

# Metal Code Bar Rail System

Manual



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- 1 Introduction..... 4**
  - 1.1 Content of this Document..... 4**
  - 1.2 Target Group, Personnel ..... 4**
  - 1.3 Symbols Used..... 4**
  
- 2 Metal Code Bars - System Overview ..... 6**
  
- 3 Laying Methods ..... 8**
  - 3.1 Attaching the Metal Code Bars Directly to the Floor..... 8**
  - 3.2 Drive-Over Profile Rails..... 9**
  - 3.3 Countersunk Profile Rails ..... 11**
    - 3.3.1 Making the Floor Groove ..... 11**
    - 3.3.2 Countersunk Profile Rails—Mounting by Gland..... 12**
    - 3.3.3 Countersunk Profile Rails—Mounting by Gluing ..... 15**
  
- 4 Curved Areas ..... 18**
  
- 5 Exchanging the Metal Code Bars..... 21**
  
- 6 Useful Tips & Recommendations..... 22**
  - 6.1 Transitioning from the Drive-Over Profile Rail to a Metal Code Bar ..... 22**
  - 6.2 Transition from a Color Track to a Metal Code Bar System ..... 23**
  - 6.3 Start/End Profile Rails in Combination with Color Tape ..... 24**
  - 6.4 Preventing Kinks on Profile Rails..... 25**

# 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



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### Note

For full information on the product, refer to the further documentation on the Internet at [www.pepperl-fuchs.com](http://www.pepperl-fuchs.com).

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### 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](http://www.pepperl-fuchs.com).

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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 dismantling lies with the plant operator.

Only appropriately trained and qualified personnel may carry out mounting, installation, commissioning, operation, maintenance, and dismantling 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:



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#### **Danger!**

This symbol indicates an imminent danger.

Non-observance will result in personal injury or death.

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#### **Warning!**

This symbol indicates a possible fault or danger.

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

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#### **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.

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#### Informative Symbols



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#### **Note**

This symbol brings important information to your attention.

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#### **Action**

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

## 2 Metal Code Bars - System Overview

In areas where auto-guided transport systems (AGTS) are operated, there are inevitably areas that are exposed to especially high mechanical stress. These in particular include intersections, gate passageways, and bends, where the wheels of the vehicle constantly cross the floor markings and can wear or damage them. This wear can result in no longer being able to detect position information.

Special metal code bars have been developed for these critical areas. The codes are printed on aluminum bars using a specially optimized procedure and are protected by an anodic layer. The metallic code bars therefore ensure reliable position determination even in areas subject to heavy stress.

There are 3 laying methods for the metal code bars:

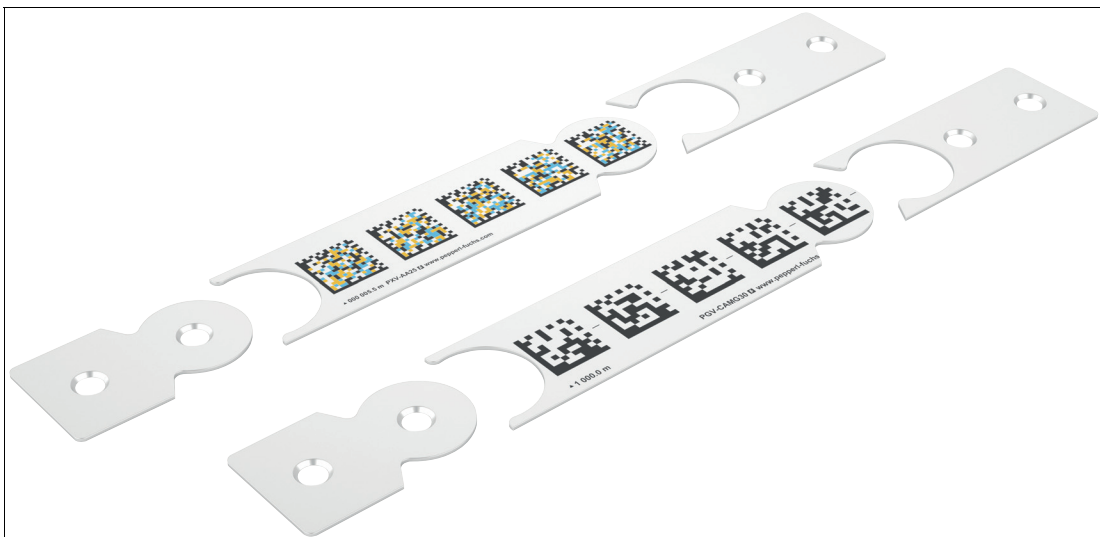
- Direct bonding by the self-adhesive layer on the underside of the code bars directly on the floor or on carriers.
- Mounting in drive-over profile rails. The profile rail is screwed into the floor and forms a flat ground sill with slanted shoulders. The code bars are glued into the provided recess with the self-adhesive layer.
- Mounting in countersunk profile rails. The countersunk profile rail is glued and/or screwed into a groove milled in the floor. The code bar is glued to the rail for this method.

The profile rails can be combined with the standard laminate code tapes. This offers the best-possible solution for both sections with heavy wear and sections without mechanical stress.

In addition to connectible modules for continuous code bars, closed profile rails are available. They are used for positioning at defined stations that were previously approached by free navigation.

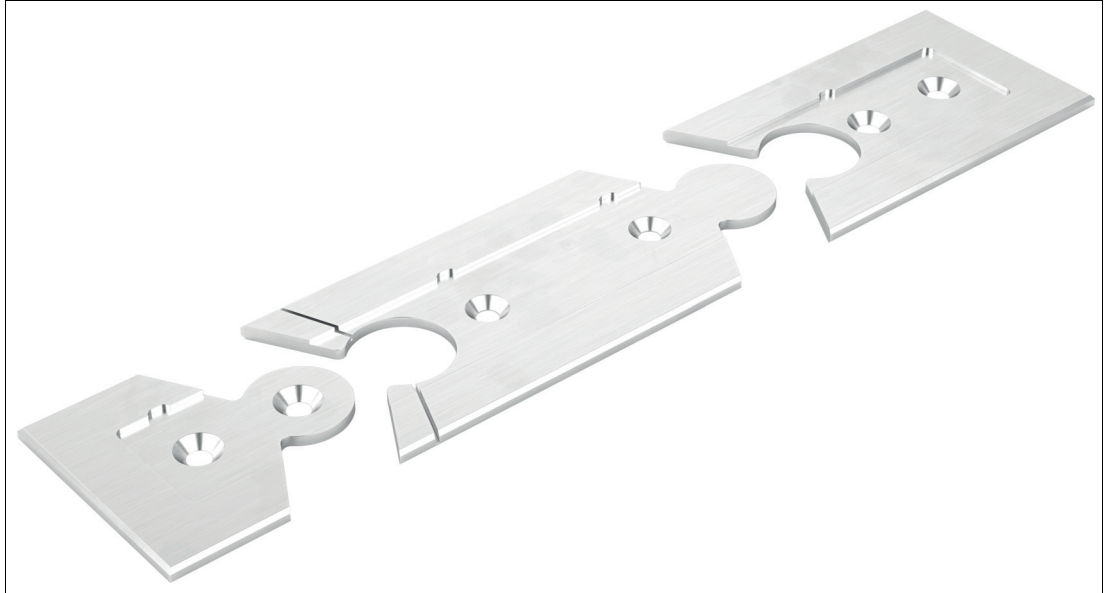
### Data Matrix metal code bars

**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.



### 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.



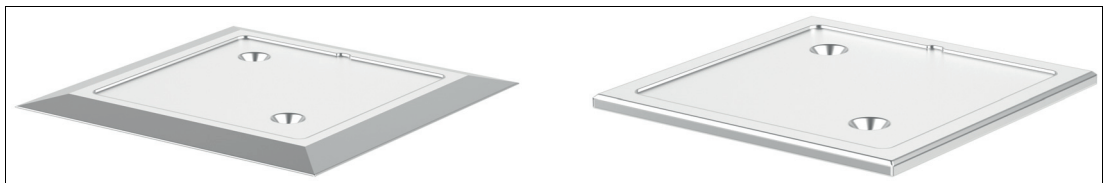
### Metal Data Matrix Tags

The **metal Data Matrix tags** made of anodized aluminum are used for the evaluation of control and position information. Metal Data Matrix tags are used as event markers. The tags provide information on branches.



### Profile Plates

The **profile plates** are used to protect the metal 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.



