



Operating instructions
Binary level sensor

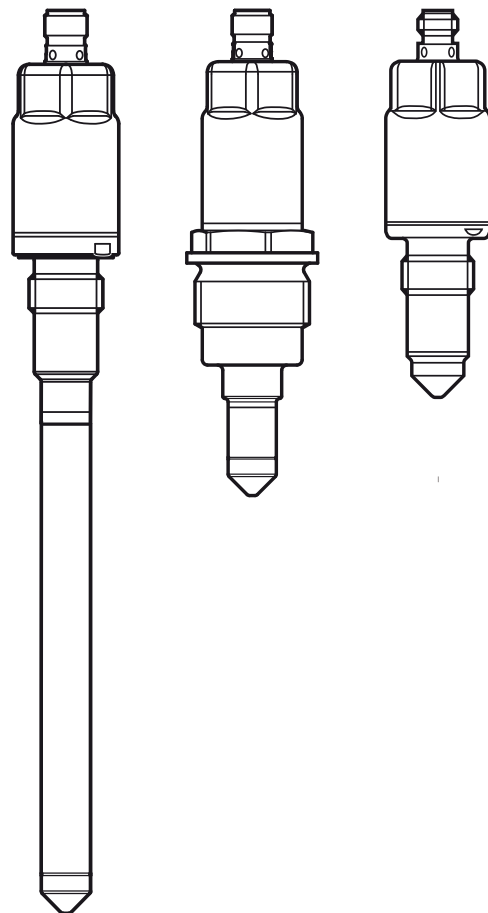
LMTx0x

LMTx1x

LMTx2x

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1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com

1.1 Explanation of symbols

- ▶ Instructions
- > Reaction or result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

2 Safety instructions

- Read this document before setting up the device and keep it during the entire service life.
- The device must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the device for its intended purpose (→ Functions and features).
- Only use the device for permissible media (→ Technical data).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the device or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the device must be carried out by qualified personnel authorised by the machine operator.
- The device and the accessories (e.g. cable) must be effectively protected against damage.



The sensor is supplied without installation / connection accessories.



► Only use accessories from ifm electronic.

Available accessories: www.ifm.com

The optimum function is not ensured when using components from other manufacturers.

3 Functions and features

The unit monitors the level of liquid, viscous and powdery media in tanks and pipes. It can be used for limit detection and run-dry protection. The separate setting of two switching thresholds enables the detection of two different media (can be used, for example, for phase separation or differentiation of media).

3.1 Applications

- Food and hygienic areas
- Detection of almost all media
- Available process connections: G1/2, G3/4 and G1
- Different probe lengths for various mounting positions and for temperature decoupling (→ 4.3.2).

Type	Factory setting ¹⁾	Sensitivity ¹⁾	Probe length ²⁾	Process connection	EHEDG	3A
LMT100	aqueous media	low	11 mm	G1/2	●	●
LMT110	oils, greases, powders	high	11 mm	G 1/2	●	●
LMT121	media with low water content	medium	11 mm	G 1/2	●	●
LMT102	aqueous media	low	38 mm	G 1/2	●	●
LMT104	aqueous media	low	153 mm	G 1/2	● ³⁾	
LMT105	aqueous media	low	253 mm	G 1/2	● ³⁾	
LMT202	aqueous media	low	28 mm	G3/4, tuning fork contour		
LMT302	aqueous media	Low	38 mm	G1, tuning fork contour		

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¹⁾ Sensitivity adjustable (→ 8 Parameter setting)

²⁾ Probe length measured from conical sealing edge (→ Technical data)

³⁾ Approval only applies if the unit is used without PEEK sealing ring (→ 5.2.2)



When a suitable unit has been selected, the presence of certain media is detected, deposits or foam are suppressed.

In the following table you can find a selection of tested media and the corresponding recommended unit type. A complete list of media is available at www.ifm.com.

Medium	LMTx0x	LMTx1x	LMTx2x
Alcohol (40 % vol.)	●	○	●
Beer	●	○	●
Butter (salted / unsalted)	○	○	●
Ice cream	○	○	●
Fat	○	●	○
Honey	○	○	●
Yoghurt, plain	●	○	○
Non-dairy creamer	○	●	○
Ketchup	●	○	○
Jam	●	○	○
Milk	●	○	●
Remoulade	●	○	○
Olive oil	○	●	○
Cream (30 %)	○	○	●
Chocolate (at approx. 40 °C)	○	○	●
Water (distilled)	●	○	●
Water (tap water)	●	○	●
Sugar (granulated sugar)	○	●	○
●	The medium can be detected without the need to change the factory setting (plug & play).		
○	The medium can be detected by setting the sensitivity (IO-Link requested) (→ 8 Parameter setting).		



The above-mentioned details are non-binding reference values. Depending on the composition of the listed media, deviations may occur.

► Check the function by an application test.

3.2 Restriction of the application area

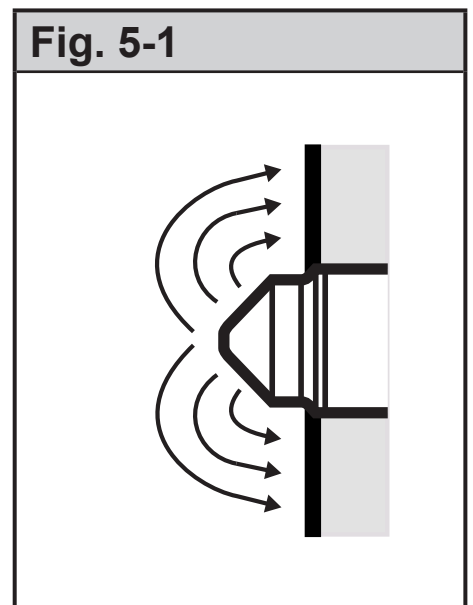
- Not suitable for abrasive media (e.g. quartz sand) and heavy bulk material.
- Not suitable for ozonised water.
- For use in aggressive media (acids and alkali):
 - ▶ Check the compatibility of the product materials beforehand (→ Technical data sheet).
- Media which are very inhomogeneous, separate from each other thus forming separation layers (e.g. oil layer on water):
 - ▶ Check the function by an application test.
- Air or gas bubbles may lead to unwanted switching operations.
 - ▶ Check the function by an application test. If required, adapt the sensitivity or set switching delays (→ 8 Parameter setting).
- Do not expose the probe tip to intensive sun radiation (UV radiation).

