



Operating instructions
Electronic level sensor
LK31xx

GB

Contents

1	Preliminary note	4
1.1	Symbols used	4
1.2	Warnings	4
2	Safety instructions	5
3	Intended use	6
3.1	Restriction of the application area	6
4	Getting started	7
4.1	Configuration example 1	7
4.2	Configuration example 2	7
5	Function	9
5.1	Measuring principle	9
5.2	Operating principle / features of the device	9
5.2.1	Operating modes	9
5.2.2	Notes on the integrated overflow prevention	10
5.2.3	Display function	10
5.2.4	Analogue function	10
5.2.4.1	Curve of the analogue signal with overflow prevention	10
5.2.4.2	Curve of the analogue signal without overflow prevention	11
5.2.5	Switching function	12
5.2.6	Offset for indicating the real level in the tank	12
5.2.7	Safe state in case of a fault	13
5.2.8	IO-Link	13
6	Installation	14
6.1	Notes on installation instructions for the operation with overflow prevention	14
6.2	Installation instructions for the operation without overflow prevention	15
6.2.1	Installation in the inactive zone	15
6.2.2	Installation in the active zone A of the probe	16
6.3	Other installation notes	16
6.3.1	Marking of the installation height	17
7	Electrical connection	18
8	Operating elements and display elements	19
9	Menu	20
9.1	Menu structure	20
10	Parameter setting	21
10.1	Notes on parameter setting via IO-Link	21
10.2	Parameter setting in general	22
10.3	Basic settings	24
10.3.1	Determine unit of measurement	24
10.3.2	Setting the offset	24
10.3.3	Setting the medium	24
10.3.4	Setting the overflow prevention	25
10.3.5	Adjusting the overflow prevention	25
10.4	Setting of output signals	26
10.4.1	Setting of the output function for OUT1	26
10.4.2	Setting of the output function for OU2	26
10.4.3	Setting the switching limits (hysteresis function)	26
10.4.4	Setting the switching limits (window function)	26
10.4.5	Setting the switching delay	26
10.4.6	Setting the switch-off delay	27
10.4.7	Setting the switching logic for the output	27
10.4.8	Defining the response of the outputs in case of a fault (safe state)	27
10.4.9	Configuring the display	27
10.4.10	Resetting all parameters to factory setting	27
10.5	Setting values and calculation aids	27
10.5.1	Setting values [OFS]	27

10.5.2	Setting values [OP]	28
10.5.3	Calculation aids [OP].	28
10.5.3.1	Definition "from the cover".	29
10.5.3.2	Definition "from the bottom".	29
10.5.4	Setting ranges [SPx] / [FHx] and [rPx] / [FLx]	29
11	Operation	30
11.1	Operating indicators	30
11.2	Reading the set parameters	30
11.3	Error indications	30
11.4	Output response in different operating states	31
12	Repair, maintenance and disposal	32
12.1	Maintenance information for the operation without overflow prevention	32
13	Factory setting	33

1 Preliminary note

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

1.1 Symbols used

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

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



WARNING

Warning of serious personal injury

- ▷ If the warning is not observed, fatal and serious injuries are possible.



CAUTION

Warning of minor to moderate personal injury

- ▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

- ▷ If the warning is not observed, damage to property is possible.

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- 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 (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Only use the product for permissible media (→ Technical data).
- The unit complies with the standard EN 61000-6-4 and is a class A product. The unit may cause radio interference in domestic areas. If interference occurs, the user must take appropriate actions.

3 Intended use

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

3.1 Restriction of the application area

- The device 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:
 - ▶ Check the correct function by performing an application test.
- For water-based media with temperatures > 35 °C, install the device in a climatic tube (→ Accessories).
- Observe max. media temperature with climatic tube: → Technical data sheet.
- For automatic medium detection: for media which are very inhomogeneous, separate from each other thus forming separation layers (e.g. oil layer on water) the following applies:
 - ▶ Check the correct function by performing 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 Configuration example 1

Device:	LKx122 (probe length L= 264 mm)
Medium to be detected:	Mineral oil
Operating mode:	Manual media selection with overflow prevention (factory setting): Operating modes (→ 9)
Installation environment:	Installation as in → Figure <i>Metal tank</i>

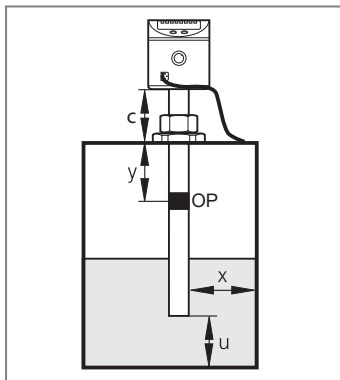


Fig. 1: Configuration example 1
Metal tank

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

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

- ▶ Ground the sensor with the tank: [Electrical connection \(→ 18\)](#)
- ▶ Observe the parameter setting sequence:
 - [MEdI] = [OIL.2]: [Setting the medium \(→ 24\)](#)
 - [OFS] = (u); e. g. (u) = 2.0 cm: [Offset for indicating the real level in the tank \(→ 12\)](#)
 - [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: [Setting values \[OP\] \(→ 28\)](#)

Calculation aids for [OP]: [Calculation aids \[OP\] \(→ 28\)](#)

- ▶ Adjust overflow prevention OP to [cOP]: [Adjusting the overflow prevention \(→ 25\)](#)
- ▷ The device is ready for operation.
- ▶ Make further settings if necessary.
- ▶ Check whether the device operates correctly.

4.2 Configuration example 2

Device:	LKx123 (with factory setting); probe length L = 472 mm
Medium to be detected:	Coolant emulsion
Operating mode:	Automatic medium detection (factory setting): Operating modes (→ 9)
Installation environment:	Installation as in → Figure <i>Metal tank</i>

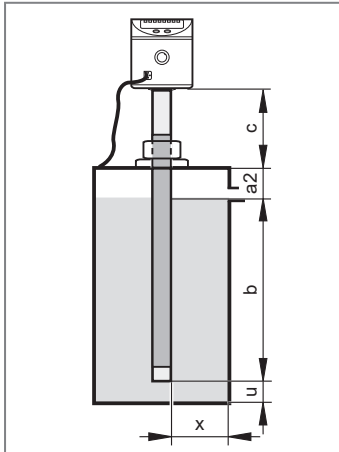


Fig. 2: Configuration example 2
Metal tank

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

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

- Ground the sensor with the tank: [Electrical connection](#) (→ [18](#))
- Observe the maximum permitted level (b).



