

SENTINEL PLUS
PRESS BRAKE
GUARDING SYSTEM

Operation Manual

LS-CS-M-073



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1 About This Manual

This section contains information about this manual. It contains the following sections:

- Document Objectives.
- Technical Competence Requirements.
- Document Organisation.
- Related Documentation.
- Guides to Notes, Cautions and Warnings.
- Obtaining Technical Assistance.

1.1 Document Objectives

This manual provides information about the operation of the Lazer Safe Sentinel Plus Press Brake Guarding System.

1.2 Technical Competence Requirements

All operators of the Sentinel Plus Press Brake Guarding System should be trained in its use, and the press brake upon which it is installed in a manner that complies with established safety practices.

1.3 Document Organisation

This manual is organised into the following chapters:

1. About This Manual.
2. Critical Safety Information.
3. System Overview.
4. LZS-005-R Operation.
5. The Sentinel Plus User Interface Panel.
6. System Operation.
7. Light Curtain Mode (Optional).
8. User and Supervisor Menus.
9. Operator Instruction and Demonstration.
10. Maintenance.
11. Appendix A – Sentinel Plus XL.
12. Appendix B – Automatic Brackets.
13. Glossary of Terms.

1.4 Related Documentation

This manual (Sentinel Plus Press Brake Guarding System Operation Manual) should be used in conjunction with the following documents:

- Lazer Safe Sentinel Plus Press Brake Guarding System Installation Manual (LS-CS-M-074).
- Lazer Safe Block Laser Alignment Guide (LS-CS-M-079 Rev 2.0).
- Lazer Safe Laser Distortion Causes and Solutions Manual (LS-CS-M-057).
- Safety of Machine Tools – Hydraulic Press Brakes EN12622:2009.
- Safety Requirements for Power Press Brakes ANSI B11.3 – 2012.

- Code for Power Press Operation: Health, safety and safeguarding requirements CSA Z142-10.
- The operation manual for your press brake.
- The operation manual for your light curtains (optional).
- LZS-XL Alignment Guide (LS-CS-M-096).

1.5 Guide to Notes, Cautions and Warnings

**Note:**

This symbol indicates helpful information that helps you make better use of your Lazer Safe product.

**Caution:**

This symbol alerts you to situations that could result in equipment damage.

**Warning:**

This symbol indicates danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

1.6 Obtaining Technical Assistance

For technical support with the Sentinel Plus Press Brake Guarding System contact your supplier or email customerservice@lazersafe.com detailing your specific requirement.

2 Critical Safety Information

2.1 Proper Use of the Sentinel Plus Guarding System

The Sentinel Plus Press Brake Guarding System is designed to protect hands and fingers in the area close to the edge of the punch. When installed correctly and safety instructions are observed fully, the Sentinel Plus system permits safe manipulation close to the punch, as well as offering effective protection while tools close at high speed.

Please note these general safety notices:

- The Sentinel Plus system is designed exclusively for installation and operation on hydraulic press brakes, or press brakes that comply with the statutory machine safety and accident prevention rules and regulations valid for the place where the press brake is operated, in particular after the system has been installed.
- The Sentinel Plus system must be installed either in the press brake factory, or by specialist technicians trained by Lazer Safe (or its authorised representatives).
- The operator must be fully conversant with the operation of the press brake and the risks associated with it, as well as the operation of the Sentinel Plus Press Brake Guarding System.
- The alignment of the protective equipment for punches of different lengths should be performed by a die setter (or someone with equivalent specialist expertise) trained in all relevant aspects of operating the press brake and the Sentinel Plus Press Brake Guarding System.
- Suitable protective equipment must be worn by the operator at all times.

2.2 Special Warnings

To ensure the highest possible degree of safety in operating a press brake fitted with the Sentinel Plus Press Brake Guarding System, it is important to note the following special warnings.



Warning: AVOID FAST, ERRATIC MOVEMENTS AS TOOLS CLOSE.

When the tools close at high speed (above the mute point) towards a static (fixed) obstruction, there will be less than maximum protection at the point where the laser detects the obstruction. For example, if a small obstruction such as a finger is rapidly and erratically pushed between the punch and an obstruction, immediately before the laser senses the static obstruction the finger might be touched.



Warning: NO PROTECTION BETWEEN MUTE POINT AND WORKPIECE.

In Normal mode, the Sentinel Plus Press Brake Guarding System protects until the laser is within 2mm of the material surface. Even though this gap is too small for a finger to be inserted, **always exercise care.**



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Sentinel Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

Entry to Field Muted mode can be password protected, and should only be used by suitably trained personnel, and only in exceptional circumstances (changing tools, maintenance, etc.).



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

In Tool Set-up Mode the laser is ON, but the optical protection is disabled. Although the Sentinel Plus Press Brake Guarding System will ensure that the machine does not exceed safe speed if the sensors are obstructed, particular caution must be exercised.

2.3 Regulatory Requirements for Use

The Sentinel Plus system can be used only on hydraulic press brakes or machines deemed by relevant regulatory authorities to have equivalent functional and dynamic characteristics.

Different regulatory requirements apply to the use of the Sentinel Plus system, depending upon whether it has been factory-fitted to a new machine or retrofitted to a machine already in operation.

2.3.1 Requirements for Factory-Fitted Systems-Within the European Union

The combination of a press brake and the Sentinel Plus system must:

- Have been type-approved by a Notified Body and
- Comply with the respective local rules and regulations in regard to machine safety and accident prevention.

2.3.2 Requirements for Factory-Fitted Systems-Outside the European Union

The combination of a press brake and the Sentinel Plus system must comply with the relevant local regulations that apply to machine safety and accident prevention.

2.3.3 Requirements for Retrofitted Systems-All Locations

The combination of a press brake and the Sentinel Plus system must comply with the relevant local regulations that apply to machine safety and accident prevention. It must also receive any other approvals that may be required by the regulations governing the operation of machinery at the location where the machine is being used.

2.3.4 Equipment Alterations

Any alterations to the examined and certified combination of protective equipment and machine are likely to void relevant approvals and certifications. Such alterations may include the integration of the machine into a robot system, or the connection of the machine to an electronic data bus system.

Similarly, any alteration of the Sentinel Plus system, or its bridging, or both, either in part or full is expressly prohibited.

Access to the electrical equipment cases of the machine control unit and the components within them is restricted to personnel trained and authorised for this purpose by Lazer Safe.

2.3.5 UL General Safety Compliance

The PGS-3 Safety Controller is UL approved, please refer to the Lazer Safe file **NRAQ.E514131** on the UL database for details (registration required).

<https://www.ul.com/apps/product-ig>

Note that the PGS-3 has been evaluated for UL General Safety compliance only; the software functionality, reliability and the safety features were not evaluated by UL.

3 System Overview

The Lazer Safe Sentinel Plus Press Brake Guarding System is a guarding system designed for hydraulic press brakes that provides a highly effective solution for both operator protection and machine productivity.

3.1 Key Benefits

- Sentinel Plus gives the operator unrestricted access to the tooling area.
- The operator can hold the work piece as close as 20mm to the bend line and operate the machine at high speed.
- Complex shapes can be produced with the "Tray / Box" and "Field Muted" modes of operation.
- The Sentinel Plus system continuously monitors the machine speed and stopping distance in real time.
- In Normal mode the LZS-R block laser detects obstructions as small as 2mm, allowing a mute point of 2mm.
- The 2mm mute point is set on the first stroke. The laser guard detects the material position, and the operator confirms the mute point.
- Failure detection is performed by real-time monitoring of the process under control.
- Sentinel Plus also supports a wide range of third party light curtains. The operator can easily switch between laser guarding or light curtains.
- Supports non 'V' tools with Special Tools Mode.
- The Sentinel Plus system can be installed either at the time of manufacture or as a retrofit to a press brake already in service.

Automatic Mute Point Set-up

The 2mm mute point set-up is automatically initiated on the first cycle. The system detects the material surface and the operator is prompted to confirm the mute point via the User Interface Panel. The system automatically monitors the mute position and detects changes in tool size and material thickness.

Advanced Monitoring Functions

Sentinel Plus automatically monitors machine performance in real time.

Sentinel User Interface Panel

The 4.3" colour graphics display makes the system very simple to operate. A magnetic backing allows the panel to be easily moved.

Quick Adjust Brackets

The TX and RX can be quickly moved clear during tool change, are easily adjusted and highly tolerant to machine vibration.

Laser Transmitter (TX)

As the tools close in high speed the protective zone is progressively muted while machine deceleration and speed is monitored. The system provides optical protection until the opening is 2mm.

Close Proximity Protection

Sentinel Plus gives the operator unrestricted access to the tooling area. The operator can hold the work piece as close as 20mm from the bend line, and still operate the machine safely in high speed.

Laser Receiver (RX)

The camera receiver features automatic Tool Alignment to detect the tool profile for simple and fast set-up.

Figure 3-1: Sentinel Plus Press Brake Guarding System Key Features

3.2 System Components

The system contains the following components:

- LZS-R Block Laser Transmitter/Receiver pair.
- PGS-3 Safety Controller.
- Sentinel Plus User Interface Panel.
- Optical Rotary Encoder.
- Bracket system for the LZS-R Transmitter and Receiver.

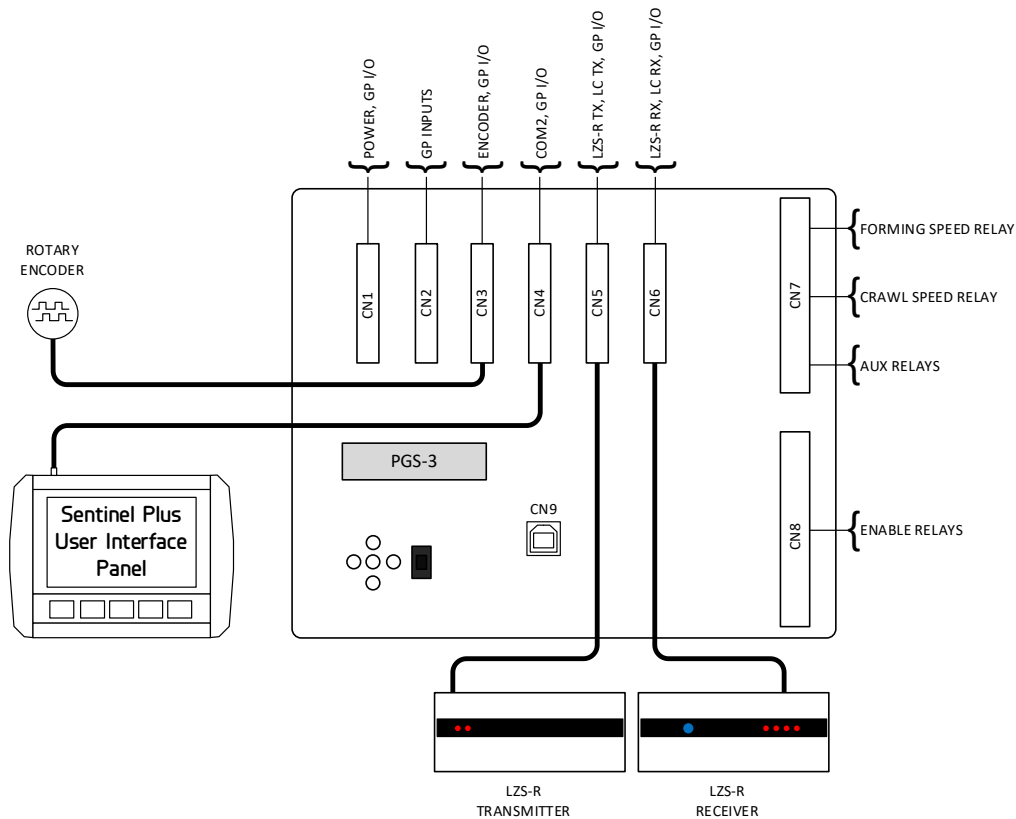


Figure 3-2: Sentinel Plus Press Brake Guarding System Components

3.3 Optical Protection Overview

The Sentinel Plus Press Brake Guarding System comes as standard with the LZS-R Block Laser transmitter and receiver pair. The transmitter and receiver are mounted on the upper beam of the press brake, allowing the operator to remain close to the work-piece as the tools close at high speed. Hands and fingers are protected by a block of laser light that monitors the zone around the punch. If an obstruction is detected the closing movement is stopped. The punch cannot make contact with the obstruction.

The Sentinel Plus Press Brake Guarding System continuously monitors the critical speeds and stopping distance of the moving member of the machine. If the safe speed is exceeded and/or the stopping distance (overrun) is exceeded, the system will issue a stop command to the machine. There is no need for a separate speed or stopping distance (overrun) monitor.



Note:

The User Interface Panel displays the status of the machine, and any action that is required by the operator. In the following sections the operator messages are shown in the following format:

Status – ACTION

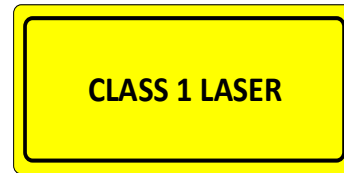
Section 5 describes the operation of the User Interface Panel in detail.

3.3.1 Laser Classification and Warnings



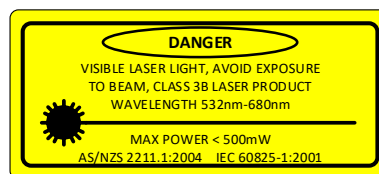
Warning: CLASS 1 LASER DEVICE

The LZS-R laser transmitter emits CLASS 1 laser light approximately 50mm x 80mm. Do not stare directly into the lasers or the transmitter window.



Warning: CLASS 3B LASER RADIATION: DO NOT OPEN OR TAMPER WITH THE LASER TRANSMITTER

The LZS-R laser transmitter contains no user serviceable components. Do not attempt to tamper with or dismantle the laser transmitter as this will void the product warranty, and may expose you to the internal laser emitter CLASS 3B LASER RADIATION that has the potential to cause eye damage.



3.3.2 LZS-R Block Laser

The Sentinel Plus system employs a LZS-R Block Laser transmitter and receiver. The transmitter projects a square beam of laser light approximately 80mm wide by 50mm high that surrounds the upper tool. This creates a silhouette (or shadow) of the upper tool on the receiver window, as shown in **Figure 3-3**.

When the system is first started the receiver performs an automatic tool alignment, where it analyses the receiver image and locates the position of the tool tip. From this it determines the optimum position for the guarding area around the tool tip.

As the tools close in high speed the LZS-R receiver first detects the presence of the material and then progressively mutes the guarding around the tool tip row by row, until the guarding is completely muted when the tool tip is 2mm above the material. The slow speed point of the press must be set so that the press beam has decelerated from high speed to pressing speed by the time the tool tip has reached the mute point.



Note:

The actual slow speed point is dependent upon the performance of the press brake. The Sentinel Plus system is optimised for high speed performance press brakes.

The guarding area around the tool tip is divided into three zones; front middle and rear (labelled **F**, **M** and **R** in **Figure 3-3**). In the illustrations describing the operation of the Sentinel Plus the lasers are shown in segments to highlight the sensor zones, however the guarding region is a continuous band around the tool tip. The system can mute these individual zones when forming various shape work pieces (e.g. tray and box shaped parts).

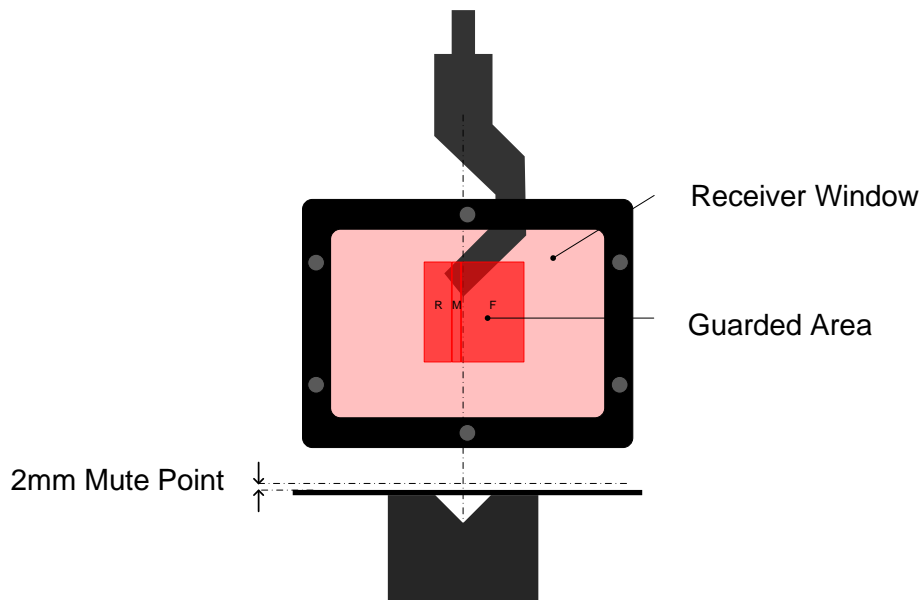


Figure 3-3: LZS-R Block Laser Receiver

3.3.3 Setup

The LZS-R receiver employs a two dimensional camera sensor which detects the laser light projected by the transmitter. This effectively captures an image of the tool silhouette, and any object (an obstruction) that enters the guarded region.

When the system is first started the Sentinel Plus automatically performs a tool alignment. As long as the silhouette of the tool tip is within the target area of the receiver (approximately the centre of the receiver window), the guarded area can be adjusted to coincide with the tool tip. If the tool tip is outside of the target area, the operator will be directed to physically move the LZS-R receiver so that the tool tip lies within the target area. **Section 4.2** explains how the operator is guided by the LZS-R receiver to the correct alignment position.

3.3.4 Mute Point

The mute point must first be established so that the system will not treat the material being formed as an obstruction. The mute point is automatically set at 2mm above the surface of the material as the tools close for the first stroke. This mute point set-up can be initiated whenever the tools are changed or the material thickness changes.

3.4 Normal Mode

This is the default mode at start-up. In Normal Mode all detection regions (front, middle and rear) are active. When the foot pedal is pressed the system checks that the guarded area is clear and allows the tools to close in high speed.

The sequence of diagrams in **Figure 3-4** shows the guarded region around the tool tip descending through the mute point. As the guarded region passes through the mute point the sensors in the receiver are muted row by row, until the mute point is reached, whereupon the entire guarded region is muted. The machine must decelerate to pressing speed before the mute point is reached. The laser transmitter is always active in Normal mode.

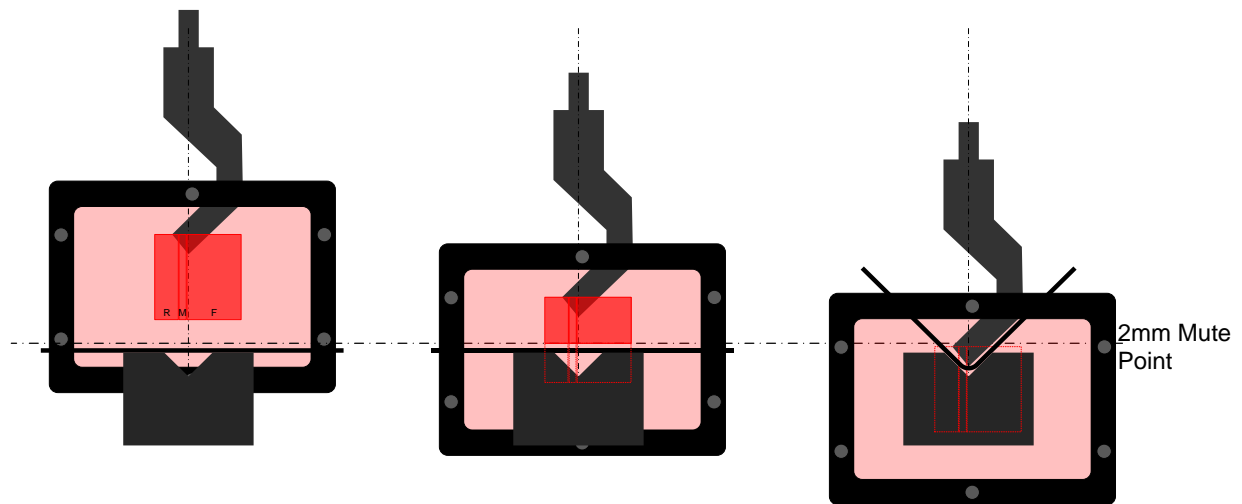


Figure 3-4: Normal Mode Operation

3.4.1 Obstruction Detection – From a Stationary Position

If any part of the guarded region is obstructed when the pedal is pressed then the tools will not move and the message **Sensors blocked – RELEASE FOOT PEDAL** will be displayed. The operator must release and press the pedal again. If the sensors are clear then the tools will start closing in high speed. If any sensor remains obstructed, the system will force the tools to close in safe speed only with the optical protection muted and display the message **LASERS INACTIVE** until the bend is completed. The sensors become active again once the tools are opened.

3.4.2 Obstruction Detection – When Tools are Closing

During high speed closing all sensors are active. If any part of the guarded region is obstructed then the closing movement is stopped and the message **Sensors blocked – RELEASE FOOT PEDAL** will be displayed. The operator must release and press the pedal to continue. If the sensors are clear then the tools will start closing in high speed. If any sensor remains obstructed, the system will force the tools to close in safe speed only with the optical protection muted and display the message **LASERS INACTIVE** until the bend is completed. The sensors become active again once the tools are opened.



