

»SENSOR DE AREA DE DETECCION AJUSTABLE MARCA CEDES
MOD.TOP/SPOT.



MANUAL DE INSTALACION



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1. About this manual

2 This 'TOF/Spot Installation and Operation Manual', with metric and US measurements is the original version.

2 The version number is printed at the bottom of each page.

3 To make sure you have the latest version, visit www.cedes.com from where this manual and related documents can be downloaded.

1.1 Measurements

4 Measurements are, if not stated otherwise, given in mm (non-bracketed numbers) and inches (numbers in brackets).

1.2 Related documents

5 TOF/Spot datasheet en
Part No. 001 206 en

6 TOF/Spot-S datasheet en
Part No. 001 213 en

7 Quickguide en de fr es zh, types P, N, C
Part No. 113 495
7 Quickguide en de fr es zh, type A
Part No. 113 496
8 Quickguide en de fr es zh, type T
Part No. 113 502

1.3 CEDES headquarter

9 CEDES AG
Science Park
9 CH-7302 Landquart
Switzerland

2. Safety information

IMPORTANT! READ BEFORE INSTALLATION!

The TOF/Spot was developed and manufactured using state-of-the-art systems and technologies. However, injury and damage to the sensor can still occur.

To ensure safe conditions:

- ▶ Read all enclosed instructions and information.
- ▶ Follow the instructions given in this manual carefully.
- ▶ Observe all warnings included in the documentation and attached to the sensor.
- ▶ Do not use the sensor if it is damaged in any way.
- ▶ Keep the instruction manual on site.

The TOF/Spot should only be installed by authorized and fully trained personnel! The installer or system integrator is fully responsible for the safe integration of the sensor. It is the sole responsibility of the planner and/or installer and/or buyer to ensure that this product is used according to all applicable standards, laws and regulations in order to ensure safe operation of the whole application.

Any alterations to the device by the buyer, installer or user may result in unsafe operating conditions. CEDES is not responsible for any liability or warranty claim that results from such manipulation.

Failure to follow instructions given in this manual and/or other documents related to the TOF/Spot may cause customer complaints, serious call backs, damage, injury or death.

2.1 Non-intended use

The TOF/Spot **must not be** used for:

- Protection of dangerous machine
- Equipment in explosive atmospheres
- Equipment in radioactive environments



Use only specific and approved safety devices for such applications, otherwise serious injury or death or damage to property may occur!

3. Symbols, safety messages

Symbol	Meaning
▶	Single instruction or measures in no particular order
1. 2. 3.	Sequenced instructions
•	List, in no order of importance
→	Reference to a chapter, illustration or table within this document
Important	Important information for the correct use of the sensor

3.1 Safety messages categories

Warning of serious health risks



WARNING Serious health risks

Highlights critical information for the safe use of the sensor. Disregarding these warnings can result in serious injury or death.

- ▶ Follow the measures highlighted by the triangle-shaped arrows
- ▶ Consult the safety information in Chapter 2 of this manual

Caution of possible health risk



CAUTION Possible health risks

Highlights critical information for the safe use of the sensor. Disregarding these warnings can result in injury.

- ▶ Follow the measures highlighted by the triangle-shaped arrows
- ▶ Consult the safety information in Chapter 2 of this manual

Notice of damage risk

NOTICE Risk of damage

Disregarding these notices can lead to damage to the sensor, the door controller and/or other devices.

- ▶ Follow the measures highlighted by the triangle-shaped arrows

4. Introduction

The TOF/Spot is a compact yet powerful single-spot measuring system with the widest range of application possibilities. It uses Time-of-Flight technology (TOF) to ensure ultra reliable detection and exact detection range setting, regardless of the background. This enables a detection range of up to 6 m (20 ft).

The sensor can measure the exact distance at which a person or object enters the detection area or it can simply switch the output at a predefined level. This means the potential application areas are immense: from safeguarding the closing door edges of revolving doors, to optimizing warehouse door opening times, to providing touchless button functionality. Its small dimensions mean the TOF/Spot is ideal as a built-in solution.

4.1 Application examples

- Closing edge of revolving doors
- Bus doors
- Closing edge of glass doors



Figure 1: Typical TOF/Spot application environment

4.2 Features of the TOF/Spot

- Exact distance setting, independent of background
- Excellent detection capability
- Universal relay output
- Insensitive to ambient light
- Easy mounting
- Compact and sleek design
- Operating range of up to 6 m
- TÜV approved (TOF/Spot-S, safety version)
- Category 2, PL C (TOF/Spot-S, safety version)

4.3 Type description

TOF/Spot - a - bb - c - d - e, ff, range

TOF/Spot version

a : - Standard
S Safety

Spot size at 2 m range

bb : 40 40 mm x 40 mm

TOF/Spot type

c : N Potentiometer
P Preset (value in m)
C Automatic calibration
A Analog
T Teach-in
USB Demo version

Output

d : U Universal (relay, PNP, NPN)
A Analog

Housing

e : Y Snap-in

Supply power

ff : AC 12 ... 24 VAC
DC 10 ... 30 VDC

, max. detection range

xx Value in m

Figure 2: TOF/Spot type description

4.4 Category 2 operation (TOF/Spot-S)

The TOF/Spot-S is certified by TÜV according to EN 13849-1, Cat. 2, PLC ; EN 16005; DIN 18650 and SIL 1 according to EN 61508.