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

- Observe the parameter setting sequence:
 - [MEdl] = [Auto]: [Setting the medium](#) (→ [24](#))
 - [OFS] = (u), e.g. (u) = 1.0 cm: [Offset for indicating the real level in the tank](#) (→ [12](#))
 - [SP1] = Set the switch point at a distance (a2) greater than 5.0 cm below the mounting element.



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

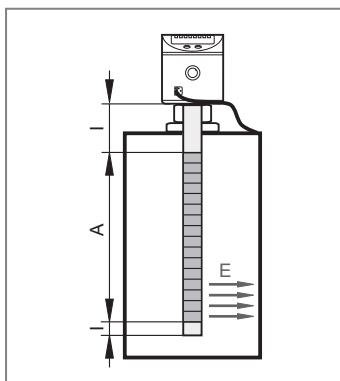
- The device must be reinitialised:
- Switch the operating voltage off and on again.
- ▷ The device is ready for operation.
- Make further settings if necessary.
- Check whether the device operates correctly.

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 measuring range of the sensor probe has 16 capacitive measuring segments. They generate measurement signals depending on the degree of coverage.



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

Fig. 3: Measuring principle

5.2 Operating principle / features of the device

The device 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	Analogue signal proportional to level (invertible)

► To adjust to the present application, select the required operating mode.

5.2.1 Operating modes

1. Manual media selection with overflow prevention (factory setting) recommended! Highest operational reliability!

The medium to be detected is set manually (parameter [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 (parameter [OP] = [OFF]). For this reason, no adjustment is required.

3. Automatic medium detection. Lowest operational reliability!

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



For automatic media detection (parameter [MEdI] = [Auto]), 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): [Maintenance information for the operation without overflow prevention](#) (→ [32](#))

5.2.2 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 OP.

- If the overflow prevention OP is activated, an adjustment to the installation situation has to be made (parameter [cOP]). Otherwise, the device is not ready for operation; [≡≡≡≡] is indicated in the display: [Operating indicators](#) (→ [30](#))
- 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 not to deactivate the overflow prevention OP!

- The overflow prevention OP is the maximum limit of the measuring range. The switch points [SPx] / [FHx] are 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, one of the outputs has not switched even though the corresponding switch point has been exceeded (e.g. due to application-related malfunctions). The response of the overflow prevention OP thus triggers the “full state” according to the configured function: [Analogue function](#) (→ [10](#)) [Switching function](#) (→ [12](#))
- 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 reacts 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 indicated on the display (Fu11 and indication of the current level change every second).

5.2.3 Display function

The device displays the current level, selectable in cm or inches. The display unit is defined by parameter setting. The set unit of measurement and the switching status of the outputs are indicated by LEDs.

5.2.4 Analogue function

The unit provides an analogue signal proportional to level. The analogue output (OUT2) can be configured

- [ou2] defines the output function of the analogue output: mA / V.
- In case of an internal fault, the output signal reacts according to the parameters set in [FOU2]!

5.2.4.1 Curve of the analogue signal with overflow prevention

- [OP] = [value ...] (Overflow prevention OP activated)
- [ou2] = [I] or [U]

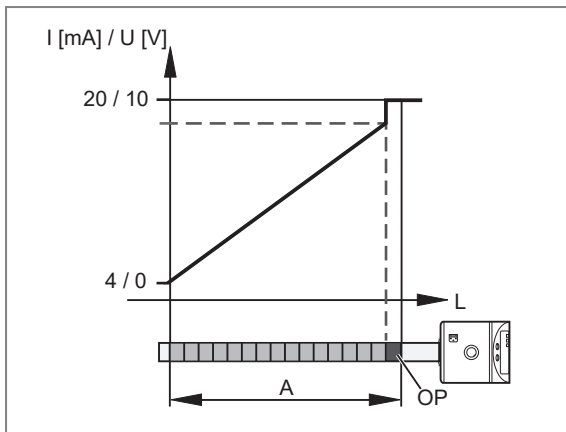


Fig. 4: OP positioned in the upper segment

A: Active zone
 OP: measuring segment overflow prevention OP
 L: level

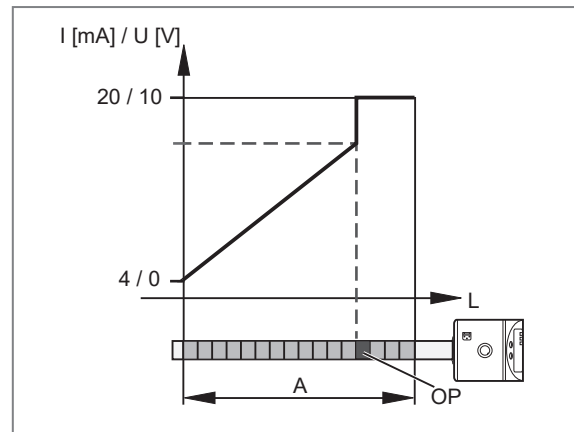


Fig. 5: OP shifted downward

A: Active zone
 OP: measuring segment overflow prevention OP
 L: level

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.

