Level probe
Operating Instructions

CLP-G5A2_-_

Table of Contents

1 Safety

1.1 Notes and symbols used

Warning notes in relation to personal injury / material damage are formulated according to the "SAFE" principle. This means they contain information on the type and source of the hazard, potential consequences as well as how to avoid and avert danger. The following hazard classifications apply in the safety notes:

⚠ DANGER

Danger designates a hazardous situation, which, if ignored, will lead to death or serious injury. The symbol next to the warning indicates the type and source of the danger.

⚠ WARNING

Warning designates a hazardous situation, which, if ignored, may lead to death or serious injury. The symbol next to the warning indicates the type and source of the danger.

⚠ CAUTION

Caution designates a hazardous situation, which, if ignored, may lead to injury. The symbol next to the warning indicates the type and source of the danger.

NOTICE

Notice designates a situation, which may cause material damages and impair the product's function if attention is not paid.

TIP

Tip provides additional useful information about the handling of the product.

Symbol/ Font	Meaning
‣	Avoiding and adverting danger in the warning note
▶	Instructions for action All instructions to be followed within a procedure are always listed in chronological order.
▪	List
Software button	Fields and buttons in the software are shown in this font.

1.2 General safety

All work on electrical systems or operating equipment may be carried out only by a specially qualified electrician according to the applicable electrotechnical regulations.

The safety of the system in which the probe is integrated is the responsibility of the operator.

1.3 Personnel qualifications

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

1.4 Intended use

The capacitive probe continuously measures the level. The probe is intended for use in accordance with the items listed here and the values from the technical specifications chapter.

- Use only with a SELV or PELV power supply.

1.5 Reasonably foreseeable misuse

Any use other than as specified in the section Intended use or extending beyond this is deemed to be improper.

The probe is not suitable for:

- use with a connection cable of more than 20 m;
- use with gaseous media;
- use in electroplating;
- use in environments with special hygiene requirements;
- use in potentially explosive atmospheres

2 Foreword

These operating instructions are intended for technicians/installers and operators and should be kept for future reference. Read these operating instructions carefully and make sure that you have fully understood the contents before installing or working with the level probe.

3 Probe installation

⚠ CAUTION

Leaking of dangerous and hot media**!**
Escaping media can injure people.

- Seal the process connection against escaping media.
- Install external limit indicator.

TIP

The use of a flat gasket is recommended. The material of the flat gasket must be selected according to the medium to be measured in the tank.

► De-energize the system and secure it against being switched on again

► Screw the probe into the thread provided in the container

► Connect the probe electrically according to the connection diagram.

► Check the container for leaks after installation.

✓ Probe is fitted.

TIP

If a probe with firmware 2.1 or lower, which is operated with the PLC via an IO-link master, is replaced, the configuration must be adapted due to the changed IODD and device ID.

4 Operation

The probe is connected to an IO-Link master and a PLC or manually to an IO-Link master and computer.

4.1 Manual operation

The sensor is controlled with an IO-Link master on the computer; the IO-Link interface of the sensor and the device-specific IODD are used

The following actions are possible:

- Identify sensor
- Read out current process data
- Read out diagnostic data
- Parameterize sensor
- Calibrate sensor

4.2 Operation with PLC

As an alternative to manual operation of the sensor, this can also be carried out automatically by the PLC using an IO-link master. The necessary information on the cyclical process data, the acyclical service data (ISDUs) and the events with the corresponding indices, their meaning and the value ranges can be found in the Technical Reference Manual (TRM).

4.3 Parameterizing the probe

The probe is supplied ex works with a standard parameterization.
If the specific application does not require it, it is not necessary to change the parameterization.

Standard parameterization:

- All PINs are set as digital outputs PNP, normally open, with switching point 50% and 10% hysteresis
- low fill level corresponds to 0% (9pF)
- high fill level corresponds to 100% (90pF)
- the LED is controlled via the device and indicates the fill level by changing color

