



USER MANUAL

MULTISCAN® HE

CO₂ laser marking system

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Preface

Audience

This manual should be read by all personnel who install or operate the MULTISCAN® HE laser.

Important!

Read this manual carefully before operating the equipment for the first time. Pay special attention to the Safety chapter.

The MULTISCAN® HE is designed and sold for integration within a marking station. The system integrator is responsible for compliance with all applicable local safety regulations.

How to use this manual

The following conventions are used in this manual.

Admonitions

The use of controls, replacement parts, adjustments, or procedures other than those specified within this manual may result in exposure to any of these hazards.

- Laser hazards
- Electrical hazards
- Environmental hazards
- Mechanical hazards.

The degree of seriousness of the hazard is indicated by the use of the following signal words:

DANGER

Indicates an imminent hazard which, if not avoided, is extremely likely to result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert the user against unsafe working practices and potential damage to the equipment.

Connector labels and signal names

Connector labels and signal names are shown in bold serif font to aid identification.

For example; **RF Enable**, **external interlock**

Marking and printing

This manual uses the terms "mark" and "marking" to describe the process of using a focussed laser beam to change the visible state of a surface. Graphical User Interface (GUI) windows within the system software and supplementary documentation may also describe this process as "print" or "printing". These terms have the same meaning in this context.

1. Safety

1.1. General safety information

It is strongly recommended that any personnel who are involved with the installation, operation or maintenance of this laser equipment should first read and fully understand the contents of this manual and Safety manual 906-0251-xx.

If there are any questions or doubts on any of the safety aspects of the equipment, then do not hesitate to contact your nearest Luxinar Aftersales office or distributor for advice before proceeding.

The installation, operation, maintenance and repair of this laser equipment must only be carried out by Luxinar service personnel or trained staff who have received correct instruction concerning the hazards associated with this particular equipment.

Important!

All safety critical instructions contained within this document are framed with a border and identified by CAUTION, WARNING or DANGER depending on the severity of the risk involved. In addition, the safety symbol ⚠ indicates that care should be taken when working with or on the laser equipment.

Luxinar does not accept liability for any damage or injury howsoever caused or arising.

The symbol given below is also used on the equipment and indicates that the user should refer to the OEM equipment operator's manual for more information on the safe operation or installation of the equipment.



1.2. Label locations

The labels shown on the following drawing are fitted to the equipment in the locations specified and must not be removed or defaced. Immediately replace any missing labels.

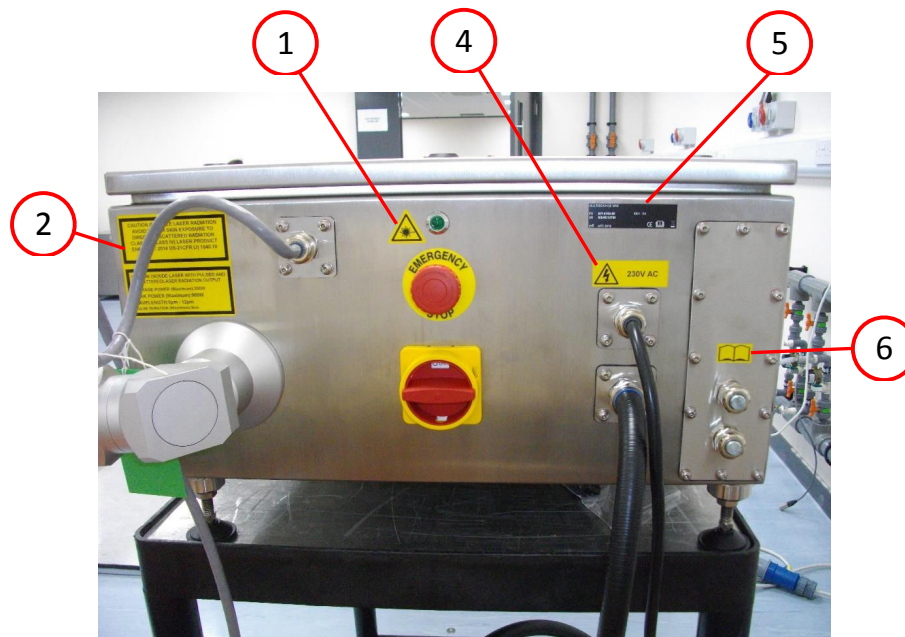


Figure 1 - Main enclosure front panel

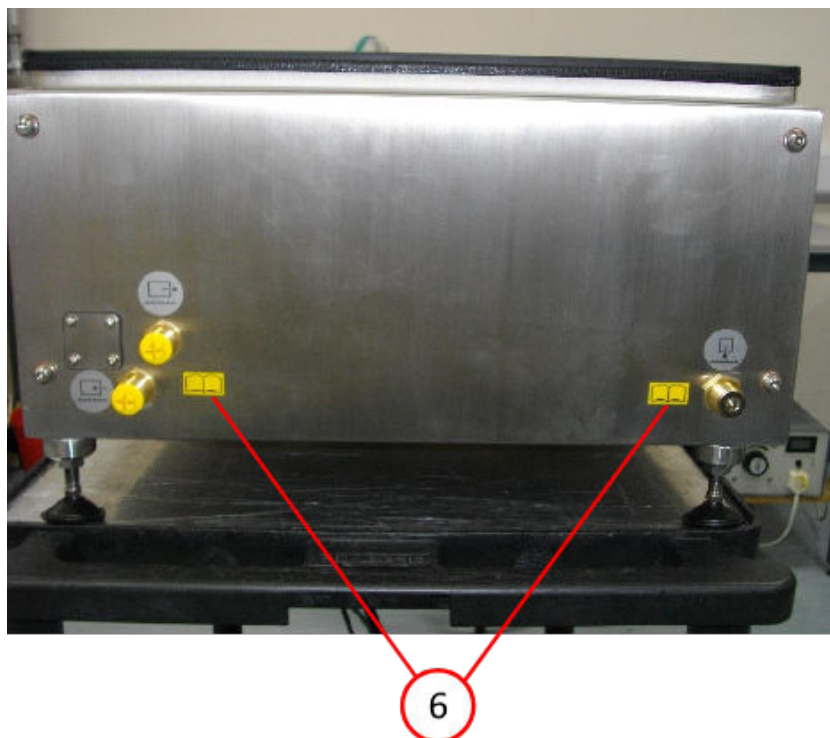


Figure 2 - Main enclosure rear panel — liquid cooling

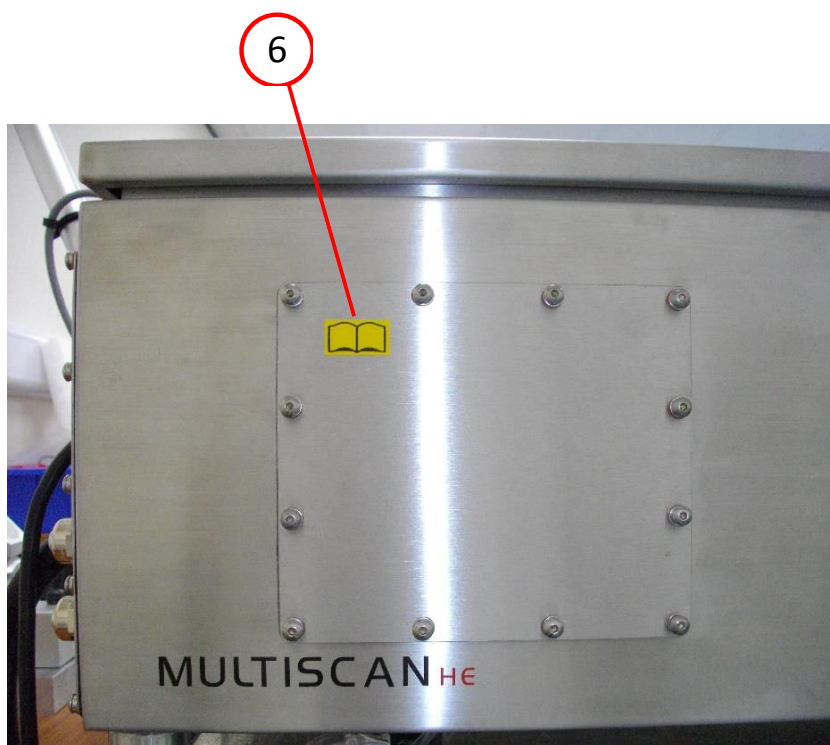


Figure 3 - Main enclosure interface access panel

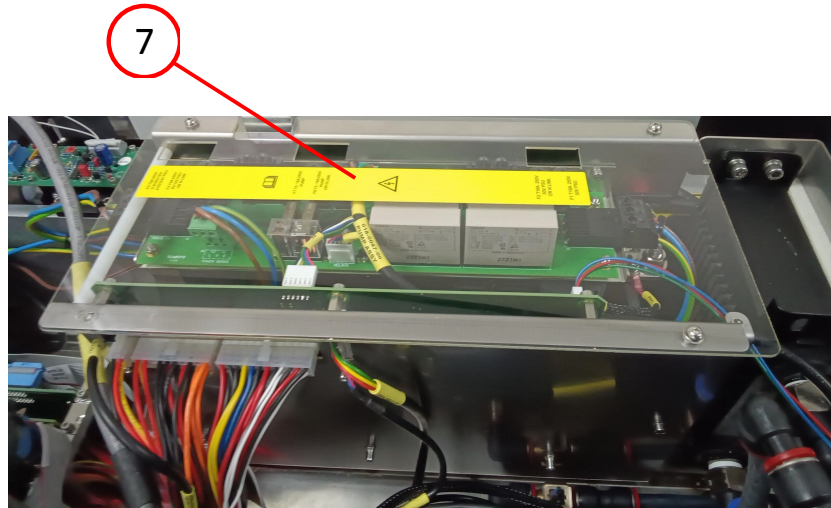


Figure 4 - Main enclosure power supply

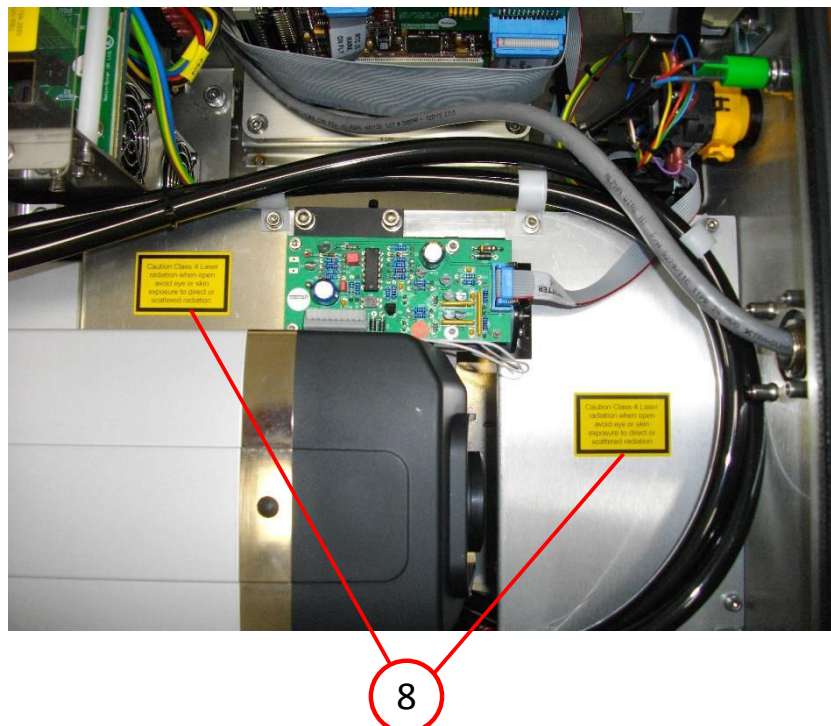


Figure 5 - Main enclosure beam path covers

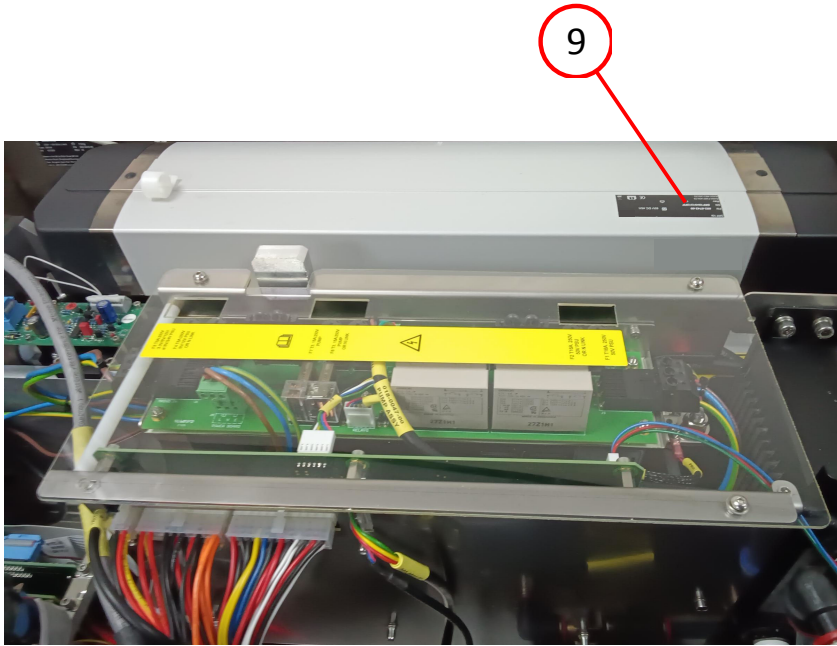


Figure 6 - Laser head identification



Figure 7 - Scanning head

1.3. Labels

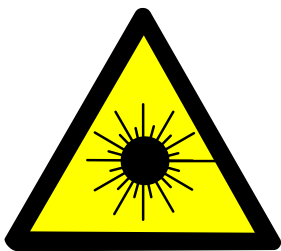


Figure 8 - Label 1 — Laser hazard

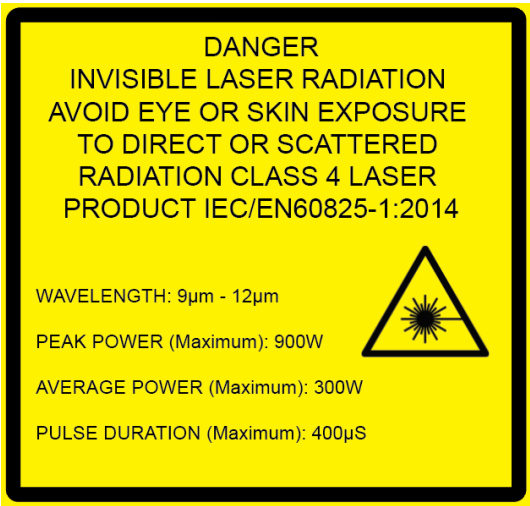
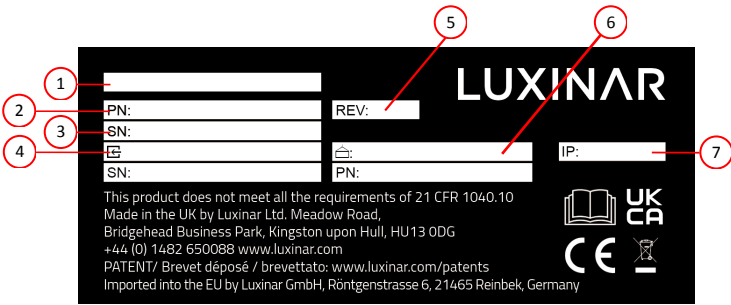


Figure 9 - Label 2 — Class 4 laser warning



Figure 10 - Label 4 — 230V AC warning



- 1 Model number
- 2 Part number
- 3 Serial number
- 4 Input
- 5 Revision
- 6 Weight
- 7 IP rating

Figure 11 - Label 5 — Product identification and certification



Figure 12 - Label 6 – Consult the user manual



Figure 13 - Label 7 — Power supply warnings

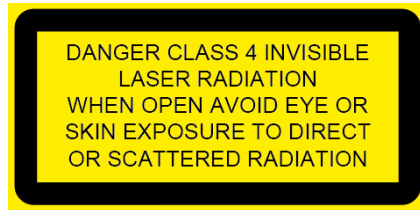


Figure 14 - Label 8 — Non-interlocked panel

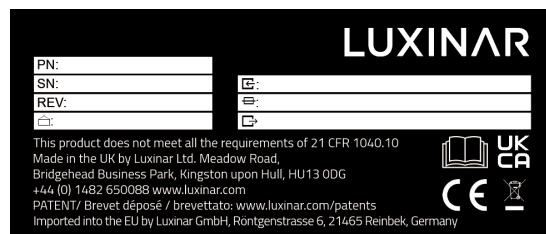


Figure 15 - Label 9 — Power supply identification and certification

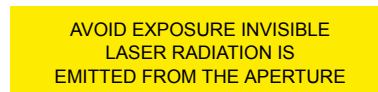


Figure 16 - Laser aperture

1.4. Maximum Permissible Exposure and Nominal Ocular Hazard Distance

The Maximum Permissible Exposure (MPE) is the level of radiation to which, under normal circumstances, persons may be exposed without adverse effects. The MPEs represent the maximum level to which the eye or skin can be exposed without consequential injury and are related to the wavelength of the laser radiation, the pulse duration or exposure duration, and the tissue at risk.

The MPEs given in the following table are informative and provided so that the integrator can calculate the Nominal Ocular Hazard Distance (NOHD), perform a risk analysis and inform the user about the safe usage of the product. However, exposure limits for the eye and the skin of employees in the work place and the general public are in many countries specified in national laws. These legally-binding national exposure limits might differ from the MPEs given in the following table.

The NOHD is the distance from the output aperture beyond which the beam irradiance or radiant exposure remains below the appropriate MPE. Importantly, the NOHD is dependent upon the beam waist size and the divergence of the beam. Therefore, the NOHD is dependent upon the optical components acting on the beam. The NOHDs given in the following table are relevant only when the laser is operated with the complete beam delivery system attached. NOHD values are quoted from the final focus lens on the scanning head. Further details of the safe use of lasers are given with IEC/ TR 60824-14 "Safety of laser products – Part 14: A user's guide."

