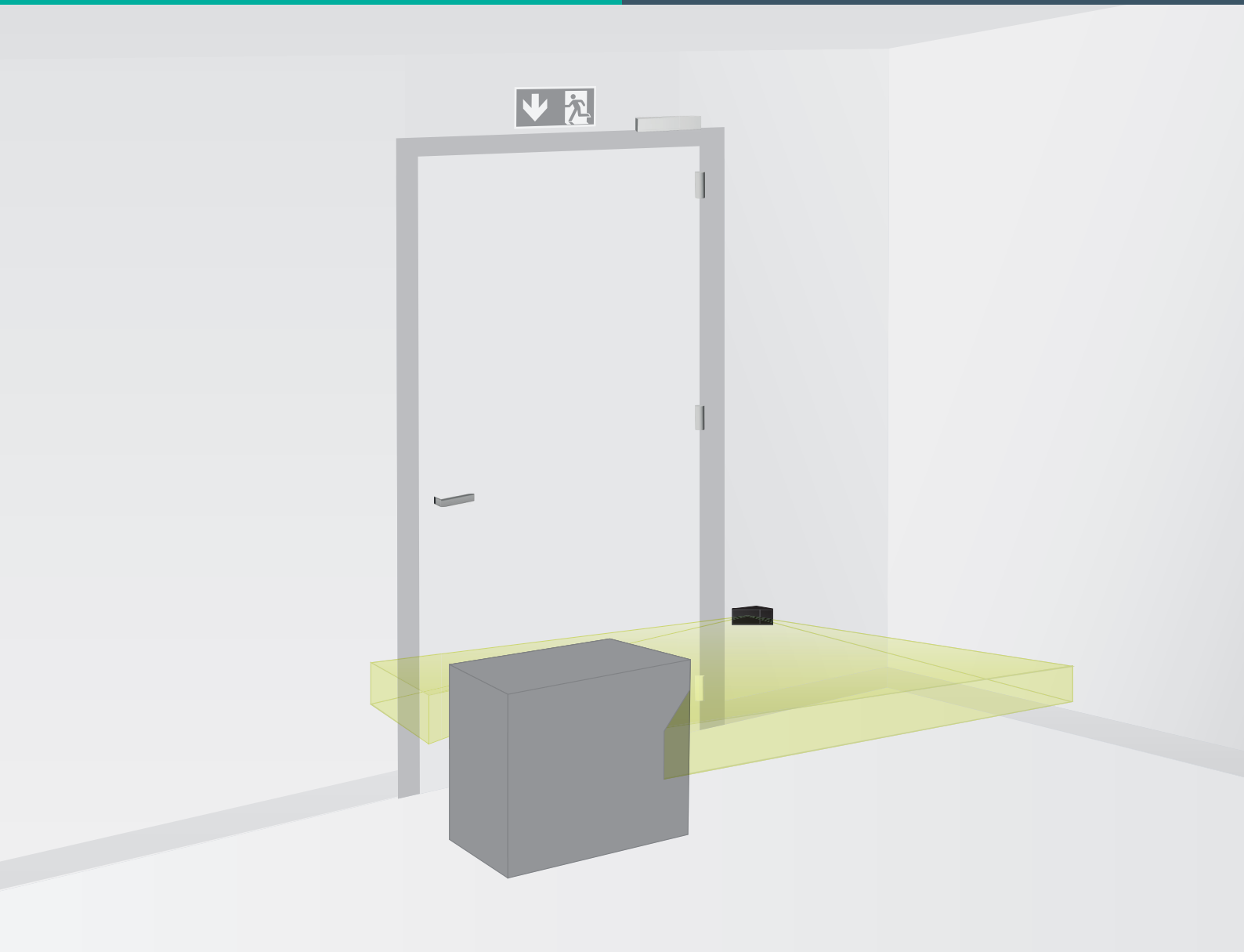
TOF Sensor
TOF-2D

Operating and Instruction Manual

EN Version 1.0

Measuring 2-D TOF Sensor for
Presence and Motion Detection



sensotek®
Intelligent Sensor Solutions

TOF Sensor TOF-2D

Operating and Instruction Manual

EN Version 1.0

Order designation: Measuring 1-D TOF sensor for presence and motion detection

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Table of content

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1. Introduction

1.1 About this manual

This document contains information you need to use your product in the applicable phases of the product life cycle. This may include

- Product identification
- Delivery, transport, and storage
- Assembly and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Disassembly
- Disposal

The documentation consists of the following parts:

- Operating and installation instructions (= this document)
- Data sheet

In addition, the documentation may consist of the following parts, if applicable::

- Certificate of conformity
- Certificates

1.2 Safety information – IMPORTANT! READ BEFORE INSTALLATION!

The TOF-2D was developed and manufactured using state-of-the-art systems and technologies. However, injury and damage to the sensor can still occur.

