messages (messages with error numbers from type Fxxx or Mxxx) are stored.

The diagnosis list is designed as a ring memory, i.e. when the memory is full the oldest messages are automatically overwritten (no message).

The following information is saved:
- Date/time
- Error number
- Error text

The diagnosis list is not read out via PC operating software. However, it can be displayed via FieldCare.

The following fall under Fxxx or Mxxx:
- Open circuit
- Sensor error
- Invalid measured value

10.4 Output function test

In the Diagnostics/Simulation menu, the user can output certain signals at the outputs (function text).

The simulation is ended automatically if the user has not pressed any buttons for 5 minutes or has switched off the function explicitly.

10.4.1 Relay tests

The user can switch the relay manually.

10.4.2 Simulation of outputs

The user can output certain signals at the outputs (function test).

Analog output

Allows you to output a current value for test purposes. You can configure fixed values:
- 3.6 mA
- 4.0 mA
- 8.0 mA
- 12.0 mA
- 16.0 mA
- 20.0 mA
- 20.5 mA
- 21.0 mA

Pulse outputs (Pulse / OC)

Allows you to output pulse packages for test purposes. The following frequencies are possible:
- 0.1 Hz
- 1 Hz
- 5 Hz
- 10 Hz
- 50 Hz
- 100 Hz
- 200 Hz
- 500 Hz

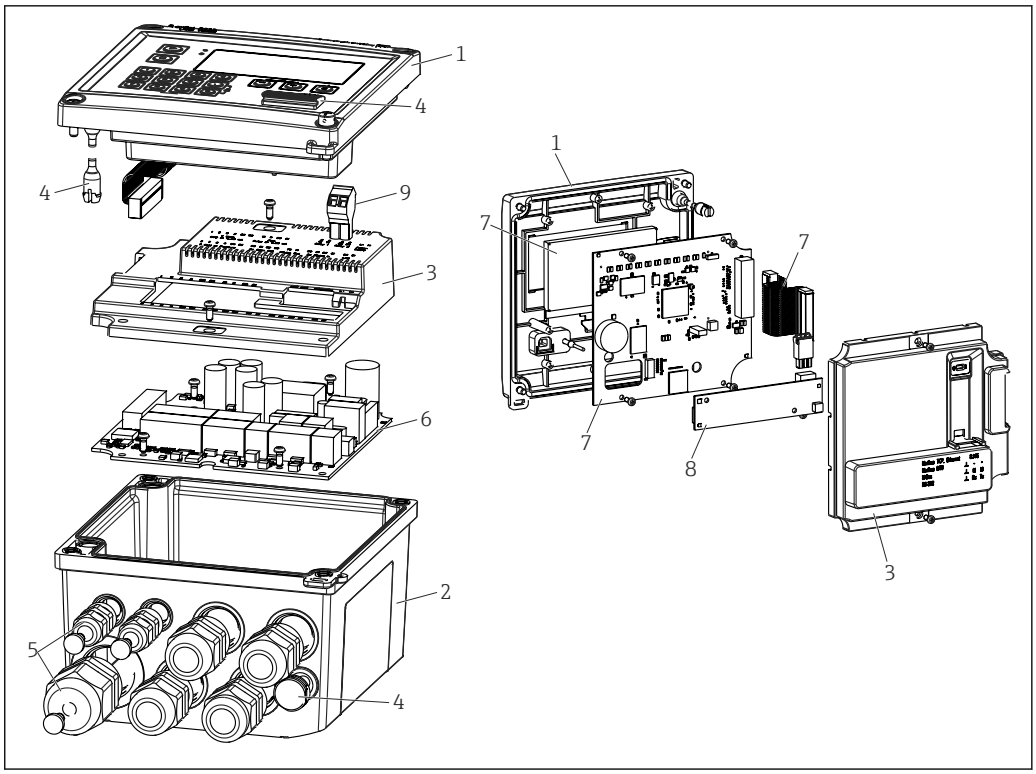
The following simulations are possible for the pulse output only:
- 1 kHz
- 5 kHz
- 10 kHz

10.4.3 Status of the outputs

The current status of the relays and open collector outputs can be queried in the "Diagnostics/Outputs" menu (e.g. relay 1: open).

10.5 Spare parts

If ordering spare parts, please specify the serial number of the device! Installation instructions are included with the spare part.



34 Spare parts of the device

Item No.	Description	Order number		
1	RA33 housing front incl. front foil	XPR0001-FA		
2	Housing base (lasered) incl. threaded plate (specify serial number)	XPR0001-UT		
3	Internal electronic covers incl. screws (for mainboard + CPU card)	XPR0001-CB		
4	Set of small parts Hinge pins, pressure compensation element, USB cover, panel seal	XPR0001-SP		
5	Cable insertion set for panel mounting 4xM20, 2xM12, 1xM25	XPR0001-SK		
6	Mainboard	XPR0003-		
		Approval	AA	Non-hazardous area
			CP	CSA General Purpose
		Supply voltage	1	100 to 230 V (AC: −15 %/+10 %, 50/60 Hz)
			2	24 V (DC: −50 %/+75 %; AC: ±50 %, 50/60 Hz)
		Output	B1	1x analog/pulses (active), 2x open collector
7	CPU card + LCD + ribbon cable	XPR0002-		
		Device type	C	RA33
		Display operating language	AA	English
			AB	German
			AC	French

Item No.	Description	Order number
		AD Spanish AE Italian AF Dutch AG Portuguese AH Polish AI Russian AR Czech
8	Communication card USB	XPR0001-KA
	Communication card USB + Ethernet	XPR0001-KB
	Communication card USB + ModBus RTU (RS485)	XPR0001-KC
	Communication card USB + RS232	XPR0001-KE
9	Plug-in terminal, 2-pin RM5.0	71084277
W/O Item No.	Pipe mounting set	XPR0001-RM
	Wall mounting set	XPR0001-WM
	DIN rail mounting set	XPR0001-DM
	Panel mounting set incl. panel seal	XPR0001-SM
	Plug-in terminal, 3-pin FMC1.5/3-ST-3.5 for digital I/O and RS485	51009210

10.6 Software history and overview of compatibility

Release

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

XX Change to main version.
No longer compatible. The device and Operating Instructions change.

YY Change to functions and operation.
Compatible. The Operating Instructions change.

ZZ Fixes and internal changes.
No changes to the Operating Instructions.

Date	Firmware version	Software changes	Documentation
	01.00.xx (incl. bugfix versions)	Original software	
	01.01.xx (incl. bugfix versions)	Mass flow input, new Modbus functions	
	01.03.xx (incl. bugfix versions)	Web server port is configurable, German help text revised	BA00300K/09/EN/05.19
	01.03.05	Extended Modbus functions, low flow cut off disengageable	BA00300K/09/EN/06.21

11 Return

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

1. Refer to the web page for information:
   http://www.endress.com/support/return-material
   ↳ Select the region.
2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

12 Disposal

12.1 IT security

Observe the following instructions before disposal:

1. Clear data
2. Reset the device
3. Delete/change passwords
4. Delete user
5. Carry out alternative or complementary measures to destroy the storage medium

12.2 Removing the measuring device

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

12.3 Disposing of the measuring device

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

13 Technical data

13.1 Input

Current/pulse input

This input can be used either as a current input for 0/4 to 20 mA signals or as a pulse or frequency input. Sensors for volume or mass flow measurement can be connected to the Batch Controller.

The input is galvanically isolated (500 V test voltage towards all other inputs and outputs).

Cycle time

The cycle time is 125 ms.

Response time

In the case of analog signals, the response time is the time between the change at the input and the time when the output signal is equivalent to 90 % of the full scale value.

