PSENvip R, PSENvip R LR
PSENvip E

PILZ
THE SPIRIT OF SAFETY

- Safe camera systems

Operating Manual-1003449-EN-06

1 Introduction

This operating manual contains information about the intended operation of the PSENvip. The PSENvip is a camera-based protection and measuring system for press brakes. It consists of 3 components and is available in 2 versions:

- Base version, consisting of
  - Transmitter PSENvip E
  - Receiver PSENvip R or PSENvip R LR
  - Special module PSSu K F FAU B
- Productive version, consisting of
  - Transmitter PSENvip E
  - Receiver PSENvip R or PSENvip R LR
  - Special module PSSu K F FAU P

The term PSENvip is used to describe both versions in this document. If a description refers exclusively to one of the two versions, the term base version or productive version will be used.

In the same way, PSSu K F FAU will be used to describe both versions of the special module PSSu K F FAU B and PSSu K F FAU P. If a description refers exclusively to one of the two versions, the full product name will be used.

The versions of the PSSu K F FAU are described in a separate operating manual PSSu K F FAU B, PSSu K F FAU P.

This operating manual is aimed at manufacturers, company operators and personnel involved in designing, maintaining and operating press brakes, which are to be safeguarded using the PSENvip.

This operating manual is not an instruction manual for the press brake that is safeguarded using the PSENvip. Please refer to the press brake operating manual for this information.

1.1 Validity of the documentation

This documentation is valid for PSENvip E from version 1.0/year of build 2014 and PSENvip R/PSENvip R LR from Hardware version 2 and Firmware version 2.0/year of build 2016. It is valid until new documentation is published.

1.2 Retaining the documentation

This documentation is intended for instruction and should be retained for future reference.

1.3 Definition of symbols

Information that is particularly important is identified as follows:

DANGER!

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.

WARNING!

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

INFORMATION

This gives advice on applications and provides information on special features.

2 Overview

PSENvip is a camera-based protection and measuring system (electrosensitive protective equipment) for press brakes. It consists of a transmitter, receiver and a PSSu module to evaluate recordings. It monitors the detection zone between the transmitter and receiver below the moving upper tool. Operation, visualisation and configuration is via a web interface on the CNC or control system driving the press.

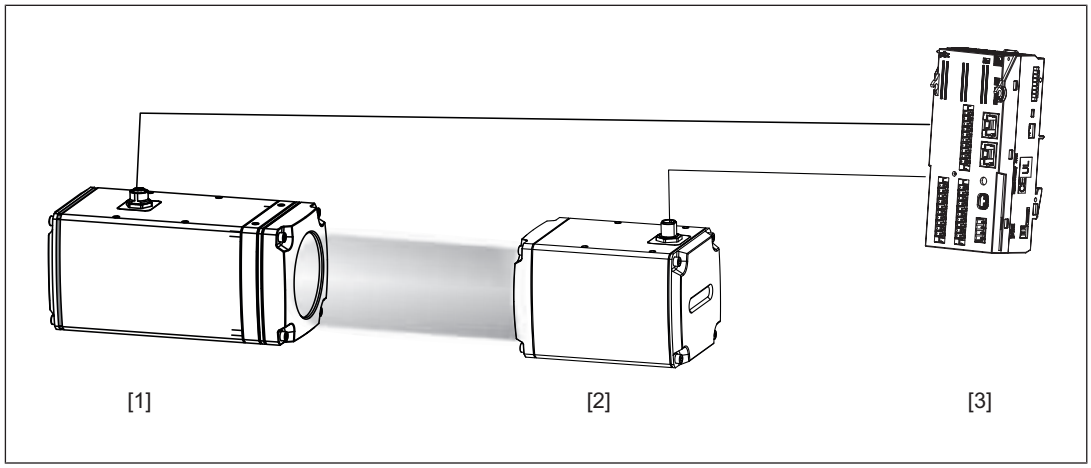


Fig.: Components of the PSENvip

Transmitter PSENvip E[2]

- Generates parallel beam
- 2 inputs for controlling the light source

Receiver PSENvip R/PSENvip R LR [1]

- Receives the light generated by the transmitter
- Sends image date to the special module PSSu K F FAU
- LED display for the status of the OSSD signal

Special module PSSu K F FAU [3]

- Image evaluation of the data provided by the receiver
- Evaluation of protected field and fast shutdown of the press if the protected field is violated
- 2 outputs to control the transmitter
- Communication via Ethernet interface with the CNC
- Troubleshooting and diagnostics

PSENvip is part of an overall system comprising:

- Press brake
- Numerical controller (CNC) with web interface for visualisation and operation
- PSENvip transmitter and PSENvip receiver
- Control system PSSuniversal PLC from the automation system PSS 4000 with special module PSSu K F FAU
- PAS4000 user program

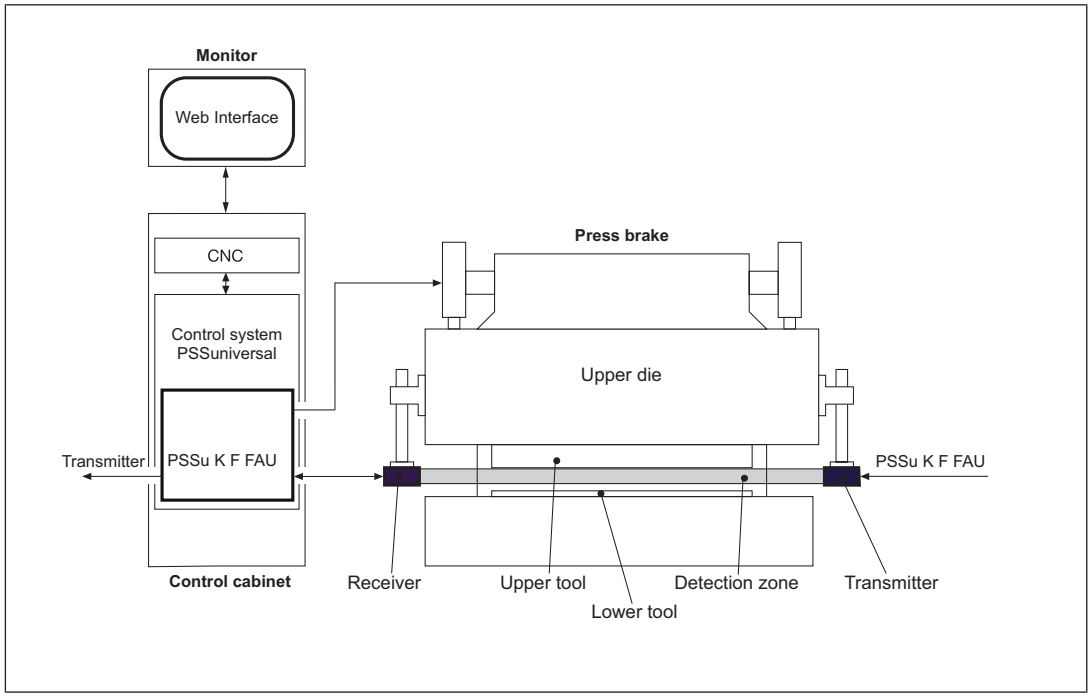


Fig.: Whole system

If the detection zone between transmitter and receiver is interrupted, the PSSu K F FAU can shut down the safety outputs immediately. The outputs that are shut down are defined in the PAS4000 user program.

There are 2 versions available for protected field monitoring:

- The base version monitors a fixed, configured protected field.
- The productive version monitors a dynamic protected field.

PSENvip automatically detects a tool contour. The adjustment during initial commissioning or during a tool change is made using the web interface on the CNC.

3 Safety

3.1 Intended use

The PSENvip is exclusively designed for stationary use on press brakes. As electrosensitive protective equipment (ESPE), PSENvip meets the requirements of a type 4 ESPE in accordance with EN 61496-1.

PSENvip safeguards the danger zone below the moving upper tool.

Danger zones outside of the protected field are not protected. Hazards in the area of the lower tool and above the protected field must be protected by the press manufacturer with appropriate measures. Please refer to the guidelines given in the "Tool shapes" section in this chapter.

Base version

- A control system PSSu PLC from the automation system PSS 4000 from Pilz must be used for safety-related evaluation of the PSENvip signals. The control system must have the FS resource system section. The special module PSSu K F FAU B must be used for signal evaluation.
- The control system PSSu PLC may mute the protective function of the PSENvip if there is a slow closing speed v ≤ 10 mm/s (creep speed mode).
- The upward movement of the press is assumed as a safe movement.
- The press brake must observe a max. overrun of 14 mm.

Productive version

- Danger zone is monitored either by
  - Using the fixed muting end point
    The productive version of PSENvip operates as standard with the fixed muting end point of 4 mm. With the fixed muting end point of 4 mm, the protected field monitors the danger zone between upper tool and workpiece up to a remaining gap of 4 mm. The control system PSSu PLC may mute the protective function of the PSENvip from the muting end point of 4 mm (4 mm point) (muting).
    Please note: The protective function of the PSENvip may be muted from a remaining gap of 6 mm, depending on the requirements of the country in which the PSENvip is operated and the requirements of the appropriate regulatory body.

    or

  - Using a configured muting end point
    The protected field monitors the danger zone between the upper tool and workpiece up to a configured remaining gap. A value between 4 mm and 1.6 mm must be configured for the muting end point. The control system PSSu PLC may mute the protective function of the PSENvip from the configured muting end point (muting).
- The upward movement of the press is assumed as a safe movement.
- The press brake must observe a max. overrun of 14 mm.
- A control system PSSu PLC from the automation system PSS 4000 from Pilz must be used for safety-related evaluation of the PSENvip signals.
  The control system must have the FS resource system section.

- The special module PSSu K F FAU P must be used for signal evaluation. If the muting end point is to be configurable, the special module PSSu K F FAU P from Hardware version 2.0 and Software version 1.1 must be used for signal evaluation.
- In the PSS 4000 user program, safety functions must be implemented to safeguard the dynamic muting of the PSENvip:
  - Monitoring of the pinch point
  - Definition of a safe position and safe speed for the upper tool
  - Activation of the entire protected field by a signal from the CNC (System-Init = 1), if the press stops during dynamic muting and the upward movement is then initiated.
- Monitoring of the press ramp is absolutely essential. Two procedures can be selected:
  - Brake ramp monitoring by the PAS4000 user program

    or
  - Brake ramp monitoring by PSEnvip
    From Hardware version 2 and Firmware version 2.0 the receiver PSENvip R/PSENvip R LR is supported by a procedure for braking ramp monitoring. For braking ramp monitoring by PSENvip, a special module PSSu K F FAU P from Hardware version 3 and Firmware version 2.0. is required.
- Certified blocks are available for the safety functions in the PAS4000 Library. The blocks are exclusively intended for use with a fixed muting end point of 4 mm.

Intended use also includes

- EMC-compliant wiring
  Please refer to the guidelines stated in this manual, in the section entitled "Wiring".
- Use of the module PSSu K F FAU B or PSSu K F FAU P
  Please refer to the operating manual PSSu K F FAU B, PSSu K F FAU P

The protective function of the PSENvip must not be adversely affected by sources of interference, e.g. wireless remote controls for cranes, welding sparks, strobe lighting effects.

The following is deemed improper use

- Any structural, technical or electrical modification to the PSENvip
- Use of the PSENvip outside the zones described in this manual
- Use of the PSENvip contrary to the documented technical details (see "Technical Details").

3.1.1 Safety during operation

Intended use also includes awareness of the hazards that arise during operation, against which the PSENvip does not provide protection.

3.1.1.1 Hazards arising from installation

When installing the PSENvip, please note the following:

- The PSENvip must be installed so that there are no crushing or shearing hazards between the moving transmitter/receiver and the fixed machine parts or any other parts around the machine.
- If hazard areas cannot be avoided, other safeguards must be put in place.

3.1.1.2 Hazards arising from a reduced protected field

The full protected field is only active in standard protected field mode. In box bending, back gauge or box bending with back gauge protected field mode, the protected field is reduced. This means there can only be limited protection against trapping and crushing. The protected field is around the tolerance zone behind the bending line. Any parts of the body within the danger zone will only be detected behind the bending line. There is a risk of injury from trapping or crushing.

3.1.1.3 Hazards arising from incorrect handling of the workpiece

PSENvip does not protect against hazards arising from incorrect handling of the workpiece.

When bending metal sheets on press brakes there is a risk of hand injuries

- From the tool's closing movement
- From the swivel movement of the parts of the metal sheet that protrude from the tool and
- From the dropping of the metal sheet when the tool is opened.

So please note the following:

- You can avoid crushing and trapping of fingers or hands if the workpiece is handled correctly.
- Wear protective gloves to prevent cuts from edges, corners and ridges.

3.1.1.4 Correct handling of the workpiece

WARNING!

Crushing and trapping of fingers or hands!

With box bending and/or back gauge bending mode, the protected field is partly blanked.

Around the bending line there is an increased risk of crushing and trapping of fingers or hands.

Correct handling with flat workpieces

- Grip the metal sheet by the front corners. Thumbs should be on top of the sheet, palms should hold the sheet from below.

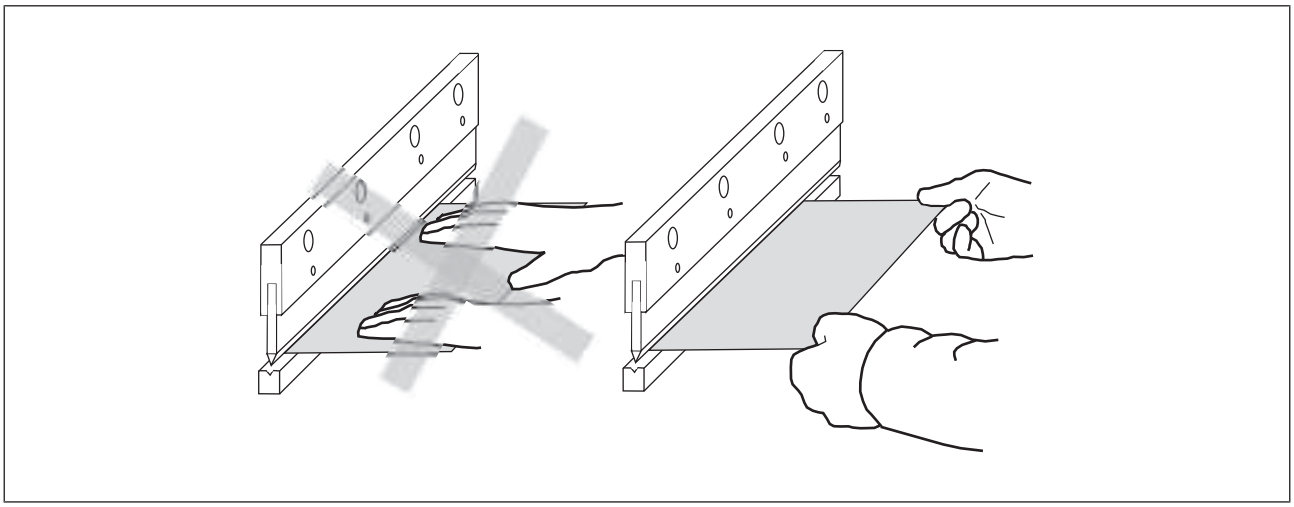


Fig.: Handling flat workpieces

Correct handling with box bending

- Hold the sheet on the right and left between the thumb and index finger.
- As you hold the sheet, do not reach with your hands into the box. During the bending operation, fingers or hands can become crushed or trapped between the workpiece and upper tool.

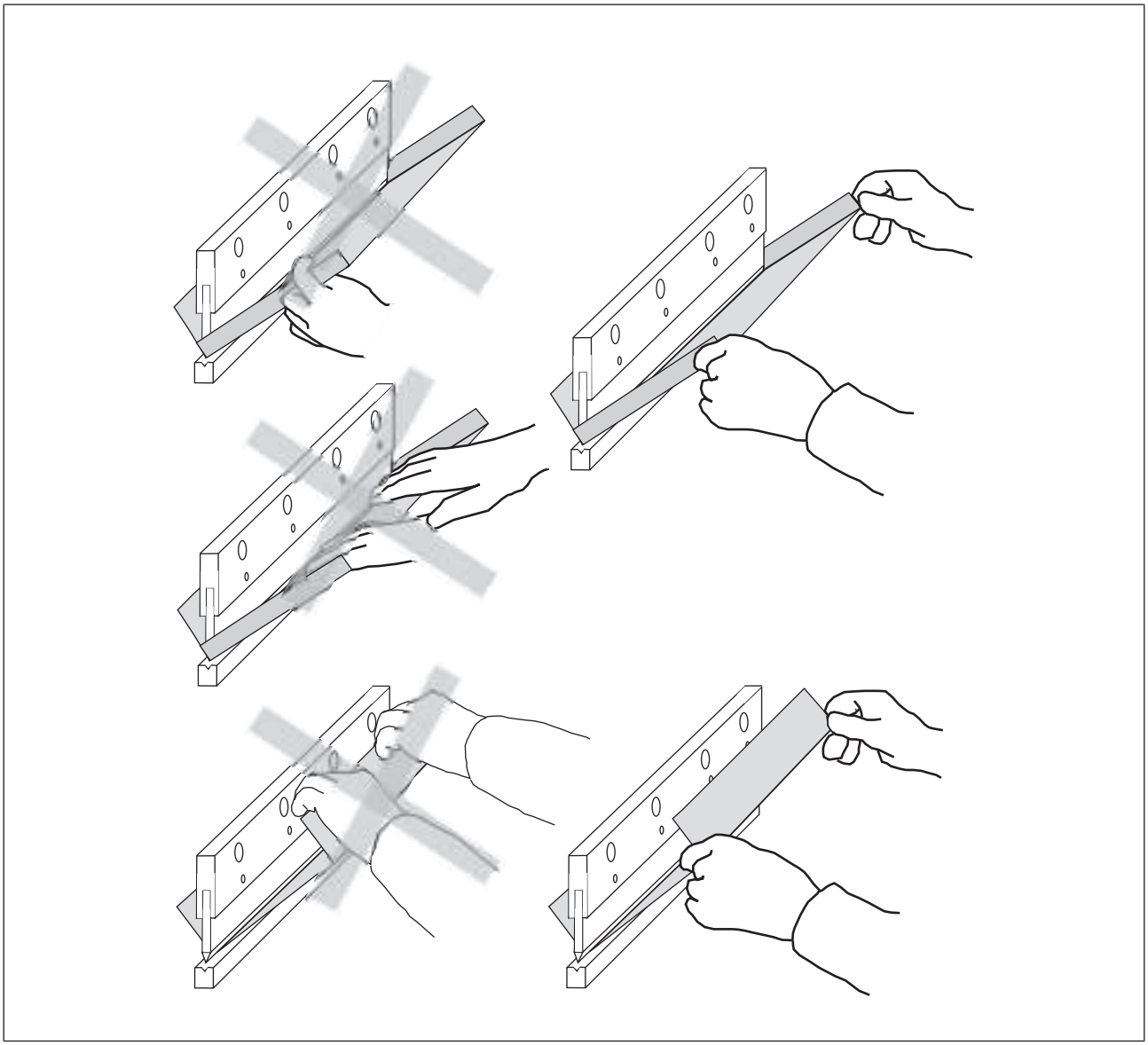


Fig.: Handling box bending

3.1.2 Tool shapes

All tool shapes are permitted in principle. They are divided into tool classes by the PSENvip. Classification is based on EN 12622, according to which the protected field must safeguard areas lying 15 mm in front of the bending line.

Please note the following when using tools:

Tool class 1

- These tools can be safeguarded in compliance with the standards: The front and rear bending lines are detected by the protected field on the PSENvip. The front segments of the protected field are at least 15 mm away from the front bending line.
- Upper tools with a width of max. 32 mm or radius of max. 25 mm.
- Press brakes can travel up to the regular switchover point at high closing speed.

Tool class 2

- These tools cannot be safeguarded in compliance with the standards: The front and rear bending lines are detected by the protected field on the PSENvip. The front segments of the protected field are less than 15 mm away from the front bending line.
- Under the following conditions, this tool class **must** be evaluated in the PAS4000 user program:
  - after the PSENvip is switched on
  - after a tool change
  - after the control system is restarted

  Please refer to the information in the operating manual for the PSSu K F FAU P (see under "Communication with the safety system").
- Upper tools with a width of max. 43 mm or radius of max. 50 mm.

WARNING!

Hazard areas that are not monitored by the PSENvip!

Additional hazard areas in zones that are not monitored by the PSENvip can lead to serious injuries (fingers or hands being crushed or trapped).

Secure these zones with appropriate additional measures:

- Carry out a hazard analysis.
- Raise the regular switchover point, which initiates braking at low speed. The switchover point must be monitored by the safety system.

Tool class 3

- These tools cannot be safeguarded in compliance with the standards: The front and rear bending lines are not detected by the protected field on the PSENvip.
- Under the following conditions, this tool class **must** be evaluated in the PAS4000 user program:
  - after the PSENvip is switched on
  - after a tool change
  - after the control system is restarted

  Please refer to the information in the operating manual for the PSSu K F FAU P (see under "Communication with the safety system").
- The following safety guideline applies for press brakes with tools in this tool class.

WARNING!

Hazard areas that are not monitored by the PSENvip!

Additional hazard areas in zones that are not monitored by the PSENvip can lead to serious injuries (fingers or hands being crushed or trapped).

Secure these zones with appropriate additional measures:

- Carry out a hazard analysis.
- Raise the regular switchover point, which initiates braking at low speed. The switchover point must be monitored by the safety system.
- Each press stroke must be acknowledged by the operator prior to initiation.

Please also note the following guidelines in danger zones in areas that cannot be detected and monitored by the safeguard.

Example: Upper tool with a danger zone outside the zone monitored by the PSENvip

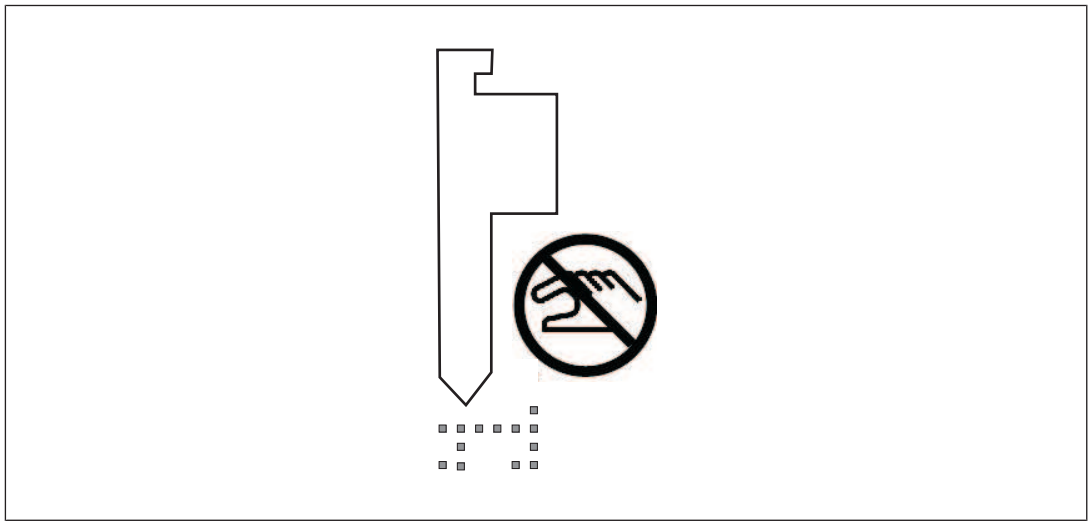


Fig.: Danger zone in unmonitored zone

Example: In unmonitored zones, the use of tools which are not fully detected by the protected field on the PSENvip (e.g. tools with a radius greater than 25 mm) will lead to the risk of fingers or hands being crushed or trapped!

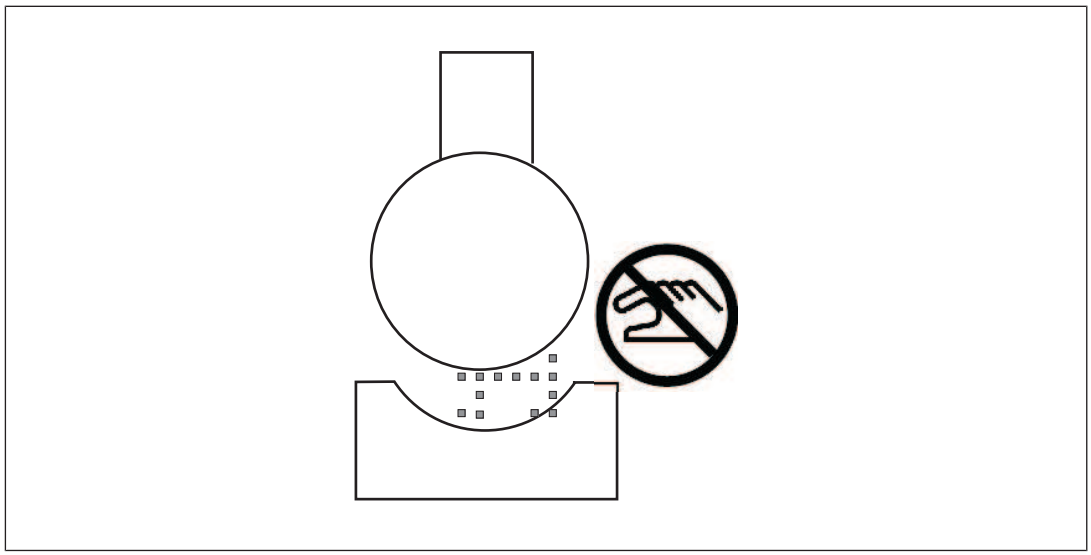


Fig.: Crush points when the tool is wider than the protected field

3.2 Safety guidelines

Failure to keep to these guidelines will render all warranty and liability claims invalid:

- All health and safety / accident prevention regulations for the particular area of application must be observed.
- Before using the unit it is necessary to perform a safety assessment in accordance with the Machinery Directive 2006/42/EC.
- Please note that manufacturers and company operators who use the PSENvip are themselves responsible for agreeing the regulations with the relevant authorities and complying with them.

3.2.1 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

- Are familiar with the basic regulations concerning health and safety / accident prevention,
- Have read and understood the information provided in the section entitled Safety
- Have a good knowledge of the generic and specialist standards applicable to the specific application.

Competent personnel must also be familiar with how to use and test ESPE and be authorised to do this by the ESPE operator.

3.2.2 EMCD

The PSENvip is designed for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.

3.2.3 Warranty and liability

All claims to warranty and liability will be rendered invalid if

- The product was used contrary to the purpose for which it is intended,
- Damage can be attributed to not having followed the guidelines in the manual,
- Operating personnel are not suitably qualified,
- Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

3.2.4 Safety during commissioning, installation and operation

Please read the guidelines stated in the chapters entitled "Commissioning", "Installation" and "Operation".

