

FOLDGUARD
FOLDING MACHINE SAFETY
& GUARDING SYSTEM

Installation Manual

LS-CS-M-078



Performance without compromise.™

lazersafe.com

📍 27 Action Road, Malaga WA 6090, Australia

✉ PO Box 2368, Malaga WA 6944, Australia

☎ +61 8 9249 4388

📠 +61 8 9249 6011

✉ info@lazersafe.com

Document Status

Document Reference Code: LS-CS-M-078
Version: 1.06
Released: 20/03/2018

Document Revision History

Date	Manual Version	Software Version	Summary of Change
21/09/2015	1.00		New Manual
15/02/2017	1.01		Updated User Interface Panel information screen. Added AUX Delay Stop menu/wiring. Added SAM forced after 3 strokes. Added clamp overtravel limit. Updated Copyright notice. Updated Declaration of Conformity.
06/07/2017	1.02		Updated extruded case, earthing, mounting options. Updated Declaration of Conformity.
09/10/2017	1.03		Added warning on powering external devices.
15/01/2018	1.04		Added Overtravel Limit menu parameter. Updated Declaration of Conformity. Updated Copyright notice.
12/02/2018	1.05		Revised all relay max operating voltages. General corrections.
20/03/2018	1.06		Modified for I/O remapping, USB communications. Amended relay specifications

Copyright Information

“Lazer Safe”, “Press Control Safety System”, “PCSS”, “PCSS-A”, “LZS-LG”, “LZS-LG-HS”, “LZS-004”, “LZS-004-HS”, “LZS-005”, “IRIS”, “IRIS Plus”, “RapidBend”, “RapidBend Plus”, “RapidBend Ultimate”, “FlexSpeed”, “FlexSpeed Plus”, “SmartLink”, “BendShield”, “BendShield Plus”, “AutoSense”, “AutoSense Plus”, “AutoSense Ultimate”, “Sentinel”, “Sentinel Plus”, “Defender”, “Defender Plus”, “FoldGuard”, “PressGuard”, “LazerGuard” and “LazerGuard Plus” are trademarks of Lazer Safe Pty Ltd.

ISaGRAF is a registered trademark of ICS Triplex ISaGRAF Inc.

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the U.S.A. and / or other countries.

The content of this manual is supplied for informational use only, is subject to change without notice and should not be construed as a commitment by Lazer Safe Pty Ltd. Lazer Safe Pty Ltd assumes no responsibility or liability for any errors, inaccuracies or omissions that may appear within this publication.

Copyright in this documentation is owned by Lazer Safe Pty Ltd. No part of this document may be reproduced or copied in any form or by any means (graphic, electronic, or mechanical including photocopying, recording, taping, or information storage and retrieval systems) without the written permission of Lazer Safe Pty Ltd.

Lazer Safe's copyright in this document is protected by Australian copyright laws (including the Copyright Act 1948 (Commonwealth)) and by international copyright treaties.

© 2018 Lazer Safe Pty Ltd. All rights reserved.

This page has been left intentionally blank

Table of Contents

1	About This Manual	1
1.1	Document Objectives.....	1
1.2	Technical Competence Requirements.....	1
1.3	Prerequisites	1
1.4	Document Organisation	1
1.5	Related Documentation.....	2
1.6	Guide to Notes, Cautions and Warnings	2
1.7	Obtaining Technical Assistance.....	2
2	Critical Safety Information	3
2.1	Proper Use of FoldGuard	3
2.2	Special Warnings	3
2.3	Regulatory Requirements for Use	4
2.3.1	Requirements For Factory Fitted Systems-Within The European Union.....	4
2.3.2	Requirements For Factory Fitted Systems-Outside The European Union.....	4
2.3.3	Requirements For Retrofitted Systems-All Locations	4
2.3.4	Equipment Alterations	4
3	System Overview	5
3.1	Key Benefits.....	5
3.2	Optical Protection Overview	6
3.2.1	Laser Classification and Warnings.....	7
3.2.2	Laser Transmitter and Receiver Setup	7
3.2.3	Mute Point	8
3.3	Normal Mode	9
3.3.1	Obstruction Detection – From a Stationary Position	10
3.3.2	Obstruction Detection - When the Clamp is Closing	10
3.4	Hemming Mode	10
3.4.1	First Stroke in Hemming Mode	10
3.4.2	Operating in Hemming Mode.....	10
3.5	Field Muted Mode	11
3.6	Safety Stop Mode	12
3.7	Bending Apron Mode	12
3.8	Bypass Mode.....	12
3.9	Emergency Stop Inputs.....	13
3.10	No Guard / No Counter Mode	13
3.11	Closed Loop Design	13
4	Transmitter and Receiver Installation	14
4.1	Floor Mounting Brackets	14
4.2	Transmitter/Receiver Mounting Plate	15
5	FoldGuard System Components.....	17
5.1	Component Identification	17

5.2	PGS-2 Safety Controller	17
5.3	LZS-004-HS High Speed Transmitter and Receiver	19
5.4	Optical Encoder	19
5.5	The FoldGuard User Interface Panel	19
6	Safety Controller Mounting and Power.....	20
6.1	Enclosure Mounting	20
6.1.1	Mounting Option 1 – Mounting Feet	20
6.1.2	Mounting Option 2 – DIN Rail Mounting	21
6.2	Main Power Supply	22
6.3	Powering External Devices	22
6.4	Earthing.....	22
7	Input / Output Connections.....	24
7.1	Relay Outputs	24
7.1.1	Forced Contact Enable (OSSD) Relays (Y00)	26
7.1.2	Forced Contact Auxiliary Relays (Y01).....	26
7.1.3	Standard Relays (Y02 & Y03)	26
7.2	Optical Encoder Interface.....	26
7.3	LZS-004-HS Transmitter and Receiver.....	28
7.4	Standard Digital Inputs	28
7.5	Standard Digital Outputs	29
7.6	Pulsed I/O Pairs	30
7.7	Serial Communications.....	30
7.7.1	COM1 Programming Interface	30
7.7.2	COM2 FoldGuard User Interface Panel	31
7.8	FoldGuard Installation Wiring Diagrams	31
8	The FoldGuard User Interface Panel.....	34
8.1	User Interface Overview	34
8.2	Error Reset Indicator and Reset Button	35
8.3	Mute Indicator.....	35
8.4	The Main Screen	35
8.4.1	Status and Action Windows.....	36
8.4.2	Main Screen Button Labels.....	36
8.4.3	Sensor Window	36
8.5	Mode Select Screen	37
8.6	Menu Screen	38
8.6.1	User Guides	39
8.7	Info Screen	39
8.7.1	System Information	40
8.7.2	Machine Information	40
9	User, Supervisor and System Menus.....	42
9.1.1	Selecting Menu Parameters.....	43

9.1.2	Setting Option Parameters	44
9.1.3	Setting Numeric Parameters.....	44
9.2	User Menu	45
9.2.1	Parameter 0 – Buzzer On/Off	45
9.3	Supervisor Menu	45
9.3.1	Parameter 0 – Supervisor Access Code	46
9.3.2	Parameter 1 – Field Muted Button Functionality	46
9.3.3	Parameter 2 – Safety Stop Button Functionality.....	46
9.3.4	Parameter 3 – Safety Distance	46
9.3.5	Parameter 4 – Language.....	47
9.4	System Menu	47
9.4.1	Parameter 0 – System Access Code	47
9.4.2	Parameter 1 – High Speed Offset	48
9.4.3	Parameter 2 – Clamp Overtravel Limit	48
9.4.4	Parameter 3 – Bypass Mode.....	49
9.4.5	Parameter 4 – Start Time.....	49
9.4.6	Parameter 5 – Encoder Travel	49
9.4.7	Parameter 6 – Clamp Travel.....	50
9.4.8	Parameter 7 – AUX Delayed Output Turn Off Time	50
10	System Commissioning	52
10.1	System Start-up	52
10.2	FoldGuard System Testing	53
11	Troubleshooting	54
11.1	Hardware and Software Versions	54
11.2	Status and Action Screens.....	54
11.3	Front Panel Display and Controls	55
11.3.1	PGS-2 LCD - Scrolling Display.....	55
11.3.2	Condition Code Display	55
11.4	Laser Guard Testing	56
11.4.1	LZS-004-HS Laser Transmitter	56
11.4.2	LZS-004-HS Receiver	56
11.4.3	Guard Test Failure.....	57
11.5	I/O Testing	57
12	Glossary of Terms	58
13	FoldGuard Specifications	59
13.1	LZS-004-HS Laser TX & RX	59
13.2	PGS-2 Safety Controller	59
13.2.1	Power Requirements	59
13.2.2	Pulsed Inputs & Outputs	59
13.2.3	Standard Inputs	59
13.2.4	Standard Outputs	60

13.2.5	Y00 Enable Relay Output (CN8)	60
13.2.6	Y01 Enable Relay Output (CN7)	60
13.2.7	Y02 & Y03 GP Relays (CN7)	60
13.2.8	Encoder	61
13.2.9	Communications Ports (CN4 & CN9)	61
13.2.10	Laser Guarding (CN5, CN6)	61
13.2.11	Functional Safety Data.....	61
13.2.12	System Reaction Time	62
14	Declaration of Conformity.....	63

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 installation, configuration and operation of the FoldGuard Folding Machine Safety and Guarding System.

1.2 Technical Competence Requirements

This manual has been written for the use of trained and competent personnel as defined below.

- Any engineer who is responsible for the planning, design and construction of automatic equipment using FoldGuard should be of a competent nature, trained to and qualified in all relevant local and national standards required to fulfil that role. Such engineers should be fully conversant in all aspects of safety with regards to automatic equipment.
- Any commissioning or service engineer must be of a competent nature, trained to and qualified in all relevant local and national standards required to fulfil that role. Such engineers should also be trained in the use and maintenance of the completed product, including being completely familiar with all associated documentation. All maintenance should be carried out in accordance with established safety practices.
- All operators of the installed equipment should be trained to use it in a manner that complies with established safety practices. Operators should also be familiar with all documentation concerning operation of the equipment.

1.3 Prerequisites

To use the **Lazer Safe FoldGuard Folding Machine Safety and Guarding System Installation Manual**, you should be fully conversant with all critical safety aspects of the Lazer Safe laser guarding system, and the folding machine upon which it is to be installed.

1.4 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 Installation.
5. FoldGuard System Components.
6. Safety Controller Mounting and Power.
7. Input / Output Connections.
8. The FoldGuard User Interface Panel.
9. User, Supervisor and System Menus.

10. System Commissioning.
11. Troubleshooting.
12. Glossary of Terms.
13. Safety Controller Specifications.
14. Declaration of Conformity.

1.5 Related Documentation

This manual (FoldGuard Folding Machine Safety and Guarding System Installation Manual) should be used in conjunction with the following documents:

- Lazer Safe FoldGuard Folding Machine Safety and Guarding System Operation Manual (LS-CS-M-077).
- Lazer Safe FoldGuard Folding Machine and Guarding System Alignment Guide (LS-CS-M-051).
- The operation manual for your folding machine.

1.6 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.

1.7 Obtaining Technical Assistance

For technical support with the FoldGuard Folding Machine Safety and Guarding System, please contact your supplier, or email customerservice@lazersafe.com detailing your specific requirement.

2 Critical Safety Information

2.1 Proper Use of FoldGuard

FoldGuard is designed to protect hands and fingers in the area close to the edge of the clamping area. When installed correctly and when safety instructions are observed fully, the FoldGuard system permits safe manipulation close to the clamp, as well as offering effective protection while the clamp closes at high speed.

Please note these general safety notices:

- The FoldGuard system is designed exclusively for installation and operation on hydraulic folding machines, or folding machines that comply with the statutory machine safety and accident prevention rules and regulations valid for the place where the folding machine is operated, in particular after FoldGuard has been installed.
- FoldGuard must be installed either in the folding machine factory, or by specialist technicians trained by Lazer Safe (or its authorised representatives).
- The operator must be fully conversant with the operation of the folding machine and the risks associated with it, as well as the operation of the FoldGuard guarding system.
- The alignment of the protective equipment should be performed by a maintenance engineer, supervisor or personnel with equivalent specialist expertise trained in all relevant aspects of operating the folding machine and the FoldGuard 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 folding machine fitted with FoldGuard, it is important to note the following special warnings.



Warning: SLOW SPEED OPERATION

Under certain circumstances FoldGuard will initiate slow speed.

However, some folding machines are not capable of changing the closing speed of the clamp to slow speed. FoldGuard will allow the clamp to close at normal operating speed, but will always perform a safety stop before the clamp closes.

The operator will have to release and press the foot pedal again to complete the clamping operation.



Warning: AVOID FAST, ERRATIC MOVEMENTS AS THE CLAMP CLOSES

When the clamp closes at high speed (above the mute point) there will be less than maximum protection at the point prior to the clamp reaching the mute point. For example, if a small obstruction, such as a finger, is rapidly and erratically pushed into the clamp area immediately before the mute point, the finger might be touched.



Warning: NO PROTECTION IN FIELD MUTED MODE

In Field Muted mode, the optical sensing is deactivated. Although FoldGuard engages the slow speed signal and forces a safety stop on each cycle, particular caution must still be exercised.

The ability to select Field Muted mode is disabled by default, and can only be enabled by personnel who have access to the Supervisor menu of the HMI. This menu is password protected and should only be accessible to suitably trained and qualified personnel.



Warning: NO PROTECTION BELOW THE SAFETY STOP POSITION

Under certain circumstances the FoldGuard system will initiate a safety stop, and

stop the clamp at the safety height (as programmed in the System menu, refer **Section 9.3.4**).

When the foot pedal is released and pressed again the clamp will close with the optical protection disabled. Particular caution must be exercised below the safety stop position.

2.3 Regulatory Requirements for Use

FoldGuard can be used only on hydraulic folding machines, or folding machines deemed by relevant regulatory authorities to have equivalent functional and dynamic characteristics.

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

2.3.1 Requirements For Factory Fitted Systems-Within The European Union

The combination of a folding machine and FoldGuard 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 folding machine and FoldGuard 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 folding machine and FoldGuard 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 FoldGuard system, or it's 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

FoldGuard is specifically designed for folding machine applications. It provides a complete safety solution including optical guarding of the clamping operation, overrun monitoring and management of additional machine safety components.

**Note:**

The OEM version of FoldGuard may be embedded with the folding machine controller, and can be customised to suit their specific operational requirements. In this case the installation and operation of FoldGuard may differ from that described in this manual.

Please contact the manufacturer of your folding machine for operating manuals or guides specific to your machine.

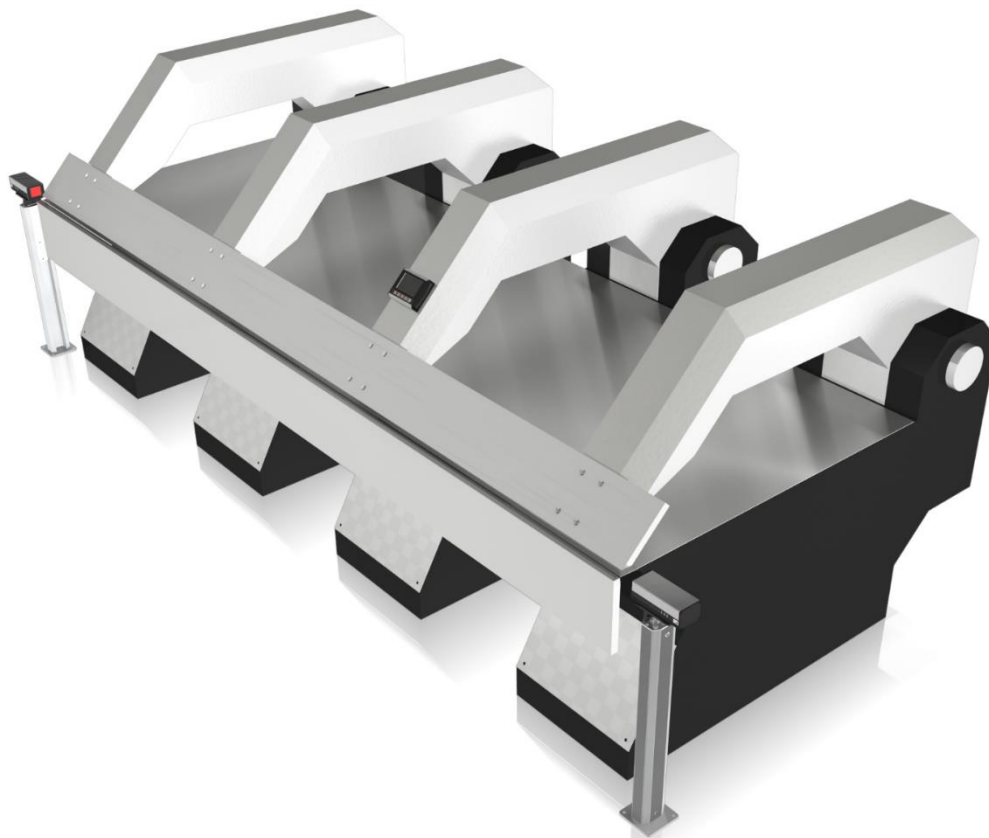


Figure 3-1: Folding Machine with FoldGuard

3.1 Key Benefits

- FoldGuard provides laser guarding of the clamping area for improved safety and productivity. Dual flat bands of continuous laser light detect obstructions as small as 4 mm, while remaining vibration tolerant.
- FoldGuard continuously monitors the stopping distance in real time.
- The 6 mm mute point is set on the first clamping. The laser detects the clamp position, and the operator confirms the mute point.
- The operator can configure FoldGuard to allow hemming operations while still guarding the clamping area.

FoldGuard provides a complete guarding solution, also monitoring operator safety switches such as emergency stop pushbuttons and kick bars.

The system contains the following components:

- LZS-004-HS Dual Laser Transmitter/Receiver pair.
- Lazer Safe Safety Controller.
- FoldGuard User Interface Panel.
- Optical Rotary Encoder.
- Floor mounting bracket system for the LZS-004-HS Transmitter and Receiver.

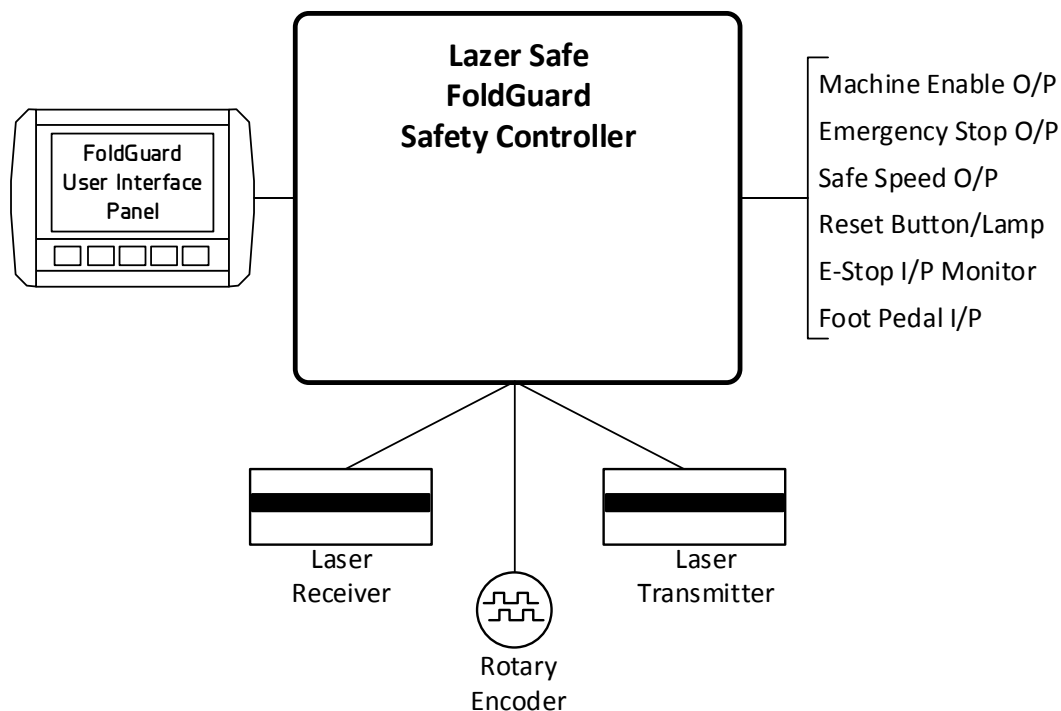


Figure 3-2: FoldGuard Folding Machine Guarding System Components

3.2 Optical Protection Overview

FoldGuard features the LZS-004-HS Dual Laser Transmitter/Receiver pair, that provides optical protection along the entire length of the clamping area. As the clamp closes in high speed the system monitors the area between the clamp and material. If any foreign obstruction (tools, operator's fingers etc.) is detected, the clamp closing movement is immediately stopped. The clamp will not make contact with the obstruction.

Stopping performance of the machine is also continuously monitored. If the machine fails to stop within safe limits, an emergency stop condition is triggered.

