



RAS407 (Model RAS4M01)

Developed for optimum availability

SICK
Sensor Intelligence.



General/Intended use

The RAS407 radar sensor (model RAS4M01) is designed for both indoor and outdoor area monitoring. Within a defined detection area, the sensor detects static and moving objects, and triggers a signal by way of a volt-free contact upon detection of a corresponding object. Up to three distance zones can be defined and have various functions assigned to them. The distance resolution is 98 cm, or 150 cm depending on the country variant.

Health hazard as a result of high-frequency electromagnetic radiation

The RAS407 radar sensor (model RAS4M01) is designed for operation in accordance with ETSI EN 300440. During operation the human exposure regulations covered by EN 62311 must be observed.

In order to limit human exposure to electromagnetic fields, suitable safety distances must be maintained during both short-term and long-term work in the radiation range of the antenna(s). Minimum distances to be maintained between the antenna and the hu-

man body during continuous transmission: 20 cm.

Variants of the RAS407 radar collision protection sensor (model RAS4M01):

Part number	Description	Certification
1072142	RAS407-2801000 7° horizontal, 28° vertical aperture angle, 1 internal sensor	AU, Europe (except AZ/FR/GB/MC/RU), AE, SG
1072143	RAS407-2801001 7° horizontal, 28° vertical aperture angle, 1 internal sensor	FR*, RU*, SA, ZA
1072144	RAS407-2800100 7° horizontal, 28° vertical aperture angle, 1 external sensor	AU, Europe (except AZ/FR/GB/MC/RU), AE, SG
1072145	RAS407-2800101 7° horizontal, 28° vertical aperture angle, 1 external sensor	FR*, RU*
1072146	RAS407-2801100 7° horizontal, 28° vertical aperture angle, 1 internal sensor, 1 external sensor	AU, Europe (except AZ/FR/GB/MC/RU), AE, SG
1072147	RAS407-2801101 7° horizontal, 28° vertical aperture angle, 1 internal sensor, 1 external sensor	FR*, RU*
1072148	RAS407-2800200 7° horizontal, 28° vertical aperture angle, 2 external sensors	AU, Europe (except AZ/FR/GB/MC/RU), AE, SG
1072149	RAS407-2800201 7° horizontal, 28° vertical aperture angle, 2 external sensors	FR*, RU*

*see "Regulatory compliance information", Page 7.

Available accessories

2061737	Mounting kit	Mounting kit for 190°/270° weather hood
2079576	Weather hood	Weather hood
2079580	USB cable	USB configuration cable
2079599	50 m cable	Shielded connection cable for external sensor, 50 m, cable end open at one side, ready-to-assemble coupling included
2079408	CD-ROM	SICK configuration tool

Prerequisites for use

Read these operating instructions carefully before you use the sensor, to ensure that you use it correctly and that it operates as it should.

The following prerequisites for using the sensor must be observed under all circumstances:

- The sensor is a 24 GHz FMCW high-frequency sensor (ISM band). Country-specific approvals must be observed.
- If the sensor is connected to a machine controller of any kind, the user is responsible for checking the conformity of the entire system.
- The manufacturer cannot be held responsible for any damage that is caused as a result of usage deviating from the intended use, failure to observe safety notes and warnings, or use outside the scope of statutory provisions.
- The sensor detects objects according to its software parameter settings, its sensitivity, and the applicable object properties. There are some objects that it is not always able to detect, particularly smaller objects or certain materials (such as cardboard). Sufficiently sized objects that are positioned in front of the sensor and are electrically conductive (such as metal) have good detection properties. In all cases, the sensor parameters that can be set using the software supplied must be optimized in relation to both the individual application case and the object detection requirements.
- The sensor's detection area may have tolerances, depending on the selected setting – that is, objects may be detected or not detected contrary to the user's wishes.
- The sensor is only suitable for use in rain and snow if the weather hood is used. It is important to note that the intensity of the rain and snow may reduce

the sensing range and the object detection abilities of the sensor, and that extreme weather conditions may stop it from being used as intended.

- Reliable object detection cannot always be guaranteed in close proximity to the sensor; i.e., up to 20 cm away from it.
- Maintenance and repair work may only be performed by the manufacturer's in-house service staff or by a specialist specifically trained in this work. Only parts approved by the manufacturer may be used as spare parts or assembly parts.
- If the security seal is damaged, all liability, guarantee, or warranty claims will be rendered null and void.