Input	Output	Reaction time [ms]
Current	Current	≤ 440
Current	Relay/digital output	≤ 250
RTD	Current/ relay/digital output	≤ 440
Cable open circuit detection	Current/ relay/digital output	≤ 440
Cable open circuit detection, RTD	Current/ relay/digital output	≤ 1100
Pulse input	Pulse output	≤ 600
Pulse input	Relay/digital output	≤ 250

Current input

Measuring range:	0/4 to 20 mA + 10 % overrange
Accuracy:	0.1 % of full scale value
Temperature drift:	0.01 %/K (0.0056 %/°F) of full scale value
Loading capacity:	Max. 50 mA, max. 2.5 V
Input impedance (load):	50 Ω
HART® signals	Not affected
A/D converter resolution:	20 bit

Pulse/frequency input

The pulse/frequency input can be configured for different frequency ranges:
- Pulses and frequencies 0.3 Hz to 12.5 kHz
- Pulses and frequencies 0.3 to 25 Hz (filters bounce contacts, max. bounce time: 5 ms)

Minimum pulse width:	
Range up to 12.5 kHz	40 µs
Range up to 25 Hz	20 ms
Maximum permissible contact bounce time:	
Range up to 25 Hz	5 ms
Pulse input for active voltage pulses and contact sensors as per EN 1434-2, Class IB and IC:	

Non-conductive state	≤ 1 V
Conductive state	≥ 2 V
No-load supply voltage:	3 to 6 V
Current limiting resistance in the power supply (pull-up at input):	50 to 2 000 kΩ
Maximum permissible input voltage:	30 V (for active voltage pulses)
Pulse input for contact sensors as per EN 1434-2, Class ID and IE:	
Low-level	≤ 1.2 mA
High-level	≥ 2.1 mA
No-load supply voltage:	7 to 9 V
Current limiting resistance in the power supply (pull-up at input):	562 to 1 000 Ω
Not suitable for active input voltages	
Current/pulse input:	
Low-level	≤ 8 mA
High-level	≥ 13 mA
Loading capacity:	Max. 50 mA, max. 2.5 V
Input impedance (load):	50 Ω
Accuracy during frequency measurement:	
Basic accuracy:	0.01 % of reading
Temperature drift:	0.01 % of measured value over entire temperature range

Temperature input current/RTD

These inputs can be used either as current inputs (0/4 to 20 mA) or RTD inputs (RTD = Resistance Temperature Detector). It is also possible to configure one input as a current input and the other as an RTD input.

The two inputs are galvanically connected but galvanically isolated from other inputs and outputs (test voltage: 500 V).

Cycle time

The cycle time of the temperature measurement is 500 ms.

Current input

Measuring range:	0/4 to 20 mA + 10 % overrange
Accuracy:	0.1 % of full scale value
Temperature drift:	0.01 %/K (0.0056 %/°F) of full scale value
Loading capacity:	Max. 50 mA, max. 2.5 V
Input impedance (load):	50 Ω
A/D converter resolution:	24 bit
HART® signals are not affected.	

RTD input

Pt100, Pt500 and Pt1000 resistance temperature detectors can be connected to this input.

Measuring ranges:	
Pt100_exact:	−200 to 300 °C (−328 to 572 °F)

Pt100_wide:	−200 to 600 °C (−328 to 1 112 °F)
Pt500:	−200 to 300 °C (−328 to 572 °F)
Pt1000:	−200 to 300 °C (−328 to 572 °F)
Connection method:	2-, 3- or 4-wire connection
Accuracy:	4-wire: 0.06 % of measuring range 3-wire: 0.06 % of measuring range + 0.8 K (1.44 °F)
Temperature drift:	0.01 %/K (0.0056 %/°F) of measuring range
Characteristic curves:	DIN EN 60751:2008 IPTS-90
Max. cable resistance:	40 Ω
Cable open circuit detection:	Outside the measuring range

Density input

Cycle time

The cycle time of the density measurement is 125 ms.

Measuring range:	0/4 to 20 mA + 10 % overrange
Accuracy:	0.1 % of full scale value
Temperature drift:	0.01 %/K (0.0056 %/°F) of full scale value
Loading capacity:	Max. 50 mA, max. 2.5 V
Input impedance (load):	50 Ω
A/D converter resolution:	24 bit
HART® signals are not affected.	

Digital inputs

The digital inputs can be used for external control. A batch run can be started or stopped via these inputs, or the inputs can prevent a new batch from starting. In addition, the time can be synchronized.

Input level

As per IEC 61131-2 Type 3:

Logical "0" (corresponds to −3 to 5 V), activation with logical "1" (corresponds to 11 to 30 V)

Input current:

Max. 3.2 mA

Input voltage:

Max. 30 V (steady-state, without destroying input)

13.2 Output

Current/pulse output (option)

This output can be used either as a 0/4 to 20 current output or as a voltage pulse output.

The output is galvanically isolated (500 V test voltage towards all other inputs and outputs).

Current output (active)

Output range:	0/4 to 20 mA + 10 % overrange
Load:	0 to 600 Ω (as per IEC 61131-2)
Accuracy:	0.1 % of full scale value
Temperature drift:	0.01 %/K (0.0056 %/°F) of full scale value
Inductive load:	Max. 10 mH
Capacitance load:	Max. 10 µF
Ripple:	Max. 12 mVpp on 600 Ω for frequencies < 50 kHz
D/A converter resolution:	14 bit

Pulse output (active)

Frequency:	Max. 12.5 kHz
Pulse width:	Min. 40 µs
Voltage level:	Low: 0 to 2 V High: 15 to 20 V
Maximum output current:	22 mA
Short-circuit proof	

2 x relay output

The relays are designed as NO contacts. The output is galvanically isolated (1 500 V test voltage towards all other inputs and outputs).

Max. relay switching capacity:	AC: 250 V, 3 A DC: 30 V, 3 A
Minimum contact load:	10 V, 1 mA
Min. switching cycles:	$>10^5$

2 x digital output, open collector (option)

The two digital outputs are galvanically isolated from one another and from all other inputs and outputs (test voltage: 500 V). The digital outputs can be used as status or pulse outputs.

Frequency:	Max. 1 kHz
Pulse width:	Min. 500 µs
Current:	Max. 120 mA
Voltage:	Max. 30 V
Voltage drop:	Max. 2 V in conductive state
Maximum load resistance:	10 kΩ For higher values, the switching edges are flattened.

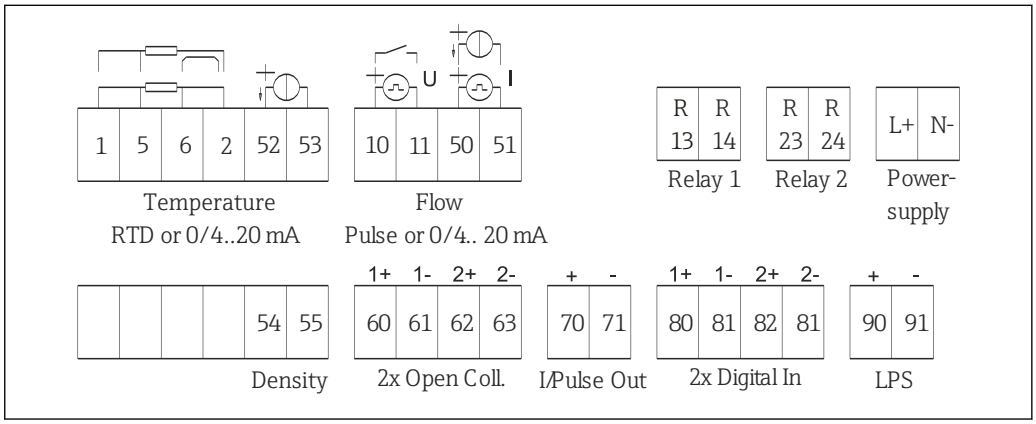
Auxiliary voltage output (transmitter power supply)

The auxiliary voltage output can be used to power the transmitter or control the digital inputs. The auxiliary voltage is short-circuit proof and galvanically isolated (500 V test voltage towards all other inputs and outputs).

Output voltage:	24 V DC ±15 % (not stabilized)
Output current:	Max. 70 mA
HART® signals are not affected.	

13.3 Power supply

Terminal assignment



35 *Terminal assignment of RA33*

Supply voltage

- Low voltage power supply unit: 100 to 230 V AC(−15 % / +10 %) $^{50}/_{60}$ Hz
- Extra-low voltage power unit:
  24 V DC (−50 % / +75 %)
  24 V AC (±50 %) $^{50}/_{60}$ Hz

An overload protection element (rated current ≤ 10 A) is required for the power cable.

Power consumption

15 VA

13.4 Communication interfaces

A USB interface (with CDI protocol), and optionally Ethernet, are used to configure the device and read out the values. ModBus is optionally available as a communication interface.

None of the interfaces has a modifying effect on the device in accordance with PTB Requirement PTBA 50.1.

USB device

Terminal:	Type B socket
Specification:	USB 2.0
Speed:	"Full Speed" (max. 12 MBit/sec)
Max. cable length:	3 m (9.8 ft)

Ethernet TCP/IP

The Ethernet interface is optional and cannot be combined with other optional interfaces. It is galvanically isolated (testing voltage: 500 V). A standard patch cable (e.g. CAT5E) can be used for the connection. 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 to office equipment using a hub or a switch.

standard:	10/100 Base-T/TX (IEEE 802.3)
Socket:	RJ-45
Max. cable length:	100 m (328 ft)

RS232 printer interface

The RS232 interface is optional and cannot be combined with other optional interfaces. A commercially available serial ASCII printer can be connected via the RS232 interface to print out batching reports directly from the device.

