SWISSDOOR
DØRTEKNIK FOR PROFESSIONELLE

SolidSense

Solid-State Scanner with
Time-of-Flight Technology for
Human-Presence Detection at Automatic Doors

Device version V1.0

Original instructions

BBC BIRCHER
Smart Access

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If you have any questions about the device, please contac us:
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Bircher Smart Access

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1 Safety

General Safety Information

Responsibility for planning, mounting, commissioning, operation, maintenance, and dismounting lies with the plant operator.

Personnel must be appropriately trained and qualified to mount, commission, operate, maintain, and dismount the device. The trained and qualified personnel must have read and understood the instructions.

Familiarize yourself with the device before use. Read the instruction manual carefully.

The corresponding datasheets, original instructions, manuals, declarations of conformity, certificates, etc. supplement this document, where applicable. These documents can be found at www.bircher.com or contact your local Bircher representative.

This documentation can be accessed by entering the product name (type code) or the item number of the product into the search field on the website.

Due to updates, the documentation is subject to continual change. The valid version is always the most up-to-date version and can be found at www.bircher.com.

Observe the laws, standards, and directives applicable to the intended use and the operating location. The device is only approved for proper and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer of any liability.

The protection of personnel and the plant is guaranteed only if the device is operated in accordance with its intended use.

Only supply the device via a power supply that meets the requirements for safety extra-low protective voltage (SELV) or protective extra-low voltage (PELV).

When connecting the device to other electrical equipment, note that there is no safe separation distance as defined in IEC 61140 between switching outputs and other circuits.

Do not modify or manipulate the device.

Switch off the device if any serious faults occur. Make sure that the device cannot be inadvertently switched on again.

Always return the device to Bircher if a defect is found.

2 Product Description

2.1 Solid-State Scanner with Static Time-of-Flight Technology

The SolidSense is a piece of protective equipment that is mounted for mobile use for personal safety at automatic doors. The three beam areas allow the device to monitor the leading edge, the door leaf, and the hinge edge. This means that only one sensor module is required per side.

The sensor system consists of a left and right sensor, which are mounted on the door hinge side (HS) or hinge opposite side (HOS). The door hinge side is the side on which the door hinges are located.

Which one is the primary sensor and which one is the secondary sensor depends on which sensor the IO module is fitted to. The sensor with the IO module is the primary sensor; the secondary sensor has a blind cover in place of the IO module. The IO module connects the device to the door controller. On delivery, the IO module is fitted to the right sensor.

Detection Field

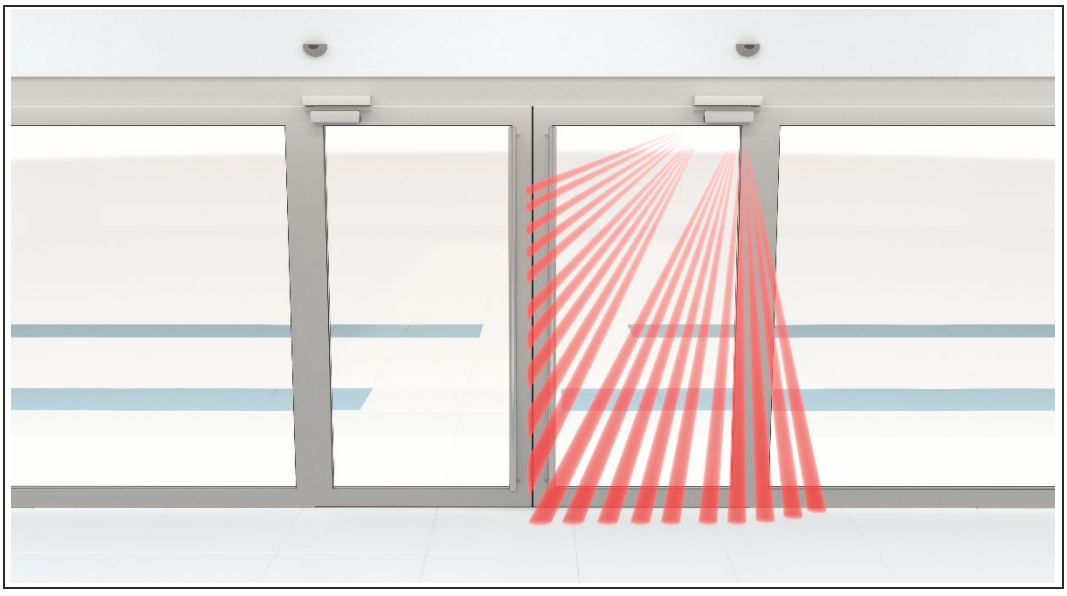


Figure 1

The device operates as a solid-state scanner and forms a completely end-to-end detection field on each door side in accordance with DIN 18650/EN 16005 (CA test body). If a person or object interrupts one or more light beams, the device triggers the switching outputs.

The detection field consists of 20 beams and is divided up as follows:

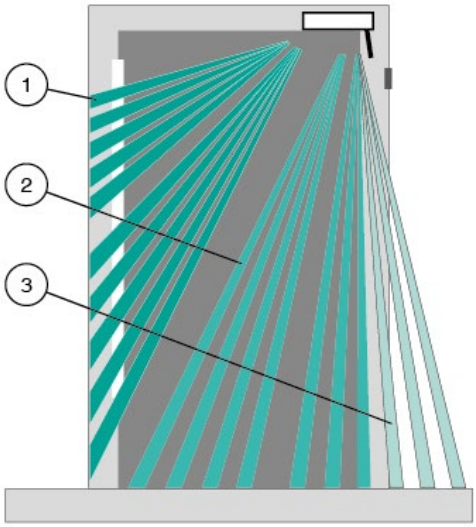


Figure 2 Schematic diagram

1	Beams for the leading edge
2	Beams for the door leaf
3	Beams for the hinge edge

The sensor system adapts to different door widths. The beams for the leading edge are emitted when the door moves approximately 15 cm.

For door handles, the detection field must be in front of the handle.

Virtual-Wall Function

The device can adjust its protection field dynamically and according to the angle. It is therefore not necessary to explicitly teach in a wall behind the open door.

During commissioning, the device determines the door's maximum opening angle. When the door is opened, the individual beams of the protection field are hidden one after the other once each opening angle is reached.

