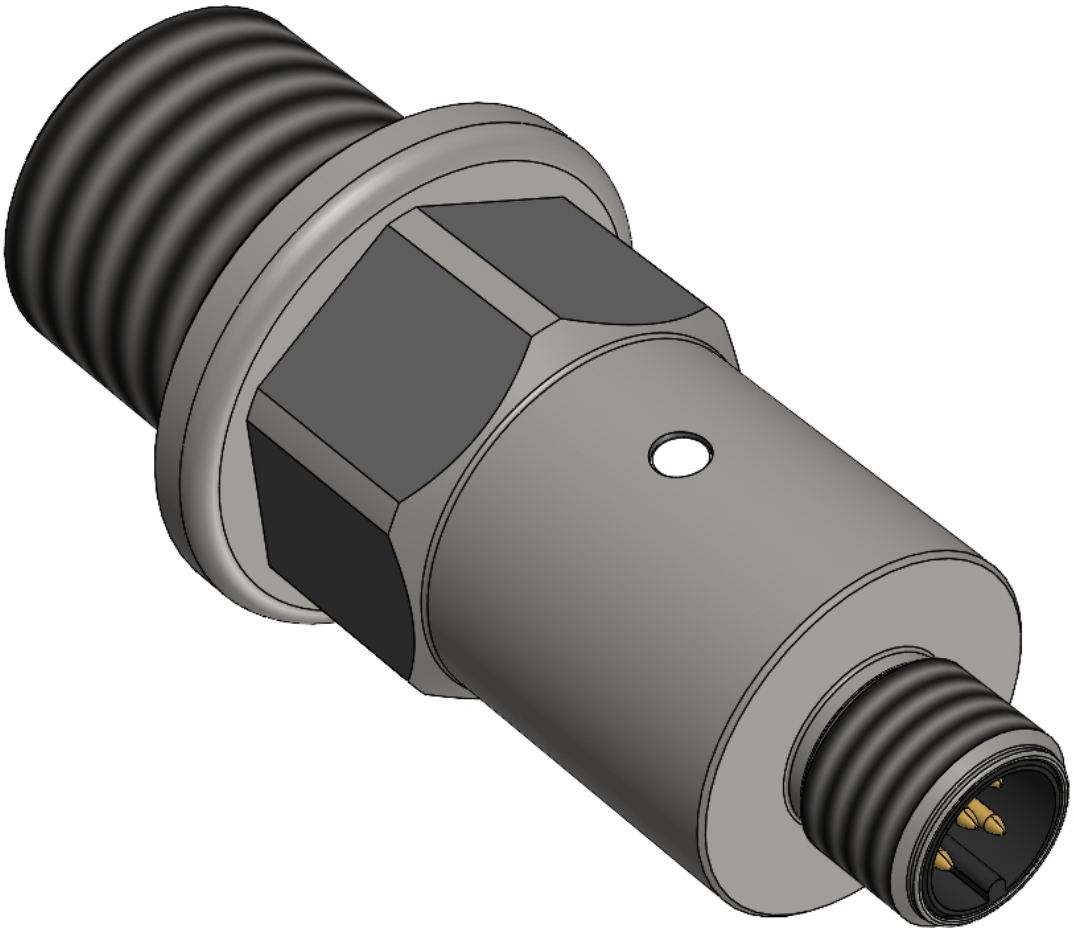
# CALIS CAS series

## Original operating instructions



IO-Link

*CAS-MQEU-M01-xxxx*

# Table of contents

# 1 Foreword

These operating instructions have been written for installers and operators and must be kept for future reference. Read these operating instructions carefully and ensure that you have fully understood the contents before installing or working with the probe.