4.4 Operating the probe with IO-Link Master

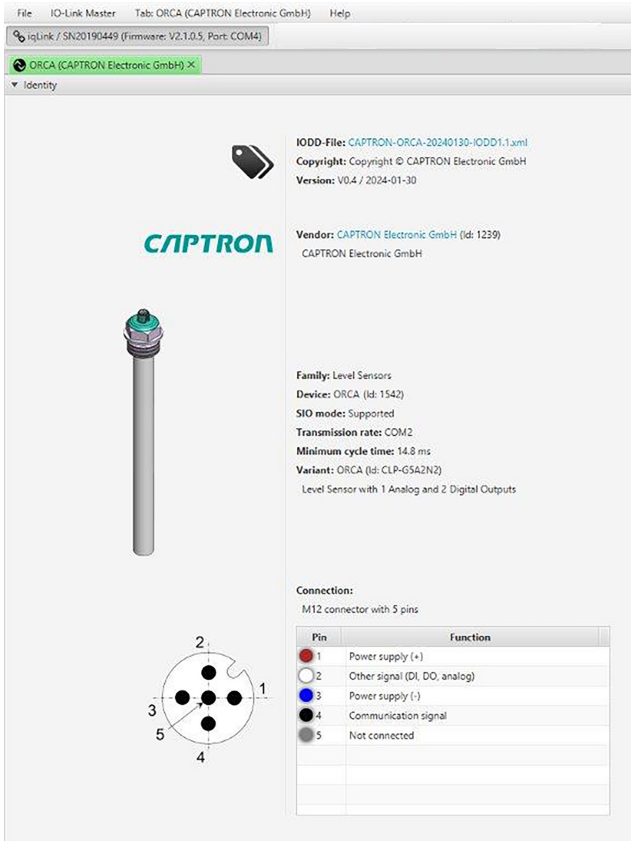
To read out sensor data, change parameters or carry out calibration, connect the device to an IO-Link master. For more information on connecting to the IO-Link master, please refer to the IO-Link master documentation.

Download the device-specific IODD from the IODD Finder page.

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

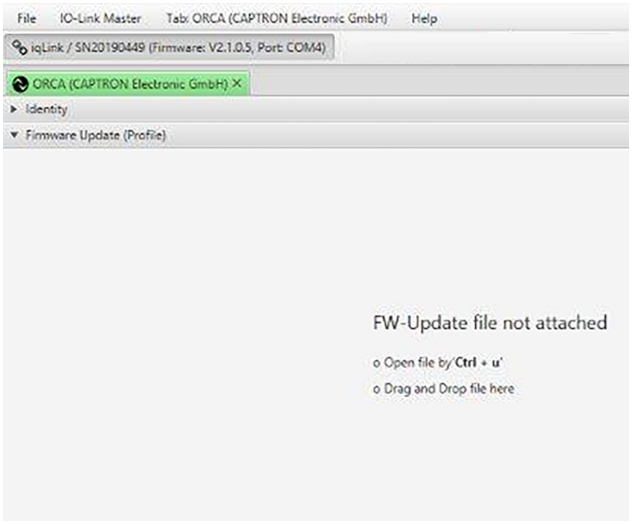
4.5 Tab Identity

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



4.6 Tab Firmware Update

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

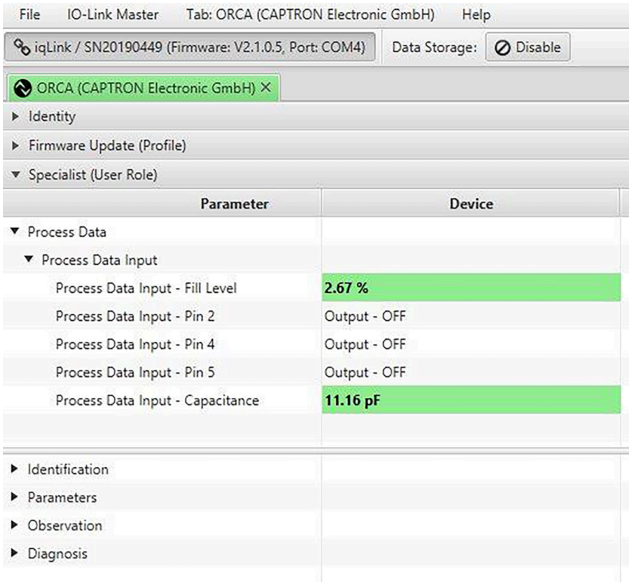


4.7 Tab Specialist

The Specialist tab is mainly used by the operator. The sensor is parameterized and calibrated here.

