

Your Global Automation Partner

**TURCK**

BCT-....  
Teachable Capacitive  
Sensors

Operating Instructions



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# 1 About These Instructions

These instructions describe the setup, the functions and use of the device and help you to operate the product for its intended use. Read these instructions carefully prior to using the product. Keep these instructions safe during the service life of the device. If the product is passed on, pass on these instructions as well.

## 1.1 Target groups

This document is written for specially trained personnel and must be read carefully by anyone who is charged with the mounting, commissioning, operation, maintenance, disassembly or disposal of the device.

## 1.2 Explanation of symbols

The following symbols are used in these instructions:

**DANGER**

DANGER indicates a direct hazardous situation with the risk of death or serious injury if it is not prevented.

**WARNING**

WARNING indicates a possible hazardous situation with the risk of death or serious injury if it is not prevented.

**NOTICE**

NOTICE indicates a situation that may cause possible damage to property if it is not prevented.

**NOTE**

NOTE indicates tips, recommendations and important information. The notes contain information, particular operating steps that facilitate work and possibly help to avoid additional work resulting from incorrect procedures.

**MANDATORY ACTION**

This symbol denotes actions that the user must carry out.

**RESULT OF ACTION**

This symbol denotes the relevant results of actions and procedures.

## 1.3 Other documents

Besides this document the following material can be found on the Internet at [www.turck.com](http://www.turck.com):

- Data sheet of the particular device
- IODD file
- IO-Link Parameters Manual

All Turck software components and the IODD can be downloaded via the Turck Software Manager. The Turck Software Manager can be downloaded free of charge at [www.turck.com](http://www.turck.com).

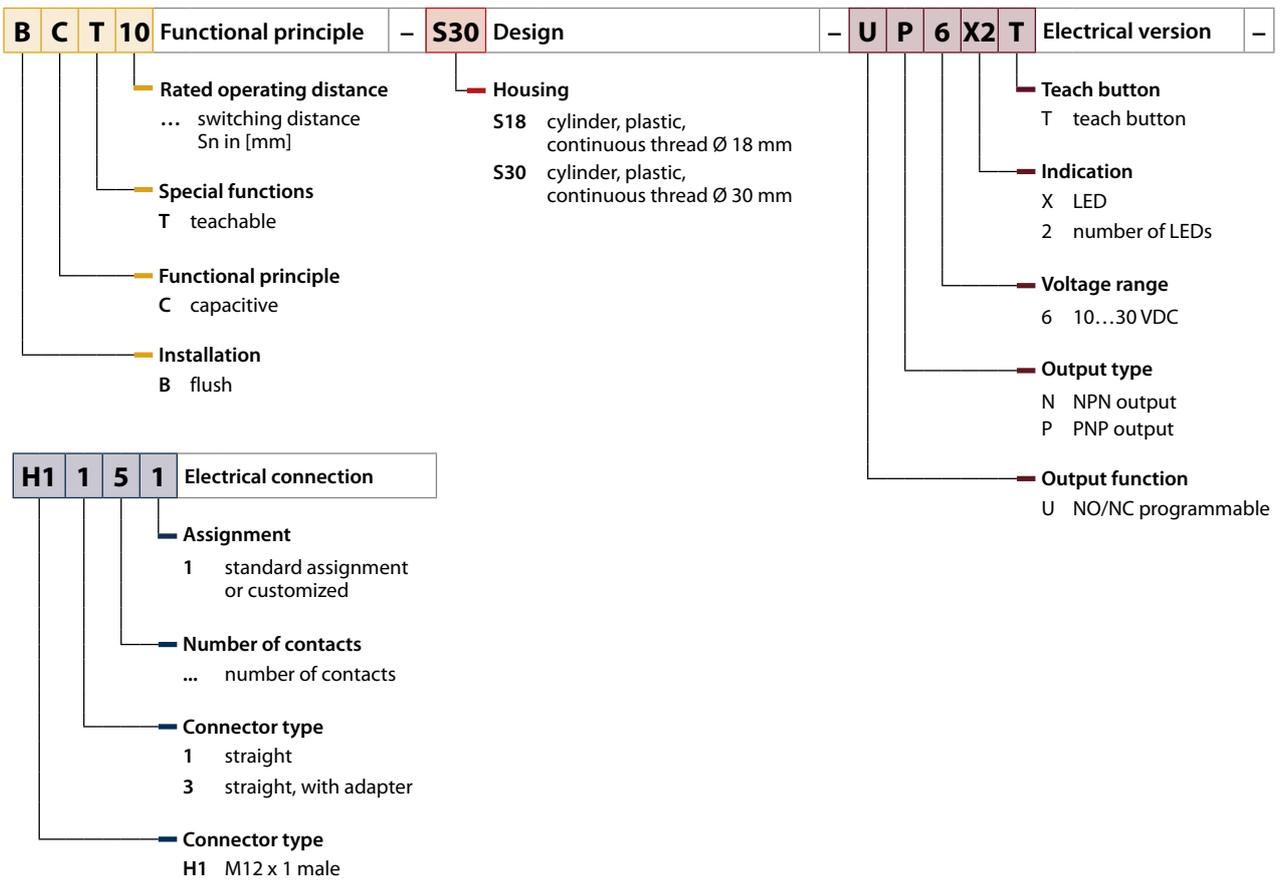
## 1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to [techdoc@turck.com](mailto:techdoc@turck.com).

