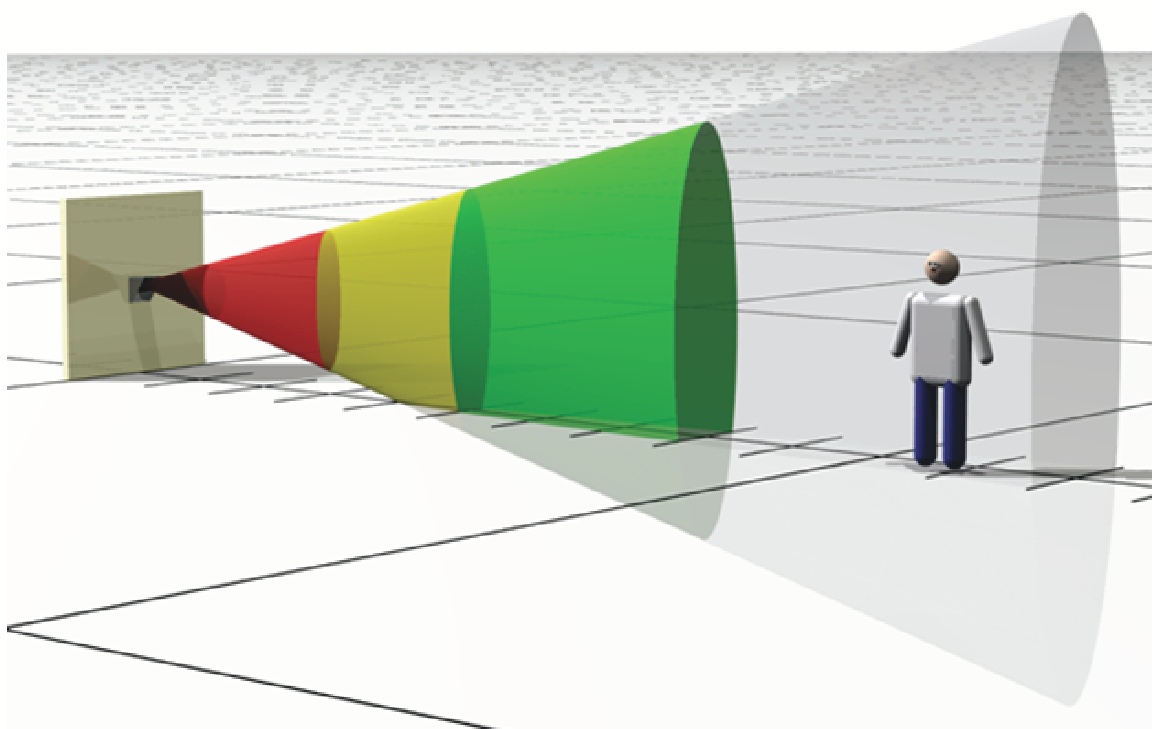




Bedienungsanleitung für RAS 400 S1 /
Operating Instructions RAS 400 S1
Controlaser Radarsensor Typ 4001



OPERATING INSTRUCTIONS / BEDIENUNGSANLEITUNG RAS 400 S1

1 General Information / Intended Use

The RAS 400 S1 sensor is designed for both indoor and outdoor area monitoring. Within a defined field of detection, the sensor recognises static and moving objects according to the definition stated below and triggers a signal by way of a potential-free contact upon recognition of a corresponding object. Optionally, up to three distance zones assignable with various functions can be defined. The intended use requires the compliance with predefined maintenance intervals.

RAS 400 S1 versions

Detection angle	Position of sensors to control unit			
	internal	internal + external	external	external + external
7°x28°	7-1-INT	7-2-INT	7-1-EXT	7-2-EXT
45°x38°			45-1-EXT	45-2-EXT

Available accessories:

- Acousto-optic signal transmitter (AOS)
- Weather protection roofing
- USB 1.1 cable
- CD-ROM RangerConfigTool software
- Camera system Voyager 7" incl. 7" TFT monitor
- Shielded service cable (arbitrary length up to 50 m)
- Pocket PC incl. preinstalled software

Please note the usage restrictions in Item 2 (Safety Instructions / Usage Prerequisites).

2 Safety Instructions / Usage Prerequisites

Please read these operating instructions carefully before you put the sensor into operation and in order to ensure orderly usage and functioning as required.

The following prerequisites for the use of the sensor RAS 400 S1 must be observed under all circumstances:

- The sensor is a 24 GHz FMCW high-frequency sensor (ISM Band) and is allowed exclusively for usage in the following countries: all EU member states. Other countries upon request.
- The sensor has been CE certified (see Item 10), i.e. it fulfils the relevant European standards. Further details on standard conformity are specified under Item 9.
- If the sensor is connected to a machine control system of any kind (with the objective of adherence to a category [B, 1, 2, 3, 4] with safety-related components of

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control units / machines according to EN 954-1), the user is responsible for examining the conformity of the entire system. The RAS 400 S1 satisfies the functional safety of programmable electronic systems according to EN 61508 SIL 1. (The certification was provided by the manufacturer itself. Information about the amount of examination is obtainable at the manufacturer.)