Note:

If the Sentinel Plus system has been installed on an up-acting machine, the Normal mode behaviour is slightly different from that described above, due to the configuration of the up-acting hydraulics. An additional control input is provided; the Open Tools Enable button.

When the enable outputs are turned off (say due to an obstruction), they will remain in the off state after the foot pedal has been released. They will turn on when the operator next presses the foot pedal to close tools.

The operator can turn on the enable outputs to open tools by pressing the Open Tools Enable button. The enable outputs will remain on only while the tools are opening, and will turn off again at the end of travel.

3.5 Tray/Box Modes

The Sentinel Plus supports two types of Tray/Box mode. In Normal mode a workpiece with large side flanges (as shown in **Figure 3-5**) would trigger an obstruction and force the press into slow speed for a long distance.

Tray/Box mode temporarily mutes the front and rear guarded regions, allowing high speed down movement until the normal slow speed point.

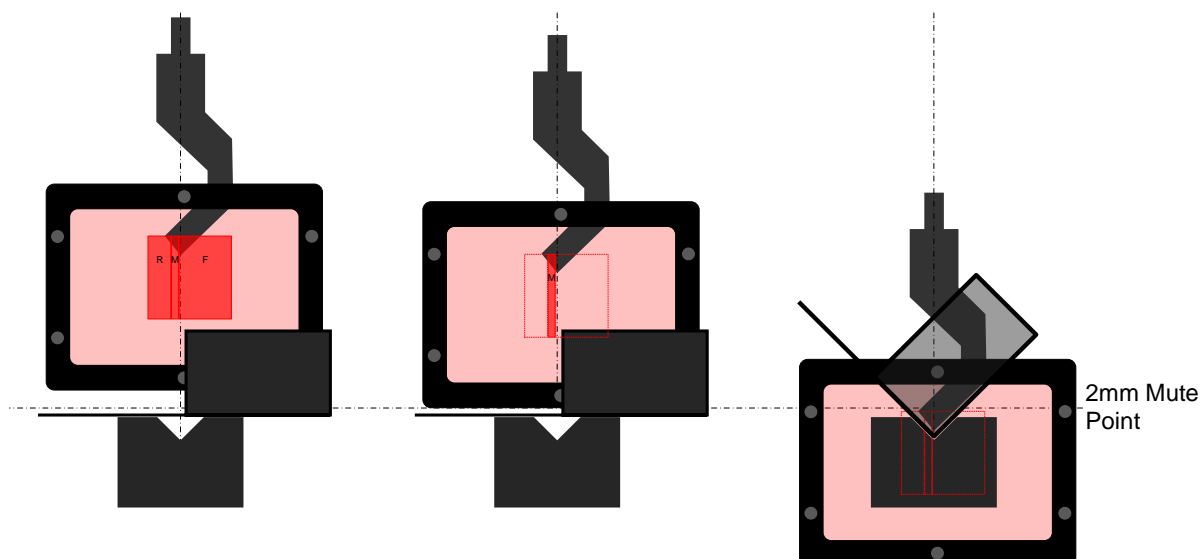


Figure 3-5: Tray/Box Mode Operation

If at any time the middle sensor is obstructed, the beam will stop and closing movement can only be completed in safe speed. When either Tray/Box Mode is selected, all sensors are active at the start of each cycle and the automatic muting of the front and rear sensors is as described in **Sections 3.5.1- 3.5.2**.

3.5.1 Tray Mode - From a Stationary Position

If there is no obstruction to any of the guarded regions then the system operates as it does in Normal Mode (refer **Section 3.4**). If the front and/or rear regions are obstructed when the pedal is pressed, then the tools will not close and the message **Front/rear sensor blocked – RELEASE FOOT PEDAL** is displayed. The operator must release and press the pedal again, at which point the system deactivates the front and rear regions and allows the tools to close in high speed (the middle region **must** remain clear) until the bend is completed. If the middle region is obstructed when the pedal is pressed then the tools will not close. The operator must release and press the pedal again. The system will force the tools to close in safe speed only with the optical protection muted and display the message **LASERS INACTIVE** until the bend is completed. The guarded regions become active again once the tools are opened.

3.5.2 Tray Mode - When the Tools are Closing

If there is no obstruction to any of the guarded regions then the system operates as it does in Normal Mode (refer **Section 3.4**). If the front and/or rear regions are obstructed then the tools will stop closing and the message **Front/rear sensor blocked – RELEASE FOOT PEDAL** is displayed. The operator must release and press the pedal again, at which point the system deactivates the front and rear regions and allows the tools to close in high speed (the middle sensor must remain clear) until the bend is completed. If the middle sensor is obstructed when the pedal is pressed then the system will force the tools to close in safe speed only with the optical protection muted and display the message **LASERS INACTIVE** until the bend is completed. The guarded regions become active again once the tools are opened.

3.5.3 Tray 2 Mode

Tray 2 mode is a variant of the standard Tray/Box mode. As in Tray/Box mode, the front and rear regions of the guarding system are disabled, so that complex shapes can be bent. The operation of Tray/Box 2 mode differs from standard Tray/Box mode in the following details.

1. Before every stroke the operator must acknowledge that they are in Tray 2 mode. The first pedal press does not close tools, but generates the message **TRAY 2 CONFIRM – RELEASE FOOT PEDAL**, alerting the operator that Tray 2 mode is selected. This message will be displayed until the pedal is released. The operator now has three seconds to press the foot pedal and perform the stroke.

2. On the second pedal press the beam moves down in high speed with the front and rear regions muted for the entire stroke. An obstruction to the front or rear sensor will **not** halt the machine and it will continue down in high speed until the slow speed point. If this second pedal press does not occur within the three second timeout, the cycle is reset, and Step 1 above must be repeated.

The middle sensor is always active, regardless of which Tray/Box mode is selected. It guards through the entire stroke (until the mute point), as described in **Sections 3.5.1- 3.5.2** above.

3.6 Back Gauge Mode

Back Gauge mode is used in cases where the back gauge of the press brake is moving forward far enough to obstruct the rear sensor. When Back Gauge mode is enabled, the rear sensor is muted 16mm above the normal mute point, allowing the back gauge to enter the work space without causing an obstruction. All other sensors operate as per Normal mode.

3.7 Field Muted Mode



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Sentinel Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

Entry to Field Muted mode can be password protected, and should only be used by suitably trained personnel, and only in exceptional circumstances (changing tools, maintenance, etc.).

In Field Muted mode, protection provided by the laser guarding is muted for the entire stroke of the beam and therefore does not provide any optical protection. However, the Sentinel Plus system maintains all of its other safety functions. For example, it continues to monitor that the closing of the tools occurs at safe speed and stops the machine if that speed is exceeded.

Field Muted mode should only be used in cases where no alternative guarding mode is acceptable. Field muted mode can be password protected by personnel with Supervisor level menu privileges.

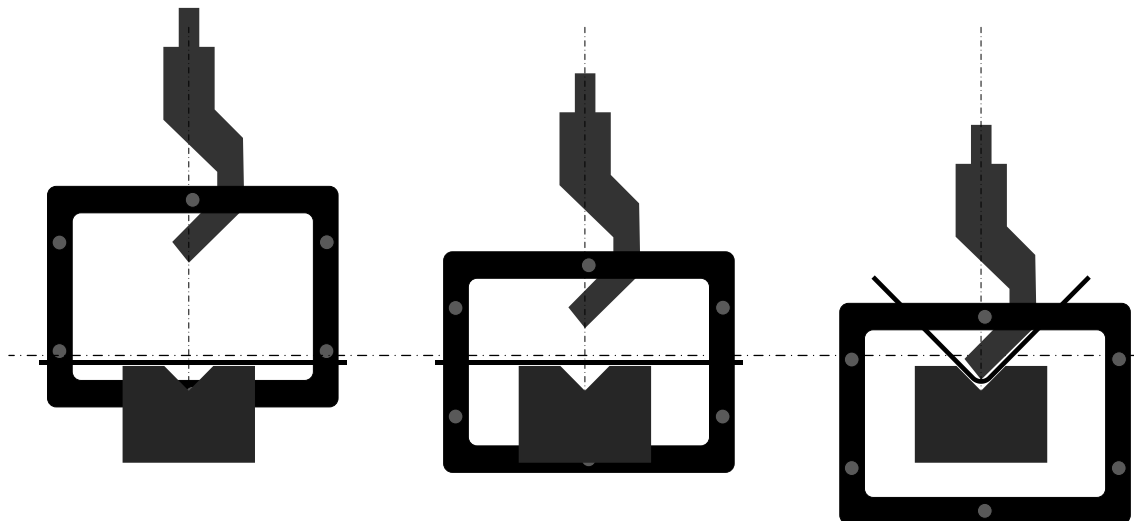


Figure 3-6: Field Muted Mode Operation

3.8 Stop at Mute Mode

The Stop at Mute Mode automatically forces the tools to stop closing at the mute point (a 2mm opening). To complete the bend the operator must release and press the pedal.

3.9 Special Guarding Modes

There are two special guarding modes which modify the way in which the laser guarding is configured; Special Tools mode and Thermal Compensation mode.

3.9.1 Special Tools Mode

The tool tip finding process in the Sentinel Plus is designed around V tools that are used in most press brake operations. Once the tool tip is found the optical protection is set to guard the danger zone around the tool tip.

Non-standard tools, such as those shown in **Figure 3-7** have silhouettes that place them outside of the normal tool tip detection range. Large V, large radius or flattening tools require the use of Special Tools mode, which changes the way in which the Sentinel Plus detects the lowest point of the tool, and sets the guarded area. This ensures that the guarded area is appropriate for the non-standard tool, and provides the highest possible level of protection for the operator.

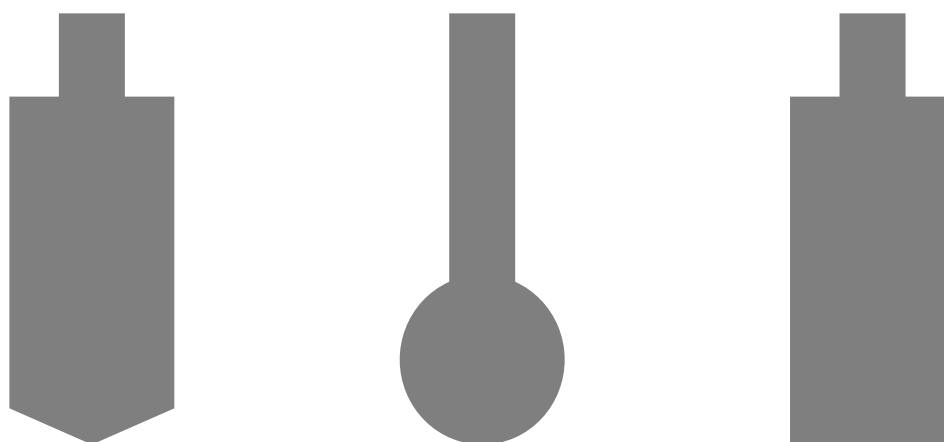


Figure 3-7: Special Tool Types (left to right) Large V, Large Radius, Flattening

Depending upon the size and shape of the tool the Sentinel Plus may have to increase the mute point. If the mute point opening is increased by the Sentinel Plus, then the slow speed point of the press must also be increased appropriately by the machine operator. The approximate slow speed point (the tool opening in mm) required by the Sentinel Plus is displayed in the System Information menu, as shown in **Figure 3-8** (refer to Section 5.7.1 for more details).

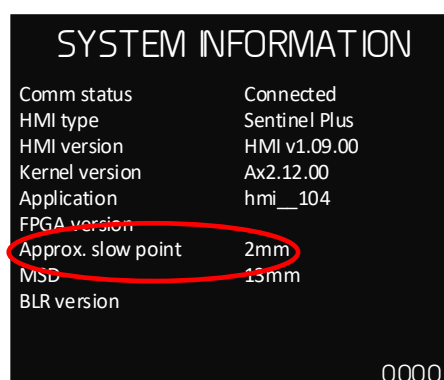


Figure 3-8: Approximate Slow Speed Point

Refer to **Table 3-1** (radius tools), **Table 3-2** (large V tools), and **Table 3-3** (flattening tools) for the recommended slow speed points.



Note:

In these tables the stated values for each of the tool sizes is nominal only, and can be detected with a tolerance of +/-3mm during the tool align process. This may therefore affect the minimum allowable mute or slow speed distance finally used, but will always be within safe and acceptable limits.

Radius	Mode	Minimum mute/slow speed
Small	-	2mm minimum
Small → R37	Special Tools	2mm minimum
R37 → R67	Special Tools	6mm minimum
R67 →	Special Tools	20mm minimum (see warning below)

Table 3-1: Radius Tools

V Angle	Mode	Minimum mute/slow speed
Less than 150°	-	2mm minimum
150 →	Special Tools	6mm

Table 3-2: Large V Tools

Tool Width	Mode	Minimum mute/slow speed
Less than 30mm	Special Tools	2mm minimum
30mm → 56mm	Special Tools	6mm minimum
56mm →	Special Tools	20mm minimum (see warning below)

Table 3-3: Flattening Tools

**Warning: CRUSHING HAZARD OUTSIDE OF THE PROTECTION AREA**

If the tool is large enough to present a crushing hazard outside of the protection area provided by the laser guards it is necessary to provide additional safety measures, such as increasing the slow speed distance of the machine (as recommended by European Standard EN12622).

If the Sentinel Plus is in Special Tools mode, and a large tool has been detected that requires a 20mm mute/slow speed point, a Stop at Mute will also be performed on every stroke.

3.9.2 Thermal Compensation Mode

The LZS-R transmits a two dimensional 'block' of laser light that surrounds the tool, and projects a silhouette (or shadow) of the tool onto the receiver window. A camera in the receiver captures and analyses an image of the silhouette to detect if an obstruction is present.

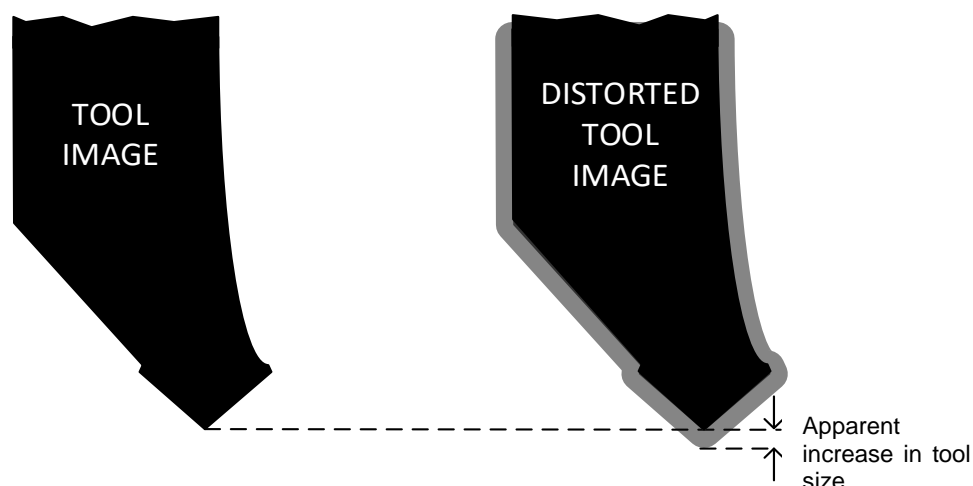


Figure 3-9: Tool Image Distortion

Differences in air temperature around the tool may cause distortion of this image making the upper tool appear larger than it actually is, as shown in **Figure 3-9**.

This distortion may be caused by:

- Local weather conditions.
- Heat generated by the press brake.
- Heating of the tool during operation.
- Airflow across the press brake caused by fans, blowers or air conditioners.

In Normal mode receiver camera pixels in the guarded area around the tool tip are grouped together into 'sensors' that are effectively 2mm x 2mm square. In Thermal Compensation mode the effective sensor size is increased to 4mm x 6mm.

This change requires that the minimum mute point opening is increased to 6mm. As with Special Tools mode the approximate slow speed point required by the Sentinel Plus is displayed in the System Information screen, see **Figure 3-8** (refer to **Section 5.7.1** for more details).

Refer to *Lazer Safe Laser Distortion Causes and Solutions Manual (LS-CS-M-057)* for further information.

3.10 Tool Set-up Mode (optional)

Tool Set-up mode is provided to allow operation of the machine during tool set-up and referencing without the Sentinel Plus system raising unnecessary error conditions. Tool Set-up mode should be considered a special case of Field Muted mode for the Sentinel Plus. All cautions and restrictions applied to Field Muted mode (see **Section 3.7**) should also be exercised in Tool Set-up mode. Tool Set-up Mode is only required for some models of press brakes.

In Tool Set-up mode the Sentinel Plus will attempt to restrict the tool closing speed to crawl speed (the crawl speed output **Y02** is active). However, some models of press brake ignore the crawl signal in Tool Set-up mode, and permit higher closing speeds. The Sentinel Plus Set-up mode will allow these higher closing speeds **on the condition that the sensors remain clear**.

- Before entering Tool Set-up mode the LZS-R transmitter and receiver must be aligned with the tool (see **Section 4.2**).
- If the closing speed is restricted to safe speed in Tool Set-up mode, then the sensors are effectively muted. Although the laser is ON, **treat the press brake as if Field Muted mode was active**.
- If the sensors remain clear **then all speed and direction monitoring is disabled**.
- If the sensors are obstructed **then safe speed is immediately enforced**.



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

In Tool Set-up Mode the laser is ON, but the optical protection is disabled. Although the Sentinel Plus Press Brake Guarding System will ensure that the machine does not exceed safe speed if the sensors are obstructed, particular caution must be exercised.

Tool Setup mode is password protected and only accessible to operators with Supervisor level access. When the TOOL SETUP button is pressed the screen prompts the operator to enter the Supervisor access code, as shown in **Figure 6-18**.

If the code is correct the Sentinel screen proceeds to the Tool Setup mode screen, and if an external mute lamp has been installed it will be switched ON to indicate that optical protection has been de-activated.

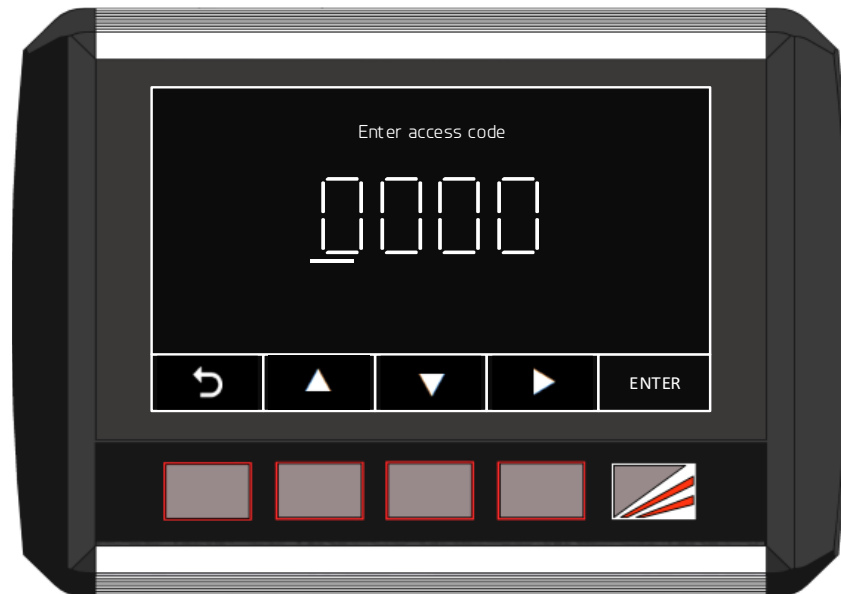


Figure 3-10: Tool Setup Mode Access Screen

3.11 Light Curtain Mode (optional)

The Sentinel Plus system also supports dual guarding, where a third party light curtain can be connected to the PGS-3. This gives the machine operator an option to select either the laser guarding function or light curtain function. When in Light Curtain Mode the Sentinel Plus continues to control the mute, speed and stop time monitoring functions.



Warning: REFER TO THE LIGHT CURTAIN MANUFACTURER'S DOCUMENTATION BEFORE OPERATING LIGHT CURTAIN MODE

The light curtain is a third party device and is not manufactured or supplied by Lazer Safe. Please ensure that the light curtain is installed and configured according to the manufacturer's instructions. Ensure the machine operator has been trained and is fully conversant in the operation and function of the light curtain prior to operating the Sentinel Plus Press Brake Guarding System in Light Curtain Mode.

3.12 Mute Mode – Restricted (optional)

The Sentinel Plus System may be installed on machines that do not support dual speed operation. However, if these machines cannot close tools at safe speed, any condition that requires safe speed will trigger an over speed error, and an E-Stop.

In this case the system must be installed with one of the Restricted options enabled. Any condition that would normally allow closing tools in safe speed (for example, while there is an uncleared obstruction) is prohibited. Tools must be opened, and the condition that is forcing safe speed cleared before normal operation can continue. A Mute Mode option can be set independently for light curtain and laser guarding.



Note:

In Mute Mode - Standard the Sentinel Plus automatically forces slow speed when setting the mute point with the LZS-R optical guards. If either the Restricted 1 or Restricted 2 options have been selected, the operator must manually set the closing speed on the mute setting stroke to less than 50mm/s.

3.12.1 Standard

The default setting is Standard mode, for machines that support dual speed operation and are able to force safe speed when required by the Sentinel Plus system.

3.12.2 Restricted 1

The Mute Mode - Restricted 1 option enforces the following conditions.

- Crawl speed is not permitted in Normal, Tray or Field Muted modes.

