USER MANUAL

LC-CABIN V2

MANUFACTURER:

LASERCOMERCIAL ENTERPRISE

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LC Lasers

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CONTENT

CHAPTER 1 – SUMMARY

1.1 INTRODUCTION

LC Lasers presents LC-CABIN, the cabin model for a safe laser working area.

The LC Lasers laser cabin has been tried and tested with special attention to simple assembly and safety. By following the safety regulations, this user guide and applying proper safety practices when working with lasers, LC-CABIN is a safe cabin for laser work.

1.2 REFERENCES

The following standards and directives have been taken into account in the preparation of this manual and can be consulted for a better understanding of the contents:

- 98/37/EC, Machinery Directive.

- 2006/95/EC, Low Voltage Directive.

- 2004/108/EC, EMC Directive.

- EN ISO 13849-1, Safety of laser products Part 4.

- EN 61010-1, Safety requirements for electrical equipment.

- Document IEC TR 60825-14:2022, Safety of laser products.

- UNE-EN60825-1:2015

CHAPTER 2 – SECURITY AND FEATURES

2.1 EQUIPMENT SUITABLE FOR LC-CABIN

LC CABIN is suitable for safe operation of the following laser equipment:

1. **LC WELD PRO 1500W.**

Main	
Model	LC-WELD PRO
Product reference	LC-SL1500W-PRO
Power consumption	<5500 W
Voltage	220-240VAC
Power Stability (2 Hours)	<1,5%
Power Stability (24 Hours)	<2%
Approx. dimensions	450x720x1100 mm (Behind the bottle holder 500mm)
Weight Approx.	<150kg
Hose Length	8m aprox.

Laser Data	
Model	L1500W-V5.1
Product reference	L1500W-V5.1-50µm
Laser Power	≤1500W
Laser Type	CW HPP
Power consumption	<3800W
Voltage	220-240VAC | 50 Hz
Maximum Power Consumption	20 A
Wavelength	1070nm ±10
Power instability	<2,5%
Power range	1-100%
Frequency range	<50 kHz
Laser Efficiency	42%
Start-up time	10 µs
Connection type	QBH

Fibre length	10m
Output fibre diameter	50 µm
Weight	20kg
Dimensions	435x339x100mm
Ambient Temperature	5~40℃
Ambient humidity	10-90%
Cooling requirement	2,2kW Q
Cooling method	Water cooling
QBH cooling water temperature	Ambient temperature (non-condensing)
Cooling water temperature	24-26℃
Cooling water flow rate	30 L/min
Storage temperature	-10-50℃
Laser Class	4 (IEC 60825-1)
Pointer power	1mW
Pointer Class	2M (IEC 60825-1)

2. LC WELD SMART

Main

Model	LC-WELD SMART
Product reference	LC-SL1500W-SMART
Power consumption	<4200W
Voltage	220-240VAC
Power Stability (2 Hours)	<2%
Power Stability (24 Hours)	<3.5%
Approx. dimensions	400x640x950 mm
Weight Approx.	<80kg
Hose Length	8m aprox.

Laser data

Model	LG1500W-V3.17
Product reference	LG1500W-V3.17-25µm
Laser Power	≤1500W
Laser Type	CW HPP
Power consumption	<3800W
Voltage	220-240VAC | 50 Hz
Maximum Power Consumption	20 A
Wavelength	1070nm ±10

Power instability	<3,5%
Power range	1-100%
Frequency range	<20 kHz
Laser Efficiency	36%
Start-up time	10 µs
Connection type	QBH
Fibre length	10m
Output fibre diameter	25 µm
Weight	40 kg
Dimensions	560x339x423mm
Ambient Temperature	5~40℃
Ambient humidity	10-90%
Cooling requirement	No
Cooling method	Gas-cooled
QBH cooling water temperature	Ambient temperature (without condensation)
Storage temperature	-10-50℃
Laser Class	4 (IEC 60825-1)
Pointer power	1mW
Pointer Class	2M (IEC 60825-1)

3. LC WELD NEO

Major

Model	LC-WELD NEO 3.0	LC-WELD NEO 4.0
Product reference	LC-SL-NEO800W	LC-SL-NEO1200W
Electricity consumption	<3000 W	<5000 W
Voltage	230VAC	
Power stability (2 hours)	<1.5%	
Power stability (24 hours)	<2%	
Dimensions approx.	440x690x430 mm	
Approx. weight	<40kg	
Hose length	<6m	

Laser data

Model	L800W-V.1-A	L1200W-V.1-A
Product reference	SL-L800W-V.1-A	SL-L1200W-V.1-A
Laser power	800W	1200W

Consumption	<2800W	<4800W
Laser type	Continuous Fiber Laser	
Wavelength	1064nm	
Power range	1-100%	
Frequency range	1-10kHz	
Gun connection type	RBH	
Fiber length	7 m	
Output fiber diameter	20 μm	
Anti-glare protection	Yeah	
Weight	27 kg	
Dimensions	404x406x160 mm	
Working temperature	0~40℃	
Ambient humidity	10-90%	
Refrigeration system	Air cooling	
Storage temperature	-10-60℃	
Laser Class	4 (IEC 60825-1)	
Pointer power	1mW	
Pointer class	2M (IEC 60825-1)	

2.2 ESTABLISHMENT OF A CONTROLLED LASER ZONE

In many jurisdictions, laser safety regulations require the appointment of a laser safety officer (LSO) in each company or institution with laser equipment.

The employer is primarily responsible for compliance and enforcement of laser safety standards, but may delegate responsibilities or tasks. The key points in establishing the controlled laser area are the determination of the maximum foreseeable irradiance to which personnel may be exposed and then the design of PPE and shielding of the laser area.

Suitable enclosures must be used to ensure a safe working area for the laser. This includes, among other things, laser safety signs, interlocks, adequate warning devices and training/safety procedures. Do not operate with the output welding head at eye level. **This safe working area is the LC-CABIN**.

