

DEFENDER PLUS
PRESS BRAKE
GUARDING SYSTEM

Operation Manual

LS-CS-M-071



Performance without compromise.™

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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.
- Prerequisites.
- 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 Defender Plus Press Brake Guarding System.

1.2 Technical Competence Requirements

All operators of the Defender 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. Transmitter and Receiver Adjustment.
5. The Defender Plus User Interface.
6. System Operation.
7. User and Supervisor Menus.
8. Operator Instruction and Demonstration.
9. Maintenance.
10. Glossary of Terms.

1.4 Related Documentation

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

- Lazer Safe Defender Plus Press Brake Guarding System Installation Manual (LS-CS-M-072).
- Lazer Safe Alignment Guide (LS-CS-M-017 Rev 2.0).
- 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.

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 Defender 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 Defender Plus Guarding System

The Defender 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 Defender 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 Defender 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 Defender Plus system has been installed.
- The Defender 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 Defender 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 Defender 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 Defender 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 Defender 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 Defender 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, all optical guarding is deactivated. Although the Defender Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

2.3 Regulatory Requirements for Use

The Defender 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 Defender 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 Defender 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 Defender 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 Defender 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 Defender 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.

3 System Overview

The Lazer Safe Defender 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

- Defender 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 Defender Plus system continuously monitors the machine speed and stopping distance in real time.
- Dual flat bands of continuous laser light detect obstructions as small as 4mm while remaining vibration tolerant.
- The 6mm 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.
- The Defender 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 6mm mute point set-up is automatically initiated on the first cycle. The laser 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

Defender Plus automatically monitors machine performance in real time.

Quick Adjust Brackets

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

Defender Plus 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.

Laser Receiver (RX)

The RX features a wide reception zone to eliminate the need for precise manual adjustment after tool change. LEDs simplify the setup and adjustment.

Laser Transmitter (TX)

As the tools close in high speed the lasers are progressively muted as machine deceleration and speed is monitored. The system provides optical protection until the tool opening is 6mm.

Close Proximity Protection

Defender 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.

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

3.2 System Components

The system contains the following components:

- LZS-LG-HS Dual Laser Transmitter/Receiver pair.
- PGS-2 Safety Controller.
- Defender Plus User Interface Panel.
- Optical Rotary Encoder.
- Bracket system for the LZS-LG-HS Transmitter and Receiver.

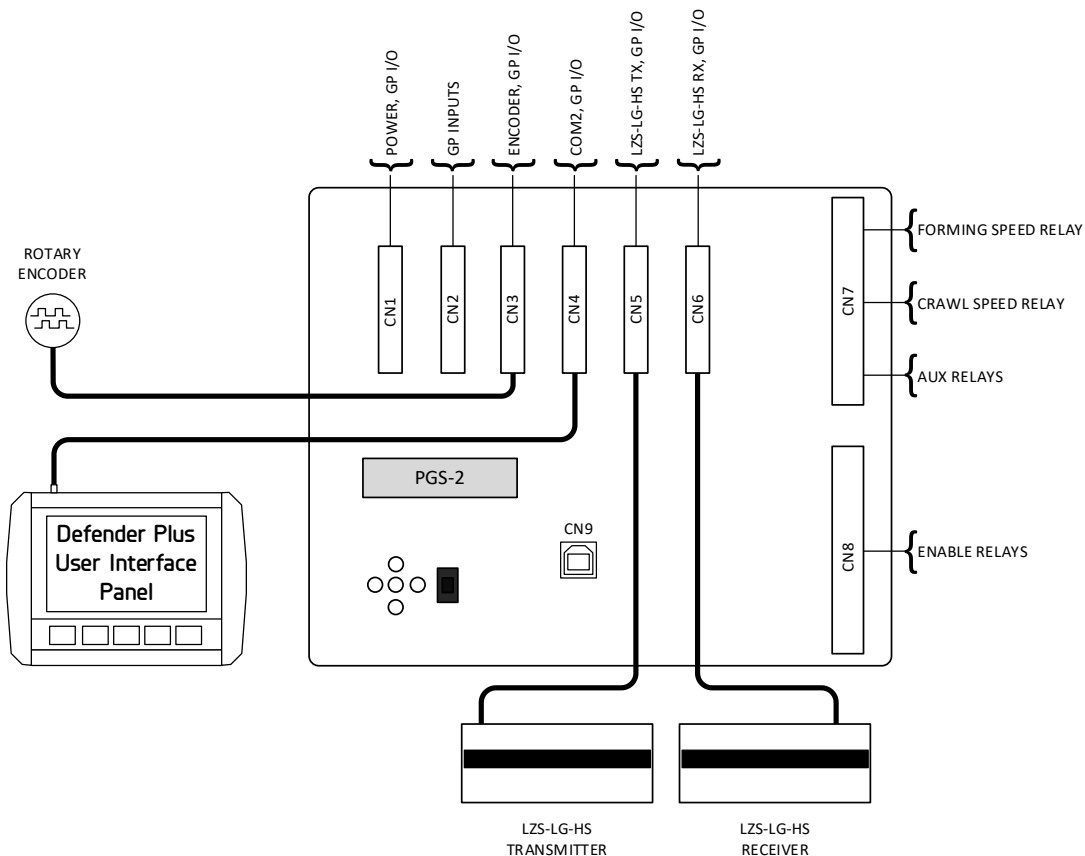


Figure 3-2: Defender Plus Press Brake Guarding System Components

3.3 Optical Protection Overview

The Defender Plus Press Brake Guarding System comes as standard with the LZS-LG-HS High Speed Dual 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 dual continuous bands of laser light that monitor the zone below the punch. If an obstruction is detected the closing movement is stopped. The punch cannot make contact with the obstruction.

The Defender 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.

3.3.1 LZS-LG-HS Dual Laser

This model features a transmitter with two parallel lasers that are 4mm and 14mm below the punch. The bottom laser (laser B) remains active during high speed closing and is then automatically muted during deceleration of the press to bending speed while the top laser (laser A) continues to provide protection until the tool opening is reduced to 6mm (4mm distance between punch and Laser A + 2mm mute point). Referring to **Figure 3-3**, for the LZS-LG-HS the laser to punch distance is 14mm, and the laser separation is 10mm. Within the receiver there are three sensor zones (front, middle and rear). In the following illustrations the lasers are shown in segments to highlight the sensor zones however the laser light will appear as a continuous band. The system can mute individual sensors when forming various shape work pieces (e.g. tray and box shaped parts).

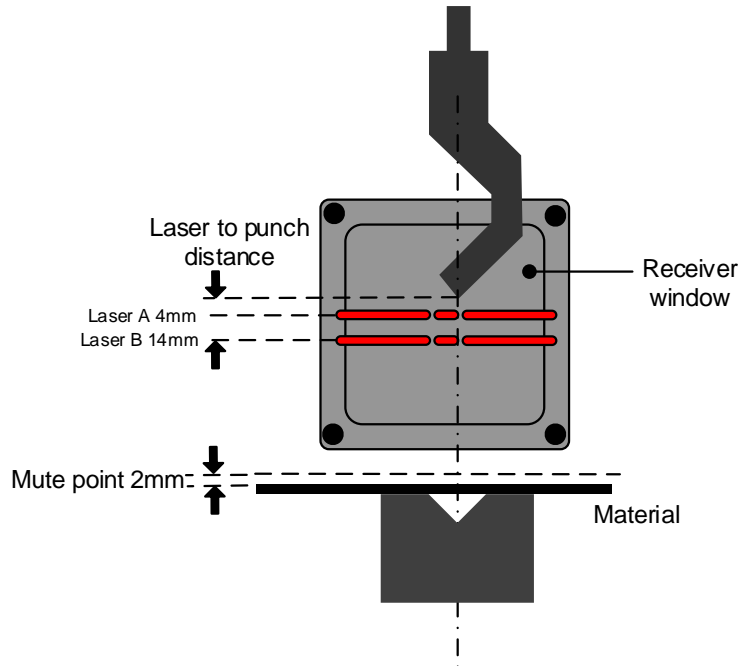


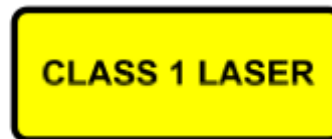
Figure 3-3: LZS-LG-HS Dual Laser

3.3.2 Laser Classification and Warnings



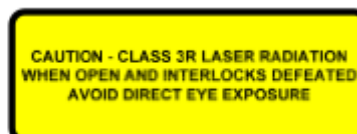
Warning: CLASS 1 LASER DEVICE

The LZS-LG-HS laser transmitter emits CLASS 1 planar lasers approximately 50mm in width. Do not stare directly into the lasers or the transmitter window.



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

The LZS-LG-HS 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 3R LASER RADIATION that has the potential to cause eye damage.



3.3.3 Setup

During setup Laser B is aligned parallel to, and 14mm below the tool tip (see the Laser to Punch Distance in **Figure 3-4** below). When the system is idle, only the lower laser (Laser B) is switched on for set-up. During machine operation when the foot pedal is pressed the top laser (Laser A) is also turned on.

