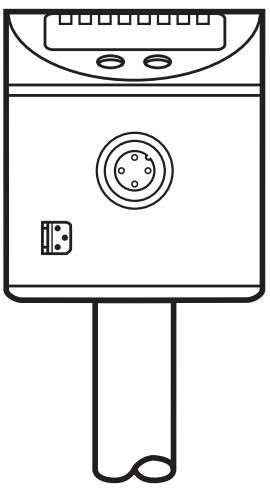
Operating instructions
Electronic level sensor

LK10xx
LK70xx

UK



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Contents

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

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur. Installation, electrical connection, set-up, operation and maintenance of the unit must be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct operation of the unit, it is necessary to use the unit in media for which it is sufficiently resistant (→ Technical data).
- The responsibility as to the suitability of the unit for the application lies with the operator The manufacturer assumes no liability for consequences of misuse by the operator.
- Improper installation and use of the units result in a loss of the warranty claims.
- 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 Applications

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

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 °C, install the unit in a climatic tube (→ accessories).
- For automatic medium detection:
  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 for each separately described case.

4.1 Example configuration 1

Applied sensor:	LK1022 (probe length L = 264 mm)
Medium to be detected:	Mineral oil
Operating mode:	Manual media selection with overflow protection (factory setting LK10xx) → 5.2.1
Type of installation:	Metal tank, installation to Fig.4-1

▶ Install sensor.

▶ Observe the distances (x), (u) and (c):

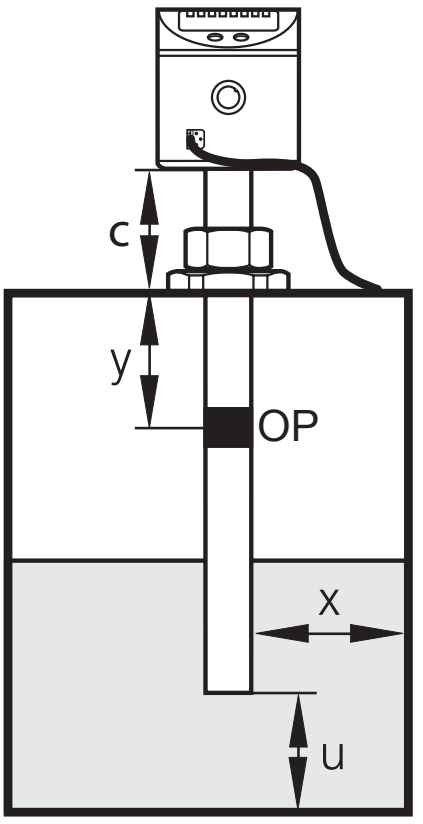
x:	min. 4.0 cm
u:	min. 1.0 cm
c:	max. 14.0 cm

▶ Ground sensor and tank via an electrical connection (→ 7).

▶ Observe the parameter setting sequence:

- [MEdI] = [OIL.2] (→ 10.2.3)
- [OFS] = (u); e.g. (u) = 2.0 cm (→ 5.2.4)
- [OP]: Set the overflow protection OP at a distance (y) greater than 4.5 cm below the mounting element.

Fig. 4-1



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: → 12.2
Calculation aids for [OP]: → 12.3

▶ Adjustment of the overflow protection OP to [cOP] (→ 10.2.5)

> **The unit is ready for operation.**

▶ Make further settings if necessary.

▶ Check whether the unit operates correctly.

4.2 Example configuration 2

Applied sensor:	LK7023 (probe length L = 472 mm)
Medium to be detected:	Coolant emulsion
Operating mode:	Automatic medium detection (factory setting LK70xx) → 5.2.1.
Type of installation:	Metal tank, installation to Fig.4-2

▶ Install sensor.

▶ Observe the distances (x), (u) and (c):

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

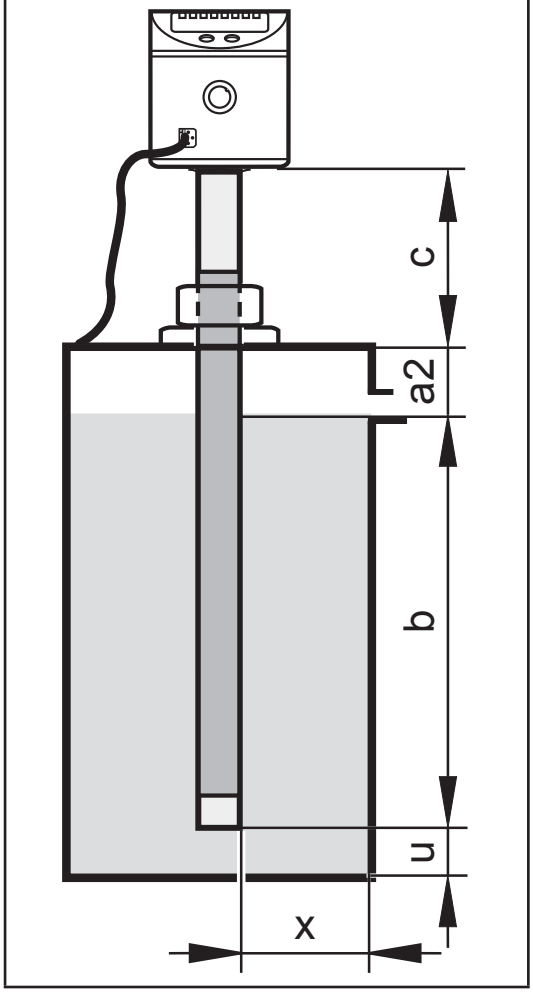
▶ Ground sensor and tank via an electrical connection (→ 7).

▶ Observe the maximum permissible level (b).

A distance (a2) greater than 5.0 cm must be observed between maximum level (b) and mounting element.

▶ Observe the parameter setting sequence:
- [MEdI] = [Auto] (→ 10.2.3)
- [OFS] = (u), e.g. (u) = 1.0 m (→ 5.2.4)
- [SP1] = Set the switch point at a distance (a2) greater than 5.0 cm below the mounting element.

Fig. 4-2



Adjustable in step increments of 0.5 cm.
Switch point [SP1] is used as overflow protection (pump off, close inlet, ...)

▶ 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.

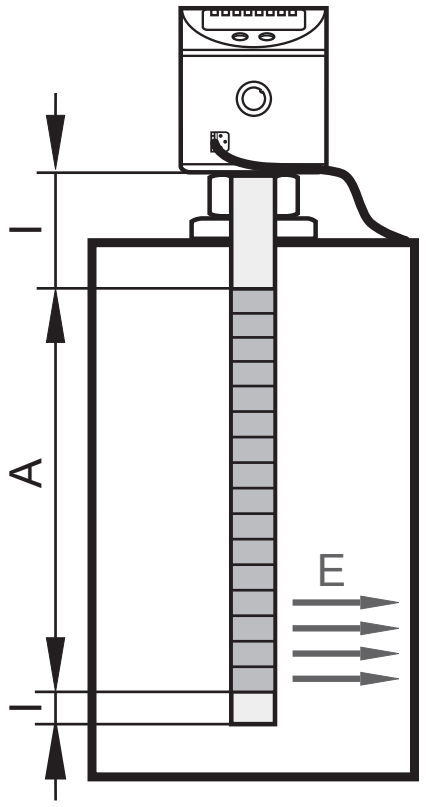
5 Function

5.1 Measuring principle

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.