- Any obstruction prohibits tools closing.
- Tool Setup mode is disabled.

3.12.3 Restricted 2

The Mute Mode Restricted 2 option enforces the following conditions.

- Crawl speed is not permitted in Normal, Tray or Field Muted modes.
- Any obstruction prohibits tools closing.
- Tool Setup mode is enabled.

3.13 Tool Change

When changing the tools the transmitter and receiver can be easily moved clear so that the punch can be removed from either end of the machine. To realign the transmitter and receiver each is moved quickly back into position.

The transmitter is adjusted to the correct distance from the punch tip with the aid of an alignment tool. The receiver is then adjusted so that the tools tip is roughly centred in the receiver window.

A tool alignment is performed, and the receiver will prompt the operator with directions that will move the receiver into the optimum position. After the tool change, the mute point is then set and confirmed by the operator on the first stroke.

3.14 Closed Loop Design

The closed loop design enables monitoring of the stopping distance (overrun) of the pressing beam every time it stops. If the stopping distance limit is exceeded, an emergency stop signal is issued and the machine is shut down.

The speed of the pressing beam is also continuously monitored during normal operation. If safe speed is required (for example if the sensors are muted), but the pressing beam is moving down beyond safe speed, an emergency stop condition is triggered. The operator will be prompted to clear the error by pressing the error reset button; **Over speed error – PRESS RESET.**



Note:

Only exceeding safe speed triggers an emergency stop condition. If any other speed is exceeded (i.e. pressing speed) the pressing beam will be halted, and the operator will be prompted to clear the error, however this can be done via the foot pedal. The panel will display the message **Over speed error – PRESS/RELEASE PEDAL.**

The system also monitors the machine process for failures of hydraulic valves, failures of electrical components, and failures in the machine controller software in relation to the actions of the parts of the machine that pose risk to the operator.

4 LZS-R Operation

This section describes the operation of the LZS-R block laser transmitter and receiver, and in particular the automatic tool alignment feature of the Sentinel Plus system.

4.1 Transmitter and Receiver LED Indicators

LEDs on the side of the transmitter and receiver indicate the state of the optical guards, as shown in **Figure 4-1**.

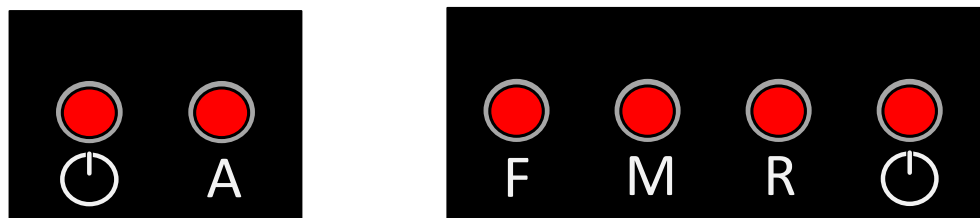


Figure 4-1: Block Laser Transmitter (left) and Receiver (right) Indicators

The transmitter has two indicators; power and **A**. The **A** indicator on the transmitter is ON whenever the laser is active i.e. the Sentinel Plus is not in Field Muted mode.

The receiver has four indicators; power, **F**, **M** and **R**. The **F**, **M** and **R** indicators turn on when the front, middle or rear segments of the guarded area are obstructed.

4.2 Alignment Procedure

The LZS-R receiver features automatic tool alignment, where the image of the tool silhouette is analysed by the receiver, the tip of the punch is located and the protection zone is accurately aligned with the tool tip position. This optimizes the level of safety and productivity provided by the Sentinel Plus system.

The automatic tool alignment process first requires that the transmitter and receiver are positioned in accordance with **Lazer Safe Block Laser Alignment Guide (LS-CS-M-025 Rev 2.0)**. This will position the transmitter, receiver and tool within the limits of the automatic tool alignment process. **Figure 4-2** is taken from the alignment guide, and shows the correct position for the tool silhouette on the receiver window.

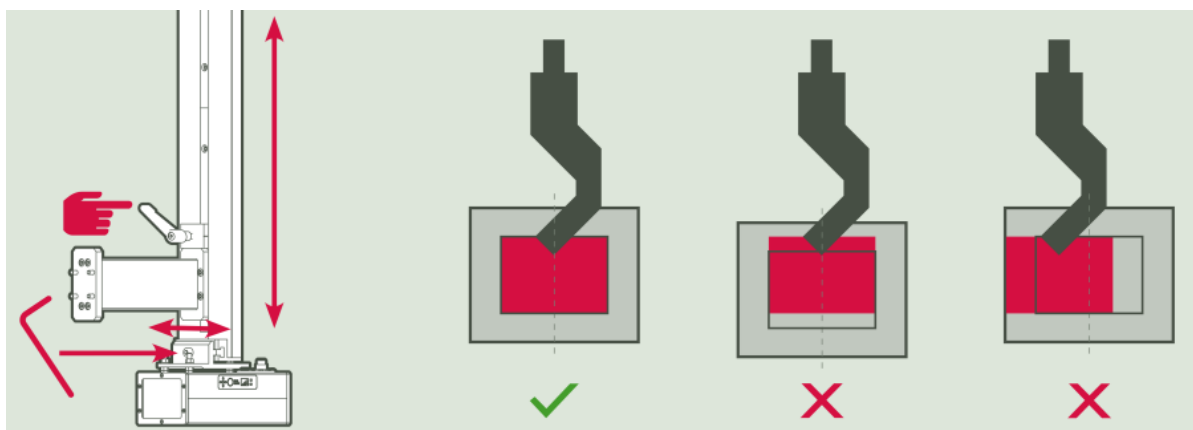


Figure 4-2: Block Laser Receiver Alignment

When the transmitter and receiver have been positioned correctly, the automatic tool alignment can be performed.

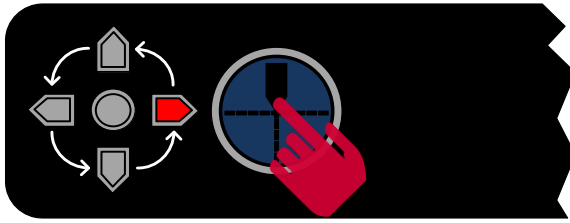


Figure 4-3: Automatic Tool Alignment

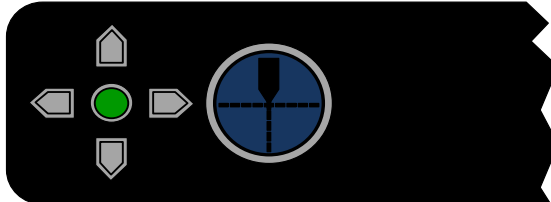


Figure 4-4: Alignment Successful

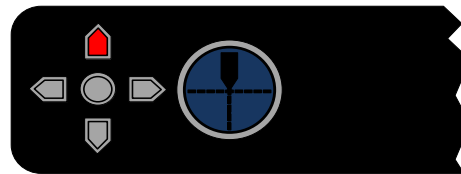
Press the Tool Align button on the receiver and the automatic tool alignment process will begin. As the image is analysed by the receiver, the red LEDs cycle as shown in **Figure 4-3**.

The time taken to locate the tool tip depends upon several factors – tool size and shape, the accuracy of the initial alignment of transmitter, receiver and punch, environmental conditions etc.

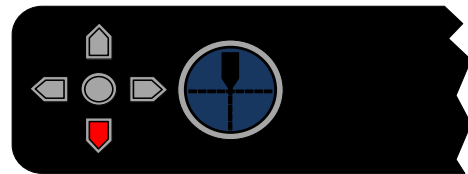
If the automatic tool alignment is successful the red LEDs stop cycling, and only the centre green LED lights, as shown in **Figure 4-4**.

If the initial position of the tool silhouette on the receiver is outside the limits of the automatic tool alignment, the red receiver LEDs indicate to the operator why the alignment was not successful, and how the position of the receiver must be changed to improve the alignment.

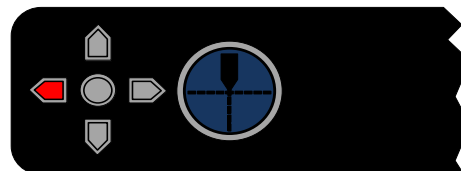
The LEDs show the direction that the receiver needs to be moved, interpreted as *if they are behind the receiver, looking at the transmitter*. **Figure 4-5** shows the directions as indicated by these LEDs.



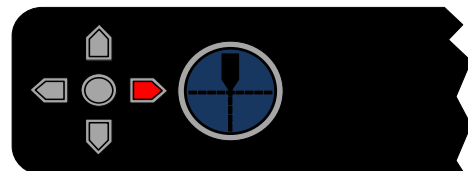
Move the receiver UP



Move the receiver DOWN



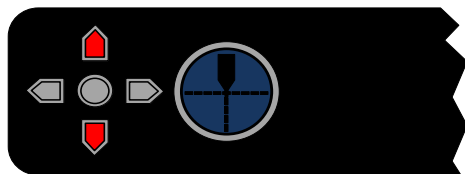
Move the receiver LEFT (front of machine)



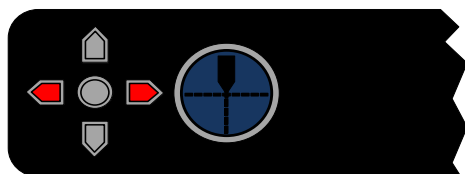
Move the receiver RIGHT (rear of machine)

Figure 4-5: Receiver Alignment Correction

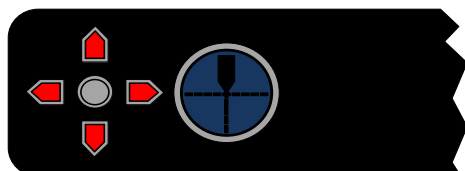
In some cases (extreme environmental conditions, unusual tool shapes, very poor alignment etc.) the automatic tool alignment may not be able to find the tool tip. Again, the receiver provides diagnostic information using the red LEDs. The status of the receiver alignment, and the recommended action is also displayed on the User Interface Panel in the Status and Action windows.



The image captured by the receiver is too dark to locate any tool silhouette. This may be caused by an obstruction, or by a poor alignment.



The image captured by the receiver is too light to locate any tool silhouette. This may be caused by poor alignment or high ambient light levels. This may also be caused when the transmitter laser is absent, as the receiver increases its sensitivity trying to find the laser.



The tool tip location has been lost. This may be caused by the power being cycled on the receiver, the mute point being reset by the operator, or the tool silhouette being lost.



Note:

It is the responsibility of the machine operator to ensure that the transmitter and receiver are correctly aligned. Correct alignment is essential to ensure maximum protection and productivity for the press brake operator.

4.3 Tool Change

When changing tools the brackets can be quickly moved up and locked clear so that the punch can be removed from the ends of the press brake.



Note:

If your machine has been optionally fitted with Lazer Safe Automatic Brackets refer to **Appendix B – Automatic Brackets** for details.

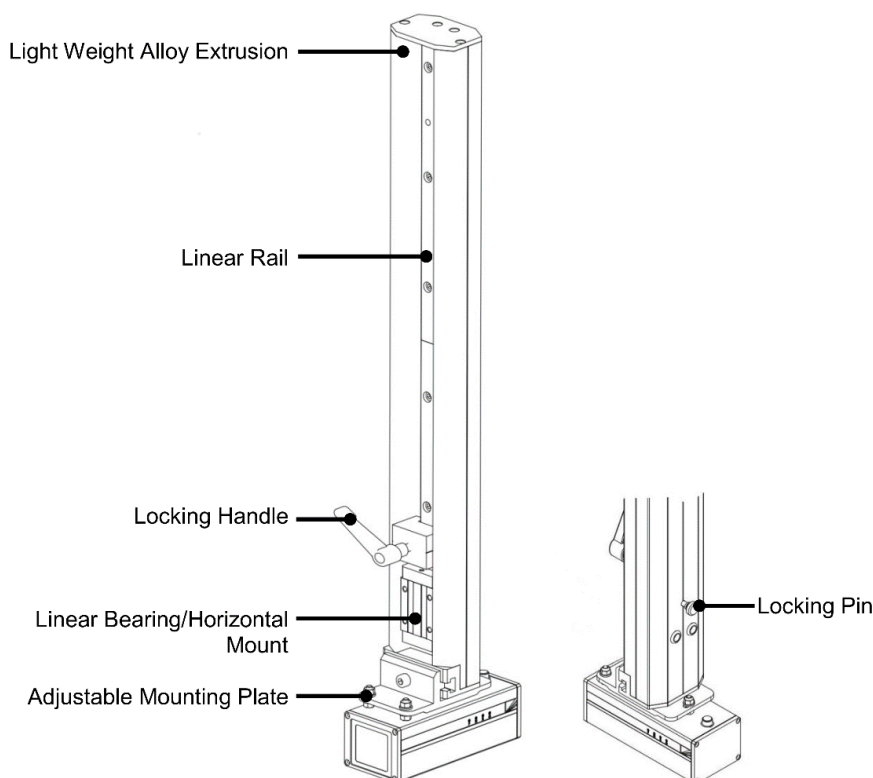


Figure 4-6: Mounting Brackets

To move the brackets for tool change simply place your hand under the transmitter or receiver and gently slide the bracket up.

Pull the locking pin out so the bracket can slide to the maximum upper position then release the locking pin. The locking pin is spring loaded so the bracket will now be held in the upper position and clear for tool change. After tool change, place your hand under the transmitter or receiver unit, pull and hold the locking pin then gently lower the bracket to the original position (the original position is maintained by the clamp/handle assembly), then release the locking pin.



Warning:

When adjusting the bracket handle ensure that the bottom of the bracket is held firmly with your free hand to prevent the bracket from free falling when the clamp is released.



Caution:

Excessive force on the bracket handle will result in the handle breaking. Do not apply excessive force when operating the handle. The handle should only be operated by hand and the use of tools or implements to tighten the handle must be avoided.

4.4 Alignment After Tool Change

After changing tools press the Tool Align button. If the automatic tool alignment is successful the system is now ready to operate.

If the automatic tool alignment does not succeed first ensure that the alignment is correct, as shown in **Figure 4-2**. Press the Tool Align button and adjust the receiver position following the directions given by the receiver LEDs, until the automatic tool alignment succeeds.

4.5 Periodic Alignment Check

The alignment of the transmitter as described in **Section 4.2** above should be checked at the following times.

- After system start-up.
- After each tool change.
- After each operator change.
- After each scheduled break or change of shift.
- Whenever the transmitter or receiver have been moved.

5 The Sentinel Plus User Interface Panel

5.1 User Interface Overview

The User Interface Panel is an advanced, industrial grade Human Machine Interface (HMI) specifically designed for the Sentinel Plus system. The operator controls the Sentinel Plus Press Brake Guarding System through a simple, menu-style user interface. The key features of the interface panel are shown in **Figure 5-1**.

Status Window

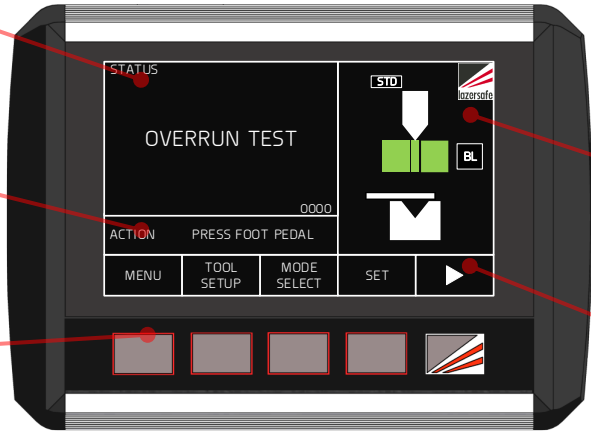
This window shows the current status of the press brake, and of the Sentinel Plus system.

Action Window

The Sentinel Plus system displays any action that is required by the operator in the Action Window.

Operator Pushbuttons

Five pushbuttons are provided for the operator to control the system, and navigate the menus.



Magnetic Backing

The panel can be mounted and moved for the convenience of the operator.

Sensor Window

This window shows the status of the receiver sensors, and the active mode.

Dynamic Button Labels

The button functions change depending upon the selected screen and machine state.

Figure 5-1: Sentinel Plus User Interface Panel

Figure 5-2 shows the different Sentinel Plus screens that can be selected by the operator. The Main screen is the top level screen (as shown in **Figure 5-1**). From here the operator can select the other screens using the panel pushbuttons.

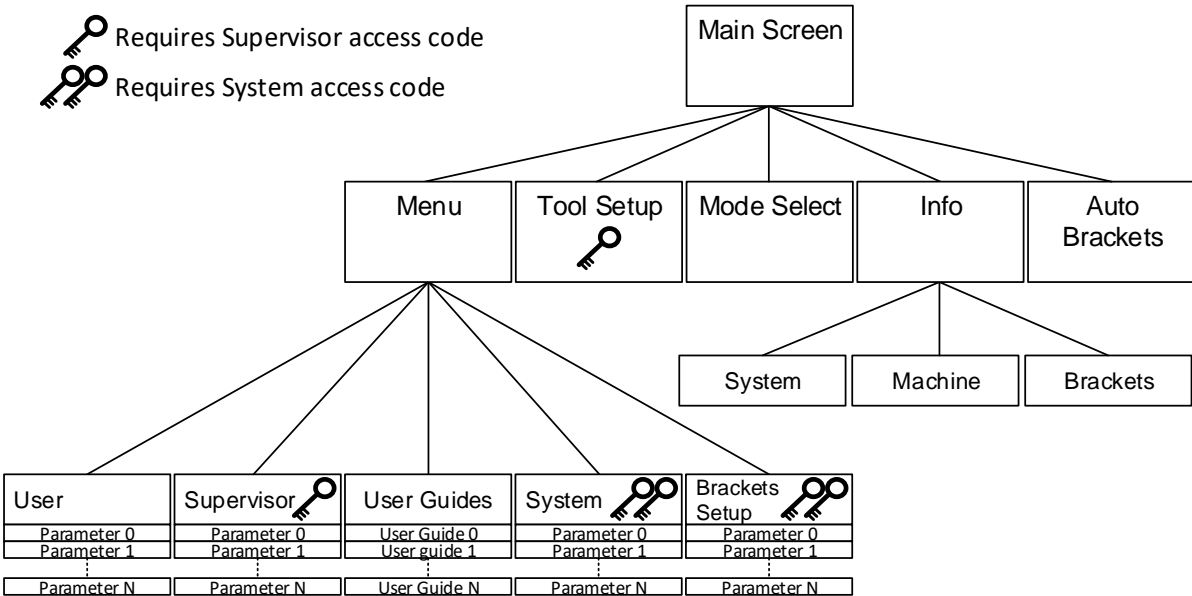


Figure 5-2: Sentinel Plus Menu Levels



Note:

An operator only needs to be familiar with the Main and Mode Select screens to perform most typical machine operations. The Mode Select screen is only required when changing guard modes.

There are three levels of access to the menu system; User, Supervisor and System. The Supervisor and System menus are restricted, and each requires a unique four-digit code to be entered before they can be accessed. This document only describes menus accessible up to the Supervisor level.

5.2 Error Reset Indicator and Reset Button

Aside from the User Interface Panel the Sentinel Plus system requires an external error reset lamp to indicate that an error or fault condition has occurred, and an error reset switch that is pressed to acknowledge the error. These are typically combined into an illuminated pushbutton that is mounted on the side of the press brake.

The reset indicator can be in one of three states:

- **OFF.** System status is normal – no error, no action is required.
- **ON.** An error has occurred – press the reset button once.
- **ON/FLASHING.** Multiple errors have occurred, press the reset button twice.

If the error cannot be cleared by pressing the reset button multiple times, then a fault or emergency stop condition has occurred that must be corrected before the error can be cleared. See the Status and Action screens of the Sentinel Plus User Interface for further information.

If the error cannot be cleared contact your supplier or Lazer Safe Customer Support for assistance.

5.3 Optional Indicators

There are two optional indicators that may be installed with your Sentinel Plus system, which allow operators to see the state of the optical protection even when they are away from the User Interface.

- **Mute Lamp.** This turns ON whenever the optical protection is muted, and ON/FLASHING in Tray/Tray 2 mode.
- **Obstruction Lamp.** This turns ON when the optical protection is obstructed.

5.4 The Main Screen

The Main screen is the top level screen of the User Interface Panel, and is shown in **Figure 5-3**. The screen is divided into four windows; The Status, Action, Button Labels and Sensor windows.

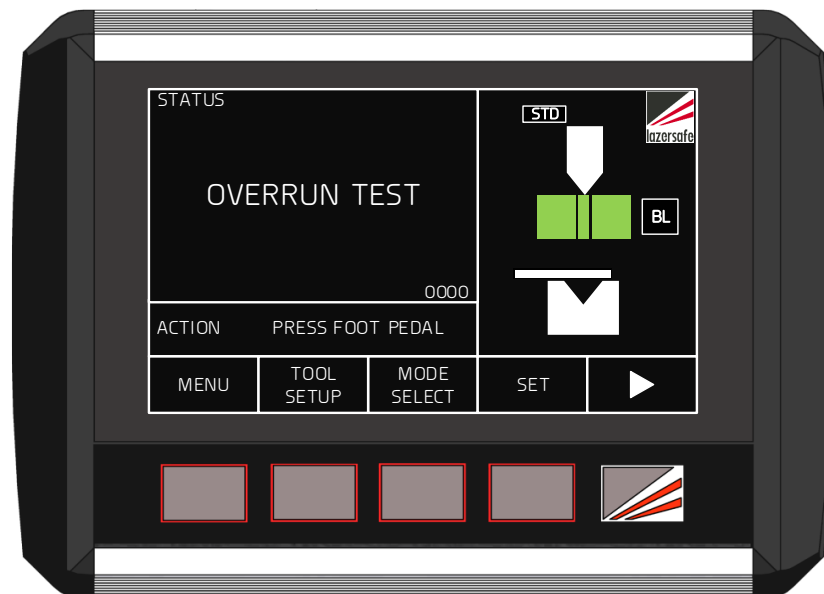


Figure 5-3: The Sentinel Plus Main Screen



Note:

If the Sentinel Plus system is idle (no button or foot pedal press) for more than 5 minutes it will display an idle screen. A button or foot pedal press will return the panel to the most recently displayed screen.

