Kirchgaesser
Industrieelektronik GmbH

Technical Information
FMM50

Electromechanical level system

The simple and easy-to-understand level meter for all bulk solids and fluids

Application

- ► Measuring principle independent of physical properties like mass density
- ► Measuring of level in bunkers and silos with powdered, fine or coarse grain bulk solids or in vessels containing liquids
- ► Level measurements up to 90 m
- ► Process temperature of up to +230 °C (+446 °F)
- ► Process pressure up to 3 bar (43.5 psi) absolute
- ► Can be used in aggressive atmospheres, for example acid or alkali vapors
- ► Separation layer detection in fluids possible with suitable sensing weights

Your benefits

- ► Suitable for process conditions in which classic ultrasonic or radar level gauges do not work reliably
- ► Precise detection of the level (accuracy of ±5 cm or ±1 pulse)
- ► Compact device with 0/4 - 20 mA current output as well as further free programmable signal outputs (for example counter pulse)
- ► Quick menu-guided local operation using a 4-line text display
- ► Fully electronic digital minimum fail-safe control, therefore no running down of the sensor weight into the silo outlet and no risk to the conveying systems

Certified according to DIN EN ISO 9001
QM
QM system

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Function and system design

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 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)

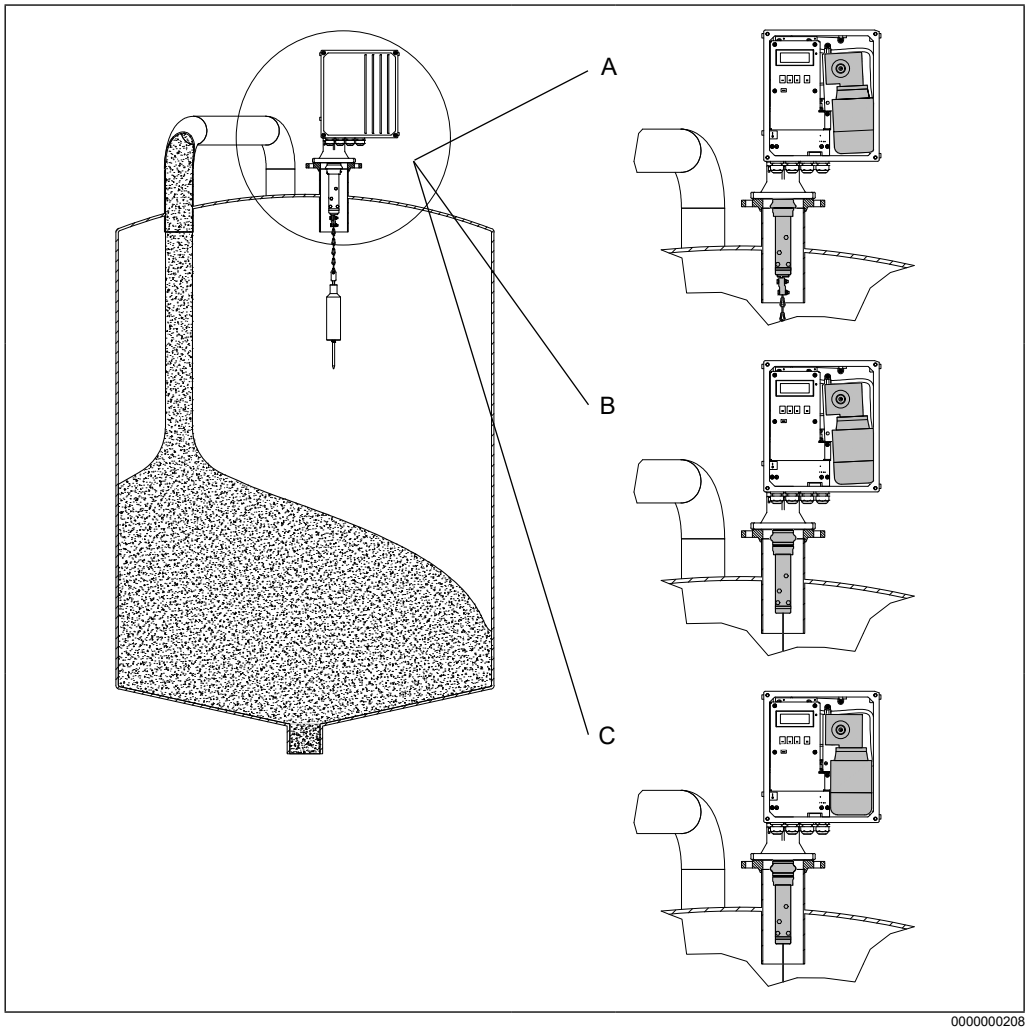

Figure 1: Measuring principle of the FMM50

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

During the entire measuring process (lowering and hoisting of the sensing weight) the device can also transmit pulses (relay output) corresponding to the length of the measuring tape, which can be recorded by a control unit or by an electromechanical counter.

Both individual measurements and periodic measurement sequences can be performed. The measurement can then be initiated manually (for example external start button) or periodically (for example programmed function of the device).

The unit is delivered with default values for the maximum measuring range according to the unit configuration (see ordering information). The menu-guided programming using the 4-line text display assures easy and fast adjustment to the bunker or silo geometry.

Measuring system

The measuring device is a compact transmitter with integrated microprocessor-controlled electronics, various in- and outputs are provided. The device can be adapted to different applications by choosing one of the suitable sensing weights.

- Type of housing and materials:
  Compact, Aluminium, optional coated
- Sensing weights and materials:
  - Steel, optional with umbrella made of Polyester
  - Stainless steel 316TI, optional with umbrella made of Polyester
  - Oval float made of plastic (PVC) or stainless steel
  - Variants for separation layer detection as accessories
- Configuration: Operation via 4-line local display with plain and help texts

Safety

The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

Security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Input

Measured variable

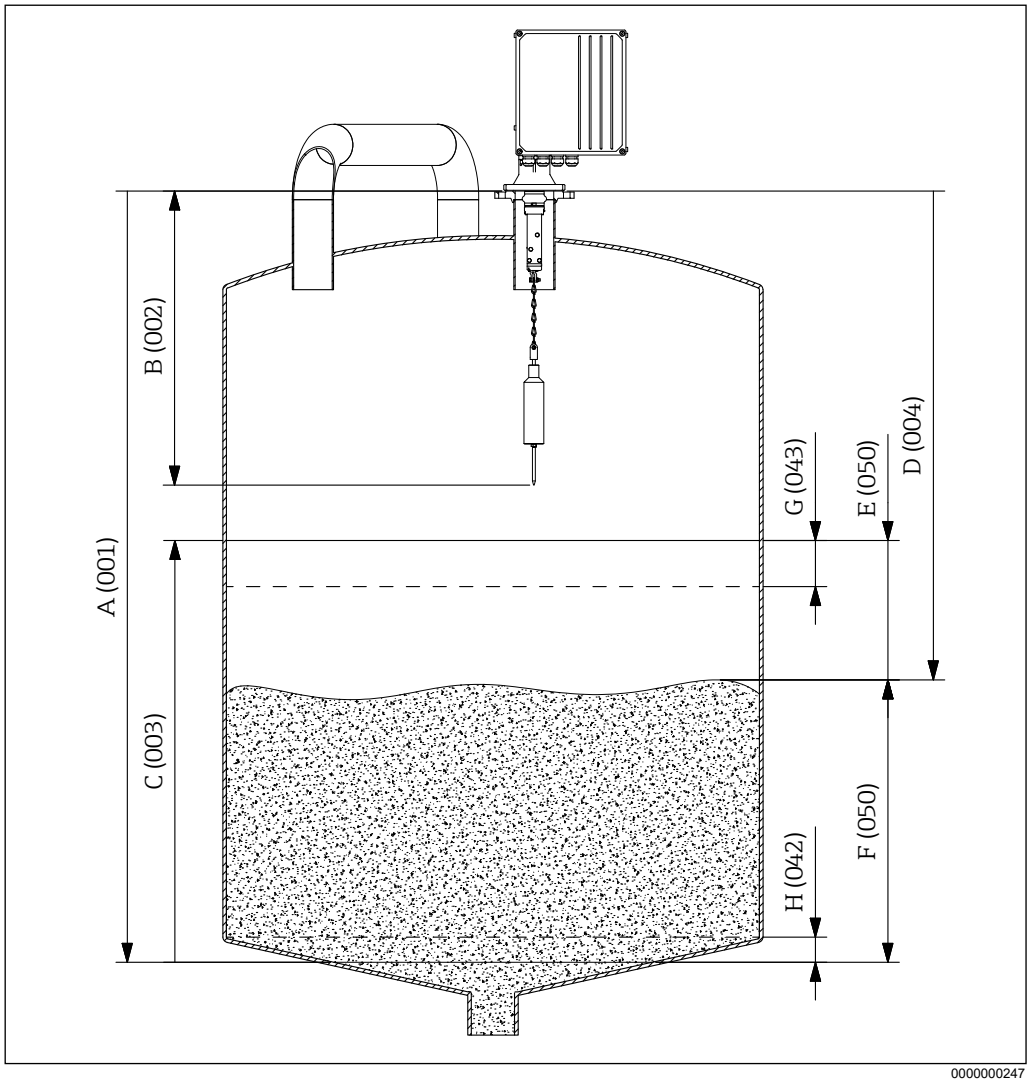

Figure 2: Parameters of the basic setup

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

Measured process value (D)
The measured value is the distance between the flange of the device minus a blocking distance (**B**) and the surface of the product.

Calculated process values
- The filling level (**F**) is computed taking into account the fixed given calibration values, for example the height of the silo (**A**).
- Furthermore, the residual volume (**E**) can be calculated as the difference between the level and the selected full calibration (**C**).
- The filling level can be converted to other values as desired, for example volume or mass, by the application of linearization.

Safety variables
The following calculated safety variables can be used as a warning if the measured value moves into these ranges.
- Security distance (**G**)
  Configurable range below the maximum measuring range (full calibration)
- Safety distance (**H**)
  Configurable range above the minimum measuring range (empty calibration)

Measuring range

Max. 90 m

The highest measurable point is given by the blocking distance plus a minimum descent length of 20 cm, this maximum length must be considered on input of the maximum measuring range (full calibration).

Block distance

The block distance (**B**) depends on the wiper length and the selected sensing weight.

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, N	0.63 m (24.80 in)	0.95 m (37.40 in)	1.45 m (57.09 in)

The individual value for the blocking distance is preset on delivery and only needs to be adjusted when changing the sensing weight for example, the relevant input option can be found in the menu.

Input signal

Remote operation possible via two inputs, each input can be assigned as either active or passive and is therfore usable.

Notice:
The device is available with an optional external start button, which is connected to the passive signal input 1. → Page 20

Inputs, active
- Connection of an external voltage
- Input voltage range: 12 to 24 V DC
- Input polarity: Normally open or normally closed
- Start pulse length: min. 200 ms

Inputs, passive
- Connection of an external command device, for example switch/button, relay contact
- Contact load: max. 0.3 W / 30 V DC
- Input polarity: Normally open or normally closed
- Start pulse length: min. 200 ms

Operating frequency

Measurement cycle

Min. 1 minute

Notice:
- When operating the measuring device, the minimum time for one measuring cycle depending on the ambient temperature and the measuring range must be observed, this time must be taken into account in all measuring modes. → Page 12
- Even with smaller measuring ranges, it is recommended not to go below a minimum time of 5 minutes for one measuring cycle.

