

ifm electronic



Operating instructions
Binary level sensor

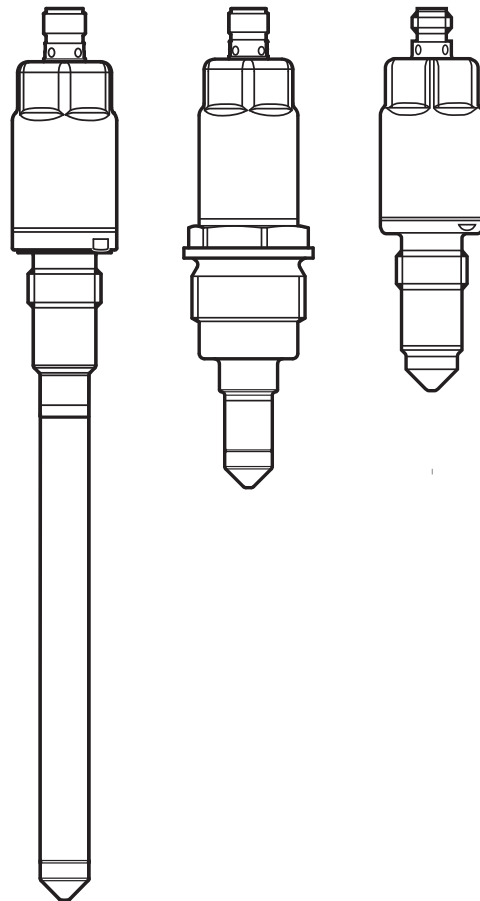
efector160[®]

LMTx9x

UK

10 / 2014

80012122 / 00



Contents

| | | |
|-------|---|----|
| 1 | Structure of the overflow protection | 4 |
| 1.1 | Illustration of the overflow protection | 4 |
| 1.2 | Function description | 5 |
| 1.3 | Type code | 6 |
| 1.4 | Scale drawing and technical data..... | 6 |
| 1.4.1 | Scale drawing of the LMT191 level detector | 6 |
| 1.4.2 | Scale drawing of the LMT192 level detector | 7 |
| 1.4.3 | Scale drawing of the LMT292 level detector | 7 |
| 1.4.4 | Scale drawing of the LMT392 level detector | 8 |
| 1.4.5 | Scale drawing of the LMT194 level detector | 8 |
| 1.4.6 | Scale drawing of the LMT195 level detector | 9 |
| 1.4.7 | Accessories | 9 |
| 1.4.8 | Technical data..... | 10 |
| 2 | Materials of the level detector..... | 11 |
| 3 | Applications..... | 11 |
| 3.1 | Restriction of the application area | 12 |
| 4 | Failure / error messages..... | 12 |
| 5 | Installation instructions | 13 |
| 5.1 | Mechanical installation of the level detector | 13 |
| 5.1.1 | Installation conditions | 13 |
| 5.1.2 | Installation of the unit..... | 14 |
| 5.2 | Electrical connection..... | 16 |
| 6 | Setting instructions | 18 |
| 6.1 | Set the response point..... | 18 |
| 6.2 | Sensitivity setting..... | 20 |
| 7 | Working instructions | 23 |
| 8 | Recurrent checks..... | 24 |

Symbols used

► Instructions

→ Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note

UK

Safety instructions

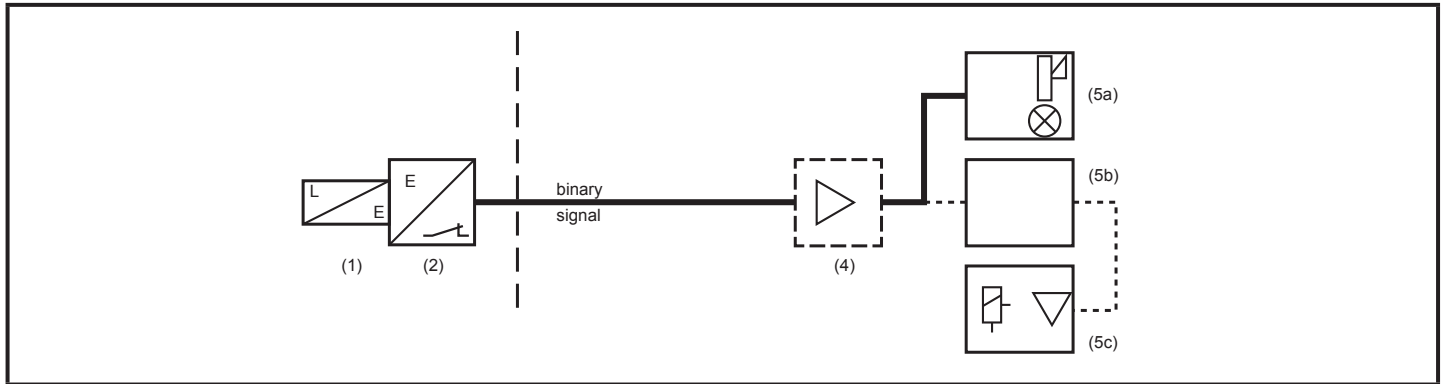
- Read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- It is the operator's responsibility to verify whether the device is suitable for the respective application. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the device result in a loss of the warranty claims.

The unit has a building authority approval according to the German Federal Water Act (WHG) and can therefore be used as overflow protection.

- In case the unit is used in applications that are subject to the German Federal Water Act: All remarks and restrictions indicated in this document have to be noted.
- The device can also be used in applications that are not subject to the German Federal Water Act. In this case some restrictions indicated in these instructions are null and void however further applications are possible, which are specifically indicated.

1 Structure of the overflow protection


1.1 Illustration of the overflow protection



- (1): Level detector (sensor, impedance spectroscopy)
- (2): Measurement transducer switching signal (built into the level detector)
- (4): Signal amplifier
- (5a): Signalling device
- (5b): Control device
- (5c): Actuator

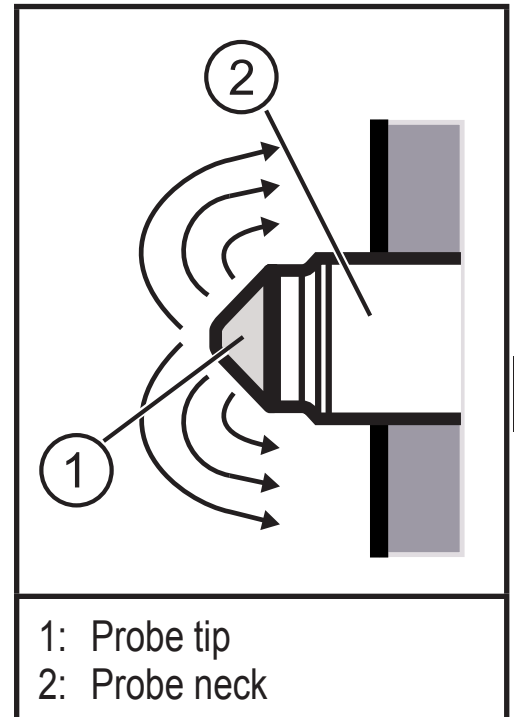
The LMT191, LMT192, LMT194, LMT195, LMT292 and LMT392 level measuring devices consist of a level detector with built-in measurement transducer. The level detector operates according to the principle of impedance spectroscopy.

