Your Global Automation Partner

TURCK

RU... High End Ultrasonic Sensors

Instructions for Use

Contents

1 About These Instructions

These operating instructions 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
- Commissioning manual IO-Link devices
- IO-Link parameters manual
- EU Declaration of Conformity (current version)
- Approvals

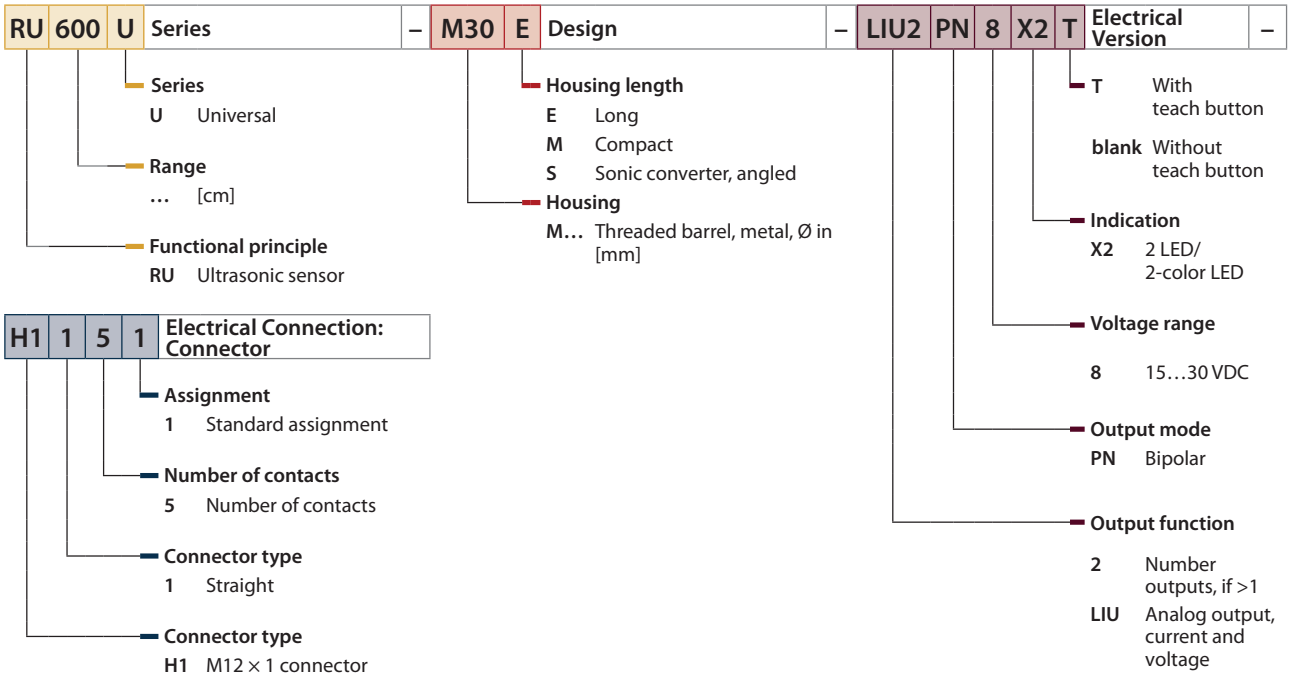
1.4 Feedback about these instructions

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

RU 600 U – M30 E – LIU2 PN 8 X2 T – H1 1 5 1



2.2 Scope of delivery

The scope of delivery includes:

- Ultrasonic sensor
- Two nuts for installation
- Quick Start Guide

2.3 Legal requirements

The device is subject to the following EC 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. [▷ 56].

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 ultrasonic sensors of the High End series are intended for the non-contact detection of solid or liquid objects as well as the distance to 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 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.
- Strong air movements can disturb the correct function of the sensor and corrupt the measured values. Avoid air currents between the sensor and the object to be detected.

4 Product Description

The devices are contained in a metal housing with an M18 or M30 male thread. The sonic transducer surface can be installed flush with the surrounding area.

All devices are provided with a metal M12 male connector for connecting the sensor cable. A switching distance can be set for object detection, which must be less than or equal to the maximum detection range, and greater than the minimum switching distance.

The devices can be taught in with a teach adapter, manual bridging or an IO-Link interface.

The devices are provided with two outputs that can be set independently of each other. Output 1 is designed as a switching output, and output 2 can either be used as a switching output, a current output or a voltage output. The switching distance and other functions can be set for both outputs.

4.1 Device overview

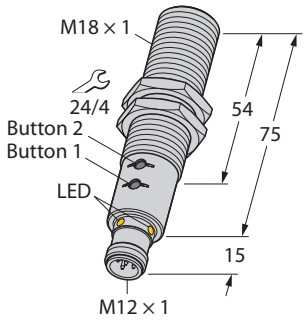


Fig. 1: Dimensions – RU…U-M18E-…

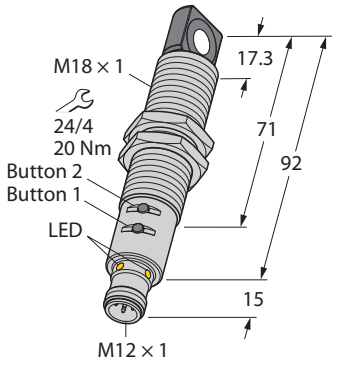


Fig. 2: Dimensions – RU…U-M18ES-…

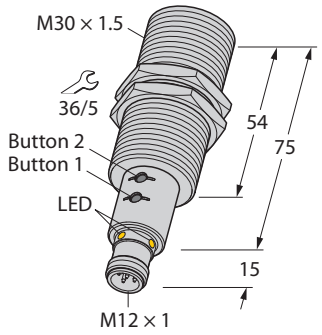


Fig. 3: Dimensions – RU…U-M30E-…

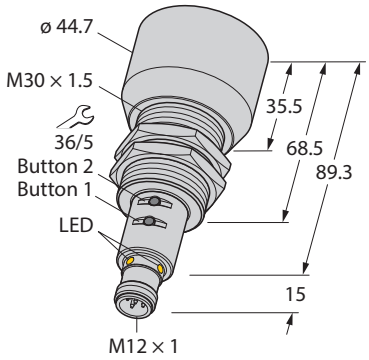


Fig. 4: Dimensions – RU600U-M30E-…

4.1.1 Indication elements

The ultrasonic sensors have a green and a yellow LED which are visible via four indication points. Only one LED can be active at one time. If an LED is active, all four indication points are lit.

4.2 Properties and features

- Smooth sonic transducer front
- Cylindrical design, potted
- M12 × 1 male connector
- Adjustable measuring range
- Temperature compensation
- NO/NC programmable
- Transmission of process value and parameterization via IO-Link

4.3 Operating principle

Ultrasonic sensors are designed for the non-contact and wear-free detection of a variety of targets by means of sound waves. It does not matter here whether the target is transparent or non-transparent, metallic or non-metallic, solid, liquid or in powder form. Environmental conditions such as spray, dust or rain also hardly affect the functioning of the sensors.

Ultrasonic sensors emit one or several ultrasonic pulses that are propagated in the air at the speed of sound. A part of the ultrasonic wave is reflected by the object. The sensor measures the total time of flight from the sensor to the object and back to the sensor. The distance to the object is then calculated with the following formula:

$D = c \times t / 2$

D Distance from the sensor to the object in m

c Speed of sound in air in m/s

t Time of flight for the ultrasonic pulse in s

To improve accuracy, the ultrasonic sensor forms the mean value from the measurement of several sound pulses before outputting a new value. The ultrasonic velocity depends on the composition and the temperature of the gas in which the sound is propagated. In most ultrasound applications, the composition of the gas is stable whereas the temperature may often fluctuate.

The speed of sound in air varies with the temperature according to the following approximation formula:

$c_{air} = 20 \times \sqrt{(273 + T)}$

c_{air} Speed of sound in air in m/s

T Temperature in °C

The speed of sound at an air temperature of 20 °C is approximately 344 m/s

The following formula applies to sensors with integrated temperature compensation:

$c_{air} = (331.5 \times 0.596 + T)$

Fluctuations in air temperature affect the speed of sound, which in turn has an effect on the total time for the echo measured by the sensor. An increase in air temperature shifts both measuring range limits closer to the sensor and the time of flight of the echo is shorter. A drop in air temperature shifts both measuring range limits away from the sensor and the time of flight of the echo is longer. This shift is approximately 3.5 % of the limit distance with a temperature change of 20 °C.

Good ultrasonic reflectors are metals, glass, stone, wood with smooth and hard surfaces, as well as liquids that are aligned appropriately to the sensor. Cloth, sand or grains absorb some of the sonic energy. Foams and skins are particularly poor reflectors.

4.4 Functions and operating modes

The ultrasonic sensors are provided with two switching outputs that can be set independently of each other. Output 1 can be used as a switching output, and output 2 can either be used as a switching output, current output (4…20 mA/0…20 mA) or voltage output (0…10 V/0…5 V/1…6 V). The start and end point of the measuring range can be set for the outputs. The measuring range must be within the detection range. The sensors can be run in normal operation as a diffuse mode or retroreflective sensor. The user can set an individual switching point as well as a window or hysteresis function.

Other operating modes (opposed, multiplex, synchronization or enable mode) can be parameterized via IO-Link.

4.4.1 Setting options

The devices feature the following setting options:

- Setting by manual bridging (shorting)
- Setting with connected teach adapter (accessories to be ordered separately)
- Setting via the pushbuttons
- Setting via IO-Link

4.4.2 Diffuse mode sensor

The diffuse mode is the standard operating mode of most ultrasonic sensors The sensor detects the required object via the echo of the ultrasonic waves. The distance to an object is determined from the time of flight. Any additional wiring or accessories are not required.

When using diffuse mode sensors, a switching point or switch window is defined. The switch window is used for window or hysteresis functions.

Diffuse mode sensor with NC function

When used as a diffuse mode sensor with an NC function, a switching point is taught in for a switch output. The output behaves as follows:

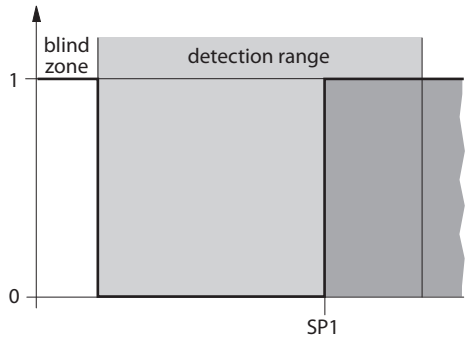


Fig. 5: Diffuse mode sensor with NC function – Behavior of the switching output

Diffuse mode sensor with NO function

When used a diffuse mode sensor with an NO function, a switching point is taught in for a switch output. The output behaves as follows:

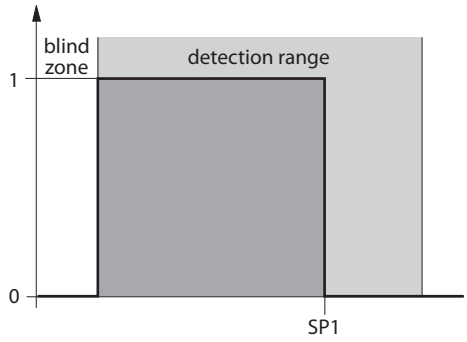


Fig. 6: Diffuse mode sensor with NO function – Behavior of the switching output

Window function

The start and end point of the switch window range can be set for the outputs. The switch window must be within the detection range.

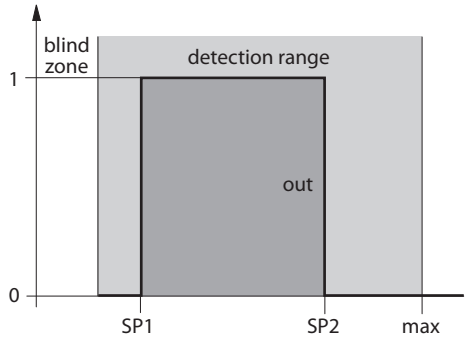


Fig. 7: Window function – Behavior of the switching output

Hysteresis function

When using the hysteresis function, a switch window is taught in that is defined by two switching points. The switching outputs have the following behavior as outputs:

If an object is moved away from the sensor, the switching output is switched on for as long as the object is located between the beginning of the detection range and switching point 2. If the object passes switching point 2, the switching output is switched off. If an object is moved towards the sensor, the switching output is switched off for as long as the object is located between the beginning of the detection range and switching point 1. If the object passes switching point 1, the switching output is switched on.