Tape running speed
0.21 to 0.35 m/s

Output

Output signal

Current output

- 0/4 to 20 mA (active, 0 to 20 mA / 4 to 20 mA programmable)
- Max. 22 mA

Relay outputs

- Quantity: 2 (optional 6)
- Contact load: max. 250 V AC / 6 A

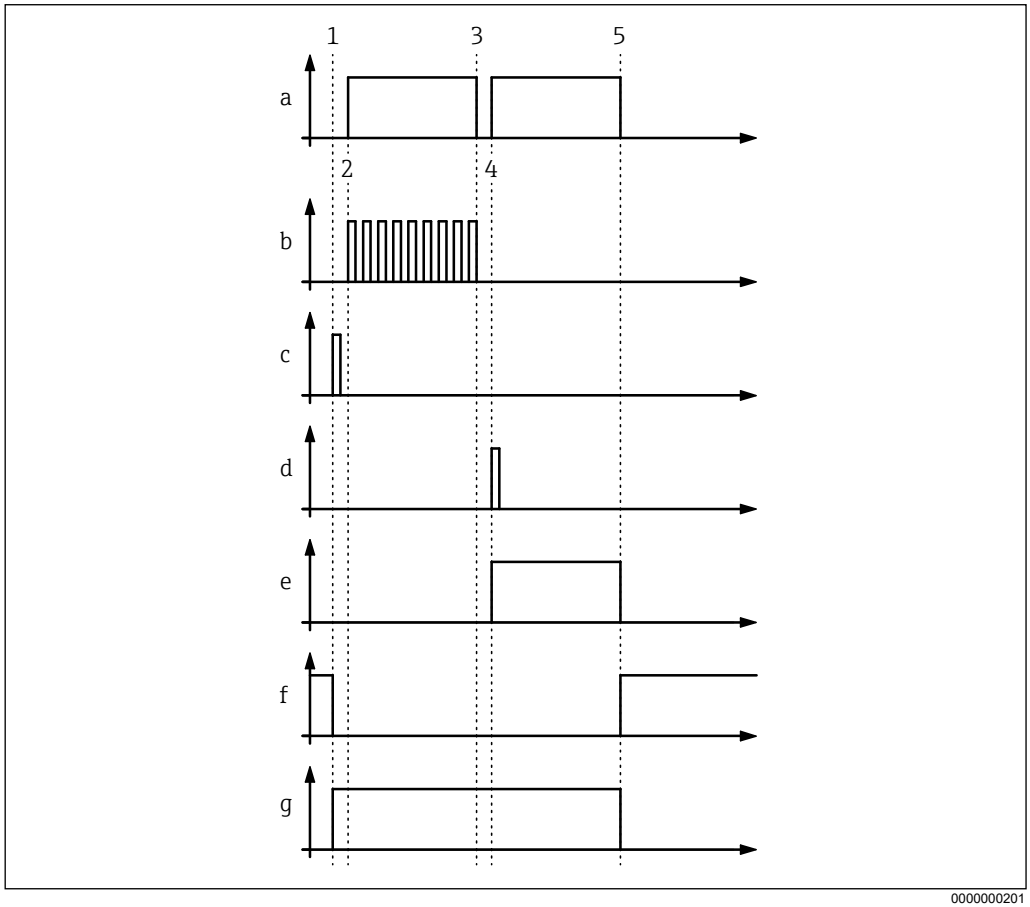

Figure 3: Programmable relay output functions

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
- Counter pulse (**b**)
  Output pulses that correspond to the length of unwound tape
- Reset pulse (**c**)
  Pulse before every new measurement
- Band return (**d**)
  Displays the lower reversal in direction of the tape (from tape run-down to tape run-up)
- Running up (**e**)
  Displayed when the tape runs back up
- Top position (**f**)
  Indicated when the upper end position is reached (end of measurement)
- Measuring (**g**)
  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
- Threshold
  Relay switches when a set threshold is exceeded or not reached

Notice:
A selected threshold with associated hysteresis applies for all relays, individual settings for each relay are not possible.

Signal on alarm

Malfunction signal can be called up via the following interfaces.

Local display
Error symbol, error code and description in plain text on the on-site display

Current output
- Minimum: minimum current value <= 3.6 mA (4-20 mA) or 0 mA (0-20 mA)
- Maximum: maximum current value + 10 % (22 mA)
- Programmable: current value 0 to 22 mA
- Hold: Last valid current value is held

Relay output
Alarm function

Load (Current output)

Max. 600 Ω

Linearization

The linearisation function of the device facilitates conversion of the measured value into engineering units such as cubic metres or hectolitres. If the filling level is not uniformly proportional to the volume within the set measuring range, then a linearization curve can be entered using a maximum of 32 reference values.

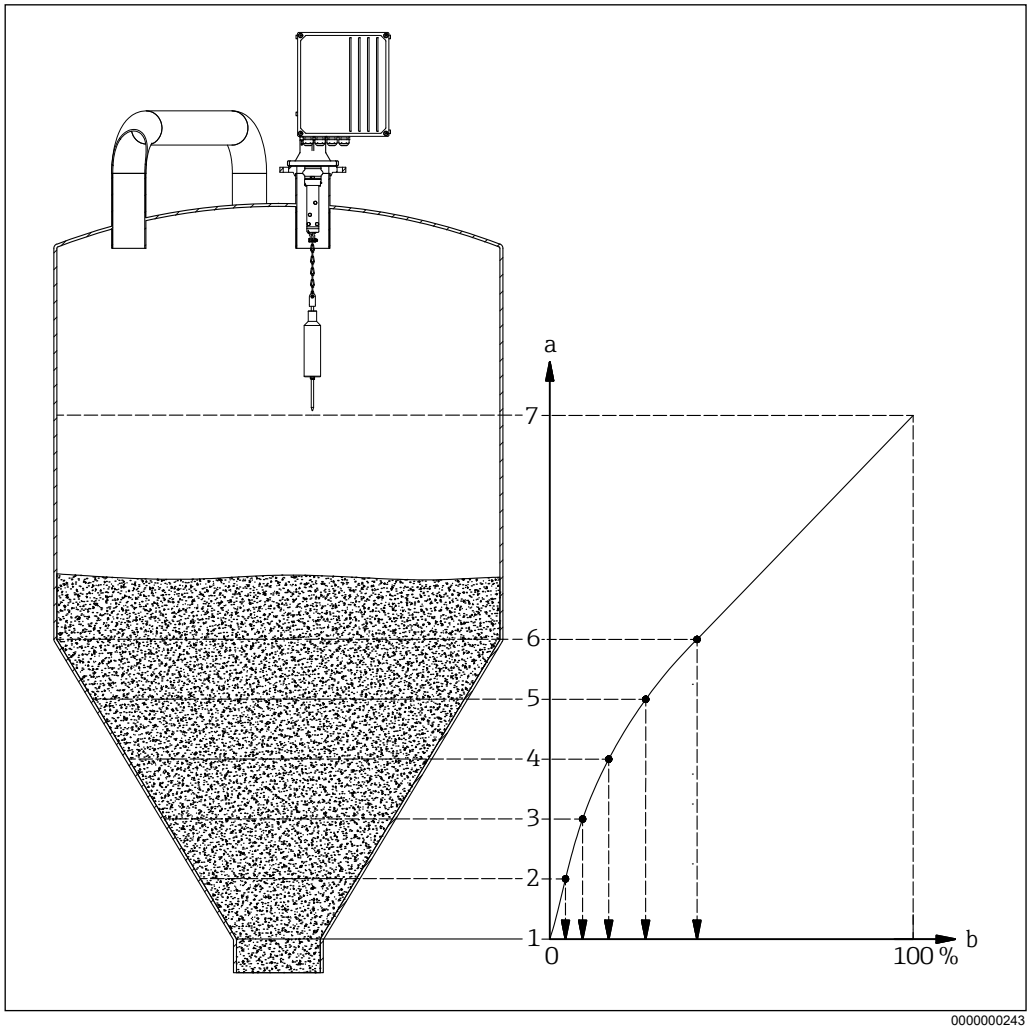

Figure 4: Manual linearization

a Level marks
b Volume

Power supply

Terminal assignment

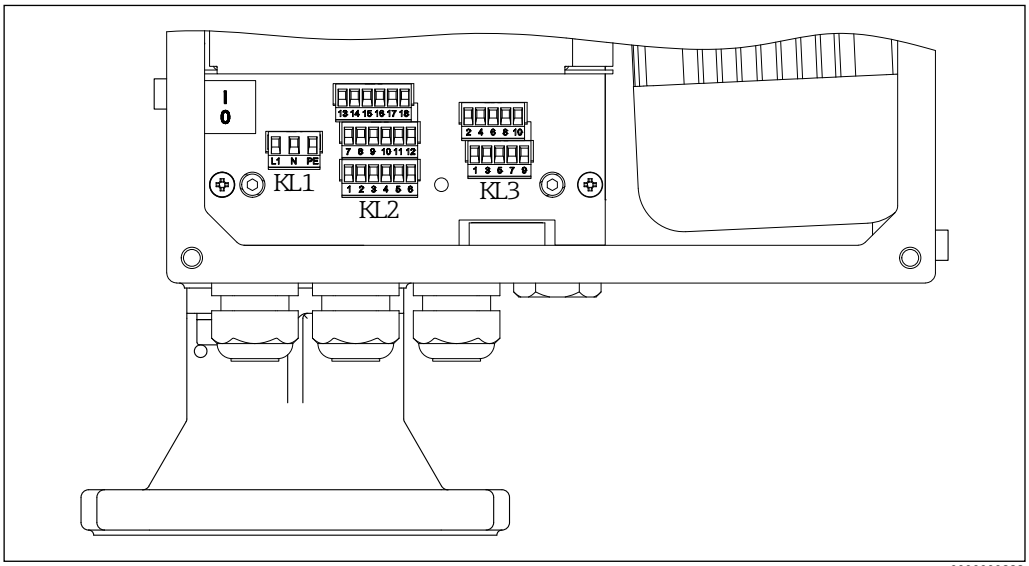

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Figure 5: Terminal assignment

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	

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	

The rest position matches with the position of the relays without power supply, this represents the alarm condition if the function "alarm" is selected.

Supply voltage

- 180 to 253 V AC, 50/60 Hz (Ordering code "**power supply**", option **1**)
- 90 to 127 V AC, 50/60 Hz (Ordering code "**power supply**", option **2**)
- Ieff = 8 A (115 V) for 40 ms / 4.4 A (230 V) for 20 ms
- Terminal assignment: 1.1 (L1) / 1.2 (N) / 1.3 (PE)

Notice:
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.
- Provide overcurrent protection device (max. 16 A) for the supply voltage.

Power consumption	• Max. 230 VA (Ordering code "**ambient temperature**", option **A** or **C**) • Max. 250 VA (Ordering code "**ambient temperature**", option **B** or **D**)
Power supply failure	• Configuration remains in the device memory • The current error is moved to the "previous error" function.
Potential equalization	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.
Terminals	• Max. 2.5 mm^2 (Supply voltage) • Max. 1.5 mm^2 (Signal inputs, relay outputs and current output)
Cable entries	• M25x1.5 • Clamping range: 10 to 17 mm (0.39 to 0.67 in) • Material: Plastic • Color: - grey (Ex-free area) - black (Ex approval) • Quantity: - 4 piece (Ordering code "**additional equipment**", option **1**) - 3 piece (Ordering code "**additional equipment**", option **2**)
Cable specification	• Minimum requirement: cable temperature range ≥ ambient temperature • Standard installation cable is sufficient for signal inputs, relay outputs and current output.

Performance characteristics

Measured value resolution	± 5 cm or ± 1 pulse (irrespective of the selected measuring range)
Maximum measured error	→ Measured value resolution

Influence ambient temperature

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

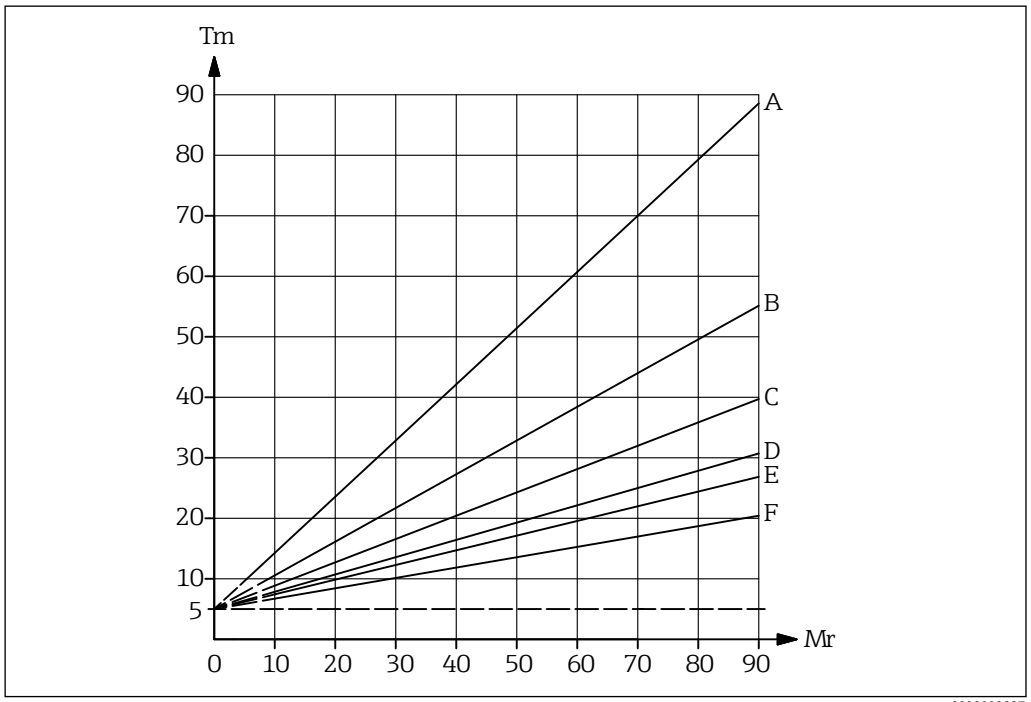

Figure 6: Minimum time for one measurement cycle

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

Mounting

Mounting location

- 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.

