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71613725
2023-06-16

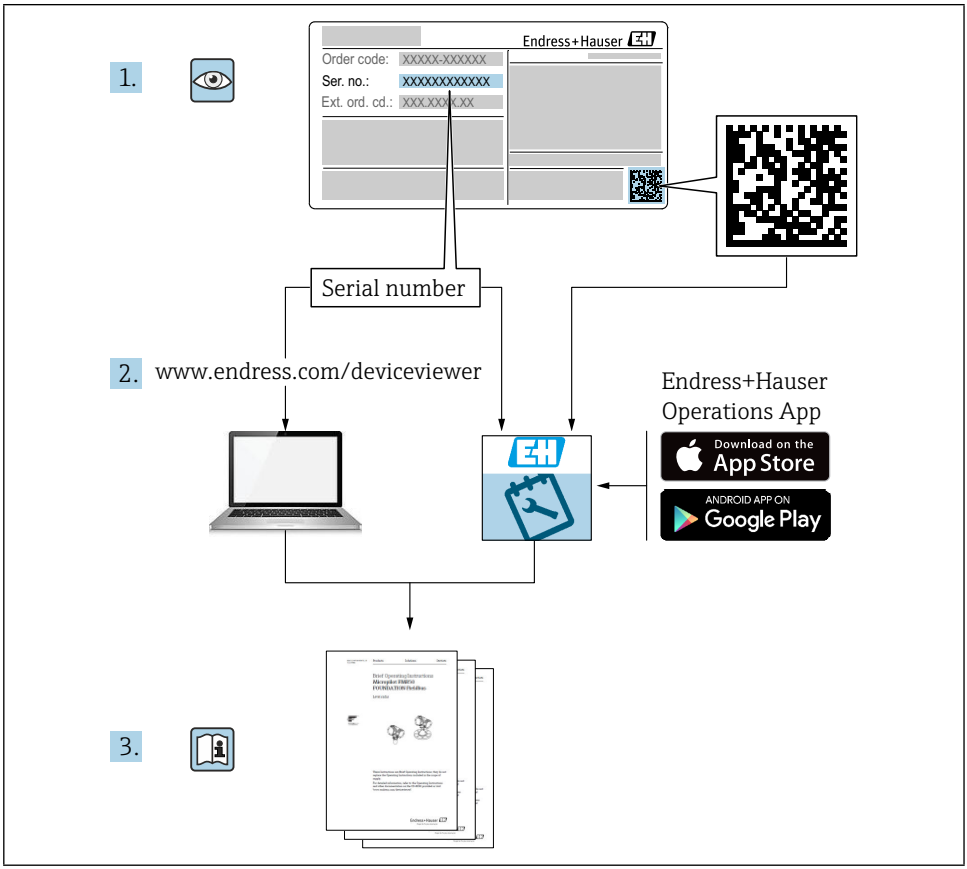
Brief Operating Instructions
Silopilot FMM50

Electromechanical level system

These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:
Available for all device versions via:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*

Endress+Hauser
People for Process Automation


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

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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

⏚ Ground connection
Grounded clamp, which is grounded via a grounding system.

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.

ℹ Tip
Indicates additional information

Reference to documentation

Reference to another section

1., 2., 3. Series of steps

1.1.4 Symbols in graphics

A, **B**, **C** ... View

1, 2, 3 ... Item numbers

Ex 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, fine-grain or coarse-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 measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or drop below the limit values for the measuring device
  TI00395F

2.2.1 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.

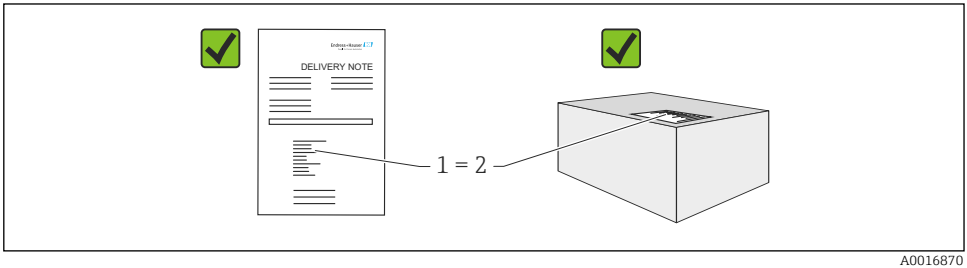
2.4.3 Hazardous area

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 Incoming acceptance



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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 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

4.1 Nameplate

The nameplate displays the legally required and device-relevant information, for example:
- Manufacturer identification
- Order number, external order code, serial number
- Technical data, degree of protection
- Firmware version, hardware version
- Information relevant to approval, reference to safety instructions (XA)
- DataMatrix code (information about the device)

4.2 Manufacturer address

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

5 Storage and transport

5.1 Storage conditions

Use original packaging.