3.2.5 Disposal

- In safety-related applications, please comply with the mission time T_M in the safety-related characteristic data.
- When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

4 Function description

4.1 Overview

The detection zone between the transmitter and receiver monitors the immediate danger zone below the moving upper tool of a press brake. The detection zone moves with the upper die, providing mobile safeguarding of the danger zone. The receiver transfers the image data from the detection zone to the special module PSSu K F FAU. If an object encroaches into the detection zone, the two outputs on the PSSu K F FAU shut down and the LED on the receiver goes out. A stop of the press stroke is initiated.

On the productive version, safety functions must be implemented in the PAS4000 user program in order to safeguard dynamic muting. Certified Pilz blocks are available for this the PAS4000 Library.

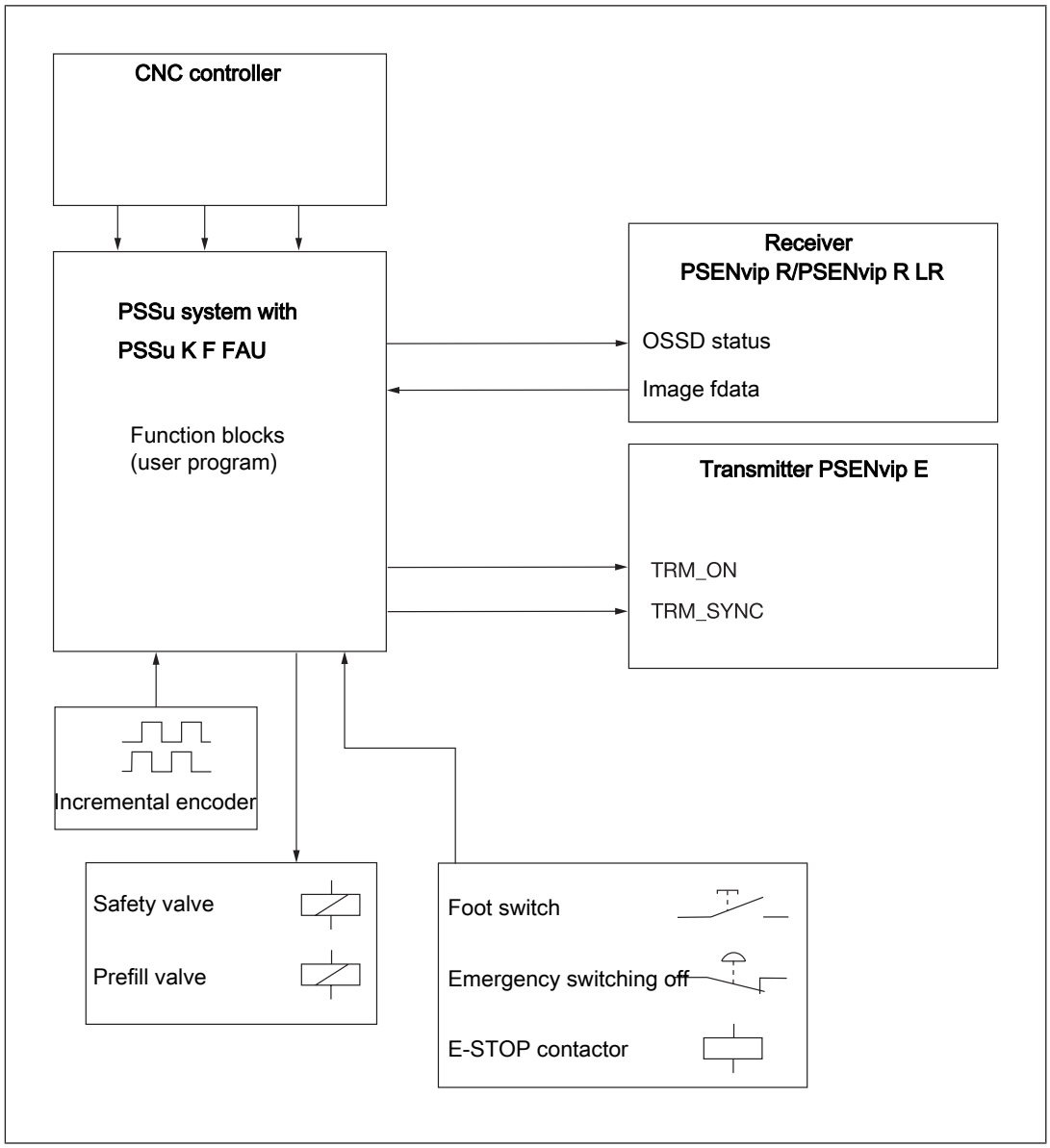


Fig.: Overview of overall system

The receiver receives the parallel light beam bundle generated by the transmitter. The light beam bundle is enclosed by the illuminated target area. The lens on the receiver only detects light that runs parallel to the optical axis. This guarantees stability against diffused light.

NOTICE

Do not use optical aids (e.g. lenses) to look at the light from the transmitter.

This could damage the eye. If you do not use optical aids, there is no danger to the eye.

The detection zone between transmitter and receiver is monitored and evaluated. The protected field is the cross section of the detection zone. It consists of several segments.

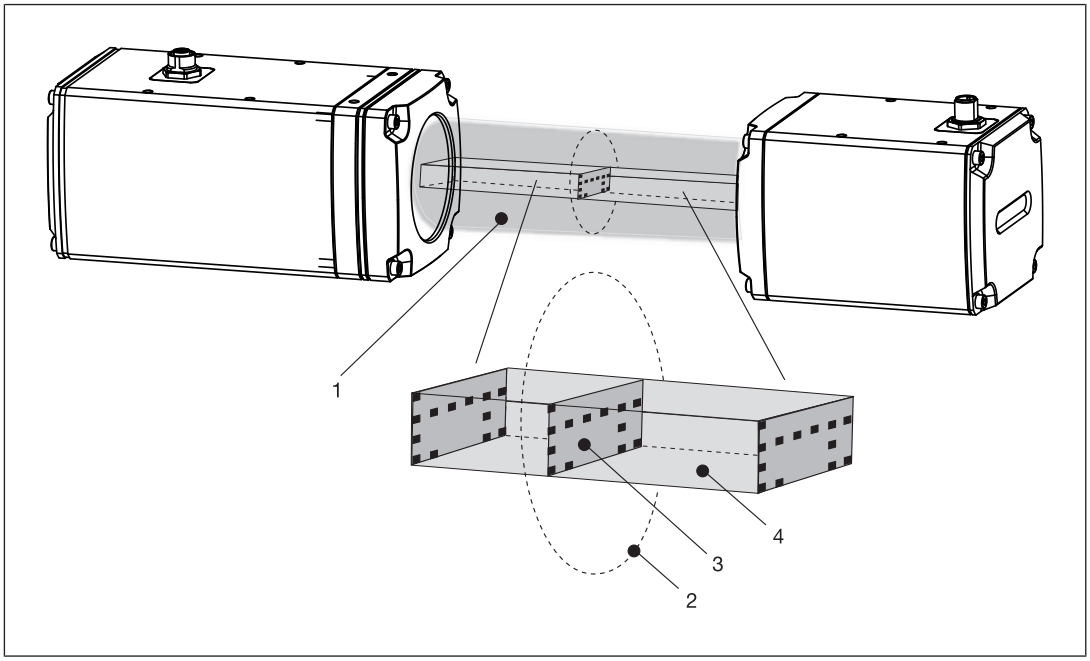


Fig.: Detection zone

Legend:

- 1: Light beam bundle
- 2: Illuminated target area
- 3: Protected field
- 4: Detection zone

The shape and size of the protected field depend on the bending function and the machine-dependent overrun. A reduced protected field is possible for box bending and/or back gauge mode (see Protected field modes).

4.2 Protected field

The protected field consists of several segments. The front and rear segments (viewed from the operator's side) can be deactivated. This provides flexibility to adapt to the bending function:

- Standard
  Full protected field: all segments active
- Box bending
  Reduced protected field: front segments deactivated
- Bending with back gauge
  Reduced protected field: rear segments deactivated
- Box bending with back gauge
  Reduced protected field: front and rear segments deactivated

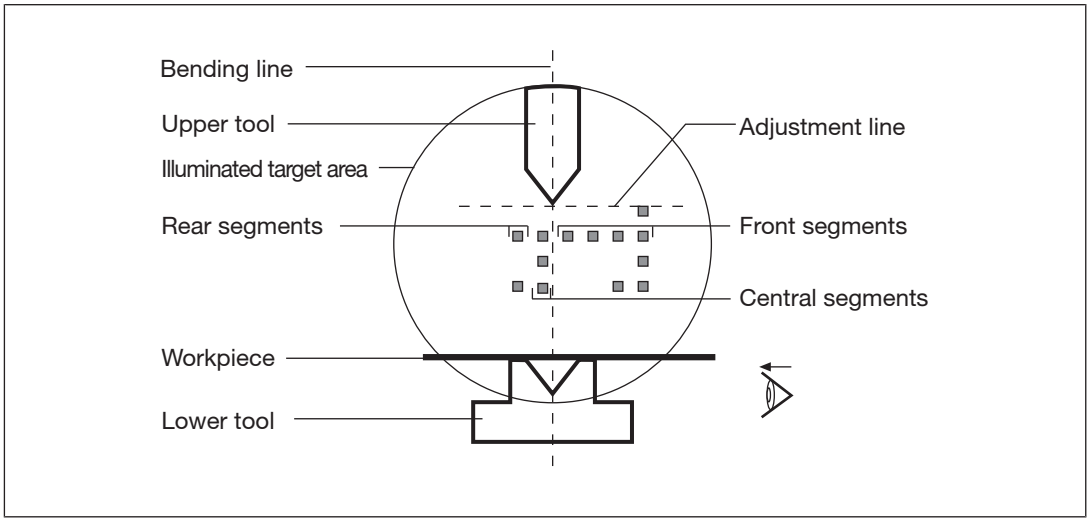


Fig.: Protected field definitions

The height of the protected field depends on the overrun (see Overrun [29])

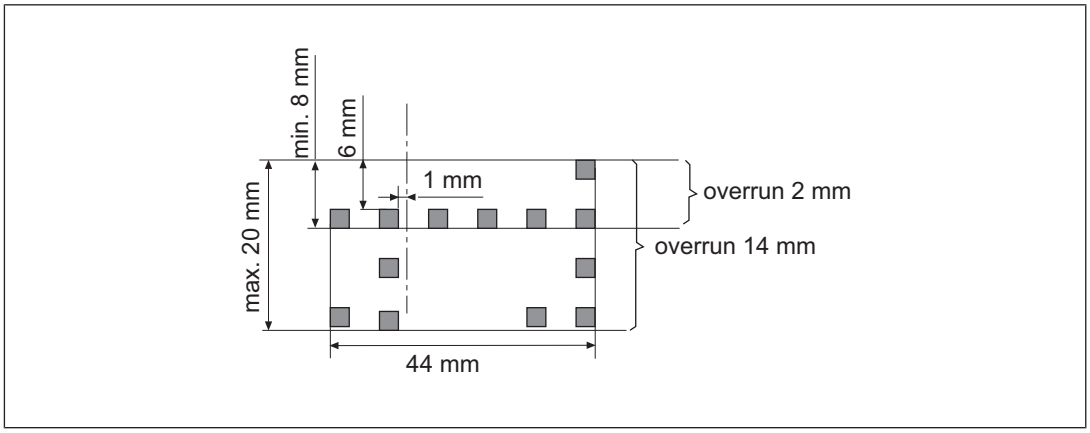


Fig.: Size of the protected field

INFORMATION

Please note that the central segments are 1 mm behind the bending line. With box bending you must ensure that the side panels of the box do not encroach into this area.

4.2.1 Protected field modes

Four protected field modes are available for adapting to different bending functions:

- Full protected field: Standard press stroke
- Reduced protected field:
  - Box bending press stroke
  - Back gauge press stroke
  - Box bending with back gauge press stroke

For protected field modes with reduced protected field, please note the following:

A downward movement with a reduced protected field **must** be initiated by consciously operating a pushbutton (= acknowledgement). The selected protected field mode is displayed via the web interface.

The following procedures are permitted:

- Acknowledgement of the reduced protected field when the downward movement starts
- Acknowledgement of the reduced protected field when the protected field meets the workpiece

  Procedure:
  - Press stroke is started (downward movement)
    The press stroke begins in "full protected field" protected field mode.
  - Press stroke is stopped
    The press stroke is stopped as soon as the protected field meets the workpiece.
    If necessary, the operator can still align the workpiece at this point.
  - Acknowledgement to continue the press stroke with reduced protected field
    The press stroke will be continued with reduced protected field as soon as continuation has been initiated by consciously operating a pushbutton.

If the protected field is interrupted in one of the "reduced protected field" protected field modes, the system immediately switches back to "full protected field" protected field mode.

Use of the protected field modes depends on the tool class. Not all protected field modes can be selected with tool class 2 and 3.

Protected field mode	Tool class		
	1	2	3
Standard Full protected field	Yes	Yes	Yes
Box bending Front segments blanked	Yes	Yes	No

Protected field mode	Tool class		
Back gauge Rear segments blanked	Yes	No	No

The operation must be confirmed after each press stroke by operating a pushbutton.

4.2.1.1 Standard protected field mode

The full protected field is available with standard protected field mode. This protected field mode is applied for flat workpieces.

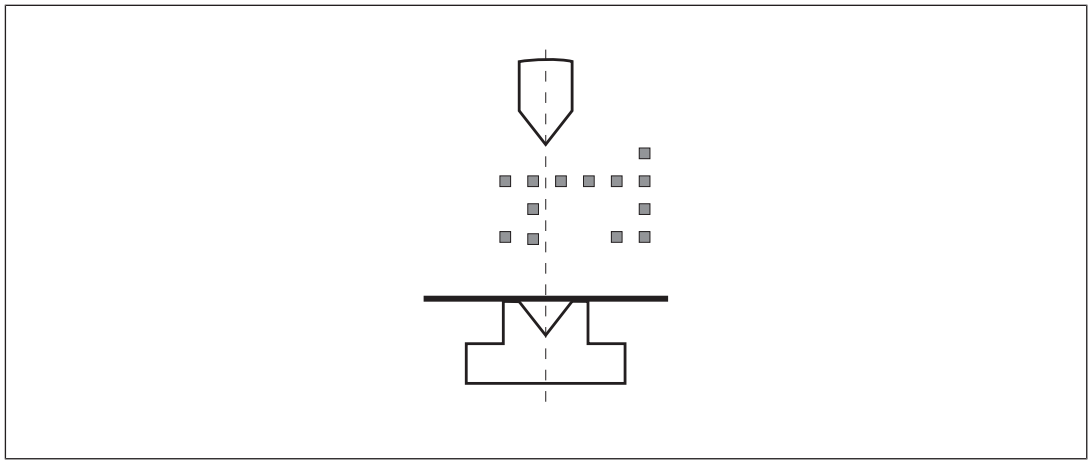


Fig.: Standard protected field mode

4.2.1.2 Box bending protected field mode

With box bending protected field mode, the front segments of the protected field are blanked. This protected field mode is used for workpieces that need to be bent several times, e.g. a box. Interruption of the front segments is to be expected and does not cause the press stroke to stop.

The central segments of the protected field are behind the bending line. The box's side panels must not encroach into the central segments.

If the middle or rear segments of the protected field are interrupted, the outputs of the special module PSSu K F FAU shut down.

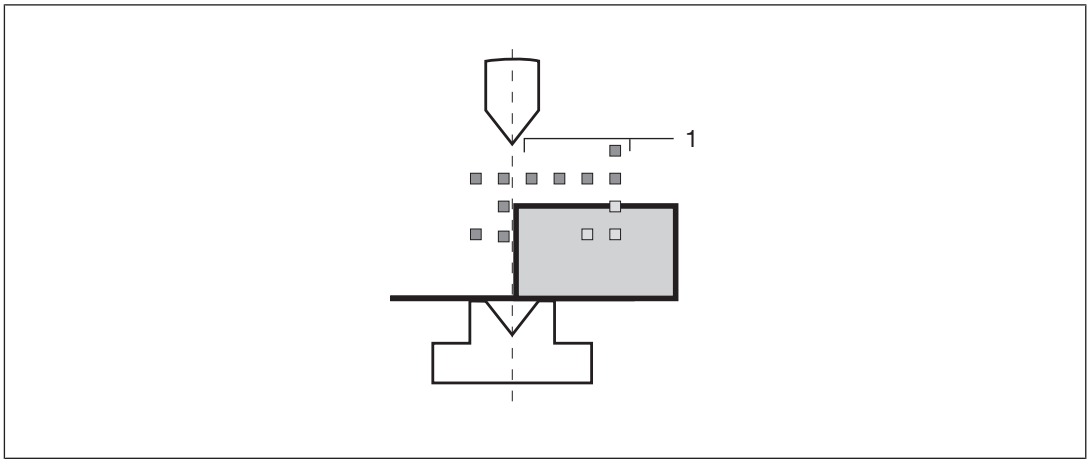


Fig.: Box bending protected field mode

Legend:

- 1: Front segments of protected field are blanked

The box bending protected field mode is only active for one press stroke and must be acknowledged by the operator before or during the press stroke.

WARNING!

Risk of injury due to reduced protected field!

Around the bending line there is an increased risk of crushing and trapping of fingers or hands because the front segments of the protected field are blanked.

Make sure that the workpiece is handled correctly (see Chapter "Safety").

4.2.1.3 Back gauge protected field mode

With back gauge protected field mode, the rear segments of the protected field are blanked. This protected field mode is used when the rear back gauge extends into the vicinity of the bending line. Interruption of the rear segments is to be expected and does not cause the press stroke to stop.

If the front and middle segments of the protected field are interrupted, the outputs of the special module PSSu K F FAU shut down.

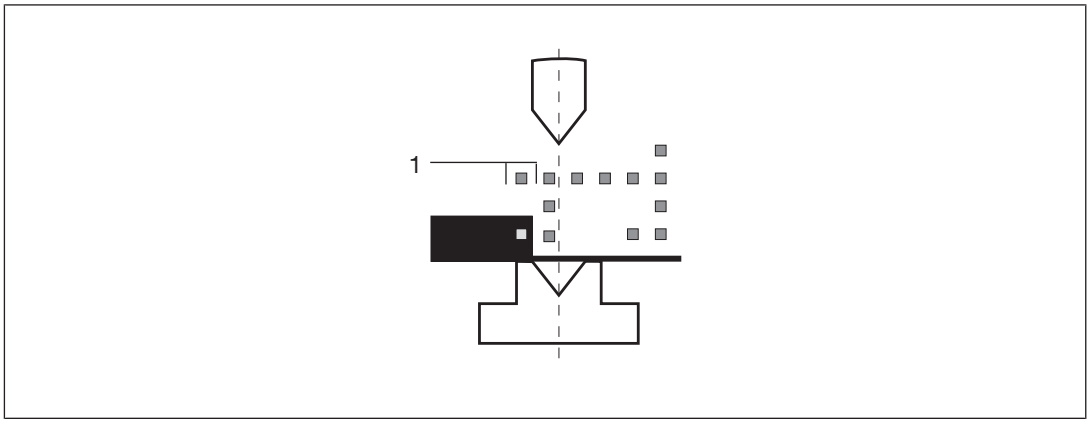


Fig.: Back gauge protected field mode

Legend

- 1: Rear segments of protected field are blanked

The back gauge protected field mode is only active for one press stroke and must be acknowledged by the operator before or during the press stroke.

WARNING!

Risk of injury due to reduced protected field!

Around the bending line there is an increased risk of crushing and trapping of fingers or hands because the rear segments of the protected field are blanked.

Make sure that the workpiece is handled correctly (see Chapter "Safety").

4.2.1.4 Box bending with back gauge protected field mode

With box bending with back gauge protected field mode, both the rear and front segments of the protected fields are blanked. This protected field mode is applied for workpieces that need to be bent several times, e.g. boxes, and when the rear back gauge extends into the vicinity of the bending line. Interruption of the front and rear segments is to be expected and does not cause the press stroke to stop.

The central segments of the protected field are behind the bending line. The box's side panels must not encroach into the central segments.

If the middle segments of the protected field are interrupted, the outputs of the special module PSSu K F FAU shut down.

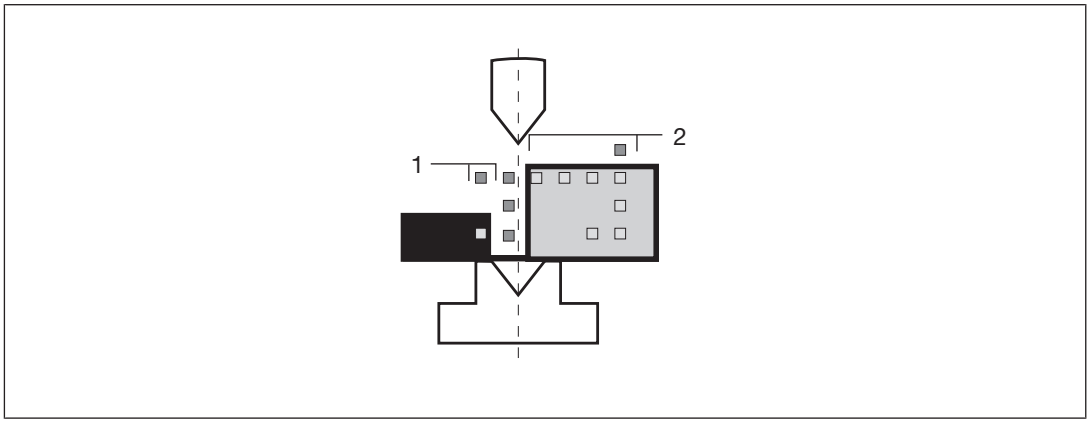


Fig.: Box bending with back gauge protected field mode

Legend

- 1: Rear segments of protected field are blanked
- 2: Front segments of protected field are blanked

The box bending with back gauge protected field mode is only active for one press stroke and must be acknowledged by the operator before or during the press stroke.

WARNING!

Risk of injury due to reduced protected field!

Around the bending line there is an increased risk of crushing and trapping of fingers or hands because the front and rear segments of the protected field are blanked.

Make sure that the workpiece is handled correctly.

4.3 Overrun

The max. overrun is a press brake variable that will depend on the machine type. It is defined during configuration of the module PSSu K F FAU (see PAS4000 online help for the PSSu K F FAU) and corresponds to the factory-set default value.

Once the closing movement has stopped, the max. overrun must not be exceeded.

WARNING!

The protected field is reduced when the overrun is too low

A reduced protected field may lead to serious injury and death.

If you require a different overrun path than the factory-set path, then use the value indicated by the manufacturer on the nameplate of the press brake, or a higher value. If you enter a lower value for the overrun, the protected field will also be reduced to an unpermitted level.

The overrun is measured each time the protected field is interrupted at a fast closing speed. If the overrun is greater than the configured value, the control system PSSu PLC must prevent the continuation of the press stroke at fast closing speed (>10 mm/s) (e.g. interlock, press stroke only possible in creep speed mode, press restart).

4.4 Overrun test

The overrun measurement can be used to check whether the configured overrun is being maintained. The overrun measurement is taken for each press stroke. However, the result of the overrun measurement is only relevant if the user carries out an overrun test. The overrun test must be evaluated in the PAS4000 user program.

NOTICE

The signal for the overrun measurement must be incorporated into the PAS4000 user program in such a way that the test complies with the press safety concept. The test must be carried out after the control system is switched on, for example, so that the initial stroke after switching the press on is a test stroke.

4.5 Muting end point (productive version)

The protected field monitors the danger zone between upper tool and workpiece up to a remaining gap. The remaining gap begins when the tip of the upper tool reaches the muting end point. So the muting end point corresponds to the end of dynamic muting (see Dynamic muting (productive version) [📖 32]) and to the start of the control system's muting of the safety function.
In practice the PSENvip must mute the protected field shortly before reaching the muting end point in order to prevent the press stroke from stopping.

On the productive version there are two options for defining the muting end point:

- Using the fixed muting end point
  The productive version of PSENvip operates as standard with the fixed muting end point of 4 mm. If the fixed muting end point is to be used, the user has nothing further to do.
  Please note: The protective function of the PSENvip may be muted from a remaining gap of 6 mm, depending on the regulations of the country in which the PSENvip is operated and the requirements of the appropriate regulatory body.
- Using a configured muting end point
  The productive version of PSENvip supports a configurable muting end point. A value in the range 4 … 1.6 mm may be configured as the muting end point. For the configuration please refer to the operating manual for the special module PSSu K F FAU P – under "Communication with the safety system".

WARNING!

Loss of safety function due to incomplete or faulty download of the configured muting end point

A muting end point less than 4mm must be configured and downloaded to the PSSU K F FAU P if required by the safety assessment for the overall application or by the regulations of the country in which the PSENvip is being used. Depending on the application, serious injury or death may result if the safety system enables the downward movement in rapid traverse mode before the download of the configured muting end point is complete.

Via the safety system's user program, make sure that downward movement in rapid traverse mode is not enabled until communication between the safety system and PSSU K F FAU P has been completed without error.

4.6 Dynamic muting (productive version)

Dynamic muting is a procedure in which the protected field is gradually reduced by deactivating defined segments. The gradual reduction begins when the protected field meets the workpiece.

Dynamic muting is only possible with the productive version.

To safeguard dynamic muting, the following safety functions must be implemented in the user program:

- Monitoring of the pinch point
- Monitoring the press braking ramp
  The following procedures are possible:
  - Brake ramp monitoring by the PAS4000 user program

    or
  - Braking ramp monitoring using PSENvip
- Definition of the safe position and safe speed of the upper tool.

Certified blocks are available in the PAS4000 Library for this purpose (see online help for PAS4000).

An advance measuring field is located below the protected field. Dynamic muting is started as soon as the advance measuring field touches the workpiece. Dynamic muting ensures that, during the downward movement of the press, the danger zone between upper tool and workpiece is monitored until the muting end point is reached (see Muting end point (productive version) [📖 31]).

The distance of the advance measuring field to the lower edge of the protected field is constant. The distance to the top edge of the protected field varies according to the length of the overrun.

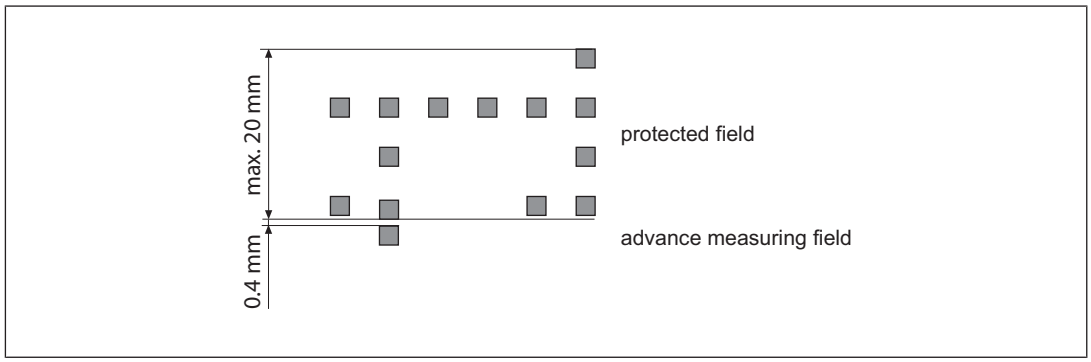


Fig.: Distance of advance measuring field from protected field

INFORMATION

If the workpiece is thinner than 1 mm, it will not be detected by the advance measurement beam.
Remedy: Attach a magnetic metal sheet to the lower tool (covering the die V-groove).

