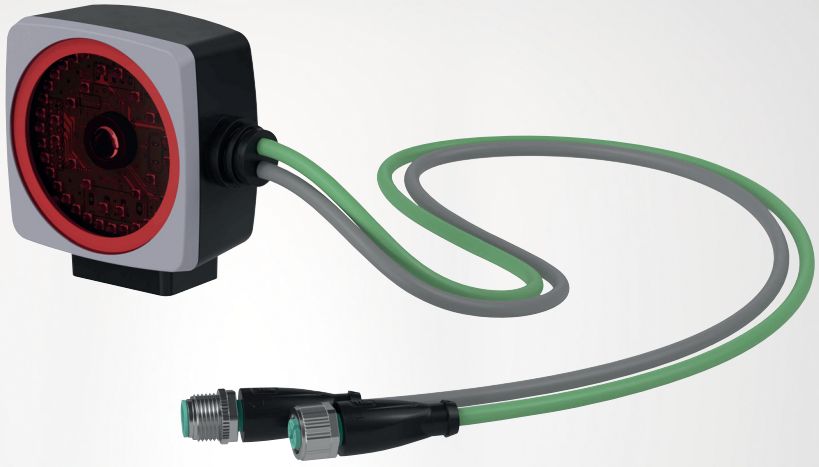
PGV*R*-F213-B12-0.7M*

Incident Light Positioning System

Manual



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1 Introduction

1.1 Content of this Document

This document contains information required to use the product in the relevant phases of the product life cycle. This may include information on 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.

The documentation comprises the following parts:

- This document
- Datasheet

In addition, the documentation may comprise the following parts, if applicable:

- EU-type examination certificate
- EU declaration of conformity
- Attestation of conformity
- Certificates
- Control drawings
- Instruction manual
- Functional safety manual
- 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.

Action

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

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2 Product Description

2.1 Use and Application

The reading head consists of a camera module and an integrated lighting unit. This reading head variant uses red light to track Data Matrix codes and tags on the floor. The codes are available as self-adhesive code tape or on robust metal code bars for harsh environments. The reading head detects Data Matrix tags for navigation within a grid.

The F213 reading head with integrated TCP/IP interface is specially designed for camera-based guidance of bots and small auto-guided transport systems (AGTS). Thanks to its compact design, this variant is particularly suitable for use in confined spaces and enables space-saving installation. With an installation depth of only 35 mm, the reading head is particularly suitable for narrow vehicle types.

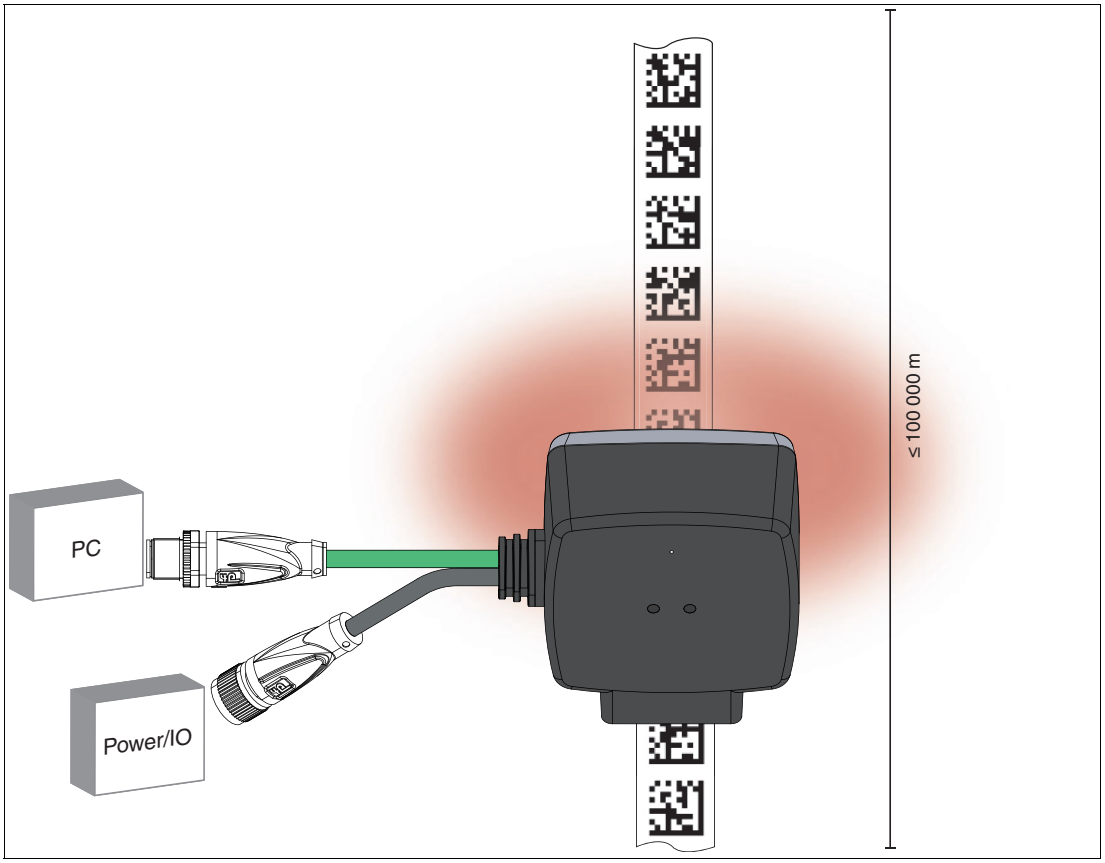

Figure 2.1 Schematic showing positioning system

The integrated TCP/IP interface allows the read head to be connected directly to a PC. This direct connection enables quick and easy commissioning without the need for an additional control unit.

Maximum Data Matrix Code Tape Length

The code tape length of up to 100 km is sufficient even for very large applications. It offers sufficient reserves for extensions or systems with several branches and parallel conveyor routes.

The read head can be optimally adapted to the respective application due to the comprehensive and simple parameterization and the freely configurable inputs and outputs.

Absolute Positioning

The Data Matrix code tape is used for the exact positioning of auto-guided transport systems (AGTS). The read head continuously reports the detected X position, the Y offset, the speed, and the angle of rotation of the AGTS.

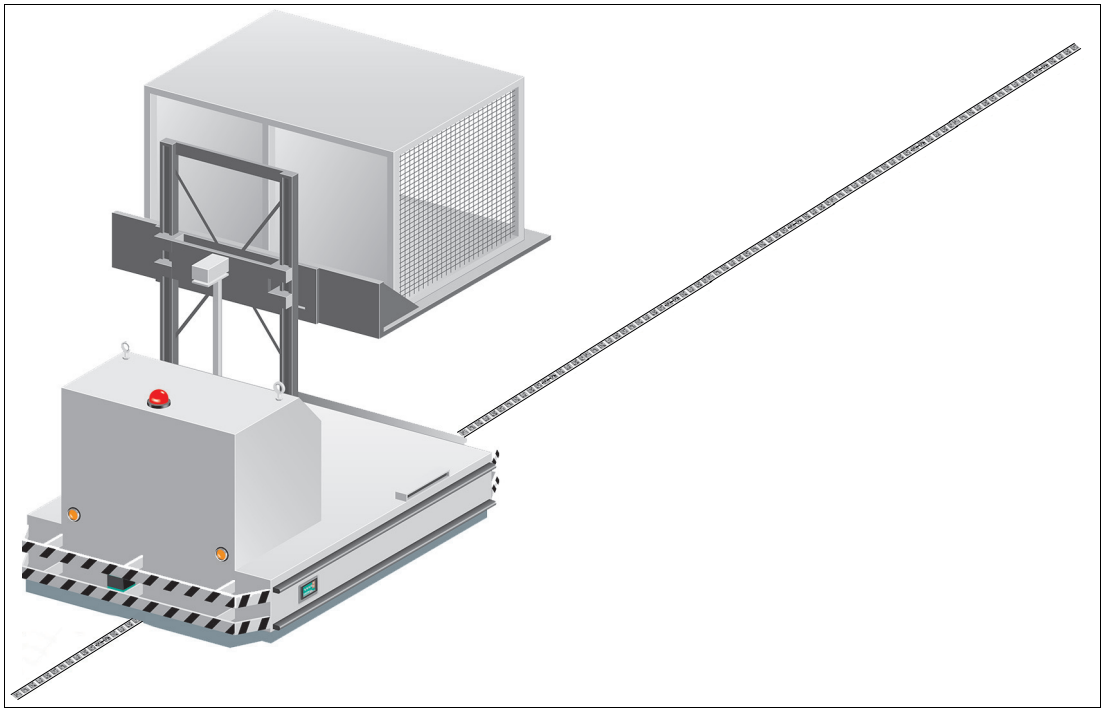

Figure 2.2 Auto-guided transport system with Data Matrix code tape

Data Matrix Tags

In addition to lane tracking, the read head can be used in tag mode. The read head detects Data Matrix tags, which are typically glued onto the floor in a grid. The individual Data Matrix tags are numbered (number range: 1 to 99999999) and contain position information. The reading head reports the tag number, the position, and the angle in relation to the zero point of the Data Matrix tag to the controller.

The tag mode allows the auto-guided transport system to move freely in as large a grid as desired, without having to mark the traverse paths with lane tapes.

The read head switches automatically between tag mode and lane tracking. This allows a transport system to be guided from one Data Matrix tag grid to another via a Data Matrix lane.

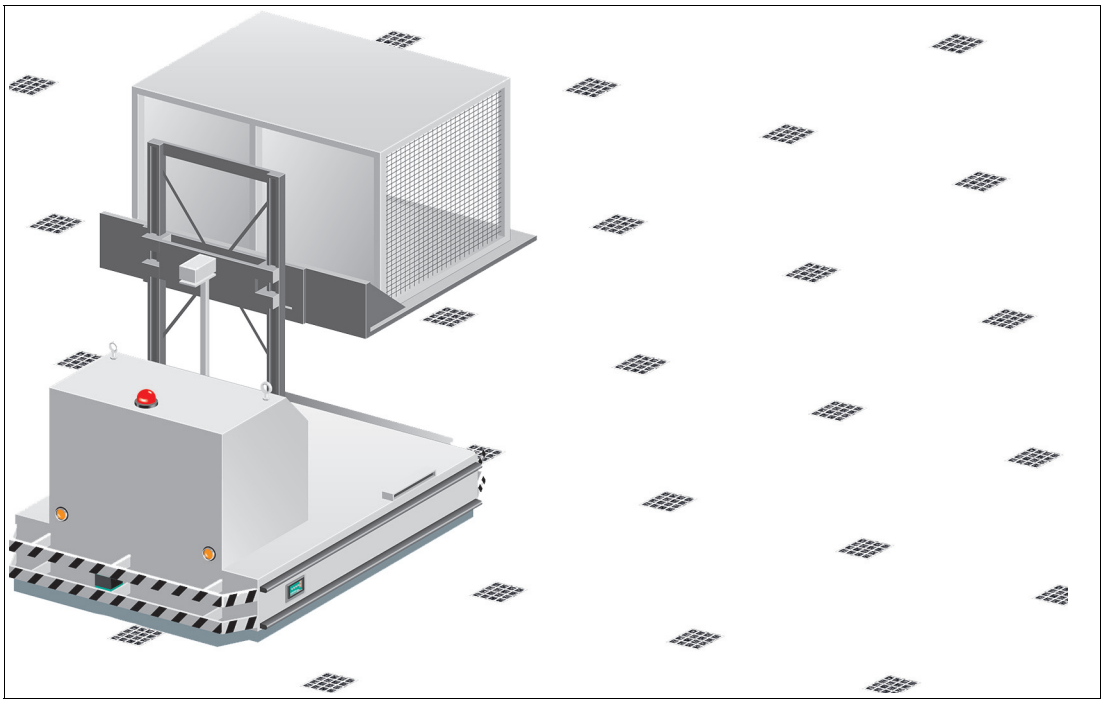

Figure 2.3 Auto-guided transport system with Data Matrix tags

2.2 LED Indicators

The read head is equipped with two indicator LEDs for carrying out visual function checks and quick diagnostics.

LEDs

LED	Color	Label	Meaning
1	Green/red	POWER ON NO CODE/ ERROR	Code detected/not detected Error
2	Green/yellow	COM STATE	TCP/IP communication

Table 2.1 LEDs

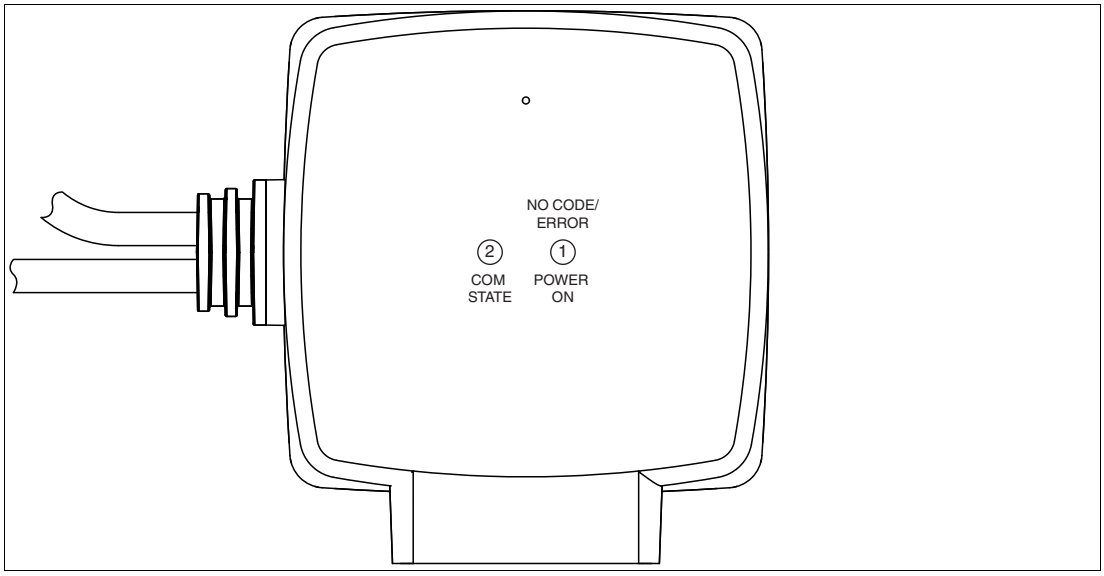

Figure 2.4 Display elements

LED 1

Mode	POWER ON	NO CODE/ ERROR	
Color	Green	Red	Description
State	Off	Off	Not ready for operation
	Lights up	Off	Codes detected
	Off	Flashing	Codes not detected
	Off	Lights up	System error

Table 2.2 Read head switched on: at least one of the LEDs is lit up or flashing

LED 2

Mode	COM STATE		
Color	Yellow	Green	Description
State	Off	Off	No power/system error
	On	Off	No connection (physical) link
	Off	On	Connected (physical) link
	x	Flashing	Communication active

Table 2.3 TCP/IP communication
x: LED status has no meaning

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2.3 Accessories

Compatible accessories offer enormous potential for cost savings. Such accessories not only save you a great deal of time and effort during initial commissioning, but also when replacing and maintaining our products.

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

Order code	Description
V1SD-G-GN*-PUR-E1S-V1D-G	Bus cable, Ethernet, M12 connector, straight to M12 connector, straight, D-coded, 4-pin, PUR cable green, Cat5e, shielded, suitable for drag chains
V1SD-G-GN*-PUR-E1S-V45-G	Bus cable, Ethernet, M12 connector, straight, D-coded to RJ45, Ethernet-coded, 4-pin, PUR cable green, Cat5e, shielded, suitable for drag chains
PCV-AG100	Alignment guide for read head
V19-G-*M-*	Configurable connection cable[1]
PCV-MB1	Mounting bracket for read head
PCV-LM25	Marker head for code tape
PGV25M-CD*-CLEAR	Protective film
PGV*-CA25-*	Data Matrix code tape
PGV*-CAM*	Data Matrix metal code bar
PGV*-CC25-*	Data Matrix control codes
PGV-CT*	Data Matrix tag

1. Ask your contact person at Pepperl+Fuchs

3 Planning

3.1 Plant Design

Before selecting and using the product, the plant designer must evaluate whether this product is suitable for the intended application. Pepperl+Fuchs has no influence on the selection and use of this product. The warranty therefore only covers the consistent quality of the product.

Ensure that this device is used only in accordance with the technical specification described in these instructions. The device must not be used in a hazardous area.

Warning!

Danger due to ambiguous position information

Using double code areas can result in duplicate position information. This can lead to unclear position information. This can result in an incorrect control logic, which poses a risk to the personnel and plant.

During planning, make sure that the position information for the read head is unique in every component of the plant. Never use double code areas.

3.2 Introduction

The read head, when used together with code tapes affixed to the floor and tags with Data Matrix codes printed on them, constitutes a high-resolution positioning system. It can be used in all applications where auto-guided transport systems (AGTS) must be positioned precisely at marked positions along a given lane.

The read head detects Data Matrix tags to navigate within a grid. The read head detects control codes and position markers in the form of Data Matrix codes printed on a self-adhesive code tape.

The Data Matrix code tape is affixed to the floor. The read head is located on an auto-guided transport system (AGTS) and guides this vehicle along the lane.

The large reading window allows up to five codes to be recorded simultaneously in one read operation, depending on the reading distance. Precise position detection is possible with just one code in the reading window. This means that large gaps in the Data Matrix code tape can be bridged. By using several Data Matrix codes as information carriers, data can be represented in a highly redundant manner.

The specified path is traveled automatically and at the same time the X position, Y offset, and speed of the Data Matrix code tape are continuously reported back to the controller. In conjunction with continuous status feedback, e.g., of quality grades, this provides high productivity, and safer and more efficient processes.

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Systemübersicht

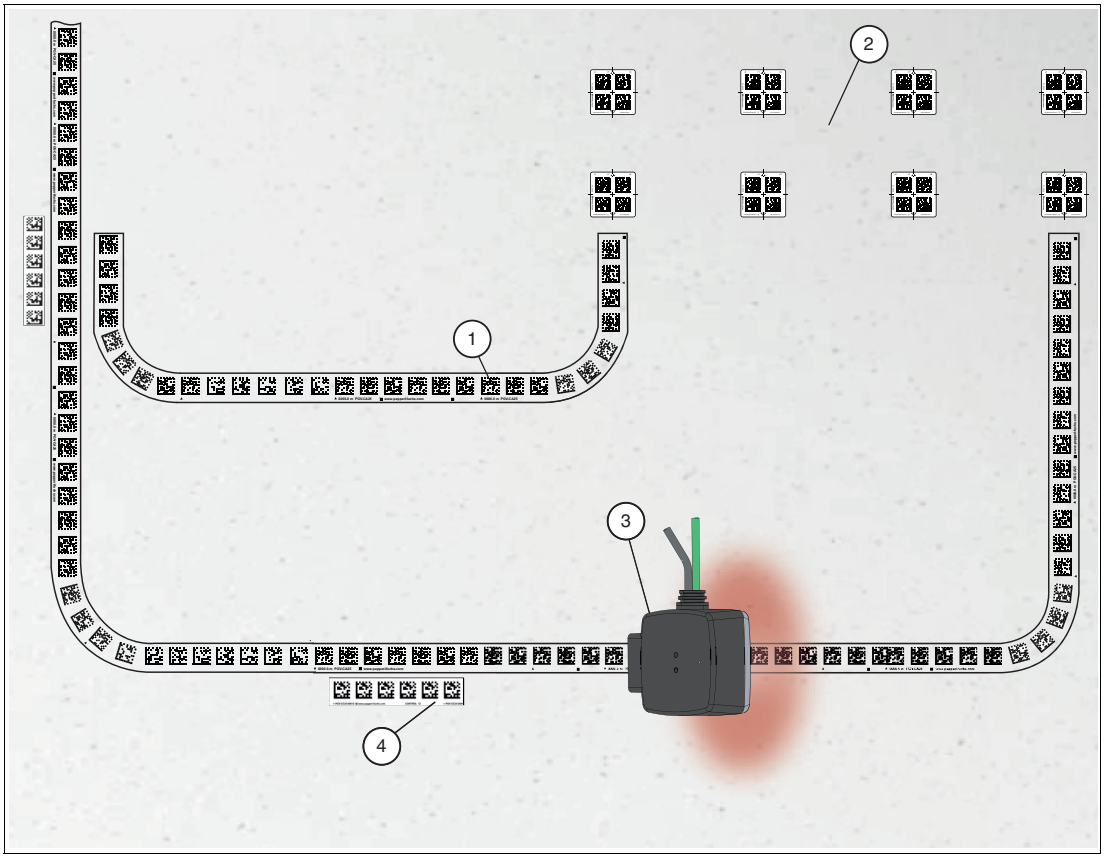


Figure 3.1 Schematic representation

1 Data Matrix positioning codes
2 Data Matrix tag grid
3 Read head
4 Data Matrix control codes

3.3 Positioning Targets

The portfolio for camera-based track guidance includes Data Matrix code tapes, Data Matrix tags, and control codes. The Data Matrix codes are available in a number of different designs to suit various requirements.

Note

Data Matrix metal code bars and color tapes are not compatible with infrared read heads.

3.3.1 Data Matrix Code Tape

Data Matrix code tapes enable the exact positioning of auto-guided transport systems. The read head continuously reports the detected position, speed, and rotation angle of the AGTS so that reliable goods transport is guaranteed at all times.

The Data Matrix code tape is made of silicone-free polyester film. There is a positioning target every 100 mm along the lower edge of the code tape. This positioning target is used for various functions, including ensuring that the Data Matrix code tape is positioned precisely when it is affixed to the floor. The reverse side of the Data Matrix code tape features a modified acrylate-based permanent adhesive.

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

Figure 3.2

Characteristics of the Data Matrix Codes

The position marks in the code tape contain information about the absolute position of the tape, and serve as reference points for the read head. The read head uses its camera to capture the image of the code and uses the information contained in the position marks to determine the exact position of the code in the camera image. This enables accurate positioning of the read head.

The code tape uses fail-safe Data Matrix codes. This is the Data Matrix code (ECC200) that is encoded using the Error Correction Code (ECC) procedure. This means that it contains additional information to correct errors when reading or transmitting the code. This is especially important for the multiple redundancy provided by the additional codes, because the codes can be heavily used or soiled under certain circumstances.

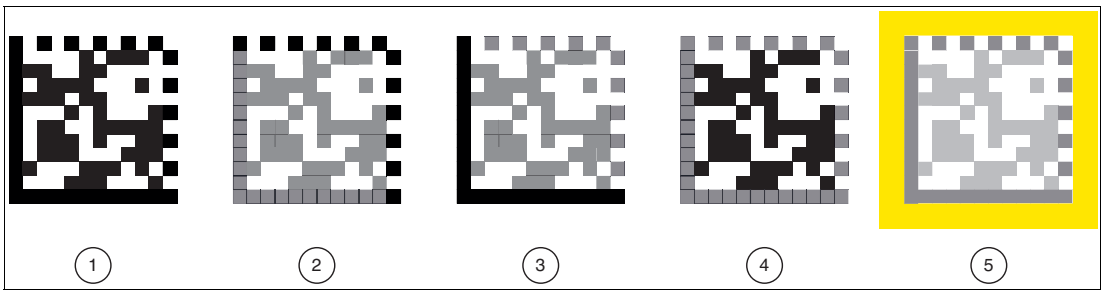


Figure 3.3 Data Matrix code ECC200

A Data Matrix code ECC200 consists of several areas that are relevant for code reading:

1 Data Matrix code according to ECC200, symbol size 12x12, black/white

2 **Alternating pattern**: The Alternating Pattern is a pattern of alternating black and white modules. The number of modules is even. It allows the data density to be determined. The Alternating Pattern is used for symbol size recognition and ECC200 type recognition.

3 **Finder pattern**: The Finder Pattern is a characteristic pattern of black modules arranged in an L shape. It is used to locate the Data Matrix code in any rotation. Distortions are also detected. The Finder Pattern is used to clearly determine the location and size of the Data Matrix code.

4 **Data range**: The data range is the actual data field in the Data Matrix code in which the information to be encoded is stored. It consists of a matrix of black and white squares representing the binary data.
Error correction range: The error correction range is a portion of the Data Matrix code that contains additional data to detect and correct errors in reading and transmitting the code. The error correction range is encoded using the Error Correction Code (ECC).

5 **Quiet zone**: The quiet zone (shown in yellow here) is a white area around the Data Matrix code. It is used to distinguish the code from other objects or the background. This makes it easier for the read head to read the code. The width of the quiet zone is 2 mm. To ensure that the read head can read the Data Matrix codes, the quiet zone of 2 mm around the Data Matrix code must not be violated when cutting the code tape.

Code Redundancy

As soon as at least one single Data Matrix code is detected in the field of view, the position output can be performed. The system therefore offers the highest possible pollution tolerance, and can also bridge expansion joints or gaps without losing position.

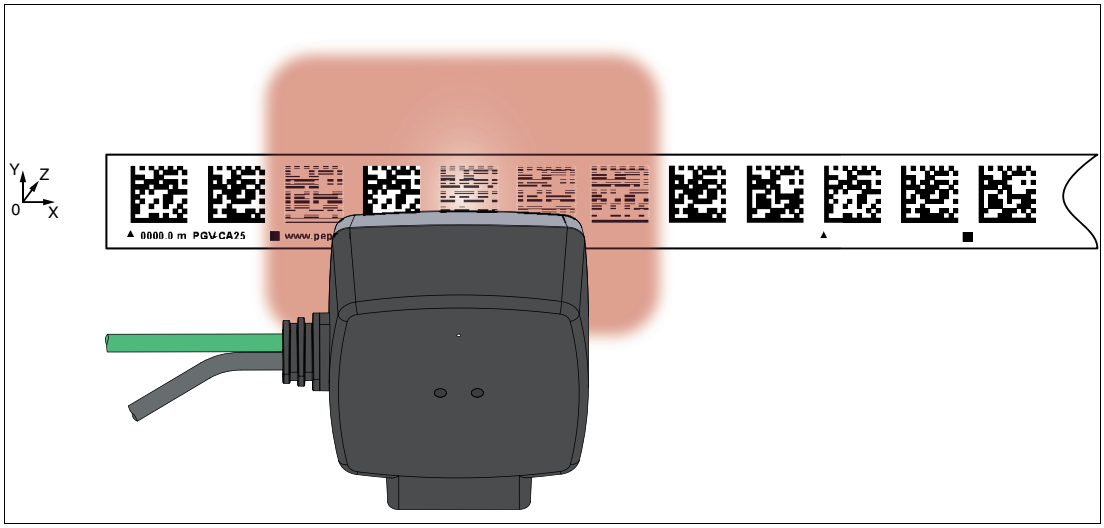


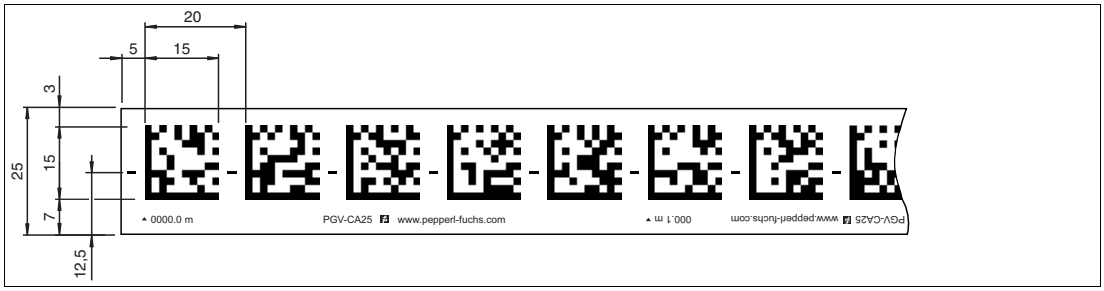
Figure 3.4 Code redundancy

Note

Note the Type of Code Tape.

The positioning system only works if the read head is used together with the suitable Data Matrix code tape. Please refer to the data sheet.

PGV*-CA25-*



Note

Center Line of the Code Tape

The center line of the code tape does not correspond to the center of the Data Matrix codes; these are slightly offset from the center line of the code tape.

The center line of the code tape corresponds to Y position = 0

Note

Behavior at X Position 0

It is recommended to use the code tape with the Data Matrix codes from a starting position greater than 100 mm. If the read head is started at a position value of less than 90 mm or if it moves sideways over the 0 mm position on the code tape, the "No Position Bit" remains set and the 0 mm position is permanently displayed to suppress the output of negative position values. A valid position output occurs as soon as the read head has passed the absolute position greater than 90 mm.

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Note

Maximum of 2 Data Matrix Code Tapes in the Reading Window

The maximum number of Data Matrix code tapes in the reading window is limited to 2 and one control code.

Basics

Distances

The distance D between the lanes should be selected so that the lanes are always in the reading window (see chapter 3.5) of the read head.

The distance between a Data Matrix position code and a Data Matrix control code must be between 0 mm and 5 mm.