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

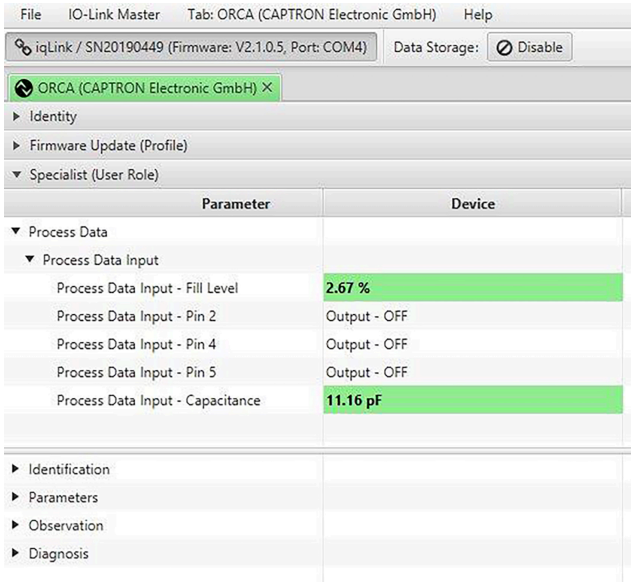
- Prozess data
- Identification
- Parameters
- Monitoring
- Diagnosis



4.7.1 Process data sub-tab

The measured capacity, the status of the outputs and the calculated fill level in % are displayed in the process data.

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

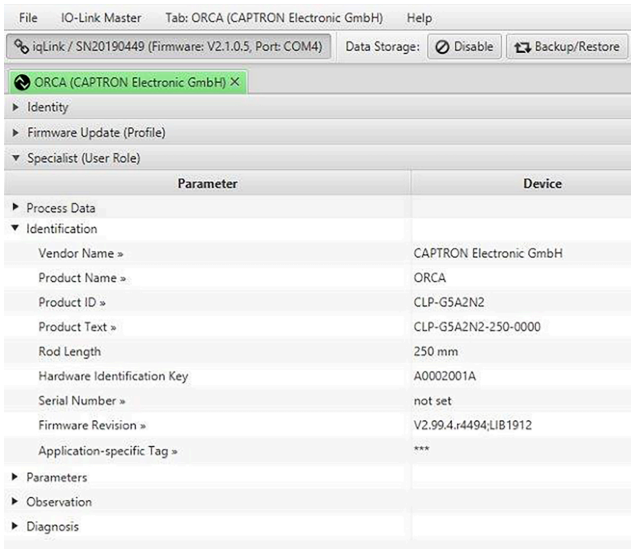


4.7.2 Identification sub-tab

In addition to the information in the “Identity” tab, this sub-tab contains further information such as information on the rod length, serial number and firmware version of the probe.

TIP

If several sensors are in use, the operator can assign a designation (e.g. name of the machine) as an application-specific tag.

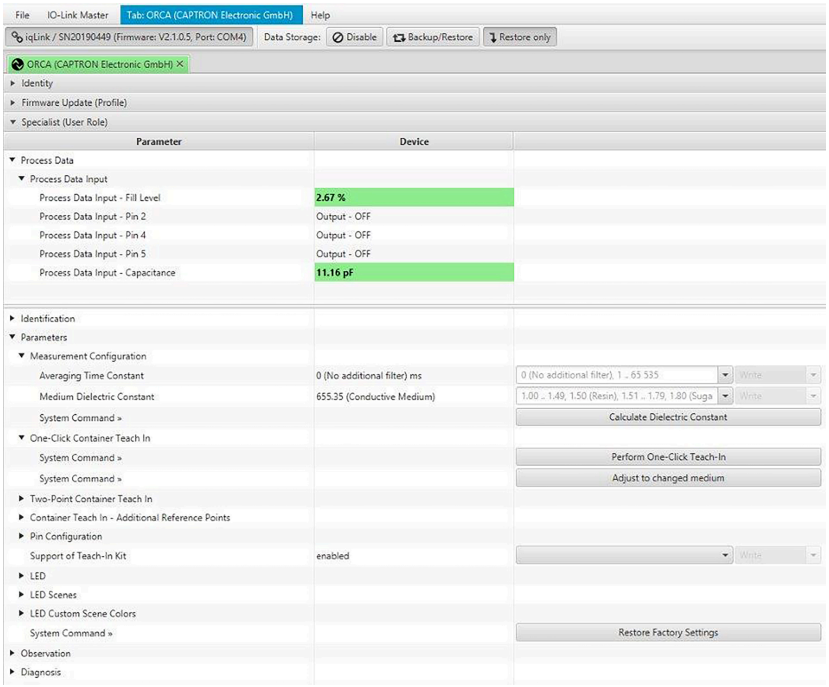


4.7.3 Parameter sub-tab

The Parameter 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



4.7.3.1 Measurement Configuration

Averaging Time Constant

The averaging of the measured value in a time range of 0 ms and 65635 ms can be set with the Averaging Time Constant. The user can therefore balance accuracy and inertia for their application. The default value is set to 0 ms ex works.