# 2 Safety

## 2.1 Notes and symbols used

Warnings for personal injury / damage to property are designed according to the "SAFE" principle. This means that they contain information on the type and source of the hazard, possible consequences and how to avoid and prevent the hazard. The following hazard classifications apply to the safety instructions:

**⚠ DANGER**

Danger indicates a hazardous situation; failure to comply will result in death or serious injury. The symbol in front of the warning indicates the type and source of the danger graphically.

**⚠ WARNING**

Warning indicates a hazardous situation; failure to observe this warning may result in death or serious injury. The symbol in front of the warning indicates the type and source of the danger graphically.

**⚠ CAUTION**

Caution indicates a hazardous situation; failure to observe this warning may result in injury. The symbol in front of the warning indicates the type and source of the danger graphically.

***NOTE***

Note indicates a situation, non-observance can lead to material damage and impair the function of the product.

**TIP**

Tip provides additional and useful information on handling the product.

| Icon | Meaning |
|---|---|
| ▸ | Avoiding and averting the danger in the warning notice |
| 1.<br>2.<br>... | Instruction for action<br>All instructions for an action process are always written and listed in chronological order. |
| ▪ | List |

**⚠ WARNING**

If the sensor is used as a safety component, people can be seriously injured or killed!

- Do not use the sensor as a safety component.

A laser of laser class 1 DIN EN 60825-1:2015-7 is installed in the CALIS level sensor.


**⚠ WARNING**

**Improper work on electrical systems!**

Electric shock can cause fatal or life-threatening injuries.

- Before working on electrical systems, de-energize them and secure them against being switched on again.
- Work on electrical systems may only be carried out by qualified personnel in accordance with local and national electrical regulations and provisions.

## 2.2 Personnel qualification

A qualified electrician is a person with suitable technical training, knowledge and experience as well as knowledge of the relevant standards, who can assess the work assigned to them accordingly and recognize potential hazards.

## 2.3 Intended use

The sensor continuously measures the distance to an object and, depending on its use, calculates the fill level in a container. The sensor is intended for use in accordance with the points and values listed here in chapter 9, "Technical data".

- Only connect to an overcurrent protection device.
- Only connect to a SELV source in accordance with HD 60364-4-41:2007, 414.3 or comparable.

## 2.4 Reasonably foreseeable misuse

Any use other than that specified in chapter 2.3, "Intended use" or use beyond this is considered improper use.

The sensor is not suitable for the following applications:

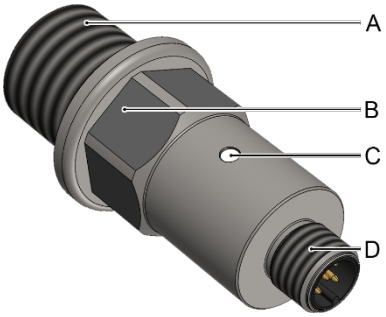
- Safety component according to Directive 2006/42/EC
- Potentially explosive atmospheres
- Areas with high direct or indirect ambient light exposure
- Railroad sector (rail traffic).

# 3 General description

The CAS-MQEU-M01-xxxx is a non-contact level sensor that uses optical time-of-flight measurement to measure the distance to the object, which it converts into a level based on calibration points taught in by the operator and makes this available via an analog signal.

Both the measured distance and the level determined according to the calibration are output via the serial IO-Link interface.

In addition, the fill level sensor outputs a switching signal via the digital interface at a defined fill level after appropriate configuration by the operator.




| | |
|---|---|
| A | Process connection |
| B | Wrench flat 23 |
| C | Status display<br>▪ LED lights up: Ready for operation<br>▸ green: high fill level<br>▸ yellow-orange: changes as the fill level drops<br>▸ red: low fill level<br>▪ LED flashes:<br>▸ red: fill level < 5 %<br>▸ orange: Error message |
| D | M12 connection |

# 4 Installation

***NOTE***

Incorrect installation can lead to incorrect measurement results or damage to the sensor.

- Observe the minimum distance between the sensor and the side walls.
- Check the mounting surface for evenness and cleanliness.
- During installation, apply a chemical threadlocker to the process connection to suit the operating conditions.

