

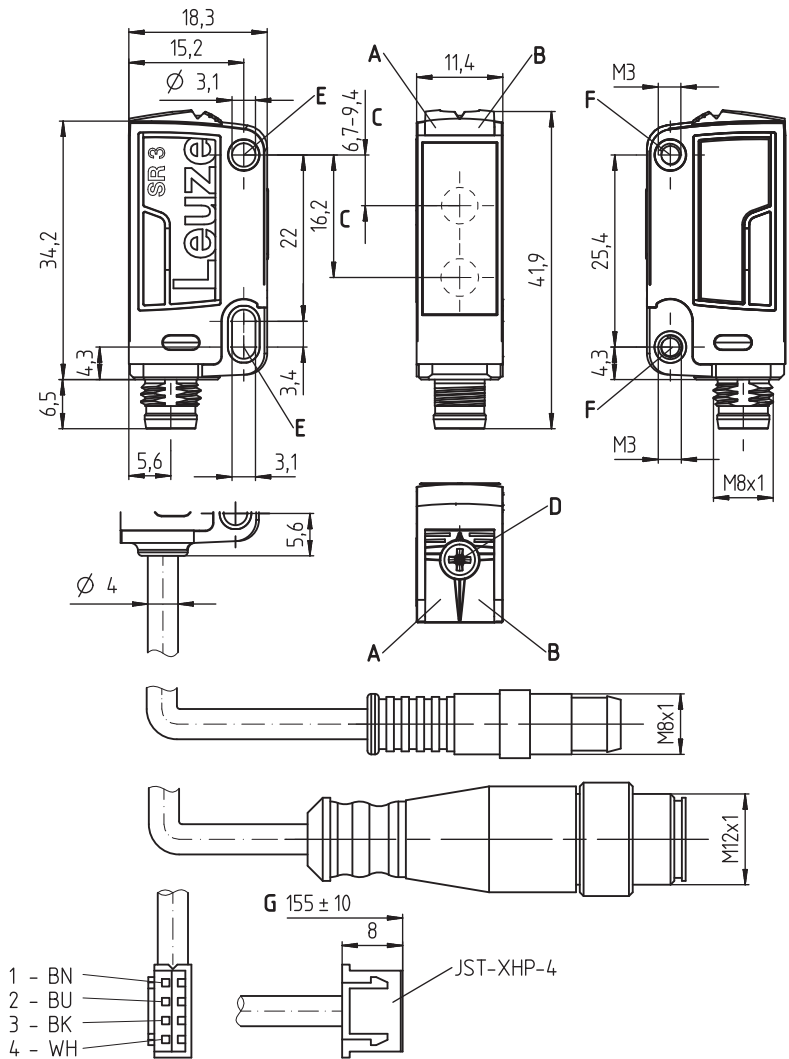
HT3CL

Laser diffuse reflection sensor with background suppression

en 03-2017/03 50130057-01



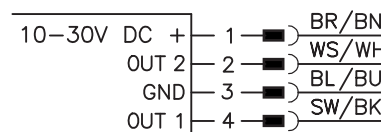
Dimensioned drawing



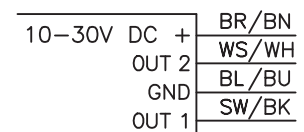
- A Green indicator diode
- B Yellow indicator diode
- C Optical axis
- D 8-turn potentiometer for scanning range adjustment
- E Mounting sleeve (standard)
- F Threaded sleeve (HT3CL...B...)
- G Dimension, incl. device

