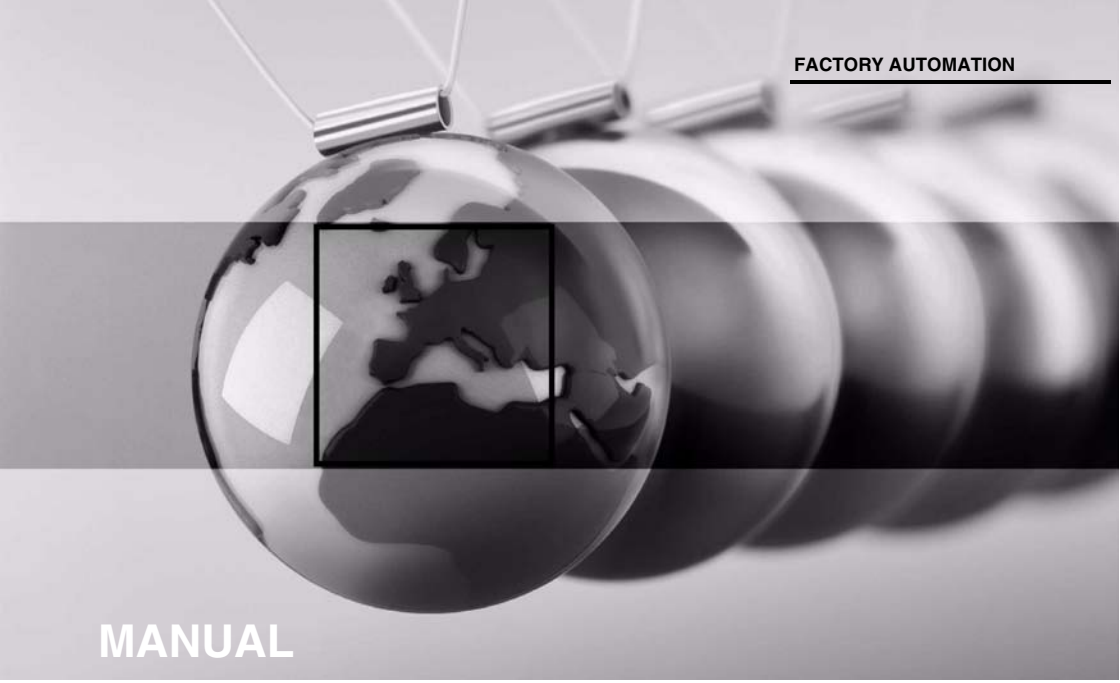
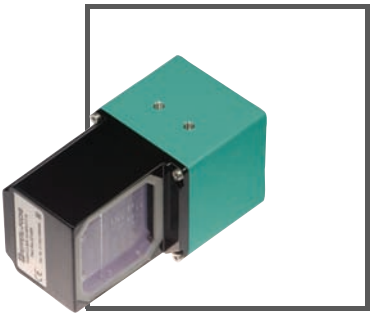


MANUAL

VOS412-BIS

VISION SENSORS FOR SHEET IDENTIFICATION



CE

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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"

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:

Pepperl+Fuchs GmbH
Lilienthalstraße 200
68307 Mannheim
Telephone: +49 621 776-4411
Fax: +49 621 776-274411
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**

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3 Safety

3.1 Symbols relevant to safety

Danger!
This symbol indicates a warning about a possible danger.

In the event the warning is ignored, the consequences may range from personal injury to death.

Warning!
This symbol indicates a warning about a possible fault or danger.

In the event the warning is ignored, the consequences may course personal injury or heaviest property damage.

Caution!
This symbol warns of a possible fault.

Failure to observe the instructions given in this warning may result in the devices and any connected facilities or systems develop a fault or fail completely.

3.2 Intended use

The VOS412-BIS system is a sheet verification sensor that was designed exclusively for the purpose of identifying sheet sequences. The sensor contains a camera, illumination unit, and microprocessor (DSP) that generates digital input and output signals as well as a network interface.