## 4.1 Determine the minimum distance to the side walls

The infrared, non-visible light beam spreads out with an opening angle and creates a light spot depending on the distance. The diameter of the light spot as a function of the distance to the exit surface of the light beam is listed in the following table. Boundary walls of the tank must not penetrate the light cone along the beam. The maximum necessary distance is required at the minimum fill level and is calculated as follows.

1. Measure the distance between the sensor and the medium at minimum level.
2. Select the corresponding Ø light spot from the table below.
3. The minimum distance to the tank wall = Ø light spot / 2 + 10 mm.

Example: Distance between sensor and medium at minimum level is 400 mm (resulting diameter of the light spot 192 mm).

192 mm / 2 + 10 mm = 106 mm

Mount the sensor approx. 110 mm from boundary surfaces.

| Distance from sensor (mm) | Ø light spot (mm) |
|---|---|
| 60 | 28,8 |
| 80 | 38,4 |
| 100 | 48,0 |
| 120 | 57,6 |
| 140 | 67,2 |
| 160 | 76,8 |
| 180 | 86,4 |
| 200 | 96,0 |
| 300 | 144,0 |
| 400 | 192,0 |
| 500 | 240,0 |
| 600 | 288,0 |
| 800 | 384,0 |
| 1000 | 480,0 |
| 1200 | 576,0 |

## 4.2 Installation implementation

Requirements: Mounting surface is even and clean.

1. De-energize the system and secure it against being switched on again.
2. Screw the sensor into the thread provided in the container.
3. Check that the plug and socket are clean and clean them if necessary.
4. Connect the plug and the socket.
5. Connect the probe electrically according to the terminal assignment.

# 5 Operation

Continuous measurement begins <1 second after the power supply is switched on. If no valid value is measured within 5 minutes, the sensor restarts.

The analog signal corresponds to a fill level between 0 % (4 mA) and 100 % (20 mA). The fill level is determined from the measured distance according to the configuration used.

The sensor is connected to an IO-Link master and a computer for operation. The following actions

are possible:

- Identify sensor
- Read out current process data
- Read out diagnostic data
- Configure sensor

To read out sensor data and change parameters, connect the device to an IO-Link master. For more information on connecting to the IO-Link master, please refer to the documentation for the IO-Link master. Load the device-specific IODD.

The user interface has the following four tabs:

- **Identity:** Information on the manufacturer and product, including IDs.
- **Firmware update:** Option to install new device firmware.
- **Specialist:** Information on current process data, device features and diagnostics as well as carrying out parameterization.
- **Events:** Information on events such as errors and warnings.