## 2 Notes on the Product

### 2.1 Product identification

**B C T 10 - S30 - U P 6 X2 - H1 1 5 1**



Teachable capacitive sensors	
BCT5-S18-UP6X2T-H1151	BCT10-S30-UP6X2T-H1151
BCT5-S18-UN6X2T-H1151	BCT10-S30-UN6X2T-H1151
BCT5-S18-UP6X2-H1151	BCT10-S30-UP6X2-H1151
BCT5-S18-UN6X2-H1151	BCT10-S30-UN6X2-H1151

### 2.2 Scope of delivery

The scope of delivery consists of the device and two nuts for mounting.

### 2.3 Legal requirements

The product is subject to the following EC directive:

- 2014/30/EC (EMC Directive)

The EC declaration of conformity is available for download from the Turck product database.

## 2.4 Manufacturer and service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats. You can access the Product Database directly via the following address:

[www.turck.de/products](http://www.turck.de/products)

For further inquiries in Germany contact the Sales and Service Team on:

Sales: +49 208 4952-380

Technical: +49 208 4952-390

For overseas inquiries contact your national Turck representative.

Hans Turck GmbH & Co. KG  
Witzlebenstraße 7  
45472 Mülheim an der Ruhr  
Germany

## 3 For your safety

The product is designed according to the latest state of the art technology. Residual hazards, however, still exist.

Observe the following warnings and safety regulations in order to prevent danger to persons and property.

Turck accepts no liability for damage caused by failure to observe these safety instructions.

### 3.1 Intended use

The devices are only designed for use in industrial applications.

The capacitive sensors are intended for the contactless detection of the presence of solid or liquid objects. Any other use is not in accordance with the intended use; Turck accepts no liability for any resulting damage.

### 3.2 Obvious misuse

The devices are not safety components and must not be used for the protection of persons or property.

### 3.3 General safety notes

- The devices only meet the EMC requirements for industrial areas and are not suitable for use in residential areas.
- The device must only be fitted, installed, operated and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Not all objects are detected equally well by the sensor. Before regular operation check whether the required object is detected.

## 4 Product description

### 4.1 Device overview

The capacitive sensors have a cylindrical design with an M18 or M30 male thread. The device front can be mounted flush with the surrounding area. All devices are provided with an M12 connector for connecting the sensor cable.