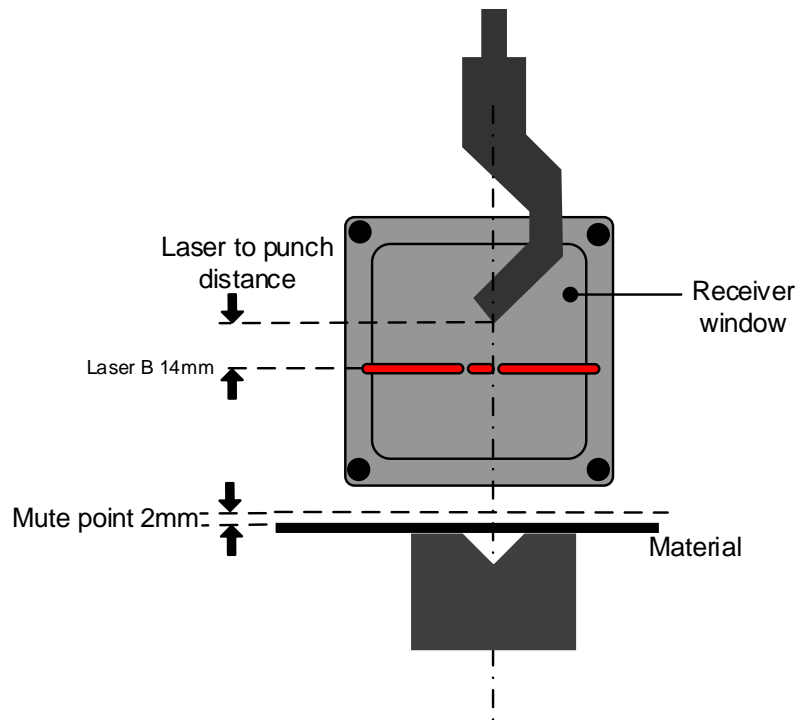


Figure 3-4: Laser to Punch Distance / Mute Point Distance

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 sensors (front, middle and rear) are active. When the foot pedal is pressed the system checks that the sensors are clear and allows the tools to close in high speed. The machine then decelerates to pressing speed just before the mute point. The lasers are automatically muted so the tool opening is 6mm when the optical protection is no longer active and the bend can be completed.



Note:

The Defender Plus 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 Defender Plus User Interface Panel in detail.

3.4.1 Obstruction Detection – From a Stationary Position

If any sensor 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 sensor is obstructed then the closing movement is stopped and the message **Sensors blocked – REASE 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 Defender 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.

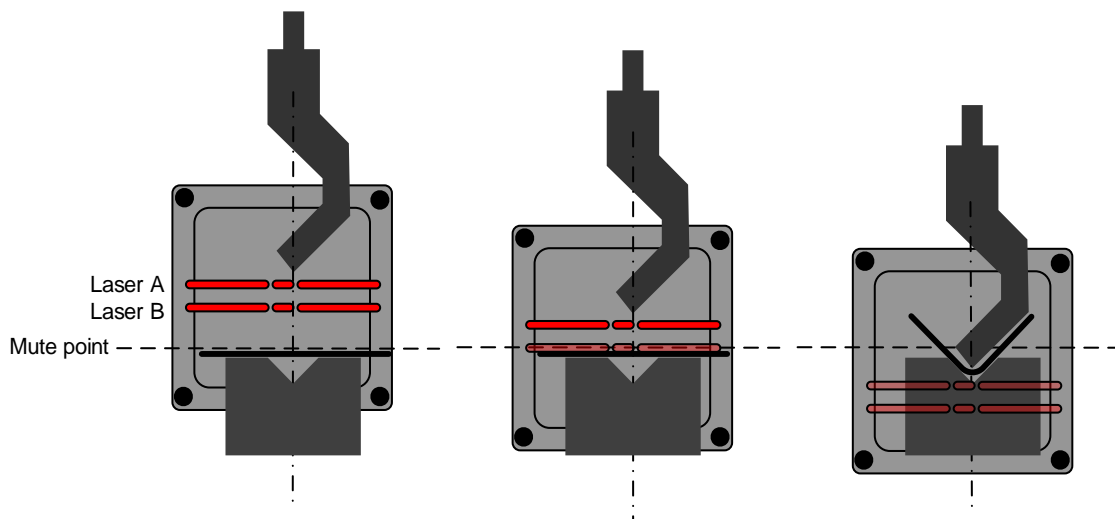


Figure 3-5: Normal Mode Operation

3.5 Tray/Box Modes

The Defender Plus system supports two types of Tray/Box mode. In these modes the front and rear sensors can be temporarily deactivated when forming tray or box shaped parts, where the work piece side flange obstructs the front and/or rear sensor. The system will allow the front and rear sensors to be temporarily deactivated so that the tools can close in high speed, which increases machine productivity. If at any time the middle sensor is obstructed, then the tools 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 are 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 sensors then the system operates as it does in Normal Mode (refer **Section 3.4**). If the front and/or rear sensors 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 sensors 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 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 sensors 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 sensors then the system operates as it does in Normal Mode (refer [Section 3.4](#)). If the front and/or rear sensors 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 sensors 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 sensors become active again once the tools are opened.

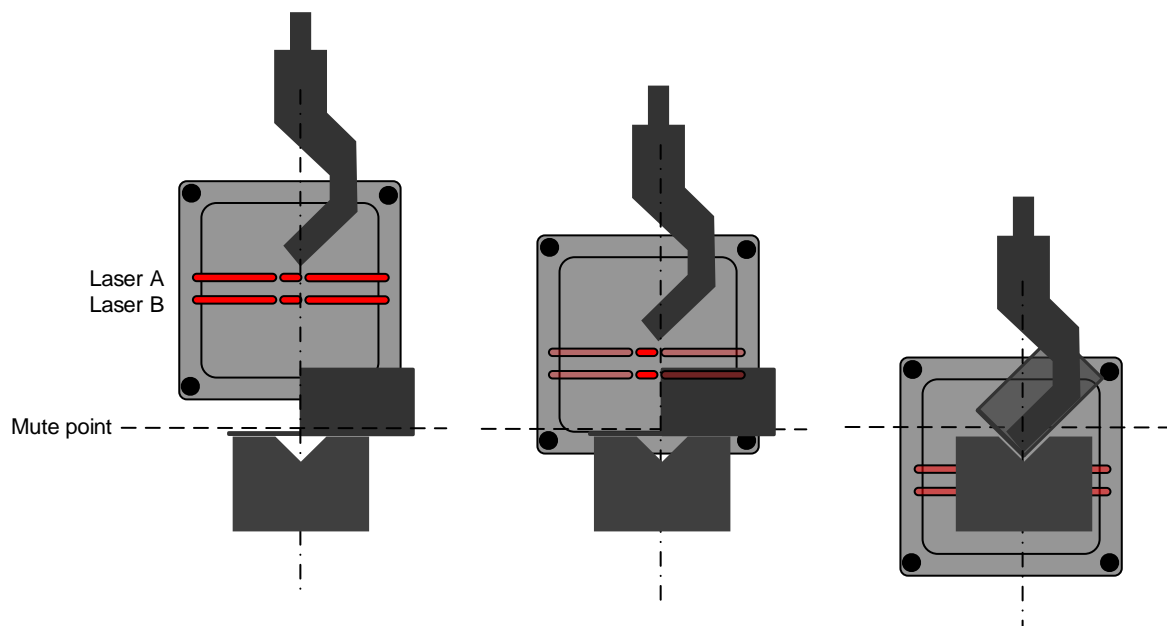


Figure 3-6: Tray/Box Mode Operation

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 sensors 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 sensors 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 mute 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

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 Defender 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.

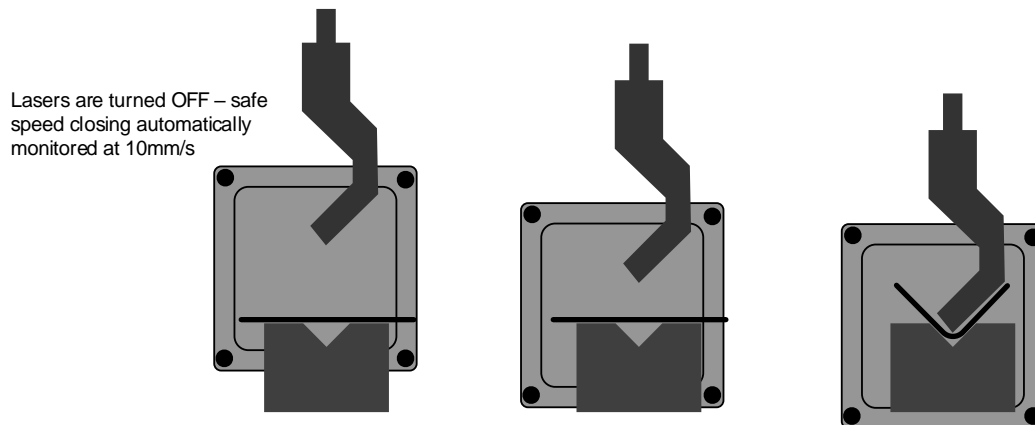


Figure 3-7: Field Muted Mode Operation



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Defender 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.).

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.