However, there are certain requirements connected to this certification:

- The system integrator has to define the correct electrical connection to the controller to fulfill Cat. 2 operation.
- The sensor must be tested regularly by the controller through the test input.
- For a safety application, the following mounting options are valid for a category 2 application:

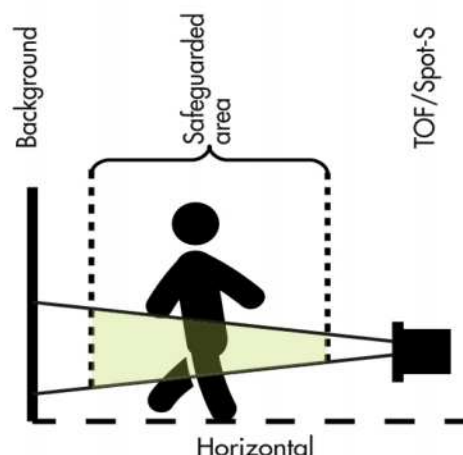


Figure 3: Horizontal safeguarding with the TOF/Spot-S

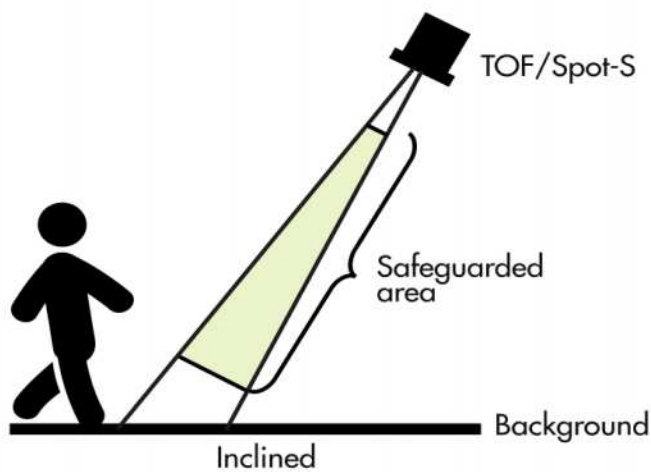


Figure 4: Inclined safeguarding with the TOF/Spot-S

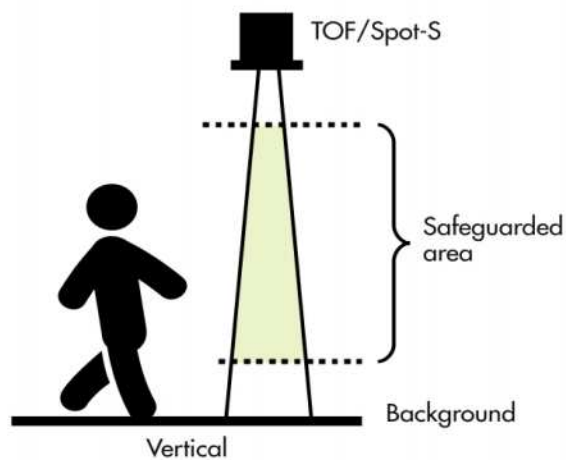


Figure 5: Vertical safeguarding with the TOF/Spot-S

- In the examples (Figure 3 to Figure 5) the sensor recognizes the background. A background is needed to successfully test the sensor with the test input. If the TOF/Spot-S doesn't recognize a background within the maximal range, the output will be switched to OBJECT DETECTED.
- The sensor looks towards a flat, plain background (non-mirroring). There is no need to be perpendicular to the optical axis.

4.5 Delivery package

A delivery package contains:

- 1 × TOF/Spot sensor with pigtail
- 1 × connection cable (2 m)
- 1 × quick guide manual (depends on the type ordered)



Figure 6: TOF/Spot delivery package

4.6 TOF/Spot product overview

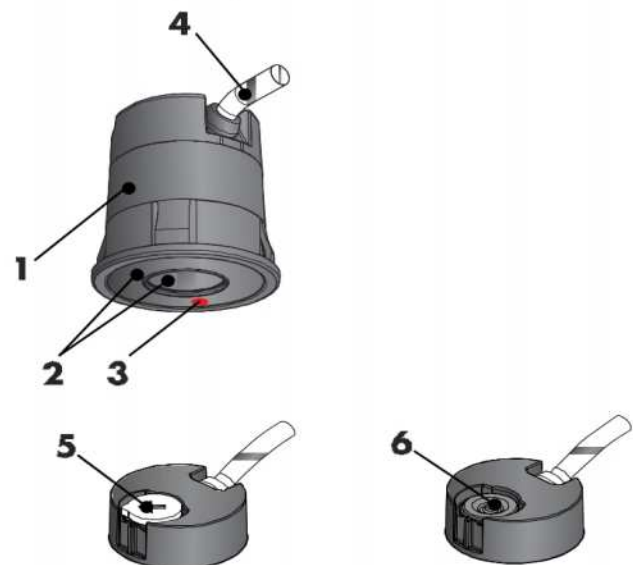


Figure 7: TOF/Spot overview

1. Snap-in housing
2. Optical window
3. Status LED
4. Connection cable with pigtail
5. Potentiometer
6. Teach-in button and cap

5. Overview

Based on Time-of-Flight technology (TOF), the TOF/Spot consists of an active infrared emitter and receiver combined in the same housing. There is one size of spot-like detection area available which reflects an exact picture of the safeguarded area.

