# LD30CNBI10BPxxIO - IO-Link

## Photoelectric Time Of Flight Sensors with IO-Link communication



## Description

The LD30CNBI10BPxxIO sensor family comes in a compact 10 x 30 x 20 mm ABS housing.
They are designed for use in applications where high-accuracy detection as well as small size is required.
Compact housing and high power LED for excellent performance-size ratio.
The compact sensor design is ideally suited to confined spaces.

## Benefits

- **Long range Background suppression** TOF (Time of Flight) sensor with IO-Link with a adjustable distance of 50 to 1.000 mm, either by potentiometer or via IO-Link.
- **Infrared laser class 1** assure a reliable detection.
- **Easy customization** to specific OEM requests by use of the build in IO-Link functionalities.
- **The output can be operated** either as a standard switching output or in IO-Link mode.
- **Fully configurable via output IO-Link v 1.1.** Electrical outputs can be configured as PNP / NPN / Push-Pull / External input, normally open or normally closed.
- **Timer functions** can be set, such as ON-delay, Off-delay, and one shots.
- **Logging functions:** Temperatures, detecting counter, power cycles and operating hours.
- **Detection modes** Single point, two point and windows mode.
- **Logic functions:** AND, OR, XOR and Gated SR-FF.
- **Analogue output:** In IO-Link mode the sensor will generate 16 bit analogue process data output representing the distance to the object.
- IO-Link
- LASER 1

## Applications

- The sensor has multiple detects functions e.g. in single point mode the presence or absence of objects are detected while cutting off the background information.
- The detection distance is very independent of the colour of the objects to be detected.
- The “analogue” distance from the sensor to the object is available via the IO-Link communication.

## Main functions

- The sensor can be operated in IO-Link mode once connected to an IO-Link master or in standard I/O mode.

**Adjustable parameters via IO-Link interface:**

- Sensing distance and hysteresis.
- Sensing modes: single point or two point or window mode.
- Timer functions, e.g.: On-delay, Off delay, One shot leading edge or trailing edge.
- Logic functions such as: AND, OR, X-OR and SR-FF.
- External input.
- Logging functions: Maximum temperatures, minimum temperatures, operating hours, operating cycles, power cycles, minutes above maximum temperature, minutes below minimum temperature, etc.
- Auto hysteresis



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# References

## Product selection key

**LD30CNBI10BP ☐ IO**

Enter the code option instead of ☐

| Code | Option | Description |
|---|---|---|
| L | - | Sensing principle: Photoelectric sensor |
| D | - | Rectangular housing |
| 30 | - | Length of housing |
| C | - | Plastic housing |
| N | - | Back trimmer |
| B | - | Diffuse reflective, Background suppression |
| I | - | infrared light |
| 10 | - | Sensing distance: 1000 mm |
| B | - | **Selectable functions:** NPN, PNP, Push-Pull, External Input (only pin 2) or External teach input (only pin 2) |
| P | - | **Selectable:** N.O. or N.C. |
| ☐ | A2 | Cable, 2 m |
| | M5 | Connector M8 |
| IO | - | IO-Link version |

## Type selection

| Connec-tion | Housing | Code |
|---|---|---|
| Cable | Plastic housing | **LD30CNBI10BPA2IO** |
| Plug | Plastic housing | **LD30CNBI10BPM5IO** |