3.8 Stop at Mute Mode

The Stop at Mute Mode automatically forces the tools to stop closing at the mute point (6mm / ¼" opening). To complete the bend the operator must release and press the pedal.

3.9 Tool Set-up Mode (optional)

Tool Set-up mode is similar to Field Muted mode, but as well as deactivating optical protection and restricting the machine to safe speed, it also disables motion monitoring. This is provided to allow operation of the machine during tool setup and referencing procedures without the Defender Plus system raising unnecessary error conditions.

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.

**Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE**

In Tool Set-up Mode, all optical guarding is deactivated. Although the Defender Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

3.10 Mute Mode - Restricted (Optional)

The Defender 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 or laser guarding.

3.10.1 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 Defender Plus system.

3.10.2 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.

3.10.3 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.

3.11 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 laser is adjusted to the correct distance from the punch tip with the aid of an alignment tool. The receiver is simply positioned so that the laser is positioned in the 40mm window reception area. In most tool changes the receiver does not require any adjustment if the punch height changes by less than 20mm. After the tool change is complete the mute point is then quickly and easily reset during the first stroke.

3.12 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 Transmitter and Receiver Adjustment

4.1 Initial Alignment

When the system is first installed, a complete alignment of the laser transmitter and receiver is required. Refer to *Lazer Safe Alignment Reference Guide (LS-CS-M-017)* for detailed step by step instructions.

4.2 Mounting Brackets

The vertical bracket is manufactured from lightweight alloy extrusion, providing a strong and stable platform for the laser transmitter and receiver, which ensures accurate laser alignment during machine operation.

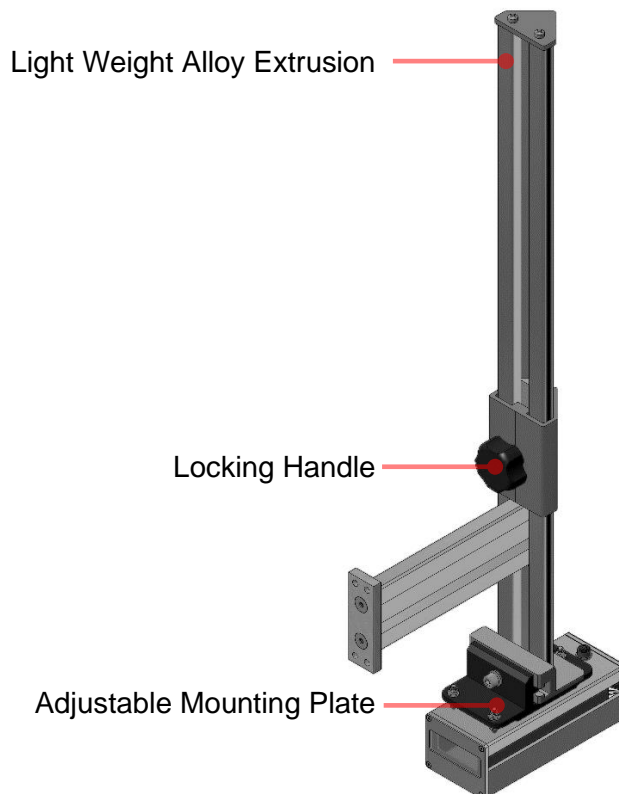


Figure 4-1: LC Mounting Brackets

4.3 Tool Change

When changing the upper tools, the brackets can be quickly moved up and locked clear so that the punch can be removed from the ends of the press beam. To release the vertical bracket unscrew the locking handle, raise the transmitter/receiver above the tools and relock.



Caution:

Always support the transmitter/receiver before releasing the locking handle. If the vertical bracket is not supported when the lock is released it will drop under its own weight to the vertical end stop. This may result in damage to the vertical bracket or the transmitter/receiver.

4.4 Adjustment After Tool Change

Any time the tools are changed the LZS-LG-HS transmitter and receiver must be checked for alignment with the new tool. If the initial alignment was performed correctly, all that is usually required after a tool change is to confirm that the laser to punch distance is correct.

The vertical position of the transmitter must be adjusted so that the lower laser (Laser B) is 14mm below the punch tip. Alignment cards are supplied with a self-adhesive tool locator tab that can be permanently fixed at the correct laser to punch distance (**Figure 4-3**).

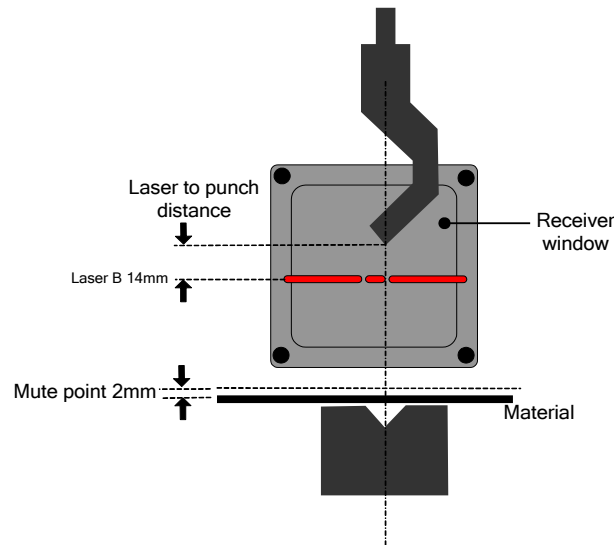


Figure 4-2: Laser to Punch Distance



Figure 4-3: Tool Locator Tabs

The operator can then attach the alignment tool to the punch, locating the tool tip in the centre groove of the locator tab at the correct laser to punch distance.

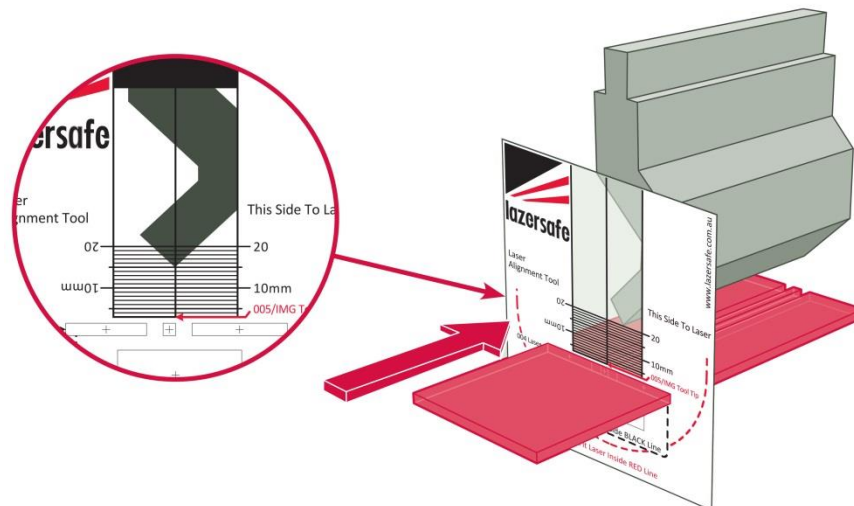


Figure 4-4: Fitting the Alignment Card to the Punch

If the new tool has changed the laser to punch distance, then the laser will not be aligned to the slots in the alignment card. The example in **Figure 4-5** shows a laser that needs to be moved down to return to alignment.

Hold the bottom of the transmitter unit with one hand, and with your other hand unscrew the locking handle on the transmitter bracket to release the clamp. Slide the bracket up or down until the laser is positioned in the slots on the transmitter alignment card. Then tighten locking handle to secure the bracket. Remove the alignment card.

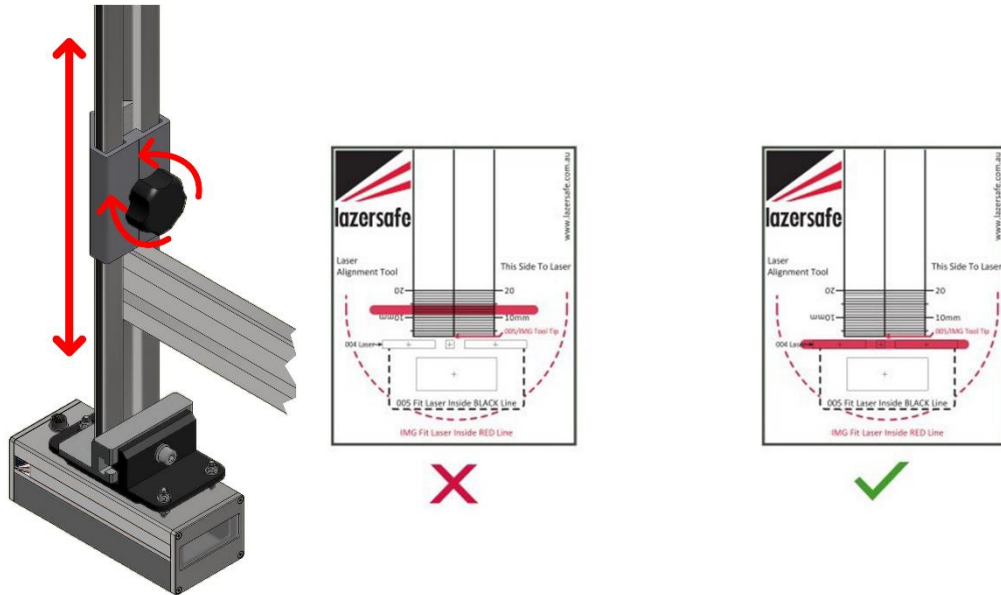


Figure 4-5: Vertical Bracket Adjustment

For the receiver you simply need to adjust the vertical position of the receiver bracket so that the laser is positioned near the middle of the window (**Figure 4-6**). In most cases, if the tool height changes by less than 20mm, the receiver will not require any adjustment.