At the same time, any changes happening behind the open door are ignored by the beams being hidden.

Pinch Protection on the Hinge Edge

The beam field is "curved" in the area around the hinge edge. The curved beam field detects when someone is reaching around the side (pinch protection). The device detects the base of the hand at powered swing doors without contact – before fingers can become trapped.

The detection area is based on the sensor setting and the height of the door.

Perform a risk analysis to check whether the finger protection function on the hinge edge meets the requirements of the application. Additional mechanical protection may be required if especially vulnerable persons such as children must be protected.

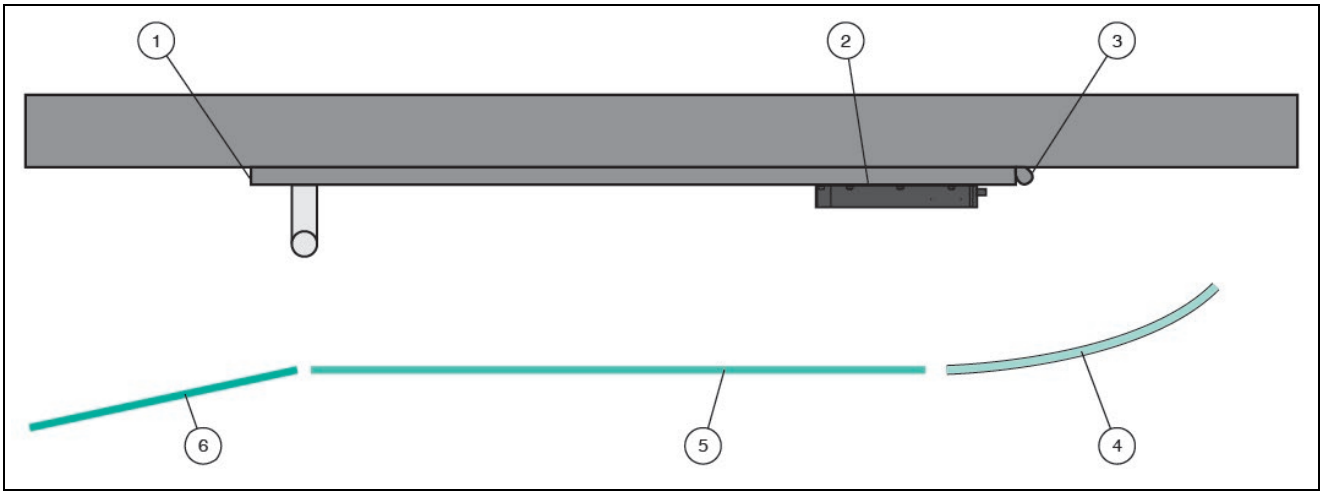


Figure 3

1	Leading edge
2	Sensor
3	Hinge edge
4	Hinge edge beam
5	Door leaf beam
6	Leading edge beam

Note

The SolidSense is a piece of electro-sensitive protective equipment that protects the hinge edge (hinge area) by detecting fingers and wrists (typ. min. Ø35 mm) at powered swing doors before the fingers are at risk of becoming trapped.

The detection area for the hinge edge is based on the sensor setting and the mounting position.

Protected upper area = lower edge of sensor – 0.35 m

Unprotected lower area:	up to 0.34 m at a mounting height of 2.1 m, increases with the mounting height (max. 0.65 m at a mounting height of 3.5 m)

A risk analysis must be performed to check whether the finger protection area at the hinge edge requires additional mechanical protection if there is a high probability of finger detection (e.g., at a kindergarten).

2.2 Dimensions

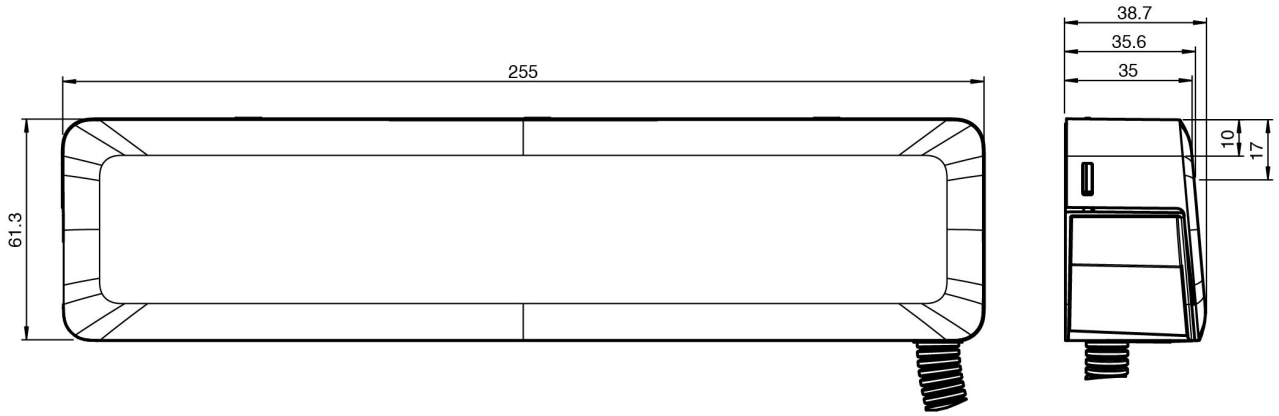
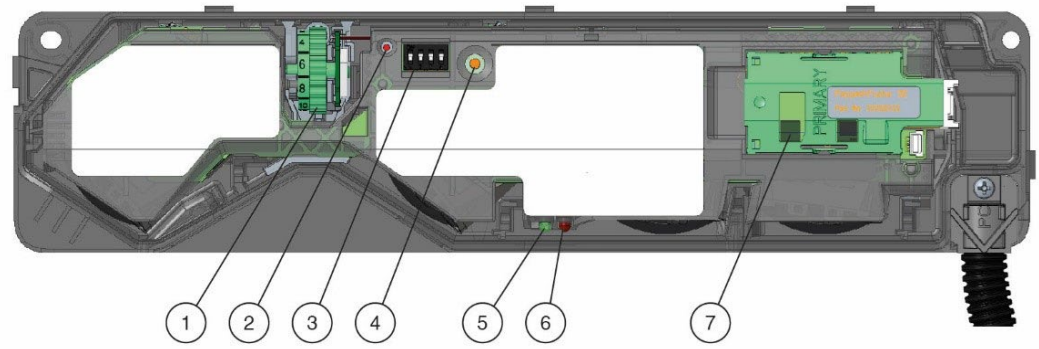


Figure 4

2.3 Indicators and Operating Elements



1	Adjustment dial for inclination angle
2	Red / green / orange status LED – teach-in, error, switch state
3	DIP switch
4	Teach-in button
5	Green switch indicator, hinge opposite side (HOS)
6	Red switch indicator (HS)
7	IO module

Figure 5

The switch state being red or green depends on the mounting side.

