



Operating instructions  
Capacitive level sensor

**KQ10xx**

**UK**

80281961 / 00 07 / 2019



# Content

1	Preliminary note.....	4
1.1	Symbols used .....	4
2	Safety instructions .....	4
3	Functions and features .....	5
3.1	Application area .....	5
3.2	Restriction of the application area .....	5
4	Getting started .....	6
5	Function .....	7
5.1	Measuring principle .....	7
5.2	Operating modes .....	8
5.3	IO-Link .....	8
5.4	Adjustments .....	8
5.5	Switching outputs .....	10
5.6	Diagnostic data .....	10
5.6.1	Index of level edge .....	10
5.6.2	Signal strength referred to the dynamic range .....	11
5.6.3	Filling edge sharpness.....	11
5.6.4	Installation quality .....	12
5.7	Internal temperature .....	12
5.8	Switching cycles counters .....	12
5.9	Operating hours counter .....	12
5.10	Damping function.....	12
6	Installation.....	14
6.1	Installation on bypass pipes .....	15
6.2	Installation on the tank.....	15
6.3	Installation on exchangeable tanks .....	15
6.4	Notes on tank adjustment.....	16
6.5	Notes on grounding .....	16
7	Electrical connection.....	16
8	Set-up .....	17
8.1	Application adjustments .....	18
8.1.1	Empty adjustment .....	18

8.1.2 Full adjustment .....	18
8.1.3 Dynamic adjustment .....	18
8.1.4 Empty and full adjustment .....	19
8.2 (→ 10.3)(→ 10.3)Adjustment of the switch points .....	19
9 Operating and display elements .....	20
10 Parameter setting .....	21
10.1 Parameter setting via PC and IO-Link master .....	21
10.2 Adjustable parameters .....	21
10.2.1 Sensor parameters .....	21
10.2.2 Indication parameters .....	22
10.2.3 Diagnostic parameters.....	22
10.2.4 Configuration of the switching outputs.....	22
10.2.5 Other parameters .....	23
10.3 Commands .....	24
10.3.1 Adjustment of the sensor .....	24
10.3.2 Setting of the switch points.....	24
10.3.3 Other commands .....	25
10.4 Active events and device status .....	25
11 Troubleshooting .....	26
11.1 Application adjustment refused .....	26
11.2 Deviation between process value and level.....	27
11.2.1 Evaluate the index of the level edge.....	28
11.2.2 Evaluate signal strength and filling edge sharpness.....	28
11.3 Events.....	28
11.3.1 Signal fault.....	28
11.3.2 Plausibility error .....	29
11.3.3 Maintenance required - Cleaning.....	30
12 Maintenance, repair and disposal.....	30
13 Factory settings .....	30

# 1 Preliminary note

Instructions, technical data, approvals, accessories and further information at [www.ifm.com](http://www.ifm.com).

## 1.1 Symbols used

▶ Instruction

> Reaction, result

[...] Designation of keys, buttons or indications

→ Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note.

## 2 Safety instructions

- The device described is a subcomponent for integration into a system.
  - The system manufacturer is responsible for the safety of the system.
  - The system manufacturer undertakes to perform a risk assessment and to create a documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the manufacturer of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ 3).
- 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.
- The unit complies with the standards EN 61000-6-4 and EN 61000-6-2. The unit may cause radio interference in domestic areas. If interference occurs, the user must take appropriate actions.

## 3 Functions and features

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### 3.1 Application area

The unit detects without contact metals, almost all plastics, glass, ceramics, wood, paper, oils, greases, water and all hydrous materials and indicates their presence by providing a switching signal or a continuous process value from 0...100 %.

The sensor detects the medium through the tank wall. The wall is suppressed by means of an adjustment function, so that only the medium is detected.



The tank wall must be made of a non-metal material.



Incorrect installation or adjustment may lead to wrong process values being provided.

- ▶ Observe chapter → 8 Set-up.
- ▶ Check proper function by an application test.

### 3.2 Restriction of the application area

- Using the unit in direct contact with the medium, with ionising radiation or in environments with direct condensation is not allowed.
- This is a class A product. This product may cause radio interference in domestic areas.
  - ▶ If required, take appropriate EMC screening measures.
- In case of highly adhesive media (e.g. glue, shampoo), there may be film formation.
- Highly conductive films or foams may be detected as level.

## 4 Getting started

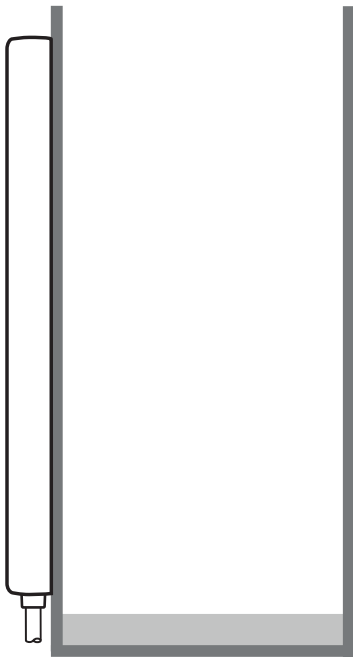
For fast set-up, carry out the following steps:

1. Fix the unit to the tank using adhesive tape (→ 6 Installation).
2. Connect the unit to an IO-Link master (→ documentation of the IO-Link master / software used).
3. Carry out an adjustment:

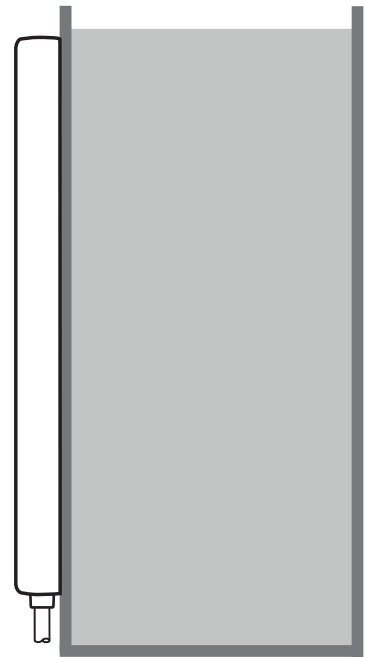
Empty adjustment (→ 8.1.1)

and / or

full adjustment (→ 8.1.2)



► Click on [Adjust empty tank]



► Click on [Adjust full tank]



The steps required may differ depending on the application. Detailed description under → 8 Set-up.

# 5 Function

## 5.1 Measuring principle

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

- An electrical field 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. For a constant wall thickness, 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 unit has 16 capacitive measuring segments (4). They generate measurement signals depending on the degree of coverage.