Although not mandatory in our jurisdiction, it is advisable to assign a laser safety officer.

- The laser safety officer, in conjunction with the equipment dealer, can work to establish the laser controlled area to protect all persons who may be in the vicinity of the operating laser equipment.

- Use the laser only in a controlled laser area with controlled access.

- A recommended option is to have administrative controls, i.e. to have a record of persons entering and leaving the laser controlled area, as well as all persons who have been trained to work with lasers.

- It must be ensured that the laser is in a controlled area where the beam cannot escape either expressly or by accident. Any barrier used in the LACZ must be made of a laser-resistant material that can withstand both direct and diffuse beams.

In the EU: see EN 60825-4.

- Outside the controlled laser area, there must be appropriate signs indicating when laser work is in progress. In addition, there must be appropriate warning and danger signs, informing of potential hazards. En la UE, el marcado de la zona láser es obligatorio según la norma EN 60825-1.

- Restrict access to the LACZ to only those persons who are trained in laser safety while operating the hand-held laser device.

Post a sign with the names of all persons authorised to work within the laser working area.

2.2.1 SAFE WORKING SPACE: CONTROLLED LASER ZONE

This room may consist of a room or an area enclosed by fixed or movable partitions (cabin, protective enclosure, etc.). It is considered to be an area with access reserved for personnel authorized by the person in charge of the unit.

- A movable wall or partition is an integral part of the means of prevention and should only be moved for planned operations with compensatory measures if necessary.

- A laser device may be installed in a box acting as collective protective equipment.

Safe working areas must be demarcated. Depending on the risk assessment carried out, one or a combination of the following options shall be chosen:

1. install the laser equipment inside a controlled area, i.e. an enclosure with fixed walls and ceiling and access door with safety switches to prevent access by third parties or unauthorized persons. Access shall be restricted to authorised personnel. In addition, a light signal external to the area may be used to indicate when laser work is in progress.

2. Use workstation partitions to protect other workers from direct and indirect laser light radiation. The material of these screens must comply with the following characteristics:

- These partitions must have a minimum height of 2 meters.
- Said area must be closed in such a way that no laser or light emission is produced to the outside.

- It must be a well-ventilated area with an extractor smoke system if necessary.
- One of these partitions will act as a door, so it has to be mobile, without losing the tightness of the whole.
- It is not necessary to close the roof, as long as we do not have other people working in an area or higher level with direct contact with the laser welding equipment.
- The material of said screens can be:
    - 2mm aluminum (preferably) or 1.5 mm aluminum.
    - 2 mm carbon steel.
    - Aluminum and rock wool sandwich panel.

- It is advisable to paint these partitions black, to avoid reflection of the material itself.
- It is recommended that the minimum work space be 3 x 3 meters.
- On the outside it must be indicated that laser work is being done inside, with the corresponding safety signs.
- Access to unauthorized persons must be prohibited. It is recommended to control the people who have access to the controlled laser area.

The characteristics of this delimited area are essential to have a safe work space once the dangers and risks exposed above are known.

DANGER

Under no circumstances can a person without the corresponding safety PPE enter the work area.

Regardless of the solution adopted, the use of approved laser protection glasses is mandatory for the operator who handles the laser welding equipment.

Other recommended security measures:

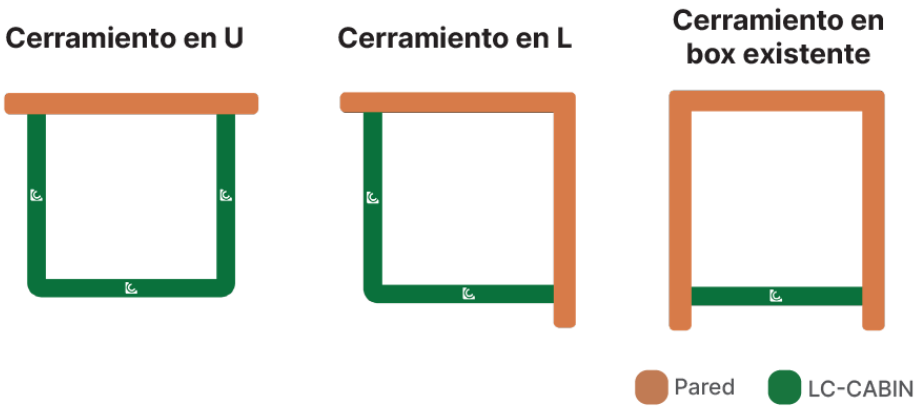
- System for light signals outside the enclosure, to know if the laser is emitting or not.
- Power cut system in case of accidental opening of the door, with the consequent interruption of the laser emission.
- Acoustic warning to know when a person wants to enter the premises and to be able to control the emission of the laser from inside.

It is mandatory to work in a controlled area to work safely. Under no circumstances will there be any unauthorized person inside the welding area.

Regarding the location of the weld gap:

- In a space without walls, with an enclosure of 4 partitions in the shape of a square or rectangle.
- In a space with a wall, with an enclosure of 3 U-shaped partitions, taking advantage of the wall.
- In a space with two walls, with an enclosure of 2 L-shaped partitions, taking advantage of the two walls.

Examples of enclosures for a laser safety area with LC-CABIN:



Example of LC-CABIN enclosure with traffic light on the outside:

⚠	**DANGER**	**The configuration of the controlled area and the position of the mobile partitions will be determined by the results of the risk assessment carried out before putting the equipment into operation.**

It is recommended that the CABINS have good lighting to carry out tasks with the laser. In general, a minimum illumination of between 100-200 lux should be provided for interventions without high visual requirements and from 300-500 lux if there are medium visual requirements such as precision work or adjustment, more lux if high visual requirements are required.