2.3.1 IO Module

NPN/PNP (Yellow)

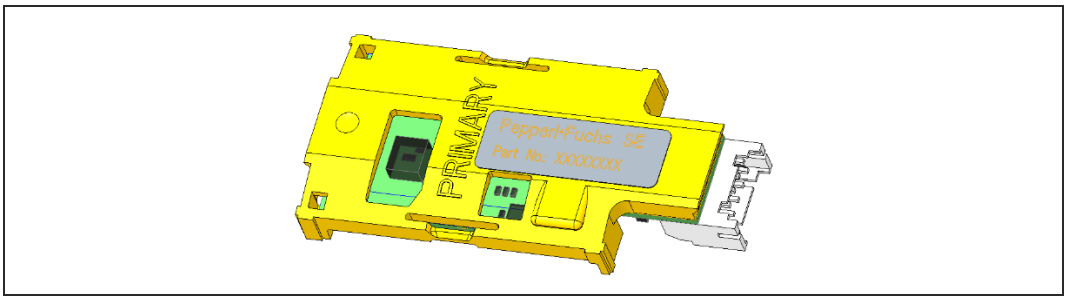


Figure 6

Solid-State Relay (Green)

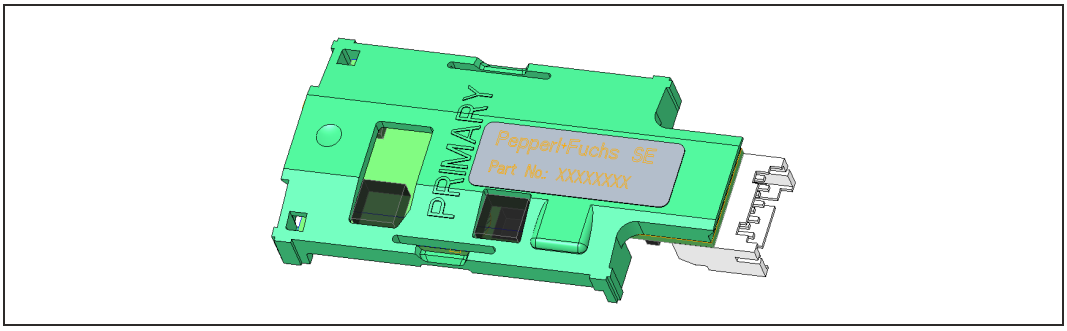


Figure 7

Both versions of the IO module can be fitted to a sensor module as desired. The sensor module with the IO module is the primary sensor.

Either sensor module can become the primary sensor via an IO module.

If both sensors are primary sensors, they must be taught in separately from each other without door hinge HS/HOS connecting cables.

Note

Replacing the IO Module

Make sure that the IO module is in a de-energized state.

Fit the IO module and blind cover to the device, ensuring they are engaged and flush.

After replacing the IO module, perform teaching in.

2.3.2 Teach-In Button

Actuation	Function
Press 1x	Activates the display
Press 2x	Starts the teach-in process, see section 4.1
Double-click 1x	Starts the one-teach process, see section 4.2
Press and hold for 3 seconds ... 10 seconds	Service Mode (see note)
Press and hold for > 10 seconds	Ignores the button press

Table 1 Teach-in button

Note

Service Mode

The protective function can be switched off for ten minutes during installation and servicing work.

- To do this, press and hold the teach-in button on the primary sensor for 3 seconds ... 10 seconds until the status LED flashes green once every 3 seconds.
- If the teach-in process has started or you press the teach-in button again for more than three seconds, you will exit Service Mode again.

2.3.3 Indicators

Status LED red / green / orange	**HS** red switch indicator	**HOS** green switch indicator	**Explanation**
Flickering orange (eight times per second)			DIP switch or inclination angle has been changed or teach-in error.
Steadily on orange			Teach-in required.
Flashing orange (one short flash, one long flash)			Teach-in has been completed successfully. However, the measurement stability being impaired by an object (e.g., door hinge) in the beam path cannot be ruled out. Goes out after 20 seconds.
Flashing orange (once per second)			One-teach mode active.
Flashing orange (twice every three seconds)			Service Mode active.
Flashing red/green (twice per second)	Detection/ LED on	Detection/ LED on	Teach-in: Teach-in process has started. ⑤ Exit the detection field.
Flashing green (twice per second)	Detection/ LED on	Detection/ LED on	Teach-in: Device is ready for gesture detection at the leading edge. ⑤ Perform gesture control at the leading edge.
Flashing red (twice per second)	Detection/ LED on	Detection/ LED on	Teach-in: Gesture was detected, width being calculated.
Flashing green (twice per second)	No detection/ LED off	Detection/ LED on	Teach-in: Device is waiting for the door teach-in cycle. The opening impulse is triggered and the door opens.
Flashing red (twice per second)	No detection/ LED off	No detection/ LED off	Teach-in: Door closes.
Steadily off			Teach-in complete.
HS: red LED on, HOS side: green LED on	⑤ Detection /LED on ⑤ No detection/ LED off	⑤ Detection / LED on ⑤ No detection/ LED off	Switch indicator during normal operation.
Flashing green (once every three seconds)			Service Mode selected / Press and hold the teach-in button for 3 seconds … 10 seconds

Table 2 Indicators

Note

Teach-In Indicator

If the teach-in process is triggered on the primary side, the indicators on both sides will exhibit the same behavior.

If the secondary sensor needs to be taught in separately, the flashing patterns will only appear for the secondary sensor; see 4.1 Teach-In.

2.3.4 DIP Switch

If a DIP switch on the primary sensor is changed after teaching in, the status LED flashes orange (eight times per second). To accept the change, press the teach-in button.