Electrical connection

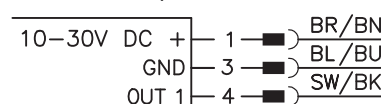
Connector, 4-pin



Cable, 4 wires



Connector, 3-pin



**15 ... 400(550) mm**  
 170(250) mm with  
 black/white error < 10%

10 - 30 V  
 DC  
 3 kHz  
 A<sup>2</sup>LS  
 ASIC

- Diffuse reflection sensor with visible laser-generated red light and adjustable background suppression
- Collimated light beam propagation with small beam diameter permits identical switching behavior within the specified scanning range
- Small and compact construction with robust plastic housing, degrees of protection IP 67 and IP 69K, tested in accordance with Ecolab for industrial application
- High switching frequency, short response time and low jitter for fast processes and high-precision applications
- Standard device in laser class 1; extended scanning area with excellent black/white ratio in laser class 2
- **NEW:** Housing variant with two integrated M3 metal threaded sleeves
- **NEW:** Housing variant with integrated slotted-hole mounting sleeve made of metal

Accessories:

(available separately)

- Mounting systems (BT ...)
- Cables with M8 or M12 connector (KD ...)

We reserve the right to make changes • PAL\_HT3C\_Laser\_en\_50130057\_01.fm

Technical data

Optical data

Typ. scanning range limit <sup>1)</sup>  
 Scanning range <sup>2)</sup>  
 Adjustment range of the switching point  
 Black/white error < 10% up to  
 Light beam diameter  
 Light beam characteristic  
 Squint angle  
 Light source <sup>3)</sup>  
 Laser class  
 Wavelength  
 Max. output power  
 Pulse duration

Laser class 1

15 ... 400mm  
 see tables  
 20 ... 400mm  
 170mm  
 approx. 1 mm, consistent  
 collimated  
 typ. ± 2°  
 laser, pulsed  
 1 acc. to IEC 60825-1:2007  
 650nm (visible red light)  
 ≤ 1.8mW  
 ≤ 5.1µs

Laser class 2

15 ... 550mm  
 20 ... 550mm  
 250mm  
 2 acc. to IEC 60825-1:2007  
 ≤ 4.5mW  
 ≤ 5.1µs

Timing

Switching frequency 3,000Hz  
 Response time 0.16ms  
 Response jitter typ. 55µs  
 Decay time 0.16ms <sup>4)</sup>  
 Readiness delay ≤ 300ms

Electrical data

Operating voltage U<sub>B</sub> <sup>5)</sup> 10 ... 30VDC (incl. residual ripple)  
 Residual ripple ≤ 10% of U<sub>B</sub>  
 Open-circuit current ≤ 20mA  
 Switching output see part number code on page 3  
 Function light/dark switching, see part number code on page 3  
 Signal voltage high/low ≥ (U<sub>B</sub>-2V)/≤ 2V  
 Output current max. 100mA <sup>6)</sup>  
 Scanning range adjustable via 8-turn potentiometer

Indicators

Green LED ready  
 Yellow LED object detected - reflection

Mechanical data

Housing plastic (high-strength PC-ABS);  
 2x diecast zinc mounting sleeves or  
 2x M3 brass threaded sleeves  
 Optics cover plastic (PMMA)  
 Fastening screws 2 x M3  
 Weight with connector: 20g  
 with 200mm cable and connector: 40g  
 with 2m cable: 50g  
 Connection type cable 2m (cross section 4x0.20mm<sup>2</sup>),  
 connector M8, metal,  
 cable 0.2m with connector M8 or M12

Environmental data

Ambient temp. (operation/storage) -40°C ... +55°C/-40°C ... +70°C  
 Protective circuit <sup>7)</sup> 1, 2, 3  
 VDE safety class III  
 Degree of protection IP 67 and IP 69K  
 Standards applied IEC 60947-5-2  
 Certifications UL 508, CSA C22.2 no.14-13 <sup>5)</sup> 8)

- 1) Typ. scan. range limit/adjustment range: max. achievable scanning range/adjustment range for light objects (white 90%)
- 2) Scanning range: recommended scanning range for objects with different diffuse reflection
- 3) Average life expectancy 50,000h at an ambient temperature of 25°C
- 4) For short decay times, an ohmic load of approx. 5kOhm is recommended
- 5) For UL applications: use is permitted exclusively in Class 2 circuits according to NEC
- 6) Sum of the output currents for both outputs, 50mA for ambient temperatures > 40°C
- 7) 1=overload protection, 2=polarity reversal protection, 3=short circuit protection for all transistor outputs
- 8) These proximity switches shall be used with UL Listed Cable assemblies rated 30V, 0.5A min, in the field installation, or equivalent (categories: CYJV/CYJV7 or PVVA/PVVA7)