5.1.1 Storage temperature

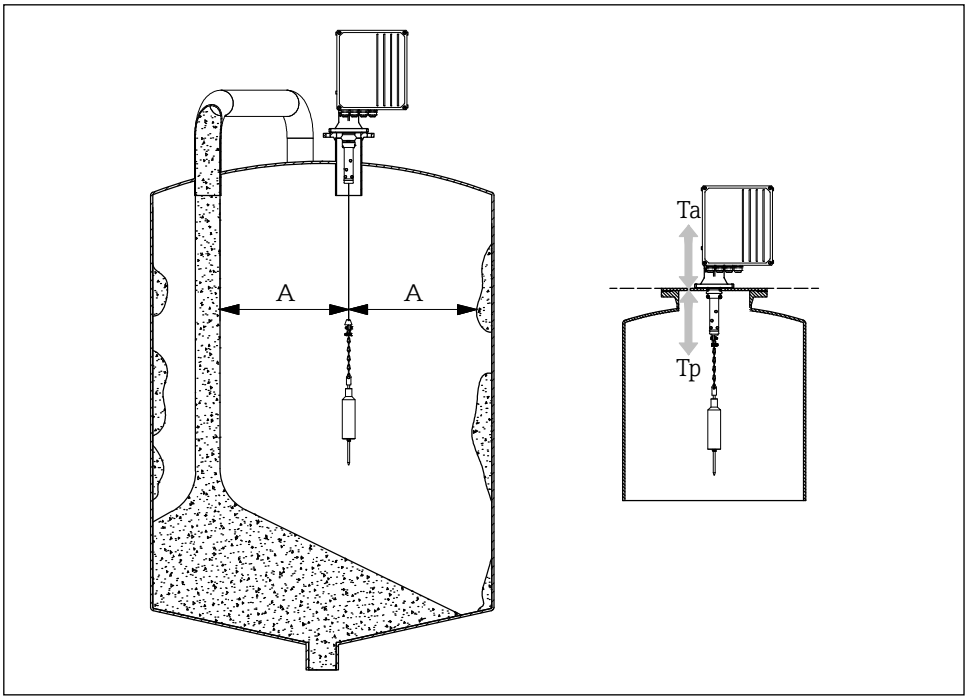
-40 to +80 °C (-40 to +176 °F)

5.1.2 Transporting the device

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

6 Mounting

6.1 Mounting conditions



1 Installation position

A Distance to the filling stream, internals, struts or cornices
Ta Ambient temperature
Tp Process temperature

Installation position
- Protect sensing weight from spillage.
- Protect measuring tape from damage.
- Select an installation position with as free a measuring path as possible.
- Select wiper length so that the sensing weight can move freely during the entire measuring process.

Mounting
- Mounting on counter flange DN100 PN16 (hole dimensions according to EN 1092-1)
- Maximum angle of inclination 2°
- Use weather protection cover or weather protection roof for outdoor installation.
- Use accessories to adapt the device to the installation situation.
- Observe maximum ambient and process conditions!

- Maximum temperature from lower edge of process adapter: +70 °C (+158 °F)
- Accessories → TI00395F

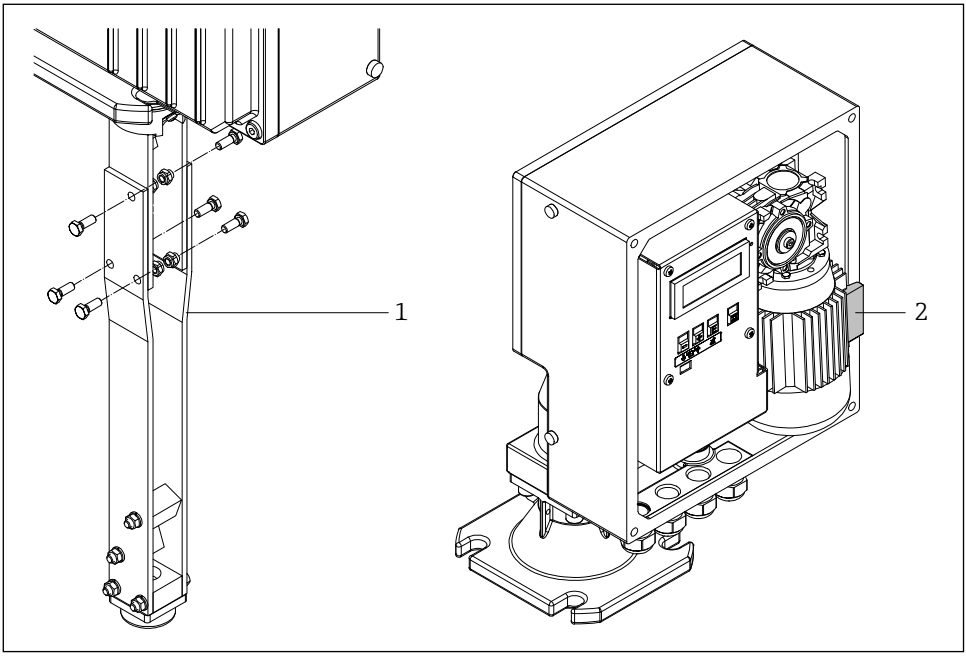
6.2 Mounting the device

6.2.1 Required tool

- To open the device: Allen key 5 mm 5 mm
- For the process connection: Appropriate installation tool
- For the sensing weight: Open-end wrench 10 mm 10 mm

6.2.2 Preparing the measuring device

- Remove all remaining transport packaging.
- For devices with an extended wiper (500/1000 mm): Mount the wiper according to the enclosed instructions
- Removing the transportation lock



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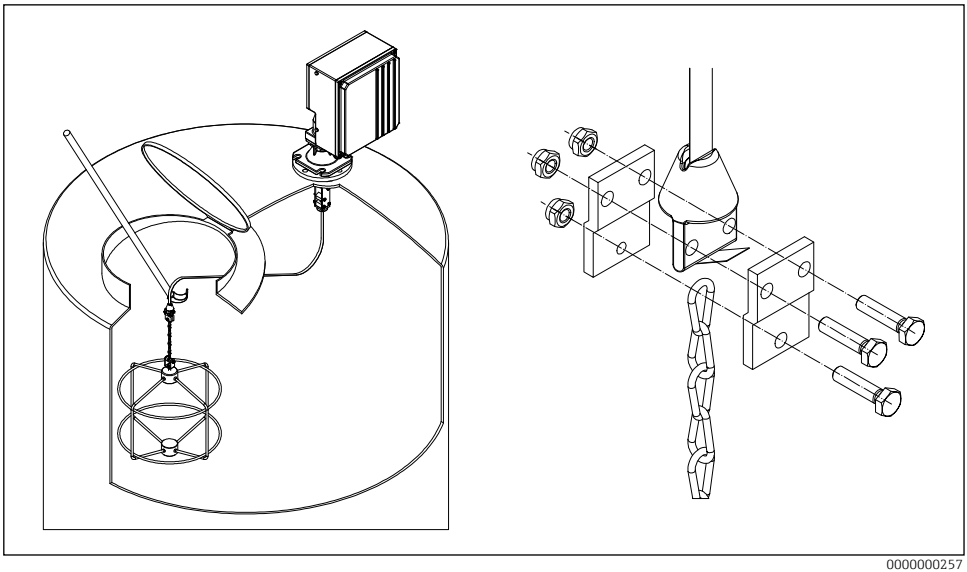
2 Removing the transportation lock