Installation

Prerequisites

Mounting and installation of the sensor should be carried out exclusively by specialists with the following qualifications:

- Experience in installing the sensor.
- Briefing in the project-specific concept.
- Training and instruction or authorization in respect of switching circuits and assemblies or systems on and off, grounding them, and marking them in accordance with the latest standards governing safety technology.
- Knowledge of the operating instructions of the sensor (this document). In particular, knowledge of the permitted ambient conditions as well as the interfaces and pin assignment.

Mounting

- Mounting direction with 7° horizontal and 28° vertical aperture angle or vice versa.
- The area in front of the sensor, in the direction of detection, must be free from obstacles.
- The installation height depends on the application. Make sure that the M12 connections (sensor and USB) are accessible on the control unit.
- Carry out fastening with the aid of the fastening clips on a level surface; ensure that mounting is carried out without vibrations as far as possible.
- The two radar sensors are equivalent. The direction assignment can be freely selected.
- The evaluation unit and the external sensors match up with one another, as can be identified from their identical serial number.
- Depending on the version, the external sensors are labeled as sensor 1 and sensor 2.

- The corresponding connection boxes are labeled accordingly on the control unit.
- Connect the sensor unit and the control unit to one another so that the choke is at the sensor side of the cable.
- Use the cable clamp supplied to fasten the choke to the weather hood or at mounting level.

Electrical connection

- The electrical connection must be de-energized.
- The pin assignment is listed in the “Interfaces/Pin assignment” section on Page 4.
- Sequence for the electrical connection:
 1. Switch off the voltage supply.
 2. If necessary, connect the external sensor/s to the control unit (M12 female connectors).
 3. Connect the relay outputs to the customer interface (see “Interfaces/Pin assignment”, page 4); unused outputs can remain open.
 4. Connect the supply voltage and the screen (see “Prerequisites for use” on page 1).
 5. Switch on the voltage supply.
- The connecting cable for the sensor unit must be installed and fastened with the choke so that it is free from kinks. There is the option of assembling the cable on site (cable specifications available on request).
- The connecting cable for the supply voltage and the relay outputs may be shortened at the open end if necessary. Opening the housing is not permitted (loss of warranty). You can find the signal assignment on the label on the housing, or in the section entitled “Interfaces/Pin assignment” on page 4.
- If you require a higher switching capacity than is specified in the technical data, you will need to use external power switching equipment. Overloading the relay contacts may lead to malfunctions or cause the sensor to be destroyed.
- The relay contacts are protected against voltage peaks by an arc-suppression combination. If another DC relay or other inductive load is switched by the sensor relay, high-voltage peaks may occur. Recommendation: To avoid high-voltage peaks, use an additional freewheeling diode.
- The connecting cable screen must be connected to ground (PE) for grounding purposes.

Configuration with ConfigTool

You can use the ConfigTool configuration software on a computer to change the settings on the sensor. A special USB cable is required for laptop connections (USB connecting cable #2079580). The USB connecting cable is not included with delivery.

Commissioning and test

Check your installation. Once the voltage supply is switched on, the sensor will be ready for operation after around 3 s.

System requirements

- Operating system: Microsoft Windows XP - Vista - Windows 7/8/10
- DotNet framework 2.0
- RAM: min. 512 MB
- Hard disk space: min. 0.5 GB
- Screen resolution: 1,024 x 768 / Color quality: 16-bit
- System character size: 100%
- 1 x USB interface (version 1.0 and up)

Installing ConfigTool

Any older versions of ConfigTool must be uninstalled. Only use the CD supplied. Insert the CD into your CD drive. The installation wizard will start automatically. If it does not, select the “Setup.bat” file in your CD drive directory. Then enter 1 for German or 2 for English, depending on the installation language you wish to use, and confirm with “Enter”. You will be taken through the installation process automatically. The driver is installed. Confirm the window that appears at the end with “OK”. A link to ConfigTool is automatically created on the desktop.

Display window

- ConfigTool is started by double-clicking on the desktop icon.
- The language selection appears after it starts.
- The display window only shows data; it is not possible to make any settings in it.
- The interface (USB0, USB1, etc.) can be selected using the drop-down box at the bottom left.
- ConfigTool will work in demonstration mode if the device is not connected.
- The table in the middle of the screen shows the distances that the sensors measure; two displays will appear if two external sensors are being used. The background color indicates whether an object is in the “Information” zone (yellow), the “Warning” zone (orange), or the “Alarm” zone (red) of the sen-

sors. If an object is detected but is not in any of the three zones, the distance display will have a green background.

- Under the distance measurement, the output states (open/closed) assigned to the zone are displayed for the three relays.

