

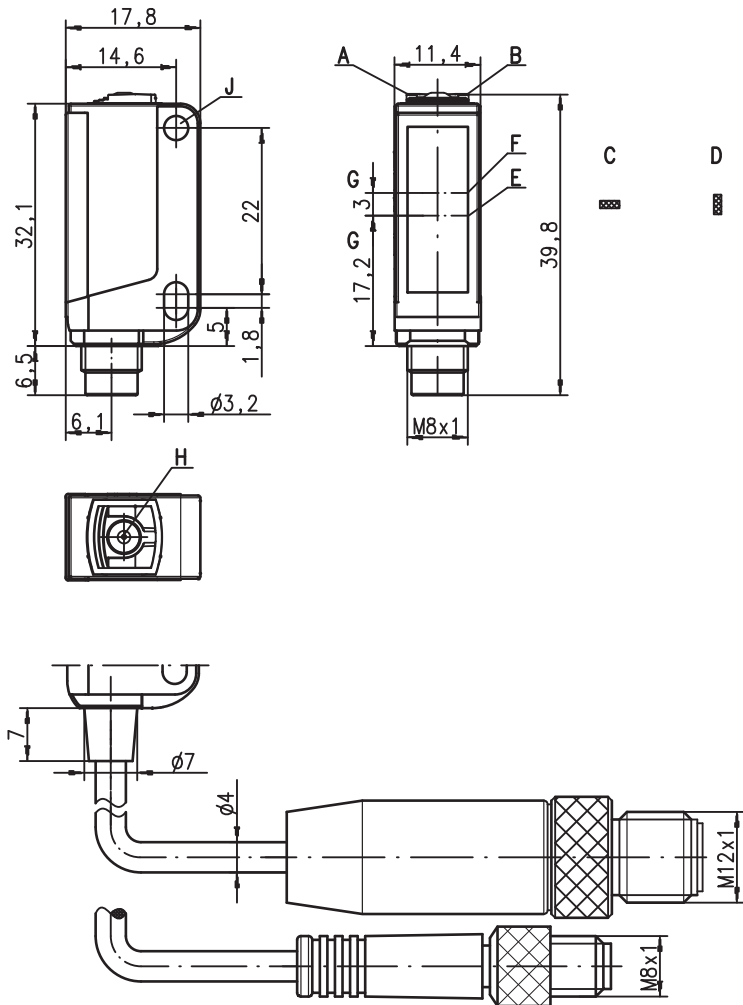
**KRTL 3B**

**Laser contrast scanner**

en 04-2011/04 50110624-01

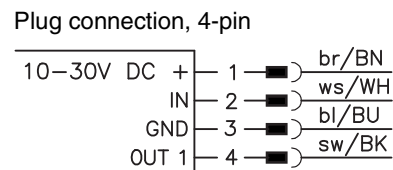


**Dimensioned drawing**



- A Green indicator diode
- B Yellow indicator diode
- C Light spot orientation horizontal
- D Light spot orientation vertical
- E Transmitter
- F Receiver
- G Optical axis
- H Teach button
- J Attachment sleeve

**Electrical connection**



**CDRH 60mm**

**IO-Link**

**10 - 30 V DC**

**TII**

- Red light laser transmitter
- Various teach variants
- Small light spot
- Switching threshold adjustment via EasyTune
- Level adaptation for glossy objects
- Keyboard lockout
- Remote teach via cable
- Pulse stretching 20ms

**Accessories:**

- (available separately)
- Mounting systems (BT 3...)
  - Cable with M8 or M12 connector (K-D ...)