The inclination of the ground will have to be a maximum of 7% to guarantee the stability of the equipment. In any case, it is recommended to work on completely flat ground, without irregularities or slope.

In no case, place the equipment on top of other objects, such as pallets, tables, elevators, etc.

2.2.2 LASER SAFETY OFFICER (LSO)

In some jurisdictions it is mandatory to establish a laser safety officer, although it is not mandatory in some countries, it is always recommended. The person in charge of laser safety (RSL) of the workplace will have to identify the maximum exposure allowed and the danger distances to determine what PPE, guards and other safety procedures are necessary to be able to safely operate the product within the controlled laser area. (ZLC). The person in charge can also establish administrative controls and access restrictions to the area where the laser equipment is worked.

2.3 CERTIFICATION

LC-CABIN is certified with PEL ratings.

PEL (T3) 10s

The EN ISO 13849-1 standard is based on probability data to determine and evaluate the control systems related to the safety of a piece of equipment. The probability or average of a dangerous failure per hour is determined.

To calculate the PL level (measure of reliability in terms of safety) it is classified into 5 levels (from A to E, with “a” being low danger and “e” being high danger). This measure takes into account the following parameters:

- Structure of the system, categories B, 1-4.
- Mean time to dangerous failure (MTTFd)
- System Diagnostic (DC) coverage
- Common Cause Failure (CCF)

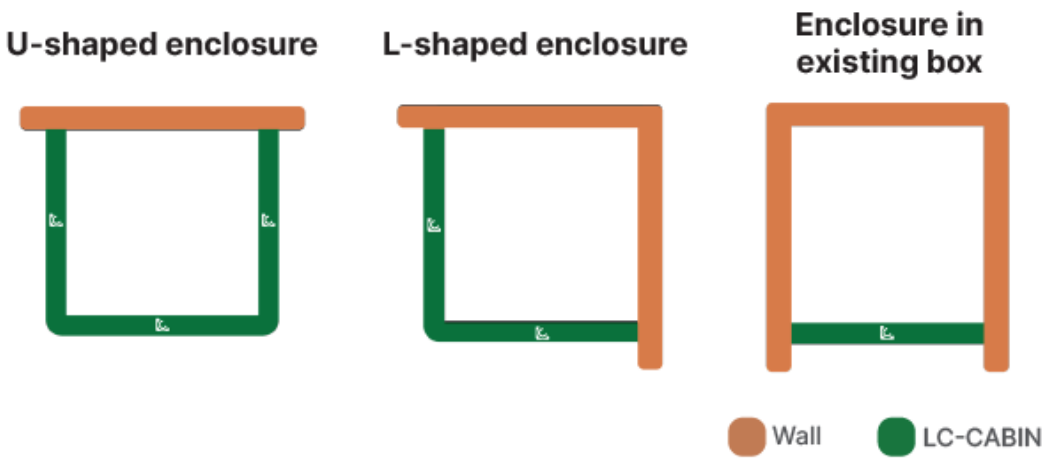
Based on these data, the required Performance Level (PLr) is determined. This data is based on the severity of the damage, the frequency or time of exposure to the hazard, the probability of avoiding or limiting the hazard.

The electrical section of the cabin (LC-SAFETY) corresponds to a level of PLd, with respect to Class 4 laser equipment.

2.4 CHARACTERISTICS OF LC-CABIN

LC-CABIN is specifically designed to follow the safety regulations necessary to form a safe laser work area specified in the previous point.

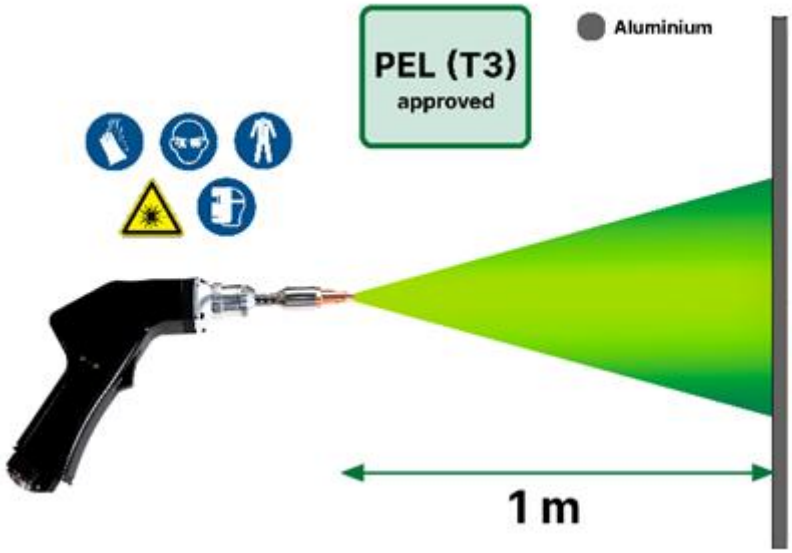
The main characteristic of LC-CABIN is that it is adaptable and modular to the client's needs, based on a design of panels that can be adapted to 3x3, 4x4 cabins or the desired design. In this way, the client's facilities can be used to form a secure area, for example:



Example of LC-CABIN output:

2.4.1 MATERIAL

The walls of LC-CABIN are made of 2-millimeter aluminum sheet (the panels) and the pillars are made of 3-millimeter iron.



