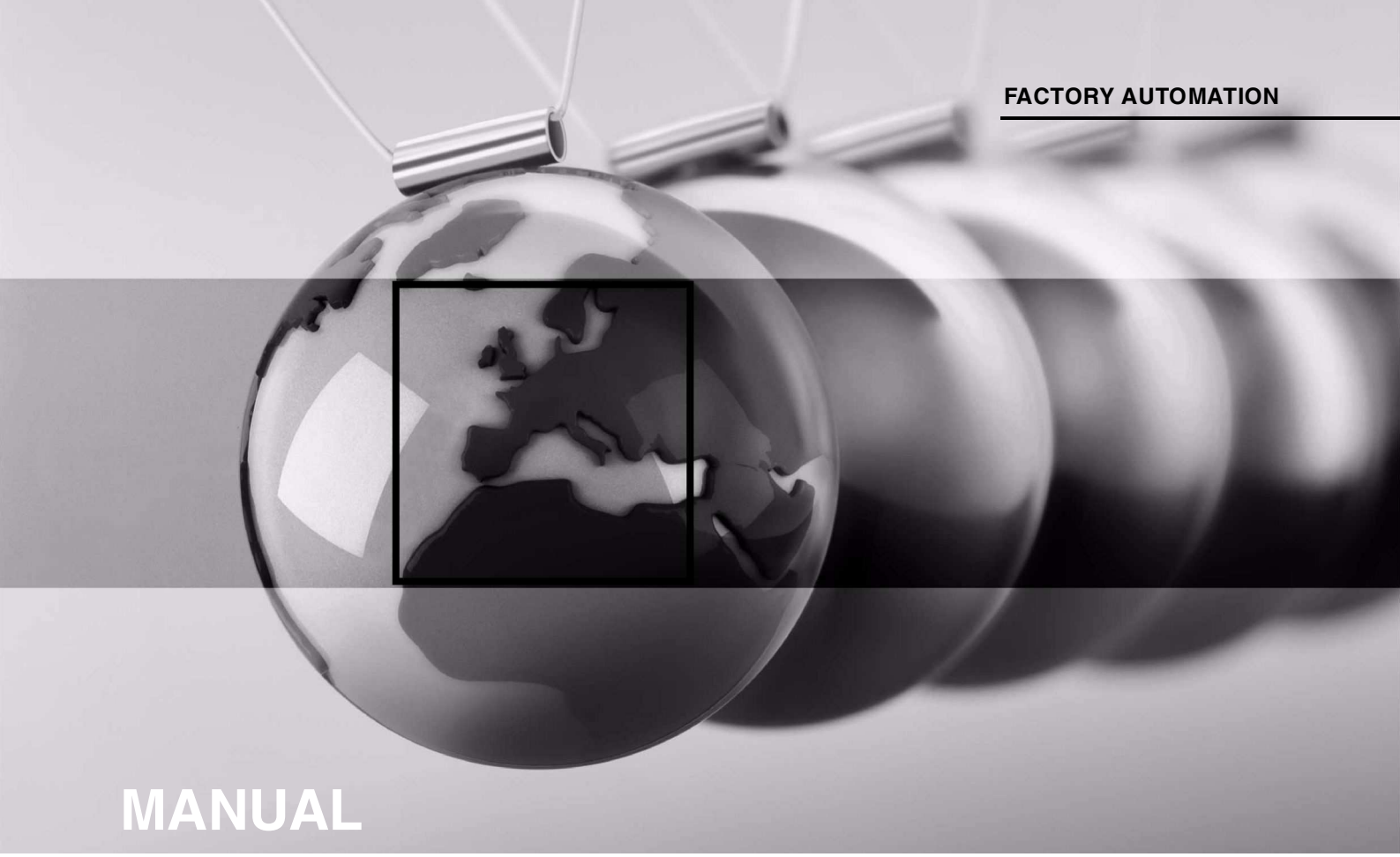
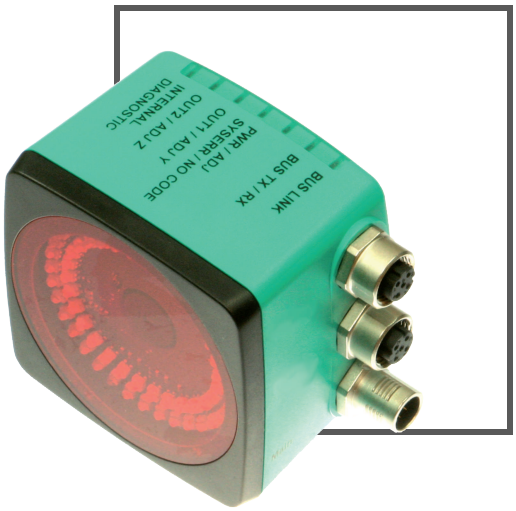


MANUAL

PCV...-F200-B25-V1D

Data Matrix Positioning System



EtherNet/IP

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"

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

2.1 CE 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.

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3 Safety

3.1 Symbols relevant to safety

Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

Warning!

This symbol indicates a possible fault or danger.

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

Caution!

This symbol indicates a possible fault.

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

3.2 Intended use

Combined with a code strip with printed Data Matrix codes, this device represents a high-resolution positioning system that can be used in all applications where precision positioning is required along extremely long travel paths, irrespective of whether the travel path is straight, curved or with inclines or declines.

Read through these instructions thoroughly. Familiarize yourself with the device before installing, mounting, or operating.

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.

3.3 General safety instructions

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

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.

Note!

Disposal

Electronic waste is hazardous waste. When disposing of the equipment, observe the current statutory requirements in the respective country of use, as well as local regulations.

4 Product Description

4.1 Use and Application

The PCV… read head is part of the positioning system in the Pepperl+Fuchs incident light process. Its features include a camera module and an integrated illumination unit, enabling it to detect position markers printed onto an adhesive code reel in the form of Data Matrix codes.

The code reel is usually mounted to a fixed part of the equipment in a stationary manner (e.g., elevator shaft, overhead conveyor mounting rails) and the read head is then mounted in parallel to a moving "vehicle" (e.g., elevator car, overhead conveyor chassis).

Maximum Length of the Code Tape

Resolution of the read head [mm]	Maximum length of the code tape [km]
10	10
1	10
0.1	10

This positioning system can be used with an appropriate resolution in equipment with extremely large layouts without restrictions.

The extensive yet user-friendly parameterization options as well as the freely configurable inputs and outputs mean that the read head can easily be adapted to suit each application.

4.2 USB Interface

The **Vision Configurator** is a useful and easy-to-use piece of software for configuring the read head. This configuration software is available as a free download from www.pepperl-fuchs.com. Follow the instructions that appear on your screen during the installation.

The PC connection required for programming and the read head power supply can be made using a special parameterization cable. This parameterization cable can be ordered as an accessory under the name "Cable unit for service interface with the power supply". This also provides the electrical supply to the read head. The parameterization cable is connected to the read head using the "Main" connector.

Connection of the Parameterization Cable

1. First connect the round plug connector to the read head.
2. Connect the plug-in power supply to the parameterization cable.
3. Plug the plug-in power supply into a socket.

   ↳ The ring light of the read head and the "PWR/ADJ/ERR/NO CODE" LED2 lights up or flashes.
4. You can now connect the USB plug-in connector to your PC.

4.3 EtherNet/IP Interface Pin Assignment

The controller and read head communicate via the EtherNet/IP interface during operation. The interface is based on Ethernet technology and works according to the CIP protocol (Common Industrial Protocol).

The connection of the read head in ongoing operation is carried out via the "EtherNet/IP 1 & 2" connectors.

4.4 LED Indicators and Controls

The PCV... read head is equipped with 6 indicator LEDs for performing visual function checks and rapid diagnostics. The read head is equipped with 2 buttons on the back of the device for activating the alignment aid (see chapter 6.1) and the parameterization mode. Button 1 is labeled ADJUST. Button 2 is labeled CONFIG.

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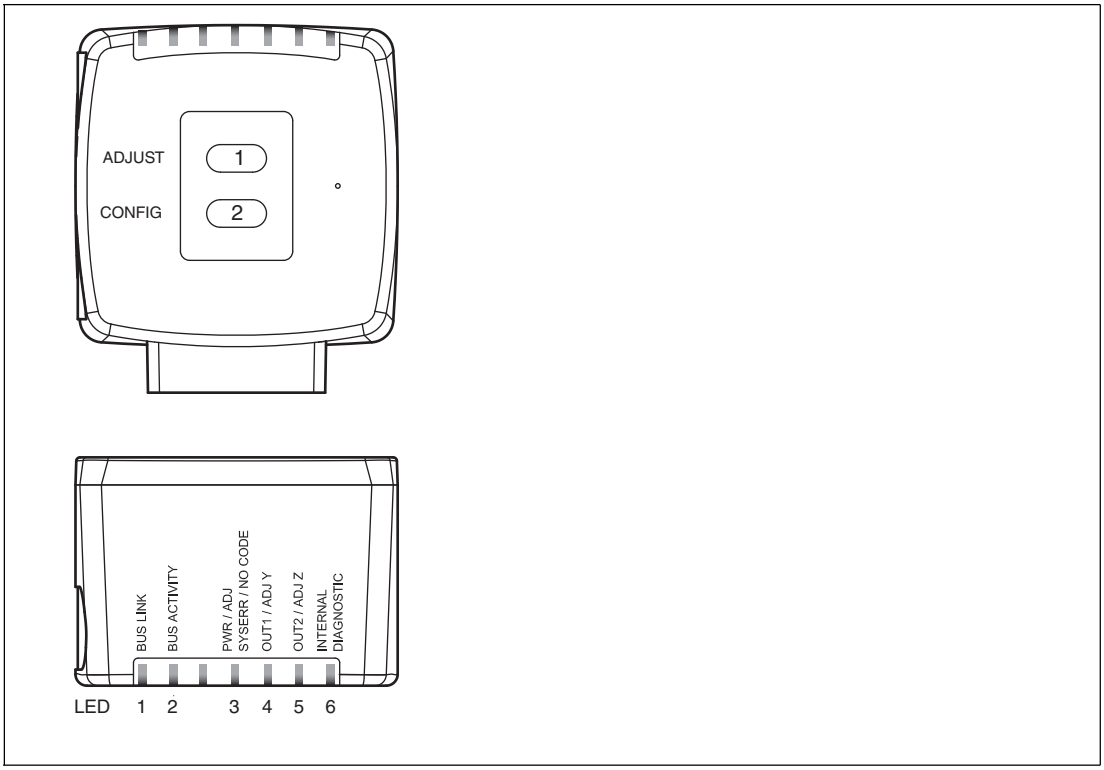

ADJUST
CONFIG
1
2
BUS LINK
BUS ACTIVITY
PWR / ADJ
SYSERR / NO CODE
OUT1 / ADJ Y
OUT2 / ADJ Z
INTERNAL
DIAGNOSTIC
LED 1 2 3 4 5 6

Figure 4.1

LED	[#1] BUS LINK	[#2] BUS TX / RX	[#3] PWR/ADJ SYSERR/NO CODE	[#4] OUT 1/ADJ Y	[#5] OUT 2/ADJ Z	[#6] INTERNAL DIAGNOSTIC	
Color	Green	Yellow	Red/green	Yellow	Yellow	Red/green/ yellow	Description
Status	Off	Off	Flashes green	Off	Off	Off	Alignment Y > setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Lights up	Off	Off	Alignment Y < setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Flashes	Off	Off	Alignment Y = setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Off	Off	Alignment Z > setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Lights up	Off	Alignment Z < setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Flashes	Off	Alignment Z = setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes red	Off	Off	Off	Alignment Code tape outside read range f_{flash} = 2 Hz
	x	x	Lights up red	x	x	x	System error
	x	x	Lights up green	x	x	x	Normal operation, code tape detected
	Lights up	x	x	x	x	x	EtherNet/IP-connection active
	x	Flashes	x	x	x	x	EtherNet/IP TX/RX data transfer
	x	x	Flashes red	x	x	x	Code not recognized f_{flash} = 2 Hz
	x	x	x	x	On	On	Internal error Return to Pepperl+Fuchs

x = LED status has no meaning

4.5 Accessories

Compatible accessories offer enormous potential for cost savings. Such accessories not only save you 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 life of these products.

Model number	Description
V19-G-ABG-PG9-FE	Grounding terminal and plug (set)
PCV-SC12 PCV-SC12A	Grounding clip
V1SD-G-*M-PUR-ABG-V1SD-G	Ethernet bus cable, M12 to M12, available in several different lengths
VAZ-V1S-B	Stopping plug for M12 connector
V19-G-*M-*	Configurable connection cable[1)]
PCV-CM20-0*	Event marker
PCV-CR20	Repair tape
PCV-KBL-V19-STR-USB	Cable unit for power supply
Vision Configurator Software	Software for camera-based sensors for convenient programming

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

5 Installation

5.1 Installing the Code Reel

The code reel is made of silicone-free polyester film. A position marker appears every 100 mm along the lower edge of the code reel (see "Dimensions, Code Reel"). This position marker is used for various functions including precise positioning of the code reel during assembly.
The reverse side of the code reel carries a permanent modified acrylate-based adhesive. Affix the self-adhesive code reel along the desired travel range. Proceed as follows:

Installing the Code Reel

1. Clean the surface of any greasy or oily deposits and dust.
2. Ensure that the surface is dry, clean, and stable.
3. Pull the protective foil at the beginning of the code reel a few centimeters forward. Place the code reel at the precise point of the required starting position on the underside, and press to attach.
4. Then affix the code reel along the desired travel range. Remove the protective film gradually so that the code reel does not accidentally adhere to the surface in the incorrect position. When affixing, ensure that the code reel does not crease or trap air bubbles.