1 Wiper extension
2 Transportation lock

- For large sensing weight (cage, bell or oval float):
  Use or create structural support measures and lower the tape border an appropriate distance before mounting.



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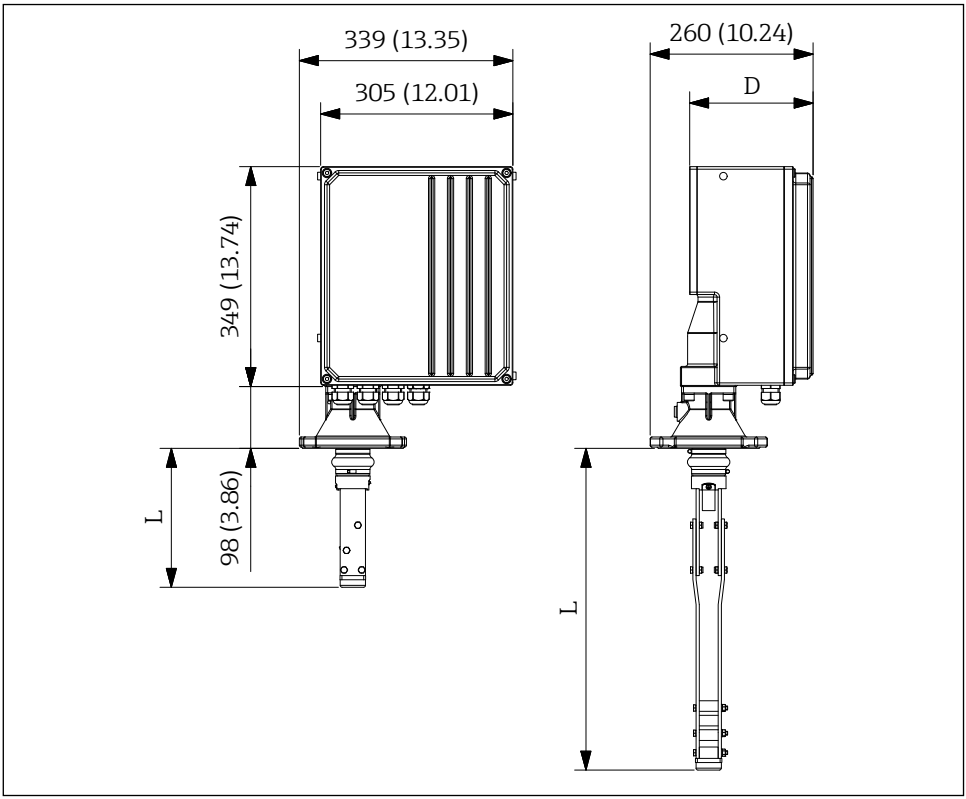
3 Mounting the sensing weight

6.2.3 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.
2. Fix the measuring device with four suitable screws.
3. Mounting the sensing weight.

- Do not crease the measuring tape (reduced service life).
- Seal: to be provided by the customer
- Mounting with accessories → TI00395F
- In case of heavy dust generation in the process: Create slight overpressure to the mounting flange (air volume as required, G¼ female connection).

6.2.4 Mounting dimensions



4 Mounting 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**

The housing depth (**D**) depends on the selected process pressure:
- 196 mm (7.72 in), Ordering code "**process pressure**", option **1**
- 211 mm (8.31 in), Ordering code "**process pressure**", option **2**

6.3 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?

7 Electrical connection

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

7.1 Connection requirements

7.1.1 Required tool

- To open the device: Allen key 5 mm
   5 mm
- For the sensing weight: Open-end wrench 30 mm
   30 mm
- For the terminals: Slotted screwdriver 0.6x3.5mm
   0,6x3,5mm
- For potential equalization: Slotted screwdriver 1.0x6.5mm
   1,0x6,5mm

7.1.2 Connecting cable requirements

The connecting cables provided by the customer must meet the following requirements:
- Permissible temperature range:
  - FMM50-*******A/C****: -20 to +70 °C (-4 to +158 °F)
  - FMM50-*******B/D****: -40 to +70 °C (-40 to +158 °F)
- Protection: IP67
- Normal installation cable sufficient
- Ø 10 to 17 mm (0.39 to 0.67 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).