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# Structure

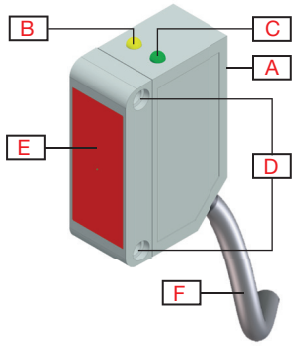



**Fig. 1** *Cable*

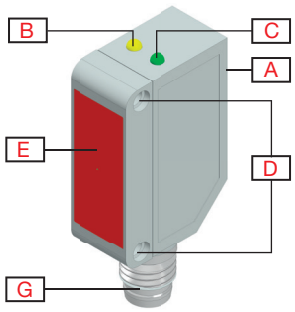



**Fig. 2** *Plug*

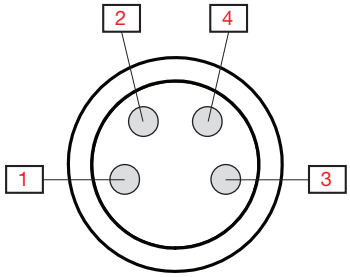



**Fig. 3** *"M8-plug" Pin numbers*

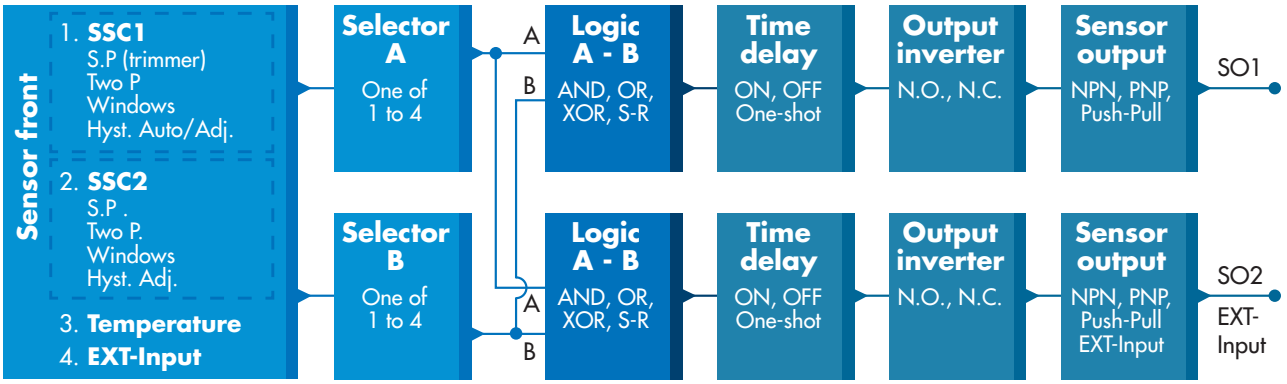
| | | | |
|---|---|---|---|
| **A** | Sensitivity adjustment (\|Back trimmer) | **G** | M8, 4-pin male connector |
| **B** | Yellow LED | **1** | Brown |
| **C** | Green LED | **2** | White |
| **D** | M3 Fixing holes for sensor mounting | **3** | Blue |
| **E** | Sensing window | **4** | Black |
| **F** | 2 m, 4 wire PVC Ø 3.3 mm cable | | |



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# Sensing

## Detection






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| | | |
|---|---|---|
| **Sensor switching channel SSC1 and SSC2** | **SSC1**<br>• Enabled<br>• Disabled<br>***Factory settings:*** *Enabled* | **SSC2**<br>• Enabled<br>• Disabled<br>***Factory settings:*** *Enabled* |
| **Switching mode** | **SSC1**<br>• Deactivated<br>• Single point mode<br>• Two point mode<br>• Windows mode<br>***Factory settings:*** *Single point mode* | **SSC2**<br>• Deactivated<br>• Single point mode<br>• Two point mode<br>• Windows mode<br>***Factory settings:*** *Single point mode* |
| **Rated operating distance ($S_n$)** | 1000 mm | Reference target, white paper with 90 % reflectivity, Size 200x200 mm |
| **Maximum detection distance** | < 1000 mm | White object 90% reflection |
| | < 1000 mm | Grey object 18% reflection |
| | < 1000 mm | Black object 6% reflection |
| **Sensitivity control** | Adjustable by potentiometer, external teach or by IO-Link settings<br>• Potentiometer disabled (SSC1)<br>• Potentiometer enabled (SSC1)<br>• External teach<br>***Factory settings:*** *Potentiometer enabled* | |
| **Sensitivity adjustment** | 50 mm ... 1000 mm | Single-turn potentiometer |
| | 210° | Electrical adjustment |
| | 240° | Mechanical adjustment |
| **Blind zone** | 0 mm | White object 90% reflection |
| | 0 mm | Grey object 18% reflection |
| | 0 mm | Black object 6% reflection |
| **Light source** | 940 nm | Infrared |
| **Light type** | Laser modulated | |
| **Laser class** | 1 | |
| **Detection angle** | ± 1.2° | @1000 mm |
| **Light spot size** | Ø 18 mm | @500 mm (\|approximation) |
| **Emitter beam angle** | ± 1.1° | @500 mm |
| **Adjustable distance** | 50-1000 mm<br>***Factory settings:*** *SP1 1000 and SP2 750* | White object 90% reflection |
| | 50-1000 mm<br>***Factory settings:*** *SP1 1000 and SP2 750* | Grey object 18% reflection |
| | 50-1000 mm<br>***Factory settings:*** *SP1 1000 and SP2 750* | Black object 6% reflection |
| **Hysteresis (H)**<br>**Manual**<br>**Automatic** | Adjustable by IO-Link<br>5 - 2000 mm (default 50 mm)<br>≤10% @ Sn (On all objects) | |
| **Detection filter** | This function can increase the immunity towards unstable targets and electromagnetic disturbances: Value can be set from 1 to 255.<br>***Factory settings:*** *1*<br>(1 is max. operating frequency and 255 is min. operating frequency) | |