5.4.1 Status and Action Windows

The Status window informs the operator of the current status of the Sentinel Plus system, and the machine it is guarding. The information provided by the Status screen includes:

- **Operating Mode.** The guard mode currently selected (Normal, Tray, Tray 2, Field Muted) is displayed during normal operation. This message will be overwritten if an error/fault condition occurs.
- **Mute Status.** The Status window turns red whenever the guarding is muted, to clearly indicate to the operator that guarding is inactive.
- **Error/Fault Messages.** If the Sentinel Plus system detects an error or fault condition the operator will be alerted by the Status window. In most cases this will be a short message that describes the error/fault condition.
- **Condition Code.** The PGS-3 Safety Controller displays Condition Codes on its scrolling LCD panel to communicate actions, errors or faults. These codes are displayed as a 4-digit hexadecimal code (numbers 1-9, letters A-F) that uniquely describes a particular condition. This Condition Code is also displayed in the lower right hand corner of the Status window.
- **Operation Pending:** If the PGS-3 Safety Controller requires that an operation is to be performed to verify the safety performance of the machine (such as an overrun test) the operator is informed of the upcoming operation in the Status window (and is also prompted for action by an Action window message).

The Action window prompts the operator with the action required to complete the current operation. For example, if a fault condition occurs, the error message and condition code are displayed in the Status window, while the Action window prompts the operator to **PRESS RESET**.

5.4.2 Main Screen Button Labels

The five buttons on the User Interface Panel change function depending upon the user selection, current screen, the Supervisor menu configuration, and the state of the machine.

The Main screen buttons are divided into two groups that can be selected by the operator, using the ► ◀ buttons to switch between the groups. The first group of buttons is used during normal operation of the press brake, as shown in **Table 5-1**.

Label	Button Function
MENU	This leaves the Main screen and enters the Menu screen. See Figure 5-2 for an overview of the menu system.
TOOL SETUP	Leaves the main screen and enters the Tool Setup screen (an access code is required to enter the Tool Setup screen).
MODE SELECT	Leaves the Main screen and enters the Mode Select screen, where the guard modes can be selected.
SET/MUTE RESET	This button can be used to set or reset the mute point. The button label changes depending upon the state of the mute point.
►	This changes the dynamic button labels to the second group as listed in Table 5-2 .

Table 5-1: Main Screen Buttons, Normal Operation.

The second group of buttons allows the operator to enter the Info screen (see **Section 5.7**) or the Automatic Brackets screen.



Note:

If Automatic Brackets have not been installed on your machine all bracket related menus will be disabled with grey text. If Automatic Brackets have been installed on your machine, refer to **Appendix B – Automatic Brackets** for details.


Label	Button Function
	This returns the dynamic button labels to those used for normal operation of the press brake, see Table 5-1 .
INFO	This leaves the Main screen and enters the Info screen. See Figure 5-2 for an overview of the menu system.
AUTO BRACKETS	This leaves the Main screen and enters the Automatic Brackets screen, refer Appendix B – Automatic Brackets .
	Reserved.
	Reserved.

Table 5-2: Main Screen Buttons, Info and Auto Brackets.

5.4.3 Sensor Window

The Sensor window shows the status of the optical protection from the point of view of the receiver (laser or light curtain). Symbols in the window show the current active mode, and the state of the receiver sensors in real time. The general appearance of the window (with laser optical protection) is shown in **Figure 5-4**, although this will change depending upon the protection options selected.

In the following sections the Sensor window will always be shown with the appropriate symbols for the operating mode being described.

Block Laser Modes

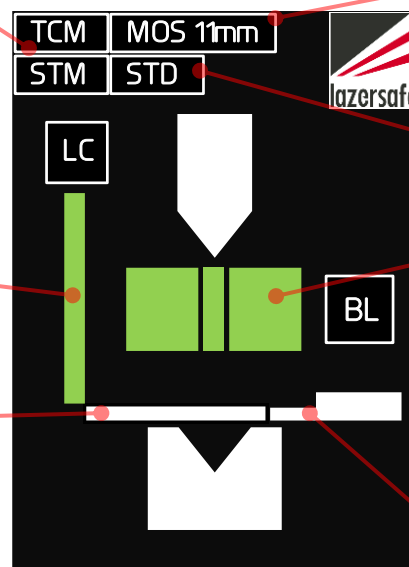
These symbols indicate if Special Tool or Thermal Compensation mode is active.

Light Curtain

If light curtain guarding is selected this symbol shows the status of the receiver sensor – green for clear, red for obstructed.

Material

This symbol shows that the guarding is set to Normal mode. This symbol will change when Tray or Tray 2 modes are selected.



Mute Off-Set Distance

Shows the mute off-set distance in millimetres.

Mute Mode

Indicates the mute mode option.

Block Laser Guarding

If laser protection is selected these symbols show the status of the **FRONT, MIDDLE** and **REAR** regions of the laser receiver – green for clear, red for obstructed.

Back Gauge

Indicates that Back Gauge mode is enabled.

Figure 5-4: Sensor Window

The block laser receiver also has indicators to show the state of the guarded region around the tool, as shown in **Figure 5-5**. The **F, M** or **R** LED is **ON** when the region is obstructed.

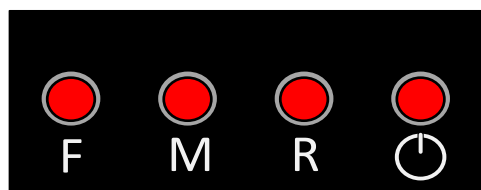


Figure 5-5: Front, Middle and Rear Obstruction Indicators

5.5 Mode Select Screen

The other screen used in most typical machine operations is the Mode Select screen. This only differs from the Main screen in the function of the five input buttons.

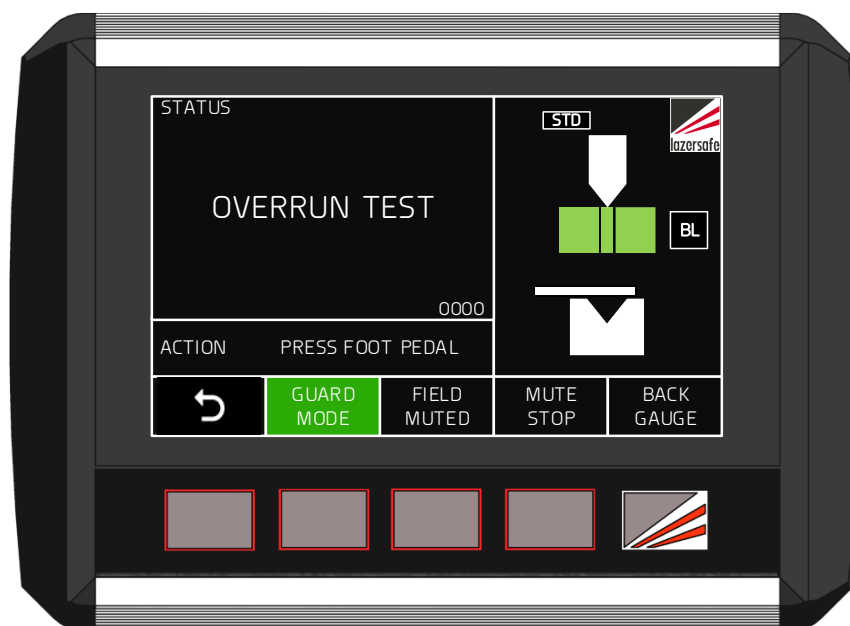


Figure 5-6: Mode Select Screen

The buttons are used to select the different guard modes (these modes are detailed in **Sections 3.3 to 3.12**). The operation of the Mode Select screen and the Sensor window symbols is explained in **Section 6**.


Label	Button Function
	This leaves the Mode Select screen and returns to the Main screen. See Figure 5-2 for an overview of the menu system.
GUARD MODE	This button cycles through the guard modes: Normal → Tray → Tray 2 → Normal etc.
FIELD MUTED	If this button is enabled, it toggles the Field Muted mode. The functionality of this button can be configured in the Supervisor menu.
MUTE STOP	If this button is enabled, it toggles the Stop at Mute mode. The functionality of this button can be configured in the Supervisor menu.
BACK GAUGE	This button toggles the Back Gauge mode.

Table 5-3: Mode Select Screen Buttons


5.6 Menu Screen

The Menu screen gives access to the menus that are used to configure the way that the Sentinel Plus system operates. There are three levels of access to the menu system; User, Supervisor and System.

The User level menu does not require an access code, and can be accessed by anyone operating the machine.

The Supervisor level menu requires an access code. This menu contains parameters that configure how the Sentinel Plus system and the User Interface Panel operate. This menu should only be accessible to suitably trained and authorized personnel.

The System and Brackets Setup menus require a system level access code. (This is the highest level access code, and can also be used to access the Supervisor level menu). These menus contain machine/site specific parameters that are set during the installation of the Sentinel Plus Press Brake Guarding System. The System and Bracket Setup menus are **not** described in this document.



Warning:
The **System and Bracket Setup** menus do not contain any user configurable parameters. These menu parameters must only be configured by trained and qualified Sentinel Plus installers. Setting incorrect parameter values may render your machine inoperable.

The Menu screen buttons are divided into two groups. The first group selects the menus that are available at user and supervisor access level. The second group selects menus that require system level access.

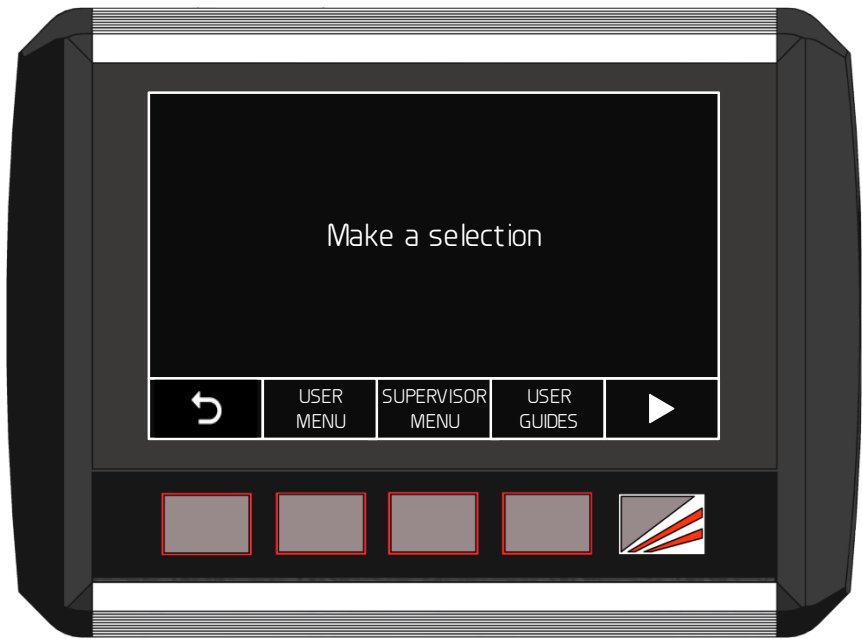


Figure 5-7: Menu Screen



Label	Button Function
	This leaves the Mode Select screen and returns to the Main screen. See Figure 5-2 for an overview of the menu system.
USER MENU	This accesses the User menu. No access code is required.
SUPERVISOR MENU	This accesses the Supervisor menu. An access level of Supervisor or System level is required.
USER GUIDES	This button selects instructional guides on the operation of the Sentinel Plus system. No access code is required.
	This changes the dynamic button labels to select the system level access menus, see Table 5-5 .

Table 5-4: Menu Screen Buttons, User/Supervisor Level Access


Label	Button Function
	This returns the dynamic button labels to the user and supervisor level access menus, see Table 5-4 .
SYSTEM MENU	This button accesses the System menu.
BRACKETS SETUP	This button accesses the Brackets Setup menu.
	Reserved
	Reserved

Table 5-5: Menu Screen Buttons, System Level Access

Once a menu has been selected the parameters can be navigated, selected and edited. The parameters are stored in non-volatile memory that is maintained even when the Sentinel Plus system is powered down. Refer to **Section 8** for detailed instructions on how to navigate and configure the User and Supervisor menus.

**Note:**

When any menu screen is selected, the safety application running on the PGS-3 turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the PGS-3 will show the Condition Code **40A1**.

5.6.1 User Guides

The User Guides are navigated in the same way as menus, using the arrow buttons. The arrow buttons step through the list of guides; the desired guide is then selected by pressing the ENTER button. Refer to **Section 8.1.1** for a description of how to navigate menus.




Label	Button Function
	This leaves the User Guide and returns to the User Guide list. See Figure 5-2 for an overview of the menu system.
	Selects the next page in the guide.
	Selects the previous page in the guide.

Table 5-6: User Guide Buttons

The User Guides are simple, step by step graphical guides for common procedures that need to be performed regularly on the Sentinel Plus system, such as the block laser tool alignment procedure.

If the guide contains more than one page the left/right arrow keys can be used to navigate the pages of the guide.

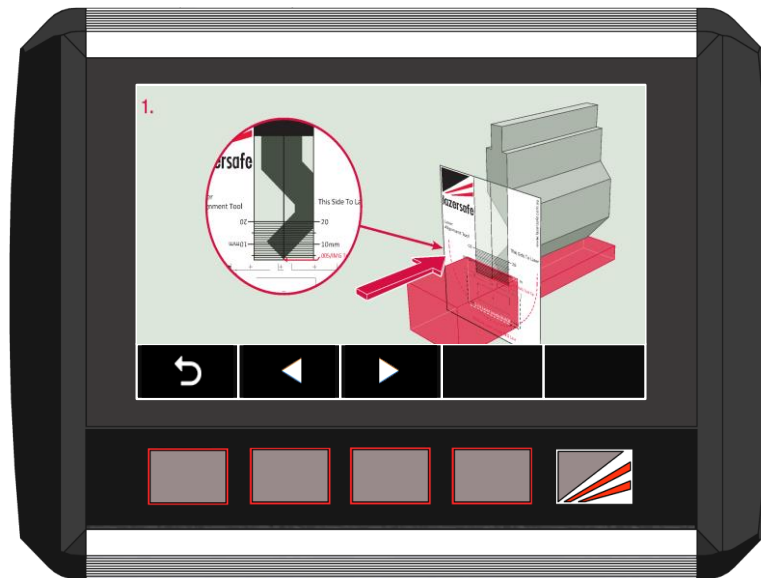


Figure 5-8: User Guide Screen

5.7 Info Screen

The Info screen is selected from the Main screen, and displays information about the Sentinel Plus system, and the press brake. The screen can be switched between displaying System Information and Machine Information.



Note:

The system parameters are stored in the User Interface Panel, and the system cannot run if the panel is disconnected. The safety application running on the PGS-3 monitors the system heartbeat signal.

If the heartbeat signal is not detected for 10 seconds, the safety application disables the down enable outputs. If the foot pedal is pressed, the PGS-3 LCD screen shows the Condition Code **40A1**.

5.7.1 System Information

System Information is displayed by pressing the **SYSTEM INFO** menu button in the Info screen.

- **Comm Status.** A heartbeat message is transmitted constantly between the PGS-3 and the panel to verify the integrity of the communications link. The **Comm status** field shows the state of the communications link; **Connected** or **Not connected**.
- **HMI type.** The User Interface Panel or HMI is used in several Lazer Safe guarding products. This is the particular guarding system for which the panel has been configured.
- **HMI version.** Sentinel Plus User Interface Panel software version.
- **Kernel version.** PGS-3 Safety Controller kernel software version.
- **Application.** PGS-3 Safety Controller application software version.
- **FPGA version.** PGS-3 Safety Controller FPGA firmware version.
- **Approx. slow point.** The slow speed point calculated by the Sentinel Plus. The press brake must be travelling in slow speed by this opening (in millimetres).
- **MSD (Manufacturer Stopping Distance).** The maximum distance that the press beam travels while stopping, as quoted by the press beam manufacturer. This value is programmed into the Sentinel Plus during installation. The stopping performance of the press beam is tested at start-up, and constantly monitored during operation (see Stop Distance in the Machine Information menu **Section 5.7.2**).
- **BLR version.** The LZS-R block laser receiver firmware version.

When contacting Lazer Safe Customer Support or your local dealer, please provide the system software version information from the System Info menu.

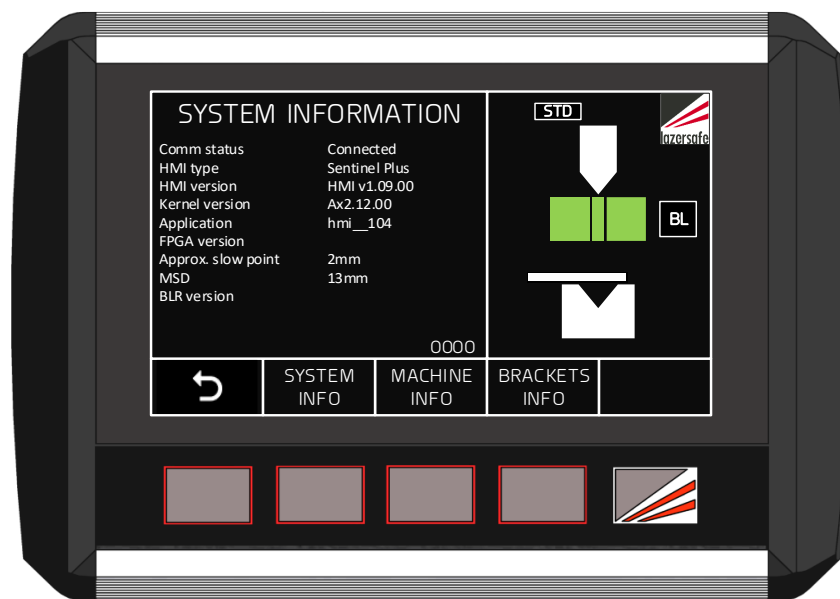


Figure 5-9: Info Screen, System Information

5.7.2 Machine Information

Machine Information is displayed by pressing the **MACHINE INFO** menu button in the Info screen.

- Stop Time. Measured by the PGS-3 each time the beam is stopped.
- Stop Distance. Measured by the PGS-3 each time the beam is stopped.
- Stop Time Limit. The maximum allowable stopping time for the machine, and only applies when light curtain guarding is active (stopping performance is normally indicated by the stopping distance). If this limit is exceeded, an emergency stop is initiated, and an overrun test is performed.

5.7.3 Brackets Information

If the press brake has Lazer Safe Automatic Brackets installed, bracket Information can be displayed by pressing the **BRACKETS INFO** menu button in the Info screen.

- Left bracket version. Left bracket firmware version.
- Comm status. The status of the PGS-3 expansion bus communications link to the left bracket. The status can be Connected or Not Connected.
- Right bracket version. As above for the right bracket.
- Comm status. As above for the right bracket.

6 System Operation

This section describes the operation of the Sentinel Plus Press Brake Guarding System from power up.

6.1 Power-up

When the Sentinel Plus is first powered it displays a start-up screen with the message **SYSTEM STARTING – PLEASE WAIT**, while it waits for the PGS-3 to complete its power on start-up test. Once the PGS-3 is initialised, the screen will change to the standard Idle screen as shown in **Figure 6-1**. Whenever the machine is idle for more than five minutes, it will return to the Idle screen.



Figure 6-1: Sentinel Plus Idle Screen

The LZS-R optical guarding system performs a self test and initialises its optical system. When the optical protection is has completed its power up tests, the green Tool Align Indicator LED will light on the receiver.

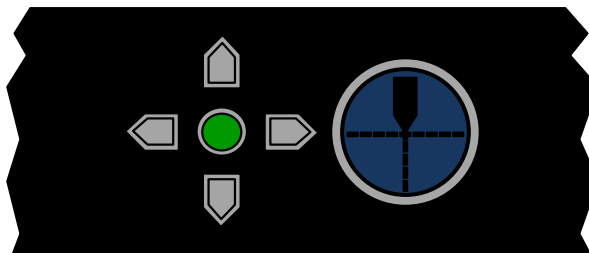


Figure 6-2: Tool Align Indicator



Note:

When Special Tools mode or Thermal Compensation mode have been selected, the operator is required to acknowledge the non-standard guard mode by manually performing a tool align at power up.

6.2 Start-up Test

By default the Sentinel Plus system starts with an emergency stop active, which must be cleared by the operator before the Enable and Auxiliary outputs are activated. Pressing the Reset button clears the emergency stop condition, and activates the outputs allowing the tools to close.

The first time the tools are closed the Sentinel Plus must perform an overrun test, where the beam is moved down in high speed, and then stopped to test the function of the emergency stop outputs, and also to assess the stopping performance of the press brake. The operator is warned of the upcoming test by a message in the Status screen, see **Figure 6-3**.

