

Your Global Automation Partner

TURCK

BCT...-M...-IOL
NCT...-M...-IOL
Capacitive Sensors

Instructions for Use



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1 About these Instructions

These instructions for use describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use during the service life of the product. If the product is passed on, pass on these instructions as well.

1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

1.2 Explanation of symbols used

The following symbols are used in these instructions:



DANGER

DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.



WARNING

WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.



CAUTION

CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.



NOTICE

NOTICE indicates a situation which may lead to property damage if not avoided.



NOTE

NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work.



CALL TO ACTION

This symbol denotes actions that the user must carry out.



RESULTS OF ACTION

This symbol denotes relevant results of actions.

1.3 Other documents

Besides this document, the following material can be found on the Internet at www.turck.com:

- Data sheet
- Declarations of conformity (current versions)
- Commissioning manual IO-Link devices
- IO-Link parameters manual

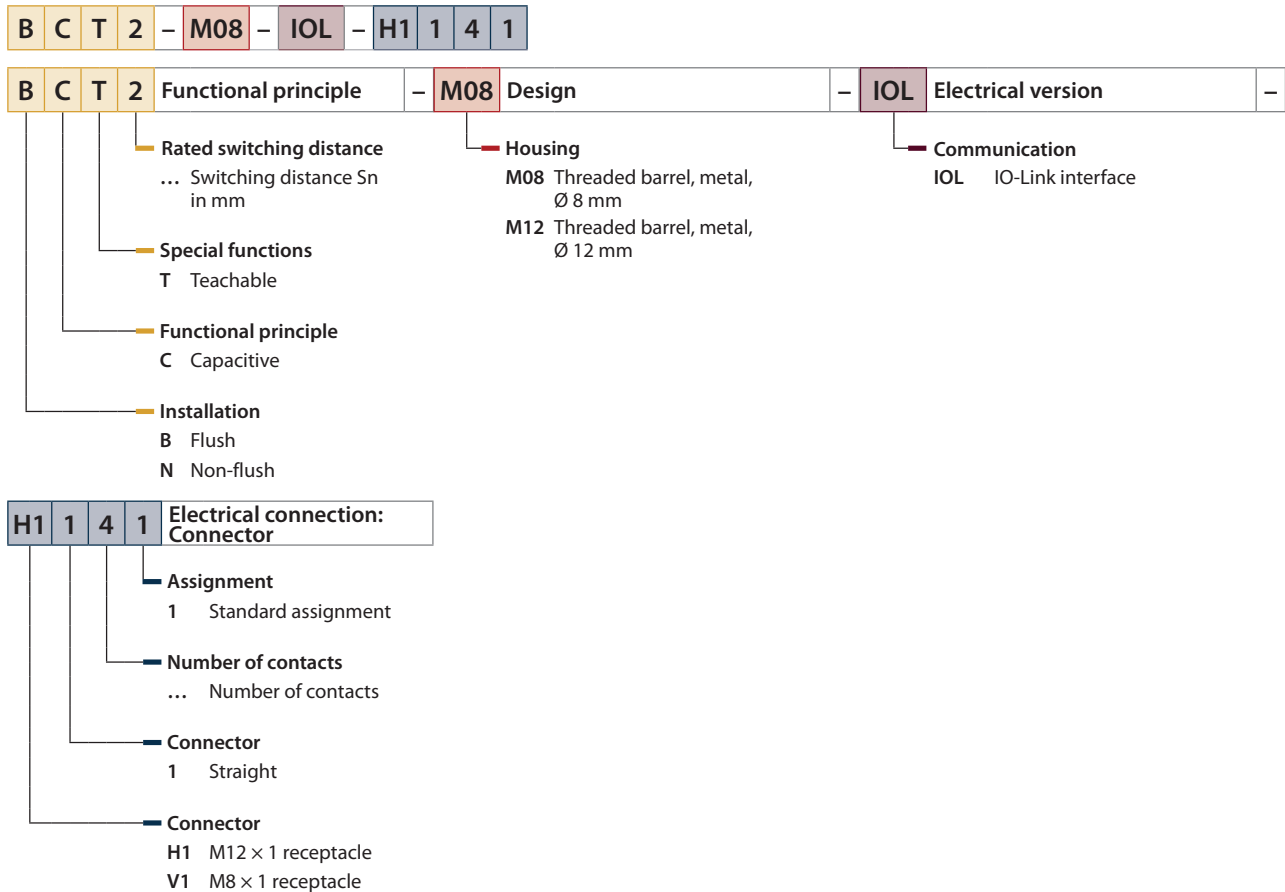
1.4 Feedback about these instructions

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.

