Operating instructions
Binary level sensor
LMCxx0
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1 Preliminary note

1.1 Symbols used

Instructions
Reaction, result
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 product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- 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 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

- Detection of almost all media, even extremely adhering or non-conductive ones.
- The sensitivity is preset at the factory. Easy set-up possible without any programming (plug and play).
- Sensitivity can be set by the user, if required (→ 8 Parameter setting).
- Available process connections: G 1/2 and 1/2" NPT. G 1/2 is available in two versions: for front installation (Fig. 3-1) and for rear installation (Fig. 3-2 and → 5.2.2).

<table>
<thead>
<tr>
<th>Type</th>
<th>Default setting</th>
<th>Sensitivity</th>
<th>Process connection</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMC100</td>
<td>Aqueous media</td>
<td>low</td>
<td>G 1/2, front</td>
<td>Fig. 3-1</td>
</tr>
<tr>
<td>LMC110</td>
<td>Oils, greases, powders</td>
<td>high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMC400</td>
<td>Aqueous media</td>
<td>low</td>
<td>G 1/2, rear</td>
<td>Fig. 3-2</td>
</tr>
<tr>
<td>LMC410</td>
<td>Oils, greases, powders</td>
<td>high</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMC500</td>
<td>Aqueous media</td>
<td>low</td>
<td>1/2&quot; NPT</td>
<td>Fig. 3-3</td>
</tr>
<tr>
<td>LMC510</td>
<td>Oils, greases, powders</td>
<td>high</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If a suitable unit is selected, the presence of certain media can be detected while deposits or foam will be suppressed.

- In addition, the unit can be used for temperature measurement (→ 8 Parameter setting).

### 3.2 Restriction of the application area

- Not suitable for hygienic areas.
- Not suitable for abrasive media (e.g. quartz sand) and heavy bulk material (e.g. stones).
- For use in aggressive media (acids and alkali):
  - Check the compatibility of the product materials beforehand (→ Technical data sheet).
- When using inhomogeneous media that will form separate layers (e.g. oil layer on water):
  - Check the function by means of an application test.
- Air or gas bubbles in liquid media 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).
4 Function

4.1 Measuring principle
The unit operates on the impedance spectroscopy method. It analyses the electrical characteristics 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 deposits or foam have different electrical properties that are used for the evaluation.

4.2 Process measured signals

Factory setting
Outputs OUT1 and OUT2 complement each other:
OUT1 = Hno; OUT2 = Hnc

<table>
<thead>
<tr>
<th>no medium detected</th>
<th>OUT1 = OFF</th>
<th>OUT2 = ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>medium detected</td>
<td>OUT1 = ON</td>
<td>OUT2 = OFF</td>
</tr>
</tbody>
</table>

The readiness for operation and the switching status are indicated by LEDs.
### 4.3 Application examples

#### 4.3.1 Application examples for front installation

<table>
<thead>
<tr>
<th>Fig. 4-2</th>
<th>Fig. 4-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Fig. 4-2" /></td>
<td><img src="image2" alt="Fig. 4-3" /></td>
</tr>
</tbody>
</table>

1: Installation only suited to some extent

- Fig. 4-2: Possible installation positions in a tank (e.g. for point level detection or as run-dry protection)
- Fig. 4-3: Fill level monitoring in pipes.

⚠️ In case of strongly adhering and viscous media, the installation positions (1) Fig. 4-2 and Fig. 4-3 are only suited to some extent. Residues might be detected as level.
4.3.2 Application examples for rear installation via pipe
Installation from the top:

Rear installation of the sensor in a pipe of variable length (3) is possible. Different response points can be implemented. Example: monitoring maximum level (1) or minimum level (2).

- Use metal probes with G 1/2 internal thread and internal diameter of min. 19 mm.

- If the sensor is permanently covered by the medium:
  - The temperature inside the pipe must not exceed the maximum ambient temperature as a consequence of an excessive medium temperature.
    (→ Technical data sheet).
Lateral installation:

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

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 or the tank. Also always take into account the potential dangers related to extreme machine and 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.

In applications subjected to pressure:

- Only use process connections suitable and robust enough for the process / the application.

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

- Check the function by an application test.

