

PCV100QS-F200-B17-V1D

**Data Matrix
Positioning System**

Manual



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1 Introduction

1.1 Content of this Document

This document contains information that you need in order to use your product throughout the applicable stages of the product life cycle. These can include the following:

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



Note

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



Note

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

The documentation consists of the following parts:

- Present document
- Datasheet

Additionally, the following parts may belong to the documentation, if applicable:

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

1.2 Target Group, Personnel

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

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

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

1.3 Symbols Used

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

Warning Messages

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

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



Danger!

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.



Warning!

This symbol indicates a possible fault or danger.

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



Caution!

This symbol indicates a possible fault.

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

Informative Symbols



Note

This symbol brings important information to your attention.



Tip

This symbol brings an useful tip to your attention.



Example

This symbol provides an example of the issue described.



Action

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

1.4 Registered Trademarks

PROFINET®: Trademark of PROFIBUS Nutzerorganisation e.V. (PNO)

SIMATIC, TIA Portal: Trademarks of SIEMENS AG

2 Safety

2.1 Security Information

The read head has a configuration interface. This is used for parameterization, for downloading image data, and for updating the firmware. The configuration interface is deactivated if there is an active PROFINET connection to the device.

The read head can be set to a recovery mode by pressing a button during the boot process: recovery mode also allows firmware updates to be performed.

From a security perspective, the following precautions must therefore be taken for the product by the responsible application operator:

- Physically secure the device against unauthorized access
- Ensure that the device is only operated on an isolated network without connection to the company network, internet, or cloud services;
 - The device may only communicate with a higher-level controller, or with a defined, trusted circle of network participants

2.2 Intended Use

Together with the positioning targets intended for this purpose, the read head forms a high-resolution optical positioning system. This system is designed for precise linear positioning of conveyor and transport systems along a defined traverse path. The positioning targets are attached to a fixed part of the system parallel to the traverse path, while the read head is mounted on the moving part of the system. Alternatively, the positioning targets can be applied to a moving part of the system while the read head is permanently mounted.



Caution!

Only use the intended positioning targets that are available as accessories for the read heads.



Caution!

The positioning system is primarily intended for indoor use. Outdoor operation is only possible to a limited extent. In particular, positioning targets outdoors must not be mounted on the ground. For more information, see chapter 4.2.



Caution!

Only operate the device within the technical parameters specified in these instructions and in the datasheet.

2.3 Reasonably Foreseeable Misuse

Any use that goes beyond or contradicts the intended use is considered misuse. The operator is solely liable for any resulting damage.

Reasonably foreseeable misuse includes in particular:

- Use in hazardous areas
- Medical applications
- Outdoor use outside the ambient conditions permitted in the datasheet
- Use of unauthorized or reproduced positioning targets
- Operation outside the specified technical parameters (e.g., supply voltage, temperature, velocity, read distance)
- Use as an independent safety component within the meaning of the Machinery Directive



Warning!

Danger due to ambiguous position information

Multiple use of code ranges can lead to ambiguous position specifications. As a result, the real position of the device cannot be clearly determined. The control logic can then perform an incorrect action at an incorrect position.

Uncontrolled movements can cause serious injury to persons and cause significant plant damage.

- During planning, ensure the position information for the read head is unique throughout the entire system.
- Never use double code ranges.



Note

If the machine manufacturer has designed the component combination accordingly, it can be used as a safety-related component within a safety function.



Caution!

Intervening in or modifying the device is not permitted

- Do not make any interventions in or modifications to the device. Such measures are not permitted.
- The use of a Data Matrix code tape that has not been approved by Pepperl+Fuchs is considered an intervention in or modification to the positioning system.
- Do not open the device. It does not contain any user-configurable or user-serviceable components.

3 Product Description

3.1 Basic System Functions

The high-resolution positioning system consists of a read head in conjunction with suitable positioning targets. Features of the read head include appropriate connection options, a camera module, and an integrated lighting unit. This eliminates the need for an additional external lighting unit such as an external strobe. In addition, the read head is insensitive to overexposure due to external lighting.

First, an image is recorded for precise positioning. The read head searches for positioning targets in this image. The exact position can then be calculated based on the position of the positioning targets in the image.

The functionality of the system is determined by the type of positioning targets used, which must be compatible with the respective read head. Different types of targets influence the specific functional and application possibilities. The basic functions of the read head in combination with the various compatible positioning targets are explained in detail below.

3.1.1 Positioning on the Code Tape

The Data Matrix code tape is used as a positioning target for precise linear positioning in conveyor and transport systems. In combination with the Data Matrix code tape, the read head records the following data:

- x position along the code tape
- y offset (y offset to the center of the code tape)
- z distance (height above the code tape)
- Speed
- Rotation angle (rotation relative to the code tape)
- Status information



Figure 3.1 Example representation of a typical linear positioning application with a fixed code tape and read head on the moving part

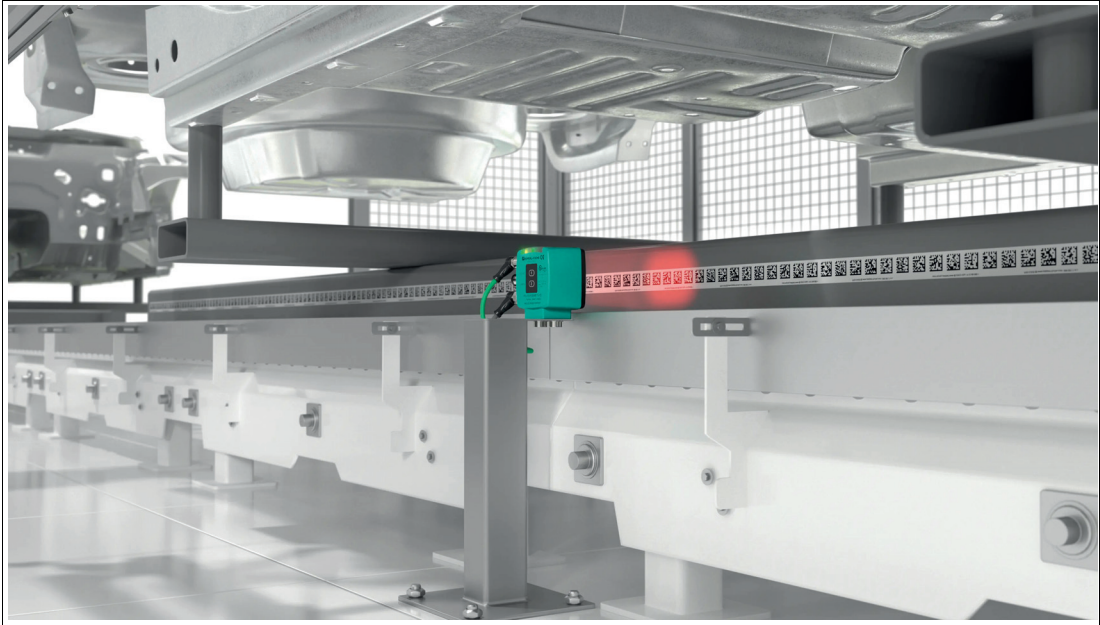


Figure 3.2 Example representation of a typical linear positioning application with a fixed read head and code tape on the moving part

3.1.2 **Maximum Data Matrix Code Tape Length**

The maximum length of the Data Matrix code tape is 100 km.

This code tape length is sufficient for very large applications and offers sufficient reserves for later expansions and for systems with many branches and parallel conveyor lines.

3.2 **LED Indicator**

The read head has seven LEDs that indicate the current operating state. The LEDs are used for visual function checks and enable quick error diagnosis.

The function and meaning of the individual LEDs are set out below.



Figure 3.3 LED Indicator



Note

The information in the following table applies to normal operation. When a control button is pressed, the behavior of the LEDs changes. The control buttons are for Pepperl+Fuchs service personnel and have no function for the end user.

LED Status

Item	Designation	LED color	LED indicator	Meaning
1 2	ACT1/Link1 ACT2/Link2		Lights up green	PROFINET connection activated
			Flashing yellow	PROFINET TX/RX data traffic
			Off	No PROFINET connection activated
3	BUS ERR		Flashing green	DCP signal is triggered via the bus
			Lights up red	PROFINET communication error
4	PWR/ADJ SYSERR/NO CODE		Lights up red	System error
			Lights up green	Normal operation, code tape detected
			Flashing red (2 Hz)	Code tape not detected
5	OUT1/ADJ Y		Lights up yellow	Output OUT1 set
6	OUT2/ADJ Z		Lights up yellow	Output OUT2 set
7	INTERNAL DIAGNOSTIC		Illuminated	Internal error, send read head to Pepperl+Fuchs for testing. NOTE - LED 6 also lights up red. - If LED 7 lights up, the states of LEDs 1 ... 5 are undefined and must not be used for visual function checks or diagnosis.

3.3 Control Elements on the Read Head

The read head has two control buttons on the rear panel that enable quick access to the respective function.

In this device type, these control buttons are exclusively for Pepperl+Fuchs service personnel, and have no function for the user.

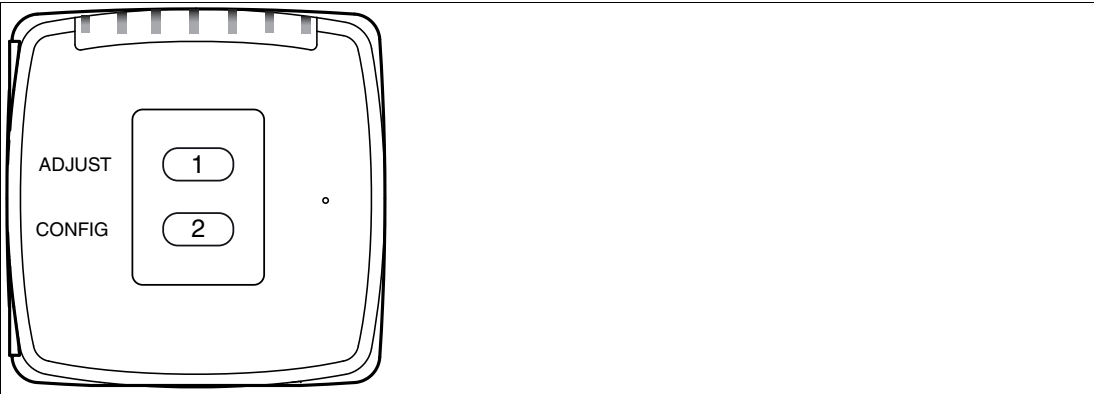


Figure 3.4 Display of the control buttons for both housing variants

3.4 Accessories

Suitable accessories for your read head can be found on the "Related products" tab of our website www.pepperl-fuchs.com.

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4 Planning

This chapter contains all the technical device properties required for error-free system planning.

Responsibility of the System Planner

The system planner is solely responsible for assessing whether the read head is suitable for the specific application and the ambient conditions. As Pepperl+Fuchs has no influence on the selection and the specific application, Pepperl+Fuchs assumes no liability for the suitability in the specific overall system.



Note

Warranty

Pepperl+Fuchs' liability is limited to the specified and consistent quality of the individual product supplied within the scope of the applicable delivery conditions.

4.1 Plant Design

The positioning system consists of a read head and matching positioning targets. Suitable positioning targets can be found as accessories on the product details page for the respective read head on our homepage in the "Related Products" tab.

In the following sections, the read head and the positioning targets are explained both individually and in how they interact as a complete system.

Usage Conditions

The permissible ambient conditions are crucial for reliable operation. Detailed information and information on ensuring system availability, even under unfavorable conditions, are included, see chapter 4.2.

Positioning Targets and Data Output

You will receive basic information on the positioning targets and a detailed description of the system functions. The output data is named and its meaning is explained. Applications for which the respective positioning targets are suitable are described.

Mounting and Tolerances

For successful installation, the tolerance ranges of the read head are described in detail. The permissible mounting options for the read head and positioning targets can be derived from this. This information forms the basis for accurate mounting.

Additional Functions

Finally, other functions of the read head are covered, such as the output of quality values.

4.2 Ambient Conditions

This section describes the ambient conditions under which the positioning system can be operated. Detailed specifications on the degree of protection, temperature range, and applicable standards can be found in the datasheet for the read head and the positioning targets.

Indoor Use

The positioning system is primarily designed for indoor use. Compliance with specified degree of protection, temperature range, and relevant standards is the basic prerequisite for proper operation.

Indoor optical interference, especially dirt on the code tape, can affect system reliability. Although the system has high redundancy, this can affect reading performance. The read head has an internal function to evaluate the optical quality of the code tape (). This function enables early detection of dirt or damage and therefore prompt corrective action. For instructions on cleaning the code tape, see chapter 8.3.

Outdoor Use

In addition to the optical interference that can occur indoors, additional environmental influences are expected outdoors. The read head and the code tape are generally resistant to outdoor environmental conditions. However, optical interference outdoors is often unavoidable. Uncontrollable environmental factors such as snow, ice, rain, or condensation can impair the read head's view of the positioning targets and prevent reliable positioning.

Note

Protective Measures Outdoors

If the system needs to be used outdoors, steps must be taken to prevent optical interference. A key measure is to protect the code tape and the read head from rain, for example by using a canopy. Water droplets on the read head glass or on the code tape can impair the reading of Data Matrix codes. Ideally, a continuous canopy should be installed between the read head and the code tape. Without such a protection, extreme snowfall or rain may cause temporary system outages.



4.3 Positioning Targets

Positioning targets are reference points within the positioning system. They enable the read head to determine its exact position.

The selection of available positioning targets depends on the respective read head type. A suitable positioning target for your specific read head can be found on the corresponding product details page on our homepage.

The following sections explain in detail the relevant properties of the positioning targets that are important for the read head.

4.3.1 Characteristics of the Data Matrix Codes

The Data Matrix code tape consists of Data Matrix codes that contain information about the absolute position. These codes act as reference points for determining the position of the read head.

Fail-Safety via ECC200

The Data Matrix code tape uses fail-safe Data Matrix codes according to ECC200 (Error Correction Code). These contain additional information to prevent and correct read and transmission errors. This ensures reliable reading even with heavily soiled or stressed code tapes and is crucial for system redundancy.

Structure of the Data Matrix Code

The following figure shows an example of an ECC200 Data Matrix code.

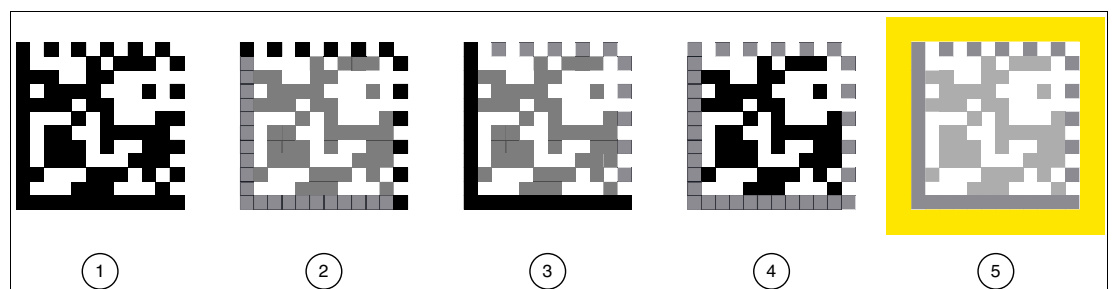


Figure 4.1 Data Matrix code ECC200

An ECC200 Data Matrix code consists of several functional areas that are required for reliable detection and evaluation:

Data Matrix Code (1)

- ECC200, symbol size 12×12, black/white

Alternating Pattern (2)

- Pattern of alternating black and white modules
- Even number of modules
- Allows the data density to be determined
- Used for symbol size recognition and ECC200 type recognition

Finder Pattern (3)

- Characteristic pattern of black modules in an "L" shape
- Allows the Data Matrix code to be found
- Detects distortion
- Clearly determines the location and size of the Data Matrix code

Data Area (4)

- Actual data field of the Data Matrix code
- Matrix of black and white modules representing the coded information
- Contains the error correction area with additional data for detecting and correcting read and transmission errors

Quiet Zone (5)

- White area around the Data Matrix code (shown in yellow in the "Data Matrix code ECC200" figure above)
- Delineates the code from other objects or the background
- Width of the quiet zone: 2 mm

Note**Respect the Quiet Zone**

The quiet zone around the Data Matrix code must have a width of **at least 2 mm**. It must not be breached by stickers or when cutting the code tape, otherwise error-free detection by the read head is no longer guaranteed.

**4.3.2****Data Matrix Code Tape**

Data Matrix code tapes enable the exact positioning of linear transport systems, such as freight elevators and monorail conveyors.

How It Works

The read head detects the information on the Data Matrix code tape and continuously supplies the following values to the higher-level system:

- **Position:** x, y, and z position
- **Orientation:** Angle
- **Speed:** Traversing speed

Material and Mounting

The code tape is made of silicone-free polyester film. The rear side is coated with a permanent acrylate adhesive, which is used to affix the code tape along the travel path.

- **Orientation aid:** There is a positioning target every 100 mm along the lower edge of the code tape. This is used for exact alignment during mounting.
- **Mounting details:** For detailed information on mounting, see chapter 5.1.
- **System limits:** The maximum permissible total length is specified, see chapter 3.1.2.



Note
System Compatibility

Error-free operation of the positioning system is only guaranteed if the read head and the code tape type used are compatible with each other. Information on compatibility can be found on the homepage.



Figure 4.2

Center Line Definition ($y = 0$)

The center line identifies the reference axis at which the read head outputs the value $y = 0$. The position of the center line depends on the code tape type:

Single-Row Code Tape (PCV*CA10)

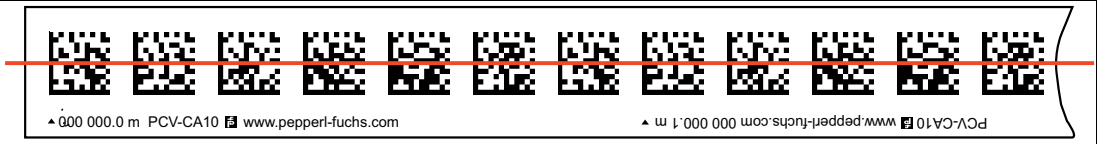


Figure 4.3 Center line in the middle of the Data Matrix codes

Double-Row Code Tape (PCV*CA20)

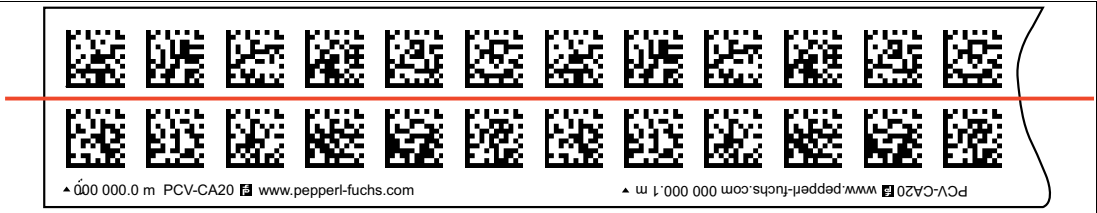


Figure 4.4 Center line in the middle between the two rows on the code tape

4.3.3 Operating with a Data Matrix Event Marker Tape

The event marker tape is a special Data Matrix code tape with a standard length of one meter. It contains Data Matrix codes in which a fixed number from the number range 001 to 999 is coded.

Function

When entering the area of an event marker tape, the read head sets a marker tape flag and outputs the marker number. Event marker tapes are used to start defined processes at specific positions in a system. To enable this functionality, the reading of the event marker tape must be programmed as an event in the control system and the associated sequence stored.

Mounting and Position Detection

The event marker tape is affixed over or next to the standard Data Matrix code tape. The corresponding setting can be configured in the read head. For configuration details, see chapter 5.3.1. If the event marker tape is affixed over the standard Data Matrix code tape, the read head does not supply an absolute position, but increments the position based on the last known absolute position.

Note

No Position Determination After Restarting over an Event Marker Tape

If the event marker tape is affixed over the standard Data Matrix code tape, the read head must not be restarted directly over an event marker tape. As the event marker tape does not supply an absolute position, the system cannot determine a valid position in this case.

Length of the Event Marker Tape

The standard length of one meter can be shortened to a minimum of three Data Matrix codes. The required length depends on the movement speed of the conveyor and transport system. The higher the speed, the longer the event marker tape must be. The full length of one meter is required at the maximum permissible movement speed of the positioning system.

The minimum length as a function of the travel speed is calculated as follows:

$$L_{\text{event marker tape}} = 0.06 \text{ m} + (V_{\text{max}} [\text{m/s}] * \text{cycle time} [\text{s}] * 2)$$

The cycle time can be found in the data sheet for your read head.

Example

Example Calculation

A speed of 3 m/s and a cycle time of 100 Hz (= 0.01 s) results in:

$$L_{\text{event marker tape}} = 0.06 \text{ m} + (3 \text{ m/s} * 0.01 \text{ s} * 2) = \mathbf{0.12 \text{ m}}$$

Marking

Event marker tape can be identified by the printed number, e.g., "MARKER 012". The following figure shows a section of an event marker tape with the number #12.



Figure 4.5 Identification of event marker tape

4.4

Position, Angle, and Velocity Output with Data Matrix Code Tape

**Note**

The following figures are shown using the example of a PXV Data Matrix code tape. The principle described applies to PCV Data Matrix code tapes in the same way.

Position Output in the x Direction

The position in the x direction is determined using the Data Matrix codes recorded in the field of view of the read head. The Data Matrix codes act as reference points for determining the position. Each code contains unique position information.

A single Data Matrix code in the field of view of the read head is sufficient for determining the position. Additional codes increase the redundancy and availability of the system.

The exact position is determined by the position of the detected Data Matrix code within the field of view. The system calculates the exact position in the x direction based on the offset from the center of the image. This enables high-precision position determination.

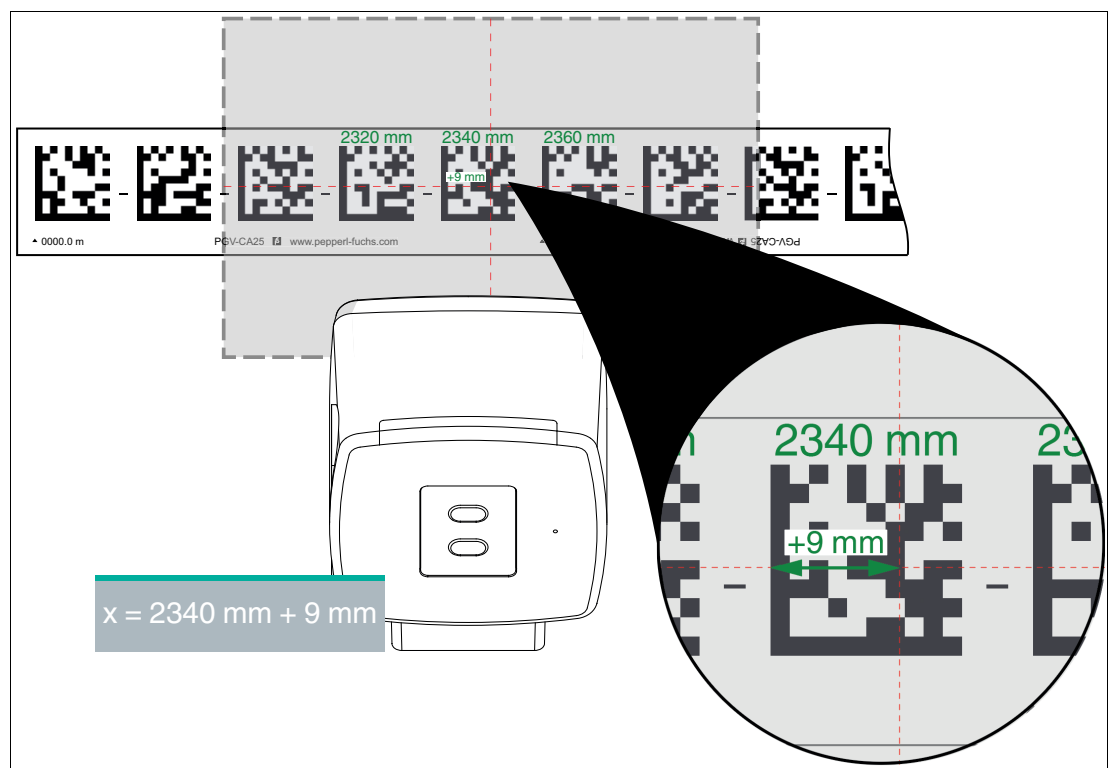


Figure 4.6 Determination of the x position via the code offset to the center of the image

Position Output in the y Direction

The read head determines the distance from the y zero line of the Data Matrix code tape to the center of the read field. This value is transmitted to the controller.

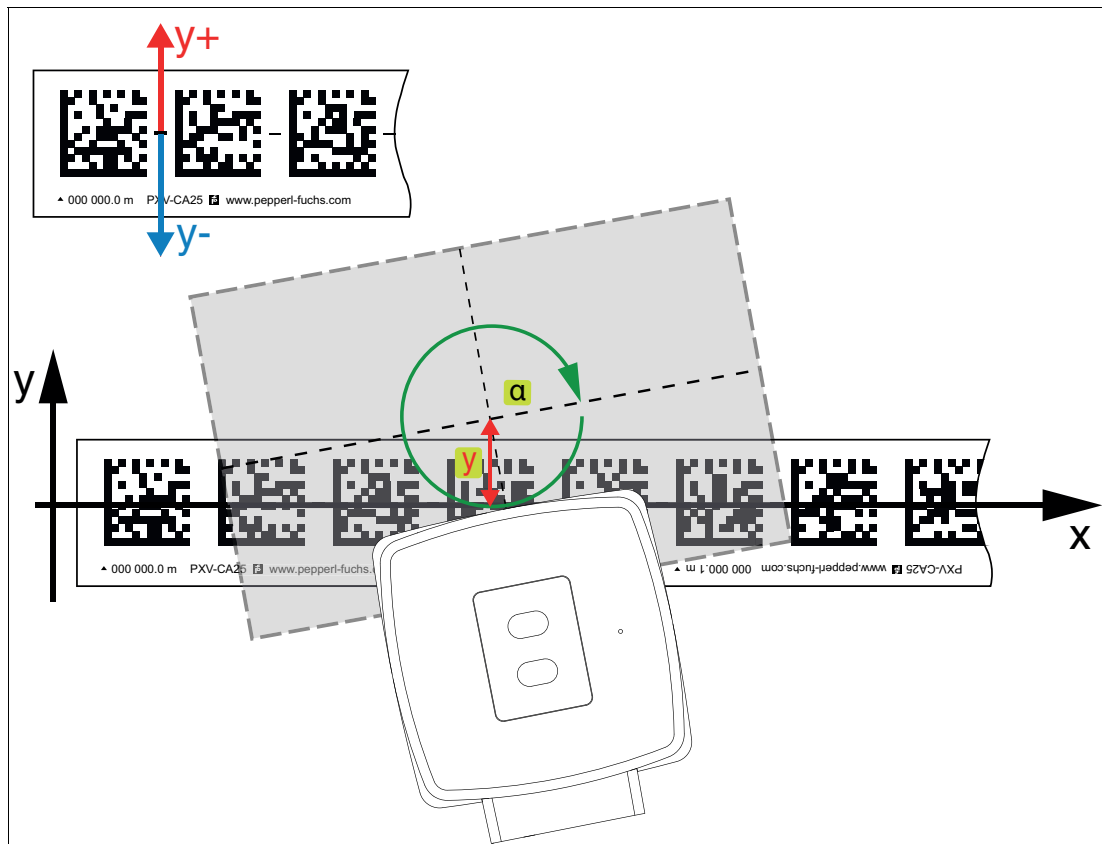


Figure 4.7 For example: Position $y = 20 \text{ mm}$ and angle $\alpha = 350^\circ$

Note

Code Tape Coordinate System

The coordinate system for the Data Matrix code tape is defined by the code tape itself. Regardless of the orientation of the read head, the positive and negative y directions always remain clearly defined and identical.

Position Output in the z Direction

The distance in the z direction to the Data Matrix code tape is determined based on the known size of the detected Data Matrix codes.

Note

Accuracy of the Position Output in the z Direction

The accuracy of the position output in the z direction requires that all Data Matrix codes located in the field of view have the same distance from the read head. This requirement is not met, for example, when the read head is tilted or when traversing curves.

Angle Value

The read head detects the absolute angle relative to the tracked lane with a maximum resolution of 0.1° .

As the Data Matrix code tape contains direction information, the angle is specified as absolute to the lane. Starting from the configured orientation, an angle up to an offset of $\pm 20^\circ$ is output.



Note

Angle Specification as an Absolute Value

Angles are output as absolute values, based on the set angular resolution (see chapter 5.3.2).

For example: With a resolution of 0.1° , an angle of 10° is output as $10^\circ / 0.1^\circ = 100$.



Note

Resolution and accuracy are different parameters. The device-specific information on resolution and accuracy can be found in the corresponding data sheet.