- [OP] = [value ...] (Overflow prevention OP activated)
- [ou2] = [InEG] or [UnEG]

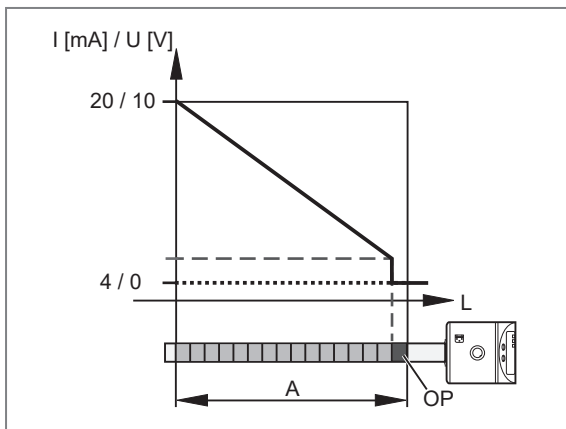


Fig. 6: OP positioned in the upper segment

A: Active zone
 OP: measuring segment overflow prevention OP
 L: level

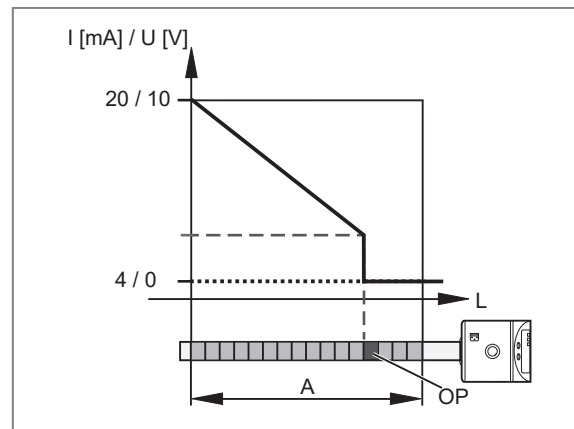


Fig. 7: OP shifted downward

A: Active zone
 OP: measuring segment overflow prevention OP
 L: level

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 (4 mA / 0 V).



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

5.2.4.2 Curve of the analogue signal without overflow prevention

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

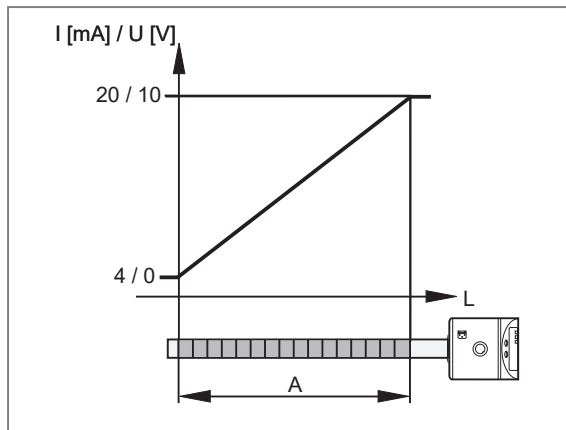


Fig. 8: [ou2] = [I] or [U]

A: Active zone
L: level

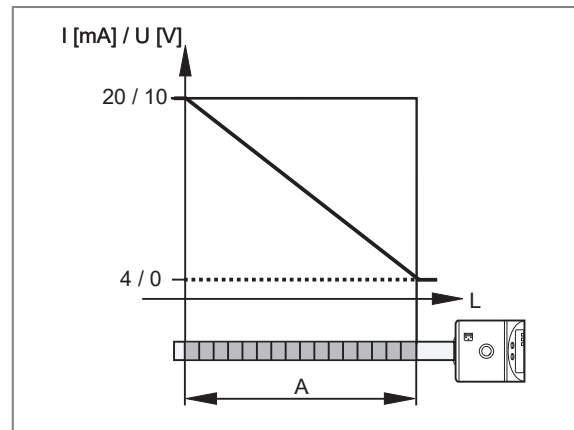


Fig. 9: [ou2] = [InEG] or [UnEG]

A: Active zone
L: level



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

Operating mode with the lowest operational reliability! [Operating modes](#) (→ [9](#))

5.2.5 Switching function

The device signals via the switching output OUT1 that a set limit has been exceeded or that the level is below the limit.

Selectable switching functions:

- Hysteresis function / normally open → *FigureHysteresis function*: [ou1] = [Hno].
- Hysteresis function / normally closed → *FigureWindow function*: [ou1] = [Hnc].



First, the setpoint [SP1] is set, then the reset point [rP1] with the requested difference.



The hysteresis for the overflow prevention OP is fixed.

- Window function / normally open → *FigureHysteresis function*: [ou1] = [Fno].
- Window function / normally closed → *FigureWindow function*: [ou1] = [Fnc].



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

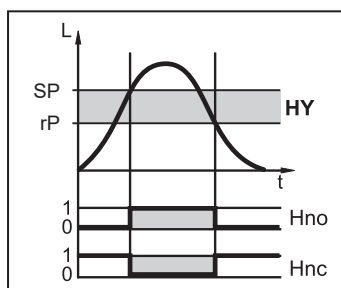


Fig. 10: Hysteresis function

L: level
HY: hysteresis

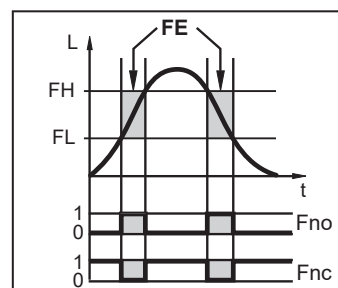


Fig. 11: Window function

L: level
FE: window

5.2.6 Offset for indicating the real level in the tank

The zone 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 device. 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 account: [IO-Link](#) (→ [13](#))

5.2.7 Safe state in case of a fault

For each output, a safe state in the event of a fault can be set. If a fault is detected, the outputs immediately pass into the defined, safe state. For this case the response of the outputs can be set via the parameters [FOU1], [FOU2]: [Defining the response of the outputs in case of a fault \(safe state\)](#) (→ [27](#))

5.2.8 IO-Link

IO-Link is a communication system for connecting intelligent sensors and actuators to automation systems. IO-Link is standardised in the IEC 61131-9 standard.



