GB

Operating instructions

Binary level sensor for overflow prevention / leakage detection according to WHG

LI213x

11462742 / 00 07 / 2022

Contents

1 Preliminary note

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

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 described here is approved according to WHG (German Federal Water Act, federal law applicable in the Federal Republic of Germany). If the device is used as an overflow prevention or leakage sensor according to WHG, the respective “Technical Description” (only available in German) must be observed in addition to this documentation.

The device monitors the level (point level) and the temperature of liquid media in tanks.

It is particularly suitable for monitoring the overfilling of tanks as part of an overflow prevention system according to WHG.

It is also particularly suitable as part of a leakage detection system in accordance with WHG to monitor the leakage of liquid media in collection rooms, collection systems, inspection chambers and hoppers.

3.1 Type designation

Level sensor type LI213x (x = probe length coded).

3.2 Application area

Water, hydrous media, oils, oil-based media, emulsions.

3.3 Restriction of the application area

- Use the product only for media to which the wetted materials are sufficiently resistant (→ Technical data sheet).
- The device is not suitable for hygienic areas.
- The device is not suitable for applications where the probe is subjected to permanent and high mechanical stress (e.g. bulk materials, abrasive media or fast flowing media containing solid particles).
- Highly conductive foam can trigger a switching operation. Check the consequences by performing a test in your application!

4 Function

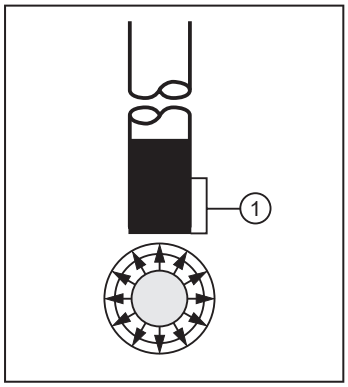
4.1 Measuring principle level

The device operates on the capacitive measuring principle. It detects by direct contact with the medium whether the requested level (point level) is reached.

The relative permittivity of a medium is important for its detection (formerly: dielectric constant). Media with a relative permittivity greater than 1.8 are reliably detected.

Electrically conductive and non conductive media are detected.

Relative permittivity (dielectric constant) of common media	
Mineral oil	≈ 2
Coolant emulsion	≈ 25...75
Glycol	≈ 37
Water	≈ 80



The device operates with radial detection characteristics. Therefore, media below the active zone (1) are not detected.

When perfectly adjusted, the presence of certain media can be detected while build-up or foam is suppressed.

4.2 Measuring principle temperature

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

4.3 Features of the device

- The device versions are offered with different probe lengths.
- Point level selectable by the installation length.
- Parameter setting via teach button or IO-Link.
- The device has two switching outputs:
  - Output OUT-OP is permanently assigned to the process value level (limit level) and is permanently designed as normally closed.
  - Output OUT2 can be assigned to either the process value level (limit level) or temperature and can be programmed as normally closed / normally open.
- Adjustment function (empty and full adjustment) to the medium to be detected.
- Defined state in case of a fault.

4.4 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

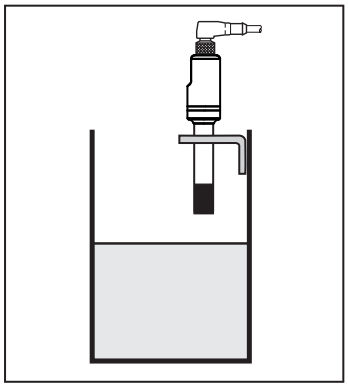
Input Output Device Description (IODD) with all parameters, process data and detailed descriptions of the device at documentation.ifm.com

IO-Link offers the following advantages:

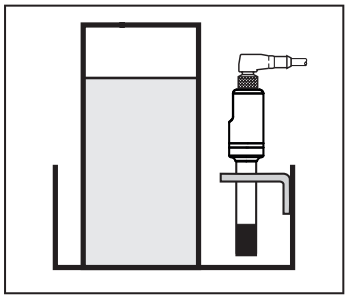
- Interference-free transmission of all data and process values
- Parameter setting in the running process or presetting outside the application
- Parameters for identifying the connected devices in the system
- Additional parameters and diagnostic functions
- Automatic backup and restore of parameter 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