One output signals the detection of an object within the detection area. With the A type, there is also a variant available, which sends the exact distance information to the controller.

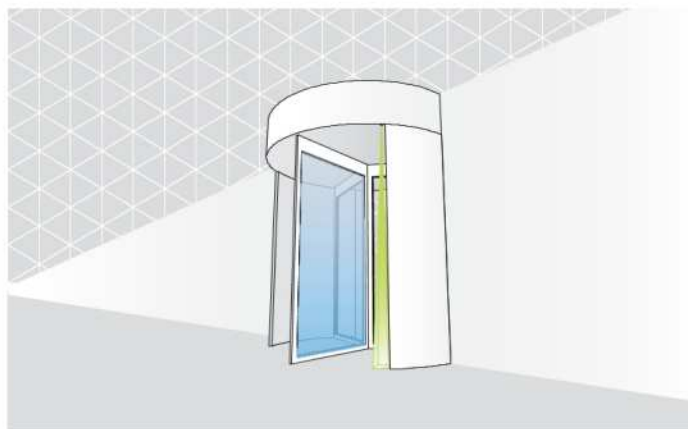


Figure 8: Closing edge of revolving doors

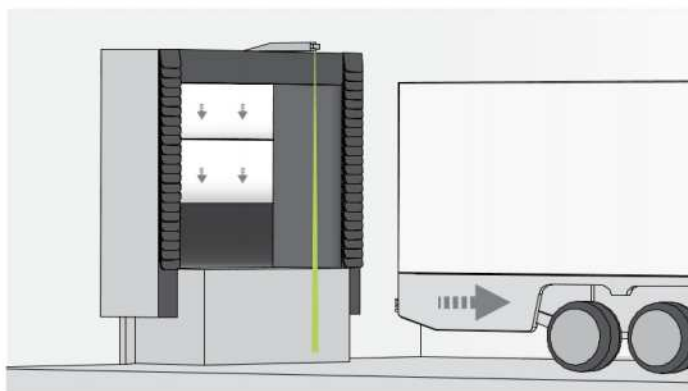


Figure 9: Warehouse doors

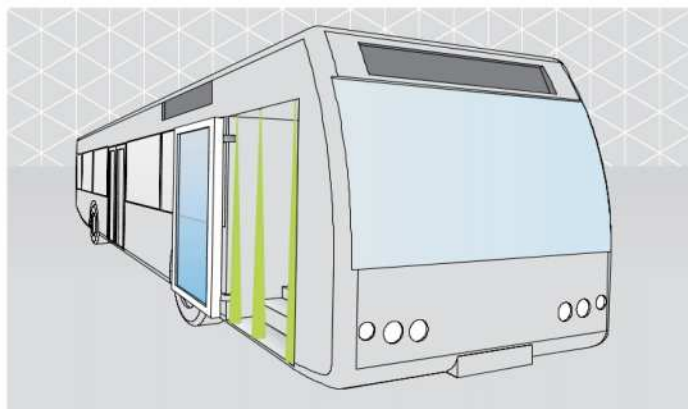


Figure 10: Closing edge of bus doors

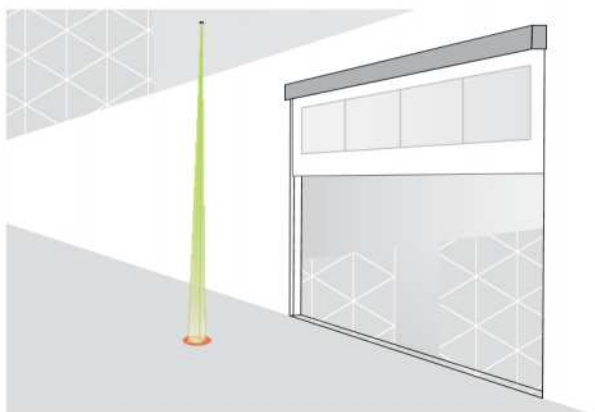


Figure 11: Replaces 'pull-string' door opening

5.1 Detection area dimensions

The maximum detection range is 6 m (20 ft). Object detection at a range less than 0.2 m (0.7 ft) cannot be guaranteed.

The TOF/Spot features a detection area of 40 x 40 mm at 2 m (1.57 x 1.57 in at 6.5 ft) range. It reads the correct distance and switches the output reliably for objects covering the full beam size (detection area). For objects being only partially in the detection area, a correct distance evaluation cannot be guaranteed.

