Leuze electronic

the sensor people

RODsoft

Configuration software for ROD4-3... / ROD4-2... / ROD4

GB 02-11/08 50110695

SOFTWARE AND PROTOCOL DESCRIPTION

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1 General information

1.1 About the program "RODsoft"

The software described here is intended for the configuration of the rotoScan ROD4 with the use of a PC.

The present **Version 1.16** of ROD4 the configuration software has been compiled for Microsoft® Windows 95/98/NT/2000/XP/Vista and permits the configuration of all ROD4 model generations ROD4-3…, ROD4-2… and ROD4/ROD4-0….

Notice!

This manual describes software version 1.16 in combination with the latest device generation ROD4-3….The previous products (ROD4 and ROD4-2…) can also be configured with RODsoft V1.16. In this case, parameters that are not supported are not displayed in the user interface; the previous products only use functions and configuration values that existed at that point in time.

With this software, it is possible to follow the measurement contour scanned by the ROD4-3… and to visualise any objects detected in the detection fields. The detection fields can be created with the program and adjusted to conform to the environment.

By means of an easy-to-use software interface, the ROD4-3… can be configured for a wide range of application areas.

Additional diagnostic and service functions round out the software.

1.2 Explanation of symbols

The symbols used in this description are explained below.

Attention!

This symbol precedes text messages which must strictly be observed. Failure to heed this information can lead to injuries to personnel or damage to the equipment.

Notice!

This symbol indicates text passages containing important information.

1.3 Contact address

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2 Hardware and software installation

2.1 Hardware

2.1.1 Connecting the rotoScan ROD4-3…

To configure the sensor, connect control cable (X1) to the power supply (safety transformer 24 V, 2.5 A, 1.25 A semi-time-lag fuse) and the interface cable (X2) to the PC or notebook. Before commissioning the system, please check the pin assignments, the wiring, the supply voltage and the safeguarding. In spite of the sensor's robust housing and fittings, which include various internal safety mechanisms, **damages resulting from misconnection** cannot be excluded.

Notice!

The connection of the ROD4-3… is described here only briefly. Detailed information can be found in the technical description "Area Scanning Distance Sensor rotoScan ROD4-3…".

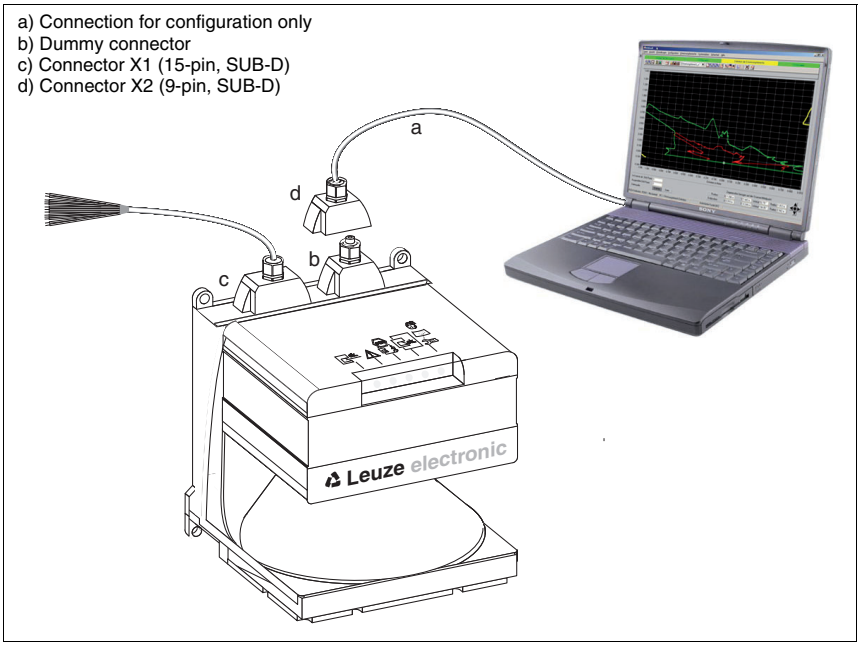


Figure 2.1: Connecting the rotoScan ROD4-3…

2.1.2 Interface assignment X1 and X2

Interfacees of the rotoScan ROD4-3…

Connection	Connector	Signals
X1	SUB-D 15-pin	• Power supply • Switching outputs/alarm output • Inputs for field pair changeover • Restart/reset input • Configuration connector
X2	SUB-D 9-pin	rotoScan ROD4-3… <–> PC interface • Parameter configuration • Detection field definition • Measurement data transfer • Diagnosis

Table 2.1: Interfaces X1 and X2

2.1.3 Connector assignments for connection X1

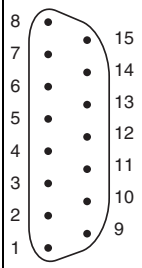
	PIN	Signal	Description	Wire colour KB-ROD4-…
	**1**	GND	Supply voltage ground	black
	2	Restart	Safe input "restart-disable", reset of the sensor and connection of the restart button	blue
	3	UB	Supply voltage +24 V DC	red
	4	FPS1	Changeover of detection field pairs	orange
	5	ALARM1	Output for object detection in the **far** detection field and for warning messages such as "Window lightly soiled" or "Window heavily soiled" (configurable). 4-field mode: Output for object detection in detection field_f 1	yellow
	6	FPS2	Changeover of detection field pairs	green
	7	FPS3	Changeover of detection field pairs	violet
	8	FPS4	Changeover of detection field pairs	grey
	9	NC	Do not use!	–
	10	NC	Do not use!	–
	11	Fn1	Semiconductor output, shutdown on object detection in the **near** detection field, channel 1. 4-field mode: Output for object detection in detection field_n 1	white
	12	Fn2	Semiconductor output, shutdown on object detection in the **near** detection field, channel 2. 4-field mode: Output for object detection in detection field_n 2	white/black
	13	NC	Do not use!	–
	14	NC	Do not use!	white/brown
	15	ALARM2	Warning and error output 4-field mode: Output for object detection in detection field_f 2	brown

Table 2.2: SUB-D15 pin assignments for interface X1

2.1.4 Connector assignments for connection X2 (RS 232)

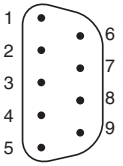
	PIN	Signal	Description
	**1**	NC	Do not use!
	2	TxD	Data communication, transmission
	3	RxD	Data communication, reception
	4	NC	Do not use!
	5	GND/shield	Ground/shielding (to be connected only on the cabinet side with PE)
	6	RS 232	Selection RS 232/RS 422, selection as RS 232 interface: do not use!
	7	NC	Do not use!
	8	NC	Do not use!
	9	Reserved	Reserved for test purposes, not wired

Table 2.3: SUB-D 9-pin – pin assignments for connection X2 as RS 232 port

2.1.5 Connector assignments for connection 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.

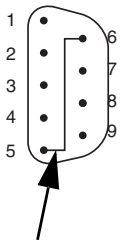
	PIN	Signal	Description
	**1**	TxD+	RS 422 transmitted data
	2	TxD-	
	3	RxD-	RS 422 received data
	4	RxD+	
	5	GND/shield	Ground/shielding (to be connected only on the cabinet side with PE)
	6	RS 422	Selection RS 232/RS 422, selection as RS 422 interface: bridge to PIN 5!
	7	NC	Do not use!
	8	NC	Do not use!
	9	Reserved	Reserved for test purposes, not wired

Table 2.4: SUB-D 9-pin – pin assignments for connection X2 as RS 422 port

2.2 Software

2.2.1 System requirements

- Intel® processor at Pentium® level or faster (or compatible models, e.g. AMD®)
- At least 16 MB RAM
- CD-ROM drive
- Hard disk with at least 30 MB available memory.
- Free RS 232 interface (serial) or alternatively RS 422
- Microsoft® Windows 95/98/NT/2000/XP

2.2.2 Installation

The supplied installation CD-ROM is required for installing the **RODsoft** configuration software. Alternatively, the **RODsoft** configuration software is available for download on the Internet under http://www.leuze.de.

A self-explanatory installation routine is started with the **Setup.exe** setup program. After the installation, the program is ready to be started.

3 First steps

3.1 General remarks

Attention!

Ensure that the connectors for interfaces X1 and X2 are correctly fabricated and that all cables are correctly connected. Serious, partially irreparable device errors may result if the X1 interface of the rotoScan ROD4-3… is wired incorrectly. If the connector for the X2 interface is wired incorrectly, the configuration data may either not be transferred at all or only in part. Also be certain to read the document "Area Scanning Distance Sensor rotoScan ROD4-xx - Technical Description". It contains important information on working with the RODsoft software.

Notice!

Switch on the power supply of the ROD4-3… before starting the ROD4-3… configuration software. Data cannot otherwise be received by the device. However, even if the ROD4-3… is not connected to the PC, you may still define parameters in Offline mode and save them on the hard disk or evaluate previously stored data.

3.2 Launching the program

To start the RODsoft configuration software, make the following menu selection: **Start** → **All Programs** → **Leuze electronic** → **RODsoft**, item **RODsoft**.

Retrieving configuration data from the ROD4-3…

After starting, your computer – together with the program – establishes a connection to the rotoScan ROD4-3… and transfers the current configuration data from the ROD4-3… to the program.

During this process, the following window appears on the screen:

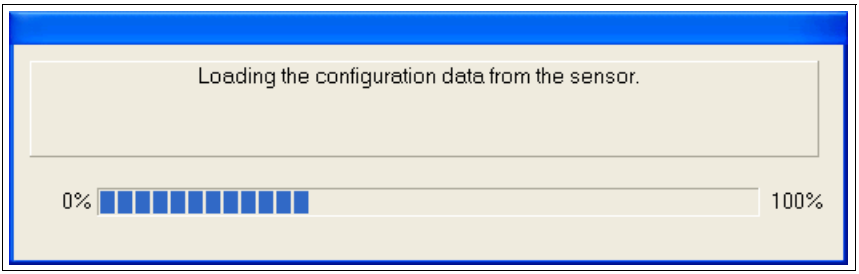


Figure 3.1: Transfer of the current configuration data

Notice!

If this process is not completed successfully, the device is not ready for operation or the connection cable is connected incorrectly.

*When starting the software without a ROD4-3… connected, you can still **create a configuration offline** and save it as a file. Select the Authorized User (AU) access level (password: ROD4LE) and edit the configuration data using the assistant.*

Defining the access level

In the next step, you are prompted by the program to identify your authorisation status by selecting an access level and entering a password which has been defined for this level.

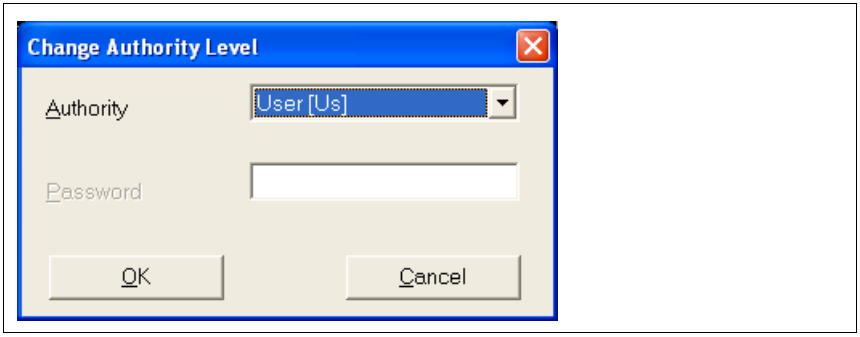


Figure 3.2: Changing the access level

For the default setting of the "User" access level, no password is required.

As User, you can display measurement values. Configuration parameters and detection fields cannot be changed (see chapter 4.5).

ROD4-3…Status information

If your access authorisation was accepted, the ROD4-3… status information is read in and displayed in a window.

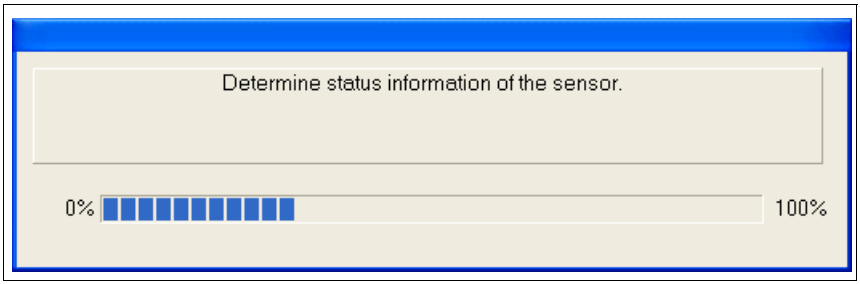


Figure 3.3: Reading in the status information

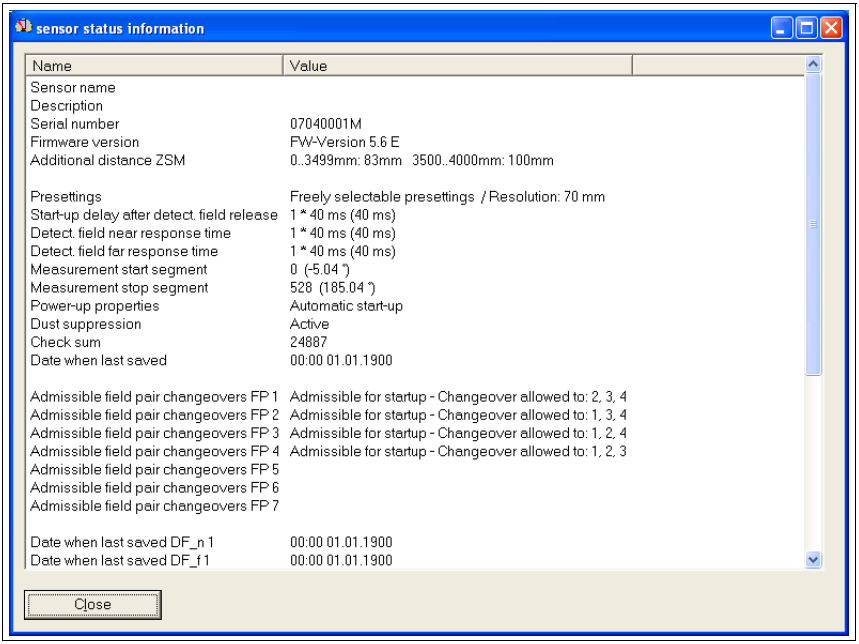
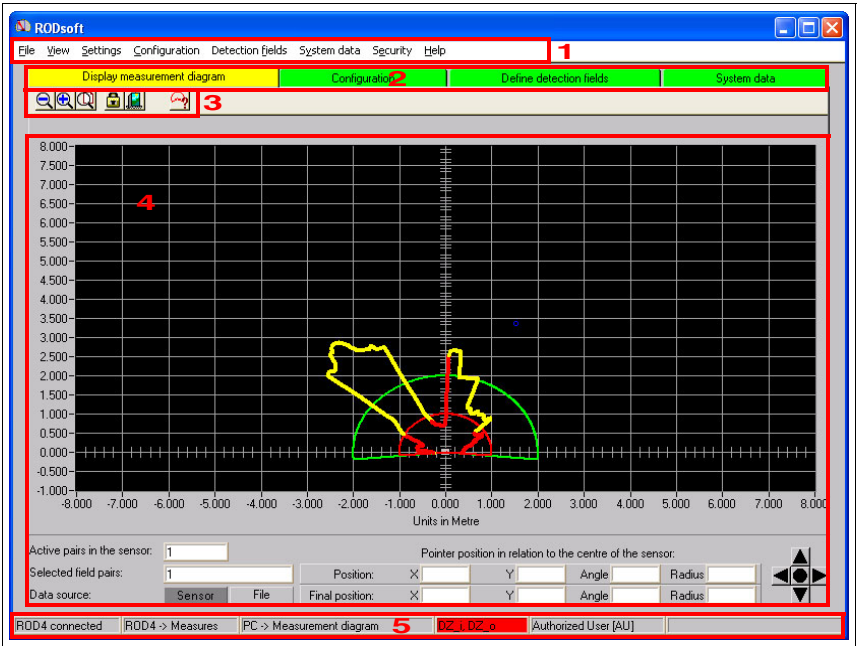


Figure 3.4: ROD4-3…Status information

User interface of the program

After you close the window which contains the sensor status information, the user interface of the configuration software appears in the foreground:



1 Menu bar

2 Tab with the 4 work areas:

- Display measurement diagram (active = yellow)
- Configuration
- Define detection fields
- System data

3 Tab-dependent function buttons

4 Graphic work area

5 Status bar

Figure 3.5: RODsoft user interface

3.3 Procedure / work areas

With RODsoft, you can work **both online** (with connected sensor) **as well as offline** (without connected sensor). To change the work area, click the appropriate tab. The active tab is displayed in yellow.

Typical procedure

- Connect sensor and start program. The current configuration data are loaded by the sensor.
- Select the Authorized User (AU) access level (password: ROD4LE).
  The status information is loaded by the sensor.
- Edit the sensor configuration and define detection fields.
- Transfer new configuration to the sensor and back up the data by saving to a file.
- Test new configuration in measurement operation.

"Display measurement diagram" tab

Measurement operation is activated; the environment is scanned and the contours of objects present in the measurement range are displayed in yellow. The current detection fields are displayed here in red (near detection field) or green (far detection field).

"Configuration" tab

All functions necessary for configuring the sensor and setting parameters are available here. The sensor configuration can be edited with the aid of the Configuration Wizard or directly in the parameter tree structure. The configuration data can be loaded by the sensor or from a file and saved to either the sensor or as a file.

For documentation purposes, the current configuration can be printed or saved as a text file. In this work area, the sensor can be reset to standard configuration values (factory setting).

"Define detection fields" tab

This work area supports the application-specific definition of up to 7 detection field pairs. The detection fields can be taught, created interactively with the mouse using the graphical interface or entered numerically. Detection fields which have already been defined can be changed, faded out or borders cut on a segment-by-segment basis.

By defining a reference boundary, not only is the active near detection field monitored, but the exact measurement values are also compared with the reference boundary.

Detection fields can be deleted, saved in the sensor or as a file and printed out.

"System data" tab

This work area is used primarily for device identification and diagnostics. Status information and diagnostic data can be loaded by the sensor. A service file can be created which contains all information necessary for diagnosing the sensor.

In addition, adjustment of the front window sensor can be performed here (e.g. following an exchange) and the sensor can be reset.

4 Description of the user interface

4.1 Graphical work area / detection fields

Various components comprise the actual graphical work area of the program. The work area serves primarily for reading the measurement values and defining the detection fields.

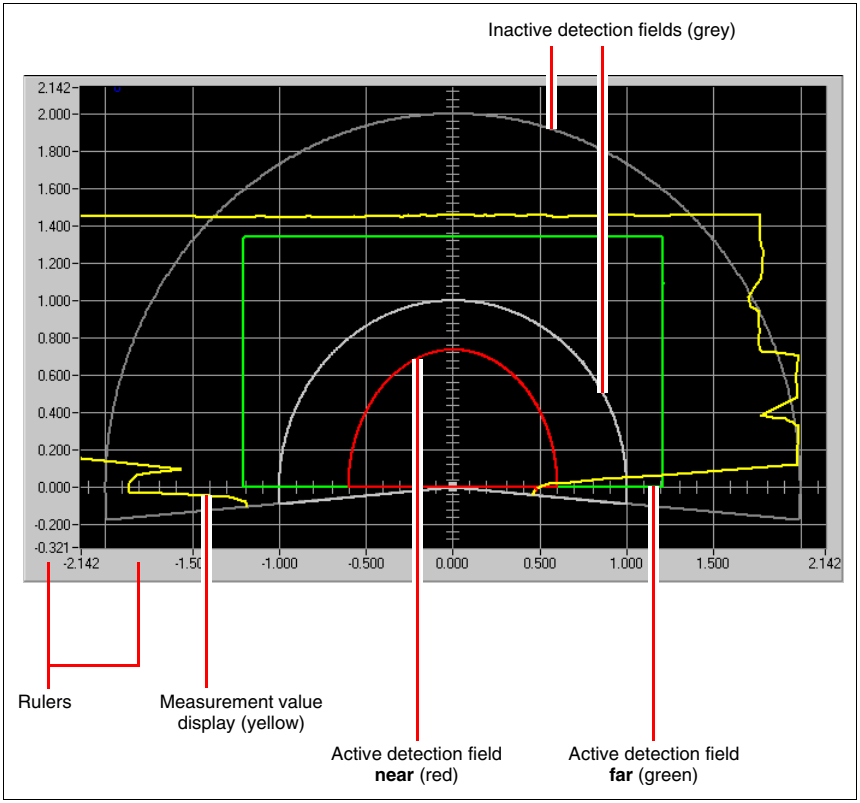


Figure 4.1: Objects on the work area

Rulers

"Meter" is the unit of measurement used for the rulers. When you zoom, the gradations on the rulers change appropriately for the given zoom level.

Displaying measurement values

In the "Display measurement diagram" tab, you can view the current measurement values of the sensor as a yellow curve. The laser in the device scans the environment at a scanning rate of 25Hz. If an object enters the scanning area, it is therefore detected by the laser within no more than 40ms. In the display, the object is displayed simultaneously with the detection by the laser.

Notice!

The display of the measurement values on the screen corresponds to the alignment of the ROD4-3…. If a person or object e.g. in the view direction of the ROD4-3… enters the scanning area from the right, the measurement line changes at the right.
You can, however, also rotate the graphical work area by 180°.

In the "Configuration" and "System data" operating modes, the last measurement contour measured prior to switching to the given operating mode is frozen on the screen.

Detection fields / detection field pairs

Eight reversible detection field pairs (7 configurable + 1 permanently defined) enable optimal adaptation to the applications. A detection field pair is considered to be the combination of both a **near** and **far** detection field. The following designations are used in the **RODsoft** configuration software:

Detection field pair x consists of **detection field_n x** (near) and **detection field_f x** (far).

The **near** and **far** detection fields are represented by different colours in the RODsoft configuration software: **near** = red, **far** = green.

Detection field pairs 1 … 7 can be freely defined by the user. Detection field pair 8 is permanently defined. Both detection field_n 8 as well as detection field_f 8 are set to zero here. This means that no area monitoring takes place when detection field pair 8 is activated, and the respective outputs are switched on.

The near detection fields (1 … 7) can be defined with a radius of up to 30m; the far detection fields (1 … 7) can be defined with a radius of up to 50m.

4.1.1 Changing over between detection field pairs

Attention!

Depending on which detection field pairs are configured, 1 or 2 detection field pairs may be simultaneously active and simultaneously monitored!

Only detection field pairs 1 through 4 are configured

If only detection field pairs 1 through 4 are configured in the **RODsoft** configuration software, i.e. it is only possible to start with a field pair between 1 and 4 and it is only possible to changeover between a field pair between 1 and 4, then a maximum of 2 detection field pairs may be simultaneously active and monitored.

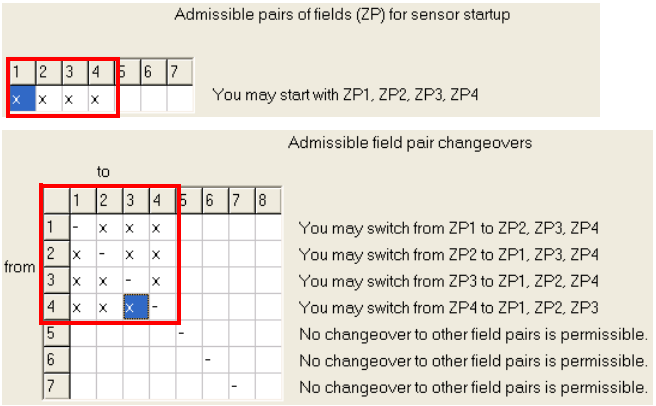


Figure 4.2: Configuring detection field pairs 1 through 4 only

The four control inputs FPS1 ... FPS4 can be used to change over between the detection field pairs. The following table shows the admissible control options.