   ↳ The adhesive on the code reel hardens after 72 hours.

Note!

Thermal Expansion of the Code Reel

The heat expansion coefficient of the attached code reel corresponds to the heat expansion coefficient of the underside.

Dimensions, Code Reel

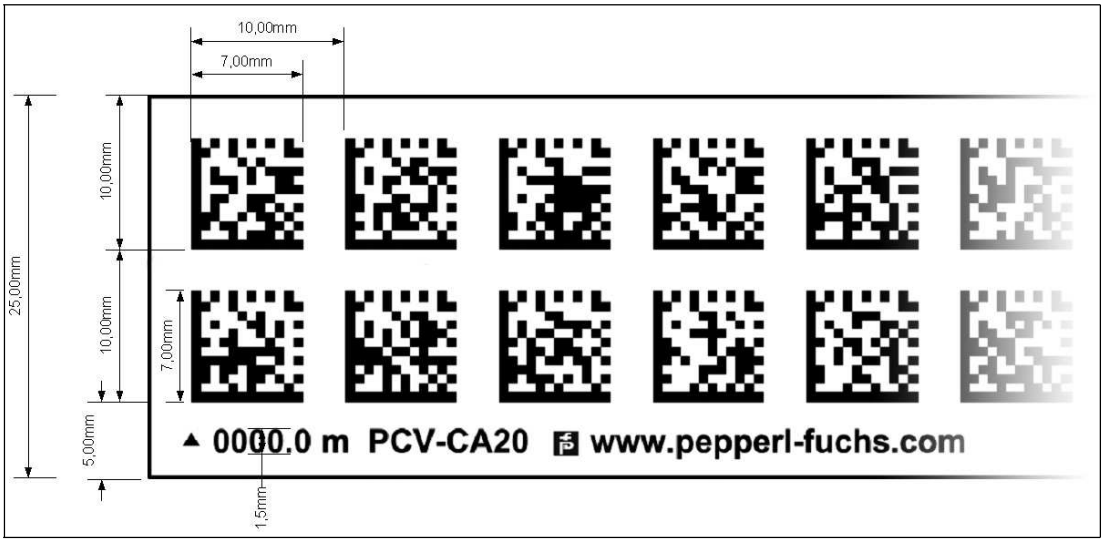


Figure 5.1

Orientation of the Code Reel and Read Head

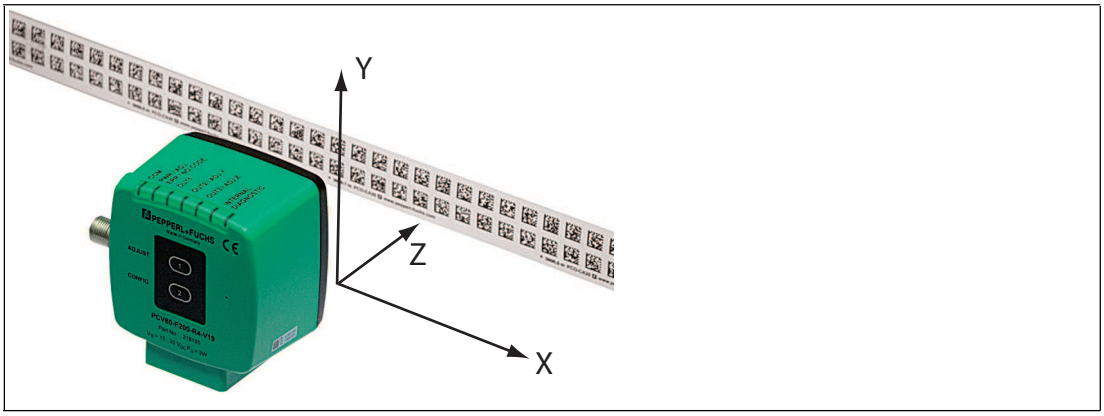


Figure 5.2

Position the code reel so that the **www.pepperl-fuchs.com** label and the position markings are below the data matrix code. The position values then increase along the X-direction. The diagram shows the orientation of a read head in the default position of 0°. The read head can be configured in the interface for other installation situations.

Code Reels with a Starting Position of 0 m

Model Number	Description
PCV6M-CA20-0	Code reel, 2-track, length: 6 m
...	...
PCV100M-CA20-0	Code reel, 2-track, length: 100 m

Code Reels with Different Starting Positions

Model Number	Description
PCV100M-CA20-0	Code reel, 2-track, length: 100 m, starting position: 0 m
PCV100M-CA20-10000	Code reel, 2-track, length: 100 m, starting position: 100 m
...	...
PCV100M-CA20-990000	Code reel, 2-track, length: 100 m, starting position: 9,900 m

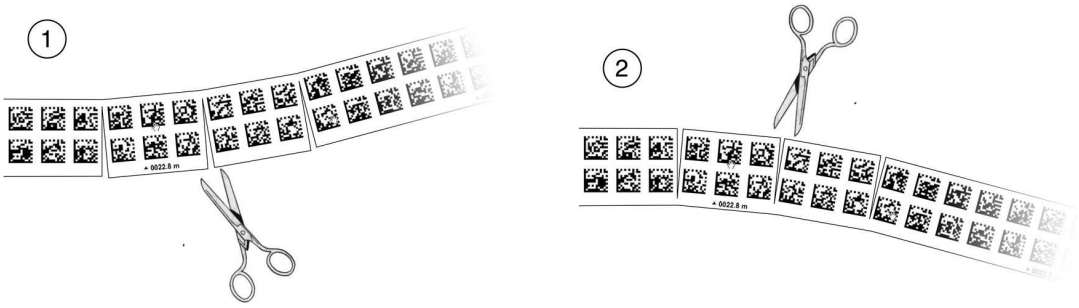
Caution!
Stop Edges
If you attach another code reel at the end of a previous code reel, the code pattern of 10 mm must be retained.

Note!
Expansion Joints
If the system covers longer distances, expansion joints are integrated in the system structure. We recommend creating breaks along the code reel. The resulting gaps should be 20 mm (2 code grids).

Note!

Inclines and Declines

If you mount the code reel on inclines or declines, cut the code reel several times at the transition point to the horizontal as shown.



1. Incline
2. Decline

Note!

Code Reels with Different Row Numbers

The PCV-CA20 code reel has two rows of code to compensate for slight deviations in the travel range in the Y-direction. The code reel is also available with other row numbers. The order code for the code reel is PCV-CAx0, whereby x represents the number of rows of code, which can be either 1 or 2. More rows are available on request–contact us for more information.

Code Reels with Different Numbers of Tracks

Model Number	Description
PCV*M-CA10-*	Code reel, 1-track
PCV*M-CA20-*	Code reel, 2-track
PCV*M-CA40-*	Code reel, 4-track
...	...

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Hysteresis Y-Axis

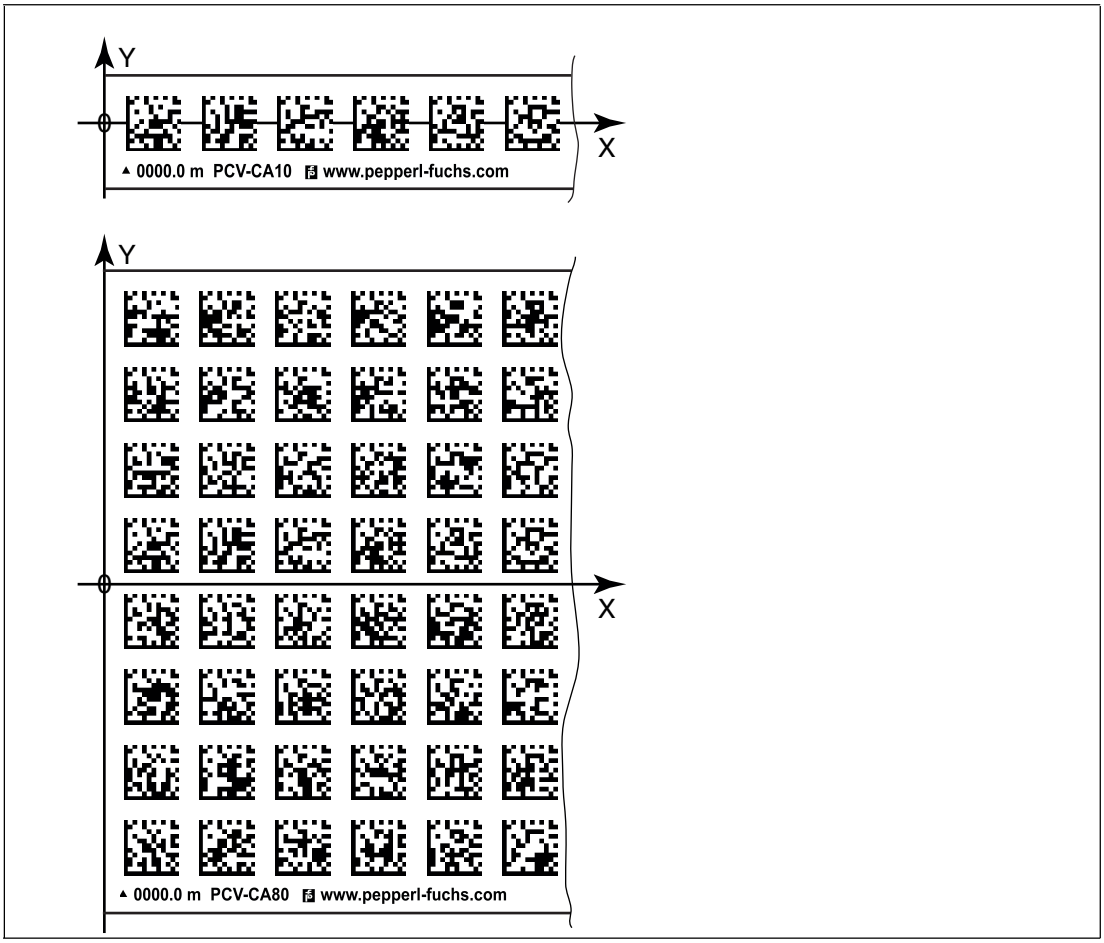

Figure 5.3 Zero line for code reels

If the read head leaves the zero line when traveling the X-axis, different threshold values will result depending on the number of tracks. If the deviation exceeds this threshold, a warning code is issued.

Y-Axis Deviation Thresholds

Code reel		Threshold	
Number of tracks	Width	Exit	Entry
1	15 mm	± 10 mm	± 6 mm
2	25 mm	± 15 mm	± 11 mm
4	45 mm	± 25 mm	± 21 mm
6	65 mm	± 35 mm	± 31 mm
8	85 mm	± 45 mm	± 41 mm

5.2 Mounting the Read Head

Mount the PCV... read head on the moving part of your equipment using the four screws on the mounting adapter of the read head. Mount the read head in such a way that the lens with ring light and camera module are aligned toward the code tape.

The stability of the mounting and the guidance of the moving system component must be such that the field of the depth of focus of the read head is not exited during operation.

The distance between the read head and the code tape should be the same as the read distance of the read head.

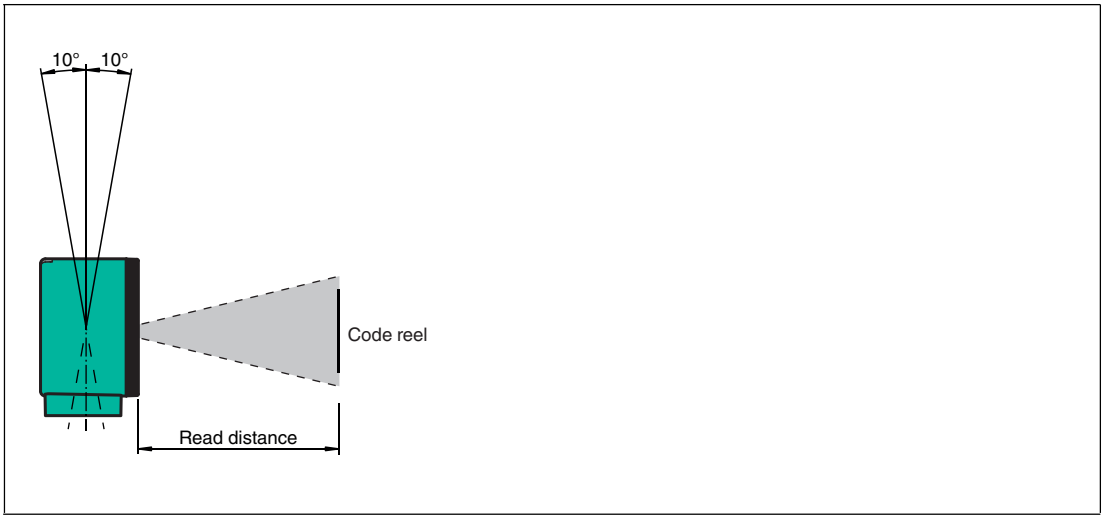

Figure 5.4 Vertical alignment tolerance

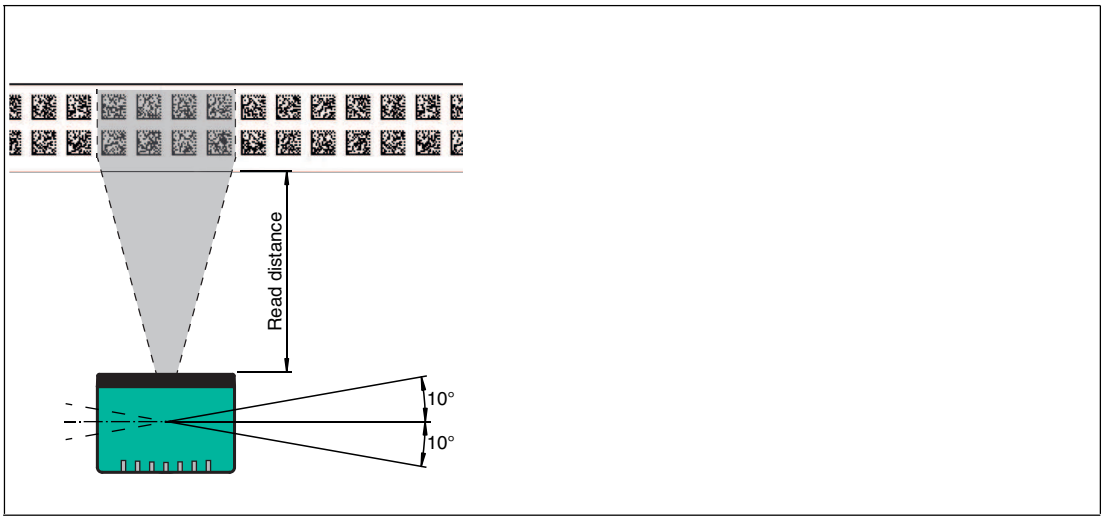

Figure 5.5 Horizontal alignment tolerance

Optimum Read Distance (Z-Axis)

