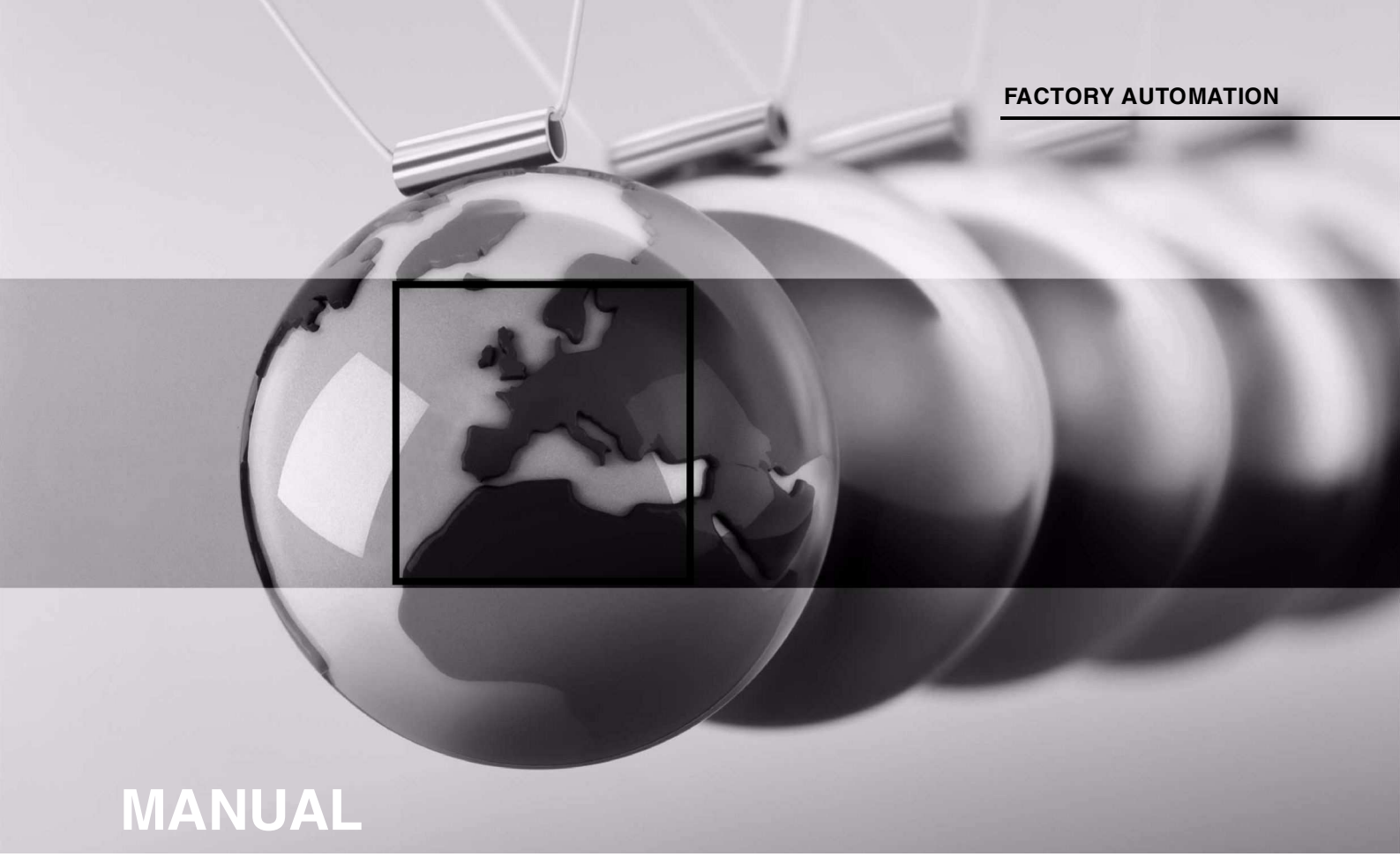
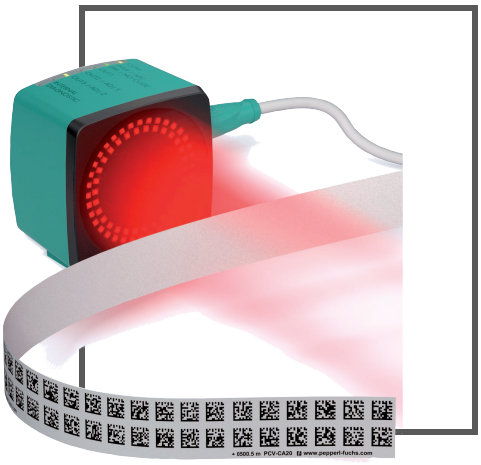


MANUAL

PCV...-F200-B16-V15

Data Matrix Positioning System



CANopen

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 LED Indicators and Controls

The PCV... read head is equipped with seven indicator LEDs for carrying out visual function checks and rapid diagnostics. The read head is equipped with two buttons on the back of the device for activating the alignment aid (see chapter 6.1) and the parameterization mode (see chapter 6.2). Button 1 is labeled ADJUST. Button 2 is labeled CONFIG.

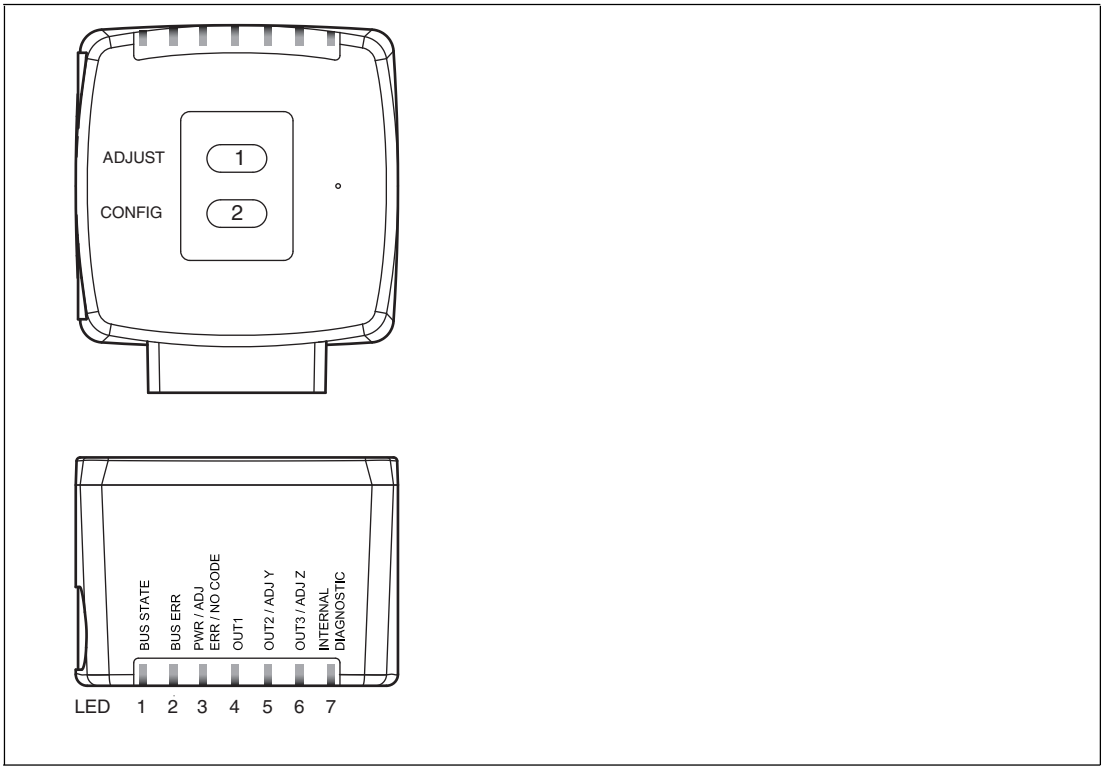

Figure 4.1

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PCV Function Indicator

LED	[#1] BUS STATE	[#2] BUS ERR	[#3] PWR/ADJ ERR/NO CODE	[#4] OUT 1	[#5] OUT 2/ADJ Y	[#6] OUT 3/ADJ Z	[#7] INTERNAL DIAGNOSTIC		
Color	Yellow	Red	Green/ red	Yellow	Yellow	Yellow	Yellow	Yellow	Description
Status	Off	Off	Flashes green	Off	Off	Off	Off	Off	Alignment Y > setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	On	Off	Off	Off	Alignment Y < setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Flashes	Off	Off	Off	Alignment Y = setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Off	Off	Off	Off	Alignment Z > setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Off	On	Off	Off	Alignment Z < setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes green	Off	Off	Flashes	Off	Off	Alignment Z = setpoint value f_{flash} = 2 Hz
	Off	Off	Flashes red	Off	Off	Off	Off	Off	Alignment Code tape outside read range. No code tape detected. f_{flash} = 2 Hz
	Off	Off	Lights up red	Off	Off	Off	Off	Off	System error
	x	x	Lights up green	x	x	x	Off	Off	Normal operation, code tape detected
	x	x	Flashes red	Flashes	Flashes	Flashes	Off	Off	Normal operation. Indication for 2 s if a button is pressed when the time lock is enabled.
	x	x	Off	Flashes	Off	Off	Off	Off	Preconfiguration/configuration mode active f_{flash} = 2 Hz
	x	x	Lights up red	Flashes	Off	Off	Off	Off	Code card faulty f_{flash} = 2 Hz for 3 sec
	x	x	Green, 1 s	Flashes	Off	Off	Off	Off	Code card detected f_{flash} = 2 Hz for 3 sec
	x	x	Off	x	x	x	Off	Off	Time lock for buttons disabled
	x	x	x	x	x	x	On	On	Internal error Return to Pepperl+Fuchs