General information on IO-Link at io-link.ifm



Input Output Device Description (IODD) with all parameters, process data and detailed descriptions of the device at documentation.ifm.com

IO-Link offers the following advantages:

- Interference-free transmission of all data and process values
- Parameter setting in the running process or presetting outside the application
- Parameters for identifying the connected devices in the system
- Additional parameters and diagnostic functions
- Automatic backup and restore of parameter sets in case of device replacement (data storage)
- Logging of parameter sets, process values and events
- Device description file (IODD - Input Output Device Description) for easy project planning
- Standardised electrical connection
- Remote maintenance

6 Installation

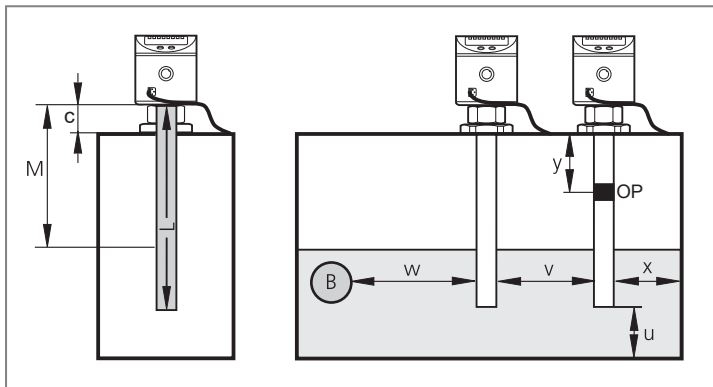


Fig. 12: Installation

L:	Probe length	u...y:	Minimum distances
M:	Zone for mounting element	OP:	Overflow prevention
c:	Maximum outside length	B:	Metallic objects in the tank

Table installation:

	LKx022		LKx023		LKx024	
	[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 not taken into account; mounting element does not protrude into the tank). Otherwise note mounting zone M.

6.1 Notes on installation instructions for the operation with overflow prevention

[MEdI] = [CLW..] or [OIL..]

[OP] = [Value ...] (Overflow prevention OP activated!)



It is permitted to fix the mounting elements within the mounting zone (M) → Figure *Installation*.

- ▶ Adhere to the maximum permitted outside length (c) according to → Table *Installation*.
- ▶ Observe the minimum distances according to → Figure *Installation* and → Table *Mounting instructions for operation with overflow prevention*.
- ▶ 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 the lower edge of the mounting element and the OP value.

Table on installation instructions for the operation with overflow prevention:

	MEdI = CLW.1		MEdI = CLW.2, OIL.1		MEdI = 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

	MEdI = CLW.1		MEdI = CLW.2, OIL.1		MEdI = OIL.2	
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]: [Calculation aids \[OP\]](#) (→ [28](#))

6.2 Installation instructions for the operation without overflow prevention

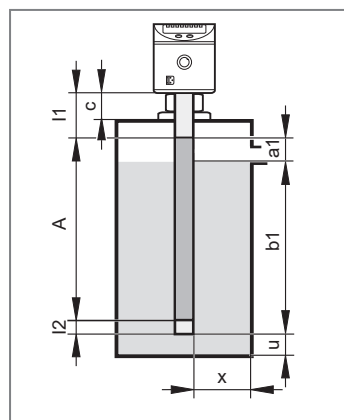
[MEdI] = [Auto] or [OP] = [OFF] (overflow prevention OP deactivated)

6.2.1 Installation in the inactive zone



Between the maximum level (b1) and the inactive zone (I1), the minimum distance (a1) has to be adhered to. → Figure and → Table *Mounting in the inactive zone*.

- Fix the device using mounting elements in the inactive zone (I1). The outside length (c) must not exceed (I1).
- Ensure that the maximum level (b1) is not exceeded after completed installation.
- Observe further minimum distances. → Table *Installation in the active zone A of the probe*.



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 (maximum outside length → Table *Installation*)

Fig. 13: Installation in the inactive zone

Table installation in the inactive zone:

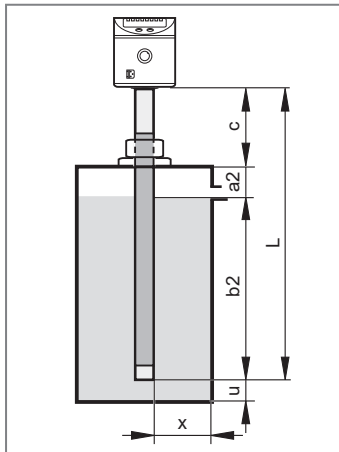
	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
I1	5.3	2.1	6.0	2.4	10.4	4.1
A	19.5	7.7	39.0	15.4	58.5	23.0
a1	1.0	0.4	1.5	0.6	2.5	1
b1	20.0	7.9	39.5	15.6	59.5	23.4

6.2.2 Installation in the active zone A of the probe



Between the maximum level (b2) and the mounting element a minimum distance (a2) has to be observed. → Figure and → Table *Installation in the active zone A of the probe*.

- Fix mounting elements in the mounting zone (M) → Figure *Installation*. Adhere to the maximum permitted outside length (c). → Table *Installation*.
- Ensure that the maximum level (b2) is not exceeded after completed installation:
- **(b2) = (L) - (c) - (a2) (without offset).**
- Observe further minimum distances. → Table *Installation in the active zone A of the probe*.



- c: Outside length (maximum outside length → Table *Installation*)
- a2: Minimum distance between mounting element and maximum level (b2).
- b2: Max. level from the lower edge of the sensor

Fig. 14: Installation in the active zone A of the probe

Table installation in the active zone A of the probe:

	LKx022		LKx023		LKx024	
	[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

*) → Figure Installation: [Installation](#) (→ [14](#))



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

Table other installation instructions:

	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.

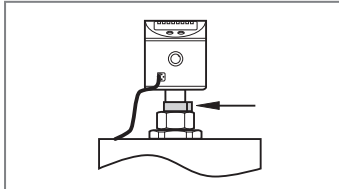


Fig. 15: Marking of the installation height

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



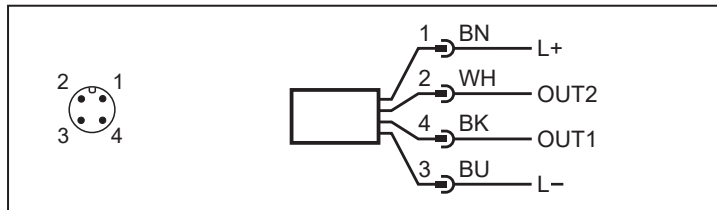
The unit must be connected by a qualified electrician.

