



Area Scanning Distance Sensor rotoScan ROD 4 / ROD 4-06 / ROD 4-08

Technical Description





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1	General information	4
1.1	Explanation of symbols	4
1.2	Declaration of conformity	4
2	Safety Notices	5
2.1	Safety standards	5
2.2	Intended Use.....	6
2.3	Working Safely	7
3	Description	9
3.1	Technical Overview.....	9
3.2	Operating principle	10
3.3	Application examples	11
4	Mounting	13
4.1	Mounting location	13
4.2	Mounting dimensions	14
5	Electrical Connection	15
5.1	Connecting the rotoScan ROD 4	15
5.1.1	Interface assignment X1 and X2.....	16
5.1.2	Connector assignments for interface X1.....	16
5.1.3	Connector assignments for interface X2 (RS 232)	17
5.1.4	Connector assignments for interface X2 (RS 422)	18
5.2	Function characteristics of the X1 interface	19
5.2.1	Input switching	19
5.2.2	Output switching	21
5.3	Function characteristics of the X2 interface	22
5.3.1	Wiring the plug.....	22
5.4	Integration in the control system	23
5.4.1	Connection example 1: without detection area pair changeover.....	23
5.4.2	Connection example 2: with detection area pair changeover	24
6	Commissioning	25
6.1	Hardware and software requirements	25
6.2	Device configuration and parameterisation.....	25
6.3	Screwing down and aligning the device	27
6.4	Switching on the device	27
7	Technical Data.....	28
7.1	Detection area data.....	28
7.2	General Specifications	30
7.3	Dimensioned drawings.....	32

8	Scope of Delivery	34
9	Maintenance	34
10	Status Messages, Errors and Error Rectification	35
10.1	Status display.....	35
10.2	Status displays.....	36

Table 2.1: Standards and directives 5

Figure 2.1: Reflectivity ROD 4/ROD 4-06 6

Figure 2.2: Attachment of the sticky label with warning notices 7

Table 3.1: Device types 9

Figure 3.1: Detection areas 10

Figure 3.2: Working range and angular resolution 10

Figure 3.3: Operating principle 11

Figure 3.4: Use with a side-tracking skate 12

Figure 4.1: Scanning planes and device edges 13

Figure 4.2: Mounting dimensions 14

Figure 5.1: Connecting the rotoScan ROD 4... 15

Table 5.1: Interfaces of the rotoScan ROD 4... - X1 and X2 16

Table 5.2: SUB-D15 pin assignments for interface X1 16

Table 5.3: SUB-D9 - pin assignments for the interface X2 as RS 232 port 17

Table 5.4: SUB-D9 - pin assignments for the interface X2 as RS 422 port 18

Figure 5.2: Inputs of interface X1 19

Figure 5.3: Detection area pair changeover with a DTS application 20

Figure 5.4: Outputs of interface X1 21

Figure 5.5: Plug wiring 22

Figure 5.6: Connection example without detection area pair changeover 23

Figure 5.7: Connection example with detection area pair changeover 24

Figure 6.1: User interface of the configuration software 26

Figure 6.2: LEDs 27

Table 7.1: Technical Data - Detection Areas 28

Figure 7.1: Object size/diffuse reflection as a function of distance for the ROD 4/ROD 4-06 29

Table 7.2: Technical Data - General Data 31

Figure 7.2: Front view 32

Figure 7.3: Lateral view 33

Figure 10.1: Status display ROD 4... 35

Table 10.1: Status displays on the rotoScan ROD 4 36

1 General information

1.1 Explanation of symbols

The symbols used in this technical description are explained below.



Attention!

This symbol appears before text passages which must absolutely be observed. Failure to heed this information may lead to injuries to personnel or damage to the equipment.



Attention Laser!

This symbol warns of possible danger through hazardous laser radiation.

The laser used in the rotoScan ROD-4... is a laser device of laser safety class 1 acc. to DIN EN 60825-1. Observe the legal and local regulations applicable to the operation of laser units.



Notice!

This symbol indicates text passages containing important information.

1.2 Declaration of conformity

The distance sensors rotoScan ROD 4, rotoScan ROD 4-06 and rotoScan ROD 4-08 have been developed and produced in accordance with the applicable European standards and directives.

The distance sensor rotoScan ROD 4 also fulfils the UL requirements (Underwriters Laboratory Inc.) for the USA and Canada.



Notice!

The corresponding declaration of conformity can be requested from the manufacturer.

The manufacturer of the product, Leuze electronic GmbH + Co. KG in D-73277 Owen/Teck, possesses a certified quality assurance system in accordance with ISO 9001.



2 Safety Notices

2.1 Safety standards

The distance sensor rotoScan ROD 4/rotoScan ROD 4-06/rotoScan ROD 4-08 (further-on abbreviated as ROD 4...) has been developed, produced and tested subject to the applicable safety standards. It represents the state of the art.

Standards and directives

The standards and directives which apply in Europe and which are to be observed during the use and installation of the ROD 4... are listed below:

Standard or Directive	Designation
98/37/EU	Machine directive
73/23/EEC	Low voltage directive
89/336/EEC	EMC - directive

Table 2.1: Standards and directives

Laser

If the functionality is not ensured, the error output is immediately activated. The laser output power and the rotational speed of the mirror are continuously monitored by the built-in control system to ensure that the requirements of laser protection class I are satisfied.

Reference measurement

A reference measurement cyclically controls the measurement function. The following functions are checked on each rotation of the mirror by means of a test object located inside of the device:

- optical systems (e.g. transmitter and receiver)
- hardware, software, etc.

Window monitoring

A total of six light axes monitor the degree of soiling of the window. During this procedure, the results are compared with two reference sensors. Moreover, these reference sensors are used for temperature compensation and ageing monitoring.

Monitored processing

The processing of measurement values in the rotoScan ROD 4... is monitored by a separate component, i.e. errors in program execution are detected immediately and appropriate protective measures initiated.

Software test

The entire system is tested when first switched on and during operation.

2.2 Intended Use



Attention!

The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not corresponding to its intended use.

The ROD 4... is a switching device for detecting objects in specified areas and outputting a message via e.g. transistor outputs.

The following measures must be heeded when using the ROD 4... unit:

- Use only in closed rooms.
Do not expose the ROD 4/ROD 4-06 to fog, rain or snow. The ROD 4-08 is available for difficult environmental conditions (dust, fog).
- Only objects that are in clear view of the sensor can be detected.
- Objects such as glass panes and mirrors that do not reflect light back to the sensor cannot be safely recognised.
- The response time must be considered when working with fast-moving objects.
- Objects with reflectivities of at least 1.8% (e.g. black cord) can be reliably detected by the ROD 4/ROD 4-06 in the respective detection areas.
The ROD 4-08 detects objects with a luminosity coefficient of at least 6%.

