FM-01F

Magnetostrictive Level Sensor

Features

/ Simple installation and configuration

/ Insensitive against vibration

/ 2-wire connection 4 to 20 mA

/ HART®-protocol optional

/ ATEX- and IECEx zone 0

/ Up to 450°C

/ Up to 120 bar

/ Up to 13 meter insertion length

/ Inst. kits offer sensor protection

/ Additional measuring of interface

Description:

A float carrying a permanent magnet moves along a slider tube carried by the fluid level up and down. A magnetorestrictive wire is built into this tube through which the electronic components transmit short current impulses that are surrounded by a ring-shaped magnetic field. When this field strikes the static magnetic field of the floater magnet, it results into a torsion impulse that travels in the direction of the sensor head at ultrasonic speed and gets recognized. The time between transmission of current and arrival of the impulse is directly proportional to the distance of the floater which is, therefore, the level. This is measured and converted into a 4-20 mA current signal and is available at the output of the device. On request, the FM-01F can also interrogate two floats at the same time and so the additional interface measurement via HART ®-Protocol can be realized, even if the interface is an emulsion or a low difference in DK value is present.

Application:

The sensor is used where small and medium levels of even hostile media are measured. The magnetostrictive principle of measurement guarantees maximum accuracy and excellent resistance and strength due to its hermetically sealed stainless steel construction. For applications in liquified gas, in extremely aggressive liquids or mechanically harsh environments, installation kits are available that can be permanently installed with the container. In these fittings, the actual sensor is simply inserted from the outside and has no contact to the interior. Versions with sliding tube of twelve millimeters or six millimeters in diameter which are arranged centrally, laterally or angled at 90 degrees and a flexible design with installation lengths up to13 meters qualify the FM-01F particularly for use in the chemical and pharmaceutical industry, in biotechnology plants, and pulp, paper and food industries. In case of an installation in hazardous areas, the sensor can be supplied with ATEX and IECEx approval for zone 0.

Technical Specifications:

Material sensor head / stainless steel 1.4305

Material sliding tube / st. steel 1.4571, (Hastelloy® C4/C22 or Titan on request)

Ambient temperature / -40. . .+85 °C

Diameter sliding tube /
FM-01F.12M: 12 mm
FM-01F.12S: 12 mm
FM-01F.06M: 6 mm
FM-01F.06S: 6 mm
FM-01F.90G: 12 mm
FM-01F.FLEX: 12 mm or 13 mm (depending on sensor length)

min. Process connection /
FM-01F.12M: G3/8" or Fl. DN25
FM-01F.12S: n.a.
FM-01F.06M: G1/4"
FM-01F.06S: G1/4"
FM-01F.90G: G3/8"
FM-01F.FLEX: G3/8"

Accuracy /
FM-01F.12M:
standard: ±0.5 mm or ±0.025 %
precision: ±0.3 mm or ±0.010 %
(precision only at standard temperature NT)
FM-01F.12S:
standard: ±0.5 mm or ±0.025 %
FM-01F.06M:
standard: ±0.75 mm or ±0.025 %
FM-01F.06S:
standard: ±0.75 mm or ±0.025 %
FM-01F.90G:
standard: ±0.75 mm or ±0.025 %
FM-01F.FLEX:
standard: ±2.0 mm or ±0.025 %

Resolution / 0.1 mm (HART®)

poss. insertion lengths /
FM-01F.12M:
100 mm to 6000 mm
(highest temperature version HH to 3000 mm)
FM-01F.12S:
200 mm to 6000 mm
(highest temperature version HH to 3000 mm)
FM-01F.06M:
100 mm to 1000 mm
FM-01F.06S:
100 mm to 1000 mm
FM-01F.090G:
150 mm to 1000 mm
FM-01F.FLEX:
1500 mm to 10000 mm
(to 15000 mmon request)

Pressure /
FM-01F.12M:
-1. . .+120 bar (20°C)
-1. . .+ 95 bar (250°C)
-1. . .+82 bar (450°C)
FM-01F.12S: n.a.
FM-01F.06M:
-1. . .+16 bar (125°C)
FM-01F.06S:
-1. . .+16 bar (125°C)
FM-01F.90G:
-1. . .+120 bar (20°C)
FM-01F.FLEX:
-1. . .+2 bar (85°C)