Table 1 - MULTISCAN® HE MPE calculation

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000

Table 2 - MULTISCAN® HE NOHD calculation

Scanning head	SC7			SC10			SC14		
Wavelength (µm)	10.6	10.25	9.3	10.6	10.25	9.3	10.6	10.25	9.3
Lens focal length (mm)	NOHD (m)								
75	13	13	12	10	10	10	7	7	7
100	17	17	16	13	13	13	10	10	9
150	25	25	24	20	20	19	14	14	13
200	33	33	32	27	26	25	19	19	18
250	—	—	—	33	33	31	24	24	22
300	—	—	—	40	40	38	29	29	27
360	—	—	—	48	48	46	35	35	33

Note: Beam divergences given in the following table apply only when the marking system is operated with the complete beam delivery system attached.

Table 3 - Beam divergence for MULTISCAN® HE

Scanning head	SC7			SC10			SC14		
Wavelength (µm)	10.6	10.25	9.3	10.6	10.25	9.3	10.6	10.25	9.3
Lens focal length (mm)	1/e ² beam diameter divergence (mrad)								
75	74	71	68	95	89	88	134	128	125
100	55	53	51	71	67	65	100	94	93
150	37	35	33	47	44	43	66	62	62
200	27	26	25	35	33	32	49	46	46
250	—	—	—	27	26	25	39	36	36
300	—	—	—	23	21	21	32	30	30
360	—	—	—	19	18	17	26	24	24

1.5. Decommissioning and disposal

Dispose of the system according to appropriate local regulations.



2. General Description

2.1. System overview

The MULTISCAN® HE is a vector laser marking system comprising:

- a Radio Frequency (RF) excited, diffusion cooled, CO₂ industrial slab laser
- a high-speed galvanometer scanning head
- a computer-based controller to position the laser beam on the workpiece
- a user interface controller, QWERTY keypad and VGA display on an umbilical cable

The MULTISCAN® HE system has been specifically designed for very low maintenance operation and minimal user intervention or adjustment. It requires no initial warm-up time or recommended daily maintenance requirements. Once the system is correctly installed and programmed it can simply be turned on and off to initiate or end marking.


WARNING


Risk of eye damage

Permanent eye damage may result if laser radiation is allowed to enter the eye either directly or by a reflective surface during procedures involving access to the laser output.

All personnel must wear protective goggles suitable for use with carbon dioxide lasers when the laser is in a Class 4 operational state.

Personnel not wearing eye protection must be excluded from the area or room containing the laser.

2.2. Marking principles

When the focused laser beam hits the surface of an infra-red absorbing material, such as ink on card, the layer of ink is normally ablated or removed from the surface to reveal the contrasting substrate material as shown diagrammatically in Figure 17.

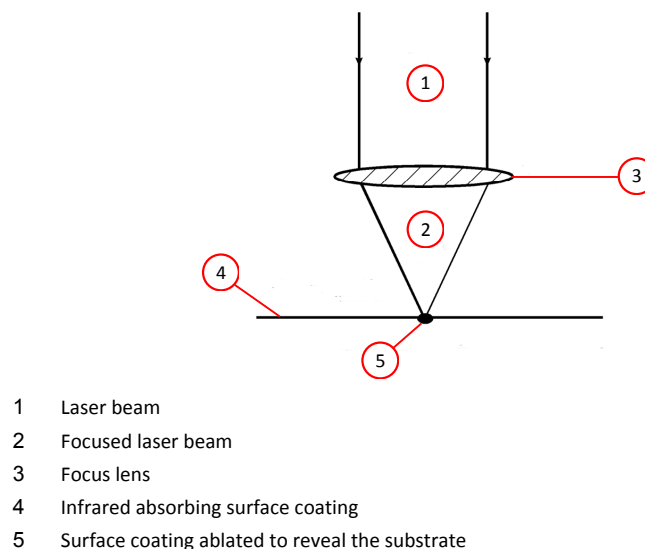


Figure 17 - Laser ablation using a focused laser beam

Many other materials also absorb at the infrared CO₂ laser wavelength and will mark successfully. These include glass (contrasting micro cracks are formed at the surface), some plastics (contrasting texture or colour is made by chemical change or melting) and coated metals. Non-absorbing materials, which cannot be marked with a CO₂ laser, include most metals, which reflect at this wavelength, and some plastics, such as polyethylene, which largely transmit the laser radiation.

To mark characters and images, the laser beam is deflected by high-speed galvanometer mirrors controlled by a computer. The computer also switches the laser beam on and off to form individual characters.

The computer is connected to a galvanometer control board via a digital interface which sends varying X and Y co-ordinate deflection values to the vector scanning head. Inside the head, each X and Y deflection value is converted to a voltage. X and Y galvanometers, (often abbreviated to 'galvos') convert the voltages into a proportional rotation of their shafts. A mirror is mounted to each shaft to deflect the laser beam. The galvanometers are mounted on perpendicular axes so that they control the deflection in the X and Y axis.

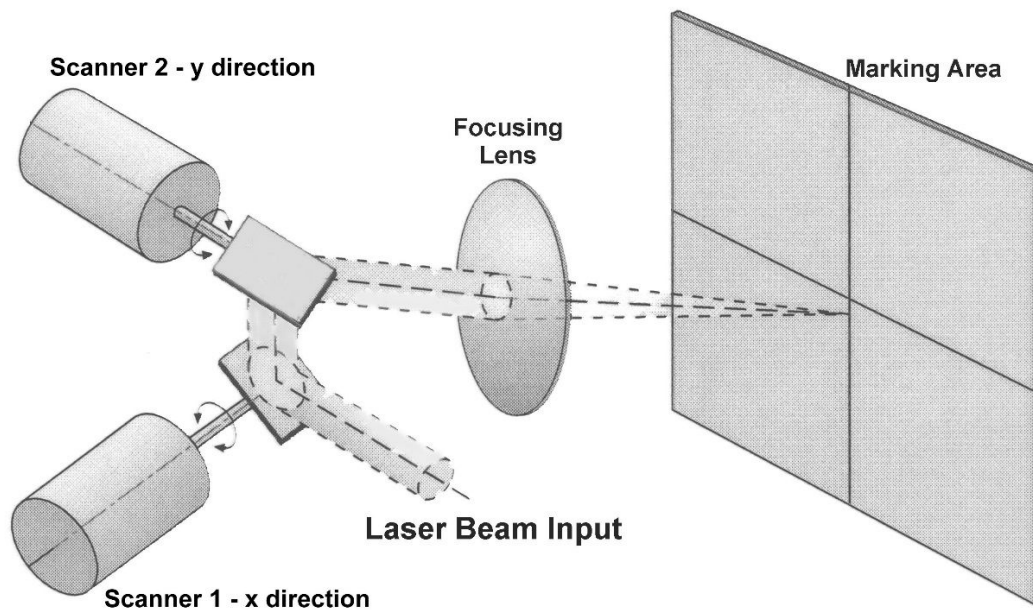


Figure 18 - Galvanometer scanning principle

The laser beam enters the head through an input aperture. Once inside, the beam is deflected by mirror X, then by mirror Y. The beam leaves the head through an objective lens which focuses the beam onto the surface to be marked. The lens is an 'F-Theta' type so that the focal point is proportional to the angle of incidence of the beam.

Distortion of the square image field is inherently caused by the path of the beam in the head and by the objective lens. Without correction, lines would be distorted into curves and the compensation of the product movement for 'on-the-fly' marking would no longer be accurate. A look-up table downloaded and stored in the galvanometer control board converts the incoming X and Y values to the corrected values.

The marking system is normally installed on a production line or conveyor where product moves past the system's scanning head. Marking of items on the production line is normally initiated by a product detector, which is mounted on the side of the production line adjacent to the system's scanning head.

By dynamically offsetting the marking by the same amount as the product movement, marking 'on-the-fly' is achieved. Accurate measurement and compensation of the product movement is achieved by using a tachometer (shaft encoder) coupled to the MULTISCAN® HE controller.

2.3. Typical production line installation



WARNING



Risk of eye damage

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure. This is a Class 4 (Class IV) laser and the beam is invisible to the eye. Please review all safety instructions and precautions given in [Chapter 1](#) before attempting to operate the system or perform maintenance procedures.

Important!

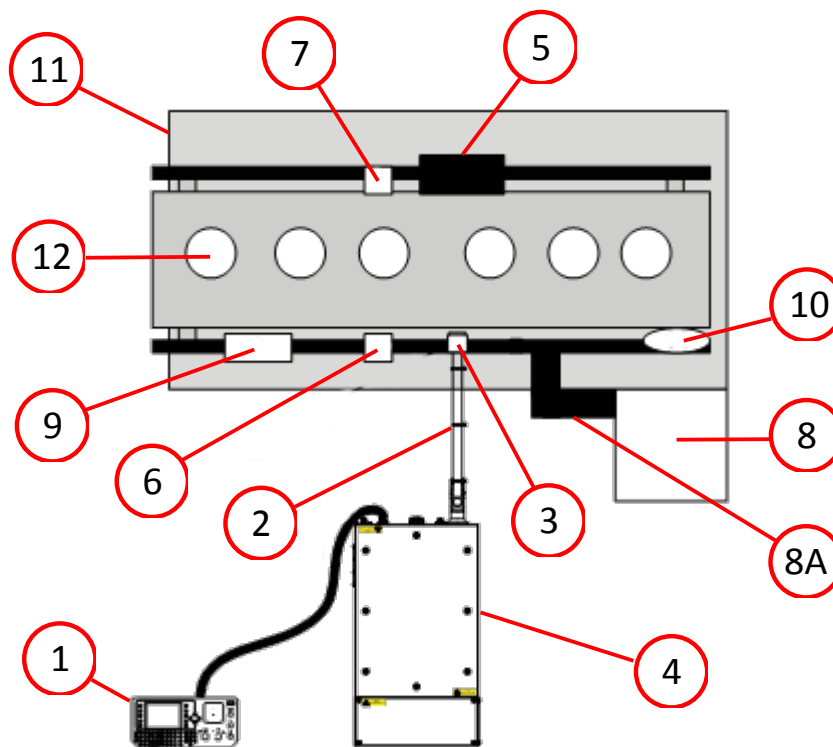
The MULTISCAN® HE is intended to be used for marking materials in an industrial environment. Use of the equipment for applications other than the intended one constitutes misuse and the laser manufacturer, Luxinar Ltd does not accept liability for any damage or injury howsoever caused or arising.

Installation of the MULTISCAN® HE onto a production line requires several peripheral items in addition to the necessary electrical, cooling and signal interfacing requirements.

These can include:

- Safety guarding to protect the operator from exposure to the laser beam or scattered laser radiation.
- Product detection to initiate marking on the material to be marked.
- Clean compressed air to prevent contamination of the final focus lens on the scanning head.
- Extraction of any fume or debris resulting from the marking process.

A typical installation with a simple 'conveyor-type' production line is shown in the following figure.



- 1 User control panel
- 2 Articulated beam delivery system
- 3 Scanning head
- 4 Main enclosure
- 5 Laser beam stop
- 6 Product detector
- 7 Product detector retro-reflector
- 8 Fume extractor
- 8A Flexible fume extraction hose and nozzle
- 9 Compressed air source for lens shielding
- 10 Shaft encoder
- 11 Guarding
- 12 Product to be marked

Figure 19 - Typical conveyor-type marking installation

Position the user control panel (1) so that it is easily accessible and visible to the operator.

The main enclosure (4) must be positioned so that the cooling vents have an unrestricted free flow of air to ensure adequate cooling. There must be a minimum of 0.5m clearance between the enclosure and any walls or other obstructions that could impede air flow.

The articulated beam delivery (2) directs the laser beam into the scanning head (3) which generates the programmed marking pattern on each product to be marked (12). The marking process is triggered by a product detector (6) that initiates a mark as each product is detected. In this example, a through-beam detector is shown with its retro-reflector (7).

On variable speed production lines, a feedback signal is required to synchronise the marking speed. The signal is normally provided by a shaft encoder integrated with the conveyer drive system. Constant speed lines do not require a feedback signal.

Depending on the material to be marked, it may be necessary to incorporate a fume extractor (8) and nozzle with flexible hose (8A) to remove debris and fume produced by the marking process. If a significant amount of debris is produced, the final lens will become contaminated, leading to a gradual degradation of mark quality and possible damage to the lens. This is prevented by blowing clean compressed air across the lens to form an air curtain. The compressed air is filtered and regulated down to an appropriate pressure by an air purification unit (9).

To provide optical protection from the laser beam, guarding must be installed to protect the operator and other personnel. In this example, a beam shield tunnel is provided which allows free passage of products past the marking point but prevents operator access and exposure to the laser beam during marking. The guarding must also incorporate a beam stop (5) that prevents damage to the guard material if marking is triggered when no product is present.

2.4. System components

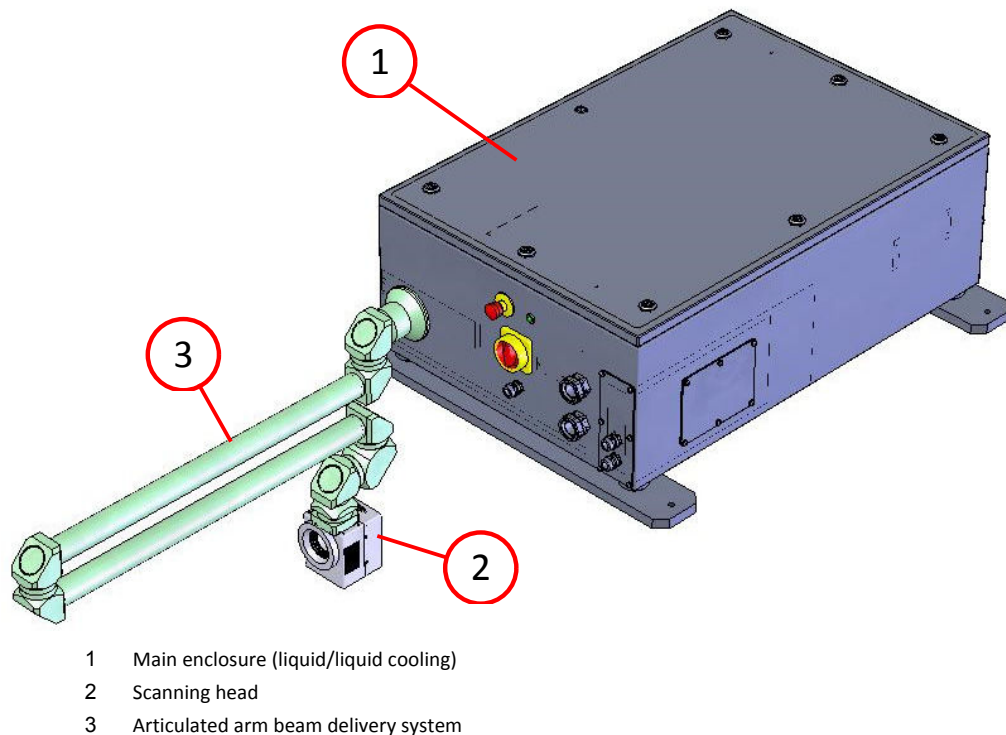


Figure 20 - MULTISCAN® HE system components

The MULTISCAN® HE system has been specifically designed for very low maintenance operation and minimal user intervention or adjustment. The system has no initial warm-up time or recommended daily maintenance requirements. Once the system is correctly installed and programmed it can simply be turned on and off to initiate or terminate marking.



Figure 21 - MULTISCAN® HE with air/liquid cooling

2.5. Main enclosure with integrated SR 10i laser head

The main enclosure contains an integrated SR 10i laser head, DC and RF power supplies, cooling system (air/liquid or liquid/liquid) and electronic control boards and interfaces for integration with the marking station. The enclosure is made from stainless steel and is sealed to IP66 standard. All cables pass through watertight glands on the front panel to prevent ingress of moisture.

2.6. Articulated arm beam delivery system

The articulated arm has sealed articulation joints containing beam turning mirrors to direct the laser beam from the main enclosure to the scanning head.

2.7. Scanning head

The scanning head directs the laser beam to follow a programmed path on the product to be marked. The beam is directed by high-speed galvanometer mirrors within the head and is focussed by a final focus lens mounted on the output face of the head.



Figure 22 - Typical scanning head

A range of scanning heads and final focus lenses is available to match the size of the marking field and the code geometry.

2.8. Control panel



Figure 23 - Control panel

The control panel is used to programme and select the code to be marked and to control the marking process. It is connected to the main enclosure by an umbilical cable.

Table 4 - Control panel features

Feature	Description
Power on key-switch	Three-position switch for Off , On and Start (momentary). The key is removable only in the Off position.
Shutter key-switch	Two-position switch for Shutter open and Shutter closed . The key is removable only in the Shutter closed position.
Status indicators	• Laser emission • Standby • Maintenance fault
Display	VGA, back-lit liquid crystal screen
Keypad	QWERTY format sealed membrane panel
Code composition and software options	Options include: fixed text, date/time, time with offset, sequential, password protection, system status messages, error/fault messages
Font types	A selection of TrueType and vector fonts
IP rating	66

2.9. Specifications

Note: This equipment is designed for overvoltage category II as defined within EN 61010-1:2010+A1:2019.

2.9.1. Marking performance

Character generation rate	Up to 1200 characters per second
Line speed range	Static or "on-the-fly" up to 500m/min

Marking field size (mm)	Final lens focal length (mm)	Scanning head model		
50x50	75	SC7	—	—
70x70	100	SC7	SC10	SC14
105x105	150	SC7	SC10	SC14
140x140	200	SC7	SC10	SC14
175x175	250	—	SC10	SC14
210x210	300	—	SC10	SC14
250x250	360	—	—	SC14

2.9.2. External interface

Table 5 - External interface features

Feature	Description
Product detector input	Two independent inputs for NPN or PNP product detector, 24 or 12VDC
Product detector output	Two independent outputs for external monitoring of the product detector input signals
Shaft encoder (tacho)	Input for control of "on-the-fly" marking for variable-speed production lines
Tacho fault	Input for monitoring the status of the tacho
Interlocks	Two independent inputs for provision of a remote emergency stop and remote (guard) interlocks
System on	Output for external monitoring of power on/power off for the system
Ready to print	Output for external monitoring of the status of the system; i.e. Standby or Ready to print
Product reject	Output for rejecting an unmarked product
Shutter status	Two independent outputs for external monitoring of the safety shutter status; i.e. Open or Closed
System enable	Input for the provision of externally enabling or disabling the system
Extractor enable	Output to enable the fume extractor when the system is ready to print
Extractor fault	Input for monitoring the status of the fume extractor
Good mark	Output for external monitoring of the status for each individual mark
Maintenance required	Output for external indication that maintenance is required
System fault	Output for monitoring when the system has a fault and is therefore not ready to print

Feature	Description
System RS232/Ethernet	Communications port for file download/external fields and remote control

2.9.3. Dimensions

Table 6 - Dimensions

System unit	Dimensions
Main enclosure — air-cooled (LxWxH) (mm)	1025x570x294
Main enclosure — liquid-cooled(LxWxH) (mm)	800x570x294
Main enclosure adjustable feet (optional)	Adjustment range 85–110mm
Control unit (LxWxH) (mm)	400x275.6x110

2.9.4. Weights

Table 7 - Weight

System unit	Weight
Main enclosure — air-cooled	115kg
Main enclosure — liquid-cooled	103kg

2.9.5. External materials

Main enclosure	316 stainless steel
Control unit enclosure	316 stainless steel
Laser head enclosure	316 stainless steel
Beam delivery tubes and articulated arms	Anodised aluminium
Scanning head	Anodised aluminium

2.9.6. Electrical supply

Mains electrical supply	230VAC $\pm$ 10%, single or bi-phase, 50/60Hz
Power consumption	4kVA peak for continuous laser output. Typically <500VA for normal marking duty.
Current	12A average, 16A peak

2.9.7. Cooling system

Liquid-cooled MULTISCAN® HE systems require an external temperature stabilised recirculating coolant circuit in order to operate correctly.