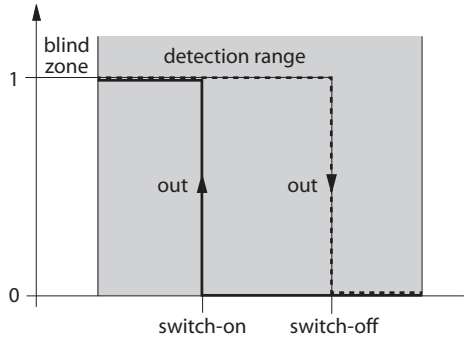


Fig. 8: Hysteresis function – behavior of switching output

Behavior of the analog output

Output 2 is factory set as an analog output and can be used either as a 4…20 mA/0…20 mA current output, a 0…10 V/0…5 V/1…6 V voltage output or as a switching output. The analog output behaves as follows:

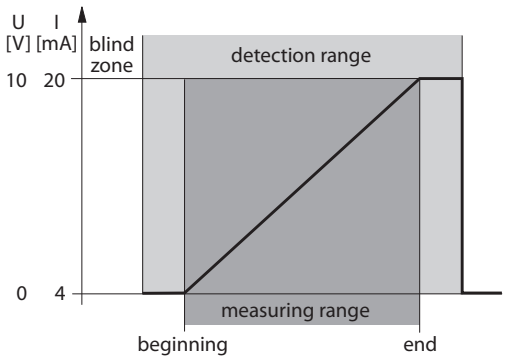


Fig. 9: Analog output – output behavior

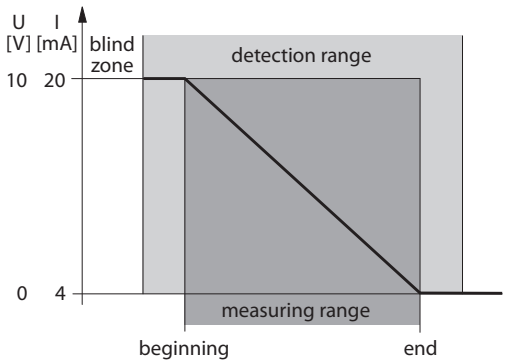


Fig. 10: Analog output inverted – output behavior

4.4.3 Retroreflective mode

When used as a retroreflective sensor, the sensor detects the echo of the ultrasonic waves of the taught reflector. The reflector can be any object with a surface that is as smooth as possible. The sensor generates a short switching window around the position of the reflector and detects the echo. The sensor switches if the echo is blocked or deflected by another object.

This operating mode is normally more reliable than the diffuse mode and is particularly suitable for objects that are difficult to detect and in difficult ambient conditions.

Any additional wiring or accessories are not required.

Synchronization with other sensors is not possible in this operating mode.

When used as a retroreflective sensor switching output 2 is switched on. The behavior of switching output 1 is inverted in relation to switching output 2.

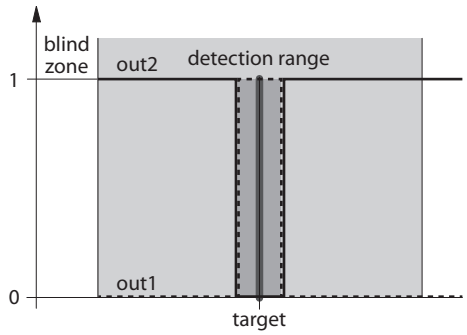


Fig. 11: Retroreflective mode – behavior of the switching output

4.4.4 IO-Link mode

Other operating modes which cannot be set via pushbuttons or the teach-in input can be set via IO-Link. This applies to the following operating modes:

- Multiplex mode
- Synchronization mode
- Enable mode
- Opposed mode

IO-Link is only required for setting up the device. The IODD of the device must be incorporated in an FDT frame (e.g. Pactware). The operating modes can be set via FDT/ IODD.

The operating modes cannot be combined with each other. The appropriate bit in the process output data is used for synchronization or multiplex operation via the IO-Link process data. In this case, wiring the sensors together is unnecessary. The time sequence is controlled by the IO-Link master.

Multiplex mode

Multiplex mode is used to prevent the mutual feedback of sensors operating at the same ultrasonic frequency. Up to ten devices can be operated in sequence. Each sensor operates at a fixed time while all other sensors remain in wait mode. Multiplex mode must be set once for all sensors via IO-Link. Each sensor is assigned a unique address between 1 and 10. The device with the highest number set operates automatically as the master clock. This requires the sensors to be interconnected.

NOTE
Multiplex mode is only possible with devices of the same type.
All connected sensors must have the same power and range in multiplex mode. In multiplex mode, only connect sensors with the same ID no. The ID no. is marked on each device.

Output 1 on the master device is not available in this mode. A teach-in operation is not possible in this mode during operation. No other accessories are required for operation.

Synchronization mode

The mutual feedback of sensors operating at the same ultrasonic frequency can be prevented in synchronization mode. Feedback is prevented since all sensors send and receive at the same time. Any number of sensors can be operated in synchronization mode. The devices do not have to be addressed. One of the sensors deployed is defined by the wiring as the master clock.

NOTE
Synchronization mode is only possible with devices of the same type.
All connected sensors must have the same power and range in synchronization mode. In synchronization mode, only connect sensors with the same ID no. The ID no. is marked on the device.

Output 1 on the master device is not available in this mode. A teach-in operation is not possible in this mode during operation. No other accessories are required for operation.

Enable mode

Enable mode enables the targeted activation and deactivation of the sonic transducer of individual sensors. In enable mode, each sensor is only active if a signal to U_B is issued at pin 5. Synchronization or multiplexing can be implemented in enable mode. Sensors with a different power and range can be used at the same time in enable mode. An ultrasonic sensor is not used as the master clock. The signal must be switched externally to each device via a PLC. The sensors do not have to be interconnected. Inactive sensors output the valid values that were last measured. The outputs can be used in the normal way. IO-Link operation is not possible in this mode.

Opposed mode

Two sensors with the same power and range are required for opposed mode. One sensor operates in this mode as the emitter and the other sensor as the receiver. The devices are positioned and aligned opposite each other. This makes it possible to double the effective range of the sensors. The opposed mode is the most reliable operating mode. All objects that interrupt the sonic wave are detected. Whether a device is to operate as an emitter or receiver is determined by the wiring.

NOTE

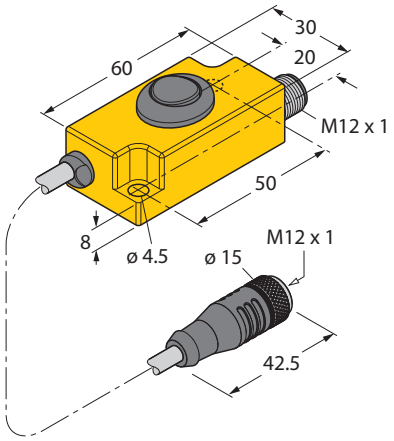
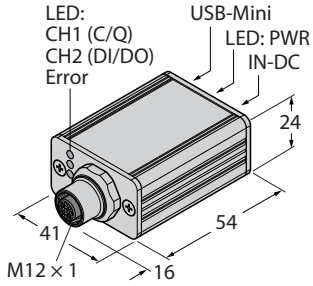
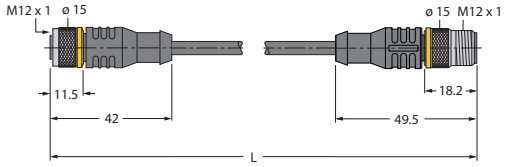
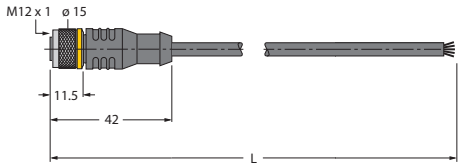
Opposed mode is only possible with devices of the same type.

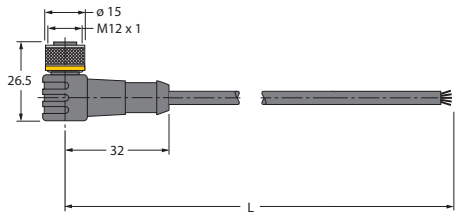
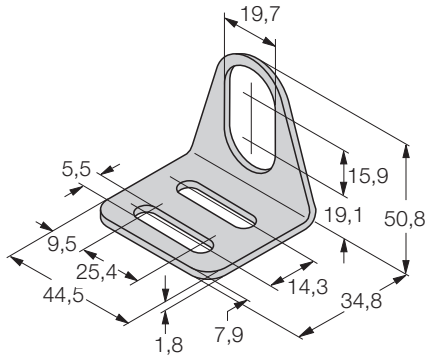
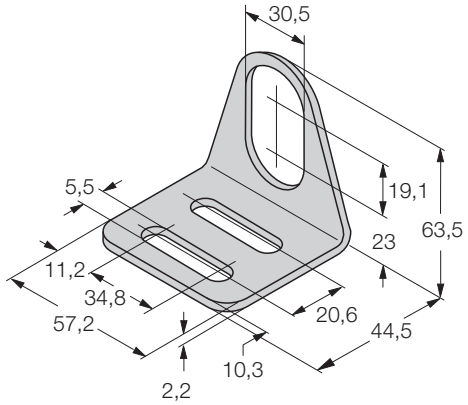
All connected sensors in opposed mode must have the same power and range. In opposed mode, only connect sensors with the same ID no. The ID no. is marked on each device.

The outputs of the sensor connected as the emitter are not available. The receiver only offers one switching output on pin 4. IO-Link operation is not possible.

4.5 Technical accessories

The following accessories are not included in the scope of delivery:

Dimension drawing	Type	ID no.	Description
	TX1-Q20L60	6967114	Teach adapter
	USB-2-IOL-0002	6825482	IO-Link adapter V1.1 with integrated USB interface
	RKC4.5T-2-RSC4.5T/TEL	6625212	Connection cable, M12 female connector, straight, 5-pin, M12 male connector, straight, 5-pin, cable length: 2 m, sheathing material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com
	RKC4.5-2/TEL	6625016	Connection cable, M12 female connector, straight, 5-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 no.	Description
	WKC4.5T-2/ TEL	6625028	Connection cable, M12 female connector, angled, 5-pin, cable length: 2 m, sheathing material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com
	MW-18	6945004	Mounting bracket, stainless steel, for M18
	MW-30	6945005	Mounting bracket, stainless steel, for M30

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 ultrasonic sensor in an application:
Avoid the overlapping of sonic cones.
This can occur if two sensors are mounted less than 200 mm (RU40…), 450 mm (RU130…), 1000 mm (RU300…) or 2000 mm (RU600…) apart.

- ▶ If this distance is undershot, synchronize the sensors using IO-Link.

The sensors can be mounted in any direction. The maximum tightening torque for fastening the sensors is 20 Nm.

- ▶ Clean the mounting surface and its 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.
- ▶ Mount the sensor so that the blind zone is clear of any relevant objects (see wave patterns or technical data).

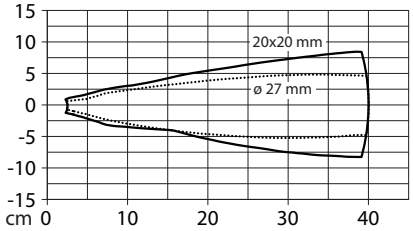


Fig. 12: RU40… wave pattern

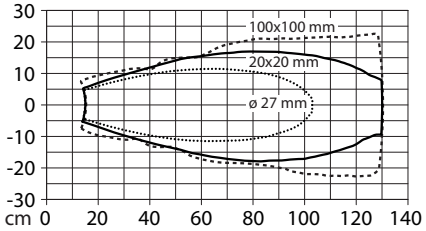


Fig. 13: RU130… wave pattern

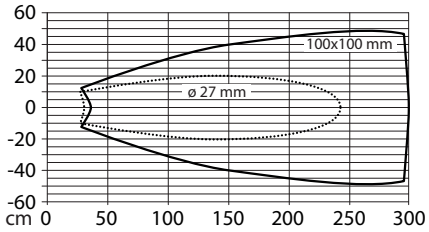


Fig. 14: RU300… wave pattern

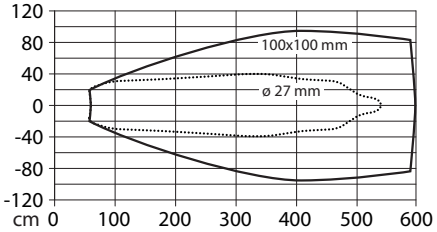


Fig. 15: RU600… wave pattern

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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 processing units.