4.5 Application examples

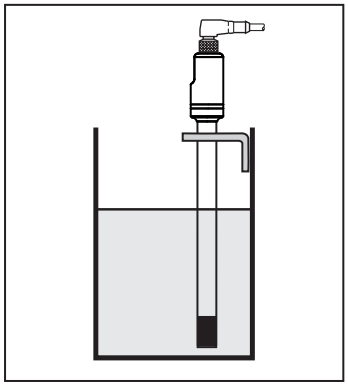
Overflow prevention in a supply tank for coolant emulsion



Leakage monitoring in the overflow vessel of a hydraulic power pack



Minimum level monitoring



5 Installation

5.1 Mechanical installation

The installation position is vertical, the required immersion depth until the response level is reached must be taken into account during installation Determining the installation depth, installation distances (→ 9)

Screw-in or flange adapters are available for installation. After attaching this mounting accessory, the probe can be passed through the opening. Use the enclosed stainless steel tube clip to determine the setting value (installation height). The tightening of the coupling nut allows the fixation of the response level following the already completed installation.

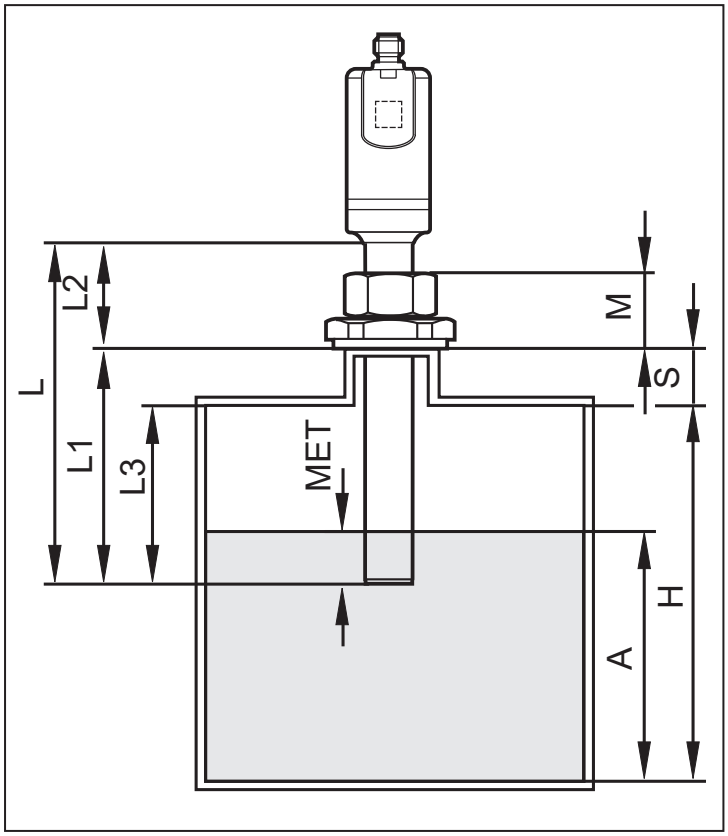
Use seals resistant to media.

5.2 Determining the installation depth, installation distances

The installation depth must be selected so that the active zone (MET) is safely covered by the liquid to be monitored and the medium is safely detected.

The immersion depth at which the device switches depends on the medium and the installation situation and is a maximum of 28 mm. Use suitable mounting accessories and enclosed stainless steel tube clip to set and mark the response level.

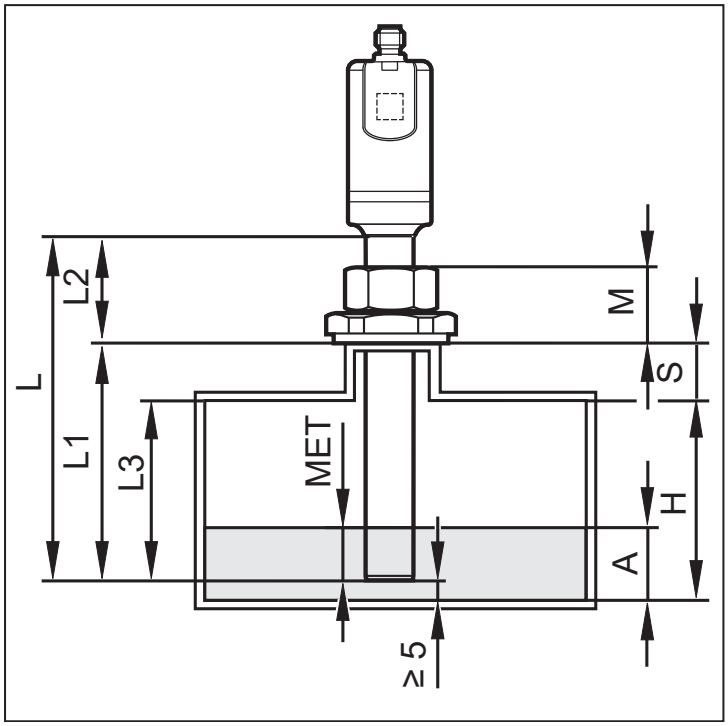
Application as overflow prevention:



