

Operating instructions
Binary level sensor
LMT0xA

GB

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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

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

1.2 Warnings used



CAUTION

Warning of personal injury

- ▷ Slight reversible injuries may result.

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Please adhere to the notes on safe use in hazardous areas: Operating instructions (Ex protection related part) for level sensors according to the EU directive 94/9/EC annex VIII (ATEX) group II, equipment category 3D/3G.
- If no operating instructions (Ex protection related part) or EC declaration of conformity are supplied with this product in the language of the EU user country, these can be requested from your dealer (see delivery note) or manufacturer (see cover sheet / back).
- Only use the product for its intended purpose (→ → Intended use).
- Only use the product for permissible media (→ Technical data).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

3 Intended use

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 Application area

- Detection of almost all media.
- Food and hygienic areas.
- Available process connections: G1/2.
- Different probe lengths for various mounting positions and for temperature decoupling.

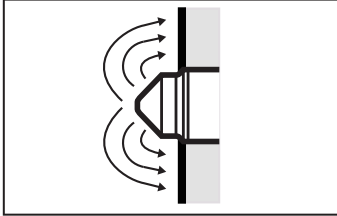
| Type | Factory setting ¹⁾ | Sensitivity ¹⁾ | Probe length ²⁾ | Process connection |
|--|-------------------------------|---------------------------|----------------------------|--------------------|
| LMT01A | Oils, greases, powders | High | 11 mm | G1/2 |
| LMT03A | Oils, greases, powders | High | 153 mm | G1/2 |
| LMT04A | Oils, greases, powders | High | 253 mm | G1/2 |
| ¹⁾ Sensitivity adjustable (→ Parameter setting) | | | | |
| ²⁾ Probe length measured from conical sealing edge (→ Technical data) | | | | |

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).
- When used in media which are inhomogeneous, separate from each other thus forming separation layers (e.g. oil layer on water):
 - ▶ Check the function by an application test.
- A large amount of air or gas bubbles may lead to changed switching characteristics. This effect can be used to implement, for example, run-dry protection or pump protection (key word: cavitation).
 - ▶ Check the function by an application test. If required, adapt the sensitivity or set switching delays (→ Parameter setting).
- Do not expose the probe tip to intensive sun radiation (UV radiation).

4 Function

4.1 Measuring principle



The unit operates on the impedance spectroscopy method. It analyses the electrical behaviour of the media to be monitored in the frequency range between 50 and 200 MHz. The probe tip generates an electrical field that is influenced by the level. The nature of the medium as well as build-up or foam have different electrical properties that are used for the evaluation.

Fig. 1: Measuring principle

4.2 Other features of the unit

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

5 Installation



CAUTION

If the medium temperature is above 50 °C (122 °F) parts of the housing can increase in temperature to over 65 °C (149 °F).

- ▷ Risk of burns
- ▶ Do not touch the unit.
- ▶ Protect the housing against contact with flammable substances and unintentional contact.
- ▶ Allow the unit and process adapter to cool down before maintenance.



Before installing and removing the unit:

- ▶ Make sure that no pressure is applied to the system and there is no medium in the pipe or tank. Also always take into account the potential dangers related to extreme machine and medium temperatures.



The sensor is supplied without installation / connection accessories.



Only use accessories from ifm electronic gmbh! The optimum function is not ensured when using components from other manufacturers.



Available accessories: www.ifm.com.

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)

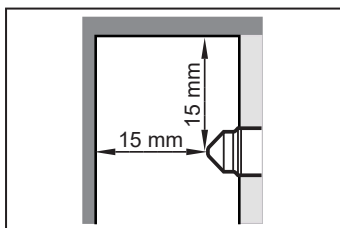


A correct fit and function of the unit and ingress resistance of the connection are only ensured using ifm adapters.



When process connections from other manufacturers are used:

- ▶ 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), see fig. sensor tip distances.