The preferred coolant is deionised water or deionised water with anti-bacterial additive. See [Appendix A](#).

Important!

To prevent condensation on optical surfaces, the coolant temperature must be maintained above the dew point.

The following look-up table defines minimum coolant temperatures (above the dew point) that avoid condensation with respect to ambient temperature and relative humidity.

Table 8 - Minimum laser resonator coolant temperatures

		Ambient temperature (°C)					
		20	25	30	35	40	45
Relative humidity	45%	19	19	19	24	29	
	50%	19	19	20	25	30	
	55%	19	19	21	26		
	60%	19	19	22	27		
	65%	19	19	23	28		
	70%	19	19	24	29		
	75%	19	20	25	30		
	80%	19	21	26			
	85%	19	22	27			
	90%	19	23	28			
	95%	19	24	29			

Table 9 - Coolant specification

Model	SR 10i
Minimum flow rate (L/min)	5
Recommended flow rate (L/min)	6
Maximum pressure	6.0bar (88psi)
Dissipation	4kW
Required refrigeration capacity	4kW
Coolant temperature	19–30°C (Optimum temperature 21°C. Allow 1% output power drop per 1°C increase.) Refer to document 906-0202-99 for more details.

2.9.8. Optics purge gas

Table 10 - Optics purge gas specification

Purge gas pressure	0.07–0.21bar (1–3psi)
Flow rate	1–2L/min
<i>Nitrogen purity</i>	
Nitrogen purity grade	≥ 4.6 (O ₂ ≤ 3vppm, H ₂ O ≤ 2vppm)
<i>Compressed air contamination limits</i>	
Oil	≤ 0.005mg/m ³
Water	≤ 0.05g/m ³
Particles	≤ 0.05μm

2.9.9. Environmental specifications

Note: This equipment is designed for indoor use only and Pollution Degree 2 as defined within EN 61010-1:2010+A1:2019

Table 11 - Environmental specifications

Ambient working temperature	5–40°C (41–104°F)
Storage temperature (with drained cooling circuit)	5–70°C 41–158°F)
Relative humidity (non-condensing)	10–90%
Maximum altitude	< 2000m
IP rating, all units	66

2.9.10. Laser characteristics

The laser head is a model SR 10i sealed cavity, RF excited, diffusion cooled slab CO₂ laser.

Table 12 - Laser performance

Wavelength	10.6μm	10.25	9.3μm
Wavelength range (μm)	10.17–10.7	10.17–10.33	9.2–9.4
Rated output power (W)	125	110	95
Minimum shipment power (W)	150	132	114
Typical shipment power (W)	165	145	125
Peak power (W)	315	280	240
Pulse energy (mJ)	5–100	5–90	4–80
Excitation frequency	81MHz		
Expected tube lifetime	20000 hours		
Maximum duty cycle	60%		
Pulse duration	2–400μs		
Pulse frequency	500Hz to 50kHz		
Beam mode M ² (K)	<1.2 (> 0.833)		

2.9.11. Scanning head characteristics



Table 13 - Scanning head characteristics

	SC7	SC10	SC14
Overall weight	726g	2151g	2551g
Height	78.5mm	114mm	157.5mm
Width	69mm	96.5mm	99.5mm
Depth	106mm	111.5mm	122.8mm
Field size for 50mm focal length lens	50x50mm	—	—
Field size for 100mm focal length lens	70x70mm	70x70mm	70x70mm
Field size for 150mm focal length lens	105x105mm	105x105mm	105x105mm
Field size for 200mm focal length lens	140x140mm	140x140mm	140x140mm
Field size for 250mm focal length lens	—	175x175mm	175x175mm
Field size for 300mm focal length lens	—	210x210mm	210x210mm
Field size for 360mm focal length lens	—	—	250x250mm

3. Operation



WARNING



Risk of injury to eyes and exposed skin

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure. This is a Class 4 (Class IV) Laser and the beam is invisible to the eye. Review all safety instructions and precautions given in [Chapter 1](#) before attempting to operate or service the system.

The MULTISCAN® HE is operated and programmed using the key switches, the QWERTY keypad and the display on the user interface panel.

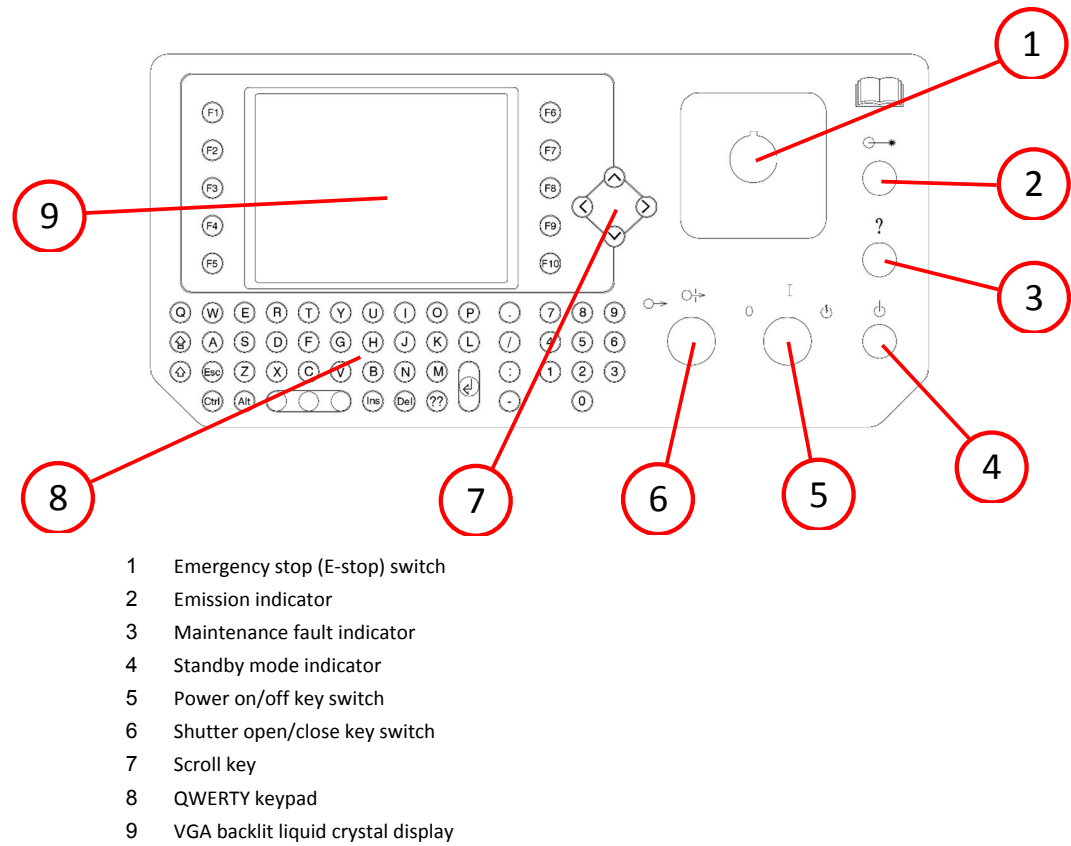
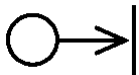
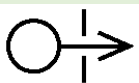
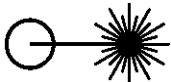


Figure 24 - Control panel layout

Table 14 - Control panel symbols

Symbol	Explanation
	Power key switch: off position
	Power key switch: on position
	Power key switch: momentary start position

Symbol	Explanation
	Shutter key switch: shutter closed position
	Shutter key switch: shutter open position
	Laser emission indicator
	Maintenance fault indicator. This fault prevents the system from marking.
	System standby indicator (conforms to 417-IEC-5009a). When in standby mode, the system will not mark until the operation indicated on the control panel has been performed.
	Refer to the user manual

Programming for the software type and version installed in the system is explained in a separate software manual.

3.1. Preliminary checks

1. Ensure mains power to the marking system is turned on.
2. If the machine is in a maintenance or installation situation with marking station guards removed, check that there are no personnel within the area and that safety warning notices are prominently displayed.
3. Check that remote interlocks are operating correctly and are closed and that the Emergency stop switch is released.
4. Check that the system can receive trigger signals from the product detector(s).
5. Clear any warning or fault messages displayed on the control panel screen.

3.2. Start-up

1. Turn the main isolator switch on the main enclosure front panel to the **On** position.
2. Insert the keys into the shutter and power key-switches on the control panel. The initial positions are **Shutter closed** and **0** (Off).
3. Ensure that the **Emergency stop** button is released by rotating it slightly clockwise.
4. Turn the power key to the **1** (On) position.
5. Turn the power key to the **Momentary start** position, then allow it to return back to the **1** (On) position.

The DC power supply turns on and the laser is enabled. This sequence takes approximately 15 seconds, during which marking is disabled and the screen displays a message **Waiting for DC supply**.

6. Turn the shutter key to the **Shutter open** position.
7. The last code to be marked before shutting down displays at the top of the screen. Press **F10** to enable marking.

Products that trigger the detector(s) will be marked using the code displayed on the screen.

Important!

Changing to different screens (status, settings, edit, etc.) incurs an additional processor load that may interrupt repetitive mark cycles.

If possible, avoid changing screens during marking.

3.3. Shut-down

1. Stop the flow of products past the detector(s).
2. On the control panel, press **F5** for Shutdown.
3. Turn the shutter key to the **Shutter closed position**.
4. Turn the power key to the **0 (Off)** position.
5. Remove both keys to prevent unauthorised use of the system.

Note: The keys can only be removed in the **Off** position.

6. Turn the main isolator switch to the **Off** position.

Note: The isolator switch is designed to be padlocked in the **Off** position to prevent unauthorised use of the system.

3.4. Manual restart after an emergency shut-down

It is a statutory requirement of 21 CFR 1040.10 that the laser output should not be restored automatically if the mains power fails or an interlock is broken and then reset. This is also a requirement of EN 60825-1:2014, where a remote interlock connection is being used as a safety interlock on an access panel of a protective enclosure that when removed, will change the class of the installed system to a Class 4 (Class IV) laser product.

3.4.1. Mains power failure

If there is a mains power failure, the laser and its power supply will be disabled and will not be re-enabled when mains power is re-established.

To restart the system, turn the main isolator switch to the **Off** position and then repeat the start-up procedure in section 3.2.

3.4.2. Remote interlock broken

If a remote interlock is broken, e.g. after opening an access door in the safety guard, the laser will be disabled. When the remote interlock is closed, the actions required to re-enable the laser depends on the interlock mode configured in the hardware or software.

The default factory setting is **Interlock Mode 1**. In this configuration, the laser will not be re-enabled when the remote interlock connection is reset. Mode 1 meets the safety requirements of CDRH and EN 60825-1:2014.

The actions required to restart the system in different modes are:

- **Interlock mode 0**

1. Turn the shutter key to the **Closed** position.
2. Turn the power key to the **1 (On)** position.
3. Turn the power key to the **Momentary start** position, then allow it to return back to the **1 (On)** position.

The DC power supply turns on and the laser is enabled. This sequence takes approximately 15 seconds, during which marking is disabled and the screen displays a message **Waiting for DC supply**.

4. Turn the shutter key to the **Shutter open** position.
5. The last code to be marked before shutting down displays at the top of the screen. Press **F10** to enable marking.

Products that trigger the detector(s) will be marked using the code displayed on the screen.

- **Interlock mode 1**

1. Press the Print button.
2. Press 'Yes' to confirm laser activation.

- **Interlock mode 2**

This is an automatic restart mode. The system will restart and the laser will be re-enabled as soon as the interlock is reset.

Important!

It is the user's responsibility to ensure that the chosen interlock mode fully conforms to local safety regulations governing use of the laser.

For more safety details, refer to [Chapter 1](#).

3.5. Restart button



Figure 25 - Restart button

The control unit includes a **Restart** button on the rear face. This button will only restart the system if a system shut-down has been performed but the mains isolator switch has not been turned off. The **Restart** button will not restart the system during normal operation.

4. Diagnostics and troubleshooting

4.1. Status indicators

The user interface board in the main enclosure has a set of indicator LEDs which illuminate when a fault is detected or when certain voltages are present.

Table 15 - User interface board LED system status indicators

Indicator number	Function
1	Interlock voltage present
2	Control panel Emergency stop
3	User Emergency stop 1
4	User external interlock 1
5	Coolant temperature (RF power supply)
6	Coolant temperature (water pipe) 50°C
7	Shutter dump temperature
8	Power on key-switch 1
9	Shutter key-switch
10	Power on key-switch 2
11	Coolant flow
12	DC enable
13	User Emergency stop 2
14	User external interlock 2
15	Laser emission indicator OK
16	External cooling
17	5V
18	12V
19	24V
20	15V
21	-15V
22	EXT 24V
23	EXT 12V
24	EXT 5V

Table 16 - RF power supply LED status indicators

Indicator number	Function
1	DC status
2	Interlock status
3	Coolant flow status
4	RF status
5	Modulation status

5. Routine maintenance

5.1. General information

The MULTISCAN® HE is designed to be low maintenance and with low consumable cost. The only routine maintenance procedures are as listed below. The system's sealed construction and low number of moving parts ensures trouble-free and reliable operation. Operational faults are reported by the monitoring system built into the control software.

Routine maintenance should be performed at the following typical frequencies.

Table 17 - Routine maintenance intervals

Action	Typical frequency	Comments
Clean the scanning head final focus lens	1 — 3 months	Depends on the working environment and materials being marked. See section 5.3
Check the interlocks	Every 6 months	See section 5.4
Check the liquid coolant level	Every 6 months	Check the coolant level and top up as required. Verify there are no leaks.
Replace the liquid coolant	Every 18 months	This should be carried out by a Luxinar trained engineer.

Other marking system components will also require periodic inspection and cleaning. These include the compressed air supply filter, the product detectors and the fume extractor filters. The maintenance interval for these components will depend on how they are integrated into the marking station.


WARNING


Risk of injury to eyes and exposed skin

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure. This is a Class 4 (Class IV) Laser and the beam is invisible to the eye. Review all safety instructions and precautions given in [Chapter 1](#) before attempting to operate or service the system.

Always ensure that the marking system is switched off and isolated from the mains supply before attempting any cleaning or maintenance procedures.

5.2. General cleaning

Always ensure that the system is switched off and isolated from the mains supply before attempting any cleaning procedures. The system is supplied with two key-switch covers as shown in the following figure. They must be fitted over the key-switches before attempting any cleaning or wash-down procedures.

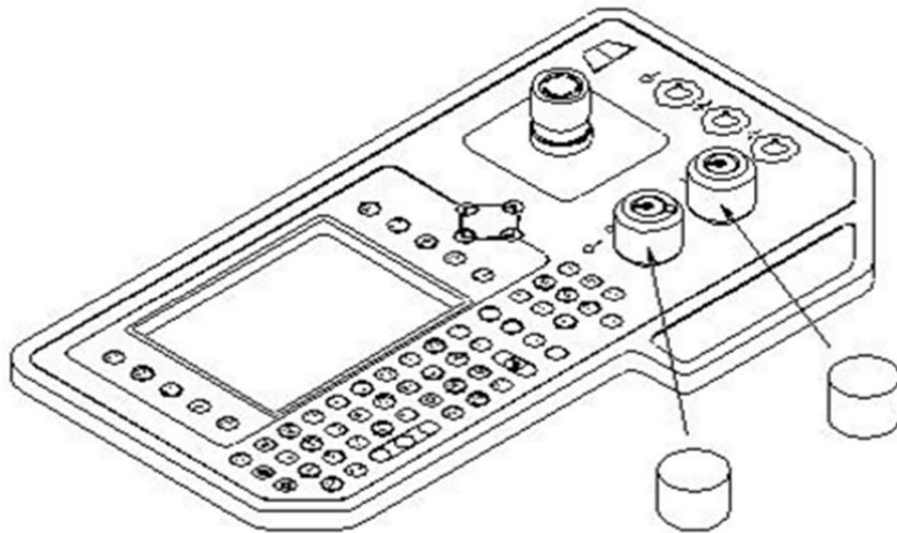


Figure 26 - Key-switch covers

Clean the external surfaces of the system with a mild detergent. It is advisable to use a damp cloth when cleaning the external cabinets and enclosures.

Important!

Take care not to allow water into the main enclosure or the final focus lens beam shroud.

5.3. Cleaning the final focus lens

The only externally exposed optical surface is the scanning head final focus lens. Where a compressed air supply for the lens protection shroud and fume extractor is correctly installed, the final focus lens should rarely need to be cleaned. If cleaning does become necessary, both the compressed air supply and fume extractor should also be inspected for correct operation and cleanliness of filters.

The most common sources of surface contaminants are fingerprints and airborne contaminants (dust, lint, smoke, etc.). If allowed to remain on optical surfaces, such contaminants will cause absorption and scattering of the laser beam and in extreme cases this may permanently damage the lens and its coatings. Improper removal of this contamination can also cause permanent damage.

