MANUAL

PHA...-F200-B6-V15B

Vision sensor for rack fine positioning

CE

PROFIBUS®

PEPPERL+FUCHS

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

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.

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:

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68307 Mannheim
Telephone: +49 621 776-4411
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E-Mail: fa-info@pepperl-fuchs.com

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2 Declaration of conformity

This product was 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, D-68307 Mannheim, has a certified quality assurance system that conforms to ISO 9001.

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 Intended Use

The PHA*...F200* is a Vision Sensor for rack fine positioning to a hole reference mark. The sensor is used in high-rack warehouses. Use the sensor only for its intended purpose.

Danger!
Moving parts

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 General safety instructions

Always operate the device as described in these instructions to ensure that the device and connected systems function correctly. The protection of operating personnel and plant is only guaranteed if the device is operated in accordance with its intended use.

The operating company bears responsibility for observing locally applicable safety regulations.

Installation and commissioning of all devices must be performed by a trained professional only.

User modification and or repair are dangerous and will void the warranty and exclude the manufacturer from any liability. If serious faults occur, stop using the device. Secure the device against inadvertent operation. In the event of repairs, return the device to your local Pepperl+Fuchs representative or sales office.

4 Product Description

4.1 Vision Sensor for Rack Fine Positioning — Use and Applications

The PHA*...-F200* Vision Sensor for rack fine positioning from Pepperl+Fuchs facilitates fast and simple positioning of stock feeders. The Vision Sensor detects circular holes in the rack structure and determines their position deviation in the X and Y directions relative to the target position.

The Vision Sensor comprises:

- Camera
- Lighting unit
- Evaluation computer with digital input and output signals
- PROFIBUS interface

Figure 4.1

4.2 Displays and Controls

The Vision Sensor unit has 7 LED indicators on the top that provide information on the various statuses of the device.

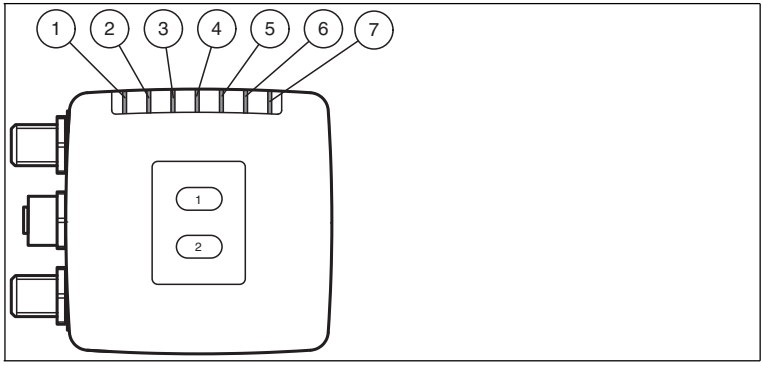

Figure 4.2 Indication operating side

(1) **BUS STATE**
Yellow LED. Indicates that the sensor communicates with PROFIBUS.

(2) **BUS ERR**
Red LED. Indicates an error in the communication.

(3) **PWR / ERR**
Red / green dual LED. Green indicates that the sensor is ready for operation. Red indicates a fault in the sensor.

(4) **ZERO POS**
Yellow LED. Indicates whether the hole is in the zero position.

(5) **RANGE**
Yellow LED. Indicates whether the hole is located in the capture range.

(6) **RP / CS**
Currently not used.

(7) **DIAG**
Yellow LED. Internal diagnostics, without function.

LED	[#1] BUS STATE	[#2] BUS ERR	[#3] PWR / ERR	[#4] ZERO POS	[#5] RANGE	[#6] RP / CS	[#7] DIAG	
Color	yellow	yellow	green/ red	yellow	yellow	yellow	yellow	Description
Status	on	X	X	X	X	X	X	Data transfer PROFIBUS
	X	flashes	X	X	X	X	X	PROFIBUS communication error f_{flash} = 1 Hz
	X	X	lights up red	X	X	X	X	System error
	X	X	lights up green	X	X	X	X	Normal operation

X = LED status has no meaning

LEDs are mounted around the camera element on the front of the Vision Sensor. The LEDs are used for light, to align the X and Y position, and for the status display.