2.5 LC-CABIN COMPONENTS

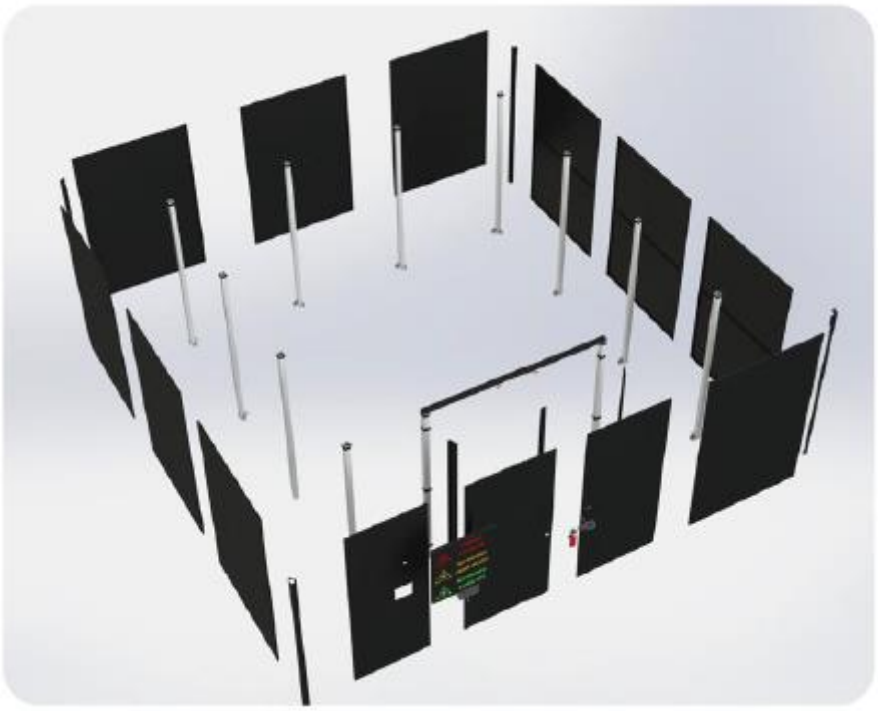
LC-CABIN can include the following components:

- Light warning. Light traffic light that reproduces laser emission notices outside.
- Panels 1500 mm wide and 2200mm. Depending on the customer's needs, different numbers of panels will be required to form the LC-CABIN.
- Security labels. Labels that inform the user of the risks and obligations, complying with the European standard EN60825.
- Pushbutton. Call button that emits an acoustic signal to warn of users entering the controlled laser zone.
- Doors. Cabin access doors with security sensors for possible accidental opening.
- Door sensor. Sensor to avoid unexpected entrances inside the cabin with a reset system in case of opening with the equipment on emission.
- Glass. It is possible to include certified laser protection windows to be able to view the interior of the cabin from the outside. There are different sizes: Glass A4, A3, A2, A1.
- LC SAFETY. LC Safety is the security system designed by LC Lasers to efficiently connect the laser equipment with the cabin. This system includes some elements previously explained, they are:
    - LC-Control.
    - Traffic light.
    - Door sensor.
    - Acoustic signal.

- Laser emission cutting.
- Manual reset.
- Safety relay.

2.5.1 CABIN PANELS

LC CABIN is adaptable to the client's workplace. In this way, we can guarantee to form a safe laser area according to the needs and available space of the client.



2.5.2 DOORS

Each door measures 1x2.2m. The double door is 2m wide in total.

2.5.3 TRAFFIC LIGHT – LIGHT WARNING

The LC CABIN system offers the possibility of including a traffic light outside the cabin to warn when a laser is being emitted and of imminent dangers in the event of opening doors.

- **LASER IN EMISSION.** If the laser is emitting, the light warning will be red, specifying 'DANGER: LASER ON'.
- **EQUIPMENT PREPARED FOR WELDING.** In this case, the traffic light will mark 'NO HAZARD: LASER READY', indicating that at any moment the laser is ready to start emitting, but it is not doing so at this moment. This signal is activated when the equipment is in the welding screen to start working.
- **EQUIPMENT STOPPED OR IN OTHER SCREENS.** The traffic light will mark 'NO HAZARD: LASER OFF' when the equipment is stopped or in other screens that are not the welding screen.

2.5.4 DOOR SENSOR

The LC-CABIN system includes a door sensor to ensure safety in case of unexpected door opening. If the door is opened while the laser is emitting, it will automatically stop emitting and it will have to be activated again by means of a reset system. This ensures safety in case the door is opened when the equipment is running.

Component type	Coded magnetic switch
Contact types and composition	2NC
Number of poles	2
Approach directions	3 directions
Rated operational voltage	24V DC
Rated insulation voltage	100V DC
Security level	Can reach category 4 with the right monitoring system and correctly wired according to EN/ISO 13849-1 Can achieve PL = e with appropriate monitoring system and correctly wired according to EN/ISO 13849-1 Can reach SIL 3 with the appropriate monitoring system and correctly wired according to EN/IEC 61508

2.5.5 SAFETY LABELS

Different types of safety signs must be placed in the cabin to warn of the risks of working with lasers and the obligation to wear the necessary EPIS inside the cabin.

The UNE-EN 60825-1 standard requires that each laser product must carry labels to warn about the class, characteristics and dangers of exposure to laser radiation generated by

the specific product, in this case, apart from existing labels present on the laser equipment, there are also labels present in the cabin. Below are the possible labels that must be placed on the outside of the cabin and their meaning:

	**Laser radiation hazard label. It can be found alone or combined with other symbols.** Pictogram according to the standard EN 60825-1 Indication, marking and maneuver, and in the technical report TR 60825-14.
	RESTRICTED ACCESS TO AUTHORIZED PERSONNEL Access prohibited to personnel not trained or authorized to be present in the controlled laser area.
	SAFETY GLASSES. Mandatory eye protection. Pictogram according to standard EN 61310 Indication, marking and operation. Part 1: Specifications for visual, audible and tactile signals, Part 7.
	GLOVES. Mandatory hand protection against burns. Pictogram according to standard EN 61310 Indication, marking and operation. Part 1: Specifications for visual, audible and tactile signals, Part 7.
	FACIAL SCREENS. Mandatory face protection. Pictogram according to standard EN 61310 Indication, marking and operation. Part 1: Specifications for visual, audible and tactile signals, Part 7.
	WARNING! RISK OF LASER RADIATION Work with the laser machine must be carried out exclusively by qualified personnel authorized by the company and in compliance with safety regulations. Pictogram according to the specific standard on laser radiation EN 60825-1.

