Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Liquicap M FMI51, FMI52

Capacitive Level Measurement
For continuous measurement in liquids

Application

The Liquicap M compact transmitter is used for the continuous level measurement of liquids.

Thanks to its robust and tried-and-tested construction (self-sealing cone), the probe can be used both in vacuums and in overpressure up to 100 bar. The sealing and insulation materials used allow operating temperatures of –80 °C to +200 °C in the medium container.
The measurement is independent of the dielectric constant (DK) as of a liquid conductivity of 100 µS/cm. In this way, various liquids can be measured without the need for recalibration.

Used in conjunction with Fieldgate (remote measured value interrogation using Internet technology), Liquicap M provides an ideal solution for inventorying materials and optimizing logistics (inventory control).

Your benefits

- No calibration necessary for media with a conductivity of 100 µS/cm and higher. The probes are calibrated to the ordered probe length on leaving the factory (0 % to 100 %). This makes easy and fast commissioning possible.
- Menu-guided local configuration via plain text display (optional)
- Universal application thanks to wide range of certificates and approvals
- Use also in safety systems requiring functional safety to SIL2 in accordance with IEC 61508
- Material in contact with the process made of corrosion-resistant material and FDA-listed materials for wetted parts
- Two-stage overvoltage protection against discharge from the container (gas discharger + protective diodes)
- Electronics can be switched for media forming buildup
- Short measured value reaction time
- No need for recalibration after replacing electronics
- Automatic monitoring of electronics
- Monitors damage to insulation and rod breaking or rope tearing
- Suitable for interface measurement

Endress+Hauser

People for Process Automation

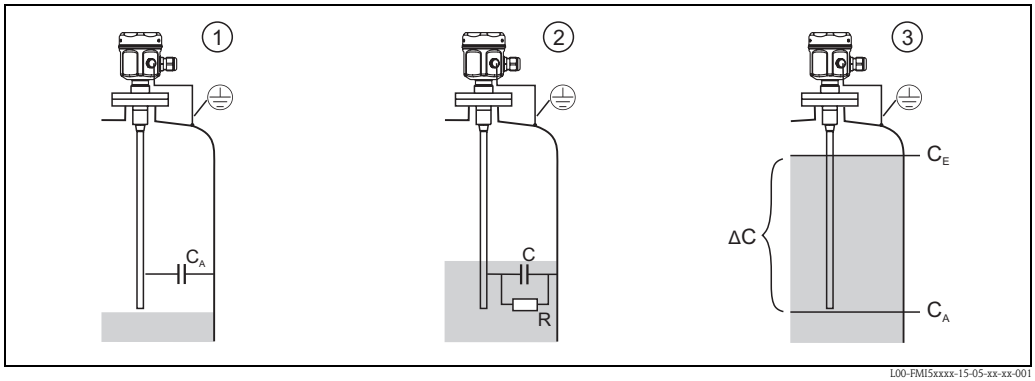
Table of contents

Function and system design

Measuring principle

The principle of capacitive level measurement is based on the change in capacitance of the capacitor due to the change in the level. The probe and container wall (conductive material) form an electric capacitor. When the probe is in air ①, a certain low initial capacitance is measured.
When the container is filled, the capacitance of the capacitor increases the more the probe is covered ②, ③.
As of a conductivity of 100 µs/cm, the measurement is independent of the value for the dielectric constant (DK) of the liquid. As a result, fluctuations in the DK value do not affect the measured value display. Furthermore, the system also prevents the effect of medium buildup or condensate near the process connection for probes with an inactive length.

Note!
A ground tube is used as a counterelectrode for containers made of nonconductive materials.



R: Conductivity of liquid
C: Capacitance of liquid
C_A: Initial capacitance (probe not covered)
C_E: Final capacitance (probe covered): change in capacitance
ΔC: Change in capacitance

Function

The selected electronic insert of the probe (e.g. FEI50H 4 to 20 mA HART) converts the measured change in capacitance of the liquid to a signal in proportion to the level (e.g. 4 to 20 mA) and thus makes it possible to display the level.

Phase-selective measurement

The electronic evaluation of the container capacitance works along the principle of phase-selective measurement. In this process, the amount of alternating current and the phase shift between the voltage and current is measured. With these two characteristic quantities, the capacitive idle current can be calculated by the medium capacitor and the real current by the medium resistance. Conductive buildup stuck to the probe rod/rope acts like additional medium resistance and causes an error in measurement. As the size of the medium resistance can be determined with phase-selective measurement, an algorithm is used to compensate the buildup on the probe.
Thus, Liquicap M has buildup compensation.

Interface measurement

The calibration values for empty and full calibration can be calculated with the ToF Tool configuration and service software from Endress+Hauser.

1.) Water, for example (the medium must be conductive ≥ 100 µS/cm)
2.) Emulsion
3.) Oil, for example (nonconductive medium < 1 µS/cm)

A certain and definite measured value is ensured even if the emulsion layer is of varying thickness. It is always the average value of the emulsion film measured.

Measuring system

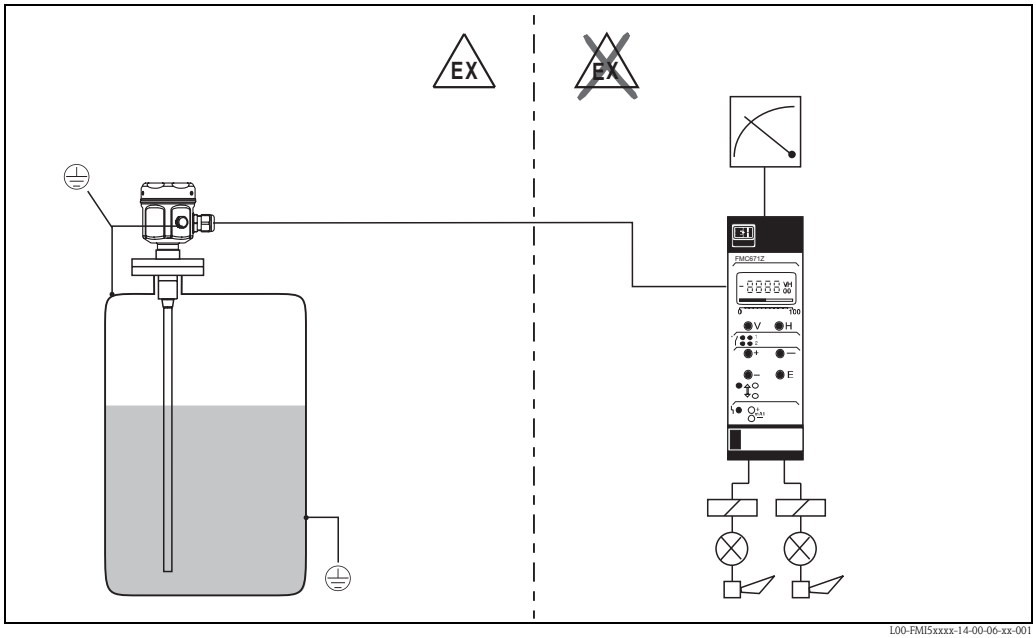
Note!
The make-up of the measuring system depends on the electronic insert selected.

PFM output (FEI57C)

The complete measuring system consists of:

- The capacitive Liquicap M FMI51 or FMI52 level probe
- The FEI57C electronic insert
- A transmitter power supply unit e.g. FMC671, FMC672, FMC661, FMX570 (order stop 2006)

Note!
- The twin-core feeder is also used for PFM signal transmission.
- In combination with a power supply unit the FEC57C will only run in a 1-channel-mode and without an automatic alignment correction.



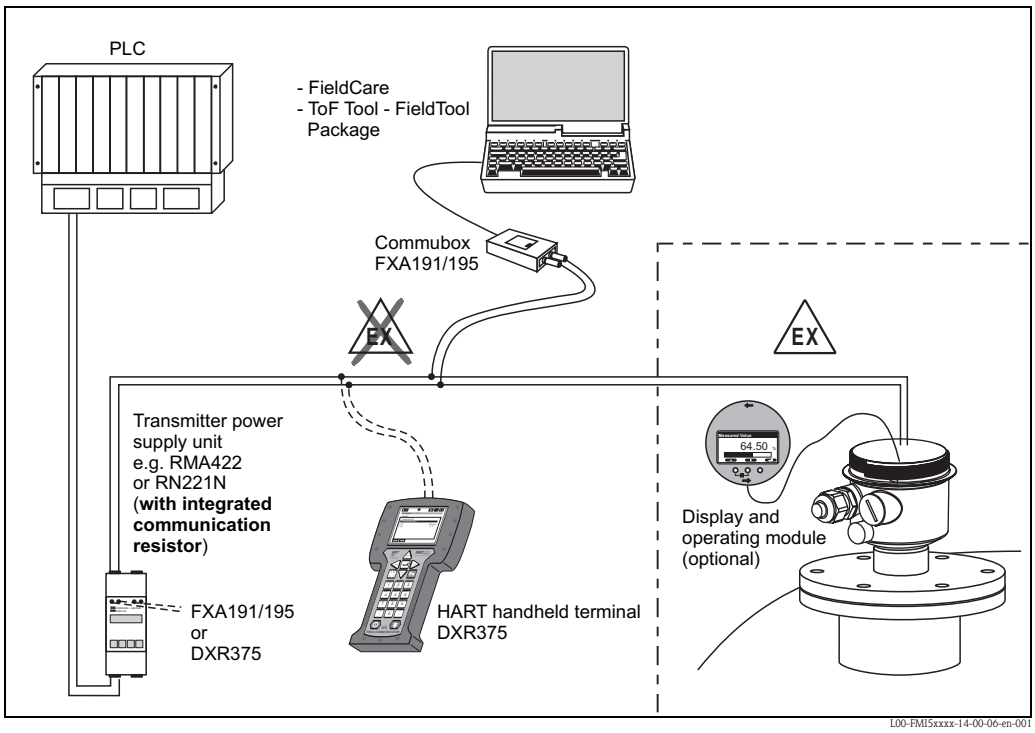
Level measurement

4 to 20 mA output with HART protocol (FEI50H)

The complete measuring system consists of:

- The capacitive Liquicap M FMI51 or FMI52 level probe
- The FEI50H electronic insert
- A transmitter power supply unit (e.g. RN221N, RNS221, RMA421, RMA422)

Note!
DC voltage must be supplied to the electronic insert. The twin-core feeder is also used for HART protocol signal transmission.



Local operation

- Standard – via keys and switches on the electronic insert
- Optional – via display and operating module

Remote operation

- With HART handheld terminal DXR375
- With a personal computer, Commubox FXA191, FXA195 and the operating programs ToF Tool – FieldTool Package or FieldCare.

Note!
ToF Tool and FieldCare are graphic operating programs for measuring devices from Endress+Hauser. They are used to support commissioning, data backup, signal analysis and documentation of the measuring point.

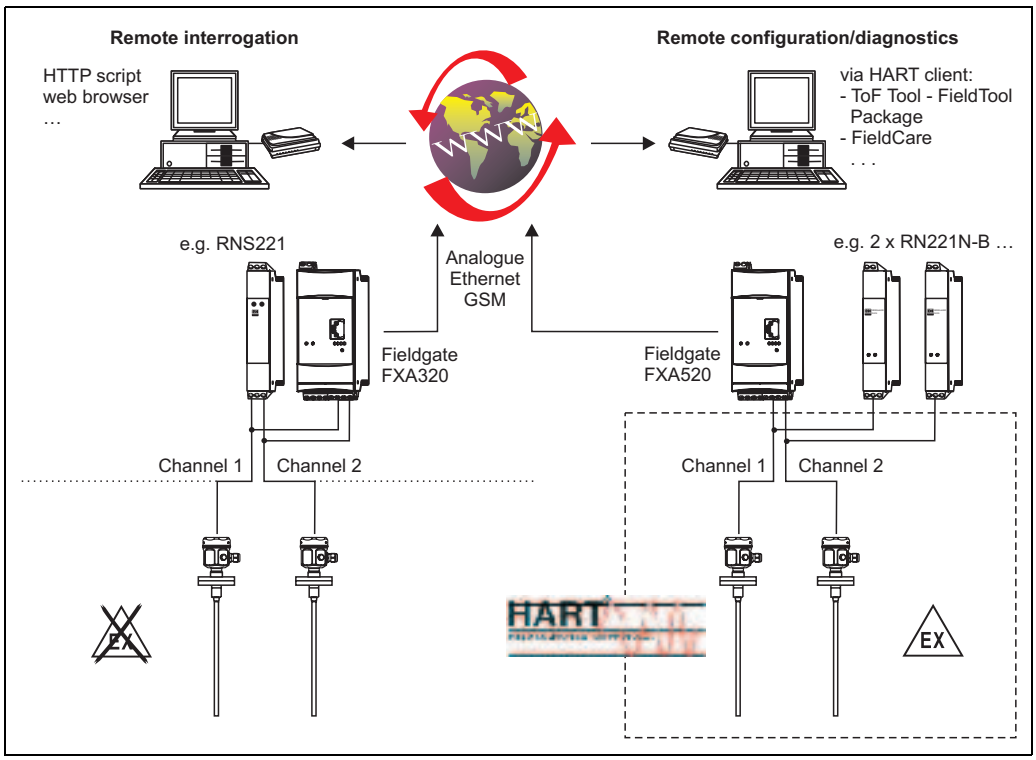
System integration via Fieldgate

Vendor managed inventory

The remote interrogation of tank or silo levels via Fieldgate enables suppliers of raw materials to gather information about the current inventories of their regular customers at any time and, for example, take this into account in their own production planning. The Fieldgate monitors the configured level limits and automatically triggers the next order as required. Here, the range of possibilities ranges from simple requisitioning by e-mail through to fully automatic order processing by incorporating XML data into the planning systems on both sides.

Remote maintenance of measuring systems

Not only does Fieldgate transmit the current measured values, it also alerts the standby personnel responsible by e-mail or SMS as required.- Service technicians can diagnose and configure the connected HART devices remotely in the event of an alarm or also for routine checks. All that is required for this is the appropriate HART operating software (e.g. ToF Tool – FieldTool Package, FieldCare, ...) for the connected device. Fieldgate forwards the information transparently. In this way, all options of the operating software in question are available remotely. By using remote diagnosis and remote configuration some onsite service operations can be avoided and all others can at least be planned and prepared better.