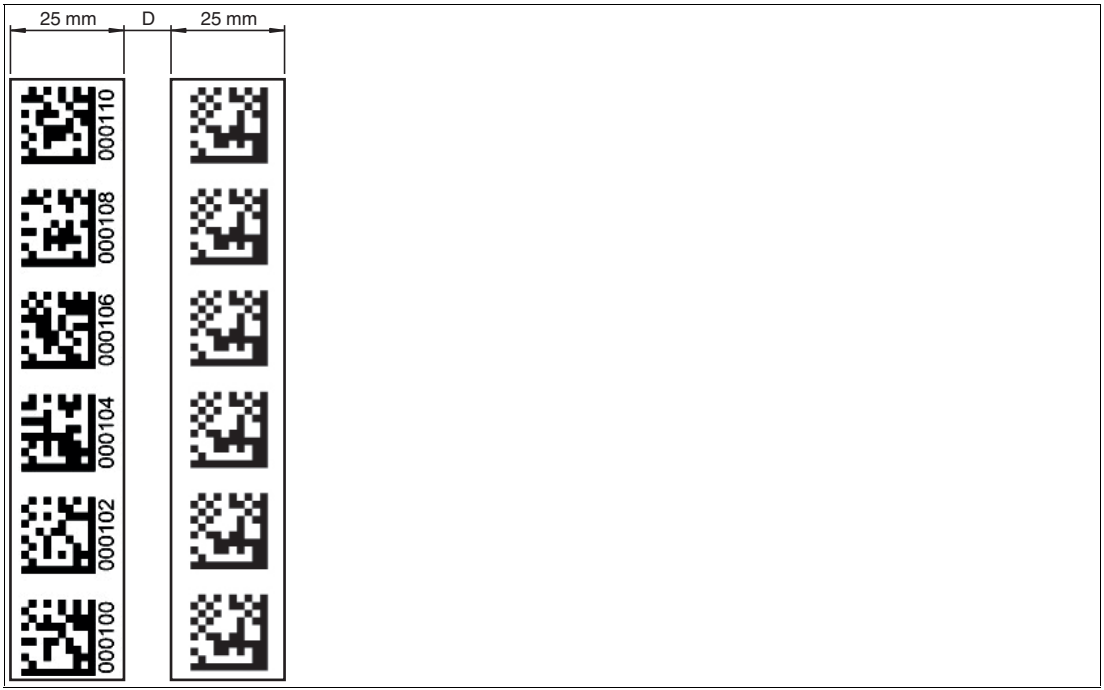


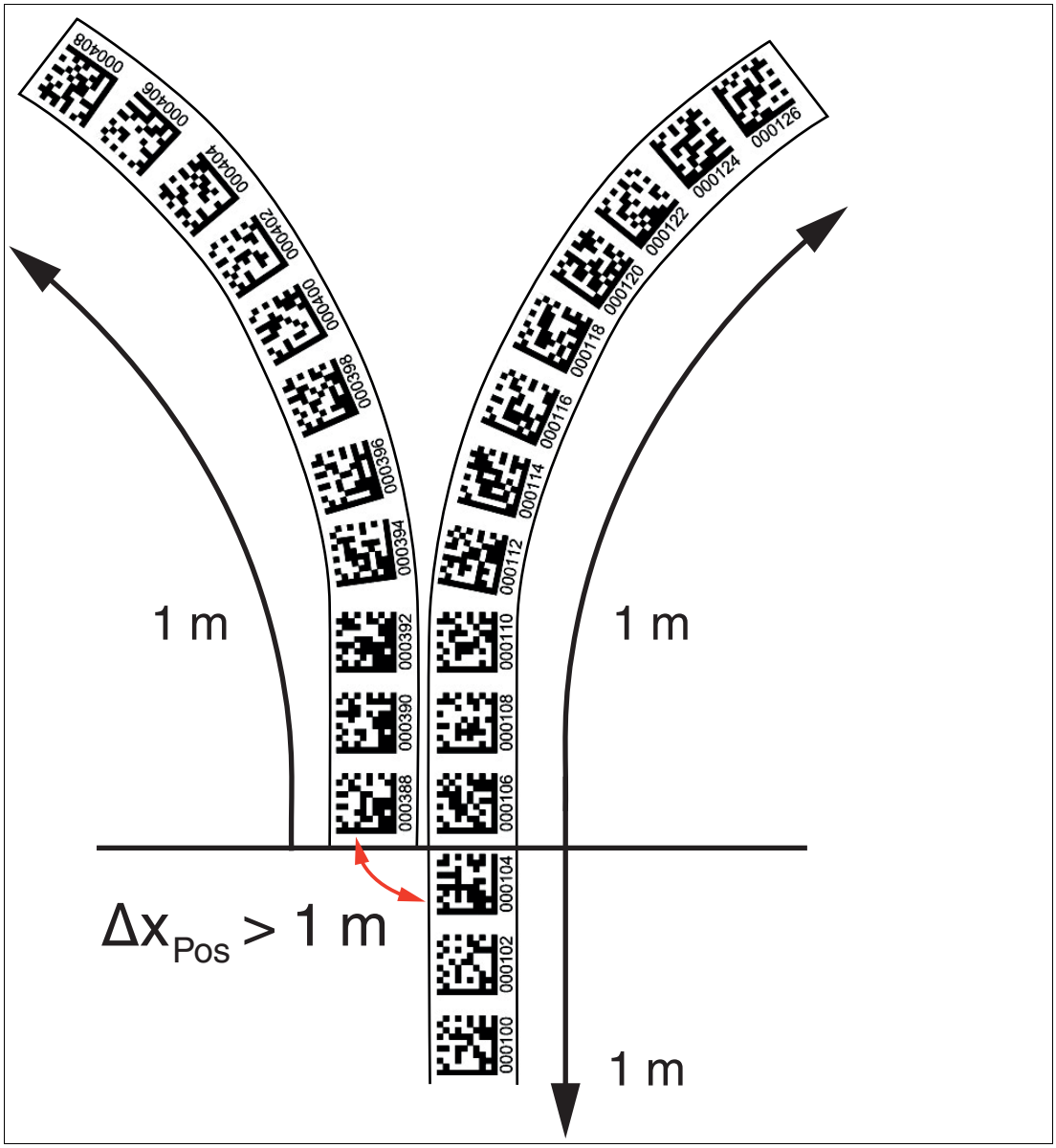
Figure 3.5 Distance: 0 mm ≤ D ≤ 5 mm

Branches/Intersections

- The read head detects one lane at the lower edge of the field of vision and two lanes at the upper edge of the field of vision; the read head therefore indicates this as a **branch**.
- The read head detects two lanes at the lower edge of the field of vision and one lane at the upper edge of the field of vision; the read head therefore indicates this as an **intersection**.

Before and after branches or intersections of lanes with position codes, the following specifications must be observed:

- The distance between the two lanes should be selected so that the newly added lane is always in the reading window of the read head. This ensures that the read head can correctly detect and read the new lane.
- The position codes of the branching or intersecting lane must be continuous over a length of 1 meter. This results in a minimum length of the main lane of 2 m.
- The difference between the absolute position of the main lane and the starting position of the branching/intersecting lane must be greater than one meter.



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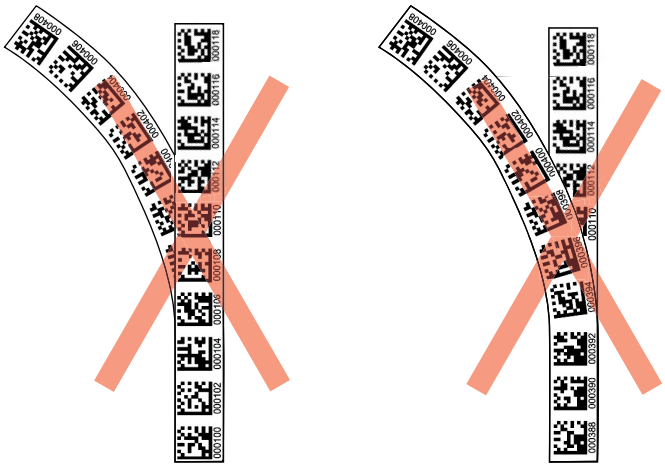
Note

Loss of Information

Make sure that Data Matrix codes are not glued over each other at a branch or intersection, since this could result in a loss of information.



Branch with Control Code

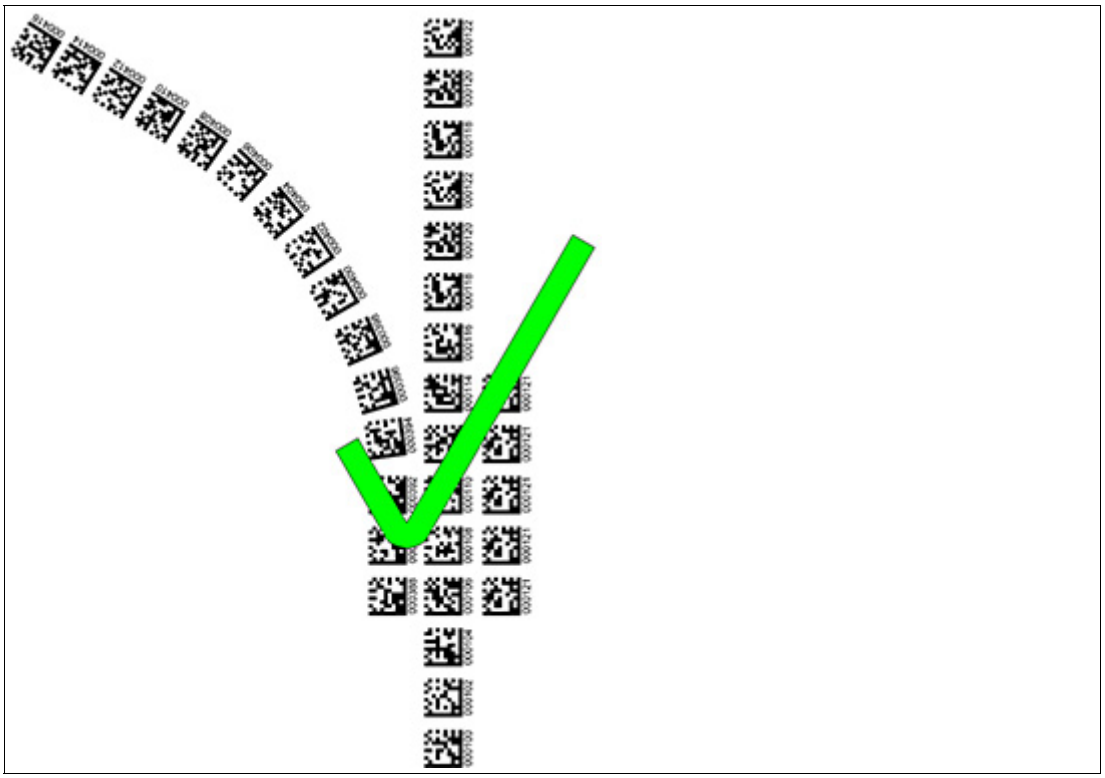


Figure 3.6 Branch with control code

Branches/Lane Change by Direction Decision or Control Logic

Normally, the AGTS is controlled at branches by the **direction decision**. The direction decision affects whether the position information is output from the right or left code tape. As long as the control logic keeps the vehicle in the lane only, the vehicle will follow the right or left lane. This is the simplest way to implement a branch, because no special control logic is required in this case.

Alternatively, a branch or lane change can also be triggered by the **control logic**. This procedure can be used, for example, for transitions from code tapes to tags or vice versa. Another application is intersections or branches in which the prerequisites for a branch with a direction decision are not met.

To change lanes using the **control logic**, the position of the branch or lane change is first stored in the controller by the plant planner. The change position (X position) from the old to the new lane is therefore known. When this position is reached, the lane change of the auto-guided transport system (AGTS) is initiated. To do this, the vehicle must be steered from the old to the new lane. As soon as only the new lane is recognized in the reading window, the lane change is complete.

To avoid losing the position when changing lanes, the position marks must be in the reading window of the read head at the same time (B). In this case, the read head has several positioning targets in its field of view that serve as reference points. Since the lane selection here cannot be made via the direction decision, it must be assumed that the read head randomly outputs the position based on one of the reference points. To ensure a safe lane change, the instructions in "Determining the position of ambiguous positioning targets" must be observed. Alternatively, the read head can ignore the position information until the lane change is complete.

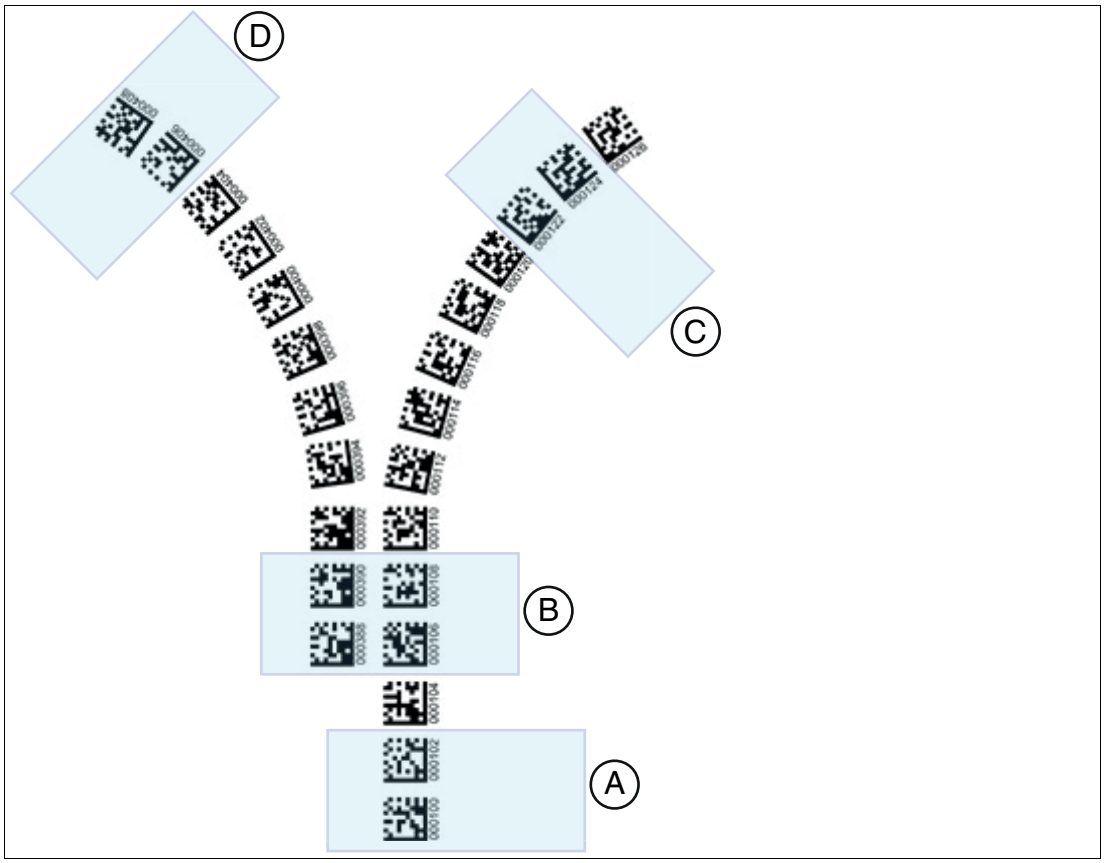


Figure 3.7 Branches/Intersections

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Meaningful lane tracking	Lane selection
A —〉 B —〉 C	Right lane
A —〉 B —〉 D	Left lane
D —〉 B —〉 A	Lane with more detailed position information
C —〉 B —〉 A	Lane with more detailed position information

Determining the Position of Ambiguous Positioning Targets

If several lanes run in parallel and the specifications for branches are adhered to, the direction decision can be used to decide whether the position information for the right or left lane is output. If the read head has several position marks in the reading window where these specifications are not met, it cannot be ensured that the position output does not jump between the two reference points. This should therefore be avoided as far as possible. However, this is not always possible at intersections or special branches.

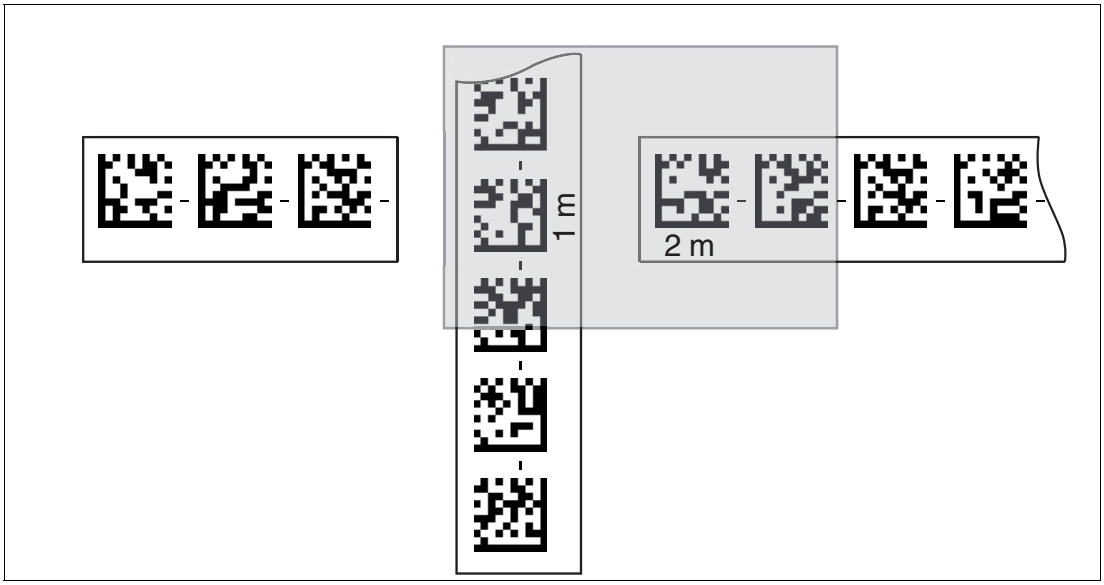

Figure 3.8

In the figure above, two different position outputs are possible, depending on which code is read.

Code at 1 m

- X: 1000 mm
- Y: -15 mm
- Angle: 0°

Code at 2 m

- X: 2000 mm
- Y: 0 mm
- Angle: 90°

If there are positions in the system where this behavior can occur, these must be taken into account. In the simplest case, the position jump is ignored. The optimal solution would be to define the position jump in the control logic as a permissible case and convert the position of the new reference point to the corresponding position of the old reference point.

3.3.2 Data Matrix Tags

In addition to lane tracking, the read head can be used in tag mode. In this mode, the read head detects Data Matrix tags, which are typically affixed to the floor in a grid. These tags are numbered in ascending order (number range: 1 to 99,999,999) and contain specific position information. The read head transmits the tag number, the position, and the angle of the auto-guided transport system (AGTS) in relation to the zero point of the recorded Data Matrix tag to the controller.

Data Matrix tags that consist of 4 to 16 Data Matrix codes offer a large tolerance range in terms of the X and Y axes. This ensures that data is transmitted reliably to the camera-based system and offers additional redundancy if individual codes become damaged or illegible.

The tag mode enables the AGTS to move freely within a specified grid as desired, without having to mark the crossing paths with lane tapes. In this case, the read head independently switches between tag mode and lane tracking, which allows the AGTS to move seamlessly from one Data Matrix tag grid to another via a Data Matrix lane.

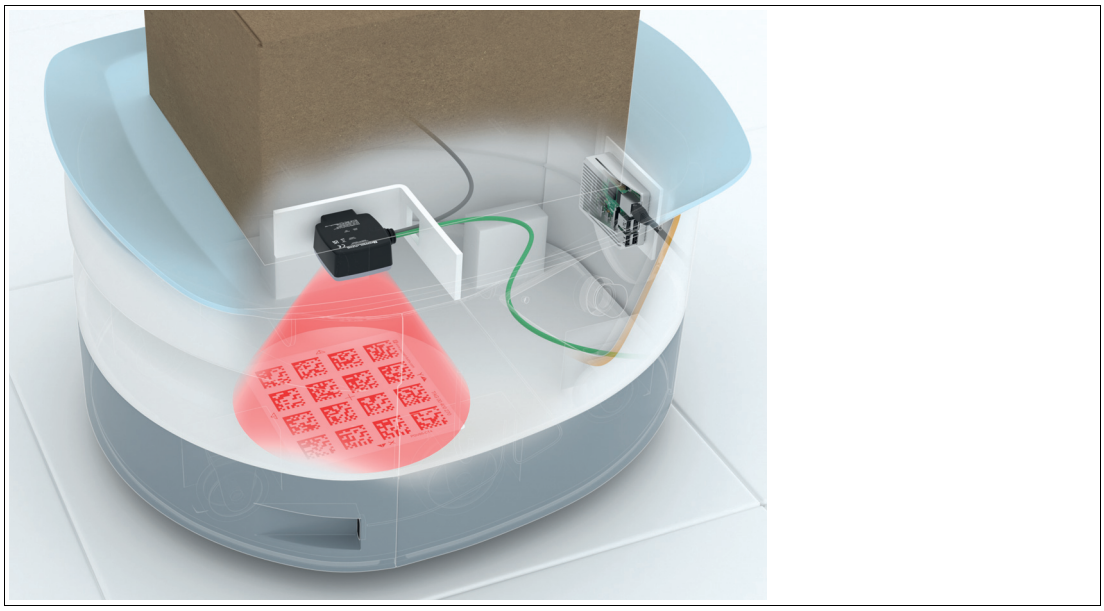

Figure 3.9 Application example: Exact AGTS alignment when picking up goods carriers (picking of loads).

A Data Matrix tag contains position information in addition to a specific number. A cross in the center of the Data Matrix tag marks the zero point. The X and the Y axes are marked starting from the zero point. The black arrow indicates the positive axis and the white arrow indicates the negative axis.

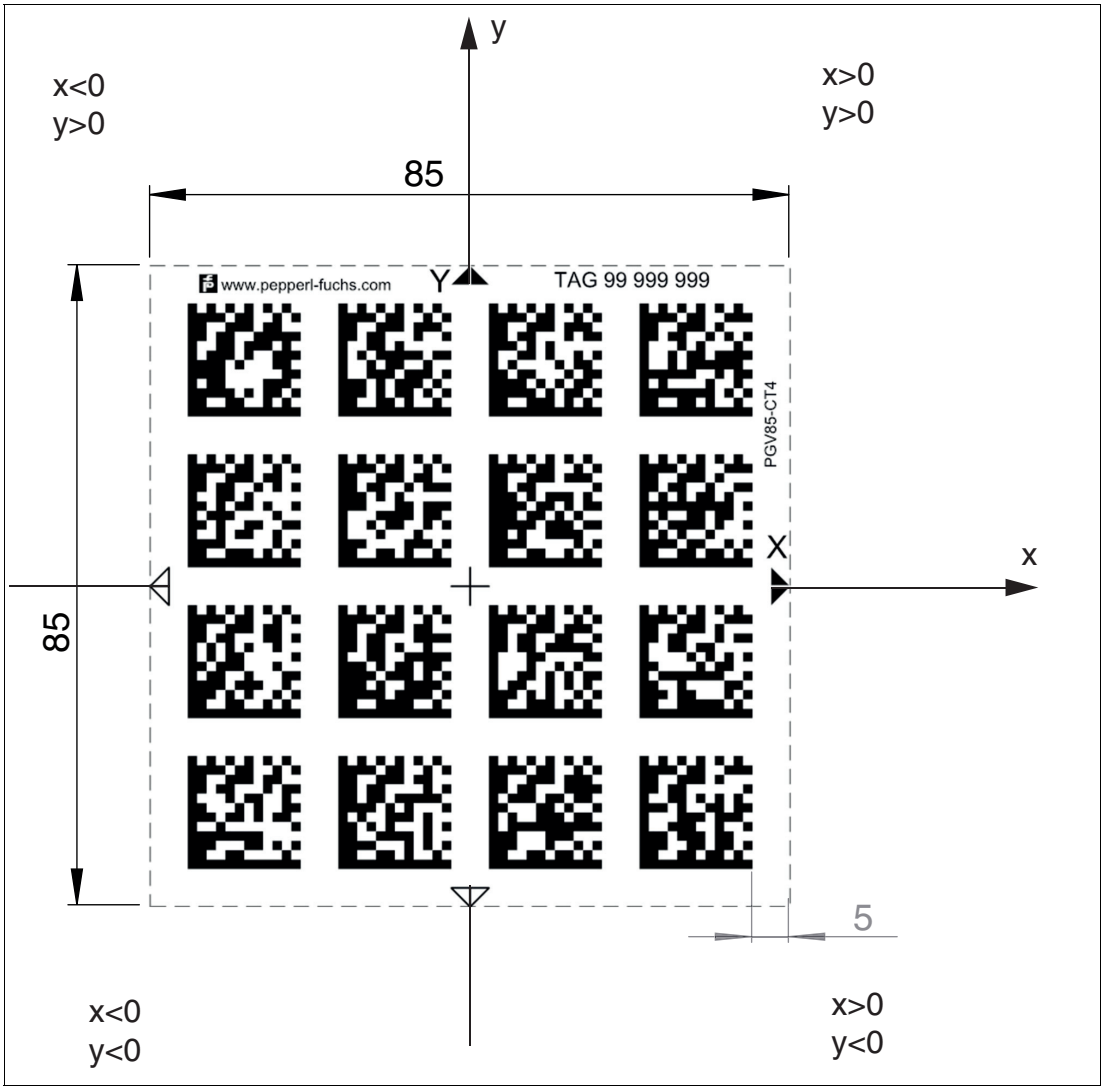

Figure 3.10 Data Matrix tag example with the number 99999999 and position information

3.3.3 Operation Using Control Codes

Alongside the Data Matrix code tape, "control codes" can also be used to initiate starts, stops, and turns by the AGTS. Control codes are short code tape strips measuring 1 m in length. When using control codes, the positioning system delivers complete positioning information and issues a predefined control number every time a control code is read. The control code control numbers range between 001 and 999.

The layout of the lane can be adjusted according to the application in question. If an auto-guided transport system (AGTS) needs to be positioned exactly, a code tape is affixed for positioning purposes. If a process needs to be triggered at a particular position or a direction decision needs to be made, a control code is affixed parallel to the actual lane.

Only a specific event and the associated process have to be programmed into the plant control system. The position in which the corresponding control code is affixed next to the code tape does not have to be determined until the point of final commissioning of the plant. Even if subsequent changes are made to the layout of a plant, the relevant control code is simply moved and affixed in the new position. There is no need to change the program.

The read head sets the control code flag in its output data when it enters the range of a control code.

The 1-meter-long control code can be shortened. However, the minimum length must be 3 codes (60 mm). The greater the movement speed of the read head, the longer the control code strip must be. If the read head travels at maximum movement speed, a full-length control code of 1 m must be affixed next to the Data Matrix code tape.

Note

Calculating the Minimum Length of the Control Code

The minimum length of a control code can be calculated according to the following formula depending on the movement speed and trigger period. In the case of this read head, the trigger period is 40 ms:

$$L_{control\ code} = 60\ mm + V_{max}\ [m/s] * T_{Trigger}\ [s] \times 2$$

Example

Example calculation

At a speed of 3 m/s and with a trigger period of 40 ms, the minimum length of the control code strip is therefore:

$L_{control\ code}$ = 60 mm + 3 m/s * 40 ms * 2 = **300 mm**

Control codes are identified by the printed number, e.g., in this case "Control 12." The following illustration shows part of control code #12.

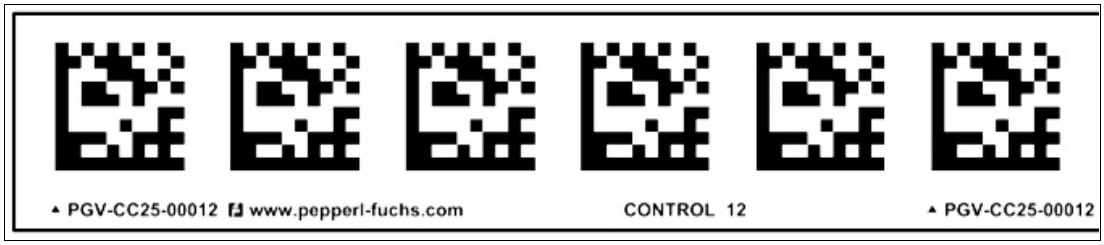

Figure 3.11 PGV-CC25-00012

Order Information (Example)

Control code numbers from **150** to **199** are required. The order is placed using the start number for the number range and the consecutive number for the number range. This results in the order designation **PGV-CC25-150-050-SET**. The number 50 in the order designation represents the number of control code strips each measuring 1 m in length.

The number of control code numbers is derived from **end code number - start code number + 1**.