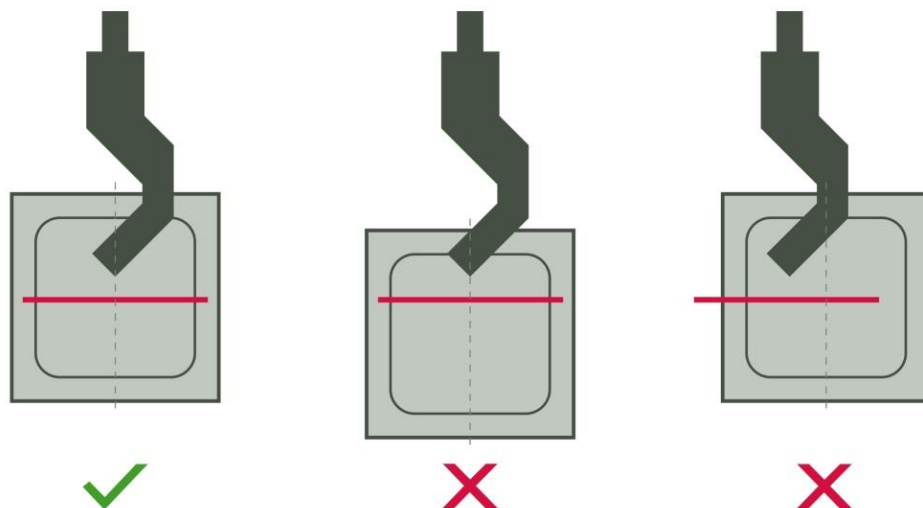


Figure 4-6: Laser Position on Receiver Window.

The mute point must now be cleared by the operator (**see Section 3.4**), and set again on the first stroke with the new tool.

4.5 Periodic Alignment Check

The alignment of the transmitter, receiver and punch should be checked using the supplied Lazer Safe alignment cards 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 Defender 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 Defender Plus system. The operator controls the Defender 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

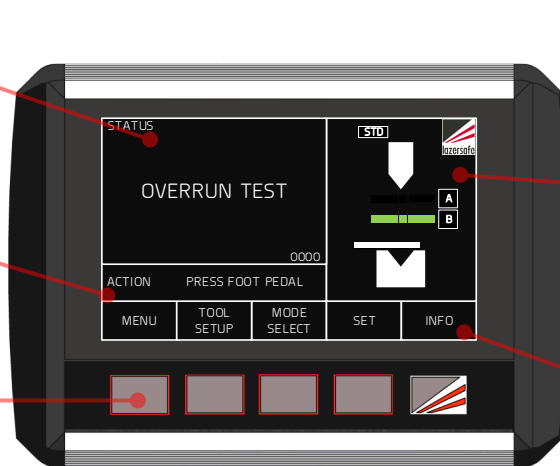
This window shows the current status of the press brake, and of the Defender Plus system.

Action Window

The Defender Plus system displays what action is required by the operator in the Action Window.

Operator Pushbuttons

Five pushbuttons are provided for the operator to control the Defender Plus 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: Defender Plus User Interface Panel

Figure 5-2 shows the different Defender 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 Defender Plus screens using the panel pushbuttons.

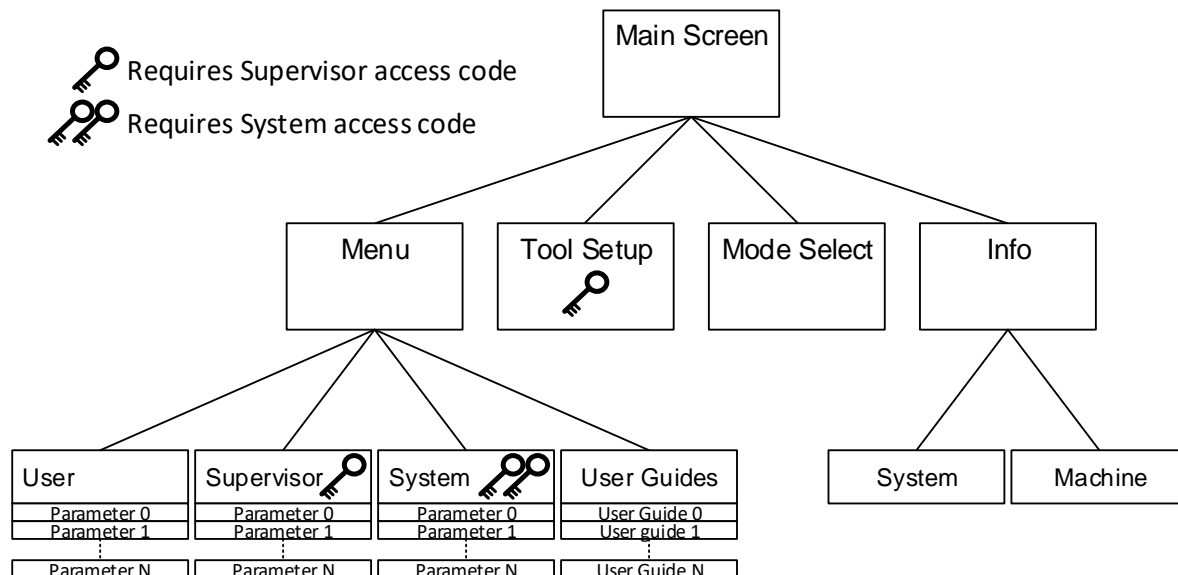


Figure 5-2: Defender Plus Menu Levels



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 Defender 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 clear 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 Defender 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 Defender 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 Defender Plus 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.



Note:

If the Defender 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.



Figure 5-3: The Defender Plus Main Screen

5.4.1 Status and Action Windows

The Status window informs the operator of the current status of the Defender 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 Defender 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-2 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-2 Safety Controller requires that an operation is to be performed to verify the safety performance of the machine (such as an over run test) the operator is informed of the upcoming operation in the Status window (and is also prompted for action by 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 current screen, the Supervisor menu configuration, and the state of the machine. The button labels for the Main screen are 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.
INFO	This leaves the main screen and enters the Info Screen. See Figure 5-2 for an overview of the menu system.

Table 5-1: Main Screen Buttons

5.4.3 Sensor Window

The Sensor window shows the status of the optical protection from the point of view of the receiver. Symbols in the window show the current active mode, and the state of the receiver sensors for lasers A and B 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.

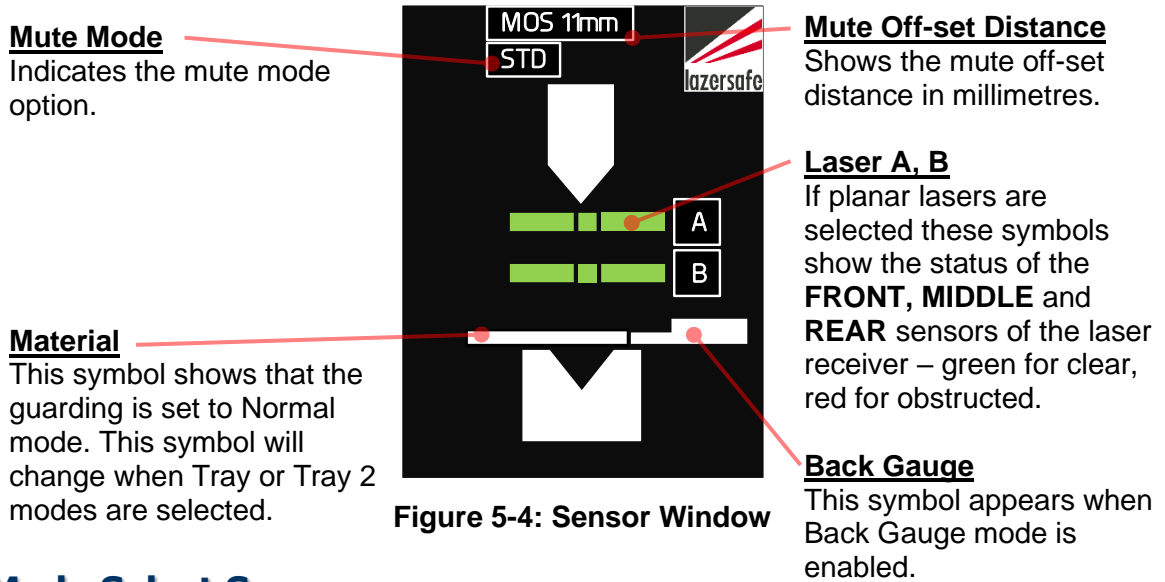


Figure 5-4: Sensor Window

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 5-5: Mode Select Screen

The buttons are used to select the different guard modes (the modes are detailed in **Sections 3.3 to 3.10**). 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 5-2: 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 Defender Plus system operates. There are three levels of access to the menu system; User, Supervisor and System. The User and Supervisor menus are detailed in **Section 7**.