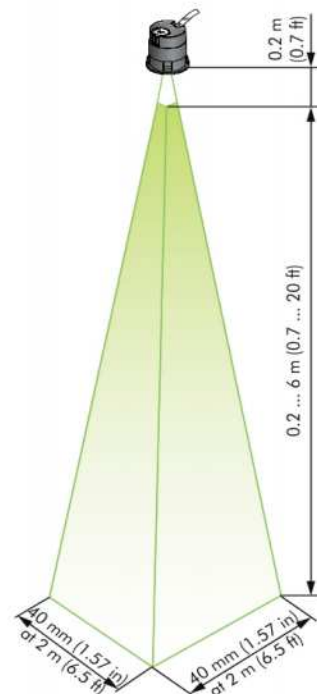


Figure 12: Dimensions of the detection area

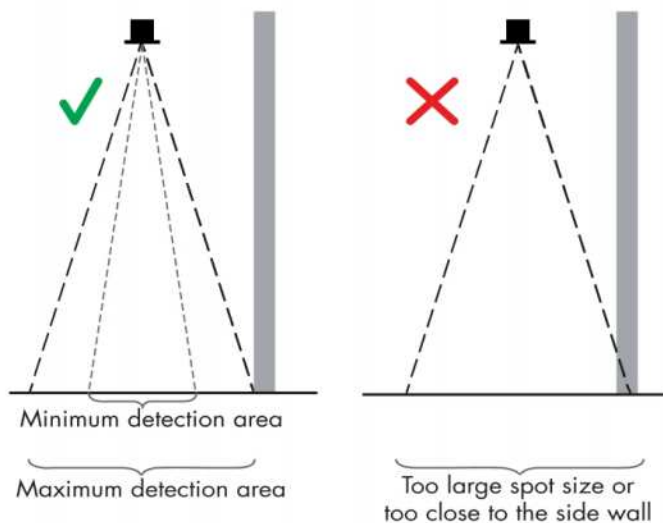
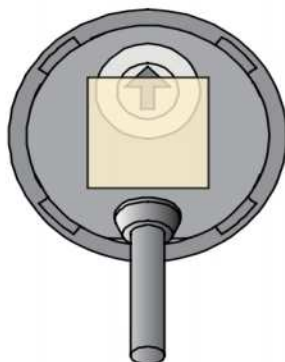


Figure 13: Illumination size of the TOF/Spot

As the illumination size is bigger than the detection size, at 2 m (6.5 ft) range, the TOF/Spot needs at least 20 cm (7.87 in) space to the next sensor to avoid interference.

5.2 Alignment

As the detection area of the TOF/Spot looks like a square, it is important to know where the flat borders and where the edges are:



Important:

- ▶ For proper functionality, the remission range of the background or the object has to be between 2 ... 90%.
- ▶ Do not use high reflective, retro-reflective or mirroring backgrounds or objects. They can lead to malfunction of the sensor due to the emitted beam not being directly remitted back to the sensor, which leads to measurements out of the operating range.

6. Configuration and operation

There are different TOF/Spot types available. Some of them need to be set manually, others are factory set.

IMPORTANT

The sensor uses a ± 40 mm (± 1.57 in) hysteresis. The hysteresis is the difference between the switching points changing the status from "free field" to "object detected" and back from "object detected" to "free field" compared to the nominal limit.

6.1 P type (Preset)

The P type needs no configuration; a specific detection range is factory set according customer request. Due to the preset value, the P type is a pure plug-and-play sensor.

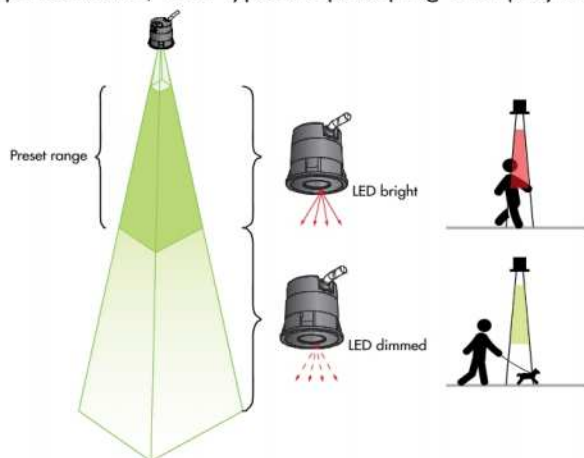


Figure 14: Configuration - P type

6.2 C type (Automatic calibration)

The C type cannot be manually calibrated. The sensor calibrates the background every time it starts up. The C type has to be fully installed and implemented into the application before connecting it to the controller.

Functionality:

Every time the sensor starts up (power-up), the TOF/Spot learns the background information anew during the first 30 s after start-up (the start-up time increases by 30 s). If the sensor has no background (e.g. it doesn't "see" anything) at start-up, the switching distance is set to 6 m (20 ft).

Important:

- ▶ When there is a background, be aware that the set switching distance is always set about 150 mm (5.9 in) less than the distance to the background or the object used for calibration.
- ▶ A background is used to calibrate the sensor. If there is none, an object has to be used for simulating the background during the distance setting or the sensor calibrates to the maximal range.
- ▶ The C type is not available as a safety version.

6.3 N type (Potentiometer)

The detection range can be individually set to between 0.2 m and 3 m (0.7 ft and 10 ft) using the potentiometer located at the rear of the sensor.

Important:

When setting with the potentiometer, use Figure 15 below as the settings are not printed on the sensor. Take a small screw driver and turn the potentiometer to the required position.

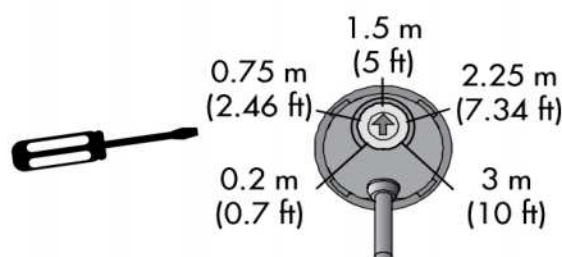


Figure 15: Example of an adjustment between 0.2 m and 3 m

Preset:

- ▶ Set the potentiometer to the limit value before the sensor is mounted.