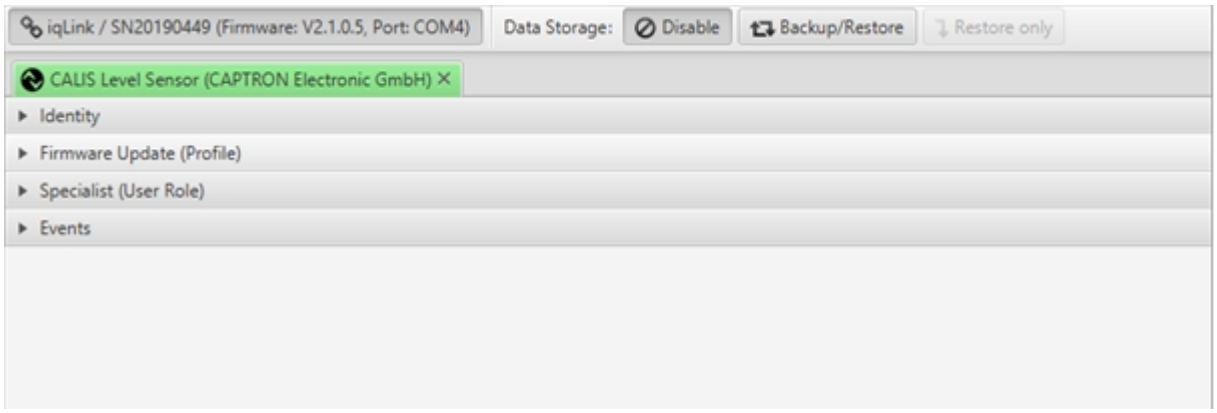



Figure 1 - Four tabs of the user interface

## 5.1 Identity tab

The *Identity* tab lists the basic data on the manufacturer and product, including the pin assignment.

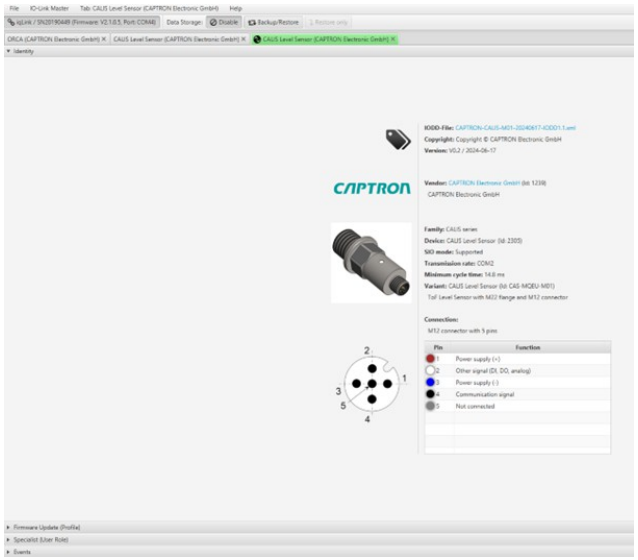


Figure 2 - Identity tab

## 5.2 Firmware Update tab

If new firmware is required, the software is stored here and saved on the sensor.
The firmware is provided by CAPTRON.

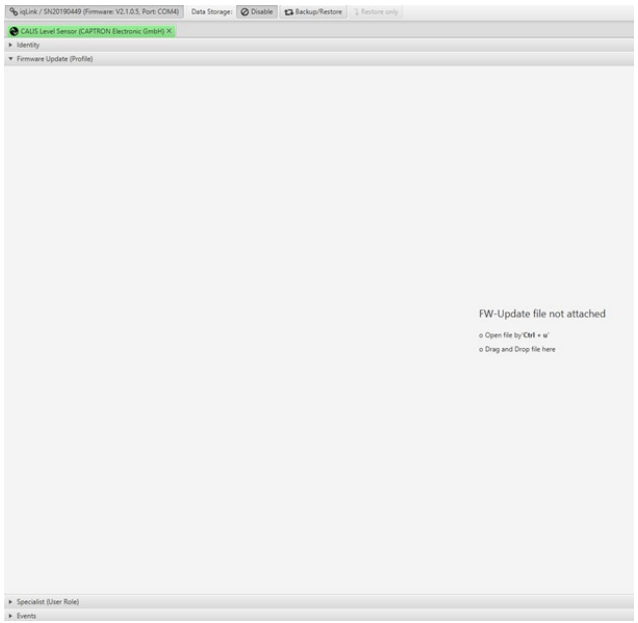



Figure 3 - Firmware update tab

## 5.3 Specialist tab

The sensor is parameterized and calibrated in the *Specialist* tab.