Fig. 5-1



I: Inactive zone
A: Active zone (16 active segments)
E: Electrical field
Dimensions → Technical data sheet

5.2 Operating principle / features of the unit

The unit can be installed in tanks of different sizes.

2 outputs are available. They can be set separately.

OUT1	Switching signal for level limit value / IO-Link
OUT2	Switching signal for level limit value

To adjust the unit to the application, choose the required operating modes.

5.2.1 Operating modes

1. Manual media selection with overflow protection (factory setting LK10xx)

Recommended! Highest operational reliability!

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

2. Manual media selection without overflow protection

Medium operational reliability!

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

3. Automatic media detection (factory setting LK70xx)
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 protection is available!

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

5.2.2 Notes on the integrated overflow protection

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

- If the overflow protection OP is activated, an adjustment to the installation situation has to be made [cOP].
- The overflow protection OP can be deactivated ([OP] = [OFF]).

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

- The overflow protection is the maximum limit of the measuring range. The switch points [SPx] / [FHx] are always below [OP]!
- The overflow protection is **not** assigned to a separate output! It offers additional protection and only leads to switching if one of the outputs has not commuted

even though the corresponding switch point has been exceeded (e.g. due to application-related malfunctions).

- Typically the overflow protection OP reacts when the selected measuring segment has been reached (a few mm before the set OP value).
- The overflow protection OP replies immediately and without delay. The set delay times (e.g. of a switch point directly below) have no effect on the overflow protection OP.
- The response of the overflow protection is indicated on the display ("Full" and indication of the current level change every second).

5.2.3 Display and switching functions

The unit displays the current level, selectable in cm or inch. The display unit is defined by parameter setting. The set unit of measurement and the switching status of the outputs are indicated by LEDs. The unit signals via two switching outputs (OUT1, OUT2) that a set limit has been exceeded or that the level is below the limit. The parameters of the switching outputs can be set.

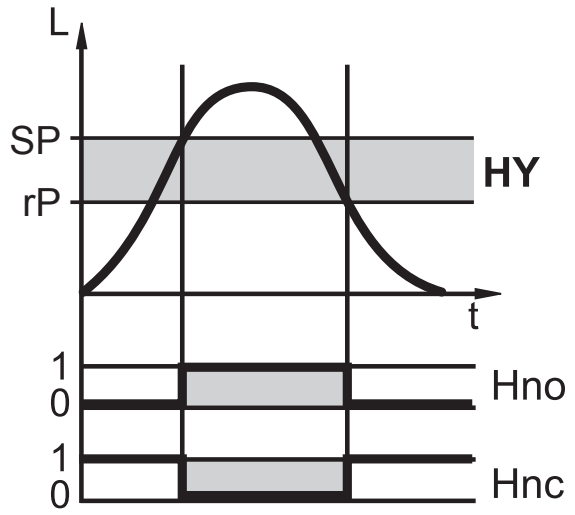
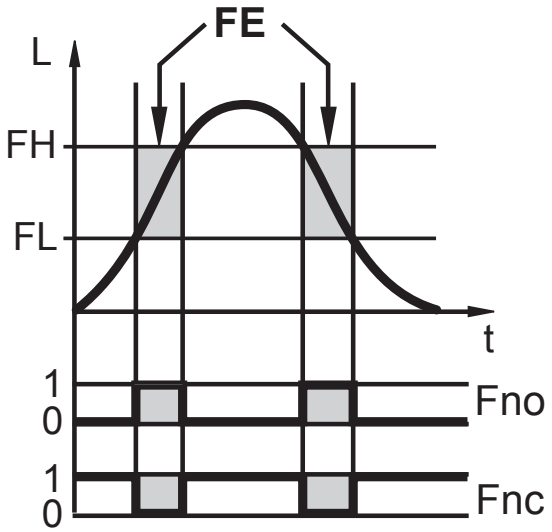
- Hysteresis function / normally open (Fig. 5-2): [oux] = [Hno].
- Hysteresis function / normally closed (Fig. 5-2): [oux] = [Hnc].

First the set point [SPx] is set, then the reset point [rPx] with the requested difference.

The hysteresis for the overfill protection OP is fixed.

- Window function / normally open (Fig. 5-3): [oux] = [Fno].
- Window function / normally closed (Fig. 5-3): [oux] = [Fnc].

The width of the window can be set by means of the difference between [FHx] and [FLx]. [FHx] = upper value, [FLx] = lower value.

Fig. 5-2	Fig. 5-3
	

L : level HY:hysteresis FE:window

5.2.4 Offset to indicate 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 (reference point = bottom of the tank).

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

The set offset only refers to the display on the unit. It has no effect on 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 → 5.2.6 .

5.2.5 Defined state in case of a fault

In case of a fault, a safe 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] (→ 10.3.7).

5.2.6 IO-Link function

This unit has an IO-Link communication interface which enables direct access to process and diagnostic data.

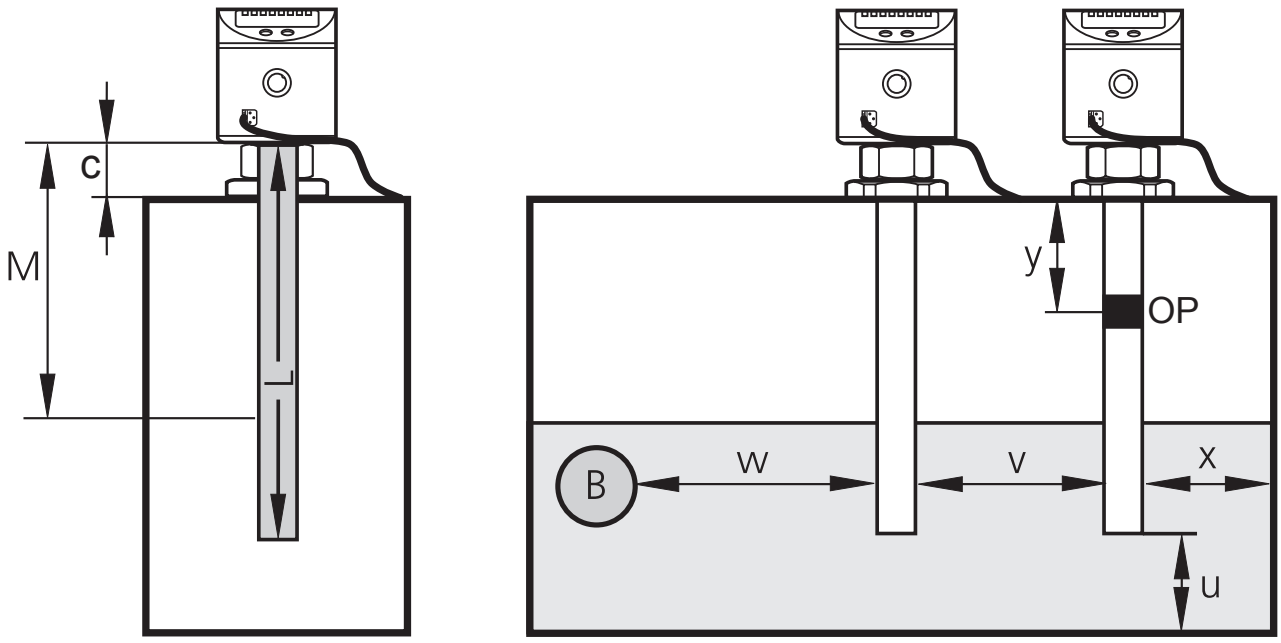
In addition it is possible to set the parameters of the unit during operation. Operation of the unit via IO-Link interface requires an IO-Link capable module (IO-Link master).