Optics cleaning materials

- Lens tissue (first quality)
- Tissues (non-perfumed for rough work, wiping hands, etc.)
- Disposable lint-free gloves
- High purity solvents (preferably anhydrous):
 - Methanol
 - Ethanol
 - Isopropyl alcohol (99.5% purity)
- Photographic blower brush
- Medicine dropper

Cleaning procedure

1. Remove the lens protection shroud and the lens but leave the lens in its holder during this procedure.
2. Thoroughly wash your hands to remove all oils, perspiration and grit, then rinse them to remove all traces of soap.
3. For added protection, wear lint-free gloves after washing.

4. If there is visible dust, lint or other solid matter on the lens surface, gently blow it off with a photographic blower brush. Coated optics require careful handling, even for the type labelled "hard-coated".
5. If the lens surface is not badly contaminated, cleaning can be done fairly easily. Fold a fresh sheet of lens tissue to form a pad several layers thick. Its size will be a compromise between fully covering the lens diameter and being too large to clean evenly.
6. Using a medicine dropper, apply enough solvent to the pad to just dampen it.
7. Draw the pad across the lens surface in one smooth stroke, using very light pressure, then discard the pad.
8. Repeat steps 5 and 6 as required, using a clean pad for each stroke, until the lens surface is clean.
9. Replace the lens into its position on the scanning head and then replace the lens protection shroud.
10. If the contamination cannot be removed, or if the surface is permanently damaged, replace the lens with a new part having the same specification and orientation.

5.4. Interlocks

It is important to verify the correct operation of external interlocks on a regular basis. In order to do this, power up the marking system to **Ready to Mark** status and then open any guard access door that is fitted with an interlock switch. The system should drop back to **Standby** status and will display an interlock fault message.

5.5. External cooling system contamination — liquid-cooled version

If the external coolant is contaminated with bacteria or has been treated with other chemicals it is necessary to clean the cooling circuit:

The pH value, conductivity and dissolved solids levels can be measured using a portable meter. The bacterial contamination level can be checked using a test kit. For more information and advice, contact Luxinar Aftersales.

Pay particular attention to the instructions provided by the manufacturer of the NALCO water treatment kit:

1. Drain off the contaminated cooling water.
Ensure that disposal of all the materials used in this product is conducted according to all local and national regulations.
2. Flush the cooling water circuit with tap water by filling and draining once only.
3. Mix tap water with deionised water in a 1:1 ratio and fill the cooling water circuit.
4. Add a NALCO biocide water treatment kit and mix well with the cooling water.
5. Operate the system for two to four days, then drain off the cooling water.
6. Flush the cooling water circuit twice.
7. Fill the cooling system with fresh deionised water and add the contents of a fresh NALCO water treatment kit.

5.6. Frost protection

If the external cooling system or chiller is located in an area where the temperature may drop below 0°C, then the cooling circuit must either be equipped with a winter-proof heating tank to prevent the cooling water temperature dropping below 15°C or the coolant must contain glycol antifreeze. For coolant details refer to [Appendix A](#).

5.7. Internal coolant replacement — all versions

For coolant draining instructions, see section [7.1](#).

For coolant refilling instructions, see section [6.7.1](#).

5.8. Fuse replacement

The configuration of the AC mains supply and DC power supply fuses depends on the mains supply input configuration. This is either:

- Single-phase
- Bi-phase

For fuse replacement specifications and details, refer to section 6.8.2.

Note: If a fuse fails again when the mains supply is reconnected, this may indicate a more serious fault. For more information and advice, contact Luxinar Aftersales.

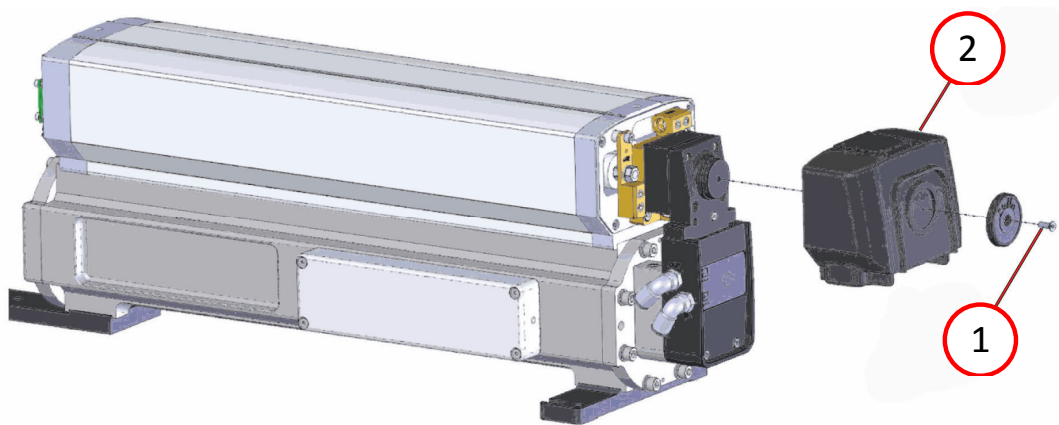
5.9. Pre-ioniser fuse replacement

The MULTISCAN® HE system has an SR 10i laser head within the main enclosure. The laser contains a fuse to protect the pre-ioniser circuit. To replace the fuse, perform the following steps:

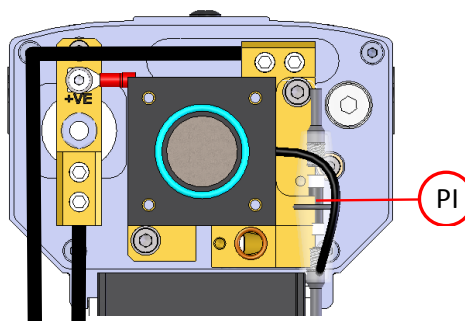


Ensure that the equipment is disconnected from the mains supply before replacing the fuse.

1. Disconnect the equipment from the mains electrical supply.
2. Remove the main enclosure top cover.
3. Remove the cover (2) from the rear end of the laser by unscrewing the fixing screw (1).



4. Remove the faulty fuse (PI).



5. Fit a replacement fuse of the same size and type.
Fuse specification: 20mm, T1A250V (Luxinar part number 552-0007-00).
6. Replace the cover and secure it with the fixing screw.

Note: If the fuse fails again after replacement, this may indicate a more serious fault. For more information and advice, contact Luxinar Aftersales.

5.10. Compressed air supply

A compressed air supply must be connected to the lens protection shroud where there is a possibility of contamination of the final lens due to the particulate matter produced as a by-product of the marking process. Contamination of the final lens will result in poor quality marking or, in the worst case, no mark on the product.

The compressed air creates an air curtain with slight over-pressure in the lens protection shroud.

The recommended two-stage air filtering requires regular inspection and maintenance. The interval between inspections will vary depending on the quality of the initial air supply.

As a basic guide, these filters should be inspected on a weekly basis after initial installation. Where necessary, replace or clean the filters, referring to the manufacturer's instructions. Blocked filters may indicate that the final focus lens has also been contaminated. See section 5.3.

If the filters are found to be clean, the inspection interval can be increased. However, Luxinar recommends that the maximum interval is no longer than one month.

5.11. Fume extractor

Always switch off the laser system and the extractor and isolate them from the mains power supply before proceeding with the inspection of extraction filters.

An approved fume extraction unit must be fitted to all installations where particulate matter or fumes are produced as a by-product of the marking process. The manufacturer of the extraction unit should recommend the correct filter combination to effectively control the fume produced in the marking process, which will depend on the materials of the substrate to be marked.

Where the marked product materials are altered or changed after initial installation, then consult Luxinar Aftersales and the manufacturer of the fume extractor for details of any required change to the extraction filter specification.

The fume extractor filters must be regularly inspected, changed and disposed of in accordance with the manufacturer's instructions. In general, this will depend on the construction of the fume extractor, the filter capacity and the amount of debris produced by the marking process. Where possible use an extraction system with a built-in filter monitoring device for automatic filter blockage detection.

5.12. Product detectors

Always ensure that the marking system is switched off and isolated from the mains supply before attempting any cleaning of the product detectors.

Product detectors can be occasionally wiped with a clean damp cloth to remove contamination from the active surfaces. Take care not to move or disturb the detectors during cleaning as this may affect the code position on the product to be marked. Do not use abrasive materials as these may damage the detectors and render them inoperative. See the manufacturer's instructions for more information on cleaning.

The inspection and cleaning interval will depend on the production line environment. If contamination is found to be light, the initial daily inspection can be increased up to a maximum of a weekly inspection.

6. Installation

6.1. Unpacking and preparation

6.1.1. Delivery check

Important!

The MULTISCAN® HE system is not designed for shipping in any orientation other than the upright position, as clearly indicated by the arrows on the outside of the packaging.

Check the outside of the packaging for obvious signs of damage or change of state of the shock or tilt labels.

If any damage to the packaging or change to the tilt or shock labels has occurred in transit, inform both Luxinar Ltd and the shipping company before taking any other action. Insurance company inspection of the damage may be necessary before proceeding with the unpacking of the equipment.

An itemised list of the ordered equipment is supplied with each shipment. On delivery and unpacking, check the equipment against the list to ensure that all items are present. If any equipment is missing, inform Luxinar Ltd immediately.

6.1.2. Unpacking

1. Unpack the system on a level and flat surface in a dry environment with plenty of room to remove the packing and to roll the MULTISCAN® HE off the pallet base of the packaging. Where appropriate, store the packaging for future use in repackaging the unit for further shipment or return.

See [Figure 27](#) for details of the packaging components. The box is fitted with a pallet base.

2. Cut the plastic bands on the outside of the box. Open the box lid and remove the polystyrene top cover and then remove the outer box.
3. Remove the accessories and polystyrene inserts.
4. Check all the components for any signs of damage. If any damage has occurred in transit, inform both Luxinar Ltd and the shipping company, before taking any other action. Insurance company inspection of the damage may be necessary before proceeding with further unpacking of the equipment.
5. Place lifting strops under the main cabinet between the feet. Use lifting equipment to lift the system and remove the remaining packaging.



Heavy equipment — risk of severe lumbar injury

The weight of the MULTISCAN® HE exceeds the single person lift limit of 18kg, as specified in EN 61010-1:2010+A1:2019. Ensure that suitable lifting equipment is employed.

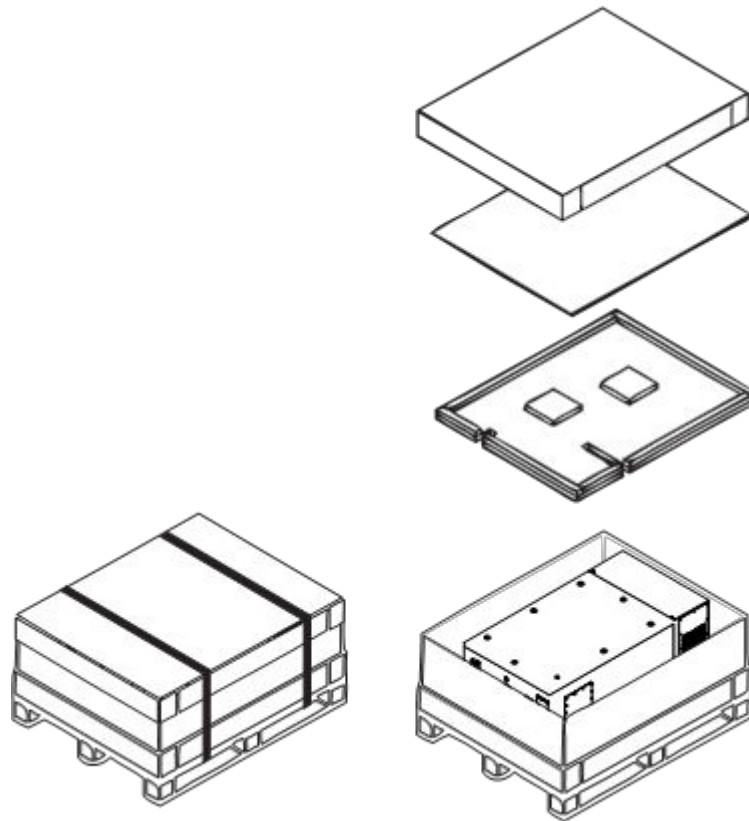


Figure 27 - Packaging components



CAUTION



Risk of damage to the articulated arm

Never apply excessive torque or leverage to the articulated arm. Although it is ruggedly constructed, the articulated arm is precision aligned and any distortion of the arm may result in misalignment of the laser beam within the scanning head.

6.2. Mechanical Installation

It is strongly recommended that any personnel who are involved with the installation, operation or maintenance of this laser equipment should first read and fully understand the contents of the Safety chapter, [Chapter 1](#).



DANGER



Risk of injury to eyes and exposed skin

This is a Class 4 (Class IV) laser product. All precautions relevant to this class of laser product should be strictly observed. Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Strict compliance with the safety precautions set out and referred to in this manual and extreme care in use are essential to minimise the chance of accidental damage to the equipment or personal injury. Luxinar does not accept liability for any damage or injury howsoever caused or arising.

Before securing any item in a permanent position, it is recommended that the components are first placed in their approximate final positions to check for best orientation and location.

Position the main enclosure close to the marking site on the production line. For systems with integrated laser head and the standard articulated arm, the maximum reach between the enclosure and the scanning head is approximately 1.6m. For short optical path beam deliveries, the reach depends on the ordered tube length.

For systems with external laser head and cable connection to the main enclosure, the laser head must be positioned close to the marking station taking into account the beam delivery type and the focal length of the final focus lens. The main enclosure may be positioned further away from the marking station, within the constraints of the length of the cables. When positioning, ensure that the cables are not strained.

In all cases, ensure that the user control panel is positioned so that operator access is convenient and that the safety warning lamps are clearly visible.

Ensure that there is free flow of air around the main enclosure to allow for unrestricted cooling of the system. There must be a minimum of 0.5m clearance between the enclosure and any walls or other obstructions that could impede air flow. This is especially important for an air-cooled system without an external chiller.

During normal operation, the ambient air temperature around the system should be in the range 5–35°C (41–95°F) for an air-cooled system or 5–40°C (41–104°F) for a system with external chiller.

When mounting the scanning head, ensure that the beam delivery is not subject to torsional or transverse forces that could cause beam misalignment.

6.3. Safety guarding

A safety guard must be fitted around the marking area to contain any direct or reflected laser radiation that may pose a threat to personnel working near to the marking station. The guard must be designed and fabricated to match the layout of the production line and position of the marking system components. An example of a simple tunnel guard is shown in the following figure.

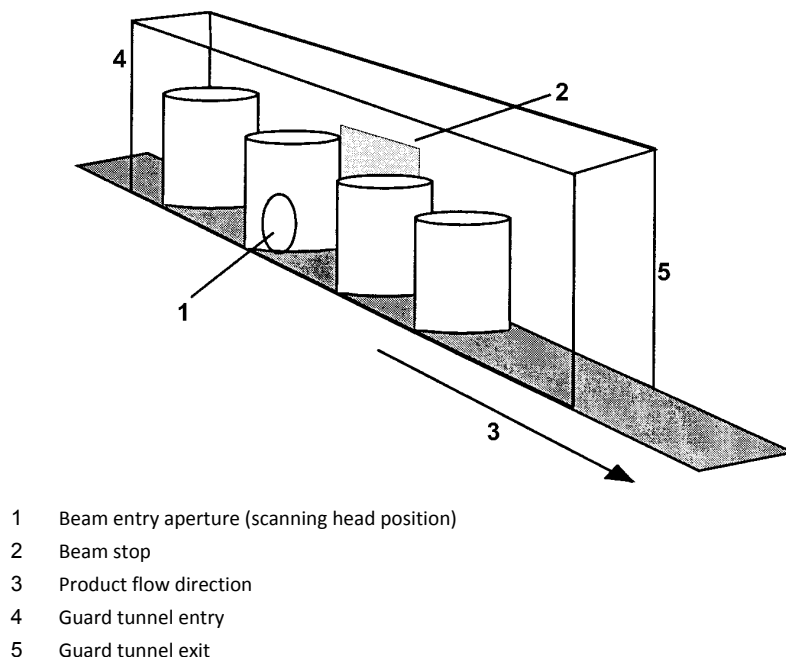


Figure 28 - Simple tunnel guard

The design of the tunnel guard must allow free flow of products in the direction of product flow (3). The length of the guard tunnel must be long enough to prevent operator access to the marking position. The size and shape of the tunnel entry (4) and exit (5) must be as small as possible to prevent operator access without impeding product flow. The beam enters the tunnel from the scanning head through an entry aperture (1) cut in the tunnel wall.

The recommended guarding material is 10mm (0.4") thick clear or smoked polycarbonate sheet. Polycarbonate is opaque to the infrared wavelength of the laser beam. If an access door is fitted to the

guard wall it must be 'light tight' and interlocked to the laser system. For interlocking details, see section 8.2.

A beam stop (2) must be fitted to prevent ablation of the guard wall if marking is triggered when no product is present to be marked. Suitable materials for the beam stop are anodised aluminium or a solid carbon block of at least 10mm (0.4") thick.

The size of the beam stop depends on the distance between the marking point and the beam stop position. As a general rule, the beam stop should be no smaller than 364mm x 364mm (14.3" x 14.3") for separations of up to 350mm (13.8") between the marking point and the beam stop position. For longer separations, contact Luxinar Aftersales for advice before proceeding. The centre position of the beam stop must be positioned exactly on the centre line of the beam entry aperture.

Note: A larger beam stop may be required if the scanning head is regularly adjusted for different mark positions on the same production line. For example, to accommodate product type variations.

6.4. Scanning head positioning

When the guarding has been fixed into position, the precise location of the scanning head can be finalised. The scanning head must be clamped into position to ensure it cannot move or be withdrawn during operation of the system.

Luxinar can provide several scanning head support assemblies depending on the type of installation environment. These include floor mounted stands and also support devices to fasten directly onto the production line. When fastening to the production line, include anti-vibration mounts to isolate the scanning head from vibration caused by operation of the production line.

A clamp is used to couple the scanning head to the support assembly and is supplied in the accessories kit. Diagrams showing all dimensions are included in [Appendix C](#). Contact Luxinar Aftersales for details of available options.

Important!

It is essential that the products are accurately positioned at the marking position to prevent variations in mark quality. Variation in the distance between the lens and the product will cause the mark quality to vary due to a change in spot size at the marking point. The reference distance between scanning head and product should vary by no more than $\pm 2\text{mm}$ ($\pm 0.08"$) for best quality marking, though larger characters may support a slightly greater variation. When an open conveyor is used, it is recommended that guide rails are fitted to constrain the product path and ensure that the reference distance remains constant.