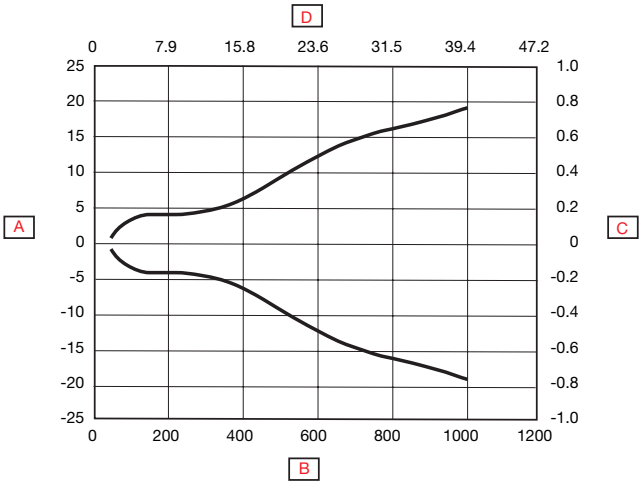
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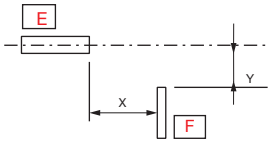
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## Alarm settings

| | |
|---|---|
| **Temperature alarm** | • High threshold -50 to +150 °C<br>• Low threshold -50 to +150 °C<br>***Factory settings:***<br>*High value 70 °C*<br>*Low value -20 °C* |

## Detection diagram




| | | | |
|---|---|---|---|
| **A** | Detection width (mm) | **D** | Sensing range (inches) |
| **B** | Sensing range (mm) | **E** | Sensor |
| **C** | Detection width (inches) | **F** | Object 25 x 25 mm, White 90% |

## Accuracy

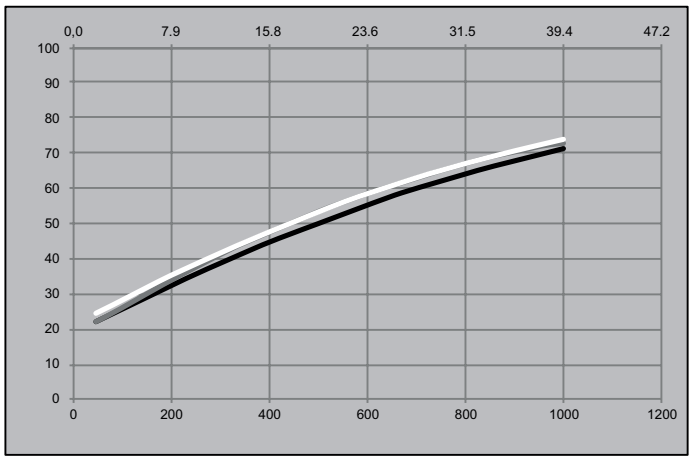
| | |
|---|---|
| **Temperature drift** | ≤ 0.05%/ºC |



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## Sensing conditions

C




A

B

| | | | |
|---|---|---|---|
| **A** | Distance from background (mm) | | (Black on white 6%/90%) |
| **B** | White background 90% (mm) | | (Grey on white 18%/90%) |
| **C** | White background 90% (inches] | | (White on white 90%/90%) |



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# Features

## Power Supply

| | |
|---|---|
| **Rated operational voltage ($U_B$)** | 10 ... 30 VDC (ripple included) |
| **Ripple ($U_{rpp}$)** | ≤ 10% |
| **No load supply current ($I_o$)** | ≤ 25 mA @ $U_B$ min. |
| | ≤ 12 mA @ $U_B$ max. |
| **Power-ON delay ($t_v$)** | ≤ 300 ms |