A binary switching signal is generated in the measurement transducer (2) (output OUT-OP). The binary switching signal controls a signalling device (5a) or a control device (5b) with actuator (5c) directly or via a signal amplifier (4).

 Non-tested plant components of overflow protection are for example the signal amplifier (4), the signalling device (5a) and the control device (5b) with its actuator (5c). These plant components must meet the requirements of sections 3 and 4 of the approval principles for overflow protection.

1.2 Function description

The unit determines changes of the impedance caused by approaching electrically conductive and non-conductive liquids in the electrical field of a capacitor (in the sensor tip ①). In the measurement transducer the change of impedance is converted into a binary switching signal.



The unit has complementary-switching outputs:

| | |
|-----------------------|--|
| OUT1 (pin 4) | <ul style="list-style-type: none"> • Switching output 1: normally open (Hno) • Communication via IO-Link |
| OUT-OP (pin 2) | Switching output for overflow protection according to the German Federal Water Act: normally closed (Hnc) |



The unit is set to aqueous media at the factory. The sensitivity of the unit can be changed via IO-Link, if requested. A "full adjustment" can also be made (switch point setting with medium present).

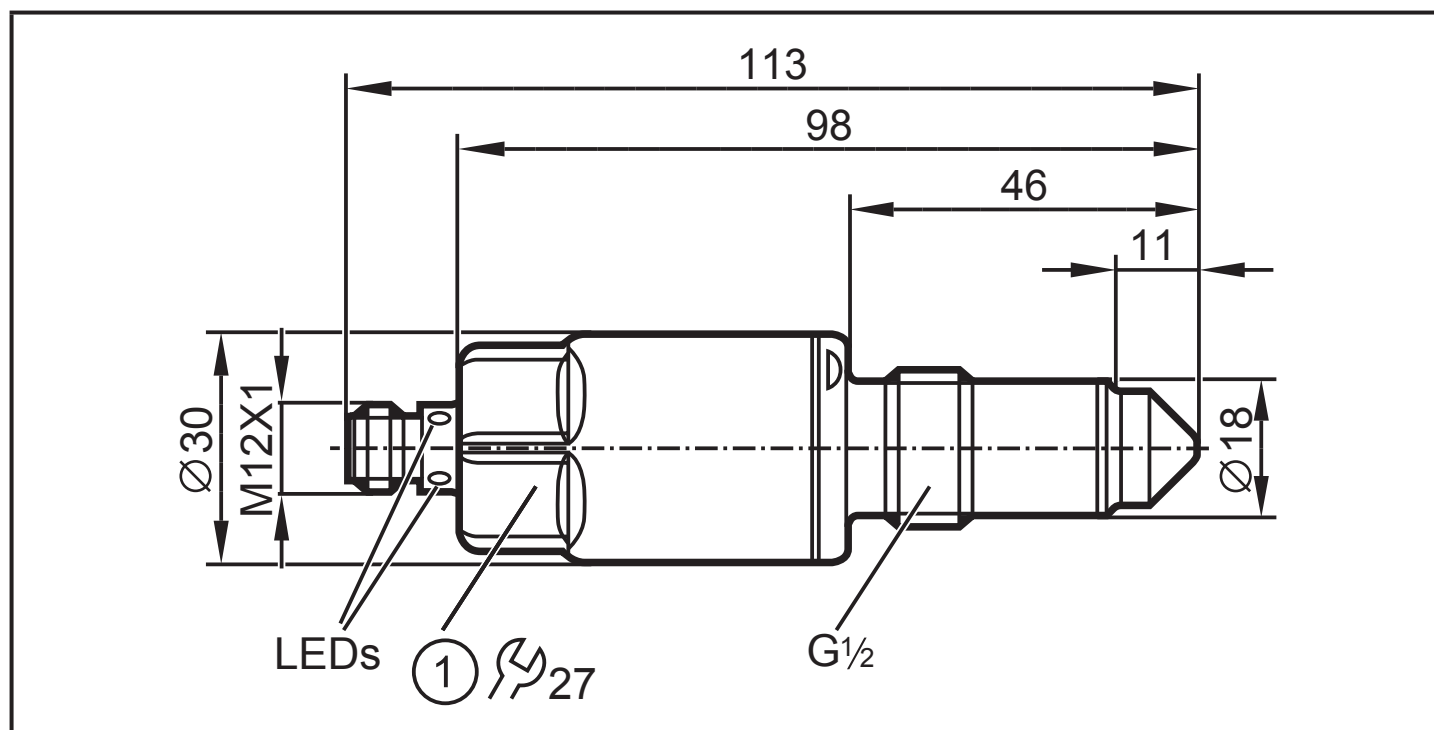
More information → 6 Setting instructions.

1.3 Type code

| Order no. | Probe length | Process connection |
|-----------|--------------|--------------------|
| LMT191 | 11 mm | G ½ |
| LMT192 | 38 mm | G ½ |
| LMT292 | 28 mm | G ¾ |
| LMT392 | 38 mm | G 1 |
| LMT194 | 153 mm | G ½ |
| LMT195 | 253 mm | G ½ |