If disturbances occur:

- Take suitable measures (grounding, shielding ...) etc.
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 minimum distance of 15 mm from the sensor tip to neighbouring objects (e.g. pipe/tank walls, structures, other LM sensors) (Fig. 5-1).

5.2 Installation procedure

5.2.1 Front installation for LMC1x0/LMC5x0
► LMC1x0: Slide the supplied flat seal over the thread onto the sensor and/or verify its correct position.
► LMC5x0: Apply a suitable sealing material (e.g. PTFE tape) to the thread, if required. Ensure that the sensor is in electrical contact with the metal process connection.
► Lightly grease the thread of the sensor using a lubricating paste suitable and approved for the application.
► Screw the sensor into the respective process connection and tighten it.
Max. tightening torque: LMC1x0: 20...25 Nm
LMC5x0: < 50 Nm
► After installation check the tank / pipe for ingress resistance.
5.2.2 Rear installation for LMC4x0

- Lay the socket (straight design) through the respective probe (Fig. 5-2).
- Slide the supplied flat seal over the (rear) thread onto the sensor/verify its position (Fig. 5-3).
- Screw the sensor to the socket (Fig. 5-4).
- Lightly grease the thread of the sensor using a lubricating paste suitable and approved for the application.
- Screw the sensor to the probe and tighten it (Fig. 5-5).
  Max. tightening torque: 20...25 Nm.
- Ensure suitable fixing/installation of the probe on the tank (Fig. 4-4).
- After installation check the tank / pipe for ingress resistance.
- Ensure suitable sealing of the cable entry at the upper pipe end (e.g. use a cable gland).

These instructions also apply for installation in a tuning fork adapter. The cable entry of the adapter has to be sealed with the enclosed cover cap. The cable must be guided downwards so that moisture is discharged.
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:

<table>
<thead>
<tr>
<th>Core colours</th>
<th>2</th>
<th>1</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BN brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BU blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WH white</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OUT1: Switching output / IO-Link
OUT2: Switching output
Colours to DIN EN 60947-5-2

Example circuits

<table>
<thead>
<tr>
<th>2 x positive switching</th>
<th>2 x negative switching</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Positive Switching Circuit" /></td>
<td><img src="image2.png" alt="Negative Switching Circuit" /></td>
</tr>
</tbody>
</table>

Factory setting OUT1 and OUT2: pnp switching signal.

Accessories: www.ifm.com
7 Interfaces

7.1 O-Link communication interface

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

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

The IODDs necessary for the unit's configuration, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about required IO-Link hardware and software can be found at www.ifm.com.

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.

In addition, the unit can be used for temperature measurement. Temperature can only be measured via the IO-Link communication interface with acyclic data exchange. The probe tip must be sufficiently covered with the medium during the measurement.

The parameters can be set before installation or during operation.

Changing parameters during operation can influence the function of the plant.

Ensure that there will be no malfunctions in your plant.
8.1 Parameter setting via PC and IO-Link interface
► Prepare computer, software and interface → Operating instructions.
► Connect the unit with the IO-Link interface.
► Follow the menu of the IO-Link software.
► Parameter setting, adjustable parameters (→ 8.3).
► Put the unit into operation.

8.2 Parameter setting via the memory plug
A parameter set can be written / transferred to the unit via a memory plug (storage module) → www.ifm.com.
► Load suitable parameter set (e.g. using a PC) to the memory plug → Operating instructions memory plug.
► 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.
► Put the unit into operation.

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.
You can find more information about the memory plug in the corresponding technical documentation → www.ifm.com.
8.3 Parameters

| SPx/rPx       | Switching thresholds of the set points (SPx) and reset points (rPx) for outputs OUT1 and OUT2. The values for SPx/rPx are set in percent of the max. process value. The process value is defined as follows:
|               | Process value in air = 0 %
|               | Process value in tap water = 100 %
|               | Minimum hysteresis: 2 %