- The manufacturer cannot be held responsible for all and any damage that is caused as a result of usage deviating from the intended use or failure to observe safety instructions and warnings or use of the device outside of the scope of statutory rules, regulations and provisions.
- Under certain circumstances, and depending on the setting of its software parameters, sensitivity as well as the individual object characteristics, the sensor may not recognise certain objects. This applies in particular to smaller objects or certain materials (e.g. cardboard). Front-faced positioned and electrically conductive objects (e.g. metal) with a sufficient size have sound recognition features. In any case, the sensor parameters which can be set using the supplied software are to be optimised to both the individual case of application and the desired object recognition. Please contact the manufacturer in this respect prior to installation as these Operating Instructions only partially contain the information required for this particular purpose.
- The detection range of the sensor is subject to tolerances depending on the selected setting, i.e. objects can be recognised or not contrary to the wish of the user. Prior to installation, please contact the manufacturer in this respect as these Operating Instructions only partially contain the information required for this particular purpose.
- If an all-weather roofing is added, the sensor is suitable for the use in rain and snow conditions. Please observe that the sensor's reachable range and object recognition can be diminished depending on the intensity of rain and snow, or, at extreme weather conditions, that a usage to the intended purpose is no longer possible.
- In close proximity to the sensor, i.e. up to a distance of 20 cm, a secure object recognition can not be guaranteed in any case.
- Maintenance and repair work shall only be carried out by the manufacturer's service team or by a specially trained and qualified person. Only those parts/components released and authorised by the manufacturer shall be used as spare or assembly parts.
- All and any claims for liability, warranty and guarantee are null and void in the event of damage to the safety seal.

3 Installation

3.1 Requirements to the qualification of personnel

If the RAS 400 S1 is used as a safety-related system according to EN-61508, assembly and installation must be carried out by trained *micas* personnel or other trained staff who have obtained the following qualifications:

- Experience in installing the RAS 400 S1.
- Introduction to the project-specific safety concept.

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- Training, instruction or permission to switch ON / OFF, earth, and identify electrical circuits and components or systems according to the latest standards of safety technology.
- Knowledge of RAS 400 S1 Operating Instructions (the document on hand), in particular of the permissible ambient conditions (Item 7) and the interfaces / terminal assignment (Item 7.1).

3.2 Assembly

- Mounting direction with opening angle 7° horizontally, 28° vertically or inversely or 45° horizontally, 38° vertically or inversely, respectively.
- The area in front of the sensor in the direction of detection must be free of obstacles.
- Installation height depending on the application. Ensure that the two M12-connections (second sensor and USB) are accessible at the control unit.
- Fastening by means of fastening shackles on a flat surface. Ensure vibration-free mounting as far as possible.
- The two sensors of the RAS 400-7-2 S1 and the RAS 400-45-2 S1 respectively are equivalent; the direction can be allocated as desired.

3.3 Electrical connection

- Connect the device in a de-energised state!
- The terminal assignment is described in Item 7.1.
- Sequence of electrical connection:
 - a) Switch off the power supply;
 - b) If applicable, connection of external sensor(s) to the control unit (M12 coupling);
 - c) Connect the relay outputs to the customer's interface (see table, Item 7.1), unused outputs can remain open;
 - d) Connect the operating voltage and the shield (see "Technical data", Item 7),
 - e) Switch on the power supply.
- The connecting cable of the sensor unit must be laid buckle-free and secured, as required. Optionally, the cable can be customised on site (detailed cable specification on request).
- The connecting cable for operating voltage and relay outputs can be shortened at the open end if required. Opening the casing is not allowed (loss of guarantee).
- If a larger switching capacity is required, other than stated in the Technical Data, external power switching equipment must be used. An overload of the relay contacts can lead to malfunctioning or to the destruction of the sensor.
- The relay contacts are protected against voltage peaks with a spark-suppressing combination. If a further DC-relay or another inductive load is switched by the RAS 400 S1 relay, then the use of an additional free-wheeling diode for avoiding high-voltage peaks is recommended.
- The connecting cable shield is to be connected to the mass (PE) for protective earthing.