Fig. 2: Sensor tip distances

5.2 Application examples

5.2.1 Unit types with short probe

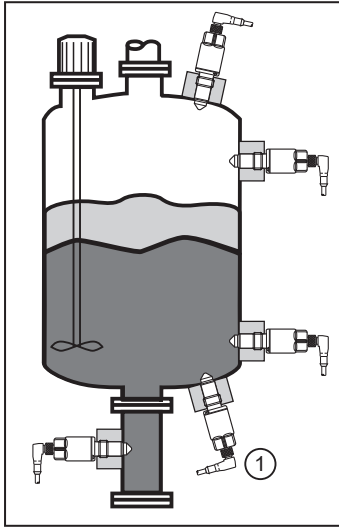


Fig. 3: Installation on a tank

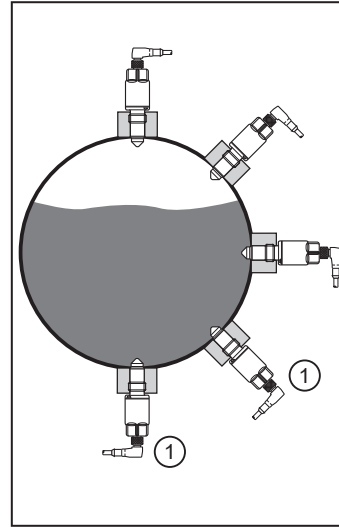


Fig. 4: Installation on a pipe

1: Installation position only suited to some extent

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



With highly adhesive and viscous media and media prone to sedimentation or build-up the installation positions (1) are only suitable to some extent. Residues might be detected as level.

5.2.2 Unit types with long probe

Installation from the top:

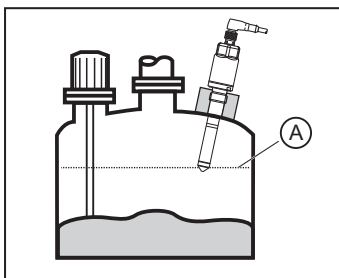


Fig. 5: Installation from the top

A: Maximum level

Fig. installation from the top: For monitoring the maximum level (A) or as overflow prevention. Different probe lengths enable different response levels.

Lateral installation:

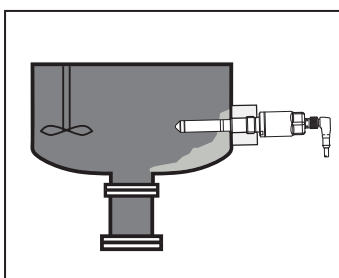


Fig. 6: Lateral installation

Fig. lateral installation: Since the probe tip is installed further into the tank, very adhesive and viscous residues can be suppressed.



The variable clamp fitting (accessory) allows variable installation of the unit types LMT03A and LMT04A in height/installation depth. This enables, for example, a high-precision adjustment of the response level. Moreover, these types can be uncoupled thermally from the process by means of the variable clamp fitting (recessed installation of the sensor electronics). This also allows applications with higher process temperature and/or with the risk of heat accumulation (e.g. tank insulation).

5.3 Notes on the use according to EHEDG



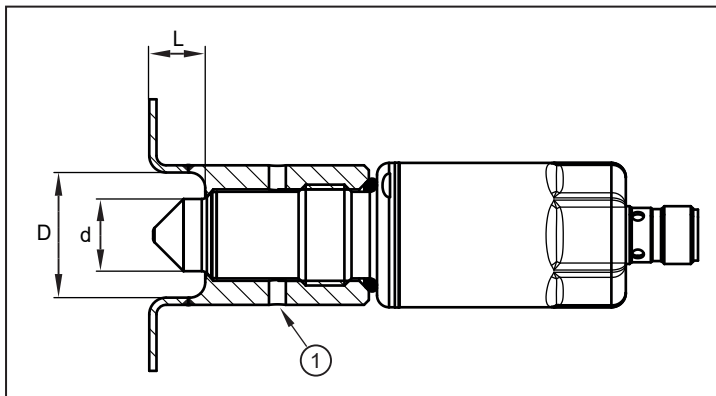
The unit is suited for CIP (cleaning in process) when installed correctly.

- ▶ Observe the application limits (temperature and material resistance) according to the data sheet.
- ▶ Ensure that the installation of the unit in the system complies with EHEDG guidelines.
- ▶ Use self-draining installation.
- ▶ Only use process adapters permitted according to EHEDG with special seals required by the EHEDG position paper.



The gasket of the system interface must not be in contact with the sealing point of the sensor.

- ▶ In case of structures in a tank, the installation must be flush mount. If not possible then direct water jet cleaning and cleaning of dead spaces must be possible.
- ▶ Leakage ports must be clearly visible and must be installed facing downwards for vertical pipes.



1: Leakage port

- ▶ To avoid dead space adhere to the dimensions:
 $L < (D - d)$.

5.4 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
- Sealing ring made of FKM (LMT03A / LMT04A)

5.5 Installation procedure

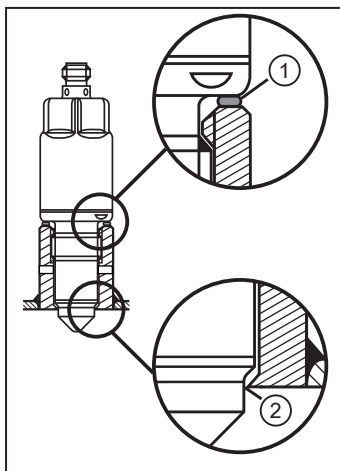
The unit is installed by means of an adapter:

- ▶ 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.