Model Number	Read Distance [mm]	Depth of Focus [mm]
PCV50*	50	± 25
PCV80*	80	± 15
PCV100*	100	± 20
PCV100*-...-6011	100	± 40

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Read Head Dimensions

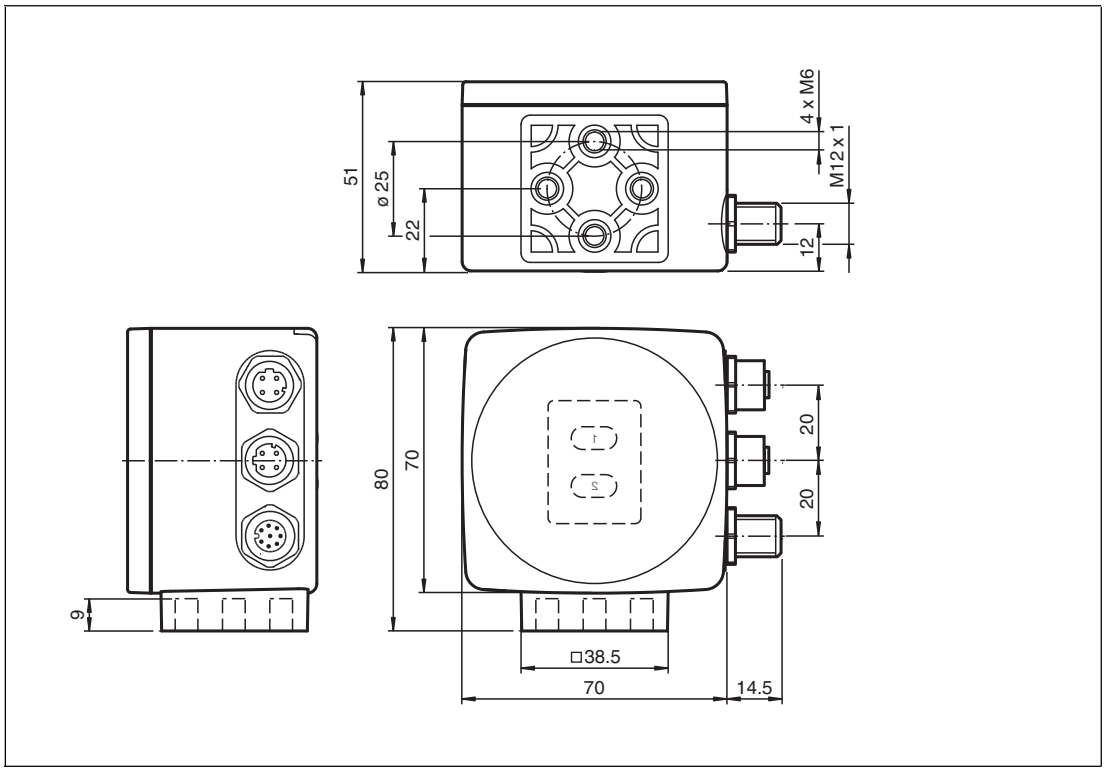

Figure 5.6

Caution!

When selecting mounting screws, ensure that the maximum insertion depth of the screws in the threaded inserts on the read head is 8 mm.

Using longer screws can damage the read head.

Caution!

The maximum torque of the mounting screws must not exceed 9 Nm.

Tightening the screws to a higher torque can damage the read head.

5.3 Electrical Connection

The PCV... read head is connected electrically 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. The configurable inputs and outputs on the read head are also located at this connection.

The port also serves as a service interface for programming the read head (see "USB interface" in this manual).

Figure 5.7

Connector Occupancy

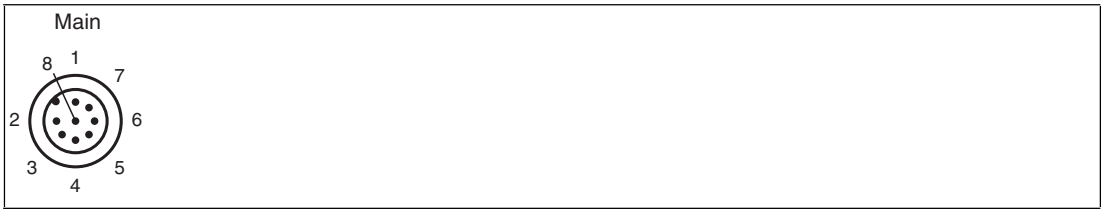

Figure 5.8

Color Assignment

Pepperl+Fuchs cordsets (female) are manufactured in accordance with EN60947-5-2. When using a type V19-... () female cordset with an open cable end on the **Main** connection, the colors are assigned as follows:

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 connection lines 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 connection lines with braided shield; never use connection lines with a film shield. The shield is integrated at both ends, i.e., in the switch cabinet or on the controller **and** on the read 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 common point in a star configuration.
- The cross-section of the cables used for grounding should be as large as possible.

Additional Ground Connection

Model number	Description
PCV-SC12	Clip for mounting an additional ground connection.
PCV-SC12A	

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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.

5.4 EtherNet/IP Connection

The PCV... read head is connected to EtherNet/IP via two 4-pin, D-coded device sockets, M12 x 1, **EtherNet/IP 1** and **EtherNet/IP 2**, on the side of the housing.

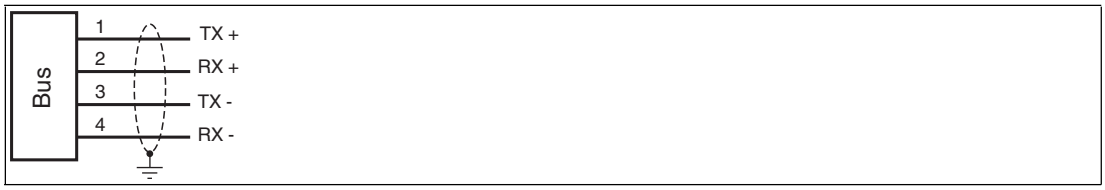


Figure 5.9

Connector Occupancy

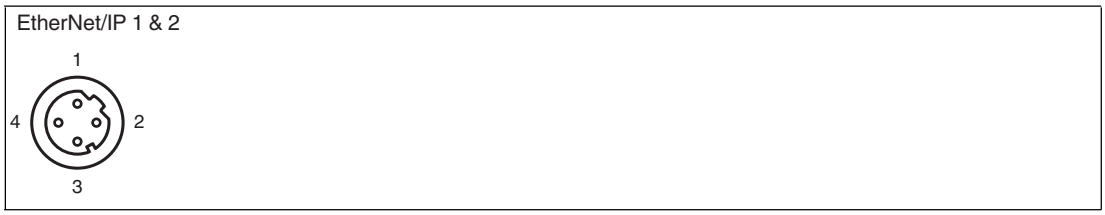


Figure 5.10

For suitable Ethernet cables, see see chapter 4.5.

6 Commissioning

6.1 Aligning the Read Head

An integrated alignment aid is available to help you align the Y and Z coordinates of the read head easily and precisely with respect to the code reel.

Note!

The activation of the alignment aid is possible only within 10 minutes of switching on the read head.

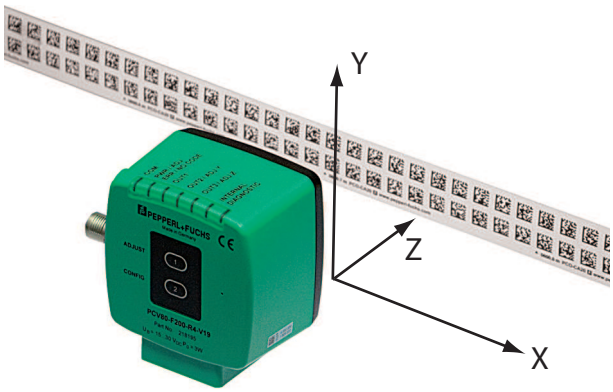
The switchover from normal operation to parameterization mode is via button 1 on the back of the read head.

Activating the Alignment Aid

1. Press button 1 for longer than 2 seconds.

   ↳ LED2 flashes green for a recognized code reel. LED2 flashes red for an unrecognized code reel. .

2. Align the Z and Y coordinates of the read head. The integral LED indicators provide assistance here.



Z coordinate: If the distance of the camera to the code reel is too small, the yellow LED5 lights up. If the distance is too great, the yellow LED5 goes out. The yellow LED5 flashes at the same time as the green LED2 when within the target range. .
Set the distance between the read head and the code reel so that the yellow LED5 and the green LED2 flash synchronously.

Y coordinate: If the optical axis of the read head is too low relative to the middle of the code reel, the yellow LED4 lights up, . If the optical axis is too high, the yellow LED4 goes out. Within the target range, the yellow LED4 flashes at the same time as the green LED2.
Set the optimal height of the read head relative to the code reel so that the yellow LED4 flashes in rhythm with the green LED2.
Briefly pressing button 1 ends the alignment aid, and the read head returns to normal operation.

6.2 Parameterizing

The PCV... reading head can be adapted to specific requirements through parameterization. The reading head can be parameterized via the service interface (internal parameterization) or via optical parameterization codes (external parameterization).

6.2.1 Internal Programming With Vision Configurator Software

Internal parameterization of the read head via the USB interface must be started within 10 minutes of the read head being switched on. A time lock disables the read head once this time has elapsed. The time lock remains inactive during the parameterization process. The time lock disables the read head only if no parameterization activities take place for more than 10 minutes.

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The **Vision Configurator** is a useful and easy-to-use piece of software for configuring the read head. This configuration software is available as a free download from www.pepperl-fuchs.com. Follow the instructions that appear on your screen during the installation.

The PC connection required for programming and the read head power supply can be made using a special parameterization cable. This parameterization cable can be ordered as an accessory under the name "Cable unit for service interface with the power supply". This also provides the electrical supply to the read head. The parameterization cable is connected to the read head using the "Main" connector.

Connection of the Parameterization Cable

1. First connect the round plug connector to the read head.
2. Connect the plug-in power supply to the parameterization cable.
3. Plug the plug-in power supply into a socket.

   ↳ The ring light of the read head and the "PWR/ADJ/ERR/NO CODE" LED2 lights up or flashes.
4. You can now connect the USB plug-in connector to your PC.

Parameterizing the read head

1. Start the **Vision Configurator** software on the PC.
2. Program the read head with the help of the "Vision Configurator" manual.
3. Transfer the parameter list to the read head.
4. Save the parameterization.
5. Unplug the plug-in power supply from the wall outlet to turn off the power supply at the head.
6. Remove the parameterization cable's USB plug-in connector from your PC
7. Remove the configuration cable from the read head.

   ↳ The read head is now parameterized according to your specifications and can be used in your application.

6.2.2 External Parameterization Using Code Cards

During external parameterization, the read head scans special code cards optically and configures the relevant parameters. Simply hold the corresponding code cards at the correct distance in front of the lens on the PCV...-F200- read head. The standard code cards are contained in the appendix.

The following parameters can be configured using code cards:

- Read head resolution [0.1 mm, 1 mm, 10 mm]
- Read head orientation [0°; 180°; 0° or 180°, 0°, 90°, 180° or 270°]
- Function of output 1 [none, speed exceeded, warning, fault, contamination, event, no position]
- Function of output 2 [none, speed exceeded, warning, fault, contamination, event, no position]
- Function of output 3 [none, speed exceeded, warning, fault, contamination, event, no position]

Programming mode activation

Note!

External parameterization of the read head using code cards must be started within 10 minutes of the read head switching on. A time lock disables the read head once this time has elapsed. The time lock remains inactive during the parameterization process. The time lock disables the read head only if no parameterization activities take place for more than 10 minutes.

If a button is pressed when the time lock is enabled, all LEDs flash and remain lit for 2 seconds during each flashing cycle.