Teach:

- ▶ Mount the sensor at its final position.
- ▶ Place an object (or person) at the limit distance.
- ▶ Turn the potentiometer clockwise, starting at the left, until the LED shines bright.
- ▶ Turn it back slowly until the LED dims.
- ▶ Now the limit is set to the correct distance.

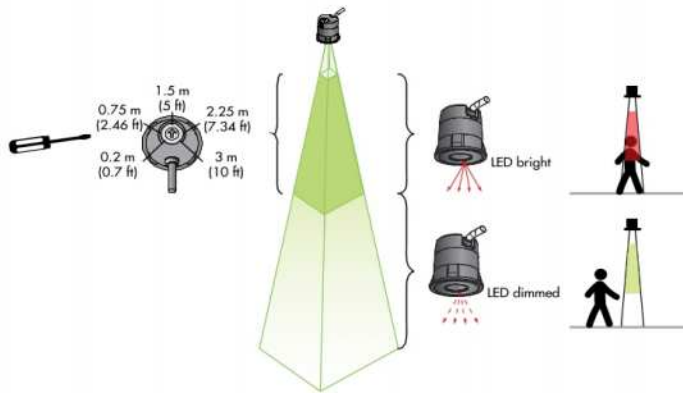


Figure 16: Configuration - N type

6.4 T type (Teach-in)

The T type features a teach-in function that can be initiated in two ways:

1. Exchange of the polarity of the supply voltage (brown wire to GND and blue wire to USP)

With the exchanged connection of GND and USP, the sensor is put into a setting mode and learns the distance to the background. The status LED starts to blink. To indicate that the calibration is finished, the sensor stops blinking and stays red for about 30 s. Now the wiring of the TOF/Spot has to be adjusted according to the electrical connections (brown wire to USP and blue wire to GND). The mode is an endless loop of 30 s setting time (blinking LED) followed by a 30 s break (red LED). In this mode, the sensor cannot work.

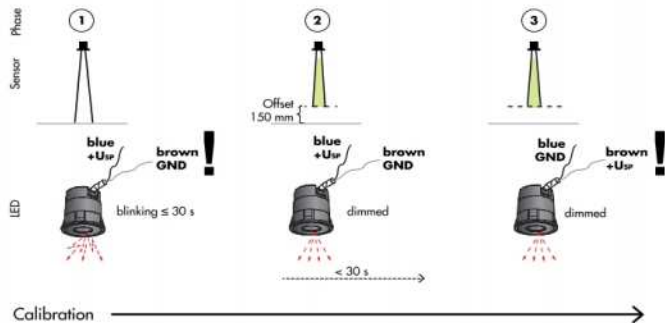


Figure 17: Configuration T type - exchange of the polarity

Please note: Only with DC supply possible

2. Setting with the teach-in button

There is a button located at the back of the sensor. When the teach-in button is pressed for at least 2 s, the LED blinks for 30 s; the detection area (distance to the background minus 150 mm (5.9 in) is saved and the LED dims. As soon as a person or object enters the detection area, the sensor switches the output.

The set switching distance can only be changed by pressing the teach-in button again.

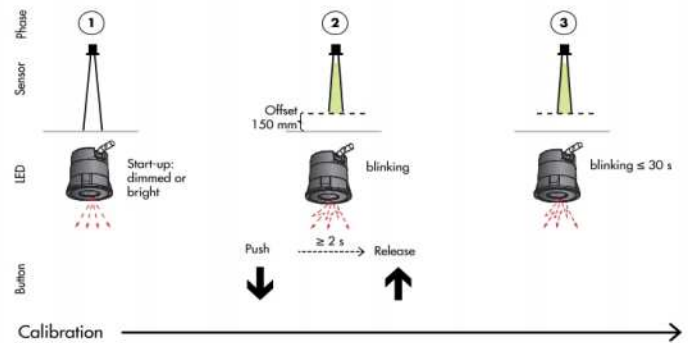


Figure 18: Configuration T type with the teach-in button

Important:

- ▶ Be aware that the set switching level is always about 150 mm (5.9 in) above the background.
- ▶ A background within the maximal detection range is used to calibrate the sensor. If there is none, an object has to be used for simulating a background. A calibration into nothingness does not work.
- ▶ When the power is switched off the sensor remembers the last setting as the switching distance. This distance can only be changed by doing the setting process again.

7. In- / Output description

There are different possibilities of in- and outputs. Please be aware that not all variants can be used with every type e.g. the A type is only available with an analog output.

7.1 Universal output (relays output)

Available for:

DC supply: Types P, N, C, T; with logic selector.

AC supply: Types P, N, T; no logic selector; output "normally closed (NC)"

The TOF/Spot features a universal (relays) output. With the help of the logic selector, the output signal can be configured according to the controller requirements for "normally open" or "normally closed" operation.

7.2 Logic selector

Available for:

DC supply: Types P, N, C, T

Important: The logic selector has to have a DC signal. An AC signal will not work.