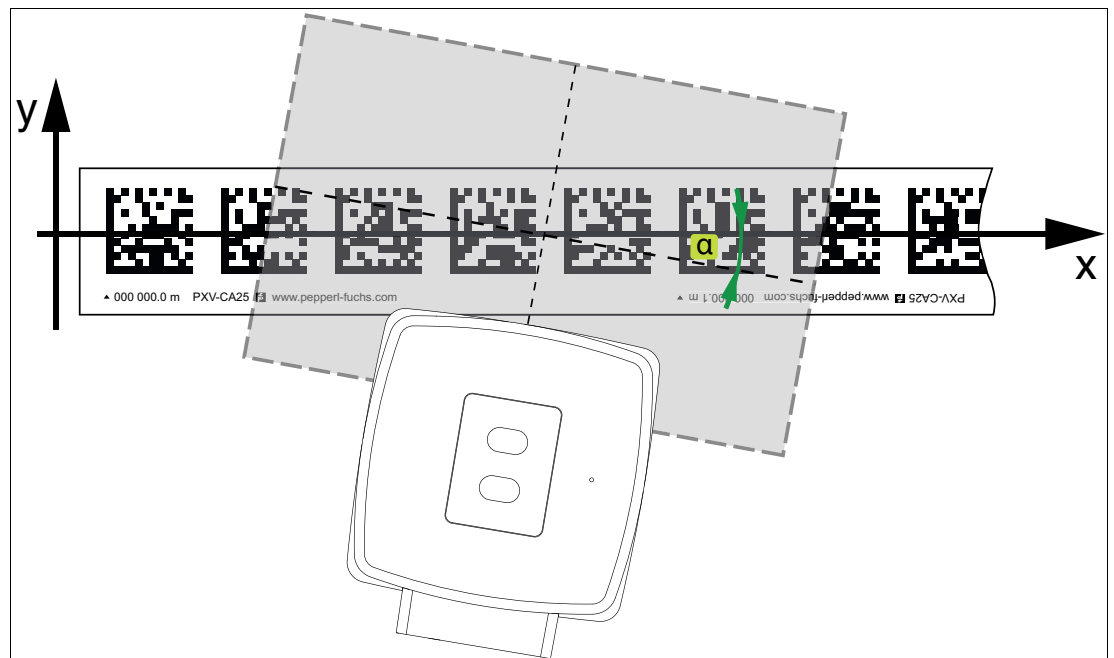


Figure 4.8 Read head alignment to the code tape at an angle of 10°

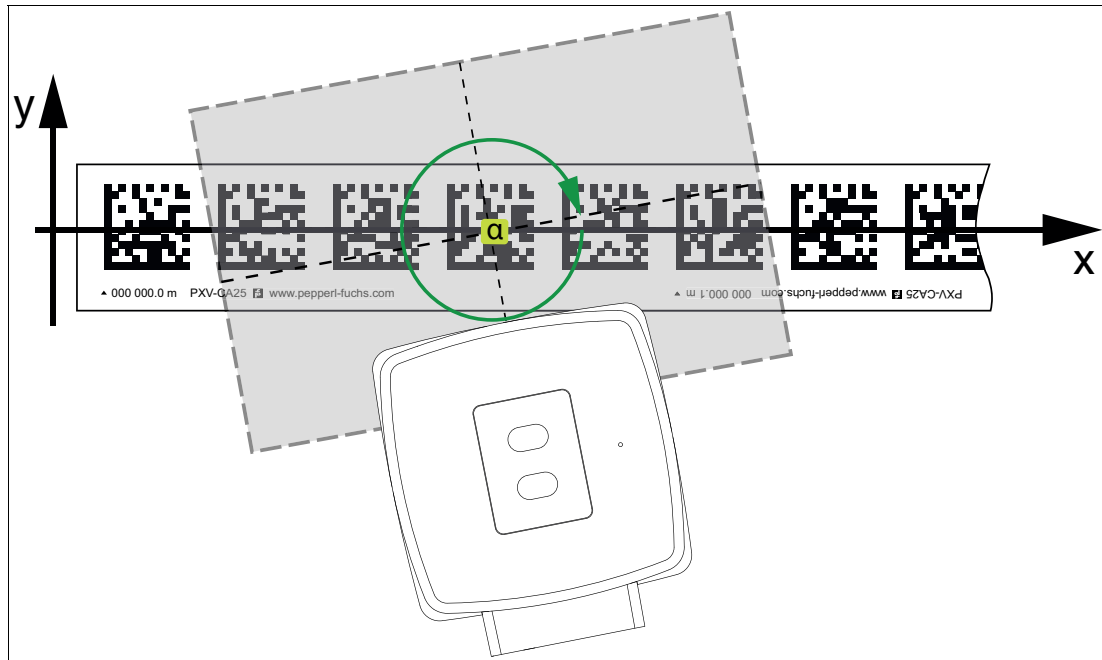


Figure 4.9 Read head alignment to the code tape at an angle of 350 °

Velocity Output

The read head determines the movement speed in the x direction based on the read Data Matrix position codes.

Direction of Travel and Sign

The output velocity can be positive or negative and therefore indicates the direction of travel:

- **Positive velocity:** Movement in the direction of ascending Data Matrix position codes (forward travel).
- **Negative velocity:** Movement in the direction of descending Data Matrix position codes (reverse travel).

Calculating the Velocity

In principle, the velocity is calculated on the basis of the most recent positions and the elapsed time between them. To increase the accuracy of the velocity value, several position values are included in the calculation.

The values from the history are divided into several blocks. The values are first averaged in the respective blocks to then calculate the velocity.

Note

Based on the calculation method, the output velocity maps a change in the actual velocity with a slight time delay.



4.5 Field of View of the Read Head

The field of view of the read head is the maximum imaging area on the sensor chip that is determined by the optical properties of the camera.

The size of the field of view depends on the distance between the read head and the positioning targets:

- As the distance increases, the field of view **increases**.
- As the distance decreases, the field of view **decreases**.

This relationship is shown in the following diagram. The exact dimensions of the field of view as a function of the distance are listed in the table below. The **nominal distance** (standard distance) of this read head is **100 mm**.

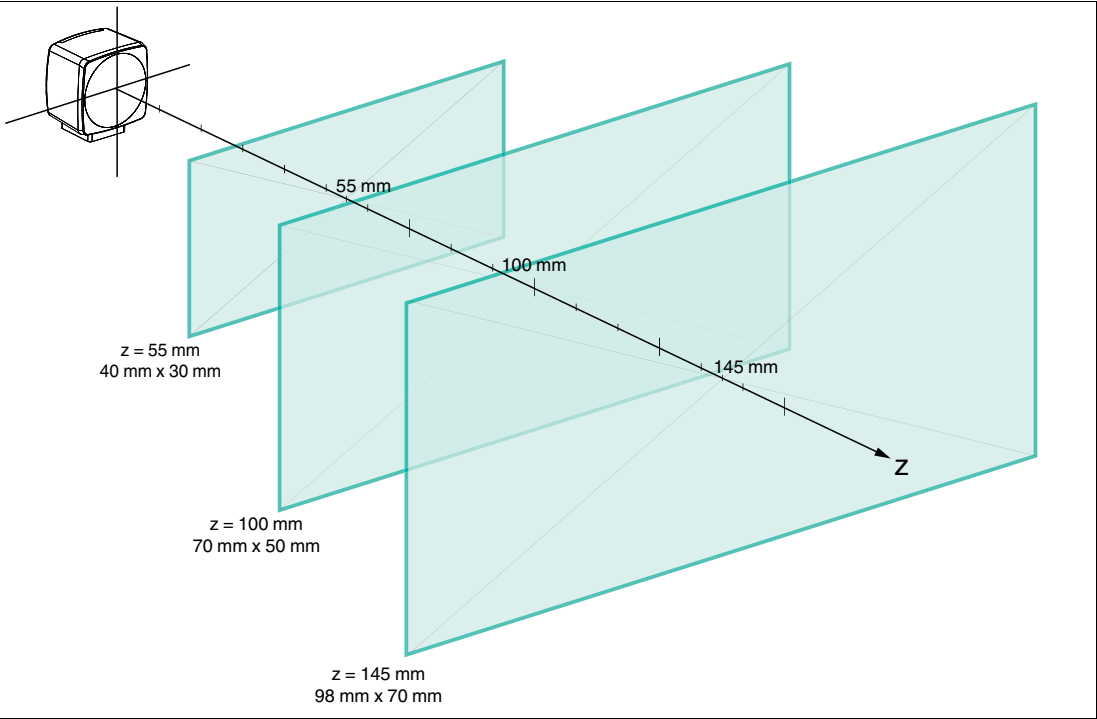


Figure 4.10 Field of view at different read distances

Read distance [mm]	Field of view size [mm]
55	40×30
100	70×50
145	98×70

4.6 Read Head Orientation

The orientation of the read head to the Data Matrix code tape is 0° as standard. This standard orientation is recommended to ensure the highest possible code redundancy.

The following configuration options are available for orientation:

- 0°
- 180°
- $0^\circ/180^\circ$
- $0^\circ/90^\circ/180^\circ/270^\circ$

Note

Alignment Accuracy

The actual orientation of the read head must not deviate too much from the configured values. Refer to the detailed information on the rotational tolerance in the z axis, see chapter 4.7

The following figures shows how different orientations affect the alignment of the read window in relation to the Data Matrix code tape.

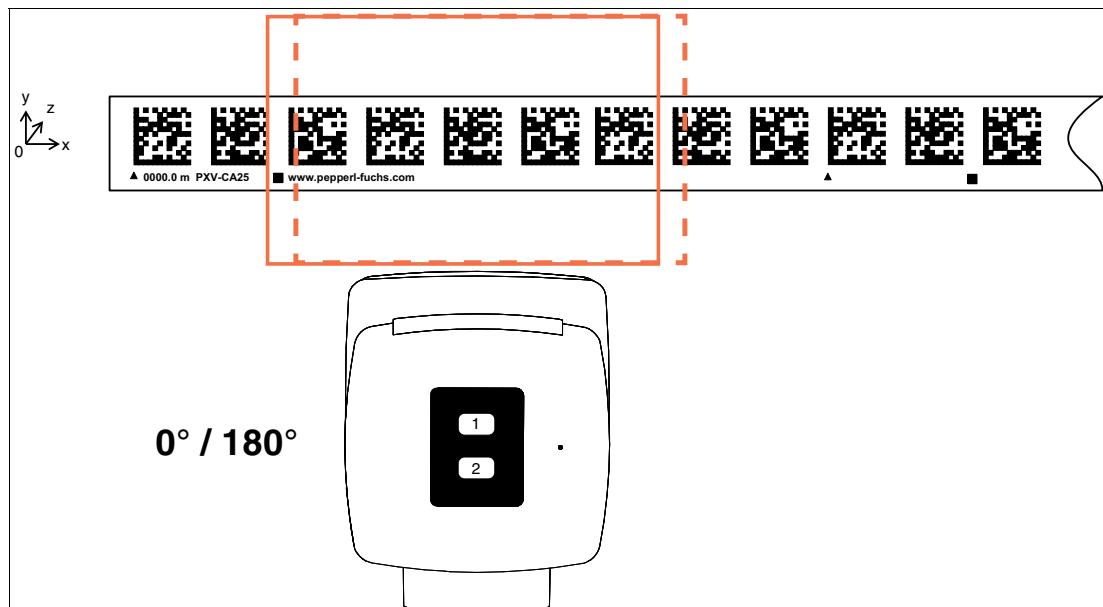


Figure 4.11 $0^\circ/180^\circ$ orientation

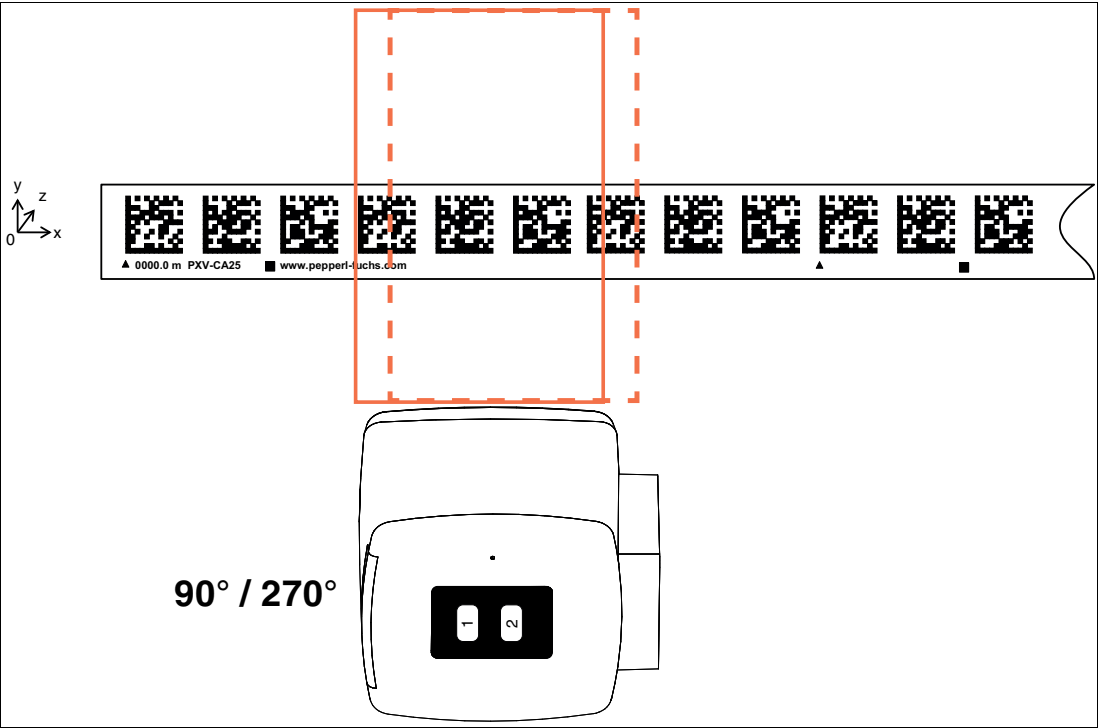


Figure 4.12 90 °/270 ° orientation

4.7 Aligning the Read Head with the Data Matrix Code Tape

Horizontal Tolerance – Read Distance z

Due to the high horizontal tolerance (z tolerance), the read head can be mounted at different distances to the Data Matrix code tape.

If the permissible read distance is not reached or exceeded, the system responds as follows:

- 1. Approaching the limit values: Output of a warning message.
- 2. Further deviation from the permissible range: Output of the message "No-Position". It is then no longer possible to record the position.

For maximum system availability, it is recommended that the read head be mounted at a nominal distance of 100 mm.



Note

If the read distance z is low, the field of view of the read head is reduced (see chapter 4.5). This reduces:

- The mounting tolerance in the y direction (see section "Vertical Tolerance—Height Tolerance y")
- The maximum permissible gap width (see chapter 4.8)

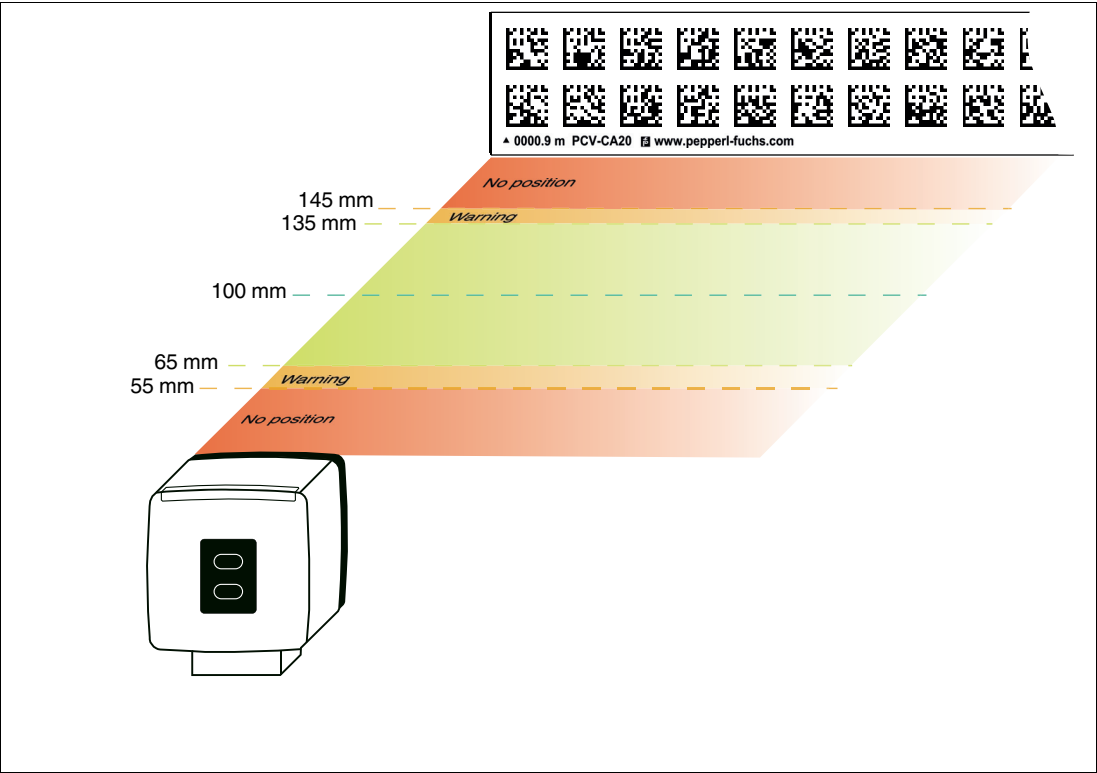


Figure 4.13 Areas of the read distance z (nominal, warning, and no position area)

Read distance z [mm]	No-Position	Warning
>145	x	
>135		x
100		
<65		x
<55	x	

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Horizontal Curve

If the Data Matrix code tape is mounted in horizontal curves, the installation position of the read head in relation to the rotational axis of the application must be taken into account.

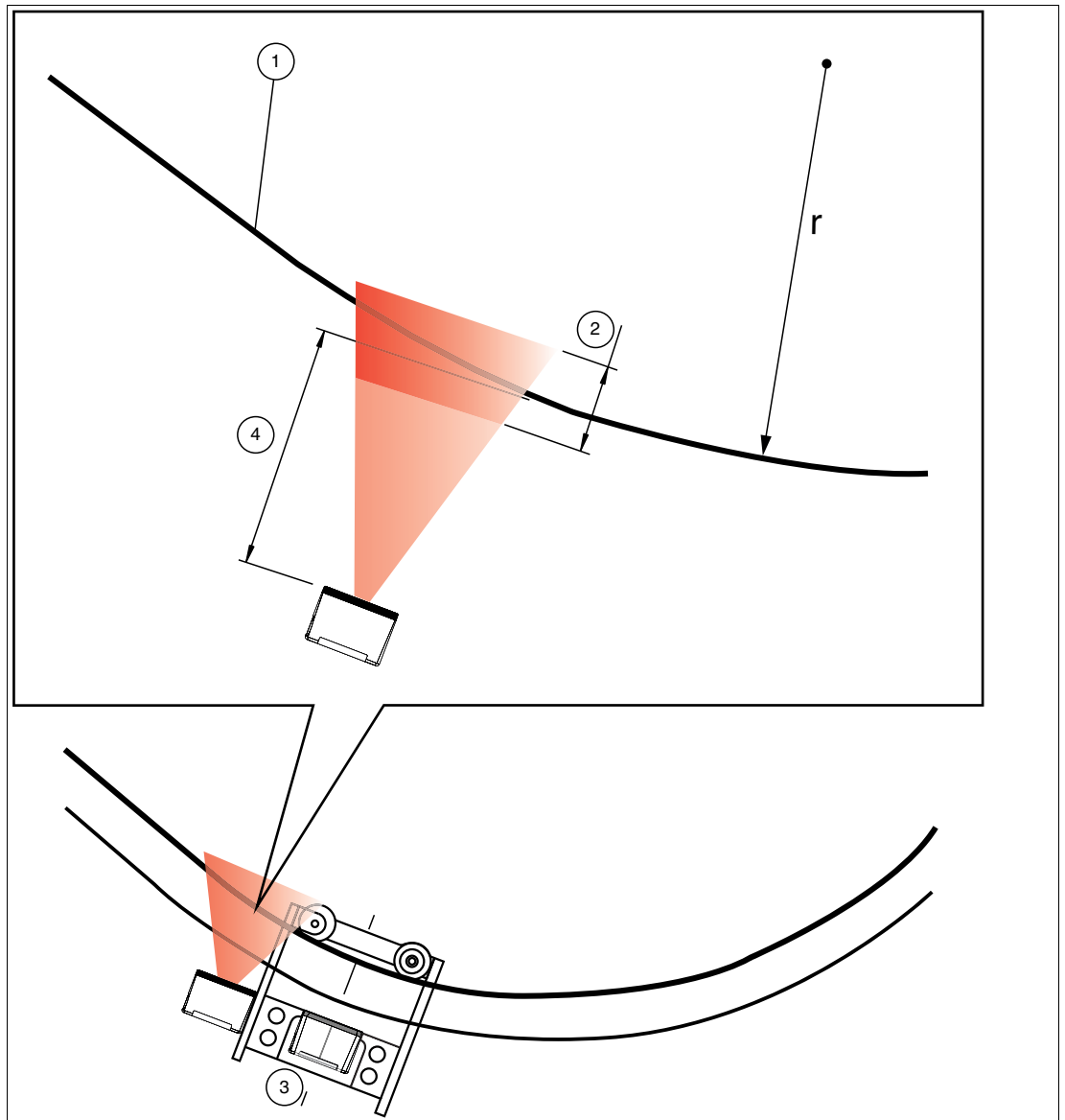


Figure 4.14 Horizontal Curve

1. Code tape
2. Permissible read distance
3. Rotational axis
4. Read distance from the read head to the code tape

If the read head is not positioned in the rotational axis, the read distance z changes depending on the curve (right or left curve):

- The read head moves closer to or further away relative to the code tape.
- The read distance z increases or decreases accordingly.

If the permissible read distance is not reached or is exceeded, the z tolerance is no longer sufficient. It is then no longer possible to record the position. Plan such curves so that the minimum and maximum read distances according to the table above are complied with.

Vertical Tolerance - Height Tolerance y

Once a Data Matrix code tape has been successfully detected, it can be removed from the field of view in the y direction from the defined zero point ($y = 0$). The exact position of the $y = 0$ line is described, see chapter 4.3.2.

Influencing Factors

The permissible tolerance in the y direction depends on:

- The orientation of the code tape ($0^\circ/180^\circ$ or $90^\circ/270^\circ$)
- The read distance z

The following applies:

- At a lower read distance z, the y tolerance is smaller.
- The y tolerance is also lower at a $0^\circ/180^\circ$ orientation than at $90^\circ/270^\circ$.

System behavior in the event of an offset of the $y = 0$ line:

- From $y = \pm 15$ mm, a warning message is output.
- The warning threshold has a hysteresis of ± 0.5 mm.
- If the offset is increased further and there is no longer a complete Data Matrix code in the field of view, the read head issues the "No position" message.

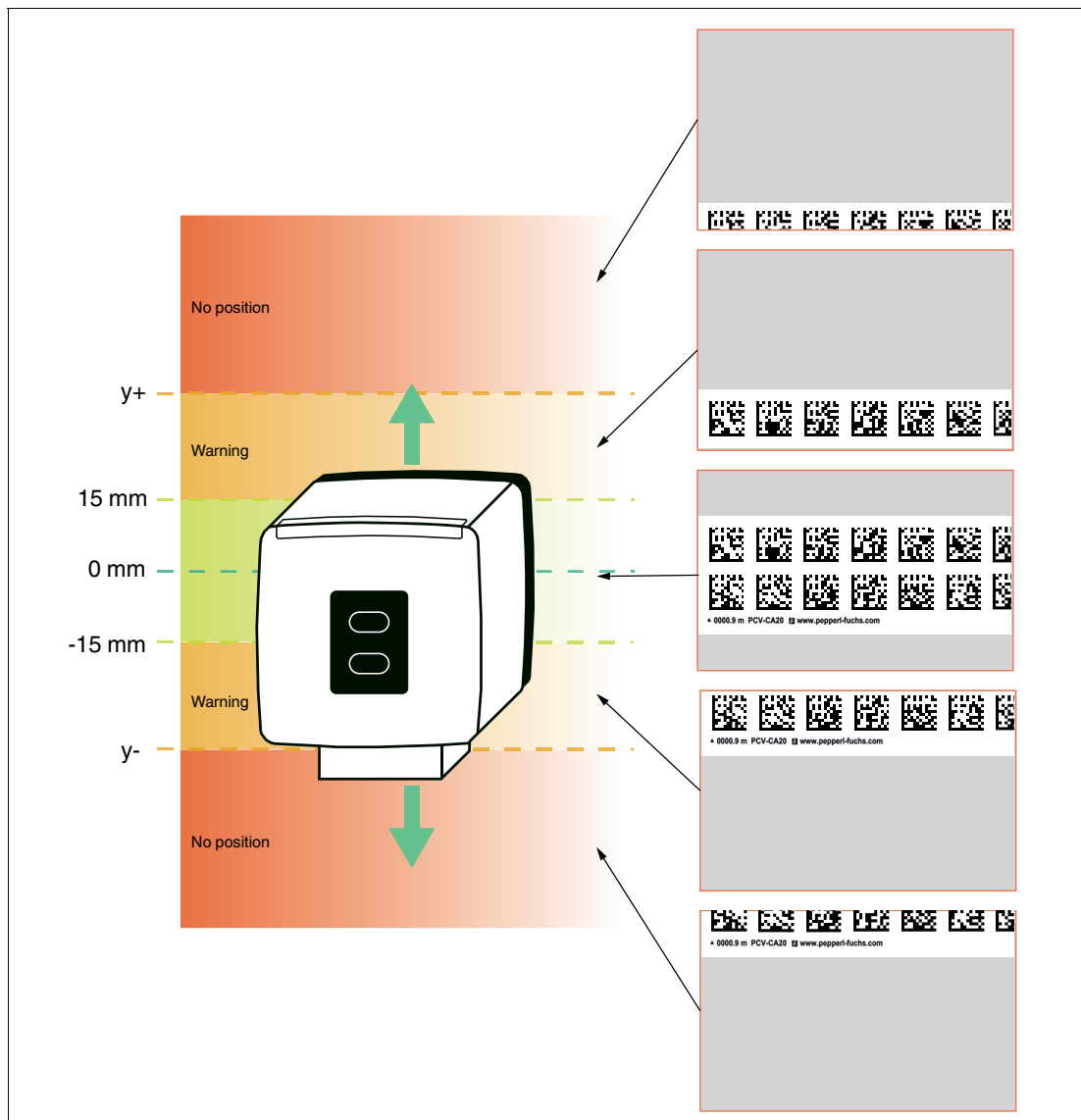


Figure 4.15 Influence of the y-height tolerance on the recorded Data Matrix code tape in the field of view

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- Nominal range (green): The read head is in an optimal position with respect to the Data Matrix code tape.
- Warning (orange): The read head is located in the limit range relative to the Data Matrix code tape, and a warning message is output. In this example, a code can still be detected so that a position can be output.
- No position (red): The read head is positioned too low in relation to the Data Matrix code tape and loses the position. The message "No position" is output.

**Note**

The position of the center line ($y = 0$) depends on the Data Matrix code tape used (see chapter 4.3.2).

Inclination Angles (Tilting)

The read head may be tilted by up to $\pm 30^\circ$. However, the maximum limit values do not apply in total.

Simultaneous tilting in the x and y directions are allowed.

**Note**

Tilting moves the field of view relative to the Data Matrix code tape.

If the inclination is too great, it is possible that there is no complete Data Matrix code in the field of view. In this scenario, position detection is not possible.