1.2.1 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-2D 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. Sensotek GmbH 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-2D may cause customer complaints, serious call backs, damage, injury or death.

1.2.2 Non-intended use

TOF-2D **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!

1.3 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

This document contains symbols to indicate warnings and informativenotes.

1.3.1 Safety messages categories

Warning notices are always provided when your actions could pose a hazard.
It is essential that you observe these warning notices for your own personal safety and to avoid damage to property.
Depending on the level of risk, the warning notices are displayed in descending order as follows:

Danger!
This symbol warns you of an imminent danger.
Failure to observe this warning may result in personal injury or death.

Warning!
This symbol warns you of a possible malfunction or danger.
Failure to observe this warning may result in personal injury or serious damage to property.

Caution!
This symbol warns you of a possible malfunction.
Failure to observe this warning may result in the product or connected systems and equipment malfunctioning or failing completely.

1.3.2 Informative notes

Notes:
This symbol indicates important information.

1.4 Declaration of conformity

EC-Declaration of conformity – Extract
The TOF-2D product complies with the following directives and harmonized standards:

EU-Richtlinien/EU-Regulation	Normen/Standards
2006/42/EC/ Supply of Machinery (Safety) Regulations 200 8 2014/30/ EU / Electromagnetic Compatibility Regulations 2016 2014/35/EU / Electrical Equipment (Safety) Regulations 2016 2011/65/EU / The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	EN 60068-2-6:2008 EN 60068-2-27:2009 EN 61000-6-2:2005 EN 61000-6-3:2007 EN 12015:2014 EN 12016:2013

The full declaration of conformity can be downloaded at www.sensotek.com.

2. Scope of delivery and device description

2.1 Delivery package

A delivery package contains:
- 1 × TOF-2D sensor with pigtail cable
- 1 × Connection cable (2 m)
- 1 × Installation guide

2.2 Device description

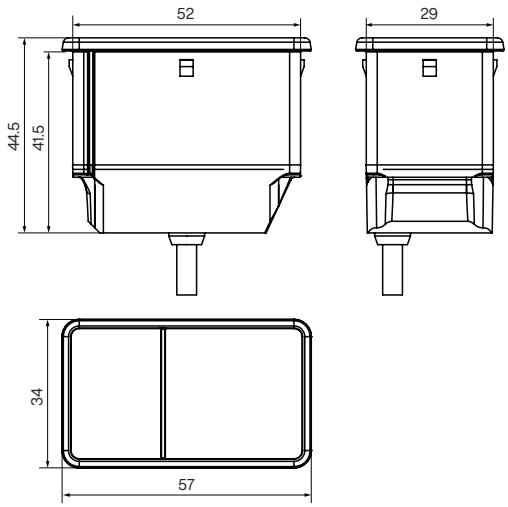
The TOF-2D is a compact yet powerful and flexible range of sensors. These detect people and objects within a planar area of max 2.0 m by 2.0 m. TOF technology enables TOF-2D sensors to operate with all types of backgrounds without any need to recalibrate. Their main feature is their ability to easily adapt to different detection field needs –
this is done using two potentiometers for x-axis and y-axis. TOF-2D sensors are available with and without blanking in both center and side mounted versions.

Technical Data

General data	
Eye safety	EN 62471:2008
EMV emission	EN 61000-6-3:2007 EN 12015:2014
EMV Immunity	EN 61000-6-2:2005 EN 12016:2013
Vibration	IEC 60068-2-6:2007
Shock	IEC 60068-2-27:2008
RoHS	2011/65/EU
Certificate	CE, UKCA
Optical	
Detection area **- Length** **- Width**	 Min. 0 ... 400 mm; Max. 0 ... 2,000 mm Min. 0 ... 400 mm; Max. 0 ... 2,000 mm
Mechanical	
Dimensions (w × h × l)	57 × 34 × 44.5 mm
Housing material	Polycarbonate
Housing color	Black
Enclosure rating	IP65
Temperature range	-20 °C … +65 °C
Electrical	
Supply voltage U_{SP}	24 VDC ±20%
Current consumption at 24 VDC	50 mA (peak max. 0.5 A)
Output	PNP/NPN (push-pull)
Max. response time	200 ms
Min. switching time	200 ms
Power-on time	1 s
Sensor: Connection cable and elektrical connections	
Length	0.25 m
Connection	M8, 6-pin
Diameter	Ø 4.2 mm
Material	PVC, black
Plug color	Blue
Connection cable and electrical connections	
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	U_{SP}
▪ black	Output
▪ green	Not connected
▪ blue	GND (0 V)
▪ white	Not used
▪ gray	Selectable output logic
Zulassungen und Zertifikate	
CE	may be operated in all countries of the European Community. In other countries, the applicable national regulations must be observed.