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Calculation example: 199 - 150 + 1 = 50 (number of control code strips each measuring 1 m in length)

Control code numbers from 1 to 999 can be ordered as required. In this example, the delivery consists of 50 control code strips, each measuring 1 m in length. The length of a single control code number is always 1 m. The control code strip is 1 m in length and can also be shortened if necessary. Please note that, depending on the travel speed and the measuring rate of the read head, the control code tape must have a minimum length to be detected reliably.

Status of Data Matrix Control Code

The orientation "O" describes the orientation of the Data Matrix control code in the reading window.

Orientation "O"

Bit1 = O1	Bit0 = O0	Description
0	0	The Data Matrix control code has the same orientation as the ascending Data Matrix position code.
0	1	Orientation of the Data Matrix control code rotated 90° clockwise relative to the ascending Data Matrix position code.
1	0	Orientation of the Data Matrix control code rotated 180° clockwise relative to the ascending Data Matrix position code.
1	1	Orientation of the Data Matrix control code rotated 270° clockwise relative to the ascending Data Matrix position code.

Side "S" specifies the side of the Data Matrix lane on which the Data Matrix control codes are present.

Side "S"

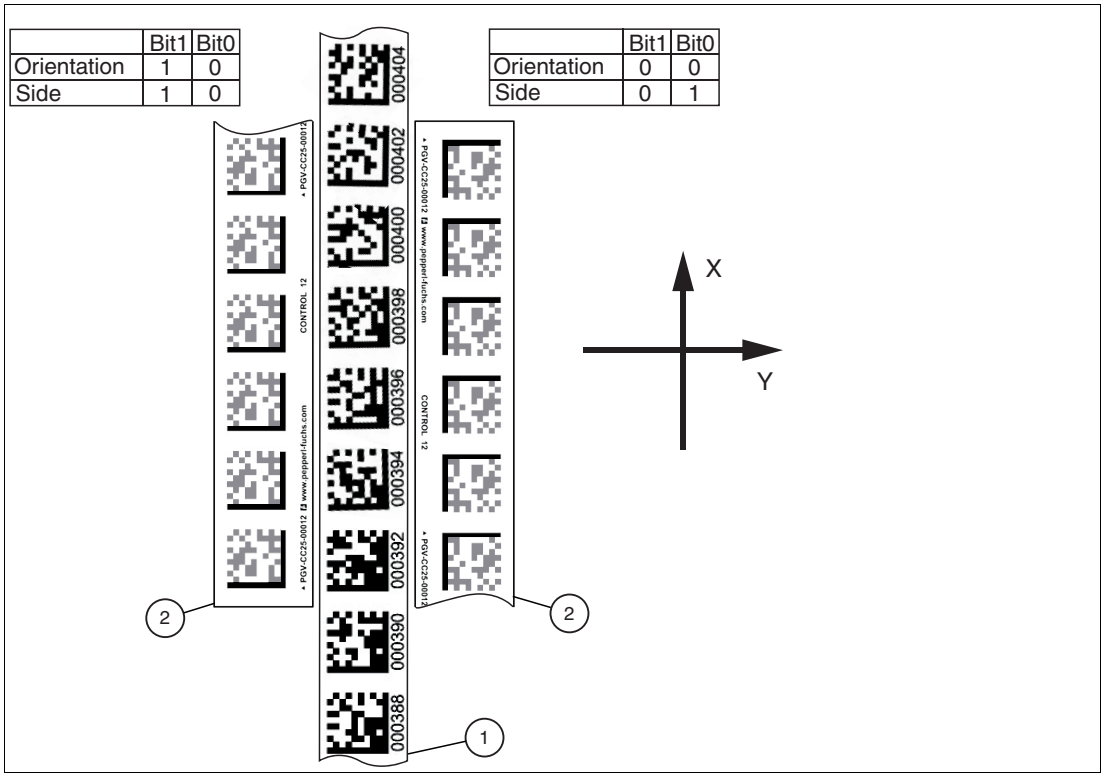
Bit1 = S1	Bit0 = S0	Description
0	0	No Data Matrix control code present or found
0	1	The Data Matrix control code is located to the right of the Data Matrix code tape.
1	0	The Data Matrix control code is located to the left of the Data Matrix code tape.
1	1	Data Matrix control code not detected

Note

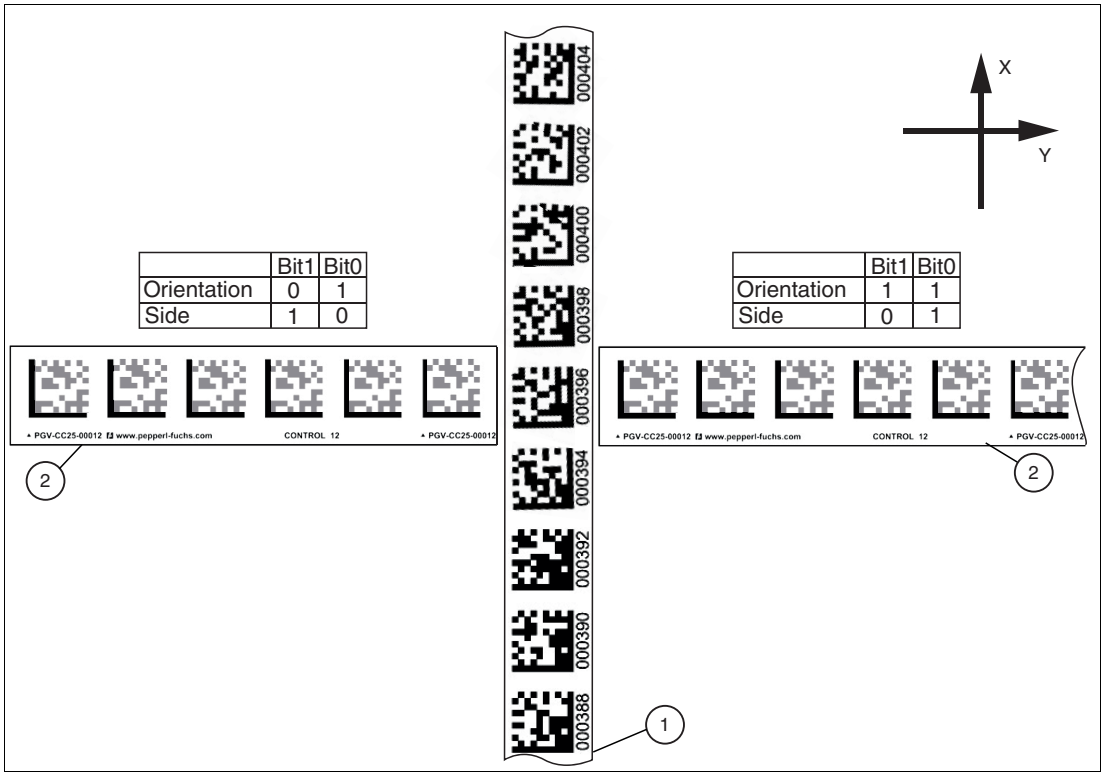
Maximum of 2 Data Matrix Code Tapes in the Reading Window

The maximum number of Data Matrix code tapes in the reading window is limited to 2 and one control code.

The following illustrations are for illustrative purposes and are simplified. The maximum number of Data Matrix control codes in the reading window is limited to 1.



1. Data Matrix position code
2. Data Matrix control code



1. Data Matrix position code
2. Data Matrix control code

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3.3.4 Metal Code Bars

The metal code bar system consists of rugged Data Matrix metal code bars and profile rails. It is especially resistant to mechanical stress. This property makes the system particularly suitable for heavily used plant areas, such as busy intersections.

Note

A separate assembly guide is available for installing the metal code bar system. Observe these instructions when installing the metal code bar system.

Data Matrix metal code bars

Data Matrix metal code bars made of anodized aluminum are used on the ground in camera-based lane guidance. Depending on the application, the code bars can be glued directly to the floor, or glued into profile rails. The code bars are modular and available in nominal lengths of 100, 200, and 500 mm.

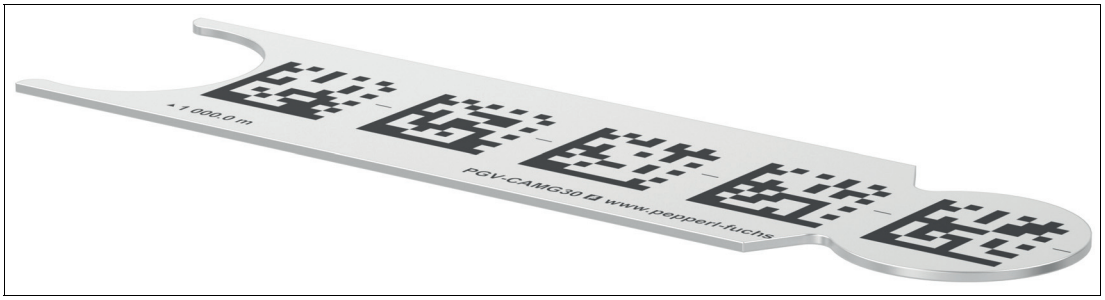


Figure 3.12

Profile Rails

The **profile rails** are used to protect the metal code bars. Depending on the application, these are mounted on the floor as drive-over profile rails or used as countersunk profile rails in a floor groove.

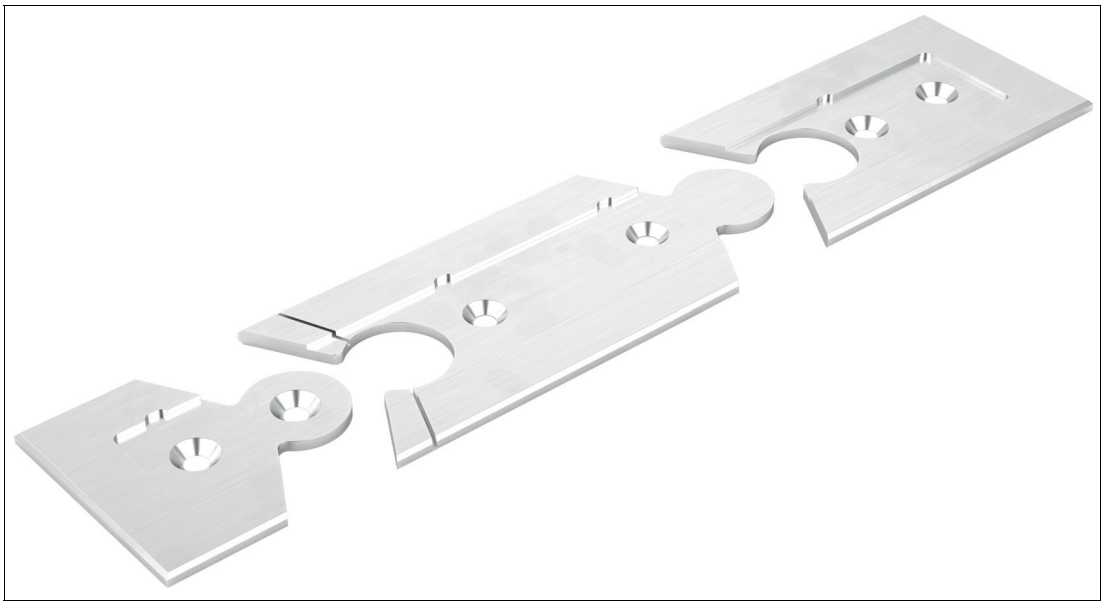


Figure 3.13

Metal Data Matrix Tags

The **metal Data Matrix tags** made of anodized aluminum are used for the evaluation of control and position information.

Figure 3.14

Profile Plates

The **profile plates** are used for mounting the tags. Depending on the application, these are mounted on the floor as drive-over profile plates or used as countersunk profile plates in a floor groove.

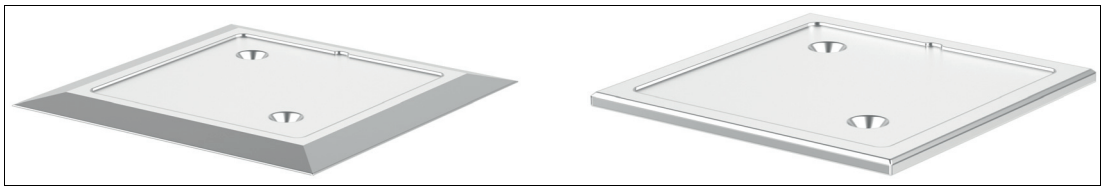


Figure 3.15

Curved Areas

Note

When the metal code bars are bent in curved areas, there is a jump in the angle of the position data. The angle jump must be tolerated by the auto-guided transport system.

Recommendations:

- The length of the metal code bars selected must be adapted to the curve radius.
- Make the transition to the curved elements in time, ideally 1 meter before the curve, to ensure a smooth transition.

Curves with Metal Code Bars Applied Directly to the Floor

By stringing the metal code bars together, a maximum angle of 32.5° can be achieved between two consecutive metal code bars.

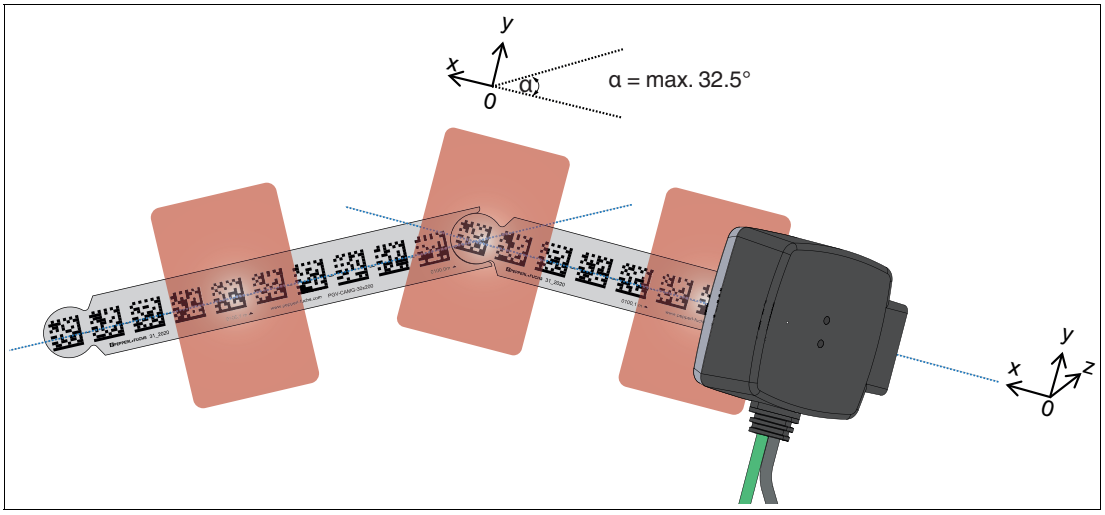


Figure 3.16

Curve radius

Metal code bar length	Min. radius
100 mm	Approx. 200 mm
200 mm	Approx. 400 mm

Curves with Drive-Over/Countersunk Profile Rails

To create curves, separable corners are removed from the profile rails to create curved areas. For left curves, the left separating corners are removed, and vice versa for right curves. By removing the corners, a maximum angle of 18° between two consecutive drive-over or countersunk profile rails can be achieved.

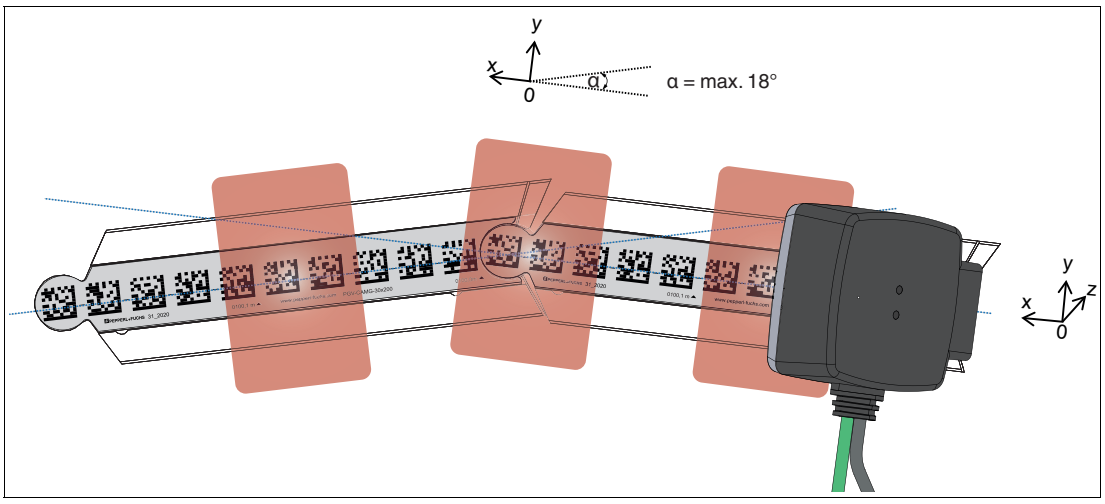


Figure 3.17

Curve radius

Profile rail length	Min. radius
100 mm	Approx. 400 mm
200 mm	Approx. 800 mm

3.4 Angle and Distance Output

Angle Value

The read head detects the absolute angle "α" in relation to the code tape with a maximum resolution of 0.1°. The angle is specified as an absolute value relative to the tracked code tape, since a Data Matrix code tape contains direction information. The output angle covers the range from 0° to 360°. The resolution can be set to the following values:

- 0.1°
- 0.2°
- 0.5°
- 1°

Note

Absolute Values

Angles are specified as absolute values. The respective value is calculated from the resolution selected under "Angular Resolution." With a resolution of 0.1°, an angle of **60**° is output as 60°/0.1° = **600**.

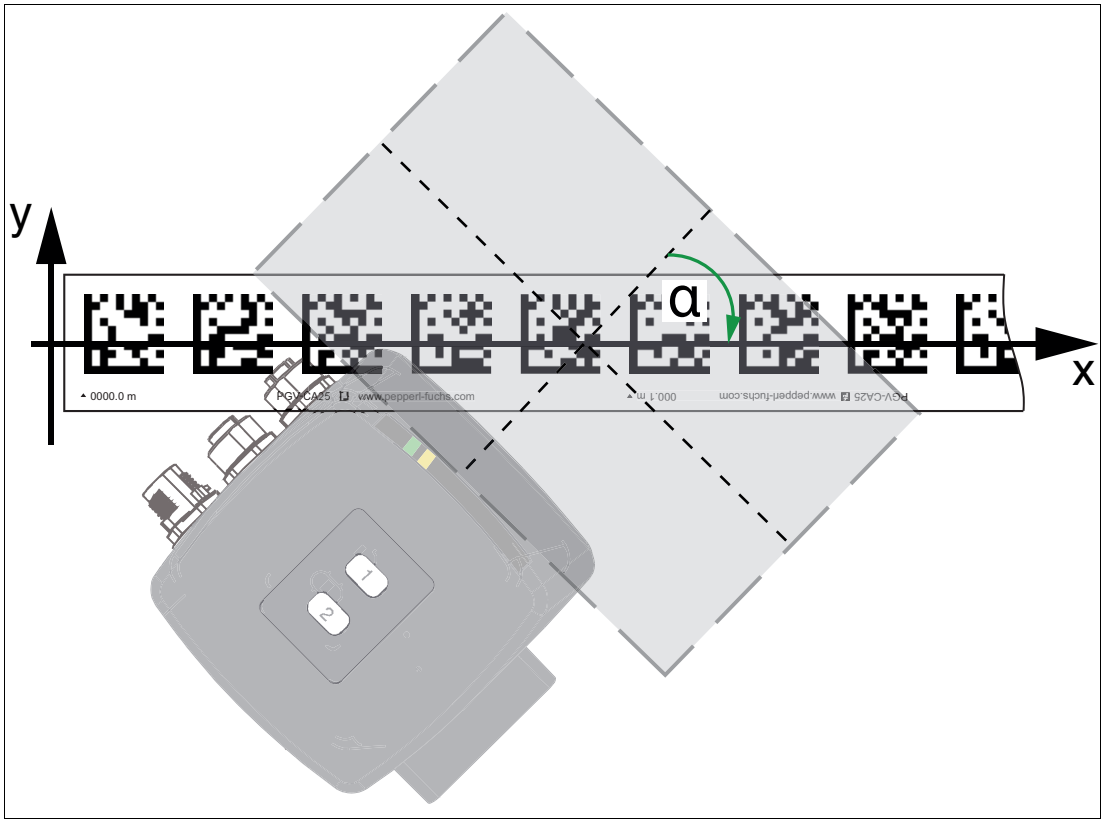


Figure 3.18 Absolute angle at 45°

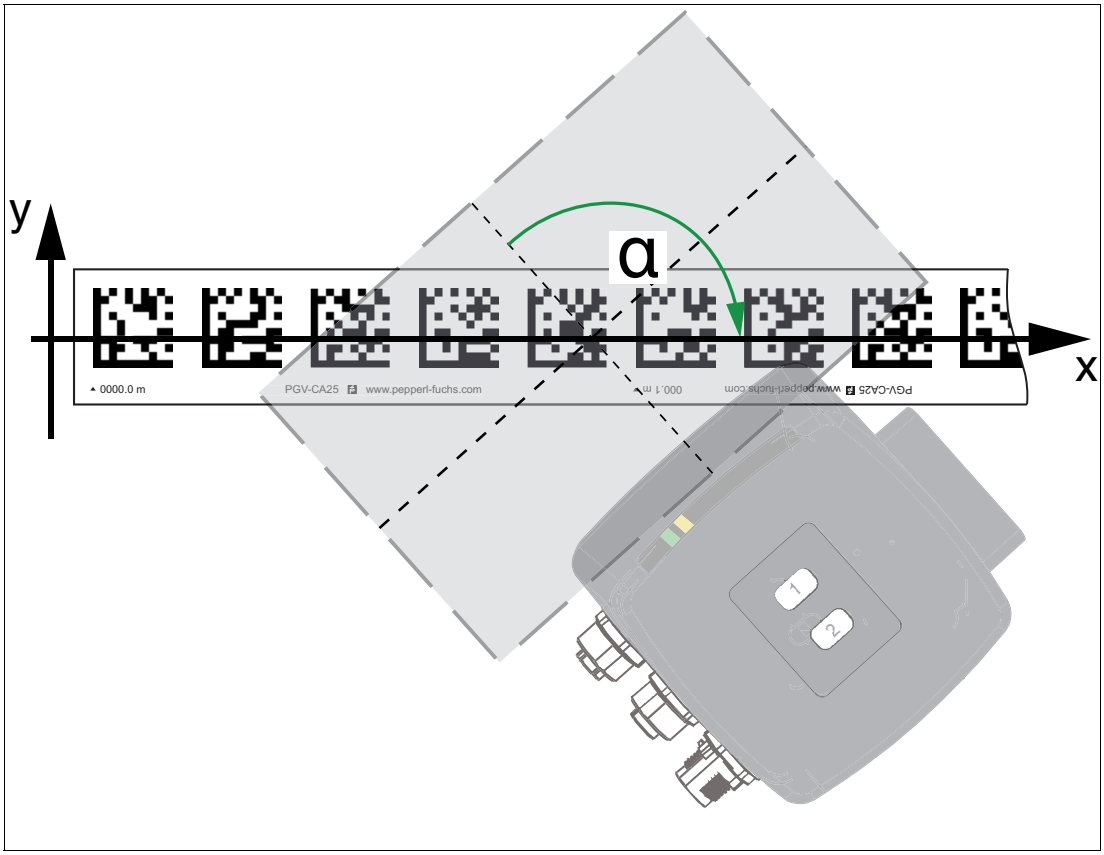


Figure 3.19 Absolute angle at 130°

Distance Output

The read head detects the distance to the Y zero line of the Data Matrix code tape and passes this value on to the controller.

The read head outputs the horizontal distance "A" relative to the Data Matrix code tape.

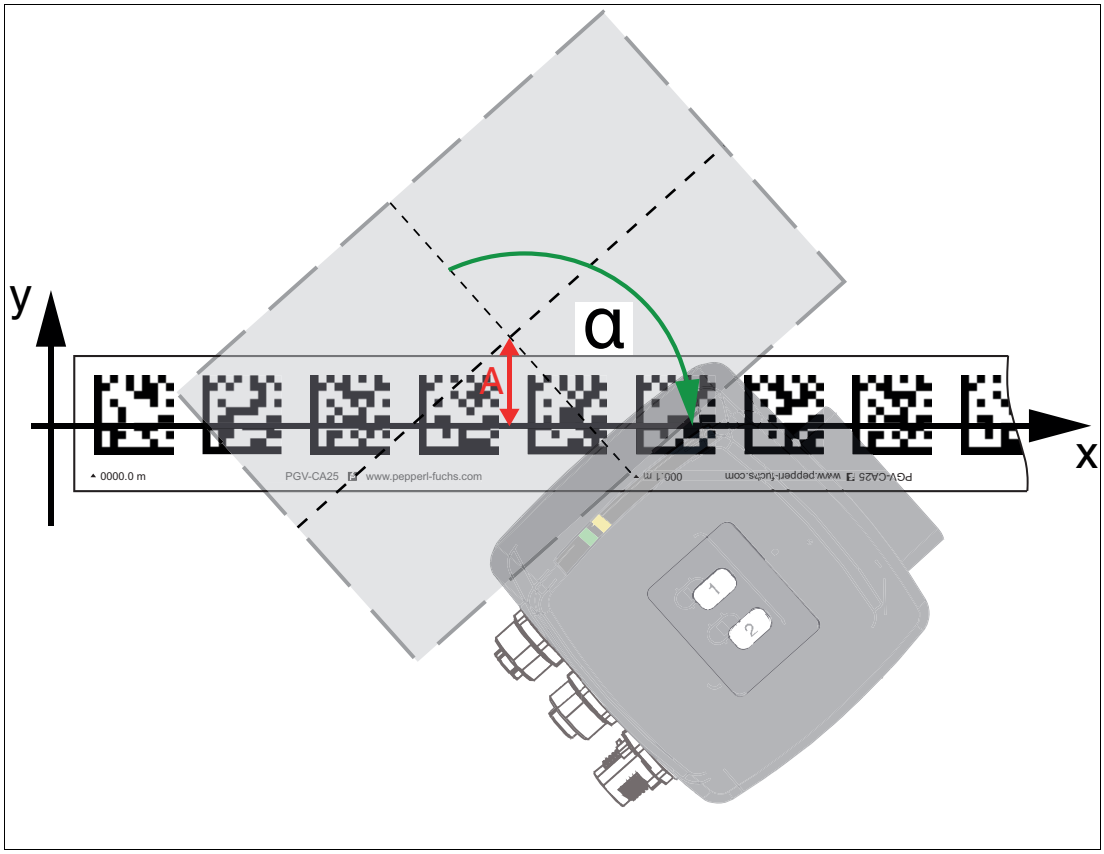


Figure 3.20 For example: Distance A = 20 mm and angle α = 130°

3.5 Reading Range of the Read Heads

The reading range is the part of the field of view of the read head in which Data Matrix codes can be decoded. It must be ensured that the Data Matrix code is completely in the reading range. Data Matrix codes require a quiet zone (white area without coding) of at least 2 mm around the code to ensure successful reading. This quiet zone must not be violated when cutting the code.

The field of view is the maximum image on the sensor chip that is determined by the optical properties of the camera. The size of the field of view varies with the distance between the read head and the Data Matrix code tape. If the read head is positioned farther away from the Data Matrix code tape, the field of view is larger. If the read head is closer to the Data Matrix code tape, the field of view is smaller due to the shorter distance.

Field of View of the Read Head

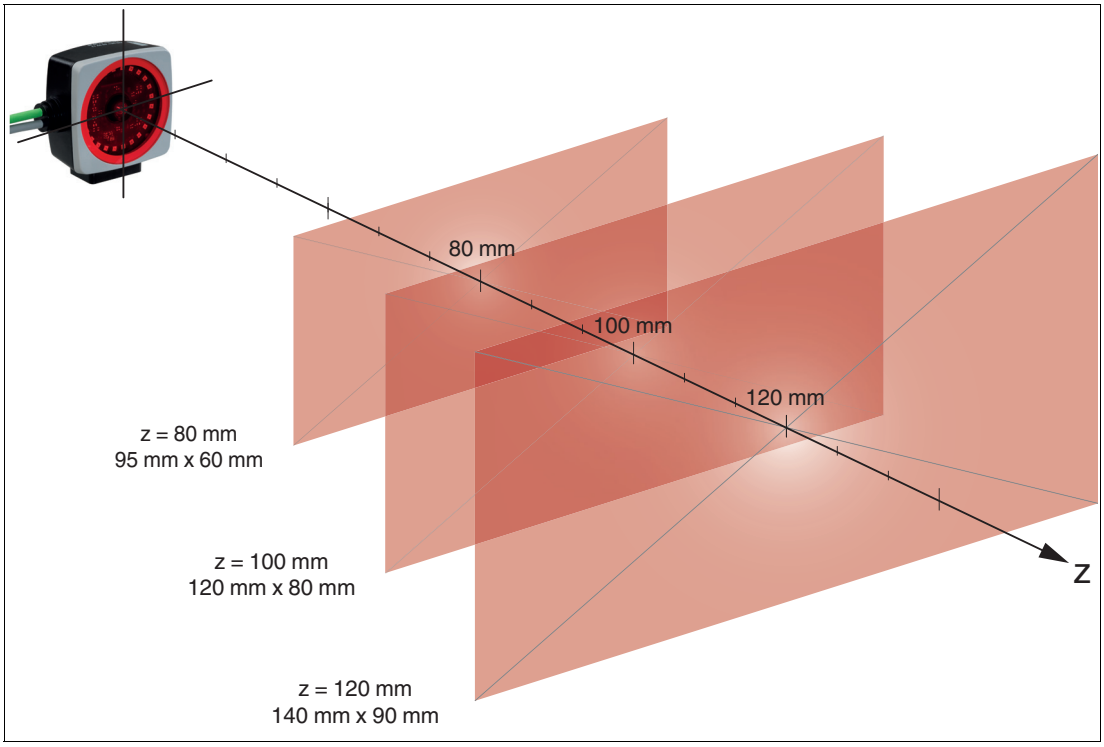


Figure 3.21 Size of the reading window of the read head in relation to the read distance z

Size of Reading Window at Nominal Distance 100 mm

Read distance z [mm]	80	100	120
Reading window size [mm]	95 x 60	120 x 80	140 x 90

3.6 Read Head Orientation

The read head offers reliable code detection from any angle. For optimal results, we recommend setting the alignment of the read head to 0° or 180° in relation to the Data Matrix code tape. In this alignment, the read head offers greater tolerance along the Y axis. Please note, however, that this alignment leads to a reduction in code redundancy.