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 Defender 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 Defender Plus Press Brake Guarding System. The System menu is **not** described in this document.



Warning:

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



Figure 5-6: 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.
SYSTEM MENU	This accesses the System menu. An access level of System is required.
USER GUIDES	This accesses instructional guides on the operation of the Defender Plus system. No access code is required.

Table 5-3: Menu Screen Buttons

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 Defender Plus system is powered down. Refer to **Section 7** 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-2 turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the PGS-2 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 7.1.1** for a description of how to navigate menus.

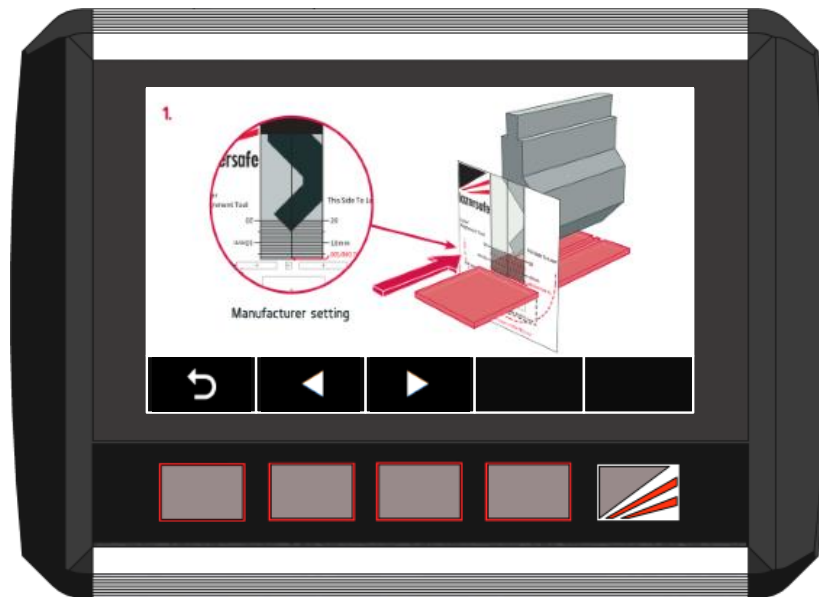


Figure 5-7: User Guide Screen

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 5-4: User Guide Buttons

The User Guides are simple, step by step graphical guides for common procedures that need to be performed regularly on Lazer Safe equipment (such as how to align LZS-LG-HS laser guards). If the guide contains more than one page, the left/right arrow keys can be used to navigate the pages of the guide.

5.7 Info Screen

The Info screen is selected from the Main screen, and displays information about the Defender 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 Defender Plus User Interface, and the system cannot run if the panel is disconnected. The safety application running on the PGS-2 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-2 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-2 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.** Defender Plus User Interface Panel software version.
- **Kernel version.** PGS-2 Safety Controller kernel software version.
- **Application.** PGS-2 Safety Controller application software version.
- **FPGA version.** PGS-2 Safety Controller FPGA firmware version.
- **Approx. slow point.** The slow speed point calculated by the Defender Plus. The press brake must be travelling in slow speed by this opening (in millimetres).
- **Laser-punch.** This field displays the laser to punch distance, as described in **Section 3.3.3**. For the Defender Plus system with dual beam LZS-LG-HS optical protection, this figure should always be set to 14mm.

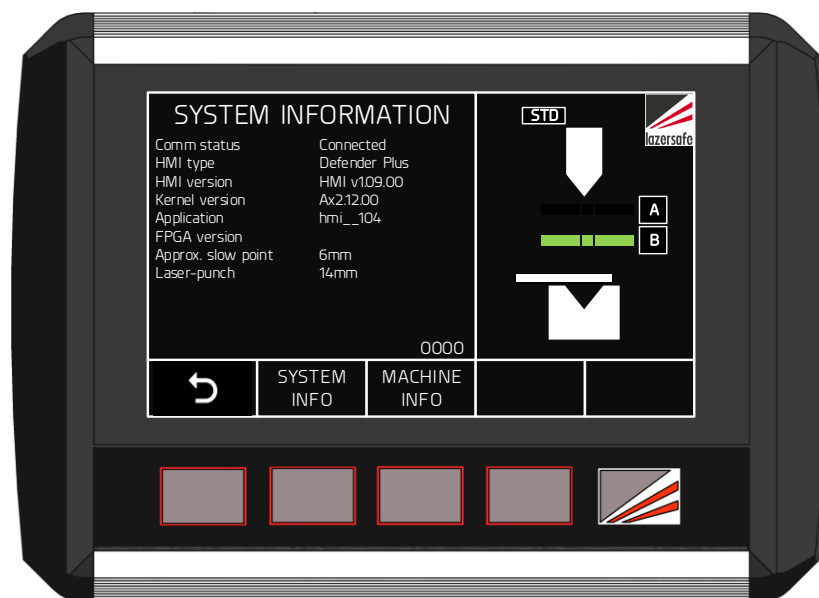


Figure 5-8: Info Screen, System Information

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

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-2 each time the beam is stopped.
- **Stop Distance.** Measured by the PGS-2 each time the beam is stopped.
- **Stop Time Limit.** This value is not applicable for the Defender Plus system and is always set to 1000ms.

6 System operation

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

6.1 Power-up

When the Defender Plus is first powered it displays a start-up screen with the message **SYSTEM STARTING - PLEASE WAIT**, while it waits for the PGS-2 to complete its power on start-up test. Once the PGS-2 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: Defender Plus Idle Screen

6.2 Start-up Test

When first started, the Defender Plus must perform an overrun test to test the function of PGS-2 emergency stop outputs, and the stopping performance of the press brake. The operator is warned of the upcoming test by the message in the Status screen, see **Figure 6-2**.



Figure 6-2: Start-up Test Screen

Immediately after power up the emergency stop outputs are in the OFF state. Press the Reset button to turn on the E-Stop and Enable outputs.

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 the laser to punch distance.
- Check that the receiver sensors are clear (see the LZS-LG-HS receiver, the PGS-2 front panel, or the Sensor window of the Defender Plus User Interface Panel).



Note:

Refer to **Section 4** for detailed information regarding alignment and laser to punch settings.

To commence the test, press the foot pedal as indicated in the Action window. 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 6-3**.

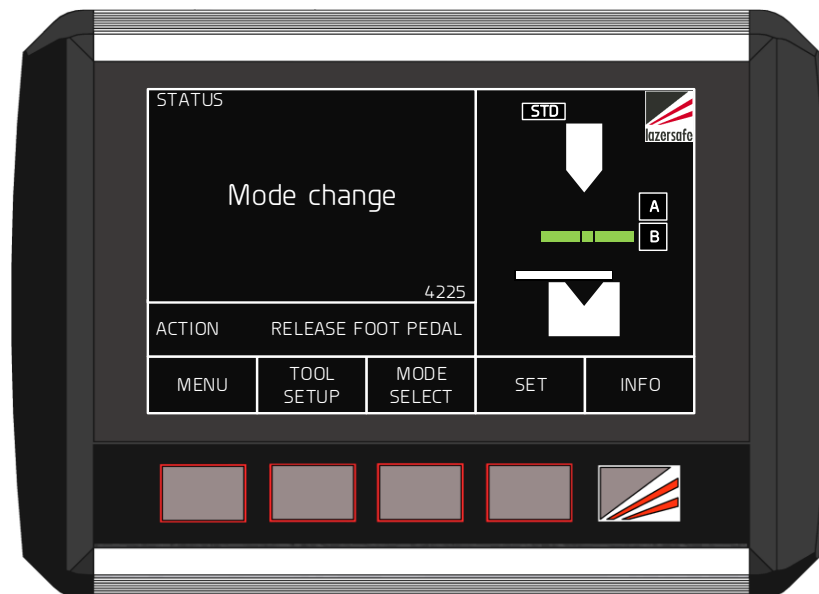


Figure 6-3: Mode Change Status Message

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 Defender 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 every power up, every 24 hours of continuous machine operation, or 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 Defender Plus panel must be in the Main screen to access the SET button.

Place a piece of sample material on the die which is the same thickness as the work piece. The Defender Plus 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.

