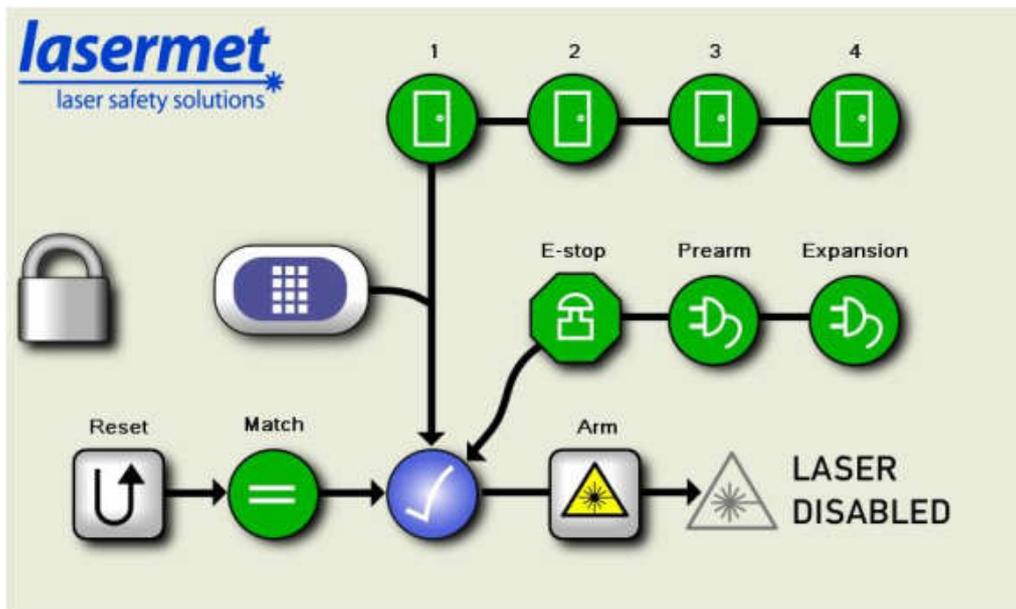


LASERMET ICS-TOUCH and ICS-6-SP Control Unit

INSTRUCTION MANUAL



INTERLOCK CONTROL SYSTEM WITH SURGEON'S PANEL

LASERMET ICS-TOUCH

Instruction Manual

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1 Declaration of Conformity



LASERMET LIMITED

**ICS-6-SP Interlock Control Panel
Drawing no. 01982-00-000**

DECLARATION OF CONFORMITY

This is to certify that the ICS-6-SP Control Unit designated by Lasernet Drawing Number 01982-00-000 has been tested in accordance with the following directives and standards and found to comply.

Lasernet certifies that this product complies with the basic requirements for health and safety as provided by the following directives and standards:

Directives: Machinery Directive 2006/42/EC June 2010
Low Voltage Directive 2014/35/EU
EMC Directive 2014/30/EU

Standards: EN ISO 13849-1:2015
Safety of Machinery – Safety-related parts of Control Systems
EN 60947-1:2007 +A1:2011 +A2:2014
Low Voltage Switchgear and Controlgear
EN 61010-1:2010 +A1:2016
Safety Requirements for Electrical Equipment

Supplier:

Lasernet Limited
Lasernet House
137 Hankinson Road
Bournemouth
BH9 1HR
Dorset
United Kingdom

Country of Origin: England

Signed:

Paul Tozer
Managing Director



Date: 10 September 2019



2 Safety Warnings

This device is intended to be used as part of a safety system which may be used to protect personnel and equipment from possible injury, damage, or loss.

As such it must be installed and wired according to these instructions and tested by suitably qualified persons. No attempt may be made to tamper with the parts, open them, or use them outside of the parameters contained herein.

The units are only designed to be fixed to surfaces using their inbuilt fixing holes. They must not come into contact with each other or any other moving part when in use. The parts should never be subject to impact or mechanical strain.

Safety switches should never be defeated or bypassed. It is imperative that all steps are taken to ensure that any spare actuators are made unavailable, such that they cannot be used to defeat the switch or reduce the protection offered by the system in any way.

Lasernet reserves the right to change the design, modify the operation of functions or add new features at any time without prior notice.

3 Concept

The ICS-6-SP Control Unit forms part of a laser interlock system which is primarily intended to protect persons from accidental exposure to hazardous lasers.

The Control Unit is intended to be installed in a control panel/cubicle and works in conjunction with and is operated by a separate human-machine interface (HMI) panel such as Lasernet's ICS-TOUCH which provides an operator with a means to control and monitor the interlock system.

The ICS-6-SP Control Unit is able to monitor several doors, windows, curtains etc. fitted with safety interlock switches and disable the laser if any are open. In this manual the term 'Door Switch' refers to any interlock switch which may be fitted to a door, cover, window blind etc.

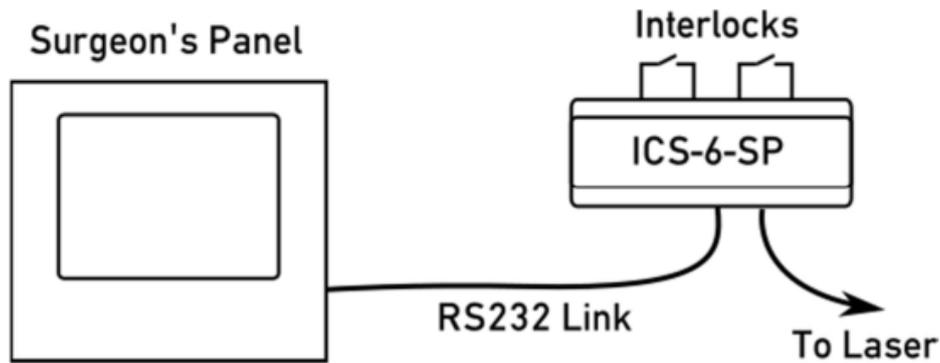
The versatile ICS-6-SP Control Unit can be connected to any number of door switches and can indicate the status of up to four switches or groups of switches. An Arm Laser button is provided on the touchscreen to arm the laser when all the safety requirements are met. An optional key lock or keycode on the touchscreen prevents unauthorised use of the system.

The ICS-6-SP has a fully dual channel cross-checked architecture and when correctly wired can realise a system compliant with EN ISO 13849-1 up to performance level 'e'.

Three safety interlock outputs each rated at 6A resistive, 250Vac, are provided to enable the laser, operate door locks etc. The interlock outputs are volt-free contacts which close when the system is armed. Each contact actually comprises two contacts in series. In the event of one contact failing to open, the other contact will open, and the system is then disabled, preventing further use and maintaining safety. The contacts can be configured for a variety of options.

A separate changeover contact is provided for operating one or two-way illuminated warning signs. The ICS-6-SP is able to monitor output devices such as contactors and shutters with feedback (such as Lasernet's LS-20 beam shutter) and the signs will display a danger indication in the event of a monitored output device failing or partly failing to assume the safe state when the system is disarmed.

The ICS-6-SP interlock controller is mounted on a DIN rail in a wall cabinet. This unit has inputs from interlocks which must be in the safe state for laser operation, such as door switches, blinds and emergency stop buttons. An output to the laser enables laser operation when all the interlock inputs are satisfied.



The ICS-6-SP is connected to the ICS-TOUCH panel by an RS232 serial data link. A 24V power supply is also required. The ICS-TOUCH acts as a status display for the ICS-6-SP and allows the user to arm and disarm the controller.

Lasernet provides a full range of laser interlock equipment including control systems, interlock switches, illuminated warning signs, laser shutters, door locks, external power supplies etc. which can be connected to provide a complete laser interlock system. Full support, design and installation is available from Lasernet, please contact us for any queries. Contact details are given at the end of this manual.

4 Summary of Evaluation of Compliance to EN ISO 13849-1:2015

To achieve a complete system performance level 'e' the system must be wired as described in this manual using suitably rated door sensors and measures taken to minimise the effects of common cause failures in the sensors and wiring which may be connected to the unit.

Achieved Characteristics:

Architecture	Category 4
Performance Level (PL)	PL = e
PFH [1/h]	2.47×10^{-8}
	(based on MTTFd being 'capped' at 100 years)
MTTFd	381 years
Mission Time	20 years
Diagnostic Coverage (DC)	99% (HIGH)

5 Installation

The ICS-6-SP Control Unit is designed to be attached to a 35mm 'top-hat' style DIN rail inside a control cabinet. It should always be enclosed in a cabinet that requires use of a tool or key to open to prevent tampering and risk of touching live connections. The unit should be installed such that the length of cable needed to connect it to the user touchscreen is less than 1.5m.

Whilst the unit itself operates on 24V it is possible that higher voltages fed from other equipment may be present on its output contacts.

The associated touch panel is fitted nearby (e.g. on a control panel) and is connected to the ICS-6-SP Control Unit via a supplied RS-232 lead.

5.1 Positioning

The ICS-6-SP Control Unit should be mounted in a convenient position for wiring. It should be inaccessible by operators. It has indicator lights on its top surface which would normally only need to be observed by installation and maintenance personnel.

Provision should be made to prevent the unit from sliding along the DIN rail after fitting, for example by the use of end clamps or other equipment.

During installation, wired connections will need to be made from the ICS-6-SP Control Unit to all the interlocked doors, warning signs, laser interlocks, shutters and other equipment as required by the system. Allowance should be made for wire retention such as plastic slotted trunking running alongside both long sides of the unit.

All of the terminals are identified on the label on the top of the unit, see next page.

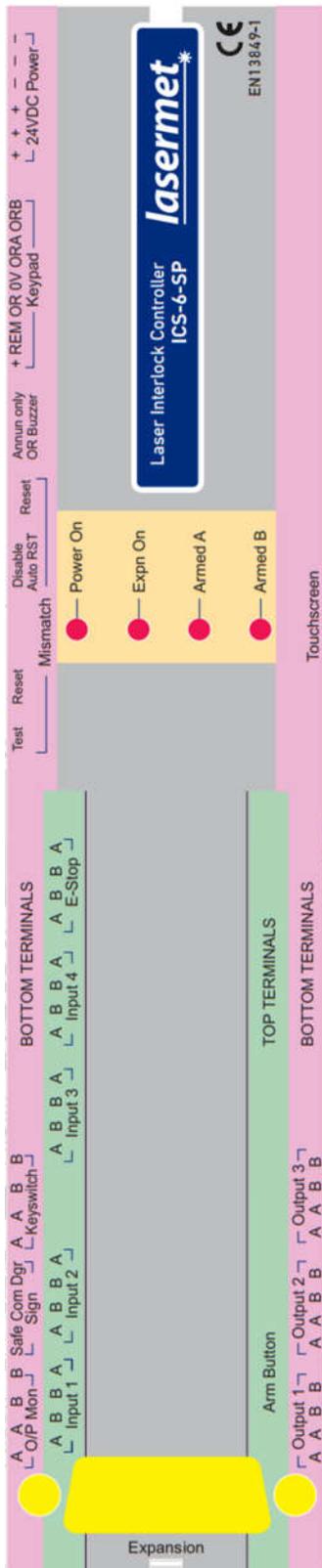


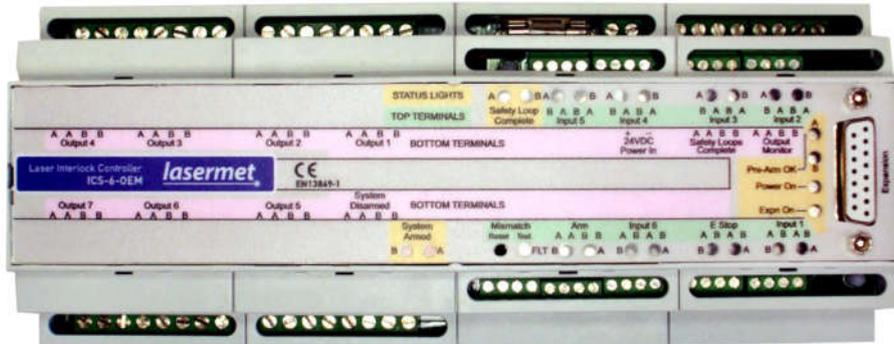
Figure 1.
ICS-6-SP Control Unit Top Label showing terminal identification.