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 Optical Sensor - Use and application areas

The sheet verification sensor from Pepperl+Fuchs is a quick and simple solution for monitoring correct sheet sequences in gathering, folding, and binding machines. Sequences can be monitored either through image comparison or by reading barcodes printed on the sheets. The inspection is performed in conjunction with each machine cycle at a speed of up to 4 m/s and a maximum of 10 sheets/s. The sensor receives a trigger signal and returns digital signals that indicate whether the current sheet corresponds with the pattern that was taught in. An encoder signal can be used to delay the trigger signal. The device can be operated locally, as a stand-alone unit, or in a network where several sensors are connected together. The sensor includes a camera, illumination unit, and microprocessor (DSP) with digital input and output signals as well as a network interface. The sensor is connected to a machine control system via these interfaces. Time-critical signals such as triggers and results are transmitted via the digital inputs/outputs. Commands for changing the operating mode and configuring different parameters can be sent to the sensor and images loaded via the network interface.

The sheet verification sensor is a single compact unit: The camera, illumination unit, and a DSP board for digitalizing and processing captured image information are enclosed in one housing.

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4.2 Displays and controls

The illumination unit contains 6 LED indicators that provide information on the status of the device.

Figure 4.1: Displays and controls

3 Power (PWR)

Lights up green when the sensor is ready for operation.

4 Result

Lights up green if the result was OK.

5 Reading process triggered (strobe)

Lights up when the reading was ended.

6 Teach in

Lights up when the teach-in process starts.

7 Trigger

Lights up yellow when a trigger signal is connected.

8 Network (LAN)

Lights up yellow as soon as a physical connection is established.

4.3 Interfaces and connections

The device includes the following connections:

Figure 4.2: Device connections

1 Network (4-pin M12 socket)

2 Power supply, inputs and outputs (8-pin M12 connector)

Power supply

There is an 8-pin M12 plug on the back of the housing to connect the power supply and the inputs and outputs. The following diagram shows the pin assignment:

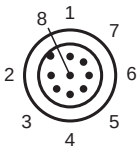

Figure 4.3: Connection layout for supply voltage and inputs and outputs

1 Encoder

2 24 V supply to device

3 RESULT output

4 STROBE output

5 TEACH input (applying a high level activates the teach in process)

6 TRIGGER input

7 Device ground (GND)

8 MODE output (High = inspection, Low = teach in)

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Network

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

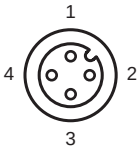

Figure 4.4: Network connection layout

1 Transmit Data (+)

2 Receive Data (+)

3 Transmit Data (-)

4 Receive Data (-)

4.4 Delivery package

- VOS412-BIS

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 Network cable

The sensor is connected to the network by an M12 connector.

Designation	Description
V45-G	RJ45 network connector, field attachable
V1S-G	4-pin M12 connector, field attachable
V1SD-G-2M-PUR-ABG-V45X-G	Connection cable, RJ45 network connector with M12 plug, 4-pin

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5 Installation

5.1 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.

5.2 Mounting the device

The device has two symmetrically positioned M5 threads on the base of the housing to allow easy installation of the sensor in your plant.

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

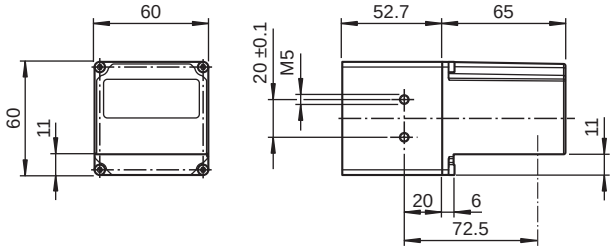

Figure 5.1: VOS410-BIS-System dimensions

The Vision Sensor is mounted at a specific distance above the surface of the sheet.

The following illustration shows an example of correct mounting:

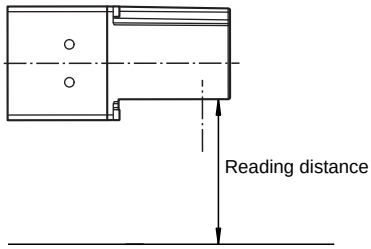

Figure 5.2: VOS412-BIS mounting

5.3 Connecting the device

Connecting the power supply

To provide power to the sensor, proceed as follows:

1. Plug the 8-pin M12 socket into the connector on the back of the housing.
2. Tighten the cap nut over the connector.
   This ensures that the power cable cannot be inadvertently pulled out.

