



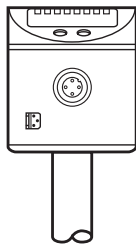
CE

Operating instructions  
Electronic level and  
temperature sensor

UK

**LT30xx**

11409005 / 00 08 / 2021



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## 1 Preliminary note

### 1.1 Symbols used

- ▶ Instructions
- > Reaction, 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

- The device described is a subcomponent for integration into a system.
  - The manufacturer of the system is responsible for the safety of the system.
  - The system manufacturer undertakes to perform a risk assessment and to create a 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 manufacturer of the system.
- 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 unit must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- The unit complies with the standard EN 61000-6-4. The unit may cause radio interference in domestic areas. If interference occurs, the user must take appropriate remedial actions.

## 3 Functions and features

### 3.1 Application area

The unit was especially designed to meet the requirements of machine tool building. It is especially suitable for monitoring coolant emulsions (also dirty) as well as cutting and hydraulic oils.

The unit monitors 2 process values: level and temperature.

### 3.2 Restriction of the application area

- The unit is not suitable for:
  - acids and alkalis
  - hygienic and electroplating applications
  - highly conductive and adhesive media (e.g. glue, shampoo)
  - granulates, bulk material
  - use in grinders (increased risk of formation of deposits).
- It is possible that foam of good conductivity is detected as level.
  - ▶ Test proper functioning in an application test.
- For water and hydrous media with temperatures  $> 35\text{ °C}$ , install the unit in a climatic tube (→ Accessories).
- For automatic medium detection (→ 5.3.1):  
For media which are very inhomogeneous, separate from each other and thus forming separation layers (e.g. oil layer on water), the following applies:
  - ▶ Test proper functioning in an application test.

## 4 Getting started

For fast set-up, the example configurations described in the following can be used for most applications. The indicated minimum distances apply exclusively to each separately described case.


## 4.1 Example configuration 1


Unit:	LT3022 (probe length $L = 264$ mm)
Medium to be detected:	Mineral oil
Operating mode:	Manual media selection with overflow prevention (factory setting) ( $\rightarrow$ 5.3.1).
Installation environment:	Metal tank, installation to Fig. 4-1

- ▶ Install unit.
- ▶ Maintain the distances (x), (u) and (c):

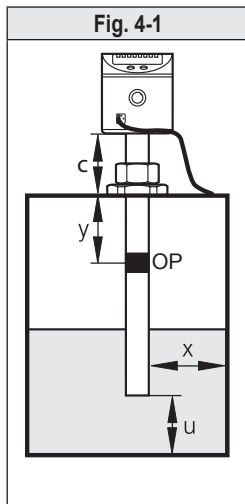
x:	min. 4.0 cm
u:	min. 1.0 cm
c:	max. 14.0 cm

- ▶ Ground sensor and tank via an electrical connection ( $\rightarrow$  7).
- ▶ Observe the parameter setting sequence:
  - [MED] = [OIL.2] ( $\rightarrow$  10.2.6)
  - [OFS] = (u); e.g. (u) = 2.0 cm ( $\rightarrow$  5.7)
  - [OP] = Set the overflow prevention OP at a distance (y) greater than 4.5 cm below the mounting element.

 For distances (y) smaller than 4.5 cm there may be malfunctioning and error messages during the adjustment process [cOP].

 Step increment and setting range ( $\rightarrow$  13.4).  
Calculation aids for [OP] ( $\rightarrow$  13.5).

- ▶ Adjustment of the overflow prevention OP to [cOP] ( $\rightarrow$  10.2.8)
- > **The unit is ready for operation.**
- ▶ Make further settings if necessary.
- ▶ Check whether the unit operates correctly.



## 4.2 Example configuration 2

Unit:	LT3023 (probe length L= 472 mm)
Medium to be detected:	Coolant emulsion
Operating mode:	Automatic medium detection (→ 5.3.1)
Installation environment:	Metal tank, installation to Fig. 4-2.

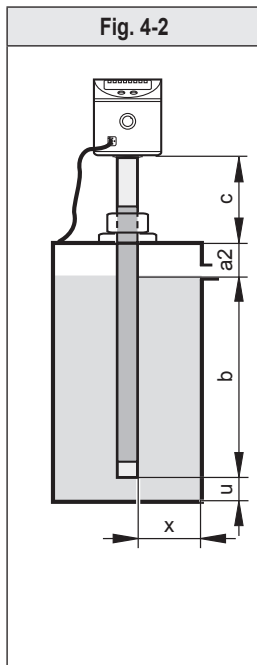
- ▶ Install unit.
- ▶ Observe the distances (x), (u) and (c):

x:	min. 4.0 cm
u:	min. 1.0 cm
c:	max. 23.0 cm

- ▶ Ground sensor and tank via an electrical connection (→ 7).
- ▶ Observe the maximum permitted level (b).

**!** A distance (a2) greater than 5.0 cm must be observed between maximum level (b) and mounting element.  
Ensure distance (a2) by means of appropriate mechanical measures (e.g. overflow, ...) or by setting a threshold value in the PLC.

- ▶ Observe the parameter setting sequence:
  - [MEdI] = [Auto] (→ 10.2.6)
  - [OFS] = (u), e. g. (u) = 1.0 cm (→ 5.7)



**i** Switch point [SP1] can be used for monitoring the medium temperature.

- ▶ **Unit must be reinitialised:**
- ▶ Switch the operating voltage off and on again.
- > **The unit is ready for operation.**
- ▶ Make further settings if necessary.
- ▶ Check whether the unit operates correctly.

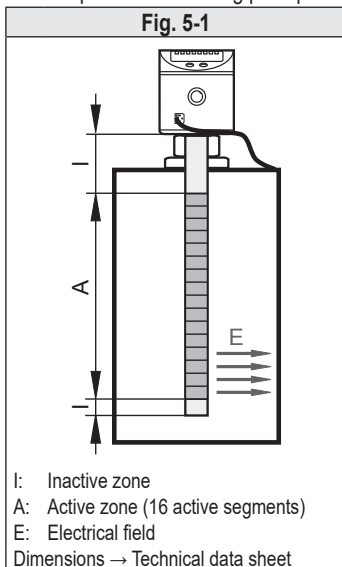


## 5 Function

### 5.1 Measuring principle level

The sensor determines the level according to the capacitive measuring principle:

- An electrical field [E] is generated and influenced by the medium to be detected. This change to the field causes a measurement signal that is electronically evaluated.
- The dielectric constant of a medium is important for its detection. Media with a high dielectric constant (e.g. water) generate a strong measurement signal, media with a low dielectric constant (e.g. oils) a correspondingly lower signal.
- The active measurement zone of the sensor probe is composed of 16 capacitive measuring segments. They generate measurement signals depending on the degree of coverage.



### 5.2 Measuring principle temperature

The temperature is detected by a Pt element at the lower end of the probe and electronically evaluated.

- Media without water content (e.g. oils) are directly (in contact with the medium) detected.
- Hydrous media can also be directly detected up to temperatures of 35 °C.



For temperatures > 35 °C a climatic tube has to be installed for use in hydrous media (→ 3.2). That means that temperature detection is indirect (not in contact with the medium).

If a climatic tube is used, considerably increased response times have to be expected.

## 5.3 Operating principle / features of the unit

The unit can be installed in tanks of different sizes. Observe the notes on installation.

