

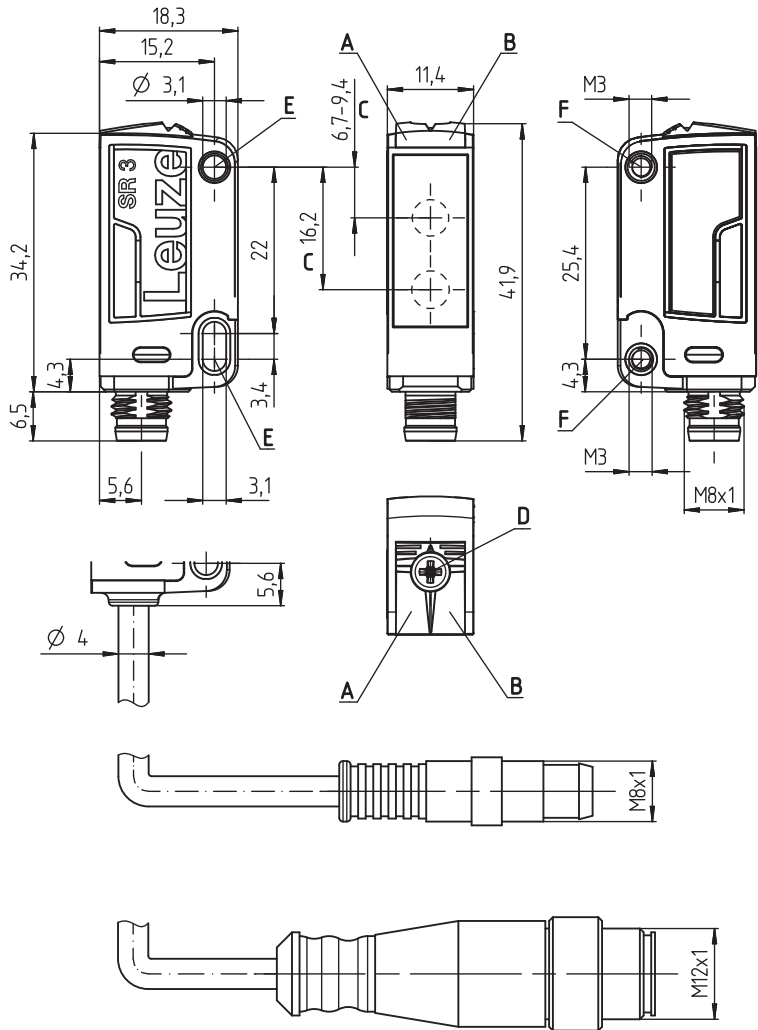
HT3CL

Laser diffuse reflection sensor with background suppression

en 01-2016/06 50130057



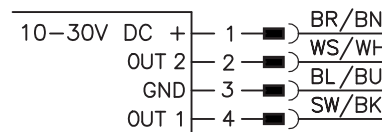
Dimensioned drawing



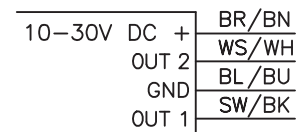
- A Green indicator diode
- B Yellow indicator diode
- C Optical axis
- D 8-turn potentiometer for scanning range adjustment
- E Mounting sleeve (standard)
- F Threaded sleeve (HT3CL....B...)

Electrical connection

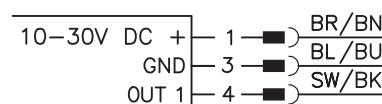
Connector, 4-pin



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

CE, UL LISTED, ECOLAB, IEC 60947..., IEC 60947..., IP 69K, IP 67

Accessories:

(available separately)

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

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

Technical data

Optical data

Typ. scanning range limit <sup>1)</sup>	<b>Laser class 1</b> 15 ... 400mm	<b>Laser class 2</b> 15 ... 550mm
Scanning range <sup>2)</sup>	see tables	
Adjustment range of the switching point	20 ... 400mm	20 ... 550mm
Black/white error < 10% up to	170mm	250mm
Light beam diameter	approx. 1 mm, consistent	
Light beam characteristic	collimated	
Squint angle	typ. ± 2°	
Light source <sup>3)</sup>	laser, pulsed	
Laser class	1 acc. to IEC 60825-1:2007	2 acc. to IEC 60825-1:2007
Wavelength	650 nm (visible red light)	
Max. output power	≤ 1.8mW	≤ 4.5mW
Pulse duration	≤ 5.1 μs	≤ 5.1 μs