Medium Dielectric Constant

The dielectric constant (DK value) of the medium to be measured is entered. The input range is between 0 and 655.35 (conductive material). Values for some materials can be selected in the drill-down area. Further values for media are listed on the DK values page.

TIP

The dielectric constant must be entered when using the “One-click container teach-in”. With other calibration methods, the value has no influence on the measurement result.

4.7.4 Calibrating the probe

The probe must be calibrated to the container and the medium.

Calibrate the probe again after changing the container or medium.

Saved parameter sets including the calibration values can be transferred to a new probe when the probe is changed. In consultation with CAPTRON, the probe can be delivered pre-configured with the parameter sets provided.

Calibration is carried out using the following methods. The accuracy of the methods increases in ascending order.

- One-Click Container Teach in
  - Is the simplest method.

- Two-Point Container Teach in
  - Probe is alligned at two fill levels
- Multiple-Point Container Teach in
  - For a Container whose fill level does not increase linearly with height
  - Up to a total of 6 adjustment points are possible.

4.7.4.1 Calibrating the probe with “One-Click Container Teach in”

Prerequisites:
- Probe is properly installed.
- container is empty.
- IO-Link master is connected and the device-specific IODD is loaded

► Enter the dielectric constant (DK value) of the medium to be measured, see “Measurement Configuration”, page 10.

► Calibrate the container Press Perform One-Click Teach in.

✓ Button turns green and is marked Done.

✓ Probe is calibrated and ready for operation.

4.7.4.2 Calibrating the probe with “Two-Point Container Teach in”

With this method, two fill levels (low and high) are calibrated.

TIP

For an accurate measurement result, select a large distance between the Low and High percentage values. The calibration points at 20 % and 80 % usually give the best results over the entire measuring range.

Prerequisites:
- Probe is mounted correctly.
- IO-Link master is connected and the device-specific IODD is loaded.

Two-Point Container Teach in

► Fill container between 0% and 25% of the desired measuring range.

► Enter the corresponding value in Container Low Fill Level.

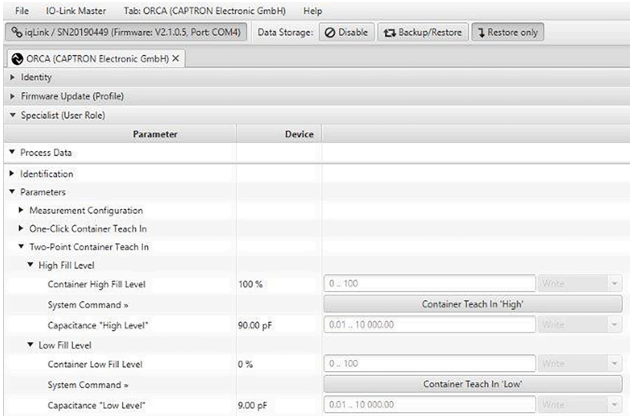
► Confirm the value with Write.

► Press container Teach in “Low”.

✓ Button turns green and is marked Done.

✓ “Low” is calibrated.

► Fill container between 25% and 100% of the desired measuring range

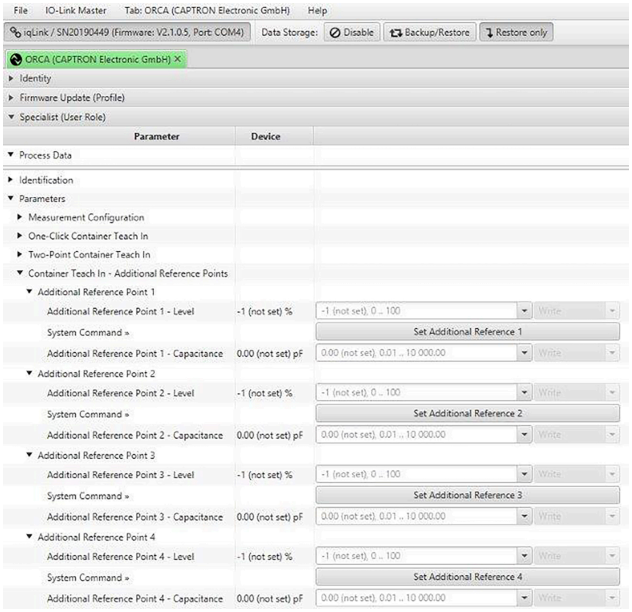


- ► Enter the desired value in Container High Fill Level
- ► Confirm the value with Write
- ► Press Container Teach in “High”.
- ✓ Button turns green and is marked with Done.
- ✓ “High” is calibrated.
- ✓ Probe is ready for operation.