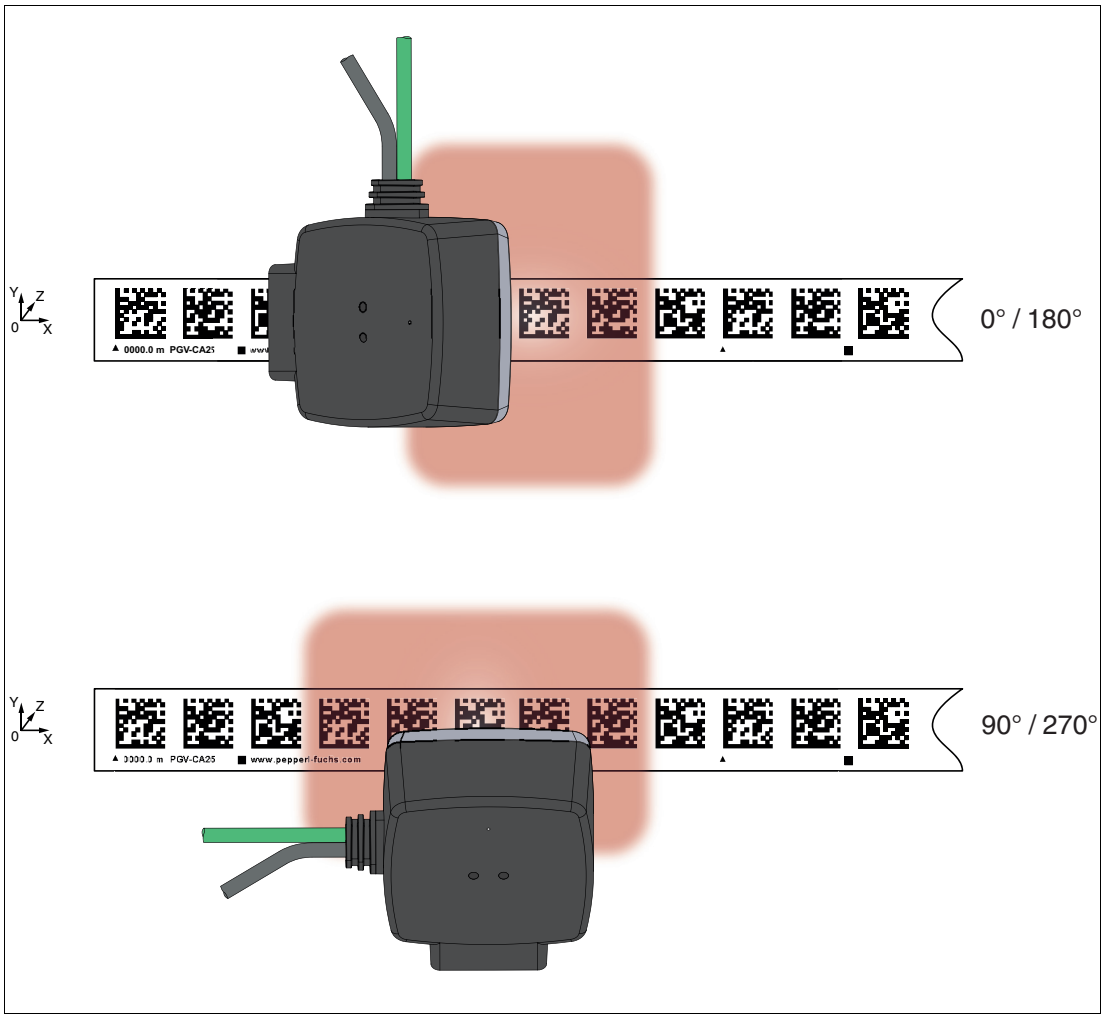


Figure 3.22 Lesekopforientierung

3.7 Aligning the Read Head with the Data Matrix Code Tape

3.7.1 Horizontal Tolerance – Read Distance z

The head offers a high depth of field at different reading distances. If the read head is mounted too close or too far away on the Data Matrix code tape, a warning message is issued. We recommend that the read head always be mounted at a nominal distance of 100 mm to ensure the highest possible availability of the system (due to resolution and code redundancy). Pay particular attention to the reduced mounting tolerance in the Y direction and the reduced gap width, especially at extremely close reading distances.

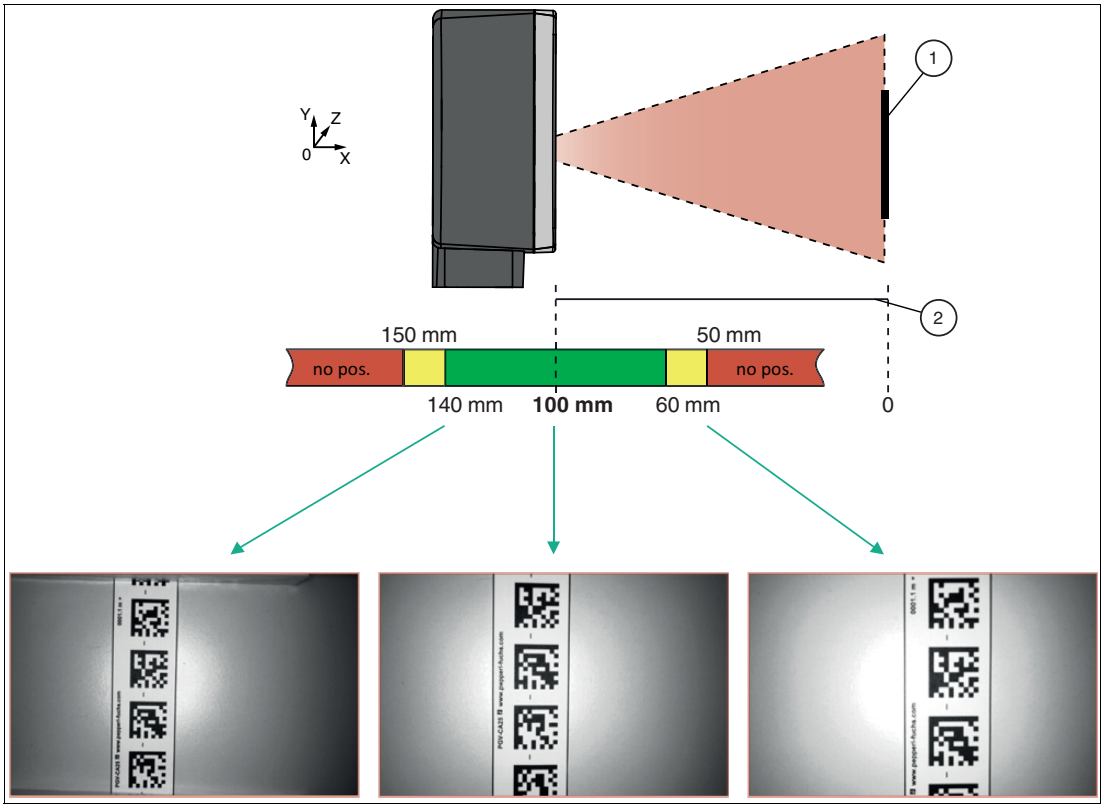


Figure 3.23

1 Data Matrix code tape

2 Read distance to the Data Matrix code tape in Z direction

Green Recommended reading range: Nominal value 100 mm ± depth of focus

Yellow Range in which a "warning bit" is set

Red Range in which a "no pos. bit" is set

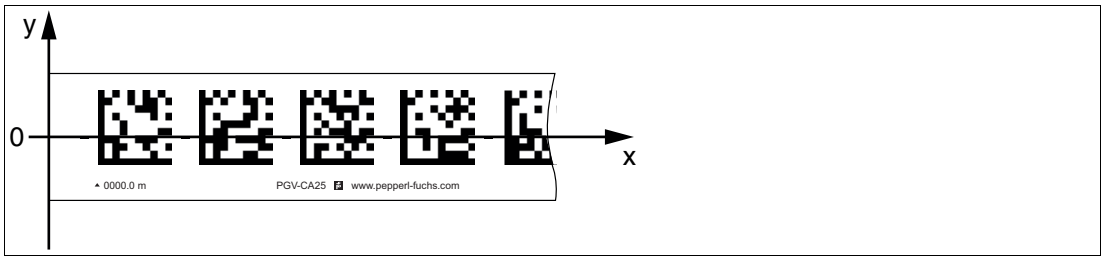
Read distance (z)	Range "no pos." bit	Range "warning" bit
< 50 mm	x	
< 60 mm		x
100 mm		
> 140 mm		x
> 150 mm	x	

3.7.2 Vertical Tolerance - Height Tolerance Y

If the read head leaves the zero line (Y = 0) in the Y direction when moving along the DataMatrix code tape (X axis), no position is recognised from the value $\pm Y_0$. The read head continuously records its position in relation to the Data Matrix code band and compares the current limit value. If the deviation exceeds the limit value (shown in red in the following illustrations), the read head loses the position, and a "no position" message is output.

Zero line (Y = 0)

If the read head has detected a Data Matrix code tape, this Data Matrix code tape can move away from the zero point in the Y direction within the field of view. The maximum Y value at which the read head can still detect this distance from the zero line is set as $+Y_0$ or $-Y_0$. These values depend on the distance (Z) of the read head and the orientation. The values specified here refer to the nominal distance.



Nominal Distance 100 mm (PGV100*)

Read Head Orientation	Height tolerance (Y)	Range "No position message"
0° or 180°	> 45 mm	x
	0 mm	
	< - 45 mm	x

Read Head Orientation	Height tolerance (Y)	Range "No position message"
90° or 270°	> 25 mm	x
	0 mm	
	< - 25 mm	x

Target Range

The read head is in an optimal position with respect to the Data Matrix code tape.

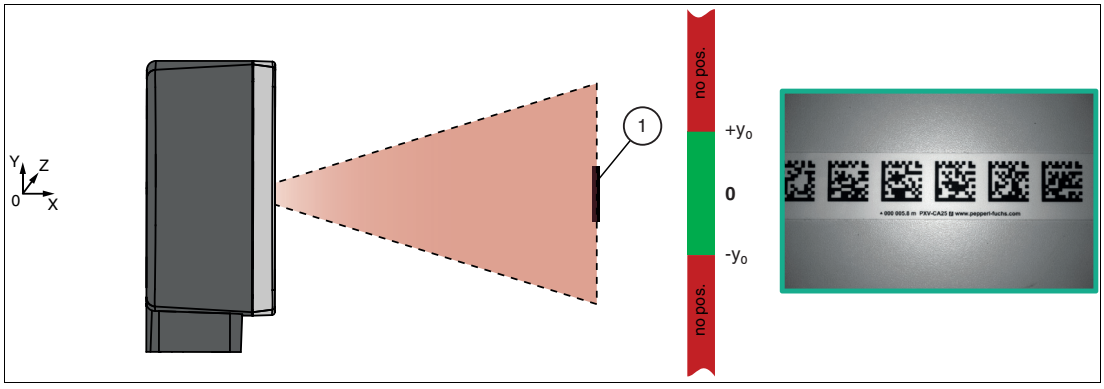


Figure 3.24 Green: recommended range

1: Data Matrix code tape

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No-Position

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.

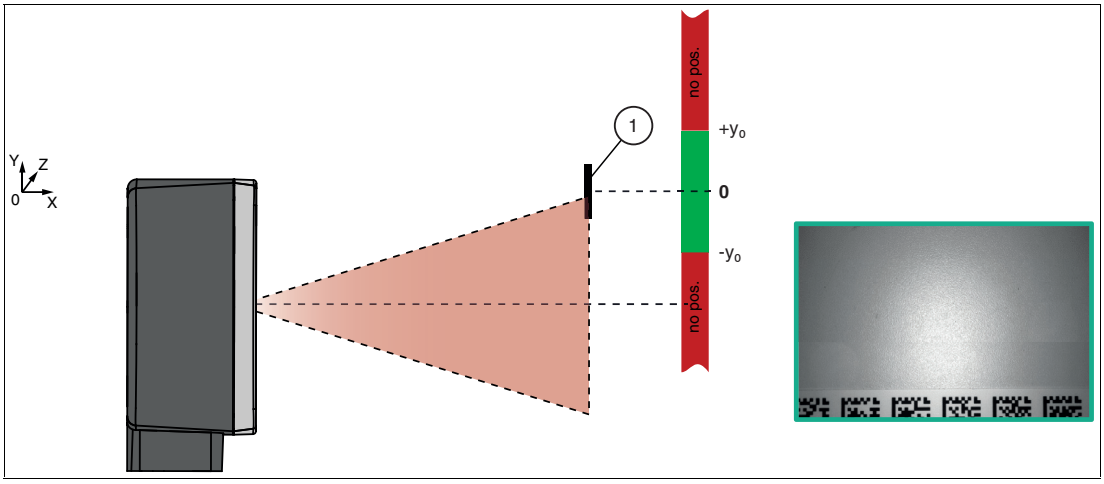

Figure 3.25 Red: Range in which a "No-position" message is set

1: Data Matrix code tape

3.7.3 Inclination Angle

Inclination angle of ± 30° possible. It should be noted that the extreme tolerances do not apply in total.

Simultaneous tilting possible in both X and Y directions.

Note

Simultaneous tilting in the X and Y directions is allowed. It is important to note that tilting the sensor shifts the reading window. If the sensor is tilted too much, this can cause the reading window to stop covering the Data Matrix codes.

Angle Tolerance on the Y Axis

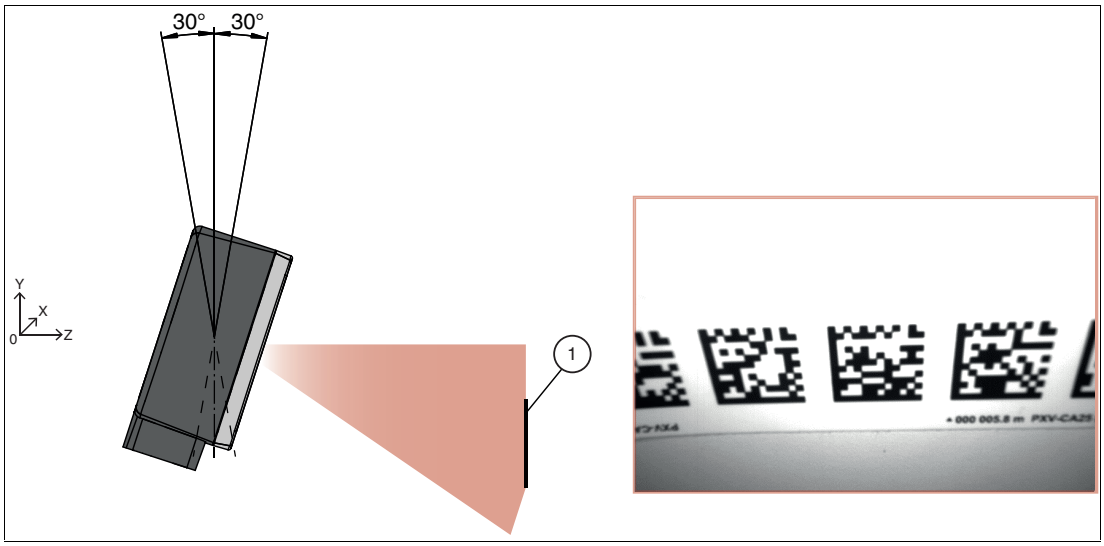

Figure 3.26 Vertical orientation tolerance

1 Data Matrix code tape

Angle Tolerance on the X Axis

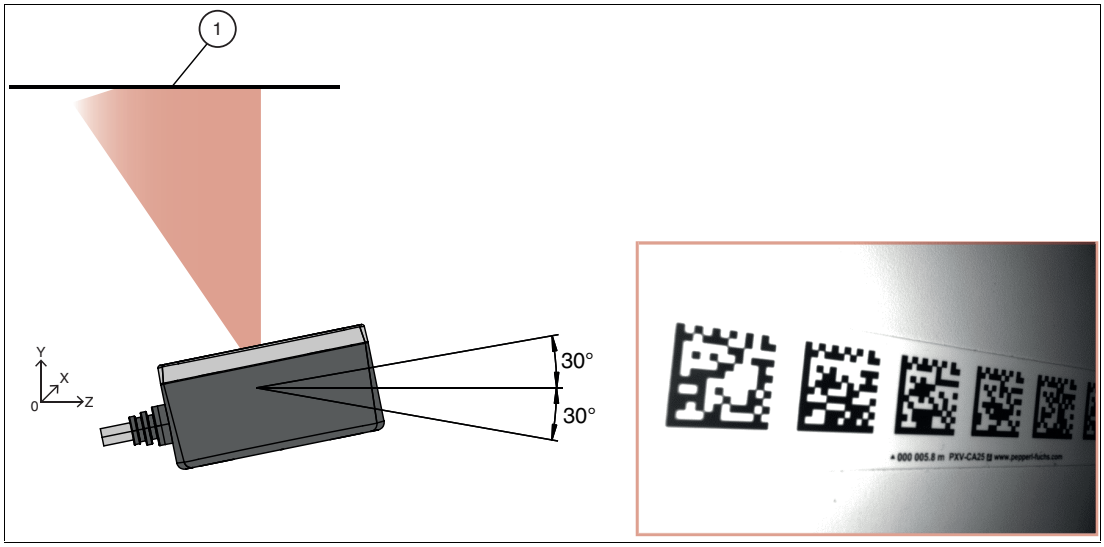

Figure 3.27 Horizontal orientation tolerance

1 Data Matrix code tape

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3.8 Gaps/Interruptions

To compensate for length changes in plant structures, expansion joints are usually required for longer tracks. If a Data Matrix code tape is applied at such locations, we recommend that you interrupt the code tape at the edge of the expansion joint and continue with a fully readable Data Matrix code tape. The read head is able to drive over expansion joints and gaps without loss of position.

The maximum gap (D) refers to the distance between two fully readable Data Matrix codes. It is therefore necessary to observe the grid of the code tape and ensure that the gaps are within the grid. The maximum gap width (D) not only depends on the reading distance, but also on the orientation of the read head.

It is therefore recommended to determine and maintain the maximum gap width based on the specific reading distance, the alignment of the read head, and the pattern of the code tape. Below are some typical values for the maximum gap width (D) depending on the read distance and the alignment of the read head.

Note

Maintain the Quiet Zone!

A quiet zone (white space without coding) of 2 mm must be maintained around the Data Matrix codes. To ensure that the read head can read the Data Matrix codes, the quiet zone of 2 mm around the Data Matrix code must not be violated when cutting the code tape.

Note

The following values apply only to straight sections, not curves.

Maximum Gap for Read Head Orientation 0°/180°

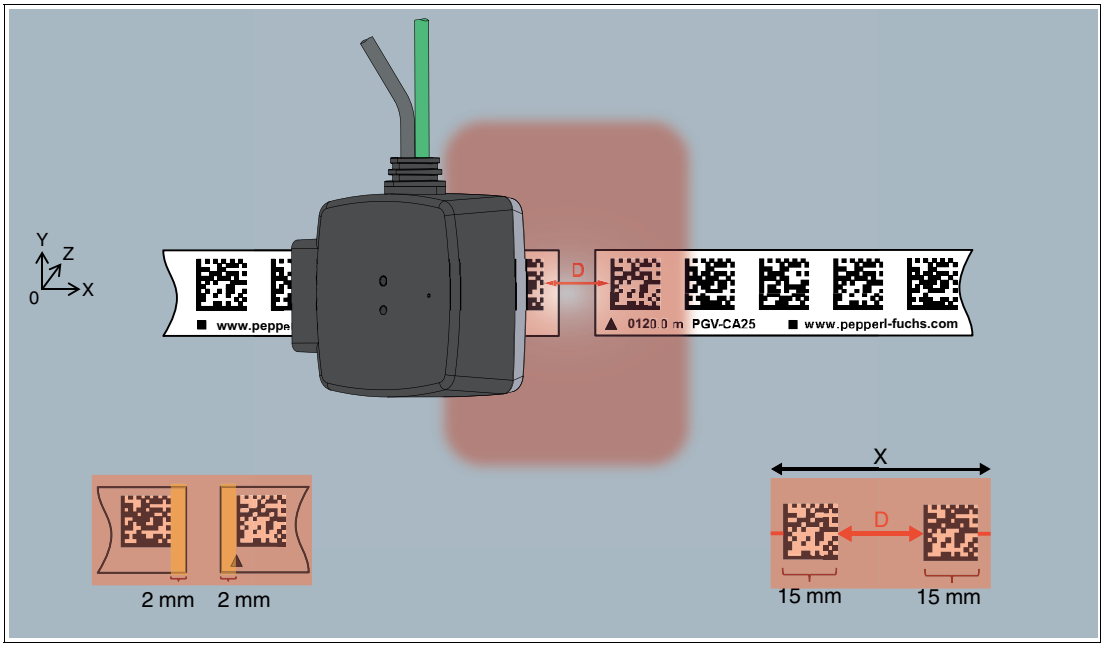


Figure 3.28 Expansion Joints / Gaps

Note

Please note that with this alignment of the read head, the code redundancy or the gap width is reduced.

Maximum Gap Width (D)

Read distance (Z)	Max. gap width (D)
80 mm	26 mm
100 mm	46 mm
120 mm	56 mm

Maximum Gap for Read Head Orientation 90°/270°

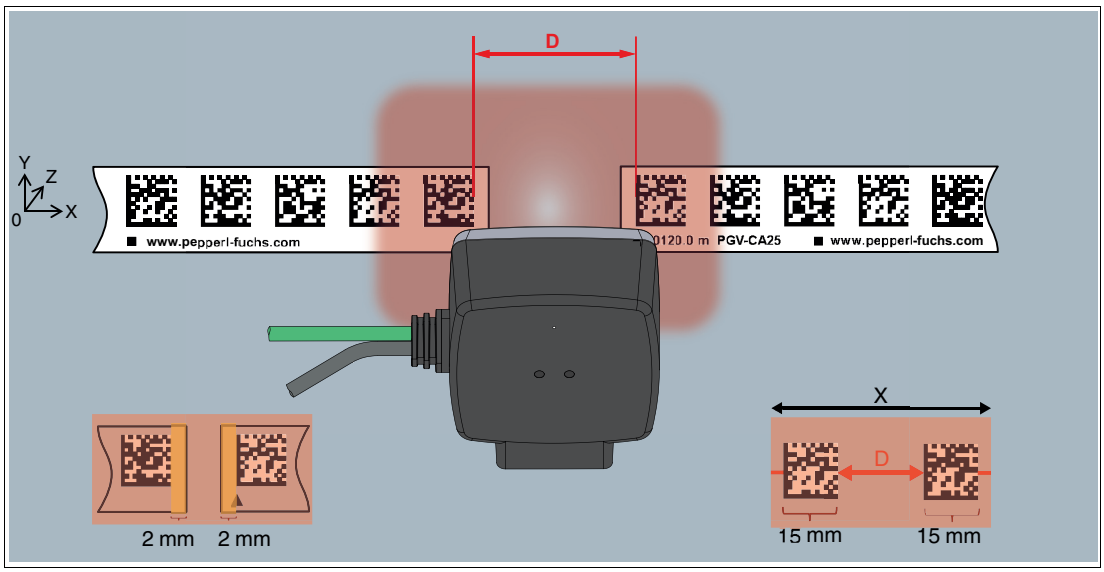


Figure 3.29 Dehnungsfugen/Lücken

Note

Please note that the gap width D defines the distance between two complete Data Matrix codes and not the actual mechanical gap width.

Maximum Gap Width (D)

Read distance (Z)	Max. gap width (D)
80 mm	61 mm
100 mm	86 mm
120 mm	106 mm

Examples of the Gap Width for Consecutive Missing Data Matrix Codes

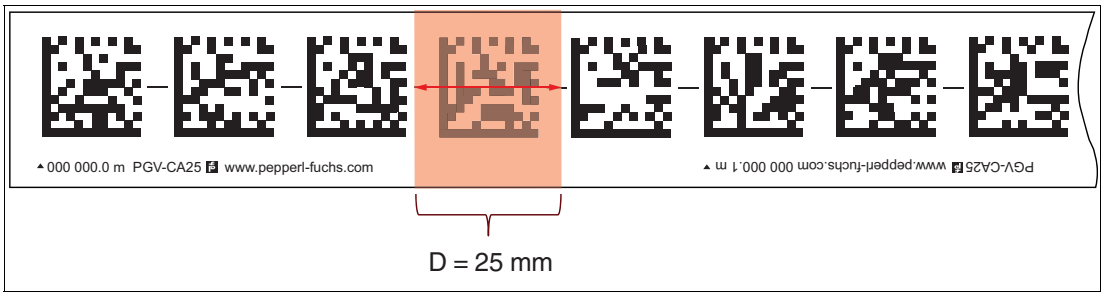
The read head expects Data Matrix codes with an ascending number sequence in a predefined grid. A new code every 20 mm. This grid should be adhered to as far as possible at the interruptions to avoid position jumps.

If the code tape is cut and glued directly to the next code number, this can lead to a position jump and therefore to a high speed value. This is because the next Data Matrix code does not come after 5 mm as expected by the positioning system, but over a longer distance, the gap width.

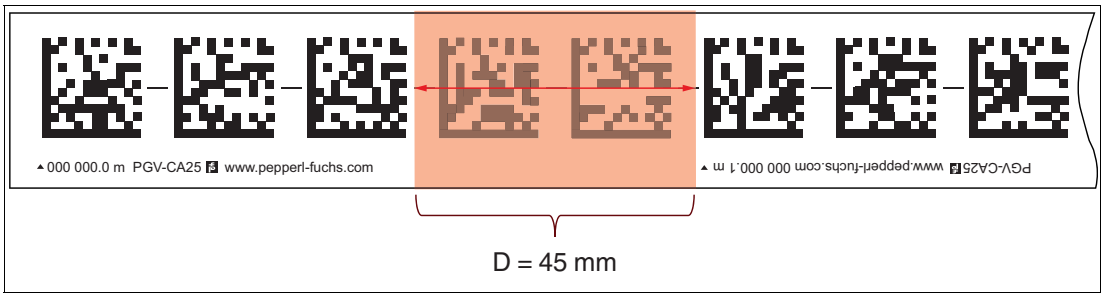
It is therefore recommended to cut the codes according to the gap width. The quiet zone of 2 mm around the code must always be observed.

The maximum number of consecutive missing Data Matrix codes is limited and depends on various factors. In particular, the reading distance, the alignment of the read head, and the pattern of the code tape are crucial here. These factors must be taken into account when applying the Data Matrix code tape. Below are some examples of the maximum allowable gap width.

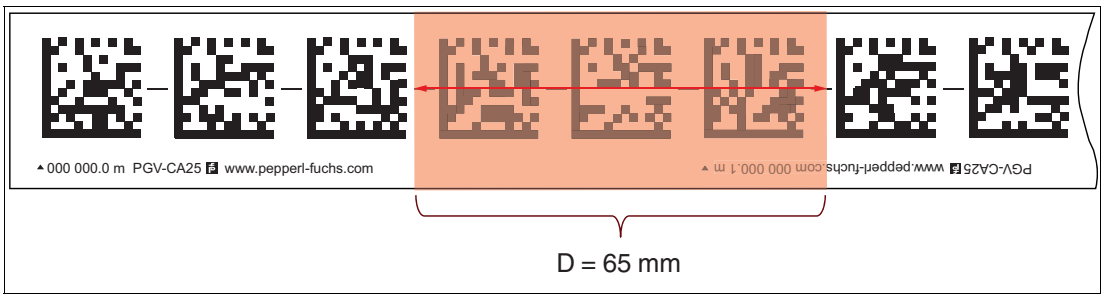
1 missing Data Matrix code



2 missing Data Matrix codes



3 missing Data Matrix codes



Cutting Rule

The code tape is laid in ascending order of position, whereby the distances between the codes are defined by the pattern of the code tape.