Timing

Switching frequency	3,000Hz
Response time	0.16ms
Response jitter	typ. 55 μs
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 Function	see part number code on page 3 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) 8)</sup>

- 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:

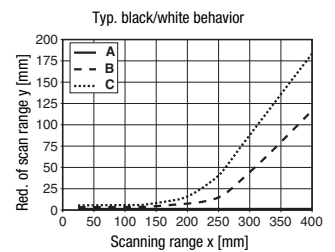
1	15	550
2	15	440
3	15	250

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

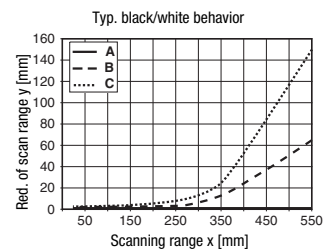
Scanning range [mm]

Diagrams

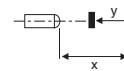
Models of laser class 1:



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.XX / 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)

## 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
				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.

## 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

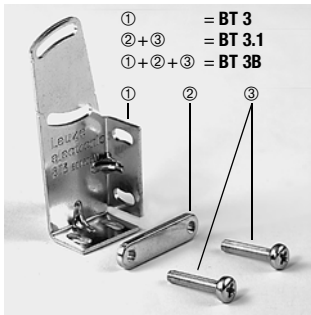
②

<p>50134032</p> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <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; margin-bottom: 2px;"> <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> <p>↑</p> <p>AVOID EXPOSURE – LASER RADIATION IS EMITTED FROM THIS APERTURE</p>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <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; margin-bottom: 2px;"> <p>RAYONNEMENT LASER NE PAS REGARDER DANS LE FASCICUL</p> <p>Puissance max. (crête): ≤ 4,5 mW Durée d'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>EXPOSITION DANGEREUSE – UN RAYONNEMENT LASER EST ÉMIS PAR CETTE OUVERTURE</p>
<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <p>RADIACIÓN LASER NO MIRAR FIJAMENTE AL HAZ</p> <p>Potencia máx. (pico): ≤ 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; margin-bottom: 2px;"> <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> <p>↑</p> <p>AVOID EXPOSURE – LASER RADIATION IS EMITTED FROM THIS APERTURE</p>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <p>RADIAÇÃO LASER NÃO OLHAR FICAMENTE O FEIXE</p> <p>Potência máx. (pico): ≤ 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; margin-bottom: 2px;"> <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> <p>↑</p> <p>EXPOSITION DANGEREUSE – UN RAYONNEMENT LASER EST ÉMIS PAR CETTE OUVERTURE</p>

**HT3CL**

**Laser diffuse reflection sensor with background suppression**

**Mounting systems**

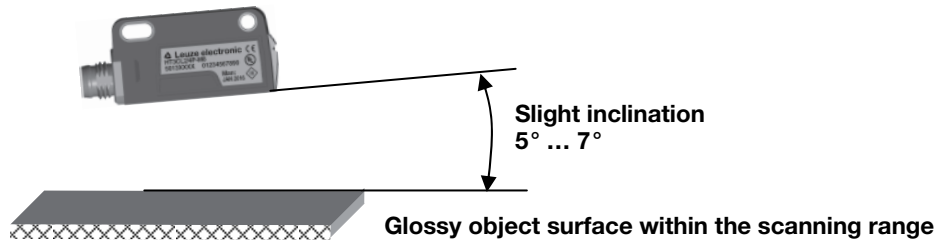


**Application notes**



● **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°).



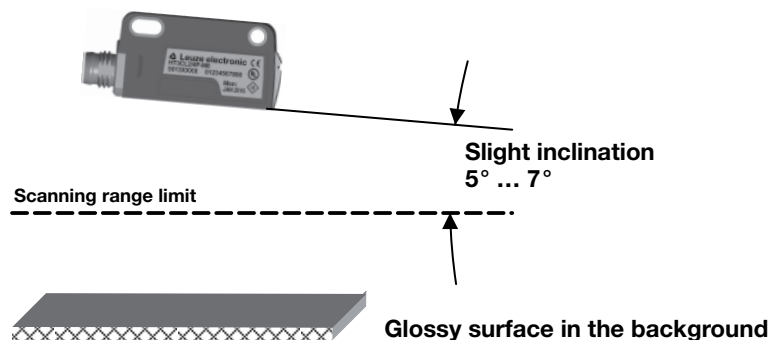
● **Avoiding interference from glossy surfaces in the background:**

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°.