A: Response level
H: Tank height
L: Probe length
L1: Insertion depth
L2: Outside length
L3: Installation depth (min.: 60 mm)
M: Height mounting adapter
MET: Maximum immersion depth (active zone) = 28 mm
S: Nozzle height

▶ Make sure that the active zone is at least 20 mm away from metallic tank walls or structures in the tank and at least 5 mm from the tank floor.

Application as leakage detection:



A: Response level
H: Tank height
L: Probe length
L1: Insertion depth
L2: Outside length
L3: Installation depth (min.: 60 mm)
M: Height mounting adapter
MET: Maximum immersion depth (active zone) = 28 mm
S: Nozzle height

▶ For early detection of a leakage, the installation depth should be as long as possible and the response level as low as possible (distance of the device from the bottom of the collection system ≥ 5 mm).

▶ Make sure that the active zone is at least 20 mm away from metallic tank walls or structures in the tank.

6 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:

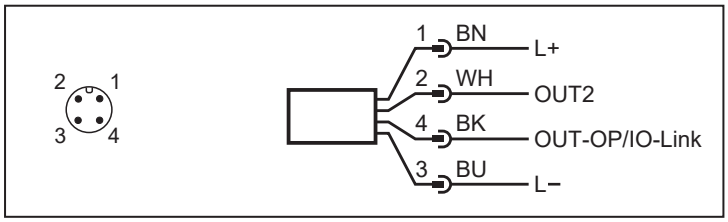


Fig. 1: Wiring diagram (colours to DIN EN 60947-5-2)

BK:	Black	BN:	Brown
BU:	Blue	WH:	White

Pin	Connection
1	L+
3	L-
4 (OUT-OP)	• Switching output (normally closed) • IO-Link
2 (OUT2)	• Switching output (NC / NO programmable)

7 Parameter setting

On delivery, the device is set to detecting low dielectric media (e.g. oils and oil-based media). In many cases the factory setting is sufficient, so that no further settings are required.

▶ Check the function by performing an application test.

In case the factory settings are not sufficient:

▶ Adapt the device to the application.

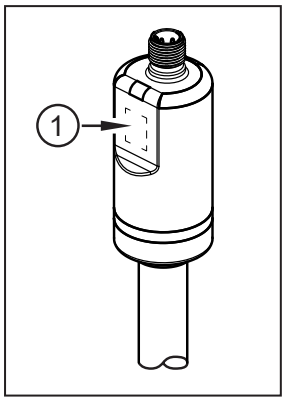
The device can be configured using the inductive teach button or via IO-Link. Some functions are only available via IO-Link.

Ensure that no malfunctions or hazardous conditions occur in the system.
All of the following operations and the described LED behaviour refer to the factory setting.

7.1 Parameter setting via the teach button

The teach button can be used first to unlock the device and then to adjust the device sensitivity.

The inductive teach button is operated with a metal object (e.g. screwdriver 1 x 5.5 mm) by applying it flat to the teach surface. No operation is triggered by short (less than 1 s) or permanent (statical) (longer than 30 s) actuation of the button.



1: Teach button

The device sensitivity is adjusted by optionally carrying out an empty adjustment and / or a full adjustment.

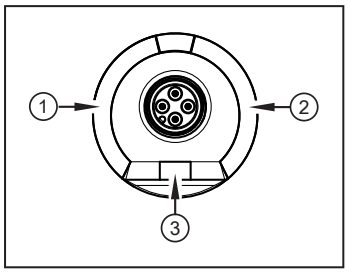
The switching thresholds (switch point and reset point) are automatically defined with the adjustment procedure.