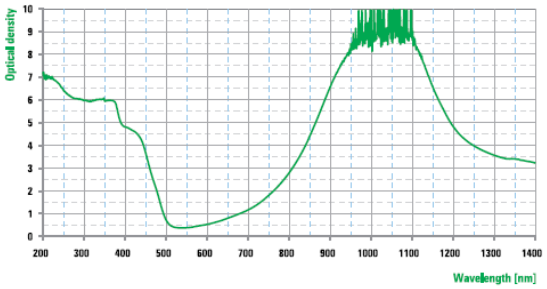
2.5.6 GLASS WINDOW

Optionally, some windows can be incorporated into the LC CABIN. These windows must necessarily have laser protection, just like the protective glasses worn by the people inside the cabin.

According to the characteristics of the source integrated in the laser welding equipment and the measurements studied, the minimum **level of protection required is DLB6 at the wavelength of 1060-1070 nm.**

The characteristics of the windows offered by LC LASERS are the following:

Filter	Full protection
Colour	Green
Material	Acrylic
Thickness	3.0 mm
VLT	31%
Aiming beam wavelength T%(λ) >10%	500-670 nm



Wavelength		OD	EN12254	EN207
190	315	7	D AB7 IR AB3	D LB7 IR LB4
315	380	5	DIR AB5	D LB4 IR LB5
840	1250	4	-	DIRM LB4
870	1190	5	DIRM AB5	DIRM LB5
890	1160	6	D AB5 IRM AB6	DIR LB6 M LB6Y
915	1140	7	D AB5 IR AB7 M AB7Y	D LB6 IR LB7 M LB7Y
945	1120	8	D AB5 I AB8 R AB7 M AB8Y	D LB6 IR LB8 M LB8Y

These windows are available in different sizes:

- DIN A4 (297x210mm)
- DIN A3 (297x420mm)
- DIN A2 (420x594mm)
- DIN A1 (594x841mm)

During the assembly of the cabin, the user must make sure that the windows are well glued and installed and do not let the laser light through some kind of gap.

2.5.7 BUTTON

Acoustic warning for the outside of the cabin. Through the button located on the outside of the cabin, an acoustic warning is emitted to warn before entering the cabin so that the appropriate security measures are taken.

2.5.8 CIERRE DE SEGURIDAD

The door allows for a security locking system with the following standards:

Standards
DIN EN 60947-5-1
UL 508 18th Edition, CSA-C22.2 No.14-18
GS-ET-19 (DGUV)
DIN EN ISO 14119
DIN EN ISO 13849-1

2.6 LC CABIN Y RIESGOS DEL EQUIPO LÁSER

When working with Class 4 laser equipment, there are a series of risks and dangers that should be analyzed prior to work. These risks and analyzes must be specified in the laser equipment user manual. The aim of LC CABIN is to provide a real solution to minimize and eliminate these risks for the user and form a controlled laser work area.

2.6.1 EYE HAZARD

NEVER look directly into a laser opening (such as the output fiber, or weld head) while the unit is on. The operator must turn off the equipment and disconnect the power to perform any maintenance action that involves the fiber cable or the fiber output head.

It is mandatory to always use the specific laser safety glasses for the laser equipment used.

Every person inside the controlled laser area must wear the mandatory and necessary EPIS. Make sure that all Personal Protective Equipment (PPE) is suitable for the power output and wavelength range listed on the laser safety labels affixed to the product.

LC CABIN is a safe cabin to form the controlled and safe laser work area, it protects the users who are outside the cabin.

- NEVER look directly into the output port when power is supplied to the laser.

- Avoid placing the laser and all optical components at eye level.

- Avoid using the laser in a dark environment.

- Use closed rooms for the laser beam.

- Always turn the key to the "OFF" position when working with the output (for example, when mounting the laser head to a device, etc.).

As an added precaution, disconnect power to the equipment.

Highly reflective metals, such as aluminum and copper, may cause some of the beam energy to be reflected back at the weld site and require additional precautions.

- Specular reflections can also pose a hazard to the operator if any part of the beam is reflected from various surfaces.

- Take precautions to understand the expected cone of specular reflection for each part processed and do not attempt to view the part or place any part of the body within the expected cone of specular reflection.

Operators and observers must also be aware of reflections at all times. More reflections are likely to occur if the laser parameters are not set correctly to achieve fusion of the target part.

2.6.2 DANGER TO SKIN

Welding and Cleaning Process - UV Radiation

Skin damage from exposure to UV radiation produced during the welding (or cleaning) process.

Precautions:

- **It is mandatory to wear the corresponding EPIS while using the equipment.**
- Required PPE includes: (1) welding shield over specified laser safety goggles, (2) flame, heat, and arc resistant gloves, (3) heavy-duty clothing suitable for welding.

DANGER

Welding Process – High Temperature

Severe skin burn from contact with a hot surface or from exposure to thermal radiation or hot particles.

Precautions:

- **The corresponding PPE must be worn during welding operations.**
- **Required PPE includes: (1) welding shield over specified laser safety goggles, (2) flame, heat, and arc resistant gloves, (3) heavy-duty clothing suitable for welding.**
- Avoid touching the weldment or the tip of the welding head nozzle or tube, with bare skin, immediately and shortly after laser emission.

Exposure to ultraviolet light can cause skin burns (similar to sunburn) and this can increase the user's risk of skin cancer and accelerate skin aging.

Depending on the intensity of the infrared light, skin lesions can include thermal burns or excessive drying of the skin.

Sparks generated during the welding process can also cause burns.