6.5. Lens focus adjustment

The focus distance should be set during installation. There should be no requirement to adjust the distance during normal operation unless changes are required to accommodate changes in product size or shape.

To change or adjust the focus distance:

1. Run a test product down the production line past the scanning head and examine the mark produced.
2. Move the head closer to the product by 1 or 2mm and repeat step 1. Compare the new and old mark for spot size and mark quality.
3. If the new spot size and mark quality are better than the old, repeat step 2 until it is clear that the latest spot size and mark quality are worse than the previous one.
4. Move the head away from the product by 1 or 2mm and verify that the new mark is better than the previous one.

This should be the optimal focus distance for the product.

6.6. Lens protection shroud

The lens protection shroud is used to couple a clean compressed air supply to the scanning head between the lens and the product. The compressed air creates an air curtain to prevent marking debris from contaminating the lens.

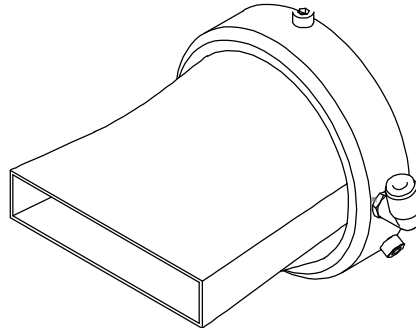


Figure 29 - Lens protection shroud



CAUTION



Risk of optical damage in the laser head

If the laser beam falls onto the stainless steel window frame, it can be reflected back through the lens to a focal position within the laser head. Test marking, and the laser power used during test marking, must be kept to a minimum to avoid potential optical damage within the head.

6.6.1. Static marking

Create the code to be marked and position it on the user interface screen. Perform a test mark to confirm the focus position and adjust the scanning head position relative to the product if required. Check that no part of the code is clipped off or attenuated by the window. For incremental fields, date codes etc., allow for mark width changes due to character changes in these fields. If the window is not perpendicular to the mark, clipping at an angle to the mark may occur. Adjust the window as described below and repeat test marking as required.

If the required code cannot be marked within the available field area allowed by the window aperture, and the code cannot be simplified or made smaller, the window size may be increased to suit. However, this will limit the effectiveness of the air curtain and should be avoided if possible.

6.6.2. On-the-fly marking

Note: When marking on-the-fly, the marking field includes an on-the-fly offset which tracks product movement. All of the marking, including this offset, must occur within the available marking field.

1. Create the code to be marked and position it on the user interface screen so that it is within the nominal marking field.
2. Enter the expected maximum line speed in the **Line settings** screen.
3. Optimise the code as necessary to achieve the optimum marking direction, position and sequence.
4. Select **Settings > Optimise > Show on-the-fly moves** and check that all of the code is still within the area indicated in the diagrams.
5. Perform a test mark to confirm the focus position and adjust the scanning head position relative to the product if required. Check that no part of the code is clipped off or attenuated by the window. For incremental fields, date codes etc., allow for width changes due to character changes in these fields. If the window is not perpendicular to the mark, clipping at an angle to the mark may occur.

6.7. Cooling system

6.7.1. Internal cooling circuit — all versions

Before switching on the system, the internal coolant reservoir must be filled with approved coolant. The approved coolant is Flowcool-plus mono propylene glycol, available from:

ICS Cool Energy
ICS House
Stephenson Road
Calmore Industrial Estate
Totton, Southampton BD4 3SA
United Kingdom
Tel.: +44 (0) 23 8052 7300
www.icscoolenergy.com

1. Ensure that the power is turned off at the mains isolator switch on the front panel of the main enclosure.
2. Remove the top cover from the main enclosure and unscrew the filler cap on the coolant reservoir.
3. Fill the reservoir to the mark with the supplied coolant and replace the filler cap.

Important!

Avoid spillage of coolant while filling the reservoir. Use absorbent paper towels to remove any spilled coolant from the interior of the service enclosure.

4. Ensure that both key switches on the control panel are in the **OFF** position, then turn on the main isolator switch.
5. Access the Service menu using the Service password (see section 9.1), then select **Pump On**. As the pump runs, air is bled from the system and the coolant level in the reservoir will drop.
***Note:** The system may sense a **Low coolant flow** error due to the presence of air in the cooling circuit.*
6. Select **Pump Off**, then top up the coolant level.
7. Repeat steps 5 and 6 until the coolant level remains constant with the pump running.
8. Check for leaks in all sections of the coolant circuit and rectify them, as necessary.
9. Run the pump for a minimum of 10 minutes to verify that there are no leaks and that the coolant level remains constant at the mark then stop the pump and switch off the system at the main isolator.
10. Check that the filler cap is securely fitted and that all spillage has been removed from within the main enclosure then replace the top cover.

6.7.2. External cooling circuit — Liquid-cooled version



Figure 30 - Coolant connections

1	Coolant drain	Before transportation or storage, remove the plug and operate the coolant pump to drain all coolant from the system.	
2	Coolant in	The coolant circuit includes a temperature control valve that opens when the internal system temperature reaches 20°C	
3	Coolant out		

6.8. Electrical supply connections

The supply characteristics are specified on the system serial number label, which is located on the front of the main enclosure. For full details, see section 2.9.

WARNING
Electrical hazard

The MULTISCAN® HE is a Class 1 Appliance, as defined by 2006/95/EEC Low Voltage Directive EN N 61010-1:2010+A1:2019, and as such, must be connected to an electrical earth (ground). See [Chapter 1](#).

6.8.1. Cable and connector

The MULTISCAN® HE main enclosure is supplied with an AC mains power cable. It is recommended that a dedicated AC power connection is provided. If the power cable is replaced, a cable rated for the specified supply voltage and current and conforming to local or national standards must be used.

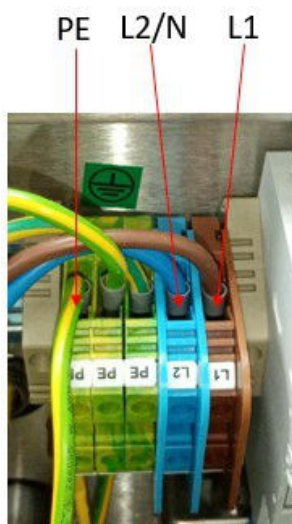
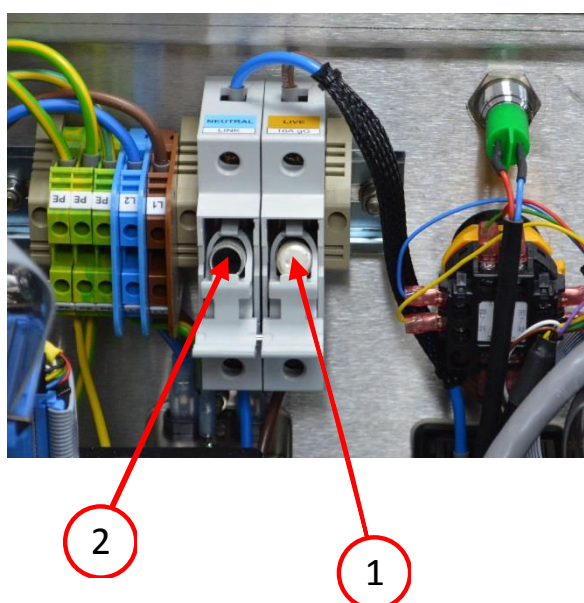


Figure 31 - Mains terminals

6.8.2. Fuse and link configuration

As delivered, the main enclosure is configured for a single phase (phase and neutral) mains supply. For connection to a bi-phase supply, internal fuses and links must be reconfigured.

Single phase configuration (Live-Neutral)



- 1 38x10mm fuse
- 2 Link

Figure 32 - Mains supply fuses/links

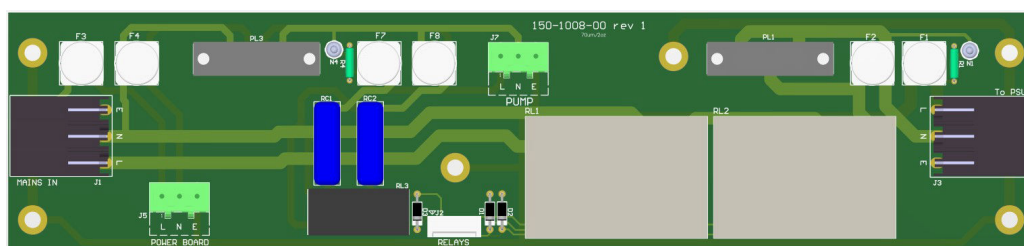


Figure 33 - Power supply fuses/links

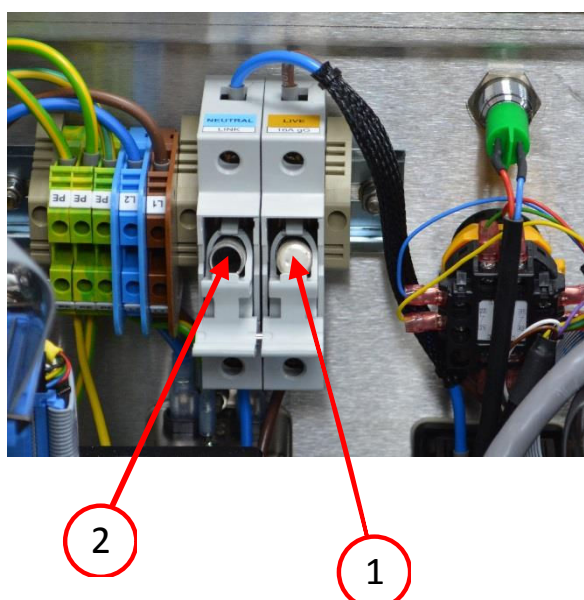
Table 18 - Fuse/link configuration

Fuse number	Component protected	Fuse rating	Link
F1, F2	50VDC power supply	16A (T16AH250V)	PL1 links out F2
F3, F4	3V3, 5V, 12V, $\pm 15V$, 24V power supplies	5A (T5AH250V)	PL3 links out F4
F7, F8	Pump	3.15A (T3.15AH250V)	PL3 links out F8

Important!

An external disconnect device must be fitted at the time of installation, and must be accessible without needing to use a tool. This must be suitably located and easily reached and must be marked as the disconnecting device for the power supply.

Bi-phase configuration



- 1 38x10mm fuse
- 2 38x10mm fuse

Figure 34 - Mains supply fuses/links

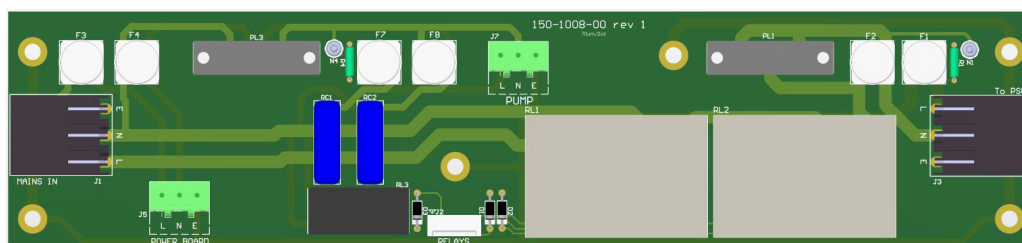


Figure 35 - Power supply fuses/links

Table 19 - Fuse/link configuration

Fuse number	Component protected	Fuse rating	Link
F1, F2	50VDV power supply	16A (T16AH250V)	PL1 link removed
F3, F4	3V3, 5V, 12V, $\pm 15V$, 24V power supplies	5A (T5AH250V)	PL3 link removed
F7, F8	Pump	3.15A (T3.15AH250V)	PL3 link removed

Important!

An external disconnect device must be fitted at the time of installation, and must be accessible without needing to use a tool. This must be suitably located and easily reached and must be marked as the disconnecting device for the power supply.

6.9. Lens protection air supply

The MULTISCAN® HE requires a clean compressed air supply to supply a positive pressure in the lens shroud. This forms an air curtain that prevents dust or debris contamination of the final focusing lens on the scanning head.

Factory compressed air must be filtered to a very high efficiency to prevent contamination from the air supply itself. The air should be filtered to an efficiency of 99.9999% at 0.01µm particle size to remove all oil, water and particulate matter.

The air should be supplied at a pressure of approximately 2.4bar (20 psig), and at a flow of approximately 15 litres per minute, using 6mm (¼ inch) polyethylene tubing. The tubing connects to the 'push in' connector on the side of the shroud.

An air purification kit meeting these requirements is available from Luxinar. This consists of a two-stage regulating filter unit. The first stage regulates the factory line pressure down to 2.4bar (20 psig) and filters bulk material down to 5µm particle size. The second stage contains a high efficiency filter to achieve the 0.01µm particle size specification.

For more information about air purification options contact Luxinar Aftersales.

6.10. Fume extractor

The marking installation should include a fume extraction system to safely remove any fume or debris produced by the marking process.



CAUTION
Environmental and health hazard

Laser induced reactions during the marking process can release hazardous particulate and gaseous by-products, which may be poisonous. Before carrying out laser processing ensure that all the applicable local and national safety standards are being followed. These may include health and safety and environmental pollution standards.

A stand-alone fume extraction system, suitable for a marking installation, is available from Luxinar. The system consists of a stand-alone fume extractor with a large-bore flexible hose and extraction nozzle designed for debris and fume removal. It is manufactured by a specialist fume extraction company and is supplied with specialised filters selected for removal of debris and fume for the materials to be marked.

Installation of the extraction system is described in the manufacturer's user manual accompanying the equipment. In a typical marking installation, the extraction unit can be sited next to the MULTISCAN® HE or underneath the production line. The extraction nozzle should be installed on the upstream side of the scanning head, close to the marking point. Contact Luxinar Aftersales for more information about extraction options.

Extractor interface signals are available for monitoring and enabling the extraction system. For interfacing details refer to section 8.6.

7. Transport and recommissioning

7.1. Internal cooling circuit draining — all versions

1. Switch off the system at the mains isolator on the front panel of the main enclosure.
2. Connect a short piece of flexible hose to the water outlet at the drain manifold. Position a suitable container to collect coolant as it drains from the system.
3. Open the tap at the drain manifold and let coolant drain into the container until the flow stops.
4. Close the tap to seal the coolant circuit and prevent spillage.
5. If the coolant will be reused after transport, return it to the original coolant container supplied with the system. Otherwise, dispose of the coolant taking note of the disposal instructions in the data sheet supplied with the coolant and with local environmental and safety regulations.

7.2. External cooling circuit draining — liquid-cooled version

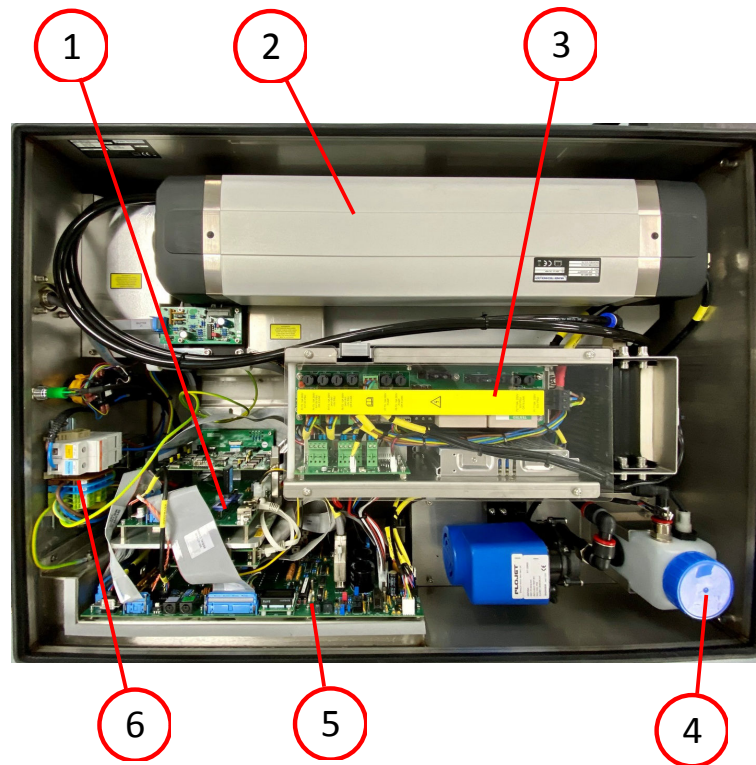
Before transporting the marking system, completely drain the cooling system to prevent damage during shipping. Use clean compressed air, at a pressure of 2bar, to blow out all traces of coolant in the cooling system pipework.

Failure to remove coolant from the system prior to transport can cause damage to the cooling system. Damage caused in this way will invalidate the warranty.

7.3. Final focus lens protection

Protect the final focus lens to prevent damage or contamination during shipping.

8. Interfacing



- 1 PC module
- 2 Laser head
- 3 Power supply
- 4 Coolant reservoir
- 5 User interface PCB
- 6 Mains supply terminal block and fuses

Figure 36 - MULTISCAN® HE main enclosure layout

8.1. User interface PCB

The user interface PCB is located in the main enclosure. All control signals, monitoring outputs and interlocks are terminated on this board.



Figure 37 - User interface PCB layout

8.2. Interlocks and security

The MULTISCAN® HE Interlock circuits are designed to meet the requirements of EN 13849. Two sets of interlocks are provided for connection of remote guard interlocks and remote stop circuits. There is also a status output, which can be monitored for integration with a system emergency stop.