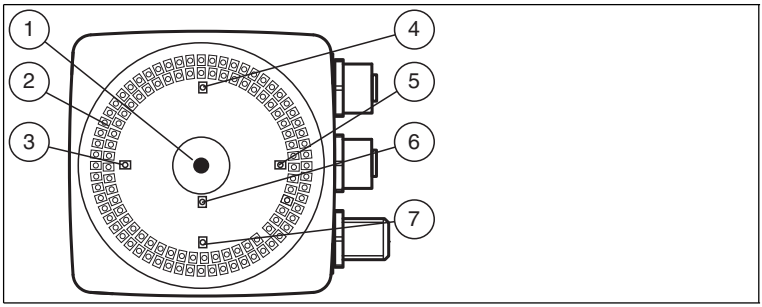

Figure 4.3 Indication camera side

1. Camera
2. LED infrared illumination
3. **-X position**
   LED red. Indicates whether the sensor is within the tolerance range.
4. **-Y position**
   LED red. Indicates whether the sensor is within the tolerance range.
5. **+X position**
   LED red. Indicates whether the sensor is within the tolerance range.
6. **Automatic**
   LED red. Flashes when the sensor is in automatic mode.
7. **+Y position**
   LED red. Indicates whether the sensor is within the tolerance range.

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Two operating buttons are mounted on the back of the Vision Sensor. With the operating button 2 "CONFIG" you can configure the fieldbus address using code cards. See chapter 6.3

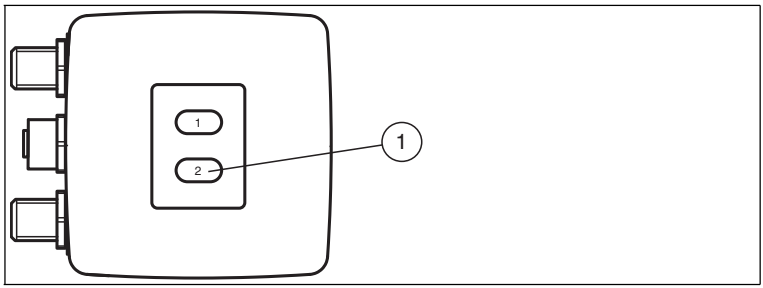


Figure 4.4 Controls

(1) Operating button 2 "CONFIG"

4.3 Interfaces and Connections

The device includes the following connections:

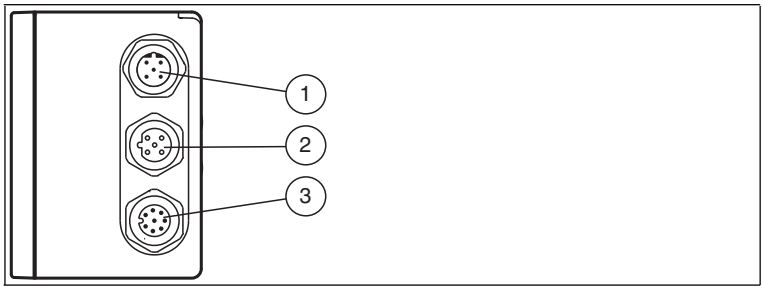


Figure 4.5 Electrical connection

(1) Profibus In (5-pin M12 connector, B-coded)
(2) Profibus Out (5-pin M12 connector, B-coded)
(3) 24 V DC+IO (Power supply, inputs and outputs, 8-pin M12 connector)

4.4 Scope of Delivery

- PHA*

Appropriate mounting hardware, cables, and other information can be found in the Accessories section and at http://www.pepperl-fuchs.com.

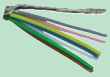
4.5 Accessories

Various accessories are available.

4.5.1 Power supply

Use the following connection cable to connect the power supply, inputs and outputs to the sensor.