Operating conditions: Installation

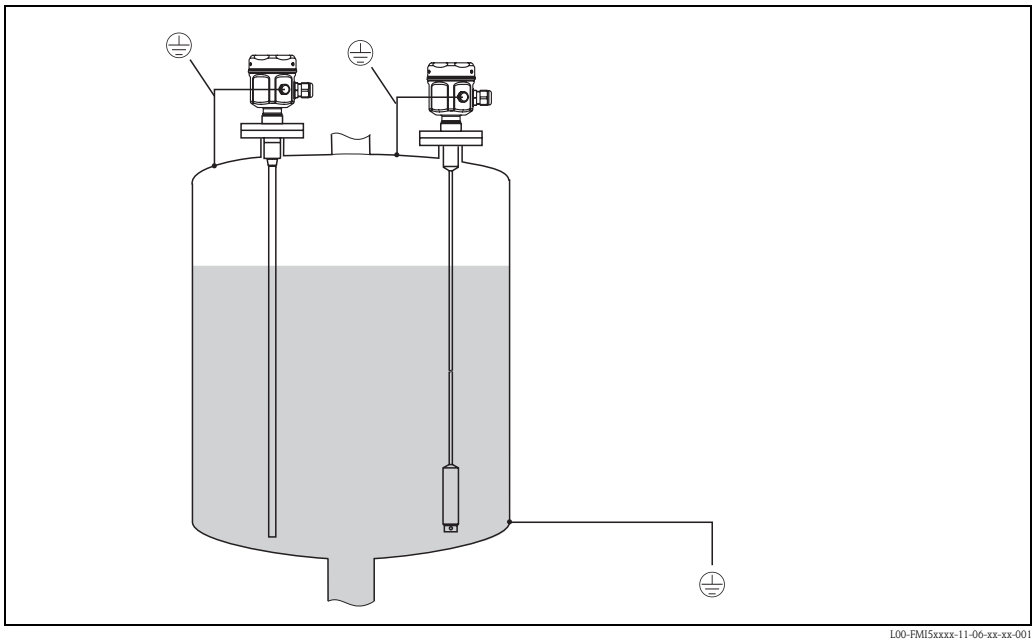
Installation instructions

Liquicap M FMI51 (rod probe) can be installed vertically from above or below.
Liquicap M FMI52 (rope probe) can be installed vertically from above.

Note!

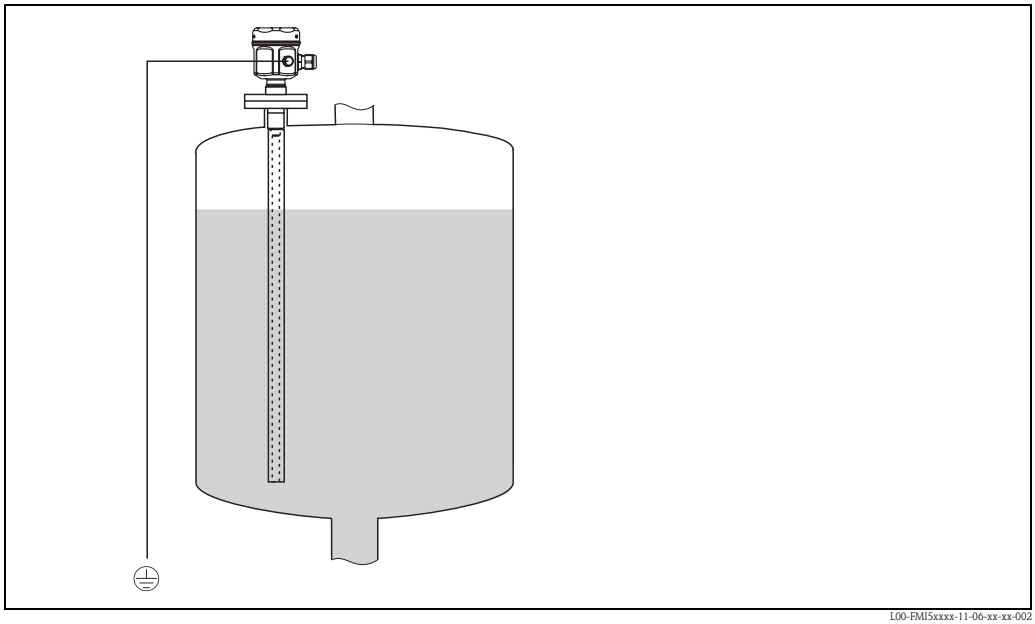
- The probe may not come into contact with the container wall! Do not install probes in the area of the filling curtain!
- When using in agitating tanks, make sure you install at a safe distance from the agitator.
- Rod probes with a ground tube should be used in the event of severe lateral load.
- When mounting, ensure there is a good electrically conductive connection between the process connection and the tank. Use an electrically conductive sealing band for example.

For containers that conduct electricity e.g. steel tanks



L00-FMI5xxxx-11-06-xx-xx-001

For containers that do not conduct electricity e.g. plastic tanks

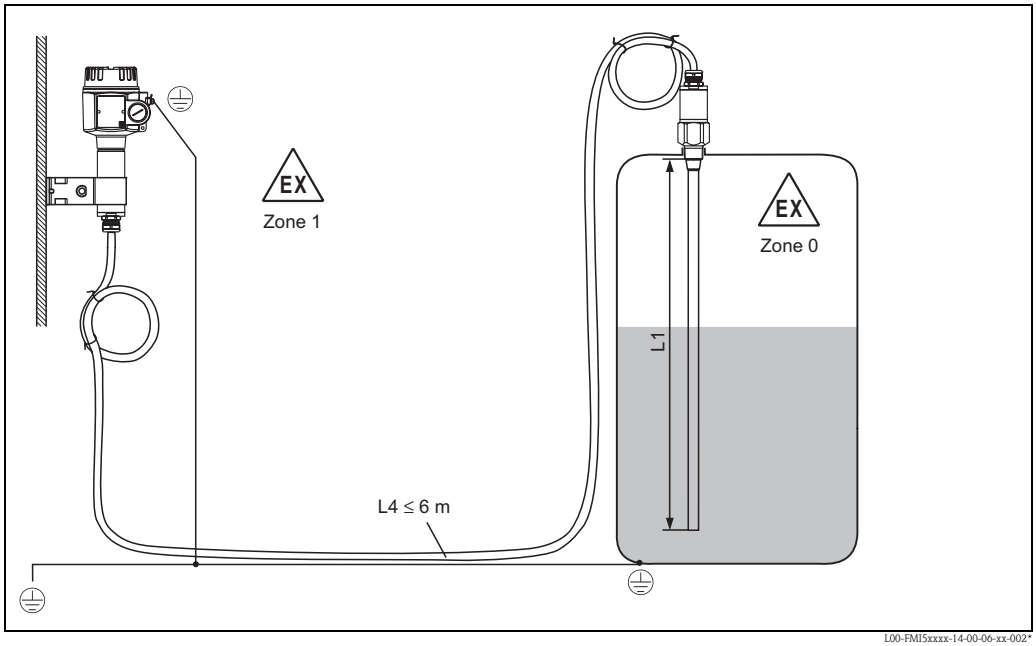


L00-FMI5xxxx-11-06-xx-xx-002

Probe with ground tube and grounding

With separate housing

For information on ordering, please refer also to the "Ordering information" => "Probe design" on Page 30 ff.

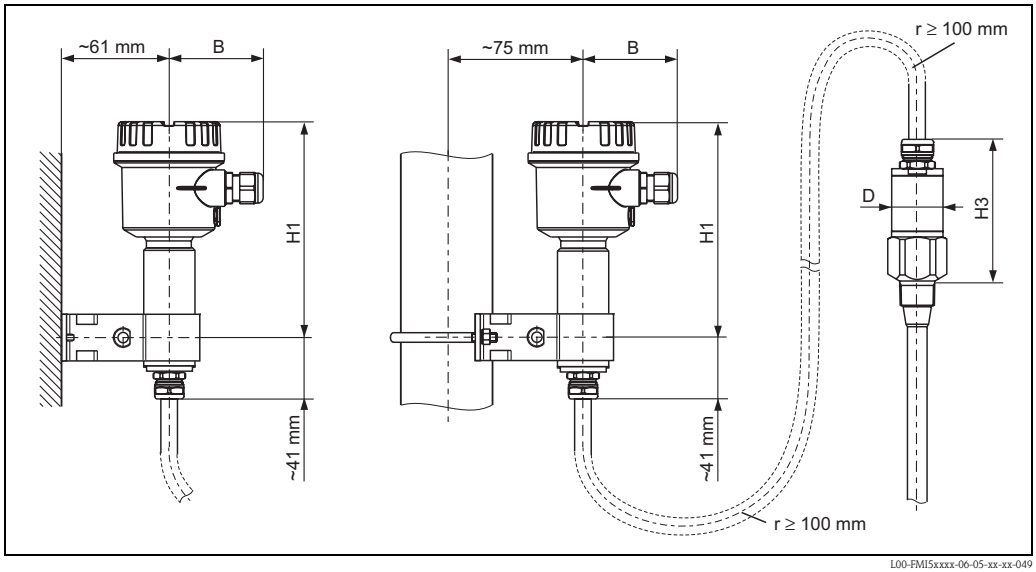


Rod length L1 max. 4 m
Rope length L1 max. 10 m

Note!
The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.
The overall length L = L1 + L4 may not exceed 10 m.
If the connecting cable is to be shortened or guided through a wall, it has to be separated from the process connection. See "Documentation" => "Operating Instructions".

Extension heights

Housing side: wall mounting | Housing side: pipe mounting | Sensor side



Note!
The cable has a bending radius of r ≥ 100 mm which may not be undershot!

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17
B (mm)	76	64	65
H1 (mm)	172	166	177
H2 (mm)	191	205	206

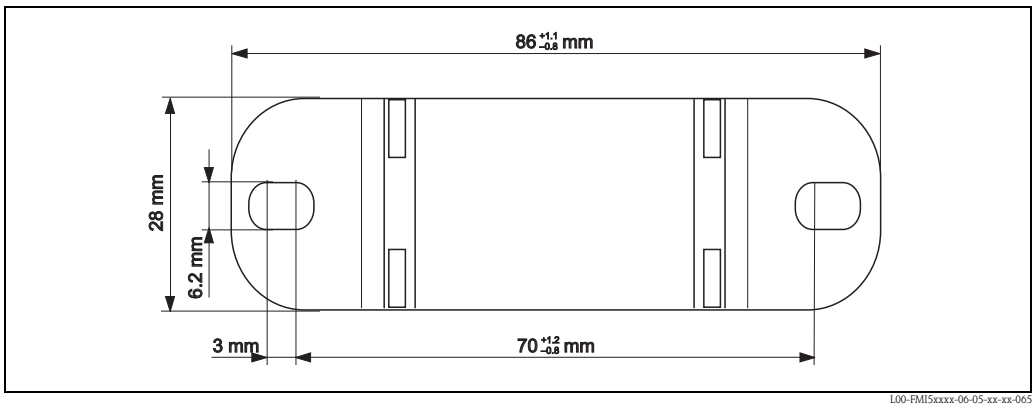
Rod probes, rope probes

	bar	**D** (mm)	**H3** (mm)
G½, G¾, G1, NPT½, NPT¾, NPT1	25	ø38	103
Clamp 1, 1½	16	ø38	122

	bar	**D** (mm)	**H3** (mm)
G1½, NPT1½	100	ø50	130
Clamp 1½	16	ø50	137
Clamp 2	16	ø50	156

Note!
Connecting cable: ø10.5 mm
Outer jacket: silicone, mechanical resistance

Wall holder unit



Note that the wall holder unit first has to be screwed to the separate housing before you can use it as a drilling template. The distance between the holes is reduced by screwing it to the separate housing.

Operating conditions: Environment

Ambient temperature range

- Ambient temperature of the transmitter: –50 °C to +70 °C (observe derating; see Page 10 ff. With WHG approval restriction on – 40 °C).
- At T_a < –20 °C and T_a > +60 °C, the functionality of the LCD display is limited.
- A weather protection cover should be used when operating outdoors in strong sunlight. For further information on the protective cover, see Page 37

Storage temperature

- –50 °C to +85 °C

Degree of protection

	IP66*	**IP67***	**IP68***	**NEMA4X****
Polyester housing F16	X	X	-	X
Stainless steel housing F15	X	X	-	X
Aluminum housing F17	X	X	-	X
Aluminum housing F13 with gas-tight process seal	X	-	X	X
Aluminum housing T13 with gas-tight process seal and separate connection compartment (EEx d)	X	-	X	X
Separate housing	X		X	X
*as per EN60529 ** as per NEMA 250				

Climate class

- DIN EN 60068-2-38/IEC 68-2-38: test Z/AD

Vibration resistance

DIN EN 60068-2-64/IEC 68-2-64: 20 to 2000 Hz, 1 $(m/s^2)^2/Hz$

Cleaning

Housing:
When cleaning, make sure that the cleaning agent used does not attack or corrode the housing surface or seals.

Probe:
Depending on the application, buildup (contamination and soiling) can form on the probe rod. A high degree of material buildup can affect the measurement result. If the medium tends to create a high degree of buildup, regular cleaning is recommended. When cleaning, it is important to make sure that the insulation of the probe rod is not damaged. If cleaning agents are used make sure the material is resistant to them!

Electromagnetic compatibility (EMC)

- Interference emission to EN 61326, Electrical Equipment Class B
  Interference immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)
- If only the analog signal is to be used, a usual commercial instrument cable is sufficient. If the superimposed communication signal (HART 4 to 20 mA) is used, a shielded cable must be used.
- A usual commercial cable can be used for PFM.