Note!

Record the network configuration

The sensor communicates with the connected machine control system using the TCP/IP protocol. To ensure communication works correctly, you must note all the changes you make to the network configuration.

Note!

Network cabling

Use a crossover network cable to connect the sensor directly to a PC. If the sensor is operated within a network, use a twisted-pair network cable to connect it to the network.

Establishing a network connection

To establish a network connection, proceed as follows.

1. If you are using a network cable that has a RJ45 network plug at one end and a 4-pin M12 socket at the other, insert the 4-pin M12 socket in the connector on the back of the sensor.
2. When delivered, the sensor has a fixed IP address (192.168.101.99). To facilitate communication within the network, you must configure your network. The configuration data can be found in the network configuration overview.

5.4 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.

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6 Commissioning

6.1 Function

The sensor provides two different methods for monitoring the correct sequence of sheets. One is image comparison and the other barcode reading.

6.1.1 Image comparison

The sensor provides two different methods for monitoring the correct sequence of sheets. One method is image comparison.

With image comparison, a sheet's image is taught into the system and all subsequent sheets are compared with this image. If the sheets are sufficiently similar, the system issues an "OK" evaluation, otherwise the evaluation is "NOK" (not ok). During image comparison, a shift in the sheet's position of up to 10 mm with respect to the taught-in sheet is permitted in a horizontal and vertical direction.

Teaching in a pattern sheet

1. Start the teaching process by setting the **TEACH** input or send the corresponding XML command to the sensor.
2. As soon as an active trigger edge is present, the pattern image is captured and stored in the sensor as a pattern.
3. Reset the input **TEACH**.

   The teach-in process is completed.

6.1.2 Barcode

A barcode must be printed on the lower or upper edge of the sheet being checked. The VOS41*-BIS system can read this barcode. The entire barcode must be positioned within the image field of the sensor. The code can be aligned horizontally or vertically within the image field.

The barcode is compared with a predefined barcode. The sensor issues the result "OK" if the barcode that was read corresponds with the stored barcode. The sensor issues the result "NOK" if the two barcodes do not correspond or the barcode could not be read. The barcode used for the comparison can be specified either as a value or defined by scanning in a barcode on a sheet.

The barcode you intend to read must have the following dimensions:

- Minimum bar width: 0.3 mm
- Barcode types: 2/5 interleaved, Code39, EAN128

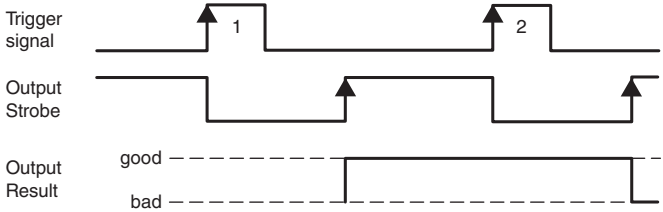
7 Operation

7.1 Inspection operating state

To start an inspection, proceed as follows:

Image inspection

1. As soon as a rising edge is present at the trigger signal, an image is captured and a subsequent inspection is performed.
2. After the image is evaluated, the output STROBE issues a high signal.
3. The output RESULT issues the result of the inspection. Low = NOK, High = OK.

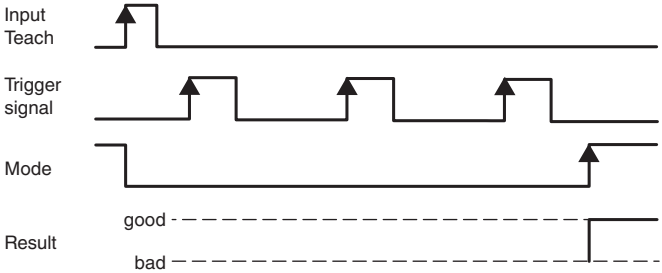


7.2 Teach-in operating state

To teach in a pattern, proceed as follows:

Teaching in patterns

1. Apply a high level signal at the **TEACH** output.



2. A rising edge at the trigger input results in the capture of one or more images, depending on the teach mode.
3. The sensor selects the best image from all the captured images and teaches it in as a pattern.
4. The teaching process is completed when the **Strobe** output is set to high.
5. The **RESULT** output issues a signal that indicates how successful the teaching process was:
   “High” = image detection taught in successfully
   “Low” = image detection not taught in successfully, the sensor operates in the gray value comparison mode.