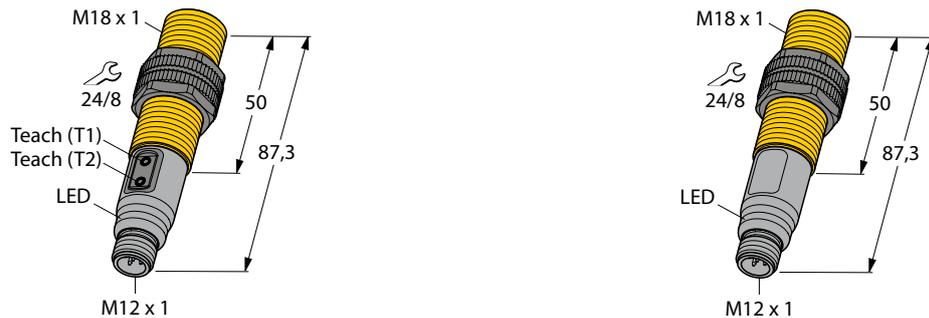


Fig. 1: Dimension drawings BCT5-S18-U\*6X2T-H1151 (with teach button) and BCT5-S18-U\*6X2-H1151 (without teach button)

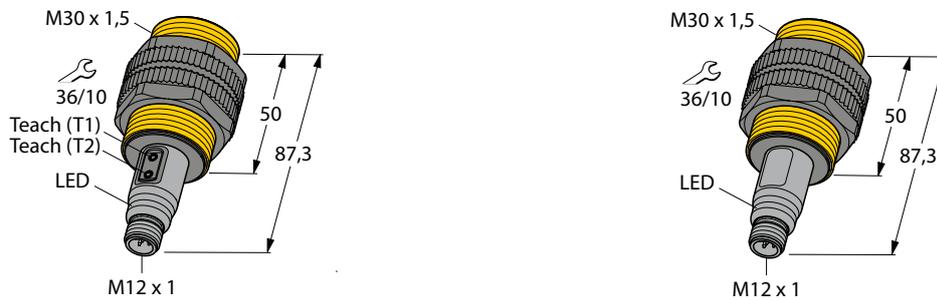


Fig. 2: Dimension drawings BCT10-S30-U\*6X2T-H1151 (with teach button) and BCT10-S30-U\*6X2-H1151 (without teach button)

#### 4.1.1 Indication elements

The capacitive sensors have a 2-color LED (green/yellow).

#### 4.1.2 Operating elements

The capacitive sensors are available with and without integrated teach buttons. Refer to the type code for the identification of the different device models.

## 4.2 Properties and features

- Threaded barrel M18 x 1 or M30 x 1.5
- Flush mountable
- Plastic, PA12-GF30, PEI
- Setting via IO-Link, teach adapter, manual bridging or teach button

## 4.3 Operating principle

The sensors detect filling levels of liquids or solids - either in direct contact with the medium, or through a non-metallic container wall. The capacitive sensors are also designed for the non-contact and wear-free detection of both metallic (electrically conductive) and non-metallic (electrically non-conductive) objects.

## 4.4 Functions and operating modes

When delivered, the device functions as a proximity switch with a rated operating distance of 5 mm (BCT5-S18- ...) or 10 mm (BCT10-S30 ...). Additional functions can be taught by the user.

### 4.4.1 Setting options

The devices can be set via IO-Link with FDT tools such as PACTware™ or via the PLC software.

The capacitive sensors are also provided with additional setting options:

- Setting via teach adapter (optional accessories, not included)
- Settings made via manual bridging via pin 5 to  $U_B$  or pin 5 to GND
- Setting via pushbuttons (for models with teach buttons)

### 4.4.2 "Medium present" mode (Full teach)

In "Medium present" (Full teach) mode, the device operates with minimum sensitivity. This is useful for applications with easy to detect media. A switch point is taught for when a medium or an object is present in the sensing range of the sensor.

The switch threshold for the "Medium present" mode is automatically set so that a safety reserve is produced for the switchoff limit. The safety reserve can be set via FDT/IODD. The switch point is below the measured capacitance. Environmental factors such as temperature deviations, condensation, the formation of film or pollution have less effect on the signal in "Medium present" mode. The switch point can be set with the "Medium present" teach button. The interval between two teach operations can be set to any length as required.

### 4.4.3 "Medium not present" mode (Empty teach)

In "Medium not present" (Empty teach) mode the device operates at maximum sensitivity. Possible uses include applications in which pre-actuation by the environment must be prevented. The switch point is taught when no medium or object is present in the detection range of the sensor.