## Input selector

| | | |
|---|---|---|
| **Input selector** | **Channel A**<br>• Deactivated<br>• SSC1<br>• SSC2<br>• Temperature alarm<br>• External input<br>***Factory settings:*** *SSC1* | **Channel B**<br>• Deactivated<br>• SSC1<br>• SSC2<br>• Temperature alarm<br>• External input<br>***Factory settings:*** *SSC1* |

## Logic functions

| | | |
|---|---|---|
| **Logic functions** | **Channel A + B for SO1**<br>• Direct<br>• AND<br>• OR<br>• X-OR<br>• SR-FF<br>***Factory settings:*** *Direct* | **Channel A + B for SO2**<br>• Direct<br>• AND<br>• OR<br>• X-OR<br>• SR-FF<br>***Factory settings:*** *Direct* |

## Time delays

| | | |
|---|---|---|
| **Timer mode** | **For SO1**<br>• Disabled<br>• Power-ON delay<br>• Power-OFF delay<br>• Power-ON delay and Power-OFF delay<br>• One-shot leading edge<br>• One-shot trailing edge<br>***Factory settings:*** *Disabled* | **For SO2**<br>• Disabled<br>• Power-ON delay<br>• Power-OFF delay<br>• Power-ON delay and Power-OFF delay<br>• One-shot leading edge<br>• One-shot trailing edge<br>***Factory settings:*** *Disabled* |
| **Timer scale** | **For SO1**<br>• [ms]<br>• [s]<br>• [min]<br>***Factory settings:*** *ms* | **For SO2**<br>• [ms]<br>• [s]<br>• [min]<br>***Factory settings:*** *ms* |
| **Timer value** | **For SO1**<br>• 0 ... 32 767<br>***Factory settings:*** *0* | **For SO2**<br>• 0 ... 32 767<br>***Factory settings:*** *0* |



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## Output Inverter

| | | |
|---|---|---|
| **Output Inverter** | **For SO1 Pin 4 Black wire:**<br>• N.O.<br>• N.C.<br>***Factory settings:*** *N.O.* | **For SO2 Pin 2 White wire:**<br>• N.O.<br>• N.C.<br>***Factory settings:*** *N.C.* |

## Sensor Output

| | | |
|---|---|---|
| **Switching Output Stage SO1 and SO2** | **For SO1 Pin 4 Black wire:**<br>• NPN<br>• PNP<br>• Push-Pull<br><br>***Factory settings:*** *PNP* | **For SO2 Pin 2 White wire:**<br>• NPN<br>• PNP<br>• Push-Pull<br>• External input, active high<br>• External input, active low<br>• External teach<br>***Factory settings:*** *PNP* |

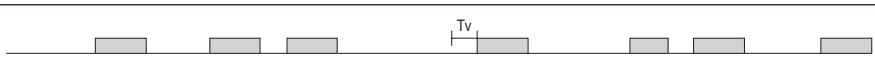
## Outputs

| | | |
|---|---|---|
| **Rated operational current ($I_e$)** | ≤ 100 mA from -25 ... 40°C (SO1 + SO2)<br>50 mA @ ≥40°C (SO1 + SO2) | |
| **OFF-state current ($I_r$)** | ≤ 100 µA | |
| **Minimum operational current ($I_m$)** | > 0,5 mA | |
| **Voltage drop ($U_d$)** | ≤ 1.0 VDC @ 100 mA DC | |
| **Protection** | Short circuit, reverse polarity, transients | |
| **Utilization category** | DC-12 | Control of resistive loads and solid-state loads with optical isolation |
| | DC-13 | Control of electromagnets |
| **Capacitive load** | 100 nF @ 100 mA | |

## Operation diagram

### For default factory sensor

Tv = Power-ON delay

| | | |
|---|---|---|
| **Power supply** | ON |  |
| **Target (Object)** | Present |  |
| **Break output (N.C.)** | ON |  |
| **Make output (N.O.)** | ON |  |

## Response times

| | | |
|---|---|---|
| **Operating frequency (f)** | ≤ 5 Hz | |
| **Response times** | ≤ 100 ms | OFF-ON ($t_{ON}$) |
| | ≤ 100 ms | ON-OFF ($t_{ON}$) |