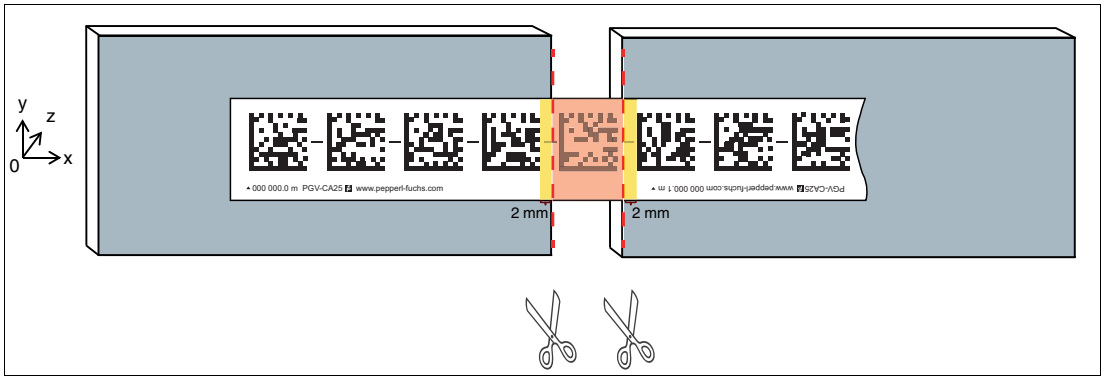


Figure 3.30

- Always cut the code tape centrally between two codes.
- In borderline situations, a projection of 2 mm of the white edge must be left.

There are several options for laying the Data Matrix code tape over gaps (e.g., expansion joints), three of which are shown below. For switch points, a position jump always takes place, so case 3 must be taken into account.

Case 1 - Continuous Bonding

Glue the Data Matrix code tape continuously and cut out the codes in the area of the gap.

Advantage: The codes remain continuously in the same position grid. Therefore, there is no difference between the logical and mechanical position.

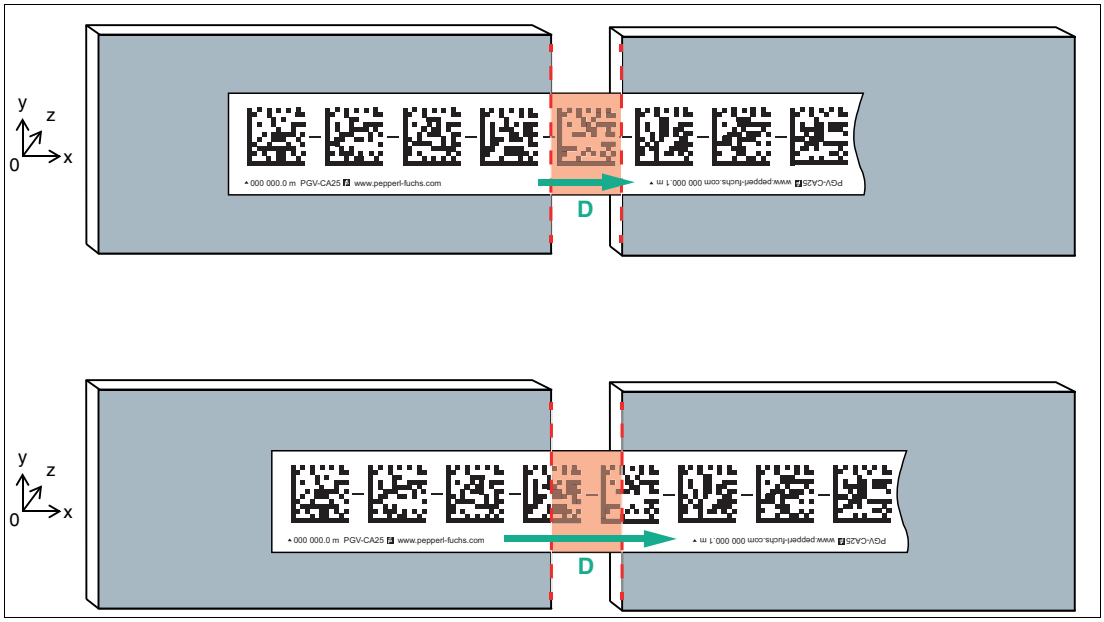


Figure 3.31

- Depending on the pattern of the Data Matrix code tape, a different number of codes can be cut out.
- The gap condition refers to the distance D between two complete Data Matrix codes. The figure below shows that the distance D is significantly larger than in the upper figure, although the gap to be bridged is the same.
- The maximum permissible gap in relation to the selected measuring distance (z) must be observed.

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Case 2 - Continuous Continuation

Glue the Data Matrix code tape up to the gap and cut out the codes in the area of the gap. Continue the code tape at the continuous component.

Advantage: In the case of extremely wide gaps, the Data Matrix code tape can be optimally mounted along the mechanical gap. However, a logical jump occurs in the position value or velocity value within the transition area, because the read head expects the Data Matrix codes in a fixed grid.

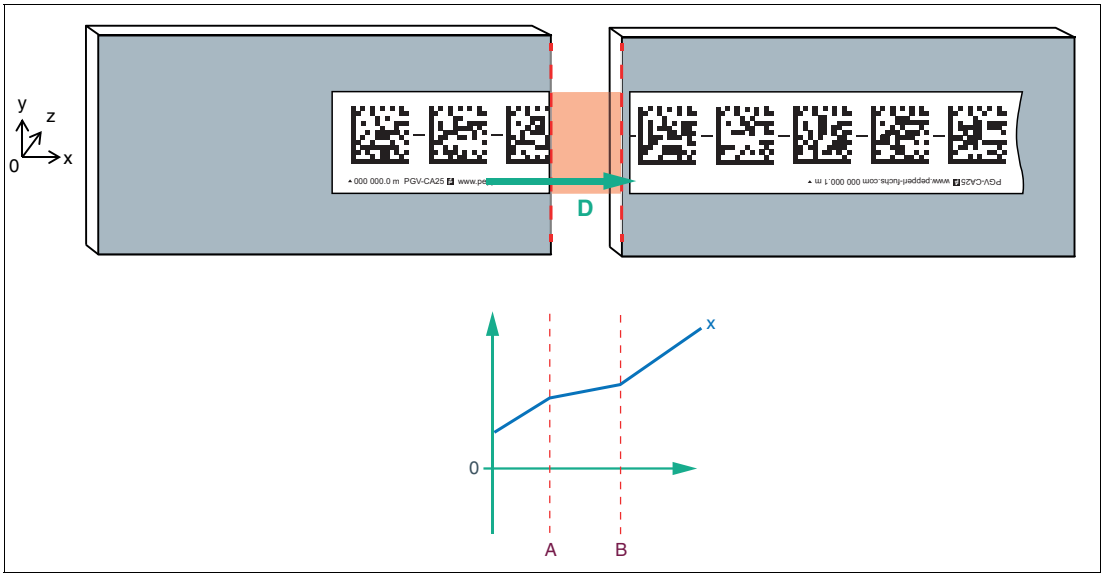

Figure 3.32

The x value is adjusted to the actual distance

Case 3 - Continuous Continuation with Position Jump

Glue the Data Matrix code tape up to the gap/expansion gap and continue the Data Matrix code tape with a position difference of > 1 meter at the continuous component.

Advantage: In the case of extremely wide gaps, the tape can be optimally mounted on mechanical gaps. The position jump results in a transition hysteresis, a defined position change or jump.

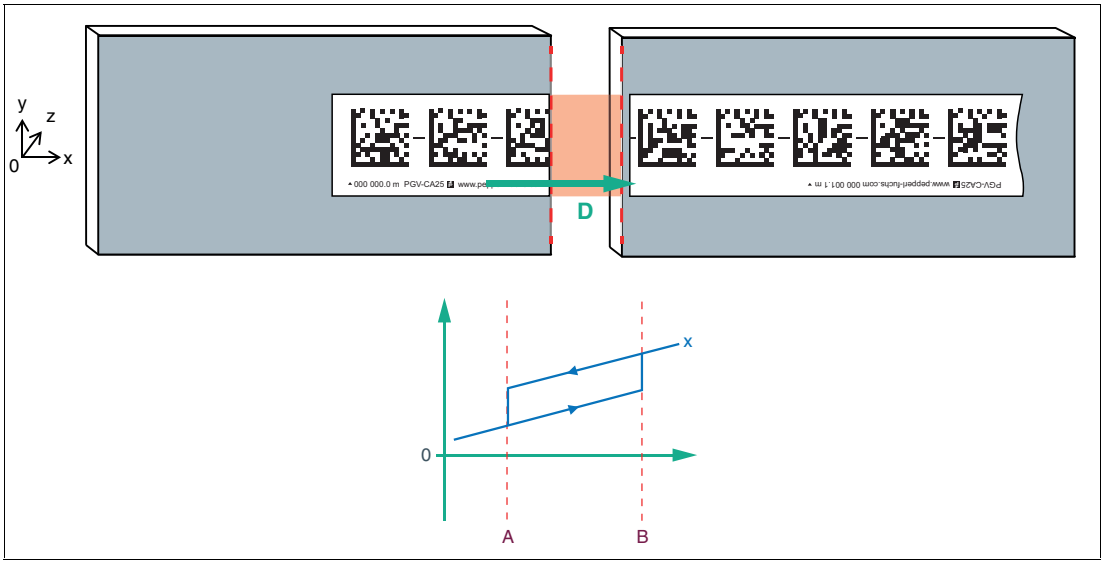

Figure 3.33

The x value remains constant at its historical value and shows a hysteresis of 21 mm. When the center of the image approaches the next code, there is a jump.

Case 4 - Gap is too Large

For a short period of time, the read head outputs the message "No Position."

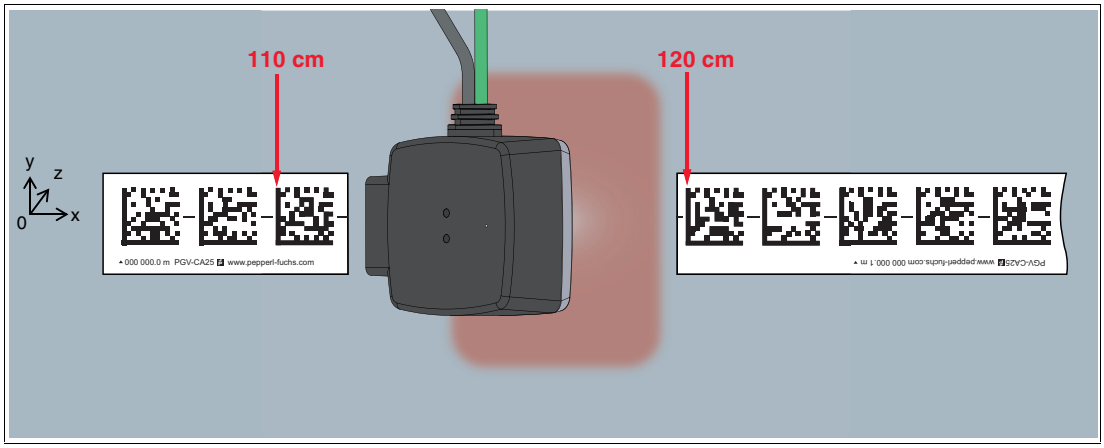

Figure 3.34

y offset

To ensure successful detection of Data Matrix codes on a code tape, the offset **V** between the position codes must not be so large that the actual codes lie outside the reading window.

Note

By transmitting the y position and the angle, lane deviations can be continuously corrected. This may result in a hard steering intervention in case of a y-offset to get the vehicle back in the lane.

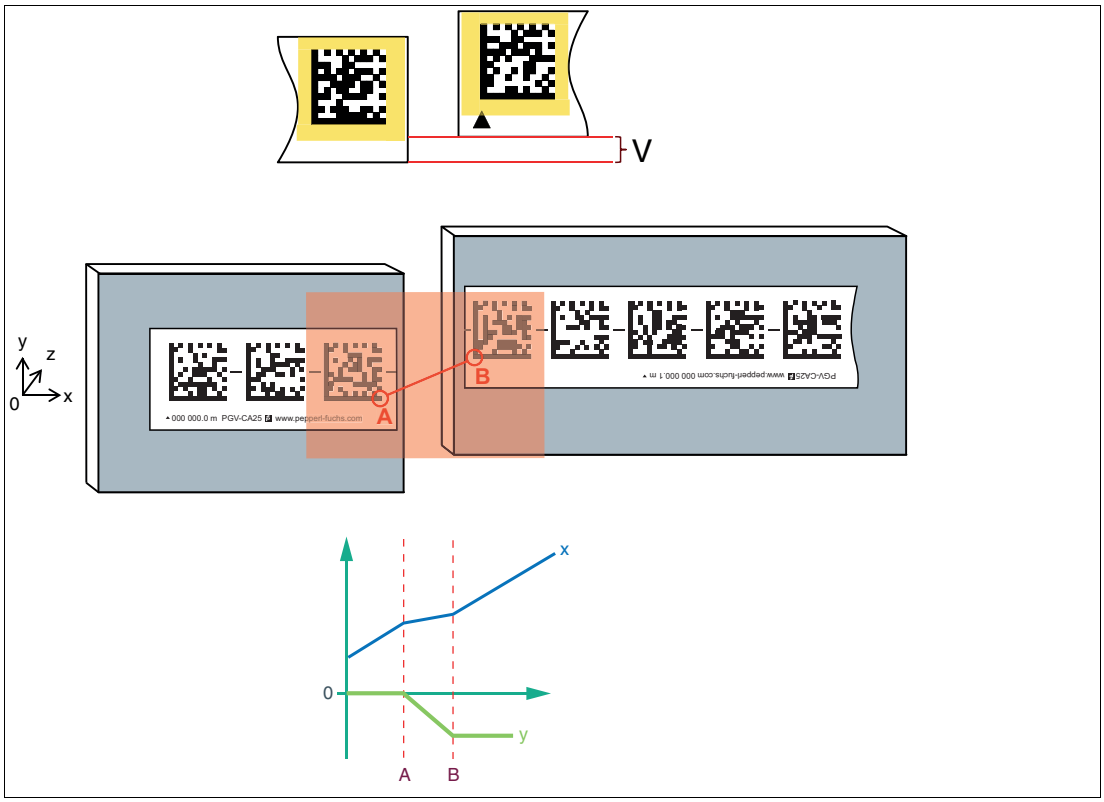

Figure 3.35 Offset

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Thermal Expansion of the Surface

Note

Thermal expansion coefficient

The thermal expansion coefficient of the attached code tape depends on the thermal expansion coefficient of the surface.

When planning the system, consider the worst-case scenario that can be caused by thermal expansion of the surface and adjust the Data Matrix code tape to fit the expansion joint accordingly.

One way of reducing the gap between the Data Matrix code tapes in the case of thermal expansion of the surface is to move the butt edges of the Data Matrix code tapes a few millimeters toward the expansion joint. Ensure that the Data Matrix code tapes do not overlap. The quiet zone around the Data Matrix codes of 2 mm must always be observed.

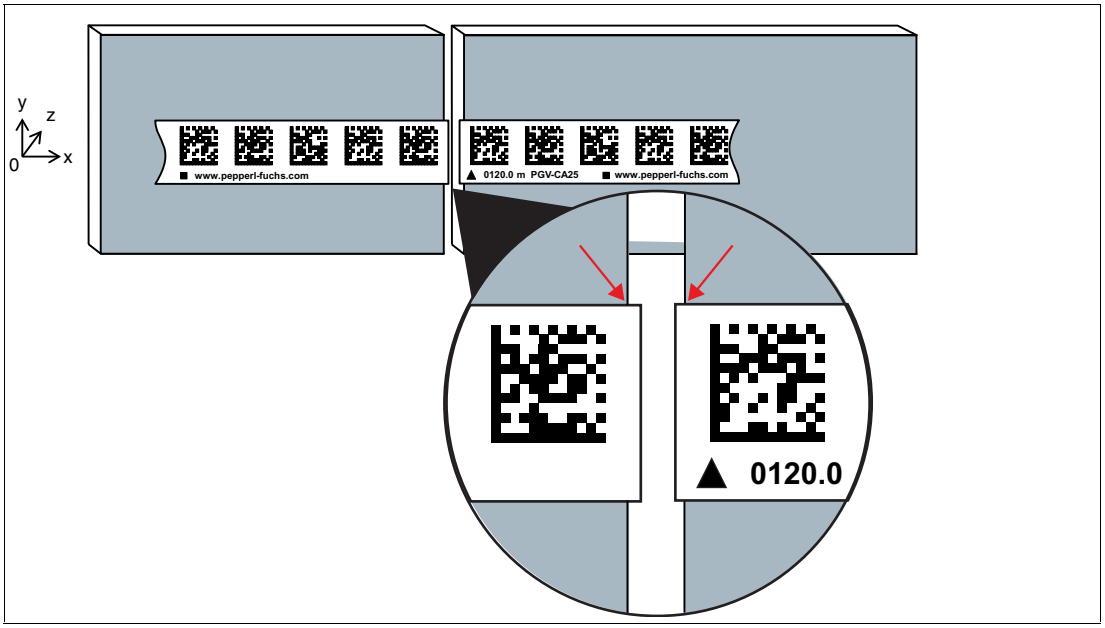

Figure 3.36

4 Installation and Commissioning

4.1 Data Matrix Code and Data Matrix Tag

The following description provides general guidance for applying Data Matrix tags or Data Matrix codes. Please note that the exact specifications may vary depending on the application.

Note

Butt edges

If you attach another Data Matrix code tape at the end of a previous Data Matrix code tape, the code pattern of 20 mm must be retained.

Note

Thermal expansion of the code tape

The affixed code tape corresponds to the heat expansion coefficient of the surface with regard to its thermal expansion. Keep this in mind when installing expansion joints, for example.

Note

Installation temperature

Maintain an installation temperature of at least 10 °C.

Note

Suggestion for an Application Device

To facilitate the application of the code tape, we recommend the use of a suitable mechanical application device. The code tape is supplied on a roll and can be cumbersome and time-consuming to apply without a mounting aid. A mechanical application device can make the process more efficient and accurate, and avoid errors when applying.

You can design a mechanical application device for your particular application. This may consistent of a mount or device, for example, that can hold and position the code tape, and a mechanism that aligns the code tape at the desired location. The mounting mechanism can be operated manually or automatically and enables quick, precise, and efficient application of the code tape.

The use of a mechanical application device can reduce the risk of errors and inaccurate positioning of the code tape. In addition, a mechanical application device can help to avoid overstretching or stretching of the code tape, which can occur when applied manually due to excessive force or uneven tension. A well-designed application device can ensure the uniform tension of the code tape during the application process. This contributes to a higher quality and durability of the code tape.

Marking the Code Tape Section

The marker head (PCV-LM25) is available to make it easier to apply the Data Matrix code tape. The marker head is used to indicate the position of the Data Matrix code tape on the traverse path.

1. Apply the marker head in place of the sensor, in the optimal alignment to the Data Matrix code tape.
2. Drive the route with the marker head.
3. Once you have completed the entire route, the Data Matrix code tape can be affixed.

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Affixing the Data Matrix Code Tape

The following description explains the basic procedure for affixing the Data Matrix code tape. Depending on where the code tape is mounted, there are certain points to consider. These can be found in other sections of this chapter.

1. Clean the surface to remove greasy, oily, or dusty dirt.
2. Ensure that the surface is dry, clean, and stable.
3. Peel off the protective film at the beginning of the tag or code tape. Place the tag or code tape exactly where you want it, press firmly, and peel off the rest of the protective film.
4. Now glue the tag or code tape in the desired location. Note the following instructions.

Note

When removing the protective film from the code tape, make sure that the code tape is not inadvertently bonded in an undesirable location. If the protective film is removed too far, the code tape may accidentally bond in the wrong position and it may be difficult to remove and reattach the code tape in the right position.

We therefore recommend that you first remove only a small piece of the protective film and carefully attach the code tape to the desired location. If it is positioned correctly, you can further peel off the protective film to fully attach the code tape. This ensures that the code tape is positioned exactly where you want it to be and that the Data Matrix codes can be read reliably.

It is important to ensure that the code tape does not come into contact with dirt or dust particles, since this may affect the adhesion and lead to poor adhesion of the code tape.

↳ Please note that the adhesive on the Data Matrix tag or code tape takes about 72 hours to harden completely. It is important that this time is observed before the code tape is fully loaded or stressed.

4.2 Replacement Tape

In the event of a repair, the code tape generator is available to you for a short-term interim solution. This provides the option to create and print code tape segments online to replace defective, heavily soiled, or missing pieces.

Note

Printed paper is not a permanent replacement for the rugged original code tapes. The printout must be used only as an emergency solution. The durability of the paper strip is extremely limited depending on the application.

1. Open the **code tape generator** on the homepage www.pepperl-fuchs.com. To do so, enter "Codeband-Generator PGV" [Code Tape Generator PGV] in the search field and click on Search.
2. Follow the instructions on the code tape generator page.
3. Print the pages of the required code tape segments and cut them to size.

   Note

   Adjust the printer setting so that the code size matches the original tape. You can measure the scaling at the top and right of the first page in the document.

4. Stick the replacement tape over the defective area of the existing code tape.

   Note

   When gluing the replacement tape to the code tape, make sure that the replacement tape continues the pattern on the code tape as accurately as possible.

   Tip

   It is recommended that you glue a protective film over the replacement tape to increase the durability of the paper tape.

4.3 Mounting the Read Head

The mounting and alignment of the read head for detecting Data Matrix codes requires precise fine adjustment of the read head. The PCV-MB1 mounting bracket is suitable for this purpose. It enables flexible and precise adjustment of the read head.

The slotted holes in the mounting bracket allow the read head to be moved in the y and z axes to achieve the most accurate alignment possible with the Data Matrix code tape.

Before mounting the read head, ensure that the depth of field area of the read head is never exited during operation. This ensures that the read head is reliable, accurate, and provides excellent performance.

Dimensional drawing

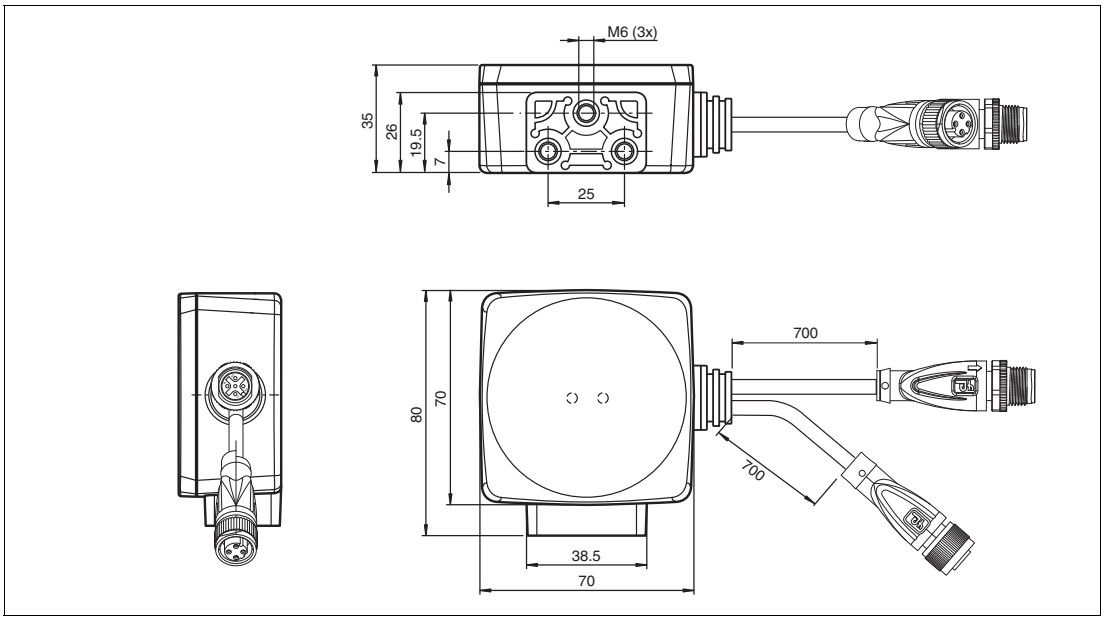

Figure 4.1 Housing dimensions

Attaching Mounting Brackets to the AGTS

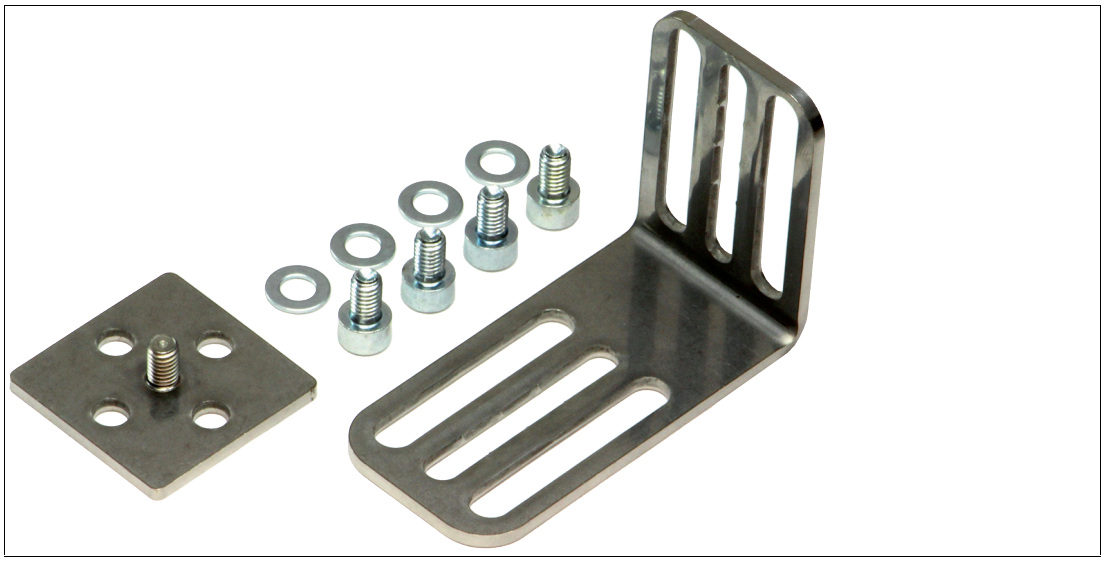

Figure 4.2 Mounting bracket (PCV-MB1)

1. Position the mounting bracket in the direction of the Data Matrix code tape so that the read head can be precisely adjusted afterward.
2. Use the three slots to mount the mounting bracket. Screw the mounting bracket onto the moving part of the system using three screws.

Note

Influencing of the measurement result

It is important to check that the mounting bracket of the read head is firmly secured to ensure stable and safe mounting of the read head.

A loose or loosely fastened mounting bracket may cause the read head to be misaligned or move during operation. This can result in incorrect measurement results.

To check that the mounting bracket is firmly seated, carry out a visual inspection of the fasteners, such as the screws, to ensure that they are tight and secure. It may be helpful to observe the read head during operation to ensure that it does not wobble or move.

Mounting the Read Head on the Mounting Bracket

Before installing the read head, ensure that a stable and secure mounting fixture is provided. Mount the read head so that the optics of the read head with ring light and camera module point toward the Data Matrix code tape.

Caution!

Damage to the reader due to wrong mounting accessory

Using longer screws can damage the reader.

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

Caution!

Damage to the reader due to inadequate attachment

If the reader is not sufficiently well and securely attached according to the requirements of the mechanical load due to the application, it can come loose and be damaged. Tightening the screws to a higher tightening torque can damage the reader.

Depending on the local installation conditions, the plant designer or commissioning engineer are responsible or the following:
tightening torque of the mounting screws: determining the minimum tightening torque for attachment according to the plant requirements.
Do not exceed the maximum tightening torque of 9 Nm.
Ensure that the attachment is in accordance with the mechanical load of the application.
Prevent the unwanted loosening of connections, e.g., by using thread-locking fluid.

3. Place the read head on the terminal block and position it in the middle. Insert the three fixing screws from below through the slots of the mounting bracket and through the terminal block. Tighten the screws so that the read head can still be moved on the terminal block.

Note

The screws should not be tightened until the read head is precisely aligned. One option is to use the alignment guide, which allows the distance between the read head and the Data Matrix code tape to be precisely set.