Figure 3-3 is a schematic representation of the optical guarding system seen from the transmitter (right hand side) of the machine. The laser transmitter/receiver pair are aligned to the fixed part of the clamp, such that the bottom laser (laser A) is 4 mm above the clamp. The top laser (laser B) is 10 mm above laser A.

Within the receiver there are three sensor zones; front, middle and rear. In the following diagrams these are shown as segments to highlight the sensor zones, however in practice the laser light is a continuous band. Dividing the receiver sensors into these three zones provides greater flexibility in the operation of the FoldGuard system, for example allowing hemming operations while still guarding the clamping area.

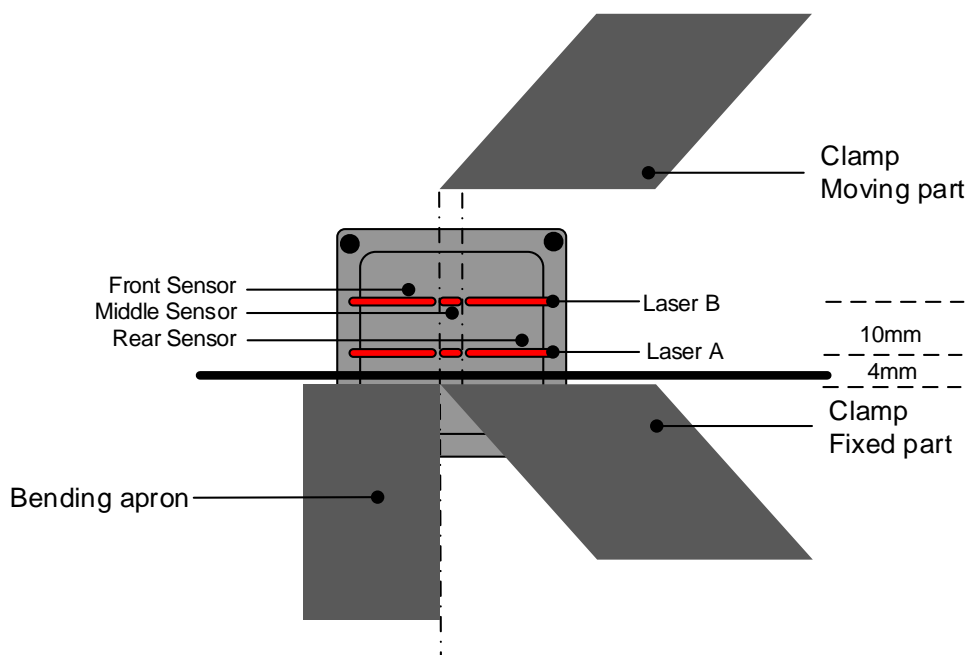


Figure 3-3: Laser to Clamp (Fixed) / Mute Point Distance

3.2.1 Laser Classification and Warnings



Warning: CLASS 1 LASER DEVICE

The LZS-004-HS laser transmitter emits CLASS 1 planar lasers approximately 50 mm in width. Do not stare directly into the lasers or the transmitter window.



CLASS 1 LASER



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

The LZS-004-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.



**CAUTION - CLASS 3R LASER RADIATION
WHEN OPEN AND INTERLOCKS DEFEATED
AVOID DIRECT EYE EXPOSURE**

3.2.2 Laser Transmitter and Receiver Setup

The laser transmitter and receiver are installed on adjustable mounting brackets that are fixed to the floor on either end of the machine. The receiver is installed at the left hand side of the machine, and the transmitter is installed at the right hand side of the machine.



Note:

The laser detectors in the LZS-004-HS are divided into three segments; the front, middle and rear. For the system to work correctly the receiver **must** be mounted on the left of the machine, and the transmitter on the right.

The mute point for each laser is automatically set at 2 mm above the laser. When the clamp closes, each laser is muted independently when the opening between the clamp and the material is 16 mm (for laser B), and then 6 mm (for laser A).

3.2.3 Mute Point

FoldGuard must first establish the mute point which is the point where the clamp enters the guarded area. When the clamp travels beyond this point the laser guarding is progressively deactivated in order to prevent the system considering the clamp as an obstruction which would trigger a stop of the machine.

After the initial start-up tests are completed FoldGuard automatically enters mute set-up mode and the operator is prompted to set the mute point. As the clamp moves down, the guarding system detects the point where laser B is obstructed by the clamp. The operator is then prompted to either confirm this position as the correct mute point or they may choose to repeat the set-up process.

Once the mute point has been confirmed, the system automatically monitors the position of the clamp, and the mute point during operation. **Figure 3-4** shows the beginning of the process; the clamp is open and both lasers are active. When the clamp opening reaches 16 mm Laser B is muted as shown in **Figure 3-5**. As the clamp continues to move down and the opening reaches 6 mm, Laser A is muted as shown in **Figure 3-6**.

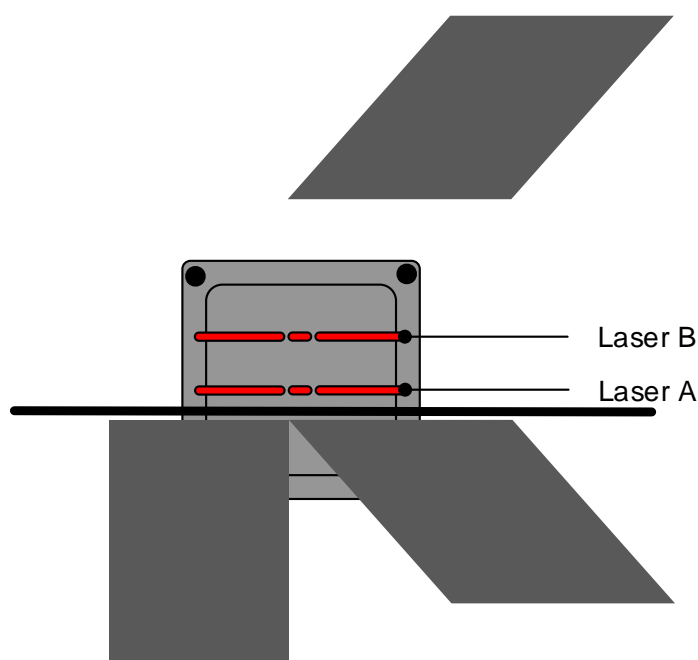


Figure 3-4: The Muting Process – Clamp Opening >16mm

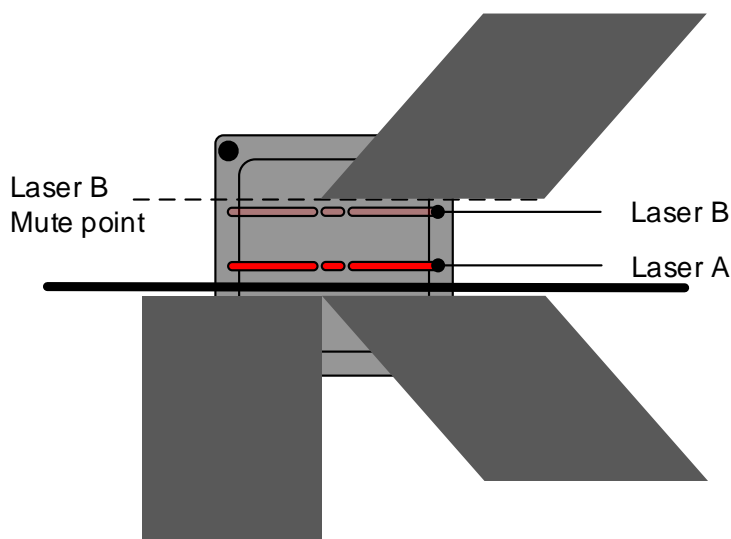


Figure 3-5: The Muting Process – Clamp Opening = 16 mm Laser B Muted

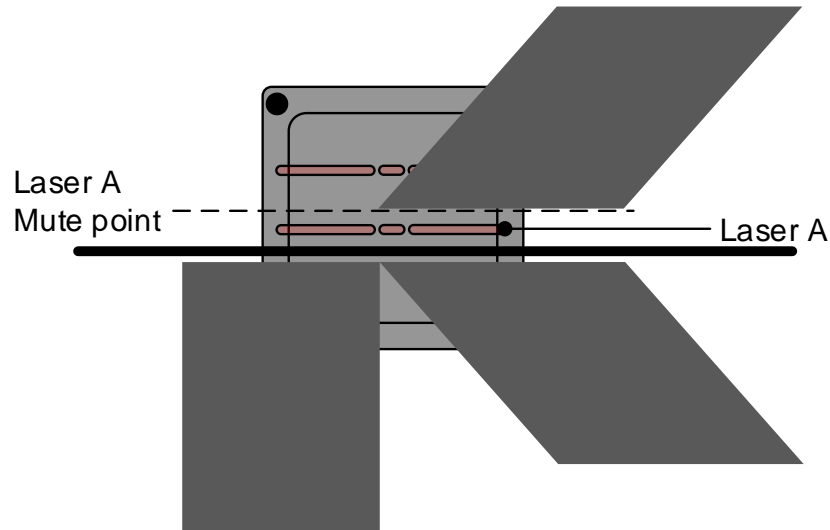


Figure 3-6: The Muting Process - Clamp Opening ≤ 6 mm Laser A and Laser B Muted

3.3 Normal Mode

In Normal mode all sensors are active; this is the default mode at start-up. When the foot pedal is pressed the system checks if the sensors are clear and allows the clamp to close in high speed. The clamp speed is then reduced to slow speed (if possible, refer to [Section 2.2](#)) before the mute point (6 mm) and clamps the material.



Note:

The FoldGuard HMI 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 8 describes the operation of the FoldGuard User Interface Panel in detail.

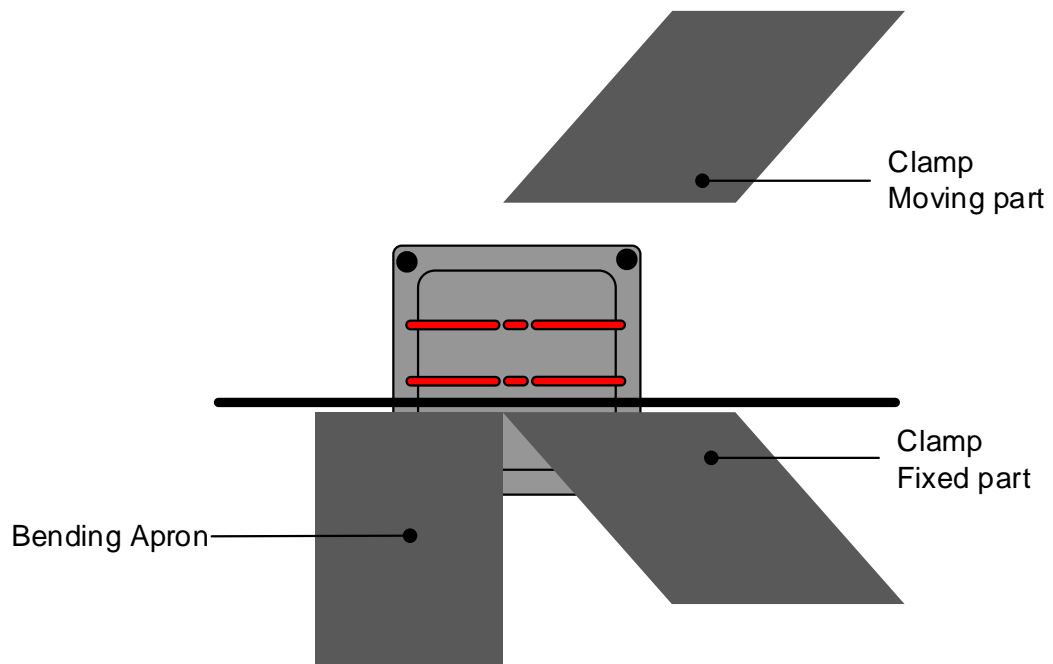


Figure 3-7: Normal Mode operation

3.3.1 Obstruction Detection – From a Stationary Position

If any sensor is obstructed when the pedal is pressed then the clamp will not move. The operator must release and press the pedal again. If the sensors are now clear, the clamp will start closing in high speed. If any sensor remains obstructed then the system will automatically mute the optical protection, and force the clamp to close in slow speed (if possible, refer to **Section 2.2**). The system then initiates a safety stop and the operator must release and press the pedal to clamp the material.

3.3.2 Obstruction Detection - When the Clamp is Closing

During high speed clamp closing all sensors are active. If any sensor is obstructed then the clamp is stopped. The operator must release and press the pedal to continue. If the sensors are clear then the clamp will start closing in high speed. If any sensor remains obstructed then the system will force the clamp to close in slow speed (if possible, refer to **Section 2.2**) but with the optical protection muted. The system then forces a safety stop and the operator must release and press the pedal to clamp the material.



Warning: NO PROTECTION BELOW SAFETY STOP POSITION

Under certain circumstances the FoldGuard system will initiate a safety stop, and stop the clamp at the safety height (programmed in the System menu, refer **Section 9.3.4**).

When the foot pedal is released and pressed again the clamp will close with the optical protection disabled. Particular caution must be exercised below the safety stop position.

When all sensors are clear the clamp closes in high speed to the mute point, and then changes to slow speed (if possible, refer to **Section 2.2**) until the material is clamped.

3.4 Hemming Mode

Selecting Hemming mode changes the operation of the FoldGuard system, to provide the operator with the flexibility to perform hemming operations while the laser guarding is still active. The operator can select Hemming mode via the HMI.

3.4.1 First Stroke in Hemming Mode

When hemming mode is first selected all of the sensors (front, middle and rear) are active, but they now function differently from Normal mode.

- The front sensor always operates as described in **Section 3.3**, halting the machine when the laser guard is obstructed.
- The middle and rear sensors are used to detect and confirm the presence of the hemming material on the first pedal press only, and are disabled thereafter.

A hemming operation is shown in **Figure 3-1**, where the material to be hemmed is allowed to obstruct the rear and middle sensor, but **not** the front sensor. The first pedal press is used to confirm that Hemming mode is indeed required, and the machine and operator are ready.

When the pedal is pressed for the first time after hemming mode is selected, the clamp will not move, and the Operator Panel will display the message Hem detected – RELEASE FOOT PEDAL. Hemming mode is now confirmed, and the middle and rear sensors are disabled (muted). The operation of the front sensor remains unchanged.

3.4.2 Operating in Hemming Mode

The next time the pedal is pressed, the clamp will close. As long as the front sensor remains unobstructed the clamp will move down at high speed, with the middle and rear sensors muted. The front sensor will continue to guard the danger zone at the front edge of the clamp.

Muting of the middle and rear sensors is controlled by a 30 second timer. If the machine remains idle (the foot pedal is not pressed), or if the machine is operated without any hemming obstructions for period of 30 seconds, the middle and rear sensors will be unmuted, and the Hemming mode confirmation will be reinitialised to operate as described in **Section 3.4.1** above.

Hemming Mode

In Hemming mode the middle and rear sensors are muted after the first pedal press. On the second pedal press the clamp can close at high speed to complete the hemming operation.

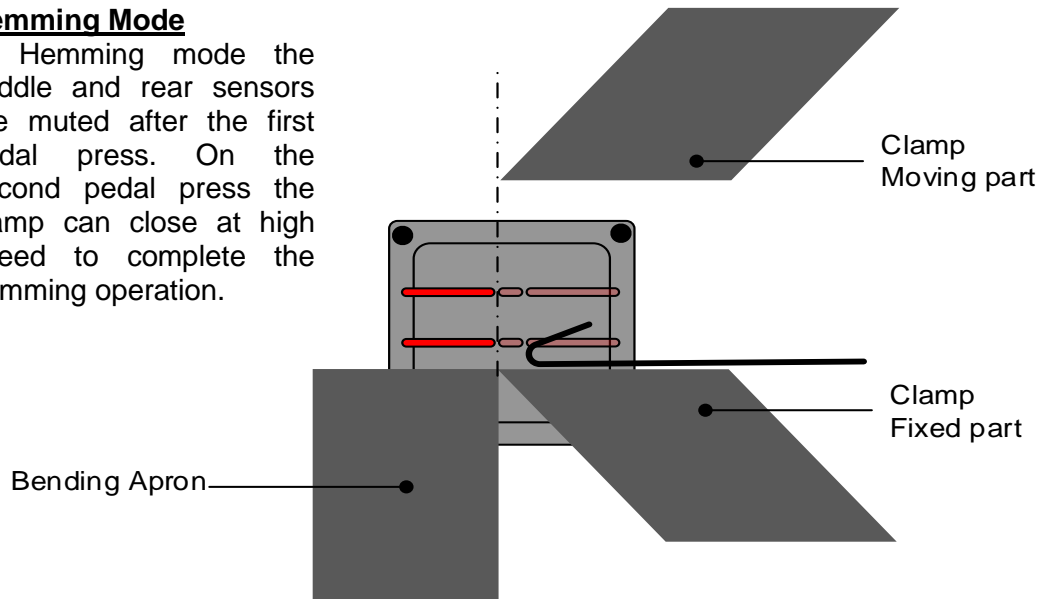


Figure 3-8: Hemming Mode operation

3.5 Field Muted Mode



Warning: NO PROTECTION IN FIELD MUTED MODE

In Field Muted mode, the optical sensing is deactivated. Although FoldGuard engages the slow speed signal (if possible, refer to **Section 2.2**) and forces a safety stop on each cycle, particular caution must still be exercised.

The ability to select Field Muted mode is disabled by default, and can only be enabled by personnel who have access to the Supervisor menu of the HMI. This menu is password protected and should only be accessible to suitably trained and qualified personnel.

Field Muted Mode

Lasers are OFF.
Clamp can only close in slow speed.

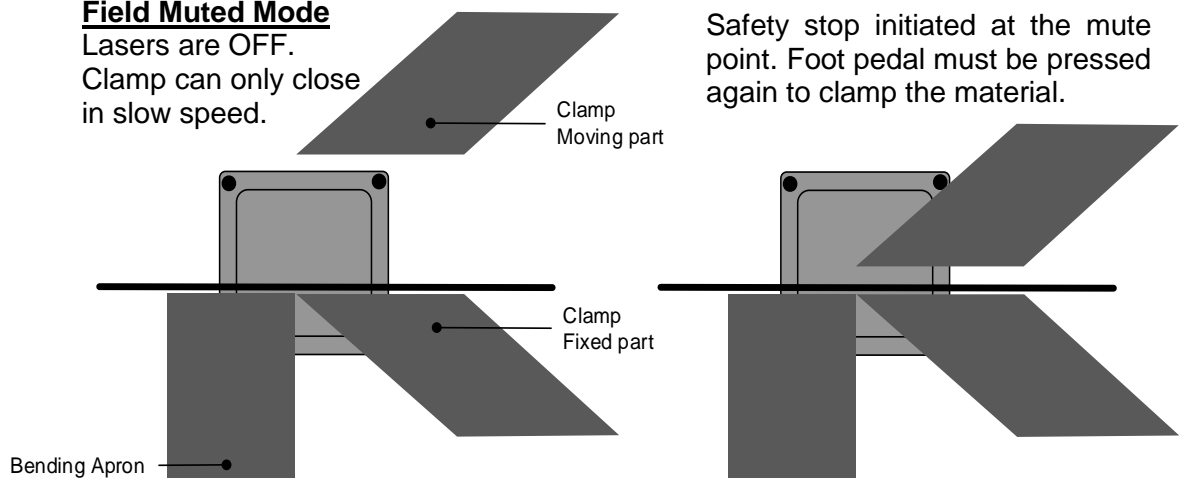


Figure 3-9: Field Muted Mode operation

In this mode, protection from the laser is muted (deactivated) for the entire stroke of the clamp and therefore does not provide optical protection. The FoldGuard system however maintains all its other safety functions and also forces a safety stop on each cycle.

Field Muted mode should only be used in cases where it is not possible to use any other mode with active protection.

3.6 Safety Stop Mode

The Safety Stop mode automatically forces the clamp to stop at a pre-defined distance above the material. The operator must release and press the foot pedal again to complete the clamping operation in slow speed (if possible, refer to **Section 2.2**).



Warning: NO PROTECTION BELOW SAFETY STOP POSITION

Under certain circumstances the FoldGuard system will initiate a safety stop, and stop the clamp at the safety height (programmed in the System menu, refer **Section 9.3.4**).

When the foot pedal is released and pressed again the clamp will close with the optical protection disabled. Particular caution must be exercised below the safety stop position.

3.7 Bending Apron Mode

In some folding machines the clamp and bending apron share a single hydraulic system. If this hydraulic system is restricted in order to force slow speed (for example when the clamp is below the mute point) then the bending apron may not operate correctly.

In this case, the FoldGuard system provides inputs for two Bending Apron Enable signals. Activating either of these inputs will disable the slow speed output, and allow the bending apron to operate at full speed.



Warning: HIGH SPEED BENDING APRON MOVEMENT

The Bending Apron Enable signal should be linked to the machine controller, to ensure that by this stage of the folding process the material is clamped. Always exercise caution when any part of the machine is operating in high speed.