Shock resistance

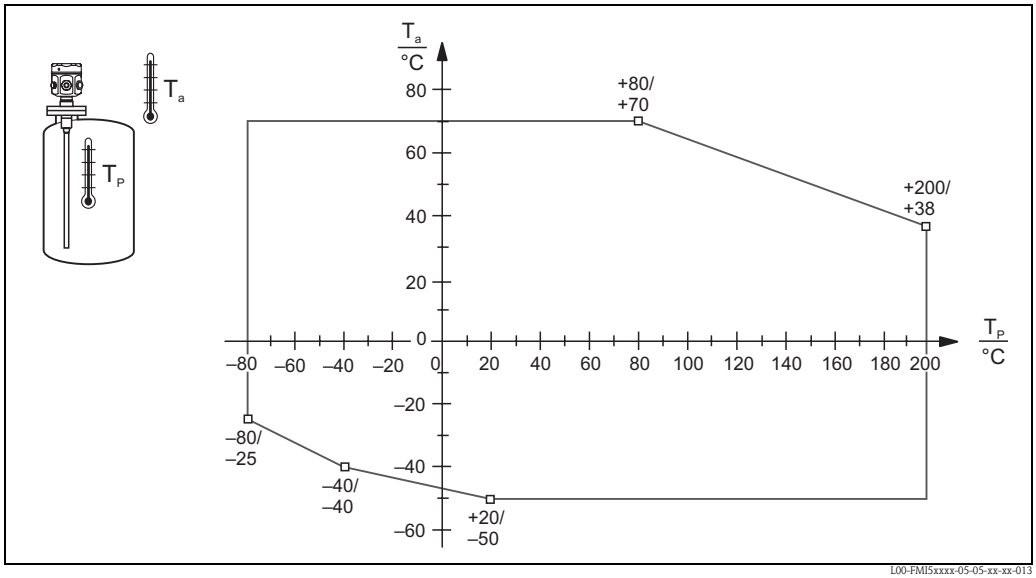
DIN EN 60068-2-27/IEC 68-2-27: 30g acceleration

Operating conditions: Process

Process temperature range

With compact housing

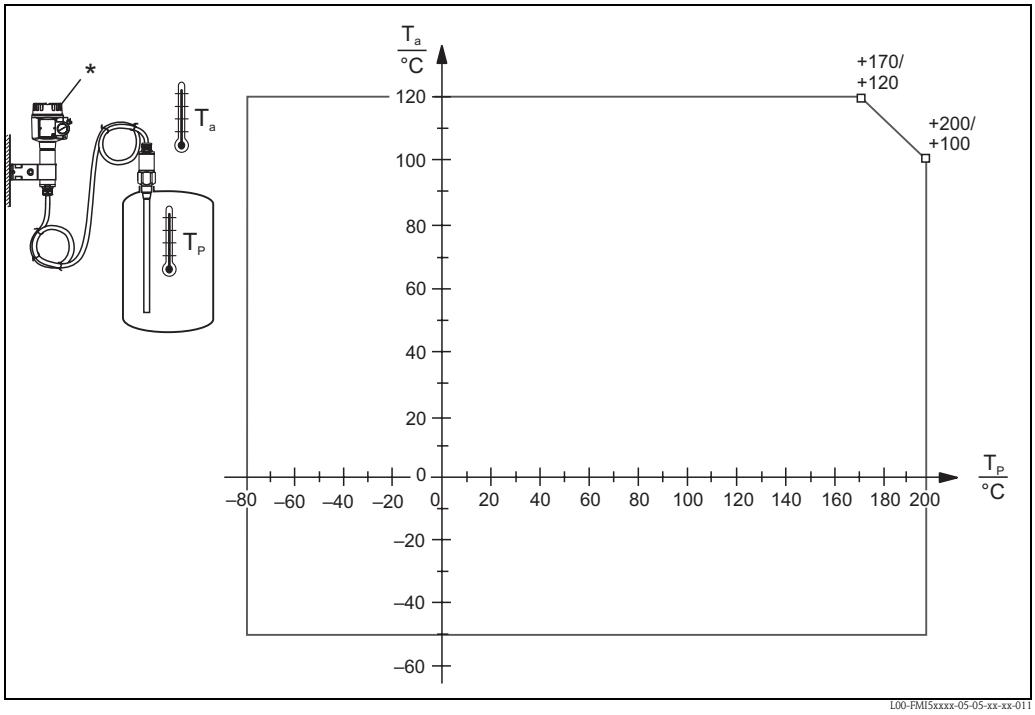
The following diagram applies to:
- Rod and rope version
- Insulation: PTFE, PFA, FEP



T_a = Ambient temperature
T_P = Process temperature

Note!
- Restriction on T_a – 40 °C for F16 polyester housing.
- Only relevant for FMI51!
  If additional option B is selected (free from paint-wetting impairment substances), the minimum ambient temperature T_a is –40 °C.

With separate housing



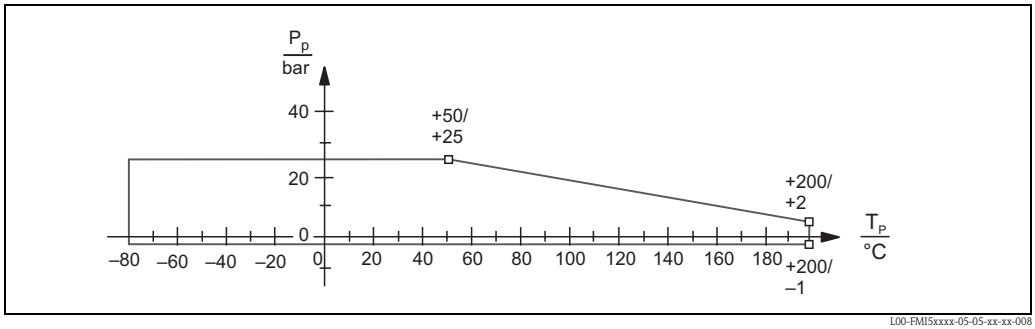
T_a = Ambient temperature
T_P = Process temperature
** The temperature at the separate housing ≤ 70 °C*

Note!
The maximum connection length between the probe and the separate housing is 6 m (L4). The desired length must be quoted when ordering a Liquicap M with a separate housing.
If the connecting cable is to be shortened or guided through a wall, it has to be separated from the process connection. See "Documentation" => "Operating Instructions".

Pressure and temperature derating

For process connections ½"; ¾", 1", flanges ≤ DN50, ≤ ANSI 2", ≤ JIS 10K
Rod insulation: PTFE
Rope insulation: FEP, PFA

Note!
See also "Process connections" on Page 16 ff.

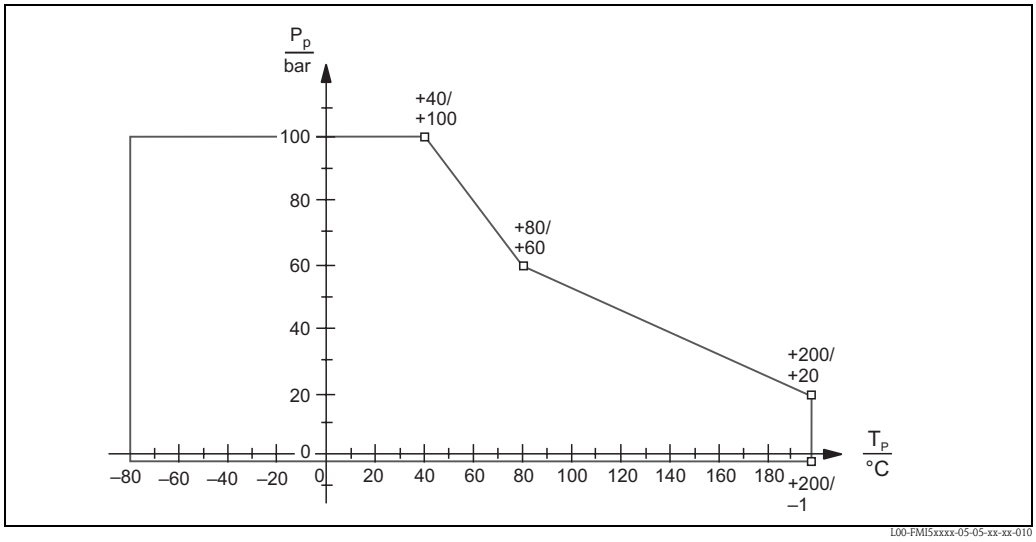


P_p: Process pressure
T_p: Process temperature

For process connections 1½", flanges > DN50, > ANSI 2", > JIS 10K

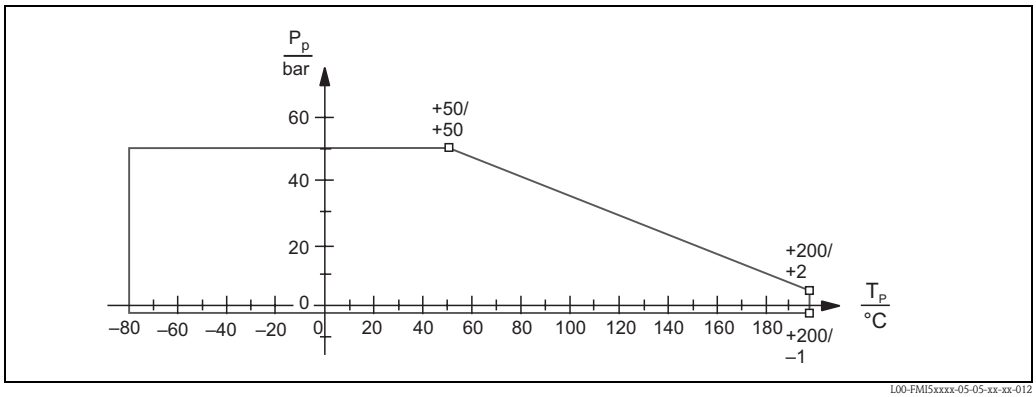
Rod insulation: PTFE, PFA
Rope insulation: FEP, PFA

Note!
See also "Process connections" on Page 16 ff.



P_p: Process pressure
T_p: Process temperature

With fully insulated inactive length:



P_p: Process pressure
T_p: Process temperature

Note!
In the case of flange process connections, the maximum pressure is limited by the nominal pressure of the flange.

Process pressure limits

Probe ø10 mm (including insulation)

–1 to 25 bar (observe dependencies: process temperature and process connection from Page 10 and Page 16 ff.)

Probe ø16 mm / ø22 mm (including insulation)

–1 to 100 bar (observe dependencies: process temperature and process connection from Page 10 and Page 16 ff.)

The pressure values permitted at higher temperatures can be found in the following standards:

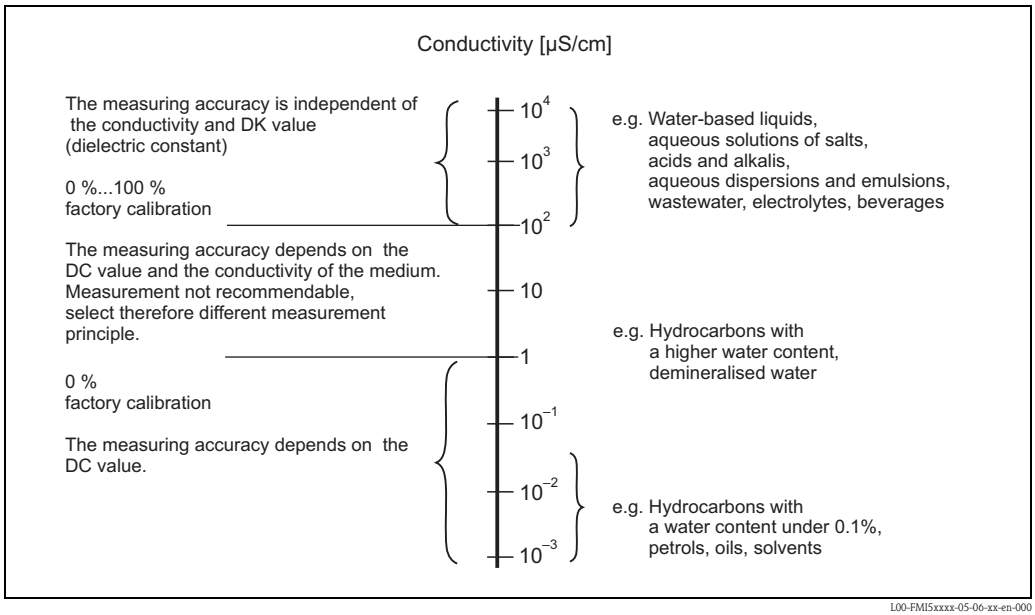
- pR EN 1092-1: 2005 Table, Appendix G2
  With regard to its stability property, the material 1.4435 is identical to 1.4404 which is grouped under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5a – 1998 Tab. 2-2.2 F316
- ASME B 16.5a – 1998 Tab. 2.3.8 N10276
- JIS B2238/2210

In each case it applies to the lowest value from the derating curves of the device and the selected flange.

State of aggregation

Medium liquid

Liquicap M operational range

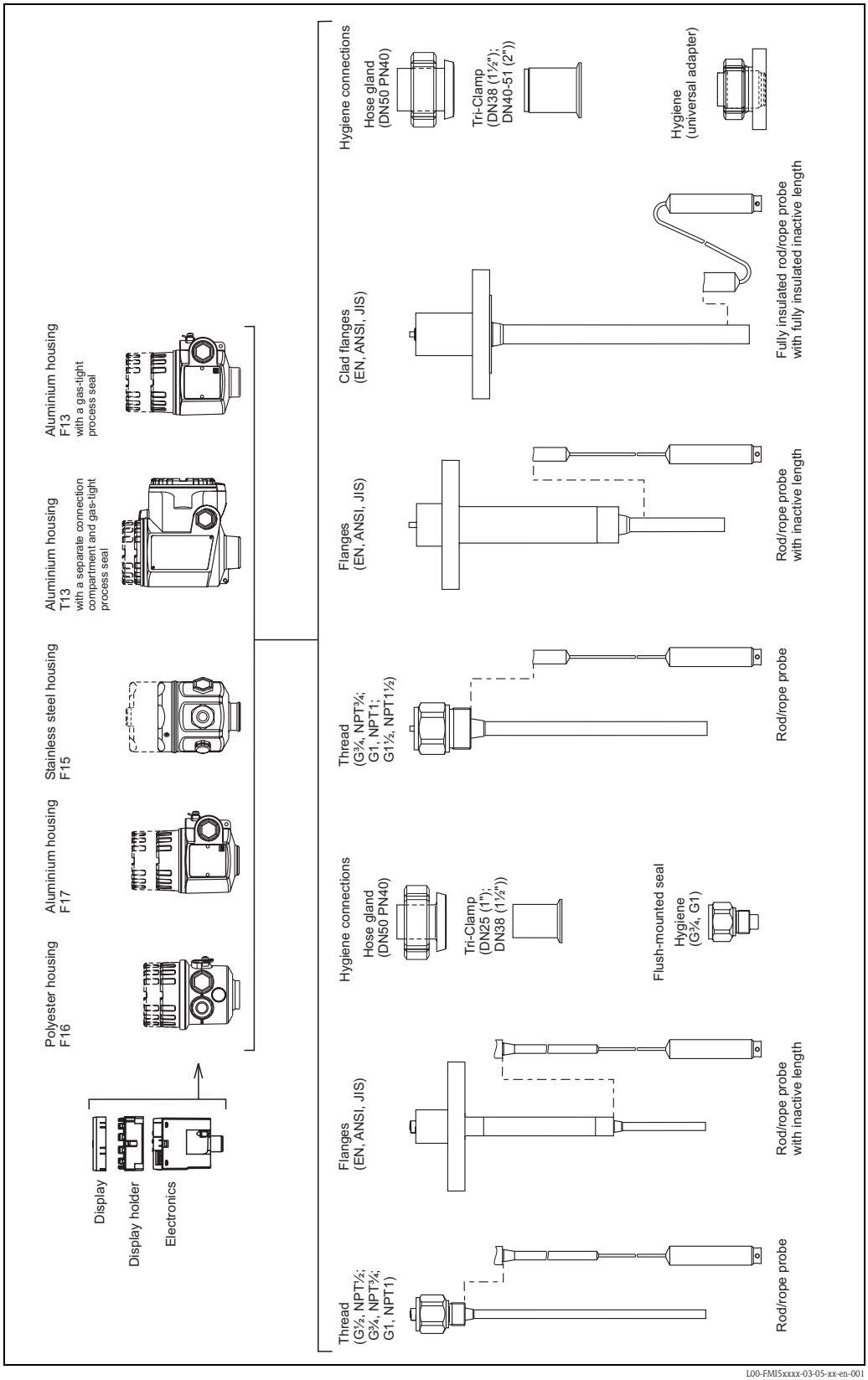


Typical DK values	
Air	1
Vacuum	1
General liquefied gases	1.2 – 1.7
Gasoline	1.9
Cyclohexane	2
Diesel fuel	2.1
General oils	2 – 4
Methyl ether	5
Butanol	11
Ammonia	21
Latex	24
Ethanol	25
Caustic soda	22 – 26
Acetone	20
Glycerine	37
Water	81

Mechanical construction

Note!
All dimensions in mm.