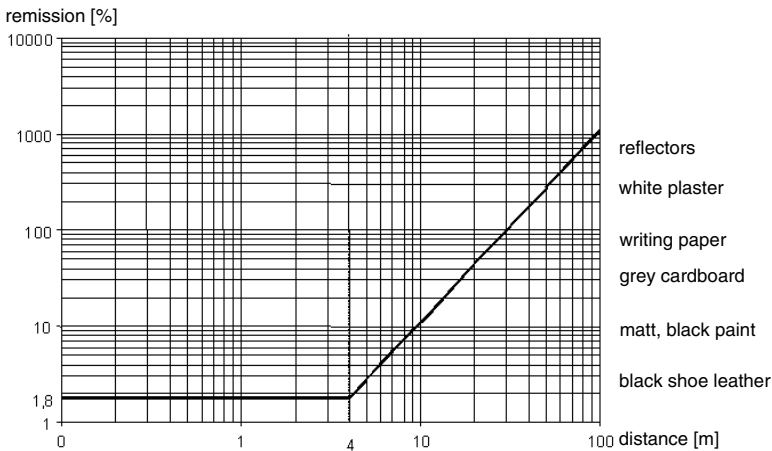


Figure 2.1: Reflectivity ROD 4/ROD 4-06

2.3 Working Safely



Attention, laser radiation!

The distance sensor ROD 4... operates with a red light laser of class 1 acc. to EN 60825-1.

The use of operating and adjusting devices other than those specified in this technical description, carrying out of differing procedures, or improper use of the distance sensor may lead to dangerous exposure to radiation!

The use of optical instruments or devices in combination with the device can increase the danger of eye damage!

Adhere to the applicable legal and local regulations regarding protection from laser beams acc. to EN 60825-1 in its latest version. Avoid mounting the distance sensor at eye level.

The reading window is the only opening through which the laser radiation can escape from the device. The housing of the distance sensor ROD 4... is sealed and has no parts that need to be adjusted or maintained by the user. The device must not be tampered with and must not be changed in any way!

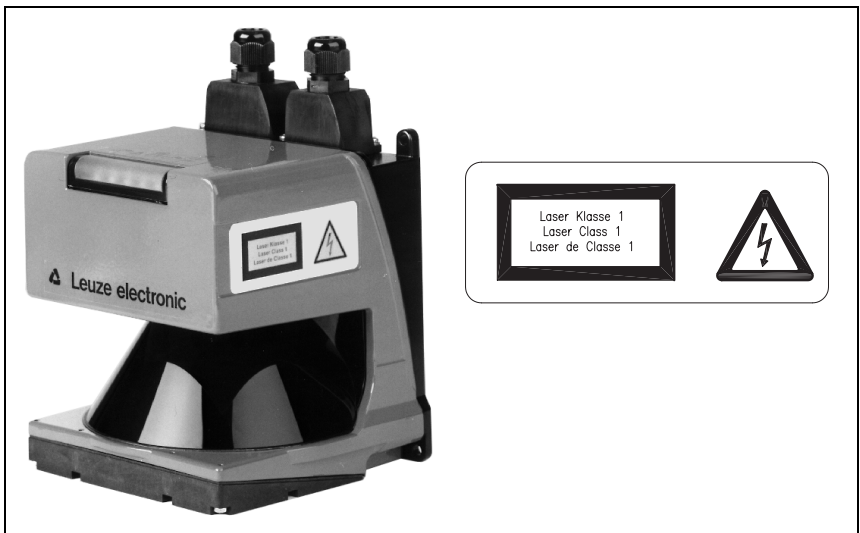


Figure 2.2: Attachment of the sticky label with warning notices

**Attention!**

Access and changes to the device, *except where expressly described in this operating manual, are not authorised.*

Documentation

All instructions contained here have to be strictly observed. Keep this technical description in a safe place. It should be accessible at all times.

Safety Regulations

Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

Qualified Personnel

Mounting, commissioning and maintenance of the device may only be carried out by qualified personnel.

Electrical work must be carried out by a certified electrician.

Repairs, in particular the opening of the housing, may only be carried out by the manufacturer or a person authorised by the manufacturer.

**Attention!**

Adjustment and change of the detection areas by means of the "RODSoft" configuration software may only be carried out by an authorised person. The password required is to be stored under lock and key by the designated person.

3 Description

3.1 Technical Overview

Designation	Type	Part No.
rotoScan ROD 4	without heater	500 36010
rotoScan ROD 4-06	with integrated heater	500 38614
rotoScan ROD 4-08	with integrated heater, with reduced receiving power for objects with luminosity coefficient > 6%	500 41423

Table 3.1: Device types

The ROD 4... device is an optical distance sensor. It could also be considered an optical, area radar unit. The device periodically transmits light pulses within a working field of 190°. If the pulses are incident upon an obstacle or a person, the light is reflected and received and analysed by the ROD 4.... From the propagation time of the radiated light, the ROD 4... unit calculates the exact co-ordinates of the "seen" objects. If the obstacle or person is located within a defined area, a stop function is executed. In this case, the semiconductor switch outputs are switched off within the system reaction time. The stop function is automatically reset once the detection area is clear or upon acknowledgement, depending on the operating mode.

The ROD 4... can detect persons or objects with diameters greater than 20mm at a distance of up to 4.0m, even when the surface of the given object is dark. Larger objects are detected at distances of up to 50m.

Four programmable detection zone pairs make possible an optimal adaptation to the applications. A detection zone pair is considered to be the combination of both an internal and an external detection zone. Inner and outer detection zones each have a different colour display.

The ROD 4... unit can be used for mobile (driverless transportation systems, side-tracking skates, ...) as well as for stationary applications (projection control, ...).

The long-range and contact-less measurement principle makes the ROD 4... unit a universally applicable monitoring device.

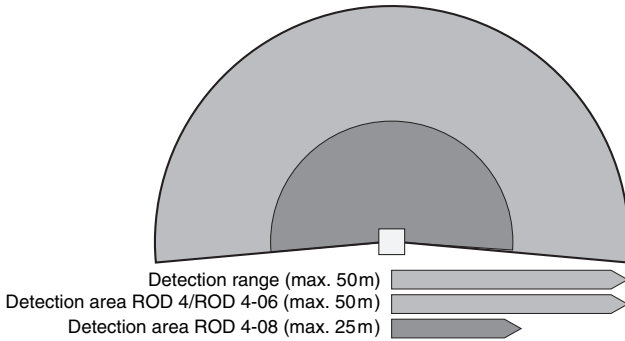


Figure 3.1: Detection areas

3.2 Operating principle

The working range of the ROD 4... (190°) is divided into 0.36° angular segments.

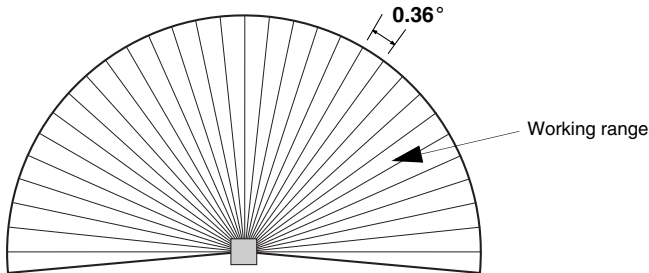


Figure 3.2: Working range and angular resolution

Bundled light pulses are generated by a laser diode with coupled transmission optics. These light pulses are reflected by a rotating mirror in such a way that a light pulse is emitted every 40ms in all angular segments (scanning rate: 25scans/s). If the light pulse is incident upon an object or person, it is reflected and subsequently detected and analysed by the ROD 4....