2 outputs are available. They can be set separately.

OUT1	<ul style="list-style-type: none"><li>• Switching signal for level limit value / IO-Link</li><li>• Switching signal for temperature limit value / IO-Link</li></ul>
OUT2	<ul style="list-style-type: none"><li>• Analogue signal proportional to the level</li><li>• Analogue signal proportional to the temperature</li></ul>

To adapt to the present application select the required operating mode.

### 5.3.1 Operating modes

#### 1. Manual media selection with overflow prevention (factory setting)

##### **Recommended. Highest operational reliability**

The medium to be detected is set manually [MEdI]. In addition, an integrated, independently functioning overflow prevention is available.

#### 2. Manual media selection without overflow prevention

##### **Medium operational reliability**

The medium to be detected is set manually as described under 1. However, the overflow prevention is deactivated. For this reason, no adjustment is required.

#### 3. Automatic medium detection

##### **Lowest operational reliability**

Each time the operating voltage is switched on, the unit adjusts itself to the medium and the installation environment.



For automatic media detection, **no** overflow prevention is available!

Automatic media detection can only function properly under certain conditions (e.g. compliance with special mounting specifications, restrictions for operation and maintenance).

### 5.3.2 Notes on the integrated overflow prevention

With the parameter [OP] (OP = overflow prevention), one of the upper measuring segments is defined as integrated overflow prevention.

- If the overflow prevention OP is activated, an adjustment to the installation situation has to be made [cOP]. Otherwise, the unit is not ready for operation; [≡≡≡≡] is displayed until readiness (→ 12.1).
- The overflow prevention OP can be deactivated ([OP] = [OFF]).



Deactivating the overflow prevention OP can impair the operational reliability. For optimum operation and maximum operational reliability, we therefore recommend to **not** deactivate the overflow prevention OP.

- The overflow prevention OP is the maximum limit of the measuring range. The switch point [SP1] / [FH1] is always below [OP].
- The overflow prevention OP is **not** assigned to a separate output. It offers additional protection and only switches if, as the level rises, the switching output has not switched even though the corresponding switch point has been exceeded (e.g. due to application-related malfunctions).
- Typically the overflow prevention OP reacts when the selected measuring segment has been reached (a few mm before the set OP value).
- The overflow prevention OP replies immediately and without delay. The set delay times (e.g. of a switch point directly below) have no effect on the overflow prevention OP.
- The response of the overflow prevention OP is only indicated on the display ("Full" and indication of the current level change every second).

### 5.4 Display functions

The device displays the current level / the current temperature, optionally in cm / inches or °C / °F. The display unit is defined by parameter setting. The set unit of measurement and the switching status of the switching output are indicated by LEDs.

The process value (level / temperature) can be changed temporarily in the operating mode.

- ▶ Briefly press [Set].
- > Display of the other unit of measurement for 30 s; the respective LED is lit.

## 5.5 Analogue function

The unit provides an analogue signal proportional to the level / temperature.

The analogue output (OUT2) can be configured:

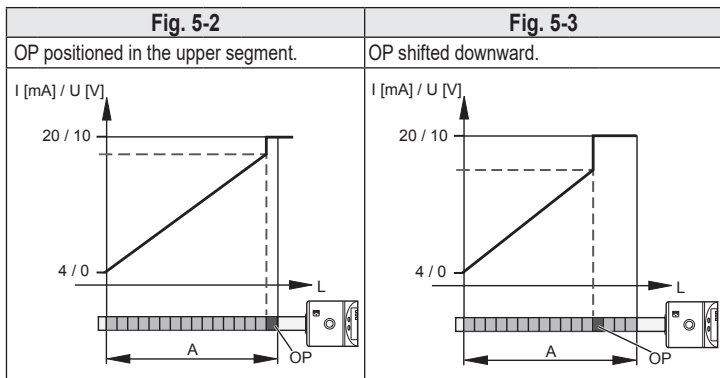
- [SEL2] assigns the process value, level / temperature to the analogue output (→ 10.2.1).
- [ou2] defines the output function of the analogue output, mA / V, (→ 10.3.2).
- In case of an internal fault, the output signal reacts according to the parameters set in [FOU2].

### 5.5.1 Level measurement with overflow prevention

[SEL2] = [LEVL]

[OP] = [value ...] (overflow prevention OP activated)

[ou2] = [I] or [U]



A: Active zone

OP: Measuring segment overflow prevention L: Level  
OP

The measuring range is limited by the active measuring segment OP. If the level reaches the measuring segment OP, the output signal jumps to its maximum value (20 mA / 10 V).

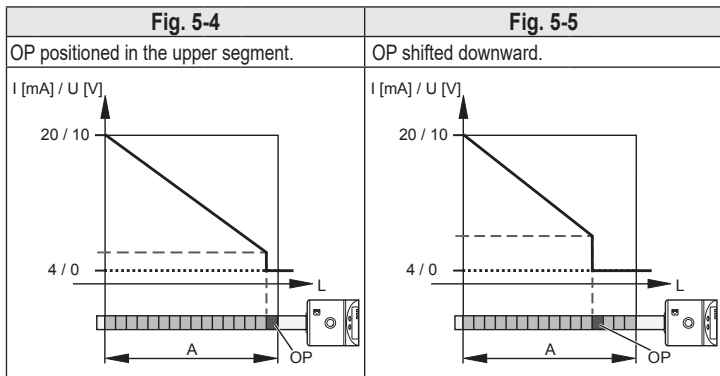


The position of the measuring segment OP does not have any influence on the gradient of the curve.

[SEL2] = [LEVL]

[OP] = [value ...] (overflow prevention OP activated)

[ou2] = [InEG] or [UnEG]



A: Active zone

OP: Measuring segment overflow prevention L: Level  
OP

The measuring range is limited by the active measuring segment OP. If the level reaches the measuring segment OP, the output signal jumps to its minimum value (4 mA / 0 V).

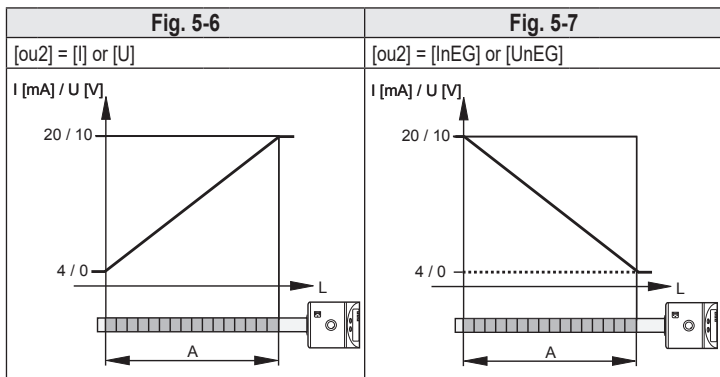


The position of the measuring segment OP does not have any influence on the gradient of the curve.

## 5.5.2 Level measurement without overflow prevention

[SEL2] = [LEVL]

[MEdI] = [Auto] or [OP] = [OFF] (overflow prevention OP deactivated)



A: Active zone

L: Level



[MEdI] = [Auto] or [OP] = [OFF]:

Operating mode with the smallest operational reliability (→ 5.3.1)

### 5.5.3 Temperature measurement

[SEL2] = [TEMP]

For temperature measurement the analogue signal can be scaled. The limits of the measuring range for the lower output signal (analogue start point = ASP2) and the upper output signal (analogue end point = AEP2) can be set.