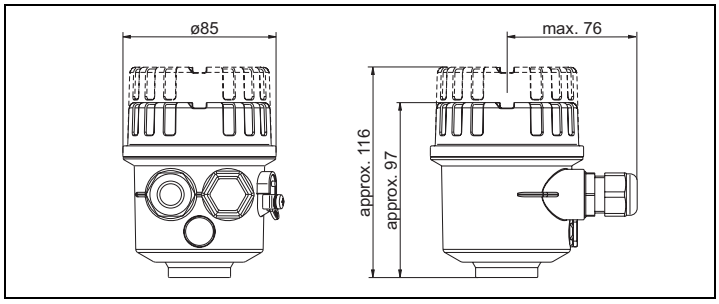
Overview



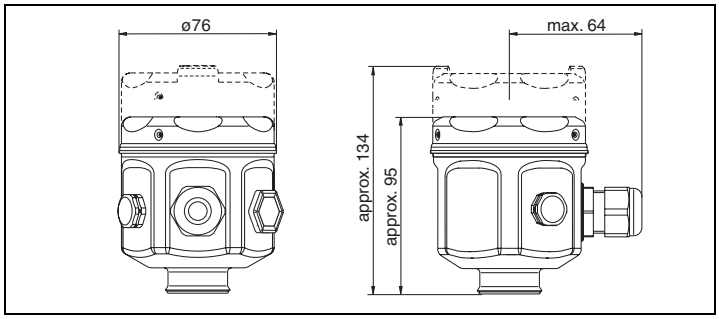
Housing

Note!
High cover for housing with display.

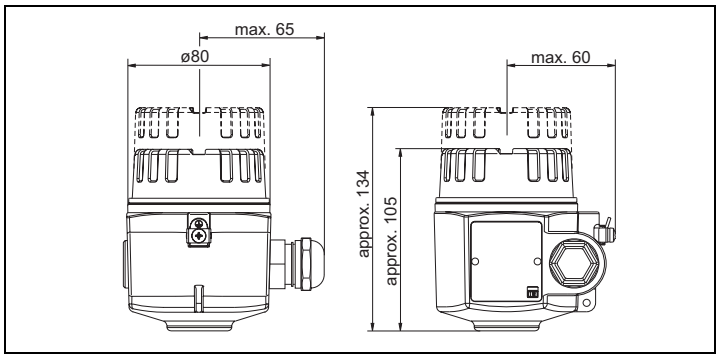
Polyester housing F16



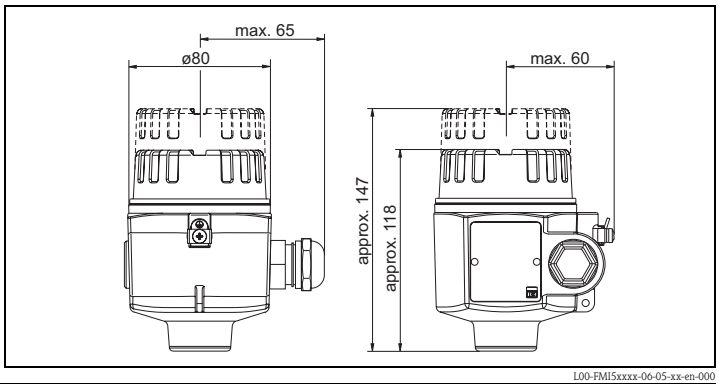
Stainless steel housing F15



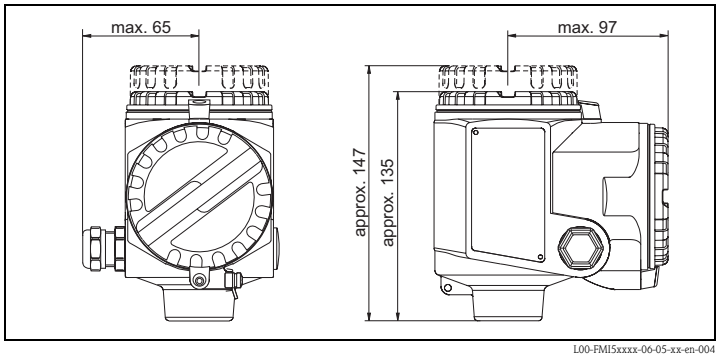
Aluminum housing F17



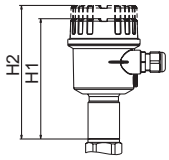
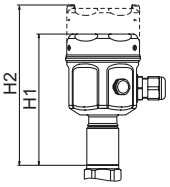
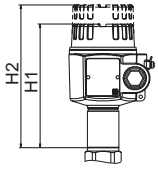
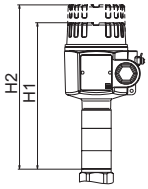
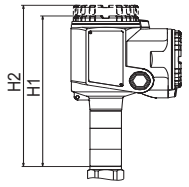
Aluminum housing F13
With gas-tight process seal



Aluminum housing T13
With separate connection compartment and gas-tight process seal

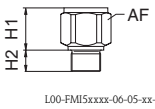
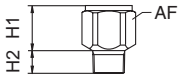
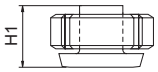
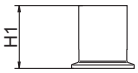


Housing extension heights with adapter

	Polyester housing F16	Stainless steel housing F15	Aluminum housing F17	Aluminum housing F13*	Aluminum housing with separate connection compartment T13*
	 L00-FMI5xxxx-06-05-xx-xx-044	 L00-FMI5xxxx-06-05-xx-xx-046	 L00-FMI5xxxx-06-05-xx-xx-045	 L00-FMI5xxxx-06-05-xx-xx-048	 L00-FMI5xxxx-06-05-xx-xx-047
Order code	2	1	3	4	5
FMI51, FMI52					
H1 (for electronic inserts without display)	144	142	152	194	202
H2 (for electronic inserts with display)	163	181	181	223	214

* Housing with gas-tight process seal

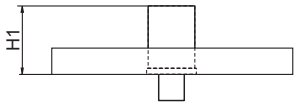
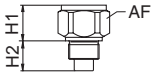
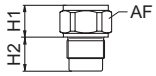
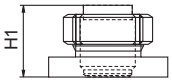
Process connections

	Thread G	Thread NPT	Threaded pipe joint	Tri-Clamp
	 L00-FMI5xxxx-06-05-xx-en-007	 L00-FMI5xxxx-06-05-xx-en-008	 L00-FMI5xxxx-06-05-xx-xx-040	 L00-FMI5xxxx-06-05-xx-xx-041
	(DIN EN ISO 228-I)	(ANSI B 1.20.1)	(DIN11851)	(ISO2852)
Rod probes ø10, rope probes				
For pressures up to	25 bar	25 bar	25 bar	16 bar
Version / order code	G½ / GCJ G¾ / GDJ G1 / GEJ	NPT½ / RCJ NPT¾ / RDJ NPT1 / REJ	DN50 PN40 / MRJ	DN25 (1") / TCJ DN38 (1½") / TJJ
Dimensions	H1 = 38 H2 = 19 AF = 41	H1 = 38 H2 = 19 AF = 41	H1 = 57	H1 = 57
Surface roughness	–	–	≤ 0.8 µm	≤ 0.8 µm
Additional information	With elastomer flat seal	–	–	EHEDG*

Rod probes ø16, rope probes							
For pressures up to	25 bar	100 bar	25 bar	100 bar	40 bar	16 bar	16 bar
Version / order code	G¾ / GDJ G1 / GEJ	G1½ / GGJ	NPT¾ / RDJ NPT1 / REJ	NPT1½ / RGJ	DN50 PN40 / MRJ	DN38 / TNJ (1½")	DN40-51 / TDJ (2")
Dimensions	H1 = 38 H2 = 19 AF = 41	H1 = 41 H2 = 25 AF = 55	H1 = 38 H2 = 19 AF = 41	H1 = 41 H2 = 25 AF = 55	H1 = 66	H1 = 47	H1 = 66
Surface roughness	–		–		≤ 0.8 µm	≤ 0.8 µm	≤ 0.8 µm
Additional information	With elastomer flat seal		–		–	–	

* EHEDG: Certificate only applies for probes without an inactive length and with a fully insulated probe rod.

	Thread G	Thread NPT	Threaded pipe joint	Tri-Clamp
Rod probes ø22, rope probes				
For pressures up to	50 bar	50 bar	–	–
Version / order code	G1½ / GGJ	NPT1½ / RGJ	–	–
Dimensions	H1 = 85 H2 = 25 AF = 55	H1 = 85 H2 = 25 AF = 55	–	–
Surface roughness	–	–	≤ 0.8 µm	≤ 0.8 µm
Additional information	With elastomer flat seal	–	–	–

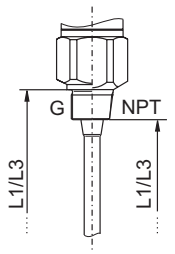
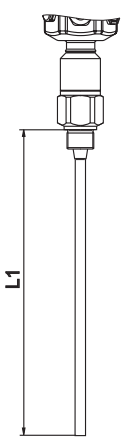
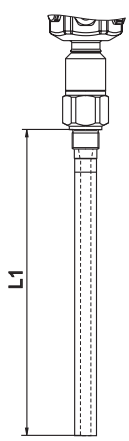
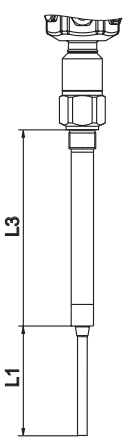
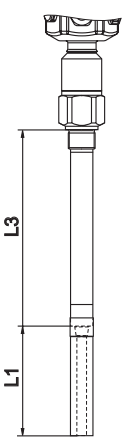
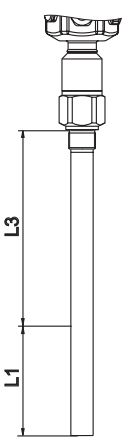
	Flanges	Hygiene connection	Hygiene connection	Hygiene connection
	 L00-FMI5xxxx-06-05-xx-xx-042	 L00-FMI5xxxx-06-05-xx-en-009	 L00-FMI5xxxx-06-05-xx-en-010	 L00-FMI5xxxx-06-05-xx-xx-043
	(EN1092-1) (ANSI B 16.5) (JIS B2220)	With flush-mounted seal	With flush-mounted seal	Adapter 44 mm with flush-mounted seal
Rod probes ø10, rope probes				
For pressures up to	Max. 25 bar (depends on flange)	25 bar	25 bar	–
Version / order code	EN / B** ANSI / A** JIS / K**	G¾ / GQJ	G1 / GWJ	–
Dimensions	H1 = 57	H1 = 31 H2 = 26 AF = 41	H1 = 30 H2 = 27 AF = 41	–
Additional information	Also clad (PTFE)	Weld-in adapter see "Accessories"Page 37 EHEDG*	Weld-in adapter see "Accessories"Page 37 EHEDG*	–
Rod probes ø16, rope probes				
For pressures up to	Max. 100 bar (depends on flange)	–	–	16 bar (tightening torque 10 Nm)
Version / order code	EN / B** ANSI / A** JIS / K**	–	–	Universal adapter / UPJ
Dimensions	H1 = 66	–	–	H1 = 57
Additional information	Also clad (PTFE)	–	–	Universal adapter see "Accessories"Page 38
Rod probes ø22, rope probes				
For pressures up to	Max. 50 bar (depends on flange)	–	–	–
Version / order code	EN / B** ANSI / A** JIS / K**	–	–	–
Dimensions	H1 = 110	–	–	–
Additional information	Only clad (PTFE)	–	–	–

* EHEDG: Certificate only applies for probes without an inactive length and with a fully insulated probe rod.
** Wildcard for nominal diameter and permitted process pressure

✎ Note!
Only use clad flanges for aggressive liquids!

Rod probes FMI51

Note!
- The active probe rod is always fully insulated (dimension L1).
- Total length of probe from sealing surface: L = L1 + L3
- Thickness of insulation for probe rod ø 10 mm = 1 mm; 16 mm = 2 mm; 22 mm = 2 mm
- For conductive liquids (>100 µS/cm), the probe is calibrated at the factory to the probe length ordered (0 % to 100 %). For nonconductive liquids (<1 µS/cm), 0% calibration is performed at the factory. Only the 100% calibration has to be carried out on site.
- The isolation is at the probe point approx. 10 mm welded. This range is not part of the active measuring range.