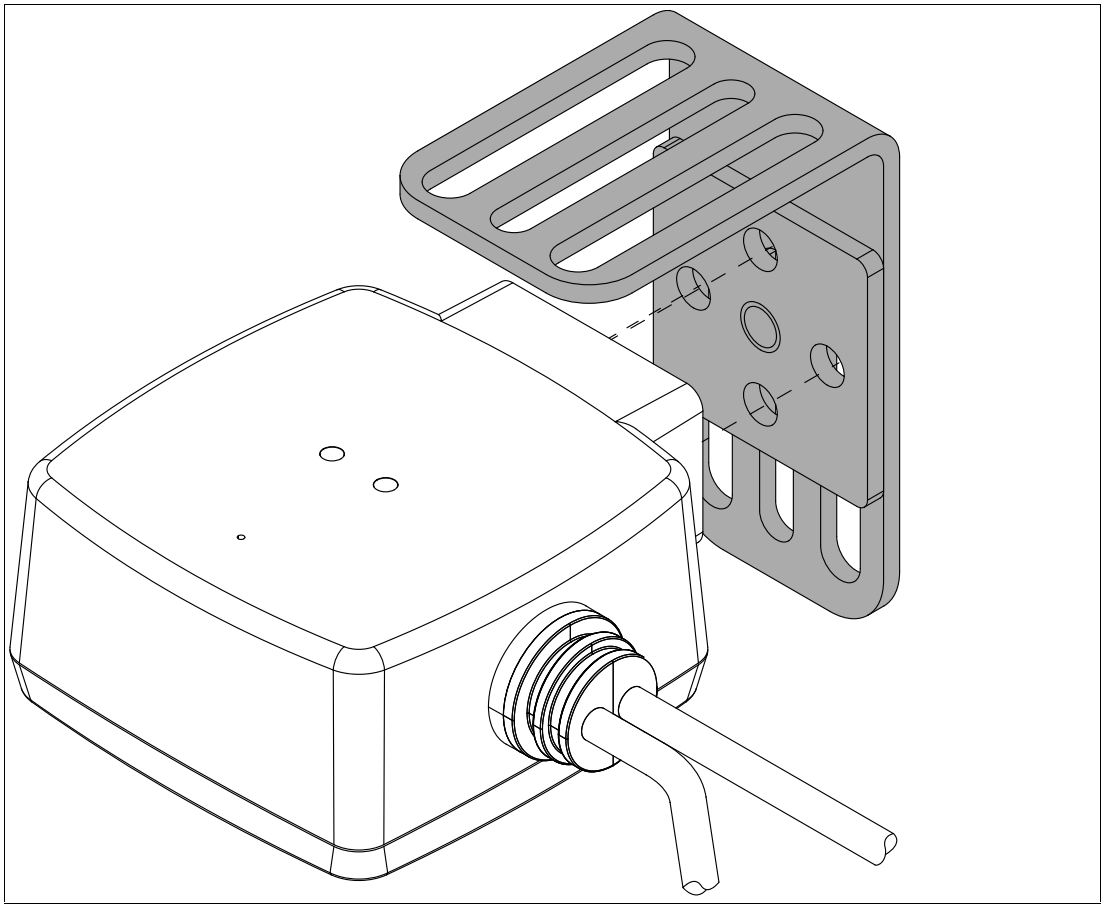

Figure 4.3 Schematic diagram for mounting the read head

Note

A guide pin is located in the center of the terminal block. This ensures that the read head is guided through the slots.

4.4 Aligning the Read Head

Since the vehicle follows the lane and compensates for deviations in the Y-direction by steering movements, the read head does not have to be aligned exactly with the lane. However, some systems require uniform alignment of all read heads to ensure that all vehicles are positioned equally. In these cases, additional fine-tuning steps are required.

Several tools are available for aligning the read head with the Data Matrix code tape:

- Mechanical alignment using the alignment aid. This enables rough adjustment in the Y and Z axis.
- Vision Configurator for fine-tuning with position data or image capture.

Alignment Using an Alignment Guide

If you have the option of attaching the alignment guide to the read heads in your application, you can use the alignment guide (PCV-AG100) to align the optical axis of the read head with the center of the Data Matrix code (dashed line) or colored tape. Please note that the PCV-AG100 alignment tool must not be used to adjust the reading distance. Use alternative tools to set the reading distance correctly.

The zero line Y = 0 is calibrated identically for all read heads with regard to the alignment guide. You can therefore determine the zero line with the help of the alignment guide when changing the read head, for example.

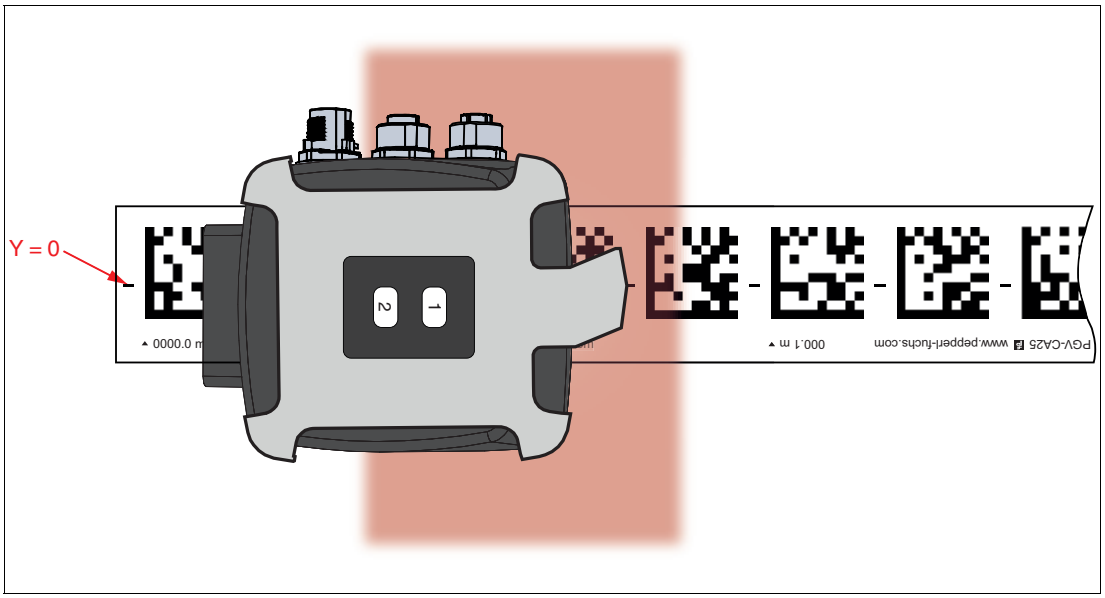

Figure 4.4 Display example

Fine alignment using the Vision Configurator

To ensure that all vehicles are aligned equally, a system-specific alignment procedure is required. The following steps are for guidance only.

1. Before fine-tuning the reading head, make sure that the vehicles are mechanically positioned as evenly as possible. Floor markings, for example, are suitable for this purpose.
2. First, follow the rough alignment steps described above.
3. Now align all read heads with a defined X and Y value. In the Vision Configurator, you can view the current position data of the read heads under the **Position View** tab (1).

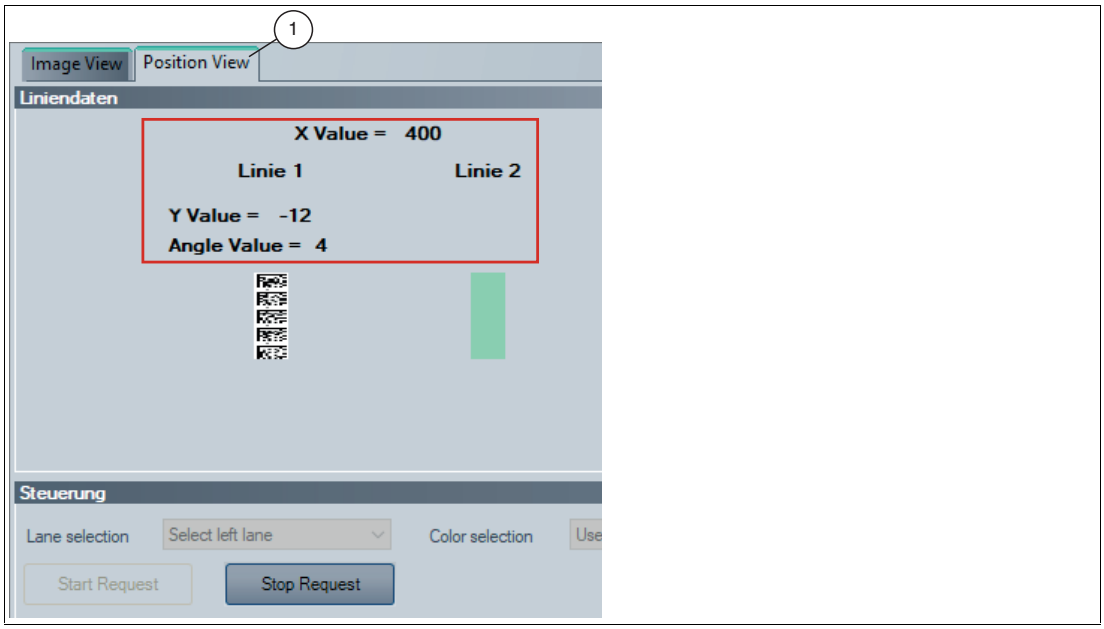

Figure 4.5 Position View

In addition, you can open the currently captured image under the **Image view** tab (1). To do this, click on **Get image** (2) in the toolbar.

Here you can display the current image of the read head via the "Image View" (1) image display. This allows you to visually recognize and check the alignment of the read head with the Data Matrix code tape.

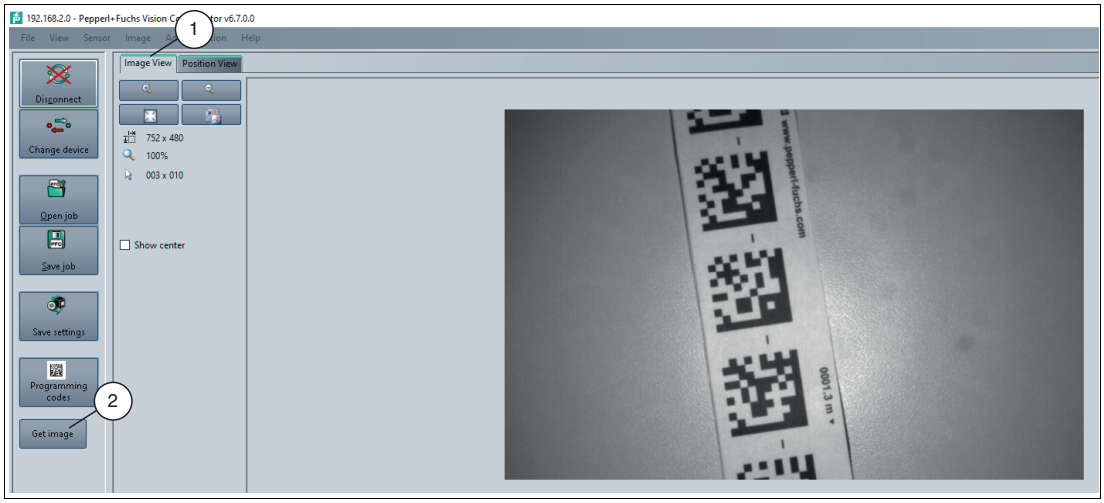

Figure 4.6 Image view

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4.5 Electrical Connection

The read head is connected to the power supply via two fixed cables on the housing side: one cable with a connector is used for the power supply and the configurable inputs and outputs of the read head. In addition, a second cable with an M12 socket is available for LAN connections.

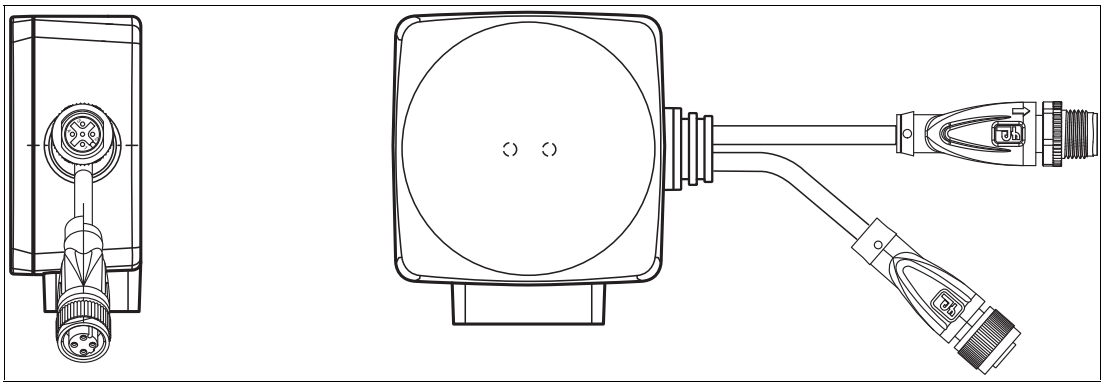


Figure 4.7 Electrical connection

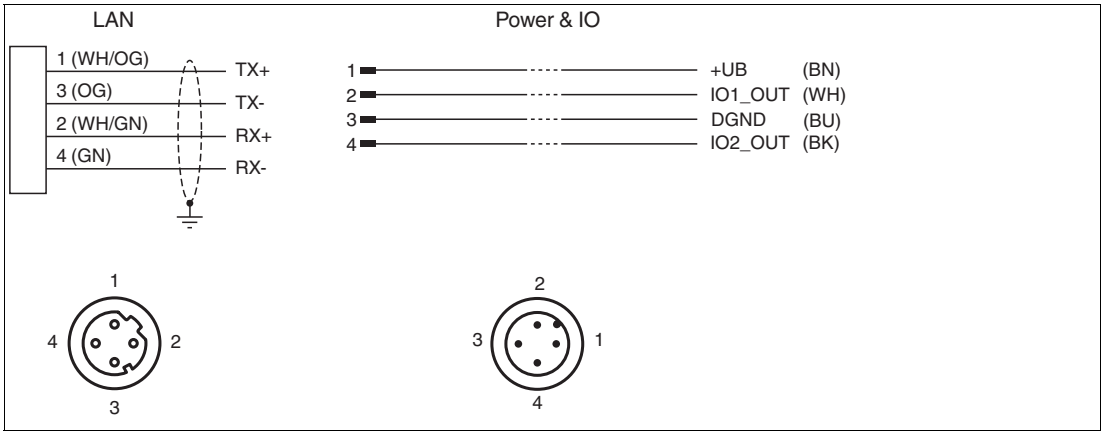


Figure 4.8 Connection assignment

Shielding Cables

The shielding of cables is required to suppress electromagnetic interference. Establishing a low-resistance or low-impedance connection with the protective conductor or equipotential bonding circuit is an especially important factor in ensuring that these interference currents do not become a source of interference themselves. The shield on the connection cable of the read head must be connected to the potential equalization on the control cabinet.

The following points relating to shielding must be noted:

- Use metal cable clips that cover large areas of the shielding.
- Place the cable shield onto the potential equalization rail immediately on entering the switch cabinet.
- Direct the protective grounding connections to a common point in a star configuration.
- The conductor cross section used for grounding should be as large as possible.

Caution!

Damage to the device

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

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

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

4.6 Setting up a Network Connection

In delivery state, the read head has a fixed IP address. To enable communication within the network, the network settings of your PC/laptop must be synchronized with the device and may need to be adjusted. To do so, proceed as follows.

Note

IP address

In delivery state, the read head has a fixed IP address.

- **192.168.2.2**

To enable communication within the network, the network settings of your PC/laptop must be synchronized with the read head and may need to be adjusted.

Note

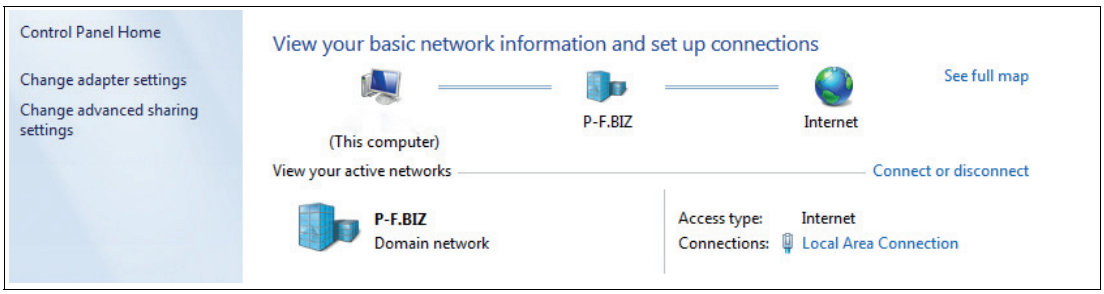
Changing the IP address

If you want to change the default IP address of the read head, you can do so using the Vision Configurator, see chapter 6.3.

Setting the PC IP Address

The following section describes how to check the network connection settings of your Windows PC and adapt them accordingly. The images in this description were created using Windows 10. The description below applies to later versions of Windows.

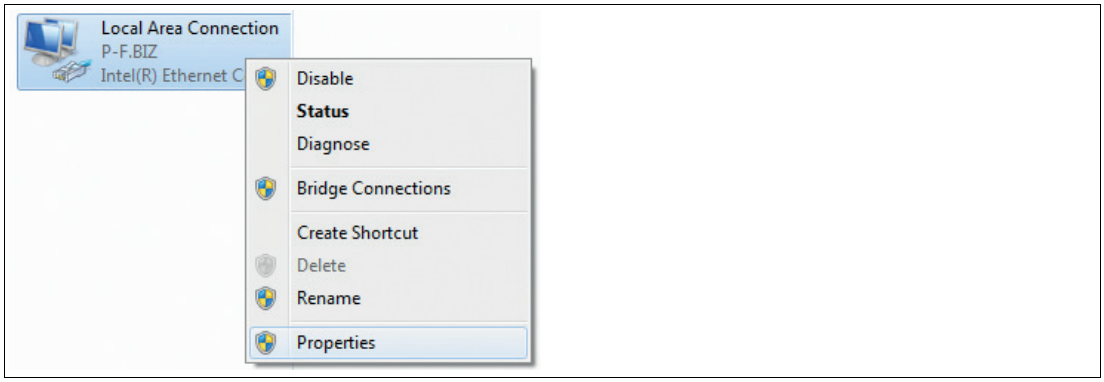
1. Click on the Windows **"Start"** button.
2. Select **"Control Panel > Network and Sharing Center."**
3. Now click on **"Change adapter settings."**



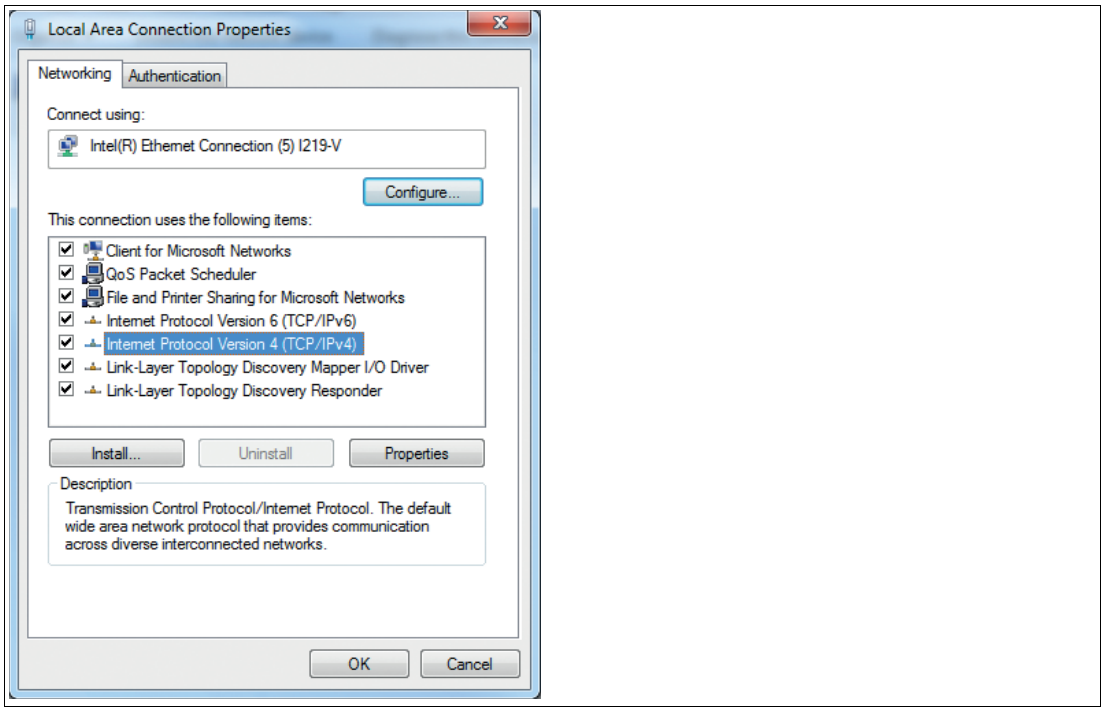
Note

Changes to the network settings of the PC/laptop require advanced user rights. If necessary, consult with your administrator.

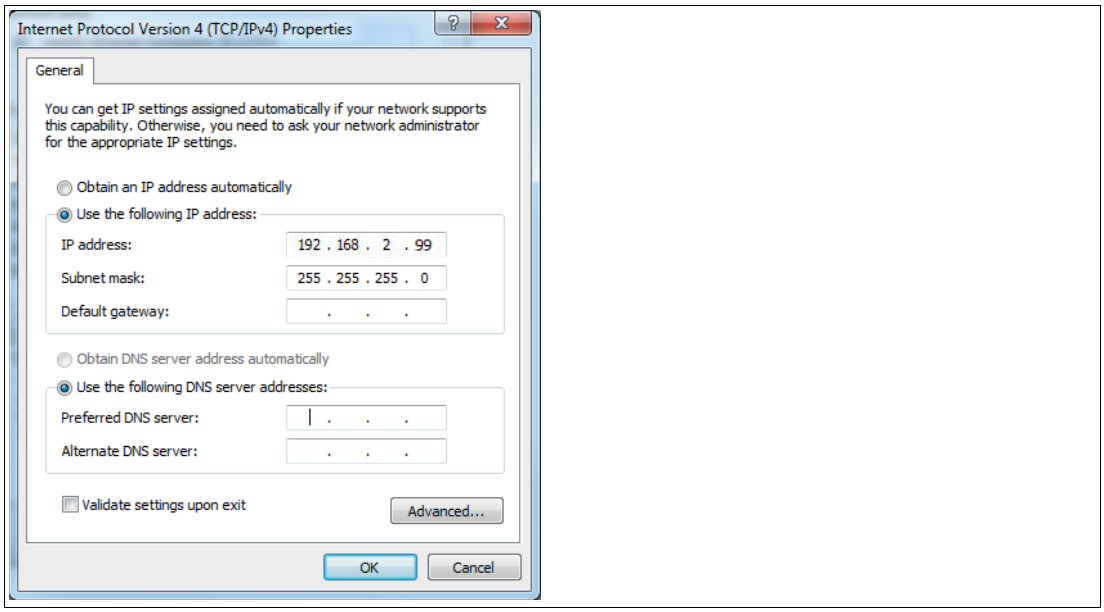
4. Select the required connection and right-click on your selection. In the selection window, select **"Properties."**



5. Double-click on **"Internet Protocol Version 4 (TCP/IPv4)."**



↳ The **Properties** window for the TCP/IP protocol opens.



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6. Select the **"General"** tab.
7. Select the input function **"Use the following IP address."**
8. Enter the read head's IP address, but only the first three segments of the IP address. The last segment must be different from the read head's IP address.
9. In this example, enter the following IP address and subnet mask:
   - **IP address: 192.168.2.99**
   - **Subnet mask: 255.255.255.0**

   Note

   Subnet mask

   To ensure seamless communication between the computer and the read head, both devices must be on the same subnet. Ensure that the IP addresses and subnet masks of both devices are configured correctly and are in the same IP address range. Otherwise, communication problems may occur and the read head may not be able to access the computer properly or vice versa.
10. Click on **"OK"** and click on **"Cancel"** in the next dialog.

    ↳ This completes the network configuration. The read head is ready for use.

5 Operation and Communication

5.1 TCP/IP Communication

The TCP/IP protocol enables communication between the PC and read head. The individual telegrams exchanged during communication are described in the following sections.

Note

Security information

The read head has a configuration interface on TCP port 50021 with a fixed IP address. This interface is used for parameterization and firmware updates. The configuration interface is disabled when the read head is in operating mode.

The read head can be set to a recovery mode by restarting with 8 V input voltage, which allows firmware updates to be completed.

From a safety point of view, the operator responsible for the application must therefore take the following precautions for the read head:

- Physically secure the read head 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

Note

Maximum request rate

Please note that request rates above 100 Hz may have a negative impact on the read head's decoding performance. To ensure optimal performance of the read head, we recommend limiting the request rate to 100 Hz. A higher request rate may have a negative impact on the device performance.

5.1.1 Request Telegram

A request telegram always consists of 2 bytes. The second byte corresponds to the first byte, but with the 8 data bits of the first byte inverted.

Structure of a Request Telegram

Byte/ bit	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Function
Byte 1	Parity	1[1]	Req. bit 4	Req. bit 3	Req. bit 2	Req. bit 1	Req. bit 0	A1	A0	Request
Byte 2	Parity	0	~Req. bit 4	~Req. bit 3	~Req. bit 2	~Req. bit 1	~Req. bit 0	~A1	~A0	Checksum

Table 5.1 Structure of a request telegram

1. R/W: 0 = response, 1 = request

Meaning of Bits

PAR	R/W	Req. bit 4	Req. bit 3	Req. bit 2	Req. bit 1	Req. bit 0	A1	A0	Function
Parity	1	1	0	0	1	0	0	0	Position inquiry (see chapter 5.1.2)
Parity	1	1	1	0	LT	RT	0	0	Selection of direction

Table 5.2 Meaning of bits

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5.1.2 Position Response Telegram

A response telegram is 21 bytes long. Bytes 1 and 2 contain the read head address and status information.