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7.3 Network interface

The network interface is used to transfer data (parameters, images, software updates) and commands in both directions (host to sensor and sensor to host).

XML strings are used to transfer parameters, commands and results.

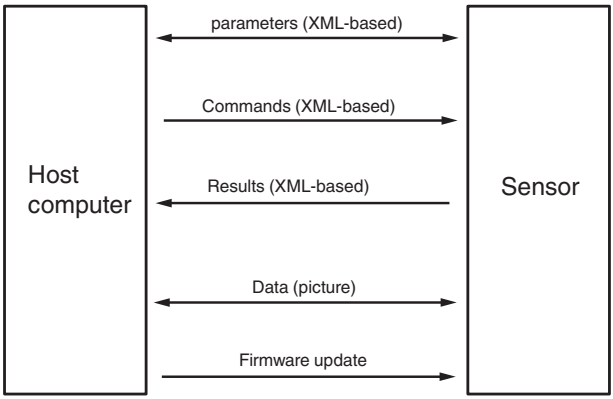

Figure 7.1: Network interface XML-Stings

Communication is established through TCP/IP via port 50005. The default IP address is 172.31.15.120.
Each data package consists of a pre-header and the actual data:

Pre-header (length: 12 bytes)	Data (length varies)

7.3.1 Pre-header

The pre-header is structured as follows:

Byte no.	Value	Width	Data type	Description	Value range
00 01	50 46	16 bit	Char	Constant	"FP" = 5046h
02 03	00 01	16 bits	Uint16	Version	Constant Current = 00 01
04 05	00 01	16 bits	Uint16	Type	00 01 = XML data 00 02 = "Image data" (image data in binary format) 00 03 = Reserved 00 04 = Reserved 00 05 = Firmware data (firmware update in Intel hex format) 00 06 = Reserved 00 07 = "Log data" (log data as XML text) 00 08 = "Result data" (result data as XML text)
06 07	00 00	16 bits	Uint16	Status	00 00 h = Current image 40 00 h = Pattern image 80 00 h = Fault pattern
08 09 10 11	00 00 12 34	32 bit	Uint32	Size	Length of subsequent data

Table 7.1: Pre-header structure

7.3.2 XML data

You can access the parameters of the sensor using XML data (type 00 01). The XML data is structured as follows:

```
<FUNCTION Modifier="SetSingleData">
        <SENSOR Type="VOS410">
                <SETTINGS>
                        <CONFIGURATION Id="Command" Name="Command"
                        Type="Command" Location="Command" Version="1">
                                <PARAMETER Id="GetLastImg" Value="1"/>
                        </CONFIGURATION>
                </SETTINGS>
        </SENSOR>
</FUNCTION>
```

You can enter one of the following command types under **FUNCTION Modifier**:

FUNCTION Modifier=“GetAllData”	Sends the overall parameter tree
FUNCTION Modifier=“SetAllData”	Sets a parameter tree
FUNCTION Modifier=“GetSingleData”	Sends back an individual parameter value
FUNCTION Modifier=“SetSingleData”	Sets an individual parameter

The individual parameters are addressed via **CONFIGURATION Id** and **PARAMETER Id**. The values can be found under Value. Descriptions of the individual parameters can be found in the appendix.see chapter 9.1

7.3.3 Commands to be executed

You can use SetSingleData and **CONFIGURATION Id=“Command“** to send commands you wish to execute to the sensor in the form of a **PARAMETER Id**:

PARAMETER Id=“GetLastImage”	Sends back the last captured image
PARAMETER Id=“GetPatImg”	Sends back the pattern image
PARAMETER Id=“GetErrImg”	Sends back the fault pattern
PARAMETER Id=“SearchTest”	Starts a teach-in process
PARAMETER Id=“TriggerStart”	Triggers an image capture (“Software trigger”)