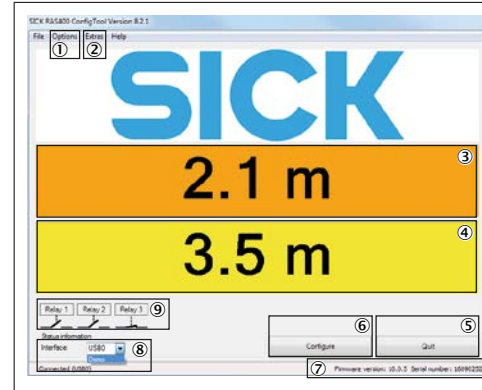
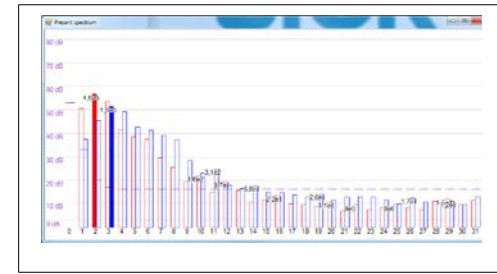


Fig. 1: ConfigTool

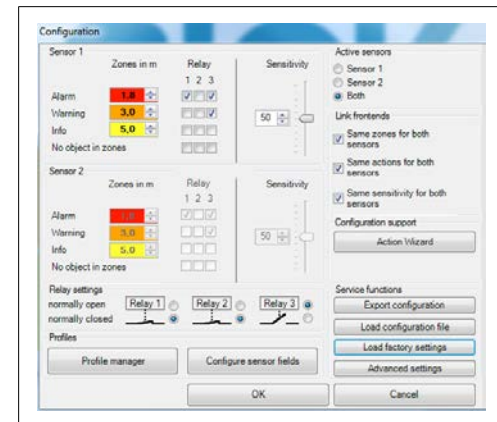
- ①. Language settings, sensor configuration
 - ②. Display sensor area, display of current spectrum, RAS diagnostics
 - ③. Distance display
 - ④. Distance display
 - ⑤. Quit ConfigTool
 - ⑥. Sensor configuration
 - ⑦. Display of firmware version and current serial number
 - ⑧. Drop-down selection box for interface, current connection status
 - ⑨. Display of relay state
- Double-clicking the distance display shows the sensor area of the relevant sensor.
 - Here, it is possible to read the current zone settings for the sensors and the distance of the perceived object.
 - The sensor position display can be changed by clicking on “Change sensor alignment”.
 - The gray lines around the border show the maximum sensitivity of 100%, while the colored fields show the areas that are currently set.
 - Selecting the “Tools” drop-down menu and “Current spectrum” opens the current spectrum of the sensor/s.
 - If there are two sensors, double-clicking on the current spectrum opens two separate windows, each showing one spectrum. If one window is closed, the two spectra are merged.



- To make settings on the sensor, select “Configure”.

Configuration window

It is possible to change the sensor settings in the configuration window. Clicking the “OK” button applies the setting changes and stores them permanently in the sensor. To reject the changes, select “Cancel”.

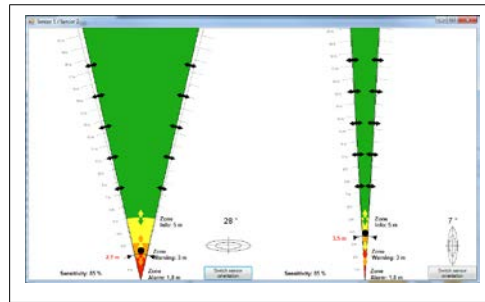


There are various function settings that can be made in this window. It is possible to assign relay actions and sensitivities manually for the sensors. If up to two sensors are selected, it is also possible to select which ones should be active and whether the settings of the two sensors should be linked.

In the “Configure” category, you will find the “Action wizard” button, which acts as an adjustment indicator. The action wizard can be used as an alternative tool for setting the relay configuration. The hardware that is available is displayed first. Clicking “Next step” guides you through the menu; it is possible to assign relay actions to the individual zones. A summary of all the settings is shown at the end of the menu. Selecting “Finish” transfers the selected settings to the configuration window.



In the "Configure" category, "Adjust sensor fields" provides a flexible way of adjusting sensitivities and zone settings by moving the markers. You can also use "Switch sensor position" to change the graphic displays of the sensor fields. Closing the window transfers the settings to the configuration window automatically. The minimum distance to the sensor is 1.8 m.