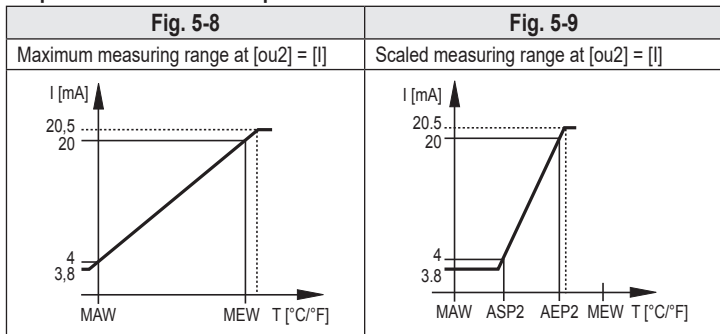
Minimum distance between [ASP2] and [AEP2] = 22 C° / 40 °F.



If the measuring range is not reached or is exceeded by more than 10 %, [UL] / [OL] is displayed (→ 12.1).

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#### Output function current output:



MAW: Initial value of the measuring range  
MEW: Final value of the measuring range

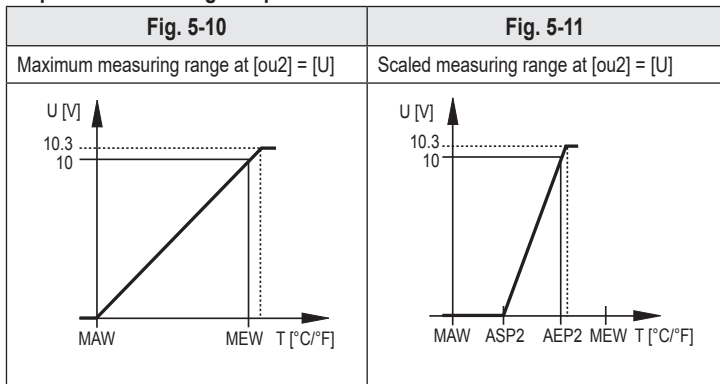
ASP2: Analogue start point  
AEP2: Analogue end point

Within the measuring range (-20...90 °C / -4...194 °F) the output signal is between 4...20 mA at [ou2] = [I] or 20...4 mA at [ou2] = [InEG] (without figure).

If the temperature value (T) is outside the measuring range, the output signal reacts as below:

	[ou2] = [I]	[ou2] = [InEG]
T < MAW (ASP2)	3.8...4 mA	20.5...20 mA
T > MEW (AEP2)	20...2.5 mA	4...3.8 mA

## Output function voltage output:



MAW = Initial value of the measuring range  
MEW = Final value of the measuring range

ASP2 = Analogue start point  
AEP2 = Analogue end point

Within the measuring range (-20...90 °C / -4...194 °F) the output signal is between 0...10 V at [ou2] = [U] or 10...0 V at [ou2] = [UnEG] (without figure).

If the temperature value (T) is outside the measuring range, the output signal reacts as below:

	[ou2] = [U]	[ou2] = [UnEG]
<b>T &lt; MAW (ASP2)</b>	0 V	10.3...10 V
<b>T &gt; MEW (AEP2)</b>	10...10.3 V	0 V



## 5.6 Switching functions

The unit signals via the switching output OUT1 that a set limit value has been exceeded or that the level is below the limit value. The switching output can be configured.

- Parameter [SEL1] assigns the process value, level / temperature to the output OUT1 (→ 10.3.1).

Selectable switching functions:

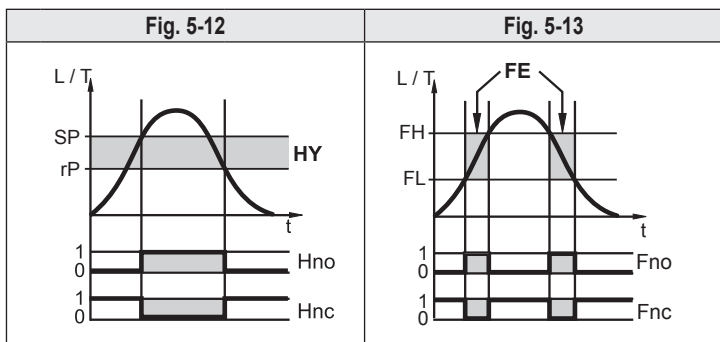
- Hysteresis function / normally open (Fig. 5-12):  $[ou1] = [Hno]$ .
- Hysteresis function / normally closed (Fig. 5-12):  $[ou1] = [Hnc]$ .

**!** First the set point (SP1) is set, then the reset point (rP1) with the requested difference [rP1].

**!** The hysteresis for the overflow prevention OP is fixed.

- Window function / normally open (Fig. 5-13):  $[ou1] = [Fno]$ .
- Window function / normally closed (Fig. 5-13):  $[ou1] = [Fnc]$ .

**i** The width of the window can be set by means of the difference between [FH1] and [FL1]. [FH1] = upper value, [FL1] = lower value.



L: Level  
T: Temperature  
HY: Hysteresis  
FE: Window

## 5.7 Offset for indicating the real level in the tank

The distance between tank bottom and lower edge of the probe can be entered as offset value [OFS]. So display and switch points refer to the actual level (point of reference = tank bottom).



For [OFS] = [0]: The reference point is the lower edge of the measuring probe.



The set offset only refers to the display on the unit. It does not have any effect on the analogue output and the process value transmitted via IO-Link. The OFS parameter, however, is correctly transmitted via IO-Link and can therefore be taken into consideration.

More information (→ 5.10).

## 5.8 Defined state in case of a fault

In case of a fault a state can be defined for each output. If a fault is detected or if the signal quality is below a minimum value, the outputs pass into a defined state. For this case the response of the outputs can be set via the parameters [FOU1] / [FOU2] (→ 10.3.9).

## 5.9 Extreme value memory

The minimum and maximum values of the temperatures occurred since the last memory reset can be retrieved via the menu items [Lo.T] and [Hi.T].

## 5.10 IO-Link

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

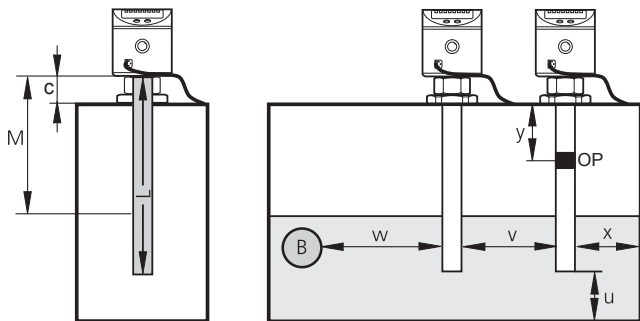
The IO-Link interface enables direct access to the process and diagnostic data and provides the possibility to set the parameters of the unit during operation.

In addition communication is possible via a point-to-point connection with a USB adapter cable.

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 can be found at [www.ifm.com](http://www.ifm.com).

## 6 Installation

Fig. 6-1



L: Probe length  
M: Zone for mounting elements  
c: Maximum outside length

u ... y: Minimum distances  
OP: Overflow prevention  
B: Metal object inside the tank

Table 6-1

	LT3022		LT3023		T3024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
L (probe length)	26.4	10.4	47.2	18.6	72.8	28.7
M (mounting zone)	14.0	5.5	23.0	9.1	36.0	14.2
c (max. outside length)*						

\* Applies to installation as shown (wall thickness of the tank lid was neglected; mounting element does not protrude inside the tank).