Observe the national and international regulations for the installation of electrical equipment.

Voltage supply according to SELV, PELV.

► Disconnect power.

► Connect the unit as follows:



Pin	Core colour	
1:	BN	Brown
2:	WH	White
3:	BU	Blue
4:	BK	Black
OUT1: switching output / IO-Link		
OUT2: Switching output		
Colours to DIN EN 60947-5-2		

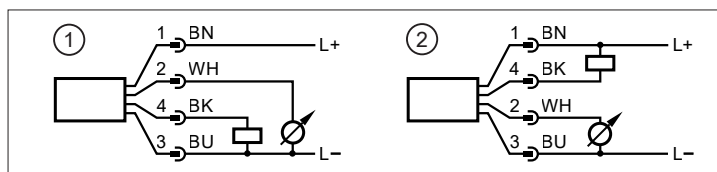
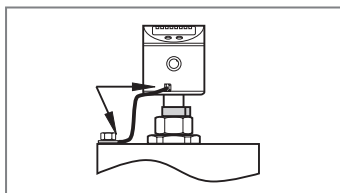


Fig. 16: Circuit examples

- 1: 1 x positive switching / 1 x analogue
 2: 1 x negative switching / 1 x analogue



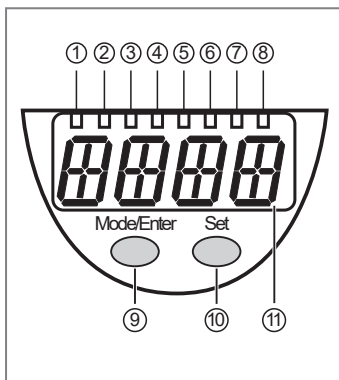
For safe function, the sensor housing must be electrically connected to the counter-electrode / grounded (= functional earth).

Use the housing connection (see drawing) and a short piece of cable with a wire cross-section of at least 1.5 mm².

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 rod / metal plate inside the tank in parallel with the probe. Observe the minimum distances to the probe.

8 Operating elements and display elements



1 to 8: Indicator LEDs

LED 1	Indication in centimetres.
LED 2	Indication in inches
LED 3 – 7	Not used.
LED 8	Switching status OUT1 (on if output 1 is switched).

9: [Mode/Enter] button

- Selection of the parameters and acknowledgement of the parameter values.

10: [Set] button

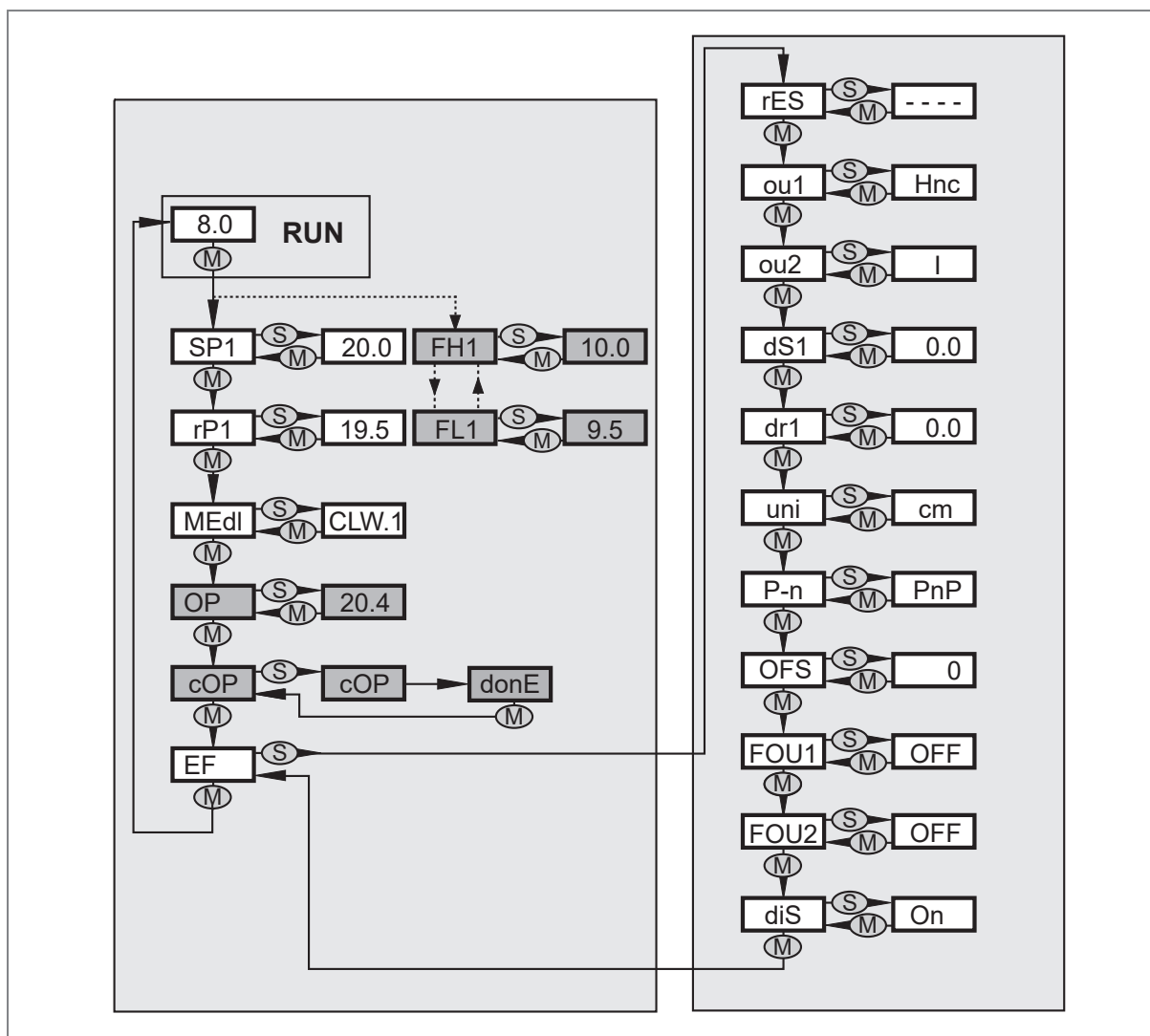
- Setting of the parameter values (scrolling by holding pressed, incrementally by pressing once).