### 3 Laying Methods

#### Decision-Making Aid for Laying Methods

Laying method	Assembly effort	Remarks
Direct bonding to the floor	Low	Under high loads, the metal code bars may be deformed See chapter 3.1
Mounting in drive-over profile rails	Easy installation	The drive-over profile rails form a ground sill See chapter 3.2
Mounting in countersunk profile rails	Elaborate mounting (Trimming in the floor required)	The metal code bars are very well protected against mechanical influences See chapter 3.3

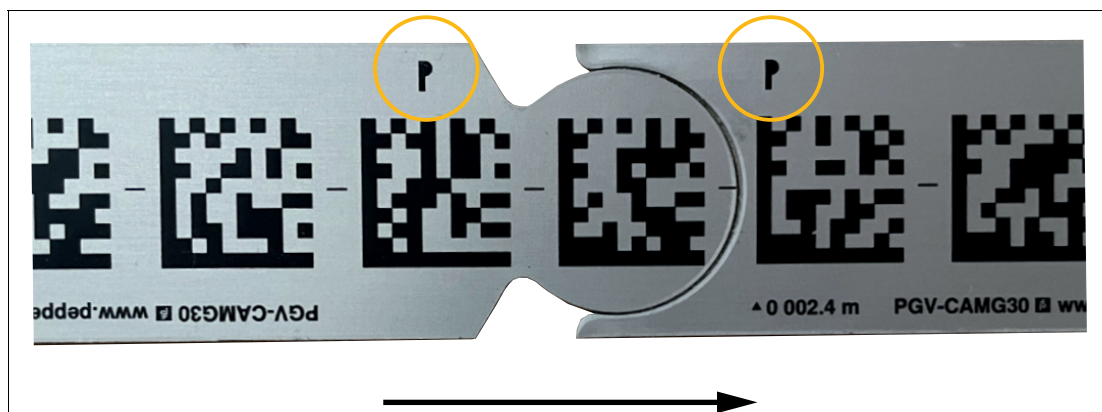
#### 3.1 Attaching the Metal Code Bars Directly to the Floor



##### Note

##### Installation Aid

The same symbols on the metal code bars make it easier to line them up.  
The position values are ascending in the direction of travel.



#### Installing Data Matrix Metal Code Bars

The following description explains the basic procedure for affixing the Data Matrix metal code bars directly to the floor.

1. Clean the surface of any greasy or oily deposits and dust.



##### Note

Observe the processing instructions for 3M industrial adhesives. Use the 3M type 9472 LE adhesive from the 300 LSE series.

2. Ensure that the surface is dry, clean, and stable.
3. It is recommended to mark the planned track before gluing it to route the metal code bars along that track without gluing it.
4. Use an AGTS to drive in the designated lane to check that the track is correctly laid.

↳ You can start adhering the metal code bars when the AGTS can travel the desired route.



5. Glue the code bars to the floor along the recorded track. To do this, use the 3M adhesive on the back.



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**Tip****Long Sections**

For long, straight distances, it is recommended to use 500 mm long metal code bars.

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**Tip****Curved Sections**

For curved sections, we recommend using 100 mm or 200 mm metal code bars or a combination of 100 mm and 200 mm metal code bars.

When laying curves, the following notes must be observed.

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6. To build a short, closed line, e.g., a 2 meter long straight line, use the following components: 1x PGV-MG-30-START-END-SET and 4x 500 mm code bars. Start with the dovetail piece and insert the ball head into the dovetail. Make sure that the position value is decreasing.
7. The adhesive on the metal code bars hardens after 72 hours.

### 3.2 Drive-Over Profile Rails

Profile rails for floor mounting. The profile rails are available in modular lengths of 100, 200, and 500 mm.

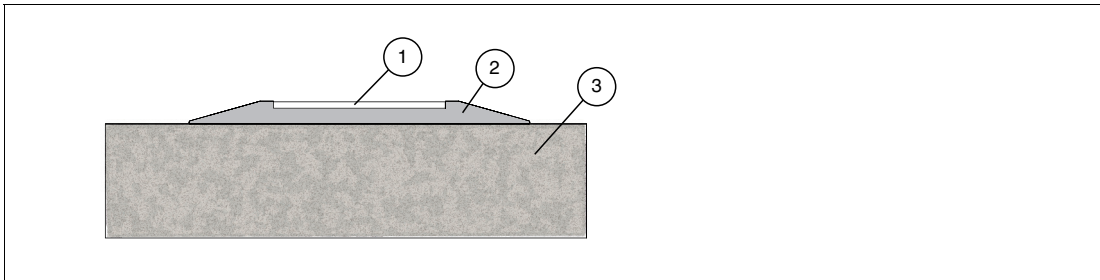


Figure 3.1 Layout

- 1 Data Matrix metal code bar
- 2 Drive-over profile rail
- 3 Base surface



#### Preparing the Base Surface

1. Clean the surface of any greasy or oily deposits and dust.
2. Make sure that the base surface is dry, clean, stable, and has a flat surface.



#### Mounting the Drive-Over Profile Rails

1. Make sure that you first insert the drive-over profile rails into each other and align them in the desired position before connecting them to the floor.



##### Note

Unevenness of the floor must not cause any kinks in the drive-over profile rail system. These can cause the subsequent mounting of the code bars to cause stresses or protrusions.

2. Fasten the drive-over profile rails to the floor using countersunk head screws M5 or M4. Which dowels can be used depends on the respective base surface. Due to the very different floor conditions, we cannot recommend dowels. Please talk to your floor layer about this.



##### Note

Make sure that the heads of the countersunk head screws are flush with the drive-over profile rail. An overhang would cause the code bars in the area of the protruding heads to not be able to build up adhesion to the drive-over profile rails.



### Tip

If the drive-over profile rails are installed for a long time before the code bars are inserted, it is advisable to protect the drive-over profile rails with the plastic protective strips. These significantly reduce contamination in the grooves of the drive-over profile rail. They are easy to remove when inserting the code bars.

3. First, insert the code bars into the drive-over profile rails without gluing to check whether they can be laid precisely.
4. After the test, glue the code bars into the drive-over profile rails with the 3M adhesive applied on the back. To achieve the highest possible adhesive strength, it is recommended to press the code bars into the drive-over profile rail with a pressure roller.



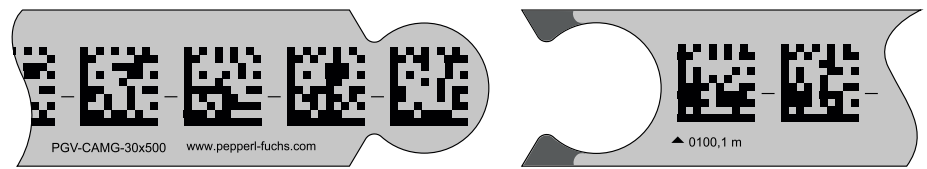
### Note

Dirt particles, such as small grains of sand or other debris, can cause the code bars to not reach their full adhesive strength, because contact with and around the dirty spots is too low.



### Tip

When using 500 mm code bars, it is recommended to start with the ball head and insert it into the dovetail.

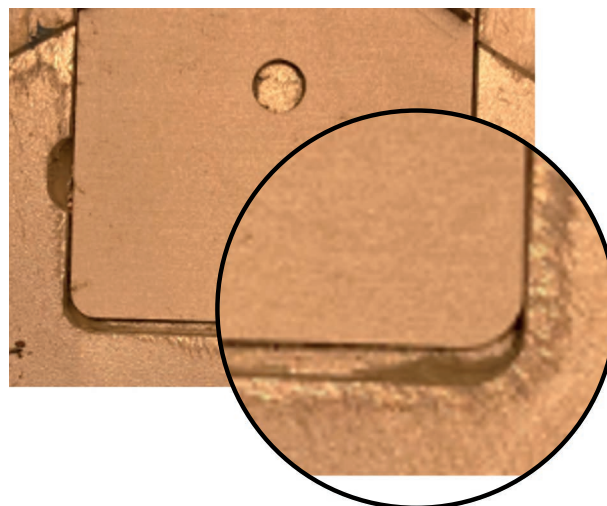


5. Insert the end segment into the drive-over profile rail without gaps.



### Note

The following figure shows that the gap is too large. As a result, the end no longer fits into the drive-over profile rail and protrudes. This creates a dirt and tripping edge.





### Example

Required elements for a short, closed straight line of 2 m in length:

#### Drive-Over Profile Rail

- 1X PGV-PR-SM START
- 1X PGV-PR-SM-END
- 4X PGV-PR-SM-CONT500

#### Metal Code Bars

- 1X PGV-MG-30 START-END KIT
  - 1x PGV000002M-CAMG30x500-000000 (starting position 0 m, length 2 m with 4 x 500 mm code bars)
-

### 3.3 Countersunk Profile Rails



#### Note

The countersunk profile rail system can be installed in a wide range of industrial floors. There are non-slip, oil-resistant, waterproof, electrically conductive, and other floors, including a wide range of floor coatings. The procedure for installation is just as different. The description of the installation of the countersunk profile rail system therefore refers only to the metal code bar system and not to the floor coating.