Control input				Meaning
FPS1	FPS2	FPS3	FPS4	
0	**0**	**0**	**0**	Detection field pair **1** is active
1	**0**	**0**	**0**	Detection field pair **1** is active
0	**1**	**0**	**0**	Detection field pair **2** is active
1	**1**	**0**	**0**	Detection field pairs **1 and 2** are active
0	**0**	**1**	**0**	Detection field pair **3** is active
1	**0**	**1**	**0**	Detection field pairs **1 and 3** are active
0	**1**	**1**	**0**	Detection field pairs **2 and 3** are active
1	**1**	**1**	**0**	**Not permitted**
0	**0**	**0**	**1**	Detection field pair **4** is active
1	**0**	**0**	**1**	Detection field pairs **1 and 4** are active
0	**1**	**0**	**1**	Detection field pairs **2 and 4** are active
1	**1**	**0**	**1**	**Not permitted**
0	**0**	**1**	**1**	Detection field pairs **3 and 4** are active
1	**0**	**1**	**1**	**Not permitted**
0	**1**	**1**	**1**	**Not permitted**
1	**1**	**1**	**1**	**Not permitted**

Table 4.1: Changeover of the detection field pairs via the control inputs

If an inadmissible state exists at the control inputs for more than 80 ms, the sensor switches to the error state.

One of detection field pairs 5 through 8 is also configured

If, in addition to detection field pairs 1 through 4, at least one of detection field pairs 5 through 8 is also configured in the **RODsoft** configuration software, i.e. it is possible to start with a field pair between 1 and 7 and/or it is possible to changeover between a field pair between 1 and 8, then only 1 detection field pair may be simultaneously active and monitored.

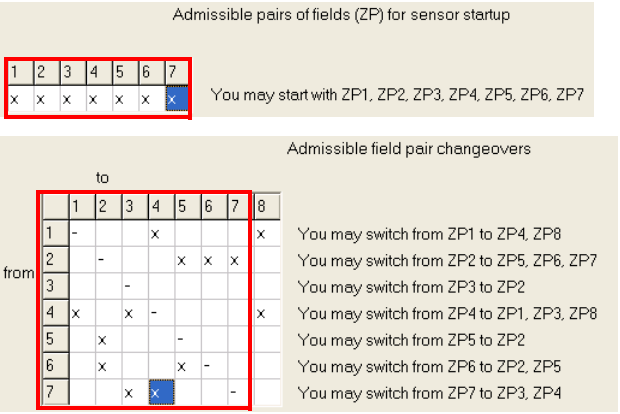


Figure 4.3: Also configuring detection field pairs 5 through 8

In this case, the four control inputs can be used to change over between the detection field pairs as follows.

Control input				Meaning
FPS1	FPS2	FPS3	FPS4	
0	0	0	0	Detection field pair **1** is active
1	0	0	0	Detection field pair **1** is active
0	1	0	0	Detection field pair **2** is active
0	0	1	0	Detection field pair **3** is active
0	0	0	1	Detection field pair **4** is active
1	1	1	0	Detection field pair **5** is active
1	1	0	1	Detection field pair **6** is active
1	0	1	1	Detection field pair **7** is active
0	1	1	1	Detection field pair **8** is active
1	1	0	0	**Not permitted**
1	0	1	0	**Not permitted**
0	1	1	0	**Not permitted**
1	0	0	1	**Not permitted**
0	1	0	1	**Not permitted**
0	0	1	1	**Not permitted**
1	1	1	1	**Not permitted**

Table 4.2: Changeover of the detection field pairs via the control inputs

While changing over between 2 detection field pairs, inadmissible states at the control inputs are tolerated for a duration of 40ms; after this period the sensor switches to the error state. The changeover between 2 detection field pairs occurs within a system reaction time of 80ms.

4.1.2 4-field mode

In 4-field mode (configuration via **RODsoft**), all 4 detection fields of detection field pairs 1 and 2 are simultaneously activated and evaluated. In this case, a separate output is assigned to each detection field pair.

Detection field	Switching output			
	Fn1	Fn2	ALARM1	ALARM2
Detection field_n 1	X			
Detection field_n 2		X		
Detection field_f 1			(X)	
Detection field_f 2				X

Table 4.3: Assignment of detection field to switching output in 4-field mode

Inputs FPS1 … FPS4 are not evaluated in 4-field mode. Detection field changeover is not possible in 4-field mode.

The 4-field mode is activated:

- in the configuration assistant under **Presettings** or
- using the menu command **Configuration –> Change –> Configuration Parameters –> Presettings**.

Attention!

Depending on the configuration, output ALARM1 may, in some cases, also signal device warnings. This means that a violation of detection field_f 1 is not uniquely signalled under certain circumstances.
All outputs are switched off during start-up. Outputs ALARM1 and ALARM2 are activated during configuration.

Notice!

Operation with 3 detection fields

If only three detection fields are to act on three outputs, only use detection field_n 1, detection field_n 2 and detection field_f 2 and set the alarm signal type for ALARM1 to "Device warning". The output ALARM1 will then only signal device warnings and is, as a result, unique.

Operation with 2 detection fields

If only two or fewer independent outputs are needed, 4-field mode is not required and should be deactivated with the appropriate RODsoft parameter.

4.1.3 Displaying measurement diagram/detection fields

In "Display measurement diagram", you can always see if an object is approaching the respective detection field or if an object has been detected within a detection field (the yellow measurement contour enters the green or red area, see figure 4.4). If the entering of the object into an active near detection field leads an object detection, the measurement contour is coloured red at this position.

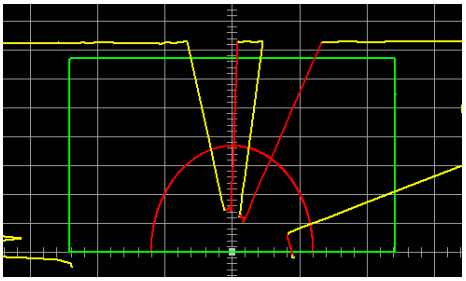


Figure 4.4: Object detection within the detection fields

If you would like to monitor only one detection field pair on the screen, you can fade out the other detection field pairs using the **Settings –> Display field pairs** menu item or the icon in the "Display measurement diagram" operating mode.

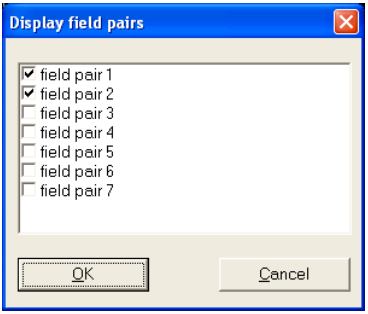


Figure 4.5: Selection of the detection field pair to be displayed

Notice!

Displaying/hiding a detection field in RODsoft has no effect on how it is monitored by the sensor! Only after a detection field pair is activated via the control inputs is it monitored by the sensor.

You can adapt detection fields to your application by editing them in the "Define detection fields" operating mode (see chapter 6).

4.2 Tabs and toolbar

4.2.1 Tabs

To simplify work with the RODsoft configuration program, the software interface is divided into 4 work areas (see chapter 3.3).

These work areas correspond to the four operating modes in the **Settings –> Operating mode** menu and are displayed as tabs. Each tab or operating mode has a toolbar of its own. How the detection field values are displayed is dependent on the selected operating mode.

You can select the operating mode either by **Clicking the respective tab** or with the **Settings –> Operating mode** menu item.

Notice!

Depending on the adjustments made previously in a given operating mode, you may, under certain circumstances, be prompted to update the data with the sensor before switching to a different operating mode.

4.2.2 Buttons

The buttons in the toolbar serve as a shortcut to commands which can also be selected from the menu bar.

General buttons

The following figure shows the general buttons, which are available in all 4 work areas:

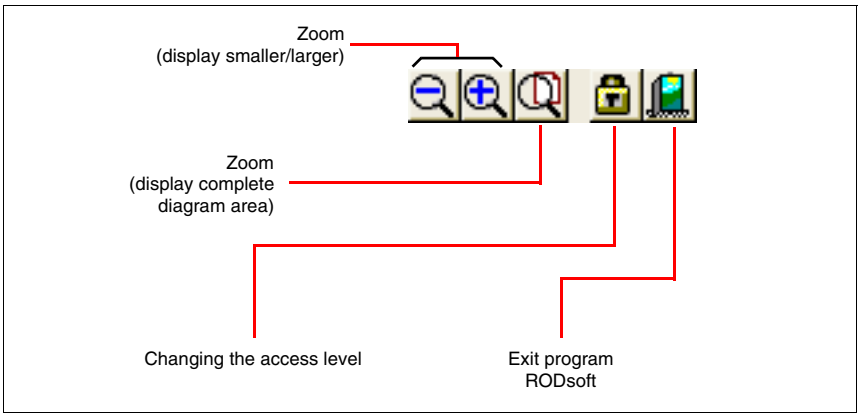


Figure 4.6: General buttons

Additional buttons in the "Display measurement diagram" operating mode

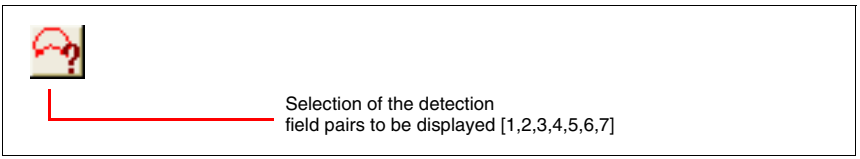


Figure 4.7: Specific icon in the "Display measurement diagram" operating mode

Additional buttons in the "Configuration" operating mode

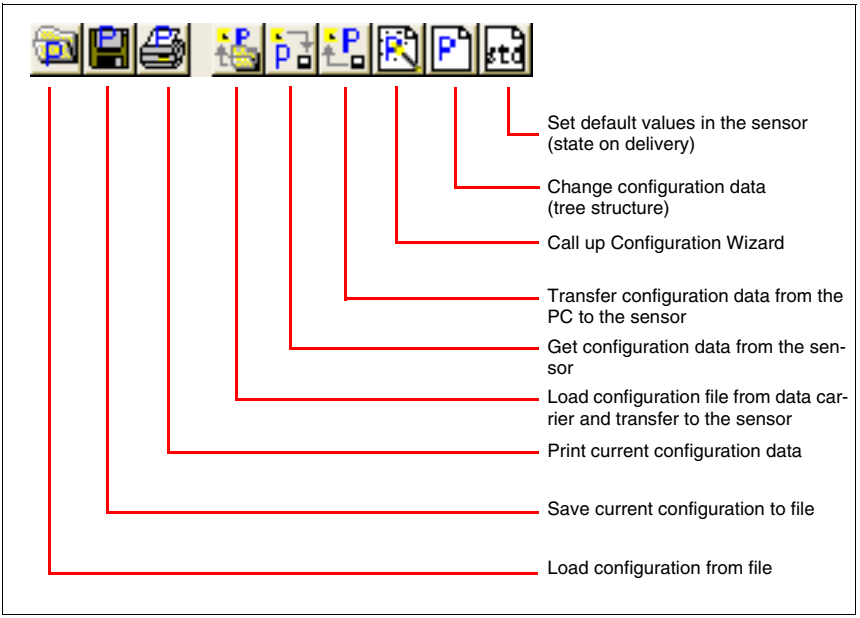


Figure 4.8: Additional buttons in the "Configuration" operating mode

Additional buttons in the "Define detection fields" operating mode

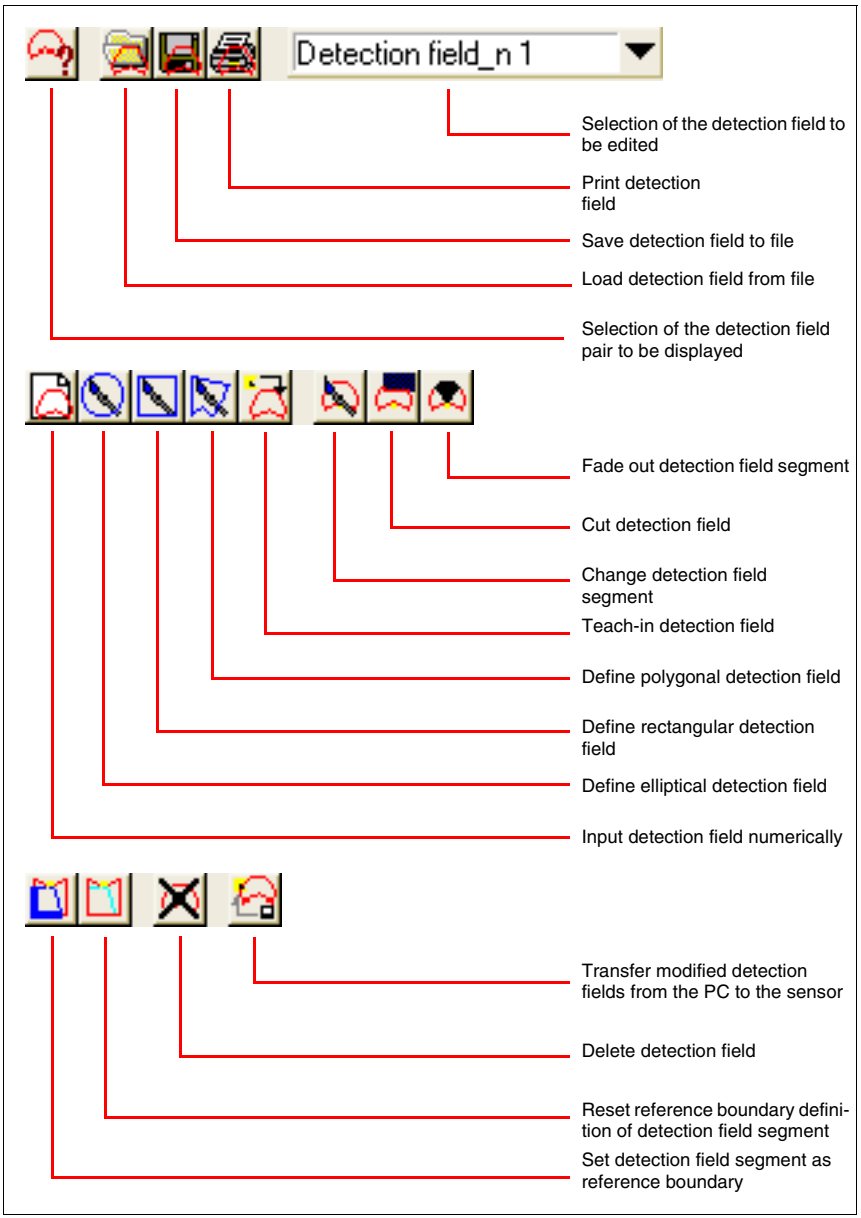


Figure 4.9: Additional buttons in the "Define detection fields" operating mode

Additional buttons in the "System data" operating mode

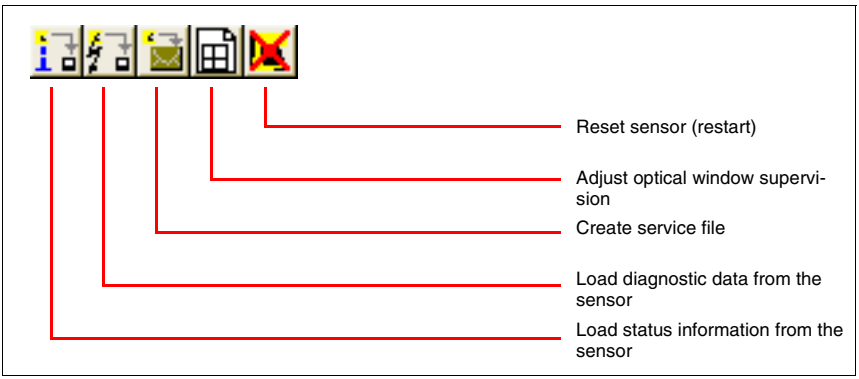


Figure 4.10: Additional buttons in the "System data" operating mode

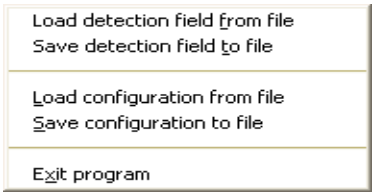
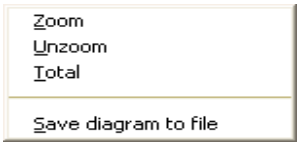
4.3 The menu bar

All program commands are located in various menus.

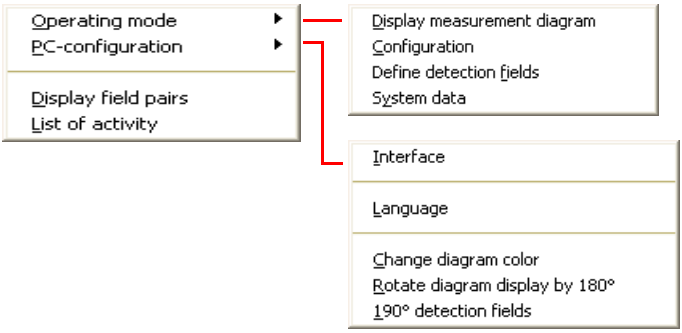
Notice!

Some menu items can only be selected if you are in the appropriate tab (work area).

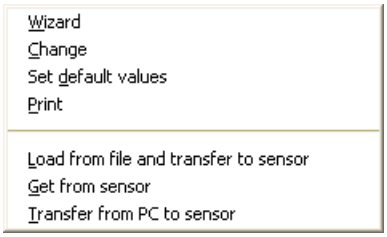
How the individual commands are used is described in detail in the following chapters. The commands located in the menus are described briefly in the following overview.

	Command	Function
File menu		
	Load detection field from file	Load saved detection fields
	Save detection field to file	Save active detection field definition
	Load configuration from file	Load stored configuration
	Save configuration to file	Save active configuration
	Exit program	Exit RODsoft
View menu		
	Zoom	Enlarge view
	Unzoom	Reduce view
	Total	View to 100%
	Save diagram to file	Save active view as bitmap

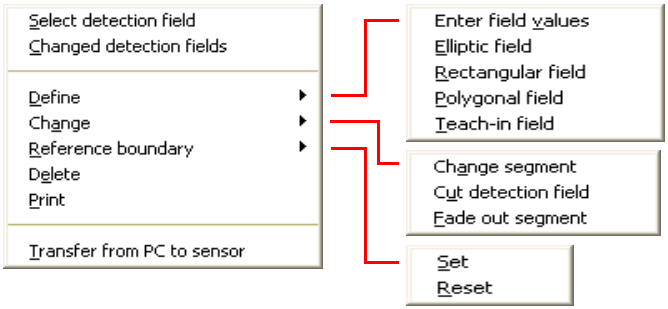
Settings menu

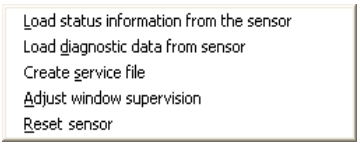
Command	Function
	
Operating mode	
Display measurement diagram	Switch between the four work areas (tabs)
Configuration	
Define detection fields	
System data	
PC-configuration	
Interface	Selection and configuration of the serial interface
Language	Selection of the language version (German / English) → expandable
Change diagram color	Selection of the background colour (black/white)
Rotate diagram display by 180°	Rotate the entire diagram area by 180°
190° detection fields	If this function is activated, expansion of the detection field definition by an additional 10° is enabled, i.e. from 180° to 190°. Measurement value acquisition itself is not affected by this.
Display field pairs	Selection of the visible detection field pairs (1/2/3/4/5/6/7)
List of activity	Display program activities with date and time in a separate window

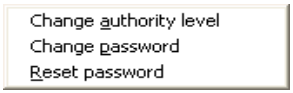
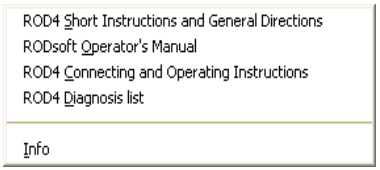
Configuration menu

Command	Function
	
Wizard	Start the Configuration Wizard
Change	Change the configuration parameters (tree structure)
Set default values in the sensor	The sensor is reset to the state upon delivery (standard configuration)
Print	Print the current configuration
Load from file and transfer to sensor	Load a saved configuration file from a data carrier and transfer to the sensor
Get from sensor	Transfer configuration data from the sensor to RODsoft
Transfer from PC to sensor	Transfer configuration data from RODsoft to the sensor

Detection fields menu

	
Select detection field	Selection of the detection field to be edited
Changed detection fields	Displays the changed detection fields which have not yet been transferred to the ROD4-3…
Define	

Command		Function
	Enter field values	Use corner points, ellipse, rectangle, polygon and measurement contour to edit a detection field
	Elliptic field	
	Rectangular field	
	Polygonal field	
	Teach-in field	
Change		
	Change segments	Edit selected detection field
	Cut detection field	Cut sides of the selected detection field
	Fade out segment	Remove individual segments of the selected detection field
Reference boundary		
	Set	Define a reference boundary
	Reset	Remove a reference boundary
Delete		Delete selected detection field
Print		Print selected detection field
Transfer from PC to sensor		Send newly defined/changed detection fields to the ROD4-3…
System data menu		
Loading status information from the sensor		Call up status information (parameter overview) from the sensor and display in a separate window
Loading diagnostic data from the sensor		Display the last ROD4-3…-device errors
Create service file		Create a service file with all device information and parameters necessary for remote diagnostics

	Command	Function
	Adjust window supervision	This function is used for calibrating the front cover sensors following replacement of the front cover. A special password, provided by the Leuze service department, is required in order to use the function.
	Reset sensor	This function sends a reset command to the sensor (e.g. if no RESTART button is provided and a device error has occurred).
Security menu		
	Change access level	Change access level
	Change password	Change password for the access level
	Reset password	If the "password is forgotten": displays the password as an encrypted number to be sent to LEUZE customer service for reactivation.
Help menu		
	ROD4 Short Instructions and General Directions	Displays a PDF file with short instructions and general directions for using the ROD4-3…[1)]
	RODsoft Operator's Manual	Displays the PDF version of the RODsoft Software and Protocol Description (this document) [1)]
	ROD4 Connecting and Operating Instructions	Displays the PDF version of the technical description ROD4-3… [1)]
	ROD4Diagnostic list	Displays a PDF file with explanations of the diagnostic codes [1)]
	Info	Version information on the configuration software RODsoft

1) Adobe Acrobat Reader required

Table 4.4: Overview of the menu commands

4.4 Displaying status information

4.4.1 Data source

Figure 4.11: Display of data source for configuration data

The fields display the source of the configuration data, i.e. the source from which the current configuration data were loaded or the location to which they were most recently written.

- **"Sensor" field active** (dark):
  Data were loaded from or saved in the sensor.
- **"File" field active** (dark):
  Data were loaded from or saved as a file.
- No field active:
  Configuration data have not yet been loaded or saved, e.g. if the program was started before the sensor was ready.

Notice!

The display also changes if only parts of the configuration data are loaded or saved (e.g. only one detection field).

4.4.2 Status bar

Important information on the current hardware and software states are displayed in the status bar:

- Connection status between sensor and PC
- Current operating state of the sensor
- State of the inputs and outputs
- The current access level

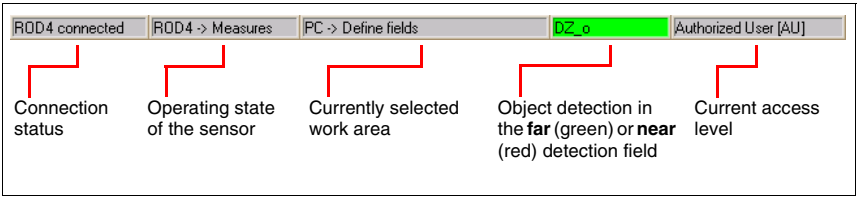


Figure 4.12: Status bar

The first field contains the operating state of the sensor. Following successful synchronisation of PC and sensor, the text of the info field changes from "ROD4 synchro" to "ROD4 connected".

The following field displays the operating mode (measurement operation) and any possible error messages. In the next field, the active work area (operating mode) of the program is displayed. The fourth field displays an object detection in one of the detection fields, **far** (green) and/or **near** (red). In the last field, the currently selected access level (see chapter 4.5) is displayed:

- User [Us]
- Maintenance [Ma]
- Authorized User [AU]
- Production [Pr]
- Development [De]

4.5 Access levels

In order to ensure that the device is configured only by trained and authorised persons, RODsoft provides different functionality for different access rights in the "Change Access Level" dialogue.