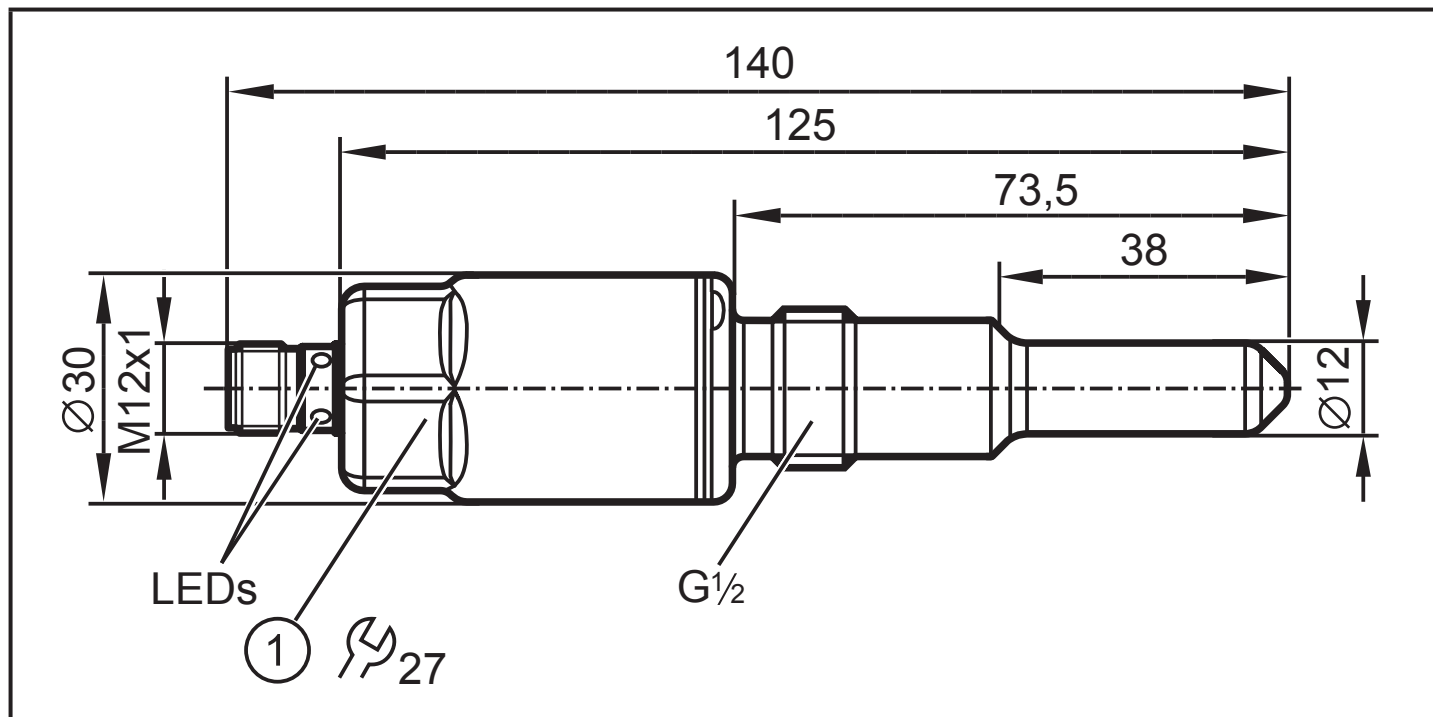
1.4 Scale drawing and technical data

1.4.1 Scale drawing of the LMT191 level detector



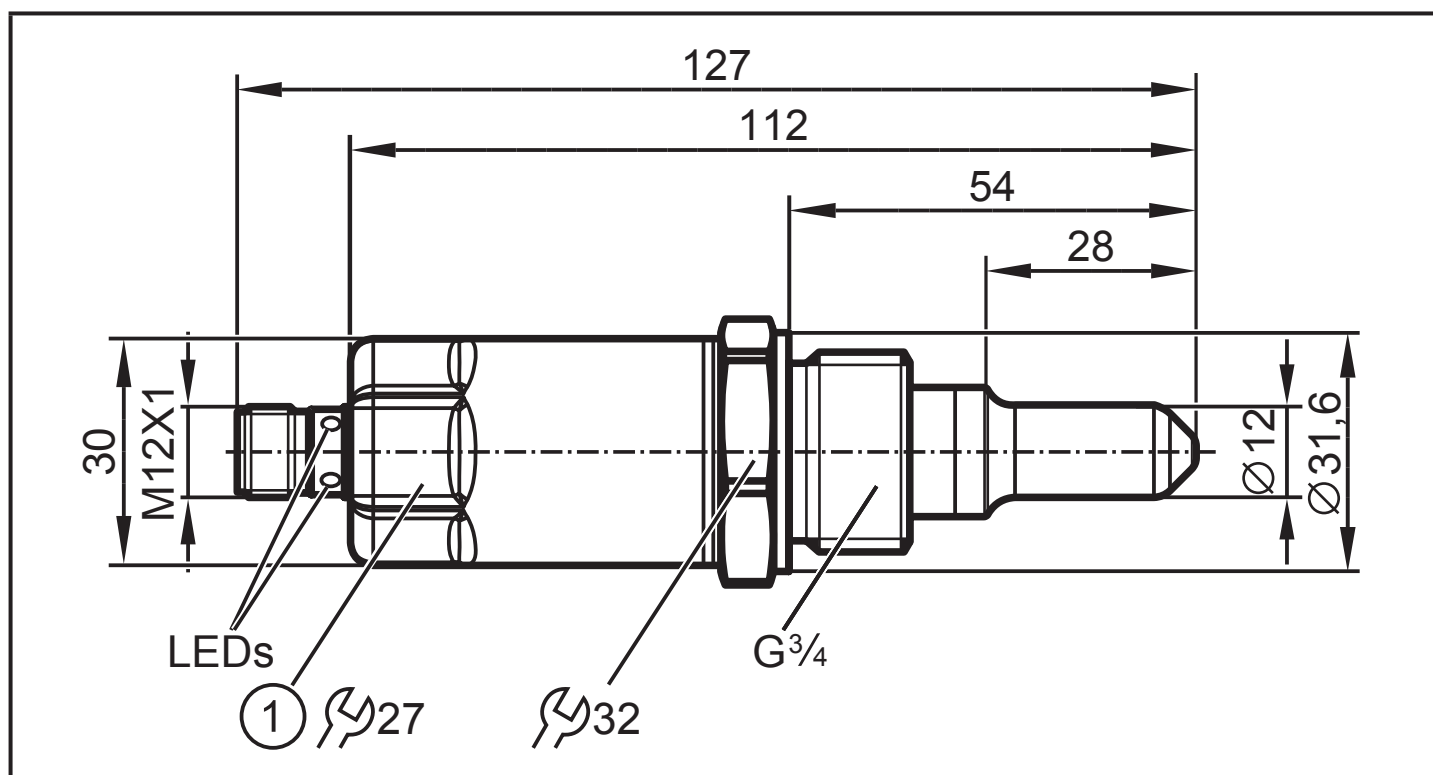
1: Tightening torque 20...25 Nm

1.4.2 Scale drawing of the LMT192 level detector



1: Tightening torque 20...25 Nm

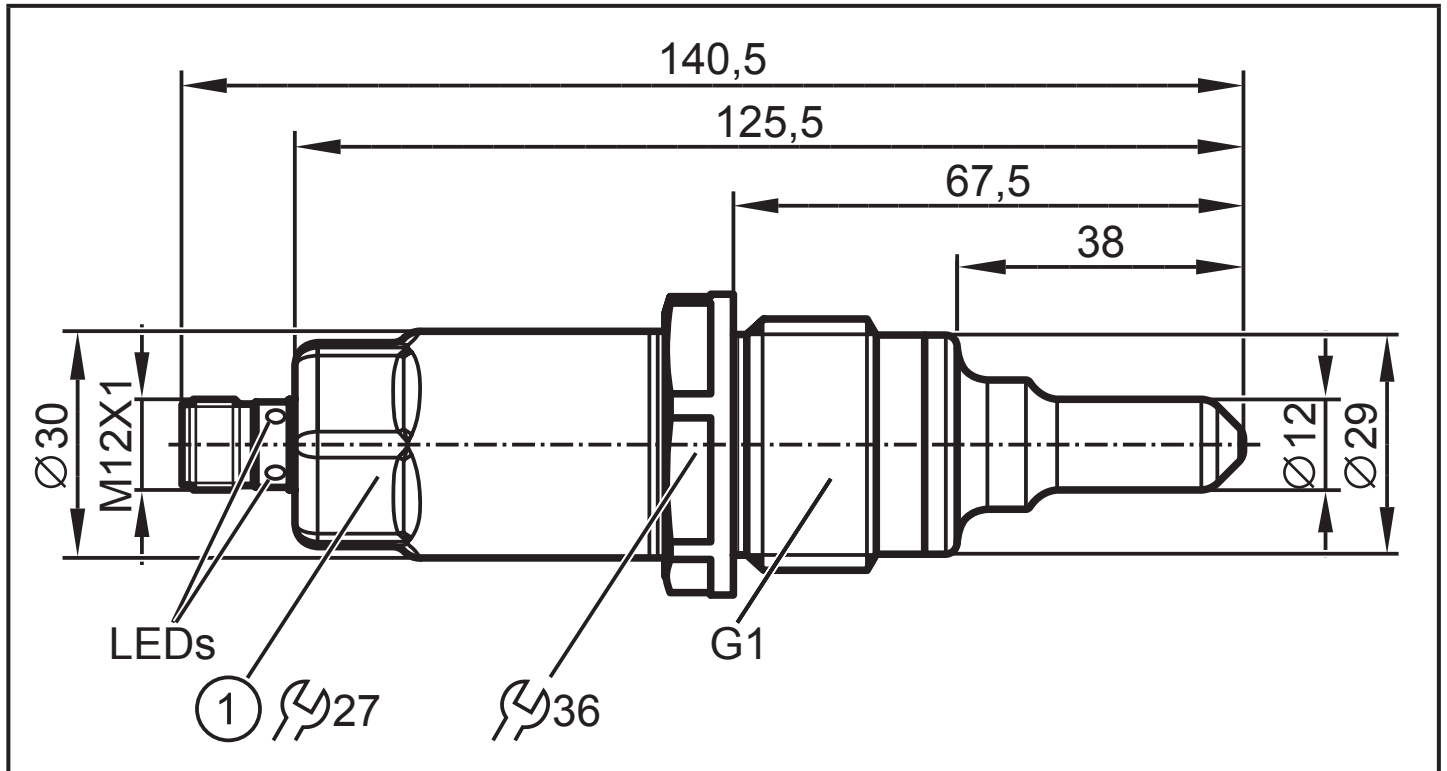
1.4.3 Scale drawing of the LMT292 level detector