11: Alphanumeric display, 4 digits

- Display of the current level.
- Indication 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



Depending on the parameter setting, the parameters available in the menu may change.

Parameter setting can be carried out via the IO-Link interface or via the operating elements on the unit.

Parameters can be set before installation or during operation.



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

► Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.



To adjust the overflow prevention [cOP], the device must be installed in the tank.

Requirements for parameter setting via the IO-Link interface:

- ✓ A suitable parameter setting software, e.g. ifm moneo|configure
- ✓ The Input Output Device Description (IODD) for the device, see documentation.ifm.com
- ✓ One IO-Link master
- Connect the IO-Link master to a parameter setting software.
- Set the port of the master to the IO-Link operating mode.
- Connect the device to a free port of the IO-Link master.
- ▷ The unit switches to IO-Link mode.
- Change parameter settings in the software.
- Write parameter settings to the unit.



Notes on parameter setting → Manual of the parameter setting software

10.1 Notes on parameter setting via IO-Link



- On delivery the device LKxxxx 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.
- via an IO-Link tool, "Teach_OP [cOP]" button.
- 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 device failure) (provided the OP is not deactivated): [Operating modes \(→ 9\)](#) is only possible with reservations: On the new device, 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 device revert to the cyclical process data transmission.

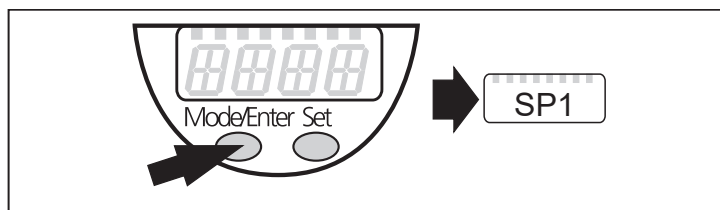


After a factory reset (button "Restore Factory Settings"), the device reboots and the factory settings are restored.

10.2 Parameter setting in general

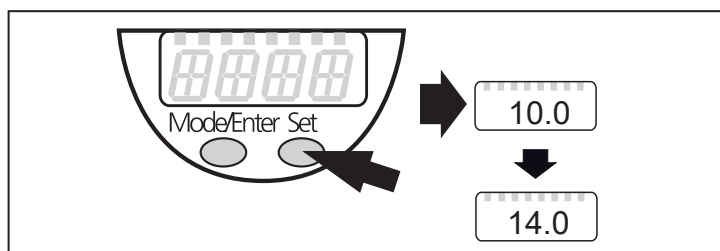
3 steps must be taken for each parameter setting:

1: Select Parameter



- ▶ Press [Mode/Enter] until the requested parameter is displayed.

2: Set parameter value

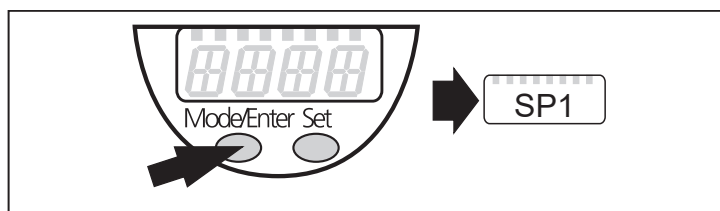


- ▶ Press [SET] and keep it pressed.
- ▷ Current setting value of the parameter flashes for 5 s.
- ▷ After 5 s: the setting value is changed.
Incrementally by pressing the button once or continuously by keeping the button pressed.
- ▷ The numerical values are incremented continuously:

For reducing the value:

- ▶ Let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.

3: Acknowledge parameter value



- ▶ Briefly press [Mode/Enter].
- ▷ The parameter is displayed again. The new setting value is saved.

Setting of other parameters:

- ▶ Start again with step 1.

Finishing the parameter setting:

- ▶ Press [Mode/Enter] several times until the current measured value is displayed, or wait for 30 s.
- ▷ The sensor returns to the process value display.

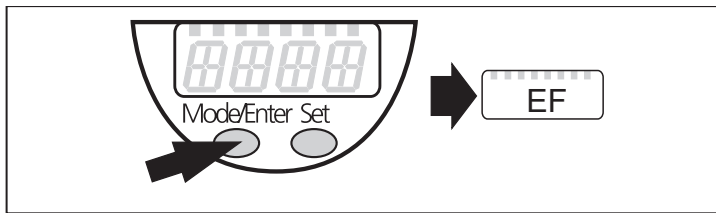


If [C.Loc] is displayed when an attempt is made to modify a parameter value, a parameter setting process is active via the IO-Link communication (temporary locking).

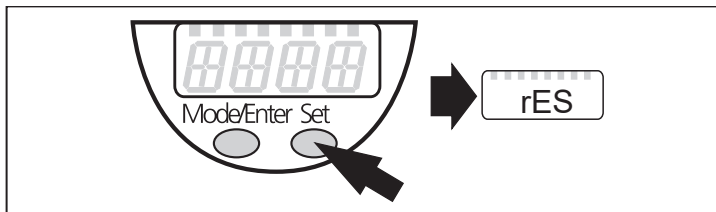


If [S.Loc] is displayed, the sensor is permanently locked via software. This locking can only be removed with a parameter setting software.

Change from menu level 1 to menu level 2



- ▶ Press [Mode/Enter] until [EF] is displayed.