The profile rails are flush with the ground or base surface. Depending on the requirements, the profile rails can be screwed into the floor groove with spacers or glued into the floor groove.

#### 3.3.1 Making the Floor Groove

The width and depth of the floor groove is dependent on the mounting type used.

**Width:** 70 ... 80 mm (depending on the filler material used and the curve radius used, if applicable)

**Depth:** 6 ... 15 mm

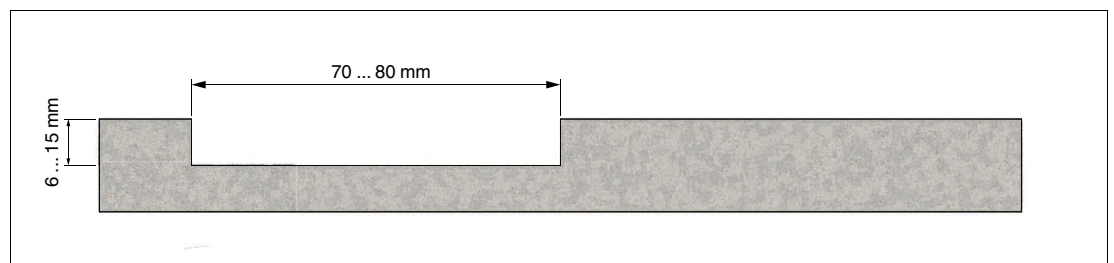


Figure 3.2 Floor groove

- If the countersunk profile rail is installed in a curve, the groove must be widened accordingly (the width depends on the curve radius).
- In most cases, the groove base does not need to be smoothed out.
- The groove must be dust-free and dry. Ensure that the base surface is clean and stable.

### 3.3.2 Countersunk Profile Rails—Mounting by Gland

Countersunk profile rails that are flush-mounted into the floor or base surface and are mounted in the floor groove by gland.

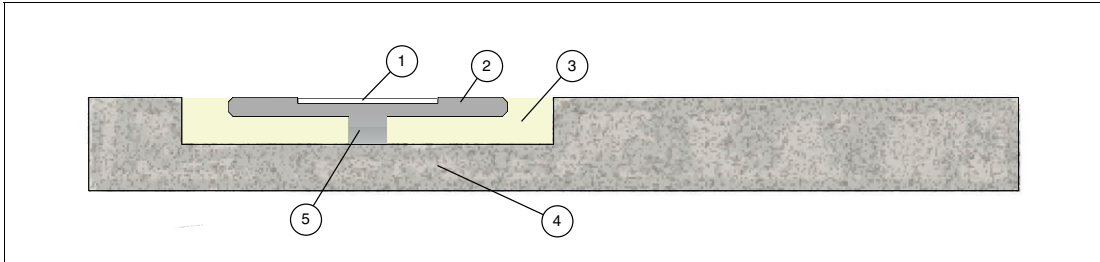


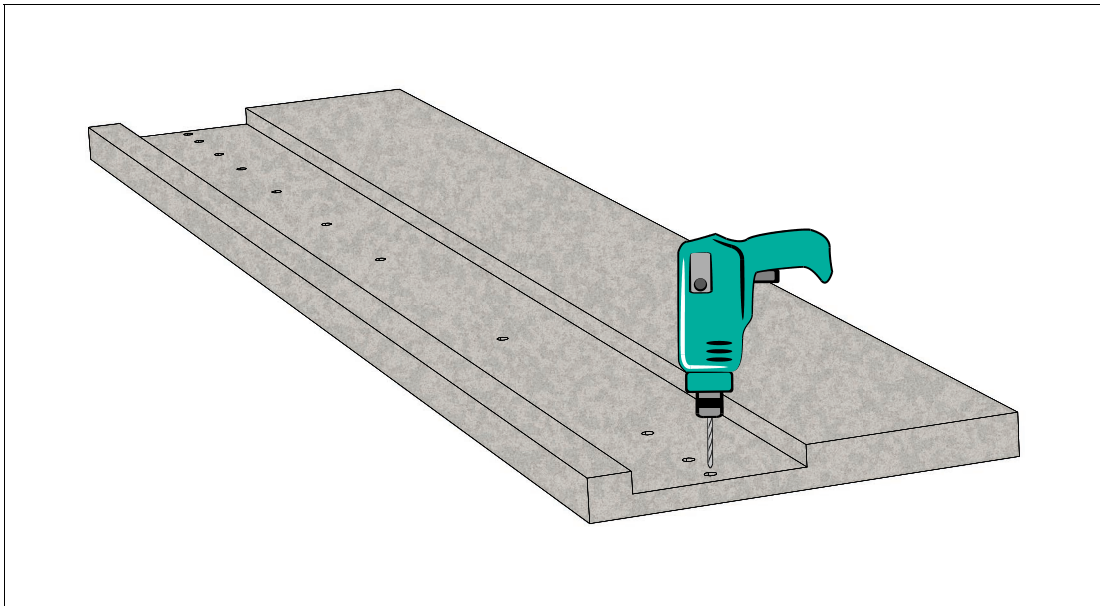
Figure 3.3 Layout

- 1 Data Matrix metal code bar
- 2 Countersunk profile rail
- 3 Adhesive
- 4 Floor with groove
- 5 Spacers

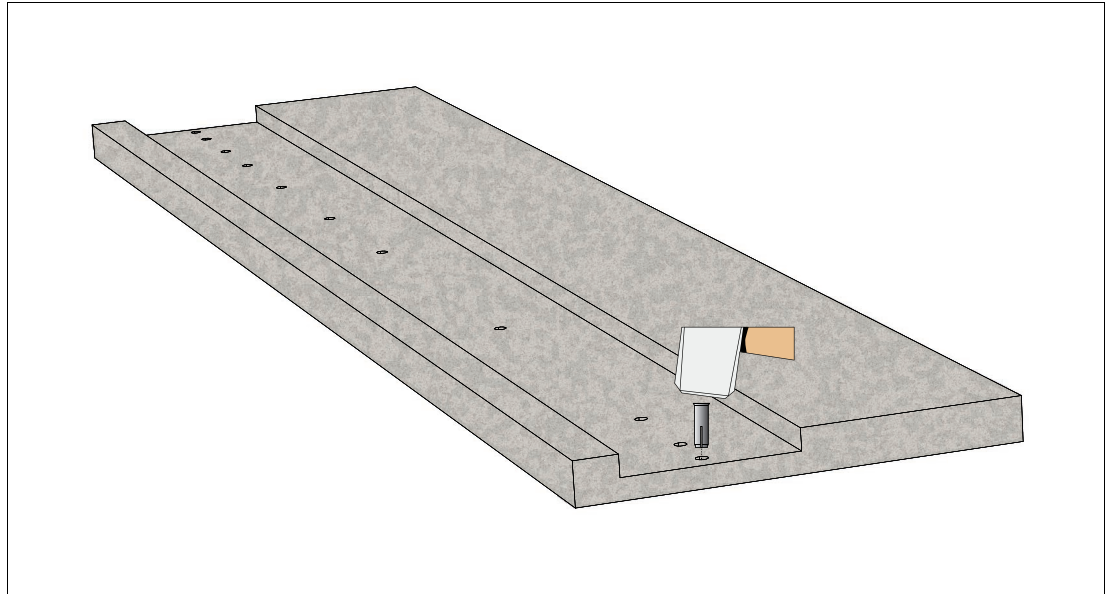


#### Mounting the Countersunk Profile Rail

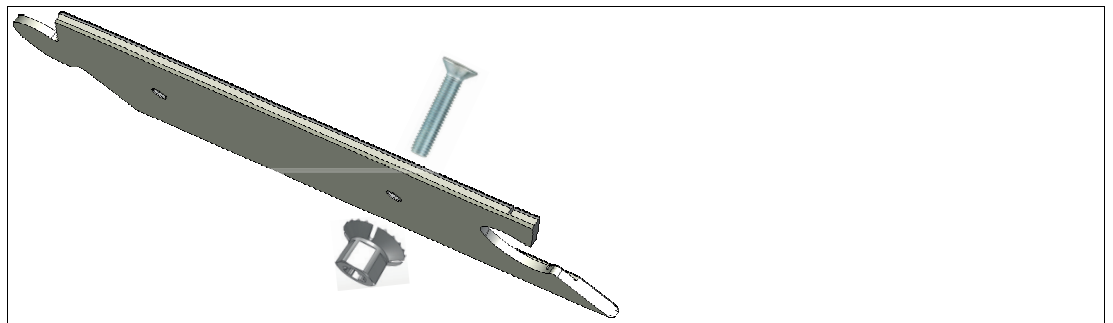
1. Align the countersunk profile rail in the prepared groove.
2. Transfer the position of the mounting holes of the countersunk profile rail to the groove base.
3. Remove the countersunk profile rail, drill the marked holes, and insert screw anchors.