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4 Function

4.1 Measuring principle

The unit operates on the impedance spectroscopy method. It evaluates the electrical behaviour of the media to be monitored in the frequency range between 50 and 200 MHz. An electrical field is generated by the probe tip which is influenced by the level. The nature of the medium and deposits or foam have different electrical characteristics that are used for the evaluation.

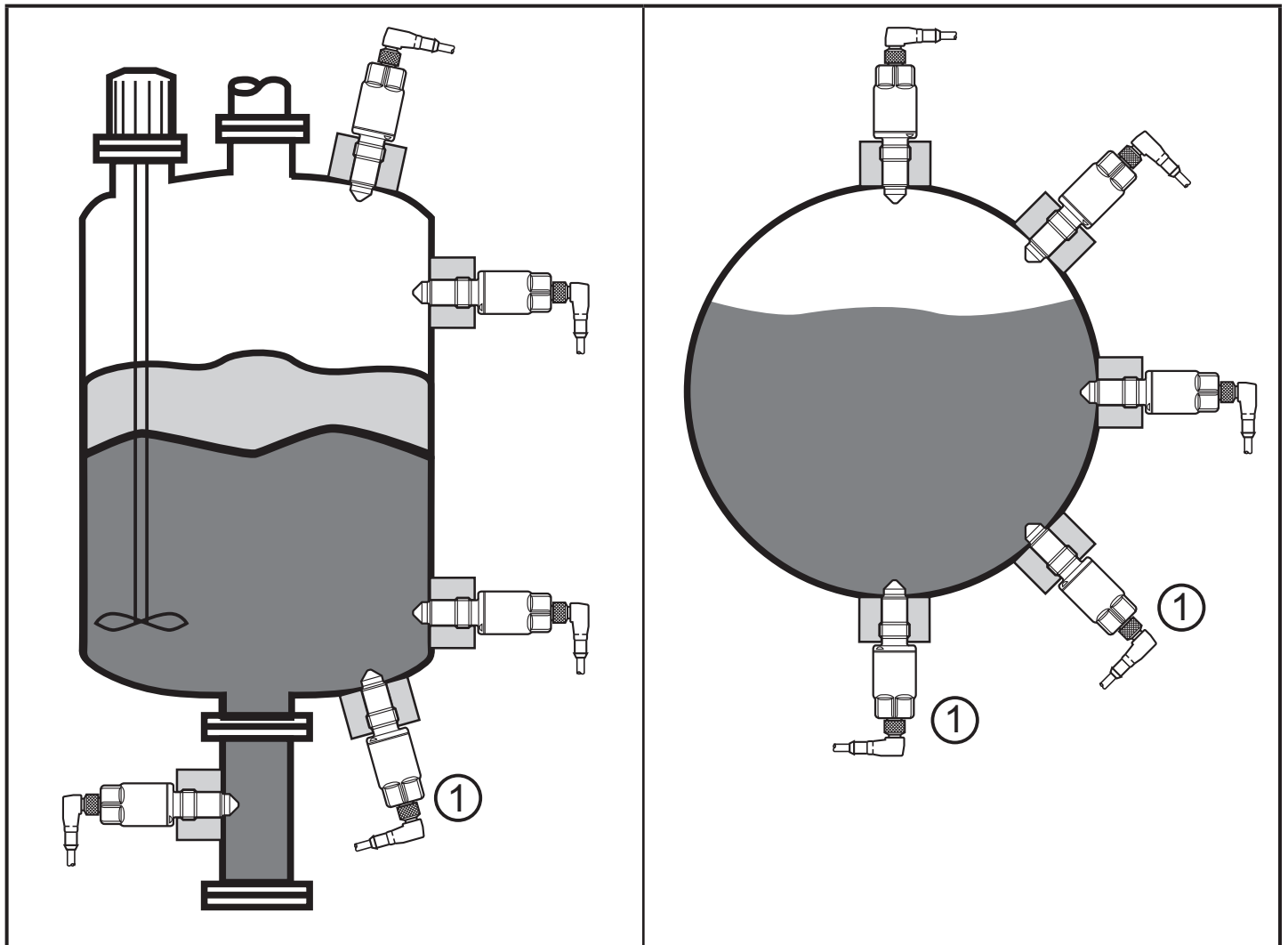


4.2 Other features of the unit

- Defined position of the cable entry for angled sockets for use of ifm welding adapters
- Streamlined sensor geometry, no blockage of the pipe when unit types with short probe are used, no pressure loss
- Orientation-independent installation possible