4 Start-Up and Testing

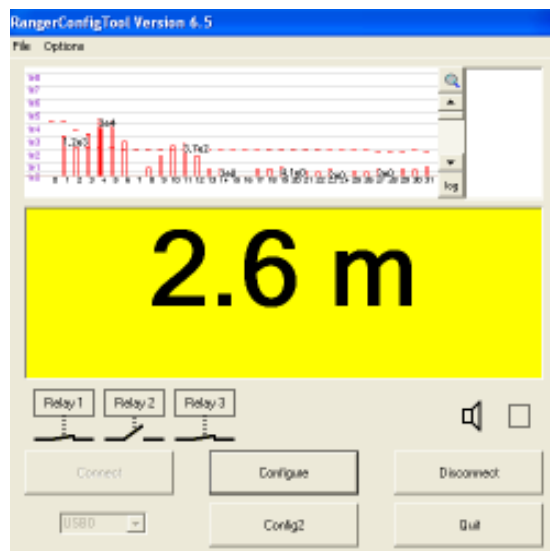
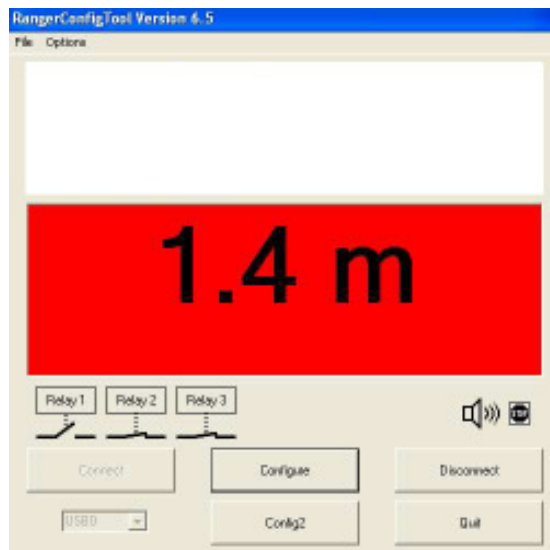
After switching on the voltage supply, the RAS 400 S1 is ready for operation. Please check your installation and put the sensor into operation based on the Start-Up Manual³.

5 Configuration Using the RangerConfigTool

Changes in settings at RAS 400 S1 can be carried out via PC / laptop using the 'RangerConfigTool' configuration software. Note: The connection of a laptop requires a special USB cable (RAS 400-USB).

5.1 Display window

- Start RangerConfigTool. In the menu "settings" you can change the user language.
- Select "connect" in the display window. Important: If you have several RAS 400 S1s connected, you may select the active unit (USB0, USB1, ...) using the scroll box bottom left before selecting "connect".
- The panel in the middle of the screen shows the distances which the sensor measures; the coloured background shows whether there is an object in the "information" (green), "warning" (yellow) or "alarm" (red) zone of the sensors.
- Under the distance measurement, the switching state (open/closed) of the three relays and – if an AOS is installed - its flashing frequency (OFF / flash slow / flash fast / continuous light) are shown.
- By double-clicking on the micas logo a spectrum chart can be opened showing the distance as well as the signal level of the detected object. With the magnifying glass an optimal upper limit for the current measuring can be selected. The upper limit of the represented range can be moved with the help of the scroll bar. With the button underneath this section you can choose between a linear



³ See Annex

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("lin") or logarithmic ("log") graph. Up to two maxima will be marked by means of a red bar. The displayed value indicates how well the object is recognisable for the sensor. The distance readings can be taken from the x-axis ($0.7 \cdot x$ -value).

- To change the settings of the connected RAS 400 S1, please select "configure".

5.2 Configuration window

The settings of the sensor can be changed in the configuration window. By means of the "accept" button, the changed settings are transmitted to the RAS 400 S1; these changes remain valid until the RAS 400 S1 is switched OFF. In order to write changes permanently into Flash ROM, select "save".

The changes are transmitted non-permanently with "OK" and the window is closed; with "cancel" the changes are rejected. If no changes have been carried out or no new settings have to be transmitted permanently, the respective buttons are deactivated.

The window has three tabs:

- f) "Zones and responses",
- g) "Calibration",
- h) "Maintenance".

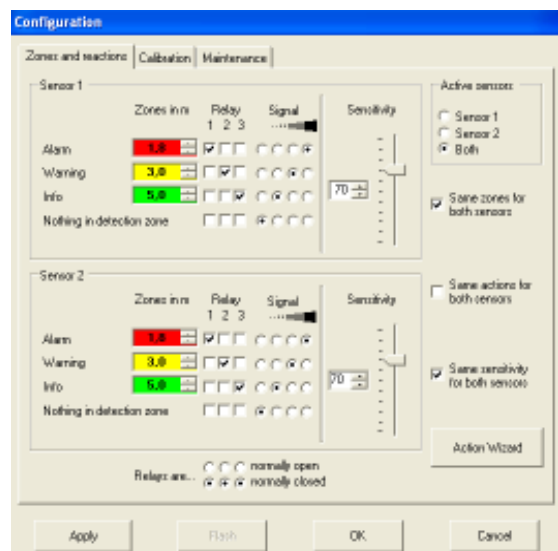
Under the "zones and responses" rubric you find on the bottom right the "actions assistant" button serving as a setting aid. In this window, you may allocate relay actions to particular zones. It is possible to choose from eight different settings. After having chosen a suitable setting, please confirm your selection with "OK" to save changes.