If the status LED lights up steadily orange, the device must be taught in again by pressing the button a second time.

Factory setting: all DIP switches on

Item	Function	
	On (up)	**Off (down)**
1	HS	HOS
2	SC version: NPN output SSR version: no function	SC version: PNP output SSR version: no function
3	Hinge edge on	Hinge edge off
4	Virtual-wall function activated	Virtual-wall function deactivated

Table 3

Special Features of DIP Switch 3 and DIP Switch 4

Item 3 "Hinge edge"	Item 4 "Virtual-wall function"	Hinge edge	Teach-in cycle	Comment
On	On	Active	Required	Factory setting
Off	On	Off	Required	
On	Off			Not permitted for swing doors
Off	Off	Off	Not required	Swing door without emitted beams

Table 4

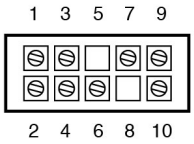
Note

The system settings via DIP switches 1–4 are configured exclusively on the primary sensor. The settings on the secondary sensor are ignored.

Note

If two primary sensors are used, the hinge edge on the door hinge side is not protected.

2.4 Connections



Pin	NPN / PNP output version		Solid-state relay output version	
1	0 V	Brown (BN)	0 V	Brown (BN)
2	24 V	Green (GN)	24 V	Green (GN)
3	n.c.		COMMON HOS	Pink (PK)
4	HOS OUT	Gray (GY)	HOS OUT	Gray (GY)
5	n.c.		n.c.	
6	n.c.		COMMON HS	Yellow (YE)
7	HS OUT	White (WH)	HS OUT	White (WH)
8	n.c.		n.c.	
9	Test+	Red (RD)	Test+	Red (RD)
10	Test-	Blue (BU)	Test-	Blue (BU)

Table 5

Test Input

The sensor must be tested. The sensor has a test input to check the outputs.

The test input must always be connected, including during teaching in. To do this, apply +24 V to Test+ and 0 V to Test-. The test is triggered by switching off the potential.

Note

No More Safety Operation

If the test input is not used, the test input must be permanently set to a fixed potential.

2.5 Scope of Delivery

Figure 8 Scope of delivery

Number	Designation	Units
1	Sensor with cover, right (delivery state: primary sensor)	1
2	Sensor with cover, left (delivery state: secondary sensor)	1
3	Door transition cable to door controller, 2.5 m	1
4	Wall bracket with two screws for corrugated hose	1
5	Screws for stopping plugs/corrugated hose bracket	2
6	Corrugated hose, 660 mm	1
7	Connecting cable for HS modules to HOS	1
8	Self-tapping screws for securing the housings	2 x 3
9	Cable seal, IP65 degree of protection	1
	Drilling template	1
	Instruction manual	1

Table 6

The number of parts may vary depending on the version.

3 Installation

Make sure that the device is de-energized during installation. The power supply may be activated only after all the circuits required for operation have been fully assembled and connected.

Make sure that the beam field is clear.

Note

Obstruction of the Beam Field

Objects that obstruct the beam field must not be mounted in the area below the sensor.

This must also be taken into account in the maintenance plan for the door.