With a PC, suitable IO-Link software and an IO-Link adapter cable communication is possible when the system is not in operation.

For 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 visit www.ifm.com.

6 Installation

Fig. 6-1



L: Probe length
M: Zone for mounting elements
c: Maximum extension length
u ... y: Minimum distances
OP: Overflow protection
B: Metal object inside the tank

Table 6-1

	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
L (rod 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. extension length)*						

* Applies to installation as shown (wall thickness of the tank lid not taken into account; mounting element does not protrude into the tank).

Otherwise note mounting zone M.

6.1 Installation instructions for operation with overflow protection

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

[OP] = [value ...] (Overflow protection OP activated)

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

- ▶ Observe the maximum permitted extension 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 protection!

The overflow protection (OP) must:

1. be below the mounting element
2. be adjusted at a minimum distance (y) to it, measured between the lower edge of the mounting element and the 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 (LKx022)	2.5	1.0	3.5	1.4	4.5	1.8
y (LKx023)	4.5	1.8	5.5	2.2	6.5	2.6
y (LKx024)	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]: (→ 12.3).

6.2 Installation instructions for operation without overflow protection

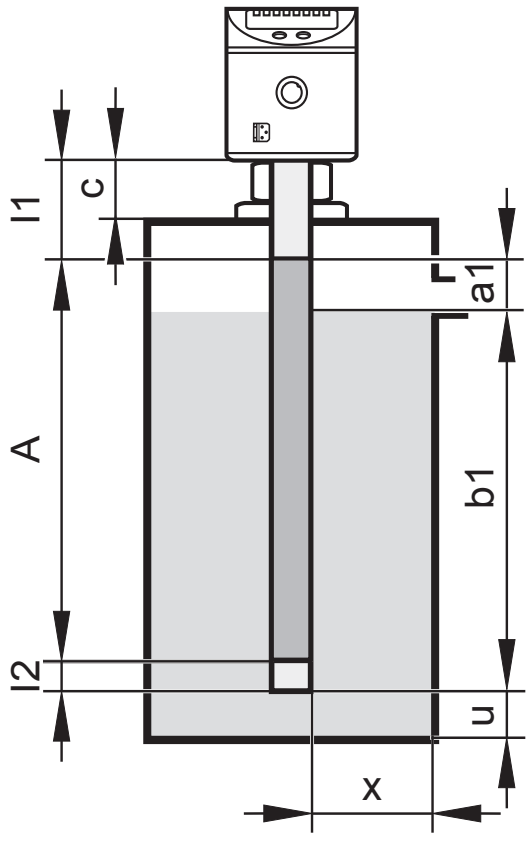
[MEdI] = [Auto] or [OP] = [OFF] (Overflow protection OP deactivated!)

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 extension length (c) may not exceed (I1) (see Table 6-3).
- ▶ Make sure that the maximum level (b1) is not exceeded after installation (see Table 6-3).
- ▶ Observe further minimum distances according to Table 6-4.

Fig. 6-2



I1 / I2: Inactive zones

A: Active zone

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

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

c: Max. permitted extension length (Observe footnote Table 6-1)

Table 6-3

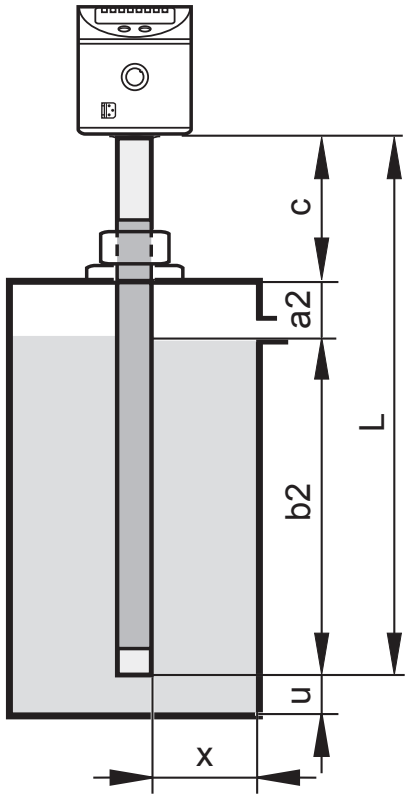
	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
I1	5.3	2.1	6.0	2.4	10.4	4.1
A	19.5	7.7	39.0	15.4	58.5	23.0
a1	1.0	0.4	1.5	0.6	2.5	1
b1	20.0	7.9	39.5	15.6	59.5	23.4

6.2.2 Installation in the active zone A of the probe

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). Adhere to maximum permitted extension length (c) (see Table 6-1).
- ▶ Ensure that the maximum level (b2) is not exceeded after completed installation:
- ▶ **(b) = (L) - (c) - (a2)** (without offset)
- ▶ Observe further minimum distances according to Table 6-4.

Fig. 6-3



c: Max. permitted extension length

a2: Minimum distance between the mounting element and the maximum level (b).

b2: Max. level from the lower edge of the sensor

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Table 6-4

	MEdI = CLW.1		MEdI = CLW.2, OIL.1		MEdI = 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 (LKx022)	2.0	0.8	2.5	1.0	3.0	1.2
a2 (LKx023)	4.0	1.6	4.5	1.8	5.0	2.0
a2 (LKx024)	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 [MEdl] = [Auto] or deactivated overflow protection [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 may **not** be completely covered by the medium! The indicated minimum distances ensure this. Too short distances may lead to maladjustments and malfunctions!

6.3 Further notes on installation

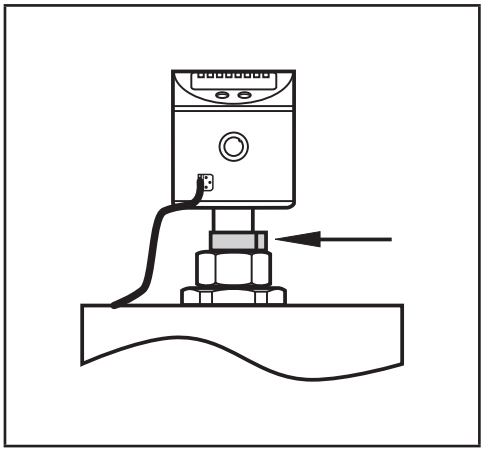
- For mounting in plastic pipes/plastic tanks, the inside (pipe) diameter must at least be 12.0 cm (4.8 inch). Install sensor in the centre.
- For mounting in metal pipes, the inside pipe diameter (d) must be at least:

Table 6-5

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

Marking 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 to ensure correct functioning of the overflow protection.

▶ Fit the stainless steel tube clip using pliers.

▶ Ensure a safe fit.

▶ To remove the clip it has to be destroyed.