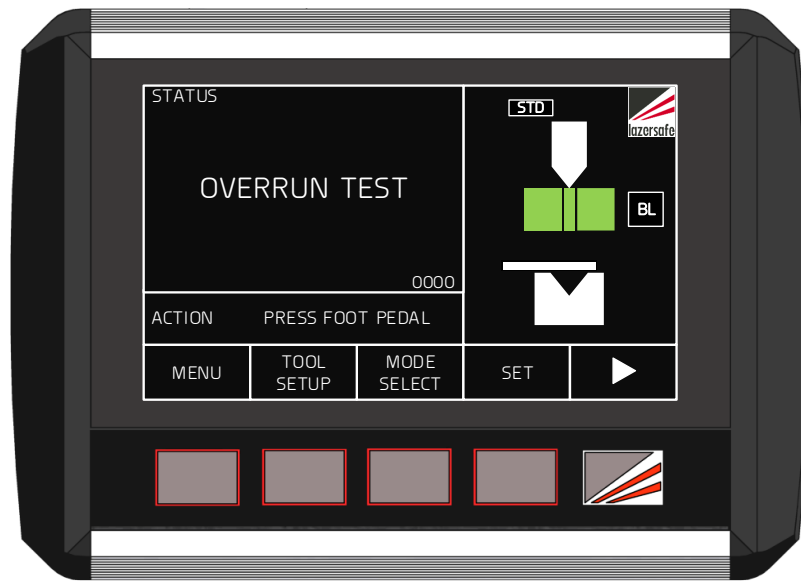


Figure 6-3: Start-up Test Screen

Before performing the overrun test check the following.

- Open the tools to a minimum opening of 100mm.
- Check that the transmitter and receiver are correctly aligned.
- Check that the receiver sensors are clear (see the LZS-R receiver or the Sensor window of the User Interface Panel).



Note:

Refer to **Section 4.2** for information on the automatic tool alignment procedure.

If the optical protection cannot be cleared, or the system has been started in Field Muted Mode, the test will be performed after 10mm of slow speed travel.

To commence the test, press the foot pedal as indicated in the Action window. The first foot pedal press performs a test on the laser guards, and alerts the operator that the system is changing to Normal mode, as shown in **Figure 6-4**.

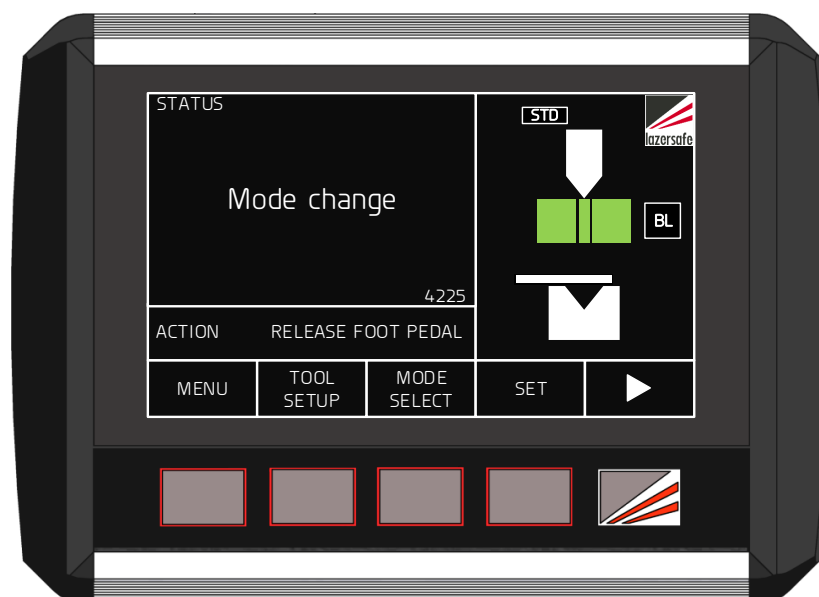


Figure 6-4: Mode Change Message

Release and press the foot pedal again. The press beam will start closing in high speed, and then automatically stop after a short distance. Depending upon the way the Sentinel Plus has been configured the test will be performed after 20mm, 50mm or 70mm of high speed travel.

When the test is complete the operator will be prompted to release the pedal: **Overrun test PASS – RELEASE FOOT PEDAL.**



Note:

After the start-up test is complete it may be necessary to reset the machine emergency stop circuit and/or restart the hydraulic pump.

The overrun test will be repeated in the following situations.

- Every power up.
- Every 24 hours of continuous machine operation.
- If the system returns to high speed operation after a slow speed start-up test.
- If the system detects that the stopping performance has deteriorated significantly during normal operation.

6.3 Setting the Mute Point

After the start-up test is complete, the operator will be prompted to set the mute point by the message **SET MUTE POINT – PRESS FOOT PEDAL.** The Sentinel Plus panel must be in the Main screen to access the **SET** button.

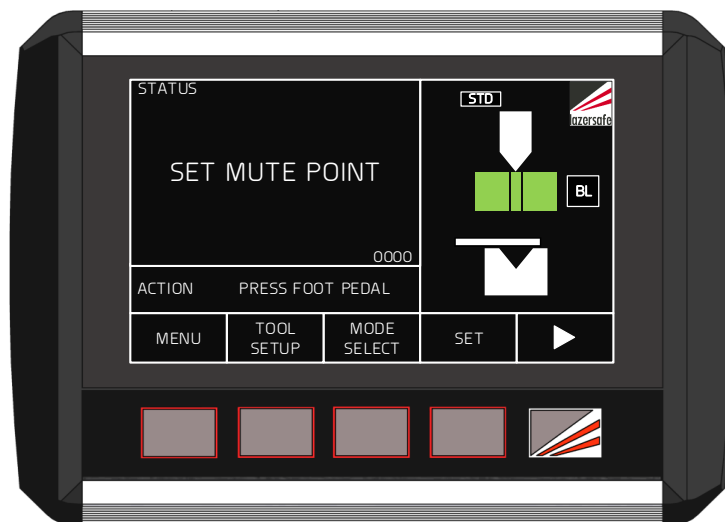


Figure 6-5: Set Mute Point Prompt Screen

For convenience place a piece of sample material on the die which is the same thickness as the work piece. The system will use this material to calculate the correct position of the mute point by traveling down and halting at the point where the laser guards detect the material.

Press the foot pedal. The press beam will descend in crawl speed and halt at the obstruction. The **SET** button will then change colour to green, which indicates that the mute point can now be set, as seen in **Figure 6-6.**



Note:

During the mute setting stroke the press beam is restricted to slow speed to ensure that the mute point is accurately detected. Also, only an obstruction to the front or middle guarding regions will allow the mute point to be confirmed and set.

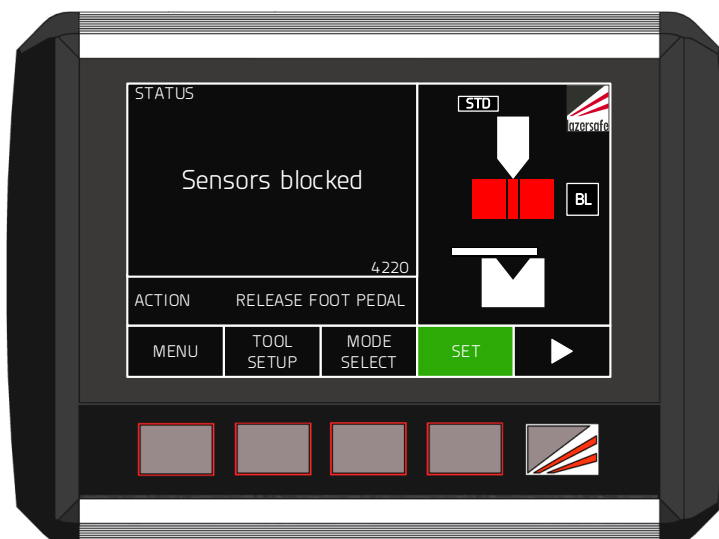


Figure 6-6: Laser Protection Obstructed by Material

Release the foot pedal. The Status screen changes to a red background, and prompts the operator to **CONFIRM MUTE POINT - PRESS SET BUTTON**, as shown in **Figure 6-7**. (If an external mute lamp has been installed, the lamp will light).

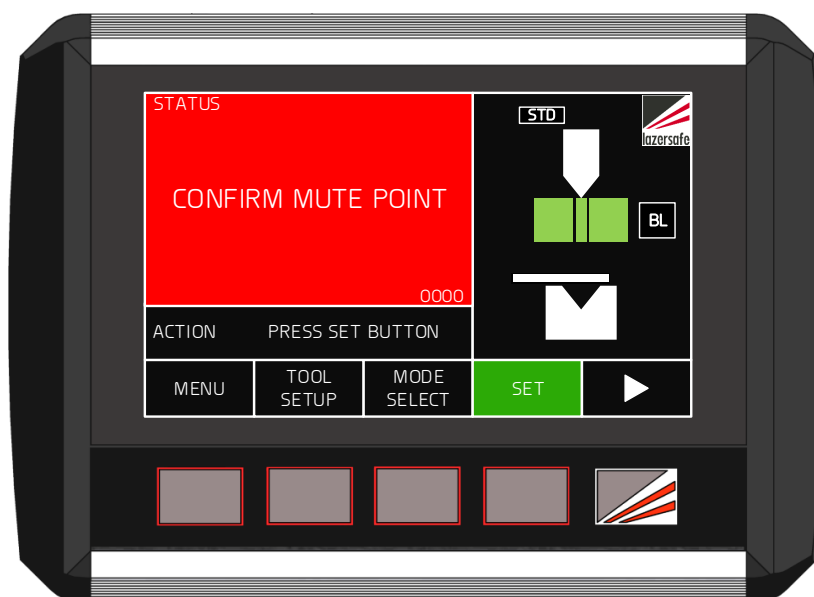


Figure 6-7: Confirm Mute Point Screen

To confirm the detected position as the mute point, press the **SET** button. The Status screen will change back to black, the obstruction clears, and the **SET** button label changes to **MUTE RESET** as shown in **Figure 6-8**. (If an external mute lamp has been installed it will turn off.)

The Status screen now displays the message **NORMAL MODE Ready to bend**.

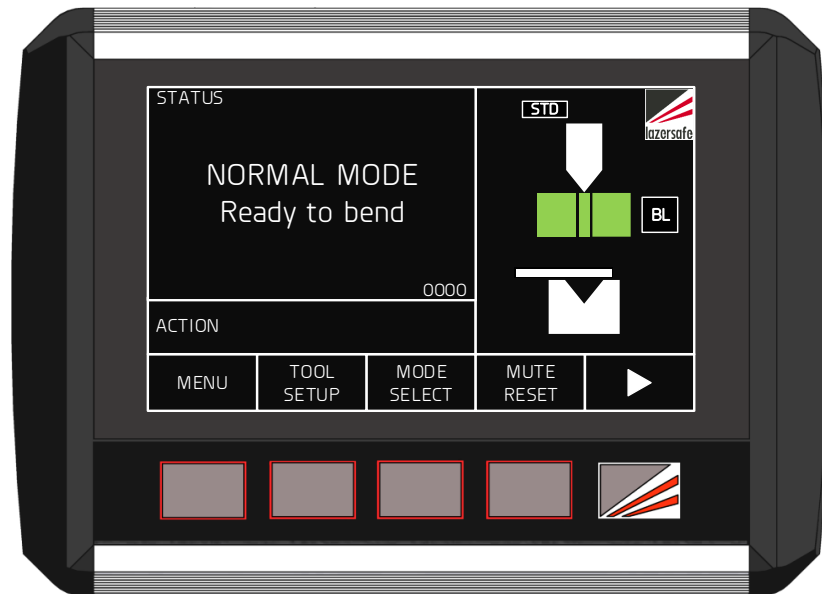


Figure 6-8: Mute Set, Ready to Bend

6.3.1 Setting the Mute Point in Restricted Mode

If the Sentinel Plus has been installed on a machine that does not support dual speed operation it must operate in Restricted mode (see **Figure 6-9**). In this mode any condition that would normally force safe speed (such as an uncleared obstruction) now prevents the tools from closing.

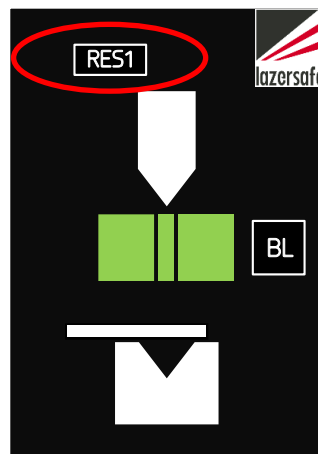


Figure 6-9: Sentinel Plus with Restricted 1 Mode Enabled

To ensure that the material is detected accurately the Sentinel Plus normally forces slow speed when setting the mute point. This is not possible on this type of machine, and the operator must manually reduce the closing speed of the press.



Note:

When setting the mute point in Restricted mode the operator must manually lower the closing speed to less than 50mm/s. If the closing speed is higher than 50mm/s the press beam will be halted and the message **Mute setting over speed error - RELEASE FOOT PEDAL** displayed.

After the mute point has been set the closing speed can be returned to normal.

6.4 Resetting the Mute Point

Any time the tools or the material thickness is changed, the mute point must be reset. When the machine is at TDC press the **MUTE RESET** button. If the machine is not at TDC, the message **Open tools to enable button function** will be displayed in the Status window.

**Note:**

Do not press the foot pedal while the **MUTE RESET** label is flashing. If the foot pedal is pressed, the mute reset operation will be cancelled.

When pressed and released, the **MUTE RESET** button will flash three times while the mute point is cleared. During this time the message **Mute point resetting – PRESS FOOT PEDAL TO CANCEL** is displayed. After the reset is complete, the screen again appears as in **Figure 6-5** prompting the operator to **SET MUTE POINT – PRESS FOOT PEDAL**.

6.5 Selecting Tray/Box Modes

To change the optical protection mode the User Interface Panel must be in the Mode Select screen. From the Main screen press the **MODE SELECT** button, and the screen will change to the Mode Select screen.

When changing modes the tools must be open with the lasers above the mute point and clear of any obstructions. Also, the system should be in Normal mode (the default start-up mode). If these conditions are not met, the Status window will display the message **Open tools to enable button function**.

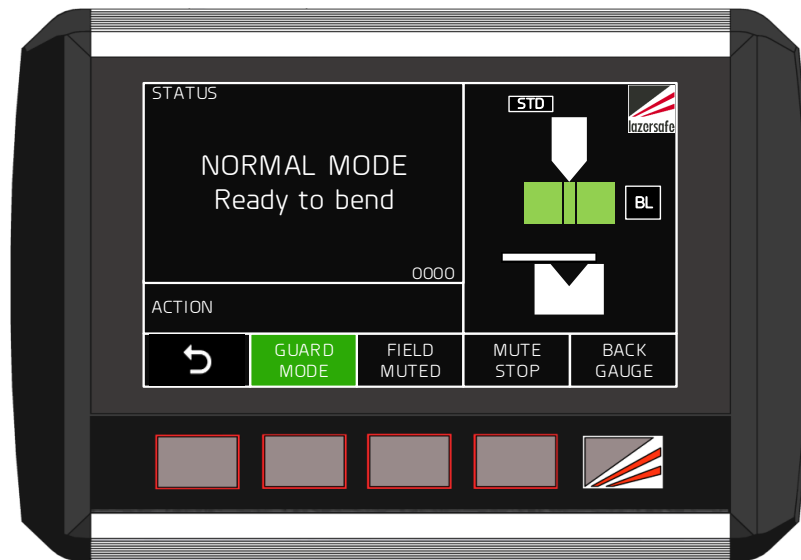


Figure 6-10: Mode Select Screen

- Press the **GUARD MODE** button to enter Tray Mode.
- Press the **GUARD MODE** button again to enter Tray 2 mode.
- Press the **GUARD MODE** button again to return to Normal mode.

The selected mode is displayed as a message in the Status screen (as long as no error messages are current), and as a symbol in the Sensor window.

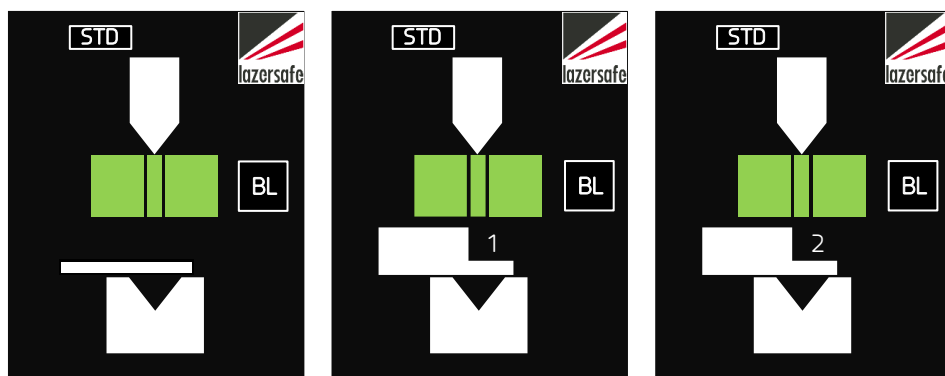


Figure 6-11: Sensor window (left to right) Normal, Tray and Tray 2 Symbols

Figure 6-11 shows the Sensor window for (left to right) Normal, Tray and Tray 2 modes. If an external mute lamp has been connected, it will flash slowly in Tray/Tray 2 mode. The system will now operate as described in **Section 3.5**.

The mute point is stored in system memory and does not need to be set again when changing to Tray/Box mode. If the operator needs to reset the mute point while in Tray/Box mode, the procedure is the same as described in **Section 6.4**, except that when the material is detected, the message Front/rear sensor blocked is displayed until the foot pedal is released.

6.6 Selecting Field Muted Mode

To change the optical protection mode the panel must be in the Mode Select screen. From the Main screen press the **MODE SELECT** button, and the screen will change to the Mode Select screen.

When changing modes the tools must be open with the lasers above the mute point and clear of any obstructions. If these conditions are not met, the Status window will display the message Open tools to enable button function. To enter Field Muted mode press the **FIELD MUTED** button.

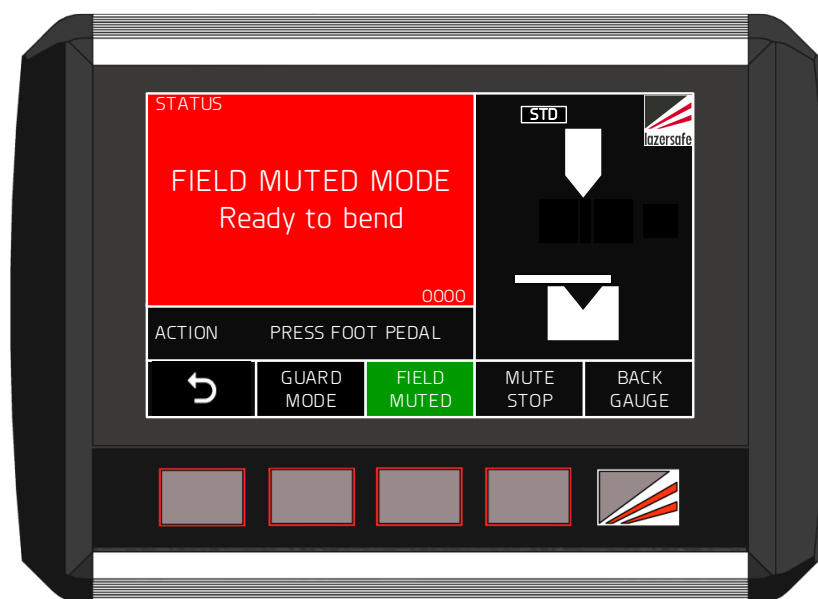


Figure 6-12: Mode Select Screen - Field Muted Mode



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Sentinel Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

Entry to Field Muted mode can be password protected, and should only be used by suitably trained personnel, and only in exceptional circumstances (changing tools, maintenance, etc.).



Note:

The Field Muted button functionality can be disabled through a parameter in the Supervisor menu. **Figure 6-13** shows the state of the button for (left to right) Enabled, Disabled-ON and Disabled-OFF.



Figure 6-13: Field Muted Button Options (left to right) Enabled, Disabled-ON, Disabled

When the system enters Field Muted Mode the screen will appear as shown in **Figure 6-14**. The **FIELD MUTED** button turns green, the Status screen turns red (to indicate that the optical protection is muted), and the message **FIELD MUTED MODE – Ready to bend** is displayed. The Sensor window now indicates that there is no optical protection (no sensor state is displayed). If an external mute lamp has been installed, this will also be turned ON.

The system now behaves as described in **Section 3.7**. When the operator presses the pedal for the first time the tools will **not** close and the message **Mode Change – RELEASE FOOT PEDAL** is displayed in the Status window. This alerts the operator that the optical protection mode has changed.

When the pedal is released and again pressed, the tools will close with the speed restricted to safe speed, and the message **LASERS INACTIVE** is displayed in the red Status window, as shown in **Figure 6-14**.