6.1 Connection diagram

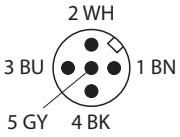


Fig. 16: Pin assignment

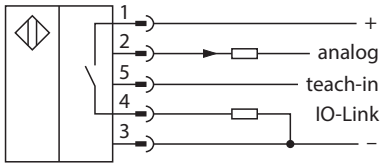


Fig. 17: Connection diagram

6.2 Connection – multiplex mode

- Sensors must be connected to the master sensor according to the following wiring diagram.

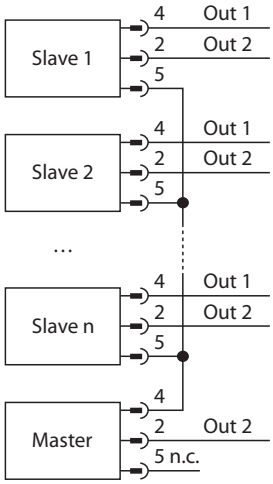
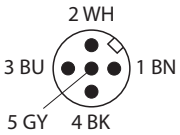


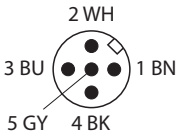
Fig. 18: Wiring diagram – multiplex mode

Connection diagram of the master sensor in multiplex mode

Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	Output 2 (analog output or switching output)
Pin 3	GND
Pin 4	Multiplex output, connected to pin 5 of the slaves
Pin 5	Not connected (n. c.)



Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	Output 2 (analog output or switching output)
Pin 3	GND
Pin 4	Output 1 (switching output)
Pin 5	Multiplex input, connected to pin 4 of the master sensor



6.3 Connection – synchronization mode

- Sensors must be connected to the master sensor according to the following wiring diagram:

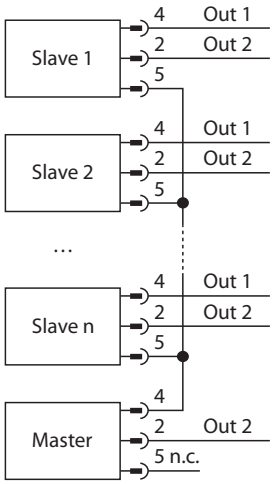


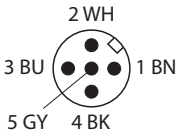
Fig. 19: Wiring diagram – synchronization mode

The sensors do not have to be addressed. The master sensor controls all sensors in a fixed time cycle with a trigger signal via pin 4:

RU40U…	RU130U…	RU300U…	RU600U…
22 ms	17.4 ms	37.4 ms	75.4 ms

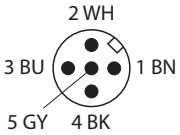
Connection diagram of the master sensor in synchronization mode

Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	Output 2 (analog output or switching output)
Pin 3	GND
Pin 4	Synchronization output, connected to pin 5 of the slaves
Pin 5	Not connected (n. c.)



Connection diagram of the slaves in synchronization mode

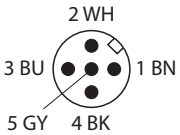
Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	Output 2 (analog output or switching output)
Pin 3	GND
Pin 4	Output 1 (switching output)
Pin 5	Synchronization input, connected to pin 4 of the master sensor



6.4 Connection – release mode

Connection diagram of the sensors in release mode

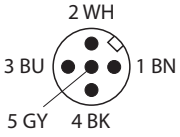
Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	Output 2 (analog output or switching output)
Pin 3	GND
Pin 4	Output 1 (switching output)
Pin 5	Release input Enable: +24 VDC Disable: GND or open



6.5 Connection – throughbeam mode

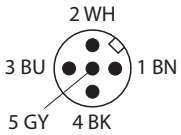
Pin assignment of the emitters in throughbeam mode

Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	No function
Pin 3	GND
Pin 4	Trigger output, connected to pin 5 of the receiver
Pin 5	Not connected (n. c.)



Pin assignment of the receiver in throughbeam mode

Pin	Pin assignment
Pin 1	+24 VDC
Pin 2	No function
Pin 3	GND
Pin 4	Output signal for object detection, signal according to the table below
Pin 5	Trigger input, connected to pin 4 of the emitter



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7 Commissioning

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

8 Operation

NOTICE
Incorrect use of the sensor
Possible damage to property due to malfunction

- ▶ Prevent the accumulation of material deposits on the surface of the sonic transducer.
- ▶ Keep the blind zone of the sensor clear. Refer to the technical data for the blind zone S_{min} of the sensor.

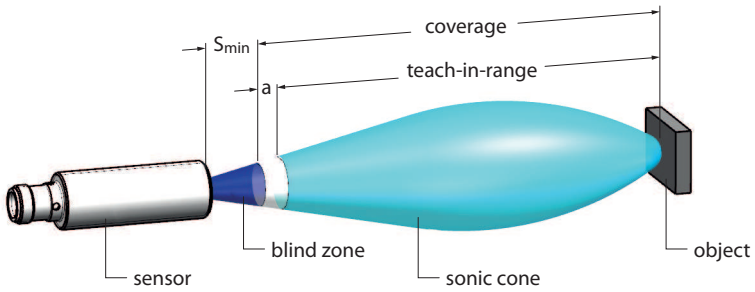

Fig. 20: Sonic cone and spread of the blind zone (schematic)

8.1 Operation as a diffuse mode sensor – LEDs

In diffuse mode the LEDs have the following indication functions:

LED	Meaning
Yellow	NO contact: Object within the teach-in range, switching output 1 on NC contact: Object within the teach-in range, switching output 1 on
Green	NO contact: Object within the detection range, switching output 1 off NC contact: Object within the teach-in range, switching output 1 off
Off (only NO contact)	No object within the detection range, switching output 1 off

8.2 Operation as a retroreflective sensor – LEDs

In retroreflective mode the LEDs have the following indication functions:

LED	Meaning
Yellow	Reflector present, switching output 1 on
Green	Object between sensor and reflector, switching output 1 off
Off	No object within the detection range, switching output 1 off

Switching output 2 inverts the signal of switching output 1.

8.3 Operation in IO-Link mode – LEDs

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

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

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9 Setting

The ultrasonic sensor has two outputs with individually adjustable limits. Output 2 is factory set as an analog output and can be used either as a current output, a voltage output or as a switching output. The user can set an individual switching point as well as a double switching point for the switching outputs. The double switching point is used for window or hysteresis functions. The output behavior of the switching outputs and the analog outputs is shown in the section Functions and operating modes. The sensor switches automatically to normal operation after the teach-in operation is successfully completed.

Teach-in the devices as follows:

	Teach-in to GND	**Teach-in to U_B**
Teach adapter	Press the pushbutton to GND	Press the pushbutton to U_B
Manual bridging (shorting)	Bridge pin 3 (BU) with pin 5 (GY)	Bridge pin 1 (BN) with pin 5 (GY)
Pushbutton on the device	Press pushbutton 1	Press pushbutton 2

The TX1-Q20L60 teach adapter is not included in the scope of delivery. To use the teach adapter connect it between the sensor and the connection cable.

Aborting the teach-in operation: Teach-in U_B for at least 2 s.

Other operating modes (e.g. multiplex, synchronization, release and throughbeam mode) and parameters can be set via IO-Link: The following flow chart illustrates the operating steps and the LED indication during the teach-in operation.

9.1 Setting via teach adapter

Selecting the output

- Select switching output 1: Press and hold down the pushbutton on the adapter to GND for 2…7 s.
- Select output 2: Press and hold down the pushbutton on the adapter to GND for 8…13 s.

Setting the switching point

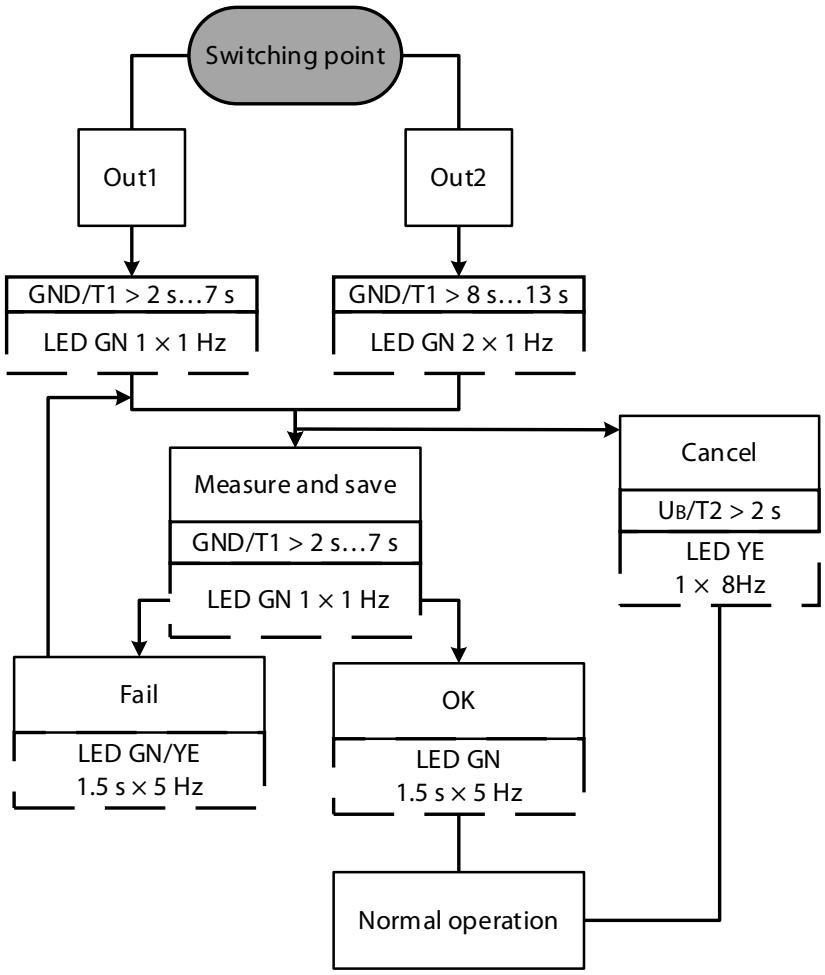

Fig. 21: Setting the switching point

- Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- Select the switching output.
- Position the object for the switching point.
- Store the switching point: Press and hold down the pushbutton on the adapter to GND for 2…7 s.

⇨ The individual switching point has been taught in successfully if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – setting the switching range

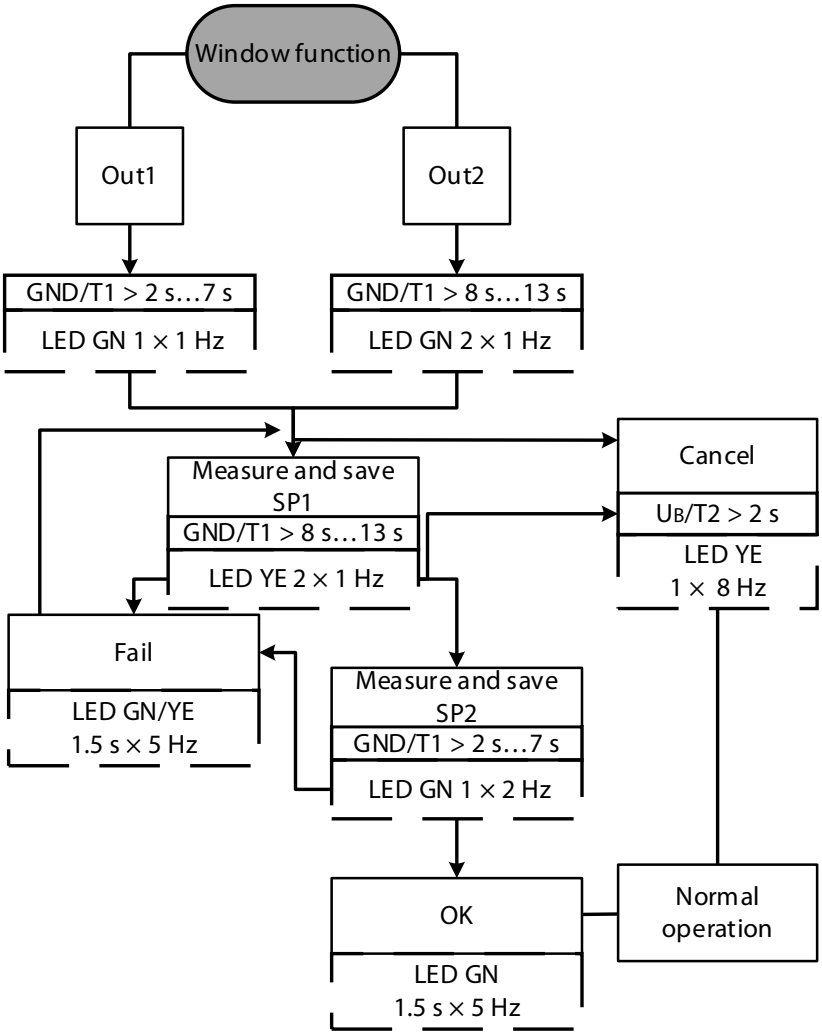

Fig. 22: Window function – setting the switching range

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Position the object for switching point 1.
- ▶ Select the switching output.
- ▶ Store switching point 1: Press and hold down the pushbutton on the adapter to GND for 8…13 s.
- ▶ Position the object for switching point 2.
- ▶ Store switching point 2: Press and hold down the pushbutton on the adapter to GND for 2…7 s.
- ⇨ The switching points have been successfully taught in if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – switching between hysteresis and window