4.3 Application examples

4.3.1 Application examples for unit types with short probe



1: Installation position only suited to some extent

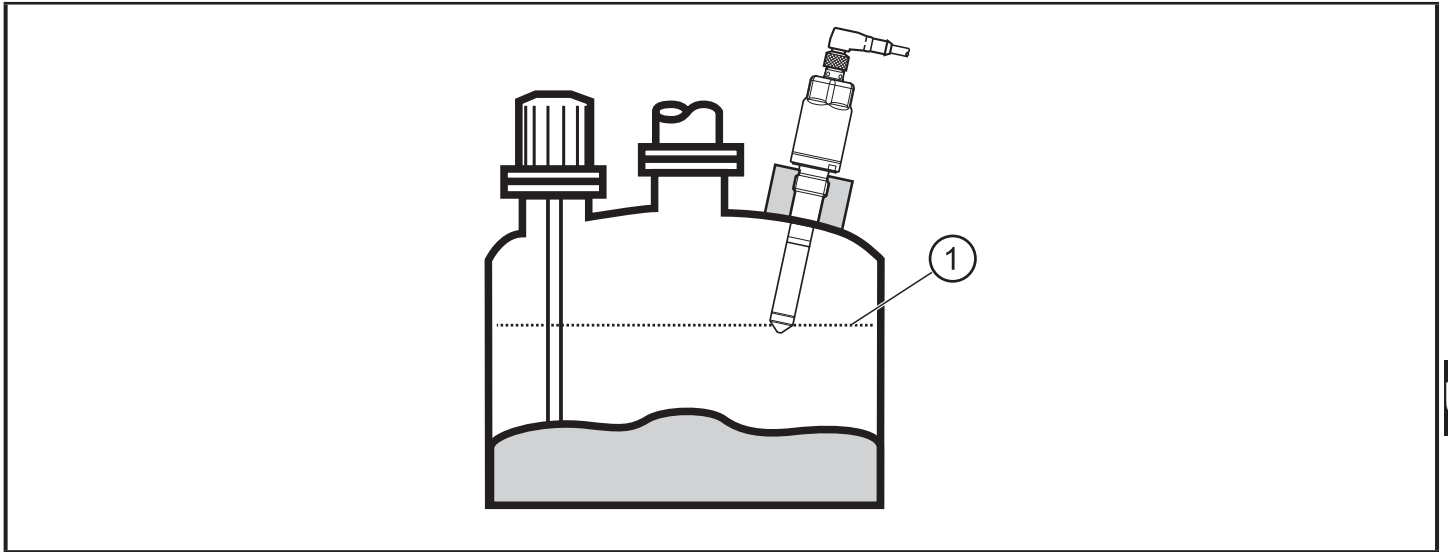
- Fig. 5-2: Possible installation positions in a tank (e.g. for point level detection or as run-dry protection).
- Fig. 5-3: Fill level monitoring in pipes



In case of strongly adhering and viscous media the installation positions (1) are only suited to some extent. Residues might be detected as level.

4.3.2 Application examples for unit types with long probe

Installation from the top:



1: Maximum level

Fig. 5-4: For monitoring the maximum level (1) or as overflow protection. Different probe lengths enable different response levels.

Lateral installation:

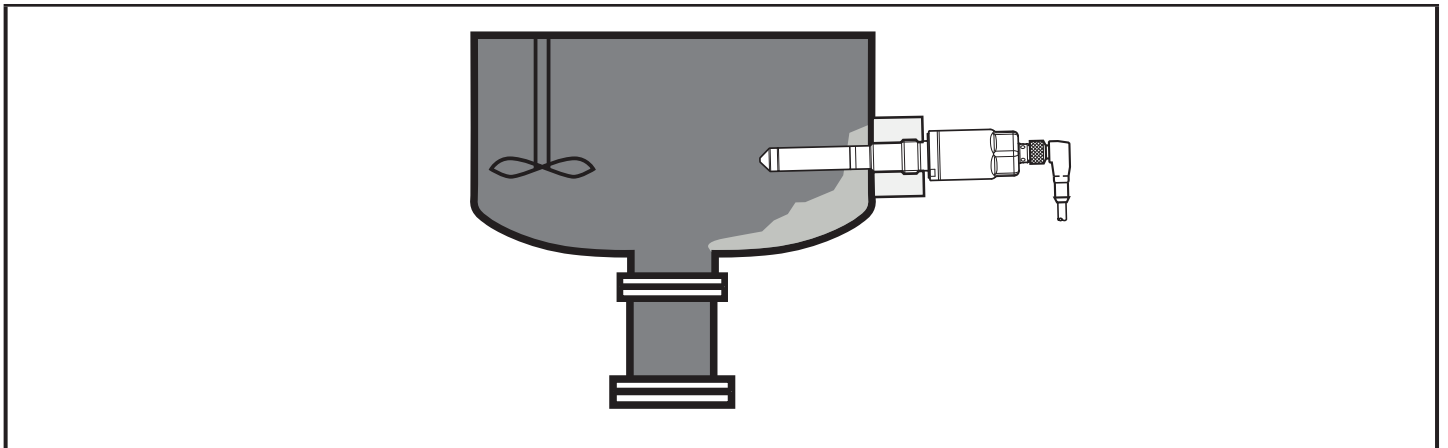


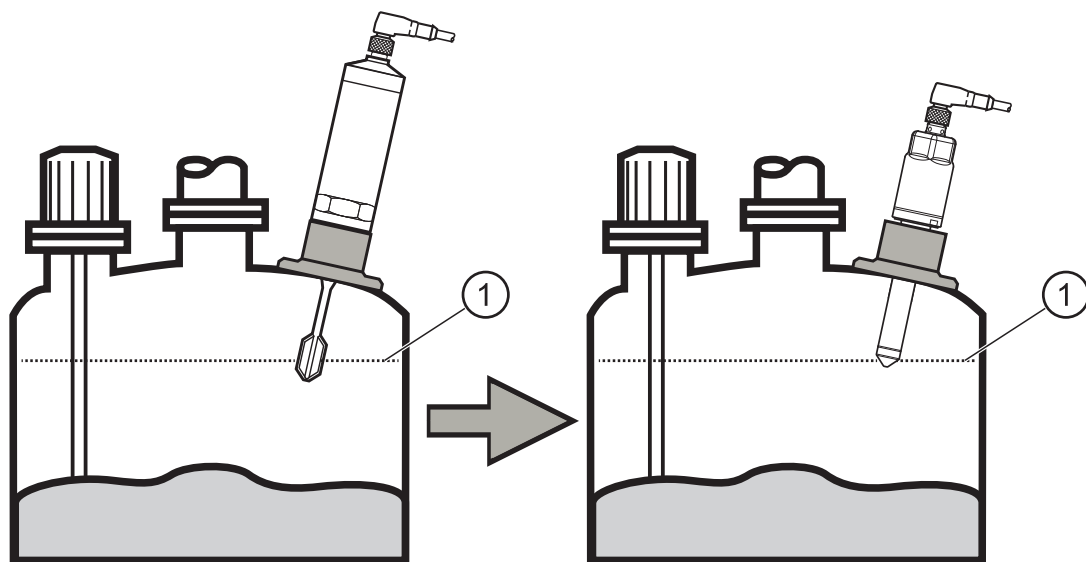
Fig. 5-5: Since the probe tip is installed further into the tank, strongly adhesive and viscous residues can be suppressed.



The variable clamp fitting (accessory) allows variable mounting for unit types LMT1x4 and LMT1x5. This enables e.g. high-precision adjustment of the response point. Moreover, these types can be thermally decoupled from the process. This also makes applications with higher process temperature and/or with the risk of heat accumulation possible (e.g. tank insulation).

4.3.3 Application example installation in existing tuning fork adapters

Fig. 5-6



1: maximum level

Fig. 5-6: Existing tuning fork welding adapters can be used in many cases with the unit types LMT2x2 and LMT3x2 (with G3/4 or G1 process connection (→ 3.1 Applications)). Typically, the response point (1) remains in most cases.

- For use of process connections from other manufacturers:
Adhere to installation location / environment (→ 5.1).



If properly installed in the original, hygienic welding adapter, EHEDG and also 3A conformity can be reached.

5 Installation



Before installing and removing the unit: Make sure that no pressure is applied to the system and there is no medium in the pipe. Also always note the potential dangers related to extreme machine or medium temperatures.

5.1 Installation location / environment

- Installation preferably in closed, metal tanks or pipes.
- The sensor must be in electrical contact with the metal process connection.



When installed in plastic tanks, there may be deterioration caused by electromagnetic interference.

- ▶ Check the function by an application test.
- ▶ If disturbances occur, appropriate measures must be taken (shielding, grounding, etc)



A correct fit and function of the unit and ingress resistance of the connection are only ensured using ifm adapters.



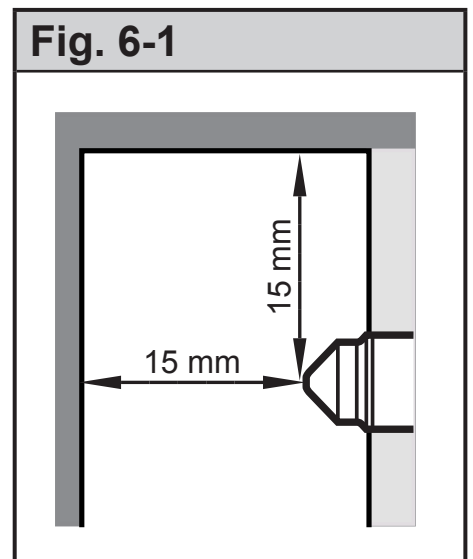
For use of process connections from other manufacturers:

- ▶ Ensure mechanical compatibility.

As a rule, ifm does not assume any responsibility for ingress resistance, hygiene and function, in particular with non-existing compatibility and incorrect installation.

When installed in restricted spaces (e.g. pipes, tank corners, structures) or in agitators and other moving objects:

- ▶ To avoid malfunction and damage on sensor and plant, adhere to a distance of min. 15 mm to neighbouring objects (e.g. pipe/tank walls, structures, other sensors) (fig. 6-1).



5.2 Installation process

The unit is installed by means of an adapter:

- ▶ Ensure cleanliness of the sealing areas. Remove protective packaging only just before mounting. In case of damaged sealing areas replace the unit or the adapter.

5.2.1 Installation LMT1x0, LMT1x1 and LMT1x2

- ▶ Slide the supplied seal (black O-ring), (1), fig. 6-2, over the thread onto the sensor and/or check for correct position.

It seals the gap on the back between the sensor and the adapter.