The *Specialist* tab is divided into the following five sub-tabs:

- Process data
- Identification
- Parameters
- Monitoring
- Diagnosis

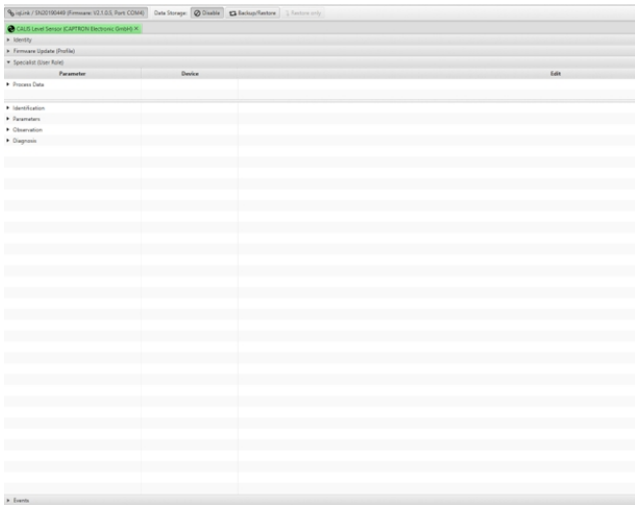


Figure 4 - Specialist tab

## 5.4 Process data sub-tab

The measured distance, the calculated fill level and the logical status of the digital output are displayed in the *process data*. ("see Figure 5 - Process Data", field 1).

If the resulting values for the 0 % and 100 % levels are within the measuring range of the probe during calibration, the both negative values and values above 100 % are displayed.

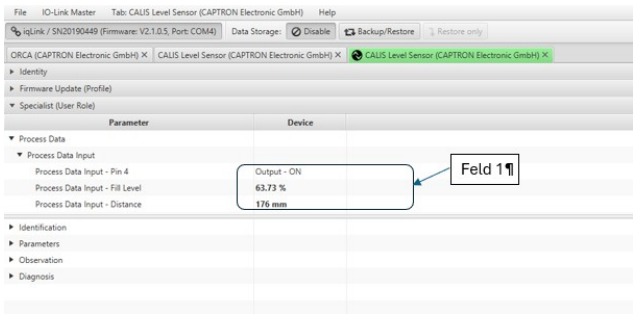



Figure 5 - Process Data

## 5.5 Identification sub-tab

In addition to the information in section 5.1, "Identity tab", further information such as details of the hardware and firmware versions are listed, as well as options for assigning tags to the application, function and location ("see Figure 6 - Identification", field 1).

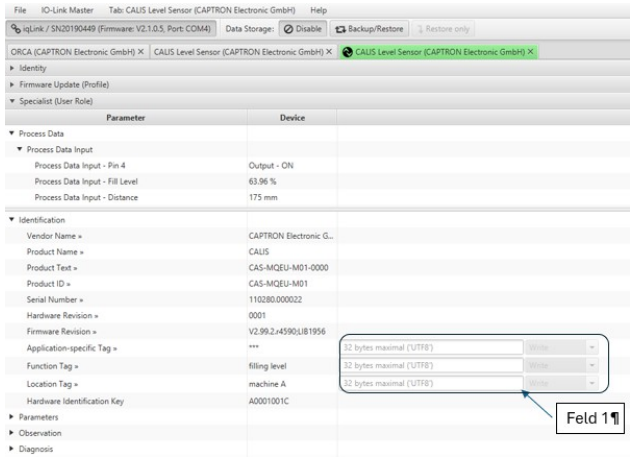



Figure 6 - Identification

## 5.6 Parameter sub-tab

The *Parameters* sub-tab has several sub-chapters.

**TIP**

Each changed value must be saved using the "Write" button. If several values have been changed, the "Write all" button can be pressed.

## 5.7 Configuration of the measurement - distance for overfill warning

Below a distance defined as fill level 100 %, a threshold can be defined that is to be used to signal an overfill ("see Figure 7 - Overfill warning distance", field 1).
If this distance is reached or undershot, the value 2 mA is output at the analog output and the LED flashes 5 times repeatedly.