2 Notes on the Product

2.1 Product identification

These instructions apply to the following capacitive sensors:



2.2 Scope of delivery

The scope of delivery includes:

- Capacitive Sensor
- Two nuts for mounting

2.3 Legal requirements

The devices are subject to the following EU directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS directive)

2.4 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▶ 22].

3 For Your Safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

3.1 Intended use

The capacitive sensors detect without contact the presence of solid, powder or liquid objects.

The devices may only be used as described in these instructions. 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 personal or property protection.

3.3 General safety instructions

- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.
- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- Not all objects are detected equally well by the sensor. The detection of the object must be checked by the user prior to regular operation.
- The power supply must comply with the regulations for a low voltage power supply with safe isolation (SELV or PELV).

4 Product Description

The devices are contained in a metal housing with an M8 or M12 male thread. The active face can be mounted flush or non-flush with the surrounding area. All devices are provided with an M8 or M12 male connector for connecting the sensor cable.

The device can only be parameterized via IO-Link.

4.1 Device overview

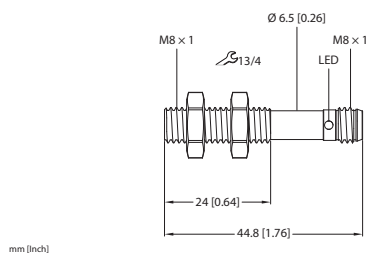


Fig. 1: BCT2-M08-IOL-V1131

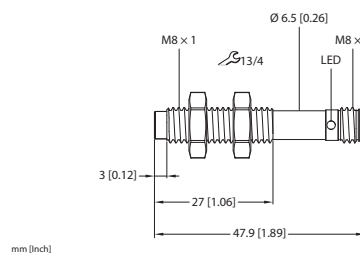


Fig. 2: NCT3-M08-IOL-V1131

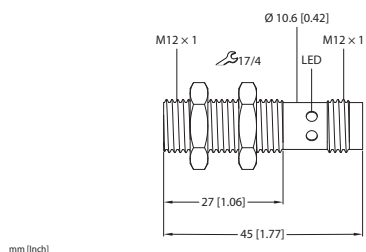


Fig. 3: BCT4-M12-IOL-V1141

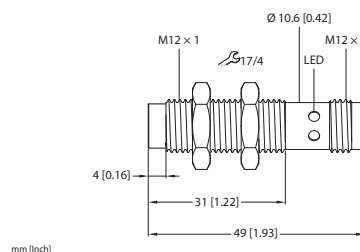


Fig. 4: NCT8-M12-IOL-V1141

4.1.1 Indication elements

The devices are provided with four yellow LEDs. The LEDs indicate the status of the switching output.

4.2 Properties and features

- Cylindrical threaded barrel
- Brass, galvanized
- Yellow plastic cap
- Flush or non-flush design
- Parameterization via IO-Link

4.3 Operating principle

The capacitive sensors are used for the contactless and wear-free detection of metallic (electrically conductive) and non-metallic (electrically non-conductive) objects. The sensors enable the counting or monitoring of moving objects. The sensors can also detect liquids or bulk material through a non-metallic container wall.

4.4 Functions and operating modes

The devices are factory set as proximity switches with a rated switching distance of 2 mm (BCT2...), 3 mm (NCT3...), 4 mm (BCT4...) or 8 mm (NCT8...). The rated switching distances can be adjusted.

The device can only be parameterized via IO-Link.

The devices are SIDI compatible.

SIDI (Simple IO-Link Device Integration) enables IO-Link devices in PROFINET applications to be configured directly in the programming environment (e.g. TIA Portal). The Turck IO-Link devices are integrated in the GSDML file of the TBEN, TBPN and FEN20 series IO-Link masters and can be set in the programming environment as submodules of a modular I/O system. The user has access here to all device properties and parameters.