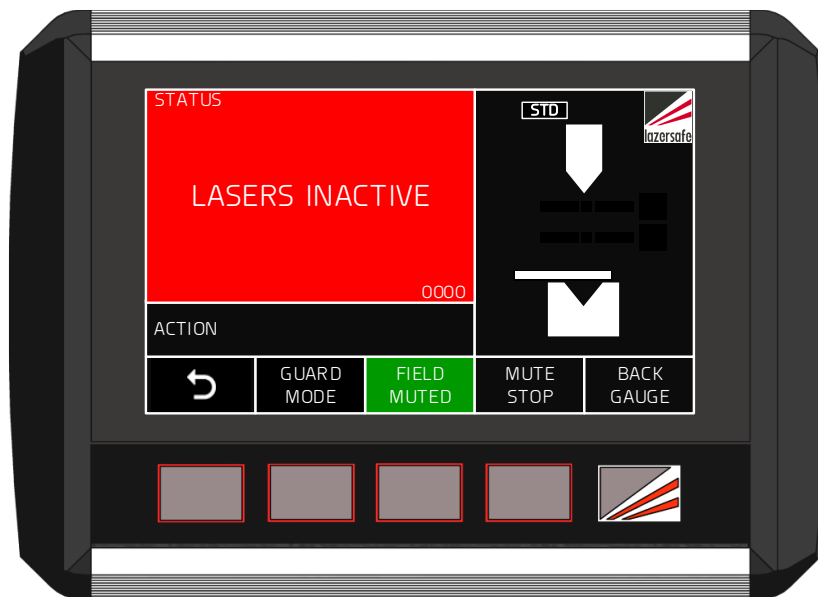


Figure 6-14: Closing Tools in Field Muted Mode

6.6.1 Exiting Field Muted Mode

To exit Field Muted mode and return to Normal mode press the **GUARD MODE** button when the tools are open. If the tools are not open, the Status window will display the message **Open tools to enable button function**. The system will always return to Normal mode after Field Muted mode, and will again appear as in **Figure 6-10**. When the foot pedal is pressed for the first time after returning to Normal mode the tools will not close, and the message **Mode Change – RELEASE FOOT PEDAL** is displayed to inform the operator that the Sentinel Plus has changed mode.

6.7 Selecting Stop at Mute Mode

To select Stop at Mute mode the Sentinel Plus panel must be in the Mode Select screen. From the Main screen press the **MODE SELECT** button, and the screen will change to the Mode Select screen. When changing modes the tools must be open with the lasers above the mute point and clear of any obstructions. If these conditions are not met, the Status window will display the message **Open tools to enable button function**.



Note:

The **MUTE STOP** button functionality can be disabled in the Supervisor menu. **Figure 6-15** shows the state of the button for (left to right) Enabled, Disabled-ON and Disabled-OFF.



Figure 6-15: Mute Stop Button Options (left to right) Enabled, Disabled-ON, Disabled

Stop at Mute is used in conjunction with other guarding modes. For example, Stop at Mute can be selected in Normal, Tray, Tray 2, Field Muted or Light Curtain mode. To enable Stop at Mute mode press the **MUTE STOP** button. The **MUTE STOP** label will turn green, and the Sensor window now displays the Stop at Mute symbol, as shown in **Figure 3-1**. The Sentinel Plus system behaves as described in **Section 3.8**.

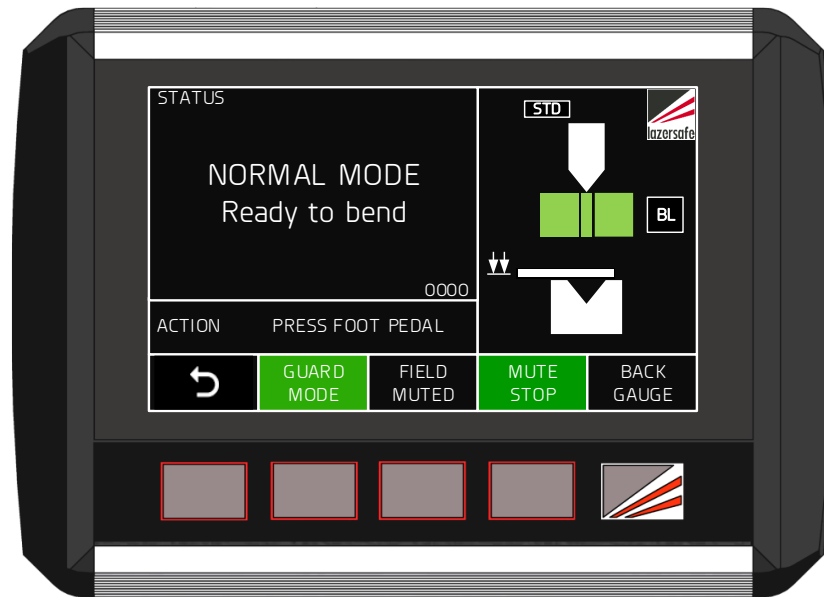


Figure 6-16: Normal Mode + Stop at Mute Mode

There are two Stop at mute symbols that can be displayed in the Sensor window.



Stop at mute – optical protection is active.



Stop at mute – optical protection is muted.

6.7.1 Exiting Stop at Mute Mode

To turn off Stop at Mute mode, press the **MUTE STOP** button when the tools are open. If the tools are not open, the Status window will display the message **Open tools to enable** button function. The Mode Select screen will again appear as shown in **Figure 6-10**.

6.8 External Stop at Mute Mode Input

In some installations the Stop at Mute mode can also be selected via an external switch or foot pedal. In the following example a foot pedal is used for the external control.

- Press/release the foot pedal. The system will enable Stop at Mute mode for one stroke. Stop at Mute mode will be disabled at the end of the stroke when the press returns to TDC.
- Lock the foot pedal **ON**. Stop at Mute mode will be enabled and remain enabled. Unlock the foot pedal **OFF**. Stop at Mute mode will be disabled the next time the press moves up to TDC. (If the press is at TDC when the input is switched off, one more stroke will be performed in Stop at Mute mode).

When Stop at Mute is active, the Stop at Mute symbol is displayed in the Sensor window.



Note:

The operation of the Stop at Mute input is independent of the User Interface Panel, and cannot be blocked in the Supervisor menu.

6.9 Selecting Back Gauge Mode

Back Gauge mode is selected from the Mode Select screen. From the Main screen press the **MODE SELECT** button, and the screen will change to the Mode Select screen. When changing modes the tools must be open with the lasers above the mute point and clear of any obstructions. If these conditions are not met, the Status window will display the message **Open tools to enable button function**.

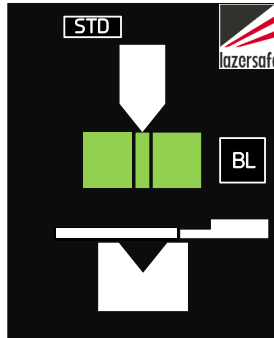


Figure 6-17: Sensor Window - Back Gauge Mode

Back Gauge mode is used in conjunction with other laser guarding modes. To select this mode press the **BACK GAUGE** button, the Sensor window will now appear as shown in **Figure 6-17**, and the **BACK GAUGE** label will turn green. The Sentinel Plus system will now behave as described in **Section 3.6**.

6.9.1 Exiting Back Gauge Mode

To turn off Back Gauge mode, press the **BACK GAUGE** button when the tools are open. If the tools are not open, the Status window will display the message **Open tools to enable button function**. The Mode Select screen will again appear as shown in **Figure 6-10**.

6.10 Tool Set-up Mode (Optional)

Tool Setup mode is selected from the Main screen. When selecting Tool Setup mode the tools must be open with the lasers above the mute point and clear of any obstructions. If these conditions are not met, the Status window will display the message **Open tools to enable button function**.



Figure 6-18: Tool Setup Mode Access Screen



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

In Tool Set-up Mode the laser is ON, but the optical protection is disabled. Although the Sentinel Plus Press Brake Guarding System will ensure that the

machine does not exceed safe speed if the sensors are obstructed, particular caution must be exercised.

Tool Setup mode is password protected and only accessible to operators with Supervisor level access. When the TOOL SETUP button is pressed the screen prompts the operator to enter the Supervisor access code, as shown in **Figure 6-18**.

If the code is correct the panel proceeds to the Tool Setup mode screen, and the Sentinel Plus system will now behave as detailed in **Section 3.10**. If an external mute lamp has been installed it will be switched ON to indicate that optical protection has been de-activated.

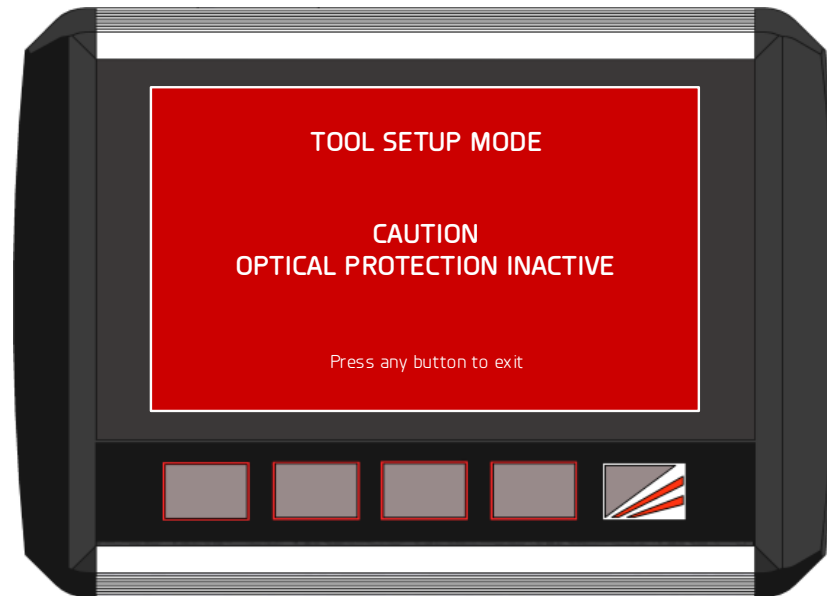


Figure 6-19: Tool Setup Mode Screen

6.10.1 Exiting Tool Setup Mode

Tool Setup mode can be exited by pressing any of the Sentinel Plus panel buttons when the tools are open. This will return the Sentinel Plus panel to the previous operating mode. If the tools are not open, the Status window will display the message **Open tools to enable button function**.

If the machine is idle for more than five minutes the Setup mode will be cancelled. If the machine does not have open tools when the timeout occurs, the Sentinel Plus will wait until the tools are opened. It will then exit Tool Setup mode, and return to the previous operating mode.

6.11 Emergency Stop Operation

Depending upon your installation, external inputs may be connected to the PGS-3 which trigger emergency stops (E-Stops). When an E-Stop occurs, operation of the machine is immediately stopped, and cannot continue until all E-Stop conditions are cleared.

- **Emergency Stop Button.** This allows the Operator to manually trigger an E-Stop of the machine. Normal operation cannot be continued until the E-Stop switch is reset.
- **Rear Gate.** A safety switch is connected to the rear gate of the press brake, and triggers an E-Stop when the rear gate is opened. The E-Stop cannot be cleared until the rear gate is closed.
- **Side Gates.** Safety switches connected to the side gates of the press brake trigger an E-Stop when either gate is opened during normal operation.

The behaviour of the system when the side gates are open depends upon which E-Stop option has been selected during installation.

E-Stop Option 1. If any side gate is open no down movement is allowed. The E-Stop cannot be cleared until the door is closed.

E-Stop Option 2. If one side gate is open (and all E-Stops have been cleared) the machine may be operated, but down movement is restricted to crawl speed. The message **CRAWL SPEED side gate open – CLOSE SIDE GATE** is displayed. If both side gates are open no down movement is allowed.

In all of the cases listed above, the User Interface Panel will display the reason for the E-Stop, and the Operator action required.

6.12 External Device Monitor (EDM)

Depending upon your installation, External Device Monitors (EDM) may have been connected to the PGS-3 which monitor the operation of valves, relays or solenoids. The Sentinel Plus continually monitors these devices to ensure that they are operating correctly.

If a monitored device fails, the Sentinel Plus will trigger an E-Stop and display the message **External device monitor A turn B error – CHECK EDM A** where

- **A** is the number of the monitor; 1,2,3 or 4.
- **B** is the type of failure, either on or off.

If the Sentinel Plus detects any voltages on the EDM inputs and the system has not been configured for EDM, it will display the message **EDM wiring does not match EDM option – CHECK EDM MENU OPTION**. This may occur if the User Interface Panel has been replaced or upgraded without the option being configured correctly.

If either of these conditions occur, please contact your local service representative.

6.13 Dual Foot Pedal Operation (Optional)

The Sentinel Plus may optionally be configured for dual foot pedal operation, which supports single operator control (using either foot pedal), or synchronised dual operator control.

The foot pedal configuration is selected by a supervisor key switch similar to that shown in **Figure 6-20**. Two lamps, mounted either on the foot pedals or in a position clearly visible to the operators, indicate which configuration is currently active.

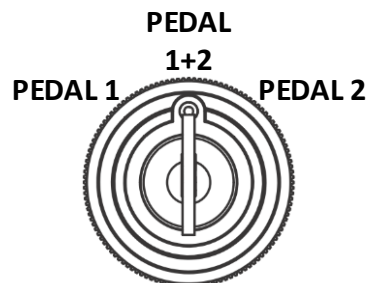


Figure 6-20: Foot Pedal Selector Key Switch

6.13.1 Single Operator Operation

For single foot pedal operation either foot pedal may be selected as the controlling down switch, and the press brake operated as normal. If at any time the non-active foot pedal is pressed, the HMI will display the message **Unexpected foot pedal press – RELEASE FOOT PEDAL**. If the inactive foot pedal is pressed while the tools are closing the closing movement is halted and cannot continue until the inactive pedal is released, and the active pedal released and re-pressed.

6.13.2 Synchronised Dual Operator Operation

When synchronised dual foot pedal operation is selected both operators must press their foot pedals at the same time to close tools. If there is a delay of more than 1 second between the two operators pressing their pedals, the message **Foot pedal 1 and 2 not synchronised – RELEASE FOOT PEDALS** is displayed. If either foot pedal is released during closing, movement is halted.

If the press beam is halted during closing for any reason (a foot pedal release, obstruction etc.) then closing cannot resume until **both** foot pedals have been released and re-pressed.

6.13.3 Fault Monitoring

Dual foot pedal installations are configured with normally open (N/O) and normally closed (N/C) switch contacts in each foot pedal. During normal operation the switch contacts must always be in opposite states; if one contact is closed (ON) then the other must be open (OFF).

If a foot pedal's switch contacts are ever both closed the message Pedal *A* contact fault - Both contacts ON - CHECK SWITCH CONTACTS is displayed, where *A* is the number of the pedal. If both switch contacts are open then the message Pedal 1 or 2 contact fault - Both contacts OFF - CHECK SWICTH CONTACTS is displayed.

In either case the press brake cannot be operated (in single or dual operator mode) until the fault is corrected.

7 Light Curtain Mode (Optional)

The Sentinel Plus Press Brake Guarding System supports dual guarding, where both the LZS-R laser guarding and a third party light curtain can be installed on the same machine. The operator can select which guarding system best suits the parts that are being formed. Changing the type of optical protection, and setting/resetting the mute point while in Light Curtain mode is restricted to Supervisor level access.

**Note:**

To use light curtains the Sentinel Plus system must be configured with operating parameters for the OEM products that have been installed. If this is not done the light curtains will not operate correctly. This requires access to the System menu, and must be done by a trained and qualified Sentinel Plus installer.

The active optical guarding system can be selected through the Supervisor Menu in the User interface Panel. When light curtains are selected, the Sentinel Plus system will deactivate the laser guarding and activate the light curtain guards. When the light curtain is active the system will automatically monitor the machine motion, speed and stopping time, as well as control the light curtain muting.

When the light curtain is first activated the operator will be required to set a new mute point. This is a manual process where the operator closes the tools until the punch contacts the material - this is the pinch or zero opening point. The operator then confirms this position by pressing the SET button and the system automatically sets the mute point at 6mm (1/4") above the zero opening position. During machine operation the light curtain remains active until the mute point is reached; at this point the light curtain is automatically muted.

**Warning: REFER TO THE LIGHT CURTAIN MANUFACTURER'S DOCUMENTATION BEFORE OPERATING LIGHT CURTAIN MODE.**

The light curtain is a third-party device and is not manufactured or supplied by Lazer Safe. Please ensure that the light curtain is installed and configured according to the manufacturer's instructions. Ensure the machine operator has been trained and is fully conversant in the operation and function of the light curtain prior to operating the Sentinel Plus Press Brake Guarding System in Light Curtain mode.

7.1 Selecting Light Curtain Mode

Light Curtain mode is activated by setting Parameter 5 in the Supervisor menu. From the Main screen press the MENU button to enter the Menu screen, and then the SUPERVISOR MENU button to enter the Supervisor menu.

**Note:**

Refer to **Section 8** for a detailed description of how to navigate the Supervisor menu. Supervisor level access is required to select Light Curtain mode, and also to set/reset the mute point in Light Curtain mode.

After entering the Supervisor access code, use the ▲▼ buttons to select SUPERVISOR PARAMETER 5 – Guard type selection, and press the ENTER button.

Supervisor Parameter 5 has two options:

- Laser protection. Enables the Lazer Safe LZS-R optical protection (and disables the light curtains).
- Light Curtain. Enables the OEM light curtain optical protection (and disables laser guarding).

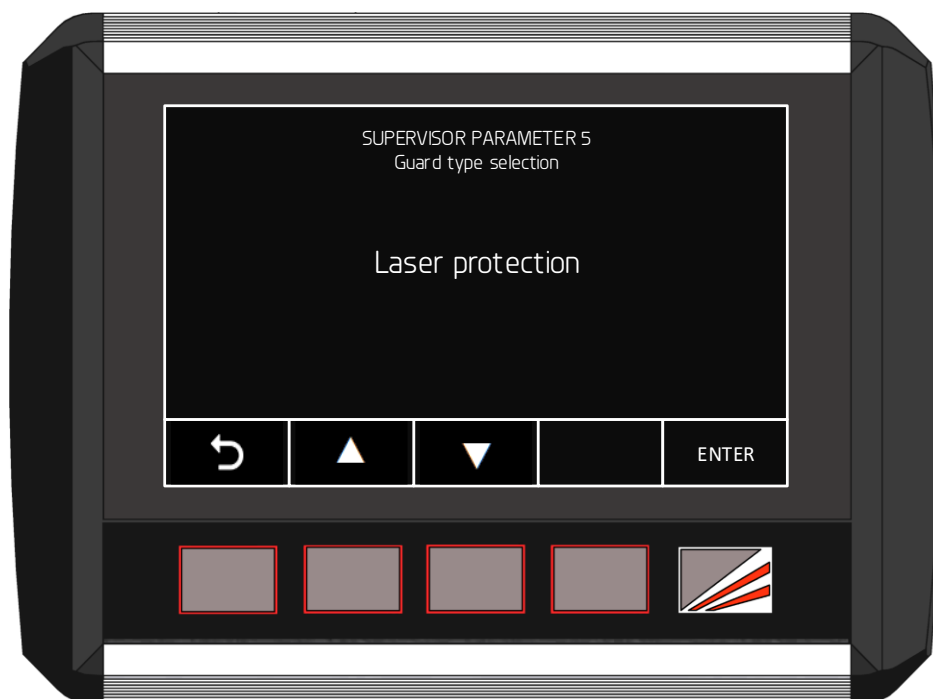


Figure 7-1: Supervisor Parameter 5

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the Light Curtain option has been selected, press the ENTER button; the value will be written into the panel's non-volatile memory, and the system will return to the parameter list. Press the ↶ button to return to the Main screen.

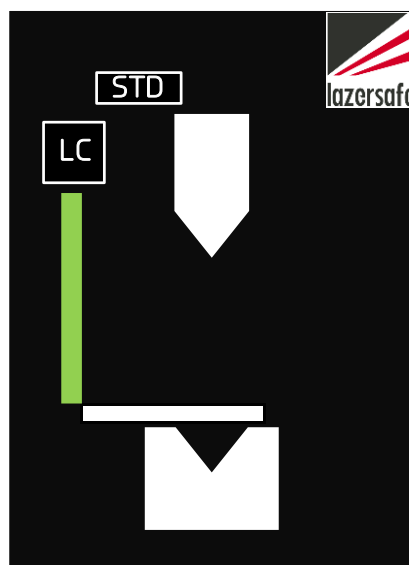


Figure 7-2: Sensor Window – Light Curtain Mode

The Sensor window in the Main screen now appears as per **Figure 7-2**. When the light curtain is clear, the light curtain symbol is green; when obstructed the light curtain symbol turns red.

When Light curtain guarding is selected, the current mute point is automatically reset by the Sentinel Plus system as it may not be appropriate for the material being worked. The operator must now set a new mute point suitable for the material being worked.

7.2 Setting the Mute Point

Upon returning to the Main screen, the operator will be prompted to set the mute point by the message SET MUTE POINT – PRESS FOOT PEDAL. When using laser optical protection the material position is automatically detected by the laser guard as the tools close. However, this is not possible with light curtain guarding, and the mute point must be set manually.

To set the mute point manually:

- Place a sample piece of material on the die.
- Press and release the foot pedal repeatedly to close the tools, and stop when the punch is just making contact with the material.

When the punch is at the correct height release the foot pedal. The SET button turns green, and the message CONFIRM MUTE POINT - PRESS SET BUTTON is displayed in the red Status window.

Setting the mute point is password protected and only accessible to operators with Supervisor level access. When the SET button is pressed the User Interface Panel prompts the operator to enter the Supervisor access code.

If the access code is correct, the User Interface returns to the Main screen, and the mute point is now set 6mm (1/4") above the pinch point. The machine can now be operated as previously described in **Section 6**.

7.3 Operating in Light Curtain Mode

Operating in Light Curtain mode is virtually identical to operation with laser guards, with the exceptions that the guard modes Tray mode, Tray 2 mode and Back Gauge mode are not required and cannot be selected.