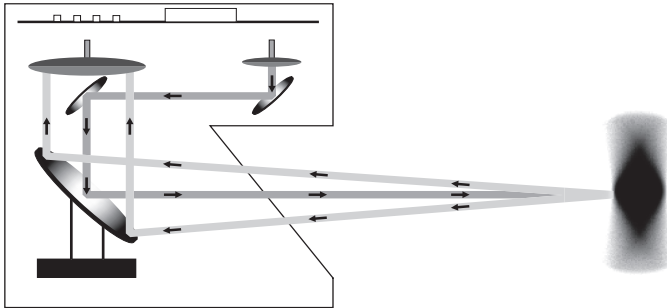


Figure 3.3: Operating principle

The ROD 4... unit works on the principle of pulse propagation time measurement. The light pulse propagation time is a direct measurement of the distance to the object.

Combination of hardware and software

The ROD 4... can be programmed using the supplied software. In addition to the device configuration, the software can also be used to adapt the detection area pairs to the given application and to save the same in the ROD 4....

The image of the surroundings generated during the scan process is compared with the specified detection area contours. If an object or person violates a detection area for a least one scan (40ms), a corresponding, user-specific reaction is triggered.

3.3 Application examples

The following examples can be considered typical areas of application for the ROD 4....

Side-tracking skate

To prevent damage to the vehicle and the load being transferred, the ROD 4... can be used for the following tasks:

- Projection control on the left and right sides of the vehicle.
- Objects located in the transportation path must be recognised in time to prevent damage to the vehicle or to the load.

This task is reliably solved using ROD 4....

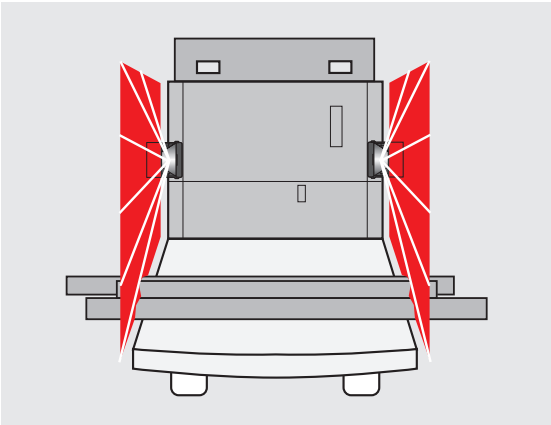


Figure 3.4: Use with a side-tracking skate

Other applications

- Buffing protection (e.g. for telfer lines)
- Contour measurement (e.g. in fully automatic car parks)
- Detection / counting of persons
- Room security / façade monitoring
- Access control
- Packet measurement / volume measurement
- etc.

4 Mounting

4.1 Mounting location

The ROD 4... unit should be mounted so that the area which is to be monitored is covered by the corresponding sensor safety field.



Attention!

Because of the optical scanning principle, only objects with good reflective properties are detected directly in front of the sensor window. Physical damage to the sensor (e.g. due to collision or climbing on) should be prevented by using a protective enclosure.

In order for the ROD 4... to function optimally, it must be mounted in a favourable position. You should make every effort to observe the following points:

- Position the ROD 4... in a protected location.
- The mounting location and the electrical supply should be located as close as possible to one another.

The following figure displays the relationship of the scanning plane with respect to the device housing. Here, the zero point for the distance measurement is the axis of rotation of the rotating mirror.

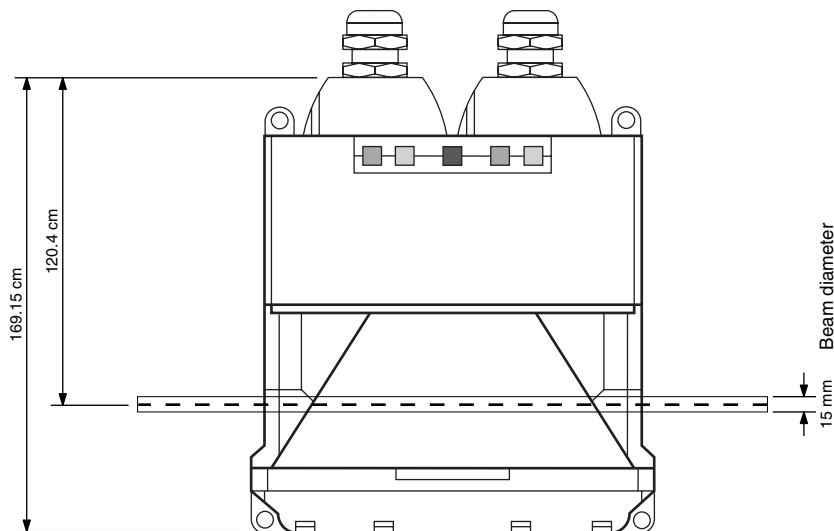


Figure 4.1: Scanning planes and device edges

For all mounting examples, an industry-suitable environment is assumed for the measurement error value.



Notice!

Under certain circumstances, a larger measurement inaccuracy can occur with strongly reflective backgrounds such as retro-reflectors (size: 100x100mm).

4.2 Mounting dimensions

The ROD 4... can be fastened using the holes on the rear of the device. No mounting kit is necessary in this case.

It is, however, recommended that the ROD 4... be mounted with the aid of the BT-ROD-4 mounting kit. The advantage of this mounting variant lies in the exchangeability of the device. The device can, in this way, be removed from the mounting kit and returned at a later time without readjusting the device.

With the aid of the BT-ROD 4 mounting kit, pitches of maximum 8° downward or upward are possible. In addition, the mounting kit allows lateral inclinations of up to ±4°.

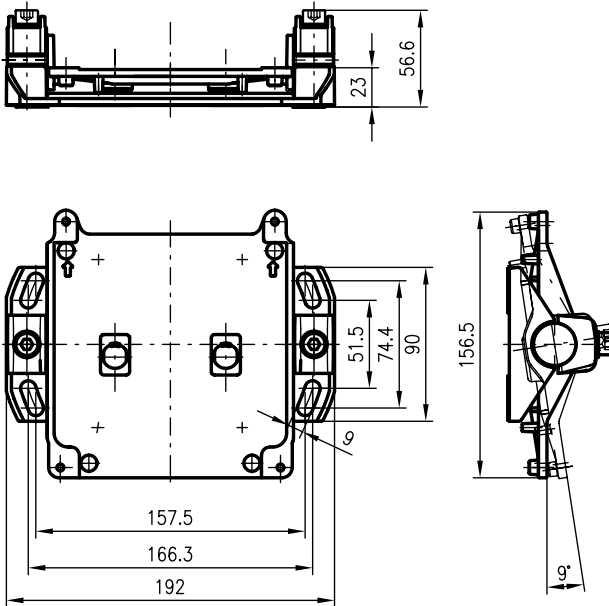


Figure 4.2: Mounting dimensions

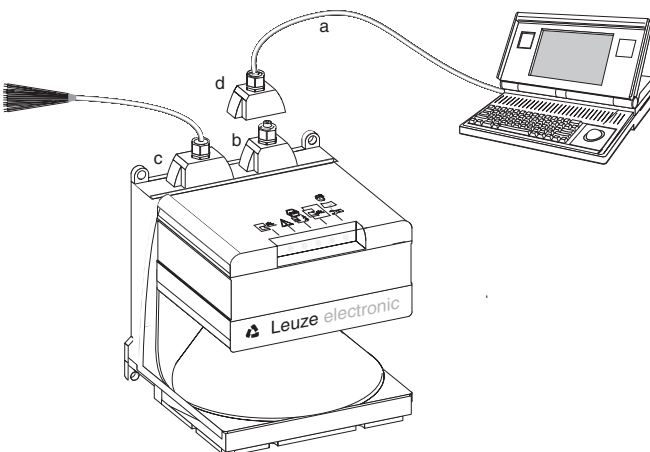
5 Electrical Connection

5.1 Connecting the rotoScan ROD 4...

For its electrical supply, the ROD 4... requires a DC voltage of 24V with a power of 10W plus the load at the outputs. The power supply must be protected using a 2.5A semi-time-lag fuse in the switch cabinet.