1: Tightening torque 35 Nm

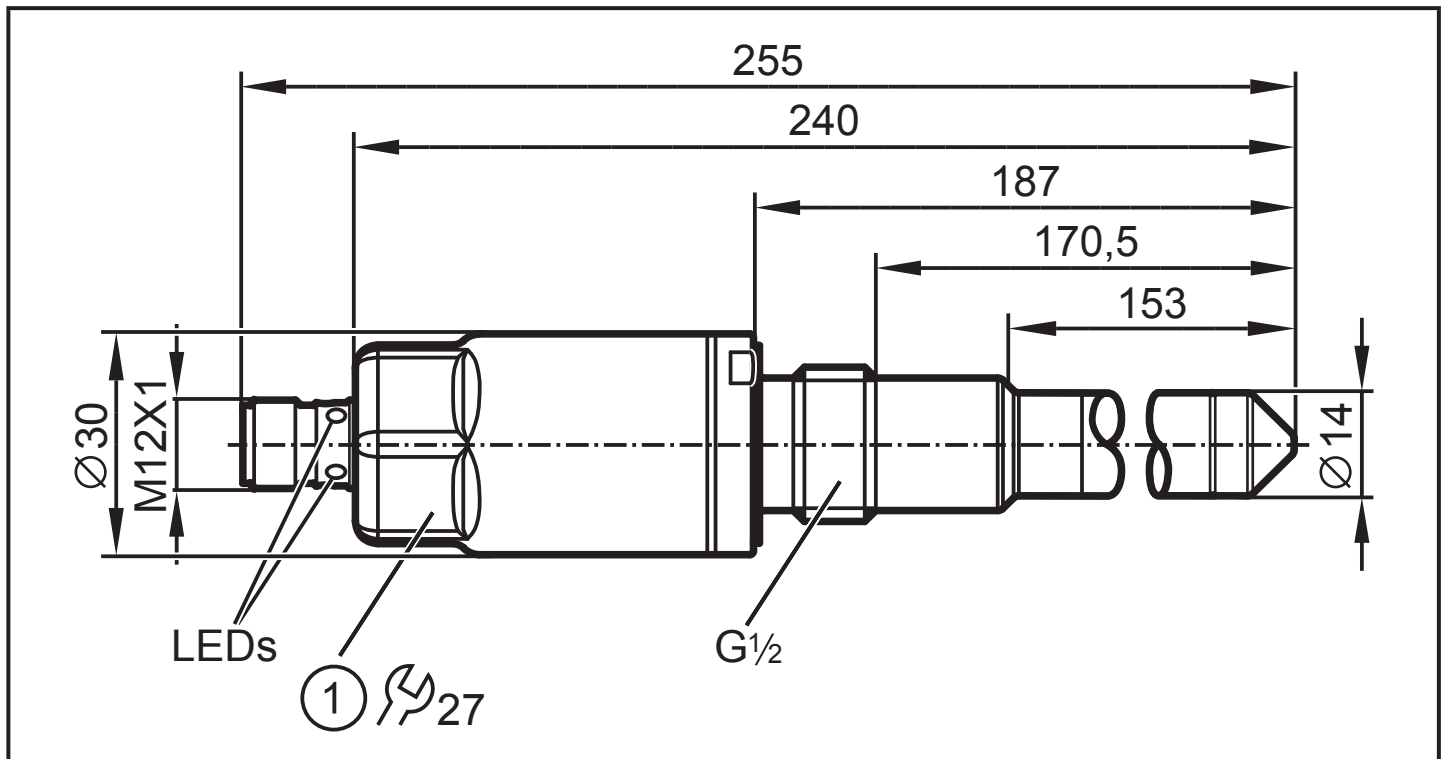
UK

1.4.4 Scale drawing of the LMT392 level detector



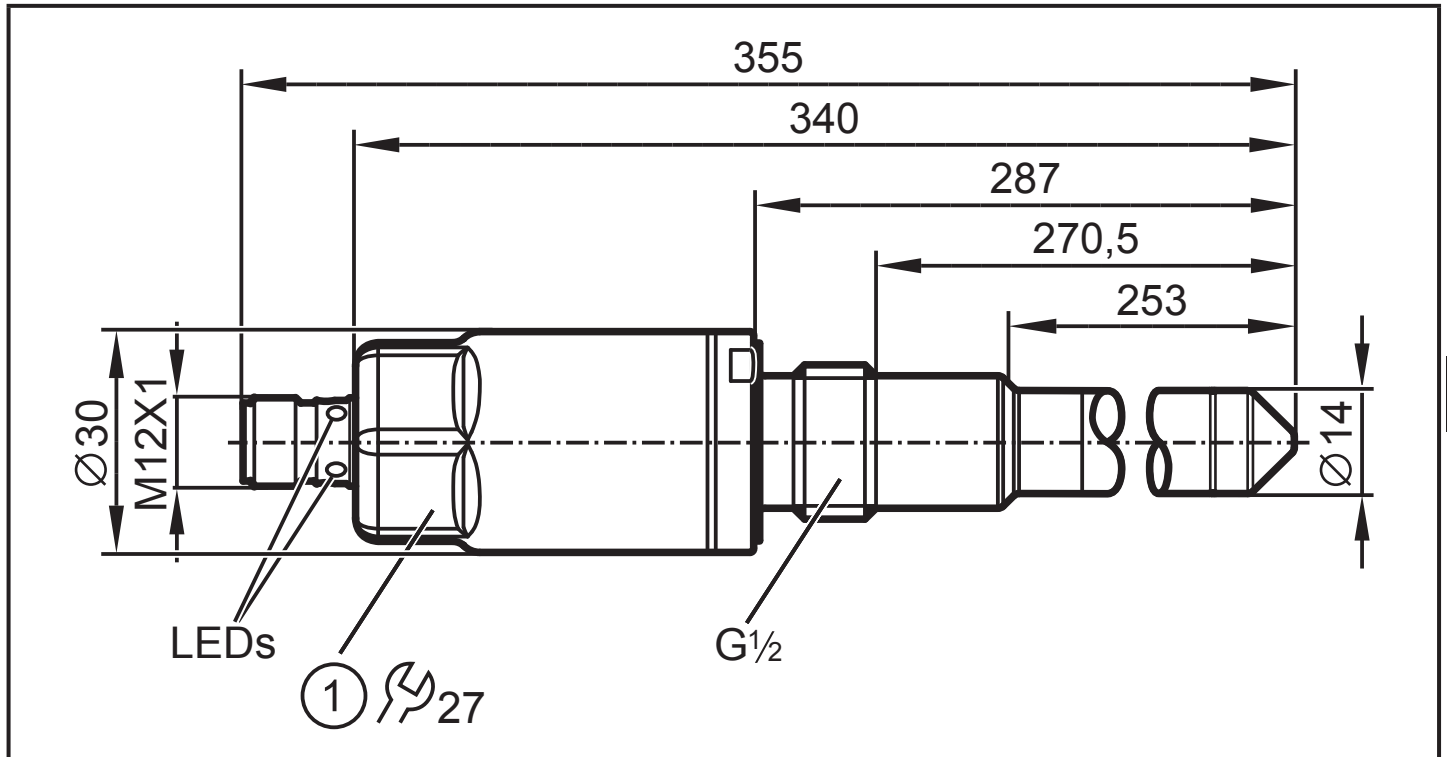
1: Tightening torque 35 Nm

1.4.5 Scale drawing of the LMT194 level detector



1: Tightening torque 20...25 Nm

1.4.6 Scale drawing of the LMT195 level detector



1: Tightening torque 20...25 Nm

1.4.7 Accessories



Suitable ifm mounting adapters are recommended for the installation.

Available accessories: www.ifm.com → New search → enter the order number → tab "Accessories"

1.4.8 Technical data

| | |
|---|--|
| Application: | |
| - Applications overflow protection to WHG* | liquids with DC > 1.8** |
| - Other applications | liquids, viscous media and powders with DC > 1.8** |
| Operating voltage U_B | 18...30 V DC |
| Electrical design | DC PNP |
| Current consumption | < 50 mA |
| Protection class | III |
| Reverse polarity protection | yes |
| Short-circuit protection of the outputs | pulsed |
| Overload protection of the outputs | yes |
| Protection rating | IP 68 / IP 69K |
| Electrical connection | M12 connector; gold-plated contacts |
| Switching output OUT1 | function: NO |
| Switching output OUT-OP (overflow protection): | |
| - function | NC |
| - not covered | current max. 100 mA, voltage max. U_B , voltage drop < 2.5 V |
| - covered | leakage current < 500 μ A |
| Communication | IO-Link (process data, parameter setting, diagnostics)*** |
| Medium temperature: | |
| - Applications to the German Federal Water Act* | 0...85 °C (up to 100 °C with oil) |
| - Other applications | -25...85 °C (up to 100 °C with oil) |
| peak (1 h) | up to 150 °C |
| LMT191: | up to -40 °C |
| Ambient temperature: | |
| - Applications subject to the German Federal Water Act* | 0...85 °C |
| - Other applications: | |
| at max. medium temperature of 100 °C | -20...85 °C |
| at max. medium temperature of 150 °C | -20...60 °C |
| LMT191: | up to -40 °C |
| Switching delay (OUT-OP / IO-Link) | max. 500 ms |

* Building authority approval according to the German Federal Water Act (WHG)

** DC = dielectric constant

*** In applications subject to the German Federal Water Act IO-Link is only permissible for parameter setting. System integration permissible only for applications that are not subject to the German Federal Water Act. Data storage not possible for reasons of security.

2 Materials of the level detector

| | |
|----------------------------|---|
| Materials (wetted parts)*: | |
| Prope tip (→ 1.2) | PEEK |
| Probe neck (→ 1.2) | 316L/1.4404, 316Ti/1.4571 |
| O-ring / flat seal | FKM |
| Housing materials** | 316L/1.4404, 316Ti/1.4571, PEEK, PEI, FKM |

UK

* Materials in direct contact with the storage liquid, its vapours or condensate.