7.2 Preparing the measuring device

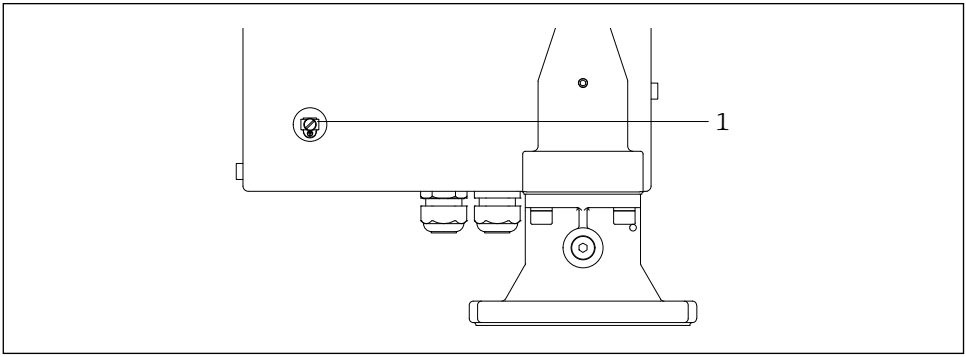
Remove the dummy plug if present.

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

7.3 Connecting the device

7.3.1 Connect potential equalization

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



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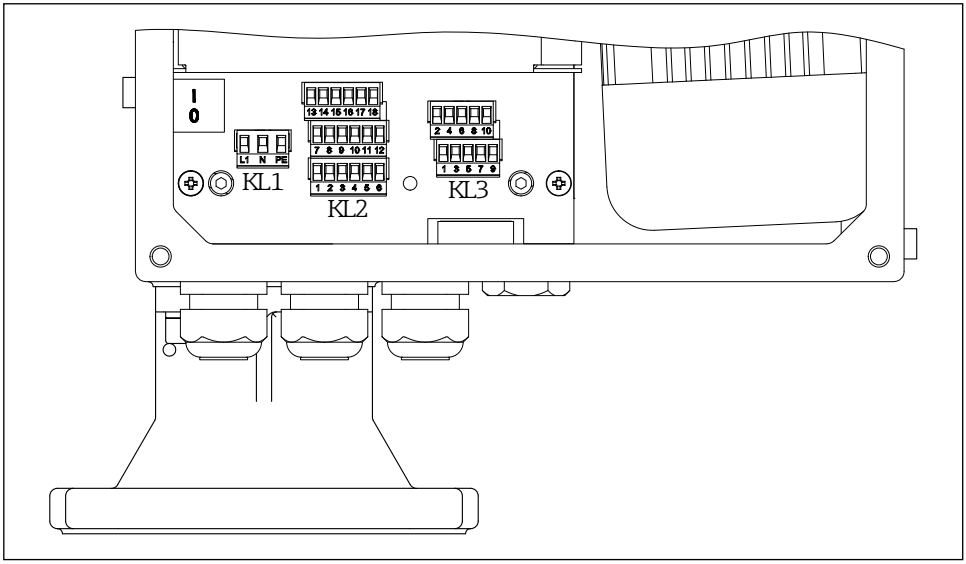
5 Connect potential equalization

1 External ground terminal

Requirements:
- The potential equalization must be connected to the external ground terminal on the device.
- For optimum electromagnetic compatibility, keep the potential equalization line as short as possible.
- The recommended cable cross-section is 2.5 mm^2.
- The potential equalization of the FMM50 must be included in the local potential equalization.

7.3.2 Connecting the device



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6 Terminal assignment

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.
6. Reverse the procedure to reassemble the device.

7.4 Terminal assignment

7.4.1 Supply voltage

- Terminal assignment: 1.1 (L1) / 1.2 (N) / 1.3 (PE)
- Voltage range
  - FMM50-*****1******: 180 to 253 V AC, 50/60 Hz
  - FMM50-*****2******: 90 to 127 V AC, 50/60 Hz
- Ieff = 8 A (115 V) for 40 ms / 4.4 A (230 V) for 20 ms
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.
- Overcurrent protection device: maximum 16 A

7.4.2 Signal input

Order code	Terminal assignment		
Without	**Input 1 (active)**	**Input 2 (active)**	
	3.1	3.3	(+)
	3.2	3.4	(–)
	Input 1 (passive)	**Input 2 (passive)**	
	3.5	3.7	
	3.6	3.8	

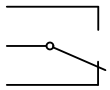
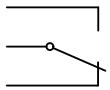
- Contact load:
  - active: 12 to 24 V
  - passive: switching contact max. 30 V DC / 300 mW

- 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.

7.4.3 Current output

- Terminal assignment: 3.9 (+) / 3.10 (–)
- Current output: 0 - 20 mA or 4 - 20 mA, active
- Load: max. 600 Ω

7.4.4 Relay output

Order code	Terminal assignment				
Output option A, B	**Relay 1**		**Relay 2**		
	2.1		2.4		
	2.2		2.5		
	2.3		2.6		
Output option B	**Relay 3**	**Relay 4**	**Relay 5**	**Relay 6**	
	2.7	2.10	2.13	2.16	
	2.8	2.11	2.14	2.17	
	2.9	2.12	2.15	2.18	