M12 connection cables

	Material	Length	Cable end, field attachable 
8-pin M12 socket, straight 	PUR	2 m	V19-G-2M-PUR-ABG
		5 m	V19-G-5M-PUR-ABG
		10 m	V19-G-10M-PUR-ABG

Field-attachable M12 connectors

Model number	Description	mm^2	Cable dia.
V19-G-ABG-PG9	8-pin M12 socket, straight	max. 0.75	5 to 8 mm

Other lengths on request.

4.5.2 Accessories

Compatible accessories offer enormous potential for cost savings. Not only do you save a great deal of time and effort when commissioning for the first time, but also when replacing and servicing our products.

If products are used in harsh ambient conditions, appropriate Pepperl+Fuchs accessories can be used to extend the service lives of these products.

Model Number	Description
V19-G-ABG-PG9-FE	Grounding terminal and plug (set)
V15B-G-*M-PUR ABG-V15B-G	PROFIBUS bus cable, M12 to M12, available in several different lengths
VAZ-V1S-B	Blind plug for M12 sockets
ICZ-TR-V15B	Terminator for PROFIBUS
V19-G-*M-*	Configurable connection cable[1)]

[1)]: Ask your contact partner at Pepperl+Fuchs

Note

If you use your Vision Sensor in a refrigeration application at below -20 °C, please ask us for special cables.

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5 Installation

5.1 Storage and transport

For storage and transport purposes, package the unit using shockproof packaging material and protect it against moisture. The best method of protection is to package the unit using the original packaging. Furthermore, ensure that the ambient conditions are within allowable range.

5.2 Preparation

Unpacking the unit

1. Check that all package contents are present and undamaged.

   ↳ If anything is damaged, inform the shipper and contact the supplier.

2. Check that all items are present and correct based on your order and the shipping documents.

   ↳ If you have any questions, please contact Pepperl+Fuchs.

3. Keep the original packing material in case you need to store or ship the unit at a later time.

5.3 Mounting the Sensor

Note!

Mounting an optical device

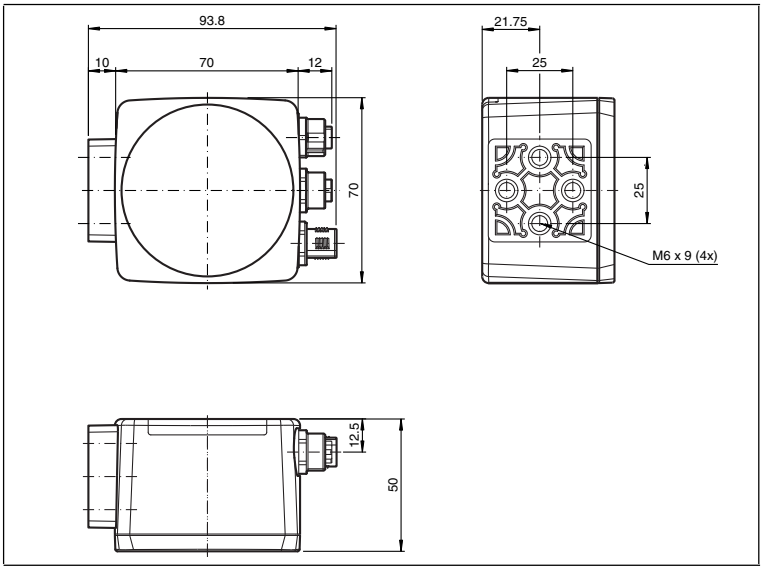
- Do not aim the sensor at the sun.
- Protect the sensor from direct long-term exposure to sun.
- Prevent condensation from forming by not exposing the sensor to any major fluctuations in temperature.
- Do not expose the sensor to the effects of any aggressive chemicals.
- Keep the lenses and reflector of the device clean. Clean with a soft cloth, using standard commercial glass cleaner if necessary.

We recommend to clean the optical surface and to check screw fittings and electrical connections at regular intervals.