Temperature /
FM-01F.12M:

st. temperature	-40. . .+125°C
high temperature	-40. . .+250°C
highest temp.	-40. . .+450°C
low temperature	-65. . .+125°C

FM-01F.12S:

st. temperature	-40. . .+125°C
high temperature	-40. . .+250°C
highest temp.	-40. . .+450°C
low temperature	-65. . .+125°C

FM-01F.06M:

st. temperature	-40. . .+125°C

FM-01F.06S:

st. temperature	-40. . .+125°C

FM-01F.90G:

st. temperature	-40. . .+85°C

FM-01F.FLEX:

st. temperature	-40. . .+85°C

Option / lowest temperature
-200. . .+85°C
(only plug connection,
only -1. . .+3 bar, on request)

Electrical Specifications:

Supply voltage / 8. . .30 VDC

Supply voltage Ex / 10. . .30 VDC

Current output / 4. . .20 mA, 2-wire, (optional HART®) failure mode acc. NAMUR NE43

HART®-Function / float position in mm, cm, m, inch or foot, position of a second float, interface (distance between floats), sensor status, configuration

Protection class / IP68

El. connection / cable gland M16 x 1.5 für cable diameters 5. . .10 mm, plug M12 or conduit connection with female thread 1/2-NPT or M20 x 1.5

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Ordering Codes:

Order number	FM-01F.	12M.	1500.	KE01.	G10.	SV.	M12.	NT.	HA/EG/EPF

FM-01F Magnetostrictive Level Sensor

Version /

12M = centrally arranged sliding tube 12 mm
12S = laterally arranged sliding tube 12 mm
06M = centrally arranged sliding tube 6 mm
06S = laterally arranged sliding tube 6 mm
90G = angled sliding tube 12 mm
FLEX = flexible sliding tube

Insertion length in mm /

[ ][ ][ ][ ][ ]

Float (Type acc. Table „Floats“) /

[ ][ ][ ][ ][ ]

Process connection /

000 = none, when laterally arranged sliding tube
G08 = G1/4“ (only for 6 mm sliding tubes)
G10 = G3/8“
G15 = G1/2“
G15 = G3/4“
G50 = G2“ (only welded)
R50 = R2“ (only welded)
N08 = 1/4“-NPT (only for 6 mm sliding tubes)
N10 = 3/8“-NPT
N15 = 1/2“-NPT
N15 = 3/4“-NPT
N50 = 2“-NPT (only welded)
F25 = flange DN25 PN40 compatible to shape C and shape D DIN2527
F50 = flange DN50 PN40 compatible to shape C and shape D DIN2527
F65 = flange DN65 PN40 compatible to shape C and shape D DIN2527
F80 = flange DN80 PN40 compatible to shape C and shape D DIN2527
F101 = flange DN100 PN16 compatible to shape C and shape D DIN2527
F104 = flange DN100 PN40 compatible to shape C and shape D DIN2527
F2Z = 2“ ANSI / ASME flange 150 lbs
F3Z = 3“ ANSI / ASME flange 150 lbs

Version process connection /

000 = none, when laterally arranged sliding tube
SV = adjustable via cutting ring joint
(up to 40 bar @ 12 mm sliding tubes, up to 16 bar @ 6 mm sliding tubes)
KV = adjustable via compression ring joint (up to 1.5 bar)
VS = welded (from 3/8“, 120 bar @ 12 mm sliding tube, 16 bar @ 6 mm sl. tube)

Electrical connection /

KV = standard cable gland for 5 mm up to 10 mm cable diameters
IGM = M20 x 1.5 female thread
IGN = 1/2“-NPT female thread
M12 = plug connection M12

Temperature range /

NT = standard temperature -40. . .+125°C
HT = high temperature -40. . .+250°C (only for 12 mm non-angled sliding tubes)
HH = highest temperature -40. . .+450°C (only for 12 mm non-angled sliding tubes)
LT = low temperature -65. . .+125°C (only for 12 mm non-angled sliding tubes)