The measured capacities are displayed for both reference points.

4.7.4.3 Calibrating the probe with “Multiple-Point Container Teach in”

Particularly with inhomogeneous containers, the measuring accuracy is improved by using additional reference points. In addition to the two reference points of the two-point container teach-in, up to four additional reference points can be used. The adjustment is carried out in the same way as the two reference points of the “Two- Point Container Teach in”. The order of the adjustment points is freely selectable.



4.7.5 Configuring switching points

Pins 2, 4 and 5 can be configured as switching points. The following table shows which configurations are possible. An analog output is not available with the “ORCA Lite” version.

PIN	Signal	Description
2	Switching output or analog output	PNP / NPN or Push-Pull; NO / NC 4...20 mA / 0...10 V
4	Switching output IO - Link communication	PNP / NPN or Push-Pull; NO / NC
5	Switching output	PNP / NPN or Push-Pull; NO / NC

TIP

To change the parameters, connect the device to an IO-Link master. More information about the connection to the IO-Link master can be found in the documentation of the IO-Link master .

Pin 2 is configured here as an example, pin 4 and pin 5 are configured analogously.

Prerequisites:

- IO-Link master is connected and the device-specific IODD is loaded.

► Define function with the Pin 2 Function drop-down list.

► Define output with the Output Function drop-down list.

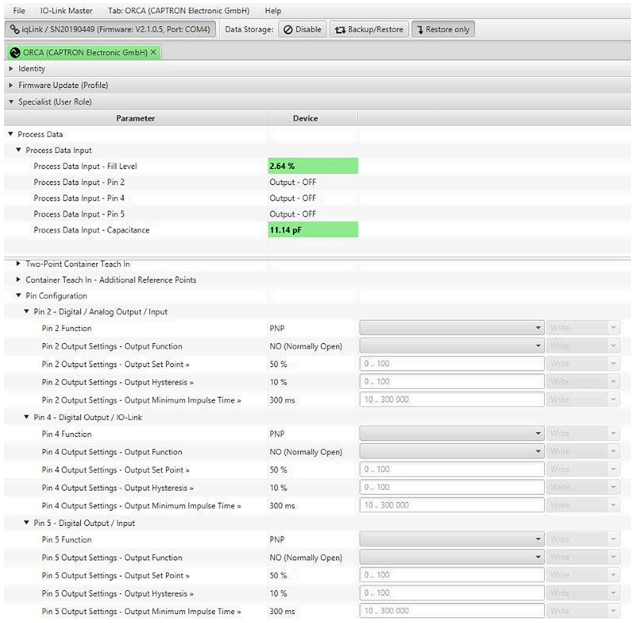
► Enter the switching point as a percentage value in the Output Set Point field.

► Enter the reset value of the switching point as a percentage value in the Output Hysteresis field.

► Enter the minimum length of the output pulse in the Output Minimum Impulse Time field. Standard value 300 ms

► Confirm all entered values with Write.

✔ Switching point is configured.



The switching point (fill level in %) and the hysteresis (difference below the switching point in %) as well as the minimum pulse time of the output can be defined and transferred.

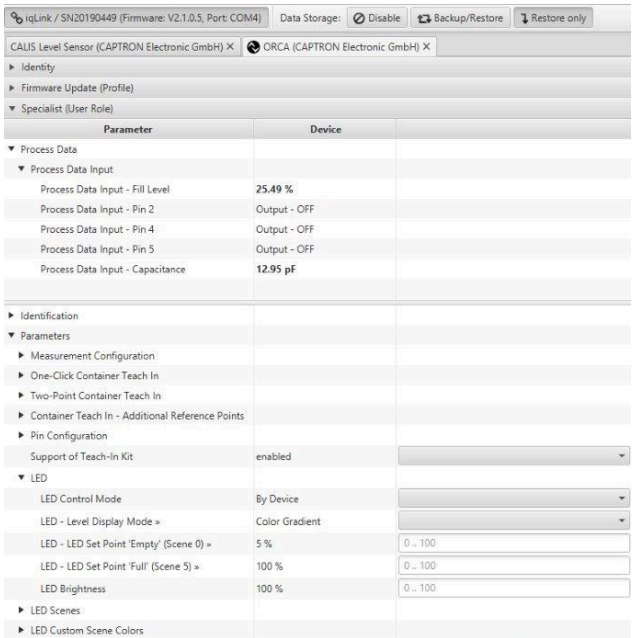
If an output is to be closed when the level falls below a defined level, set the output as “normally closed” and set the defined level at set point minus hysteresis and the set point is then above the defined level. Set point is then above the defined fill level, quasi as a hysteresis level above the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

4.7.6 LED

The color and mode of the LED can be set.

