

Operating Instructions

Silopilot FMM20

Electromechanical level system



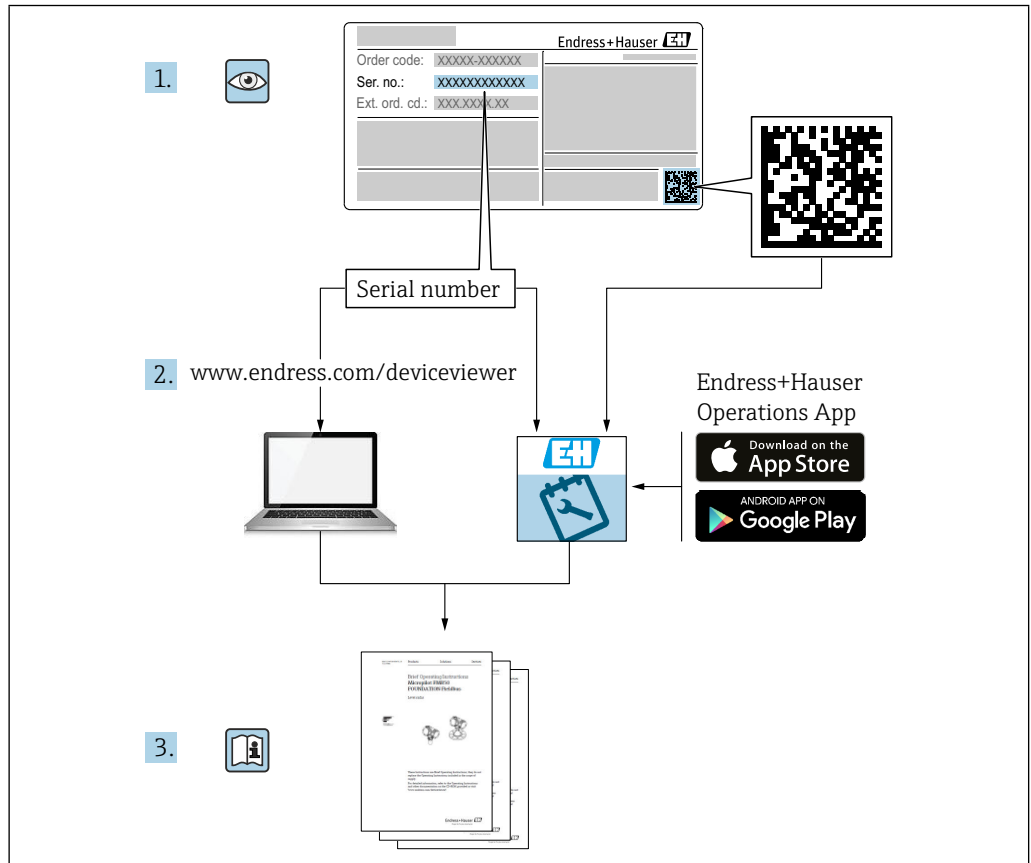


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1 About this document

1.1 Symbols

1.1.1 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.

1.1.2 Electrical symbols

 Protective Earth (PE)

A terminal which must be connected to ground prior to establishing any other connections.

1.1.3 Symbols for certain types of information

 Permitted


Procedures, processes or actions that are permitted.


 Forbidden

Procedures, processes or actions that are forbidden.

 Tip

Indicates additional information

 Reference to documentation

 Reference to another section

 Reference to graphic


 1., 2., 3. Series of steps

1.1.4 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

 Hazardous area

 Safe area (non-hazardous area)

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e. g., commissioning and maintenance:

- ▶ Trained, qualified specialists must have a relevant qualification for the specific function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Must have read and understood the instructions in the manual and supplementary documentation
- ▶ Follow instructions and comply with conditions

2.2 Designated use

Only use the meter for level measurement in bunkers or silos with dusty or fine-grain bulk solids or in tanks containing liquids. Improper use can pose hazards. Ensure that the measuring device is free of defects while it is in operation.

- Use the device only in media to which the process-wetted materials are adequately resistant.
- Do not exceed or drop below the limit values for the measuring device
TI0042 1F

Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Clarification of borderline cases:

- In the case of special fluids and media used for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

Danger of burns from contact with surfaces!

- ▶ If necessary, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

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

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.

2.4.1 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.

2.4.2 Repair

To ensure continued operational safety:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe national regulations pertaining to the repair of an electrical device.
- ▶ Only use original spare parts and accessories from Endress+Hauser.

2.4.3 Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):

- ▶ Check the nameplate to verify whether the ordered device can be used as intended in the hazardous area.

2.5 Product safety

This state-of-the-art measuring device is designed in accordance with good engineering practice to meet operational safety standards, has been tested, and left the factory in perfect functioning order.

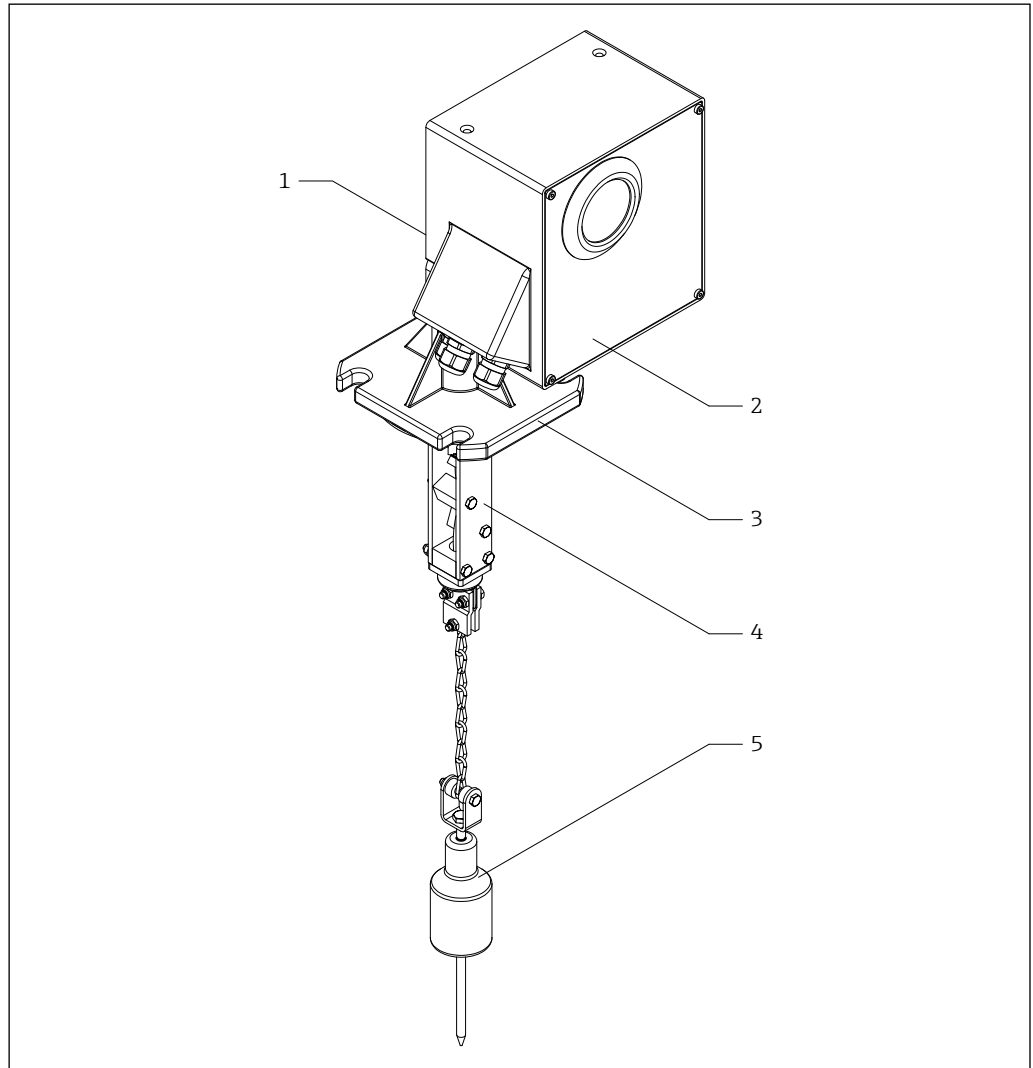
It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Product description

Electromechanical level meter for level measurement in bunkers or silos with dusty, fine-grain or coarse-grain bulk solids or in tanks containing liquids

3.1 Product design

3.1.1 Complete device

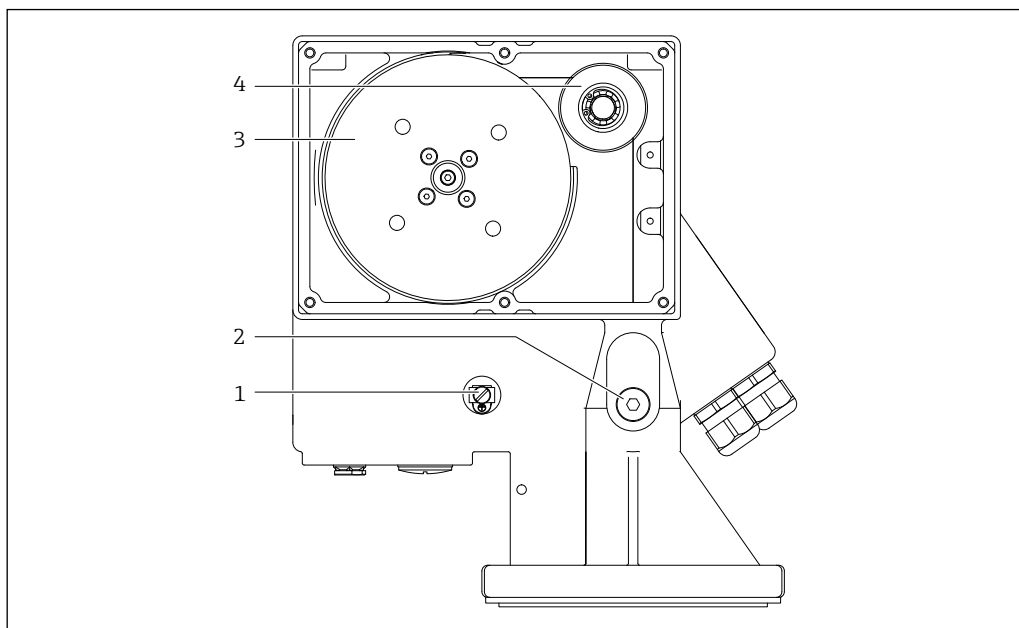


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1 Structure of the FMM20

- 1 Process side (spool compartment)
- 2 Electronics side (electronics compartment)
- 3 Process connection (DN100 PN16, hole sizes as per EN 1092-1)
- 4 Wiper
- 5 Sensing weight

3.1.2 Process side

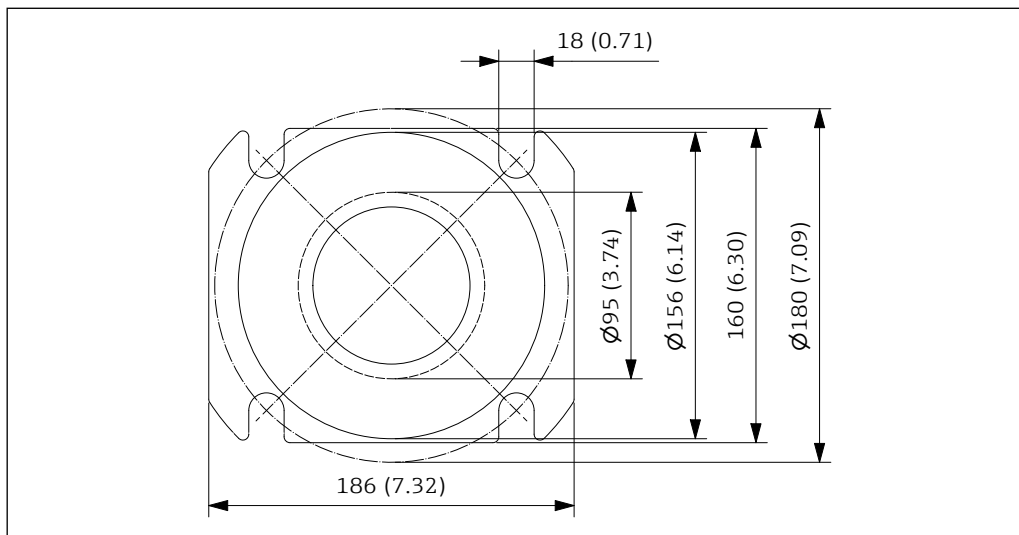


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2 Process side of the FMM20

- 1 Connecting potential matching
- 2 Purge air connection
- 3 Tape spool with measuring tape
- 4 Counting wheel

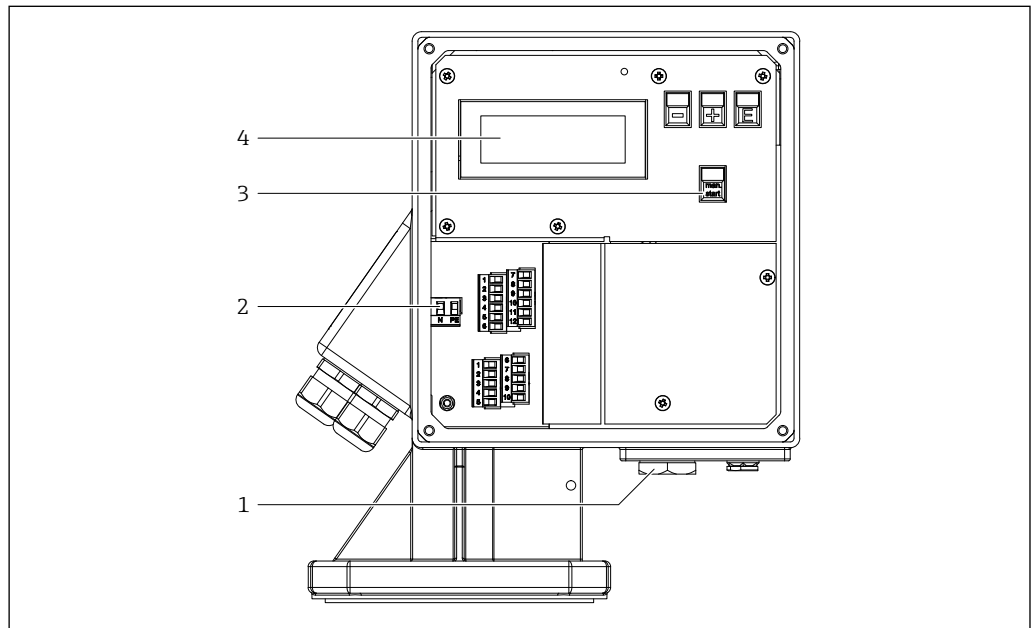
3.1.3 Process connection



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3 Process connection. Unit of measurement mm (in)

3.1.4 Electronics side

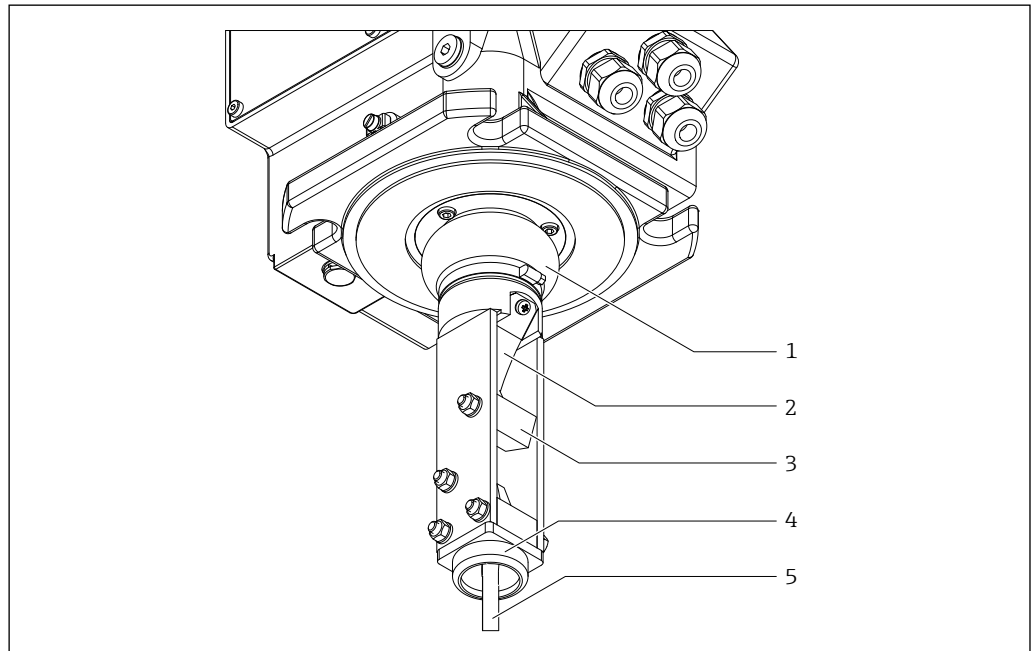


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4 Electronics side of the FMM20

- 1 Optional external start button
- 2 Terminals
- 3 Operating buttons
- 4 Display

3.1.5 Wiper



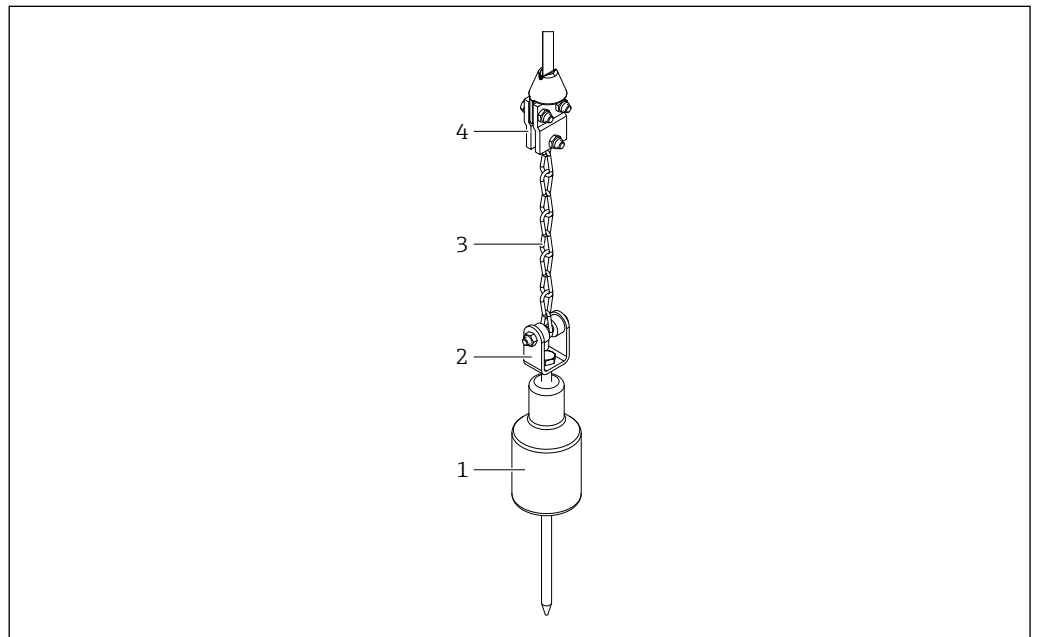
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5 Wiper of the FMM20

- 1 Bellows
- 2 Tape-wipe scraper
- 3 Scraper block
- 4 End guide
- 5 Measuring tape

i Observe minimum process connection diameter of 95 mm (3.74 in) for installation of wiper mechanism and sensing weights **B** to **E**, **N** and **P** (see order code).