4. Provide holes with knock-in screw anchors.



5. Insert the M5 mounting screws through the bores in the countersunk profile rails and affix the countersunk profile rails with a suitable flat washer, a rubber ring, or a spacer sleeve.

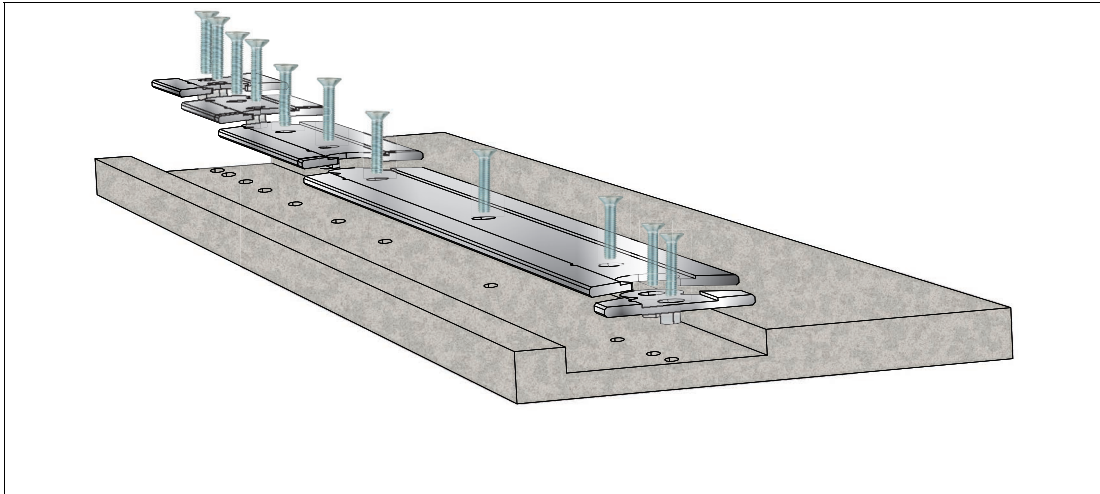


6. Attach the countersunk profile rail to the pre-drilled holes in the floor groove and align or level it.

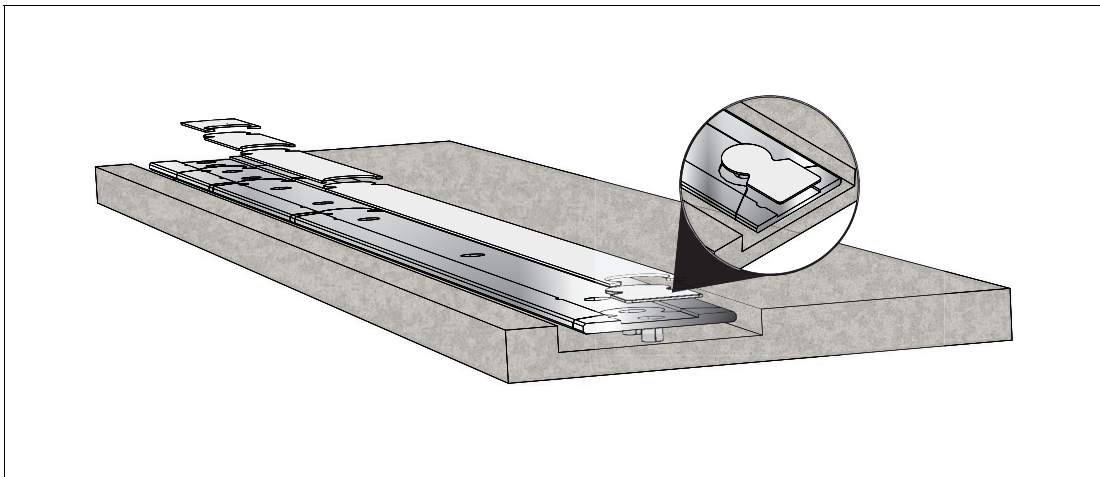


### Note

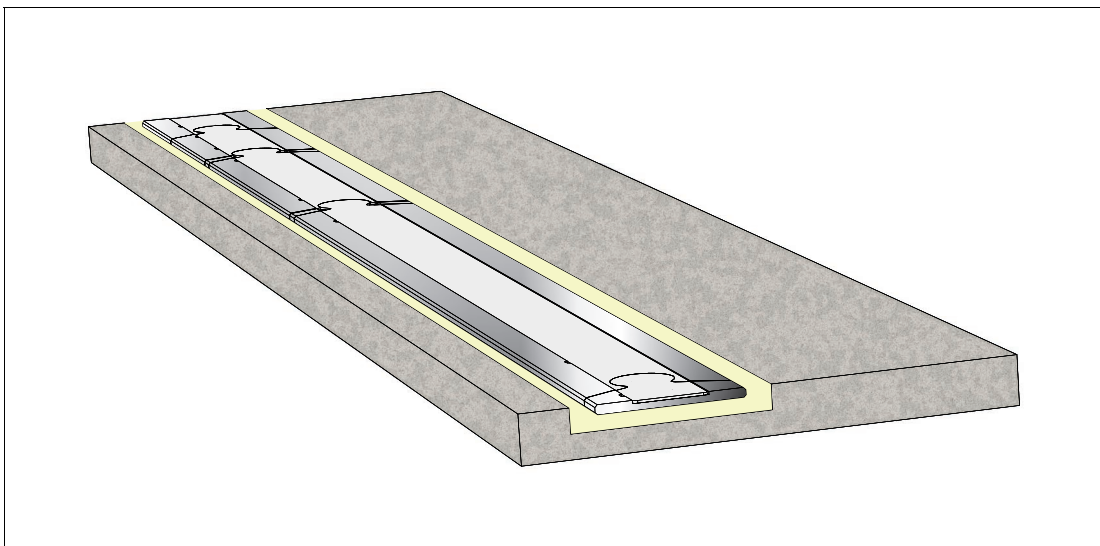
- Make sure that the countersunk profile rails are inserted into each other and aligned in the required position before connecting to the floor.
- Care must be taken to ensure that no kinks (neither inward nor outward) occur in the countersunk profile rail system. These can lead to stresses or protrusion of the code bars when the code bars are subsequently mounted.
- The countersunk profile rails must be leveled at the height of the floor surface so that the countersunk profile rails are flush with the floor.



7. Insert the mounting protection strips into the countersunk profile rail to protect the profile rail.



8. Fill the floor groove with a suitable floor filler.



9. Allow the floor filler to harden. Observe the information provided by the adhesive manufacturer
10. Remove the mounting protection strips and insert the metal code bars into the appropriate countersunk profile rails.



### 3.3.3 Countersunk Profile Rails—Mounting by Gluing

Countersunk profile rails that are flush-mounted into the floor or base surface and are mounted in the floor groove by gluing.