We reserve the right to make changes • DS\_KRTL3B\_en.fm

## Specifications

### Optical data

|                              |   |
|------------------------------|---|
| Scanning range <sup>1)</sup> | 60mm ± 20mm                               |
| Light spot dimensions        | 0.5mm x 1.0mm (at a distance of 60mm)     |
| Light spot orientation       | vertical (see dimensioned drawing)        |
| Light source <sup>2)</sup>   | laser-generated red light (laser class 1) |
| Wavelength                   | 655nm                                     |
| Max. output power            | 1mW                                       |
| Pulse duration               | 4µs                                       |

### Sensor operating modes

|           |                    |
|-----------|--------------------|
| IO-Link   | COM2 (38.4kBaud)   |
| SIO       | standard push-pull |
| Dual Core | no                 |

### Timing of the sensor

|                              |   |
|------------------------------|---|
| Internal switching frequency | 4kHz  |
| Internal response time       | 125µs   |
| Response jitter, internal    | 35µs  |
| Repeatability <sup>3)</sup>  | 0.05mm  |
| Delay before start-up        | ≤ 300ms   |
| Teach process                | static 1-point, static 2-point or dynamic 2-point |
| Teach delay                  | ≤ 10ms  |

### Timing of the outputs

|               |       |   |
|---------------|-------|---|
| Response time | Pin 4 | IO-Link COM2: acc. to IO-Link specification (typically 2.5ms) |
|               |       | SIO: 50µs   |

### Electrical data

|                                       |           |   |
|---------------------------------------|-----------|---|
| Operating voltage $U_B$ <sup>4)</sup> | with SIO  | 10 ... 30VDC (incl. residual ripple)                  |
|                                       | with COM2 | 18 ... 30VDC (incl. residual ripple)                  |
| Residual ripple                       |           | ≤ 15% of $U_B$  |
| Output/function                       | .../2...  | pin 4: GND if mark detected                           |
|                                       | .../4...  | pin 4: $U_B$ if mark detected                         |
|                                       | .../6...  | pin 4: IO-Link SIO mode, $U_B$ if mark detected       |
|                                       | .../6...  | pin 4: IO-Link COM2 mode, see configuration file IODD |
| Signal voltage high/low               |           | ≥ ( $U_B - 2V$ ) ≤ 2V                                 |
| Output current                        |           | max. 100mA  |
| Open-circuit current                  |           | ≤ 20mA  |

### Indicators

|  |   |
|--|---|
| Green LED in continuous light                | ready   |
| Green and yellow LED flashing at 3Hz         | teach event active                              |
| Green and yellow LED flashing at 8Hz         | teaching error                                  |
| Green LED off and yellow LED flashing at 8Hz | device error                                    |
| Yellow LED in continuous light               | mark detected (dependent on the teach sequence) |
| Yellow LED flashing at 8Hz                   | laser error, replace device                     |
| Transmitter LED flashing at 8Hz              | teaching error                                  |

### Mechanical data

|                       |   |
|-----------------------|---|
| Housing <sup>5)</sup> | plastic (PC-ABS), with attachment sleeve, nickel-plated steel |
| Optics cover          | plastic (PMMA)  |
| Weight                | 10g   |
| Connection type       | M8 connector, metal   |

### Environmental data

|                                   |  |
|-----------------------------------|--|
| Ambient temp. (operation/storage) | -10°C ... +55°C / -30°C ... +70°C      |
| Protective circuit <sup>6)</sup>  | 2, 3                                   |
| VDE safety class                  | III                                    |
| Protection class                  | IP 67                                  |
| Laser class                       | 1 (in accordance with EN 60825-1)      |
| Standards applied                 | IEC 60947-5-2                          |
| Certifications                    | CDRH 21 CFR 1040, UL 508 <sup>4)</sup> |

### Options

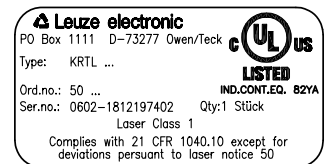
|                          |  |
|--------------------------|--|
| <b>Input pin 2</b>       |  |
| Function characteristics | keyboard lockout / line teach / pulse stretching |
| Input active/not active  | ≥ 8V/≤ 2V or not connected                       |
| <b>Output pin 4</b>      |  |
| Line teach active        | for SIO 2Hz at the switching output              |
|                          | for COM2 see configuration file IODD             |
| Error after line teach   | for SIO 2Hz at the switching output              |
|                          | for COM2 see configuration file IODD             |