Tables

Models of laser class 1:

1	15	400
2	15	250
3	15	170

Models of laser class 2:

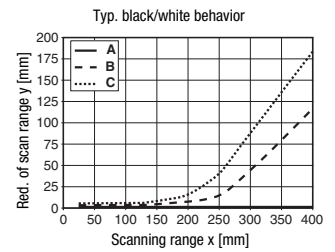
1	15	550
2	15	440
3	15	250

1	white 90%
2	gray 18%
3	black 6%

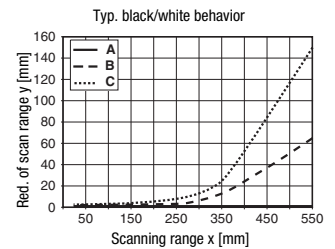
Scanning range [mm]

Diagrams

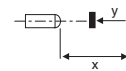
Models of laser class 1:



Models of laser class 2:



- A white 90%
- B gray 18%
- C black 6%



Notes

Observe intended use!

- ⚠ This product is not a safety sensor and is not intended as personnel protection.
- ⚠ The product may only be put into operation by competent persons.
- ⚠ Only use the product in accordance with its intended use.

# HT3CL Laser diffuse reflection sensor with background suppression

## Part number code

HT3CL1-XXXXX.X / 4P-200-S12

<b>Operating principle</b>	
HT	Diffuse reflection sensor with background suppression
<b>Construction/version</b>	
3C	SR3C series
<b>Light type</b>	
N/A	Red light
I	Infrared light
<b>Radiation source</b>	
N/A	LED
L1	Laser class 1
L2	Laser class 2
<b>Pre-set scanning range (optional)</b>	
XXXX	Pre-set scanning range [mm]
<b>Equipment</b>	
N/A	Standard
B	Housing model with two M3 threaded sleeves (brass)
S	Small light spot
L	Long light spot
XL	Extra long light spot
V	V-optics
F	Permanently set scanning range
<b>Scanning range adjustment</b>	
N/A	Scanning range adjustable via 8-turn potentiometer
1	270° potentiometer
<b>Switching output/function OUT 1/IN: Pin 4 or black conductor</b>	
2	NPN transistor output, light switching
N	NPN transistor output, dark switching
4	PNP transistor output, light switching
P	PNP transistor output, dark switching
X	not connected (n. c.)
<b>Switching output/function OUT 2/IN: Pin 2 or white conductor</b>	
2	NPN transistor output, light switching
N	NPN transistor output, dark switching
4	PNP transistor output, light switching
P	PNP transistor output, dark switching
X	Not connected (n. c.)
<b>Electrical connection</b>	
N/A	Cable, PVC, standard length 2000mm, 4-wire
M8	M8 connector, 4-pin (plug)
M8.3	M8 connector, 3-pin (plug)
200-M8	Cable, PVC, length 200mm with M8 connector, 4-pin, axial (plug)
200-M8.3	Cable, PVC, length 200mm with M8 connector, 3-pin, axial (plug)
200-M12	Cable, PVC, length 200mm with M12 connector, 4-pin, axial (plug)
100Y1	Cable, PVC, length 115mm with JST-XHP-4 connector, 4-pin

## Order guide

The sensors listed here are preferred types; current information at [www.leuze.com](http://www.leuze.com)