4.4.1 Internal monitoring functions

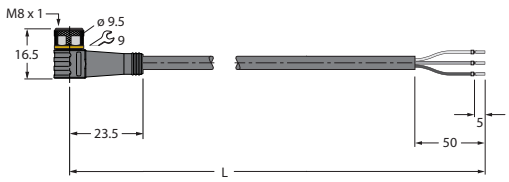
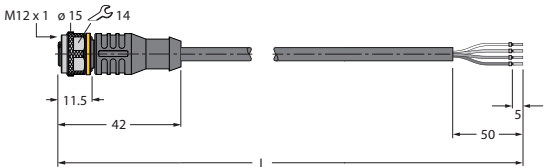
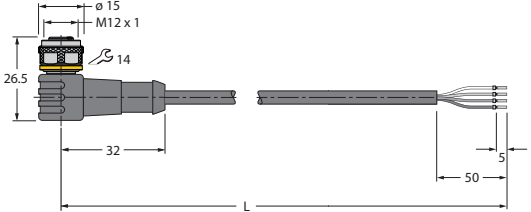
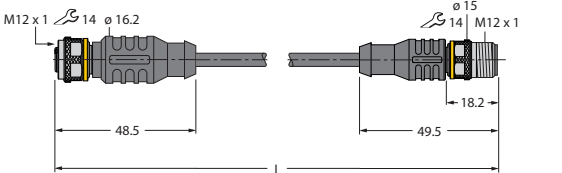
The device is provided with an internal temperature monitoring.

The device is also equipped with a monitoring function. The monitoring function enables conclusions to be drawn about the load and the failure probability of the sensor. The device status can be indicated via the IO-Link parameters.

4.5 Technical accessories

The following accessories are not supplied with the device:

Dimension drawing	Type	ID	Description
	USB-2-IOL-0002	6825482	IO-Link adapter V1.1 with integrated USB interface
	PKG4M-2-RSC4.4T/TXL	6627063	Connection cable, M8 female connector, straight, 4-pin; M12 male connector, straight, 4-pin; cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	PKG3M-2-TXL	6625550	Connection cable, M8 female connector, straight, 3-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	PKW3M-2-TEL	6625064	Connection cable, M8 female connector, angled, 3-pin, cable length: 2 m, sheathing material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com

Dimension drawing	Type	ID	Description
	PKW3M-2/ TXL	6625556	Connection cable, M8 female connector, angled, 3-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	RKC4.4T-2/ TXL	6625503	Connection cable, M12 female connector, straight, 4-pin, cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com
	WKC4.4T-2/ TEL	6625025	Connection cable, M12 female connector, angled, 4-pin, cable length: 2 m, sheathing material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com
	RKC4.4T- P7X2-2- RSC4.4T/TEL	6627320	Connection cable, M12 female connector, straight, 4-pin; M12 male connector, straight, 4-pin; cable length: 2 m, sheathing material: PUR, black; cULus approval; other cable lengths and types available, see www.turck.com

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

5 Installing



NOTE

When using more than one sensor in the application: Avoid the overlapping of electrical fields.

An overlap can occur if two sensors are mounted closer together than the stated minimum mounting distances.

- ▶ Observe the minimum mounting distances.

The sensors can be mounted in any direction. The maximum tightening torque for fastening the sensor is 5 Nm.

- ▶ Clean the mounting surface and surroundings.
- ▶ When using a mounting aid: fasten the sensor in the mounting aid.
- ▶ Install the sensor or mounting aid at the intended position.
- ▶ Ensure that the rear plug connector is accessible.

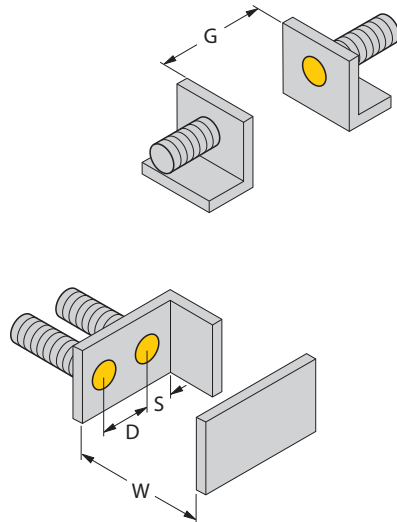


Fig. 5: Minimum mounting distances

The minimum mounting distances are as follows:

Distance	BCT2...	NCT3...	BCT4...	NCT8...
G	16 mm	16 mm	18 mm	18 mm
S	12 mm	12 mm	18 mm	18 mm
D	16 mm	16 mm	24 mm	24 mm
W	8 mm	8 mm	9 mm	9 mm

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 an SELV or PELV power supply and/or processing units.