Above the "actions assistant" button you may choose the active sensors. The setting fields for a non-active sensor are blocked.

On the left side, you may set up for both sensors at which distance the three zones should start.

On the right, you can determine which events ("object within the zone") initiate which action (opening / closing of relays; signal by acousto-optic transmitter). In addition, you can determine the sensor's sensitivity. If you increase the value, smaller objects are recognised as well. However, under certain circumstances the system is susceptible to accidental triggering due to surface unevenness or objects in the peripheral zone of the detection field.

Under "sensor settings" you can decide which relay shall work as a "break contact element" or as a "make contact element".



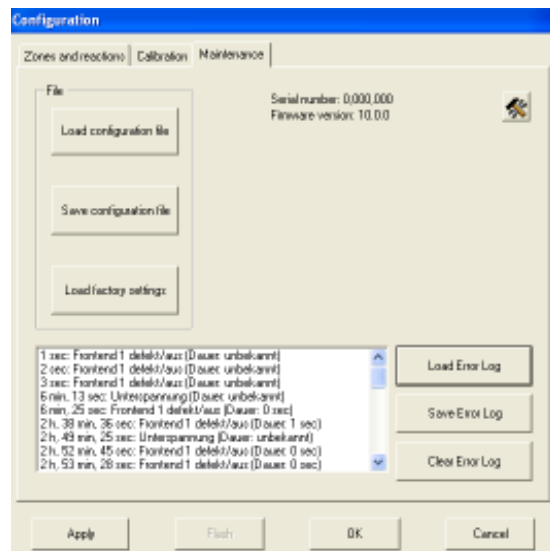
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(Note: To guaranteeing functional safety according to EN 61508, the relays must be used as break contact elements).

The Figure shows an example setting: relay 1 or relay 2 opens if there is an object in the alarm zone of sensor 1 or sensor 2; otherwise, all relays remain closed. If there is an object in the information, warning or alarm zones of sensor 1, the AOS (if installed) signals this with an increased flashing frequency or tone up to continuous lighting or tone respectively. The AOS does not react to objects in the detection zone of sensor 2. If you activate on the right side in the case of two active sensors "identical zones", "identical actions" and "identical sensitivity", the sensor-1 settings apply also for sensor 2.

On the bottom right you find the "actions assistant" button serving as a setting aid. In this window, you may allocate relay actions to particular zones. It is possible to choose from eight different settings. After having chosen a suitable setting, please confirm your selection with "OK" to save changes.

Under the "calibration" rubric, there are the modi "manual mode" and "automatic mode". The RAS 400 S1 comes already calibrated when it leaves the factory. Renewed calibration is only required when replacing individual sensors. To do this, please contact your service partner at info@micas.de or +49 (37298) 309-0. We are at your disposal for further memory settings or troubleshooting under the "maintenance" item.



Under the "maintenance" rubric it is possible to load or save your selected settings. Using the lower of the three buttons, it is possible to reset the basic settings. In the window appearing now, you may select if the basic calibration settings should be transferred. Do not activate this option if the sensors are correctly calibrated, otherwise the sensor-specific calibrations get lost.

The RAS 400 S1 permanently carries out self-tests and saves any changes of the operating state in the operating log. Unintended deletion of the operating log is protected by a password.

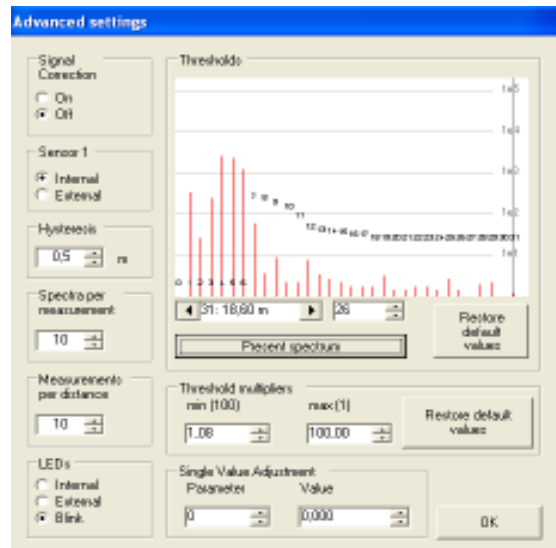
On the top right there is a button for entering the expert mode by means of a password request (the password is provided by us on request). The spectrum chart shown in the expert mode can be used for setting up or changing the threshold values.

