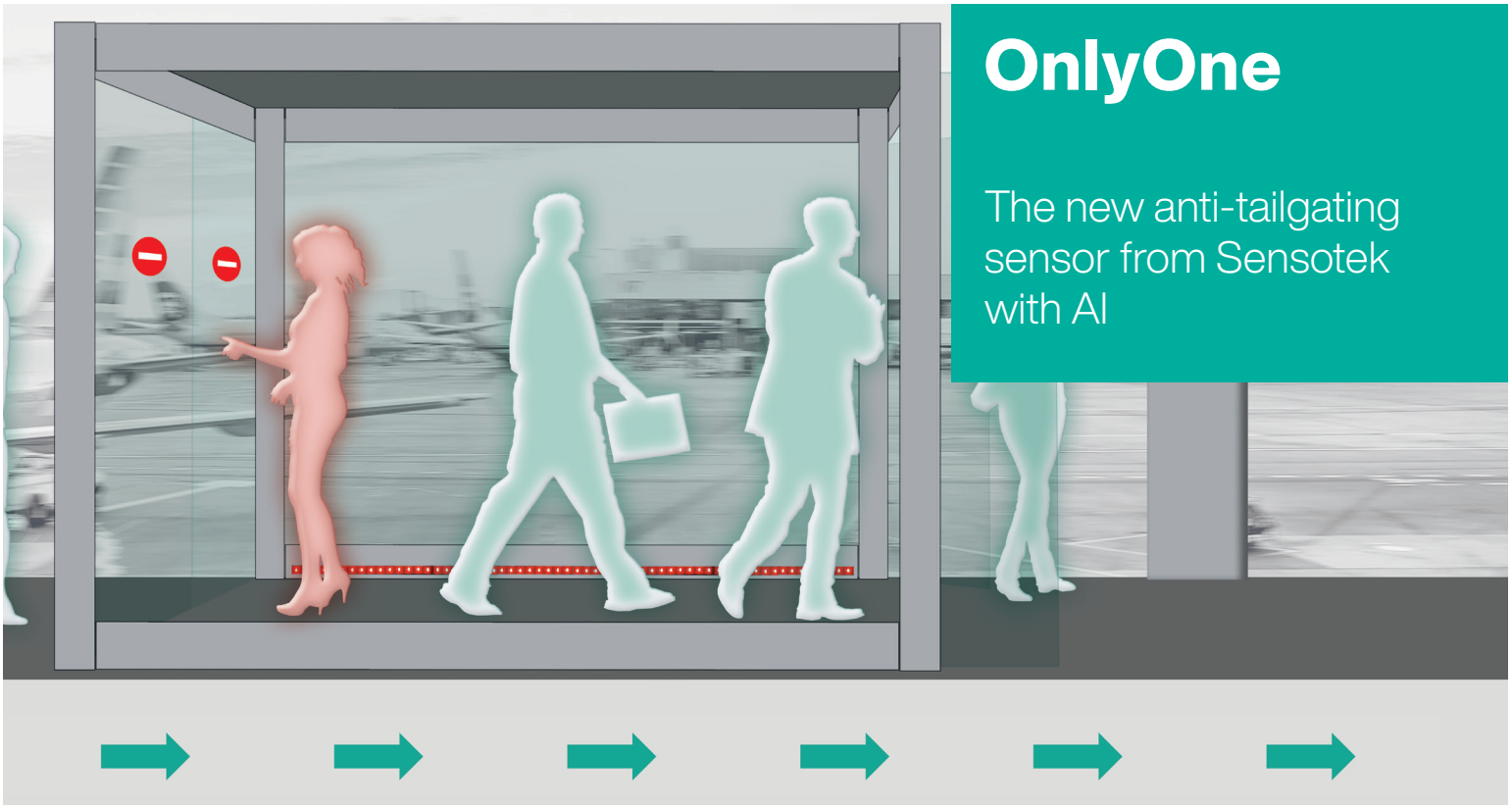

OnlyOne

The new anti-tailgating sensor from Sensotek with AI

Anti-Tailgating - Secure Count

Turnstile Separation Application

Version 403-0010

sensotek®
Intelligent Sensor Solutions

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1 Functional principle

Separation systems are structural measures for access control to a restricted area. People are checked for their authorisation and individually granted or revoked access.

The anti-tailgating sensor is designed as a person recognition system for security interlocks. Sensor interlock systems ensure that only one single, authorized person is allowed access to the secured area.

The following situations are safely detected by the system via artificial intelligence (AI) functions:

2 Components

The anti-tailgating sensor OnlyOne – consists of:

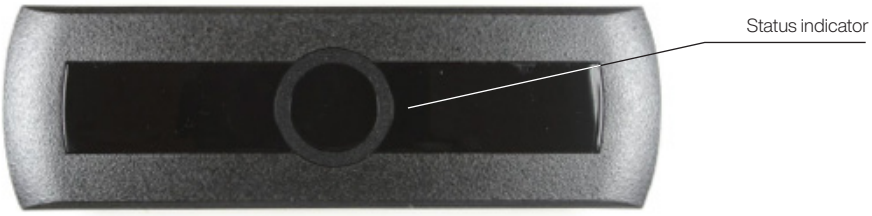
- Sensor 403-0002
- Converter box 320-0015
- M12/RJ45 Adapter Cable 205436 HZ
- Mounting kit 397-0016
- sCON-S Cable 397-0009

2.1 Sensor

The anti-tailgating sensor operates according to the Time of Flight measurement principle (TOF) combined with artificial intelligence (AI) algorithms. The system determines distance information within the detection resolution of 500 pixels.
From these individual distances, a sequence of images (3D image streaming) is evaluated in the sensor, which as a result distinguishes three states:

- Detection area free
- One person passes the detection area
- More than one person pass the detection area

The states indicated above are continiously transmitted as a data stream via Ethernet to the converter box.