Terminal:	3-pin plug-in terminal
Transmission protocol:	serial
Transmission rate:	300/1200/2400/4800/9600/19200/38400/57600/76800

RS485

Terminal:	3-pin plug-in terminal
Transmission protocol:	RTU
Transmission rate:	2400/4800/9600/19200/38400
Parity:	choose from none, even, odd

Modbus TCP

The Modbus TCP interface is optional and cannot be ordered with other optional interfaces. It is used to connect the device to higher-order systems to transmit all measured values and process values. Form a physical point of view, the Modbus TCP interface is identical to the Ethernet interface.

Modbus RTU

The Modbus RTU (RS-485) interface is optional, and cannot be ordered with other optional interfaces.

It is galvanically isolated (testing voltage: 500 V) and is used to connect to higher-order systems to transmit all measured values and process values. It is connected via a 3-pin plug-in terminal.

13.5 Performance characteristics

Reference operating conditions	▪ Power supply 230 V AC ±10 %; 50 Hz ±0.5 Hz ▪ Warm-up period > 2 h ▪ Ambient temperature 25 °C ±5 K (77 °F ±9 °F) ▪ Humidity 39 % ±10 % RH.
Arithmetic unit	The system operates with a scan cycle of 125 ms. The flow at the specified response times is reliably recorded by the Batch Controller, but may deviate by this amount from the preset filling quantity. By using the after-run correction or reducing the flow rate in single-stage batching, the accuracy of the fill volume is increased. Using two filling stages enables both fast and highly accurate batching.

13.6 Installation

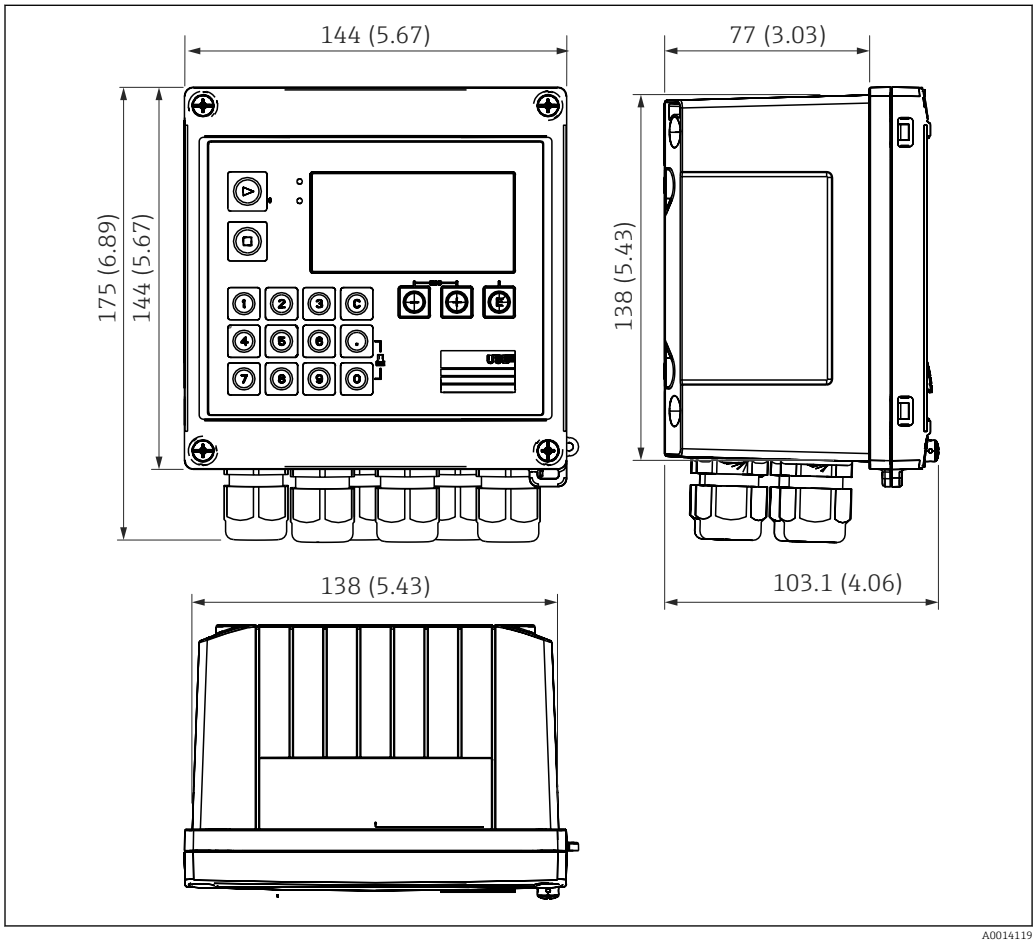
Mounting location	Wall/pipe mounting, panel or DIN rail as per IEC 60715
Installation position	The only factor determining the orientation is the legibility of the display.

13.7 Environment

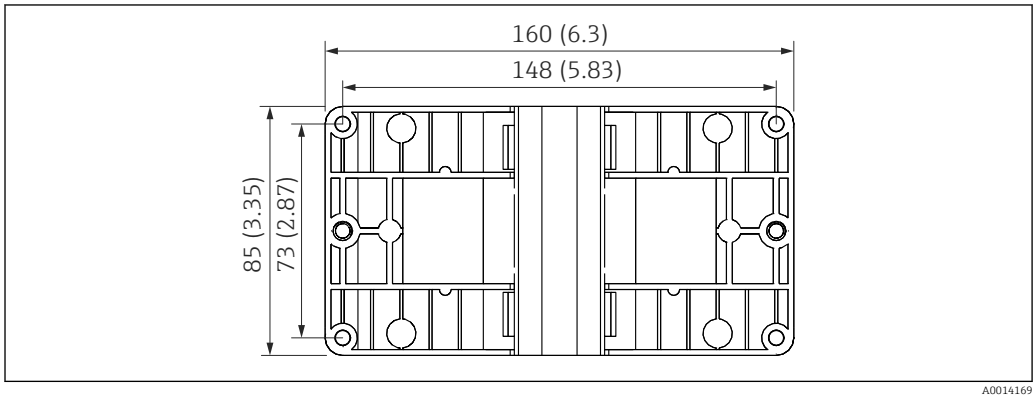
Ambient temperature range	−20 to +60 °C (−4 to +140 °F)
Storage temperature	−30 to +70 °C (−22 to +158 °F)
Climate class	As per IEC 60 654-1 Class B2, as per EN 1434 environment class C
Humidity	Maximum relative humidity 80 % for temperatures up to 31 °C (87.8 °F), decreasing linearly to 50 % relative humidity at 40 °C (104 °F).
Electrical safety	As per IEC 61010-1 and CAN C22.2 No 1010-1. ▪ Class II equipment ▪ Overvoltage category II ▪ Pollution level 2 ▪ Overcurrent protection ≤ 10 A ▪ Operating altitude: up to 2 000 m (6 560 ft.) above MSL
Degree of protection	▪ Panel mounting: IP65 at front, IP20 at rear ▪ DIN rail: IP20 ▪ Field housing: IP66, NEMA4x (for cable gland with double seal insert: IP65)
Electromagnetic compatibility	As per EN 1434-4, EN 61326 and NAMUR NE21

13.8 Mechanical construction

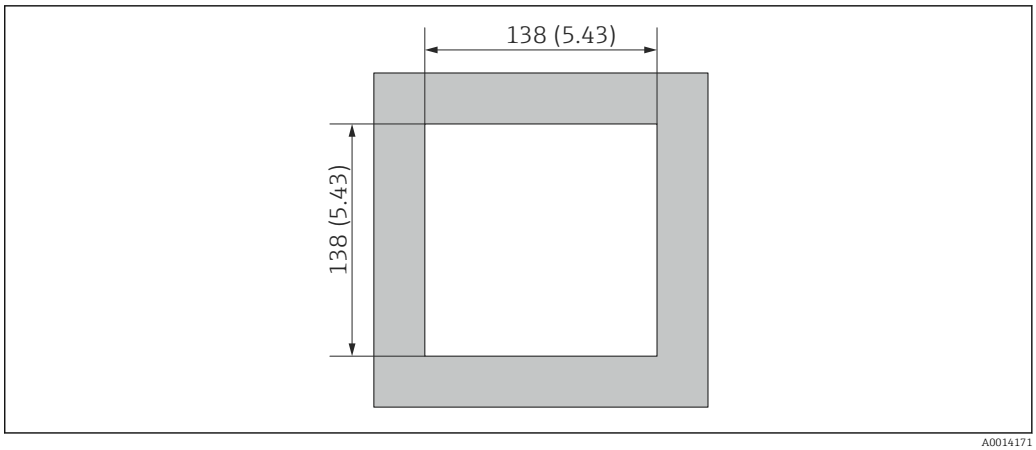
Design, dimensions



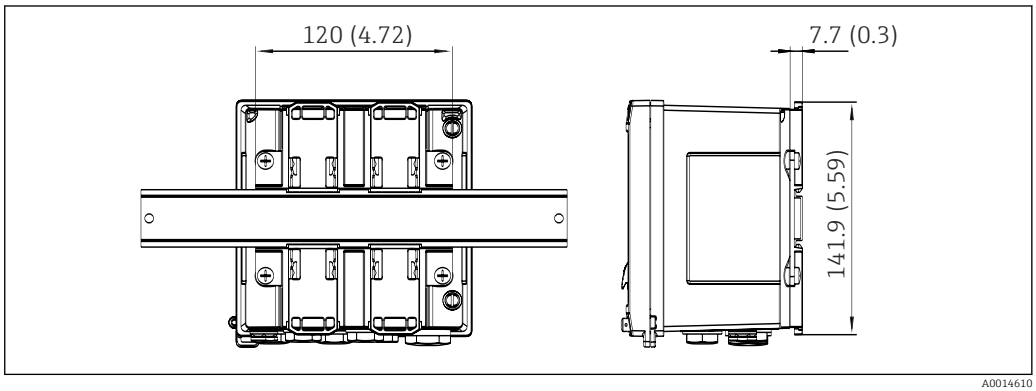
36 Batch Controller housing; dimensions in mm (in)