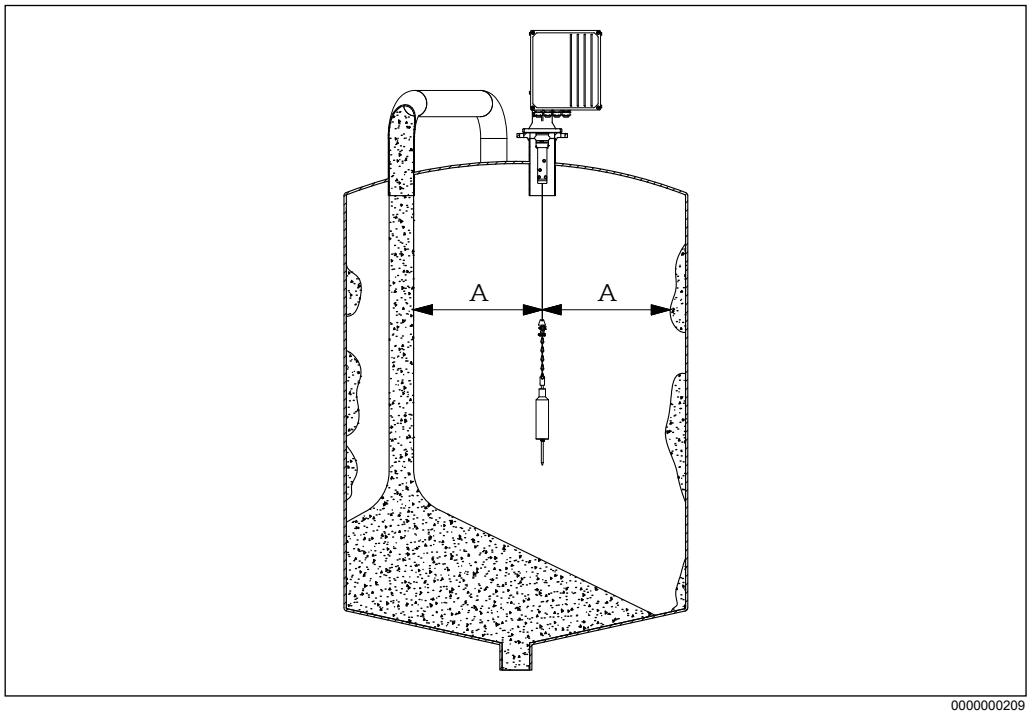

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Figure 7: Installation position

A Distance

Notice:
Take due account of the shape and location of the product inflow cone and the outflow funnel within the vessel.

Mounting position

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°). A suitable mounting aid (bubble level) can be found inside versions with a powder-coated housing. When the electronics cover is opened, this can be used for alignment.

Installation instructions

- 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.
- When mounting outdoors, use weather protection cover or attach weather protection roof.
- Normal weights, umbrella weights and bag weights can be passed through the DN100 mounting flange into the bunker/silo. When using larger sensing weights, such as cage weights, bell weights, floats and some bag-type weights, access provision must be present in the construction of the bunker/silo for installation of these weights.
- 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 mounting flange (airflow quantity as required). There is a G1⁄4 female connection provided for this purpose at the device flange.

Selection sensing weights

When selecting the sensing weight the following points should be considered:

- During the measuring process, the sensing weight must not sink into the product, nor must it be allowed to slide off the cone.
- The sensing weight must be suitable for the chemical properties of the filling material and the temperatures prevailing in the bunker or silo.
- Special types for your individual applications are available on request.

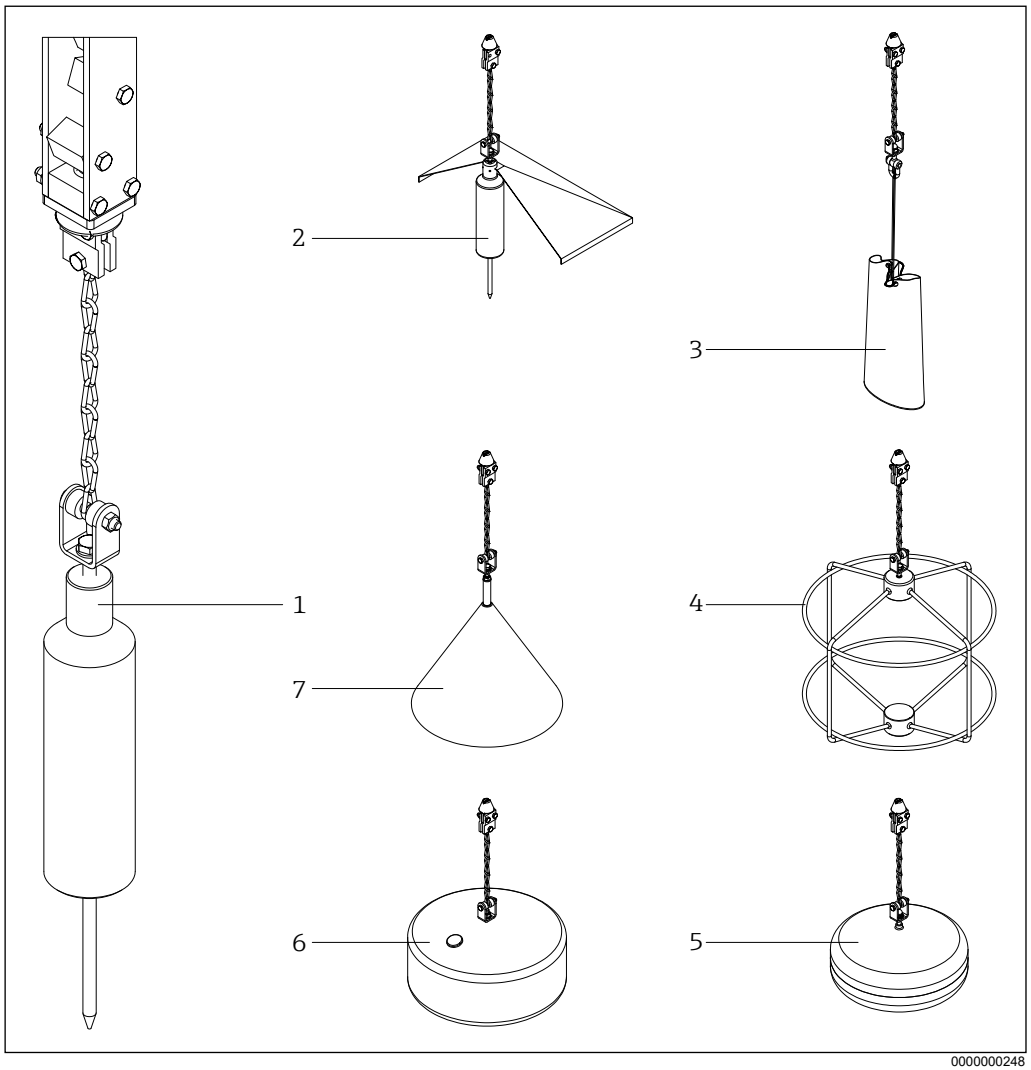

Figure 8: Sensing weight

Normal weight (1)

Ordering code "**sensing weight**", option **B** or **C**

- Application for coarse bulk materials, for example coal, ore or stones, and for granulates.
- Material: Steel or stainless steel 316Ti (1.4571)
- Weight: 3.5 kg
- The spike can be taken off.

Umbrella weight (2)

Ordering code "**sensing weight**", option **D** or **E**

- Application for very light and loose bulk solids, for example flour or coal-dust.
- Material: Steel or stainless steel 316Ti (1.4571), Polyester
- Weight: 3.9 kg (option D) / 3.8 kg (option E)
- Maximum permissible temperature: +150 °C (+302 °F)
- When folded closed, the weight can be passed through the DN100 mounting flange into the bunker.
- The umbrella weight has a large square surface area which prevents it from sinking deeply into the product.

Medium bag (3)

Ordering code "**sensing weight**", option **G**

- Application in bunkers to which for example mills are connected down-stream. The bag contains whichever product is contained within the bunker.
- Material: Bag made of polyester, all metal parts made from stainless steel
- Weight: 0.25 kg (empty) / 3.5 kg (filled)
- Maximum permissible temperature: +150 °C (+302 °F)
- The bag shall be closed at the top to prevent the contents from falling out if the bag tips over when it hits the slope of a dump cone.

Cage weight (4)

Ordering code "**sensing weight**", option **J**

- For fine bulk solids in silos with relatively small outlet openings that must not be blocked by a sensing weight which has broken free. Also suitable for high temperatures for which a bag may not be used.
- Material: Stainless steel 316Ti (1.4571)
- Weight: 3.5 kg
- The weight could become lodged over the product outlet, but would allow the bulk solid to pass through. Since the cage weight cannot enter a conveyor system (for example cellar wheel feeder or screw conveyor), no damage can result.

Oval float (5+6)

- Application for liquids, for example fuel oil, also for granulates.
- The float must be filled with product to a total weight of 3.5 kg.
- If the bunker/silo has a downstream crushing or milling system, we recommend using the electrical signal function "tape breakage" or the use of a cage weight to avoid damaging the system in the event of the sensing weight breaking free.

Ordering code "**sensing weight**", option **N** (5)

- Material: Stainless steel 316Ti (1.4571)

Ordering code "**sensing weight**", option **M** (6)

- Material: Hard PVC (maximum permissible temperature: 0 to +60 °C (+32 to +140 °F))
- Use of the oval float made of hard PVC in the "Dust ignition-proof" version is not permitted!

Bell weight (7)

Ordering code "**sensing weight**", option **L**

- For light and loose bulk solids; especially where higher temperatures and particular characteristics preclude the use of an umbrella weight.
- Material: Stainless steel 316Ti (1.4571)
- Weight: 4.3 kg

Special installation

Weather protection cover

When using the protectin hood available as an accessory, a free height of at least 400 mm (15.75 in) is required above the measuring device for mounting.

Weather protection cover → Page 27

Environment

Ambient temperature

- -20 to +70 °C (-4 to +158 °F) (The readability of the display may be impaired at temperatures outside the temperature range.)
- -40 to +70 °C (-40 to +158 °F) using the self-regulating device heater

Storage temperature

-40 to +80 °C (-40 to +176 °F)

Degree of protection

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

Electromagnetic compatibility

- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity to EN 61326, Appendix A (Industrial)

Process

Process temperature

- -20 to +70 °C (-4 to +158 °F), Ordering code "**process temperature**", option **1**
- -20 to +150 °C (-4 to +302 °F), Ordering code "**process temperature**", option **2**
- -20 to +230 °C (-4 to +446 °F), Ordering code "**process temperature**", option **3**
- Observe deviating temperature ranges for the accessories offered!

The maximum process temperature at the unit from the bottom of the adaptor flange upwards is +70 °C (+158 °F). In the presence of higher process temperatures in the vicinity of the mounting location, suitable installation provisions must be utilized to assure these temperature guidelines.

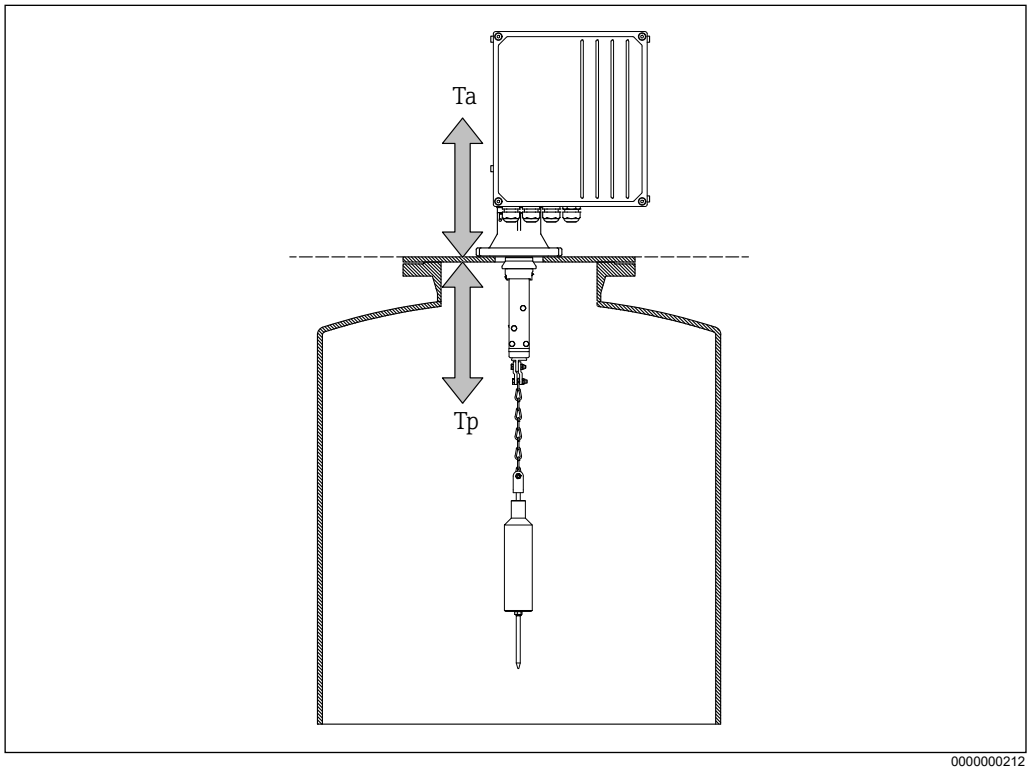

Figure 9: Permissible ambient temperatures at the FMM50

Ta -20 to +70 °C (-4 to +158 °F)
-40 to +70 °C (-40 to +158 °F) using the self-regulating device heater
Tp -20 to +230 °C (-4 to +446 °F)

Notice:
- An extension for the process connection can be used to separate the device from the higher process temperatures. The maximum allowed temperature of +70 °C (+158 °F) can be met through this. The required length of the connection nozzle is dependant on the actual process and ambient conditions.
- We recommend the following minimum length of the process connection nozzle:
  - 500 mm at process temperatures up to 150 °C (+302 °F)
  - 1000 mm at process temperatures up to 230 °C (+446 °F)
- Suitable process adapter extensions with a length of 790 mm for use with 1000 mm wiper are available as accessory. → Page 27
- When using process nozzles with longer lengths than 230 mm (length of the standard wiper), longer wipers can be ordered as a device option. Alternatively, the length of the chain between tape border and sensing weight can be increased, corresponding parts are available as an accessory.