5.5.1 Installation LMT01A (hygiene-compliant)

The seal is formed by the flush front of the PEEK sealing cone (2).

- ▶ If required: Slide the supplied seal (black O-ring), (1) 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 to protect against the ingress of contamination in the thread area.



The seal between the housing and the process connection (1) can compensate for variable insertion depths but not for the system pressure.

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

- ▶ If required: Lightly grease the thread using a suitable lubricating paste which has been approved for this application.
- ▶ Screw the sensor into the respective process connection and tighten it. Maximum tightening torque: 20...25 Nm
- ▶ After installation check the tank / pipe for ingress resistance.

5.5.2 Installation LMT03A and LMT04A

The unit can be adapted for hygienic zero-leak via two sealing versions: Flush mount zero-leak using metal-to-metal sealing (fig. LMT seal, metal-to-metal), or via insertion of an additional PEEK gasket (fig. LMT seal, PEEK).



The PEEK sealing ring is not supplied with the unit. It can be ordered separately (E43323).



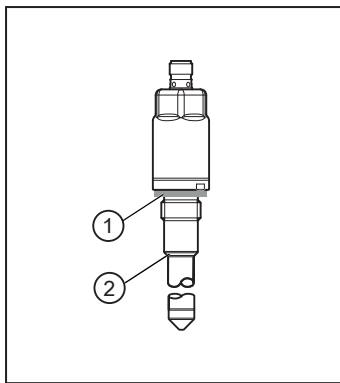
The PEEK sealing ring has been rated for ifm adapters with end stop towards the medium.



If the sealing between the housing and the process connection ((1) in fig. LMT seal, metal-to-metal) is to withstand the system pressure, no end stop for the flush mount sealing area exists.

- ▶ In this case, the PEEK sealing ring must not be used.

Flush mount hygienic zero-leak using metal-to-metal sealing (2):

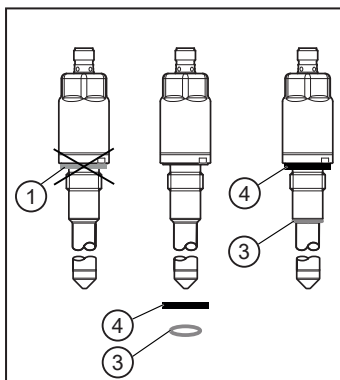


- 1: Green flat seal
2: Metal sealing cone

Fig. 7: LMT seal, metal-to-metal

- ▶ Insert the green flat seal (1) and/or check its position.
- ▶ If required: Lightly grease the thread using a suitable lubricating paste which has been approved for this application.
- ▶ Screw the sensor into the respective process connection and tighten it.
Maximum tightening torque: 20...25 Nm.
- ▶ After installation check the tank / pipe for ingress resistance.

Flush mount hygienic zero-leak using PEEK gasket (3):



- 1: Green flat seal
3: PEEK sealing ring beige (accessory E43323)
4: Black flat seal (E43323)

Fig. 8: LMT seal, PEEK.

- ▶ If needed, replace green flat seal (1) (on delivery) with black flat seal (4). The flat seal (4) is supplied with the article E43323!
- ▶ Slide the PEEK sealing ring (3) onto the sensor tip until you feel the end stop (cone).
- ▶ If required: Lightly grease the thread using a suitable lubricating paste which has been approved for this application.
- ▶ Screw the sensor into the respective process connection and tighten it.
Maximum tightening torque: 20...25 Nm.
- ▶ After installation check the tank / pipe for ingress resistance.

6 Electrical connection



The device must be connected by a qualified electrician.

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

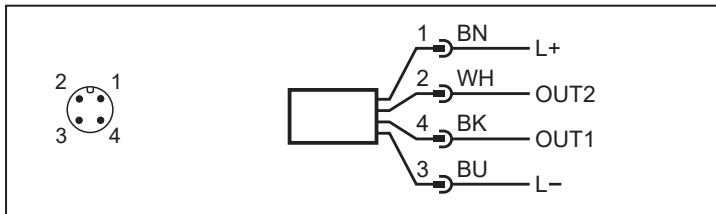
Supply voltage SELV, PELV according to the technical data sheet.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

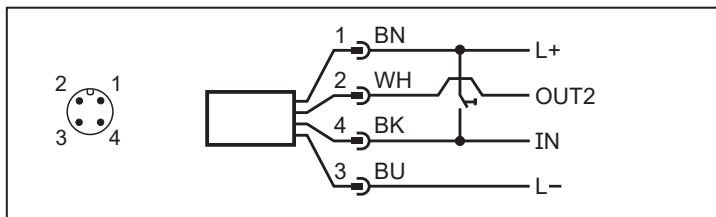


For marine applications (if approval available for the device), additional surge protection is required.