- Contact load: max. 250 V AC / 6 A

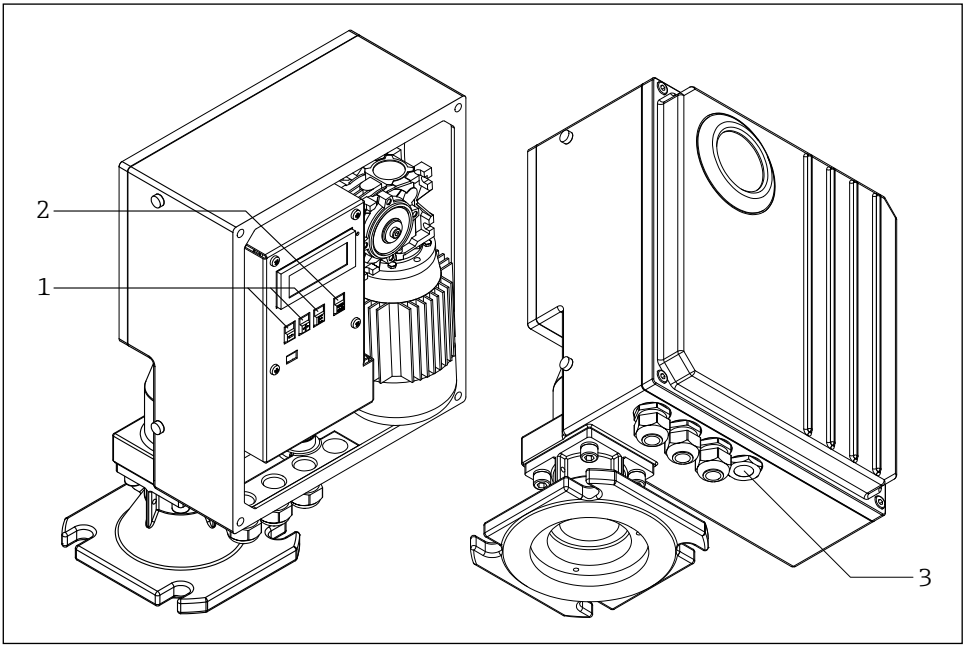
7.5 Ensuring the degree of protection

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.
4. Unused cable entries must be sealed with suitable blanking plugs.

7.6 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 connectors firmly tightened?
- ❑ Does the supply voltage match the specifications on the nameplate?
- ❑ No reverse polarity, is terminal assignment correct?
- ❑ If supply voltage is present, is the green LED lit?

8 Operation options



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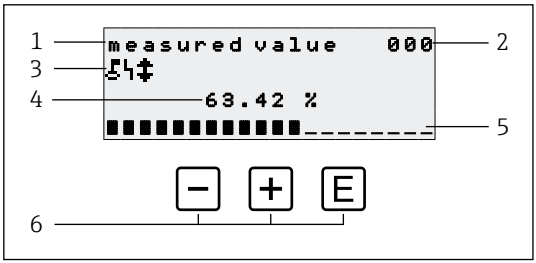
7 Operation options

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

8.1 Access to the operating menu via the local display

8.1.1 Operational display



8 *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

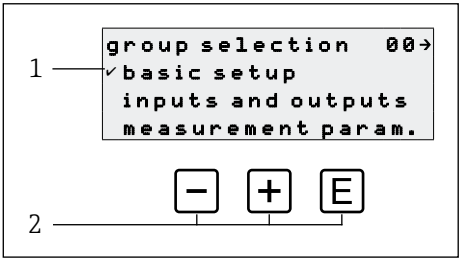
Key	Meaning
E	Switch to group selection 00, 01, ...
+ / −	Not used

- 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.
- 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.

8.1.2 Navigation view



9 *Navigation view*

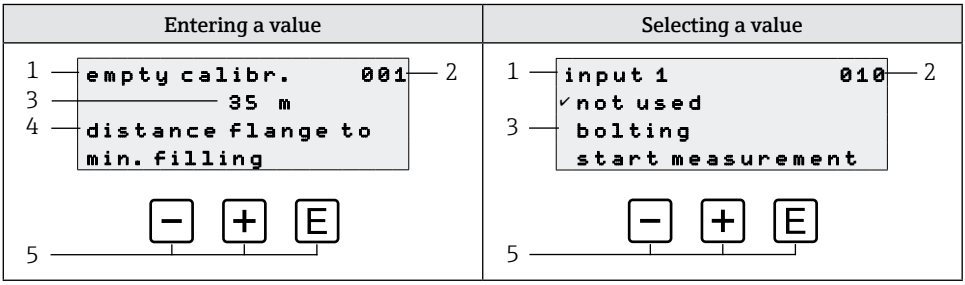
1 Function groups
2 Operating elements

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

8.1.3 Edit view



10 *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** ▪ 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** ▪ Activates the edit mode ▪ Changes the displayed character (0, 1, 2, … , A, B, C, …) **Selecting a value** Moves the active option up
E	▪ Navigation to the right within a function group ▪ In edit mode: - 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

8.1.4 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	▪ 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
− + + + E	▪ Enables or disables hardware locking ▪ Operating keys have no function on their own ▪ "man. start" and external start button are not locked

Key	Meaning
[man start] or external start button	The measurement procedure starts if the device is in the display mode (function 000)

8.1.5 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. −++E: Press all operating keys while the device is in the measured value 000 mode.
   → The keypad lock is enabled
2. −++E: 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.
- Disabling write protection via the access code → Operating Instructions

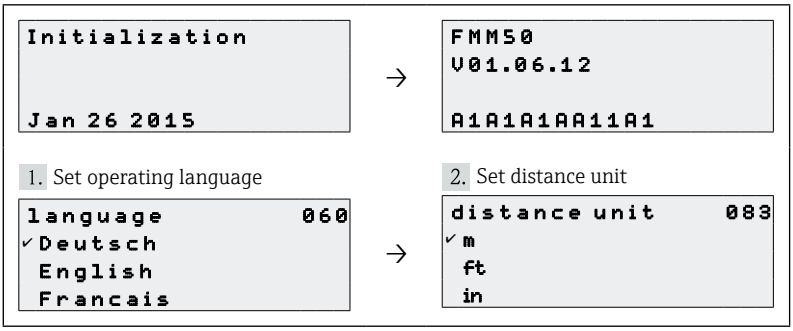
9 Commissioning

9.1 Function check

Function check
- "Post-installation check" checklist
- "Post-connection check" checklist