To configure the scanner, connect control cable (X1) to the power supply and the interface cable (X2) to the PC or laptop. Before commissioning the system, please check the pin assignments, the wiring, the supply voltage and the safeguarding. In spite of the scanner's robust housing and fittings, which include various internal safety mechanisms, damages resulting from misconnection remain possible.

PIN	Signal
1	GND
2	Restart
3	UB
4	SFU1
5	Alarm
6	SFU2
7	SFU3
8	SFU4
9	NC
10	NC
11	OSSD1
12	OSSD2
13	NC
14	NC
15	Warn



- a) Connection for parameterisation only
- b) Dummy connector
- c) Connector X1 (15-pin, SUB-D)
- d) Connector X2 (9-pin, SUB-D)

Figure 5.1: Connecting the rotoScan ROD 4...



Attention!

In normal operation, you **must** permanently connect the two connection housings with the ROD 4.... If one of the two connection housings is missing, the ROD 4... no longer meets protection class IP 65.

5.1.1 Interface assignment X1 and X2

Interface No.	Interface type	Interface function
X1	SUB-D15	Connections for: <ul style="list-style-type: none"> • Power supply • Switching and signal lines
X2	SUB-D9	rotoScan ROD 4... - PC interface <ul style="list-style-type: none"> • Parameter configuration • Detection zone definition • Data transmission • Diagnostics

Table 5.1: Interfaces of the rotoScan ROD 4... - X1 and X2

5.1.2 Connector assignments for interface X1

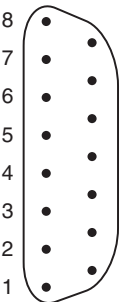
	PIN	Signal	Description
	1	GND	Supply voltage ground
	2	Restart	Safe input "restart-disable", reset the scanner and connection of the restart button
	3	UB	Supply voltage +24 V DC
	4	SFU1	Changeover to detection zone pair 1
	5	Alarm	Output upon violation of outer detection zone and for warning messages such as "window lightly soiled" or error messages such as "window heavily soiled" (both functions can be parameterised)
	6	SFU2	Changeover to detection zone pair 2
	7	SFU3	Changeover to detection zone pair 3
	8	SFU4	Changeover to detection zone pair 4
	9	NC	do not use!
	10	NC	do not use!
	11	OSSD1	Semiconductor output, shutdown upon violation of the inner detection zone, channel 1
	12	OSSD2	Semiconductor output, shutdown upon violation of the inner detection zone, channel 2
	13	NC	do not use!
	14	NC	do not use!
	15	Warn	Warning and error output

Table 5.2: SUB-D15 pin assignments for interface X1



Attention!

Any additionally used switching components (e.g. button for restarting) must be permanently mounted.

- Loosely position the button at the intended position.
- Switch on the voltage supply of the ROD 4... which has been configured for the application.
- Violate the active inner detection area, e.g. by entering it. The violation is indicated by the following status display (see also Chapter 10.1):



Red LED illuminated:
outputs OSSD1 and OSSD2 disabled

Yellow LED with continuous light:
restart-disable active

- Now actuate the restart button and observe the left, green LED. If this LED illuminates, you are no longer in the inner detection area and the location of the button is suitable. If the LED does not illuminate, there are still objects located within the inner detection area. In this case, change the location of the button and perform the test again.

5.1.3 Connector assignments for interface X2 (RS 232)

	PIN	Signal	Description
	1	NC	do not use!
	2	TxD	Data communication, transmission
	3	RxD	Data communication, reception
	4	NC	do not use!
	5	GND/shield	Ground/shielding (to be connected only on the cabinet side with PE)
	6	RS 232	RS 232 detection
	7	NC	do not use!
	8	NC	do not use!
	9	reserved	Reserved for test purposes, not wired

Table 5.3: SUB-D9 - pin assignments for the interface X2 as RS 232 port

5.1.4 Connector assignments for interface X2 (RS 422)



Notice!

If you would like to work with an RS 422 interface, you must connect PIN 6 with PIN 5 (GND) by means of a bridge.

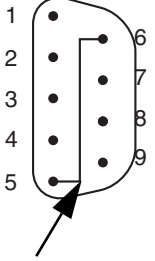
	PIN	Signal	Description
 <p>Connection PIN 5 to PIN 6</p>	1	TxD+	RS 422 transmitted data
	2	TxD-	
	3	RxD-	RS 422 received data
	4	RxD+	
	5	GND/shield	Ground/shielding (to be connected only on the cabinet side with PE)
	6	RS 422	RS 422 detection, select as interface RS 422 by bridging on PIN 5
	7	NC	do not use!
	8	NC	do not use!
	9	reserved	Reserved for test purposes, not wired

Table 5.4: SUB-D9 - pin assignments for the interface X2 as RS 422 port

5.2 Function characteristics of the X1 interface

5.2.1 Input switching

Two pluggable connection housing are located on the top of the device. A prewired cable is fastened to the connection housing with the SubD 15-pin interface by means of solder connections at the solder points of the plug (see figure 5.5).

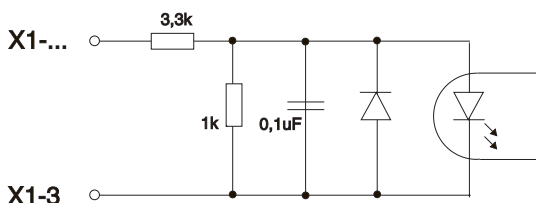


Figure 5.2: Inputs of interface X1

"SFU1 - SFU4"

With the ROD 4..., it is possible to work with up to four detection area pairs. Use the inputs X1-4 (SFU1), X1-5 (SFU2), X1-6 (SFU3) and X1-7 (SFU4) to changeover between the detection area pairs.

Example of detection area pair changeover:

- Detection area pair 1 (X1-4) is the active, primary detection area
- The +24VDC supply voltage is applied to detection area pair 2 (X1-6)
- In this state both detection area pairs are active
- Detection area pair 1 (X1-4) is switched off within one second
- In this state detection area pair 2 (X1-6) is active

The following situation would be possible with a DTS application:

The vehicle enters an intersection area while detection area pair 1 is switched on (①). To prevent objects from coming into danger, detection area pair 2 is switched on before the curve (②). Detection area pair 1 is switched off within one second. The vehicle travels around the curve with detection area pair 2 active (③). Afterward, detection area pair 2 is again switched off and detection area pair 1 activated. The vehicle continues to travel with detection area pair 1 active (④).