3.1.6 Sensing weight

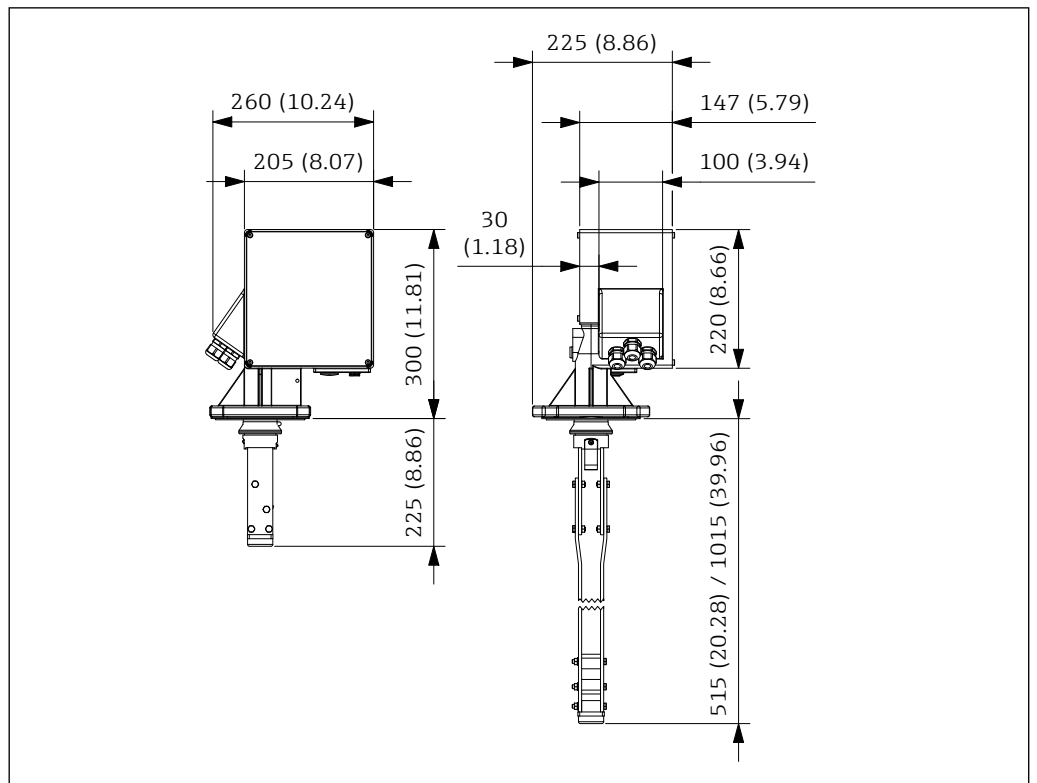


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6 Sensing weight of the FMM20 (here: steel/stainless steel)

- 1 Sensing weight
- 2 Rotating bush
- 3 Chain
- 4 Tape border

3.1.7 Housing dimensions



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7 Housing dimensions. Unit of measurement mm (in)

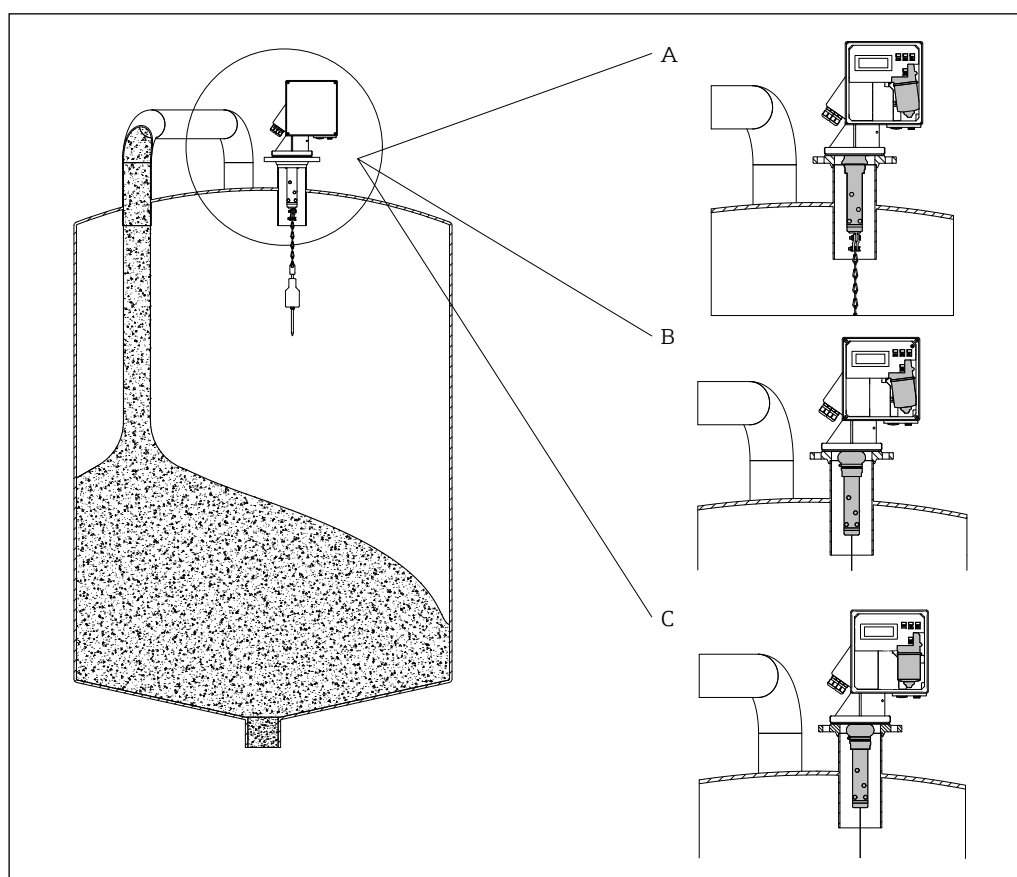
The wiper length (L) depends on the selected maximum nozzle height:

- 225 mm (8.86 in), Ordering code "**maximum connection height; wiper**", option **A** or **B**
- 515 mm (20.28 in), Ordering code "**maximum connection height; wiper**", option **C** or **D**
- 1015 mm (39.96 in), Ordering code "**maximum connection height; wiper**", option **E** or **F**

3.2 Measuring principle

The FMM works according to a simple measuring principle:

1. When a measurement starts (manually or automatically), a sensing weight is lowered by a motor and spring action causes the wiper to be moved slightly out of its end position. As the weight is lowered, the measuring tape passes over a counting wheel which sends a pulse to the electronics every 2.5 cm.
2. When it hits the medium, the freely oscillating motor tilts from its working position, in which it is held by the weight of the sensing weight, to its rest position. This is detected by the electronics and the motor is switched off.
3. The sensing weight is pulled up again and counter pulses are detected once more.
4. As soon as the sensing weight reaches the measuring device, it causes the wiper to move to its top position which is detected by the electronics.
5. The motor is switched off, the measuring cycle is ended and the measured value, which depends on the configuration, is put out:
 - Display value on the LC display
 - Current value at the 4-20 mA current output
 - Relay switching (e.g. for the "top position" or "measuring" function)



000000294

8 Measuring principle of the FMM20


- A Sensing weight in the top position
 B Sensing weight when lowered (run-down) or raised (run-up)
 C Sensing weight on reaching the surface of the medium

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during goods acceptance:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions, e. g. XA, provided?
- Is the device properly secured?

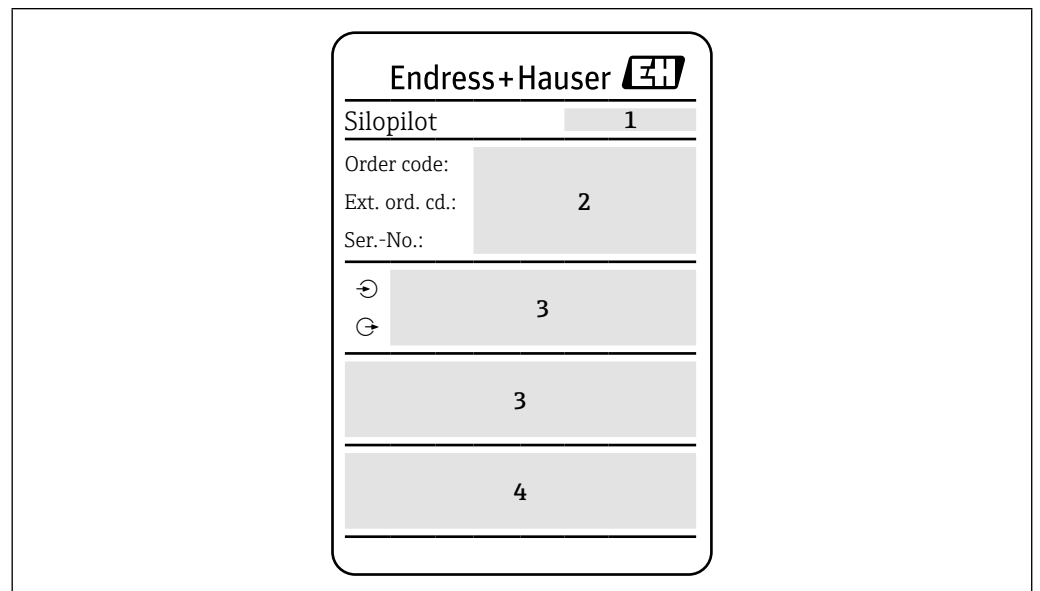
 If one of these conditions is not met, please contact the manufacturer's sales office.


4.2 Product identification

The measuring device can be identified in the following ways:

- Nameplate data
- Extended order code with breakdown of the device features on the delivery note
- Enter serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All of the information on the measuring device is displayed along with an overview of the scope of technical documentation provided
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) on the nameplate

4.2.1 Nameplate



 9 Nameplate data

- 1 Manufacturer address
- 2 Order number, external order code, serial number
- 3 Technical data
- 4 Approval-specific information

4.2.2 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Storage temperature

→  72

4.3.2 Transporting the device

Transport the device to the measuring point in the original packaging.



Do not remove the transportation lock until after mounting.

5 Mounting

5.1 Mounting conditions

5.1.1 Installation position

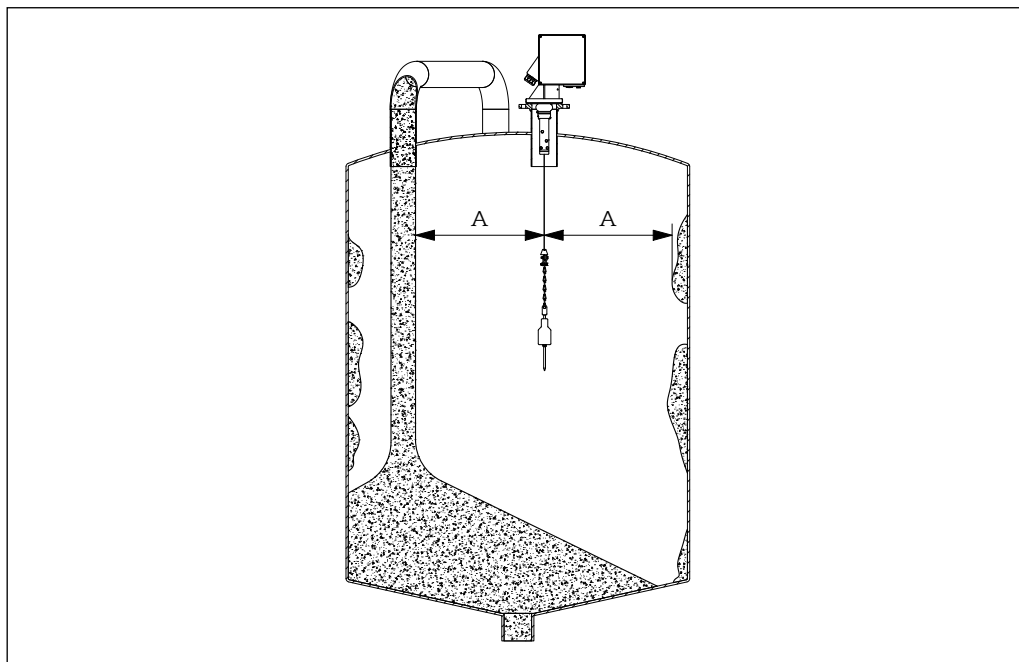
Select the installation location on the bunker or silo ceiling such that product falling inside during filling or cornices (product accumulating on container wall) collapsing inward are prevented from covering the sensing weight or damaging the measuring tape.

Take due account of the shape and location of the product inflow cone and the outflow funnel within the container. Do not run the measuring path too close to fixtures and struts so that the measuring tape does not brush against them when the sensing weight swings around.

Select the length of the wiper so that the sensing weight can move freely during downward or upward running and does not, for example, come into contact with the edges of a connection pipe. The sensing weight should be located in the middle between the container wall and filling curtain when it is run up and down.



Incorrect measurements cannot be ruled out if the sensing weight cannot run free and unobstructed during the measurement.



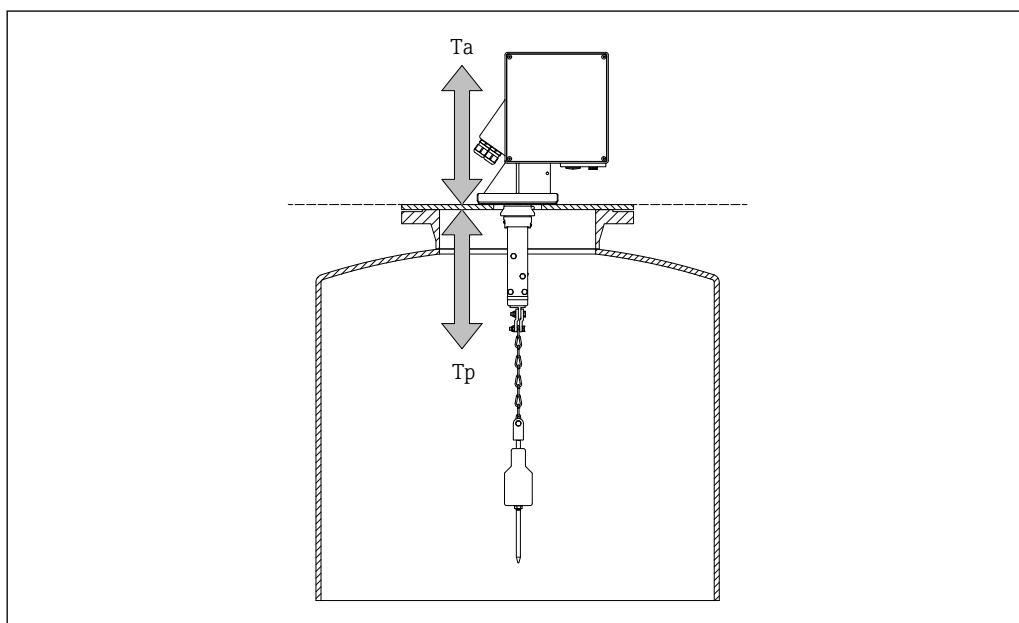
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10 Installation position

A Distance

Normally, the measuring device is mounted on a counter flange DN100 PN16 (bore dimensions as per EN 1092-1) or a flange of the same connection dimensions. The counter flange must be mounted in such a way that it is perfectly horizontal so that the device can also be mounted horizontally onto it (maximum angle of inclination 2°).

5.1.2 Ambient and process requirements



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11 Ambient and process requirements

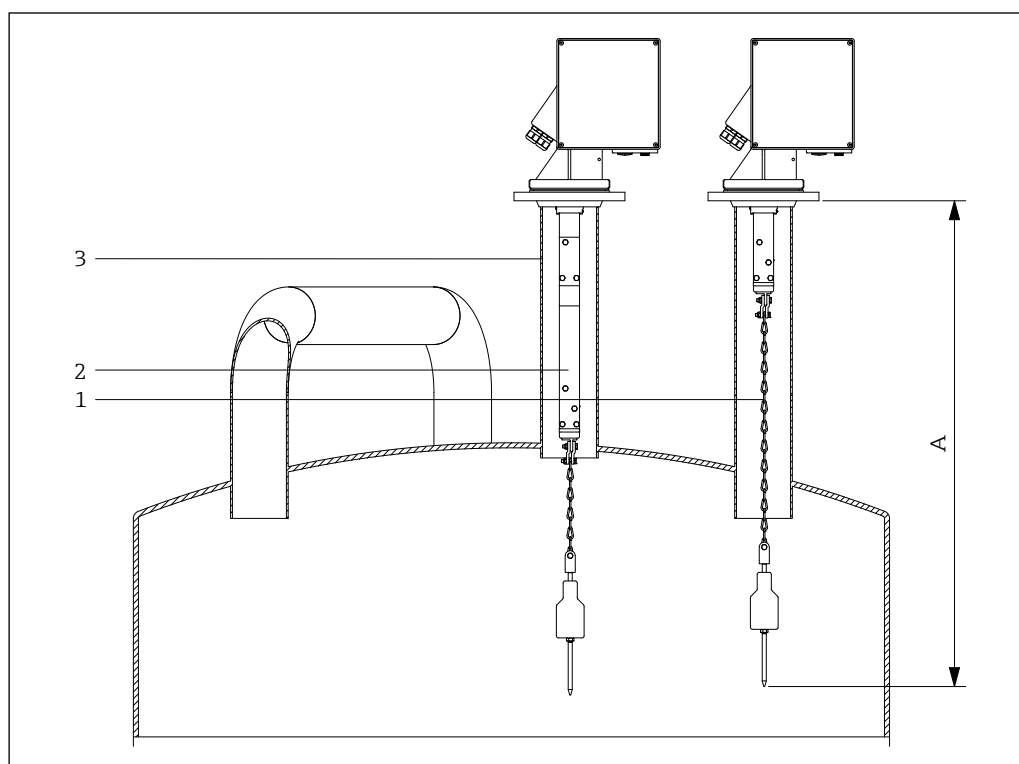
Ta Ambient temperature → 72

Tp Process temperature → 72

Observe the maximum process temperature of +70 °C (+158 °F) at the measuring device (from the lower edge of the process adapter) during installation.

- ▶ In case of higher process temperatures in the area of the installation site, create a suitable structural measure for compliance with this temperature condition.
- ▶ Use an extension of the process connection nozzle to keep the meter away from high process temperatures. The length of the connection nozzle is based on the specific process and ambient conditions.

- i
 - When using process nozzles with longer lengths than 230 mm (length of the standard wiper), longer wipers can be ordered as a device option (see ordering options).
 - Alternatively, the chain between the tape border and the sensing weight can be extended accordingly; corresponding material is available as an accessory.
 - A suitable weather protection cover for the measuring device is available as an accessory.
 - Accessories → 64




12 Mounting on process nozzle

- A Block distance
- 1 Extended chain
- 2 Wiper extension
- 3 Existing process nozzle

5.2 Mounting the device

5.2.1 Required tool

- To open the device: 3 mm
- For the process connection: Appropriate installation tool
- For the sensing weight: 10 mm

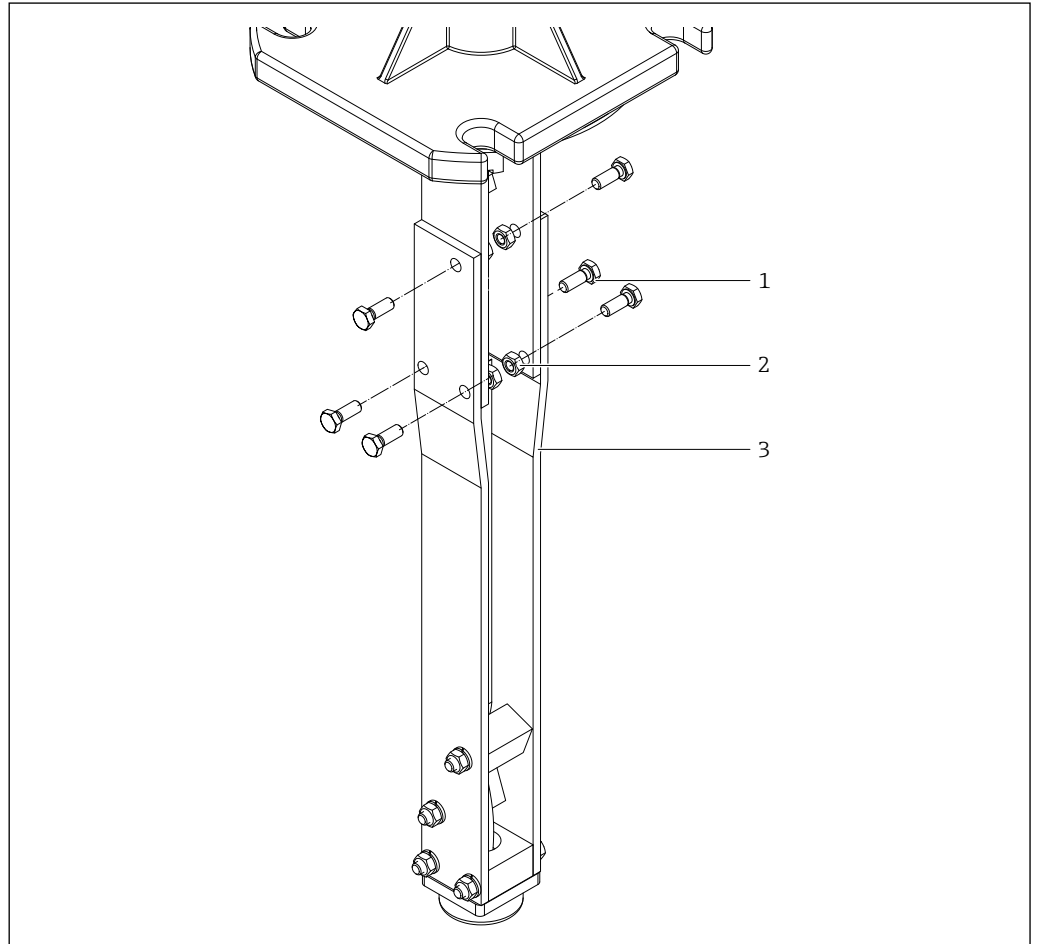
-  To mount the device on a standard counter flange DN100 PN16 (bore dimensions as per EN 1092-1), two ring wrenches or open-end wrenches measuring 24 mm AF are needed to mount the four M16 screws.

5.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.

For devices with an extended wiper (500/1000 mm):

2. Mount the wiper.

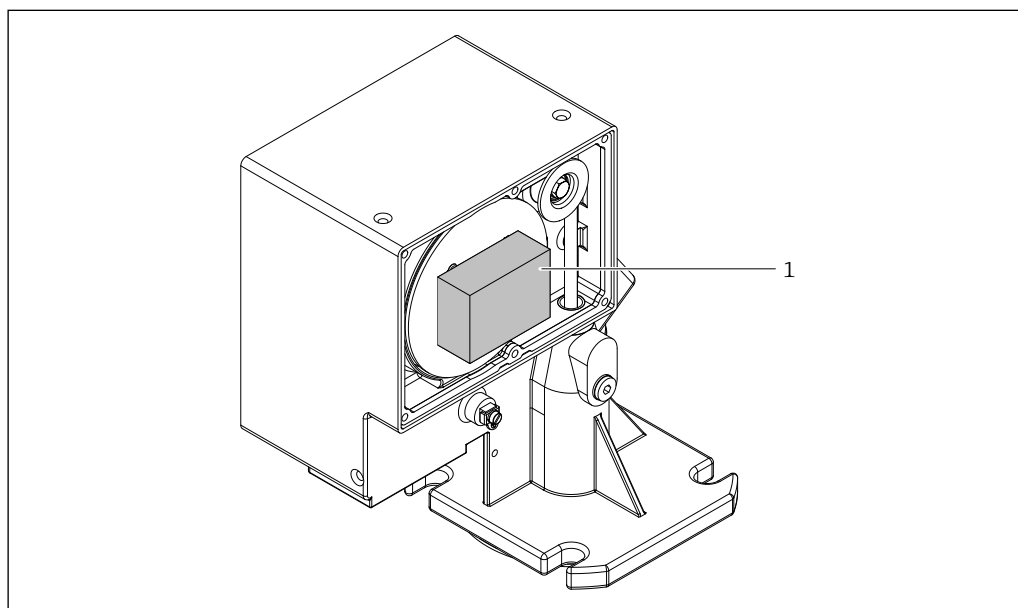


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13 Mounting the wiper extension

- 1 Hexagonal-head bolt M6
- 2 Hexagonal nut
- 3 Wiper extension


3. Remove the transportation lock on the spool side



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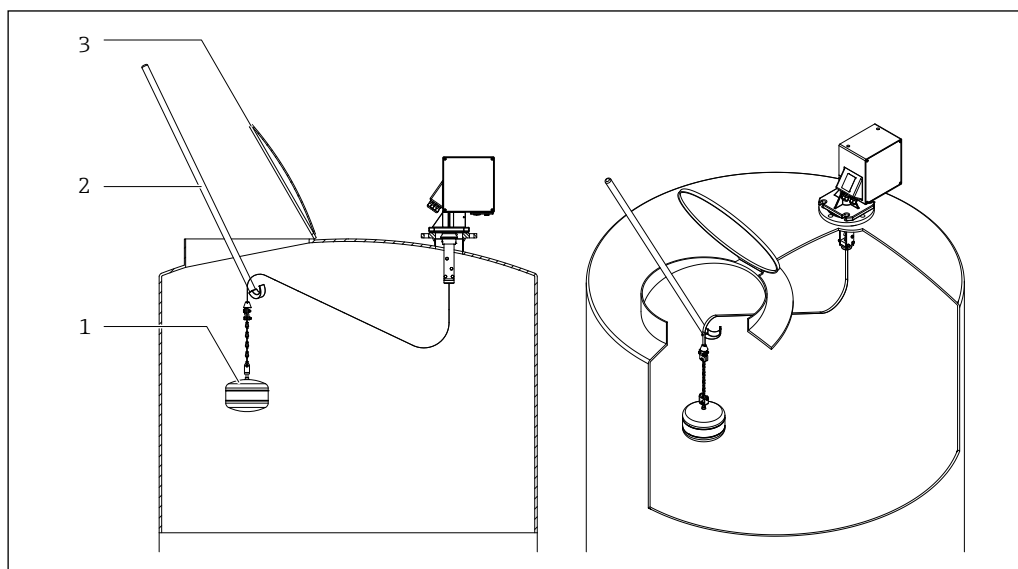
 14 Removing the transportation lock

1 Transportation lock


 If the transportation lock is not removed, this can cause unforeseeable responses on the part of the device.