** Materials not in direct contact with the storage liquid but with its vapours or condensate.

3 Applications

The level detector with integrated measurement transducer can be used for conductive and non-conductive liquids with a relative dielectric constant (DC) of min. 1.8. The device is suitable for installation in fixed tanks or those used as fixed tanks with pressures of -0.5...10 bar for the reception of liquids that are hazardous to water.



For applications that are not subject to the German Federal Water Act (WHG):

- The device can be used not only for liquids but also for viscous media and powders with DC > 1.8.
- The unit can also be used in tanks in a pressure range of -1...40 bar.

In general the following applies:

- For use in aggressive media (e.g. acids and alkalis):
 - ▶ Check the compatibility of the product materials beforehand (→ 2 Materials of the level detector).
- Media which are very inhomogeneous separate from each other thus generating separation layers (e.g. oil layer on water):

- ▶ Check the function by an application test.
- If foam formation is to be detected:
 - ▶ Check adjustment to foam (→ 6.2).
 - ▶ Check the function by an application test.

3.1 Restriction of the application area

- The unit is not suitable for abrasive media.
- The unit is not suitable for applications in which the probe tip is exposed to intense solar radiation (UV radiation).

4 Failure / error messages



The OUT-OP output (overflow protection) works to the principle of normally closed operation. This ensures that in case of wire break or interruption of the auxiliary energy the same status as if the max. level had been reached is signalled (→ 1.4.8 Technical data).

The unit displays the following additional operating states:

| Operating status | LEDs | OUT1 | OUT-OP |
|--|----------------|---------------|---------------|
| 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 | Flashes yellow | - | ¹⁾ |
| Short circuit output 2 | Flashes yellow | ¹⁾ | - |
| Error / failure | Flashes green | OFF | OFF |

¹⁾ According to the level

5 Installation instructions

5.1 Mechanical installation of the level detector



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 note the potential dangers related to extreme machine and medium temperatures.

UK

5.1.1 Installation conditions



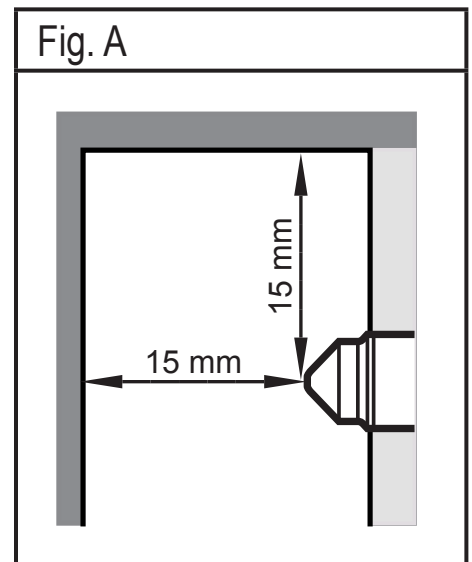
It is preferably installed in closed, metal tanks. When installed in plastic tanks, there may be deterioration caused by electromagnetic interference. In this case:

- ▶ Check the function by an application test.
- ▶ In case of interference, take suitable measures (shielding, grounding etc.).



Installation in pipes from DN25 is possible (for short probes).