Teach only has an effect on the process value “level” and always affects both outputs (OUT-OP and OUT2).

Any other settings can only be configured via IO-Link

The device is locked at the beginning of operation and after 120 s of inactivity (operating hurdle to avoid unintentional input of incorrect values).

7.2 Operating status and switching status indication



1: 2: LED1 (yellow) and LED2 (yellow) = switching status OUT-OP
3: LED3 (green) = operating status

Fig. 2: Top view and LEDs

*) On delivery, the two yellow LEDs (LED1 and LED2) indicate the switching status of output OUT-OP. This behaviour can be configured via IO-Link: Parameter setting via IO-Link (→ 17)

7.3 Unlock device

▶ Actuate teach button for at least 10 s.

▷ The green LED3 flashes with approx.1 Hz during the 10 s. Expiration of the 10 s is acknowledged with double-flashing (approx. 2 Hz).

▶ Release the teach button (remove metal object).

▷ The green LED is lit permanently. The device is now unlocked.

After 120 s of inactivity, the device locks itself again automatically.

▶ Initiate operations within this period.

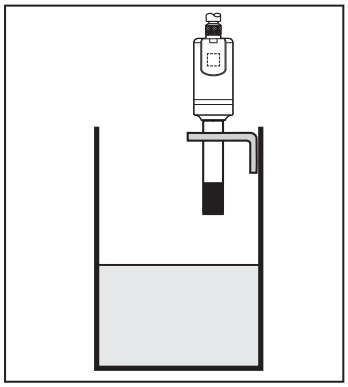
The green LED flashes by way of signalling if you try to initiate operation while the device is locked. The device remains locked if the teach button is released before 10 s have expired.

7.4 Empty adjustment

7.4.1 Application as overflow prevention or maximum monitoring

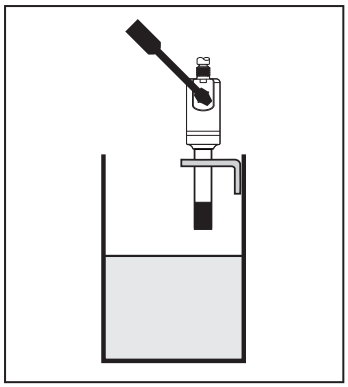
The device must be adjusted after installation in the empty tank (empty adjustment). The tank can be considered to be “empty” when the medium to be detected is min. 20 mm away from the active zone. If the installation situation or the medium is changed, it is mandatory to carry out the empty adjustment again.

If the device detects a medium after adjustment, its switching status changes.



▶ Empty the tank until the medium is at least 20 mm below the end of the probe.

▶ Unlock device



- ▶ Actuate the teach button for at least 1 s / not more than 4 s.
- ▷ First, the green LED3 is shortly extinguished, after 1 s the two yellow LEDs flash slowly (approx.1 Hz).
- ▶ Release the teach button (remove metal object).
- ▷ Successful empty adjustment is acknowledged with a double-flashing (approx. 2 Hz) of the green LED.
- ▷ The device is ready for operation.

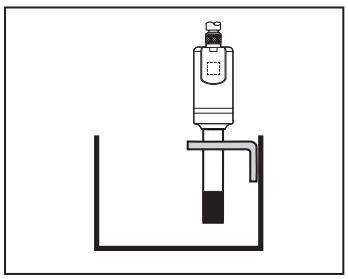
After the empty adjustment, all LEDs (LED1...3) light up.

The device is operational just with empty adjustment. However, it is recommended to carry out a “full adjustment” with the active zone being completely covered after empty adjustment. On the basis of the values for the empty state / full state the device software determines the optimum position of the switching thresholds between the two states. Using both adjustment criteria (empty and full adjustment) results in the maximum operational reliability for the application. The full adjustment can be repeated as often as you like. The stored value for the empty state is not overwritten by the full adjustment. After a new empty adjustment both values are automatically reset; the values defined last are overwritten.

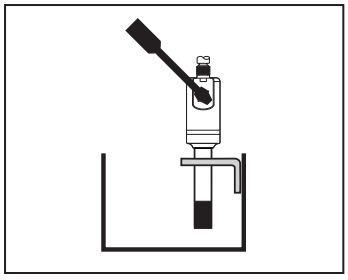
7.4.2 Application as leakage detection

The device must be adjusted after installation in the empty collection system (empty adjustment). If the installation situation is changed, it is mandatory to perform the empty adjustment again.