Process pressure

- 0.8 to 1.1 bar (12 to 16 psi) absolute, Ordering code "**process pressure**", option **1**
- 0.8 to 3.0 bar (12 to 43 psi) absolute, Ordering code "**process pressure**", option **2**

Heating

It is recommended that at ambient temperatures below 0 °C (+32 °F) a device with integrated heater is chosen (ordering code "**ambient temperature**", option **B** and **D**).

Vibration

Due to the layout, the device should not be exposed to vibration. The pendular motion of the motor combined with vibrations can lead to erratic triggering of the tape switch and therefore to faulty measurements.

Mechanical construction

Dimensions

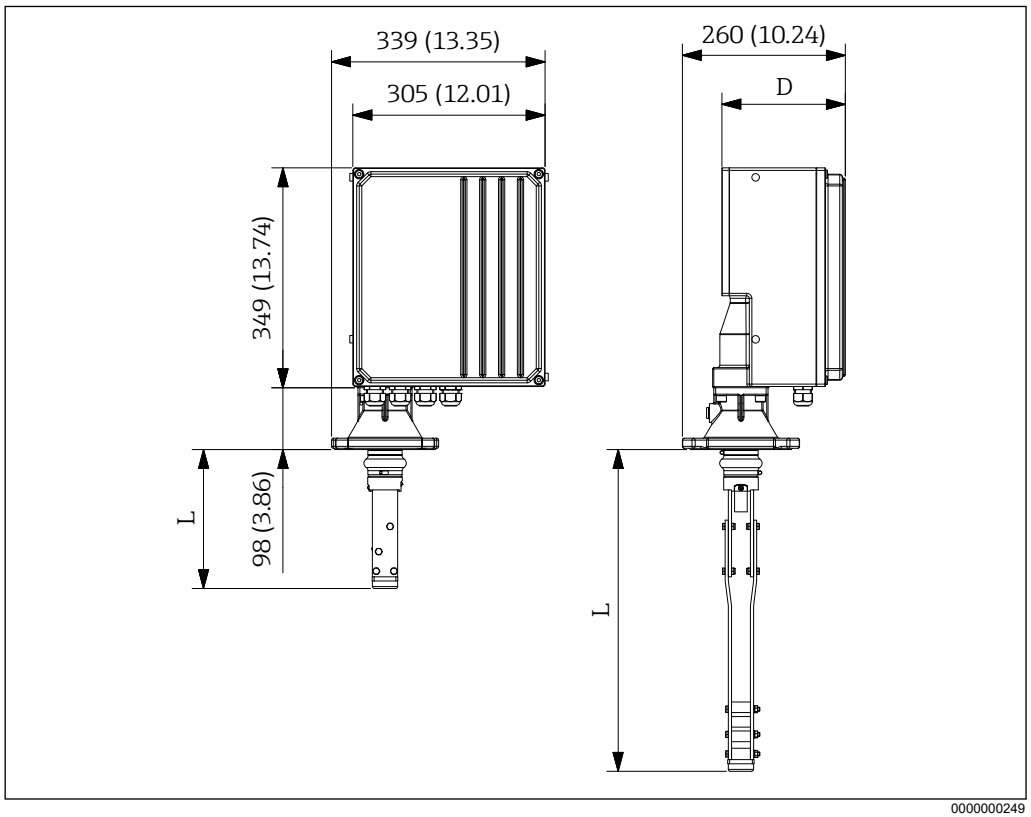

Figure 10: Housing dimensions. Unit of measurement mm (in)

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**

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**

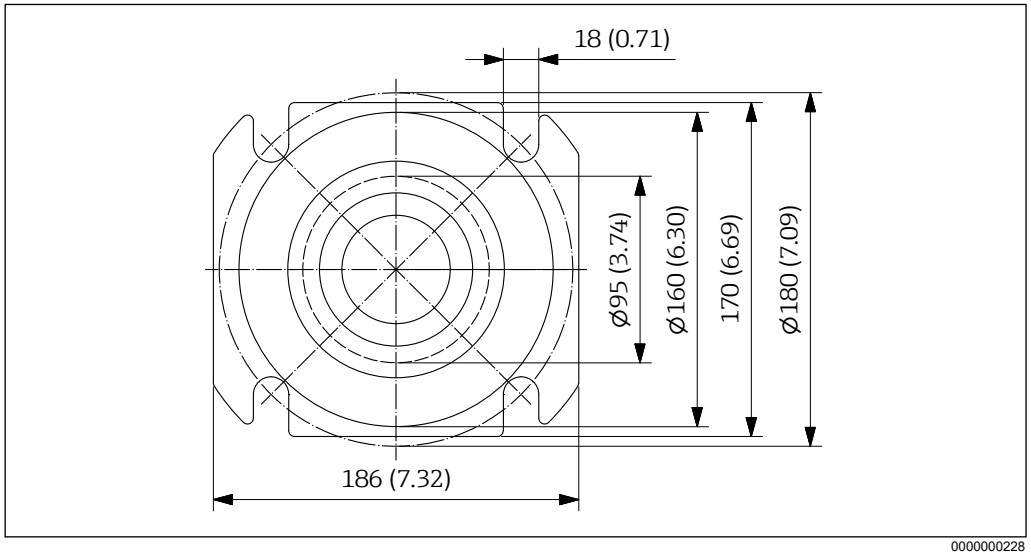

Figure 11: Dimensions of the process connection. Unit of measurement mm (in)

Notice:
Minimum process connection diameter of 95 mm (3.74 in) for installation of wiper mechanism and sensing weights

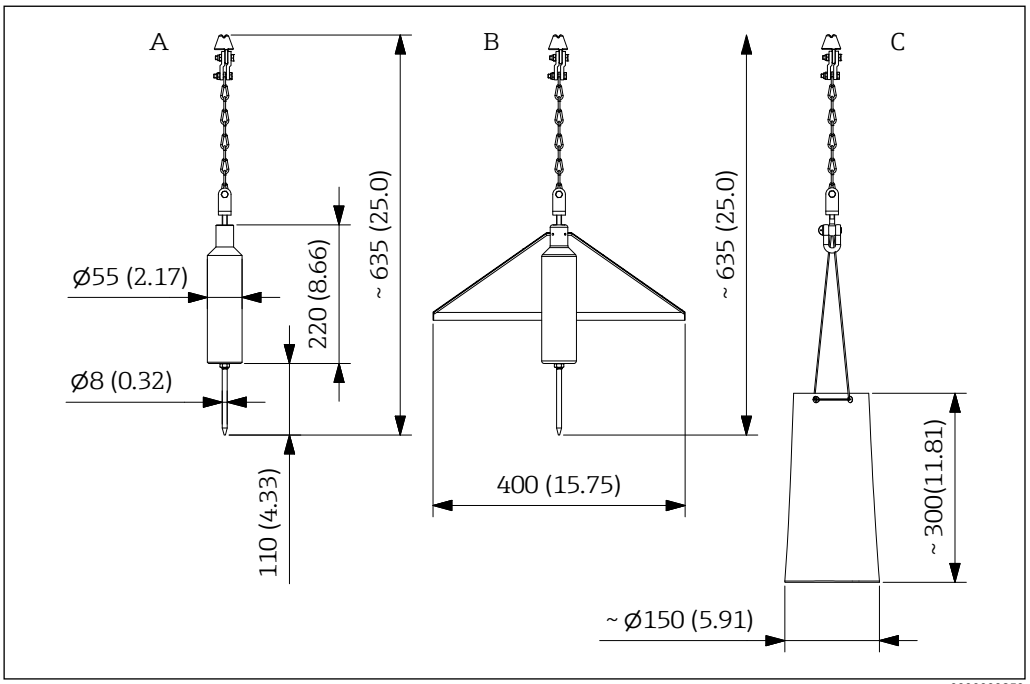

Figure 12: Dimensions of sensing weights - Standard (with umbrella) and medium bag. Unit of measurement mm (in)

A Normal weight
B Umbrella weight
C Medium bag

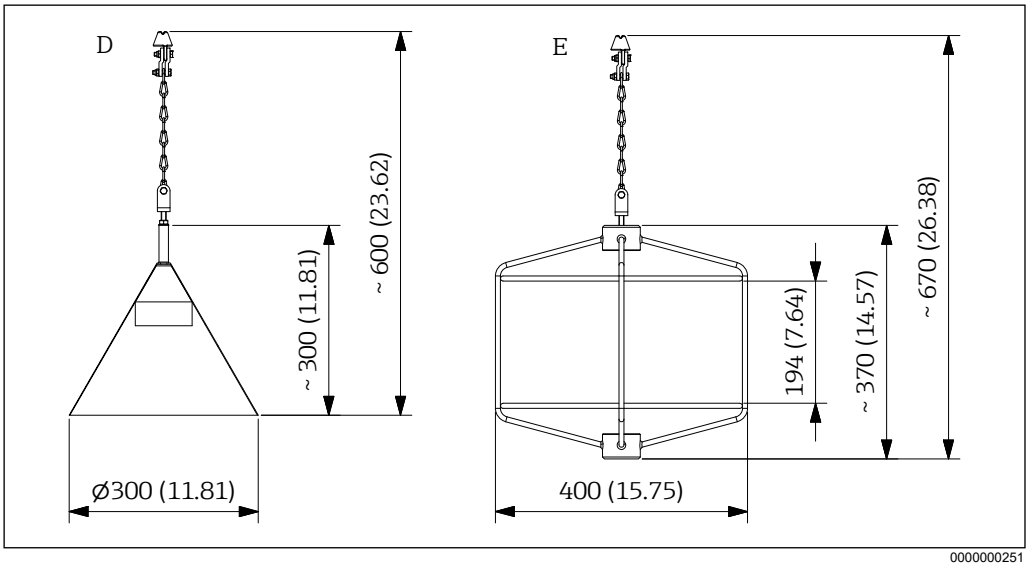

Figure 13: Dimensions of sensing weights - Bell and cage. Unit of measurement mm (in)

D Bell weight
E Cage weight

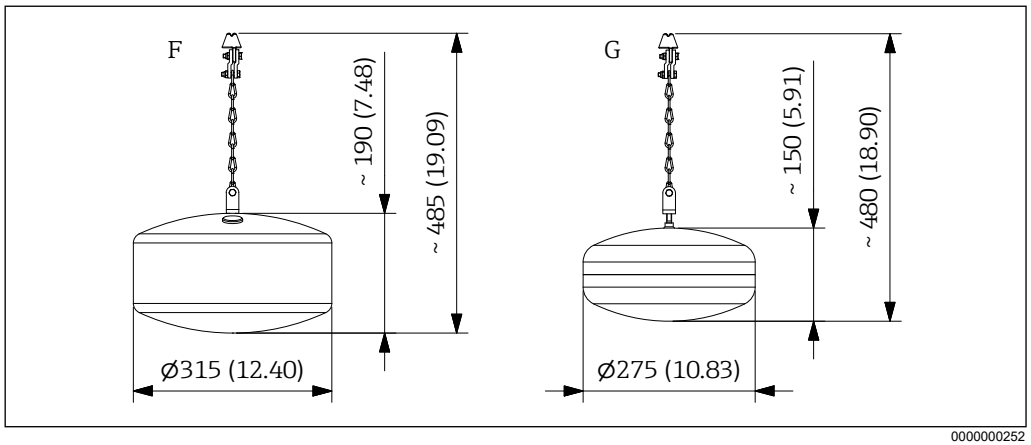

Figure 14: Dimensions of sensing weights - Oval float. Unit of measurement mm (in)

F Oval float (plastic)
G Oval float (stainless steel)

Weight

- 22 to 28 kg (depends on the selected type of device, without sensing weight)
- Sensing weight → Page 13

Materials

- Housing: Aluminum (optional coated, RAL 5012 and RAL 7035)
- Wiper: Aluminum/steel or stainless steel
- Measuring tape: Stainless steel or plastic
- Sensing weight → Page 13

Process connection

- Flange
- Hole dimensions DN100 PN16 according to EN 1092-1

Operability

Operation concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning
Menu guidance with brief explanations of the individual parameter functions

Reliable operation
- Operation in the following languages: English, German, French, Japanese
- Other operating languages can be ordered optionally (product configurator)
- Help texts in the selected language

Efficient diagnostics increase measurement availability
- Display of the current and the previous error
- Help texts for every occuring error
- Various simulation options

The parameterization is stored internally and is retained even after the supply voltage is removed. No operation is required while the device is working. Adaptation to the application must only be carried out during initial installation. However, subsequent changes can be made and saved at any time.