Nearest the edge of the label on a pink background are the identifications of the bottom row terminals.

Next to these, on a green background are the identifications for the top rows of terminals.

In the yellow box there are indication lights which light up when the unit incoming power is on, expansion socket power is on and when the two output channels are armed.

6 Wiring



ICS-6-SP Fail-safe Laser Interlock Controller

The ICS-6-SP Control Unit is a versatile interlock system and there are a variety of ways in which it can be used. Be sure you know which configuration you require before you attempt to wire the unit. If you require further assistance, please call Lasernet technical help. Contact details are at the end of this manual.

A 2.5mm slotted screwdriver will be needed to access the screw terminals.

6.1 Power In

The ICS-6-SP requires 24VDC power. The power supply should be able to provide at least 1A for the unit, plus any other equipment that may be run off the same supply such as 24V illuminated signs, magnetic door locks (maglocks) etc.

Connect the power supply to terminal block '24VDC Power' on the ICS-6-SP. Three terminals are provided for +24V, any one of which may be used for the incoming power. The others are available for feeding the touch panel and 24V equipment such as illuminated signs and maglocks. The same applies for the 0V terminals.

6.2 ICS-6-SP Inputs

Mechanical Interlock Switches

Up to four door interlock switches may be directly wired to the ICS-6-SP. By making external connections, more switches can be added and arranged in groups for indication purposes.

The interlock switches are wired to the terminals labelled Input 1 through to Input 4. Each interlock switch should have two safety contacts which are closed when the door is closed. Some door contacts such as Lasernet's IS-MECH switches have an additional monitor contact which closes when the door is opened. This is not used in ICS-6-SP.

A 4-way terminal block is provided for each door interlock switch. One of the safety contacts which are closed when the door is closed is wired to the 'A' terminals. The other safety contact is wired to the 'B' terminals.

If the system is required to perform to ISO 13849 performance level 'e', two switches are usually required to be fitted to each door, with the safety contact of one switch wired to the 'A' terminals and the safety contact from the second switch wired in a separate cable to the 'B' terminals. If there is any possibility of both cables being damaged for the same reason simultaneously it may also be necessary to route the cables in different paths.

If the laser hazard is considered low, it is possible to use switches with only one safety contact. In this case connect the switch across the 'A' terminals. Fit a wire link across the 'B' terminals. The Mismatch Detector cannot be used and must be disabled, see the Mismatch Detector section below.

It is usual to use low voltage 4-core flexible cable for these connections and Lasernet can supply suitable cable in standard PVC or low smoke zero halogen (LSZH) types.

If an Interlock input is not used, one wire link should be fitted to connect the 'A' terminals together, and a second wire link to connect the 'B' terminals on each unused terminal block.

The example diagram below shows a system with two doors wired for ISO 13849 performance level 'e'. Each door has two switches.

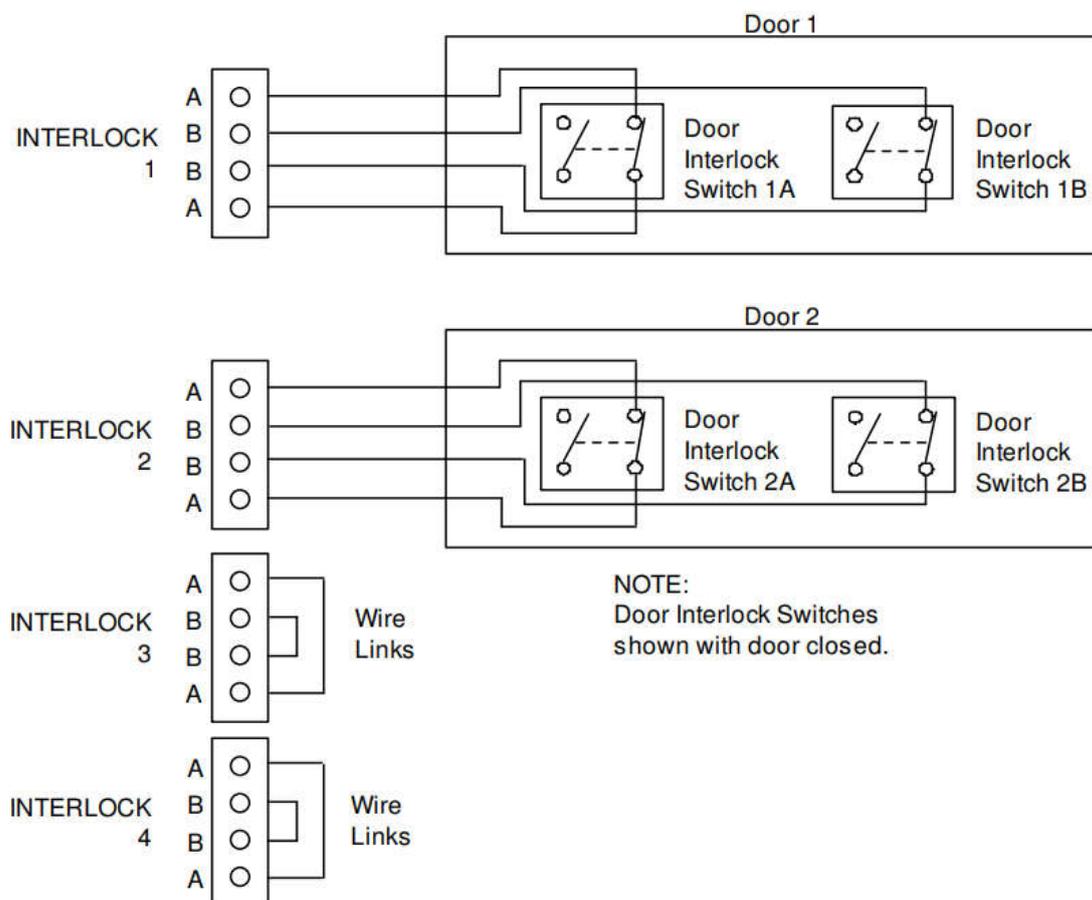


Figure 2.

If you have more than four doors you can wire them in groups. A common situation is where there are double doors. Interlock switches need to be fitted to both, and the two doors can then be wired together so that a single monitor indication light will illuminate on the front panel of the ICS-6-SP if either of the doors is open. The switches in a group should be wired with their safety contacts in series. Each group may have several switches. An example diagram for two door interlock switches wired in a group is shown below.

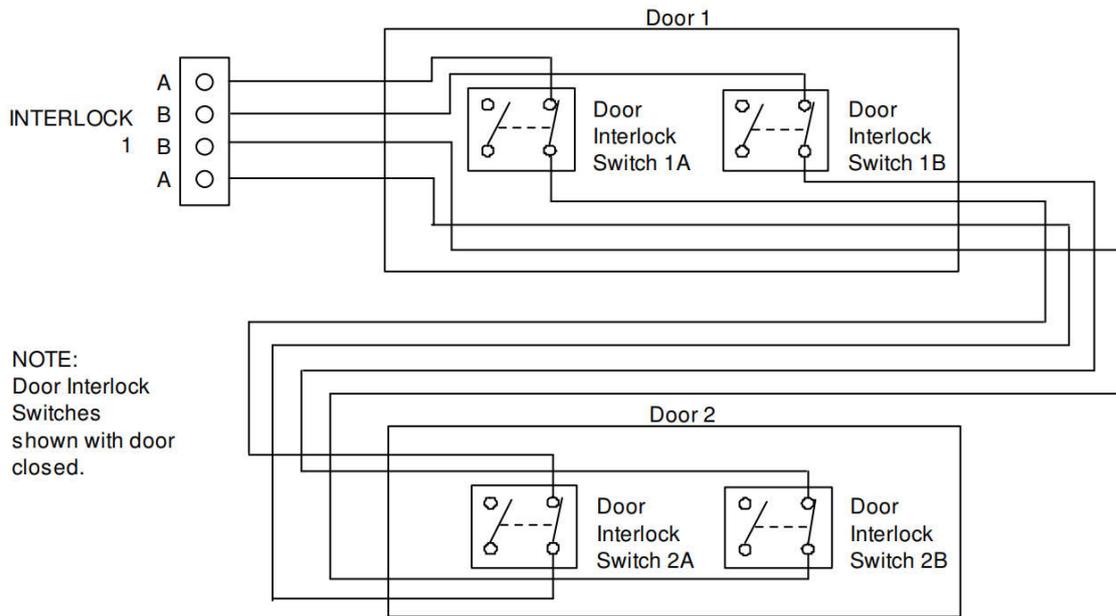


Figure 3.

If the laser hazard is low and the door switches have sufficient safety integrity it may be acceptable to use a simplified arrangement as shown below. This relies on successful operation of the door switch and contact failures are not detected. The ICS-6-SP mismatch detector should be disabled if this arrangement is used. The example shows a system with two doors.

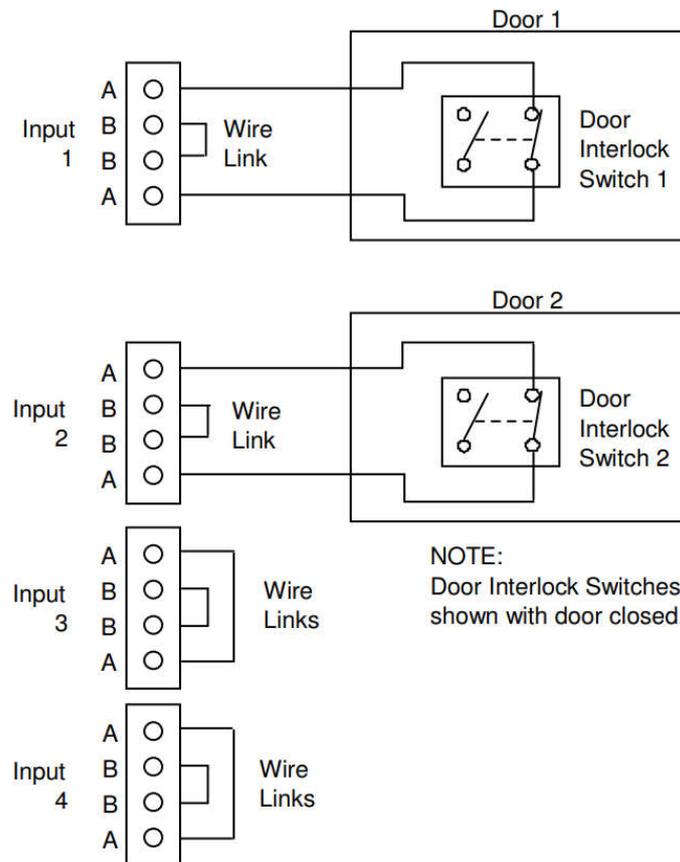


Figure 4.