Field Muted mode and Stop at Mute mode operate as described in **Sections 3.7** and **3.8**.

7.4 Resetting the Mute Point

Any time the tools or the material thickness is changed, the mute point must be reset. When the tools are open, press the MUTE RESET button. If the machine is not at TDC, the message Open tools to enable button function will be displayed in the Status window.



Note:

Do not press the foot pedal while the MUTE RESET label is flashing. If the foot pedal is pressed, the mute reset operation will be cancelled.

Resetting the mute point is also password protected and only accessible to operators with Supervisor level access. When the RESET MUTE button is pressed the Sentinel Plus User Interface Panel prompts the operator to enter the Supervisor access code.

If the access code is correct the User Interface returns to the Main screen, the MUTE RESET button will flash three times as the mute point is cleared, and the operator is prompted to SET MUTE POINT - PRESS FOOT PEDAL.

7.5 Exiting Light Curtain Mode

To leave Light Curtain mode repeat the steps described in **Section 7.1**, and select Planer Laser as the guarding option.

Exit the Supervisor menu and return to the Main screen. When planar laser guarding is selected, the current mute point is automatically reset by the Sentinel Plus system, as this may not be appropriate for the material being worked. The operator must now set a mute point suitable for material being worked, see **Section 6.3**.

8 User and Supervisor Menus

The Menu screen gives access to the menus that are used to configure the way that the Sentinel Plus system operates. There are three levels of access to the menu system; User, Supervisor and System. To access the Menu screen press the **MENU** button in the Main screen.

The User level menu does not require an access code, and can be accessed by anyone operating the machine.

The Supervisor level menu requires an access code. This menu contains parameters that configure how the Sentinel Plus system and the User Interface Panel operate. This menu should only be accessible to suitably trained and authorized personnel.

The System menu requires an access code. (This is the highest level access code, and can also be used to access the Supervisor level menu). This menu contains machine/site specific parameters that are set during the installation of the Sentinel Plus Press Brake Guarding System. The System menu is **not** described in this document.



Figure 8-1: Menu Screen

Label	Button Function
	This leaves the Mode Select screen and returns to the Main screen. See Figure 5-2 for an overview of the menu system.
USER MENU	This accesses the User menu. No access code is required.
SUPERVISOR MENU	This accesses the Supervisor menu. An access level of Supervisor or System level is required.
USER GUIDES	This button selects instructional guides on the operation of the Sentinel Plus system. No access code is required.
	This changes the dynamic button labels to select the system level access menus, see Table 5-5 .

Table 8-1: Menu Screen Buttons, User/Supervisor Level Access



Note:

When any menu screen is selected, the safety application running on the PGS-3 turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the PGS-3 will show the Condition Code **40A1**.


Label	Button Function
	This returns the dynamic button labels to the user and supervisor level access menus, see Table 5-4 .
SYSTEM MENU	This button accesses the System menu.
BRACKETS SETUP	This button accesses the Brackets Setup menu.
	Reserved
	Reserved

Table 8-2: Menu Screen Buttons, System Level Access

Once a menu has been selected the parameters can be navigated, selected and edited. The parameters are stored in non-volatile memory that is maintained even when the Sentinel Plus system is powered down.



Warning:

The System menu does not contain any user configurable parameters. System menu parameters must only be configured by trained and qualified Sentinel Plus installers. Setting incorrect parameter values in the System menu may render your machine inoperable.

8.1.1 Selecting Menu Parameters

This section explains how to select and change the parameters in the Parameter List. For all of the menus (User, Supervisor and System) the parameters are navigated using the Sentinel Plus buttons, as shown in **Figure 8-2** and **Table 8-3**. The arrow buttons step through the parameter list; the parameter is selected by pressing the ENTER button.



Note:

Lists and values that are navigated using arrow keys always appear as loops. When the end of the list is reached, the next button press will return the screen to the start of the list.



Figure 8-2: Menu Parameter Screen





Label	Button Function
	This leaves the Parameter List and returns to the Menu screen. See Figure 5-2 for an overview of the menu system.
	This changes the displayed parameter to the next parameter in the list (Parameter 0 → Parameter 1 → Parameter 2 etc.)
	This changes the displayed parameter to the previous parameter in the list. (Parameter 2 → Parameter 1 → Parameter 0 etc.)
ENTER	This selects the displayed item.

Table 8-3: User/Supervisor/System Menu Buttons

There are two types of parameters:




- **Options.** The value for the parameter can be selected from a list of options.
- **Numbers.** The parameter takes a numerical value between 0 and 9999.

8.1.2 Setting Option Parameters

Option parameters are navigated in the same way as menus, using the buttons described in **Figure 8-2** and **Table 8-3**. The arrow buttons step through the list of options; the desired option is then selected by pressing the ENTER button. When the ENTER button is pressed the value is stored in the panel's non-volatile memory, and the User Interface Panel returns to the parameter list. Changes can be abandoned at any time by pressing the  button.

8.1.3 Setting Numeric Parameters

Some parameters (such as access codes) require numeric values to be entered by the user. The numeric parameters are always displayed as four digits, ranging from 0000 to 9999. The Parameter screen also displays the name of the parameter, the units (typically millimetres or milliseconds) and the allowable range of parameter value.

The digit to be changed is underlined by a cursor starting with the left-most digit (i.e. the digit '1' in **Figure 8-3** below). The   buttons are pressed to increment or decrement the value of the underlined digit. Once the digit has been changed, the  button is used to select the next digit, which is then underlined by the cursor.


This is continued until the parameter is set to the desired value. When the ENTER button is pressed the value is stored in the panel's non-volatile memory, and the User Interface Panel returns to the parameter list. Changes can be abandoned at any time by pressing the  button.



Figure 8-3: Numeric Parameter Screen





Label	Button Function
	This leaves the Parameter and returns to the Parameter List. See Figure 5-2 for an overview of the menu system.
	Increments the selected digit i.e. 0→1→2 etc.
	Decrements the selected digit i.e. 0→9→8 etc.
	Moves the cursor to the right to select the next digit to be changed. After the last digit, the cursor will loop back to the first digit.
ENTER	This stores the parameter in non-volatile memory, and returns to the Parameter list.

Table 8-4: Numeric Parameter Screen Buttons

**Note:**

The Sentinel Plus system will not allow a value to be entered which is outside of the allowable range for that parameter. The valid range of values is displayed next to the parameter's name in the Parameter screen (ignore the units). If an attempt is made to exceed the valid range, an **Entry out of range** message is displayed, and the value will not be saved.

8.2 User Menu

The user menu does not have access control, and can be accessed by anyone.

8.2.1 Parameter 0 – Buzzer On/Off

This parameter sets the behaviour of the buzzer.

- **ENABLED.** The default setting is for the buzzer to sound on every button press.
- **DISABLED.** The buzzer will never sound.

Use the ▲ ▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.2.2 Parameter 1– Special Tools Mode

Special Tools mode can be enabled/disabled by this user selectable parameter. This parameter has two options.

- **DISABLED.** The default setting is for Special Tools mode to be disabled.
- **ENABLED.** Enables Special Tools mode as described in **Section 3.9.1**.

The operator can tell when Special Tools mode is enabled by the STM symbol in the Sensor window, as shown in **Figure 8-4**.

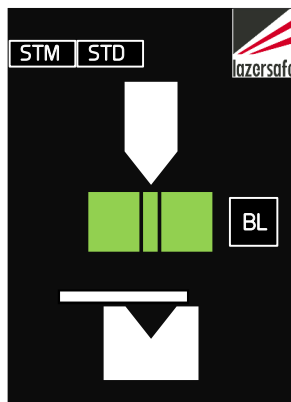


Figure 8-4: Special Tools Mode Enabled

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.2.3 Parameter 2 – Thermal Compensation Mode

Thermal Compensation mode can be enabled/disabled by this user selectable parameter. This parameter has two options.

- **DISABLED.** The default setting is for Thermal Compensation mode to be disabled.
- **ENABLED.** Enables Thermal Compensation mode as described in **Section 3.9.2**.

The operator can tell when Thermal Compensation mode is enabled by the TCM symbol in the Sensor window, as shown in **Figure 8-4**.

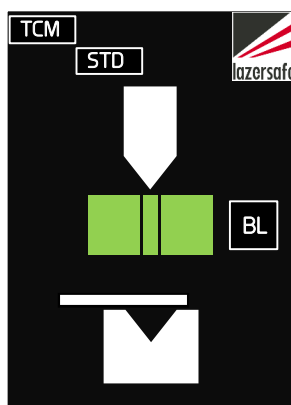


Figure 8-5: Thermal Compensation Mode Enabled

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3 Supervisor Menu

The Supervisor menu is password protected. When the SUPERVISOR MENU button is pressed, the operator is prompted to enter the Supervisor level access code, as shown in **Figure 8-6**. This is a numeric parameter as described in **Section 8.1.3**, and shown in **Figure 8-3**.



Note:

The factory default supervisor access code is 1111. This should be changed as soon as the system is installed. If the Supervisor password is lost, contact Lazer Safe Customer Support or your local supplier for assistance.



Figure 8-6: Supervisor Menu Access Screen

If an attempt to enter an access code fails, the message **Access code incorrect. Try again** is displayed. There is no limit to the number of attempts that can be made.

8.3.1 Parameter 0 – Supervisor Access Code

This parameter sets the value of the Supervisor level access code and can take any value from 0000 – 9999.

Use the ► button to navigate the digits, and the ▲▼ buttons to change the digit value. Changes can be abandoned at any time by pressing the ↶ button. When the desired digit has been set press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3.2 Parameter 1 – Field Muted Button Functionality

In the Mode Select screen the FIELD MUTED button is used to place the Sentinel Plus system into Field Muted mode. Field Muted mode disables the optical protection and restricts the maximum pressing speed to safe speed, as described in **Section 3.7**.



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Sentinel Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

Entry to Field Muted mode can be password protected, and should only be used by suitably trained personnel, and only in exceptional circumstances (changing tools, maintenance, etc.).

This parameter has three options (also described in **Section 6.6**), that sets the functionality of the FIELD MUTED button.

- **ENABLED.** The button functions as normal.
- **DISABLED-ON.** The Sentinel Plus system is permanently locked in Field Muted Mode.
- **DISABLED-OFF.** The button is disabled, and Field Muted mode cannot be selected.

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3.3 Parameter 2 – Mute Stop Button Functionality

In the Mode Select screen the MUTE STOP button is used to put the system into Stop at Mute mode, as described in [Section 3.8](#). This parameter has three options (as described in [Section 6.7](#)), that sets the functionality of the MUTE STOP button.

- **ENABLED.** The button functions as normal.
- **DISABLED-ON.** The Sentinel Plus system is permanently locked in Stop at Mute Mode.
- **DISABLED-OFF.** The button is disabled, and Stop at Mute mode cannot be selected.

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3.4 Parameter 3 – Mute Off-Set Distance

The Mute Off-set parameter can be used to raise the mute point by up to 65mm from the defined mute point. This is used to prevent irregularities in the work piece (such as bends or rivets) from causing false obstructions. Optical protection will be disabled at the mute off-set height, and the machine will be forced into safe speed.

This value is measured in millimetres (mm), and can be set between 0 and 65mm (0000 – 0065 for the parameter screen value). During normal operation the value is displayed in the Sensor window, see [Figure 8-7](#).

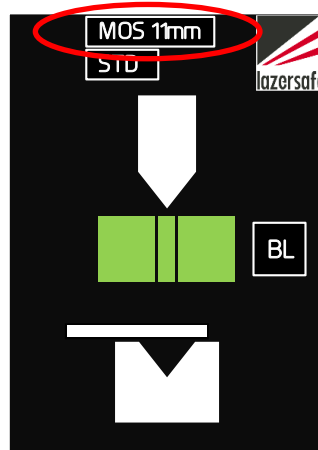


Figure 8-7: Mute Off-set Display



Note:

In some installations this menu item may be disabled with grey text, and cannot be selected.

Use the ► button to navigate the digits, and the ▲▼ buttons to change each digit value. Changes can be abandoned at any time by pressing the ↶ button. When the desired digit has been set press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3.5 Parameter 4 – Language

The language displayed by the Sentinel Plus User Interface is set in the Language menu.

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

8.3.6 Parameter 5 – Guard Type Selection

The Sentinel Plus system has the option of supporting light curtain optical protection. If light curtains have been installed and configured this parameter is used to switch between the planar lasers and the light curtains. The parameter has two options:

- **Laser Protection.** Enables the Lazer Safe LZS-R optical protection (and disables the light curtains).
- **Light Curtain.** Enables the OEM light curtain optical protection (and disables Lazer Safe laser guarding).

Use the ▲▼ buttons to navigate the options. Changes can be abandoned at any time by pressing the ↶ button. When the desired option has been selected, press the ENTER button, the value will be written into the panel's non-volatile memory, and the system will return to the parameter list.

Refer to **Section 7** for further details of Light Curtain mode operation.

9 Operator Instruction and Demonstration

Installer Reference #: _____

Instructor's Name: _____ Company: _____

Signature: _____ Date: _____

Ensure that the responsible person - Operator, Foreman or Manager (whoever the company designates as responsible) reads and understands the manual (translate if necessary).

It is suggested that the manual be given to this person as the installation is started so they will have read the manual by the time the installation is completed.

9.1 Equipment Identification

Component	Model	Serial Number	Notes
Safety Controller	PGS-3		
Transmitter	LZS-R		
Receiver	LZS-R		
User I/F Panel	Sentinel Plus HMI		
Left Bracket	Automatic Bracket		
Right Bracket	Automatic Bracket		

9.2 Starting the System

Refer to **Sections 6.1** and **6.2** for a detailed description.

- Explain how the transmitter and receiver operate. Demonstrate the automatic tool alignment, and explain the diagnostics signals given by the receiver LEDs.
- Demonstrate how the receiver detects the laser in segments (using a 4 mm Allen key is usually convenient). Show how blocking the laser like this is indicated on the PGS-3, the receiver LEDs and the User Interface Sensor window.
- Demonstrate and explain the start-up test. Demonstrate the stopping test during start-up and explain how it tests the safety stopping performance of the machine and either passes or shuts the machine down with an error. Explain the 24 hour test if the machine is run continually for 24 hours.

9.3 Mute Point Setting

Refer to **Section 6.3** and **Section 6.4** for a detailed description.

- **Highlight the purpose of the mute point.** Explain that the laser detects obstructions 2mm above the surface of the material that you have set mute from. Explain how a change in material thickness will be detected if it is greater than 2mm.
- **Get the operator to demonstrate setting and resetting the mute point.** Make sure the process outlined in **Section 6.3** and **Section 6.4** is understood.
- Ensure that it is understood that the mute point is set from the front and middle sensors.

9.4 Operation in Normal Mode

Refer to **Section 3.4** for a detailed description.

Refer to **Section 6.5** for selecting guard modes.

- Ensure that it is understood what happens when the system runs in normal mode.
- **The process must be understood and demonstrated.**
- Ensure it is understood that the protecting laser field is muted after the first obstruction and that the Mute lamp remains permanently lit to indicate this status. Explain the sensor blanking function of the receiver rear sensors.

9.5 Tray / Tray 2 / Back Gauge mode

Refer to **Section 3.5** and **Section 3.6** for detailed descriptions.

Refer to **Sections 6.5** and **6.9** for selecting/exiting these modes.

- Explain and demonstrate how this process is useful in box and tray type bending.
- **Get the operator to go into and come out of the Tray modes themselves.**
- Explain that the mute point is retained when switching from normal to Tray/Box mode. Also get them to change mute point in Tray mode.
- In Tray mode, make sure they understand that the front and rear sensors are muted after an obstruction, but if the middle sensor is obstructed the laser will be muted for the remainder of the stroke.
- Explain the difference between Tray and Tray2 mode, including the need for a confirmation pedal press at the beginning of each stroke.
- Explain the reason for Back Gauge mode, and the elevated rear sensor mute height (16mm).

9.6 Field Muted Mode

Refer to **Sections 3.7** for a detailed description.

Refer to **Section 6.6** for selecting/exiting Field Muted mode.

- Demonstrate this function and ensure the operator understands that the laser protection will be switched off and the machine will only operate in safe speed while being used in this mode.
- Explain that the system will monitor the machine speed and stopping performance. Make sure the operator is aware that a responsible person should have access to the password for enabling the field-muted mode button.
- Show how to switch back to normal mode.



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Sentinel Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

Entry to Field Muted mode can be password protected, and should only be used by suitably trained personnel, and only in exceptional circumstances (changing tools, maintenance, etc.).

9.7 Stop at Mute Mode

Refer to **Section 3.8** for a detailed description.

Refer to **Section 6.7** for selecting/exiting Stop at Mute mode.

- Explain and demonstrate the Stop at Mute function.
- Explain how this mode can be used when forming complex parts or parts with deep side flanges to increase machine productivity.

9.8 Setting the Laser Position

Refer to **Section 4.2** and *Lazer Safe Block Laser Alignment Guide (LS-CS-M-025 Rev 2.0)* for a detailed description of laser alignment.

- Explain and demonstrate how to adjust the Transmitter and Receiver height.
- **Get the operator to adjust the brackets and check the alignment of the laser.**
- Demonstrate how the alignment cards are used to set the distance of the laser from the punch ensuring that it is parallel.
- Show how the receiver sensor status can be viewed by the indicator LEDs on the PGS-3, the receiver and in the Sensor window of the User Interface Panel.
- Explain that if the transmitter and receiver are not correctly aligned, the mute point can be inaccurately detected when bending and that errors conditions can be generated that will prevent normal operation.

9.9 Back Gauge Interference

Refer to **Section 3.6** and for a detailed description.

Refer to **Section 6.9** for selecting/exiting Back Gauge mode.

- **Ensure that the operator understands the effect of the back gauge on the rear sensor section.** If an obstruction occurs, the system will react by stopping the machine.
- Get the operator to activate/de-activate Back Gauge mode using the Sentinel Plus panel.

9.10 Running the System

- Have the operator perform each of the main functions.
- Using each mode of the system have the operator bend some test pieces of material and also making sure to utilise the Tray / Box mode for a demonstration of the operation during box bending.
- **Ensure the operator is aware of each mode they are in, and the different Status/Action/Sensor windows in the Sentinel Plus panel display.**

9.11 Dual Guarding Option – Light Curtain (if installed)

- Demonstrate how to activate light curtain mode via the Sentinel Plus panel.
- Demonstrate how the mute point position is determined by manually inching the tools closed until the punch contacts the material (the Pinch Point or Zero Point).
- Explain that an access code is required for the set and reset operations.
- Explain that the mute point is set 6mm (1/4") above the Pinch Point.
- Explain how the light curtain is active and that the machine can still be operated in safe speed if the light curtain is obstructed then the tool opening is more that 6mm (1/4 inch).
- **Have the operator select light curtain mode and set the mute point. Have the operator select laser guarding mode again and reset the mute point.**



Warning: REFER TO THE LIGHT CURTAIN MANUFACTURER'S DOCUMENTATION BEFORE OPERATING LIGHT CURTAIN MODE

The light curtain is a third party device and is not manufactured or supplied by Lazer Safe. Please ensure that the light curtain is installed and configured according to the manufacturer's instructions. Ensure the machine operator has been trained and is fully conversant in the operation and function of the light curtain prior to operating the Sentinel Plus Press Brake Guarding System in Light Curtain Mode.

9.12 Special Tools Mode

Refer to **Section 3.9.1** for a detailed description.

Refer to **Section 8.2.2** for selecting/exiting Special Tools mode.

- Have the operator select Special Tools mode from the User menu.
- Explain the circumstances where Special Tools mode is required.
- Explain how the slow speed point changes with the detected tool size.
- Explain the differences between Special Tools mode and normal operation.
- Show the operator how to determine the approximate slow speed point from the System Information menu.

9.13 Thermal Compensation Mode

Refer to **Section 3.9.2** for a detailed description.

Refer to **Section 8.2.3** for selecting/exiting Thermal Compensation mode.

- Have the operator select Thermal Compensation Mode from the User menu.
- Explain the circumstances where Thermal Compensation mode is used.
- Explain the differences between Thermal Compensation mode and normal operation.
- Show the operator how to determine the approximate slow speed point from the System Information menu.

9.14 Tool Set-up Mode Option

- Demonstrate how to select Tool Set-up mode via the Sentinel Plus User Interface Panel. Explain that a tool alignment must be performed before entering Tool Set-up mode.
- Explain that in Tool Set-up mode although the laser is ON, the optical protection is muted, and the press brake should be treated as if it is in Field Muted mode.
- If the machine is capable of closing at high speeds in Tool Set-up mode, explain that speed monitoring is only disabled if the sensors are clear. Any obstruction immediately re-enables speed monitoring.



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

In Tool Set-up Mode the laser is ON, but the optical protection is disabled. Although the Sentinel Plus Press Brake Guarding System will ensure that the machine does not exceed safe speed if the sensors are obstructed, particular caution must be exercised.

9.15 Up-Acting Option (if installed)

- Explain the difference in operation of an up-acting machine.
- Demonstrate the use of the Open Tools Enable pushbutton, to close the Enable contacts.

9.16 Restricted Mode (if installed)

- Note the Mute Mode symbol on the Sensor window indicating if the press is in Standard, Restricted 1 or Restricted 2 mode.
- Explain why Restricted mode is enabled (i.e. the machine does not support dual speed) and how this is different from standard Sentinel Plus operation.
- Explain that the operator must reduce the closing speed to less than 50mm/s when setting the mute point in Restricted mode.
- Demonstrate the mute setting procedure.