Procedure:

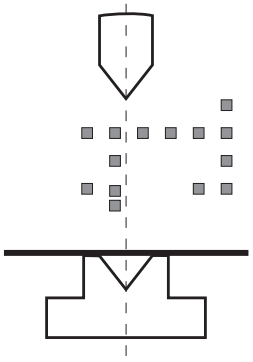
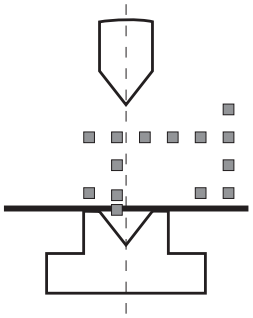
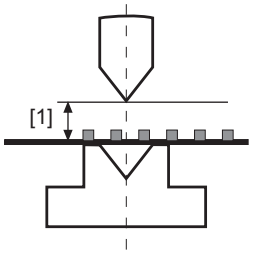
1. The press is on downward movement. The protected field moves down with the upper tool.
2. The advance measuring field touches the workpiece.
3. The advance measuring field is used to hold the protected field stationary at the pinch point on the workpiece. The segment division is optimised for the dynamic muting process.
4. The respective upper segments are deactivated before the upper tool enters the protected field.

NOTICE

When the muting end point is reached, the protected field is interrupted and the PSENvip initiates a press stop via the OSSDs and the fast shutdown of the PSSu K F FAU P. To prevent the press stopping, fast shutdown must be deactivated in the safety system's user program, thereby overriding the shutdown.

States of the OSSD/mute signal

The OSSD signal from the special module PSSu K F FAU controls the outputs; the mute signal signals whether dynamic muting is activated or deactivated. The signal states are displayed via the LEDs OSSD and Mute. On the receiver, an LED lights up green when the OSSD signal is 1 (protected field clear). It lights up red when the OSSD signal is 0 (protected field interrupted).

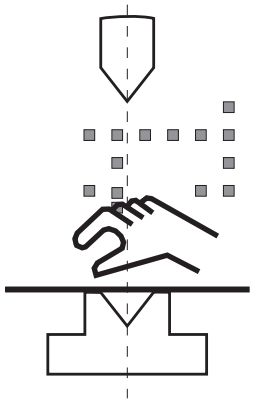
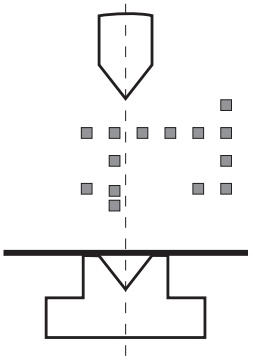
Full protected field active OSSD signal: 1 Mute signal: 1 LED OSSD = lights LED Mute = lights	
Full protected field active, advance measuring field touches workpiece OSSD signal: 1 Mute signal: 1 -> 0 LED OSSD = lights LED Mute = off	
[1] Remaining gap with ▸ fixed muting end point: 4 mm ▸ configured muting end point: 4 ... 1.6 mm OSSD signal: 1 -> 0 Mute signal: 0 LED OSSD = goes out LED Mute = off	

4.6.1 Standard interrupted press stroke

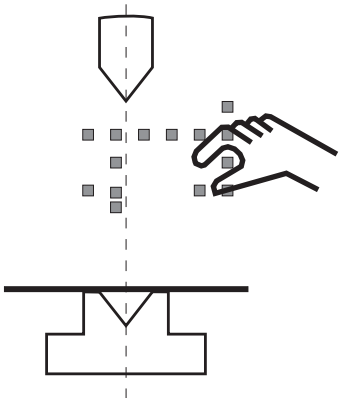
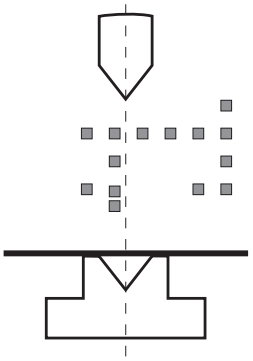
The press stroke must be interrupted if

- an object interrupts the advance measuring field,
- there is side intervention into the protected field,
- there is side intervention into a reduced protected field during dynamic muting.

Procedure when advance measuring field is interrupted

Downward movement: Object interrupts advance measuring field, starts dynamic muting OSSD signal: 1 Mute signal: becomes 0 LED OSSD: lights LED Mute: goes out Control system initiates the stopping of the press, measuring field was not interrupted in the expected position (pinch point)	
Upper tool continues moving for the overrun distance, protected field interrupted. Object is removed. Protected field cleared. Press stroke can be resumed.	

Side intervention with full protected field or reduced protected field during the dynamic muting

Object interrupts the protected field to the side: OSSD signal: 1->0 Mute signal: 1 LED OSSD = goes out LED Mute = lights Control system initiates the stopping of the press stroke.	
Upper tool continues moving for the overrun distance, protected field interrupted. Object is removed. Protected field cleared. Press stroke can be resumed.	

4.7 Braking ramp monitoring (productive version)

When using the productive version of PSENvip braking ramp monitoring is absolutely essential. To monitor the braking ramp the press overruns must be measured at various speeds; i.e. an overrun profile must be created. The user has to determine a monitoring curve (worst case curve) from the overrun profile. The determined monitoring curve is valid generally and it can be adapted upwards if required, provided that safety is guaranteed.

Further information is available under Configure braking ramp monitoring [📖 98].

Two procedures can be selected for brake ramp monitoring:

Brake ramp monitoring by the PAS4000 user program

In this procedure the current position has to be determined safely using two incremental encoders. The electronic modules PSSu E F INC and PSSu K F INC are available to record and evaluate the current position values safely. Please refer to the operating manual of the electronic module you are using.
It is the task of the PAS4000 user program to monitor the monitoring curve for any violation using the safely determined current positions.

Braking ramp monitoring using PSENvip

From Hardware version 2 and Firmware version 2.0 the receiver PSENvip R/PSENvip R LR is supported by a procedure for braking ramp monitoring. For braking ramp monitoring by PSENvip, a special module PSSu K F FAU P from Hardware version 3 and Firmware version 2.0 is required.
For braking ramp monitoring, the values of the monitoring curve (worst case curve) have to be transferred via the PAS4000 user program to the special module PSSu K F FAU P. Please refer to the PSSu K F FAU operating manual for this information.
The special module PSSu K F FAU P uses the current position values coming from the PSENvip to monitor the monitoring curve for violation.

4.8 System cycle base version

This section illustrates the interdependencies of the parameters on the press brake, the base version and the control system PSSu PLC during a press stroke. The upward movement of the press is assumed as a safe movement. The following signals and states are considered:

- OSSD signal: The PSSu K F FAU calculates the status of the protected field from the image data on the receiver and generates an OSSD signal. The OSSD signal controls the outputs of the PSSu K F FAU. If the protected field is clear, the OSSDSignal is 1. It switches to 0 if the protected field is interrupted.
- Creep speed mode: Signal that indicates creep speed mode to the safety system.
- Status of protected field: Free, interrupted
- Signal System-Init: If the CNC signals to the PSSu K F FAU B that the press brake is at top dead centre or in an upward movement, System-Init = 1.
- Signal from foot switch: The press stroke is started by operating the foot switch, the signal is 1. If the foot switch is released, the signal switches to 0 and the press stops.
- Closing speed v

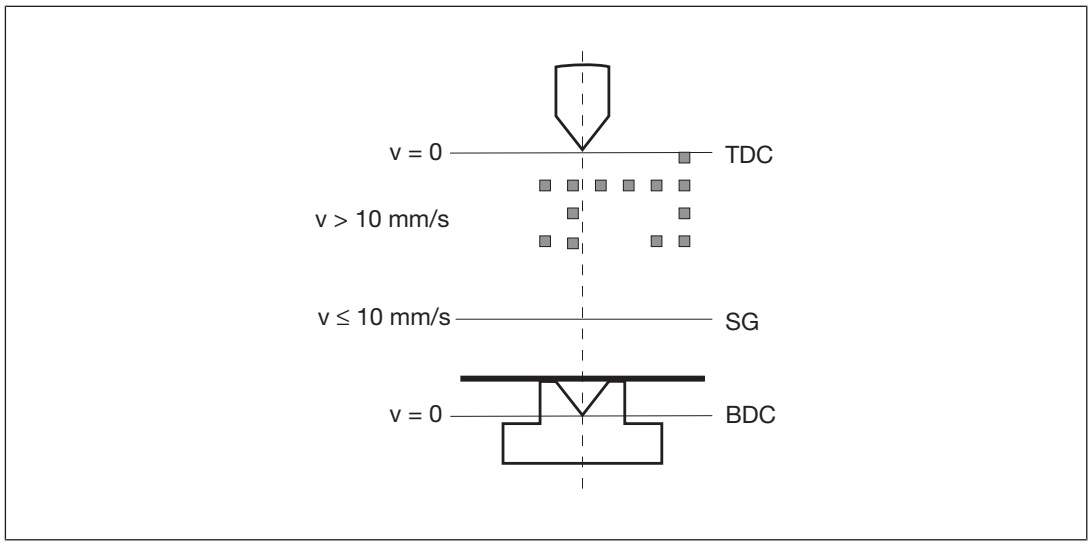


Fig.: Definitions

Legend:

- TDC: Top dead centre
- SG: Creep speed mode signal
- BDC: Bottom dead centre
- v = 0: Closing speed at top/bottom dead centre
- v > 10 mm/s: Closing speed in rapid traverse
- v ≤10 mm/s: Closing speed in creep speed mode

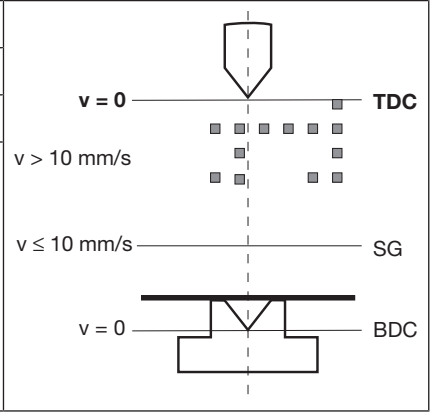
4.8.1 System cycle for standard press stroke

PSENvip transfers a position value to the special module PSSu K F FAU B (see I/O-D data type PROTECTION_FIELD_SIZE):
Position = <*Configured overrun*> + 8 mm

A press stroke with full protected field has the following states:

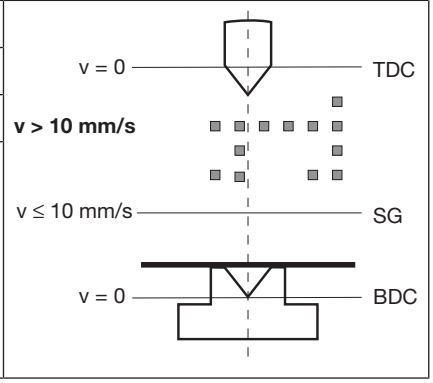
- **Press is at top dead centre**

  Protected field: Free

Signal/action	Status	Press
Foot switch	0	
System-Init	1	
OSSD	1	
Creep speed	0	

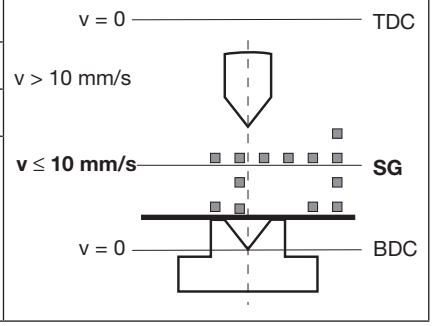
- **Downward movement (rapid traverse)**

  Protected field: Free

Signal/action	Status	Press
Foot switch	**1**	
System-Init	**0**	
OSSD	1	
Creep speed	0	

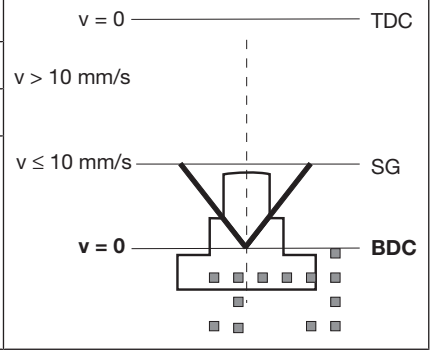
- **Downward movement (creep speed)**

  Protected field: Free

Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	1	
Creep speed	**1**	

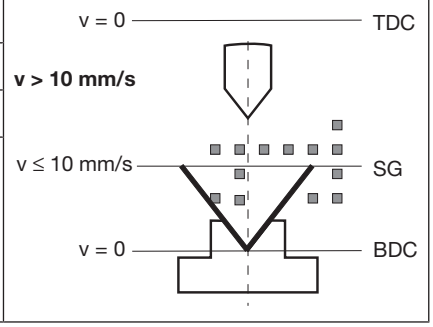
Press is at bottom dead centre

Protected field: Interrupted

Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	**0**	
Creep speed	1	

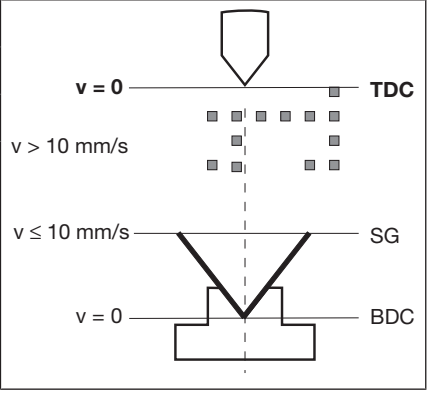
Upward movement (rapid traverse)

Protected field: Free or interrupted

Signal/action	Status	Press
Foot switch	1	
System-Init	**1**	
OSSD	**0 or 1**	
Creep speed	0	

Press is at top dead centre

Protected field: Free

Signal/action	Status	Press
Foot switch	**0**	
System-Init	1	
OSSD	**1**	
Creep speed	0	

4.8.2 System procedure in box bending press stroke

PSENvip transfers a position value to the special module PSSu K F FAU B (see I/O-D data type PROTECTION_FIELD_SIZE):
Position = <*Configured overrun*> + 8 mm

Please note:

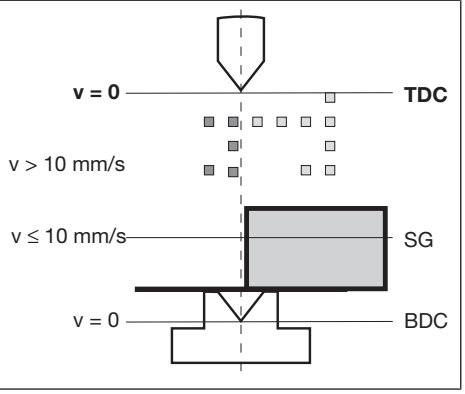
- On each press stroke, the "Reduced protected field" protected field mode **must** be started via an acknowledgement. The acknowledgement can take place either when the press stroke is started at top dead centre or after the protected field meets the workpiece (see Protected field modes [📖 23]).
- In box bending protected field mode, the front segments of the protected field are blanked.

4.8.2.1 Acknowledgement when starting at top dead centre

The reduced protected field starts with an acknowledgement (e.g. acknowledgement button), when the downward movement is started at top dead centre (TDC). The following states are available:

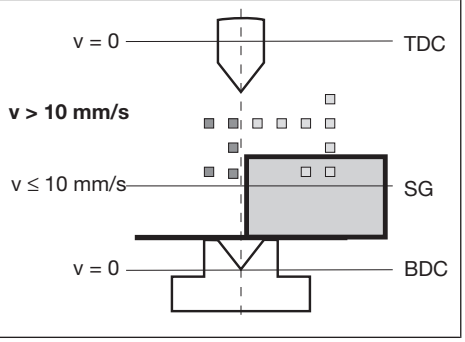
- **Press is at top dead centre**

  Protected field: Free

Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	1	
Creep speed	0	

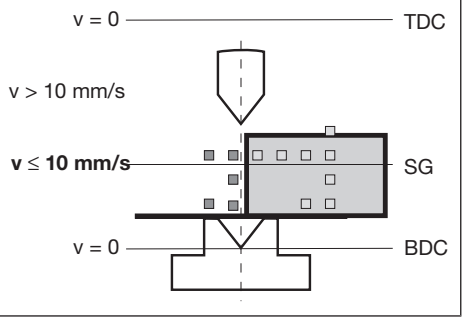
- **Downward movement (rapid traverse)**

  Protected field: Free

Signal/action	Status	Press
Foot switch	**1**	
Acknowledgement of "reduced protected field" protected field mode	**0 -> 1**	
System-Init	**0**	
OSSD	1	
Creep speed	0	

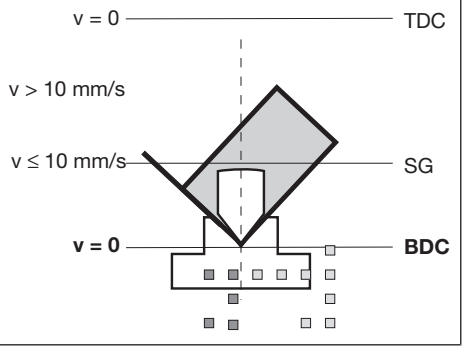
Downward movement (creep speed)

Protected field: Free

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**1 or 0**	
System-Init	0	
OSSD	1	
Creep speed	**1**	

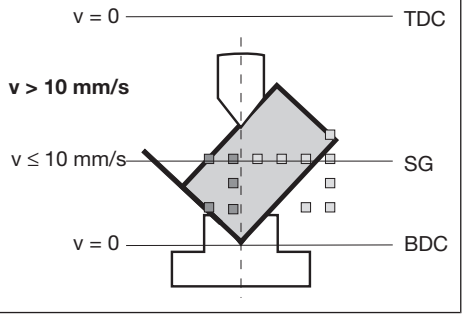
Press is at bottom dead centre

Protected field: Interrupted

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**0**	
System-Init	0	
OSSD	**0**	
Creep speed	1	

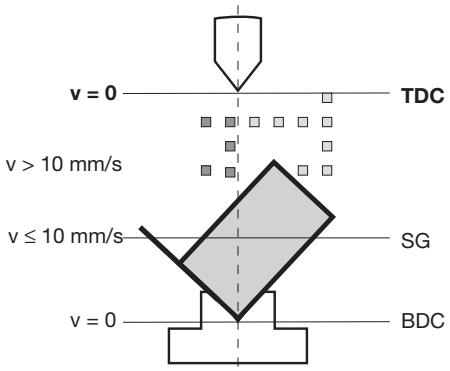
Upward movement (rapid traverse)

Protected field: Free or interrupted

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	**1**	
OSSD	**0 or 1**	
Creep speed	0	

Press is at top dead centre

Protected field: Free

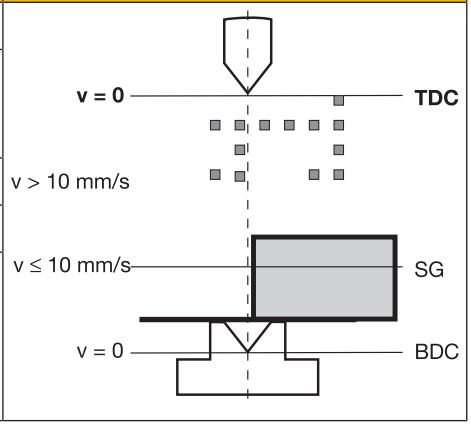
Signal/action	Status	Press
Foot switch	**0**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	**1**	
Creep speed	0	

4.8.2.2 Acknowledgement after protected field meets the workpiece

The press stroke is stopped when the protected field meets the workpiece. The reduced protected field starts after the downward movement is stopped with the acknowledgement (e.g. acknowledgement button). The following states are available:

- **Press is at top dead centre**

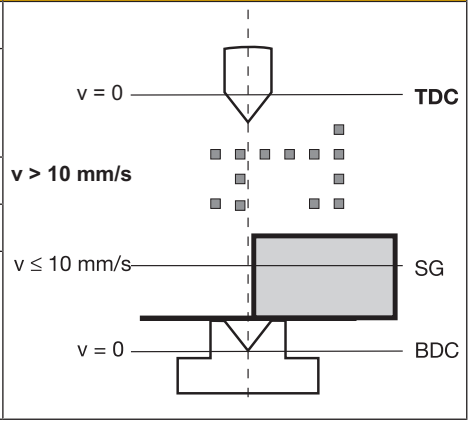
  Protected field: Free

Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	1	
Creep speed	0	

- **Downward movement (rapid traverse)**

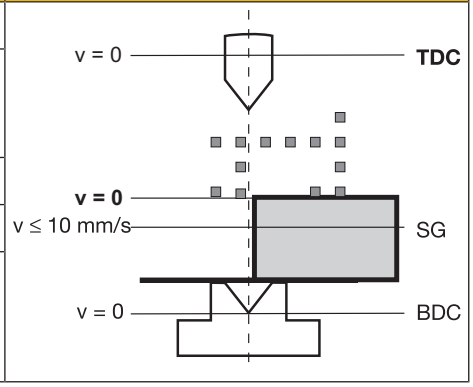
  Full protected field active

  Protected field: Free

Signal/action	Status	Press
Foot switch	**1**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	**0**	
OSSD	1	
Creep speed	0	

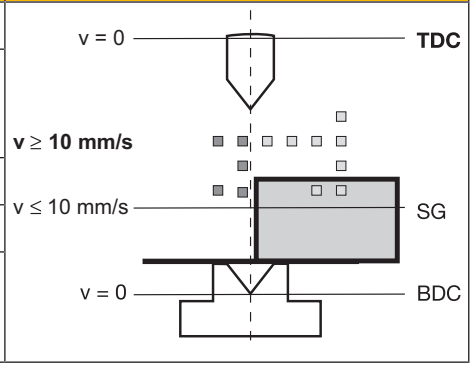
- **Downward movement is stopped, full protected field meets the workpiece**

  Protected field: Interrupted

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 -> 0**	
Creep speed	0	

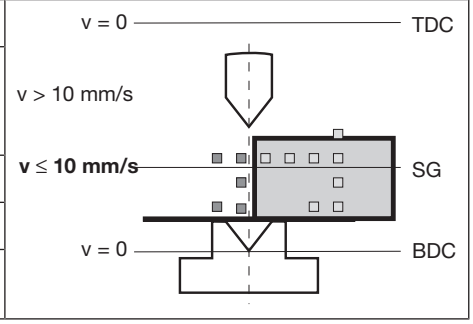
- **Downward movement is continued with reduced protected field, start via acknowledgement**

  Protected field: Free

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**0 -> 1**	
System-Init	0	
OSSD	**1**	
Creep speed	0	

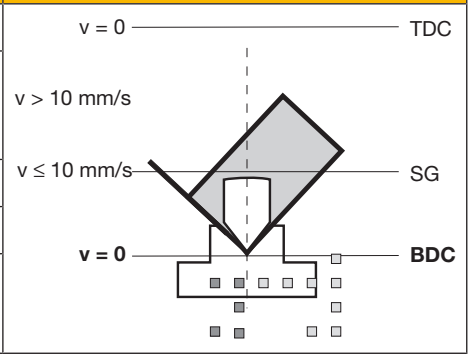
- **Downward movement (creep speed)**

  Protected field: Free

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**1 or 0**	
System-Init	0	
OSSD	1	
Creep speed	**1**	

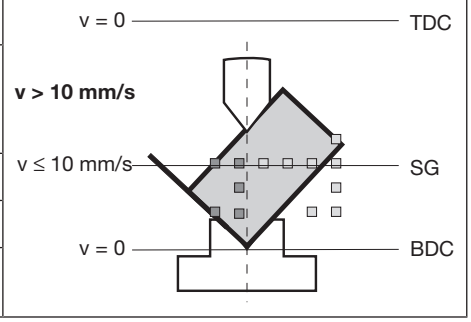
- **Press is at bottom dead centre**

  Protected field: Interrupted

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**0**	
System-Init	0	
OSSD	**0**	
Creep speed	1	

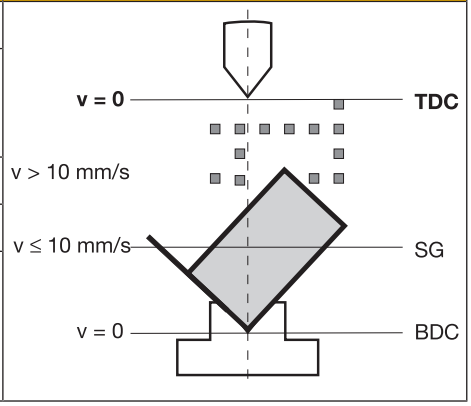
Upward movement (rapid traverse)

Protected field: Free or interrupted

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	**1**	
OSSD	**0 or 1**	
Creep speed	**0**	

Press is at top dead centre

Protected field: Free

Signal/action	Status	Press
Foot switch	**0**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	**1**	
Creep speed	0	

4.8.3 System cycle for back gauge press stroke

The system cycle is the same as for box bending. Please note that with back gauge protected field mode, the rear segments of the protected field are blanked. On each press stroke, the "Reduced protected field"protected field mode must be started via an acknowledgement.

4.8.4 System cycle in for box bending with back gauge press stroke

The system cycle is the same as for box bending. Please note that with box bending with back gauge protected field mode, both the front and rear segments of the protected field are blanked. On each press stroke, the "Reduced protected field"protected field mode must be started via an acknowledgement.

4.8.5 System cycle for overrun measurement

The overrun is measured using the central segments of the protected field. The status of evaluation field A is evaluated during overrun measurement. The evaluation field is 6 mm below the tool centre point. The overrun measurement begins when the protected field is interrupted.