Sensor laser class 1		Sensor laser class 2		Accessories mounting systems <sup>1)</sup>	
Order code	Part no.	Order code	Part no.	Order code	Part no.
HT3CL1/4P-M8	50129391	HT3CL2/4P-M8	50129395	<b>For sensors with through-holes:</b>	
HT3CL1/4P	50129392	HT3CL2/4P	50129396	BT 3	50060511
HT3CL1/4P-200-M12	50129393	HT3CL2/4P-200-M12	50129397	BT 3.1 <sup>2)</sup>	50105585
HT3CL1/4P-200-M8	50129394	HT3CL2/4P-200-M8	50129398	BT 3B	50105546
HT3CL1.B/4P-M8	50133614	HT3CL2.B/4P-M8	50133618	<b>For sensors with threaded sleeves:</b>	
HT3CL1.B/4P	50133615	HT3CL2.B/4P	50133619	BT 200M.5	50118542
HT3CL1.B/4P-200-M12	50133616	HT3CL2.B/4P-200-M12	50133620	BT 205M <sup>2)</sup>	50124651
HT3CL1.B/4P-200-M8	50133617	HT3CL2.B/4P-200-M8	50133621	BTU 200M-D10	50117256
HT3CL1/4P-100Y1 <sup>3)</sup>	50136348			BTU 200M-D12	50117255
				BTU 200M.5-D12	50120426
				BTU 200M-D14	50117254

1) See "Mounting systems" on page 5.

2) Packaging unit: PU = 10 pcs.

3) Special version with JST-XHP-4 connector: dimensions including device 155mm ± 10mm

## Laser safety notices - laser class 1

### ATTENTION, LASER RADIATION – LASER CLASS 1

The device satisfies the requirements of IEC 60825-1:2007 (EN 60825-1:2007) safety regulations for a product of **laser class 1** as well as the U.S. 21 CFR 1040.10 regulations with deviations corresponding to "Laser Notice No. 50" from June 24, 2007.

- ↳ Observe the applicable statutory and local laser protection regulations.
- ↳ The device must not be tampered with and must not be changed in any way.  
There are no user-serviceable parts inside the device.  
Repairs must only be performed by Leuze electronic GmbH + Co. KG.

## Laser safety notices - laser class 2

### ATTENTION, LASER RADIATION – LASER CLASS 2

#### Never look directly into the beam!

The device satisfies the requirements of IEC 60825-1:2007 (EN 60825-1:2007) safety regulations for a product of **laser class 2** as well as the U.S. 21 CFR 1040.10 regulations with deviations corresponding to "Laser Notice No. 50" from June 24, 2007.

- ↳ Never look directly into the laser beam or in the direction of reflected laser beams!  
If you look into the beam path over a longer time period, there is a risk of injury to the retina.
- ↳ Do not point the laser beam of the device at persons!
- ↳ Interrupt the laser beam using a non-transparent, non-reflective object if the laser beam is accidentally directed towards a person.
- ↳ When mounting and aligning the device, avoid reflections of the laser beam off reflective surfaces!
- ↳ CAUTION! The use of operating or adjusting devices other than those specified here or carrying out of differing procedures may lead to dangerous exposure to radiation.
- ↳ Observe the applicable statutory and local laser protection regulations.
- ↳ The device must not be tampered with and must not be changed in any way.  
There are no user-serviceable parts inside the device.  
Repairs must only be performed by Leuze electronic GmbH + Co. KG.

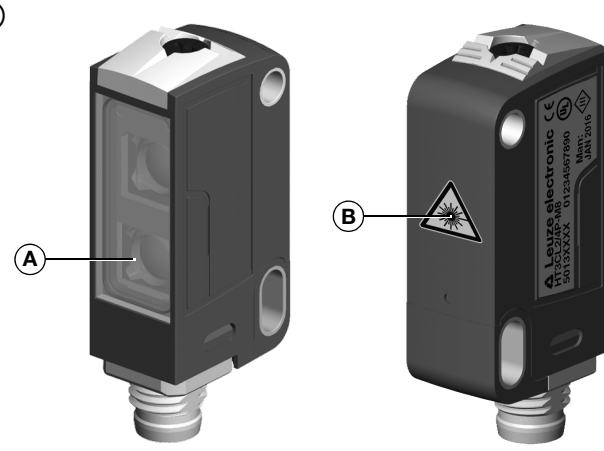
### NOTE

#### Affix laser information and warning signs!

Laser information and warning signs are attached to the device (see ①). In addition, self-adhesive laser warning and information signs (stick-on labels) are supplied in several languages (see ②).