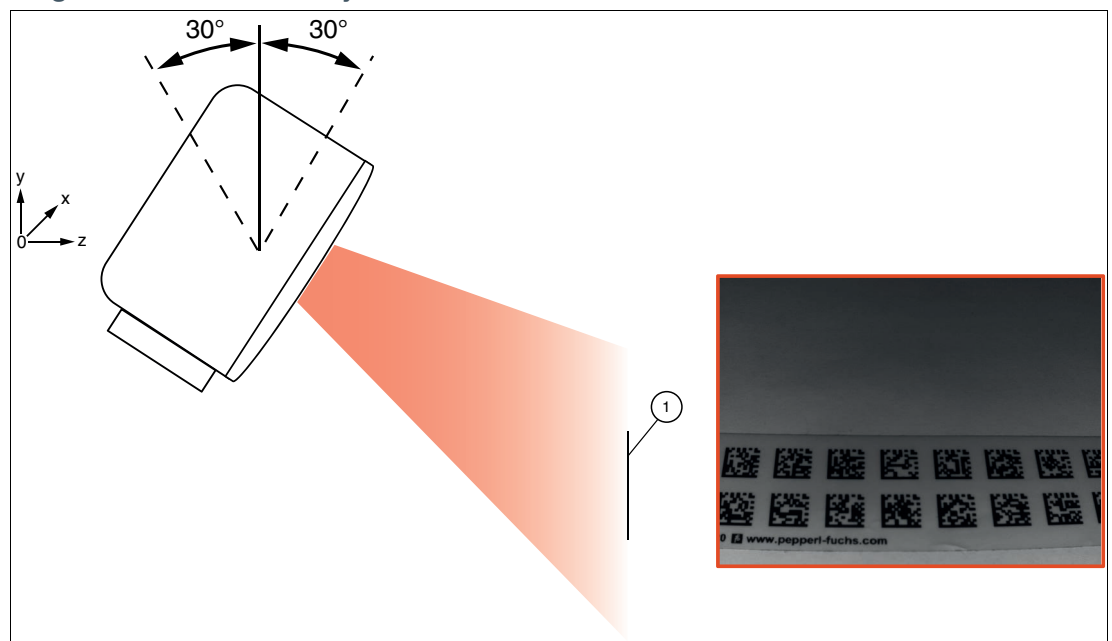
Angular Tolerance on the y Axis

Figure 4.16 Example tilt of the read head around the y axis ($\pm 30^\circ$)

Angular Tolerance on the x Axis

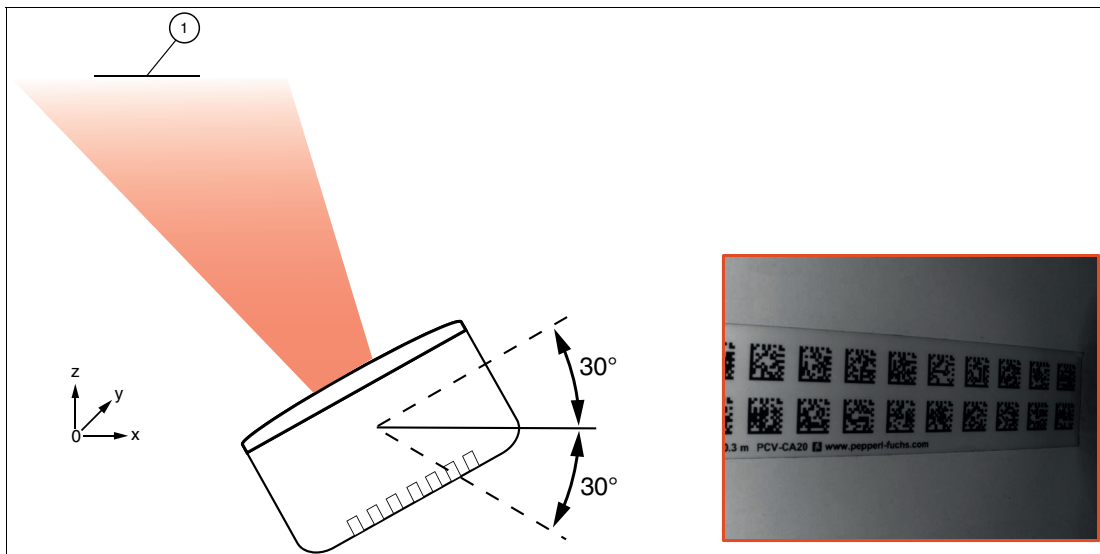


Figure 4.17 Example tilt of the read head around the x axis ($\pm 30^\circ$)

Rotational Tolerance in the z Axis

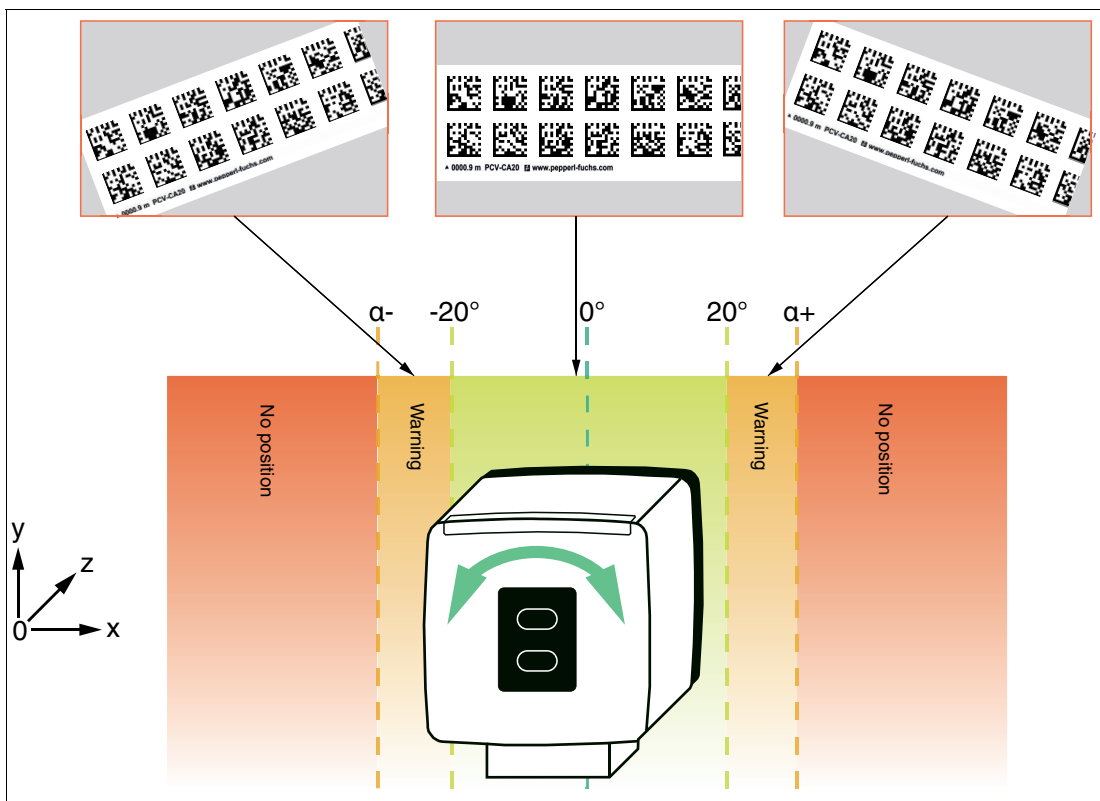


Figure 4.18 Influence of the rotation on the recorded Data Matrix code tape in the field of view
Based on the configurable orientations (see chapter 4.6), rotation around the z axis up to $\pm 20^\circ$ is permitted. If there is an offset of $\pm 20^\circ$, a warning message is displayed. However, the maximum limit values do not apply in total.

If the rotation angle is exceeded, reliable position detection is not possible.

Inclines and Declines

If the Data Matrix code tape is mounted on ascending and descending gradients and the read head is not in the rotational axis of the application, there is a relative rotation between the reading window and the code tape.

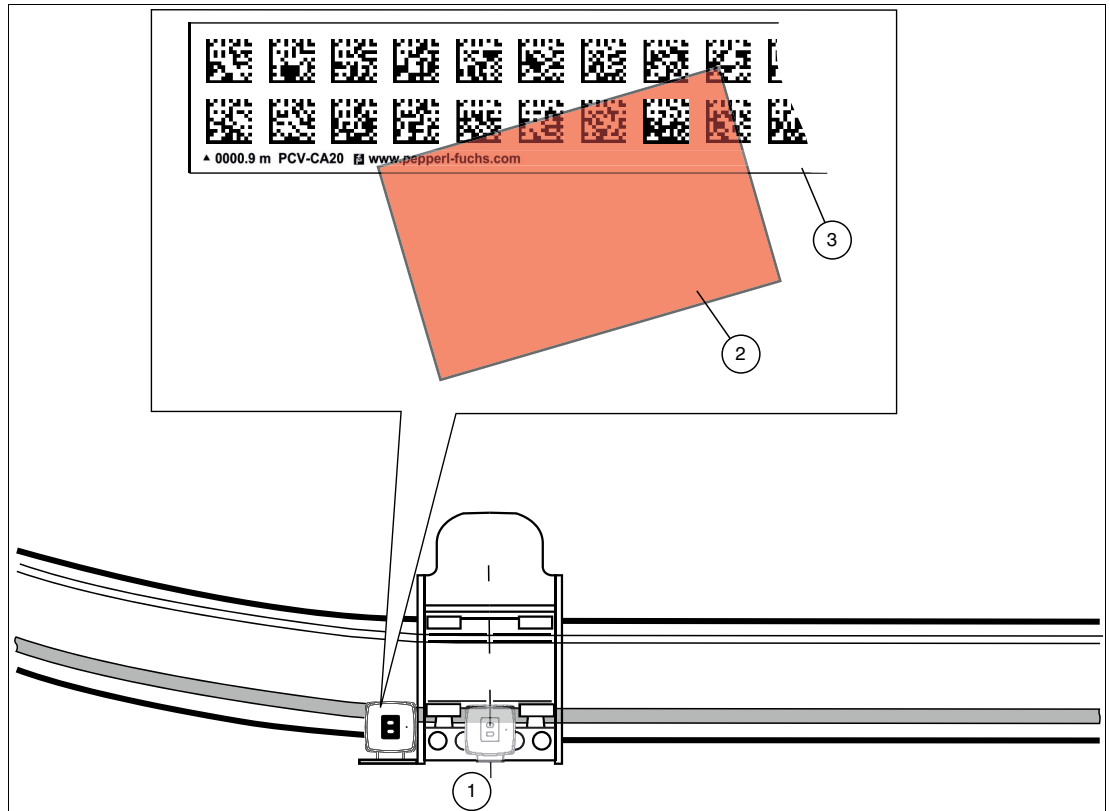


Figure 4.19 Example illustration of a read head mounted offset to the rotational axis

1. Rotational axis
2. Reading window
3. Code tape

Position detection is only possible if:

- There is at least one complete Data Matrix code in the reading window and
- The maximum rotation in the z axis of $\pm 20^\circ$ is adhered to

4.8 Gaps/Interruptions

To compensate for length changes in plant structures, expansion joints are usually required for longer tracks.

Attaching the Data Matrix Code Tape Around Gaps

If a Data Matrix code tape is routed over expansion joints or other gaps, it is generally recommended to interrupt the code tape in the area of the gap. The read head is able to travel over expansion joints and gaps without loss of position.

Several mounting options are available for attaching the Data Matrix code tape at these points, which are described later.

Meaning of the Fixed Code Grid

When planning, it should be noted that the read head expects the Data Matrix codes in a fixed grid of 10 mm. If this grid is not adhered to in the area of the interruption or at adjacent code sections, the position and velocity values calculated by the read head may change abruptly.

These effects must be taken into account accordingly when designing the application.

Illustrative Examples

The following are examples that illustrate the importance of adhering to the code grid.

Grid Adhered To

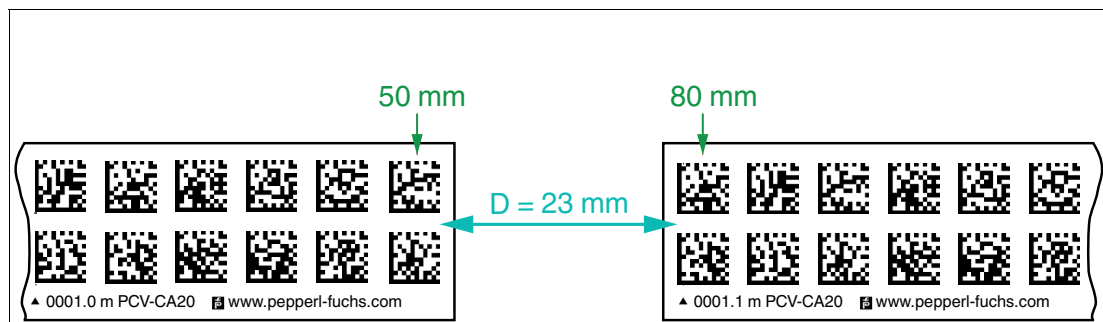


Figure 4.20 Grid adherence across gaps

- **Situation:** A gap with a gap width "D" of 23 mm is bridged. The Data Matrix code immediately before the gap contains the position information 50 mm, the first Data Matrix code after the gap contains the position information 80 mm.
- **Result:** In this case, the grid is adhered to, as the Data Matrix codes expected in the area of the gap are not present and the Data Matrix codes continue after the gap with the correct, grid-compliant Data Matrix codes.

Grid Not Adhered To

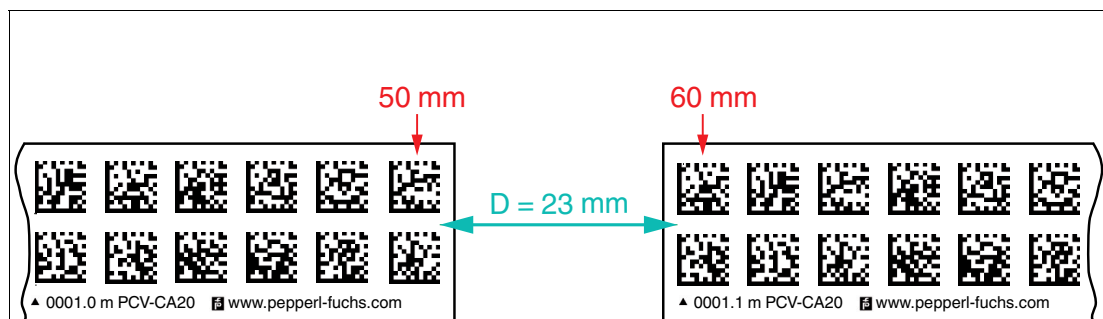


Figure 4.21 Grid violation across gaps

- **Situation:** A gap with a gap width "D" of 23 mm is bridged. The Data Matrix code immediately before the gap contains the position information 50 mm, the first Data Matrix code after the gap contains the position information 60 mm.

- **Result:** In this case, the grid is not adhered to because the read head would have expected the Data Matrix code with the position information "60 mm" immediately after the "50 mm" code, not only after some additional distance in the ascending x direction. The x position value and the velocity value change abruptly.



Note

Effect of Grid Violations on Extrapolation

If extrapolation is activated, a violation of the grid can lead to a short-term incorrect calculation of the x position value (see section 0093). If there are violations of the code grid in the system and extrapolation is still to be used, these short-term incorrect positions must be taken into account when designing the vehicle control system.

Maximum Gap Width

When mounting the Data Matrix code tape over expansion joints or structural gaps, the maximum gap width (D) must be observed.

The maximum gap width (D) is defined as the distance between two fully readable Data Matrix codes. It depends on the read distance (z) and the orientation of the read head.



Note

Respect the Quiet Zone

A free area, the quiet zone, of 2 mm must be maintained around each Data Matrix code. The quiet zone is the white, code-free area between two Data Matrix codes.

- Never cut the code tape within this 2 mm quiet zone.
- You will find an important additional note on this in the "Cutting Rule" section.

Reference Values for the Maximum Gap Width (D)

Below are some typical reference values for the maximum gap width (D) depending on the read distance (z) and the orientation of the read head.

Maximum Gap Width with a Read Head Orientation of 0 °/180 °

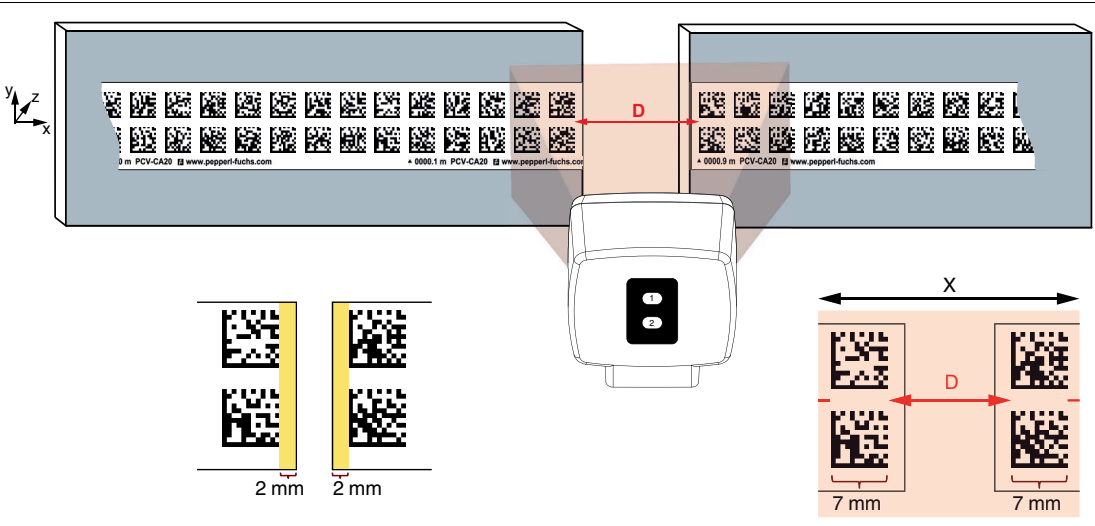


Figure 4.22

Read distance z [mm]	Maximum gap width D [mm]
55	22
100	52
145	80

Maximum Gap Width with a Read Head Orientation of 90 °/270 °

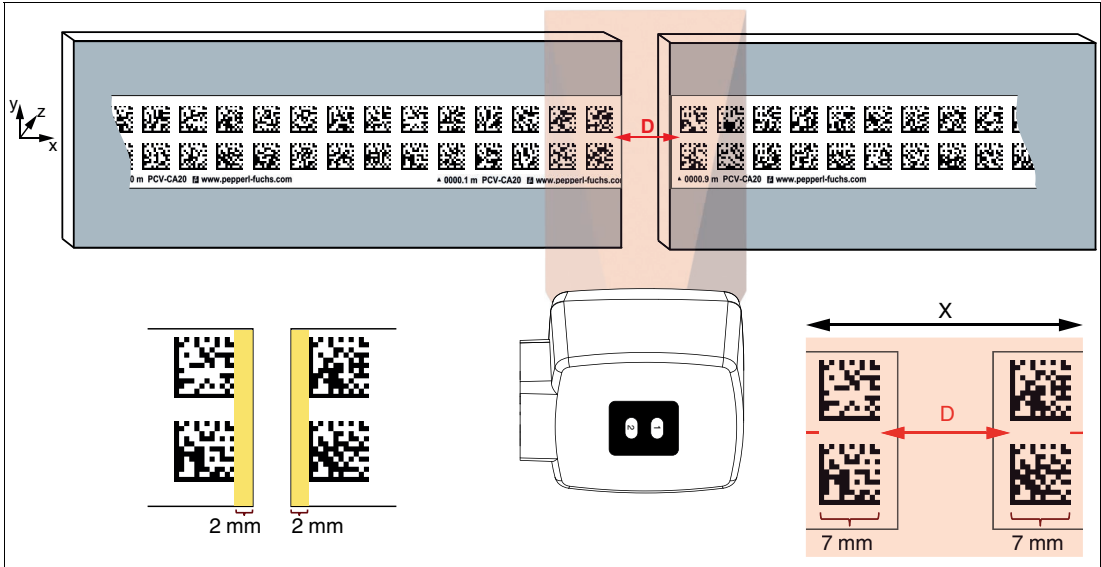


Figure 4.23

Read distance z [mm]	Maximum gap width D [mm]
55	14
100	32
145	52

Calculating the Maximum Gap Width

Note

The specified values are reference values. The actual maximum permissible gap width depends on the exact read distance and the orientation of the read head.

An approximation of the maximum gap width (D) can be calculated as follows:

Maximum gap width (D) = reading window width in the x direction of the code tape - 14 mm - 4 mm - safety value

Parameter	Statement
Reading window width (in the x direction)	Typical values for the reading window width are specified, see chapter 4.5. - For a read head orientation of 0 °/180 °, use the value for the long side of the reading window in the formula. - For a read head orientation of 90 °/270 °, use the value for the short side of the reading window.
14 mm	This value comprises the width of two Data Matrix codes (2 x 7 mm = 14 mm)
4 mm	Quiet zone required on both sides (2 x 2 mm = 4 mm).
Safety value	A value to be defined by you as the user that compensates for tolerances resulting from mounting or bonding inaccuracies of the code tape. Use a suitable buffer for your system.

Cutting Rule

Correct cutting of the code tape is crucial for reliable reading.



Caution!

Incorrect reading due to violation of the quiet zone

The distance between two Data Matrix codes is 3 mm. Cutting in the center between the codes would violate the required quiet zone of 2 mm on each side.

Detection is normally still possible. However, the following points should be observed as far as possible:

- Never cut the code tape in the center between two codes.
- When cutting to incorporate a gap, always remove at least one complete Data Matrix code to ensure the quiet zone of the previous code is retained.

An exception to this recommendation is affixing gaps according to option 1, as no codes may be removed in this case.

Mounting Options for Bridging Gaps

Depending on the application and the size of the gap, different mounting methods are available.



Note

Constant Movement Speed

The diagrams below are based on the assumption of a constant movement speed.

Option 1 - Affixing without Removing Codes

- **Advantage:** Smooth transition of position instead of an abrupt change, higher redundancy, and optimal mounting along a mechanical gap.
- **Effect:** -

Affix the Data Matrix code tape up until the gap. Cut the tape before the gap precisely between two codes. Do not violate any code or quiet zone. Continue the code tape on the next component.



Note

Comparison with Option 3

If any of the codes are violated or removed, observe the behavior described in option 3 instead.

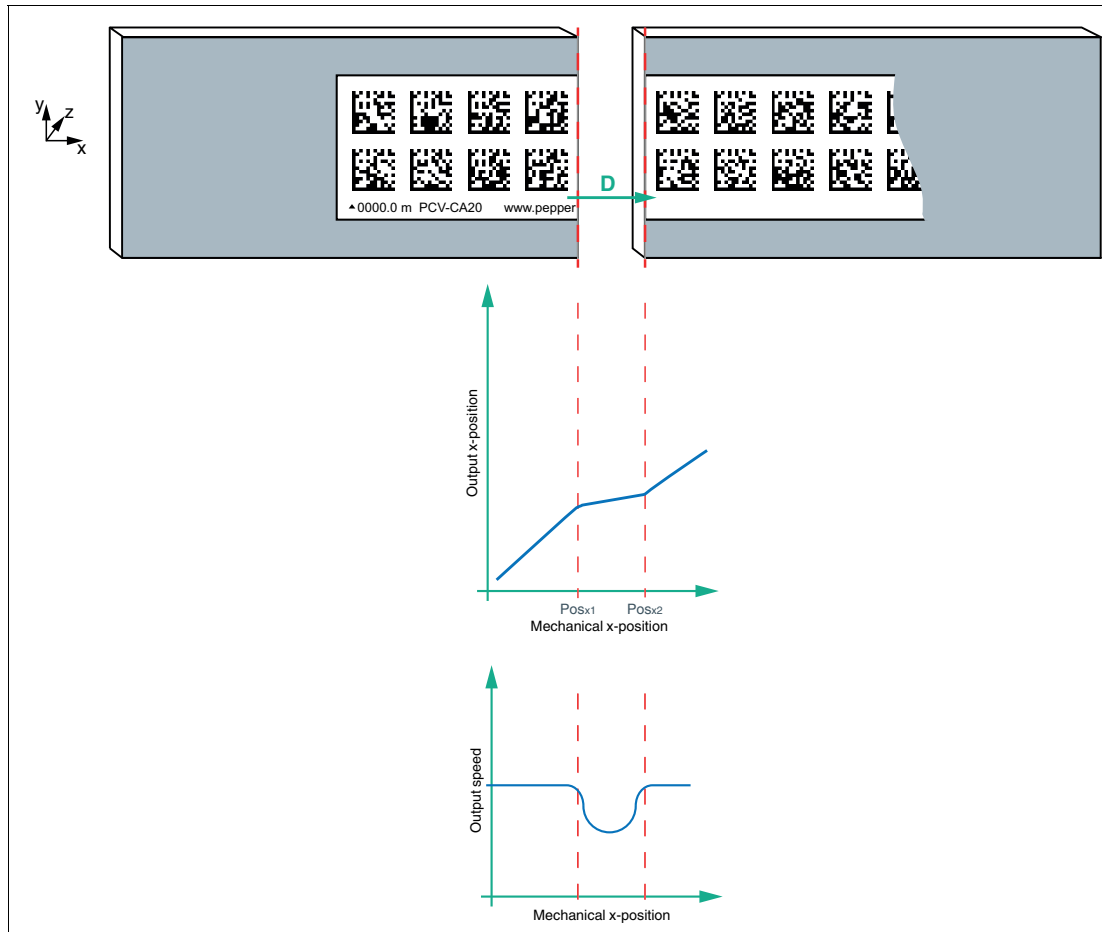


Figure 4.24 Adhesive bonding without cutting out codes

In this case, the position is determined based on several codes and then interpolated. This does not lead to an abrupt change, but to a smooth transition of the position.

Note

Transition Behavior

A smooth transition cannot be guaranteed. If the codes on one side of the code tape are temporarily not detected, this reference point is omitted and is no longer available for interpolation.

In the worst case scenario, the position can then jump back and forth between the different reference points in the area of the gap.

The velocity output by the read head is lower in this range because the calculated position change is less than the actual movement speed.

In the case of very wide gaps, the Data Matrix code tape can be optimally mounted along the mechanical gap.

Compared to the unfavorable case with option 2 where the gap width D increases despite bridging an identical gap, this option offers higher redundancy.

Option 2—Affixing Continually with Codes Removed

- **Advantage:** Optimization to minimize abrupt position changes.
- **Effect:** Redundancy may be reduced.

The Data Matrix code tape is initially affixed continuously over the mechanical gap.

One or more Data Matrix codes are then specifically cut out in the area of the gap.

The remaining Data Matrix codes are still arranged in the defined grid.

The effective gap width (D) results from the number of codes removed and from the positioning of the code tape over the mechanical gap. Depending on how the code tape is affixed, a different effective gap width may result.

The following figure shows how the gap width (D) in the lower image is larger, although the mechanical gap is the same in both illustrations. The reason for this is that two Data Matrix codes in the lower image are unfavorably located in the area of the gap and must therefore be removed.

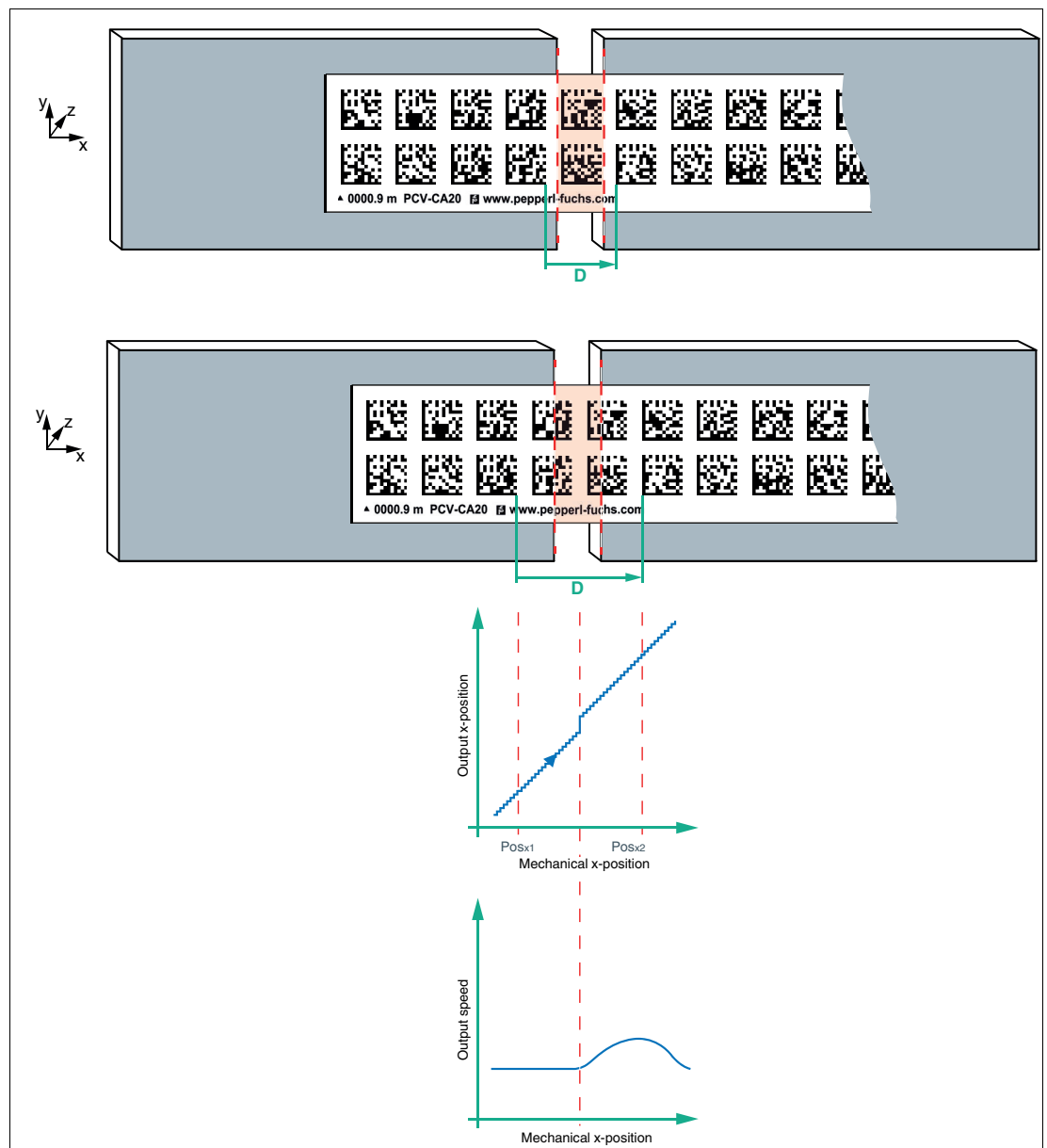


Figure 4.25 Continuous mounting with cut-out codes

Influences such as the thermal expansion of the surface can cause a small position jump.

If a position jump occurs in the transition area, the velocity will increase simultaneously for system-related reasons (see figure above).

The velocity value is slightly increased or decreased over several device cycles and then returns to the original value. For further details on calculating the velocity, see chapter 4.4.