A: Evaluation field

P: Test piece

v_{max}: maximum closing speed

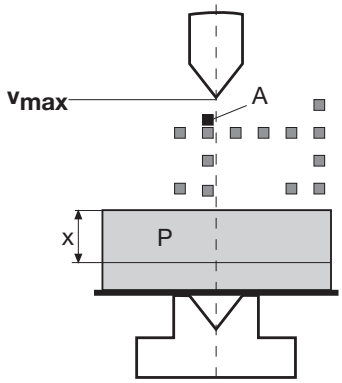
x: Set overrun

y: Measured overrun

OverrunMeasurement: Signal for overrun from the special module PSSu K F FAU (see operating manual of the PSSu K F FAU B, PSSu K F FAU P)

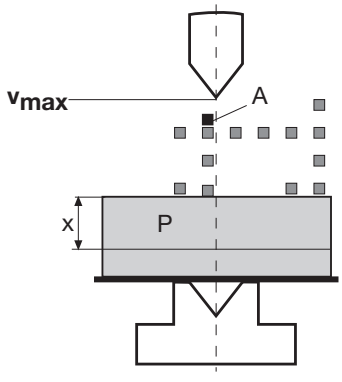
▶ **Downward movement with maximum closing speed v_{max}**

Protected field: Free

Signal/action	Status	Press
OverrunMeasurement	0	
Overrun measurement	0	

▶ **Downward movement with maximum closing speed v_{max}, braking process initiated, start of overrun measurement**

Protected field: Interrupted

Signal/action	Status	Press
OverrunMeasurement	1	
Overrun measurement	1 (evaluation field clear)	

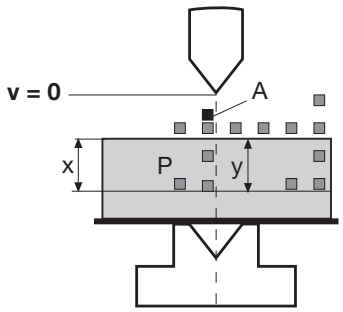
- **Overrun observed**

  Protected field: Interrupted

  Closing speed v = 0,

  End of overrun measurement,

  y = x

Signal/action	Status	Press
OverrunMeasurement	1	
Overrun measurement	1 (evaluation field clear)	

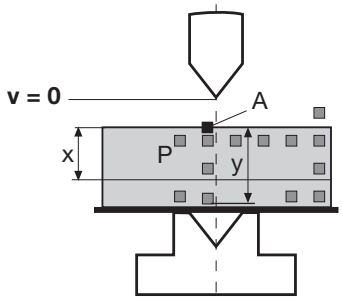
- **Overrun exceeded**

  Protected field: Interrupted

  Closing speed v = 0,

  End of overrun measurement,

  y > x

Signal/action	Status	Press
OverrunMeasurement	0	
Overrun measurement	0 (evaluation field interrupted)	

When the protected field is interrupted, the PAS4000 user program must check whether the evaluation field was interrupted. If the configured overrun has been exceeded, the possibility of the press stroke continuing at fast closing speed (>10 mm/s) must be excluded. This can be achieved as follows, for example

- Interlock
- Press stroke only possible at creep speed
- Restarting the press

When the protected field is clear again, on the base version, overrun measurement will be reset automatically. On the productive version, overrun measurement will be reset when the protected field is clear again and is at full size.

4.9 System cycle productive version

This section illustrates the interdependencies of the parameters on the press brake, the productive version and the control system PSSu PLC during a press stroke. The following signals and states are considered:

- Signal from foot switch: The press stroke is started by operating the foot switch, the signal is 1. If the foot switch is released, the signal switches to 0 and the press stops.
- Signal System-Init: If the CNC signals to the PSSu K F FAU P that the press brake is at top dead centre or in an upward movement, System-Init = 1.
- OSSD signal: The PSSu K F FAU calculates the status of the protected field from the image data on the receiver and generates an OSSD signal. The OSSD signal controls the outputs of the PSSu K F FAU. If the protected field is clear, the OSSDSignal is 1. It switches to 0 if the protected field is interrupted.
- Status of protected field: Free, interrupted
- Mute signal: signals whether dynamic muting is activated or deactivated. Dynamic muting starts when the advance measuring field touches the pinch point on the workpiece. It ends when the tool centre point reaches the muting end point.
  The signal is reset to "1" when the protected field is fully activated and the advance measuring field is clear.
  A protected field that has already been partly deactivated can be completely reactivated by
  - side intervention
  - the signal System-Init = 1
- Muting OSSD signal: The OSSD signal is muted.
  If the tool centre point reaches the muting end point, the OSSD signal switches from 1 to 0. To enable the downward movement of the press to continue, the OSSD signal must be muted.
- Monitoring of braking ramp: if the advance measuring field reaches the pinch point, monitoring of the braking ramp must be started
- Monitoring of pinch point: if the advance measuring field reaches the pinch point, monitoring of the pinch point must be started

The upward movement of the press is assumed as a safe movement.

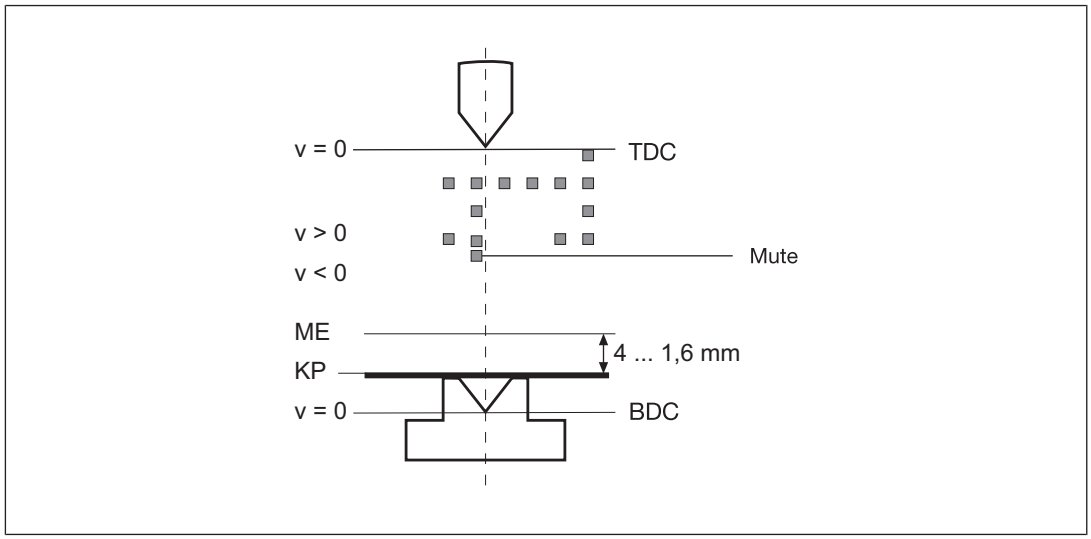


Fig.: Definitions

Legend:

- TDC: Top dead centre
- ME: Muting end point (4 … 1.6 mm), end of dynamic muting
- PP: Pinch point
- BDC: Bottom dead centre
- v = 0 mm/s: Closing speed at top/bottom dead centre
- v > 0 mm/s: Downward movement
- v < 0 mm/s: Upward movement
- Mute: influences mute signal

4.9.1 System cycle for standard press stroke

PSENvip transfers position values to the special module PSSu K F FAU P (see I/O data type PROTECTION_FIELD_SIZE), which can be used in the user program for feasibility testing.

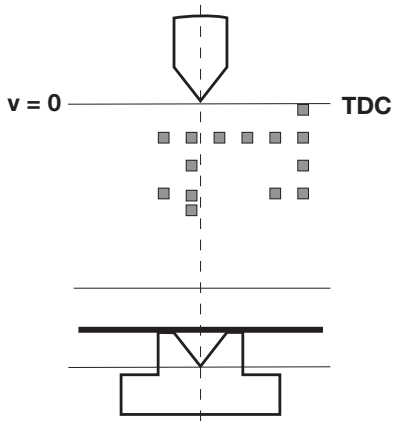
A press stroke with full protected field has the following states:

- **Press is at top dead centre**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

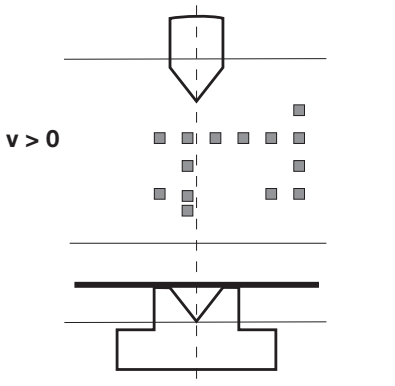
Signal/action	Status	Press
Foot switch	0	
System-Init	1	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

- **Downward movement (rapid traverse)**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

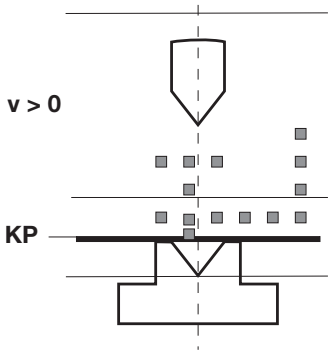
Signal/action	Status	Press
Foot switch	**1**	
System-Init	**0**	
OSSD	**1**	
Mute	**1**	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

- **Downward movement, advance measuring field touches workpiece at the pinch point (KP)**

Protected field: Free

Dynamic muting: Start

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + 6 mm + 2 mm – (2 mm from first muting stage)
Position = <*Configured overrun*> + 6 mm

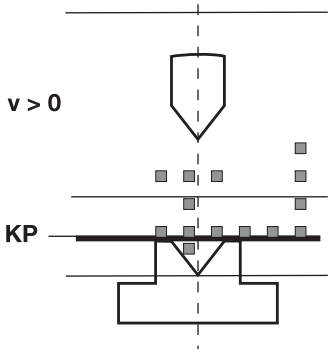
Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	1	
Mute	**1 -> 0**	
Muting OSSD	Inactive	
Monitoring of braking ramp	**Start**	
Monitoring of pinch point	**Active**	

- **Downward movement, gradual reduction of protected field**

Protected field: Free

Dynamic muting: Active

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + (6 mm + 2 mm) – (2 mm x number of muting stages)
Example for 2nd muting stage: Position = <*Configured overrun*> + 4 mm

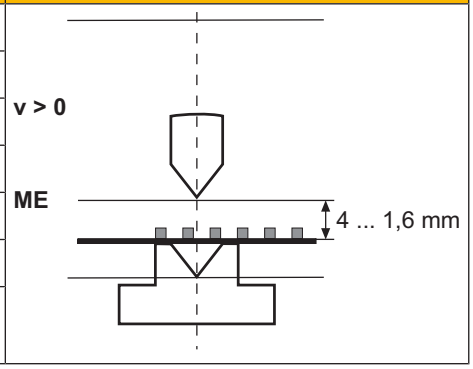
Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	1	
Mute	**0**	
Muting OSSD	Inactive	
Monitoring of braking ramp	**Active**	
Monitoring of pinch point	Active	

- **Downward movement, tool centre point reaches muting end point (ME)**

Protected field: Interrupted

Dynamic muting: End

Position = Minimum protected field height (including reserve, without advance measuring field)
Position = <*Configured muting end point*> + 0.4 mm (rounded to mm)
Position value is frozen

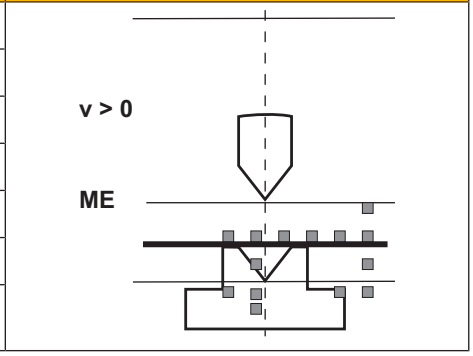
Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	**1 -> 0**	
Mute	0	
Muting OSSD	**Start**	
Monitoring of braking ramp	Active	
Monitoring of pinch point	**Inactive**	

- **Downward movement**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

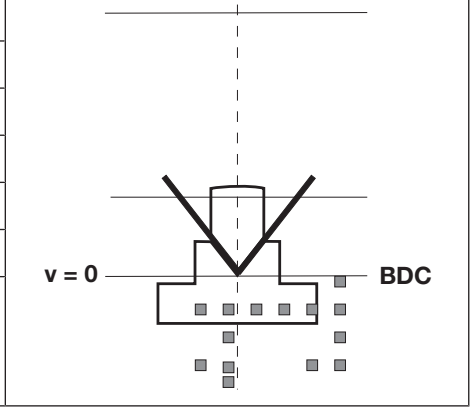
Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	**0**	
Mute	0	
Muting OSSD	**Active**	
Monitoring of braking ramp	**End**	
Monitoring of pinch point	Inactive	

- **Press is at bottom dead centre**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

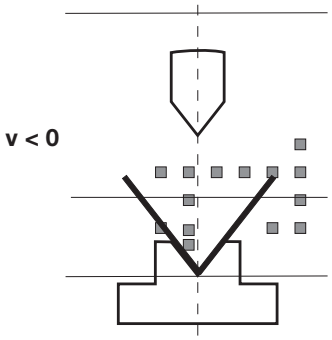
Signal/action	Status	Press
Foot switch	1	
System-Init	0	
OSSD	0	
Mute	0	
Muting OSSD	**End**	
Monitoring of braking ramp	**Inactive**	
Monitoring of pinch point	Inactive	

Upward movement, advance measuring field is cleared

Protected field: Free or interrupted

Dynamic muting: Inactive

Position = Frozen value

Signal/action	Status	Press
Foot switch	**1 or 0**	
System-Init	0	
OSSD	**1 or 0**	
Mute	**0 -> 1**	
Muting OSSD	**Inactive**	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

The foot switch may only be released during a safe upward movement.

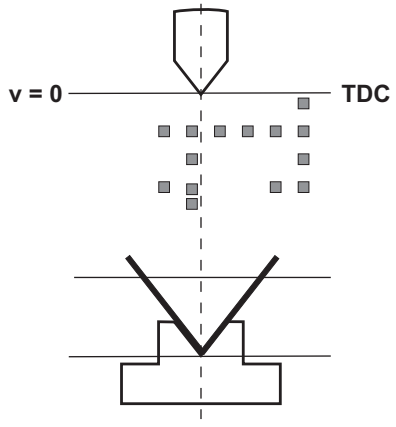
Press is at top dead centre

Protected field: Free

Dynamic muting: Inactive

Position = Protected field height (including reserve + advance measuring field)

Position = <*Configured overrun*> + 6 mm + 2 mm

Signal/action	Status	Press
Foot switch	0	
System-Init	**1**	
OSSD	**1**	
Mute	**1**	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

4.9.2 System cycle for box bending press stroke

PSENvip transfers position values to the special module PSSu K F FAU P (see I/O data type PROTECTION_FIELD_SIZE), which can be used in the user program for feasibility testing.

Please note:

- On each press stroke, the "Reduced protected field" protected field mode **must** be started via an acknowledgement. The acknowledgement can take place either when the press stroke is started at top dead centre or after the protected field meets the workpiece (see Protected field modes [📖 23]).
- In box bending protected field mode, the front segments of the protected field are blanked.

4.9.2.1 Acknowledgement when starting at top dead centre

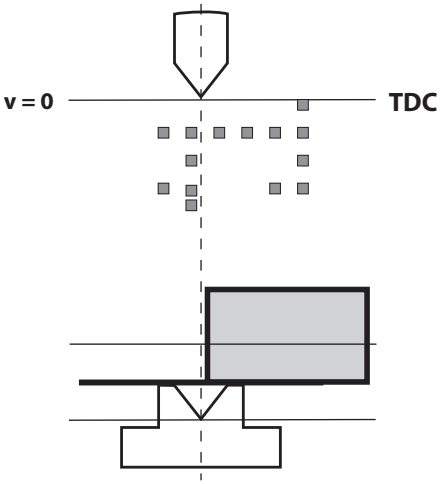
The reduced protected field starts with an acknowledgement (e.g. acknowledgement button), when the downward movement is started at top dead centre (TDC). The following states are available:

- **Press is at top dead centre**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

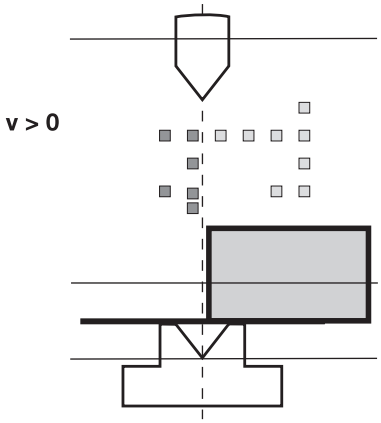
Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

- **Downward movement (rapid traverse)**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

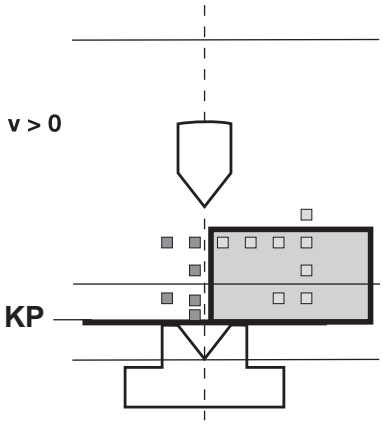
Signal/action	Status	Press
Foot switch	**1**	
Acknowledgement of "reduced protected field" protected field mode	**0 -> 1**	
System-Init	**0**	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

- **Downward movement, advance measuring field touches workpiece at the pinch point (KP)**

  Protected field: Free

  Dynamic muting: Start

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm – (2 mm from first muting stage)
  Position = <*Configured overrun*> + 6 mm

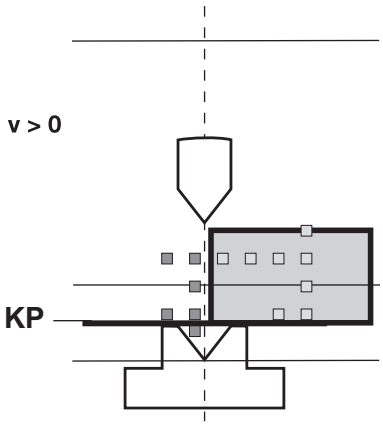
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**1 or 0**	
System-Init	0	
OSSD	1	
Mute	**1 -> 0**	
Muting OSSD	Inactive	
Monitoring of braking ramp	**Start**	
Monitoring of pinch point	**Active**	

- **Downward movement, gradual reduction of protected field**

  Protected field: Free

  Dynamic muting: Active

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + (6 mm + 2 mm) – (2 mm x number of muting stages)
  Example for 2nd muting stage: Position = <*Configured overrun*> + 4 mm

Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**0**	
System-Init	0	
OSSD	1	
Mute	**0**	
Muting OSSD	Inactive	
Monitoring of braking ramp	**Active**	
Monitoring of pinch point	Active	

- **Downward movement, tool centre point reaches muting end point (ME)**

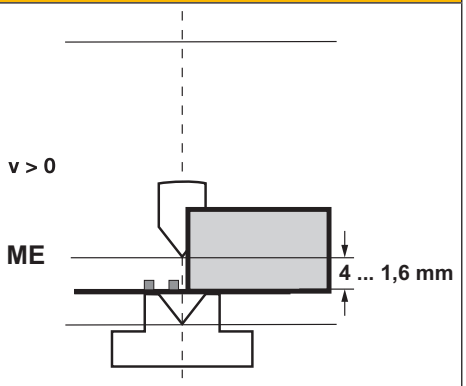
  Protected field: Interrupted

  Dynamic muting: End

  Position = Minimum protected field height (including reserve, without advance measuring field)

  Position = <*Configured overrun*> + 0.4 mm (rounded to mm)

  Position value is frozen

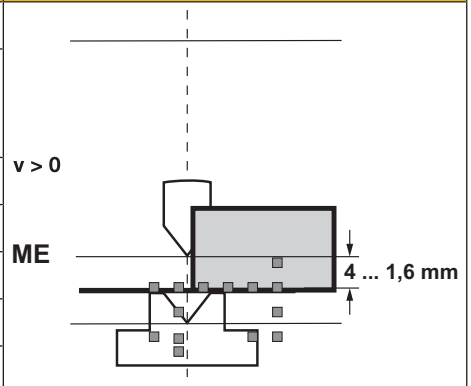
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 -> 0**	
Mute	0	
Muting OSSD	**Start**	
Monitoring of braking ramp	Active	
Monitoring of pinch point	**Inactive**	

- **Downward movement**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

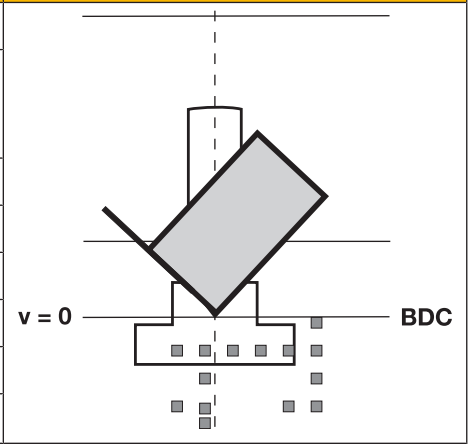
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**0**	
Mute	0	
Muting OSSD	**Active**	
Monitoring of braking ramp	**End**	
Monitoring of pinch point	Inactive	

- **Press is at bottom dead centre**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

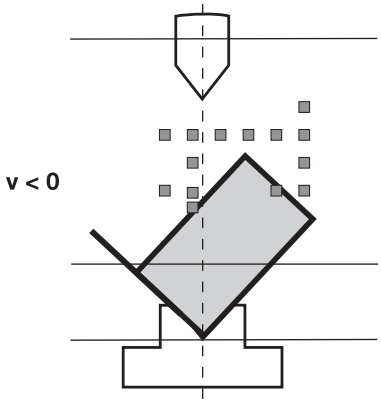
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	0	
Mute	0	
Muting OSSD	**End**	
Monitoring of braking ramp	**Inactive**	
Monitoring of pinch point	Inactive	

- **Upward movement, advance measuring field is cleared**

  Protected field: Free or interrupted

  Dynamic muting: Inactive

  Position = Frozen value

Signal/action	Status	Press
Foot switch	**1 or 0**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 or 0**	
Mute	**0 -> 1**	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

The foot switch may only be released during a safe upward movement.

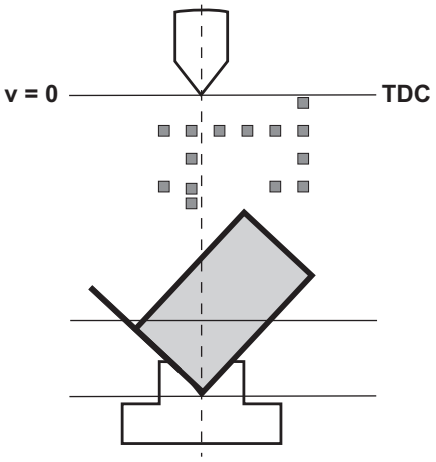
- **Press is at top dead centre**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)

  Position = <*Configured overrun*> + 6 mm + 2 mm

Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	**1**	
OSSD	**1**	
Mute	**1**	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

4.9.2.2 Acknowledgement after protected field meets the workpiece

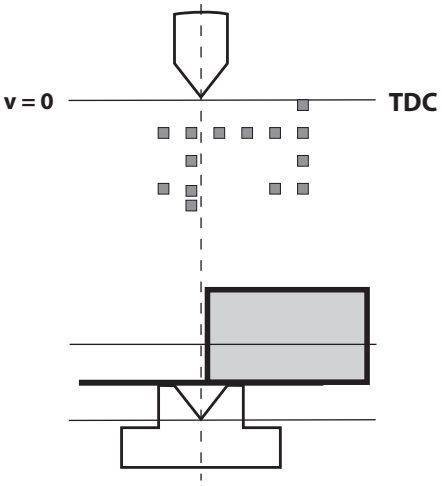
The press stroke is stopped when the protected field meets the workpiece. The reduced protected field starts after the downward movement is stopped with the acknowledgement (e.g. acknowledgement button). The following states are available:

- **Press is at top dead centre**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

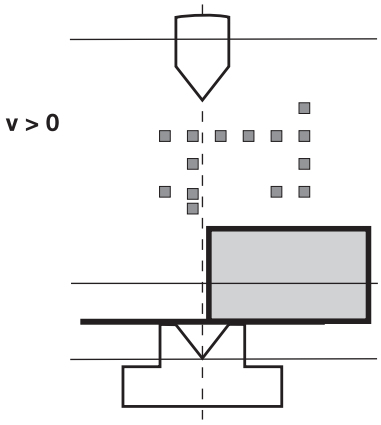
- **Downward movement (rapid traverse)**

  Full protected field active

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)
  Position = <*Configured overrun*> + 6 mm + 2 mm

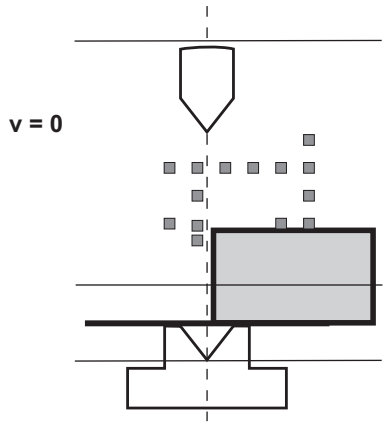
Signal/action	Status	Press
Foot switch	**1**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	**0**	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

Downward movement is stopped, full protected field meets workpiece

Protected field: Interrupted

Dynamic muting: Inactive

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + 6 mm + 2 mm

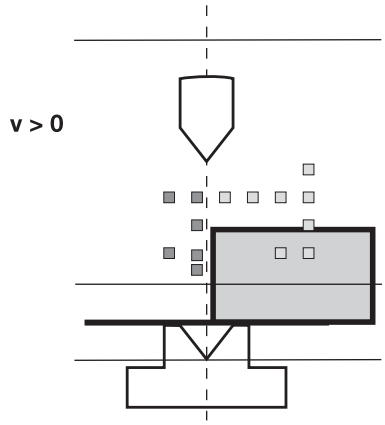
Signal/action	Status	Press
Foot switch	**1**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 -> 0**	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

Downward movement is continued with reduced protected field, start via acknowledgement

Protected field: Free

Dynamic muting: Inactive

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + 6 mm + 2 mm

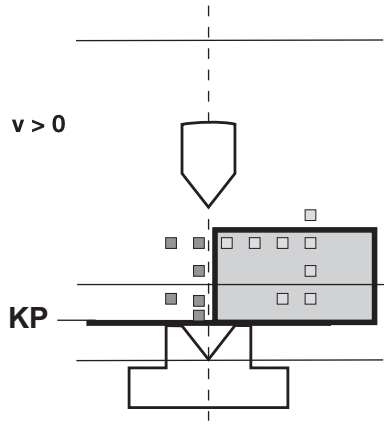
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	**0 -> 1**	
System-Init	0	
OSSD	**1**	
Mute	1	
Muting OSSD	**Inactive**	
Monitoring of braking ramp	**Inactive**	
Monitoring of pinch point	**Inactive**	

Downward movement, advance measuring field touches workpiece at the pinch point (KP)

Protected field: Free

Dynamic muting: Start

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + 6 mm + 2 mm – (2 mm from first muting stage)
Position = <*Configured overrun*> + 6 mm