The switchover from normal mode to parameterization mode is made by pressing button 2 on the back of the read head.

Parameterization Mode Activation

1. Press button 2 for longer than 2 s.

   ↳ Yellow LED3 now flashes.

2. Hold the "ENABLE" code in front of the camera system on the read head to trigger final activation

   ↳ If the "ENABLE" activation code is detected, the green LED2 lights up for 1 sec. If the activation code is not detected, LED2 lights up red for 2 seconds.

Parameterization

Place the parameterization code in the field of vision of the camera module.

↳ After the parameterization code is detected, the green LED2 lights up for 1 sec. In the event of an invalid parameterization code, LED2 lights up red for 2 seconds.

Exiting Parameterization Mode

Hold the "STORE" code in front of the camera system on the read head to save the configuration

↳ When the "STORE" memory code is detected, the green LED2 lights up for 1 sec. The parameterization is stored in the nonvolatile memory of the read head and parameterization mode is terminated. Parameterization of the read head is now complete. If the memory code is not detected, LED2 lights up red for 2 seconds.

Note!

Press button 2 briefly to exit parameterization mode. Any parameter changes that are made but have not yet been saved are discarded. The read head operates with the last valid parameters that were saved.

The code cards "CANCEL", "USE", and "DEFAULT"

Holding one of these cards in front of the reading head exits parameterization mode with the following consequences:

- **CANCEL:**

  All parameter changes that are made but have not yet been saved are discarded. The reading head operates with the last valid parameters that were saved.

- **USE:**

  For test purposes, the reading head operates with the parameters that have just been modified. The parameterization is not saved, however. After being switched off and on again, the reading head operates with the last valid parameters that were saved.

- **DEFAULT:**

  All parameters in the reading head are overwritten with the original default settings. Re-enter the configuration mode and save the default settings nonvolatile with the code card STORE.

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7 Operation and communication

7.1 Communication via EtherNet/IP

7.1.1 General Information on Communication via EtherNet/IP

The read head communicates with the controller (e.g., PLC) via EtherNet/IP. An object-oriented fieldbus system for exchanging data between nodes based on Ethernet technology.

The management and development of the EtherNet/IP standards are subject to the Open DeviceNet Vendor Association (ODVA). More information on EtherNet/IP will be supplied on request by the Open DeviceNet Vendor Association (ODVA) at the following Internet address:

ODVA, Inc

4220 Varsity Drive, Suite A

Ann Arbor, MI 48108-5006 USA

http://www.odva.org e-mail: mailto:odva@odva.org

The basic properties of the interface are:

- Transfer rate 10 Mbit/s or 100 Mbit/s, half or full duplex operation
- Automatic negotiation of the transfer rate and the duplex method (auto-negotiation)
- Automatic setting for crossed lines (auto-crossover)

EtherNet/IP protocol works according to the CIP protocol (Common Industrial Protocol) and is used to control, configure, monitor, and collect data. Time-sensitive data exchange (implicit messaging) takes place using the UDP/IP protocol and non-time-sensitive data exchange (explicit messaging) using the TCP/IP protocol.

The read head supports the following features:

- "Listen only", "Input only", and "Exclusive Owner" connection types
- Message transmission as "Multipoint data transfer" (Multicast) and "Point-to-point data transfer" (Unicast)
- Cycle time (request packet interval) ≥ 2 ms
- Dynamic Host Configuration Protocol (DHCP)
- Device Level Ring (DLR)
- Address Conflict Detection (ACD)

The read head is integrated in the network via a EDS file (electronic data sheet) with a configuration tool such as RSLOGIX5000. The EDS file contains all of the information about device-specific parameters and operating modes.

Downloading the EDS file

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

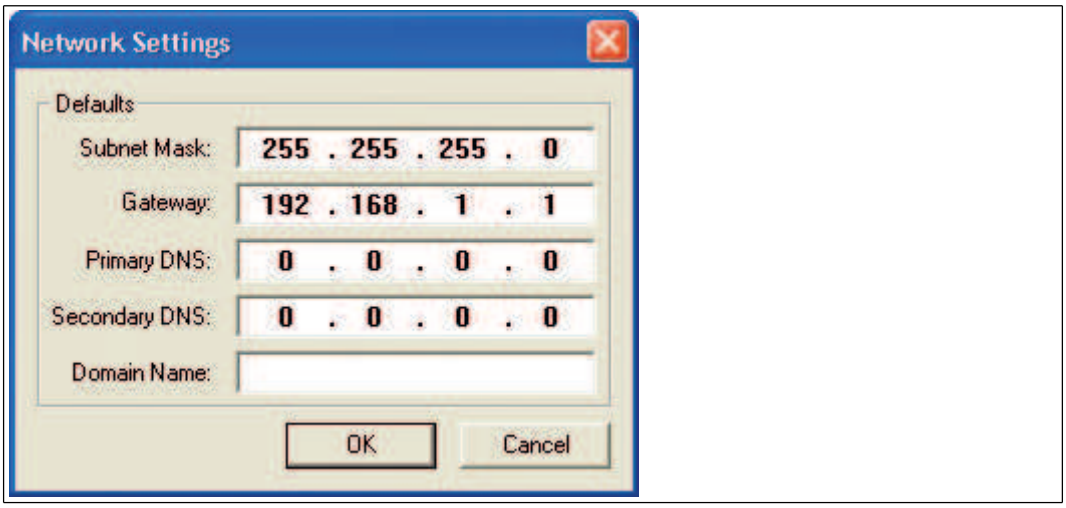
To access the product detail page for the device, go to http://www.pepperl-fuchs.com and type information about the device (e.g., the product description or the item number) into the search function.

7.1.2 Setting the IP Address

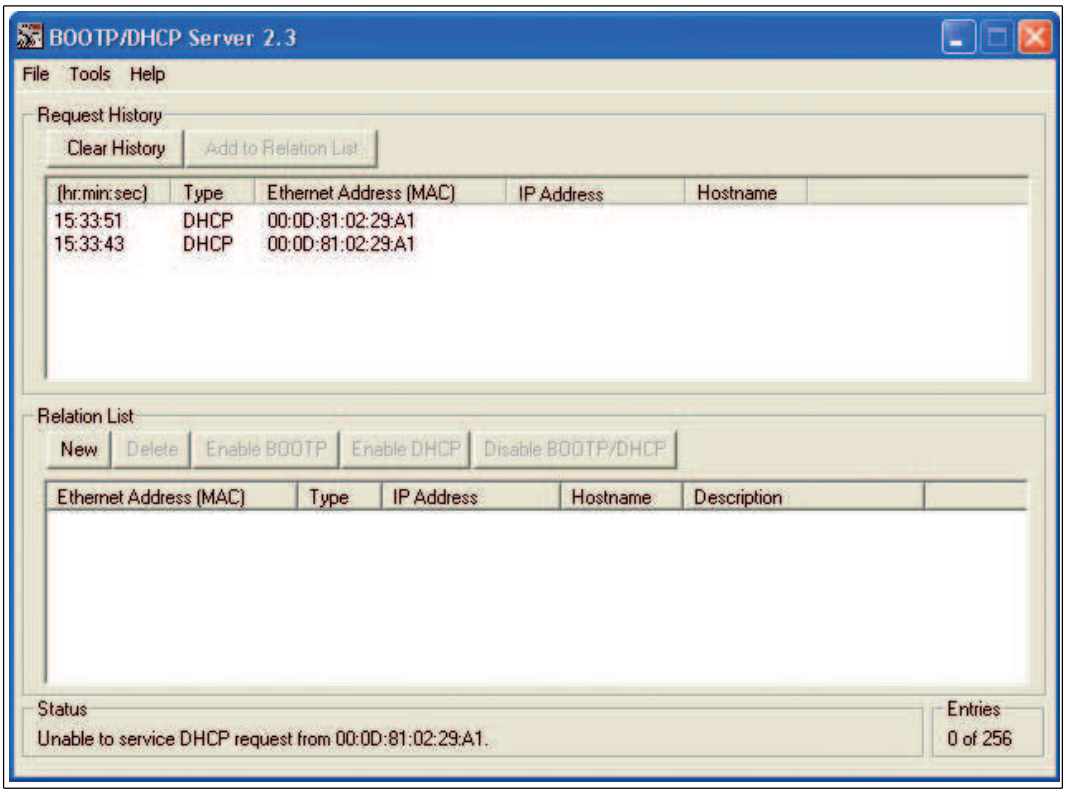
The read head is delivered in DHCP mode and waits for an address assignment from the control system.

The following section describes the address assignment via the software **BOOT/DHCP server** from Rockwell Automation as an example.

1. Connect the read head with the DHCP server.
2. Start the **BOOT/DHCP server** software.
3. Enter the following data in the **Network Settings** menu:
   - Subnet Mask "255.255.255.0 "
   - Gateway "192.168.1.1"
   - the remaining fields are not filled in.



4. Switch on the supply voltage to the read head.



↳ The read head cyclically carries out DHCP requests. This enters the MAC address of the read head in the **Request History** field to the list.

5. Enter the desired IP address in the **New Entry** menu.
   - The software automatically adopts the MAC address of the read head.
   - The "hostname" function is not supported.
   - You may enter text under "Description".

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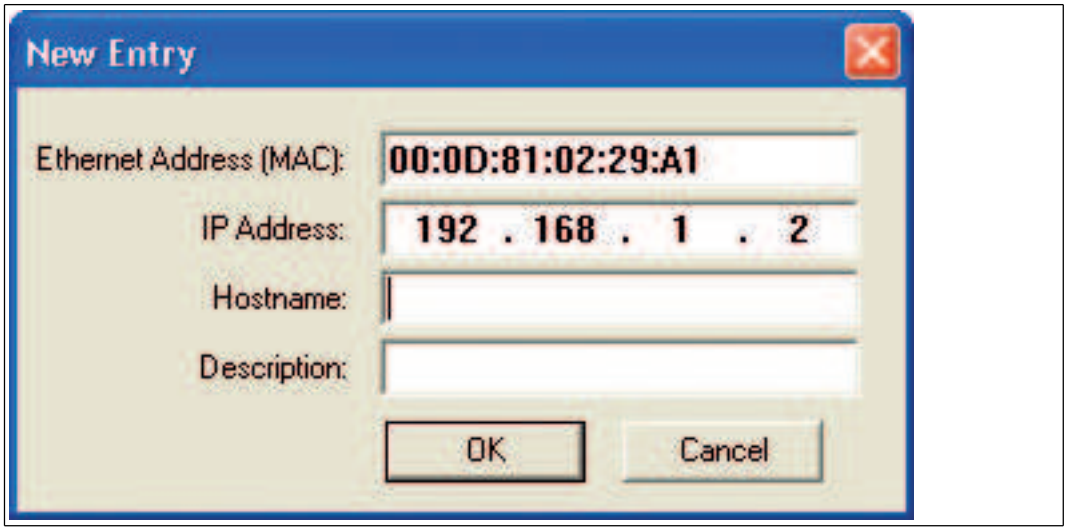
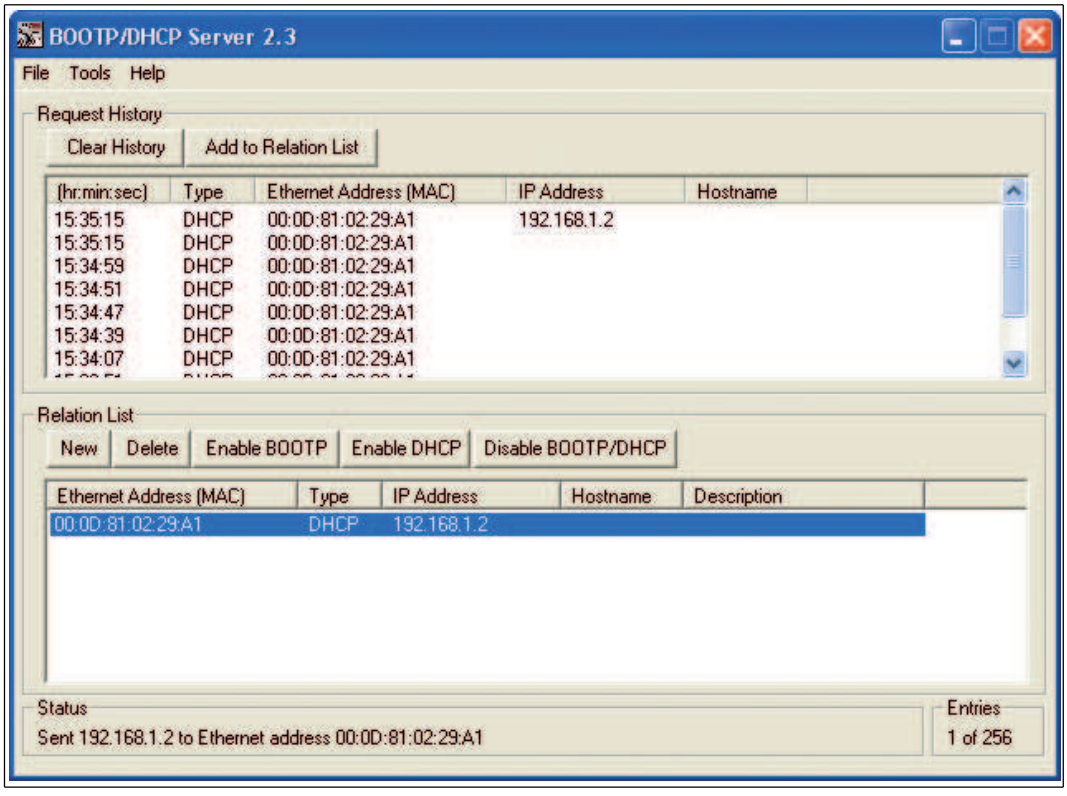