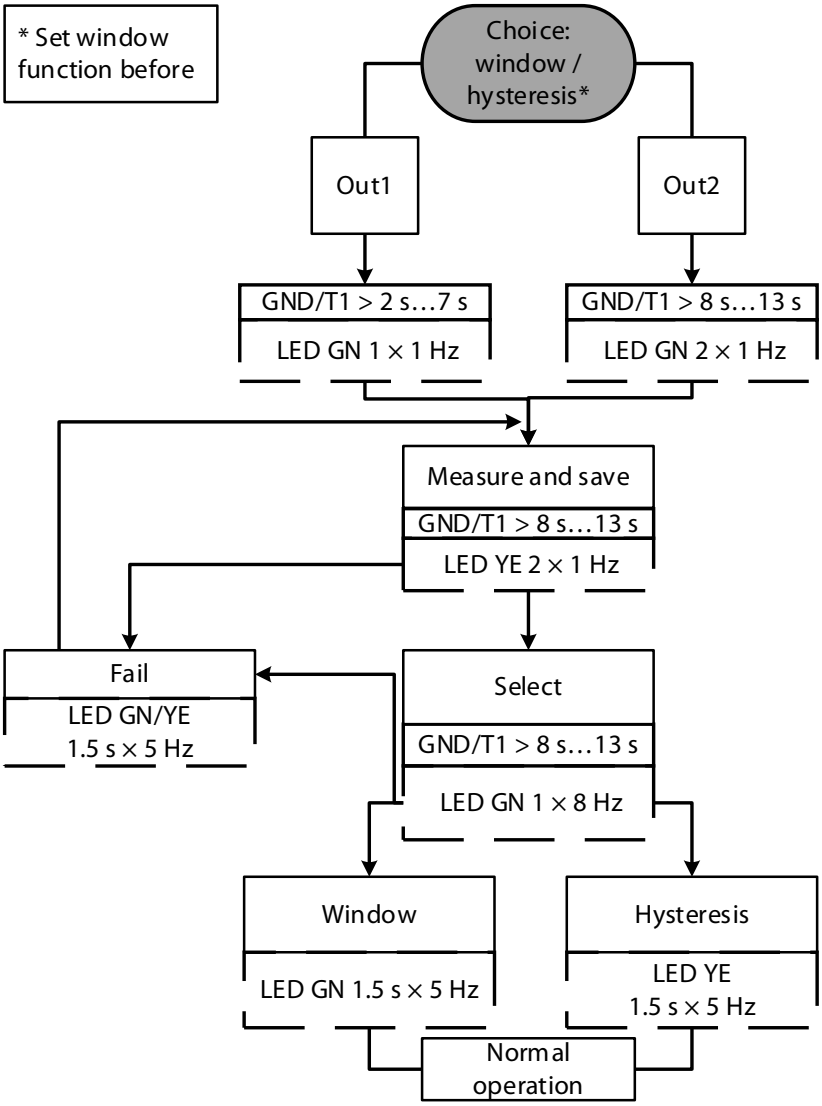

Fig. 23: Window function – switching between hysteresis and window

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Select the switching output.
- ▶ Press and hold down the pushbutton on the adapter to GND for 14…19 s.
- ⇨ The output function has been successfully inverted as an NO contact if the green LED flashes for 1.5 s at a frequency of 5 Hz.
- ⇨ The output function has been successfully inverted as an NC contact if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Inverting the output function (NO/NC)

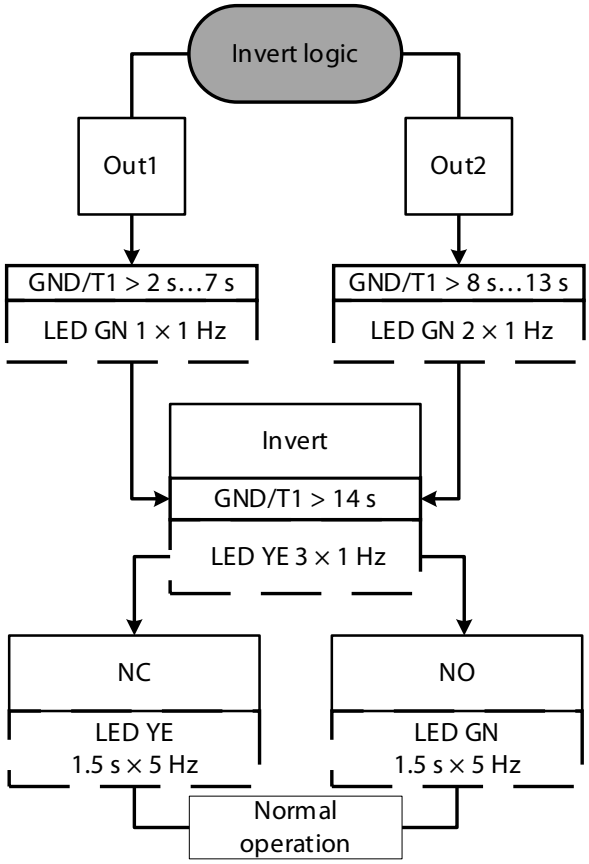

Fig. 24: Inverting the output function (NO/NC)

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Select the switching output.
- ▶ Press and hold down the pushbutton on the adapter to GND for 14…19 s.
- ⇨ The output function has been successfully inverted as an NO contact if the green LED flashes for 1.5 s at a frequency of 5 Hz. The output function has been successfully inverted as an NC contact if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Setting operation as a retroreflective sensor

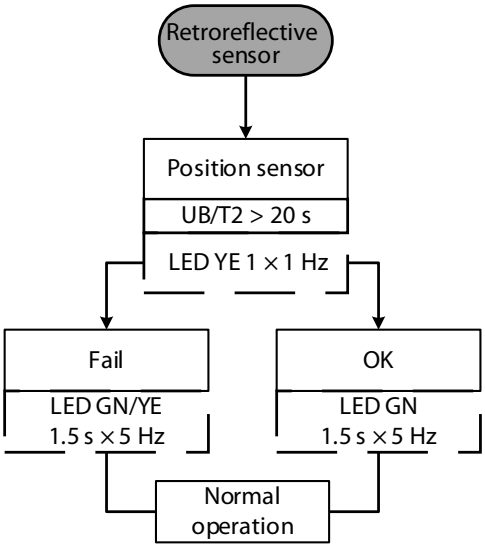

Fig. 25: Setting operation as a retroreflective sensor

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Position the reflector in the detection range.
- ▶ Press and hold down the pushbutton on the adapter to U_B for at least 21 s.
- ⇨ The sensor is set successfully as a retroreflective sensor if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Reset to factory settings

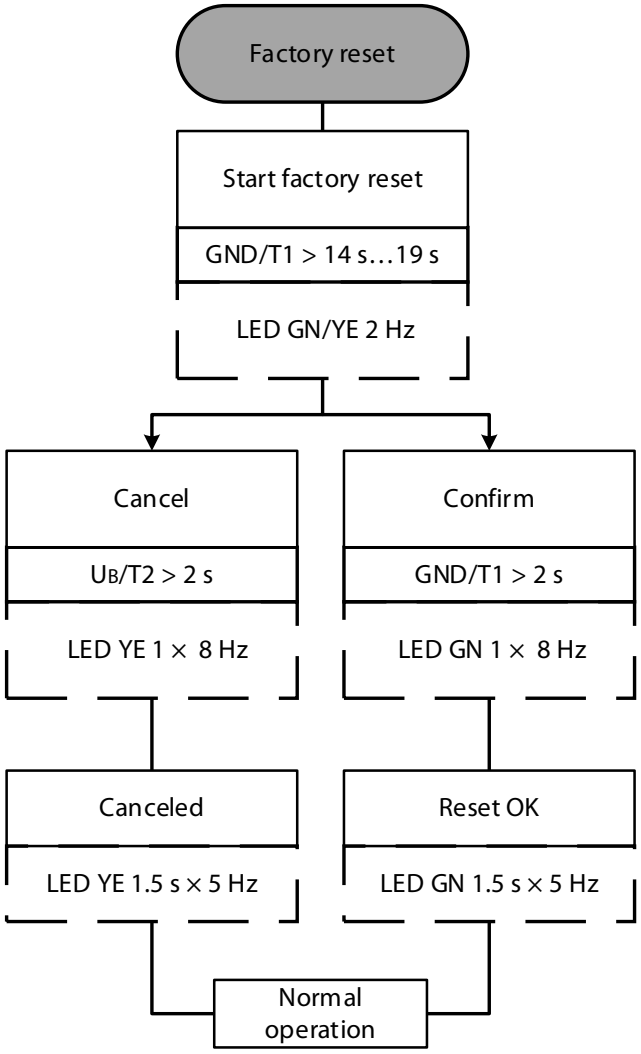

Fig. 26: Reset to factory settings

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Starting the reset to factory settings: Press and hold down the pushbutton on the adapter to GND for 14…19 s.
- ▶ Confirming the reset to factory settings: Press and hold down the pushbutton on the adapter to GND for 2…7 s.
- ⇨ The device has been successfully reset to the factory settings if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a current output

NOTE
If output 2 is set as a current output, the closer teach-in point corresponds to limit value 1 (4 mA) and the teach-in point further away to limit value 2 (20 mA).

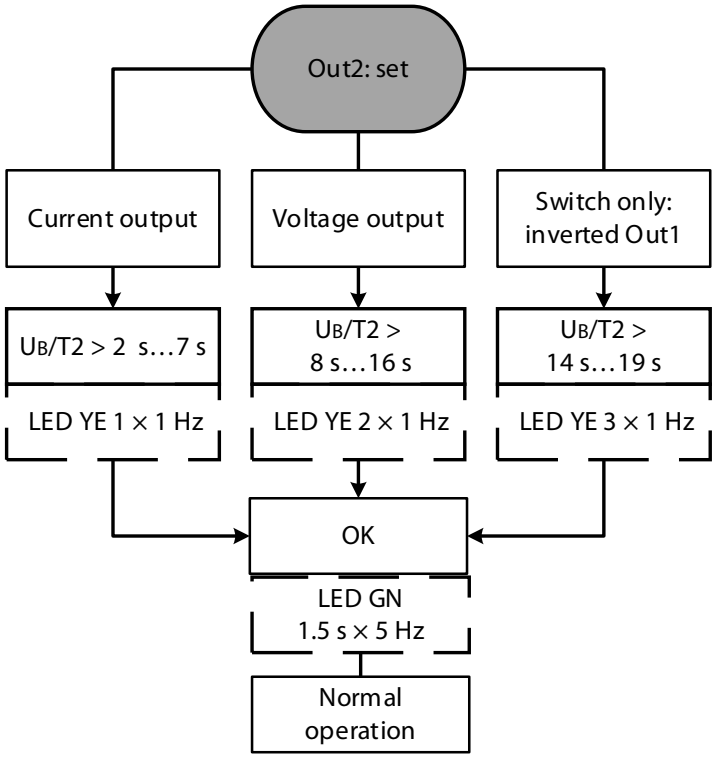

Fig. 27: Setting output 2

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Press and hold down the pushbutton on the adapter to U_B for 2…7 s.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a current output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a current output

NOTE
If output 2 is set as a voltage output, the closer teach-in point corresponds to limit value 1 (0 V) and the teach-in point further away to limit value 2 (10 V).