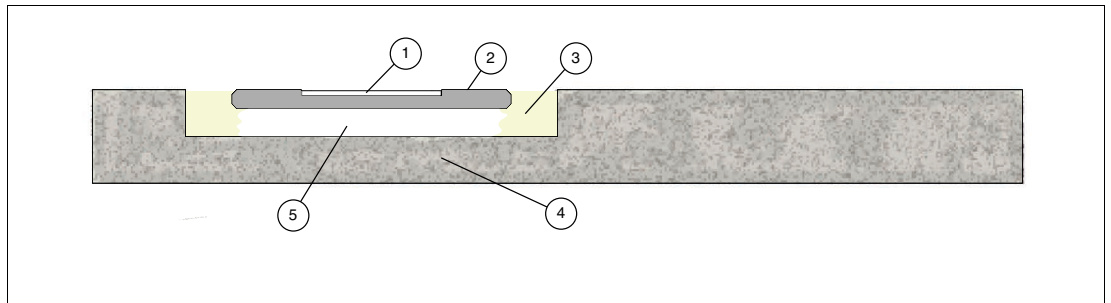


Figure 3.4 Layout

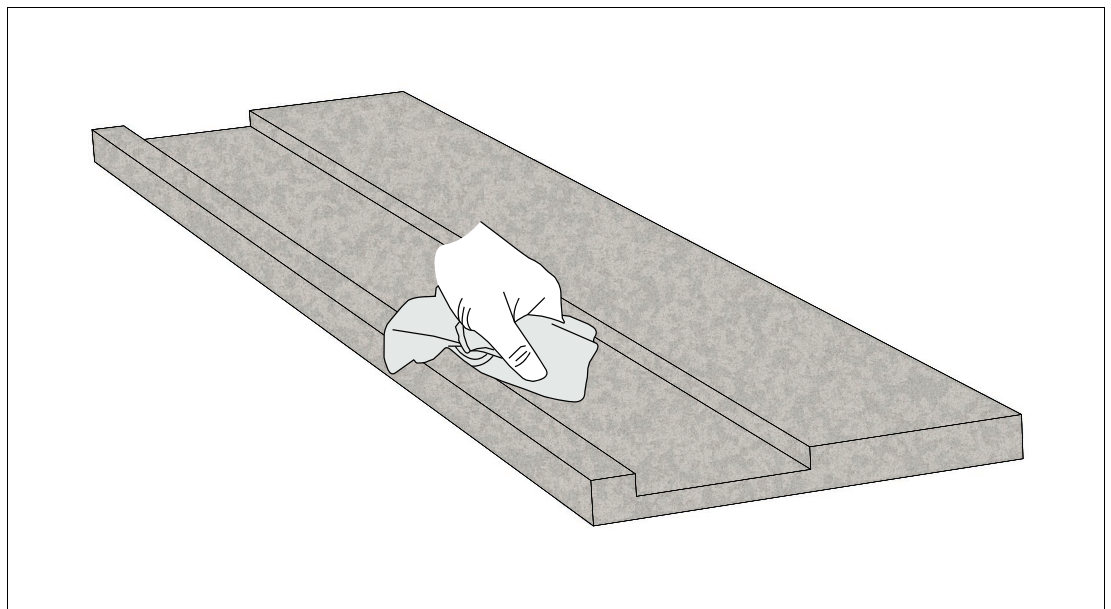
- 1 Data Matrix metal code bar
- 2 Countersunk profile rail
- 3 Adhesive
- 4 Floor with groove
- 5 Adhesive



#### Mounting the Countersunk Profile Rail

The following description explains the basic procedure for affixing the countersunk profile rail in the floor groove.

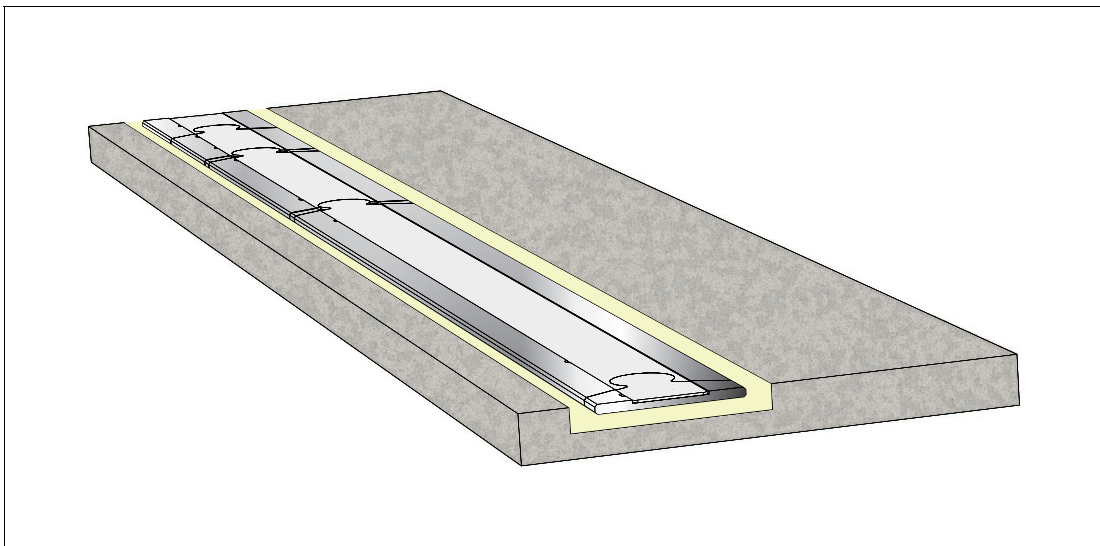
1. Clean the surface of any greasy or oily deposits and dust.



2. Ensure that the surface is dry, clean, and stable.
3. Insert the mounting protection strips into the countersunk profile rail to protect the profile rail against accidental penetration of the adhesive or floor filler.



4. Apply a suitable adhesive into the groove (strong and flexible).
5. Carefully press the countersunk profile rails into the adhesive and align them to the floor level so that the countersunk profile rail is flush with the floor. Make sure that no adhesive penetrates the countersunk profile rails through the open holes. If adhesive does leak through the holes, it must be removed before hardening.



6. If necessary, remove any adhesive residue from the edges of the countersunk profile rails or, if necessary, backfill the sides of the countersunk profile rails with additional adhesive.
7. Distribute the adhesive evenly on the countersunk profile rail. Position the countersunk profile rail in the floor groove and push it in. Note that the countersunk profile rail is inserted into the floor at ground level.
8. Allow the floor filler to harden. Allow sufficient time for the adhesive to harden. Observe the information provided by the adhesive manufacturer.
9. Remove the mounting protection strips and insert the metal code bars into the appropriate countersunk profile rails.

## 4 Curved Areas

When designing the required curve radius, we recommend using 100 mm and 200 mm metal rails (countersunk profile / drive-over profile rails).

### 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.

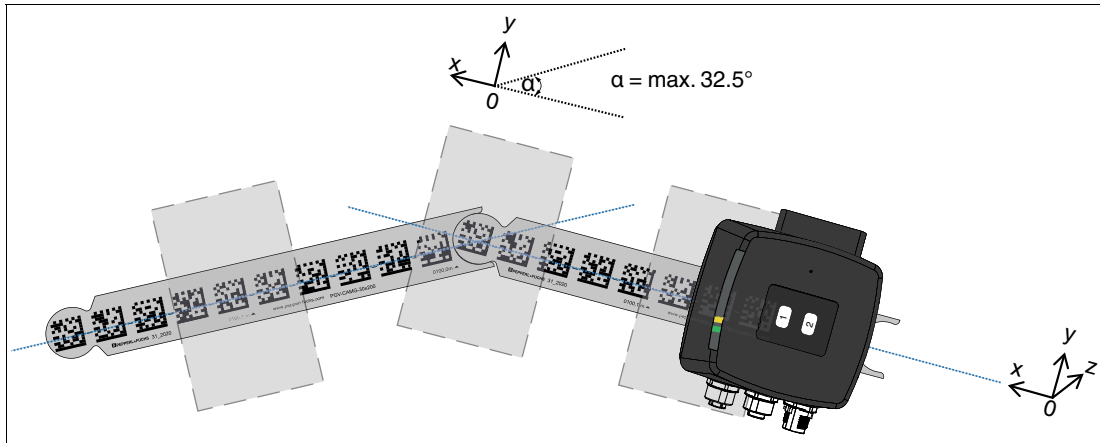


Figure 4.1

#### Curve radius

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

With a combination of 100 mm and 200 mm code bar rails, each curve radius can be implemented above the minimum radius.

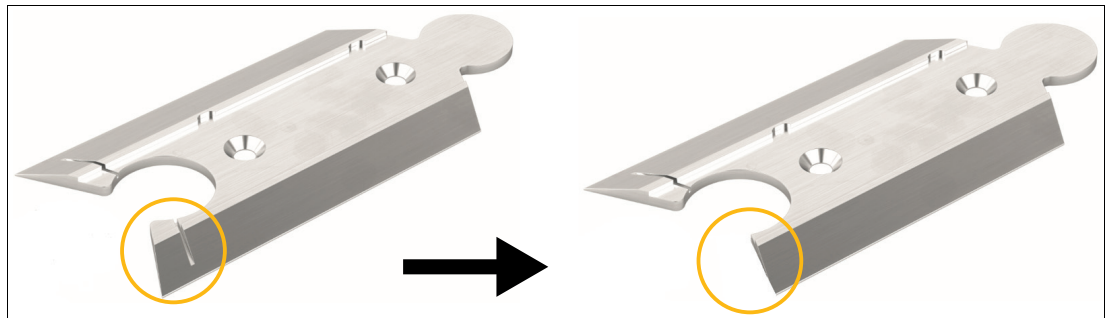
#### Note

It is recommended that you record the curve on the floor before gluing it and place the code bars on the marked track without gluing it. The track in the curve should be traversed with an AGTS to check whether the specified path of the AGTS is being adhered to. Only then should the code bars be glued on.



### Curves with Drive-Over / Countersunk Profile Rails

The routing of the code bar system is illustrated by way of example using the drive-over profile rails. It also applies to the countersunk profile rail system.



To create curves, separable corners are removed from the profile rails to create curved areas. In the upper image on the right, this is shown for a right curve. For left curves, the left separating corners are removed

By removing the corners, a maximum angle of 18° between two consecutive drive-over or countersunk profile rails can be achieved.