Table 20 - Interlock circuit connections

Pin	Type	Function
<i>Interlock chain 1, J14</i>		
1	Emergency stop 1, volt-free output	Emergency stop contact
2	Emergency stop 1 return, volt-free output	Emergency stop contact
3 ⁽¹⁾	External emergency stop 1 input	24VDC interlock circuit

Pin	Type	Function
4 ⁽¹⁾	External emergency stop 1, return input	24VDC interlock circuit
5 ⁽¹⁾	Remote interlock 1 input	12/24VDC interlock circuit ⁽²⁾
6 ⁽¹⁾	Remote interlock 1, return input	12/24VDC interlock circuit ⁽²⁾
7	Not used	
8	Not used	
<i>Interlock chain 2, J37</i>		
1	Emergency stop 2, volt-free output	Emergency stop contact
2	Emergency stop 2 return, volt-free output	Emergency stop contact
3 ⁽¹⁾	External emergency stop 2 input	24VDC interlock circuit
4 ⁽¹⁾	External emergency stop 2, return input	24VDC interlock circuit
5 ⁽¹⁾	Remote interlock 2 input	12/24VDC interlock circuit ⁽²⁾
6 ⁽¹⁾	Remote interlock 2, return input	12/24VDC interlock circuit ⁽²⁾
7	Not used	
8	Not used	

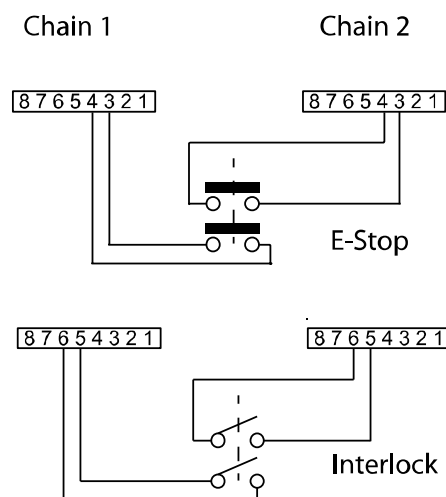


Figure 38 - Interlock and emergency stop (E-stop) chains

8.3. Scanning head to main enclosure cable

The scanning head cable is connected between the rear of the scanning head and the main enclosure. It provides DC power and galvanometer control signals to the scanning head. The standard cable length is 3m and it is supplied complete with connectors.


CAUTION


Risk of damage to the galvanometers

Ensure that the MULTISCAN® HE is switched off before connecting, disconnecting or reconnecting the cable.

1. Connection required for system operation.
2. The voltage interlock mode level is selected via JP1 and JP2 on the User interface board and also using the Software interface. Mode 0 = 24V. Mode 1 & Mode 2 = 12V. Refer to the Software configuration, [Chapter 9](#).

8.4. Product detector

A signal indicating the presence of a product at the marking position is required to trigger product marking. The signal can be provided by:

- An external product detector
- A **product present** signal from the production line controller

Where a product detector is used, it should be mounted on an adjustable bracket close to the marking position. The bracket must allow adjustment of the detector position to ensure that the mark is positioned correctly on the product.

The detector can be mounted upstream or downstream of the marking position; i.e. detection on the leading or trailing edge of the product or a registration mark on its label. It is recommended that the detector is mounted on the opposite side of the scanning head to any extraction nozzle used for fume and/or debris removal. This will help to prevent contamination of the detector, particularly if it is an optical type.

Table 21 - Product detector connections

Pin	Type	Function
<i>Product detect 1 input J20, Product detect 2 input J21</i>		
1	Output 12V @ 100mA	12V fused source
2	Output 24V @ 100mA	24V fused source
3	Detector input	NPN mode detector input
4	Open collector fused, current limited input. 24V max.	PNP mode common collector input
5	Common ground	—
6	Common ground	—

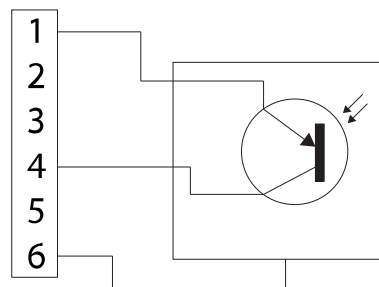


Figure 39 - Product detector, PNP mode

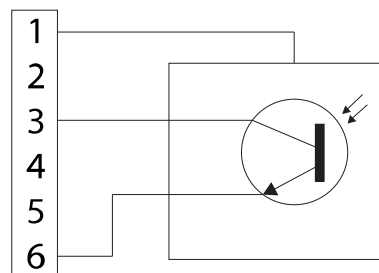


Figure 40 - Product detector NPN mode

The edge of the product that triggers marking is selected by the switch below the J20 and J21 connectors.

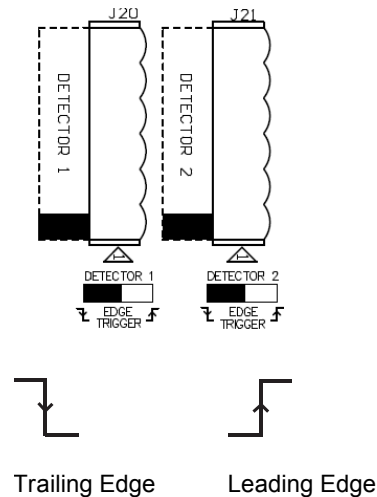


Figure 41 - Detector edge selection

Many types of product detectors are available and must be selected for reliable operation with the product or surface to be marked. For advice about selection of product detectors, contact Luxinar Aftersales.

8.4.1. Dual detector installation

The MULTISCAN® HE can accommodate two independent product detectors. Dual-detector configuration is recommended for all flammable products. The dual-detector configuration ensures that multiple mark triggering is not possible on stalled, or blocked, production lines, as would be the case for a single detector. If this were allowed to occur, multiple marks could be made in one position on the same product. The combination of the heat from the focused laser beam and multiple marks in the same position may create a fire hazard for flammable products.

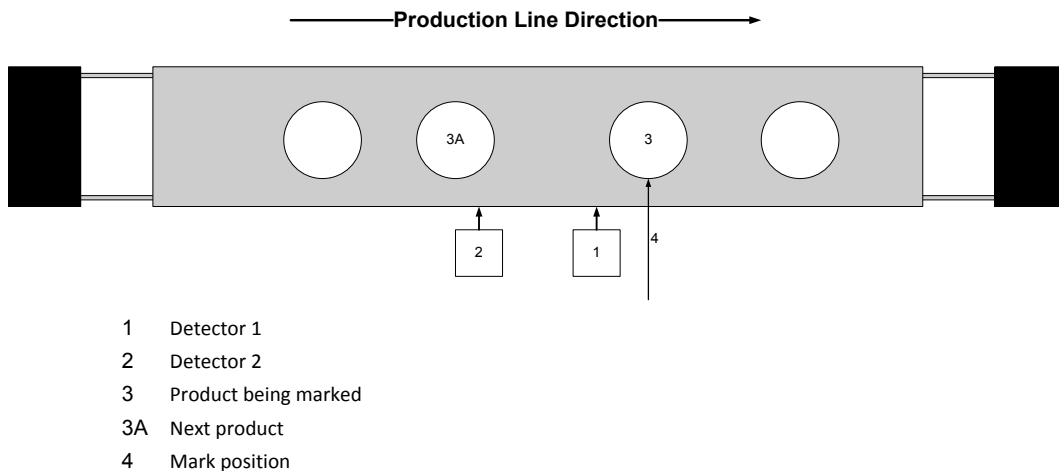


Figure 42 - Dual-detector configuration

In a dual-detector configuration, the detectors are mounted so that a gate signal from detector 2 is followed by a mark trigger signal from detector 1 and before detector 2 sends a new gate signal when it detects the next product. Figure 42 shows an arrangement for dual-detector operation. Detector 1 (1) and detector 2 (2) are shown detecting the trailing edge of a product (3), which is currently being marked at the mark position (4). Detector 2 (2) will not detect the next product (3A) until after the current mark has been completed.

Detector spacing depends on the width of the product to be marked and the normal spacing between products. A spacing of less than one product width is normally recommended for reliable operation. Do not space the detectors at exactly the width of the product, as interruption of both detectors may be possible in a stalled or blocked line situation.

Note: When stalled products or blockages are cleared, carefully inspect the products involved to verify correct mark information and quality.

8.5. Tacho

A tacho (usually a shaft encoder) can be used to control the code length when marking on a variable speed production line. It is not required if the MULTISCAN® HE is installed on a constant speed conveyor section of the production line, where the speed past the marking position does not vary during a production run.

The shaft encoder unit can be mechanically coupled to a friction wheel or directly to the conveyor drive shaft in order to provide tacho feedback pulses proportional to the speed of the production line. As the production line moves faster, more pulses are produced by the shaft encoder.

The recommended pulse-rate required for the MULTISCAN® HE is in the range of 10–50 pulses per millimetre of production line movement.

Table 22 - Shaft encoder (tacho) connections

Pin	Type	Function
<i>Shaft encoder (tacho) input J19</i>		
1	Output 12V @ 100mA	12V fused source
2	Output 24V @ 100mA	24V fused source
3	Opto-isolated input	Tacho input A
4	Opto-isolated input at 90° phase difference from input A	Tacho input B
5	Opto-isolated, pulled low for OK	Tacho OK
6	Common ground	—
<i>Tacho OK</i>		
Switch	INT selected	Tacho OK signal generated internally
	EXT selected	Tacho OK signal generated externally by the user

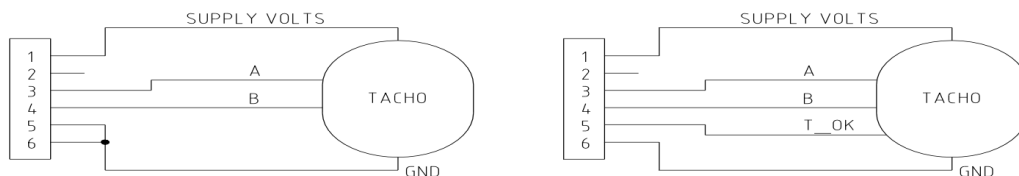


Figure 43 - Tacho OK — internal/external

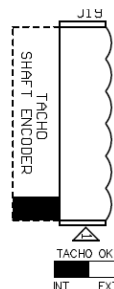


Figure 44 - Tacho OK selection

8.5.1. Calculation of friction wheel diameter

- Assume a shaft encoder (tacho) with output of 2000 pulses per revolution.
- Required pulse-rate = 12 pulses per mm
- Calculated wheel circumference = $2000/12 = 166.67\text{mm}$
- Calculated wheel diameter = $166.67/\pi = 53\text{mm}$ (where $\pi = 3.14159$)

Refer to the Software manual for more details concerning calculation of the shaft encoder (tacho) resolution. For more information about shaft encoder options contact Luxinar Aftersales.

8.6. Additional interface connections

Shutter status output J12

The **Shutter status** output monitors the position of the internal safety shutter. The shutter remains closed until the system is ready to print.

Pin	Type	Function
1	12V @ 100mA	12V resettable fused source
2	Open collector resettable fused, current limited input. 24V max.	Shutter closed, NPN mode
3	100mA current source	Shutter closed, PNP mode
4	Open collector resettable fused, current limited input. 24V max.	Shutter open, NPN mode
5	100mA current source	Shutter open, PNP mode
6	Common ground	—

Detector status output J13

The **Detector status** output monitors the outputs of product detectors connected to the system.

Pin	Type	Function
1	12V @ 100mA	12V resettable fused source
2	Open collector resettable fused, current limited input. 24V max.	NPN mode detector 1
3	100mA current source	PNP mode detector 1
4	Open collector resettable fused, current limited input. 24V max.	NPN mode detector 2
5	100mA current source	PNP mode detector 2
6	Common ground	—

Maintenance required J17

The **Maintenance required** output becomes active when an error or fault condition is detected that is not serious enough to prevent marking but should be promptly corrected. It will be active for the following conditions:

- VSWR fault
- Extractor fault
- Emission lamp fault
- External coolant fault/Coolant solenoid fault (liquid-cooled systems only)
- Detector fault
- RTC (Real-Time Control) fault (galvo overscan, print incomplete)
- Mark not loaded
- COM port disconnected
- Invalid barcode
- No external update received (for single-shot external update mode)

Pin	Type	Function
1	12V (protected)	12V source
2	Open collector 100mA current drain	5–30V (external source) 12V (internal source)
3	Open emitter 100mA current source	5–30V (external source) 12V (internal source)
4	Common ground	—

Memory select input J11

The **Memory select** input is a 4-bit signal used to control the current code selection and/or to reset configured counter/increment fields ⁽³⁾. Available signal options are:

- Disabled — changes on **Memory select** have no effect on the system.
- 4-bit — enables selection of up to 16 independent codes.
- 3-bit — enables selection of up to 8 independent codes.
- 3-bit + **Counter reset** — enables selection of up to 8 independent codes plus reset of a configured counter/increment field to a known value.
- **Counter reset** — resets a configured counter/increment field to a known value.

Pin	Type	Function
1	+5V	+5V source
2	Opto-isolated input, 330Ω pull up to +5V	Memory select 3 (MSB)
3	Opto-isolated input, 330Ω pull up to +5V	Memory select 2
4	Opto-isolated input, 330Ω pull up to +5V	Memory select 1
5	Opto-isolated input, 330Ω pull up to +5V	Memory select 0 (MSB)
6	0V	—

Good mark J16

The **Good mark** output is issued when a mark is completed without errors.

Important!
Good mark and **Product reject** signals are mutually exclusive.

Pin	Type	Function
1	12V (protected)	12 source
2	Open collector 100mA current drain	5–30V (external source) 12V (internal source)
3	Open emitter 100mA current source	5–30V (external source) 12V (internal source)
4	Common ground	—

System On J28, Extractor Enable J26, Ready to Print J23, Product Reject O/P J24, System Fault O/P J27

These outputs are made available on volt-free relay contacts, as shown in the following table.

3. Requires configuration within the software interface. Refer to the software manual for further details.

Pin	Type	Function
1	Normally closed relay contact	Volt free contact
2	Normally open relay contact	Volt free contact
3	Common relay contact	Volt free contact

- **System on**
The **System on** output becomes active when the main marking application is running (via the system watchdog).
- **Extractor enable**
The **Extractor enable** output is active when marking is enabled and is used to control operation of a fume extraction system.
- **Ready to print**
The **Ready to print** output is active when the system is in marking mode and the shutter is open. In this state, the system is ready to accept detector input and initiate a mark. The output will *not* become active when:
 - The system is in pause mode
 - A **System fault** output is active
 - Marking is disabled
 - The shutter is closed
- **Product reject**
The **Product reject** output becomes active when system errors are detected during the mark. It will become active for the following conditions:
 - VSWR fault
 - RTC (Real-Time Control) fault (galvo overscan, mark incomplete)
 - External update fault
 - Single-shot update fault
 - Invalid barcode data
- **System fault**
The **System fault** output is active when a fault condition exists that prevents the system from entering print mode. If the system is in mark mode when the condition occurs, marking is terminated.

Important!

The fault condition must be cleared before the system can return to print mode. After clearing the fault, the complete mark start-up sequence must be carried out.

Enable inputs J18

These inputs are opto-isolated, as shown in the following table.

Pin	Type	Function
1	Common ground	—
2	Opto-isolated input, 1kΩ source impedance	System enable
3	Opto-isolated input, 1kΩ source impedance	Extractor fault
4	Common ground	—

- **System enable**
The **System enable** input enables marking when active. It can also be used to change from pause to marking mode without requiring a command from the user interface.

- **Extractor fault**

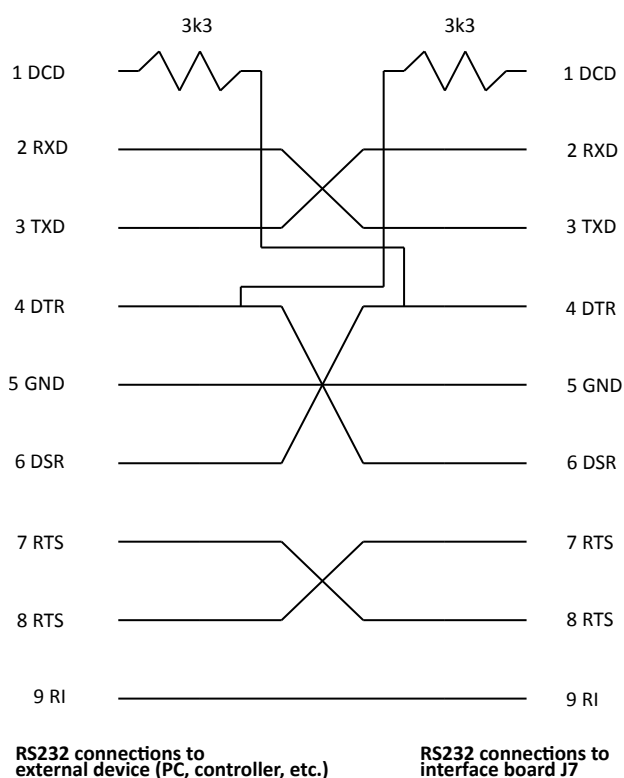
The **Extractor fault** input (from a fume extractor in fault condition) activates a warning indicator and the **Maintenance required** output.

User V_{out} J10

Pin	Type	Function
1	Output 12V @ 1A	User 12V source
2	Output 24V @ 1A	User 24V source
3	0V	GND
4	0V	GND
5	0V	GND

Com 1 RS232 J7

The **RS232** interface allows a remote controller to interrogate and control the system.



Ethernet

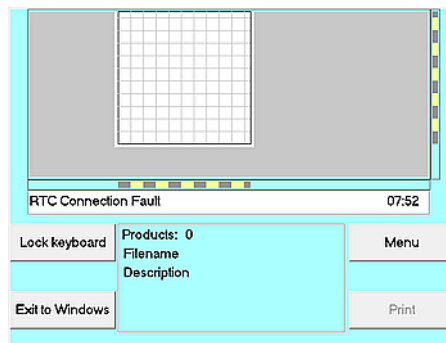
Contact Luxinar Aftersales for further information.

9. Software configuration

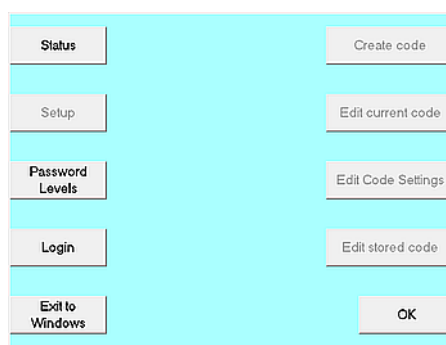
9.1. Service menu

Software configuration options are available on the Service menu screen. Access to this screen is only possible using the Service password. Contact Luxinar Aftersales for password details and advice. To access the screen:

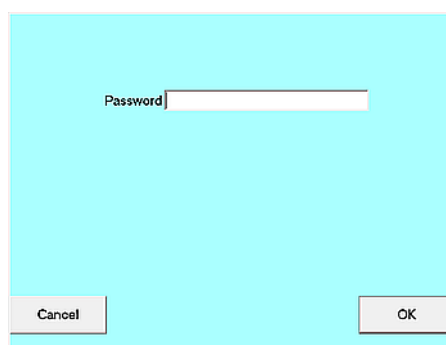
1. From the home screen, Press F9 for **Menu**.