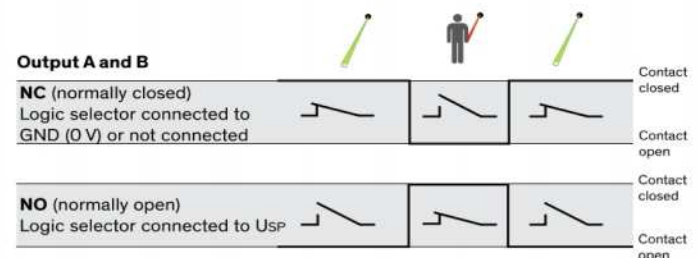


Figure 19: Logic selector

7.3 Analog output

Available for:

DC supply: Type A; no logic selector

The A type has an analog current output that is directly related to the measured distance to the object in the detection field. The value of the analog output has a range of 4 ... 20 mA and corresponds directly to the measured distance.

The value of the current output in regards of the distance is as follows:

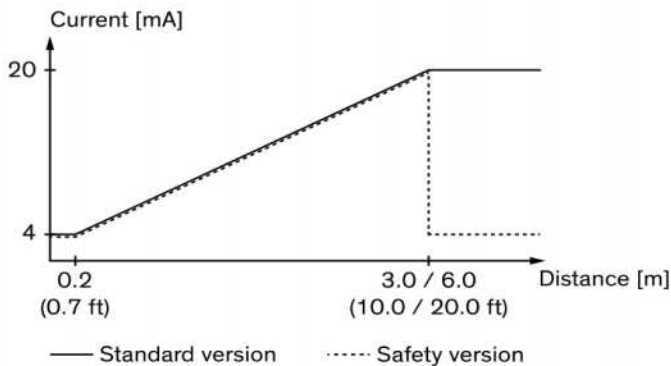


Figure 20: Analog output

The load needs to be a maximum of 250 Ω and leads to a respective voltage output of 1 ... 5 VDC.

7.4 Test input

Available for:

All TOF/Spot-S with DC supply

The logic of the test signal is being recognized automatically. This works as follows:

1. Connect the TOF/Spot-S with the controller.
2. Power up the controller.
3. The sensor recognizes the voltage level at the test input during the power up time and sets the test to inactive. From this point on, this level is used as "test inactive".
4. When the voltage level of the test input changes, the sensor will recognize it as test signal (test active). The sensor switches the output and the status LED to "OBJECT DETECTED" (see Figure 25, Timing diagram).
5. As soon as the voltage level of the test input switches back to the initial level, the sensor returns to normal operating mode. The output voltage level switches back only if the background or an object is within the operating range, but outside the switching level (Detection field FREE).

Important:

- ▶ A test sequence must be implemented by the system integrator to achieve safe operation according Cat. 2.
- ▶ The test signal has to be a DC signal, an AC signal will not work.
- ▶ The test can only be used if the sensor has a permanent background. If not, the test cannot be carried out.

8. Installation

It is recommended to carry out the system installation according to the following steps:

1. Check if the scope of delivery is complete.
2. Mark clearly that the modifying system is out of service and switch off main power and door control unit.
3. The installation place needs to fulfill the criteria detailed in Chapter 5.1.
4. Drill a hole at the required position (see drilling template for flush and surface mounting).
5. If needed, mount the mounting bracket.
6. Screw or snap in the sensor at the defined position.
7. Connect the TOF/Spot with the controller.

8.1 Mounting of snap-in housing

The mounting hole recommended for flush mounting is 30 to 31 mm. The sheet thickness cannot be greater 3 mm.

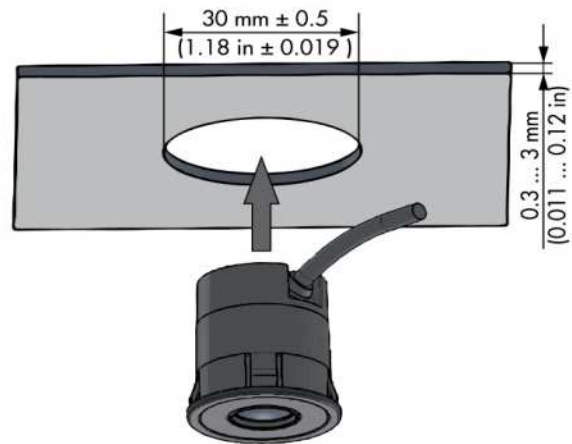


Figure 21: Mounting of snap-in housing

9. Electrical connection

There are different possibilities according to supply power and output chosen.

9.1 Power

There are two variants, one with a DC power supply (10 ... 30 VDC) and one with an AC power supply (12 ... 24 VAC). The two variants have to be ordered accordingly.

Outputs available for DC and AC supply power:
Relay output (Universal output; types P, C, N, T)

TOF/Spot	USP (10 ... 30 VDC)	brown	Controller
	Output A	black	
	Output B	green	
	GND (0 V)	blue	
	Test input*	white	
	Logic selector	gray	

Figure 22: Solid-state relay output (DC supply)

TOF/Spot	~Vcc (12 ... 24 VAC)	brown	Controller
	Output A	black	
	Output B	green	
	~Vcc (12 ... 24 VAC)	blue	
	n.c.	white	
	n.c.	gray	

Figure 23: Solid-state relay output (AC supply)

Important:

- ▶ Output A and Output B are interchangeable
- ▶ Any unconnected (n.c.) wires have to be separated and isolated

* If test input not used - connect with USP or GND

Outputs available with a DC supply power only:

TOF/Spot	USP (10 ... 30 VDC)	brown	Controller
	Analog output (4 ... 20 mA)	black	
	Analog GND	green	
	GND (0 V)	blue	
	Test input*	white	
	n.c.	gray	

Figure 24: Analog output

- ▶ Any unconnected (n.c.) wires have to be separated and isolated. No termination needed.
- ▶ Only the relay output is available in combination with an AC supply power.