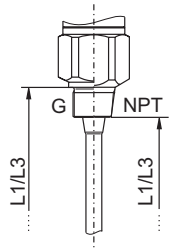
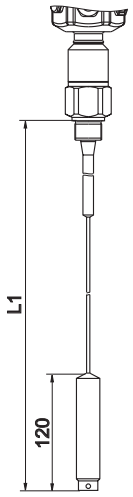
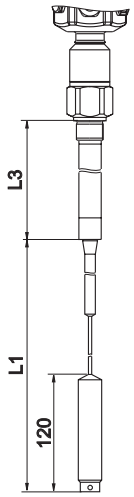
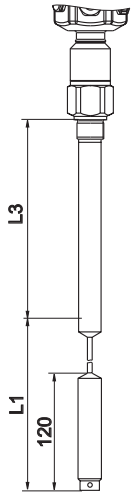
	Rod probe	**Rod probe with ground tube**	**Rod probe with inactive length**	**Rod probe with inactive length and ground tube**	**Rod probe with fully insulated inactive length**
 L00-FMI5xxxx-06-05-xx-xx-061.eps					 L00-FMI5xxxx-06-05-xx-xx-051
Total length (L)	100 to 4000	100 to 4000	100 to 6000	100 to 6000	300 to 4000
Active rod length (L1)	100 to 4000	100 to 4000	100 to 4000	100 to 4000	150 to 3000
Inactive rod length (L3)	-	-	100 to 2000	100 to 2000	150 to 1000
Probe rod diameter	10 / 16	10 / 16	10 / 16	10 / 16	22*
Diameter of ground tube with or without inactive length	- / -	22 / 43	22 / 43	22 / 43	22*
Lateral loading capacity (Nm) at 20 °C	< 15 / < 30	< 40 /< 300	< 30 /< 60	< 40 /< 300	< 25
For use in agitating tanks	-	- / X	-	- / X	-
For conductive liquids > 100 µS/cm	X	-	X	-	X
For nonconductive liquids < 100 µS/cm	-	X	-	X	-
For aggressive liquids	X	-	-	-	X
For high-viscosity liquids	X	-	X	-	X
For use in plastic tanks	-	X	-	X	-
For use in mounting nozzles	-	-	X	X	X
In the event of condensate on tank ceiling	-	-	X	X	X

X = recommended
* probe shaft

Length tolerance L1, L3 **up to 1 m:** 0...–5 mm **1 m up to 3 m:** 0...–10 mm **3 m up to 6 m:** 0...–20 mm

FMI52 rope probes

Note!
- The active probe length is always fully insulated (dimension L1).
- Total length of probe from sealing surface: L = L1 + L3
- All rope probes are prepared for tensioning in containers (tensioning weight with anchor hole)
- For conductive liquids (>100 µS/cm), the probe is calibrated at the factory to the probe length ordered (0 % to 100 %). For nonconductive liquids (<1 µS/cm), 0% calibration is performed at the factory. Only the 100% calibration has to be carried out on site.
- Not suitable for agitator tanks, high-viscosity liquids and plastic tanks.
- Thickness of rope insulation 0.75 mm
- In the range of the anchor weight the measurement is not linear.

	Rope probe	**Rope probe with inactive length**	**Rope probe with fully insulated inactive length**
 L00-FMI5xxxx-06-05-xx-xx-061.eps			 L00-FMI5xxxx-06-05-xx-xx-036
Total length (L)	420 to 10000	420 to 12000	420 to 11000
Active rope length (L1)	420 to 10000	420 to 10000	420 to 10000
Inactive length (L3)	-	150 to 2000	150 to 1000
Probe rope diameter	4	4	4
Anchor weight diameter	22	22	22
Anchor hole diameter	5	5	5
Tensile loading capacity (N) of probe rope at 20 °C	200	200	200
For conductive liquids > 100 µS/cm	X	X	X
For nonconductive liquids < 100 µS/cm	X	X	X
For aggressive liquids	X	-	X
For use in mounting nozzles	-	X	X
In the event of condensate on tank ceiling	-	X	X

X = recommended

Length tolerance L1, L3 **up to 1 m:** 0...–10 mm **1 m up to 3 m:** 0...–20 mm **3 m up to 6 m:** 0...–30 mm **6 m up to 12 m:** 0...–40 mm

Technical data (probe)

Capacitance values of probe

- Basic capacitance: approx. 18 pF

Additional capacitance

- Mount the probe with a minimum distance of 50 mm from a conductive container wall:
  Probe rod: approx. 1.3 pF/100 mm in air
  Probe rope: approx. 1.0 pF/100 mm in air
- Fully insulated probe rod in water:
  Approx. 38 pF/100 mm (16 mm rod)
  Approx. 45 pF/100 mm (10 mm rod)
  Approx. 50 pF/100 mm (22 mm rod)
- Insulated probe rope in water: approx. 19 pF/100 mm
- Rod probe with ground tube:
  – Insulated probe rod: in air approx. 6.4 pF/100 mm
  – Insulated probe rod: in water approx. 38 pF/100 mm (16 mm rod)
  – Insulated probe rod: in water approx. 45 pF/100 mm (10 mm rod)

Probe lengths for continuous measurement in conductive liquids

- With FEI57C, FEI50H
  – Rod probe (range 0 to 2000 pF for ≤ 4000 mm)
  – Rope probe < 6 m (range 0 to 2000 pF)
  – Rope probe > 6 m (range 0 to 4000 pF)

Weight

- With F15, F16, F17 or F13 housing approx. 4.0 kg
  - + Flange weight
  - + Probe rod 0.5 kg/m (with ø10 mm probe rod) or
    + Probe rod 1.1 kg/m (with ø16 mm probe rod) or
    + Probe rope 0.04 kg/m (with rope probes)
- With T13 housing approx. 4.5 kg
  - + Flange weight
  - + Probe rod 0.5 kg/m (with ø10 mm probe rod) or
    + Probe rod 1.1 kg/m (with ø16 mm probe rod) or
    + Probe rope 0.04 kg/m (with rope probes)

Material

Housing

- Aluminum housing F17, F13, T13: GD-Al Si 10 Mg, DIN 1725, with plastic coating (blue/gray)
- Polyester housing F16: PBT-FR fiberglass reinforced polyester (blue/gray)
- Stainless steel housing F15: corrosion-resistant steel 316L (14435)

Housing cover and seals

- Housing cover and seals:
  – Aluminum housing F17, F13, T13: EN-AC-AlSi10Mg, plastic-coated
    cover seal: EPDM
  – Polyester housing F16: cover made of PBT-FR or with cover with sight glass made of PA12
    cover seal: EPDM
  – Stainless steel housing F15: AISI 316L
    cover seal: silicone

Process connection seal

- Sealing ring for process connection G½, G¾, G1, G1½ :
  Elastomer fiber, asbestos-free, resistant to oils, solvents, steam, weak acids and alkalis;
  To 300 °C and to 100 bar

Probe material

- Probe rod, ground tube, process connection, inactive length, tensioning weight for rope probe: 1.4435 (316L)
- Probe rope: 1.4401 (AISI 316)
- Probe insulation: PFA or PTFE (in conformity with FDA)
- Rope insulation: PFA or FEP (in conformity with FDA)

Input

Measured variable

Continuous measurement of change in capacitance between probe rod and container wall or ground tube, depending on the level of a liquid.

Measuring range with electronic insert FEI50H (4 to 20 mA HART) FEI57C (PFM)

- Measuring frequency:
  – 500 kHz
- Span:
  – ΔC = 25 to 4000 pF recommended (2 to 4000 pF possible)
- Final capacitance:
  – C_E = max. 4000 pF
- Adjustable initial capacitance:
  – C_A = 0 to 2000 pF (< 6 m probe length)
  – C_A = 0 to 4000 pF (< 6 m probe length)

Input signal

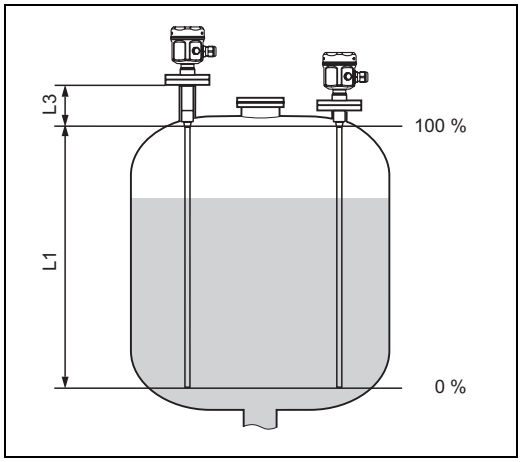
Probe covered => high capacitance
Probe not covered => low capacitance

Measuring condition

- Measuring range L1 possible from the tip of the probe to the process connection.
- Particularly suited for small containers.

Note!
When installing in a nozzle, use inactive length (L3).

The 0 %, 100 % calibration can be inverted.



L00-FMI5xxxx-15-05-xx-xx-002

Output

Output signal

FEI50H (4 to 20mA/HART Version 5.0)

- 3.8 to 20.5 mA with HART protocol

FEI57C (PFM)

- The transmitter superimposes current pulses (PFM signal 60 to 2800 Hz) with a pulse width of approx. 100 µs and a current strength of approx. 8 mA on the supply current (approx. 8 mA).

Signal on alarm

FEI50H

Fault diagnosis can be called up as follows:
- Via the local display:
  – Red LED
- Via the local display showing:
  – Error symbol
  – Plain text display
- Via the current output: 22 mA
- Via the digital interface (HART status error message)

FEI57C

Fault diagnosis can be called up as follows:

- Via the local display:
  – Red LED
- Via the local display at the switching unit: silometer (FMX570, FMC671/672), Prolevel (FMC661/662)

Linearization

FEI50H

The Liquicap M linearization function enables conversion of the measured value into any desired length or volume units. Linearization tables for volume calculation of horizontal cylindrical tanks and spherical tanks are pre-programmed. Any other tables with up to 32 value pairs can be input manually or semi-automatically.

FEI57C

With FEI57C, linearization takes place in the switching units.

Power supply

Electrical connection

Connection compartment

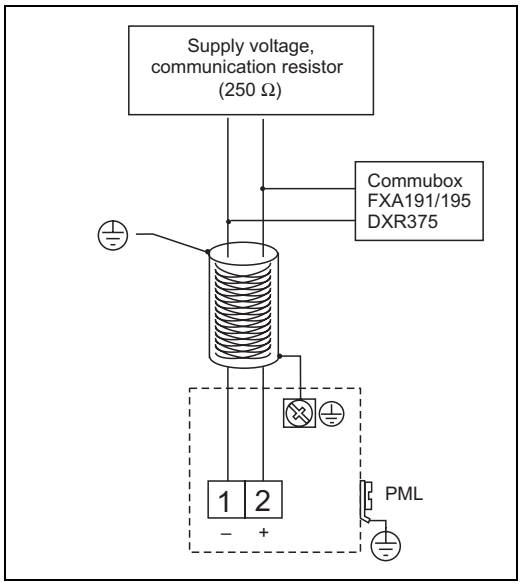
Five housings are available:

	Standard	EEx ia	EEx d	Gas-tight process seal
Plastic housing F16	X	X	–	–
Stainless steel housing F15	X	X	–	–
Aluminum housing F17	X	X	–	–
Aluminum housing F13	X	X	–	X
Aluminum housing T13 (with separate connection compartment)	X	X	X	X

Terminal assignment

2-wire, 4 to 20 mA with HART

The twin-core connecting cable is connected to the screw terminals (conductor cross-section 0.5 to 2.5 mm) in the connection compartment at the electronic insert. If the superimposed communication signal (HART) is used, a shielded cable must be used and the shielding connected at the sensor and power supply.
Protective circuits against reverse polarity, HF-influences and overvoltage peaks are integrated (see TI241F "EMC test procedures").

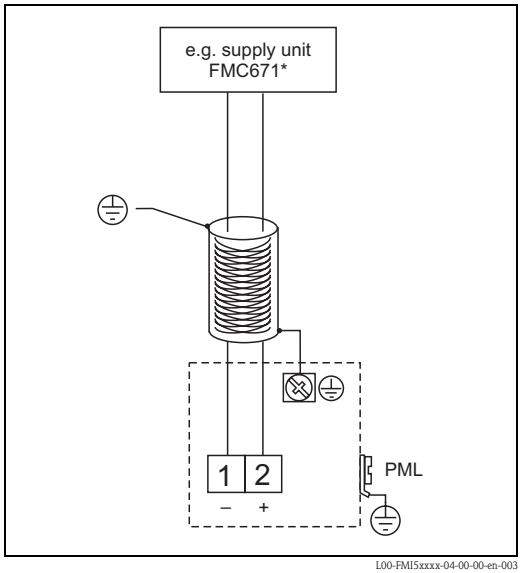


L00-FMI5xxxx-04-00-00-en-002

2-wire, PFM

The twin-core, shielded connecting cable with a cable resistance of max. 25 Ω per core is connected to the screw terminals (conductor cross-section 0.5 to 2.5 mm) in the connection compartment. The shielding must be connected at the sensor and power supply.
Protective circuits against reverse polarity, HF-influences and overvoltage peaks are integrated (see TI241F "EMC test procedures").

* Order stop 2006.

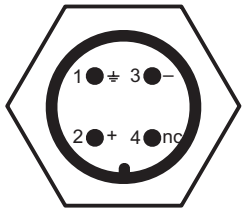


L00-FMI5xxxx-04-00-00-en-003

Connector

For the versions with a connector (M12 or 7/8"), the housing does not have to be opened to connect the signal line.

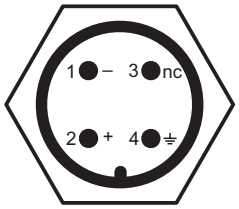
PIN assignment for M12 connector (PROFIBUS PA standard, HART)



L00-FMxxxxxx-04-00-00-yy-016

PIN	Meaning
1	Ground
2	Signal +
3	Signal –
4	Not assigned

PIN assignment for 7/8" connector (Fieldbus FOUNDATION standard, HART)



L00-FMxxxxxx-04-00-00-yy-017

PIN	Meaning
1	Signal –
2	Signal +
3	Not assigned
4	Ground

Supply voltage

All of the following voltages are terminal voltages directly at the device:

FEI50H:

- 12.0 to 36 VDC (in the non-hazardous area)
- 12.0 to 30 VDC (in hazardous areas EEx ia)
- 14.4 to 30 VDC (in hazardous areas EEx d)

FEI57C:

- 14.8 VDC from related supply unit e.g. FMC661 (* order stop 2006)

Note!
Both electronic inserts have integrated reverse polarity protection.