If the device detects a medium after adjustment, its switching status changes.



- ▶ Make sure that the collection system is empty, otherwise empty it completely.
- ▶ Unlock device



- ▶ Actuate the teach button for at least 1 s / not more than 4 s.
- ▷ First, the green LED3 is shortly extinguished, after 1 s the two yellow LEDs flash slowly (approx.1 Hz).
- ▶ Release the teach button (remove metal object).
- ▷ Successful empty adjustment is acknowledged with a double-flashing (approx. 2 Hz) of the green LED.
- ▷ The device is ready for operation.

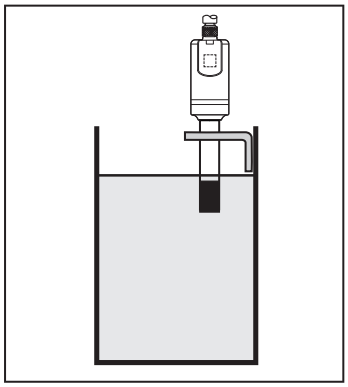
After the empty adjustment, all LEDs (LED1...3) light up.

The device is operational just with empty adjustment. However, it is recommended to carry out a “full adjustment” with the active zone being completely covered after empty adjustment. It is recommended to use a test medium with the same dielectric constant as the medium to be monitored for leakage. On the basis of the values for the empty state / full state the device software determines the optimum position of the switching thresholds between the two states. Using both adjustment criteria (empty and full adjustment) results in the maximum operational reliability for the application. The full adjustment can be repeated as often as you like. The stored value for the empty state is not overwritten by the full adjustment. After a new empty adjustment both values are automatically reset; the values defined last are overwritten.

7.5 Full adjustment

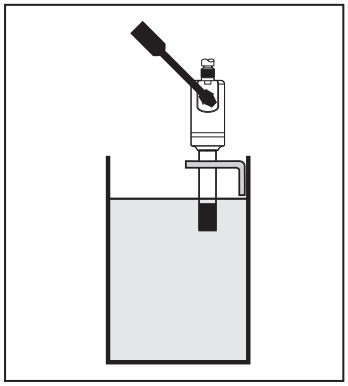
7.5.1 Application as overflow prevention or maximum monitoring

After empty adjustment the full state is to be achieved, if possible, so that the device switches (both yellow LEDs are off).



▶ Fill the tank until the active zone is completely covered.

▶ Unlock device



▶ Actuate the teach button for at least 4 s / not more than 7 s.

▷ First, the green LED3 is shortly extinguished, after 1 s the two yellow LEDs start flashing slowly (approx. 1 Hz) before flashing quickly (approx. 2 Hz) after 4 s.

▶ Release the teach button (remove metal object).

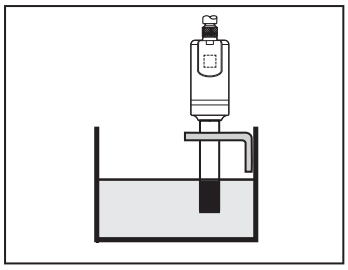
▷ Successful full adjustment is acknowledged with a double-flashing (approx. 2 Hz) of the green LED.

▷ The device is ready for operation.

After the full adjustment, both yellow LEDs are off, only the green LED is still on.

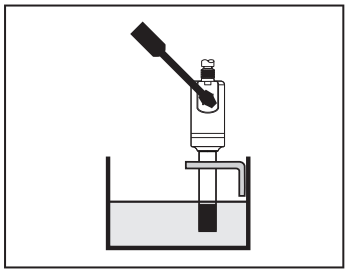
7.5.2 Application as leakage detection

After the empty adjustment, the state “probe covered” should be established, if possible, so that the device switches (both yellow LEDs are off).



▶ Fill the collection system or simulate the full state in a suitable way with a test tank filled with a test medium until the active zone is completely covered.

▶ Unlock device



▶ Actuate the teach button for at least 4 s / not more than 7 s.

▷ First, the green LED3 is shortly extinguished, after 1 s the two yellow LEDs start flashing slowly (approx. 1 Hz) before flashing quickly (approx. 2 Hz) after 4 s.

▶ Release the teach button (remove metal object).