6.1 Wiring diagrams

6.1.1 Wiring diagram for ...CT...-M08...-V1131



Fig. 6: Pin assignment

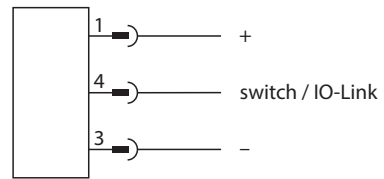


Fig. 7: Wiring diagram

6.1.2 Wiring diagram for ...CT...-M12...-H1141

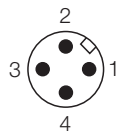


Fig. 8: Pin assignment

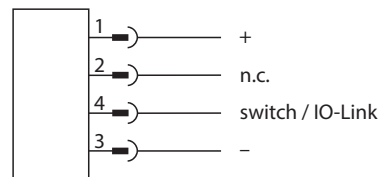


Fig. 9: Wiring diagram

7 Commissioning

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

8 Operation

The factory set switching distance is 2 mm (BCT2...), 3 mm (NCT3...), 4 mm (BCT4...) or 8 mm (NCT8...).

The output function is factory set as NO (NO contact) and the output signal as PNP.

8.1 LED indications

LEDs	Meaning
Yellow	Sensor actuated
Yellow flashing (2 × 2 Hz)	Teach-in operation successful. The sensor switches to normal operation.
Yellow flashing (10 Hz)	Dynamic teach active

9 Setting

The capacitive sensor is provided with a switching output with an adjustable switching point. The sensor switches automatically to normal operation after the teach-in operation is successfully completed. The time interval between two teach-in operations can be any length.

The device can only be parameterized via IO-Link.



NOTE

The taught in value is rejected if a determined switching point is outside of the assured switching distance. The device indicates an error and returns to normal operation without any changes.

9.1 Settable functions and features

Parameter	Meaning
Application Specific Tag	The specific application can be described in which the sensor is used.
Parameter (write) Access Lock	Access to the device parameters is locked or unlocked.
Device Reset	The command restarts the device. Communication is interrupted momentarily.
Application Reset	The function resets application parameters. Communication is not interrupted and the sensor is switched to a predefined operating state. Identification parameters are not affected by this command.
Restore Factory Settings	The function restores the device to the factory setting. The device is restarted after the reset. Communication is interrupted.
Reset diagnostic information	All diagnostics information of the device is reset to the factory setting. The counter of the switching operations and the maximum and minimum of the sensor signal are also reset.
Sensing mode	The device offers three modes with different scan rates: <ul style="list-style-type: none"> ■ Standard (100 Hz) ■ Accuracy (10 Hz) ■ Speed (200 Hz)
Switching output mode	The switching output can be configured as a PNP or NPN output. The PNP output is active by default.
Function	The switching output can be set either as an NO contact or as an NC contact. NO contact is active by default.
Hysteresis value	The size of the hysteresis window can be set in % (10 % or 20 % of the maximum sensor signal).
Current switching point	The current switching point can be set manually. It is also possible to view the current switching point.
Switching output switch-on delay	The switch-on of the switching output can be delayed.
Switching output switch-off delay	The switch-off of the switching output can be delayed.
Single Value Teach start	The single value teach-in is started. The current process value is calculated here and is set as the switching point. A value below the switching point activates the switching output. The process value range is from 0...5000, with 0 corresponding to the possible full scale of a detected object.
Two Value Teach without object (teachpoint 1)	The two-value teach-in is started. Perform teach-in without object in front of the sensor. The result is stored in the Teach point parameter.
Two Value Teach with object (teachpoint 2)	Perform teach-in with object in front of the sensor. If both teach points are present, the teach-in can be started via the Two Value Teach apply parameter.

Parameter	Meaning
Two Value Teach apply	The two-value teach-in from teach point 1 and teach point 2 is used. The arithmetic average value of the two teach points is set as a switching point.
Dynamic Teach start	The dynamic teach-in is started. All objects that pass the sensor are measured. The highest and lowest value of the object is determined. The arithmetic average value is formed from the two values. The LEDs flash at a frequency of 10 Hz during the operation. The teach-in is performed until the teach-in is stopped via Dynamic Teach stop .
Dynamic Teach stop	The dynamic teach-in is stopped. The arithmetic average value of the two teach points is set as a switching point.
SP1 teach point status	It is possible to view at SP1 teach point status whether the current teach-in operation was successful.
Teach cancel	The current teach-in operation is aborted and all teach points are set to zero.

9.2 Setting via IO-Link

9.2.1 Single value teach

The single value teach teaches a detected object as a switching point.