Coded Magnetic Interlock Switches

Coded magnetic switches supplied by Lasermet cannot be overridden by the use of a magnet. Wire the safety circuits in the same way as described in the 'Mechanical Interlock Switches section. The monitor contacts should not be used.

The Lasermet IS-MDC-12 is a dual channel magnetic door switch. If the mismatch detector is used in the ICS-6-SP, any single contact failure in the door switch will be detected and the laser inhibited. In this switch the red and blue wires are taken to the 'A' terminals and the black and white wires to the 'B' terminals. The green and yellow wires are not used.

For the highest level of safety two separate door switches may be used, one wired to the 'A' terminals and one to the 'B' terminals.

If the laser hazard is low and the door switches have sufficient safety integrity it may be acceptable to use the simplified arrangement described in the Mechanical Interlock Switches section above.

Emergency Stop and Break Glass Switches

The ICS-6-SP treats Emergency Stop switches in the same way as Door Interlock switches. Ideally the Emergency Stop switch should have two contacts which open when the button is pressed (2NC).

Connect one safety contact, which opens when the button is pressed, to the 'A' terminals of the E-STOP terminal block. Connect the other safety contact to the 'B' terminals.

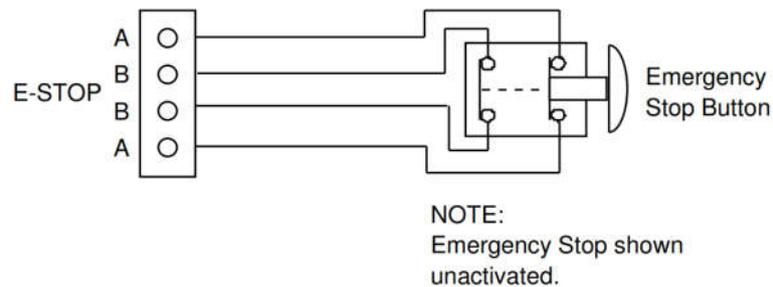


Figure 5.

If there are two or more switches, connect the contacts in series as shown below.

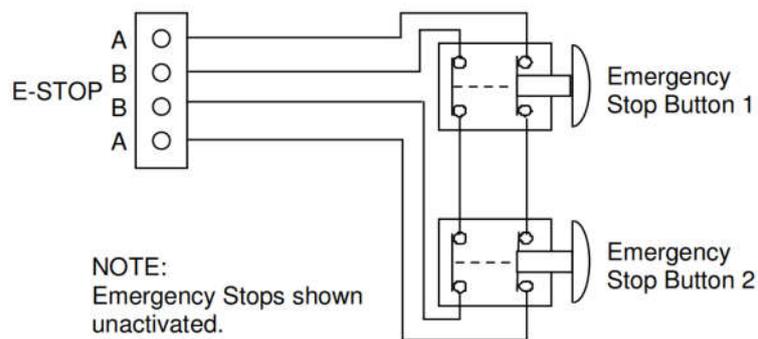


Figure 6.

As mentioned in the interlock switches section above, if the laser hazard is low and the emergency stop switch has sufficient safety integrity it may be acceptable to use a switch with just one contact. The switch should be wired across the 'A' terminals and a wire link fitted across the 'B' terminals. The ICS-6-SP mismatch detector should be disabled if this arrangement is used.

If an emergency stop is not used, a wire link must be fitted between the two 'A' terminals on the E-STOP terminal block, and a second wire link across the 'B' terminals.

Note: The emergency stop switch should be checked periodically.

6.3 ICS-6-SP Illuminated Sign Control Output

Mains Voltage Warning Signs e.g. SlimJim and Low Profile Signs

Always check that the supply voltage rating of any signs matches your mains supply before connecting. To avoid risk of shock always ensure the mains supply is isolated before making these connections.

Option 1 *One Way Illuminated Sign*

The warning sign will come on when the ICS-6-SP is armed.

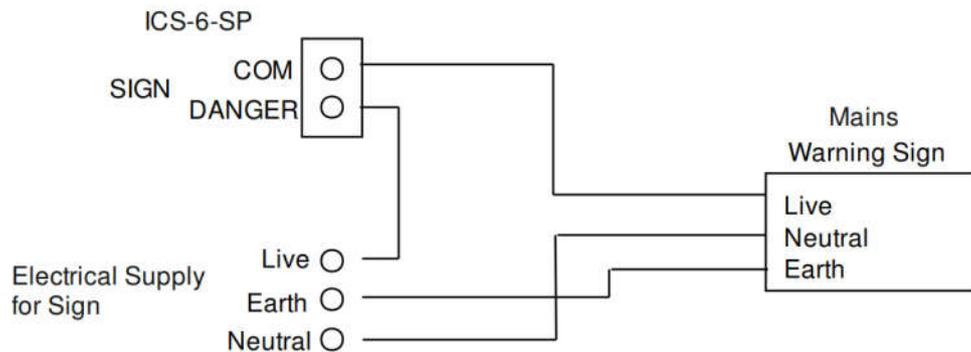


Figure 7.

Option 2 *Two way Illuminated Warning Sign*

The first warning sign will come on when the ICS-6-SP is powered. The first warning sign will go off and the second warning sign will come on when the 'Arm Laser' button is pressed.

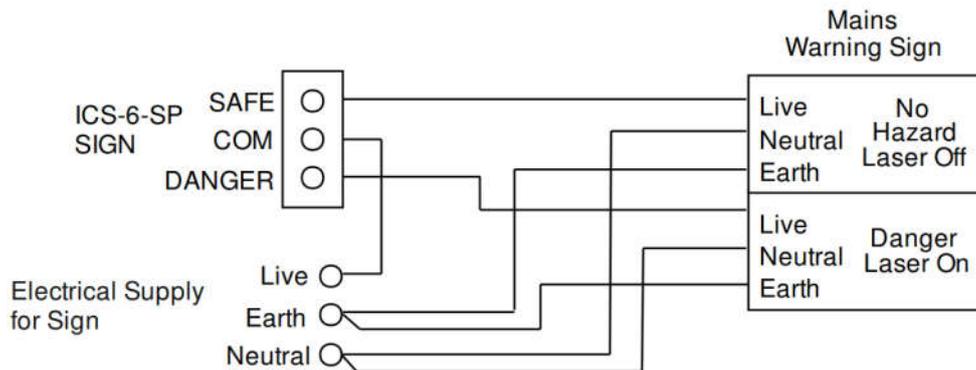


Figure 8.

Low Voltage DC Warning Signs

The following options are for 24VDC warning signs such as Lasermet's Miniature and Ultra Warning Signs. These signs must not be connected to the mains supply. If the power supply feeding the ICS-6-SP is powerful enough the sign can be powered by spare terminals on the 24VDC Power terminal block on the ICS. The ICS-6-SP needs 1A. Refer to the manual supplied with the sign for its current requirements.

For further assistance on Lasernet products or for supply of suitable power supplies please contact Lasernet through your local distributor or see the contact details at the end of this manual.

Option 1 *One Way Illuminated Sign*

The warning sign will come on when the ICS-6-SP is armed.

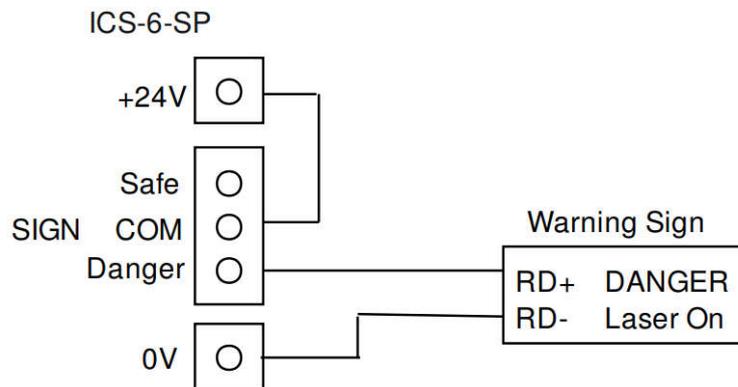


Figure 9.

Option 2 *Two way Illuminated Warning Sign*

The first warning sign will come on when the ICS-6-SP is powered. The first warning sign will go off and the second warning sign will come on when the unit is armed. Note that in the case of the Lasernet Miniature and Ultra 2-way warning signs, both indications are displayed in the same unit.

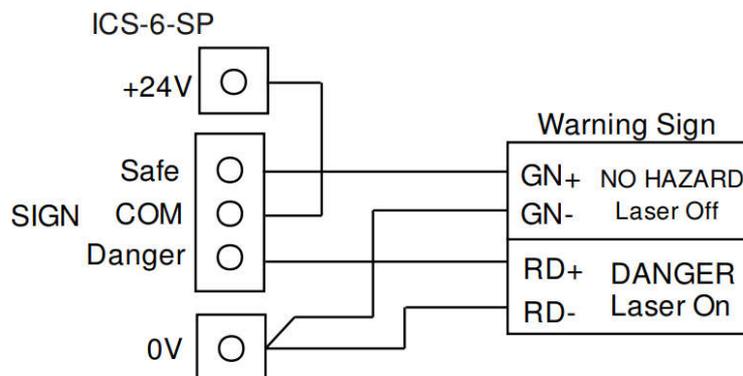


Figure 10.

Note regarding Sign Operation

If output devices such as LS-20 shutters or contactors are fitted, or if the laser has feedback contacts which close to prove that it is in a safe condition and the feedback signal from such devices is taken to the 'Output Monitor' terminals of the ICS-6-SP Control Unit, the sign green 'Laser Off' indication will not be given if these devices are not proven to be in the safe condition or if they are removed from the system.

6.4 Output Contacts

The ICS-6-SP has three volt-free Output contacts which may be used for various purposes including:

- Switching laser power;
- Controlling beam shutters;
- Operating the laser's interlock input;
- Controlling door locks.

Laser Power Supply (4A maximum)

With this option, the laser mains supply is only switched on when the Arm Laser button is pressed. This option is only suitable for smaller lasers that don't have an interlock input. The maximum current that may be switched is 4 amps, and the circuit must be protected at the source by a fuse or circuit breaker not exceeding 5A rating.

To avoid risk of shock always ensure the mains supply is isolated before making these connections.

Be sure to use suitable mains-rated wiring and ensure compliance with local electrical wiring regulations.