The following figure shows how the gap width (D) changes when one or more codes are removed.

Examples of Gap Width (D)

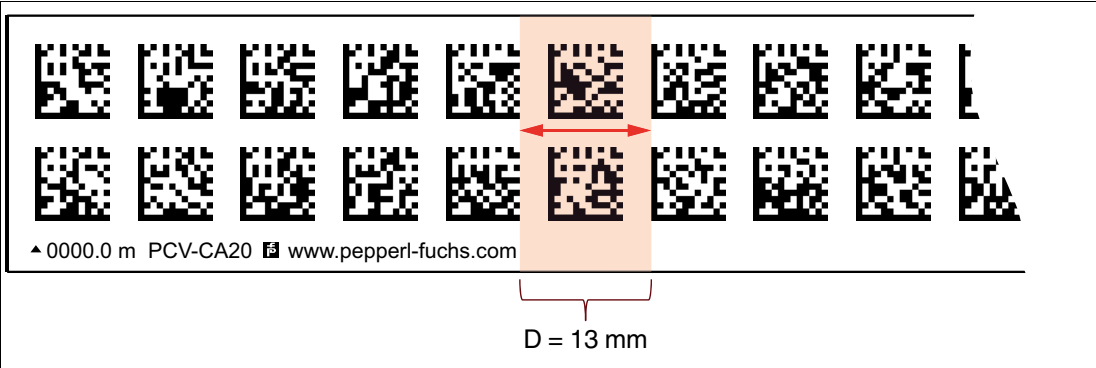


Figure 4.26 D = 13 mm

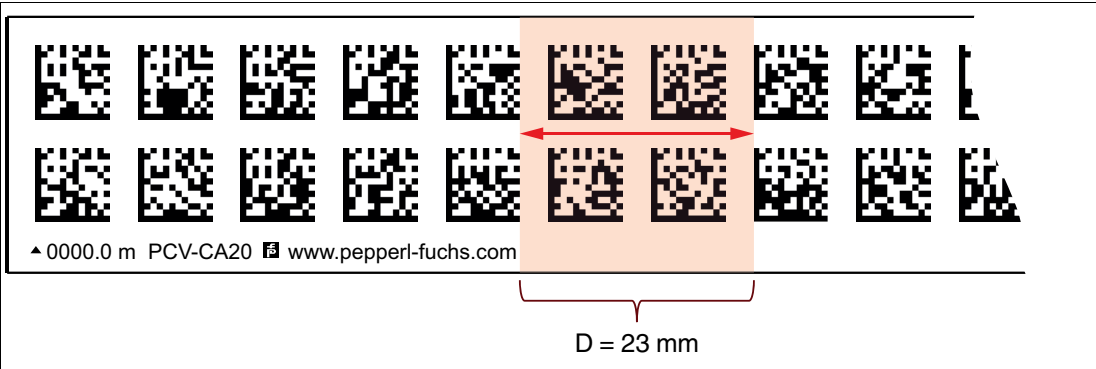


Figure 4.27 D = 23 mm

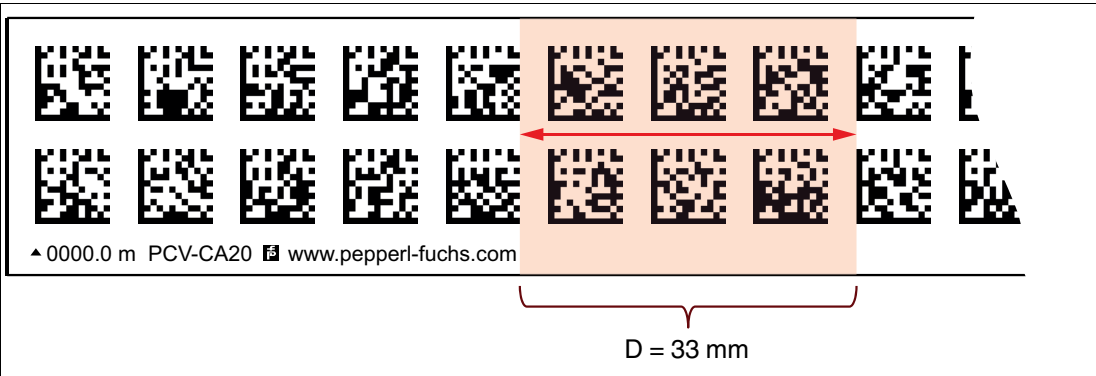


Figure 4.28 D = 33 mm

Removed codes	Effective gap width (D) [mm]
1	13
2	23
3	33

**Note****Maximum Number of Removed Data Matrix Codes**

The maximum permissible number of consecutive Data Matrix codes that can be removed is limited by the maximum gap width (D).

This depends on the read distance and the orientation of the read head.

Option 3 - Continuous Placement

- **Advantage:** Higher redundancy and optimal mounting along mechanical gaps
- **Effect:** Position and velocity jump

The Data Matrix code tape is affixed up to the mechanical gap.

To reduce the position jump in a targeted manner, one or more complete codes should be removed.

Example

The gap width D is 23 mm.

The Data Matrix code tape is affixed up to the mechanical gap.

Instead of continuing to affix the continuous code tape directly after the gap, two complete Data Matrix codes can be removed, namely the codes that would be within the gap if the grid was observed.

After these codes have been removed, the code tape is moved up to the edge of the gap and affixed there.

The number of Data Matrix codes to be removed depends on the gap width to be bridged.

- One code can be removed for smaller gap widths.
- Several complete codes can be removed for larger gap widths.

The number of Data Matrix codes that would be within the gap if the code tape was affixed continuously (see option 2) acts as a guide.

After the gap, the code tape is continued with the next complete Data Matrix code.

**Note****Comparison with Option 3**

If no codes are damaged or removed, the behavior described in option 1 will occur instead.

As the fixed grid of the Data Matrix codes is not adhered to in this case, a logical jump of the x position values occurs in the transition range and a corresponding change of the velocity values.

In the case of very wide gaps, optimally mount the Data Matrix code tape along the mechanical gap.

Compared to the unfavorable case with option 2 where the gap width D increases despite bridging an identical gap, this option offers higher redundancy.

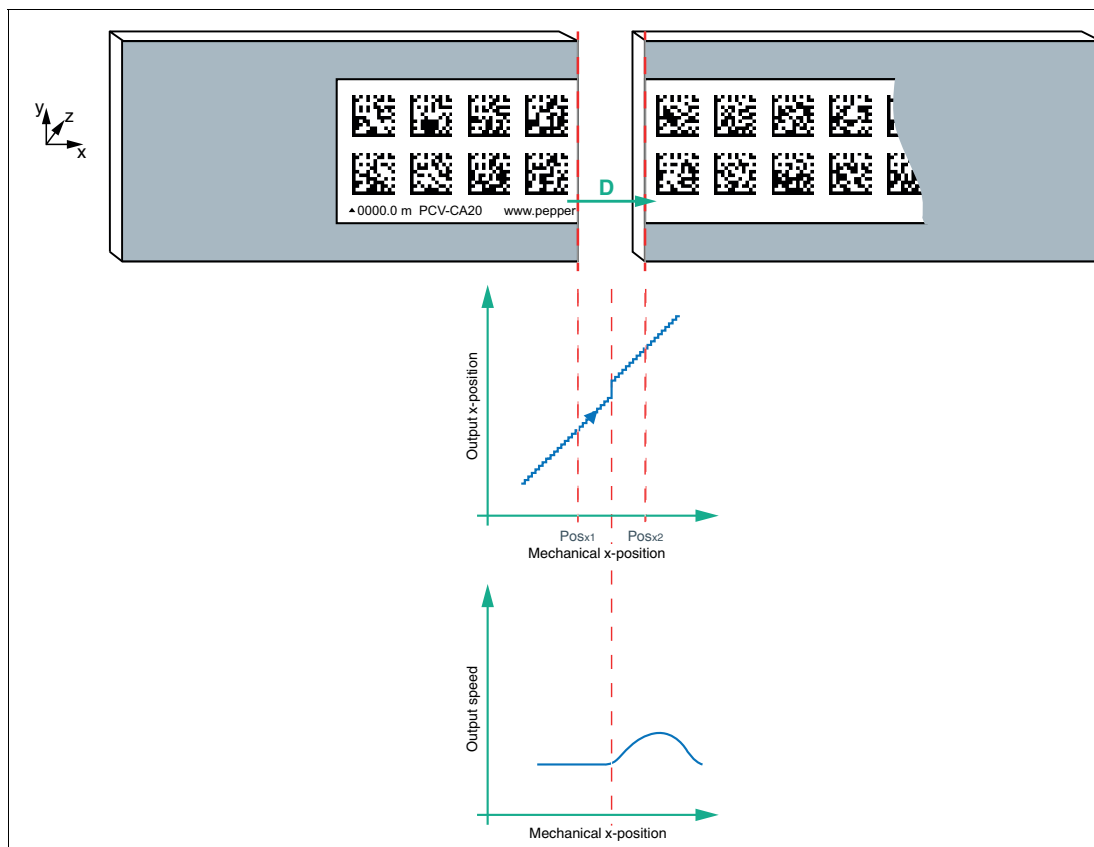


Figure 4.29 Continuous mounting

The position jump leads to a simultaneous velocity increase for system-related reasons (see figure above).

The velocity value is slightly increased or decreased for 17 successive cycles and then returns to the original value. For further details on calculating the velocity, see chapter 4.4.

Note

Avoid Cut-off Codes at the Edge of the Gap

A code that is only partially visible at the edge of a gap must be avoided, since the reader can attempt to decode this incomplete code.

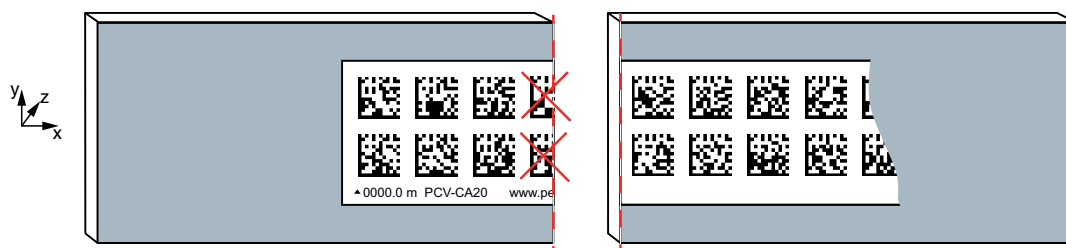


Figure 4.30

- Completely remove the last code before the gap.
- When doing so, strictly observe the 2 mm quiet zone of the second-to-last code that is retained in full.

Option 4—Continuous Placement without Velocity Jump

- **Advantage:** High redundancy and optimal mounting along mechanical gaps, no velocity jump, defined hysteresis
- **Effect:** Position Jump

The Data Matrix code tape is affixed up to the mechanical gap.

After the gap, the code tape is continued with a complete Data Matrix code whose position information is more than 1 m different from the previous Data Matrix code.

In contrast to option 3, there is no velocity jump in this variant as a result of a grid violation. There is no sudden increase in the velocity, as the read head detects large position differences as a jump.

In this case, a hysteresis also prevents the position from jumping back and forth between the reference points. The prerequisite is that the code tape can be read reliably on both sides of the gap.

In the case of very wide gaps, the Data Matrix code tape can be optimally mounted along the mechanical gap.

Compared to the unfavorable case with option 2 where the gap width D increases despite bridging an identical gap, this option offers higher redundancy.

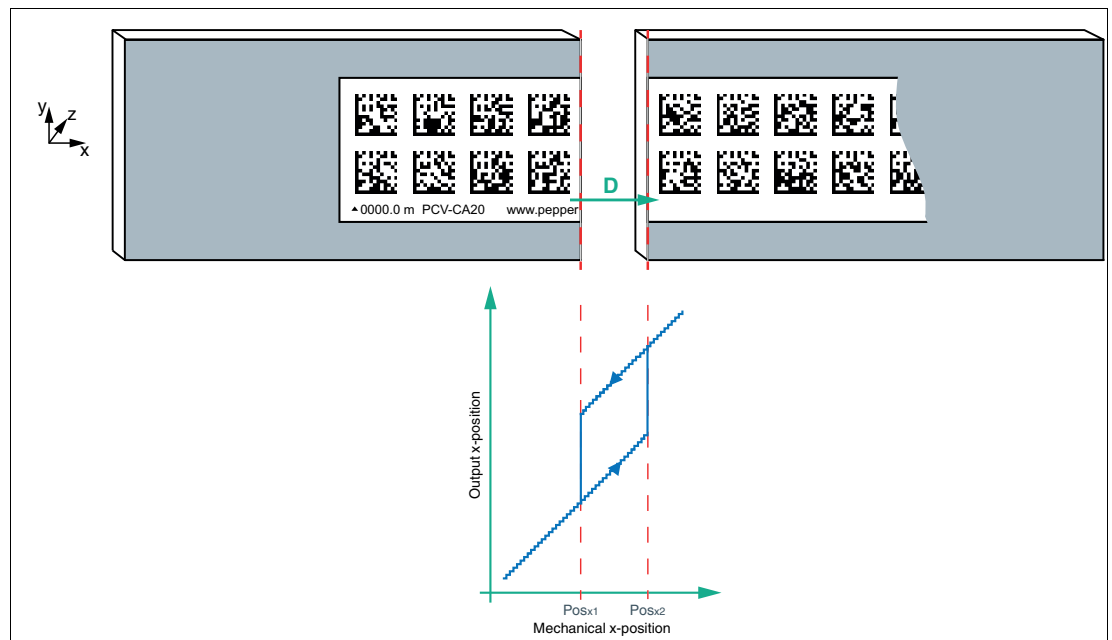


Figure 4.31 Continuous mounting without speed jump

A position hysteresis occurs in the transition area, as shown in the figure above.



Note

Transition Hysteresis Behavior

The exact time of the transition hysteresis cannot be guaranteed precisely, so that the position jump can also occur within the gap area.

**Note****Avoid Cut-off Codes at the Edge of the Gap**

A code that is only partially visible at the edge of a gap must be avoided, since the reader can attempt to decode this incomplete code.

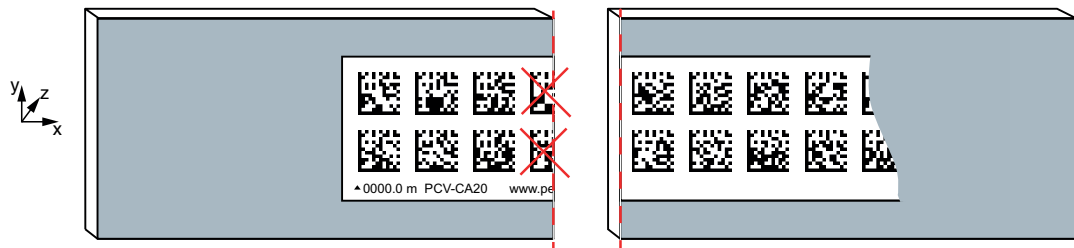


Figure 4.32

- Completely remove the last code before the gap.
- When doing so, observe the 2 mm quiet zone of the second-to-last code that is retained in full.

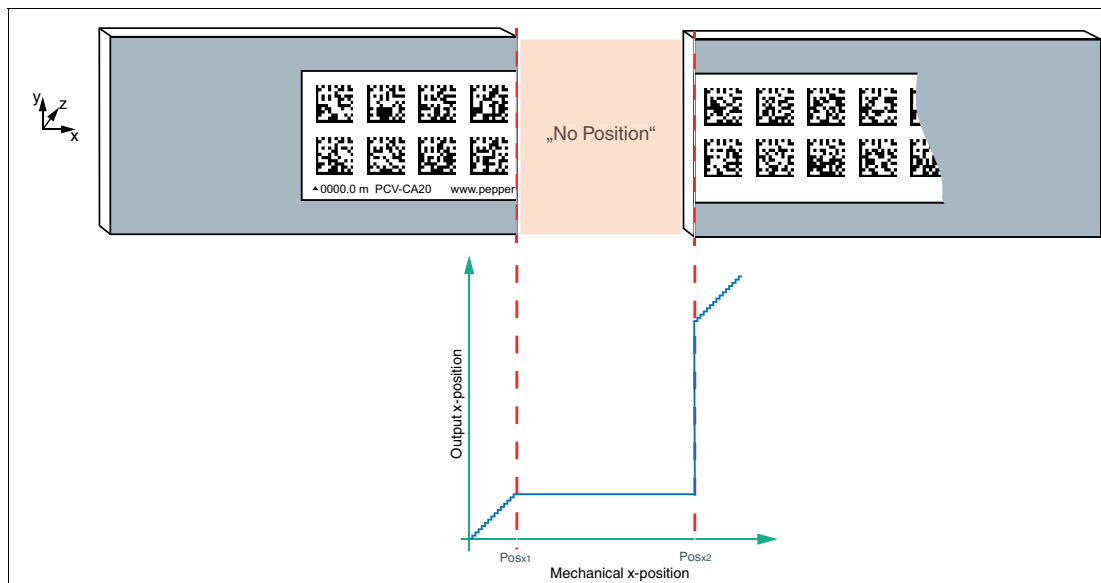
Option 5 - Excessive Gap ("No Position")

Figure 4.33 Gap too large ("No Position")

If the mechanical gap is too large, the read head issues the warning message "No Position".

In this case, the "X-Position at no-position" parameter can be set to "Last valid value", see chapter 5.3.

As a result, the last valid x position is still output over the gap.

If the "X-Position at no-position" parameter is not set, the value 0 for the x position is output by default.

**Note****Restarting the Read Head over Gaps**

If the read head is restarted above the gap, position detection is not possible.

The last valid x position is no longer available after a restart.

A restart over the gap should therefore be avoided, if possible.

Y Offset over Gaps

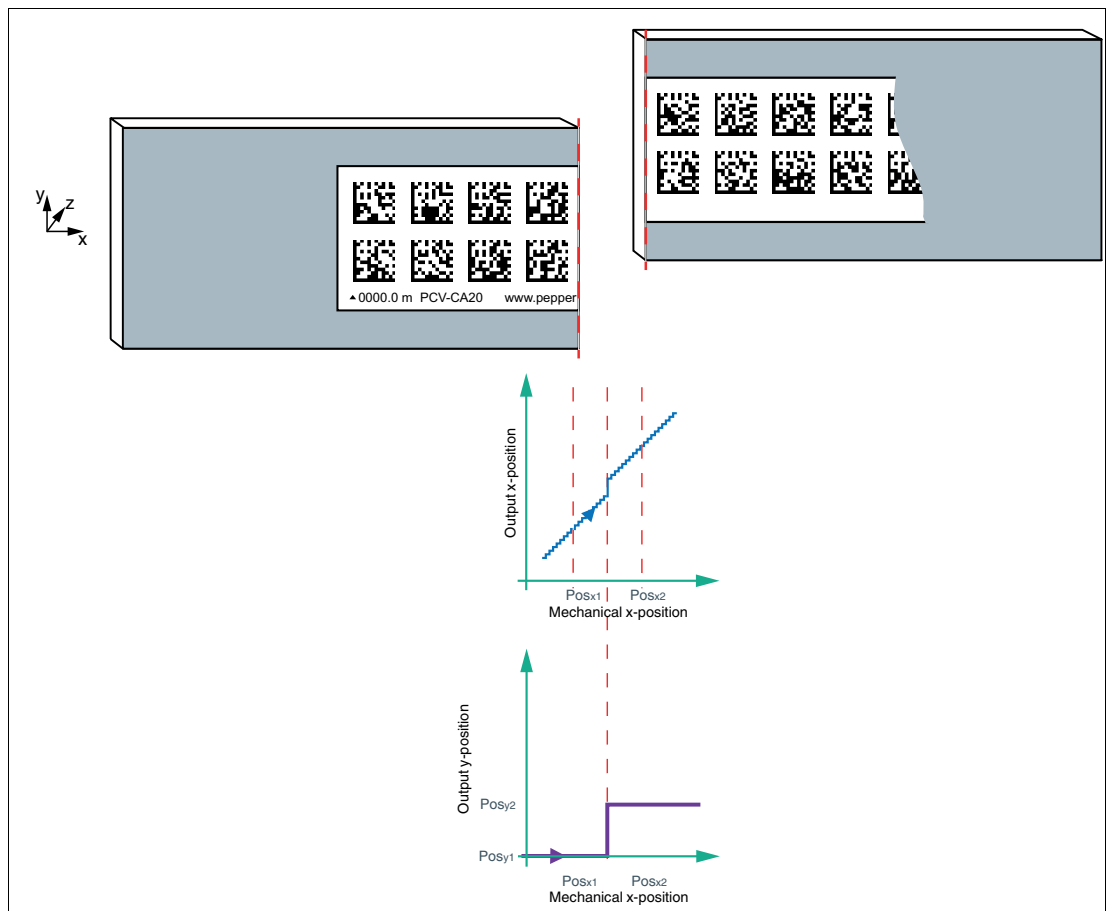


Figure 4.34 Offset across gaps

If there is a Y offset between two Data Matrix code tape strips over a gap, the offset must not exceed a certain limit value.

If the Y offset is too large, the Data Matrix codes are no longer completely in the reading window of the read head, meaning that code detection is no longer possible.



Note

Jump in the Y Position Value

A Y offset leads to a jump in the Y position values and must be taken into account accordingly in the control logic.

Thermal Expansion of the Surface

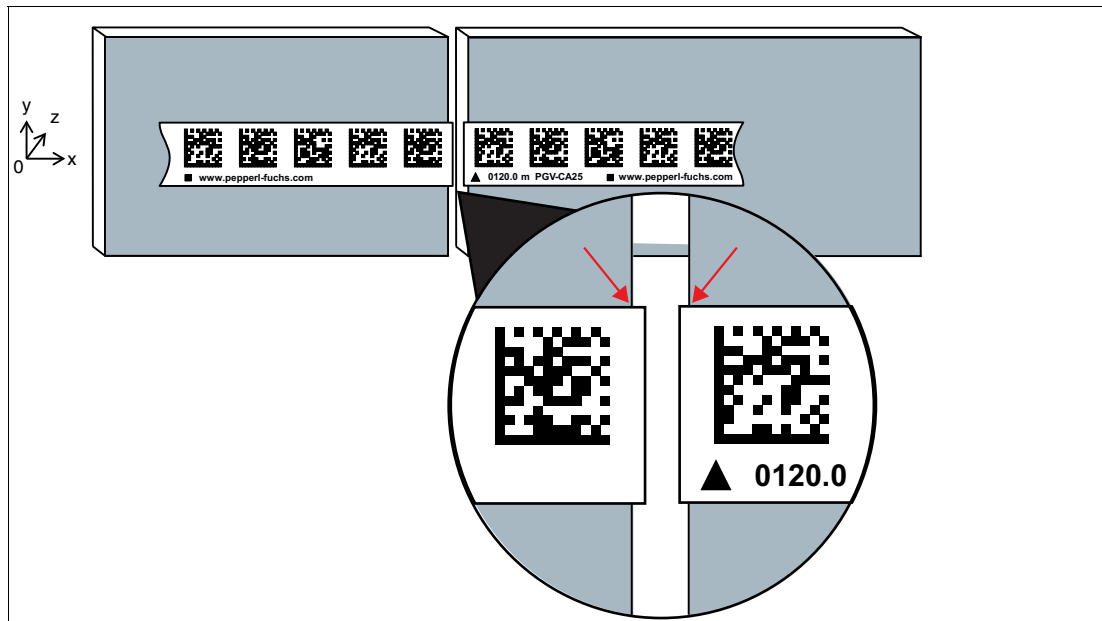


Figure 4.35 Thermal expansion



Note

Thermal Expansion of the Surface

The thermal expansion coefficient of the affixed Data Matrix code tape is significantly determined by the thermal expansion coefficient of the surface.

When planning the system, the maximum possible gap width that can occur at the minimum expected temperature must be taken into account.

One possible approach to reducing the effective gap width is to offset the butt edges of the Data Matrix code tapes a few millimeters in the direction of the gap.

It must be ensured that the code tapes do not overlap even at maximum thermal expansion, so that the quiet zone of 2 mm around the Data Matrix codes is maintained.

4.9 Quality Grades

Continuous monitoring of the quality grades enables early detection of contamination or damage to the Data Matrix code tape and the read head.

This applies both during commissioning and during operation. Regular monitoring increases operational safety and facilitates quick localization of the cause in the event of a fault.

The scene detected by the read head, including the code tape, is qualified.

The quality is assessed using a scale of 1 to 6, with 1 being the best quality. Values of 3 or worse indicate that the read head or the code tape should be checked. The value 7 can also be output for the code tape quality. This means that no code was detected and therefore no position can be determined.

The quality grades are determined for the Data Matrix code tape for positioning and for the event marker tape.



Note

A poor quality assessment can also have the following causes:

- Inaccurate alignment of the read head
- Incorrect read distance
- Incorrect mounting of the Data Matrix code tape

Check these points before assuming that the code tape is damaged.



Tip

Additional Diagnostic Information

In addition, the number of Data Matrix codes detected is output.

This value can be used for further diagnostics and analysis.

The read head generally only requires one Data Matrix code to determine the absolute position. To ensure sufficient redundancy, there must be at least three decoded Data Matrix codes in the field of view. Depending on the code tape used and the mounting position, significantly more codes can be found in the field of view of the PCV read head. This can be read from the output number of detected Data Matrix codes.

Evaluating the Quality Grade

Quality Grade for New Application of the Data Matrix Code Tape

For an optimal installation, both the quality grade and the number of Data Matrix codes should be taken into account.



Note

Code Tape Types

Single- and double-row code tapes are available for the PCV read head. When using a double-row code tape, there are twice as many codes in the field of view as with a single-row code tape. This further increases redundancy and should be taken into account when evaluating the number of decoded codes.

Quality grade	Number of codes detected	Evaluation	Action
1	> 6	Very good mounting	No action required
	3 ... 6	Installation within tolerance range	Check the code tape for contamination and clean if necessary (for more information, see chapter 8.3)
2	2 ... 3	Installation within tolerance range	Check the code tape for contamination and clean if necessary (for more information, see chapter 8.3)
3	2	Mounting marginal, unacceptable	• Check the code tape for damage and contamination. • Check the routing of the code tape. • Pay particular attention to problematic branches or intersections. • Check for unfavorable curve radii and ascending and descending gradients.
4	1 ... 2	Unacceptable mounting	See measures for quality grade 3. No approval for operation.
5			
6			
7	0	No code detected, operation is not possible	See measures for quality grade 3. No approval for operation.

Quality Grade for Ongoing Operation

Both the quality grade and the number of decoded codes should also be used for further diagnostics.

Quality grade	Number of codes detected	Evaluation	Action
1	> 6	Excellent	No action required
	3 ... 6	Good	No action required
2	2 ... 3	Satisfactory	Note positions with a quality value of ≥ 2 . Check during the next routine inspection and clean if necessary (for more information, see chapter 8.3).
3	2	Acceptable	Immediately check positions with a quality value of ≥ 3 for damage and contamination. Clean the code tape or repair if necessary.
4	1 ... 2	Not acceptable	Immediately check positions with a quality value of ≥ 4 for damage and contamination. Immediately clean or repair the code tape.
5			
6			
7	0	No code detected, operation is not possible	Immediately clean or repair the code tape at positions with a quality value of 7.

Note

The recommended grades and actions assume that the Data Matrix code tape has been applied in one continuous length.

Code tape gaps can cause poorer quality grades, even though there is no defect.

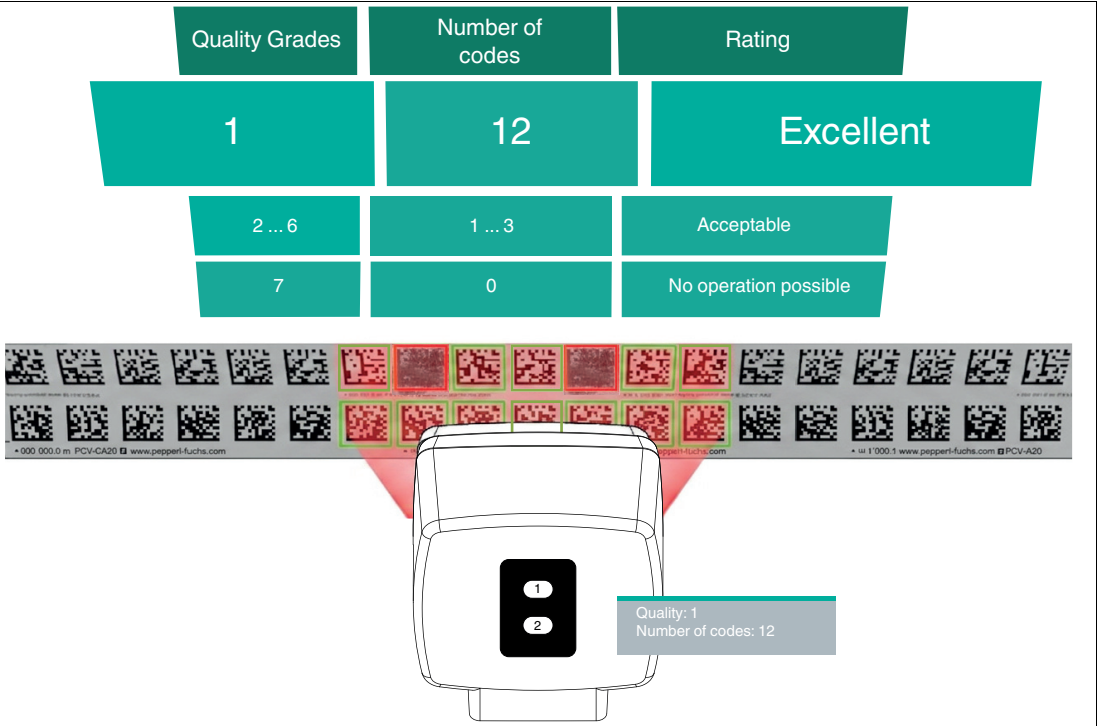




Note

The quality grades can also be monitored via the switching outputs.
For more information, see chapter 5.3.3.