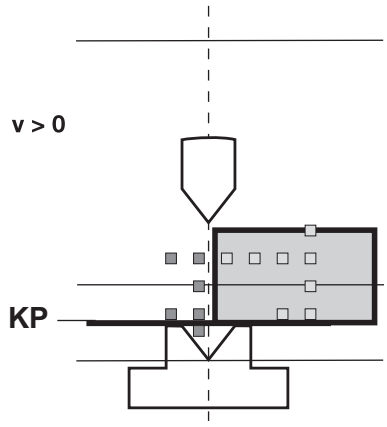
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	1 or 0	
System-Init	0	
OSSD	1	
Mute	**1 -> 0**	
Muting OSSD	Inactive	
Monitoring of braking ramp	**Start**	
Monitoring of pinch point	**Active**	

▸ **Downward movement, gradual reduction of protected field**

Protected field: Free

Dynamic muting: Active

Position = Protected field height (including reserve + advance measuring field)
Position = <*Configured overrun*> + (6 mm + 2 mm) – (2 mm x number of muting stages)
Example for 2nd muting stage: Position = <*Configured overrun*> + 4 mm

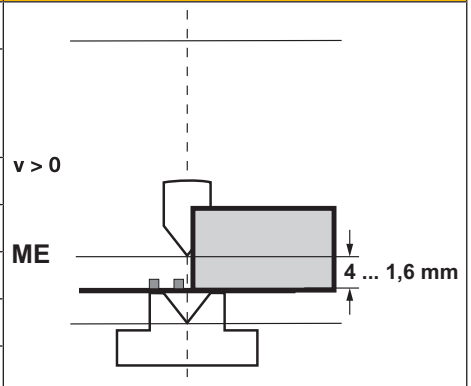
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	1	
Mute	**0**	
Muting OSSD	**Inactive**	
Monitoring of braking ramp	**Active**	
Monitoring of pinch point	Active	

▸ **Downward movement, tool centre point reaches muting end point (ME)**

Protected field: Interrupted

Dynamic muting: End

Position = Minimum protected field height (including reserve, without advance measuring field)
Position = <*Configured overrun*> + 0.4 mm (rounded to mm)
Position value is frozen

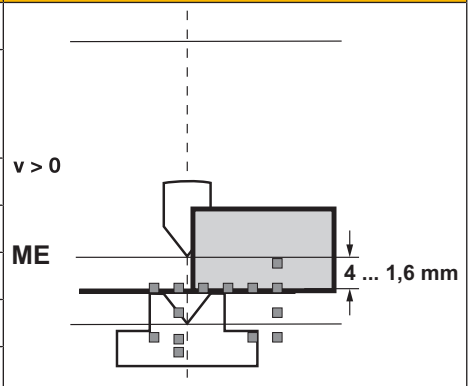
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 -> 0**	
Mute	0	
Muting OSSD	**Start**	
Monitoring of braking ramp	**Active**	
Monitoring of pinch point	**Inactive**	

- **Downward movement**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

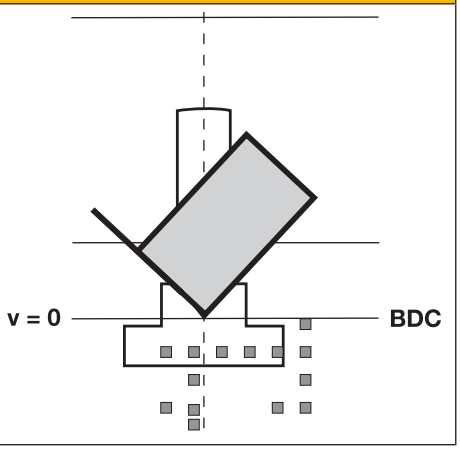
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**0**	
Mute	0	
Muting OSSD	**Active**	
Monitoring of braking ramp	**End**	
Monitoring of pinch point	Inactive	

- **Press is at bottom dead centre**

  Protected field: Interrupted

  Dynamic muting: Inactive

  Position = Frozen value

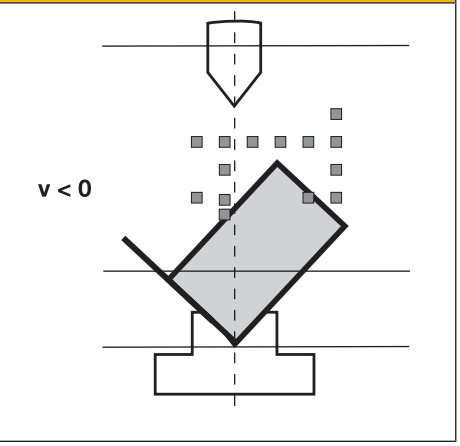
Signal/action	Status	Press
Foot switch	1	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	0	
Mute	0	
Muting OSSD	**End**	
Monitoring of braking ramp	**Inactive**	
Monitoring of pinch point	Inactive	

- **Upward movement, advance measuring field is cleared**

  Protected field: Free or interrupted

  Dynamic muting: Inactive

  Position = Frozen value

Signal/action	Status	Press
Foot switch	**1 or 0**	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	0	
OSSD	**1 or 0**	
Mute	**0 -> 1**	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

The foot switch may only be released during a safe upward movement.

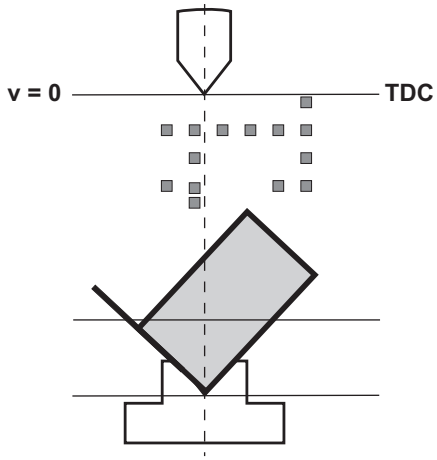
- **Press is at top dead centre**

  Protected field: Free

  Dynamic muting: Inactive

  Position = Protected field height (including reserve + advance measuring field)

  Position = <*Configured overrun*> + 6 mm + 2 mm

Signal/action	Status	Press
Foot switch	0	
Acknowledgement of "reduced protected field" protected field mode	0	
System-Init	1	
OSSD	1	
Mute	1	
Muting OSSD	Inactive	
Monitoring of braking ramp	Inactive	
Monitoring of pinch point	Inactive	

4.9.3 System cycle for back gauge press stroke

The system cycle is the same as for box bending. Please note that with back gauge protected field mode, the rear segments of the protected field are blanked. On each press stroke, the "Reduced protected field"protected field mode must be started via an acknowledgement.

4.9.4 System cycle for box bending with back gauge press stroke

The system cycle is the same as for box bending. Please note that with box bending with back gauge protected field mode, both the front and rear segments of the protected field are blanked. On each press stroke, the "Reduced protected field"protected field mode must be started via an acknowledgement.

4.10 Web interface

A web interface is opened in a web browser on the CNC or on a PC; it communicates with PSENvip via an Ethernet interface. It provides the following options:

- ***Operation***

  Current tool class and the selected protected field mode are displayed

- ***Tool change***

  Tool adjustment during a tool change: The contour of the tool is recorded and assigned to a tool class. Guides can be used to position the tool correctly.

- ***Adjustment***

  Alignment of receiver to transmitter: The tool is shown with guides and an adjustment template. It is possible to check that the transmitter and receiver are aligned correctly.

- ***Service***

  System's configuration data, diagnostic data, Firmware status and error messages for support with troubleshooting. Have this data ready if you require support from Pilz if there is an error.

- ***Settings***

  Adjusting the settings: the settings can be changed once a password has been entered. The default user name is "admin" and the default password is "psenvip". Confirm your entry with ***Submit***

  – A new password can be entered.

  – The title of the web interface can be changed

  – Access to the Tool Change and Adjustment options can be restricted to certain IP addresses. A max. of 5 IP addresses can be entered.

  – A Firmware update can be performed. Please contact Pilz to perform a Firmware update.

INFORMATION

The ***Settings*** option can only be selected if the ***Operation*** option has already been active.

Help

Help for this web interface is displayed

Layout

Buttons on the left or right-hand border of the web interface are displayed.

The web interface also shows the status of the OSSD signal via a red or green ellipse. If an error occurs, an error message is shown.

Operation and installation are described in the Commissioning chapter and in the online help for the web interface.

5 Installation

5.1 General requirements

Please note during installation:

- The PSENvip may only be installed by qualified personnel.
- The environmental data for the PSENvip must be taken into account (see Technical details).
- The transmitter and receiver should be installed with the respective front lenses aligned in parallel to each other.
- The distance between transmitter and receiver must be maintained (see Technical Details [📖 113]).

WARNING!

A restricted field of vision or inadequate mounting will restrict the protected field!

A restricted protected field may lead to serious injury and death.

Ensure that the field of vision of the front lenses on the transmitter and receiver is not restricted. Do not attach any other optical elements such as glass/plastic surfaces, films or lenses.

- Check the mounting of the transmitter and receiver on a regular basis.
- Check that the mounting of the transmitter and receiver is not accidentally working its way loose as a result of vibration from the press brake.

5.2 Install transmitter and receiver

The fastening kit consists of an adapter plate, adjustment plate with slot nut and a mounting plate. The bracket on the upper die must have a corresponding groove in which to insert the slot nut (see diagram).

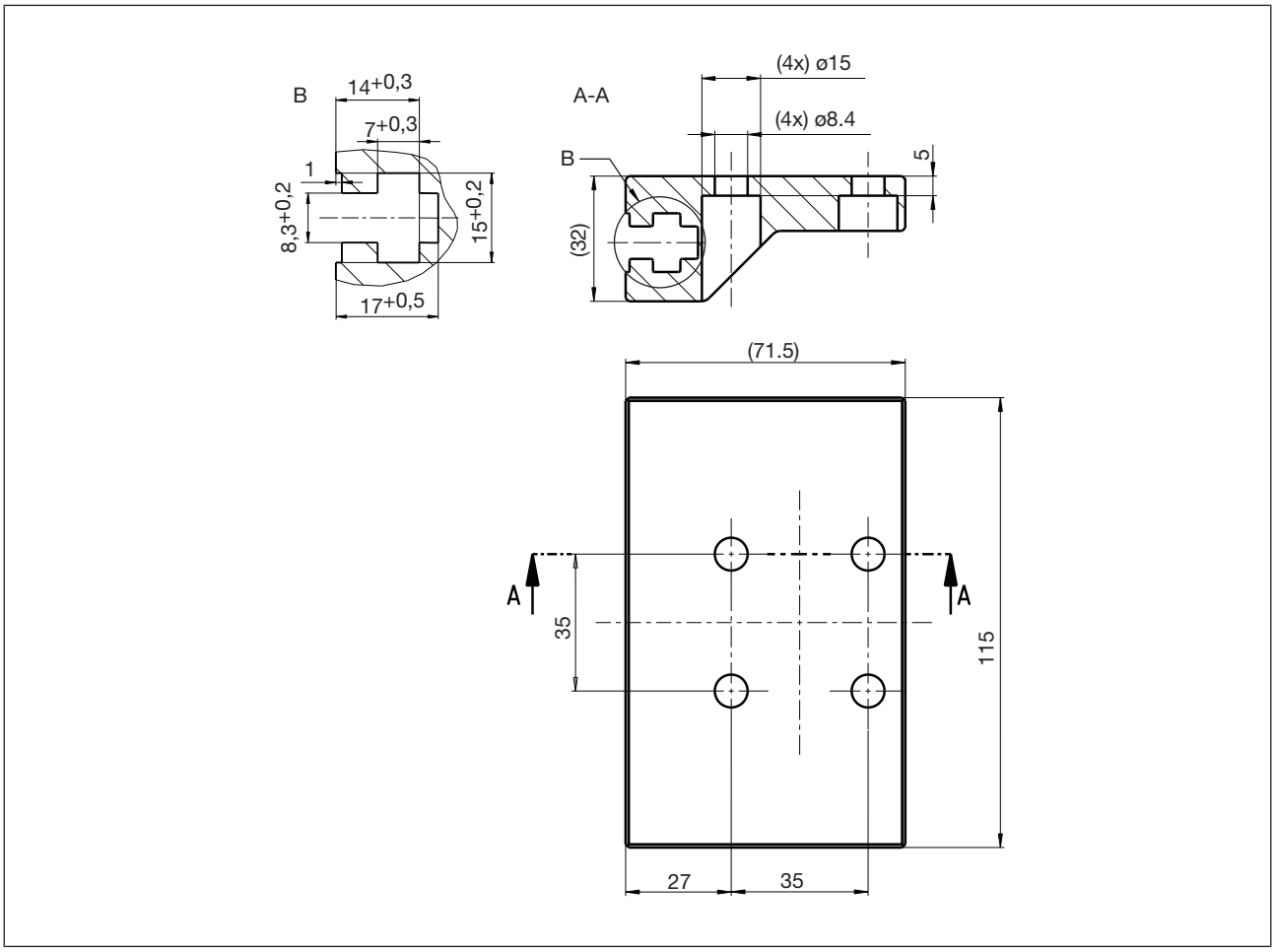


Fig.: Dimensions of adapter plate with groove (dimensions in mm)

The process for installing the transmitter and receiver is the same.

To install the system, proceed as follows:

- Fasten the adjustment plate and mounting plate as shown in the following diagram. Ensure that the flat washers, spring washers and nuts are attached in the right order.

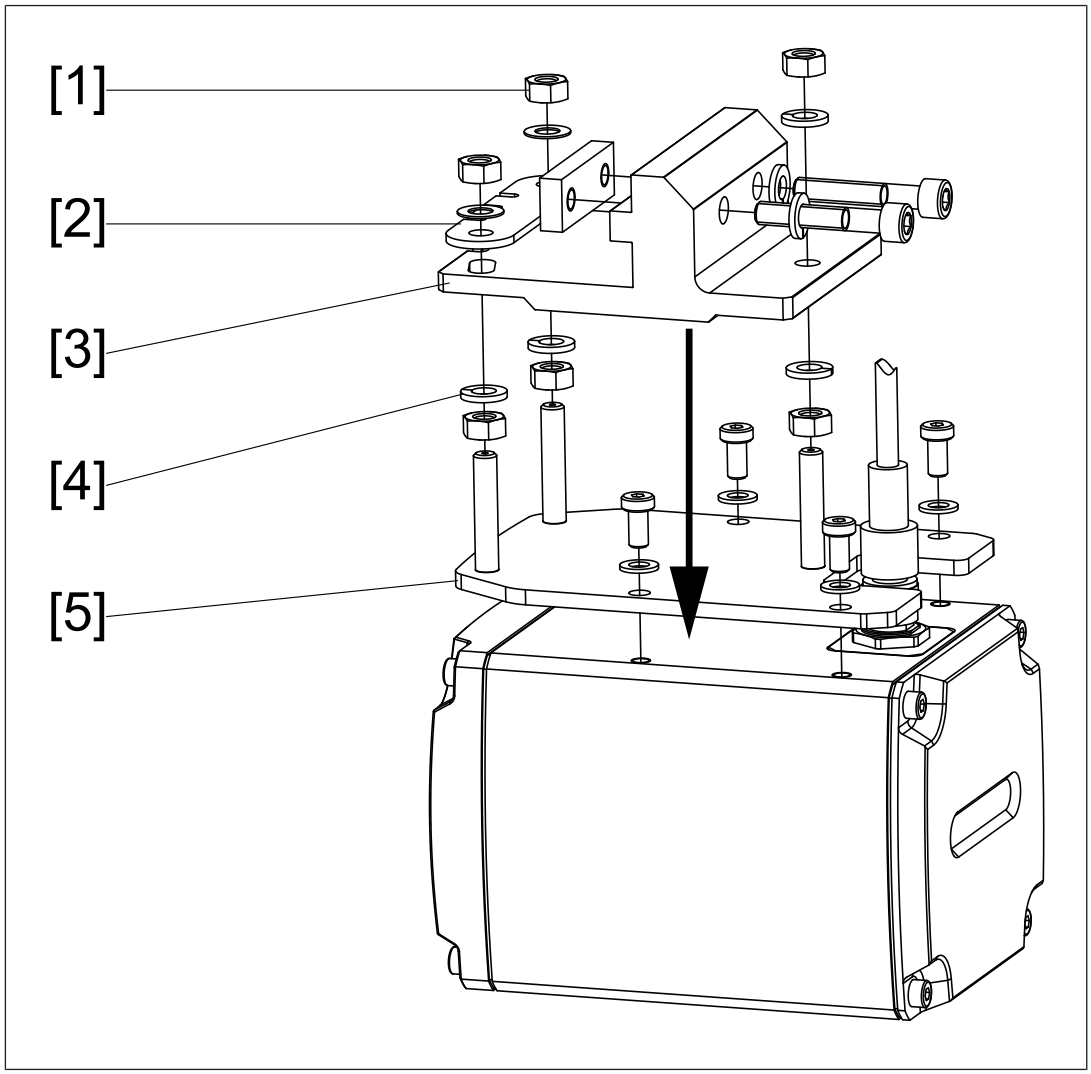


Fig.: Installing transmitter and receiver

Legend:

- [1]: Nut
- [2]: Auxiliary adjustment plate
- [3]: Adjustment plate
- [4]: Flat washer
- [5]: Mounting plate

Viewed from the operator's side, the receiver is installed on either the left or right-hand bracket and then the transmitter on the other bracket.

- Slide the nut slot on the adjustment plate into the groove on the bracket attached to the upper die.

5.3 Dimensions

5.3.1 Transmitter

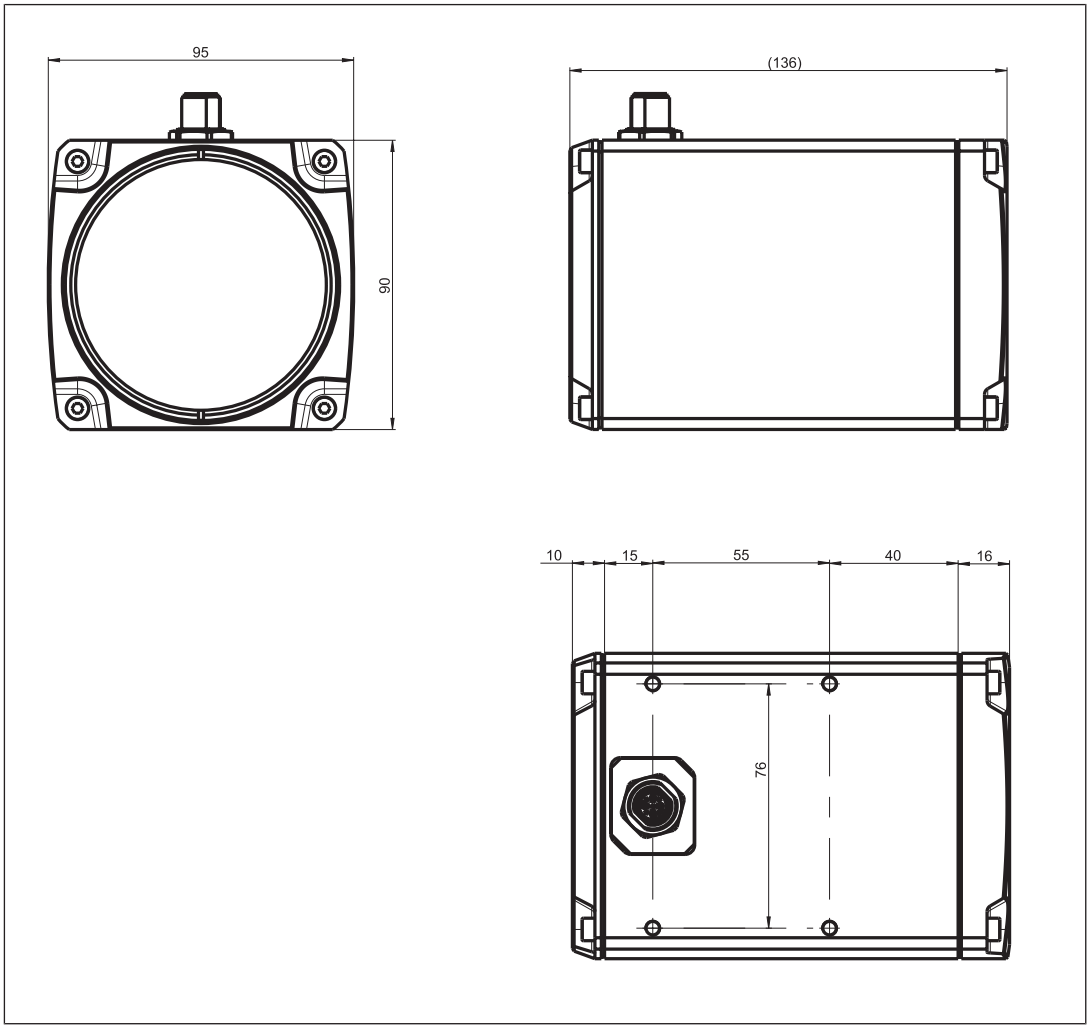


Fig.: Dimensions: Transmitter (dimensions in mm)

5.3.2 Receiver

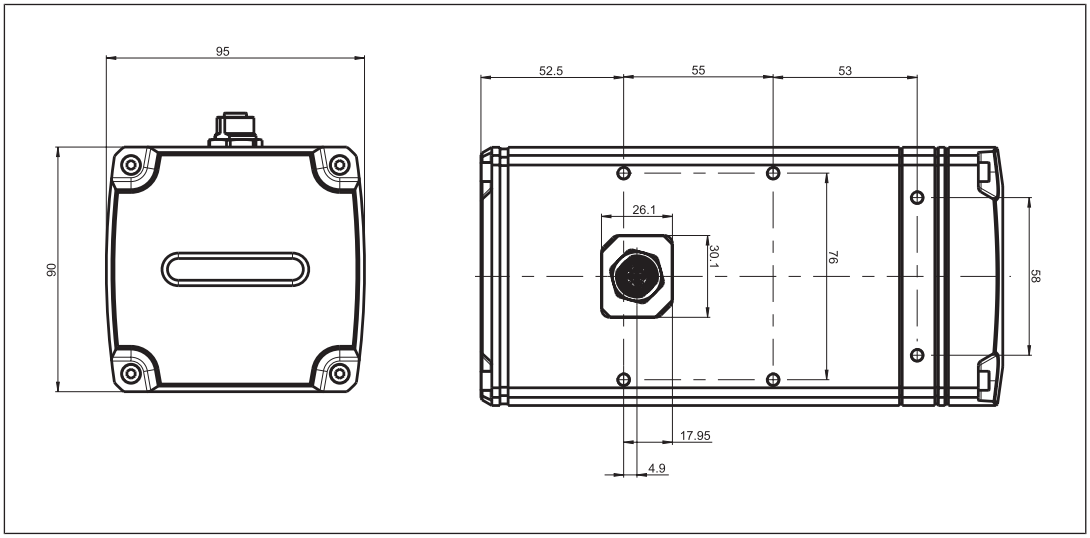


Fig.: Dimensions: Receiver (dimensions in mm)

5.3.3 Fastening kit for the transmitter

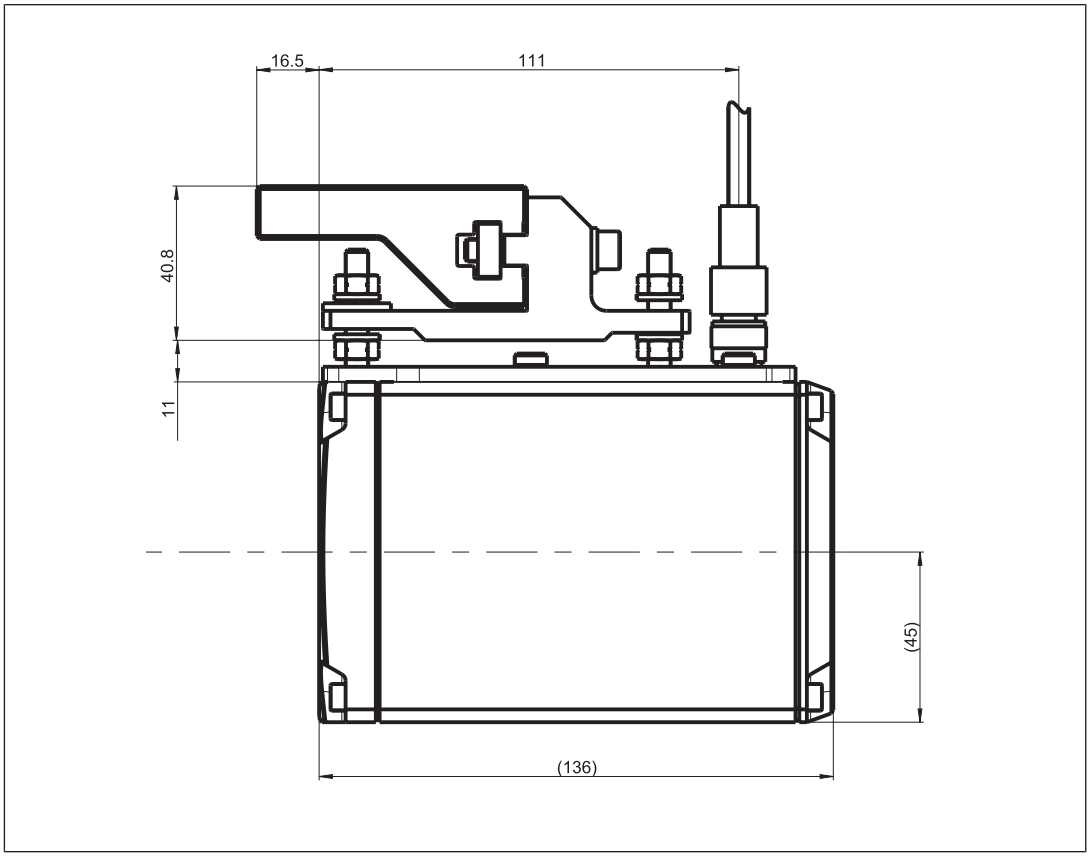


Fig.: Dimensions: Fastening kit for the transmitter (dimensions in mm)

5.3.4 Fastening kit for the receiver

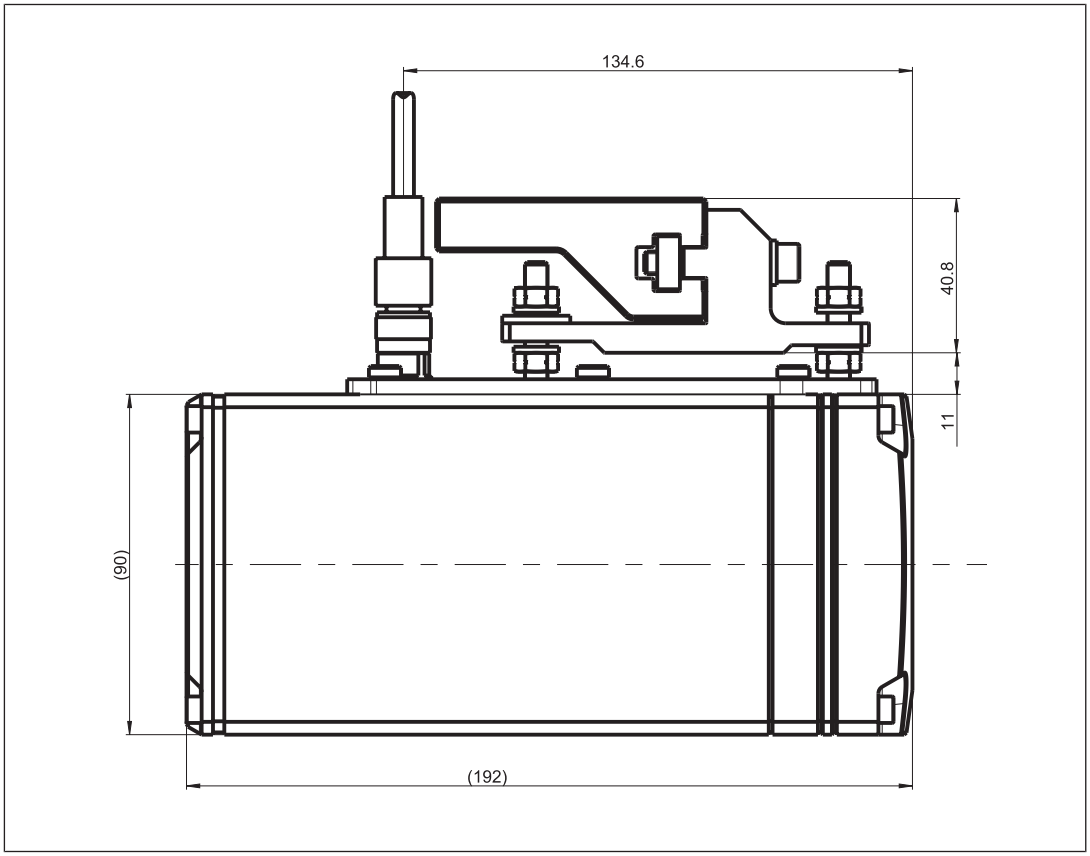


Fig.: Dimensions: Fastening kit for the receiver (dimensions in mm)

6 Wiring

6.1 Notes on wiring

WARNING!