2.3 Dimensions

2.3.1 Sensor



2.3.2 Mounting brackets

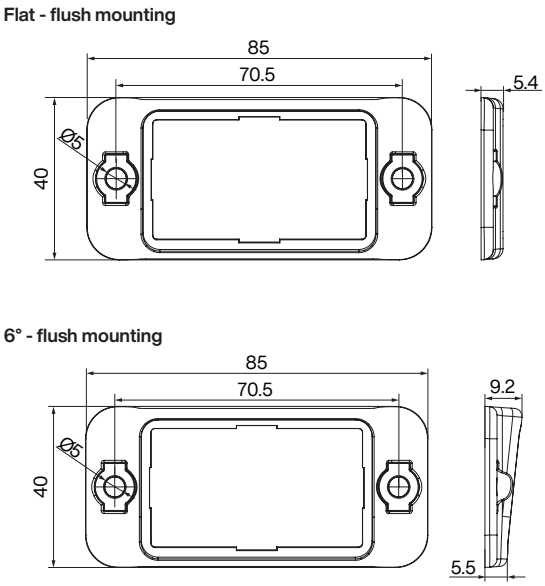


Figure 1: All dimensions in mm

2.4 Detection fields

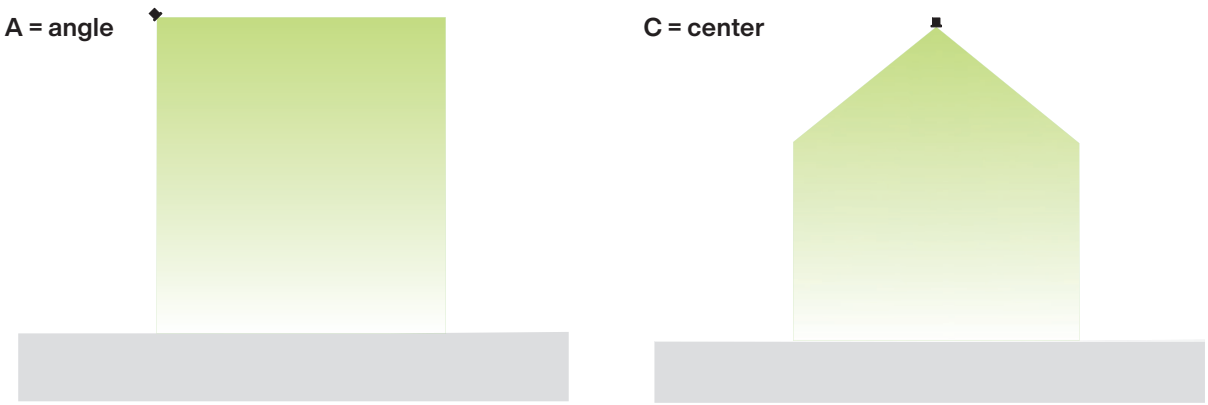


Figure 2: TOF-2D detects objects within a maximum area of 2.0 m by 2.0 m. A side-mounted and a centermounted version are available