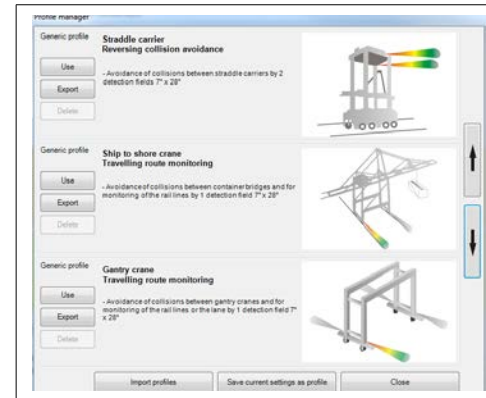


Clicking the "Profile management" button in the "Profiles" category opens a menu containing various sensor configuration default settings for certain standard applications, relating to sensitivities, relay settings, distances, and so on. It is only possible to select profiles with which the available hardware configuration is compatible. Clicking "Use" activates the relevant profile immediately and stores the settings in the sensor. The settings in the configuration window are also updated to reflect these values. Selecting "Export" saves the relevant profile to a file that you can apply to another system, for example, using "Import profiles". "Import profiles" adds new profiles to the profile management function. It is possible to assign images to the profiles and to give them any names and descriptions you wish. You may only "Delete" profiles you have created yourself; generic profiles cannot be deleted. "Save current settings as profile" saves the settings that were previously made in the configuration window. It is then possible to assign this profile a name, a description, and an image. New profiles are added at the very bottom of the list. "Close" takes you back to the configuration window.

Additional functions are stored in the "Service functions" category. "Export configuration" saves all the current configuration settings, allowing you to store customized settings and, for example, transfer them to another sensor system. Additional fine-tuned settings can be made in expert mode.

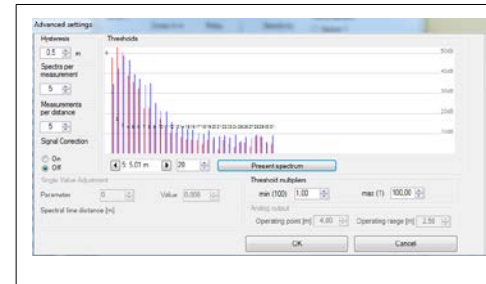
"Load factory settings" resets all the settings to their default values.

Using "Load configuration file", you can import configuration settings that have been saved previously or transferred from another system, and transfer them to the current system.



"Expert settings" opens a spectral line diagram and provides additional options for making settings. The distance between two spectral lines is around 0.98/1.50 m.

The figure below shows an example of settings.



The measurement should take place at a distance between 0.70 m and 4.20 m. Any "disruptive" objects in the area beyond 4.20 m are not shown. Clicking on the button below this, "Current spectrum", displays the current spectrum. You can add individual thresholds directly to the diagram using the mouse or determine them using the two combo boxes under the spectrum display. The left allows you to select the spectral line and the right allows you to set the threshold.

To extend the sensitivity range, the "Threshold multipliers" must be changed. If the range is to be extended upward, the left value must be reduced. If the range is to be extended downward, the maximum value must be increased.

On the left-hand side, it is possible to change the tolerance range in relation to the limits of a detection zone, using "Hysteresis". You can also select the "Number of spectra per measurement" (the higher this value, the lower the sensitivity to changes, but the more stable the value). If a high number of measurements is selected per output, the value will be more stable. Only set "Interference suppression" if other 24 GHz sources (such as a second RAS407, model RAS4M01) cause problems during measurement.

Clicking "OK" exits the "Expert settings" dialog box and transfers the settings to the configuration window. "Cancel" rejects all the changes in the expert settings and takes you back to the configuration window.

Troubleshooting

The sensor is not detecting any obstacles:

- Check voltage supply.
- Increase sensitivity (configuration/alarm settings).
- Check the settings for the zones and the active sensors (configuration/zones and responses).

The sensor is detecting obstacles even though no objects are in the detection area:

- Check the mounting position (too low above the ground? Highly reflective objects at the side of the detection area?).
- If necessary, mount the sensor so that it is tilted slightly forward.
- Reduce the sensitivity.

The tool signals “No sensor found at USBx” when connection takes place:

- Check the voltage supply for the sensor.
- Check the USB connection.
- Install USB drivers (the USB controller/USB serial converter device must be displayed in the device manager when the radar sensor is connected).
- Start the device manager and double-click on the USB controller/USB serial converter to open the “USB serial converter properties” window. On the “Advanced” tab, remove the check mark at “Load VCP”.

The measured values in the display window do not match up:

- Multiple objects in the sensor’s field of view that are less than 98/150 cm away from one another may be detected as a single object, the distance of which is specified as a few decimeters too high.
- Distances below 1.8 m are at close range and may in some cases be subject to restrictions in the display of the distance value.