The switch threshold is automatically set for the "Medium not present" mode so that there is a safety reserve for the switchoff limit. The safety reserve can be set via FDT/IODD. In this case, the switch point is above the measured capacitance. Environmental factors such as temperature deviations, condensation, the formation of film or pollution have less effect on the signal in "Medium present" mode. The "Medium not present" teach enables the switch point to be set. The interval between two teach operations can be set to any length as required.

4.4.4 “Switch point between medium present and medium not present” mode (Complete teach)

“Switch point between medium present and medium not present” mode is suitable for applications with difficult environmental conditions or media with little contrast. This requires the “Medium present” and “Medium not present” teach operations to be carried out in succession. The switch point is in the middle of the capacitances measured with the two teach operations. In “Switch point between medium present and medium not present” mode, the difference between the full and empty state of a container can be detected.

4.4.5 Internal voltage and temperature monitoring

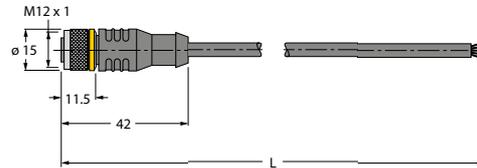
The device is provided with internal voltage and temperature monitoring. The monitoring function provides information to determine the load and failure probability of the sensor.

4.5 Technical accessories

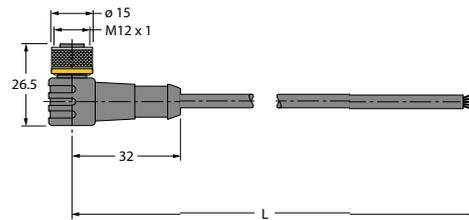
The accessories are not supplied with the device and must be ordered.

Item designation	Description	Figure
TX1-Q20L60	Teach adapter	
USB-2-IOL-0002	IO-Link adapter V1.1 with integrated USB port	
RKC4.5T-2-RSC4.5T/TEL	Connection cable between sensor and USB-2-IOL-002, 2 m long	

Item designation	Description	Figure
RKC4.5-5T-2/TEL	Female connector, straight, with 2 m PVC cable, open end	



WKC4.5-5T-2/TEL	Female connector, angled, with 2 m PVC cable, open end	
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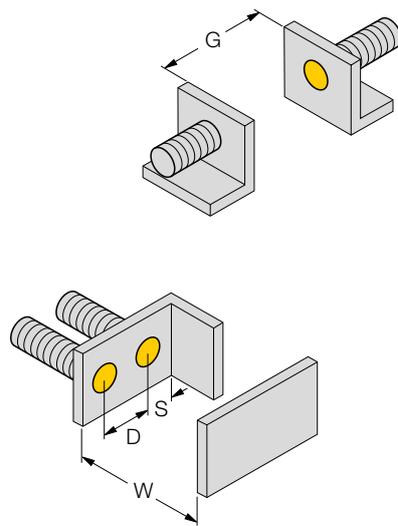


In addition to the above-mentioned connection cables, Turck also offers other cable types for specific applications with the correct terminals for the capacitive sensors. More information on this is available from the Turck product database at <http://www.turck.de/products> in the Connectivity area.

## 5 Mounting

The sensors can be mounted in any position (orientation). The maximum tightening torque for fastening the sensors is 2 Nm (BCT5-S18-...) or 5 Nm (BCT10-M30-...).

- Clean the mounting surface and the surrounding area.
- When using a mounting bracket: Fasten the sensor in the mounting bracket.
- Install the sensor or the mounting fixture at the intended location.
- Make sure that the connector on the rear of the sensor remains accessible.
- Observe the minimum mounting distances.



	BCT5-S18-...	BCT10-S30-...
Distance D	36 mm	60 mm
Distance W	15 mm	30 mm
Distance S	27 mm	45 mm
Distance G	30 mm	60 mm

Fig. 3: Minimum installation distances

- When using more than one sensor in the application: Avoid the overlapping of the electrical fields. This overlap can occur if two sensors are mounted less than 36 mm (for BCT5-S18-...) or 60 mm (for BCT10-S30-...) apart.