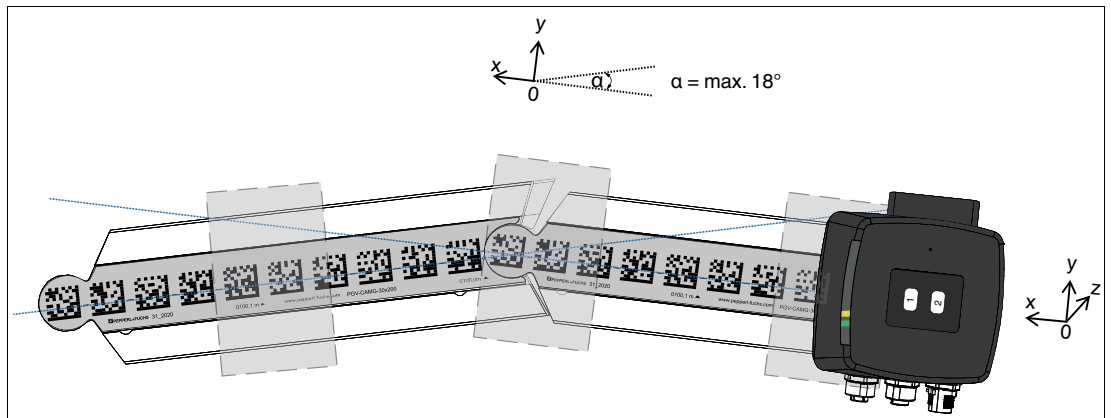


Figure 4.2

#### Curve radius

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

With a combination of 100 mm and 200 mm drive-over / countersunk profile rails, each curve radius can be implemented above the minimum radius.



#### Note

##### Code Bars in Curves

It must be ensured that the code bars are glued as flush as possible with the profile of the drive-over / countersunk profile rails. In the following figure on the left, the code bar is not inserted correctly; in the figure on the right, the code bar is inserted correctly.

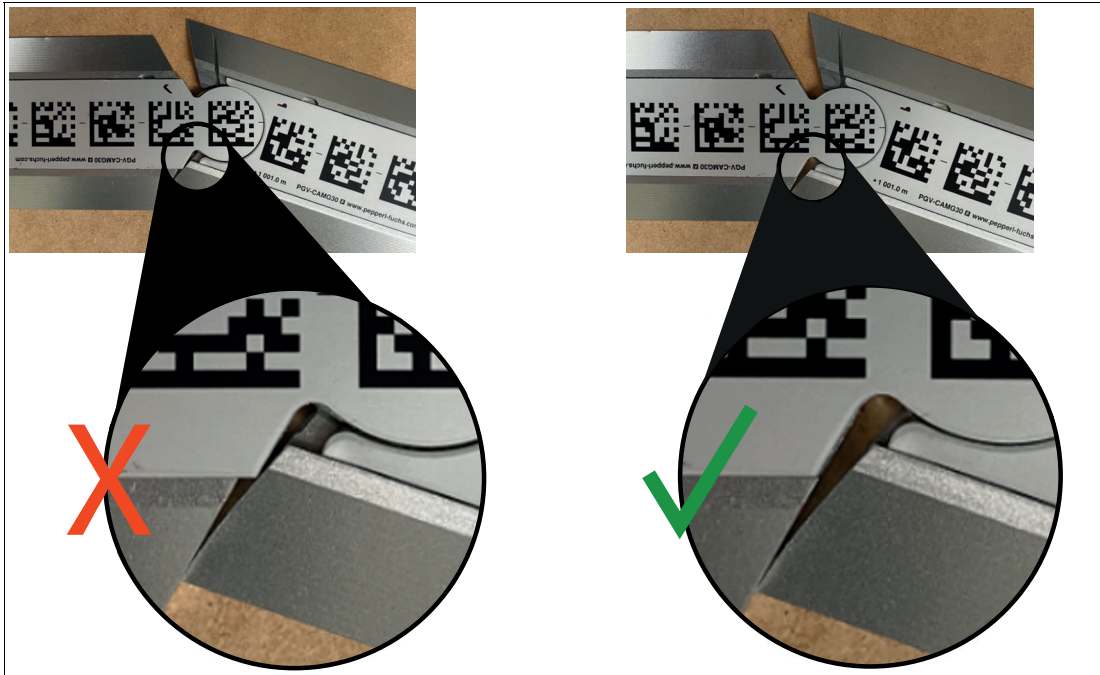


Figure 4.3



**Note**

**Countersunk Profile Rails in a Curve**

The following figures show what to pay attention to when installing countersunk profile rails in a curve.

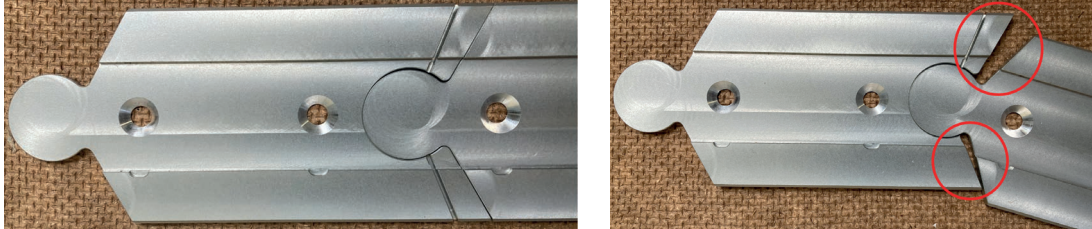


Figure 4.4

**Figure on the Left**

- Here it can be seen that the countersunk profile rails can be laid close to each other in the prepared groove in the floor without filler material getting into the groove into which the code bars are later inserted.

**Figure on the Right**

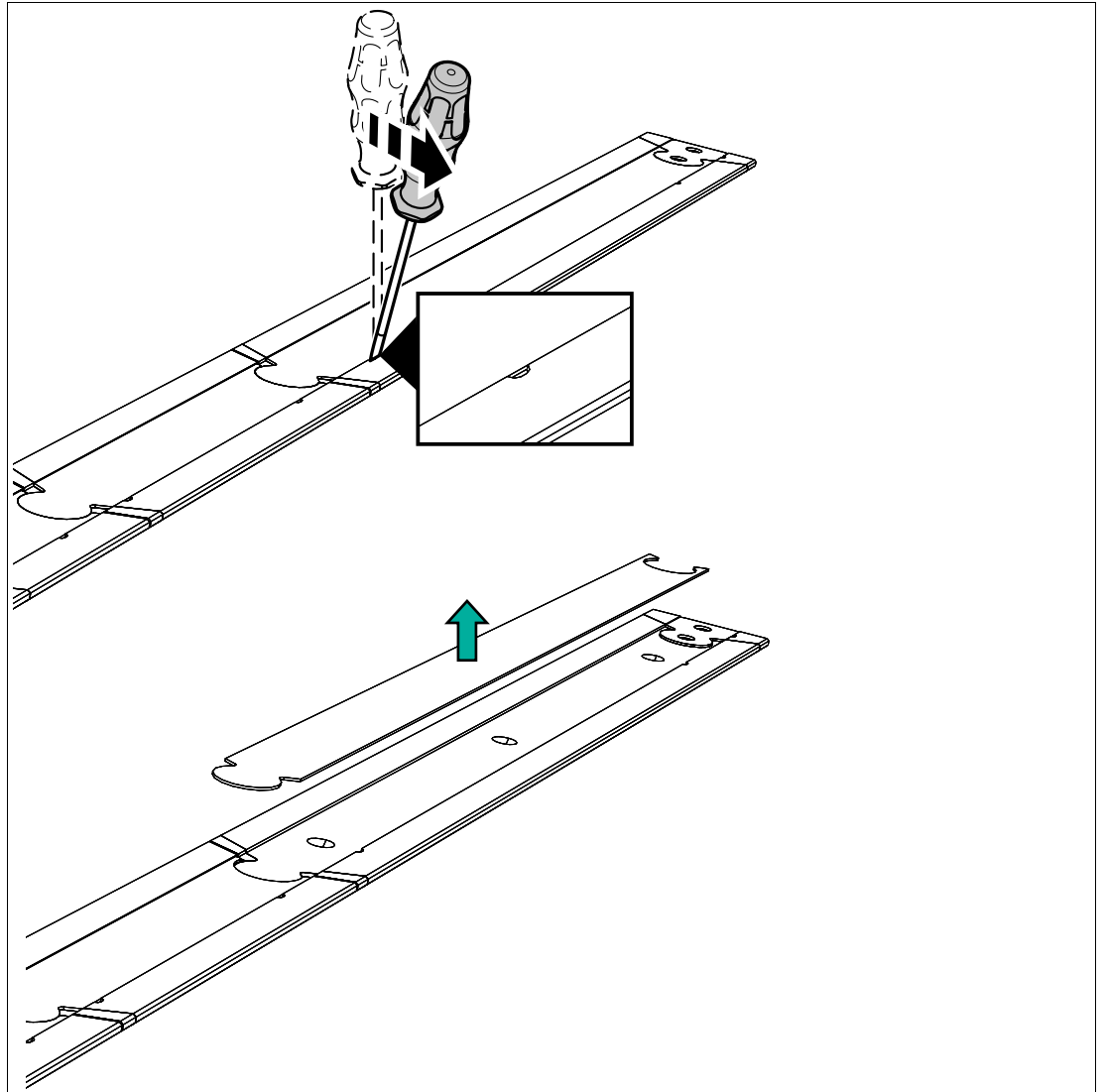
- This figure shows the installation of the countersunk profile rails in a curve. The areas marked in red create gaps into which filler material can enter. This can cause contamination of the groove for the code bars.