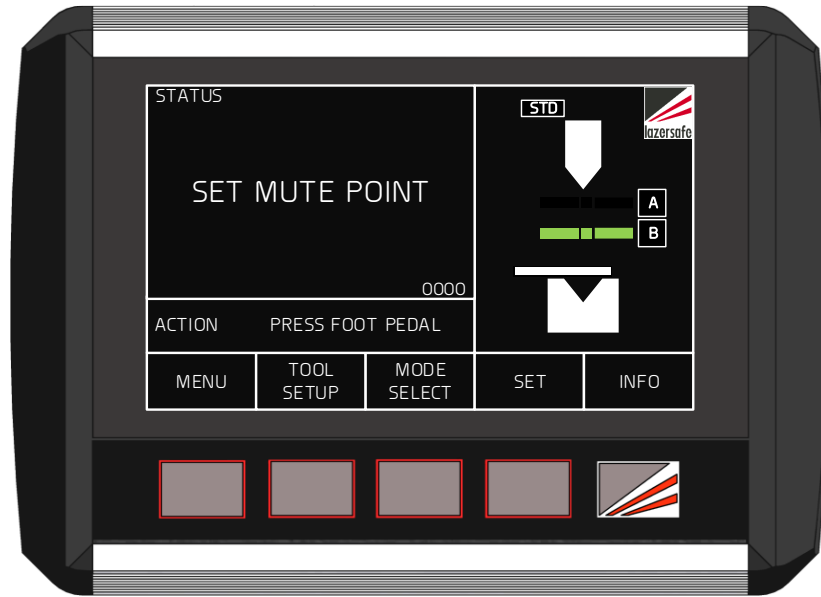


Figure 6-4: Set Mute Point Prompt Screen

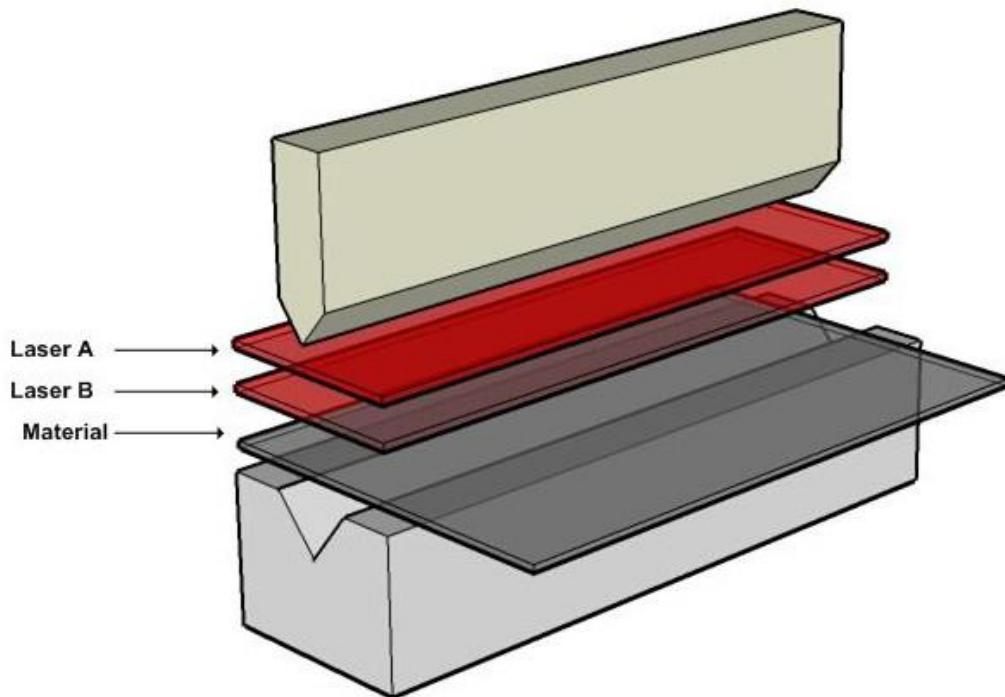


Figure 6-5: Material Placement on the Die



Note:

During mute point set-up the Defender Plus Press Brake Guarding System uses only the front and middle sensors of the receiver to detect the material.

Press the foot pedal. Laser A will activate, and the tools will close until Laser B (the bottom laser) is obstructed by the sample material. The Sensor window will show Laser B as obstructed, and the SET button will change colour to green, which indicates that the mute point can now be set, as seen in **Figure 6-6**.

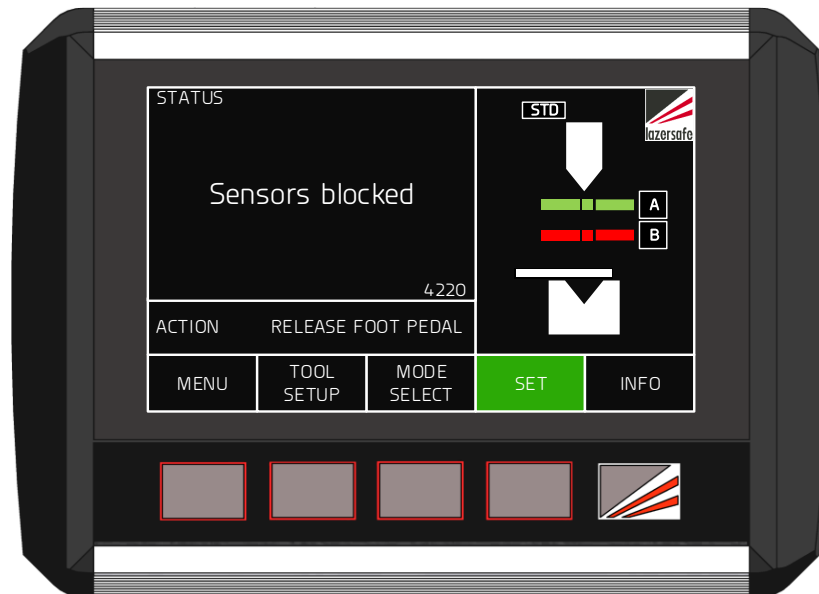


Figure 6-6: Laser B Obstructed by the Material

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).

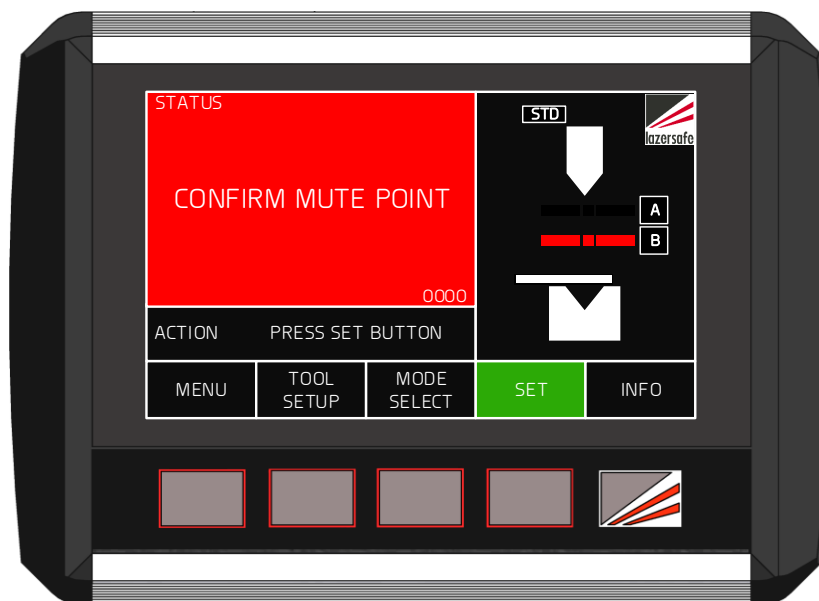


Figure 6-7: Confirm Mute Point Screen

To confirm the detected position as the mute point, press the **SET** button. The Status screen will change back to black, 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**.

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 6-4** prompting the operator to SET MUTE POINT – PRESS FOOT PEDAL.

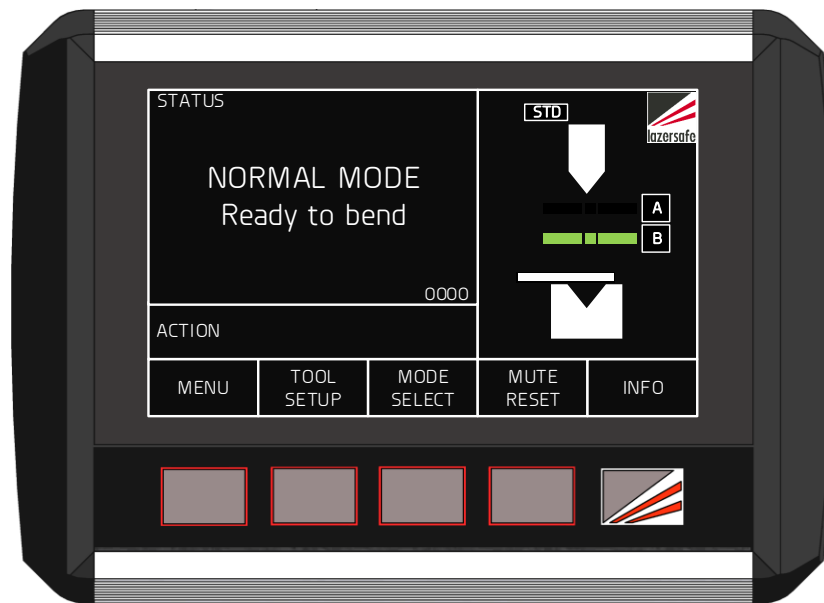


Figure 6-8: Mute Set, Ready to Bend

6.5 Selecting Tray/Box Modes

To change the optical protection mode the Defender 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. 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**.