3.8 Bypass Mode

The Bypass mode of operation disables the FoldGuard system's optical protection, and allows the folding machine to operate in high speed. During operation of the folding machine in this mode, all stopping distance and speed checks, start-up tests as well as other hardware safety checks are no longer performed.



Warning:
NO PROTECTION IN BYPASS MODE.

In Bypass mode all optical guarding, start-up tests, speed checks, and hardware safety checks are disabled. The machine can run unguarded in high speed while the operator is unprotected.

Entry to Bypass mode is password protected and is only available to personnel with System level access. This mode should only be used by suitably trained personnel, and only in exceptional circumstances.

Extreme care must be used when operating a machine in Bypass mode. Access to the machine should be restricted by physical barriers, and the machine should never be left unattended in an operational state.

To enable Bypass mode the operator needs to perform 3 steps (the order is not important):

- Enable the mode in the System menu, refer **Section 9.4.3**.
- Activate the Special Mode input of the PGS-2, refer **Section 7.8**.
- Switch to Field Muted mode.

Bypass mode can be restricted by disabling the Field Muted button on the Operator Panel.

3.9 Emergency Stop Inputs

The FoldGuard system supports four operator controlled emergency stop switch inputs:

- E-Stop Pushbutton.
- Kick Bar.
- Pedal 1.
- Pedal 2.

These are all normally closed, dual contact safety switch inputs. If an emergency stop condition is triggered by the operator the machine will be immediately stopped, and the source of the emergency stop identified by a message on the User Interface Panel. The emergency stop must then be cleared before normal operation can continue.

If more than one emergency stop input is active at the same time a general emergency stop message will be displayed. All emergency stop controls must then be checked in turn by the operator until the source is determined, and cleared.

If any of the safety inputs is in a state that is not valid for a dual contact safety switch, the operator will be informed that a switch is faulty. All emergency stop inputs must then be tested, and if necessary repaired before the machine can re-enter service.

3.10 No Guard / No Counter Mode

The OEM version of FoldGuard provides the manufacturer with the option of installing the system without the LZS-004-HS laser guards, optical encoder or User Interface Panel. In this case the FoldGuard system acts as a safety controller monitoring the emergency stop inputs only, with the option of being upgraded to a complete FoldGuard system at a later date.

3.11 Closed Loop Design

As well as the optical protection provided by FoldGuard, the system also monitors the movement of the machine.

This closed loop design enables monitoring of the stopping distance (overrun) of the clamp every time it stops. If the stopping distance limit is exceeded, an emergency stop condition is triggered, and the machine is shut down.

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 Installation

This section describes the installation of the laser transmitter and receiver, which monitor the workspace around the clamping area.

4.1 Floor Mounting Brackets

The laser transmitter and receiver are mounted to the floor using the Folding Machine Mounting Bracket kit, as shown in **Figure 4-1** below.



Figure 4-1: Floor Mounting The Laser Transmitter and Receiver

These brackets ensure that the laser guarding system stays aligned during machine operation, to maximize the safety and reliability of the guarding system. The base plate has 4x10 mm mounting holes to secure the stands to the floor with suitable concrete anchors (not supplied with the kit).

Bracket height can be adjusted from approximately 900 mm to 1070 mm.

The dimensions of the baseplate, and the adjustment range of the vertical brackets are shown in **Figure 4-2**.

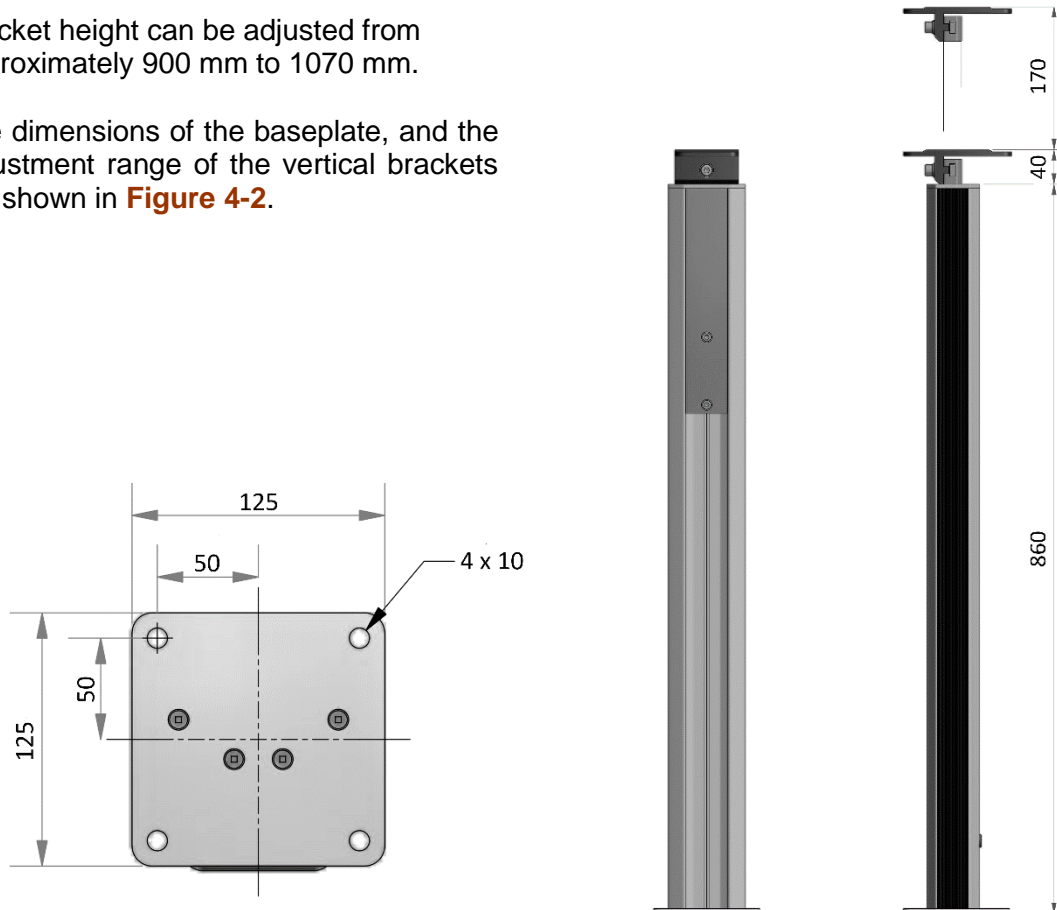


Figure 4-2: Mounting Bracket Dimensions (Millimetres)

The dimensions of the baseplate, and the adjustment range of the vertical brackets are shown in **Figure 4-2**. Install the base plate so that its centre line aligns with the bending line of the machine, where the clamp meets the swing beam, see **Figure 4-3**.

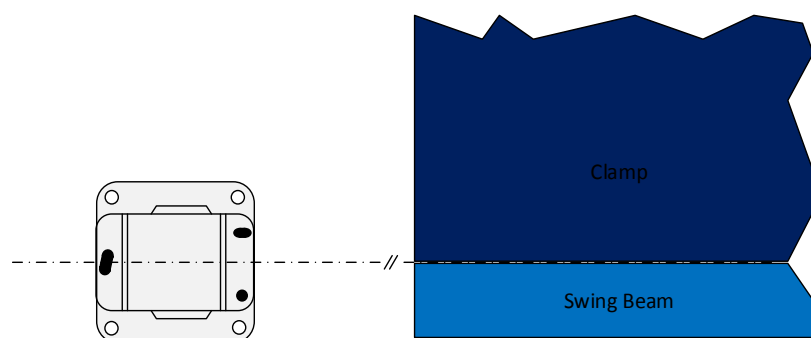


Figure 4-3: Aligning The Base Plate –Top View

This will ensure that the laser transmitter and receiver have the greatest adjustment range during the laser alignment procedure.



Note:

The laser detectors in the LZS-004-HS are divided into three segments; the front, middle and rear. For the system to work correctly the receiver **must** be mounted on the left of the machine, and the transmitter on the right.

4.2 Transmitter/Receiver Mounting Plate

The laser transmitter/receiver is attached to the mounting plate as shown in **Figure 4-4**. The transmitter is mounted on the right side bracket, the receiver on the left.

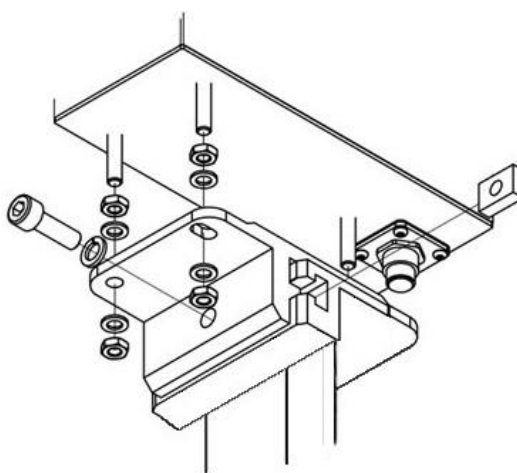


Figure 4-4: Mounting The Transmitter/Receiver

The mounting plate allows for approximately 40mm of horizontal movement to ensure that the laser transmitter can be aligned with the bending line of swing beam/clamp, and that the receiver can be aligned with the transmitter.

- 1 Fit an M6 nut followed by an M6 washer to each of the laser guard's mounting posts. Screw the nuts down until all are approximately 5 mm from the bottom of the post. This will give adequate adjustment range during alignment.
- 2 Fit the mounting plate to the laser guard.
- 3 Fit an M6 washer, followed by an M6 nut to each mounting post.

- 4 Fit the M8 hex head bolt, washer and locking nut.
- 5 Slide the mounting plate into the mating groove on the floor mounted vertical bracket, and finger tighten.

At this stage the cables can be connected by screwing the M12 sockets onto the plugs at the rear of the laser guards, and the laser guards aligned.

Before operating the machine it is necessary to check the alignment of the laser transmitter and receiver. While the alignment should never require adjustment after the system has been installed, it is necessary for this alignment to be periodically checked to ensure correct and safe operation. The alignment should be checked each day before operating the machine and at the start of each shift or operator change.



Warning:

The machine should **not** be operated until the alignment of the FoldGuard transmitter and receiver is verified.

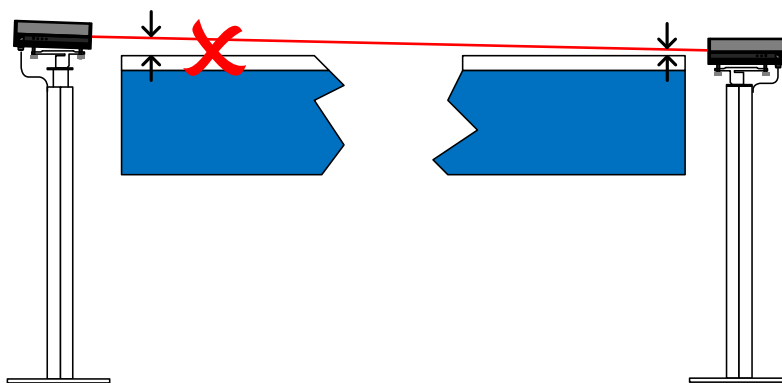


Figure 4-5: Lazer Guard Misaligned – Not Parallel to Clamp

The importance of correct alignment can be seen in **Figure 4-5**. Although laser guarding is active and will operate correctly, due to misalignment between the laser guard and the bed of the folding machine there is a large unguarded gap at the left of the machine. This is unsafe, as a finger or hand could be placed in this gap without triggering an obstruction when guarding is disabled (muted) below the mute point.

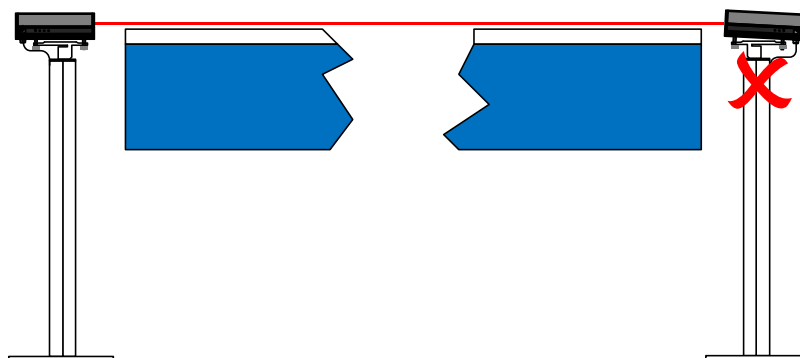


Figure 4-6: Lazer Guard Misaligned - Receiver Not Level

Figure 4-6 is an example of how the receiver can be misaligned. Although the laser guard is parallel to the folding machine bed, the receiver is not level and square to the laser. Laser B is aligned correctly, however Laser A and Laser B are separated by a distance of 10 mm and Laser A may not be reliably detected. This could lead to intermittent problems during operation of the machine, and a reduction in productivity.

Lazer Safe provides an alignment tool to ensure that the LZS-004-HS is aligned accurately to the folding machine bed and clamp. Refer to the ***Lazer Safe FoldGuard Folding Machine Safety and Guarding System Alignment Guide (LS-CS-M-051)*** for instructions on how to perform the alignment.

5 FoldGuard System Components

5.1 Component Identification

The FoldGuard Folding Machine Safety and Guarding System is comprised of the following components.

Component	Product Code	Description
PGS-2 Controller Kit. Optical Encoder Kit. PGS-2 Plug Kit.	0012100500	Lazer Safe Safety Controller. Encoder and mounting hardware for speed/position monitoring. Connectors CN1-CN8.
LZS-004-HS (TX and RX)	0011002101	Dual Laser Transmitter and Receiver
FoldGuard HMI	0020015000	FoldGuard User Interface Panel.
Cable, M12, 5 m	0031030900	For use with transmitter, receiver or HMI.
Cable, M12, 10 m	0031031000	For use with transmitter, receiver or HMI.
Cable, M12, 20 m	0031031300	For use with transmitter, receiver or HMI.
FoldGuard Bracket System	0018500100	Floor mounting brackets for LZS-004-HS TX/RX

Table 5-1: Component Identification

5.2 PGS-2 Safety Controller

The FoldGuard System is controlled by the Lazer Safe PGS-2 Safety Controller. The PGS-2 has two identical but independent CPUs on its motherboard, which control all of the inputs and outputs of the I/O board. Both CPUs must concur before any action can take place, and all inputs and outputs are monitored to confirm that they are functioning correctly.

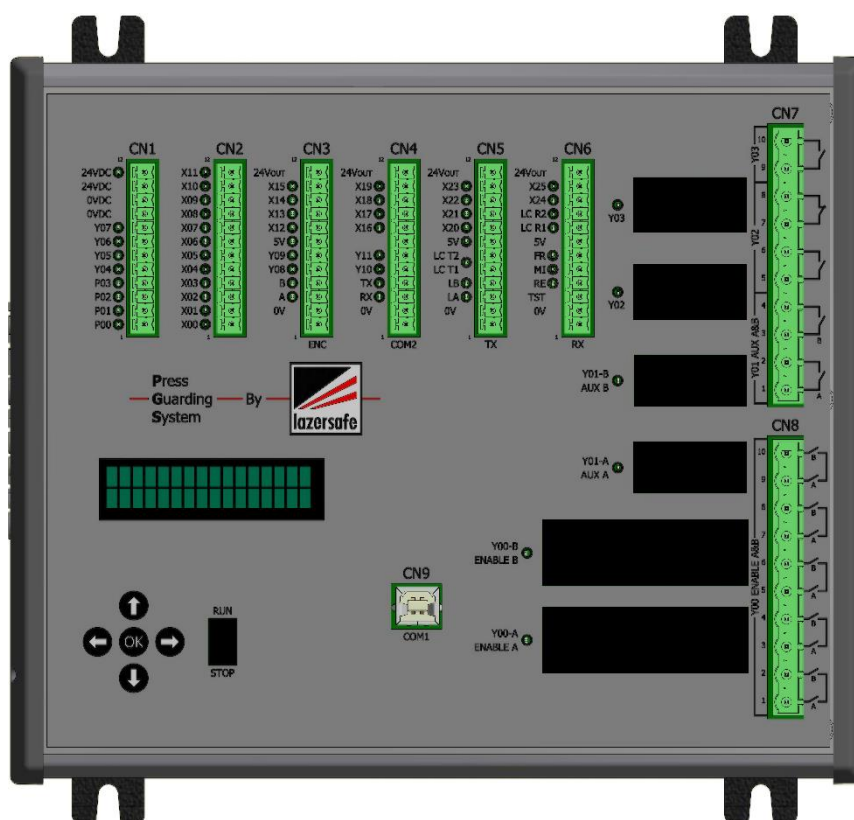
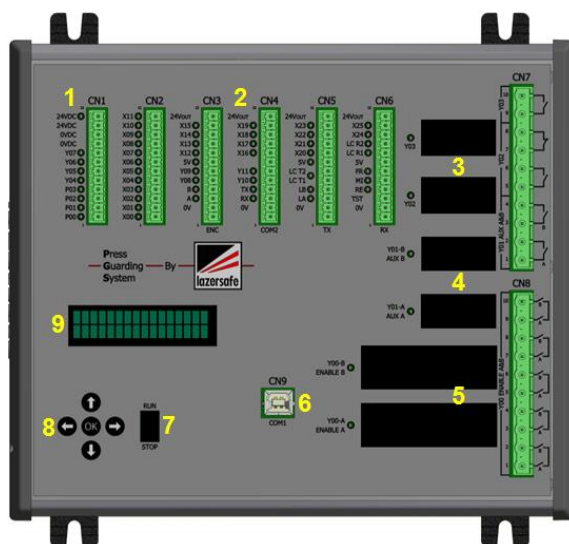


Figure 5-1: PGS-2 Safety Controller

The I/O board is electrically isolated from the motherboard by opto-couplers and digital isolators.



- 1 Power Terminals
- 2 I/O Terminals
- 3 Crawl Speed Relay (Y02)
- 4 Auxiliary Relays
- 5 Enable Relays
- 6 Communications Port
- 7 Run/Stop Switch
- 8 OK Button/Display Select
- 9 LCD Display

Table 5-2: PGS-2 Main Features

1. **Power Terminals:** The PGS-2 has two inputs for 24 VDC allowing for a maximum current draw of 16 A. Refer to [Section 6.2](#) for power and earthing recommendations.
2. **I/O Terminals:** Pluggable screw terminals for connection of guards and sensors. All inputs and outputs have LED indicators.
3. **Crawl Speed Relay (Y02):** Relay contacts for controlling the speed of the folding machine. LEDs indicate the state of the relay. Refer to [Section 7.1.3](#) for details of the standard relay outputs. (Y03 is not used in the FoldGuard system).
4. **Auxiliary Relays:** Dual forced contact safety relays for initiating an emergency stop of the folding machine. LEDs indicate the state of the relays. Refer to [Section 7.1.2](#) for details of the relay outputs.
5. **Enable Relays:** Dual forced contact safety relays for the main enable control of the folding machine. LEDs indicate the state of the relays. Refer to [Section 7.1.1](#) for details of the relay outputs.
6. **Communications Port:** An inbuilt USB to serial adaptor allows the PGS-2 software to be updated by service personnel in the field. Refer to [Section 7.7.1](#) for details of the communication port.
7. **Run/Stop Switch:** The Run/Stop switch controls the safety application, and is only used by service personnel. During normal operation this should be left in the RUN position.
8. **OK/Display Select:** The left/right arrow buttons select which of the two CPUs has control of the LCD display. The OK button is used to put the PGS-2 into boot mode for software updating by service personnel. Refer to [Section 11.3.1](#) for details of the information shown on the LCD display.
9. **LCD Display:** This displays the current configuration and status of the PGS-2 and the FoldGuard system. Any action taken by the PGS-3 is described by a Condition Code displayed here. Common Condition Codes are translated into human readable messages displayed on the User Interface Panel.

5.3 LZS-004-HS High Speed Transmitter and Receiver

Laser guarding for the FoldGuard system is provided by the LZS-004-HS laser transmitter and receiver, which are floor mounted either side of the folding machine. The transmitter and receiver are connected to the PGS-2 safety controller via the cables provided.



Note:

The laser detectors in the receiver are arranged in three sections; front, middle and rear. For the system to work correctly the guards must be oriented correctly; **the receiver must be installed on the left side of the machine, and the transmitter on the right.**

5.4 Optical Encoder

FoldGuard provides closed loop monitoring of the folding machine's operation by measuring the real time movement of the clamp to ensure that the direction and stopping performance are correct and as expected by the PGS-2. The PGS-2 measures the travel and direction of the clamp via the A and B phased signal outputs from the optical encoder. (The encoder also outputs a Z reference signal once per revolution, which is **not** required by the PGS-2).

For complete instructions on how to install the encoder kit, refer to *Lazer Safe Encoder Installation Manual (LS-CS-M-028)*.

5.5 The FoldGuard User Interface Panel

The FoldGuard User Interface Panel provides the following functionality:

- Installer configurable machine specific system parameters.
- Supervisor configurable operational parameters.
- Operator control and real-time machine status display during machine operation.