LED modes

- static
- pulsed
- flashing



4.7.6.1 LED Control Mode

Control can be selected directly via the sensor “By Device” or via the process data “by IO-Link Process Data” for IO-Link communication. The procedure for IO-Link communication is described in the TRM.

4.7.6.2 LED level display mode

The fill level can be displayed with the LED in two ways.

- Color gradient

  The color changes continuously depending on the fill level.

- Output switch points

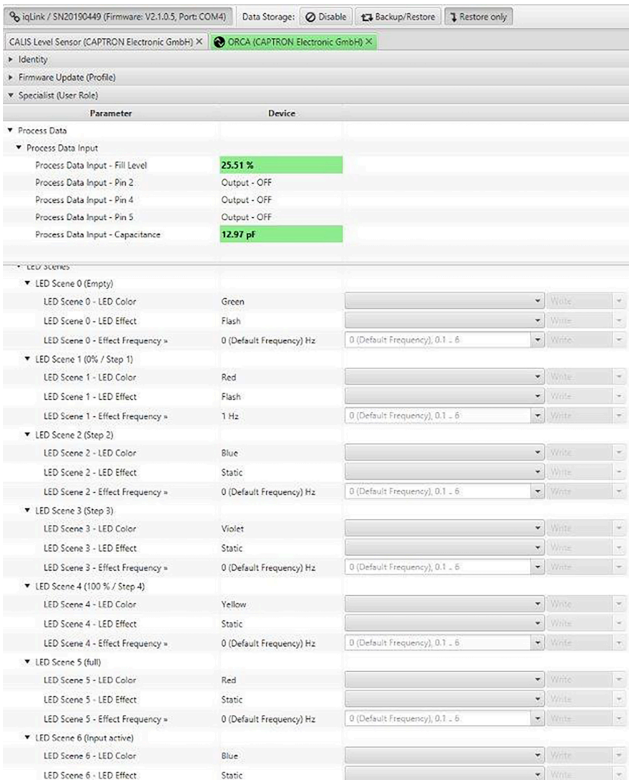
  The LED changes color in four steps, defined by the set points of the digital outputs (pins 2, 4 and 5). For this type of display, the definition of set points and hysteresis for pins 2 and 5 is also important if they have been defined as inputs

“LED Set Point Empty” and Full “LED Set Point Full”
Regardless of the set points defined for the pins, the states “LED Set Point Empty” and “LED Set Point Full” can be defined and displayed here.

„LED Brightness“
The brightness of the LED can be set via “LED Brightness”.

4.7.6.3 LED Scenes

Up to 6 scenes can be defined. Depending on the “Level Display Modes” selected, the overview of the characteristics of the LED scenes is shown in the following table.



Scene Number	Color Gradient Mode	Output Switch Points Mode	Example
0	fill level lower than “LED Set Point Empty”		Red, flashing

Scene Number	Color Gradient Mode	Output Switch Points Mode	Example
1	Reference color 0%	Fill level lower than all output set points	Red
2		Fill level lower than one output set points	Orange
3		Fill level lower than two output set points	Yellow
4	Reference color 100%	Fill level greater than all output set points	Green
5	fill level greater than “LED Set Point Full”		Green, flashing
6	High signal on any input pin		Blue, flashing

The color and lighting effect of the LED can be selected for each scene via drop boxes.