## 6 Connection

- ▶ Connect the female connector of the connection cable to the male connector of the sensor.
- ▶ Connect the open end of the connection cable to the power supply and/or the processing units.

### 6.1 Wiring diagrams

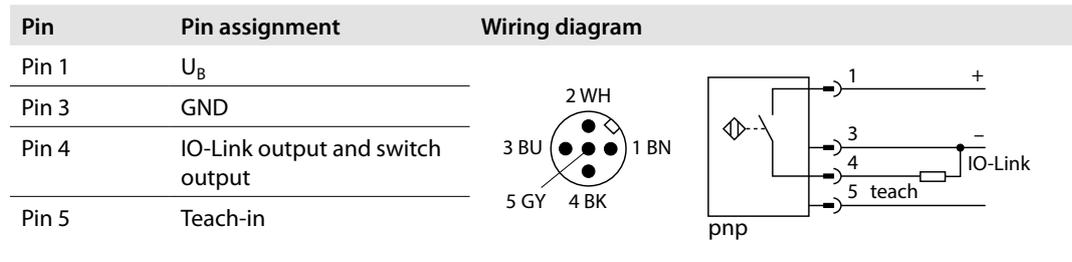


Fig. 4: Sensor wiring diagram (BCT...-UP...)

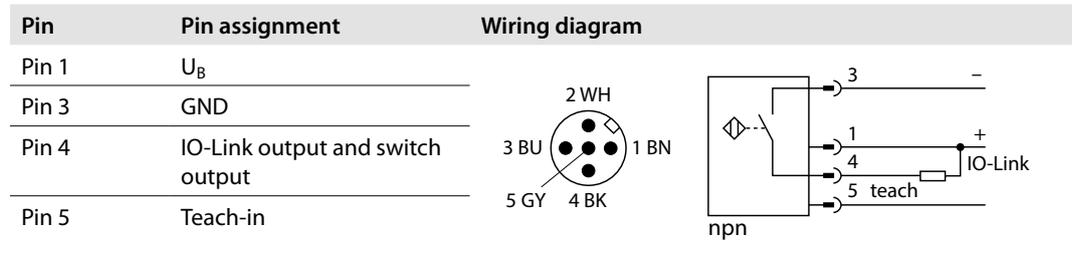


Fig. 5: Sensor wiring diagram (BCT...-UN...)

## 7 Commissioning

The device is operational automatically once the cables are connected and the power supply is switched on.

## 8 Operation



**WARNING!**

The devices are not safety devices.

**Risk of injury due to misuse!**

► Do not use sensors for the protection of personnel and machinery

On delivery, the switching distance of the sensor  $S_n$  is (see sect. "Technical Data"). The output function is NO (normally open).

### Operation as a diffuse mode sensor

In diffuse mode operation the LEDs have the following indication function:

LED indication	Meaning
Yellow lit	Sensor actuated
Green lit	Sensor not actuated
Flashes momentarily	Teach button feedback signal
Goes out for about 0.5 s	Teach operation successful. The sensor switches to normal operation.
Green fast flashing for approx. 1 s	Teach operation failed

### 8.1 Operation in IO-Link mode – LED indication

In IO-Link mode the LEDs have the following indication function:

LED indication	Meaning
Green, lit with short interruptions	IO-Link mode started

## 9 Setting

The capacitive sensor has a switching output with an adjustable switch point. After successful teach-in the sensor automatically runs in the normal operating mode. The interval between two teach operations can be set to any length as required.



### NOTE

If a determined switch point is outside of the saved switching interval, the taught value is rejected. The device indicates a fault and returns to normal operation without any changes.