Notice!

The duration for the changeover between detection area pairs is limited to maximum 1 s.

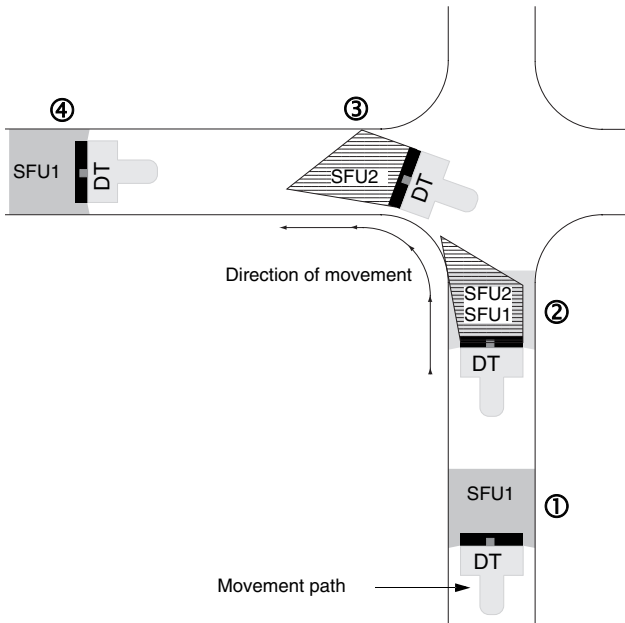


Figure 5.3: Detection area pair changeover with a DTS application



Notice!

When configuring the switching on or switching off of detection area pairs, make certain that the ROD 4... changes over within the response time.



Attention!

If no detection area pair or more than two detection areas are selected by you, ROD 4... reports an error via X1-5 and the corresponding LED in the display field.

"RESTART"

The RESTART input X1-2 has, depending on operating status, several functions:

- Enable restart after a detection area violation.
- New-start after correcting a device error.
- A high signal of at least 3 s and maximum 6 s duration triggers a RESET.

This input must be set from a separate button and may not be connected to the rest of the control system in order to prevent unintentional enabling of the system. The restart button must be positioned so that it cannot be activated by a person standing in a safety field.

5.2.2 Output switching

The signal outputs are used to control indicator lamps or relays which indicate the device status. This is switched from a transistor output with open collector set to "active high" (operating voltage).

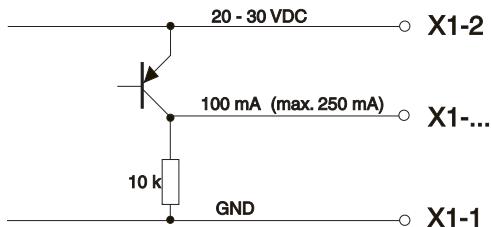


Figure 5.4: Outputs of interface X1

"Alarm" (X1-5)

X1-5 = "active high" signals that the device is ready for operation. A "low" output indicates one of the following conditions:

- Violation of the **outer** detection area
- Warning state, e.g. slightly soiled window detected – user should clean window before a device error is reported and outputs OSSD1 and OSSD2 are switched off
- Device error, e.g. resulting from a faulty reference measurement or heavily soiled window

Both the signalling upon violation of the outer detection area as well as the signalling of the warning state can be parameterised (see user manual for the configuration software "RODsoft").

"OSSD1" (X1-12) and "OSSD2" (X1-11)

These two semiconductor outputs report violation of the **inner** detection area.

5.3 Function characteristics of the X2 interface

The RS 232/422 interface (X2) is used to

- configure and parameterise the ROD 4...,
- transmit measurement data for viewing on a monitor,
- for analysing the co-ordinates during the parameterisation (e.g. for DTS applications) as well as
- for error diagnosis and troubleshooting.

The connection housing for interface X2 is delivered standard with a blank PG cable gland.

To configure and parameterise the ROD 4..., open the connection housing and connect your interface cable. After configuring and/or parameterising, connect the connection housing with the blank PG cable gland.

5.3.1 Wiring the plug

To connect the device, use the supplied connection housings.

Each connection housing consists of the following individual parts:

- Housing with sealing ring and cross-recessed fastening screws
- PG-cable glands (M16) with blank plugs
- SubD 9-pin plug or SubD 15-pin plug, each with solder connection

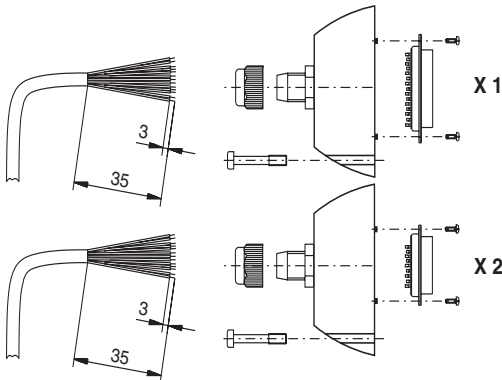


Figure 5.5: Plug wiring

Observe when wiring:

- cable cross-section = min. 0.5 mm²
- cable outer diameter = 5 ... 9mm
- max. cable length = 50m
- use shielded cable

5.4 Integration in the control system

The two following examples illustrate possibilities for connection to a control system.

After connecting the operating voltage PIN X1-3 (+U_B) to PIN X1-1 (GND) and activating at least one of the detection area pairs (X1-4, X1-6, X1-7 or X1-8), the device is ready for operation.

5.4.1 Connection example 1: without detection area pair changeover

Integrating the ROD 4... with discrete external wiring with relay or contactor without detection area pair changeover:

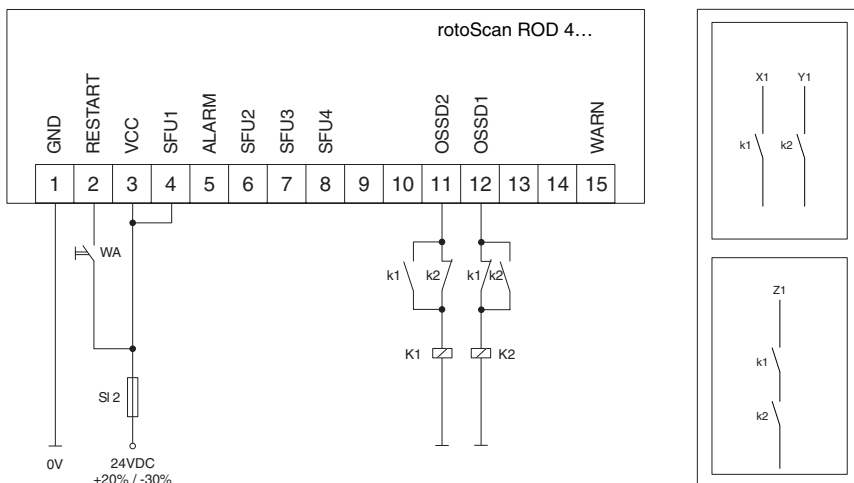


Figure 5.6: Connection example without detection area pair changeover

With this connection example, the restart-disable is realised by means of the command device "WA" connected at the RESTART input (X1-2). The device must, in this case, be configured with the software in such a way that the operating mode "with restart-disable" is active.