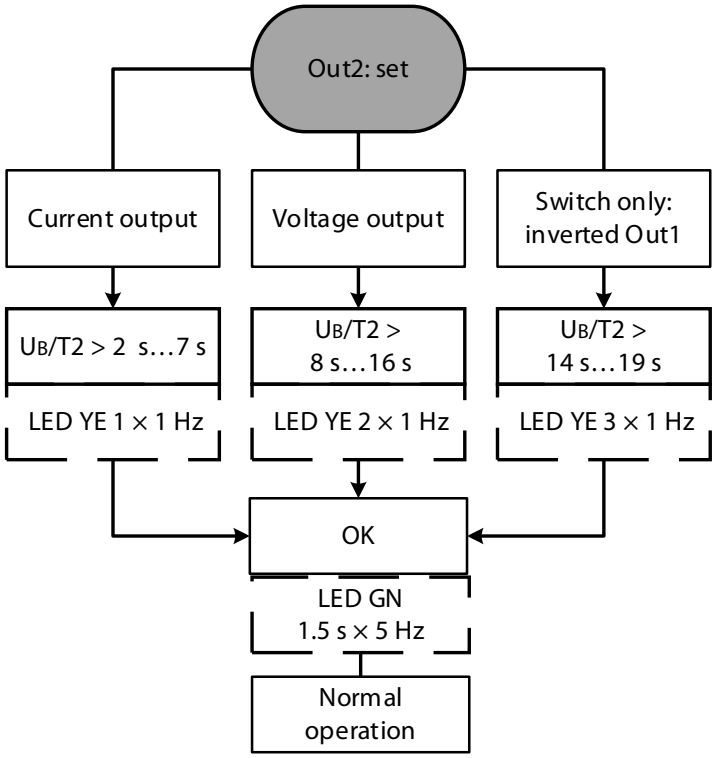

Fig. 28: Setting output 2

- ▶ Connect the TX1-Q20L60 teach adapter between the sensor and the connection cable.
- ▶ Press and hold down the pushbutton on the adapter for 8…13 s to U_B.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a voltage output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a switching output

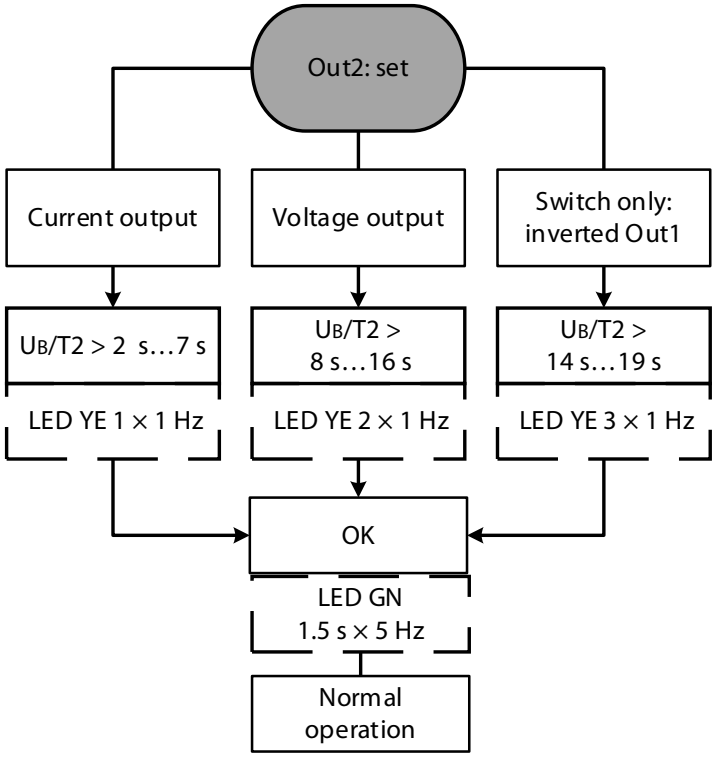

Fig. 29: Setting output 2

- ▶ Press and hold down the pushbutton on the adapter to U_B for 14…19 s.
- ⇨ Output 2 is set successfully as a switching output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

9.2 Setting by manual bridging (shorting)

Selecting the output

- Select switching output 1: Bridge pin 3 (BU) with pin 5 (GY) for 2…7 s.
- Select output 2: Bridge pin 3 (BU) with pin 5 (GY) for 8…13 s.

Setting the switching point

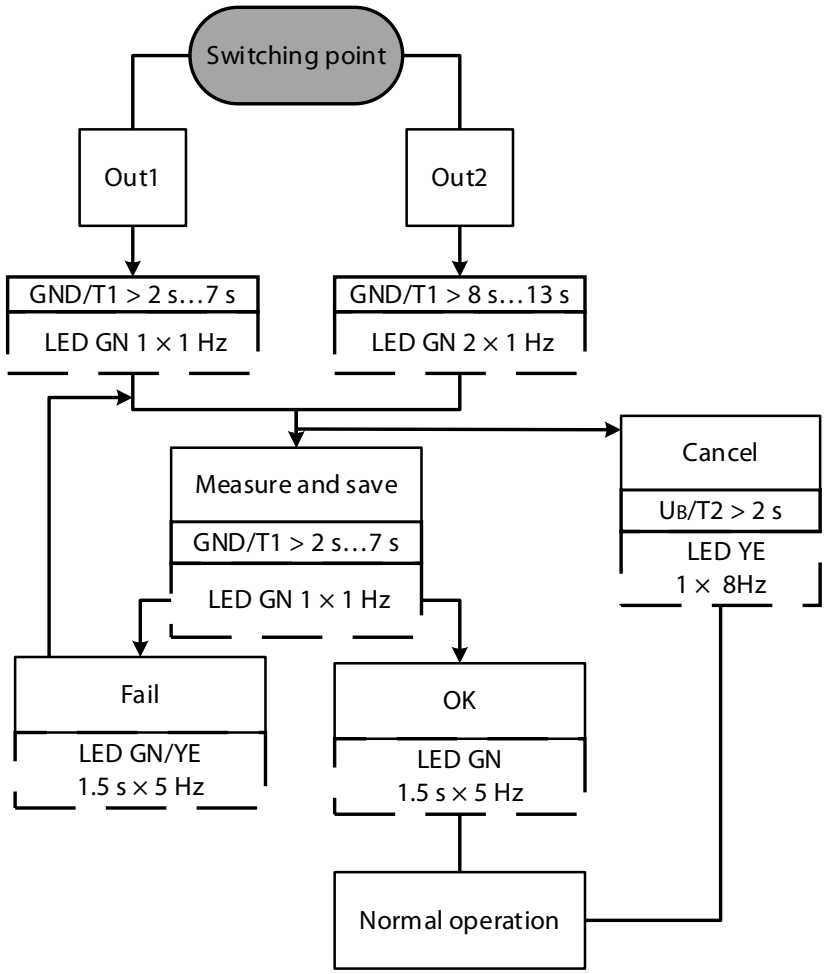

Fig. 30: Setting the switching point

- Select the switching output.
- Position the object for the switching point.
- Store the switching point: Bridge pin 3 (BU) with pin 5 (GY) for 2…7 s.
- ⇨ The individual switching point has been taught in successfully if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – setting the switching range

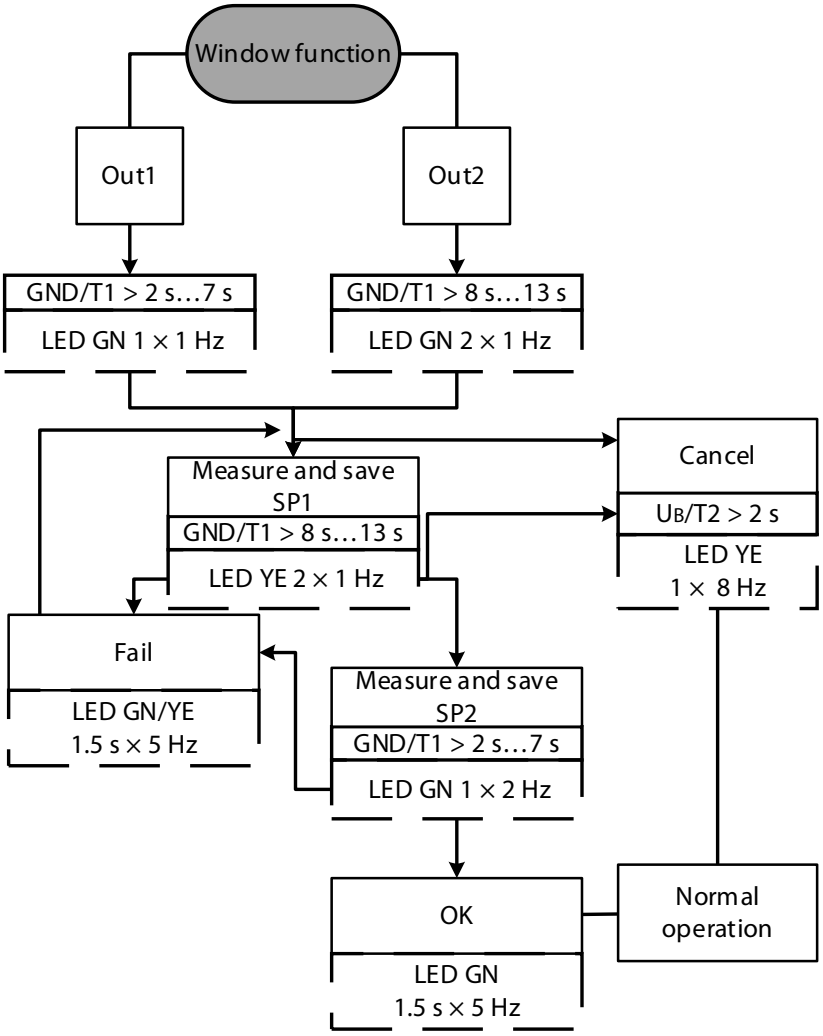

Fig. 31: Window function – setting the switching range

- ▶ Position the object for switching point 1.
- ▶ Store switching point 1: Bridge pin 3 (BU) with pin 5 (GY) for 8…13 s.
- ▶ Position the object for switching point 2.
- ▶ Store switching point 2: Bridge pin 3 (BU) with pin 5 (GY) for 2…7 s.
- ⇨ The switching points have been successfully taught in if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – switching between hysteresis and window

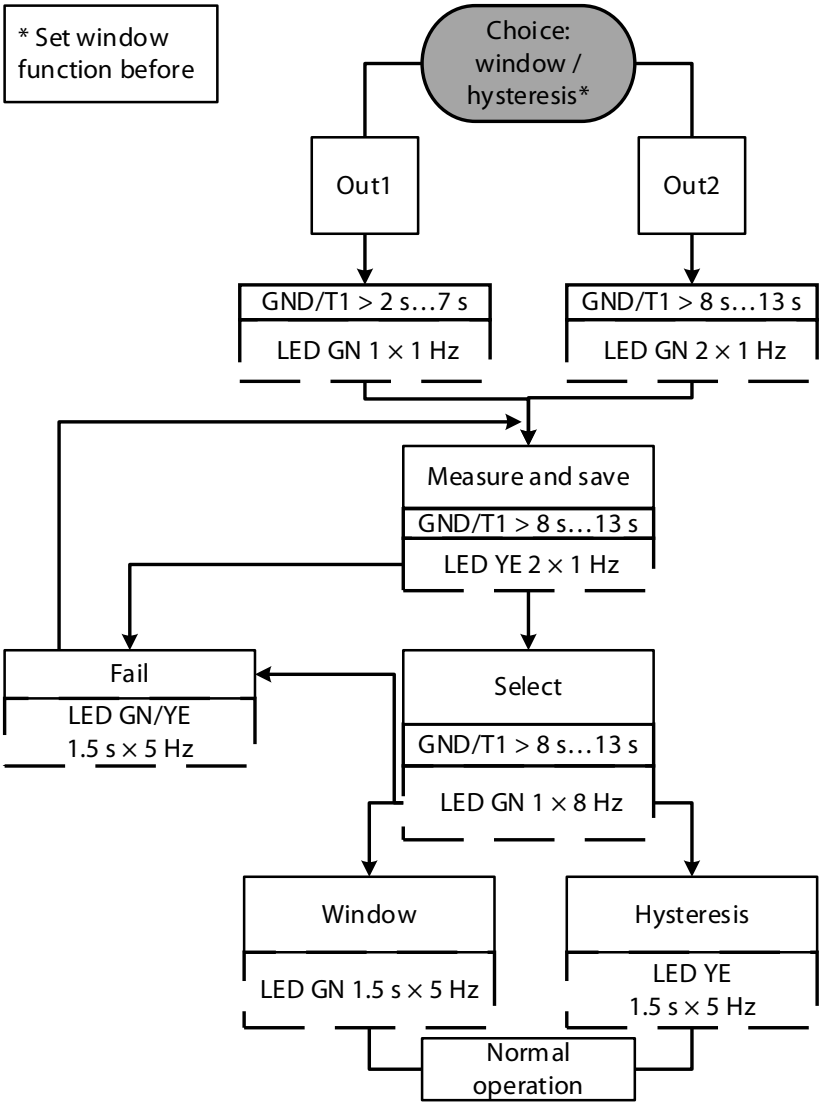

Fig. 32: Window function – switching between hysteresis and window

- ▶ Position the object at any point in the detection range.
- ▶ Bridge pin 3 (BU) with pin 5 (GY) for 14…19 s.
- ⇨ The output function has been successfully inverted as an NO contact if the green LED flashes for 1.5 s at a frequency of 5 Hz.
- ⇨ The output function has been successfully inverted as an NC contact if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Inverting the output function (NO/NC)