2.5 Type description

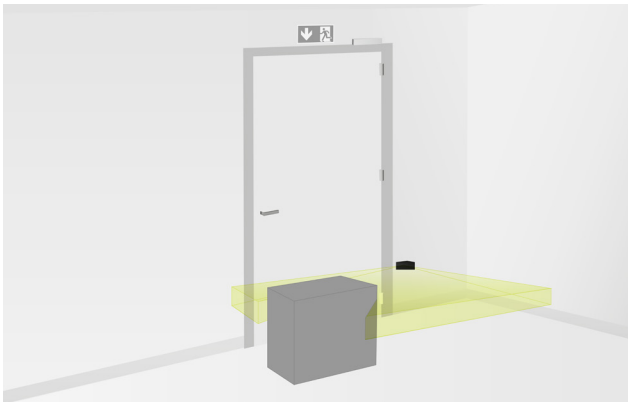
TOF-2D-AN: angle/Potentiometer
TOF-2D-AN-B: angle/Potentiometer/Blanking
TOF-2D-AT: angle/Teach-In
TOF-2D-AT-B: angle/Teach-In/Blanking
TOF-2D-CN: center/Potentiometer
TOF-2D-CN-B: center/Potentiometer/Blanking
TOF-2D-CT: center/Teach-In
TOF-2D-CT-B: center/Teach-In/Blanking

2.6 Features of the TOF-2D

- Excellent detection capability, independent of reflectance
- Individual setting of the detection area
- Detection area operates with all types of background

2.7 Application examples

- Presence-detection
- Object-detection



3. Configuration

3.1 Type of threshold setting

The distance at which the sensor triggers an output is the threshold. The TOF-2D requires a threshold setting for the x-axis as well as the y-axis using potentiometers.

Notes: The sensor uses a ±120 mm (±4.72 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.

3.1.1 Threshold setting via potentiometer

The threshold distance at which the sensor triggers an output is set with a potentiometer for the x-axis and y-axis. This is done using the potentiometer at the back of the sensor. If the sensor points to a background, the distance of the switching threshold to the background is recommended to be set at 150 mm.

Important:
When mounted horizontally, the cable exit of the sensor in the Figure 3 is always at the bottom.

- The scale is not printed on the sensor. The potentiometer can be adjusted linear from of 0.4 m to 2.0 m; see Figure 3 below.
- Take a small screw driver and turn the potentiometer to the required position.

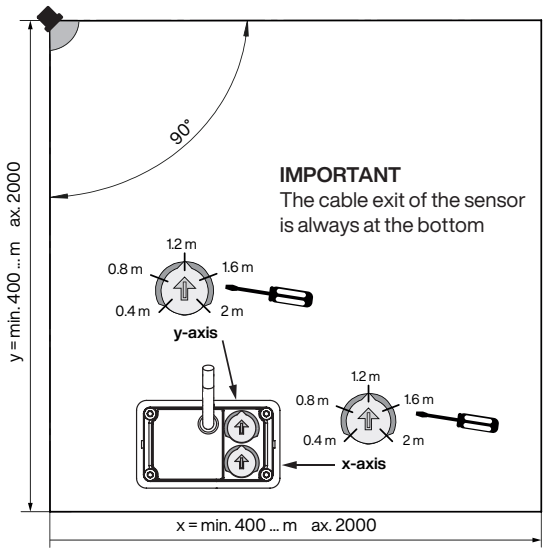


Figure 3: A type: Detection field using potentiometer

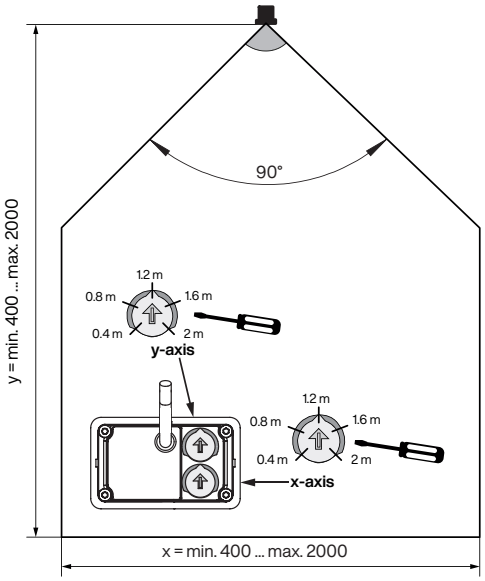


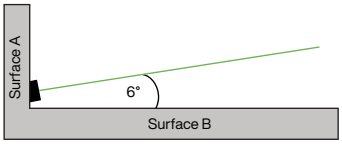
Figure 4: C type: Detection field using potentiometer

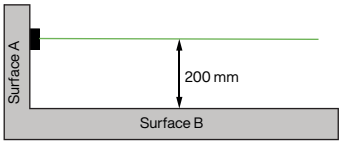
Parameter	Value
Operating range x-axis	Min.: 0 ... 400 mm Max.: 0 ... 2,000 mm
Operating range y-axis	Min.: 0 ... 400 mm Max.: 0 ... 2,000 mm
Aperture angle	90°