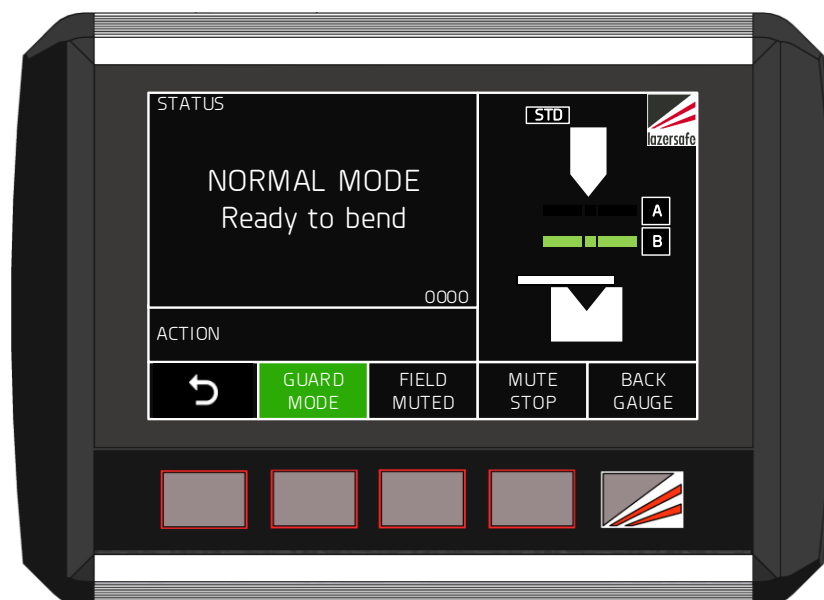


Figure 6-9: Mode Select Screen

- 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 6-10 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**.

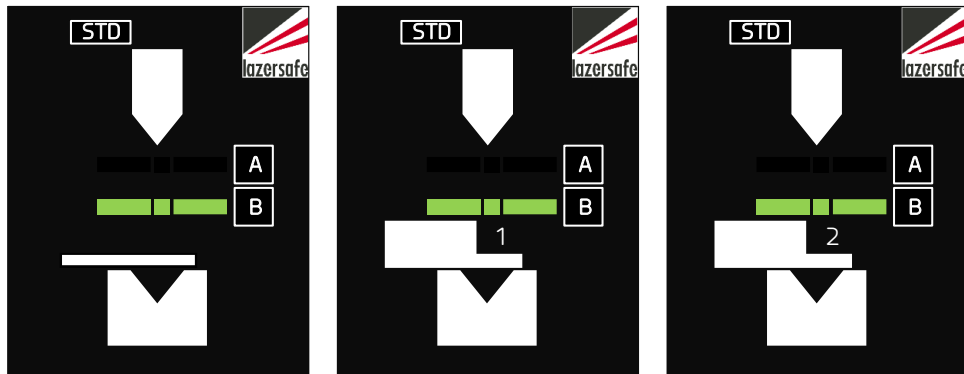


Figure 6-10: Sensor window (left to right) Normal, Tray and Tray 2 Symbols

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 Defender 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.

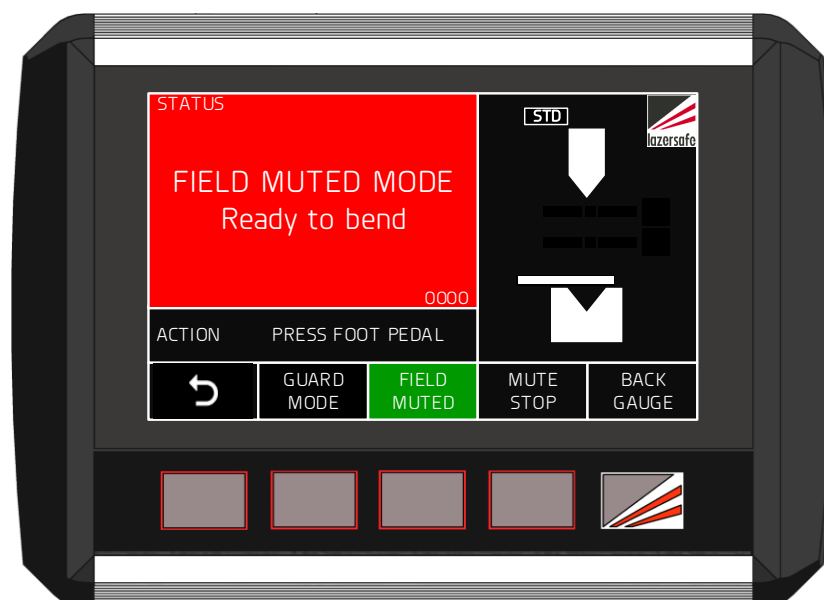


Figure 6-11: Mode Select Screen - Field Muted Mode



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, all optical guarding is deactivated. Although the Defender 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.).

To enter Field Muted mode press the FIELD MUTED button. When the Defender Plus system enters Field Muted Mode the screen will appear as shown in **Figure 6-13**. 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.



Note:

The Field Muted button functionality can be disabled through a parameter in the Supervisor menu. **Figure 6-12** shows the state of the button for (left to right) Enabled, Disabled-ON and Disabled-OFF.



Figure 6-12: Field Muted Button Options (left to right) Enabled, Disabled-ON, Disabled

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 6-13**.

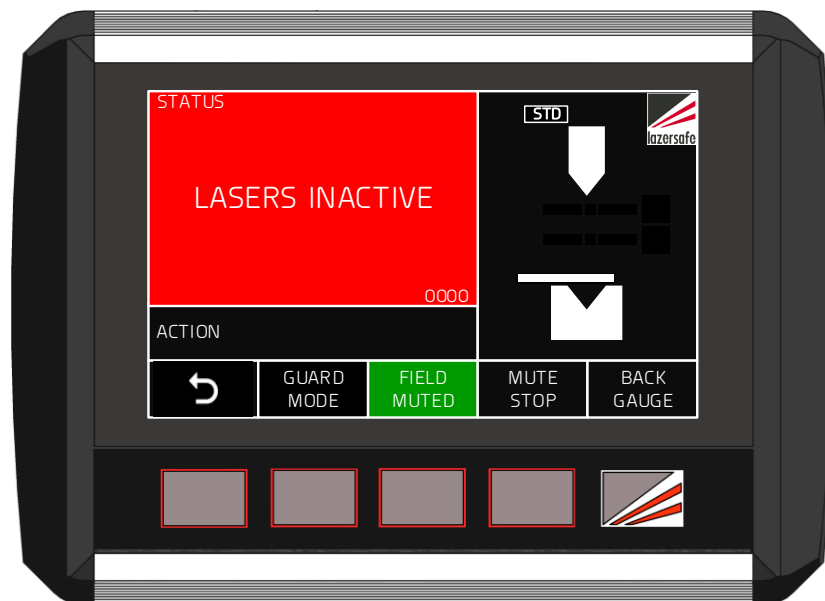


Figure 6-13: Closing Tools in Field Muted Mode

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 Defender Plus system will always return to Normal mode after Field Muted mode, and will again appear as in **Figure 6-9**. 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 Defender Plus has changed mode.

6.7 Selecting Stop at Mute Mode

To select Stop at Mute mode the Defender 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**.

Stop at Mute is used in conjunction with other guarding modes. For example, Stop at Mute can be selected in Normal, Tray, Tray 2 or Field Muted 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 Defender Plus system behaves as described in **Section 3.8**.



Note:

The **MUTE STOP** button functionality can be disabled in the Supervisor menu. **Figure 6-14** shows the state of the button for (left to right) Enabled, Disabled-ON and Disabled-OFF.



Figure 6-14: Mute Stop Button Options (left to right) Enabled, Disabled-ON, Disabled

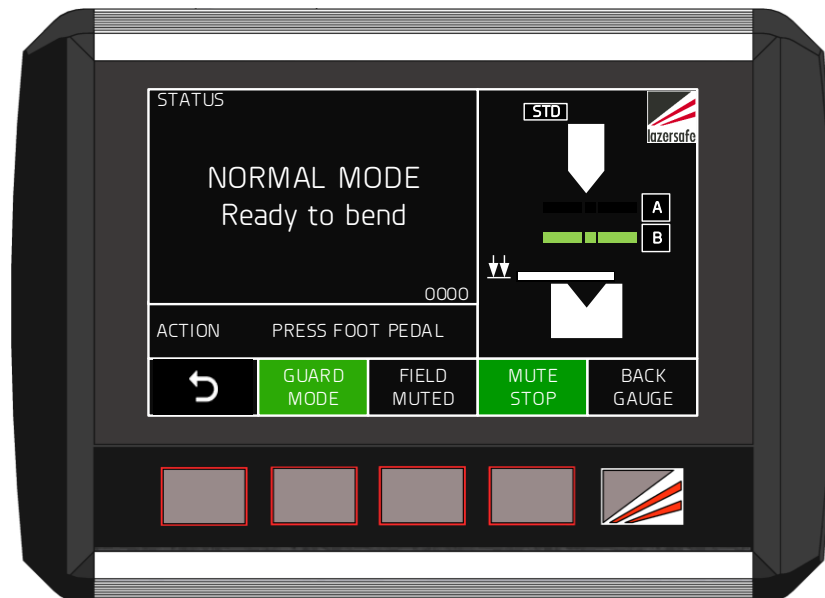


Figure 6-15: Normal Mode + Stop at Mute Mode

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 6-9**.