- 1) Scanning range: recommended range with performance reserve
- 2) Average life expectancy 50,000h at an ambient temperature of 25°C
- 3) At conveyor speed 1m/s
- 4) For UL applications: for use in class 2 circuits according to NEC only
- 5) Patent Pending Publ. No. US 7,476,848 B2
- 6) 2=polarity reversal protection, 3=short-circuit protection for all transistor outputs

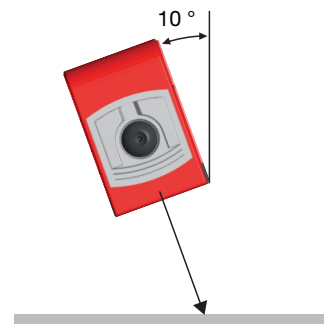
## Tables

## Diagrams

## Remarks



- This product may only be used by qualified personnel and must only be used for the approved purpose. This sensor is not a safety sensor and is not to be used for the protection of persons.
- With glossy objects, the sensor is to be fastened at an inclination of approx. 10° relative to the object surface.



**IO-Link process data**

The sensor transmits 2 bytes to the master.

| Data bit |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Assignment              | Default settings   |
|----------|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|-------------------------|--|
| 15       | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |                         |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching output        | 0 = no mark, 1 = mark detected   |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Not used                | Free   |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Sensor operation        | 0 = off, 1 = on  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching threshold LSB | Value range 0 ... 31<br>(0 ... 100% in approx. 3% steps)<br><br>0% = min. switching threshold<br>100% = max. switching threshold |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching threshold     |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching threshold     |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching threshold     |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Switching threshold MSB |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Active transmitter LSB  | 00 = red,<br>01 = green or white,<br><br>10 = blue,<br>11 = all colors on (teach-in active)                                      |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Active transmitter MSB  |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Not used                | Free   |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Measurement value LSB   | Value range 0 ... 31<br>(0 ... 100% in approx. 3% steps)<br><br>0% = min. signal level<br>100% = max. signal level               |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Measurement value       |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Measurement value       |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Measurement value       |  |
|          |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   | Measurement value MSB   |  |



Additional information on the IO-Link service data is available on request.

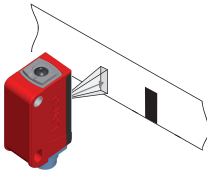
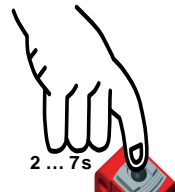

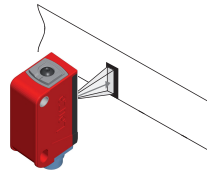


## Order guide

| Selection table                     |  | Order code →                            |   |  |   |   |
|-------------------------------------|--|---|---|--|---|---|
| Equipment ↓                         |  | KRTL 3B/6.3111-S8<br>Part no. 501 11321 | KRTL 3B/4.3111-S8<br>Part no. 501 10592 | KRTL 3B/2.3111-S8<br>Part no. 50110593 | KRTL 3B/4.3111,200-S12<br>Part no. 50110594 | KRTL 3B/2.3111,200-S12<br>Part no. 50110595 |
| Transmitter color                   | white light  |   |   |  |   |   |
|                                     | RGB (red, green, blue)   |   |   |  |   |   |
|                                     | laser-generated red light (laser class 1)                          | ●                                       | ●                                       | ●                                      | ●   | ●   |
| Light spot orientation              | vertical   | ●                                       | ●                                       | ●                                      | ●   | ●   |
|                                     | horizontal   |   |   |  |   |   |
|                                     | round  |   |   |  |   |   |
| Output (OUT 1)                      | PNP transistor output  |   | ●                                       |  | ●   |   |
|                                     | NPN transistor output  |   |   | ●                                      |   | ●   |
|                                     | push-pull switching output   | ●                                       |   |  |   |   |
|                                     | IO-Link COM2   | ●                                       |   |  |   |   |
| Input (IN)                          | teach input  | ●                                       | ●                                       | ●                                      | ●   | ●   |
| Housing                             | standard   | ●                                       | ●                                       | ●                                      | ●   | ●   |
|                                     | economy  |   |   |  |   |   |
| Connection                          | M8 connector, metal  | 4-pin                                   | ●                                       | ●                                      | ●   |   |
|                                     | M8 connector, plastic  | 4-pin                                   |   |  |   |   |
|                                     | 200mm cable with M12 connector                                     | 4-pin                                   |   |  |   | ● ●   |
| Teach-in method                     | static 1-point   |   |   |  |   |   |
|                                     | static 2-point   | ●                                       | ●                                       | ●                                      | ●   | ●   |
|                                     | dynamic 2-point  |   |   |  |   |   |
| Response time / Switching frequency | 50µs / 10kHz   |   |   |  |   |   |
|                                     | 83µs / 6kHz  |   |   |  |   |   |
|                                     | 125µs / 4kHz   | ●                                       | ●                                       | ●                                      | ●   | ●   |
| Configuration                       | switching threshold adjustment with EasyTune via teach button      | ●                                       | ●                                       | ●                                      | ●   | ●   |
|                                     | remote teach, keyboard lockout and pulse stretching via pin 2      | ●                                       | ●                                       | ●                                      | ●   | ●   |
|                                     | teach level 1, teach-level 2 and pulse stretching via teach button | ●                                       | ●                                       | ●                                      | ●   | ●   |