* If test input not used - connect with USP or GND

10. Start-up

1. Switch on mains and power up the door control unit.
2. Check if LED lights up.
3. Check the distance setting and the reaction of the sensor, including the status LED, by placing a hand into the detection area at different heights.
4. Perform a test run with the controller using the test input.

Important:

11. Timing diagrams

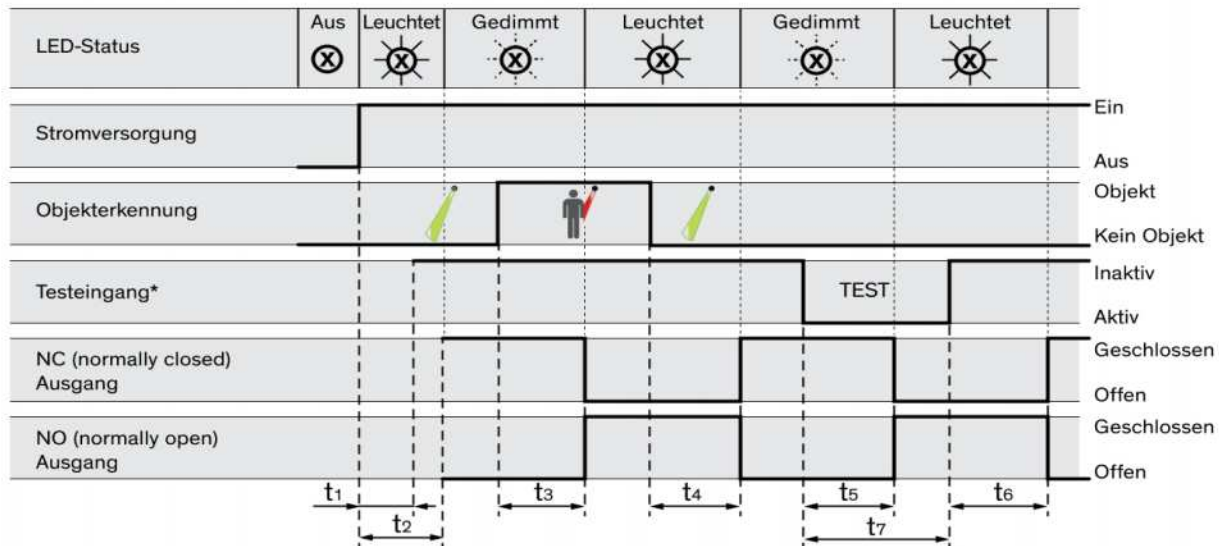


Figure 25: Timing diagram for relay output

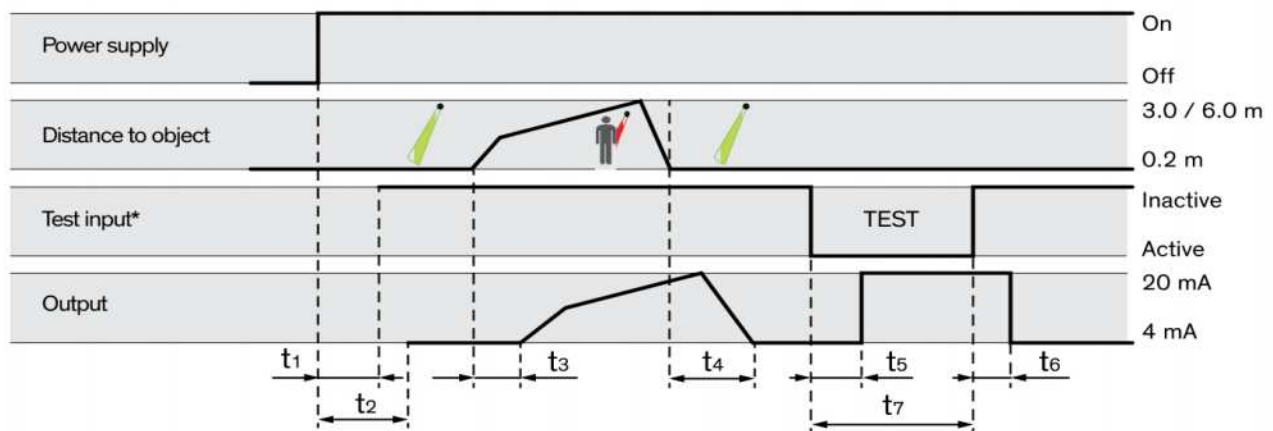


Figure 26: Timing diagram for the analog output

* Teachable at start-up

	Time	Value
Start-up time test input	t_1	< 200 ms
Power-on time	t_2	1,000 ms
Response time	t_3	≤ 60 ms
Release time	t_4	≤ 60 ms
Test response time	t_5	5 ms
Test release time	t_6	≤ 60 ms
Test time	t_7	> 60 ms