Parameters programmed into the User Interface Panel are stored in non-volatile memory in the panel, and configure the PGS-2 whenever it is powered. The operation of the user interface panel is described in detail in **Section 8**.



Figure 5-2: FoldGuard User Interface Panel



Note:

All configuration data is stored in the panel. If the communications link between the HMI and the PGS-2 is broken, the FoldGuard system will not operate.

6 Safety Controller Mounting and Power

This section details the mounting requirements of the PGS-2 Safety Controller, and the recommended power and earthing scheme.

6.1 Enclosure Mounting

The PGS-2 unit should be mounted in the machine control cabinet of the folding machine in a manner that permits easy access and termination of all control and monitoring signals.

Figure 6-2 shows the mounting dimensions for the PGS-2 unit.

When mounting the PGS-2 unit into the cabinet, ensure consideration is given to the following points.

- Proximity to all connections required.
- Access for service.
- Clearance for connectors to allow easy connection or disconnection.
- Location of adjacent ducting and height of ducting.
- Visibility of the LED indicators.

The recommended clearance measurements from the edge of the top cover when mounting the PGS-2 units are:

- Top and bottom: 40 mm.
- Left hand side: 10 mm.
- Right hand side: 65 mm.

Please note that these are only recommended measurements and can vary depending on the type of connectors, covers and ducting used for installation of the PGS-2.

6.1.1 Mounting Option 1 – Mounting Feet

Four feet are provided with the PGS-2 that are inserted into the extruded case for mounting the safety controller in the same manner as previous PGS-2 models. The mounting feet simply slide into the extruded rails provided on the rear of the case, see **Figure 6-1**.

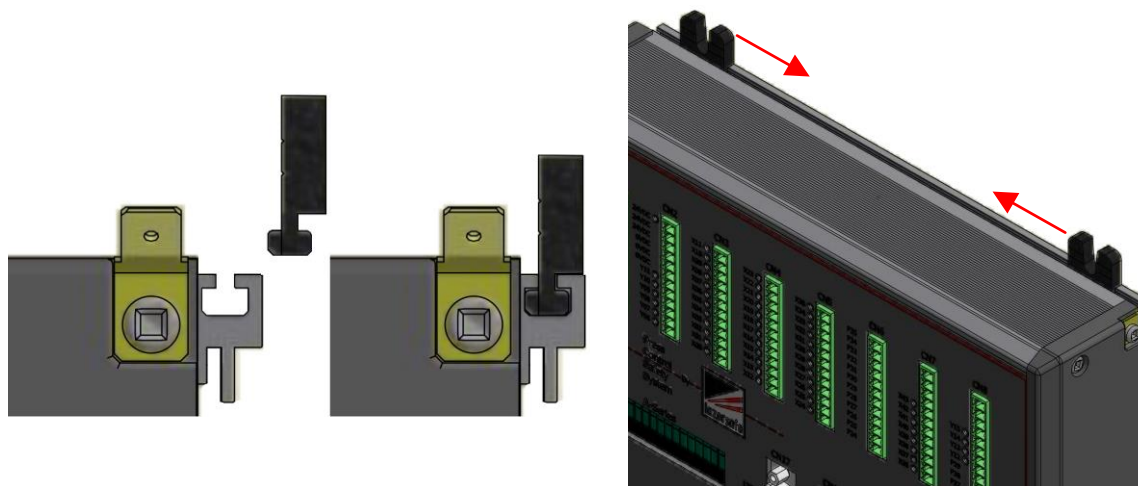


Figure 6-1: PGS-2 Mounting Foot Installation



Note:

To ensure secure and stable mounting always use **all** four mounting feet supplied with the PGS-2.

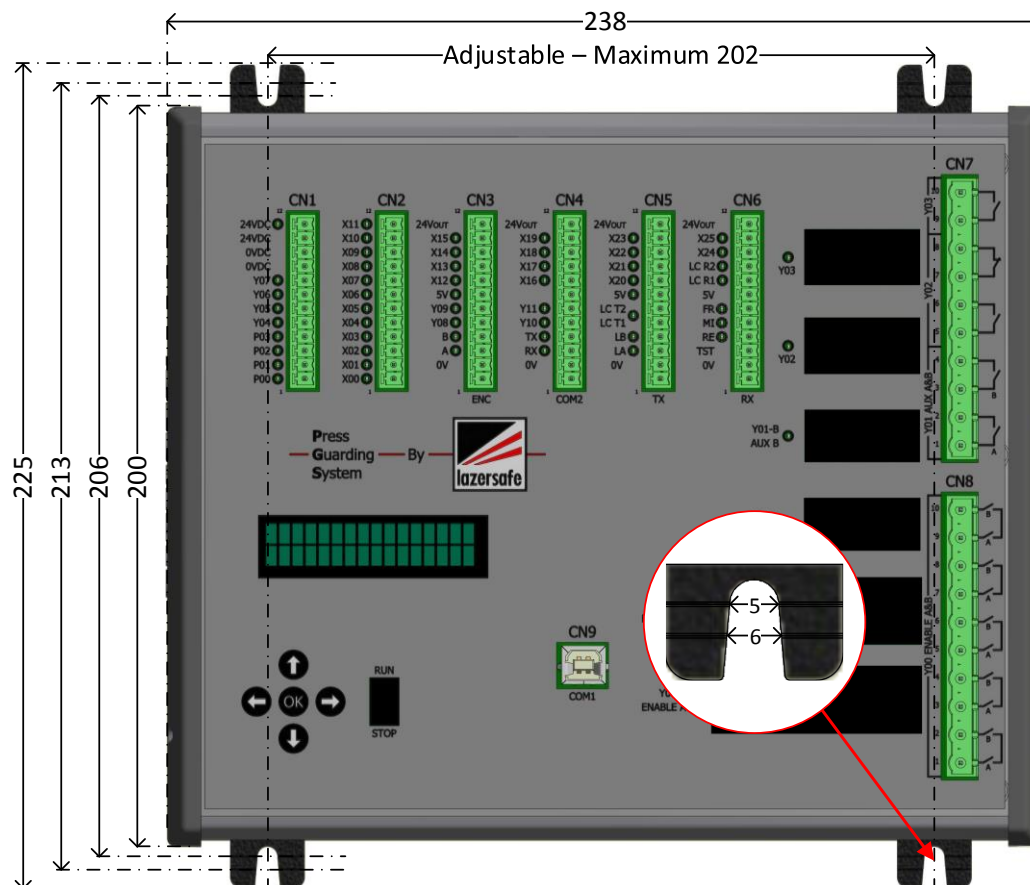


Figure 6-2: PGS-2 Series Mounting Dimensions

6.1.2 Mounting Option 2 – DIN Rail Mounting

The PGS-2 also has the option of being mounted on DIN rail. Three spring loaded DIN rail mounts are provided on the rear of the extruded case; the mounting dimensions are shown in Figure 6-3.

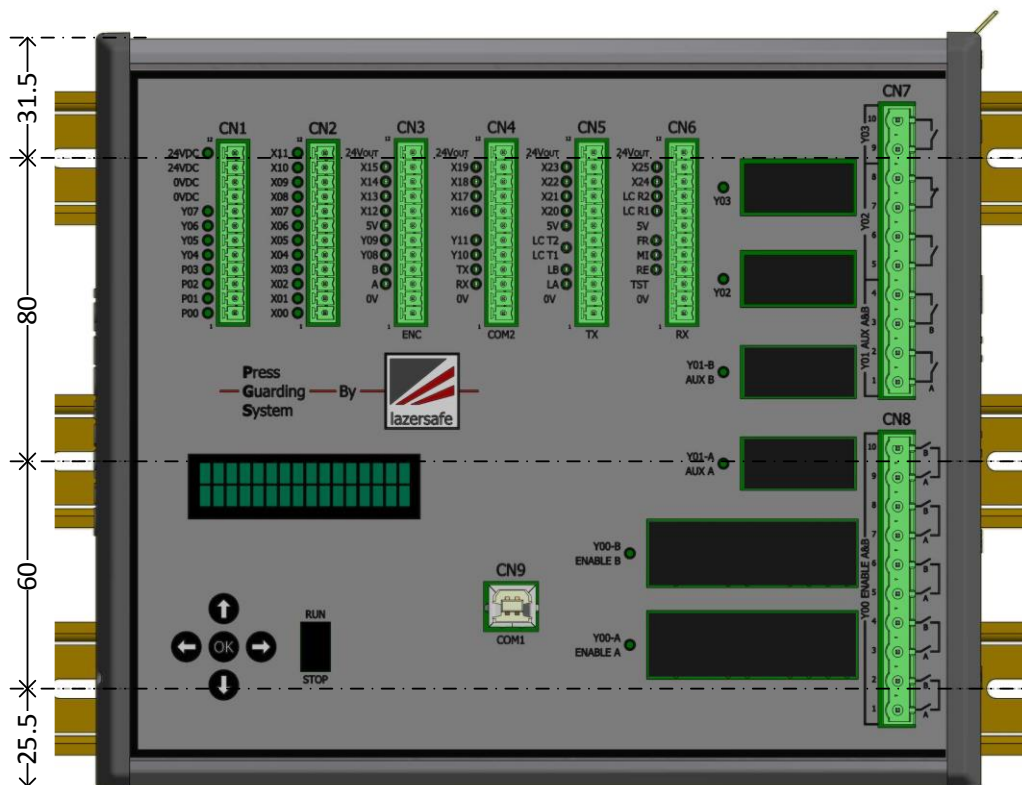


Figure 6-3: PGS-2 Series DIN Rail Mounting Option

If the PGS-2 is not mounted in the control cabinet then it should be mounted in a suitable enclosure.

- The enclosure must be rated to **IP54 or higher**.
- The enclosure must be of all metal construction, securely mounted and suitably earthed.
- Cable entries must not reduce the ingress protection level, and must be sealed using cable glands or adhesive sealing compounds.
- There should be sufficient access to the safety controller for inspection and maintenance.

6.2 Main Power Supply

The PGS-2 main 24 VDC power supply is connected to the CN1 connector, a 12-way removable terminal block as shown in **Figure 6-4**. Two terminals are provided for the 24 VDC supply, which allows for an absolute maximum current draw of 16 A.



Note:

The current requirements of the PGS-2 will vary depending upon the system configuration; the number and type of indicator lamps etc. A basic system (LZS-004-HS Laser Guarding only) will draw approximately 1 Amp. Overcurrent protection, whether fuses or circuit breakers, should be selected as appropriate for the current requirements of your installation by suitably qualified personnel.

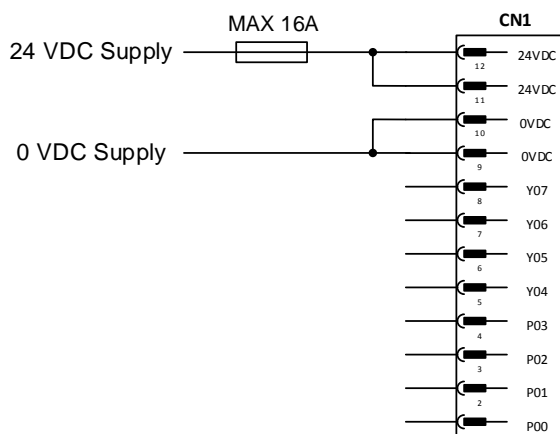


Figure 6-4: PGS-2 Main Power Supply



Note:

When making the connections for the main power supply to the PGS-2, it is recommended a Timonta FGS2-44-1-I filter or compatible device be installed between the 24 VDC power supply and the main power connection to the PGS-2.

6.3 Powering External Devices

The 24 VDC power terminals on connectors CN3 - CN6 are provided to power Lazer Safe hardware only, and **must not** be used to power relays, contactors, solenoids etc. Power for these devices should be taken directly from the main 24 VDC power supply, as this will significantly reduce interference and noise generated by the switching equipment.

6.4 Earthing

It is important that the PGS-2 is earthed correctly and in accordance with the recommendations stated in this manual. This will ensure that the PGS-2 and all hardware components operate correctly screened from outside interference that may cause operational problems.

The PGS-2 is provided with a 6.35 mm male spade connector for earthing the case to the cabinet earth of the folding machine.

It is considered best earthing practice to earth only one end of the sensor cables at a common point, as close as possible to the PGS-2. **Figure 6-5** shows an example of how to terminate the signal cables using DIN rail shielded cable strain relief or aluminium P-clips, when the PGS-2 is mounted in the main control cabinet of the folding machine.

If the PGS-2 is mounted in its own enclosure away from the main equipment, then the signal cables should be earthed and secured at the entry point of the enclosure, using a similar method to that described below.



Note:

On some early models of the PGS-2 there are terminals labelled **PE**. These should **not** be used for terminating signal cable shields.

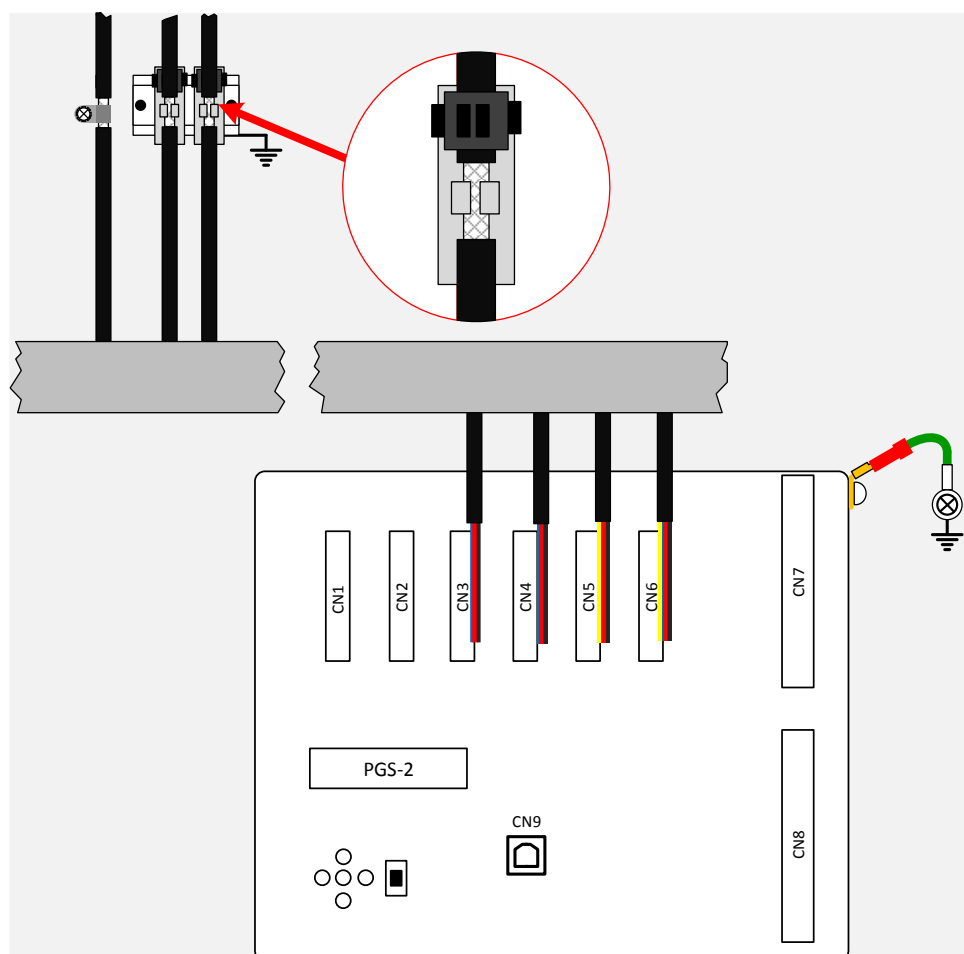


Figure 6-5: PGS-2 Sensor and Enclosure Earthing

Referring to **Figure 6-5**, when terminating the signal cables (encoder, guards etc.) the outer insulator of the cable is first removed at the earthing point, exposing the braided shield. The cable is then clipped into the mounting point at the exposed braid, and secured using a cable tie to provide strain relief. The cable mount provides electrical contact from the signal cable shield to the frame of the folding machine. This termination method is preferred as it mechanically secures the signal cables, provides good contact to the system earth, and prevents fraying of the signal cable braid at the termination.

If DIN rail mount strain relief is not available, or is not appropriate for your installation, aluminium P-clips are a suitable alternative. To ensure good electrical contact between the shield and the machine cabinet earth, they must tightly fit the braided cable, and be fixed using self-tapping screws and star washers.

7 Input / Output Connections

The PGS-2 has been designed with a combination of inputs and outputs to suit most installation requirements. Some are dedicated to specific functions, while others provide general purpose I/O. All inputs and outputs are electrically isolated from the motherboard and the CPUs of the safety controller.

The types of I/O provided by the PGS-2 are:

- Forced contact dual relay safety outputs (dry contacts).
- N/O and N/C relay outputs (dry contacts).
- Optical encoder interface.
- LZS-004-HS transmitter and receiver interfaces.
- 24 VDC standard digital inputs.
- 24 VDC standard digital outputs.
- Pulsed input/output pairs.
- Serial communications ports.

PGS-2 Connector Summary	
Connector	Description
CN1	Pulsed O/P P00-P03, Standard O/P Y04-Y07, 24 VDC Power
CN2	Standard I/P X00-X11
CN3	Encoder Interface, Standard I/P X12-X15, Standard O/P Y08-Y09, 24 VDC
CN4	User Interface Panel, Standard I/P X16-X19, Standard O/P Y10-Y11, 24 VDC
CN5	LZS-004-HS TX, Light Curtain T1-T2, Standard I/P X20-X23, 24 VDC
CN6	LZS-004-HS RX, Light Curtain I/P R1-R2, Standard O/P X24-25, 24 VDC
CN7	Y01 Auxiliary (2 x N/O), Y02 Crawl Speed (1 x N/O 1 x N/C), Y03 (1 x N/O)
CN8	Y00 Enable (5 x Series connected N/O)
CN9	Serial communications, diagnostics, programming

Table 7-1: PGS-2 Connector Summary

Example wiring drawings are given in **Section 7.8**. These may vary depending upon your installation.

7.1 Relay Outputs

The PGS-2 is equipped with Schrack forced contact relays for the Enable (Y00) and Auxiliary (Y01) outputs. In addition to the contacts terminated on Y00 and Y01, N/C contacts from each relay are monitored by the dual CPU controllers to ensure that the relays are operating correctly (as these are forced contact relays the state of this monitor contact will always represent the state of all other contacts). The relays are also periodically tested by the PGS-2 controllers during normal operation, and when the machine is idle.

A standard PCB mounting relay is used for the Crawl Speed (Y02). As this is not a forced contact relay, only the internal relay drivers are monitored by the PGS-2.

The contact configuration for the Y00, Y01, Y02 and Y03 relays are shown in **Figure 7-2** below. Partial specifications for all relays are given in **Sections 13.2.5 - 13.2.7**. For further information on the relays, please refer to the manufacturer's data sheets.

**Caution:**

Never exceed the manufacturer's rated limits for the relay contacts. For advice on how to interface the PGS-2 to your machine, please contact Lazer Safe Customer Support customerservice@lazersafe.com.

Lazer Safe recommends the use of suppressor or “snubber” circuits across the Enable contact load to reduce the impact of electrical arcing on the life of the relay contacts, and to minimise electrical interference generated during switching. Electrical arcing across the relay contacts results in high temperatures which can lead to degradation of the contact surface by evaporation, melting and metal migration. Due to the small air gaps between the contacts as they open, even relatively low voltages can induce arcing.

The type and rating of the snubber circuit will depend upon the characteristics of the load (resistive, inductive, capacitive), and the switching voltage (amplitude, AC/DC). When operating valves or solenoids, please consult the load manufacturer's data sheets for the most appropriate form of arc suppression for the load rating and operating conditions.

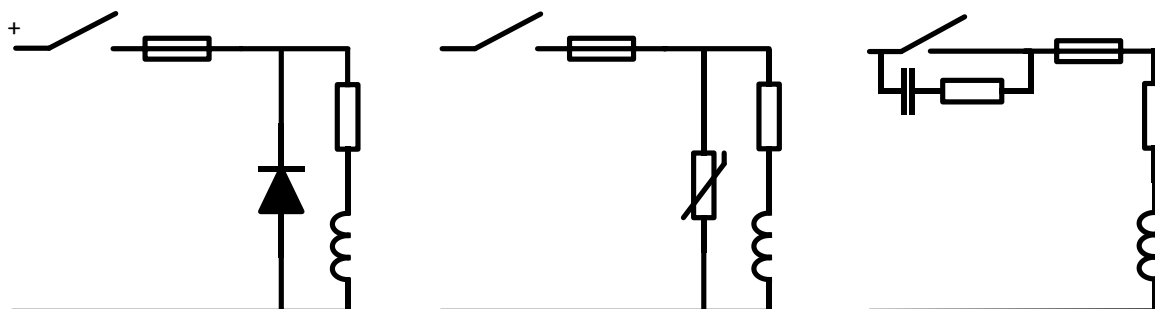


Figure 7-1: Diode, Varistor and RC Snubber Networks

The PGS-2 has been designed to withstand surge voltages of up to 2500 V. Lazer Safe recommends that the Enable contacts should be protected against surge voltages to ensure that the contact voltage never exceeds 2500 V.