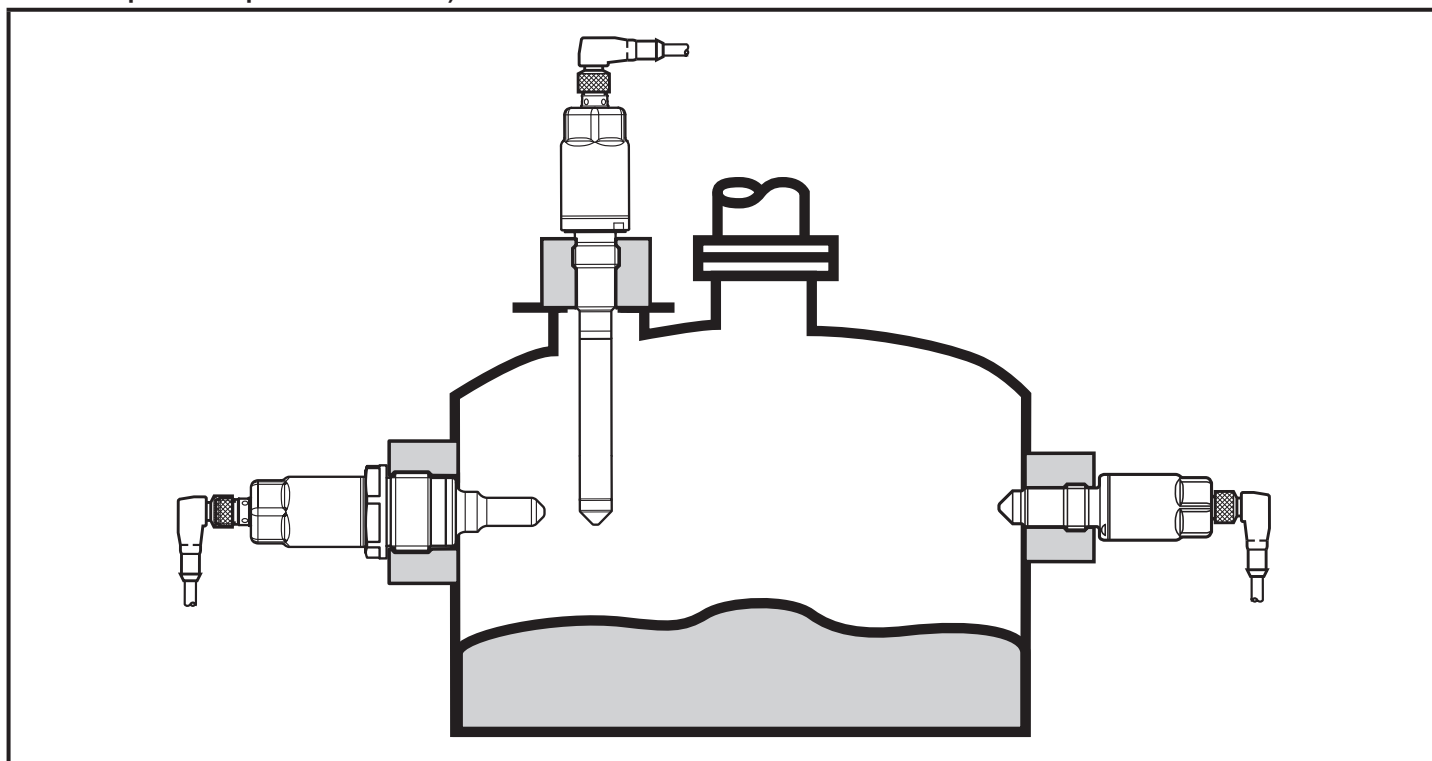
- ▶ To avoid malfunction and damage on sensor and plant, adhere to a distance of min. 15 mm to neighbouring objects (e.g. pipe/tank walls, structures, other LMT sensors) (fig. A).



The unit can be installed by screwing it into a mounting adapter or by directly screwing it into a threaded ferrule on the tank.

The level detector can be mounted in any position. The usual installation position is from the side or from the top. The following figure illustrates the possible installation positions.

The response level is determined by the installation situation and depends on the installation height or the tank height and the ferrule height; the immersion depth specific to the level detector is also to be taken into consideration (calculation of the response point → 6.1).



- The types LMT194 and LMT195 are recommended for the installation from the top.
- Types with short probe lengths are recommended for the installation from the side (→ 1.3 Type code).

5.1.2 Installation of the unit

Suitable ifm mounting adapters are recommended for the installation. Their front cone is used as process connection.

Available accessories: www.ifm.com → New search → enter the order number → tab "Accessories"



If another adapter is used or in case of direct installation via the internal thread of the unit:

- ▶ Ensure mechanical compatibility. Use medium-resistant seals.
- ▶ In addition check the function by an application test.

If a mounting adapter is used:

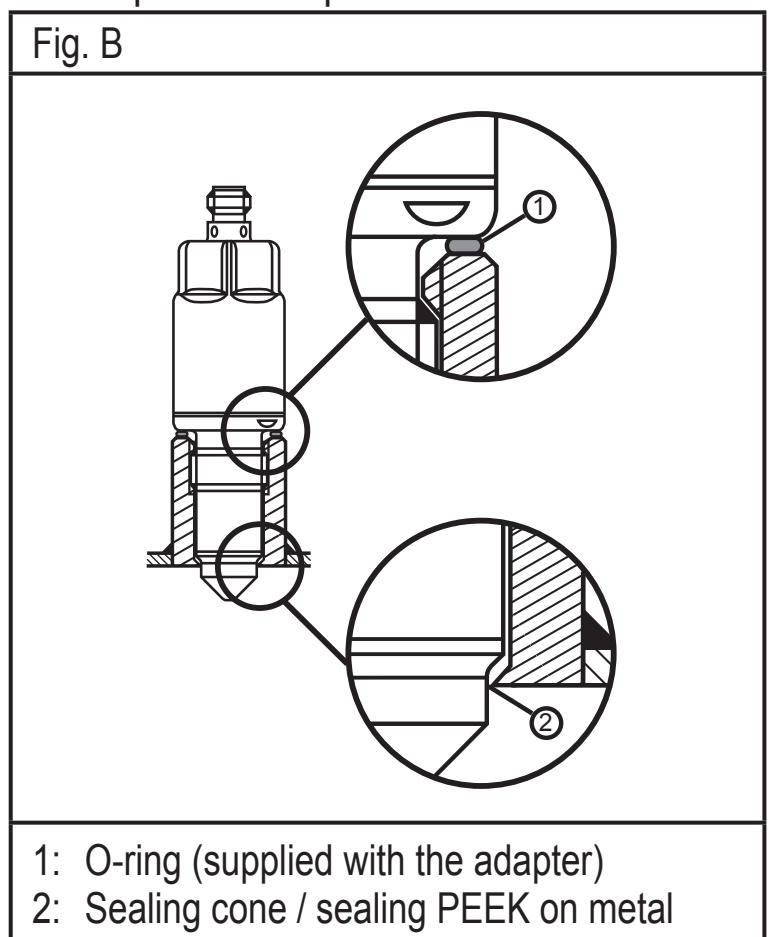
- ▶ Observe the installation instructions of the adapter used.
- ▶ Ensure cleanliness of the sealing areas. Remove protective packaging only just before mounting. In case of damaged sealing areas replace the unit or the adapter.