The following figures show examples of different quality grades when reading the Data Matrix code tape.
The images illustrate typical states of the code tape, ranging from very good read quality to heavily contaminated or damaged areas.



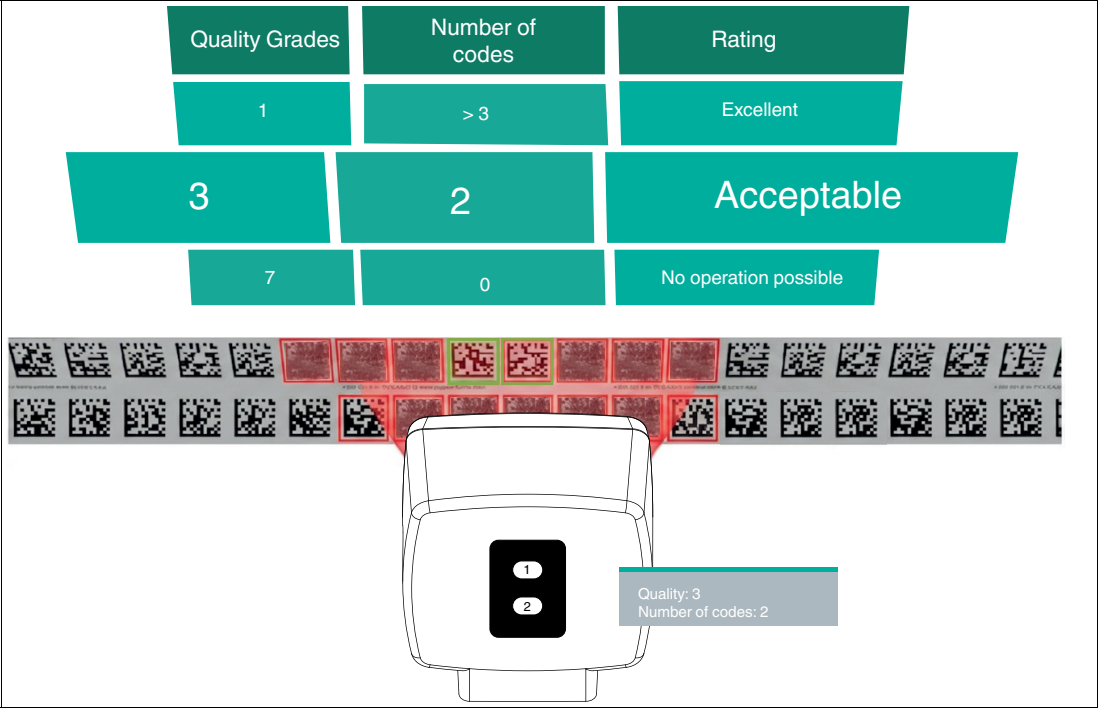


Figure 4.37 Reduced quality due to contamination or damage

4.10 Real-Time Positioning

Cycle Time and Latency

- **Cycle time:** specifies the time interval at which the read head records an image.
- **Latency:** describes the time required by the read head for image processing and for calculating the position values.

The specific values for the cycle time and latency of your read head can be found in the respective datasheet.

The read head has a timestamp function. This enables chronological assignment of image captures and the associated position data. This makes the read head suitable for demanding real-time applications. The function is described in more detail below.

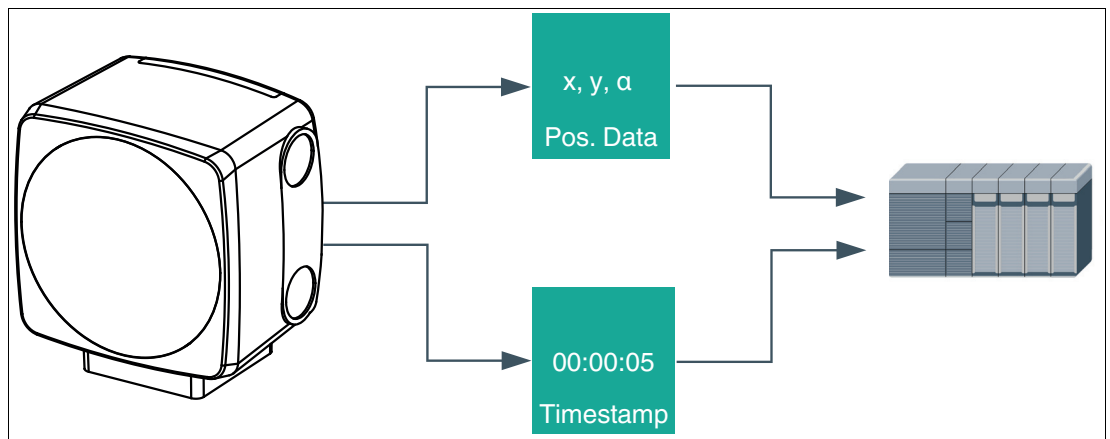


Figure 4.38 Features overview

Timestamp

The timestamp indicates the exact time the image was recorded, which is used to determine the position values. It is based on a continuously incrementing 32-bit counter with an internal time base of 27 MHz that is not synchronized with an external source. The time stamp can be used to determine the exact cycle time between two consecutive images:

$$\text{Cycle time [s]} = \frac{\text{Timestamp (image)} - \text{Timestamp (image - 1)}}{27 \text{ MHz}}$$

5 Installation and Commissioning

The following sections describe the installation and commissioning of the positioning system. Only the mounting process is described. The planning specifications for mounting must be observed, see chapter 4.

Positioning Targets

The different types of positioning targets that are compatible with this read head are addressed in separate subsections.



Note

Metal Positioning Targets

Metal positioning targets are not addressed in this manual. Corresponding information can be found in the separate manual on the Pepperl+Fuchs homepage.

Read Head

The installation and configuration of the read head is divided into the following topics:

- **Mounting the read head:** Mechanical mounting at the place of use.
- **Electrical connection:** Wiring and power supply.
- **Alignment:** Fine adjustment of the read head to the positioning target.
- **Configuration:** Software settings.

5.1 Positioning Targets

The basic mounting process is identical for all positioning targets available as accessories from Pepperl+Fuchs, as these are always affixed. Specific features of individual positioning targets are described in the corresponding subsections.

Preparing the Base Surface

The condition of the surface is crucial for permanent adhesion of the positioning target.

- Completely remove any residues such as grease, oil, and dust.
- Ensure that the surface is dry, clean, and stable.



Carrying Out the Mounting Process



Caution!

Loss of adhesive force due to contamination

Dust or skin oils on the bonding surface significantly impair adhesion.

- Do not touch the bonding surface
- Protect the exposed adhesive layer from contamination.

1. Check the temperature range specified on the datasheet for mounting the respective positioning target in advance.
2. First, remove a short length of the protective film from one end only.
3. Precisely place the positioning target in the intended position and firmly press down the exposed end.
4. Gradually remove the remaining protective film while smoothing and pressing down the positioning target.

**Note****Curing Time**

The adhesive needs **72 hours** to fully cure. Do not place a mechanical load on the positioning target during this time.

5.1.1 Data Matrix Code Tape

During mounting, observe the planning information, see chapter 4. For Data Matrix code tapes, the specifications also apply, see chapter 2.2, see chapter 4.3.2, and see chapter 4.8.

Preparing for Mounting

The code tape must be mounted precisely parallel to the traverse path of the read head. Depending on the equipment and route length, two aids are available:

Using the PCV-LM25 Marker Head (Accessory)

- Mount the marker head in place of the sensor, in the optimal alignment to the code tape.
- Traverse the entire path to mark the ideal position of the code tape.

Using an Application Device

- For long paths, a mechanical device is recommended to guide the code tape evenly and to avoid overstretching due to excessive tensile force.
- The code tape is delivered on a roll. A suitable mechanical application device can be designed for the respective application, e.g., in the form of a bracket that holds, guides, and positions the roller with the code tape.



Affixing the Code Tape

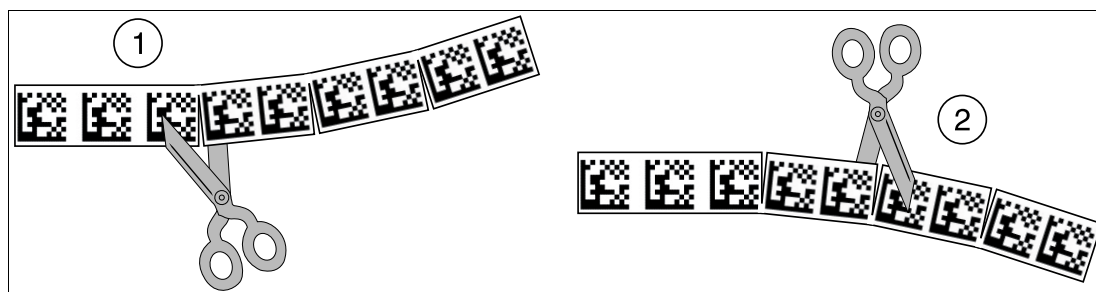
**Caution!**

Loss of adhesive strength

Avoid accidental application of the code tape, as repeated removal and reaffixing significantly reduces adhesion and durability.

- Affix the code tape precisely during the first contact.

1. Pull off the protective strip on the back of the code tape piece by piece.
2. Affix the code tape along the intended position. Make sure that you do not stretch the code tape.
3. **Inclines and Declines:** For steep inclines or declines, incisions must be made on the outside of the code tape (see the following figure).



- 1 Incline
- 2 Decline

4. **Roller transitions:** At the transition to the next roller, make sure that the 20 mm grid of codes continues precisely.

**Note****Quality Grades**

If the quality values have declined after the code tape has been mounted, this may indicate contamination, damage, or incorrect alignment. For more information, .

**Note****Length Changes**

The specified length markings and tolerances apply to the unmounted code tape. The actual length may vary due to:

- Improper application can shorten the effective length of the code tape.
 - Tensioning the code tape can cause an extension of the effective length.
 - Temperature expansion of the surface can influence the effective length of the code tape during operation.
-

5.1.2 Emergency Spare Code Tape

A code tape printed on paper can be used as a short-term interim solution if code tape segments are defective, heavily soiled, or not present.

A code tape generator is available for this purpose on the Pepperl+Fuchs homepage.



Note

Limited Durability of Printed Code Tapes

Printed paper is **not a permanent replacement** for the rugged original code tapes. The printout must only be used as an **emergency solution**.

The durability of the paper code tape is severely limited, depending on the application.



Note

Mounting Specifications

The specifications also apply to the mounting of replacement code tapes and must be observed, see chapter 5.1.1.



Creating and Installing a Replacement Code Tape

1. Open the code tape generator on the homepage at www.pepperl-fuchs.com. To do this, enter the search term "code tape generator" in the search field and start the search.

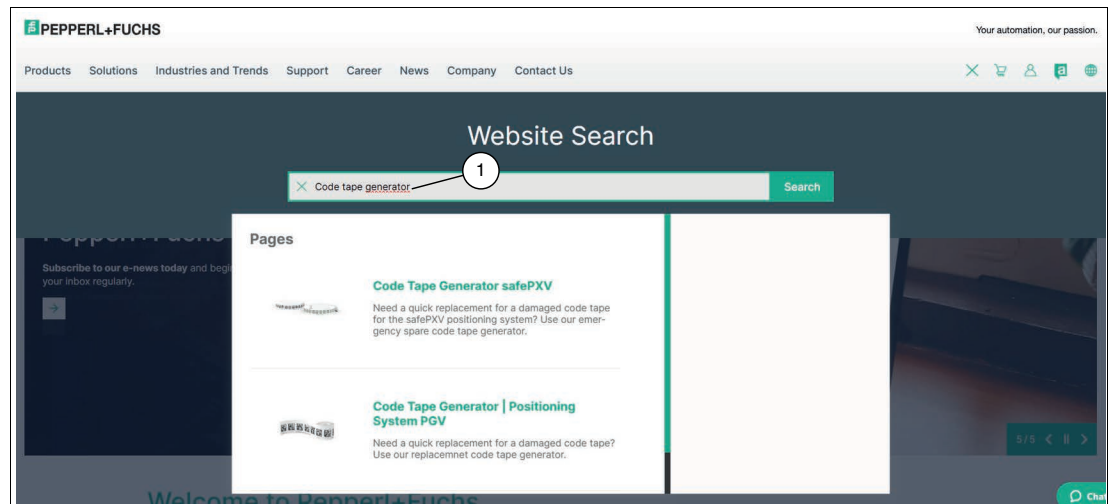


Figure 5.1 Code Tape Generator

2. Select the code tape generator that is compatible with your system.
3. Follow the instructions on the generator.
4. Print the pages of the required code tape segments and cut them precisely to size.



Note

Print Settings

Make sure that the printer settings are selected so that the code size exactly matches the original code tape.

The correct scaling can be checked using the dimensions on the top and right of the first page of the document.

5. Affix the replacement code tape over the defective area of the existing code tape.

6. Preferably apply adhesive to the back of the replacement code tape.

**Note****Avoid Placing Tape on the Front**

Do not cover the codes or the quiet zone with adhesive tape. Transparent adhesive tape can also impair the detection of the codes due to reflections.

7. Align the replacement tape so that it seamlessly continues the grid of the code tape.

**Tip****Suitable Protective Film**

To increase the resistance of the paper code tape, we recommend that you apply a suitable protective film. You can find suitable accessories on our homepage.

**Warning!**

Danger due to uncontrolled movements!

If code tape segments are not replaced properly or replaced by code tapes with deviating position information, the taught-in reference points may change. This can cause the control logic to perform actions at incorrect positions.

The resulting uncontrolled movements can cause serious injury to persons and considerable damage to the system.

5.2

Read Head

The read head is commissioned in several steps. The recommended sequence may vary depending on the installation situation and application. The individual steps are described in the following subsections:

- Mounting
- Electrical Connection
- Alignment

Certain alignment procedures require an electrical connection to be established in advance. In addition, the code tape must already be mounted to align the read head.

The following procedure is therefore generally recommended:

1. Mount the code tape
2. Mounting the read head
3. Establish the electrical connection
4. Align the read head on the code tape

**Caution!**

Risk of injury due to strobe effect

Strobe effects may occur when lighting is flashing. These can cause optical illusions, such as rotating parts appearing to be at a standstill or moving more slowly. This results in a risk of injury.

- Mount and align the device so that no rotating parts are illuminated.
- If such an arrangement is unavoidable for system-related reasons, mark the hazardous area in the system with clearly visible warnings.

5.2.1 Read Head Assembly



Note

Technical Drawing

A technical drawing of the read head with full dimensions is included in the datasheet.

Planning and Preparation

The appropriate installation position is selected as part of the system planning (see chapter 4). Pay particular attention to the requirements, see chapter 4.5, and see chapter 4.6.

- The assembly must be designed to make subsequent fine adjustment possible. Alternatively, the read head must be precisely aligned during initial assembly.
- We recommend the use of mounting brackets with slots to enable flexible and precise alignment.

A suitable mounting bracket with slots is available under the product designation PCV-MB1 on our homepage.



Figure 5.2 Mounting bracket (PCV-MB1)

- Mount the bracket so that the slots allow adjustment in the direction of the code tape.

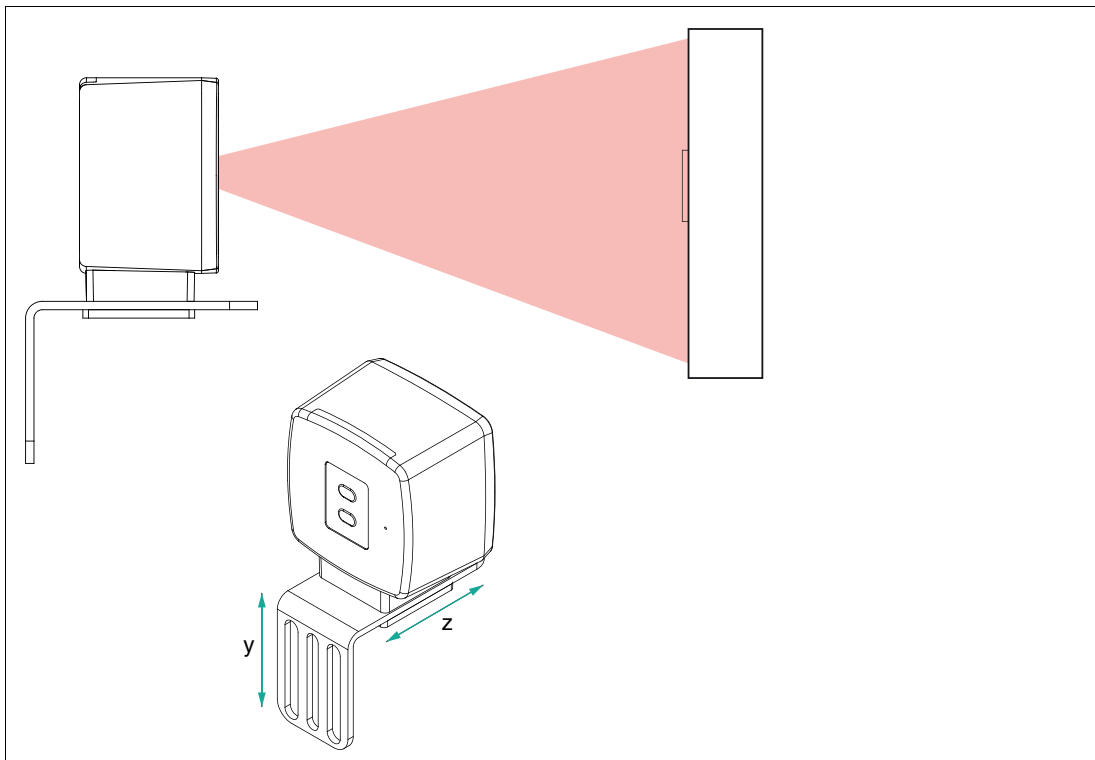


Figure 5.3 Example illustration of the read head on the mounting bracket

Mechanical Installation

Secure the read head using four screws. To ensure long-term stability and to prevent damage to the housing, observe the following limit values:

Parameters	Value
Max. tightening torque	9 Nm
Max. screw-in depth	9 mm
Min. tightening torque	System-specific (to be defined by the planner)

Notes on Mounting

- The screw connection must be designed for the individual mechanical loads (vibrations, shocks) of the application.
- If necessary, use thread-locking fluid to prevent loosening due to temperature or vibration.



Warning!

Personal injury due to incorrect position values

Loose fastenings result in the read head moving uncontrollably during operation. The resulting incorrect position values can result in unpredictable travel movements, which pose a risk to personnel and the system.



Caution!

Damage to Property Due to Inadequate Securing

If the read head is not secured in accordance with the mechanical load, it can completely detach. This could result in the destruction of the device and potential consequential damage to the system.

5.2.2

Electrical Connection

The electrical connection of the read head is established via connector plug connectors on the side of the housing.

Only use suitable cables and connectors for the connection. Suitable accessories can be found on our homepage on the respective product details page.

"Main" Connection

The connector labeled "Main" is used to connect the power supply. The configurable inputs and outputs are also available via this connection.

More information on the configurable inputs and outputs is described in, see chapter 5.3.3.



Caution!

Device damage due to incorrect voltage

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

- Only operate the device with direct current (DC).
- Make sure that the supply voltage is within the specified range (see datasheet).
- Make sure that the wiring for the connection lines has been completed correctly.



Note

Inverse-polarity protection

The read head has reverse polarity protection, which prevents damage in the event of incorrect polarity.

The inputs and outputs are also protected against reverse polarity.

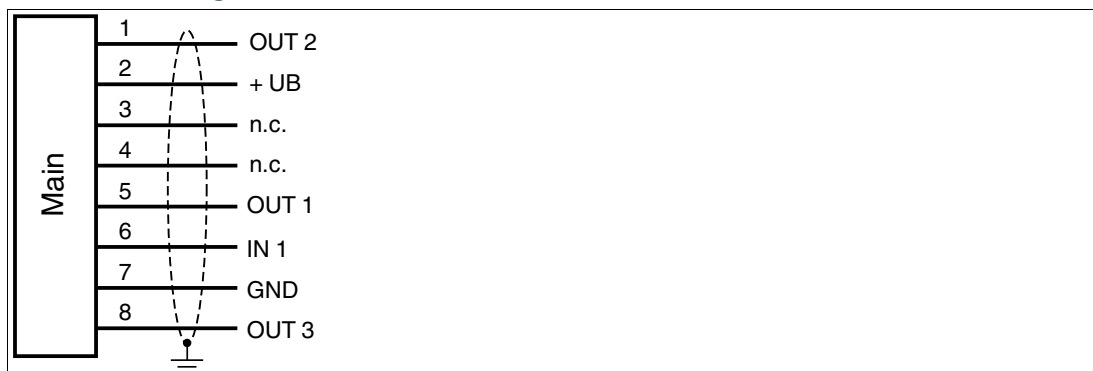
"Main" Pin Assignment

Figure 5.4 Main Connection Layout

Pin	Designation	Configurable
1	Output OUT 2	Yes
2	Operating voltage +U _B	-
3	Not used	-
4	Not used	-
5	Output OUT 1	Yes
6	Input IN 1	Yes
7	Ground GND	-
8	Output OUT 3	Yes

The default settings for the configurable inputs and outputs can be found in the read head data sheet.

Influence from Sources of Electromagnetic Interference

Electrical devices generate electrical and magnetic fields during operation, which can impair the function of other equipment.

Typical sources of interference in industrial environments include rectifiers, motors, and frequency converters. The electrical and magnetic fields generated by these devices can cause capacitive or inductive coupling, and interfere with the functioning of close-by devices, such as sensors.

Electrostatic discharge (ESD) can also impair the functioning of devices in industrial environments.

The following sets out measures to protect the read head from malfunctions caused by the sources of interference set out above.

Only use shielded connection lines for the electrical connection.

The braided shield must be connected to the equipotential bonding system on both sides over a large area and with low impedance.

"On both sides" means that this is required both on the PLC / in the switch cabinet, and on the read head.

The ground terminal, available as an accessory, is used to connect the device to the equipotential bonding on the read head.

The ground terminal is attached to the "Main" plug. From there, a ground cable must be routed to the nearest ground point or to a grounded metal part.

Ground Cable Requirements

- Largest possible cable cross-section
- Shortest possible cable length (typically < 20 cm)
- Place cable over a large area on a metallic surface
- Use a toothed lock washer to ensure a large, low-impedance, reliable connection

PROFINET Connection

For PROFINET integration, the device has two 4-pin D-coded sockets (port 1 and port 2) on the side of the housing.

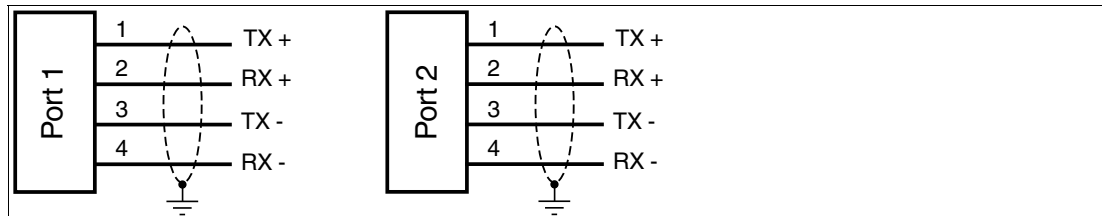


Figure 5.5 Port 1 and Port 2 Pin Assignment

The two sockets on the read head are internally connected to each other via an integrated switch. This bundles the data traffic of the PROFINET environment via the two ports. The device communicates within the PROFINET environment and allows additional field devices to be connected.

5.2.3 Alignment of the Read Head

Align the read head, see chapter 4. Carry out a fine alignment using the position values as set out below. This procedure is possible for all device types and ensures maximum system availability and accuracy.

System-Specific Alignment Method

In systems with several vehicles along a traverse distance, a system-specific alignment method must be developed. This ensures that all read heads are aligned equally with the truck. This is also recommended for systems with only one vehicle per traverse distance, so that the alignment can be precisely restored when a device is replaced.

Significance of Uniform Orientation

The following figure illustrates the problem. Despite the identical x-position of the read head, the conveyor containers are offset if the mechanical mounting position on the conveyor container varies.

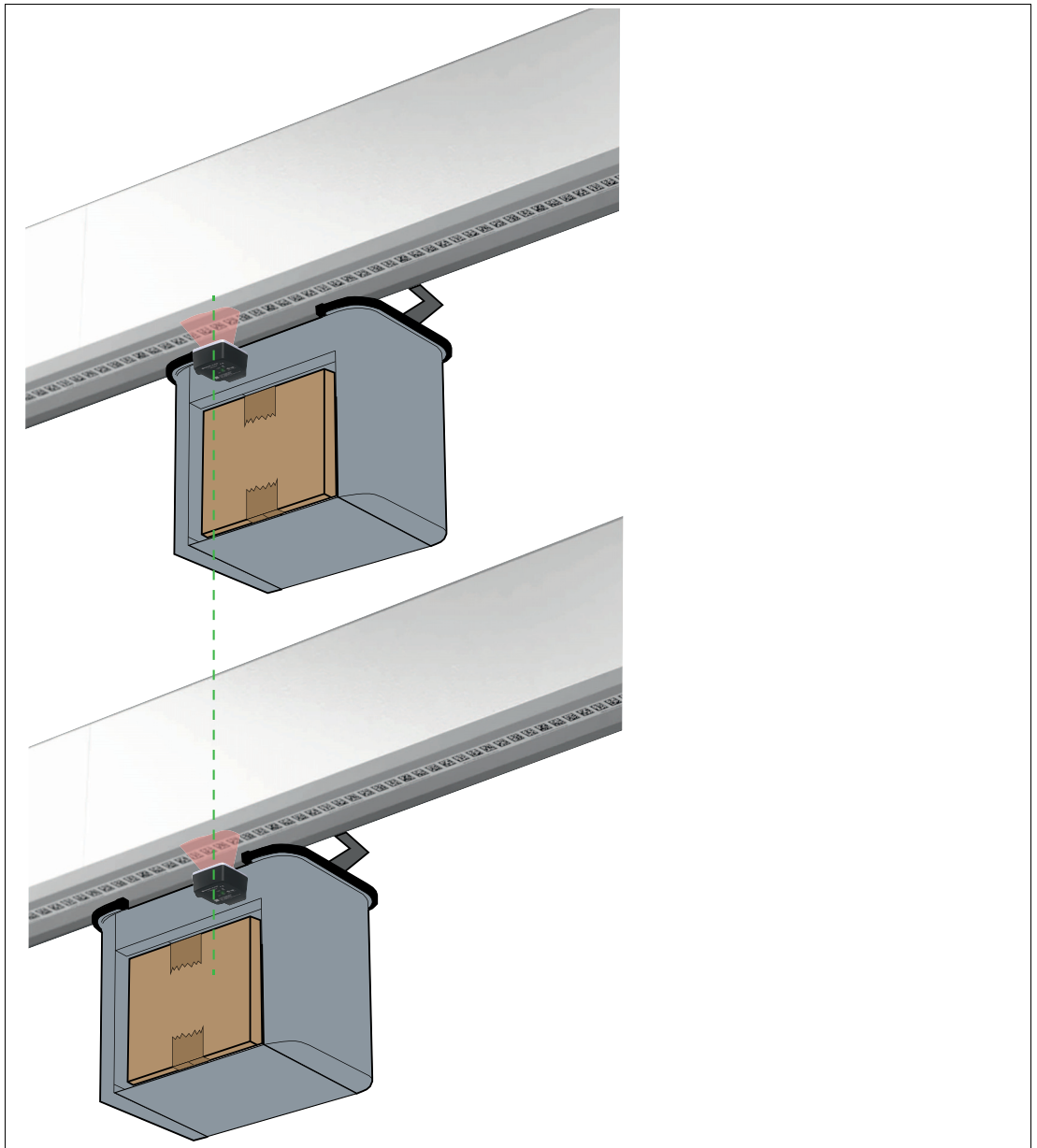


Figure 5.6 Illustration



Carrying Out the Alignment Procedure

1. Define a position for the alignment. It must be possible to position the vehicles manually at this position without reference to the read head (e.g. using colored markings).
2. Align all read heads in this position to specified x, y, and z values.
3. Display the position values in the controller. Alternatively, use the position display in the "Vision Configurator" (see chapter 7.1).

Alignment Criteria

x Value

- Alignment to a defined x-value is critical to ensure that all the conveyor containers are positioned identically along the route.

y and z Values

- In many systems, changes occur along the traverse distance including
 - the read distance
 - the height of the read head relative to the positioning markings.

When aligning using position values, the y and z values must be selected to represent an optimal compromise for the entire system. Identical alignment of all read heads to the same y and z values helps significantly to increase availability.