It is also recommended that the Enable circuit is fuse protected, as shown in **Figure 7-1**, to prevent the possibility of the contacts being ‘welded’ in a closed state by an extreme over current event. Refer to **Section 13.2.5** for details of the recommended fuse type, rating and approvals.

The minimum contact load is 50 mW (or 5 V/10 mA). If switching light loads (such as digital inputs to CNCs or PLCs) additional circuitry may be required to achieve acceptable wetting of the relay contacts, and fritting of the contact surface.

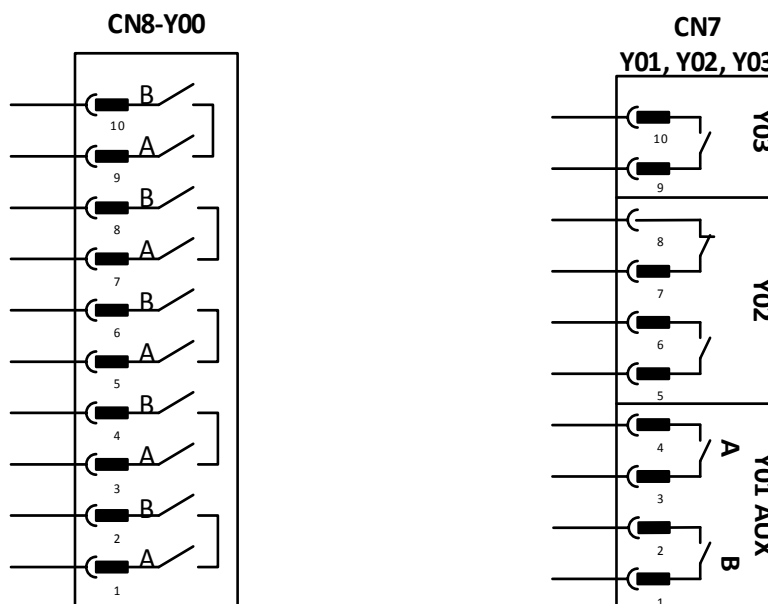


Figure 7-2: Relay Outputs

7.1.1 Forced Contact Enable (OSSD) Relays (Y00)

The Enable contacts are configured as dual (series connected) N/O contacts; one contact from the Enable A relay, one contact from the Enable B relay. Each relay is controlled by one of the independent CPUs, and both relays must operate before the enable signal path is closed. Failure of either relay will prevent the operation of the machine. Refer to **Figure 7-2** for connection details of the Enable relays.

The Enable relays are used to control the clamp, and are closed during normal operation. The PGS-2 opens these contacts to stop the clamp, for example when the guarding system is obstructed. The contacts should be connected in series with the hydraulic valve coils, or with the machine approach signal. Lazer Safe recommends that the OSSD contacts are protected from over-current conditions by fuses; refer to **Section 13.2.5** for fuse specifications.

7.1.2 Forced Contact Auxiliary Relays (Y01)

The Auxiliary contacts are configured as separate N/O contacts for the Auxiliary A and Auxiliary B relays. These contacts open when an emergency stop is required, for example if the PGS-2 detects that the clamp has not stopped within the predefined stopping distance/time limits. These contacts should be connected in series with the machine's emergency stop circuit.

Refer to **Figure 7-2** for connection details of the auxiliary relays.

7.1.3 Standard Relays (Y02 & Y03)

Y02 is the Crawl Speed relay, and controls the speed change of the clamp from high speed to low (or crawl) speed.



Warning: SLOW SPEED OPERATION

Under certain circumstances FoldGuard will initiate slow speed.

However, some folding machines are not capable of changing the closing speed of the clamp to slow speed. FoldGuard will allow the clamp to close at normal operating speed, but will always perform a safety stop before the clamp closes.

The operator will have to release and press the foot pedal again to complete the clamping operation.

The crawl relay will always be operated when a crawl speed condition is forced, for example when the system is placed into Field Muted mode. In addition to forced crawl situations, a height above the mute point can be set (via the System menu) where this relay will engage on every stroke, refer to **Section 9.4.2** for details on how to set the crawl distance.

The crawl speed contacts should be wired in parallel with contacts that engage the slow speed valve, or in series with the high speed valve coils that force slow speed when switched off (N/O and N/C contacts are provided, as shown in **Figure 7-2**). The crawl contacts can also be connected to the slow speed control circuit, or the safety speed input of a CNC controller or PLC.

Y03 is not currently used in the FoldGuard system.

7.2 Optical Encoder Interface

The FoldGuard system supports a single incremental optical encoder, requiring only the A and B phased signal from the encoder (the Z reference signal is not required). The optical encoder is interfaced to CN3, as shown in **Figure 7-3** (wire colours are correct at time of publication). LEDs indicate the state of the A and B signals.

The shield of the encoder (not shown) should be connected as per the manufacturer's recommendations; refer to the data sheet for the **Omron E6C2-CWZ6C 50 mm Rotary Encoder**.

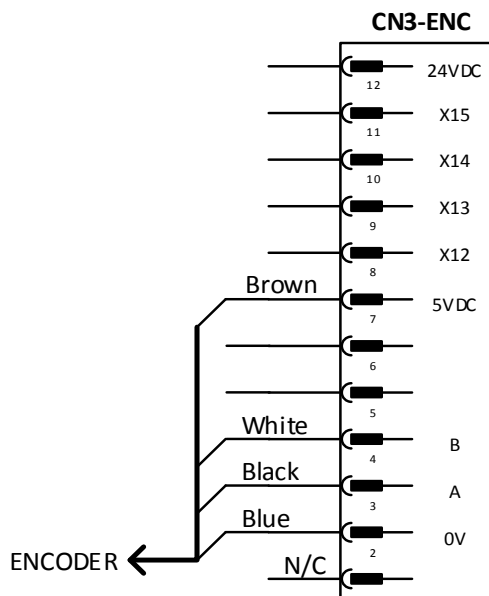


Figure 7-3: Optical Encoder Interface



Note:

The direction of rotation of the encoder (as seen by the PGS-2) depends upon its orientation when installed. If during commissioning the FoldGuard system gives condition codes indicating that the clamp is travelling in the wrong direction, swap wires A (black) and B (white). This will reverse the sense of the encoder.

In a typical installation the encoder measures the clamp opening by actually measuring the travel of the hydraulic cylinder, as shown in **Figure 7-4**. The encoder must be mounted so that the encoder chain runs parallel to the travel of the cylinder (**Figure 7-4** left). Mounted in this way the encoder chain and the cylinder move the same distance during clamping.

If the encoder chain is not parallel to the stroke of the cylinder (**Figure 7-4** right) the travel of the chain will not be equal to the travel of the cylinder during closing, resulting in non-linearity of the encoder measurement. This will cause position and speed errors being reported by the PGS-2. For complete instructions on how to install the encoder kit, refer to **Lazer Safe Encoder Installation Manual (LS-CS-M-028)**.

If the distance travelled by the encoder chain at the cylinder is greater or smaller than the clamp travel, the encoder measurement must be scaled by the FoldGuard system. This is done by entering the encoder travel and the clamp travel (in millimetres) into the System menu (see **Sections 9.4.6** and **9.4.7** for details), so that FoldGuard can calculate the correct scaling factor required.

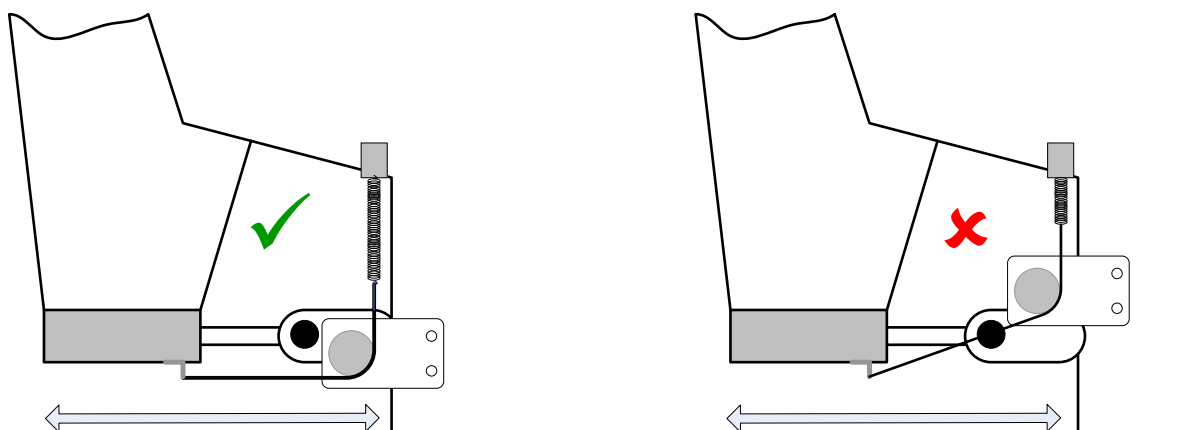


Figure 7-4: Encoder Kit Installation, Correct (Left) and Incorrect (Right).

7.3 LZS-004-HS Transmitter and Receiver

The LZS-004-HS cables are pre-terminated at the transmitter and receiver end with M12 connectors, the pin-out of the M12 connector is shown in **Table 7-2**.

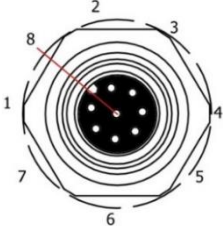
M12x8 Tx/Rx Front View	#	Colour	Transmitter	Receiver
	1	Black	—	0 VDC
	2	Brown	—	5 VDC
	3	White	—	Middle
	4	Blue	Laser A	Front
	5	Red	5 VDC	Rear
	6	Shield	—	—
	7	Yellow	Laser B	Test
	8	Green	0 VDC	—

Table 7-2 Transmitter/Receiver Cable Pin-out

The LZS-004-HS transmitter is connected to CN5 of the PGS-2 and the receiver to CN6, as shown in **Figure 7-5**. The shields of the transmitter and receiver are terminated at the transmitter and receiver housing.

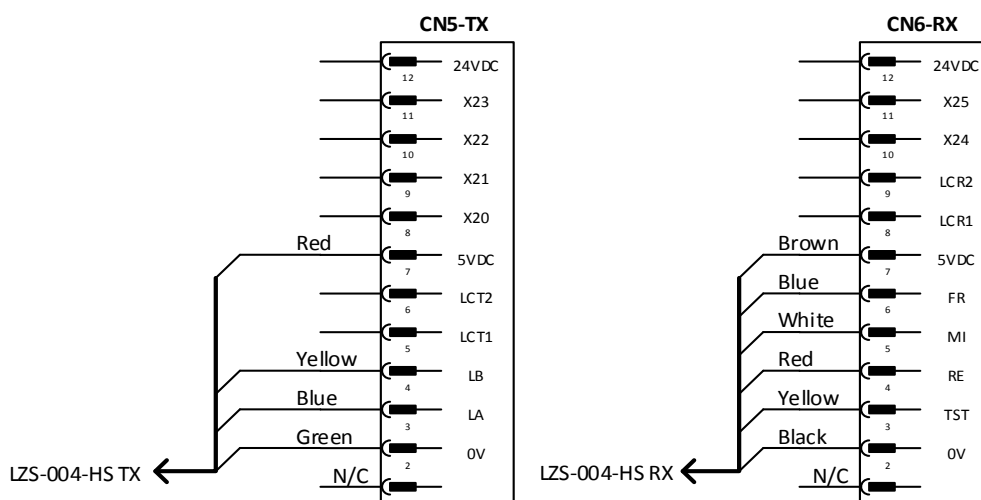


Figure 7-5: LZS-004-HS Transmitter and Receiver Connections

Transmitter connections LA and LB refer to laser A and laser B of the dual laser transmitter; laser A is the bottom laser, laser B is the top laser. The operation of the two lasers is periodically tested by the PGS-2, and it is essential that these are connected correctly or the system will fail these tests. LEDs are provided to show the state of the LA and LB outputs.

The states of the front, middle and rear sensors of the LZS-004-HS receiver are indicated by LEDs next to the FR, MI and RE inputs of CN6. When the system is operating, the transmitter is active, and the guards are aligned correctly, these LEDs are ON to indicate that the sensor is clear of any obstruction.

When a sensor in the receiver is obstructed, its LED will turn OFF.

7.4 Standard Digital Inputs

Each standard input available on the module requires a 24 VDC signal to be applied for the input to be set to the **ON** state. An indicator LED shows the state of the input.

All standard inputs are connected to the motherboard via opto-couplers which provide the necessary electrical isolation between the inputs and the CPUs. All standard inputs are labelled with the prefix "X", followed by the input number for the PGS-2.

At this time not all digital inputs available on the PGS-2 have been allocated in the FoldGuard system. **Table 7-3** summarises the current digital input allocation.

PGS-2 Digital Input Allocation Summary			
I/P	Connector	Description	Note
X04	CN2-5	Foot Pedal	1
X05	CN2-6	Bending Apron Active	3
X06	CN2-7	Bending Apron Active	3
X09	CN2-10	Error Reset Switch N/O	2
X10	CN2-11	Error Reset Switch N/C	2
X17	CN4-9	Special Mode Switch	4

Table 7-3: Standard Digital Input Allocation Summary

- Foot pedal:** This is required for all installations.
- Error reset switch:** This is required for all installations.
- Bending Apron Active:** The operation of the Bending Apron mode is described in **Section 3.7**. Both inputs are identical and they can be used individually or together. These inputs are optional.
- Special mode switch:** Enables Special mode for the PGS-2, and is required to enter Bypass mode – refer to **Section 3.8** for details.

Refer to **Section 13.2.3** the specifications of the digital inputs.

7.5 Standard Digital Outputs

Each standard output is a solid state high side driver switching 24 VDC from the power supply connection on CN1, and is opto-coupler isolated from the dual CPU controllers. An indicator LED shows the state of the output. All standard outputs are labelled with the prefix "Y", followed by the output number for the PGS-2 unit.



Note:

Each output can continuously supply up to 1.6 A at 24 VDC, however the **total current load of all digital outputs must not exceed 15 A**. Exceeding this limit may cause damage to the PGS-2.

At this time not all digital outputs available on the PGS-2 have been allocated in the FoldGuard system. **Table 5-1** summarises the current digital output allocation.

PGS-2 Digital Output Allocation Summary			
O/P	Connector	Description	Note
Y04	CN1-5	AUX Delayed Stop	1
Y05	CN1-6	Obstruction Lamp	2
Y06	CN1-7	Mute Lamp	3
Y07	CN1-8	Status Lamp	4

Table 7-4: Standard Digital Output Allocation Summary

- AUX Delayed Stop:** Y04 is ON during normal operation. When an E-Stop condition occurs Y04 turns OFF after a pre-set delay. The delay time is set in the System menu, see **Section 9.4.8**.
- Obstruction Lamp:** Indicates an obstruction to the guarding system. This indicator is optional.
- Mute Lamp:** Duplicates the Mute indication on the User Interface, refer to **Lazer Safe FoldGuard Folding Machine Safety and Guarding System Operation Manual (LS-CS-M-077)** for details. This indicator is optional.

- 4 **Status Lamp:** Indicates the current state of the guarding system and is lit when a condition has occurred that may require operator intervention. **This indicator is required in all installations.**

Refer to **Section 13.2.4** the specifications of the digital outputs.

7.6 Pulsed I/O Pairs

Pulsed I/O pairs consist of a pulsed output and its associated input. These are safety I/O that are continuously tested for integrity during normal operation, and must be wired in pairs (i.e. P00 **must** be wired to X00) via a N/C contact.

As with the standard inputs, all pulsed inputs are labelled with the prefix "X" followed by the input number of the PGS-2 unit. The pulsed output is labelled with the prefix "P", followed by the associated input number.

PGS-2 Digital Output Allocation Summary					
O/P	Connector	I/P	Connector	Description	Note
P00	CN1-1	X00	CN2-1	E-Stop Pushbutton and Kick Bar (2 x N/C)	
P01	CN1-2	X01	CN2-2	E-Stop Pushbutton and Pedal 1 (2 x N/C)	
P02	CN1-3	X02	CN2-3	Kick Bar and Pedal 2 (2 x N/C)	
P03	CN1-4	X03	CN2-4	Pedal 1 and Pedal 2 (2 x N/C)	

Table 7-5: FoldGuard E-Stop Pulsed I/O Pairs

Each E-Stop (pushbutton, pedal 1, pedal 2, kick bar) requires a normally closed, dual contact safety switch input. If any E-Stop inputs are not required they must be bridged to prevent false E-Stops being triggered.

The E-Stop inputs must be wired exactly as described in **Table 7-5**, as they are linked to messages generated by the User Interface Panel. Several different types of message may be triggered by an E-Stop.

If a single E-Stop condition can be unambiguously decoded by the FoldGuard software a message naming the E-Stop will be displayed. For example if only P00/X00 and P01/X01 are open circuit, the following message is displayed.

Emergency stop button pressed - RESET E-STOP BUTTON

If there are multiple E-Stops active the FoldGuard may not be able to decode the condition into a single message. A general E-Stop message is displayed, and the operator will need to check all E-Stop switches.

Emergency stop input active - CHECK E-STOP SWITCHES

If only one contact of any E-Stop is open the switch is considered faulty, an E-Stop is triggered and a synchronization fault message is displayed. The machine will not be allowed to operate until the fault is repaired.

Emergency stop switch synchronisation error - CHECK E-STOP SWITCH CONTACTS

Refer to **Section 13.2.2** the specifications of the pulsed input/output pairs.

7.7 Serial Communications

The PGS-2 is equipped with two serial communications ports, COM1 and COM2.

7.7.1 COM1 Programming Interface

COM1 is an internal serial to USB converter for connecting to a laptop or PC, and is primarily for loading software updates that are provided by Lazer Safe. The serial port may also be used for installation diagnostics.

7.7.2 COM2 FoldGuard User Interface Panel

All M12 terminated cables supplied with the FoldGuard system are interchangeable and may be used for the User Interface Panel communications cable. The flying lead is terminated in CN4 of the PGS-2 (COM2), refer **Table 7-6** for wiring details.

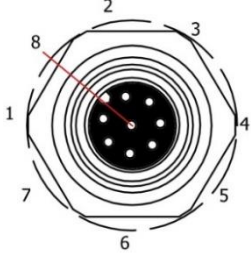
M12x8 Tx/Rx Front View	#	Colour	Function	PGS-2 CN4 Pin
	1	Black		
	2	Brown		
	3	White		
	4	Blue	TX	4
	5	Red	24 VDC	12
	6	Shield		
	7	Yellow	RX	3
	8	Green	0 V	2

Table 7-6: PGS-2 to User Interface Panel, Serial Port COM2



Note:

The User Interface Panel must be connected to the PGS-2 for it to operate correctly. If communications between the PGS-2 and the panel is interrupted for more than 10 seconds, the PGS-2 will turn off the enable outputs.

7.8 FoldGuard Installation Wiring Diagrams

An example wiring diagram for the FoldGuard Folding Machine Safety and Guarding System is given in **Figure 7-6** and **Figure 7-7**.