The adjoining figure shows an example setting: measuring shall be carried out at a distance of 0.60 m up to 3.60 m. 'Disturbing' objects are hidden in the zone exceeding 3.60 m.

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By clicking on the button underneath this section, the current spectrum is displayed. Threshold values can be entered directly into the chart by means of the mouse, or can be determined with the help of the two indicated fields. In the left field, the relevant spectral line can be selected, in the right field the threshold can be set up.

In order to extend the sensitivity range, the threshold value multipliers are to be changed. If the range is to be extended upwards, the left value is to be reduced. If the sensitivity range is to be extended downwards, the right value is to be increased.



On the left hand side, there is an opportunity to change the tolerance band for detection zone limits using the hysteresis value. In addition, the number of spectra per measurement can be adjusted (the higher the number, the lower the sensitivity to changes, but the more stable the value). With a high number of measurements per output the value gets more stable. An interference suppression is to be selected only in the case of measurement problems caused by other 24 GHz sources (e.g. a second RAS 400 S1).

The single value settings should be changed only after prior consultation with micas AG.

Press "OK" to exit the "expert settings" dialog.

6 Troubleshooting

The sensor fails to recognise obstacles:

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

The sensor recognises obstacles even though there are no objects in the detection field:

- Check mounting position (Too low above the ground? Intensively reflecting objects at the side of the detection field?).
- If necessary, position the sensor with a gradient slightly upwards.
- Reduce sensitivity.

The tool signals "no sensor found at USBx" during connection:

- Check power supply of the sensor.

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- Check USB connection.
- Install the USB driver (If the RAS 400 S1 is connected, the device manager must indicate the following device: "USB controller/USB serial converter device").
- Start the device manager and open by double-clicking in "universal serial bus controllers / USB serial converter" the window "features of USB serial converter", deactivate under the "advanced" tab the check mark at "load VCP".

The displayed measuring values are not correct:

- Check the calibration (configuration / calibration).
- Several objects within the sensor detection field, whose distances are less than 70 cm from one another, can be recognised as one object the distance of which is given a few decimetres too high.
- Possibly, distances below 1.8 m are not stated correctly.

The relays fail to open when the object re-exits the zone:

- Not a fault. 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 zones (configuration / zones and responses).

7 Technical Data

<i>Sensor:</i>	
Measuring principle:	FMCW HF sensor
Frequency:	24,125 GHz \pm 125 MHz according to EN 300 440
HF performance (EIRP):	approx. +20 dBm
Distance resolution:	approx. 70 cm
Resolution (interpolated):	approx. 10 cm
Response time:	< 0.5 s
Detection range:	0.20 – 20 m (RAS 400-7-1/2 S1) or 0.20 – 8 m (RAS 400-45-1/2 S1) 3 zones can be adjusted
Detection angles:	7° x 28° (RAS 400-7-1/2 S1) or 45° x 38° (RAS 400-45-1/2 S1)
<i>Interfaces:</i>	
Operating voltage:	10 – 30 V DC, 24 V AC \pm 10%
Power input:	< 500 mA, depends on configuration and operating voltage
<i>Outputs:</i>	3 x relay, potential-free contacts, max. 42V / 0.5A

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PC interface:	USB
<i>Cables and plug-in connectors:</i>	
Power supply, relay outputs:	Length: 3 m Cable: 8 x 0.25 mm ² , shielded Control unit connection: non-detachably connected Machine control connection: wire end ferrules
Connection control unit / sensor unit:	Length: 3 m/5 m (other lengths upon request) Cable: 5 x 0.14 mm ² , shielded Control unit connection: 5-pole M12 plug-in connector (plug at control unit, coupling at cable) Control unit connection: 5-pole M12 plug-in connector (plug at control unit, coupling at cable)
USB:	Length: 3 m Cable: 4 x 0.25 mm ² shielded (or standard USB cable) Control unit connection: 5-pole M12 plug-in connector (plug at cable, coupling at control unit) PC connection: standard USB plug (Type A)
<i>Casing:</i>	
Control unit:	Size: 101 x 151 x 60 mm, Material: ABS grey Degree of protection: IP66
External sensor:	Size: 101 x 151 x 60 mm (RAS 400-7-2 S1) or 63 x 97 x 38 mm (RAS 400-45-1/2 S1), Material: ABS grey Degree of protection: IP66 (RAS 400-7-2 S1) or IP65 (RAS 400-45-1/2 S1)
Ambient temperature:	-20 °C to 60 °C