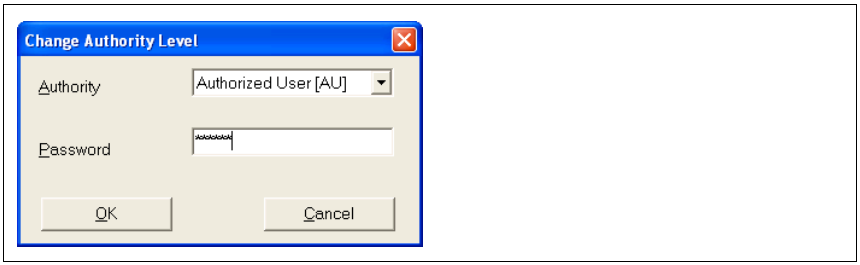


Figure 4.13: Changing the access level

Access levels and access rights

Registration is by means of predefined access levels, each of which is protected against unauthorised access by means of a password. In the "Authorized User" access level, detection fields can also be created "off-line", i.e. without a connected ROD4-3…. These detection fields can then, for example, be stored on diskette.

The following access levels are available:

Level (abbr.)	Password	Access
User (Us)	No password	General program settings, display and analysis of measurement values, loading the current ROD4-3… configuration data to the PC. Changes cannot be made to the configuration data!
Maintenance (Ma)	ROD4/GOY	Device configurations can be loaded from a diskette and stored in the ROD4-3…. Changes cannot be made to the configuration data!
Authorized User (AU)	ROD4LE	Full access to all functions
Production (Pr)		Manufacturer-specific access
Development (De)		Manufacturer-specific access

Table 4.5: Access levels and passwords

Passwords may be entered in either upper- or lower-case letters. No changes can be made to the device configuration in the "User" access level. This level is, therefore, not password protected. All functions which are not permitted in the given access levels are faded out in grey. The current access level is displayed in the status display. (see section 4.4.2 "Status bar").

Notice!

The password set at the factory for Authorized User (AU) is "ROD4LE". When configuring the rotoScan ROD4-3… for the first time, the employee responsible for (Ma) and (AU) is to define new passwords, save them and store the data carriers in a safe location.

Figure 4.14: Notice for password changes

Changing the password

To change the password, select the **Change password** command from the **Security** menu. In the following dialogue, enter a new password and repeat the entry to ensure correctness. Confirm the entry with **OK**.

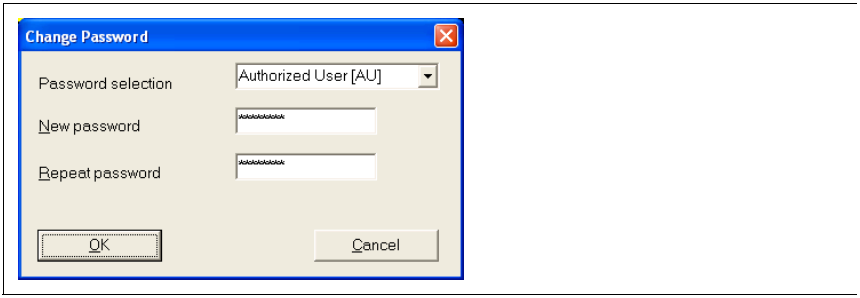


Figure 4.15: Changing the password

Attention!

If the password is no longer known, select the ***Security*** → ***Reset password*** *menu item.*

Resetting the password

After actuating the **Generate** button, a security password is generated and displayed in red text.

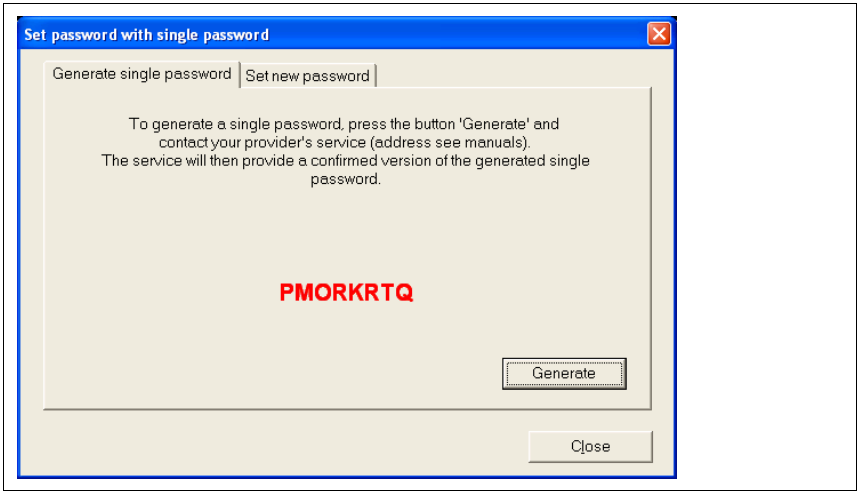


Figure 4.16: Resetting the password

This is to be sent by either fax or mail to Leuze electronic together with the complete address of the company, the user name and the sensor serial number. You will immediately receive a confirmed single password which is to be entered in the "Set new password" dialogue.

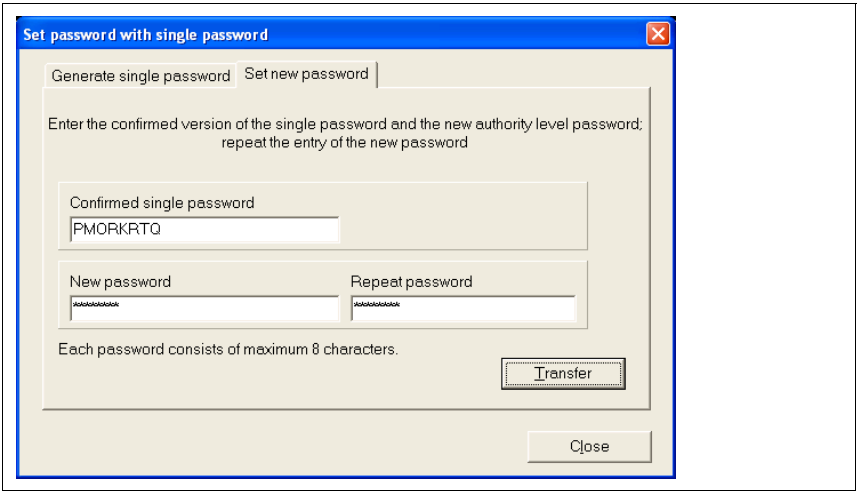


Figure 4.17: Confirming the single password

After the new password has been entered in both fields, access is restored to the sensor in the "Authorized User (AU)" level.

If the confirmed single password is entered incorrectly, the sensor indicates an error message by means of LED no. 5. Furthermore, a corresponding error message is displayed on the screen after approx. 2 minutes. Please note that during this period RODsoft is disabled and no entry is possible.

Changing the access level

If you would like to change your access level during operation, select the **Security** → **Change access level** menu item or click the icon, which is visible in all four toolbars. In the following dialogue window, change to the desired level, enter the required password and confirm the process with **OK**.

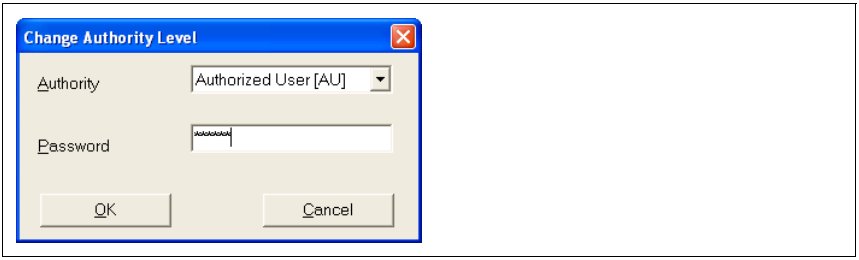


Figure 4.18: Changing the access level

4.6 Program settings

4.6.1 Configuring the serial interface

Use the **Settings –> PC-configuration –> Interface** menu item to set the serial interface (COM…) and desired transmission rate in baud (bit/s) which are to be used.

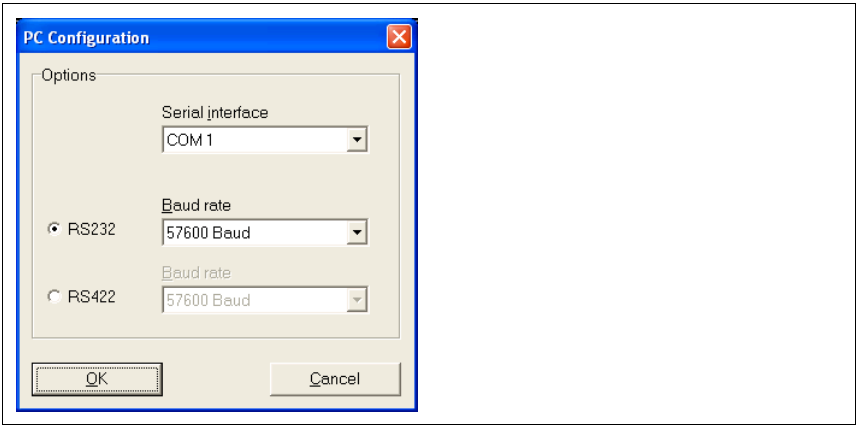


Figure 4.19: Configuring the serial interface

4.6.2 Setting the program language

Use the **Settings** → **PC-Configuration** → **Language** menu item to select the program language. Select between German, English, French and Italian.

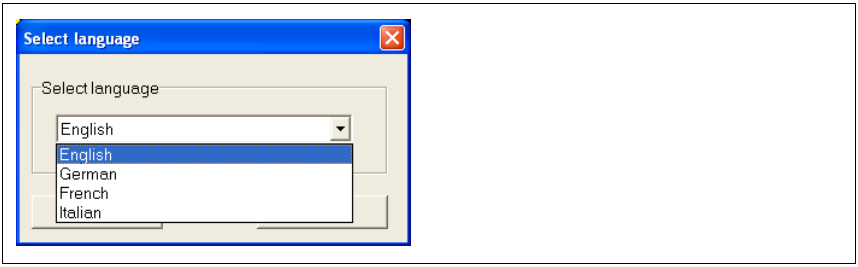


Figure 4.20: Setting the program language

Notice!

A change of the language selection does not take effect until the program is restarted.

4.6.3 Selecting the background colour

To better recognise the measurement curves (yellow), it is recommended that the background colour be set to black (default). On the other hand, when creating the detection fields, white is better suited. To select between these two colours, select the **Settings –> PC-configuration –> Change diagram color** menu item.

5 Editing / configuring the device configuration

5.1 General information and procedure

Initial configuration

- Carefully study the guidelines and standards which apply to your application. For information, refer to the "Safety information" chapter in the rotoScan ROD4-3… technical description.
- Start your PC with all necessary peripheral devices - without connecting the sensor.
- Install RODsoft.
- When unpacking the rotoScan ROD4-3…, avoid touching the front cover and the window monitoring sensors.
- Connect the rotoScan ROD4-3… via connector X1 accordance with the instructions.
- Connect the rotoScan ROD4-3… to the PC via connector X2 in accordance with the instructions.
- After applying the operating voltage, the sensor indicates communication readiness after approx. 10s. This is indicated by the message "ROD4 connected" on the screen.
- The predefined detection field pairs are, due to the factory settings, superimposed upon one another; each pair is therefore only visible as a single contour. Only one detection field pair is activated and displayed in colour at any one time.
- Please observe the specifications for the voltage supply in the rotoScan ROD4-3… technical description.
- Take note of any objects detected on the basis of the predefined detection fields.

Changing a configuration or a detection field

- Note, that before making changes, error-free data communication must be possible. This is indicated on the screen by the status message "ROD4 connected".
- Changes are only possible in the "Authorized User (AU)" access level and above.
- In addition, changes are only possible if a configuration is also loaded in the PC. This can be performed via the hard disk or via the sensor.
- Changes to a configuration are accepted by RODsoft only following successful acknowledgement (**Accept** or **OK** button).
- **Changes take effect only after successful data transmission to the sensor.**
- If detection fields are loaded as a file, e.g. from the hard disk, the plausibility of the sensor configuration is to be checked.
- The safety notices in the rotoScan ROD4-3… technical description must be observed.

Creating a configuration without a connected sensor

- After calling up RODsoft, the "Authorized User (AU)" access level is to be selected.
- The measurement field is first displayed without measurement contours.
- Enter the password for the respective user level.
- A configuration file can be loaded into the PC from the hard disk. The file extension is **`*.rs`**.
- Please note that the configuration files contain sensor configurations and detection field definitions.
- A detection field file can be loaded into the PC from the hard disk.
  The file extension is **`*.sf`**.
- Note that detection field files do not contain sensor configurations.
- Stored files can be loaded into the sensor.

5.2 Current sensor configuration

Retrieving the configuration

If the ROD4-3… is connected to the PC on program start, the current parameters are automatically transferred from the device to the PC. This also occurs if the device was temporarily not connected to the PC (e.g. exchanging the device) and is detected by the program as again being present on the serial interface.

If you have made changes to the configuration and have not transferred the previous configuration to the device, you have the option of manually loading the configuration stored in the ROD4-3….

To do this, on the menu bar select the **Configuration** → **Get from sensor** menu item or click the  icon in the "Configuration" tab. The current device configuration will then be read back in.

Attention!

Before making changes, store the current configurations! These can be used in the event of incorrectly entered parameters to restore the original settings.
Information on storing configurations can be found in chapter 5.4.

5.3 Changing configuration parameters

Notice!

The device configuration can only be viewed and edited in the "Authorized User" access level.

In principle, there are 2 possibilities for editing the configuration data of the sensor:

- with the **Configuration Wizard**, which guides you step-by-step through the entry of the most important parameters.
- directly **in the tree structure for the parameters** in the Configuration Parameters window

5.3.1 Configuration Wizard

With the aid of the Configuration Wizard, you can edit the sensor's most important parameters. The parameters and their possible values will be explained in detail.

To start the Configuration Wizard,

- select the "Configuration" tab and then the **Configuration -> Wizard** menu item or
- click the  icon on the "Configuration" tab toolbar.

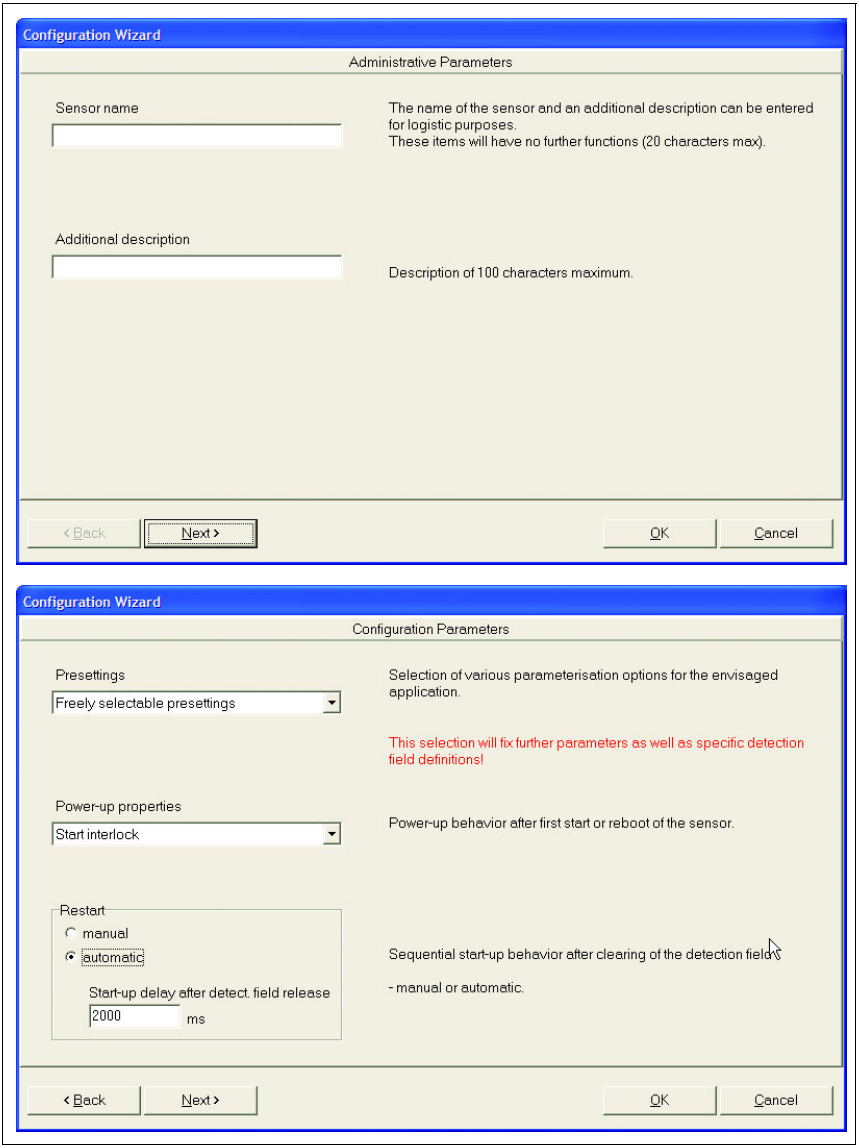


Figure 5.1: Configuration Wizard, pages 1 and 2

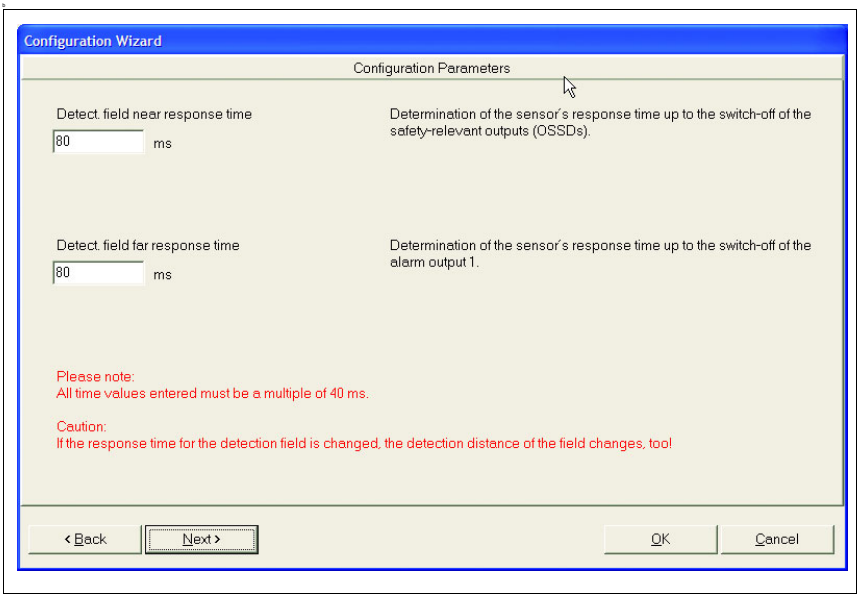


Figure 5.2: Configuration Wizard, page 3

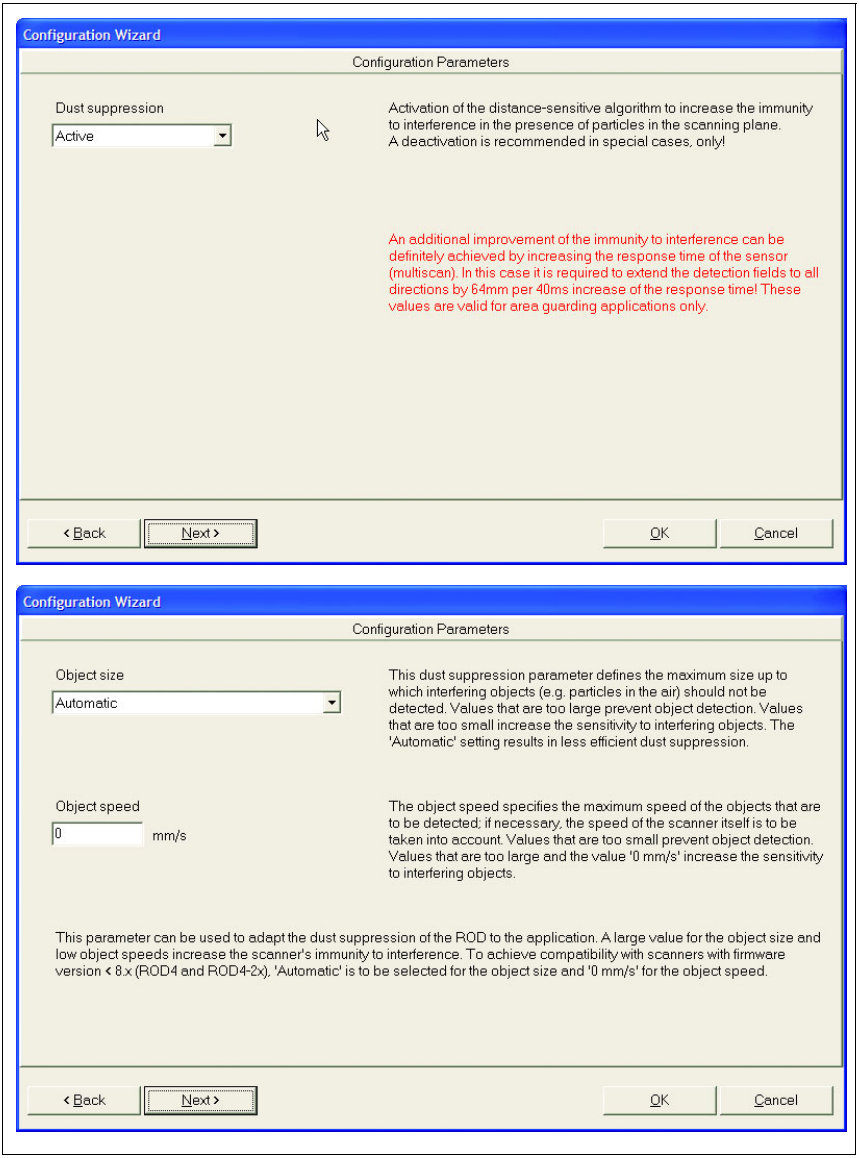


Figure 5.3: Configuration Wizard, pages 4 and optional page 4a

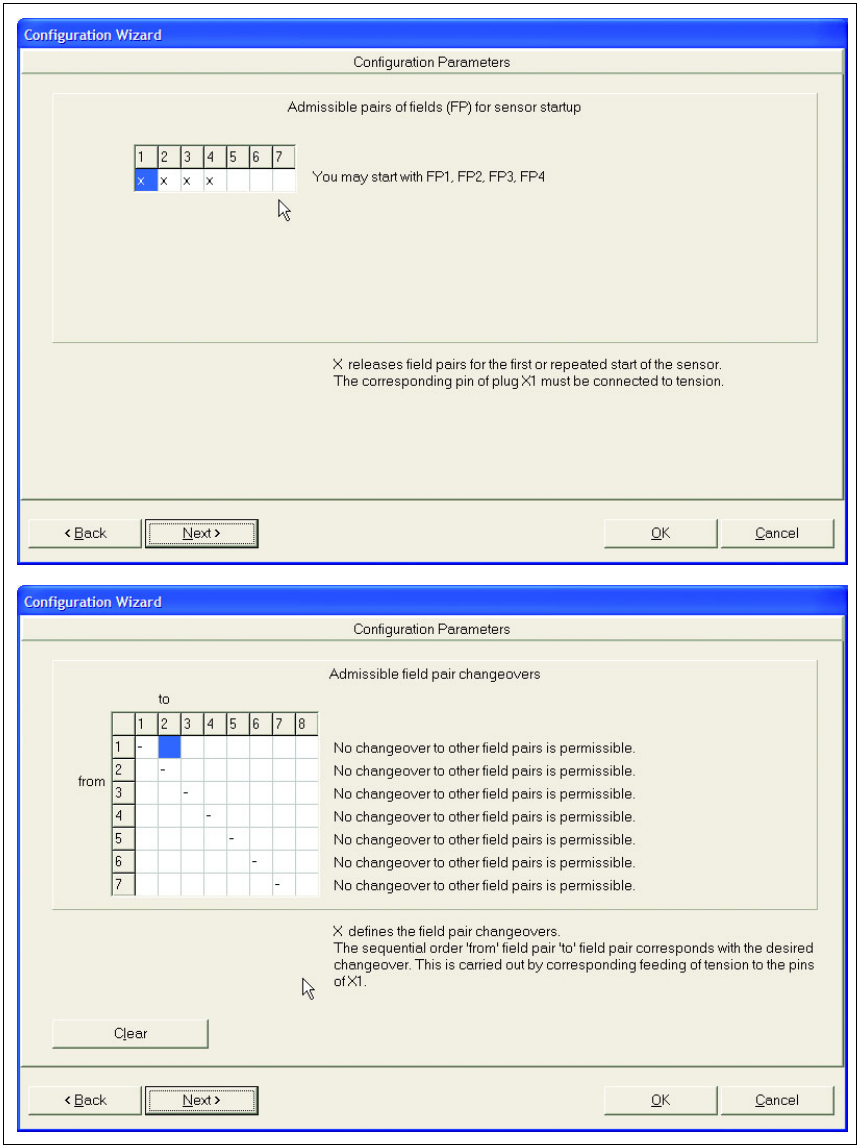


Figure 5.4: Configuration Wizard, pages 5 and 6

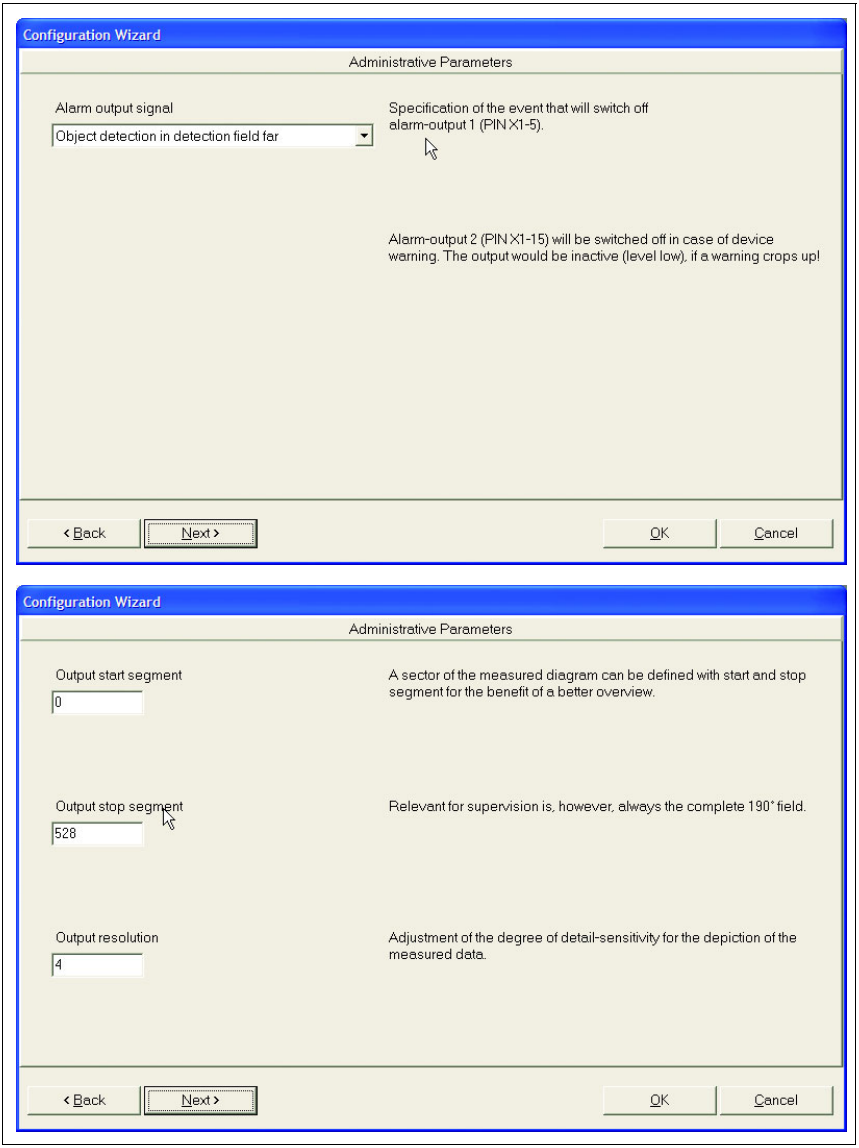


Figure 5.5: Configuration Wizard, pages 7 and 8

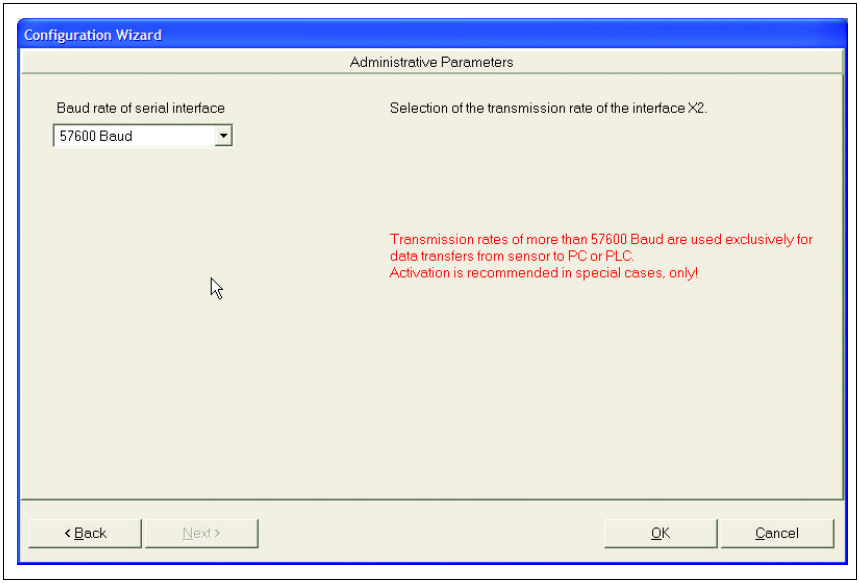


Figure 5.6: Configuration Wizard, page 9

5.3.2 Tree view of the configuration

To change the sensor's configuration parameters directly in the tree structure, open the **Configuration Parameters** window as follows:

- Select the "Configuration" tab and then select the **Configuration** -> **Change** menu item or
- click the icon on the "Configuration" tab toolbar.

A dialogue window consisting of three parts appears as illustrated in the following figure:

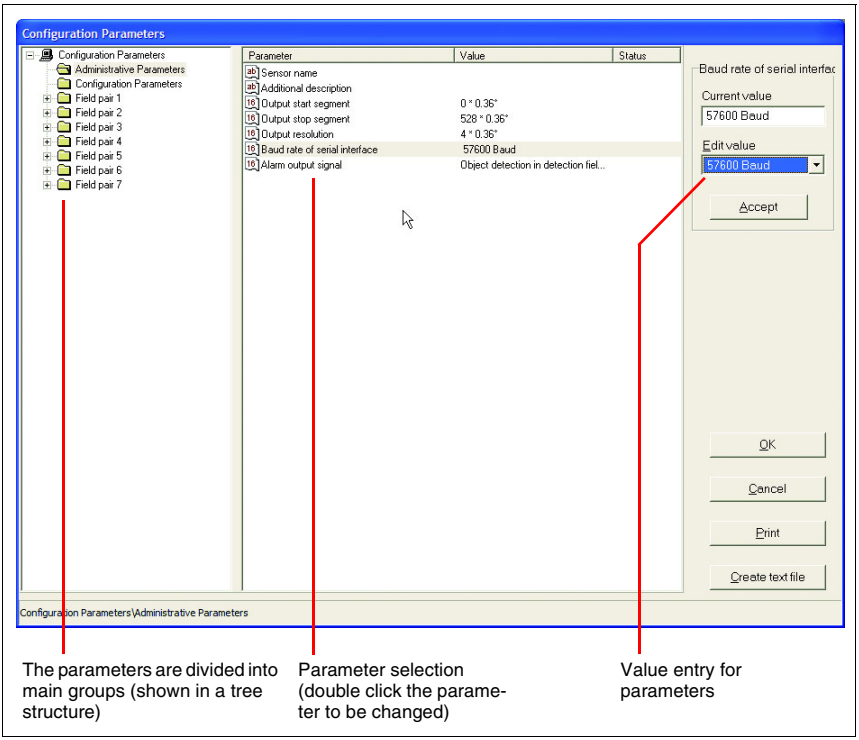


Figure 5.7: ROD4-3… Configuration parameters

To change a parameter, select the desired parameter group on the left side and double-click the desired parameter in the middle.

The parameter can be changed on the right side of the window by entering a value or by selecting a value from a list. To confirm your entry, you must click on Apply before exiting the window with OK.

Notice!

*In the Status field, **R** means read only; all other parameters can be changed.*

Folders "Administrative Parameters" and "Configuration Parameters"

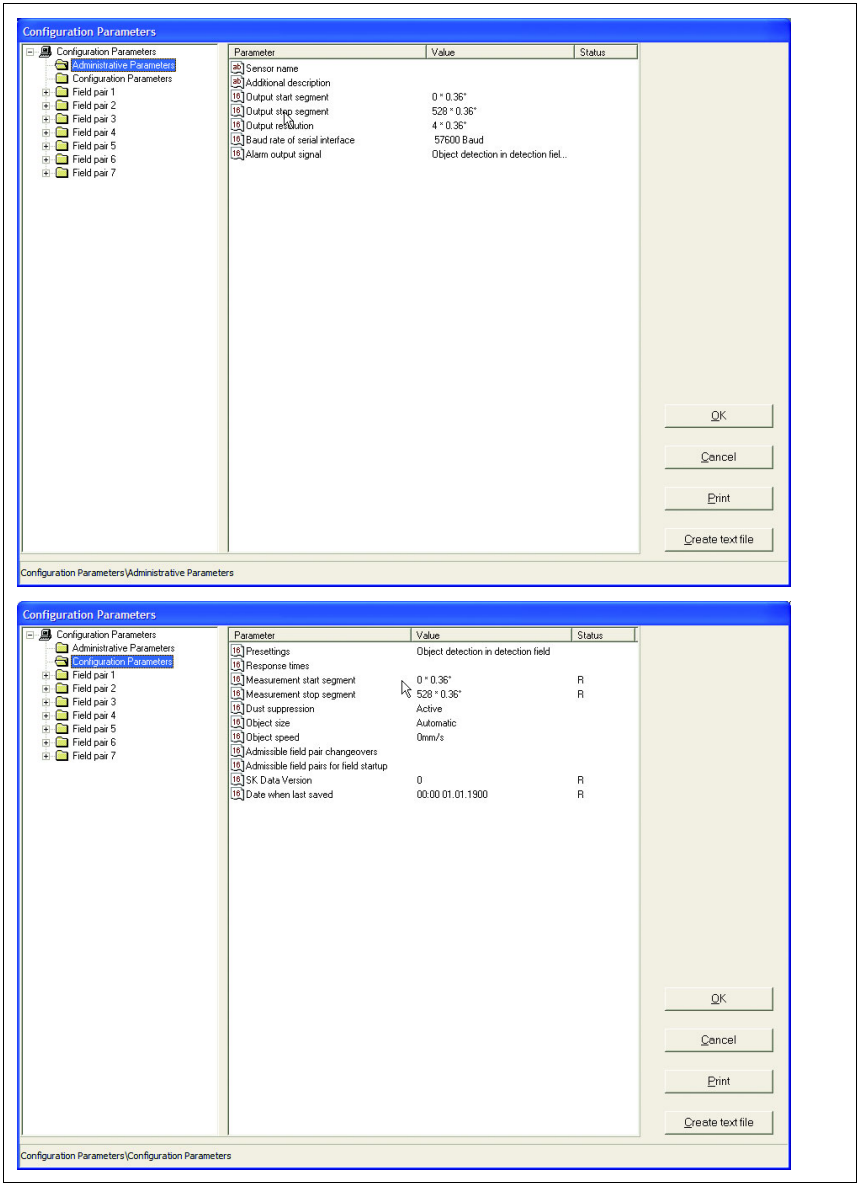


Figure 5.8: Folders "Administrative Parameters" and "Configuration Parameters"

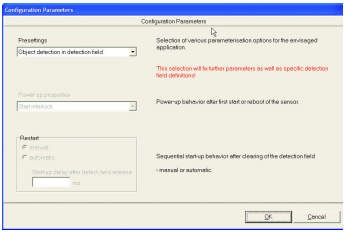
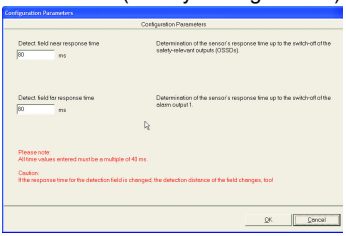
Description of the administrative parameters

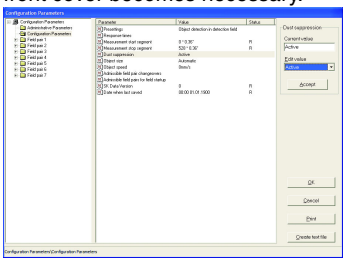
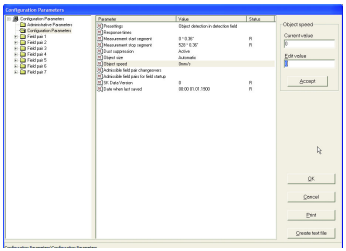
Parameter	Function/Setting	Status	Input option
Sensor name	Sensor name		Max. 20 characters
Additional description	User-side additional description		Max. 100 characters
Output start segment	Definition of the first contour segment beginning with which the measurement values are output		Segments 0 … 528 (Segments 0 … 528 correspond to 190°, segments 14 to 514 correspond to 180°)
Output stop segment	Definition of the last contour segment up to which the measurement values are output		Segments 0 … 528 (Segments 0 … 528 correspond to 190°, segments 14 to 514 correspond to 180°)
Output resolution	This value specifies the size of the resolution interval. Assuming the measurement contour is output beginning with measurement value 0 through 528 and the resolution is set to the value 4, the smallest measurement value in each of the sector ranges 0…3, 4…7, 8…11, …, 524…527 is output.		1 … 8

Parameter	Function/Setting	Status	Input option
Baud rate of serial interface	Change in the baud rate. The max. baud rate for the PC interface is 115200 baud (factory setting: 57600 baud). Please observe the following notices: Baud rates above 115200 baud are suitable for measurement data transfer only since they no longer permit access to the sensor via PC/RODsoft. Remedy: Reset the baud rate to the factory setting 57600 baud (s. technical description). If using *ROD4* and *ROD4-2…* sensors, it is advisable to leave the factory setting unchanged since higher baud rates are not supported by *ROD4* and *ROD4-2…* sensors.		9600 to 687500 baud Transmission rates for ROD4-3…: 9600 Bd 19200 Bd 38400 Bd 57600 Bd 115200 Bd 345600 Bd 687500 Bd Transmission rates for ROD4/ROD4-2…: 9600 Bd 19200 Bd 38400 Bd 57600 Bd 109700 Bd 384000 Bd 768000 Bd
Alarm output signal	Selection of the event which leads to a signal at output ALARM1		• None • Device warning • Object in detection field far • Device warning or object in detection field far

Table 5.1: Description of "Administrative Parameters", Folder 1

Description of the "Configuration parameters"

Parameter	Function/Setting	Status	Input option
Presettings	Settings for the measurement value resolution, the 4-field mode, the power-up properties and the restart disable are made in a separate window 		Start interlock/start-up test/automatic start-up, start-up delay 40 ms … 10160 ms
Response times	Settings for response times in multiples of 40 ms for the near and far detection fields are made in a separate window (factory setting: 80 mm) 		40 ms … 2000 ms in multiples of 40 ms
Measurement start segment	Measurement of the first contour segment	R	
Measurement stop segment	Measurement of the last contour segment	R	

Parameter	Function/Setting	Status	Input option
Dust suppression	With activated dust suppression (factory setting), sensor availability is increased in the event of small particles in the air, such as insects. This also maximises the time which may pass before cleaning of the front cover becomes necessary.  **Notice:** Please note that the settings relevant for the dust suppression must be carried out in different parameter windows. For details please refer tosection 5.3.5 "Supplementary information on the "Dust suppression" parameter".		• Activated (recommended) • Deactivated
Object size/ object speed	Object size: Dust suppression parameter specifying the maximum size of interfering objects (factory setting: 70mm). Object speed: Parameter that must also be observed for dust suppression. It sets the maximum speed of objects to be detected (factory setting: 1600mm/s). 		• 35mm • 70mm • 150mm • 250mm • Automatic 0 …10,0000mm/s

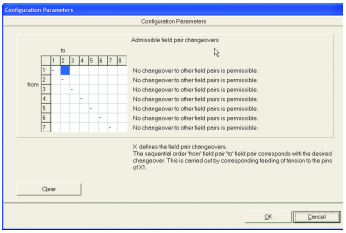
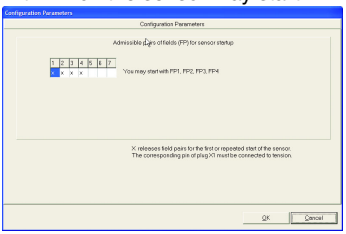
Parameter	Function/Setting	Status	Input option
Admissible field pair changeovers	The admissible detection field pair changeovers are defined in a separate window 		Click the desired fields to define the admissible field pair changeovers.
Admissible field pairs for sensor start-up	Definition of the detection field pairs with which the sensor may start 		Click the desired fields to define the admissible field pairs.

Table 5.2: Description of "Configuration Parameters", Folder 2

5.3.3 Supplementary information on the "Presettings" parameter

Standardised parameter presettings for various applications are offered for selection in a dialogue window.

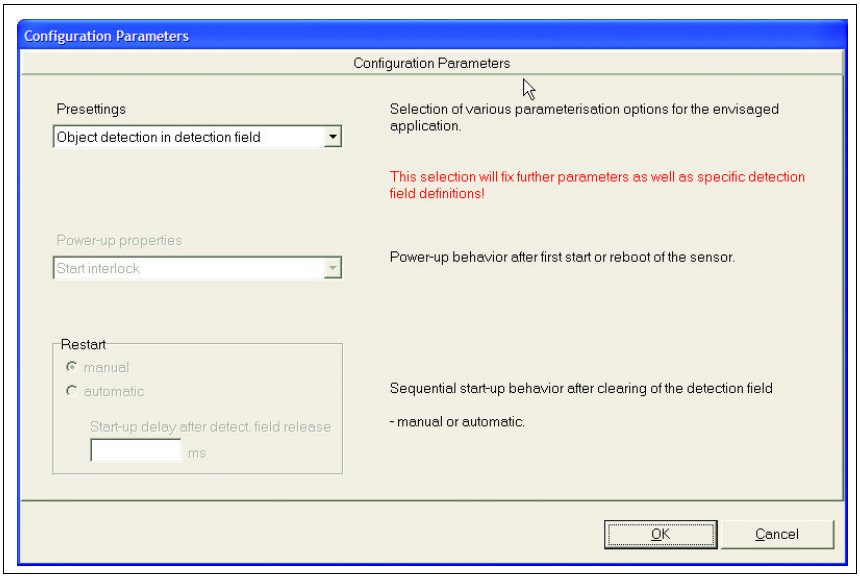


Figure 5.9: Parameters for presettings/power-up properties/restart

Here, you can find base setting for various application areas. Among others, the **4-field mode** is activated here (see chapter 4.1.2 "4-field mode"). The "Freely selectable presettings" selection offers maximum flexibility.

The "Resolution" parameter cannot be changed in RODsoft. Here, the term resolution is not equivalent to other uses of the term, such as "output resolution" or "angular resolution".

5.3.4 Supplementary information on the "Power-up properties" parameter

Automatic start-up

After the sensor is switched on, outputs Fn1/Fn2 are enabled following a start-up delay.

Start interlock

After the sensor is switched on, the restart button must be actuated (24 V on PIN 2 of interface X1 for max. 4 s) in order to activate the outputs.

Start-up test

After switching on the sensor, the near detection fields must be clear after the start-up delay period has passed; outputs Fn1/Fn2 are switched off. To activate outputs Fn1/Fn2, at least one near detection field must be occupied and then again be cleared.

Restart

The restart behaviour determines how switching outputs Fn1/Fn2 are switched after a detection field is occupied in the event of subsequent non-occupancy.

Manual restart

The start interlock is active and the restart button must be actuated.

Automatic restart

The outputs are activated following a start-up delay.

5.3.5 Supplementary information on the "Dust suppression" parameter

In the RODsoft configuration software, the following parameters determine the function of the dust suppression:

- the dust suppression (factory setting: activated)
- the object size (factory setting: 70mm)
- the object speed (factory setting: 1600mm/s)
- the response time (factory setting: 80ms)
- the sector size

Notice!

Please note that the settings relevant for the dust suppression must be carried out in different parameter windows.

Dust suppression

With activated dust suppression (recommended), sensor availability is increased in the event of small particles in the air, such as insects. This also maximises the time which may pass before cleaning of the front cover becomes necessary. A deactivation is generally not required.

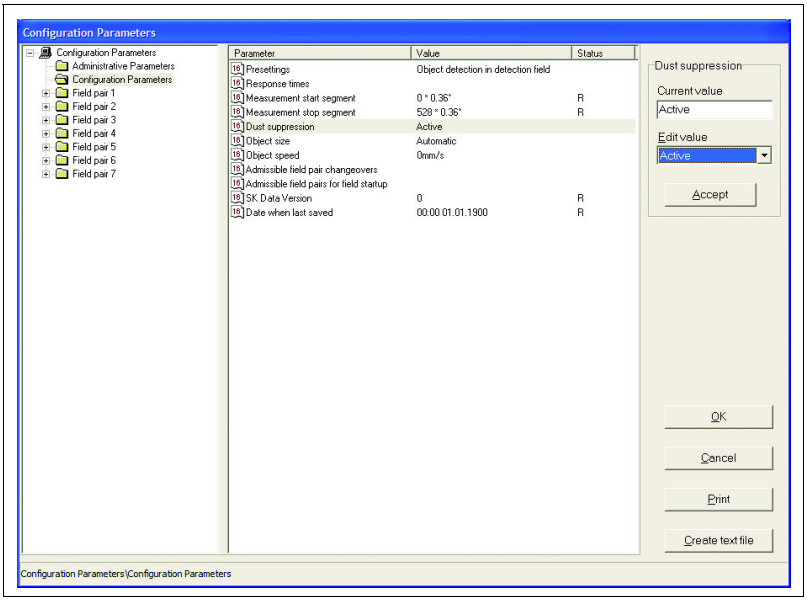


Figure 5.10:Parameter "dust suppression"

Dust suppression is implemented globally, i.e. it is used in all detection fields.

For individual detection fields, the availability may also be increased by raising the response times and the minimum object width by setting a sector size > 2 or > minimum object width.

Notice!

If the sector size > 1, the entry for the minimum object size and the object size in millimeters are irrelevant for this detection field.
Please find detailed information on minimum object width and sector size as prerequisites for the object detection in table 5.3 on page 61.

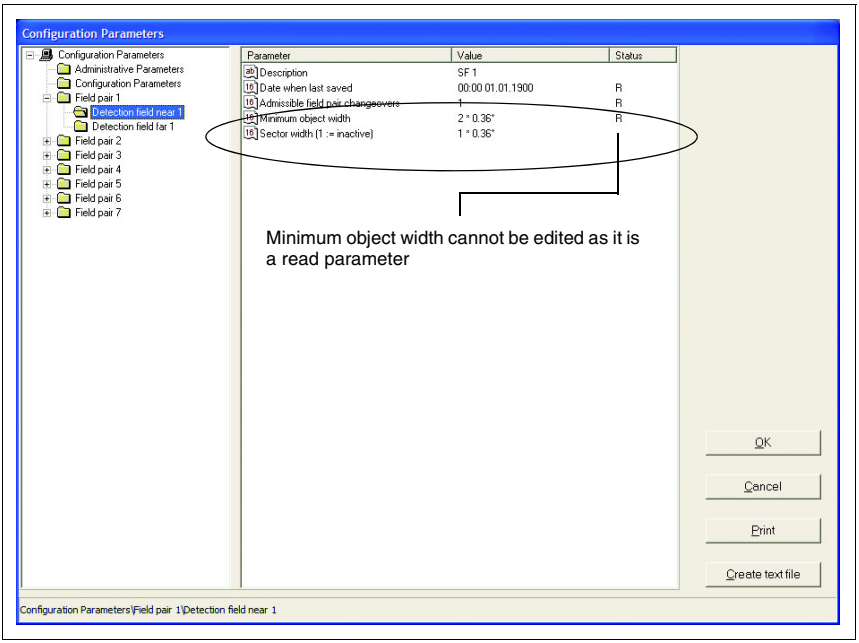


Figure 5.11: Influencing the dust sensitivity for individual detection fields

Object size/object speed

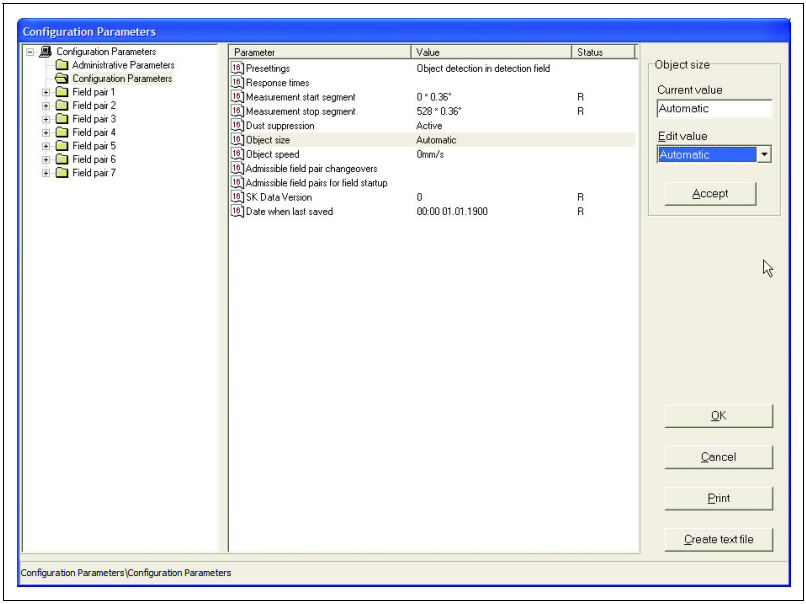


Figure 5.12:Parameter "Object size/object speed"

The **object size** parameter defines the maximum size up to which interfering objects (e.g. particles in the air) should not be detected. Values that are too large prevent object detection. Values that are too small increase the sensitivity to interfering objects. The 'Automatic' setting results in less efficient dust suppression.

The **object speed** specifies the maximum speed of the objects that are to be detected; if necessary, the speed of the sensor itself is to be taken into account. Values that are too small prevent object detection. Values that are too large and the value '0 mm/s' increase the sensitivity to interfering objects.

Comment:
Speed refers not only to the speed at which an object moves toward the sensor (speed component $\mathbf{v_x}$ in figure 5.13); it generally refers to the maximum speed with which objects may move in the detection field (speed components $\mathbf{v_x}$ and $\mathbf{v_y}$ in figure 5.13). As area scanning occurs in the XY plane, speed component $\mathbf{v_z}$ cannot be detected and evaluated. The maximum object speed can be best optimised through testing.

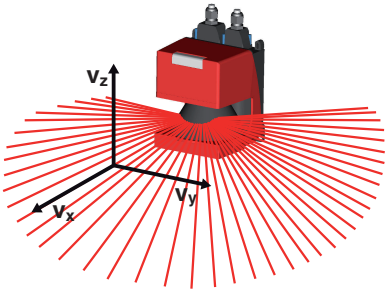


Figure 5.13:Components of the object speed

Response time

Another important parameter is the response time.

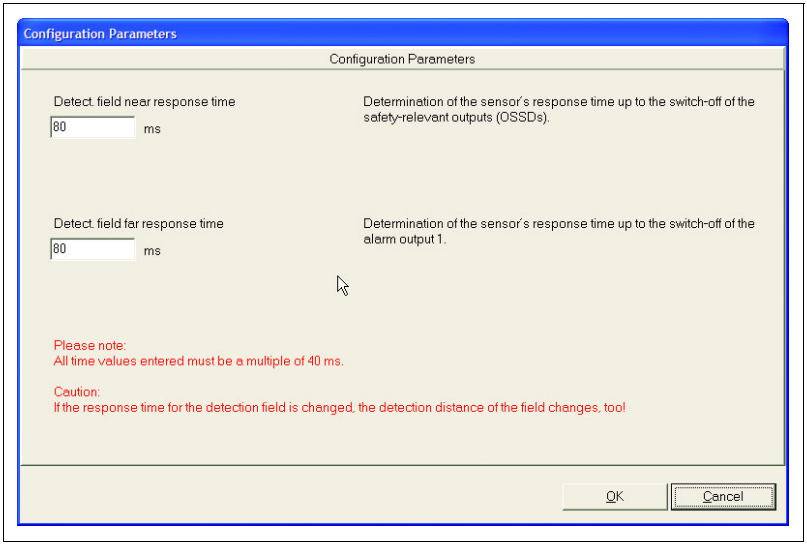


Figure 5.14: Parameter "response time"

The longer the selected response time, the more calculating time is available for the dust-suppression algorithm and, thus, the more powerful the dust suppression. With a response time < 80 ms, only the object size is evaluated.

Notice!

When specifying the response time, note that the object speed in a radial direction to the sensor must be taken into account.

Dust suppression is more efficient the:

- greater the selected object size
- lower the selected object speed
- longer the response time

It is a good idea to optimise the values preset ex works (object size: 70mm, object speed: 1600mm/s, response time: 80ms) for the respective application through practical tests.

Notice!

By setting the object size parameter to "automatic" and the object speed parameter to "0mm/s", you obtain a ***Compatibility mode for oldROD4/ROD4-2… models****.*
In addition, you should observe the following points:

Config. connector*:If a ConfigPlug with ROD4-3… configuration (with activated dust suppression) is plugged into a ROD4-2…, the configuration is accepted, but the old dust suppression used!*

RODsoft*: If a ROD4-3… configuration with new dust suppression is loaded from a file while a ROD4 or ROD4-2… is plugged in, the new dust suppression parameters are not displayed. The sensor uses the old dust suppression following the transfer. The ROD4-3… configuration becomes a ROD4-2… compatible configuration.*

A ROD4-3… configuration can also be loaded if a ROD4/ROD4-2… was selected. The new dust suppression parameters are not displayed in this case. The sensor uses the old dust suppression following the transfer.

5.3.6 Supplementary information on the "Admissible field pair changeovers" parameter

With its seven freely configurable detection field pairs, the rotoScan ROD4-3… offers a high degree of application flexibility. Through the assignment of the admissible changeover order in the "**Admissible field pair changeovers**" dialogue, the detection field selection is monitored for plausibility. Inadmissible switching orders are detected and result in the switching off of outputs Fn1/Fn2. Furthermore, each detection field can also be defined as an **admissible detection field on sensor start**.

These function characteristics find application, for example, on **d**riverless **t**ransport **v**ehicles for detection field changeovers for straight-ahead and curved paths as well as vehicle starts in a straight line.

Detection field parameters

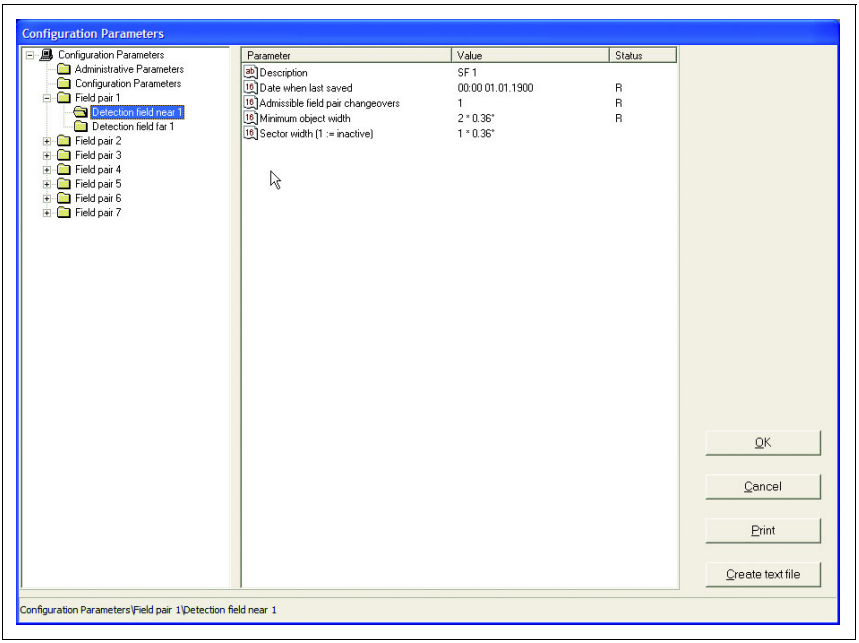


Figure 5.15: "Detection field" folder

Parameter	Function/Setting	Status	Input option
Description	Detection field name		20 characters
Date when last saved	Date and time the detection field was last saved	R	
Admissible field pair change-overs	Specification of the detection field pairs to which the device may changeover	R	
Minimum object width	This parameter is permanently stored and is calculated from the maximum radius of the detection field. Objects are detected if at least the minimum number (multiple of 0.36°) of consecutive scanning beams is incident on an object. **Notice:** After the transfer of the configuration from the PC into the ROD this value may not necessarily be the one that is actually active. As the value is computed by the ROD and is not loaded back into the PC by the "Fast configuration", it may differ. Manual loading of the configuration data fixes this.	R	
Sector width	This parameter can be changed. If the value for the sector size is > 1, objects are detected if at least this number (multiple of 0.36°) of consecutive scanning beams is incident on an object. If the sector width is > 1, the calculated minimum object size is immaterial.		1 … 30

Table 5.3: Description of "Detection fields 1 … 7"

5.4 Storing/loading configuration

To store the changed parameters, select the **File –> Save configuration to file** menu item or click the symbol in the "Configuration" tab.

Here, you can enter the name of the file and select the folder in which the file is to be stored.

To reload a configuration, select the **File –> Load configuration from file** menu item or click the symbol in the "Configuration" tab. Select the desired configuration file (`*.rs`) and then click "Open".

The configuration saved in this file is now read into RODsoft.

5.5 Transferring a configuration to the sensor

Changed configuration parameters are initially stored only temporarily in your PC's main memory.

Attention!

Store a modified configuration as a file so that in the event of transmission errors or program crashes the changed settings can be reloaded.

In order for the modified data to be stored in the sensor, you must transfer them to the device. To transfer the data to the sensor, select the **Configuration → Transfer from PC to sensor** menu item or click the icon in the "Configuration" tab.

After transferring the data, the configuration parameters are read back by the sensor as a check. An info window informs you of the successful transfer.

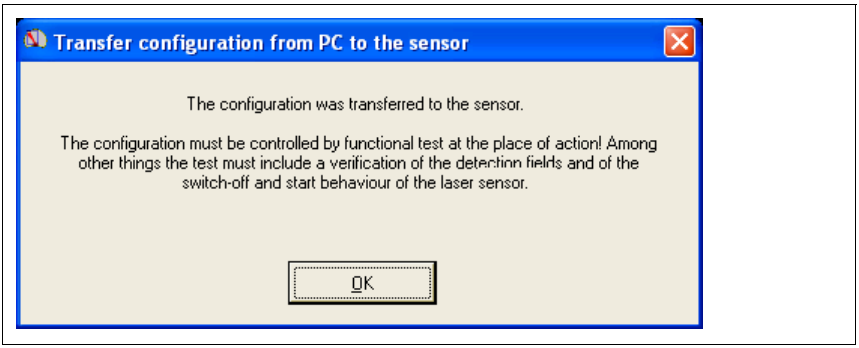


Figure 5.16: Info window following successful transfer of the configuration to the sensor

5.6 Resetting sensor to factory settings

With the aid of the **Configuration –> Set default values** menu command, the factory configuration (state on delivery) of the ROD4-3… can be restored.

Listed in the following table are the most important factory settings:

Parameter	Value
Names of near detection fields	Detection field near 1 … 7
Radius of near detection fields	1 m
Sector range of near detection fields	0 … 528 (190°)
Response time of near detection fields	80 ms
Names of far detection fields	Detection field far 1 … 7
Radius of far detection fields	2 m
Sector range of far detection fields	0 … 528 (190°)
Response time of far detection fields	80 ms
Detection field changeover	1, 2, 3, 4 to 1, 2, 3, 4
Start detection field pairs	1, 2, 3, 4
Alarm output signal	Object detection in detection field far
Presettings	Freely selectable presettings (4-field mode deactivated)
Restart	Automatic
Start-up behaviour	Automatic start-up
Dust suppression	activated for all ROD4-3…, object size: 70 mm, object speed: 1600 mm/s
Start segment output	0
Stop segment output	528
Output resolution	4*0.36°
Baud rate of serial interface	57,600 baud
Name of the sensor	–
Description of the sensor	–

Table 5.4: Factory settings ROD4-3…

6 Working with detection fields

6.1 General information

6.1.1 Position determination

Optical position display

In order to be able to precisely read the cursor position for a certain point in the diagram area, fields containing the cursor position are provided at the right below the diagram area.

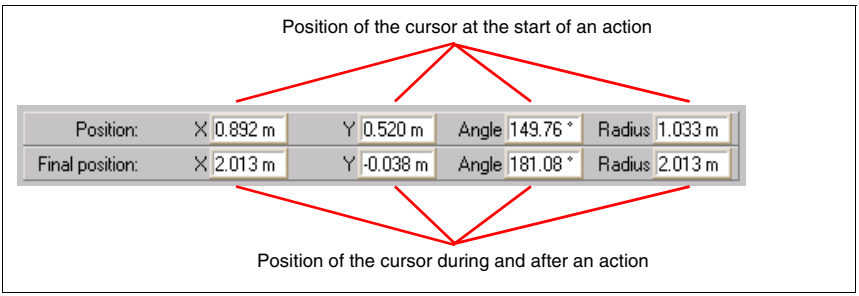


Figure 6.1: Display of the cursor position relative to the sensor midpoint

If you click the mouse at a specific location in the diagram area, this position is displayed in the upper fields, Position "X" and "Y" in Cartesian co-ordinates and "Angle" and "Radius" in polar co-ordinates. In addition, the click location is indicated by a blue circle (position indicator). In this way it is possible to read exact values from measurement curves.

The values in the lower row, "Final position", are used for precise positioning when creating detection fields.

Rulers / grid

The rulers and grid are also available for determining positions.
They are scaled in meters.

6.1.2 Enlarging or reducing the work area

The zoom functions offered by the program allow you to modify the size of the work area.

The program contains two variants of the "Zoom" function:

- the automatic, incremental zoom and
- the manual, stepless zoom.

Automatic zoom

Click the  and  icons (or the use the **View** → **Zoom/Unzoom** menu item) to enlarge or reduce the work area step by step. There are 26 steps, whereby each step increases or reduces the original work area by approx. 25%.

Manual zoom

This zoom variant facilitates the direct area enlargement of a manually selected area. You may only perform enlargements here! Perform reductions using the automatic zoom.

In order to enlarge a specific area of the surface, proceed as described below:

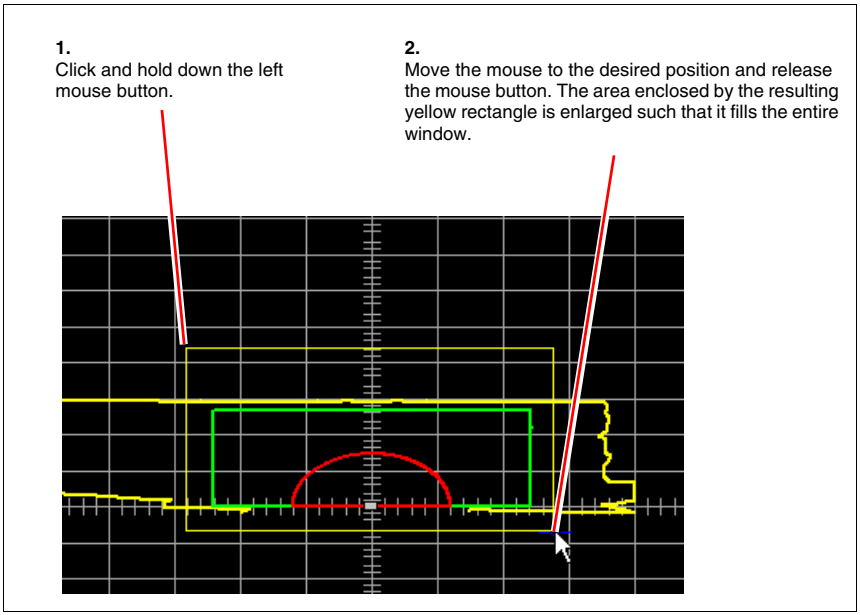


Figure 6.2: Manual zoom

Restoring the total view

To return to the total view from any zoom level, select the **View –> Total** menu item or click in the toolbar.

In the positioning cross (lower right), click the point in the middle to adjust the size such that it fills the measurement value display.

Click the point in the middle to optimally adjust the view to the diagram area.

6.1.3 Moving the display

The positioning cross can be used to move the display in the horizontal and vertical directions.

Click the appropriate motion arrow, depending on the direction in which you would like to move the view.

If you press the **F1** key, a mode is activated in which you can move the displayed view with the mouse. To do this, click the display area and, while holding down the left mouse button, move the mouse in the direction in which you would like to move the area. The length of the line displayed during this process corresponds to the length of the move. The **position indicator is displayed in red during this process**.

6.2 Defining detection fields

The ROD4-3… scans the surroundings and displays the measured area contour as a yellow measurement line on the work area. In addition, it constantly compares the measured contour with the active detection field definitions stored in the device. The detection fields can be graphically defined interactively with the aid of the RODsoft configuration software. To do this, select the "Define detection fields" tab.

The software supports you in the matching of object and field sizes by listing the maximal field sizes in the list box shown below. More details on the object size may be found in section "Description of the "Configuration parameters"".

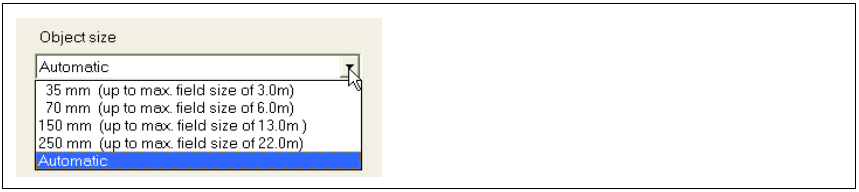
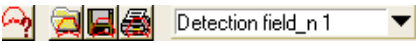


Figure 6.3: List box for object size setting - dust suppression parameters

Notice!

Each of the 7 near and far detection fields are, due to the factory settings, superimposed upon one another; each pair is therefore only visible as a single contour. One detection field pair is always activated.

In the button bar 

, you can select the detection field you would like to adjust. This selection can also be made using the **Detection fields –> Select detection field** menu item.

Notice!

You may edit the detection fields only if you possess the required authorisation! If necessary, save the original detection fields prior to defining new fields!

The buttons in the toolbar are thematically ordered and are identical to the commands in the **Detection fields** menu.

6.2.1 Creating new detection fields

You can adjust the appearance of the detection fields individually for your specific requirements. The following functions are available for this purpose:

Designation	Icon	Menu
Enter values of detection field		**Detection fields –>Define –> Enter field values**
Ellipse		**Detection fields –> Define –> Elliptic field**
Rectangle		**Detection fields –> Define –> Rectangular field**
Polygon		**Detection fields –> Define –> Polygonal field**
Teach-in detection field		**Detection fields –> Define –> Teach-in field**

Table 6.1: Tools for the new creation of detection fields

In the following sections, all tools are described and information is provided for possible applications.

Enter field values

Normally, a rectangular detection field in the ROD4-3… is the same size to the left and right side, i.e. symmetric about the Y-axis. It is, however, possible, that one of the two sides is smaller or larger than the other side. In such cases, the "Enter field values" detection field definition is used.

When creating the definition, proceed as follows:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the "Enter field values" function from the menu or toolbar. The following window appears:

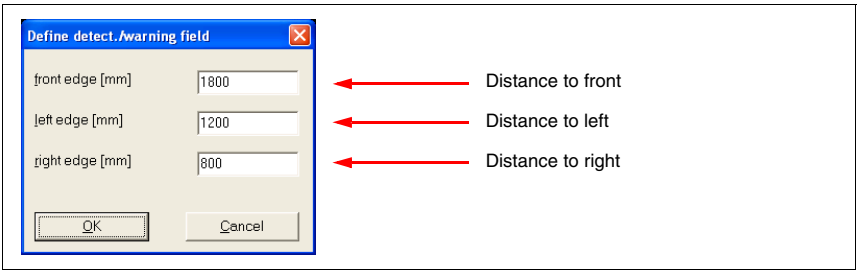


Figure 6.4: Numerical field value entry

- In the dialogue mask, enter the required dimensions (in mm) and confirm the entries with **OK**.
- The resulting detection field has a rectangular shape with all of the characteristics of the "Rectangle" detection field shape.

Notice!

*If one of the dimensions has been selected too large, an error message appears informing you of this. In this case, confirm with **OK** and correct the values.*

The max. admissible radius value is 30m for the near detection fields and 50m for the far detection fields.

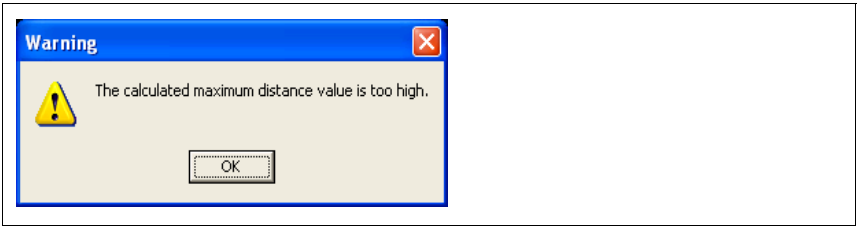


Figure 6.5: Warning notice "Distance value too high"

Ellipse

The "Ellipse" is well suited for many areas of application.

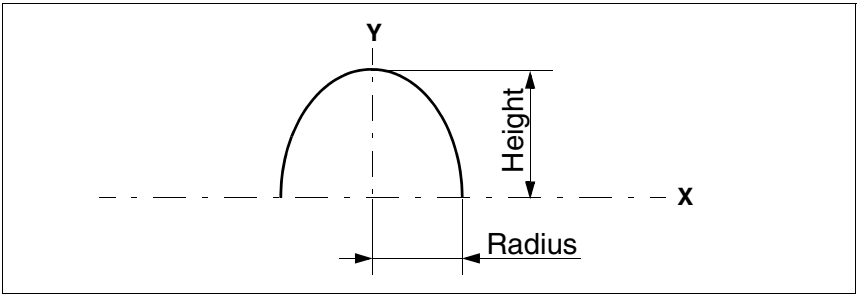


Figure 6.6: Elliptical detection field

How to create an elliptical detection field:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Find the two values for radius and height on the work area and click the point for fast orientation later. The position indicator (blue circle) is set at this point. You can see the current co-ordinates of this point in the optical position indicator.
- Select the **Elliptic field** function from the menu or the toolbar.
- Click the point marked earlier and, for exact positioning, keep the mouse button depressed.

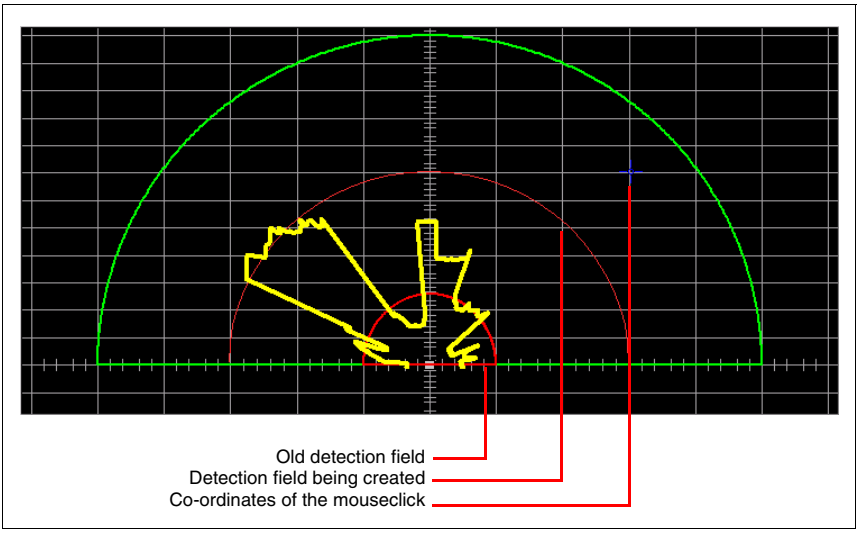


Figure 6.7: Positioning an "elliptical" detection field

- Orient yourself using the optical position indicator.
- Only after the mouse button is released is the old detection field erased from the screen and the new detection field displayed.

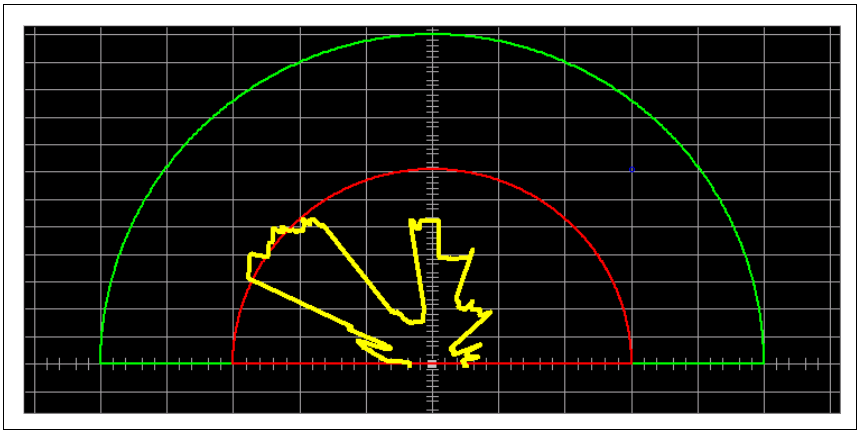


Figure 6.8: New "elliptical" detection field

Rectangle

As with the elliptical detection fields, there are two values here which play a roll: the height and width.

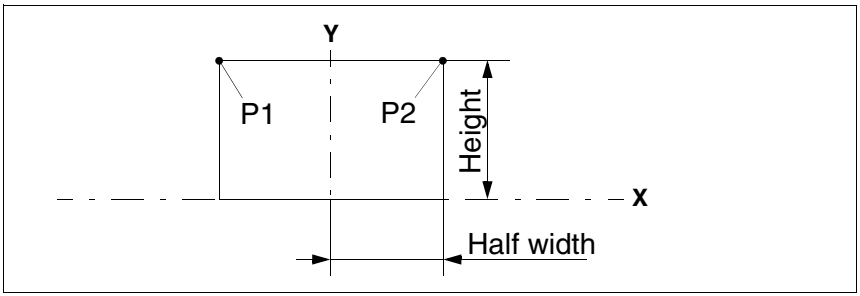


Figure 6.9: Rectangular detection field

- Select the **Rectangular field** function from the menu or the toolbar.
- The remaining steps in the creation of the rectangular detection field function as with "Ellipse". Please refer to the previous section for the required steps

Polygon

With the "polygonal" detection field shape, you set the corner points of the detection field directly. It is, therefore, possible to exclude certain objects which are permanently in the scanning area (e.g. columns).

When defining a polygonal detection field, proceed as follows:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the **Polygonal field** function from the menu or the toolbar.
- Please set the corner points of the polygon from left to right!
- On the diagram area, click the first corner point of the detection field.
- If you hold the mouse button pressed, you can use the optical position indicator to precisely position the points.

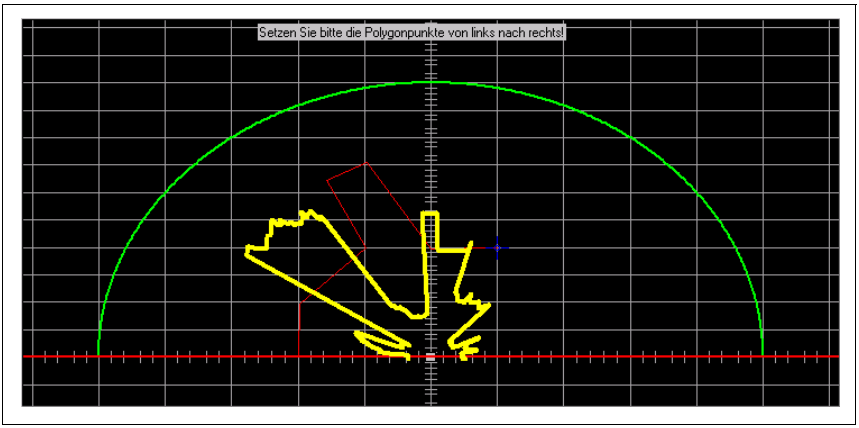


Figure 6.10: Creating a "polygonal" detection filed

- Click the next corner point.
- Set all other corner points in the same way.
- After you have set the last corner point, click the **right** mouse button on the work area and the polygon closes.
- If you set the last corner point slightly below the zero line of the X axis, the polygon closes automatically and the following message appears on the screen:

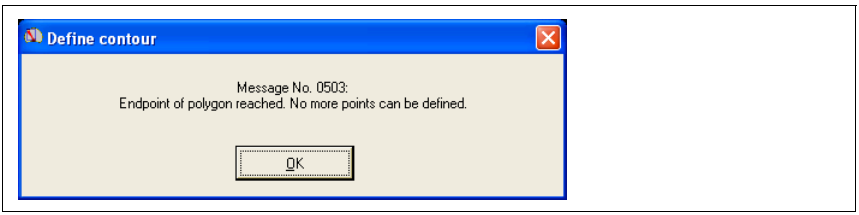


Figure 6.11: Message: Endpoint of polygon reached

Teach-in detection field

In addition to the previously described options for detection field definition, it is also possible to create a detection field on the basis of the current measurement contour.

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the **Teach-in field** function from the menu or the toolbar. The following window appears:

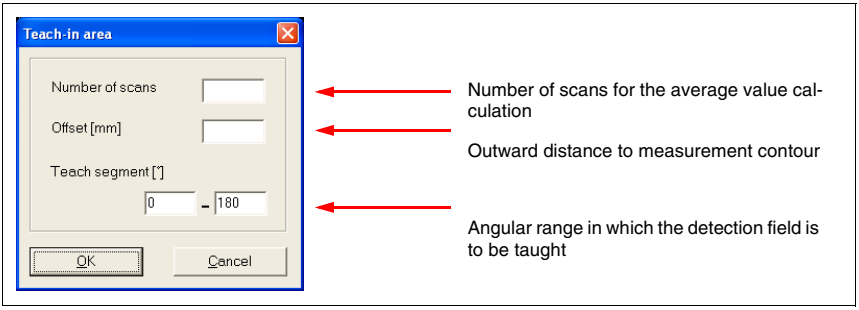


Figure 6.12: Input window for teaching-in detection field

- Enter the desired values for the **Number of scans**, **Offset** and **Teach segment** (see figure 6.12) for teaching-in the detection field and confirm with **OK**. The teach event begins and progress is displayed in a window.

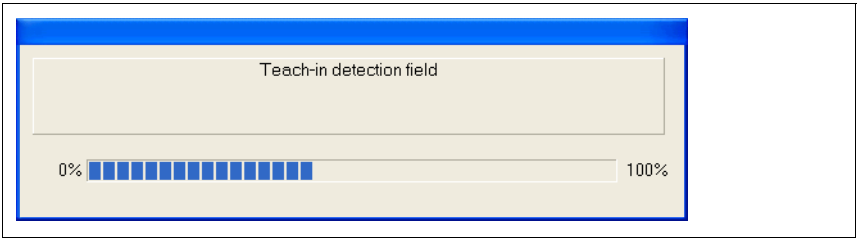


Figure 6.13: Progress bar for detection-field teach-in

Notice!

If you selected a large value (e.g. > 10) for the Number of scans *parameter, the time required for the teach event is correspondingly long. Guidelines:*

Number of scans = 10 –> Duration of teach event approx. 7s
Number of scans = 20 –> Duration of teach event approx. 12s
Number of scans = 50 –> Duration of teach event approx. 26s

- Upon conclusion of the teach event, the new detection field is displayed.

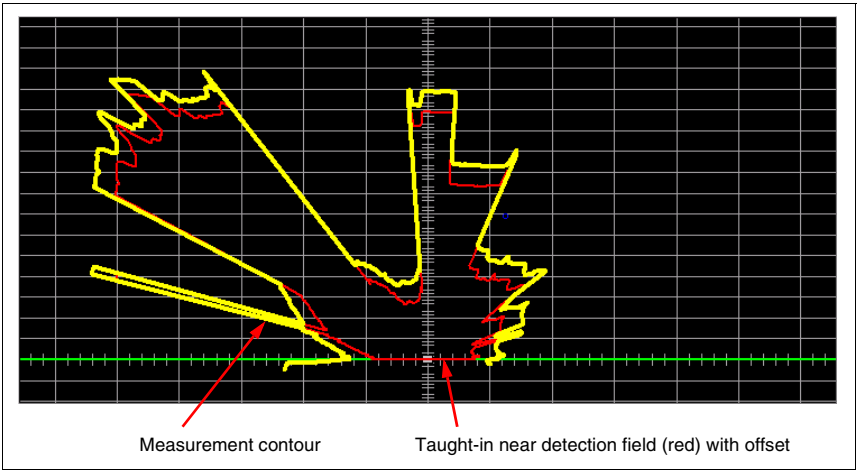


Figure 6.14: Example of a taught-in detection field

6.2.2 Changing detection fields

If you would like to change existing detection fields, you can use the following functions:

Designation	Icon	Menu
Change segments		**Detection fields → Change → Change segments**
Cut detection field		**Detection fields → Change → Cut detection field**
Fade out segment		**Detection fields → Change → Fade out segment**

Table 6.2: Tools for changing detection fields

The use of the tools is described in the following sections.

Changing segments

In order to adapt existing detection fields to the environmental conditions, you can use the "Change segment" function.

The following scenario is used as an example:

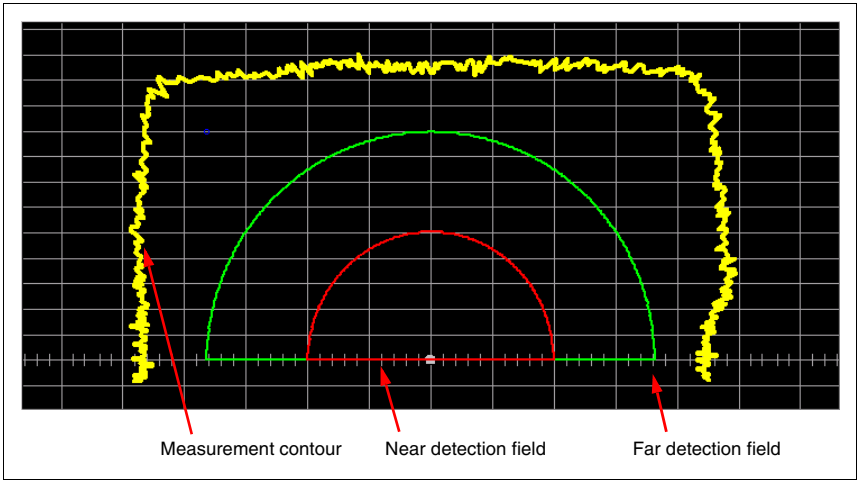


Figure 6.15: Change segment - initial situation

When making the change, proceed as follows:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the **Change segment** function from the menu or the toolbar.
- Rectangular segment points are now displayed on the detection field line. Depending on the size of the detection field, the distances between the points may vary.
- Please set the corner points of the polygon from left to right!

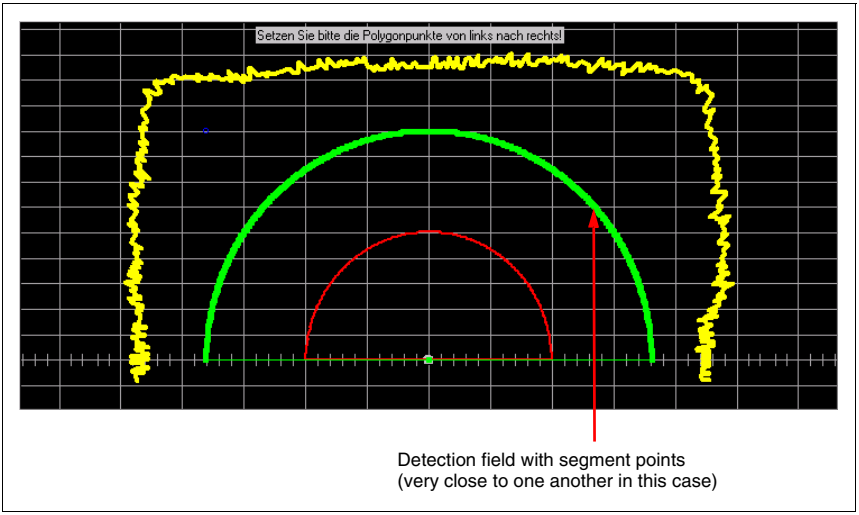


Figure 6.16: Change segment - segment points

- Find the point on the curve beginning with which you would like to redefine the detection field segment using a polygon.
- Click the first point and hold down the mouse button. A green or red line appears. The end of this line defines the new location of the point. You can change this line until the mouse button is released.

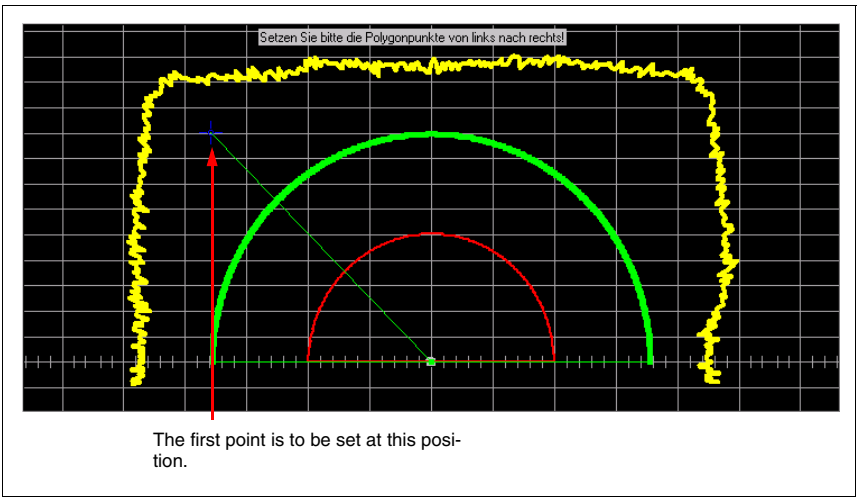


Figure 6.17: Change segment - moving the 1st segment point

- Click the next corner point and hold down the mouse button.
- A second line is created. This line is connected to the first line. The end of the line describes the new location of this point. You can change the line until the mouse button is released.

Figure 6.18: Change segment - setting the next corner point

- If necessary, use the left mouse button to set further corner points.
- Complete your entry by clicking the **right** mouse button on the work area; the polygon closes and the changed detection field is displayed.

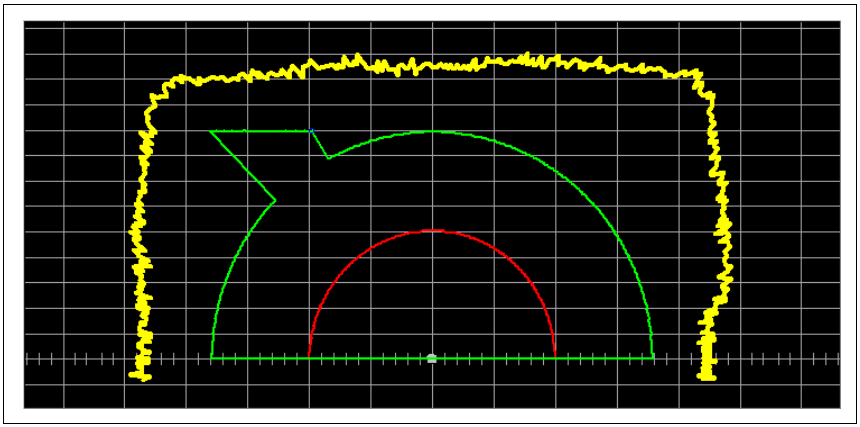


Figure 6.19: Change segment - completion

Cut detection field

With the "Cut detection field" function, you can reduce the size of an already defined detection field at the left, right or front.

The following sequence explains the procedure using an example:

The following scenario is used as an example:

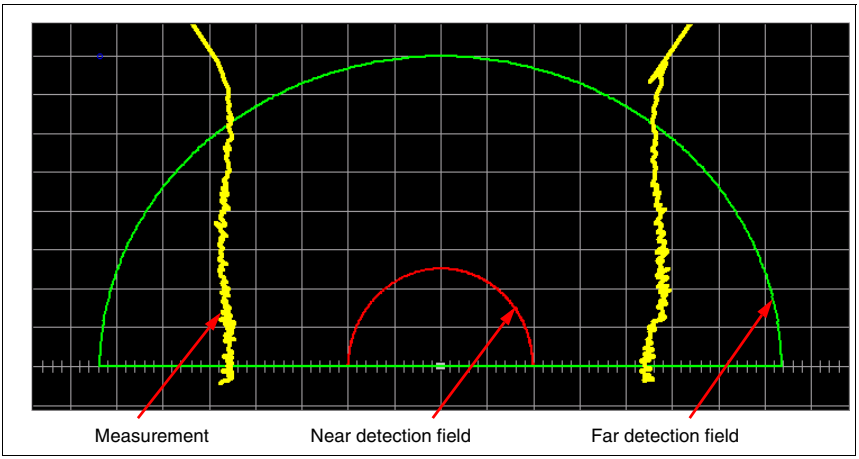


Figure 6.20: Cut detection field - initial situation

When making the change, proceed as follows:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the **Cut detection field** function from the menu or the toolbar.
- In the following input mask, indicate which values you would like to cut and enter the required dimensions. In the example, the left edge is to be cut to -225 mm.

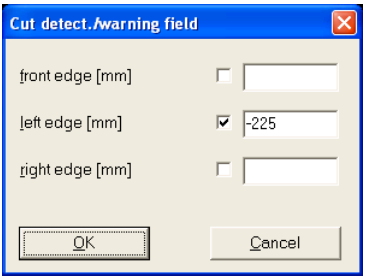


Figure 6.21: Input mask - cut detection field

- Confirm the entry with **OK** and the detection field is cut to the specified dimension.

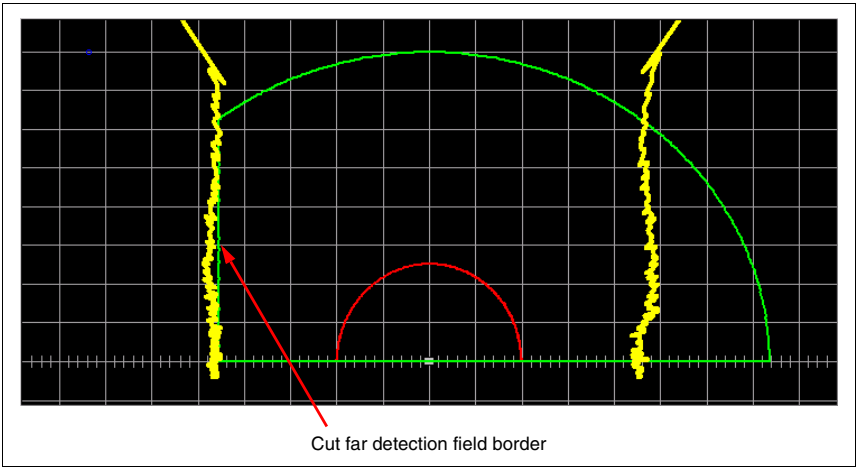


Figure 6.22: Cut detection field - completion

Fade out segment

The "Fade out segment" function, on the other hand, serves to remove angular segments **from already existing** detection fields. A segment intersects the detection field at two points.

Notice!

By supressing all fields completely, the effective measurement rate can be increased as the available transmission period for the measurement values increases (see "Increasing the effective measurement rate" on page 92).

The following scenario is used as an example:

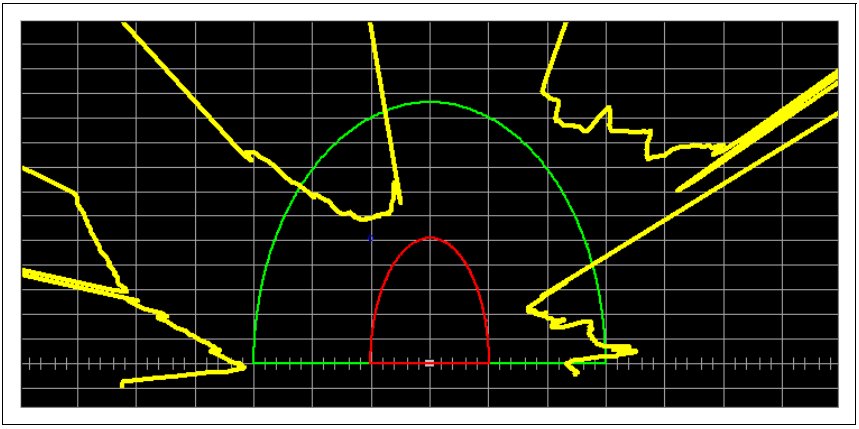


Figure 6.23: Fade out segment - initial situation

When making the change, proceed as follows:

- Select the detection field which is to be adjusted (**Detection fields –> Select detection field**).
- Select the **Fade out segment** function from the menu or the toolbar.
- To select the segment to be faded out, click the lower intersection point using the optical position controls.

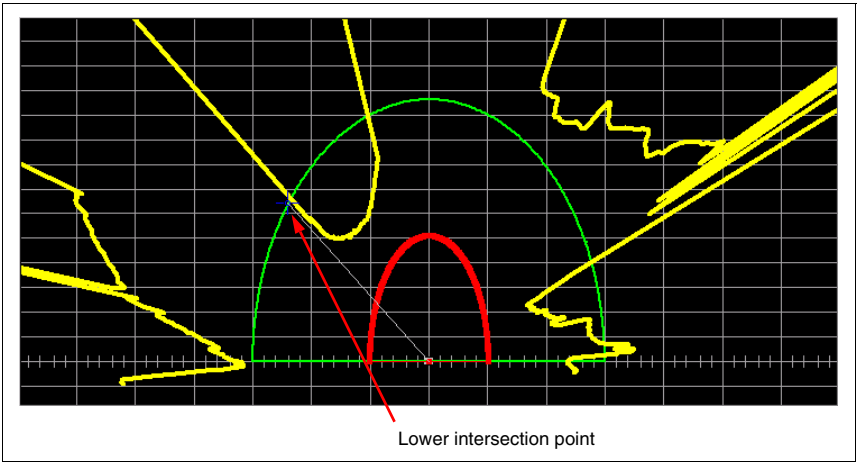


Figure 6.24: Fade out segments - 1st intersection point

- Then click the upper intersection point. The segment is displayed in grey as long as the mouse button is depressed.

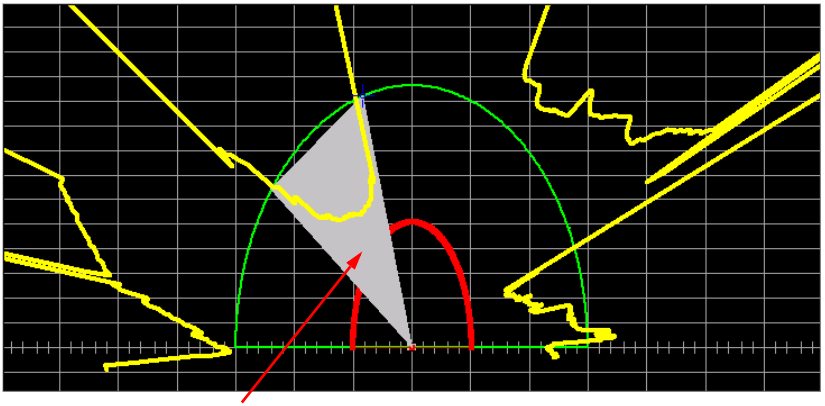


Figure 6.25: Fade out segment - 2nd intersection point

- When the mouse button is released, the selected segment is faded out of the detection field.

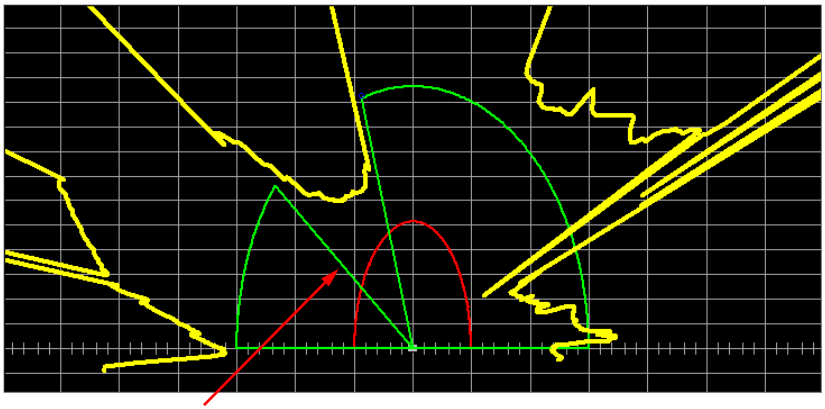


Figure 6.26: Fade out segment - completion

6.3 Reference boundaries

By defining one or more reference boundaries on a near detection field, you have access to another monitoring option.