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## Indication

| Green LED | Yellow LED | Power | Function |
|---|---|---|---|
| **SIO and IO-Link mode** | | | |
| ON | ON | ON | ON (stable)* SSC1 |
| ON | OFF | ON | OFF (stable)* SSC1 |
| OFF | ON | - | ON (Not stable) SSC1 |
| OFF | OFF | - | OFF (Not stable) SSC1 |
| - | Flashing 10 Hz<br>50% dutycycle | ON | Output short-circuit |
| - | Flashing (0.5…20 Hz) | ON | Timer indication |
| **SIO mode only** | | | |
| - | Flashing 1 HZ<br>ON 100 ms<br>OFF 900 ms | ON | External teach by wire.<br>Only for single point mode |
| - | Flashing 1 HZ<br>ON 900 ms<br>OFF 100 ms | ON | Teach time window (3 - 6 sec) |
| - | Flashing 10 HZ<br>ON 50 ms<br>OFF 50 ms<br>Flashing for 2 sec | ON | Teach time out (12 sec) |
| - | Flashing 2 HZ<br>ON 250 ms<br>OFF 250 ms<br>Flashing for 2 sec | ON | Teach successful |
| **IO-Link mode only** | | | |
| Flashing 1 HZ<br>ON 900 ms<br>OFF 100 ms | - | ON | Sensor is in IO-Link mode |
| Flashing 2 Hz<br>50% dutycycle | | ON | Find my sensor |

**See operation diagram*

## LED indication

| | |
|---|---|
| **LED indications** | • LED Indication disabled<br>• LED Indication enabled<br>• Find my sensor<br>***Factory settings:*** *LED Indication enabled* |



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## Environmental

| | | |
|---|---|---|
| **Ambient temperature** | -25°... +50°C (-13°... +122°F) | Operating [1] |
| | -40° ... +70°C (-40° ... +158°F) | Storage [1] |
| **Ambient light** | ≤ 50 000 lux (indirect) @ <5° | @ 3000 … 3200 °K |
| | ≤ 5 000 lux (direct) @ <5° | |
| **Vibration** | 10 ...150 Hz, 1.0 mm/15 g | EN 60068-2-6 |
| **Shock** | 30 $g_n$ / 11 ms, 6 pos, 6 neg per axis | EN60068-2-27 |
| **Drop test** | 2 x 1 m and 100 x 0.5 m | EN 60068-2-31 |
| **Rated insulation voltage ($U_i$)** | 50 VDC | |
| **Dielectric insulation voltage** | ≥ 500 VAC rms | 50/60 Hz for 1 min. |
| **Rated impulse withstand voltage** | 1 kV | 1.2/50 µs |
| **Pollution degree** | 3 | EN60947-1 |
| **Overvoltage category** | III | IEC60664; EN60947-1 |
| **Degree of protection** | IP67 | IEC60539; EN60947-1 |
| **NEMA Enclosure Types** | 1 | NEMA 250 |
| **Ambient humidity range** | 35% ... 95% | Operating [2] |
| | 35% ... 95% | Storage [2] |

[1] *Do not bend the cable in temperatures below -10°C*
[2] *With no icing or condensation*

## EMC

| | | |
|---|---|---|
| **Electrostatic discharge immunity test** | ± 8 kV @ air discharge or<br>± 4 kV @ contact discharge | IEC 61000-4-2 |
| **Radiated radio-frequency electromagnetic field immunity test (80 MHz ... 1 GHz and 1..4 GHz ... 2 GHz)** | 10 V/m | IEC 61000-4-3 |
| **Electrical fast transient/Burst immunity test** | ±2 kV / 5 kHz<br>using the capacitive coupling clamp | IEC 61000-4-4 |
| **Conducted disturbances induced by radio-frequency fields immunity test (150 kHz ... 80 MHz)** | 10 Vrms | IEC 61000-4-6 |
| **Power frequency magnetic field immunity test** | 30 A/m 38 µT | IEC 61000-4-8 |



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## Diagnostic parameters

| Function | Unit | Range |
|---|---|---|
| **Values stored in the sensor (Saved every hour)** | | |
| **Operating Hours** | [h] | 0 … 2 147 483 647 |
| **Number of Power Cycles** | [cycles] | 0 … 2 147 483 647 |
| **Maximum temperature - All time high** | [°C] | -50 ... +150 |
| **Minimum temperature - All time low** | [°C] | -50 ... +150 |
| **Detection counter SSC1** | [cycles] | 0 … 2 147 483 647 |
| **Minutes above Maximum Temperature** | [min] | 0 … 2 147 483 647 |
| **Minutes below Minimum Temperature** | [min] | 0 … 2 147 483 647 |
| **Values stored in the sensor (Saved with events)** | | |
| **Download counter** | [counts] | 0 …65 536 |
| **Values not saved in sensor** | | |
| **Maximum temperature - Since last power-up** | [°C] | -50 ... +150 |
| **Minimum temperature - Since last power-up** | [°C] | -50 ... +150 |
| **Current temperature** | [°C] | -50 ... +150 |