9.2 Powering up the measuring device

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

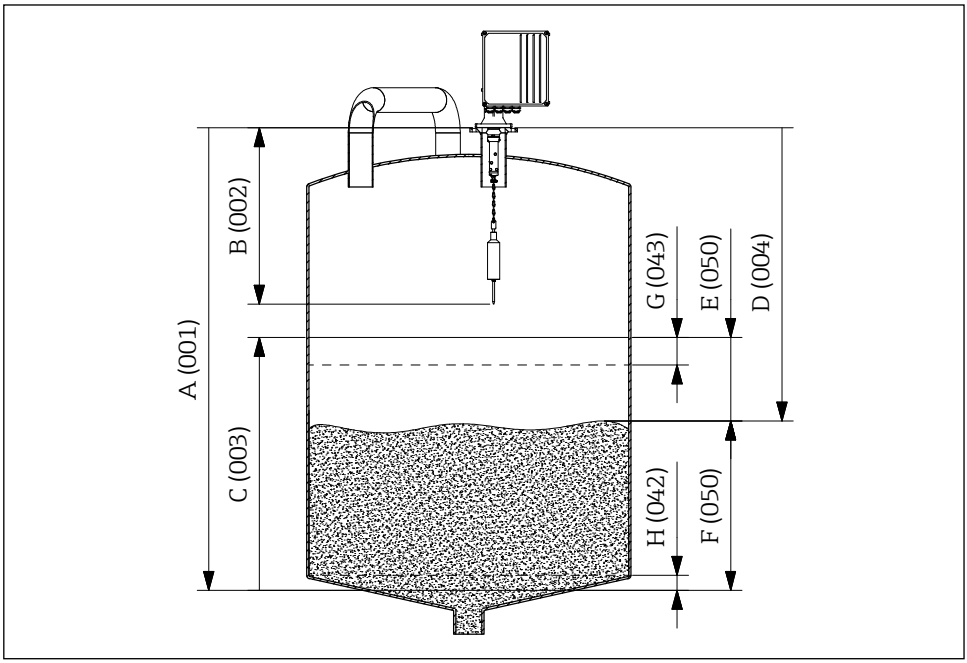


9.3 Configuring the device

The device is configured via the individual function groups and the associated functions in the groups. The following chapters list the functions required for normal commissioning. Special functions such as linearization can be found in the BA00286F operating manual. The default values are always shown in bold in the following chapters, unless they are explicitly mentioned.

9.3.1 Basic setup

Adapting to the application (for example full and empty calibration)



11 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

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

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

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:

Range of values: 0.23 to 5 m (or converted value in feet/inches)
Default: 0.8 m

Block distances as a function of sensing weights

Sensing weight	Wiper		
	230 mm	500 mm	1000 mm
B, C, D, E, L	0.80 m (31.50 in)	1.10 m (43.31 in)	1.60 m (63.00 in)
G	1.20 m (47.24 in)	1.50 m (59.06 in)	2.00 m (78.74 in)
J	0.86 m (33.86 in)	1.16 m (45.67 in)	1.66 m (65.35 in)
M	0.65 m (25.59 in)	0.95 m (37.40 in)	1.45 m (57.09 in)
N	0.63 m (24.80 in)	0.93 m (36.61 in)	1.43 m (56.30 in)
71301873 / 71301875	0.85 m (33.46 in)	1.15 m (45.28 in)	1.65 m (64.96 in)

Full calibration

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

Range of values: 1 m ... empty calibr. - block distance (or converted value in feet/inches)
Default: Length of measuring tape - 0.8 m

Measurement type

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

- 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.

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). Due to the high tensile forces of the measuring device, the measuring tape may tear or be pulled out of the sensing weight attachment in this mode of operation.

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.

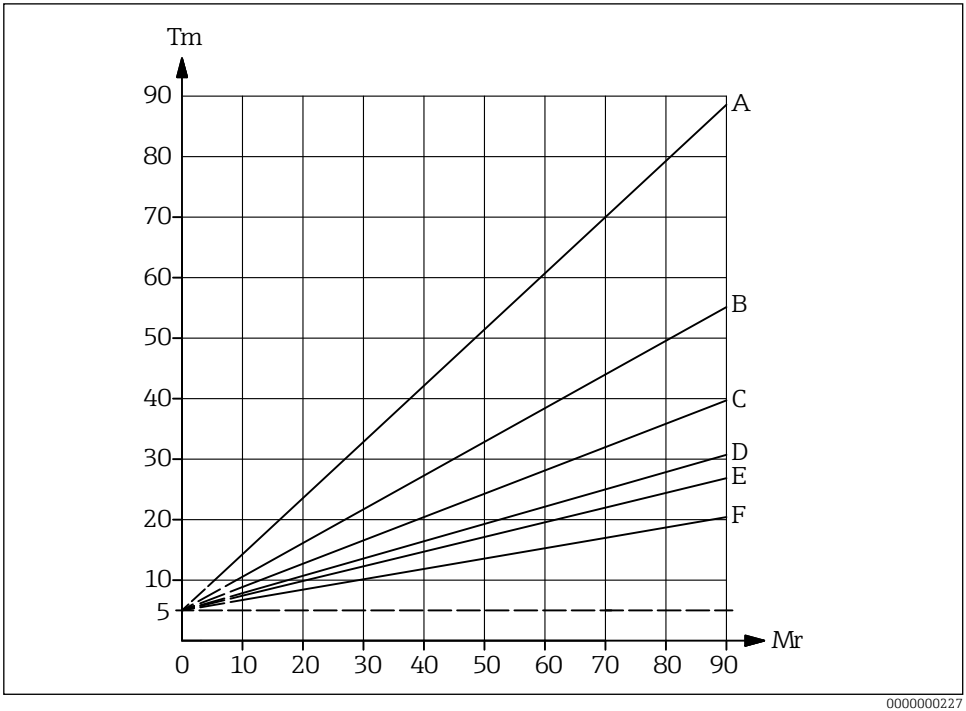
Distance/measured value → 22
Display of the measured distance between the device and the medium and the current measured value in **dist./meas.value 004** function:

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

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:

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

The minimum time for a measuring cycle depending on the ambient temperature and the measuring range must be observed.