Unintended machine start up!

A unintended start may lead to serious injury and death.

Voltage should be removed from the whole machine and PSENvip during wiring.

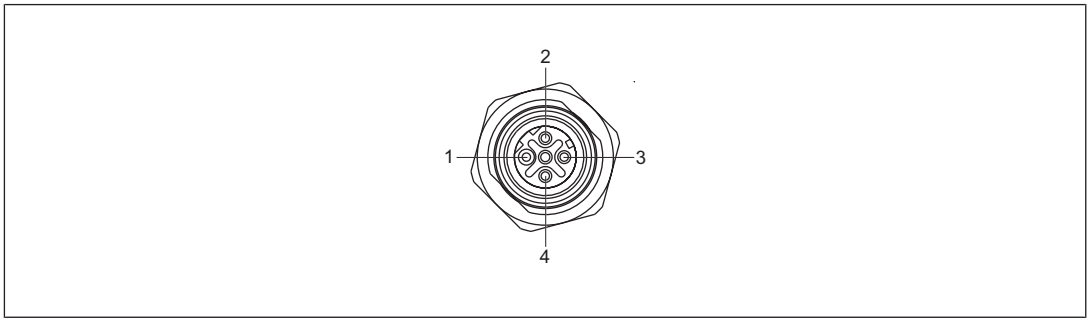
Please observe the following when wiring:

- The transmitter and receiver should only be connected using shielded cables (available as accessories). The cable shield is connected to the metal coupling on the M12 connectors.
- Earth the cable shield connection within the control cabinet, e.g. on a bus bar.
- We recommend you use Pilz ready-made cable to connect the PSENvip (see Order references).
- To use the PSENvip in accordance with the requirements of UL, only use cables listed under Category Code CYJV.
- Protect the cable from mechanical damage. If the cable is not protected through the machine, it should be laid in armoured hose. Lay the cable in such a way that wire short circuits are excluded.
- Avoid interference (e.g. from motors, power lines) by laying cables in a way that is EMC-compliant.

When the wiring is complete the protective equipment will need to undergo a function test (see Check function of protective equipment)

6.2 Receiver

A 4-pin M12 female connector is used to connect to the module PSSu K F FAU. It is located on the top of the receiver.



Configuration:

PIn No.	Designation	Cable colour
1	SerDes+	yellow
2	+5V	white
3	SerDes-	orange
4	GND	blue

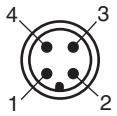
We recommend you use Pilz ready-made cable (see Order references).

If you wish to make the connection cable yourself, please use:

- Category Cat5 cable
- STP star quad cable
- Cable with a diameter of AWG22

6.3 Transmitter

A 4-pin M12 male connector is used to connect to the module PSSu K F FAU. It is located on the top of the transmitter.



Configuration:

Pin no.	Designation	Cable colour
1	24 V DC	brown
2	TRM_SYNC	white
3	0 V	blue
4	TRM_ON	black
Housing	FE	

We recommend you use Pilz ready-made cable (see Order references).

6.4 Connection diagram

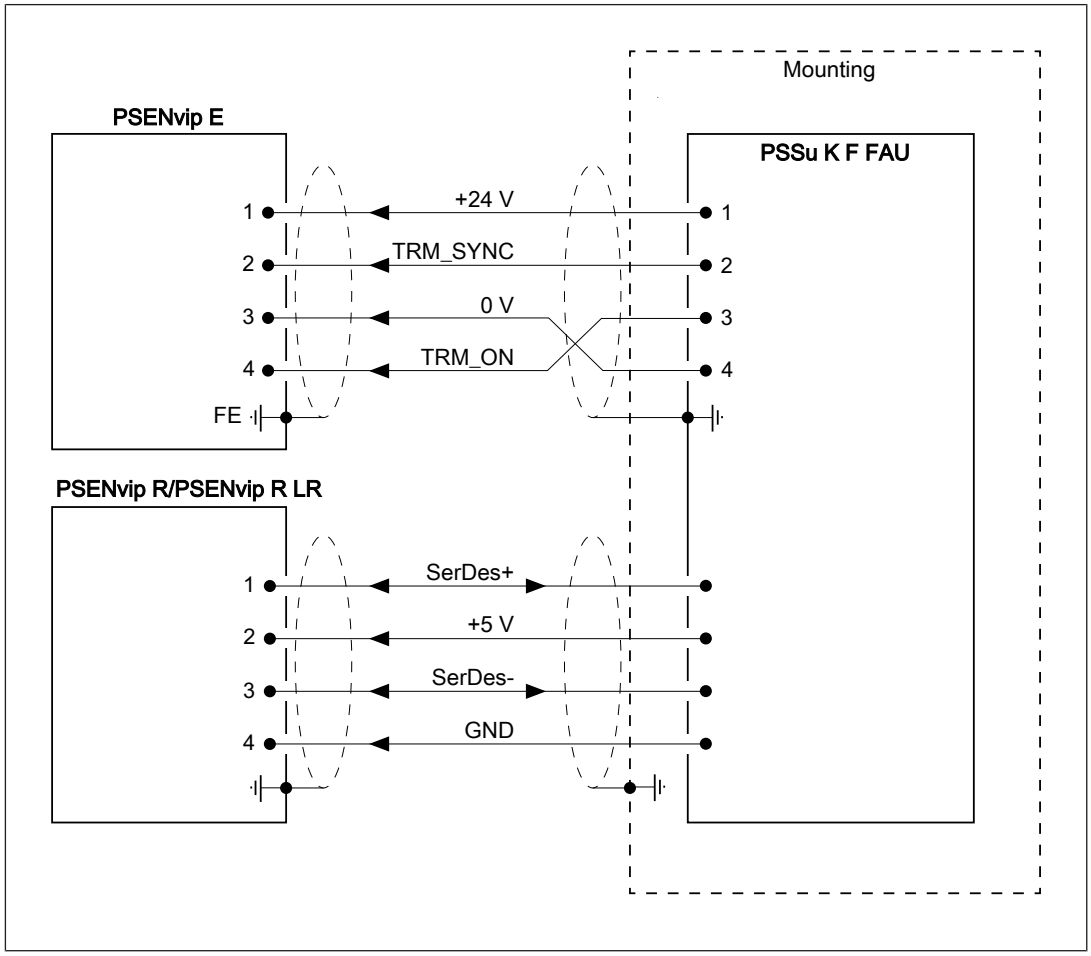


Fig.: Connection diagram

7 Commissioning

During initial commissioning, the transmitter and receiver on the PSENvip must be exactly aligned with each other and with the tool. These processes are described under "Initial commissioning". Once initial commissioning is complete, the PSENvip is ready for operation.

The behaviour of the PSENvip when power is switched on is described under Operation.

INFORMATION

When changing the tool, follow the instructions provided under Initial commissioning:

- Position tool
- Make adjustment during tool change

7.1 Web interface

The web interface connects the CNC (or PC) to the special module PSSu K F FAU via an Ethernet interface.

INFORMATION

The tool change and adjustment functions are only possible if the IP address of the CNC or PC is stated in the configuration of the PSSu K F FAU (see online help for PAS4000).

Prerequisites:

A web browser is installed on the CNC or PC.

7.2 Initial commissioning

During initial commissioning, follow the steps below:

- Align transmitter and receiver
  - – Align transmitter
  - – Position tool
  - – Align receiver
- Make adjustment during tool change
- On the productive version: Configure braking ramp monitoring
- Use the test piece to test the function of the safeguard

Prerequisites:

- Transmitter and receiver must be installed correctly on the press brake (see Installation [📖 71]) and electrically wired (see Wiring [📖 77]).
- An upper tool must be fitted to the right and left-hand edge of the press brake.
- The supply voltage is present (PSSu K F FAU).

CAUTION!

Have the protective equipment tested and certified before commissioning for the first time!

Any machine safeguarded by the PSENvip must be tested and certified by qualified personnel before it is placed on the market. A test report must be generated and archived during initial commissioning.

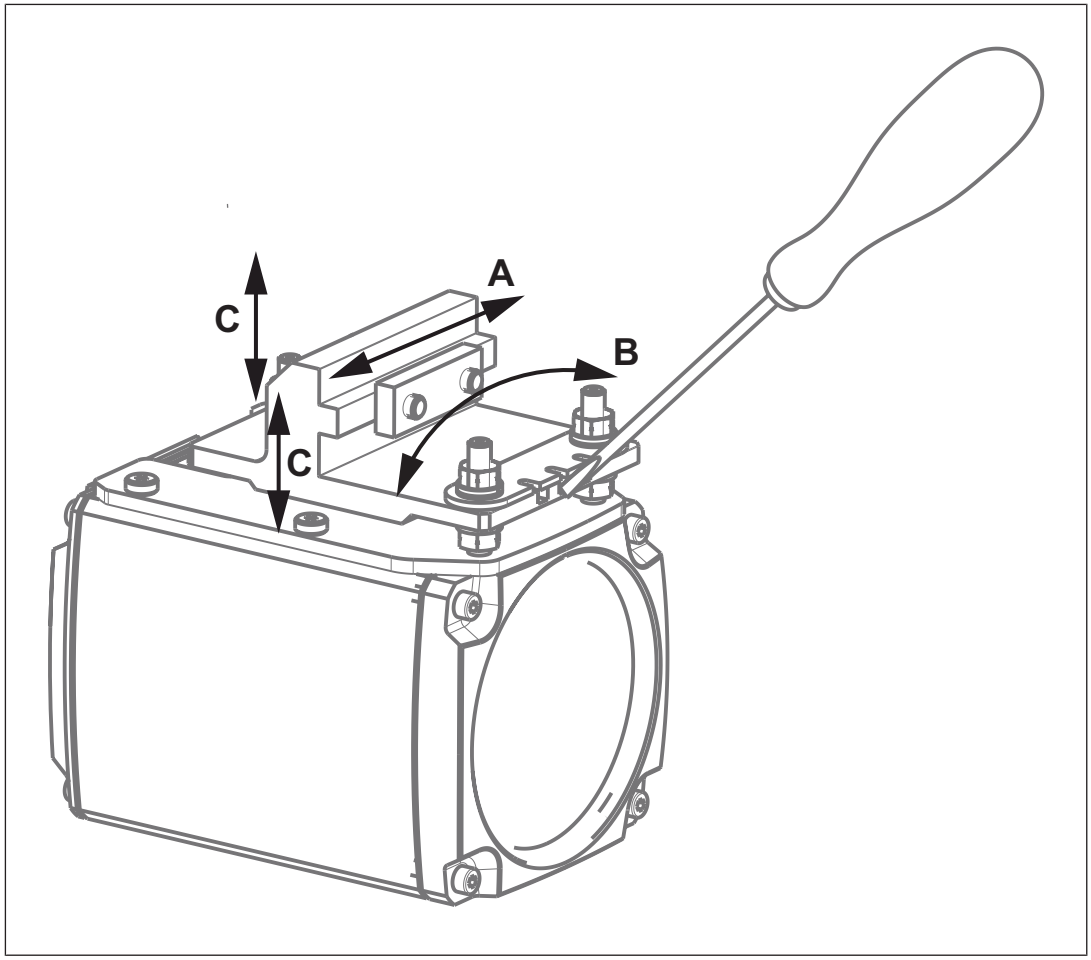
Please note the guidelines given under "Safety".

The individual steps are described in the following subsections.

7.2.1 Align transmitter and receiver

Once installed, the transmitter and receiver must be exactly aligned to each other and to the centre point of the upper tool. The vertical and horizontal alignment is performed using adjustment templates and is displayed on the web interface.

The PSENvip transmitter and receiver can be adjusted in three directions.

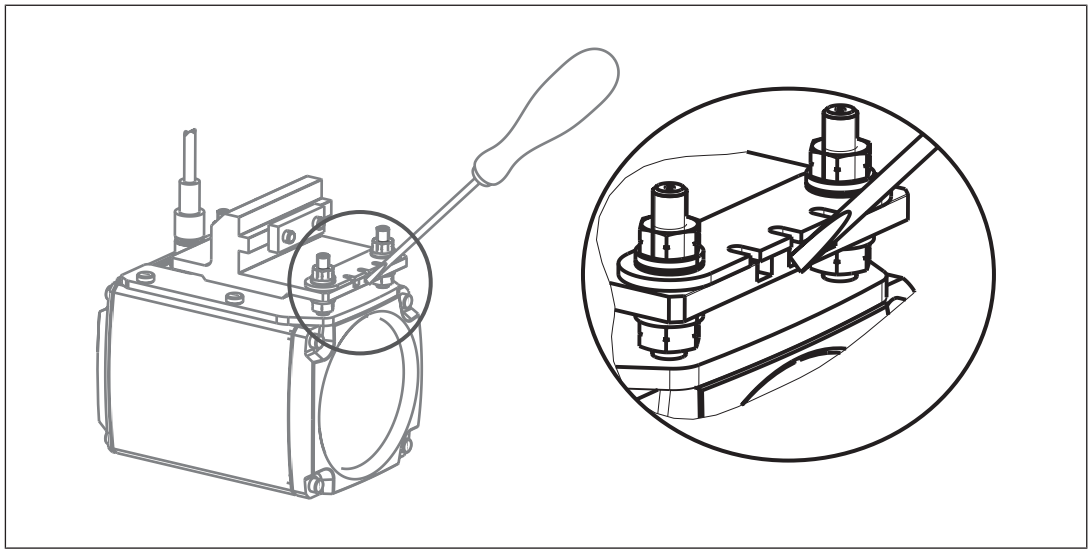


Direction	What?
A	Move horizontally within the groove of the adjustment plate
B	Rotate on a horizontal plane within the slot holes of the adjustment plate
C	Move vertically by adjusting the nuts on the bolts

Guidelines for the mechanical alignment of transmitter and receiver:

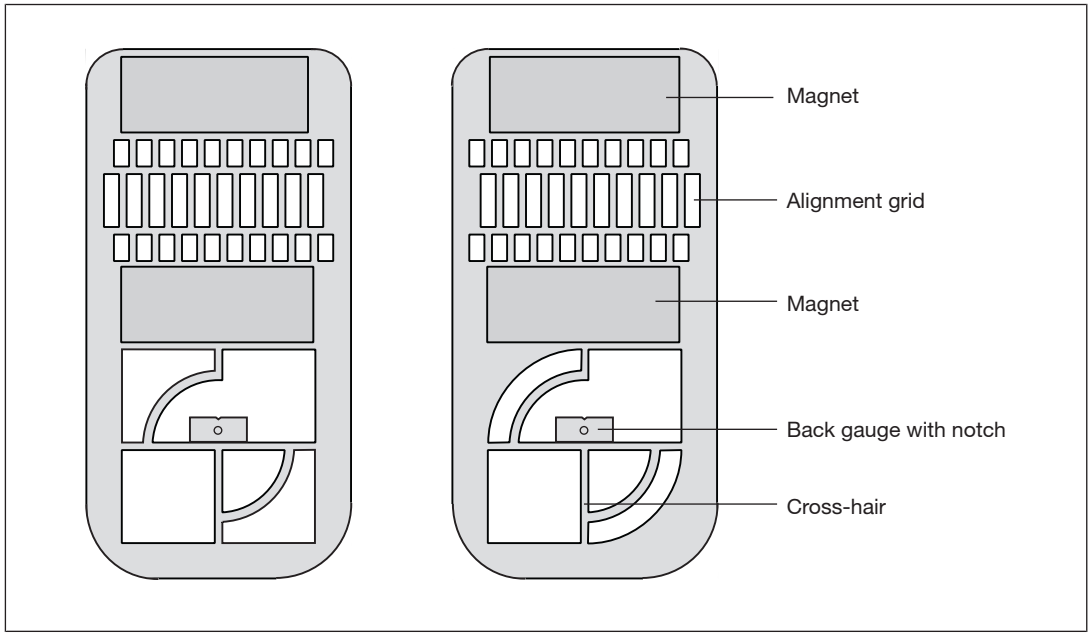
- When making the alignment, the nuts on the bolt connecting the PSENvip to the adjustment plate should only be hand-tightened.
- There are three notches on the adjustment plate and auxiliary adjustment plate for rotating the transmitter and receiver. The transmitter or receiver is inserted into the slot holes on the adjustment plate (adjustment direction B).

- Push the screwdriver blade into the middle notch of the auxiliary adjustment plate and adjustment plate.
- Rotate the screwdriver blade in the required direction.
- You can use the left or right-hand notch to rotate the transmitter or receiver even further to the left or right.



7.2.1.1 Align transmitter

One of the adjustment templates supplied can be used to align the transmitter.



The adjustment templates differ in the way the cutouts are arranged. It does not matter which adjustment template you select for the transmitter.

Alternatively you can use an adjustment template that is screwed to a bracket. Installation is described at the end of this chapter.

- Attach an adjustment template with magnets to the upper tool. The tip of the upper tool must sit in the notch on the stop of the adjustment template.

  Align the alignment grid of the adjustment template to the contour of the upper tool.

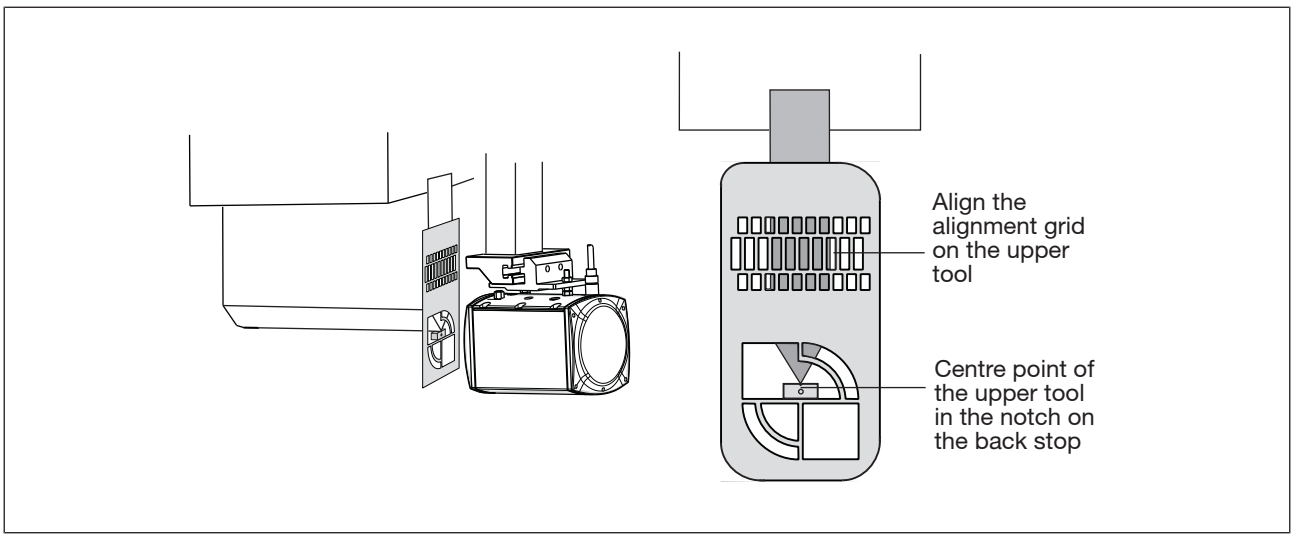


Fig.: Attach the adjustment template to the transmitter

- The illuminated target area must completely envelop the receiver. If you hold a white sheet of paper behind the receiver you will be able to see the contours of the receiver better.

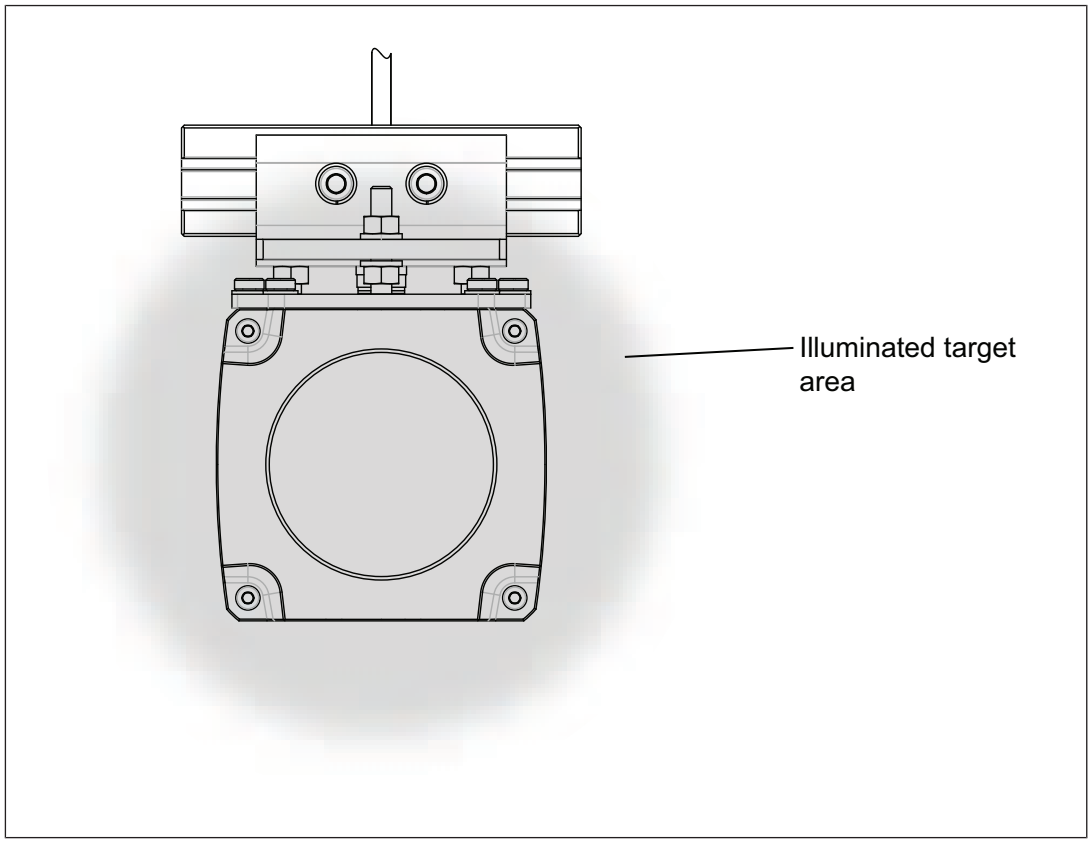


Fig.: Receiver – illuminated by transmitter

- If the illuminated target area does not enclose the receiver as shown in the diagram, then you will need to realign the transmitter

INFORMATION

Carefully align the illuminated target area to the receiver. This will make the adjustments in the following work stages easier.

Installation of the adjustment template with bracket (see Order reference for accessories):

- Fasten the template to the bracket using half length taper-grooved dowel pins and cylinder head bolts (see illustration).

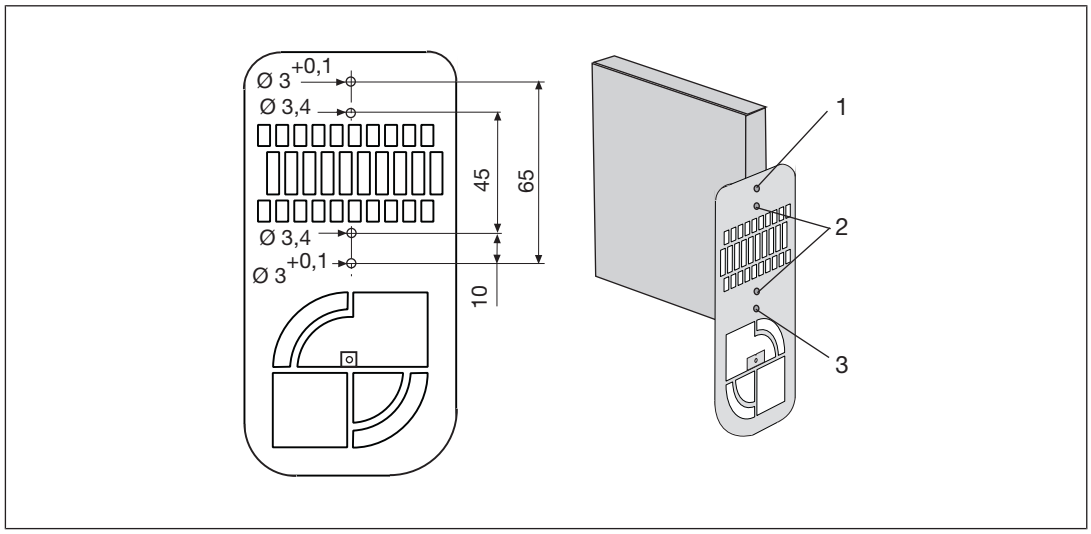


Fig.: Adjustment template to attach to bracket

- 1: Ø 3 mm DIN 1472 half length taper-grooved dowel pin
- 2: M3 x 10 cylinder head bolts
- 3: Ø 3 mm DIN 1472 half length taper-grooved dowel pin
- Attach the bracket to the upper tool clamp.