7.1 Interfaces / terminal assignment

Power supply:	10 – 30 V DC or 24 V ± 10% AC, Power input < 500 mA, Connecting cable at control unit
Output signals:	3 x potential-free relay contact, Relays may be allocated arbitrarily to the detection zones using the software, switching capacity max. 42V / 0.5 A, Connecting cable at control unit
USB:	USB 1.1 connection, Connecting bush, 5-pole M12 at the control unit, with blanking plug

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Sensor:	Sensor unit connection: 5-pole M12 connecting plug at the control unit
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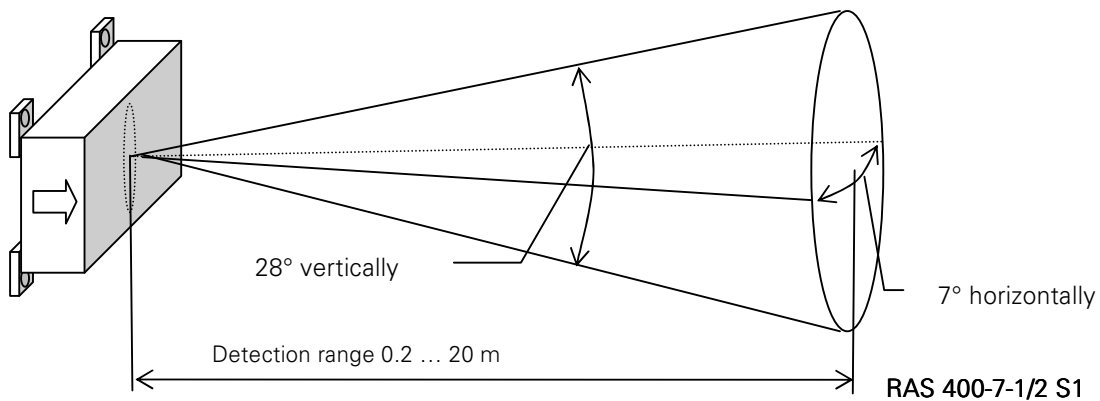
The connecting cable for the control unit has the following connecting allocation:

white	Operating voltage - / ~
brown	Operating voltage + / ~
green, yellow	relay 1
pink, grey	relay 2
blue, red	relay 3
black	shield / mass

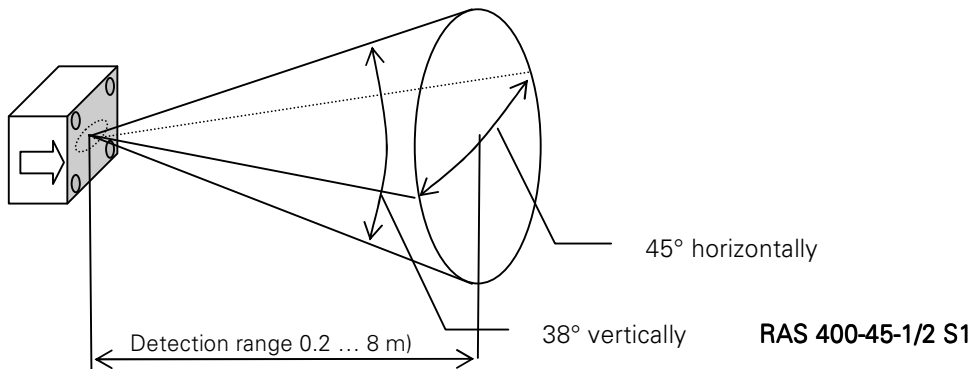
7.2 Detection range

The sensor detection range forms an asymmetrical cone shape according to the following table:

Model	RAS 400-7-1 S1 and -2 S1	RAS 400-45-1 S1 and -2 S1
Opening angle, horizontal (approx.)	7°	45°
Opening angle, vertical (approx.)	28°	38°
Length of the detection range	from 0.20 to 20 m	from 0.20 to 8 m
Length of the setting area	adjustable from 1.80 to 20 m	adjustable from 1.80 to 8 m



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8 Maintenance, Repair and Servicing

The use of RAS 400 S1 for applications requiring functional safety according to EN 61508 SIL1 as well as for any other applications, periodic preventive maintenance is mandatory. Maintenance must be carried out once a year, however, after 5,000 operating hours at the latest (with due regard to Items 8.1 and 8.2).

When exceeding the required maintenance interval, the functional safety cannot be further guaranteed. In this case, the warranty claim lapses also for any other applications. The operator / end user of the system is responsible for planning the maintenance procedure in due time.

8.1 Authorized personnel, equipment

The maintenance must be carried out by micas after-sales service or by authorized service partners. Service partners are subject to specific maintenance training by micas AG.