37 Mounting plate for wall, pipe and panel mounting; dimensions in mm (in)



38 *Panel cutout in mm (in)*

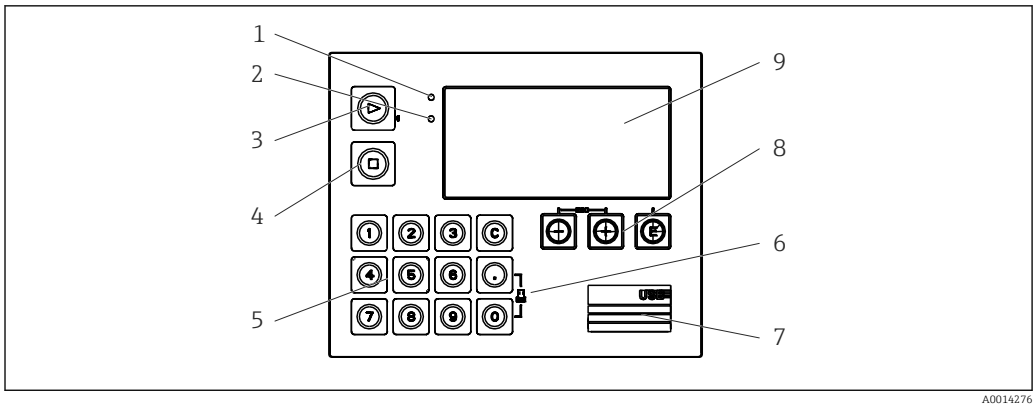


39 *Dimensions of DIN rail adapter in mm (in)*

Weight	Approx. 700 g (1.5 lbs)
Materials	Housing: fiber-glass reinforced plastic, Valox 553
Terminals	Spring terminals, 2.5 mm² (14 AWG); auxiliary voltage with plug-in screw terminal (30-12 AWG; torque 0.5 to 0.6 Nm) .

13.9 Operability

Languages	You can choose from one of the following operating languages on the device: English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Czech
Display elements	▪ Display: 160 x 80 dot-matrix LCD with white backlighting, color changes to red in the event of an alarm, active display area 70 x 34 mm (2.76" x 1.34") ▪ LED status display: Operation: 1 x green Fault message: 1 x red



40 Display and operating elements

1 Green LED, "Operation"
2 Red LED, "Fault message"
Function keys:
3 Start batch manually
4 Stop batch manually
5 Numeric keypad
6 Start printout
7 USB connection for configuration
8 Operating keys: -, +, E
9 Display: 160x80 dot-matrix display

Local operation

3 keys, "-", "+", "E".

14 function keys:
- Start / stop function: Press the "Start" button to start a batch run. Press "Stop" to pause the batch that is currently running. Press "Stop" again to abort the batch; press "Start" to resume the batch run.
- Function C: Press "C" when a batch is stopped to reset the counters on the display to their initial values.
- Print function: Press "0" and "." simultaneously to trigger a printout of the last batch run. To avail of this functionality, the "RS232 printer interface" option must be purchased.

Configuration interface

USB interface at front, optional Ethernet: configuration via PC with FieldCare Device Setup configuration software.

Data logging

Real-time clock
- Deviation: 15 min per year
- Power reserve: 1 week

Software

- **Field Data Manager software MS20**: visualization software and database for analyzing and evaluating the measured data and calculated values as well as tamper-proof data logging.
- **FieldCare Device Setup**: The device can be configured with the FieldCare PC software. FieldCare Device Setup is included in the scope of delivery for RXU10-G1 (see "Accessories") or can be downloaded free of charge from www.produkte.endress.com/fieldcare.

13.10 Certificates and approvals

CE mark

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE-mark.

Other standards and guidelines	▪ IEC 60529: Degrees of protection provided by enclosures (IP code) ▪ IEC 61010-1: 2001 cor 2003 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures ▪ IEC 61326 series: Electromagnetic compatibility (EMC requirements) ▪ NAMUR NE21, NE43: Association for Standards for Control and Regulation in the Chemical Industry ▪ ASTM D1250-04 / API MPMS 11.1 Manual of Petroleum Measurement Standards Chapter 11—Physical Properties Data Section 1.
CSA GP	CAN/CSA-C22.2 No. 61010-1, 2nd edition

14 Appendix

14.1 Operating functions and parameters

If a number in the form XXXXXX-XX is specified in a table row next to a parameter, the parameter can be accessed directly.

For this purpose go to the menu **Expert** → **Direct Access** and enter the number specified.

14.1.1 Language menu

Deutsch English Español Français Italiano Nederlands Polski Portuguese Russkij ceština	Select the operating language of the device from the list.

14.1.2 Display/operation menu

Select recipe		Select which recipe should be used. Only visible if recipe management is activated in **Setup** → **Advanced setup** → **Application** → **Batch information**.
Preset counter		Enter the preset counter.
Change group		Choose the group which should be displayed. Change automatically between the configured display groups or display one of the 6 display groups → 🖹 41
Display brightness		You can adjust the brightness of the display here. Number: 1-99
Display contrast		You can adjust the contrast of the display here. Number: 20-80
Stored values		Display the analyses stored in the device → 🖹 41.
	Display	Choose the data which should be displayed. The following information is displayed depending on the configured display value: ▪ Status ▪ Start time ▪ End time ▪ Duration ▪ Batch name ▪ Batch number ▪ Preset counter ▪ Quantity ▪ Number The batch report can be printed with the "Print" option.
	Print	Print out the batch report

14.1.3 Setup menu

In this setup, you can select only the most common/important operating options. Special settings can also be configured via "Expert".

Units		100001-00	Select your unit system (SI or US units). All units are switched to the selected unit system, but configured values are not converted.
Signal type		210000-00	Input for contact sensors as per EN 1434-2, Class ID + IE. Pulse (current): Current pulse input: = 8 mA Low level, = 13 mA High level.
Unit		210004-00	Specify the technical (physical) unit for the measuring point connected to this input.
Counter unit		210005-00	Technical unit of the count input, e.g. liter, m^3, ...
Pulse value		210013-00	Unit for the pulse value, e.g. pulse/l, l/pulse...
Value		210003-00	Pulse factor = factor which, multiplied by an input impulse, yields the physical value. Example: 1 pulse corresponds to 5 m^3, pulse value is set to "m^3/pulse" → enter "5" here. Decimal number, 8 digits including leading sign and decimal separator.
Date/time			Set date/time.
Range start		210008-00	Transmitters convert the physical measured variable into standardized signals. Enter the start of the measuring range here. Example: 0 to 100 m^3/h of the sensor converted to 4 to 20 mA : 0.
Meas. range end		210009-00	Enter the end of the measuring range here, e.g. "100" for a transmitter with 0 to 100 m^3/h.
Date/time			Show and set date and time.
	UTC time zone	120000-00	Current UTC time zone (UTC = coordinated universal time).
	Actual date	120001-00	Actual date. Format as configured under date format.
	Actual time	120002-00	Actual time. HH:MM, 12/24-hour as configured in the time format.
	Changing		You can change the date and time here.
		UTC time zone	120010-00	
		Date/time	120013- 00	
Advanced setup			Additional settings that are not essential for the basic operation of the device.
	System		Basic settings that are needed to operate the device (e.g. date, time, communication settings etc.)
		Access code	100000-00 or 100010-00 (FieldCare)	4-digit number. Using this code, setup access can be protected from unauthorized persons. In order to change any parameter the correct code must be entered. Factory setting: "0", i.e. changes can be made at any time. Make a note of the code and store in a safe place.
		Device tag	000031-00	Individual name of the device (max. 17 characters).
		Decimal separator	100003-00	Select the format in which the decimal separator character is to be displayed.
		Units	100001-00	Select your unitary system. All units are switched to the factory settings, but configured values are not converted!