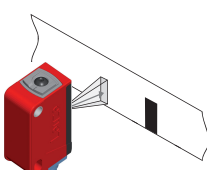


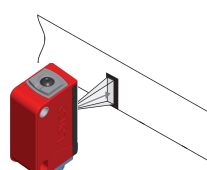


## Static 2-point teach

Suitable for manual positioning of the marks (availability dependent on device type).

### Switching threshold in center:

|   |  |   |  |   |  |
|---|--|---|--|---|--|
| <p>Position the background.</p>  | <p>Press teach button for 2 ... 7s and release.</p>  <p>Value for background is accepted.</p> | <p>LEDs flash simultaneously.</p>  <p><b>Simultaneous flashing</b></p> | <p>Position the mark.</p>  | <p>Briefly press teach button.</p>  <p>Value for mark is accepted.</p> | <p>Device in RUN mode. Yellow LED illuminates.</p>  <p>Switching threshold set in the center.</p> |
|---|--|---|--|---|--|

### Switching threshold near the mark:

|   |   |   |  |   |   |
|---|---|---|--|---|---|
| <p>Position the background.</p>  | <p>Press teach button for 7 ... 12s and release.</p>  <p>Value for background is accepted.</p> | <p>LEDs flash alternatingly.</p>  <p><b>Alternating flashing</b></p> | <p>Position the mark.</p>  | <p>Briefly press teach button.</p>  <p>Value for mark is accepted.</p> | <p>Device in RUN mode. Yellow LED illuminates.</p>  <p>Switching threshold is set near the mark.</p> |
|---|---|---|--|---|---|

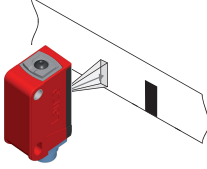
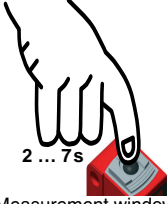

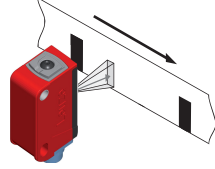


**KRTL 3B**

**Laser contrast scanner**

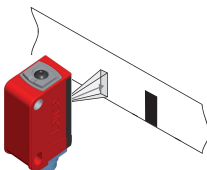
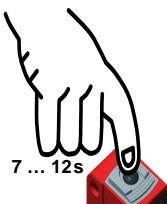

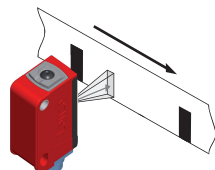


**Dynamic 2-point teach**

Suitable for marks moved during automated machine processes (availability dependent on device type).