6.3.1 Mounting accessories:

Available accessories: www.ifm.com

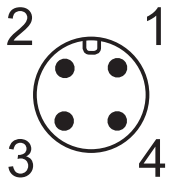
7 Electrical connection

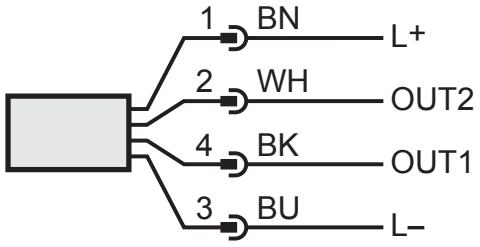
The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:

Core colours	
BK	black
BN	brown
BU	blue
WH	white

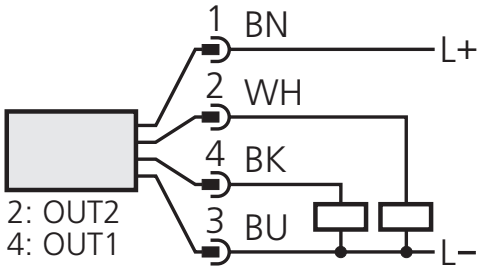




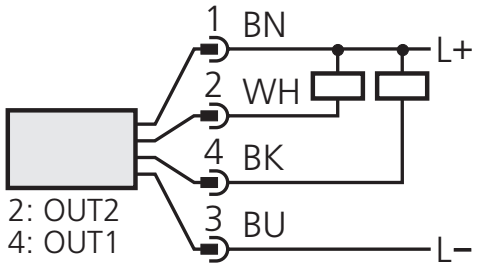
OUT1: Switching output / IO-Link
OUT2: Switching output
Colours to DIN EN 60947-5-2

Example circuits

2 x positive switching



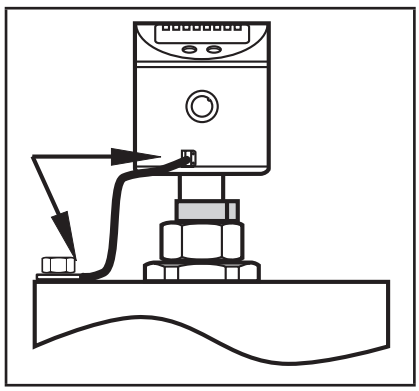
2 x negative switching



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

▶ For this, use the housing connection (see drawing) and a short piece of cable with a core cross-section of at least 1.5 mm².

When using metal tanks, the tank wall serves as the machine earth.
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.



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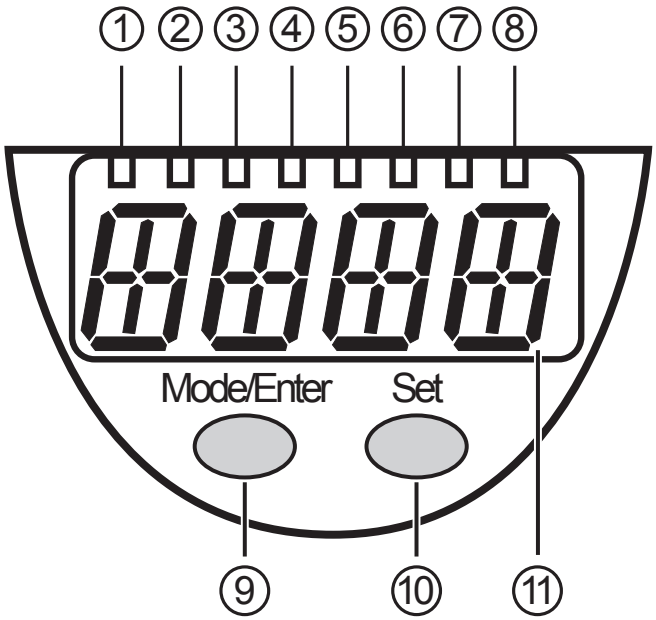
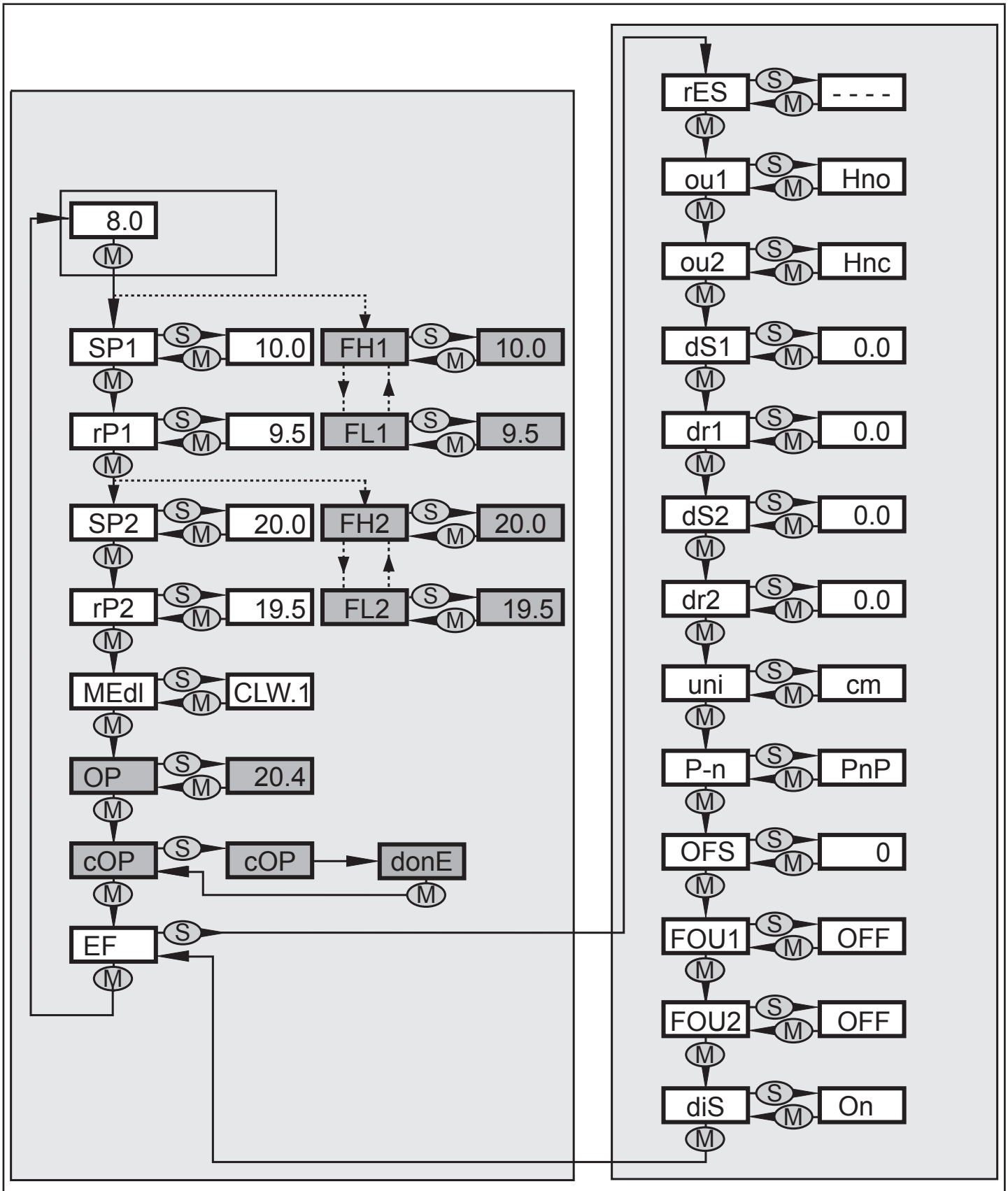
8 Operating and display elements



1 to 8: Indicator LEDs	
LED 1	Indication in cm.
LED 2	Indication in inch.
LED 3 - 6	Not used.
LED 7	Switching status OUT2 (lights when output 2 is switched).
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 (scrolling by holding pressed; incremental by pressing briefly).	
12: Alphanumeric display, 4 digits	
- Display of the current level. - Indication of the parameters and parameter values. - 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 .