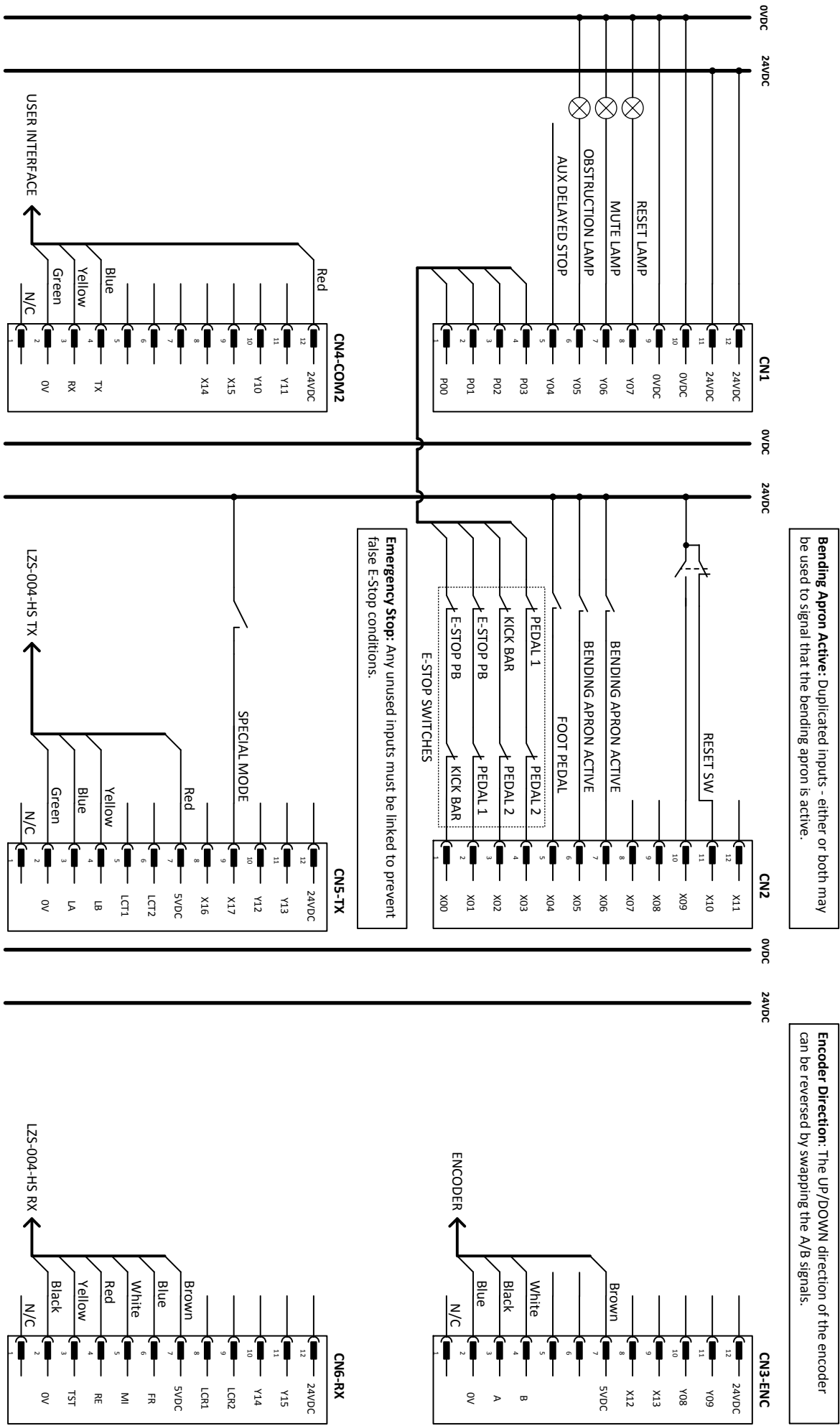


Figure 7-6: FoldGuard Wiring Diagram – Digital I/O

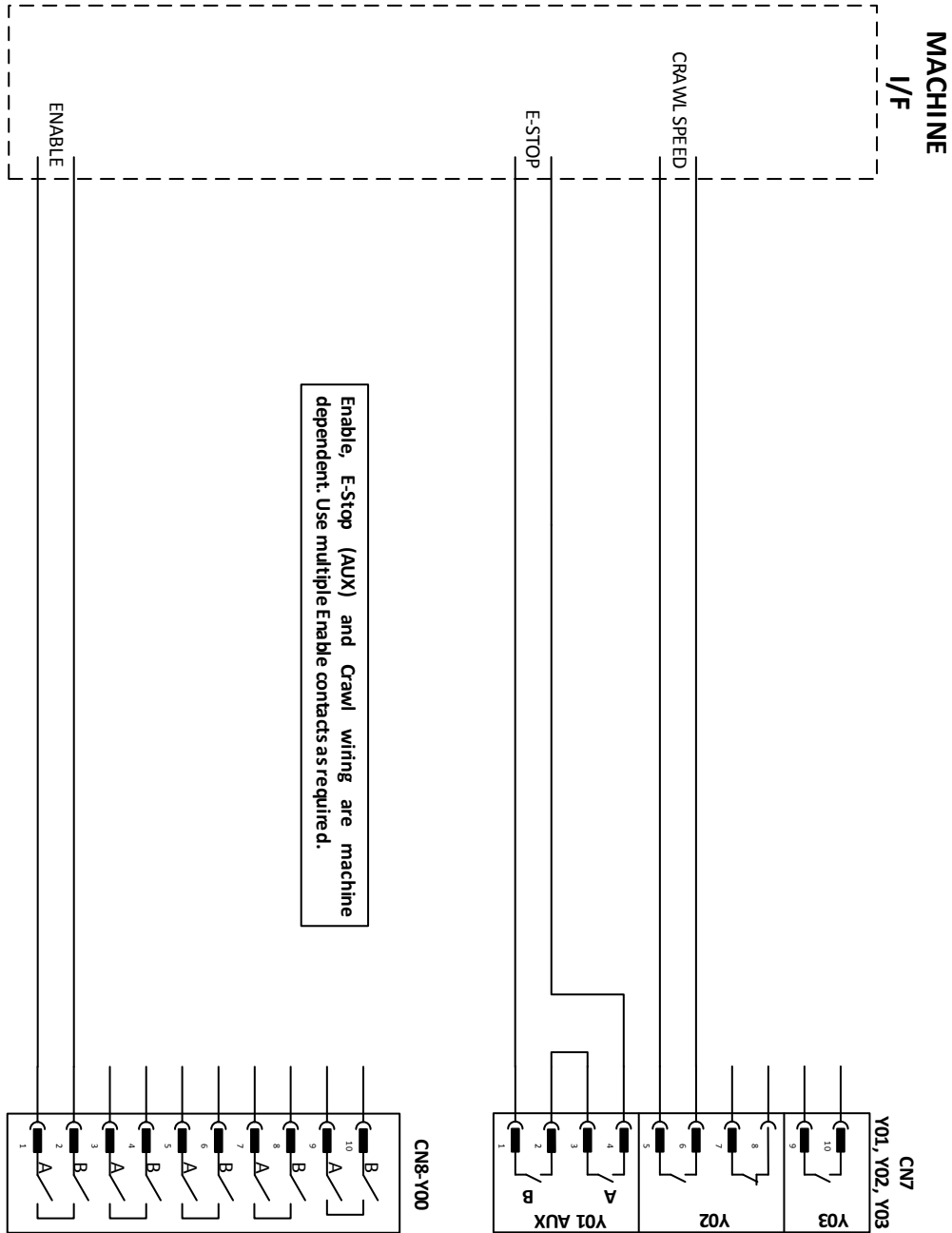


Figure 7-7: FoldGuard/Folding Machine Interface Wiring Example

8 The FoldGuard User Interface Panel

8.1 User Interface Overview

The User Interface Panel is an advanced, industrial grade Human Machine Interface (HMI) specifically designed for the FoldGuard system. The operator controls the FoldGuard Folding Machine Guarding System through a simple, menu-style user interface. The key features of the interface panel are shown in **Figure 8-1**.

Status Window

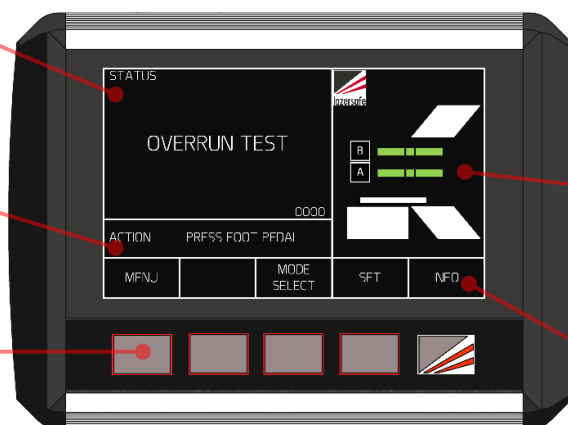
This window shows the current status of the folding machine, and of the FoldGuard system.

Action Window

The FoldGuard 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 FoldGuard 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 8-1: FoldGuard User Interface Panel

Figure 8-2 shows the different FoldGuard User Interface Panel screens that can be selected by the operator. The Main screen is the top level screen (the screen also shown in **Figure 8-1**). From here the operator can select the other FoldGuard screens using the panel pushbuttons.

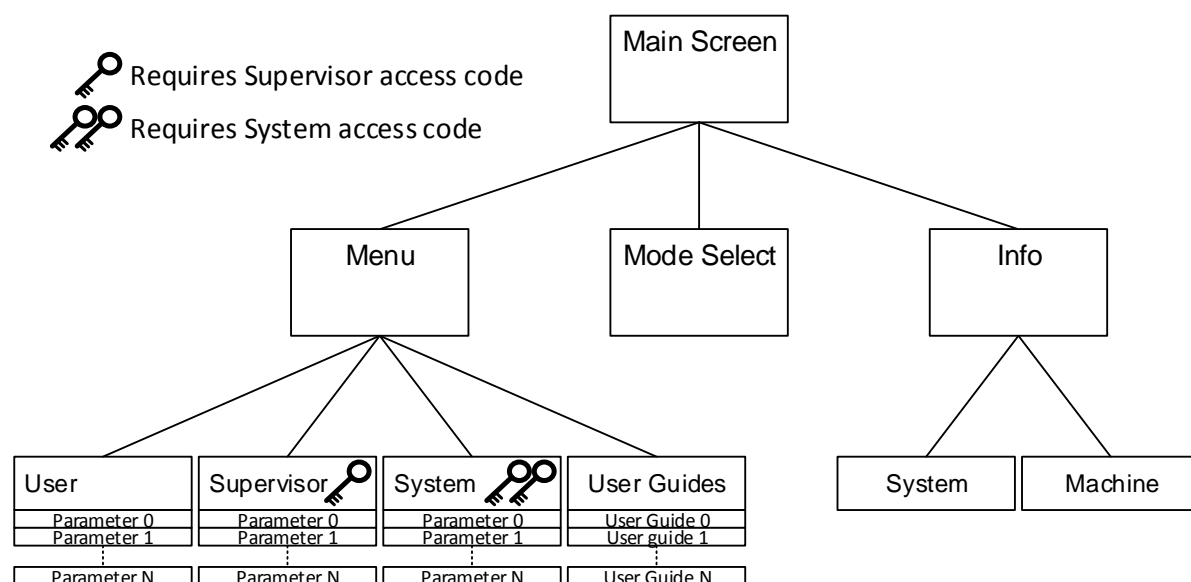


Figure 8-2: FoldGuard Menu Levels



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.

8.2 Error Reset Indicator and Reset Button

Aside from the User Interface Panel the FoldGuard 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 folding machine.

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 FoldGuard User Interface for further information.

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

8.3 Mute Indicator

The Operator can clearly see when the FoldGuard system's optical protection is muted, as the background of the Status screen on the User Interface Panel turns RED.

8.4 The Main Screen

The Main screen is the top level screen of the FoldGuard User Interface Panel, and is shown in **Figure 8-3**. The screen is divided into four windows; The Status, Action, Button Labels and Sensor windows.

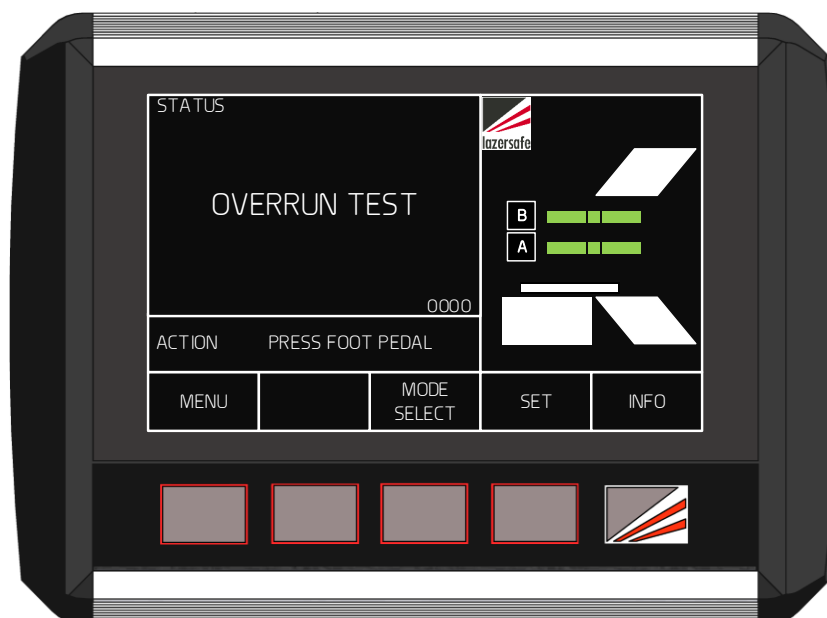


Figure 8-3: The FoldGuard Main Screen



Note:

If the FoldGuard 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.

8.4.1 Status and Action Windows

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

- **Operating Mode.** The guard mode currently selected (Normal, Hemming or Field Muted) is displayed during 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 FoldGuard 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 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 or machine state. This condition code is also displayed in the lower right hand corner of the Status window.
- **Operation Pending:** If the 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 an 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**.

8.4.2 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 8-1**.

Label	Button Function
MENU	This leaves the Main screen and enters the Menu screen. See Figure 8-2 for an overview of the menu system.
NOT USED	This button is not active in the FoldGuard system.
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 8-2 for an overview of the menu system.

Table 8-1: Main Screen Buttons

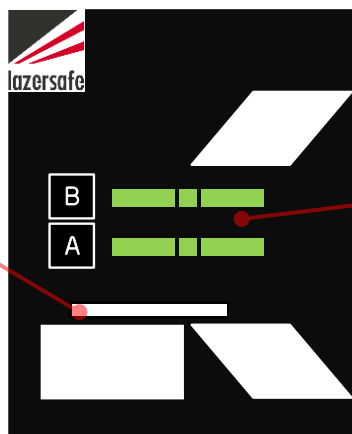
8.4.3 Sensor Window

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 active) is shown in **Figure 8-4**, 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.

Material

This symbol shows that the guarding is set to Normal mode. This symbol will change when Hemming mode is selected.

**Laser A, B**

When the optical guarding is active these symbols show the status of the **FRONT**, **MIDDLE** and **REAR** sensors of the laser receiver – green for clear, red for obstructed.

Figure 8-4: Sensor Window

8.5 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.

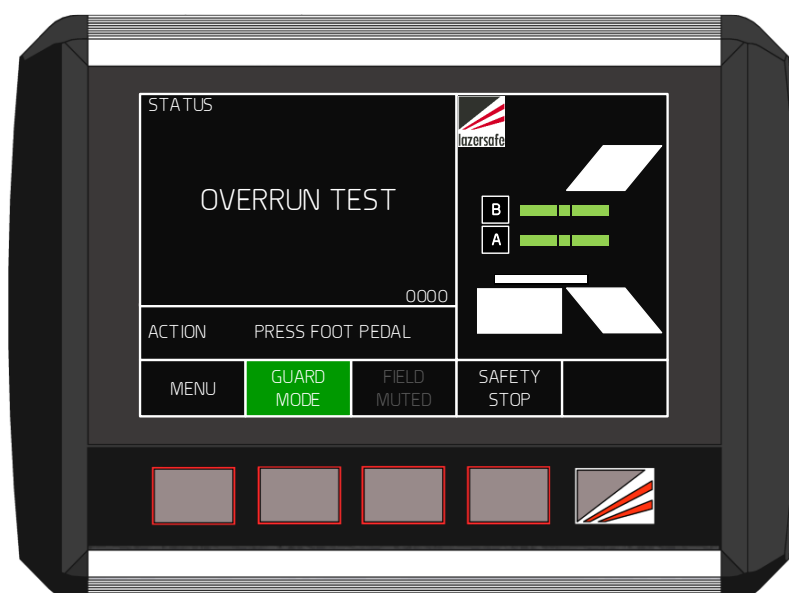


Figure 8-5: Mode Select Screen

The buttons are used to select the different guard modes (the modes are detailed in **Sections 3.3 to 3.8**). The operation of the Mode Select screen and the Sensor window symbols is explained in **Section 8.5**.

Label	Button Function
MENU	This leaves the Mode Select screen and returns to the Main screen. See Figure 8-2 for an overview of the menu system.
GUARD MODE	This button cycles through the guard modes: Normal → Hemming → Normal etc.
FIELD MUTED	If this button is enabled, it toggles the Field Muted mode. The functionality of this button is disabled by default, and can be configured in the Supervisor menu.
SAFETY STOP	If this button is enabled, it toggles the Safety Stop mode. The functionality of this button can be configured in the Supervisor menu.

Table 8-2: Mode Select Screen Buttons

8.6 Menu Screen

The Menu screen gives access to the menus that are used to configure the way that the FoldGuard 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 8**.

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 FoldGuard 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 FoldGuard Folding machine 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 FoldGuard installers. Setting incorrect parameter values may render your machine inoperable.



Figure 8-6: Menu Screen

Label	Button Function
	This leaves the Menu screen and returns to the Main screen. See Figure 8-2 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 FoldGuard system. No access code is required.

Table 8-3: 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 FoldGuard 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 Safety Controller turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the Safety Controller's LCD display will show the Condition Code **40A1**.

8.6.1 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 9.1.1** for a description of how to navigate menus.

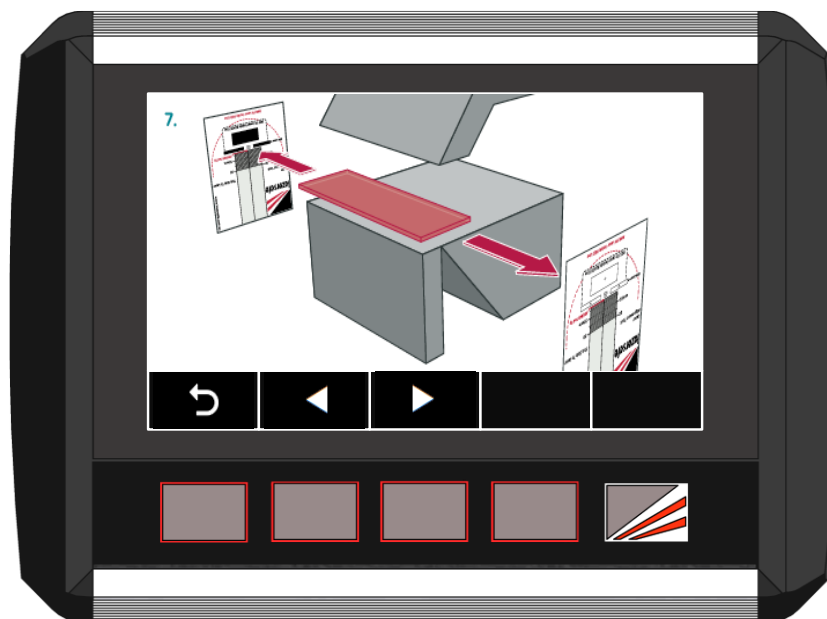


Figure 8-7: User Guide Screen

Label	Button Function
	This leaves the User Guide and returns to the User Guide list. See Figure 8-2 for an overview of the menu system.
	Selects the next page in the guide.
	Selects the previous page in the guide.

Table 8-4: 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-004-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.

8.7 Info Screen

The Info screen is selected from the Main screen, and displays information about the FoldGuard system, and the folding machine. The screen can be switched between displaying System Information and Machine Information.



Note:

The system parameters are stored in the FoldGuard User Interface, and the system cannot run if the panel is disconnected.

The safety application running on the Safety Controller monitors a system heartbeat signal from the HMI. 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 Safety Controller's LCD screen shows the Condition Code **40A1**.

This does not apply to systems configured for No Guard / No Counter.

8.7.1 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 Safety Controller 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.** This shows the type of Lazer Safe guarding system for which the HMI has been configured.
- **HMI version.** The FoldGuard User Interface Panel software version.
- **Kernel version.** The Safety Controller kernel software version.
- **Application.** The Safety Controller application software version.
- **FPGA version.** PGS-3 Safety Controller FPGA firmware version.
- **Approx. slow point.** The slow speed point calculated by the Fold Guard. The clamp must be travelling in slow speed by this opening (in millimetres).
- **Laser-punch.** This does not change for the FoldGuard system, and should always be set at 14 mm.

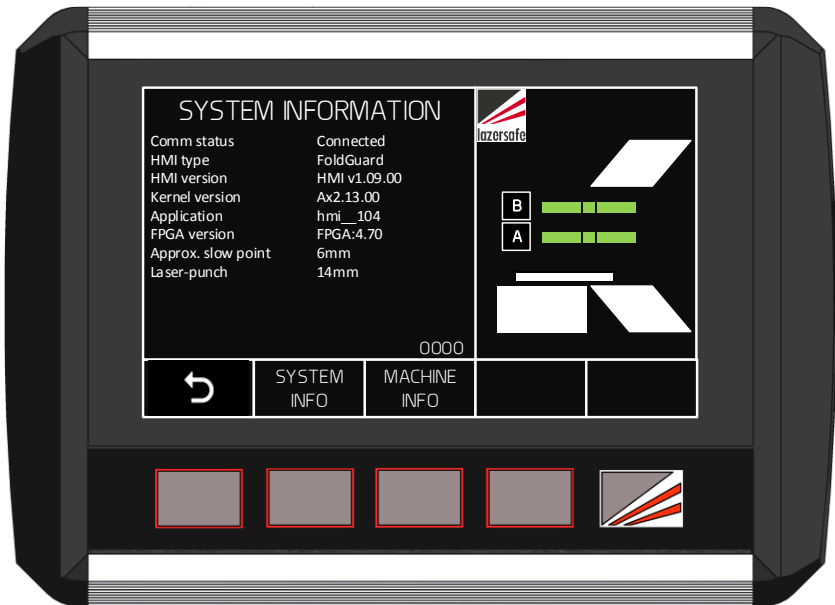


Table 8-5: Info Screen, System Information

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

8.7.2 Machine Information

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

- **Stop Time.** Measured by the Safety Controller each time the clamp is stopped.