The same process of laser welding transfers a significant amount of energy and heat onto a material. Parts worked with laser equipment can be hot even after the job is complete. Likewise, the nozzle, tube, and other parts of the laser gun may be hot during use. Make sure to use the PPE indicated to protect yourself from burns, such as gloves and appropriate clothing.

It is essential to take precautions to avoid skin damage by using the clothing indicated for work with laser welding equipment, resistant to fire, heat and electric arc. The clothing must be sufficiently resistant to UV radiation.

During the laser welding process, different risks linked to working with materials with different characteristics can occur. The laser reacts with the material and can generate vapors, fumes, sparks and different particles. These fumes and particles can pose a hazard. It is relevant that LC CABIN has an extraction system in case of working with materials that generate a significant amount of smoke.

PELIGRO

Welding Process – Fumes and Particles

Damage to body tissues or organs from exposure to fumes and other by-products generated by the welding process.

Precautions:

- The user must take measurements based on the material of the part to be welded. During welding, keep your head away from the fumes.
- Always weld in an area with adequate ventilation.
- Hazardous and toxic fumes, vapors and particles must be captured and expelled from the work area using an extraction system.
- Make sure the work surface is well ventilated. The opening of the collection unit should be located as close as possible to the process area.
- PPE (respiratory protection) must be used if the hazardous substances released cannot be extracted near the process.

It is advisable to use a fume and vapor extraction system, duly located near the welding area or LC CABIN, and it must evacuate said fumes and vapors outside the work area, ensuring clean air renewal.

If the material to be welded generates a lot of fumes due to its composition (galvanized, aluminized or other treatments), it will be mandatory to incorporate a smoke and vapor extraction system or, failing that, respiratory protection equipment with air supply.

The fumes generated by the welding process may have components that are harmful to health. It can negatively affect the lungs, heart, and central nervous system.

When the laser interacts with target materials such as plastics, metals, or composites, the target material can begin to vaporize. The fumes and mists are often unseen, but they are highly toxic and pose a serious health hazard.

UV emissions that occur during the welding process can react with oxygen and nitrogen in the air to form ozone and nitrogen oxides which, in high concentrations, can be deadly.

DANGER

Asphyxiation hazard in poorly ventilated confined spaces

Gases used in the welding process itself such as argon or nitrogen can accumulate in the environment.

	Dangerous concentrations of toxic fumes and gases can build up very quickly and cause unconsciousness and death by suffocation. **Precautions:** **- Perform a routine air check to determine the levels of hazardous fumes in the area where the laser equipment is being worked on.** - In confined spaces and other circumstances, the use of a respirator may also be necessary.
	**Cotton safety clothing that completely covers the operator's arms and torso is recommended to provide adequate skin protection. The welder must wear protective glasses and face shields. As well as special welding gloves (TIG type gloves are recommended), which in addition to protecting from radiation, protect against micro projections from the welding process.**

2.6.4 GAS BOTTLE SAFETY

The laser welding equipment requires gas to perform a good finish on the welds, as in other techniques and methods of joining metals by fusion.

The placement and arrangement of the gas bottles within the LC CABIN must be taken into account.

The cylinders can explode or be damaged if they are placed incorrectly or near the welding area, which can cause accidents and property damage. The fall or tipping of the bottle can also cause damage and accidents.

Precautions:

- The cylinders must be placed in such a way that they remain protected and located in such a way that they cannot be hit.
- The cylinders must be away from sparks, sources of heat or possible flames, as well as the deflection of the laser beam.
- The cylinder must be stored in an upright position and secured to a fixed support.

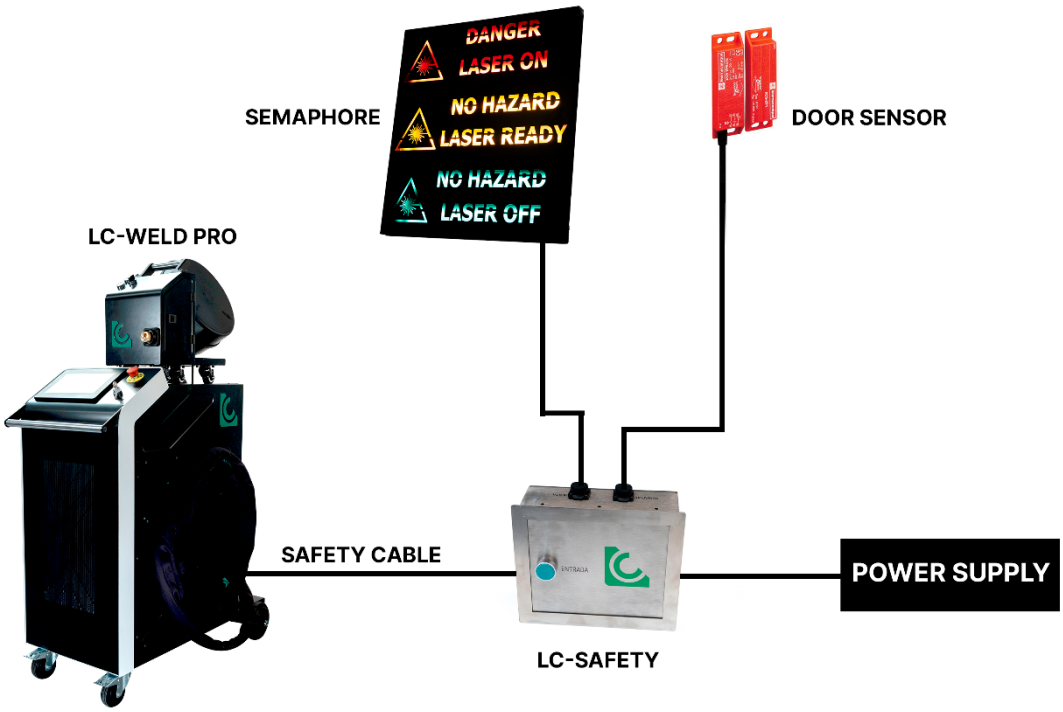
It is necessary to have working regulators in good condition that are suitable for the gas and pressure required. All hoses and couplings must also be suitable for the application and kept in good working order.