OnlyOne sensor housing

The status indicator shows the operational readiness of the sensor.

2.2 Converter box

The converter box receives the sensor's data stream via an Ethernet connection, evaluates it and generates binary switching signals which control the outputs and the LEDs status.

Output signals:	Output 1:	One person - OK/Pass
	Output 2:	More than one person - NOK/Reject

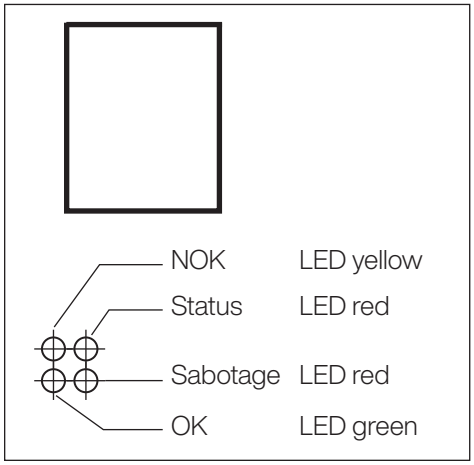
The outputs are inverse to the LEDs.
If no output is active, this corresponds to the state "Area Clear" when the sensor system is active.

The 4 display-LEDs on the converter box indicate the function of the outputs and the signal transmission.

Utilisation of outputs for separation application as follows:

Status	LED			
	OK Bit 0	NOK Bit 1	Sabotage Bit 2	Status
Detection area clear				✕
One person detected	●			✕
More than one person detected	●	●		✕
Object in detection area	●			✕
Sensor covered - sabotage (flash 6 HZ)	●	●		✕
System ok (flash 1 Hz)				✕
Sensor communication error (flash 3 Hz)				✕

Chart LED displays

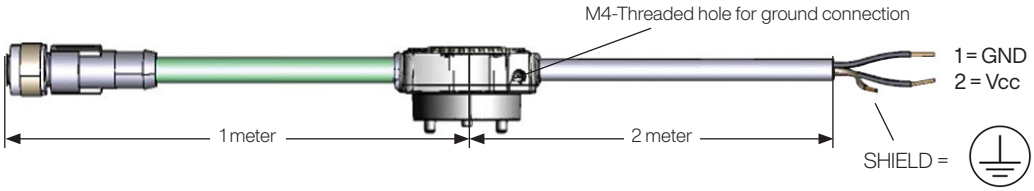


Location of the LED-displays

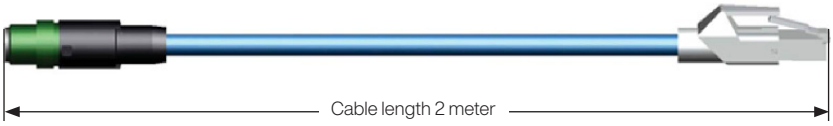
2.3 Connecting cable

A stable signal connection is only ensured with the following cables:

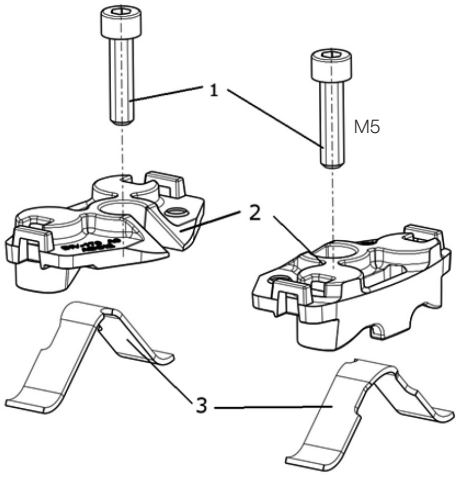
- Connector sCON-S Cable 397-0009



- M12/RJ45 Adapter Cable 205436 HZ



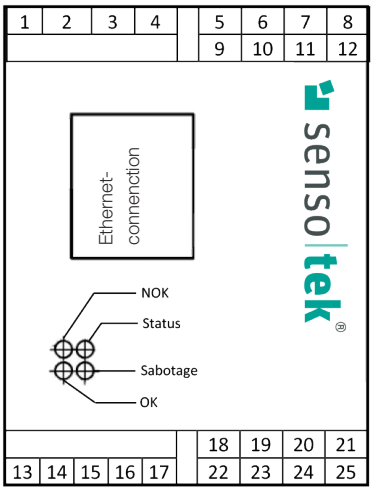
2.4 Mounting kit



1 Cylinder head screw DIN912 M5x20 A2
2 Spring holder DIV-170
3 Flat spring SH-DIV-119

3 Terminal connection

All terminals are detachable screw terminals.