Positioning

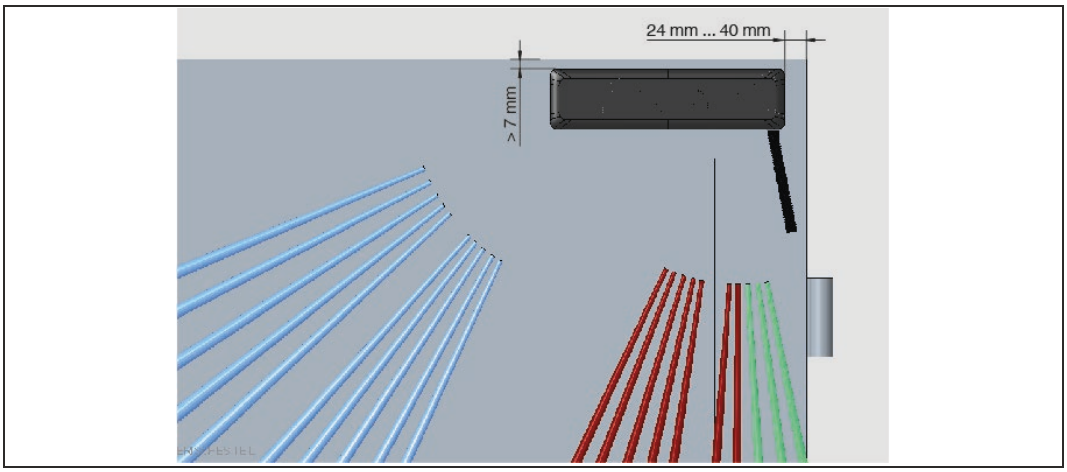


Figure 9 Position of device – door without door closer

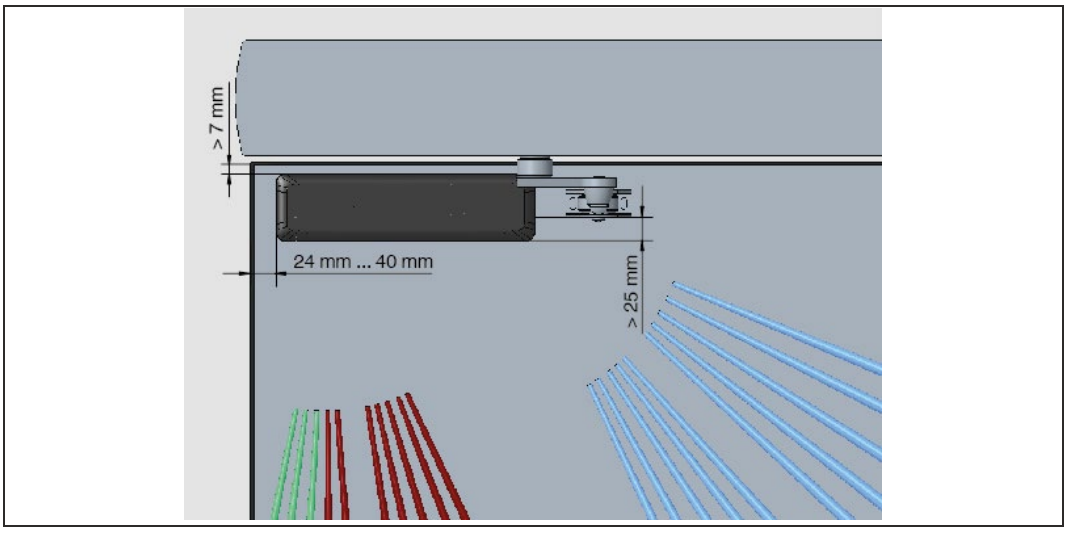


Figure 10 Position of device – door with scissor arm

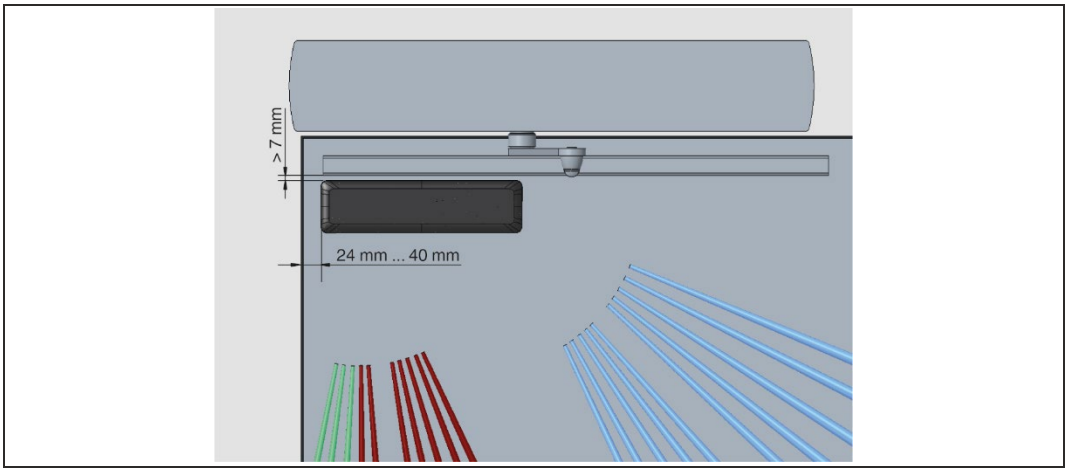


Figure 11 Position of device – door with slide rail

Note

Cross-Talk Between Multiple Devices

There is no cross-talk between the sensors.

3.1 Mounting

Mounting the Sensors

1. Unpack the kit.

Note

Mounting Position

Make sure to maintain sufficient distance from the closing edges.

2. Use the drilling template to determine the position on the door frame.

Figure 12

3. Make the hole for the HS/HOS cable in the hatched area on the drilling template (min. Ø 8 mm).

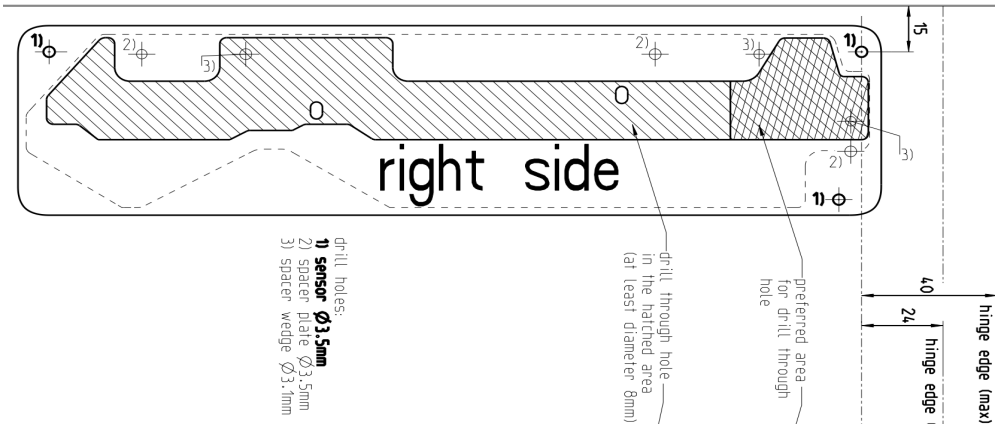


Figure 13 Drilling template

4. Make two holes (1+2) with a 3.5 mm spiral drill. If possible, make a third hole (3).

Figure 14

5. Route the HS/HOS cable through the center (L = 500 mm) and leave the cable hanging.

6. Remove the cover by inserting a screwdriver into the opening and pressing against the inner side wall of the cover.

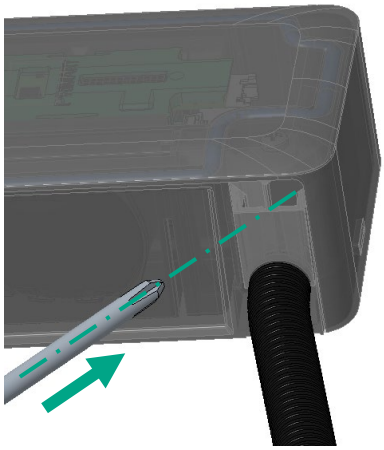


Figure 15

7. Once the side rear catch is released, lever open the cover.

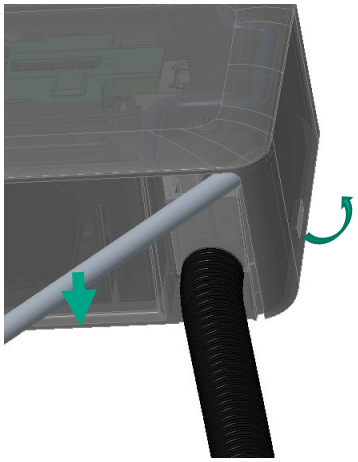


Figure 16

8. If you are using an NPN / PNP IO module, set DIP switch 2 as desired.

9. Preferably fit the IO module to the sensor on the control side.
On delivery, the IO module is fitted to the right sensor.