Table 1: General timing table

	Time	Value
Test input	HIGH	10 VDC ... U_{SP}
	LOW	0 ... 3 VDC
Logic selector input	NC: normally closed	0 ... 3 VDC
	NO: normally open	10 VDC ... U_{SP}
Output A and B (relay)	Voltage pin to GND	-30 ... +30 V
	Voltage between pins	-60 ... +60 V
	Current	< ± 150 mA
Analog output	Current	4 ... 20 mA
	Voltage	< 6 VDC
	Input resistance	< 250 Ω

Table 2: General value table

12. LED signal

LED status	Description
LED off	No power
LED dimmed red	No object detected
LED bright red	Object detected or test active
LED blinking (C and T type only)	Distance setting active

13. Trouble shooting

Status	Action
LED off	<ul style="list-style-type: none"> ▶ Check supply power ▶ Check electrical connections
Object in the safeguarded area and LED dimmed red	<ul style="list-style-type: none"> ▶ Check distance setting ▶ Check alignment
No object in the safeguarded area and LED bright red	<ul style="list-style-type: none"> ▶ Check electrical connections ▶ Check distance setting ▶ Check alignment
The output doesn't switch after starting test	<ul style="list-style-type: none"> ▶ Is an object in the detection area? ▶ Check electrical connections
The output doesn't switch back after ending of test	<ul style="list-style-type: none"> ▶ Sensor doesn't see a background ▶ Is an object in the detection area? ▶ Check distance setting

If the problem persists, please contact your local CEDES representative (www.cedes.com).

14. Maintenance

Although the TOF/Spot does not need regular maintenance, a periodical functional check is strongly recommended as follows:

- ▶ Check the mounting position and detection area of the sensor
- ▶ Clean the optical window with a soft towel and a little soapy water

NOTICE

Damage to the optical window

- ▶ Never use any solvents, cleaners or mechanically abrasive towels or highpressure water to clean the sensors.

15. Disposal

The TOF/Spot should only be replaced if a similar protection device is installed. Disposal should be done using the most up-to-date recycling technology according to local regulations and laws. There are no harmful materials used in the design and manufacture of the sensor. Traces of such dangerous materials may be found in the electronic components but not in the quantities that are harmful.

16. Product Label

Each TOF/Spot and TOF/Spot-S is labelled as below.
It contains following information:



Figure 27: Product label - TOF/Spot (standard version)



Figure 28: Product label - TOF/Spot-S (safety version)

Lot No.:

yymmdd: year (2 digits), month, day
 mmmmmmmm: manufacturing job number
 eeeee: employee number responsible for final test
 cccccc: incremental number

17. Technical data

Optical

Operating range	
- Types P, C, T and A	0.2 ... 6 m (0.7 ... 20 ft)
- Types N and A	0.2 ... 3 m (0.7 ... 10 ft)
Active light spot at 2 m distance	40 mm × 40 mm (1.57 in × 1.57 in at 6.5 ft)
Switching level	
- Types C and T	0.15 m (5.9 in) from background
Measurement precision	±5% at 2 m (at 6.5 ft) ±10 cm (3.93 in) over the whole range
Max. ambient light	100,000 Lux

Mechanical

Dimensions	Ø 29.5 × 35.8 mm (1.16 × 1.41 in)
Housing material	Polycarbonate
Housing color	Black
Enclosure rating	IP65
Operating temperature range	-40 °C... +60 °C
Relative humidity (non-condensing)	0 ... 95%

Electrical

Supply voltage USP	10 ... 30 VDC / 12 ... 24 VAC
Current consumption at 24 VDC	50 mA
Peak current consumption during power-up at 24 VDC	500 mA
Output	Solid-state relay, analog
Max. switching voltage	60 V
Max. switching current	150 mA
Max power-up time	1 s
Max. response time	60 ms
Test response time	5 ms

Connection cable and electrical connection

Sensor

Length	0.25 m
Connection	M8, 6-pin
Diameter	Ø 4.2 mm
Material	PVC, black
Plug color	Blue

Connection cable

Length	2 m (other lengths on request)
Connection	M8, 6-pin
Diameter	Ø 4.2 mm
Material	PVC, black
Plug color	Blue
Wires	AWG26
• brown	+Usp
• black	Output A and analog output
• green	Output B and analog GND
• blue	GND (0 V) / -Usp
• white	Test input
• gray	Logic selector

General

EMC emission	EN 61000-6-3:2007, EN 12015:2014
EMC immunity	EN 61000-6-2:2005, EN 12016:2013 +A1:2008
Vibration	EN 60068-2-6:2008
Shock	EN 60068-2-27:2009
Change of temperature	EN 60068-2-14:2009
Safety rules for the construction and installation of lifts	DIN EN 81-1/-2:2010
Part 20: Passenger and goods passenger lifts	DIN EN 81-20:2011
Certificates	CE, TÜV

TOF/Spot-S

Applicable standards	EN ISO 13849-1:2008, Cat. 2 PL C* EN 12978:2009 DIN 18650:2010, clause 5.7.4 EN 16005:2013, clause 4.6.8 EN 61508:2010, SIL1*
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* only when the sensor is pointed towards a background within the max. operating range

18. Dimensions

Measurements all dimensions in mm (inches)



CEDES



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»SENSOR DE AREA DE DETECCION AJUSTABLE MARCA CEDES
MOD.TOP/SPOT.



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