<table>
<thead>
<tr>
<th>Type of medium:</th>
<th>Reference values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous / water-based media:</td>
<td>SPx = 70 %, rPx = 62 % (factory setting LMCx0x)</td>
</tr>
<tr>
<td>Media with low water content:</td>
<td>SPx = 35 %, rPx = 29 %</td>
</tr>
<tr>
<td>Oils, fats, powdery media:</td>
<td>SPx = 8 %, rPx = 5 % (factory setting LMCx1x)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>oux</th>
<th>Output function for OUTx:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- [Hno] = hysteresis function/NO</td>
</tr>
<tr>
<td></td>
<td>- [Hnc] = hysteresis function/NC</td>
</tr>
<tr>
<td></td>
<td>- [Fno] = window function/NO</td>
</tr>
<tr>
<td></td>
<td>- [Fnc] = window function/NC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOUx</th>
<th>Response of the outputs OUTx in case of a fault.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- [OFF] = switching output switches OFF in case of a fault.</td>
</tr>
<tr>
<td></td>
<td>- [On] = output switches ON in case of a fault.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>dsx</th>
<th>Switching delay for OUTx.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting range 0...10 s. Step increment 0.1 s.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>drx</th>
<th>Switch-off delay for OUTx.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Setting range 0...10 s. Step increment 0.1 s.</td>
</tr>
</tbody>
</table>

| P-n | Switching logic for the outputs (PnP or nPn) |

8.4 System commands

<table>
<thead>
<tr>
<th>tSP1</th>
<th>Teach to medium 1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Full adjustment to the medium 1 to be detected, automatically sets the switching thresholds SP1/rP1 for OUT1.</td>
</tr>
<tr>
<td></td>
<td>No teach is possible for oux = [Fno] / [Fnc].</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>tSP2</th>
<th>Teach to medium 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Full adjustment to the medium 2 to be detected, automatically sets the switching thresholds SP2/rP2 for OUT2.</td>
</tr>
<tr>
<td></td>
<td>No teach is possible for oux = [Fno] / [Fnc].</td>
</tr>
</tbody>
</table>

| rES | Restore factory setting |
8.5 Set to the full vessel [tSPx]
► 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 means of an application test.

9 Operation
After power-on, the device is in the operating mode. It carries out its evaluation functions and switches the outputs.
► Check whether the unit operates correctly.

Table 9-1 indicates the factory settings. In this state, OUT1 is = Hno and OUT2 is = Hnc.

<table>
<thead>
<tr>
<th>Table 9-1</th>
<th>Operating mode</th>
<th>LEDs</th>
<th>OUT1</th>
<th>OUT2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit ready for operation, no medium detected</td>
<td>green</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>Unit ready for operation, medium detected</td>
<td>yellow</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>No operating voltage</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>Short circuit output 1</td>
<td>Flashing yellow</td>
<td>-</td>
<td>1)</td>
</tr>
<tr>
<td></td>
<td>Short circuit output 2</td>
<td>Flashing yellow</td>
<td>1)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Error / failure</td>
<td>-</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>

1) According to the level

The LEDs always indicate the switching status of output OUT1.

10 Maintenance, repair and disposal
► Check the probe tip for deposits and damage from time to time. Clean the unit if badly soiled. In case of damage replace the unit.

When the medium is changed, it may also be necessary to use another type of unit or adapt the sensitivity.
► 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 Factory setting

<table>
<thead>
<tr>
<th></th>
<th>LMCx0x</th>
<th>LMCx1x</th>
<th>User setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td>70 %</td>
<td>8 %</td>
<td></td>
</tr>
<tr>
<td>rP1</td>
<td>62 %</td>
<td>5 %</td>
<td></td>
</tr>
<tr>
<td>ou1</td>
<td>Hno</td>
<td>Hno</td>
<td></td>
</tr>
<tr>
<td>SP2</td>
<td>70 %</td>
<td>8 %</td>
<td></td>
</tr>
<tr>
<td>rP2</td>
<td>62 %</td>
<td>5 %</td>
<td></td>
</tr>
<tr>
<td>ou2</td>
<td>Hnc</td>
<td>Hnc</td>
<td></td>
</tr>
<tr>
<td>FOU1</td>
<td>OFF</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>FOU2</td>
<td>OFF</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>dS1</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>dS2</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>dr1</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>dr2</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P-n</td>
<td>PnP</td>
<td>PnP</td>
<td></td>
</tr>
</tbody>
</table>

More information at www.ifm.com