For devices with a large sensing weight (such as a float):

4. Use or create structural support measures and lower the tape border an appropriate distance before mounting.



000000325

 15 Mounting large sensing weights

- 1 Sensing weight (here: float)
- 2 Rod with hook
- 3 Entry hatch or similar


Mounting the device

1. Fit the measuring device on the process connection and align it in such a way that
 - the housing is horizontal (maximum angle of inclination 2°),
 - the cable entries (and the external start button where applicable) are accessible, and

- the display is directed towards the user.

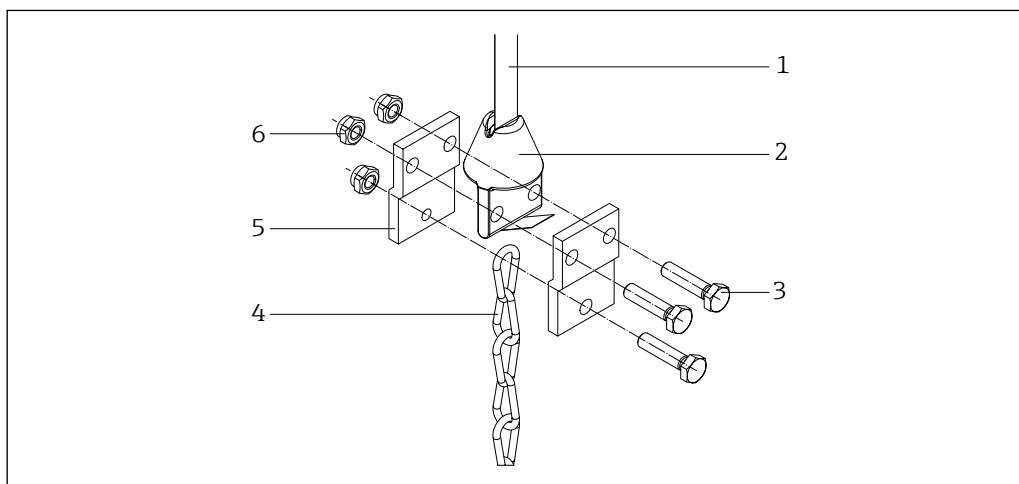
i Do not crease the measuring tape when inserting the sensing weight, this will result in a reduced service life.

2. Fix the measuring device with four suitable screws.


i When installing in bunkers/silos with heavy dust loadings, a slight positive pressure can be generated at the device by connecting a compressed air line to its device flange (airflow quantity as required). There is a G1/4 female connection provided for this purpose. →  2

3. Mounting the sensing weight.

- i**
 - The sensing weight must be outside the connection when the measuring tape is wound up.
 - The maximum height of the process connection nozzle is dictated by the length of the wiper. This height is 230 mm if a standard wiper is used.
 - The wiper is also available in lengths of 500 mm and 1000 mm (see ordering options, other lengths as special version on request).



000000225

 16 Mounting the sensing weight

- 1 Measuring tape
- 2 Tape border
- 3 Hexagonal-head bolt M6
- 4 Chain
- 5 Clamping bracket
- 6 Hexagonal nut

5.3 Post-installation check

- Is the device undamaged (visual inspection)?
 - Does the device conform to the measuring point specifications?
- For example:
- Process temperature
 - Process pressure
 - Ambient temperature
- Are the measuring point number and labeling correct (visual inspection)?
 - Is the device adequately protected against precipitation and direct sunlight?
 - Is the device properly secured?

6 Electrical connection



For a device for the hazardous area:
Observe the instructions in the Ex documentation (XA).

6.1 Connection requirements

6.1.1 Required tool


To open the device:

 3 mm


For the cable glands:

 SW24

For the terminals:



 0.6 x 3.5 mm

For potential equalization:

 1.0 x 6.5 mm

6.1.2 Connecting cable requirements

The connecting cables provided by the customer must meet the following requirements:

- Permissible temperature range →  72
- Protection →  72
- Normal installation cable sufficient
- Clamping range: 7 to 12 mm (0.28 to 0.47 in)

NOTICE

- Observe the maximum thermal load of the cables and lines introduced.
- The gland is only admissible for the connection of fixed-installation lines and cables. Appropriate strain relief must be ensured by the operator.
- Mount the cable gland so that it is protected against mechanical damage ("low" degree of mechanical risk – impact energy: 4 Joule).

6.2 Preparing the measuring device

Remove the dummy plug if present.

Housing not sealed tight!


- Operational reliability of the measuring device could be compromised. Use suitable cable glands that match the degree of protection.
- If the measuring device is supplied with cable glands: Observe the cable specifications

6.3 Connecting the device

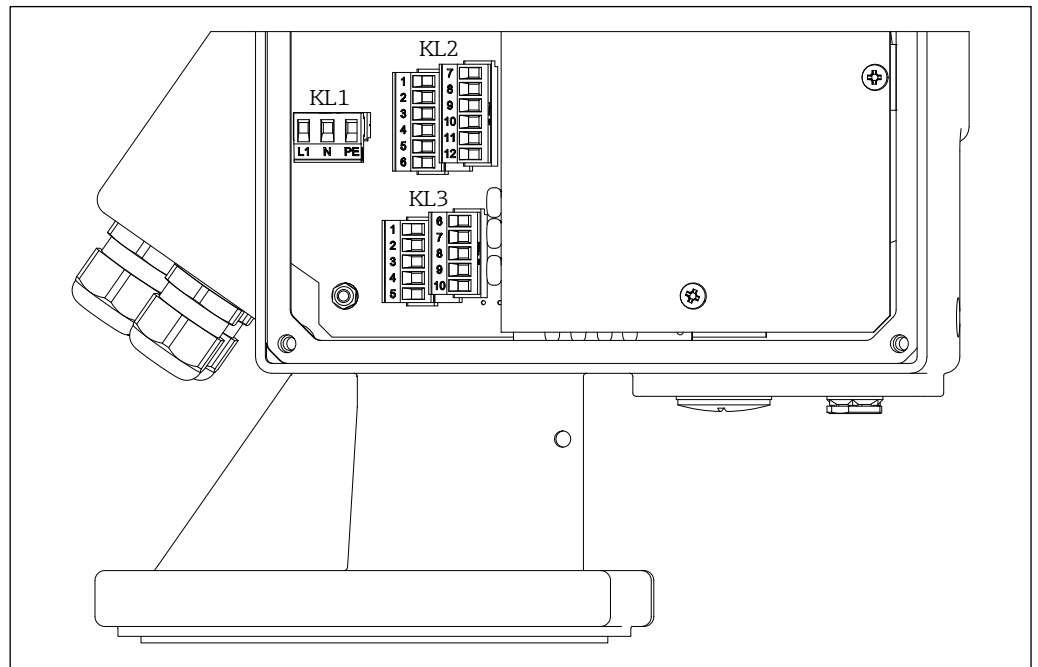
6.3.1 Connect potential equalization

The potential equalization for the device must be integrated into the existing potential equalization on site.

Requirements:

- The potential equalization must be connected to the external ground terminal on the device. →  2
- For optimum electromagnetic compatibility, keep the potential equalization line as short as possible.
- The recommended cable cross-section is 2.5 mm².
- The potential equalization of the FMM20 must be included in the local potential equalization.

6.3.2 Connecting the device



17 Terminal assignment

000000302

Connect the device as follows:

1. Unscrew the housing cover on the electronics side (large cover).
2. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.
3. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
4. Connect the cable in accordance with the terminal assignment.
5. Firmly tighten the cable glands. → 72
6. Reverse the procedure to reassemble the device.

i Details clamping range and tightening torque
→ 72

6.3.3 Supply voltage

- Terminal assignment: 1.1 (L1) / 1.2 (N) / 1.3 (PE)
- Voltage range → 72
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.
- Overcurrent protection device: maximum 16 A

6.3.4 Signal input

Contact load → 70

Order code	Terminal assignment		
	Without	Input 1 (active)	Input 2 (active)
3.1		3.6	(+)
3.3		3.8	(-)
Input 1 (passive)		Input 2 (passive)	
3.1		3.6	
3.2		3.7	

- i** ■ The signal inputs (active/passive) can only be used alternatively. An input can only be assigned as either active or passive.
 - In the case of the device version with an external start button, this button is connected to the passive signal input 1. Only signal input 2 (active or passive) is then available.
 - A start pulse must be present for at least 200 ms for it to be evaluated.

6.3.5 Current output

- Terminal assignment: 3.9 (+) / 3.10 (-)
- Current output: 0 - 20 mA or 4 - 20 mA
- active
- Load → 71

6.3.6 Relay output

Contact load → 71

Order code	Terminal assignment		
	Relay 1	Relay 2	
Output option A, C	2.1	2.4	
	2.2	2.5	
	2.3	2.6	
Output option C	Relay 3	Relay 4	
	2.7	2.10	
	2.8	2.11	
	2.9	2.12	

6.3.7 Optocoupler output

Contact load → 71

Order code	Terminal assignment	
Output option C	3.4	
	3.5	

- i** ■ Optional output on devices with 4 relays.
 - When using the "counter pulse" output function, the counter pulses are output in parallel with relay 4.

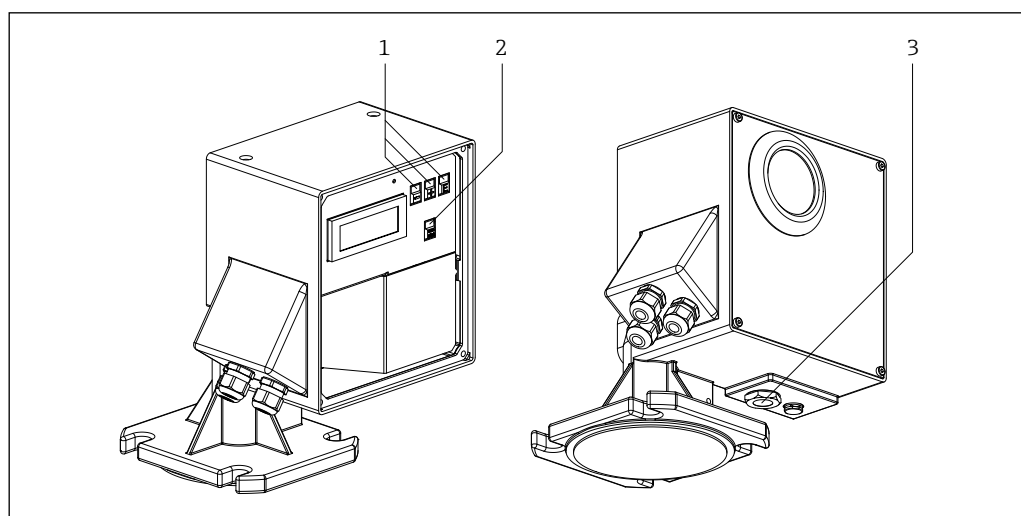
6.4 Ensuring the degree of protection

1. Check that the housing seals are clean and fitted correctly. Dry, clean or replace the seals if necessary.
2. Tighten all housing screws.
3. Firmly tighten the cable glands. → 72
4. Unused cable entries must be sealed with suitable blanking plugs.

6.5 Post-connection check

- Is the device or cable undamaged (visual inspection)?
- Do the cables used comply with the requirements?
- Do the mounted cables have adequate strain relief?
- Are the cable glands mounted and firmly tightened?
- Does the supply voltage match the specifications on the nameplate?
- No reverse polarity, is terminal assignment correct?
- If supply voltage is supplied: does information appear on the display?
- Are all the housing covers installed and tightened?

7 Operation options



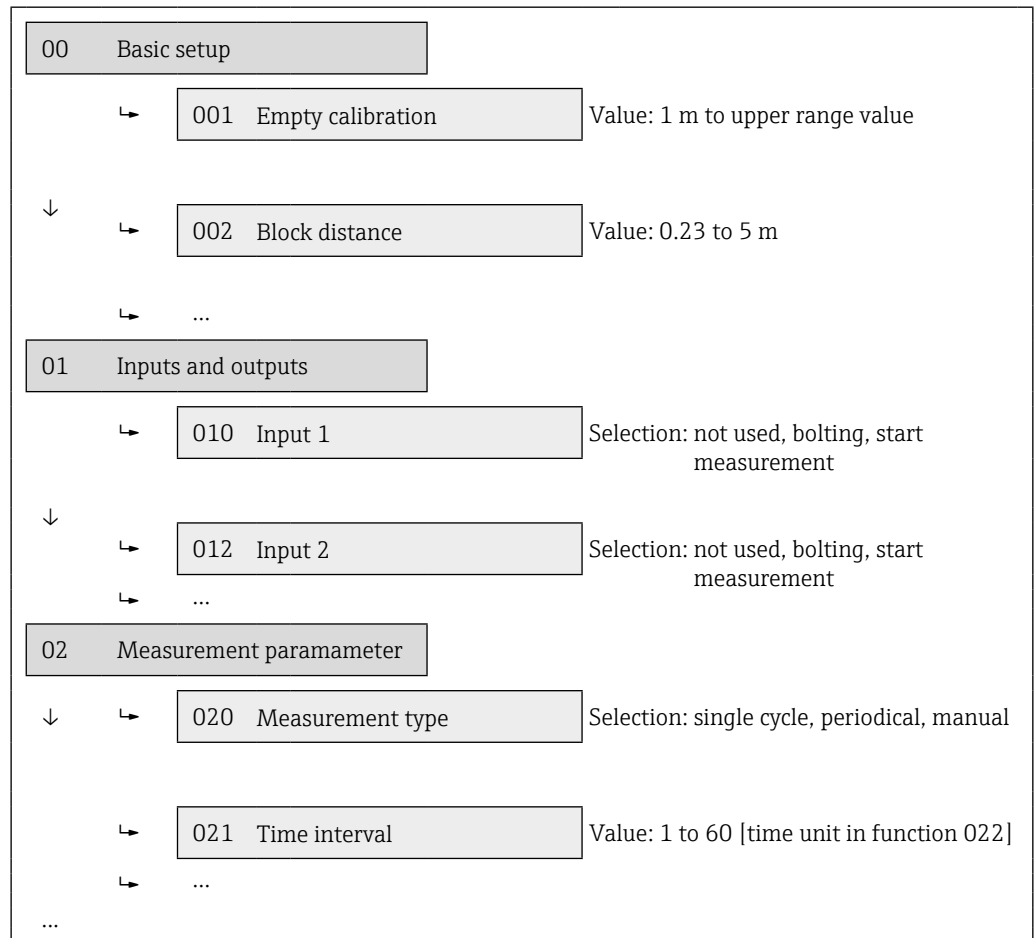
18 Operation options

- 1 Operating keys for configuration
- 2 Button to start a measurement manually
- 3 External button to start a measurement manually

000000312

7.1 Structure and function of the operating menu

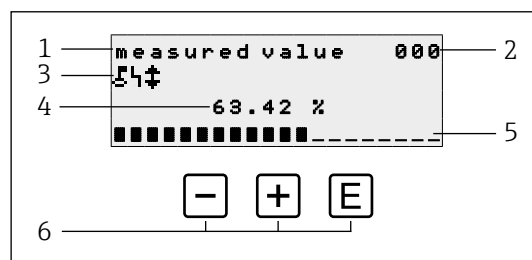
Overview operating menu and parameters → 73



19 Schematic structure of the operating menu

7.2 Access to the operating menu via the local display

7.2.1 Operational display



20 Operational display




- 1 Name of function
- 2 Function number
- 3 Display symbols
- 4 Measured value and unit
- 5 Bargraph of measured value
- 6 Operating elements

Operating options

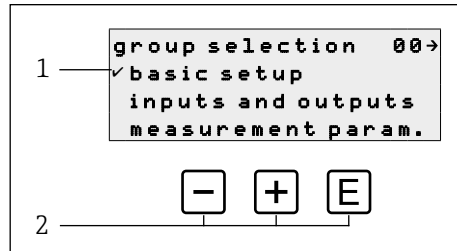
Key	Meaning
E	Switch to group selection 00, 01, ...
+ / -	Not used

- i** The operational display essentially corresponds to the measured value display (function 000).
- The operational display appears automatically after the start-up procedure. Only then can a measurement operation commence.
- During initial commissioning, function 060 "language" and function 083 "distance unit" appear once only. Afterwards, the measured value display appears. → 28
- The default values are always shown in bold in the following chapters, unless they are explicitly mentioned.

Display symbols

Symbol	Meaning
	This lock symbol is displayed when the measuring device is locked and no entries can be made.
	This alarm symbol is shown when the device is in an alarm condition (error condition). A flashing symbol indicates that a fault has occurred.
	This symbol flashes when the device is in the "manual" measurement mode. When the button is pressed, the symbol disappears and the direction selected (run up ↑ run down ↓) is shown.

7.2.2 Navigation view



21 Navigation view

- 1 Function groups
- 2 Operating elements

The active selection of the function group (here "basic setup") is indicated by a check mark in front of the menu text.

Operating options

Key	Meaning
-	Moves the active function group down
+	Moves the active function group up
E	Switches to the active function group

7.2.3 Edit view

Entering a value		Selecting a value	
1	empty calibr. 001	1	input 1 010
3	35 m	3	not used
4	distance flange to min. filling	3	bolting
			start measurement
5	[-] [+] [E]	5	[-] [+] [E]

22 Edit view

- 1 Name of function
- 2 Function number
- 3 Numerical value or selection
- 4 Help text
- 5 Operating elements

Operating options

Key	Meaning
[-]	Entering a value <ul style="list-style-type: none"> ▪ Activates the edit mode ▪ Changes the displayed character (9, 8, 7, ..., Z, Y, X, ...) Selecting a value Moves the active option down
[+]	Entering a value <ul style="list-style-type: none"> ▪ Activates the edit mode ▪ Changes the displayed character (0, 1, 2, ..., A, B, C, ...) Selecting a value Moves the active option up
[E]	<ul style="list-style-type: none"> ▪ Navigation to the right within a function group ▪ In edit mode: <ul style="list-style-type: none"> - Change to the next character - At the end, accept the entry by switching to the next function

Editing options

The following characters are available for selection when editing:

- Numerical values: 0 to 9 and "." (period) as the separator in the unit selected
- Tag number (function 080): additionally letters A to Z and "-" (minus)
- Navigation characters:
 - "<" goes one or more spaces to the left
 - ">" goes one or more spaces to the right

7.2.4 Operating elements

Key	Meaning
[-]	Entering a value Activates the edit mode and reduces the value Selecting a function group or a value Moves the active option down
[+]	Entering a value Activates the edit mode and increases the value Selecting a function group or a value Moves the active option up
[E]	<ul style="list-style-type: none"> ▪ Navigation to the right within a function group ▪ In edit mode: Accept the value entered
[-] + [+]	Navigation to the left within a function group
[+] + [E]	Increases the contrast of the liquid crystal display
[-] + [E]	Decreases the contrast of the liquid crystal display

Key	Meaning
+ +	<ul style="list-style-type: none"> Enables or disables hardware locking Operating keys have no function on their own "man. start" and external start button are not locked
or external start button	The measurement procedure starts if the device is in the display mode (function 000)

7.2.5 Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The function group (00, 01, 02, etc.) and the function number (000, 001, 002, etc.) appear on the top left of the display.

Example: Configuring safety distance

1. → Switch to group selection

```
group selection 00→
✓basic setup
  inputs and outputs
  measurement param.
```

2. / → Change the function group to be selected until the function group can be selected

```
group selection 04→
✓safety settings
  linearization
  display
```

3. → Select the safety settings function group; the first function in this group is displayed

```
output on alarm 040
✓MIN (0/3.6mA)
  MAX (22mA)
  hold
```

4. → Switch to the next function(s) of the function group until the desired function is displayed

```
safety distance 042
  0.00 m
minimum distance
to empty calibration
```

5. / → Edit mode activated, the first character starts flashing, enter the desired character string

```
safety distance 042
  ■.00 m
minimum distance
to empty calibration
```

6. → Accept the entry and change to the next function


7.2.6 Disabling write protection via the access code

If the lock symbol appears on the local display and in front of the input values in the functions, configuration is protected by an access code. No more values can be entered or changed in the entire operating menu with the exception of the **unlock parameter 074** function.

If write access is locked via local operation, it can be unlocked by entering the access code via the relevant access option.

The lock via access code is enabled and disabled as follows:







1. Select the **unlock parameter 074** function
2. Enter the access code
 - 100 → Write protection is disabled
 - <>100 → Write protection is enabled


 If the keypad is locked, the lock symbol also appears on the display. However in this case the unlock parameter 074 = 100.

7.2.7 Enabling and disabling the keypad lock

If the lock symbol appears in the local display and in front of the input values of the functions, the parameterization is protected by a key lock, no more values can be entered or changed in the entire operating menu.

The keypad lock is enabled and disabled as follows:



1.  +  + : Press all operating keys while the device is in the measured value 000 mode. → The keypad lock is enabled
2.  +  + : Press all operating keys again while the device is in the measured value 000 mode. → The keypad lock is disabled

 If write protection is enabled via the access code, the lock symbol appears on the display. However in this case the unlock parameter 074 is unequal 100.