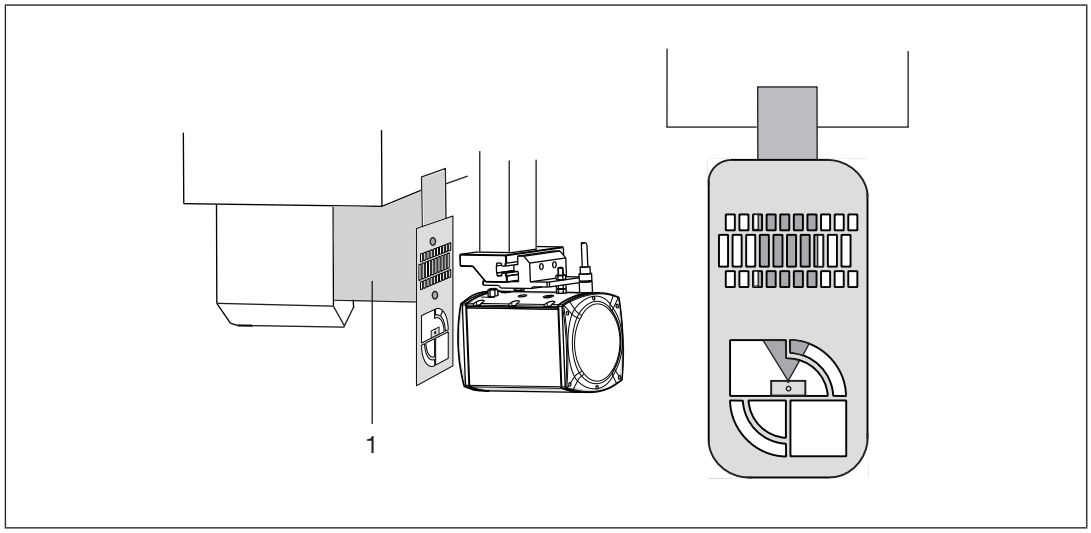


Fig.: Adjustment template with bracket

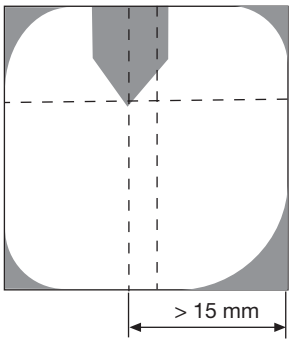
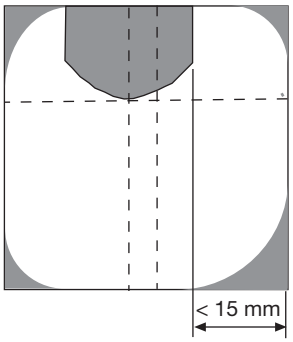
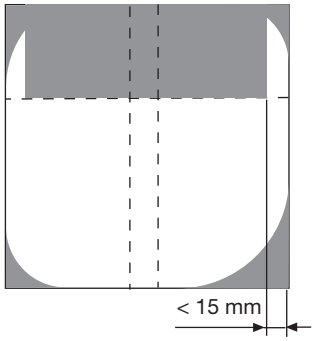
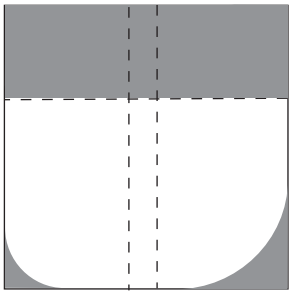
7.2.1.2 Position tool

The correct adjustment of the upper tool also depends on the tool shape. During initial commissioning, the upper tool should be positioned in a way that corresponds to the expected tool class.

The web interface shows the tool with two bending lines on the ***Tool Change*** page. There must be alignment to one of the two bending lines, depending on the tool class.

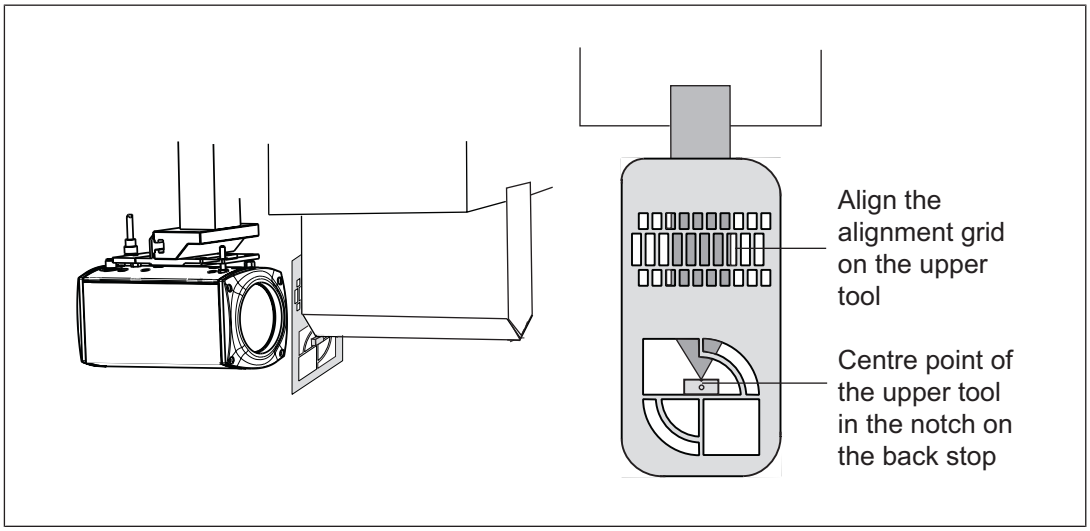
In the following examples, please note that the maximum width of the respective tools for the tool class can be achieved when the appropriate bending line is used.

Examples of the correct adjustment of various tool types:

	Tool class 1: Pointed tools For these tools we recommend alignment to the left-hand bending line. The distance from the bending line to the front segments of the protected field is >15 mm.
	Tool class 2: Semi-circular tools For these tools we recommend alignment to the left-hand bending line. The distance from the front bending line of the tool to the front segments of the protected field is <15 mm. The rear bending line of the tool is detected by the protected field. The position of the front bending line must be considered in the hazard analysis.
	Tool class 2: Stamp For these tools we recommend alignment to the central bending line. The distance from the front bending line of the tool to the front segments of the protected field is <15 mm. The rear bending line of the tool is detected by the protected field. The position of the front bending lines must be considered in the hazard analysis.
	Tool class 3: Stamp The front and rear bending lines of the tool are outside the protected field. The position of the bending lines must be considered in the hazard analysis.

7.2.1.3 Align receiver

- Attach an adjustment template with magnets to the upper tool. The tip of the upper tool must sit in the notch on the stop of the adjustment template.
- Align the alignment grid of the adjustment template to the contour of the upper tool.



Open the *Adjustment* menu in the web interface. You will see the tool displayed with the bending lines and a template. The example below shows a tool on which the bending line is approximately 7 mm to the left of centre.

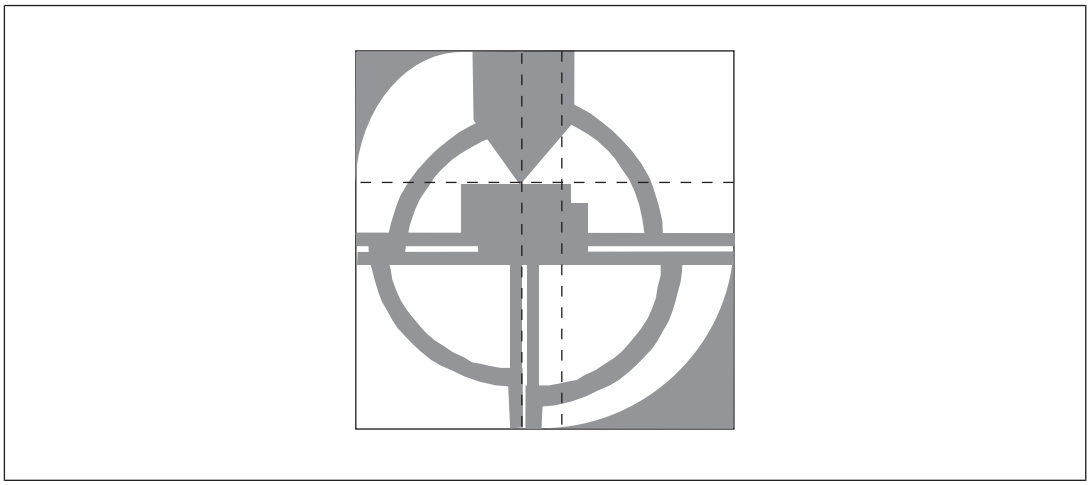


Fig.: Incorrect adjustment

The receiver is correctly aligned with the transmitter when

- The cross-hairs of both adjustment templates overlap
- The quadrants form a full circle and
- The centre point of the upper tool is on the bending line.

The correct adjustment image is shown in the following diagram.

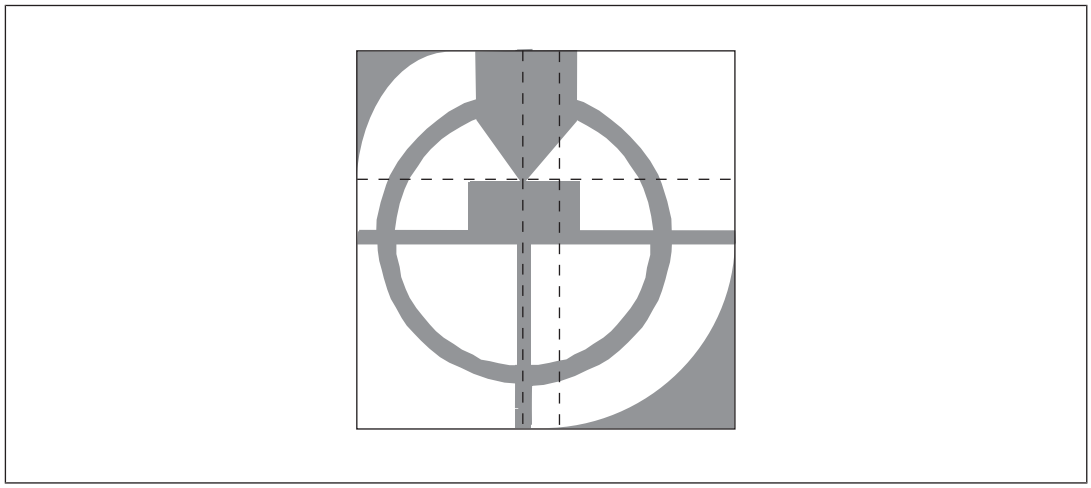


Fig.: Correct adjustment image

INFORMATION

The adjustment templates have different cut-outs around the cross-hair. This makes it easier to evaluate the adjustment direction required by the transmitter and receiver.

- Adjust the direction of the receiver as described in the section entitled "Adjustment directions of transmitter and receiver", until a correct adjustment image is displayed.
- Remove the adjustment templates.

The correct adjustment image must correspond to the image shown in the following diagram:

- The bending line should be on the vertical guide.
- The tool centre point should be aligned with the horizontal guide (the horizontal guide is firmly in the middle of the range bar (see Make adjustment during tool change [92]).

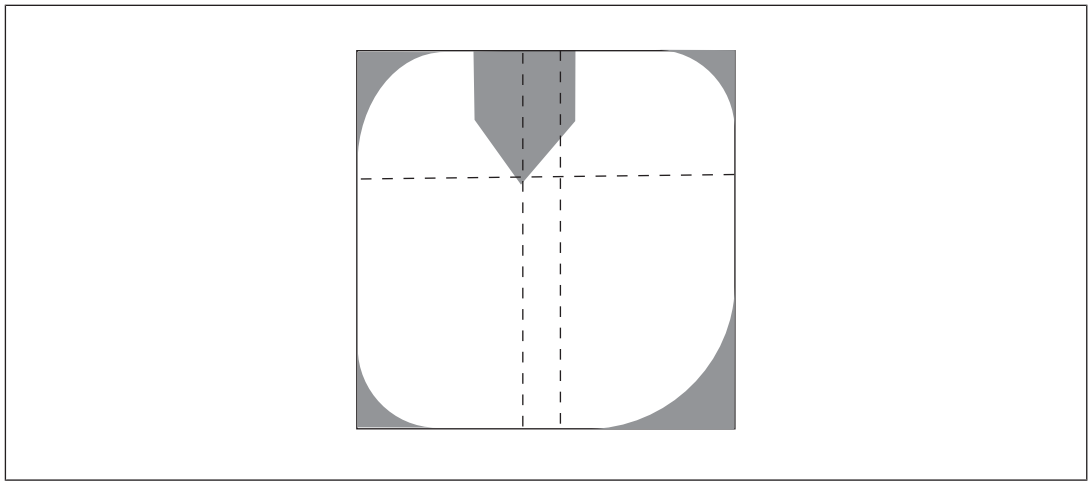


Fig.: Correct adjustment image

- Press the button **Show guide frame**.

A guide frame is shown. The guide frame must be clear of objects, with the exception of the tool centre point, which extends into the guide frame. The following diagram illustrates a valid and an invalid adjustment image.

In the case of an invalid adjustment (receiver aligned incorrectly with transmitter), the **Out of range** message will also appear.

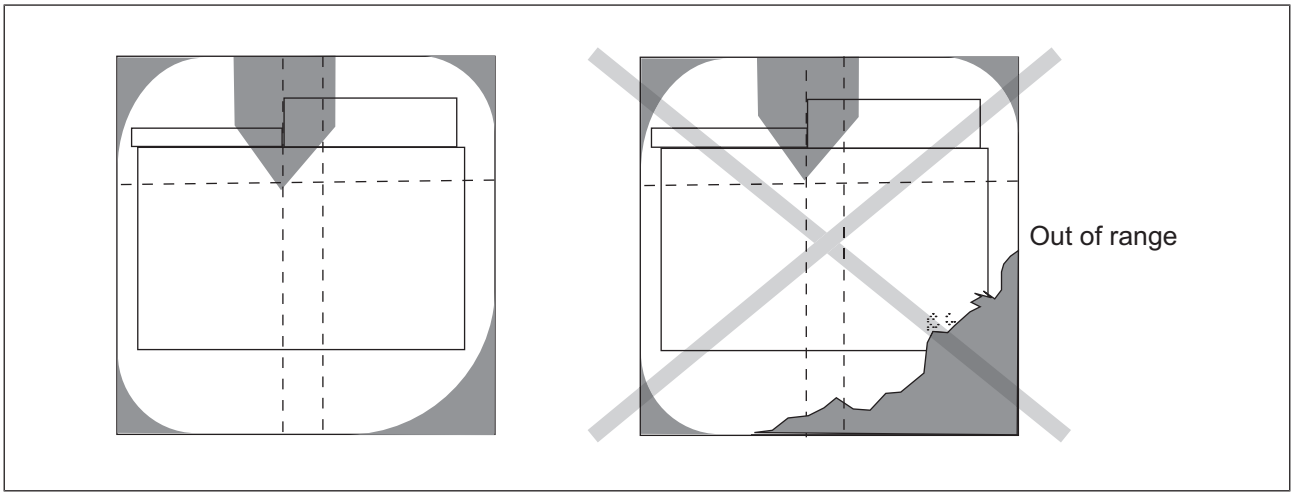


Fig.: Checking the adjustment image with superimposed guide frame

- You can switch to the adjustment image without guide frame by pressing **Cancel guide frame**.
- Exit the adjustment by selecting another option, e.g. ***Operation***.

The transmitter and receiver are now mechanically aligned.

NOTICE

After you have aligned the transmitter and receiver you will still need to carry out the step for "Adjustment during tool change" (see Adjustment during tool change [92]).

7.2.2 Make adjustment during tool change

The adjustment line is automatically tracked to the tool centre point. The tracking of the adjustment line is shown on the web interface.

Prerequisites:

- Transmitter and receiver must be exactly aligned to each other and to the centre point of the upper tool, as described under Align transmitter and receiver.
- The supply voltage must be present.

CAUTION!

The manufacturer or operator of the press must use appropriate measures to ensure safe selection of the "Adjustment during tool change" operating mode.

CAUTION!

The protective equipment must be tested following a tool change adjustment!

Use the standardised test piece to perform a function test, see under Test the function of the safeguard.

7.2.2.1 Tool detection

All tool shapes are permitted in principle. Please note the warnings given under Tool shapes [📖 15].

Assignment to a tool class depends on

- Compliance with the requirement from EN 12622, whereby the protected field must safeguard areas lying 15 mm before the front bending line.
- Full or partial detection of the upper tool via the protected field.

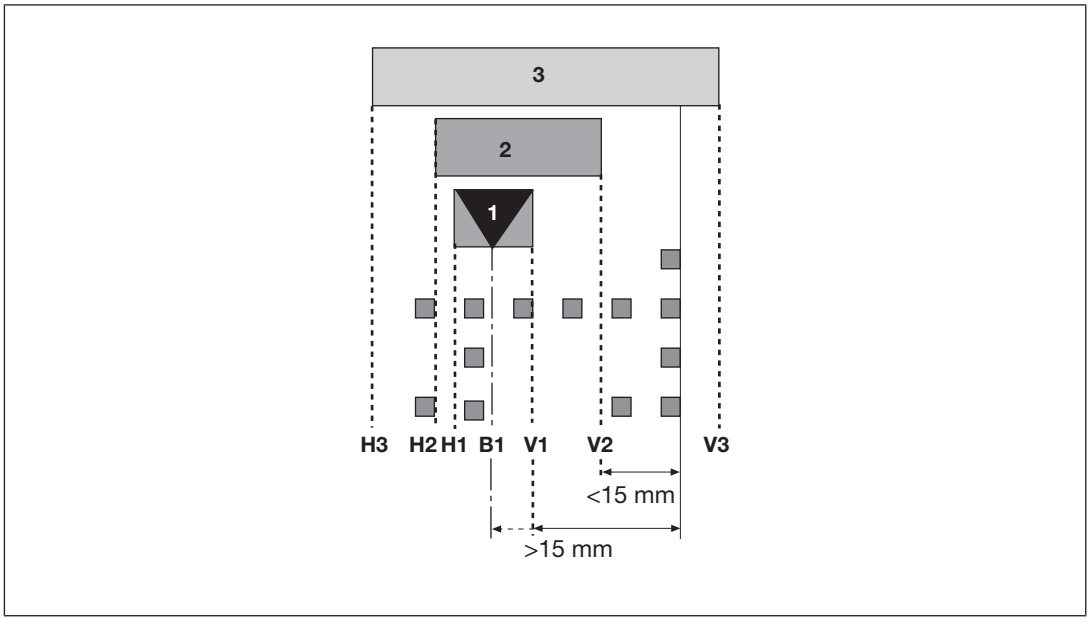


Fig.: Classification of tools into tool classes

Tool class 1

- The contour of these tools is fully detected by the PSENvip.
- The front (V1 or B1) and rear (H1 or B1) bending lines are within the protected field.
- The front segments of the protected field are at least 15 mm away from the front bending line.
- These tools are safeguarded in compliance with the standards.
- Example:

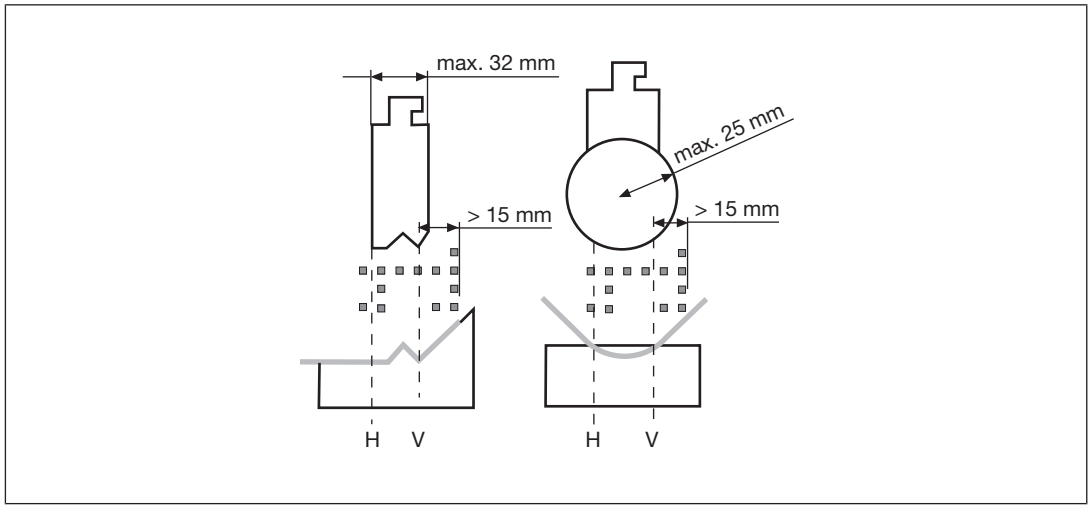


Fig.: Example for tool class 1

Tool class 2

- The contour of these tools is fully detected by the PSENvip.
- The front (V2) and rear (H2) bending lines are within the protected field.
- The front segments of the protected field are less than 15 mm away from the front bending line.
- These tools are not safeguarded in compliance with the standards.
- Example:

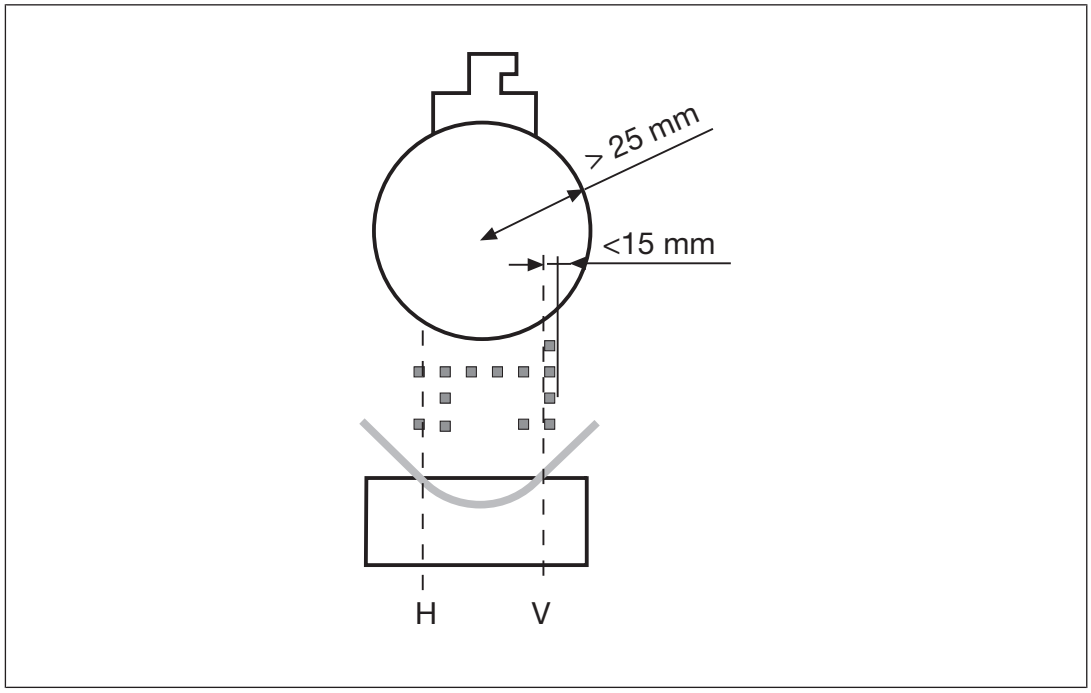


Fig.: Example for tool class 2

Tool class 3

- The contour of these tools is not fully detected by the PSENvip.
- The front (V3) and/or rear (H3) bending lines are within the protected field.
- These tools are not safeguarded in compliance with the standards.
- Example:

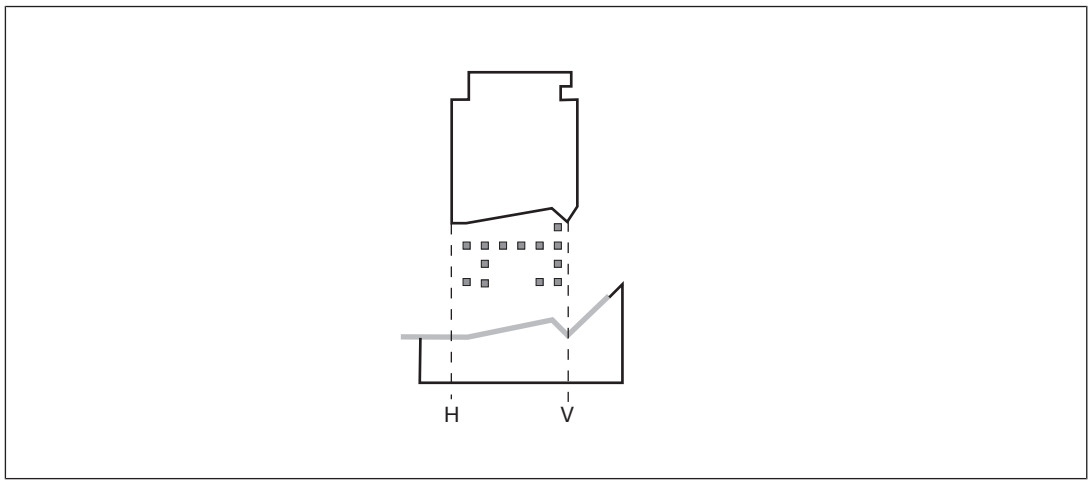
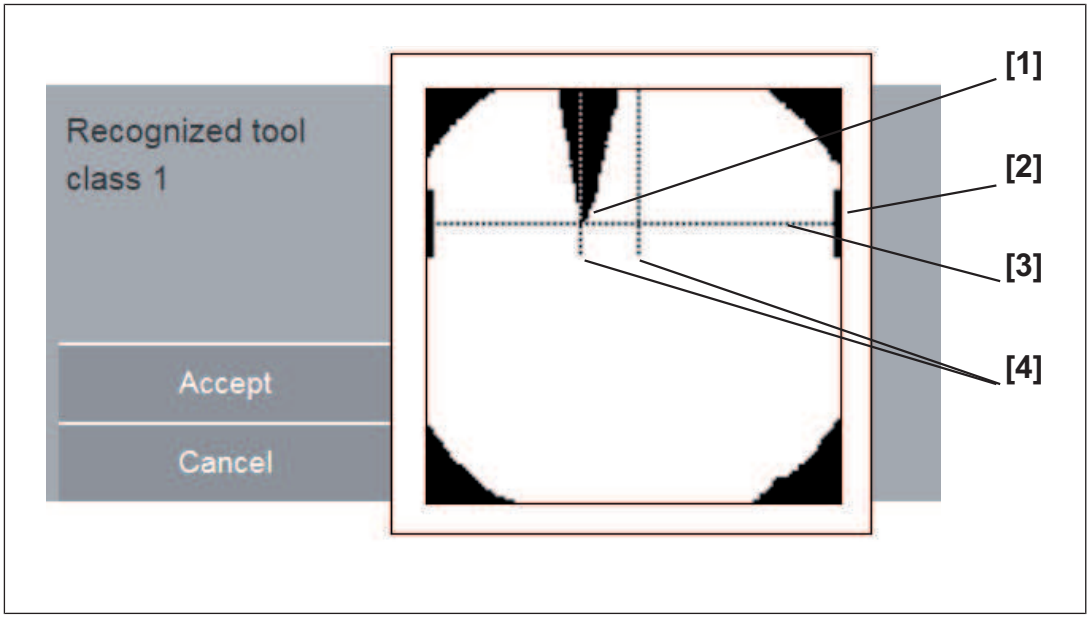


Fig.: Example for tool class 3

7.2.2.2 Adjustment in the web interface

Open the ***Tool change*** page in the web interface. You will see the tool centre point with guides.