## Events Configuration

| Events | Factory default setting |
|---|---|
| **Temperature fault event** | Inactive |
| **Temperature over-run** | Inactive |
| **Temperature under-run** | Inactive |
| **Short circuit** | Inactive |

## Process data configuration

| Process Data | Factory default setting |
|---|---|
| **Analogue value** | Active |
| **SO1, Switching output 1** | Active |
| **SO2, Switching output 2** | Active |
| **SSC1, Sensor switching channel 1** | Inactive |
| **SSC2, Sensor switching channel 2** | Inactive |
| **TA, Temperature alarm** | Inactive |
| **SC, Short circuit** | Inactive |

## Process data structure

4 Bytes, Analogue value 16 ... 31 (16 bit)



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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Byte 0** | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 |
| | **MSB** | - | - | - | - | - | - | - |
| **Byte 1** | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
| | - | - | - | - | - | - | - | **LSB** |
| **Byte 2** | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| | - | - | - | - | **SC** | **TA** | **SSC2** | **SSC1** |
| **Byte 3** | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| | - | - | - | - | - | - | **SO2** | **SO1** |



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# Mechanics/electronics

## Connection

| | |
|---|---|
| **Cable** | 2 m, 4-wire 4 x 0.14 mm², Ø = 3.3 mm, PVC, Black |
| **Plug** | M8, 4-pin, male |

## Wiring

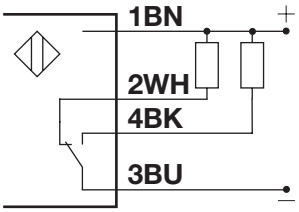



**Fig. 4** *NPN*

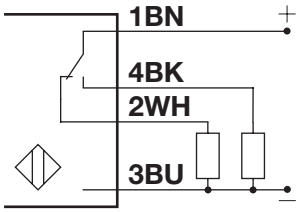



**Fig. 5** *PNP*

| BN | WH | BK | BU |
|---|---|---|---|
| Brown | White | Black | Blue |

## Housing

| | | |
|---|---|---|
| **Body** | ABS | |
| **Front glass** | PMMA, Red | |
| **Trimmer shaft** | POM, Grey | |
| **Indication** | TPU, Transparent | |
| **Sealing** | NBR70 | |
| **Dimensions** | 10.8 x 30 x 20 mm | |
| **Weight** | ≤ 50 g | Cable version |
| | ≤ 20 g | Plug version |