Terminal	Signal	Function	
1	GND 0V	power supply 24 V	
2	24 V		
3	GND 0 V	power supply 24 V	
4	24 V		
5		n. u. / do not connect	
6		n. u. / do not connect	
7		n. u. / do not connect	
8		n. u. / do not connect	
9		n. u. / do not connect	
10		n. u. / do not connect	
11		n. u. / do not connect	
12		n. u. / do not connect	
13	SAB	n. u. / do not connect	
14	NOK	NOK/Reject	
15	OK	OK/Pass	
16	IN2	not used	
17	IN1	counter / state reset	
18	COM1	common	Relay output NOK Bit 1
19		not connected	
20	NO1	normally open	
21	NC1	normally closed	
22	COM0	common	Relay output OK Bit 0
23		not connected	
24	NO0	normally open	
25	NC0	normally closed	

4 Functionality

The door system consists of a turnstile or rotating drum door (3 or 4 wings), a door controller and a Badge Reader or similar means of authentification. The OnlyOne Security System is an add-on, which does not interfere with the basic operations of the door, but mainly provides added security by implementing the separation feature.

To understand the functional description given here, please refer to 5.3.1 Physical layout on page 13 (layout and locations), and 5.2 Turnstile wiring on page 12.

The added functionality is to disable unlocking of the turnstile by disconnecting the authentication system via the OK/Pass NC contact, and to provide a re-lock signal if more than one person attempts to pass or an error occurs via the NOK/Reject NO contact.

Use main cases are as follows:

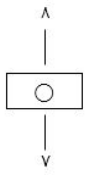
- One Person passes: Standing at Position A3, the Person A authenticates and passes the turnstile via positions A2 and A1.
  Once the Person A enters the DCL area, the OK/Pass output of the system activates, disabling the authentication device.
  Therefore, no other person can authenticate while the door is in use. Once passing is completed, the door system locks itself and is ready for the next pass. This locking of the door is connected to the OnlyOne signal input, which re-arms the system immediately.
- While one person passes, a second person attempts to follow (tailgating or piggy-backing): Standing at position A3, Person A authenticates and starts passing. Now, Person B follows. As before, Person A will cause the authentication device to become inactive. As soon as the sensor detects Person B when passing position A2, it activates the NOK/Reject output, which immediately re-locks the door. Both persons have to leave the DCL area, before the system is operational again. Once the DCL Area is clear, this is detected internally and will also re-arm the OnlyOne system for the next pass.
- One person without authentication waits inside the door for a second person to authenticate and get “pushed” through (reverse tailgating): When person A enters the DCL Area, the OK/Pass output activates, thus disabling the authentication device. As a result, nobody can authenticate until the DCL area has been cleared. Once the area is clear, the system re-arms and is again ready for action.

Examining those use cases should give a good idea about the overall functionality and the added value of the OnlyOne Security System.

5 Installation and commissioning

Sensor positioning guidelines:
The sensor must be mounted overhead, facing straight down without any obstacles in view, at the position where the counting or detection of people should occur. It is vitally important for the proper function of the overall system (i.e. Door Assembly and OnlyOne Security System) to choose the optimum position.
The mounting positions of the sensor must be horizontal, with a maximum tilt tolerance of ± 5 °.
If the Sensor is mounted above a rotating drum utilizing brushes or similar as air gaskets, make sure the brushes never touch the sensor surface to avoid permanent damage by grating.

It is essential that the main direction of people passing the sensor is basically orthogonal to the sensor (see diagram below). See also section 6 Detection field for reference.



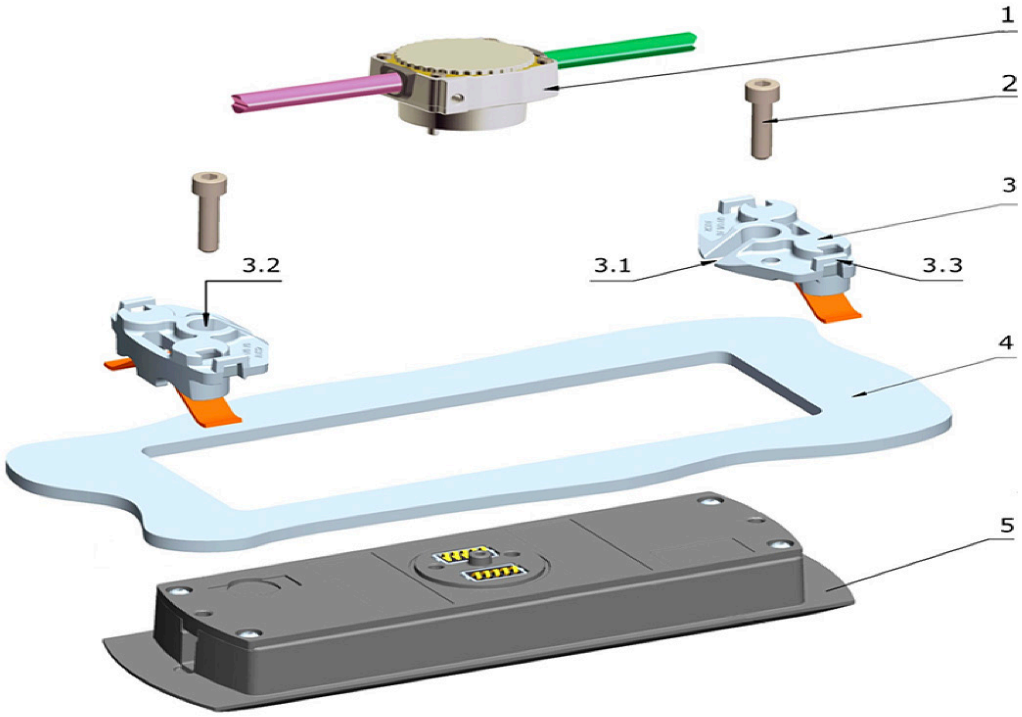
People flow forward

People flow reverse

Installation - option:
The sensors must be installed on a horizontal surface. The maximum horizontal tilt tolerance is ± 5 °
If the upper door panel does not permit direct mounting, the required horizontal position of the sensor can be achieved by means of suitable sensor brackets.