10. Insert the HS/HOS cable into the primary sensor (side facing the drive).

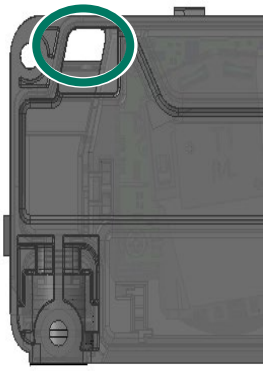


Figure 17

11. Leave the HS/HOS cable protruding out of the housing by approx. 80 mm.

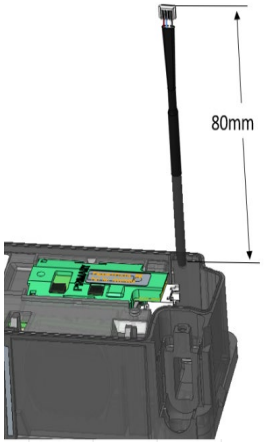


Figure 18

12. Pull the rest of the cable through to the secondary sensor.

13. Secure the primary sensor with the crosshead screws provided.

14. Thread the HS/HOS cable into the housing for the secondary sensor.

15. Insert the cable into the depot space on the back of the device and secure the cable between the terminal lugs.

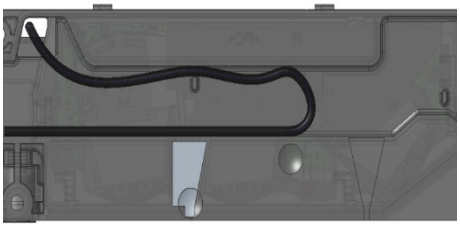


Figure 19

16. Secure the secondary sensor.

17. Plug the HS/HOS plug into the socket.

18. Attach the stopping plug to the secondary sensor with a 3x8 mm crosshead screw.

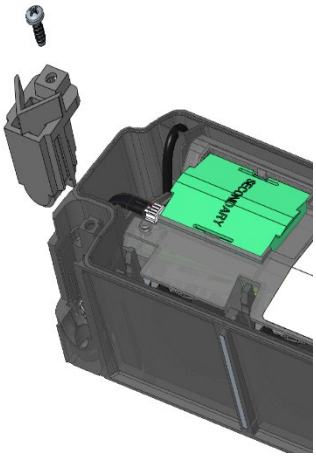


Figure 20

↳ The secondary sensor is fully assembled.

19. If necessary, fit the IP65 seal to the door transition cable with ten-pin connection socket.

20. Insert the door transition cable to the drive on the primary sensor into the corrugated hose.

Figure 21

21. Push the door transition cable through the opening on the housing of the primary sensor.

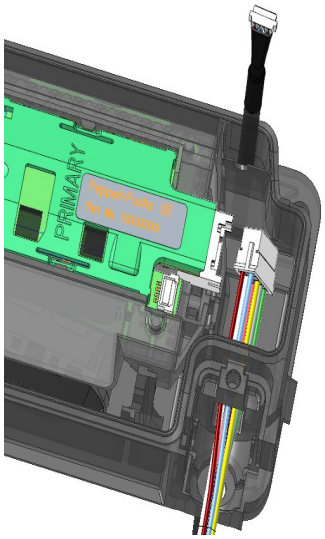


Figure 22

22. Push the corrugated hose up to the opening in the housing and then press it down into the retaining ribs.

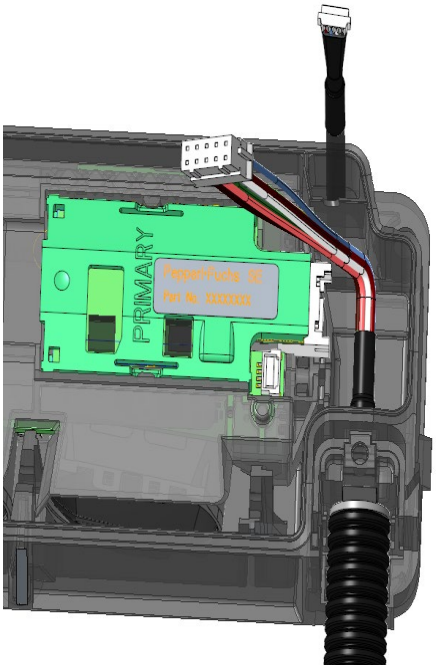


Figure 23

23. Fit the corrugated hose bracket to the corrugated hose and secure the bracket with a 3x8 mm crosshead screw.

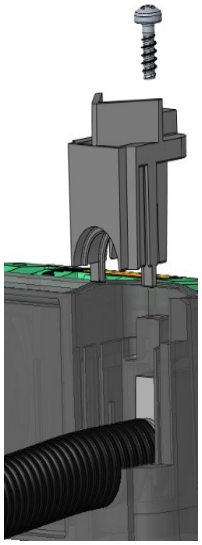


Figure 24

24. Disconnect the IO module and connect the ten-pin cable to the IO module. Pull the IO module off using your thumb and index finger.

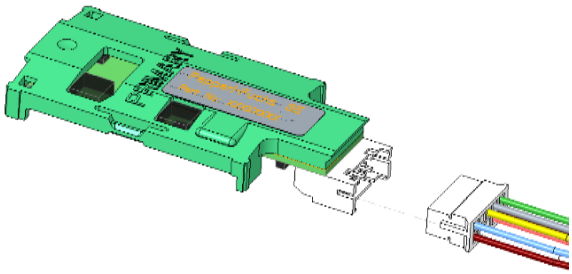


Figure 25

25. Plug the HS/HOS plug into the socket.

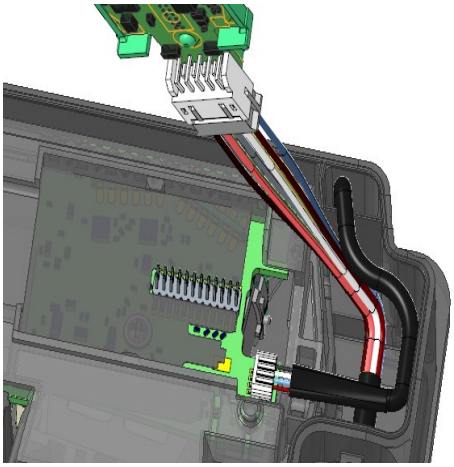


Figure 26

26. Reconnect the IO module to the device. Carefully store any excess cable in the terminal compartment.

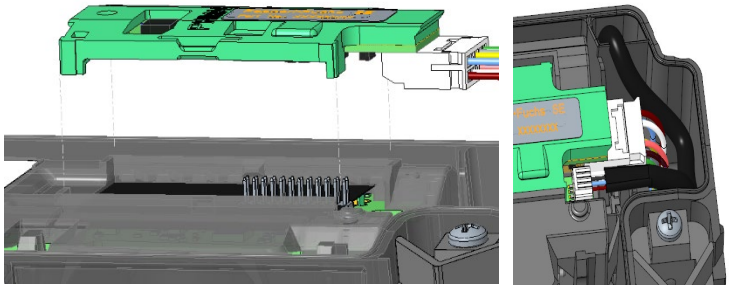


Figure 27

27. Route the door transition cable to the drive and connect the cable using the screw terminal.

28. Secure the corrugated hose to the wall bracket.

Setting the Inclination Angle

The installer must check that the device is working correctly every time the inclination angle is changed.