- ↳ Affix the laser information sheet to the device in the language appropriate for the place of use.  
When using the device in the US, use the stick-on label with the "Complies with 21 CFR 1040.10" notice.
- ↳ Affix the laser information and warning signs near the device if no signs are attached to the device (e.g., because the device is too small) or if the attached laser information and warning signs are concealed due to the installation position.  
Affix the laser information and warning signs so that they are legible without exposing the reader to the laser radiation of the device or other optical radiation.

①



**A** Laser aperture  
**B** Laser warning sign

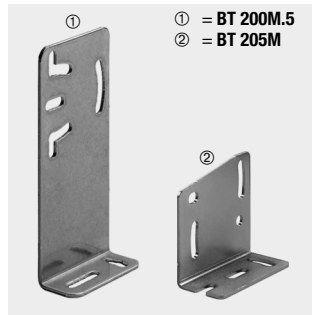
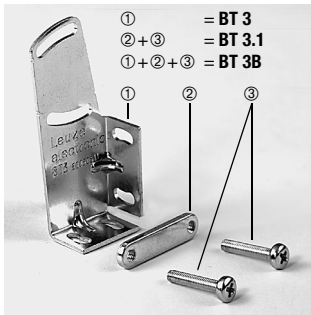
②

<p style="text-align: center;"><b>50134032</b></p> <div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>LASERSTRAHLUNG NICHT IN DEN STRAHL BLICKEN</p> <p>Max. Leistung (peak): ≤ 4,5 mW Impulsdauer: ≤ 5,1 µs Wellenlänge: 650 nm</p> <p>LASER-KLASSE 2 DIN EN 60825-1:2008-05</p> </div>	<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>RADIAZIONE LASER NON FISSARE IL FASCIO</p> <p>Potenza max. (peak): ≤ 4,5 mW Durata dell'impulso: ≤ 5,1 µs Lunghezza d'onda: 650 nm</p> <p>APPARECCHIO LASER DI CLASSE 2 EN 60825-1:2007</p> </div>
<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>LASER RADIATION DO NOT STARE INTO BEAM</p> <p>Maximum Output (peak): ≤ 4,5 mW Pulse duration: ≤ 5,1 µs Wavelength: 650 nm</p> <p>CLASS 2 LASER PRODUCT EN 60825-1:2007</p> </div>	<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>RAYONNEMENT LASER NE PAS REGARDER DANS LE FASCIAU</p> <p>Puissance max. (crête): ≤ 4,5 mW Durée de l'impulsion: ≤ 5,1 µs Longueur d'onde: 650 nm</p> <p>APPAREIL LASER DE CLASSE 2 EN 60825-1:2007</p> </div>
<p>↑</p> <p>AVOID EXPOSURE – LASER RADIATION IS LIMITED FROM THIS APERTURE</p>	<p>↑</p> <p>EXPOSITION DANGEREUSE – UN RAYONNEMENT LASER EST ÉMIS PAR CETTE OUVERTURE</p>
<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>RADIACIÓN LASER NO MIRAR FIRMAMENTE AL HAZ</p> <p>Potencia máx. (peak): ≤ 4,5 mW Duración del impulso: ≤ 5,1 µs Longitud de onda: 650 nm</p> <p>PRODUCTO LASER DE CLASE 2 EN 60825-1:2007</p> </div>	<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>RADIAÇÃO LASER NÃO OLHAR FIRMAMENTE O FEIXE</p> <p>Potência máx. (peak): ≤ 4,5 mW Período de pulso: ≤ 5,1 µs Comprimento de onda: 650 nm</p> <p>EQUIPAMENTO LASER CLASSE 2 EN 60825-1:2007</p> </div>
<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>LASER RADIATION DO NOT STARE INTO BEAM</p> <p>Maximum Output (peak): ≤ 4,5 mW Pulse duration: ≤ 5,1 µs Wavelength: 650 nm</p> <p>CLASS 2 LASER PRODUCT IEC 60825-1:2007 Complies with 21 CFR 1040.10</p> </div>	<div style="border: 1px solid black; padding: 2px; font-size: 8px;"> <p>激光辐射 勿凝视光束</p> <p>最大输出 (峰峰): ≤ 4,5 mW 脉冲持续时间: ≤ 5,1 µs 波长: 650 nm</p> <p>2 类激光产品 GB7247.1-2012</p> </div>
	

