MANUAL

2D Laser Scanner
OMD10M-R2000-B23
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.

Bevor Sie dieses Gerät montieren und in Betrieb nehmen, lesen Sie diese Betriebsanleitung bitte sorgfältig durch. Die in dieser Betriebsanleitung enthaltenen Anleitungen und Hinweise dienen dazu, Sie schrittweise durch die Montage und Inbetriebnahme zu führen und so einen störungsfreien Gebrauch dieses Produktes sicher zu stellen. Dies ist zu Ihrem Nutzen, da Sie dadurch:

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
Telefon: +49 621 776-4411
Fax: +49 621 776-274411
E-Mail: fa-info@pepperl-fuchs.com
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.
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 devices and any connected facilities or systems, 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.
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.

### 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.
4 Product Description

4.1 R2000 Laser Scanner

The new two-dimensional R2000 laser scanner is made up of a static body, on which a continuously turning measurement module with the 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 angle resolution, precise light spot, visible measurement beam, 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 graphic 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. Due to the low amount of laser light emitted, operating personnel are neither injured nor harmed.
4.2 Operating Principle

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

In comparison with other distance measurement processes, time-of-flight measurement is affected very little by any faults in the measuring environment. As a result, this measurement process can be used with high levels of measurement 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](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Designation</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operating status indicator</td>
<td>Green</td>
</tr>
<tr>
<td>2</td>
<td>Error indicator</td>
<td>Red</td>
</tr>
<tr>
<td>3</td>
<td>&quot;Next&quot; menu button</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&quot;Return&quot; menu button</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Q2 - no function</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Q1 - no function</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Laser face</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ethernet link indicator</td>
<td>Green</td>
</tr>
<tr>
<td>9</td>
<td>Ethernet activity indicator</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

Table 4.1 Indicators and Controls
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 pin assignment:

![Power supply connection layout](image)

Figure 4.2 Power supply connection layout

1. 24 V power supply
2. Not used
3. Ground (GND)
4. Not used

**Service**

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

![Service connection layout](image)

**Interface:**

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

![Ethernet connection layout](image)

Figure 4.3 Ethernet connection layout

1. TD+
2. RD+
3. TD-
4. RD-

The connector housing is located on the shield.
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

4.6  Accessories

The following products are available as accessories.

<table>
<thead>
<tr>
<th>Bezeichnung</th>
<th>Beschreibung</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1SD-G-2M-PUR-ABG-V45-G</td>
<td>Patch cable M12 to RJ45, length 2 m</td>
</tr>
<tr>
<td>V1SD-G-5M-PUR-ABG-V45-G</td>
<td>Patch cable M12 to RJ45, length 5 m</td>
</tr>
<tr>
<td>V1SD-G-ABG-PG9</td>
<td>Single-ended male cordset, M12 D-coded, 4-pin for bus cable</td>
</tr>
<tr>
<td>V1-G-2M-PUR</td>
<td>Female cordset, straight, M12, 4-pin, PUR cable, length 2 m</td>
</tr>
<tr>
<td>V1-W-2M-PUR</td>
<td>Female cordset, angled, M12, 4-pin, PUR cable, length 2 m</td>
</tr>
</tbody>
</table>
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 Assembly

**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.

![Dimensional drawing R2000](image)

**Figure 5.1** Dimensional drawing R2000

### 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. On account of 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:

<table>
<thead>
<tr>
<th>LAN</th>
<th>Service</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>RD+</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>TD-</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>RD-</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Shield</td>
<td>Shield</td>
</tr>
<tr>
<td>1</td>
<td>24 V DC</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0 V</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 5.2 R2000 pin assignment
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.
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. Make sure that the "Disable NetBIOS over TCP/IP" menu item has been selected in the network menu under Advanced -> WINS ->.

![Internet Protocol Version 4 (TCP/IPv4) Properties](image)

Note!

Device Restart
You must restart the device after changing the Ethernet configuration.
7 Operation

7.1 Menu Structure
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

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![UP_ARROW]</td>
<td>This button is used as the &quot;Next&quot; 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.</td>
</tr>
<tr>
<td>![LEFT_ARROW]</td>
<td>Pressing this button selects the displayed menu item. This button has a similar function to the ENTER button on the computer keyboard.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Menu display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top row</td>
<td>The current menu level is shown in the top row.</td>
</tr>
<tr>
<td>Bottom row</td>
<td>The currently selected element is shown in the bottom row.</td>
</tr>
<tr>
<td>Dash</td>
<td>One dash means that you are in the main menu. Two dashes mean that you are in the submenu.</td>
</tr>
</tbody>
</table>

Operation

Pressing the ENTER button takes you into the menu structure.

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![UP_ARROW]</td>
<td>You change to the next menu element. If you hold down (&gt; 1 second) the &quot;Next&quot; button or &quot;ENTER&quot; button, you will change to the next higher menu element.</td>
</tr>
<tr>
<td>![LEFT_ARROW]</td>
<td>You change to the selected menu element. If you hold down (&gt; 1 second) the &quot;Next&quot; button or &quot;ENTER&quot; button, you will change to the next higher menu element.</td>
</tr>
</tbody>
</table>

Menu entry

<table>
<thead>
<tr>
<th>Menu entry</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>End</td>
<td>This menu entry ends the main menu.</td>
</tr>
<tr>
<td>Back</td>
<td>This menu entry changes to the next higher menu element.</td>
</tr>
</tbody>
</table>
## Change count parameters

<table>
<thead>
<tr>
<th>Menu display</th>
<th>Top row</th>
<th>This shows the current parameter.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom row</td>
<td>This shows the currently selected parameter value.</td>
</tr>
<tr>
<td></td>
<td>Underlined parameter value</td>
<td>This is the currently activated value.</td>
</tr>
</tbody>
</table>

**Operation**

<table>
<thead>
<tr>
<th>Operation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>†</td>
<td>You change to the next available parameter value.</td>
</tr>
<tr>
<td></td>
<td>If you hold down the button (&gt; 1 second), you will change to the next higher menu element without changing the parameter.</td>
</tr>
<tr>
<td>‣</td>
<td>You activate the parameter value currently displayed.</td>
</tr>
<tr>
<td></td>
<td>If you hold down the button (&gt; 1 second), the displayed parameter is activated and the display returns to the higher-level menu element.</td>
</tr>
</tbody>
</table>

## Changing Numerical Parameters

<table>
<thead>
<tr>
<th>Menu display</th>
<th>Top row</th>
<th>This shows the name of the displayed parameter.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom row</td>
<td>This shows the current value of the parameter.</td>
</tr>
<tr>
<td></td>
<td>Underlined parameter value</td>
<td>This is the parameter value currently being edited.</td>
</tr>
</tbody>
</table>

**Operation**

<table>
<thead>
<tr>
<th>Operation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>†</td>
<td>You increase the currently selected digit.</td>
</tr>
<tr>
<td></td>
<td>If you hold down the button (&gt; 1 second), you increase the selected digit at a faster rate</td>
</tr>
<tr>
<td>‣</td>
<td>You change to the next editable digit.</td>
</tr>
<tr>
<td></td>
<td>If you hold down the button (&gt; 1 second), you change to the confirm menu.</td>
</tr>
</tbody>
</table>

**Confirm menu**

<table>
<thead>
<tr>
<th>Top row</th>
<th>This shows the changed number.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom row</td>
<td>This shows the actions that can be carried out (Save, Edit, Cancel).</td>
</tr>
</tbody>
</table>

**"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

<table>
<thead>
<tr>
<th>Menu display</th>
<th>Top row</th>
<th>Name of the displayed parameter.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom row</td>
<td>This shows the current value of the parameter.</td>
</tr>
</tbody>
</table>

**Operation**

<table>
<thead>
<tr>
<th>Operation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>†</td>
<td>You change to the next menu element.</td>
</tr>
<tr>
<td></td>
<td>If you hold down (&gt; 1 second) the &quot;Next&quot; button or &quot;ENTER&quot; button, you will change to the next higher menu element.</td>
</tr>
<tr>
<td>‣</td>
<td>no function</td>
</tr>
<tr>
<td></td>
<td>If you hold down (&gt; 1 second) the &quot;Next&quot; button or &quot;ENTER&quot; button, you will change to the next higher menu element.</td>
</tr>
</tbody>
</table>

## Back Menu Item

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

**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 also active following a restart.

- **Display off**: The display goes dark as soon as the menu is exited.
- **Static logo**: The Pepperl+Fuchs logo and the "Pepperl+Fuchs" lettering are displayed.
- **Bargraph distance**: A distance diagram is shown on the display. 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 where a reflector is detected.
- **Echo diagram**: The measured signal strength is shown in the form of a graph on the display.