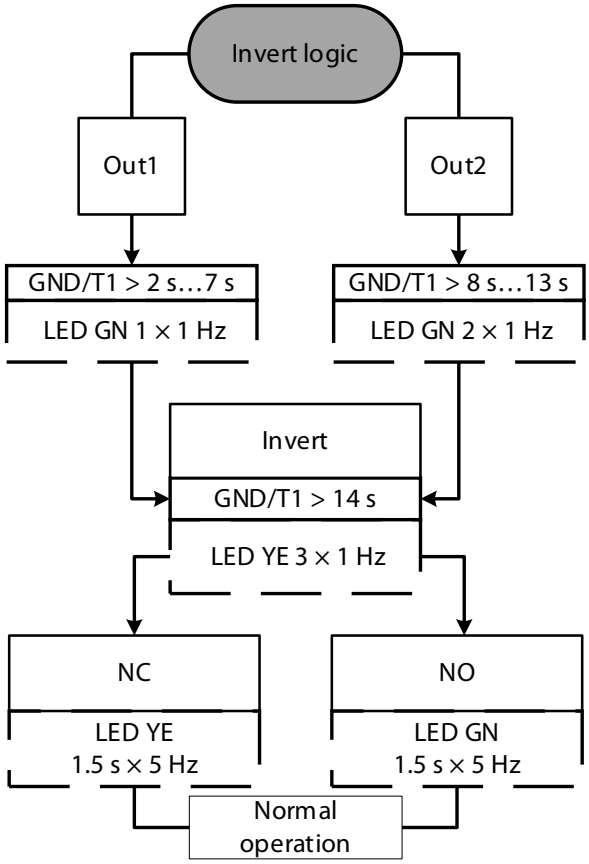

Fig. 33: Inverting the output function (NO/NC)

- ▶ Select the switching output.
- ▶ Bridge pin 3 (BU) with pin 5 (GY) for 14…19 s.
- ⇨ The output function has been successfully inverted as an NO contact if the green LED flashes for 1.5 s at a frequency of 5 Hz. The output function has been successfully inverted as an NC contact if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Setting operation as a retroreflective sensor

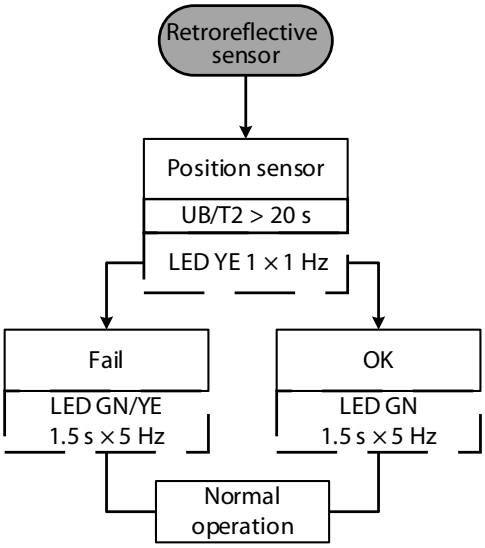

Fig. 34: Setting operation as a retroreflective sensor

- ▶ Position the reflector in the detection range.
- ▶ Bridge pin 1 (BN) with pin 5 (GY) for at least 21 s.
- ⇨ The sensor is set successfully as a retroreflective sensor if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Reset to factory settings

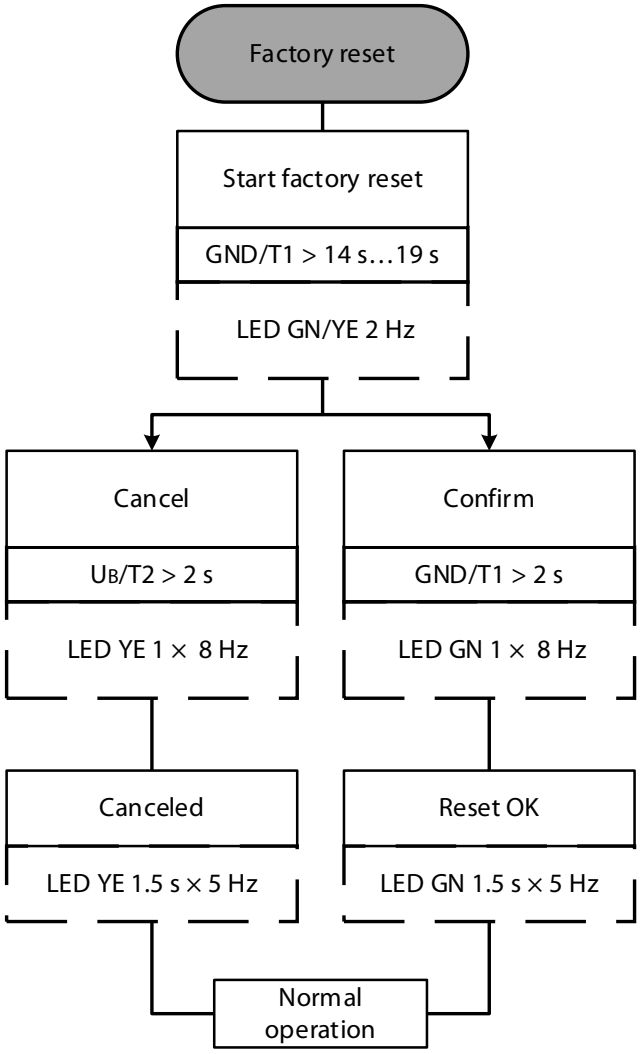

Fig. 35: Reset to factory settings

- ▶ Starting the reset to factory settings: Bridge pin 3 (BU) with pin 5 (GY) for 14…19 s.
- ▶ Confirming the reset to factory settings: Bridge pin 3 (BU) with pin 5 (GY) for 2…7 s.
- ⇨ The device has been successfully reset to the factory settings if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a current output

NOTE
If output 2 is set as a current output, the closer teach-in point corresponds to limit value 1 (4 mA) and the teach-in point further away to limit value 2 (20 mA).

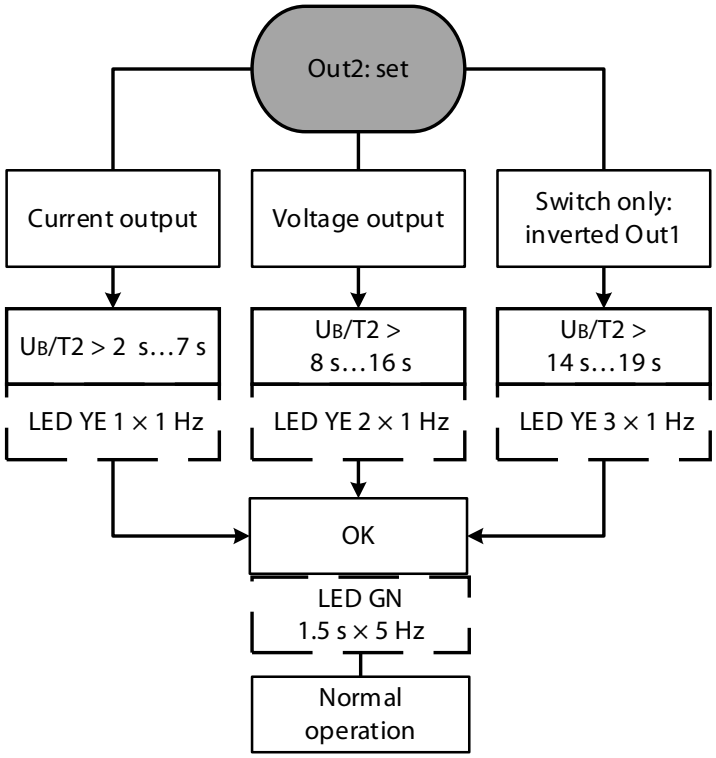

Fig. 36: Setting output 2

- ▶ Bridge pin 1 (BN) with pin 5 (GY) for 2…7 s.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a current output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a voltage output

NOTE
If output 2 is set as a voltage output, the closer teach-in point corresponds to limit value 1 (0 V) and the teach-in point further away to limit value 2 (10 V).

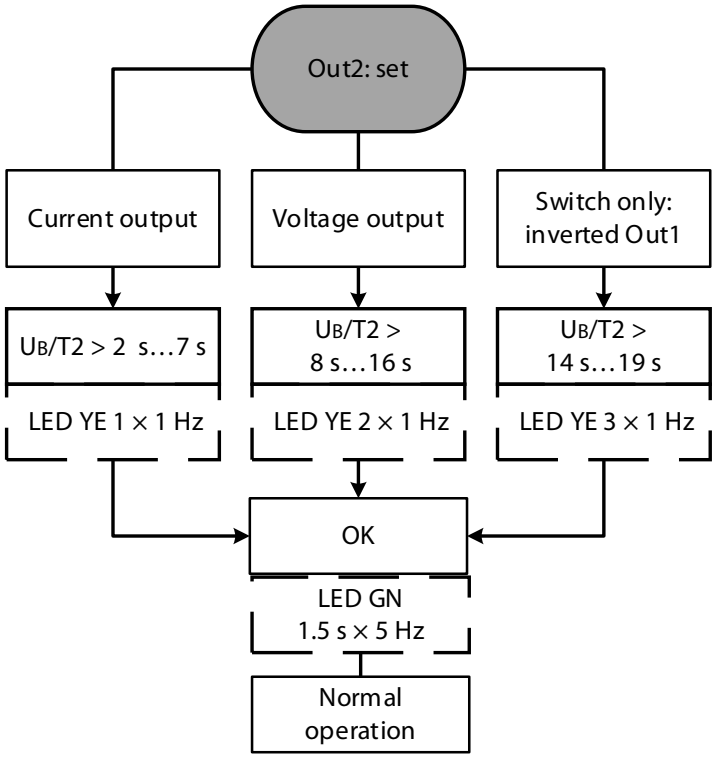

Fig. 37: Setting output 2

- ▶ Bridge pin 1 (BN) with pin 5 (GY) for 8…13 s.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a voltage output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a switching output

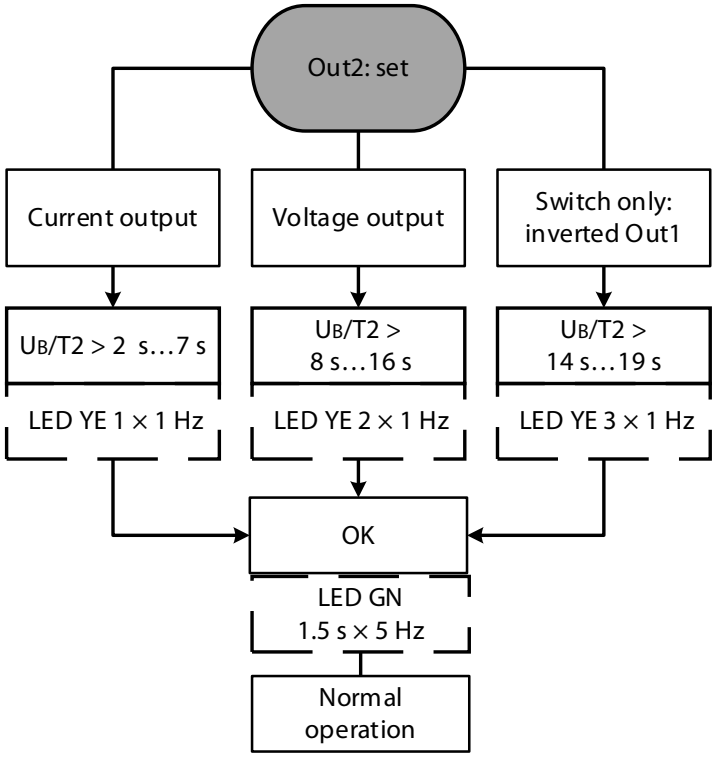

Fig. 38: Setting output 2

- ▶ Bridge pin 1 (BN) with pin 5 (GY) for 14…19 s.
- ⇨ Output 2 is set successfully as a switching output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

9.3 Setting via the pushbuttons

NOTE
The devices with a teach button are ready for teaching in up to 300 s after the power supply is switched on. The teach button is then automatically locked. A new teach-in operation is only possible after the power supply has been reset.