Detection area pair changeover is not provided in this example. For this purpose, directly connect SFU1 (X1-4) to the operating voltage VCC. The relays K1 and K2 used here have overlapping contacts (make before break) and are operated directly at the two semiconductor outputs OSSD1 (X1-12) and OSSD2 (X1-11).

The two semiconductor outputs possess an internal electronic current limit and are protected in the event of errors by fuse SI 2.

5.4.2 Connection example 2: with detection area pair changeover

Integrating the ROD 4... with discrete external wiring with relay or contactor with detection area pair changeover:

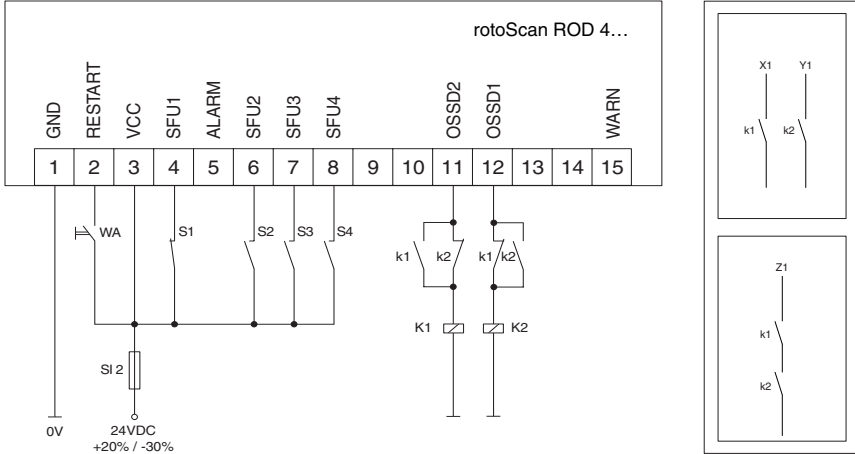


Figure 5.7: Connection example with detection area pair changeover

A detection area pair changeover of four detection area contours (an inner and an outer contour each) is possible via inputs X1-4 (SFU1), X1-5 (SFU2), X1-6 (SFU3) and X1-7 (SFU4) in this example. The restart-disable and contactor monitoring are realised via the RESTART input.

The ROD 4... is operated in this case in the operating mode "with restart-disable". The currently active, violated detection area is released by the command device "WA". The relays K1 and K2 used here have overlapping contacts (make before break) and are operated directly at the two secure semiconductor outputs OSSD1 (X1-12) and OSSD2 (X1-11).

6 Commissioning

The ROD 4... can be adapted by the user for the given application requirements.

6.1 Hardware and software requirements

First steps with the device require the basis ROD 4... unit, an interface cable and a PC. For the voltage supply, a power supply unit possessing the characteristics described in chapter "Technical Data" on page 28 is required.

The PC used should meet the following requirements:

- Intel® processor at Pentium® level or faster (or compatible models, e.g. AMD®)
- At least 16 MB RAM
- 3½" floppy drive
- Hard disk with at least 8 MB available memory.
If the detection area or configuration values are to be stored, additional disk space is required.
- Free RS 232 interface (serial) or alternatively RS 422
- Microsoft® Windows 95/98/NT/2000/XP

To install the configuration software "RODsoft", you need the five supplied installation floppy disks. The set-up program is provided on the first diskette. This program launches a self-explanatory installation routine. After the installation, the program is ready to be started.

6.2 Device configuration and parameterisation

For the device configuration and parameterisation, you require the configuration software "ROD-Soft", which is included in the delivery contents.

**Notice!**

The description of the program can be found in the user manual, which is also included in the delivery contents.

**Attention!**

We assume here, that you perform the user-specific configuration and parameterisation of the ROD 4... using this user manual.

Commissioning procedure:

- Install the configuration software on the PC (setup.exe)
- Connect the ROD 4... to the PC using a standard 9-pin sub-D cable
- Enter password "ROD 4LE" in level "authorised customer"

Short description:

The detection area can then be displayed under "Display measurement contour". Under "ROD 4 configuration" the response times, the detection area changeovers and other parameters are defined. To program the detection area, select the field "Define detection area". Error codes and other information are contained in the ROD 4 system data.

A more detailed description is included on the CD of this technical description.

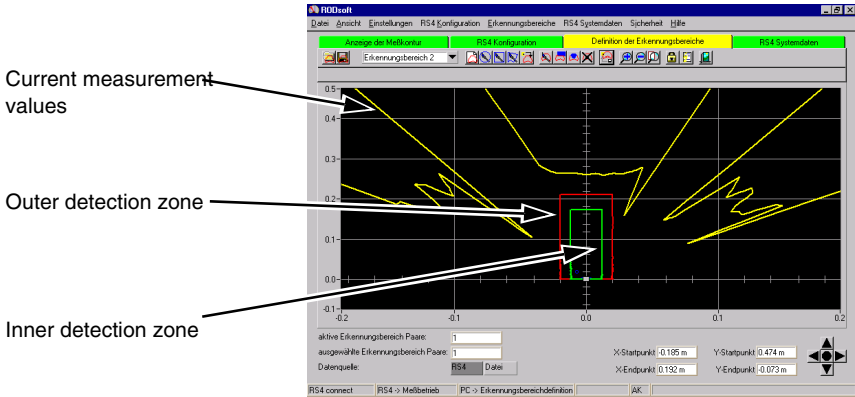


Figure 6.1: User interface of the configuration software



Attention!

Before commissioning the device, you must adjust the device parameters and the detection areas for your application. To do this, use the user manual as a guide to configure the ROD 4... in such a way that the given danger area is optimally protected by the device.

6.3 Screwing down and aligning the device

The ROD 4... is to be mounted and aligned as described in Chapter 4.

6.4 Switching on the device

Once the device is installed, the required device parameters set and the detection areas defined, the ROD 4... can be put into operation.

After you have switched on the voltage supply of the ROD 4..., the status display (see chapter 10.1 "Status display") remains undefined for the first seconds. Afterwards, the right yellow Error LED illuminates until the nominal rotational speed of the rotating mirror is achieved. Once the yellow Error LED goes out, the ROD 4... is ready for operation.



Figure 6.2: LEDs



Notice!

If the ROD 4... has not yet been configured, i.e. the device is still in the delivery state (restart-disable is switched on in this state), the Error LED is continuously illuminated. For commissioning, adjust the application parameters appropriately for your application (see Chapter 6.2).

7 Technical Data

7.1 Detection area data

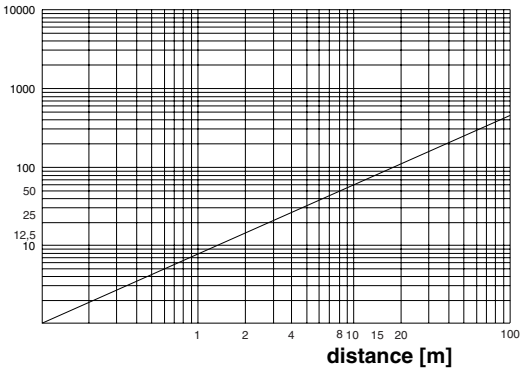
Inner detection area	
Detection area	ROD 4/ROD 4-06: 0 ... 50m ROD 4-08: 0 ... 25m
Reflectivity	ROD 4/ROD 4-06: from min. 1.8% (matte black) ROD 4-08: from min. 6%
Object size	see Figure 7.1
Response time	at least 40ms (corresponds to 1 scan)
Number of detection area pairs	4 (selectable via switching inputs)
Output	two PNP transistor outputs, 24V/250mA
Start-up	the start-up testing and start disable are parameterised separately.