**Switching threshold in center**

|   |  |   |  |  |   |
|---|--|---|--|--|---|
| <p>Position the background.</p>  | <p>Press teach button for 2 ... 7s and release.</p>  <p>2 ... 7s</p> <p>Measurement window opens.</p> | <p>LEDs flash simultaneously.</p>  <p><b>Simultaneous flashing</b></p> | <p>Allow marks to pass through dynamically.</p>  | <p>Briefly press teach button.</p>  <p>Measurement window closes.</p> | <p>Device in RUN mode. Yellow LED is off.</p>  <p>Switching threshold set in the center.</p> |
|---|--|---|--|--|---|

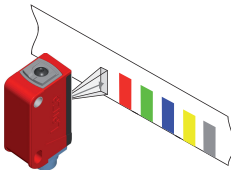
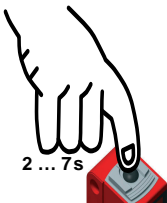

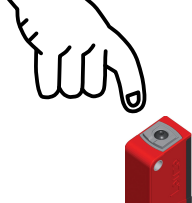

**Switching threshold near the mark**

|   |  |   |  |  |  |
|---|--|---|--|--|--|
| <p>Position the background.</p>  | <p>Press teach button for 7 ... 12s and release.</p>  <p>7 ... 12s</p> <p>Measurement window opens.</p> | <p>LEDs flash alternatingly.</p>  <p><b>Alternating flashing</b></p> | <p>Allow marks to pass through dynamically.</p>  | <p>Briefly press teach button.</p>  <p>Measurement window closes.</p> | <p>Device in RUN mode. Yellow LED is off.</p>  <p>Switching threshold is set near the mark.</p> |
|---|--|---|--|--|--|

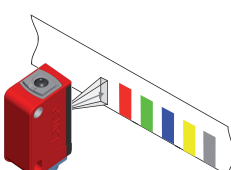
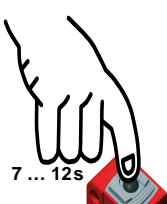

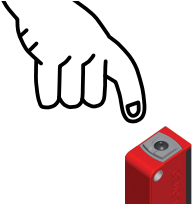

**Static 1-point teach**

Suitable for detecting all marks outside of the reference value (availability dependent on device type).

**Standard sensitivity**

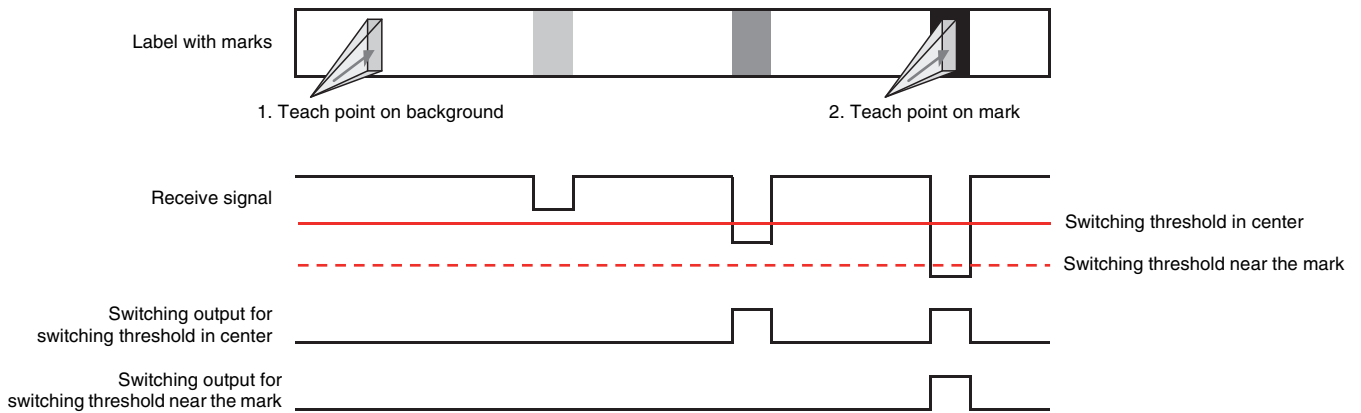
|  |   |   |   |   |
|--|---|---|---|---|
| <p>Position the reference value.</p>  | <p>Press teach button for 2 ... 7s.</p>  <p>2 ... 7s</p> | <p>LEDs flash simultaneously.</p>  <p><b>Simultaneous flashing</b></p> | <p>Release teach button.</p>  <p>Value is accepted.</p> | <p>Device in RUN mode. Yellow LED is off.</p>  <p>Standard sensitivity is set.</p> |
|--|---|---|---|---|