**HT3CL**

**Laser diffuse reflection sensor with background suppression**

**Mounting systems**

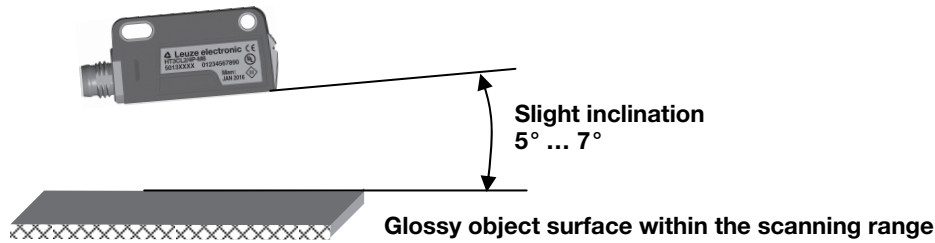


**Application notes**



● **Detection of glossy surfaces within the scanning range:**

When detecting glossy surfaces (e.g. metals), the light beam should not hit the object surface at a right angle. A slight inclination is enough to detect the object reliably. The following applies: the smaller the scanning range, the greater the angle of inclination (approx. 5° to 7°).



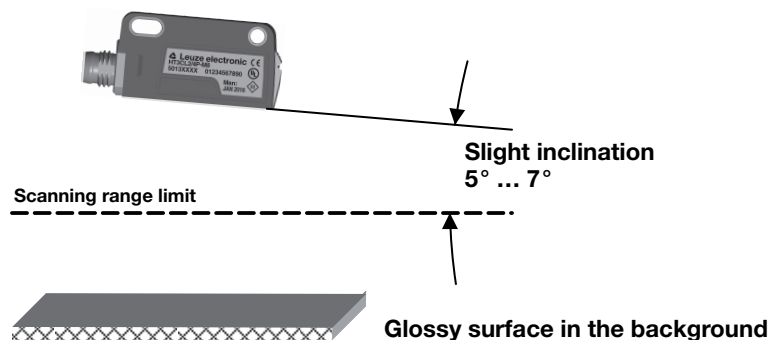
● **Avoiding interference from glossy surfaces in the background:**

If a glossy surface is in the background (distance larger than scanning range limit), reflections may cause interfering signals. They may be avoided by mounting the device at a slight inclination (see figure below).



**Attention!**

It is imperative to note the task and the associated inclination of the sensor of approx. 5° ... 7°.