Angle Position

- Avoid twisting or tilting the read head in relation to the code tape.

Alternative Alignment Methods

Depending on the read head type, other methods are available for aligning the read head.

These are set out in the following sections.

The above instructions apply regardless of the selected alignment method.

Selecting the Reference Point

If you do not align to predefined position values, the alignment is performed by optimizing at the selected reference point.

The alternative methods are designed to optimize the orientation locally at this point, and can replace an orientation to fixed y and z values.

The reference point must be a representative compromise for the entire system with regard to the reading distance and height to the code tape.

However, these methods cannot be used to ensure alignment to a defined x value.

5.2.4 Alignment Using an Alignment Guide

Using an alignment guide is a very simple and at the same time precise way of aligning the read head to the correct height and the intended read distance. This is listed as an accessory on the product details page of the respective read head on our homepage under the "Related Products" tab.



Assembly Process

1. Set the alignment guide on the read head from the rear.



Note

Correct Positioning of the Alignment Guide

The correct positioning depends on the selected installation position or orientation of the read head and is shown in the following figure.

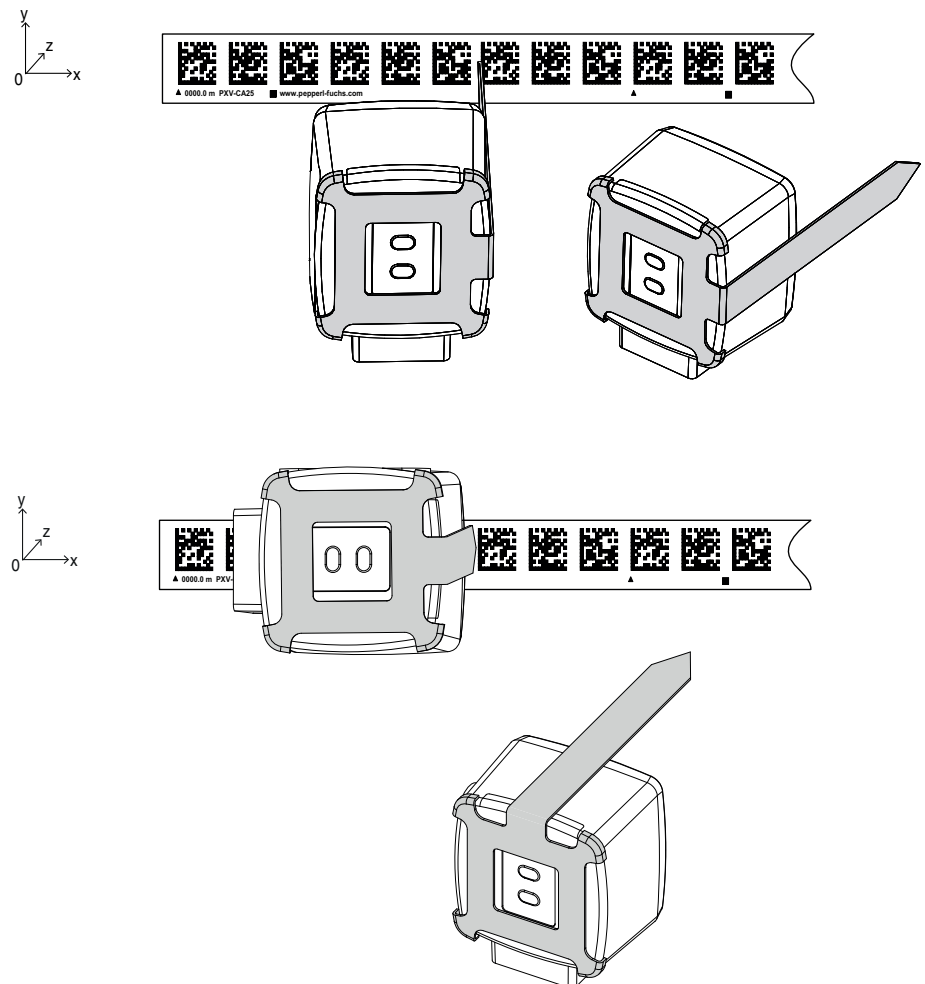


Figure 5.7

2. Align the read head so that the tip of the alignment guide lightly touches the code tape.
3. The tip must point exactly to the $y = 0$ line of the code tape (details on the definition of the $y = 0$ line, see chapter 4.3.2).

**Note****Nominal Distance**

The alignment guide is designed exclusively for adjustment to the specified nominal distance.

**Note****Compatibility**

The alignment guide is not fully compatible with all housing designs.

Limitation: For housing type F200A, the arrangement of plugs and mounting block blocks the placement of the alignment guide in certain orientations. Check the accessibility of your selected mounting variant in advance.

5.2.5**Image Capture Check**

For read heads that support a connection to the Vision Configurator, the alignment of the read head can be checked using an image capture. The detailed procedure is set out, see chapter 7.7.

**Note**

The instructions described below apply to initial commissioning. To check for contamination or damage to the code tape, the corresponding sections elsewhere must be observed.

To check the alignment, the crosshair that marks the center of the image should be displayed using the "Show Center" function. The crosshair must be aligned to the center of the code tape or to the line $y = 0$ (see chapter 4.3.2).

Image capture using the displayed crosshair is also suitable for optimizing the y-alignment. It can be used to check whether the code tape is straight in the image or whether the read head is mounted twisted or tilted.

The nominal distance cannot be set using image acquisition. Alternative adjustment methods provided for this purpose must be used for this.

5.3**Configuration**

This chapter sets out the procedure for parameterizing the device.

For a detailed description of the individual parameters, see chapter 5.3.1.

Two options are available for parameterizing the device:

- Parameterization using the **"Vision Configurator"** software tool
- Parameterization via the **device description file (GSDML file)**

Parameterization Using "Vision Configurator"

Parameterization is possible using the "Vision Configurator" software tool.

For detailed information on Vision Configurator, see chapter 7.1, see chapter 7.3, and see chapter 7.8.

This software gives you full access to all device parameters.

Parameterization via the Device Description File (GSDML File)

Alternatively, it is possible to parameterize using the device description file.

However, the complete parameter range is not available.

With PROFINET, a field device is integrated into the project planning tool via a device description file (, section: "Project Planning with GSDML File"). You import the GSDML file into your project planning tool. You can use the GSDML file to specify the device configuration. Parameterization via the GSDML file is activated by selecting the "Configuration" module.

**Note****Overwriting Parameters via the Controller**

If the "Configuration" module is activated in the device description file, the controller overwrites all parameters contained that were previously changed by the Vision Configurator.

This is done regardless whether the parameter values have changed compared to the existing device configuration.

If the read head is parameterized via the controller, the configured parameter values are stored in the read head in the volatile memory. This means that the configured parameter values are also visible in the Vision Configurator. However, if the read head is restarted, the parameter values are reset to the values saved in the Vision Configurator.

For a complete list of configuration parameters, see , section: "Configuration Module (Global Primary Data)". Once project planning is complete, the IO controller transmits the parameterization to the field device. Parameterization is carried out automatically by the IO controller.

**Note****Undefined State of the Switching Outputs**

The state of the switching outputs is undefined while the configuration is being transferred from the controller to the read head.

The state of the switching outputs can therefore change briefly.

**Downloading the GSDML File**

The GSDML file required for the device is available for download in the "Software" area of the product details page.

1. Open the website www.pepperl-fuchs.com.
2. Enter the appropriate product name in the product search.
3. Open the product details page and go to the "Software" area.
4. Download the GSDML file.

5.3.1 Parameters

Name	Options	Statement	Access
Product name	-	Device name	R
Name	-	Name of the manufacturer	R
Website	-	Link to the manufacturer's homepage	R
Item number	-	Item number of the device	R
Serial number	-	Serial number of the device	R
Version	-	Device firmware version	R
Maximum protocol x-position value	-	Maximum position value up to which the system can position	R
Code tape orientation	0°, 180°, 0°/180°, 0°/90°/180°/270°, 90°/270°	Orientation of read head in relation to code tape.	W
Code tape width	1 row, 2 rows, 4 rows, 6 rows	Number of Data Matrix code series on the code tape. This parameter must be adapted to the code tape type used.	W
Resolution x	0.1 mm, 1 mm, 10 mm	Resolution of the x Position. Multiply the resolution by the raw data value to obtain the absolute position.	W
X position offset	Integer value	The value set here is added to the raw data value of the x position. Observe the set "Resolution x".	W
Resolution y	0.1 mm, 1 mm, 10 mm	Resolution of the y position. Multiply the resolution by the raw data value to obtain the absolute position.	W
Y position offset	Integer value	The value set here is added to the raw data value of the y position. Observe the set "Resolution y".	W
Resolution Speed	0.1 m/s, 0.01 m/s, 0,001 m/s	Resolution of the speed. Multiply the resolution by the raw data value to obtain the speed.	W
Resolution Angle	1°, 0.5°, 0.2°, 0.1°	Resolution with which the angle is displayed when positioning via code tape.	W
No position x	Last valid position, Specified position	Behavior of the device when no x position is detected.	W
No position x value	Integer value	Position value in "Specified position" for x.	W
No position y	Last valid position, Specified position	Behavior of the device when no y position is detected.	W
No position y value	Integer value	Position value in "Specified position" for y.	W
No position speed x	Last valid speed, Specified speed	Behavior of the device when no speed is detected.	W
No position speed x value	Integer value	Speed at "Specified speed".	W

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Name	Options	Statement	Access
Internal overspeed value	Integer value	Adjustment to the maximum speed of the read head.	W
Extrapolation	No extrapolation, Linear extrapolation	Extrapolation behavior (see chapter 5.3.2).	W
X value at error	Error No., Last valid value, Specified value	Behavior of the x data at error.	W
Error value (x)	Integer value	Value for x at error.	W
Y value at error	Error No., Last valid value, Specified value	Behavior of the y data at error.	W
Error value (y)	Integer value	Value for y at error.	W
Speed value at error	Error No., Last valid value, Specified value	Behavior of the speed at error.	W
Error value (Speed)	Integer value	Value for speed at error.	W
Image resolution	Full Half horizontal, full vertical Full horizontal, half vertical Half horizontal, half vertical Quarter horizontal, quarter vertical	Image resolution for Vision Configurator.	W

**Note****Differentiating Resolution and Accuracy**

The parameterizable resolution does not correspond to the accuracy. Refer to the device-specific data sheet for information on accuracy.

5.3.2**Extrapolation**

Extrapolation is a procedure in which values outside the previously observed range are derived from known data. In the specific case of the read head, future position values are calculated based on the last valid position and the last valid speed.

Advantages of Extrapolation**Higher Query Rate**

- The read head can be queried with a cycle time that is shorter than the cycle time of the read head without x-position values being output multiple times.

Increased Real-Time Accuracy

- Position queries can take place at times when the read head has not yet determined any new position values. In this case, the current position is estimated using extrapolation. As a result, the output value is usually closer to the actual position at the time of the query than the last determined position value.

Bridging Gaps

- If an area without readable position information is passed through unintentionally, under certain circumstances it can be bridged using extrapolation without loss of position. The prerequisite is that the duration without valid position values does not exceed 100 ms.

Limits and Possible Deviations of Extrapolation

Extrapolation accuracy is based on the assumption of a constant speed. In practice, however, deviations can occur, which can result in incorrect predictions in the short term. These are automatically corrected by subsequent, valid measurements.

Please note the following scenarios that may affect accuracy:

Constant Speed

- At a constant speed, the predicted position values are very accurate.

High Speed Changes

- Rapid speed changes can cause incorrect predictions in the short-term. These are only corrected by newly determined position values.

Violations of the Code Tape Grid

- Gaps in the code tape can result in a sudden change in position and an incorrectly calculated speed (see chapter 4.8). This also results in an incorrect position forecast.

Leaving the Read Range

- If the read head moves to an area without valid position information, it extrapolates the position for up to 100 ms. Even when specifically entering an area without position detection, incorrect position predictions can occur in the short term.

5.3.3 Configuring the Inputs and Outputs

This chapter sets out the configurable inputs and outputs of the read head.

Configurable Outputs

The configurable outputs (see chapter 5.2.2) can be parameterized using one of the following functions:

Function	Description
No function	Deactivates the output.
No position	Output is set when it is not possible to determine position.
Warning	Output is set when a warning occurs.
Error	Output is set when an error occurs.
Event	Output is set when an event marker tape is read.
Overspeed	Output is set when a defined speed is exceeded (see parameter "Overspeed value" below.)
Quality values	Output is set from a quality value (see parameter "Q-Value Threshold" below.)

Additional Parameters for Outputs

Additional parameters are available for some output functions:

Parameter name	Description
Overspeed value	If an output is parameterized to the "Overspeed" function, this parameter is used to specify the speed value from which the output becomes active.
Q-Value Threshold	If an output is parameterized to the "Q value" function, this parameter is used to specify the threshold value for the quality value that determines the switching behavior of the output. - If the quality value is less than the parameterized threshold value, the output becomes active. - If the quality value is greater than or equal to the parameterized threshold value, the output becomes inactive.
Event-List	If an output is parameterized to the "Event" function, this parameter can be used to set at which event marker numbers the output is set (see chapter 0022). The "Event List" parameter can be configured as follows: - All events: Output is set for all event marker numbers - Range: Here a lower limit ("Lower Border" and an upper limit "Upper Border") of event marker numbers can be configured. The output is set for event marker numbers within this range. - List: Individual event marker numbers for which the output is set can be configured here.

Configurable Inputs

The configurable inputs (see chapter 5.2.2) can be parameterized using one of the following functions:

Function	Description
No function	Deactivates the input.
Illumination Control	If the input is parameterized to "Illumination control," the illumination of the read head can be controlled: Input set: Illumination is switched off. Input not set: Illumination is active.

6 Operation and Communication

6.1 General Information on Communication via PROFINET

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

PROFINET IO is the communication concept for decentralized automation systems. Field devices are integrated into a network as IO devices and process data is cyclically exchanged with a controller (IO controller). The process data of the field devices is transferred to the process image of the controller.

The PROFINET IO device model is based on slots and channels, and is conceptually oriented to PROFIBUS DP. The device properties are written in a GSDML file (generic station description markup language based on XML.) PROFINET IO is engineered in the same way as PROFIBUS DP. Decentralized field devices are assigned to a controller during project planning.

Device Types

PROFINET IO distinguishes between the following device types:

- **IO-Controller:** A controller (PLC) that executes the automation program.
- **IO-Device:** A decentralized field device (e.g. the read head) that is assigned to an IO controller.
- **IO-Supervisor:** A programming unit or PC for commissioning and diagnostics.

6.2 PROFINET IO Interface of the Read Head

The read head functions as a PROFINET IO device that exchanges cyclically with the assigned IO controller during operation.

Interface Properties

- **Transfer rate:** 100 Mbit/s
- **Function Range:** Conformance Class B
- **I&M functions:** Supports identification and maintenance data from IM0 to IM3.

6.3 Identification and Maintenance (I&M)

I&M data is information stored in the device for unique identification within a system.

Identification Data (I Data)

- Device-specific information (e.g. item number, device name)
- Cannot be changed

Maintenance Data (M Data)

- System-related information (e.g. installation location, installation date)
- Set initial during commissioning
- Can be changed

Overview of I&M Data Records

Data record	Content
IM0	Device identification (item number, device name, etc.)
IM1	System and location identification
IM2	Installation date
IM3	Additional information

6.4 Project Planning with GSDML File

A field device is integrated into the project planning tool by way of a device description. The properties of the field device are described in the device description GSDML (Generic Station Description Markup Language) file. The GSDML file contains the field device data (technical features and information for communication) that you need to operate the device in a PROF-INET network. Some tools refer to the GSDML file in abbreviated form as "GSD file".

Project Planning Steps

- **Import:** The GSDML file is imported into the project planning tool.
- **Assigning an Address:** The corresponding addresses are assigned to the input and output channels of the device in the process image of the controller. The user program reads the sensor data (inputs) and writes control commands (outputs) via these addresses.
- **Data Transmission:** Once project planning is complete, the project planning and configuration data is transferred to the IO controller. The assigned field devices are parameterized automatically.



Downloading the GSDML File

You can find the relevant GSDML file in the "Software" area of the product detail page.

1. Go to the website www.pepperl-fuchs.com.
2. Enter the product name or item number in the search field to access the product details page.

6.5 Device Identification and Addressing

Function	Value on delivery
MAC address	Clearly printed on the rear of the device.
Device name	pxv-f200
IP address	192.168.2.2

General Device Information

Parameter	Value
Vendor	Pepperl+Fuchs
Vendor ID	0x005D
Main family	Encoders
Product family	Position systems
Device ID	0x1010
Information	Device family: Encoders

6.6 Overview of PROFINET Modules

Type	Module name	Abbreviation	Description
Configuration	Configuration	-	Configuration of the global primary data
Input data (Sensor >> Controller)	Status	STS	Status information (error, warning etc.)
	X position	XP	Position value in x direction
	Y position	YP	Position value in y direction
	Z distance	Z	Distance in z direction
	Angle	ANG	Angle output
	Speed	SPD	Speed output
	Warning	WRN	Warning information
	Event marker	EV	Number of the detected event marker
	Quality index	Q	Quality index output
	Timestamp	TS	Timestamp output
	Framecounter	FC	Image counter output
Output data (Controller >> Sensor)	Output control data	-	Control data from the controller to the sensor

Module Descriptions

Configuration Module (Global Primary Data)

The global primary data allows you to parameterize the read head using PROFINET.

Global primary data is always transferred to the read head in full.

- **Module Ident Number:** 0x00000012
- **Submodule Ident Number:** 0x00000102

Orientation (Index: 193, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range		Description
Orientation	Unsigned32	0	0	0 °	Orientation of the sensor relative to the code tape
			1	180 °	
			2	0° or 180°	
			3	0°, 90°, 180°, or 270°	

Code Tape Type (Index: 194, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range		Description
Code tape type	Unsigned32	0	1	One row	Type of code tape used
			2	Two rows	
			3	Three rows	
			4	Four rows	
			5	Five rows	
			6	Six rows	
			7	Seven rows	
			8	Eight rows	

Resolution Settings (Index: 195, Length: 16 Bytes)

Designation	Data type	Byte offset	Value range		Description
Resolution of x position	Unsigned32	0	0	0.1 mm	Specifies the resolution of the x position values (multiplier for x position data)
			1	1 mm	
			2	10 mm	
Resolution of y position	Unsigned32	4	0	0.1 mm	Specifies the resolution of the y position values (multiplier for y position data)
			1	1 mm	
			2	10 mm	
Angular resolution	Integer32	8	-16384 ... 16384 360 = 1° 3600 = 0.1°		Specifies the resolution of the angle values (multiplier for the angle data)
Speed resolution	Unsigned32	12	0	0.1 m/s	Specifies the resolution of the speed values (multiplier for the speed output)
			1	0.01 m/s	
			2	0.001 m/s	

Source of the Input Data (Index: 196, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range		Description
Selection of PROFINET protocol or hardware as input data source	Unsigned32	0	0	Hardware	Determines the input data source
			1	Protocol	

Digital Input 1 (Index: 197, Length: 1 Byte)

Designation	Data type	Byte offset	Value range		Description
Input function	Unsigned8	0	128	No function	Functions for selected digital input
			135	Switch on/off illumination	

Digital Output 1 (Index: 198, Length: 6 Bytes)

Designation	Data type	Byte offset	Value range		Description
Output functions	Unsigned8	0	0	No function	Functions for selected digital output
			1	Speed exceeded	
			2	Warning	
			3	Error	
			4	Quality grade	
			5	Event	
			6	No position	
Limit value for exceeding the maximum speed	Integer32	1	2 ... 125		In dm/s
Threshold for quality value	Unsigned8	5	2 ... 7		

Digital Output 2 (Index: 199, Length: 6 Bytes)

Designation	Data type	Byte offset	Value range		Description
Output functions	Unsigned8	0	0	No function	Functions for selected digital output
			1	Speed exceeded	
			2	Warning	
			3	Error	
			4	Quality grade	
			5	Event	
			6	No position	
Limit value for exceeding the maximum speed	Integer32	1	2 ... 125		In dm/s
Threshold for quality value	Unsigned8	5	2 ... 7		

Digital Output 3 (Index: 200, Length: 6 Bytes)

Designation	Data type	Byte offset	Value range		Description
Output functions	Unsigned8	0	0	No function	Functions for selected digital output
			1	Speed exceeded	
			2	Warning	
			3	Error	
			4	Quality grade	
			5	Event	
			6	No position	
Limit value for exceeding the maximum speed	Integer32	1	2 ... 125		In dm/s
Threshold for quality value	Unsigned8	5	2 ... 7		

Behavior with Missing Position Data (Index: 201, Length: 32 Bytes)

Designation	Data type	Byte offset	Value range		Description
Behavior with missing x-position data	Unsigned32	0	0	Last valid position	Defines the output value if no position has been determined
			1	Defined value	
Defined output value for x position data	Integer32	4	0 ... 100000000		Attention: Observe resolution of x position
Behavior with missing y-position data	Unsigned32	8	0	Last valid position	Defines the output value if no position has been determined
			1	Defined value	
Defined output value for y position data	Integer32	12	-10000000 ... 10000000		Attention: Observe resolution of y position
Behavior with missing angle data	Unsigned32	16	0	Last valid position	Defines the output value if no position has been determined
			1	Defined value	
Defined output value for angle data	Unsigned32	20	0 ... 65,535		Attention: Observe angular resolution
Behavior with missing speed data	Unsigned32	24	0	Last valid position	Defines the output value if no position has been determined
			1	Defined value	
Defined output value for speed data	Integer32	28	-32768 ... 32767		Attention: Observe speed resolution

X Offset (Index: 202, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range	Description
Sensor offset in x direction	Integer32	0	-199999999 ... 199999999	Attention: Observe resolution of x position

Angle Offset (Index: 204, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range	Description
Angle offset of the sensor	Integer32	0	-16383 ... 16383	Attention: Observe angular resolution

Extrapolation (Index: 205, Length: 4 Bytes)

Designation	Data type	Byte offset	Value range	Description
Extrapolation	Unsigned32	0	0	Extrapolation off
			1	Linear extrapolation
				Selects the extrapolation settings

Marker Position (Index: 206, Length: 1 Byte)

Designation	Data type	Byte offset	Value range	Description
Marker position	Unsigned8	0	0	Event marker instead of the code tape
			1	Event marker in addition to code tape
				Selects the event marker position

Input Data Modules

Status Module

Status information, one word (2 bytes)					
Module Ident Number	Submodule Ident Number	Data type	Data bits		Description
0x00000013	0x00000103	Unsigned16	Bit 8	Error	Error code in x position (notify Pepperl und Fuchs)
			Bit 9	No position detected	XP=0; YP=0; ANG=0; SPD=0
			Bit 10	Warning	see warning module
			Bit 11	Event marker detected	see event marker module
			Bit 12	Position detected	-
			Bit 13	Speed exceeded detected	-
			Bit 14	Illumination is switched off	-
			Bit 15	Toggle bit	Bit switches regularly and can be used as a heart-beat signal

x Position Module

Position value in x direction, two words (4 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x00000014	0x00000014	Integer32	32 bit x position data MSB first, binary coded	0 ... 100,000,000 0



Note

Note the resolution of the x position set in the configuration module (0.1 mm, 1 mm or 10 mm). This resolution should be applied as a multiplier to the output raw value.

For example: An x position value of 10,000 corresponds to a position of 1,000 mm at a set resolution of 0.1 mm.

The maximum x position is 100 km.

y Position Module

Position value in x direction, two words (4 bytes)			
Module Ident Number	Submodule Ident Number	Data type	Content
0x00000015	0x00000015	Integer32	32 bit x position data MSB first, binary coded with a complement of two

**Note**

Note the resolution of the y position set in the configuration module (0.1 mm, 1 mm or 10 mm). This resolution should be applied as a multiplier to the output raw value.

For example: A y position value of -22 corresponds to a position of -2.2 mm at a set resolution of 0.1 mm.

z Distance Module

Position value in x direction, two words (4 bytes)			
Module Ident Number	Submodule Ident Number	Data type	Content
0x00000016	0x00000016	Unsigned16	16 bit z distance data MSB first, binary coded

Angle Module

Output of the angle, one word (2 bytes)			
Module Ident Number	Submodule Ident Number	Data type	Content
0x00000017	0x00000017	Unsigned16	16 bit angle data MSB first, binary coded

**Note**

Observe the angular resolution set in the configuration module (e.g. $360 = 1^\circ$ or $3600 = 0.1^\circ$). This resolution should be applied as a multiplier to the output raw value.

For example: An angle value of 15 corresponds to an angle of 1.5° at a set resolution of $3600 = 0.1^\circ$.

Speed Module

Output of the speed, one word (2 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x00000018	0x00000018	Integer16	16 bit speed data MSB first, binary coded with a complement of two	0 ... 15000

**Note**

Observe the speed resolution set in the configuration module (0.1 m/s, 0.01 m/s or 0.001 m/s). This resolution should be applied as a multiplier to the output raw value.

For example: A speed value of 50 corresponds to a speed of 0.5 m/s at a set resolution of 0.1 mm.

If the speed is unknown, the value 65535 is output.

Warning Module

Warning information, one word (2 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Data bits	Meaning
0x00000019	0x00000109	Unsigned16	Bit 0	Reserved 04
			Bit 1	Reserved 05
			Bit 2	Reserved 06
			Bit 3	Reserved 07
			Bit 4	Reserved 08
			Bit 5	Reserved 09
			Bit 6	Reserved 10
			Bit 7	Reserved 11
			Bit 8	Code with non-PCV/PXV content found
			Bit 9	Sensor too close to code tape
			Bit 10	Sensor too far from code tape
			Bit 11	Y position too high, the read head is just before "No position"
			Bit 12	Y position too low, the read head is just before "No position"
			Bit 13	Rotation angle in Z axis too high, the read head is just before "No position"
			Bit 14	Reserved 02
			Bit 15	Reserved 03

**Note**

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

Event Marker Module

Event marker number, one word(2 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x0000001A	0x0000001A	Unsigned16	Last event marker number MSB first, binary coded	0 ... 999

Quality Index Module

Output of the quality index, two words (4 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x0000001B	0x0000010B	Unsigned8	Quality value of 1 to 7, 1 byte MSB first, binary coded	1 ... 7
			Number of decoded codes, 1 byte MSB first, binary coded	0 ... 15
			Reserved, 1 byte	-
			Reserved, 1 byte	-

Time Stamp Module

Output of the time stamp, two words (4 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x0000001C	0x0000001C	Unsigned32	Timestamp MSB first, binary coded	0 ... 4294967295

Note

If the time stamp reaches its maximum value (see value range), a counter overflow occurs. In this case, the time stamp is reset to 0 and starts again.

Image Counter Module

Output of the image counter, two words (4 bytes)				
Module Ident Number	Submodule Ident Number	Data type	Content	Value range
0x0000001D	0x0000001D	Unsigned32	Framecounter MSB first, binary coded	0 ... 4294967295

Note

If the image counter reaches its maximum value (see value range), a counter overflow occurs. In this case, the image counter is reset to 0 and starts again.

Output Data Modules

Output Control Data Module

Control data from the controller to the sensor, 1 byte				
Module Ident Number	Submodule Ident Number	Data type	Data bits	Meaning
0x0000001E	0x0000010E	Unsigned8	Bits 0 ... 3	Reserved
			Bit 4	Switch on/off illumination 0: on (default value) 1: off (lighting off)
			Bits 5 ... 7	Reserved

7 Vision Configurator

7.1 Installing Vision Configurator

Vision Configurator is software that can be used to establish an initial connection to the read head. Various device parameters can be configured and saved in the device via this connection. In addition, the software enables the read-head image capture to be visualized.



