

# Safety Logic Plus

*The simple way to build a complex Safety Interlock System that uses no software*

Lasermet's Safety Logic Plus is a simple but cost effective and safe concept whereby the logic configuration required for a safety interlock system is hard wired in a single logic enclosure.

The system uses modules that receive inputs from all of the interlock switches individually from the building that has the laser facility.

This enclosure contains all of the logic functions for the safety interlock. It is set to arm the laser via the Lasermet Interlock Controller when all of the safe conditions have been met. This includes self-checking.

## Customers can...

- Design and build complex safety interlock systems
- Virtually eliminate obsolescence (30+ years life expectancy)
- Simplify on-site installation
- Reduce installation time and costs
- Simplify testing and fault finding

## Simple design

- All safety switches are wired back to the enclosure
- All logic functions are performed in the enclosure
- Modules are used for all logic functions

## Safety

- It is a fail-safe system
- It uses dual channels
- It has full cross checking of all circuits

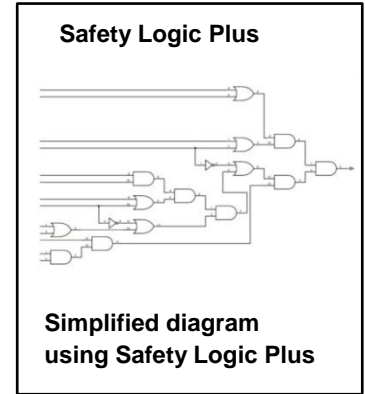
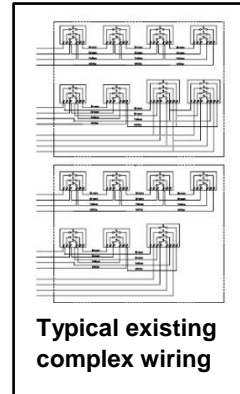
The laser will not arm until all circuits are checked on both channels and all conditions are satisfied – including self-checking.

## Obsolescence is virtually eliminated because there is...

- No software
- No Programmable Logic Control
- No operating system
- No specialist training

## Costs are reduced because...

- Installation, maintenance and testing is straightforward
- No specialist PLC training is required
- The design enables easy and fast fault finding
- Logic changes are done within the enclosure



The above diagram shows the typical complexity and subsequent simplification of circuitry as pictorial representations only. Some of the 32 connections in the complex diagram are wired together so that ultimately the same number of inputs and outputs feature on each diagram.



**Typical logic module within the Safety Logic Plus enclosure**

## Benefits of Safety Logic Plus

- Virtually eliminates obsolescence
- Easy to maintain and understand
- Installation and maintenance by competent electricians
- Simple proven components
- Follows basic engineering logical principles
- Logic changes can be implemented in the single enclosure
- Cost effective
- Fault finding made easy
- Dual channel
- Cross checked system

## Background to the requirement for Safety Logic Plus

Conventional simple interlock systems comprise a number of door contacts which are connected in series to form a safety loop. This is fed back to Lasernet's interlock controller.

However, with more powerful lasers and greater numbers of them, it is even now more important that laser safety interlocks are cost effectively installed, and that their logic can be easily understood, maintained and updated, especially when there are additional lasers or changes to the facility.

### Increased complexity

Modern interlock systems now often need to be configurable to provide multiple modes of operation and varying areas of coverage. Implementing such systems using point-to-point wiring between the various door contacts and controls within a building presents significant challenges for installation, test and fault-finding, which in turn increases the cost of installation and maintenance.

### The Lasernet Solution

To address this need Lasetmet introduced the Safety Logic Plus concept, which is a non-processor based fail-safe logic system that provides all the logical functions of the interlock system in a single enclosure. All that is required is to wire each door contact and other controls on individual cables to Safety Logic Plus. The logic function of the system is carried out by interconnecting the internal logic modules according to the logic diagram. This can be wired by a competent electrician.

### Simplicity and safety through hard wired logic

The wiring system can be simplified by working out the basic logic using AND and OR gate modules. All of the components are basic electrical components such as hard wired jumper type connectors, relays and LEDs.

### Safety through design

The relay-based logic gates are connected using jumper leads to provide the logic function. Every module can be checked easily as it has its own LED. A cross checking function is applied to every module so that if it fails, or if there is no input to it, the laser will not arm. Double safety circuits are used throughout the system.

## Virtual elimination of obsolescence

This logic system eliminates the obsolescence problems which have already become apparent with PLC based systems, which are dependent on interface standards and operating systems that rapidly go out-of-date. No programming languages are needed, no software or computer with its operating system is required and therefore it is highly unlikely to go obsolete.

Safety Logic Plus eliminates a range of problems through its fail-safe design. All wires are fed from all remote door locks or switches directly back to the enclosure where the logical functions are determined.