8 Commissioning

8.1 Function check

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist →  19
- "Post-connection check" checklist →  23

8.2 Powering up the measuring device

First time the device is switched on, the following appears on the display:

Initialization phase

```
Initialization
Jan 3 2020
```

↓

The device type, version (hardware and software) and the order code are displayed

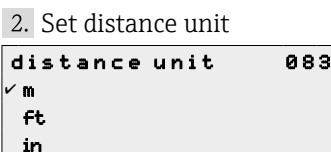
```
FMM20
V01.01.16
A14A1AD1A1
```

↓

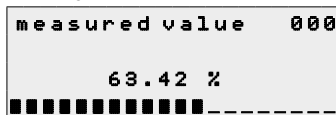
1. Set operating language



```
language      060
✓ Deutsch
  English
  Francais
```

↓



↓
Display switches to the measured value screen




-  A measurement must first be performed before it is possible to obtain a measured value that is valid for the current measuring point.
- If nothing appears on the local display or a diagnostic message is displayed: "Diagnostics and troubleshooting" chapter →  46

8.3 Set operating language

Selection of the language for the text on the display in function **language 060**:










- Selection:
- Deutsch
 - **English**
 - Francais
 - ニホソゴ (Katakana, Japanese)

 Other operating languages can be ordered optionally (product configurator)

8.4 Configuring the device

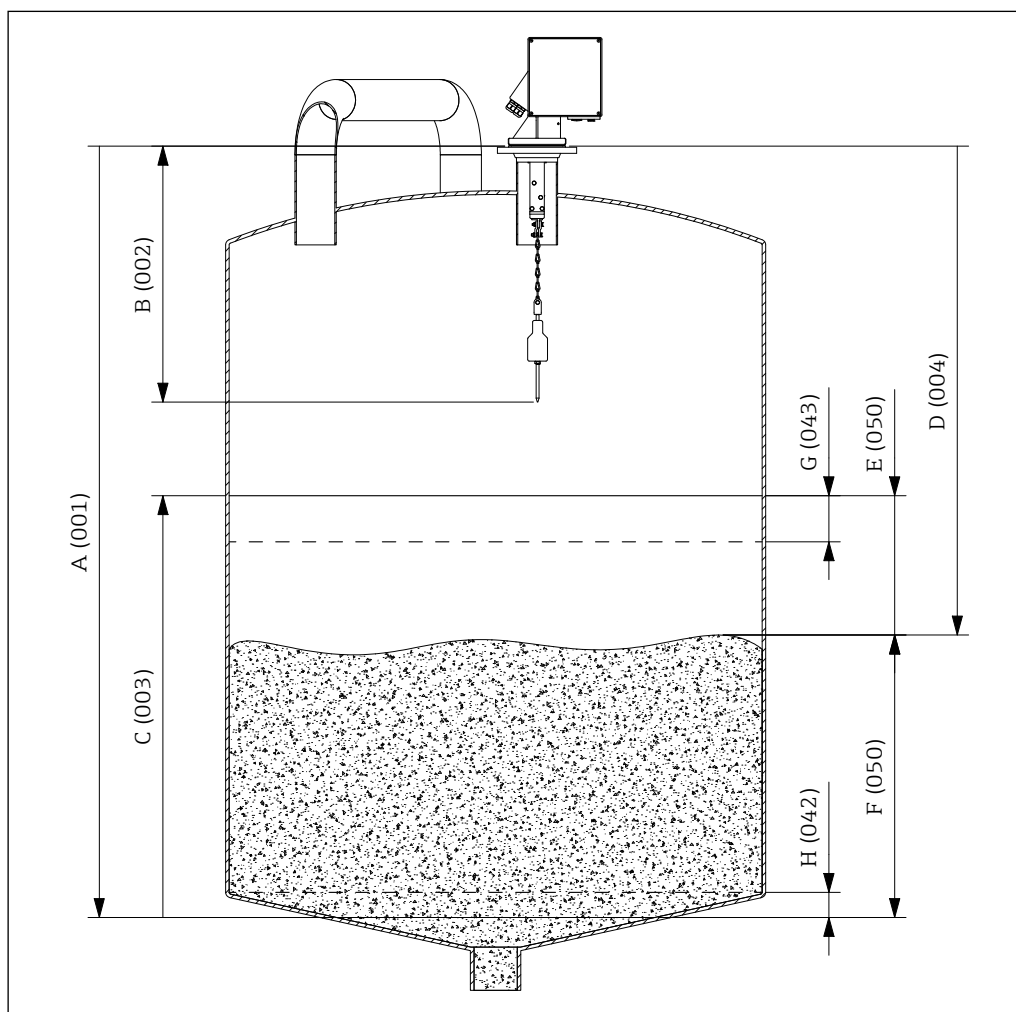
The device is configured via the individual function groups and the associated functions in the groups.

Function group	Device functions
Basic setup (00) →  30	Adapting to the application (for example full and empty calibration)
Inputs and outputs (01) →  35	Device functions for changing the behaviour of the inputs and of the relay outputs, for example by specifying the relay output functions
Measurement parameter (02) →  31	Adapting to the measurement requirements (for example specifying the time interval for periodic measurement)
Current output (03) →  33	Adapting the current output (for example selecting the magnify function)
Safety settings (04) →  40	Adapting the measuring device to the safety requirements (for example selecting the behaviour of the current output in an alarm condition)
Linearization (05) →  38	Adapting the measuring device to the application with regard to measured value generation (for example selecting to display a volume in a technical unit)
Display (06) →  34	Adapting the display (for example selecting the menu language)

Function group	Device functions
Diagnostics (07) → 46	Error analysis and troubleshooting (for example resetting to default values)
System parameters (08) → 38	Advanced adaptation of the measuring device to the measuring point (for example entering a tag name)

8.4.1 Basic setup

In most cases, the basic setup is sufficient for successful commissioning, more complex measurement tasks may require further settings.



000000298

23 Parameters of the basic setup

- A Empty calibration
- B Block distance
- C Full calibration
- D Distance
- E Ullage
- F Level/volume
- G Security distance
- H Safety distance

8.4.1.1 Empty calibration

Input distance between the mounting flange (reference point for measurement) and the minimum fill level (= zero point) in **empty calibr. 001** function:

```
empty calibr. 001
      35 m
distance flange to
min. filling
```

Range of values: 1 m ... length of measuring tape (or converted value in feet/inches)

8.4.1.2 Block distance

Enter distance between the flange of the device and the end of the sensing weight (in upper limit position) in **block distance 002** function:

```
block distance 002
      0.80 m
distance flange to
bottom weight
```

Range of values: 0.23 to 5 m (or converted value in feet/inches)

Default: 0.8 m



Table detailing all the default values depending on the wiper length and the sensing weight → 70

8.4.1.3 Full calibration

Input distance between the minimum fill level (=zero point) and the maximum fill level (= span) in **full calibration 003** function:

```
full calibration 003
      34 m
measuring range
max.=empty-bd
```

Range of values: 1 m ... empty calibr. - block distance (or converted value in feet/inches)

Default: Length of measuring tape - 0.8 m

8.4.1.4 Measurement type

Select type of measurement of the device in **measurement type 020** function:

```
measurement type 020
✓ single cycle
periodical
manual
```

Selection:

- **single cycle**
Activation of single cycle measurement (manually using buttons on the device or using a corresponding input signal in function 010 and 012)
- **periodical**
Activation of time-controlled measurements (time interval defined in functions 021 and 022)
- **manual**
The sensing weight can only be moved using the keys on the device. This type of measurement allows the user to move the sensing weight slowly, e.g. when changing the cage sensing weight.



A measurement can only be taken when the device is in the "measured value (000)" mode. This also applies to the device version with an external start button.

NOTICE

In the manual mode, the upper limit switch and the tape switch have no function! Users must themselves check in which position the sensing weight is currently located. With this type of measurement, the sensing weight can (depending on the maximum tape length) be lowered into unauthorized areas of the container (or into an outlet worm for example).

8.4.1.5 Distance/measured value

Display of the measured distance between the device and the medium and the current measured value in **dist./meas.value 004** function:

```
dist./meas.value 004
distance 0.90 m
meas.val 3.75 %
```

The display depends on the number of decimal places (function 062), the distance unit (function 083) and also linearization where applicable.

8.4.1.6 Time interval

Input time interval for the measurement type "periodical" (see function 020) depending on the unit (see function 022) in **time interval 021** function:

```
time interval 021
1 h
```

Range of values: 1 ... 60 (Function 022)



The minimum time for a measuring cycle depending on the measuring range must be observed. → 71

8.4.1.7 Time unit

Input unit of time interval (see function 021) in **time unit 022** function:

```
time unit 022
✓h
min.
```

Selection:

- h (Hour(s))
- min. (Minute(s))

8.4.1.8 Normal or short

Select operating mode for the "single cycle" and "periodical" type of measurement in **normal or short 023** function:

```
normal or short 023
✓normal
short
```

Selection:

- **normal**

At the start of a measurement, the measuring device lowers the sensing weight as far as the product and the sensing weight is then pulled back into the upper end position.

- short

At the start of a measurement, the measuring device lowers the sensing weight as far as the product and the sensing weight is then only raised by the length specified in function 028 "run-up length".



Notes on the "short" operating mode:

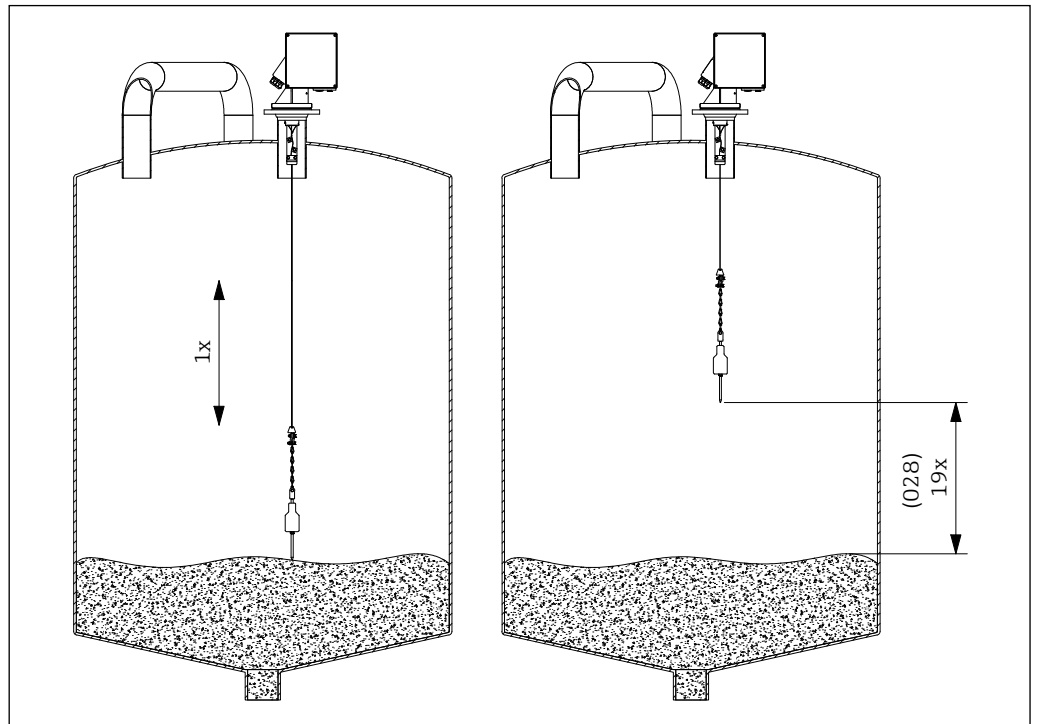
- The weight moves back into the upper end position every 20 measuring cycles.
- Use input or relay output with "upper limit position" function for locking to protect the sensing weight from spillage.
- Relay output cannot be used for counting pulses, since the device does not move to a defined point (and thus no defined distance) at the end of a measurement.
- Before dismounting the device, move the sensing weight to the upper end position ("manual" type of measurement).

8.4.1.9 Run-up length

Input of the length that the sensing weight moves up in the "short" operating mode (see function 023) in **run up length 028** function:

```
run-up length      028
      1.0 m
run-up length
for short measure
```

Range of values: 1 m ... Empty calibration - 1 m (or converted value in feet/inches)



24 Run-up length

000000326

8.4.2 Current output

8.4.2.1 Current range

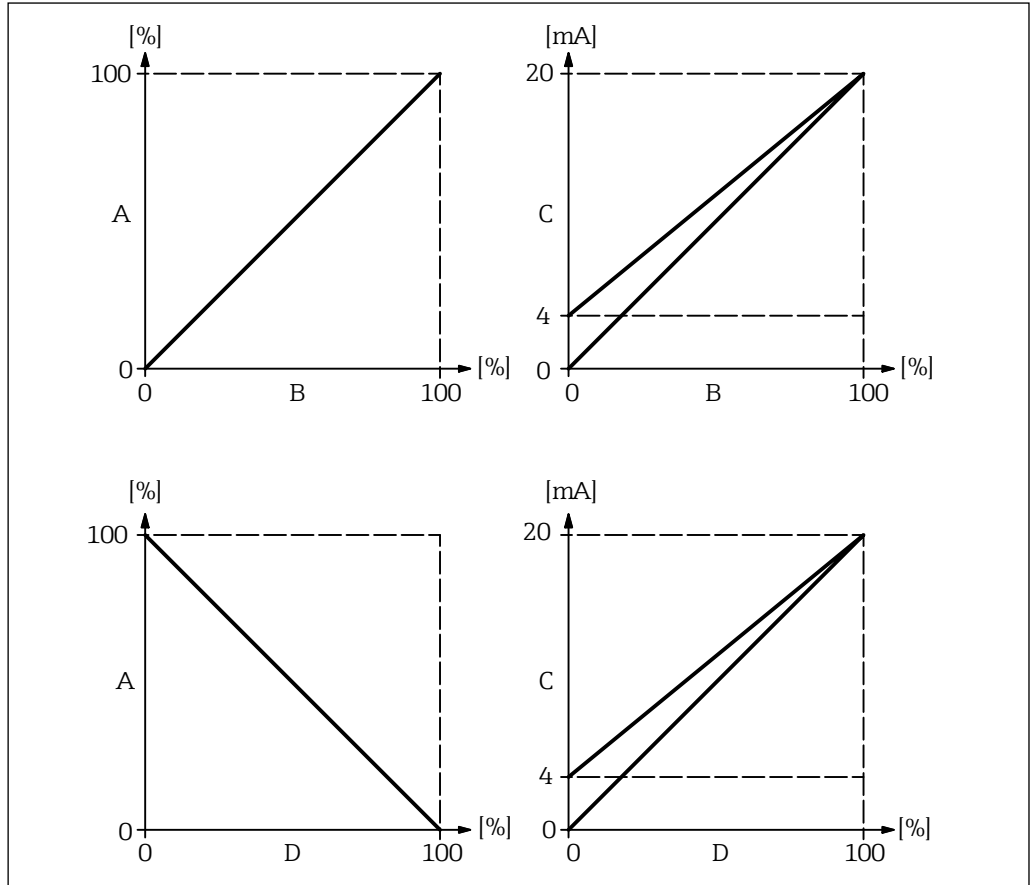
Selection current output range (see function 030) in **current range 033** function:

```
current range      033
✓ 4-20 mA
  0-20 mA
```

Selection:

- 4-20mA
- 0-20mA

- i** The behaviour of the current output can be influenced by the level/volume 050 function as follows:
- The settings "level DU" or "level CU" cause an increasing output current as the level increases.
 - The settings "ullage DU" or "ullage CU", on the other hand, cause a decreasing output current as the filling level increases.



25 Behaviour of the current output

- A Filling level
- B Level (volume)
- C Current
- D Ullage

8.4.3 Display

8.4.3.1 Back to home

Input of time until return to measured value display (000) in **back to home 061** function:

```
back to home 061
    100 s
time until jump back
home automatically
```

Range of values: 3 ... 9999 seconds
 Default: 100

8.4.3.2 No. of decimals

Selection number of decimal places (among others for the measured value display (000)) in **no. of decimals 062** function:

```
no. of decimals 062
✓ x
  x.x
  x.xx
```

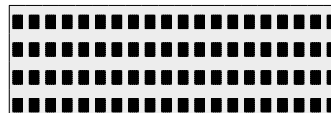
Selection:

- x
- x.x
- x.xx
- x.xxx

8.4.3.3 Format display

Activation test LC display (all points are activated for approx. 2 seconds) in **format display 063** function:

```
format display 063
✓ off
  on
```



Selection:

- off
- on

8.4.4 Output

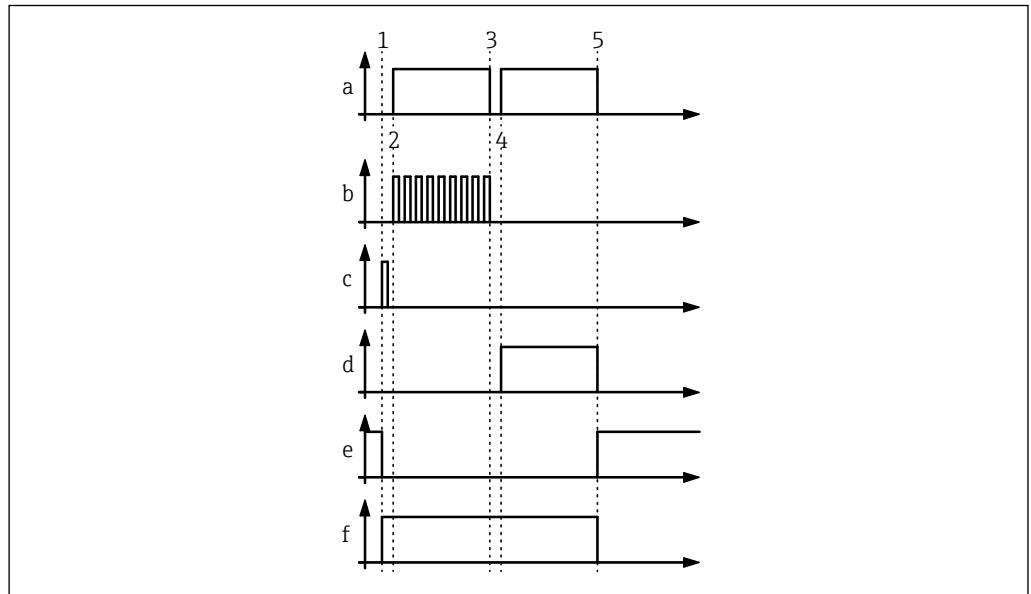
8.4.4.1 Relay output 1

Selection behavior relay 1 in **relay output 1 014** function:

```
relay output 1 014
✓ alarm
  threshold
  service interval
```

Selection:

- **alarm**
Relay switches as soon as an error is detected.
- **service interval**
Relay switches when the value set in the service interval (024) function is reached.
- **counter pulses**
Relay switches at the pulse value set in function 015 and at the counter pulse length set in function 016.
- **reset pulse**
Relay switches at the reset pulse length set in function 019 before a new measurement (for example, to reset an external counter).
- **running up**
Relay switches when the sensing weight runs up.
- **top position**
Relay switches as soon as the upper end position of the sensing weight (end of measurement) is reached.
- **measuring**
Relay switches during the entire measuring cycle.



000000305

26 Programmable relay output functions

Measurement cycle (a)

1. A measurement starts (time-controlled or event-controlled)
2. The sensing weight is lowered
3. The surface of the medium is detected (measured value generation)
4. The sensing weight is raised
5. The measurement ends

Programmable relay output functions

Relay output function	Meaning
Counter pulses (b)	Output pulses that correspond to the length of unwound tape
Reset pulse (c)	Pulse before every new measurement
Running up (d)	Displayed when the tape runs back up
Top position (e)	Indicated when the upper end position is reached (end of measurement)
Measuring (f)	Indicates an active measuring cycle, for example to lock a filling system to protect the sensing weight from being buried
Alarm	Relay switches in a fault condition
Service interval	Relay switches when the set number of measuring cycles is reached

i The rest position corresponds to the state of the relays with the power supply switched off, this corresponds to an active alarm if the "alarm" function is selected.

8.4.4.2 Relay output 2 to 4

The functionalities of the outputs correspond to those of the relay for output 1 (see function 014). Outputs 3 (01C) and 4 (01C) are only optionally available (see order code).

Default:

Relay output 2 (01A): Service interval

Relay output 3 (01B): Measuring

Relay output 4 (01C): Top position

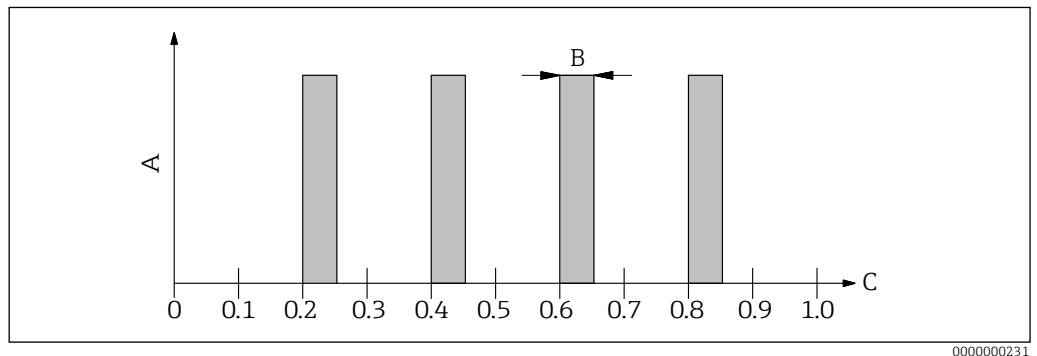
8.4.4.3 Pulse weight

Input run-down distance (set value x 2.5 cm) per pulse at the counter pulse output in **pulse weight 015** function:

```
pulse weight    015
    10
length per pulse
output = value * 2.5cm
```

Range of values: 1 to 20 (2.5 to 50 cm or converted value in feet/inches)
 Default: 1

Example pulse weight = 8:
 Every 0.2 m run-down distance, the preset counting pulse output, for example relay 1, outputs a counting pulse (input pulse length in "pulse length (016)" function).



27 Pulse weight

- A Counter pulse
- B Pulse length
- C Move distance of measuring tape

8.4.4.4 Pulse length

Input counter pulse length (value range dependent on pulse weight in function 015) in **pulse length 016** function:

```
pulse length    016
    50 ms
length of the
counter pulse
```

Range of values:

- 30 to 100 ms (pulse weight = 1)
- 30 to 250 ms (pulse weight = 2)
- 30 to 400 ms (pulse weight = 3)
- 30 to 550 ms (pulse weight = 4 to 20)

Default: 50 ms

8.4.4.5 Reset pulse

Input length reset pulse with selected relay output function 014 "reset pulse" in milliseconds in **reset pulse 019** function:

```
reset pulse    019
    300 ms
length of the
reset pulse
```

Range of values: 30 to 1000 ms
 Default: 300 ms

8.4.5 Inputs


8.4.5.1 Input 1

Selection behavior of input 1 in **input 1 010** function:

```
input 1          010
✓not used
  bolting
  start measurement
```

Selection:

- **not used**
- bolting
 - If there is a signal at input 1, the measuring device is blocked for further measurements. If necessary, the sensing weight is moved into the upper end position, and the measurement is cancelled immediately.
- start measurement
 - If there is a signal at input 1, the measuring device starts a new measurement.

 In the device version with an external start button, this button is connected to input 1. The function is then set to "start measurement" at the factory.

8.4.5.2 Input 2 (012)

For selection options see input 1 (010)

Default: not used

8.5 Advanced settings

8.5.1 Device tag

Input maximum 16-digit alphanumeric measuring point designation in **tag no. 080** function:

```
tag no.          080
  Ratingen Silo 1
```

Default: -----

8.5.2 Distance unit

Length unit selection (basis for all display and input values, with the exception of the customer unit (CU), if this has been selected) in **distance unit 083** function:

```
distance unit    083
✓m
  ft
  in
```

Selection:

- m (Meter)
- ft (Feet)
- in (Inch)

8.5.3 Linearization

8.5.3.1 Level/volume

Selection of measured value display (000) in **level/volume 050** function:

```
level/volume    050
✓level CU
  level DU
  ullage CU
```

Selection:

- **level CU**
Display the level in customer units. The unit can be selected in the customer unit function (056), and the full-scale value can be set in the maximum scale function (057). Measured value linearization is possible.
- **level DU**
Display the level in the selected distance unit (function 083).
- **ullage CU**
Display the ullage in customized units. The unit can be selected in the customer unit function (056), and the full-scale value can be set in the maximum scale function (057). Measured value linearization is possible.
- **ullage DU**
Display the residual distance in the distance unit selected (function 083).



The reference point for residual distance and/or residual volume is the "full calibration (003)".