The device has four symmetrically positioned M6 threads on the base of the housing to allow easy installation of the sensor in your plant.

The operating distance differs according to the sensor. The correct operating distance can be found in the technical data for the sensor to be installed.

The following illustration shows all the relevant housing dimensions in mm:



The surface must be level in order to prevent the housing from becoming distorted when the fittings are tightened. We advise securing the screws with spring disks in order to prevent the sensor becoming misaligned. Following installation of the sensor, ensure that there is still sufficient space to connect the connecting cable to the sensor.

5.4 Electrical Connection

The PHA... read head is electrically connected via an 8-pin M12 x 1 connector on the side of the housing. The power supply and communication with peripheral devices are established via this connection.

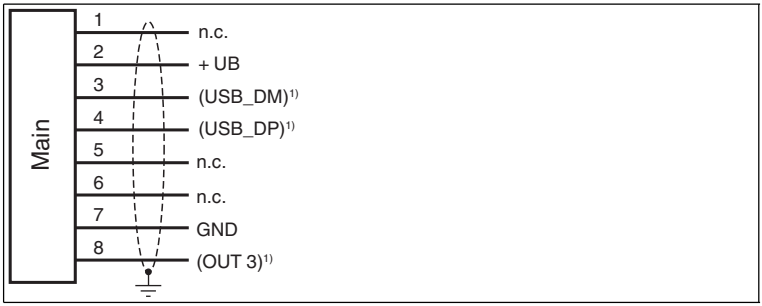


Figure 5.1 1) = not relevant for the electrical connection

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Connector Assignment

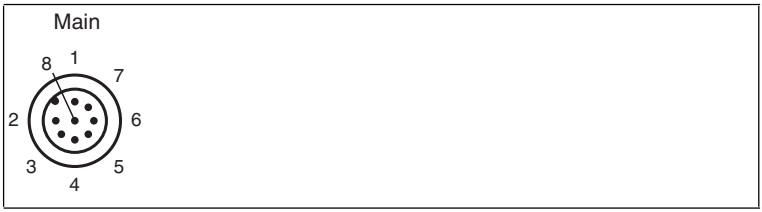

Figure 5.2

Color Assignment

Pepperl+Fuchs female cordsets are manufactured in accordance with EN 60947-5-2. When using a type V19-... (see chapter 4.5.2) female cordset with an open cable end on the Main connection, the following color assignment applies:

Connection pin	Strand color	Color Abbreviation
1	white	WH
2	brown	BN
3	green	GN
4	yellow	YE
5	gray	GY
6	pink	PK
7	blue	BU
8	red	RD

Shielding cables

The shielding of cables is required to suppress electromagnetic interference. Establishing a low resistance or low impedance connection with the conductor or equipotential bonding circuit is a particularly important factor in ensuring that these interference currents do not become a source of interference themselves. Always use cables with braided shield, never use cables with a foil shield. The shield is integrated at both ends, i.e. in the control cabinet and on the controller **and** the reading head. The grounding terminal available as an accessory allows easy integration in the equipotential bonding circuit.

In exceptional cases, the shielding of a connection at one end may be more favorable if

- an equipotential bonding cable is not laid or cannot be laid.
- a film shield is used.

The following points relating to shielding must also be noted:

- Use metal cable clips that cover large areas of the shield.
- After installing the cable shield in the control cabinet, place it directly on the equipotential bonding rail.

- Direct the protective grounding connections to a collective point in a star configuration.
- The cross-section of the cables used for grounding should be as large as possible.

Caution!
Damage to the device

Connecting an alternating current or excessive supply voltage can damage the device or cause the device to malfunction.

Electrical connections with reversed polarity can damage the device or cause the device to malfunction.

Connect the device to direct current (DC). Ensure that the supply voltage rating is within the specified device range. Ensure that the connecting wires on the female cordset are connected correctly.