Otherwise note mounting zone M.

## 6.1 Installation instructions for operation with overflow prevention

[MEdl] = [CLW..] or [OIL..]

[OP] = [value ...] (overflow prevention OP activated)



It is permitted to fix the mounting elements within the mounting zone (M) (Fig. 6-1).

- ▶ Observe the maximum permitted outside length (c) according to Table 6-1.
- ▶ Observe the minimum distances according to Fig. 6-1 and Table 6-2.
- ▶ Observe the notes on the integrated overflow prevention OP.



The overflow prevention OP must:

1. be below the mounting element
2. be set at a minimum distance (y) to it.

The minimum distance is measured between lower edge mounting element and OP value.

**Table 6-2**

	MEdl = CLW.1		MEdl = CLW.2, OIL.1		MEdl = OIL.2	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
x	2.0	0.8	3.0	1.2	4.0	1.6
u	1.0	0.4	1.0	0.4	1.0	0.4
y (LT3022)	2.5	1.0	3.5	1.4	4.5	1.8
y (LT3023)	4.5	1.8	5.5	2.2	6.5	2.6
y (LT3024)	6.0	2.4	7.0	2.8	8.0	3.2
v	4.5	1.8	4.5	1.8	4.5	1.8
w	4.0	1.6	5.0	2.0	6.0	2.4




Calculation aids for [OP] (→ 13.5)

## 6.2 Installation instructions for operation without overflow prevention

[MEdI] = [Auto] or [OP] = [OFF] (overflow prevention OP deactivated)

### 6.2.1 Installation in the inactive zone

 Between the maximum level (b1) and the inactive zone (I1), minimum distance (a1) must be adhered to (see Fig. 6-2 and Table 6-3).

- ▶ Fix the unit using mounting elements in the inactive zone (I1). The outside length (c) must not exceed (I1) (see Table 6-3).
- ▶ Ensure that the maximum level (b1) is not exceeded after completed installation (see Table 6-3).
- ▶ Observe further minimum distances according to Fig. 6-4.

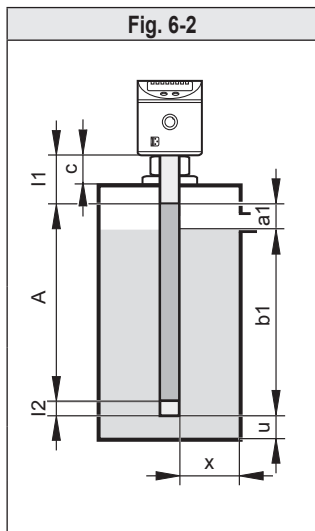
I1 / I2: Inactive zones

A: Active zone

a1: Minimum distance between the inactive zone (I1) and the maximum level (b1)

b1: Max. level from the lower edge of the sensor (without offset)

c: outside length  
(max. outside length Table 6-1)



**Table 6-3**

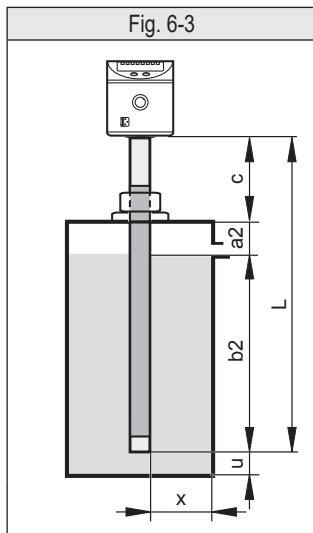
	LT3022		LT3023		LT3024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
I1	5.3	2.1	6.0	2.4	10.4	4.1
A	19.5	7.7	39.0	15.4	58.5	23.0
a1	1.0	0.4	1.5	0.6	2.5	1
b1	20.0	7.9	39.5	15.6	59.5	23.4

## 6.2.2 Installation in the active zone

**!** A minimum distance (a2) between maximum level (b2) and mounting element has to be observed (see Fig. 6-3 and Table 6-4).

- ▶ Fix mounting elements in the mounting zone (M) (see Fig. 6-1). Adhere to maximum permitted outside length (c) (see Table 6-1).
  - ▶ Ensure that the maximum level (b2) is not exceeded after completed installation:
- (b2) = (L) - (c) - (a2)** (without offset)
- ▶ Observe further minimum distances according to Table 6-4.

- c: outside length  
(max. outside length Table 6-1)
- a2: Minimum distance between the mounting element and the maximum level (b2).
- b2: Max. level from the lower edge of the sensor.



**Table 6-4**

	MEdl = CLW.1		MEdl = CLW.2, OIL.1		MEdl = OIL.2 / Auto	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
x	2.0	0.8	3.0	1.2	4.0	1.6
u	1.0	0.4	1.0	0.4	1.0	0.4
a2 (LT3022)	2.0	0.8	2.5	1.0	3.0	1.2
a2 (LT3023)	4.0	1.6	4.5	1.8	5.0	2.0
a2 (LT3024)	6.0	2.4	7.0	2.8	8.0	3.2
v *)	4.5	1.8	4.5	1.8	4.5	1.8
w *)	4.0	1.6	5.0	2.0	6.0	2.4

\*) → Fig. 6-1.



In case of automatic medium detection [MEdI] = [Auto] or deactivated overflow prevention [OP] = [OFF], the sensor reinitialises itself each time it is switched on and makes adjustments to the medium and the installation environment. The active zone / measuring range must **not** be completely covered by the medium. The indicated minimum distances ensure this. Too short a distance may lead to maladjustments and malfunctions.

### 6.3 Other installation notes

- For mounting in plastic pipes/plastic tanks, the inside (pipe) diameter must at least be 12 cm (4.8 inches). Install sensor in the centre.
- For mounting in metal pipes the inside pipe diameter (d) must be at least:

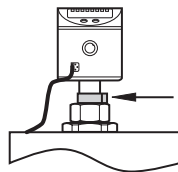
	MEdI = CLW.1		MEdI = CLW.2, OIL.1		MEdI = OIL.2 / Auto	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
d	4.0	1.6	6.0	2.4	10.0	4.0

#### 6.3.1 Marking of the installation height

- ▶ Fix the set installation height with the supplied stainless steel tube clip.

If the sensor is removed from the fixture for maintenance reasons, the clip serves as a limit stop when remounting the sensor. Thus an inadvertent maladjustment of the sensor is excluded. This is in particular necessary for the correct function of the overflow prevention OP.

- ▶ Fit the stainless steel tube clip using pliers.
- ▶ Ensure a safe fit.
- ▶ To remove the clip it has to be destroyed.



## 7 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 according to EN 50178, SELV, PELV.

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

Core colours			
BK	black		
BN	brown		
BU	blue		
WH	white		
			OUT1: switching output / IO-Link
			OUT2: analogue output 4 ... 20 mA / 0 ... 10 V
			Colours to DIN EN 60947-5-2

### Example circuits

1 x positive switching / 1 x analogue	1 x negative switching / 1 x analogue
<p>2: OUT 2 4: OUT 1</p>	<p>2: OUT 2 4: OUT 1</p>

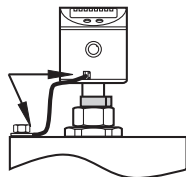


For safe function, the sensor housing must be electrically connected to the counter-electrode (grounding).