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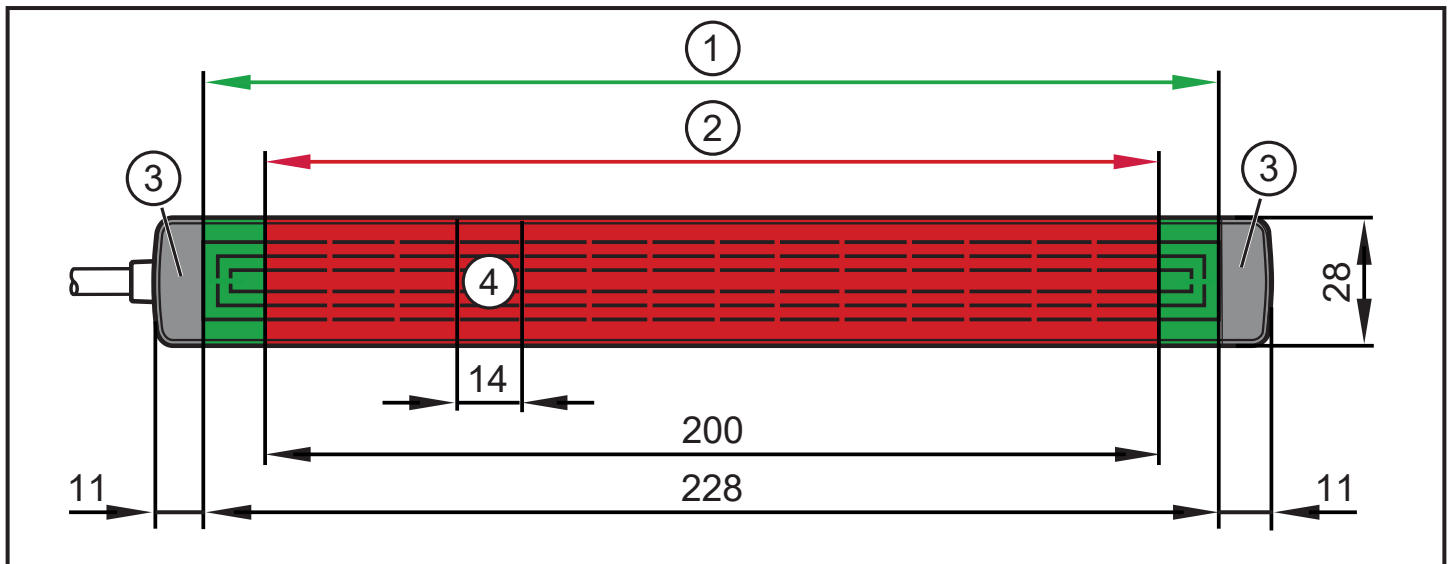


Fig. 1: Measuring range and detection range of the sensor.

1: Detection range (green)

3: Limit range (grey)

2: Measuring range (red)

4: Measuring segment (electrode)

Media can be detected within the detection range (1). The process value refers to this range.

The measuring range (2) is always two sensor elements smaller than the detection range. This is where accuracy is at its highest.

The limit range (3) is outside the detection range.



The sensor always provides the most recent valid process value. A process value is valid if the device status has the value "0".

## 5.2 Operating modes



The unit can only be configured via IO-Link.

The following operating modes can be set:

- Measurement over the maximum detection range
- Limitation of the detection range  
Adjacent sensor elements can be suppressed from the top as well as from the bottom in order to reduce the detection range (→ 10.2.1). A maximum of 10 sensor elements can be deactivated.
- Orientation  
The evaluation logic of the sensor can be rotated by 180° so that the sensor can also be mounted overhead, with the connection cable facing upwards (→ 10.2.1). Note that the limitation of the sensor elements always refers to the level. Limitation from the bottom refers to the lower sensor elements and limitation from the top refers to the upper sensor elements.
- Setting of the sensor sensitivity  
Two levels are available for sensor sensitivity, high and low. The high sensitivity level is suited for the detection of low dielectric bulk material, for example. The low sensitivity level can be used for detection of high dielectric media.

## 5.3 IO-Link

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 while it is in operation. Operation of the unit via the IO-Link interface requires an IO-Link master.

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

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at [www.ifm.com](http://www.ifm.com).

## 5.4 Adjustments

Before the sensor is used, it must be adjusted. Different application adjustments are available.



- **Empty adjustment**  
After fixing the unit to the tank, this adjustment is carried out to suppress the environment. No medium to be detected must be in the detection range. If only an empty teach is carried out, the sensor operates independently of the medium.
- **Full adjustment**  
A full adjustment is carried out with the detection range being completely covered. The sensor is adjusted to the medium to be detected. Changing the medium without carrying out a new adjustment can have a detrimental effect on the performance of the sensor in the application.
- **Dynamic adjustment**  
If no full adjustment or empty adjustment can be carried out, a dynamic adjustment can be carried out. The level of the medium to be detected must be within the detection range and there must be a distance of at least 4 sensor elements between the level and the upper limit of the detection range → 5.1, Fig. 1. In case of the dynamic adjustment, the sensor is adjusted to the medium, similar to the full adjustment. This means that changing the medium without carrying out a new adjustment can have a detrimental effect on the performance of the sensor in the application.



Only use the dynamic adjustment as sole adjustment if there is no other possibility.



If an empty adjustment has been carried out, no additional dynamic adjustment will be accepted.

The application adjustments can be combined. Sorted by operational reliability, the following combinations are possible:

Operational reliability	Adjustment	Application example
1 (highest)	Empty adjustment and full adjustment	For complex applications (e.g. draining liquid films).
2	Only empty adjustment	<ul style="list-style-type: none"> <li>• When the medium in the tank is changed.</li> <li>• In case of a significantly fluctuating dielectric constant.</li> </ul>
3	Only full adjustment	<ul style="list-style-type: none"> <li>• If no empty adjustment is possible</li> <li>• If the medium is not changed.</li> </ul>
4 (lowest)	Only dynamic adjustment	Only if no empty adjustment or full adjustment is possible.

## 5.5 Switching outputs

The unit has 3 physical switching outputs that can be configured differently (→ 10.2.4).



PNP or NPN operation can only be set for all switching outputs respectively.