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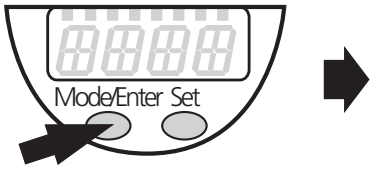
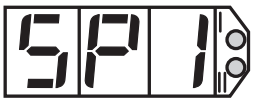
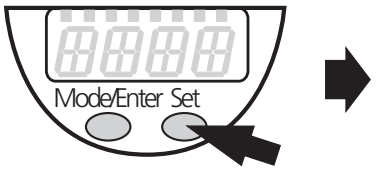
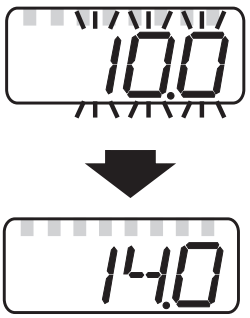
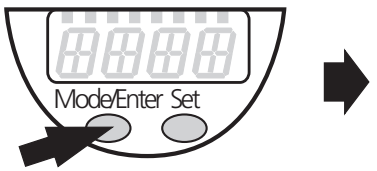
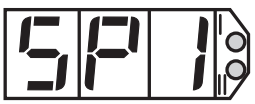
10 Parameter setting

10.1 Parameter setting in general

1			▶ Press [Mode/Enter] several times until the required parameter is displayed. To select parameters in the extended menu (menu level 2): ▶ Select [EF] and briefly press [Set].
2			▶ Press and hold [Set]. > The current parameter value flashes for 5 s. > Value is increased* (step by step by pressing the button once or continuously by keeping the button pressed).
3			▶ Briefly press [Mode/Enter] (= confirmation). > The parameter is displayed again; the new parameter value is effective.
4	Change more parameters: ▶ Start again with step 1.		Finishing the parameter setting: ▶ Wait for 30 s or press and hold [Mode/Enter]. > The current measured value is displayed. ▶ Release [Mode/Enter], > the parameter setting is completed.

*) 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.

To unlock the unit:

▶ press both buttons simultaneously for 10 s.

> [uLoc] is displayed.

The unit can be programmed before or after installation. Exception: to adjust the overflow protection [cOP], the unit **must** be installed in the tank.

10.2 Basic settings

Setting ranges of all parameters: → 12
Factory settings of all parameters: → 14

10.2.1 Setting the unit of measurement [uni]

▶ Enter [uni] before entering the values for SPx, rPx, OP or OFS.
This avoids unintentional maladjustments.

▶ Select [uni] ▶ Set the unit of measurement: [cm], [inch]	**uni**

10.2.2 Setting the offset [OFS]

The distance between tank bottom and lower edge of the measuring probe can be entered as offset value (→ 5.2.4).

▶ Set [OFS] before entering the values for SPx, rPx or OP.
This avoids unintentional maladjustments.

▶ Select [OFS]. ▶ Set the value for the offset. Note the set unit of measurement [uni].	**OFS**

10.2.3 Setting the medium [MEdI]

▶ Select [MEdI] and set the corresponding sensitivity:		**MEdI**
[CLW.1] =	water, hydrous media, coolant emulsions.	
[CLW.2] =	water-based media for temperatures > 35 °C (installation in climatic tube).	
[OIL.1] =	oils with an increased DC value (e.g. some synthetic oils).	
[OIL.2] =	oils with a low DC value (e.g. mineral oils).	
[Auto] =	automatic medium detection.	

▶ In case of doubt, select [OIL.2] for oils.
▶ Proper functioning is to be ensured by carrying out 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 protection is available. In that case, the menu points [OP] and [cOP] are not available.

10.2.4 Setting the overflow protection [OP]

▶ Comply with minimum distances and installation instructions. ▶ Select [OP]. ▶ Define the position of the overflow protection. The option [OP] = [OFF] **deactivates** the overflow protection.	**OP**

▶ Set [OP] before [SPx] or [FHx].

> [SPx] / [FHx] decreases if [OP] is reduced to a value ≤ [SPx] / [FHx] after setting [SPx] / [FHx].

> If [OP] is increased, [SPx] / [FHx] also increases if [OP] and [SPx] / [FHx] are close together (1 x step increment).

When the overflow protection is deactivated [OP] = [OFF] or [MEdI] = [Auto], the safe function of the sensor must be verified with particular care. For this, 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 menu item [cOP] is not available.

10.2.5 Adjusting the overflow protection [cOP]

Only adjust the overflow protection OP when the unit is installed.

If possible, carry out the adjustment when the tank is empty!

However, the tank may be partly filled.

▶ Make sure that the overflow protection OP is not covered by the medium! Observe the minimum distance between the overflow protection OP and the level (→ Table 10-1).

▶ Select [cOP] ▶ Press [SET] and keep it pressed. > [cOP] flashes for some seconds; then the continuous display indicates that the adjustment is being made. > If the adjustment is successful, [donE] is displayed. ▶ Confirm with [Mode/Enter]. > If the adjustment is not successful, [FAIL] is displayed. ▶ Lower the level if necessary or correct the position of the overflow protection [OP] and repeat the adjustment operation.	**cOP**

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

Table 10-1

	[cm]	[inch]
LKx022	2.0	0.8
LKx023	3.5	1.4
LKx024	5.0	2.0

The position of the overflow protection 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.

With the setting [MEdI] = [Auto] or [OP] = [OFF], the parameter [cOP] is not available.

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

- [MEdI] or [OP] has been changed. In this case ---- appears in the display.
- the installation position (height, orientation) has been changed.
- the connection between the sensor and the tank ground (e.g. length of the jumper cable) has been changed.

With deactivated overflow protection [OP] = [OFF] or [MEdI] = [Auto]:

To assign the basic settings and to adapt to the medium and installation environment the unit has to be reinitialised when installed.

▶ Switch the operating voltage off and on again.

10.3 Setting of output signals

10.3.1 Setting the output function [oux] for OUTx

▶ Select [oux] and adjust the switching function: [Hno] = hysteresis function / normally open [Hnc] = hysteresis function / normally closed [Fno] = window function / normally open [Fnc] = window function / normally closed If the switching output is used as an overflow protection, the setting [oux] = [Hnc] (NC function) is recommended. The principle of normally closed operation ensures that wire break or cable break is also detected.	**ou1** **ou2**

10.3.2 Set the switching limits [SPx] /[rPx] (hysteresis function)

▶ Make sure that the function [Hno] or [Hnc] is set for [oux]. ▶ Set [SPx] first, then [rPx]. ▶ Select [SPx] and set the value at which the output is set.	**SP1** **SP2**
▶ Select [rPx] and set the value at which the output resets.	**rP1** **rP2**

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

10.3.3 Set the switching limits [FHx] / [FLx] (window function)

▶ Make sure that for [oux] the function [Fno] or [Fnc] is set. ▶ Set [FHx] first, then [FLx]. ▶ Select [FHx] and set the upper limit of the acceptable range.	**FH1** **FH2**
▶ Select [FLx] and set the lower limit of the acceptable range.	**FL1** **FL2**

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

10.3.4 Set the switching delays [dSx] for switching outputs

▶ Select [dSx] and set the value between 0.0 and 60 s. The switching delay takes place according to VDMA.	**dS1** **dS2**

10.3.5 Set the switch-off delay [drx]

▶ Select [drx] and set the value between 0.0 and 60 s. The switching delay takes place according to VDMA.	**dr1** **dr2**

10.3.6 Set output logic [P-n]

▶ Select [P-n] and set [PnP] or [nPn].	**P-n**

10.3.7 Response of the outputs in case of a fault [FOUx]

▶ Select [FOUx] and set the value: [On] = the output switches ON in case of a fault [OFF] = the output switches OFF in case of a fault. A hardware fault or too low a signal quality is considered to be a fault. Overflow is not considered to be a fault.	**FOU1** **FOU2**

10.3.8 Configuration of the display [diS]

▶ Select [diS] and set the value: [On] = The display is switched on in the operating mode. Update of the measured values every 500 ms [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.	**diS**

10.3.9 Reset all parameters to factory settings [rES]

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

11 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.