x = LED status has no meaning

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CANopen Function Indicator

LED	[#1] BUS STATE	[#2] BUS ERR	[#3] PWR/ADJ ERR/NO CODE	[#4] OUT 1	[#5] OUT 2/ADJ Y	[#6] OUT 3/ADJ Z	[#7] INTERNAL DIAGNOSTIC		
Color	Yellow	Red	Green/ red	Yellow	Yellow	Yellow	Yellow	Yellow	Description
Status	Flickers	Flickers	x	x	x	x	x	x	Detection of auto baud rate $f_{flicker}$ = 10 Hz
	Flashes	x	x	x	x	x	x	x	"Preoperational" mode f_{flash} = 2.5 Hz
	Flashes once	x	x	x	x	x	x	x	Stopped 1 x on briefly, 1 s off
	Lights up	x	x	x	x	x	x	x	"Operational" mode

x = LED status has no meaning

CANopen Error Indication

LED	[#1] BUS STATE	[#2] BUS ERR	[#3] PWR/ADJ ERR/NO CODE	[#4] OUT 1	[#5] OUT 2/ADJ Y	[#6] OUT 3/ADJ Z	[#7] INTERNAL DIAGNOSTIC		
Color	Yellow	Red	Green/r ed	Yellow	Yellow	Yellow	Yellow	Yellow	Description
Status	Flickers	Flickers	x	x	x	x	x	x	Detection of auto baud rate $f_{flicker}$ = 10 Hz
	x	Flashes	x	x	x	x	x	x	General configuration error f_{flash} = 2.5 Hz
	x	Flashes once	x	x	x	x	x	x	Warning limit reached 1 x on briefly, 1 s off
	x	Flashes twice	x	x	x	x	x	x	"Control Event" error 2 x on briefly, 1 s off
	x	Flashes 3 times	x	x	x	x	x	x	Synchronization error 3 x on briefly, 1 s off
	x	Flashes 4 times	x	x	x	x	x	x	"Event Timer" error 4 x on briefly, 1 s off
	x	Lights up	x	x	x	x	x	x	CANopen error

x = LED status has no meaning

4.3 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 life of these products.

Model number	Description
V19-G-ABG-PG9-FE	Grounding terminal and plug (set)
PCV-SC12 PCV-SC12A	Grounding clip
V15-G-*M-PUR-CAN-V15-G	CANopen bus cable, M12 to M12, available in several different lengths
VAZ-V1S-B	Stopping plug for M12 connector
ICZ-TR-CAN/DN-V15	Terminator for CANopen
PCV-CM20-0*	Event marker
PCV-CR20	Repair strip

[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

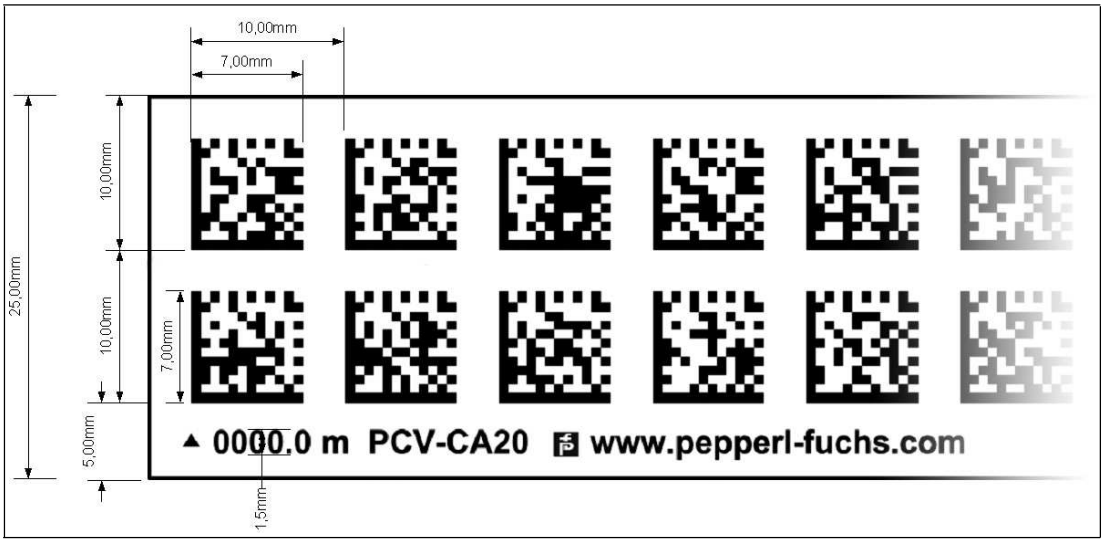


Figure 5.1

Orientation of the Code Reel and Read Head

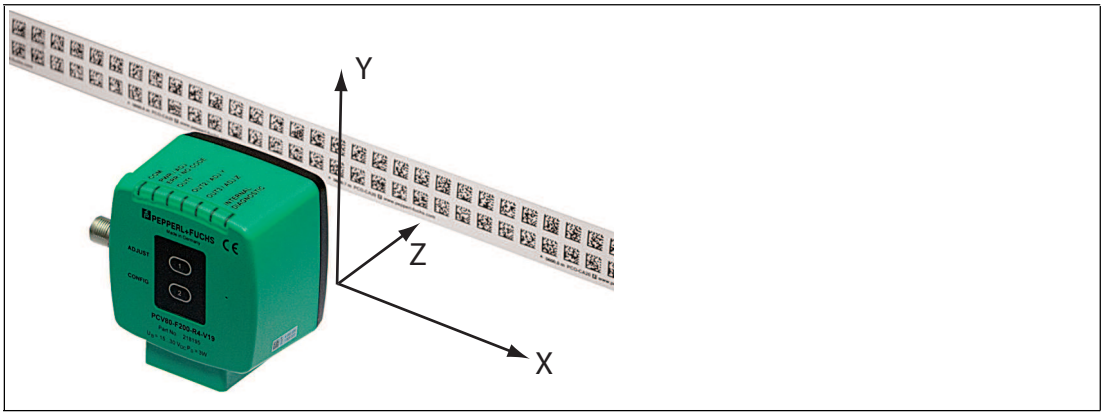


Figure 5.2

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!

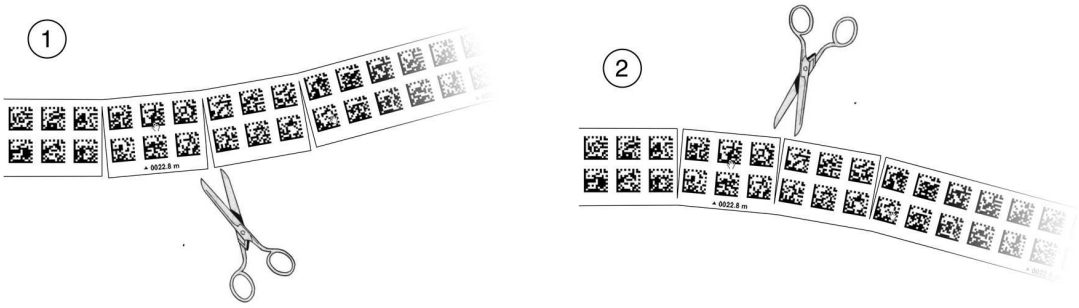
Expansion Joints

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

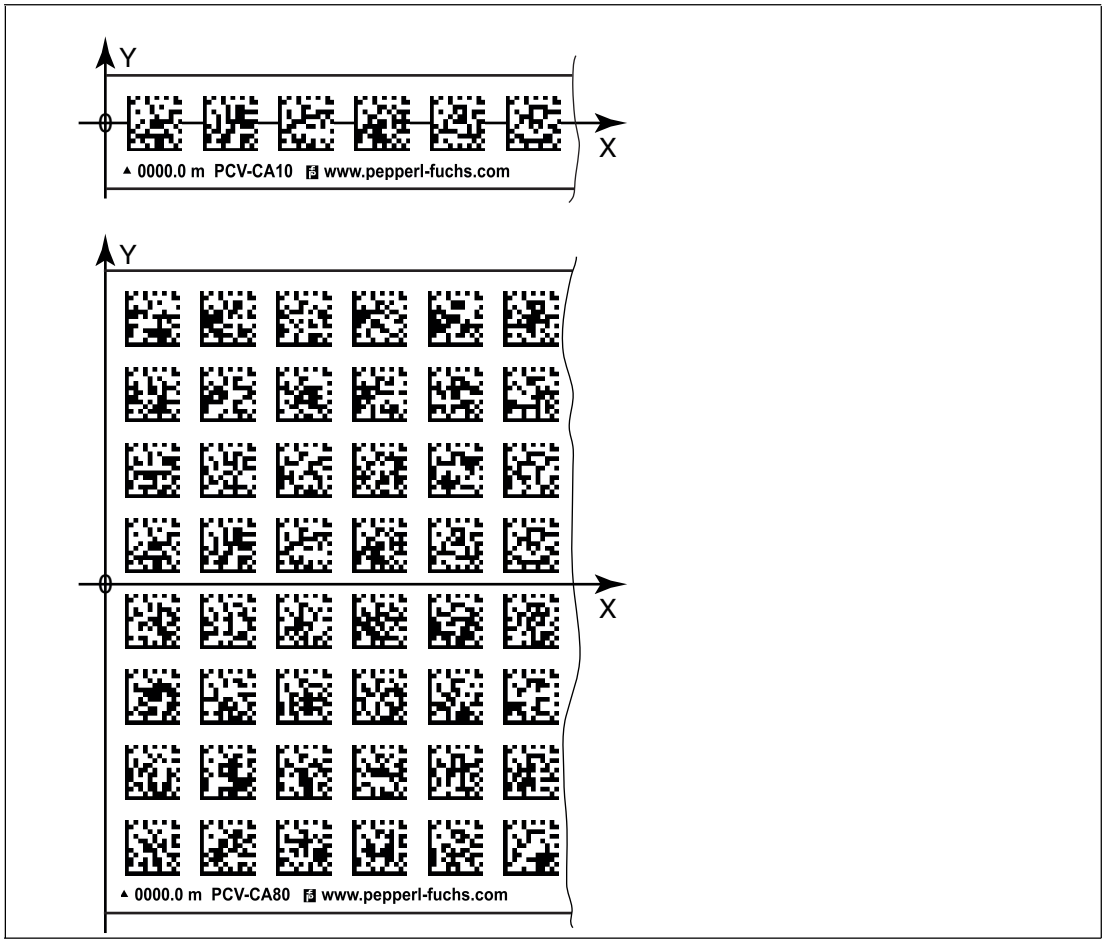

Figure 5.3 Zero line for code reels

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.