4.7.7 System command

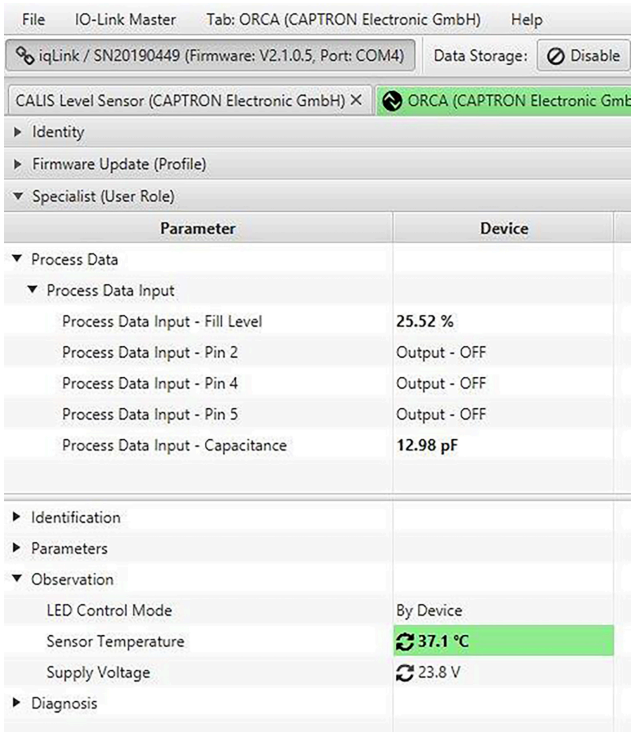
The system command is used to reset the probe to the factory setting. Not only the parameterization is reset to the factory setting, the calibration values are also deleted. The probe must be calibrated again.

4.7.8 Monitoring

The Monitoring chapter displays information and status for the following points:

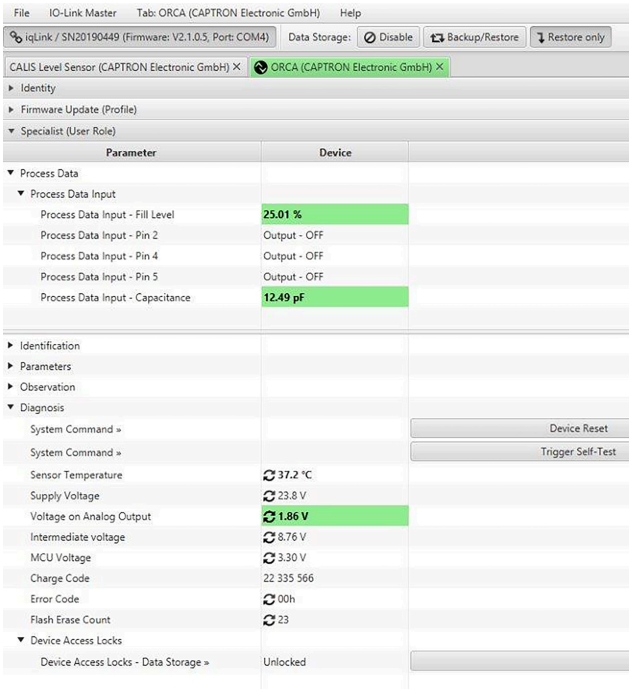
- The current configuration of the LED control modes
- The current probe temperature

  The current temperature of the probe head, or more precisely the electronics of the probe, is displayed. This is not the temperature of the medium.
- The current supply voltage



4.7.9 Diagnosis

Compared to the information in the Monitoring chapter, the Diagnostics chapter contains a larger amount of data and the option of using system commands to restart the sensor, initiate a self-test and lock the device.



The “Reset device” system command is used to perform a warm start of the sensor. Unlike the “Set factory settings” system command, the parameterization and calibration values are retained in the device

The “Trigger Self-Test” system command is used to check the electrical function of the LED.

In addition, the sensor temperature (electronics in the probe head), the supply voltage of the probe, the voltage at the analog output, internal voltage values (intermediate and MCU) are monitored and the values are displayed.

If the sensor temperature exceeds 90°C, this is registered as an error and displayed as an error code.

The internal voltage values as well as the batch number and the flash erase count are details that may be important for CAPTRON Service in the event of a fault.

An overview of the error codes can be found in the following list.

Blink Code	I0-Link Error Code	Code description
1	0x0001	internal error
2	0x0002	Error with intermediate voltage
4	0x0008	Supply voltage overrun / underrun
8	0x0080	Parameter memory error
9	0x0100	Parameter error
12	0x0800	LED error
13	0x1000	overload on dig ital output
-	0x2000	overload on analog output

Blink Code	I0-Link Error Code	Code description
15	0x4000	Temperature overrun

4.8 Events

A “Logbook” is available in the Events tab. Errors and warnings that occur are documented in the logbook with a time stamp. The time stamp documents the appearance and disappearance of the message. Possible events displayed are shown in the following list.