**High sensitivity**

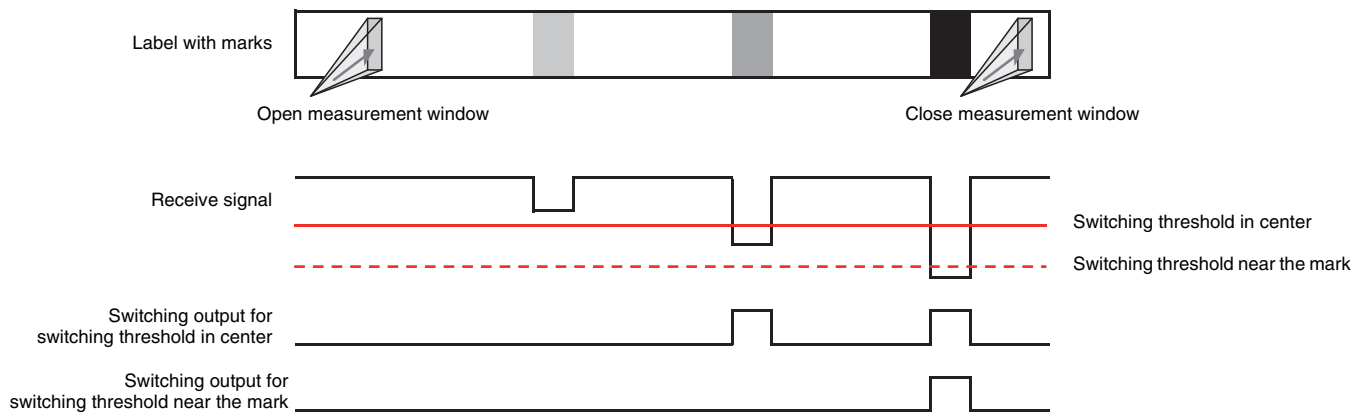
|  |   |   |   |   |
|--|---|---|---|---|
| <p>Position the reference value.</p>  | <p>Press teach button for 7 ... 12s.</p>  <p>7 ... 12s</p> | <p>LEDs flash alternatingly.</p>  <p><b>Alternating flashing</b></p> | <p>Release teach button.</p>  <p>Value is accepted.</p> | <p>Device in RUN mode. Yellow LED is off.</p>  <p>High sensitivity is set.</p> |
|--|---|---|---|---|