### Changes easily made

The design is such that any competent engineer who can follow the wiring diagram is able to check, test, modify or replace any modules or wiring. He does not require any diagnostic software, programming skills, any specific operating systems or other potentially obsolete test equipment. The system can be adapted, upgraded and modified at one point – within Safety Logic Plus.

## Safety Logic Plus addresses many issues

- **Complex site wiring**

Alterations to existing, conventional, wiring system installations can be difficult and time consuming and therefore expensive. Safety Logic Plus is therefore a cost effective solution.

- **Fault finding**

Often faults can be identified almost immediately due to the design.

- **Loss of cable identification**

This can often happen to cables during either installation or during the working life of the system when maintenance or modifications to the building or the wiring itself takes place. Safety Logic Plus simplifies identifying unmarked installed cables.

- **Maintenance of systems**

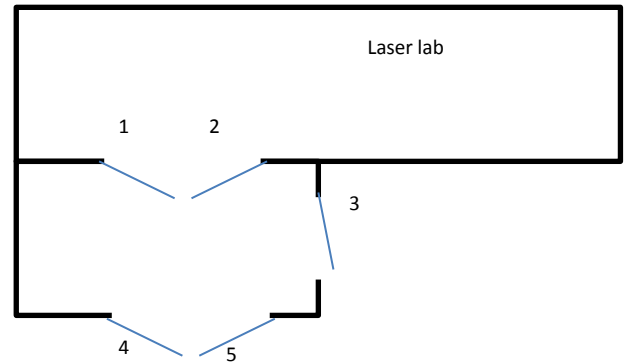
Elimination of bugs in software associated with any software used – especially Programmable Logic Controllers. As there is no software it cannot go obsolete. This includes the software itself, the programme type (including language) and the operating system on which it runs. Any maintenance or changes are easily implemented for the anticipated lifetime of the equipment which is expected to exceed 30 years.

## Design

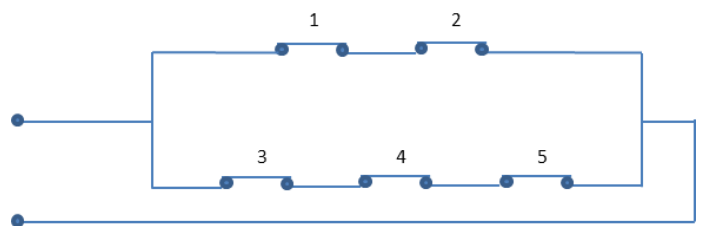
### Simplified example scenario

#### Example

This diagram shows a simple laser lab arrangement with 5 access doors. For a minimum safe situation doors 2 and 3 must be closed or doors 3,4 and 5 need to be closed.

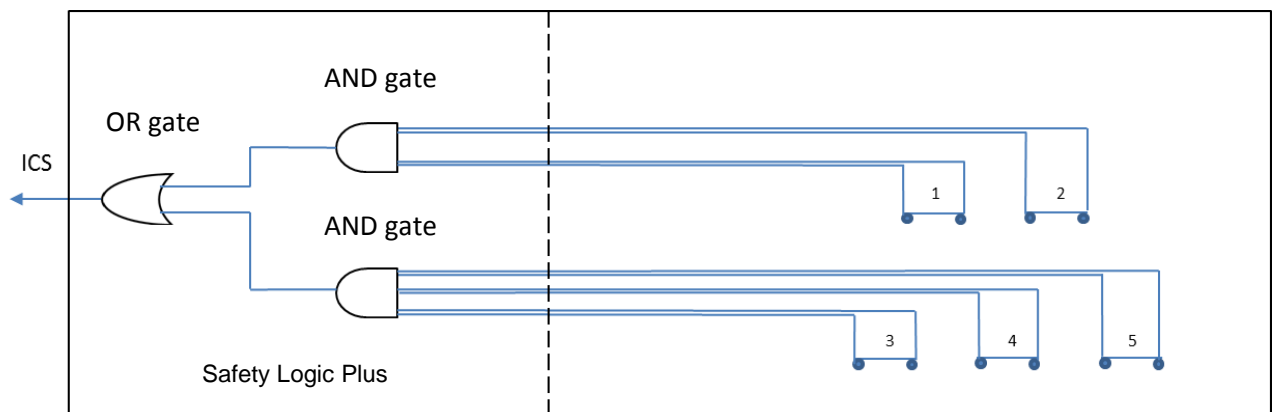


A typical interlock system using the building infrastructure to separate and run the minimum number of cables is represented here.



Safety Logic Plus (below) receives direct inputs from every interlock switch.

The safety logic can then easily be followed for each remote switch. If there are any changes then these can be carried out within Safety Logic Plus without having to trace and rewire and disrupt any of the building.



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