

**LASERMET  
LASER JAILER**

**INSTRUCTION MANUAL**

***laser jailer***  
active laser guarding system

**ACTIVE LASER GUARDING SYSTEM**

# LASERMET Laser Jailer Instruction Manual

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# 1 Declaration of Conformity



**LASERMET LIMITED**

**LASER JAILER SYSTEM**

## DECLARATION OF CONFORMITY

This is to certify that the Laser Jailer System (Active Laser Guarding System) 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 17 May 2016  
Low Voltage Directive 2014/35/EU 20 April 2016

Standards:	IEC EN 60825-1:2014	<i>Safety of Laser Products</i>
	EN 60825-4:2006+A2:2011	<i>Safety of Laser Products, Part4: Laser Guards</i>
	EN ISO 13849-1:2015	<i>Safety of Machinery: Safety Related Parts of Control Systems</i>
	IEC 60947-1:2007+A2:2014	<i>Low Voltage Switchgear and Control gear</i>
	EN ISO 12100:2010	<i>Safety of Machinery: General Principles for design</i>
	EN 61010-1:2010	<i>Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory use</i>
	EN 61508-1: 2010	<i>Functional Safety of Electrical/Electronic/ Programmable Electronic Safety-related Systems</i>

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

Country of Origin: England



Signed.

Paul Tozer  
Managing Director

Date: 31 July 2018

## **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.

### 3 Concept

Modern high-power lasers can be capable of cutting through their enclosures, making it difficult to ensure that the beam is safely contained in the event of it striking the enclosure surface. Multi-kilowatt lasers can readily burn through steel, concrete etc. This is particularly hazardous if the beam delivery system is moveable e.g. by being mounted on a robot.

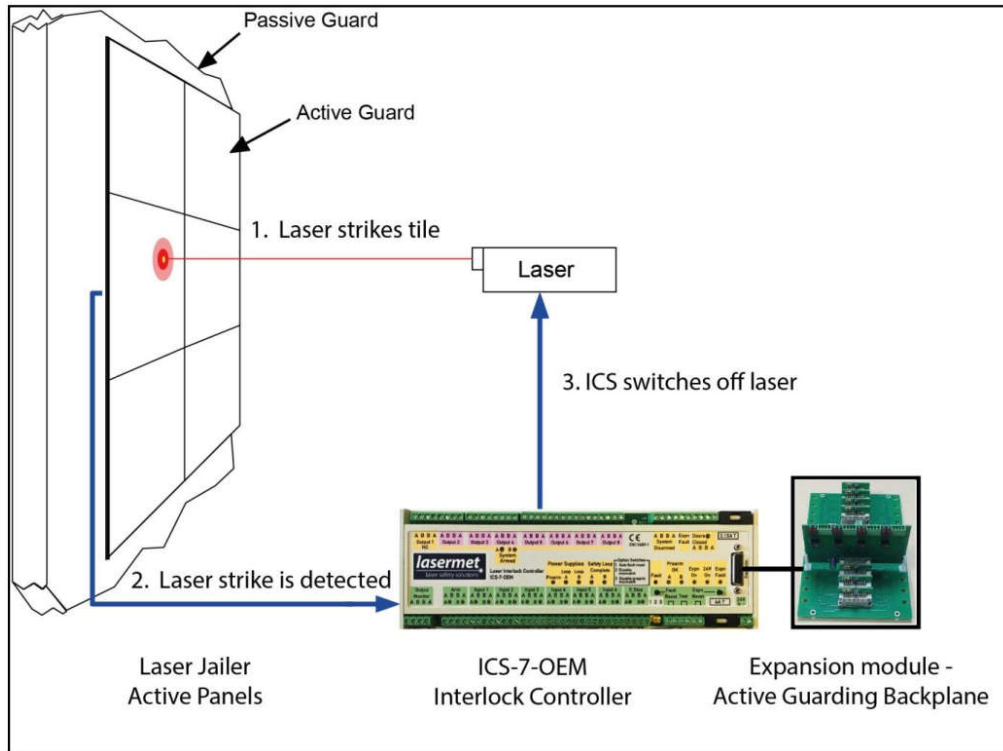
When it becomes impractical to provide safe passive containment an alternative approach is required. One method is to use active guarding, which detects a laser beam striking the enclosure surface and causes the laser beam to be turned off.

The Laser Jailer system uses inherently fail-safe laser detecting panels which are fitted to the laser side of the enclosure. The tiles are electrically interconnected to a monitoring and detection circuit board which is fitted inside the Interlock Control System (ICS).

The ICS forms the heart of a laser interlock and apart from monitoring the Laser Jailer panels also monitors door contacts, emergency stop buttons etc. and provides control of illuminated signage, override facility, door locking and so on. The ICS is usually connected to the interlock connector on the laser or to a beam shutter, so that the ICS can disable the laser beam if the enclosure is struck.