Selecting the output

- ▶ Select switching output 1: Press and hold down pushbutton 1 for 2…7 s.
- ▶ Select output 2: Press and hold down pushbutton 1 for 8…13 s.

Setting the switching point

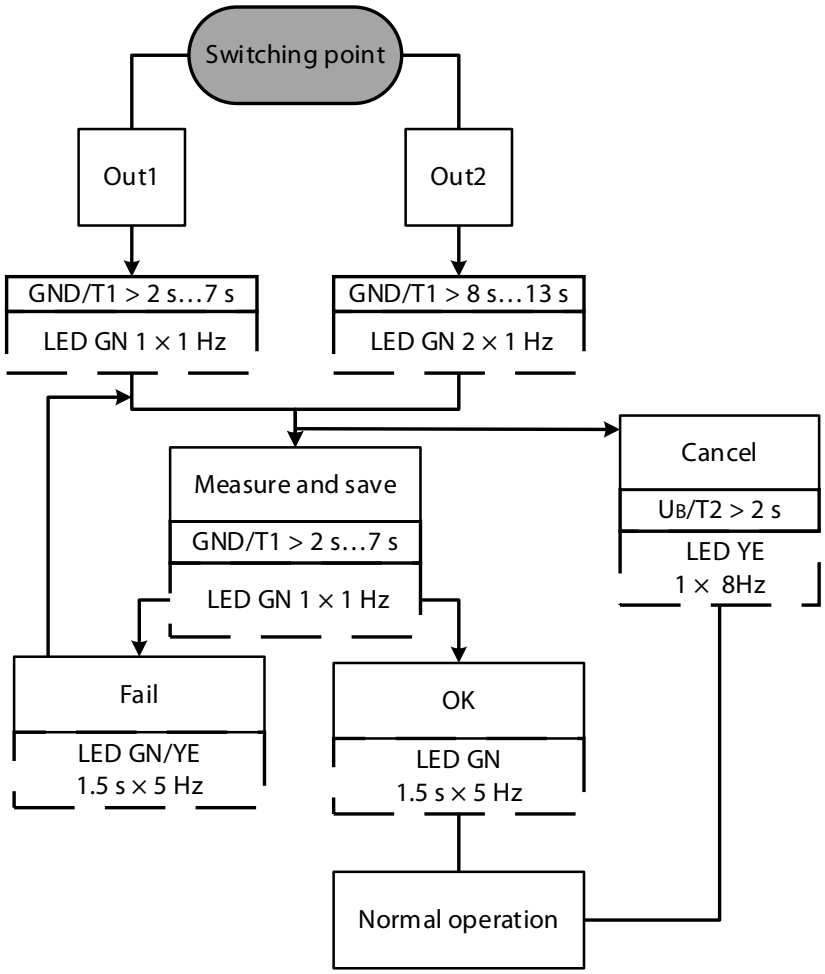

Fig. 39: Setting the switching point

- ▶ Select the switching output.
- ▶ Position the object for the switching point.
- ▶ Save the switching point: Press and hold down pushbutton 1 for 2…7 s.
- ⇨ The individual switching point has been taught successfully if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – setting the switching range

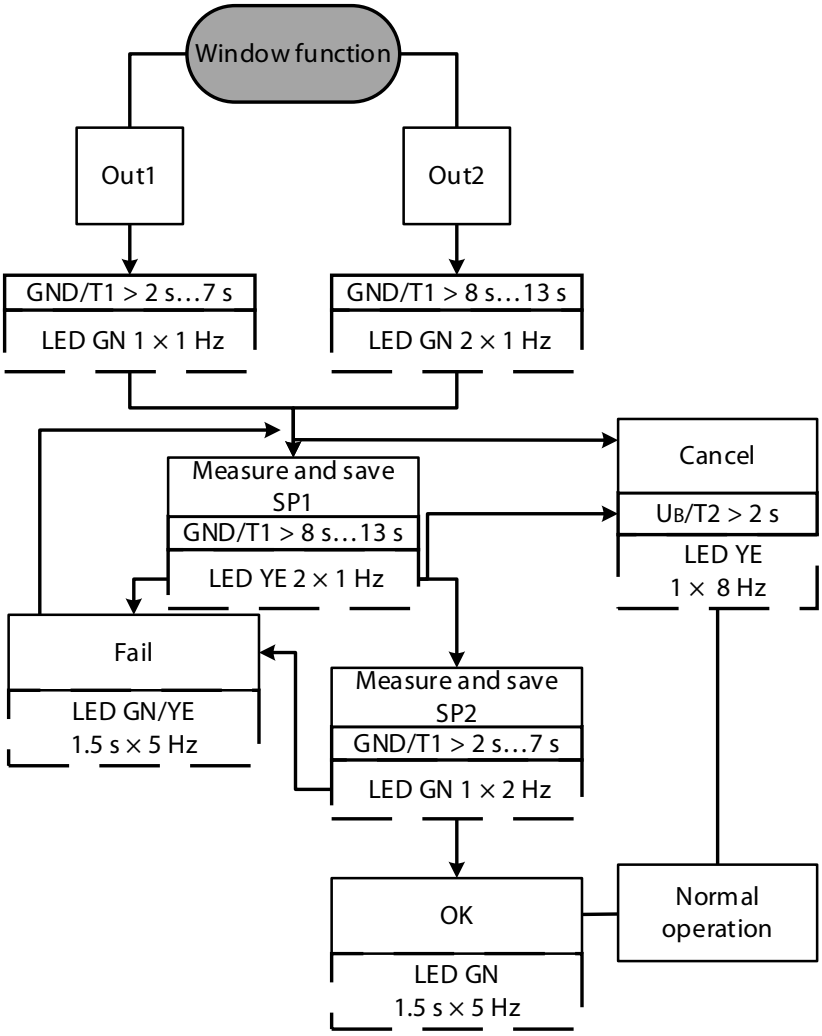

Fig. 40: Window function – setting the switching range

- ▶ Position the object for switching point 1.
- ▶ Select the switching output.
- ▶ Store switching point 1: Press and hold down pushbutton 1 for 8…13 s.
- ▶ Position the object for switching point 2.
- ▶ Store switching point 2: Press and hold down pushbutton 1 for 2…7 s.
- ⇨ The switching points have been successfully taught if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Window function – switching between hysteresis and window

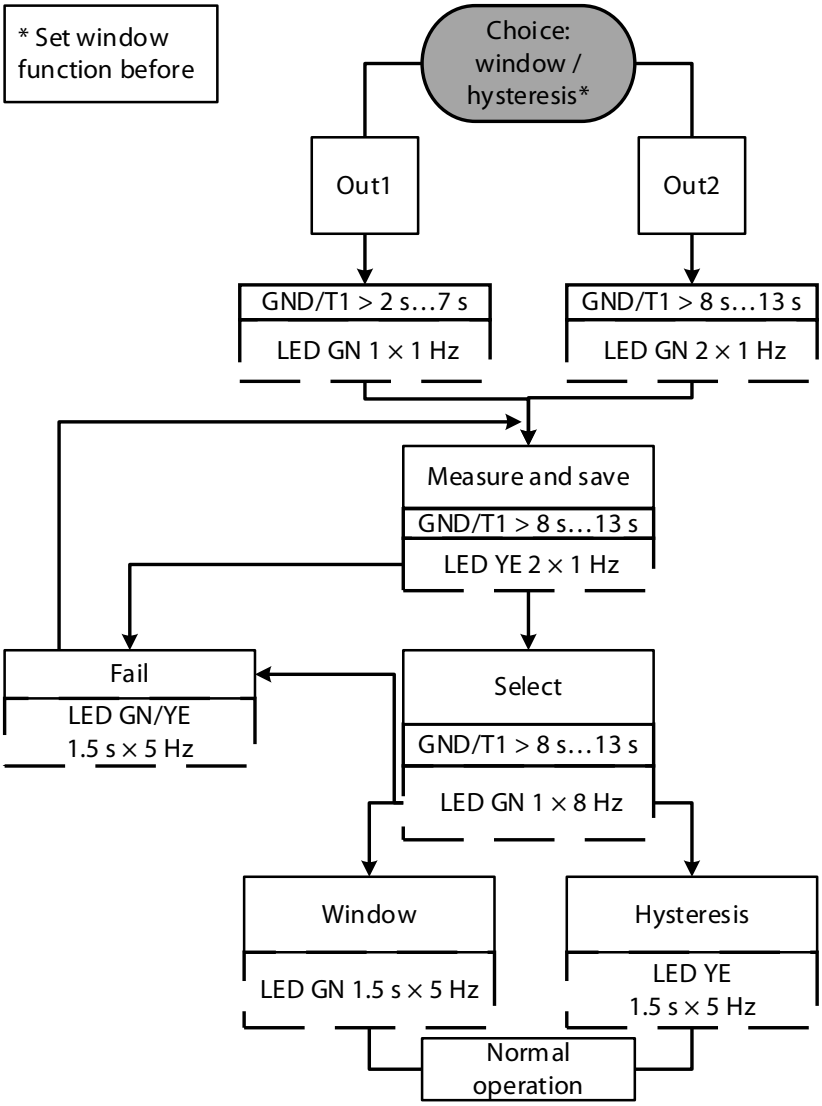

Fig. 41: Window function – switching between hysteresis and window

- ▶ Position the object at any point in the detection range.
- ▶ Press and hold down pushbutton 1 for 8…13 s.
- ▶ Press and hold down pushbutton 1 once more for 8…13 s.
- ⇨ The individual switching point has been taught in successfully if the green LED flashes for 1.5 s at a frequency of 5 Hz.
- ⇨ The hysteresis function has been taught in successfully if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Inverting the output function (NO/NC)

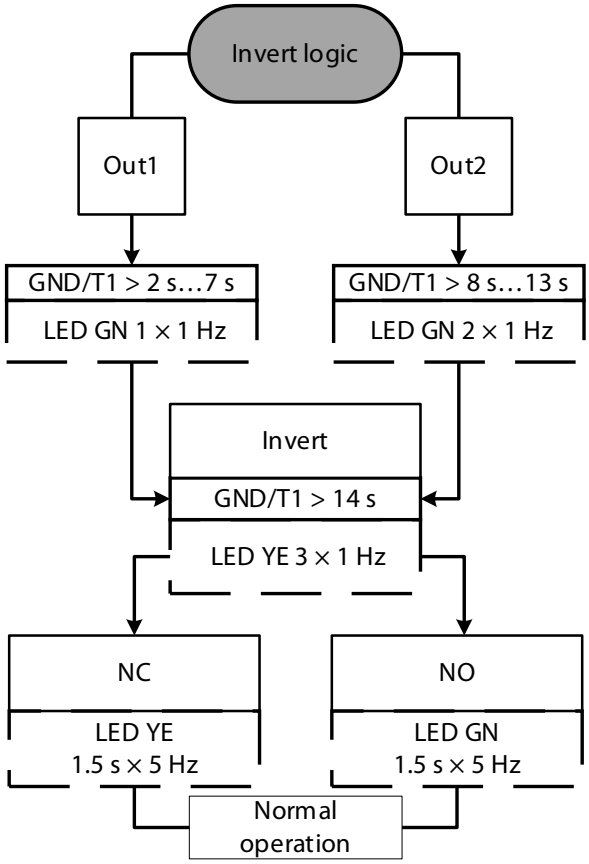

Fig. 42: Inverting the output function (NO/NC)

- ▶ Select the switching output.
- ▶ Press and hold down pushbutton 1 for 14…19 s.
- ⇨ The output function has been successfully inverted as an NO contact if the green LED flashes for 1.5 s at a frequency of 5 Hz.
- ⇨ The output function has been successfully inverted as an NC contact if the yellow LED flashes for 1.5 s at a frequency of 5 Hz.