- ▶ Position the object in front of the sensor head. The distance must correspond to the distance in the application.
- ▶ Select the **Single Value Teach start** parameter in the FDT frame.
- ⇒ The **Current switchpoint value** parameter is set in the sensor.
- ⇒ The **Teach quality** parameter shows the result of the teach-in operation.

9.2.2 Two value teach

The two value teach makes it possible to teach in two teach points (sensor values). The sensor sets the arithmetic average value of the two teach points as a switching point. The first value can be taught in with or without an object. The second value must detect an object.

The teach-in operation can be used to distinguish between two objects. This requires the difference between measured process values to be sufficiently large. If the difference is insufficient, the sensor outputs the **Teachpoint 1 and 2 not taught or not successful** message.

- ▶ If a first object is present: position the object in front of the sensor head. The distance must correspond to the distance in the application.
- ▶ Irrespective of whether an object is present: select **Two Value Teach without object (teachpoint 1)**.
- ▶ Position the second object in front of the sensor head. The distance must correspond to the distance in the application.
- ▶ Select **Two Value Teach with object (teachpoint 2)**.
- ▶ Confirm teach-in with **Two Value Teach apply**.
- ⇒ The **Current switchpoint value** parameter is set in the sensor.
- ⇒ The **Teach quality** parameters shows the result of the teach-in operation.

9.2.3 Dynamic teach (Autoteach)

Dynamic teach (Autoteach) automatically teaches in two two teach points (sensor values). The sensor sets the arithmetic average value of the two teach points as a switching point. The teach-in operation can be set during the process.

- ▶ Select the **Dynamic Teach start** parameter in order to start the teach-in operation.
- ⇒ The LEDs flash yellow at a frequency of 10 Hz.
- ▶ Move objects past the sensor at least 10 × or for at least 10 s. The distance must correspond to the distance in the application.
- ▶ Select the **Dynamic Teach stop** parameter if all objects were detected multiple times.
- ⇒ The **Current switchpoint value** parameter is set in the sensor.
- ⇒ The switching point is taught in successfully if the LEDs flash 2 × at a frequency of 2 Hz.

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

Ensure that the plug connections and cables are always in good condition.

The devices are maintenance-free, clean dry if required.

12 Repair

The device must not be repaired by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to Turck.

12.1 Returning devices

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from <https://www.turck.de/en/retoure-service-6079.php> and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

13 Decommissioning

- ▶ Disconnect the connection cable from the power supply and/or processing units.
- ▶ Disconnect the connection cable from the device.
- ▶ Undo the connections of the device or if necessary the mounting aid for the mounting area.
- ▶ If present: undo the connection between the device and the mounting aid.

14 Disposal



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

15 Technical Data

	BCT2-M08-IOL-V1131	NCT3-M08-IOL-V1131	BCT4-M12-IOL-H1141	NCT8-M12-IOL-H1141
Hysteresis	10...20 %			
Ambient temperature	-25...+70 °C			
Temperature of medium	-25...+70 °C			
Switching distance	2 mm	3 mm	4 mm	8 mm
Electrical data				
Operating voltage	18...30 VDC (SELV or PELV)			
DC rated operational current	≤ 100 mA			
Switching frequency	0.2 kHz			
Insulation test voltage	≤ 0.5 kV			
Communication protocol	IO-Link			
SIO mode compatible	Yes			
Number of digital outputs	1			
Output function	3-pin, NC/NO (programmable), PNP/NPN		4-pin, NC/NO (programmable), PNP/NPN	
Voltage drop at I _e	≤ 2 V			
Protection class	III			
IO-Link				
IO-Link specification	Specified according to version 1.1			
Parameterization	FDT/DTM			
Transfer rate	COM 2/38.4 kbps			
Process data width	16-bit			
Measured value information	12-bit			
Frame type	2.2			
Mechanical data				
Design	Threaded barrel, M8 × 1		Threaded barrel, M12 × 1	
Dimensions (length)	44.8 mm	47.9 mm	45 mm	49 mm
Housing material	Metal, galvanized brass			
Material of active face	Plastic, yellow			
Electrical connection	Male connector, M8 × 1		Male connector, M12 × 1	
Protection type	IP67			
MTTF	1080 years acc. to SN 29500 (Ed. 99) 40 °C			
Switching state indication	4 × LEDs (yellow)			

16 Turck subsidiaries – contact information

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Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové www.turck.cz
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