Installing the Software

Proceed as follows to install Vision Configurator as follows:

1. Go to the homepage www.pepperl-fuchs.com.
2. Enter the product name or item number of your read head in the search field.
3. On the product details page, navigate to the Software area.
Alternatively: Search directly for "Vision Configurator" to access the software product page.
4. Download the software package.
5. Save the .ZIP file locally and unzip it fully.
6. Start the installation file (exe file).
7. Follow the instructions of the installation wizard.
8. Install all displayed driver packages.
9. After completion, start the Vision Configurator via:
 - **Start menu:** Start >> All programs >> Vision Configurator
 - **Desktop icon** (if selected during installation)

7.2 Getting Started

Vision Configurator Start Window

The Vision Configurator start window is structured as follows:

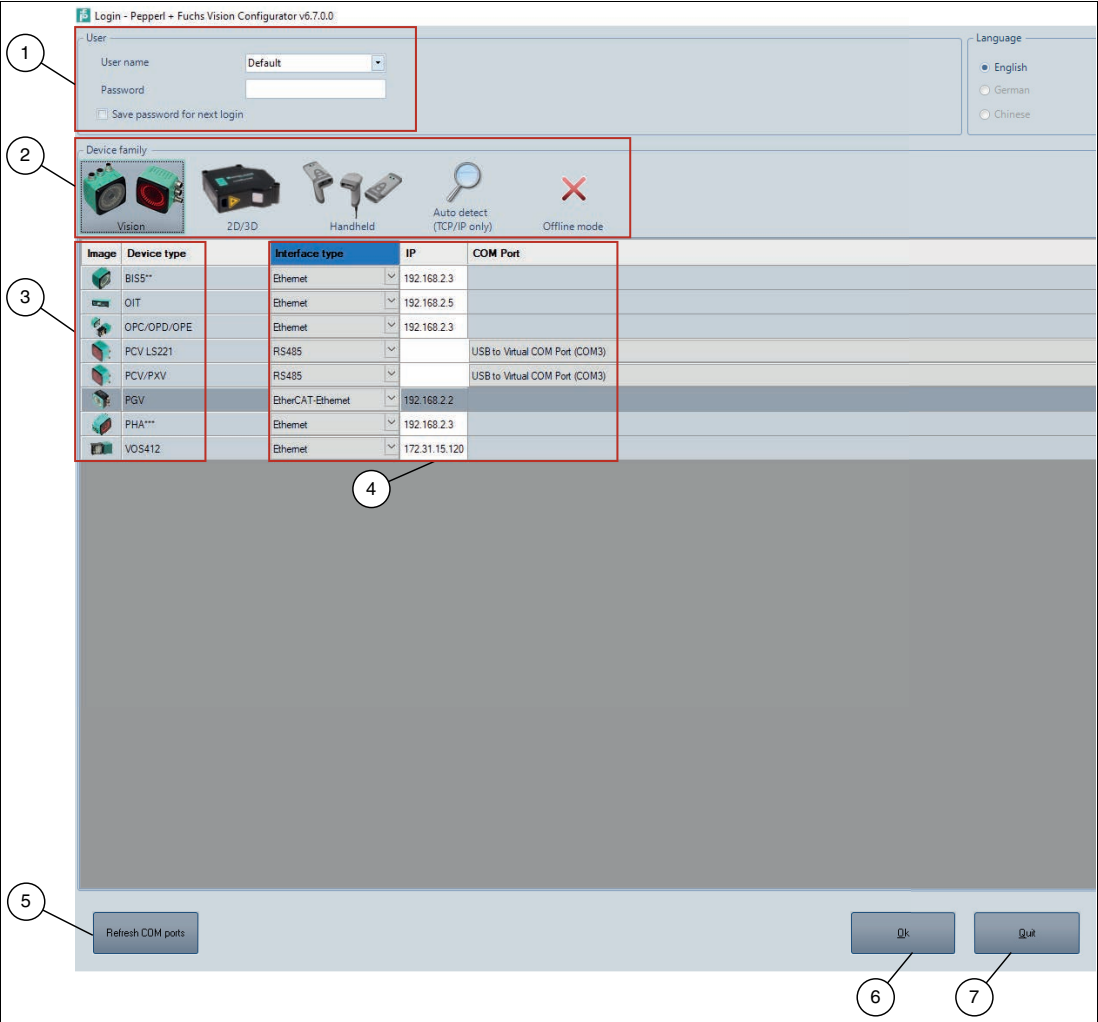


Figure 7.1 Vision Configurator start window



Selecting Users (1)

- 1. Select the desired user from the "Username" drop-down menu.
- 2. Enter the appropriate password in the "Password" input field.
- 3. Select the "Save password for next login" check box if you want to save the password for the next login.

Available users

The following table provides an overview of the available users, their passwords, and the respective authorizations:

User rights	Password	Description
Default	(No password)	- View all information - Configure the read head - Create users at same level or lower
User	User	- View all information - Configure the read head - Create users at same level or lower
Admin	PF	- View all information - Configure the read head - Create and delete users
PFAdmin	-	Access only for Pepperl+Fuchs service personnel

Selecting a Device Family (2)

Under "Device family," select the "Vision" device family. An overview of the available device types is displayed.

Additional Options:

- **Auto detect (TCP/IP only):** Automatic device detection for TCP/IP devices.
- **Offline Mode:** Enables work without a connected sensor.

Selecting the Device Type (3)

Select your device type under "Device type". You can find the device type in the first three characters of the device name.

Selecting the Connection Type (4)

Under "Interface type," select the appropriate connection type for your read head from the drop-down menu.

Depending on the device variant, the following additional fields are available:

- IP
- COM port
- Baud rate
- Head address

Unavailable fields are grayed out. More detail on the configuration can be found in the subsequent chapters.

Refresh COM Ports (5)

Updates the list of detected COM ports. Useful if the read head was connected after starting the Vision Configurator and the COM port is not yet displayed.

Note

Whether this function is relevant depends on the read head variant. More information on this can be found in the following chapters.

OK (6)

Click "OK" to establish a connection to the connected read head.

Quit (7)

Click "Quit" to close the Vision Configurator.



7.3 Connecting the Read Head to the PC



Connecting the Read Head to the PC

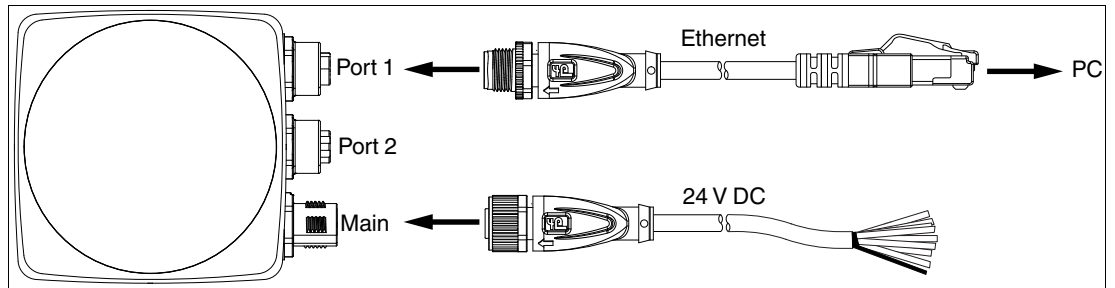


Figure 7.2 Cabling

1. Establish an Ethernet connection between the PC and the read head. A suitable cable can be found under the "Related products" tab on our homepage.
2. Connect the Ethernet cable to the Ethernet port on the read head.
3. Connect the other end to the Ethernet port on the PC. If your PC does not have the appropriate port, use a suitable Ethernet adapter.



Caution!

Adhere to the connection sequence

First connect the cable to the "Main" port before switching on the power supply.

4. Connect the 24 V DC power supply to the "Main" port on the read head. A suitable cable can be found under the "Related products" tab on our homepage.



Setting up Windows Network Communication between the Read Head and a PC/Laptop



Note

IP Configuration

On delivery, the read head has the IP address **192.168.2.2**.

To enable communication between the read head and the PC in this network, the network settings of the PC must be adapted to the address range of the read head.

The following steps set out how to set this up in Windows 11. The illustrations in this description were created using Windows 11.

1. Click the Windows Start button.
2. Select "Control Panel > Network and Sharing Center".

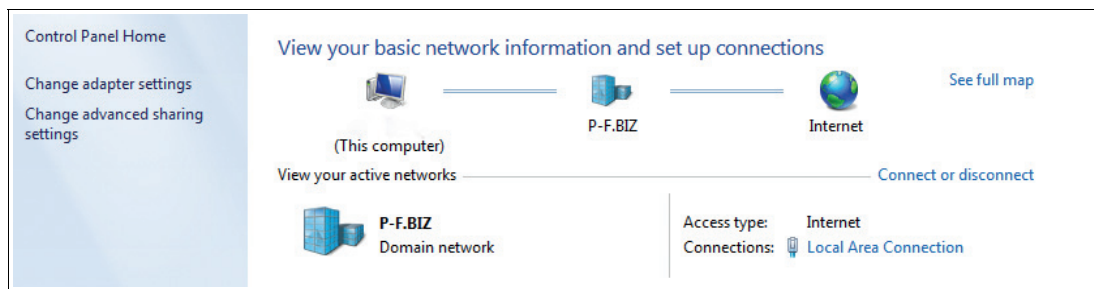


Figure 7.3 Network and Sharing Center

3. On the left, click "Change adapter settings".
4. Select the appropriate network connection and right-click it.

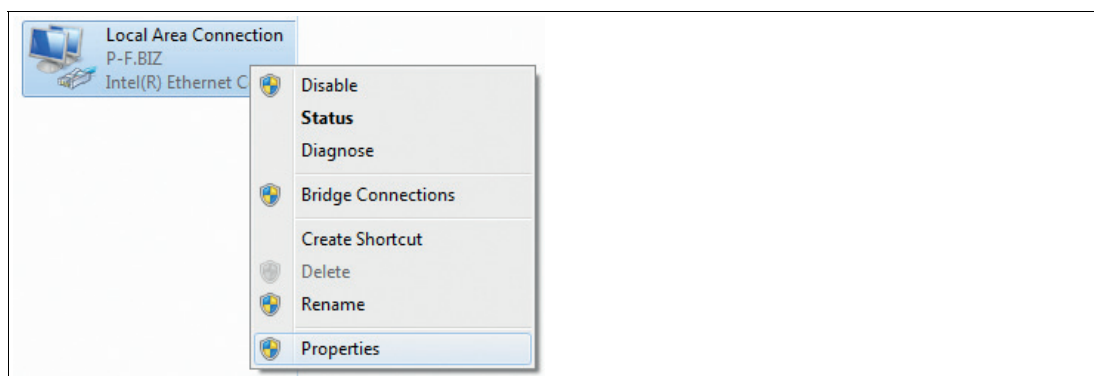


Figure 7.4 Properties context menu

5. Select "Properties" from the context menu.

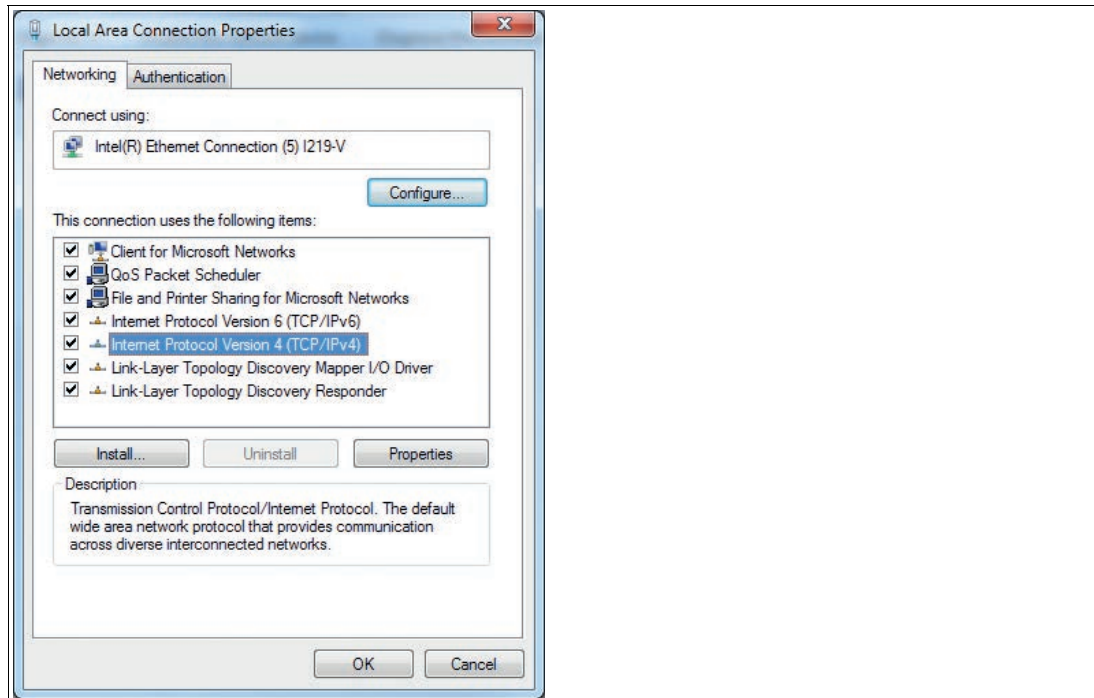


Figure 7.5 Internet Protocol, Version 4 (TCP/IPv4)

6. Double-click "Internet Protocol Version 4 (TCP/IPv4)".
- ↳ The Internet Protocol, Version 4 (TCP/IPv4) Properties window opens.

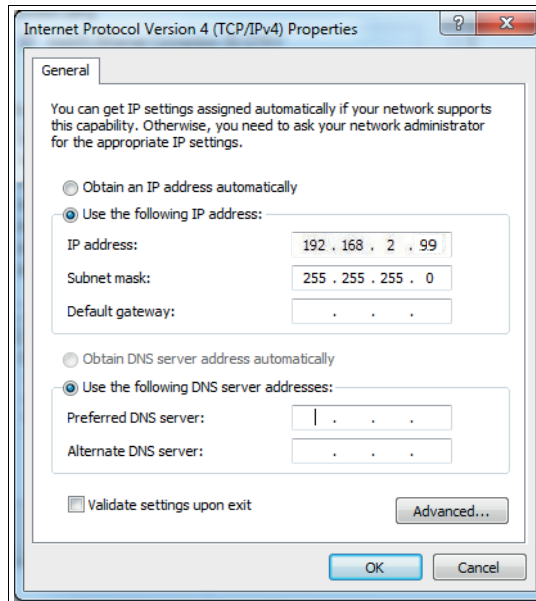


Figure 7.6 Use the following IP address option

7. Activate the "Use the following IP address".
8. Enter an IP address from the same address area as the read head. The first three blocks of the address must be identical. The last block must be different from the read head's IP address.



Note

Make sure that this address is not already being used by another participant in the network.

9. In this example, enter the following IP address and subnet mask:
 - **IP address: 192.168.2.99**
 - **Subnet mask: 255.255.255.0**
10. Click OK and then OK again to apply the settings.

Establishing a Connection in Vision Configurator

Open Vision Configurator. There are two ways to connect to the read head:

Automatic Detection

- Under "Device Family", select the option "Auto Detect (TCP/IP only)". If the configuration is successful, the read head is automatically displayed in the device list.

Manual Connection

- Under "Interface type," select the appropriate interface and enter the IP address of the read head in the "IP" field.

7.4 Application Window Structure



Note
Depending on the read-head variant, not all menu items are available in the application window. Only the menu items that are required for the configuration of the respective read head are displayed.

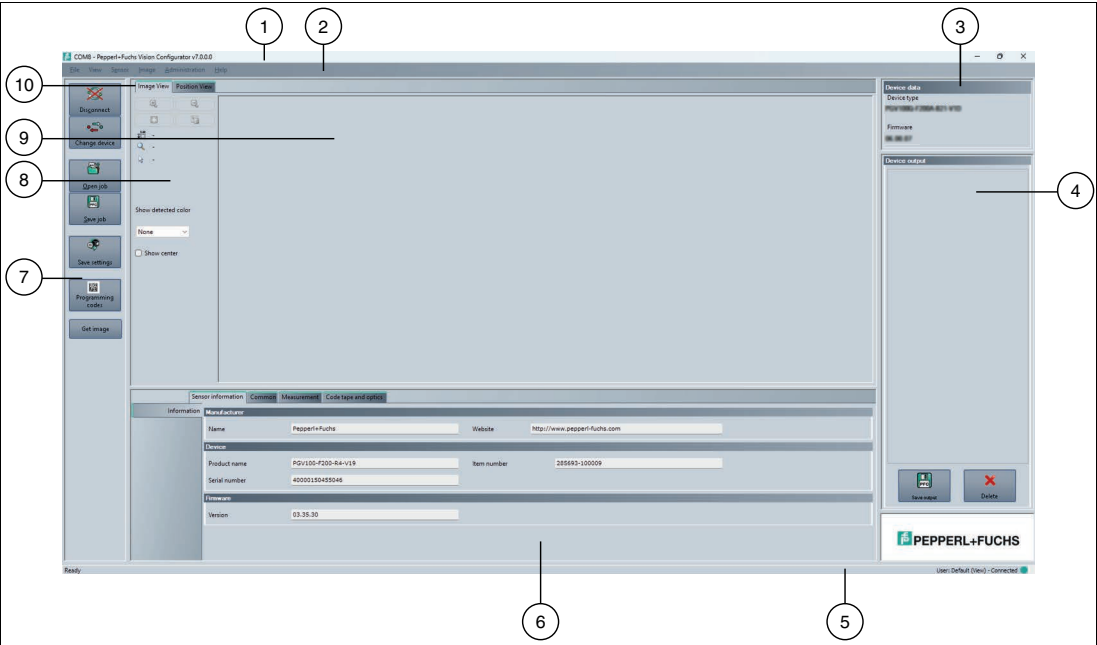


Figure 7.7 Vision Configurator application window

Application Window

Item	Naming	Description
1	Title bar	- Buttons: Minimize, Maximize, Close - Version of the Vision Configurator - COM port or IP address of the read head (depending on device)
2	Menu Bar	Contains all Vision Configurator menus.
3	Device Data	Displays the specific device designation and the currently installed firmware version of the device.
4	Device Output	Displays error messages from the device. "Save Output": Saves messages as a text file "Delete": Deletes messages from the display
5	Status bar	Displays logged-in user role (Default, User, Admin, etc.) and connection status.
6	Configuration window	Central area for configuring all device-specific parameters.
7	Toolbar	Access to functions via graphical buttons.
8	Tabs	Tabs for different views (selection depends on the read head): "Image View": Display of recorded images "Position view": Display of position and status data

Item	Naming	Description
9	Image display	Visualization of the images captured by the read head.
10	Toolbar	Tools for editing the images (located below the "Image View" tab).

7.5

Menu Bar

This chapter sets out the available menus of the Vision Configurator and their associated functions.



Note

Not all functions are available for every read-head variant. Functions that are not supported by the connected read head are not displayed in the respective menu.

Menu File

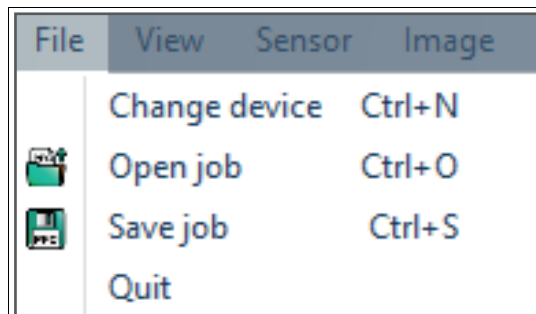


Figure 7.8 File menu

Function	Description
Change device	Disconnects the read head and returns to the Login window. A different read head can be selected there, for example.
Open job	Opens a Windows navigation window where a locally saved configuration file can be selected. The selected configuration file is loaded onto the read head. Note: Depending on the type of read head, this configuration can be overwritten by the controller.
Save job	Saves the current read head configuration as a file locally on the computer.
Quit	Ends the Vision Configurator.

Menu View

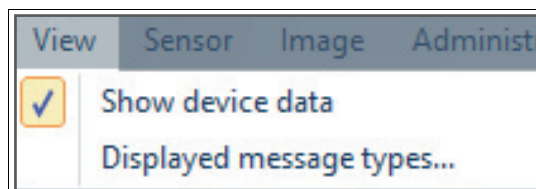


Figure 7.9 Menu View

Function	Description
Show device data	Activates or deactivates the "Device Data" area display in the user interface.
Displayed message types...	This function has no significance for the connected read-head type.

Sensor Menu

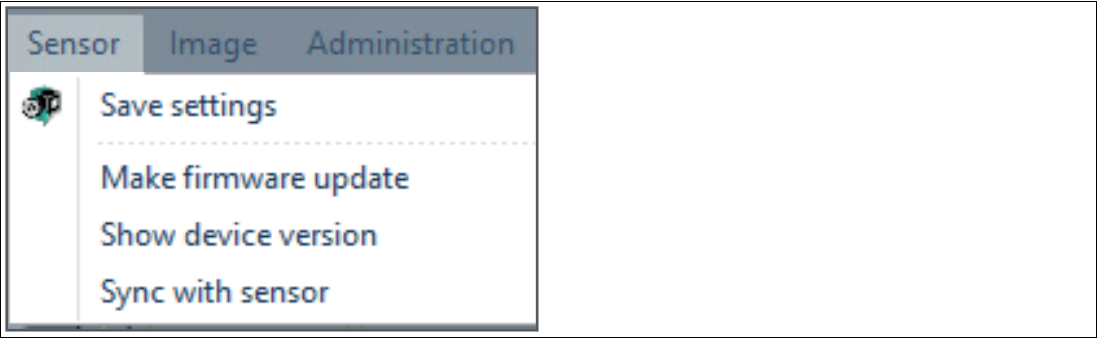


Figure 7.10 Menu Sensor

Function	Description
Save settings	Saves the current settings to the read head.
Make firmware update	Enables the read-head firmware to be updated.
Show device version	Displays the device name and the currently installed firmware version.
Sync with sensor	Reloads the current parameters from the read head.

Menu Image

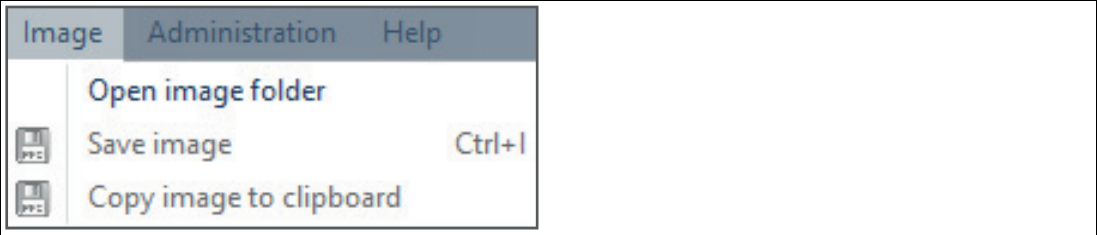


Figure 7.11 Menu Image

Function	Description
Open image folder	Opens the folder where an image was last saved via Save Image.
Save image	Saves the image currently displayed locally.
Copy image to clipboard	Copies the currently displayed image to the clipboard.

Menu Administration



Figure 7.12 Menu Administration

Function	Description
Change user...	Disconnects the read head and returns to the Login window. There, for example, another user can be logged in or another read head can be selected.
Programming codes	Opens a window for creating code cards.

Menu Help

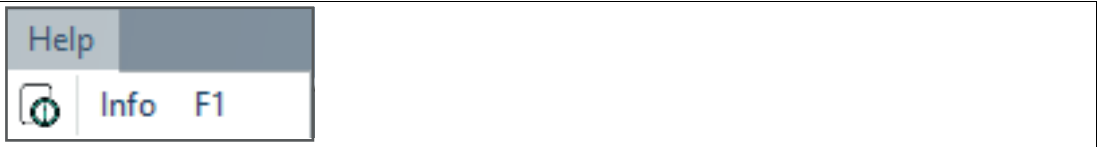
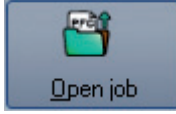
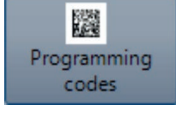
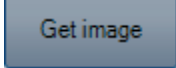


Figure 7.13 Menu Help

Function	Description
Info	Displays general information about the Vision Configurator.

7.6 Toolbar

The toolbar contains the following buttons:

Button	Function	Description
	Connect [Connect]	Establishes the connection between the PC and the connected read head.
	Disconnect [Disconnect]	Disconnects the existing connection between the read head and the PC.
	Open job [Open Job]	Opens a locally stored configuration file.
	Save Job [Save Job]	Saves the current read head configuration as a file locally on the computer.
	Save settings [Save settings]	Saves the configuration to the read head.
	Programming codes [Programming codes]	Opens a window for creating code cards.
	Get Image [Get Image]	Triggers a manual image capture. The result is displayed in the Image View tab.

7.7 Image Capture and Display (Image View)

The "Image View" tab displays images that were recorded using the **"Get Image"** button.

Possible Applications

The image display helps you with the following tasks:

Mounting and Alignment

- After the read head has been mounted in the intended installation position, an image can be captured. The orientation to the positioning mark can be checked using the image and corrected if necessary.

Quality control

- The image display allows the optical properties of the positioning marks to be assessed. In this way, dirt, damage, and unwanted reflections can be detected, for example.

Fault Analysis

- If reading problems occur, an image capture is used as the basis for the root cause analysis.



Start Image Capture

1. Click on the "Get Image" button to capture an image.

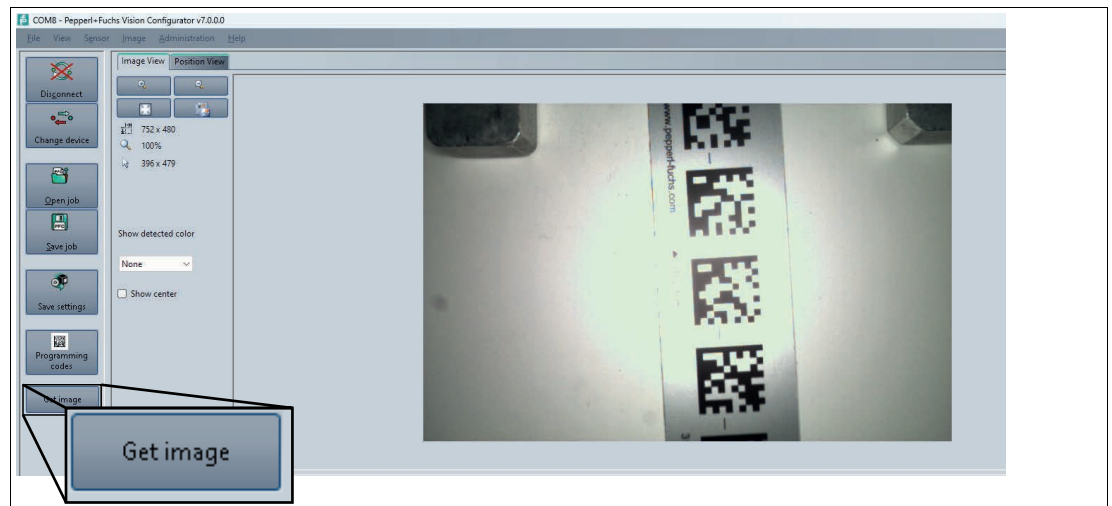


Figure 7.14 "Get Image" button

Context Menu (Right-Click on the Image)

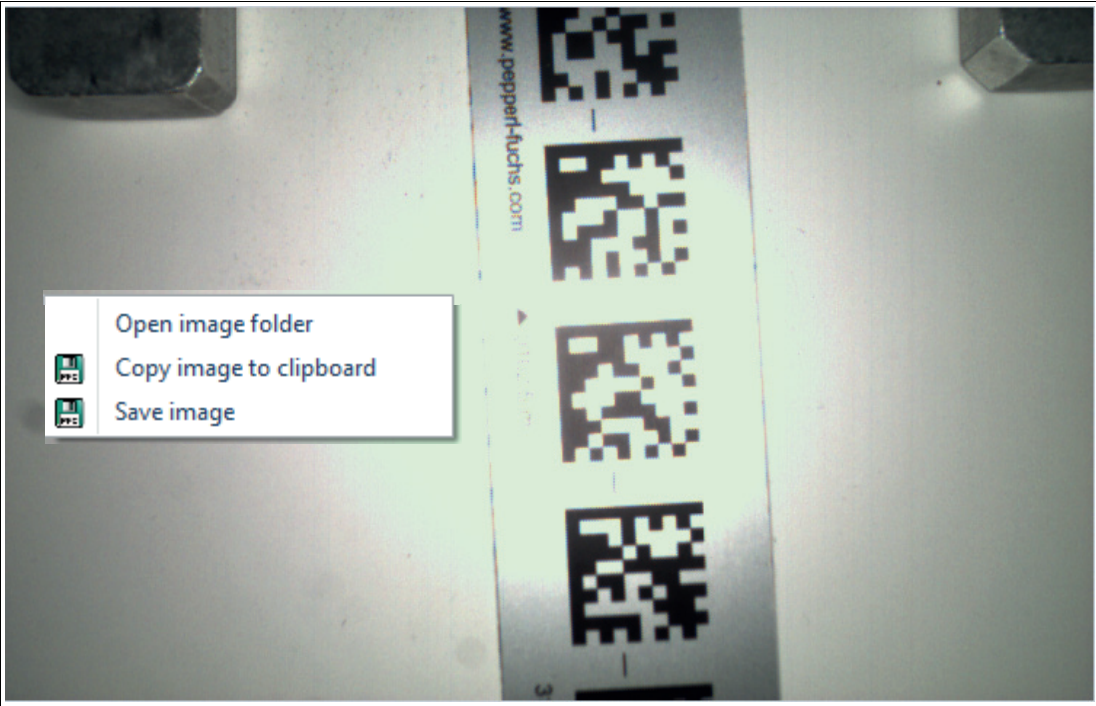


Figure 7.15 Context Menu (Right-Click on the Image)

Function	Description
Open image folder	Opens the folder where an image was last saved via Save Image.
Copy image to clipboard	Copies the currently displayed image to the clipboard.
Save image	Saves the recorded image in a save location that can be chosen.