The relays do not open when the object exits the zone:

- This is not an error. At the factory, a hysteresis of 50 cm is set; i.e., the object must be outside the zone by this particular distance to ensure that the action set for this zone can be completed.
- Check the action settings for the zone (configuration/zones and responses).

Technical data

Sensor:	
Measurement principle:	FMCW HF sensor
HF performance (EIRP):	Max. +20 dBm
Frequency:	24,000–24,250 GHz (AU, Europe except GB/FR, AE, SG) 24,050–24,250 GHz (FR/RU/SA/ZA)
Distance resolution ¹⁾ :	Approx. 98 cm (AU, Europe except GB/FR, AE, SG) Approx. 150 cm (FR/RU/SA/ZA)
Measurement accuracy (interpolated):	Approx. 15 cm
Response time ²⁾ :	< 0.5 s
Detection range ³⁾ :	0.20 – 20 m
Detection angle:	7° x 28°
Interfaces:	
Supply voltage:	10.5 – 30 V DC
Current consumption:	< 500 mA, depending on configuration and supply voltage
Outputs:	3 x relays, volt-free contacts, max. 42 V/0.5 A
PC interface:	USB
Cables and plug connectors:	
Voltage supply, relay outputs:	Length: 3 m Cable: 8 x 0.25 mm ² shielded Control unit connection: permanently connected Machine controller connection: ferrules
Control unit/sensor connection:	Length: 6 m Cable: 5 x 0.14 mm ² shielded Control unit connection: 5-pin M12 plug connector (male connector on control unit, coupling on cable) Sensor connection: 5-pin M12 plug connector (male connector on control unit, coupling on cable), with choke
USB:	Length: 3 m Cable: 4 x 0.25 mm ² shielded (or another; standard USB cable) Control unit connection: 5-pin M12 plug connector (male connector on cable, coupling on control unit) PC connection: standard USB male connector (type A)

Housing:	
Control unit:	Dimensions: 101 x 151 x 60 mm Material: ABS gray Degree of protection: IP 65
Sensor:	Dimensions: 101 x 151 x 60 mm Material: ABS gray Degree of protection: IP 65
Ambient temperature:	-20 °C to 60 °C

Interfaces/Pin assignment

Voltage supply:	10.5 – 30 V DC or 24 V ± 10% AC, current consumption < 500 mA, connecting cable at control unit
Output signals:	3 x volt-free relay contacts, relay assignments to detection zones can be set however required using software, max. switching capacity 42 V/0.5 A, connecting cable at control unit
USB:	USB 1.1 port, 5-pin M12 female connector on control unit, with blind plugs
Sensor:	Connection for sensor unit, 5-pin M12 connector on control unit

The control unit connecting cable has the following pin assignment:

White	Supply voltage -
Brown	Supply voltage +
Green, yellow	Relay 1
Pink, gray	Relay 2
Blue, red	Relay 3
Black	Screen/ground

Detection range

Model	Type: RAS407 Model: RAS4M01
Horizontal aperture angle (approx.)	7°
Vertical aperture angle (approx.)	28°
Length of detection range	From 0.20 to 20 m
Length of adjustment range	From 1.80 to 20 m

¹⁾ Separation ability, minimum distance between 2 targets.

²⁾ Dependency on target detection.

³⁾ Dependent on RCS of object.