Table 1: Parameter - detection field

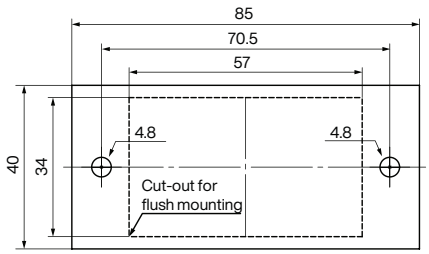
4. Installation

1. Switch off main power to the control unit and mark clearly that this system is out of service before performing any work on the system.
2. Define the ideal place to mount the sensor Important: The TOF-2D must be mounted with a 6° angle or with a minimum distance of 200 mm parallel to Surface B.

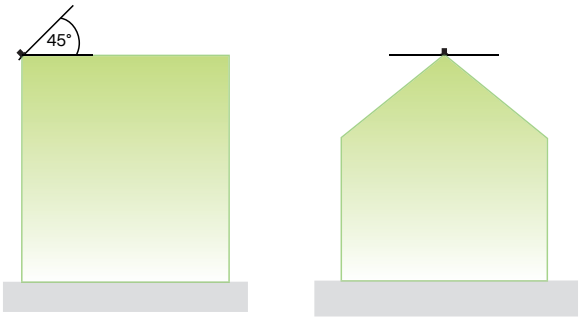




3. Cut a hole at the defined position into Surface A. For the use of the flush mounting use the delivered drilling pattern or use a surface mounting kit. More details about available surface mounting kit are written in the accessories sheet of the TOF-2D.



Important: The angle type has to be mounted at a 45° angle to the detection area. The centre type can be mounted flat (0°).



4. Place the sensor and connect it according connecting diagram in Chapter 5.
5. Switch on mains and power-up the control unit.
6. Adjust the detection field.
7. Test if the system is working correctly.

5. Input / Output description and electrical connection

Generally the TOF-2D has one output that is triggered when an object is sensed in the detection field. For this purpose, a push-pull output is used. With the logic selector (gray wire, Figure 6), the logic of the output signal can be configured for “HIGH“ on object or “LOW“ on object operation (Figure 5), according to the controller requirements. The logic selection is performed during start-up.

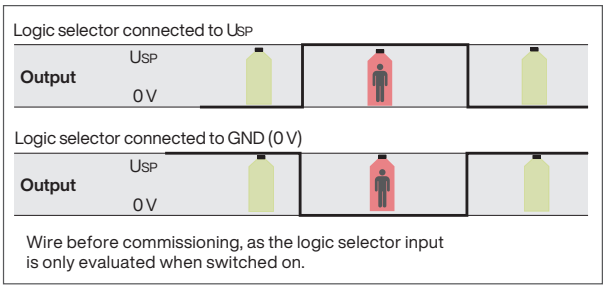


Figure 5: Output (PNP/NPN) logic

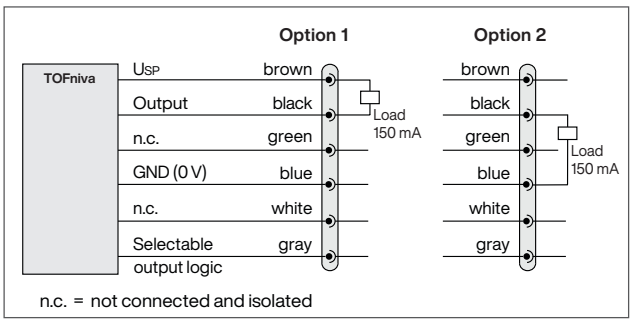
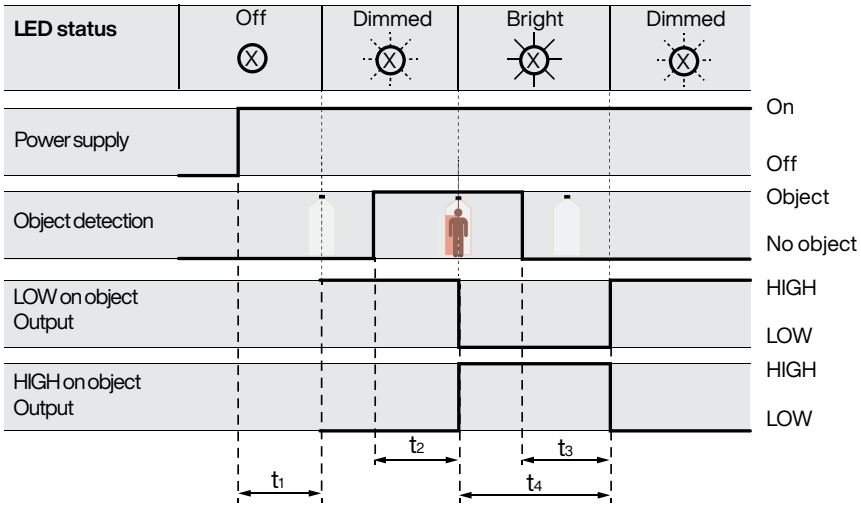