Response telegram from the read head — lane tracking

	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	Parity	0	CC2	A1	A0	CC1	WRN	NP	ERR
Byte 2	Parity	0	TAG [0][1]	0	0	0	1	LT	RT
Byte 3	Parity	0	Reserved	Reserved	Reserved	Reserved	XPR23	XPR22	XPR21
Byte 4	Parity	0	XPR20	XPR19	XPR18	XPR17	XPR16	XPR15	XPR14
Byte 5	Parity	0	XPR13	XPR12	XPR11	XPR10	XPR09	XPR08	XPR07
Byte 6	Parity	0	XPR06	XPR05	XPR04	XPR03	XPR02	XPR01	XPR00
Byte 7	Parity	0	YPL13	YPL12	YPL11	YPL10	YPL09	YPL08	YPL07
Byte 8	Parity	0	YPL06	YPL05	YPL04	YPL03	YPL02	YPL01	YPL00
Byte 9	Parity	0	YPR_13	YPR_12	YPR_11	YPR_10	YPR_09	YPR_08	YPR_07
Byte 10	Parity	0	YPR_06	YPR_05	YPR_04	YPR_03	YPR_02	YPR_01	YPR_00
Byte 11	Parity	0	ANGL13	ANGL12	ANGL11	ANGL10	ANGL09	ANGL08	ANGL07
Byte 12	Parity	0	ANGL06	ANGL05	ANGL04	ANGL03	ANGL02	ANGL01	ANGL00
Byte 13	Parity	0	ANGL-R_13	ANGR_12	ANGR_11	ANGR_10	ANGR_09	ANGR_08	ANGR_07
Byte 14	Parity	0	ANGL-R_06	ANGR_05	ANGR_04	ANGR_03	ANGR_02	ANGR_01	ANGR_00
Byte 15	Parity	0	O1_1	O1_0	S1_1	S1_0	CC1_09	CC1_08	CC1_07
Byte 16	Parity	0	CC1_06	CC1_05	CC1_04	CC1_03	CC1_02	CC1_01	CC1_00
Byte 17	Parity	0	O2_1	O2_0	S2_1	S2_0	CC2_09	CC2_08	CC2_07
Byte 18	Parity	0	CC2_06	CC2_05	CC2_04	CC2_03	CC2_02	CC2_01	CC2_00
Byte 19	Parity	0	WRN13	WRN12	WRN11	WRN10	WRN09	WRN08	WRN07
Byte 20	Parity	0	WRN06	WRN05	WRN04	WRN03	WRN02	WRN01	WRN00
Byte 21	Parity	0	XOR B1.6 ... B20.6	XOR B1.5 ... B20.5	XOR B1.4 ... B20.4	XOR B1.3 ... B20.3	XOR B1.2 ... B20.2	XOR B1.1 ... B20.1	XOR B1.0 ... B20.0

Table 5.3 Response telegram from the read head — lane tracking

1. If bit = 0: read head follows the lane tape

Response telegram from the read head — Data Matrix tag

	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	Parity	0	CC2	A1	A0	CC1	WRN	NP	ERR
Byte 2	Parity	0	TAG [1][1]	0	0	0	1	LT	RT
Byte 3	Parity	0	Reserved	Reserved	Reserved	Reserved	XPL23	XPL22	XPL21
Byte 4	Parity	0	XPL20	XPL19	XPL18	XPL17	XPL16	XPL15	XPL14
Byte 5	Parity	0	XPL13	XPL12	XPL11	XPL10	XPL09	XPL08	XPL07
Byte 6	Parity	0	XPL06	XPL05	XPL04	XPL03	XPL02	XPL01	XPL00
Byte 7	Parity	0	YPL13	YPL12	YPL11	YPL10	YPL09	YPL08	YPL07
Byte 8	Parity	0	YPL06	YPL05	YPL04	YPL03	YPL02	YPL01	YPL00
Byte 9	Parity	0	TAG_55	TAG_54	TAG_53	TAG_52	TAG_51	TAG_50	TAG_49
Byte 10	Parity	0	TAG_48	TAG_47	TAG_46	TAG_45	TAG_44	TAG_43	TAG_42
Byte 11	Parity	0	ANGL13	ANGL12	ANGL11	ANGL10	ANGL09	ANGL08	ANGL07
Byte 12	Parity	0	ANGL06	ANGL05	ANGL04	ANGL03	ANGL02	ANGL01	ANGL00
Byte 13	Parity	0	TAG_41	TAG_40	TAG_39	TAG_38	TAG_37	TAG_36	TAG_35
Byte 14	Parity	0	TAG_34	TAG_33	TAG_32	TAG_31	TAG_30	TAG_29	TAG_28
Byte 15	Parity	0	TAG_27	TAG_26	TAG_25	TAG_24	TAG_23	TAG_22	TAG_21
Byte 16	Parity	0	TAG_20	TAG_19	TAG_18	TAG_17	TAG_16	TAG_15	TAG_14
Byte 17	Parity	0	TAG_13	TAG_12	TAG_11	TAG_10	TAG_09	TAG_08	TAG_07
Byte 18	Parity	0	TAG_06	TAG_05	TAG_04	TAG_03	TAG_02	TAG_01	TAG_00
Byte 19	Parity	0	WRN13	WRN12	WRN11	WRN10	WRN09	WRN08	WRN07
Byte 20	Parity	0	WRN06	WRN05	WRN04	WRN03	WRN02	WRN01	WRN00
Byte 21	Parity	0	XOR B1.6 ... B20.6	XOR B1.5 ... B20.5	XOR B1.4 ... B20.4	XOR B1.3 ... B20.3	XOR B1.2 ... B20.2	XOR B1.1 ... B20.1	XOR B1.0 ... B20.0

Table 5.4 Response telegram from the read head — Data Matrix tag

1. If bit = 1: read head detects Data Matrix tag

Designation	Function
A	Address of the read head
ANGL	Absolute angle of the left lane
ANGR	Absolute angle of the right lane
CC1_#/CC2_#	Control code 1 or 2 with number # detected Control code 2 is evaluated via the "Split value" function.[1]
CC1/CC2	Associated control code is detected.
ERR	Error message Error codes are stored in XP00 ... XP23. Additional information on the codes can be found in the **Error Codes** table.
LT/RT	Selected direction decision
NP	No absolute X position
O1_#/O2_#	Orientation control code for lane. .
S1_#/S2_#	Relative position control code for lane. .
TAG	Data Matrix tag detected
TAG_#	Data Matrix tag with number # detected

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Designation	Function
WRN	Warning message Warnings are stored in WRN00 ... WRN13. Additional information on the codes can be found in the **Warning Messages** table.
XPL	X position of left lane
XPR	X position of right lane
YPL	Y position of left lane
YPR	Y position of right lane

Table 5.5 Functional description of the bits

1. Should you have any questions, please contact Pepperl+Fuchs

Error Codes

Error code	Description	Priority
2	No clear position can be determined, e.g., difference between codes is too great, code distance incorrect	4
5	No direction decision available,	2
6	Internal	3
> 1000	Internal error	1

Table 5.6 Error Codes

Warning Messages

Warning message	Description
WRN00	Code with content not typical of PGV found
WRN01	Read head too close to code tape
WRN02	Read head too far from code tape
WRN03	Reserved
WRN04	Reserved
WRN05	The read head is rotated or tipped in relation to the code tape
WRN06	Low level of code contrast
WRN07	Reserved
WRN08	Reserved
WRN09	Reserved
WRN10	Reserved
WRN11	Reserved
WRN12	Reserved
WRN13	Reserved

Table 5.7 If no warnings are present, the bits are set to 0.

5.1.2.1 Position/Lane

You can use the following table to draw conclusions on the current section in the reading window based on the feedback from the read head regarding Data Matrix tag **TAG**, No X Position **NP**, absolute X position **XP** and the Y position and angle **YPS/ANG**.

Meaning of Bits

TAG	NP	XP	YPS/ANG	Meaning
0	0	+[1]	+	Data Matrix lane available.
0	1	-	-	No evaluable objects exist.
1	0	+	+	Position on the basis of a Data Matrix tag, X position is signed.

Table 5.8 Meaning of bits

1. Valid data present

5.1.3 Direction Decision Request Telegram

Byte/ bit	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Function
Byte 1	Parity	1	1	1	0	LL	RL	A1	A0	Request
Byte 2	Parity	0	0	0	1	~LL	~RL	~A1	~A0	Checksum

Response Telegram for Direction Decision

	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	Parity	0	CC2	A1	A0	CC1	WRN	NP	ERR
Byte 2	Parity	0	0	0	0	0	0	LL	RL
Byte 3	Parity	0	XOR B1.6 ... B2.6	XOR B1.5 ... B2.5	XOR B1.4 ... B2.4	XOR B1.3 ... B2.3	XOR B1.2 ... B2.2	XOR B1.1 ... B2.1	XOR B1.0 ... B2.0

Meaning of Bits

LL	RL	Meaning
0	0	Error code 5
0	1	Follow right-hand lane
1	0	Follow left-hand lane
1	1	Straight ahead

Table 5.9

Example

Request telegram when read head address = 0

Request	Response	Description	Example
0xE8, 0x17	See "**Response Telegram for Direction Decision**"	Follow left-hand lane	--"0x02"--
0xE4, 0x1B		Follow right-hand lane	--"0x01"--
0xEC, 0x13		Straight ahead	--"0x03"--
0xE0, 0x1F		No lane is selected Error code 5	--"0x00"--

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6 Vision Configurator

Vision Configurator enables the read head to be configured and used with a user-friendly operator interface. The standard functions include establishing a connection to the read head, the parameterization of operating parameters, saving data sets, visualizing the camera capture of the read head, and error diagnosis.

Note

The latest version of the Vision Configurator software can be found online at https://www.pepperl-fuchs.com. The Vision Configurator manual outlines the properties of the operating software for multiple devices. You can access this manual from our website.

Note

Documenting the network configuration

The TCP/IP communication protocol is used for communication between the read head and the connected PC. To ensure smooth communication, you should carefully log any changes to the network configuration.

6.1 Installing Vision Configurator

Installing Vision Configurator

The following describes how to obtain the installation file from the Pepperl+Fuchs homepage and install it.

1. Go to the Pepperl+Fuchs homepage at http://www.pepperl-fuchs.com and enter the product designation or item number in the search function. You can find the Vision Configurator software in the **Software** section of the device's product detail page.
2. Save the installation file locally.
3. Start the exe file.
4. Follow the instructions for the installation process.

   ↳ After installation, several image processing functions are available in the Windows Start menu under **"Start > All programs > Vision Configurator."**

6.2 Getting Started

After starting the Vision Configurator, you should perform the following steps:

- Select a corresponding user role depending on the settings you want to make in Vision Configurator.
- Select the device family to which your read head belongs (Vision).
- Select the type of sensor that is compatible with your read head (PGV).
- Select the connection type that connects your read head to the PC (TCP/IP).
- Enter the IP address of the read head to establish the connection.
- As an option, the "Auto detect (TCP/IP only)" function can be used to display all connected TCP/IP Ethernet devices, see chapter 6.3.

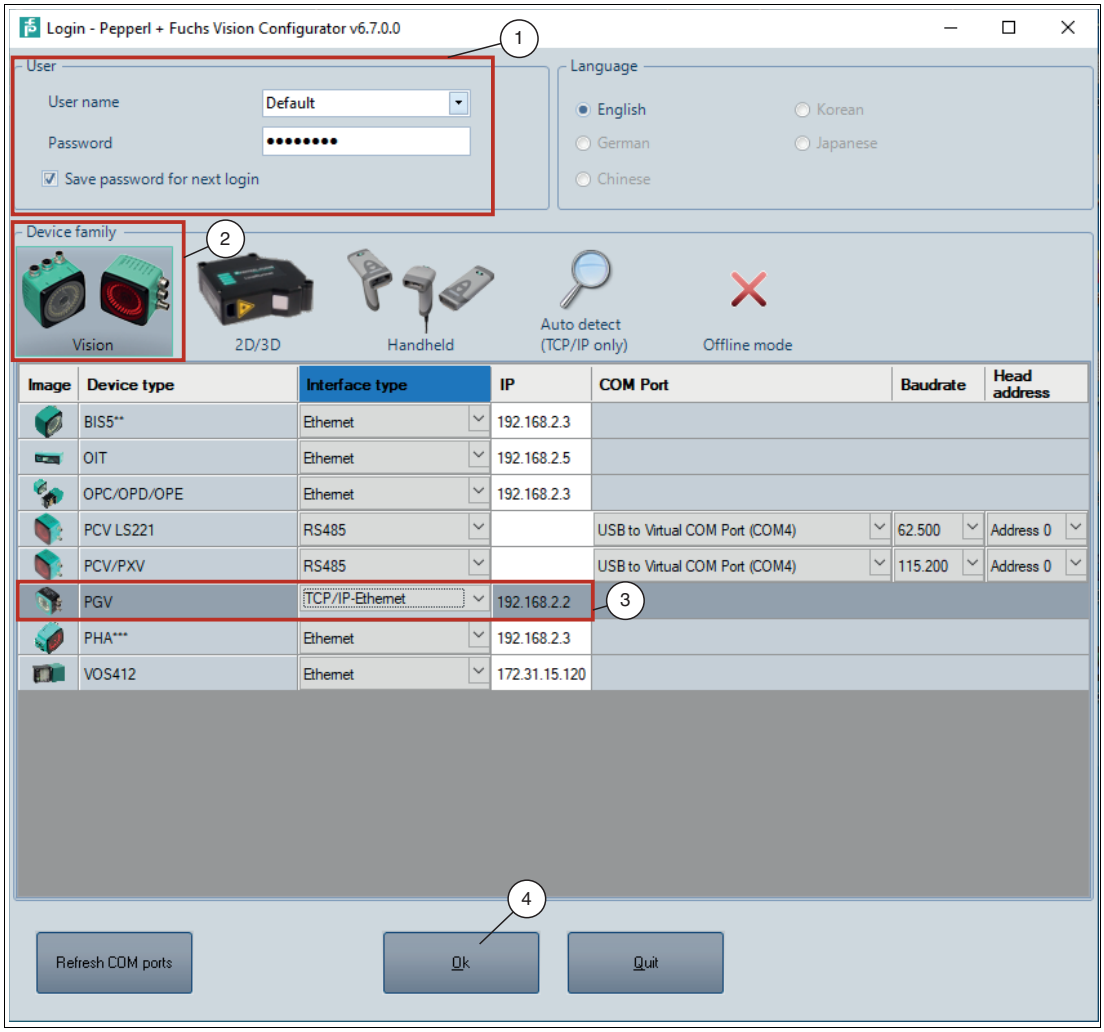

Figure 6.1

Selecting Users (1)

1. Select the required user from the drop-down list **User name**.
2. Enter the appropriate password in the **Password** input field.
3. If you want to save the password for the next time you log in, select the **Save password for next login** check box.

User Account Privileges and Rights

Note

On delivery, the following user roles are predefined in **User name** in the **User** screen with various authorizations.

User Rights and Password

User rights	Description	Password
Default	View all information Create users at same level or below	No password required
User	View all information Sensor configuration Create users at same level or below	User
Admin **PFAdmin**	View all information Sensor configuration Create and delete users	Access only for Pepperl+Fuchs service personnel

Selecting a Device Family (2)

The device family is selected in the **Device family** screen as follows:

1. Left-click on the "Vision" device family.

↳ A list of the available sensor types is displayed.

Selecting the Sensor Type (3)

1. Left-click on the "PGV" device family.

↳ The selected sensor type is highlighted in dark gray.

Selecting the Connection Type (3)

The connection type is selected in the **Interface type** screen as follows:

1. Select "Ethernet" from the **Interface type** drop-down list.

Entering the IP Address (3)

The IP address required to establish the connection is set in the **IP** screen.

1. Enter the IP address.

Note

IP Address

In delivery state, the read head has a fixed IP address.

- **192.168.2.2**

To ensure seamless communication between the computer and the read head, both devices must be on the same subnet. Ensure that the IP addresses and subnet masks of both devices are configured correctly and are in the same IP address range. Otherwise, communication problems may occur and the read head may not be able to access the computer properly or vice versa.

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6.3 Auto Detect—Changing the IP Address

The **Auto detect (TCP/IP only)** function is available in Vision Configurator. This function allows you to view all connected TCP/IP Ethernet devices. You can select the device you are looking for in the output window and read or change information such as the device's IP address. This function is useful if you have inadvertently changed the IP address and no longer know it.

Changing the IP Address—Option 1

You can only perform the following description if UDP broadcasts are not blocked by the fire-wall. Otherwise, follow the description below (Changing the IP Address—Option 2).

1. Select the "Auto detect (TCP/IP only)" function (1).

↳ If a read head is detected, the following output window appears with the corresponding read head.

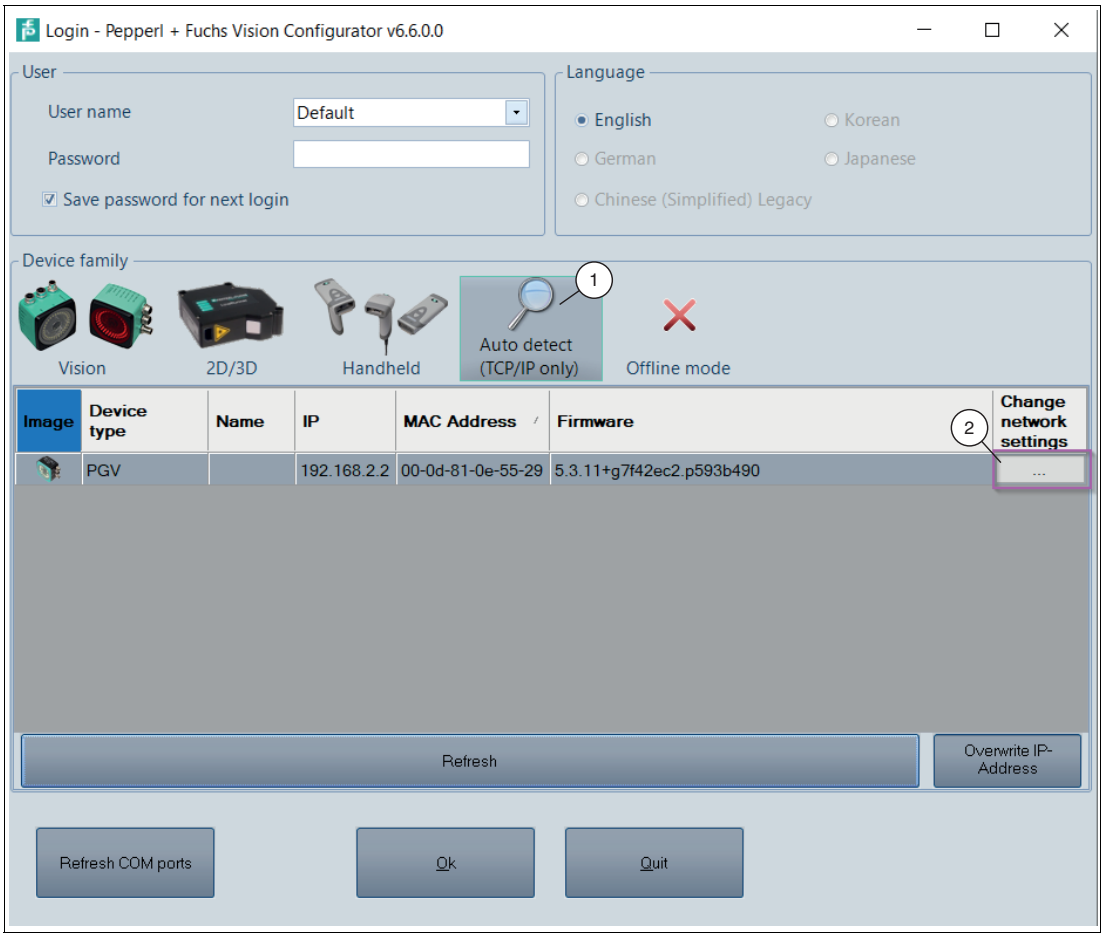
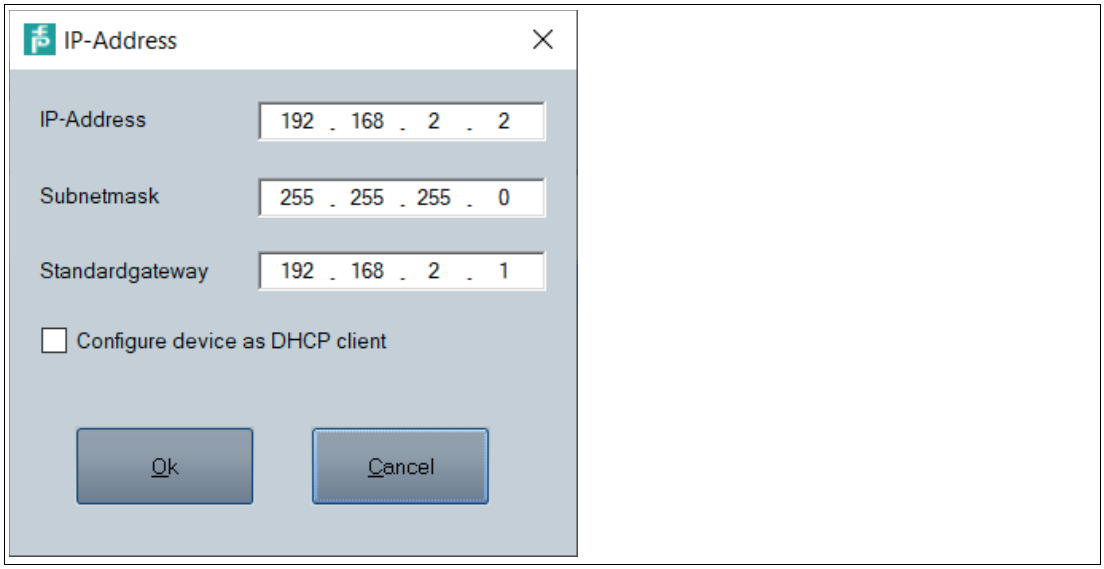


Figure 6.2 Auto Detect

2. Click on the three dots "..." in "Change network settings" (2).

↳ The "IP-Address" window opens. You can now change the read head's IP address.



3. Click on "OK" to confirm the entry.

Changing the IP Address—Option 2

If incoming UDP broadcasts are blocked by the firewall but outgoing broadcasts are allowed, no read head is displayed at this point. Proceed as follows to change the IP address:

1. Select the "Auto detect (TCP/IP only)" function (1).

↳ No read head is displayed at this point, since incoming UDP broadcasts are blocked by the firewall.

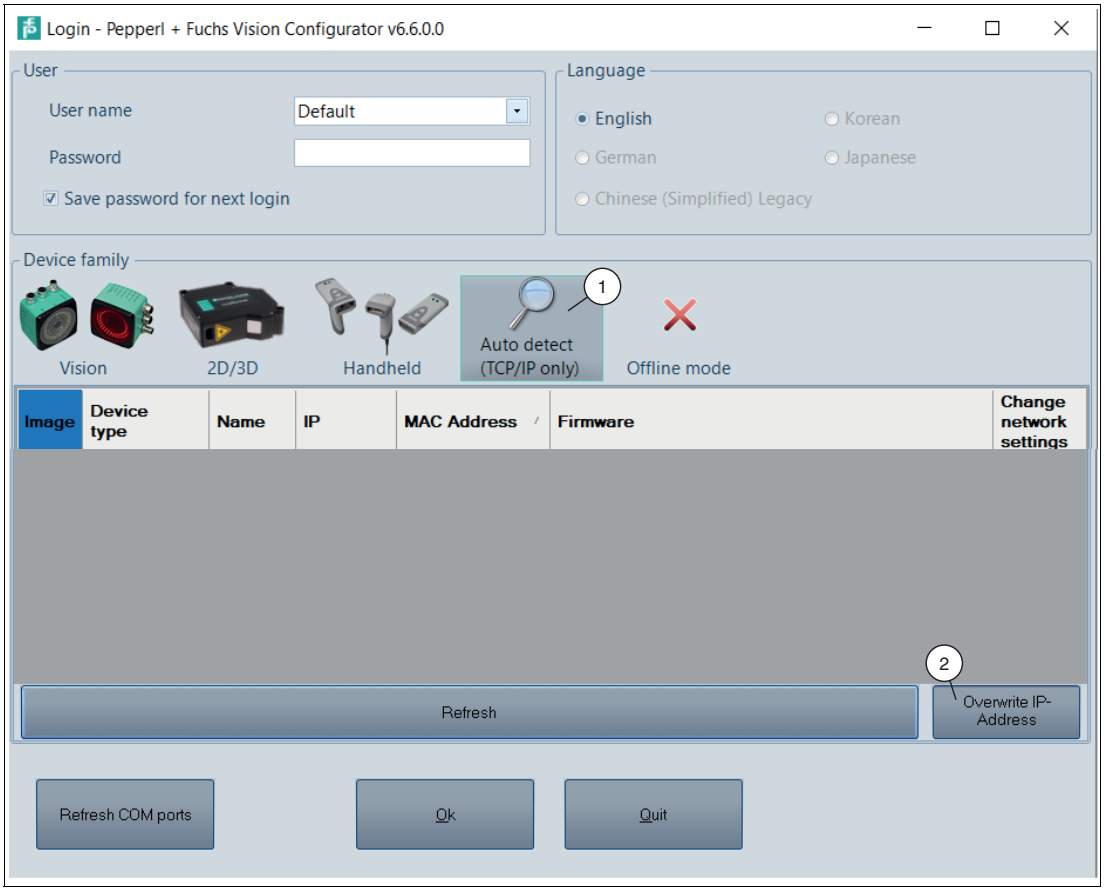
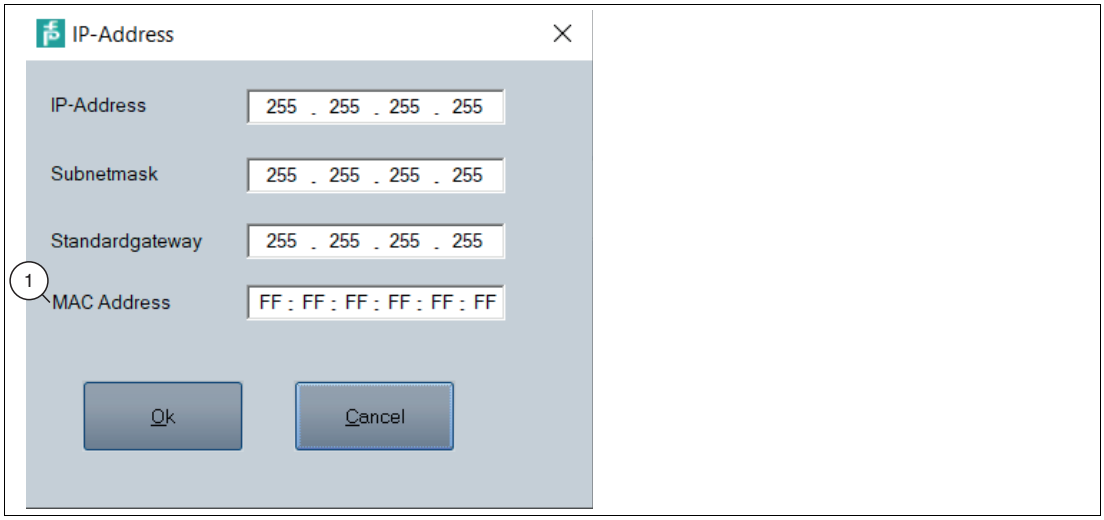


Figure 6.3 Auto Detect

2. Select "Overwrite IP-Address" (2).

↳ The "IP-Address" window opens. You can now overwrite the read head's IP address.



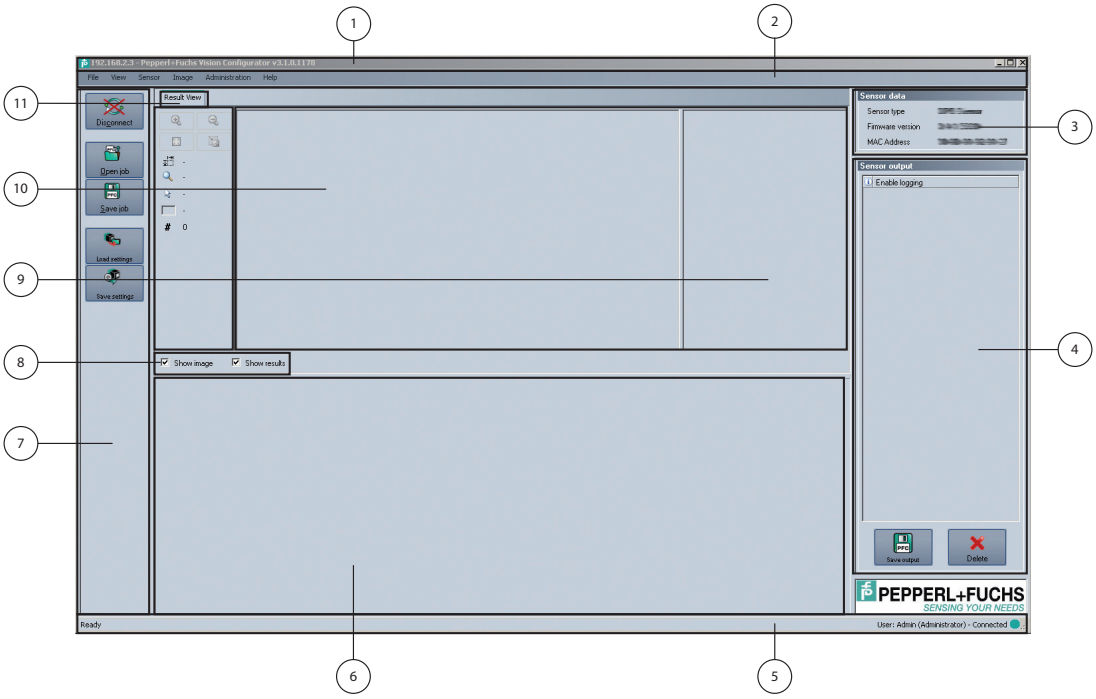
3. Enter the MAC address of the read head in the input window. You can find this address on the read head.
4. Click on "OK" to confirm the entry.

6.4 Application Window Structure

The application screen opens after you log in.

Note

The individual functions depend on the type of sensor connected and the current authorization level, so they are not always all visible.



The software is designed to be similar to most Windows applications.

1	Title bar	• Shows the IP address, the software name, and the version number • Contains the **Minimize/Maximize/Close** buttons
2	Menu bar	• Displays all the menus in the program • Provides an overview and helps with navigation
3	**Sensor data** screen	• Displays data for the connected sensor
4	**Sensor output** screen	• Shows the log display
5	Status bar	• Displays status information about the application
6	Configuration window	• Contains the sensor-specific parameters that you can set
7	Toolbar	• Contains icon buttons as an extension to the menu
8	Check boxes	• **Show images**: Enables or disables the image display • **Show results**: Enables or disables the results area
9	Results area	• Displays results from the sensor • A varying number of tabs can be displayed depending on which sensor is connected • This field can be enabled or disabled via **Show results**

10	Image display	• Displays the images captured or stored in the error memory • This field can be enabled or disabled via **Show images**
11	Tab	Displays information about the current image and the pixel under the mouse pointer. The following items are displayed: • Image size • Zoom level • Mouse position in image coordinates • Current grayscale value • Image number

6.5 Menu Bar

The menu bar contains a list of menu items. The functionality depends on the type of sensor that is connected and the permissions of the user logged in.

Figure 6.4 Menu Bar

6.5.1 *File* Menu

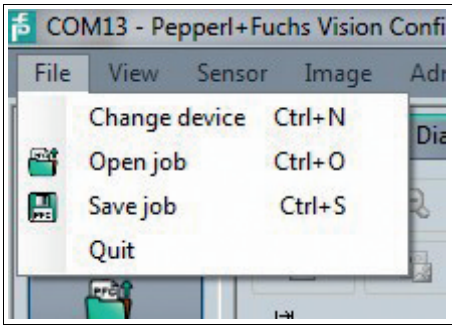


Figure 6.5 **File** Menu

Change device	Disconnects the device and returns to the Login dialog.
Open job	Loads a sensor configuration stored on the PC.
Save job	Saves the current sensor configuration on the PC.
Quit	Terminates the program.