## Switching threshold diagrams

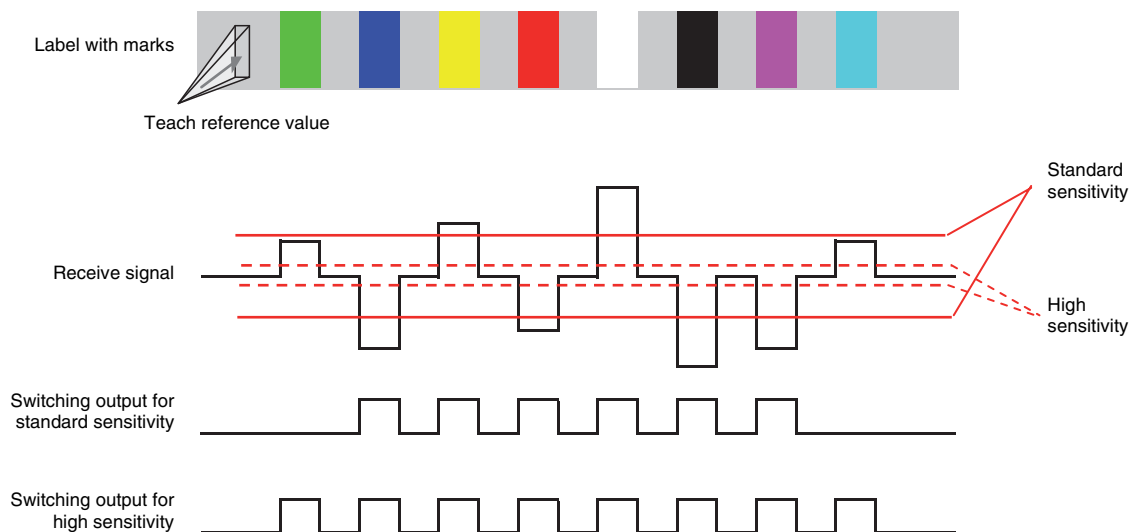
### Static 2-point teach



### Dynamic 2-point teach

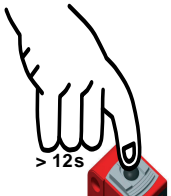


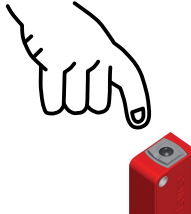


### Static 1-point teach



**Pulse stretching option**



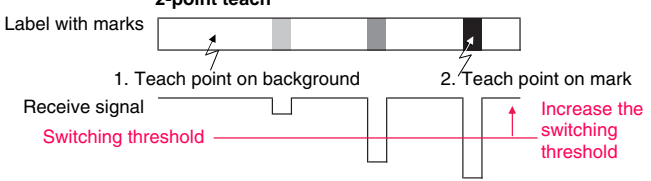
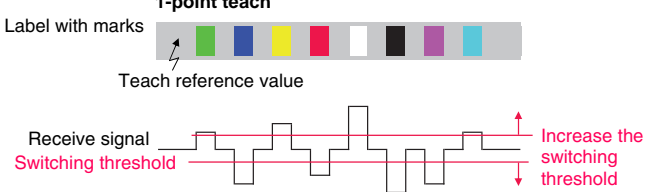
Switching pulse stretching on or off:

|  |  |   |
|--|--|---|
| <p>Press the teach button longer than 12s.</p>  <p>&gt; 12s</p> | <p>Only the green LED flashes.</p> <div style="display: flex; flex-direction: column; gap: 10px;"> <div data-bbox="347 358 646 425">  <p>The pulse stretching is switched off</p> </div> <div data-bbox="347 470 646 537">  <p>The pulse stretching is switched on</p> </div> </div> <p>After releasing the button, the yellow LED displays the state:<br/>         yellow LED on: pulse stretching ON<br/>         yellow LED off: pulse stretching OFF</p> | <p>Release teach button.</p>  <p>Change is accepted.</p> |
|--|--|---|



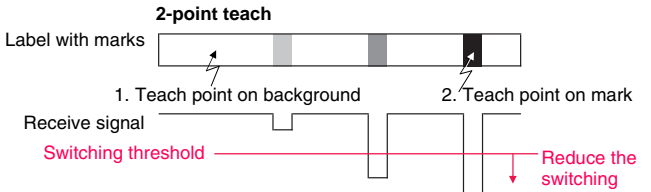
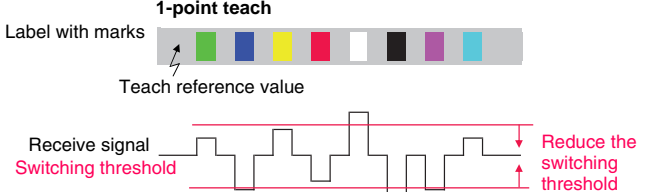
**"EasyTune" option - fine tuning of the switching threshold**

Following power-on and completed teach event: Green LED illuminates continuously (ready)  
 Yellow LED on/off continuously (mark detected/not detected)

**Increasing the switching threshold:**

|  |  |  |
|--|--|--|
| <p><b>Long press of the button = large force expenditure = increase switching threshold</b></p> <p>Each press of the button with a duration between 200ms and 2s increments the switching threshold.</p>  <p>200ms ... 2s</p> |  <p><b>Green LED flashes briefly once</b></p> <p>A press of the button is acknowledged by a single, brief <b>flash of the green LED</b> – the new switching threshold is now valid.</p> | <div style="display: flex; flex-direction: column; gap: 20px;"> <div data-bbox="790 913 1444 1108"> <p><b>2-point teach</b></p>  </div> <div data-bbox="790 1120 1444 1321"> <p><b>1-point teach</b></p>  </div> </div> |
|--|--|--|