Factory setting: position 6 for a mounting height of 2.10 m.

1. Adjust the inclination angle on the hand dial according to the table and scale.

Recommended Settings in Accordance with DIN 18650/EN 16005

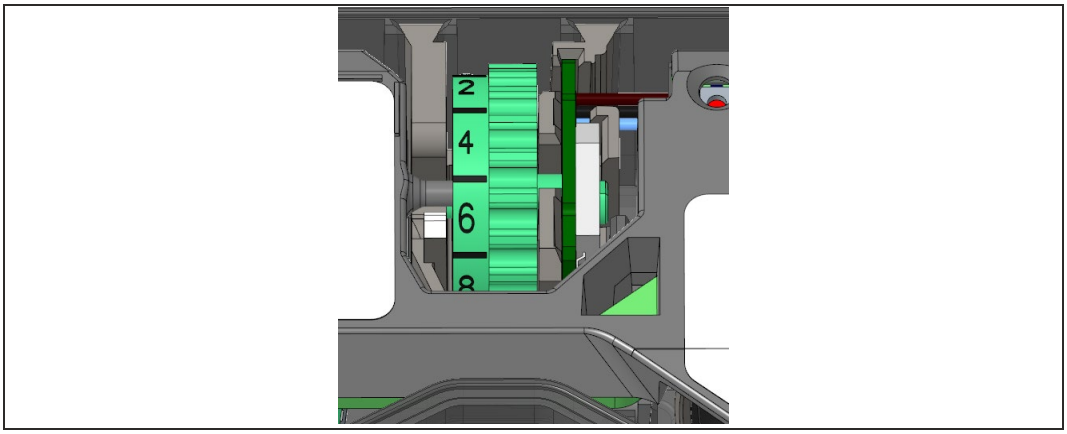


Figure 28

Mounting height (see datasheet)		Position of adjustment dial
[cm]	**[inch]**	
190–220	75–87	6 (factory setting)
250	98	4
300	118	3
350	138	2

Table 7

4 Commissioning

4.1 Teach-In

During the teach-in process, the device first learns the distance to the ground and then the distance to the leading edge (door width). The device learns the door's maximum opening angle with a subsequent teach-in cycle.

The installer must check that the device is working correctly after each teach-in.

Preparing the Device

1. Check that the door drive is ready for operation.
2. Close the door.
3. Remove any objects from the door area that are not part of the usual environment.
4. Make sure that there are no people inside the detection field.
5. Set the DIP switch on the primary sensor (see section 2.3.4).
6. Adjust the inclination angles of the primary and secondary sensors.
7. Remove the protective film from the lens and, if necessary, clean the entire front panel.

Note

After switching on the device, it may take a few seconds for the teach-in process to start.

Teaching In the Device

Status LED (orange)	Description
Steadily on	The device has changed the factory settings or inclination angles. The device is ready to teach in.
Off	Device has been taught in.
Flickering (eight times per second)	DIP switch has been changed. A device has been replaced. Teach-in unsuccessful. Repeat the teach-in process.

Table 8

1. To start the teach-in process:
   - ⑤ If the orange status LED is steadily on, press the teach-in button once.
   - ⑤ If the orange status LED is off or flickering, press the teach-in button twice (do not double-click).

   ↳ The status LED flashes red and green alternately.
2. Next, exit the protection field and remove all objects within ten seconds.

   ↳ The device determines the distance to the ground.
3. When the status LED flashes green, perform gesture control on the leading edge within ten seconds.
   Gesture control: Slowly interrupt the beams in a section of approximately 60 cm along the leading edge.

   ↳ Once gesture detection has been completed successfully, the status LED flashes red for two seconds.

   ↳ As soon as the status LED flashes green again, the output is enabled.

   ↳ If DIP switch 4 is on, the device waits for the teach-in cycle.

4. Initiate the door teach-in cycle.

- ⑤ While the door is being opened, the status LED continues to flash green.
- ⑤ While the door is being closed, the status LED flashes red (twice per second).

↳ *Teach-in successful:* The status LED goes out after opening and closing the door. The sensor system is ready for operation. Complete commissioning, see 4.3.

↳ *Teach-in successful and the status LED flashes orange (one short flash, one long flash):* The measurement stability being impaired by an object (e.g., door hinge, handles) in the beam path cannot be ruled out. LED goes out after 20 seconds.

↳ *Teach-in unsuccessful:* The status LED flashes orange (eight times per second). Repeat the teach-in process, see 4.1.

Note

If the secondary sensor is installed at a significantly larger or smaller distance from the hinge edge than the primary sensor, the leading edge of the secondary sensor must be taught in.

To do this, press the teach-in button on the secondary sensor and carry out gesture control.

If there is a grid or a highly reflective or glass floor, it may be necessary to place a white A3 sheet under the sensor in the area of the hinge edge.

If there is a glass wall in the area of the hinge edge, it may be necessary to cover the entire area of the hinge edge during the teach-in process.

Note

Gesture Detection

Note the distance from the gesture control point to the wall. The distance to the wall must be at least 5 cm.