11.1 Operating indicators

[----] (continuous)	Initialisation phase after power on.
[Numerical value] + LED 1	Current level in cm.
[Numerical value] + LED 2	Current level in inch.
LED 7 / LED 8	Switching status OUT2 / OUT1 (LED x is lit if output x is switched).
[----]	Level below the active zone.
[FULL] + [numerical value] alternately	The overflow protection OP is reached (overflow warning) or the level is above the active zone.
≡≡≡≡	It is necessary to adjust [cOP] of the overflow protection 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.

11.2 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.

11.3 Error indications

	Possible cause	Recommended measures
[Err]	Fault in the electronics.	▶ Replace the unit.
[SEnS]	• Interfering sources • Faulty wiring • Problems with the supply voltage	▶ Check electrical connection. ▶ Check the connection between the sensor and the tank ground.
[FAIL]	Error during adjustment of the overflow protection OP: • Overflow protection covered by the medium during adjustment. • Overflow protection soiled. • Minimum distances too short. • Mounting element detected below the overflow protection. • Measured value not constant.	▶ Lower the level, if necessary. ▶ Clean the probe. ▶ Observe the notes on installation. ▶ Correct the position of the overflow protection. ▶ Repeat the adjustment. ▶ Deactivate OP (→ 5.2.2).
[SC1] + LED 8 [SC2] + LED 7	Flashing: Short circuit in switching output OUT1 or OUT2.	▶ Remove the short circuit.
[SC] + LED 7 + LED 8	Flashing: Short circuit in both switching outputs.	▶ Remove the short circuit.
[PArA]	Faulty data set.	▶ Reset to factory settings [rES].

11.4 Output response in different operating states

Table 11-1

	OUT1	OUT2
Initialisation phase	OFF	OFF
Overflow protection OP not adjusted	OFF	OFF
Overflow protection OP not adjusted or deactivated, normal operation	According to the level and [ou1] setting	According to the level and [ou2] setting
Fault	OFF for [FOU1] = [OFF] ON for [FOU1] = [On]	OFF for [FOU2] = [OFF] ON for [FOU2] = [On]

12 Technical data

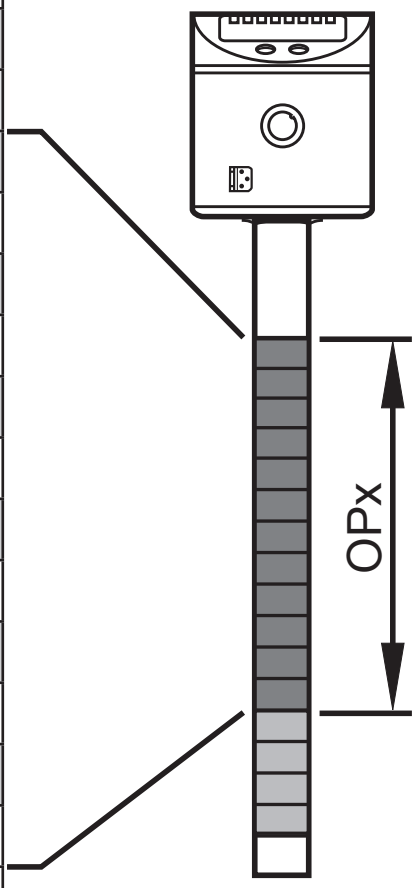
Technical data and scale drawing at www.ifm.com.

12.1 Setting values [OFS]

Table 12-1				
	[cm]		[inch]	
Setting range	0...200.0		0...78.8	
	LKx022 LKx023	LKx024	LKx022 LKx023	LKx024
Step increment	0.5	1	0.2	0.5

Setting values [OP]

Tab. 12-2					
LKx022		LKx023		LKx024	
[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].

If [OFS] > [0], they increase by the set offset value.

Example LK1022: According to Table 12-2 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 cm = 27.4 cm.

12.2 Calculation aids [OP]

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

The following applies (Fig. 12-1):

B + c = L + u and **B = z + y**	B: tank height c: outside length (maximal → 6) y: required response level OP from the cover (minimum → 6.1, maximum → 12.2)	L: probe length u: distance between probe and tank bottom z: required response level OP from the bottom (maximum: z < L - c - y or z < B - y)

12.2.1 Definition “from the cover“

Requested distance (y) of the overflow protection OP “from the cover“ is defined.

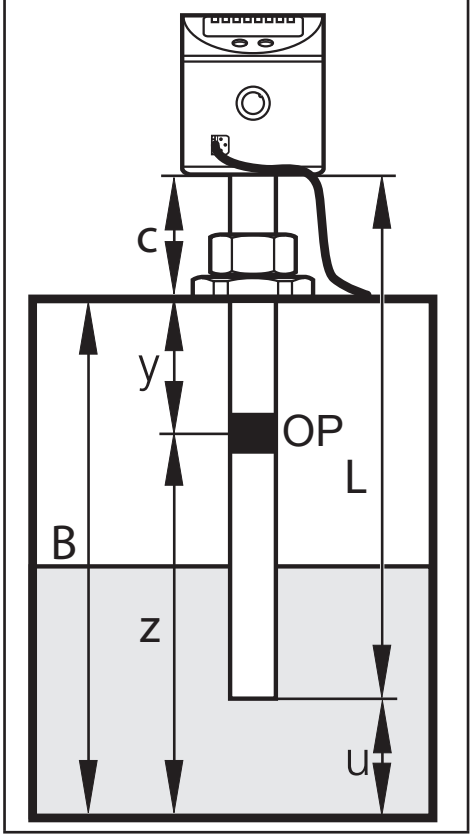
- Without offset ([OFS] = [0]): [OP] = L - c - y
- With offset ([OFS] = u): [OP] = L - c - y + u
  or
  [OP] = B – y

Example:
c = 3.0 cm, y = 5.0 cm, u = 1.0 cm

Without offset: [OP] = 26.4 cm - 3.0 cm - 5.0 cm
= 18.4 cm

With offset: [OP] = 26.4 cm - 3.0 cm - 5.0 cm - 1.0 cm
= 19.4 cm

Fig. 12-1



12.2.2 Definition “from the bottom“

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

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

Example:
z = 18.0 cm (from the tank bottom), u = 1.0 cm
Without offset: [OP] = 18.0 cm - 1.0 cm = 17.0 cm
With offset: [OP] = 18.0 cm
Round the calculated value to the next lower adjustable value → 11.2.

12.3 Setting ranges [SPx] / [FHx] and [rPx] / [FLx]

Table 12-3						
	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
[SPx] / [FHx]	2.5...20.0	1.0...8.0	3.5...39.0	1.4...15.4	6.0...59.0	2.5...23.5
[rPx] / [FLx]	2.0...19.5	0.8...7.8	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	0.5

The values apply if [OFS] = [0].
If [OFS] > [0], they increase by the set offset value.