5.5 PROFIBUS Connection

The PHA... read head is connected to PROFIBUS via a 5-pin M12 x 1 connector **Bus in** and a 5-pin M12 x 1 socket **Bus out**, located on the side of the housing.

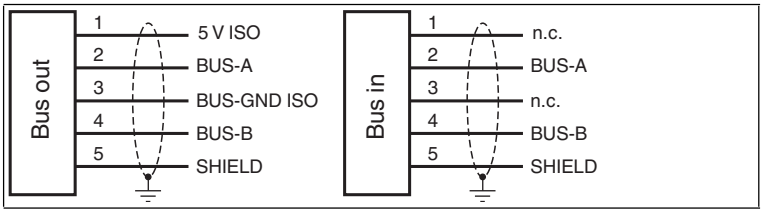

Figure 5.3

Connector Assignment

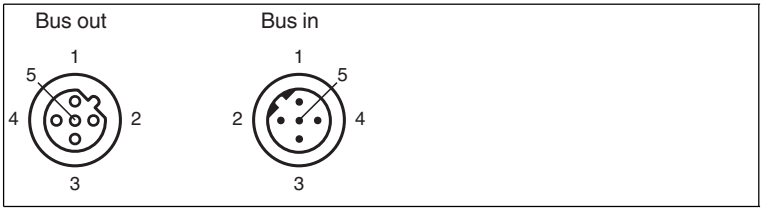

Figure 5.4

For details of suitable PROFIBUS cables, see chapter 4.5.2.

6 Commissioning

6.1 Sensor Functionality

The PHA...-F200* Vision Sensor detects circular holes in the rack structure and determines their position deviation from the target position. The Vision Sensor operates in two dimensions — X and Y, X being the horizontal direction and Y the vertical direction. → see Figure 6.1 on page 17. The operating distance (distance between the rack profiles and the front panel of the sensor) must be within the working range of the sensor.

Orientation coordinate system

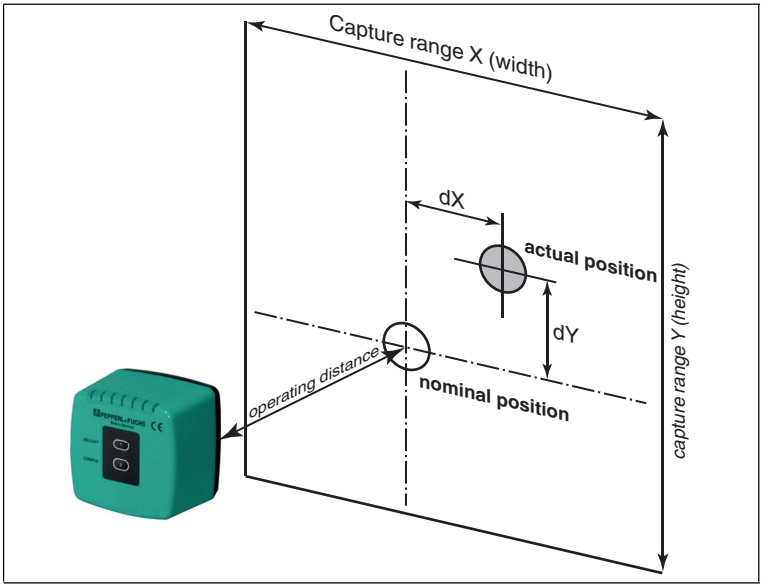

Figure 6.1

f the hole is located in the target position, a deviation zero is output.

The Vision Sensor detects dark holes on a light background. Observe the following points:

- Only one circular hole may be present in the capture range.
- All holes to be detected must have the same diameter.
- The surface surrounding the hole should only reflect diffusely.
- The area behind the hole should be unobstructed to a range of 500 mm.
- There should be no light source behind the hole.
- The Vision Sensor must be aligned parallel to the capture range.
- The actual operating distance must correspond to the operating distance of the Vision Sensor.

Capture range

The capture range is the area in the camera's line of vision, within which the Vision Sensor can detect a hole.