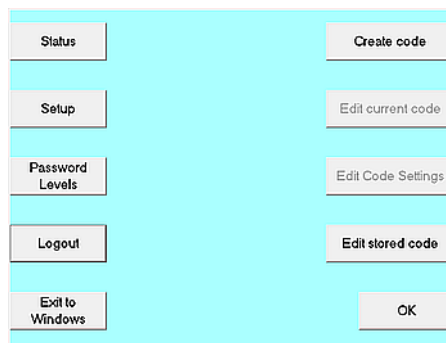
The main menu displays.



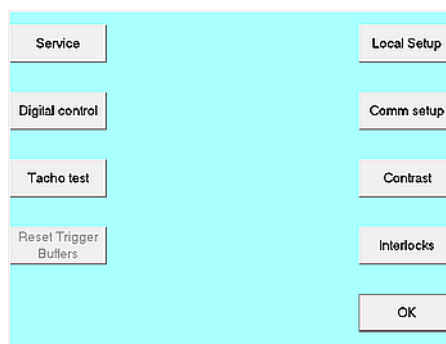
2. Press F4 for **Login**. The password entry screen displays.



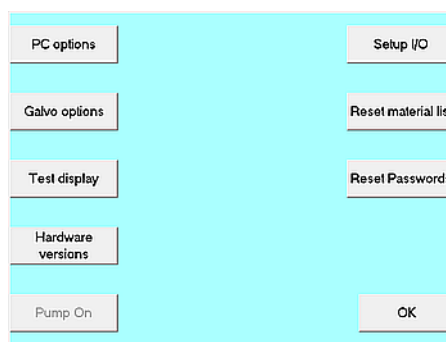
- Enter the **Service** password and press F10 for **OK**. The main menu displays with **Setup** activated.



- Press F2 for **Setup**. The setup menu displays.



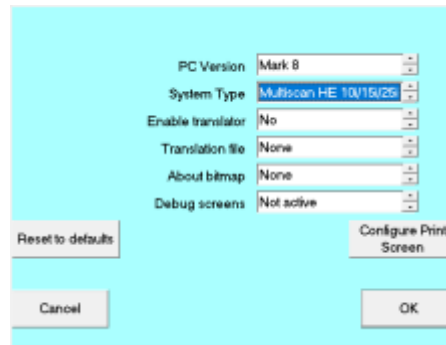
- Press F2 for **Service**. The service menu displays.



- Press F1 for **PC options** — see section 9.2
- Press F2 for **Galvo options** — see section 9.3
- Test display
- Hardware versions
- Press F6 for **Setup I/O** — see section 9.4
- Reset material list
- Reset passwords
- Press F5 for **Pump On**. This turns on the coolant circulation pump.
- Press F10 for **OK** to save any changes and return to the previous menu.

9.2. PC options

Use the up/down arrows or function keys to select fields and values.



Shutdown type

Select the termination method for MVSEditor. **Shutdown system on quit** closes all operations so that the system can be switched off. **Exit to Windows on quit** closes MSVEditor and returns control to the operating system.

PC Version

This field displays the version of the system PC.

System Type

This field displays the marking system type. **MSVE** or **MSHE**. (Available in software version MVS5.55.001 and above)

Enable translator

Allow the translator application to be run together with the MSVEditor software. This is normally done offline, in demo mode, on a standard Windows-based PC.

Translation file

Select a software translation file to display localised user interface text in place of the default text. In this mode, changes can be made to the localised text strings without the need to apply a software update.

About bitmap

Select a bitmap graphic file to display on the **About** screen and as a background image.

Debug screens

Shows or hides additional debugging information about the internal state of the control software.

Reset to defaults

Press F4 to reset all PC options settings to the factory defaults.

Configure Print Screen

Press F9 for **Print Screen Configuration**. The Print Screen Configuration screen displays to allow configuration of **CTRL** and **ALT** key functions. See section 9.2.1.

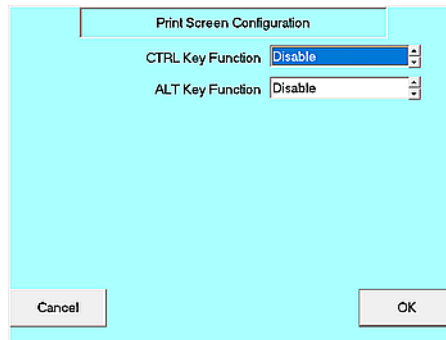
OK

Press F10 for **OK** to save any changes and return to the previous menu.

Cancel

Press F5 for **Cancel** to discard any changes and return to the previous menu.

9.2.1. Print Screen Configuration



The **CTRL** and **ALT** keys can be configured to perform various functions within the main **Print** screen.

Disable

Both keys are disabled and have no effect when pressed.

Detector delay (Available in software version MV55.50.003 and above)

Press and hold **CTRL/ALT** keys for direct access to the **Detector delay** setting, without the need to fully edit the current mark code.

The delay is in milliseconds (ms) or millimeters (mm) depending on the **On-the-Fly** setting for the current mark mode.

If the current mark mode is set to **Product present** detector mode, the delay is applied to the product interval.

OK

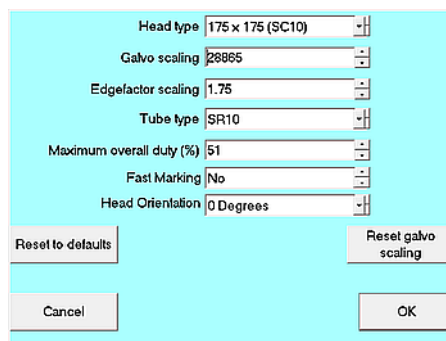
Press F10 for **OK** to save any changes and return to the previous menu.

Cancel

Press F5 for **Cancel** to discard any changes and return to the previous menu.

9.3. Galvo options

Use the up/down arrows or function keys to select fields and values.



Head type

This field selects the scanning head and lens combination fitted to the system. Any change to this setting requires a complete system restart for the change to take effect.

Galvo scaling

This field selects a scaling factor to adjust the overall mark size.

Edge factor scaling

This is an advanced laser setting used to prevent burn-in effects.

Tube type

This field selects the laser type integrated in the system.

Maximum overall duty

This field selects the maximum overall duty for the system. The calculated Minimum pitch/Interval value is adjusted to maintain the Maximum overall duty within the set limit.

Fast marking

When active, this setting reduces the amount of data processing between marks. It only applies to mark codes that contain fixed information, such as fixed text strings, or logos, and operator fields.

Head orientation

This field selects a rotational transformation to the mark code to match the orientation of the scanning head. Possible values are: 0, 90, 180 and 270 degrees.

Reset to defaults

Press F4 to reset all galvo options settings to the factory defaults.

Reset galvo scaling

Press F9 to reset the galvo scaling to the factory defaults.

OK

Press F10 for **OK** to save any changes and return to the previous menu.

Cancel

Press F5 for **Cancel** to discard any changes and return to the previous menu.

9.4. Setup I/O

Use the up/down arrows or function keys to select fields and values.

Good Mark duration (ms)	10
Bad Mark duration (ms)	10
Maximum Buffered Triggers	0
Buffered Trigger Reset Mode	Reset on pause
Detector Lockout	Disable
Dual Interlock/EStop Hardware	Not Fitted
Reset to defaults	
Cancel	OK

Good Mark duration (ms)

This field sets the duration of a **Good Mark** output signal in milliseconds.

Bad Mark duration (ms)

This field sets the duration of a **Bad Mark** output signal in milliseconds.

Maximum Buffered Triggers

This field sets the maximum number of trigger signals that can be buffered before initiating a mark.

Buffered Trigger Reset Mode

Select the buffered trigger reset mode.

Reset on pause clears any buffered trigger signals when the system enters a paused state (e.g. when an external interlock is opened).

Retain on pause retains any buffered trigger signals for immediate use when the system returns from a paused state.

Detector Lockout

Enabled allows the system to ignore detector signals for a set distance or duration after receipt of the initial detector signal. This prevents spurious triggering if the detector generates multiple signals from a single product (e.g. caused by reflections).

When enabled, an additional parameter is available in the **line settings** menu that allows an inhibit distance or duration to be specified.

Note: The inhibit setting is only available for detector modes "Single 1" and "Single 2".

Dual Interlock/E-stop Hardware

Set to **Fitted** if Dual Interlock and Dual Emergency Stop hardware is integrated in the system.

When enabled, the system will report any mismatch between the two interlock channels, in addition to performing the safety function.

When set to **Not fitted** the system will perform the safety function but will not report differences between the two interlock channels.

Appendix A. Coolant requirements and additives

The following requirements concerning water quality and permitted additives must be complied with.

A.1. Coolant quality

Table 23 - Coolant quality

Description	Value
Coolant type	De-mineralised, deionised or distilled water with corrosion inhibitor & anti-bacterial treatment
Conductivity	<1000µS/cm
Total hardness	<10ppm
pH value	7–8.5
Bacteria level	<1000cfu/ml

The pH value, conductivity and dissolved solids levels can be measured with a portable meter and the bacteria level can be checked with a test kit. For more information contact your local Luxinar Aftersales office.

A.2. Suspended particle removal

To remove particulate contamination, an in-line filter with a pore size of 100µm must be fitted as close as possible to the laser coolant inlet. The filter should be regularly checked for blockages and cleaned or replaced where necessary. This is particularly important after bacterial growth has been detected and anti-bacterial treatment applied.

A.3. Corrosion and anti-bacterial inhibitor

To prevent bacterial formation and corrosion of the cooling water circuit, Luxinar has tested and approved a specialist water treatment kit which is manufactured by NALCO.

Three water treatment kits are available, dependant on the total volume of the cooling water circuit to be used:

Circuit volume	Reference
50–199L	Order No.: 480-Luxinar 20.88
200–350L	Order No.: 480-Luxinar 60.88
351–500L	Order No.: 480-Luxinar 100.88

Order water treatment kits directly from NALCO at:

Nalco Deutschland GmbH,
Solmstraße 41
60486 Frankfurt am Main
Germany
Tel.: +49 69 7934-0
Customer service tel.: +49 7141 703 216
E-mail: custserv.germany@nalco.com

NALCO are equipped to ship kits worldwide.

- **Expiration period**
Two years
- **Storage temperature**
0–25°C

- **Disposal of used material**

Ensure that the disposal of all the materials used in this product is conducted according to all local and national regulations.

- **Instructions for use**

Completely empty both inhibitor bottles which are included with the NALCO kit into the cooling water reservoir tank. After mixing the NALCO chemicals with the cooling water, the pH value should be between 6.5 and 9.0.



WARNING



Risk of injury to eyes

Use appropriate eye protection when handling chemicals used in the NALCO water treatment kit.

- NALCO 460-RS200 is a multi-metal corrosion inhibitor to ensure effective protection against corrosion of stainless steel, copper and copper alloys and it also works as a bacteriostatic and hardness stabiliser.
- NALCO 7330 is a biocide which removes bacteria and organic contamination (algae and slime) from the water circuit.

NALCO RS200 and 7330 are completely compatible with glycol. The glycol should be without any inhibitor (concentration 30–35% glycol in demineralised water).

The use of inhibitors, biocides, other substances or hardness stabilisers other than the specialist NALCO kit may cause premature failure of the laser. It is the user's responsibility to ensure that the specification of any alternative additive is equivalent to that of the NALCO additive.

- **Cooling system maintenance**

After six months of operation, drain off the coolant and refill with fresh water treated with the appropriate NALCO kit or equivalent anti-bacterial product, as specified in [Table 23](#).

Ensure that the disposal of all the materials used in this product is conducted according to all local and national regulations.

Appendix B. Cooling system pressure drop curve

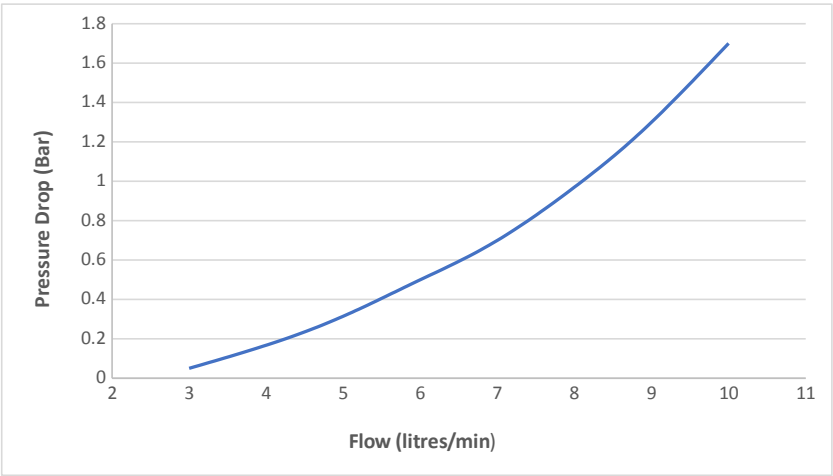
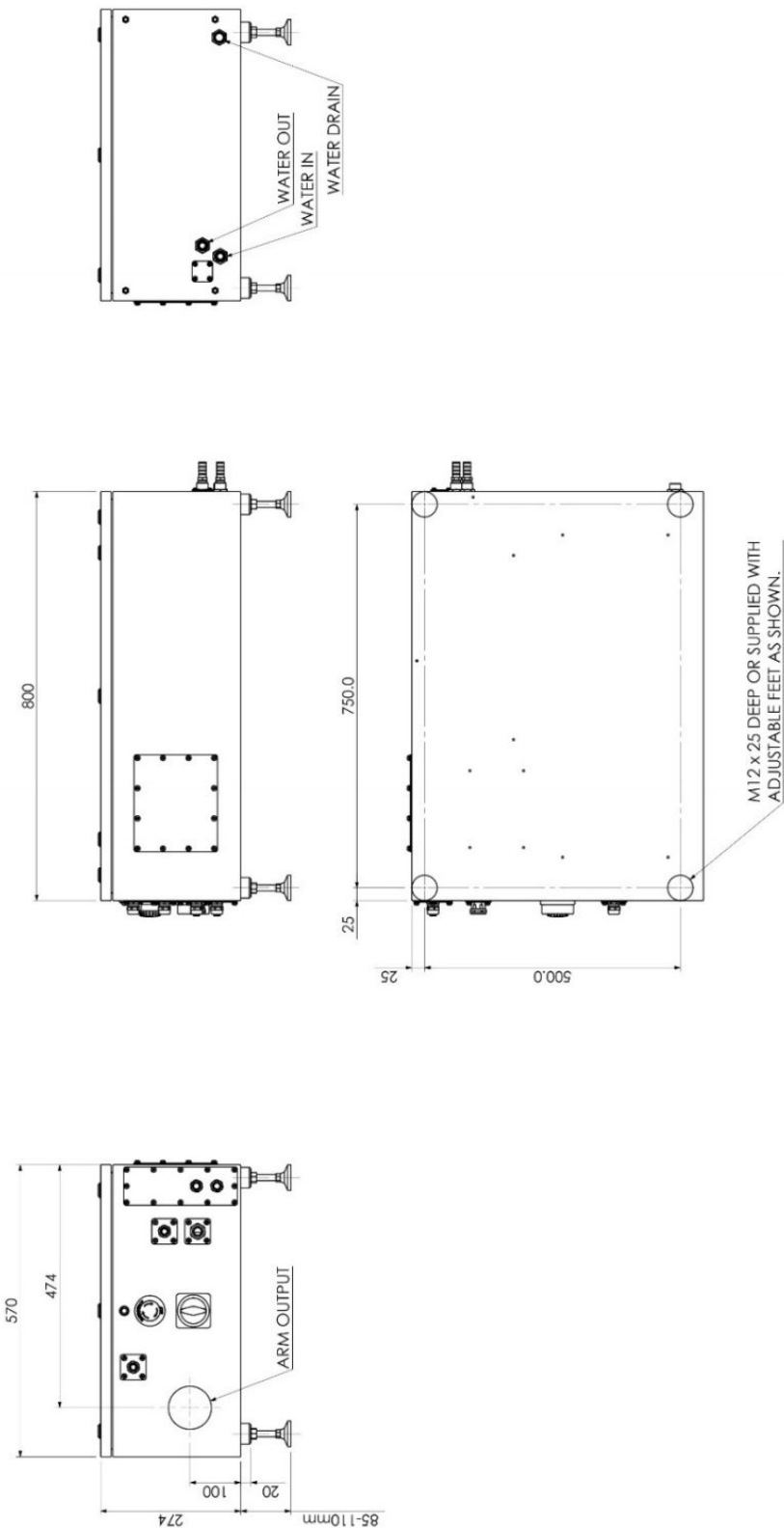