Cable entry

- Cable gland: M20x1.5 (for EEx d only cable entry)
  Two cable glands are included in scope of delivery.
- Cable entry: G ½ or ½ NPT

Power consumption

FEI50H

Min. 40 mW, max. 800 mW

FEI57C

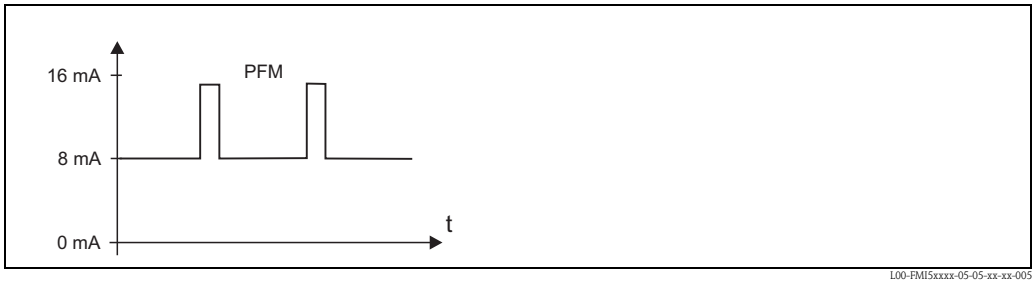
Max. 250 mW

Current consumption

FEI50H (4 to 20 mA/HART)

- Current consumption: 3.8 to 22 mA
- HART multidrop operation: 4 mA

FEI57C



Frequency: 60 to 2800 Hz

HART residual ripple

47 to 125 Hz: Uss = 200 mV (with 500 Ω)

HART noise (FEI50H)

500 Hz to 10 kHz: Ueff < 2.2 mV (with 500 Ω)

Performance characteristics

Reference operating conditions

- Temperature = +20 °C ±5 °C
- Pressure = 1013 mbar abs. ±20 mbar
- Humidity = 65 % ±20%
- Medium = water from mains (conductivity ≥ 180 µS/cm)
- Rod probe PFA: Probe length 1 m

Maximum measured error

- Linearity: 0.5 %
- Reproducibility: 0.1 %

Influence of ambient temperature

Electronic insert

< 0.06 % / 10 K related to the full scale value

Separate housing

Change in capacitance of connecting cable 0.015 pF/m per K

Startup settling time

FEI50H
14 s (stable measured value after switch-on procedure)

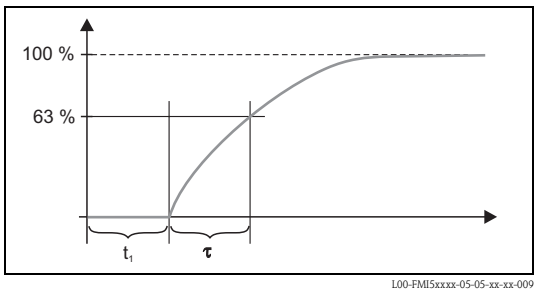
FEI57C
1.5 s (stable measured value after switch-on procedure)

Measured value reaction time

FEI50H
$t_1 \leq 0.3$ s
$t_1 \leq 0.5$ s for operating mode SIL

FEI57C
$t_1 = 0.3$ s

Note!
Observe integration time of switching unit



τ = Integration time
t_1 = Measured value reaction time

Integration time

FEI50H

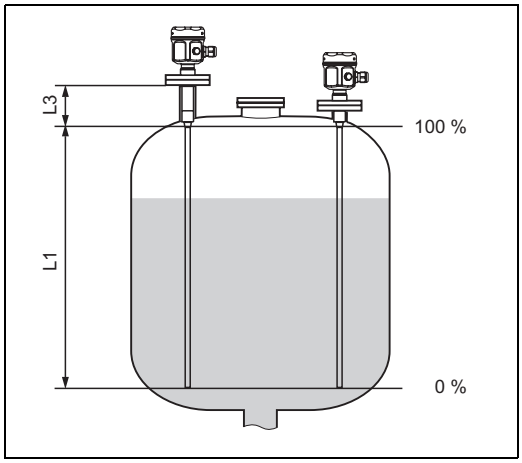
τ =1 s (factory setting) 0 to 60 s can be set.
The integration time affects the speed at which the display and the current output react to changes in the level.

Accuracy of factory calibration

	Probe length < 2 m	Probe length > 2 m
Empty calibration (0 %)	≤ 5 mm	Approx. 2 %
Full calibration (100 %)	≤ 5 mm	Approx. 2 %

Medium conductivity ≥ 100 µS/cm
Minimum distance to container wall = 250 mm

✎ Note!
In an installed state, recalibration is only necessary if:
- The 0 % or the 100 % value have to be adjusted specifically for the customer.
- The liquid is not conductive.
- The distance from probe to tank wall is < 250 mm.



L00-FMI5xxxx-15-05-xx-xx-002

Resolution

FEI50H

Analog in % (4 to 20 mA)
- FMI51, FMI52: 11 bit/2048 steps, 8 µA
- The resolution of the electronics can be directly converted to units of length of the probe FMI51 or FMI52.
  e.g. active probe rod 1000 mm
  Resolution = 1000 mm/2048 = 0.48 mm

FEI57C

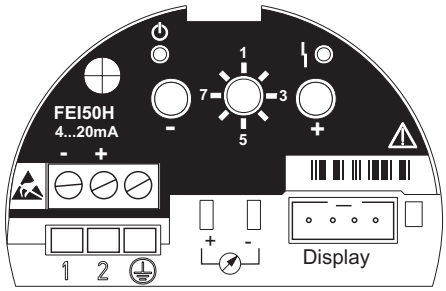
- Zero frequency f_0 60 Hz:
  Sensitivity of the electronic insert = 0.685 Hz/pF
  Entry in switching unit FMC671 under V3H5 and V3H6 or V7H5 and V7H6

Human interface

Electronic inserts

FEI50H

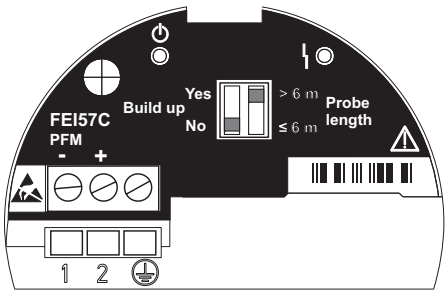
- Green LED (⏻ operational status)
- Red LED (ϟ fault message)
- Key (-)
- Key (+)
- Mode switch
  - 1 : Operation
  - 2 : Empty calibration
  - 3 : Full calibration
  - 4 : Measuring modes
  - 5 : Measuring range
  - 6 : Self-test
  - 7 : Reset (factory settings)
  - 8 : Upload sensor EEPROM
- 4 to 20 mA current pick-off, e.g. for full/empty calibration with multimeter. (No need to disconnect circuit!)
- Display connection



L00-FMI5xxxx-07-05-xx-xx-000

FEI57C

- Green LED (⏻ operational status)
- Red LED (ϟ fault message)
- DIP switch, buildup (YES/NO)
- DIP switch, probe length (> 6 m/< 6 m)



L00-FMI5xxxx-07-05-xx-xx-002

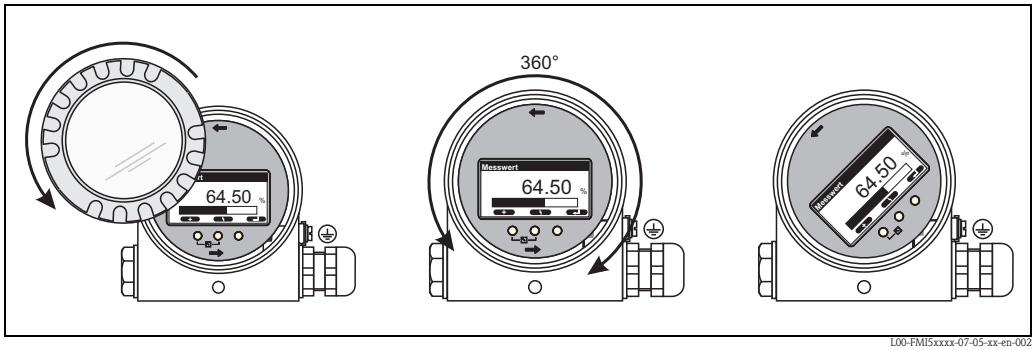
Operating concept with FEI50H display (optional)

The measured value is displayed and Liquicap M is configured onsite by means of a graphic display. The menu guidance with integrated help texts ensures quick and safe commissioning.
For accessing the display, the cover of the electronics compartment can also be opened in hazardous areas (EEx ia).
FieldCare and ToF Tool are graphic operating programs for Endress+Hauser measuring devices which support remote configuration with documentation of the measuring point and also more in-depth analytical functions.

Display (optional)

Liquid crystal display (LCD display)

Graphic display with operating keys

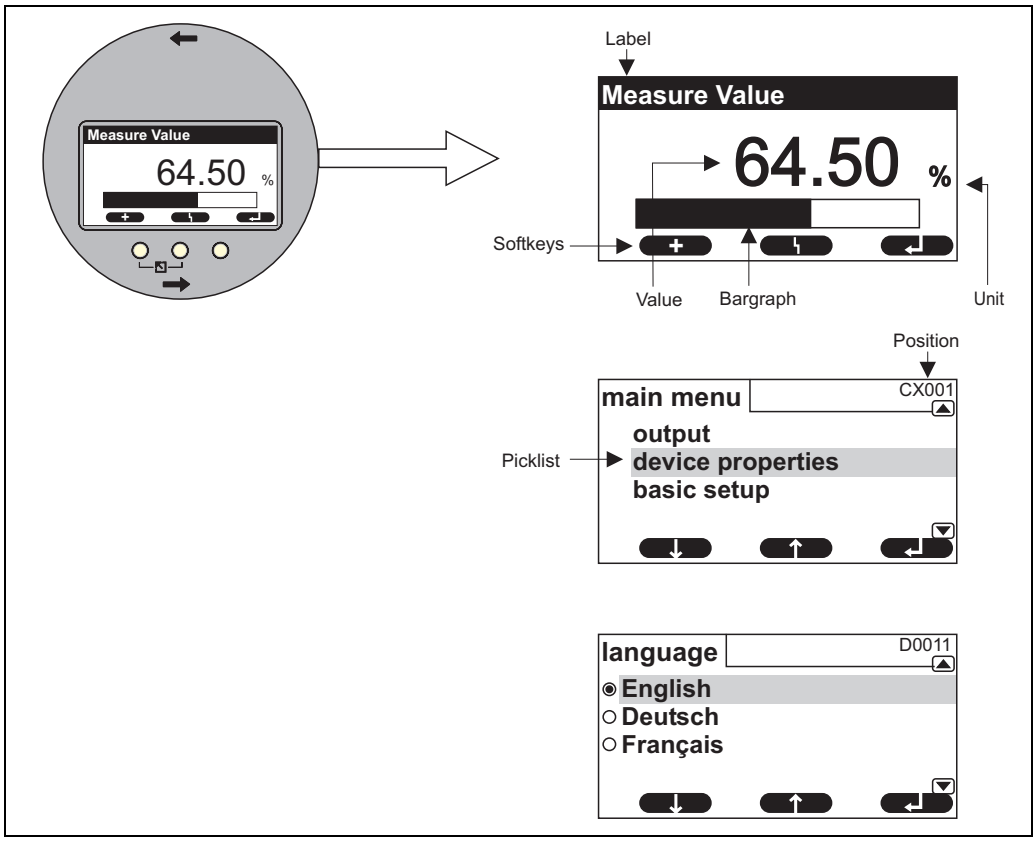


L00-FMI5xxxx-07-05-xx-en-002

Display alignment: can be rotated 360°

Local operation

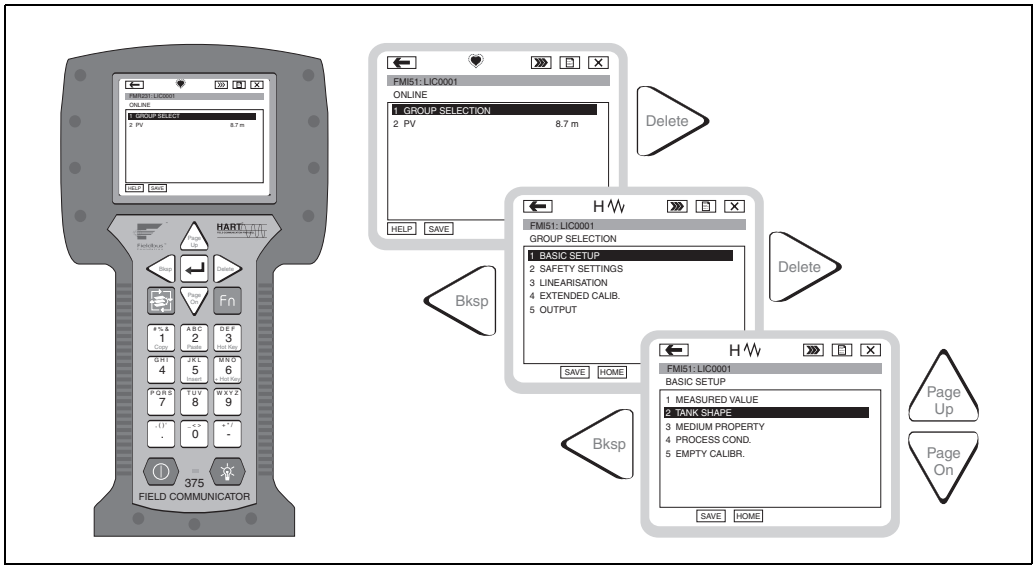
The display can be used to configure via 3 keys directly at the device. All device functions can be set via menu operation. The menu consists of function groups and functions. Application parameters can be read or set in the functions.



L00-FMIxxxxx-07-00-00-en-002

Operation with handheld terminal Field Communicator DXR375

The handheld terminal DXR375 can be used to set all device functions via menu operation.



L00-FMI5xxxx-07-00-00-xx-007

Note!
Further information on the HART handheld terminal is provided in the associated Operating Instructions which can be found in the carrying case for DXR375.