Table 6.1 **File** Menu

6.5.2 *View* Menu

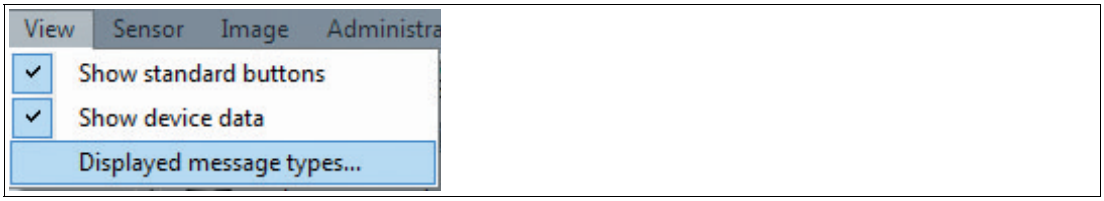


Figure 6.6 **View** Menu

Show standard buttons	Toggles the display of the buttons in the bar on the left on and off.
Show device data	Hides the display of the sensor data in the top right of the screen.
Displayed message types...	Opens a selection window in which the following display windows can be activated or deactivated: Info, Result OK, Result not OK, Warning, Error, Critical, Assert.

Table 6.2 **View** menu

6.5.3 *Sensor* menu

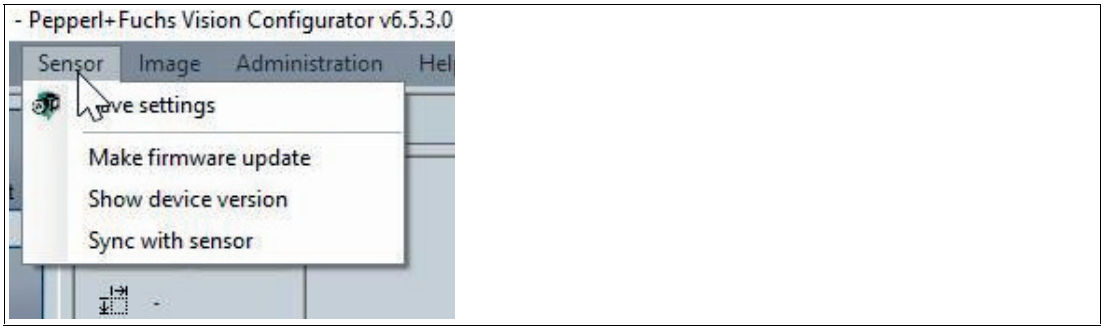


Figure 6.7 **Sensor** menu

Save settings	Saves the settings to the sensor
Make firmware update	Performs a firmware update. This command should only be used by experienced users.
Show device version	Displays the device version
Sync with sensor	Synchronization with the sensor

Table 6.3 **Sensor** menu

Note

Firmware Update

Restart the read head after the firmware update.

6.5.4 *Image* Menu

Figure 6.8 **Image** menu

Open image folder	Opens the folder in which images are currently saved
Save image	Saves the image currently displayed on the PC
Copy image to clipboard	Loads an image file to the clipboard
Show graphic	Switches display data sent from the sensor on and off in the image.

Table 6.4 **Image** menu

6.5.5 *Administration* Menu

Figure 6.9 **Administration** menu

User administration	Opens a window that shows all currently created users at the same authorization level or lower. New users at the same authorization level or lower can be created and deleted here. In addition, a user password can be reset to the default password for the relevant user level.
Change password	Changes the current user's password.
Change user	The login screen opens and a different user and/or sensor can be selected.
Load XML file...	Loads XML data from a computer.
Create reader programming code	Creates a reader programming code

Table 6.5 **Administration** menu

6.5.6 *Help* Menu

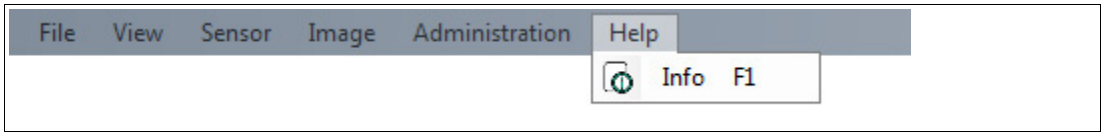


Figure 6.10 **Help** menu

Info	Displays information about Vision Configurator.

Table 6.6 **Help** menu

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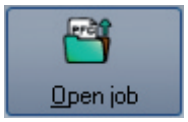
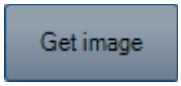
6.6 Toolbar

The toolbar can be used to select various functions.

	Selecting the Connect button establishes a connection between the PC and the read head.
	The connection between the PC and the read head is disconnected.
	Load the saved read head settings to a read/write tag.
	The settings you have made are saved to a read/write tag (PC, USB stick, etc.).
	All settings made are saved on the actual read head.
	The read head records an image. The image can be displayed straight away in "Image View."

6.7 Device Data

The connected device type (Device type) and the firmware version (Firmware) are displayed in the Device data area.

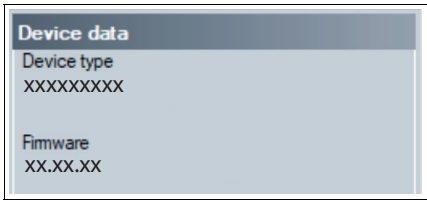


Figure 6.11 Device data

6.8 Sensor Output

This area shows the communication between the Vision Configurator and the connected sensor. To select which messages are to be displayed, select **View > Displayed message types**.

Figure 6.12 Sensor output

Two buttons are located in the lower area.

Save output	Saves the content of the window to a text file.
Delete	Deletes the contents of the window.

6.9 Image Display

The image display [Image View] (1) allows you to view the current capture of the read head. As an example, you can move the read head into difficult mounting positions and display the capture. This allows you to detect the alignment of the read head with the Data Matrix code and readjust it.

You can open the currently captured image under the **Image view** tab. To do this, click on **Get Image** in the toolbar.

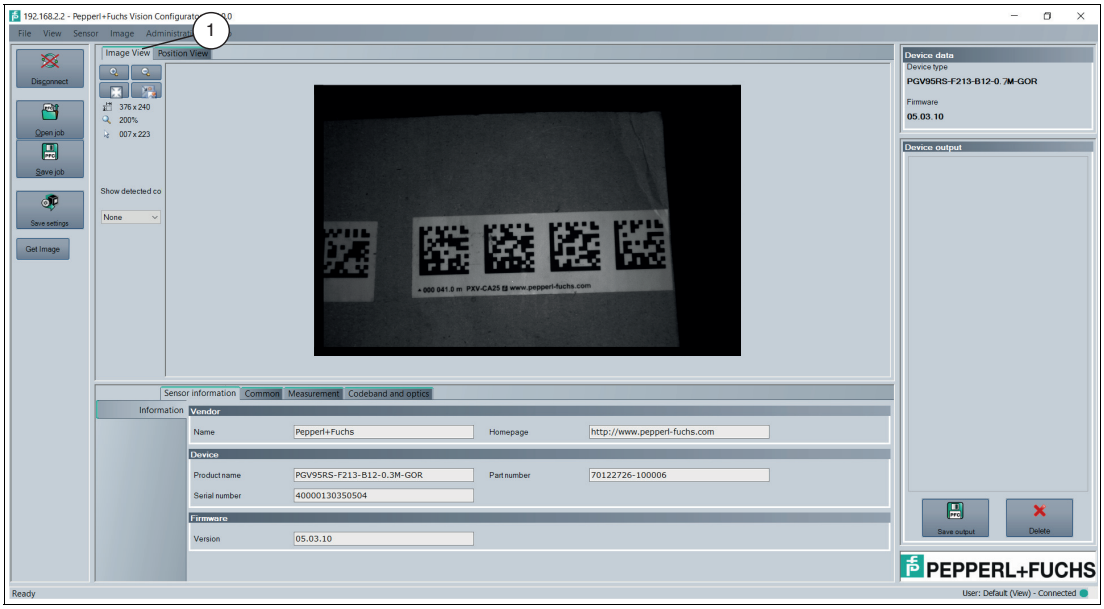


Figure 6.13

Right-clicking on the captured image opens the following context menu:

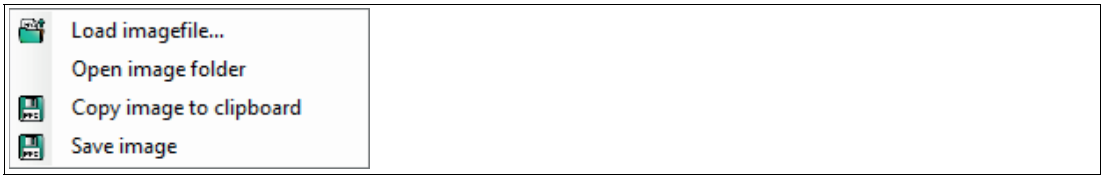


Figure 6.14 Image View context menu screen

Designation	Function
Load image file...	Loads a sensor image. You can select the sensor image.
Open image folder	Opens the storage location
Copy image to clipboard	Copies image to the clipboard
Save image	Saves the displayed sensor image

Toolbar

The toolbar is located on the left side under the **Image View** tab. The toolbar contains several useful functions that are used to further process recorded images. The following functions are available.

Figure 6.15 Toolbar

Position	Designation	Function
1	Magnifier +	Zoom into the image.
2	Magnifier -	Zoom out of the image.
3	Original size	Displays image in original size.
4	Size details	Image size information box (length and width in pixels)
5	Zoom factor	Current zoom factor in percent (zoom factor 100% is original image size)
6	Position details	Position of the cursor within the image
7	Displays the detected color track	This selection is a tool for finding color tracks. Not relevant for this device, since no color tracks are used.
8	Fit to window	Adjusts the image display in relation to the size of the image display area.

6.10 Position View

The "Position View" (1) can be used to display the recorded absolute X position, the Y offset, the angle value (2), and various status values (3). The display is started with the "Start request" button and stopped with the "Stop request" button (4).

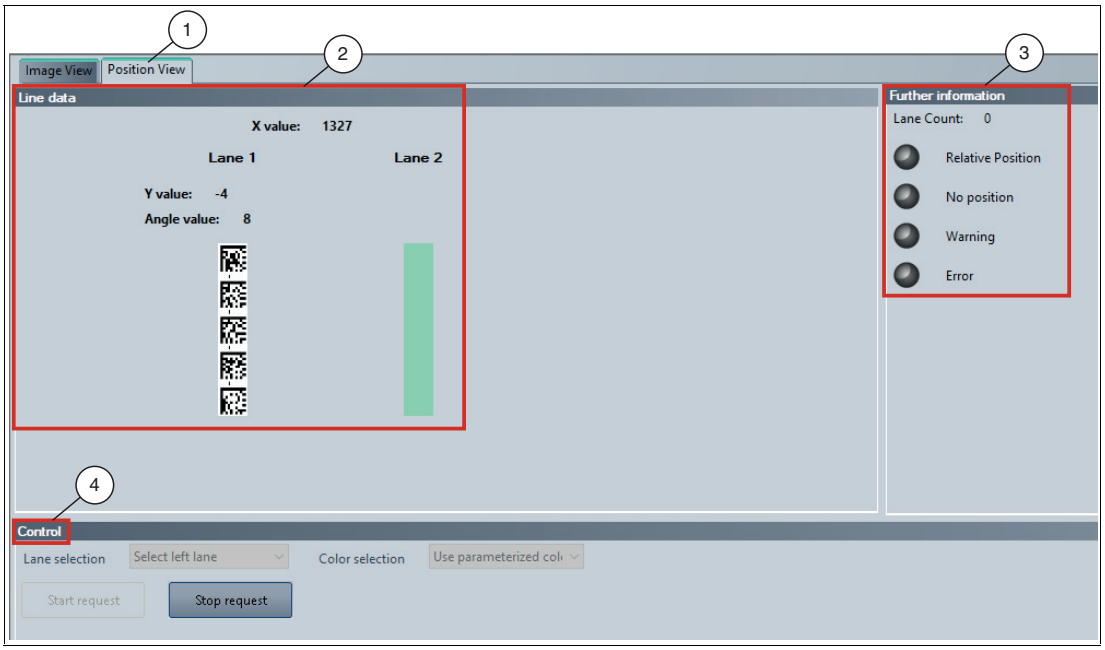


Figure 6.16

1 Position view

2 Position data [line data]

3 Status information [more information]

4 Has no function in the case of this read head version

Position Data [Line Data]

The display of the position information is launched with the "Start request" button.

Display	Description
X value	X position in mm
Y value	X position in mm
Angle value	Scaled angle of the code relative to the read head
Lane 1	The position information of the Data Matrix code tape is displayed.
Lane 2	Detection of an additional lane. Only the position information of the selected lane is output.

Status information [more information]

Message	Description
Lane Count	The lane count indicates the number of Data Matrix lanes found in the reading window.
Relative Position	Relative Position
No position	No absolute position
Warning	Warning message Additional information about the codes can be found in the "Warning Messages" table.
Error	Error message

6.11 Configuration Window

Various parameters are specified in the configuration window. The individual parameters depend on the current authorization level and are therefore not always all visible. Some features are available in different versions only. Depending on the parameters set, some fields will be grayed out.

Note

Making changes

If you want to make changes, you must complete the two steps below for the changes to take effect:

- Save the settings: After you have made the changes you want, save the settings in "Save settings."
- Restart the read head: Once you have saved the settings, the read head must be restarted for the changes to take effect.

6.11.1 Sensor Information Tab

The **Sensor information** tab contains the **Information** menu item. The **Information** menu item allows you to view more detailed information on the sensor.

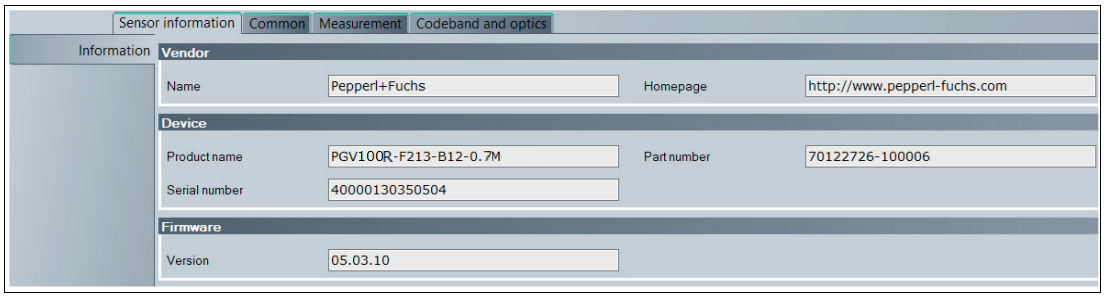


Figure 6.17 Sensor Information tab

Vendor	Name	Manufacturer
	Homepage	Manufacturer homepage
Device	Product name	Product name
	Serial number	Serial number
	Part number	Item number
Firmware	Version	Firmware version

6.11.2 Common Tab

There are three menu items available in the **Common** tab. The purpose of this section is to present the menu items in more detail.

Input/Output Menu Item

This section contains editable parameters for configuring the digital inputs, digital outputs, and read head inputs/outputs.

Inputs always have the input function (cannot be changed).

Outputs always have the output function (cannot be changed).

- **Input/output**
  Identifies the connection as an input or output.
  "Input" identifies the connection as an input.
  "Output" identifies the connection as an output.
- **Function**
  Assigns a function to the connection. The possible functions depend on whether the connection is an input or output.

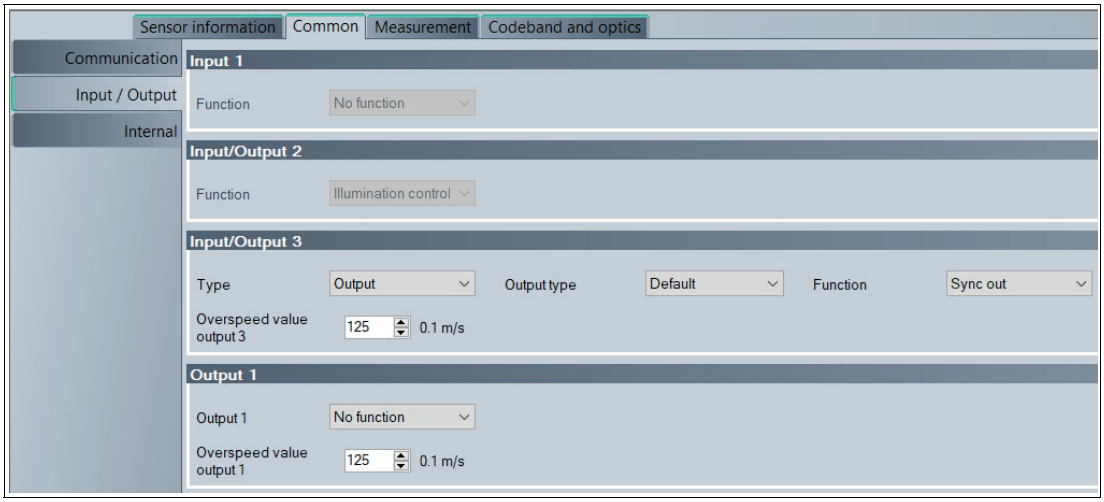


Figure 6.18

Input 1

Grayed out, no function

Output 1

Grayed out, no function

Input/Output 2

Illumination control

If one of the two inputs and outputs is configured as an input and the "Illumination control" function is activated, it means as follows:

- If the input is not set, the read head captures an image as usual and simultaneously triggers the flash to illuminate the scene.
- If the input is set, no flash is triggered for the image capture.
  This option can be used to save energy, since the sensor does not have to provide values in this case. In addition, repeated flashes can be perceived as disruptive.

Input/Output 3

Figure 6.19

Designation		Function
Type	Output	The connection is identified as an output
	Input	The connection is identified as an input
Function	No function	The "No function" setting deactivates the input or output.
	Overspeed	"Overspeed" activates the output if the speed is exceeded.
	Warning	"Warning" activates the output if a warning occurs.
	Error	"Error" activates the output if the error bit is set.
	Dirty	"Dirty" activates the output if there is a critical level of contamination on the read head or code tape.
	Event	Option is not used.
	No position	"No position" activates the output if the position cannot be determined. (e.g., no code tape in the field of view of the read head)
Overspeed value output 3	Overspeed value output 3	Determines the speed above which an overspeed message should be displayed. If one of the outputs is configured to "Overspeed," this is activated when the speed is exceeded.

Internal Menu Item

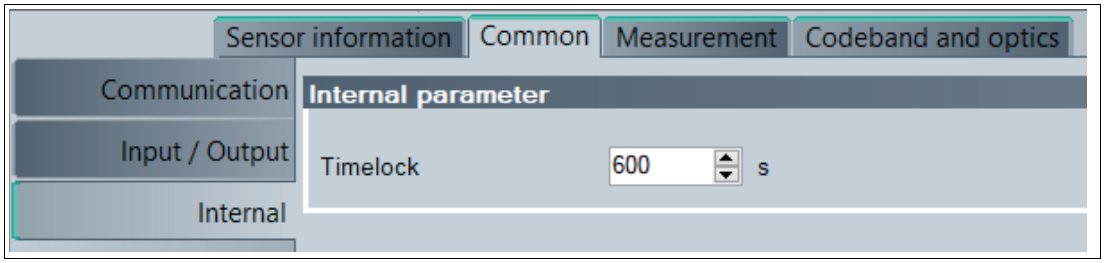


Figure 6.20

Internal parameter

Designation	Function
Timelock	Defines after which time without parameterization activity the time lock of the read head is locked. Entered in seconds as an integer value. 0 means that this functionality is inactive and the read head can always be parameterized.

6.11.3 Measurement Tab

Two menu items are available in the **Measurement** tab. The purpose of this section is to present the menu items in more detail.

Resolution/offset

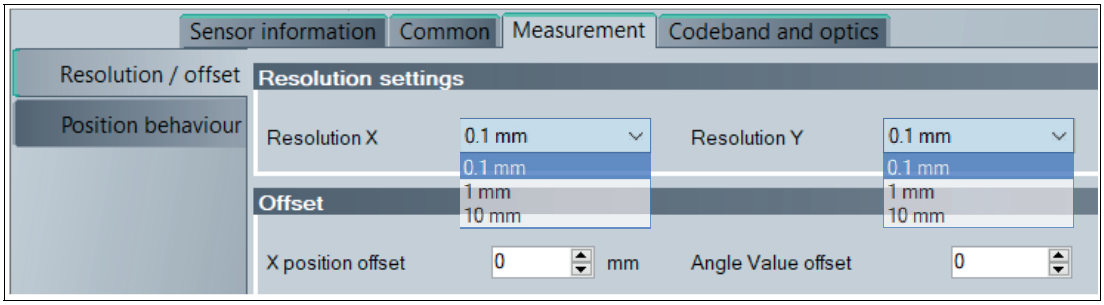


Figure 6.21

Resolution settings

Designation	Function
Resolution X	0.1 mm 1 mm 10 mm
Resolution Y	0.1 mm 1 mm 10 mm

Position behavior

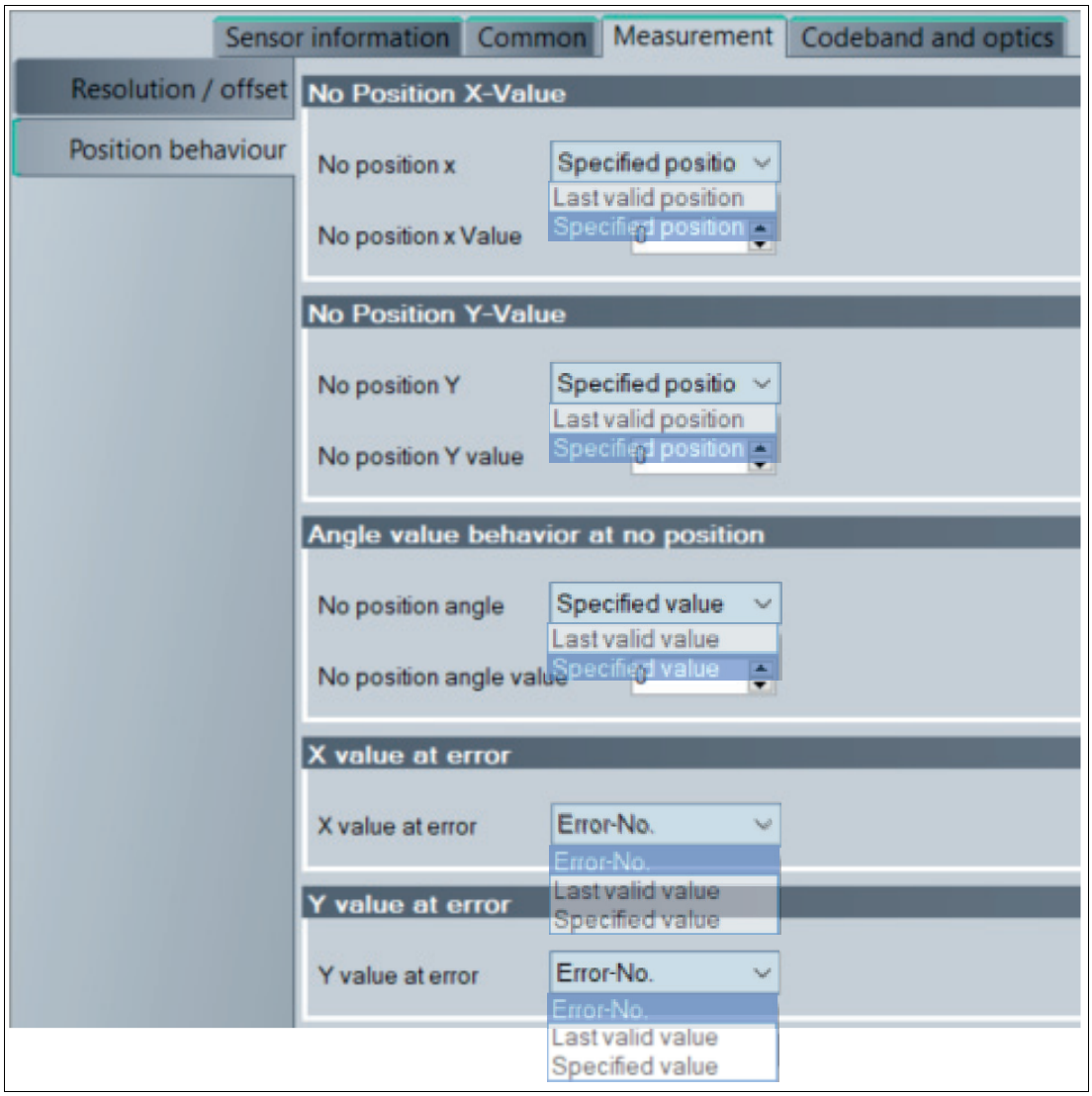


Figure 6.22

No Position X-Value

No position x

Designation	Function
Last valid position	The last valid x position is output with "Last valid position."
Specified position	"Specified position" outputs a defined x position value.

No position x value

No Position Y-Value

No position Y

Designation	Function
Last valid position	The last valid y position is output with "Last valid position."
Specified position	"Specified position" outputs a defined y position value.

No position y value

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Angle value behavior at no position

No position angle

Designation	Function
Last valid value	The last valid position angle is output with "Last valid value."
Specified value	"Specified value" outputs a specified angle value.

No position angle value

X value at error

Defines the output value when an error occurs in the x direction.

X value at error

Designation	Function
Error-No.	"Error-No." displays the error code.
Last valid value	The last valid x position is output with "Last valid value."
Specified value	"Specified value" outputs a specified x position value.

Y value at error

Defines the output value when an error occurs in the y direction.

Y value at error

Designation	Function
Error-No.	"Error-No." displays the error code.
Last valid value	The last valid y position is output with "Last valid value."
Specified value	"Specified value" outputs a specified y position value.

7 Maintenance

Caution!

Device may become hot during prolonged operation

After a long operation time, the metal surfaces (plug) and the housing of the sensor have an elevated temperature relative to the environment.

This must be taken into account during service work. Let the device cool down before operating.

If the read head is faulty, it must be replaced with a new device. The read head may not be repaired.

No position values can be determined wherever sections of the Data Matrix code tape are dirty or destroyed.

Note

Replacing Damaged or Destroyed Data Matrix Code Tape

The operator is responsible for replacing dirty or destroyed sections of Data Matrix code tape with original Data Matrix code tape. Replacement sections can be obtained from Pepperl+Fuchs.

Note

Replacing the Read Head

If there is a defect, always replace the read head with an original device.

Note

Reference Run

For example, no reference run is required after a replacement, as all read heads are aligned identically with each other.

Note

Prior to Use of a Replacement Device

In the event of replacement, the plant operator is responsible for setting the PROFINET name according to the old device.

7.1 Maintenance

The device is maintenance-free.

7.2 Testing

The device does not need to be tested. To ensure adequate availability, we recommend regularly examining the read head and the Data Matrix code tape for mechanical damage and removing contamination.

A regular proof test is not required since the minimum interval for a proof test is longer than the useful lifetime. If the device is subjected to sources of potential mechanical damage or vibration in the plant, we recommend regularly inspecting the device with regard to the integrity of the housing (water ingress) and the right fastening (loose mounting screws).

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7.3 Cleaning

Caution!

Material damage due to improper cleaning

Treating surfaces with the wrong cleaning agents and liquids can damage the surface and therefore disrupt the function of the read head or make the Data Matrix codes illegible.

Cleaning the Read Head

Check that the components are securely mounted and that optical surfaces are clean.

Regularly clean the surface of the read head lens. The cleaning interval depends on the ambient conditions and the climate within the plant.

Use a soft, lint-free cloth to clean the surfaces.

Cleaning the Data Matrix Code Tape

The surface of the Data Matrix code tape consists of a polyester film with a special matt surface for diffuse reflection. The use of incorrect cleaning agents, or constant brushing can lead to the risk of the matt surface of the Data Matrix code tape being polished smooth. If the Data Matrix code tape has a shiny surface, this impairs detection of the codes by the read head. To avoid polishing the surface, do not apply strong pressure when cleaning the Data Matrix code tape.

Only use a non-aggressive plastic cleaner to clean the code tapes. We recommend cleaning the code tape with cotton or microfiber cloths.

Note

We do not recommend the use of conveyor brushes or permanent cleaning systems. These can damage the surface of the code tapes and make the Data Matrix codes unreadable.

Note

Damage to the surface is often invisible to the naked eye. Only an image capture with the read head itself shows whether interfering reflections occur at the relevant point.

7.4 Repair

Do not repair or manipulate the device.

If there is a defect, always replace the device with an original device.

Only use accessories specified by the manufacturer.

8 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.

9 Appendix

9.1 ASCII table

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

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