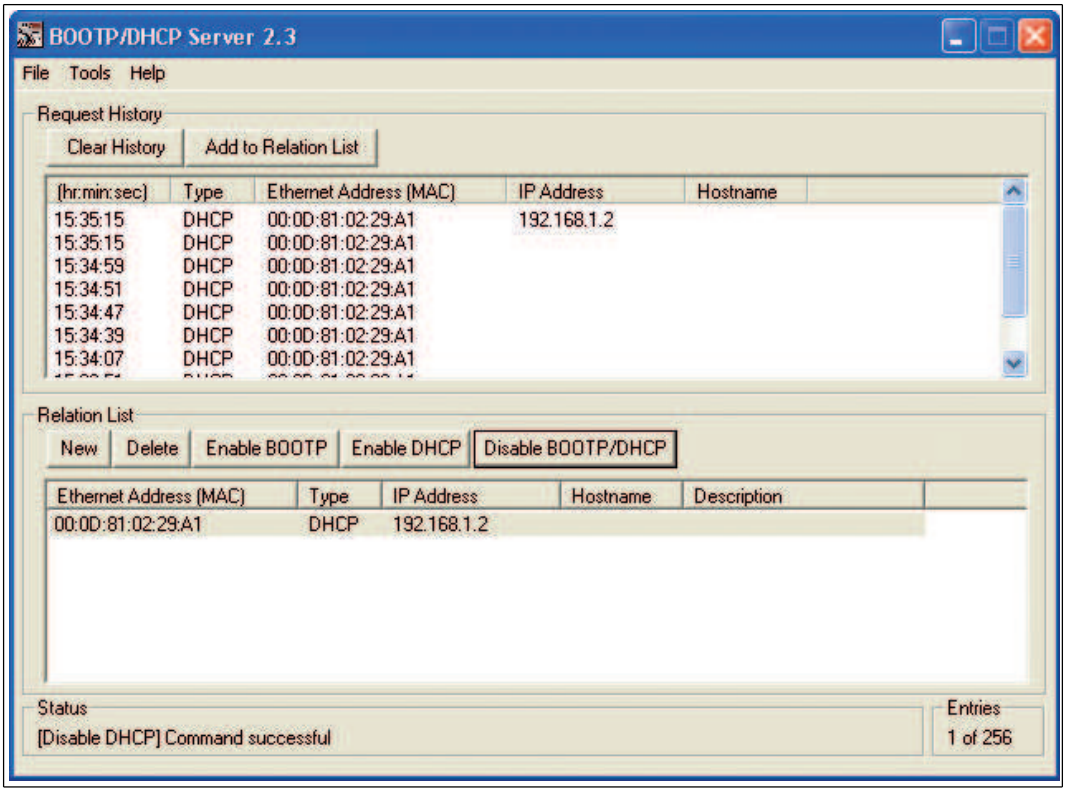
6. Confirm the entries of the address data using **OK**.

   ↳ The IP address is assigned to the read head on the next DHCP request. The new address data will be displayed in the **Relation List** field.



7. Press the **Disable BOOTP/DHCP** key in the **Relation List** field.

   ↳ In this way, the assigned IP address is saved permanently in the read head.



7.1.3 EtherNet/IP objects

All the data and functions of the read head are defined via objects in accordance with the EtherNet/IP standards. The read head corresponds to the "Encoder Device Type 0x22" device profile.

The read head supports the following listed standard and product-specific classes.

Standard classes

Class ID	Class description
0x01	Identity Object
0x02	Message Router Object
0x04	Assembly Object
0x06	Connection Manager Object
0xF5	TCP/IP Interface Object
0xF6	Ethernet Link Object
0X47	DLR Object
0X48	Quality of Service

Product-specific class

Class ID	Class description
0x23	Position Sensor Object

The parameters are not directly addressable from the network with the "Set" or "Get" attribute services. Access is via Assembly Objects (Class Code 0x04)

Cyclic data communication with assembly objects (Class Code 0x04)

Assemblies are special CIP objects used for cyclic data communication (implicit messaging). These are composed of one or more attributes of various objects. These objects allow you to send or receive data from multiple objects by means of a connection. The composition of the assemblies in the read head is fixed and cannot be modified by the user.

Input assemblies

Instance no.	Description	Size [byte]	Attribute	Attribute ID	Data type
1	Position	4	Position Value Signed (X-Position)	10	DINT
100	Position + speed	8	Position Value Signed (X-Position)	10	DINT
			Velocity Value	24	DINT
101	Status, X-position, Y-position, Speed, Warning, Event	18	Status Word	100	UINT
			Position Value Signed (X-Position)	10	DINT
			Y-position	101	DINT
			Velocity Value	24	DINT
			Warning flags	102	UINT
			Event number	103	UINT

Addresses required for the various connection types

The connection type defines the connection between the control system (originator), in this case the controls, and the target device (target), in this case the read head. The following options are available for data traffic.

Data from the control system to the destination device

Instance no. (dec.)	Size [byte]	Connection type
192	0	Listen only
193	0	Input only

Data from the target device to the control system

Instance no. (dec.)	Size [byte]	Assemblies
1	4	Position
100	8	Position + speed
101	18	Status, X-position, Y-position, Speed, Warning, Event (lists only)

7.1.4 Attributes of the Ethernet/Read Head IP Objects

Position Sensor Object attributes (Class ID 0x23)

Class attributes

ID	Name	Access	Data type	Size [byte]	Description
1	Revision	-	UINT	2	Object inspection

Standard instance attributes for object 0x23

ID	Attribute	Access	Data type	Size [byte]	Description
10	Position Value Signed (X-Position)	-	DINT	4	X-Position in two's complement
24	Velocity Value	-	DINT	4	Speed

Specific read head attributes

ID	Attribute	Access	Data type	Size [byte]	Description
100	Status Word	-	UINT	2	Status Information
101	Y-position	-	UINT	4	Y-position in two's complement
102	Warning flags	-	UINT	2	Warnings
103	Event number	-	UINT	2	Event marker number

Basic data structure

1 byte = 8-bit value

Byte 4	Byte 3	Byte 2	Byte 1
Example: XP31 ... XP24 MSB (Most Significant Byte)	Example: XP23 ... XP16	Example: XP15 ... XP08	Example: XP07 ... XP00 LSB (least significant byte)

Position data X: Position Value Signed (ID 10)

Size	Type	Content
4 byte consistent	Input data	32-bit X data LSB first LSB = **l**east **s**ignificant **b**yte Resolution: 0.1 mm, 1 mm, 10 mm, binary coded At a resolution of 1 mm and 10 mm: L_{max} = 10.00 km = 10,000,000 mm

The following default settings apply:

- The X position is output in the two's complement.
- The value is output in the set resolution of the device.
- The default is mm.
- If the ERR bit is set in the "status word (ID 100)" attribute, the error number is transferred to this attribute.

Data of the attribute 10

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 2	Bit 0
Byte 1	XP07	XP06	XP05	XP04	XP03	XP02	XP01	XP00
Byte 2	XP15	XP14	XP13	XP12	XP11	XP10	XP09	XP08
Byte 3	XP23	XP22	XP21	XP20	XP19	XP18	XP17	XP16
Byte 4	XP31	XP30	XP29	XP28	XP27	XP26	XP25	XP24

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Position data Y: Y position (ID 101)

Size	Type	Content
4 byte consistent	Input data	32-bit Y data LSB first Resolution: 0.1 mm, 1 mm, 10 mm, binary coded in two's complement

The following default settings apply:

- The Y position is output in the two's complement.
- The value is output in the set resolution of the device.
- The default is mm.

Data of the attribute 101

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 2	Bit 0
Byte 1	YP07	YP06	YP05	YP04	YP03	YP02	YP01	YP00
Byte 2	YP15	YP14	YP13	YP12	YP11	YP10	YP09	YP08
Byte 3	YP23	YP22	YP21	YP20	YP19	YP18	YP17	YP16
Byte 4	YP31	YP30	YP29	YP28	YP27	YP26	YP25	YP24

Speed Data: Velocity Value (ID 24)

Size	Type	Content
4 byte consistent	Input data	32-bit speed data Resolution: 0.1 m/s, 0.01 m/s, 0.001 m/s, binary coded Speed from 0 ... 12.5 m/s **Example:** Speed = 4.7 m/s --> speed output = 47 at a resolution of 0.1 m/s 65535 for unknown speed

The following default settings apply:

- The value is output in the set resolution of the device.
- The default is dm/s.

Data of attribute 24

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 2	Bit 0
Byte 1	SP07	SP06	SP05	SP04	SP03	SP02	SP01	SP00
Byte 2	SP15	SP14	SP13	SP12	SP11	SP10	SP09	SP08
Byte 3	SP23	SP22	SP21	SP20	SP19	SP18	SP17	SP16
Byte 4	SP31	SP30	SP29	SP28	SP27	SP26	SP25	SP24

Status: Status word (ID 100)

Size	Type	Content
2 bytes	Input data	16-bit status

If the ERR bit is set, there is an error. The error number is transmitted to the "Value signed (ID 10)" attribute.

Data of attribute 100

Bit no.	Content Byte 1, 2 Status	Function
1	ERR	Error message (error code in XP00–XP15); remaining bits = 0, see **Error Codes**
2	NP	No position information/OUT (XP = 0, YP = 0, SP = 0)
3	WRN	Warnings present; see **Warning Attribute**
4	EV	Event present see **Event Attribute**
5	0	-
...	...	-
16	0	-

Error codes

Error code	Description	Priority
1	Read head tipped 180°	2
2	No clear position can be determined (difference between codes is too great, code distance incorrect, etc.)	3
> 1000	Internal error	1

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Event: Event marker no. (ID 103)

Size	Type	Content
2 byte consistent	Input data	Last event marker Last event no.

The event marker no. is binary coded and unsigned.

Data of attribute 103

Bit no.	Content Byte 1, 2 Last event marker data
1	EV00
2	EV01
3	EV02
4	EV03
5	EV04
6	EV05
7	EV06
8	EV07
9	EV08
10	EV09
11	0
...	...
16	0

Warning: warning flags (ID 102)

Size	Type	Content
2 byte consistent	Input data	Last warnings Last warning no.

A set bit indicates that the corresponding warning is active.

Data of attribute 102

Bit no.	Content Byte 1, 2 Last warning data
1	WRN00
2	WRN01
3	WRN02
4	WRN03
5	WRN04
6	WRN05
7	WRN06
8	WRN07
9	WRN08
10	WRN09
11	WRN10
12	WRN11
13	WRN12
14	WRN13
15	WRN14
16	WRN15

Warning data set

Bit no.	Content Byte 1, 2	Description
1	WRN01	A code with non-read head (PCV) content was found.
2	WRN02	Read head too close to code tape
3	WRN03	Read head too far from code tape
4	WRN04	Y position too large. The sensor is just before OUT
5	WRN05	Y position too small. The sensor is just before OUT
6	WRN06	The read head is rotated or tipped in relation to the code tape
7	WRN07	Low level of code contrast
8	WRN08	Repair tape detected
9	WRN09	Temperature too high
10	WRN10	Reserved
11	WRN11	Reserved
12	WRN12	Reserved
13	WRN13	Reserved
14	WRN14	Reserved
15	WRN15	Reserved

Note!

If no warnings are present, all bits in the warning data set are set to 0.

7.2 Operation with Repair Tape

The repair tape is a short code reel with a length of one meter. The repair tape is used to bridge defective or damaged areas of an existing code reel.

1. Cut the repair tape to the required length
2. Cover the defective area of the code reel with the repair tape

Note!

When placing a repair tape on the code reel, make sure that the repair tape represents as accurate a continuation of the grid on the code reel as possible.

When the read head enters the range of a repair tape, it sets an event flag in the output data. You also have the option of triggering a defined action when an event occurs by parameterizing one of the outputs accordingly (). Actions of this type can be initiated when a certain event, all events, or events from an event list occur.

Note!

The repair tape works incrementally. In so doing, it adds one value to the previous read position on the code reel. If the read head starts on a repair tape, the read head reports an error. Move the read head to a position on the code reel away from the repair tape to read the absolute value.

Tip

If repairs are required, the **Code Reel Generator** at www.pepperl-fuchs.com can be used as a short-term workaround. This allows code reel segments to be generated and printed out online.

Enter the start value in meters and the code reel length of the section to be replaced in meters. This produces a printable PDF file with the required segment of the code reel.

Only use the printout as an emergency solution. The durability of the paper strip varies greatly depending on the application!

Refer to the Accessories chapter for order information relating to repair tape.

7.3 Operating with event markers

In numerous position coding system applications, defined processes must be started at specific positions so that the controller can evaluate the position data measured by the reading head. However, this means that the exact positions for triggering events of this kind must be defined as early as the system planning stage and can no longer be modified during the construction phase or commissioning. If modifications are made, the position data stored in the control software must be adapted accordingly, which involves a great deal of time and effort.

Activating a process through the detection of so-called event markers is a much more flexible method. Only a specific event and the process linked with the event have to be programmed into the system controller. The position in which the corresponding event marker is placed along the code strip can be decided immediately before final commissioning of the system. Even if subsequent changes are made to the layout of a system, the relevant event marker is simply moved to the new position without requiring program modifications.