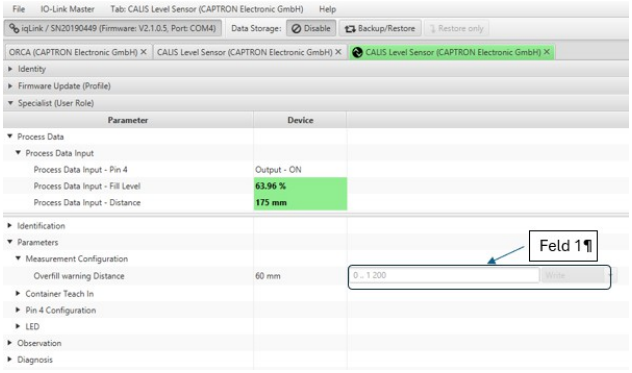



Figure 7 - Overfill warning distance

## 5.8 Adjustment of the sensor (fill level to distance) - Container Teach in

Up to 6 calibration points can be used, between which the level is calculated by linear regression as a function of the distance from the sensor. At least
2 adjustment points ("High level" and "Low level") must b used.

- The fill level for each calibration point must be entered manually ("see Figure 8 - Container Teach in", field 1).
- the distance can either be entered manually ("see Figure 8 - Container Teach in", field 2).

  Or

- By filling the container to the corresponding fill level and pressing the *"Calibrate ... Level"* or *"Set Additional Reference x"* you can
  the sensor measures the associated distance for the corresponding calibration point.
  ("see Figure 8 - Container Teach in", field 3)


Figure 8 - Container Teach in

Irrational definitions such as greater distance at higher fill levels are interpreted by the sensor as

error is detected and displayed by the flashing LED.
At the same time, this error is listed in the *Event* tab.

The following default values are set at the factory:

- High level 100 % and 40 mm
- Low level 0 % and 1200 mm
- all "additional references" - 1 (not set)

As a result, there is a linear relationship between the distance over the entire measuring range and the current value.

## 5.9 Pin 4 Configuration

Pins 4 can be configured as switching points. The following table shows which configurations are possible.

| PIN | Signal | Description |
|---|---|---|
| 4 | Switching output<br>IO - Link communication | PNP / NPN or push-pull; NO / NC |

- Define function with the drop-down list *Pin 4 Function* ("see Figure 9 - Pin 4 configuration", field 1).
  - Default value is PNP.
- Define output with the drop-down list *Output Function* ("see Figure 9 - Pin 4 configuration", field 2).
  - Default value is NO.
- Enter the switching point as a percentage value in the *Output Set Point* field ("see Figure 9 - Pin 4 configuration", field 3).
  - Default value is 50%.
- Enter the reset value of the switching point in the *Output Hysteresis* field as a percentage value ("see Figure 9 - Pin 4 configuration", field 4).
  - Default value is 10%.
- Enter the minimum length of the output pulse in the *Output Minimum Impulse Time* field.
  Default value is 300 ms ("see Figure 9 - Pin 4 configuration", field 5)
- Confirm all entered values with *Write*.

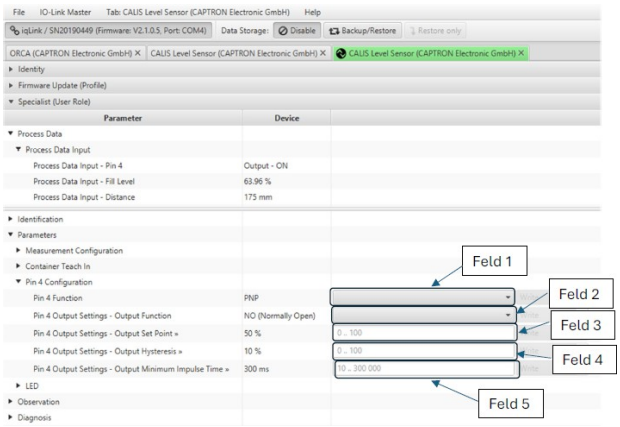



Figure 9 - Pin 4 configuration

If an output is to be closed when the level falls below a defined level, then define the output as "normally closed" and set the defined level at set point minus hysteresis and the set point is then above the defined level, quasi as a hysteresis level above the switching point.