With an activated reference boundary, the exact position of objects is monitored. Not only whether an object is located **within** the active detection field in this case, but also whether an object was removed.

If the object position deviates from the reference boundary by more than the tolerance value, the sensor also switches off outputs Fn1/Fn2. The tolerance value T for monitoring is ±150mm independent of the measurement distance. The reference boundaries are displayed in blue in the diagram area.

Notice!

For applications in which the presence of a known object is to be checked, the reference boundary functionality is an important monitoring instrument.

Notice!

If a reference contour for a detection field is defined and the dust suppression is activated or the sector size for this detection field is changed, the reference object may have a "hole" that matches the sector size or the computed minimum object width (e.g. 250mm).
*If the width of the reference object is smaller than the configured sector size or the detection field dependent minimum object width, it may happen that the removal of the reference object does **not** lead to the switch-off of the corresponding Fn1/Fn2 output.*

The following 4 figures illustrate position monitoring with reference boundaries.

Object in front of the reference boundary outside of the tolerance value

If an object is located **in front of the reference boundary outside of tolerance value T**, outputs Fn1/Fn2 are switched off even though no object is located in the near detection field.

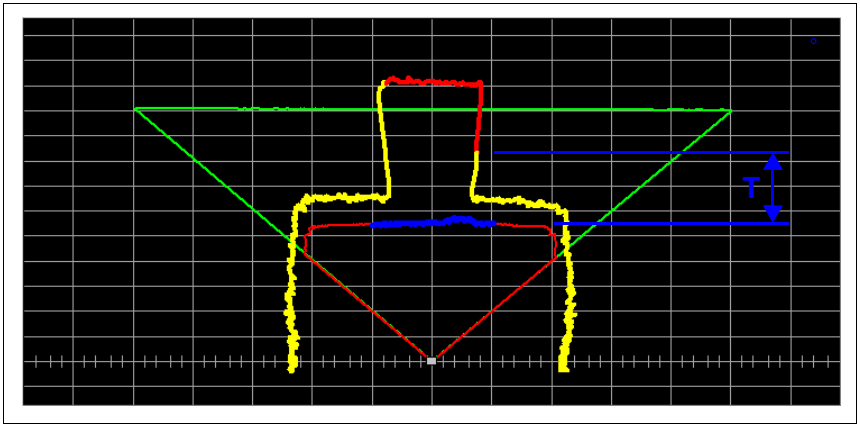


Figure 6.27: Object in front of reference boundary outside of tolerance value T

Object in front of the reference boundary within the tolerance value

If an object is located **in front of the reference boundary within tolerance value T**, outputs Fn1/Fn2 remain switched on.

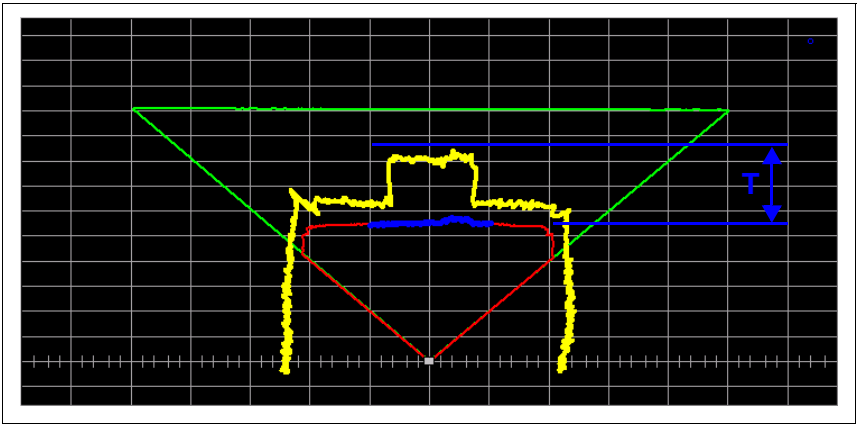


Figure 6.28: Object in front of the reference boundary within tolerance value T

Object behind the reference boundary within the tolerance value

If an object is located **behind the reference boundary within tolerance value T**, outputs Fn1/Fn2 remain switched on even though the object was detected within the near detection field.

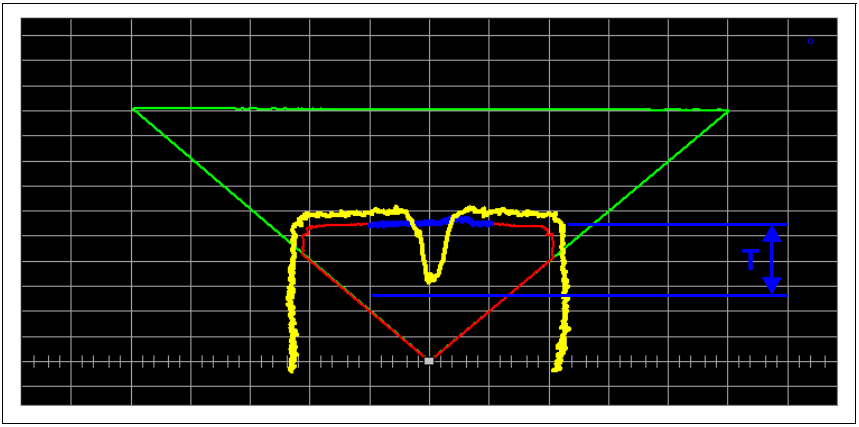


Figure 6.29: Object behind the reference boundary within tolerance value T

Object behind the reference boundary outside of the tolerance value

If an object is located **behind the reference boundary outside of tolerance value T**, outputs Fn1/Fn2 are switched off.

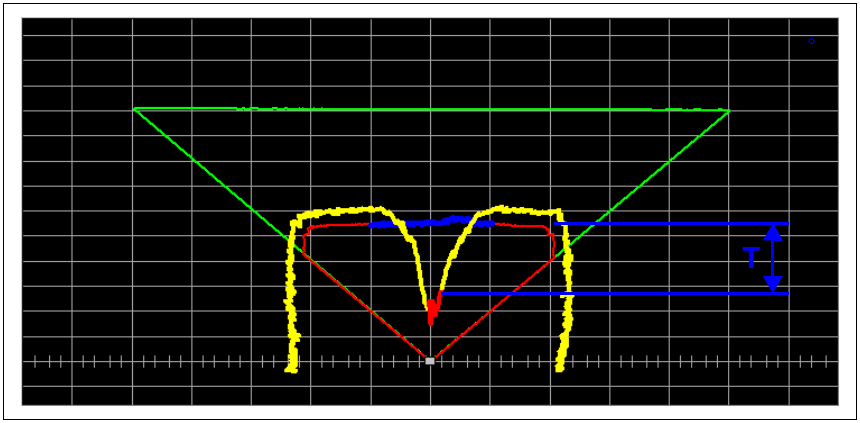


Figure 6.30: Object behind the reference boundary outside of tolerance value T

Defining a detection field segment as a reference boundary

When defining a reference boundary, proceed as follows:

- Select the respective near detection field (**Detection fields –> Select detection field**).
- Select the **Set reference boundary** function from the menu or the toolbar.
- Click the point on the near detection field in the diagram area at which the reference boundary is to begin. If you hold the mouse button pressed, you can use the optical position indicator to precisely position the points.

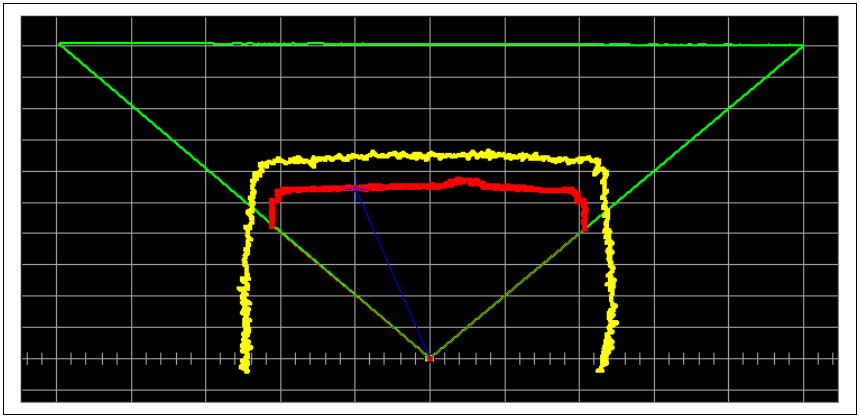


Figure 6.31: Defining a reference boundary - boundary start

- Click the point on the near detection field in the diagram area at which the reference boundary is to end. If you keep the mouse button pressed down, the reference boundary segment is displayed in blue and you can precisely position the points.

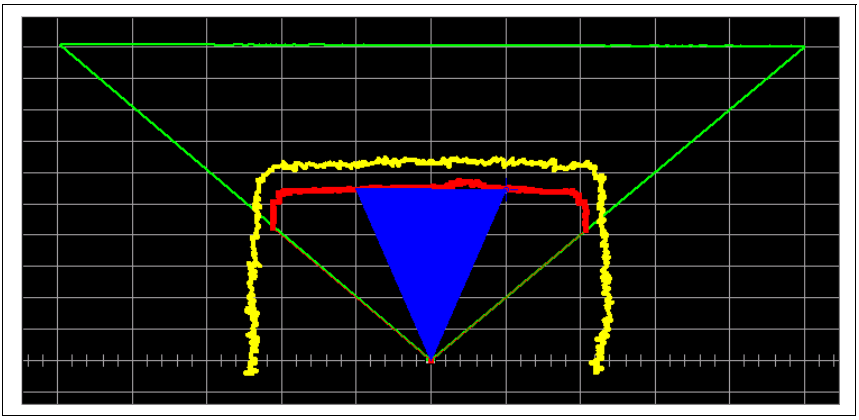


Figure 6.32: Define reference boundary - boundary end

- The reference boundary is now defined. Additional reference boundaries can be defined on the same or other detection field borders in the same way.

Resetting a reference boundary definition for a detection field segment

When removing a reference boundary definition, proceed as follows:

- Select the respective near detection field (**Detection fields –> Select detection field**).
- Select the **Reset reference boundary** function from the menu or the toolbar.
- The remaining procedure corresponds to that for defining a reference boundary.

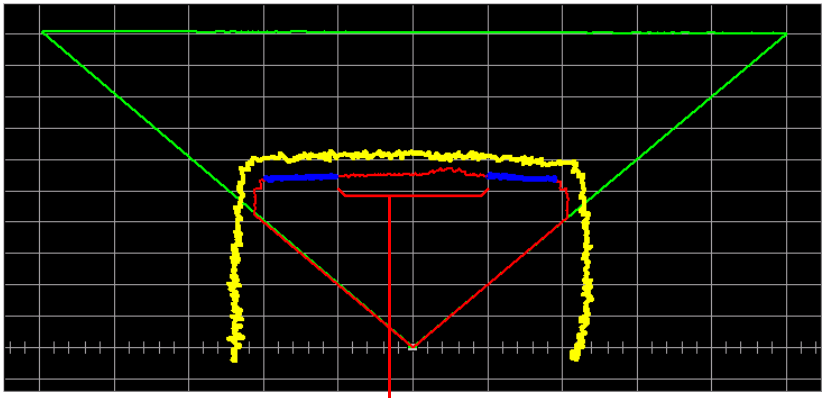


Figure 6.33: Resetting a reference boundary

6.4 Saving and loading detection fields

Individual or multiple detection fields can be saved and loaded as files independent of the configuration parameters.

Saving detection fields

To save changed detection fields on a data carrier, select the **File –> Save detection field to file** menu item or click the  button in the "Define detection fields" tab.

Enter a file name, select a folder and then click **Save**.

Loading detection fields

To reload a stored detection field definition, select the **File –> Load detection field from file** menu item or click the  button in the "Define detection fields" tab. Select the desired file and then click **Open**.

The detection fields stored in this file are now read into RODsoft and can be edited and transferred to the sensor.

6.5 Transferring detection fields

Changed detection fields are initially stored only in RODsoft and, in order to become active, must be transferred to the sensor.

In order for the changed detection fields to be stored in the sensor, you must transfer them to the device. You can transfer the data either via the menu bar (**Detection fields –> Transfer from PC to sensor**) or via the toolbar in the "Define detection fields" tab by clicking the  button.

Selecting the detection fields to be transferred

First, a window appears in which all changed detection fields (since the last data update with the sensor) are listed.

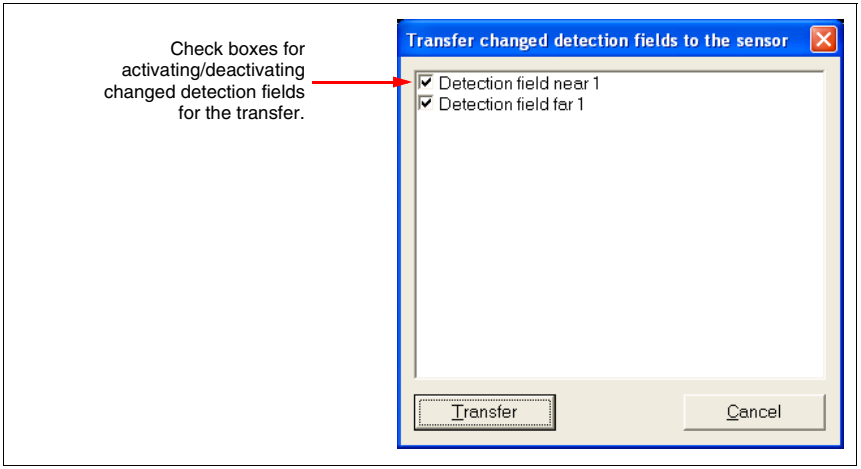


Figure 6.34: Selecting the detection fields to be transferred

After selecting the detection fields, confirm with **Transfer**.

The detection fields are transferred to the sensor. Afterwards, the following info window appears with warning notices.

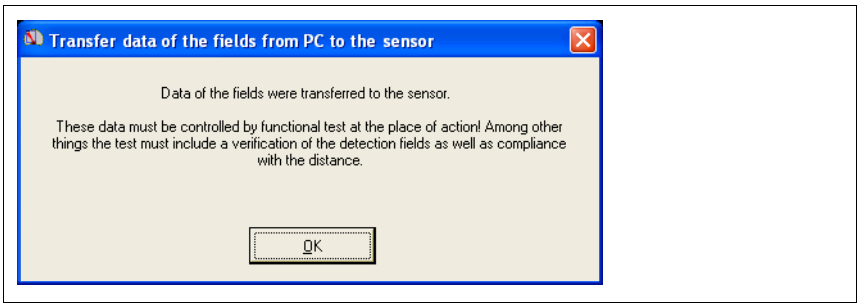


Figure 6.35: Notice after transferring the detection fields

7 Measurement data transfer / protocol info

The transmission protocol described here describes the transfer of the sensor's measurement values via the serial interface (connection X2). The structure of the protocol cannot be defined by the user.

The sensor cannot receive data from the PC via this protocol, i.e. it can be considered to be a 'one-way' protocol.

After the supply voltage is applied and the subsequent self-test completed, the ROD4-3… sensor continuously sends data on the serial interface using the protocol described here.

7.1 Time behaviour / transmission speed

Attention!

The relationships between data quantity and transmission rate described below must absolutely be taken into account when using the binary protocol for measuring applications!

The deflection of the laser beam in the interior of the sensor occurs by means of a rotating mirror, which turns at a rate of 25 rotations per second, i.e. 1 rotation (360°) lasts 40ms. During each rotation, a measurement occurs over the entire 190° detection range. Transfer of the measurement values occurs during the remaining 170° of a rotation, in which no measurement occurs. This means that there are approximately 18ms available for measurement value transfer.

At a transmission rate of 57.6kbit/s (factory setting), 99 bytes can thus be transferred in 19ms (see figure 7.1). At a transmission rate of 115.2kbit/s, twice the amount of data (198 bytes) is transferred within the same time period. That is, the measurement data transfer is twice as fast.

Example for the data transmission

Start segment:	0
Stop segment:	528
Resolution:	1
Baud rate:	115.2kbit/s

During one rotation, the sensor determines at most 529 measurement values of 16 bits each. This means that during a rotation, a maximum of 1058 bytes of measurement data plus approx. 22 bytes of protocol frame are generated, i.e. 1080 bytes. This is more than 6 times as much as can be transferred with the default transmission rate of 57.6kbit/s during one rotation.

To prevent data loss, the sensor uses a transmission buffer which is processed before a new set of measurement values is written (see figure 7.1).

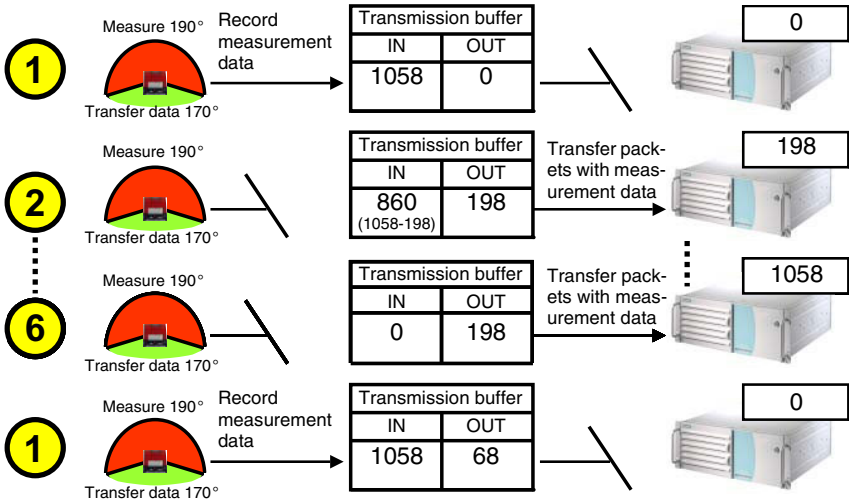


Figure 7.1: Example of measurement data transfer

In this example (start segment: 0, stop segment 528, resolution: 1, baud rate 115kbit/s), it therefore takes at most 6 rotations at 41ms each, i.e. 240ms, until the measurement values are updated. This results in an effective measurement rate of approx. 4 measurement contours per second.

Increasing the effective measurement rate

You can increase the effective measurement rate by taking the following measures:

- **Reduction of the data** by adjusting the angular step size and the start /stop angle:
  - Increase the angular step size by adjusting the "Resolution" parameter in multiples of 0.36° (see figure 5.5 on page 44 and table 5.1 on page 49).
  - Limit the detection range of the sensor (< 190°) by increasing the start angle and reducing the stop angle.
    The measurement value transmission thus starts immediately once the stop segment has been reached and ends only once the start segment has been reached again.
- **Increase the transmission rate**
  provided this is supported by the control and/or PC (see figure 5.6 on page 45 and table 5.1 on page 49).
- **Extending the** available **transfer period** for the measurement values
  by suppressing ALL detection fields.
  Notice: In this case, field evaluation no longer takes place.

Notice!

The configuration must then be saved in the sensor. It can only be saved to a file if the configuration can be read back from the sensor.

Example for extending the transfer period:

The setting start segment = 200, stop segment = 328, resolution = 2 (angular range 46°, every 2nd beam) results in a data volume of approx. 191 bytes. At a baud rate of 115kbaud, it takes 26ms to transfer all measurement values.

Not using the "Suppress Segment" function results in a transmission time of 19ms. This means only every second scan is transmitted.

If, however, all segments are suppressed, the available transmission time is 35ms. Result: the entire scan data is transferred (every scan).

Notice!

An effective measurement rate of 25 scans/s over 190° at a resolution = 1 can be achieved via RS 422 with a transmission rate of 687.5kbit/s!

Attention!

Transmission rates > 115200 baud are only suitable for measurement data transfer.
If a transmission rate greater than 115200 baud is configured, access to the sensor with PC/ RODsoft is no longer possible. Remedy: Reset the baud rate to the factory setting (s. technical description).

7.2 Protocol structure

The protocol structure is described chronologically from top to bottom. The possible values of individual bytes and their meaning are described below.

Time	No. of bytes	Designation	Description
↓	2	**Start**	Start of data transfer from the ROD4
↓	1	**Operation**	Normal operation / error / warning
↓	1	**Option 1**	Is always transferred, indicates the operating state, and whether options 2 and 3 are transferred
↓	1	**Option 2**	The state of the **near** and **far** detection fields is always transferred during the measurement value transmission
↓	1	**Option 3**	Active field pair; always transferred during the measurement value transmission
↓	8	**Scan number**	Is incremented by 1 following each scan of the ROD4 to permit each scan to be uniquely identified
↓	1	**Angular step size**	Angular separation between two successively transferred measurement values
↓	2 (3) [1]	**Start angle**	Angle at which the measurement value output starts for each scan
↓	2 (3) [1]	**Stop angle**	Angle of the most recently transferred measurement segment for each scan
↓	2x no. of meas. values [2]	**Distance measurement value**	Output of the distance measurement values of the entire scan in sequence
↓	1	**Check byte**	XOR of all characters transferred
↓	3	**End**	End of the data transfer from the ROD4

1) 3 bytes, if the value = 0, see note below
2) + number of 0xFF inserted

Attention!

*If two zeros follow each other in the data stream, a fill byte with the value 255 (**0xFF**) is inserted.*

***Examples**: A distance measurement value of 0 is represented as 0x00 0x00 **0xFF**.*
*The two consecutive measurement values 256mm (0x01 0x00) and 250mm (0x00 0xFA) are displayed as 0x01 0x00 0x00 **0xFF** 0xFA.*

7.2.1 Start

The start character consists of two bytes that always have the value 0x00,0x00.

MSB							**start byte 1** LSB	MSB							**start byte 2** LSB
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7.2.2 Operation

The operation character consists of one byte and identifies the type of the message transmitted.

If a warning message is transferred, no measurement data is transferred for the scan; if an error message is transferred, the sensor switches to error mode

MSB			Operation byte				LSB	Meaning of the bits
0	0	0	0	1	1	1	0	0x14 = regular alive messagefrom the sensor unless measurement values are transferred
0	0	0	1	0	1	1	1	0x23 = Measurement values
0	0	1	1	0	1	0	1	0x53 = Error messages
0	0	1	1	0	1	1	0	0x54 = Warning messages

7.2.3 Option 1

Option byte 1 is always transferred and indicates whether further option bytes follow. In addition, information about the operating state is provided here.

MSB			Option byte 1				LSB	Meaning of the bits
						0	1	Option 1 only
						1	0	Option 1 + Option 2
						1	1	Option 1 + Option 2 + Option 3
			0	0	1			Initialisation
			0	1	0			Measurement operation (normal operation)
			1	0	0			Error / fault

7.2.4 Option 2

Option byte 2 is transferred only if bit 1 of option byte 1 is set. It specifies whether objects have been detected in the near and far detection fields. In addition, information about the operating state is provided here.

MSB			Option byte 2				LSB	Meaning of the bits
							0/1	1 = detection field **near 1** occupied
						0/1		1 = detection field **far 1** occupied
					0/1			1 = warning
				0/1				1 = fault
			0/1					1 = restart-disable
		0/1						1 = detection field **near 2** occupied
	0/1							1 = detection field **far 2** occupied
0/1								1 = option byte 3 is transferred

7.2.5 Option 3

Option byte 3 is transferred only if bit 0 and bit 1 of option byte 1 and bit 7 of option byte 2 are set. It specifies which field pairs are transferred as detection field 1 and detection field 2 in option byte 2.

MSB				Option byte 3			LSB	Meaning of the bits
1					E1.2	E1.1	E1.0	001: detection field 1 = field pair 1 to 111: detection field 1 = field pair 7
1		E2.2	E2.1	E2.0				001: detection field 2 = field pair 1 to 111: detection field 2 = field pair 7
1	0/1							specifies the state of outputs Fn1/Fn2. 0 = outputs Fn1/Fn2 switched off

7.2.6 Scan number

The scan number can be used to determine the time between two transferred scans. For each individual scan, the sensor increments the scan number by 1. The sensor captures 25 individual scans per second.

The scan number itself consists of 32 bits. To prevent a small value in the transmission of 4 bytes from creating a double null (i.e., start sequence), fill bytes with a value of 0xFE are inserted between the individual bytes of the scan number.