Figure 45 - MULTISCAN® HE pressure drop curve

Appendix C. Dimensional drawings



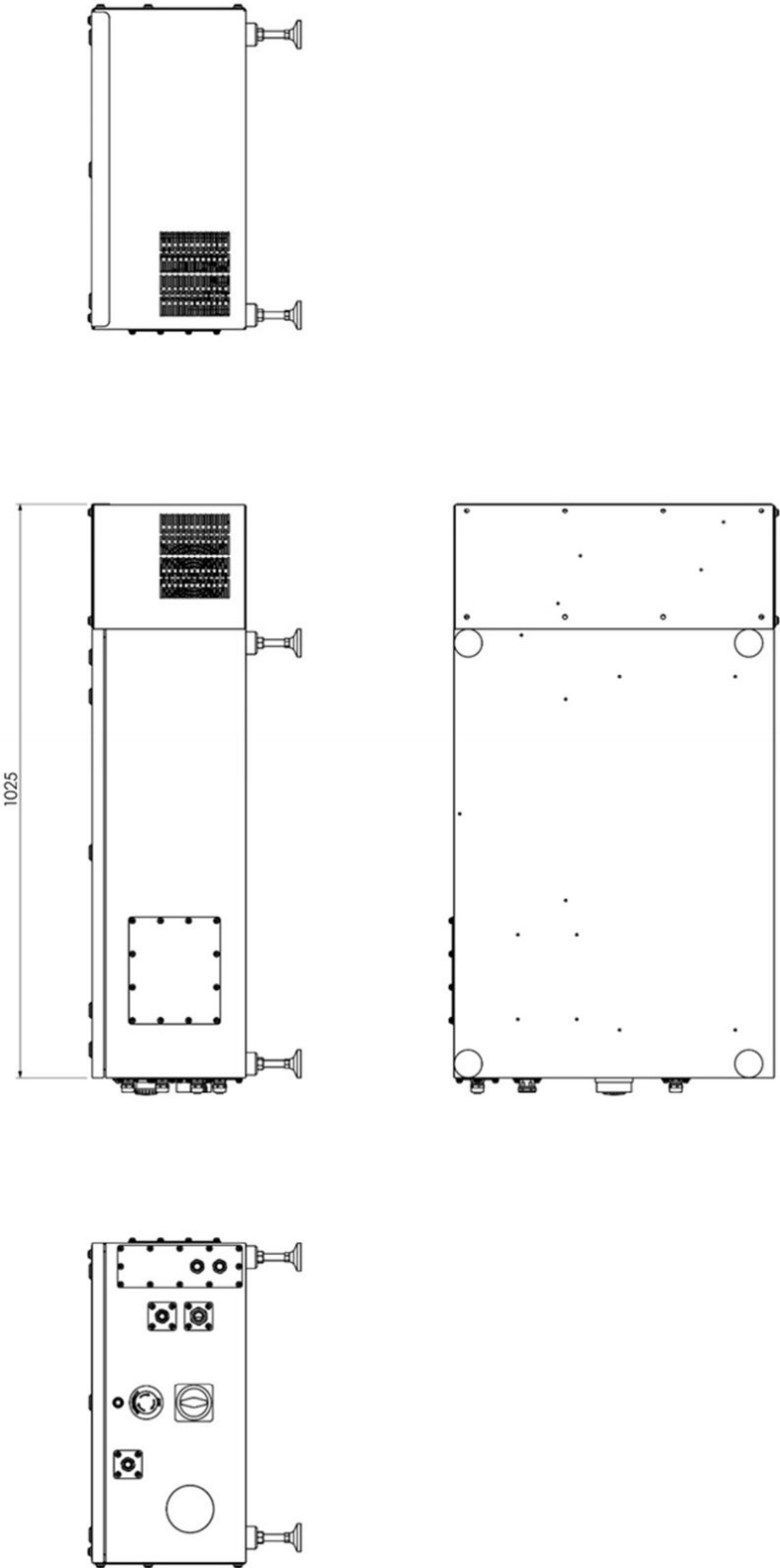


Figure 47 - Main enclosure — air-cooled

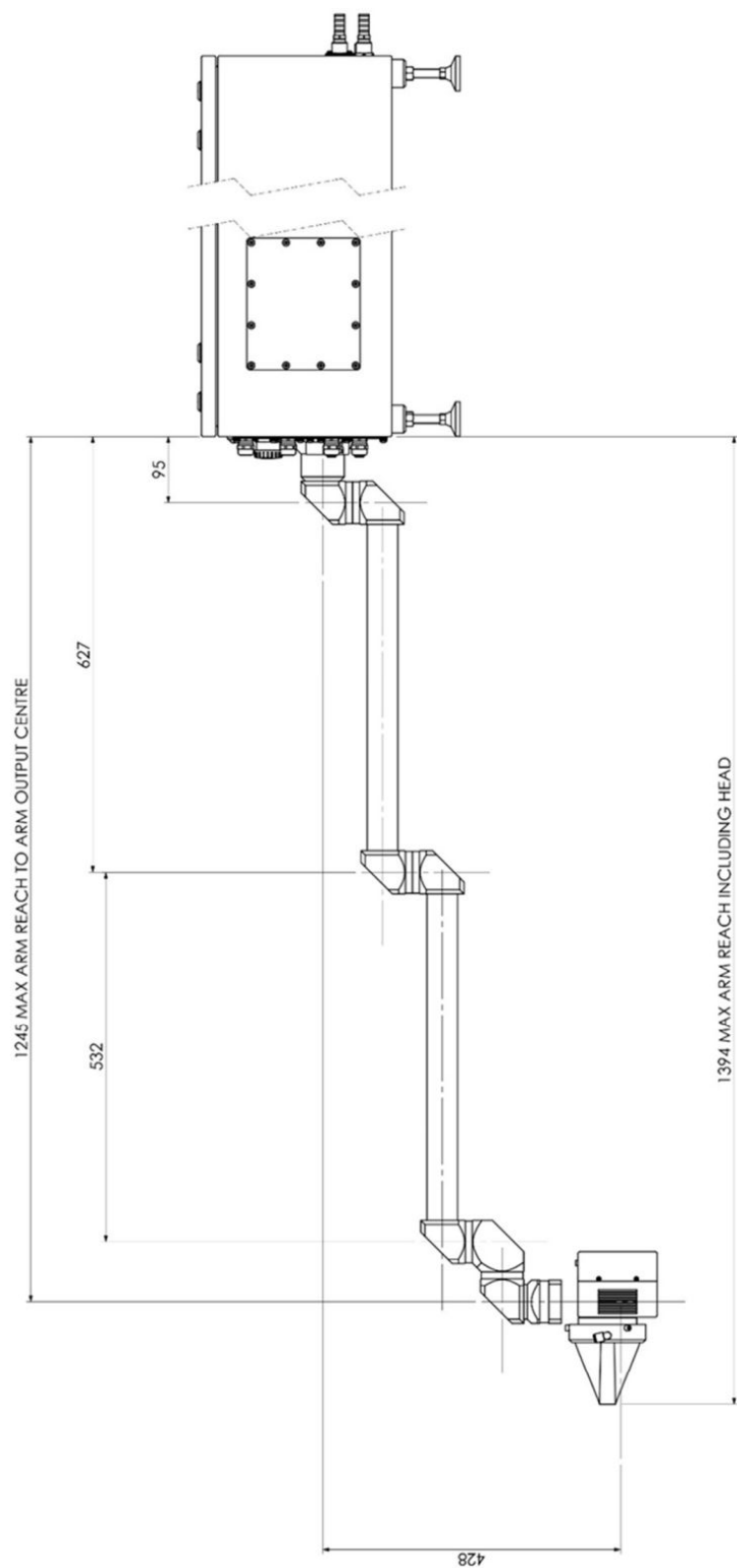


Figure 48 - Articulated arm beam delivery — 470mm

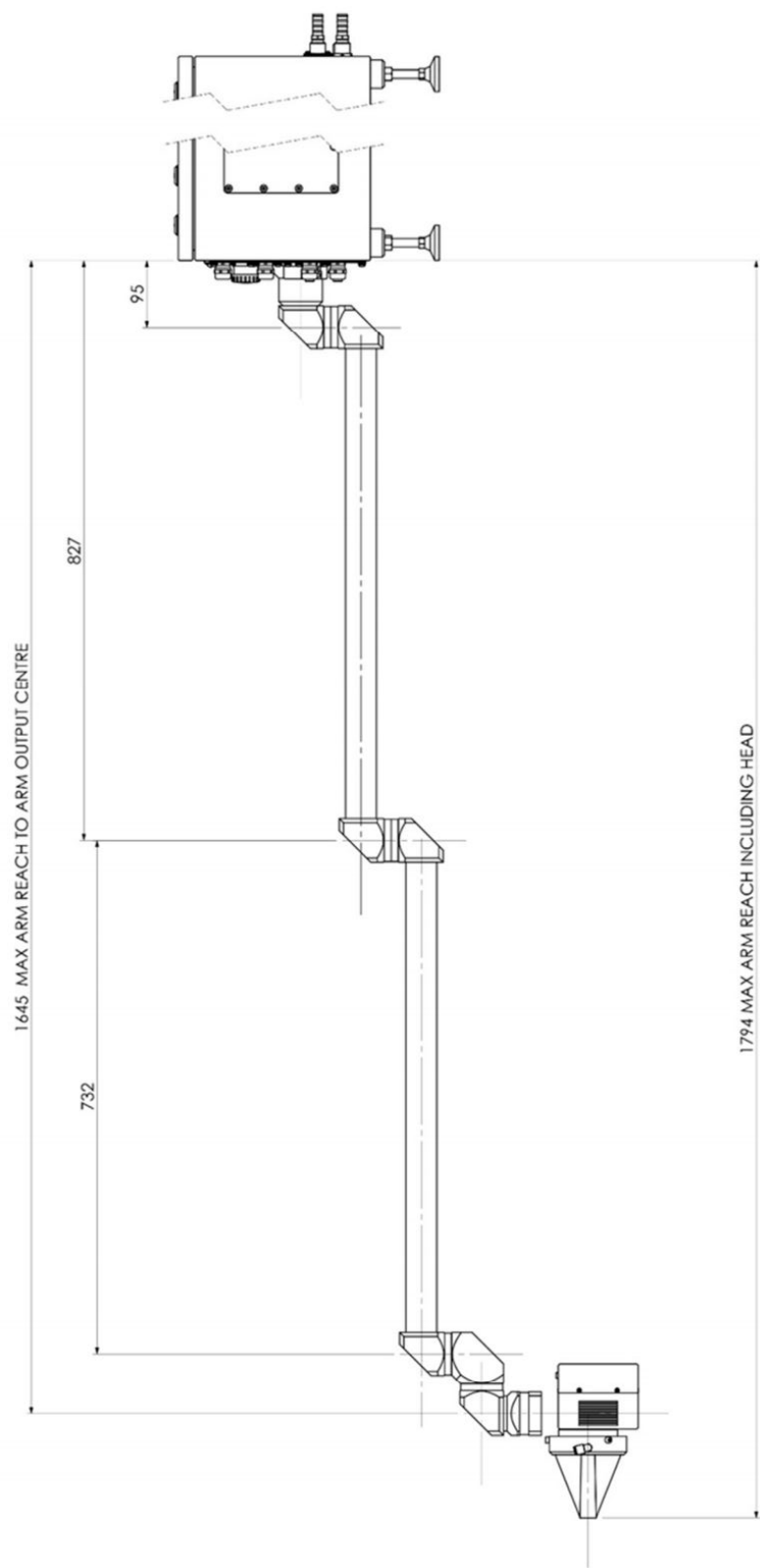


Figure 49 - Articulated arm beam delivery — 640mm

Appendix D. Calculations for laser safety glasses selection

The Maximum Permissible Exposure (MPE) is the level of radiation to which, under normal circumstances, persons may be exposed without adverse effects. The MPE represents the maximum level to which the eye or skin can be exposed without consequential injury and is related to the wavelength of the laser radiation, the pulse duration or exposure duration, and the tissue at risk.

The MPE given in the following table is informative and provided so that the integrator can calculate the Nominal Ocular Hazard Distance (NOHD), perform a risk analysis and inform the user about the safe usage of the product. However, exposure limits for the eye and the skin of employees in the workplace and the general public are, in many countries, specified in national laws. These legally binding national exposure limits might differ from the MPE stated in the table.

Table 24 - Worst case parameters for calculations

Wavelength (μm)	10.6	10.25	9.3
Maximum average radiant power (W)	295	260	225
Maximum pulse energy (mJ)	195	175	150
MPE (W/m ²)	1000	1000	1000

The NOHD is the distance from the beam focus beyond which the beam irradiance or radiant exposure remains below the appropriate MPE. Importantly, the NOHD is dependent upon the beam waist size and the divergence of the beam. Therefore, the NOHD is dependent upon the optical components acting on the beam. The NOHDs have been calculated for each combination of scan head, scanning lens and operational wavelength using the maximum radiant power and the maximum pulse energy. These values represent the worst case when calculating NOHDs and exceed the normal expected operation of the system. Normal operation is more typically represented by the typical shipment power. The minimum shipment power represents the minimum guaranteed power when the system ships (see section 2.9.10).

The calculated NOHDs are only relevant when the specified scanning head and final focus lens are used. If these are modified or replaced with other optics it is the responsibility of the integrator or end user to recalculate the NOHDs. Further details of the safe use of lasers are given within IEC/ TR 60825-14 'Safety of laser products – Part 14: A user's guide'.

The following table summarises the operating parameters for the MULTISCAN® HE with SC7, SC10 and SC14 scanning heads.

The irradiance, radiant exposure and optical density have been calculated for the combination of scan head, scanning lens and operational wavelength using the maximum radiant power and the maximum pulse energy. These values represent the worst case and exceed the normal expected operational conditions of the system. The operation is more typically represented by the typical shipment power. The minimum shipment power represents the minimum guaranteed power when the system ships.

The irradiance, radiant exposure and optical density have been calculated to aid the selection of suitable laser safety glasses. Further information can be found within BS EN 207: 2017. Other safety measures may be required to reduce the expected exposure to acceptable levels. Further details of the safe use of lasers are given within IEC/ TR 60825-14 'Safety of laser products – Part 14: A user's guide'.

Table 25 - Optical density calculation for the MULTISCAN® HE with SC7, SC10 and SC14 scanning heads — wavelength 10.6μm

Scanning head aperture (mm)	Final lens focal length (mm)	Beam diameter (mm)	NOHD (m)	Irradiance (Wm ⁻²)	Radiant exposure (Jm ⁻²)	Optical density
7	75	0.19	13	2.1x10 ¹⁰	1.4x10 ⁷	8
7	100	0.26	17	1.1x10 ¹⁰	7.6x10 ⁶	8
7	150	0.39	25	5.0x10 ⁹	3.4x10 ⁶	7
7	200	0.52	33	2.8x10 ⁹	1.9x10 ⁶	7
10	75	0.15	10	3.3x10 ¹⁰	2.2x10 ⁷	8

Scanning head aperture (mm)	Final lens focal length (mm)	Beam diameter (mm)	NOHD (m)	Irradiance (Wm ⁻²)	Radiant exposure (Jm ⁻²)	Optical density
10	100	0.20	13	1.8x10 ¹⁰	1.2x10 ⁷	8
10	150	0.30	20	8.1x10 ⁹	5.4x10 ⁶	7
10	200	0.41	27	4.5x10 ⁹	3.0x10 ⁶	7
10	250	0.51	33	2.9x10 ⁹	1.9x10 ⁶	7
10	300	0.62	40	2.0x10 ⁹	1.3x10 ⁶	7
10	360	0.75	48	1.3x10 ⁹	9.0x10 ⁵	7
14	75	0.11	7	6.7x10 ¹⁰	4.4x10 ⁷	8
14	100	0.14	10	3.7x10 ¹⁰	2.5x10 ⁷	8
14	150	0.21	14	1.6x10 ¹⁰	1.1x10 ⁷	8
14	200	0.29	19	9.0x10 ⁹	6.0x10 ⁶	7
14	250	0.36	24	5.7x10 ⁹	3.8x10 ⁶	7
14	300	0.44	29	3.8x10 ⁹	2.6x10 ⁶	7
14	360	0.54	35	2.6x10 ⁹	1.7x10 ⁶	7

Table 26 - Optical density calculation for the MULTISCAN® HE with SC7, SC10 and SC14 scanning heads — wavelength 10.25µm

Scanning head aperture (mm)	Final lens focal length (mm)	Beam diameter (mm)	NOHD (m)	Irradiance (Wm ⁻²)	Radiant exposure (Jm ⁻²)	Optical density
7	75	0.19	13	1.8x10 ¹⁰	1.2x10 ⁷	8
7	100	0.26	17	9.9x10 ⁹	6.6x10 ⁶	7
7	150	0.39	25	4.3x10 ⁹	2.9x10 ⁶	7
7	200	0.52	33	2.4x10 ⁹	1.6x10 ⁶	7
10	75	0.15	10	2.8x10 ¹⁰	1.9x10 ⁷	8
10	100	0.21	13	1.6x10 ¹⁰	1.0x10 ⁷	8
10	150	0.31	20	6.9x10 ⁹	4.6x10 ⁶	7
10	200	0.42	26	3.8x10 ⁹	2.5x10 ⁶	7
10	250	0.52	33	2.4x10 ⁹	1.1x10 ⁶	7
10	300	0.63	40	1.7x10 ⁹	1.3x10 ⁶	7
10	360	0.76	48	1.1x10 ⁹	7.5x10 ⁵	7
14	75	0.11	7	5.7x10 ¹⁰	3.8x10 ⁷	8
14	100	0.15	10	3.1x10 ¹⁰	2.1x10 ⁷	8
14	150	0.22	14	1.4x10 ¹⁰	9.1x10 ⁶	8
14	200	0.30	19	7.5x10 ⁹	5.0x10 ⁶	7
14	250	0.38	24	4.7x10 ⁹	3.1x10 ⁶	7
14	300	0.45	29	3.2x10 ⁹	2.1x10 ⁶	7
14	360	0.55	35	2.1x10 ⁹	1.4x10 ⁶	7

Table 27 - Optical density calculation for the MULTISCAN® HE with SC7, SC10 and SC14 scanning heads — wavelength 9.3µm

Scanning head aperture (mm)	Final lens focal length (mm)	Beam diameter (mm)	NOHD (m)	Irradiance (Wm ⁻²)	Radiant exposure (Jm ⁻²)	Optical density
7	75	0.18	12	1.7x10 ¹⁰	1.1x10 ⁷	8
7	100	0.25	16	9.4x10 ⁹	6.3x10 ⁶	7
7	150	0.37	24	4.2x10 ⁹	2.8x10 ⁶	7
7	200	0.49	32	2.3x10 ⁹	1.6x10 ⁶	7
10	75	0.14	10	2.8x10 ¹⁰	1.9x10 ⁷	8
10	100	0.19	13	1.5x10 ¹⁰	1.0x10 ⁷	8
10	150	0.29	19	6.9x10 ⁹	4.6x10 ⁶	7
10	200	0.39	25	3.8x10 ⁹	2.5x10 ⁶	7
10	250	0.49	31	2.4x10 ⁹	1.6x10 ⁶	7
10	300	0.52	38	1.7x10 ⁹	1.1x10 ⁶	7
10	360	0.71	46	1.1x10 ⁹	7.6x10 ⁵	7
14	75	0.10	7	5.7x10 ¹⁰	3.8x10 ⁷	8
14	100	0.13	9	3.2x10 ¹⁰	2.1x10 ⁷	8
14	150	0.20	13	1.4x10 ¹⁰	9.3x10 ⁶	8
14	200	0.27	18	7.7x10 ⁹	5.1x10 ⁶	7
14	250	0.34	22	4.8x10 ⁹	3.2x10 ⁶	7
14	300	0.42	27	3.3x10 ⁹	2.2x10 ⁶	7
14	360	0.51	33	2.2x10 ⁹	1.5x10 ⁶	7

Please note that while every effort has been made to ensure that the data given in this document is accurate, due to a policy of continuous improvement, the information, figures, illustrations, tables, specification and schematics contained herein are subject to change without notice.



DANGER

Class 4

Visible and Invisible laser radiation

Avoid eye or skin exposure
to direct or scattered radiation

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