Outer detection area	
Detection area	ROD 4/ROD 4-06: 0 ... 50m ROD 4-08: 0 ... 25m
Reflectivity	ROD 4/ROD 4-06: from min. 1.8% (matte black) ROD 4-08: from min. 6%
Object size	see Figure 7.1
Response time	at least 40ms (corresponds to 1 scan)
Number of detection area pairs	4 (selectable via switching inputs)
Output	one PNP transistor output, max. 100mA

Contour measurement	
Scanning range	ROD 4/ROD 4-06: 0 ... 50m ROD 4-08: 0 ... 25m
Luminosity coefficient	see Figure 7.1
Object size	see Figure 7.1
Output	serial interface RS 232, RS 422
Resolution / sector	5mm
Sector width	0.36°
Repeatability	± 15mm

Table 7.1: Technical Data - Detection Areas

object size [mm]



remission [%]

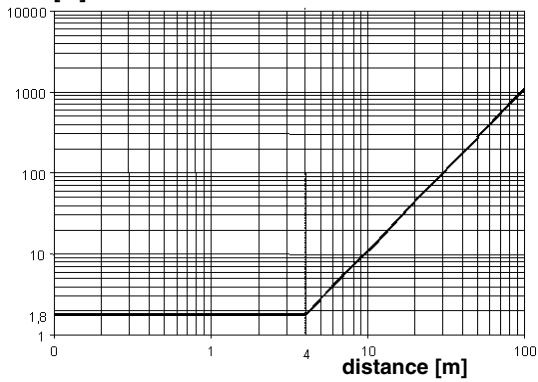


Figure 7.1: Object size/diffuse reflection as a function of distance for the ROD 4/ROD 4-06

7.2 General Specifications

Power supply	
Voltage supply	+24VDC +20% / -30%
Overcurrent protection	via fuse 2.5A semi-time-lag in the switching cabinet
Current consumption	approx. 400mA (approx. 2A with heating)
Power consumption	10 ... 50W at 24VDC
Overvoltage protection	overvoltage protection with protected limit stop
Voltage dips	acc. to EN 61496-1 (VDE 0113, part 201)

Inputs	
Restart/Reset	command device for operating mode with restart-disable and/or device reset; dynamically monitored, 24VDC optically decoupled (activate for 2s)
Detection zone pair switching	select from 4 detection area pairs via 4 control lines with internal monitoring (detection area pairs = 1,2 ; 3,4 ; 5,6 ; 7,8), 24VDC optically decoupled

Outputs	
for inner detection area	2x semiconductor output, PNP max. 250mA short-circuit monitored, overcurrent protected, load must demonstrate lowpass characteristics, limit frequency $f_g \leq 1$ kHz
for outer detection area/ soiling	PNP transistor output, max. 100mA
Warning and error output	PNP transistor output, max. 100mA

Parameterisation	
Configuration software	configuration software "RODsoft" under Windows 9x/NT/2000/XP with secure protocol for programming

Interfaces	
RS 232 RS 422	among others for device parameterisation

Optical properties	
Angular range	max. 190°
Angular resolution	0.36°
Scanning rate	25scans/s or 40ms/scan
Laser safety class	class 1 (eye safe), DIN EN 60825-1 wavelength = 905 nm beam divergence = 2 mrad time base= 100s
Laser beam	approx. 15 mm diameter
Environmental and material data	
Protection class	IP 65 acc. to IEC 60529
Contact protection	all-insulated safety class 2
Operating temperature	0°C ... +50°C, with heating -20°C ... +50°C
Storage temperature	-20°C ... +60°C
Humidity	DIN 40040 Table 10, code letter E (moderately dry)
Dimensions	140x155x135 (WxHxD) in mm
Distance from scanning plane to bottom edge of housing	approx. 50mm
Connection	2 connectors (can be plugged from above, solder connection)
Cable length	max. 50m with conductor cross-section 0.5mm ²
Transmitter	infrared laser diode ($\lambda = 905\text{nm}$)
Housing	diecast aluminium, plastic
Weight	approx. 2kg
Vibrating stress	acc. to IEC 60068 part 2 - 6, 10 ... 55 Hz max. 5 G
Continuous shock	acc. to IEC 60068 part 2 - 29, 10 G, 16 ms
Interference rejection	as per DIN EN 61496-3 (in accordance with the requirements for type 4) as well as per DIN 40839-1/3 test impulse 1, 2, 3a, 3b and 5 (no application for vehicles with combustion motors)
Rotating mirror drive	brushless DC motor
Rotating-mirror bearings	maintenance-free ball bearing