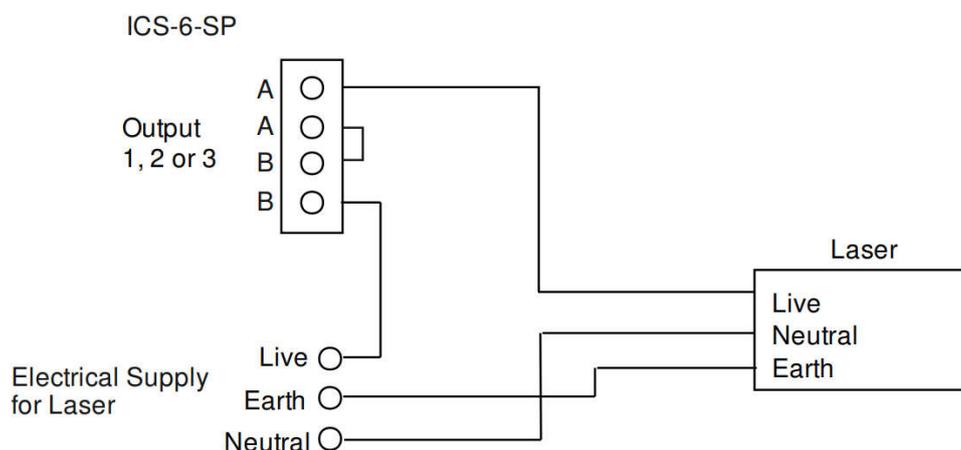


Figure 11.

The contact is rated at 4A resistive load maximum. If the laser mains supply requirement exceeds the capability of the ICS-6-SP, please contact Lasermet who can provide an external contactor unit with dual monitored safety contactors for switching higher powers.

Beam Shutters

The ICS-6-SP may operate one or more beam shutters and one or more laser interlocks. For permanent fixed installations these may be directly wired to the ICS-6-SP. Where there is any possibility of the equipment being changed or moved it is often most convenient to be able to unplug the equipment.

Lasermet provide a range of small distribution boxes which allow for convenient positioning of wall or surface-mounted plugs for laser interlocks and sockets for shutters. The boxes are available with different combinations of plugs and sockets.

Most lasers only have a single channel interlock input which can present problems if the safety system has to comply with ISO 13849 performance level 'e' since two methods of control are usually required. Some lasers have internal beam shutters which may be controlled by the ICS-6-SP. If the laser has two means of disabling e.g. interlock and internal shutter it is recommended that both are used. Otherwise it may be necessary to consider having an external shutter in addition to the laser's own interlock if a high safety integrity is required.

Lasermet's beam shutters are supplied with suitable leads to plug into the distribution boxes. Open-ended leads are provided for laser interlocks allowing the customer to fit the correct plug for his laser.

Laser Shutter Supply (4A maximum)

The ICS-6-SP is able to provide both continuous and switched supplies using one of the Output contacts. Several shutters of the same type may all be powered from one Output contact, please contact Lasermet for details if required.

Note: The selected Output contact used for switching shutters must not be used for any other purpose.

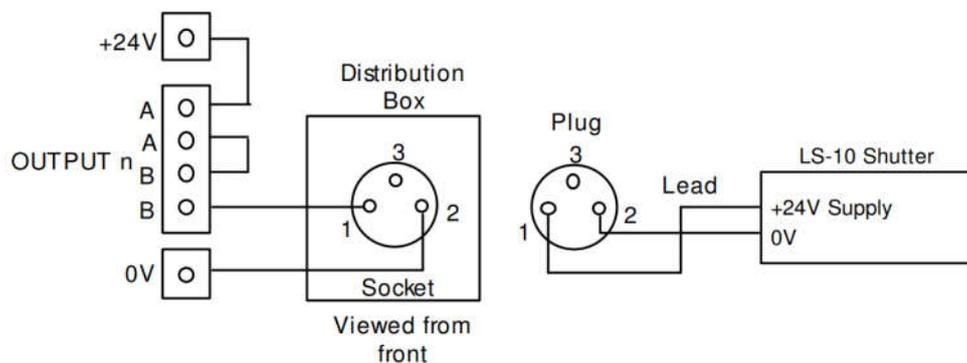


Figure 12.

LS-10 Shutter

Use the above circuit. Note- old versions of LS-10 will only work off 12VDC so a separate 12VDC supply will be required.

LS-20 and LS-200 Shutter

The LS-20 and LS-200 Shutters can use the above circuit, however it is recommended that the monitoring circuit shown below is included to allow the ICS-6-SP Control Unit to monitor the shutter and to detect any faults.

If using the LS-20 SIL3 twin shutter the circuit below must be used to achieve the SIL3 / PL 'e' rating.

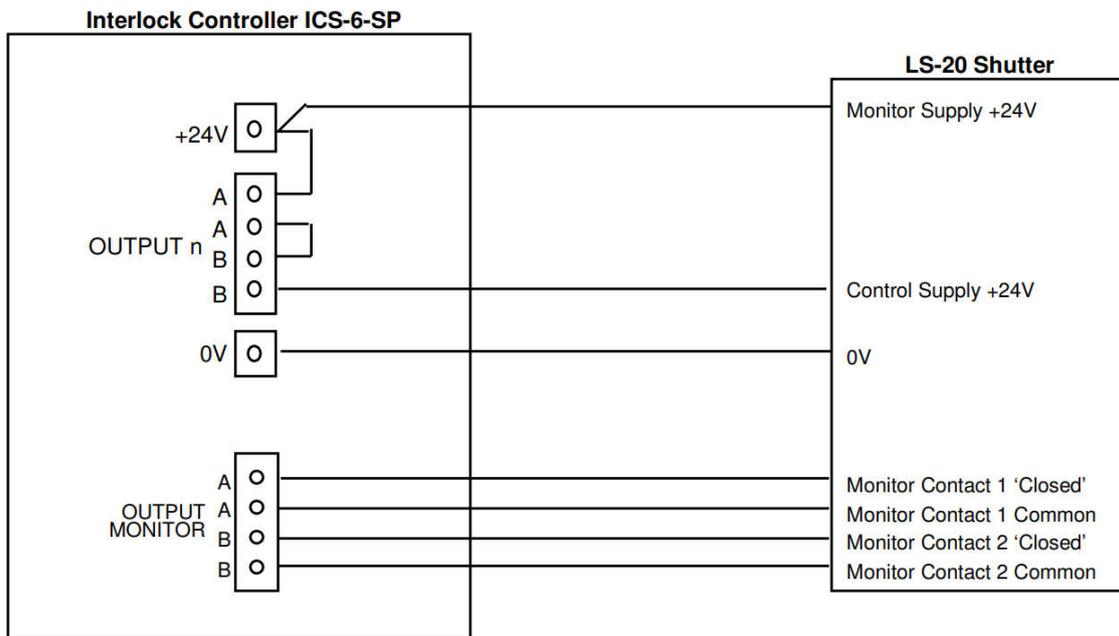


Figure 13.

The LS-20 Shutter has its own distribution socket. The wiring connections inside the distribution box are shown below:

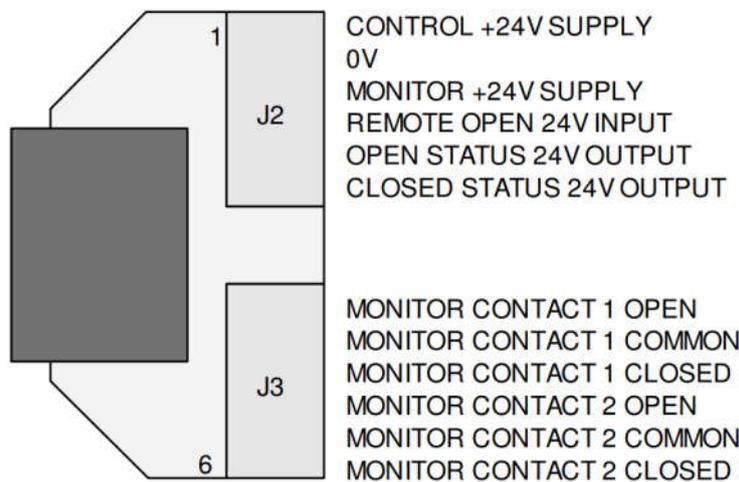


Figure 14.

Laser Shutter - with own power supply

If your shutters have their own power supply or are to be run from an existing supply, you can use one of the controller outputs to operate them. If the shutter requires a single contact to operate it, connect the A and B contacts of the controller output in series as shown in the wiring diagrams above for LS shutters, so that the shutter closes if either one or both output contacts open.

The connections should be arranged so that the shutter closes when the ICS Output contact opens. Any ICS-6-SP Control Unit output used for shutters must not also be used for laser interlock control.

The contact is limited to 4 amps resistive load. If your shutter is solenoid-based it may need a protection diode fitted to prevent possible damage to the ICS-6-SP Control Unit.

Interlock Connectors

Any of the ICS-6-SP Control Unit output contacts may be used to operate a laser's interlock control, provided they haven't been used for any other purpose. The contacts are closed when the ICS-6-SP Control Unit is armed. If there is more than one laser each must use its own output connector on the ICS-6-SP Control Unit. Interlock sockets of several lasers must not be connected together.

Where the controller is part of a fixed laser system it is usual to directly connect the two devices. For lasers with a single interlock channel use the following connections:

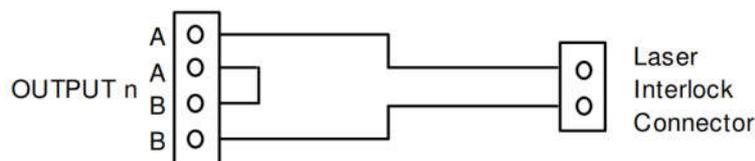


Figure 15.

For lasers with dual channel interlocks use the following connections:

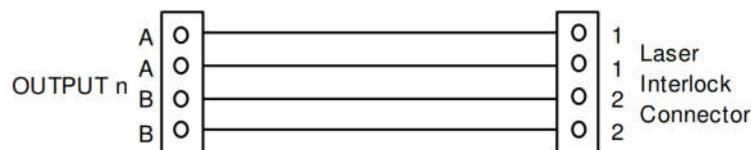


Figure 16.

Where the laser may be removed from the system or exchanged a Lasernet Distribution Box may be used to provide a connection point convenient to the laser. In this case for lasers with a single channel interlock the A and B ICS-6-SP Control Unit output channels are connected in series to pins 1 and 2 of the plug of the distribution box. See the diagram on the next page.

Leads are available in various lengths to plug into the distribution box. The other end of the lead is unconnected to allow fitment of a plug suitable for the laser, as different lasers have different connectors.

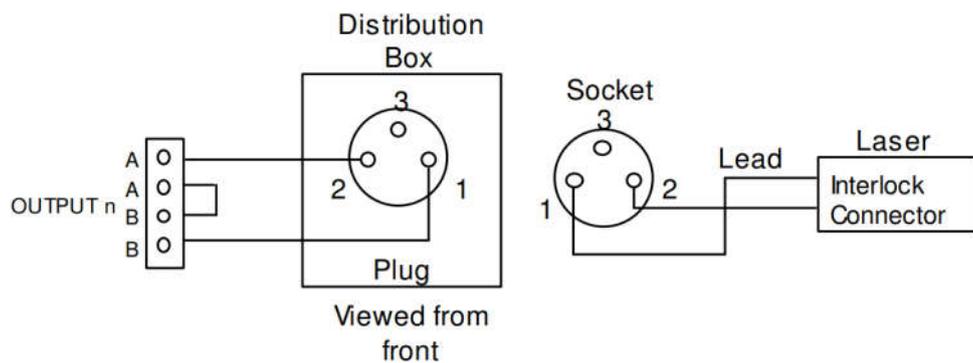


Figure 17.