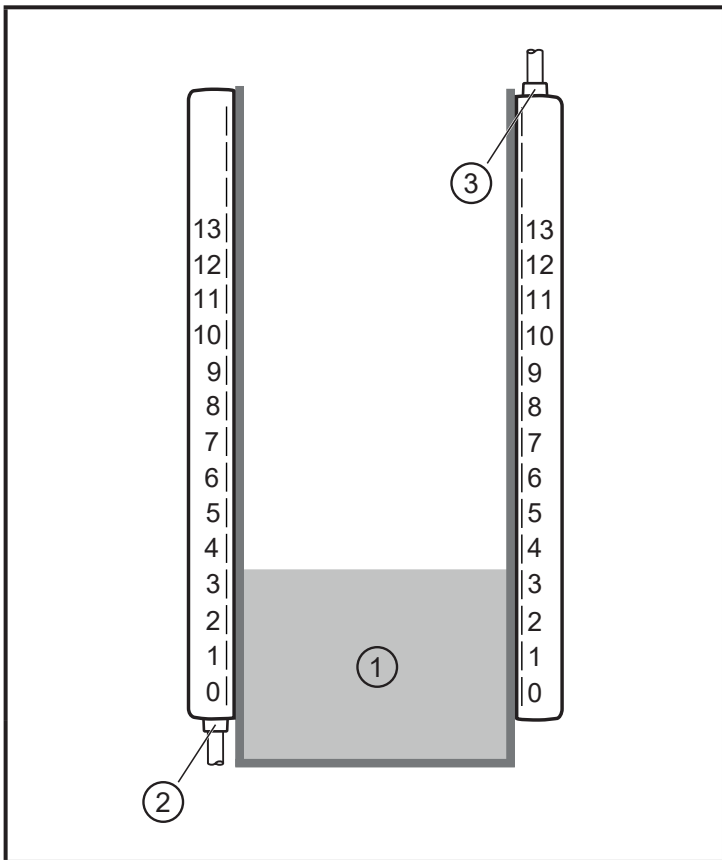
## 5.6 Diagnostic data

The unit provides diagnostic data for the assessment of the operational reliability. Besides, root cause analysis is facilitated in case of a fault (→ 11). There are four diagnostic parameters (→ 10.2.3):

- Index of level edge
- Signal strength referred to the dynamic range
- Filling edge sharpness
- Installation quality

### 5.6.1 Index of level edge

Indicates the electrode at which the edge of the level was detected.



In this example, the index of the level edge has the value 3.

Fig. 2: Index of level edge

- 1: Medium
- 2: Orientation: connector at bottom
- 3: Orientation: connector on top

The zero electrode is always at the bottom, independent of the sensor's orientation. The set limitation of sensor elements from the top or from the bottom

limits the provided index. For example, if the limitation of the elements from the bottom has been set to 2, the minimum index of the level edge will also be 2.

If no level edge can be detected, the device decides whether the detection range is completely covered or uncovered based on the application adjustments carried out (→ 8.1).

Detection range completely covered:	"13-topOffset"
Detection range uncovered:	"bottomOffset"

If no decision can be made based on the adjustments or if no adjustment has been carried out, the substitute value "0xFF" is provided.

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### 5.6.2 Signal strength referred to the dynamic range

Indicates the signal strength measured at the edge of the level in a value range from 0 to 100. If no edge of the level could be detected, the substitute value "0xFF" is provided. A low value can for example indicate that the wall is too thick or that the medium has a low dielectric constant.

### 5.6.3 Filling edge sharpness

Relates to the sharpness of the edge of the level in a value range from 0 to 100. If no edge of the level could be detected, the substitute value "0xFF" is provided. A low value can for example indicate an uneven filling edge.

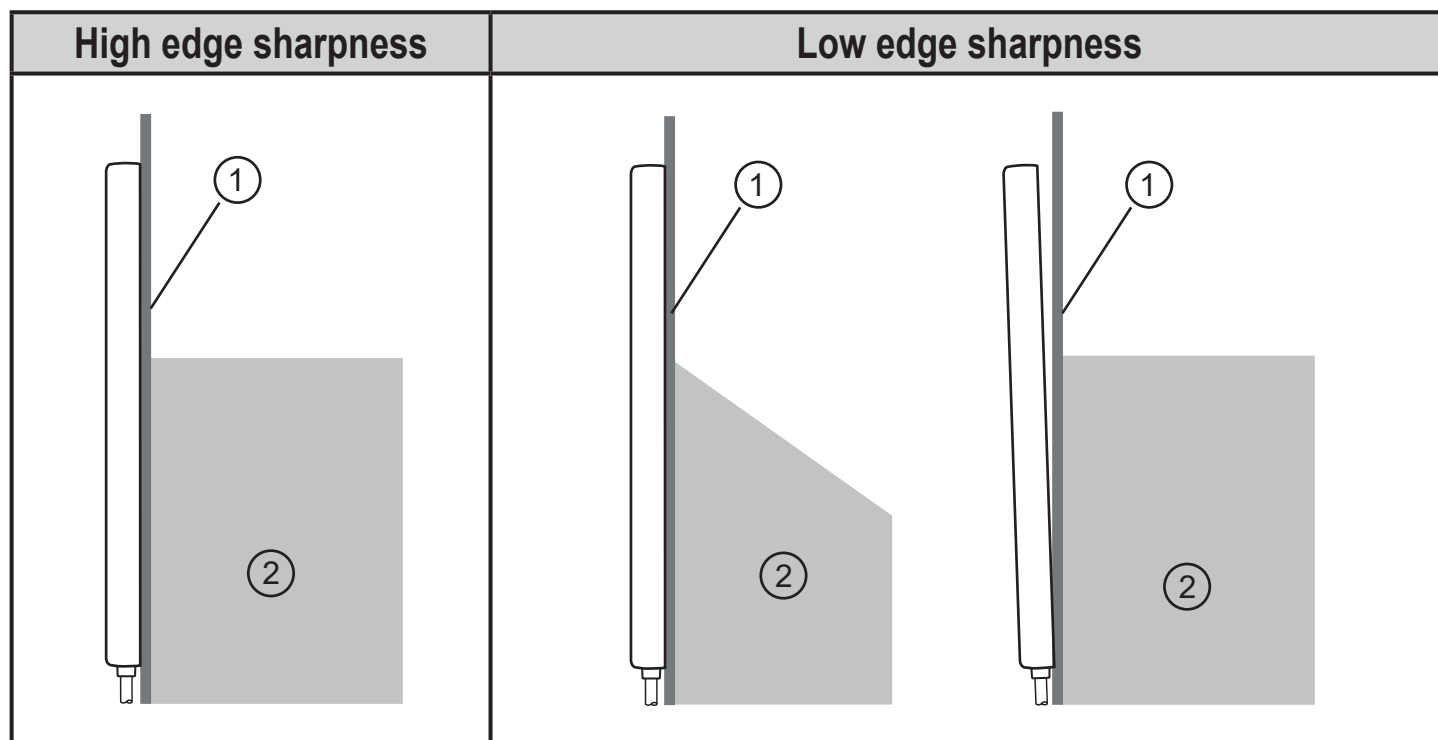


Fig. 3: Representation of the edge sharpness

- 1: Tank wall
- 2: Medium

If the edge sharpness is too low, it may not be possible for the sensor to correctly detect the level.



The edge sharpness can only be determined if the medium to be detected is within the measuring range of the unit.

#### **5.6.4 Installation quality**

Relates to the installation quality. Only available if an empty adjustment has been carried out, otherwise the substitute value "0xFF" is provided. A low value may for example indicate metal parts that are too close to the sensing face of the sensor (→ 6 Installation).

#### **5.7 Internal temperature**

The internal temperature of the unit can be read (→ 10.2.5).

Minimum value and maximum value are cyclically stored in the memory of the unit. The values can be used for orientation after a new start of the unit.



As a rule, the internal temperature does not correspond to the ambient temperature due to the internal heating of the unit.