		Fault switching			100002-00	If the device detects a system error (e.g. hardware defect) or a fault (e.g. cable open circuit), the selected output switches. Selection: Relay 1/2 or OpenCollector 1/2
		Date/time setting				Date/time set-up
			Date format		110000-00	Select in which format the date is to be set and displayed.
			Time format		110001-00	Select in which format the time is to be set and displayed.
		Date/time				Set date/time.
			UTC time zone		120000-00	Current UTC time zone (UTC = coordinated universal time).
			Actual date		120001-00	Actual date. Format as configured under date format.
			Actual time		120002-00	Actual time. HH:MM, 12/24-hour as configured in the time format.
			Changing			You can change the date and time here.
				UTC time zone	120010-00	Set your UTC time zone (UTC = universal time coordinated).
				Date/time	120013-00	Set your current date and your current time.
			NT/ST changeover			Settings for summer time changeover
				NT/ST changeover	110002-00	Function for summer/normal time changeover. Automatic: Changes to the local regional regulations; Manual: Changeover times can be set in the following addresses ; Off: No changeover times required.
				NT/ST region	110003-00	Selects the regional settings for summer/normal time changeover.
				Begin summer time		
				Occurrence	110005-00	Day in spring on which the switch from standard time to summer time takes place, e.g. for the fourth Sunday in March: select 4.
				Day	110006-00	Day of the week on which the switch from standard time to summer time takes place in spring, e.g. for the fourth Sunday in March: select Sunday.
				Month	110007-00	Month on which the switch from standard time to summer time takes place in spring, e.g. for the fourth Sunday in March: select March.
				Date	110008-00	Day, when in the spring a change from normal to summer time occurs.
				Time	110009-00	Time when the clocks go forward one hour on the day the time changes from standard time to summer time (format: hh:mm).
				End summer time		
				Occurrence	110011-00	Day on which the switch back from summer time to standard time takes place in fall, e.g. for the fourth Sunday in October: select 4.
				Day	110012-00	Day of the week on which the switch back from summer time to standard time takes place in fall, e.g. for the fourth Sunday in October: select Sunday.
				Month	110013-00	Month in which the switch back from summer time to standard time takes place in fall, e.g. for the fourth Sunday in October: select October.
				Date	110014-00	Day, when in the autumn a change from summer to normal time occurs.
				Time	110015-00	Time when the clocks go back one hour on the day the time changes from summer time to standard time (format: hh:mm).
		Units				You can set the unit of your calculated variables here.

				100001-00	Select your unit system (SI or US units). All units are switched to the factory settings for the selected unit system, but configured values are not converted.
		Ethernet			Set-up required, if you are using the Ethernet interface of the unit.
			DHCP	150002-00	The device can get its Ethernet settings through DHCP. ▪ The settings determined are displayed only after the setup is applied. ▪ Note: The unit always gets the same IP address if the leasing time is set long enough on the DHCP server. The PC software needs the IP address determined to establish a connection!
			IP address	150006-00	If you have configured DHCP = 'No', enter the IP address for the device here. This IP address is assigned by your network administrator. Please contact him or her. If DHCP = 'Yes', the IP address obtained by DHCP is displayed here.
			Subnetmask	150007-00	If you have configured DHCP = 'No', enter the subnet mask (you receive this from your network administrator). If DHCP = 'Yes', the subnet mask obtained by DHCP is displayed here.
			Gateway	150008-00	If you have configured DHCP = 'No', enter the gateway (you receive this from your network administrator). If DHCP = 'Yes', the gateway obtained by DHCP is displayed here.
			Web server	470000-00	Switch the Web server function on or off (= factory setting). The instantaneous values can only be displayed using an Internet browser when the Web browser is activated. Only possible using the Ethernet interface!
		Modbus			Configure the Modbus settings for the device. Only visible for devices with Modbus (option).
			Device address	480000-00	Enter the device address where it should be possible to reach this device in the bus.
			Baud rate	480001-00	Set the transmission rate for communication.
			Parity	480002-00	Make sure the settings are compatible with the PC software settings!
			Port	480004-00	Port via which the Modbus protocol can be addressed.
			Byte sequence	480005-00	Byte addressing, i.e. the transmission sequence of the bytes, is not specified in the MODBUS specification. For this reason, it is important to coordinate the addressing method between the master and slave during commissioning. This can be configured here.
			Reg. 0 to 2		Specify which values can be read out.
				Value	500000-00	Choose the value which should be transmitted.
				Analysis	500001-00	Select which counter (e.g. interval, daily counter, etc.) is to be transmitted. Only if a counter has been set for "Value".
			Reg. 3 to 5		Specify which values can be read out.
				Value	500000-01	Choose the value which should be transmitted.
				Analysis	500001-01	Select which counter (e.g. interval, daily counter, etc.) is to be transmitted.
			Reg. 6 to 8		Specify which values can be read out.
				Value	500000-02	Choose the value which should be transmitted.
				Analysis	500001-02	Select which counter (e.g. interval, daily counter, etc.) is to be transmitted.

			...		...	...
			Reg. 87 to 89			Specify which values can be read out.
				Value	500000-29	Choose the value which should be transmitted.
				Analysis	500001-29	Select which counter (e.g. interval, daily counter, etc.) is to be transmitted.
		Device options				Hardware and software options.
			Optional outputs		990000-00	
			Communication		990001-00	
			Protocol		990007-00	
			Compensation+RTD		990009-00	
	Inputs					Settings for the analog and digital inputs.
		Flow				Settings for the flow input.
			Signal type		210000-00	Select the signal type connected. ▪ 4 to 20 mA (DP flow): Input for flow measurements based on the differential pressure method (e.g. orifice plate) ▪ Pulse U+IB+IC: Input for active voltage pulses and contact sensors as per EN 1434-2, Class IB + IC. ▪ Pulse Cl. ID+IE: Input for contact sensors as per EN 1434-2, Class ID + IE. ▪ Pulse I: Current pulse input: ≤ 8 mA Low level, ≥ 13 mA High level.
			Channel identifier		210001-00	Name of the measuring point connected to this input. Customized text, 6 characters.
			Type		210014-00	Flow type of the input signal (volume flow or mass flow).
			Pulse input		210002-00	Specify whether the pulse input is a fast (up to 12.5 kHz) or slow (up to 25 Hz) input. Only if Pulse has been selected as the signal type.
			Pulse value		210003-00	Pulse factor = factor which, multiplied by an input impulse, yields the physical value. Example: 1 pulse equals 5 m^3 → enter a "5". Decimal number, max. 8 digits including decimal separator. Only if Pulse has been selected as the signal type. The pulse values available for selection are displayed depending on the setting in the "Type" parameter.
			Unit		210004-00	Specify the technical (physical) unit for the measuring point connected to this input. The pulse values available for selection are displayed depending on the setting in the "Type" parameter.
			Decimal places		210006-00	Number of places after decimal point for the display. E.g. measured value: 20.12348 l/s The following can be displayed: ▪ None: 20 l/s ▪ One: 20.1 l/s ▪ Two: 20.12 l/s ▪ Three: 20.123 l/s The value is rounded where necessary.

			Counter unit	210005-00	Technical unit of the count input, e.g. liter, m^3, ... The pulse values available for selection are displayed depending on the setting in the "Type" parameter.
			Decimal places	210007-00	Number of digits after the decimal point for the counter.
			Range start		Transmitters convert the physical measured variable into standardized signals. Enter the start of the measuring range here. Example: 0 to 100 m^3/h of the sensor converted to 4 to 20 mA : 0. Decimal number, max. 8 digits including decimal separator. Only for 0/4-20 mA.
			Meas. range end		Enter the end of the measuring range here, e.g. "100" for a transmitter with 0 to 100 m^3/h. Decimal number, max. 8 digits including decimal separator Only for 0/4-20 mA.
			Low flow cut off		If the volume flow recorded is below the set value, these quantities are not added to the counter. If the input is scaled from 0 to y, or if the pulse input is used, all values that are smaller than the set value are not recorded. If the input is scaled from -x to +y, all values around the zero point (e.g. also negative values) are not recorded. Decimal number, max. 8 digits including decimal separator.
		Temperature			Settings for the temperature input.
			Signal type	220000-00	Select the signal type connected.
			Connection type	220001-00	Configure whether an RTD assembly is connected with 3 or 4 wires. Only for signal type Pt100, Pt500 or Pt1000.
			Channel identifier	220002-00	Name of the measuring point connected to this input. Customized text, max. 6 characters.
			Unit	220003-00	Specify the technical (physical) unit for the measuring point connected to this input.
			Decimal places	220004-00	Number of places after decimal point for the display.
			Range	220005-00	Set the desired measuring range. Can only be set for Pt100 or platinum RTD (CvD). A small measuring range increases the accuracy of temperature measurement.
			Range start	220006-00	Transmitters convert the physical measured variable into standardized signals. Enter the start of the measuring range here. Only for 0/4 to 20 mA. Decimal number, max. 8 digits including decimal separator.
			Meas. range end	220007-00	Enter the end of the measuring range here. Only for 0/4 to 20 mA. Decimal number, max. 8 digits including decimal separator.
			Default value	220009-00	Specify a fixed temperature value with which the device should perform calculations. Only for signal type = default value
		Density			Settings for the density input
			Signal type	220000-01	Select the signal type for the density input or set the "Default value".
			Channel identifier	220002-01	Identifier for the density input. Customized text, 6 characters.
			Unit	220003-01	Select the density unit.
			Decimal places	220004-01	Select the number of decimal points that are used for the density input.