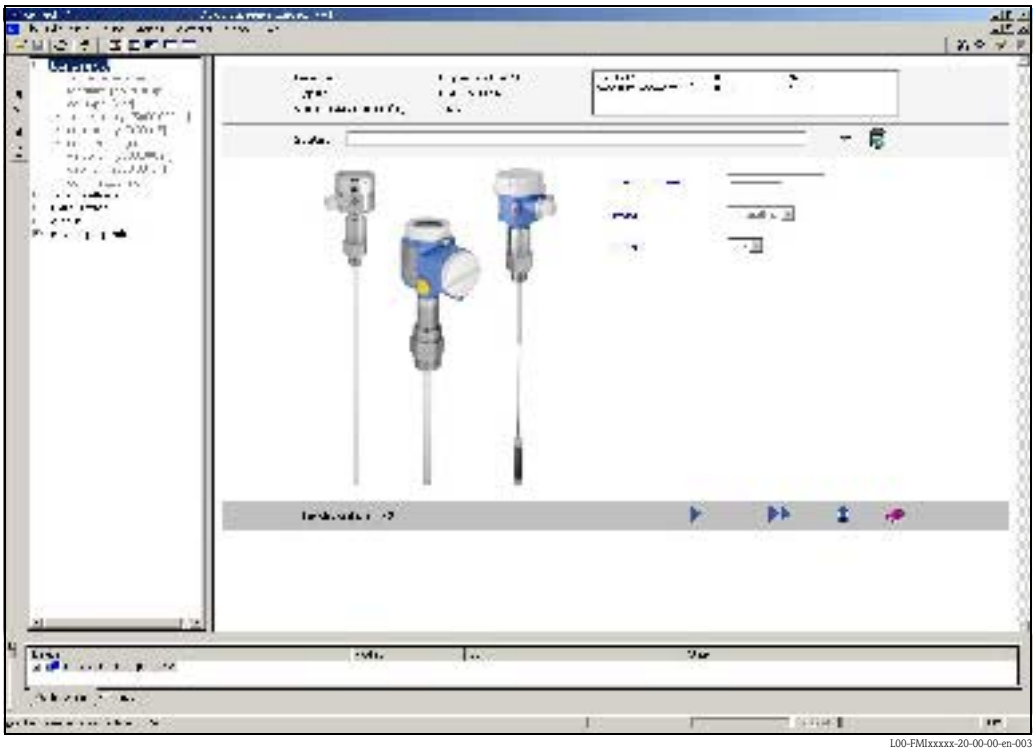
Remote operation

HART can be used for Liquicap M remote operation. Settings can be made on site.

Operation with ToF Tool

ToF Tool is a graphic operating program for measuring devices from Endress+Hauser. It is used to support commissioning, data backup, signal analysis and documentation of the devices.
The following operating systems are supported: WinNT4.0, Win2000 and WinXP.

The ToF Tool supports the following functions:
- Configuration of transmitters in online operation
- Linearization table (creating, editing, importing and exporting)
- Loading and saving device data (upload/download)
- Documentation of the measuring point



L00-FMIxxxxx-20-00-00-en-003

Connection options:
- HART with Commubox FXA191, FXA195

Operation with FieldCare

FieldCare is an FDT-based system asset management tool from Endress+Hauser. It can configure every intelligent field device in your system and helps you in managing these devices.
The use of status information means that you also have a simple but effective tool for monitoring devices.

- Supports all Endress+Hauser devices
- Supports all third-party devices which support the FDT standard, e.g. drives, I/O systems, sensors etc.
- Ensures the full functionality of all devices with DTMs
- Offers general profile operation for third-party fieldbus devices without vendor DTM

Certificates and approvals

CE mark

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations that are listed in the EC Declaration of Conformity and thus meet the legal requirements of the EC Directives. Endress+Hauser confirms the conformity of the device by affixing to it the CE mark.

Ex approval

See "Ordering information" from Page 30

Other standards and guidelines

EN 60529
Degrees of protection by housing (IP code)

EN 61010
Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures

EN 61326
Interference emission (Class B equipment), interference immunity (Annex A – Industrial).

NAMUR
Association for Standards for Control and Regulation in the Chemical Industry

Ordering information

Note!
In this list, versions which are mutually exclusive are not marked.

Liquicap M FMI51

10		Approval:		
	A	Non-hazardous area		
	B	Non-hazardous area,		WHG (German Water Resources Act)
	C	ATEX II 1/2 GD	EEx ia IIC T6	
	D	ATEX II 1/2 GD	EEx ia IIC T6,	WHG
	E	ATEX II 1/2 GD	EEx ia IIB T6	
	F	ATEX II 1/2 GD	EEx ia IIB T6,	WHG
	H	ATEX II 1/2 GD	EEx ia IIC T6,	
		XA, observe safety instructions (electrostatic charge)!		
	J	ATEX II 1/2 GD	EEx ia IIC T6,	WHG
		XA, observe safety instructions (electrostatic charge)!		
	K	ATEX II 1/2 G	EEx ia IIC T6,	WHG
		XA, observe safety instructions (electrostatic charge)!		
	L	ATEX II 1/2 G	EEx d (ia) IIC T6,	WHG
		XA, observe safety instructions (electrostatic charge)!		
	M	ATEX II 3 GD	EEx nA II T6,	WHG
	N	CSA General Purpose, CSA C US		
	P	CSA/FM IS Cl. I, II, III	Div. 1+2 Gr. A-G	
	R	CSA/FM XP Cl. I, II, III	Div. 1+2 Gr. A-G	
	S	TIIS Ex ia IIC T3		
	T	TIIS Ex d IIC T3		
	Y	Special version, to be specified		
	1	NEPSI Ex ia IIC T6		
	2	NEPSI Ex d(ia) IIC T6		

20		Inactive Length L3:		
		Price per 100 mm/1 inch		
		L3: 100 to 2000 mm/4 to 80 inch for 316L		
		L3: 150 to 1000 mm/6 to 40 inch for PTFE fully insulated		
		Protection against condensate + bypassing container nozzles		
	1	Not selected		
	2	..... mm,		316L
	3	..... mm,		316L + fully insulated PTFE
	5	..... inch,		316L
	6	..... inch,		316L + fully insulated PTFE
	9	Special version, to be specified		

30 Active Probe Length L1; Insulation:

Price per 100 mm/1 inch
L1: 100 to 4000 mm/4 to 160 inch for ø10 mm, ø16 mm
L1: 150 to 3000 mm/6 to 120 inch for ø22 mm (fully insulated)

A	..... mm,	10 mm rod,	316L; PTFE
B	..... mm,	16 mm rod,	316L; PTFE
C	..... mm,	22 mm rod,	316L; PTFE
D	..... mm,	16 mm rod,	316L; PFA
E	..... mm,	10 mm rod,	316L; PTFE + ground tube
F	..... mm,	16 mm rod,	316L; PTFE + ground tube
G	..... mm,	16 mm rod,	316L; PFA + ground tube
H	..... inch,	0.4 inch rod,	316L; PTFE
K	..... inch,	0.6 inch rod,	316L; PTFE
M	..... inch,	0.9 inch rod,	316L; PTFE
N	..... inch,	0.6 inch rod,	316L; PFA
P	..... inch,	0.4 inch rod,	316L; PTFE + ground tube
R	..... inch,	0.6 inch rod,	316L; PTFE + ground tube
S	..... inch,	0.6 inch rod,	316L; PFA + ground tube
Y	Special version, to be specified		

50 Process Connection:

Threaded connection

GCJ	G ½,	316L, 25 bar	Thread ISO228
GDJ	G ¾,	316L, 25 bar	Thread ISO228
GEJ	G 1,	316L, 25 bar	Thread ISO228
GGJ	G 1½,	316L, 100 bar	Thread ISO228
RCJ	NPT ½,	316L, 25 bar	Thread ANSI
RDJ	NPT ¾,	316L, 25 bar	Thread ANSI
REJ	NPT 1,	316L, 25 bar	Thread ANSI
RGJ	NPT 1½,	316L, 100 bar	Thread ANSI

Hygiene connection

GQJ	G ¾ ,	316L, 25 bar, EHEDG	Thread ISO228
	Accessories installation, weld-in adapter		
GWJ	G 1,	316L, 25 bar, EHEDG	Thread ISO228
	Accessories installation, weld-in adapter		
MRJ	DN50 PN40,	316L	DIN11851
UPJ	Universal adapter 44 mm	316L, 16 bar	

Tri-Clamp connection

TCJ	DN25 (1"),	316L,	EHEDG	Tri-Clamp ISO2852
TJJ	DN38 (1½"),	316L,	EHEDG	Tri-Clamp ISO2852
TDJ	DN40-51 (2"),	316L,		Tri-Clamp ISO2852
TNJ	DN38 (1½"),	316L, 3A		Tri-Clamp ISO2852
	Tri-Clamp removable			

EN flanges

B0J	DN25 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B1J	DN32 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B2J	DN40 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B3J	DN50 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
CRJ	DN50 PN25/40 B1,	316L	Flange EN1092-1 (DIN2527 C)
DRJ	DN50 PN40 C,	316L	Flange EN1092-1 (DIN2512 F)
ERJ	DN50 PN40 D,	316L	Flange EN1092-1 (DIN2512 N)
BSJ	DN80 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
CGJ	DN80 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
DGJ	DN80 PN16 C,	316L	Flange EN1092-1 (DIN2512 F)
EGJ	DN80 PN16 D,	316L	Flange EN1092-1 (DIN2512 N)
BTJ	DN100 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
CHJ	DN100 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
	PTFE clad		
B0K	DN25 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
B1K	DN32 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
B2K	DN40 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
B3K	DN50 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
BSK	DN80 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)
BTK	DN100 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)

50 Process Connection:

ANSI flanges

ACJ	1" 150 lbs RF,	316/316L	Flange ANSI B16.5
ANJ	1" 300 lbs RF,	316/316L	Flange ANSI B16.5
AEJ	1½" 150 lbs RF,	316/316L	Flange ANSI B16.5
AQJ	1½" 300 lbs RF,	316/316L	Flange ANSI B16.5
AFJ	2" 150 lbs RF,	316/316L	Flange ANSI B16.5
ARJ	2" 300 lbs RF,	316/316L	Flange ANSI B16.5
AGJ	3" 150 lbs RF,	316/316L	Flange ANSI B16.5
ASJ	3" 300 lbs RF,	316/316L	Flange ANSI B16.5
AHJ	4" 150 lbs RF,	316/316L	Flange ANSI B16.5
ATJ	4" 300 lbs RF,	316/316L	Flange ANSI B16.5
AJJ	6" 150 lbs RF,	316/316L	Flange ANSI B16.5
AUJ	6" 300 lbs RF,	316/316L	Flange ANSI B16.5
	PTFE clad		
ACK	1" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
ANK	1" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
AEK	1½" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
AQK	1½" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
AFK	2" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
ARK	2" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
AGK	3" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
AHK	4" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5

JIS flanges

KCJ	10K 25 RF,	316L	Flange JIS B2220
KEJ	10K 40 RF,	316L	Flange JIS B2220
KFJ	10K 50 RF,	316L	Flange JIS B2220
KGJ	10K 80 RF,	316L	Flange JIS B2220
KHJ	10K 100 RF,	316L	Flange JIS B2220
KRJ	20K 50 RF,	316L	Flange JIS B2220
	PTFE clad		
KCK	10K 25 RF,	PTFE >316L	Flange JIS B2220
KEK	10K 40 RF,	PTFE >316L	Flange JIS B2220
KFK	10K 50 RF,	PTFE >316L	Flange JIS B2220
KGK	10K 80 RF,	PTFE >316L	Flange JIS B2220
KHK	10K 100 RF,	PTFE >316L	Flange JIS B2220
YY9	Special version, to be specified		

60 Electronics; Output:

A	FEI50H;	4 to 20 mA HART + display
B	FEI50H;	4 to 20 mA HART
C	FEI57C;	2-wire PFM
V	Prepared for FEI5x + display,	cover high, transparent
W	Prepared for FEI5x,	cover flat
Y	Special version, to be specified	

70 Housing:

1	F15	316L	IP66, NEMA4X
2	F16	polyester	IP66, NEMA4X
3	F17	aluminum	IP66, NEMA4X
4	F13	aluminum + gas-tight process seal	IP66, NEMA4X
5	T13	aluminum + gas-tight process seal + separate connection compartment	IP66, NEMA4X
9	Special version, to be specified		

80 Cable Entry:

A	Gland M20 (EEx d > thread M20)
B	Thread G ½
C	Thread NPT ½
D	Thread NPT ¾
E	Plug M12
F	Plug $^{7}/_{8}$"
Y	Special version, to be specified

90	**Type of Probe:**	
	L4: 300 to 6000 mm/12 to 240 inch	
	1	Compact
	2	2000 mm L4 cable > separate housing
	3	....mm L4 cable > separate housing
	4	80 inch L4 cable > separate housing
	5	....inch L4 cable > separate housing
	9	Special version, to be specified

100	**Additional Option:**		
	A	Basic version	
	B	Cleaned for silicone- free service*	
	C	Metal probe rod surface refining**	
	D	EN10204-3.1 (316L wetted parts),	Inspection certificate
	E	EN10204-3.1 (316L wetted parts), NACE MR0175	Inspection certificate
	F	SIL declaration of conformity	
	S	GL marine certificate	
	Y	Special version, to be specified	

FMI51	Product designation

* With this option, the complete device is cleaned for applications free from paint-wetting impairment substances
** With this option, the surface of the probe rod (316L) is passivated and acts as additional corrosion protection

Liquicap M FMI52

10 Approval:

A	Non-hazardous area	
B	Non-hazardous area,	WHG
E	ATEX II 1/2 GD	EEx ia IIB T6
F	ATEX II 1/2 GD	EEx ia IIB T6, WHG
H	ATEX II 1/2 GD	EEx ia IIC T6,
	XA, observe safety instructions (electrostatic charge)!	
J	ATEX II 1/2 GD	EEx ia IIC T6, WHG
	XA, observe safety instructions (electrostatic charge)!	
K	ATEX II 1/2 G	EEx ia IIC T6, WHG
	XA, observe safety instructions (electrostatic charge)!	
L	ATEX II 1/2 G	EEx d (ia) IIC T6, WHG
	XA, observe safety instructions (electrostatic charge)!	
M	ATEX II 3 GD	EEx nA II T6, WHG
N	CSA General Purpose, CSA C US	
P	CSA/FM IS Cl. I, II, III	Div. 1+2 Gr. A-G
R	CSA/FM XP Cl. I, II, III	Div. 1+2 Gr. A-G
S	TIIS Ex ia IIC T3	
T	TIIS Ex d IIC T3	
Y	Special version, to be specified	
1	NEPSI Ex ia IIC T6	
2	NEPSI Ex d(ia) IIC T6	

20 Inactive Length L3:

Price per 100 mm/1 inch
L3: 100 to 2000 mm/4 to 80 inch for 316L
L3: 150 to 1000 mm/6 to 40 inch for PFA fully insulated
Protection against condensate + bypassing container nozzles

1	Not selected	
2	... mm,	316L
3	... mm,	316L + fully insulated PFA
5	... inch,	316L
6	... inch,	316L + fully insulated PFA
9	Special version, to be specified	

30 Active Probe Length L1; Insulation:

Price per 1000 mm/10 inch
L1: 420 to 10000 mm/17 to 400 inch; fully insulated

A	... mm L1,	316; FEP
B	... mm L1,	316; PFA
C	... inch L1,	316; FEP
D	... inch L1,	316; PFA
Y	Special version, to be specified	