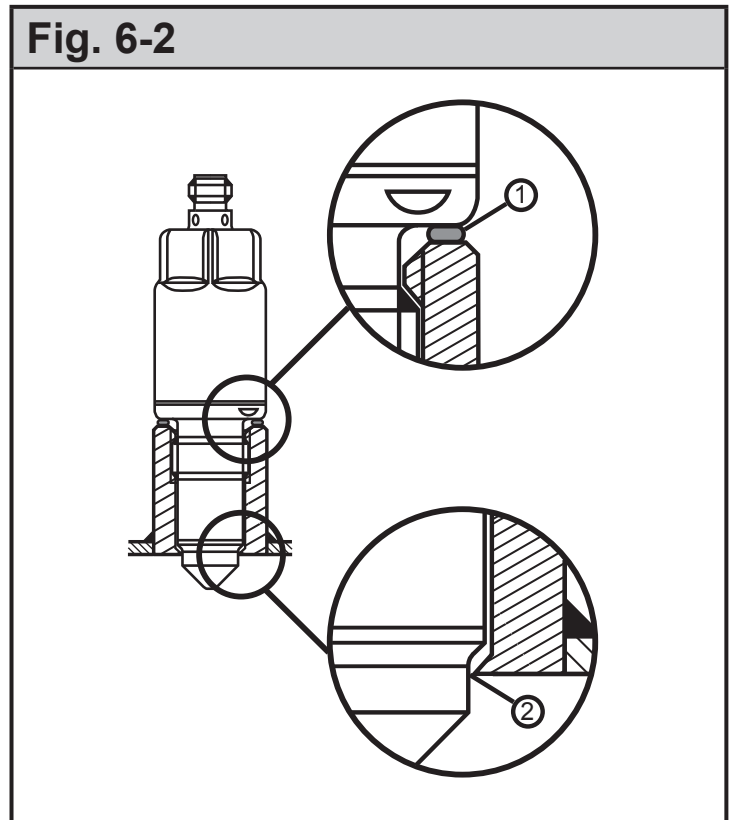
If a seal is supplied with the sensor, please use this seal. If no seal is supplied with the sensor, use the seal supplied with the adapter.



Unsuitable seals may cause problems with ingress resistance:

O-ring too large: Leakage on the sensor tip (2), fig. 6-2.

O-ring too flat: Leakage on the gap on the back between the sensor and the adapter.



1: Seal on the back (O-ring, black)
2: Sealing cone / sealing PEEK on metal

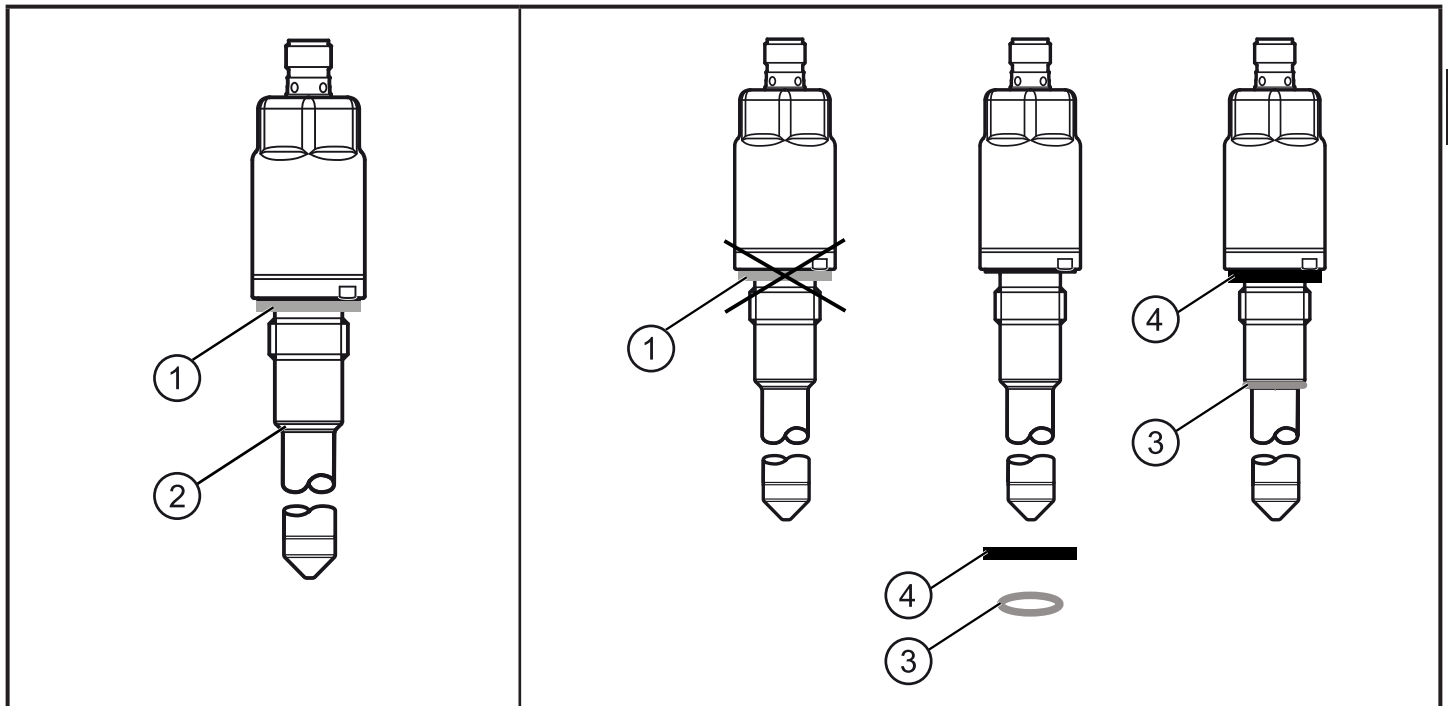
- ▶ Slightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.
- ▶ Screw the sensor into the respective process connection and tighten it. Max. tightening torque: 20...25 Nm
- ▶ After installation check the tank / pipe for ingress resistance.

5.2.2 Installation LMT1x4 and LMT1x5

The seal is formed by the flush front of the metal cone (2), fig. 6-3.



As an option, a PEEK sealing ring (3), fig. 6-4, is available. If the welding adapter is slightly warped or the sealing surface slightly damaged, the use of the PEEK sealing ring is recommended. The PEEK sealing is not supplied with the unit. It can be ordered separately.