Maintenance activities and corrective actions to be taken

	Maintenance activity	Error handling / corrective action
1	Check the RAS 400 S1 for mechanical damage: - casing - connecting cable - secure fitting of plugs - warranty seal	Replacement, if required
2	Save the configuration (original configuration of customer)	
3	Save the logfile and check it for critical non-conformances; check the number of operating hours since last calibration	Fault analysis; configuration adjustment, if required, or replacement
4	Function check: - object recognition using a radar reflector within the	Check of settings; replace, if required

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	custom-made set limits - function check of all output signals (relays, AOS if needed)	
5	Calibration check: - distance measurement using a radar reflector at a defined distance of 3 m (or depending on application) - deviation must be < 0.2 m	Recalibration using a radar reflector
6	Delete the sensor logfile	
7	Save configuration again (if changed during maintenance)	

8.2 Documentation

The maintenance procedure must be documented by means of a servicing report containing the following information:

- date;
- series number;
- number of operating hours (currently / since last maintenance);
- documentation of all above mentioned tasks;
- the saved logfile; and
- the saved configuration (original and changes, if any).

The servicing report must be signed by both the service engineer and the customer.

To ensure the intended functioning, the sensor is subject to periodic servicing every 12 months (however, at the latest after a maximum of 5,000 operating hours) by the manufacturer's after-sales service or a specifically trained specialist.

The sensor must be protected against coarse dirt.

9 Standards, Guidelines

The RAS 400 S1 complies with the following standards:

Directive 1999/05/EC (R&TTE Directive)

EN 300 440 (radio systems with low transmission range)

Directive 89/336/EEC (EMC Directive)

EN 61000-6-2/08.2002 (noise immunity for industrial environments)

EN 61000-6-3/08.2002 (emission standard for residential, commercial & light-industrial environments)

EN 61000-3-2/12.2001 (limits for harmonics)

EN 61000-3-3/05.2002 (voltage fluctuations and flicker limits)

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EN 61508, SIL 1: Functional safety of electrical/electronic/programmable electronic safety-related systems

EN 60721-3-7: 1995 class 7M3 (mechanical environmental conditions)

Inspected and tested according to 1995/54/EC Directive (motor vehicle EMC directive) (without certification).

10 Certificates

10.1 Declaration of Conformity according to EN 61508 SIL1*

 <p style="text-align: center;">Konformitätserklärung zur EN 61508 SIL 1 Declaration of Conformity to the EN 61508 SIL 1</p> <p>Hersteller Hersteller:</p> <p>micas AG Tafelfving 16-25 08276 Döbeln/Leipzig</p> <p>erklärt, dass das Produkt declares that the product:</p> <p>Kollektorschleusen RAS 400 S1</p> <p>für bestimmungsgemäße Verwendung, entsprechend der Produktbeschreibung. if suitable for intended use in accordance with the product description.</p> <p>für sicherheitsbezogene Anwendung bis zu dem Sicherheitsintegritätslevel SIL 1 gemäß folgender Norm verwendet werden darf. may be used for safety-related applications up to the Safety Integrity Level SIL 1 according to the following standard:</p> <p>EN 61508 Funktionale Sicherheit sicherheitsbezogener elektroelektronischer/programmierbarer elektronischer Systeme Functional safety of electro-electronic/programmable electronic safety-related systems</p> <table border="1" style="width: 100%;"> <tr> <td>Lebenszeit / Mean-time-between-failure</td> <td>Höhe oder kontinuierliche Anfahrleistung / Height or continuous thrust</td> </tr> <tr> <td>Zykluszeit / Cycle-time</td> <td>T₁ = 1 Jahr / year</td> </tr> <tr> <td>SIL</td> <td>1</td> </tr> <tr> <td>HFT</td> <td>5</td> </tr> <tr> <td>SFF</td> <td>> 80%</td> </tr> <tr> <td>Übertragungsrate / Transfer rate</td> <td>50</td> </tr> </table> <table border="1" style="width: 100%;"> <tr> <td>FFD_{0.1}</td> <td>1 = 10⁶</td> </tr> <tr> <td>Z_{0.1}</td> <td>280 VIT</td> </tr> <tr> <td>Z_{0.2}</td> <td>810 VIT</td> </tr> <tr> <td>Z_{0.3}</td> <td>212 VIT</td> </tr> <tr> <td>Z_{0.4}</td> <td>585 VIT</td> </tr> </table>	Lebenszeit / Mean-time-between-failure	Höhe oder kontinuierliche Anfahrleistung / Height or continuous thrust	Zykluszeit / Cycle-time	T ₁ = 1 Jahr / year	SIL	1	HFT	5	SFF	> 80%	Übertragungsrate / Transfer rate	50	FFD _{0.1}	1 = 10 ⁶	Z _{0.1}	280 VIT	Z _{0.2}	810 VIT	Z _{0.3}	212 VIT	Z _{0.4}	585 VIT	 <p>Ort und Datum der Konformitätserklärung Place and date of the declaration of conformity:</p> <p><i>[Signature]</i> <i>[Signature]</i></p> <p>Storant: Dr. Mark Ebert Managing Partner</p> <p>Erwicklungsleiter: Dr. Michael Fritzsche Head of R&D</p>
Lebenszeit / Mean-time-between-failure	Höhe oder kontinuierliche Anfahrleistung / Height or continuous thrust																						
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* The conformity examination was provided by the manufacturer itself.