Installation procedure:
Mounting the sensor (5) at the desired installation location: Without the sCON cable connected, insert the sensor into the cutout from below, then fix using the mounting brackets (3) and screws (2) from above. Next, attach the sCON connector (1) as follows: Make sure to properly align the guidance pins on the connector with the holes on the sensor. Note: The holes/pins are asymmetrical to the center, to prevent incorrect alignment of the electrical connections. If the pins do not fit the holes, turn connector 180°. While inserting, do not force the sCON connector into the contacts. When properly aligned, almost no pressure is required. Once the connector sits firmly on it's place, there is no gap remaining between sensor and connector surfaces. Hold down connector with one hand, then tighten the thumb wheel screw with the other. Do not utilize any tool to tighten the screw, as applying to much force is not necessary and might damage the thread.

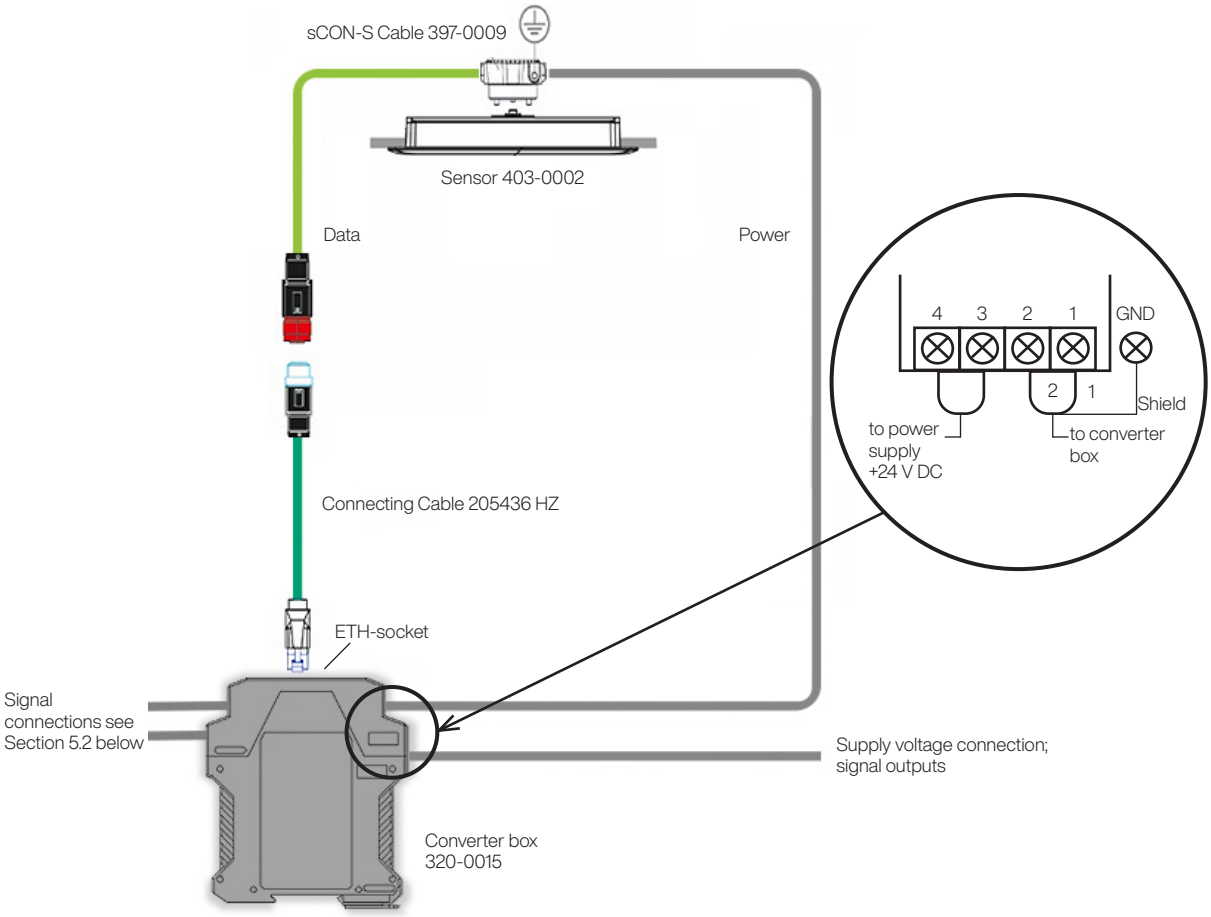
Verify proper installation:
The sensor must sit firmly in the cutout with enough pressure applied by the spring brackets to prevent it from hanging loose. The sCON connector must also sit firmly on the sensor, with no gap between surfaces of sensor and connector. Tighten the thumb wheel screw by hand. Route and fix the cables as desired, make sure to leave enough slack to make it possible to remove panel, but without having the cables interfering with any moving parts of the door. Once everything is correct, put the cover or panel containing the sensor in place.