The hole diameter should be 10–15 % of the capture range width.

Tolerance range

The sensor provides the -X, +X, -Y, +Y deviation as an LED display. The target position is located within a rectangular tolerance range. The LEDs are operated as follows, depending on the X and Y deviations.

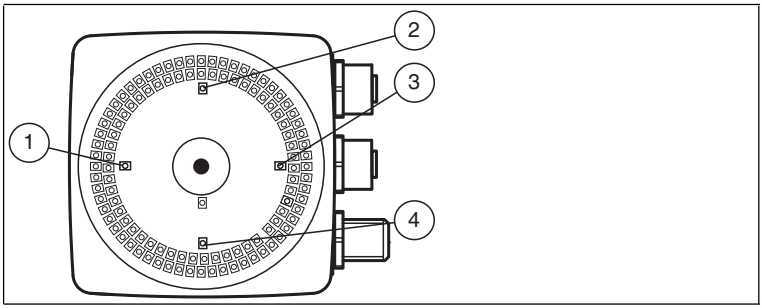

Figure 6.2 Indication camera side

1 **-X position**
LED red. Indicates whether the sensor is within the tolerance range.

2 **-Y position**
LED red. Indicates whether the sensor is within the tolerance range.

3 **+X position**
LED red. Indicates whether the sensor is within the tolerance range.

4 **+Y position**
LED red. Indicates whether the sensor is within the tolerance range.

Tolerance in X-Direction

LED -X Position	LED +X Position	
red	red	X-direction within tolerance
off	red	X too large
red	off	X too small

Tolerance in Y-Direction

LED -Y Position	LED +Y Position	
red	red	Y-direction within tolerance
off	red	Y too large
red	off	Y too small

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6.2 Operating Modes

The sensor has two operating modes:

- Setup
- Automatic

In setup mode, the sensor parameterization can be changed and diagnostic functions called up. The sensor is always in automatic mode once the operating voltage has been applied.

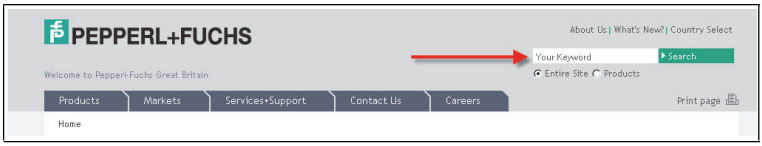
6.3 External Parameterization of the Fieldbus using Code Cards

During the external configuration of the fieldbus address, the read head optically senses special code cards and then sets the respective fieldbus address. To do this, simply hold the corresponding code cards at the correct distance in front of the optic of the reading head.

You can find the manual "Code Cards to configure the Fieldbus address" at www.pepperl-fuchs.com. see chapter 6.3.1.

6.3.1 Product documentation on the internet

You can view all the relevant documentation and additional information on your product at http://www.pepperl-fuchs.com. Simply enter the product name or model number in the **Product/Key word search** box and click **Search**.



Select your product from the list of search results. Click on the information you require in the product information list, e.g., **Technical documents**.

A list of all available documents is displayed.

7 Operation

7.1 Communication via PROFIBUS

7.1.1 General information on PROFIBUS DP

The PROFIBUS DP is a standardized, open fieldbus, which enables data exchange between PLCs, PCs, operating and observation devices, and also sensors and actuators.

For more detailed information on the PROFIBUS DP, refer to the PROFIBUS standard EN 50170 and to the current literature on the subject (e.g. M. Popp, “The New Rapid Way to PROFIBUS DP” available (in German) from the PROFIBUS user organization).

Note!

The PROFIBUS User Organization e.V. Haid- and Neu-Str. (PNO) publishes informational brochures and a PROFIBUS product catalog (www.PROFIBUS.com).

7.1.2 PROFIBUS DP Communication Parameters

The communication parameters can be taken from the GSD file. The GSD file name is **pf0d7b.gsd**.