Example of volume measurement (no linearization)

- Full calibration (003) = 20 m
- Silo volume (in selected measuring range) = 500 m³
- Current level = 4 m

Measurement of current volume

Level/volume (050) = level CU
 Linearization (051) = linear
 Customer unit (056) = m³
 Maximum scale (057) = 500
 → Measured value (000) = 100 m³

Measurement of residual volume

Level/volume (050) = ullage CU
 Linearization (051) = linear
 Customer unit (056) = m³
 Maximum scale (057) = 500
 → Measured value (000) = 400 m³

8.5.3.2 Customer unit

Selection customer unit in function **customer unit 056**:

```
customer unit    056
✓%
kg
t
```

Selection:

- % (Percentage)
- Weight: kg, t
- Volume: m³, ft³
- Length: m, ft, in

8.5.3.3 Maximum scale

Input upper-range value (in the selected unit and the selected decimal places) in **max. scale 057** function:

```
max.scale        057
100 %
```

Range of values: 1 to 100000

Default: 100

8.5.4 Safety settings

8.5.4.1 Output on alarm

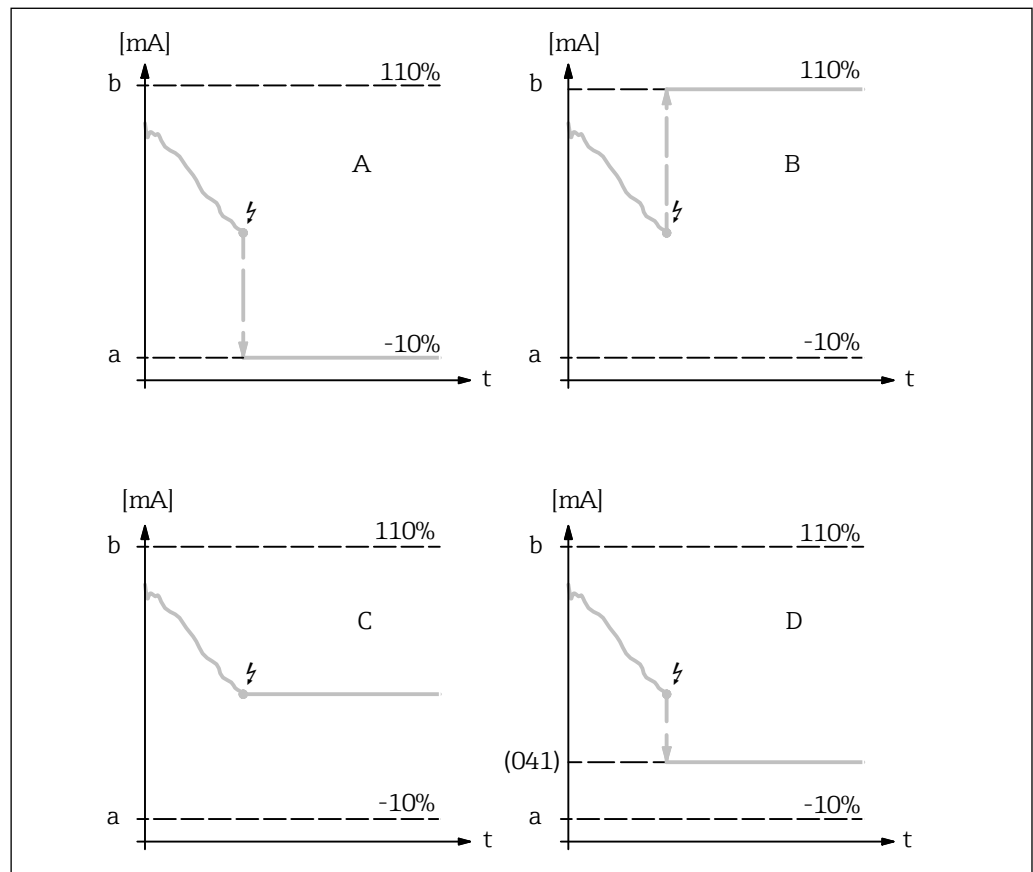
Selection behavior current output in case of error in **output on alarm 040** function:

```

output on alarm 040
✓ MIN (0/3.6mA)
  MAX (22mA)
  hold
    
```

Selection:

- **MIN (0/3.6mA)**
Current drops to 0 mA or to 3.6 mA (depending on function 033) in case of error.
- **MAX (22mA)**
Current increases to 22 mA in case of error.
- **hold**
In the event of an error, the last output current is retained.
- **user-specific**
In the event of an error, the current set in function 041 is output.



000000246

28 Behaviour of the current output in the event of an error

- a 3.6 mA
- b 22 mA
- A MIN (0/3.6mA)
- B MAX (22mA)
- C Hold
- D User-specific

8.5.4.2 Output on alarm

Input user-specific current value in case of error (see function 040) in **output on alarm 041** function:


```
output on alarm 041
    3.60 mA
```

Range of values: 0 to 22.00 mA
Default: 3.60 mA

8.5.4.3 Safety distance

Input minimum distance to parameterized zero point in **safety distance 042** function:

```
safety distance 042
    0.00 m
minimum distance
to empty calibration
```

Range of values: 0 m ... (full calibration - safety distance) (or converted value in feet/inches)


 This function prevents the sensing weight from being lowered into an unauthorized area of the silo or bunker, such as an outlet worm.

8.5.4.4 Security distance

Input security distance before block distance in **security distance 043** function:

```
security dist. 043
    0.00 m
minimum distance
to full calibration
```

Range of values: 0 m ... (full calibration - safety distance) (or converted value in feet/inches)

 This zone is used as a warning that if the fill level continues to rise, future measurements might be invalid since the block distance (and therefore also the minimum run-down length of the FMM) might be undershot.

8.5.4.5 In security distance

Selection of alarm behavior when security distance is reached (if a value greater than zero was entered in function 043 "security distance") in **in security distance 044** function:

```
in securit.dist. 044
✓warning
alarm
```

Selection:

- warning
- alarm

8.5.4.6 In safety distance

Selection of alarm behavior when safety distance is reached (if a value greater than zero was entered in function 042 "safety distance") in **in safety distance 045** function:

```
in safety dist. 045
✓warning
alarm
```

Selection:

- warning
- alarm

Device response when the safety distance is reached

1. In safety distance = warning

- The sensing weight stops when the safety distance is reached.
- The current measurement (level = full calibration (002) – safety distance (042)) ends with a valid measured value.
- The current value that corresponds to the measured value is output at the current output.
- Warning W661 is shown on the display (error symbol flashes).

2. In safety distance = alarm

- The sensing weight stops when the safety distance is reached.
- The current measurement is rejected (the last valid measured value is displayed).
- The current value at the current output adopts the value selected in the "output on alarm" (041).
- Error A660 is shown on the display (error symbol is permanently lit).
- The relay with the selected "alarm" function switches.

8.5.5 Service interval


8.5.5.1 Service interval

Input number of measuring cycles until next service (among others tape change) in **service interval 024** function:

```
service interval 024
      45000
num. of measurements
til tape change
```

Range of values: 1 to 90000

Default: 45000


-  ▪ If the set value is reached, the FMM issues a warning.
- The relay output with the "service interval" function switches.
 - Resetting the warning or the switched relay output in "service interval counter 025" function
 - The number of measurements of the FMM until the next service depends on the process environment, the value must be adjusted depending on the degree of contamination and/or condition of the measuring tape.
 - For the device version with plastic measuring tape (order code "measuring range", option 7) we recommend a maintenance interval of 10000, this value is preset on delivery.

8.5.5.2 Service interval counter

Display current service interval counter and reset counter in **service interval counter 025**:

```
serv.int.counter 025
      5678
```

Range of values: 0 to 90000

-  To reset a service message, the maintenance interval counter must be set to 0. After the number of measurements entered in the "service interval 024" function, a warning appears again.

8.6 Simulation

The simulation makes it possible to simulate different process variables in the process and the alarm behavior of the device without real level measurements, as well as to check downstream signal chains (for example, the switching of a discharge screw).

8.6.1 Simulation

Selection of measured value simulation in **simulation 026** function:

```
simulation      026
✓ sim. off
  sim. level
  sim. volume
```

Selection:

- **sim. off**
Simulation is switched off.
- **sim. level**
A fill level can be specified in function 027. In such cases, the range of values is based on the maximum scale value entered in function 057. The value entered is shown on the measured value display. The functions of the relay outputs and the current output follow the simulation value.
- **sim. volume**
A volume can be specified in function 027. In such cases, the range of values is based on the maximum scale value entered in function 057. The value entered is shown on the measured value display. The functions of the relay outputs and the current output follow the simulation value.
- **sim. current**
A current value can be specified in function 027. The measured value display continues to show the last measured value. The functions of the relay outputs do not follow the simulation value.

When in simulation mode, normal measuring with the FMM is not possible.

- If the device was in manual mode before simulation was activated, the sensing weight remains in its current position.
- If the FMM was in measuring mode before simulation was activated, this mode remains active. The last measured value is saved internally and is shown on the measured value display when the simulation is over.
- If the FMM was in single cycle mode before simulation was activated, this mode is no longer active. The inputs and the "man.start" button are deactivated. A measurement which has already been started is ended as usual, the measured value is saved internally and is shown on the measured value display when the simulation is over.



During simulation, the measured value display (function 000) shows the alarm symbol.

8.6.2 Simulation value

Input value of simulation type selected in function 026 in **simulation value 027** function:

```
sim. value      027
  10.00 mA
```

Range of values: 0 to 99 m (Level)
0 to 22.00 mA (Current)
0 to 100000 (Volume)

Example of fill level simulation


Device settings:

- Empty calibration (001) = 30 m
- Full calibration (003) = 20 m
- Level/volume (050) = level CU
- Linearization (051) = linear
- Customer unit (056) = m³
- Maximum scale (057) = 1000

1. Simulation (026) = sim. level, Simulation value (027) = 800
 → Measured value (000) = 800 m³
 → Current output = 16.8 mA
2. Simulation (026) = sim. level, Simulation value (027) = 200
 → Measured value (000) = 200 m³
 → Current output = 7.2 mA

8.6.3 Protecting settings from unauthorized access

To protect the configuration of the FMM against unintentional modifications after commissioning, the following options are available:

- Write protection via access code
- Write protection via keypad lock → 28

Input unlock parameter to lock parameter input in **unlock parameter 074** function:

```
unlock parameter 074
      100
for lock code
see manual
```

Range of values:



- 100 Parameter input unlocked
- <>100 Parameter input locked

9 Operation



9.1 Set operating language

Operating languages supported by the FMM → 29

9.2 Configure display

- Basic settings for the local display → 28
- Local display test → 35

9.3 Reading measured values

- Measured value (000) → 24
- Distance/measured value (004) → 32

9.4 Adapt measured values to process conditions

All the functions from chapter "Commissioning" are available for this purpose.

9.5 Manual

The "manual" mode (see measurement type 020 function) gives the user the possibility to move the sensing weight slowly (for example for a tape change).

In the manual mode, the measured value 000 function automatically shows the length of tape that has been lowered. The value displayed depends on the distance unit (m, ft, in) selected in function 083 and on the number of decimal places to be displayed as selected in function 062.

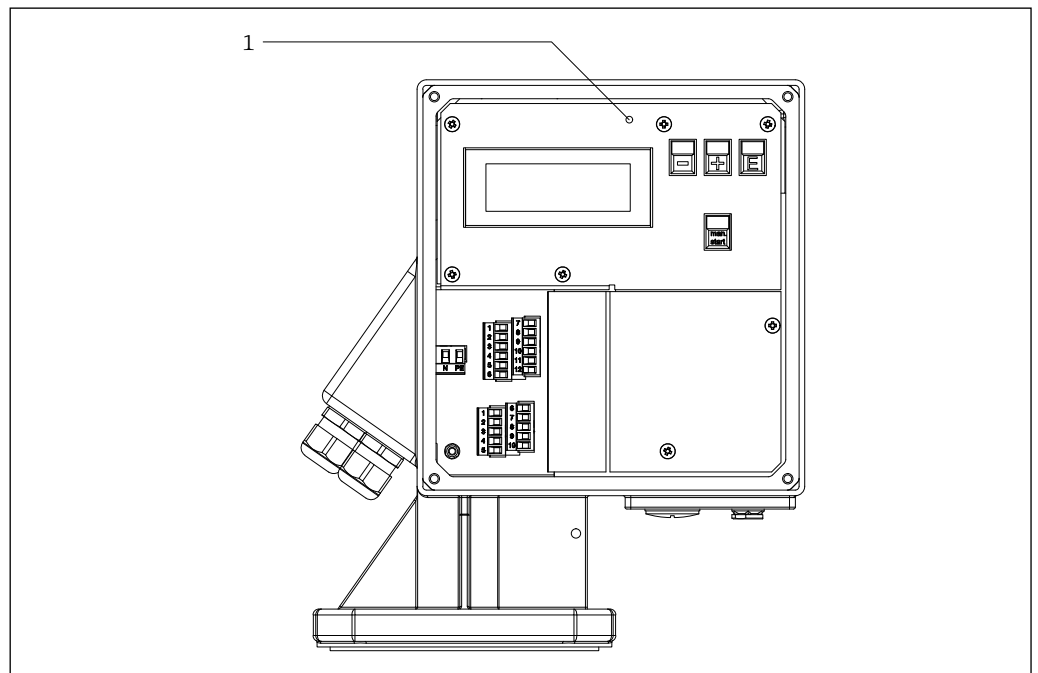
- i** ■ The sensing weight can only be moved manually in measured value 000 function.
- The last valid measured value remains saved internally, it is not overwritten in manual mode. The outputs continue to follow this value (e.g. with a 50 % fill level, 12 mA is still output at the current output).
- After the manual mode has been finished, the measured value display is automatically switched back to the originally selected display (for example level in customer units).

NOTICE

In the manual mode, the upper limit switch and the tape switch have no function! Users must themselves check in which position the sensing weight is currently located. With this type of measurement, the sensing weight can (depending on the maximum tape length) be lowered into unauthorized areas of the container (or into an outlet worm for example).

9.6 LED

The green LED positioned to the right of the LC display is used to display the pulses of the counting wheel during a measurement process. The counting wheel sends a pulse to the evaluation electronics every 5 cm of tape length. The status of the LED changes at the same time. Once the measurement process is complete, the last LED status is retained.



29 LED

1 LED for counting wheel pulses

000000327

10 Diagnostics and troubleshooting

10.1 General troubleshooting

Troubleshooting the local display

Error	Possible cause	Remedy
Local display dark and no output signals	No contact between connecting cables and terminals	Check the connection of the cables and correct if necessary
	Electronics are defective	Repair the FMM → 62
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark	Adjust the contrast setting → 26
	Display module is defective	Repair the FMM
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured	Change the operating language → 29

Troubleshooting the output signals

Error	Possible cause	Remedy
Signal output outside the valid range	Electronics are defective	Repair the FMM → 62
Device shows correct value on local display, but signal output is incorrect, though in the valid range	Parametrization errors	Check and correct parameterization
Device measures incorrectly	Parametrization errors	Check and correct parameterization
	Device is being operated outside the range of application	Observe limit values

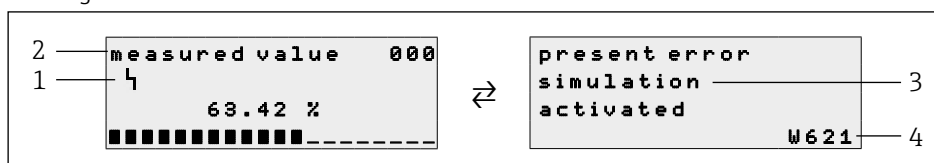
Troubleshooting access problems

Error	Possible cause	Remedy
Not possible to write to parameters, access code = 100	Hardware locking enabled	Disable locking
Not possible to write to parameters, access code ≠ 100	Software locking enabled	

10.2 Diagnostic functions on the local display

10.2.1 Diagnostic messages

Faults detected by the self-monitoring system of the FMM are displayed as a diagnostic message in alternation with the measured value 000 function.



30 Diagnostic messages

- 1 Alarm symbol
- 2 Measured value (Function 000)
- 3 Help text pertaining to the current error
- 4 Error code

If two or more diagnostic events (alarm or warning) are pending simultaneously, only the diagnostic message of the diagnostic event with the highest priority (= lowest number) is shown.

10.2.2 Present error

Display present error with error code and letter "W" for warning or "A" for alarm in **present error 070** function:

```
present error    070
simulation
activated
                W621
```

If there is a warning, it will only be displayed. In the case of an alarm, this is also output via the "alarm" relay output, provided that this has been selected.

10.2.3 Previous error

Display previous error with error code and letter "W" for warning or "A" for alarm in **previous error 071** function:

```
previous error  071
minimum run down
length underflow
                A440
```

10.2.4 Resetting errors

Delete the displayed errors in **clear error 072** function:

```
clear errors    072
✓keep
erase previous
erase present
```


Selection




- **keep**
Errors are not deleted.
- **erase previous**
The last error is deleted.
- **erase present**
The current error is deleted.
- **erase all**
The current (070) and previous (071) errors are deleted.


10.3 Overview of the diagnostic functions

Error code	Diagnostic messages	Remedy
A100	Checksum error in internal program memory	1. Reset hardware 2. Avoid EMC problems 3. If the alarm is still present after a reset, contact service and/or replace the electronics
A101	Check sum error in EEPROM 1	
A102	Check sum error in EEPROM 2	
A103	Initialization failed	
A106	Program download error	Only for service technicians: Repeat download and/or restart
W110	Default service parameters loaded	1. Warning that a reset has been performed 2. Disappears automatically the next time an entry is made
W111	Default user parameters loaded	
W112	Default input/output configuration loaded	


Error code	Diagnostic messages	Remedy
A120	Error when loading the service parameters	1. Reset hardware 2. Avoid EMC problems 3. If the alarm is still present after a reset, contact service and/or replace the electronics
A121	Error when loading the user parameters	
A122	Error when loading the input/output configuration	
A123	Error when loading the last measured values	
A125	Error when loading the display texts	1. Reset hardware 2. Avoid EMC problems 3. If the alarm is still present after a reset, contact service and/or replace the electronics
A130	Process of saving the service parameters has failed	
A131	Process of saving the user parameters has failed	
A132	Process of saving the input/output configuration has failed	
A133	Process of saving the measured values has failed	
A200	Interface to motor controller defective	1. Reset hardware 2. Avoid EMC problems 3. If the alarm is still present after a reset, contact service and/or replace the electronics
A201	Initialization of the motor controller failed	
A202	Fatal motor error	

 The fatal motor error A202 comprises multiple errors in the motor drive system and indicates critical damage to the electronics and/or motor.

Error code	Diagnostic messages	Remedy
A205	Motor current consumption is too high	1. Reset hardware 2. Avoid excessive heating of the measuring device: - Observe the minimum time for a measuring cycle →  71 - Observe the maximum ambient temperature - Observe the maximum weight of the sensing weight 3. If the alarm is still present after a reset, contact service and/or replace the motor
A206	Motor driver defective	1. Reset hardware 2. If the alarm is still present after a reset, contact service and/or replace the electronics
A220	Temperature in the device is too high	1. Check the ambient temperature 2. Check the measurement cycle time →  71
A330	Maximum time for a measurement exceeded	1. Check the wiper →  52 The wiper must move to the upper end position for a measurement to finish. 2. If the alarm persists after several measurements, contact service

 ■ When a measurement starts, an internal counter is started. If the measurement is not completed within approximately 10 minutes, this error message appears.
■ If the wiper does not reach the top position, no pulses are received from the counting wheel. A450 is then the last error code in function 071.


Error code	Diagnostic messages	Remedy
A340	Sensing weight/tape is torn	<ol style="list-style-type: none"> 1. Check the sensing weight and measuring tape: Replace sensing weight and/or measuring tape if necessary 2. Motor is in contact with the tape switch for an extended period when the tape is run up: Check installation (maximum angle of inclination 2°)

 The error message appears if the motor is in contact with the tape switch for approx. 100 ms.

Error code	Diagnostic messages	Remedy
A350	Sensing weight is buried	<ol style="list-style-type: none"> 1. Free the sensing weight by hand 2. If the sensing weight is not buried: Check the current consumption of the motor
A430	Tape switch expected	Contact service and/or replace tape switch
A431	Limit switch expected	Contact service
A440	Minimum run-down distance not reached	<ol style="list-style-type: none"> 1. Check the installation position 2. Observe minimum sensing weight run-down distance of 20 cm. 3. Sensing weight present?
A450	Time for counting wheel pulses exceeded	<ol style="list-style-type: none"> 1. Check the counting wheel 2. Reset hardware 3. If the alarm persists after several measurements, contact service


 This error message mostly appears in conjunction with error A330 if the upper end position is not reached.

Error code	Diagnostic messages	Remedy
A460	Slip on counting wheel	<ol style="list-style-type: none"> 1. Check the counting wheel 2. Reset hardware 3. If the sensing weight is located near the level: Check the wiper to see whether it has left the measuring device 4. If the alarm persists after several measurements, contact service



-  The error message appears if the difference between the counting wheel pulses during run-up and run-down is too large.
- If the wiper does not fully leave the measuring device, the sensing weight is understood to have arrived at the upper end position when the weight is raised and therefore this is interpreted as the end of the measurement procedure. This is what causes a maximum difference between the counting wheel pulses.

Error code	Diagnostic messages	Remedy
A470	The measurement could not be started	Check the device for damage or blocking parts
W621	Simulation activated	Switch off simulation → 42
A630	Maximum drain length exceeded	Check adjustment → 30

Error code	Diagnostic messages	Remedy
A650 W651	Security distance not reached	1. Check the installation situation 2. Check parameterization
A660 W661	Safety distance not reached	
W681	Measurement range exceeded	

-  The error message appears if the measuring device detects a measured value above the full calibration (tape switch is triggered).
- If this error message occurs regularly, the installation position should be inspected to ensure that no struts or internal fixtures are obstructing the lowering (run-down) of the sensing weight.

Error code	Diagnostic messages	Remedy
W700	Tape must be changed	1. Check measuring tape, replace if necessary 2. Reset service interval counter

-  If this error message appears regularly without there being a need to replace the tape, the service interval 024 can be increased. → 42



10.4 Resetting the device

Reset to factory settings in **reset 073** function:

```
reset          073
                0
for reset code
see manual
```

Range of values:

- 333 performs reset
- <>333 does not perform a reset

-  At least one basic setup must have been performed before the measuring device can be reset.
- Table for noting the set parameters in order to be able to restore the desired functions after a reset → 73


10.5 Device information

The following functions contain information about the identification of the device.

10.5.1 Protocol and software version

Display of protocol and software version in **protocol+sw-no. 081** function:

```
protocol+sw-no. 081
V01.01.16
```

-  For information on repairing or ordering spare parts for firmware versions for special technical products (TSP), contact Endress+Hauser Service.