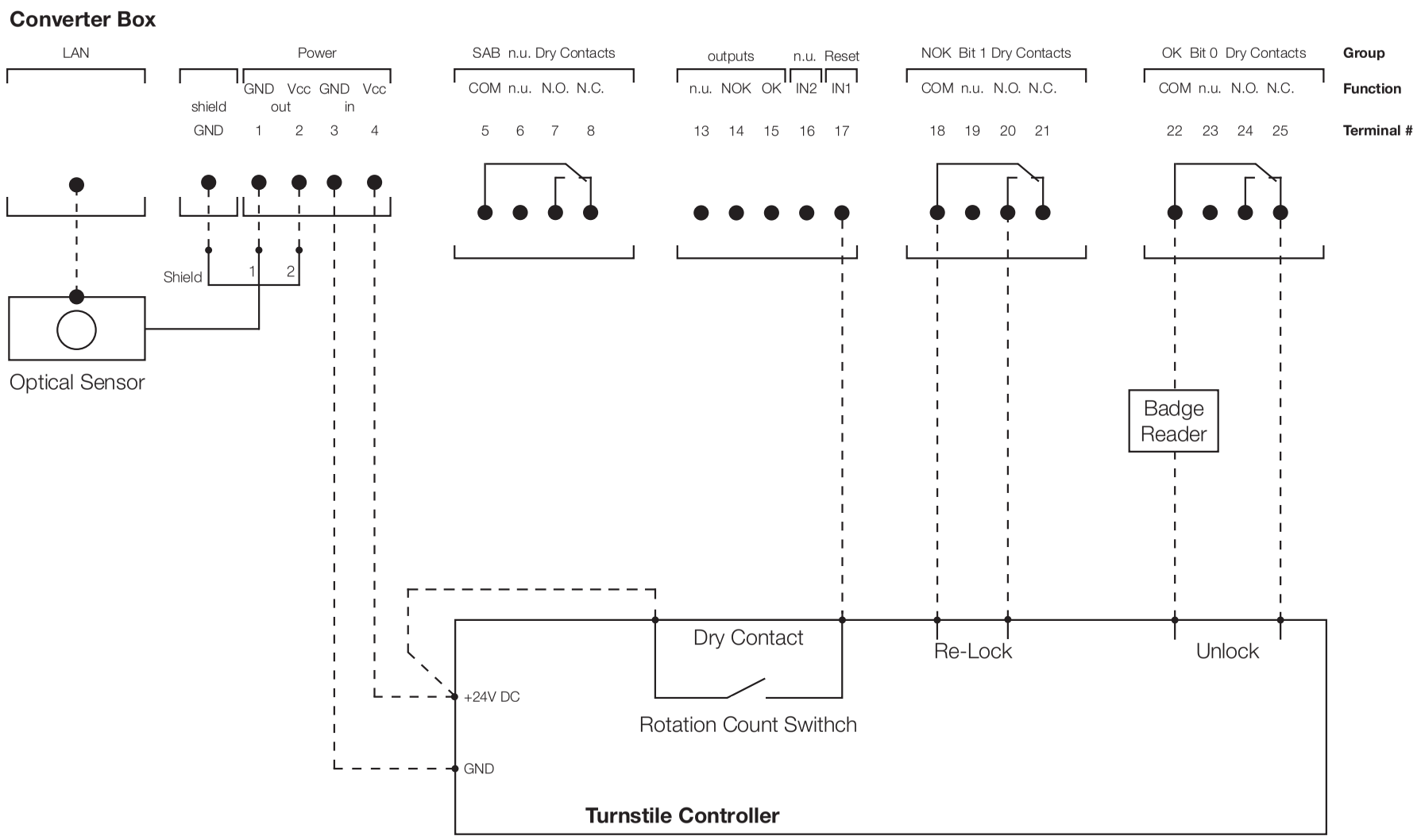
1 **sCON-S** for MATRIX-Sensors of the installation option
2 Cylinder head screw, hex wrench size 4mm (2 pieces; mounting kit)
3 Mounting kit: 2x spring holders with pre-assembled flat spring
3.1 Guide groove for pushing the holding system under the cylinder head screw
3.2 Hole for cylinder head screw for centring and locking the sensor
3.3 Fastening loop for cable ties
4. Rectangle cut-out for assembly
5. Sensor of the installation option

5.1 Converter box connection

OnlyOne sensors with sCON-S are connected to a 4-pin M12-connector type ETH to the Ethernet socket of the converter box.
The power cable of the sCON-S adapter is connected to the voltage supply terminals of the converter box.



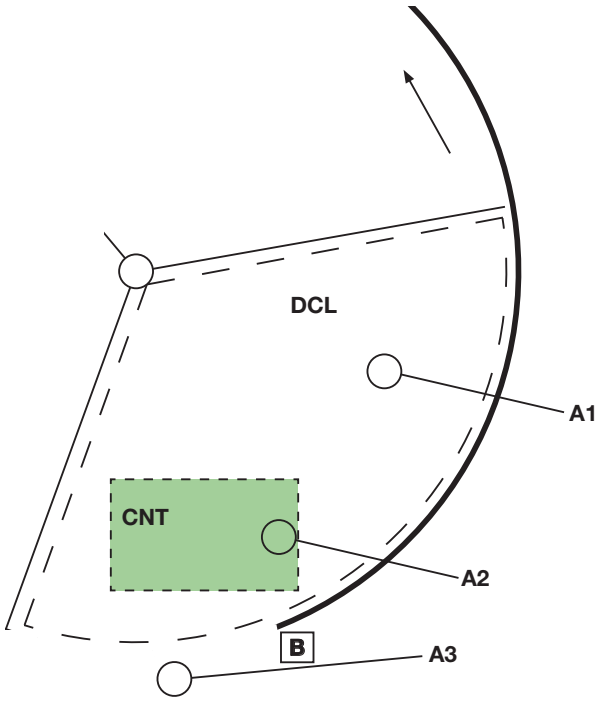
5.2 Turnstile wiring



N.O. = normally open N.C. = normally closed COM = common n.u. = not used, don‘t connect