Event markers are short code strips one meter in length. The event marker bears the encoded event number and position information in incremental form. Event markers are available with event numbers from 001 to 999. To transfer the exact position data, the reading head calculates the last absolute position of the code strip before it entered the event range and adds the incremental offset from the codes of the event markers.

When the reading head enters the range of an event marker, it sets an event flag in the output data. You also have the option of triggering a defined action when an event occurs by parameterizing one of the outputs accordingly (). Actions of this type can be initiated when a certain event, all events or events from an event list occur.

The 1 meter long event marker can be shortened. However, the minimum length should be 30 mm (3 codes). If the travel speed of the reading head increases, a longer event marker is required. If the reading head travels at maximum speed, a full length event marker of 1 meter must be positioned over the code strip.

The minimum length of an event marker can be calculated according to the following formula depending on the travel speed and the trigger period:

$L_{Event\ marker}$ = 30 mm + V_{max} [m/s] * $T_{trigger}$ [s] x 2

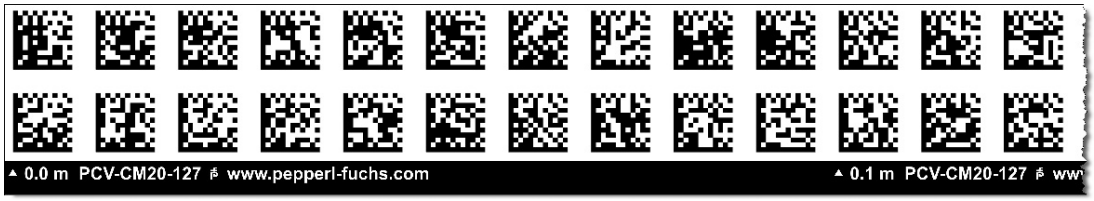
With auto trigger, the trigger period is 0.025 s.

Example calculation
At a speed of 3 m/s and with a trigger period of 25 ms, the minimum length of the event marker is therefore:
$L_{Event\ marker}$ = 30 mm +3 m/s * 0.025 s * 2 = **180 mm**

Note!

When placing an event marker on the code strip, make sure that the event marker represents an accurate continuation of the grid on the code strip where possible.

The printed event number and the inverted text identify event markers in contrast to the identification on code strips (white text on a black background).



The illustration shows part of the event marker #127

Refer to the Accessories chapter for order information relating to event markers.

8 Appendix

8.1 Code Cards for External Parameterization

Here, you can find the code cards that enable you to parameterize some basic read head functions step by step. For the exact external parameterization procedure .

Note!

When performing external parameterization with code cards, we recommend copying and printing out the relevant pages in this manual and cutting out the code cards. This prevents the read head from mistakenly detecting another code card on the same page. If you intend to use this manual directly for parameterization, cover the code cards that you do not require with a sheet of paper, for example.

8.1.1 Code Cards With Special Functions

The following code cards have special functions:

- ENABLE
- STORE
- CANCEL
- USE
- DEFAULT

The code card "ENABLE"

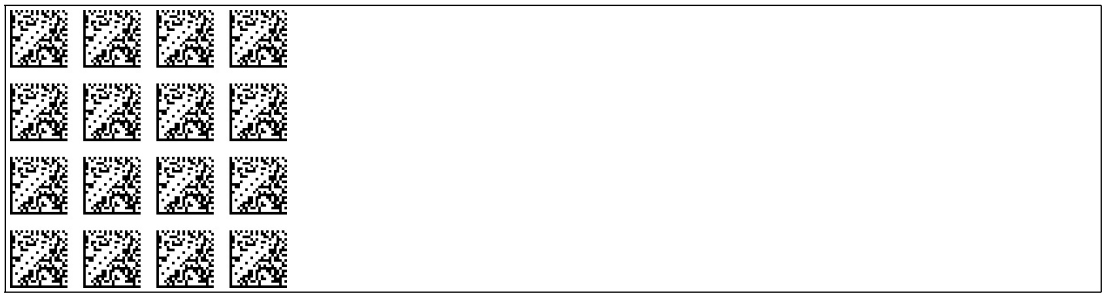


Figure 8.1 The code card "ENABLE" is used to activate external parameterization operating mode.

The code card "STORE"

Figure 8.2 The code card "STORE" stores the modified parameterization in the non-volatile memory of the reading head and terminates external parameterization operating mode.

The code card "CANCEL"

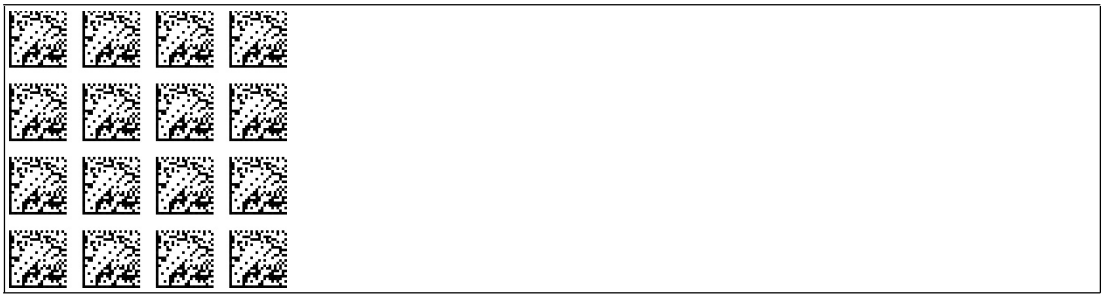


Figure 8.3 The code card "CANCEL" discards the modified parameterization and terminates external parameterization operating mode. The reading head switches to normal mode and adopts the last valid configuration that was saved.

The "USE" code card

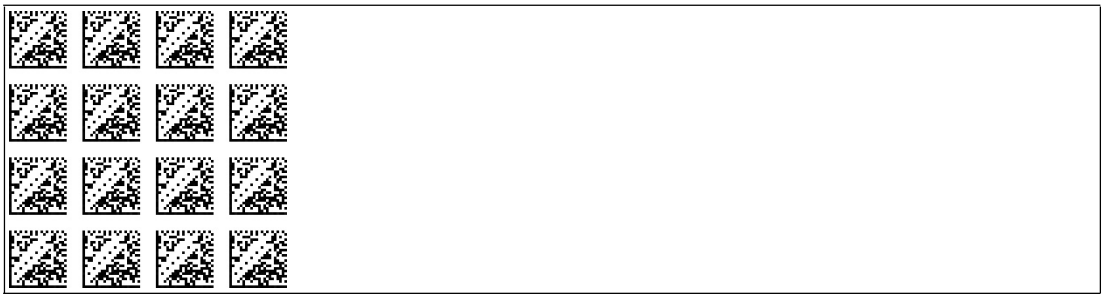


Figure 8.4 The "USE" code card takes over the set configuration **volatile** in the read head working memory and terminates the external parameterization operating mode. The read head then operates with this configuration. However, if the read head is switched off and on again, the configuration is lost and the read head operates with the last valid configuration that was saved. This function is used primarily for test purposes.

The "DEFAULT" code card

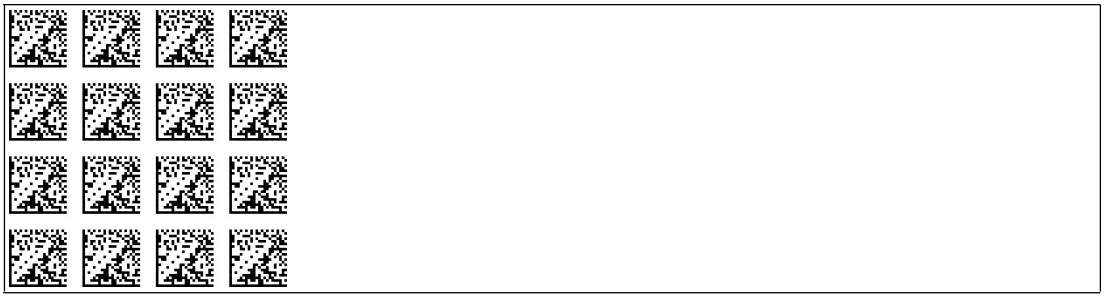


Figure 8.5 The "DEFAULT" code card restores the read head settings to default and terminates external parameterization operating mode.

8.1.2 Code Cards for Adjusting the Resolution

Parameterization enables you to assign a position data resolution of 0.1 mm / 1 mm / 10 mm to the read head.

Resolution: 0.1 mm

Figure 8.6 The code card assigns a position data resolution of 0.1 mm / 1 mm / 10 mm to the reading head.

Resolution: 1 mm

Figure 8.7 The code card assigns a position data resolution of 0.1 mm / 1 mm / 10 mm to the reading head.

Resolution: 10 mm

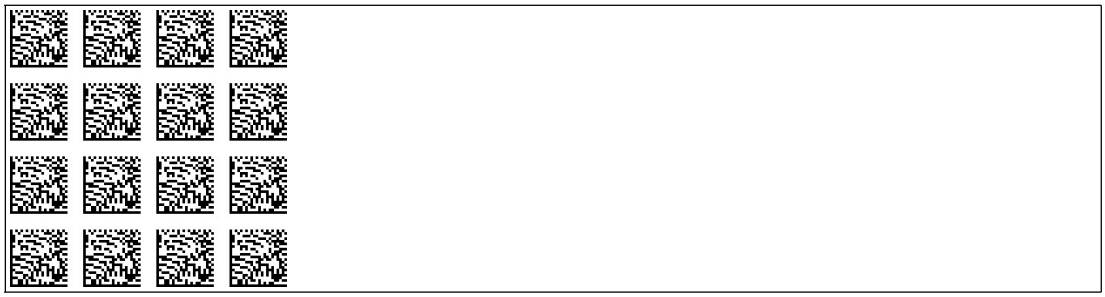


Figure 8.8 The code card assigns a position data resolution of 0.1 mm / 1 mm / 10 mm to the reading head.

Maximum Length of the Code Tape

Resolution of the read head [mm]	Maximum length of the code tape [km]
10	10
1	10
0.1	10

8.1.3 Code Cards for Setting the Orientation

If the alignment of the read head to the code tape does not correspond to the default setting, the orientation must be adjusted. The orientation can be set at an angle of 0°, 180°, or automatic detection in 90° increments.

Orientation 0°

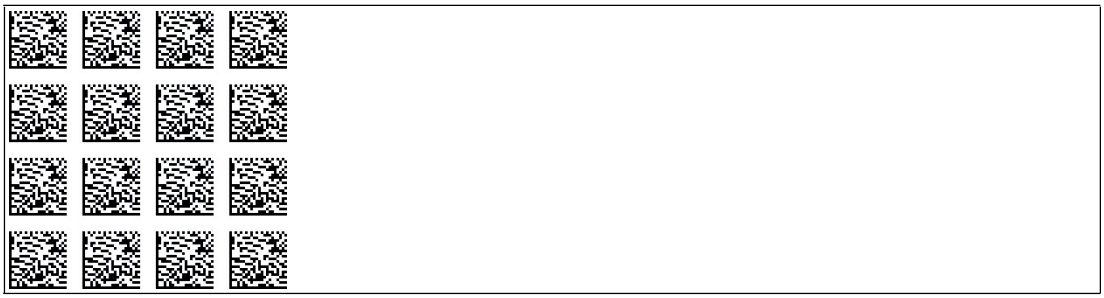


Figure 8.9 The code card assigns the orientation 0° to the read head.

Orientation 180°

Figure 8.10 The code card assigns the orientation 180° to the read head.

Orientation 0° or 180°

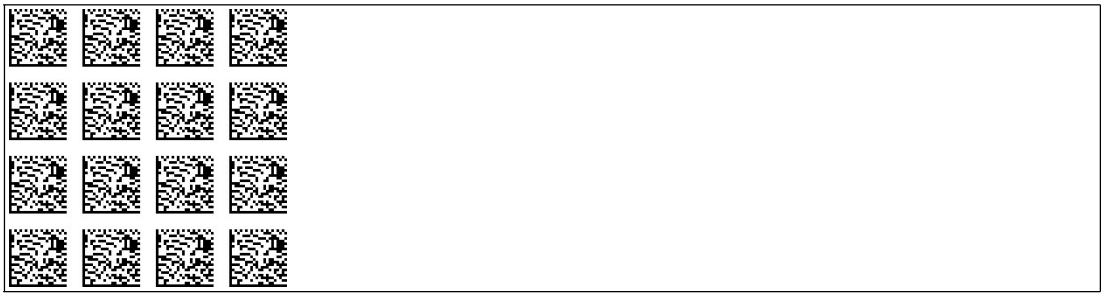


Figure 8.11 The code card automatically assigns the orientation 0° or 180° to the read head.

Orientation 0°, 90°, 180°, or 270°

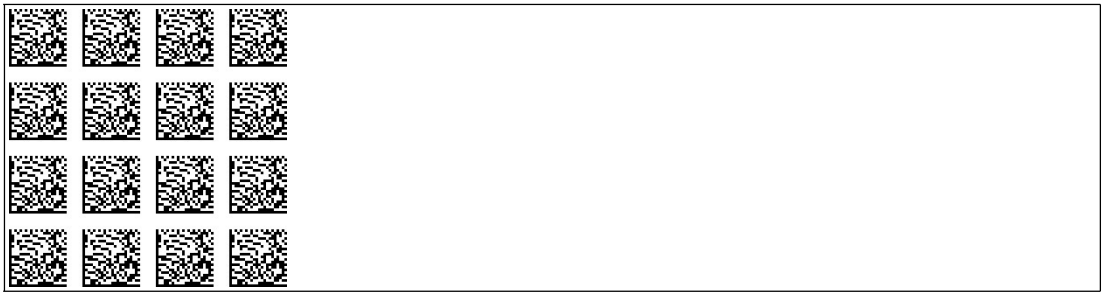


Figure 8.12 The code card automatically assigns the orientation 0°, 90°, 180°, or 270° to the read head.