10.5.2 serial number

Display of the serial number in **serial number 082** function:

serial no.	082
U10000KIR20	

10.6 Firmware history

Firmware version	Changes	Documentation
01.01.16	Software revised: Short measurement	BA00334F/97/13.17
01.01.15	Software revised (internal)	BA00334F/97/13.17
01.01.13	Software revised: <ul style="list-style-type: none"> ▪ Relay output counter pulses ▪ Internal error handling (A450) 	BA00334F/97/13.17
01.01.10	Software upgrade: Adjustable short measurement (function 028)	BA00334F/97/13.17
01.01.09	Software revised: Default function "service interval" (024) adapted	BA334F/97/01.07
01.01.08	Software revised: Manual mode	BA334F/97/01.07
01.01.07	Software revised: Default function "service interval" (024) adapted	BA334F/97/01.07
01.01.06	Software revised: Japanese display texts corrected	BA334F/97/01.07
01.01.05	Software revised: Japanese display texts corrected	BA334F/97/01.07
01.01.04	Software upgrade: <ul style="list-style-type: none"> ▪ Enhanced functionality ▪ New serial numbers according to E+H Standard 223 	BA334F/97/01.07
01.01.03	Software revised: <ul style="list-style-type: none"> ▪ Internal error handling (A470) ▪ Hardware lock corrected ▪ Initialization and measurement mode (internal) 	BA334F/97/01.07
01.01.02	Software revised: <ul style="list-style-type: none"> ▪ Burial procedure ▪ Japanese help texts corrected 	BA334F/97/01.07
01.01.01	Software revised (internal)	BA334F/97/01.07
01.01.00	Software upgrade: <ul style="list-style-type: none"> ▪ "in safety distance" (045) function added ▪ Help texts EN/FR/JP added/revised ▪ Default function "time unit" (022) changed to "h" (hour) 	BA334F/97/01.07
01.00.01	Original software	BA334F/97/09.06

11 Maintenance

The following maintenance work may be required depending on the level of fouling.

11.1 External cleaning

When cleaning the exterior of the measuring device, ensure that the cleaning agent used does not corrode the housing surface and seals.

11.2 Cleaning the spool compartment

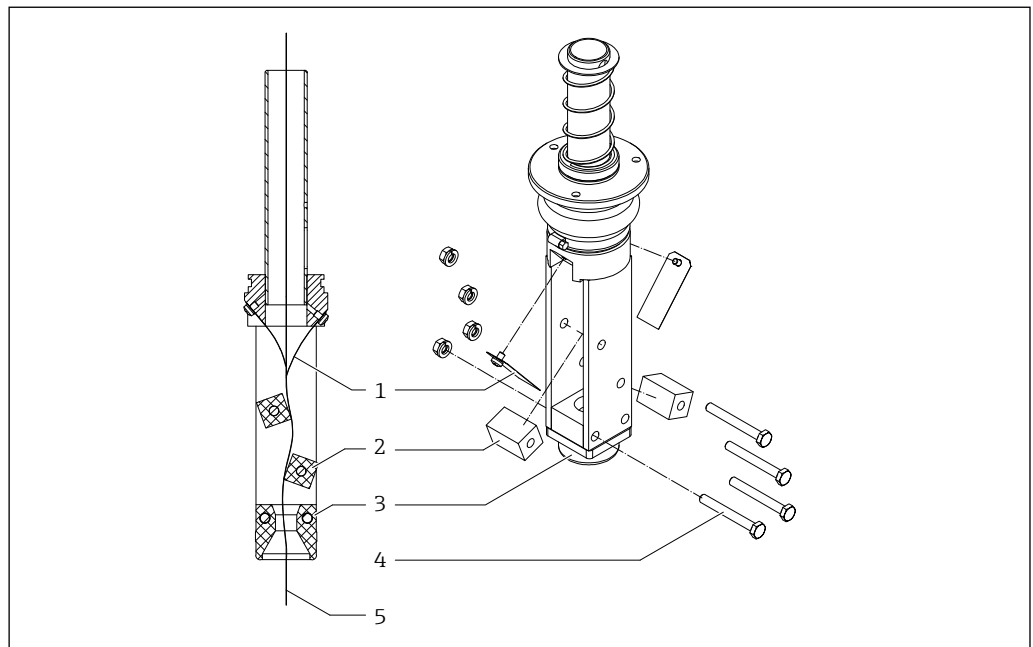
The cleaning periods depend on the properties of the bulk solid. If a lot of dust has accumulated, we would recommend blowing in small amounts of clean compressed air via the mounting flange.

11.3 Wiper check

The two scraper blocks in the wiper are worn to a greater or lesser extent depending on the abrasive nature of the product and then no longer sufficiently clean the measuring tape.

With the wiper removed, check the following points:

- Check whether the measuring tape is cutting into the cone and bore of the end guide. If there are deep gashes, there is a risk of the measuring tape jamming. Replace the end guide if necessary.
- Are the two tape-wipe scrapers in good contact with the measuring tape? If worn, the tape-wipe scrapers must be replaced.
- Is the bellows still in perfect condition? If it is damaged, it must be replaced.





31 Wiper check

- 1 Tape-wipe scraper
- 2 Scraper block
- 3 End guide
- 4 Screws M6x50
- 5 Measuring tape

11.4 Measuring tape check

The greatest mechanical load is put on the measuring tape, therefore the tape should be checked as follows at regular intervals:

1. If the visible part (sensing weight in the upper limit position) of the measuring tape is damaged, unwind it a bit (type of measurement: "manual" 020) until it looks flawless and in perfect condition.
2. Cut off the damaged part and re-mount the sensing weight.
3. If the measuring tape is damaged over a longer distance, the entire measuring tape must be replaced.

-  Do not cut off too much, consider the original tape length and the measurement range required (container height).
- Do not cut off too much, consider the original tape length and the measurement range required (container height).
- Tape spools in standard lengths are available as accessories for easy changeover.
→  56

11.5 Spool compartment check

The spool compartment must be inspected at regular intervals:

- Do not cut off too much, consider the original tape length and the measurement range required (container height).
- If the tape spool is severely attacked or damaged, it must be replaced.
- If the counting wheel is very difficult to turn when the measuring tape is unloaded or if it is damaged, it must be replaced.
- If the cover gasket is badly affected or damaged, it must be replaced.

11.6 Service

Endress+Hauser offers a wide variety of services for maintenance such as onsite inspection and maintenance or device tests.

-  Contact your Endress+Hauser Sales Center for information on services and spare parts.

12 Repair

12.1 General notes

Repair and modification concept

The Endress+Hauser repair and modification concept provides for the following:

- The measuring devices have a modular design.
- Spare parts are grouped into logical kits and are accompanied by Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to a variant with different certification by the Endress+Hauser Service team or at the factory.

Notes concerning repair and modification

- Observe the following when repairing or modifying a measuring device:
 - Use original Endress+Hauser spare parts only.
 - Carry out the repair according to the Installation Instructions.
 - Observe the applicable standards, national regulations, Ex documentation (XA) and certificates.
- Document every repair and modification and enter the details in the W@M life cycle management database.

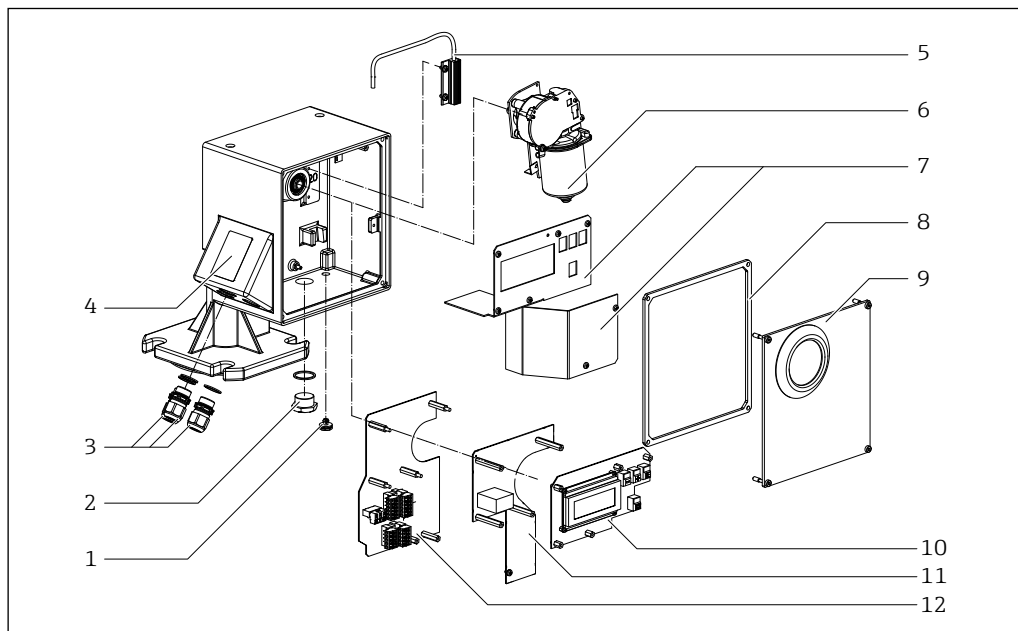
12.2 Spare parts

General notes:

- Please refer to the instruction leaflet supplied or these Operating Instructions for installation instructions.
- Each spare part is identified by an order number. When changing parts, please make sure that only a suitable spare part is installed.
- Other spare part numbers apply for special versions (TSP) of devices, please contact Endress+Hauser if you want to order a spare part for your special version.

⚠ WARNING

- If incorrect spare parts are installed in Ex-certified devices, the device is no longer compliant with Ex specifications and can no longer be operated in the hazardous area.
- If the wrong supply voltage is selected, this can destroy spare parts immediately.

12.2.1 Electronics side

32 Spare parts electronics side

000000315

1 Pressure equalization element

- 71031705 Pressure equalization element, plastic, not an Ex version
 71032447 Pressure equalization element, stainless steel, Ex version

2 External start push button

- 71031710 External start push button, stainless steel socket

3 Cable gland

- 71031694 Cable gland, 3 parts, with Ex certification
 71031689 Cable gland, 3 parts, without Ex certification

4 Nameplate

- 71296636 Replacement nameplate

i When ordering, please specify the order code of the device which is to receive the replacement nameplate.

5 Device heater

- 71031795 Device heater, 115/230 V AC
 71031709 Device heater, 24 V DC

6 Motor/gearbox unit

- 71031654 Motor/gearbox unit, 24 V DC, 150 N
 71031655 Motor/gearbox unit, 24 V DC, 150 N, extended climate resistance

7 Electronic cover

- 71031706 Cover, steel plate with inscription, two-part
 71031707 Cover, steel plate with inscription, two-part, extended climate resistance

8 Cover seal for electronics compartment

71031652	Seal, non-Ex version (including cover seal for spool compartment)
71031653	Seal, Ex version or climate version (including cover seal for spool compartment)

9 Housing cover (incl. cover seal)

71031695	Housing cover, not coated, without sight glass
71031696	Housing cover, coated, without sight glass
71031697	Housing cover, not coated, with sight glass
71031698	Housing cover, coated, with sight glass

10 PCB FMM20_C / P048_C

71031783	Processor
71031784	Processor, extended climate resistance

11 PCB FMM20_N / P048_N

71031779	Power supply 90 to 253 V AC
71031780	Power supply 90 to 253 V AC, extended climate resistance

PCB FMM20_D / P048_D

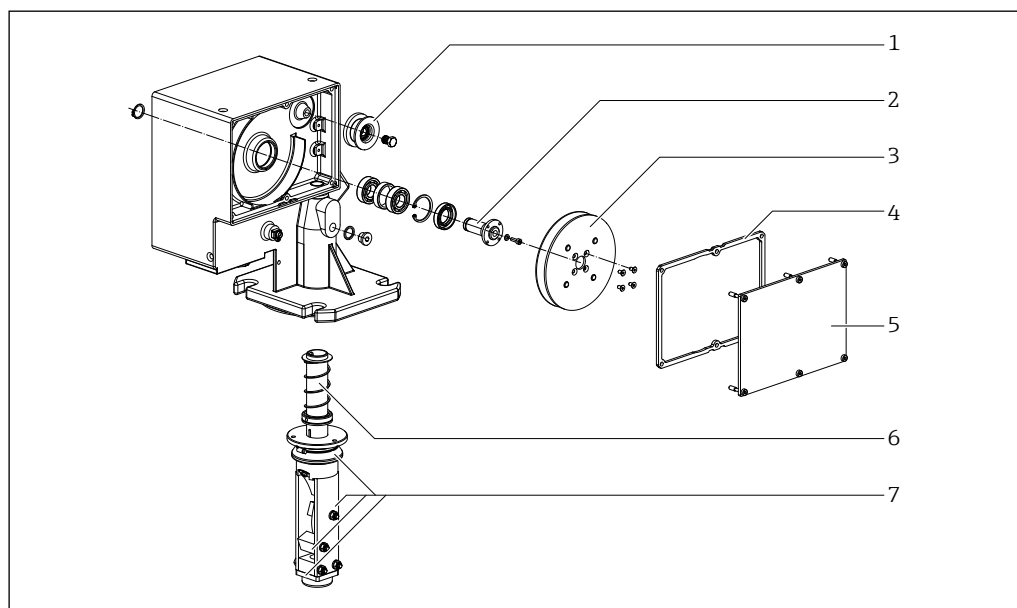
71031781	Power supply 20 to 28 V DC
71031782	Power supply 20 to 28 V DC, extended climate resistance

12 PCB FMM20_M / P048_M

71031711	90 to 253 V AC, 2 relays, non-Ex version, without heating connection
71031751	90 to 253 V AC, 2 relays, non-Ex version, without heating connection, extended climate resistance
71031747	90 to 253 V AC, 2 relays, non-Ex version, with heating connection
71638242	90 to 253 V AC, 2 relays, non-Ex version, with heating connection, extended climate resistance
71031713	90 to 253 V AC, 4 relays, non-Ex version, without heating connection
71031752	90 to 253 V AC, 4 relays, non-Ex version, without heating connection, extended climate resistance
71031748	90 to 253 V AC, 4 relays, non-Ex version, with heating connection
71638244	90 to 253 V AC, 4 relays, non-Ex version, with heating connection, extended climate resistance
71031745	90 to 253 V AC, 2 relays, Ex version, without heating connection
71031753	90 to 253 V AC, 2 relays, Ex version, without heating connection, extended climate resistance
71031749	90 to 253 V AC, 2 relays, Ex version, with heating connection
71638247	90 to 253 V AC, 2 relays, Ex version, with heating connection, extended climate resistance
71031746	90 to 253 V AC, 4 relays, Ex version, without heating connection
71031754	90 to 253 V AC, 4 relays, Ex version, without heating connection, extended climate resistance
71031750	90 to 253 V AC, 4 relays, Ex version, with heating connection
71638249	90 to 253 V AC, 4 relays, Ex version, with heating connection, extended climate resistance
71031767	20 to 28 V DC, 2 relays, non-Ex version, without heating connection
71031775	20 to 28 V DC, 2 relays, non-Ex version, without heating connection, extended climate resistance
71031771	20 to 28 V DC, 2 relays, non-Ex version, with heating connection
71638234	20 to 28 V DC, 2 relays, non-Ex version, with heating connection, extended climate resistance
71031768	20 to 28 V DC, 4 relays, non-Ex version, without heating connection
71031776	20 to 28 V DC, 4 relays, non-Ex version, without heating connection, extended climate resistance
71031772	20 to 28 V DC, 4 relays, non-Ex version, with heating connection
71638235	20 to 28 V DC, 4 relays, non-Ex version, with heating connection, extended climate resistance
71031769	20 to 28 V DC, 2 relays, Ex version, without heating connection
71031777	20 to 28 V DC, 2 relays, Ex version, without heating connection, extended climate resistance

71031773	20 to 28 V DC, 2 relays, Ex version, with heating connection
71638237	20 to 28 V DC, 2 relays, Ex version, with heating connection, extended climate resistance
71031770	20 to 28 V DC, 4 relays, Ex version, without heating connection
71031778	20 to 28 V DC, 4 relays, Ex version, without heating connection, extended climate resistance
71031774	20 to 28 V DC, 4 relays, Ex version, with heating connection
71638240	20 to 28 V DC, 4 relays, Ex version, with heating connection, extended climate resistance

12.2.2 Process side



000000316

33 Spare parts for the process side

1 Counting wheel

71031650 Counting wheel, complete

2 Drive shaft

71031649 Drive shaft incl. ball bearings, shaft seal and mounting material

3 Tape spool

71031658 Steel/aluminium, stainless steel measuring tape, 15 m

71031659 Stainless steel/aluminium, stainless steel measuring tape, 15 m, extended climate resistance

71031671 Steel/aluminium, stainless steel measuring tape, 32 m

71031672 Stainless steel/aluminium, stainless steel measuring tape, 32 m, extended climate resistance

71629573 Steel/aluminium, stainless steel measuring tape, 42 m

71629574 Stainless steel/aluminium, stainless steel measuring tape, 42 m, extended climate resistance

71629597 Steel/aluminium, plastic measuring tape, 8 m

71629599 Stainless steel/aluminium, plastic measuring tape, 8 m, extended climate resistance

4 Cover seal for spool compartment

71031652 Seal, non-Ex version (including cover seal for electronics compartment)

71031653 Seal, Ex version or climate version (including cover seal for electronics compartment)

5 Housing cover (incl. cover seal)

71031699 Housing cover, not coated

71031700 Housing cover, coated

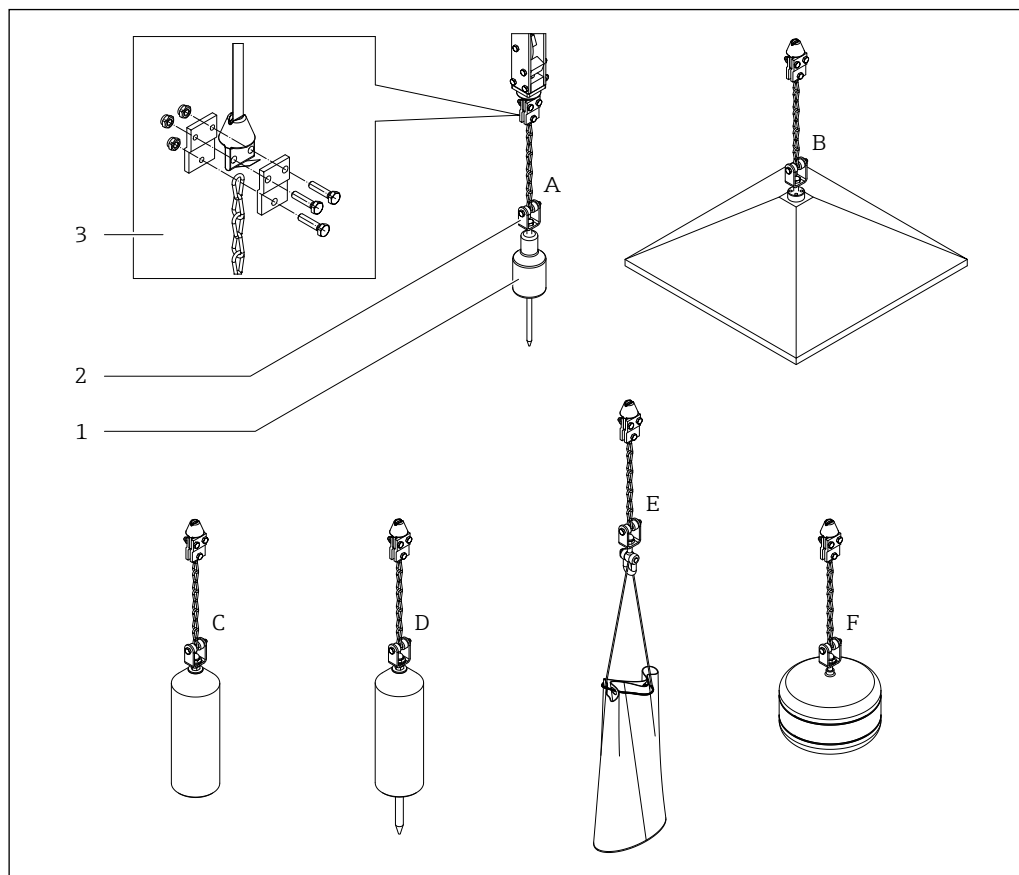
6 Wiper

71031621	230 mm, aluminum/steel, process temperature of up to +70 °C (+158 °F)
71031622	230 mm, stainless steel, process temperature of up to +70 °C (+158 °F)
71031623	230 mm, aluminum/steel, process temperature of up to +150 °C (+302 °F)
71031624	230 mm, stainless steel, process temperature of up to +150 °C (+302 °F)
71031625	500 mm, aluminum/steel, process temperature of up to +70 °C (+158 °F)
71031626	500 mm, stainless steel, process temperature of up to +70 °C (+158 °F)
71031627	500 mm, aluminum/steel, process temperature of up to +150 °C (+302 °F)
71031628	500 mm, stainless steel, process temperature of up to +150 °C (+302 °F)
71031629	1000 mm, aluminum/steel, process temperature of up to +70 °C (+158 °F)
71031630	1000 mm, stainless steel, process temperature of up to +70 °C (+158 °F)
71031631	1000 mm, aluminum/steel, process temperature of up to +150 °C (+302 °F)
71031632	1000 mm, stainless steel, process temperature of up to +150 °C (+302 °F)

7 Wiper spare parts kit

52028080	End guide, tape-wipe scrapers, scraper block, bellows, mounting material, process temperature of up to +70 °C (+158 °F)
52028081	End guide, tape-wipe scrapers, scraper block, bellows, mounting material, process temperature of up to +150/230 °C (+302/446 °F)

12.2.3 Sensing weight



34 Spare parts sensing weight

000000317

1 Sensing weight (incl. rotating bush)

71031620	Plastic (C)
71456386	Plastic, with spike (stainless steel) (D)
71031615	Steel (A)
71031616	Stainless steel (A)
71031617	Steel + umbrella (B)
71031618	Stainless steel + umbrella (B)
71031619	Medium bag (E)
71456353	Float, 316Ti (F)

2 Rotating bush

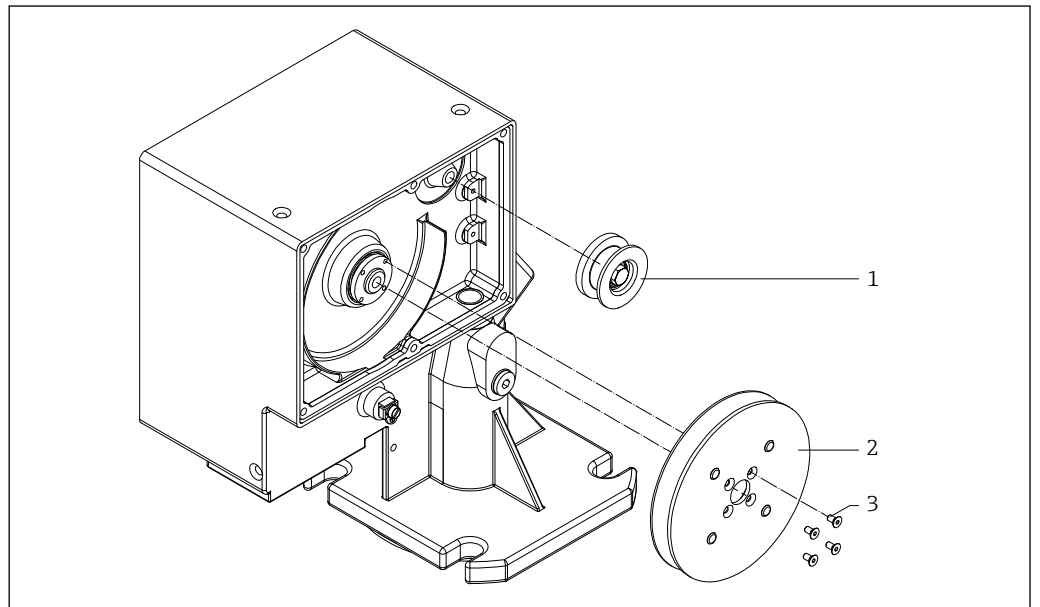
52028100	Rotating bush, mounting material, steel
52028101	Rotating bush, mounting material, stainless steel

3 Sensing weight mounting


52028088	Tape border, rotating bush, chain, mounting material, steel
52028089	Tape border, rotating bush, chain, mounting material, stainless steel

12.3 Replacing components

12.3.1 Replacing the tape spool





000000329


 35 Replacing the tape spool

- 1 Counting wheel
- 2 Tape spool
- 3 Mounting screws

Replacing the tape spool

1. Move the sensing weight down a little (at least 5 cm) in the "manual mode (020)" type of measurement to relieve the tension on the measuring tape.