5.3 Turnstile application

5.3.1 Physical layout



DCL = Door Clear Area
CNT = Count Area
B = Badge Reader

Person can stand at **A1**
or
Person can stand at **A2**
or
Person can stand at **A3**

5.3.2 Input/output state Diagram

Konverter Box Var: 02 FW: 2.2.0 ED03 10.10.2019

Input States								Output States					
Zero	One	Two	DCL	Reset	TimeOut	SAB	ComErr	OK	NOK	SAB	STA	Comment	Function
0	0	0	0	0	0	0	0	0	0		B0	All clear, no person, no object in range	Badge Reader active
x	x	x	1	0	0	0	0	1	0		B0	Object in range, no person detected	Badge reader inactive
0	1	0	1	0	0	0	0	1	0		B0	One person counted and still in range	Badge reader inactive
0	0	1	1	0	0	0	0	1	1		B0	Two persons counted and still in range	Badge reader inactive, relock door
x	x	x	x	x	x	1	0	1	1		B3	Sabotage detected by sensor	Badge reader inactive, relock door
x	x	x	x	x	x	x	1	1	1		B2	Communication Error	Badge reader inactive, relock door
												B0: ~1Hz, B2: ~3Hz, B3: ~6Hz	

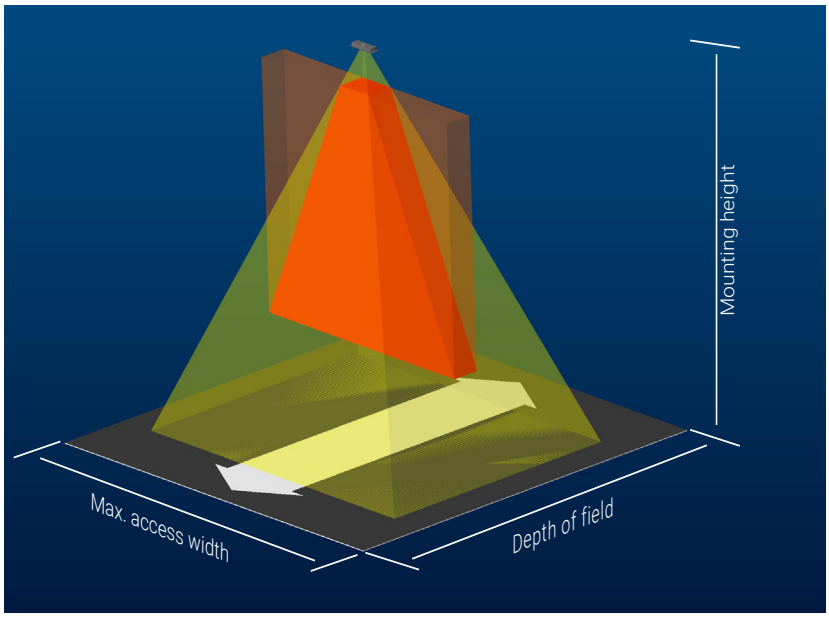
5.4 Power ON and function check

The initial commissioning of the sensor system should be done in the following steps (the observation of the LEDs on the converter box described here should also be verified via the output signals at the system control):

- Verify the wiring between sensor, converter box and system control (polarity, proper connections).
- Turn on power supply.
- Check the status indicator of the sensor - turns on after ≈ 5 sec.
- Check if communication between sensor and converter box is working (LED status of converter box flashes) - settles to 1 Hz pattern after ≈ 20 sec.
- Check if the Door Clear Area A1 is free (the OK and NOK LEDs must be off).
- One person is in the Door Clear Area A1 - LED OK lights up, stays on while person remains.
- One person passes the Count Area A2 - LED OK lights up, turns when door rotation is completed, or 2 sec. after person leaves door clear area A1.
- Two people pass the Count Area A2 - LED OK and NOK light up, stay on while any person remains.
- The sensor window is fully covered - LED OK and NOK light up, stay on while condition persists, turn off ≈ 5 sec after condition clears.
- System is ready.