CHAPTER 3 – LASER EQUIPMENT CONNECTION WITH LC CABIN

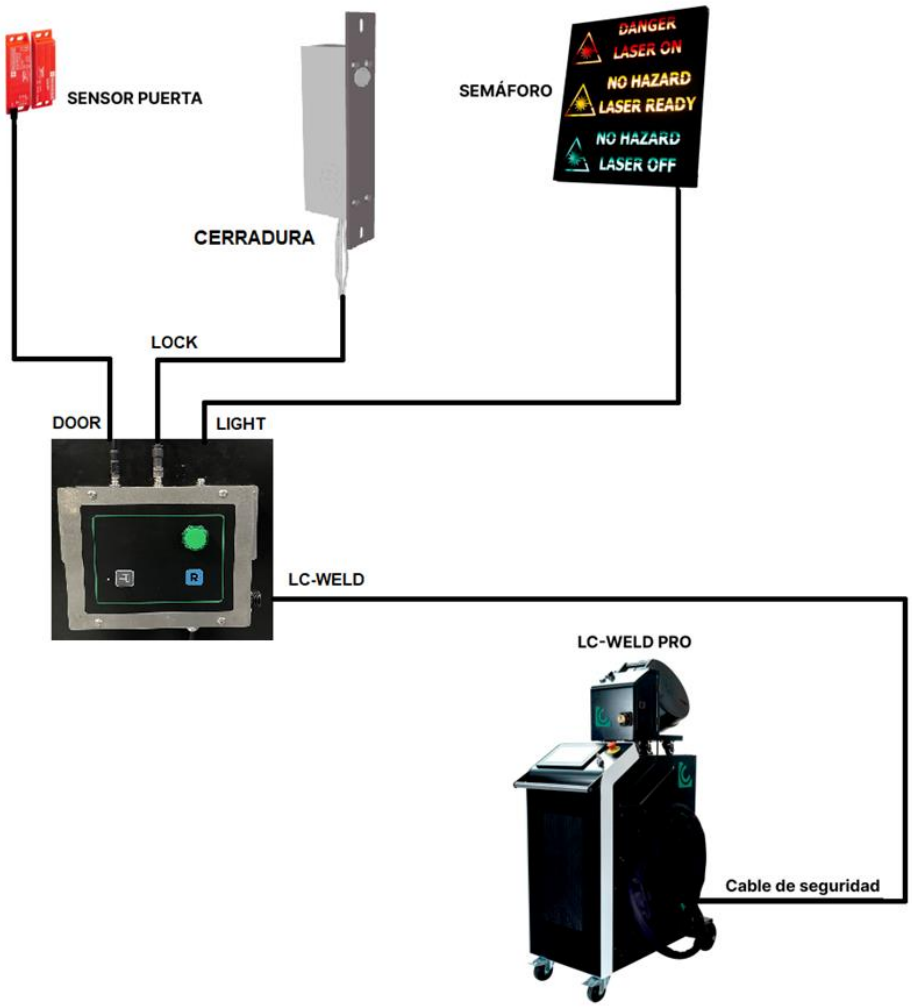
The LC SAFETY system is LC Lasers' own system to connect the LC WELD PRO equipment to an LC CABIN. LC SAFETY offers a safe and simple connection between the laser welding equipment, the external traffic light and the cabin door sensor to avoid unexpected openings with the active laser. The LC CABIN cabin offers to form a laser safety zone to work safely with the equipment.

The following diagram summarizes the connection between the LC WELD PRO equipment and the LC CABIN through the LC SAFETY system:

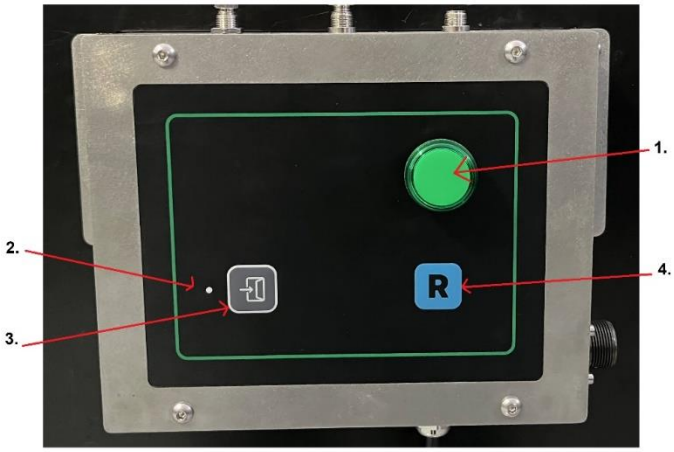
(a) Standard LC-SAFETY:



(b) LC-SAFETY with LOCK-DOOR type closure:

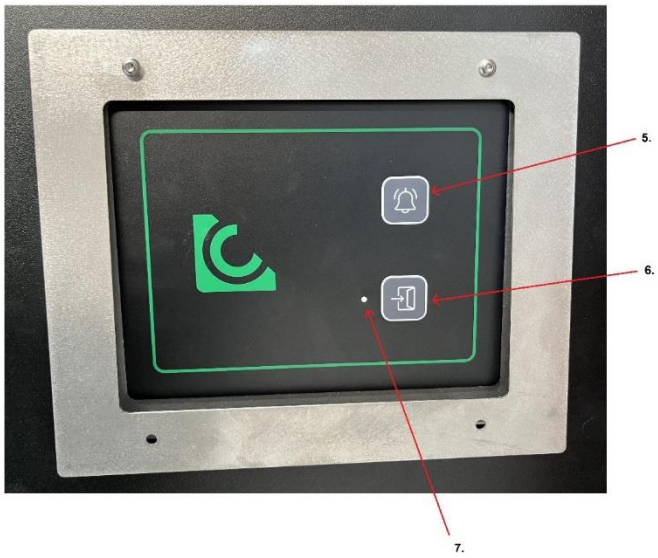


Detail of the indication and control elements inside the cabin:



1. Interlock status indicator.
2. Door unlock indicator.
    a. Flashing indicates delay in unlocking the door.
    b. Permanent light indicates unlocked door.
3. Door unlock button.
4. Interlock reset button.