1: green flat seal
2: metal sealing cone

3: PEEK sealing, beige
4: black flat seal

Installation using the metal sealing cone (2), fig. 6-3

- ▶ Insert the green flat seal (1) and/or check its position.
It seals the gap on the back between the sensor and the adapter.
- ▶ Slightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.
- ▶ Screw the sensor into the respective process connection and tighten it.
Max. tightening torque: 20...25 Nm
- ▶ After installation check the tank / pipe for ingress resistance.

Installation using the PEEK sealing ring, fig. 6-3

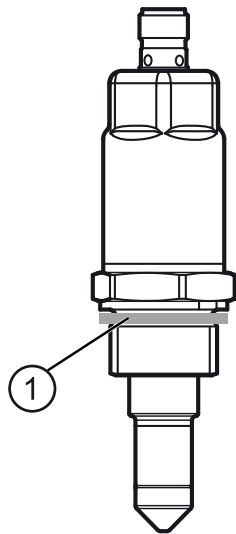
- ▶ Replace the green flat seal (1) with the black flat seal (4).
The flat seal (4) is supplied with the article.
- ▶ Slide the PEEK seal (3) onto the sensor tip until the end stop (cone).
- ▶ Slightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.
- ▶ Screw the sensor into the respective process connection and tighten it.
Max. tightening torque: 20...25 Nm
- ▶ After installation check the tank / pipe for ingress resistance.

5.2.3 Installation LMT2x2 and LMT3x2 in existing tuning fork adapters

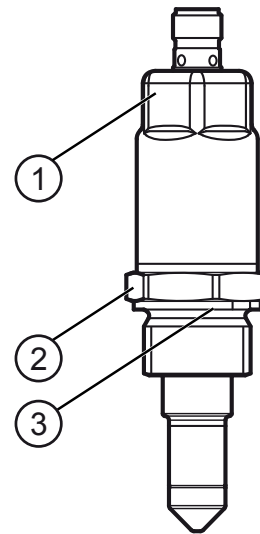
Installation in existing tuning fork adapters with flush seal via O-ring
(→ 4.3.3 Application example installation in existing tuning fork adapters).

- ▶ For use of process connections from other manufacturers:
Adhere to installation location / environment (→ 5.1).
- ▶ Observe the mounting remarks of the manufacturer of the existing adapter!
- ▶ Insert the green flat seal (1), fig. 6-5, and/or check its position.
It seals the gap on the back between the sensor and the adapter.
- ▶ Slide a suitable, original O-ring and a possibly existing spacing ring of the adapter over the sensor the right way round (G 3/4) and/or check the position of the adapter (G1).
- ▶ Check the state and material of the O-ring, replace if necessary.
- ▶ Slightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.
- ▶ Screw the sensor into the adapter and tighten at the hexagonal nut (2), fig. 6-6, until the sensor touches the end stop (3) of the welding adapter.
Max. tightening torques for the hexagon*) (2), fig. 6-6:

LMT2x2	*) AF 32	75 Nm
LMT3x2	*) AF 36	100 Nm

Fig. 6-5

1: Green flat seal

Fig. 6-6

1: Hexagon AF 27
 2: Hexagon LMT2x2 AF32/LMT3x2 AF36
 3: End stop

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Max. tightening torque for the hexagon AF 27 (1), fig. 6-6: 35 Nm!

► After installation check the tank / pipe for ingress resistance.

5.3 Notes on 3A compliant installation

Some versions of the unit have a 3A approval (→ 3.1 Applications). It is only valid in conjunction with adapters with 3A approval.



- Even with 3A compliant accessories, units without 3A approval cannot be mounted in accordance with 3A.
- Not suitable for use where the criteria for paragraph E1.2/63-03 of the 3A standard 63-03 have to be met.

5.4 Note on the use in accordance with EHEDG

Depending on the version, the unit is certified to EHEDG. It is only valid in conjunction with adapters with EHEDG approval (accessory).

- For use of process connections from other manufacturers: Adhere to installation location / environment (→ 5.1).
- Make sure that the sensor is integrated into the system in accordance with EHEDG.



The EHEDG approval only applies if the unit is used without PEEK sealing ring (→ 5.2.2).

6 Electrical connection



The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

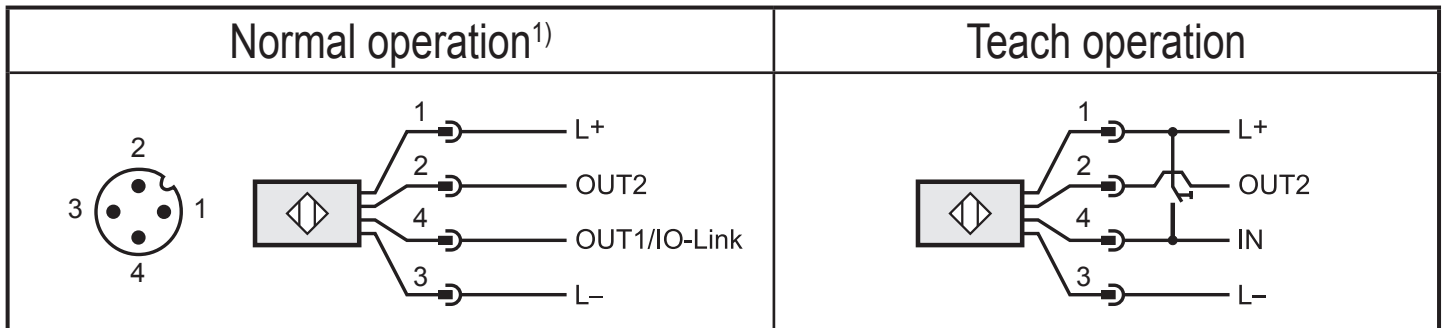
Voltage supply to EN 50178, SELV, PELV



For marine applications (if approval available for the device), additional surge protection is required.