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## Dimensions

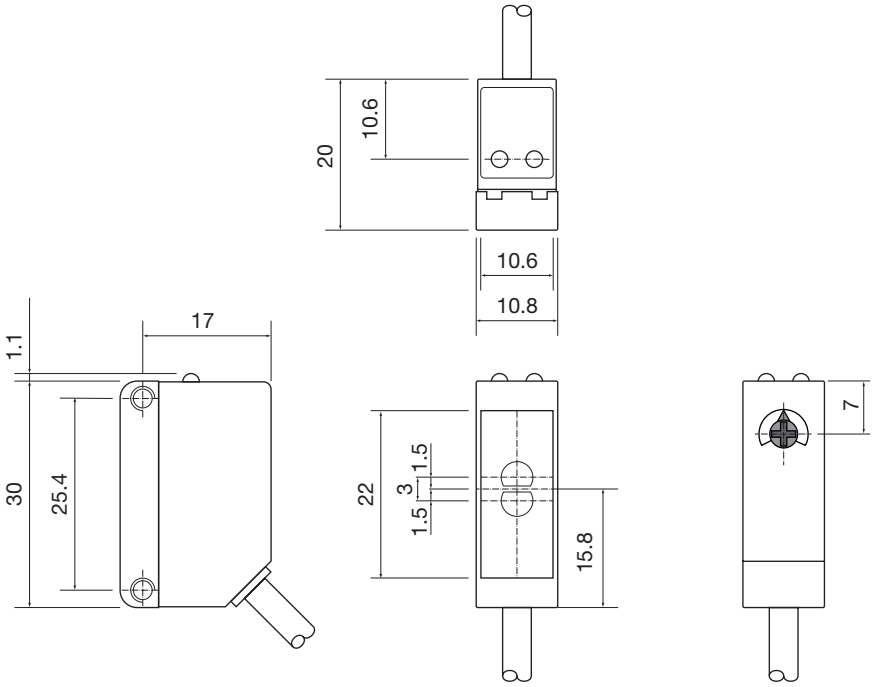



**Fig. 6** *Cable*

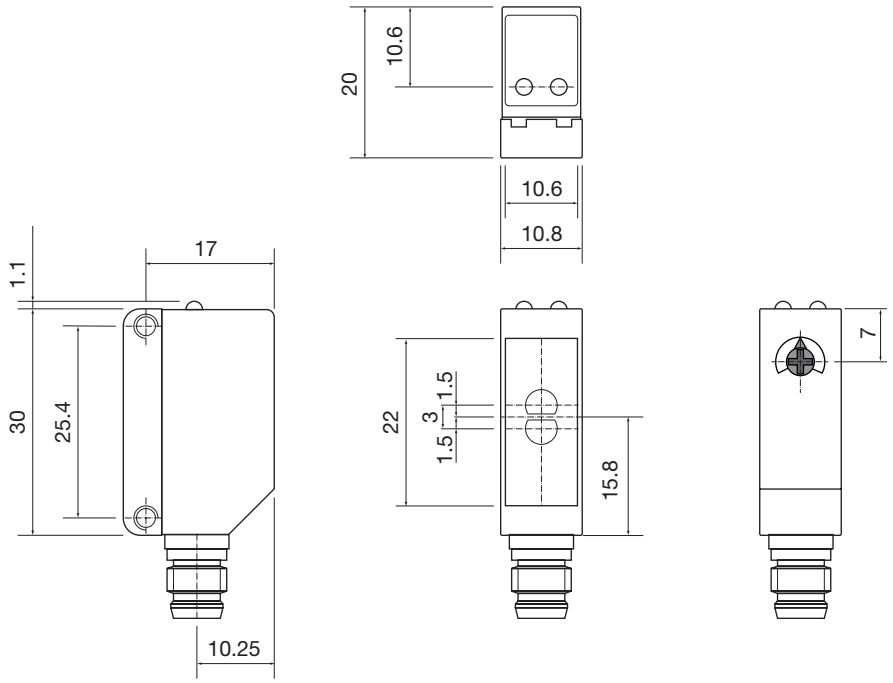


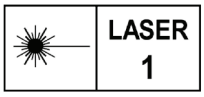

**Fig. 7** *Plug*



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# Compatibility and conformity

## Approvals and markings

| | | |
|---|---|---|
| **General reference** | Sensor designed according to EN60947-5-2 | |
| **$MTTF_d$** | 132.2 years @ 40°C (+104°F) | ISO 13849-1, SN 29500 |
| **CE-marking** | CE | |
| **Approvals** | c UL us (UL508 + C22.2) | |
| **Other Approvals** |   | Class 1 laser according to IEC 60825-1:2014<br>Complies with IEC / EN 60825-1:2014 and 21 CFR 1040.10 1040.11 except for deviations pursuant to Laser Notice No. 56, dated January 19, 2018 |

## IO-Link

| | |
|---|---|
| **IO-Link revision** | 1.1 |
| **Transmission rate** | COM2 (38.4 kbaud) |
| **SDCI-Norm** | IEC 61131-9 |
| **Profile** | Smart sensor profile 2nd edition, common profile |
| **Min. cycle time** | 5 ms |
| **SIO mode** | Yes |
| **Min. master port class** | A (4-pin) |
| **Process data length** | 32 bit |



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# Delivery contents and accessories

## Delivery contents

- Photoelectric switch: LD30CNBI10BPxxIO
- Screwdriver
- Packaging: Carton box

## Accessories

- Mounting bracket: APD30-MB2 to be purchased separately
- Connector type: CON.54NF.. series to be purchased separately

## Further information

| Information | Where to find it | QR |
|---|---|---|
| IO-Link manual | http://cga.pub/?c0e592 | |
| Mounting brackets | http://cga.pub/?6fa29a | |
| Connectors | http://cga.pub/?ed457b | |

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