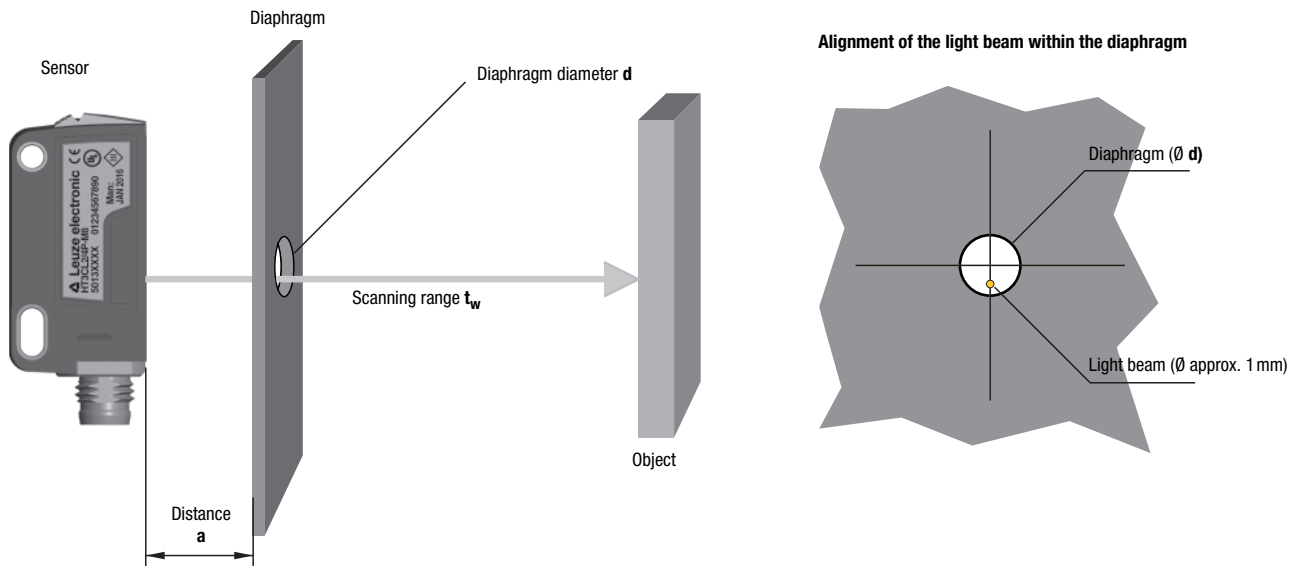


- Objects should only be moved laterally from the right or left. Moving in objects from the connection side or operating side is to be avoided.
- Outside of the scanning range, the sensor operates as an energetic diffuse reflection sensor. Light objects can still be reliably detected up to the scanning 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

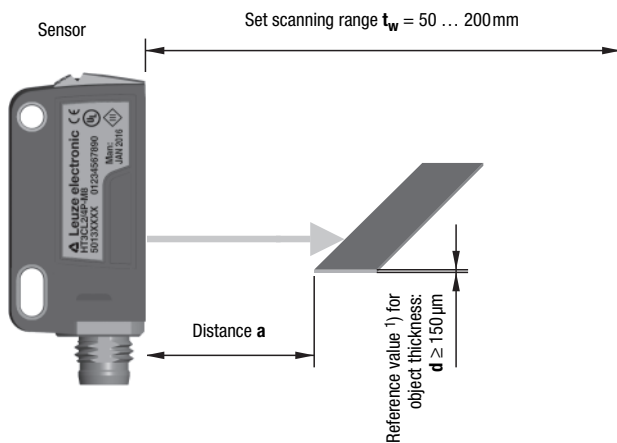
It is sometimes necessary to mount the sensor behind plant parts so that the light beam has to pass through an opening (diaphragm) that is as small as possible. Here, the detection depends, among other things, on set scanning range  $t_w$ , distance  $a$  between diaphragm and sensor, and diaphragm diameter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