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 the external 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**.

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 6-16**, and the **BACK GAUGE** label will turn green. The Defender Plus system will now behave as described in **Section 3.6**.

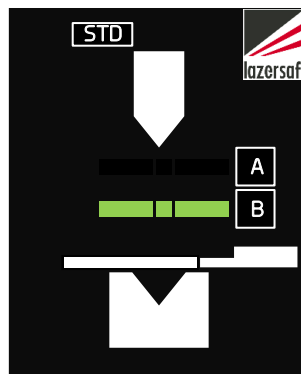


Figure 6-16: Sensor Window - Back Gauge Mode

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 6-9**.

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.



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

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



Figure 6-17: Tool Setup Mode Access Screen

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 6-17**.

If the code is correct the Defender Plus screen proceeds to the Tool Setup mode screen, and the Defender Plus system will now behave as detailed in **Section 3.9**. If an external mute lamp has been installed it will be switched ON to indicate that optical protection has been de-activated.

6.10.1 Exiting Tool Setup Mode

Tool Setup mode can be exited by pressing any of the Defender Plus panel buttons when the tools are open. This will return the Defender 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 Defender Plus will wait until the tools are opened. It will then exit Tool Setup mode, and return to the previous operating mode.

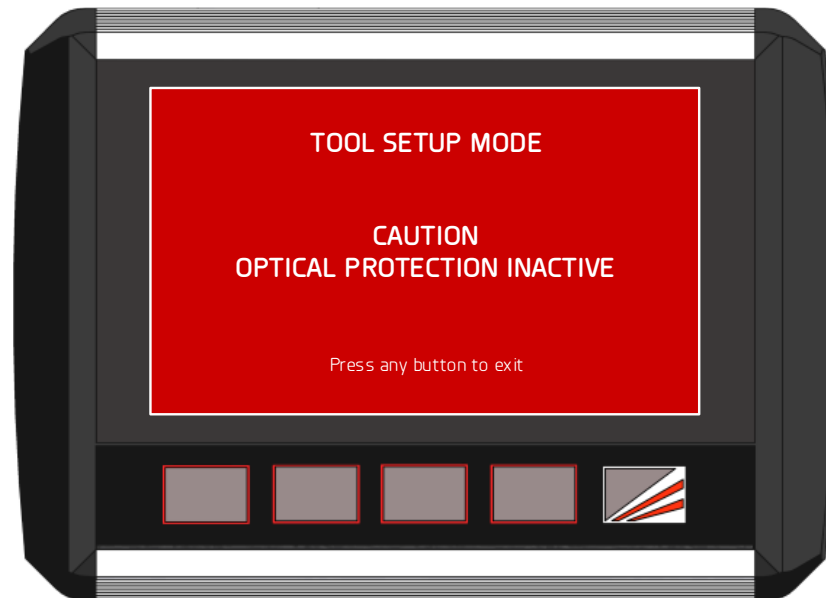


Figure 6-18: Tool Setup Mode Screen

6.11 Emergency Stop Operation

Depending upon your installation, external inputs may be connected to the PGS-2 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-2 which monitor the operation of valves, relays or solenoids. The Defender Plus continually monitors these devices to ensure that they are operating correctly.

If a monitored device fails, the Defender 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 Defender 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.

7 User and Supervisor Menus

The Menu screen gives access to the menus that are used to configure the way that the Defender 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 Defender 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 Defender Plus Press Brake Guarding System. The System menu is **not** described in this document.



Figure 7-1: Menu Screen


Label	Button Function
	This leaves the Menu 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 is required.
SYSTEM MENU	This accesses the System menu. An access level of System is required.
USER GUIDES	This accesses instructional guides on the operation of the Defender Plus system. No access code is required.

Table 7-1: Menu Screen Buttons



Note:

When any menu screen is selected, the safety application running on the PGS-2 turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the PGS-2 will show the Condition Code **40A1**.

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 Defender 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 Defender Plus installers. Setting incorrect parameter values in the System menu may render your machine inoperable.

7.1.1 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 Defender Plus buttons, as shown in **Figure 7-2** and **Table 7-2**. 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 7-2: 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 7-2: 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.

7.1.2 Setting Option Parameters

Option parameters are navigated in the same way as menus, using the buttons described in **Figure 7-2** and **Table 7-2**. 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 Defender Plus’s non-volatile memory, and the Defender Plus User Interface returns to the parameter list. Changes can be abandoned at any time by pressing the ↶ button.

7.1.3 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 7-3** 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 Defender Plus’s non-volatile memory, and the Defender Plus User Interface returns to the parameter list. Changes can be abandoned at any time by pressing the ↶ button.



Figure 7-3: 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 7-3: Numeric Parameter Screen Buttons

**Note:**

The Defender 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.

7.2 User Menu

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

7.2.1 Parameter 0 – Buzzer On/Off

This parameter sets the behaviour of the buzzer.

- **ENABLED.** The buzzer will 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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

7.3 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 7-4**. This is a numeric parameter as described in **Section 7.1.3**, and shown in **Figure 7-3**.

**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 7-4: 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.

7.3.1 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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

7.3.2 Parameter 1 – Field Muted Button Functionality

In the Mode Select screen the FIELD MUTED button is used to place the Defender 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 Defender 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 Defender 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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

7.3.3 Parameter 2 – Mute Stop Button Functionality

In the Mode Select screen the MUTE STOP button is used to put the Defender Plus 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 Defender 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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

7.3.4 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 7-5](#).

**Note:**

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

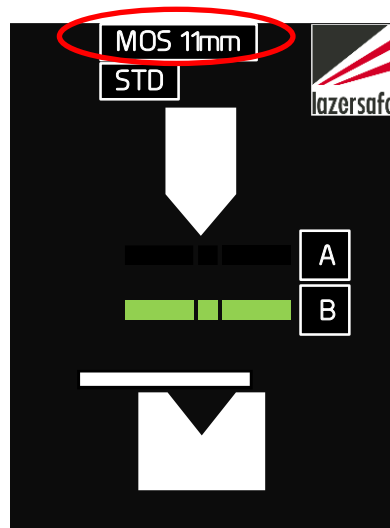


Figure 7-5: Mute Off-set Display

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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

7.3.5 Parameter 4 – Language

The language displayed by the Defender 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 Defender Plus's non-volatile memory, and the system will return to the parameter list.

8 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.

8.1 Equipment Identification

Component	Model	Serial Number	Notes
Controller	PGS-2		
Transmitter	LZS-LG-HS		
Receiver	LZS-LG-HS		
User I/F Panel	Defender Plus HMI		

8.2 Starting the System

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

- 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.
- Explain how the transmitter and receiver operate. 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-2, the receiver LEDs and the User Interface Sensor window.

8.3 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.

8.4 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.

8.5 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).

8.6 Field Muted Mode

Refer to **Sections 3.7** and **Section 6.6** for detailed descriptions.

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 Defender 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.).

8.7 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.

8.8 Setting the Laser Position

Refer to **Section 4** and the *Lazer Safe Alignment Guide (LS-CS-M-017 Rev 2.0)* for a detailed description on 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-2, 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.

8.9 Back Gauge Interference

- **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 Defender Plus panel.

8.10 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 Defender Plus panel display.

8.11 Tool Set-up Mode Option

- Demonstrate how to select Tool Set-up Mode via the Defender Plus User Interface Panel.
- Explain that the laser protective field is deactivated and that the tool will close in safe speed only.



Warning: NO OPTICAL PROTECTION IN TOOL SET-UP MODE

In Tool Set-up Mode, all optical guarding is deactivated. Although the Defender Plus Press Brake Guarding System ensures that the machine does not exceed safe speed in this mode, particular caution must still be exercised.

8.12 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.

8.13 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 Defender Plus operation.

8.14 Customer Sign Off – Training Completed

Company Name: _____

Date: _____

Names of Company Representatives:

Signatures of Company Representatives:

9 Maintenance

9.1 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.

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.

9.2 Bracket Maintenance

To maintain smooth and secure operation of the LC brackets they should be periodically inspected and cleaned. The vertical rails of the LC brackets do not require lubrication.

10 Glossary of Terms

Term	Description
Approach	The closing movement of the tools
Approach signal	A signal from the press brake controller to the Defender 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 >10 mm/s
Back gauge mode	Operating mode of the Defender Plus system where the rear sensor is muted 16 mm above the mute point to prevent interference from the back gauge.
Beam / pressing beam	The moving member of the press brake
Condition code	Status information from the PGS-2 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 (valve/solenoid monitor).
Field muted mode	Operating mode of the Defender 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)
Laser A	The upper laser of the LZS-LG-HS
Laser B	The lower laser of the LZS-LG-HS
Mute	Deactivation of the protective laser field
Mute point	The point where the optical protection is deactivated
Normal mode	Default operating mode of the Defender Plus
Opening	The distance between the lower and upper tools
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
Safe speed	The closing of the tools in slow speed ≤ 10 mm/s
Stop at Mute Mode	Operating mode of the Defender 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 Defender Plus when some of the sensor zones are deactivated for high speed forming of tray and box shaped parts.