In the case of Laser Jailer, if a powerful laser beam misses its target and hits a detector panel on the enclosure wall, the monitoring circuit detects this, which in turn trips the ICS thus disabling the laser. Because of the inherently fail-safe detection technique used, any failure of the detector panel will also disable the laser. There are no maximum or minimum beam diameter requirements and no maximum or minimum laser power limits (very low power densities may not cause the system to trip but they will also be too low to cause any damage to the tiles or escape the enclosure).

When the Laser Jailer system is tripped, the monitoring and detection circuit memorises such an event and prevents the system from being re-armed. There are various options for enabling re-arm of the system (see Maintenance and Repair Manual).



The Laser Jailer system is intended to prevent penetration of the enclosure walls and to prevent injury to personnel outside the enclosure should an exceptional beam excursion event occur.

Testing has shown that a Laser Jailer system can disable a multi-kilowatt laser before any damage occurs to the wall behind. However, in practice this depends upon the beam irradiance to which the enclosure is exposed. A complete Active Guarding Enclosure will consist of an Active Guard and a Passive Guard (behind the Active Guard). The function of the Passive Guard is to contain the laser beam for long enough to allow the laser to be shut down. The Active Guard Protection Time quoted in the Protective Exposure Limit (PEL) specification is the minimum time for which the enclosure will contain the laser beam, at the quoted PEL, after the control system has issued the shutdown command. The user must ensure that the laser beam emission can be shut down within this time.

Lasermet 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 Lasermet, please contact us for any queries. Contact details are given at the end of this manual.

## 4 Operation

Please see the ICS-7-OEM Interlock Controller Manual.

### 4.1 Laser Detection

If a powerful laser beam strikes a Laser Jailer tile the detection system will disable the ICS, shutting off the laser beam.

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

### 5.1 Performance Levels of ICS-7-OEM Interlock Controller

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]	$1.19 \times 10^{-8}$
MTTFd	201 years
Mission Time	20 years
Diagnostic Coverage (DC)	99% (HIGH)

### 5.2 Performance Levels of Laser Jailer Camouflage Active Guarding Panels

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]	$5.26 \times 10^{-8}$
MTTFd	50 years
Mission Time	20 years
Diagnostic Coverage (DC)	99% (HIGH)

### 5.3 Performance Levels of Active Guarding Interface / Backplane

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]	$5.26 \times 10^{-8}$
MTTFd	50 years
Mission Time	20 years
Diagnostic Coverage (DC)	99% (HIGH)

## 6 Specifications

### 6.1 IEC 60825-4 Protective Exposure Limit

100 mm Panel Systems with Active Guarding

For 450 – 1200 nm wavelength

Area	PEL	Active Guard Protection Time
4 mm <sup>2</sup>	5 GW/m <sup>2</sup>	0.5 s
2000 mm <sup>2</sup>	10 MW/m <sup>2</sup>	5 s

Note that the Active Guard Protection time is the time the enclosure will contain the laser beam after the Interlock Control System has issued the shutdown signal. Therefore, the laser must cease output within 0.5 s of receiving the signal from the Lasermet Interlock Controller.

### 6.2 Steel Enclosure Systems with Active Guarding

For 450 – 1200 nm wavelength

Area	PEL	Active Guard Protection Time
4 mm <sup>2</sup>	1 GW/m <sup>2</sup>	0.5 s
2000 mm <sup>2</sup>	2.5 MW/m <sup>2</sup>	5 s

Note that the Active Guard Protection time is the time the enclosure will contain the laser beam after the Interlock Control System has issued the shutdown signal. Therefore, the laser must cease output within 0.5 s of receiving the signal from the Lasermet Interlock Controller.

#### Available Tile Sizes

The Laser Jailer panels each have an effective coverage of 500 X 630mm.

### 6.3 Environmental Conditions

Operating and Storage                    -10°C to +55°C, 10% - 80% relative humidity non-condensing

The tiles are intended for fixed indoor benign environments and should not be exposed to water or moisture exceeding the above limits.



## **7 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.

## 8 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.

For sales and technical support:

**Lasermet Ltd.**

Lasermet House,  
137 Hankinson Road,  
Bournemouth  
BH9 1HR  
United Kingdom.

Tel: +44 (0) 1202 770740

Fax: +44 (0) 1202 770730

Email: [sales@lasermet.com](mailto:sales@lasermet.com)

Website: [www.lasermet.com](http://www.lasermet.com)

**Lasermet Inc.**

10N Martingale Road, Suite 400,  
Schaumburg, Illinois 60173  
United States.

Tel: 847 466 1475

Email: [usa@lasermet.com](mailto:usa@lasermet.com)

Website: [www.lasermet.com](http://www.lasermet.com)