			Range start	220006-01	Configure what value corresponds to 0/4 mA. Numerical value, max. 8 digits including decimal separator.
			Meas. range end	220007-01	Configure what value corresponds to 20 mA. Numerical value, max. 8 digits including decimal separator.
			Default value	220009-01	Specify a fixed density value with which the device should perform calculations. Only for signal type = default value.
		Digital 1/2			Setting up only required if the digital inputs (e.g. events) are to be used.
			Function	DI 1: 250000-00 DI 2: 250000-01	Select the required function, → 🖹 38. Digital inputs are High active; this means the described effect is achieved by a high input. Low = −3 to +5 V High = +12 to +30 V
	Outputs				Settings only required if outputs (e.g. relays or analog outputs) are to be used.
		Universal output			Settings for the universal output (current or pulse output).
			Signal type	310000-00	Select the output signal for this channel.
			Channel/value	310001-00	Select which channel or calculated value is to be output at the output.
			Start value	310003-00	Configure what value corresponds to 0/4 mA. Numerical value, max. 8 digits including decimal separator (can only be selected for the 0/4 to 20 mA signal type).
			Full scale value	310004-00	Configure what value corresponds to 20 mA. Numerical value, max. 8 digits including decimal separator (can only be selected for the 0/4 to 20 mA signal type).
			Damping	310005-00	Time constant of the first order low pass for the output signal. This is used to prevent severe fluctuations in the output signal (can only be selected for the 0/4 to 20 mA signal type). Numerical value, max. 8 digits including decimal separator.
			Current start value	310022-00	Current that should be output at the start of the batch. Only for the setting "Channel/value =Curve".
			Start max	310020-00	Two points are defined for the actuator curve. This is the percentage value to reach the 20 mA value. Only for the setting "Channel/value =Curve".
			Stop max	310021-00	Two points are defined for the actuator curve. This is the percentage value to leave the 20 mA value. Only for the setting "Channel/value =Curve".
			Pulse value	310006-00	The pulse value specifies what quantity an output pulse corresponds to (e.g. 1 pulse = 5 liters). Numerical value, max. 8 digits including decimal separator.
			Pulse width	310007-00	The pulse width limits the max. possible output frequency of the pulse output. Define a fixed or dynamic pulse width.
			Pulse width	310008-00	You can set the pulse width in the range from 0.04 to 1 000 ms here. Numerical value, max. 8 digits including decimal separator. Visible only if a user-defined pulse width was selected.
		Open Collector 1/2			Settings for the open collector output (pulse or status).
			Function	OC 1: 320000-00 OC 2: 320000-01	Specify what the open collector output should output (pulses or status).

			Operating mode	320001-00 320001-01	Function of the open collector: ▪ NC contact: The contact is closed in its quiescent state (maximum safety). ▪ NO contact: The contact is open in its quiescent state.
			Channel/value	320002-00 320002-01	Select which channel/value is to be output at the output. Only for function = pulse output.
			Pulse value	320004-00 320004-01	The pulse value specifies which quantity an output pulse corresponds to (e.g. 1 pulse = 5 liters). Only for function = pulse output.
			Pulse width	320005-00 320005-01	The pulse width limits the max. possible output frequency of the pulse output. Define a fixed or dynamic pulse width. Only for function = pulse output.
			Pulse width	320006-00 320006-01	You can set the pulse width in the range from 0.5 to 1 000 ms here. Numerical value, max. 8 digits including decimal separator. Visible only if a user-defined pulse width was selected.
		Relay			Setup for the selected relay
			Operating mode	Relay 1: 330000-00 Relay 2: 330000-01	Relay function: ▪ NC contact: The relay is closed in its quiescent state (maximum safety). ▪ NO contact: The relay is open in its quiescent state.
	Application				Configure various application-specific settings (e.g. group settings, limit values, etc.).
		Batch settings			
			Batch active	400010-00	Defines whether a status signal should be output at an output when a batching operation is active
			Batch mode	510000-00	Three batch modes are available. ▪ In the standard mode batching runs to the end of the preset counter. ▪ In the automatic restart mode, a sequence is started by the start command that repeats batching until it ends. ▪ In the manual batch mode, a preset counter is not required; batching is started and ended locally or via control input.
			Restart delay	510001-00	This time defines the interval between a completed batch and an automatically restarted batch in the "Autom. restart" batching mode.
			Counting direction	510002-00	The counting direction determines the way the preset counter is shown on the display. If the direction is forwards, the counter is increased from 0 to the preset counter value; if it is backwards, it is decreased from the preset counter value to 0.
			Filling stages	510003-00	Two filling stages can be used for accurate dosing of a batch. A larger-quantity flow rate can be stopped earlier and the total quantity can be dosed with more accuracy until the preset counter value is reached using another, lower flow rate.
			Switches fill stage 1	510004-00	Specifies the output with which the main filling stage is controlled.
			Switches fill stage 2	510005-00	Specifies which output is used for the filling stage with the additional, larger flow rate.
			Delay stage 2	510006-00	The delay specifies the time after which the second valve with the larger flow rate is activated.
			Pre-stop fill stage 2	510008-00	The pre-stop specifies what the remaining quantity is when filling stage 2 is ended and fine-dosing starts.

			Fixed correction	510009-00	Fixed after-run correction is used to compensate for longer valve closing times and response times and to achieve more accurate batching results. It can also be used to keep incorrect quantities to a minimum when initially teaching the system even if the automatic after-run correction function is activated.
			Autom. correction	510010-00	Automatic after-run correction complements the fixed correction function and automatically corrects the accuracy to compensate for system variations caused, for example, by valve aging.
			Max. preset counter	510012-00	The maximum preset counter defines the maximum value that can be entered as the preset counter value in order to prevent the entry of large incorrect values.
		Batch information			The **Batch information** menu is used to manage identifiers and recipes.
			Recipe management	510100-00	Recipe management can be activated. The identifier, manual after-run correction and preset counter can be preconfigured for different batches and selected during operation without setup access.
			Number	510101-00	Enter the desired number of preconfigurable recipes here. Possible values: 1-30
			Batch name	510105-00	Use this option to enter the batch identifier which will then be stored in the batch report.
			Batch no. start value	510110-00	Use this option to enter the start value of the current batch number.
			Reset batch no.	510111-00	Use this option to reset the current number to the start value.
			Recipe 1 to 30		
				Batch name	510102-00 ...-29	Use this option to enter the batch identifier which will then be stored in the batch report.
				Preset counter	510104-00 ...-29	This preset counter represents the preconfigured preset counter value, which is used when the recipe is selected but can still be modified.
				Fixed correction	510109-00 ...-29	Fixed after-run correction is used to compensate for longer valve closing times and response times and to achieve more accurate batching results. It can also be used to keep incorrect quantities to a minimum when initially teaching the system even if the automatic after-run correction function is activated.
		Compensation			The **Compensation** menu contains all of the settings for correcting the volume or converting to mass using additional measured variables.
			Compensation	530000-00	Activate the compensation function to correct the flow volume or to calculate the mass (only if Inputs/flow/type = "Volume flow"). A density sensor or temperature sensor is required for the compensation. When a temperature sensor is used, the density is calculated on the basis of the reference condition and reference density.
			Product group	530001-00	Select your product group here. The user-defined option allows the correction of any medium using density or temperature measurement or the calculation of the mass using a density sensor. The mineral oil options initiate volume correction based on the temperature sensor and an optional, additional density sensor.
			The result is	530008-00	Select "Corrected volume" here to perform volume correction. Select "Mass" here to convert the measured volume into mass. The mass unit is set in the "Mass unit" parameter. Only visible if "Inputs/flow/type" = "Volume flow".
			Mass unit	530009-00	Use this option to specify the required mass unit into which the volume should be converted. The counter value then appears on the display and in the analyses in this mass unit. The preset counter must also be entered in this unit. Only visible if "Inputs/flow/type" = "Volume flow" and "The result is" = "Mass".