6 Detection field

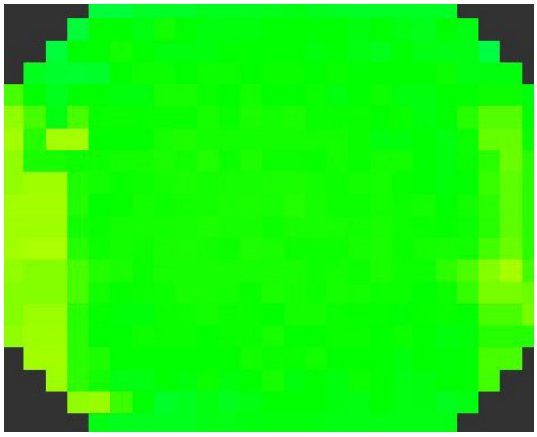
The detection field range depends on the mounting height of the sensor.
Mounting height: 2.00 m – 2.40 m
Access width: 0.50 m (adjustable) – 1.50 m



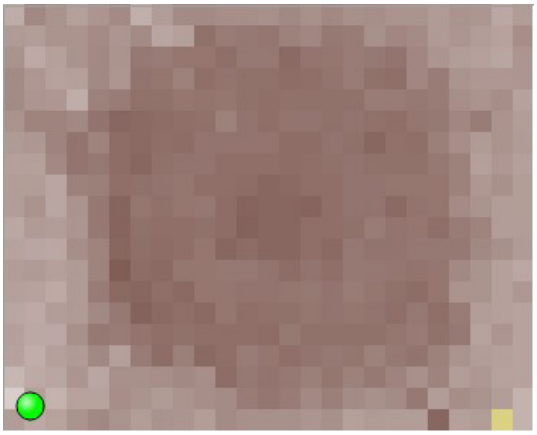
Mounting height [m]	Max. access width [m]	Depth of field [m]
2.0	1.1	0.9
2.1	1.2	0.9
2.2	1.3	1.0
2.3	1.4	1.0
2.4	1.5	1.0

The detection field range indicated above describes the maximum dimensions of the field. It can be adjusted, i.e. masked or limited based on pixels, to suit the respective application.

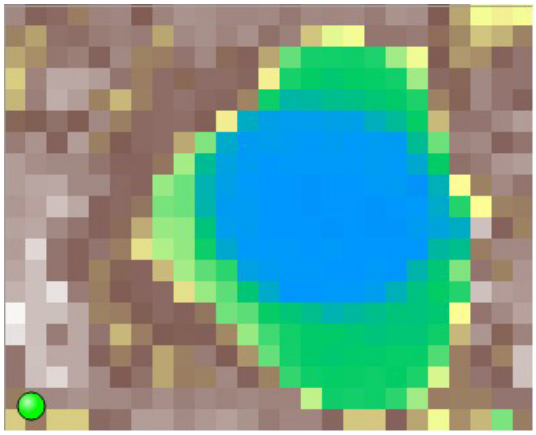
The first image below shows the „field of view“ of the sensor. The coloured elements are measured values that the sensor can evaluate, the black elements are pixels which are not taken into account. These can be preset if desired. The other images show actual samples taken from real applications.



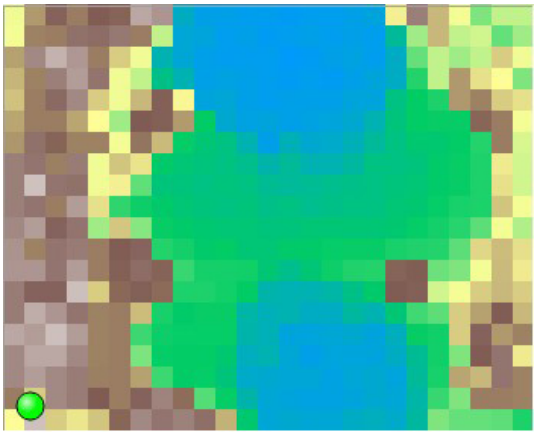
Sensor “field of view”



Example: Empty detection area



Example: One person



Example: Two persons

7 Fault Indications

Fault	LED-display Converter box/sensor	Cause	Troubleshooting
No function	LED-Status in the sensor doesn't light up	No supply voltage Converter box defective Power cable between converter box and sensor interrupted or inverted	Check power supply Replace converter box Check wiring
Outputs do not switch	LED-Status flashes fast (3 Hz)	Data transmission disturbed Sensor defective	Check cable between sensor and converter box Replace sensor

8 Technical data

8.1 Sensor

8.1.1 General information

Light source:	Led infrared
Eye safety:	Exempte
Ambient light limit:	60,000 Lux
Measurement method:	TOF (time of flight)

8.1.2 Electrical specifications

Operating voltage:	24 V DC -30%/+40%; polarity safe
Power consumption:	typ. 6 W, max. 9 W
Output:	Ethernet 10/100 MBit
Led:	Status LED
Response time:	100 ms

8.1.3 Mechanical specifications

Protection degree:	IP65	
Material:	Housing:	Aluminium-Die-casting
	Window:	Plastic (Makrolon)
Mass:	Sensor:	260 g surface-mounted housing; 340 g flush-mounted housing

8.1.4 Other specifications

Ambient temperature:	-20°C ... +60°C
Storage temperature:	-40°C ... +85°C
Protection category:	III

8.1.5 Electrical connection

Connection:	via Ethernet cable adapter and supply voltage

8.1.6 Compliance with standards and directives

EMV-directive 2014/53/EU (RE) (L153/62-106)