#### **5.8 Switching cycles counters**

The number of switching cycles can be read or reset if the switching output has been configured accordingly. The switching cycles counters are cyclically stored in the memory of the unit (→ 10.2.5 Other parameters). The values can be used for orientation after a new start of the unit.

#### **5.9 Operating hours counter**

The number of operating hours can be read from the memory of the unit via IO-Link (→ 10.3.3 Other commands).

#### **5.10 Damping function**

With the damping function (→ 10.2.1 Sensor parameters), the process value can be filtered and delayed.

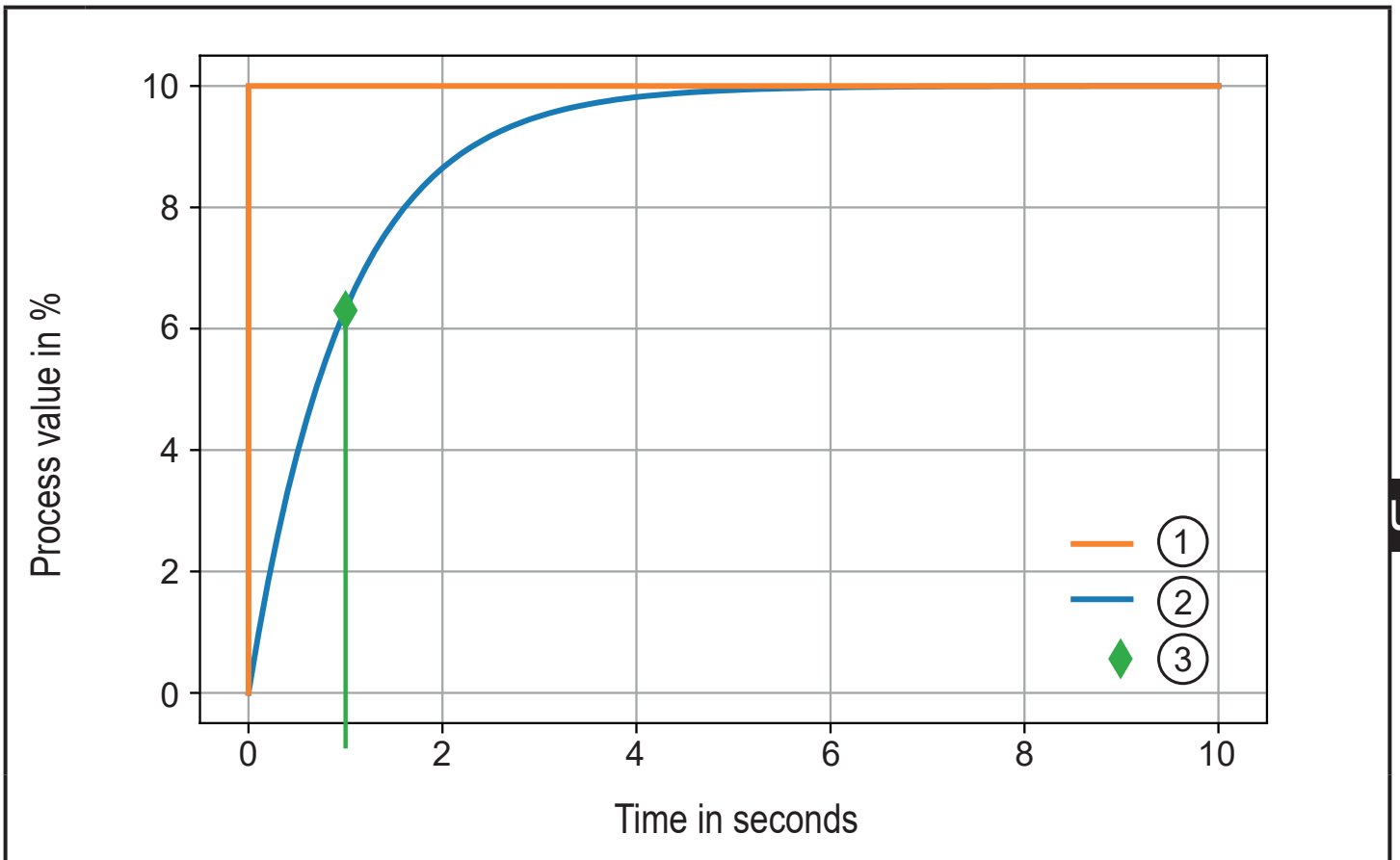


Fig. 4: Example: damping function for a damping value of one second

- 1: Measuring value sensor (without damping)
- 2: Process value / level (with damping)
- 3: Damping value (1 s)

## 6 Installation

If the sensor is installed in a metal tank with a non-metal window, the following installation conditions are to be noted in order to ensure correct operation:

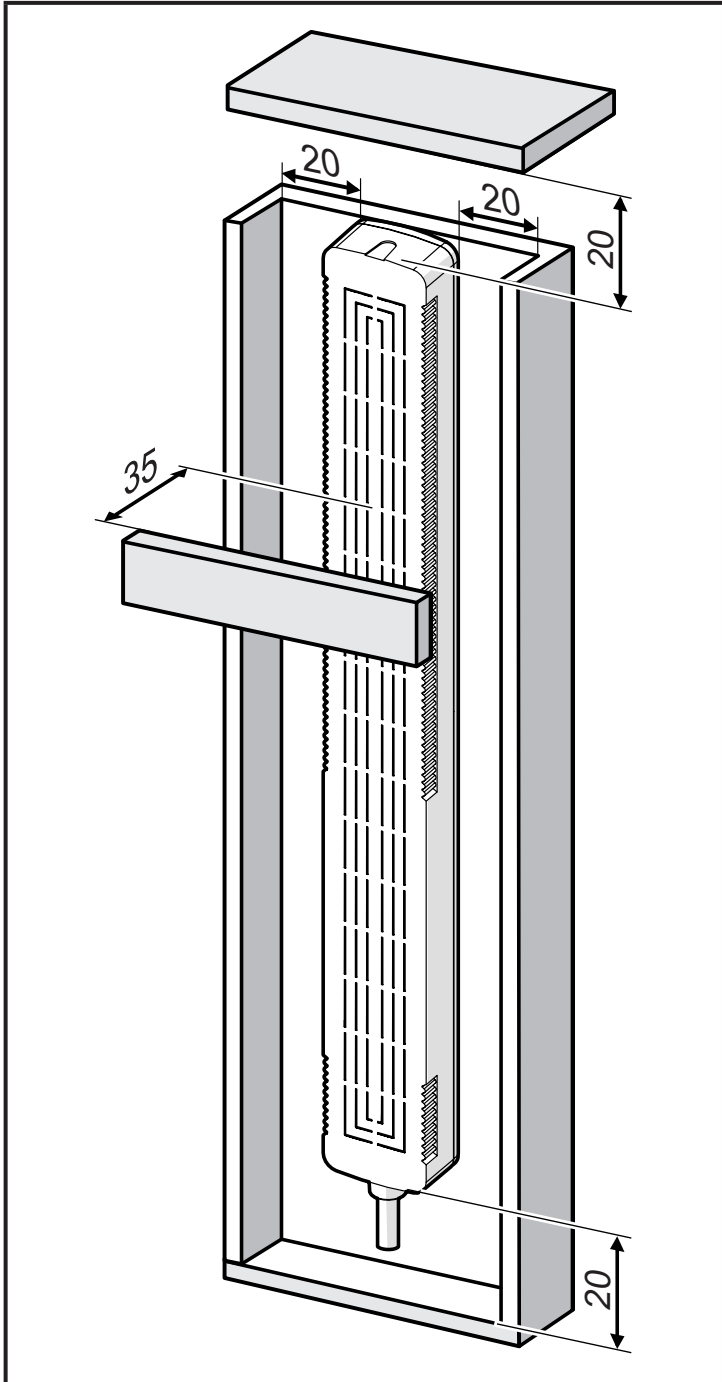


Fig. 5: Installation distances to metal objects



If the device is installed with the cable facing upwards, the parameter [Orientation] must be set to "Connector on top" (→ 10.2.1).

► Lay the connection cable as straight as possible and do not coil it.



If you do not adhere to the installation conditions, you do so at your own risk. If the conditions to ensure sufficient grounding are not adhered to, the conductive surface must be parallel to the sensing face.

Several units can be mounted head to head or so that they overlap.

## 6.1 Installation on bypass pipes

Using the E12676 mounting adapter, the unit can be mounted on bypass pipes with a circular cross section. To ensure correct mounting, the external diameter of the bypass pipe should be between 5 and 25 mm.



When the unit is mounted on a bypass pipe, the supply cable must be guided through the cable clamp.

## 6.2 Installation on the tank

The unit can be attached to tank walls by means of double-sided adhesive tape (available as accessory E12677). Using different adhesive tape may lead to the unit detaching from the tank and is done at your own risk. The adhesive tape used must not contain any conductive material.



The sensor must be flush to the tank. Curved, flexible tanks may lead to measurement errors and malfunction.



If curvature of the tank cannot be avoided, the sensor elements at the edge of the sensor that are affected by the curvature can be deactivated (→ 10.2.1).

## 6.3 Installation on exchangeable tanks

For exchangeable tanks, the back of the unit can be screwed to the tank using the E12675 mounting adapter and an M6 screw. One screwing point per adapter.



Maintain a constant distance between sensor and tank.

## 6.4 Notes on tank adjustment

- During set-up or a after replacement of the unit, a tank adjustment must be carried out.
- If only an empty adjustment has been carried out, the adjustment should be repeated when the sensor is removed from the tank and reinstalled.
- If no empty adjustment or no other adjustment in addition to the empty adjustment has been carried out, new adjustments should be carried out when the medium or tank is changed.

## 6.5 Notes on grounding



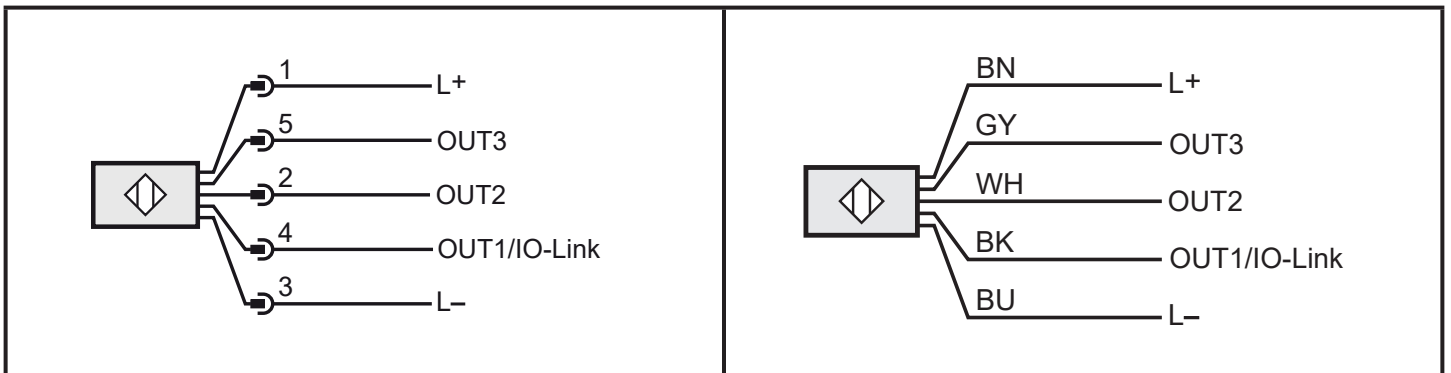
In order for the unit to function correctly, sufficient grounding of the unit as well as of the installation and tank must be ensured.

## 7 Electrical connection



The unit must be connected by a qualified electrician.  
Voltage supply according to EN 50178, SELV, PELV.

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



Colours to DIN EN 60947-5-2

BK: black, BN: brown, BU: blue, WH: white, GY: grey

Pin	Connection
4 (OUT1)	<ul style="list-style-type: none"> <li>• Switching signal</li> <li>• IO-Link</li> </ul>
2 (OUT2)	<ul style="list-style-type: none"> <li>• Switching signal</li> </ul>
5 (OUT3)	<ul style="list-style-type: none"> <li>• Switching signal</li> </ul>



## 8 Set-up



On delivery the unit is not operational. First an application adjustment must be carried out.

After installation and electrical connection, the configuration of the unit can be changed and adjustments can be carried out.



Changing one of the following parameters will reset the application adjustment (→ 10.2.1):

- Limitation of sensor elements
- Orientation
- Sensitivity

If these parameters are to deviate from the factory settings, they must be transferred to the unit prior to the application adjustment.

## 8.1 Application adjustments



After an adjustment, there may be increased measurement deviation when the tank is filled or emptied for the first time.

### 8.1.1 Empty adjustment

- ▶ Empty the tank until the level is at least 20 mm below the set detection range.
- ▶ Click on [Adjust empty tank] (→ 10.3.1).
  - > If no IO-Link error occurs, the adjustment was successful.
  - > Event [Parameter missing] is not indicated any more.
  - > The running light of the LED bar graph goes out.
- ▶ Fill the tank to check whether the unit operates correctly.

### 8.1.2 Full adjustment

- ▶ Fill the tank until the level is at least 20 mm above the set detection range.
- ▶ Click on [Adjust full tank] (→ 10.3.1).
  - > If no IO-Link error occurs, the adjustment was successful.
  - > Event [Parameter missing] is not indicated any more.
  - > All LEDs in the detection range are on.
- ▶ Empty the tank to check whether the unit operates correctly.