- ▶ Use the housing connection (see drawing) and a short piece of cable with a wire cross section of min. 1.5 mm<sup>2</sup>.

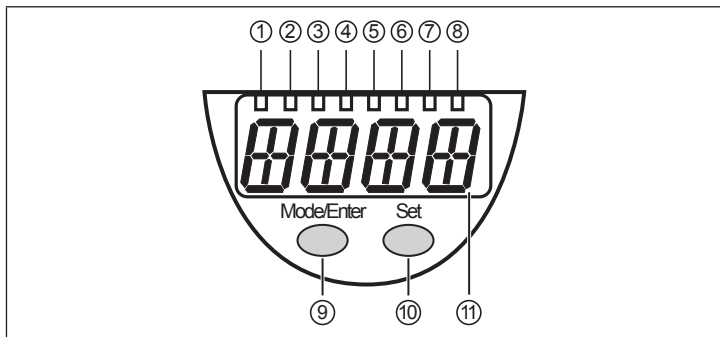
When using metal tanks, the tank wall serves as the counter-electrode.

For plastic tanks, a counter-electrode must be provided, e.g. a metal plate inside the tank in parallel with the probe. Adhere to minimum distances to the probe.





## 8 Operating and display elements



### 1 to 8: Indicator LEDs

LED 1	Indication in cm
LED 2	Indication in inches
LED 3	Indication in °C
LED 4	Indication in °F
LEDs 5 - 7	Not used
LED 8	Switching status OUT1 (lights when output 1 is switched).

### 9: [Mode / Enter] button

- Selection of the parameters and acknowledgement of the parameter values

### 10: [Set] button

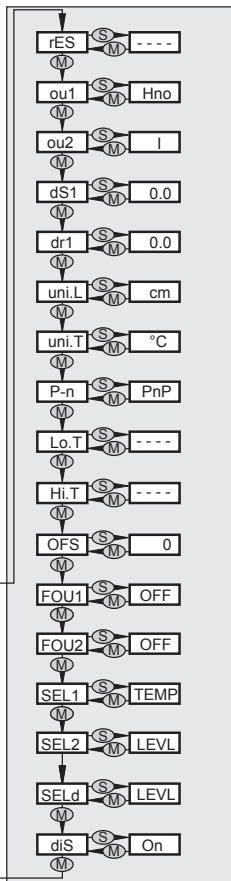
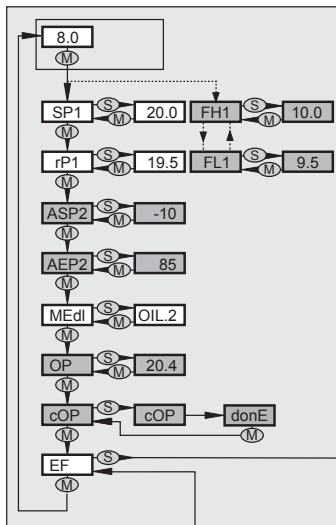
- Setting of the parameter values (continuously by holding pressed; incremental by pressing briefly).

### 11: Alphanumeric display, 4 digits

- Display of the current level / the current temperature.
- Display of the parameters and parameter values.
- Display of the operating and fault indication.

# 9 Menu

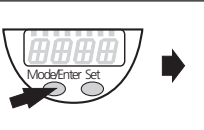

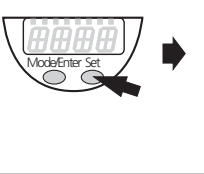





## 9.1 Menu structure



Menu items highlighted in grey, e.g. **cOP**, are only active when assigned parameters have been selected.

# 10 Parameter setting

## 10.1 Parameter setting in general

1			<ul style="list-style-type: none"><li>▶ Press [Mode/Enter] until the requested parameter is displayed. To select parameters in the extended menu (menu level 2):</li><li>▶ Select [EF] and briefly press [Set].</li></ul>
2		  	<ul style="list-style-type: none"><li>▶ Press and hold [Set].</li><li>&gt; The current parameter value flashes for 5 s.</li><li>&gt; Value is increased* (step by step by pressing the button once or continuously by keeping the button pressed).</li></ul>
3			<ul style="list-style-type: none"><li>▶ Briefly press [Mode/Enter] (= confirmation).</li><li>&gt; The parameter is displayed again; the new parameter value is effective.</li></ul>
4	Change more parameters: <ul style="list-style-type: none"><li>▶ Start again with step 1.</li></ul>		Finishing the parameter setting: <ul style="list-style-type: none"><li>▶ Wait for 30 s or press and hold [Mode/Enter].</li><li>&gt; The current measured value is displayed.</li><li>▶ Release [Mode/Enter].</li><li>&gt; The parameter setting is completed.</li></ul>

\*) Decrease the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.

**Timeout:** If no button is pressed for 30 s during programming, the unit returns to the operating mode with unchanged values (exception: cOP).

**Locking / unlocking:** The unit can be locked electronically to prevent unauthorised setting (factory setting: not locked).

▶ Make sure that the unit is in the normal operating mode.

To lock the unit:

- ▶ Press both buttons simultaneously for 10 s.
- > [Loc] is displayed.

For unlocking:

- ▶ Press both buttons simultaneously for 10 s.
- > [uLoc] is displayed.



The unit can be configured before or after installation.

Exemption: To adjust the overflow prevention [cOP], the unit **must** be installed in the tank.

## 10.2 Basic settings

Setting ranges of all parameters: (→ 13)

Factory settings of all parameters: (→ 15)

### 10.2.1 Assign process values to the outputs [SEL1] / [SEL2]

<ul style="list-style-type: none"> <li>▶ Select [SEL1] (for OUT1) / [SEL2] (for OUT2)</li> <li>▶ Assign process value to the output:</li> </ul> <p>[LEVL] =    The process value level is assigned to the output.</p> <p>[TEMP] =    The process value temperature is assigned to the output.</p>	<b>SEL1</b> <b>SEL2</b>
---	----------------------------

### 10.2.2 Assign process value to the display [SELd]

<ul style="list-style-type: none"> <li>▶ Select [SELd]</li> <li>▶ Select process value that is to be displayed as default:</li> </ul> <p>[LEVL] =    Level is displayed.</p> <p>[TEMP] =    Temperature is displayed.</p>	<b>SELd</b>
---	-------------

### 10.2.3 Define unit of measurement for level [uni.L]



▶ Enter [uni.L] before the limits for level are entered.

This avoids unintentional maladjustments.

<ul style="list-style-type: none"> <li>▶ Select [uni.L]</li> <li>▶ Define unit of measurement for the level:</li> </ul> <p>[cm] =        level in cm</p> <p>[inch] =      level in inches</p>	<b>uni.L</b>
---	--------------

### 10.2.4 Set the unit of measurement for the temperature [uni.T]



▶ Enter [uni.T] before the limits for temperature are entered.

This avoids unintentional maladjustments.

<ul style="list-style-type: none"> <li>▶ Select [uni.T]</li> <li>▶ Set unit of measurement for the temperature:</li> </ul> <p>[°C] =        temperature in °Celsius</p> <p>[°F] =        temperature in °Fahrenheit</p>	<b>uni.T</b>
---	--------------

## 10.2.5 Set the offset [OFS]

The distance between tank bottom and lower edge of the measuring probe can be entered as offset value (→ 5.7).