Options (multipie choices as e.g. HA/EG/ possible) /

HA = HART®-protocol additional to 4 to 20 mA-signal
EX = ATEX- and IECEx-approval for zone 0
EG = increased accuracy up to ±0.3 mm or ±0.010 % (depends on version, only at -40°C to +125°C)
PO = electro-polished surface
LPG = with additional installation kit for liquid gas containers
EHD = with additional heavy-duty installation kit for applications in rough areas
EP2 = with additional installation kit made from polypropylene with thread G2“
EP3 = with additional installation kit made from polypropylene with thread G3“
EPF = with additional installation kit made from polypropylene with flange DN65 up to DN100 (clear text)
EV2 = with additional installation kit made from PVDF with thread G2“
EV3 = with additional installation kit made from PVDF with thread G3“
EVF = with additional installation kit made from PVDF with flange DN65 up to DN100 (clear text)

Versions & installation kits:

FM-01F Magnetostrictive Level Sensor

The standard version of the FM-01F has a centrally arranged sliding tube of 12 mm diameter and a float which is selected according to the specific weight of the medium and resistance to the medium. This sensor is mounted with a compression fitting with stainless steel cutting ring up to 40 bar or a compression fitting with PTFE-clamping ring up to 1.5 bar, making it adjustable in the immersion depth.

For higher process pressures the FM-01F is supplied with a hermetically welded thread or flange and thus can be used up to 120 bar. For limited space a variant with 90 degrees angled sliding tube is available. Mounting to magnetic level gauges (e.g Profimess MA-400) is enabled by the execution with laterally arranged sliding tube. When the FM-01F is mounted with pipe clamps closely attached to the measuring chamber of the magnetic level indicator the internal float of the magnetic level gauge is detected. Appearances in small laboratory containers with little mounting space are possible by using the variant of the FM-01F with 6 mm sliding tube, which may be arranged centrally or sideways, depending on requirements.

On particularly high containers no gauges with rigid sliding tubes can be used, because on the one hand they can no longer be transported on trucks, but also the assembly effort is very high. In this case, the variants of the FM-01F provide the flexible design (FLEX). The sensor is simply rolled up for transport and unrolled again for installation, so that installation lengths up to 15 meters can be achieved. A load weight on the end of the probe ensures a taut position of the probe, so that the float can move freely.

Function:
As accessories installation kits are available. They consist of a casing pipe with process connection and a float. They are installed in the tank and the magnetostrictive transmitters are introduced from outside. The FM-01F now detects the magnets of the inner float through the pipe wall of the installation kits and measures the level of the liquid inside. In this case, the FM-01F does not come into contact with the medium.

Aggressive liquids:
To detect the level of aggressive fluids installation kits made from PP or PVDF are available. The liquid to be measured here comes in contact exclusively with the selected plastic.

Portable tanks:
Installation kits offer an optimal solution for applications where containers or barrels have to be delivered from supplier to customer. The level can be monitored here both on the supplier side during filling, as well as on the customer side when emptying, without the need of opening the container.

Pressure tanks:
When using installation kits, the FM-01F is in unpressurized area. A pressure test may thus be carried out without the mounted FM-01F. The level sensor can be retrofitted or replaced without opening the container once more.

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Installation kits:

Installation kit for LPG-Tanks

Length /	150 mm to 4500 mm
Material /	st. steel 1.4571
Temperature /	-40. . .+85 °C
Pressure /	max. 16 bar
Product float /	cylinder 40 x 120 mm Buna®
spec. Weight /	> 0.45 g/cm³

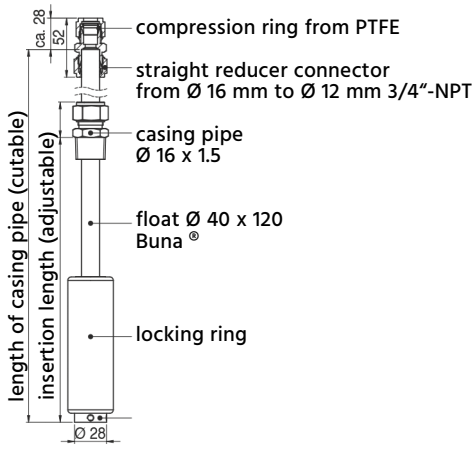
Heavy-Duty installation kit

Length /	1000 mm to 6000 mm
Material /	st. steel 1.4571
Sliding tube Ø /	18 x 2 mm
Process connection /	welded flange or thread
Temperature /	-40. . .+450°C
Pressure /	max. 60 bar
Product float /	according to order
spec. Weight /	according to order