12 Minimum time for one measurement cycle

A Ambient temperature 70 °C (158 °F)
B Ambient temperature 60 °C (140 °F)
C Ambient temperature 50 °C (122 °F)
D Ambient temperature 40 °C (104 °F)
E Ambient temperature 30 °C (86 °F)
F Ambient temperature 20 °C (68 °F)
Tm Minimum time for one measurement cycle
Mr Measuring range

Time unit
Input unit of time interval (see function 021) in **time unit 022** function:
- **h** (Hour(s))
- min. (Minute(s))

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

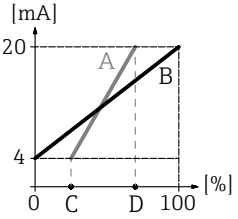
Notes on the "short" operating mode:
- The weight moves back into the upper end position every 20 measuring cycles.
- Use input or relay output with "upper limit position" function for locking to protect the sensing weight from spillage.
- Relay output cannot be used for counting pulses, since the device 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).

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:

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

9.3.2 Current output

Current mode
Selection behavior of current output in **current mode 030** function:
- **normal**: The current output supplies a current of 0/4 to 20 mA (adjustable in function 033) referred to 0 to 100 % of the set measuring range (see function 002 "full calibr.").
- magnify: Only a part of the measuring range is mapped to the output current range of 0/4 to 20 mA, this range is defined in 031 "0/4mA value" and 042 "20mA value" function.



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13 Current mode

A Magnify
B Normal
C Function 031 (0/4mA value)
D Function 032 (20mA value)

0/4mA value

Input lower limit current output (see function 030) in **0/4mA value 031** function:

Range of values: depends on distance unit and/or CU

20mA value

Input upper limit current output (see function 030) in **20mA value 032** function:

Range of values: depends on distance unit and/or CU

When changing the maximum scale value (in function 057), the 0/4 mA value or the 20 mA value must also be adapted.

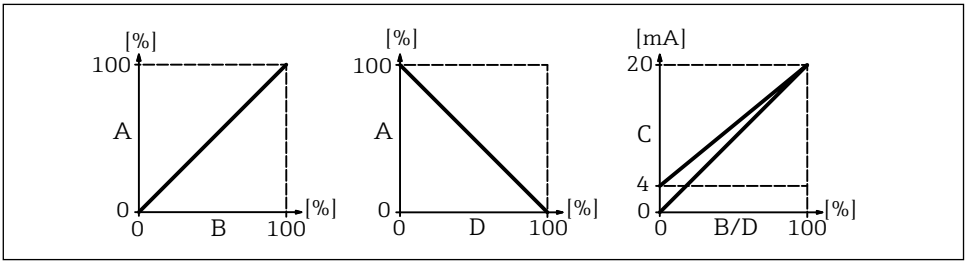
Current range

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

- **4-20mA**
- 0-20mA

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.



0000000262

14 Behaviour of the current output

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

9.3.3 Display

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

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

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

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

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

- **off**
- on

9.3.4 Output

Relay output 1
Selection behavior relay 1 in **relay output 1 014** function:
- **alarm**: Relay switches as soon as an error is detected.
- threshold: Relay switches as soon as a set limit value (see function 017 and 018) is exceeded or not reached.
- 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).
- band return: Relay switches during reversal in direction of tape from tape run-down to tape run-up.
- 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.

- 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.
- A selected limit value (function 017) with an associated hysteresis (function 018) applies for all relays where the "threshold" function has been selected. It is not possible to set individual values for the threshold and hysteresis for each relay.

Relay output 2 to 6
The functionalities of the outputs correspond to those of the relay for output 1 (see function 014). Outputs 3 (01C) to output 6 (01E) are only optionally available (see order code).

Default:
Relay output 2 (01A): Service interval
Relay output 3 (01B): Measuring
Relay output 4 (01C): Threshold
Relay output 5 (01D): Reset pulse
Relay output 6 (01E): Band return

Pulse weight
Input run-down distance (set value x 5 cm) per pulse at the counter pulse output in **pulse weight 015** function:

Range of values: 1 to 20 (5 to 100 cm or converted value in feet/inches)
Default: 1

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

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

Threshold
Input limit value of relay outputs with selected relay output function 014 = "limit value" in percent of the measuring range (level) in **limit value 017** function:

Range of values: 0 to 100 %
Default: 60 %

Hysteresis
Input hysteresis of relay outputs with selected relay output function 014 = "limit value" (related to falling below the limit value in function 017) in percent of the measuring range in **hysteresis 018** function:

Range of values: 0 to 100 %
Default: 3 %

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

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

9.3.5 Inputs

Input 1
Selection behavior of input 1 in **input 1 010** function:
- **not used**
- bolting: If there is a signal at input 1 (see also function 011), 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.

Polarity input 1
Selection polarity input 1 for selected "bolting" or "start measurement" (function 010) in **polarity input 1** function:
- **NO contact**: The input function becomes active if the input contact is closed (passive input) or voltage is applied (active input).
- NC contact: The input function becomes active if the input contact is opened (passive input) or the voltage level drops (active input).

Input 2
For selection options see input 1 (010)
Default: not used

Polarity input 2
For selection options see contact input 1 (011)
Default: NO contact

9.3.6 Advanced settings

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

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

Resetting errors
Delete the displayed errors in **clear error 072** function:
- **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.

Resettting the device
Reset to factory settings in **reset 073** function:
- 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.