For [OFS] = [0] the reference point = lower edge of the measuring probe.



▶ Set [OFS] before the values for SP1, rP1 and OP are entered.

This avoids unintentional maladjustments.

<ul style="list-style-type: none"><li>▶ Select [OFS].</li><li>▶ Set the value for the offset.</li></ul> Note the set unit of measurement [uni.L].	<b>OFS</b>
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## 10.2.6 Set the medium [MEdI]

<ul style="list-style-type: none"><li>▶ Select [MEdI]</li><li>▶ Set sensitivity matching the medium to be detected: [CLW.1] = water, hydrous media, coolant emulsions. [CLW.2] = water, hydrous media, coolant emulsion for temperatures &gt; 35 °C (installation in climatic tube). [OIL.1] = oils with an increased dielectric constant (e.g. some synthetic oils). [OIL.2] = oils with a low dielectric constant (e.g. mineral oils). [Auto] = automatic medium detection.</li></ul>	<b>MEdI</b>
---	-------------

▶ In case of doubt, select [OIL.2] for oils.

▶ Test proper functioning in an application test.




The settings [CLW.1] and [CLW.2] suppress deposits (e.g. metal swarf).


The settings [OIL.1] and [OIL.2] suppress a bottom layer of higher dielectric water or swarf which is a few cm high. If no oil layer is present (or if it is very thin), the bottom layer is detected.


With the setting [MEdI] = [Auto], **no** overflow prevention OP is available. In that case, the menu items [OP] and [cOP] are not available.

## 10.2.7 Set the overflow prevention [OP]


<ul style="list-style-type: none"><li>▶ Comply with minimum distances and installation instructions.</li><li>▶ Select [OP].</li><li>▶ Define the position of the overflow prevention OP.</li></ul> <p>The option [OP] = [OFF] <b>deactivates</b> the overflow prevention OP.</p>	<b>OP</b>
--	-----------

-  ▶ Set [OP] before [SP1] or [FH1].
- > If [OP] is set to another value ≤ [SP1] / [FH1] after setting [SP1] / [FH1], [SP1] / [FH1] shifts downwards.
- > If [OP] and [SP1] / [FH1] are close to each other (1 x step increment), [SP1] / [FH1] increases if [OP] increases.

 When the overflow prevention is deactivated [OP] = [OFF] or [MEd] = [Auto], the safe function of the sensor must be verified with particular care. Switch-on and switch-off processes and special operating states such as very full tanks, possible maintenance and cleaning operations are to be considered in the verification.

 For setting [OP] = [OFF] the parameter [cOP] is not available

## 10.2.8 Adjust the overflow prevention [cOP]

-  Only adjust the overflow prevention OP when the unit is installed. If possible, carry out the adjustment when the tank is empty. The tank may be partly filled.
- ▶ Make sure that the overflow prevention OP is not covered by the medium. Observe the minimum distance between the overflow prevention OP and the level (→ Table 10-1).

<ul style="list-style-type: none"><li>▶ Select [cOP]</li><li>▶ Press [SET] and keep it pressed.</li><li>&gt; [cOP] flashes for some seconds; then the continuous display indicates that the adjustment is being made.</li><li>&gt; If the adjustment is successful, [donE] is displayed.</li><li>▶ Confirm with [Mode/Enter].</li><li>&gt; If the adjustment is not successful, [FAIL] is displayed.</li><li>▶ If necessary, lower the level or correct the position of the overflow prevention [OP] and repeat the adjustment operation.</li></ul>	<b>cOP</b>
---	------------

Minimum distance between the overflow prevention OP and the level during adjustment:

Table 10-1		
	[cm]	[inch]
LT3022	2.0	0.8
LT3023	3.5	1.4
LT3024	5.0	2.0



The position of the overflow prevention OP can be determined by calling up the parameter [OP]. Note the offset if necessary.

The current level is to be determined manually since the unit is not yet ready for operation before the adjustment.



When the overflow prevention is activated ([OP] = [value ...]), an adjustment [cOP] must be carried out each time:

- [MEdI] or [OP] were changed. In this case  $\equiv$  appears in the display.
- The installation position (height, orientation) was changed.
- The connection between the sensor and the tank ground (e.g. cable length) was changed.



With deactivated overflow prevention [MEdI] = [Auto] or [OP] = [OFF] it is necessary for the unit for applying the basic settings and adaptation to the medium and installation environment:

1. to be installed in the application
2. to be reinitialised.

► Switch the operating voltage off and on again.

## 10.3 Setting of output signals

### 10.3.1 Set output function [ou1] for OUT1 (switching output)

<p>► Select [ou1] and set the switching function:</p> <p>[Hno] = hysteresis function / normally open            [Hnc] = hysteresis function / normally closed            [Fno] = window function / normally open            [Fnc] = window function / normally closed</p> <p>If the switching output is used as an overflow prevention, the setting [ou1] = [Hnc] (NC function) is recommended. The principle of normally closed operation ensures that wire break or cable break is also detected.</p>	<b>ou1</b>
---	------------

### 10.3.2 Set output function [ou2] for OUT2 (analogue output)

<ul style="list-style-type: none"><li>▶ Select [ou2] and set the output function: [I] = current output 4...20 mA [U] = voltage output 0...10 V [InEG] = current output 20...4 mA (inverted) [UnEG] = voltage output 10...0 V (inverted)</li></ul>	<b>ou2</b>
---	------------

### 10.3.3 Define switching limits [SP1] / [rp1] (hysteresis function)

<ul style="list-style-type: none"><li>▶ Make sure that the function [Hno] or [Hnc] is set for [OU1].</li><li>▶ First set [SP1] then [rP1].</li><li>▶ Select [SP1] and set the value at which the output is set.</li></ul>	<b>SP1</b>
<ul style="list-style-type: none"><li>▶ Select [rP1] and set the value at which the output is reset.</li></ul>	<b>rP1</b>


[rP1] is always lower than [SP1]. The unit only accepts values which are lower than [SP1]. If [SP1] is shifted, [rP1] also shifts provided that the lower end of the setting range is not reached.

### 10.3.4 Define switching limits [FH1] / [FL1] (window function)

<ul style="list-style-type: none"><li>▶ Make sure that for [ou1] the function [Fno] or [Fnc] is set.</li><li>▶ First set [FH1] then [FL1].</li><li>▶ Select [FH1] and set the upper limit of the acceptable range.</li></ul>	<b>FH1</b>
<ul style="list-style-type: none"><li>▶ Select [FL1] and set the lower limit of the acceptable range.</li></ul>	<b>FL1</b>

[FL1] is always lower than [FH1]. The unit only accepts values which are lower than the value for [FH1]. If [FH1] is shifted, [FL1] also shifts provided that the lower end of the setting range is not reached.

### 10.3.5 Scale analogue signal [ASP2] / [AEP2]

 The menu items [ASP2] and [AEP2] are only available with [SEL2] = [TEMP].