Example of the representation:



- 1: Tool centre point
- 2: Range bar
- 3: Adjustment line
- 4: Central and rear bending line

The vertical position of the tool centre point must be within the range bar. If the adjustment line is at the upper or lower end of the range bar, the symbol will appear and the "Out of range" message will be displayed.

If the symbol appears on the display, there is a problem with the lighting of the receiver by the transmitter:

- Check that the transmitter and receiver are aligned correctly. The illuminated target area must completely envelop the receiver. If necessary, realign the transmitter (see Align transmitter [📖 85]).
- Remove any potential contamination on the lens of the transmitter or receiver.

The adjustment has been carried out correctly when none of the symbols appear:

- Accept the adjustment by pressing ***Accept***. The button switches to the function ***Confirm***. Confirm the adjustment within 3 seconds by pressing ***Confirm***.

You can exit the menu at any time without confirming by ***Cancel*** or select another option. In this case, the previous tool data will be retained.

7.2.3 Configure braking ramp monitoring

Braking ramp monitoring is only relevant for the productive version.

To monitor the braking ramp the press overruns must be measured at various speeds; i.e. an overrun profile must be created.

An Excel tool can be used to determine the monitoring curve (worst case curve) from the measured values. The determined monitoring curve can be used for both braking ramp monitoring by the PAS4000 user program and for braking ramp monitoring by PSENvip. When the certified blocks for the PAS4000 library are used, the Excel tool can be used to calculated the required base values for braking ramp monitoring.

The current Excel tool is available in the download area of the Pilz homepage. It is a packed file (ZIP file). The download is only available for registered users. Unregistered users can register free of charge. A valid E-mail address is required for registration.

- Name of the ZIP file:
  PSENvip_OverrunCalculationTool_for_RampMonitoring_<*Version*>.zip
  (e.g. PSENvip_OverrunCalculationTool_for_RampMonitoring_1_0_0.zip)
- Contents of the ZIP file:
  - Excel tool
    PSENvip_OverrunCalculationTool_for_RampMonitoring_<*Version*>.xls
    (e.g. PSENvip_OverrunCalculationTool_for_RampMonitoring_1_0_0.xls)
  - Operating manual
    PSENvip_Operat_Man_OverrunCalculationTool_for_RampMonitoring_1003525-<*Language*>-<*Version*>.pdf
    (e.g. PSENvip_Operat_Man_OverrunCalculationTool_for_RampMonitoring_1003525-DE-01.pdf)

7.2.4 Test the function of the safeguard

Before operating the press brake, the safeguard must be subjected to a function test. The function test includes:

- Detection of objects
- Overrun measurement

The function test is carried out using a test piece in accordance with EN 12622, Annex G.

Prerequisites

- The press brake is fully configured with the upper tool (maximum weight).
- Transmitter and receiver are correctly aligned and ready for operation.
- The press brake is at top dead centre.
- Standard protected field mode is selected.

Sequence

Function test using the test rod (= test piece handle)

- Move the test rod (14 mm diameter) slowly along the whole detection zone at the tip of the upper tool.

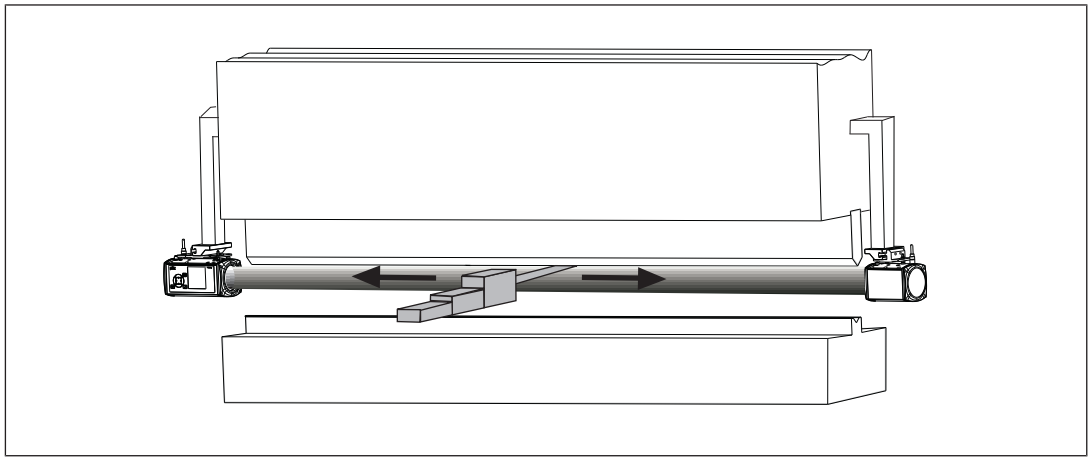


Fig.: Function test using test rod

The test rod must be detected along the whole length of the detection zone.

The OSSD signal switches from 1 to 0. The LED on the receiver lights up red.

INFORMATION

The following tests should be carried out 10 times during initial commissioning.

Function test with 10 mm and 15 mm test piece

- Position the 10 mm high section of the test piece on top of the lower tool.
- Initiate a press stroke.

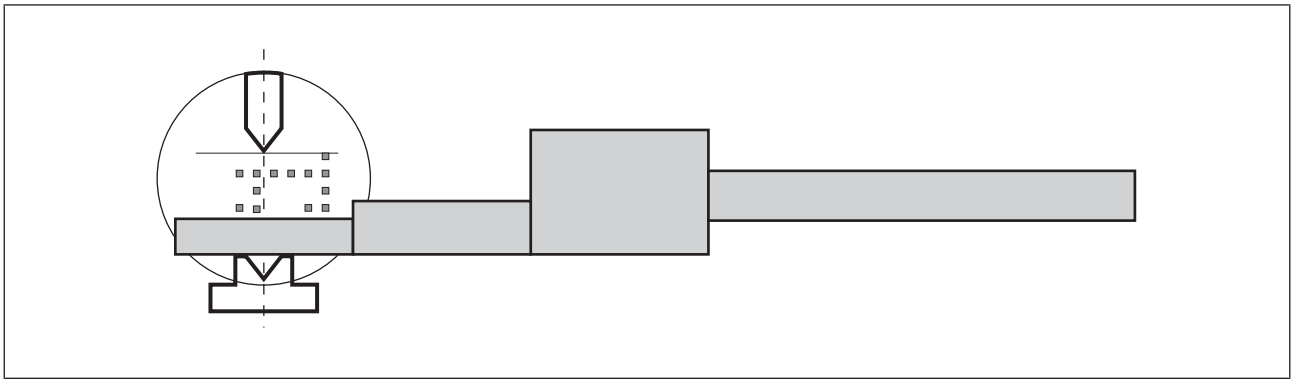


Fig.: Function test using test piece

The test piece breaks the protected field. The press stroke is stopped. The upper tool should not touch the test piece.

- Once the press stroke has stopped, push the 15 mm high section of the test piece beneath the upper tool.

The upper tool should not touch the test piece.

Function test using the 35 mm test piece

- Move the press to top dead centre.
- Position the 35 mm high section of the test piece on top of the lower tool.
- Initiate a press stroke.

The test piece breaks the protected field. The press stroke is stopped. The upper tool should not touch the test piece.

WARNING!

The press brake must be shut down immediately if the test reveals a fault!

Failure to comply could result in a **hazardous situation,** which could lead to **serious injury and death**.

In this case, have the safety equipment checked by qualified staff.

8 Operation

After power is switched on, PSENvip carries out a self test and is then ready for operation. If an error is detected during the self test, PSENvip reports the error on the web interface. Troubleshooting guidelines can be found under Diagnostics and troubleshooting.

WARNING!

Potential loss of safety function due to inadequate testing and maintenance!

Failure of the safety function may lead to serious injury and death.

For this reason, carry out a visual inspection and function test prior to each operation (see Change, maintenance [📖 108]).

8.1 Procedure after power up

After power is switched on, PSENvip runs through an initialisation phase and carries out a self test:

- The transmitter is switched off.
- The LED on the receiver lights up red.
- During the self test, various LEDs on the PSSu K F FAU change their status. They are not lit constantly until the self test has elapsed. The meaning of the LEDs is described in the operating manual PSSu K F FAU. All outputs on the PSSu K F FAU are switched off.

INFORMATION

During commissioning of a PSENvip with a **new receiver**, data are transferred between the receiver and the special module PSSu K F FAU. The transfer of data leads to two restarts of the special module an to a fault on the control system PSSu PLC. The "DIAG" LED on the system's head module flashes red.

Procedure:

– Wait until the data have been transferred and loaded.
  The LEDs "ON" and "RUN" on the special module light up green.
  Furthermore, the LED "PROT" lights up green or the LED "HALT" lights up red on the special module.
– Restart the control system.

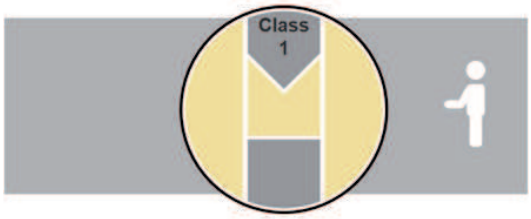
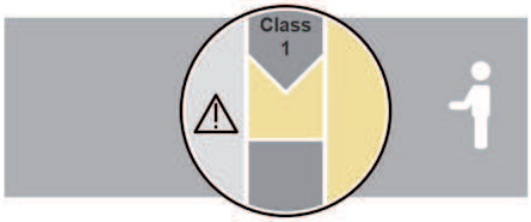
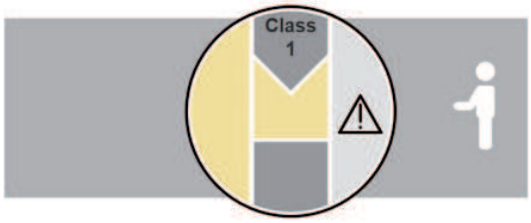
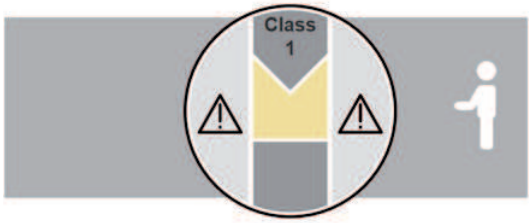
The initialisation phase and self-test are also run

- after the PSSu PLC control system is reset
- after an internal error

After the initialisation and self test, the PSENvip is ready for operation and protected field monitoring is active:

- The transmitter is switched on.
- The web interface displays the active protected fields. The symbol for the OSSD is red if the protected field is interrupted. It is green if the protected field is clear.
- The LED on the receiver lights up red if the protected field is interrupted. It lights up green if the protected field is clear.
- PSSu K F FAU: The SUP LED lights up. The meaning of the remaining LEDs is described in the operating manual PSSu K F FAU B, PSSu K F FAU P.

Examples for displaying the protected fields in the web interface:

Web interface	Protected field mode
	Standard
	Back gauge
	Box bending
	Box bending with back gauge

NOTICE

Carry out a function test!

When the initial press stroke occurs after the machine is switched on, a function test must be carried out on the PSENvip, using the test piece.

- Set standard protected field mode.
- Operate the foot switch to initiate the press stroke.
- Carry out a function test as described under Test the function of the safeguard [98].

If you have selected a protected field mode with reduced protected field, on each press stroke you will need to start the reduced protected field via an acknowledgement. Use an acknowledgement button for the acknowledgement.

WARNING!

Risk of injury due to reduced protected field

Around the bending line there is an increased risk of crushing and trapping of fingers or hands because

- with box bending protected field mode, the front segments of the protected field are blanked,
- with back gauge protected field mode, the rear segments of the protected field are blanked,
- with box bending with back gauge protected field mode, both the front and rear segments of the protected field are blanked
  - Make sure that the workpiece is handled correctly (see Safety [12]).

8.2 Tool change and adjustment after tool change

When a tool is changed, the tool must be repositioned and then an adjustment must be carried out. Both processes are carried out in the web interface. The process is described under "Commissioning":

- Position tool [📖 88]
- Make adjustment during tool change [📖 92]

In the web interface, when a tool change is requested via the ***Tool Change*** menu or an adjustment is requested after a tool change via the ***Adjustment*** menu, protected field monitoring is interrupted and:

- The LED on the receiver lights up red.
- The web interface shows the selected menu. The symbol for the OSSD is red.
- PSSu K F FAU: The SUP LED goes out. The meaning of the remaining LEDs is described in the operating manual PSSu K F FAU B, PSSu K F FAU P.

Once the adjustment (***Adjustment***) or tool change (***Tool Change***) is complete, the system runs a test. Once the test has been completed successfully, the system starts protected field monitoring automatically. If an error is detected during the test, protected field monitoring will not be started and an error is reported.

8.3 Set-up mode

Set-up mode must be initiated by the "Power off" signal on the PSSu K F FAU. The system only performs basic functions; adjustment or tool change are stopped.

- In the web interface, all options except for ***Help*** and ***Service*** are inactive. The symbol for the OSSD is red. The message "System in standby mode" is displayed.
- Transmitter and receiver are switched off.
  The OSSD LED on the receiver will be off. For tandem operation of presses it is now possible to remove and to re-insert the receiver and the transmitter without an error message.

9 Diagnostics and Troubleshooting

9.1 Error Management

The PSENvip continuously carries out self-tests and input/output tests during operation. If an error is discovered, the following sequence is triggered:

- Transmitter or receiver errors are displayed via the web interface and forwarded as diagnostic messages to the PSSu system to be handled there.
- Errors on the PSSu K F FAU are handled within the PSSu system (see operating manual PSSu K F FAU B, PSSu K F FAU P)
- Major errors are displayed in both the web interface and the PSSu system.

The reaction to an error depends on the severity of that error.

9.1.1 Transmitter/receiver error

The following transmitter or receiver errors are detected:

- Optical errors

  e.g. incorrect intensity, too much scatter, poor adjustment, contamination
- Adjustment error
  - detected tool does not match the referenced tool
  - lack of tool adjustment following tool change
- Tool class/communication error (user program communication error)
  - no communication or faulty communication between user program and PSENvip
  - invalid user program
  - invalid CNC setting or faulty tool detection
  - invalid muting end point configuration
- Receiver error
  - no communication between receiver and PSSu K F FAU
  - wiring error
  - no receiver available (PSSu K F FAU can be used as a standalone I/O module with outputs that shut down quickly)

Reaction:
The error is displayed via the web interface. The LED on the receiver lights up red. The HLT LED on the PSSu K F FAU lights up red. A diagnostic message is sent to the PSSu system. Except: If the PSSu K F FAU is operated without a receiver, no message is sent.

Remedy:
Rectify the error and acknowledge the error via the web interface. If you make an adjustment, acknowledgement is automatic.

9.1.2 Major errors

Major errors can include:

- Internal errors
- Interface errors, e.g. between PSSu K F FAU and transmitter/receiver
- Wiring errors or electromagnetic interference

Reaction:
After a major error, the outputs on the PSSu K F FAU are shut down and the Err LED lights up red. The transmitter is off and the receiver on the LED lights up red. PSENvip is restarted automatically. The restart is carried out up to 3 times. If the error is still present afterwards, PSENvip remains switched off. The error is displayed via the web interface (if possible) and is reported to the PSSu system.

Remedy: Rectify the error and then restart the PSENvip (switch supply voltage off and then on again). If this doesn't help, exchange the device.

10 Change, maintenance

Tests are used for early identification of defects on the press brake and its safeguards. They help to maintain a safe, working condition, i.e. to prevent accidents.

The test of the protective equipment consists of:

- A function test using the test piece

  and

- a visual inspection

WARNING!

The press brake must be shut down immediately if the test reveals a fault!

Failure to comply could result in a **hazardous situation,** which could lead to **serious injury and death**.

In this case, have the safety equipment checked by qualified staff.

10.1 Regular checks and maintenance

The following checks must be carried out at regular intervals:

Interval	Function test with:		
	Test rod	Test piece (10, 15 mm)	Test piece (35 mm)
10 x during initial commissioning		x (with upper tool over whole length of machine)	x (with upper tool over whole length of machine)
Each time it is switched on		x	x
After 3 months		x	x
1 x per year	x (with upper tool over whole length of machine)	x (with upper tool over whole length of machine)	x (with upper tool over whole length of machine)
After tool change	x	x	x
after Firmware up-date	x	x	x

Carry out the test as described under Test the function of the safeguard.

INFORMATION

This inspection may only be carried out by qualified personnel

- **Visual inspection of transmitter and receiver for**:
  - – Condition of the installation and attachment
  - – Any damage on the housing and lens
  - – Damage to the electrical connections
  - – Contamination on the lens
  - – Check the messages on the display.

  Test interval
  - – Regular, depending on the pollution of the surrounding area
- **Inspection of safeguards and protection measures on the press brake**

  Test intervals:
  - – At least annually (more frequently depending on use)

INFORMATION

The inspection may only be carried out by appointed expert (competent person). The result of these tests must be entered in the inspection book or in the machine file. Any serious non-conformances must be rectified before the press brake is returned to operation.

10.2 Check after modification

After each modification, the safeguards and protection measures on the press brake must be checked. For example, modifications may be: Tool change, adjustment of overrun, change of user program, Firmware update or exchange of PSENvip and/or components on the PSENvip.

INFORMATION

Before modifying a safe process/a safe machine, the impact of the modification on the safety of the process/machine must be analysed.

- If the analysis has shown that safety functions need to be validated and tested after the modification, then both the modification itself and the course of the entire process must be inspected.
- Modifications should only be carried out by persons with the necessary knowledge and experience (competent persons).

10.3 Cleaning the lens

Clean the lens as follows:

- Remove the dust from the front lens using a soft brush.
- Spray the front lens using an alcohol glass cleaner. Do not allow drops to form on the lens.
- Use a soft cloth to wipe across the whole of the front lens.
- Remove any heavier dirt without scratching the front lens.

11 Technical details

General	584100	584101	584200
Certifications	**CE, TÜV, UL Listed**	**CE, TÜV, UL Listed**	**CE, TÜV, cULus Listed**
ESPE type	**4**	**4**	**4**
Sensor's mode of operation	**Optical**	**Optical**	–
Height of the detection zone	**20 mm**	**20 mm**	–
Max. width of detection zone	**44 mm**	**44 mm**	–
Min. strength of workpiece	**2 mm**	**2 mm**	–
Measuring range of overrun	**2 - 14 mm**	**2 - 14 mm**	–
Resolution			
Detection capability	**8 mm**	**8 mm**	–
Protection type	**Finger**	**Finger**	–
Operating range	**0,1 - 13 m**	**0,1 - 18 m**	–
Resolution of overrun	**2 mm**	**2 mm**	–
Electrical data	**584100**	**584101**	**584200**
Supply voltage			
Voltage	**5 V**	**5 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-10 %/+10 %**	**-10 %/+10 %**	**-20 %/+20 %**
Output of external power supply (DC)	**0,8 W**	**0,8 W**	**5 W**
Optical data	**584100**	**584101**	**584200**
Type of light source	–	–	**High Power LED**
Diameter of illuminated target area	–	–	**70 mm**
Used wavelength range	**510 - 550 nm**	**510 - 550 nm**	**510 - 550 nm**
Average service life LED	–	–	**50.000 h**
Inputs	**584100**	**584101**	**584200**
Number	–	–	**2**
Voltage at inputs	–	–	**24 V DC**
Input current range	–	–	**2,2 - 7 mA**
Min. threshold voltage when signal changes from "1" to "0"	–	–	**8 V**
Max. threshold voltage when signal changes from "0" to "1"	–	–	**12 V**
Max. overall line capacitance Clmax	–	–	**20 nF**
Potential isolation between input and internal module bus voltage	–	–	**No**

Times	584100	584101	584200
Response time t1	**4,65 ms**	**4,65 ms**	–
Environmental data	**584100**	**584101**	**584200**
Ambient temperature			
In accordance with the standard	**EN 60068-2-14**	**EN 60068-2-14**	**EN 60068-2-14**
Temperature range	**0 - 50 °C**	**0 - 50 °C**	**0 - 50 °C**
Storage temperature			
In accordance with the standard	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**	**EN 60068-2-1/-2**
Temperature range	**-40 - 70 °C**	**-40 - 70 °C**	**-40 - 70 °C**
Climatic suitability			
In accordance with the standard	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 61000-6-4, EN 61496-1**	**EN 61000-6-4, EN 61496-1**	**EN 61000-6-4, EN 61496-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Shock stress			
In accordance with the standard	**EN 60068-2-27**	**EN 60068-2-27**	**EN 60068-2-27**
Acceleration	**10g**	**10g**	**10g**
Duration	**16 ms**	**16 ms**	**16 ms**
Protection type			
In accordance with the standard	**EN 60529**	**EN 60529**	**EN 60529**
Housing	**IP54**	**IP54**	**IP54**
In accordance with UL	**1**	**1**	**1**
Mechanical data	**584100**	**584101**	**584200**
Connection type	**M12, 4-pin**	**M12, 4-pin**	**M12**
Cable	**Cable sets**	**Cable sets**	**LiYY 4 x 0.25 mm2**
Max. cable length	**20 m**	**20 m**	**75 m**
Material			
Top	**Aluminium**	**Aluminium**	**Aluminium**
Dimensions			
Height	**90 mm**	**90 mm**	**90 mm**
Width	**95 mm**	**95 mm**	**95 mm**
Depth	**192 mm**	**192 mm**	**136 mm**
Weight	**2.410 g**	**2.410 g**	**1.000 g**

Where standards are undated, the 2014-04 latest editions shall apply.

11.1 Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	IEC 61508 PFH_D [1/h]	IEC 61508 SIL	IEC 61508 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	3,30E-09	SIL 3	2,91E-04	20

All the units used within a safety function must be considered when calculating the safety characteristic data.

INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

12 Order reference

12.1 Device

Product type	Features	Order no.
PSENvip E	PSENvip transmitter	584 200
PSENvip R	PSENvip receiver	584 100
PSENvip R LR	PSENvip receiver	584 101

12.2 Accessories

Connector and cable

Product type	Features	Order no.
PSEN cable M12-4sm MI-Osm MOVE, 8m	Connection cable 8 m, Connector: M12, straight, Mini I/O straight	584 569
PSEN cable M12-4sm MI-Osm MOVE, 10m	Connection cable 10 m, Connector: M12, straight, Mini I/O straight	584 570
PSEN cable M12-4sm MI-Osm MOVE, 15m	Connection cable 15 m, Connector: M12, straight, Mini I/O straight	584 571
PSEN cable M12-4sm MI-Osm MOVE, 20m	Connection cable 20 m, Connector: M12, straight, Mini I/O straight	584 572
PSEN op cable axial M12 4-p. shield. 5m	Connection cable transmitter 5 m Connector M12 straight	630 304
PSEN op cable axial M12 4-p. shield. 10m	Connection cable transmitter 10 m Connector M12 straight	630 305
PSEN op cable axial M12 4-p. shield. 20m	Connection cable transmitter 20 m Connector M12 straight	630 270
PSEN op cable axial M12 4-p. shield. 30m	Connection cable transmitter 30 m Connector M12 straight	630 309

Mechanics

Product type	Features	Order no.
PSENvip AS2	Set of mounting plates for transmitter and receiver	583 210
PSENvip AS2 R	Mounting plate for receiver	583 215
PSENvip AS2 E	Mounting plate for transmitter	583 216
PSENvip AP2	Set of adjustment plates for transmitter and receiver	583 211
PSENvip AT mag	Adjustment templates with magnet	583 203
PSENvip AT spring mount	Adjustment templates with spring element for attachment	583 207
PSENvip AT mech	Adjustment templates with mechanical attachment	583 204

Product type	Features	Order no.
PSENvip MS	Supporting arms for installing PSENvip on a press, additional PSENvip MB (583 205) required	583 206
PSENvip MB	Adapter pieces for mounting PSENvip AP on to any bracket	583 205
PSENvip TP	Test piece	583 200

13 Attachment

13.1 Check list

The following check list is intended as a guide to provide support when commissioning and recommissioning the PSENvip and when carrying out the regular inspection as required.

Please note that the check list is not intended to replace the plant-specific safety analysis required for commissioning/recommissioning, nor the resulting inspections and actions.

INFORMATION

Commissioning, recommissioning and regular inspection may only be carried out by competent personnel.

We recommend that you keep the completed check list and store it with the machine documentation for reference.

No.	Action	OK	Not OK	Notes
1	**Check the category/standards**			
	Does the category of the PSENvip match the category required for the plant/machine?			
	Have the standards applicable for the plant/machine been considered?			
2	**Check the ambient conditions for PSENvip**			
	Are the technical details of the PSENvip complied with?			
3	**Check the wiring of the PSENvip**			
	Are all the electrical connections to the PSENvip wired correctly?			
	Do the power supply for generating the 24 V supply voltage and the voltages to the inputs on the PSENvip comply with the regulations for safe electrical isolation?			
	Are the cables adequately shielded?			
4	**Visual inspection**			
	Make sure that there are no objects in the protected space between the transmitter and receiver.			
	Make sure that there are no transparent materials between the transmitter and receiver (e.g. glass panel).			
	Are all the mechanical connections to the PSENvip attached correctly?			
	Cables are undamaged?			

No.	Action	OK	Not OK	Notes
5	**Check commissioning**			
	Has the system been commissioned correctly in accordance with the documentation?			
6	**Check the circuitry of the programmable safety and control system**			
	Have the outputs that have been defined as OSSDs been incorporated in accordance with the required category?			
	Are the switching elements that are connected to the outputs (e.g. valves, contactors) monitored via feedback loops?			
	Does the wiring of the inputs and outputs match the circuit diagram?			
7	**Check the effectiveness of the PSENvip during the hazardous movement**			
	Is the PSENvip effective throughout the whole of the hazardous movement of the plant/machine?			
	Is the safety function tested in accordance with the instructions specified in this documentation?			
8	**Check protected field modes**			
	Do the protected field modes operate in accordance with the setting of the operating mode selector switch?			

Date: ……

Signature: ……

Support

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