Setting operation as a retroreflective sensor

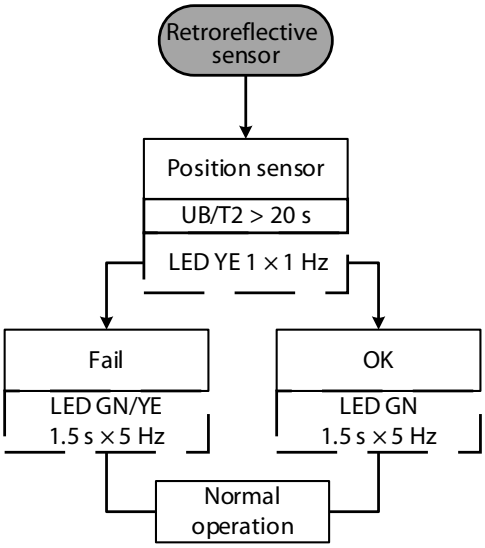

Fig. 43: Setting operation as a retroreflective sensor

- ▶ Position the reflector in the detection range.
- ▶ Press and hold down pushbutton 2 for at least 21 s.
- ⇨ The sensor is set successfully as a retroreflective sensor if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Reset to factory settings

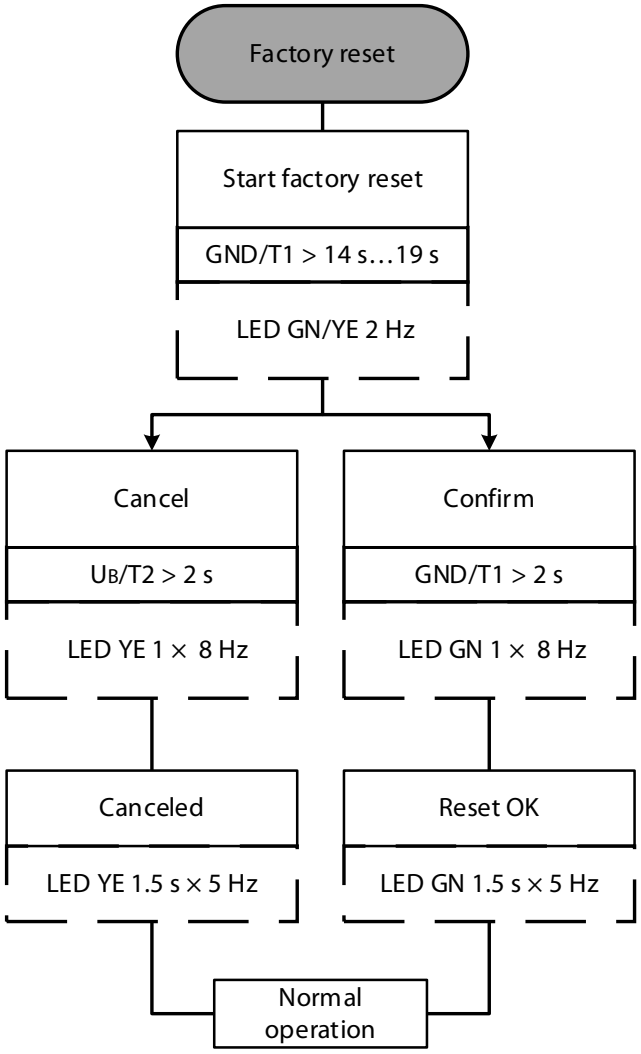

Fig. 44: Reset to factory settings

- ▶ Starting the reset to factory settings: Press and hold down pushbutton 1 for 14…19 s.
- ▶ Confirming the reset to factory settings: Press and hold down pushbutton 1 for 2…7 s.
- ⇨ The device has been successfully reset to the factory settings if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a current output

NOTE
If output 2 is set as a current output, the closer teach-in point corresponds to limit value 1 (4 mA) and the teach-in point further away to limit value 2 (20 mA).

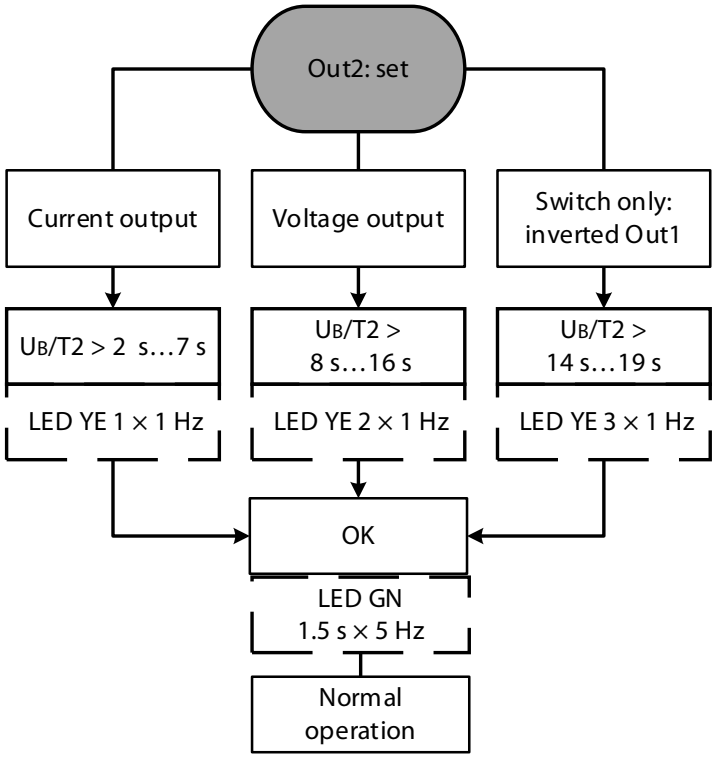

Fig. 45: Setting output 2

- ▶ Press and hold down pushbutton 2 for 2…7 s.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a current output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a voltage output

NOTE
If output 2 is set as a voltage output, the closer teach-in point corresponds to limit value 1 (0 V) and the teach-in point further away to limit value 2 (10 V).

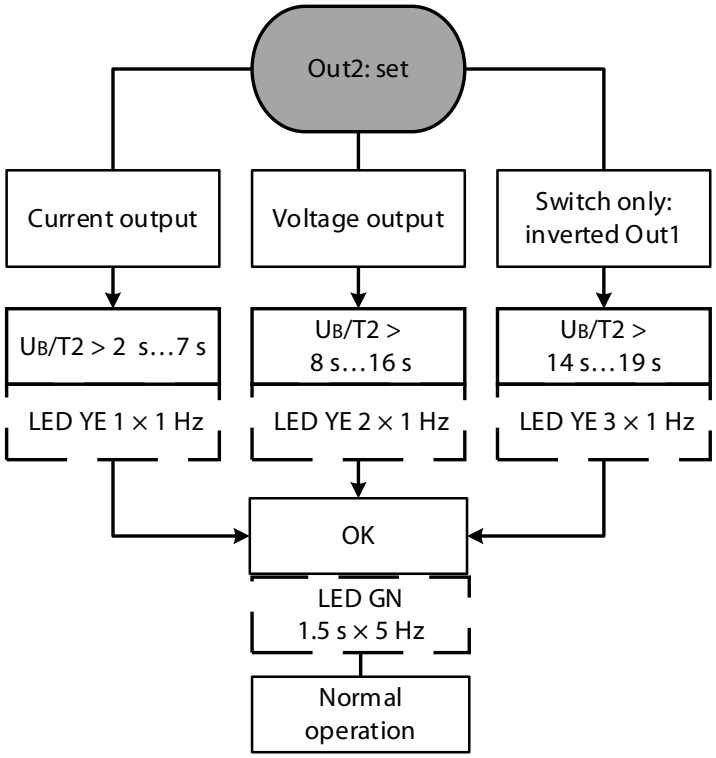

Fig. 46: Setting output 2

- ▶ Press and hold down pushbutton 2 for 8…13 s.
- ▶ Set limit values for the window function.
- ⇨ Output 2 is set successfully as a voltage output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

Setting output 2 as a switching output

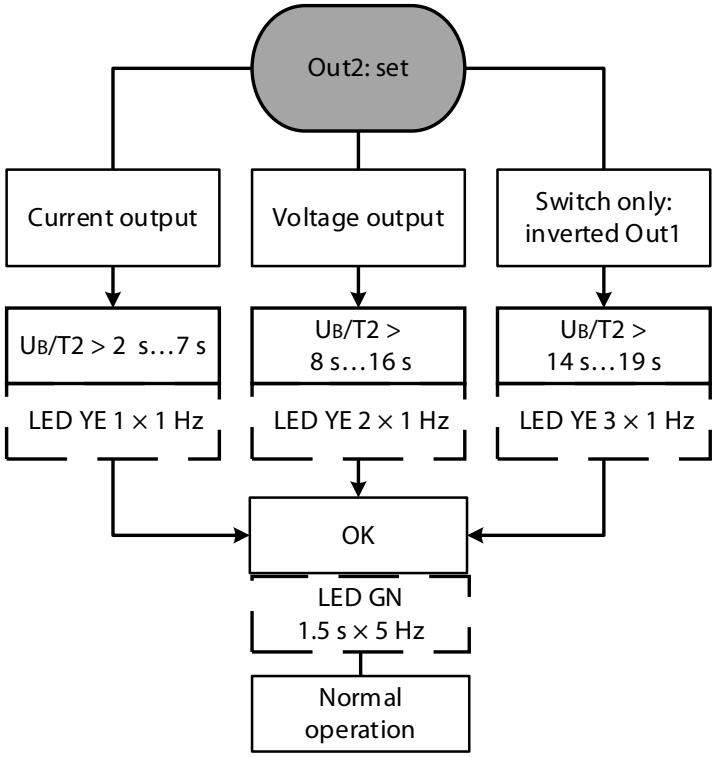

Fig. 47: Setting output 2

- ▶ Press and hold down pushbutton 2 for 14…19 s.
- ⇨ Output 2 is set successfully as a switching output if the green LED flashes for 1.5 s at a frequency of 5 Hz.

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 ■ DTM IODD Interpreter ■ IODD configuration file for RU Series ultrasonic sensors	■ IO-Link Devices Commissioning (D900633) ■ IO-Link parameters manual

Further information on operating modes and parameters in IO-Link mode is provided in the IO-Link Parameters manual.

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

To improve operation, wipe off dust and dirt from the face of the sonic transducer with a damp cloth.

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 Disposal

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

14 Technical Data

Technical data	RU40U…-M18…	RU130U…-M18…	RU130U…-M30…
Blind zone S_{min}	2.5 cm	15 cm	15 cm
Operating range	40 cm	130 cm	130 cm
Resolution	0.5 mm	1 mm	1 mm
Minimum size – switching range – measuring range	 5 mm 50 mm	 10 mm 100 mm	 10 mm 100 mm
Operating voltage	15…30 VDC	15…30 VDC	15…30 VDC
Rated operational current	≤ 150 mA	≤ 150 mA	≤ 150 mA
No-load current	≤ 50 mA	≤ 50 mA	≤ 50 mA
Operating temperature	-25…+45 °C	-25…+45 °C	-25…+45 °C
Storage temperature	-40…+80 °C	-40…+80 °C	-40…+80 °C
Switching hysteresis	5 mm	10 mm	10 mm
Switching frequency	7Hz	8 Hz	8 Hz
Approvals	CE, cULus	CE, cULus	CE, cULus

Technical data	RU300U…-M30…	RU600U…-M30…
Blind zone S_{min}	30 cm	60 cm
Operating range	300 cm	600 cm
Resolution	1 mm	1 mm
Minimum size – switching range – measuring range	25 mm 250 mm	50 mm 500 mm
Operating voltage	15…30 VDC	15…30 VDC
Rated operational current	≤ 150 mA	≤ 150 mA
No-load current	≤ 50 mA	≤ 50 mA
Operating temperature	-25…+70 °C	-25…+50 °C
Storage temperature	-40…+80 °C	-40…+80 °C
Switching hysteresis	25 mm	≤ 50 mm
Switching frequency	4 Hz	1.6 Hz
Approvals	CE, cULus	CE, cULus

UL conditions: T_a 0…+85 °C, use the same power supply for all circuits.

15 Turck Subsidiaries - Contact Information

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Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst **www.multiprox.be**
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