Normal operation (factory setting):



Teach operation:



| Pin | Core colours | |
|---|--------------|-------|
| 1: | BN | brown |
| 2: | WH | white |
| 3: | BU | blue |
| 4: | BK | black |
| OUT1: | | |
| <ul style="list-style-type: none"> • PNP / NPN switching output • IO-Link | | |
| IN: | | |
| <ul style="list-style-type: none"> • Input for teach signal | | |
| OUT2: | | |
| <ul style="list-style-type: none"> • PNP / NPN switching signal | | |
| Colours to DIN EN 60947-5-2 | | |



Factory setting OUT1 and OUT2: PNP switching signal:



In the factory setting, the teach operation is deactivated.

- ▶ Activation: → 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 Parameter setting

With a suitable unit the presence of certain media can be detected while build-up or foam is suppressed. In many cases the factory setting is 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.

The parameters can be set before installation and set-up of the unit or during operation.



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

- ▶ Make sure that there will be no malfunctions or dangerous operation in your plant.
- ▶ Note the potential dangers related to extreme plant conditions.

7.1 IO-Link communication interface

The device has an IO-Link communication interface which requires an IO-Link-capable module.

The IO-Link interface allows:

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

The IO-DDs 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 can be found at www.ifm.com.

7.2 Parameter setting using PC and USB IO-Link master

- ▶ Preparing the PC, software and master. Observe the → Operating instructions of the respective units / software.
- ▶ Connect the unit to the USB IO-Link master (→ Accessories).
- ▶ Follow the menu of the IO-Link software.
- ▶ Set the parameters; adjustable parameters(→ Parameters).
- ▶ Check if the unit has accepted the parameter settings. If necessary, read sensor again.
- ▶ Remove the USB IO-Link master and put the unit into operation.

7.3 Parameter setting via memory plug

Via a memory plug (→ Accessories), 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.

- ▶ Load suitable parameter set (e.g. using a PC) to the memory plug. Observe the (→ Operating instructions) of the memory plug.
- ▶ Make sure that the sensor has the original factory settings.
- ▶ Connect the memory plug between sensor and socket.
- ▷ When voltage is supplied, the parameter set is transferred from the memory plug to the sensor.
- ▶ Remove the memory plug and put the unit into operation.

7.4 Parameter setting during operation

- ▶ Make sure that the sensor is connected to an IO-Link-capable module (master).
- ▶ Read the sensor using suitable IO-Link software. Observe the → operating instructions of the respective software.
- ▶ Set the parameters, adjustable parameters (→ IODD Description).
- ▶ Check if the unit has accepted the parameter settings. If necessary, read sensor again.
- ▶ Check whether the unit operates correctly.

For further information, please refer to the IODD description (www.ifm.com) or to the context-specific parameter descriptions of the used parameter setting software.

7.5 Parameters

| Name | Description | | | | | | |
|-------------------------------|---|------------------------------|------------------------|-------------------------------|------------------------|----------------------|----------------------|
| SP1 / SP2 rP1 / rP2 | <p>Set points [SP1] / [SP2] and reset points [rP1] / [rP2].</p> <p>Important: [SPx] must be higher than [rPx]. If [SPx] is set to a value below [rPx], this is rejected by the device software.</p> <p>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 %</p> <p>Reference values:</p> <table border="1"> <tr> <td>Aqueous / water-based media:</td> <td>SPx = 62 %, rPx = 54 %</td> </tr> <tr> <td>Media with low water content:</td> <td>SPx = 35 %, rPx = 29 %</td> </tr> <tr> <td>Oils, fats, powders:</td> <td>SPx = 8 %, rPx = 5 %</td> </tr> </table> | Aqueous / water-based media: | SPx = 62 %, rPx = 54 % | Media with low water content: | SPx = 35 %, rPx = 29 % | Oils, fats, powders: | SPx = 8 %, rPx = 5 % |
| Aqueous / water-based media: | SPx = 62 %, rPx = 54 % | | | | | | |
| Media with low water content: | SPx = 35 %, rPx = 29 % | | | | | | |
| Oils, fats, powders: | SPx = 8 %, rPx = 5 % | | | | | | |
| ou1 / ou2 | <p>[ou1] / [ou2]: output function for OUT1 / OUT2:</p> <ul style="list-style-type: none"> – [Hno] = hysteresis function/normally open – [Hnc] = hysteresis function/normally closed – [Fno] = window function / normally open – [Fnc] = window function / normally closed <p>Parameter [ou1] also provides the option [tch]:</p> <ul style="list-style-type: none"> – [tch] = configure pin 4 as input for the teach signal | | | | | | |
| FOU1 / FOU2 | <p>Behaviour of the outputs OUT1 / OUT2 in case of a fault:</p> <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 | <p>Delay time of the outputs in case of a fault: Setting range 0...5 s, step increment 0.2 s</p> | | | | | | |
| dS1*) / dS2*) | <p>Switch-on delay for OUT1 / OUT2: Setting range 0...10 s, step increment 0.2 s *) Parameter [dSx] is not available for LMT01A!</p> | | | | | | |
| dr1 / dr2 | <p>Switch-off delay for OUT1 / OUT2: Setting range 0...10 s, step increment 0.2 s</p> | | | | | | |
| P-n | Output polarity for the outputs (PnP or nPn) | | | | | | |