Toolbar of the "Image View" Tab

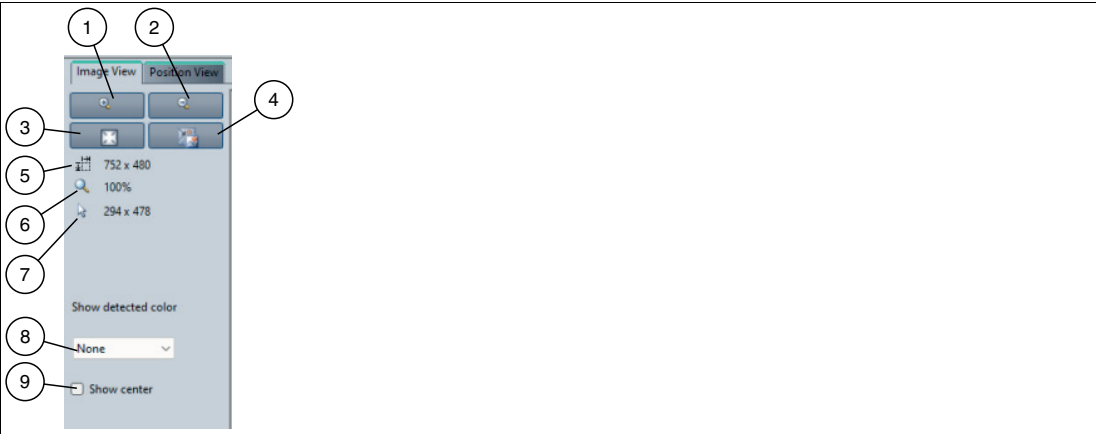


Figure 7.16 Toolbar

Item	Function	Description
1	Image zoom in	Enlarges the image view
2	Image zoom out	Reduces the image view

Item	Function	Description
3	Set original image size	Displays the image in its original size (100 %)
4	Fit image	Adjusts the image to the size of the display area
5	Image Size	Displays image dimensions in pixels (width × height)
6	Zoom factor	Displays the current zoom factor
7	Position details	Displays the position of the cursor within the image
8	Show detected color	Highlights areas where the read head has detected the selected color Note: Not available on all devices
9	Show center	Indicates the center of the image

7.8 Configuration Window

The configuration window contains the parameters available for configuration. The visibility of individual parameters depends on the set authorization level (see chapter 0052).

In addition, not all parameters are available for each device. Unavailable parameters are either hidden or grayed out.

A complete description of all available parameters is included, see chapter 5.3.1.

7.8.1 Sensor Information Tab

The "Information" menu item is available under the "Sensor Information" tab. This contains general information about the connected device.

The following information is displayed:

Sensor information	
Information	
Vendor	
Name	Pepperl+Fuchs
Homepage	http://www.pepperl-fuchs.com
Device	
Product name	PKV100-F200-B17A-V1D
Serial number	40000130351086
Part number	293431-100029
Firmware	
Version	05.03.05

Figure 7.17 Example display of the Sensor information tab

Range	Designation	Description
Vendor	Name	Name of the manufacturer
	Homepage	Website of the manufacturer
Device	Product name	Device's product designation
	Serial number	Serial number
	Part number	Item number
Firmware	Version	Installed firmware version

7.8.2 **Fieldbus Parameters Tab**

The **"Fieldbus"** menu item is available under the **"Fieldbus parameters"** tab.
The following information is displayed:

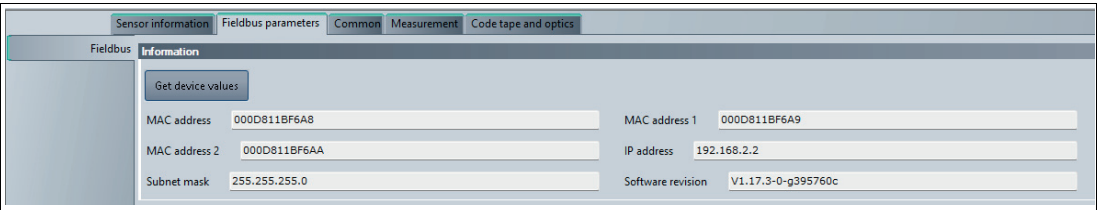


Figure 7.18 Example display of the Fieldbus Parameters tab (Fieldbus parameters)

You can use the "Get device values" button to access various information about the fieldbus parameters of your read head, including:

- MAC address
- MAC address 1
- MAC address 2
- IP address
- Subnet mask
- Software revision



Note

Two different firmware versions are installed on the read head. The firmware version displayed under the "Sensor information" tab must not be confused with the software revision displayed here.

7.8.3 **Tab Common**

Depending on the read head, up to three menu items are available under the **"Common"** tab.

Menu Item Input/Output

You can configure the available inputs and outputs of the read head in the "Input/ output" menu item. Detailed information on the possible configurations is set out, see chapter 5.3.3.

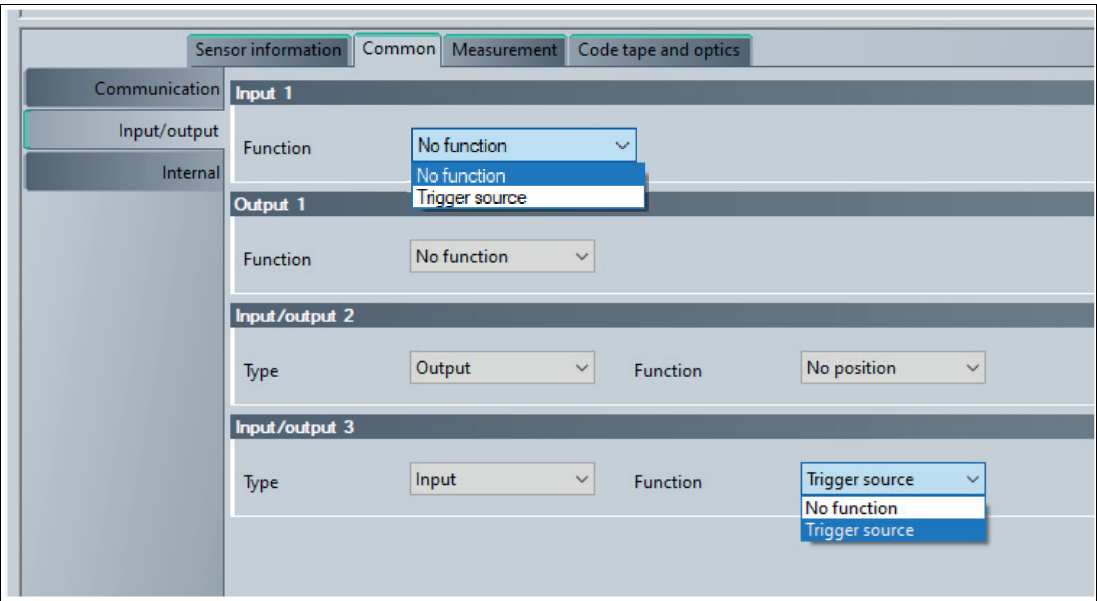


Figure 7.19 Example display of the menu item Input/ output



Note

The number of configurable inputs and outputs depends on the read head. Therefore, the display of the inputs and outputs in this menu item may vary, and differ from the example shown.

Menu Item Internal

You can configure the "Time lock" parameter in the menu item "Internal". A detailed explanation of this parameter is included, see chapter 5.3.1.

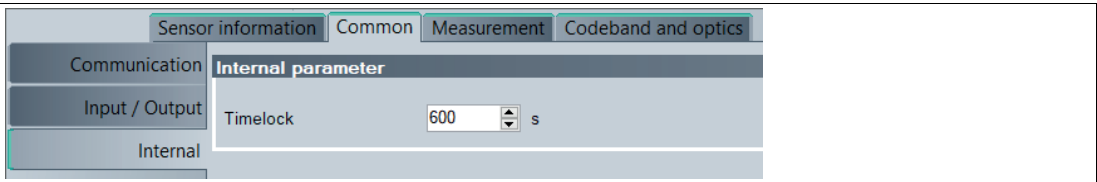


Figure 7.20

Menu Item Communication

In the "Communication" menu item, you can configure the RS-485 parameter "RS-485 head address", "Baudrate" and "Bus termination". A detailed explanation of this parameter is included, see chapter 5.3.1.

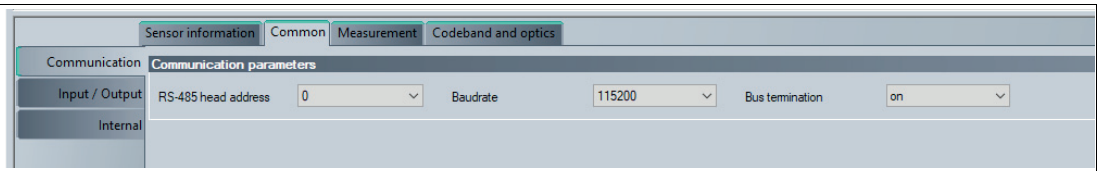


Figure 7.21 Communication menu



Note

The "Communication" menu item is only displayed if your device has an RS-485 interface.

7.8.4 Tab Measurement

Three menu items are available in the "**Measurement**" tab.

Measurement

In the "Measurement" menu item, you can activate or deactivate the extrapolation and configure the "Internal Overspeed Value" parameter.

A detailed description of these parameters can be found in chapters 0093 and 0105.

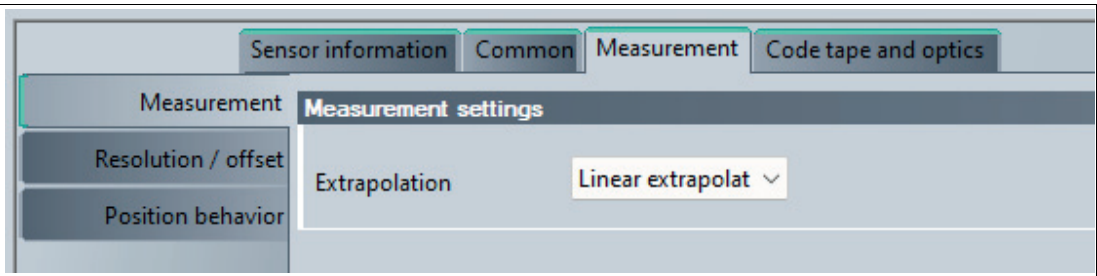


Figure 7.22 Example display of the menu "Measurement"

Resolution / Offset

You can set various resolution and offset settings in the "Resolution / offset" menu item. The resolution of the x position, the y position, the angle, and the speed can be configured.

An offset can additionally be configured for the x position, the y position, and the angle.

Sensor information				Fieldbus parameters		Common		Measurement		Code tape and optics	
Measurement		Resolution settings									
Resolution / offset		Resolution X		1 mm		Resolution Y		1 mm		Resolution angle (Color tape 1° fixed)	
Position behavior		Offset									
		X position offset		0		mm		Y position offset		0	
										Angle value offset	
										0	

Figure 7.23 Example display of the menu "Resolution / offset"

Position Behavior

In the "Position behavior" menu item, you can configure the behavior in the event of a position loss or an error. You can specify which value the x position, y position, and speed should assume in this situation.

A list of the available configuration options can be found in chapter 0105.

Sensor informationFieldbus parametersCommonMeasurementCode tape and optics

Measurement

Resolution / offset

Position behavior

No-position X value

No-position XSpecified position

No-position X value0

No-position Y value

No-position YSpecified position

No-position Y value0

No-position speed value (x)

No-position speed XSpecified speed

No-position speed X value0

Angle value behavior at no-position

No-position angleSpecified value

No-position angle value0

Angle value at error

Angle value at errorError-No.

X value at error

X value at errorError-No.

Y value at error

Y value at errorError-No.

Speed value at error

Speed value at errorError-No.

Figure 7.24 Example display of the menu "Position behaviour"

7.8.5 Tab Code Tape and Optics

The Code tape menu item is available in the "Code tape and optics" tab.

Menu Code Tape

Under this menu item you can configure both the number of Data Matrix code series on the code tape and the orientation of the read head in relation to the Data Matrix code tape.
A detailed explanation of this parameter is included, see chapter 5.3.1.

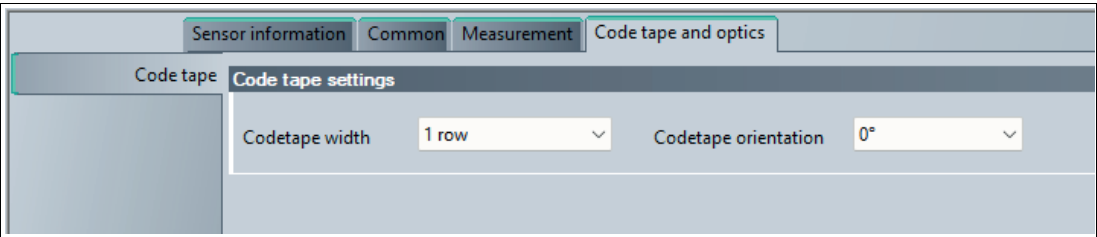


Figure 7.25 Example display of the menu "Code tape"

7.9 Position View

"Position View" Tab

The "Position View" tab is used to visualize and query the operating data of the read head. It is divided into three separate areas:

- **Control**—select and request position data
- **Further Information**—displays position, speed, and status information
- **Code Quality Statistic**—statistical evaluation of quality data

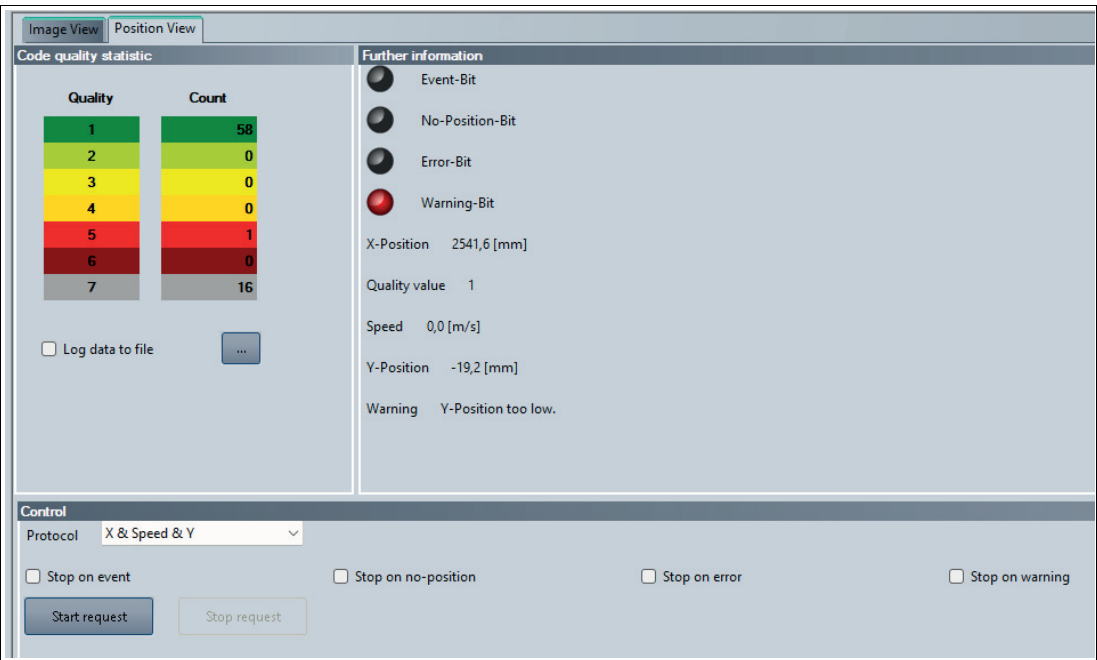


Figure 7.26 "Position View" Tab

"Control" Area

The data queries to the read head are configured and controlled in this area.

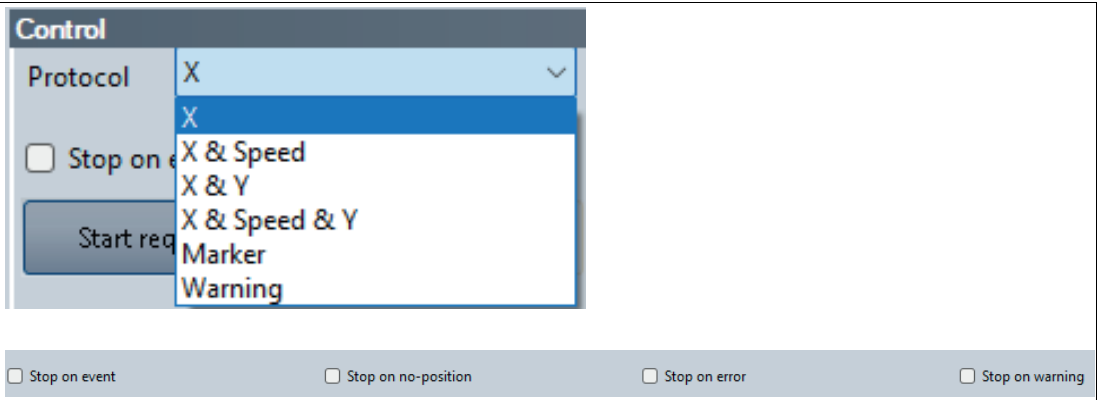


Figure 7.27 "Control" Area

Selecting the Query Protocol

The Protocol drop-down menu is used to specify which specific information will be requested from the read head.

Selection	Requested data
X	Position value in x direction
X & Speed	X position and speed
X & Y	Position data in x and y direction
X & Y & Speed	X and y position and speed
Marker	Number of the detected event marker
Warning	Current pending warning

Automatic Stop Conditions

If one of the defined stop conditions occurs (stop on event, stop on no-position, stop on error or stop on warning), the data query is automatically stopped. At the same time, the read head saves the image recorded at this exact time to enable a visual analysis of the event.

Starting and Stopping Data Query

- **Start Request:** Starts a cyclical query of the selected data.
- **Stop Request:** Ends the current data query.

"FurtherInformation" Area

The position, speed, and status information are displayed in this area.

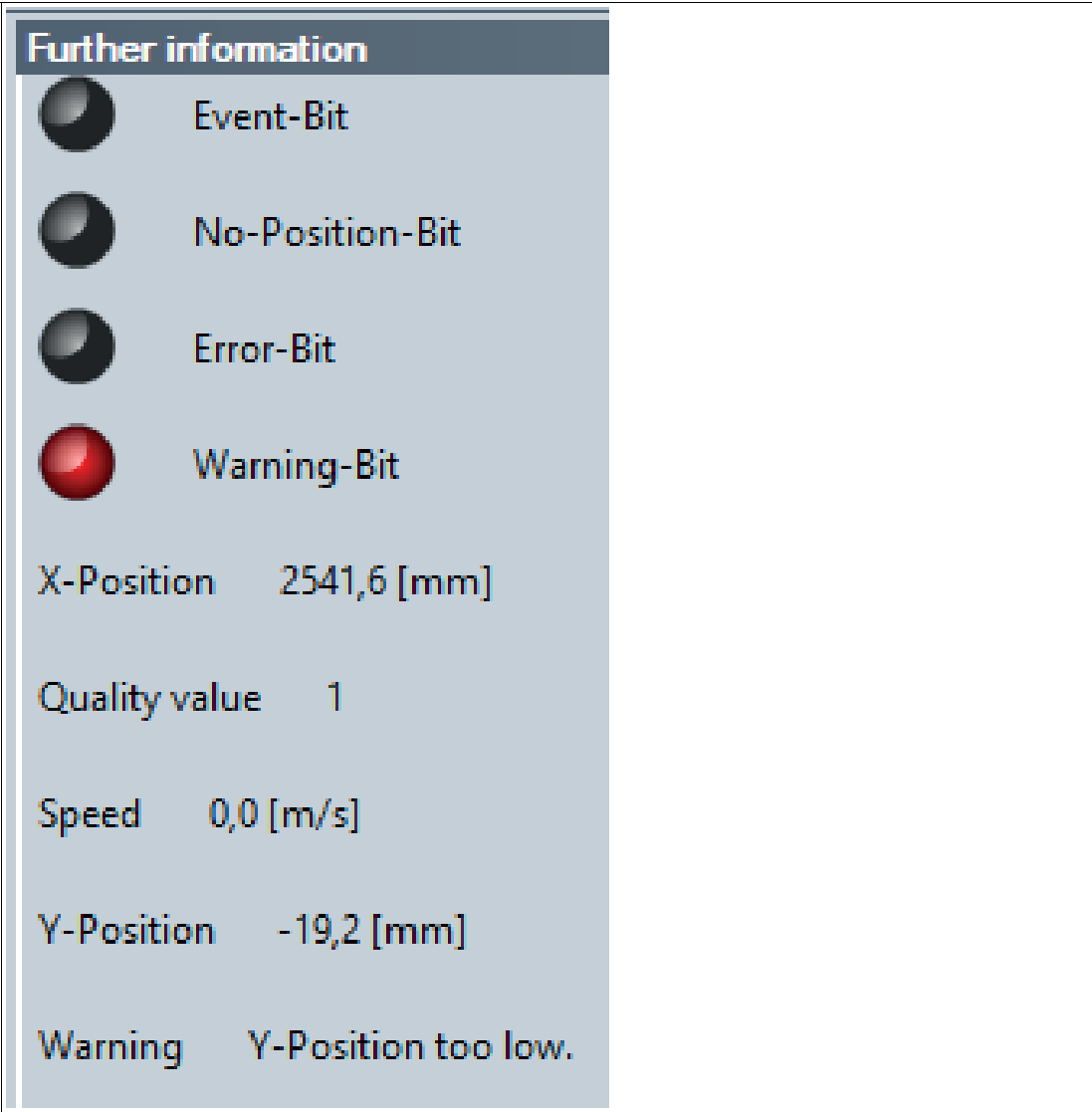


Figure 7.28 "Further Information" area

Parameter	Description
Event-Bit	Indicates that an event marker has been detected.
No-Position-Bit	Indicates that no absolute position could be determined.
Error-Bit	Indicates an active error.
Warning-Bit	Indicates an active warning.
X position	Raw data value of the x position
Quality value	Quality value display
Speed	Raw data value of the speed
Y position	Raw data value of the y position
Warning	Warning message
Angle value	Displays the current angle value.

**Note****Converting Raw Data**

The position and speed values displayed are raw data. To determine the real values, these must be multiplied by the resolution set in the configuration module. For more detail, see see chapter 4.4, , .

Set status bits (active) are highlighted in red for better detection. If the warning bit is active, the exact warning message can be queried via the Warning protocol selection in the "Control" area.

8 Maintenance

General Procedure

When replacing devices, follow the same work instructions as for initial commissioning. For detailed information, see chapter 5.

Using an Original Device

In the event of a defect, the device must always be replaced with an original device from the manufacturer. After replacing the device, the plant operator is obliged to reconnect the device and, if necessary, change the device name, address, and device configuration to match the replaced device.

Manufacturer-Specified Accessories

When replacing other system components, only use accessories that have been specified by the manufacturer. As an interim solution, defective or very dirty code tape can be temporarily replaced with a self-printed replacement tape (see chapter 5.1.2).



Caution!

Danger due to heat generation on the device

The device may heat up when used for a long period of time. The temperature of metal surfaces (plugs) and the housing of the read head may increase after a long period of operation.

Allow the device to cool down before carrying out any work.



Caution!

Danger due to changed position information

If a defective code tape is replaced with a section with different position information, the previously learned reference points are lost. Multiple use of identical code ranges can lead to ambiguous position information, meaning that the actual position of the device cannot be precisely determined. Before installing a replacement code tape, ensure that the position information for the read head is unique in the entire plant area.

If the code tape is not replaced with sufficient precision or the read head is aligned differently relative to the vehicle, the learned reference points will shift accordingly. This can lead to reduced positioning accuracy within the plant. Therefore, make sure that the replacement is carried out carefully and precisely.

8.1 Servicing

The device is maintenance-free.

8.2 Testing

Regular Inspection

To ensure high operational availability, we recommend regularly inspecting the read head and the Data Matrix code tape for mechanical damage and removing any contamination (see chapter 8.3). There is no need for an additional proof test because the prescribed interval is longer than the normal service life of the device.

Additional Inspection under Exceptional Ambient Conditions

If the device is exposed to ambient conditions in the plant that could cause potential mechanical damage or vibration, it is advisable to regularly inspect the integrity of the device housing (especially water ingress) and the correct seating of fasteners (e.g., loose fastening screws).

8.3 Cleaning



Note

General Information

Even with the correct sensor alignment, read errors can occur due to contamination. This is especially likely when the code tape is installed on the floor. This chapter describes the correct cleaning procedures for the code tape and read head.

Cleaning the Code Tape

Cleaning intervals

Because contamination levels vary between installations, fixed cleaning intervals cannot be defined. Note the following:

- In some circumstances, the read head may fail to read codes that still appear to be legible.
- It is difficult for the human eye to assess readability for the read head.
- To maintain system performance, early cleaning is recommended when there is visible contamination.
- Quality grades are used for early detection of contamination.
- Cleaning becomes essential once read errors begin to occur.

The image below shows a heavily soiled code tape that is barely legible. At this level of contamination, individual codes may already be unreadable, which can lead to system disruptions.

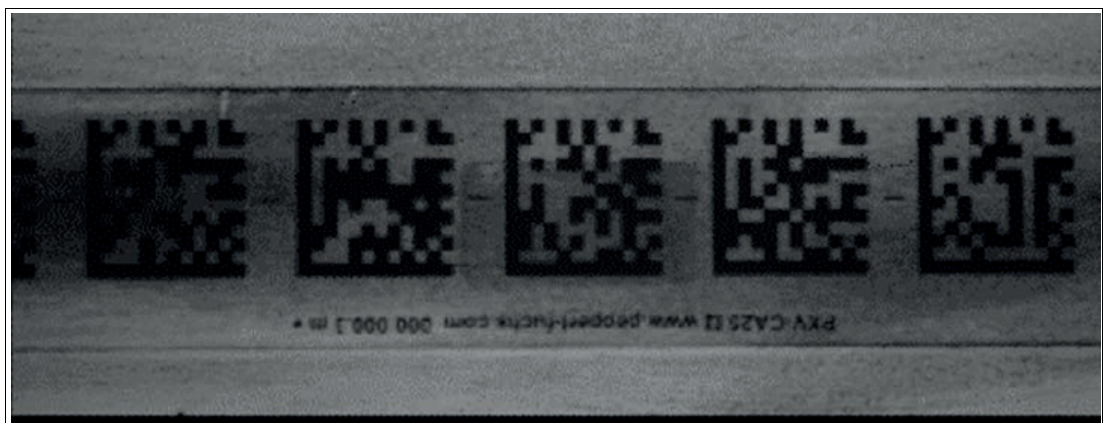


Figure 8.1

Correct cleaning method

The surface of the code tape is designed to diffuse incident light and minimize disruptive reflections.



Note

Impaired Functionality Due to Incorrect Cleaning

Incorrect cleaning may polish the code tape, causing reflections that may not be visible to the human eye but that interfere with system performance. To check this, capture an image with the read head.

The image below shows a reflective code tape with visible reflections of the lighting ring.

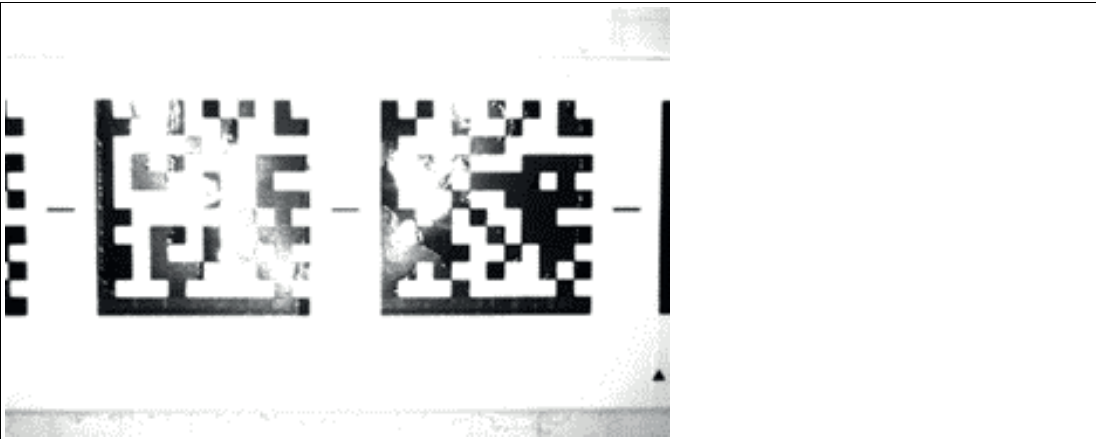


Figure 8.2

Recommended Cleaning Agents and Materials

	Recommendation	Do not use
Cleaning cloths	Cotton or microfiber cloths	Brushes or rough cloths (e.g., paper towels)
Cleaning agents	Plastic-safe cleaner only	Acetone, petroleum, brake cleaner, isopropanol

Cleaning technique

Avoid applying excessive pressure so as not to polish the surface.

Automated cleaning

- Recommended: Contactless cleaning systems (e.g., mobile suction systems)
- Not recommended: Cleaning systems in continuous direct contact with the code tape (e.g., mobile brushes) because these may polish the surface over time and cause disruptive reflections

Code tape replacement

If cleaning is not possible, a temporary workaround is to generate and print a new code tape using a generator.

Cleaning the Read Head

Cleaning intervals

Because contamination levels vary between installations, fixed cleaning intervals cannot be defined. The impairment of read performance depends heavily on the type of contamination. If in doubt, capture an image with the read head to check whether contamination is affecting the optical surfaces.

Components to be cleaned

Only the optically active surfaces of the read head need to be cleaned:

- Front glass (located in front of the lighting unit and lens)

	Recommendation	Alternative
Cleaning cloths	Water	Non-aggressive cleaning agents
Cleaning agents	Lint-free cotton or microfiber cloths	-

8.4 Repair

Repairing or manipulating the device is not permitted.

9

Disposal

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

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