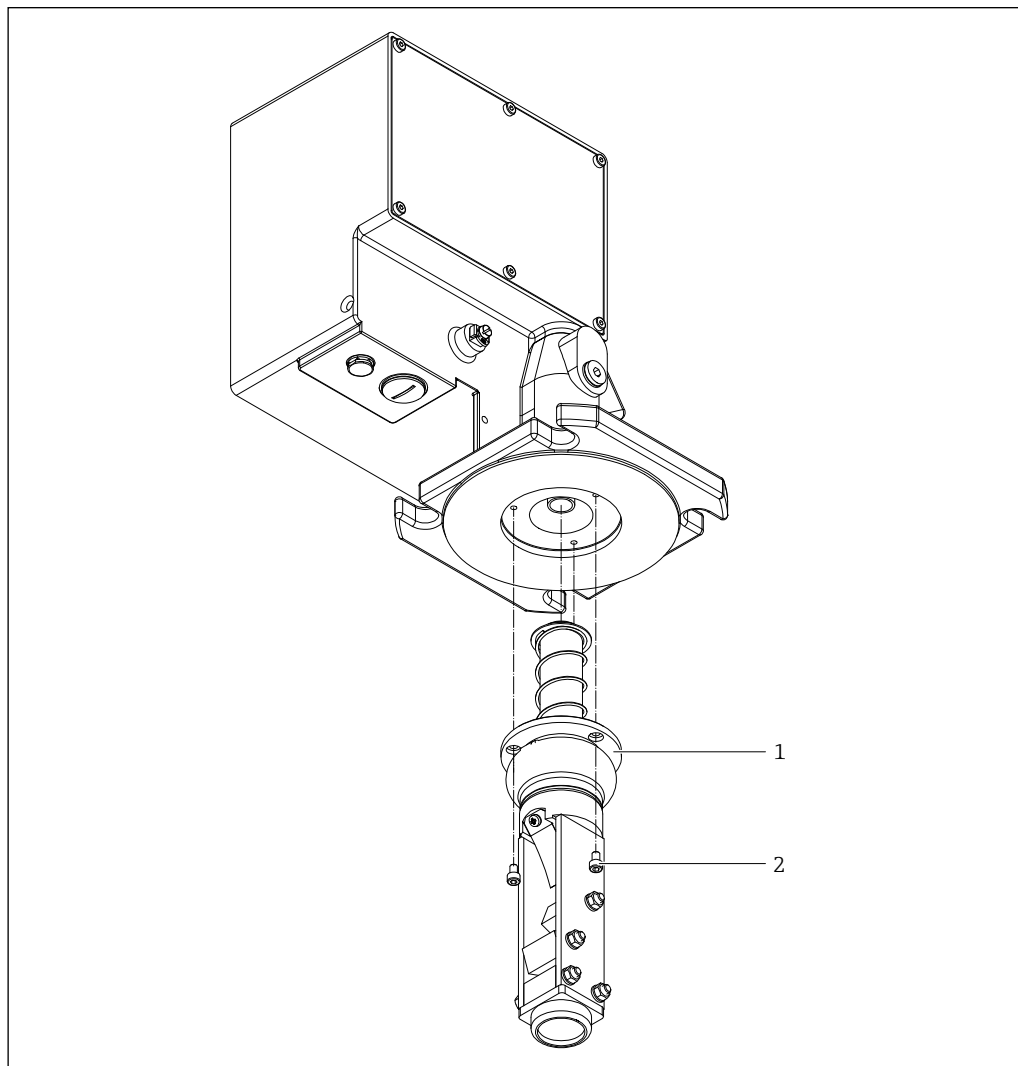
 When using larger sensing weights, such as the float weight, the weight must be lowered to an appropriate hatch. →  18

2. Switch off the power supply if the sensing weight is easily accessible. Disconnect the mains cable if the measuring device needs to be removed.
3. Remove and/or expose the measuring device until the wiper and sensing weight are accessible.
4. Remove the tape border from the measuring tape. →  19
5. Loosen the screws of the tape spool.

 To simplify the process of changing the tape, we recommend removing the counting wheel.

6. Carefully remove the tape spool and unwound part of the measuring tapes from the device.
7. A new tape spool is then installed in reverse order.

12.3.2 Replacing the wiper



000000330

36 Replacing the wiper

- 1 Wiper
- 2 Mounting screws M5x8

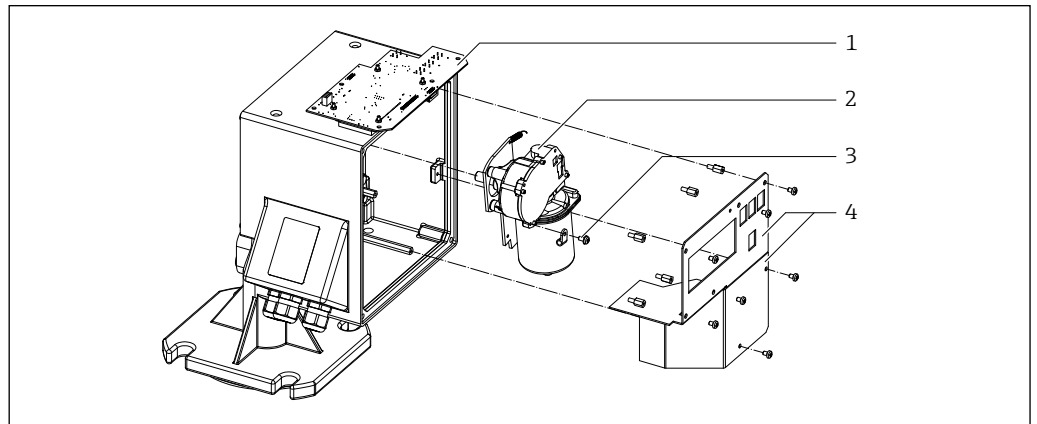
Replacing the wiper

1. Move the sensing weight down a little (at least 5 cm) in the "manual mode (020)" type of measurement to relieve the tension on the measuring tape.
2. Switch off the power supply if the sensing weight is easily accessible. Disconnect the mains cable if the measuring device needs to be removed.
3. Remove and/or expose the measuring device until the wiper and sensing weight are accessible.
4. Release the tape border and remove it (and therefore also the sensing weight) from the measuring tape.
5. Release the three screws on the wiper, the wiper can now be removed.

i When dismantling and/or installing, ensure that the measuring tape is positioned correctly in the wiper. The measuring tape must not be turned in the spool compartment. The spool compartment cover should be opened during installation for this purpose.

6. Reassemble in reverse order, making sure that the guide groove on the wiper is correctly positioned in relation to the guide screw on the housing.

12.3.3 Replacing the motor/gearbox unit



000000331

37 Replacing the motor/gearbox unit

- 1 PCB FMM20_C (Processor)
- 2 Motor/gearbox unit
- 3 Motor connection cable clamp
- 4 Electronic cover

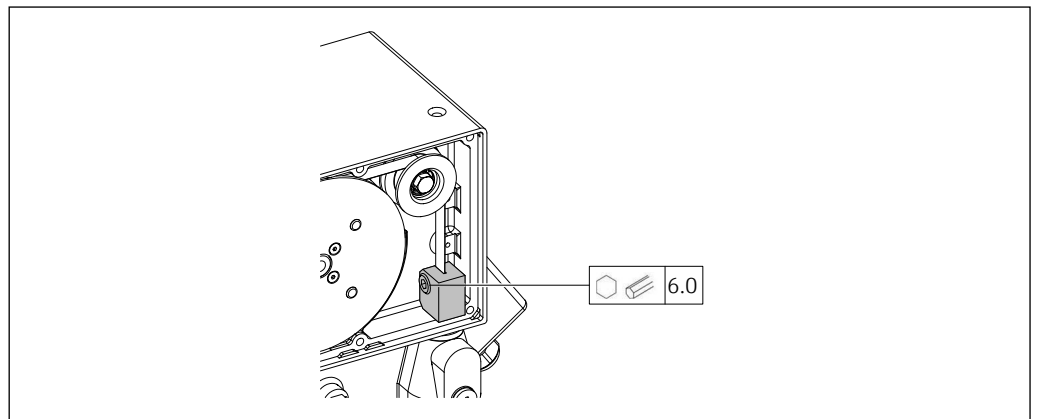
Replacing the motor/gearbox unit

1. Move the sensing weight down a little in the "manual mode" (020) type of measurement to relieve the tension on the measuring tape and therefore the drive shaft, and then fix the sensing weight or the measuring tape in place.



A tape stopper is available as accessory for this purpose.

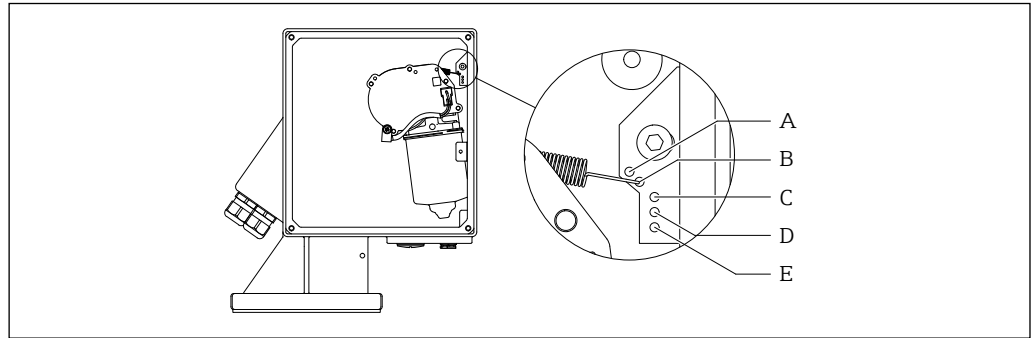
→ 70



000000333

38 Usage tape stopper

2. Switch off the power supply if the sensing weight is easily accessible. Disconnect the mains cable if the measuring device needs to be removed.
3. Loosen the screws of the cover plates and remove the covers.
4. Disconnect the plug of the motor connection cable (top right).
5. Dimensions of plastic sensing weight and float
6. Detach PCB FMM20_C (processor+display) and carefully place on the housing (PCB is still connected to the electronics with 2 flat cables).
7. Carefully unhook the return spring.



000000332

39 Gear motor with return spring

- A Position not used
- B Position FMM20-**4*/FMM20-**7*
- C Position FMM20-**5*
- D Position FMM20-**8*
- E Position not used

8. The motor-gearbox combination can now be removed carefully.
9. A new drive unit is then installed in reverse order.

WARNING

The screw for mounting the motor must always be refitted with the copper washer (explosion protection for certified devices).

12.3.4 Replacing the electronic unit

A detailed description of the replacement process is included with every new electronic unit, so the exact procedure will not be described here.

- i** The electronic unit should only be replaced by a specialist.
- When working with electronic components, ensure that you have sufficient ESD protection (protection against electrostatic discharge).
- Only use the electronics permitted for the device type when replacing parts (the use of incorrect electronics may result in the destruction of the device or the loss of Ex-certification).

Once an electronic unit has been replaced, a basic setup must be performed again and all the parameters must be re-entered. Therefore the following procedure is recommended:

- Make a note of all the settings.
- After replacement, transfer all the settings noted.

12.4 Return

The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at

<http://www.endress.com/support/return-material>

12.5 Disposal



If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste.

Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

12.5.1 Removing the measuring device

1. Switch off the measuring device.
2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" chapters in the logically reverse sequence. Observe the safety instructions when doing so.

WARNING

Danger to persons from process conditions! Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

12.5.2 Disposing of the measuring device

Observe the following when disposing:

- Observe valid national regulations.
- Ensure proper separation and reuse of the device components.

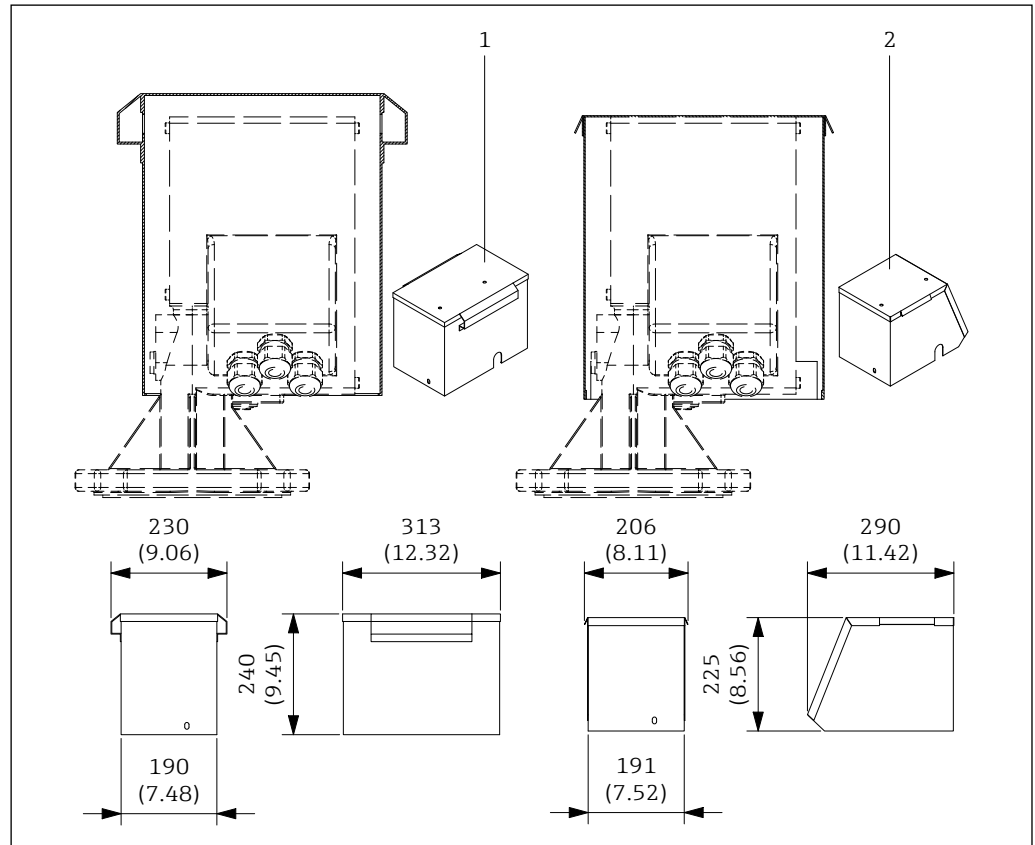
WARNING

Danger to personnel and environment from fluids that are hazardous to health! Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

13 Accessories

13.1 Device specific accessories

13.1.1 Weather protection cover



000000314

■ 40 Weather protection cover. Unit of measurement mm (in)

- 1 Stainless steel version
- 2 Aluminium version

The weather protection cover is simply fitted over the device once the device is installed and fastened on the device with four screws. You will need a free height of at least 240 mm (9.45 in) above the measuring device for installing and/or dismantling.

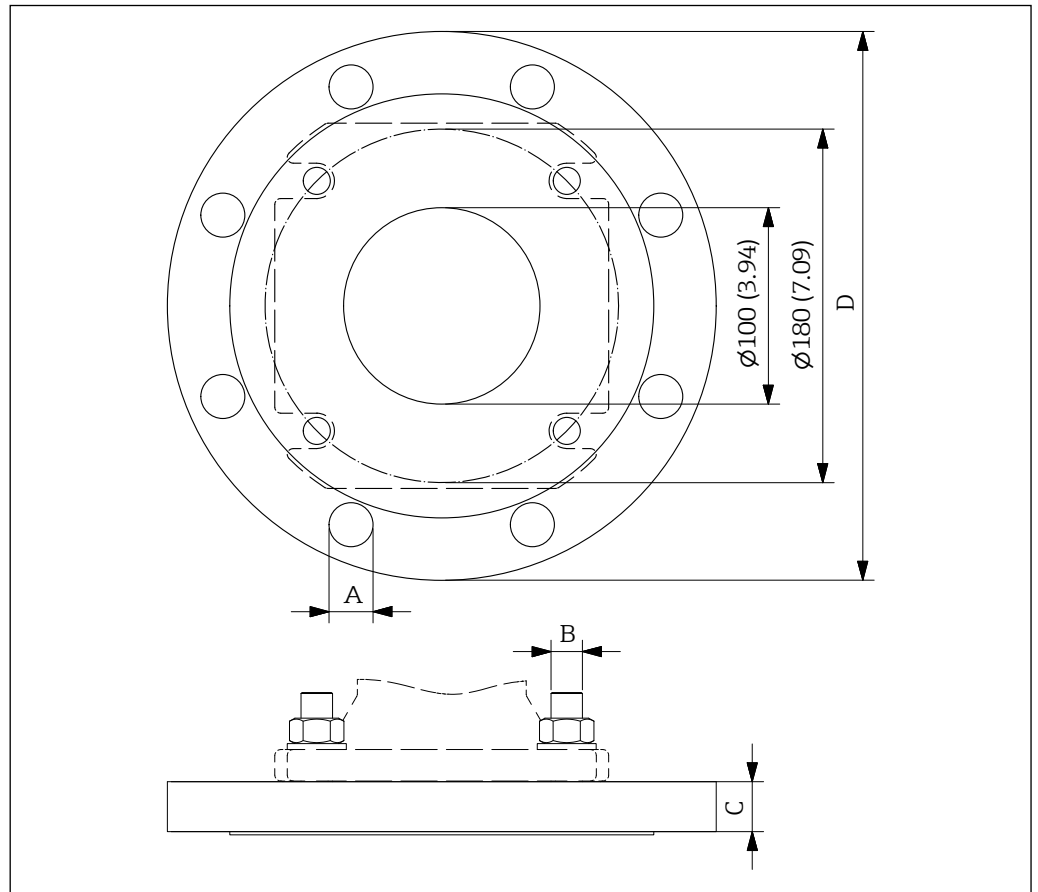
- Order number: 71028956
 - Material: Stainless steel 304 (1.4301)
 - Mounting screws enclosed
 - Weight: 4.3 kg (9.48 lb)
- Order number: 71075962
 - Material: Aluminum
 - Mounting screws enclosed
 - Weight: 0.7 kg (1.54 lb)

13.1.2 Adapter flange

The following adapter flanges can be used to adapt to existing process connections.

13.1.2.1 Adapter flange for lower pressure ratings

The adapter flange is mounted between the process connection of the device and the application. As the flange is not very high, the clearance needed for the device is only marginally increased.



41 Adapter flange (example ASME B16.5 6" 150 lbs). Unit of measurement mm (in)

000000240

Order number:

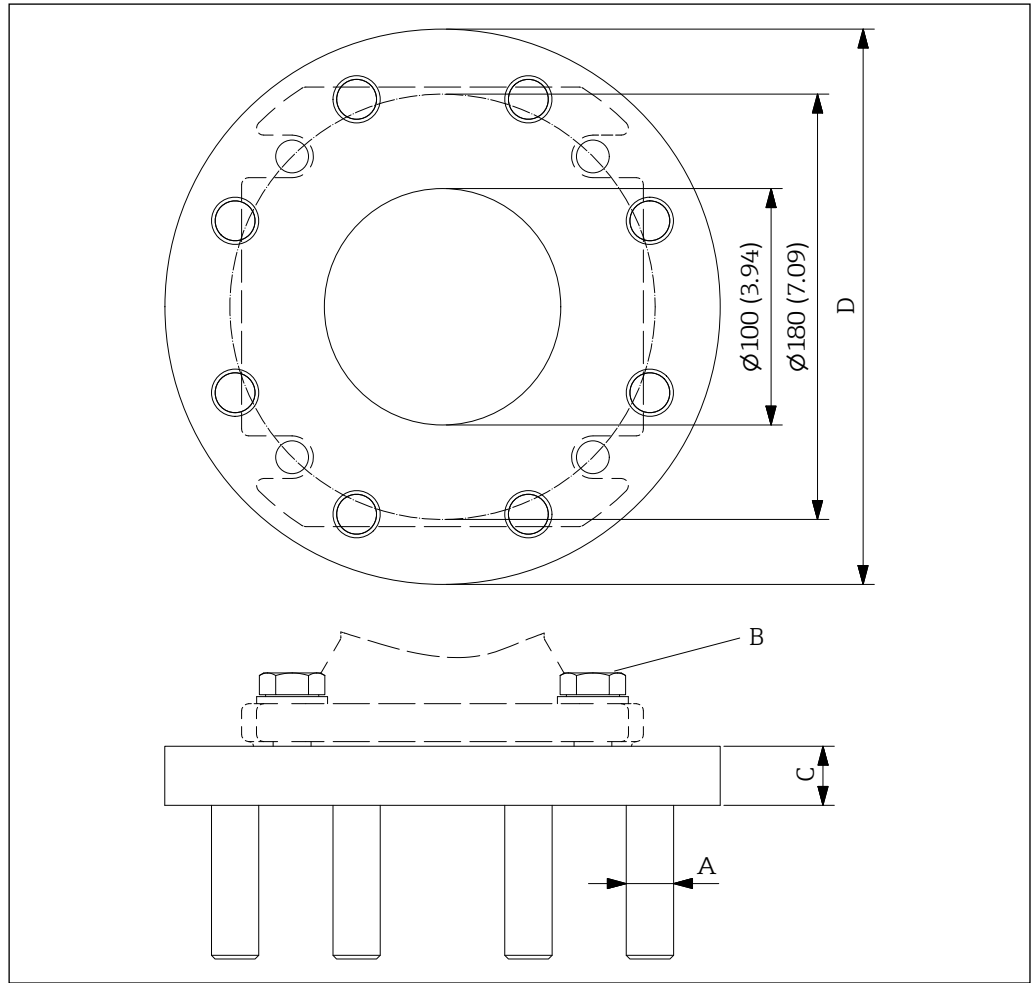
- 71301820 (DN150, PN16, EN1092-1, stainless steel 316Ti, 9 kg (19.8 lb))
- 71301821 (DN150, PN16, EN1092-1, steel, 9 kg (19.8 lb))
- 71301822 (DN200, PN16, EN1092-1, stainless steel 316Ti, 15 kg (33.1 lb))
- 71301824 (DN200, PN16, EN1092-1, steel, 15 kg (33.1 lb))
- 71301811 (6", 150lbs, ASME B16.5, stainless steel 316Ti, 10 kg (22 lb))
- 71301815 (6", 150lbs, ASME B16.5, steel, 10 kg (22 lb))
- 71301816 (8", 150lbs, ASME B16.5, stainless steel 316Ti, 18 kg (39.7 lb))
- 71301817 (8", 150lbs, ASME B16.5, steel, 18 kg (39.7 lb))

Dimension (mm (in)):

Order number	Holes	A	B	C	D	
71301820	8	22 (0.87)	M16	22 (0.87)	285 (11.22)	
71301821						
71301822	12	22 (0.87)		24 (0.94)	340 (13.39)	
71301824						
71301811	8	22.4 (0.88)	UNC 5/8"	25.4 (1)	279.4 (11)	
71301815						
71301816				28.6 (1.13)		342.9 (13.5)
71301817						

- The delivery contains suitable nuts to secure the measuring device to the adapter flange.