7.1.3 PROFIBUS DP features

The following is a list of the most important performance features of PROFIBUS DP:

- DP slave functionality with functions Data_Exchange, RD_Inp, RD_Outp, Slave_Diag, Set_Prm, Chk_Cfg, Get_Cfg, Global_Control, Set_Slave_Address.
- Modular DP slave device with one module each for writing and reading data.
- Transfer rates of 9.6 kbit/s, 19.2 kbit/s, 93.75 kbit/s, 187.5 kbit/s, 500 kbit/s, 1.5 Mbit/s, 3 Mbit/s, 6 Mbit/s and 12 Mbit/s auto-synchronizing.
- Adjustable device address 00h … 7Eh.

7.1.4 PROFIBUS DP functions

Function	Description	Master
Set_Prm	Transfers parameter data to a DP slave	Class 1
Chk_Cfg	Transfers the configuration data for testing to a DP slave	Class 1
Get_Cfg	Reads out the configuration data of a DP slave	Class 2
Data_Exchange	Sends output data to a DP slave device and requests input data from a DP slave	Class 1
RD_Inp	Reads the input data of a DP slave	Class 2
RD_Outp	Reads the output data of a DP slave	Class 2
Global_Control	Sends special commands to one or more DP slaves	Class 1
Slave_Diag	Reads the diagnostic information of a DP slave	Class 1
Set_Slave_Address	Modifies the device address	Class 2

7.1.5 PROFIBUS Modules

The PROFIBUS address for the read head can be modified in a nonvolatile manner via the "Change Station Address" (Set_Slave_Add) PROFIBUS function when switching on in a point-to-point connection.

The default address for the read head is 3.

1 word = 16-bit value

1 byte = 8-bit value

The following modules enable read head data to be called up via PROFIBUS.

Deviation X coordinate

Module

Module No.	Size	Type	Content
1	2 words consistent	Input data	32 bit X data MSB first (MSB = **m**ost **s**ignificant **b**it) Two's complement -100 000 to 100 000 µm

Response

Bit No.	Content	
	Word 1 X data	Word 2 X data
1	XD16	XD00
2	XD17	XD01
3	XD18	XD02
4	XD19	XD03
5	XD20	XD04
6	XD21	XD05
7	XD22	XD06
8	XD23	XD07
9	XD24	XD08
10	XD25	XD09
11	XD26	XD10
12	XD27	XD11
13	XD28	XD12
14	XD29	XD13
15	XD30	XD14
16	XD31	XD15

Deviation Y coordinate

Module

Module No.	Size	Type	Content
2	2 words consistent	Input data	32 Bit Y data MSB first Two's complement -100 000 to 100 000 µm

Response

Bit No.	Content	
	Word 1 Y data	Word 2 X data
1	YD16	YD00
2	YD17	YD01
3	YD18	YD02
4	YD19	YD03
5	YD20	YD04
6	YD21	YD05
7	YD22	YD06
8	YD23	YD07
9	YD24	YD08
10	YD25	YD09
11	YD26	YD10
12	YD27	YD11
13	YD28	YD12
14	YD29	YD13
15	YD30	YD14
16	XD31	YD15

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Status

Module

Module No.	Size	Type	Content
3	1 Word consistent	Input data	8 Bit status MSB first

Response

Bit No.	Content Word 1 Status
1	ST00
2	ST01
3	ST02
4	ST03
5	ST04
6	ST05
7	ST06
8	ST07

Radius

Module

Module No.	Size	Type	Content
4	1 Word consistent	Input data	8 Bit radius MSB first 0 to 100 %

Response

Bit No.	Content Byte 1 Radius
1	RD00
2	RD01
3	RD02
4	RD03
5	RD04
6	RD05
7	RD06
8	RD07

Counter

Module

Module No.	Size	Type	Content
5	1 Word consistent	Input data	8 Bit counter MSB first 0 to 255

Response

Bit No.	Content Word 1 Counter
1	CNT00
2	CNT01
3	CNT02
4	CNT03
5	CNT04
6	CNT05
7	CNT06
8	CNT07