## 5.10 Brightness of the LED

- The brightness can be set by entering a percentage value from 1 to 100 % ("see Figure 10 - Observation and Diagnosis", field 1).
  - The default value is 25 %.

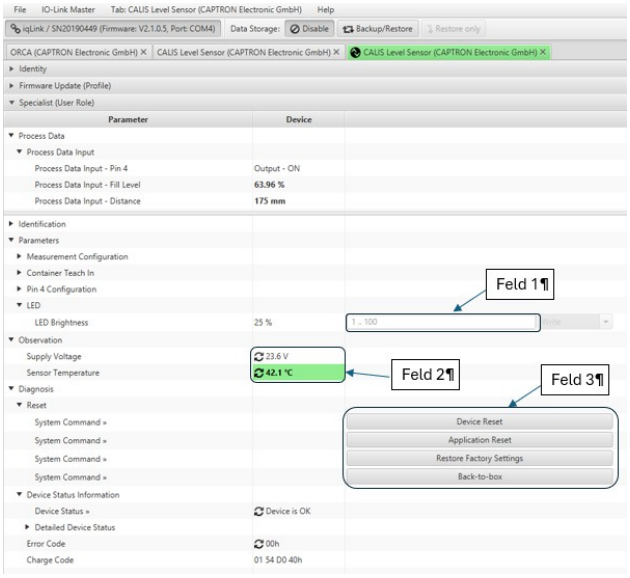



Figure 10 - Observation and diagnosis

## 5.11 Observation sub-tab

The current supply voltage level and the current temperature of the electronics in the sensor are displayed in this area ("see Figure 10 - Observation and diagnosis", field 2).

## 5.12 Diagnosis sub-tab

A reset can be performed on the sensor in this area ("see Figure 10 - Observation and Diagnosis", field 3). Four types of resets are possible in accordance with the IO-Link standard.

| Name | Description |
|---|---|
| Reset device | A warm start is triggered and the device is reset to its initial state. Communication is interrupted by the device and then restarted by the master. |
| Reset application | The parameters of the technology-specific application are set to default values. The identification parameter remains unchanged. An upload to the data memory of the master is carried out if this is activated in the port configuration of the master. |
| Restore factory settings | The device parameters are reset to the factory settings. Note: Downloading the data storage can overwrite the factory settings the next time the device is switched off and on again. |
| Back-to-Box | The device parameters are reset to the factory settings and communication is blocked until the next time the device is switched off and on again. Note: Disconnect the device directly from the master connection. |

The status of the sensor (device status) is shown in accordance with the specifications of the IO-Link standard.

The error code is only displayed temporarily as long as the error exists. The illustration shows that the container is overfilled. The following error codes are available.

| Blink Code | I0-Link error code | Description |
|---|---|---|
| 1 | 0x0001 | Internal error |
| 2 | 0x0002 | Error of an internal voltage |
| 4 | 0x0008 | Supply voltage too high / low |
| 5 | 0x0010 | Container overfilled / sensor error |
| 8 | 0x0080 | Parameter memory error |
| 9 | 0x0100 | Parameter error |
| 12 | 0x0800 | LED error |
| 13 | 0x1000 | Load on digital output too high |
| 15 | 0x4000 | Temperature too high |

## 5.13 Events tab

The *Event* tab provides a log book. The following events can be recorded.

| Event no. | Type | Definition and recommended action |
|---|---|---|
| 16912 | Warning | Overheating of the appliance - remove the heat source |
| 20496 | Error | Hardware malfunction - device replacement |
| 20752 | Warning | Supply voltage too high - Check supply voltage |
| 20753 | Warning | Supply voltage too low - Check supply voltage |
| 25376 | Error | Parameter error - check set values according to data sheet |

# 6 Maintenance

Clean the front screens of the sensor regularly depending on how dirty they are used.