START-UP MANUAL RAS 400 S1

Annex to the Operating Instructions: Start-Up Manual RAS 400 S1

If the RAS 400 S1 is used as a safety-related system according to EN-61508, assembly and installation must be carried out by trained micas personnel or other trained persons who have obtained the following qualifications:

- Experience in installing the RAS 400 S1.
- Introduction to the project-specific safety concept.
- Training and instructions or permission, respectively, to switch on / off, earth, and mark electrical circuits and components or systems according to the latest standards of safety technology.
- Knowledge of the RAS 400 S1 Operating Instructions, particularly of pin assignment and ambient conditions.

Checklist 1: Installation

<i>General:</i>		
Visual inspection	Device free of visible damages:	<input type="checkbox"/> yes <input type="checkbox"/> no
Serial number	Serial number of the sensor:
Assembly	All screws tightened / device properly assembled:	<input type="checkbox"/> yes <input type="checkbox"/> no
	Check if assembly height and alignment of sensor detection zone warrant the monitoring job being carried out.	<input type="checkbox"/> yes <input type="checkbox"/> no
Detection field	Detection field normally free of obstruction:	<input type="checkbox"/> yes <input type="checkbox"/> no
	Check if the surface of the ground is suitable (free of highly reflective surfaces):	<input type="checkbox"/> yes <input type="checkbox"/> no
<i>Electrical connection</i>		
Power supply (brown / white)	Voltage:V <input type="checkbox"/> AC <input type="checkbox"/> DC
Relay load	Load switched by relay:	<input type="checkbox"/> inductive <input type="checkbox"/> capacitive <input type="checkbox"/> resistive / ohmic
	Relay load limit observed:	<input type="checkbox"/> yes <input type="checkbox"/> no
Connection of external sensor	External sensor connected:	<input type="checkbox"/> yes <input type="checkbox"/> no

START-UP MANUAL RAS 400 S1

	Cable length (maximum of 50 m):	Cable length: m <input type="checkbox"/> yes <input type="checkbox"/> no
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Prior to functional testing, the type of object has to be determined which generates the lowest radar signal and which is to be recognised by RAS 400 S1 [e.g. person (adult, child) vehicle ...]. The sensitivity of the sensor(s) must be adjusted in a way that no triggering occurs when the detection range is object-free (i.e. some levels lower than the lowest sensitivity level at which the sensor will be activated).

For all relevant zones it is to be inspected whether the above determined object causes the desired responses (relay positions) (to be documented in Checklist 2). This is, as far as possible, to be checked for the total length of each relevant zone.⁴

Checklist 2: Functional Test

<i>Object type</i>	
Sensor 1	Alarm zone	<input type="checkbox"/> OK
	Warning zone	<input type="checkbox"/> OK
	Information zone	<input type="checkbox"/> OK
	Detection field free of objects	<input type="checkbox"/> OK
Sensor 2	Alarm zone	<input type="checkbox"/> OK
	Warning zone	<input type="checkbox"/> OK
	Information zone	<input type="checkbox"/> OK
	Detection field free of objects	<input type="checkbox"/> OK

If one of the required responses does not take place within 0.5 sec., the entire functional testing must be repeated with changed settings (sensitivity; threshold values, if required). If during the test procedure no setting is found at which the desired triggering is caused, but no triggering is caused with a free detection field, the functional test is considered failed. This is to be documented.

⁴ The attached CD contains the configuration files 'TestSensor1.ras' and 'TestSensor2.ras' at which relay 1 is assigned to the respective sensor of alarm zone, relay 2 – to the sensor of warning zone, and relay 3 - to information zone. Open these files by means of the Ranger Config Tool and accept/transfer the values to RAS 400 S1 to easily start testing of sensors.

START-UP MANUAL RAS 400 S1

Upon completion of the test, the sensor settings are to be saved permanently in the Flash ROM and are to be entered into Checklist 3; in addition the configuration file is to be saved. This file (as a print-out or on data carrier) is part of the documentation of validation.

Checklist 3: Configuration

	Distance (m)	Relays 1	Relays 2	Relays 3	Sensitivity
Alarm					
Warning					
Info					
No object					

Alarm					
Warning					
Information					
No object					

Same actions
for both sensors

Break contact element			
Make contact element			

Start-up carried out at:

By:

Signature: