

Distance Sensor

R1000

Manual



With regard to the supply of products, the current issue of the following document is applicable:
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1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on the following:

- Product identification
- Delivery, transport, and storage
- Mounting and installation
- Commissioning and operation
- Maintenance and repair
- Troubleshooting
- Dismounting
- Disposal



Note

For full information on the product, refer to the further documentation on the Internet at www.pepperl-fuchs.com.



Note

For specific device information such as the year of construction, scan the QR code on the device. As an alternative, enter the serial number in the serial number search at www.pepperl-fuchs.com.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Functional safety manual
- Other documents

1.2 Target Group, Personnel

Responsibility for planning, assembly, commissioning, operation, maintenance, and dismantling lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling of the product. The personnel must have read and understood the instruction manual and the further documentation.

Prior to using the product make yourself familiar with it. Read the document carefully.

1.3 Symbols Used

This document contains symbols for the identification of warning messages and of informative messages.

Warning Messages

You will find warning messages, whenever dangers may arise from your actions. It is mandatory that you observe these warning messages for your personal safety and in order to avoid property damage.

Depending on the risk level, the warning messages are displayed in descending order as follows:



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.

Informative Symbols



Note

This symbol brings important information to your attention.



Tip

This symbol brings an useful tip to your attention.



Example

This symbol provides an example of the issue described.



Action

This symbol indicates a paragraph with instructions. You are prompted to perform an action or a sequence of actions.

2 Declaration of Conformity

This product was developed and manufactured in line with the applicable European standards and directives.



Note

A declaration of conformity can be requested from the manufacturer.

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



3 Safety

3.1 Safety Notes

Read the following information carefully and observe this information when working with the device. Failure to observe the safety information and warning messages in this documentation may lead to malfunctions and hazardous situations during operation.

This can lead to personal injury or death.

Target Group, Personnel

The personnel must be appropriately trained and qualified in order to carry out mounting, installation, commissioning, operation, maintenance, and dismounting of the device. The trained and qualified personnel must have read and understood the instruction manual.

Prior to using the product make yourself familiar with it. Read the instruction manual carefully.

Reference to Further Documentation

Observe directives, standards, and national laws applicable to the intended use and the operating location.

Intended Use

The device is only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

Operation, Maintenance, Repair

Do not remove the nameplate.

Do not remove the warning markings.

Do not repair, modify, or manipulate the device.

If there is a defect, always send back the device to Pepperl+Fuchs.

If there is a defect, always replace the device with an original device.

Only use accessories specified by the manufacturer.

When using the device, observe the applicable safety guidelines for these applications.

Supply the device with a power supply that meets the requirements for safety extra-low voltage (SELV) or protective extra-low voltage (PELV).

Do not point the device directly at the sun.

Delivery, Transport, Disposal

Keep the original packaging. Always store and transport the device in the original packaging.

The device, built-in components, packaging, and any batteries contained within must be disposed in compliance with the applicable laws and guidelines of the respective country.

4 Product Description

4.1 R1000 Distance Sensor

The exact positioning of automated storage and retrieval systems, moving carriages, cranes, and operating machines, and the performance of length measurements in the woodworking industry, for concrete saws, and in elevator construction, requires distance sensors that are capable of returning measured values at a high measuring rate over large distances with millimeter precision.

Distance sensors are used wherever straight-line distances need to be determined precisely and reliably.

Photoelectric distance sensors are virtually wear-free and are easy to install.

Additional benefits offered by these devices are short assembly and commissioning times, the high degree of reliability of a photoelectric measuring system, and easy interchangeability.

The available interfaces are:

- SSI interface (synchronous serial interface)
- RS-422
- PROFINET IO

The photoelectric distance sensors in the R1000 series meet the safety requirements of laser class 1 (EN 60825). The low amount of laser light emitted ensures that operating personnel are not injured or harmed.

4.2 Function Principle

The devices work according to the principle of pulse ranging technology (PRT). The device measures the time between sending a light pulse and receiving the reflected pulse. Due to the constancy of the speed of light, this time is a measurement of distance.

The light source and light receiver are located in the device. A reflector is required for measuring the distance, and must be installed opposite the device. By virtue of its technical features, Pulse Ranging Technology (PRT) is particularly well-suited for high-precision distance measurement over large distances compared to other methods of distance measurement.

In comparison to other distance measurement processes, time-of-flight measurement is largely independent of the measuring environment, and can therefore be used to a high degree of accuracy in harsh everyday industrial conditions.



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 barometric pressure amounts to -0.3 ppm/hPa.

The user must take these factors into consideration when measuring long distances.

4.3 Indicators and Operating Elements

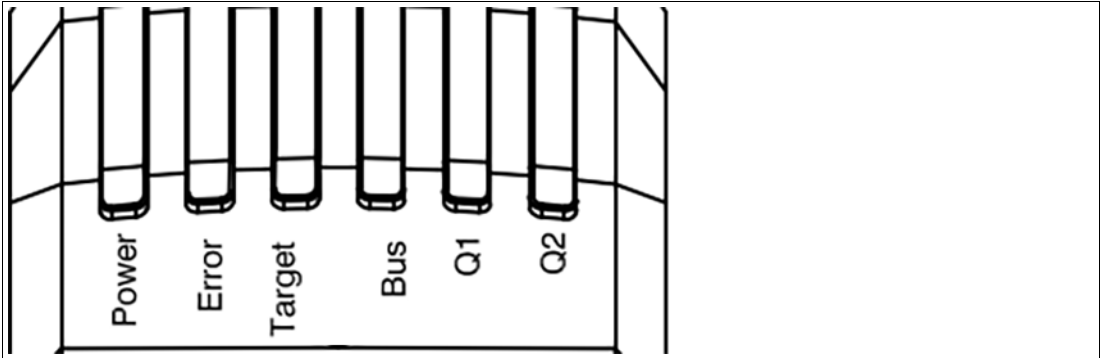


Figure 4.1 Indicators

Designation	Color	Description
Power	Green	Lights up when supplied with operating voltage
Error	Red	Lights up when there is an error; flashes in the event of a warning
Target	Yellow	Lights up when the sensor detects a reflector
Bus	Green	Signals interface activities
Q1	Yellow	Visualizes the state of I/Q1
Q2	Yellow	Visualizes the state of Q2

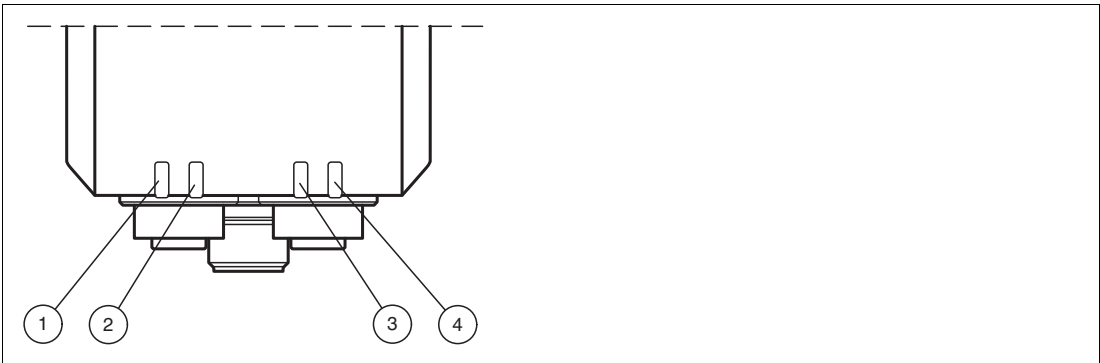


Figure 4.2 LEDs at the bottom of the housing

Item	SSI Device	PROFINET Device
1	N/A	Link
2		Activity
3		Activity
4		Link

For SSI devices, the LEDs at the bottom of the housing do not have a function.

For PROFINET devices, the LEDs each display the link and activity for the Ethernet connection on the respective plug, if connected.

4.4 Interfaces and Connections

The following connections are found on all devices:

Voltage Supply

There is a 4-pin M12 plug on the rear of the housing for connecting the voltage supply. The following diagram shows the pinout:

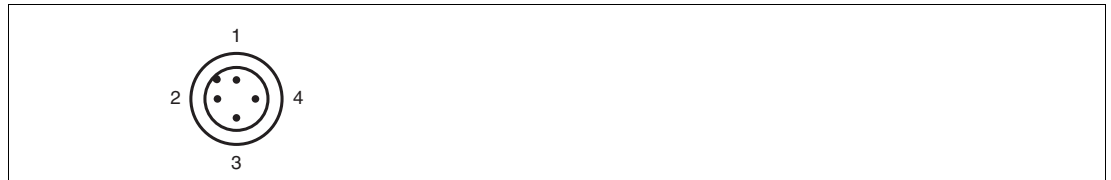


Figure 4.3 Voltage supply connection assignment

- 1 24 V power supply
- 2 Q2
- 3 0 V (GND)
- 4 I/Q1

Interfaces:

Different connection types can be found on the back of the housing depending on what interface is used. The following diagrams show the pinouts:

Interface Type: SSI (Synchronous Serial Interface)

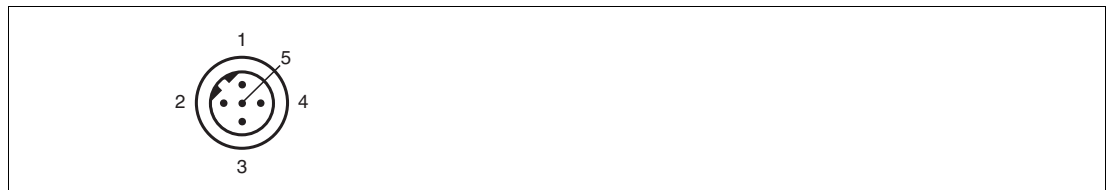


Figure 4.4 SSI interface connection assignment

- 1 D+
- 2 D-
- 3 CLK+
- 4 CLK-
- 5 n.c.

The connector housing is located on the shield.

Interface Type: RS-422



Figure 4.5 RS-422 connection assignment

- 1 TXD+
- 2 TXD-
- 3 RXD+

4 RXD-

5 n.c.

The connector housing is located on the shield.

Interface Type: PROFINET IO

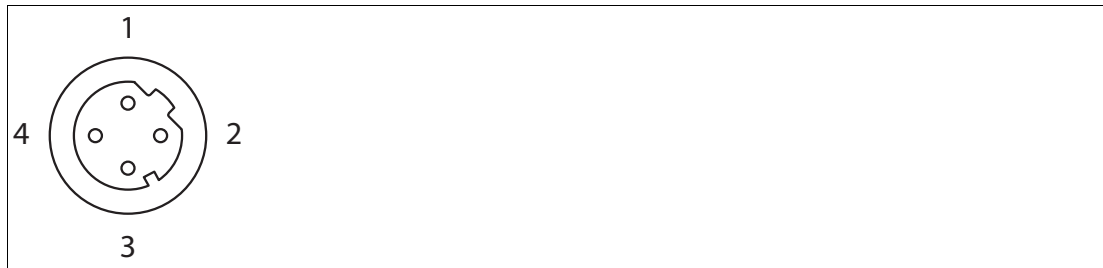


Figure 4.6 PROFINET IO connection layout

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:

- R1000
- Safety information and laser label
- Grounding set

4.6 Accessories

You will find accessories online at www.pepperl-fuchs.com on the product page for the relevant device or on the relevant datasheet.

5 Installation

5.1 Storage and Transport

Pack the device for storage and transport in a way that protects it against impact.

Protect the device against moisture.

Always store and transport the device in the original packaging.

Also take note of the permitted ambient conditions.



Note

In all cases, avoid subjecting the device to condensation, as this could have an effect on internal parts and cause damage.

5.2 Unpacking

Check the product for damage while unpacking. If the product should be damaged, 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 contact Pepperl+Fuchs.

5.3 Mounting



Caution!

Risk of damage due to improper operation.

Improper operation can result in damage to the device.

- 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 any influences caused by aggressive chemicals.
In particular, avoid agents that contain hydrocarbons, such as mineral spirits, alcohol, and solvents.
 - Keep the glass on the device and the reflector clean.
Use soft cloths. If necessary, clean the glass with water and a small amount of dish detergent.
-



Note

Use M6 mounting screws with 8 mm thread length.

Mounting Aid

The mounting aid OMH-R1000-02 enables fine adjustment. To align the laser beam of the device on the reflector as centrally as possible, the device can be adjusted by $\pm 2.5^\circ$ along the Y-axis or Z-axis using the fixture.



Mounting the Fixture on the Wall

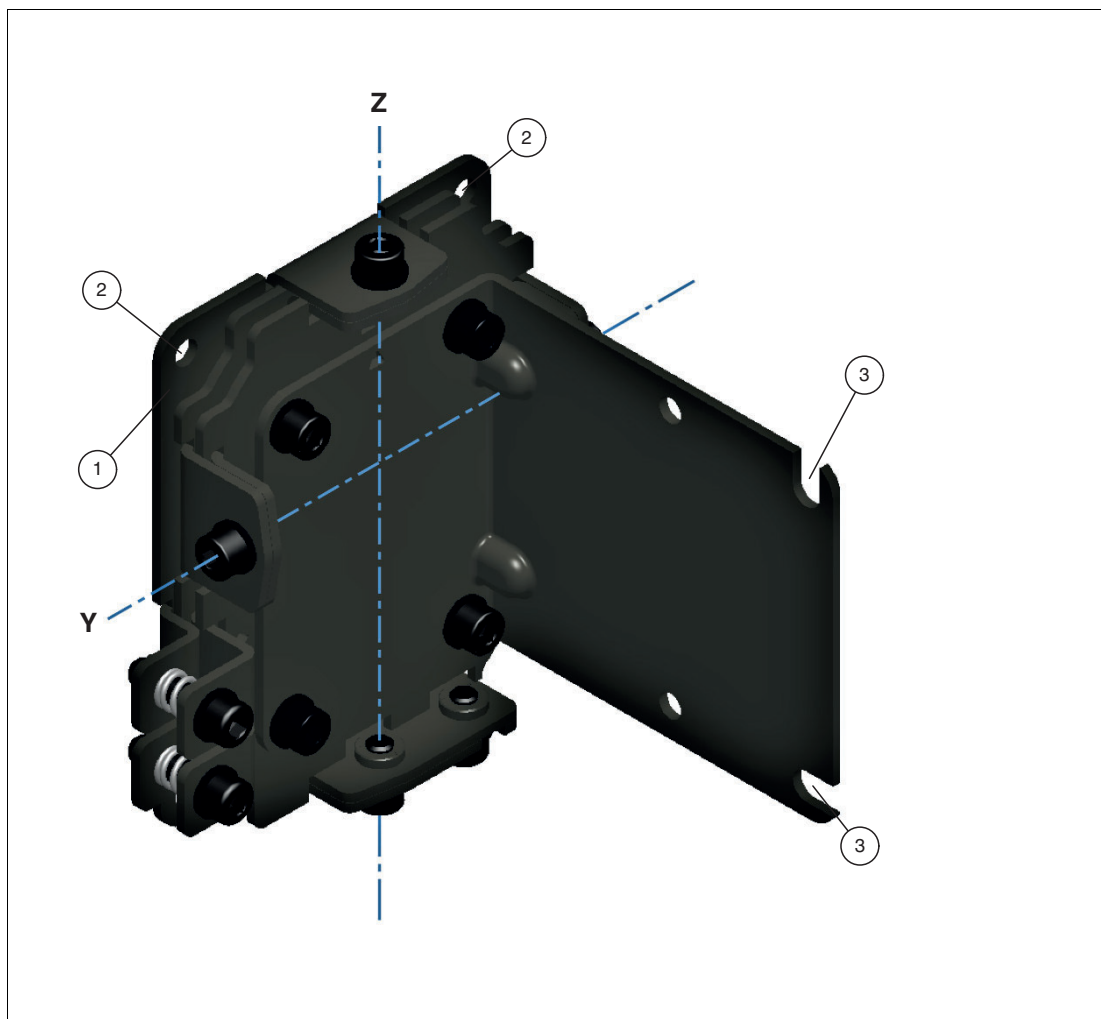


Figure 5.1

- 1 Base plate
- 2 Bore Ø 5.3 mm
- 3 Slot

1. Position the fixture in the desired measurement direction.



Note

To precisely adjust the device horizontally or vertically, align the fixture to the optimal vertical position.

2. Position the intersection of the Y-axis and Z-axis at the level of the reflector.
3. To install the fixture, use the holes (2) in the corners of the base plate (1). Secure the fixture with four M5 mounting screws and four flat washers.



Note

Influencing of the Measurement Result

A loose fixture can affect the measurement result.
Check that the fixture is firmly seated.



Mounting the Device on the Fixture

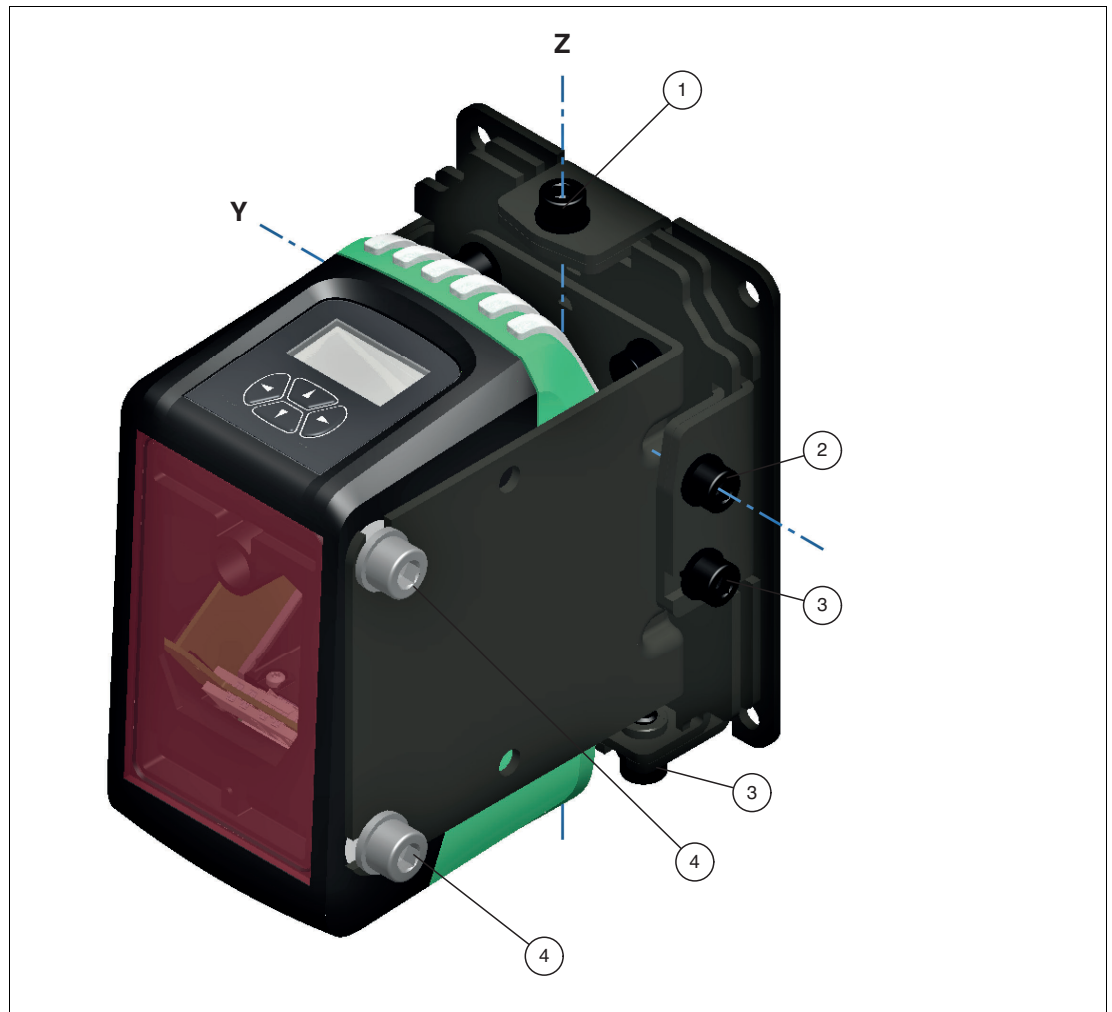


Figure 5.2

- 1 Z-axis locking screw
- 2 Y-axis locking screw
- 3 Locking screw for holding the device in position
- 4 M6 fixing screw with flat washer

1. Remove the device from the packaging.
2. Screw the M6 fixing screws with the flat washers (4) into the M6 tapped side holes so that the clearance between the flat washer and the device wall is approximately 3 mm. The fixing screws are included in the scope of delivery.

3. Hang the device in the slots of the fixture and tighten the M6 fixing screws to secure the device to the fixture.
Ensure a maximum tightening torque of 3.6 Nm when securing the fixing screws.

**Note**

Before adjusting the device, make sure that all locking screws on the fixture have been loosened.

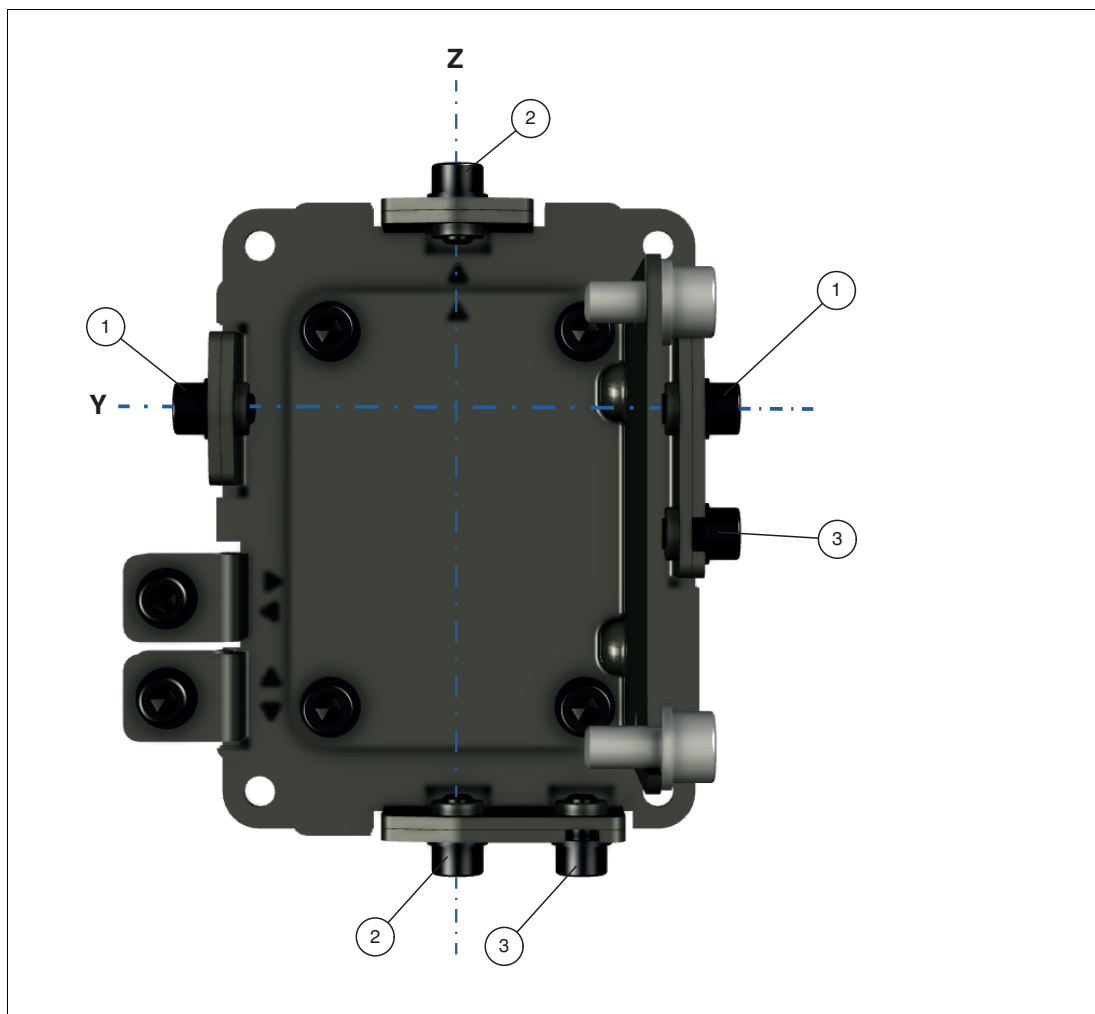


Figure 5.3

- 1 Y-axis locking screw
- 2 Z-axis locking screw
- 3 Locking screw for holding the device in position



Adjusting the Device

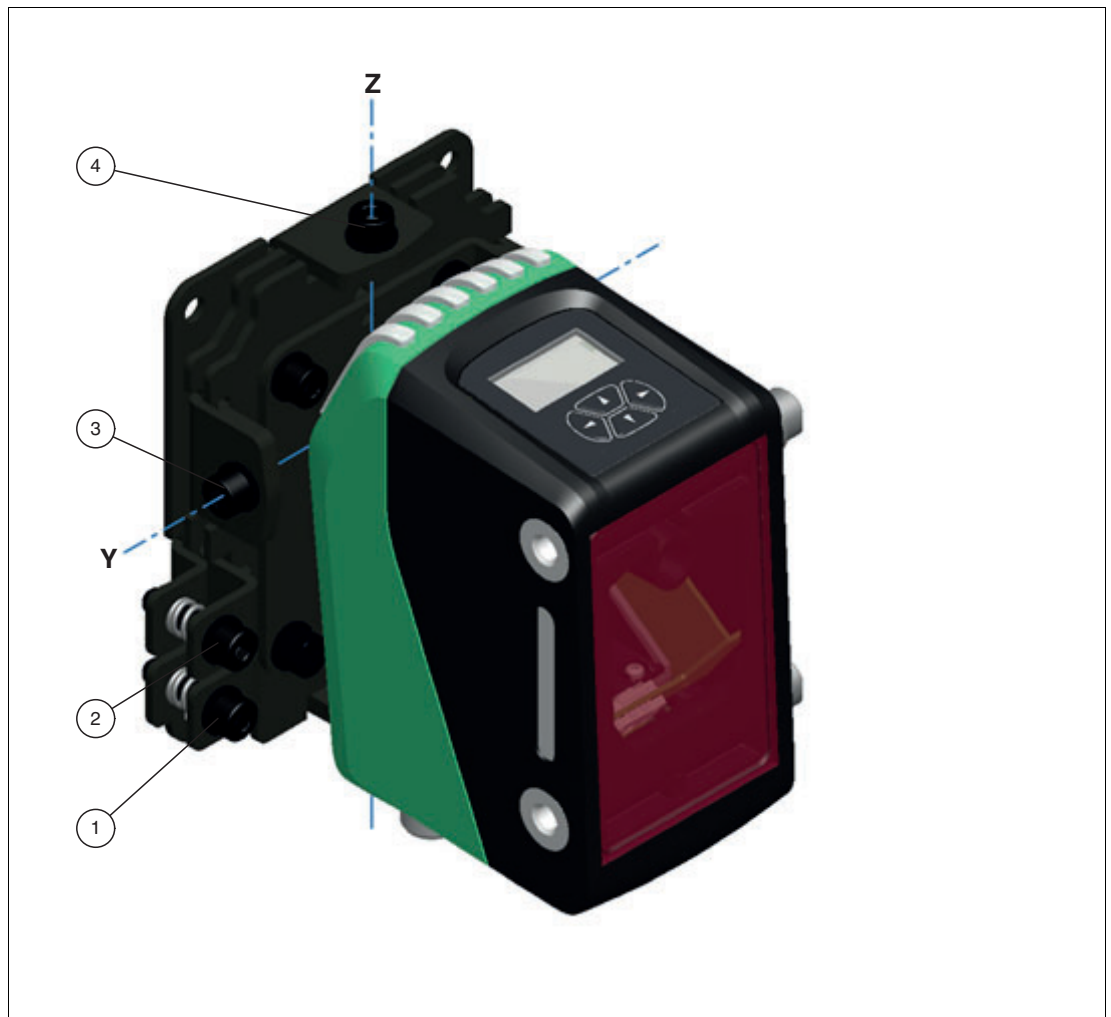


Figure 5.4

- 1 Y-axis adjusting screw
- 2 Z-axis adjusting screw
- 3 Y-axis locking screw
- 4 Z-axis locking screw

1. Switch on the device so that the laser beam is visible on the reflector.
2. First place the reflector at a close distance (e.g., 5 m).



Tip

To make the laser beam easier to see, we recommend that you position the reflector by eye in the vicinity of the device.

3. Align the laser beam as centrally as possible by turning the tilt adjustment screw with an Allen key. First set the Y axis and then the Z axis.

- **Y-axis:**
To move the laser beam to the left on the reflector, turn the adjusting screw (1) clockwise.
To move the laser beam to the right on the reflector, turn the adjusting screw (1) counter-clockwise.
 - **Z-axis:**
To move the laser beam down on the reflector, turn the adjusting screw (2) clockwise.
To move the laser beam up on the reflector, turn the adjusting screw (2) counterclockwise.
4. Gradually increase the distance to the reflector and repeat the last step.
 5. To secure the device in the set position, tighten the locking screws to hold it in place.
 6. To prevent accidental movement of the device during operation, tighten the two M5 locking screws (3) on the Y-axis and the two M5 locking screws (4) on the Z-axis.
Ensure a maximum tightening torque of 4.4 Nm when securing the fixing screws.

5.4 Reflector Selection



Note

The VDM02 reflector can be used as an attachment to the VDM01. It is used only for the purpose of capturing the measuring spot if it drifts due to unevenness or vibrations.

Use the VDM02 reflector only in conjunction with the VDM01 reflector.

	Reflector 250 mm x 250 mm	Reflector 500 mm x 500 mm	Reflector 1000 mm x 1000 mm	VDM01 reflector (500 mm x 500 mm)	VDM02 reflector (500 mm x 250 mm)
OMR50M-R1000	Yes	Yes	Yes	Yes	Yes
OMR150M-R1000	No	Yes	Yes	Yes	Yes
OMR300M-R1000	No	No	No	Yes	Yes

Table 5.1 Reflector selection

5.5 Reflector Arrangement

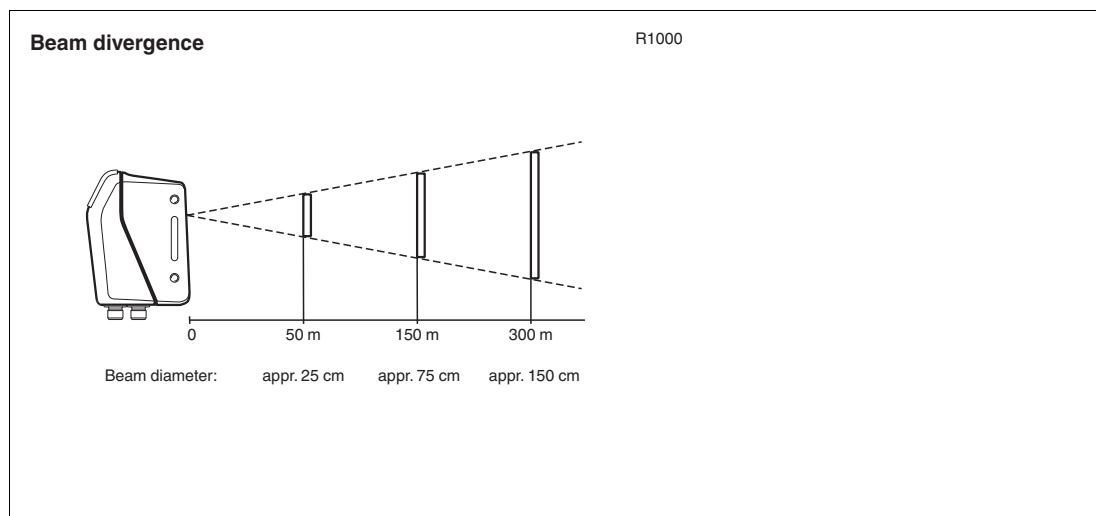


Figure 5.5 Reflector size (R1000 side view)

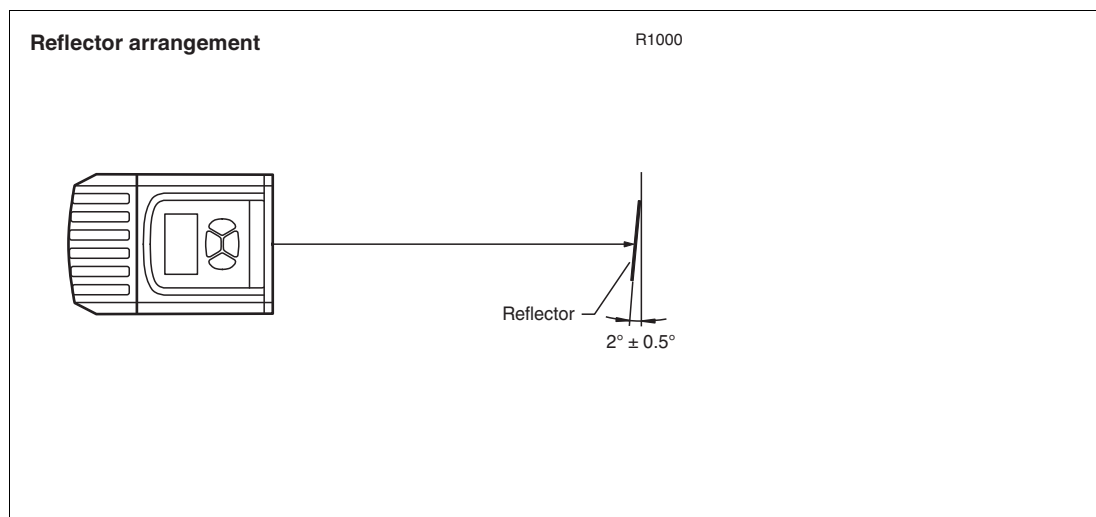


Figure 5.6 Mounting of the reflector

5.6 Device Connection

SSI



Note

Terminal resistor

If there is no terminal resistor connected on the interface card, a 100 Ω terminal resistor (0.25 W) must be connected between Data+ and Data- on the control computer. Double-sided screen mounting is recommended.

PROFINET IO

The device has two Ethernet connections, which are connected via an integrated switch. The two connections are equivalent, so it does not matter whether the device is connected to the master via the left-hand or right-hand connection.

An additional PROFINET device can be connected via the second connection (bus topology), which simplifies the cabling in the plant.

5.7 Grounding/Shielding

The grounding can be mounted using the thread on the bottom of the device. The mounting threads are at the same potential as the thread on the bottom of the housing.

Accessories for connecting the grounding are included in the scope of delivery.

- 6.3 mm cable lug
- Cable eye for connecting loose cable (can be used as an alternative to a cable lug)
- M4 mounting screw with hexagon socket, 10 mm thread length
- Lock washer

The device has mounting holes on the side and an M4 hole on the underside. The functional ground can be connected to the M4 hole.

These holes are connected to an internal metal frame and the "0 V" connection pin via overvoltage protection elements.

If interfaces are used that require shielding (e.g., SSI), place the shield on both sides and connect the functional ground to the PE. The shielding of the interface connection has an internal electrical connection to the metal frame and therefore to the functional ground.

Note

The overvoltage protection elements limit the maximum voltage between "0 V" and functional ground to 50 V. A 500 V insulation test cannot therefore be performed.

5.8 Notes for Parallel Operation of R1000 Series Devices and Optical Data Couplers

If R1000 series devices and optical data couplers are operated in parallel, observe the following:

Arranging the devices

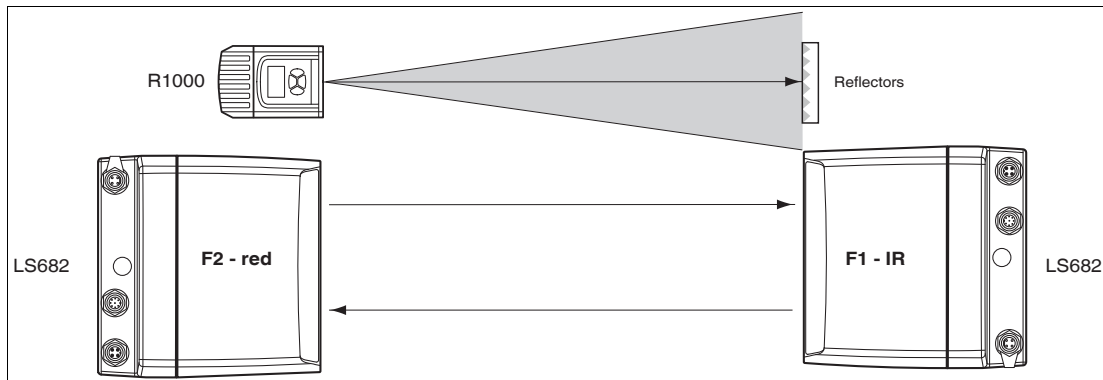


Figure 5.7

When commissioning, make sure that the optical data couplers are correctly aligned with each other first before the R1000 is put into operation.

6 Commissioning



Commissioning the Device

- 1. Connect the distance measurement device to the power supply.
↳ The device starts an initialization phase for a maximum of 5 seconds.
- 2. If the device was not aligned correctly, refer to the messages on the display.
- 3. If the device was aligned correctly with the reflector and valid measurements are obtained, the red error LED (ERR) goes out and the yellow target LED (TGT) lights up.
↳ The device is ready for operation.
↳ The device provides valid measured values.
- 4. Allow a warm-up phase of 10 minutes for the distance measurement device.
↳ The distance sensor achieves the specified measurement accuracy after 6 minutes.

6.1 Display

6.1.1 Operation Indicator

During normal operation (menu not active), an operation indicator provides information about the state of the device.

In addition to the currently measured distance, the display shows important configurable settings of the device.

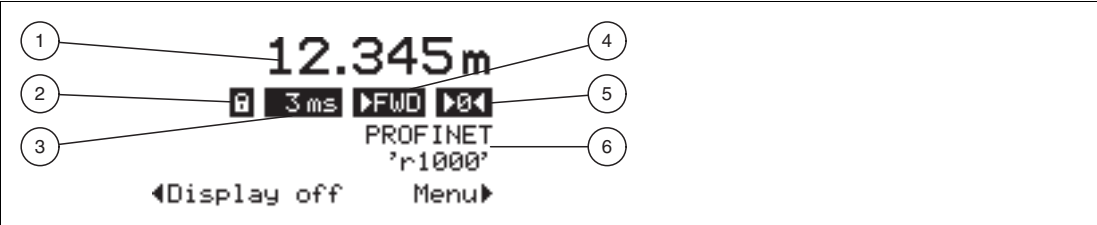


Figure 6.1

Item	Designation	Reference
1	Measured value	
2	Write protection	See chapter 7.1.1
3	Measurement delay	See chapter 7.3.1
4	Counting direction	See chapter 7.3.1
5	Offset	See chapter 7.3.1
6	Communication interface	Serial: see chapter 7.3.4 PROFINET: see chapter 7.3.5

6.1.2 Display Timeout

The display switches off after a configurable time.



Activating the Display

1. To activate the display, press any key.



Deactivating the Display

1. To explicitly deactivate the display, press the  key.

7 Settings

7.1 Operation

The device offers a wide range of configuration options organized in a hierarchical menu structure.

Four membrane keys are located below the display. You can use these four keys to navigate within the menu structure and change the settings.

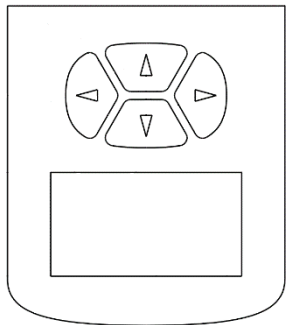


Figure 7.1 Display and arrow keys

Meaning of Keys

	Call the main menu Call submenus Confirm changes / input values
	Return to the operating display Exit submenus Discard changes / input values Deactivate the display
	Navigate up in the menu tree Change values
	Navigate down in the menu tree Change values

Table 7.1

When you enter numerical values, the device constantly verifies that the value entered is valid. A corresponding message is issued if unacceptable values are entered. Invalid values cannot be saved.

Once all the settings have been made, you can use the  key to return to the operating indicator. If no further keys are pressed within the menu levels for 10 minutes, the display automatically returns to the operating indicator.

You can choose to display the menu in German or English.

7.1.1 Write Protection

While the device is communicating with the controller, it is not possible to make parameter changes via the display or the operating push buttons.

The following symbol is displayed in the operation indicator on the display and in the menu to indicate that write protection is activated: 

7.2 Menu Structure

Bold formatting indicates the default value.

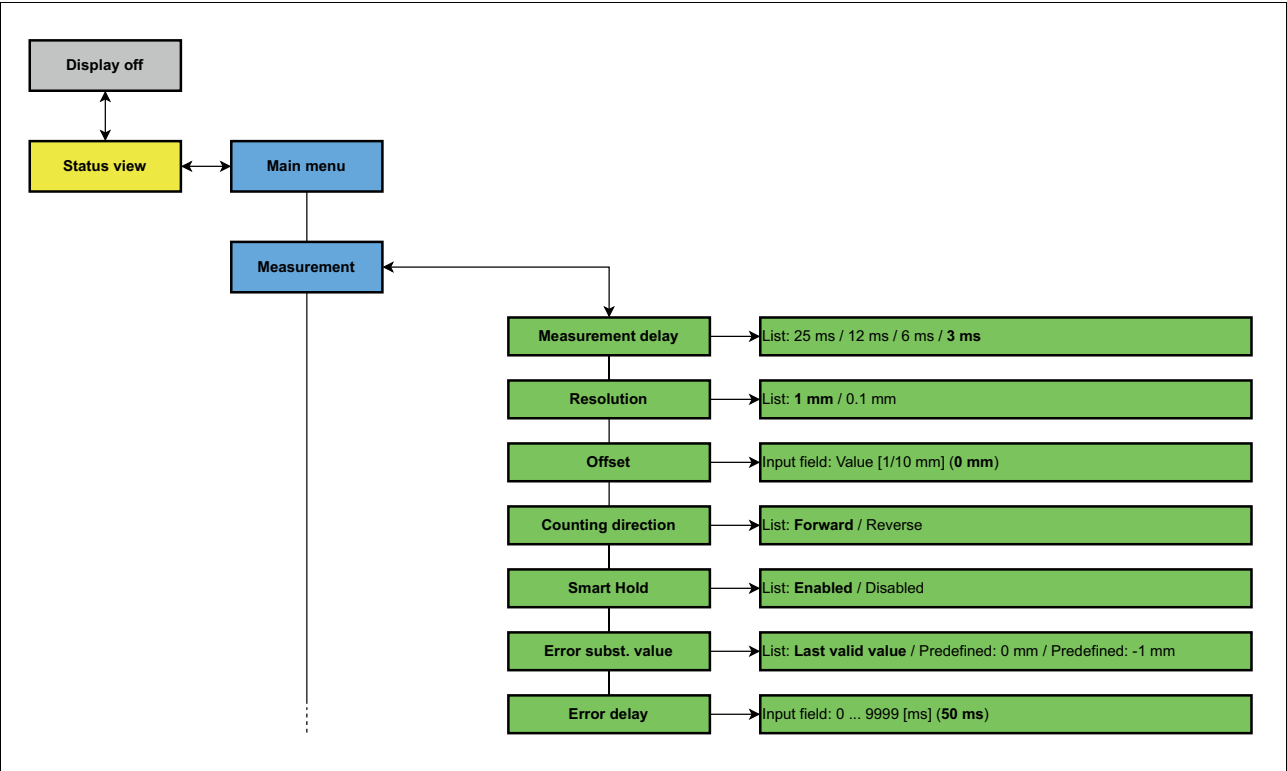


Figure 7.2 Menu structure (1/3)

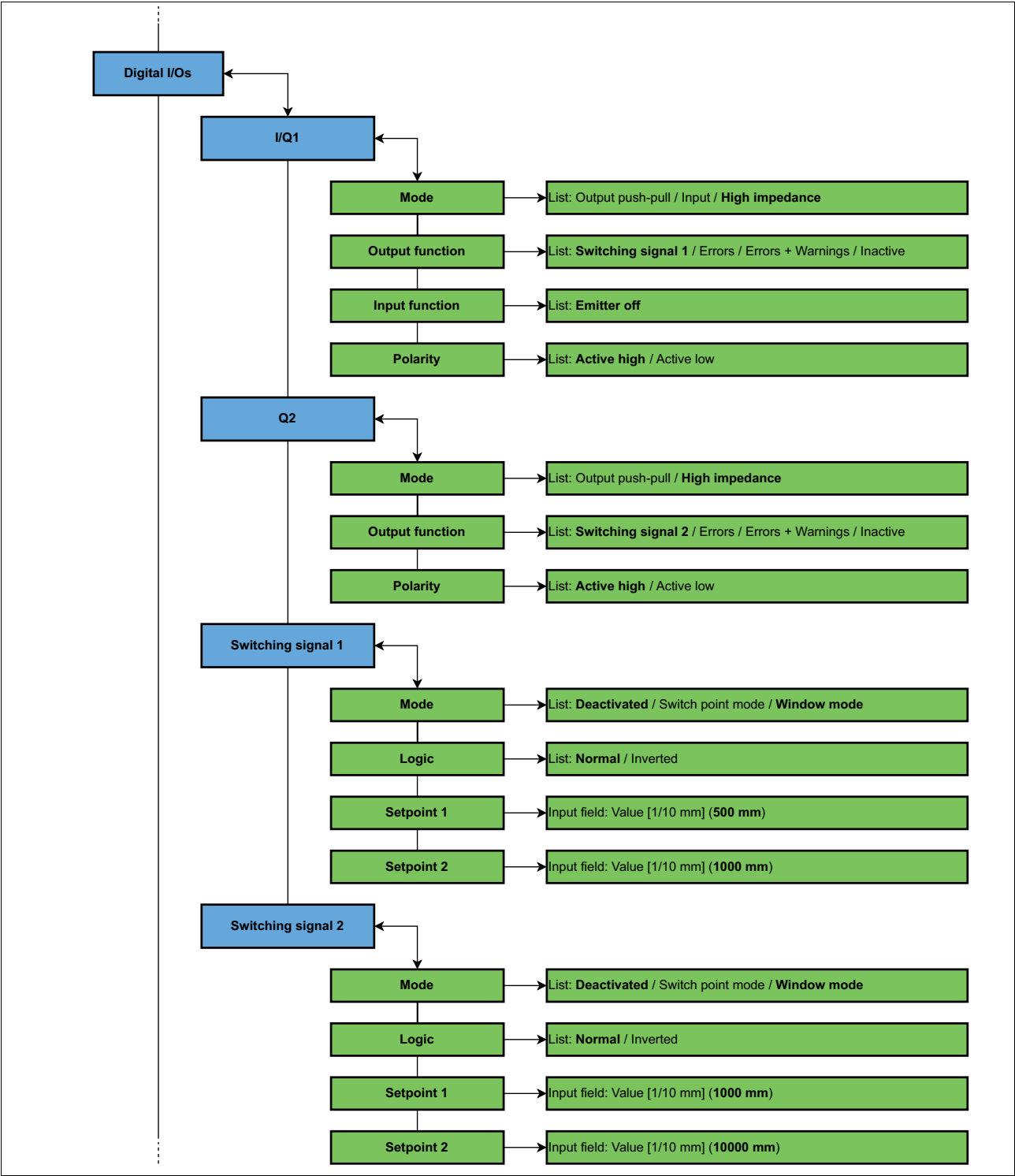


Figure 7.3 Menu structure (2/3)

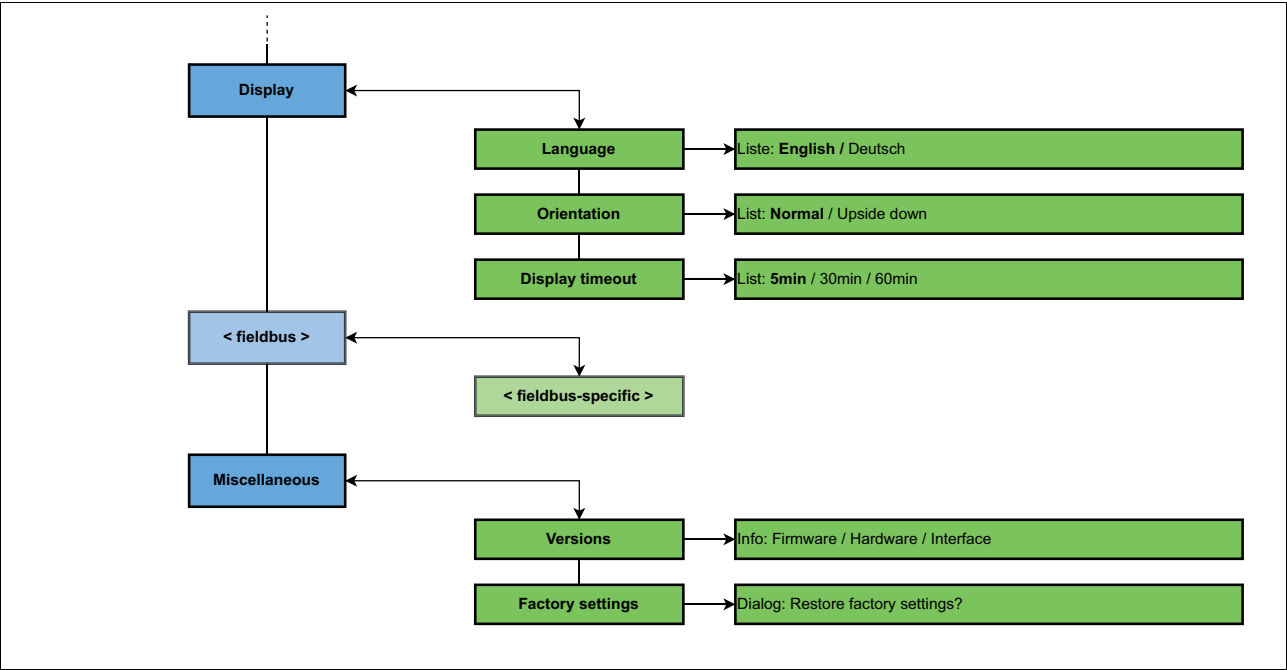


Figure 7.4 Menu structure (3/3)

Serial/SSI

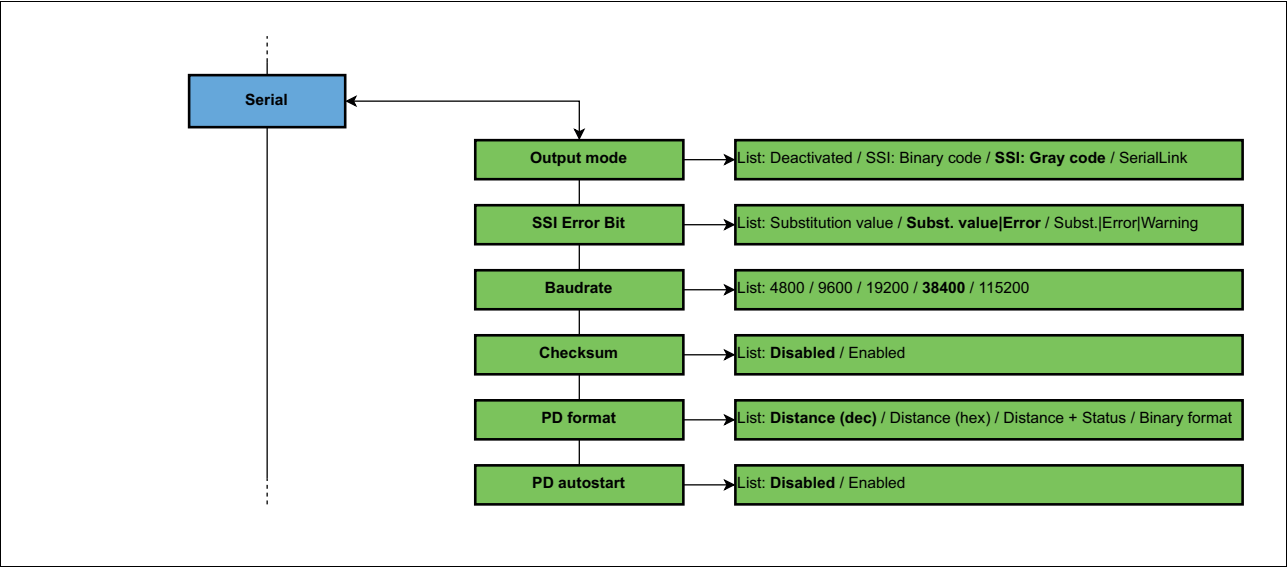


Figure 7.5 Serial/SSI menu structure

PROFINET

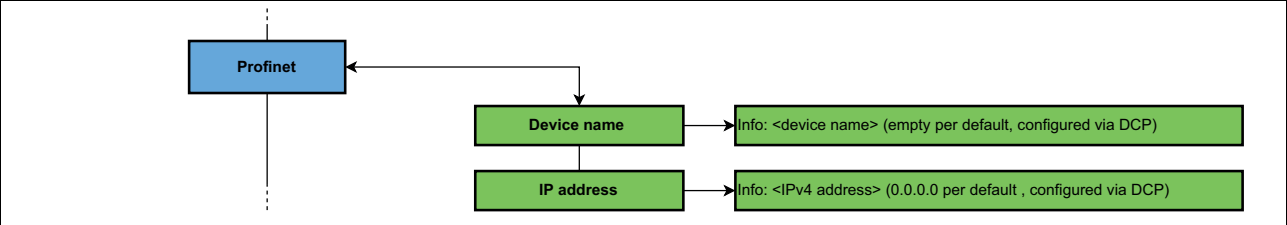


Figure 7.6 PROFINET menu structure

7.3 Description of Menu Items

7.3.1 Measurement Menu Item

The "Measurement" submenu contains various parameters that have an impact on recording and issuing the distance measured value.

Measurement Delay

This setting is used to determine the measurement delay for the measured values output by the sensor. A higher measurement delay reduces the measurement noise; a smaller measurement delay improves the reaction time.

The following measurement delay can be set:

- 25 ms
- 12 ms
- 6 ms
- 3 ms

Measured Value Resolution

This parameter defines the resolution of the distance value output on the display and in the process data. The settings "1 mm/bit" and "0.1 mm/bit" are available for selection.

Offset

This value moves the zero point of the measurement. This enables multiple devices with different positions to be set to identical distances. It does not change the absolute detection range. The measured value output is calculated from the sum of the absolute measured value and the signed offset. The resulting measured value is used when testing the distance limits.



Note

If the resulting measured value is negative, an error is displayed by the device.

- If this is the case, increase the offset.
-

Counting Direction

The counting direction setting can be used to invert the measurement's counting direction. The device displays 0 mm at maximum distance. As the distances become smaller, the output value increases. The measured value that is output is calculated from the difference between the threshold detection range and the real measured value.

Smart Hold

The Smart Hold function reduces the noise of the distance value that is output at a standstill. The measurement remains active. Changes to the distance value are output only if they exceed an internal threshold value.

Error Substitute Value

This option defines which distance value is output by the device in the event of an error.

You can select the following values:

- Substitute value 0 mm
- Substitute value -1 mm
- Last valid measured value

The substitute value -1 mm is displayed as 999.999 m. If the device is unable to determine a valid measured value when using the "last measured value" setting, the value 999.999 m is output.

Error Delay

This setting defines a time delay for outputting an error. The delay occurs between the occurrence of an error and the signaling of the error using the error flag and signal indicator. The error delay is specified in milliseconds.

7.3.2 Digital I/Os Menu Item

7.3.2.1 I/Q1 and Q2

Mode

This menu item can be used to select the functionality of the respective I/O. The device has two I/O pins. The two I/O pins can be configured independently of each other via the menu. In the delivery state, both I/Os have high impedance.

Output Function

The following output functions are available:

- Switching signal
- Errors
- Error and warnings
- Inactive

The output functions can be selected independently of each other.

Input Function

I/Q1 can also be configured as an input. This input enables the emitter to be switched off.

Polarity

This menu item can be used to electrically invert the input/output logic.

7.3.2.2 Switching Signal 1 and 2

Mode

The Mode menu item defines the behavior of the respective switching signal. Window mode is selected as the default value, which activates the switching signal within the set switch points. Alternatively, a separate switch point (switch point 1) or deactivated mode can be selected.

Logic

This menu item can be used to invert the logic behavior of the switching signal.

Switching Signal 1 and 2

The values for the switch points can be set independently of each other. The resolution for this value is 0.1 mm.

7.3.3 Menu Item Display

Display Language

You use this menu item to select the menu language. The available settings are German and English.

Display Orientation

You use this menu item to change the orientation of the display. The setting options are 0° and 180° for overhead mounting. In this case, the function of the keys is rotated by 180°.

Display Timeout

You use this menu item to set the time after which the display is automatically deactivated. The following values can be selected:

- 5 min
- 30 min
- 60 min

7.3.4

Serial Menu Item



Note

The "Serial" menu item is only displayed if the device is equipped with a serial interface (SSI/RS422).

Output Mode

This menu item is used to configure the serial interface. The following output modes can be set:

- Deactivated
- SSI: Binary code
- SSI: Gray code
- SerialLink

SSI Error Bit

This menu item is used to configure the behavior of the SSI error bit. The SSI error bit can be set:

- if an error substitute value is present
- if an error substitute value is present or an error occurs
- if an error substitute value is present or an error or warning occurs

The menu entry is visible only if the output mode is set to "SSI: Binary code" or "SSI: Gray code".

Baudrate

Different baud rates are available for SerialLink communication:

- 4800 bit/s
- 9600 bit/s
- 19200 bit/s
- 38400 bit/s
- 115200 bit/s

The menu entry is visible only if the output mode is set to "SerialLink".

Checksum

The use of a checksum for SerialLink communication can be enabled or disabled.

The menu entry is visible only if the output mode is set to "SerialLink".

PD Format

The following process data formats are available for SerialLink communication:

- Distance as a decimal value
- Distance as a hexadecimal value
- Distance as a hexadecimal value and status information
- Distance in binary format and status information

Details of the different output formats can be found in the "SerialLink Communication Protocol".

The menu entry is visible only if the output mode is set to "SerialLink".

PD Autostart

Using the SerialLink interface, process data can be output via a command (delivery state) or automatically when the device is switched on.

The menu entry is visible only if the output mode is set to "SerialLink".

7.3.5

PROFINET Menu Item



Note

The "PROFINET" menu item is only displayed if the device is equipped with a PROFINET IO interface.

The device name and IP address can be changed via the discovery and configuration protocol (DCP).

Device Name

This menu item displays the current PROFINET device name of the device.

The device name cannot be changed directly via the menu. Instead, it must be assigned to the device once using a configuration tool or service tool.

IP Address

This menu item displays the current IP address of the device.

The IP address cannot be changed directly via the menu. The IP address is assigned to the device by the controller.

7.3.6

Miscellaneous Menu Item

Versions

You can use this menu item to check the hardware version, firmware version, and interface version.

You can find firmware release notes on the product detail page at www.pepperl-fuchs.com.

Factory Settings

You can use this menu item to reset all of the device's settings to the factory default settings. A security prompt is displayed to protect against accidental resets.

8 Troubleshooting

8.1 Error Messages

The device is capable of issuing a number of error messages. Error messages indicate that the device is not working optimally.

Some errors may affect the determination and output of measured values.

Error LED	Power LED	Error Message on the Display	Cause	Fault Repair
On	Off	Device faulty	A fault that cannot be resolved by the user has been detected.	Contact the service center.
On	On	No reflector detected	Reflector is not detected.	- Check the alignment of the device. - If necessary, clean the lens.
On	On	Measured value above measuring range	Reflector is too far from the device.	Position the reflector within the measuring range. More information can be found in the datasheet.
On	On	Measured value below measuring range	Reflector is too close to the device.	Position the reflector within the measuring range. More information can be found in the datasheet.
On	On	Negative measured value	The sum of the absolute measured value and the user-defined offset is negative.	Correct the offset.
On	On	Invalid measured values	The device does not determine any valid measured values.	Check the device for dirt and clean the optical interface if necessary.
On	On	Device temperature too low	Ambient temperature too low.	Use the device only within the permitted temperature range; if necessary, wait for the temperature to rise. More information can be found in the datasheet.
On	On	Device temperature too high	Ambient temperature too high.	Use the device only within the permitted temperature range. Check whether it is in direct sunlight. More information can be found in the datasheet.
On	On	Overload at output Q1 or Q2	Short circuit or overload has occurred at switching output Q1 or Q2.	Check the connection of the switching outputs.
On	On	Operating voltage too low	Supply voltage is inadequate.	Check the supply voltage.

Table 8.1

8.2 Warning Messages

The device can issue various warning messages. Warning messages indicate that the device may be approaching a fault state. Measured value determination and measured value output are not affected at any time.

Error LED	Power LED	Error Message on the Display	Cause	Fault Repair
Flashing	On	Device temperature too low	Ambient temperature too low.	Use the device only within the permitted temperature range; if necessary, wait for the temperature to rise. More information can be found in the datasheet.
Flashing	On	Device temperature too high	Ambient temperature too high.	Use the device only within the permitted temperature range. Check whether it is in direct sunlight. More information can be found in the datasheet.
Flashing	On	Weak signal	Echo signal is inadequate.	- Check the alignment of the device. - If necessary, clean the lens.
Flashing	On	Emitter deactivated	The emitter was switched off via the I/Q1 input function.	To continue obtaining valid data, activate the emitter via the input function.
Off	On	Parameter access failed	Operation could not be completed successfully.	Repeat the operation that was initiated.

Table 8.2

9 Appendix

9.1 Description of Interfaces

9.1.1 General

Process Data: Format

The data is transmitted serially at all interfaces. A distance value, any error information (status flags), and the status of the I/O pins are always output as process data. Depending on the interface, the process data composition is defined as either fixed (e.g., SSI) or configurable (e.g., RS-422). For details, please refer to the description of the individual interfaces.

Process Data: Distance value

The distance value is transmitted as binary data. The number of bytes used and the byte order (little-endian, big-endian) are configured in accordance with the interface.

The resolution of the distance value transmitted in the process data can be configured via the "Resolution" parameter (see chapter 7.3.1). When configuring the resolution, the value of the least significant byte (LSB) can be set to 0.1 mm or 1 mm. "1 mm/bit" resolution is the default selection.

In case of fault (depending on the "Error subst. value" parameter setting), the last valid measured value or the value zero is output. If the "Last measured value" setting does not have a valid measured value, the largest value that can be displayed in the process data (e.g., 0xFFFFFFFF) is output.

9.1.2 RS-422

The protocol of the RS-422 interface is described in detail in a separate document. You can find the protocol description on the product detail page at www.pepperl-fuchs.com.

9.1.3 PROFINET

9.1.3.1 General Information on Communication via PROFINET

PROFINET is an open standard for industrial automation based on industrial Ethernet. PROFINET integrates information technology with established standards such as TCP/IP and XML in automation technology.

Within PROFINET, PROFINET IO is the communication concept for the construction of decentralized applications. This means decentralized field devices are integrated through PROFINET IO. The familiar IO view of PROFIBUS DP is used where the usable data of the field devices is transferred to the controller process image in cycles. PROFINET IO is a device model consisting of slots and channels, which is based on the main features of PROFIBUS DP. The field device properties are written in a Generic Station Description (GSD) markup language based on XML. PROFINET IO is engineered in the same way as has long been the case for system integrators of PROFIBUS DP. The decentralized field devices are assigned in the controller configuration.

PROFINET IO distinguishes between the following three device types:

- IO controller: Controller that executes the automation program (PLC).
- IO device: Decentrally assigned field device that is assigned to an IO controller.
- IO supervisor: Programming unit/PC with commissioning and diagnostics.

9.1.3.2 PROFINET IO Interface

The R1000 distance sensor is a PROFINET IO device that communicates cyclically with the assigned PROFINET I/O controller during operation.

The PROFINET IO interface of the R1000 supports the following features:

- 100 Mbits/s transmission rate
- Real-time category (RT)
- The range of functions in accordance with **Conformance Class B**
- Identification & Maintenance functions (I&M):
 - IM0: Manufacturer data (read-only)
 - IM1: Tag information (read/write)
 - IM2: Date/time (read/write)
 - IM3: Description (read/write)

9.1.3.3 Device Identification

The following properties serve to identify a PROFINET device:

- **MAC address:** printed on the back of the device
- **Device name:** empty in delivery state
- **IP address:** delivery state is 0.0.0.0

To put the device into operation, it is necessary to assign a valid device name and a valid IP address to the device. The device name and IP address are changed via the DCP of the controller. The length of the device name is limited to 240 bytes. The HMI display presents a maximum of 19 characters.

9.1.3.4 Commissioning the Participants

Each PROFINET device requires a unique device name in the configuration for operation.



Note

Designating a Device Name

The length of the device name is limited to a maximum of 240 bytes. The display supports max. 19 characters. For longer names, only the first 19 characters are displayed.

Please note that the PROFINET naming convention must be applied when allocating the device name. The specifications for permitted characters, length, and the structure of the name must be taken into account.

1. The following characters are permitted:
 - Lower case letters a ... z
 - Digits 0 ... 9
 - Hyphens
 - Periods
2. Each name component within the device name must not exceed 63 characters. A name component is a character string between two periods.
3. The device name must not begin or end with a hyphen.
4. The device name must not begin with the character string "port-xyz" (x, y, z = 0 ... 9).
5. The device name must not take the form of an IP address n.n.n.n (n = 0 ... 255).

The device name must be assigned to the device once using the configuration tool or a service tool (DCP functionality). Once the name has been assigned, the device permanently stores the device name. The MAC address is printed on the device and can be used to assign the device correctly.

During system startup, the PROFINET controller identifies the device belonging to the project based on the device name. If no manual IP address has been allocated in the project, the PROFINET controller automatically assigns an IP address to the device.

9.1.3.5 Project Planning Using Device Description

As with PROFIBUS DP, a field device is integrated into the project planning tool by way of a device description. The field device properties are described in the GSD file. The GSD file contains the field device data that you need to operate the device in a PROFINET network. This includes technical features and information about communication.

Import the GSD file into a project planning tool. Assign peripheral addresses to the individual channels of the field devices as usual. The peripheral input addresses incorporate the received data. The user program evaluates and processes this data. The user program generates the peripheral output values and sends them to the control interface.

Once project planning is complete, the IO controller receives the project planning and configuration data. The IO controller parameterizes and configures the field devices automatically.

Downloading the GSD File

You can find the relevant GSD file in the **Software** section of the product detail page for the device.

To access the product detail page for the device, go to <http://www.pepperl-fuchs.com> and type e.g., the product description or the item number into the search function.

9.1.3.6 GSD Modules

The device is a modular PROFINET device. As a result, the configuration parameters required during system startup and the desired process data can be used selectively. The modules are selected in the GSD file in the project.

Observe the following boundary conditions:

- A maximum of 6 modules can be plugged in.
- Each module may be used only once.

Process Data Module

The "Distance and Status" GSD module enables configuration of the measurement in the sensor and provides process data for distance measurement. See chapter 9.1.3.7

Parameter Modules

The configuration of the device can be changed via a series of parameter modules. These modules contain **no** process data.

The structure of the parameterization and the available parameters correspond to the configuration options via the user interface. See chapter 7

- "Display" GSD module
- "Q1 Digital Input/Output" GSD module
- "Q2 Digital Output" GSD module
- "Switching signal SSC1" GSD module
- "Switching signal SSC2" GSD module

9.1.3.7 PROFINET Process Data

The "Distance and Status" process data module supplies the controller with 10 bytes of input data. The structure of the input data is documented in the table below and stored in the GSD file:

Address	Process Data	Data Type	Description
0	Distance value	INT32	Current measured value with resolution [mm] or [1/10 mm], depending on the configuration
4	Status flags	UINT16	Current status of the device: • Bit 0: Error substitute value active • Bit 1: Reflector detected • Bit 2: Output Q1 active • Bit 3: Output Q2 active • Bit 4: Reserved (0) • Bit 5: Switching signal 1 active • Bit 6: Switching signal 2 active • Bit 7 ... 12: Reserved (0) • Bit 13: Device reports a warning • Bit 14: Device reports an error • Bit 15: Device reports a defect
6	Warning messages	UINT16	Details of why a warning is displayed: • Bit 0: Reserved (0) • Bit 1: Device temperature too low • Bit 2: Device temperature too high • Bit 3: Emitter deactivated • Bit 4: Reserved (0) • Bit 5: Weak signal • Bit 6 ... 15: Reserved (0)
8	Error messages	UINT16	Details of why an error is displayed: • Bit 0: No reflector detected • Bit 1: Device temperature too low • Bit 2: Device temperature too high • Bit 3: Measured value above measuring range • Bit 4: Measured value below measuring range • Bit 5: Measured value negative (incorrect offset) • Bit 6: Invalid measured values • Bit 7: Overload at output Q1 or Q2 • Bit 8: Reserved (0) • Bit 9: Operating voltage too low • Bit 10 ... 15: Reserved (0)

Table 9.1 "Distance and Status" process data module

9.1.3.8 Factory Settings

Devices with a PROFINET interface can be restored to factory settings via the user interface and via PROFINET. This resets all configuration parameters to the default value and deletes the device name and the IP address of the device.

After factory settings have been restored, the device must be commissioned again as a PROFINET participant.

9.1.3.9 DCP Signal Indication

The DCP signal indication is used to locate a PROFINET device. The function is triggered by the PROFINET controller and initiates a visible signal: On the device, the "Power", "Target", "Q1", and "Q2" LEDs flash in a characteristic pattern for 3 seconds.

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