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7.3.4 Image data

The image data (type 00 02) is transferred in the following format:

Byte no.	Value	Width	Data type	Description	Value range
00 01	00 01	16 bit	Uint16	Format	01: SW 8 bit 02: SW 16 bit
02 03	12 34	16 bit	Uint16	Width	Width in pixels
04 05	34 12	16 bit	Uint16	Height	Height in pixels
06 07	12 34	16 bit	Uint16	FrameCounter	Continuous image number
08 -	XX	"Width * Height * Format"	Uint8 / Uint16	Data	Image data

Table 7.2: Image data

7.3.5 Result data

The sensor responds to different actions or results by sending a result data set (type 00 08):

```
<SENSOR Version="1" Type=”VOS410”>
    <SETTINGS>
        <CONFIGURATION Id="Result" Name="Result" Type="Result"
        Location="General">
            <Result Id=……./>
        </CONFIGURATION>
    </SETTINGS>
</SENSOR>
```

Various values are transferred under **Result Id**, depending on the situation.

After completing the teach-in process

Result Id="TeachIndex"	ValueType= Index of the image that was selected for the teach-in process in multiple image learning mode see chapter 9.1
Result Id="TeachQuality"	ValueType= Variable indicating the suitability of the image

After transferring an image

Result Id=“Image type:	ValueType=“PatImage” Transferred image is pattern image ValueType=“ActImage” Transferred image is current image ValueType=”ErrImage” Transferred image is error image
Result Id=“Check”	ValueType=“X;Y;dX;dy” X/Y = Position of the search area, dx/dy= Size of the search area
Result Id=“Ref”	ValueType=“X;Y;dX;dy” X/Y = Position of the reference area, dx/dy= Size of the reference area
Result Id=“Operating mode”	ValueType=“Correlation” Image comparison operates in correlation mode ValueType=“Graylevel” image comparison operates in gray value mode

8 Troubleshooting

8.1 What to do in the event of an error

Before requesting a service call, please check that the following actions have been taken:

- Test the equipment according to the following checklists,
- Telephone assistance from the Service Center in order to isolate the problem.

Checklist

Error	Cause	Remedy
"PWR" LED not lit up	The power supply is switched off.	Check whether there is a reason for it being switched off (installation or maintenance work etc.). Switch the power supply on, if necessary.
"PWR" LED not lit up	The M12 socket is not connected to the connector on the sensor.	Connect the 8-pin M12 socket to the sensor and tighten the cap nut by hand.
"PWR" LED not lit up	Wiring fault in the splitter or control cabinet.	Check the wiring carefully and repair any wiring faults.
"PWR" LED not lit up	Supply cable to the sensor is damaged.	Replace the damaged wire.
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.

- If none of the above remedies correct the problem, please contact the Service Center. Please have the fault patterns and version number of the sensor. The version number can be found at the bottom left of the operator interface.

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9 Appendix

9.1 Parameters

You can access the sensor parameters directly via the XML commands **SetSingleData** and **GetSingleData**. Each parameter is allocated a **CONFIGURATION Id** and **PARAMETER Id**.

General parameters: CONFIGURATION ID="General"

PARAMETER Id="IPAddress"	Value=IP address where the VOS412 can be accessed in the network
PARAMETER Id="SubNetMask"	Value=Subnet mask for TCP/IP network
PARAMETER Id="Gateway"	Value=Gateway in the TCP/IP network

Operating mode parameters: CONFIGURATION Id="VOS410"

PARAMETER Id="InspectionMode"	Value="BARCODE_INSPECTION": "Barcode" mode Value="PATTERN_INSPECTION": "Image comparison" mode
PARAMETER Id="TeachMode"	Value="TEACH_MODE_1_1_1": **One** image is captured at **one** position on **one** sheet with one exposure Value="TEACH_MODE_TRIPLE": 3 images are captured on one sheet with 3 different exposures. Images are captured at 1-5 positions on the sheet, the number of positions is defined with the parameter **CapturePositionsOnPage**
PARAMETER Id="CapturePositionsOnPage"	Value=Number of image capture positions on one sheet
PARAMETER Id="TeachTimeout"	Value=Time in ms after which the teaching process is stopped **CAUTION:** When the optimal image is captured, the taught-in data is stored in the permanent flash memory on the sensor. The saving process lasts another few seconds, which extends the overall teaching process
PARAMETER Id="FlashStart"	Value=Start value flash duration (in 10 µs) in image capture modes with several exposures
PARAMETER Id="FlashStep"	Value=incremental flash duration (in 10 µs) for image capture modes with several exposures