Detail of the indication and control elements outside the cabin



5. Sound warning button.
6. Door unlock button.
7. Door unlock indicator.
    a. Flashing indicates delay in unlocking the door.
    b. Permanent light indicates unlocked door.

CHAPTER 4 – OPERATION OF THE CONTROL SYSTEM

4.1 OPERATING CONDITIONS

For the correct operation of the cabin security system, it must be ensured that::

- The cabin control is connected to the welding machine.
- Door sensors are properly aligned when the door is closed.
- The Laser welding machine is active.

DANGER

Under no circumstances can a person without the corresponding safety PPE enter the work area.

The PPE must be found next to the cabin access area.

Regardless of the solution adopted, the use of approved laser protection glasses is mandatory for the operator who handles the laser welding equipment.

4.2 ACCESS SEQUENCE TO THE INTERIOR OF THE CABIN

The access sequence and the elements to take into account for the two variants of LC-SAFETY are detailed below.

(a) LC-SAFETY standard model:

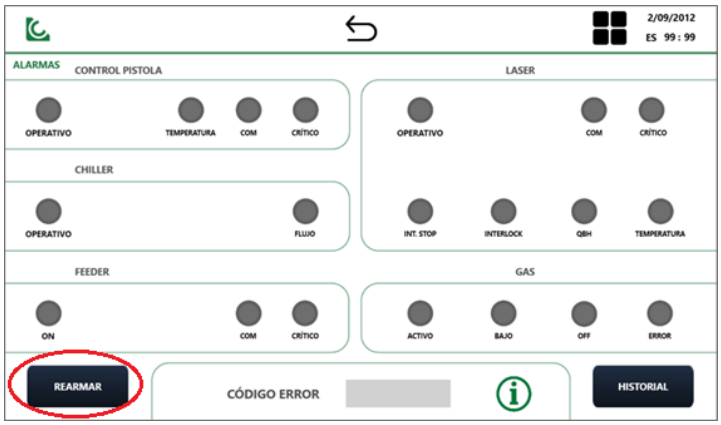
1. It is recommended to press the audible alert to alert the possible operator of access inside the cabin.

2. When opening the cabin door, the safety control immediately deactivates the emission of the laser beam through the Interlock signal.

3. To be able to work the welding equipment* again, close the cabin door and press the “RESET” button.

4. The Indicator Light will remain illuminated if the access door is closed and the system has been successfully rearmed.

*If at the time of access (deactivation of the Interlock signal) the welding machine is emitting laser or on the welding screen, the Interlock alarm will appear on the screen. To reactivate the machine it is necessary to press the RESET button that appears on the alarm screen.



(a) LC-SAFETY model with LOCK-DOOR type closure:

1. The access door is locked by default when the door is closed.

2. It is recommended to press the audible alert to alert the possible operator of access inside the cabin. Button nº 5

3. To access inside the cabin, it is necessary to press button number 6

4. The security control immediately deactivates the emission of the laser beam using the Interlock signal.

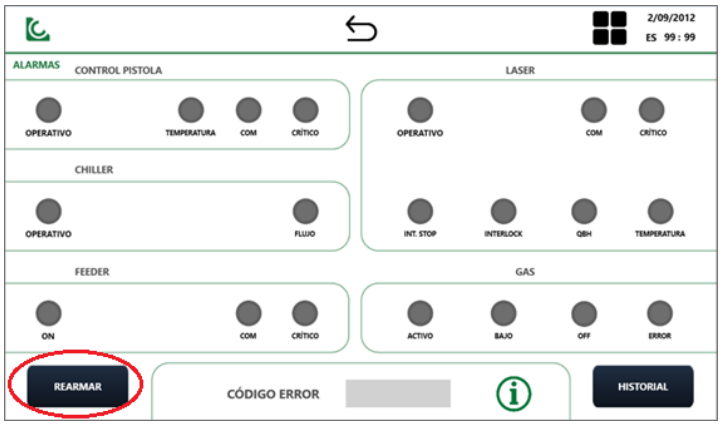
5. A 3-second delay begins to unlock the cabin door. During this time, indicator light number 7 flashes.

6. After 3 seconds the door unlocks allowing access and the light indicator turns on statically.

7. The Door locks again after 5 Seconds. At this moment, indicator No. 7 goes off and the interlock signal can be reset using Reset button No. 4.

8. Indicator Light #1 will remain illuminated if the access door is closed and the system has been successfully rearmed*.

*If at the time of access (deactivation of the Interlock signal) the welding machine is emitting laser or on the welding screen, the Interlock alarm will appear on the screen. To reactivate the machine it is necessary to press the RESET button that appears on the alarm screen.



4.3 POSSIBLE OPERATIONAL FAULTS

Cases of possible malfunctions:

- The green indicator light (1) does not remain active. It is activated only when the RESET button (4) is pressed.

Recommended actions:

a) Make sure the door is closed and the door sensors are correctly aligned. This problem may be due to a failure in the door sensor detection.
b) The machine must be turned on and correctly connected to the cabin safety control.

For technical assistance, contact your official LC LASERS distributor. Our team is here to answer your questions and provide you with the assistance you need to keep your LC-SAFETY system running smoothly.