Event Code	Type	Definition and recommended maintenance action
6144	Error	Output Overload - Output current too high - maximal 200 mA
6145	Error	Voltage Output Overload- Current on analog voltage output too high
6146	Warning	Current Output Overload - Resistance on current output too high
16912	Warning	Device temperature over run - Clear source of heat
16928	Warning	Device temperature under run - Insulate device
20496	Error	Component malfunction - Repair or exchange
20752	Warning	Primary supply voltage over-run - Check tolerance
20753	Warning	Primary supply voltage under-run - Check tolerance
25376	Error	Parameter error - Check data sheet and values

5 Remove probe

- ► Disconnect the system from its voltage supply and secure it against being switched on again.
- ► If necessary, depressurize the system.
- ► Disconnect the electrical connection from the probe.
- ► Remove probe.

6 Disposal

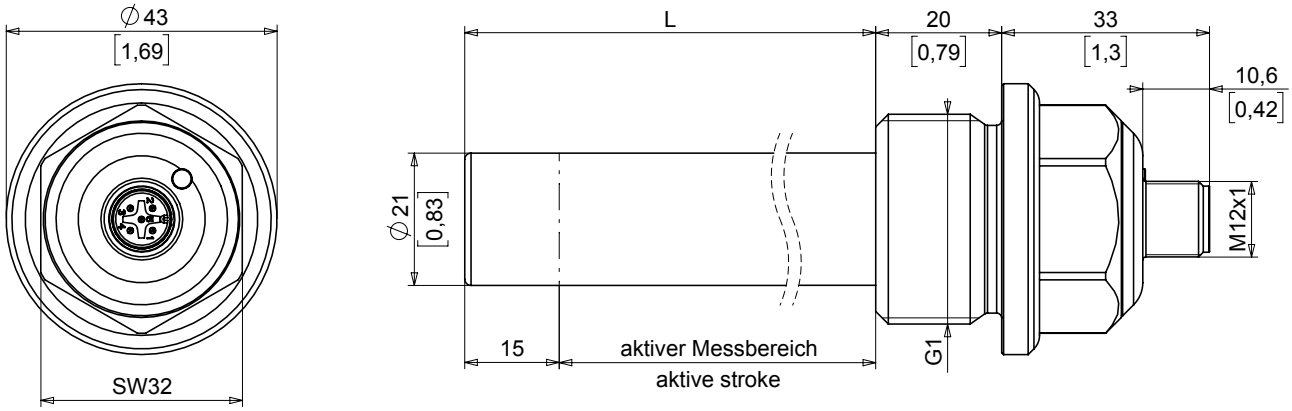
Different types of electrical and electronic components must be recycled according to their type. All applicable statutory, state and local laws and regulations must be complied with.

7 Technical specifications

Technical specifications at 24 V and 20 °C	
Connection	Plug M12

Technical specifications at 24 V and 20 °C	
Operating voltage	⎓ DC 24 V (19.2 to 28.8 V)
Power consumption	typically 29 mA
Load current	typically 50 mA max. 200 mA
Operating temperature	0°C (32°F)…+70°C (158°F)
Analog output	4...20 mA / 0...10 V
Switching output	NPN/PNP/Push-Pull, NO/NC switchable
Switching point position	adjustable
Measurement accuracy	± 2% of upper range limit
Repeat accuracy	± 1% of upper range limit
Response time	<1 s
Degree of protection IP	IP67
Compressive strength	10 bar
Communication interface	IO-Link specification V1.1
Measuring principle	Capacitive
Process connection	V4A
Probe rod	PTFE
DK medium	>1.8 (dielectric constant ε_r)

7.1 Dimensional drawing

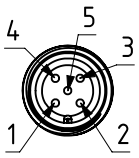


TIP

Metric and imperial measurements are used in drawings. Imperial measurements are marked with [ ].

7.2 Connection option

Plug M12, 5-pin



Pin	Signal	Description
1	U_V	+24V DC supply voltage
2	Switching output or analog output	PNP / NPN; NO / NC 4...20 mA / 0...10 V
3	GND	0V
4	Switching output IO-Link communication	PNP / NPN; NO / NC
5	Switching output	PNP / NPN; NO / NC

8 Manual updates

CAPTRON reserves the right to make changes to the contents of this manual as needed. The most current version can be found on our website www.captron.com .

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The operating instructions have been authored and published by
CAPTRON Electronic GmbH
Johann-G.-Gutenberg-Straße 7
82140 Olching – Germany
Tel.: +49 (0) 8142 44 88 – 160
sales@captron.com
www.captron.com

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