UK

After the installation of the adapter or the preparation of the process connection, the level detector can be screwed into the adapter or the process connection.

- ▶ If required, insert a suitable seal ①, Fig. B *, or check its position; it seals the gap on the back between the sensor and the adapter/tank.


* Fig. B: Installation example when an ifm adapter is used.



- ▶ Slightly grease the thread of the sensor using a lubricating paste which is suitable and approved for this application.


- ▶ Screw the sensor into the adapter and tighten it observing the following tightening torques:

| Tightening torques: | |
|----------------------------------|------------|
| Unit with G ½ process connection | 20...25 Nm |
| Unit with G ¾ process connection | 35 Nm |
| Unit with G 1 process connection | 35 Nm |

 For the correct and reliable function the sensor always has to be in contact with the metal process connection, therefore:

- ▶ Do not use any additional sealing material (e.g. PTFE tape).
- ▶ After installation check the tank / pipe for ingress resistance.

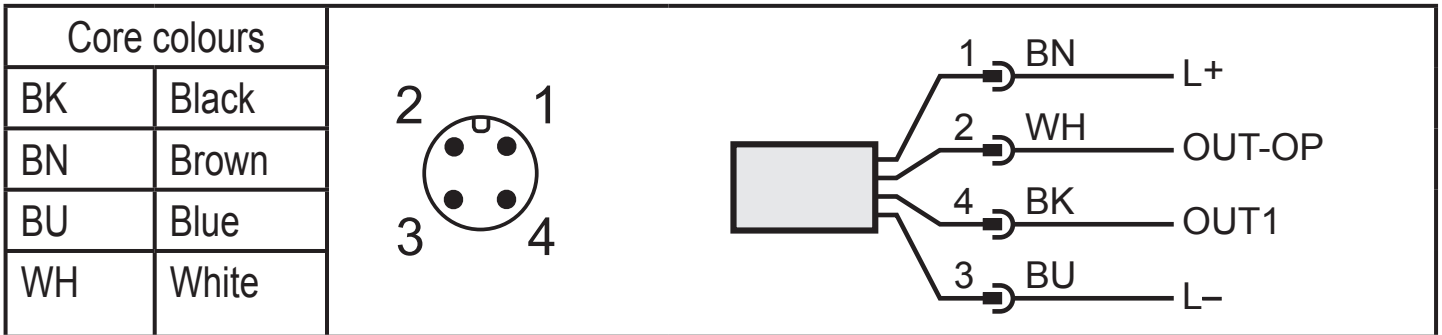
5.2 Electrical connection

 The unit must be connected by a qualified electrician.
Observe the national and international regulations for the installation of electrical equipment.

Voltage supply to EN 50178, SELV, PELV.

- ▶ Connect the level detector using a prewired M12 socket that meets the installation regulations (not supplied with the unit).
- ▶ Connect a signalling device and/or control device downstream of the checked machine parts of the overflow protection (output OUT-OP, pin2).
- ▶ Disconnect power.

► Connect the unit as follows:



OUT1: switching output 1:
normally open (Hno) / IO-Link

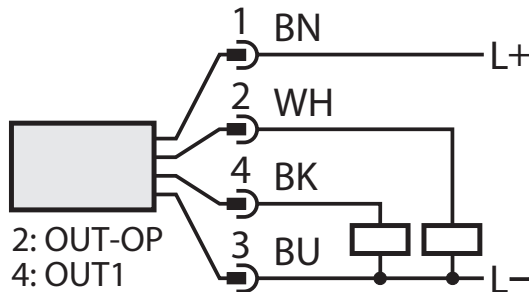
OUT-OP: switching output for overflow
protection, normally closed (Hnc)

These outputs switch in a complementary way.
Colours to DIN EN 60947-5-2

UK

Example circuit

2 x positive switching



6 Setting instructions

6.1 Set the response point

The response height (A) is to be determined by means of the approval principles (→ German version of the operating instructions, annex 1) according to the level permissible in the tank. The permissible level can be calculated to TRbF (technical rules for flammable liquids) no. 2.2, for example. The overrun quantity and the switching delays have to be taken into account.

The max. switching delay between the time the level has been reached and the switching output response is 0.5 seconds.

With vertical installation the tank height (H), the installation length (L) and the ferrule height (S) determine the response height.

With lateral installation the installation height (E) of the mounting adapter or the threaded ferrule determine the response height.



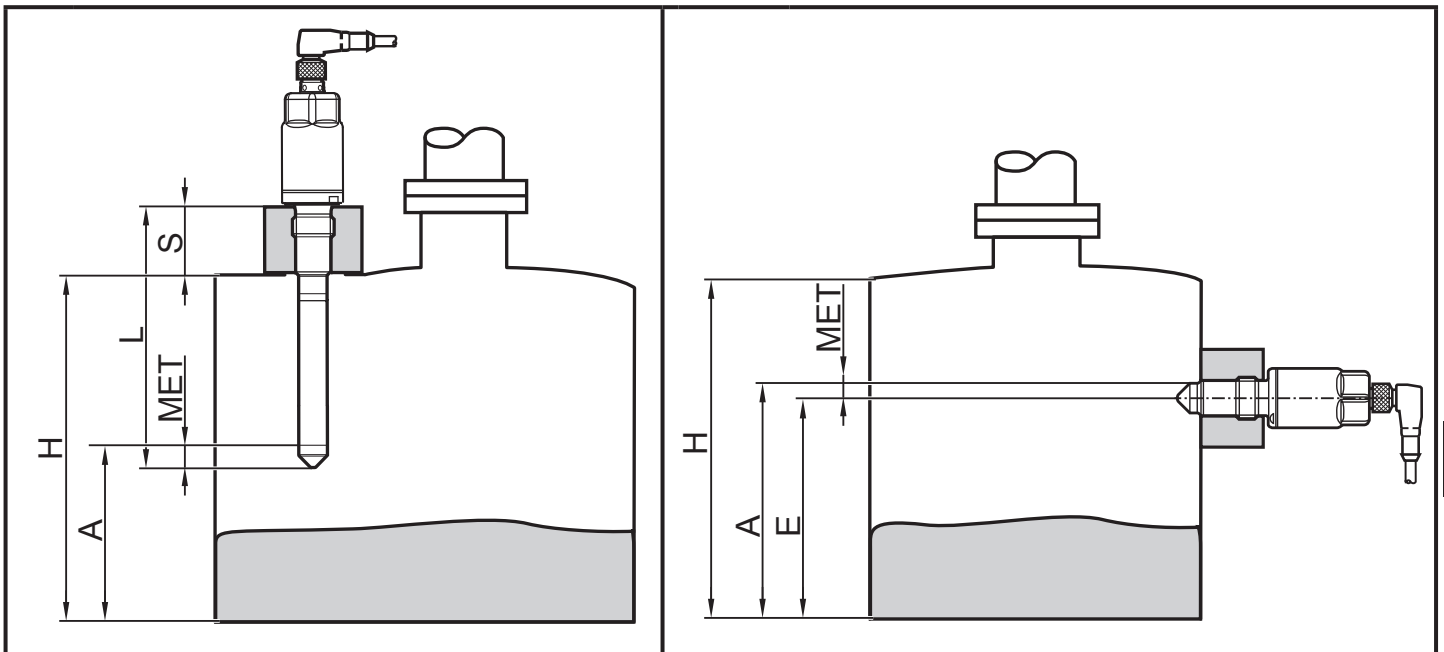
The types LMT194 and LMT195 are recommended for vertical installation. Types with short probe lengths are recommended for lateral installation (→ 1.3 Type code).