On-site operation

Operating elements

- Local operation (parameterization) with 3 push buttons (**1**): −, +, E
- Local operation (start measuring) with one push button (**2**), optional with external start button (**3**), ordering code "**additional equipment**", option **2**

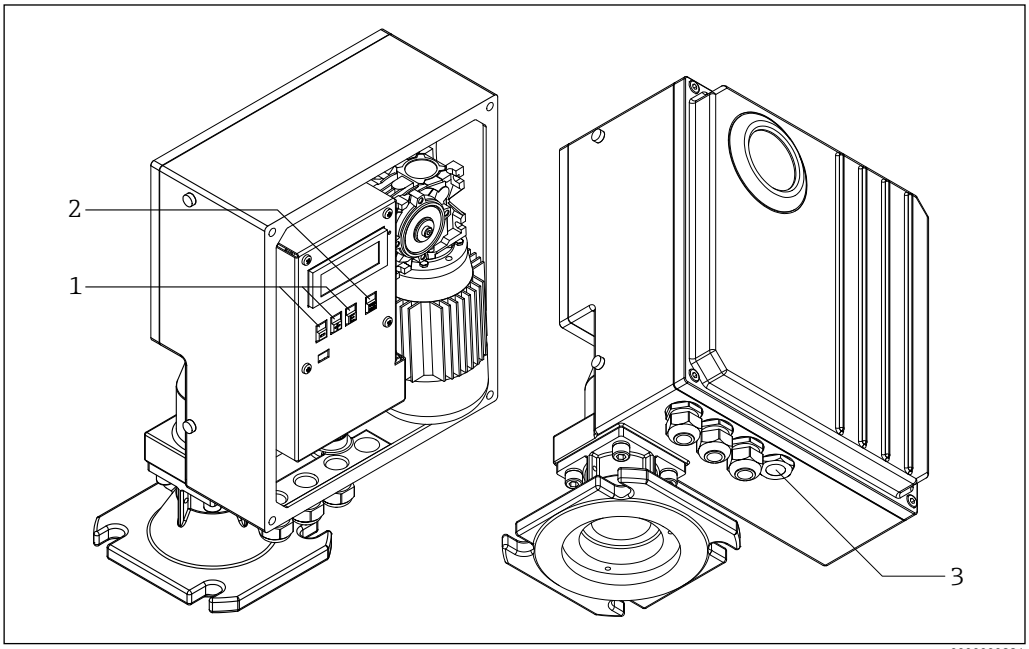

Figure 15: On-site operation

1 Operating keys for configuration
2 Operation key start measurement
3 Operation key start measurement, external

Display elements
• 4-line display
• 20 characters per line
• Display contrast adjustable by using a key combination
• Display of measurand numeric and graphic

Notice:
Permitted ambient temperature for the display: -20 to +70 °C (-4 to +158 °F), the readability of the display may be impaired at temperatures outside the temperature range.

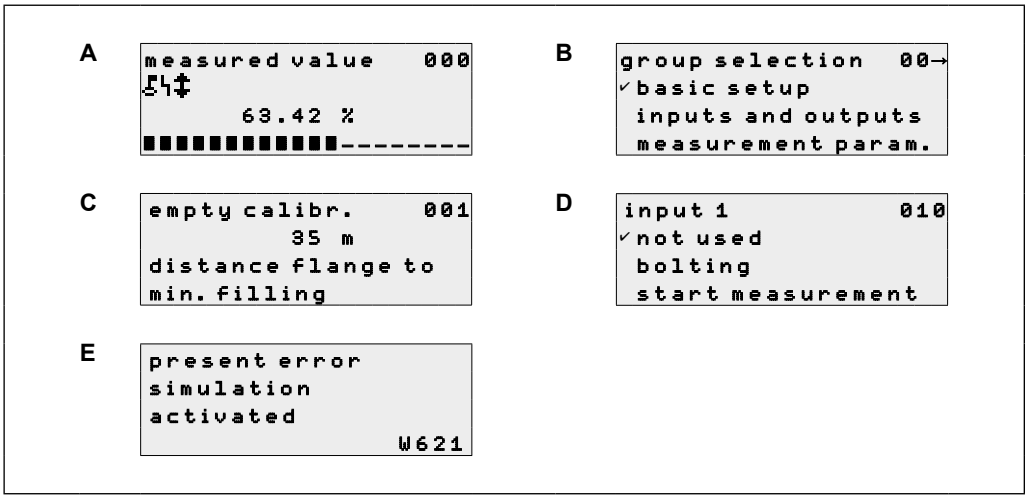

Figure 16: Display options

A Operational display (measured value display)
B Navigation view
C Entering a value
D Selecting a value
E Diagnostic messages

Languages

- Deutsch
- English
- Francais
- Katakana, Japanese
- Other operating languages can be ordered optionally (product configurator)

Safety Instructions

Features of the ATEX version

- Marking:
  Ⓔx II 1/2D Ex ta/tb IIIC T99°C Da/Db
  II 2D Ex tb IIIC T99°C Db
- Certification number:
  BVS 05 ATEX E 001

Designated use

- The FMM50 may only be operated when the housing is closed.
- The FMM50 version certified according to ATEX must only be repaired by the manufacturer.
- The requirements laid down in EN 60079, for example relating to dust deposits and temperatures, must be observed.
- Please take care that the ambient temperature will not be greater than +70°C, even if the process temperature range is between +70°C and +230°C. Use special equipment (e.g. process adapter extension) or select possible mounting position to keep this condition.

Installation instructions

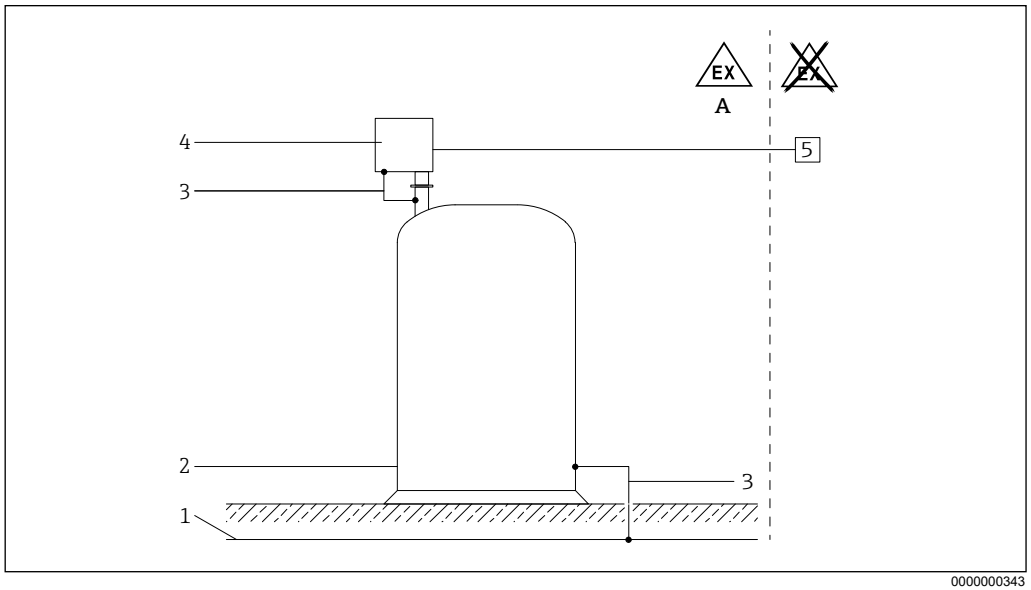

Figure 17: Installation instructions

A Zone 21
1 Potential equalization
2 Vessel (Zone 20, Zone 21)
3 Potential matching line
4 FMM50
5 Power and signal circuits

Certificates and approvals

CE mark

The level meter FMM50 is in conformity with the statutory requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.
By applying the CE mark, Kirchgaesser confirms that the device has passed the necessary tests.

RoHS

The level meter complies with the substance restrictions of the Restriction of Hazardous Substances Directive 2011/65/EU and the Delegated Directive 2015/863/EU.

Ordering information

Ordering information FMM50

10	**Approval:**						
	A	Ex-free area					
	B	ATEX II 1/2D Ex ta/tb IIIC T99°C Da/Db					
		ATEX II 2D Ex tb IIIC T99°C Db					
	Y	Special version, to be specified					
20		**Housing:**					
		1	Aluminum				
		2	Aluminum, coated				
		9	Special version, to be specified				
30			**motor traction power:**				
			A	Max. 250 N, bulk density low			
			B	Max. 500 N, bulk density high			
			Y	Special version, to be specified			
40				**Measuring range:**			
				1	25 m, stainless steel (301, modified)		
				2	35 m, stainless steel (301, modified)		
				3	50 m, stainless steel (301, modified)		
				4	70 m, stainless steel (301, modified)		
				5	90 m, stainless steel (301, modified)		
				6	15 m, Plastic (PE, PP coated)		
				9	Special version, to be specified		
50					**Max. nozzle height; tape wiper:**		
					A	230 mm, aluminum/steel	
					B	230 mm, stainless steel	
					C	500 mm, aluminum/steel	
					D	500 mm, stainless steel	
					E	1000 mm, aluminum/steel	
					F	1000 mm, stainless steel	
					Y	Special version, to be specified	

60						**Supply voltage:**							
						1	180 to 253 V AC, 50/60 Hz						
						2	90 to 127 V AC, 50/60 Hz						
						9	Special version, to be specified						
70							**Output:**						
							A	0/4 to 20 mA + 2x relay, adjustable					
							B	0/4 to 20 mA + 6x relay, adjustable Relay functions: counting, reverse, upwards, max. position, alarm, limit or measuring active					
							Y	Special version, to be specified					
80								**Ambient temperature:**					
								A	-20 to +70 °C				
								B	-40 to +70 °C + heater				
								C	-20 to +70 °C + extended climate resistance				
								D	-40 to +70 °C + extended climate resistance + heater				
								Y	Special version, to be specified				
90									**Process temperature:**				
									1	-20 to +70 °C			
									2	-20 to +150 °C			
									3	-20 to +230 °C			
									9	Special version, to be specified			
100										**Process pressure:**			
										1	0.8 to 1.1 bar (12 to 16 psi) absolute		
										2	0.8 to 3.0 bar (12 to 43 psi) absolute		
										9	Special version, to be specified		
110											**Sensing weight:**		
											A	Without	
											B	Steel	
											C	Stainless steel	
											D	Steel + umbrella	
											E	Stainless steel + umbrella	
											G	Medium bag	
											J	Stainless steel cage	
											L	Stainless steel bell	
											M	Oval float (PVC)	
											N	Oval float (316Ti)	
											Y	Special version, to be specified	
120												**additional equipment:**	
												1	basic version
												2	sight glass + start button (external)
												9	Special version, to be specified

Extended order code

The following order code is optional:

130	**Other operating languages: *1**	
	AR	Czech
140	**Service: *1**	
	IM	User-specific settings
	I7	Product documentation on paper
	I9	Special version, to be specified
150	**Test, certificate, declaration: *1**	
	KH	Final inspection report
	K9	Special version, to be specified
160	**Accessories mounted: *1**	
	NA	Process adapter as replacement for the standard adapter, 150 lbs, ASME, RF 4", aluminum
	NB	Process adapter as replacement for the standard adapter, 150 lbs, ASME, RF 4", aluminum, coated
	N9	Special version, to be specified
170	**Accessories enclosed: *1**	
	PA	Weather protection cover
	SD	Chain, 2.00 m (78.74 in), 316
	TA	Adapter flange DN150 PN16, 316Ti
	TB	Adapter flange DN150 PN16, steel
	TC	Adapter flange DN200 PN16, 316Ti
	TD	Adapter flange DN200 PN16, steel
	TE	Adapter flange 6" 150 lbs, 316Ti
	TF	Adapter flange 6" 150 lbs, steel
	TG	Adapter flange 8" 150 lbs, 316Ti
	TH	Adapter flange 8" 150 lbs, steel
	TI	Adapter flange DN100 PN25/40, 316Ti
	TJ	Adapter flange DN100 PN25/40, steel
	TK	Adapter flange 4" 300 lbs, 316Ti
	TL	Adapter flange 4" 300 lbs, steel
	TM	Adapter flange 4" 600 lbs, 316Ti
	TN	Adapter flange 4" 600 lbs, steel
	UA	Process adapter DN50 PN16, 316Ti
	UB	Process adapter DN50 PN16, steel
	UC	Process adapter DN65 PN16, 316Ti
	UD	Process adapter DN65 PN16, steel
	UE	Process adapter DN80 PN16, 316Ti
	UF	Process adapter DN80 PN16, steel
	UG	Process adapter 2" 150 lbs, 316Ti
	UH	Process adapter 2" 150 lbs, steel
	UI	Process adapter 3" 150 lbs, 316Ti
	UJ	Process adapter 3" 150 lbs, steel
	UK	Process adapter 4" 150 lbs, 316Ti

170	**Accessories enclosed: *1**	
	UL	Process adapter 4" 150 lbs, steel
	UM	Process adapter with spray water cleaning
	UN	Process adapter extension, 316Ti
	VA	Sensing weight for separation layer detection HD, 316Ti
	VB	Sensing weight for separation layer detection, HD, 316Ti, PP coated
	VC	Sensing weight for separation layer detection LD, 316Ti
	VD	Sensing weight for separation layer detection, LD, 316Ti, PP coated
	V9	Special version, to be specified
180	**Marking: *1**	
	Z1	Measuring point (TAG), see additional specification

*1 Multiple selection possible

Comments regarding the product structure

For devices with certification, the following restrictions apply:
- Measuring range (**40**): (**6**) not permitted
- Sensing weight (**110**): (**M**) not permitted
- additional equipment (**120**): (**2**) not permitted

The following limitations apply to devices with a process temperature range of up to +150 °C:
- Sensing weight (**110**): (**M**) not permitted

The following limitations apply to devices with a process temperature range of up to +230 °C:
- Sensing weight (**110**): (**D**), (**E**), (**G**) and (**M**) not permitted

Other limitations:
- Ambient temperature (**80**): (**C**) and (**D**) only in conjunction with coated housing

Notice:
- We recommend a nozzle of 400 - 500 mm height with process temperatures from +70 °C up to +150 °C (**FMM50-********2*****) for a temperature reduction. In this case a wiper length of 500 mm must be used.
- We recommend a nozzle of 900 - 1000 mm height with process temperatures from +70°C up to +230°C (**FMM50-********2*****) for a temperature reduction. In this case a wiper length of 500 mm must be used.

Scope of delivery

The scope of delivery includes a minimum of the FMM50 in one cardboard box.
Depending on the ordering code the following additional parts are supplied:
- Sensing weight (option **J**, **L** and **M** in one separate cardboard box)
- Wiper extension 500/1000 mm in one separate cardboard box
- Accessories (usually packed separately)

User-specific settings

The extended order code (services (140) = IM) is used to preset all settings of the FMM50 ex works according to customer requirements. For this purpose, the corresponding equipment variant (**FMM50-************+IM**) must be selected when ordering and the "Customer-specific settings" form (ad042010en, see next page for form) must be enclosed.

User-specific settings

Kirchgaesser
Industrieelektronik GmbH

The order option for FMM50 with user-specific settings requires that all necessary parameters and options are mentioned. Whereever informations are missing, default values will be used. This completed form must be supplied with every order.

Order code: **FMM50 -** | | | | | | | | | | | | |

Settings basic setup, display and system parameters

001 empty calibr.	003 full calibration	020 measure. type	021 time interval	022 time unit	023 normal or short	024 serv. interv.
_____ m/ft/in	_____ m/ft/in	❑ **single cycle** ❑ periodical	_____ [022]	❑ **h** ❑ min.	❑ **normal** ❑ short	_____
028 run up length	**060 language**	**061 back to home**	**062 no. of decim.**	**080 tag no.**	**083 distance unit**	
_____ m/ft/in	❑ **English** ❑ Deutsch ❑ Français ❑ ニホソゴ	_____ s (default: 100)	❑ X ❑ X.X ❑ **X.XX** ❑ X.XXX	_____ (max. 16 digits)	❑ **m** ❑ ft ❑ in	

Settings inputs and current output

010 input 1	011 Polarity input 1	012 input 2	013 polarity input 2
❑ **not used** ❑ bolting ❑ start measurement	❑ NC contact ❑ **NO contact**	❑ **not used** ❑ bolting ❑ start measurement	❑ NC contact ❑ **NO contact**
030 current mode	**031 0/4 mA value**	**032 20 mA value**	**033 current range**
❑ **normal** ❑ magnify	_____ [056]	_____ [056]	❑ **4-20 mA** ❑ 0-20 mA

Settings relay outputs

014 relay 1	01A relay 2	01B relay 3	01C relay 4	01D relay 5	01E relay 6
❑ **alarm** ❑ service interval ❑ counter pulses ❑ reset pulse ❑ running up ❑ top position ❑ measuring ❑ threshold ❑ band return	❑ alarm ❑ **service interval** ❑ counter pulses ❑ reset pulse ❑ running up ❑ top position ❑ measuring ❑ threshold ❑ band return	❑ alarm ❑ service interval ❑ counter pulses ❑ reset pulse ❑ running up ❑ top position ❑ **measuring** ❑ threshold ❑ band return	❑ alarm ❑ service interval ❑ counter pulses ❑ reset pulse ❑ running up ❑ top position ❑ measuring ❑ **threshold** ❑ band return	❑ alarm ❑ service interval ❑ counter pulses ❑ **reset pulse** ❑ running up ❑ top position ❑ measuring ❑ threshold ❑ band return	❑ alarm ❑ service interval ❑ counter pulses ❑ reset pulse ❑ running up ❑ top position ❑ measuring ❑ threshold ❑ **band return**
015 pulse value	**016 pulse length**	**017 limit value**	**018 hysteresis**	**019 reset pulse**	
_____ (default: 1)	_____ ms (default: 50)	_____ % (default: 60)	_____ % (default: 3)	_____ ms (default: 300)	

Safety settings and linearization

040 output on alarm	041 output on alarm	042 safety distance	043 security distance	044 in security distance
❑ **MIN (0/3.6mA)** ❑ MAX (22mA) ❑ hold ❑ user-specific	_____ mA	_____ [083]	_____ [083]	❑ **warning** ❑ alarm
045 in safety distance	**050 level/volume**	**051 linearization**	**056 customer unit**	**057 max. scale**
❑ **warning** ❑ alarm	❑ **level CU** ❑ ullage CU ❑ level DU ❑ ullage DU	❑ **linear** ❑ manually *1 ***1 you need to enter manually a linearization curve**	❑ **%** ❑ ft^3 ❑ kg ❑ m ❑ t ❑ ft ❑ m^3 ❑ in	_____ [056]

Note:
• The bold marked options are the default values.
• Settings like "_____ [123]" relate to the option you select in function 123.

ad042010en/Rev. 1.0

Accessories

Device specific accessories

Weather protection cover

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 400 mm (15.75 in) above the measuring device for installing and/or dismantling.

- Material: Stainless steel 304 (1.4301)
- Weight: 7.5 kg (16.5 lb)
- Order number: 306354

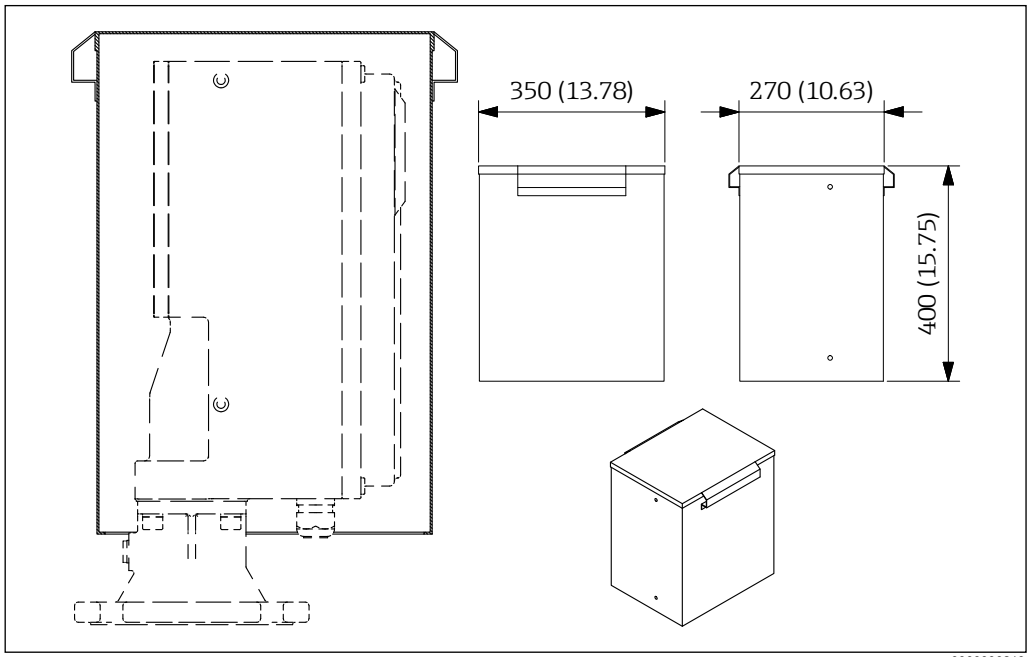

Figure 18: Weather protection cover

Process adapter extension
If process temperatures are between +150 ... +230 °C (+302 ... +446 °F), the following process adapter extensions can be used to reduce the temperature when using the 1000 mm wiper extension:
• Material: Stainless steel 316Ti (1.4571)
• Weight: 16 kg (35.3 lb)
• The delivery contains suitable screws and nuts to secure the measuring device to the process adapter extension.
• Order number: 306369

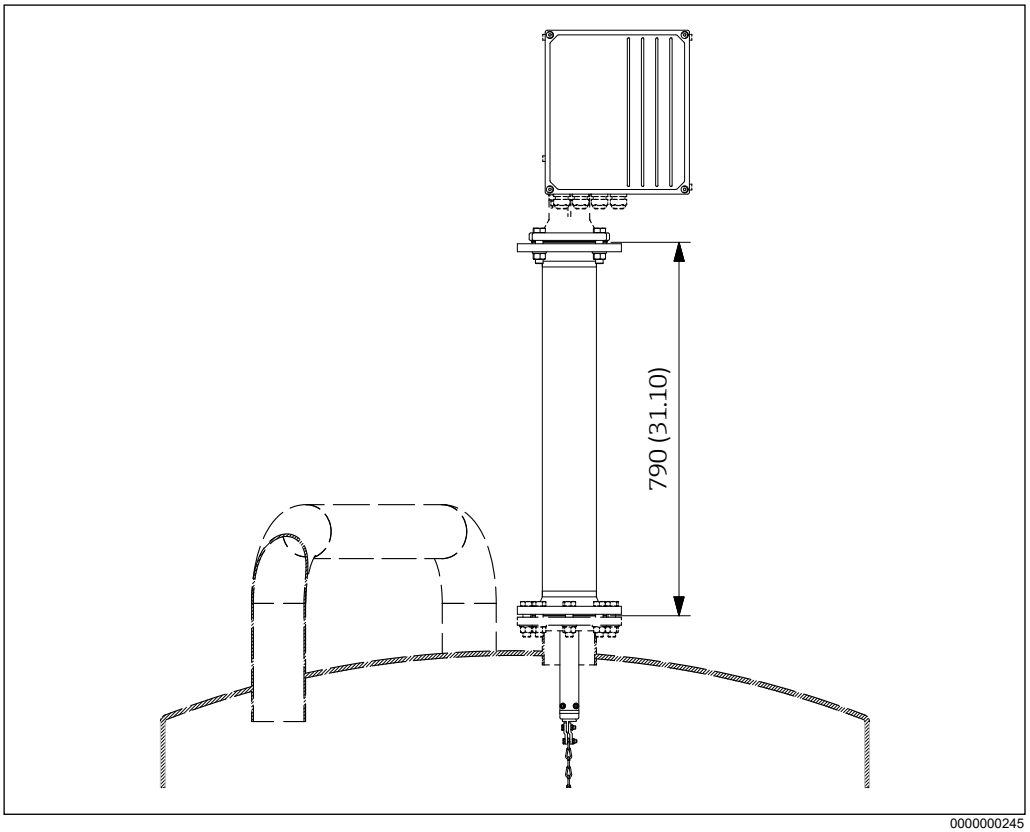

Figure 19: Process adapter extension. Unit of measurement mm (in)

Adapter flange for lower pressure ratings
The following adapter flanges can be used to adapt to existing process connections. 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.