Make sure that these areas are kept as clean as possible. It is recommended to remove any material that has penetrated the groove immediately during installation.

## 5 Exchanging the Metal Code Bars

To exchange the metal code bars, there are notches in each profile rail. A slot-head screwdriver can be used to pry out the metal code bars at the notches.

After removing the defective metal code bar, clean the rail of dirt and adhesive residue. The new metal code bar can be inserted and pasted back into place with light pressure.



### Note

#### Adhesive Residues

The adhesive of 3M is the type 9472 LE from the 300 LSE series. This adhesive was chosen to hold the metal code bars on the various base surfaces with a permanent adhesive force. The adhesive also adheres to low-energy surfaces (e.g., polyethylene, polypropylene, LSE plastics,...). To dissolve this adhesive, it is recommended to heat it with a heat gun or a blow-dryer. This makes the adhesive viscous and easier to remove.

## 6 Useful Tips & Recommendations

### 6.1 Transitioning from the Drive-Over Profile Rail to a Metal Code Bar

A series of metal code bars that pass from a drive-over profile rail system to a metal code bar that is glued to the floor.

The position values come up from the drive-over profile rail and pass into the metal code bar mounted on the floor. The Z offset at the transition point is approximately 3 mm. The large depth of field of the PGV system also enables this installation method.

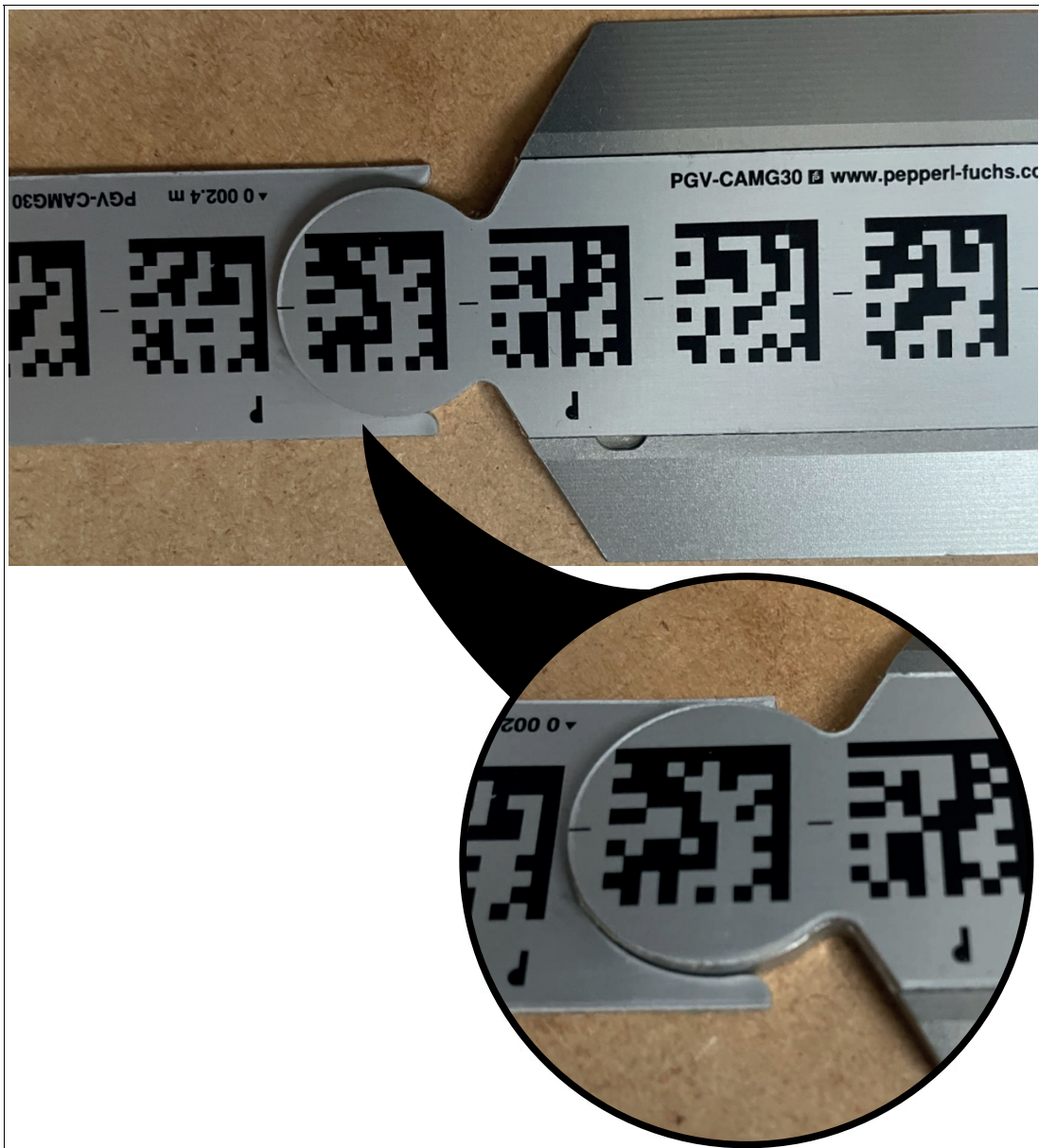


Figure 6.1

#### Note

It is also possible to work with a color tape instead of the metal code bar. In this case, ensure that the color tape is at least 10 mm wide and not more than 40 mm wide. For more information about the color tape, see the documentation for the corresponding read head.

## 6.2 Transition from a Color Track to a Metal Code Bar System

You can combine color tapes and Data Matrix metal code bars. Note, however, that Data Matrix metal code bars take precedence over color tapes.

The following figures show the data output from the read head when combining color tape and DataMatrix metal code bars.

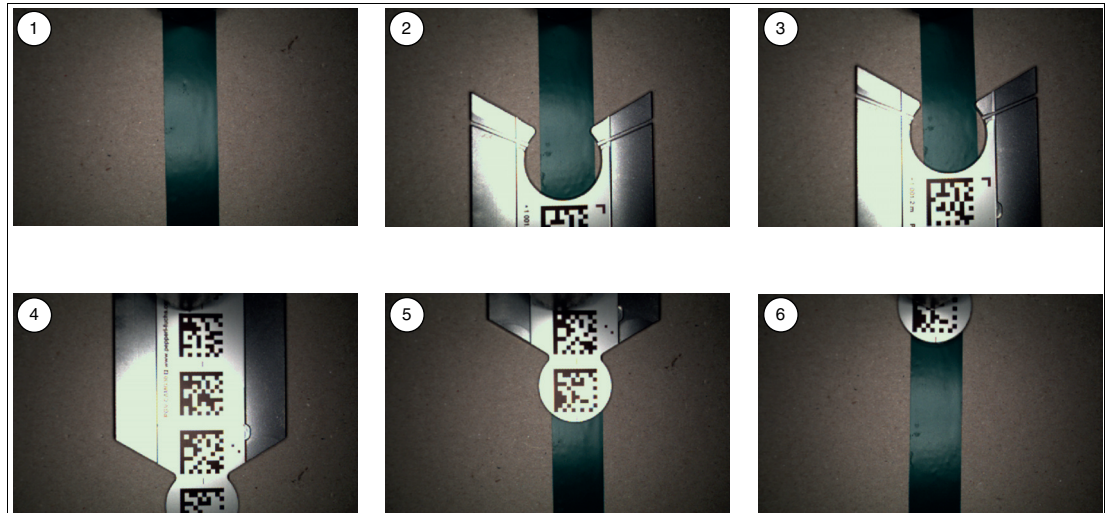


Figure 6.2

Figures 1 ... 6 show the gradient of a colored lane transition to a metal code bar and back to a colored lane.

In Figures 1 and 2, the read head outputs the Y value and the angle. Only in Figure 3 does the read head decode a code and now, in addition to the Y value and angle, it also outputs the X position, relative to the image center of the read head. These values are also output in Figures 4 and 5, where the read head is located on a code lane (metal code bar).

Only when the metal code bar is completely exited, when the read head no longer detects a complete code, does it switch to the color lane and return the Y value and the angle.