Most industrial lasers are now designed to be compliant with EN 13849-1 and feature two interlock input channels. This will require a distribution plug and socket with more connections. Furthermore, some lasers also include one or two ‘laser safe’ contacts which can be monitored by the ICS-6-SP. In this instance if either or both ‘laser safe’ contacts are not closed the ICS-6-SP will not illuminate the ‘Laser Off’ section of any such warning sign and arming will be inhibited. Depending on the safety performance of the laser itself such a system could meet EN 13849-1 performance level ‘e’.

The wiring of such a laser is shown below. Please contact Lasermet for assistance with distribution boxes, connectors and leads if required.

If other devices are using the Output Monitor terminals, for example an LS-20 shutter, all the safe proving contacts for each channel should be wired in series to the Output Monitor connector such that the circuit is complete when all devices are in the safe condition.

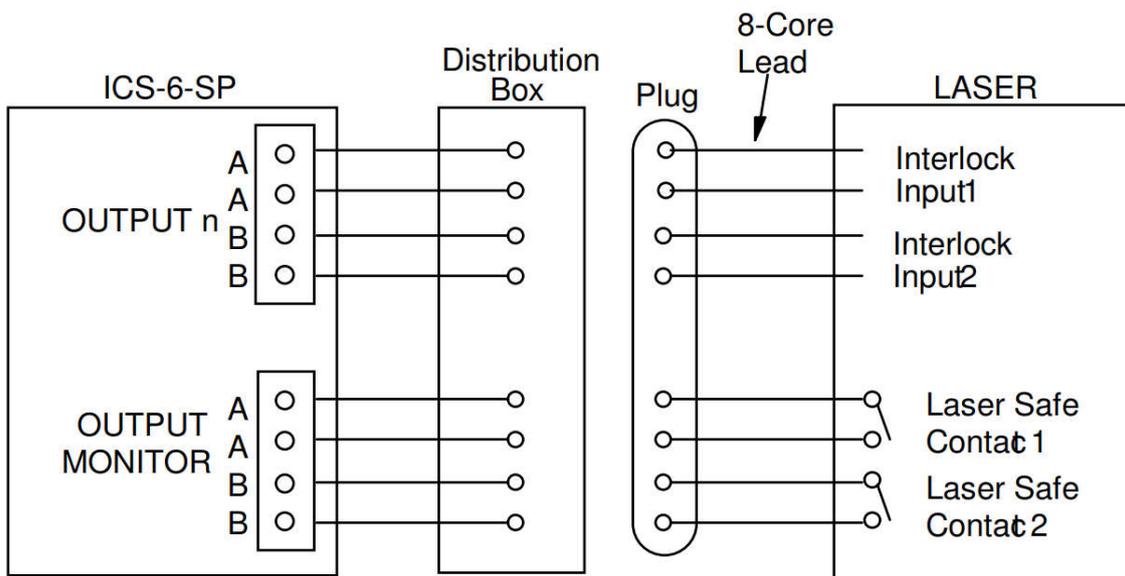


Figure 18.

If the Output Monitor terminals are unused a wire link must be fitted between the ‘A’ terminals, and a second link between the ‘B’ terminals on the Output Monitor terminal block.

Electro Magnetic Door Locks

Use only fail-safe door locks provided by Lasernet (electric door strikes or maglocks). These will prevent access to the room while the laser is on while always allowing people to enter or leave the room in the event of a power loss. In order to ensure that people can always enter or leave the room in the event of an emergency it will be necessary to put an emergency stop or break glass switch near each door. If in doubt call Lasernet technical help.

The door should be fitted with interlock switches (see ICS-6-SP Inputs section) so that the laser is disabled if a door is opened using the break glass switch.

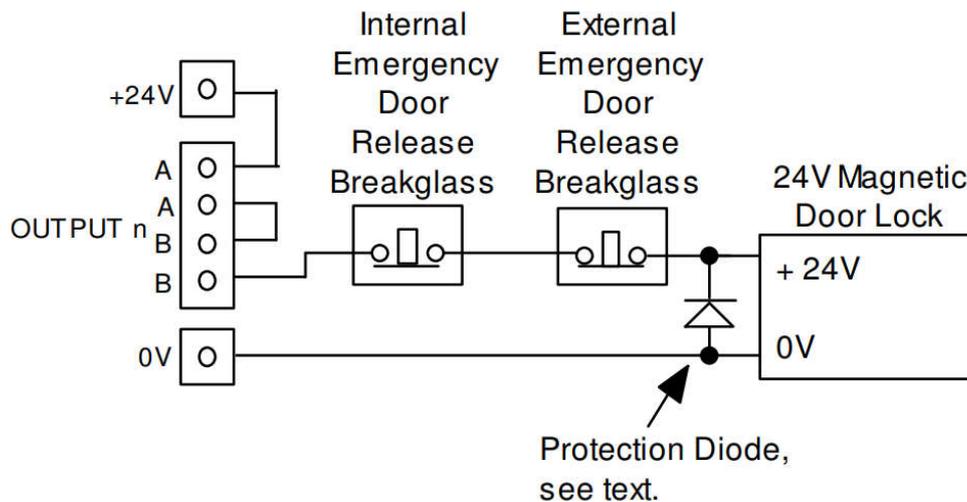


Figure 19.

Note that several maglocks can be wired in parallel from the same ICS-6-SP Control Unit output provided the 4A maximum rating of the contact is not exceeded.

Some locks can be configured for 12V or 24V supply. They should be set for 24V operation and run off the 24V supply to reduce the current consumption to 0.25A per lock. To set Lasernet Maglocks for 24V operation, open the terminal access cover on the lock. Remove the two black links from the circuit board and refit one of them across the middle two pins. Park the spare link with one side on one of the empty end pins so it is not lost. If in doubt, refer to the instructions supplied with the maglock.

In all cases a diode rated at 1A 50V or more must be wired directly across the terminals of each door lock. Lasernet's Maglocks usually have the diode fitted as standard and it is essential that the supply is connected the right way round.

6.5 Override

Override / Entry Keypad

The Lasernetmet ICS-KP12 is an entry keypad with built-in fail-safe override timer. It may be used either as a key-coded override control, as a door release where door locks are used, or both. A dedicated connector is provided for it in ICS-6-SP. The keypad is usually fitted adjacent to the entry door on the outside of the controlled area, and a door release exit button is provided on the inside which activates the keypad remotely. The exit button may be wired to the keypad or ICS-6 according to installation preference. Note that if the door is fitted with a magnetic lock, emergency door release break glass switch(es) should be provided to release the door in the event of evacuation emergency as shown in the Electro Magnetic Door Locks section above.

The access code and durations of the timed override and door release are programmable, refer to the keypad instruction leaflet.

The diagram below shows the circuit where a lock is provided on the door. If no lock is provided this part of the circuit may be omitted, and the keypad may be programmed not to activate the door relay and 'Door Unlocked' indication. Refer to the keypad instruction leaflet.

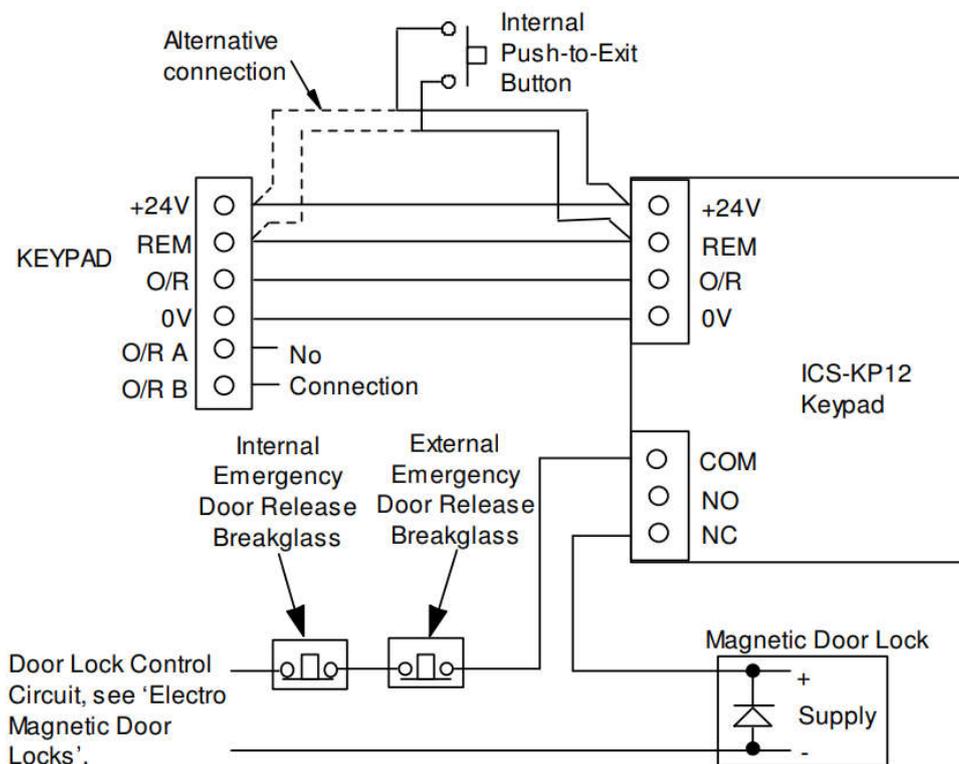


Figure 20.

Override Switch without Timer

It is possible to configure the ICS-6-SP to give an unlimited override. This may be useful for maintenance purposes or when the access door may be open for some time. In general, such an arrangement may require additional site procedures to ensure safety while the interlock is overridden.

The override device may be a switch or other contact which remains closed for the duration of the override. A key-operated switch may be preferable to prevent unauthorised use.

If a maglock is fitted to the door the override switch needs an additional contact which opens when activated, so that the lock is disabled allowing the door to be opened.

The override control contact is wired as shown below.

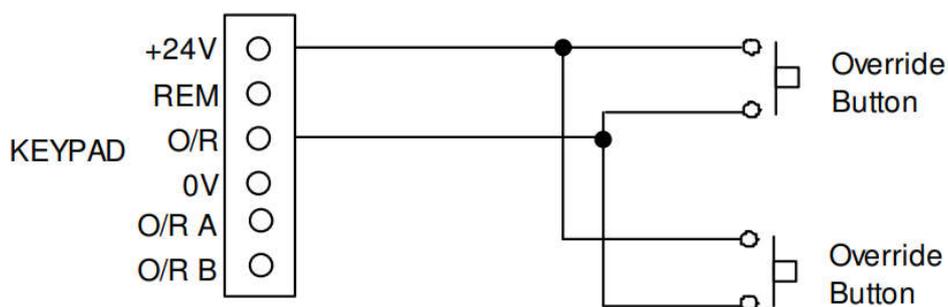


Figure 21.

The buzzer may be unnecessarily annoying in this mode of operation so it may be disabled.

Local Override

Where there are several entrances to the laser enclosure it may be desirable for the override to be only applied to a particular entrance, such that the laser will be disarmed if another entrance is opened while the override is active.

To achieve this, the overriding device needs to have two isolated contacts which close to bypass the safety contacts of the relevant door switch, and a third contact to activate the override indications on the ICS-6-SP. If a maglock is fitted to the door the overriding device needs a fourth contact which opens when activated, so that the lock is disabled allowing the overridden door to be opened.