13.1.2.2 Adapter flange with studs for higher pressure ratings



42 Adapter flange (example DN100 PN25/40). Unit of measurement mm (in)

000000241

- Order number:
 71301826 (DN100, PN25/40, EN1092-1, stainless steel 316Ti, 7 kg (15.4 lb))
 71301829 (DN100, PN25/40, EN1092-1, steel, 7 kg (15.4 lb))
 71301831 (4", 300lbs, ASME B16.5, stainless steel 316Ti, 11 kg (24.3 lb))
 71301833 (4", 300lbs, ASME B16.5, steel, 11 kg (24.3 lb))
 71301834 (4", 600lbs, ASME B16.5, stainless steel 316Ti, 16 kg (35.3 lb))
 71301835 (4", 600lbs, ASME B16.5, steel, 16 kg (35.3 lb))

■ Dimension (mm (in)):

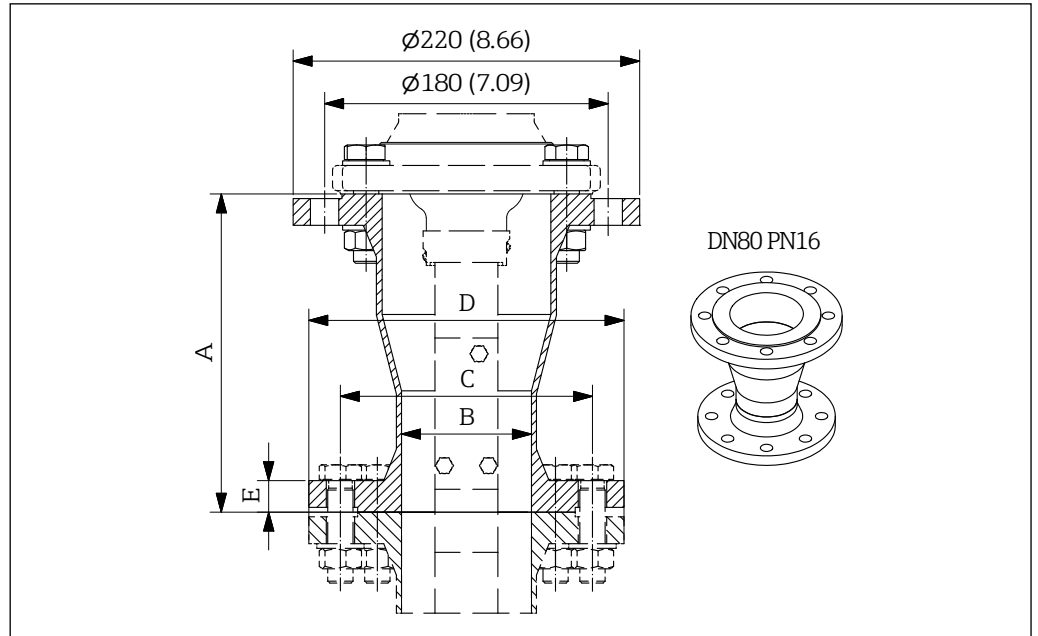
Order number	Stud bolts	A	B	C	D
71301826	8	M22	M16	25 (0.98)	235 (9.25)
71301829					
71301831		UNC 3/4"	UNC 5/8"	31.8 (1.25)	254 (10)
71301833					
71301834					
71301835			38.1 (1.5)	273.1 (10.75)	

- The delivery suitable screws to secure the measuring device to the adapter flange.

13.1.3 Process adapter

13.1.3.1 Process adapters for smaller nominal diameters

The following process adapters can be used to adapt to existing process connections with smaller nominal diameters (< DN100).



43 Process adapter (example DN80 PN16). Unit of measurement mm (in)

■ Order number:

- 71301837 (DN50, PN16, EN1092-1, stainless steel 316Ti, 10.5 kg (23.1 lb))
- 71301839 (DN50, PN16, EN1092-1, steel, 10.5 kg (23.1 lb))
- 71301841 (DN65, PN16, EN1092-1, stainless steel 316Ti, 11 kg (24.3 lb))
- 71301843 (DN65, PN16, EN1092-1, steel, 11 kg (24.3 lb))
- 71301844 (DN80, PN16, EN1092-1, stainless steel 316Ti, 10 kg (22 lb))
- 71301857 (DN80, PN16, EN1092-1, steel, 10 kg (22 lb))
- 71301858 (2", 150lbs, ASME B16.5, stainless steel 316Ti, 11 kg (24.3 lb))
- 71301859 (2", 150lbs, ASME B16.5, steel, 11 kg (24.3 lb))
- 71301861 (3", 150lbs, ASME B16.5, stainless steel 316Ti, 11.5 kg (25.3 lb))
- 71301864 (3", 150lbs, ASME B16.5, steel, 11.5 kg (25.3 lb))
- 71301867 (4", 150lbs, ASME B16.5, stainless steel 316Ti, 12.5 kg (27.6 lb))
- 71301868 (4", 150lbs, ASME B16.5, steel, 12.5 kg (27.6 lb))

■ Dimension (mm (in)):

Order number	A	B	C	D	E
71301837	400 (15.75)	54.5 (2.15)	125 (4.92)	165 (6.50)	18 (0.71)
71301839		70.3 (2.77)	145 (5.71)	185 (7.28)	
71301841					
71301843					
71301844	200 (7.87)	82.5 (3.25)	160 (6.30)	200 (7.87)	200 (7.87)
71301857					
71301858	420 (16.54)	52.6 (2.07)	120.7 (4.75)	152.4 (6.00)	20 (0.79)
71301859					
71301861	220 (8.66)	78 (3.07)	152.4 (6.00)	190.5 (7.50)	23.9 (0.94)
71301864					
71301867	128 (5.04)	102.4 (4.03)	190.5 (7.50)	228.6 (9.00)	
71301868					

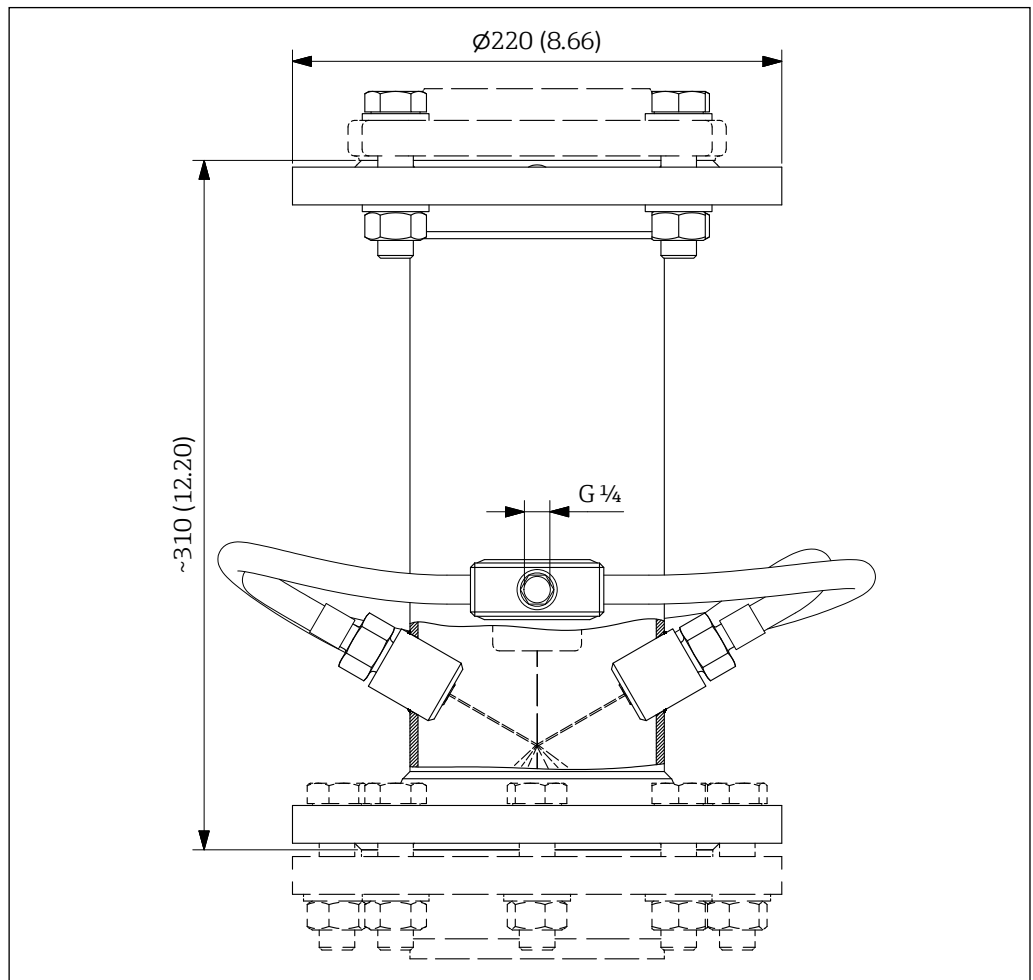
- The delivery contains suitable screws and nuts to secure the measuring device to the process adapter extension.

i To prevent incorrect measurements if the sensing weights swings, the lower edge of the wiper should project out of the reduced area (diameter **B**).

13.1.3.2 Process adapter with spray water cleaning

The following process adapter can be used with spray water cleaning to prevent any damage from chemical substances that can enter the measuring device via the measuring tape.

- i**
 - The process adapter is mounted between the process connection of the measuring device and the application.
 - Filtered water should only be used for spray water cleaning as otherwise the nozzles could clog.
 - The amount of water needed is between 1 l/min (1 bar) and 3 l/min (6 bar).
 - Use the adapter only for pressureless processes.

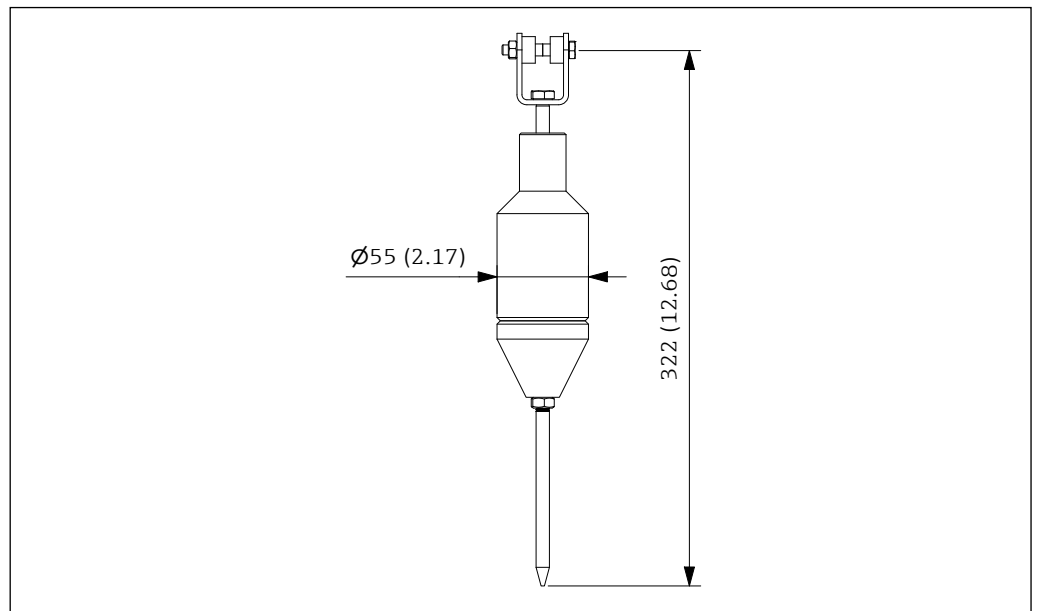


44 Process adapter with spray water cleaning. Unit of measurement mm (in)

000000218

- DN100 PN16 (Connection dimensions according to DIN EN 1092-1)
- Material: 316Ti (1.4571)
- Weight: 15 kg (33.1 lb)
- Order number: 71301886
- Mounting screws enclosed
- For pressureless processes only!

13.1.4 Sensing weights for interface measurement



☑45 Sensing weight for interface measurement in liquids with a significant difference in density.
Unit of measurement mm (in)

000000313

- Order number:
 - 71629601 (Stainless steel 316Ti (1.4571))
 - 71629605 (Stainless steel 316Ti (1.4571), coated)
- Weight: 1.8 kg (4 lb)

i The deviating block distance must be observed!
→ ☰70

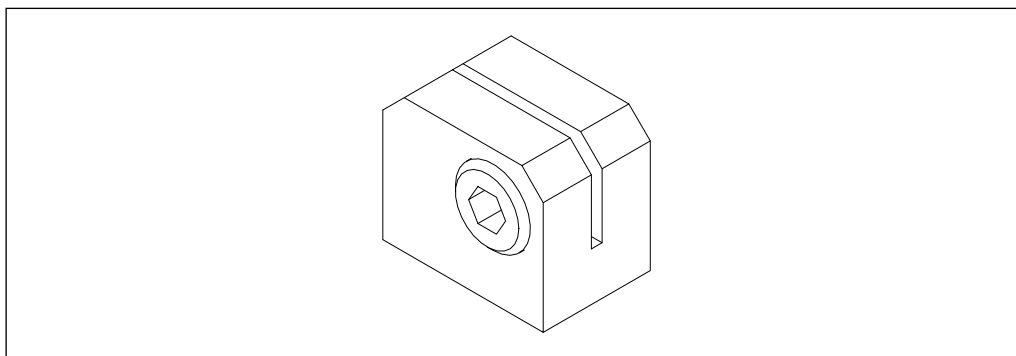
13.1.5 Chain to increase the block distance

The following chain can increase the block distance by a maximum distance of 2 m in the event of longer connections which the sensing weight should not enter into. → ☰70

i If the sensing weights sway significantly, we recommend the use of the extended wiper.

- Order number: 71301880
- Material: Stainless steel316
- Length: 2 m (78.74 in)
- Weight: 0.3 kg (0.66 lb)

13.2 Device-specific tool



000000334

46 Tape stopper

The following measuring tape stopper is available for a change of the gear motor in the application, the operation is done with an Allen key 6 mm AF.

- Order number: 71001352
- Material: Steel and brass

14 Technical data

14.1 Input

14.1.1 Measured variable

- **Direct measured variable**
Level (in selectable units)
- **Calculated measured variable**
Volume (in selectable units)

14.1.2 Measuring range

FMM20-****4*******: 15 m (590.6 in)
 FMM20-****5*******: 32 m (1259.8 in)
 FMM20-****7*******: 8 m (315.0 in)
 FMM20-****8*******: 42 m (1653.5 in)

14.1.3 Block distance

Sensing weight	Wiper		
	230 mm	500 mm	1000 mm
B - E, N	0.72 m (28.35 in)	1.02 m (40.16 in)	1.52 m (59.84 in)
G	1.22 m (48.03 in)	1.52 m (59.84 in)	2.02 m (79.53 in)
P	0.82 m (32.28 in)	1.12 m (44.09 in)	1.62 m (63.78 in)
X	0.63 m (24.80 in)	0.93 m (36.61 in)	1.43 m (56.30 in)
71629601/ 71629605	0.77 m (30.31 in)	1.07 m (42.13 in)	1.57 m (61.81 in)

14.1.4 Input signal

- 2 signal inputs (start measurement, bolting)
- active: 12 to 24 V
 - passive: switching contact max. 30 V DC / 300 mW
 - Start pulse length: min. 200 ms

14.2 Output

14.2.1 Output signal

- Current output 0 - 20 mA / 4 - 20 mA
 - active
 - max. load: 600 Ω
- 2/4 Relay outputs
 - Contact load: max. 250 V AC / 6 A
- Optocoupler output
 - Optional output on devices with 4 relays.
 - Contact load: max. 30 V DC / 10 mA

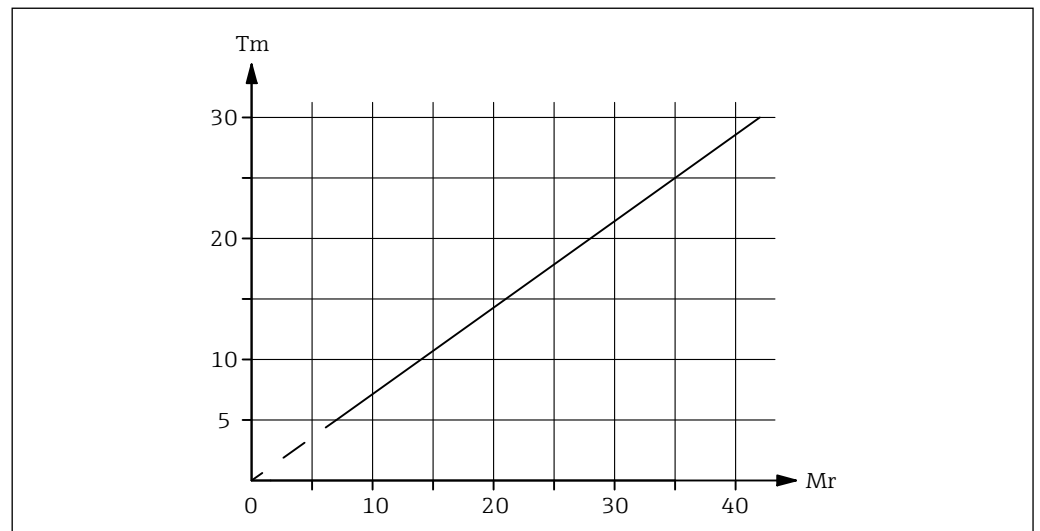
14.2.2 Signal on alarm

- Error symbol, error code and description in plain text on the on-site display
- Current output, configurable
- Relay outputs (alarm)
- Optocoupler output

14.3 Performance characteristics

Measured error: ± 2.5 cm

14.4 Minimum time for one measurement cycle



47 Minimum time for one measurement cycle

Mr Measuring range (in meters)

Tm Minimum time for one measurement cycle (in minutes)

14.5 Running speed

Tape running speed: 0.16 to 0.25 m/s

14.6 Power supply

14.6.1 Supply voltage

- FMM20-****1****: 90 to 253 V AC, 50/60 Hz
- FMM20-****3****: 20 to 28 V DC
- For the DC version of the FMM20 with optional heating, the maximum inrush current is 10 A (≤ 2 s).
- $I_{max} = 16$ A
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.

14.6.2 Power consumption

- Max. 150 VA / 150 W
- Max. 170 VA / 170 W (using the self-regulating device heater)

14.6.3 Cable entries

- M20x1.5
- Clamping range: 7 to 12 mm (0.28 to 0.47 in)
- Material: Plastic
- Color:
 - grey (Ex-free area)
 - black (Ex approval)
- Tightening torque:
 - 4.5 Nm (Ex-free area)
 - 1.5 Nm (Ex approval)
- Quantity: 3

14.7 Environment

14.7.1 Ambient temperature

- FMM20-*****D/F***: -20 to +60 °C (-4 to +140 °F)
- FMM20-*****E/G***: -40 to +60 °C (-40 to +140 °F)
- For outdoor operation in strong sunlight: Use weather protection cover

14.7.2 Storage temperature

-40 to +80 °C (-40 to +176 °F)

14.7.3 Degree of protection

- With closed enclosure: IP67
- With closed enclosure and with the use of the external start button: IP65
- With open housing: IP20

14.7.4 Electromagnetic compatibility

- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity to EN 61326, Appendix A (Industrial)
- A normal installation cable is sufficient for the wiring.

14.8 Process

14.8.1 Process temperature

- FMM20-*****1***: -20 to +70 °C (-4 to +158 °F)
- FMM20-*****2***: -20 to +150 °C (-4 to +302 °F)

14.8.2 Process pressure

0.8 to 1.1 bar (12 to 16 psi) absolute

14.9 Additional technical data



Latest technical information: Endress+Hauser website:

www.endress.com → Downloads

15 Appendix

The following tables provide an aid to documentation (for example, in the event of replacement of the electronics).

Basic setup	Default	User setting
001 Empty calibration	Length of measuring tape	
002 Block distance	→ 70	
003 Full calibration	001 - 002	

Inputs and outputs	Default	User setting
010 Input 1	not used	
012 Input 2	not used	
014 Relay output 1	alarm	
015 Pulse weight	1	
016 Pulse length	50 ms	
019 Reset pulse	300 ms	
01A Relay output 2	service interval	
01B Relay output 3	measuring	
01C Relay output 4	threshold	

Measurement parameter	Default	User setting
020 Measurement type	single cycle	
021 Time interval	1	
022 Time unit	Hour(s)	
023 Normal or short	normal	
024 Service interval	45000	
028 Run-up length	1 m	

Current output	Default	User setting
033 Current range	4-20mA	

Safety settings	Default	User setting
040 Output on alarm	MIN (0/3.6mA)	
041 Output on alarm	3.60 mA	
042 Safety distance	0 m	
043 Security distance	0 m	
044 In security distance	warning	
045 In safety distance	alarm	

Linearization	Default	User setting
050 Level/volume	level CU	
056 Customer unit	%	

Linearization	Default	User setting
057 Maximum scale	100 %	
Display	Default	User setting
060 Language	English	
061 Back to home	100 s	
062 No. of decimals	x.xx	
Diagnostics	Default	User setting
074 Unlock parameter	100	
System parameters	Default	User setting
080 Device tag	-----	
083 Distance unit	m	

www.addresses.endress.com