- **Stop Distance.** Measured by the Safety Controller each time the clamp is stopped.
- **Stop Time Limit.** This parameter does not apply to the FoldGuard system.

9 User, Supervisor and System Menus

The Menu screen gives access to the menus that are used to configure the way that the FoldGuard 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 FoldGuard 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 FoldGuard Folding Machine Guarding System. The System menu is **not** described in this document.



Figure 9-1: Menu Screen

Label	Button Function
	This leaves the Menu screen and returns to the Main screen. See Figure 8-2 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 FoldGuard system. No access code is required.

Table 9-1: Menu Screen Buttons



Note:

When any menu screen is selected, the safety application running on the Safety Controller turns off the enable outputs, and the machine cannot run. If the foot pedal is pressed, the LCD display on the Safety Controller 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 FoldGuard 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 FoldGuard installers. Setting incorrect parameter values in the System menu may render your machine inoperable.

9.1.1 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 FoldGuard buttons, as shown in **Figure 9-2** and **Table 9-2**. 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.

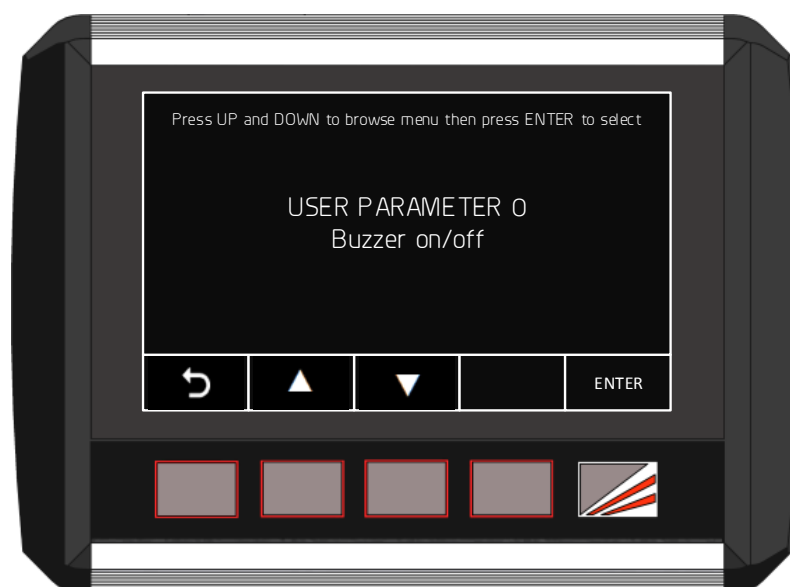


Figure 9-2: Menu Parameter Screen

Label	Button Function
	This leaves the Parameter List and returns to the Menu screen. See Figure 8-2 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 9-2: 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.

9.1.2 Setting Option Parameters

Option parameters are navigated in the same way as menus, using the buttons described in **Figure 9-2** and **Table 9-2**. 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 FoldGuard system's non-volatile memory, and the User Interface returns to the parameter list. Changes can be abandoned at any time by pressing the ↶ button.

9.1.3 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 9-3** 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 non-volatile memory, and the FoldGuard User Interface returns to the parameter list. Changes can be abandoned at any time by pressing the ↶ button.



Figure 9-3: Numeric Parameter Screen

Label	Button Function
↶	This leaves the Parameter and returns to the Parameter List. See Figure 8-2 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 9-3: Numeric Parameter Screen Buttons

**Note:**

The FoldGuard 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.

9.2 User Menu

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

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

9.3 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 9-4**. This is a numeric parameter as described in **Section 9.1.3**, and shown in **Figure 9-3**.

**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.

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.

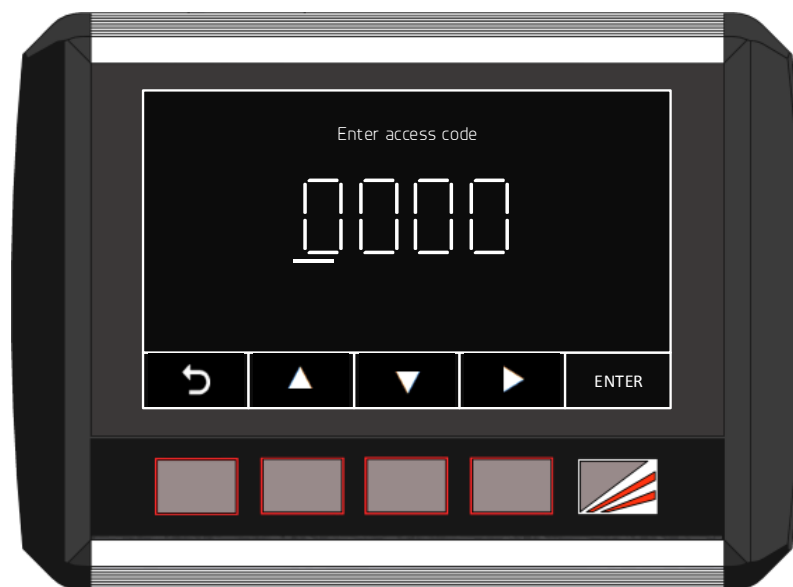


Figure 9-4: Supervisor Menu Access Screen

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

9.3.2 Parameter 1 – Field Muted Button Functionality

In the Mode Select screen the FIELD MUTED button is used to place the FoldGuard system into Field Muted mode. Field Muted mode disables the optical protection and restricts the maximum pressing speed to slow speed (if possible, refer to **Section 2.2**), as described in **Section 3.5**.



Warning: NO OPTICAL PROTECTION IN FIELD MUTED MODE

In Field Muted mode, the optical sensing is deactivated. Although FoldGuard engages the slow speed signal and forces a safety stop on each cycle, particular caution must still be exercised.

The ability to select Field Muted mode is disabled by default, and can only be enabled by personnel who have access to the Supervisor menu of the HMI. This menu is password protected and should only be accessible to suitably trained and qualified personnel.

This parameter has three that sets the functionality of the FIELD MUTED button.

- **ENABLED.** The button FIELD MUTED button is functional.
- **DISABLED-ON.** The FoldGuard system is permanently locked in Field Muted Mode.
- **DISABLED-OFF.** The button is disabled, and Field Muted mode cannot be selected.

Refer to *Lazer Safe FoldGuard Folding Machine Safety and Guarding System Operation Manual (LS-CS-M-077)* for details on this operating mode.

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

9.3.3 Parameter 2 – Safety Stop Button Functionality

In the Mode Select screen the SAFETY STOP button is used to put the FoldGuard system into Safety Stop mode, as described in **Section 3.6**. This parameter has three options that sets the functionality of the SAFETY STOP button.

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

Refer to *Lazer Safe FoldGuard Folding Machine Safety and Guarding System Operation Manual (LS-CS-M-077)* for details on this operating mode.

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

9.3.4 Parameter 3 – Safety Distance

The safety distance is the size of the clamp opening where a safety stop is performed. This value is measured in millimetres (mm), and can be set between 12 and 20 mm (0012 - 0020 for the parameter screen value).

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

9.3.5 Parameter 4 – Language

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

9.4 System Menu

System menu parameters are normally only changed during the installation of the FoldGuard system, and are not changed during normal operation. The System menu is password protected.

When the SYSTEM MENU button is pressed, the installer is prompted to enter the System level access code, as shown in **Figure 9-5**. This is a numeric parameter as described in **Section 9.1.3**, and shown in **Figure 9-3**.



Note:

The factory default System level access code is **1234**. This should be changed as soon as the system is installed. If the System password is lost, contact Lazer Safe Customer Support, or your local supplier for assistance.

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.



Figure 9-5: System Menu Access Screen



Note:

In some cases changes to System level parameters will not come into effect until after the safety controller has been power cycled. If this is required it will be noted in the parameter descriptions.

9.4.1 Parameter 0 – System Access Code

This parameter sets the value of the System level access code and can take any value from 0000 to 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 FoldGuard's non-volatile memory, and the system will return to the parameter list.

The safety controller does **not** need to be power cycled when this parameter is changed.

9.4.2 Parameter 1 – High Speed Offset

This parameter sets the height above the material at which the crawl relay is activated, and can take any value from 0 to 65 mm. When the clamp reaches this point the crawl relay is activated, and downward motion is switched to crawl (slow) speed.

A forced crawl condition (such as enabling Field Muted mode) always overrides this distance parameter.



Warning: SLOW SPEED OPERATION

Under certain circumstances FoldGuard will initiate slow speed.

However, some folding machines are not capable of changing the closing speed of the clamp to slow speed. FoldGuard will allow the clamp to close at normal operating speed, but will always perform a safety stop before the clamp closes.

The operator will have to release and press the foot pedal again to complete the clamping operation.

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

The safety controller does **not** need to be power cycled when this parameter is changed.

9.4.3 Parameter 2 – Clamp Overtravel Limit

As detailed in **Section 3.2**, the optical protection should be aligned above the fixed part of the clamp (using the alignment tool) so that the danger zone of the machine is adequately protected. To ensure that the transmitter and receiver are not set too far above the lower clamp to be effective, the FoldGuard system enforces an overtravel limit, where (by default) the clamp cannot travel more than 6 mm below the clamping point.

However on some longer machines this limit may need to be increased due to the following.

- Large folding machines may warp slightly as they clamp.
- Long sheets of material can sit unevenly on the lower clamp, artificially raising the mute point several millimetres.

The value of the overtravel limit can be set from a minimum of 6 mm (the default) to a maximum of 12 mm.

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

The PGS-2 must be power cycled when this parameter is changed.

9.4.4 Parameter 3 – Bypass Mode

Bypass mode is enabled/disabled in this menu as one of the three requirements for putting the FoldGuard system into Bypass mode. For details of Bypass mode operation and activation, refer to **Section 3.8**.



Warning: NO PROTECTION IN BYPASS MODE.

In Bypass mode all optical guarding, start-up tests, speed checks, and hardware safety checks are disabled. The machine can run unguarded in high speed while the operator is unprotected.

Entry to Bypass mode is password protected and is only available to personnel with System level access. This mode should only be used by suitably trained personnel, and only in exceptional circumstances.

Extreme care must be used when operating a machine in Bypass mode. Access to the machine should be restricted by physical barriers, and the machine should never be left unattended in an operational state.

This parameter has two options:

- **DISABLED.** Bypass mode is disabled.
- **ENABLED.** Bypass mode is 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 FoldGuard's non-volatile memory, and the system will return to the parameter list.

The safety controller does **not** need to be power cycled when this parameter is changed.

9.4.5 Parameter 4 – Start Time

When the operator presses the foot pedal, the FoldGuard system monitors the movement of the clamp via the encoder signals. If the clamp does not move within a specified time, the FoldGuard will raise an error, as this may indicate there is a fault with the folding machine, or with the encoder.

However, in all machines there is some delay between the time when the pedal is pressed and movement of the clamp. To account for variations in this time for different folding machines, the Start Time parameter adjusts the amount of time the system waits before raising an error.

The start time can take any value from 0 to 2000 ms. The system default value is 1000 ms.

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

The safety controller does **not** need to be power cycled when this parameter is changed.

9.4.6 Parameter 5 – Encoder Travel

This option is used in conjunction with the Clamp Travel (see **Section 9.4.7**) option to adjust the amount of travel that the guarding system measures during clamping.

Due to the layout of some folding machines it may not be possible to directly measure the travel of the clamp with a rotary encoder, and it may be necessary to mount the encoder where it measures hydraulic piston travel instead, such as in **Figure 9-6**. If the clamp travel and encoder travel are not equal, the opening measurement will be incorrect.

If the distance travelled by the encoder chain at the cylinder is greater or smaller than the clamp travel, the encoder measurement must be scaled by the FoldGuard system. This is done by entering the encoder travel and the clamp travel into the System menu so that FoldGuard can calculate the correct scaling factor required.

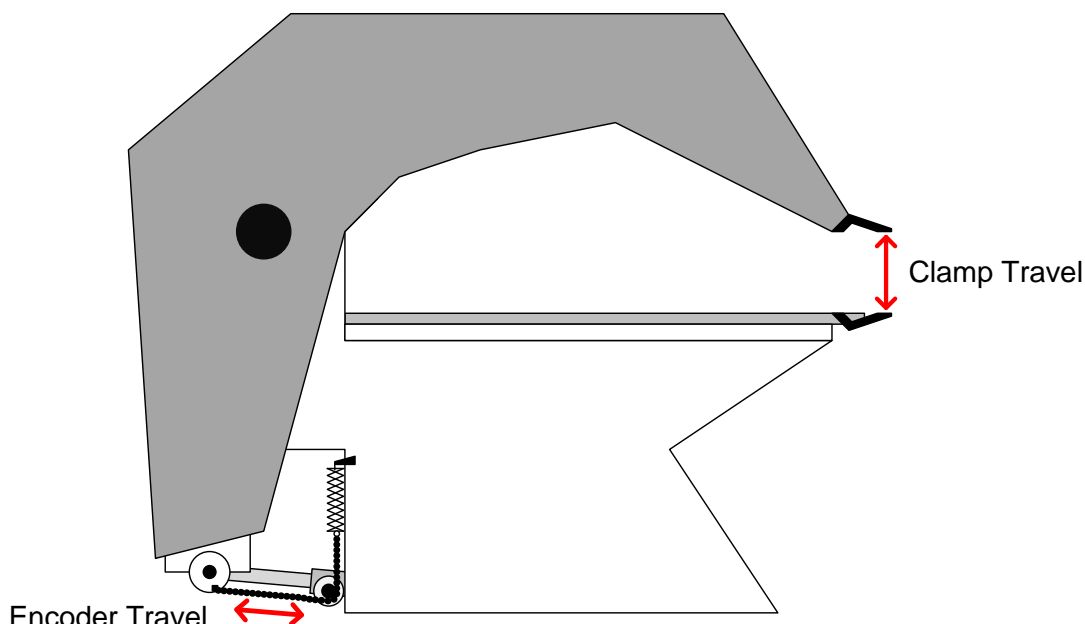


Figure 9-6: Clamp Travel and Encoder Travel

Enter the distance that the encoder chain travels during a normal clamping stroke, in millimetres. The default value is 500 mm. See [Section 9.4.7](#) for the Clamp Travel menu.

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

The PGS-2 must be power cycled when this parameter is changed.

9.4.7 Parameter 6 – Clamp Travel

This option is used in conjunction with the Encoder Travel option to adjust the amount of movement that the guarding system measures during clamping. Refer to [Section 9.4.6](#) for further information.

Enter the distance that the clamp travels during a normal clamping stroke, in millimetres. The default value is 500 mm.

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

The PGS-2 must be power cycled when this parameter is changed.

9.4.8 Parameter 7 – AUX Delayed Output Turn Off Time

The AUX relay output (Y01) is connected into the E-Stop circuit of the Folding Machine to stop the machine when emergency stop condition is triggered by the FoldGuard system. However on some machines it may be necessary to allow the hydraulic system to function for several seconds after the emergency stop condition has occurred, to allow the clamp to be opened.

The AUX Delayed Stop Output (Y04) is linked in software to the E-Stop condition. During normal operation Y04 is ON. When an emergency stop condition is triggered the AUX relay output (Y01) turns off immediately. Y04 will remain ON for a pre-set delay and then turn OFF. As soon as the E-Stop condition is cleared and the system reset, Y01 and Y04 turn on immediately.

This option sets the turn off delay time for Y04. The value can be set between 2000 ms and 5000 ms. The default is 2000 ms.

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

The PGS-2 must be power cycled when this parameter is changed.

10 System Commissioning

10.1 System Start-up

Figure 10-1 shows the normal start-up sequence of the FoldGuard system from the time that the PGS-2 is powered, until the time the laser guarding becomes active (times given are approximate).

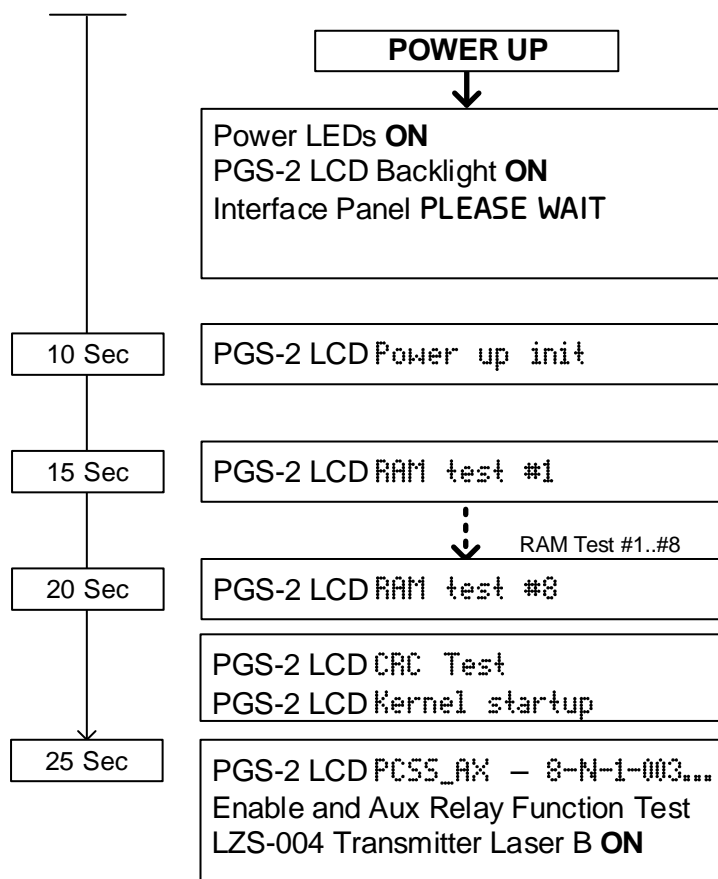


Figure 10-1: FoldGuard Power Up Sequence

At this stage the laser guarding is active, and the safety application is running, however the Enable relays (Y00 A,B) are not yet turned on, and the machine is **not** ready to operate. Before the system can be operated the laser transmitter and receiver alignment must be checked. Refer to **Lazer Safe FoldGuard Folding Machine and Guarding System Alignment Guide (LS-CS-M-051)** for details on the alignment process.

Before the clamp moves for the first time after power up, the PGS-2 performs a guard test, which tests the integrity of the optical protection. If the test passes, the clamp will be allowed to move on the next pedal press. If the test fails, the message Guard test FAIL – Release foot pedal is displayed, and the clamp will not be allowed to move until the fault is corrected.

Further details of the operation of the FoldGuard system can be found in **Lazer Safe FoldGuard Folding Machine Safety and Guarding System Operation Manual (LS-CS-M-077)**.

10.2 FoldGuard System Testing

Power-up the system and perform the system tests as listed in **Table 10-1** below.

FoldGuard Initial System Testing	
Step	Normal Mode
1	Close the clamp with no obstructions.
2	Close the clamp with no obstructions with the safety stop mode on.
3	Close the clamp with obstructions.
4	Set a new mute point and close the clamp with no obstructions.
Step	Hemming Mode
1	Close the clamp with no obstructions.
2	Close the clamp with no obstructions with the safety stop mode on.
3	Close the clamp with a front sensor obstruction.
4	Close the clamp with a rear sensor obstruction.
5	Close the clamp with a middle sensor obstruction.
6	Set a new mute point and close the clamp with no obstructions.
Step	Field Muted Mode
1	Set the mute point.
2	Close the clamp.
3	Close the clamp with the safety stop mode on.
Step	Bypass Mode (see warning below)
1	Select Bypass mode in the menu
2	Enable Special mode switch
3	Enable Field Muted mode
4	Confirm warning message

Table 10-1: Initial System Tests



Warning: NO PROTECTION IN FIELD MUTED MODE

In Field Muted mode, the optical sensing is deactivated. Although FoldGuard engages the slow speed signal and forces a safety stop on each cycle, particular caution must still be exercised.

The ability to select Field Muted mode is disabled by default, and can only be enabled by personnel who have access to the Supervisor menu of the HMI. This menu is password protected and should only be accessible to suitably trained and qualified personnel.

11 Troubleshooting

The FoldGuard system has several features that assist in diagnosing any problems that may arise during installation or operation.

11.1 Hardware and Software Versions

When contacting Lazer Safe Customer Support it is important to provide the serial numbers of your hardware and version numbers of software. All Lazer Safe products are clearly labelled with product and serial numbers.