50 Process Connection:

Threaded connection

GDJ	G ¾,	316L, 25 bar	Thread ISO228
GEJ	G 1,	316L, 25 bar	Thread ISO228
GGJ	G 1½,	316L, 100 bar	Thread ISO228
RDJ	NPT ¾,	316L, 25 bar	Thread ANSI
REJ	NPT 1,	316L, 25 bar	Thread ANSI
RGJ	NPT 1½,	316L, 100 bar	Thread ANSI

Hygiene connection

GWJ	G 1	316L, 25 bar, EHEDG	Thread ISO228
	Accessories installation, weld-in adapter		
MRJ	DN50 PN40,	316L	DIN11851
UPJ	Universal adapter 44 mm	316L, 16 bar, EHEDG	

Tri-Clamp connection

TCJ	DN25 (1"),	316L,	EHEDG	Tri-Clamp ISO2852
TJJ	DN38 (1½"),	316L,	EHEDG	Tri-Clamp ISO2852
TDJ	DN40-51 (2"),	316L,		Tri-Clamp ISO2852

EN flanges

B0J	DN25 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
B1J	DN32 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)

50	Process Connection:			
	B2J	DN40 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
	B3J	DN50 PN25/40 A,	316L	Flange EN1092-1 (DIN2527 B)
	CRJ	DN50 PN25/40 B1,	316L	Flange EN1092-1 (DIN2527 C)
	DRJ	DN50 PN40 C,	316L	Flange EN1092-1 (DIN2512 F)
	ERJ	DN50 PN40 D,	316L	Flange EN1092-1 (DIN2512 N)
	BSJ	DN80 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
	CGJ	DN80 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
	DGJ	DN80 PN16 C,	316L	Flange EN1092-1 (DIN2512 F)
	EGJ	DN80 PN16 D,	316L	Flange EN1092-1 (DIN2512 N)
	BTJ	DN100 PN10/16 A,	316L	Flange EN1092-1 (DIN2527 B)
	CHJ	DN100 PN10/16 B1,	316L	Flange EN1092-1 (DIN2527 C)
		PTFE clad		
	B0K	DN25 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
	B1K	DN32 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
	B2K	DN40 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
	B3K	DN50 PN25/40,	PTFE >316L	Flange EN1092-1 (DIN2527)
	BSK	DN80 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)
	BTK	DN100 PN10/16,	PTFE >316L	Flange EN1092-1 (DIN2527)
	ANSI flanges			
	ACJ	1" 150 lbs RF,	316/316L	Flange ANSI B16.5
	ANJ	1" 300 lbs RF,	316/316L	Flange ANSI B16.5
	AEJ	1½" 150 lbs RF,	316/316L	Flange ANSI B16.5
	AQJ	1½" 300 lbs RF,	316/316L	Flange ANSI B16.5
	AFJ	2" 150 lbs RF,	316/316L	Flange ANSI B16.5
	ARJ	2" 300 lbs RF,	316/316L	Flange ANSI B16.5
	AGJ	3" 150 lbs RF,	316/316L	Flange ANSI B16.5
	ASJ	3" 300 lbs RF,	316/316L	Flange ANSI B16.5
	AHJ	4" 150 lbs RF,	316/316L	Flange ANSI B16.5
	ATJ	4" 300 lbs RF,	316/316L	Flange ANSI B16.5
	AJJ	6" 150 lbs RF,	316/316L	Flange ANSI B16.5
	AUJ	6" 300 lbs RF,	316/316L	Flange ANSI B16.5
		PTFE clad		
	ACK	1" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
	ANK	1" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
	AEK	1½" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
	AQK	1½" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
	AFK	2" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
	ARK	2" 300 lbs,	PTFE >316/316L	Flange ANSI B16.5
	AGK	3" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
	AHK	4" 150 lbs,	PTFE >316/316L	Flange ANSI B16.5
	JIS flanges			
	KCJ	10K 25 RF,	316L	Flange JIS B2220
	KEJ	10K 40 RF,	316L	Flange JIS B2220
	KFJ	10K 50 RF,	316L	Flange JIS B2220
	KGJ	10K 80 RF,	316L	Flange JIS B2220
	KHJ	10K 100 RF,	316L	Flange JIS B2220
	KRJ	20K 50 RF,	316L	Flange JIS B2220
		PTFE clad		
	KCK	10K 25 RF,	PTFE >316L	Flange JIS B2220
	KEK	10K 40 RF,	PTFE >316L	Flange JIS B2220
	KFK	10K 50 RF,	PTFE >316L	Flange JIS B2220
	KGK	10K 80 RF,	PTFE >316L	Flange JIS B2220
	KHK	10K 100 RF,	PTFE >316L	Flange JIS B2220
	YY9	Special version, to be specified		

60	Electronics; Output:		
	A	FEI50H; 4 to 20 mA HART + display	
	B	FEI50H; 4 to 20 mA HART	
	C	FEI57C; 2-wire PFM	
	V	Prepared for FEI5x + display,	cover high, transparent
	W	Prepared for FEI5x,	cover flat
	Y	Special version, to be specified	

70	**Housing:**		
1	F15 316L	IP66, NEMA4X	
2	F16 polyester	IP66, NEMA4X	
3	F17 aluminum	IP66, NEMA4X	
4	F13 aluminum + gas-tight process seal	IP66, NEMA4X	
5	T13 aluminum + gas-tight process seal + separate connection compartment	IP66, NEMA4X	
9	Special version, to be specified		

80	**Cable Entry:**
A	Gland M20 (EEx d > thread M20)
B	Thread G ½
C	Thread NPT ½
D	Thread NPT ¾
E	Plug M12
F	Plug $^{7}/_{8}$"
Y	Special version, to be specified

90	**Type of Probe:**	
L4: 100 to 6000 mm/12 to 240 inch		
1	Compact	
2	2000 mm L4 cable	> separate housing
3	....mm L4 cable	> separate housing
4	80 inch L4 cable	> separate housing
5	....inch L4 cable	> separate housing
9	Special version, to be specified	

100	**Additional Option:**	
A	Basic version	
D	EN10204-3.1 (316L wetted parts),	Inspection certificate
E	EN10204-3.1 (316L wetted parts), NACE MR0175	Inspection certificate
F	SIL declaration of conformity	
S	GL marine certificate	
Y	Special version, to be specified	

FMI52	Product designation

Accessories

Protective cover

For F13 and F17 housing (only possible with flat cover!)
Order number: TSP17090

Shortening kit for FMI52

Order number: 942901-0001

Commubox FXA191, FXA195 HART

For intrinsically safe HART communication with ToF Tool/FieldCare via an RS232C interface or USB.

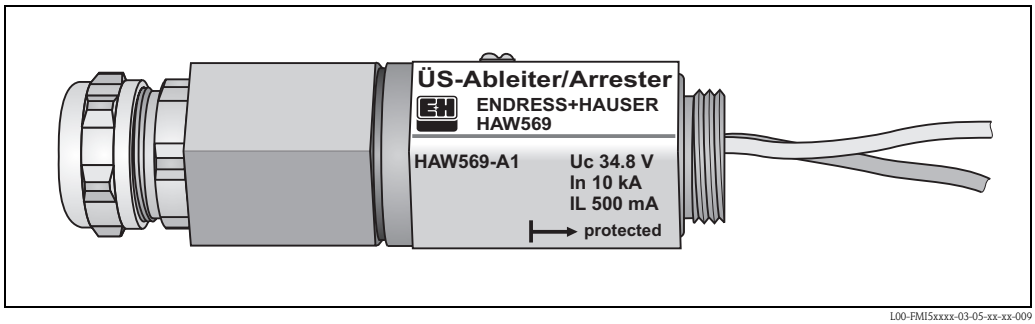
Surge arrester HAW569

Order number:

- HAW569-A11A (non-hazardous)
- HAW569-B11A (hazardous area)

Note!
Both these versions can be screwed directly into the housing (M20x1.5).

Surge arrester for limiting overvoltage in signal lines and components.
The HAW562Z module can be used in hazardous areas.



L00-FMI5xxxx-03-05-xx-xx-009

Weld-in adapter for universal adapter

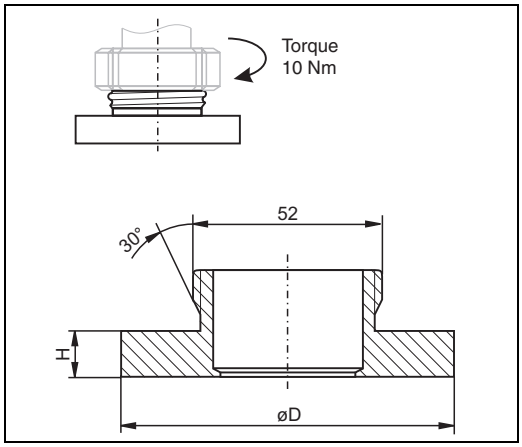
- Order number: 52006262
  Order number: 52010173 with 3.1 certificate
  Diameter D: 85 mm
  Height H: 12 mm
- Order number: 214880-0002
  Order number: 52010174 with 3.1 certificate
  Diameter D: 65 mm
  Height H: 8 mm

For flush-mounted Liquicap M installation with process connection UPJ

Material: corrosion-resistant steel 1.4435 (AISI 316L)

Replacement seal:
Silicone O-ring (Set of 5 seals—FDA-listed)
Order number: 52023572

max. 16 psi / –20 ... 150°C



L00-FMI5xxxx-06-05-xx-en-012

Weld-in adapter for G ¾

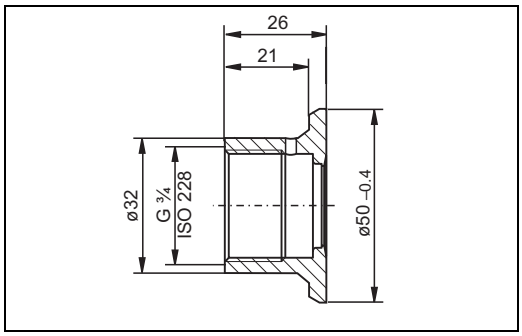
- Order number: 52018765 with 3.1 certificate
  For flush-mounted Liquicap M installation with process connection GQJ
  (seal included in scope of delivery)

Material: corrosion-resistant steel 1.4435 (AISI 316L)

Weight: 0.13 kg
Certificate: EHEDG

Replacement seal:
Silicone O-ring (5-piece set - FDA listed)
Order number: 52021717

max. 25 psi / –50 ... 150°C



L00-FTL5xxxx-06-05-xx-xx-026

Weld-in adapter for G 1

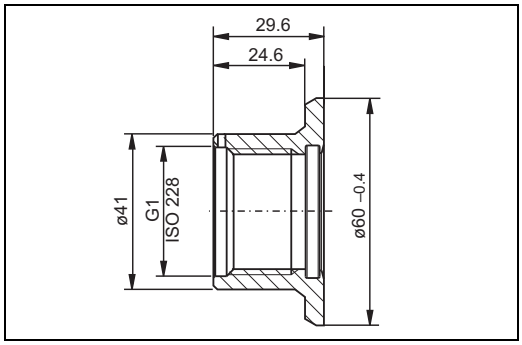
- Order number: 52001051
  Order number: 52011896 with 3.1 certificate
  For flush-mounted Liquicap M installation with process connection GWJ
  (seal included in scope of delivery)

Material: corrosion-resistant steel 1.4435 (AISI 316L)

Weight: 0.19 kg
Certificate: EHEDG

Replacement seal:
Silicone O-ring (5-piece set - FDA listed)
Order number: 52014472

max. 25 psi / –50 ... 150°C



L00-FTL5xxxx-06-05-xx-xx-020

Spare parts

Electronic insert

- FEI50H electronic insert
  52028260
- FEI57C electronic insert
  52028261

Cover for housing without display

- Cover for aluminum housing F13: gray with sealing ring
  52002698
- Cover for stainless steel housing F15: with sealing ring
  52027000
- Cover for stainless steel housing F15: with clasp and sealing ring
  52028268

- Cover for polyester housing F16, flat: gray with sealing ring
  52025606
- Cover for aluminum housing F17, flat: with sealing ring
  52002699
- Cover for aluminum housing T13, flat: gray with sealing ring/electronics compartment
  52006903
- Cover for aluminum housing T13, flat: gray with sealing ring/connection compartment
  52007103

Cover for housing with display

- Cover for stainless steel housing F15: with sight glass, clasp and sealing ring
  52028267
- Cover for stainless steel housing F15: high, with sight glass and sealing ring
  52028269
- Cover for stainless steel housing F15: high, with sight glass, clasp and sealing ring
  71005440
- Cover for aluminum housing F13/F17: high, with sight glass and sealing ring
  52028270
- Cover for aluminum housing T13: high, with sight glass/electronics compartment for EEx d
  52028271
- Cover for polyester housing F16: high, with transparent housing and sealing ring
  52025605

Display with holder

- Display with holder for electronic insert FEI50H
  52028266

Seal set for stainless steel housing

- Seal set for stainless steel housing F15: with 5 sealing rings
  52028179

Terminal module

- Terminal module 2-pin EEx d, RFI filter for T13 housing
  71020804

Supplementary Documentation

Note!
This documentation is available on the product pages at www.endress.com

Technical Information

- Fieldgate FXA320, FXA520
  TI369F/00/en

Operating Instructions

- Liquicap M FMI51, FMI52 (PFM)
  BA297F/00/en
- Liquicap M FMI51, FMI52 (HART)
  BA298F/00/en

Certificates

ATEX safety instructions

- Liquicap M FMI51, FMI52
  ATEX II 1/2 G (EEx ia IIC/IIB T3 to T6), II 1/2 D IP65 T 85 °C
  XA327F/00/a3
- Liquicap M FMI51, FMI52
  ATEX II 1/2 G (EEx d (ia) IIC/IIB T3 to T6)
  XA328F/00/a3

Overfill protection DIBt (WHG)

- Liquicap M FMI51, FMI52
  ZE265F/00/de

Functional safety (SIL2)

- Liquicap M FMI51, FMI52
  SD198F/00/en

Control Drawings

- Liquicap M FMI51, FMI52
  FM
  ZD220F/00/en
- Liquicap M FMI51, FMI52
  CSA
  ZD221F/00/en

Patents

This product is protected by at least one of the patents listed below.
Further patents are under development.

- DE 203 00 901 U1
- DE 103 22 279,
  WO 2004 102 133,
  US 2005 003 9528
- DE 203 13 695,
  WO 2005 025 015

Instruments International

Endress+Hauser
Instruments International AG
Kaegenstrasse 2
4153 Reinach
Switzerland

Tel. +41 61 715 81 00
Fax +41 61 715 25 00
www.endress.com
info@ii.endress.com

Endress+Hauser

People for Process Automation

TI401F/00/en/04.07
FM+SGML 6.0 ProMoDo