▷ Successful full adjustment is acknowledged with a double-flashing (approx. 2 Hz) of the green LED.

▷ The device is ready for operation.

After the full adjustment, both yellow LEDs are off, only the green LED is still on.

7.6 Parameter setting via IO-Link

After a factory reset the device reboots and the factory settings are restored.

When the medium is changed, it may also be necessary to adapt the device settings.

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.

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

7.6.1 Parameter setting via the memory plug

A parameter set can be written to the device / can be recorded by the device via a memory plug (ifm storage module): www.ifm.com.

In order to allow for data to be written from the memory plug to the device, the device must have the factory setting.

If the device has been configured, the memory plug records the parameter set which can then be transferred to other devices of the same type.

- ▶ Load a suitable parameter set (e.g. from a PC or from a device of the same type) to the memory plug.
- ▶ Connect the memory plug between device and socket.
- ▷ Device with factory setting:
  When voltage is supplied, the parameter set is transferred from the memory plug to the device.
- ▷ Device with changed settings:
  When voltage is supplied, the memory plug records the parameter set of the device.
- ▶ Remove the memory plug.
- ▶ Put the device into operation.

More information on the memory plug: → Documentation www.ifm.com.

7.7 Adjustable parameters and system commands

Parameter	Options
SEL2	Assignment of the switching output OUT2 to the process value: [LEVL] = level[1)] [TEMP] = temperature
P-n	Output polarity for the switching outputs: [PnP] = positive switching [nPn] = negative switching
ou2	Output configuration for switching output OUT2 (level / temperature) [Hno] = hysteresis function / normally open [Hnc] = hysteresis function / normally closed [Fno] = window function[2)] / normally open [Fnc] = window function[2)] / normally closed [OFF] = output OFF (high impedance)
SP-OP - LEVL	Switch point for switching output OUT-OP (overflow prevention / leakage detection)
	[SP-OP] must be greater than [rP-OP]. If the [SP-OP] is set below the [rP-OP], this will be rejected by the device software.
	The values for [SP-OP] / [rP-OP] are set in per cent of the maximum process value. The process value is defined as follows: Process value in the air (not predamped): approx. 0 % Process value in tap water = approx. 100 %[3)]
rP-OP - LEVL	Reset point for switching output OUT-OP (overflow prevention / leakage detection)
SP2 - LEVL	Switch point for switching output OUT2 (level)
	[SP2] must be greater than [rP2]. If the [SP2] is set below the [rP2], this will be rejected by the device software.
rP2 - LEVL	Reset point for switching output OUT2 (level)
SP2 (FH2) - TEMP	Switch point for switching output OUT2 or upper limit with window function for temperature ([SEL2]=[TEMP]).

Parameter	Options
SP2 (FH2) - TEMP	[SP2 (FH2)] must be greater than [rP2 (FL2)]. If the [SP2 (FH2)] is set below the [rP2 (FL2)], this will be rejected by the device software.
rP2 (FL2) - TEMP	Reset point for switching output OUT2 or lower limit with window function for temperature ([SEL2]=[TEMP]).
dS2	Switch-on delay[4]) for OUT2. Setting range 0.0...10.0 s
dr2	Switch-off delay[4]) for OUT2. Setting range 0.0...10.0 s
FOU2	Response of OUT2 in case of a fault: [OFF] = switching output switches OFF in case of a fault. [On] = switching output switches ON in case of a fault. [OU] = switching output reacts according to process value, if possible.
uni.T	Selection of the temperature unit: [°C] = temperature is displayed in °C (degrees Celsius) [°F] = temperature is displayed in °F (degrees Fahrenheit).
Lo.T	Minimum value memory for the temperature
Hi.T	Maximum value memory for the temperature
LED mode	Indication of the switching states by LEDs: [OUT-OP] = Both yellow LEDs (LED1 and LED2) indicate the switching status of output OUT-OP. [OUT-OP+OUT2] = LED1 indicates the switching status of OUT-OP and LED2 the switching status of OUT2.
Access locks to the device. Local parameter setting	[Open] = Parameter setting via teach button is permitted. [Locked] = Parameter setting via teach button is locked.

[1]) This setting is not possible in combination with [ou2] = [Fno] or [Fnc].

[2]) This setting is only possible in combination with [SEL2] = [TEMP].