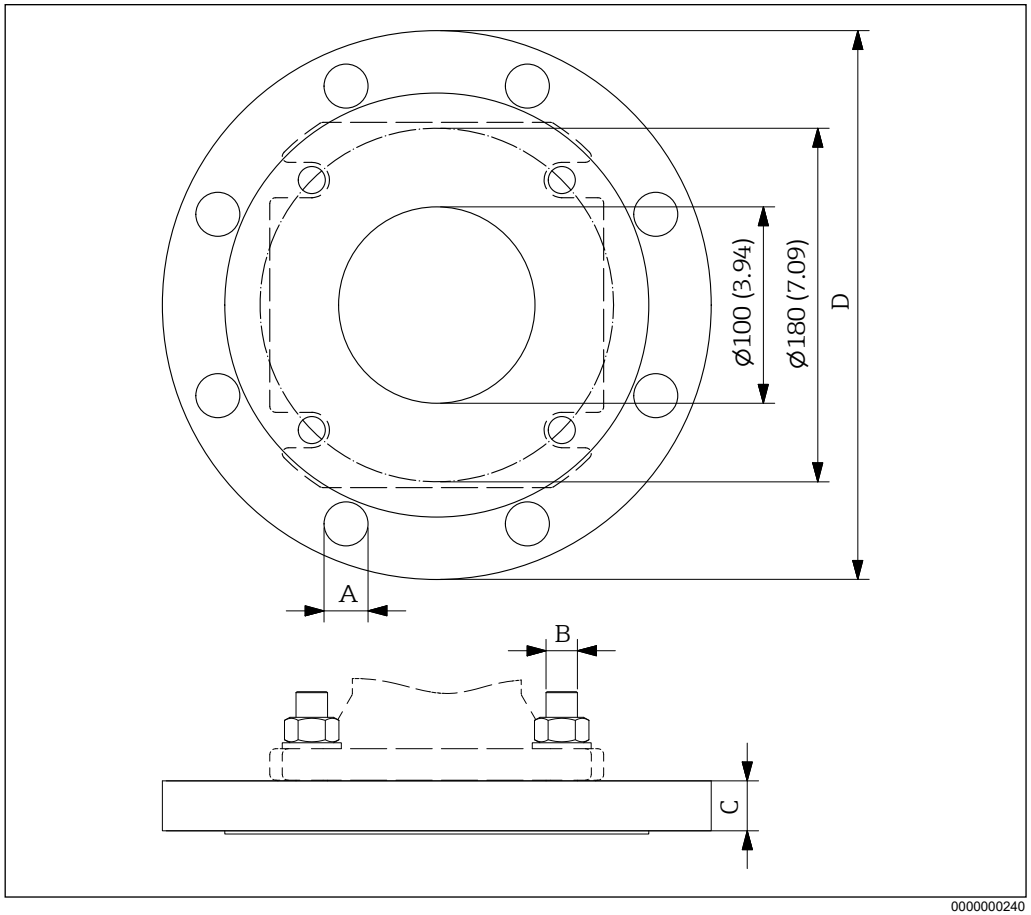

Figure 20: Adapter flange (example ASME B16.5 6" 150 lbs). Unit of measurement mm (in)

• Order number:
306881 (DN150, PN16, EN1092-1, stainless steel 316Ti, 9 kg (19.8 lb))
306882 (DN150, PN16, EN1092-1, steel, 9 kg (19.8 lb))
306883 (DN200, PN16, EN1092-1, stainless steel 316Ti, 15 kg (33.1 lb))
306884 (DN200, PN16, EN1092-1, steel, 15 kg (33.1 lb))
306874 (6", 150lbs, ASME B16.5, stainless steel 316Ti, 10 kg (22 lb))
306876 (6", 150lbs, ASME B16.5, steel, 10 kg (22 lb))
306877 (8", 150lbs, ASME B16.5, stainless steel 316Ti, 18 kg (39.7 lb))
306878 (8", 150lbs, ASME B16.5, steel, 18 kg (39.7 lb))
• Dimension (mm (in)):

Order number	Holes	A	B	C	D
306881	8	22 (0.87)	M16	22 (0.87)	285 (11.22)
306882					
306883	12	22 (0.87)		24 (0.94)	340 (13.39)
306884					
306874	8	22.4 (0.88)	UNC 5/8"	25.4 (1)	279.4 (11)
306876					
306877				28.6 (1.13)	342.9 (13.5)
306878					

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

Adapter flange with studs for higher pressure ratings
The following adapter flanges can be used to adapt to existing process connections.

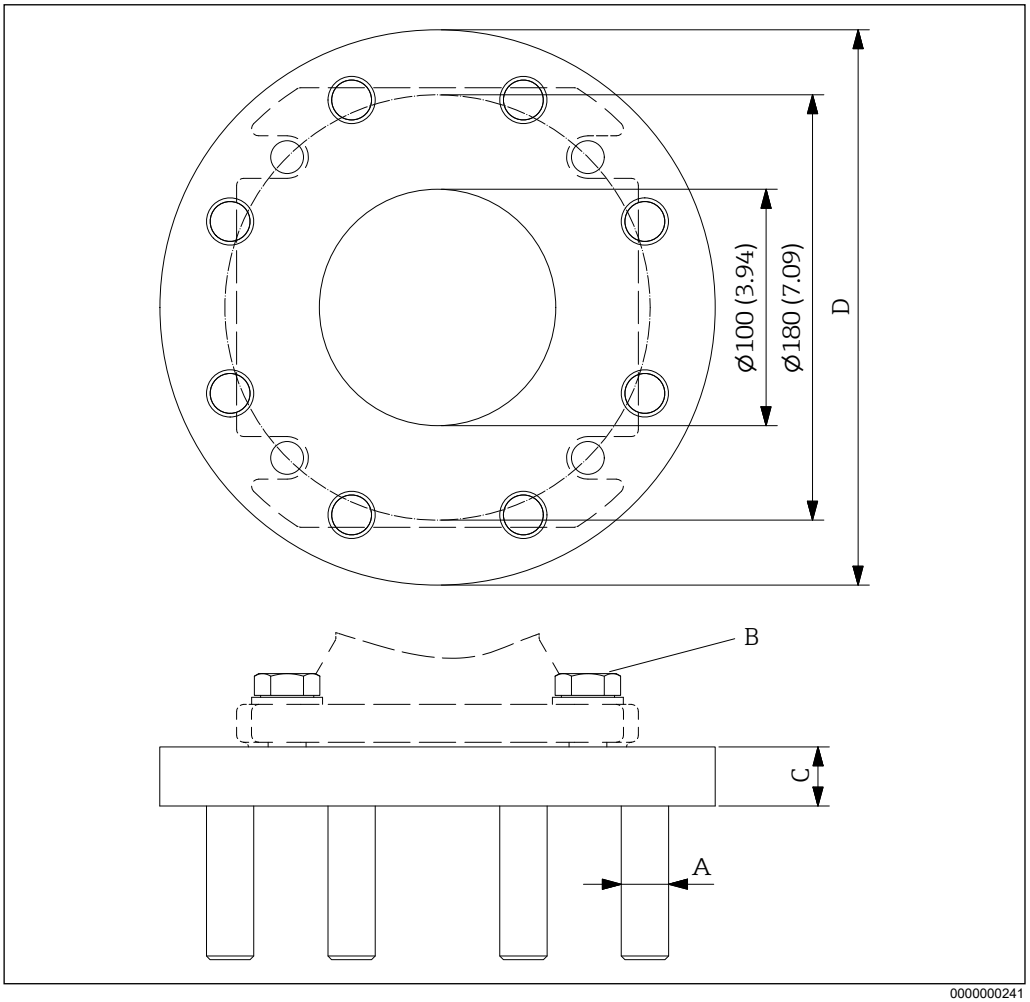

Figure 21: Adapter flange (example DN100 PN25/40). Unit of measurement mm (in)

• Order number:
306879 (DN100, PN25/40, EN1092-1, stainless steel 316Ti, 7 kg (15.4 lb))
306880 (DN100, PN25/40, EN1092-1, steel, 7 kg (15.4 lb))
306870 (4", 300lbs, ASME B16.5, stainless steel 316Ti, 11 kg (24.3 lb))
306871 (4", 300lbs, ASME B16.5, steel, 11 kg (24.3 lb))
306872 (4", 600lbs, ASME B16.5, stainless steel 316Ti, 16 kg (35.3 lb))
306873 (4", 600lbs, ASME B16.5, steel, 16 kg (35.3 lb))
• Dimension (mm (in)):

Order number	Stud bolts	A	B	C	D
306879	8	M22	M16	25 (0.98)	235 (9.25)
306880					
306870		UNC 3/4"	UNC 5/8"	31.8 (1.25)	254 (10)
306871					
306872				38.1 (1.5)	273.1 (10.75)
306873					

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

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

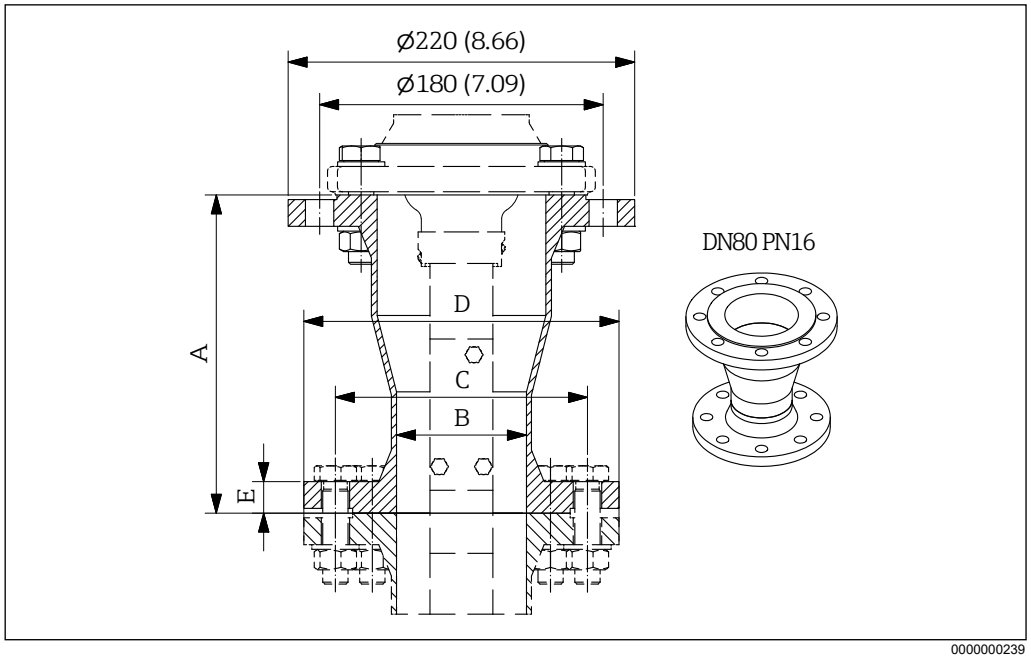

Figure 22: Process adapter (example DN80 PN16). Unit of measurement mm (in)

• Order number:
306922 (DN50, PN16, EN1092-1, stainless steel 316Ti, 10.5 kg (23.1 lb))
306923 (DN50, PN16, EN1092-1, steel, 10.5 kg (23.1 lb))
306924 (DN65, PN16, EN1092-1, stainless steel 316Ti, 11 kg (24.3 lb))
306925 (DN65, PN16, EN1092-1, steel, 11 kg (24.3 lb))
306926 (DN80, PN16, EN1092-1, stainless steel 316Ti, 10 kg (22 lb))
306927 (DN80, PN16, EN1092-1, steel, 10 kg (22 lb))
306916 (2", 150lbs, ASME B16.5, stainless steel 316Ti, 11 kg (24.3 lb))
306917 (2", 150lbs, ASME B16.5, steel, 11 kg (24.3 lb))
306918 (3", 150lbs, ASME B16.5, stainless steel 316Ti, 11.5 kg (25.3 lb))
306919 (3", 150lbs, ASME B16.5, steel, 11.5 kg (25.3 lb))
306920 (4", 150lbs, ASME B16.5, stainless steel 316Ti, 12.5 kg (27.6 lb))
306921 (4", 150lbs, ASME B16.5, steel, 12.5 kg (27.6 lb))
• Dimension (mm (in)):

Order number	A	B	C	D	E
306922	400 (15.75)	54.5 (2.15)	125 (4.92)	165 (6.50)	18 (0.71)
306923					
306924		70.3 (2.77)	145 (5.71)	185 (7.28)	
306925					
306926	200 (7.87)	82.5 (3.25)	160 (6.30)	200 (7.87)	200 (7.87)
306927					
306916	420 (16.54)	52.6 (2.07)	120.7 (4.75)	152.4 (6.00)	19.1 (0.75)
306917					
306918	220 (8.66)	78 (3.07)	152.4 (6.00)	190.5 (7.50)	23.9 (0.94)
306919					
306920	128 (5.04)	102.4 (4.03)	190.5 (7.50)	228.6 (9.00)	
306921					

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

Process adapter as replacement for the standard adapter
The standard process adapter can be replaced by one of the following adapters to adapt to existing process connections.