Default Settings
The default settings 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 End Menu Item

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

10.1 Technical Data

**General specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>0.2 ... 10 m</td>
</tr>
<tr>
<td>Light source</td>
<td>laser diode</td>
</tr>
<tr>
<td>Light type</td>
<td>modulated visible red light</td>
</tr>
<tr>
<td>Laser nominal ratings</td>
<td></td>
</tr>
<tr>
<td>Note</td>
<td>LASER LIGHT, DO NOT STARE INTO BEAM</td>
</tr>
<tr>
<td>Laser class</td>
<td>1</td>
</tr>
<tr>
<td>Wave length</td>
<td>660 nm</td>
</tr>
<tr>
<td>Beam divergence</td>
<td>1 mrad</td>
</tr>
<tr>
<td>Pulse length</td>
<td>5 ns</td>
</tr>
<tr>
<td>Repetition rate</td>
<td>250 kHz</td>
</tr>
<tr>
<td>max. pulse energy</td>
<td>&lt; 4 nJ</td>
</tr>
<tr>
<td>Measuring method</td>
<td>Pulse Ranging Technology (PRT)</td>
</tr>
<tr>
<td>Scan rate</td>
<td>10 ... 50 s⁻¹</td>
</tr>
<tr>
<td>Scanning angle</td>
<td>360°</td>
</tr>
<tr>
<td>Diameter of the light spot</td>
<td>&lt; 20 mm at 10 m</td>
</tr>
<tr>
<td>Ambient light limit</td>
<td>&gt; 80000 Lux</td>
</tr>
<tr>
<td>Resolution</td>
<td>1 mm</td>
</tr>
</tbody>
</table>

**Functional safety related parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTTF₀</td>
<td>75 a</td>
</tr>
<tr>
<td>Mission Time (T_M)</td>
<td>20 a</td>
</tr>
<tr>
<td>Diagnostic Coverage (DC)</td>
<td>0 %</td>
</tr>
</tbody>
</table>

**Indicators/operating means**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation indicator</td>
<td>LED green</td>
</tr>
<tr>
<td>Data flow indicator</td>
<td>LED yellow: active ethernet LED green: Ethernet link</td>
</tr>
<tr>
<td>Function indicator</td>
<td>LED red: fault LED yellow: Q1 + Q2</td>
</tr>
<tr>
<td>Control elements</td>
<td>2 Button</td>
</tr>
<tr>
<td>Parameterization indicator</td>
<td>24 x 360 Pixel, red</td>
</tr>
</tbody>
</table>

**Electrical specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>10 ... 30 V</td>
</tr>
<tr>
<td>Ripple</td>
<td>10 % within the supply tolerance</td>
</tr>
</tbody>
</table>
### No-load supply current
\[ \leq 400 \text{ mA} / 24 \text{ V DC} \]

### Protection class
III (operating voltage 50 V)

### Power consumption
\[ < 10 \text{ W} \]

### Time delay before availability
\[ < 40 \text{ s} \]

#### Interface
- **Interface type**: Fast Ethernet
- **Protocol**: HTTP, TCP/IP and UDP/IP

#### Measurement accuracy
- **Measuring speed**: 250000 measurements per second
- **Measured value noise**: \( \pm 9 \text{ mm} \) (1 sigma, on reflector film)
- **Angle accuracy**: \(< 0.05^\circ\)
- **Absolute accuracy**: \(\pm 35 \text{ mm}\)
- **Repeat accuracy**: \(< 12 \text{ mm}\)

#### Ambient conditions
- **Ambient temperature**: -10 ... 50 °C (14 ... 122 °F)
- **Storage temperature**: -20 ... 70 °C (-4 ... 158 °F)
- **Relative humidity**: 95 %, no moisture condensation

#### Mechanical specifications
- **Protection degree**: IP65
- **Connection**: 4-pin, M12x1 connector, standard (supply), M12x1 connector, 8-pin, A-coded (Service), M12x1 socket, 4-pin, D-coded (LAN)
- **Material**
  - **Housing**: ABS + PC + aluminum
  - **Optical face**: PMMA
  - **Mass**: approx. 0.8 kg

#### Compliance with standards and directives
- **Directive conformity**
  - EMC Directive 2004/108/EC
  - EN 60947-5-2:2007
- **Standard conformity**
  - Product standard
  - Laser class
  - IEC 60825-1:2007
  - EN 60825-1:2007

#### Approvals and certificates
- **CCC approval**: CCC approval / marking not required for products rated \(\leq 36 \text{ V}\)
10.2 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

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