<ul style="list-style-type: none"><li>▶ Select [ASP2] and set the analogue start point.</li></ul>	<b>ASP2</b>
<ul style="list-style-type: none"><li>▶ Select [AEP2] and set the analogue end point.</li></ul>	<b>AEP2</b>



### 10.3.6 Set switching delay [dS1] for switching output

<p>▶ Select [dS1] and set the value between 0.0 and 60 s. The switching delay reacts according to VDMA.</p>	<b>dS1</b>
---	------------

### 10.3.7 Set switch-off delay [dr1] for switching output

<p>▶ Select [dr1] and set the value between 0.0 and 60 s. The switching delay reacts according to VDMA.</p>	<b>dr1</b>
---	------------

### 10.3.8 Define switching logic [P-n] for switching output

<p>▶ Select [P-n] and set [PnP] or [nPn].</p>	<b>P-n</b>
---	------------

### 10.3.9 Define response of the outputs in case of a fault [FOUx]

<p>▶ Select [FOUx] and set value:</p> <p>[On] = Output switches ON in case of a fault. Analogue output switches on &gt; 21 mA / 10 V in case of a fault.</p> <p>[OFF] = Output switches OFF in case of a fault. Analogue output switches on &lt; 3.6 mA / 0 V in case of a fault.</p> <p>[OU] = Output reacts according to process value (if possible).</p> <p>A hardware fault, too low a signal quantity, overtemperature or undertemperature are considered to be a fault. Overflow is not considered to be a fault (→ 12.5).</p>	<b>FOU1 FOU2</b>
--	----------------------

### 10.3.10 Configure display [diS]

<p>▶ Select [diS] and set value:</p> <p>[On] = The display is switched on in the operating mode. Update of the measured values every 500 ms</p> <p>[OFF] = The display is switched off in the operating mode. When one of the buttons is pressed, the current measured value is displayed for 30 s. The indicator LEDs remain active even if the display is deactivated.</p>	<b>diS</b>
--	------------

### 10.3.11 Reset all parameters to factory settings [rES]

<p>▶ Select [rES].</p> <p>▶ Press and hold [Set] until [----] is displayed.</p> <p>▶ Briefly press [Mode/Enter].</p> <p>&gt; The unit reboots and the factory settings are restored.</p>	<b>rES</b>
--	------------

## 11 Notes on parameter setting via IO-Link



On delivery the LT30xx-type unit is not operational.

First, the integrated overflow prevention OP has to be adjusted.

Depending on the application, OP adjustment can be carried out in different ways:

- directly on the display (→ 10).
- via an IO-Link tool (e.g. LR DEVICE), button "Teach\_OP [cOP]".
- via the controller: write the value 208 to the IO-Link index 2 (length: 1 byte).



The OP adjustment is not part of the data storage.

Therefore, a simple replacement (e.g. in case of a unit failure) is only possible with reservations: On the new unit, the OP adjustment has to be carried out manually, either via the operating keys or via IO-Link. Only when the OP adjustment has been carried out successfully does the unit revert to the cyclical process data transmission.



After a factory reset (button "Restore Factory Settings"), the device reboots and the factory settings are restored.

## 12 Operation

After switch-on of the operating voltage, the unit is in the operating mode (= normal 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.

### 12.1 Operation indication

**Table 11-1**

[----] (continuous)	Initialisation phase after power on.
[numerical value] + LED 1	Current level in cm.
[numerical value] + LED 2	Current level in inches.
[numerical value] + LED 3	Current temperature in °C.
[numerical value] + LED 4	Current temperature in °F.
LED 8	Switching status OUT1 (lights when output 1 is switched).

[UL]	Warning: temperature below approx. -30 °C / -25 °F.
[OL]	Warning: temperature exceeding approx. +100 °C / +215 °F.
[----]	Level below the active zone.
[FULL] + [numerical value] alternately	The overflow prevention OP is reached (overflow warning) or the level is above the active zone.
≡≡≡≡	It is necessary to adjust [cOP] of the overflow prevention OP.
[Loc]	Unit locked via operating keys; parameter setting impossible. For unlocking press the two setting buttons for 10 s.
[uLoc]	Unit is unlocked / parameter setting is possible again.
[C.Loc]	The unit is temporarily locked. Parameter setting via IO-Link is active (temporary locking).
[S.Loc]	Unit is permanently locked via software. This locking can only be removed with a parameter setting software.

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## 12.2 Read the set parameters

- ▶ Briefly press [Mode/Enter] (if required, repeat several times).
- > Menu items are passed through until the requested parameter has been reached.
- ▶ Briefly press [Set].
- > Respective parameter value is displayed for 30 s.

## 12.3 Read / reset extreme value memory temperature

- ▶ Select parameter [Lo.T] or [Hi.T]
- ▶ Briefly press [Set] for reading.
- > Device displays the stored maximum or minimum value for 30 s.
- ▶ To delete the memory keep [Set] pressed until [----] is displayed.
- ▶ Briefly press [Mode/Enter].

## 12.4 Fast selection level / temperature

In the operating mode:

- ▶ Briefly press [Set].
- > Display of the other process value for 30 s; the respective LED is lit.

## 12.5 Error indications

Table 11-2

	Possible cause	Recommended measures
[Err]	Fault in the electronics.	► Replace the unit.
[SEnS]	<ul style="list-style-type: none"> <li>• Interfering sources (e.g. EMC)</li> <li>• Poor cables</li> <li>• Supply voltage disturbed</li> </ul>	<ul style="list-style-type: none"> <li>► Check electrical connection.</li> <li>► Check connection between the sensor and the tank ground.</li> </ul>
[FAIL]	Error during adjustment of the overflow prevention OP: <ul style="list-style-type: none"> <li>• Overflow prevention covered by the medium during adjustment.</li> <li>• Overflow prevention soiled.</li> <li>• Minimum distances too short.</li> <li>• Mounting element detected below the overflow prevention.</li> <li>• Measured value not constant.</li> </ul>	<ul style="list-style-type: none"> <li>► Lower the level, if necessary.</li> <li>► Clean the probe.</li> <li>► Observe the notes on installation.</li> <li>► Correct the position of the overflow prevention OP.</li> <li>► Repeat the adjustment.</li> <li>► Deactivate OP (→ 5.3.1).</li> </ul>
[cr.UL]	Error: temperature below approx. -40 °C / -45 °F.	► Check process temperature and correct, if necessary.
[cr.OL]	Error: temperature exceeding approx. +125 °C / +255 °F.	► Check process temperature and correct, if necessary.
[SC1] + LED 8	Flashing: short circuit in switching output OUT1.	► Remove the short circuit.
[PArA]	Faulty data set.	► Reset to factory settings [rES].

## 12.6 Output response in different operating states

Table 11-3

	OUT1	OUT2*
Initialisation phase	OFF	0 mA
Overflow prevention OP not adjusted	OFF	3.5 mA
Overflow prevention OP adjusted or deactivated, normal operation	according to process value and [ou1] setting	according to process value 4...20 mA
Fault	OFF for [FOU1] = [OFF] ON for [FOU1] = [On]	< 3.6 mA at [FOU2] = [OFF] > 21 mA at [FOU2] = [On]
* If the output function [ou2] = [I] has been selected		

## 13 Technical data



Technical data and scale drawing at [www.ifm.com](http://www.ifm.com).

### 13.1 Setting values [OFS]

	[cm]		[inch]	
Setting range	0...200.0		0...78.8	
	LT3022 LT3023	LT3024	LT3022 LT3023	LT3024
Step increment	0.5	1	0.2	0.5



The values of the following tables, setting ranges Table 12-2 and setting values Tab 12-4, apply to [OFS] = [0]; if OFS > 0 they increase by the set OFS value.