13 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.

13.1 Maintenance information for operation without overflow protection

[MEdI] = [Auto] or [OP] = [OFF] (the overflow protection is 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 has been removed from the tank and inserted again during operation.
- If the active zone of the sensor has been 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 has been changed.

- After a change of media with dielectric constants that differ significantly. For manual selection of media, first the [MEdI] setting needs to be adjusted.

14 Factory setting

	Factory setting			User setting
	LKx022	LKx023	LKx024	
SP1	10.0	19.5	29.0	
rP1	9.5	19.0	28.0	
SP2	20.0	39.0	59.0	
rP2	19.5	38.5	58.0	
OP*	20.4	40.7	60.6	
MEdI	LK10xx: CLW.1 LK70xx: Auto			
cOP	----			
rES	----			
ou1	Hno			
ou2	Hnc			
dS1	0.0			
dr1	0.0			
dS2	0.0			
dr2	0.0			
uni	cm			
P-n	PnP			
OFS	0			
FOU1	OFF			
FOU2	OFF			
diS	On			

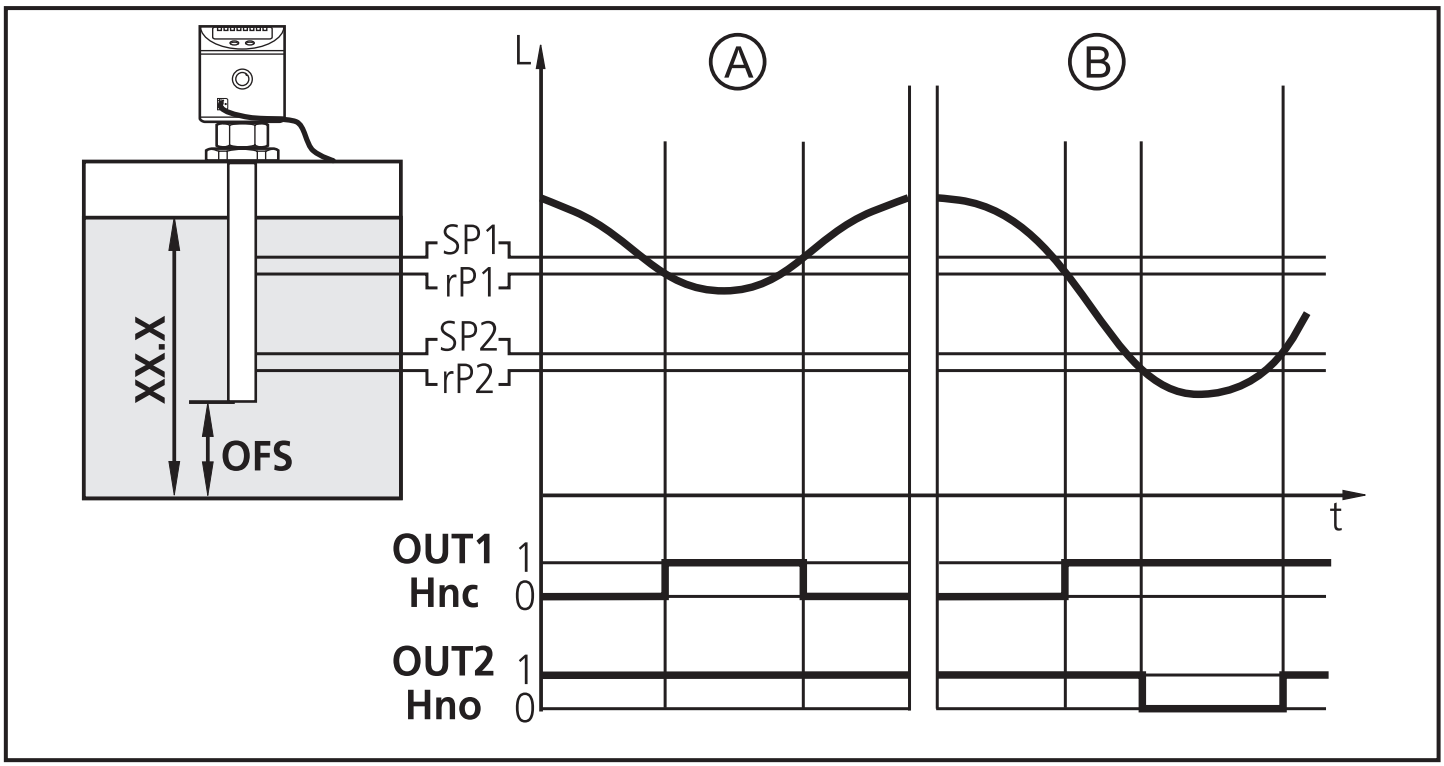
* Not available / inactive for LK70xx

15 Applications

15.1 Hydraulic tank

Minimum level monitoring with early warning and alarm

Switching output 1: early warning	
SP1	slightly above rP1 (to suppress wave movements)
rP1	below preset level → early warning, start refilling
ou1	hysteresis function, normally closed (Hnc)
Switching output 2: alarm	
SP2	min. value reached again → alarm reset
rP2	below min. value → alarm
ou2	hysteresis function, normally open (Hno)



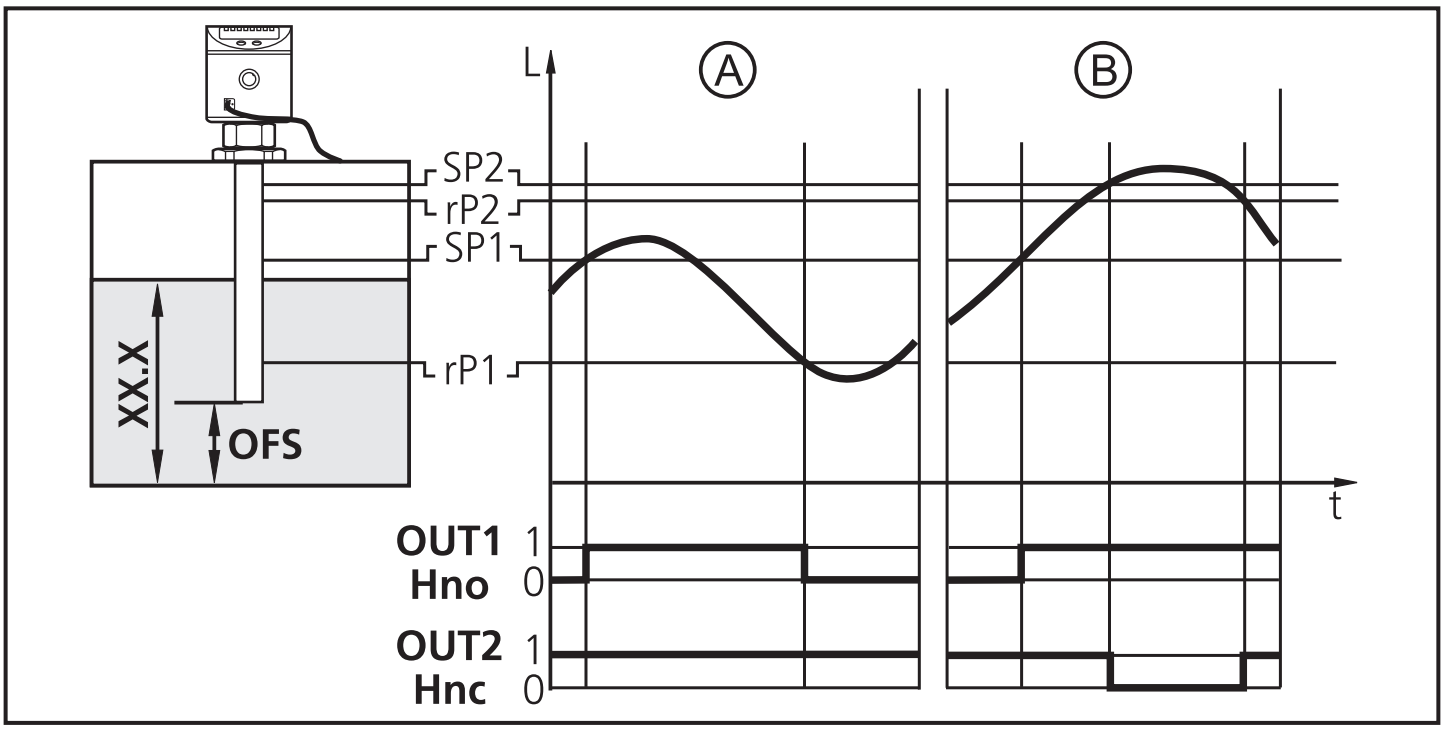
XX.X = display value,
A = early warning, B = alarm