Lasernet offer the ICS-KP14 which provides this functionality. Refer to the ICSKP14 manual for specific details.

When this mode of operation is used it is essential that the override function on the ICS-6-SP is disabled so that the other inputs are not overridden. To do this locate the 'Annun only' marking on the ICS and unclip and remove the associated cover to access the configuration link as shown below. Remove the link to set the unit to Annunciation Only mode. In this mode the ICS will indicate on the touch panel and sound its buzzer when an override is active but will not itself be overridden. Refit the cover when finished.

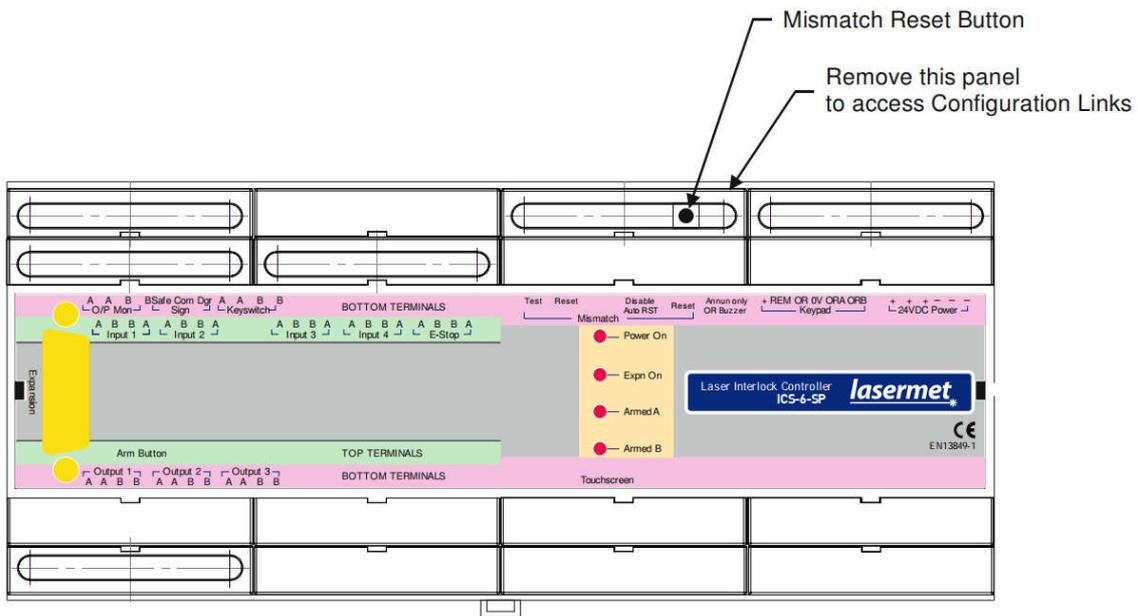


Figure 22.

Override Alarm

There is an audible Override alarm inside the ICS-6-SP which is enabled when the O/R Buzzer jumper is fitted on the unit. To access the configuration link locate it using the label on the unit and unclip and remove the cover, see the diagram above. Refit the cover when finished.

The touch panel indicates when the override is in operation.

7 Expansion Boards

The ICS-6-SP Control Unit can be connected to one or more Lasernet Interlock Expansion Boards which provide extra functionality.

Boards which are currently available include:

Active Beamguard Interface

Lasernet's Active Beamguard system is intended to be used with lasers which are potentially capable of damaging or burning through their enclosures. The enclosure is lined with replaceable active detection panels. If the laser burns through the panel it is shut down before it burns through the enclosure. The fail-safe Interface is able to monitor a large number of Active Guard panels and the ICS-6-SP Control Unit is able to automatically test the operation of the panels and the interface each time the system is armed.

Safety Logic Plus Interface

Safety Logic Plus consists of a range of fail-safe logic function blocks which can be hardwired to realise a complex safety interlock. Each block is dual channel crosschecked and does not use processors or software. Programming is achieved through hardwiring. This means obsolescence is minimised and the system is maintainable for a long service life. The Interface Board allows ICS-6-SP Control Unit to read the output of a Safety Logic Plus system whilst automatically testing it and providing fault protection.

Relay Expansion Card

This module contains a number of uncommitted relays which may be connected as required to provide extra functionality or for interfacing to alarm, security or process control systems.

Other types of expansion boards are under development.

7.1 Installing Expansion Boards

Expansion boards are fitted into a separate module and connected to the ICS-6-SP Control Unit using a dedicated 15-way 'D' connector on the top of the unit.

Refer to the instructions supplied with the expansion unit for further details of how to fit expansion boards. Each expansion board has its own dedicated set of instructions showing how it is connected to external equipment and used.

If the expansion module is not used a termination plug must be fitted into the socket on the top of the ICS-6-SP Control Unit. The controller will not operate if the socket is left empty.

8 Mismatch Detector

The ICS-6-SP trips out and disables the laser when either of its two safety circuits opens. If all the door interlock and emergency stop switches have two contacts, one in each safety loop, then it is normal for both safety circuits to open more or less simultaneously.

When the ICS-6-SP Safety Circuit Mismatch Detection is enabled, if the second safety circuit does not open within a short time of the first (typically around 1 second), a mismatch is triggered and the Mismatch Fault symbol is shown on the touch panel. It is then not possible to arm the system.

Safety Circuit Mismatch Detection can only be used if all inputs to the ICS-6-SP Control Unit are dual channel. This includes all the door contacts and emergency stop buttons. If any input only operates one channel, then a mismatch will inevitably occur, and the mismatch detector will be triggered. In the event that it is not possible for all of the inputs to be dual channel, the mismatch detector must be disabled as described later in this section. Note that the use of a single channel safety contact and the disabling of the mismatch detector will reduce the achievable safety performance level of the system.

8.1 Configurable Options for Safety Circuit Mismatch Events

Mismatch Event Behaviour

In the event of a mismatch being detected either of the following two actions are available depending on the option switch settings:

- a) Lock out, preventing further use, unless the system is reset by switching it off and on again;
- b) Lock out, preventing further use, unless the system is attended to by a qualified technician.

Option a) is suitable for mission-critical applications where the inability to use the laser would be costly or inconvenient. Having detected and indicated that there is a fault it allows the system to be reset to operate on the one good safety circuit provided the faulty circuit has been closed. The need to manually reset the system before it can be used provides a clear indication to operators that there is a problem that needs to be addressed at the earliest opportunity and that other risk limitation steps may be required in the interim. An example might be to secure the affected door out of use until it can be repaired.

Option b) is the lowest risk option, as once a safety circuit fault has been detected the system cannot be used. The ICS-6-SP can only be reset by opening the cabinet in which it is mounted and operating the Fault Reset button. Procedures should indicate that this is only carried out by suitably trained technicians once the fault has been repaired.

By default, the mismatch detector is factory set to be enabled in option 'a' above.

To change the settings of the Safety Circuit Mismatch Detection the configuration links must be accessed by removing a cover as shown below.

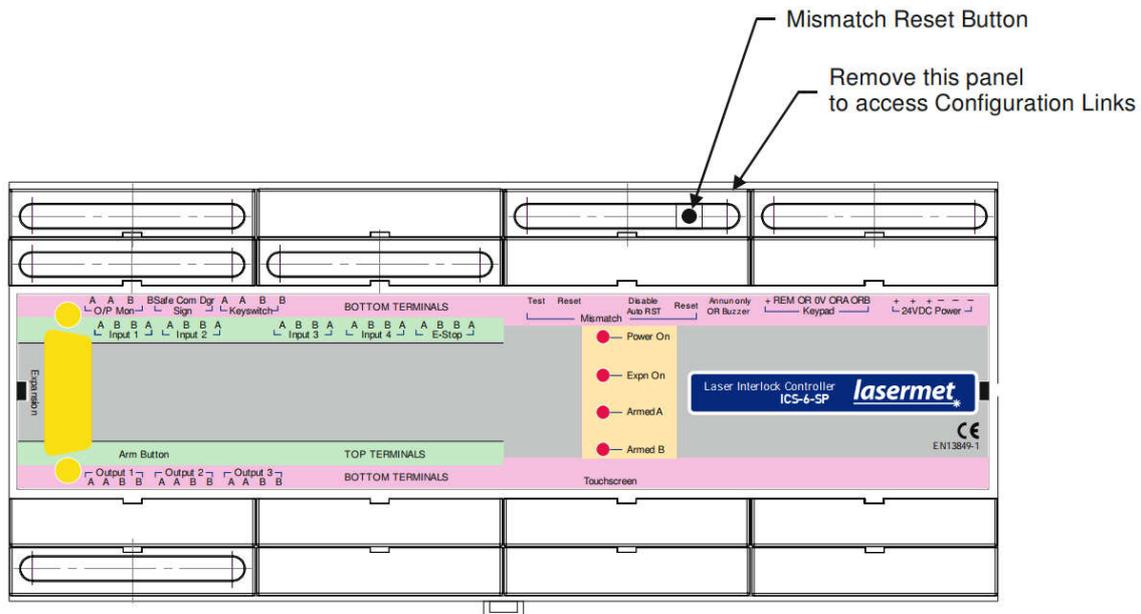


Figure 23.

To prevent the mismatch detector from being reset by cycling the power i.e. to require the detector to be reset by a technician, remove the link 'Auto RST'.

Note that when the link 'Auto RST' is fitted, the power to the ICS-6-SP Control Unit must be turned off for at least 10 seconds to reset the detector and clear the indication.

The Mismatch Detector is enabled by default. To disable the mismatch detector, close the link labelled 'Disable'.

Carefully clip the cover back into place once any adjustments have been made.

8.2 Clearing a Mismatch Fault Indication

In all cases the fact that a mismatch fault has been indicated warns users that the safety of the system may be compromised. Site-specific instructions should indicate the actions to be taken by users in such an event.

If the auto reset option has been selected, the system may be temporarily cleared by turning the power supply off, waiting for ten seconds, then turning it back on again. In this case the system should be attended to by a suitably qualified technician to identify and repair the fault at the earliest opportunity as a fault has been identified and the system may cease to provide protection without further warning.

If the ICS-6-SP Control Unit has been configured to permanently lock out, it can only be reset by pressing the Mismatch Reset button using a suitable tool through the hole in the cover as shown in the previous section above. This should only be undertaken by suitably qualified technicians once the fault has been identified and repaired as otherwise the unit will just lock out again.

8.3 Mismatch Detector Remote Test and Reset

Terminals are provided that allow for remote testing and resetting of the mismatch detector if desired. For example, a key-operated switch could be connected to the terminals so that when it is set one way it tests the mismatch detector, and when set the other way resets it. The key is then returned to the mid position and removed to allow normal operation to resume.

The 'test' switch should have a contact which is normally closed, and which opens to perform the test. The 'reset' switch should have a contact which closes momentarily to reset the detector.

If the test function is not used a wire link must be fitted across the 'Test' terminals.

Contact Lasernet or your local distributor for assistance if you wish to use these features.

9 LED Indicators

The ICS-6-SP relies on its associated touch panel to provide an operator interface and the LED's on the unit provide very basic information to service personnel. Refer to the touch panel instruction manual for details.

24VDC Power On

This LED illuminates green when 24V power is being provided to the unit.