**Reducing the switching threshold:**

|   |  |  |
|---|--|--|
| <p><b>Short press of the button = small force expenditure = reduce switching threshold</b></p> <p>Each press of the button with a duration between 2ms and 200ms decrements the switching threshold.</p>  <p>2ms ... 200ms</p> |  <p><b>Green LED flashes briefly once</b></p> <p>A press of the button is acknowledged by a single, brief <b>flash of the green LED</b> – the new switching threshold is now valid.</p> | <div style="display: flex; flex-direction: column; gap: 20px;"> <div data-bbox="790 1442 1444 1646"> <p><b>2-point teach</b></p>  </div> <div data-bbox="790 1657 1444 1859"> <p><b>1-point teach</b></p>  </div> </div> |
|---|--|--|



If the upper or lower end of the adjustment range is reached, the green and yellow LEDs flash at a considerably higher frequency of 8Hz for the duration of one second.

## Sensor adjustments via the input IN (Pin 2)



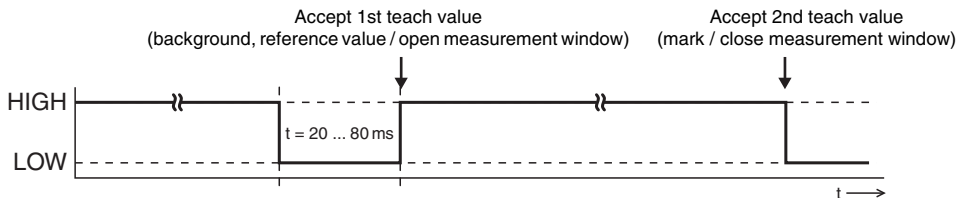
The following description applies to PNP switching logic!

Signal level LOW  $\leq 2V$

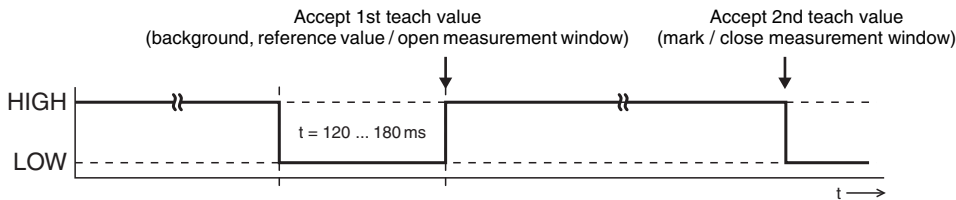
Signal level HIGH  $\geq (U_B - 2V)$

With the NPN models, the signal levels are inverted!

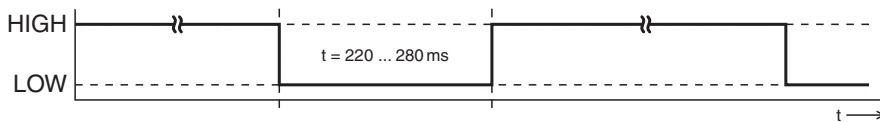
### Switching threshold in center / standard sensitivity



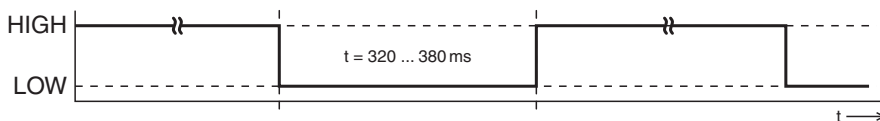
### Switching threshold near the mark / high sensitivity



### Pulse stretching ON



### Pulse stretching OFF



## Locking the teach button via the input IN (Pin 2)



A static HIGH signal ( $\geq 20ms$ ) at the teach input locks the teach button on the device if required, such that no manual operation is possible (e.g., protection from erroneous operation or manipulation).

If the teach input is not connected or if there is a static low signal, the button is unlocked and can be operated freely.