- If the level is below rP1, output 1 switches until liquid is refilled. If SP1 is reached again, output 1 switches off.
- If the level is above SP2, output 2 switches. If the level falls below rPs or if there is a wire break, output 2 switches off.
- By setting SP1 the maximum level can be controlled / monitored: the value of SP1 determines up to which level (max) is to be refilled. When the maximum level is reached, this is signalled by the LED OUT1 going out and output 1 switching off.

15.2 Pumping station

Empty the tank with overflow protection

Switching output 1: control to empty tank	
SP1	upper value exceeded → submersible pump ON
rP1	lower value reached → submersible pump OFF
ou1	hysteresis function, normally open (Hno)
Switching output 2: overfill protection (for the LK10xx, it is recommended to use the integrated overflow protection (parameter [OP])	
SP2	maximum value exceeded → alarm
rP2	slightly below SP2 (to suppress wave movements)
ou2	hysteresis function, normally closed (Hnc)
OP	overflow protection *)



XX.X = display value,
A = empty, B = overflow protection

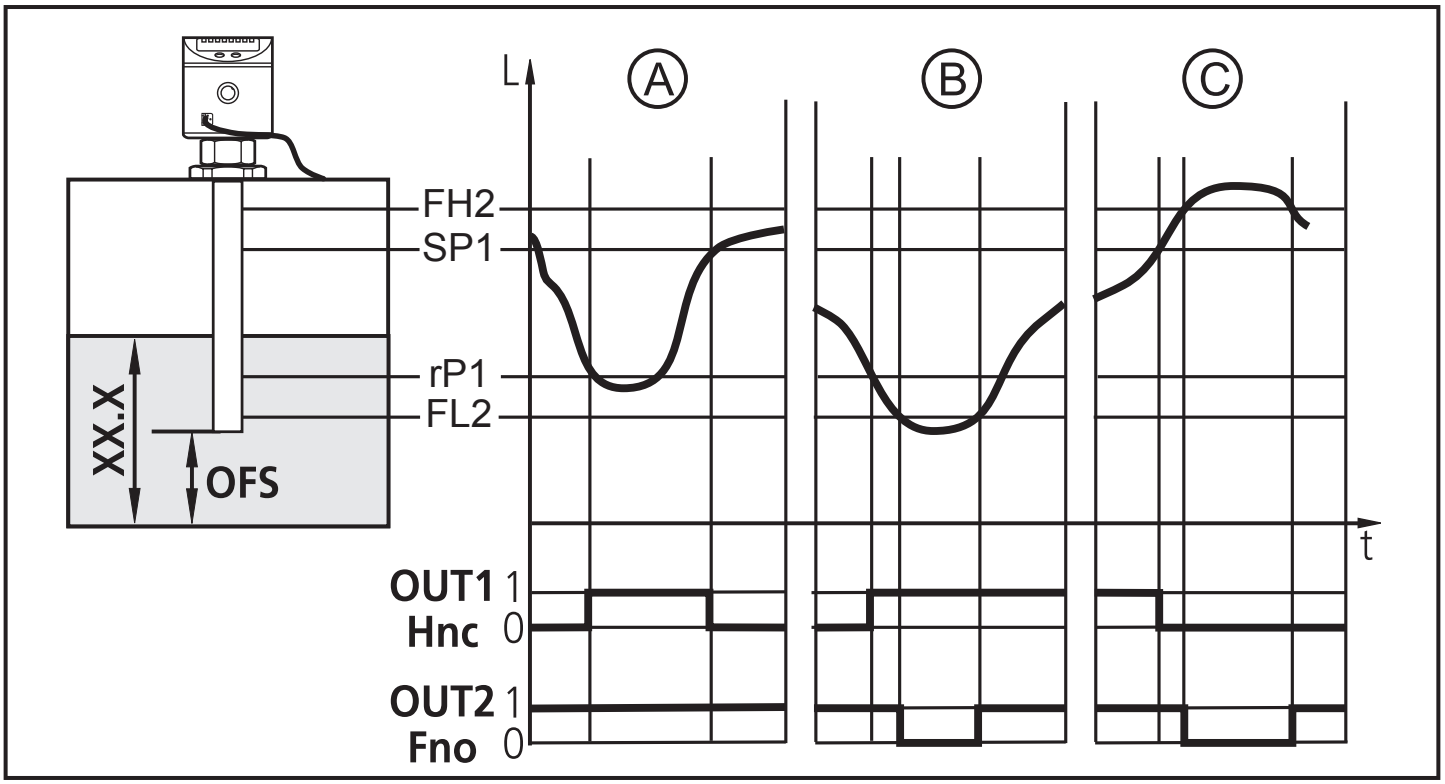
- If SP1 is exceeded, output 1 switches (submersible pump ON). If the level is below rP1 again, output 1 switches off (submersible pump OFF).
- If SP2 is exceeded or if there is a wire break, output 2 switches off.

*) It is recommended to use the integrated overflow protection (parameter [OP]). If SP2 is set to a maximum value, the response of the overflow protection (OP) immediately leads to a switching operation. In that case, SP2 functions as a directly acting overflow switch point.

15.3 Storage tank

Monitoring of the acceptable range (alarm) and level control

Switching output 1: refilling	
SP1	upper preset value reached → finish refilling
rP1	below lower preset value → start refilling
ou1	hysteresis function, normally closed (Hnc)
Switching output 2: safety function min - max	
SP2	max. value exceeded → alarm
rP2	below min. value → alarm
ou2	window function, normally open (Fno)



XX.X = display value,
A = refill; B = min. monitoring; C = max. monitoring

- If the level is below rP1, output 1 switches until liquid is refilled. If SP1 is reached again, output 1 switches off.
- If the level is below FL2 or above FH2 or if there is a wire break, output 2 switches OFF (→ alarm).
- The logical operation between the outputs 1 and 2 indicates whether there is overflow or the actual level is below the minimum level.
  - Overflow: output 1 and output 2 switched off.
  - Below min. value: output 1 switched on and output 2 switched off.

More information at www.ifm.com