### 8.1.3 Dynamic adjustment

- ▶ Fill the tank until the level is in the measuring range.
- ▶ Click on [Start dynamic tank adjustment] (→ 10.3.1).
  - > The running light of the LED bar graph goes out. The level detected is indicated.
- ▶ Check whether the level is detected correctly. During the dynamic adjustment, the level may change within the valid range.
- ▶ Click on [Stop dynamic tank adjustment] (→ 10.3.1).
  - > If no IO-Link error occurs, the adjustment was successful.
  - > Event [Parameter missing] is not indicated any more.
- ▶ Empty the tank to check whether the unit operates correctly.



If the sensor elements have been limited, the valid measuring range for the dynamic adjustment is changed accordingly.



The dynamic adjustment will not stop automatically. It must be stopped or aborted via a command (→ 10.3.1).

#### 8.1.4 Empty and full adjustment

- ▶ Empty the tank until the level is at least 20 mm below the set detection range.
- ▶ Click on [Adjust empty tank]
  - > If no IO-Link error occurs, the adjustment was successful.
  - > Event [Parameter missing] is not indicated any more.
  - > The running light of the LED bar graph goes out.
- ▶ Fill the tank until the level is at least 20 mm above the set detection range.
- ▶ Click on [Adjust full tank]
  - > If no IO-Link error occurs, the adjustment was successful.
- ▶ Check whether the unit operates correctly.

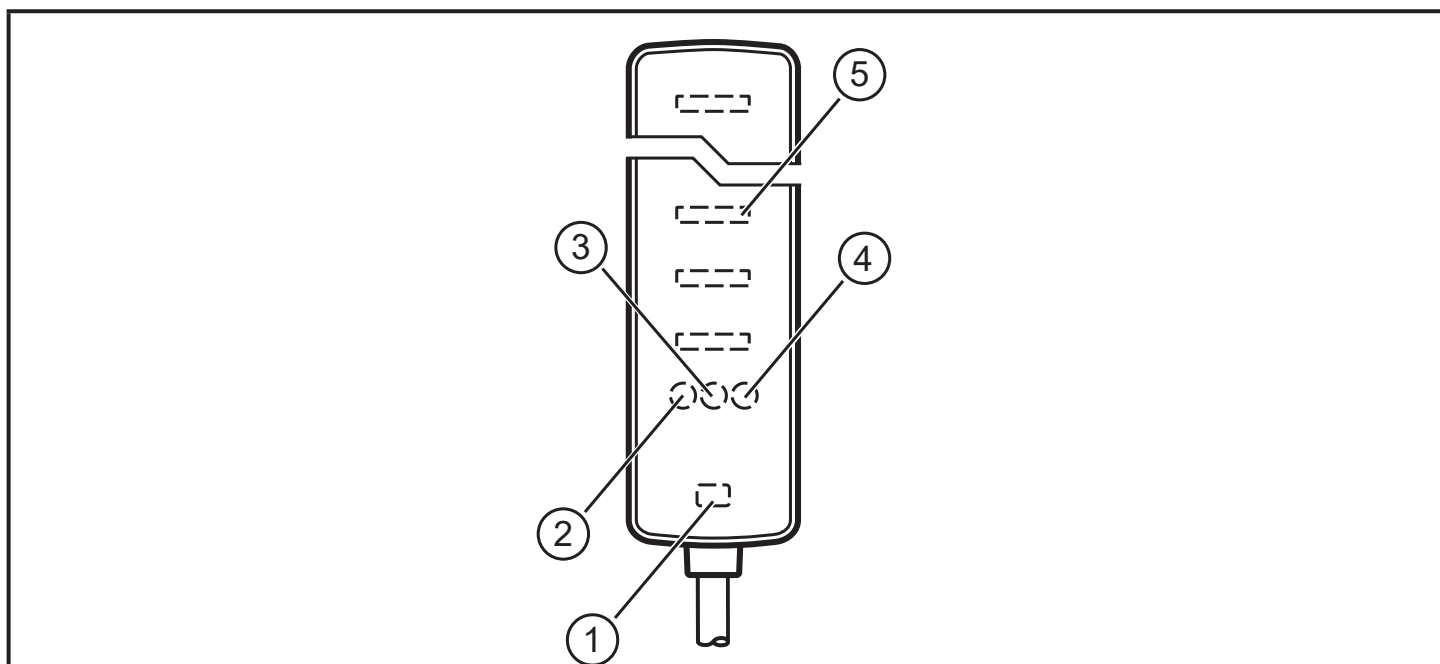
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#### 8.2 (→ 10.3)(→ 10.3)Adjustment of the switch points

Besides the configuration of the switch points via the corresponding parameters (→ 10.2.4), the switch points can also be adjusted by means of the level.

- ▶ Fill or empty the tank until the requested level is reached.
- ▶ Carry out the desired standard command (→ 10.3.2).

## 9 Operating and display elements



LED	Colour	Indication
①	green	status LED
②	yellow	switch point 1 (OUT 1)
③	yellow	switch point 2 (OUT2)
④	yellow	switch point 3 (OUT3)
⑤	green	LED bar graph (indication of the level)

Status LED (1) is on when the unit is connected to the voltage supply and ready for operation. The switch point LEDs (2), (3) and (4) are on when the corresponding output is switched. The switching outputs must be configured accordingly (→ 10.2.4). The LED bar graph (5) indicates the level after the adjustment has been carried out. If no adjustment has been carried out, this is indicated by means of a periodic running light.

Some or all of the LEDs can be deactivated via IO-Link (→ 10.2.2).

The following LED modes can be set:

- all LEDs inactive
- only status LED active
- status and switch point LEDs active
- all LEDs active (factory setting)


# 10 Parameter setting

## 10.1 Parameter setting via PC and IO-Link master

- ▶ Prepare PC, software and master → observe the operating instructions of the respective units / software.
- ▶ Connect the unit with the IO-Link master.
- ▶ Follow the menu of the IO-Link software.
- > Without ifm software: parameter setting according to the IODD PDF.
- ▶ Set the parameters.
- ▶ Check if the parameter setting was accepted by the unit. If necessary, read sensor again.
- ▶ Put the unit into operation (if necessary, remove the IO-Link master).


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## 10.2 Adjustable parameters

 The following IO-Link parameters merely provide an overview. A complete list can be found in the IODD of the unit.

### 10.2.1 Sensor parameters

Parameter	Value range	Description
Sensitivity	High (2) Low (0)	Sets the unit's sensitivity, two levels are available.
Orientation	Connector at bottom (0) Connector on top (1)	Changes the measuring logic of the unit, depending on installation with the cable facing upwards or downwards.
Limitation of the sensor elements. Bottom	0...10	Deactivates sensor elements from the bottom.
Limitation of the sensor elements. Top	0...10	Deactivates sensor elements from the top.
Minimum recognition threshold	64...4030	Minimum threshold above which the level can be detected.
Damping of the measured signal (dAP)	0...3600 s	Sets the damping of the process value.

 A maximum of 10 sensor elements can be deactivated.