Dimensional drawings

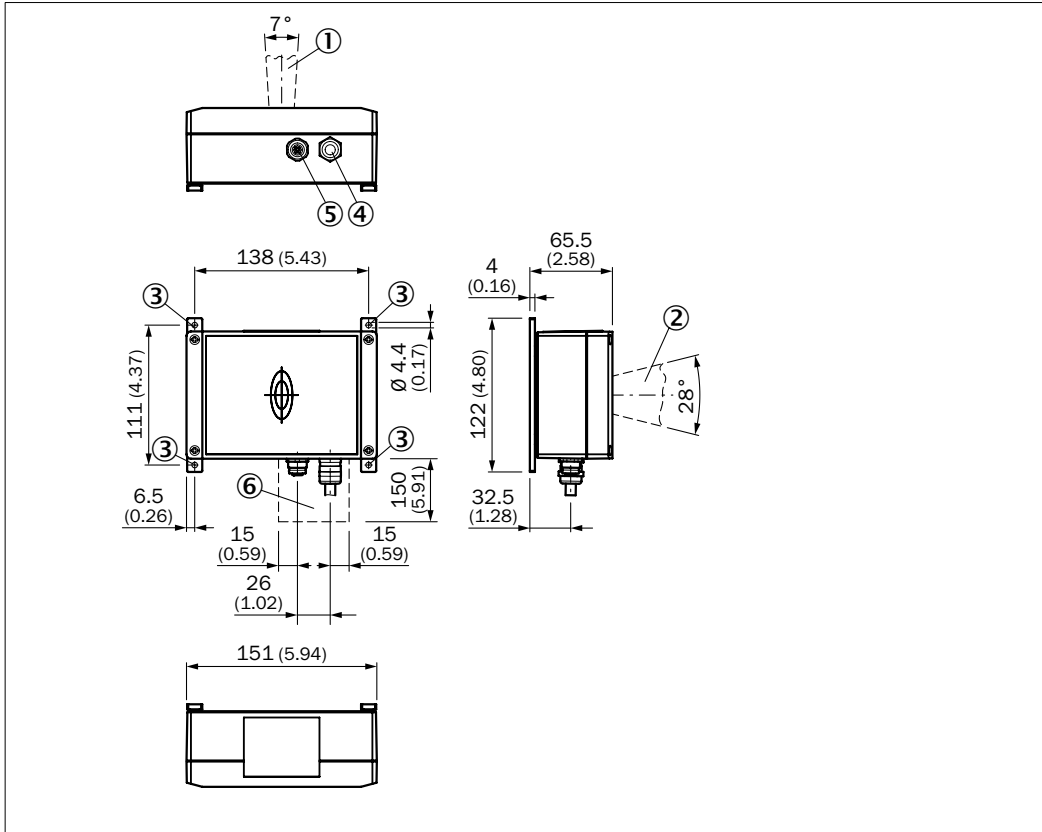


Fig. 2: RAS407 - 280100X

- ①. Horizontal angle
- ②. Vertical angle
- ③. Fixing holes, 4 x Ø 4.4
- ④. Supply connection
- ⑤. USB port
- ⑥. Recommended space for connections

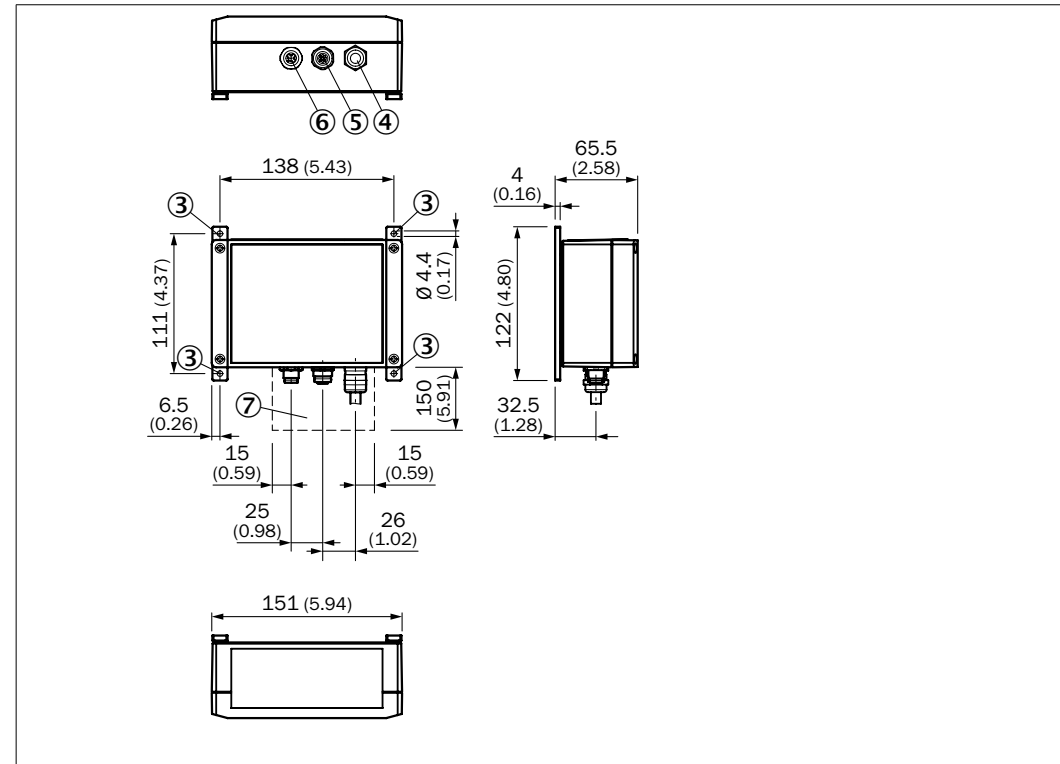


Fig. 3: RAS407 - 280110X control unit with internal sensor (aperture angle as per Fig. 2) and external sensor
RAS407 - 280010X control unit for one external sensor

