MANUAL

2-D Laser Scanner
OMD10M-R2000-B23,
OMD30M-R2000-B23,
OMD12M-R2000-B23

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SENSING YOUR NEEDS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

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1 Introduction

1.1 Introduction

Congratulations

You have chosen a device manufactured by Pepperl+Fuchs. Pepperl+Fuchs develops, produces and distributes electronic sensors and interface modules for the market of automation technology on a worldwide scale.

Read these instructions carefully before you install this device and put it into operation. Instructions and hints included in this manual lead you step by step through the installation and commissioning and provide a trouble-free use of this product. This is for your benefit, since this helps you to:

- ensures the safe operation of the device
- exploit the full functionality of the device
- avoid operating errors and related disturbances
- avoid costs due to disruptions and repair work
- increase the effectiveness and efficiency of your system.

Keep these instructions for reference for later work on the equipment.

Please check after opening the package, that the device isn't damaged and the completeness of the delivered goods.

Symbols used

The following symbols are used in this manual:

Note!

This symbol draws your attention to important information.

Handling instructions

You will find handling instructions beside this symbol

Contact

If you have any questions about the device, its functions, or accessories, please contact us at:

Pepperl+Fuchs GmbH
Lilienthalstraße 200
68307 Mannheim
Telephone: +49 621 776-4411
Fax: +49 621 776-274411
E-Mail: fa-info@pepperl-fuchs.com

1.2 Validity

This manual applies to devices from firmware 1.20 and hardware 1.00 onward. The versions can be found in the device menu; see chapter 7.3.3.

For devices with older versions, documentation is available on request.

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2 Declaration of Conformity

All products were developed and manufactured under observance of the applicable European standards and guidelines.

Note!

A Declaration of Conformity can be requested from the manufacturer.

The product manufacturer, Pepperl+Fuchs GmbH, 68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

ISO**9001**

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3 Safety

3.1 Symbols Relevant to Safety

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

Non-observance may cause personal injury or serious property damage.

Caution!

This symbol indicates a possible fault.

Non-observance could interrupt the device and any connected systems and plants, or result in their complete failure.

3.2 General Safety Information

The following basic instructions must be observed at all times:

- The device must not be commissioned until the manual has been read and understood
- The power supply to produce the supply voltage must have a safe electrical isolation by means of double insulation and a safety transformer according to DIN VDE 0551 (corresponds to IEC 742)
- The device must not be used outside of its specification without suitable protective measures
- Modifying the device is not permitted
- Do not point the devices in direct sunlight and do not take measurements in sunlight
- Do not remove the warnings or rating plates

Installation and commissioning of all devices must be performed only by personnel specially trained for that purpose.

Protection of operating personnel and the system is not ensured if the product is not used in accordance with its intended use.

The laws and guidelines applicable for the use or the intended purpose must be observed. Devices are approved only for proper usage in accordance with intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

Use only recommended original accessories.

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If you are unable to resolve faults, switch the device off. Make sure that the device cannot be switched back on accidentally. If the device needs to be repaired, return it to Pepperl+Fuchs. If you open or modify the device yourself, not only are you endangering yourself and others but you will void any warranty and absolve the manufacturer from any liability.

Dispose of unusable devices in accordance with the applicable national statutory regulations.

For instance, you can take the sensor to a designated collection point for electronic waste.

STOP	***Danger!*** In applications involving stock feeders and moving carriages, care must be taken to ensure that the applicable safety regulations are observed at all times. Failure to do so may result in serious or fatal injury!

3.3 Laser Class 1

Class 1 Laser Product

This sensor is certified according to laser protection class 1.

⚠	***Warning!*** Class 1 laser light The laser light can be an irritant, especially in a dark environment. Do not point lasers at people! Maintenance and repairs should only be carried out by authorized service personnel! Install the device so that the warning is clearly visible and readable. Caution: Use of controls, adjustments, or performance of procedures other than those specified herein may result in harmful laser beam exposure.

3.4 Intended Use

The R2000 laser scanners are measuring devices that are used on automated transport systems or other movable machinery in intralogistics. They are also used on stationary equipment in the area of factory and building automation.

Make sure that the devices are used only for their intended purpose.

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4 Product Description

4.1 R2000 Laser Scanner

The two-dimensional R2000 laser scanner is made up of a static body, on which a continuously turning measurement module with an emitter laser and receiver element is located. The laser scanner uses Pulse Ranging Technology (PRT). The implementation of this innovative operating principle permits unbroken scanning of the surroundings through a full 360°.

As a compact 360° scanner with high measuring frequency, small angular resolution, precise light spot, visible measurement beam (OMD10M-R2000-B23), and an integrated all-round display, the system can be used in numerous applications in factory automation. In addition to completing familiar tasks from industrial areas such as logistics, transportation, and material handling, the system can be used for innovative applications in buildings automation, automatic navigation of autonomous vehicles, or for monitoring rooms.

One particular highlight of the laser scanner is the row of LEDs arranged on the back of the measurement module. Rotating the scanner produces a cylinder-shaped projection surface, which is suitable for displaying text-based as well as graphical information. In this way, commissioning and operations can be carried out without aids such as a PC or Notebook. Operating and diagnostic information can be seen directly during ongoing operation.

The laser scanner from the R2000 series fulfills the safety requirements of laser class 1 in measurement mode. The low amount of laser light emitted guarantees that operating personnel are neither injured nor harmed.

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4.2 Functional Principle

The laser scanner works according to the principle of Pulse Ranging Technology (PRT). As part of this principle, the time between sending a light pulse and receiving the reflected pulse from an object is measured in the device. Due to the constancy of the speed of light, this time is a measurement of distance.

In comparison with other distance measurement processes, runtime measurement is affected very little by any disturbances in the measuring environment. As a result, this measurement process can be used with a high level of accuracy even under tough everyday industrial conditions. The light source and light receiver are located in the rotating sensor head.

Note!

Influence of ambient conditions

The speed of light depends on the air temperature and barometric pressure.

The influence of the air temperature amounts to 1 ppm/K.

The influence of the barometric pressure amounts to -0.3 ppm/hPa.

These faults must be taken into consideration by the user in the case of longer distances.

In the operating range (-10 °C ... +50 °C) this fault amounts to 0.6 mm at a distance of 10 m.

4.3 Indicators and Controls
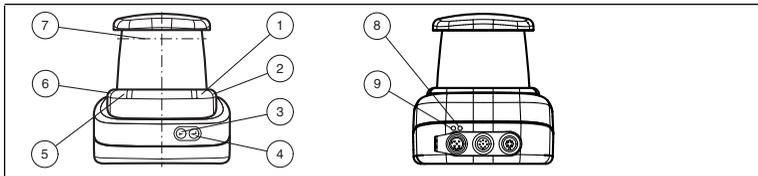
Figure 4.1   Indicators and Controls

No.	Designation	Color
1	Operating status indicator	Green
2	Error indicator	Red
3	"Next" menu button	
4	"Return" menu button	
5	Q2 - no function	
6	Q1 - no function	
7	Laser face	
8	Ethernet link indicator	Green
9	Ethernet activity indicator	Yellow

Table 4.1   Indicators and Controls

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4.4 Interfaces and Connections

The following connections are found on all devices:

Power supply

There is a 4-pin M12 connector on the rear of the housing to connect the power supply. The following diagram shows the pinning:

Figure 4.2   Power supply connection layout

1   24 V power supply

2   Not used

3   Ground (GND)

4   Not used

MultiPort

The 8-pin M12 connector on the rear of the housing is for service purposes.

Interface:

There is a 4-pin M12 socket on the back of the housing to connect the Ethernet interface. The following diagram shows the pinning:

Figure 4.3   Ethernet connection layout

1   TD+

2   RD+

3   TD-

4   RD-

The connector housing is located on the shield.

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4.5 Scope of Delivery

The scope of delivery includes:

- R2000
- Quick start guide
- Protective cover
- 3 x socket cap screws, M5 x 10
- 3 x washers, size 5

○
⃥ *Note!*

Installation Instructions for North America

If a connection is made to the M12 multi-pin connector, the product shall be used with a UL-listed cable/connector (CYJV) assembly rated minimum 30 VDC, minimum 1.0 A, in the final installation for power supply.

4.6 Accessories

The following products are available as accessories.

Designation	Description
V1SD-G-2M-PUR-ABG-V45-G	Patch cable M12 to RJ45, length 2 m
V1SD-G-5M-PUR-ABG-V45-G	Patch cable M12 to RJ45, length 5 m
V1SD-G-ABG-PG9	Single-ended male cordset, M12 D-coded, 4-pin for bus cable
V1-G-2M-PUR	Single-ended female cordset, straight, M12, 4-pin, PUR cable
V1-W-2M-PUR	Single-ended female cordset, angled, M12, 4-pin, PUR cable
MH-R2000	Mounting bracket, quick-lock and adjustment aid

○
⃥ *Note!*

Installation Information for North America

If a connection is made with the M12 multi-pin connector, then in the final installation of the power supply, the product must be used with a UL-listed cable/connector assembly (CYJV) that is designed for at least 30 VDC and at least 1.0 A.

Designation	Description
V1-G-BK-2M-PUR-U	Single-ended female cordset, straight, M12, 4-pin, PUR cable, length 2 m, "UL recognized"
V1-G-BK-5M-PUR-U	Single-ended female cordset, straight, M12, 4-pin, PUR cable, length 5 m, "UL recognized"
V1-G-BK-10M-PUR-U	Single-ended female cordset, straight, M12, 4-pin, PUR cable, length 10 m, "UL recognized"

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To parameterize the 2-D laser scanner conveniently via a software interface, you need the corresponding device type manager (DTM) in addition to the FDT framework program (PACTware 4.x). Both PACTware and the DTM are available at www.pepperl-fuchs.com.

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5 Installation

5.1 Storage and Transport

Package the device for storage and transport such that it is protected from impact and moisture. The original packaging provides optimum protection. Also take note of the permitted ambient conditions.

Note!

If the temperature is subject to major fluctuations during transport, the device must be allowed to acclimatize for around two hours prior to installation and use. During this acclimatization period, avoid subjecting the device to condensation at all costs, as this could have an effect on internal parts and cause damage.

5.2 Unpacking

Check the product for damage while unpacking. In the event of damage to the product, inform the post office or parcel service and notify the supplier.

Retain the original packaging in case the device must be stored or shipped again at a later date.

Should you have any questions, please direct them to Pepperl+Fuchs.

5.3 Mounting

Caution!
Safety information

Do not point the sensor into the sun.

Protect the sensor against direct and prolonged sunlight.

Prevent condensation from forming by ensuring that the sensor is not subjected to any major temperature fluctuations.

Do not subject the sensor to aggressive chemicals.

Keep the glass on the device clean.

For cleaning, use only water (if necessary with a little detergent) and a soft microfiber cloth! The use of other detergents is not permitted! The glass must never be cleaned when dry!

The device can be fitted with the supplied socket head screws with washers on the underside of the device.

Caution!
Screw-in depth

The maximum screw-in depth in the base must not exceed 8 mm, otherwise the device will be mechanically destroyed! The minimum screw-in depth is 5 mm.
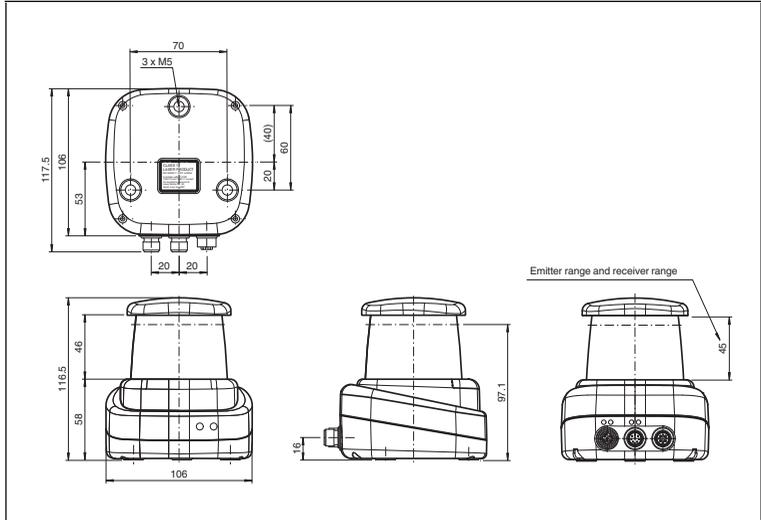
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Figure 5.1   Dimensional drawing R2000

Note!

Keep the emitting/receiving area clear

During assembly, make sure that the emitting/receiving area is kept clear. If the emitting/receiving area is covered, this reduces the performance of the 2D laser scanner.

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5.4 Device Connection

Electrical connection in line with IP65

Put protective covers on unused M12 connectors.

↪ The IP65 protection class is achieved. The protective covers can be ordered as accessories see chapter 4.6.

The device conforms to protection class III. This means that the power has to be supplied as a low protective voltage (PELV).

The power supply of the device is 10 VDC ... 30 VDC. Due to the integrated motor, an increased level of startup current is required compared with normal operation. It is recommended that power supplies with 1 A (at 24 V) or with 2 A (at 12 V) are used.

The maximum cable length is 30 m.
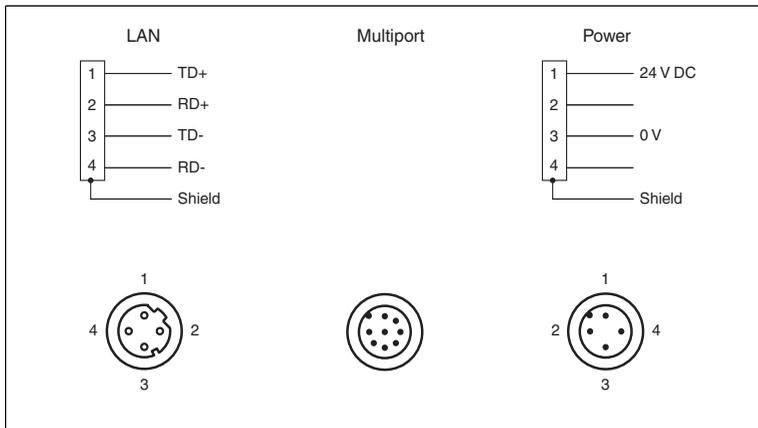
The pin assignment is as follows:

Figure 5.2   R2000 pin assignment

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6   Commissioning

▶

1. Connect the device to the power supply.

    ↳ The initialization phase lasts approx. 15 seconds. This phase is shown by circles moving down the display.

2. After the initialization phase, the Pepperl+Fuchs logo will appear.

    ↳ The device is now ready for operation.

To achieve the best measurement accuracy, allow the device to warm up for 30 minutes.

The sensor has been tested and calibrated before delivery. It can be put into operation immediately.

In general, it is recommended to use a dedicated network card for the connection to the device.

6.1   Ethernet Configuration

The device has three different address modes. Select your preferred mode from the modes described below. The setting is configured directly on the device using the menu interface.

Auto IP

In this mode, the device independently selects a "Link-Local" IP address in the 169.254.0.0/16 range. It is ensured that the selected address is not already being used by another device.

The device is configured to Auto IP by default. The Auto IP setting is the ideal way to establish a direct connection to a PC. Set the DHCP mode (Dynamic Host Configuration Protocol) on the PC. To do this, select the TCP/IP protocol in the network card properties and select the "Obtain an IP address automatically" setting there. After approx. 30 seconds, Windows assigns an Auto IP for the PC.

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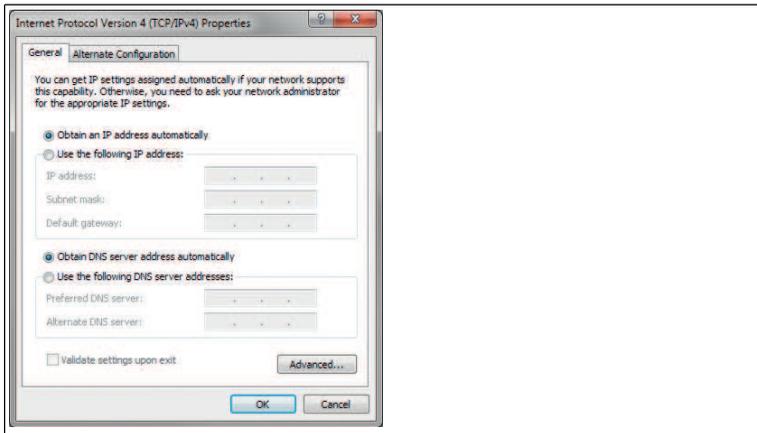
DHCP

Set the device to DHCP under the "Address mode" menu item. The DHCP configuration requires a DHCP server in the local network, e.g., a router. See the "Auto IP" item for information on this.

Manual IP

Set the device to manual under the "Address mode" menu item. The IP address is set to 10.0.10.9 and the subnet mask to 255.0.0.0 by default. To connect the device to the PC, the network card must be configured as follows. Set the required IP address in the network card menu. Select the TCP/IP protocol in the network card properties and select the "Use the following IP address" setting there. Enter the required IP address and subnet mask in these fields.
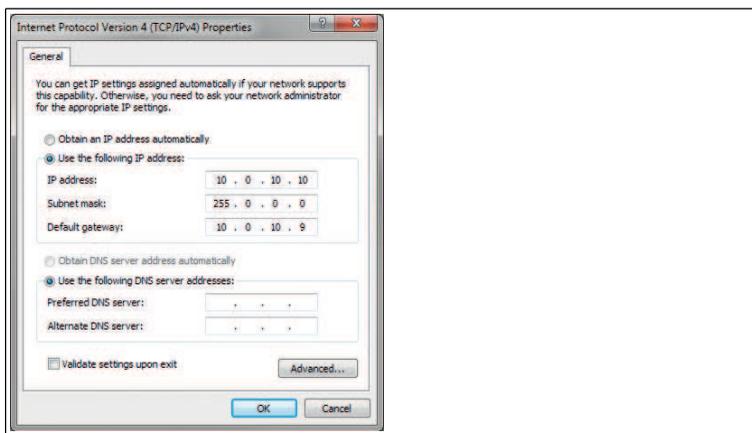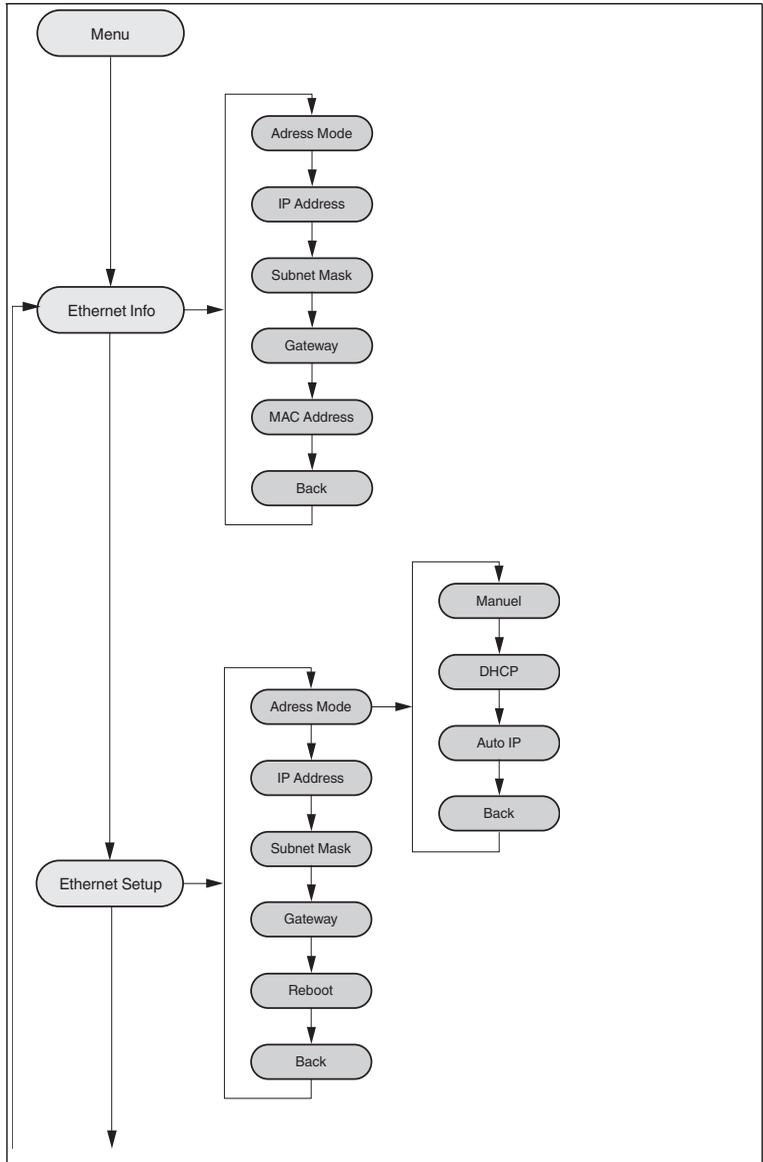

Note!

Device restart

You must restart the device after changing the Ethernet configuration.

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7 Operation

7.1 Menu Structure

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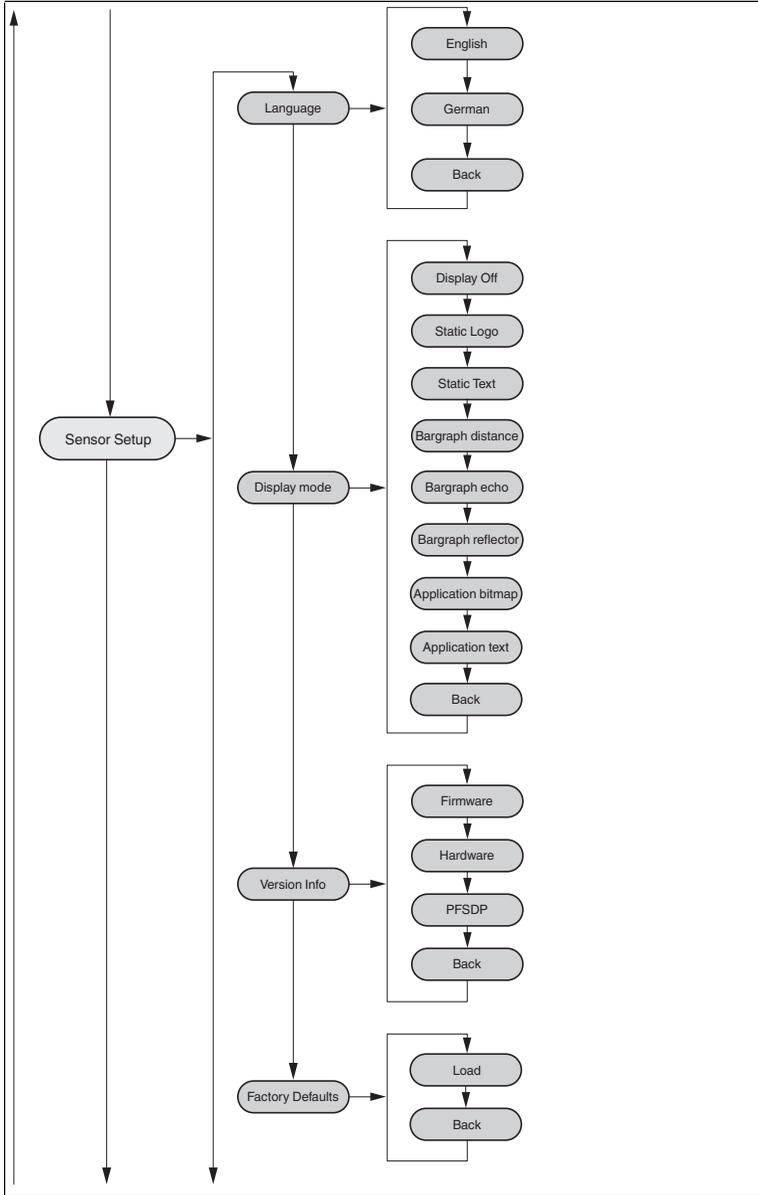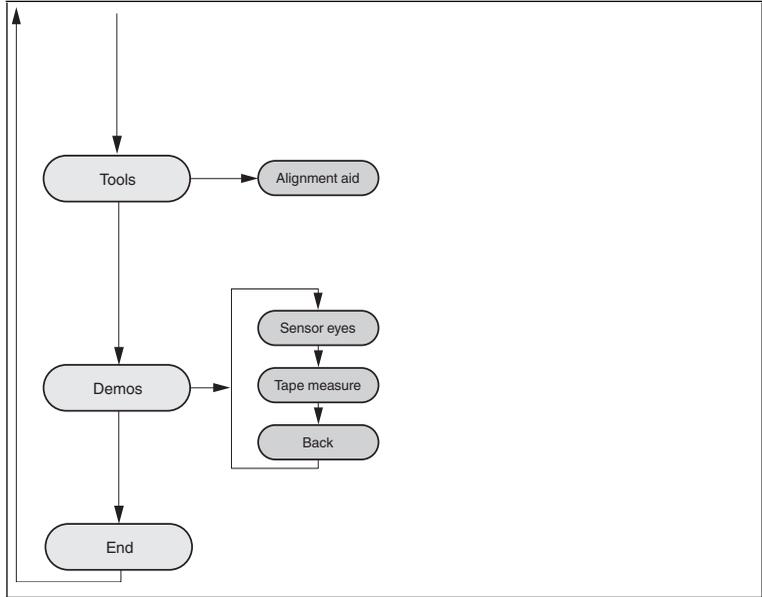
7.2 Operation

The sensor is operated using two buttons, located on the front of the sensor, with which you can navigate in the menu structure. You can change the parameters or enter values using these buttons.

Meaning of Buttons

▶	This button is used as the "Next" button. Pressing this button takes you to the next menu item. You can change a value with this button. This button has a similar function to the ARROW button on the computer keyboard.
↵	Pressing this button selects the displayed menu item. This button has a similar function to the ENTER button on the computer keyboard.

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In each menu item, the values already set are displayed with an underscore. These values can be changed. However, please note that these values should only be changed by personnel with the necessary expertise on the impact of the change.

If no other button is pressed within 60 seconds in the menu levels, the menu is ended automatically.

Navigation in the Menu

Menu display	
Top row	The current menu level is shown in the top row.
Bottom row	The currently selected element is shown in the bottom row.
Dash	One dash means that you are in the main menu.
	Two dashes mean that you are in the submenu.
Operation	
Pressing the ENTER button takes you into the menu structure.	
▶	You change to the next menu element.
	If you hold down (> 1 second) the "Next" button or "ENTER" button, you will change to the next higher menu element.
↵	You change to the selected menu element
	If you hold down (> 1 second) the "Next" button or "ENTER" button, you will change to the next higher menu element.
Menu entry	
End	This menu entry ends the main menu.
Back	This menu entry changes to the next higher menu element

Change count parameters

Menu display	
Top row	This shows the current parameter.
Bottom row	This shows the currently selected parameter value.
Underlined parameter value	This is the currently activated value.
Operation	
▶	You change to the next available parameter value.
	If you hold down the button (> 1 second), you will change to the next higher menu element without changing the parameter.
↵	You activate the parameter value currently displayed.
	If you hold down the button (> 1 second), the displayed parameter is activated and the display returns to the higher-level menu element.

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Changing Numerical Parameters

Menu display	
Top row	This shows the name of the displayed parameter.
Bottom row	This shows the current value of the parameter.
Underlined parameter value	This is the parameter value currently being edited.
Operation	
▶	You increase the currently selected digit.
	If you hold down the button (> 1 second), you increase the selected digit at a faster rate
↵	You change to the next editable digit.
	If you hold down the button (> 1 second), you change to the confirm menu.
Confirm menu	
Top row	This shows the changed number.
Bottom row	This shows the actions that can be carried out (Save, Edit, Cancel).
"Save" action	The changed value is accepted and saved.
"Edit" action	You change back to the edit display.
"Cancel" action	The changes are rejected and you change to the higher-level menu.

IP Configuration Display

Menu display	
Top row	Name of the displayed parameter.
Bottom row	This shows the current value of the parameter.
Operation	
▶	You change to the next menu element.
	If you hold down (> 1 second) the "Next" button or "ENTER" button, you will change to the next higher menu element.
◀	no function
	If you hold down (> 1 second) the "Next" button or "ENTER" button, you will change to the next higher menu element.

Back Menu Item

You return to the higher-level menu via the "Back" menu item

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7.3 Description of Menu Items

7.3.1 Ethernet Info Menu Item

This menu item provides fast access to the IP configuration currently in use. The data can be read only in this menu item.

Address Mode

The address mode currently being used is displayed in this subitem.

IP Address

The IP address currently being used is displayed in this subitem.

Subnet Mask

The subnet mask currently being used is displayed in this subitem.

Gateway

The gateway currently being used is displayed in this subitem.

MAC Address

The MAC address currently being used is displayed in this subitem.

Note!

Changing the IP Configuration

Changes to the IP configuration take effect only after a restart! The IP configuration currently used by the device is displayed in the "Ethernet Info" menu item. If these settings differ from the settings made under the "Ethernet Setup" menu item, the device must be restarted.

7.3.2 Ethernet Setup Menu Item

Change the IP configuration data in this menu item.

Address Mode
- "Manuel": Here an IP address, the subnet mask, and the gateway can be assigned manually to the device
- "DHCP": The device is assigned an IP address by a DHCP server (e.g., Windows PC)
- "AutoIP": The device can be detected automatically by the PC

IP Address

The IP address to be used in the address mode: "Manual" can be set in this menu item.

Subnet Mask

The subnet mask to be used in the address mode: "Manual" can be set in this menu item.

Gateway

The Gateway can be set in this menu item.

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Reboot

The device can be restarted in this menu item.

Note!

Changing the IP Configuration

Changes to the IP configuration take effect only after a restart! The IP configuration currently used by the device is displayed in the "Ethernet Info" menu item. If these settings differ from the settings made under the "Ethernet Setup" menu item, the device must be restarted.

7.3.3   Sensor Setup Menu Item

Language

The language can be set to German or English using this menu item.

Display mode

The display mode defines the display in normal mode when the menu is not active. The display mode is set on a permanent basis. It is active following a restart.

- **Display off**: The display goes dark as soon as the menu is exited.
- **Static logo**: The display shows the Pepperl+Fuchs logo. The logo can be replaced with a custom bitmap file that will still be available after switching the device on/off (saved in EEPROM). See the Ethernet protocol description for details on programming.
- **Static text**: The display shows the text "Pepperl+Fuchs R2000". The text can be replaced with custom text that will still be available after switching the device off/on (saved in EEPROM). See the Ethernet protocol description for details on programming.
- **Bargraph distance**: The display shows a bar graph indicating the distance. The measured values in all directions are shown in the form of a bar chart. The bars become smaller as the distance increases.
- **Bargraph reflector**: A bar is shown on the display at the point at which a reflector is detected.
- **Bargraph echo**: The measured signal strength is shown in the form of a graph on the display.
- **Application bitmap**: A custom bitmap file (24x252 bit) is shown on the display that is no longer available after switching off the device (saved in RAM). See the Ethernet protocol description for details on programming.
- **Application text**: Custom text is shown on the display that is no longer available after switching off the device (saved in RAM). See the Ethernet protocol description for details on programming.

Note!

The **Static logo** and **Static text** display modes are suitable for infrequent changes to the logo and text data.

The **Application bitmap** and **Application text** display modes are suitable for frequent changes to the logo and text data.

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Version Info

- **Firmware**: The display shows the current version of the firmware.
- **Hardware**: The display shows the current version of the hardware.
- **PFSDP**: The display shows the current version of the **P**epperl+**F**uchs **S**can **D**ata **P**rotocol.

Factory defaults

The factory defaults for the sensor can be loaded in this menu item. To do this, you must select "Load" in the submenu and confirm by pressing the "Enter" button. You must restart the device to accept all the changes.

7.3.4   Demos Menu Item

A demo is only active temporarily. As soon as another option is selected in the menu, the demo becomes inactive. This also applies to restarting.

Sensor Eyes

A pair of eyes, which focuses on moving objects, appears on the display. If no activity is detected within five seconds, the "eyes" close. If scanner movement is, in fact, detected, the "eyes" open again.

Tape Measure

In this demo, the scanner measures the distance in a forward direction (x-axis). The value is then shown in the display.

7.3.5   Tools Menu Item

Alignment aid

A bar is shown on the display at the point at which a reflector is detected. An angular scale is shown at the bottom of the display. The "Alignment aid" tool is automatically exited after approximately ten minutes and the stored display mode is activated.

7.3.6   End Menu Item

End

Pressing the "Enter" button to confirm ends the menu and the display mode set is displayed.

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8 Maintenance and Repair

8.1 Maintenance

Observe the applicable national regulations when maintaining the sensor. Essentially, the sensor is maintenance free. Nonetheless, check the technical safety of the sensor system at regular intervals by looking for damage to the housing. Check the sensor for dirt every now and then. To clean the sensor, wipe it at regular intervals with a dry or damp soft cloth. This will ensure it continues to function properly. The housing is made of plastic. For this reason, do not use acetone or detergents containing solvents.

8.2 Repairs

If it appears that safe operation of the system is no longer possible, the system must be taken out of operation and steps taken to prevent it being used inadvertently. If the device needs to be repaired, return it to Pepperl+Fuchs. If you open or modify the device yourself, not only are you endangering yourself and others but you will void any warranty and absolve the manufacturer from any liability.

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9 Troubleshooting

9.1 Troubleshooting

Interference

- The sensor must be firmly mounted. It must not vibrate.
- The sensor must not be installed behind a cover.
- The sensor should be installed so it is protected from rain.

Note!

When carrying out the insulation measurement, be aware that suppressor diodes have been installed for electromagnetic compatibility.

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10 Appendix

10.1 Technical Data "Ultra High Density" Models

General specifications

	OMD10M-R2000-B23-* Standard Range	OMD30M-R2000-B23-* Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Measurement range	0.2 ... 3 m (bk 10%) 0.2 to 10 m (wh 90%) 0.2 to 60 m (reflector)	0.1 ... 10 m (bk 10%) 0,1 ... 30 m (wh 90 %) 0,1 ... 100 m (reflector)	0.1 ... 10 m (bk 10%) 0,1 ... 30 m (wh 90 %) 0,1 ... 100 m (reflector)
Light source	laser diode	laser diode	laser diode
Light type	modulated visible red light	modulated infrared light	modulated infrared light
Laser nominal ratings			
Note	LASER LIGHT , DO NOT STARE INTO BEAM	LASER RADIATION , DO NOT STARE INTO BEAM	LASER RADIATION , DO NOT STARE INTO BEAM
Laser class	1	1	1
Wave length	660 nm	905 nm	905 nm
Beam divergence	1 mrad	transversal 2 mrad , longitudinal 10 mrad	transversal 2 mrad , longitudinal 10 mrad
Pulse length	5 ns	5 ns	5 ns
Repetition rate	250 kHz	250 kHz	250 kHz
max. pulse energy	< 4 nJ	< 94 nJ	< 94 nJ
Measuring method	Pulse Ranging Technology (PRT)	Pulse Ranging Technology (PRT)	Pulse Ranging Technology (PRT)
Scan rate	10 ... 50 s^{-1}	10 ... 50 s^{-1}	10 ... 50 s^{-1}
Scanning angle	360°	360°	360°
Diameter of the light spot	< 20 mm at 10 m	25 mm x 105 mm at 10 m	25 mm x 105 mm at 10 m
Ambient light limit	> 80000 Lux	> 80000 Lux	> 80000 Lux
Resolution	1 mm	1 mm	1 mm

Functional safety related parameters

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
$MTTF_d$	75 a	75 a	75 a
Mission Time (T_M)	20 a	20 a	20 a
Diagnostic Coverage (DC)	0 %	0 %	0 %

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Indicators/operating means

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Operation indicator	LED green	LED green	LED green
Data flow indicator	LED yellow: active ethernet LED green: Ethernet link	LED yellow: active ethernet LED green: Ethernet link	LED yellow: active ethernet LED green: Ethernet link
Function indicator	LED red: fault LED yellow: Q1 + Q2	LED red: fault LED yellow: Q1 + Q2	LED red: fault LED yellow: Q1 + Q2
Control elements	2 Button	2 Button	2 Button
Parameterization indicator	24 x 252 pixels , red	24 x 252 pixels , red	24 x 252 pixels , red

Electrical specifications

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Operating voltage	10 ... 30 V DC	10 ... 30 V	10 ... 30 V
Ripple	10 % within the supply tolerance	10 % within the supply tolerance	10 % within the supply tolerance
No-load supply current	≤ 400 mA / 24 V DC	≤ 400 mA / 24 V DC	≤ 400 mA / 24 V DC
Power consumption	< 10 W	< 10 W	< 10 W
Time delay before availability	< 40 s	< 40 s	< 40 s

Interface

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Interface type	Fast Ethernet	Fast Ethernet	Fast Ethernet
Protocol	HTTP , TCP/IP and UDP/IP	HTTP , TCP/IP and UDP/IP	HTTP , TCP/IP and UDP/IP

Measurement accuracy

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Measuring speed	250000 measurements per second	250000 measurements per second	250000 measurements per second
Measured value noise	± 9 mm (1 sigma, on reflector film)	typ. ± 10 mm (1 sigma; max 20 mm; 0,1 m ... 8 m) typ. ± 12 mm (1 sigma; max 20 mm; 8 m ... 100 m)	typ. ± 10 mm (1 sigma; max 20 mm; 0,1 m ... 8 m) typ. ± 12 mm (1 sigma; max 20 mm; 8 m ... 100 m)
Angle resolution	0.014 °	0.014 °	0.014 °

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	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Absolute accuracy	typ. ± 35 mm	typ. ± 25 mm	typ. ± 25 mm
Repeat accuracy	< 12 mm	< 12 mm	< 12 mm

Ambient conditions

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Ambient temperature	-10 ... 50 °C (14 ... 122 °F)	-10 ... 50 °C (14 ... 122 °F)	-30 ... 50 °C (-22 ... 122 °F)
Storage temperature	-20 ... 70 °C (-4 ... 158 °F)	-20 ... 70 °C (-4 ... 158 °F)	-40 ... 70 °C (-40 ... 158 °F)
Relative humidity	95 % , no moisture condensation	95 % , no moisture condensation	95 % , no moisture condensation

Mechanical specifications

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Degree of protection	IP65	IP65	IP67
Connection	4-pin, M12x1 connector, standard (supply) , 8-pin, M12x1 connector, A-coded (MultiPort) , 4-pin, M12x1 socket, D-coded (LAN)	4-pin, M12x1 connector, standard (supply) , 8-pin, M12x1 connector, A-coded (MultiPort) , 4-pin, M12x1 socket, D-coded (LAN)	4-pin, M12x1 connector, standard (supply) , 8-pin, M12x1 connector, A-coded (MultiPort) , 4-pin, M12x1 socket, D-coded (LAN)
Material			
Housing	ABS + PC + aluminum	ABS + PC + aluminum	ABS + PC + aluminum
Optical face	PMMA	PMMA	PMMA
Mass	approx. 0.8 kg	approx. 0.8 kg	approx. 0.8 kg

Compliance with standards and directives

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
Directive conformity			
EMC Directive 2004/108/EC	EN 60947-5-2:2007	EN 60947-5-2:2007	EN 60947-5-2:2007
Standard conformity			
Product standard	EN 60947-5-2:2007 , IEC 60947-5-2:2007	EN 60947-5-2:2007 , IEC 60947-5-2:2007	EN 60947-5-2:2007 , IEC 60947-5-2:2007
Laser class	IEC 60825-1:2007 EN 60825-1:2007	IEC 60825-1:2007 EN 60825-1:2007	IEC 60825-1:2007 EN 60825-1:2007

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Approvals and certificates

	OMD10M-R2000-B23 Standard Range	OMD30M-R2000-B23 Long Range	OMD30M-R2000-B23-*-T-* Long Range, cold store
CCC approval	CCC approval / marking not required for products rated ≤36 V	CCC approval / marking not required for products rated ≤36 V	CCC approval / marking not required for products rated ≤36 V
UL approval	cULus Listed, Class 2 Power Source, Type 1 enclosure	cULus Listed, Class 2 Power Source, Type 1 enclosure	cULus Listed, Class 2 Power Source, Type 1 enclosure

10.2 Technical Data "High Density" Models

General specifications

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Measurement range	0.1 ... 10 m (bk 10%) 0.1 … 30 m (wh 90 %) 0.1 … 30 m (reflector)	0.2 ... 10 m (bk 10%) 0.2 … 12 m (wh 90 %) 0.3 ... 12 m (reflector)
Light source	laser diode	laser diode
Light type	modulated infrared light	modulated infrared light
Laser nominal ratings		
Note	LASER RADIATION , DO NOT STARE INTO BEAM	LASER RADIATION , DO NOT STARE INTO BEAM
Laser class	1	1
Wave length	905 nm	905 nm
Beam divergence	transversal 2 mrad , longitudinal 10 mrad	transversal 2 mrad , longitudinal 10 mrad
Pulse length	5 ns	5 ns
Repetition rate	84 kHz	84 kHz
max. pulse energy	< 94 nJ	< 94 nJ
Measuring method	Pulse Ranging Technology (PRT)	Pulse Ranging Technology (PRT)
Scan rate	10 ... 50 s^{-1}	10 ... 50 s^{-1}
Scanning angle	360°	360°
Diameter of the light spot	25 mm x 105 mm at 10 m	25 mm x 105 mm at 10 m
Ambient light limit	> 80000 Lux	> 80000 Lux
Resolution	1 mm	1 mm

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Functional safety related parameters

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
MTTF$_d$	75 a	75 a
Mission Time (T$_M$)	20 a	20 a
Diagnostic Coverage (DC)	0 %	0 %

Indicators/operating means

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Operation indicator	LED green	LED green
Data flow indicator	LED yellow: active ethernet LED green: Ethernet link	LED yellow: active ethernet LED green: Ethernet link
Function indicator	LED red: fault LED yellow: Q1 + Q2	LED red: fault LED yellow: Q1 + Q2
Control elements	2 Button	2 Button
Parameterization indicator	24 x 252 pixels , red	24 x 252 pixels , red

Electrical specifications

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Operating voltage	10 … 30 V DC	10 ... 30 V
Ripple	10 % within the supply tolerance	10 % within the supply tolerance
No-load supply current	≤ 400 mA / 24 V DC	≤ 400 mA / 24 V DC
Power consumption	< 10 W	< 10 W
Time delay before availability	< 40 s	< 40 s

Interface

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Interface type	Fast Ethernet	Fast Ethernet
Protocol	HTTP , TCP/IP and UDP/IP	HTTP , TCP/IP and UDP/IP

Measurement accuracy

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Measuring speed	84000 measurements per second	84000 measurements per second
Measured value noise	typ. ± 10 mm (1 sigma; max 20 mm; 0,1 m ... 8 m) typ. ± 12 mm (1 sigma; max 20 mm; 8 m ... 30 m)	typ. ± 20 mm (1 sigma)

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	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Angle resolution	0.042 °	0.042 °
Absolute accuracy	typ. ± 25 mm	typ. ± 40 mm
Repeat accuracy	< 12 mm	< 12 mm

Ambient conditions

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Ambient temperature	-10 ... 50 °C (14 ... 122 °F)	-10 ... 50 °C (14 ... 122 °F)
Storage temperature	-20 ... 70 °C (-4 ... 158 °F)	-20 ... 70 °C (-4 ... 158 °F)
Relative humidity	95 % , no moisture condensation	95 % , no moisture condensation

Mechanical specifications

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Degree of protection	IP65	IP65
Connection	4-pin, M12x1 connector, standard (supply) , 8-pin, M12x1 connector, A-coded (MultiPort) , 4-pin, M12x1 socket, D-coded (LAN)	4-pin, M12x1 connector, standard (supply) , 8-pin, M12x1 connector, A-coded (MultiPort) , 4-pin, M12x1 socket, D-coded (LAN)
Material		
Housing	ABS + PC + aluminum	ABS + PC + aluminum
Optical face	PMMA	PMMA
Mass	approx. 0.8 kg	approx. 0.8 kg

Compliance with standards and directives

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
Directive conformity		
EMC Directive 2004/108/EC	EN 60947-5-2:2007	EN 60947-5-2:2007
Standard conformity		
Product standard	EN 60947-5-2:2007 , IEC 60947-5-2:2007	EN 60947-5-2:2007 , IEC 60947-5-2:2007
Laser class	IEC 60825-1:2007 EN 60825-1:2007	IEC 60825-1:2007 EN 60825-1:2007

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Approvals and certificates

	OMD30M-R2000-B23-*-HD-* Long Range	OMD12M-R2000-B23-*-HD-*
CCC approval	CCC approval / marking not required for products rated ≤36 V	CCC approval / marking not required for products rated ≤36 V
UL approval	cULus Listed, Class 2 Power Source, Type 1 enclosure	cULus Listed, Class 2 Power Source, Type 1 enclosure

10.3 Amplitude Characteristics

In addition to the measured value output for the distance, the R2000 provides an echo amplitude for each measuring step. The measured value for the echo amplitude is a value with no unit of measurement in a range from 0...4095 digits.

The echo amplitude is a measure of the energy received by the R2000. The measured value is dependent on the surface properties of the measurement object (reflectivity, structure), the distance from the measurement object, and the angle of incidence of the measurement beam. The measurement of the echo amplitude is not calibrated and is used for relative distinction between different object reflectivities.

In particular, evaluation of the echo amplitudes can be used to distinguish between natural surfaces and reflector film.

The picture below shows the curve of the echo amplitude on reflector film (diamond grade 983-10). The curve represents the smallest expected measured value in relation to the distance.

The second curve represents the largest value on white (90 % reflectivity), natural surfaces in relation to the distance.
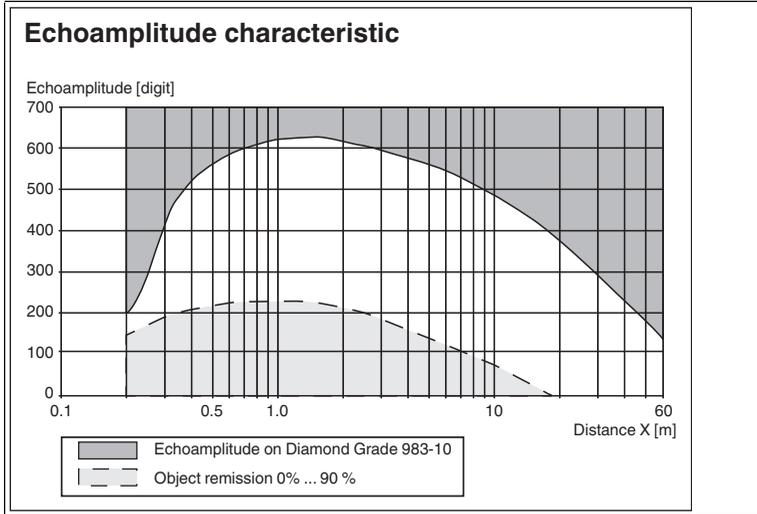
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Echoamplitude characteristic

Echoamplitude [digit]

Figure 10.1   Amplitude characteristics for OMD10M-R2000-B23-V1V1D*

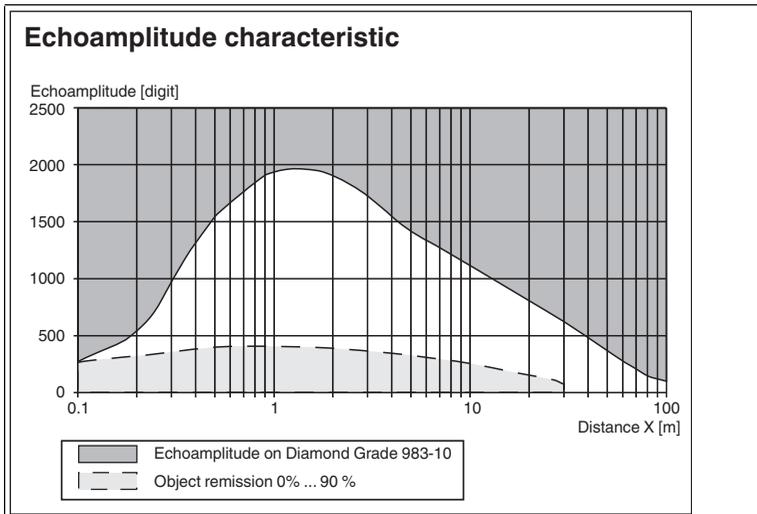## Echoamplitude characteristic

Echoamplitude [digit]

Figure 10.2   Amplitude characteristics OMD30M-R2000-B23-V1V1D*; OMD30M-R2000-B23-V1VD-HD-1L (ends at 30 m); OMD12M-R2000-B23* (ends at 12 m)

The measurement on reflector film is based on a vertical angle of incidence on a reflector strip that is 40 mm wide an an angle resolution of 0.071°.

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The measurement on a white (90 % reflectivity), natural surface is based on a vertical angle of incidence and an emitted beam that hits the measurement object with its full geometry.

If the emitted beam is at an entrance angle of 60°...70° on the reflector foil, the measured value drops by approximately 50% compared to the value for a vertical entrance angle.

10.4 Pulse Ranging Technology (PRT) Glossary

Accuracy	The degree to which the measurement result corresponds to the true value of the measurement. The accuracy is a relative deviation based on a measurement standard. For practical applications, a distinction is drawn between different influencing factors.
Absolute accuracy	Specifies the total of all systematic measurement errors (e.g., linearity, device offset) over a defined distance, reflectivity range, and temperature range that cannot be eliminated by other actions, such as averaging.
Repeat accuracy (repeatability)	The measurement is repeated under the same conditions on the same target. The deviation is the repeatability value. The measured value signal noise is not taken into account.
Measured value signal noise	Randomly distributed deviation of a measured value by an average value. The distribution of the individual measurement values typically follows a statistical normal distribution.
Measurement range	The range between the smallest and largest object distance in which the measuring instrument supplies readings within the specification.

10.5 Using Open Source Programs

Pepperl+Fuchs uses a range of open source software in the R2000 laser scanner. This relates to the programs listed individually below under 1 to 12. We have edited programs 1 to 4:

1. U-Boot
2. Blackfin uClinux
3. Xenomai
4. Mongoose Webserver
5. Libedit
6. Giflib
7. Libncurses
8. ST Standard Peripherals Library
9. ARM CMSIS Header
10. IAR LIBC
11. AVR LIBC
12. CRC Bibliothek

You can use all programs in accordance with the respective license. The licenses, their exact scope, and the respective exclusions of liability can be found in the header of the files themselves.

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Heading image area.

Worldwide Headquarters
Pepperl+Fuchs GmbH
68307 Mannheim · Germany
Tel. +49 621 776-0
E-mail: info@de.pepperl-fuchs.com

USA Headquarters
Pepperl+Fuchs Inc.
Twinsburg, Ohio 44087 · USA
Tel. +1 330 4253555
E-mail: sales@us.pepperl-fuchs.com

Asia Pacific Headquarters
Pepperl+Fuchs Pte Ltd.
Company Registration No. 199003130E
Singapore 139942
Tel. +65 67799091
E-mail: sales@sg.pepperl-fuchs.com

www.pepperl-fuchs.com

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