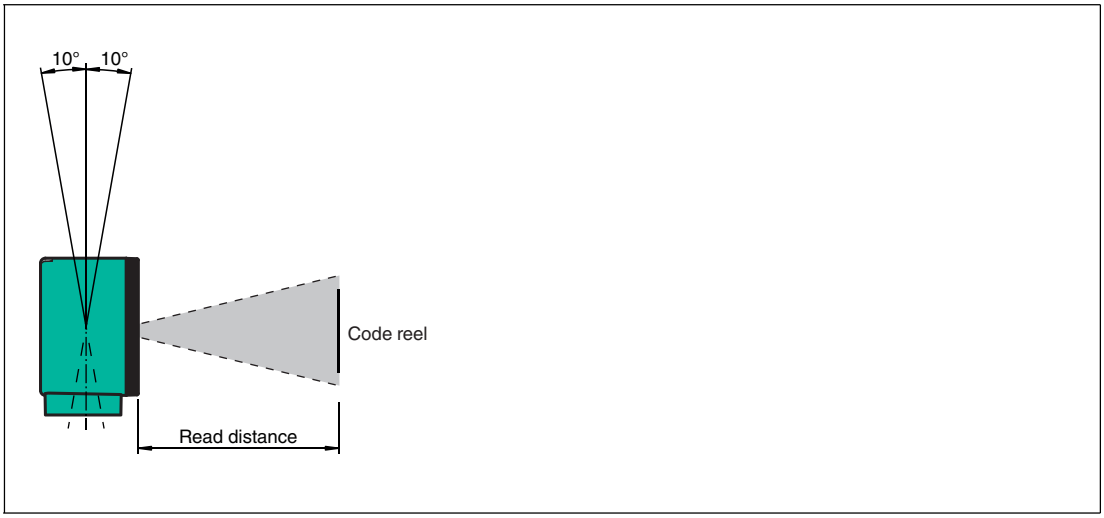

Figure 5.4 Vertical alignment tolerance

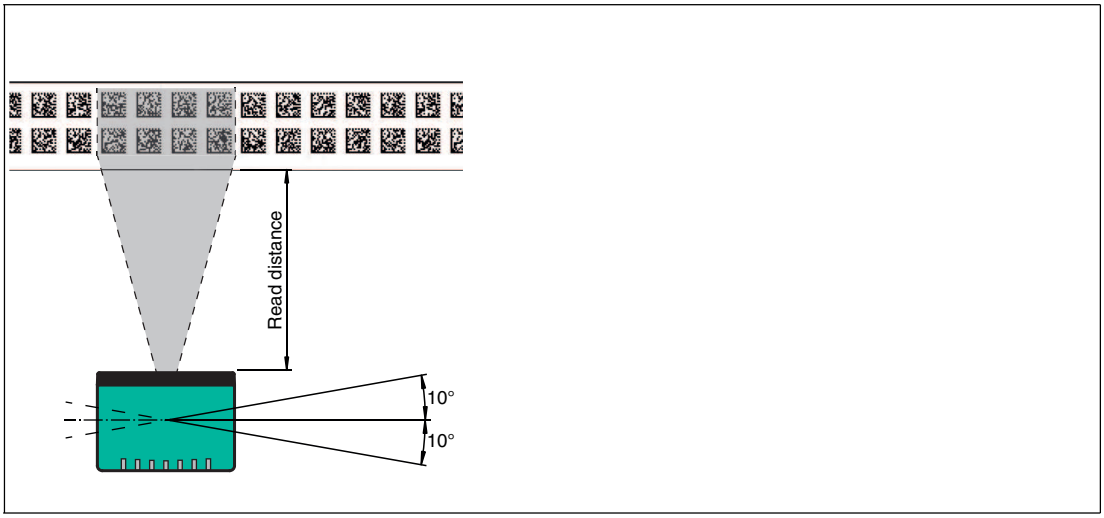

Figure 5.5 Horizontal alignment tolerance

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

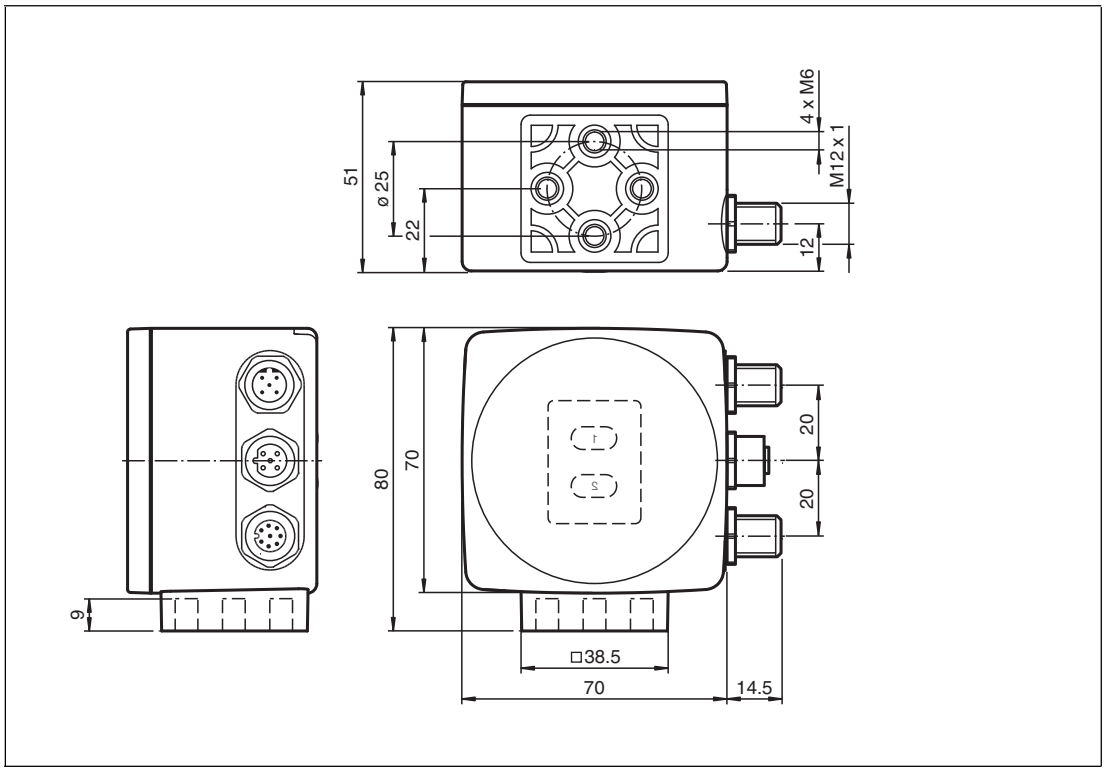

Figure 5.6

Caution!

When selecting the length of the mounting screws to be used, make sure that the insertion depth of the screws into the threaded inserts on the read head does not exceed 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 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. The configurable inputs and outputs of the read head are located at this connection.

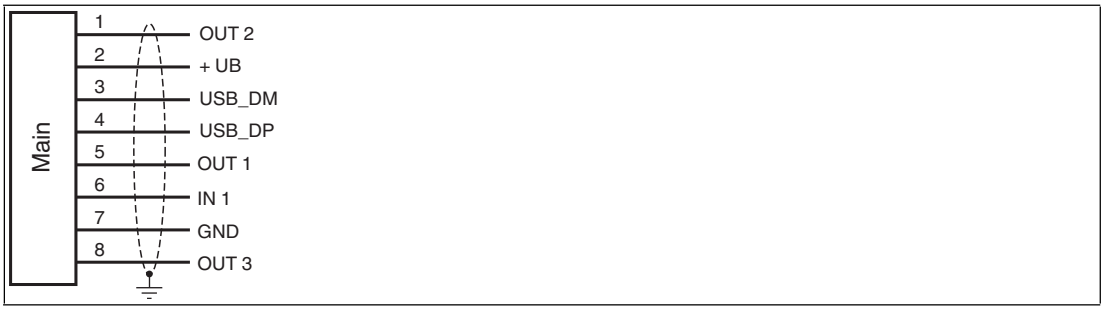

Figure 5.7

Connector Assignment

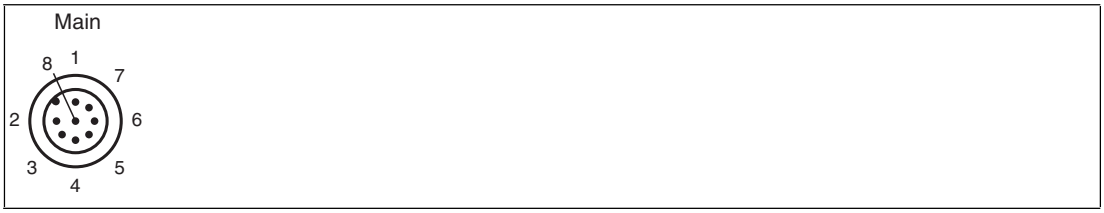

Figure 5.8

Color Assignment

Pepperl+Fuchs female cordsets 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 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 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 CANopen Connection

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

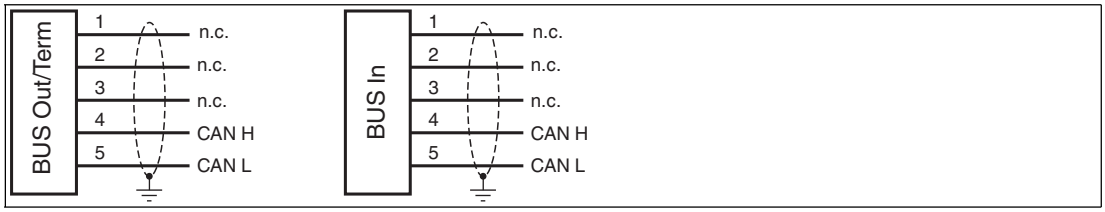


Figure 5.9

Connector Assignment

Figure 5.10

For details of suitable CANopen cables, see chapter 4.3.