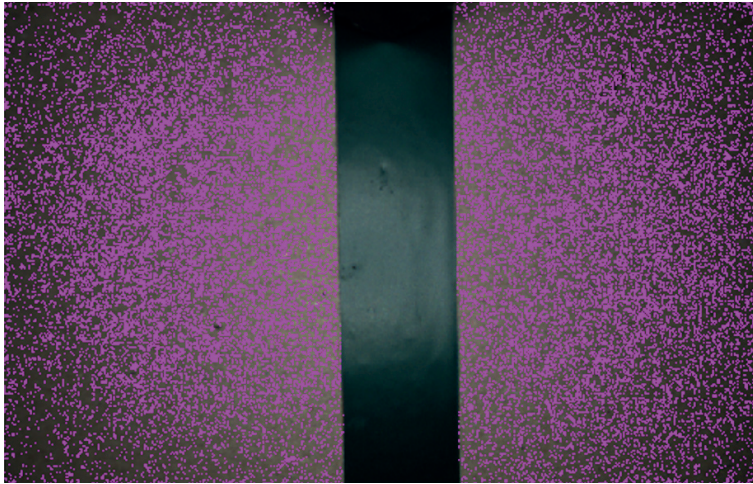


**Tip**

**Software-Assisted Floor Examination**

It is recommended that you perform a floor analysis with the read head for the color content in the floor before selecting the color lane. The Vision Configurator configuration tool (available free of charge on the Pepperl+Fuchs homepage) can be used for this purpose.

The following figure shows which color content can occur in the floor. The figure shows that there is a very high proportion of red in the floor. It is important to make sure that the correct color selection of the color lane is made before gluing or painting a color tape.



**6.3**

**Start/End Profile Rails in Combination with Color Tape**



Figure 6.3 Transition of countersunk profile rails with end segment to a color tape

It is also possible to design countersunk profile rails or drive-over profile rails in combination with start/end profile rails and to use color tape for further navigation. In this case, it is recommended that the start and final control segments (PGV-MG30-START-END-SET) be covered with the color tape used for further navigation.

The easiest way to do this is to place the two start and final control segments into each other, glue the color tape as centrally as possible to the code, cut the start and final control segments at the interface with a sharp knife, and insert them into the start/end profile rails (see figure above). The transition from the start/end profile rail to the color tape has a gap of about 15 mm (the same for drive-over/countersunk profile rails), which must be taken into account during navigation. It is recommended that the short piece be given an appropriate color tape.

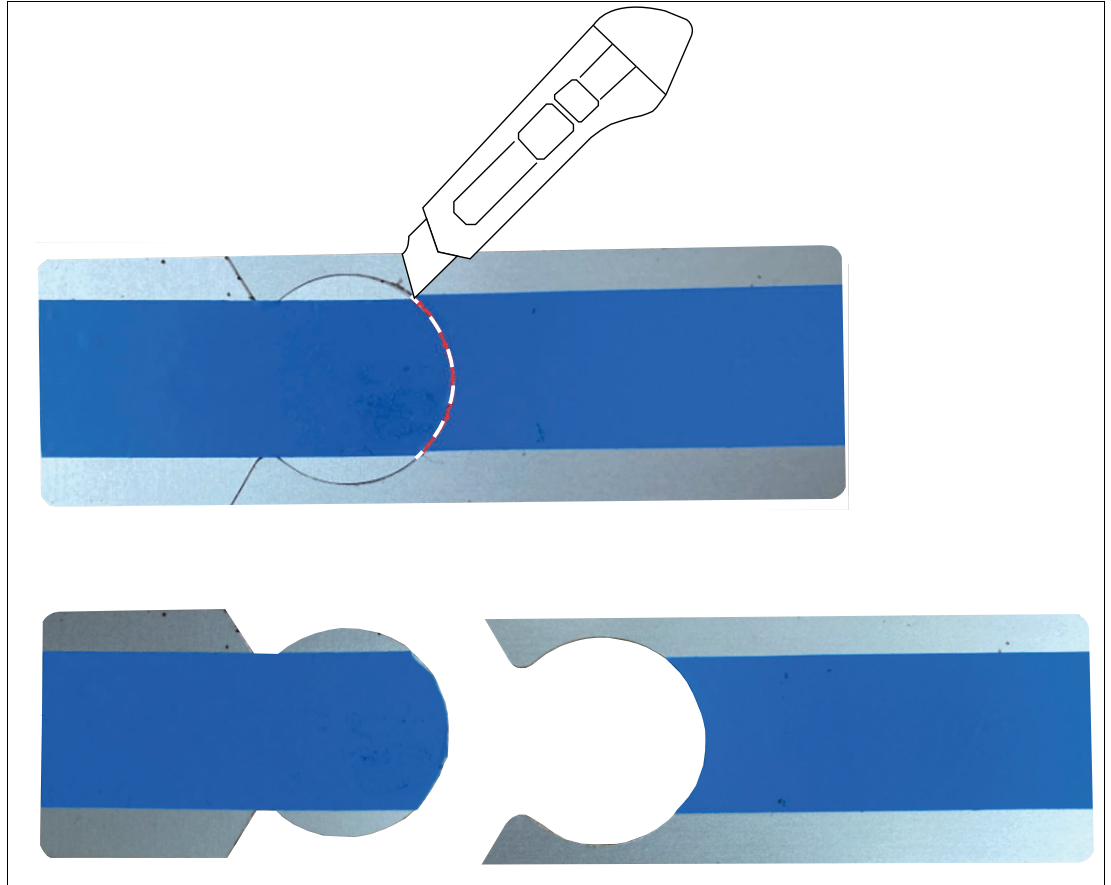


Figure 6.4

## 6.4 Preventing Kinks on Profile Rails

Make sure that there are no inward or outward kinks in the rail system. These can lead to stresses or protrusion of the code bars when the code bars are subsequently inserted.

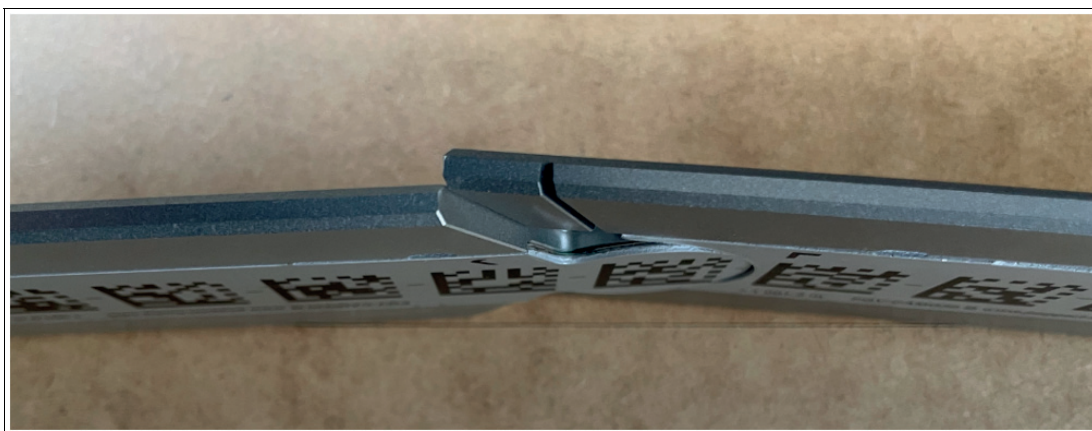


Figure 6.5 Countersunk profile rails kinked inward

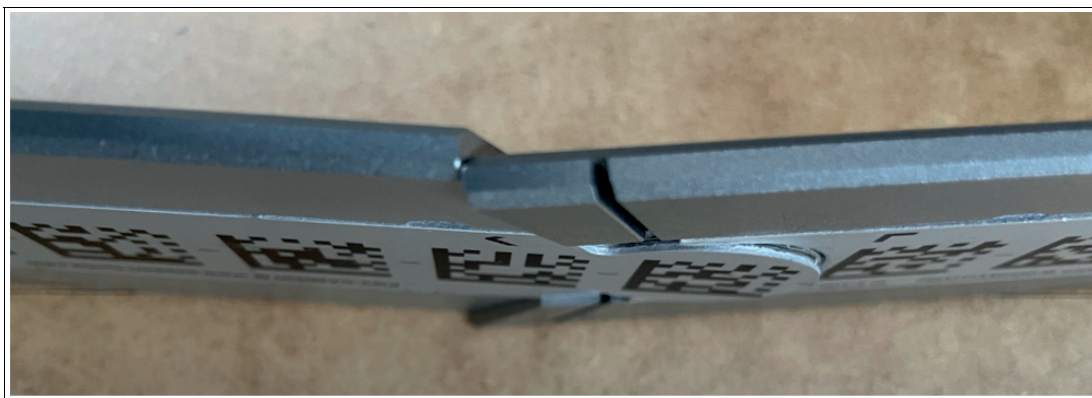


Figure 6.6 Countersunk profile rails kinked outward

Both also apply to the drive-over profile rails

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