[3]) Tap water in a grounded metal tank

[4]) Response according to VDMA. According to VDMA the switch-on delay always has an effect on SP, the switch-off delay always on rP irrespective of whether the normally open or normally closed function is used.

System commands	
Reset to factory settings	Restore delivery state (factory settings)
Empty teach	Empty adjustment, automatically sets the switching thresholds for level.
Full teach	Full adjustment to medium, automatically sets the switching thresholds for level.
Reset [Hi.T] and [Lo.T]	Reset maximum and minimum value memory
Flash On	Visual signalling (double-flashing) for localisation ON. The signalling ends automatically after 1 minute.
Flash Off	Visual signalling (double-flashing) for localisation OFF
Start simulation	Start simulation The process value for level is set to 100 %, output OUT-OP opens.
Stop simulation	Stop simulation The process value for level is set to the real value again.

7.8 Parameter setting examples via IO-Link

7.8.1 Application as overflow prevention or maximum monitoring

- ▶ Set switching output OUT2 to temperature detection.
  Example: [SEL2] = [TEMP]
- ▶ The temperature output OUT2 shall be employed as alarm output (as normally closed with a high temperature threshold). Example: [ou2] = [Hnc]
- ▶ Set the alarm temperature to 80°C.
  Example:
  [SP2 (FH2)-TEMP] = 80;
  [rP2 (FL2)-TEMP] = 75.
- ▶ Transfer the parameter data to the device
- ▶ Carry out the empty adjustment by executing the system command [Empty Teach].
- ▶ If possible, carry out a full adjustment to the medium to be detected:
  Fill the tank until the active zone of the device is completely covered.
  Notes: → Empty adjustment and full adjustment.
- ▶ Execute the system command [Full Teach].

Any other settings are left at factory setting.

7.8.2 Application as leakage detection

- ▶ Make sure that the collection system is empty, otherwise empty it completely.
- ▶ Carry out the empty adjustment by executing the system command [Empty Teach].
- ▶ If possible, carry out a full adjustment to the medium to be detected:
  Fill the collection system until the active zone of the device is completely covered.
  Notes: → Empty adjustment and full adjustment.
- ▶ Execute the system command [Full Teach].

Any other settings are left at factory setting.

8 Operation

8.1 Function check

After power-on the device is in the 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.

8.2 Operation indication by LEDs (factory setting)

Both yellow LEDs (LED1 and LED2) indicate the switching status of output OUTOP.

The switching status of output OUT2 is not indicated by LEDs in the factory setting.

Operating status	LED1 (yellow) (OUT-OP)	LED2 (yellow) (OUT-OP)	LED3 (green) (Operating voltage)
Device ready for operation, no medium detected	OFF	OFF	ON
Device ready for operation, medium detected	ON	ON	ON
No operating voltage / operating voltage too low	OFF	OFF	OFF
Short circuit OUT-OP	flashes at 4 Hz		ON
Short circuit OUT2	flashes at 4 Hz		ON
Error / failure	OFF	OFF	flashes at 8 Hz
Visual signalling for localisation	double flashing at 1 Hz		ON
Teach operation	→ Parameter setting via the teach button		
Fault during the teach operation	Flashes at 8 Hz yellow/green for 2 s		
Teach with the device locked → Unlock device	X	X	flashes at 1 Hz

9 Maintenance, repair and transport

- ▶ Avoid the formation of deposits and soiling at the sensor element.
- ▶ To avoid damage to the device, no hard or sharp objects must be used when cleaning the device manually.
- ▶ It is not possible to repair the unit.
- ▶ After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.
- ▶ Check the device and the mounting adapter at regular intervals and tighten again, if necessary.

After removal of the device or a change of media with dielectric constants that differ greatly (e.g. oil / water) another adjustment should be carried out.

10 Factory setting

Parameter	Factory setting	User settings
SP-OP - LEVL	5 %	
rP-OP - LEVL*)	4.5 %	
ou2	Hno	
SP2 - LEVL	5 %	
rP2 - LEVL	4.5 %	
SP2 (FH2) - TEMP	65 %	
rP2 (FL2) - TEMP	62 %	
ds2	0.0	
dr2	0.0	
FOU2	OFF	
uni.T	°C	
LED mode	OUT-OP	
SEL2	LEVL	
P-n	PnP	
Lo.T	---	
Hi.T	---	