MSB	Scan number (8 bytes)						LSB
byte 3	fill byte	byte 2	fill byte	byte 1	fill byte	byte 0	fill byte
xxxx xxxx	1111 1110	xxxx xxxx	1111 1110	xxxx xxxx	1111 1110	xxxx xxxx	1111 1110

7.2.7 Angular step size

The angular step size specifies the angular separation between two successively transferred measurement values as a multiple of 0.36 °. The angular step size is dependent on what value was set in RODsoft for the "output resolution" parameter
(standard setting 4*0.36 degrees = 1.44 degrees).

Factory setting: 1

MSB				Angular step size			LSB	Example
x	x	x	x	x	x	x	x	0000 0101: angular step size = 1.8°

7.2.8 Start angle

This value specifies the angular segment of the current scan at which the measurement value output begins. Possible values: 1 (0x00,0x01) to 529 (0x02,0x11). The start angle corresponds to the "Output start segment" parameter, which can be set in RODsoft.

Factory setting: 1

MSB							LSB	MSB							LSB	Example
Start angle byte 1								**Start angle byte 2**								
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0x00 0x0A: Start segment output = 9 = -1.76°

7.2.9 Stop angle

This value specifies the angular segment of the current scan at which the measurement value output ends. Possible values: 1 (0x00,0x01) to 529 (0x02,0x11). The stop angle corresponds to the "Output stop segment" parameter, which can be set in RODsoft.

Factory setting: 529

MSB							LSB	MSB							LSB	Example
Stop angle byte 1								**Stop angle byte 2**								
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0x00 0x14: Stop segment output = 19 = 1.84°

7.2.10 Distance measurement value

All distance measurement values that were measured between start and stop angle using the previously defined angle step size are transferred as successive 2 byte values. If the output resolution is > 1*0.36°, the minimum value within the resolution interval is transferred.

MSB							LSB	MSB							LSB	Meaning of the bits
Distance byte 1								**Distance byte 2**								
															0/1	1 = object in near detection field detected
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		15 bit distance measurement value with 2mm resolution

The following table shows by means of example the chronological order of distance measurement values transmitted for start angle = 10, angular step size = 2, stop angle = 18:

Time	Bytes	Designation	Meaning
↓	0x10, 0x00	**Distance 1**	4096mm at angle -1.44° (angular segment no. 10), no object in detection field near
↓	0x10, 0x01	**Distance 2**	4096mm at angle -0.72° (angular segment no. 12), object in near detection field
↓	0x10, 0x03	**Distance 3**	4098mm at angle 0.0° (angular segment no. 14), object in near detection field
↓	0x10, 0x02	**Distance 4**	4098mm at angle 0.72° (angular segment no. 16), no object in near detection field
↓	0x10, 0x04	**Distance 5**	4100mm at angle 1.44° (angular segment no. 18), no object in near detection field

7.2.11 Check byte

The check byte has a value range of 0x01 to 0xFF.

It is the result of an XOR of all bytes transferred, including operation and option bytes, i.e., from after the start byte up to the last byte before the check byte.

To avoid collision with the end mark, the check byte must never have the value 0x00. If the computed result of the XOR is 0x00 – this is only the case if 0x00 was transferred as LSB for the distance measurement value – then a 0xFF is transmitted as check character.

Attention!

*If two zeros follow each other in the data stream, a fill byte with the value 255 (**0xFF**) is inserted.*

MSB			**Check byte**				LSB	**Meaning of the bits**
x	x	x	x	x	x	x	x	XOR of all bytes from the start to the check byte

7.2.12 End

The end mark consists of three bytes that always have the value 0x00,0x00,0x00.

MSB			**End byte 1**				LSB	MSB			**End byte 2**				LSB	MSB			**End byte 2**				LSB
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7.3 Transmission of warning and error messages

The operating character (see chapter 7.2.2 "Operation") transmitted by the sensor while in the warning or error state is either **0x54 = warning message** or **0x53 = error message**. In this case, the user data (see chapter 7.2 "Protocol structure") consist of warning or error messages, respectively.

Attention!

*If two zeros follow each other in the data stream, a fill byte with the value 255 (**0xFF**) is inserted.*

An error or warning consists of the following parts:

1. **Error number** (2 bytes, unsigned integer):
   The number specifies the given error/warning.
2. **Parameter** (2 bytes, unsigned integer):
   The value parameter contains additional information on the respective error/warning number which can, however, be ignored by the user.
3. **Error location** (2 bytes, unsigned integer):
   The error location specifies where or by which routine the error/warning was triggered.

For the 16-bit values, first the high byte and then the low byte is transmitted.

7.3.1 Warning messages

A warning is transmitted if one of the 6 window-monitoring photoelectric sensors is triggered. The warning is transmitted twice per interrupted photoelectric sensor.

Attention!

A warning is only transmitted twice per photoelectric sensor.

Location	Description	No.	Error description
1705	Processing of the window-monitoring photoelectric sensor data	**3**	Photoelectric sensor on the front cover monitor interrupted, front cover soiled

7.3.2 Error messages

An error message is transmitted if the sensor switches to the error state.
An error message is transmitted exactly once.

Notice!

***Error locations** and **error numbers** with their respective meanings are described in Table 8.1 beginning on page 101.*

8 System information and error handling

You can execute the following tasks in the **System data** menu or in the "System data" tab:

- Load status information from the sensor.
- Load diagnostic data from sensor.
- Create service file.
- Adjust window supervision.
- Reset sensor.

8.1 Loading status information from the sensor

To load status information from the sensor, click in the toolbar or select the **System data –> Load status information from the sensor** menu item.

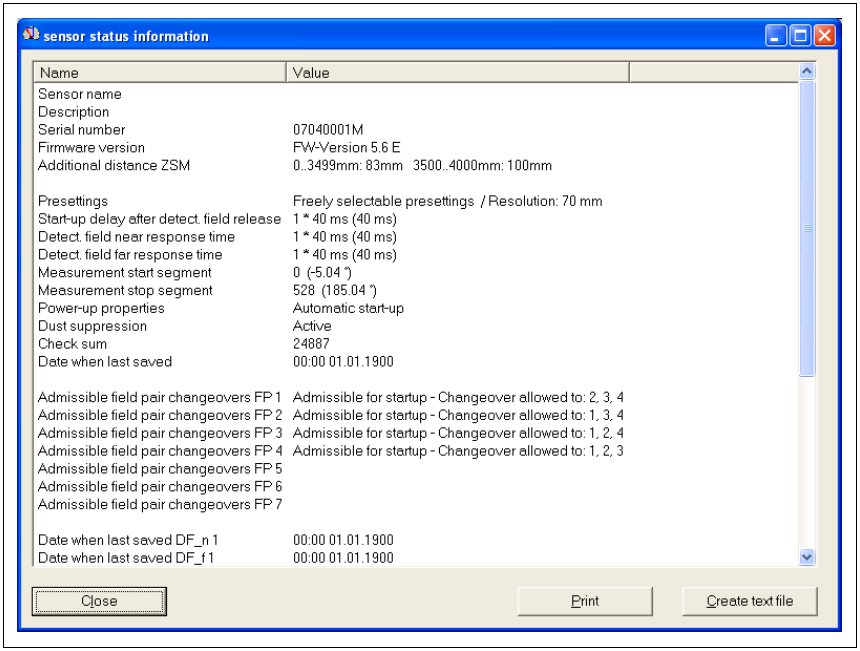


Figure 8.1: Loading status information from the sensor

You can print out and save the status information as a text file.

8.2 Loading diagnostic data from the sensor

All errors which occur in the sensor during operation are stored in a diagnostic list in the device. To display this list, click in the toolbar or select the **System data –> Load diagnostic data from sensor** menu item.

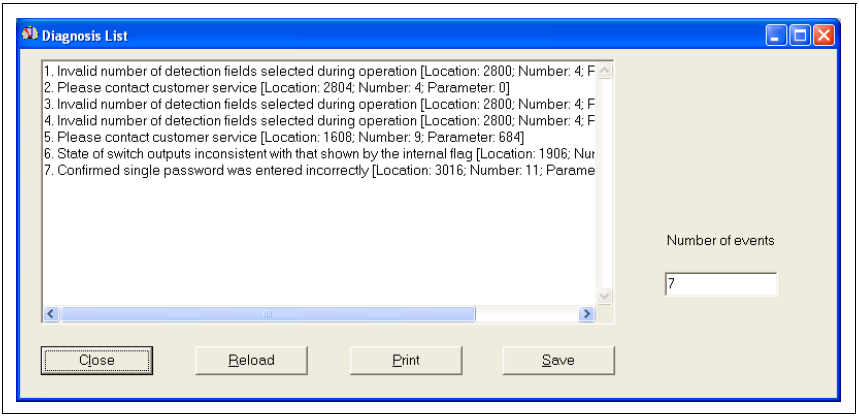


Figure 8.2: Sensor diagnostic list

The error messages (see chapter 8.2.1 "Diagnostic codes and causes") are documented from top to bottom in chronological order. In addition, the total number of events which have occurred is displayed at the right. The information in the list allows you to make good deductions about the possible causes of errors.

You can print out and save the diagnostic list as a text file.

Notice!

The "Contact customer service" message does not necessarily indicate a hardware error. Ask customer service about the meaning and the possible causes.

8.2.1 Diagnostic codes and causes

The messages from the last 8 events are documented. This first memory slot always contains the most recent error message.

Listed in the following table are all errors together with corresponding troubleshooting notices:

Location	No.	Meaning	Measure
102	**2**	Data transfer error on interface X2.	↳ Check the interface parameters and start the transfer again.
103	**2**	Data transfer error on interface X2.	↳ Check the interface parameters and start the transfer again.
104	**2**	Data transfer error on interface X2.	↳ Check the interface parameters and start the transfer again.
105	**6**	Function, access, command not permitted at currently selected access level.	↳ Change the access level and start the transfer again.
201	**4**	Interface X2 time specifications not complied with, last message overwritten.	↳ Check the interface parameters and start the transfer again.
302	**2**	Interface X2 time specifications not complied with, send data not acknowledged.	↳ Check the interface parameters and start the transfer again.
306	**5**	Previous message not completely issued, interface X2 time specifications not complied with.	↳ Check the interface parameters and start the transfer again.
801	**2**	Error memory cannot be read, internal defect	↳ If reset is not successful, contact customer service.
805	**6**	Error memory cannot be transferred, transmission error at interface X2	↳ Check the interface parameters and start the transfer again.
1002	**1**	Motor does not reach nominal rotational speed after start-up; internal defect.	↳ If reset is not successful, contact customer service.
1002	**2**	Motor speed not constant after start-up; internal defect.	↳ If reset is not successful, contact customer service.
1003	**1**	Motor does not reach nominal rotational speed after start-up; internal defect.	↳ If reset is not successful, contact customer service.
1003	**2**	Motor speed not constant after start-up; internal defect.	↳ If reset is not successful, contact customer service.
1003	**3**	Motor speed not constant after start-up; time-out.	↳ If reset is not successful, contact customer service.

Table 8.1: ROD4-3… – diagnostic codes, causes and measures

Location	No.	Meaning	Measure
1110	**4**	Switching outputs Fn1/Fn2 cannot be switched, short-circuit with 0 V DC or +24 V DC.	Check the connection/wiring of Fn1/Fn2.
1110	**5**	Switching outputs Fn1/Fn2 cannot be switched, short-circuit between Fn1 and Fn2.	Check the connection/wiring of Fn1/Fn2.
1110	**6**	Switching outputs Fn1/Fn2 cannot be switched, short-circuit with 0 V DC or +24 V DC.	Check the connection/wiring of Fn1/Fn2.
1111	**7**	Short-circuit between switching outputs Fn1/Fn2.	Check the connection/wiring of Fn1/Fn2.
1111	**8**	Short-circuit of one switching output (Fn1 or FN2) with 0 V DC.	Check the connection/wiring of Fn1/Fn2.
1111	**9**	Short-circuit of one switching output (Fn1 or FN2) with +24 V DC.	Check the connection/wiring of Fn1/Fn2.
1606	**4**	Angle error detected, poss. rotation of the sensor housing; switch-off and reset followed.	If reset is not successful, contact customer service.
1607	**5**	Angle error detected, poss. rotation of the sensor housing; switch-off and reset followed.	If reset is not successful, contact customer service.
1608	**8**	Motor speed not constant during operation, poss. rotation of the sensor housing.	If reset is not successful, contact customer service.
1608	**9**	Motor speed not constant during operation, poss. rotation of the sensor housing.	If reset is not successful, contact customer service.
1608	**10**	Motor speed not constant during operation, poss. rotation of the sensor housing.	If reset is not successful, contact customer service.
1705	**1**	Signal of a photoelectric sensor of the window monitoring below the bottom limit, dirty front cover.	Clean the front cover according to instructions (see Technical Description).
1705	**2**	Signal from a photoelectric sensor of the window monitoring above the upper limit, oil/grease on the front cover.	Clean the front cover according to instructions (see Technical Description).
1906	**1**	Switching outputs Fn1/Fn2 cannot be switched, internal or external short-circuit.	Check the connection/wiring of Fn1/Fn2. If reset is not successful, contact customer service.

Table 8.1: ROD4-3… – diagnostic codes, causes and measures

Location	No.	Meaning	Measure
1906	2	Switching outputs Fn1/Fn2 cannot be switched, internal or external short-circuit.	↳ Check the connection/wiring of Fn1/Fn2. If reset is not successful, contact customer service.
1906	5	Read back error on switching outputs Fn1/Fn2, internal or external short-circuit.	↳ Check the connection/wiring of Fn1/Fn2. If reset is not successful, contact customer service.
1906	6	Error on the laser's switch-off path, switch-off because of eye safety, internal defect.	↳ If reset is not successful, contact customer service.
1907	4	Angle error detected, poss. rotation of the sensor housing; switch-off and reset followed.	↳ If reset is not successful, contact customer service.
1907	7	Angle error detected, poss. rotation of the sensor housing; switch-off and reset followed.	↳ If reset is not successful, contact customer service.
2002	12	Configuration data displayed for inspection not acknowledged quickly enough	↳ Start the transfer again.
2007	18	Date of the currently transmitted detection field is older than the date of the detection field stored in the sensor.	↳ Update the PC's date and time setting.
2017	19	Data transfer error with ConfigPlug.	↳ Replace the ConfigPlug or the complete cable with plug.
2017	23	The connected sensor does not support the configuration file in the ConfigPlug.	↳ Change the sensor, observe the device type.
2017	24	The connected sensor does not support the configuration file in the ConfigPlug.	↳ Change the sensor, observe the device type.
2017	26	Date of the currently transmitted configuration is older than the date of the configuration stored in the sensor.	↳ Update the PC's date and time setting.
2201	5	Number of measurements in the scan too small due to rotational speed error in the motor or because internal fuse was blown.	↳ If reset is not successful, contact customer service.
2302	1	Error occurred during sensor start-up.	Sequential error.
2401	10	Reference measurement failed; glare from another light source (905 nm) or rotation speed error.	Sensor performed reset.

Table 8.1: ROD4-3… – diagnostic codes, causes and measures

Location	No.	Meaning	Measure
2401	13	Reference measurement failed, dust in the device, due to the plug housing or dummy cap not being screwed on.	Screw the plugs of interfaces X1 and X2.
2401	41	Reference measurement failed; glare from another light source (905 nm) or rotation speed error.	Sensor performed reset.
2402	10	Reference measurement failed; glare from another light source (905 nm) or rotation speed error.	Sensor performed reset.
2402	41	Reference measurement failed; glare from another light source (905 nm) or rotation speed error.	Sensor performed reset.
2701	1	Invalid diagnostic command received, software incompatible with firmware.	Use a newer version of the configuration software.
2702	3	Invalid diagnostic value requested, software incompatible with firmware.	Use a newer version of the configuration software.
2800	2	2 field pair control inputs activated longer than 1 s.	Check the switchover times of the control inputs FPS1 - FPS4.
2800	3	The detection field changeover which occurred does not match the preset which was programmed in the sensor.	Check the activation of the detection fields in the program wizard.
2800	4	More than 2 detection fields activated during operation.	Check the activation of the control inputs FPS1 - FPS4.
2800	6	Unusable or defective control voltage for the detection field activation.	Check the activation of the control inputs FPS1 - FPS4.
2800	8	No detection field activated. Can occur during operation and switching off the device.	If detected during running operation, check the activation of the control inputs FPS1 - FPS4.
2801	1	Error while testing the inputs for detection field changeover; internal defect.	Contact the customer service.
2802	3	The detection field activation which occurred does not match the preset which was programmed in the sensor.	Check the activation of the detection fields in the program wizard.
2802	4	More than 2 detection fields selected when starting the sensor.	Only activate one of the control inputs FPS1 - FPS4.
2802	6	Unusable or defective control voltage for the detection field activation.	Check the activation of the control inputs FPS1 - FPS4.
2802	8	No detection field activated during start-up of the sensor.	Activate one of the control inputs FPS1 - FPS4.

Table 8.1: ROD4-3… – diagnostic codes, causes and measures

Location	No.	Meaning	Measure
2804	3	The detection field activation which occurred does not match the preset which was programmed in the sensor.	↳ Check the activation of the detection fields in the program wizard.
2804	4	No detection field clearly selected.	↳ Check the activation of the control inputs FPS1 - FPS4.
2804	6	Unusable or defective control voltage for the detection field activation.	↳ Check the switchover times of the control inputs FPS1 - FPS4.
3016	11	Confirmed single password entered wrong.	↳ Repeat the password entry.
3203	6	Sensor has optical glare caused by another device.	↳ Switch off the supply voltage and start the sensor again.
3203	7	Sensor has optical glare caused by another device.	↳ Switch off the supply voltage and start the sensor again.

Table 8.1: ROD4-3… – diagnostic codes, causes and measures

8.3 Create service file

Click  in the toolbar or select the **System data –> Create service file** menu item to create a service file (file extension `*.sdc`) which contains all data relevant for comprehensive diagnostics and analysis by the Leuze service department:

- Configuration data
- Diagnostic list
- Complete system data

Create this service file if you would like to contact the Leuze service department, and send this together with a your application and error description.

8.4 Adjust window supervision

After replacing the front cover of the sensor, a device-internal calibration of the photoelectric sensor for window monitoring must be performed.

Attention!

Please note that both the replacement of the front cover as well as adjustment of the front cover sensor may only be performed by trained, competent personnel.
This function is only available after entering a special password.
A front cover to be calibrated must be free of contamination.

To call up this function, select the **System data –> Adjust window supervision** menu item or click .

For further information on replacing and adjusting the front cover, please contact the Leuze service department.

8.5 Resetting the sensor

Select the **System data –> Reset sensor** menu item to send a reset command to the sensor via the PC. Use this function, for example, if a device error occurs continuously.

9 Appendix

9.1 Terms and abbreviations ROD4-3… and RODsoft software

4-field mode

In 4-field mode (configuration via RODsoft), all 4 detection fields of detection field pairs 1 and 2 are simultaneously activated and evaluated. In this case, a separate output is assigned to each detection field pair. The 4-field mode is activated: via the configuration wizard under **Presettings** or via the menu under **Configuration** –> **Change** –> **Configuration parameters** –> **Presettings**.

Alarm output ALARM1

Semiconductor output which signals a device warning and error and/or occupancy of a detection field. The function can be selected in RODsoft via the "alarm signal type". The output is at pin 5 of interface X1 and is designated in the ROD4 handbook as ALARM.

Alarm output ALARM2

Semiconductor output which signals a device warning and error.
The output is at pin 15 of interface X1 and is designated in the ROD4 handbook as WARN.

Start interlock

Following device start-up, the restart button must be actuated in order to activate the outputs.

Start-up test

Following device start-up, the near detection fields must be clear after the start-up delay period has passed; the outputs are switched off. To activate the outputs, at least one near detection field must be occupied and then again be cleared.

Start-up delay

Configurable time which must pass before a permanently clear near detection field activates the corresponding switching output. The start-up delay for far detection fields is permanently set to 80 ms.

Response time

Time which must pass before a permanent detection field occupancy switches off the corresponding switching output (separately configurable for near and far detection fields).

Output start-stop segment, output resolution

Used to configure the measurement value transmission at serial interface X2. The configuration is made in multiples of 0.36°. A detection range of 180° corresponds to a start segment of 14*0.36° and a stop segment of 514*0.36°. If the output resolution is > 1*0.36°, the minimum value within the resolution interval is transferred/displayed. Notice: Monitoring of the detection fields also occurs outside of the configured transmission range.

F

Field

Detection field

Long version of the term **field.**

Near detection field

Max. detection range 30m, object detection within the **near** detection field affects outputs Fn1 (pin X1-11) and Fn2 (pin X1-12). The **near** detection field is represented in the user interface of the RODsoft configuration software by the colour red.

Fn

Short version of the term **near detection field**.

Far detection field

Max. detection range 50m, object detection within the **far** detection field affects output ALARM1 (pin X1-5, depending on the configuration). The **far** detection field is represented in the user interface of the RODsoft configuration software by the colour green.

Ff

Short version of the term **far detection field**.

FP

Field pair, detection field pair;
The configuration software can be used to configure a total of up to 7 field pairs in the ROD4-3…, each with two detection fields (**near** and **far**).

FP1

Field pair 1.

FPS

Field pair changeover.

Minimum object size

This parameter is permanently stored and is calculated from the maximum radius of the detection field. Objects are detected if the conditions listed under the keyword object detection are met.

Object detection

Conditions for the object detection

- If the dust suppression is **activated**:
  - The minimum number of consecutive beams, defined with the "Minimum object width"/"sector width" parameters, is incident on an object.
  - Object detection must occur in the detection field for each consecutive individual scan (number of individual scans calculated from the response time: response time 120ms –> 3 individual scans).

- If the dust suppression is **deactivated**:
  - The minimum number of consecutive beams, defined with parameter "sector width", is incident on an object. With the standard setting, sector width = 1 (not active), objects larger than a single beam are detected.
  - Object detection must occur in the detection field for each consecutive individual scan (the number of individual scans is calculated from the response time: response time 120 ms –> 3 individual scans).

Object speed

Parameter that must also be observed for dust suppression. It sets the maximum speed of objects to be detected (factory setting: 1600 mm/s).

Object size

Dust suppression parameter specifying the maximum size of interfering objects (factory setting: 70 mm).

Scanning rate

Rotational frequency of the sensor deflection mirror = 25 Hz.

Sector width

This parameter can be changed. If the value for the sector size is > 1, objects are detected if the minimum number of consecutive scanning beams (multiple of 0.36°) is incident on an object. If the sector size > 1, the entry for the minimum object size and the object size in millimeters are irrelevant for this detection field.

Baud rate of serial interface

Used to configure the transmission rate (9.6 … 687.5 kbit/s) at serial interface X2 of the sensor. The baud rate is continuously changed in the sensor.
Important notice:
If the baud rate is changed, a PC cannot initially be connected to the sensor via RODsoft. This must first be adjusted in RODsoft with the **Settings –> PC-configuration –> Interface** menu item (max. 57,600Bd at RS 232). We recommend working with the factory setting of 57,600 Bd.
In general, higher baud rates are not compatible with ROD4 and ROD4-2… devices. If the baud rate at X2 is set to a higher value, a connection is no longer possible with RODsoft via the RS 232. Resetting to 57600 Bd can only be performed via an external connection at pin X1-2 (see ROD4-xx technical description).

The following baud rates are supported:

ROD4-3…	ROD4/ROD4-2…
9600 Bd	
19200 Bd	
38400 Bd	
57600 Bd	
115200 Bd	109700 Bd
345600 Bd	384000 Bd
687500 Bd	768000 Bd

Dust suppression

With the introduction of the new ROD4-3… models, considerably more effective dust suppression was implemented in the devices. With activated dust suppression (recommended), sensor availability is increased in the event of small particles in the air, such as insects. This also maximises the time which may pass before cleaning of the front cover becomes necessary.

Dust suppression is implemented globally, i.e. it is used in all detection fields. In the RODsoft configuration software, the following parameters determine the function of the dust suppression:

- the dust suppression (factory setting: activated)
- the object size (factory setting: 70mm)
- the object speed (factory setting: 1600mm/s)
- the response time (factory setting: 80ms)
- the sector size

Restart

Determines how switching outputs are switched following object detection in a near detection field in the event of subsequent non-occupancy.

- Manual restart: The restart button must be actuated and start disable must be active.
- Automatic restart: Following a start-up delay, the outputs are activated.

Angular resolution

Smallest technically possible resolution of the sensor in angular degrees.

Numerics

A

B

C

D

E

F

H

I

L

M

N

O

P

R

S

T

U

W

Z