The device reacts at an immersion depth MET at the latest which depends on the installation position and the unit type (→ table page 19).

Calculation of the ferrule height or the installation height:

Vertical installation: $S = A + (L - MET) - H$

Lateral installation: $E = A - MET$



S: Ferrule height
 H: Tank height
 A: Response height

MET: Immersion depth (→ table below)
 E: Installation height
 L: Installation length (→ table below)

| Order no. | Installation length L | Immersion depth MET | Max. ferrule height S |
|-------------------------|-----------------------|-------------------------|-----------------------|
| LMT191 | 46 mm | 11 mm* / 8 mm** | 34 mm |
| LMT192 | 73.5 mm | 38 mm* / 8 mm** | 50 mm |
| LMT292 | 54 mm | 28 mm* / 8 mm** | 34 mm |
| LMT392 | 67.5 mm | 38 mm* / 8 mm** | 47 mm |
| LMT194 | 187 mm | 11 mm* / 8 mm** | 167 mm |
| LMT195 | 287 mm | 11 mm* / 8 mm** | 267 mm |
| * Vertical installation | | ** Lateral installation | |



For rating the ferrule height the indicated, max. ferrule height must not be exceeded.

Example:

A tank of a height $H = 400$ mm is to be monitored; the response height A is to be 300 mm. The LMT194 sensor is to be used; it is to be installed vertically. What is the required ferrule height?

The ferrule height is calculated as follows:

$$S = 300 \text{ mm} + (187 \text{ mm} - 11 \text{ mm}) - 400 \text{ mm} = 76 \text{ mm}.$$

Then the max. permissible ferrule height of the unit of 167 is observed.



In applications that are not subject to the German Federal Water Act (WHG) annex 1 of the German version of the operating instructions does not have to be observed. In this case the installation position is freely selectable.

6.2 Sensitivity setting



In many cases the factory setting is absolutely sufficient (→ 1.2 Function description). For special applications it is also possible to adapt the sensitivity to the respective application (parameter setting).

For parameter setting an IO-Link software is necessary (e.g. "LINERECORDER SENSOR" or "ifm Container"). The USB interfaces with the order no. E30396 or E30390 are available for the connection of the sensor via the USB interface.



During parameter setting the tank must not be filled.



The user menu is accessible once a password has been entered. On delivery it is "2014".



The program library of the available DTM objects, the IO Device Description (IODD) and the FDT service program "ifm Container" can be downloaded at www.ifm.com → Service → Download.

- ▶ Connect the USB interface to the unit and the control panel (e.g. laptop).
- ▶ Start the parameter setting software.
- ▶ Read the unit parameters (function depends on the parameter setting software used).
- > The current device parameters are displayed.
- ▶ Enter the password under [KeyCode].
On delivery, the password is "2014".
- ▶ Transfer the unit parameters to the unit. The function depends on the parameter setting software used.

- > The unit is unlocked.
- ▶ Read the unit parameters again.
- > The valid password is displayed.

There are 3 possibilities to set the sensitivity:

1. Use of the reference values (explanations SP / rP → table "Unit parameters")
 - ▶ Use the factory setting for aqueous media.
In case of doubt restore the factory setting with the parameter [rES].
 - ▶ For other media, e.g. oils, media with a low water content, ..., set [SP] or [rP] to the recommended reference values (→ table "Unit parameters").
 - ▶ Transfer the changed parameter setting to the unit.

2. Automatic adjustment teach full state
 - ▶ Establish the full state. The sensor tip must be completely covered.
 - ▶ Carry out an adjustment teach full state [TSP].
 - > The unit sets the switch points SP and rP automatically.
 - > Wait for the response of the unit.
 - ▶ Read the unit parameters to check if they are correct.

3. Manual sensitivity setting after the current process value has been read
 - ▶ Establish the full state. The sensor tip must be completely covered.
 - ▶ Read the current process value. The function depends on the parameter software used.
 - ▶ SP and rP lower (!) than the process value read.
Example: Read process value with "full" = 50.
Settings: SP is set to 45, rP to 40.

When parameter setting is completed, the password can be changed under parameter [CodE] (recommended).

- ▶ Enter the new password under [CodE].

- ▶ Transfer the changed parameter set to the unit.
- ▶ Disconnect the USB interface from the device.
- > The unit is ready for operation.

| Unit parameters | |
|-----------------|---|
| SP / rP | <p>Sensitivity of the set point (SP) and the reset point (rP). The values for SP / rP are set in per cent of the maximum process value. The percentage is defined as follows:</p> <ul style="list-style-type: none"> • Process value in air = 0 % • Process value in tap water = 100 % • Minimum hysteresis = 2 % <p>Reference values:</p> <ul style="list-style-type: none"> • Aqueous / water-based media: SP = 62 %, rP = 54 % (factory setting) • Sticky media with low water content: SP = 35 %, rP = 29 % • Oils, fats, (viscous media and powders)*: SP = 8 %, rP = 5 % |
| TSP | <p>Teach to medium: Full adjustment to the medium to be detected automatically sets the switching thresholds SP / rP.</p> |
| rES | <p>Restore the factory setting</p> |
| Code | <p>Change the password / define an individual password. The password protects all unit parameters against undesired changes.</p> <ul style="list-style-type: none"> • Setting range: 1000...9999 • If an individually defined password is lost, the unit can no longer be accessed. <p>▶ Keep the individually defined password in a safe place!</p> |

* Use of the unit in viscous media and powders is only permissible in applications that are not subject to the German Federal Water Act (WHG).

7 Working instructions

Note the following instructions:

- ▶ Connect the checked parts of the overflow protection to a downstream signalling device and/or control device.
- ▶ Observe the operating instructions of the related devices.
- ▶ Check the correct connection and function of the overflow protection before they are put into operation.



In normal status the LEDs light green:

- Device ready for operation
- Sensor zone not covered
- Switching output OUT-OP switched

More information → 4 Failure / error messages

The level detector is maintenance-free if used according to the instructions. If electrically-conductive deposits of the media stick to the sensor tip:

- ▶ Adapt the interval of the operation check and cleaning after soiling.

8 Recurrent checks

The system operator is responsible to select the type of check and the time intervals. The following applies:

- ▶ Check the functionality of the overflow protection in reasonable time intervals, min. once a year.
- ▶ Carry out this check so that the correct function of the overflow protection in conjunction with all components is verified.



The correct function can be verified by approaching the response height during filling.

- ▶ If filling up to the response height is not possible: Cause the level detector to react by appropriate simulation of the level or the physical measuring effect.

If the function of the level detector / measurement transducer cannot be identified (connection of function-preventing error), the check can also be carried out by simulating the respective output signal.



For further notes we refer you to the guideline VDI/VDE 2180, sheet 4.

More information at www.ifm.com



Note on approvals to WHG:

The unit described here has been approved to WHG (Federal Water Act, Federal Act applicable in the Federal Republic of Germany).

For more detailed provisions and information on the approval to WHG please see the German operating instructions.