9.17 Dual Foot Pedal (if installed)

- Demonstrate the use of the foot pedal selector switch and indicator lamps.
- Demonstrate single and dual pedal operation, highlight the 1 second time limit in synchronised dual operator mode.
- Explain possible foot pedal switch fault conditions and messages.

9.18 Sentinel Plus XL (if installed)

- Demonstrate how to align the transmitter and receiver using the alignment tools and the receiver alignment mask. Show the operator how the alignment mask is stored on the back of the receiver when not in use.
- Explain how the minimum speed change point will be 14mm (as opposed to 2mm with the standard Sentinel Plus system).
- Explain that the use of Special Tools Mode and Thermal Compensation Mode are disabled in the HMI, and why these modes are redundant due to the LZS-XL functionality.

9.19 Automatic Brackets (if installed)

- Demonstrate how to drive the brackets to the HOME position when tools are to be unloaded/loaded from the ends of the press brake.
- Demonstrate how to use the AUTO ADJUST function.
- Demonstrate how to use the MANUAL ADJUST function.
- Explain and demonstrate the purpose of the BRACKETS STOP function.
- Demonstrate how the brackets may be manually wound up and down via the 6mm hex drive located in the top of each bracket. Ensure that the operator understands that a spanner or low-speed cordless drill can be used for manual winding, and that driving the brackets at high-speed may result in damage to the bracket electronic control circuit.

9.20 Customer Sign Off – Training Completed

Company Name: _____ Date: _____

Names of Company Representatives: Signatures of Company Representatives:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

10 Maintenance

10.1 Transmitter & Receiver

To maintain the transmitter and receiver, the filter window on both units should be regularly inspected to ensure they are free from finger prints, grease, dirt and scratches. The filter window should be replaced if it is damaged in any way.

Clean the transmitter and receiver windows with a weak solution of soap or detergent and lukewarm water. Do not use window cleaning sprays, scouring compounds, acetone, alcohol, gasoline, benzene, carbon tetrachloride or lacquer thinner to clean the window.

1. Dampen a soft, non-abrasive cloth or chamois with the cleaning solution, wring out any excess liquid.
2. Wipe the windows of the transmitter and receiver clean.
3. Dry the windows with a soft, non-abrasive cloth or chamois.

10.2 Vertical Bracket

To maintain smooth operation of the vertical mounting brackets, periodically check and clean the linear rails.

1. Using a soft cloth clean the linear rail and wipe away any grease and dirt that may have accumulated.
2. Lubricate the rail with a light, mineral oil based grease. A grease with a lithium thickener will adhere better to the surface of the rail.
3. Wipe away all excess lubricant (excess lubricant will collect dust and dirt).
4. Move the bracket through its full range of travel several times.
5. Check that all mounting bolts are tight.

11 Appendix A – Sentinel Plus XL

When the Sentinel Plus is to be used on long machines (8-15m between the transmitter and receiver), the standard LZS-R block laser system is replaced with the LZS-XL transmitter/receiver. This section describes the differences between the Sentinel Plus and Sentinel Plus XL systems.

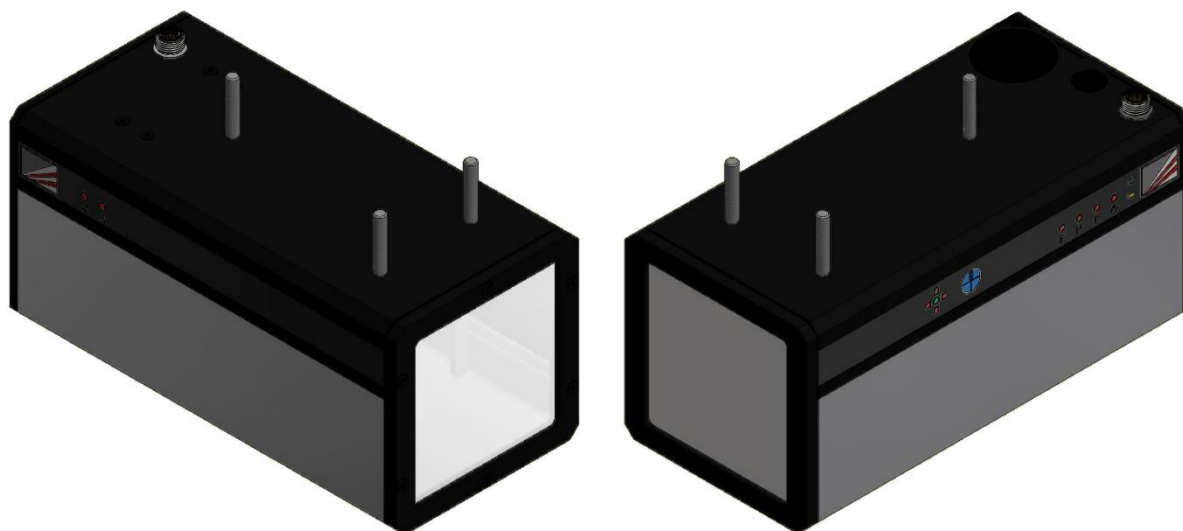


Figure 11-1: Sentinel Plus XL Transmitter and Receiver

The operation of the Sentinel Plus XL is almost identical to the standard Sentinel Plus, but with the following differences.

- Special Tools mode (User Menu, [Section 8.2.2](#)) is disabled.
- Thermal Compensation mode (User Menu, [Section 8.2.3](#)) is disabled.
- The User Interface Panel displays the **XL** symbol in the Sensor screen, see [Figure 11-2](#).

Sentinel Plus XL indicator

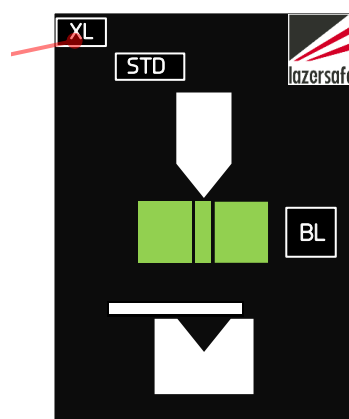


Figure 11-2: Sensor Window for Sentinel Plus XL

The LZS-XL transmitter/receiver are supplied with the Type 3 Laser Alignment Tools and an Alignment Plate. The transmitter and receiver are aligned as shown in **Lazer Safe LZS-XL Alignment Guide (LS-CS-M-096)**.

12 Appendix B – Automatic Brackets

12.1 Automatic Brackets Overview

The Lazer Safe Automatic Brackets are a direct replacement for the standard Lazer Safe Bracket Mounting System that allow accurate, remote adjustment of the bracket height via the User Interface Panel. **Figure 12-1** shows the main components of the Automatic Brackets. The brackets automate the process of moving the LZS-R transmitter and receiver clear while the press brake tools are being changed, and then accurately re-aligning the laser guards to the new tool tip position.



Note:

The Automatic Brackets can only be operated with standard Sentinel Plus LZS-R block lasers.



Figure 12-1: Lazer Safe Automatic Brackets

The motor driven Automatic Brackets have internal encoders that monitor the speed and position of the brackets. There are three valid positions that the brackets can be moved to by the press brake operator.

- **Hardware Home.** This is the uppermost position for the bracket set by the hard stop limit switch at the end of bracket travel. If the internal encoder count has been lost, the bracket will reference at this position.
- **Software Home.** This position is set by the installer during commissioning. This is the position that the bracket will move to during a tool change.
- **Aligned.** This is guarding position during normal operation of the press brake. The alignment can be performed automatically by the system, or manually by the operator.



Caution:

The 6mm hex drive is provided to manually adjust the Automatic Brackets with a spanner or low speed drill when they are unpowered. Driving at high speed may result in damage to the bracket electronics.

12.2 Operator Controls

This section describes the screens and menus available to the operator for normal operation of the Automatic Brackets.

12.2.1 Auto Brackets Screen

The Auto Brackets screen provides all of the bracket controls available to the operator (user level access). Note that the operator can only move the brackets up or down as a pair, and adjustments to individual brackets can only be made in the Brackets Setup menu by a qualified installer with system level access.



Note: When any bracket menu screen is selected, the safety application running on the PGS-3 turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the PGS-3 will show the Condition Code **40A1**.

In the Main screen of the User Interface Panel press the ► button to change the panel buttons, see **Figure 12-2**.

Press the AUTO BRACKETS button to open the Automatic Brackets screen, or press ◀ to return to the normal press brake operation buttons.

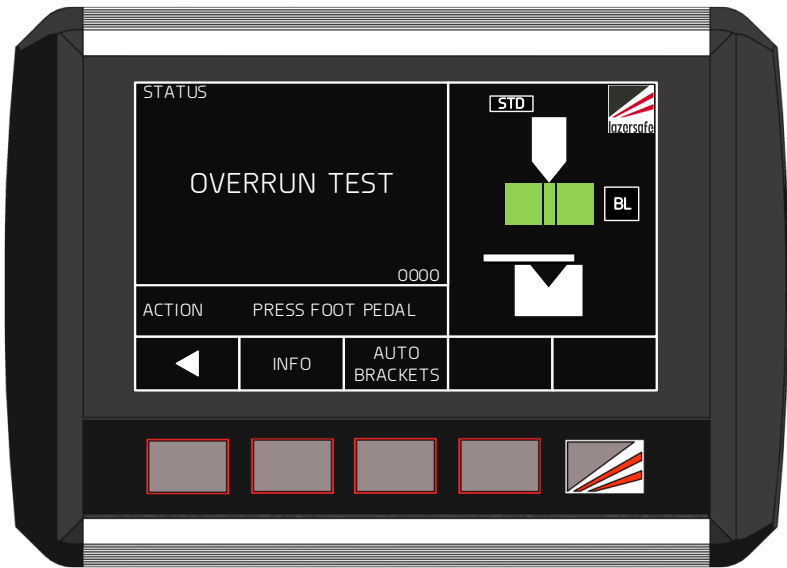


Figure 12-2: Main Screen Info/Auto Brackets Buttons

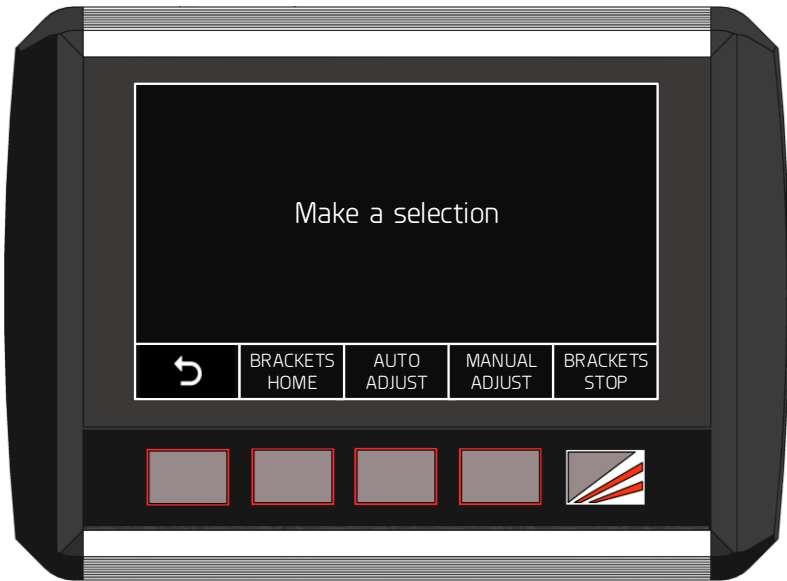


Figure 12-3: Auto Brackets Screen

Table 12-1 lists the functions of the Auto Bracket screen buttons.


Label	Button Function
	This leaves the Automatic Brackets screen and returns to the Main screen. See Figure 5-2 for an overview of the menu system.
BRACKETS HOME	Press to move the Automatic Brackets to the software home position. Press and hold for 3 seconds to move to the hardware home position (hard stop limit) to reference the brackets, and then move to software home.
AUTO ADJUST	Press to realign the transmitter and receiver with the new tool. If the brackets are not at the software home position they will first move home, and then move to the alignment position.
MANUAL ADJUST	Press to open the Manual Adjust screen. This gives the operator control of the bracket movement and tool alignment via the panel.
BRACKETS STOP	Press to immediately stop the brackets and cancel the current command.

Table 12-1: Automatic Bracket Screen Buttons

For a normal tool change with Automatic Brackets the operator should perform the following steps. The brackets can be stopped at any time by pressing the **BRACKETS STOP** button.

1. Press **BRACKETS HOME**. The brackets will move to the software home position and stop clear of the upper tools. Note that whenever the brackets are moving to/from the home position the panel displays the message **Brackets moving to position - PLEASE WAIT**.
2. Change the press brake tools.
3. Press **AUTO ADJUST**. The brackets will move down at 12.5mm/s until the tool silhouette is detected by the receiver. They will then slow to 1mm/s to accurately position the tool tip in the receiver window. A tool align is automatically triggered to complete the process.
4. Return to the Main screen to operate the press.



Note:

If the laser is obstructed at any time after the tool silhouette has been detected the alignment will fail, and the panel will display the message **Tool scan interference - PRESS RESET**. Press the reset button, clear the obstruction and repeat the procedure.

12.2.2 Manual Adjust Screen

There are some special cases such as Special Tools mode (**Section 3.9.1**) where the Auto Adjust feature cannot be used to align the transmitter/receiver with the tool tip, and the operator must set the bracket position manually.

Press the **MANUAL ADJUST** button, and the screen will appear as in **Figure 12-4**, the button functions are listed in **Table 12-2**.

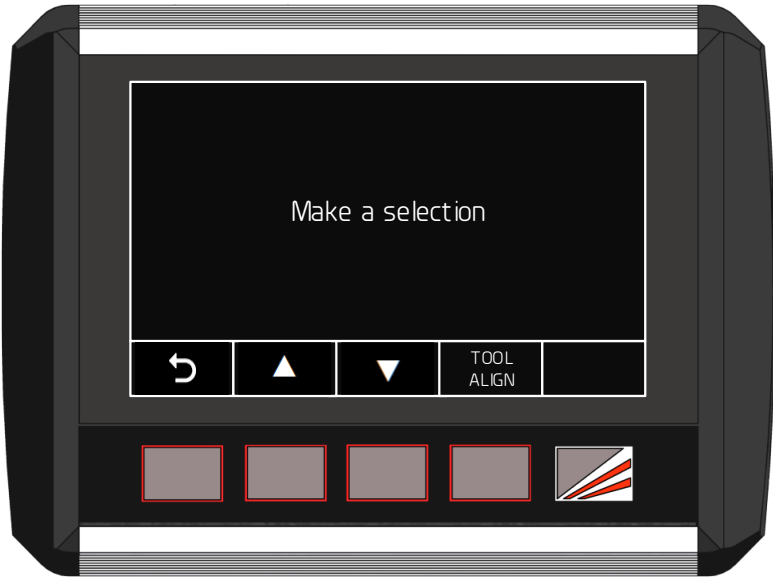


Figure 12-4: Manual Adjust Screen

Label	Button Function
	This leaves the Manual Adjust screen and returns to the Auto Brackets screen.
	Move both brackets up at 12.5mm/s.
	Move both brackets down at 12.5mm/s.
TOOL ALIGN	Press to perform a tool align on the LZS-R receiver.
	Reserved

Table 12-2: Manual Adjust Screen Buttons

In most cases only a vertical alignment will be needed for the LZS-R transmitter/receiver after a tool change, as shown in **Figure 12-5** taken from *Lazer Safe Block Laser Alignment Guide (LS-CS-M-079 Rev 2.0)*.

Place the transmitter laser alignment card (Type 2) on the tool as shown in **Figure 12-5 (a)**. Use the ▲ ▼ to move both brackets until the block laser aligns with the guides, see **Figure 12-5 (b)**.

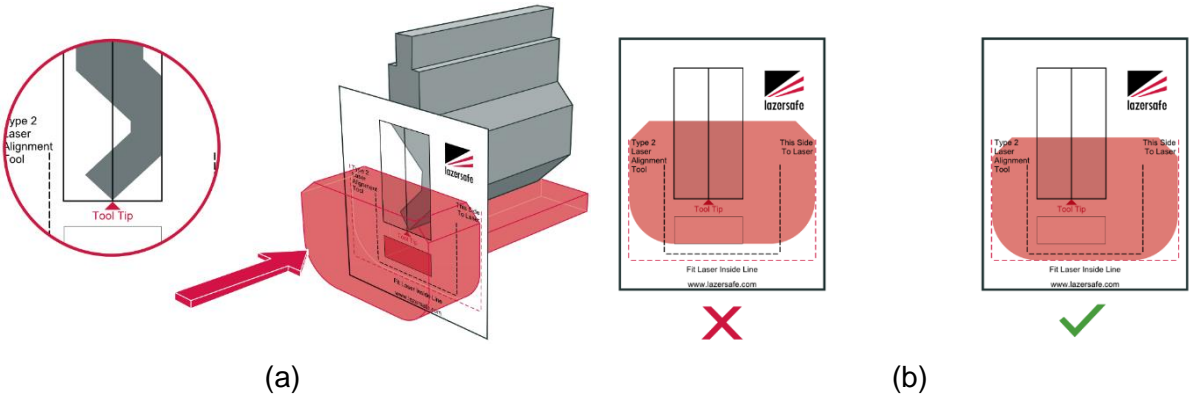


Figure 12-5: LZS-R Manual Alignment

Remove the alignment card from the tool and perform a tool align using the TOOL ALIGN button on the panel or on the LZS-R receiver.

Be sure to follow the guidelines for periodic alignment checks given in **Section 4.5**.

12.3 Automatic Bracket Condition Codes

Common PGS-3 condition codes related to bracket operation are translated into messages and actions for the operator by the User Interface Panel. These codes are also listed in **Table 12-3** below.

I - Indication only. No operator action is required.

OA - Operator Action. The operator must perform the recommended action.

Code	Actions	Description
42A5	I	Brackets busy. Performing a positioning command.
42A6	I	Transmitter bracket lower limit position
42A7	I	Receiver bracket lower limit position
42A8	I	Transmitter bracket upper limit position
42A9	I	Receiver bracket upper limit position
42AA	OA	Transmitter bracket motor stalled. Press error reset.
42AB	OA	Receiver bracket motor stalled. Press error reset
42AC	OA	Transmitter bracket supply voltage low. Press error reset.
42AD	OA	Receiver bracket supply voltage low. Press error reset.
42AE	OA	Transmitter bracket store failed. Press error reset.
42AF	OA	Receiver bracket store failed. Press error reset.
42B3	OA	Transmitter bracket not responding. Service personnel to investigate.
42B4	OA	Receiver bracket not responding. Service personnel to investigate.

Table 12-3: Automatic Bracket Condition Codes

12.4 Automatic Bracket Maintenance

Lazer Safe recommends that the following Automatic Bracket maintenance procedure is conducted once every two months .

- Using a soft cloth clean the linear rail and wipe away any lubricant and dirt that may have accumulated along the rail.
- Apply a lubricant to the lead screw as required. The recommended lubricant is a general-purpose silicon lubricant with a temperature range better than -10C to +120C.
- Manually drive the bracket up and down several times along the full range of vertical movement. Listen for any irregular sounds during the movement.
- Wipe away any excess lubricant from the linear bearing and lead screw.
- Check that each bracket is level, and then tighten all mounting screws.

13 Glossary of Terms

Term	Description
Approach	The closing movement of the tools.
Approach signal	A signal from the press brake controller to the Sentinel Plus controller to indicate that the foot pedal has been pressed to allow the tools to close.
Approach speed	The closing of the tools in high speed >10mm/s.
Back gauge mode	Operating mode of the Sentinel Plus system where the rear sensor is muted 16mm above the mute point to prevent interference from the back gauge.
Beam / pressing beam	The moving member of the press brake.
Box mode	See Tray/Tray 2 mode.
Condition code	Status information from the PGS-3 displayed as a four digit hexadecimal number (0-9, A-F).
Crawl speed	See safe speed.
Danger zone	The point where any part of the body may be trapped between tools.
Die	Bottom tool of the press brake.
EDM	External Device Monitor, i.e. valve/solenoid monitor.
Field muted mode	Operating mode of the Sentinel Plus where the protective laser field is turned off and the closing of the tools is possible in safe speed only.
HMI	Human Machine Interface (i.e. the User Interface Panel).
MSD	Manufacturer's Stopping Distance. The distance that the beam typically travels after a beam stop has been initiated, as stated by the Press brake manufacturer.
Mute	Deactivation of the protective laser field.
Mute point	The point where the optical protection is deactivated, typically expressed as an opening, or tool height above the material.
Normal mode	Default operating mode of the Sentinel Plus.
Opening	The distance between the lower and upper tools, or the upper tool and the surface of the material.
Open tools	Increase the opening, retract the pressing beam.
Optical protection	Lazer Safe laser guards, or OEM light curtains.
Punch	Top tool of the press brake.
Retract	The opening movement of the tools.
Restricted mode	Mute mode where the press does not support dual speed operation.
Safe speed	The closing of the tools in slow speed $\leq 10\text{mm/s}$.
Stop at Mute mode	Operating mode of the Sentinel Plus system where the press beam is stopped at the mute point.
Stopping distance / overrun	The distance the tools continue to close before coming to a stop when a stop command is issued.
Tray/Tray 2/Box mode	Operating mode of the Sentinel Plus when some of the sensor zones are deactivated for high speed forming of tray and box shaped parts.