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.

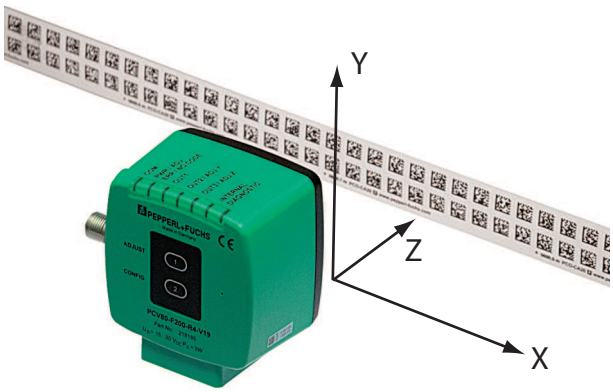
The switchover from normal operation to parameterization mode is via button 1 on the back of the read head.

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 Parameterization of Fieldbus Address and Baud Rate

Before the read head can communicate with the CANopen fieldbus, you must set the **fieldbus address** and **baud rate** parameters.

Parameterization using Code Cards

During external parameterization, the read head scans the 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 read head.

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Fieldbus Address

During the first start process, the read head adopts the stored bus address 003 (= default). To change the fieldbus address of the read head, use code cards for parameterizing the fieldbus address 001 to 125. These code cards are printed in a separate manual.

You can find the manual for the code cards for configuring the fieldbus address at www.pepperl-fuchs.com. See chapter 6.2.1.

Baud Rate

Data on the CANopen network can be exchanged at various baud rates of between 10 kBaud and 500 kBaud. The read head supports the following baud rates:

Baud Rate
10 kBaud
20 kBaud
50 kBaud
125 kBaud
250 kBaud (= default)
500 kBaud
Auto baud rate

The code cards for parameterizing the baud rate from 10 kBaud to 1 MBaud and the auto baud rate are printed in the Appendix to this manual.

See chapter 8.3.

Code Cards for Controlling Parameterization

The code cards for controlling parameterization are printed in the Appendix to this manual.

See chapter 8.2.

Note!

For external parameterization with code cards, either copy or print the required pages of the manual. Cut out the required code cards to prevent the read head from mistakenly detecting another code card on the same page.

However, if you do parameterize the read head using the manual, cover the code cards that you do not require with a sheet of paper, for example.

Activation of Parameterization Mode

1. Press button 2 on the rear of the read head for longer than 2 seconds.

   ↳ Yellow LED3 now flashes.

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

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

Note!

Time Lock

Start external parameterization of the read head using code cards within 10 minutes of the read head being switched on. A time lock disables the read head after 10 minutes. The time lock remains inactive during the parameterization process. The time lock disables the read head if no parameterization activity takes place for more than 10 minutes.

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

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 s. In the event of an invalid parameterization code, the LED2 lights up red for 2 s.

Exiting Parameterization Mode

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

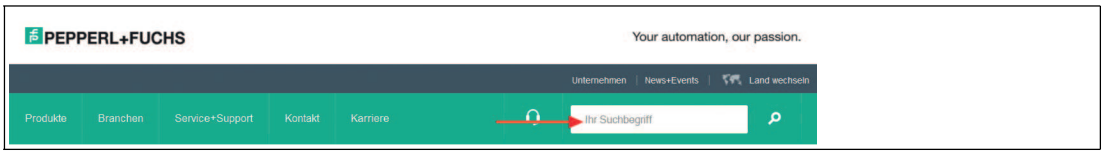
↳ When the "STORE" memory code is detected, the green LED2 lights up for 1 s. The parameterization is stored in the nonvolatile memory of the read head and parameterization mode is terminated. Parameterization of the read head is now complete. If the memory code is not detected, the LED2 lights up red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

Note!

If you press button 2 briefly in parameterization mode, this mode is closed immediately. 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.

6.2.1 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**.

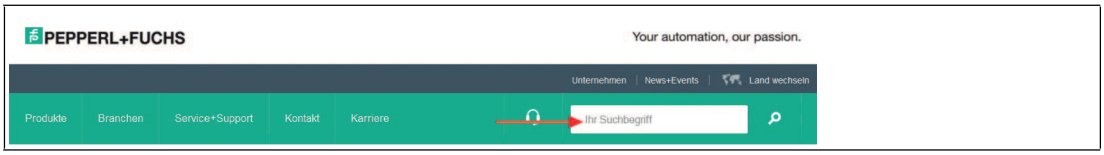


Select your product from the list of search results. Click on the information you require in the product information list, e.g., **Technical documents**.

A list of all available documents is displayed.

6.3 EDS Configuration File

To assist with the configuration, you can download the EDS file from the download area of our Internet homepage http://www.pepperl-fuchs.com. Simply enter the product name or item number in the **Product/Keyword** 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., **Software**.

A list of all available downloads is displayed.

7 Operation and communication

7.1 Data Exchange in the CANopen Bus

7.1.1 General Information about CANopen

CANopen is a multimaster-compliant fieldbus system based on the CAN (**C**ontroller **A**rea **N**etwork).

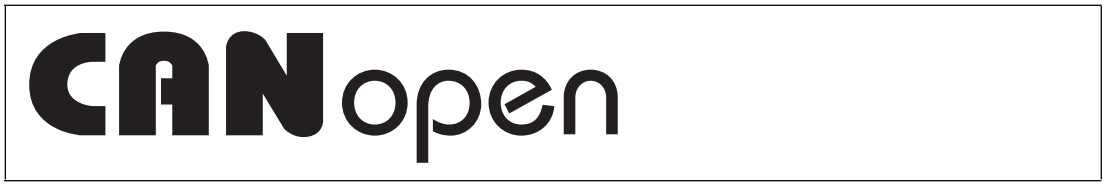


Figure 7.1

Devices on the CANopen fieldbus communicate via message identifiers rather than via addresses. This allows all devices to access the fieldbus at any time. Fieldbus access is according to the CSMA/CA principle (**C**arrier **S**ense **M**ultiple **A**ccess/**C**ollision **A**voidance). Each device intercepts the fieldbus and can send messages whenever the fieldbus is free. If two devices start an access at the same time, the device with the highest priority, i.e., the lowest identifier, is assigned the access right. Devices with a lower priority interrupt the data transfer and make a further access attempt once the fieldbus becomes free.

Any device can receive the messages. An acceptance filter ensures that messages are received only by the intended devices. Data is transferred via message telegrams. Message telegrams consist of a COB ID (**C**ommunication **Ob**ject **Id**entifier) and a maximum of 8 subsequent bytes. The COB ID dictates the priority of the messages. The COB ID is made up of the function code and the node number.

The function code describes the message type:

- **Message with service data (SDO)**

  For parameterization of object directory entries

  - Any length
  - Cyclical transmission
  - SDOs of a device are combined in the object directory
  - Mailbox is placed on a (server) SDO, 36 bytes long
- **Message with process data (PDO)**

  For transmitting real-time data

  - Maximum 8 bytes long
  - Cyclical or event-controlled transmission
  - Distinction between send (max. 512) and receive PDOs (max. 512)
  - In the CAN, PDOs occupy their own identifier
- **Messages for network management (NMT)**

  For controlling the finite state machine of the CANopen device and for monitoring the nodes
- Further objects such as synchronization object (SYNC), time stamp and error messages (EMCY).

The most important attributes of the process data objects (PDOs) and service data objects (SDOs) are shown in the table below.

Process data objects (PDOs)	Service data objects (SDOs)
Are used for real-time data exchange	Permit access to the object directory; each SDO assembles a point-to-point service communication channel.
Typically messages with high priority	Messages with lower priority
Synchronous and asynchronous data transfer	Typically asynchronous data transfer
Cyclical and noncyclical transmission	Typically noncyclical transmission
Data of the PDOs can be configured via SDOs	Use of the data field is dictated by the CMS (CAN Message Specification) Multiplexed Domain Protocol.
Preformatted data field	Access to an entry in the device object directory via index and subindex.

Additional Information

CAN in Automation (CiA)
International Users and Manufacturers Group e.V.
Kontumazgarten 3
90429 Nuremberg, Germany

http://www.can-cia.org/

- CiA Draft Standard V4.02
- CiA Draft Standard 303 LED-Behavior

7.1.2 Basic Technical Information about CANopen

Connecting the Bus System

Within the CANopen network, all devices communicate via a 2-pin network cable. All devices are then connected with the cable in parallel. To prevent interfering reflections within a network, you must connect a suitable terminator to each end. For suitable cables and terminators,see chapter 4.3.

Device Profile

CANopen defines various device profiles for numerous device types. At present, read head PCV*-F200*-B16-V15 does not correspond to any special device profile. The "Generic Device" profile is therefore assigned to the read head.

Bus Length

The maximum line length within a CANopen network is dictated by the signal runtime. Communication within the network requires that signals are present on all bus nodes at the same time. The network can be adapted to the existing line lengths through various baud rates. The values in the table below serve as a reference point. The actual values may differ, depending on the application concerned.

Baud rate [kBit/s]	Max. bus length [m]
1000	30
500	100
250	250
125	500
50	1000

For information on setting the baud rate for the read head, see chapter 6.2.

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Shielding

Ensure continuous shielding when cabling the read head. For the suitable fieldbus cables, see chapter 4.3.

Behavior at Startup

After switch-on, the read head in a CANopen network passes through several operating states.

1. **Initialization**

   Startup process of the read head.

2. **Pre-Operational**

   Read head state on completion of the startup process. The read head reports this state to the NMT master.

3. **Operational**

   Operative state of the read head. The NMT master sets this state via an NMT start node telegram once it has received the Pre-Operational message from the read head.

Exchange of Process Data

Within the CANopen network, process data is exchanged via Process Data Objects (PDO). See chapter 7.1.1. Process data objects are divided into:

- **Transmit PDOs (TxPDO)**

  Process data objects that transmit input data and diagnostic data.