## 10.2.2 Indication parameters

Parameter	Value range	Description
LED mode	<ul style="list-style-type: none"> <li>• All LEDs inactive (0)</li> <li>• Only status LED active (1)</li> <li>• Only status and switch point LEDs active (2)</li> <li>• All LEDs active (3)</li> </ul>	Activate or deactivate LED indication

## 10.2.3 Diagnostic parameters

Parameter	Value range	Description
Index of level edge	bottomOffset... 13-topOffset, substitute value "0xFF"	The electrode in the measuring range at which the level was detected.
Signal strength	0...100, substitute value "0xFF"	Signal strength of the level referred to the dynamic range of the sensor.
Filling edge sharpness	0...100, substitute value "0xFF"	Indicates the edge sharpness of the level detected.
Installation quality	0...100, substitute value "0xFF"	Predamping of the sensor referred to its dynamic range.

## 10.2.4 Configuration of the switching outputs

With the exception of parameter [P-n], all outputs can be configured separately.

Parameter	Value range	Description
P-n	PNP (0), NPN (1)	Output polarity for the switching outputs
FOUx	OU (1), On (2), OFF (4)	Response of OUTx in case of a fault.
oux	Hno / hysteresis function, NO (3), Hnc / hysteresis function, NC (4), Fno / window function, NO (5), Fnc / window function, NC (6), OFF / output off (16)	Output configuration of OUTx.

Parameter	Value range	Description
SPx / FHx	5...95 %	Switch point x in % (upper window limit)
rPx / FLx	5...95 %	Switch-off point in % (lower window limit)
dSx	0...43200 s	Switching delay for the switch point.
drx	0...43200 s	Switching delay for the switch-off point.
OUTx Counter	0...2000000000	Counts the number of switching cycles. Can only be read.

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## 10.2.5 Other parameters

Parameter	Value range	Description
Internal temperature	-100...300 °C	Internal temperature of the sensor.
Internal minimum [Lo.T] temperature	-100...300 °C	Lowest internal temperature measured.
Internal maximum [Hi.T] temperature	-100...300 °C	Highest internal temperature measured.
Power cycles	0...1000000	Number of switch-on operations.
Operating hours	0...500000 h	Number of operating hours.
Minimum memory value	0...100 %	Lowest process value measured.
Maximum memory value	0...100 %	Highest process value measured.

## 10.3 Commands

### 10.3.1 Adjustment of the sensor

Command	Description
Adjust empty tank	Carries out the empty adjustment of the sensor. The environment is suppressed.
Adjust full tank	Carries out the full adjustment of the sensor. The environment is suppressed.
Start dynamic tank adjustment	Starts the dynamic adjustment. The level must be within the measuring range, but at least 4 sensor elements below the upper limit of the detection range.
Stop dynamic tank adjustment	Stops the dynamic adjustment and calculates the adjustment values.
Cancel dynamic tank adjustment	Aborts the dynamic adjustment without calculating adjustment values.
Reset tank adjustments	Resets all application adjustments of the sensor.

### 10.3.2 Setting of the switch points

Besides setting of the switch points via IO-Link(→ 10.2.4), the switch point and the switch-off point can be set to the currently provided process value.

Command	Description
Adjust SPx	Sets the switch point of OUTx to the current process value.
Adjust rPx	Sets the switch-off point of OUTx to the current process value.



During teaching of the switch-off point, it is checked whether the switch-off point to be taught is below the set switch point. If this is not the case, the teach will be refused.



During teaching of the switch point, the switch-off point will automatically be adjusted by the sensor so that the hysteresis between switch point and switch-off point that was set before the teach is maintained. The switch point and the switch-off point must be within the value range (→ 10.2.4). If this is not the case, the switch-off point and the switch point will be limited by the value range and the hysteresis will be reduced accordingly.



### 10.3.3 Other commands

Command	Description
Reset [Lo] memory	Resets the minimum value memory of the process value (→ 10.2.5).
Reset [Hi] memory	Resets the maximum value memory of the process value (→ 10.2.5).
Reset [Hi] and [Lo] memory	Resets the maximum and minimum value memories of the process value (→ 10.2.5).
Restore Factory Settings	Resets all parameters of the unit to the factory settings.
Reset [Hi.T] and [Lo.T] memory	Resets the maximum and minimum value memories for the internal sensor temperatures.
Reset counter to zero	Resets the switching cycles counters of all switching outputs to zero.
Flash On	All LEDs of the unit start flashing.
Flash Off	The LEDs stop flashing.

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### 10.4 Active events and device status

Event	Device status	Description
Device hardware fault	Failure (4)	The unit does not provide valid measured data due to an internal communication error.
Short circuit	Functional check (3)	Short circuit detected on OUT2 or OUT3.
Parameter missing	Functional check (3)	No adjustment has been carried out yet.
Parameter fault	Functional check (3)	A parameter written to the unit has the wrong value range or the wrong length.
Maintenance required - Cleaning	Maintenance required (1)	There are deposits on the unit. The event is only provided if a full adjustment as well as an empty adjustment have been carried out.
Signal fault	Out of specification (2)	The measured signal is outside the dynamic range of the unit or the measured values are below the adjusted empty values (e.g. because the unit has detached from the tank wall).
Plausibility error	Out of specification (2)	The level cannot be clearly determined (e.g. if the medium flow is interrupted or in case of air inclusions).



The event [Maintenance required - Cleaning] is only provided if a full adjustment as well as an empty adjustment have been carried out. If this is not the case, no event is provided, even if there are deposits.



The event [Parameter missing] is only provided if no application adjustment has been carried out yet. After successful adjustment the event is no longer indicated.

## 11 Troubleshooting

In the following, some common errors and events are described.



Ensure correct mounting and configuration of the unit.




If only an empty adjustment or full adjustment has been carried out, there may be increased measurement deviation in the detection range when the tank is filled or emptied for the first time or when the medium is changed → 5.1, Fig. 1.


### 11.1 Application adjustment refused

Description	Troubleshooting
IO-Link error during the application adjustment.	<ul style="list-style-type: none"> <li>▶ Check the installation conditions (→ 6).</li> <li>▶ Check if the distance between units and cabling is sufficient.</li> <li>▶ Ensure that the unit is fixed securely to the tank wall.</li> <li>▶ Check the grounding and, if necessary, correct it (→ 6.5).</li> <li>▶ Repeat the application adjustment.</li> </ul> <p>If the error is still present:</p> <ul style="list-style-type: none"> <li>▶ Set the sensitivity of the unit to [Low] (→ 10.2.1).</li> <li>▶ Repeat the application adjustment.</li> </ul>