- ①. -
- ②. -
- ③. Fixing holes, 4 x Ø 4.4
- ④. Supply connection
- ⑤. USB port
- ⑥. Connection for sensor unit
- ⑦. Recommended space for connections

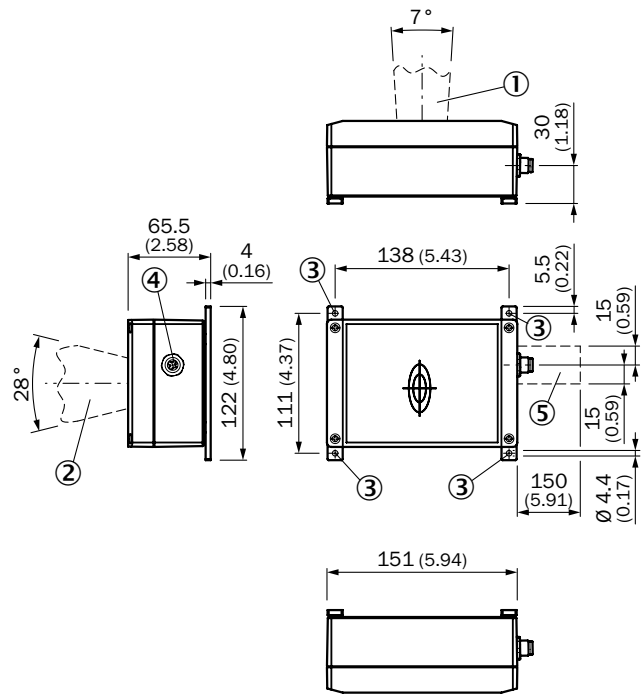


Fig. 4: Sensor (sensor unit)

- ①. Horizontal angle
- ②. Vertical angle
- ③. Fixing holes, 4 x Ø 4.4
- ④. Connection for control unit
- ⑤. Recommended space for connections

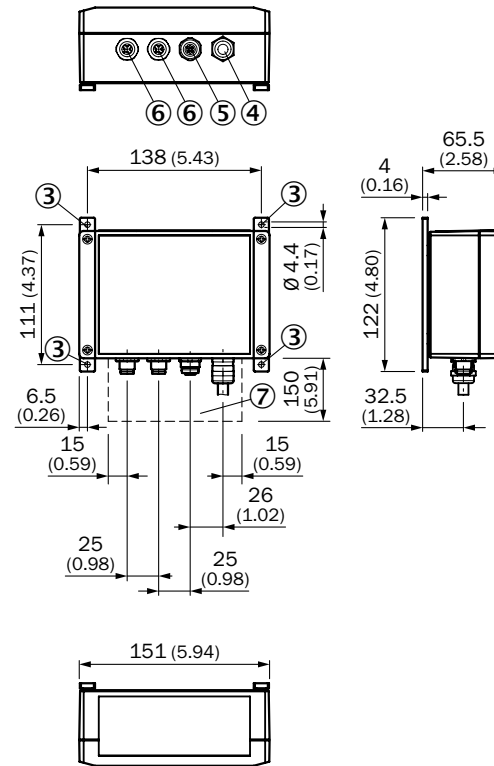


Fig. 5: RAS407 - 280020X control unit for two external sensors

- ①. -
- ②. -
- ③. Fixing holes, 4 x Ø 4.4
- ④. Supply connection
- ⑤. USB port
- ⑥. Connection for sensor unit
- ⑦. Recommended space for connections