- **Receive PDOs (RxPDO)**

  Process data objects that transmit output data.

The first 4 PDOs per transmit or receive data packet transmit the default CAN identifier. All other PDOs of a data packet can be configured by the user.

Communication Types

In the CANopen network, various communication types are specified for process data objects. The communication type of each PDO is controlled via the "Transmission Type" parameter. The "Transmission Type" parameter is defined in subindex 2 of the communication parameter object (from 0x14000) and is transmitted during the startup process via an SDO. See chapter 7.1.1.

The read head supports the following communication types:

"Transmission Type" parameter	Transmission	Description
0	Event-controlled Synchronous	**TxPDO**: Data is detected upon receipt of a SYNC (= **sync**hronization object). Data is transmitted only in the event of a change. **RxPDO**: Data is sent event-controlled and adopted in a SYNC.
1	Cyclic Synchronous	Data is adopted and transmitted cyclically at each nth SYNC. n = 1 ... 240. n can be individually assigned for each PDO to control transmission cycles.
241 ... 251	Reserved	
252 (TxPDO only)	Synchronous RTR (= **R**emote **T**ransmission **R**equest)	Data is detected upon receipt of a SYNC. Data is sent via RTR only on request.

"Transmission Type" parameter	Transmission	Description
253 (TxPDO only)	Asynchronous RTR	Data is detected and sent via RTR only on request.
254	Event-controlled Manufacturer-specific	Read head sends data when "Operational" state is set and in the event of changes.
255	Event-controlled Profile-specific	Read head sends data when "Operational" state is set and in the event of changes.

Communication Monitoring

To monitor bus communication, you can configure the following process in the read head.

- **Node guarding**

  If you have configured the read head for node guarding, the NMT master sends guard telegrams that have to be answered by the read head with the current CANopen status. The gap between the guard telegrams is defined in object 0x100C. See chapter 7.1.3.

  If the read head does not send a response, a "Node Guard Event" is set. Node guarding is deactivated when you set the "Guard Time" in object 0x100C to 0.

- **Lifeguarding**

  If you have configured the read head for lifeguarding, the read head sends lifeguard telegrams that have to be answered by the NMT master. The gap between a lifeguard telegram and the response from the NMT master is defined in object 0x100D. See chapter 7.1.3.

  If the guard telegram remains unanswered for the defined time, the read head sets a "Lifeguarding Event" and sends an EMCY telegram. Lifeguarding is deactivated when you set the "Guard Time" in object 0x100C or the "Life Time Factor" in object 0x100D to 0.

- **Heartbeat**

  The read head can be configured both as emitter and receiver of a heartbeat telegram. If the read head is configured for sending a heartbeat telegram, this telegram will be monitored by the NMT master or a different bus node. If the read head is configured for receiving a heartbeat telegram, the read head monitors a different bus node or the NMT master.

  Configure heartbeat telegram transmission in object 0x1017. Specify the gap between the heartbeat telegrams via the "Heartbeat Producer Time". The heartbeat is deactivated when the "Heartbeat Producer Time" is set to 0.

  Configure heartbeat telegram receipt in object 0x1016. Specify the gap between the heartbeat telegrams via the "Heartbeat Consumer Time". The heartbeat is deactivated when the "Heartbeat Consumer Time" is set to 0.

Failsafe

Failsafe is the behavior of the read head when errors occur. The failsafe behavior is controlled via a parameter.

The behavior of the read head in the event of a CANopen error can be controlled via object 0x1029 "Behavior in the event of an error". For a detailed description, see chapter 7.1.3.

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7.1.3 CANopen Object Directory

Note!

CANopen Parameter Communication

This section contains the information required for the data exchange via CANopen. Data is exchanged with the read head via objects. These objects and their respective permissible functions are defined in the following SDO directory.

The read head supports the identifier format 2.0A (11 bit identifier) according to the CAN specification. The extended 29 bit identifier is not supported.

Supported Objects

Object	Description
0x1000	Device type
0x1001	Error register
0x1008	Manufacturer device name
0x1009	Manufacturer hardware version
0x100A	Manufacturer software version
0x100C	Guard time
0x100D	Lifetime factor
0x1014	Emergency ID
0x1015	Emergency inhibit time
0x1016	Consumer heartbeat time
0x1017	Producer heartbeat time
0x1018	Identity object
0x1029	Error behavior
0x1200	1. Server SDO parameter (default SDO)
0x1400	Receive PDO 1 parameter
…	…
0x1403	Receive PDO 4 parameter
0x1600	Receive PDO 1 mapping
…	…
0x1603	Receive PDO 4 mapping
0x1800	Send PDO 1 parameter
0x1801	Send PDO 2 parameter
0x1A00	Send PDO 1 mapping
0x1A01	Send PDO 2 mapping
0x2000	Position data and status data
0x3000	Serial number
0x3001	Parameterization object

The device-specific object directory OV contains all parameters and process data for the read head. The parameters and process data are listed in tables. The object directory has two defined areas. In the first area, the read head is described in general terms. It contains the device ID, the name of the manufacturer, the communication parameters, etc. In the second area, the specific functionality of the read head is described.

An entry in the object list is identified via a 16-bit index and an 8-bit subindex. Access to device parameters and process data, such as input signals and output signals, device functions, and network variables is provided via the assignment within the object list in standardized form over the CANopen network.

Device Type

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1000	0	Device Type	unsigned32[1)]	ro (= **r**ead **o**nly)	no	0x00000000

Table 7.1 The device type of the read head is 0x00000000, since no specific device profile is implemented.
[1)] = data type without prefix, 32 bit

Error Register

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1001	0	Error Register	unsigned8	ro	no	0x00

The 8 bit data of the error register describe errors as follows:

Bit							
7	6	5	4	3	2	1	0
0	Reserved	Reserved	Communication error	Reserved	Reserved	Reserved	Generic error not specified in more detail[2)]

Table 7.2 [2)] = Flag is set for every error message.

SYNC Identifier

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1005	0	COB-ID SYNC Message	unsigned32	rw (= **r**ead/**w**rite)	no	0x00000080

The 32 bit data of the identifier in the SYNC message describes the synchronization as follows:

Bit			
31	30	...	10 ... 0
Has no meaning	0[3)]	...	Identifier 0x80 = 128_{dec}

Table 7.3 [3)] = always 0, since read head is only for SYNC consumers, not SYNC producers.

Device Name of Bus Node

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1008	0	Manufacturer Device Name	visible string[4)]	ro	no	PCV-FBP

Table 7.4 [4)] = ASCII string, variable length

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Hardware Version Number of the Bus Node

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1009	0	Manufacturer Hardware Version	visible string	ro	no	-

Software Version Number of the Bus Node

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x100A	0	Manufacturer Software Version	visible string	ro	no	-

Gap between Guard Telegrams

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x100C	0	Guard Time [ms]	unsigned16	rw	no	0

Watchdog Master Monitoring

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x100D	0	Lifetime Factor	unsigned8	rw	no	0

Table 7.5 Lifetime factor x guard time = lifetime (watchdog for life guarding - master monitoring)

Identifier of the Emergency Telegram

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1014	0	COB-ID Emergency	unsigned32	ro	no	0x00000080 + Node ID

Consumer Heartbeat Time

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1016	0	Number of subsequent parameters	unsigned8	ro	no	40
	1 ... 64	Consumer Heartbeat Time[5)]	unsigned32	rw	no	0

Table 7.6 [5)] = expected heartbeat cycle time [ms] and node ID of the monitored bus node

The monitored identifier guard ID results from the default identifier distribution: Guard ID = 0x700 + node ID

Bit		
31 ... 24	23 ... 16	15 ... 0
Reserved[6)]	Node ID	Heartbeat Time [ms]

Table 7.7 [6)] = always 0

Producer Heartbeat Time

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1017	0	Producer Heartbeat Time[7)]	unsigned16	rw	no	0

Table 7.8 [7)] = Time [ms] between two sent heartbeat telegrams

Identify Object

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1018	0	Number of subsequent parameters	unsigned8	ro	no	4
	1	Manufacturer identifier	unsigned32	ro	no	0x000000AD
	2	Device identifier	unsigned32	ro	no	0
	3	Version number	unsigned32	ro	no	0
	4	Production date[8)]	unsigned32	ro	no	0

Table 7.9 [8)] = low word - high byte: calendar week (dec.); low word - low byte: calendar year (dec.)

Behavior in the Event of an Error

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1029	0	Number of subsequent parameters	unsigned8	ro	no	1
	1	Consumer Heartbeat Time[9)]	unsigned8	rw	no	0

Table 7.10 [9)] = For procedure in case of communication errors, see the table below

Data bit	Procedure in case of communication errors
0x00	Read head changes from **Operational** to **Pre-Operational**
0x01	Read head retains current status
0x02	Read head changes to **Stopped**

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Communication Parameter 1 TxPDO

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1800	0	Number of subsequent parameters	unsigned8	ro	no	5
	1	COB ID	unsigned32	rw	no	0x00000180 + Node ID
	2	Transmission Type	unsigned8	rw	no	254
	3	Repeat delay [value x 100 µs]	unsigned16	rw	no	0
	4	Not used				
	5	Event Timer	unsigned16	rw	no	0

COB ID: Bit			
31	30	29 ... 11	10 ... 0
PDO present: 0 = currently present 1 = not present	RTR access: 0 = permitted 1 = not permitted	...	CAN identifier[10)]

Table 7.11 [10)] = Cannot be changed when PDO is currently present

Communication Parameter 2 TxPDO

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x1801	0	Number of subsequent parameters	unsigned8	ro	no	5
	1	COB ID	unsigned32	rw	no	0x00000280 + Node ID
	2	Transmission Type	unsigned8	rw	no	254
	3	Repeat delay [value x 100 µs]	unsigned16	rw	no	0
	4	Not used				
	5	Event Timer	unsigned16	rw	no	0