Duration LED flash

Module

Module No.	Size	Type	Content
6	1 Word consistent	Input data	16 Bit flashtime MSB first 0 to 255 µs

Response

Bit No.	Content Word 1 Flashtime
1	FT00
2	FT01
3	FT02
4	FT03
5	FT04
6	FT05
7	FT06
8	FT07
9	FT08
10	FT09
11	FT10
12	FT11
13	FT12
14	FT13
15	FT14
16	FT15

7.1.6 Global Primary Data

With the global primary data you can parameterize the read head via PROFIBUS. The global primary data is always transferred completely to the read head.

Designation	Function	Type	Primary data		
			min.	max.	default
Hole Diameter	Diameter of the hole to be detected in mm	Uint8	1 mm	30 mm	**13 mm**
Diameter Tolerance	Tolerance of the hole diameter	Uint8	0 mm	100 mm	**30 mm**
Position Tolerance	Tolerance of the hole position	Uint8	0 mm	30 mm	**3 mm**
Working Distance	Working distance between read head - surface with hole	Uint32	0 mm	1000 mm	**300 mm**
Search Width	Width of the search area	Uint32	0 mm	720 mm	**100 mm**
Search Height	Height of the search area	Uint32	0 mm	480 mm	**100 mm**
Zero X	Zero position on the X coordinate	int16	-300 mm	300 mm	**0 mm**
Zero Y	Zero position on the Y coordinate	int16	-300 mm	300 mm	**0 mm**
Relative X	Relative displacement of the X coordinate	int16	-300 mm	300 mm	**0 mm**
Relative Y	Relative displacement of the Y coordinate	int16	-300 mm	300 mm	**0 mm**
Invert X Axis	Inversion of the X coordinate	bool	0	1	**0** = nicht invertiert
Invert Y Axis	Inversion of the Y coordinate	bool	0	1	**0**= nicht invertiert
Swap Axis	Swapping the X/Y coordinates	bool	0	1	**0** = nicht vertauscht

Table 7.1 **Bold** = Default value

8 Maintenance and repair

8.1 Maintenance

The cable is maintenance-free. To get the best possible performance out of your device, keep the optical unit on the device clean and clean it when necessary.

Observe the following instructions when cleaning:

- Do not touch the optical unit with your fingers.
- Do not immerse the device in water. Do not spray the device with water or other fluids.
- Do not use a scouring agent to clean the surface of the device.
- Use a cotton or paper cloth moistened with water or isopropyl alcohol (not soaked).
- Remove any residual alcohol using a cotton or paper cloth moistened with distilled water (not soaked).
- Wipe the device surfaces dry using a lint-free cloth.

8.2 Repair

The devices must not be repaired, changed or manipulated. If there is a defect, the product must always be replaced with an original device.

9 Troubleshooting

9.1 What to Do in the Event of an Error

Before you have the device repaired, take the following actions:

- Test the equipment according to the checklist below.
- Contact our Service Center in order to localize the problem.

Checklist

Fault	Cause	Remedy
"PWR" LED does not light up	The power supply is switched off.	Check whether there is a reason why it is switched off (installation or maintenance work, etc.). Switch the power supply on if appropriate.
"PWR" LED does not light up	Wiring fault in the splitter or control cabinet, cable break	Check the wiring carefully and repair any wiring faults. Check the cable to ensure proper function.
No connection to the device	Network cable not connected	Connect the network cable.
No connection to the device	Wrong network cable used	Direct connection between PC and device: use a crossover network cable. Connection via an existing network: use a twisted-pair network cable.
No connection to the device	Wrong network IP used	Check the entry for the network IP and ensure that you have entered the correct IP for the sensor.

- If none of the above remedies corrects the problem, please contact our Service Center. Please have the fault patterns and the version number of the firmware available. The firmware version number can be found at the top right of the user interface.

FACTORY AUTOMATION – SENSING YOUR NEEDS

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06/2013