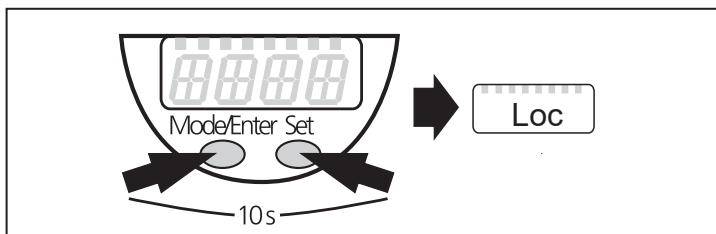


- ▶ Briefly press [Set].
- ▷ The first parameter of the submenu is displayed (here: [rES]).

Lock / unlock

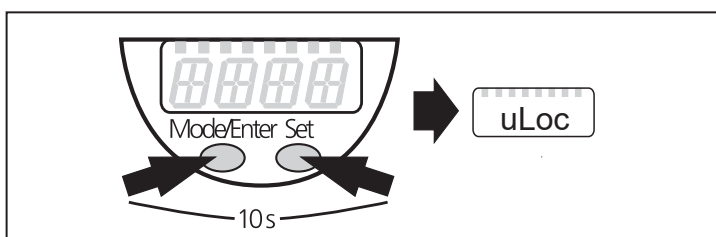
The device can be locked electronically to prevent unintentional settings.

Locking:



- ▶ Make sure that the device is in normal operating mode.
 - ▶ Press [Mode/Enter] + [Set] simultaneously for 10 s.
 - ▷ [Loc] is displayed.
- [Loc] is briefly displayed if you try to change parameter values.

Unlocking:



- ▶ Press [Mode/Enter] + [Set] simultaneously for 10 s.
- ▷ [uLoc] is displayed.

Timeout:

If no button is pressed for 30 s during parameter setting, the device returns to the operating mode with unchanged values.



The device can be configured before or after installation.

Exception: to adjust the overflow prevention [cOP], the device must be installed in the tank.

10.3 Basic settings

Setting ranges of all parameters: [Setting values and calculation aids](#) (→ [□ 27](#))

Factory settings of all parameters: [Factory setting](#) (→ [□ 33](#))

10.3.1 Determine unit of measurement



► Enter [uni] before entering the values for SPx, rPx, OP or OFS.

▷ This avoids unintentional wrong settings.

► Select [uni]	[uni]
► Determine unit of measurement: [cm], [inch]	

10.3.2 Setting the offset

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



► Set [OFS] before entering the values for SPx, rPx or OP.

▷ This avoids unintentional wrong settings.

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

10.3.3 Setting the medium

► Select [MEdL].		[MEdL]
[CLW.1] =	Water, water-based media, coolant emulsions.	
[CLW.2] =	Water, hydrous media, coolant emulsions for temperatures > 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: Operating modes (→ □ 9)	

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

► Check the correct function by performing 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 [MEdL] = [Auto], **no** overflow prevention OP is available. In that case, the menu items [OP] and [cOP] are not available.

10.3.4 Setting the overflow prevention

▶ Observe minimum distances and installation specifications ▶ Select [OP] ▶ Define the position of the overflow prevention OP. The option [OP] = [OFF] deactivates the overflow prevention OP.	[OP]
--	------



- ▶ Set [OP] before [SPx] or [FHx].
 - ▷ If [OP] is reduced after setting [SPx] / [FHx] to a value $\leq$ [SPx] / [FHx], [SPx] / [FHx] shifts downwards.
 - ▷ If [OP] is increased, [SPx] / [FHx] is also increased if [OP] and [SPx] / [FHx] are close together (1 x step increment).



When the overflow prevention is deactivated [OP] = [OFF] or [MEdI] = [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 the setting [OP] = [OFF], the menu item [cOP] is not available.

10.3.5 Adjusting the overflow prevention



Only adjust the overflow prevention OP when the device 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.

▶ 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 by clicking on [Mode/Enter]. ▷ If the adjustment is not successful, [FAIL] is displayed. ▶ If necessary, lower the level or correct the position of the overflow prevention [OP] and repeat the adjustment operation.	[cOP]
--	-------

Table minimum distance between the overflow prevention OP and the level during adjustment:

	[cm]	[inch]
LKx022	2.0	0.8
LKx023	3.5	1.4
LKx024	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 device 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] have been changed. In this case $\Xi\Xi\Xi\Xi$ is displayed.
- 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 ([OP] = [OFF] or [MEdl] = [Auto]):

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

- ▶ Switch the operating voltage off and on again.

10.4 Setting of output signals

10.4.1 Setting of the output function for OUT1

▶ Select [OU1] and set the switching function: • [Hno] = hysteresis function/normally open • [Hnc] = hysteresis function/normally closed • [Fno] = window function/normally open • [Fnc] = window function/normally closed Notice: if the switch point 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.	[OU1]
--	-------

10.4.2 Setting of the output function for OU2

▶ 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).	[OU2]
--	-------

10.4.3 Setting the switching limits (hysteresis function)

▶ Make sure that the function [Hno] or [Hnc] is set for [OU1]. ▶ Select [SP1] and set the value at which the output switches.	[SP1]
▶ Select [rP1] and set the value at which the output switches off. [rP1] is always smaller than [SP1]. The device only accepts values which are lower than the value for [SP1]. If [SP1] is shifted, [rP1] also shifts provided that the lower end of the setting range is not reached.	[rP1]

10.4.4 Setting the switching limits (window function)

▶ Make sure that the function [Fno] or [Fnc] is set for [OU1]. ▶ Select [FH1] and set the upper limit of the acceptable range.	[FH1]
▶ Select [FL1] and set the lower limit of the acceptable range. [FL1] is always smaller than [FH1]. The device 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.	[FL1]

10.4.5 Setting the switching delay

▶ Select [dS1] and set a value between 0.0 and 60 s. The switch-on delay reacts according to VDMA.	[dS1]
---	-------

10.4.6 Setting the switch-off delay

► Select [dr1] and set the value between 0.0 and 60 s. The switch-off delay reacts according to VDMA.	[dr1]
--	-------