► Disconnect power.

► Connect the unit as follows:



¹⁾ factory setting

Pin	Connection	Core colours for ifm sockets
1	Ub+	brown
3	Ub-	blue
2 (OUT2)	pnp / npn switching signal	white
4 (OUT1)	<ul style="list-style-type: none"> • pnp / npn switching signal • IO-Link • input for external teach signal 	black



Factory setting OUT1 and OUT2: pnp switching signal



• In the factory setting, the teach operation is deactivated.

For activation: → 8.1 Parameter setting via PC and IO-Link interface
[ou1] = [tch]

• Only output OUT2 is available in the teach mode.



The connection accessories are not supplied with the unit. They can be ordered separately.

7 Interfaces

7.1 IO-Link communication interface

This unit has an IO-Link communication interface which requires an IO-Link-capable module for operation.

The IO-Link interface permits:

- direct access to process and diagnostic data,
- parameter setting of the unit outside the plant via IO-Link interface,
- parameter setting of the unit during operation via the IO-Link master.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software are available at www.ifm.com.

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8 Parameter setting



When a suitable unit has been selected, the presence of certain media is detected, deposits or foam are suppressed. In many cases the factory setting (→ 3.1 Applications) is absolutely sufficient. For special requirements it is possible to adapt/configure the sensitivity and other functions to the corresponding application. Splashes, wave movements and air bubbles can be suppressed, for example, by setting a switching delay.

Parameters can be set before installation or during operation.



If you change parameters during operation, this will influence the function of the plant.

- ▶ Ensure that there will be no malfunctions in your plant.
- ▶ Note the potential dangers related to extreme plant conditions.

8.1 Parameter setting via PC and IO-Link interface

The interface connects sensors with IO-Link capability to a PC and provides the following options via the IO-Link interface:

- Reading of the current parameter setting.
- Parameter setting of the sensor.
- Reading of the current measured values and further process values.

The interface is not suitable for permanent installation as an automation device.

8.2 Parameter setting via the memory plug

Via a memory plug (→ accessory), a parameter set can be written/transferred to the unit.




The memory plug can also be used to save the current parameter setting of a unit and to transfer it to other units of the same type.

8.3 Parameter setting during operation



Parameter setting during operation requires the connection to a module (master) with IO-Link capability (→ 7.1).

8.4 Parameters:

Name	Description	
SP1/SP2 rP1/rP2	Set points [SP1] / [SP2] and reset points [rP1] / [rP2].	
	 [SPx] must be higher than [rPx]. If [SPx] is set to a value below [rPx], this is rejected.	
	The values for [SPx]/[rPx] are set in per cent of the maximum process value . The process value is defined as follows: Process value in air = 0 %; process value in tap water = 100 % Setting range [SPx]: 4...98 %; step increment: 1 % Setting range [rPx]: 2...96 %; step increment: 1 %; minimum hysteresis: 2 % Reference values:	
	Aqueous / water-based media:	SPx = 62 %, rPx = 54 % (factory setting LMTx0x)
	Media with low water content:	SPx = 35 %, rPx = 29 % (factory setting LMTx2x)
Oils, fats, powdery media:	SPx = 8 %, rPx = 5 % (factory setting LMTx1x)	
ou1 ou2	[ou1] / [ou2]: output function for OUT1/OUT2 <ul style="list-style-type: none"> - [Hno] = hysteresis function/NO - [Hnc] = hysteresis function/NC - [Fno] = window function/NO - [Fnc] = window function/NC Parameter [ou1] also provides the option [tch]: <ul style="list-style-type: none"> - [tch] = configure pin 4 as input for the teach signal (→ 6),(→ 8.8) 	
FOU1 FOU2	Behaviour of the outputs OUT1 / OUT2 in case of a fault <ul style="list-style-type: none"> - [OFF] = output opens in case of a fault (factory setting) - [On] = output closes in case of a fault 	
dFo	Delay time of the outputs in case of a fault Setting range 0...5 s; step increment 0.2 s	
dS1*) dS2*)	Switching delay for OUT1 / OUT2 Setting range 0...10 s; step increment 0.2 s *) Parameter [dSx] is not available for LMT100, LMT110 and LMT121.	
dr1 dr2	Switch-off delay for OUT1 / OUT2 Setting range 0...10 s, step increment 0,2 s	
P-n	Output polarity for the outputs (PnP or nPn)	

8.5 System commands:

tSP1	Teach switch point 1 to medium 1 • Full adjustment to the medium 1 to be detected, automatically sets the switching thresholds SP1/rP1 for OUT1.
tSP2	Teach switch point 2 to medium 2 • Full adjustment to the medium 2 to be detected, automatically sets the switching thresholds SP2/rP2 for OUT2.
rES	Restore the factory setting

8.6 Unit locking / data storage

The IO-Link master stores all parameters of the connected sensor (data storage) if configured in the master. When a sensor is replaced by a sensor of the same type, the parameters of the old sensor are automatically written to the new sensor if configured in the master and if the sensor allows this.

For safety reasons the data storage can be refused by the sensor.

Factory setting: [Open]

Data storage	- [Open] = unit allows parameter download from the master - [Locked] = unit refuses parameter download from the master
--------------	---

8.7 Full adjustment via IO-Link

Full adjustment allows optimum sensitivity of the unit can be set to the medium to be detected (deposits and foam are suppressed):

- ▶ Fill the tank/pipe.
- > The probe tip must be completely covered with the medium.
- ▶ Execute the system command [tSP1] or [tSP2].
- > The unit automatically sets the switching thresholds [SPx]/[rPx].
- ▶ Check the function by an application test.