Image comparison mode parameters CONFIGURATION Id="PatternSearch"

PARAMETER ID="RoiXStart"	Value=Horizontal start position of the search area in pixels (default value is 248)
PARAMETER Id="RoiYStart"	Value=Vertical start position of the search area in pixels (default value is 112)
PARAMETER Id="Tolerance X"	Value=Width of the search area in pixels (default value is 752)
PARAMETER Id="Tolerance Y"	Value=Height of the search area in pixels (default value is 480)

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Barcode mode parameters: CONFIGURATION Id="Barcode"

PARAMETER Id="CompareCode"	Value=Comparison string
PARAMETER Id="Code39"	Value="0": Code39 deactivated Value="1": Code39 active
PARAMETER Id="Code128"	Value="0": Code128 deactivated Value="1": Code128 active
PARAMETER Id="Code25"	Value="0": Code 2/5 interleaved deactivated Value="1": Code 2/5 interleaved active
PARAMETER Id="PharmaCodeOnly"	Value="0": Pharmacode deactivated Value="1": Pharmacode active, barcode deactivated
PARAMETER Id="StartAutomatic"	Value="0": No automatic search Value="1": Automatic search, "Orientation", "XStart", "YStart", "XEnd" and "YEnd" have no effect
PARAMETER Id="XStart"	Value=First column for barcode search with StartAutomatic Value="0"
PARAMETER Id="YStart"	Value=First line for barcode search with StartAutomatic Value="0"
PARAMETER Id="XEnd"	Value=Last column for barcode search with StartAutomatic Value="0"
PARAMETER Id="YEnd"	Value=Last line for barcode search with StartAutomatic Value="0"
PARAMETER Id="Orientation"	Value="hor": Barcode and Pharmacode only search horizontally Value="ver": Barcode and Pharmacode only search vertically

9.2 Technical data

General data	
Resolution	752 x 480 pixels
Read distance	60 mm or 90 mm (depending on the device)
Depth of focus	± 5 mm
Read field	70 mm x 44 mm or 80 mm x 50 mm (depending on the device)
Type of light	Integrated LED flash (white)
Cycle time	< 150 ms
Object speed	max. 4 m/s
Display/controls	
Operating display	Green LED: Ready for operation
Electrical data	
Operating voltage	10 ... 30 V DC
Current consumption	200 mA
Interface 1	
Connection interface	Ethernet
Protocol	TCP/IP

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Transfer rate	100 MBit/s
Cable length	max. 30 m
Input	
Input voltage	External supply 24 V ± 15% PELV
Switching current	3.5 mA at 24 V DC
Cable length	max. 30 m
Output	
Number/Type	3 electronic outputs, PNP
Operating mode	PNP optically isolated, short circuit and overload resistant
Switching voltage	24 V
Switching current	max. 100 mA per output
Cable length	max. 30 m
Ambient conditions	
Ambient temperature	0 ... 45 °C
Storage temperature	-20 ... 60°C
Mechanical data	
Degree of protection	IP65
Connection	8-pin M12 connector, 4-pin M12 socket
Enclosure	Die-cast zinc, powder-coated
Lens	Glass
Mounting	4 x M5 thread
Weight	Approx. 730 g

Table 9.1: Technical data

FACTORY AUTOMATION – SENSING YOUR NEEDS

Pepperl+Fuchs sets the standard in quality and innovative technology for the world of automation. Our expertise, dedication, and heritage of innovation have driven us to develop the largest and most versatile line of industrial sensor technologies and interface components in the world. With our global presence, reliable service, and flexible production facilities, Pepperl+Fuchs delivers complete solutions for your automation requirements – wherever you need us.

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