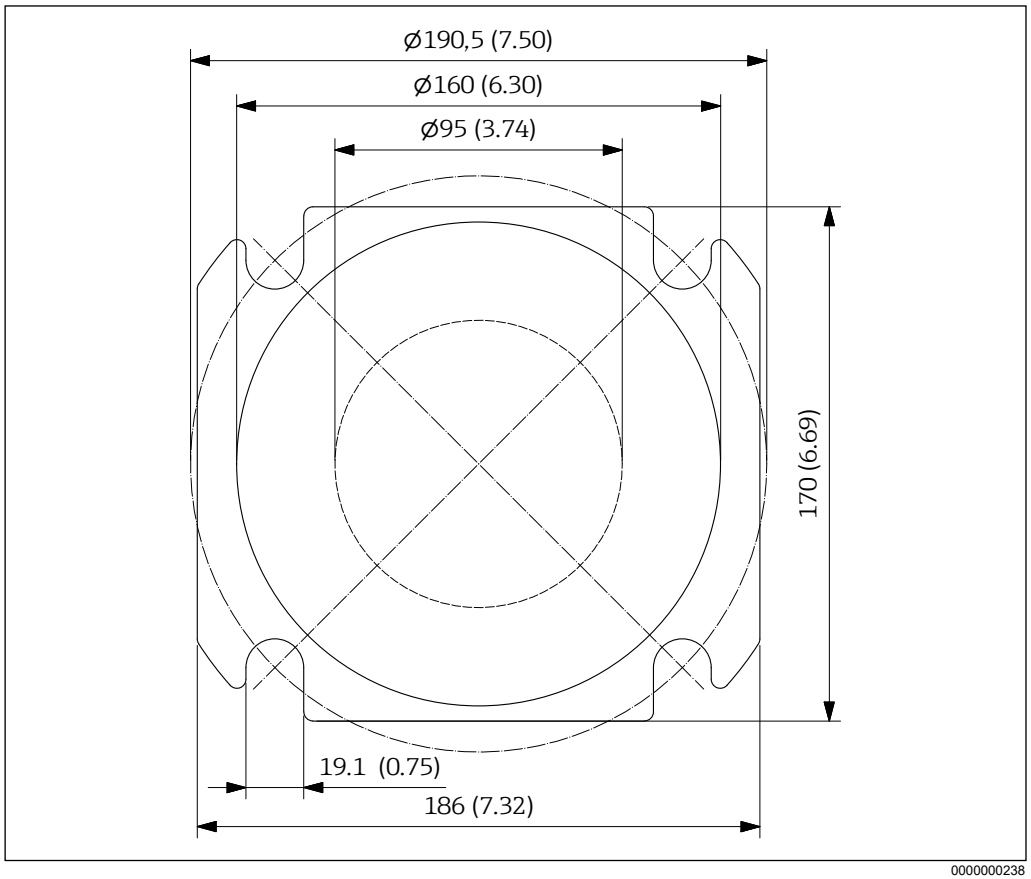

Figure 23: Process adapter as replacement for the standard adapter. Unit of measurement mm (in)

- Order number:
  306440 (150 lbs, ASME, RF 4", aluminum)
  306443 (150 lbs, ASME, RF 4", aluminum, coated)

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. The process adapter is mounted between the process connection of the measuring device and the application.

Notice:
- 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.

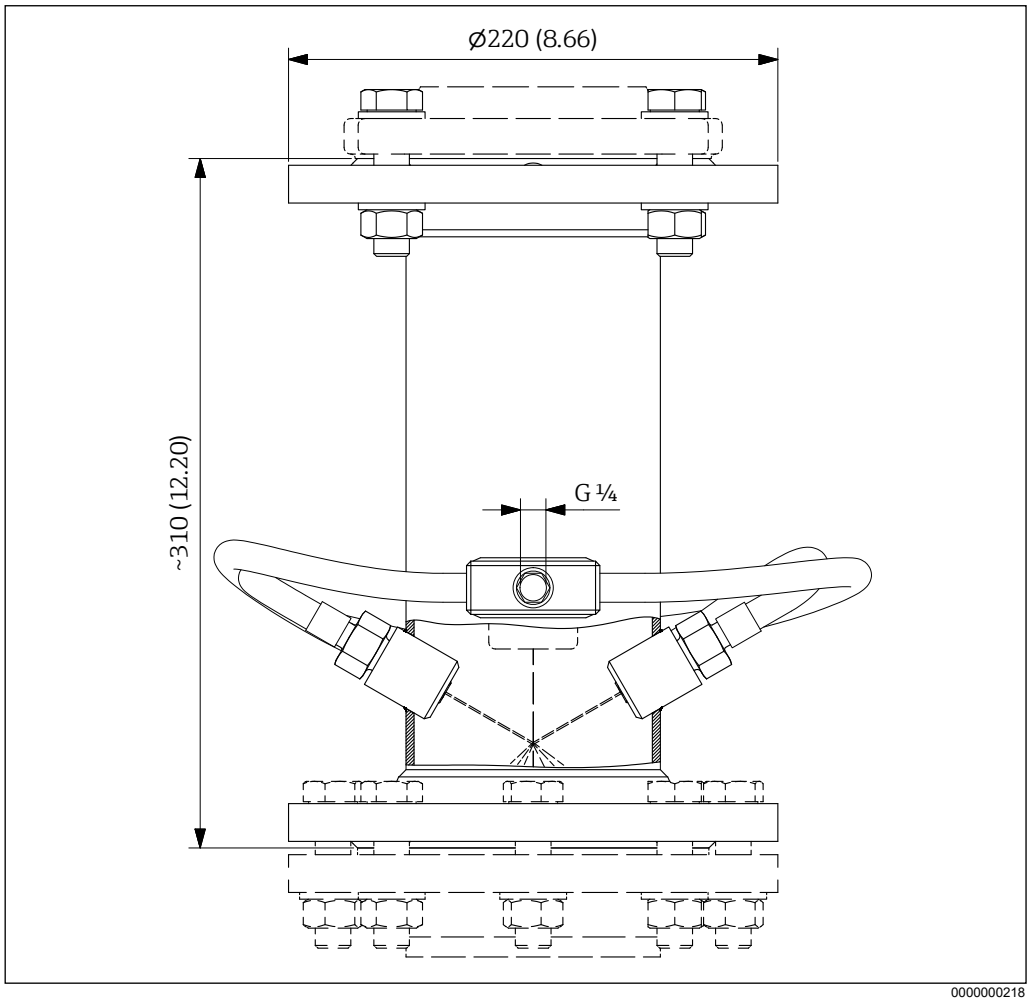

Figure 24: Process adapter with spray water cleaning. Unit of measurement mm (in)

- DN100 PN16 (Connection dimensions according to DIN EN 1092-1)
- Material: 316Ti (1.4571)
- Weight: 15 kg (33.1 lb)
- Order number: 306928
- Mounting screws enclosed
- For pressureless processes only!

Sensing weights for interface measurement

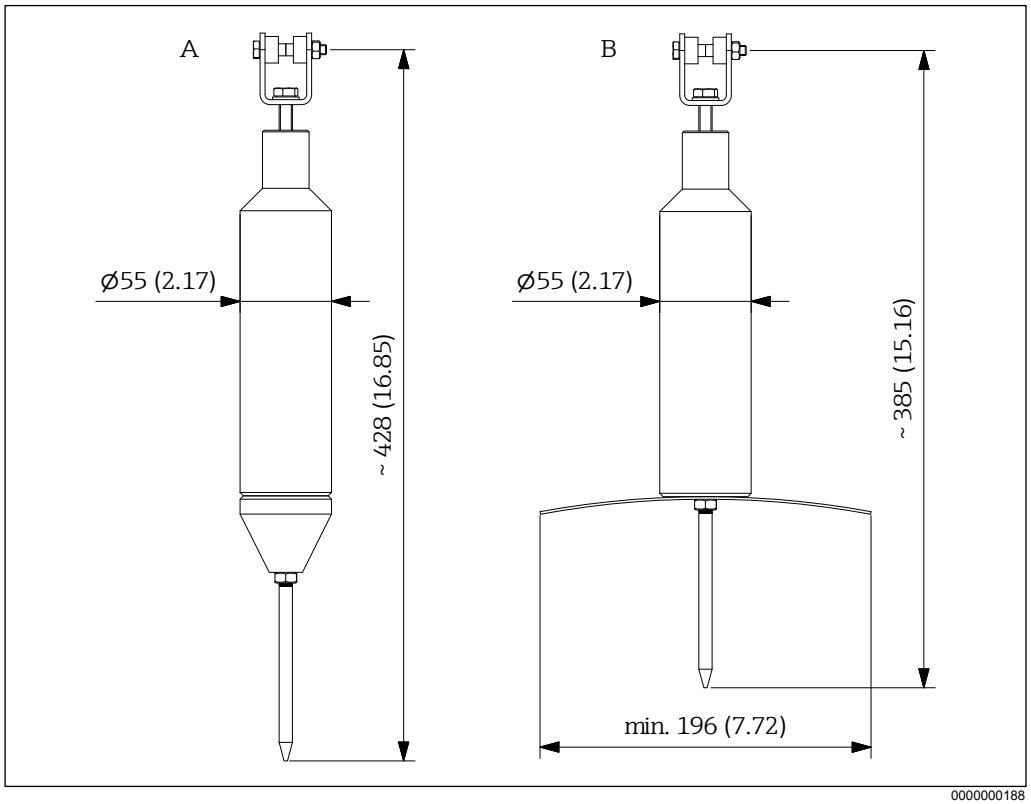

Figure 25: Sensing weights for interface measurement. Unit of measurement mm (in)

Sensing weight for interface measurement in liquids with a significant difference in density (**A**)
- Order number:
  306897 (316Ti (1.4571))
  306898 (316Ti (1.4571), coated)
- Weight: 4 kg (8.82 lb)

Sensing weight for interface measurement in liquids with a minor difference in density (**B**)
- Order number:
  306899 (316Ti (1.4571))
  306901 (316Ti (1.4571), coated)
- Weight: 4 kg (8.82 lb)

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.

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

- Order number:
  306905 (Length: 2 m (78.74 in), Weight: 0.3 kg (0.66 lb))
  313258 (Length: 4 m (157.48 in), Weight: 0.6 kg (1.32 lb))
- Material: Stainless steel 316

Device-specific tool

Removal tool

For a change of the measuring tape and the gear motor, the following removal tool is available, the operation is carried out with an Allen key 5 mm AF.
• Order number: 306857
• Material: Steel

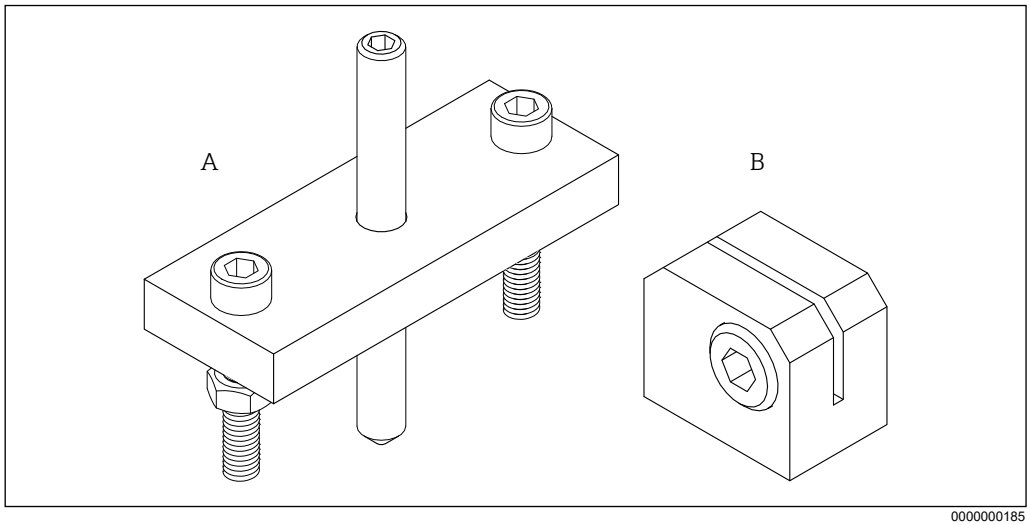

Figure 26: Device-specific tool

A Removal tool
B Tape stopper

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: 306858
• Material: Steel and brass

Supplementary documentation

Operating Instructions

Installation and initial commissioning – contains all functions in the operating menu that are required for a typical measuring task. Functions beyond this scope are not included.
→ **ba042000**

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