8.8 Parameter setting via the teach input

The teach input must be activated. This requires previous configuration via IO-Link (→ 8.4), parameter [ou2] = [tch].



Output OUT2 must be configured as hysteresis function (Hnc or Hno). If the window function is set, an error during teaching results (→ 8.8.3 Error during teaching).



Only output OUT2 is available in the teach mode. In the teach mode the LEDs indicate the switching status of output OUT2.

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8.8.1 Carry out the full adjustment via teach input

- ▶ Fill the tank until the probe tip is completely covered.
- ▶ Apply Ub+ to pin 4 for >2 ... < 5 s.



The tool which is available for this process is the teach button (accessory).

- > LEDs are flashing with 2 Hz (▬▬▬▬).
- > After teaching the LEDs light for 2 s, then the colours change to regular operating mode (table → 8.8.2).

8.8.2 Changing the output function

Output OUT2 can be changed from "NC" (Hnc) to "NO" (Hno) and vice versa.

- ▶ Apply Ub+ to pin 4 for >5 ... < 10 s.
- > LEDs are flashing, first with 2 Hz (▬▬▬▬), after 5 s with a 1 Hz double flashing (▬▬▬▬▬▬).
- > After the change the LEDs light for 2 s. Then the colours change to regular operating mode (table below).
- > After the successful changeover, the LEDs light as follows:

No medium detected	LEDs = yellow (for Hnc)	LEDs = green (for Hno)
Medium detected	LED2 = green (for Hnc)	LED2 = yellow (for Hno)

8.8.3 Fault during the teach operation

The teach operation is cancelled in case of a fault:

- > LEDs are flashing green/yellow with 8 Hz.
- > The unit returns to the operating mode with unchanged settings.

Possible faults:

- Time error (teach time too long / too short)
- Internal sensor signal not clear
- Wrong output function: (→ 8.8 Parameter setting via the teach input)
- Process value too low (< 9 %, e.g. for powders), SPx/rPx must be set manually (→ 8.1 Parameter setting via PC and IO-Link interface).

9 Operation

When the supply voltage has been applied, the unit is in the operating mode. It carries out its evaluation functions and switches the outputs.

Outputs OUT1 and OUT2 complement each other.



The following table shows the factory settings. In this state OUT1 = Hno and OUT2 = Hnc.

- Check whether the unit operates correctly.

9.1 Switching states and display by LEDs

Operating status	LEDs	OUT1	OUT2
Unit ready for operation, no medium detected	green	OFF	ON
Unit ready for operation, medium detected	yellow	ON	OFF
No operating voltage	OFF	OFF	OFF
Short circuit output 1	flashing yellow	-	1)
Short circuit output 2	flashing yellow	1)	-
Error / failure	-	OFF	OFF
Teach operation	(→ 8.8.1) and (→ 8.8.2)		
Fault during the teach operation	LEDs are flashing green/yellow with 8 Hz		

1) according to the level



The LEDs always indicate the switching status of output OUT1 (exception: Teach mode (→ 8.8)).

9.2 System results IO-Link

Code	Type	Description
20480 d / 50 00 h	Error	Hardware error in the unit. ▶ Replace device
25376 d / 63 20 h	Error	Parameter fault ▶ Verify the data sheet and the values
30480 d / 77 10 h	Error	Short circuit ▶ Verify the installation
36350 d / 8D FE h	Warning	Test event. Event appears if index 2 is set to the value 240, event disappears if index 2 is set to the value 241
36351 d / 8D FF h	Warning	Test event. Event appears if index 2 is set to the value 242, event disappears if index 2 is set to the value 243

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10 Maintenance, repair and disposal

- ▶ From time to time check the probe cap for deposits and damage. Clean it in case of strong soiling. In case of damage replace the unit.
- ▶ After removal and before reinstallation of the unit carefully clean the probe neck and the installation slot - especially the sealing cone - with appropriate methods to ensure that it is resistant to ingress and without dead space.



- ▶ If the variable clamp fitting is used (→ 4.3.2): Check the correct position of the safety chain or the securing wire between the clamp fitting and the sensor from time to time.

- ▶ Replace if damaged!



When the medium is changed, it may also be necessary to use another type of unit or adapt the sensitivity (→ 3.1 Applications).

- ▶ It is not possible to repair the unit.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

- ▶ In case of returns ensure that the unit is free from soiling, especially of dangerous and toxic substances.

For transport only use appropriate packaging to avoid damage of the unit.

11 Notes on the regulation (EC) 1935/2004



The following components of the product are designed for permanent contact with food according to the regulation (EC) 1935/2004:

- Sensor tip made of PEEK
- Sealing ring made of PEEK (→ 5.2.2)
- Sealing ring made of FKM (LMT104 / LMT105)

12 Factory setting

	LMTx0x	LMTx1x	LMTx2x	User settings
SP1	62 %	8 %	35 %	
rP1	54 %	5 %	29 %	
ou1	Hno	Hno	Hno	
SP2	62 %	8 %	35 %	
rP2	54 %	5 %	29 %	
ou2	Hnc	Hnc	Hnc	
FOU1	OFF	OFF	OFF	
FOU2	OFF	OFF	OFF	
dS1*)	0.0	0.0	0.0	
dS2*)	0.0	0.0	0.0	
dr1	0.0	0.0	0.0	
dr2	0.0	0.0	0.0	
P-n	PnP	PnP	PnP	
dFo	0.0	0.0	0.0	

Percentage values refer to the process value (→ 8 Parameter setting).

*) Parameter is not available for LMT100, LMT110 and LMT121

More information at www.ifm.com