7.6 System commands

| | |
|------|---|
| tSP1 | <p>Teach switch point 1 to medium 1</p> <ul style="list-style-type: none"> • Full adjustment to medium 1 to be detected, automatically sets the switching thresholds SP1/rP1 for OUT1. |
| tSP2 | <p>Teach switch point 2 to medium 2</p> <ul style="list-style-type: none"> • Full adjustment to medium 2 to be detected, automatically sets the switching thresholds SP2/rP2 for OUT2. |
| rES | Restore the factory setting |

7.7 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 | <ul style="list-style-type: none"> – [Open] = Unit allows parameter download from the master. – [Locked] = Unit refuses parameter download from the master. |
|--------------|---|

7.8 Full adjustment via IO-Link

Full adjustment enables optimum sensitivity of the unit to be set to the medium to be detected (build-up 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.

7.9 Parameter setting via the teach input

The teach input must be activated.

- ▶ This requires previous configuration via IO-Link: Parameter [ou1] = [tch].



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

7.9.1 Full adjustment via the teach input

- ▶ Fill the tank until the probe tip is completely covered.
- ▶ Apply Ub+ to pin 4 for > 2 ... < 5 s.
- ▷ LEDs flashing at 2 Hz.
- ▷ After teaching the LEDs are on for 2 s. Then the colours change to regular operating mode.

7.9.2 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 are on for 2 s. Then the colours change to regular operating mode.
- ▷ After the successful change, the LEDs are on as follows:

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

7.9.3 Fault during the teach operation

- ▶ Faulty teach operation
- ▷ Teach operation stopped
- ▷ 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: (→ Parameter setting via the teach input)
- Process value too low (< 9 %, e.g. for powders), SPx/rPx must be set manually (→ Parameter setting via PC and IO-Link interface).

8 Operation

After power-on the device is in the operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

- ▶ Check whether the unit operates correctly.

8.1 Switching states and LED indicators



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

| 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 | (> Full adjustment via the teach input) and (> Changing the output function) | | |
| Fault during the teach operation | LEDs are flashing green/yellow with 8Hz. | | |
| ¹⁾ according to the level | | | |



The LEDs always indicate the switching status of output OUT1 (exception: teach operation (> Parameter setting via the teach input)).

8.2 System events IO-Link

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

9 Maintenance, repair and disposal

- ▶ Check sensor tip at regular intervals for deposits and damage. Clean the unit if badly soiled. 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 the unit is resistant to ingress and without dead space.
- ▶ It is not possible to repair the unit.
- ▶ In case of return shipment, ensure that the unit is free from soiling, especially from dangerous and toxic substances.
- ▶ For transport only use appropriate packaging to avoid damage of the unit.
- ▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.



If the variable clamp fitting is used:

- ▶ Check the correct position of the safety chain or the securing wire between the clamp fitting and the sensor at regular intervals.
- ▶ Replace damaged parts.

10 Factory setting

| | LMT0xA | User settings |
|---|--------|---------------|
| SP1 | 8 % | |
| rp1 | 5 % | |
| ou1 | Hno | |
| SP2 | 8 % | |
| rp2 | 5 % | |
| ou2 | Hnc | |
| FOU1 | OFF | |
| FOU2 | OFF | |
| dS1*) | 0.0 | |
| dS2*) | 0.0 | |
| dr1 | 0.0 | |
| dr2 | 0.0 | |
| P-n | PnP | |
| dFo | 0.0 | |
| Percentage values refer to the process value (→ Parameter setting). | | |
| *) Parameters not available for LMT01A. | | |