Expansion Socket Power On

This LED illuminates green when 24V power is being provided to the Expansion socket on the top of the unit.

'System Armed' LEDs

When the ICS-6-SP has been armed the 'System Armed' LED's will light orange to warn that the ICS-6-SP Control Unit has enabled the laser.

10 Operation

Once correctly wired, the ICS-6-SP is extremely easy to use. The following instructions cover the most common arrangements. For more complex customer-specific systems, additional procedures may apply.

10.1 Starting Up

Refer to the instruction manual for the touch panel used to control the ICS-6-SP.

- 1) Apply 24V power to the controller.
- 2) Unlock the interlock controller using either the keypad on the touch panel or by other means as may be provided.
- 3) Close all interlocked doors. An indication is shown on the touch panel if any door is not closed.
- 4) Check any Emergency Stop buttons are released- if any have been pressed an indication will be shown on the touch panel.
The touch panel will indicate that the controller is ready to be armed.
- 5) When you are ready to operate the laser, operate the 'Arm' button on the touch panel. If all is well the touch panel will show a yellow laser hazard symbol and indicate that the laser is enabled. On the Controller unit the amber 'Armed' A and B lights will be illuminated.

Note: Be aware that this action restores power to the shutters or the laser, and may result in accessible laser beams, depending on your system set up. The system should only be armed when everyone is ready and the necessary safety precautions have been taken e.g. protective eyewear etc.

10.2 Resuming Operation after an Interlock Switch has been opened

When any interlocked door is opened or the emergency stop button is activated, the ICS-6-SP Control Unit will cut the power to the laser or the shutters and the 'Laser Enabled' indication will be extinguished. To resume laser operation:

- 1) Close all interlocked doors (where necessary). Note indications on touch panel.
- 2) Reset the emergency stop button (where necessary).
- 3) When ready to restart, operate the Arm Laser button on the touch panel.

Note: Be aware that this action restores power to the shutters or the laser, and may result in accessible laser beams, depending on your system set up. This action should only be taken when everyone is ready and the necessary safety precautions have been taken e.g. protective eyewear etc.

11 ICS-TOUCH User Interface Status Display

11.1 Interlock Inputs

The state of up to four separate interlock inputs is shown by 'door' icons, which change colour according to the state. The interlocks have two redundant channels to maximise safety.



Interlock OK



Interlock open



Interlock OK on channel A, open on channel B



Interlock OK on channel B, open on channel A

11.2 Emergency Stop Input

The state of the emergency stop input is shown in the same way, using a 'mushroom button' icon.



No E-stop



E-stop active



E-stop active on channel B



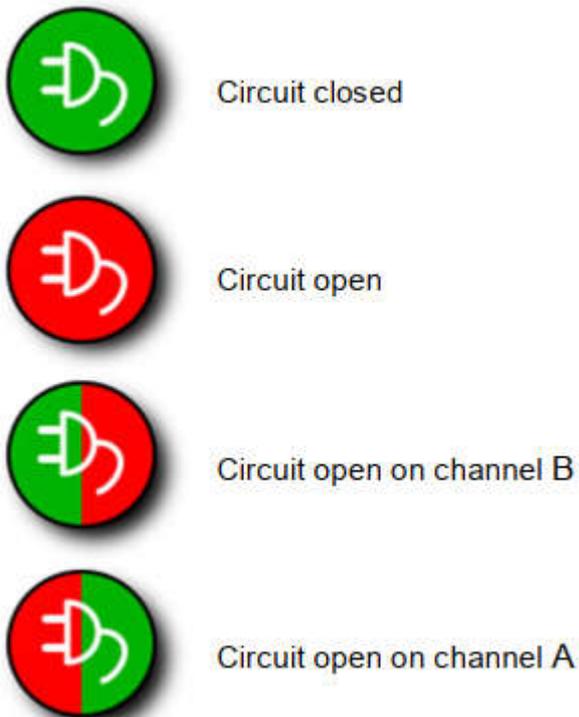
E-stop active on channel A

11.3 Pre-arm and Expansion Status

The laser interlock controller incorporates a proving circuit to check that the system is in a safe condition before attempting to arm. This is known as the pre-arm loop. The pre-arm loop may be wired to include the monitor contacts of the laser or shutters, where provided. These indicate that the laser will not immediately radiate when the interlock controller is armed. The pre-arm loop is normally closed before arming and is opened by the interlock controller when the system is armed, so at this point the state should change from green (closed) to red (open).

It is possible to extend the interlock controller with add-ons connected via the expansion socket. The safety loop status of expansion units can also be monitored. The normal status is the same as for the interlocks (closed – green).

The state of these inputs is indicated by 'plug' icons, since they represent circuits that may be connected or disconnected.



11.4 Mismatch Indication and Reset

All the safety circuits are dual channel with mismatch detection. If their states differ there is a mismatch condition, indicating a fault somewhere in the circuit. For instance, one contact of a door switch may not be closing. If this occurs, a fault condition will be indicated, and the fault condition will be latched until reset.

Note that a short period of mismatch is allowed by the interlock controller, because two switches will never close at exactly the same time.

The mismatch is indicated by an icon on the display, and a touch button is provided to reset the fault condition after the fault has been rectified. Touching the button sends a message to the ICS-6-SP, which then attempts to reset the fault latch. If the fault no longer exists, this will succeed.



No mismatch – all circuits are the same on both channels



Mismatch on at least one circuit



Touch button to reset the latched fault

11.5 'Safety Circuits OK' Indication

If all the circuits mentioned in the previous sections are in the safe state, the user will be able to arm the interlock controller. The overall ready status is indicated by an icon.



All safety circuits complete – ready to arm



At least one condition not fulfilled – check the other icons

11.6 Arming the Interlock Controller

The ICS-6-SP offers two options for arming – either a physical push-button connected directly to the interlock controller, or a touch button on the ICS-TOUCH display. If the display touchscreen is to be used, a button will be displayed in one of three different states, depending on the arm status.



Greyed out – arming is not available



Ready to arm when touched



Shown when the controller is armed – touch to disarm

When the touch button is pressed, the panel sends a message to the ICS-6-SP. The interlock controller makes the arming decision based on its inputs. The display simply acts as a push-button switch.

11.7 Arming Indication

The display to the right of the arm button indicates the arming status.



11.8 Override Indication

The ICS-TOUCH has an override input which allows the safety interlocks (but not the emergency stop) to be temporarily overridden. This is normally used with a Lasermet keypad to provide a coded door override.

Use of the override is indicated by a flashing keypad icon on the display.



Normal state of keypad icon



Keypad icon when flashing

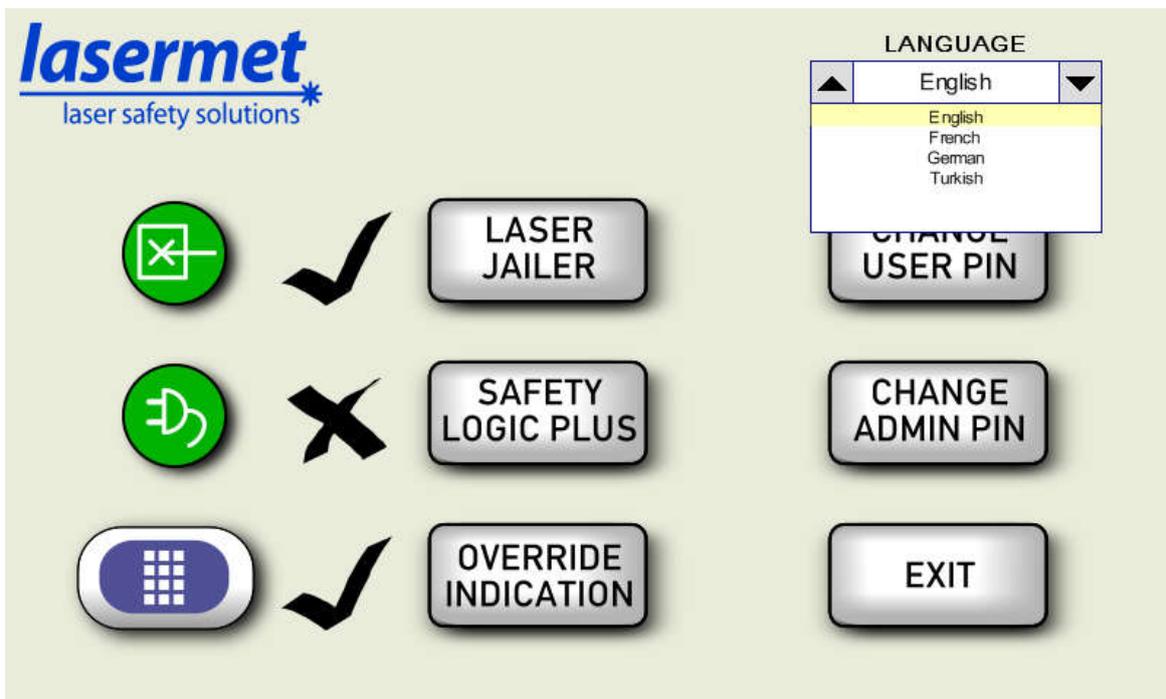
11.9 Language Options

The ICS-TOUCH has English as the default language. However, it can be configured for French, German, or Turkish.

To switch to another language, navigate to the Admin Page by pressing the lock icon. This will prompt for the admin password. The default admin password is 1234.



On the Admin Page, press on the dropdown textbox and select a language. Use the up and down arrow keys to navigate.



12 ICS-TOUCH Access Control using PIN

The ICS-6-SP System has two possible methods of access control: either a physical keyswitch wired directly to the interlock controller, or a PIN entered via a keypad on the ICS-TOUCH.

12.1 Lock Status Display

Using either method of access, the ICS-6-SP may be locked or unlocked. This is indicated by an icon to the left of the status display, which also acts as a touch button.



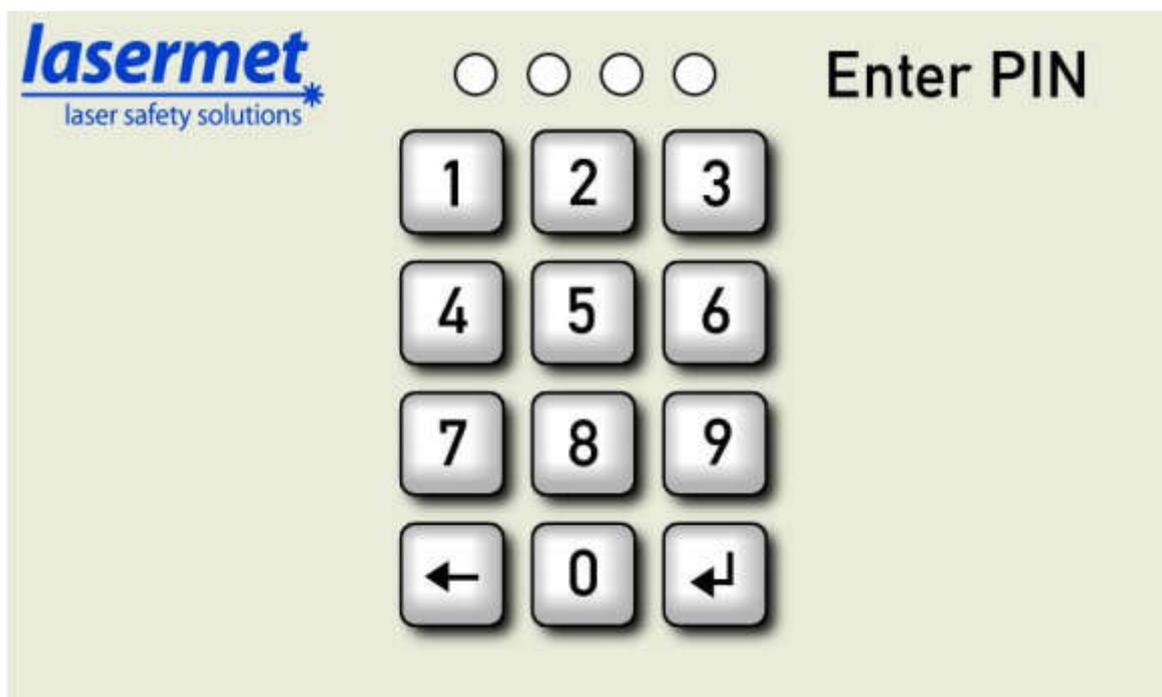
The interlock controller is locked – no functions are available. Touching the icon opens the PIN entry screen.