Teach in the devices as follows:

	Switch point: Medium present <sup>1</sup>	Switch point: Medium not present <sup>1</sup>	Change NC/NO	Reset
IO-Link	All operating modes are teachable via FDT/IODD.			
Teach adapter	Press and hold down the pushbutton on the adapter to U <sub>B</sub> for 2...9 s	Press and hold down the pushbutton on the adapter to GND for 2...9 s	Press and hold down the pushbutton on the adapter to U <sub>B</sub> for more than 10 s	Press and hold down the pushbutton on the adapter to GND for more than 10 s
Teach buttons T1/T2	Press and hold down T1 for 2...9 s	Press and hold down T2 for 2...9 s	Press and hold down T1 for > 10 s	Press and hold down T2 for > 10 s
Manual bridging (pin 5)	Connect to U <sub>B</sub> for 2...9 s	Connect to GND for 2...9 s	Connect to U <sub>B</sub> > 10 s	Connect to GND for > 10 s

<sup>1</sup>Set the switch point centrally between "Medium present" and "Medium not present": Teach both medium states in sequence.

The TX1-Q20L60 teach adapter is not supplied with the device and must be ordered additionally. To use the teach adapter connect it between the sensor and the connection cable.

### 9.1 Setting via the teach adapter

#### "Medium present" teach

- Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- Specify object/level for switch point.
- Press and hold down the pushbutton on the adapter to U<sub>B</sub> for 2...9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% below the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

#### "Medium not present" teach

- Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- Specify object/level for switch point.
- Press and hold down the pushbutton on the adapter to GND for 2...9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% above the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Inverting the output function (NO/NC)

- Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- Specify object/level for switch point.
- Press and hold down the pushbutton on the adapter to  $U_B$  for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Reset to factory settings

- Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- Press and hold down the pushbutton on the adapter to GND for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Set the switch point between "Medium present" and "Medium not present"

- Reset sensor to factory settings.
- Carry out "Medium present" teach.
- Carry out "Medium not present" teach.
- The switch point is in the middle of the measured capacitances measured at teaches "Medium present" and "Medium not present".



#### NOTE

The "Medium present" and "Medium not present" teaches can be made in any order and with any time interval.

## 9.2 Setting by manual bridging (shorting)

### "Medium present" teach

- Specify object/level for switch point.
- Pin 5 to  $U_B$  for 2 ... 9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% below the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### "Medium not present" teach

- Specify object/level for switch point.
- Hold pin 5 to GND for 2 ... 9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% above the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

## Inverting the output function (NO/NC)

- Specify object/level for switch point.
- Hold pin 5 to  $U_B$  for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

## Reset to factory settings

- Specify object/level for switch point.
- Hold pin 5 to GND for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

## Set the switch point between "Medium present" and "Medium not present"

- Reset sensor to factory settings.
- Carry out "Medium present" teach.
- Carry out "Medium not present" teach.
- The switch point is in the middle of the measured capacitances measured at teaches "Medium present" and "Medium not present".



### NOTE

The "Medium present" and "Medium not present" teaches can be made in any order and with any time interval.

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## 9.3 Setting via pushbuttons

### "Medium present" teach

- Specify object/level for switch point.
- Press and hold down pushbutton 1 for 2...9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% below the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### "Medium not present" teach

- Specify object/level for switch point.
- Press and hold down pushbutton 2 for 2...9 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed. In this case, the switch point is 20% above the capacitance measured in the teach mode.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Inverting the output function (NO/NC)

- Specify object/level for switch point.
- Press and hold down pushbutton 1 for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Reset to factory settings

- Specify object/level for switch point.
- Press and hold down pushbutton 2 for more than 10 s.
- If the LED goes out for about 0.5 s and the sensor returns to normal operation, the teach operation has been successfully completed.
- If the green LED flashes rapidly for about 1 s, the teaching process has failed and must be repeated.

### Set the switch point between “Medium present” and “Medium not present”

- Reset sensor to factory settings.
- Carry out “Medium present” teach.
- Carry out “Medium not present” teach.
- The switch point is in the middle of the measured capacitances measured at teaches “Medium present” and “Medium not present”.



**NOTE**

The “Medium present” and “Medium not present” teaches can be made in any order and with any time interval.

## 9.4 Setting via IO-Link

The following components are required for setting the device via IO-Link:

Hardware	Software	Documentation
USB IO-Link adapter USB-2-IOL-0002	PACTware™ parameter software	System start manual IO-Link (D900063)
	DTM IODD Interpreter	
	IODD configuration file for BCT... capacitive sensors	

Refer to the IO-Link parameter manual for further information on operating modes and parameters in IO-Link mode.