Table 7.2: Technical Data - General Data

7.3 Dimensioned drawings

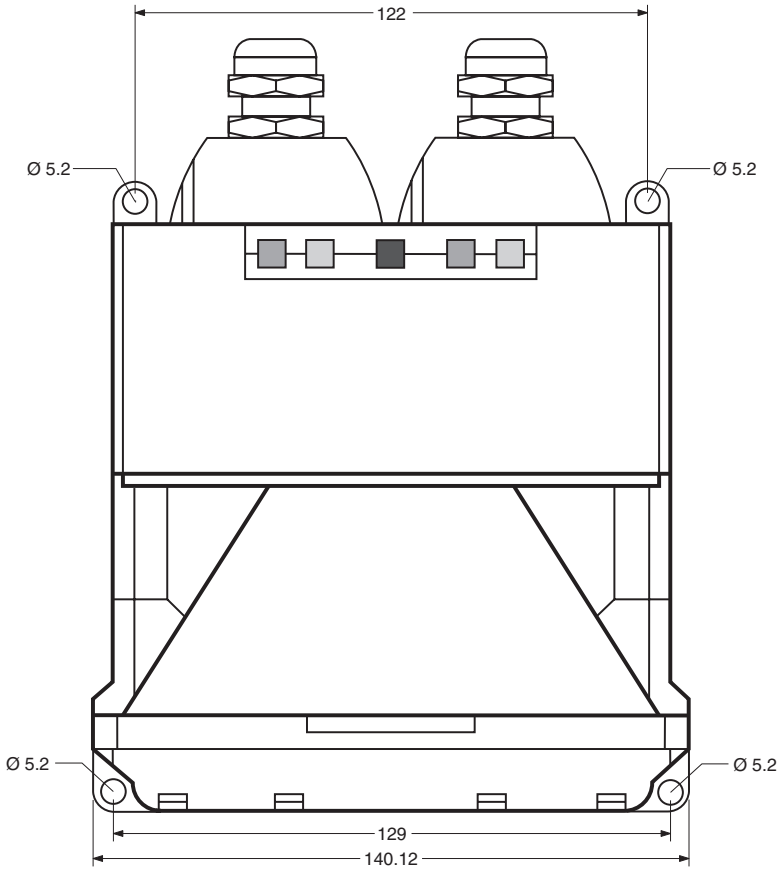


Figure 7.2: Front view

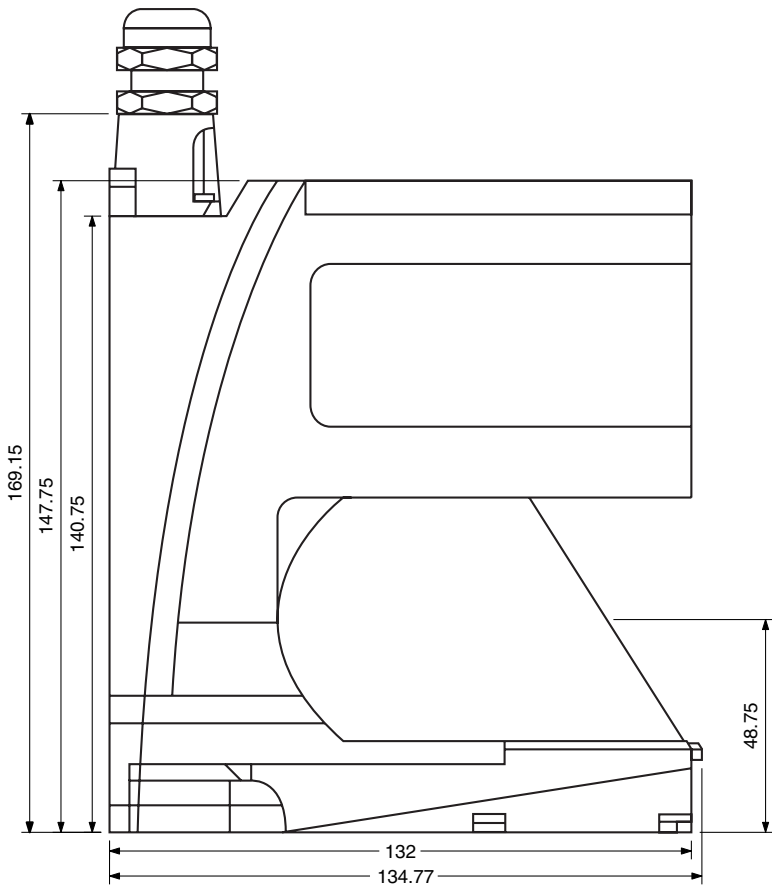


Figure 7.3: Lateral view

8 Scope of Delivery

The basic unit consists of:

- rotoScan ROD 4...
- 2 connector covers, including connectors for solder connection
- "RODsoft" Configuration Software
- rotoScan ROD 4... technical description
- user manual "RODsoft" Configuration Software

The following **accessories** are available:

- mounting kit BT-ROD 4
- cable with connector set (5m and 10m)

9 Maintenance

The response of the detection area should be checked annually to ensure availability.

The front cover should be cleaned in regular intervals (application dependent) with a soft cloth and commercially available glass cleaner.



Attention!

Do not use solvents or cleaning agents containing acetone. Use of improper cleaning agents can damage the optical window.

If window monitoring continues to report a soiled cover even after cleaning, it must be replaced with a new front cover.



Attention!

When replacing the front cover, the ROD 4... must always be disconnected from the voltage supply. The replacement must only be performed by trained personnel in a clean environment.

After replacing the front cover, the window sensors must be adjusted with the aid of the "RODsoft" configuration software (see "RODsoft" user manual).

10 Status Messages, Errors and Error Rectification

10.1 Status display

The status of the ROD 4... can be read using the five LEDs located on the front side. A white cover protects the LEDs from contamination and guarantees protection class IP 65. When in a voltage-free state, the LEDs are hidden from view by this cover.

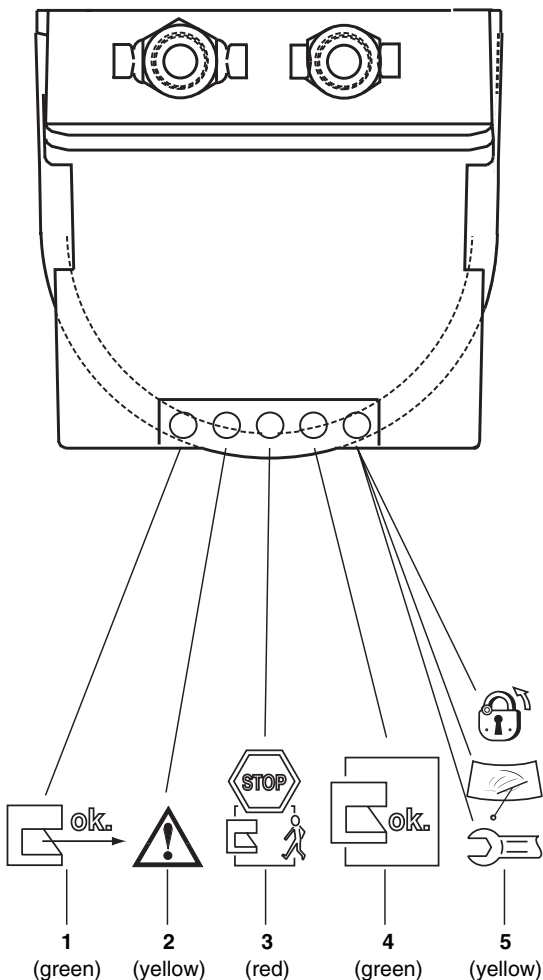


Figure 10.1: Status display ROD 4...

LED	Colour	Function / Meaning
1	green	sensor functions active, inner detection area is free
2	yellow	outer detection area is occupied
3	red	OSSD outputs are switched off
4	green	OSSD outputs are free
5	yellow	<ul style="list-style-type: none"> slow flashing (SF): warning message fast flashing (FF): error message continuous light (CL): restart-disable locked

10.2 Status displays



Notice!

The rotoScan ROD 4 uses two different types of messages at the "Alarm" output:

Warning message - Information for the user indicating that a non-critical device error has been detected (e.g. window contamination).

Error message - System has detected a critical device error and switches off the semiconductor outputs OSSD1 and OSSD2.







LED	Status
	<ul style="list-style-type: none"> inner detection area is free, OSSD outputs (X1-11, X1-12) are enabled.
	<ul style="list-style-type: none"> inner detection area is free, OSSD outputs (X1-11, X1-12) are enabled, outer detection area is occupied, (output X1-5 "Alarm-OSF" is enabled)
 SF	<ul style="list-style-type: none"> inner detection area is free, OSSD outputs (X1-11, X1-12) are enabled, warning message due to e.g. soiled front cover
 CL	<ul style="list-style-type: none"> inner detection area is occupied, OSSD outputs (X1-11, X1-12) are disabled, restart-disable is active
 CL	<ul style="list-style-type: none"> inner detection area is free, OSSD outputs (X1-11, X1-12) are disabled, restart-disable is switched on
 FF	<ul style="list-style-type: none"> inner detection area is occupied, OSSD outputs (X1-11, X1-12) are disabled, output "Alarm-Error" (X1-5) is enabled

Table 10.1: Status displays on the rotoScan ROD 4