### 13.2 Setting ranges switching limits for level

	LT3022		LT3023		LT3024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
[SP1] / [FH1]	2.5...20.0	1.0...7.8	3.5...39.0	1.4...15.4	6.0...59.0	2.5...23.5
[rP1] / [FL1]	2.0...19.5	0.8...7.6	3.0...38.5	1.2...15.2	5.0...58.0	2.0...23.0
Step increment	0.5	0.2	0.5	0.2	1	0.5

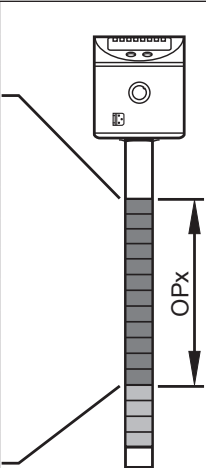
### 13.3 Setting ranges switching limits for temperature

	[°C]	[°F]
[SP1] / [FH1]	-19.5...90	-3...194
[rP1] / [FL1]	-20...89.5	-4...193
Step increment	0.5	1

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## 13.4 Setting values [OP]

Table 12-4					
LT3022		LT3023		LT3024	
[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
20,4	8,0	40,7	16,0	61	23,9
19,1	7,5	38,3	15,1	57	22,4
17,9	7,1	35,8	14,1	53	21,0
16,7	6,6	33,4	13,1	50	19,5
15,5	6,1	31,0	12,2	46	18,1
14,3	5,6	28,5	11,2	42	16,7
13,0	5,1	26,1	10,3	39	15,2
11,8	4,7	23,6	9,3	35	13,8
10,6	4,2	21,2	8,3	31	12,3
9,4	3,7	18,8	7,4	28	10,9
8,2	3,2	16,3	6,4	24	9,5
6,9	2,7	13,9	5,5	20	8,0



OPx: Setting range [OP]

The indicated values for [OP] refer to the distance between OP and the lower edge of the probe.

The values apply if [OFS] = [0]



With [OFS] > [0] the values increase by the set OFS value. Example  
LT3022: According to Table 12-4 OP has to be set to segment 20.4 cm.

[OFS] = 7.0 cm

[OP] is to be set to 20.4 cm + 7.0 mm = 27.4 cm.

## 13.5 Calculation aids [OP]

**!** For proper functioning of the overflow prevention OP a minimum distance (y) (Fig. 12-1) must be observed (→ 6.1).

The following applies (Fig. 12-1):

<b>B + c = L + u</b> and <b>B = z + y</b>	B: tank height c: outside length (maximal → 6)	L: probe length u: distance between probe and tank bottom
	y: required response level OP from the cover (minimum → 6.1 maximum → 13.4).	z: required response level OP from the bottom (maximum: $z < L - c - y$ or $z < B - y$ ).

### 13.5.1 Definition "from the cover"

Requested distance (y) of the overflow prevention OP "from the cover" is defined.

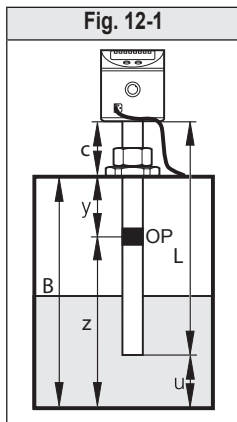
- Without offset ([OFS] = [0]):  $[OP] = L - c - y$
- With offset ([OFS] = u):  $[OP] = L - c - y + u$   
or  
 $[OP] = B - y$

Example LT3022:

$c = 3.0 \text{ cm}$ ,  $y = 5.0 \text{ cm}$ ,  $u = 1.0 \text{ cm}$

Without offset:  $[OP] = 26.4 \text{ cm} - 3.0 \text{ cm} - 5.0 \text{ cm}$   
 $= 18.4 \text{ cm}$

With offset:  $[OP] = 26.4 \text{ cm} - 3.0 \text{ cm} - 5.0 \text{ cm} + 1.0 \text{ cm}$   
 $= 19.4 \text{ cm}$



### 13.5.2 Definition "from the bottom"

Response level (z) of the overflow prevention OP from the tank bottom is defined.

- Without offset ([OFS] = [0]):  $[OP] = z - u$
- With offset ([OFS] = u):  $[OP] = z$

Example LT3022:

$z = 18.0 \text{ cm}$  (from the tank bottom),  $u = 1.0 \text{ cm}$

Without offset:  $[OP] = 18.0 \text{ cm} - 1.0 \text{ cm} = 17.0 \text{ cm}$

With offset:  $[OP] = 18.0 \text{ cm}$

Round the calculated value to the next lower adjustable value (→ 13.4).

## 13.6 Setting ranges [ASP2] and [AEP2]

	[°C]		[°F]	
	min	max	min	max
[ASP2]	-20	68	-4	154
[AEP2]	2	90	36	194
Step increment	0.5		1	

## 14 Maintenance / cleaning / change of medium

When removing or installing the unit for maintenance and cleaning work:

- ▶ Make sure that the stainless steel tube clip is fixed to the sensor.
- > It must be possible to exactly reproduce the installation height and position.
- ▶ Remove the sensor and clean it / carry out maintenance
- ▶ Install sensor exactly in the same position as before. Otherwise check the parameter [OP] and carry out [cOP] once again.

### 14.1 Maintenance information for operation without overflow prevention

[MEdI] = [Auto] or [OP] = [OFF] (overflow prevention OP deactivated)

The unit must be reinitialised in the following cases (switch the operating voltage briefly off and on again):

- After all maintenance operations.
- After cleaning operations (e.g. water jet cleaning of the sensor probe).
- If the sensor was removed from the tank and then installed again during operation.
- If the active zone of the sensor was touched with the hand or grounded objects (e.g. a screwdriver, a cleaning lance).
- If the connection between the sensor and the tank wall/counter-electrode was changed.
- After a change of the medium with considerably differing dielectric constants. For manual selection of media, first the [MEdI] setting needs to be adjusted.



## 15 Factory setting

	Factory setting			User setting
	<b>LT3022</b>	<b>LT3023</b>	<b>LT3024</b>	
SP1	<b>70 (°C)</b>	<b>70 (°C)</b>	<b>70 (°C)</b>	
rP1	<b>67 (°C)</b>	<b>67 (°C)</b>	<b>67 (°C)</b>	
ASP2*)	<b>0.0 (°C)</b>	<b>0.0 (°C)</b>	<b>0.0 (°C)</b>	
AEP2*)	<b>90.0 (°C)</b>	<b>90.0 (°C)</b>	<b>90.0 (°C)</b>	
MEdl	<b>OIL.2</b>	<b>OIL.2</b>	<b>OIL.2</b>	
OP	<b>20.4 (cm)</b>	<b>40.7 (cm)</b>	<b>61.0 (cm)</b>	
cOP	----			
rES	----			
ou1	<b>Hno</b>			
ou2	<b>I</b>			
dS1	<b>0.0</b>			
dr1	<b>0.0</b>			
uni.L	<b>cm</b>			
uni.T	<b>°C</b>			
P-n	<b>PnP</b>			
Lo.T	----			
Hi.T	----			
OFS	<b>0</b>			
FOU1	<b>OFF</b>			
FOU2	<b>OFF</b>			
SEL1	<b>TEMP</b>			
SEL2	<b>LEVL</b>			
SEld	<b>LEVL</b>			
diS	<b>On</b>			

\*) Parameter only available for [SEL2] = [TEMP].