## 9.4.1 IO-Link parameters

Different parameters can be set for the specific application via the IO-Link interface.

Parameter	Meaning
Memory	Use IO-Link data retention mode: Transfer parameter data from the device to the IO-Link master. If a device is replaced, the data can be transferred from the master to the new device.
Data memory lock	Locking and unlocking the data memory
Local parameter setting lock	Lock and unlock the pushbuttons on the sensor
Switch point	Set the safety reserve between the measured capacitance and the taught switch point
Sensor teach state	Indicates which teach operation was last carried out
<b>Switch point behavior</b>	
Output function	Invert the output function (NO/NC)
Mode selection	Choose between one switch point (single mode) and two switch points (window mode)
Hysteresis value	Fixed default value for hysteresis

## 9.5 Example of use: Adjust sensor for poorly detectable media

In this example, the sensor for detecting poorly detectable media (e.g. sticky adhesive liquids) in a tank has to be taught. For this a switch point must be taught between "Medium present" and "Medium not present".

- Reset sensor to factory settings.
- Level detection - Teach the sensor when the tank is full: Carry out "Medium present" teach.
- Level detection - blank out the wall when tank is empty: Carry out "Medium not present" teach.
- The switch point is in the middle of the measured capacitances measured at teaches "Medium present" and "Medium not present".



### NOTE

The "Medium present" and "Medium not present" teaches can be made in any order and with any time interval.

## 10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults. If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

## 11 Maintenance

The proper condition of the connectors and cables must be checked regularly. The devices are maintenance-free, if necessary, clean with a damp cloth.

## 12 Repair

The device must not be repaired by the user. The device must be decommissioned if it is faulty and sent to Turck. Also observe here the specific warranty conditions agreed with the shipment.

### 12.1 Returning devices

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at [http://www.turck.de/static/media/downloads/01\\_Declaration\\_of\\_Decontamination\\_EN.pdf](http://www.turck.de/static/media/downloads/01_Declaration_of_Decontamination_EN.pdf) and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

## 13 Decommissioning

- Remove the connection cable from the power supply and/or processing units.
- Remove the connection cable from the sensor.
- Undo the connections of the sensor or the mounting bracket from the mounting area.
- If necessary, undo the connection of the sensor to the mounting bracket.

## 14 Disposal

The devices must be disposed of correctly and must not be included in normal household garbage.

## 15 Technical Data

	BCT5-S18-...	BCT10-S30-...
Nominal switching distance (flush)	5 mm	10 mm
Nominal switching distance (non-flush)	7.5 mm	15 mm
Assured switching distance	$\leq (0.75 \times S_n)$ mm	
Hysteresis	2 ... 20%	
Temperature drift	typ. 20 %	
Repeat accuracy	$\leq 2\%$ of full scale	
Ambient temperature	-25...+70°C	
Operating voltage	10...30 VDC	
Residual ripple	$\leq 10\%$ $U_{SS}$	
DC rated operational current	$\leq 200$ mA	
No-load current $I_0$	$\leq 15$ mA	
Residual current	$\leq 0.1$ mA	
Switching frequency	10 Hz	
Rated insulation voltage	$\leq 0.5$ kV	
Output function	5-wire, programmable, PNP (UP), NPN (UN), IO-Link	
Short-circuit protection	yes, cyclic	
Voltage drop at 200 mA	$\leq 2.4$ V	
Wire breakage / reverse polarity protection	yes, complete	
Design	Threaded barrel, M18 x 1	Threaded barrel, M30 x 1.5
Housing material	Plastic, PA 12-GF30, PEI	
Material active face	Plastic, PA12-GF30	
Admissible pressure on front cap	$\leq 6$ bar	$\leq 3$ bar
Max. tightening torque of housing nut	2 Nm	5 Nm
Vibration resistance	55 Hz (1 mm)	
Shock resistance	30 g (11 ms)	
Protection type	IP67	
MTTF	1080 years acc. to SN 29500, Ed. 99, 40 °C	
Switching status display	2-color LED (green / yellow)	



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