COB ID: Bit			
31	30	29 ... 11	10 ... 0
PDO present: 0 = currently present 1 = not present	RTR access: 0 = permitted 1 = not permitted	...	CAN identifier[11)]

Table 7.12 [11)] = Cannot be changed when PDO is currently present

Mapping 1 TxPDO

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value	Meaning[12)]
0x1A00	0	Number of subsequent parameters	unsigned8	rw	no	8	Number of mapped objects
	1	1. mapped object	unsigned32	rw	no	0x00000108	**Position data XP24-XP31** Data = 0x2000, byte 1
	2	2. mapped object	unsigned32	rw	no	0x00000208	**Position data XP16-XP23** Data = 0x2000, byte 2
	3	3. mapped object	unsigned32	rw	no	0x00000308	**Position data XP08-XP15** Data = 0x2000, byte 3
	4	4. mapped object	unsigned32	rw	no	0x00000408	**Position data XP00-XP07** Data = 0x2000, byte 4
	5	5. mapped object	unsigned32	rw	no	0x00000508	**Speed SP08-SP15** Data = 0x2000, byte 5
	6	6. mapped object	unsigned32	rw	no	0x00000608	**Speed SP00-SP07** Data = 0x2000, byte 6
	7	7. mapped object	unsigned32	rw	no	0x00000708	**Status b08-b15** Data = 0x2000, byte 7
	8	8. mapped object	unsigned32	rw	no	0x00000808	**Status b00-b07** Data = 0x2000, byte 8

Table 7.13 [12)] = Application objects: 2 byte index, 1 byte subindex, 1 byte number of bits

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Mapping 2 TxPDO

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value	Meaning[13)]
0x1A01	0	Number of subsequent parameters	unsigned8	rw	no	8	Number of mapped objects
	1	1. mapped object	unsigned32	rw	no	0x00000908	**Position data YP24-YP31** Data = 0x2000, byte 9
	2	2. mapped object	unsigned32	rw	no	0x00000A08	**Position data YP16-YP23** Data = 0x2000, byte 10
	3	3. mapped object	unsigned32	rw	no	0x00000B08	**Position data YP08-YP15** Data = 0x2000, byte 11
	4	4. mapped object	unsigned32	rw	no	0x00000C08	**Position data YP00-YP07** Data = 0x2000, byte 12
	5	5. mapped object	unsigned32	rw	no	0x00000D08	**Event EV08-EV15** Data = 0x2000, byte 13
	6	6. mapped object	unsigned32	rw	no	0x00000E08	**Event EV00-SP07** Data = 0x2000, byte 14
	7	7. mapped object	unsigned32	rw	no	0x00000F08	**Warning WRN08-WRN15** Data = 0x2000, byte 15
	8	8. mapped object	unsigned32	rw	no	0x00001008	**Warning WRN00-WRN07** Data = 0x2000, byte 16

Table 7.14 [13)] = Application objects: 2 byte index, 1 byte subindex, 1 byte number of bits

Position Data and Status Data

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Default value
0x2000	0	Number of subsequent parameters	unsigned8	ro	no	16
	1	Position data XP31...XP24	unsigned8	ro	no	0x00
	2	Position data XP23...XP16	unsigned8	ro	no	0x00
	3	Position data XP15...XP08	unsigned8	ro	no	0x00
	4	Position data XP07...XP00	unsigned8	ro	no	0x00
	5	Speed data SP15...SP08	unsigned8	ro	no	0x00
	6	Speed data SP07...SP00	unsigned8	ro	no	0x00
	7	Reserved	unsigned8	ro	no	0x00
	8	Status	unsigned8	ro	no	0x00
	9	Position data YP31...YP24	unsigned8	ro	no	0x00
	10	Position data YP23...YP16	unsigned8	ro	no	0x00
	11	Position data YP15...YP08	unsigned8	ro	no	0x00
	12	Position data YP07...YP00	unsigned8	ro	no	0x00
	13	Event marker EV10...EV08	unsigned8	ro	no	0x00
	14	Event marker EV07...EV00	unsigned8	ro	no	0x00
	15	Warnings WRN15...WRN08	unsigned8	ro	no	0x00
	16	Warnings WRN07...WRN00	unsigned8	ro	no	0x00

Binary input: Bit							
7	6	5	4	3	2	1	0
XP31	XP30	XP29	XP28	XP27	XP26	XP25	XP24
XP23	XP22	XP21	XP20	XP19	XP18	XP17	XP16
XP15	XP14	XP13	XP12	XP11	XP10	XP09	XP08
XP07	XP06	XP05	XP04	XP03	XP02	XP01	XP00
SP15	SP14	SP13	SP12	SP11	SP10	SP09	SP08
SP07	SP06	SP05	SP04	SP03	SP02	SP01	SP00
0	0	0	0	0	0	0	0
0	0	0	0	EV	WRN	NP	ERR[14)]

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Binary input: Bit							
7	6	5	4	3	2	1	0
YP31	YP30	YP29	YP28	YP27	YP26	YP25	YP24
YP23	YP22	YP21	YP20	XP19	YP18	YP17	YP16
YP15	YP14	YP13	YP12	YP11	YP10	YP09	YP08
YP07	YP06	YP05	YP04	YP03	YP02	YP01	YP00
0	0	0	0	0	EV10	EV09	EV08
EV07	EV06	EV05	EV04	EV03	EV02	EV01	EV00
WRN15	WRN14	WRN13	WRN12	WRN11	WRN10	WRN09	WRN08
WRN07	WRN06	WRN05	WRN04	WRN03	WRN02	WRN01	WRN00

Table 7.15 [14)] = When the ERR bit is set, the XP, YP, and SP bits contain the specific error code or the last valid value (depending on the corresponding parameter settings)

CANopen Data Range

X position **XP**: ± 0 - ± 10,000 m (valid for all resolutions)

Y position **YP**: ± 0 - ± 10,000 m (valid for all resolutions)

Speed **SP**: 0 - 65 m/s, unknown speed = 65535

Events **EV**: 0 - 998, repair strip = 999

Warning bitfield **WRN**: contains the warnings for the last measuring cycle. The 16 warnings with the highest priority are listed.

WRN00 corresponds to Warning Code 0

WRN15 corresponds to Warning Code 15

"1" = warning active.

Additionally, the WRN bit is set in the status word.

Warning Codes

Warning code	Description	Priority
0	No other warning present. This code appears when all warnings have been read.	-
1	A code with non-PCV content was found	1
2	Read head too close to code tape	2
3	Read head too far from code tape	3
4	Y position too large. The sensor is just before OUT	4
5	Y position too small. The sensor is just before OUT	5
6	The read head is rotated or tilted in relation to the code tape	6
7	Low level of code contrast	7
8	Repair strip detected	8
9	Temperature too high	9
10	Reserved	-
11	Reserved	-
12	Reserved	-
13	Reserved	-

Warning code	Description	Priority
14	Reserved	-
15	Reserved	-

Table 7.16 If no warnings are present, all bits in the warning data set are set to 0.

Serial Number

Index	Subindex	Designation	Data type	Attribute	PDO mapping possible	Value
0x3000	0	Serial number	ASCII string	ro	no	Serial number

7.1.4 Device Parameters

The device parameters allow you to parameterize the read head using CANopen. The device parameters are always transferred to the read head in full.

Parameterization Object 0x3001

Subindex	Designation	Function	Data type	Attribute	Primary data
0	Number of subsequent parameters	Number of subindices	unsigned8	ro	16
1	Orientation	Orientation of read head in relation to code tape	unsigned32	rw	**0x00: 0°** 0x01: 180° 0x02: 0°/180° 0x03: 0°/90°/180°/270°
2	Code Tape Type	Configuration of code tape width	unsigned32	rw	0x00: surface 0x01: 1-row **0x02: 2-row** 0x03: 3-row 0x04: 4-row 0x05: 5-row 0x06: 6-row 0x07: 7-row 0x08: 8-row
3	X-Resolution	Resolution: Multiplier for the length in the direction of the X coordinate	unsigned32	rw	0x00: 0.1 mm **0x01: 1 mm** 0x02: 10 mm
4	Y-Resolution	Resolution: Multiplier for the length in the direction of the Y coordinate	unsigned32	rw	0x00: 0.1 mm **0x01: 1 mm** 0x02: 10 mm
5	Speed-Resolution	Resolution: Multiplier for the velocity output	unsigned32	rw	**0x00: 0.1 m/s** 0x01: 0.01 m/s 0x02: 0.001 m/s
6	Horizontal Offset	Length: Offset in the direction of the X coordinate	signed32	rw	**0 mm** – ±10,000,000 mm

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Subindex	Designation	Function	Data type	Attribute	Primary data
7	Reserved	Reserved	unsigned8	ro	-
8	Output1 Function	Meaning of the output signal at output 1	unsigned8	rw	**0x00: No Function** 0x01: Overspeed 0x02: Warning 0x03: Error 0x04: Dirty 0x05: Event 0x06: No Position 0x07: Repair Strip
9	Output1 Overspeed Value	Speed at which output 1 is activated	unsigned32	rw	0 – 65,534 cm/s **125 cm/s**
10	Output2 Function	Meaning of the output signal at output 2	unsigned8	rw	**0x00: No Function** 0x01: Overspeed 0x02: Warning 0x03: Error 0x04: Dirty 0x05: Event 0x06: No Position 0x07: Repair Strip
11	Output2 Overspeed Value	Speed at which output 1 is activated	unsigned32	rw	0 – 65,534 cm/s **125 cm/s**
12	Output3 Function	Meaning of the output signal at output 3	unsigned8	rw	**0x00: No Function** 0x01: Overspeed 0x02: Warning 0x03: Error 0x04: Dirty 0x05: Event 0x06: No Position 0x07: Repair Strip
13	Output3 Overspeed Value	Speed at which output 3 is activated	unsigned32	rw	0 – 65,534 cm/s **125 cm/s**
14	No Position Value X	X value if no code tape is visible	Array of unsigned8 Bytes 0 - 3	rw	0x00: Last Valid Position **0x01: Specified Position**
	Specific Value X	Specific X value	Bytes 4 - 7	rw	**0 mm** - 10,000,000 mm

Subindex	Designation	Function	Data type	Attribute	Primary data
15	No Position Value Y	Y value if no code tape is visible	Array of unsigned8 Bytes 0 - 3	rw	0x00: Last Valid Position **0x01: Specified Position**
	Specific Value Y	Specific Y value	Bytes 4 - 7	rw	**0 mm** - ±10,000,000 mm
16	No Position Value Speed	Speed value if no code tape is visible	Array of unsigned8 Bytes 0 - 3	rw	0x00: Last Valid Speed **0x01: Specified Speed**
	Specific Value Speed	Specific speed value	Bytes 4 - 7	rw	**0 mm/s** - 65535 mm/s

Table 7.17 **Bold** = default values

7.2 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 (see parameterization software description). 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:

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

With auto trigger, the trigger period is 0.025 s.