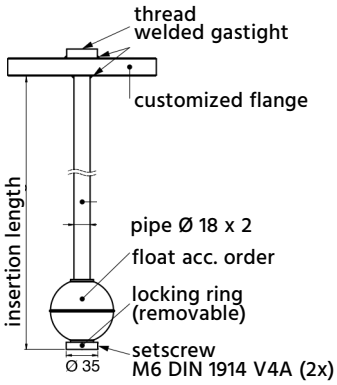
Plastic inst. kit from PVC, PP or PVDF

Length /	150 mm to 5000 mm
Material /	PP or PVDF, (PVC on request)
Sliding tube Ø /	16 mm
Process connection /	thread G2“ or G3“ flange DN65 to DN100
Temperature /	Polypropylene: -20. . .+85°C PVDF: -20. . .+100°C PVC: -20. . .+60°C
Pressure /	max. 1 bar
Product float /	cylinder 55 x 69 mm
spez. Gewicht /	> 0.82 g/cm³

LPG-installation kit



Heavy-Duty-installation kit



Plastic-installation kit

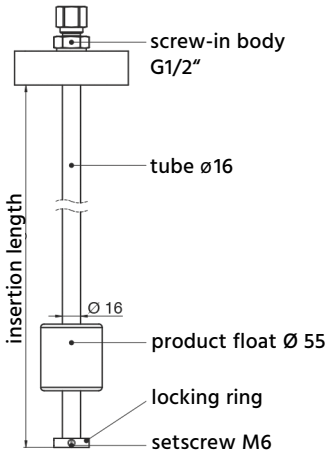
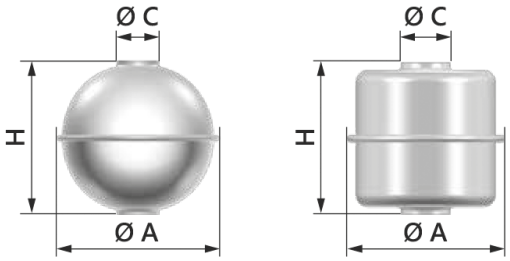


Table Floats:

Depending on the application, different types of floats are available. The necessary ring magnet for the contactless transmission of the level is installed in the float and thus has no contact with the medium. The selection of the float depends on the process conditions (medium, pressure and temperature).



Media spec. weight	min. spec weight	Temperature range	Operat. press. max.	A (mm)	H (mm)	C (mm)	Shape*	Type
Stainless steel 1.4571								
≥ 0.95 g/cm³	< 0.85 g/cm³	-200. . .+250°C	50 bar	43.0	40.0	15.0	K	KE01
≥ 0.85 g/cm³	< 0.75 g/cm³	-200. . .+250°C	20 bar	43.0	40.0	15.5	K	KE02
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	40 bar	52.0	52.0	15.5	K	KE03
≥ 0.60 g/cm³	< 0.50 g/cm³	-200. . .+250°C	20 bar	52.0	49.0	15.5	K	KE04
≥ 0.45 g/cm³	< 0.36 g/cm³	-40. . .+250°C	25 bar	83.0	82.0	15.0	K	KE05
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	16 bar	43.0	43.0	15.5	Z	ZE01
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	5 bar	29.5	40.0	12.5	Z	ZE02
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	1 bar	29.5	40.0	12.5	Z	ZE03
≥ 0.78 g/cm³	< 0.67 g/cm³	-20. . .+100°C	16 bar	27.0	31.0	10.0**	Z	ZE04
Stainless steel 1.4571 with conical spring for detection of remaining quantity								
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	16 bar	43.0	43.0	15.5	Z	ZEF01
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	5 bar	29.5	40.0	12.5	Z	ZEF02
≥ 0.78 g/cm³	< 0.67 g/cm³	-20. . .+100°C	16 bar	27.0	31.0	10.0**	Z	ZEF03
Stainless steel 1.4571 precision float								
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	drucklos	54.0	31.0	13.0/23.4	Z	ZEP01
Titanium								
≥ 0.50 g/cm³	< 0.40 g/cm³	-200. . .+250°C	20 bar	50.0	48.0	15.4	K	KT01
≥ 0.40 g/cm³	< 0.30 g/cm³	-40. . .+125°C	25 bar	83.0	81.0	15.0	K	KT02
≥ 0.50 g/cm³	< 0.42 g/cm³	-40. . .+125°C	25 bar	98.0	96.0	23.0	K	KT03
≥ 0.69 g/cm³	< 0.59 g/cm³	-200. . .+450°C	200 bar	60.0	59.0	14.5	K	KT04
Hastelloy® C 276								
≥ 0.70 g/cm³	< 0.60 g/cm³	-200. . .+250°C	10 bar	46.0	48.0	15.2	Z	ZH01
BUNA®								
≥ 0.45 g/cm³	< 0.38 g/cm³	-40. . .+80°C	16 bar	40.0	120.0	18.0	Z	ZB01
≥0.45 g/cm³	< 0.38 g/cm³	-40. . .+80°C	16 bar	30.0	45.0	13.0	Z	ZB02
Plastic float (POM with graphite)								
≥ 0.65 g/cm³	< 0.55 g/cm³	-40. . .+80°C	1 bar	55.0	14.0	12.5	T	TP01