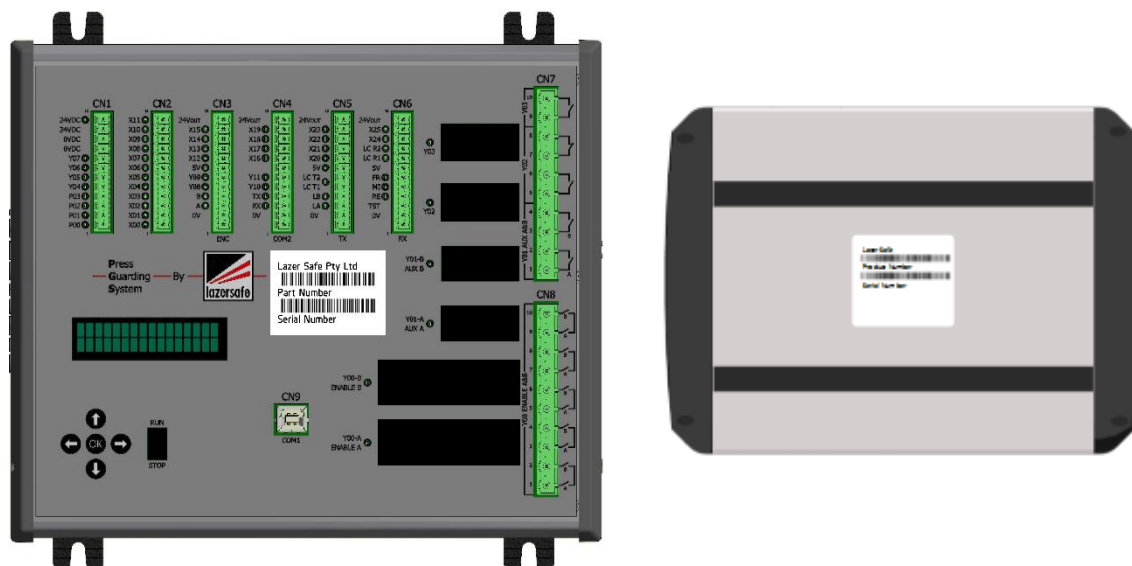


Figure 11-1: Product and Serial Number Labels

Software version information for the PGS-2 and the User Interface Panel can be read from the Info screen, refer to **Section 8.7.1** for details. PGS-2 software can also be read directly from the PGS-2 LCD screen, as described in **Section 11.3.1**.

11.2 Status and Action Screens

The Status and Action screens display information about the current state of the PGS-2, including fault messages and any actions required of the operator. The User Interface Panel translates condition codes from the PGS-2 into human readable messages. If the condition code is not a commonly used code, it will not be translated.

Checking the status screen for messages and/or conditions codes is the first step when trying to diagnose any operating problems.

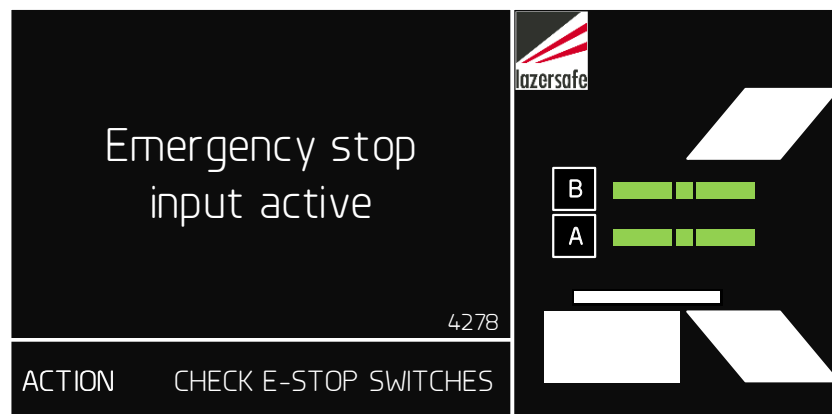


Figure 11-2: Status, Action and Sensor Screens

11.3 Front Panel Display and Controls

Figure 11-3 shows the front panel controls for the PGS-2.

The **Run/Stop** switch controls the state of the safety application. If this is switched to the off position, the safety application software that runs the PGS-2 will halt, and all outputs will turn off. The scrolling message will change to display hardware version information, and the application version will read **No App.** (The application name in the System Information screen will also read **No app.**)

The **Run/Stop** switch must always be left in the **Run** position during normal operation.

The **OK** button is used to put the PGS-2 into boot mode, which is required when updating the kernel software. Refer to **Lazer Safe PCSS-A Software Download Manual (LS-CS-M-045)** for details on how to upgrade the software for the PGS-2.

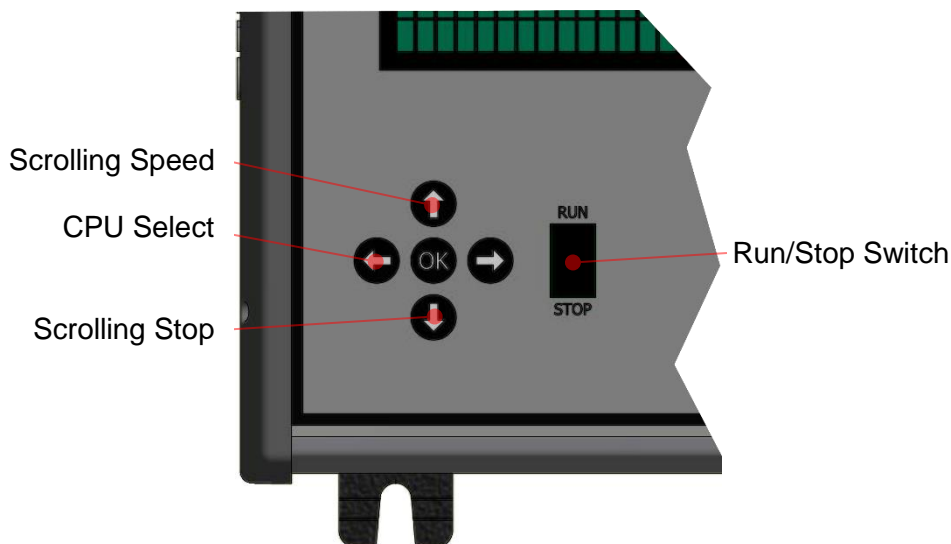


Figure 11-3: Application Run/Stop and CPU Display Select

The scrolling display is controlled by the up/down keys. Pressing the up key ↑ increases the speed of the scrolling; pressing the down key ↓ halts the display.

11.3.1 PGS-2 LCD - Scrolling Display

During normal operation the display scrolls information on how the PGS-2 is configured, which is a requirement for a safety controller. These parameters are fixed and controlled by Lazer Safe for all FoldGuard system installations.

Ax 2.16.00 for PCSS (CPU 1) hmi__109

KERNEL CPU APPLICATION

Figure 11-4: Scrolling Software Information

The last three codes of the scrolling display (as seen in **Figure 11-4** above) represent the software kernel version, which one of the two CPUs has control of the display, and the name of the safety application.

The software kernel and safety application are periodically updated by Lazer Safe, and these version numbers are required when contacting Lazer Safe Customer Support.

11.3.2 Condition Code Display

The User Interface Panel displays error messages in the Status screen. These messages are human readable translations of condition codes generated by the PGS-2. If the panel develops a fault, or if it is disconnected from the PGS-2, the raw condition codes can still be read directly from the PGS-2 LCD screen.

The condition codes are four digit, hexadecimal (alpha-numeric) codes that can contain the digits 0-9, and the letters A-F. The display of a condition code may be triggered by a mode change (e.g. leaving Field muted mode), may represent a condition that has stopped the machine (e.g. an obstruction) or may report a system fault (e.g. the receiver has failed a guard test).



Note:

The PGS-2 has duplicated CPU controllers. Either CPU can raise a condition code independent of the other. If the machine stops, and the display continues to show normal scrolling information, use the left/right arrow keys $\leftarrow \rightarrow$ (see **Figure 11-3**) to change the CPU that has control of the LCD screen.

If an error condition arises that requires assistance from Lazer Safe Customer Support, it is important to record any condition codes that occur, and report them in your assistance request.

11.4 Laser Guard Testing

Figure 11-5 shows the LZS-004-HS transmitter and receiver connections, and LED indicators.

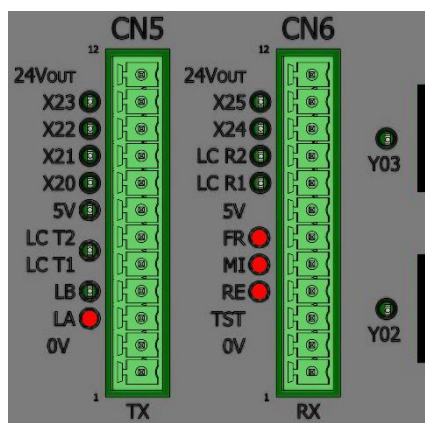


Figure 11-5: Laser Guarding I/O Connection

11.4.1 LZS-004-HS Laser Transmitter

After the power up sequence the laser guarding becomes active. Laser A is the bottom laser, laser B is the top laser. The LEDs **LA** and **LB** on CN5 are illuminated when the corresponding laser is turned **ON**. The lasers operate in the following sequence.

- Laser A and laser B are on until the mute point.
- Only laser A is on below the mute point.

11.4.2 LZS-004-HS Receiver

The LZS-004-HS receiver has laser sensors that are arranged in three segments – front middle and rear. Connector CN6 has LED indicators that indicate the state of the front (**FR**), middle (**MI**) and rear (**RE**) sensors. The LEDs are **ON** when the laser path is clear of obstructions. For the system to operate correctly the receiver segments **must** be connected to the correct input.

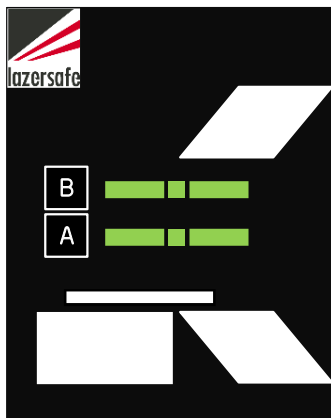


Figure 11-6: User Interface Sensor Window

These indicators are duplicated in the Sensor window of the User Interface Panel.

11.4.3 Guard Test Failure

The laser guarding is tested on start-up, and each time the clamp opens. Aside from the unlikely event that the hardware is faulty, the most common causes of a guard test fault after installation is:

- Laser A and laser B are cross connected (laser A → **LB**, laser B → **LA**).
- The laser path is blocked.
- The transmitter and receiver are not correctly aligned.

11.5 I/O Testing

The PGS-2 tests for the correct operation of the relays, buttons and general purpose I/O. If a fault is detected, the PGS-2 will display one of the following condition codes.

PGS-2 Input / Output Fault Codes		
Code	Message	Description
4042	-	Error reset switch is not wired correctly or is faulty
6840-6843	-	Pulsed input 0 – 3 fail, pulse not detected (stuck hi or lo)
6880-6883	-	Pulsed input 0 – 3 fail, fault detected (stuck hi or lo)
68C0	-	Enable relay Y00 failed to turn off (relay contacts monitored)
68C1	-	Auxiliary relay Y01 failed to turn off (relay contacts monitored)
68C2	-	Crawl relay drive circuit failed to turn off ¹
68C4-68CF	-	GP output 4-15 failed to turn off
68D0	-	Enable relay Y00 failed to turn on (relay contacts monitored)
68D1	-	Auxiliary relay Y01 failed to turn on (relay contacts monitored)
68D2	-	Crawl relay drive circuit failed to turn on ¹
68D4-68DF	-	GP output 4-15 failed to turn on

Table 11-1: PGS-2 Input / Output Condition Codes

Note 1. Standard relays are not monitored using their contacts, only the internal drive circuit is monitored.

12 Glossary of Terms

Term	Description
Bending Apron	The lower part of the folding machine that move up to fold the material. The swing beam.
Clamp	The moving part of the folding machine that holds the material being bent.
Condition code	Status information from the PGS-2 displayed as a four digit hexadecimal number (0-9, A-F)
Crawl speed	The slow speed of the clamp
Danger zone	The point where any part of the body may be trapped between tools
Field muted mode	Operating mode of the FoldGuard where the protective laser field is turned off and the closing of the tools is possible in safe speed only.
Hemming mode	Operating mode of FoldGuard when some of the sensor zones are deactivated to allow hemming operations.
HMI	Human Machine Interface (i.e. the User Interface Panel)
Laser A	The lower laser of the LSZ-004-HS
Laser B	The upper laser of the LZS-004-HS
Mute	Deactivation of the protective laser field
Mute point	The point where the optical protection is deactivated
N/C	Normally closed contact
N/O	Normally open contact
Normal mode	Default operating mode of the FoldGuard
Opening	The distance between the upper and lower clamp
Open clamp	Increase the opening, retract the pressing beam
Optical Protection	Lazer Safe laser guards
Safety Stop	Operating mode where the clamp is stopped at the safety height
Stopping distance / overrun	The distance the tools continue to close before coming to a stop when a stop command is issued.
Swing beam	See Bending Apron

13 FoldGuard Specifications

13.1 LZS-004-HS Laser TX & RX

Optical range	15 meters net (distance between windows of the transmitter and receiver)
Object detection resolution	4 mm
Laser classification	CLASS 1 (IEC 60825-1)
Laser dimension	Each laser is approximately 50 mm (W) x 2 mm (H)

13.2 PGS-2 Safety Controller

13.2.1 Power Requirements

Supply voltage	24 VDC \pm 10%
Supply current	1 A max continuous (excluding output load current) 16 A total max continuous

13.2.2 Pulsed Inputs & Outputs

Inputs	(4x) X00 – X03
Input voltage	24 VDC \pm 10%
Input current	15 mA
Voltage on	14 VDC minimum
Voltage off	12 VDC maximum
Delay on	0.02 ms
Delay off	0.02 ms
Isolation	Opto-coupler
Pulsed Outputs	(4x) P00 – P03
Switching voltage	24 VDC \pm 10%
Max switching current	1.6 A
Leakage current	0 mA
Isolation	Opto-coupler
On display	Red LED

13.2.3 Standard Inputs

Inputs	(22x) X04 – X25
Input voltage	24 VDC \pm 10%
Input current	15 mA
Voltage on	14 VDC minimum
Voltage off	12 VDC maximum
Delay on	0.02 ms
Delay off	0.02 ms
Isolation	Opto-coupler
On display	Red LED

13.2.4 Standard Outputs

Outputs	(8x) Y04 – Y11
Switching voltage	24 VDC \pm 10%
Max switching current	6 A peak, 1.6 A continuous
Total max switching current	15 A continuous
Leakage current	0 mA
Delay on	0.11 ms max
Delay off	0.16 ms max
Isolation	Opto-coupler
On display	Red LED

13.2.5 Y00 Enable Relay Output (CN8)

Output contacts	5 x dual N/O
Relay	2 x Schrack Force Guided Relay SR6C V23050-A1024-A551
Max switching voltage	120 VAC
Max switching current	4 A
Min recommended load	5 V, 10 mA
Recommended short circuit protection (Externally mounted, not provided by Lazer Safe)	NEOZED Fuse D01 10A Utilization category gL/gG acc.IEC60269-1; IEC60269-3-1; VDE036-T301
Mechanical endurance	10x10⁶ cycles
Electrical endurance AC15-5A (0.1Hz)	50x10³ cycles
Electrical endurance AC1-8A (0.1Hz)	40x10³ cycles
Electrical endurance DC13-5A (0.1Hz)	100x10³ cycles
Electrical endurance DC1-8A (0.1Hz)	100x10³ cycles

The full manufacturer product specification is available from <http://www.te.com/en/home.html>

13.2.6 Y01 Enable Relay Output (CN7)

Output contacts	2 x N/O
Relay	2 x Schrack Force Guided Relay SR2M V23047-A1024-A511
Max switching voltage	120 VAC
Max switching current	4 A
Min recommended load	5 V, 10 mA
Mechanical endurance	10x10⁶

The full manufacturer product specification is available from <http://www.te.com/en/home.html>

13.2.7 Y02 & Y03 GP Relays (CN7)

Output contacts	1xN/O, 1xN/C (Y02). 1xN/O (Y03)
Relay	Omron G2RL-24
Max switching voltage	120 VAC
Max switching current	4 A
Min recommended load	5 V, 10 mA
Mechanical endurance	20x10⁶

13.2.8 Encoder

Power	5 V DC (1.5 A max)
Encoder inputs	A, B
Resolution	63 μ m

13.2.9 Communications Ports (CN4 & CN9)

COM 1 (CN9, ISaGRAF)	Serial – USB 'B'
COM 2 (CN4, FoldGuard User Interface Panel)	RS232 (TX, RX)

13.2.10 Laser Guarding (CN5, CN6)

Inputs

Input points (laser)	3
Input points (light guard)	2
Input voltage (laser)	5 - 24 VDC \pm 10%
Input voltage (light guard)	24 VDC \pm 10%
Voltage on (laser)	1.5 VDC
Voltage on (light guard)	14 VDC
Voltage off (laser)	1.5 VDC
Voltage off (light guard)	12 VDC
Delay on	0.1 ms
Delay off	0.1 ms
Isolation	Opto-coupler
On display	Red LED

Outputs

Output points (laser)	2
Output points (light guard)	1
Output supply voltage (laser)	5 VDC @ 1 A
Output supply voltage (light guard)	24 VDC @ 1 A
Max switching current (laser)	15 mA
Max switching current (light guard)	1 A @ 30 VDC
Delay on (laser)	0.1 ms
Delay on (light guard)	2 ms
Delay off (laser)	0.1 ms
Delay off (light guard)	3 ms
Isolation (laser)	Opto-coupler
Isolation (light guard)	Relay
On display	Red LED

13.2.11 Functional Safety Data

	<u>EN61508:2010</u>	<u>EN62061</u>
PGS-2	PFH=6.62E-9 1/h; PL e; SIL3 MTTF=high	PFH=5.57E-9 1/h; PL e; SIL3 MTTF=high
PGS-2 + LZS-004/ LZS-LG	PFH=7.37E-9 1/h; PL e; SIL3 MTTF=high	PFH = 6.53E-9 1/h; PL e; SIL3 MTTF = high

13.2.12 System Reaction Time

(Total system reaction time from input to OSSD - see Note 1:)

Optical obstruction (PGS-2 + LZS-004/ LZS-LG)	11 ms
Standard input to OSSD	2.6 ms
Pulsed input to OSSD	7.6 ms
Over-speed to OSSD (see Note 2)	$T_s + 2 \text{ ms}$

Note 1: For detailed performance or testing information please contact Lazer Safe Customer Support customerservice@lazersafe.com.

Note 2: The over-speed calculation is performed over two consecutive 2 mm sampling distances. T_s is the time taken for the tool to travel 4 mm.

14 Declaration of Conformity



Lazer Safe Original Declaration of Conformity

EC Declaration of Conformity

<i>The undersigned, representing the manufacturer</i>	Lazer Safe Pty Ltd 27 Action road Malaga, WA 6090 - AUSTRALIA
<i>and the authorised representative, established within Community, authorised to compile the technical file</i>	REM Software & Automation s.r.l. Via M.Fanti 216 41100 Modena, Italy
<i>Herewith declare that the Product</i>	PGS-2
<i>Product identification (part number)</i>	Sw. Ver. Ax 2.17.00
<i>Reference the attached list of product modules</i>	Planar laser sender and receiver: LZS004 and LZS-LG
<i>Serial Number</i>	1801001 - 2312999



Product Safety Functions

PGS-2 provides press brake control, safety and operator guarding. Optical protection, stopping performance, overrun monitor, valve monitor, speed monitor, emergency stop.

are in conformity with the provisions of the following EC Directives when installed in accordance with the installation instructions, contained in the product documentation:

2006/42/EC	Machinery Directive
2014/30/EU	EMC Directive

And that the standards and/or technical specifications referenced below have been applied:

EN 61496-1:2013	Safety of Machinery – Electro-sensitive Protective equipment. General and Particular requirements
IEC 61496:2012	Safety of Machinery – Electro-sensitive Protective equipment. General and Particular requirements
EN 61496-2:2013; IEC 61496-2:2013	Safety of Machinery – Electro-sensitive Protective equipment. General and Particular requirements
EN 12622:2009+A1:2013, section 5.1.1.5	Machine tools safety – Hydraulic Press Brakes
EN 61508:2010	Functional Safety of Electrical/electronic programmable electronic safety related systems
EN60204-1:2006	Safety of Machinery-Safety related parts of control systems Part 1: General requirements
EN ISO 13849-1:2015	Safety of Machinery-Safety related parts of control systems Part 1: General principles for design
EN 62061:2005+A1:2013	Safety of machinery—Functional safety of safety-related electrical, electronic and programmable electronic control systems

Conformance of a type sample belonging to the above-mentioned product family with the regulations from the EC machine directive has been certified by:

TÜV NORD CERT GmbH, Langemarckstr. 20,
D-45141 Essen

Certification Body Machinery
Notified body 0044

Certificate Number: 44 205 13 099727

Signature:

Name, position: Rob Appleyard, Managing Director

Manufacturer:

Lazer Safe Pty Ltd
27 Action road,
Malaga, WA 6090
AUSTRALIA

Place and Date: Perth, Australia, 22/12/2017