			Volume unit	530009-00	Use this option to specify the required unit for the calculated volume. The counter value then appears on the display and in the analyses in this unit. The preset counter must also be entered in this unit. Only visible if "Inputs/flow/ type" = "Mass flow".
			Density unit	530002-00	Use this option to select your preferred density unit in which the subsequent values must be entered.
			Operating density	530003-00	Select "Measured" here if you want to use a density sensor for the measurement. If you calculate the density internally, you only require a temperature sensor and can select "Calculated".
			Reference condition	530004-00	Use this option to select the required reference operating condition for volume correction.
			Reference density	530005-00	Use this option to enter the density of the medium under the reference operating conditions selected previously.
			Pressure unit	530007-00	Use this option to select your preferred pressure unit in which the subsequent values must be entered.
			Pressure	530006-00	Use this option to enter the pressure at which the medium flow is measured. This value is also taken into account when calculating volume correction. It suffices to enter a relative pressure value of 0 to switch off compensation based on the pressure value.
			Expansion unit	530011-00	
			Expansion coeff.	530010-00	The thermal expansion coefficient describes the expansion of a medium in the event of a temperature change of 1 °C/°F starting from the temperature set in the reference condition.
		Batch printout			All of the relevant parameters to print out a batch report can be defined here.
			Printout	510200-00	You can activate the printout here. You can also choose whether printing can be initiated manually via local operation, or whether a printout should also take place at the end of every batch.
			Baud rate	510214-00	Set the transmission rate for communication.
			Number of copies	510201-00	Use this option to set the required number (0-5) of automatic printouts.
			Characters/line	510212-00	Enter the maximum number of characters per line here.
			Number of headers	510202-00	Use this option to specify the required number of lines (0-5) for user-defined text at the start of the batch report.
			Header x	510203-00 to 06-00	Use this option to specify the user-defined text to be printed on the batch report.
			Number of footers	510207-00	Use this option to enter the number of lines for user-defined text at the end of the batch report.
			Footer x	510208-00 to 11-00	Use this option to specify the user-defined text to be printed on the batch report.
			Blank rows at the end	510215-00	Enter the number of blank lines required at the end of the printout to make it easier to tear off.
			Print direction	510213-00	Use this option to select the print direction based on the properties of the printer you are using (starting from the first line or last line).
			Test print	510216-00	Use this option to start printing in order to check your settings.
		Display groups			Put the inputs/calculated values into groups such that you can call up the information you need at the touch of a button during operation.

			Group 1 to 6			Various general settings for the groups for measured value display of the device.
				Designation	460000-00 -01, -02, -03, -04, -05	Enter a name for these groups.
				Value 1	460001-00 -01, -02, -03, -04, -05	Select which input/which calculated variable in this group is to be displayed.
				Value 2	460003-00 -01, -02, -03, -04, -05	Select which input/which calculated variable in this group is to be displayed.
				Value 3	460005-00 -01, -02, -03, -04, -05	Select which input/which calculated variable in this group is to be displayed.
				Display		If you select a counter in "Value 1 to 3", in "Display", you can configure which data of the counter are to be displayed.

14.1.4 Diagnostics menu

Actual diagnos.			050000-00	Displays the current diagnostic message.
Last diagnostics			050005-00	Displays the last diagnostic message.
Last restart			050010-00	Information as to when the device was last restarted (e.g. due to a power failure).
Diagnostics list				All pending diagnostic messages are listed.
Event logbook				Events such as a limit value violation and power failure are listed in the correct time sequence.
Device information				Displays important device information.
	Device tag		000031-00	Individual device tag name (max. 17 characters).
	Serial number		000027-00	Please send these details with any questions about the unit.
	Order number		000029-00	Please send these details with any questions about the unit.
	Order identifier		000030-00	Please send these details with any questions about the unit.
	Firmware version		000026-00	Please send these details with any questions about the unit.
	ENP version		000032-00	Please send these details with any questions about the unit.
	ENP device name		000020-00	Please send these details with any questions about the unit.
	Device name		000021-00	Please send these details with any questions about the unit.
	Manufacturer ID		000022-00	Please send these details with any questions about the unit.
	Manufacturer name		000023-00	Please send these details with any questions about the unit.
	Firmware		009998-00	Please send these details with any questions about the unit.
	Hardware			Information on the hardware components.
		Device running time	010050-00	Indicates how long the device was in operation.
		Fault hours	010051-00	Indicates how long the device experienced a fault.
		Ethernet		Information about the Ethernet interface of the device. Only for devices with Ethernet interface.
			Firmware version	010026-00	Firmware version of Ethernet card. Please send these details with any questions about the unit.
			Serial number	010027-00	Serial number of Ethernet card. Please send these details with any questions about the unit.
	Device options			Hardware and software options of the device.
		Optional outputs	990000-00	
		Communication	990001-00	
		Protocol	990007-00	
		Compensation	990009-00	
Measured values				Displays the current measured values of the device. For displaying on the device.

	Hold	060000-00	Stops the entire measured value acquisition/storage. Select "No" to exit the hold function. The hold function is exited automatically after 5 minutes.
Outputs			Current status of outputs (if used).
	Universal output	060120-00	Value currently output at the universal output.
Simulation			Various functions/signals can be simulated for test purposes here. In Simulation mode normal recording of the measured values is interrupted and the intervention is logged in the event log.
	Universal output	050200	Choose the value which should be output. Select "Switched off" to exit the simulation. The simulation is exited automatically after 5 minutes. The simulation is NOT exited automatically when exiting the menu.
	Open Collector 1/2	050205-00 050210-00	Choose the value which should be output. Select "Switched off" to exit the simulation. The simulation is exited automatically after 5 minutes. The simulation is NOT exited automatically when exiting the menu.
	Relay 1/2	050215-00 050220-00	Manual activation of the selected relay. The simulation is exited automatically after 5 minutes. The simulation is NOT exited automatically when exiting the menu.

14.1.5 Expert menu

In the Expert menu, all parameters and settings of the device can be changed.

The menu contains all the parameters / settings from the **Setup** menu in addition to those described below.

Direct access						Direct access to parameters (rapid access).
Service code					010002-00	Please enter service code to make service parameter visible. For PC operating software only.
System						Basic settings that are needed to operate the device (e.g. date, time, communication settings etc.).
	Language				010000-00	Select the operating language of the device.
	PRESET				000044-00	Resets all parameters to the factory settings! Can be changed via the service code only.
	Clear memory				059000-00	Clear internal memory
	Reset				059100-00	Reset analysis to 0.
	Ethernet					Set-up required, if you are using the Ethernet interface of the unit.
		MAC address			150000-00	MAC address of the device
		Port			150001-00	The system communicates with the PC software through this communication port. Default: **8000** If your network is protected by a firewall, this port may have to be enabled. Please contact your network administrator if this is the case.
	Device options					Hardware and software options of the device.
		Activation code			000057-00	Here, you can enter a code to enable the device options.
Inputs						Settings for the analog and digital inputs.
	Flow					
		Meas.val. corrct.				Determining the correction values to balance measurement tolerances. Proceed as follows: ▪ Measure the current value at the lower measurement range. ▪ Measure the current value at the upper measurement range. ▪ Enter the lower and upper target and actual value.
			Range start			Lower correction value.
			Target value		210051-00	Enter the setpoint at the start of the measuring range here (e.g. measuring range 0 l/h to 100 l/h: 0 l/h).
			Actual value		210052-00	Enter the value actually measured here (e.g. measuring range 0 l/h to 100 l/h: measured 0.1 l/h).
			Meas. range end			Upper correction value.
			Target value		210054-00	Enter the setpoint at the end of the measuring range here (e.g. measuring range 0 l/h to 100 l/h: 100 l/h100l/h).
			Actual value		210055-00	Enter the value actually measured here (e.g. measuring range 0 l/h to 100 l/h: measured 99.9 l/h).