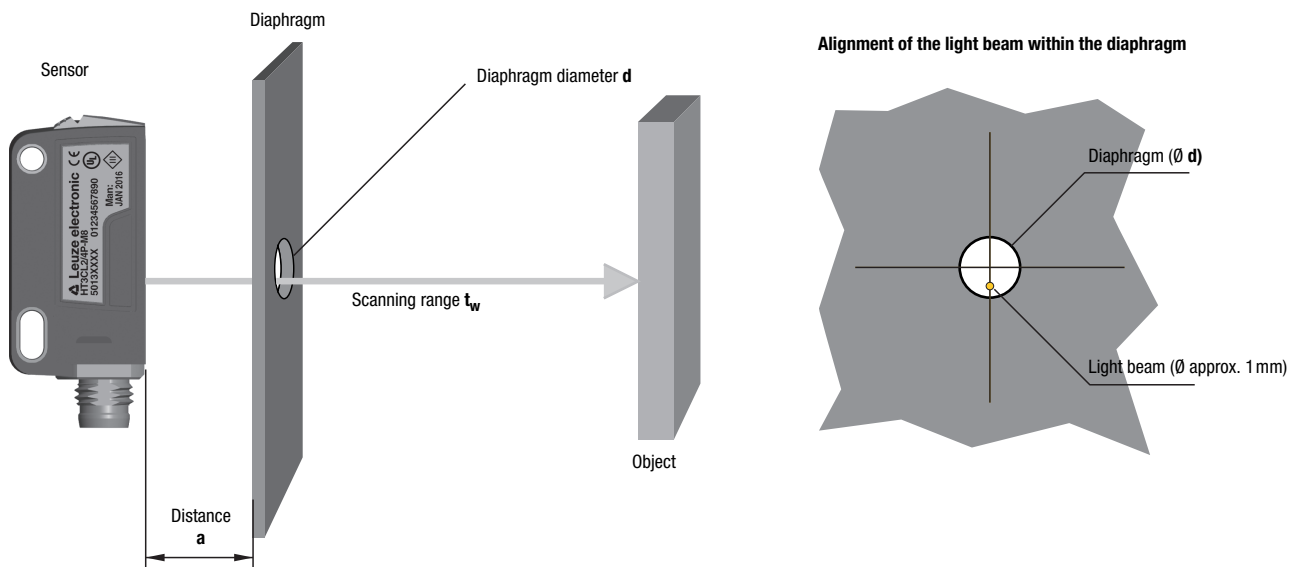


- Objects should only be moved laterally from the right or left. Moving in objects from the connection side or operating side is to be avoided.
- Outside of the scanning range, the sensor operates as an energetic diffuse reflection sensor. Light objects can still be reliably detected up to the scanning range limit.
- The sensors are equipped with effective measures for the maximum avoidance of mutual interference should they be mounted opposite one another. Opposite mounting of multiple sensors of the same type should, however, absolutely be avoided.

### Object detection behind diaphragms

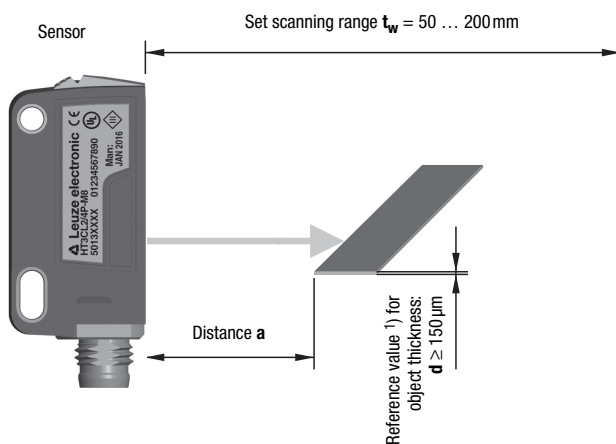
It is sometimes necessary to mount the sensor behind plant parts so that the light beam has to pass through an opening (diaphragm) that is as small as possible. Here, the detection depends, among other things, on set scanning range  $t_w$ , distance  $a$  between diaphragm and sensor, and diaphragm diameter  $d$ . Here are some reference values <sup>1)</sup>:


Distance $a$ [mm] between sensor and diaphragm	Diaphragm diameter $d$ [mm], dependent on scanning range $t_w$ [mm] on a white object (90% diffuse reflection) set on the sensor		
	$t_w = 100$	$t_w = 200$	$t_w = 300$
10	10	10	10
30	8	8	9
50	7	8	9
80	6	7	8
100	6	6	8
120		6	8
150		5	6
180		5	6
200		5	6



### Detection of smallest objects

The laser sensor can also detect extremely thin parts (e.g. sheet metal plates or wire). Detection here depends, among other things, on set scanning range  $t_w$ , distance  $a$  to the object, and object size/thickness  $d$ .



<sup>1)</sup>  Reference values are not guaranteed properties. Due to the multitude of possible influencing factors, they must be confirmed in the application.