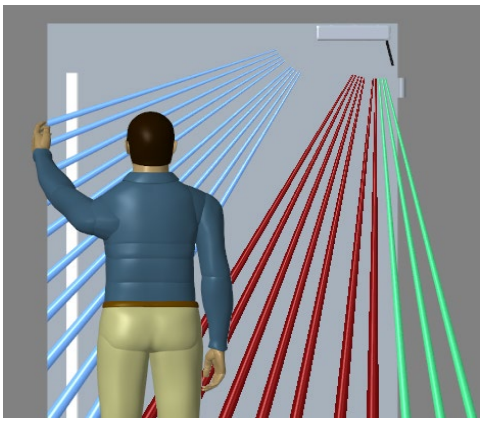


Figure 29

4.2 One-Teach Function

If the inclination angle is subsequently changed, the one-teach function enables shorter teaching in. Teaching in of the ground and gesture control are not performed.

If the system has not been taught in beforehand, double-clicking for one-teach mode will be ignored.

A significant change in the angular position may make it necessary to perform a full teach-in.

Teaching In the Device in One-Teach Mode

1. To start the teach-in process, double-click the teach-in button.

   ↳ The status LED flashes orange (once per second):

   - One-teach mode is active on both sides of the door.
   - The hinge edge is deactivated.

2. Adjust the inclination angle of the sensor on one or both sides of the door as required. To check the effectiveness, close and open the door.

3. To apply the setting, press the teach-in button once.

   ↳ The hinge edge is reactivated.

4. As soon as the status LED flashes green again, initiate the door teach-in cycle.

   ⑤ While the door is being opened, the status LED continues to flash green.

- While the door is being closed, the status LED flashes red (twice per second).

↳ *One-teach-in successful:* The status LED goes out after opening and closing the door. The sensor system is ready for operation.

↳ *One-teach-in unsuccessful:* The status LED flickers orange (eight times per second). Repeat the teach-in process, see 4.1.

4.3 Completion of Commissioning

Checking Object Detection

1. To check object detection, perform the following tasks:
   - Place the cover flat on the housing and press it down until all nine tabs are engaged.
   - After commissioning, check the protective effect of the system. Observe the relevant standards and directives (DIN 18650/EN 16005).
   - After mounting or device exchange, the device must be taught in.

Note

When the door is opened and closed, the leading edge beams extend approximately 15 cm beyond the gesture control point. Beams are emitted automatically and taught-in structural obstacles are taken into account. The beams for the hinge edge automatically adapt to the boundary conditions, if necessary.

Documentation of Parameterization

After commissioning, document the settings made for the device.
Supplement or update this documentation including in the event of subsequent changes to the configuration on a device that has already been commissioned.
A corresponding template for documentation can be found at www.bircher.com.

5 Troubleshooting

Status LED	Cause	Countermeasure
Red (HS LED) and green (HOS LED): light up simultaneously on the primary side	Test input not connected or connected incorrectly.	⑤ Check the test input.
Red: flashes three times every three seconds	Gyroscope is faulty.	⑤ Replace the IO module and teach in the device again.
Red: flashes four times every three seconds	Internal device fault.	⑤ Check the HS/HOS cable, replace the device if necessary.
Orange: one short flash, one long flash	Measurement stability impaired by an object, e.g., door hinge or handle, in the beam path.	⑤ If necessary, remove the object from the beam path. ⑤ If necessary, use a spacer plate (accessory). ⑤ If necessary, change the angle setting. ⑤ If necessary, check the cable routing in the device.

Table 9

Red / green switch indicator	Cause	Countermeasure
Flashes (once per second) in the color of the side	Operating reserve is too low.	⑤ Carefully clean the front panel.

Table 10

6 Appendix

6.1 Technical Data (Excerpt)

Refer to the datasheet for complete technical data.

General Specifications

Light emitter		IRED 850 nm
Sensing principle		Solid-state scanner with time-of-flight technology
Operating voltage	U_B	24 V DC ±20 %
No-load supply current	I_0	Max. 200 mA (per module)
Switching voltage		Max. 30 V DC
Protection class		III
Switching type		Switching when protection field is clear
Response time		≤ 50 ms at mounting height ≤ 2500 mm ≤ 80 ms at mounting height > 2500 mm
Ambient temperature		-30 °C ... 60 °C (-22 °F ... 140 °F)
Relative humidity		25 % ... 95 %, non-condensing
Mounting height		See datasheet
Degree of protection		IP65
Connection		Plug with 8-wire connection cable
Material		
Housing		PC (polycarbonate)
Optical face		PC (polycarbonate)

Functional Safety Data

Safety integrity level	SIL 2
Performance level	PL d

Table 11

6.2 Device Overview

Designation	Description
SolidSense-...-SC ...	Left / right module with NPN / PNP semiconductor output
SolidSense-...-SSR ...	Left / right module with solid-state relay

Table 12

Both modules in a kit must have the same device function version.

6.3 Accessories

Only use accessories that have been specified by the manufacturer.

Connection	
SolidSense transfer loop	Flexible connecting cable for door controller, standard 2.5 m, including corrugated hose and bracket
SolidSense connecting cable	Connecting cable between primary sensor and secondary sensor
SolidSense adapter glass door	Adapter for installation on glass doors
SolidSense cable adapter N/P	Adapter for connecting the plugin IO module and existing cables
SolidSense spacer plate	Spacer between door leaf and sensor
SolidSense spacer wedge	Wedge
SolidSense cable door	Flexible connecting cable for door controller
SolidSense cable door Hal-free	Halogen-free connecting cable for door controller

Table 13

6.4 Acceptance Protocol

General Information

Date		
Name		Signature
Device information	Device designation:	
	Serial number:	
	Operating location:	
	☐ Initial commissioning	
	☐ Change	
	Reason for change:	
Remarks		

Device Settings for Door Hinge Side (Primary Sensor yes ☐ /no ☐)

Adjustment dial position					
DIP-Schalter [1]	Nr.	1	2	3	4
	ON	HS [2]	NPN	Hinge edge active	Virtual wall active
	OFF	HOS [3]	PNP	Hinge edge inactive	Virtual wall inactive
Special features during commissioning					

Device Settings for Door Hinge Opposite Side (Primary Sensor yes ☐ /no ☐)

Adjustment dial position					
DIP switches [1]	Nr.	1	2	3	4
	ON	HS [2]	NPN	Hinge edge active	Virtual wall active
	OFF	HOS [3]	PNP	Hinge edge inactive	Virtual wall inactive
Special features during commissioning					

[1] DIP switches only work with the primary sensor. [2] Door hinge side [3] Door hinge opposite side

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