10.4.7 Setting the switching logic for the output

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

10.4.8 Defining the response of the outputs in case of a fault (safe state)

► Select [FOUx] and set the value: • [On] = switching output switches ON in case of a fault. Analogue output switches to value > 21 mA / 10 V in case of a fault. • [OFF] = switching output switches OFF in case of a fault. Analogue output switches to value < 3,6 mA / 0 V Hardware faults (error message [Err]) or a faulty data set (error message [PArA]) are considered to be faults: Error indications (→ □ 30) Overflow or activation of the overflow prevention OP is not considered to be a fault.	[FOU1] [FOU2]
--	--------------------------

10.4.9 Configuring the display

► 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]
--	-------

10.4.10 Resetting all parameters to factory setting

► Select [rES] ► Press and hold [Set] until [----] is displayed. ► Briefly press [Mode/Enter]. ▷ The device reboots and then the factory settings are restored.	[rES]
---	-------

10.5 Setting values and calculation aids

10.5.1 Setting values [OFS]

	[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

10.5.2 Setting values [OP]

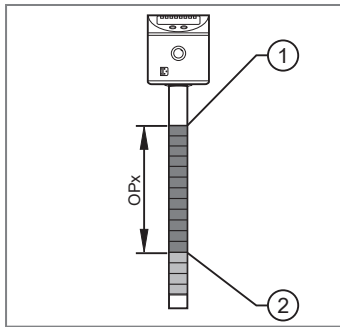


Fig. 17: Setting values / OPx:
Setting range [OP]

Section	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
①	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
②	6.9	2.7	13.9	5.5	20	8.0



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 LKx122:

According to → Table *Setting values [OP]*, 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.

10.5.3 Calculation aids [OP]



For proper functioning of the overflow prevention OP the minimum distance (y) (→ Figure: definition from above) must be observed.

The following correlations apply:

$B + c = L + u$ and $B = z + y$	B: Tank height c: Outside length (maximum: Installation (→ 14)). y: required response level OP from above (minimum: Notes on installation instructions for the operation with overflow prevention (→ 14), maximal: Setting values [OP] (→ 28)).	L: Probe length u: Distance between probe and tank bottom z: Required response level OP from the bottom (maximum: $z < L - c - y$ or $z < B - y$)
---------------------------------------	--	--

10.5.3.1 Definition "from the cover"

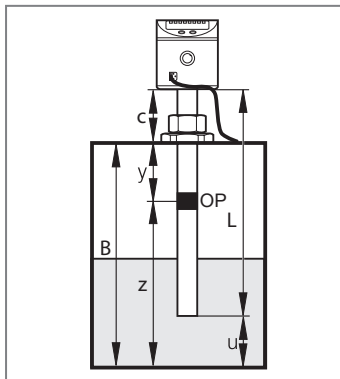


Fig. 18: Definition "from the cover"

Required 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:

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

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

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

10.5.3.2 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:

$z = 18.0 \text{ cm}$ (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: [Reading the set parameters](#)
(→ [30](#))

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

	LKx022		LKx023		LKx024	
	[cm]	[inch]	[cm]	[inch]	[cm]	[inch]
[SPx] / [FHx]	2.5...20.0	1.0...7.8	3.5...39.0	1.4...15.4	6...59	2.5...23.5
[rPx] / [FLx]	2.0...19.5	0.8...7.6	3.0...38.5	1.2...15.2	5...58	2.0...23.0
Step increment	0.5	0.2	0.5	0.2	1	0.5



The values apply if [OFS] = [0].

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

11 Operation

After switch-on of the supply voltage, the device 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 device 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 inches.
LED 8	Switching status OUT1 (on if output 1 is switched).
[----	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, or a detected mounting element has been reached.
[=====]	Adjustment [cOP] of the overflow prevention OP necessary.
[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 device is temporarily locked; parameter setting via IO-Link is active (temporary locking).
[S.Loc]	The device is permanently locked via software. This locking can only be removed with a parameter setting software.

11.2 Reading the set parameters

- Briefly press [Mode/Enter] (if required, repeat several times).
- ▷ Menu structure is scrolled until the required parameter has been reached.
- Briefly press [Set].
- ▷ Respective parameter value is displayed for 30 s.

11.3 Error indications

Indication	Possible cause	Recommended actions
[Err]	Fault in the electronics *)	► Replace the unit.
[FAIL]	Error during adjustment of the overflow prevention OP: • Overflow prevention covered by the medium during adjustment. • Overflow prevention soiled. • Minimum distances too short • Mounting element detected below the overflow prevention. • Measured value not constant.	► Lower the level, if possible. ► Clean the probe. ► Observe the notes on installation. ► Correct the position of the overflow prevention OP. ► repeat the adjustment. ► Deactivate OP.
[SC1] + LED 8	Flashing: Short circuit in switching output OUT1.	► Remove the short circuit.
[PArA]	Faulty data set *)	► Reset to factory settings [rES].

*) The outputs change into the safe state: [Output response in different operating states \(→ 31\)](#)

11.4 Output response in different operating states

	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 setting [ou1]	According to the process value 4...20 mA
Fault / safe state	OFF for [FOU1] = [OFF] ON for [FOU1] = [On]	OFF for [FOU2] = [OFF] ON for [FOU2] = [On]

12 Repair, maintenance and disposal

- ▶ After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.
- ▶ For transport only use appropriate packaging to avoid damage of the unit.
- ▶ In case of return shipment, ensure that the unit is free from soiling, especially from dangerous and toxic substances.

When removing or installing the unit for maintenance and cleaning:

- ▶ 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.

12.1 Maintenance information for the operation without overflow prevention

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

- ▶ The device 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 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 sensor and tank wall / counter-electrode was changed.
 - After a change of the medium with considerably differing dielectric constants. For manual selection of media, first the [MEdl] setting needs to be adjusted.

13 Factory setting

	Factory setting			User settings
	LKx022	LKx023	LKx024	
SP1	20.0	39.0	59	
rP1	19.5	38.5	58	
OP	20.4	40.7	61	
MEdI	CLW.1			
cOP	----			
rES	----			
ou1	Hnc			
ou2	I			
dS1	0.0			
dr1	0.0			
uni	cm			
P-n	PnP			
OFS	0			
FOU1	OFF			
FOU2	OFF			
diS	On			