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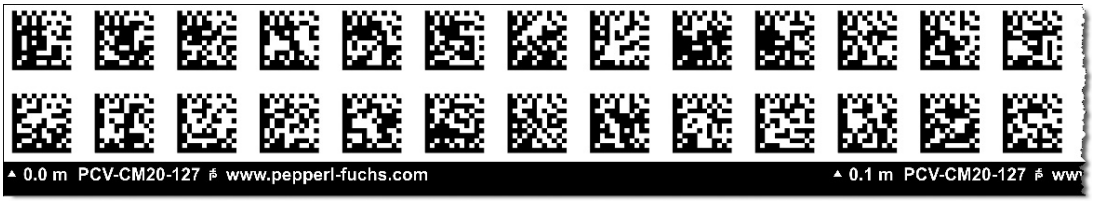
Example calculation
At a speed of 3 m/s and with a trigger period of 25 ms, the minimum length of the event marker is therefore:
$L_{Event\ marker}$ = 30 mm +3 m/s * 0.025 s * 2 = **180 mm**

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.

7.3 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 (see parameterization software description). 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.

8 Appendix

8.1 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**	**l**
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**	**|**
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**

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8.2 Code cards with special functions

The following code cards have special functions:

- ENABLE
- STORE
- CANCEL
- USE
- DEFAULT

Enable

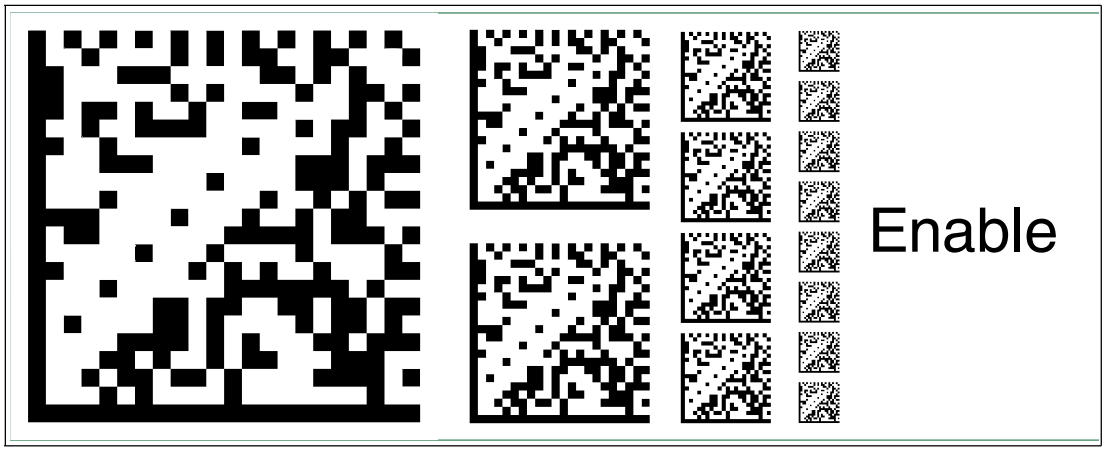

Figure 8.1 The code card "ENABLE" is used to activate external parameterization operating mode.

Store

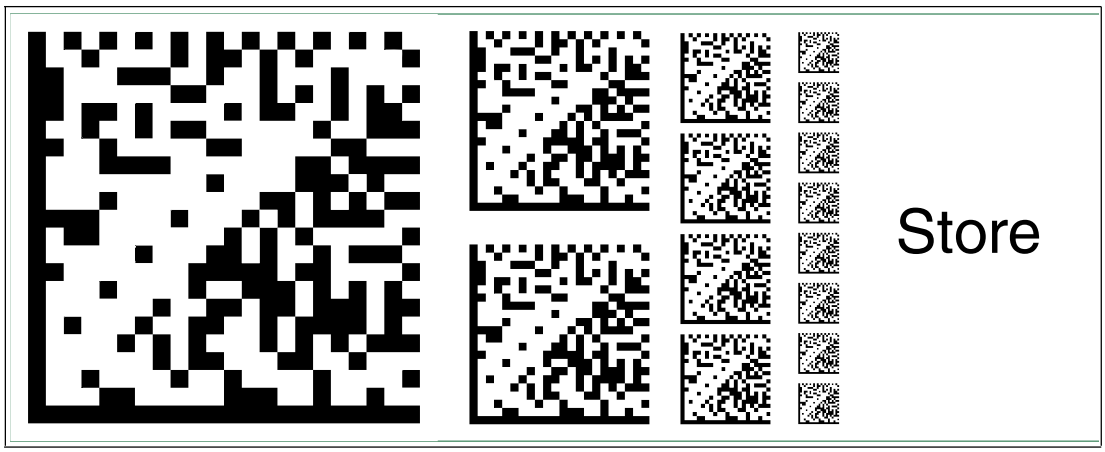

Figure 8.2 The code card "STORE" stores the modified parameterization in the non-volatile memory of the reading head and terminates external parameterization operating mode.

Cancel

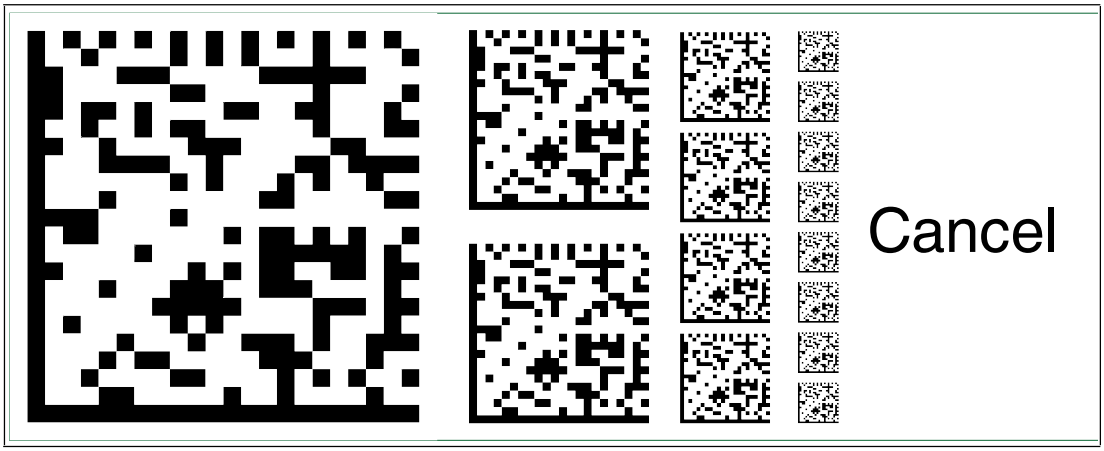

Figure 8.3 The code card "CANCEL" discards the modified parameterization and terminates external parameterization operating mode. The reading head switches to normal mode and adopts the last valid configuration that was saved.

Use

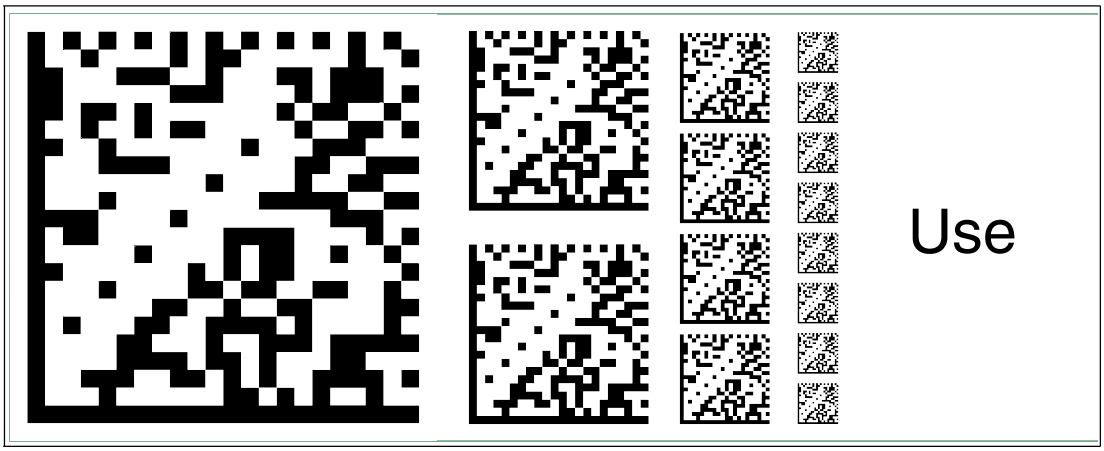

Figure 8.4 The code card "USE" adopts the modified configuration in the **volatile** working memory of the reading head and terminates external parameterization operating mode. The reading head then operates with this configuration. However, if the reading head is switched off and on again, the configuration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

Default

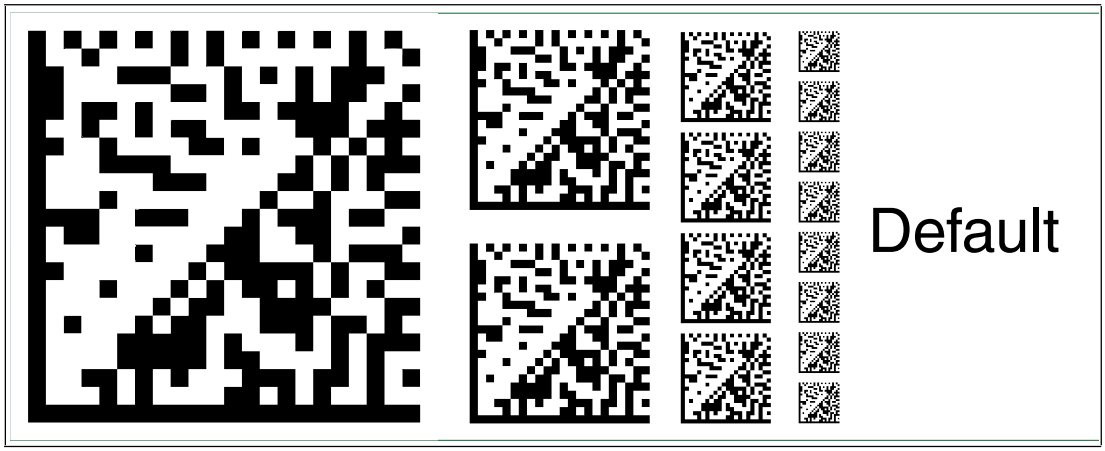

Figure 8.5 The code card "DEFAULT" restores the settings of the reading head to default and terminates external parameterization operating mode.