# 7 Dismantling

1. De-energize the system and secure it against being switched on again.
2. Disconnect the electrical connection and remove the sensor.

# 8 Waste disposal

Electrical and electronic components of various types must be sorted for recycling. All applicable state, federal and local laws and regulations must be complied with without restriction.

# 9 Technical data

| | |
|---|---|
| Operating voltage | DC 24 V (16.8...30.0 V)<br>for max. 0.1 s 14.4 V, for max. 1.0 s 33.6 V |
| Process connection | V4A |
| Operating temperature | -40 °C (-40 °F)...+70 °C (158 °F) |
| Storage temperature | -40 °C (-40 °F)...+70 °C (158 °F) |
| Protection class IP | IP67 |
| Analog interface | 4 ... 20 mA (0 % ... 100 % fill level) 2mA<br>for warning threshold and error |
| Digital output | PNP, NPN, PushPull; NO/NC |
| Communication interface | IO-Link version 1.1 |
| Measuring principle | ToF |
| Laser class (IEC 60825-1:2015-7) | 940 nm Class 1 |
| Measuring range | 40 mm -1200 mm |
| Accuracy | +/- 20 mm at 20 °C |
| Standby time | <1 s |
| Response time | 2,2 s |
| Operating current (IB) | 85.1 mA at 24 V and 50 mA load current at the switching output |
| Maximum output load Current output | 250 Ω |
| Inrush current | Typically 8.55 A at 24 V |
| Melting integral | Typically 123.97 $A^2\mu s$ at 24 V |
| MTBF | >780,00h at 40°C; >144,000h at 70°C |

## 9.1 Dimensioned drawing

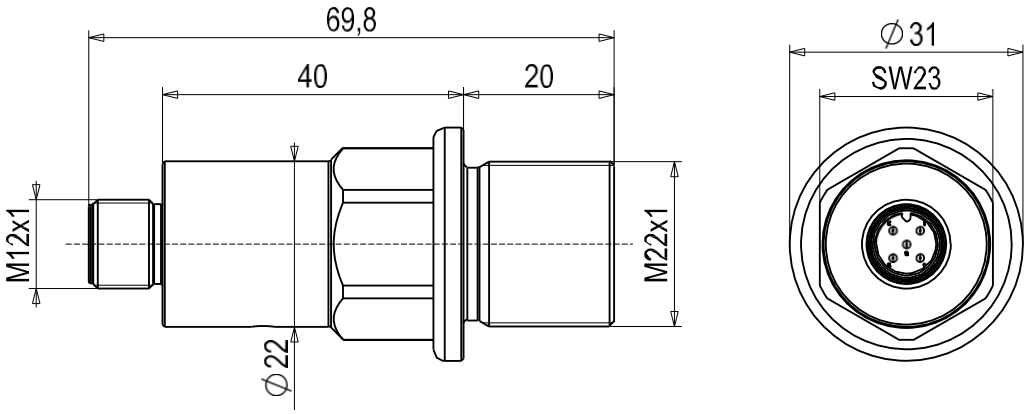
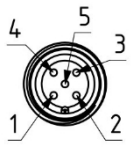



Figure 11 - Dimensional drawing

## 9.2 Pin assignment

M12 plug, 5-pin




| Pin | Signal | Description |
|---|---|---|
| 1 | $U_V$ | Operating voltage |
| 2 | Analog fill level signal | 4...20 mA (0 % ... 100 % fill level); 2 mA for warning threshold or error |
| 3 | GND | 0 V |
| 4 | Digital output<br>IO-link communication | PNP, NPN, PushPull; NO/NC |
| 5 | n.c. | - |

# 10 Manual updates

CAPTRON reserves the right to adapt the content of these instructions if necessary. The latest version can be found on our website www.captron.com.

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# 12 Imprint

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