Figure 6: Connection diagram

6. Start-up

1. Switch on mains and power up.
2. Check if LED lights up.
3. Check the distance setting and the reaction of the sensor, including the status LED, by placing an object into the detection area at different heights and widths.

7. Timing diagram



	Time	Value [ms]
Power-on time	t_1	1,000
Max. response time	t_2	200
Release time	t_3	200
Min. switching time	t_4	200

Figure 7: General timing diagram / general timing table

8. LED signals

The red LED provides the sensor's status. The respective LED is dimmed when the power is OK and the detection field is free. The LED glows bright when an object is detected and the respective output triggered. The LED is visible from the front.

LED status	Description
LED off	No power
LED dimmed red	No object detected
LED bright red	Object detected

9. Blanking

The TOF-2D is also available with a blanking function (-B variants). Versions that features blanking trigger the output when objects are dynamic (moving) within the detection field. Static objects within the detection field will be ignored and blanked out (after 30 seconds). This covers with objects that are already present at power up (i.e. bollards).

Start-up:

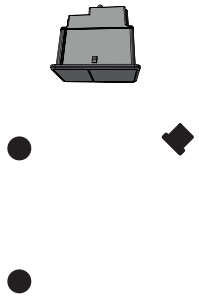


Figure 8: Active blanking - start-up sequence with i.e. bollards.

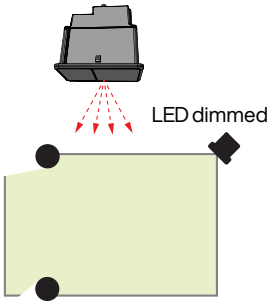


Figure 9: After start-up the bollards are blanked out from the detection field.

Active blanking:

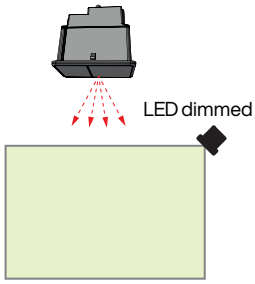


Figure 10: The detection field is free.

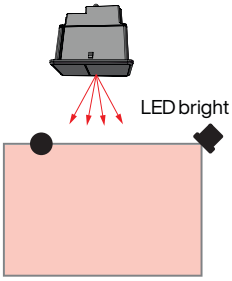


Figure 11: A static object is placed in the detection field (i.e a trash bag). The object will be detected.

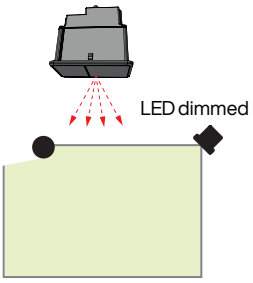


Figure 12: After 30 s the static object will be blanked out and the TOF-2D continues its operation with the new geometry

10. Trouble shooting

Status	Action
LED off	■ Check supply power ■ Check electrical connections
Object in the safeguarded area and LED dimmed red	■ Check distance setting

No object in the safeguarded area and LED bright red	■ Check electrical connections ■ Check distance setting ■ Check alignment

If the problem persists, please contact Sensotek GmbH (+49 7163 93926-0; info@de.sensotek.com; www.sensotek.com).

11. Maintenance

Although the TOF-2D 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.

Note: Damage to the optical window
Never use any solvents, cleaners or mechanically abrasive towels or highpressure water to clean the sensors.

12. ESD-Safety

Warning! The device contains sensitive electronic components that may be affected by electrostatic discharge (ESD). Use appropriate ESD protection measures, such as wrist straps, to protect the device from damage.

13. Decommissioning

Note: The device may only be taken out of service by trained specialist personnel. Before dismantling, ensure that the power supply is disconnected.

14. Disposal

The TOF-2D 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.