** only for versions FM-01F.06M and FM-01F.06S

* K = sphere; Z = cylinder; T = disk

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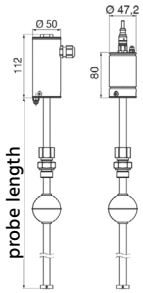
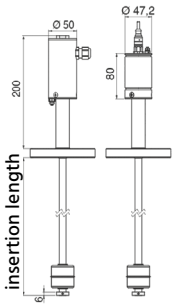
Dimensions in mm:

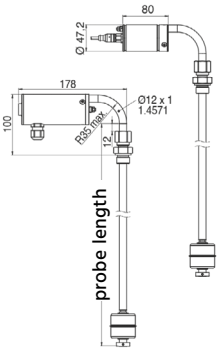
FM-01F.12M - thread version



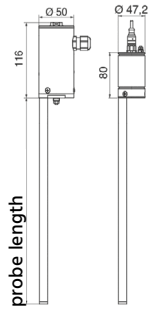
FM-01F.12M - flange version



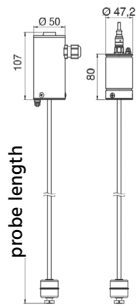
FM-01F.90G - angled version



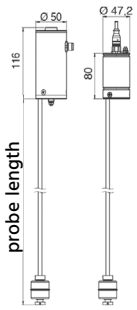
FM-01F.12S - bypass version



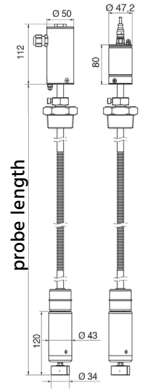
FM-01F.06M - 6 mm central



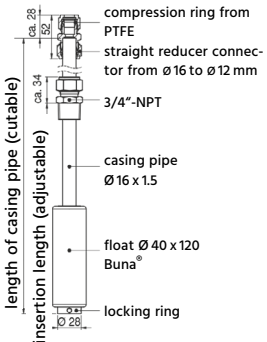
FM-01F.06S - 6 mm lateral



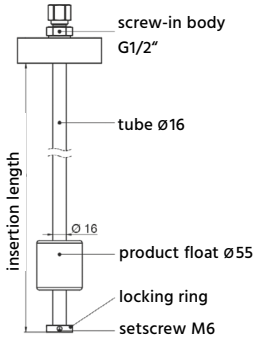
FM-01F.FLEX - flexible version



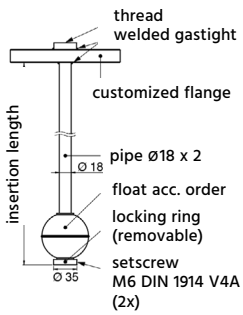
Installation kit for LPG-tanks



Installation kit from PP or PVDF



Heavy-Duty installation kit



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