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8.1.4 Code Cards for Adjusting Output 1

Parameterization enables you to assign various functions to output 1 on the read head. The following functions are available:

- None
- Speed exceeded
- Warning
- Fault
- Contamination
- Event
- No position

Output 1: no function

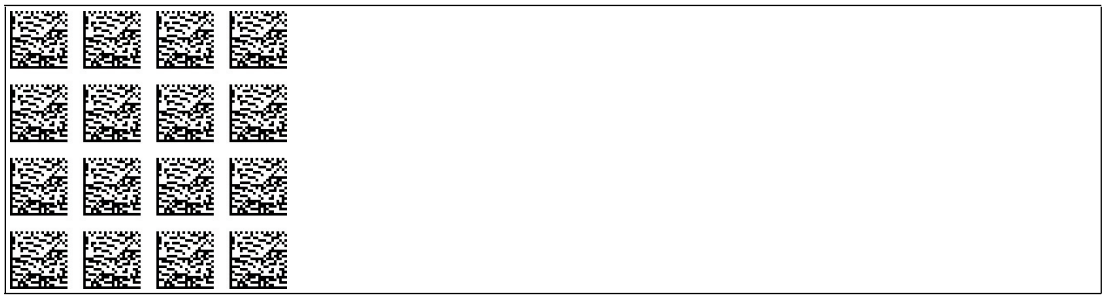

Figure 8.13 Output 1 has no function.

Output 1: speed exceeded

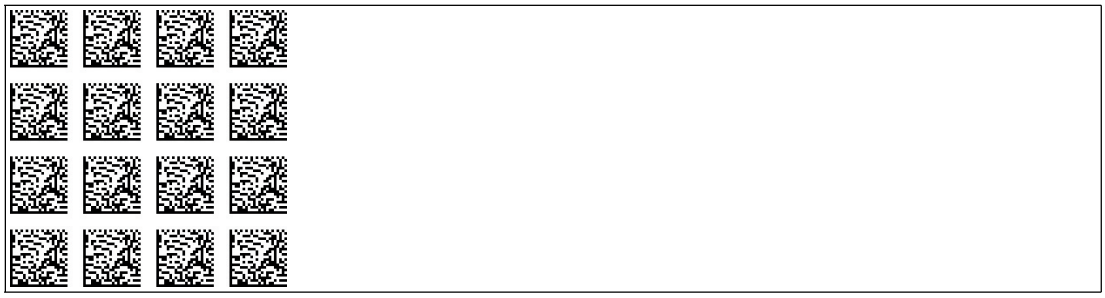

Figure 8.14 Output 1 carries the potential $+U_B$ if the speed exceeds the defined maximum speed.

Output 1: Warning

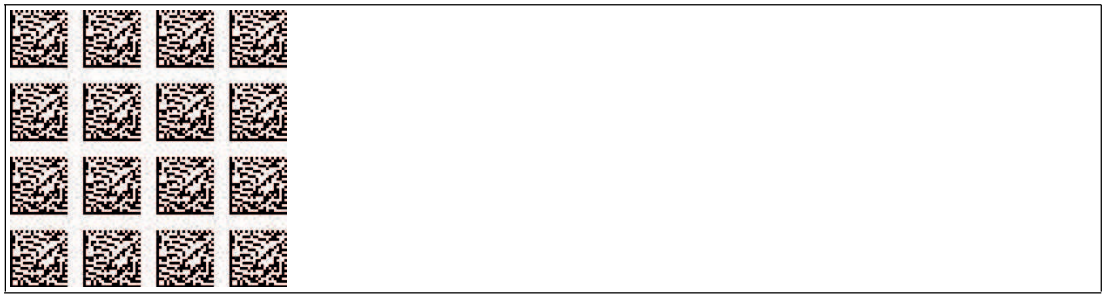

Figure 8.15 Output 1 carries the potential $+U_B$ as long as a warning message is present on the read head.

Output 1: Fault

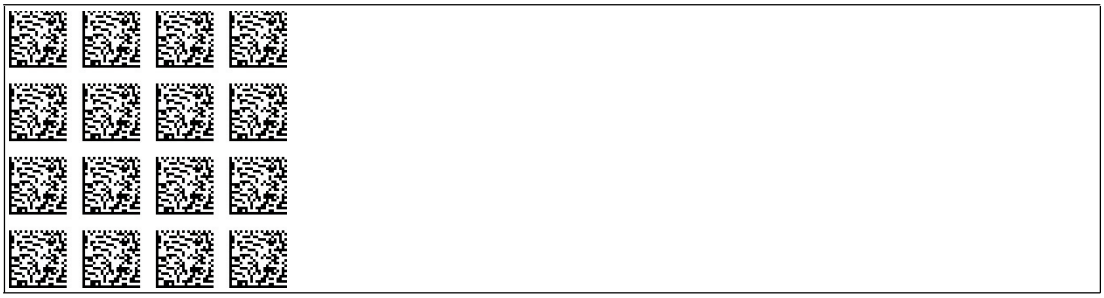

Figure 8.16 Output 1 carries the potential $+U_B$ as long as an error message is present on the read head.

Output 1: Pollution

Figure 8.17 Output 1 carries the potential $+U_B$ as long as a pollution message is present on the read head.

Output 1: Event

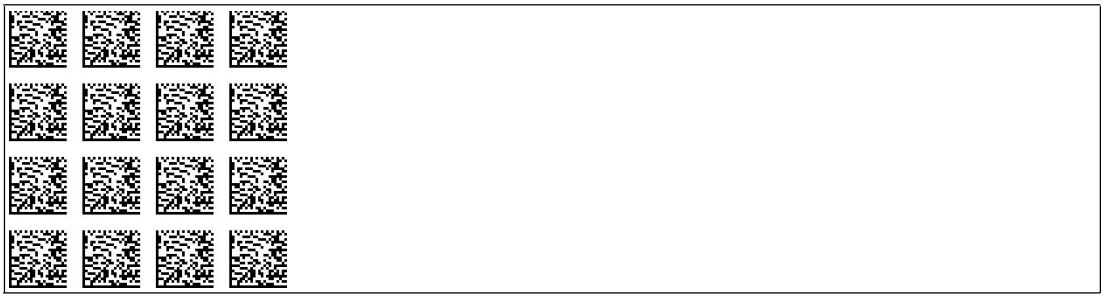

Figure 8.18 Output 1 carries the potential $+U_B$ as long as an event marker is present on the read field of the read head.

Output 1: no position

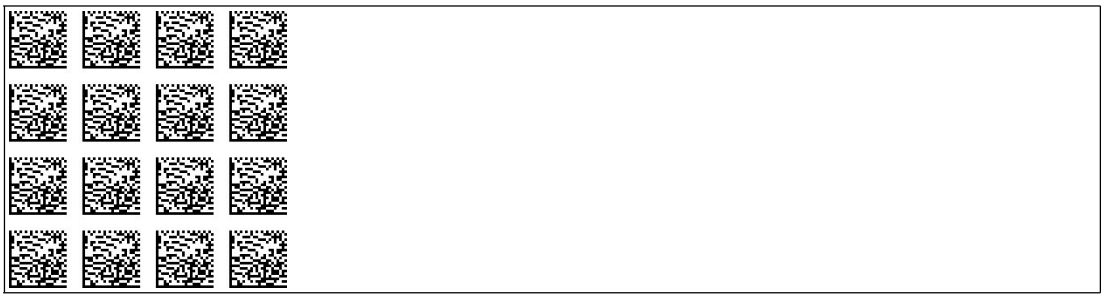

Figure 8.19 Output 1 carries the potential $+U_B$ when the reading head is not reading position information.

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8.1.5 Code Cards for Adjusting Output 2

Parameterization enables you to assign various functions to output 2 on the read head. The following input / output functions are available:

- Output: none
- Output: Overspeed message
- Output: Warning
- Output: Fault
- Output: Pollution
- Output: Event
- Output: No position

Output 2: no function

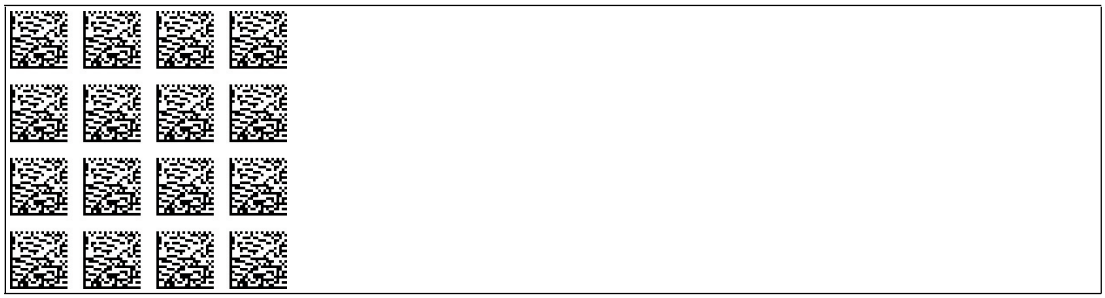

Figure 8.20 Input/output 2 is defined as an output but has no function.

Output 2: speed exceeded

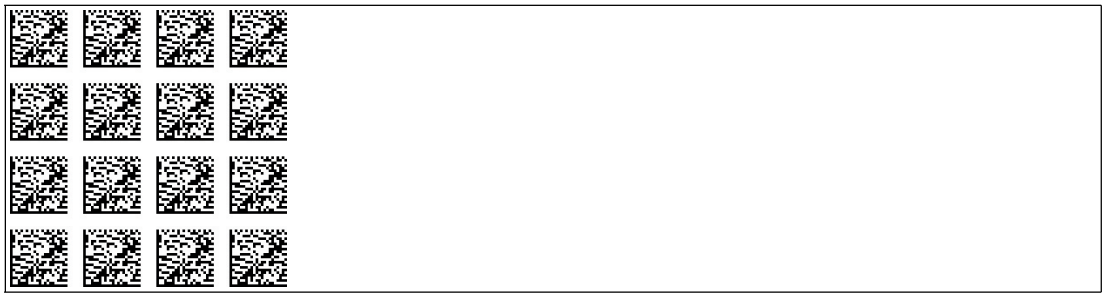

Figure 8.21 Input/output 2 is defined as an output. This output carries the potential $+U_B$ if the speed exceeds the defined maximum speed.

Output 2: Warning

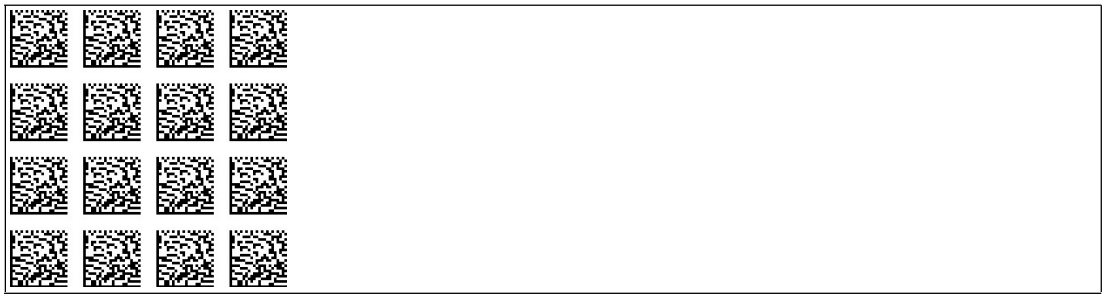

Figure 8.22 Input/output 2 is defined as an output. This output carries the potential $+U_B$ as long as a warning message is present in the read head.

Output 2: Fault

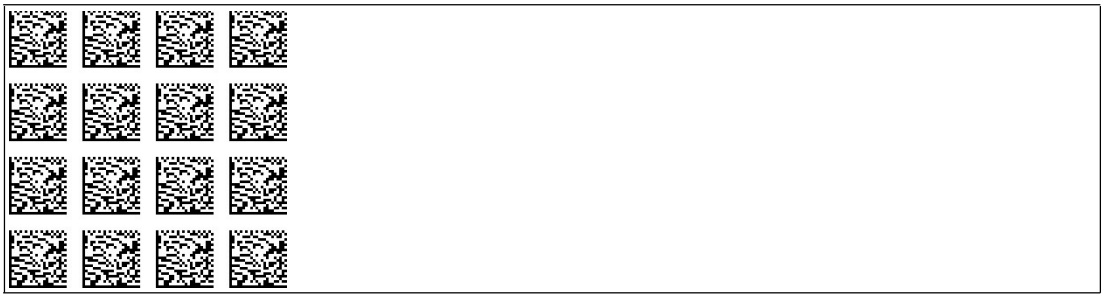

Figure 8.23 Input/output 2 is defined as an output. This output carries the potential $+U_B$ as long as an error message is present on the read head.

Output 2: Pollution

Figure 8.24 Input/output 2 is defined as an output. This output carries the potential $+U_B$ as long as a pollution message is present in the read head.