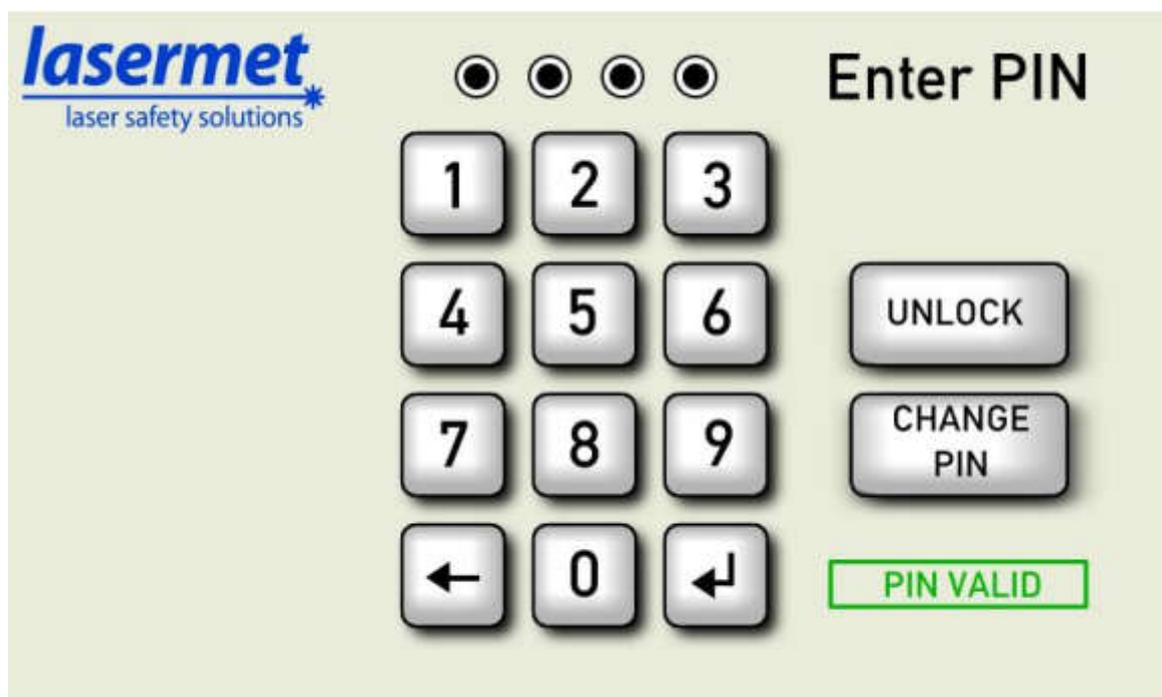
The interlock controller is unlocked and can be used. Touching the icon locks the system and the icon reverts to the locked state.

12.2 PIN Entry

When the 'locked' icon is touched, the PIN entry screen is opened.

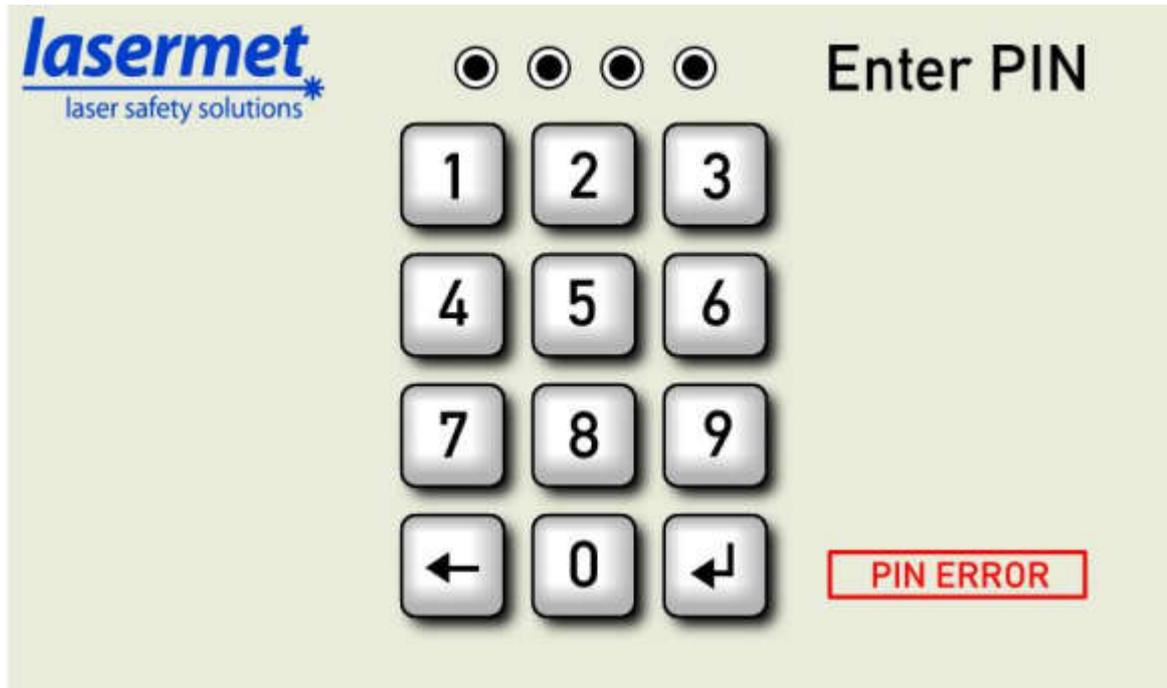


The user then enters a 4-digit PIN using the numeric touch keys, and the backspace key if necessary, to correct errors. Four dots are displayed above the keypad, and the unit beeps for each key press. The default PIN is '3333'. When all four digits have been entered, the user presses the enter key. For a successful entry, the following screen is displayed.



The user can then select whether to start using the controller immediately, or to change the PIN. Selecting 'unlock' will return the display to the status screen. A message is sent to the ICS-6-SP controller, which unlocks and then sends a return message to display the unlocked status. There may be a brief delay while this happens.

If the PIN fails, the following display is seen, and the status screen is shown after a short delay.



If the user has entered the correct PIN and elects to change the PIN, the PIN entry screen will remain, the four dots will be cleared, and the user can enter the new PIN. Since this is automatically valid, the user will be immediately returned to the status screen and the interlock controller will unlock.

13 Fuses

The ICS-6-SP Control Unit has a number of internal protection fuses which might blow under conditions of fault or wiring error. In particular the safety loop fuses are usually blown if during wiring the A and B safety loops are crossed over.

The fuses below are located inside the top of the unit. To access them, the front panel of the ICS-6-SP Control Unit must be removed. To do this, first remove the two screwlocks adjacent to the Expansion connector. Insert the blade of a 3mm flat screwdriver into the rectangular slot at the ends of the front panel and carefully prise it off.

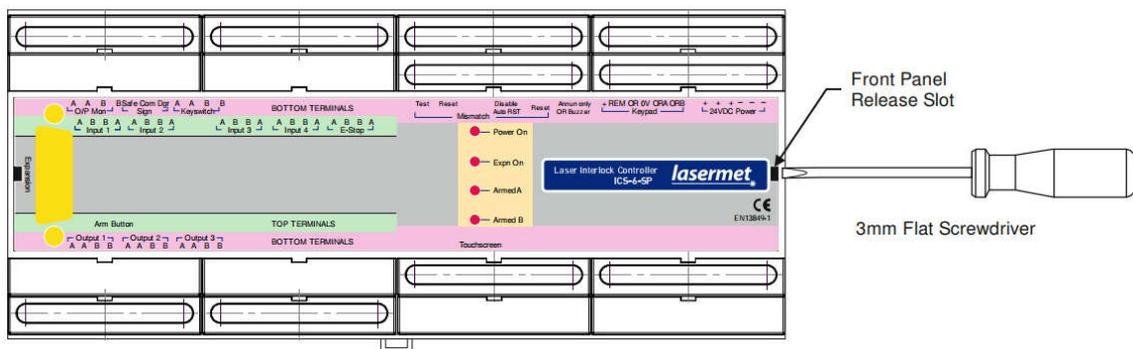


Figure 24.

F1	A Safety Loop	315mA 20 X 5mm
F2	B Safety Loop	315mA 20 X 5mm
F3	Expansion Module +24V Power	3.15AT 20 X 5mm

14 Specifications

Safety Performance	Up to PL'e' to EN ISO 13849-1:2015 see section 4.
Shutdown Time	6ms typical. Measured from opening of safety circuits to opening of interlock operator contacts.
Maximum Safety Loop Resistance	220Ω at 24V supply voltage 140Ω at 21.5V supply voltage
Supply Voltage	24V DC (21.5 – 26.5V).
Power Consumption	24W typical (ICS-6-SP Control Unit with Touch panel)
No. of Output Contacts	3, dual channel
Output Contact Rating	4A 50VDC resistive load
Ingress Protection	IP20
Operating Conditions	0° to 55°C, 0% - 95% relative humidity non-condensing
Size	263mm wide X 233mm high X 89mm deep
Weight	1kg

Dimensions are approximate. Values given as 'typical' are average values measured across a number of samples and are not guaranteed. Lasermet reserve the right to alter any specification without prior notice.

15 Warranty

Lasermet provide a 12-month warranty for defects in materials and manufacture, from the date of installation or delivery. Installations completed by Lasermet are covered against defects in workmanship for 12 months.

Damage or defects caused by other factors are not covered. For example, industrial contamination, incorrect cleaning, storm damage. Consequential loss is not covered under warranty. Compensation for indirect or direct loss or damage is expressly excluded. Rectification of the defects or a replacement does not initiate a new warranty period.

For all deliveries, payments and other legal transactions, English law takes precedence for any litigation.

16 Contact Details

Lasermet provide a full range of laser interlock equipment including interlock switches, illuminated warning signs, laser shutters, entry keypads with built-in fail-safe override timer, door locks, external power supplies etc. which can be interconnected to provide a complete system. We also supply equipment and consultancy covering all aspects of laser safety. Full support, design, and installation is available from Lasermet, please contact us for any queries.

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