EN 62471: 2008 Photobiological safety of lamps and lamp systems

8.2 Converter box

8.2.1 Electrical specifications

Operating voltage:	24 V DC + - 15%, polarity safe
Power consumption:	max. 10 W
Operating display:	Red LED (status) normal operation: Flash ≈ 1 Hz Sensor comm. error: Flash ≈ 3Hz Sensor Error (sabotage): Flash ≈ 6 Hz
Function display:	Green LED (OK) Yellow LED (NOK) Red LED (Sabotage)
Inputs:	IN1, IN2: Open / 0V: inactive 24 V DC: Active Input resistance 5 kOhm
Semiconductor outputs:	OK, NOK, Sabotage Polarity: PNP, inverse to the LEDs display (output active when LED lights up) Voltage drop at the opposite output 24 V: < 1V Switching current: 150 mA, short-circuit protected
Relay outputs::	OK, NOK, Sabotage Changeover contacts, relay active when LED lights up Switching voltage: min: 10 V AC/DC; max: 48 VDC Switching current: min. 5 mA; max. 3 A Switching capacity: min. 0.5 W; max. 150 W
Operation readiness (complete system):	≈ 20 sec
Response time (complete system/mode switch):	Relay output 300 ms Semiconductor output 250 ms

8.2.2 Other specifications

Ambient conditions:	Ambient temperature:	-20°C ... +60°C
	Storage temperature:	-40°C ... +85°C
	Protection category:	III
Mechanical specifications:	Protection degree:	IP20
	Material:	ABS
	Weight:	400 g

8.2.3 Electrical connection

The terminal connection is explained in section 3.

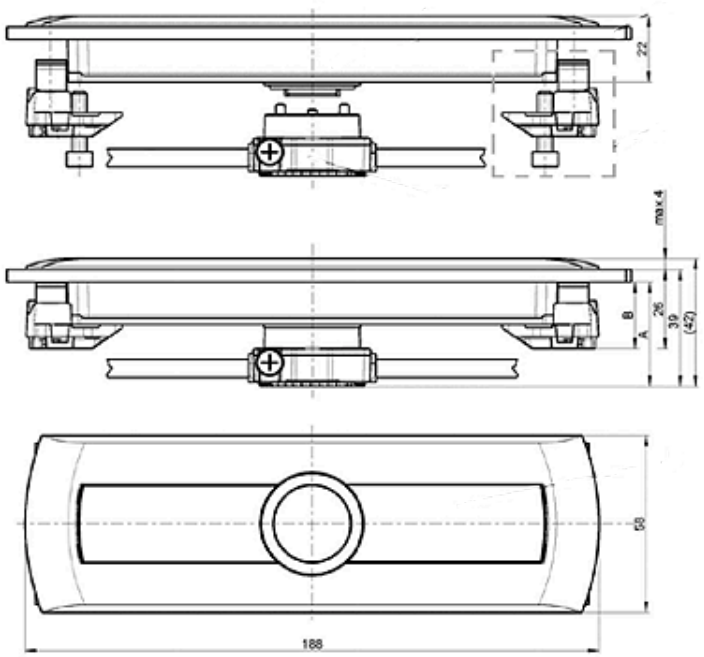
Connection type: Screw terminals

5-pins (X2):	Minimum conductor cross-section 0.14 mm^2 (AWG 26)
	Maximum conductor cross-section 1.5 mm^2 (AWG 16)
4-pins (X1,X3,X4):	Minimum conductor cross-section 0.2 mm^2 (AWG 23)
	Maximum conductor cross-section 2.5 mm^2 (AWG 14)

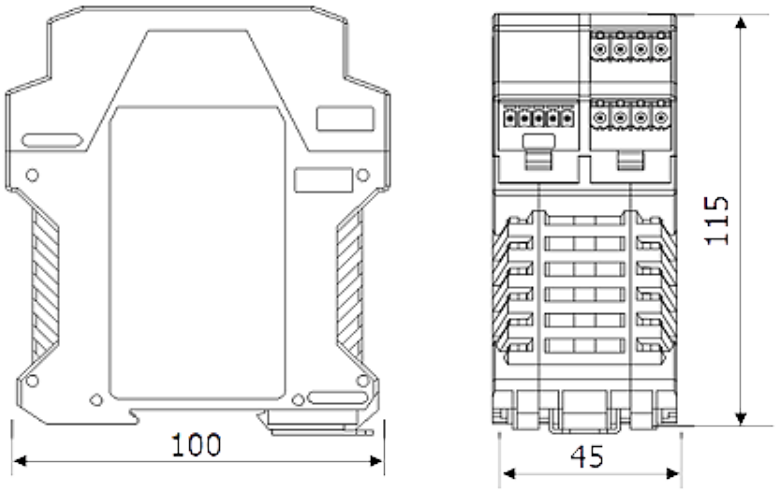
8.2.4 Compliance with standards and directives

EMV-Directive 2014/53/EU (RE) (L153/62-106)

9 Dimensions



Dimension of the sensor in the installation housing



Dimensions of the converter box in the DIN rail housing

10 Safety instructions

The device must be operated with Safety Extra Low Voltage (SELV) which complies with the stipulations in the safety standards based on IEC 60950. This device must be installed and maintained only by qualified, trained personnel.

A time-lag fuse with 2.5A must be switched between the sensor and the power supply. If there is a very high level of electrostatic discharge in the vicinity of the front sensor, it will be restarted for safety reasons and automatically re-initialised.

11 Cleaning sensor window

In order to maintain the functional surface of the sensor's plastic window, the following important indications should be considered when cleaning:

- The regular cleaning of the externally visible surfaces of the sensor can be done perfectly with lukewarm water and a soft and clean cloth.
- The wiping pressure and the wiping intensity must be limited during cleaning so that scratches are avoided.
- Hard objects (such as: wood, nails, scouring sponges or objects made of wire) are unsuitable for cleaning.