Output 2: Event

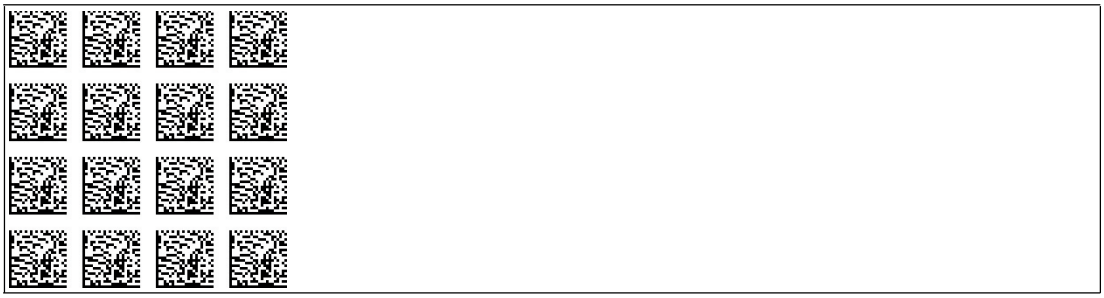

Figure 8.25 Input/output 2 is defined as an output. This output carries the potential $+U_B$ as long as an event marker is present in the read field of the read head.

Output 2: no position

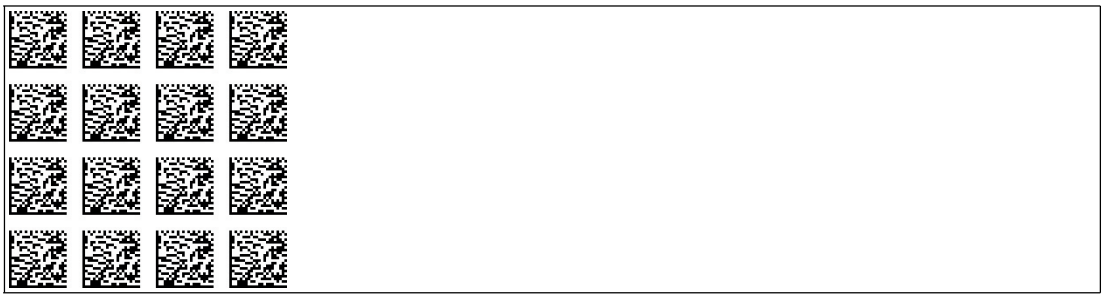

Figure 8.26 Input/output 2 is defined as an output. This output carries the potential $+U_B$when the reading head is not reading position information.

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8.1.6 Code Cards for Adjusting Output 3

Parameterization enables you to assign various functions to output 3 on the read head. The following input / output functions are available:

- Output: None
- Output: Overspeed message
- Output: Warning
- Output: Fault
- Output: Pollution
- Output: Event
- Output: No position

Output 3: no function

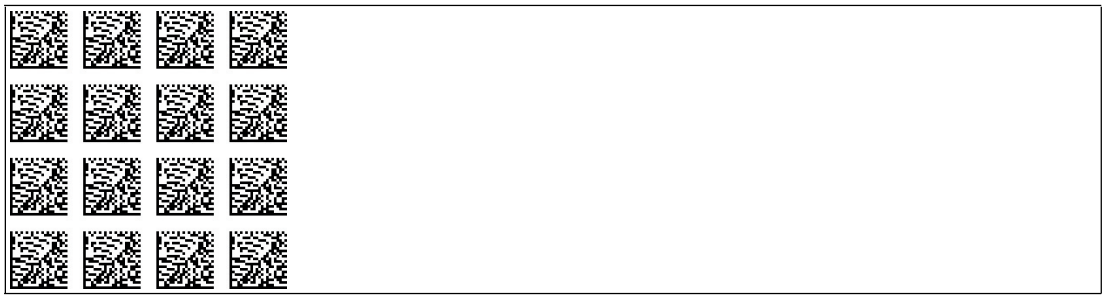

Figure 8.27 Input/output 3 is defined as an output but has no function.

Output 3: speed exceeded

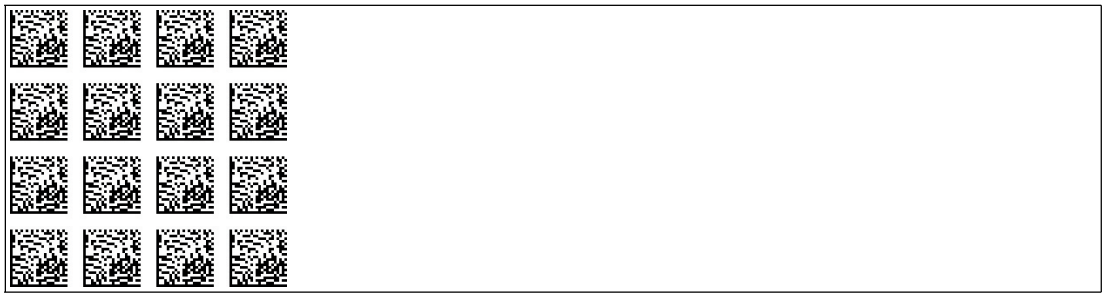

Figure 8.28 Input/output 3 is defined as an output. This output carries the potential $+U_B$ if the speed exceeds the defined maximum speed.

Output 3: Warning

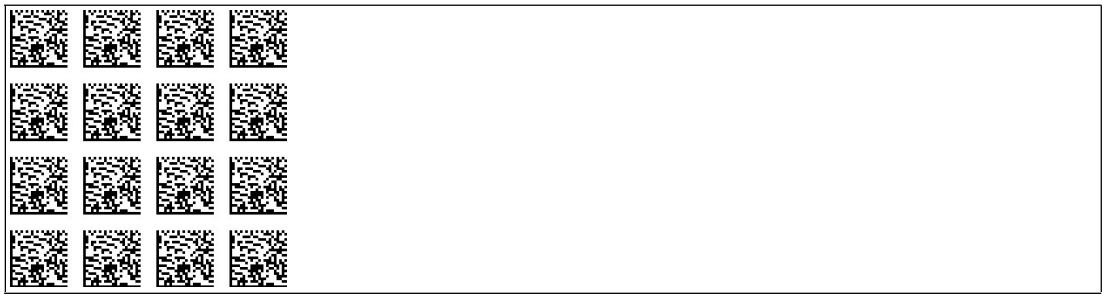

Figure 8.29 Input/output 3 is defined as an output. This output carries the potential $+U_B$ as long as a warning message is present in the read head.

Output 3: Fault

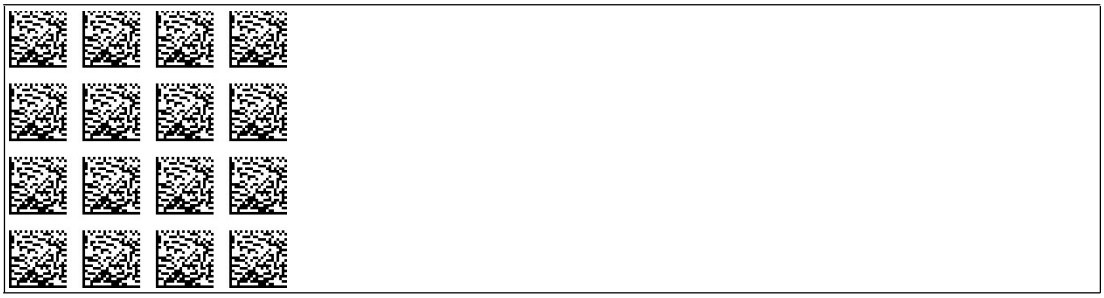

Figure 8.30 Input/output 3 is defined as an output. This output carries the potential $+U_B$ as long as an error message is present on the read head.

Output 3: Pollution

Figure 8.31 Input/output 3 is defined as an output. This output carries the potential $+U_B$ as long as a pollution message is present in the read head.

Output 3: Event

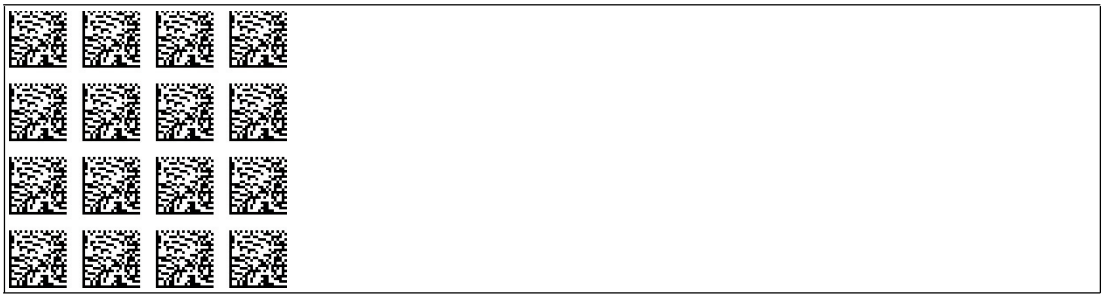

Figure 8.32 Input/output 3 is defined as an output. This output carries the potential $+U_B$ as long as an event marker is present in the read field of the read head.

Output 3: no position

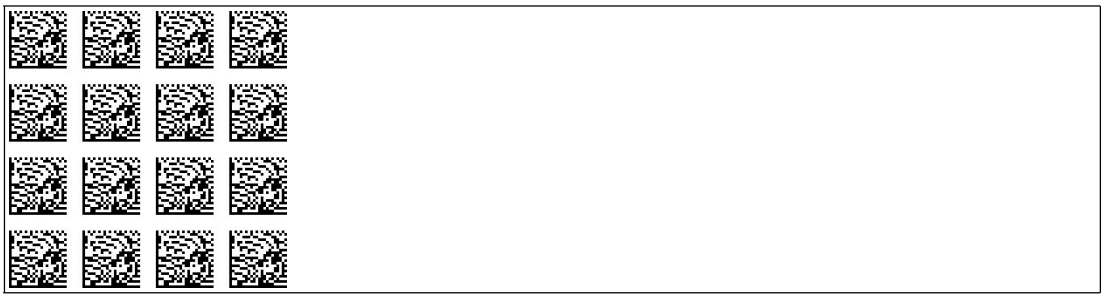

Figure 8.33 Input/output 3 is defined as an output. This output carries the potential $+U_B$when the reading head is not reading position information.

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8.2 ASCII table

hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII	hex	dec	ASCII
00	0	NUL	**20**	**32**	**Space**	40	64	@	**60**	**96**	'
01	1	SOH	**21**	**33**	**!**	41	65	A	**61**	**97**	**a**
02	2	STX	**22**	**34**	**"**	42	66	B	**62**	**98**	**b**
03	3	ETX	**23**	**35**	**#**	43	67	C	**63**	**99**	**c**
04	4	EOT	**24**	**36**	**$**	44	68	D	**64**	**100**	**d**
05	5	ENQ	**25**	**37**	**%**	45	69	E	**65**	**101**	**e**
06	6	ACK	**26**	**38**	**&**	46	70	F	**66**	**102**	**f**
07	7	BEL	**27**	**39**	**'**	47	71	G	**67**	**103**	**g**
08	8	BS	**28**	**40**	**(**	48	72	H	**68**	**104**	**h**
09	9	HT	**29**	**41**	**)**	49	73	I	**69**	**105**	**I**
0A	10	LF	**2A**	**42**	*****	4A	74	J	**6A**	**106**	**j**
0B	11	VT	**2B**	**43**	**+**	4B	75	K	**6B**	**107**	**k**
0C	12	FF	**2C**	**44**	**,**	4C	76	L	**6C**	**108**	**I**
0D	13	CR	**2D**	**45**	**-**	4D	77	M	**6D**	**109**	**m**
0E	14	SO	**2E**	**46**	**.**	4E	78	N	**6E**	**110**	**n**
0F	15	SI	**2F**	**47**	**/**	4F	79	O	**6F**	**111**	**o**
10	16	DLE	**30**	**48**	**0**	50	80	P	**70**	**112**	**p**
11	17	DC1	**31**	**49**	**1**	51	81	Q	**71**	**113**	**q**
12	18	DC2	**32**	**50**	**2**	52	82	R	**72**	**114**	**r**
13	19	DC3	**33**	**51**	**3**	53	83	S	**73**	**115**	**s**
14	20	DC4	**34**	**52**	**4**	54	84	T	**74**	**116**	**t**
15	21	NAK	**35**	**53**	**5**	55	85	U	**75**	**117**	**u**
16	22	SYN	**36**	**54**	**6**	56	86	V	**76**	**118**	**v**
17	23	ETB	**37**	**55**	**7**	57	87	W	**77**	**119**	**w**
18	24	CAN	**38**	**56**	**8**	58	88	X	**78**	**120**	**x**
19	25	EM	**39**	**57**	**9**	59	89	Y	**79**	**121**	**y**
1A	26	SUB	**3A**	**58**	**:**	5A	90	Z	**7A**	**122**	**z**
1B	27	ESC	**3B**	**59**	**;**	5B	91	[	**7B**	**123**	**{**
1C	28	FS	**3C**	**60**	**<**	5C	92	\	**7C**	**124**	**I**
1D	29	GS	**3D**	**61**	**=**	5D	93	]	**7D**	**125**	**}**
1E	30	RS	**3E**	**62**	**>**	5E	94	^	**7E**	**126**	**~**
1F	31	US	**3F**	**63**	**?**	5F	95	_	**7F**	**127**	**DEL**

FACTORY AUTOMATION – SENSING YOUR NEEDS

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

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

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

www.pepperl-fuchs.com

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