Weather hood

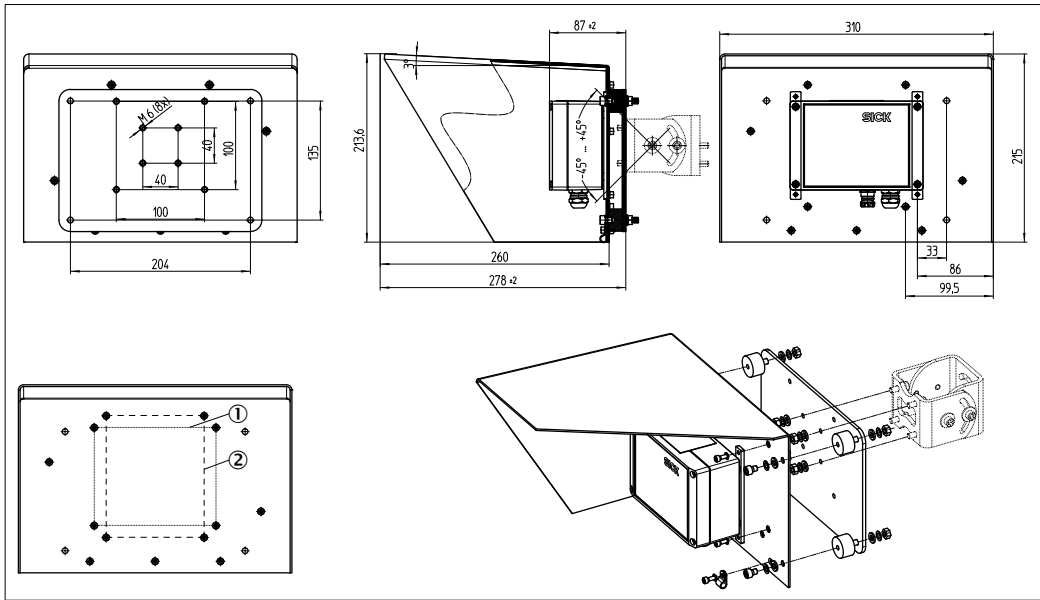


Fig. 6: Weather hood

- ①. 138 x 111 mm, 7°/28° sensor, control unit
- ②. 111 x 138 mm, 7°/28° sensor, control unit

Sensing range diagram

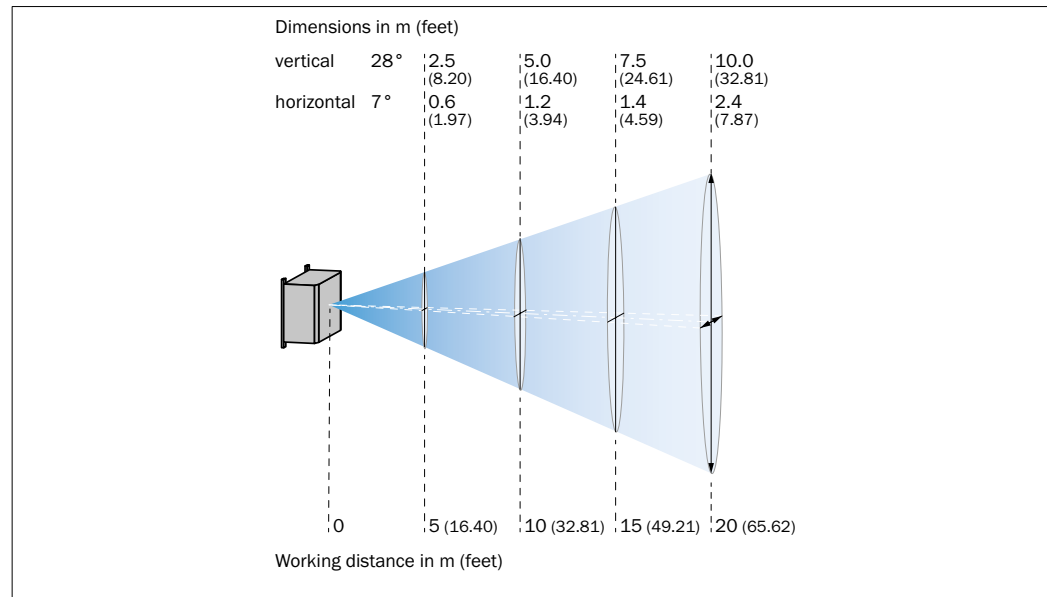


Fig. 7: Schematic sensing range diagram

Regulatory compliance information

This product may only be operated in countries for which approval has been granted.

An approval is granted for countries or regions named under "Variants of the RAS407 radar collision protection sensor (model RAS4M01):", page 1.

Please observe the country-specific information for operation:

European Union



Hereby, SICK AG declares that the radio equipment type RAS407-28x is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address: www.sick.com

Exceptions

France: only for fixed applications

Great Britain: not compliant

Australia



Singapore

Complies with
IMDA Standards
DA107301

United Arab Emirates

TRA
REGISTERED No:
ER54329/17
DEALER No:
DA64100/17

Russia

Only fixed applications with the following restrictions:

1. The equipment for detecting movement should be installed along roads at 4 m distance from controlled part of road.

2. The installation of equipment for detecting movement should be performed perpendicularly to movement direction of one- or multilane road with permissible deviation #15 degrees.

3. The installation height of equipment for detecting movement should not exceed 5 m above a road.

4. The tilt angle of the main beam to horizon should be minus 20 degrees or less.

Saudi Arabia

No country-specific information.

South Africa

No country-specific information.

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