8.3 Code Cards for Setting the Baud Rate

Parameterization allows you to assign various transfer rates to the reader for communication via CANopen.

Baud Rate: 10 kBaud

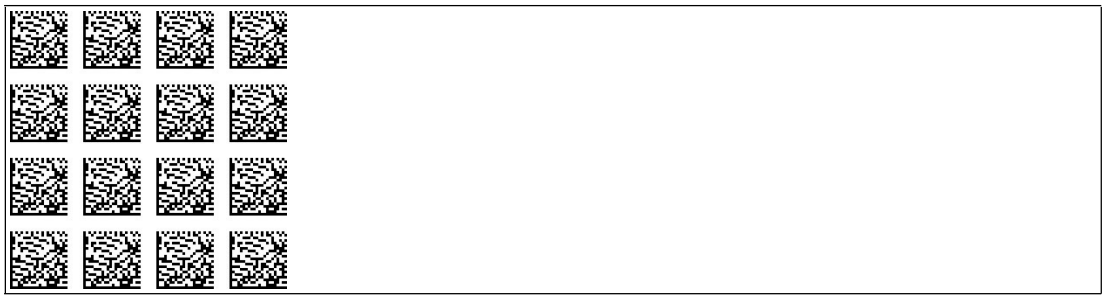

Figure 8.6 The code card assigns the 10 kBaud baud rate to the read head

Baud Rate: 20 kBaud

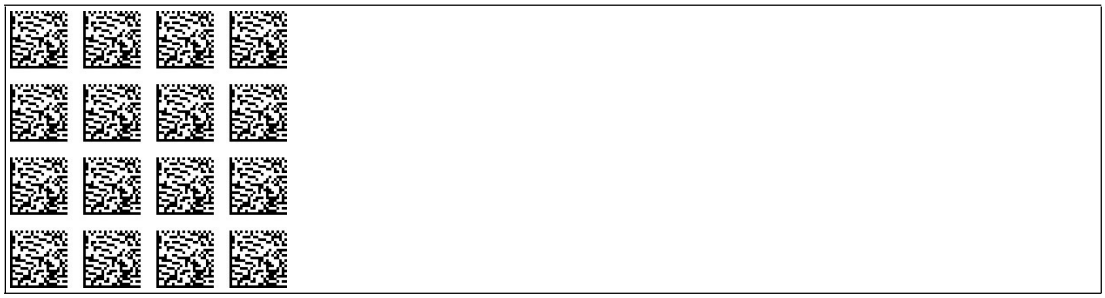

Figure 8.7 The code card assigns the 20 kBaud baud rate to the read head

Baud Rate: 50 kBaud

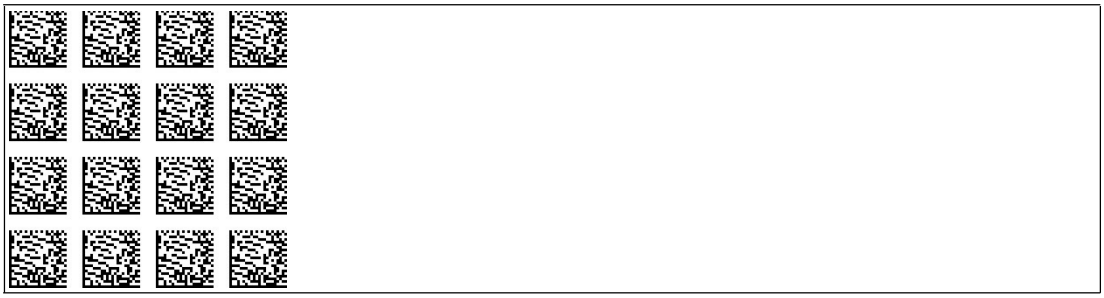

Figure 8.8 The code card assigns the 50 kBaud baud rate to the read head

Baud Rate: 125 kBaud

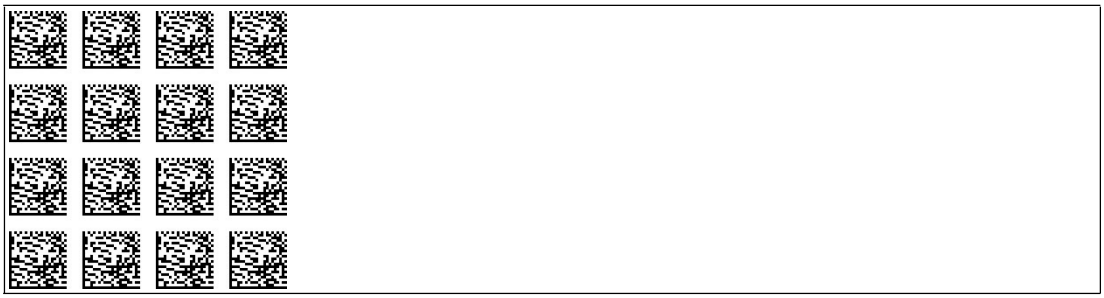

Figure 8.9 The code card assigns the 125 kBaud baud rate to the read head

Baud Rate: 250 kBaud

Figure 8.10 The code card assigns the 250 kBaud baud rate to the read head

Baud Rate: 500 kBaud

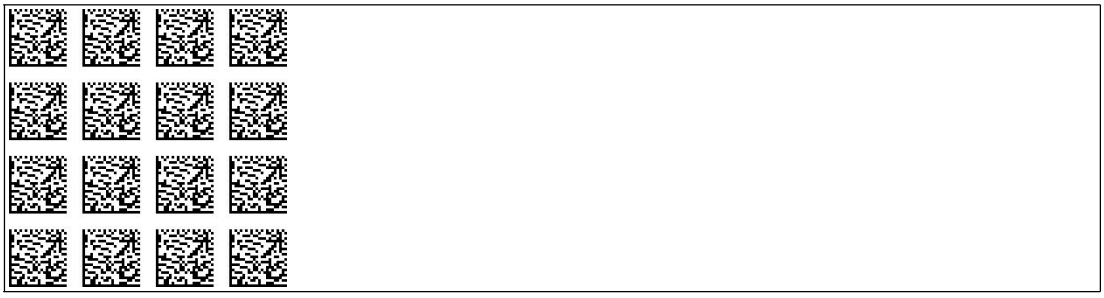

Figure 8.11 The code card assigns the 500 kBaud baud rate to the read head

Baud Rate: 1 MBaud

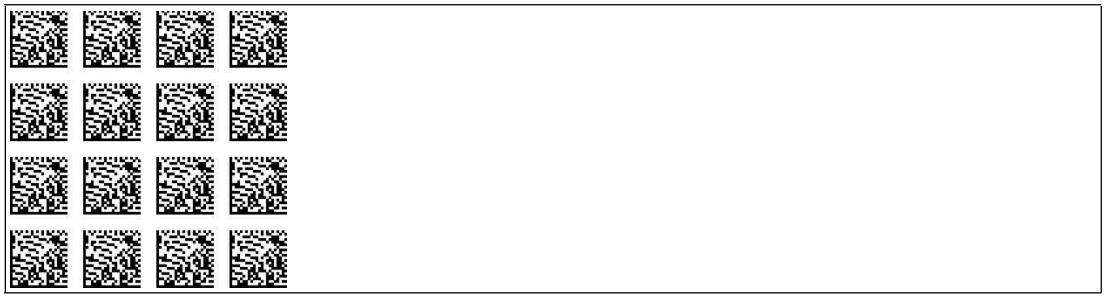

Figure 8.12 The code card assigns the 1 MBaud baud rate to the read head

Auto Baud Rate

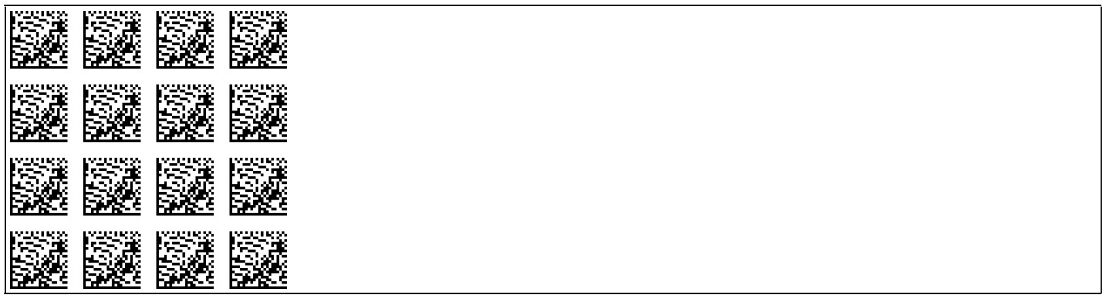

Figure 8.13 The code card assigns the auto baud rate to the read head.

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