9.3.7 Linearization

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

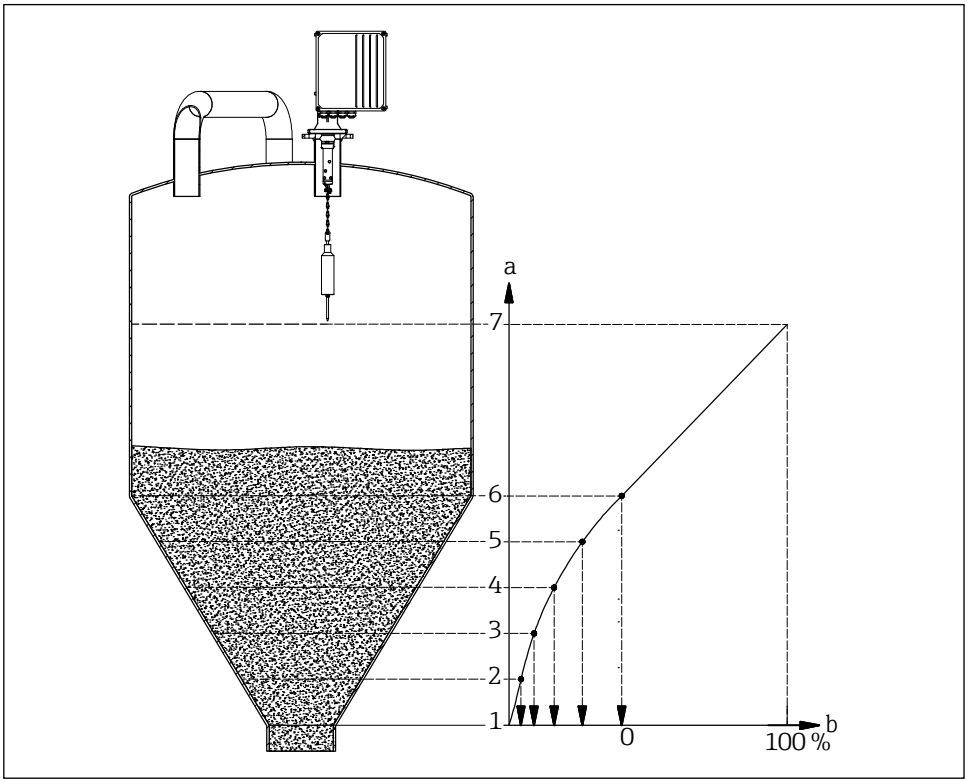
The reference point for residual distance and/or residual volume is the "full calibration (003)".

Linearization
Activation linearization (relationship between the fill level and the container volume and/or product weight and permits a measurement in customer units (CU)) in **linearization 051** function:
- **linear**: The relationship between the fill level and the container volume is linear.
- table on: Activates a previously entered linearization table.
- clear table: Deletes an existing linearization table
- manually: Enter a linearization table

Entering a linearization table
1. Select manual linearization (= enter a linearization table)
2. Select table point 1 (start with 1, maximum 32 points)
3. Enter the level pertaining to point 1
4. Enter the associated volume (weight)
5. Should another point be entered in the table?
6. Select table point 2

Continue either until 32 table points have been selected or until manual entry of the linearization table is completed by selecting "next point = no". Once the linearization table has been activated via "table on", linearization is activated.

If the customer unit (function 056) and/or maximum scale (function 057) is changed, the linearization table has to be re-entered and/or also adjusted!



15 *Manual linearization*

a Level marks
b Volume

- Before entering a linearization table, any tables still present from before must be deleted (linearization (051) = "delete table").
- Once a linearization table has been entered, it must be activated (linearization (031) = "table on").
- Once a linearization table has been entered, it can be deactivated by selecting "linear". This does not delete the table and it can be reactivated at any time by selecting "table on".

Customer unit

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

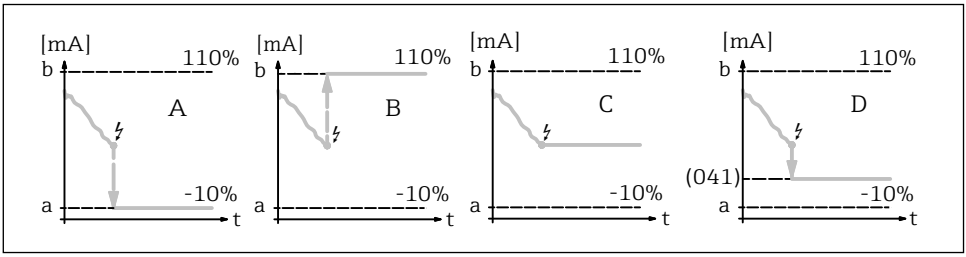
- **%** (Percentage)
- Weight: kg, t
- Volume: m^3, ft^3
- Length: m, ft, in

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

Range of values: 1 to 100000
Default: 100

9.3.8 Safety settings

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



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16 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

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

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

Safety distance → 22
Input minimum distance to parameterized zero point in **safety distance 042** function:

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

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

Security distance → 🖹22
Input security distance before block distance in **security distance 043** function:

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.

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:
- **warning**
- alarm

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:
- warning
- **alarm**

9.3.9 Service interval

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

Range of values: 1 to 90000
Default: 45000 (measuring tape made of stainless steel) / 10000 (measuring tape made of plastic)

- 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.

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

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.

9.3.10 Simulation

Simulation

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

- 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 (e.g. the limit value) 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 (e.g. the limit value) 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 (e.g. the limit value) do not follow the simulation value.

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

Simulation value

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

- 0 to 99 m (Level)
- 0 to 22.00 mA (Current)
- 0 to 100000 (Volume)

Protecting settings from unauthorized access

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

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

Enabling and disabling the keypad lock → 21

Resetting errors

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

- **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.

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