			Damping	210010-00	Fast changes in the measured value or an irregular pulse input are attenuated at the input. Result: The measured values on the display, or values relayed via digital communication, change more slowly and measured value spikes are avoided. This damping does not affect the counter. Decimal number, max. 5 digits incl. decimal separator. Factory setting: 0.0 s
		Fault mode			Settings that define how this channel is to react under fault conditions (e.g. cable open circuit, over range).
			NAMUR NE 43	210060-00	Activate/deactivate the 4 to 20 mA loop monitoring as per NAMUR recommendation NE 43. The following error ranges apply when NAMUR NE43 is switched on: ▪ ≤ 3.8 mA: under range ▪ ≥ 20.5 mA: over range ▪ ≤ 3.6 mA or ≥ 21.0 mA: sensor error ▪ ≤ 2mA: cable open circuit
			On error	210061-00	Configure what value the device should continue working with (for calculations) if the measured value is not valid (e.g. cable open circuit).
			Error value	210062-00	Only if the setting "Error value" has been selected under "On error". The device continues calculating with this value in the event of an error. The calculated values are recorded in the deficit counter. The normal counter remains unchanged (does not run).
	Temperature				Settings for the temperature input.
		Damping		220008-00	Factory setting: 0.0 s. The more unwanted interference is superimposed over the measuring signal, the higher the value should be set. Result: Fast changes are dampened/suppressed. Decimal number, max. 5 digits incl. decimal separator.
		Meas.val. corrct.			Determining the correction values to balance measurement tolerances. Proceed as follows: ▪ Measure the current value at the lower measurement range. ▪ Measure the current value at the upper measurement range. ▪ Enter the lower and upper target and actual value.
			Offset	220050-00	Factory setting "0". This offset is only effective on the analog input signal (no maths / bus channels). Only for RTD. Decimal number, max. 8 digits including decimal separator.
			Range start		Lower correction value Only for 0/4 to 20 mA.
			Target value	220052-00	Enter the lower setpoint here (e.g. measuring range 0 °C to 100 °C: 0 °C). Decimal number, max. 8 digits including decimal separator. Only for 0/4 to 20 mA.
			Actual value	220053-00	Enter the lower value actually measured here (e.g. measuring range 0 °C to 100 °C: measured 0.5 °C). Decimal number, max. 8 digits including decimal separator. Only for 0/4 to 20 mA.
			Meas. range end		Upper correction value Only for 0/4 to 20 mA.
			Target value	220055-00	Enter the upper setpoint here (e.g. measuring range 0 °C to 100 °C: 100 °C). Decimal number, max. 8 digits including decimal separator. Only for 0/4 to 20 mA.
			Actual value	220056-00	Enter the upper value actually measured here (e.g. measuring range 0 °C to 100 °C: measured 99.5 °C). Decimal number, max. 8 digits including decimal separator. Only for 0/4 to 20 mA.

		Fault mode			Settings that define how this channel is to react under fault conditions (e.g. cable open circuit, over range).
			NAMUR NE 43	220060-00	Activate/deactivate the 4 to 20 mA loop monitoring as per NAMUR recommendation NE 43. The following error ranges apply when NAMUR NE43 is switched on: ▪ ≤ 3.8 mA: under range ▪ ≥ 20.5 mA: over range ▪ ≤ 3.6 mA or ≥ 21.0 mA: sensor error ▪ ≤ 2 mA: cable open circuit
			On error	220061-00	Configure what value the device should continue working with (for calculations) if the measured value is not valid (e.g. cable open circuit).
			Error value	220062-00	Only if the setting "Error value" has been selected under "On error". The device continues calculating with this value in the event of an error. The calculated values are recorded in the deficit counter. The normal counter remains unchanged (does not run).
	Density				Settings for the temperature input.
		Damping		220008-01	Factory setting: 0.0 s. The more unwanted interference is superimposed over the measuring signal, the higher the value should be set. Result: Fast changes are dampened/suppressed. Decimal number, max. 5 digits incl. decimal separator.
		Meas.val. corrct.			Determining the correction values to balance measurement tolerances. Proceed as follows: ▪ Measure the current value at the lower measurement range. ▪ Measure the current value at the upper measurement range. ▪ Enter the lower and upper target and actual value.
			Range start		Lower correction value
			Target value	220052-01	Enter the lower setpoint here. Decimal number, max. 8 digits including decimal separator.
			Actual value	220053-01	Enter the lower value actually measured here. Decimal number, max. 8 digits including decimal separator.
			Meas. range end		Upper correction value
			Target value	220055-01	Enter the upper setpoint here. Decimal number, max. 8 digits including decimal separator.
			Actual value	220056-01	Enter the upper value actually measured here. Decimal number, max. 8 digits including decimal separator.
		Fault mode			Settings that define how this channel is to react under fault conditions (e.g. cable open circuit, over range).
			NAMUR NE 43	220060-01	Activate/deactivate monitoring as per NAMUR recommendation NE 43. The following error ranges apply when NAMUR NE43 is switched on: ▪ ≤ 3.8 mA: under range ▪ ≥ 20.5 mA: over range ▪ ≤ 3.6 mA or ≥ 21.0 mA: sensor error ▪ ≤ 2 mA: cable open circuit
			On error	220061-01	Configure what value the device should continue working with (for calculations) if the measured value is not valid (e.g. cable open circuit).
			Error value	220062-01	Only if the setting "Error value" has been selected under "On error". The device continues calculating with this value in the event of an error. The calculated values are recorded in the deficit counter. The normal counter remains unchanged (does not run).
Outputs					Settings only required if outputs (e.g. relays or analog outputs) are to be used.

	Universal output			Settings for the universal output (current or pulse output).
		Failure current	310009-00	Set the current to be output in the event of an error (e.g. cable open circuit at the input). Numerical value, max. 8 digits including decimal separator.
		Meas.val. corrct.		Here, you can correct the output current value (necessary only if the device that carries out the further processing cannot compensate for any measurement section tolerances). Proceed as follows: ▪ On the connected device, read out the displayed value in both the upper and lower measuring range. ▪ Enter the lower and upper target and actual value.
			Start value	Lower correction value.
			Target value	310051-00	Enter the lower setpoint here.
			Actual value	310052-00	Here, enter the lower actual value which is displayed at the connected device.
			Full scale value		Upper correction value
			Target value	310054-00	Enter the upper setpoint here.
			Actual value	310055-00	Here, enter the upper actual value which is displayed at the connected device.
Application				Configure various application-specific settings (e.g. group settings, limit values, etc.).
		Batch settings		Batching-related parameters are defined in the **Batch settings** menu.
			Max. fill deviation	510013	This percentage value defines a percentage limit by which the actual amount may deviate from the desired amount before a message is displayed.
			Wait at batch end	510011	This parameter defines the time that the device must wait once a valve has closed so that the system settles down and therefore accuracy is increased. This time must first elapse before a new batch can be started. The setting 999s allows the user to switch off leak monitoring during a batch and if a batch in inactive. The "Wait at batch end" function is then permanently set to 0 seconds.
			Timeout flow	510015	This parameter defines the period of time within which flow must occur when a batching process is started. A message is displayed if this time elapses and no quantifiable flow is measured.
			Power failure response	510016	The "Power failure response" parameter defines the startup behavior following a power failure during active batching. Batching is either started with the status "paused" and can then be resumed or canceled, or batching is resumed automatically.
Diagnostics				Device information and service functions for swift device check. This information can also be found in the Diagnostics / Device information menu
	ENP device name		000020-00	Please send these details with any questions about the unit.
	Device name		000021-00	Please send these details with any questions about the unit.
	Serial number		000027-00	Please send these details with any questions about the unit.
	Order number		000029-00	Please send these details with any questions about the unit.
	Order identifier		000030-00	Please send these details with any questions about the unit.

14.2 Symbols

Symbol	Description
	Device locked
F	Fault For example, error in a channel not displayed in the current group.
M	Maintenance required For example, maintenance required in a channel not displayed in the current group.
	External communication, e.g. fieldbus
SIM	Simulation
	Low value
	High value
^	Counter overflow
▶	Batch active
■	No batch active
⏸	Batch paused
	Batch in automatic restart mode
Name of the inputs and process values	
Count	Number of batches
DI 1	Digital input 1
DI 2	Digital input 2
Good	Number of successful batches
Name	Batch name
No.	Batch number, PSC preset counter
PSC	Preset counter
ρ	Density
ρ ref	Reference density
ΣM	Mass counter, total
ΣM (i)	Mass counter, current batch
ΣM	Volume counter, total
ΣV (i)	Volume counter, current batch
Σx	Deficit counter
Temp.	Temperature
VCF	Volume correction factor

14.3 Definition of important system units

Volume	
bl Device display "bbl"	1 barrel (general liquids), corresponds to 119.24047 l
gal	1 US gallon, corresponds to 3.7854 l
Igal	Imperial gallon, corresponds to 4.5609 l
l	1 liter = 1 dm^3
hl	1 hectoliter = 100 l
m^3	Corresponds to 1 000 l
ft^3	Corresponds to 28.37 l
Temperature	
	Conversion: ▪ 0 °C = 273.15 K ▪ °C = (°F - 32)/1.8
Pressure	
	Conversion: 1 bar = 100 kPa = 100 000 Pa = 0.001 mbar = 14.504 psi
Mass	
ton (US)	1 US ton, corresponds to 2 000 lbs (= 907.2 kg)
ton (long)	1 long ton, corresponds to 2 240 lbs (= 1 016 kg)
Density	
kg/m^3	1 kg/m^3 corresponds to 0.0624 lb/ft^3
lb/ft^3	1 lb/ft^3 corresponds to 16.018 kg/m^3

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