## 11.2 Deviation between process value and level

Description	Troubleshooting
<p>The level indicated is too low, although the level is within the measuring range</p>	<ul style="list-style-type: none"> <li>▶ Check whether the event [Signal fault] is provided, if applicable, carry out the instructions in (→ 11.3.1).</li> <li>▶ Check whether the event [Plausibility error] is provided, if applicable, follow the instructions in (→ 11.3.2) .</li> <li>▶ Fill the tank until at least one electrode of the measuring range is completely covered.</li> <li>▶ Read the parameter [Index of level edge] (→ 10.4).</li> </ul> <p> Further procedure:→ 11.2.1 Evaluate the index of the level edge.</p>
<p>The process value is in the measuring range although the tank is empty.</p>	<ul style="list-style-type: none"> <li>▶ Check whether the event [Signal fault] is provided, if applicable, carry out the instructions in (→ 11.3.1).</li> <li>▶ Check whether the event [Plausibility error] is provided, if applicable, carry out the instructions in (→ 11.3.2).</li> <li>▶ Carry out an empty and full adjustment (→ 8.1.4).</li> </ul> <p>If only an empty adjustment is possible:</p> <ul style="list-style-type: none"> <li>▶ Fill the tank until at least one electrode of the measuring range is completely covered.</li> <li>▶ Read the parameter [Signal strength] (→ 10.2.3).</li> <li>▶ Calculate the minimum recognition threshold (signal strength x 14).</li> <li>▶ Write the determined value to parameter [Minimum recognition threshold] (→ 10.2.1).</li> </ul>
<p>The process value is in the measuring range although the tank is full.</p>	<ul style="list-style-type: none"> <li>▶ Check whether the event [Signal fault] is provided, if applicable, carry out the instructions in (→ 11.3.1).</li> <li>▶ Check whether the event [Plausibility error] is provided, if applicable, carry out the instructions in (→ 11.3.2).</li> <li>▶ Carry out an empty and full adjustment (→ 8.1.4).</li> </ul> <p>If only a full adjustment is possible:</p> <ul style="list-style-type: none"> <li>▶ Empty the tank until at least one electrode of the measuring range is completely uncovered.</li> <li>▶ Read the parameter [Signal strength] (→ 10.2.3).</li> <li>▶ Calculate the minimum recognition threshold (signal strength x 14).</li> <li>▶ Write the determined value to parameter [Minimum recognition threshold] (→ 10.2.1).</li> </ul>

## 11.2.1 Evaluate the index of the level edge

Index of level edge	Troubleshooting
<ul style="list-style-type: none"> <li>The substitute value "255" is provided. Reason: the measured signal is too weak.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Increase the sensitivity of the sensor (→ 10.2.1).</li> <li>▶ Check the [Minimum recognition threshold] and reduce it or reset it to factory setting (→ 10.2.1).</li> <li>▶ Reduce the wall thickness of the tank.</li> </ul>
<ul style="list-style-type: none"> <li>The index of the level edge maintains the minimum value even though the tank continues to be filled.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Check the grounding and, if necessary, correct it (→ 6.5)</li> </ul> <p>When used on a bypass pipe:</p> <ul style="list-style-type: none"> <li>▶ Insert the supply cable into the adapter.</li> </ul>
<ul style="list-style-type: none"> <li>The index of the level edge is in the measuring range. However, the position significantly deviates from the actual level.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Read the parameter [Signal strength] (→ 10.2.3).</li> </ul>  Further procedure:→ 11.2.2 Evaluate signal strength and filling edge sharpness.

## 11.2.2 Evaluate signal strength and filling edge sharpness

Parameter / value	Troubleshooting
Signal strength < 10	<ul style="list-style-type: none"> <li>▶ Reduce the wall thickness of the tank.</li> <li>▶ Increase the sensitivity of the sensor (→ 10.2.1).</li> <li>▶ Read parameter [Filling edge sharpness] (→ 10.4).</li> </ul>
Filling edge sharpness < 50	<ul style="list-style-type: none"> <li>▶ Install the unit where the edge of the level is at a right angle to the active face.</li> </ul>

## 11.3 Events

### 11.3.1 Signal fault

Event only occurs if at least one application adjustment has been carried out.

Description	Troubleshooting
<p>Possible causes:</p> <ul style="list-style-type: none"> <li>• Measured capacitances are below the values of the empty adjustment (only if an empty adjustment has been carried out).</li> <li>• Measured capacitances are greater than the dynamic range of the sensor.</li> <li>• Measured capacitances are smaller than the dynamic range of the sensor (e.g. in case of external electromagnetic interference).</li> </ul>	<p>If an empty adjustment has been carried out:</p> <ul style="list-style-type: none"> <li>▶ Check whether the unit has detached from the tank wall.</li> <li>▶ Check the installation conditions (→ 6).</li> <li>▶ Carry out a new empty adjustment (→ 8.1.1).</li> </ul> <p>If the error is still present:</p> <ul style="list-style-type: none"> <li>▶ Set the sensitivity of the sensor to [Low] (→ 10.2.1).</li> <li>▶ Carry out a new empty adjustment (→ 8.1.1).</li> </ul> <p>If no empty teach has been carried out:</p> <ul style="list-style-type: none"> <li>▶ Check whether the unit has detached from the tank wall.</li> <li>▶ Check the installation conditions (→ 6).</li> <li>▶ Carry out a full adjustment (→ 8.1.2)</li> </ul>

### 11.3.2 Plausibility error

Event only occurs if at least one application adjustment has been carried out.

Description	Troubleshooting
<p>The level cannot be clearly determined.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> <li>• Air inclusions</li> <li>• Interruption of the medium flow</li> <li>• Contact with the sensor</li> <li>• Deposits</li> <li>• Metal parts near the detection range</li> </ul>	<ul style="list-style-type: none"> <li>▶ Mount the unit where the medium to be detected cannot stick.</li> <li>▶ Mount the unit at a sufficient distance to metal parts (→ 6).</li> <li>▶ Avoid deposits by cleaning the unit at regular intervals.</li> <li>▶ Do not touch the unit during the adjustment and during operation.</li> </ul>



If an empty adjustment and a full adjustment have been carried out, the event [Maintenance required - Cleaning] is provided when deposits begin to form (→ 10.4).

### 11.3.3 Maintenance required - Cleaning

The event only occurs if a full adjustment and an empty adjustment have been carried out and the signal strength is at least 15 (→ 10.2.3).

For applications with a lower signal strength, the unit cannot provide warnings of deposits.

Description	Troubleshooting
Deposits above the level	► Clean the tank's inside in the detection range of the unit.

## 12 Maintenance, repair and disposal

If used correctly, no maintenance and repair measures are necessary.

- Keep the sensing face and, if applicable, the clear space free from deposits, foreign bodies and fittings.

It is not possible to repair the unit.

- After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

## 13 Factory settings

Parameter	Factory setting
P-n	0 (PnP)
dAP	0
FOUx	1 (OU)
ou1	3 (Hno / hysteresis function, NO)
SP1 (FH1)	25
rP1 (FL1)	20
ou2	16 (OFF / Output Off)
SP2 (FH2)	50
rP2 (FL2)	45
ou3	16 (OFF / Output Off)
SP3 (FH3)	75
rP3 (FL3)	70
Sensitivity	2 (Hi / High)
LED mode	3 (ALL_On)

Parameter	Factory setting
Orientation	0 (bottom / connector at bottom)
Minimum recognition threshold	128