LUXINAR
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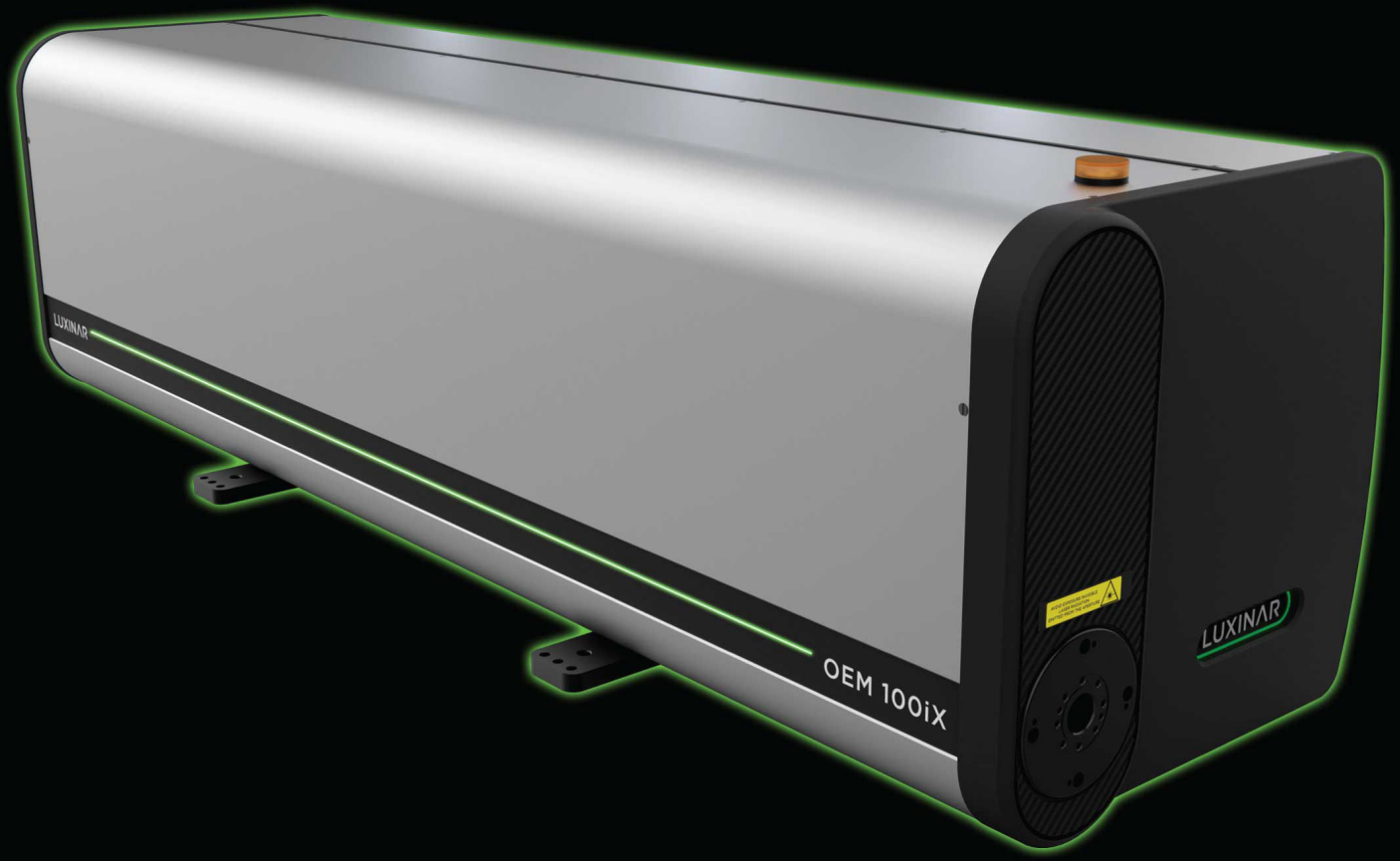

USER MANUAL

OEM 100iX

Sealed CO_2 laser source

Original Instructions

Aftersales contact details

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www.luxinar.com

Warranty shipments, returns and adjustments

Warranty claims must be made promptly and must be received by Luxinar Ltd during the applicable warranty period.

Always identify the product, by both model number and serial number, when contacting Luxinar Aftersales.

If it becomes necessary to return a product for repair and/or adjustment, the instructions as to how and where these products should be shipped must be obtained from Luxinar Aftersales.

Service and repair

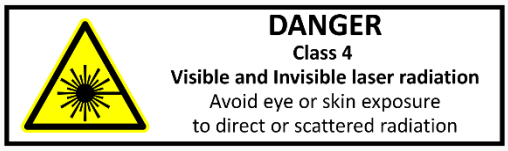
Servicing or calibration of the system can only be carried out by trained Luxinar service engineers or customers who have undertaken and passed a Luxinar approved service training course. Details of training courses and servicing can be obtained from the local Luxinar Aftersales address.

Contents

Section 1

General Description

Safety Information



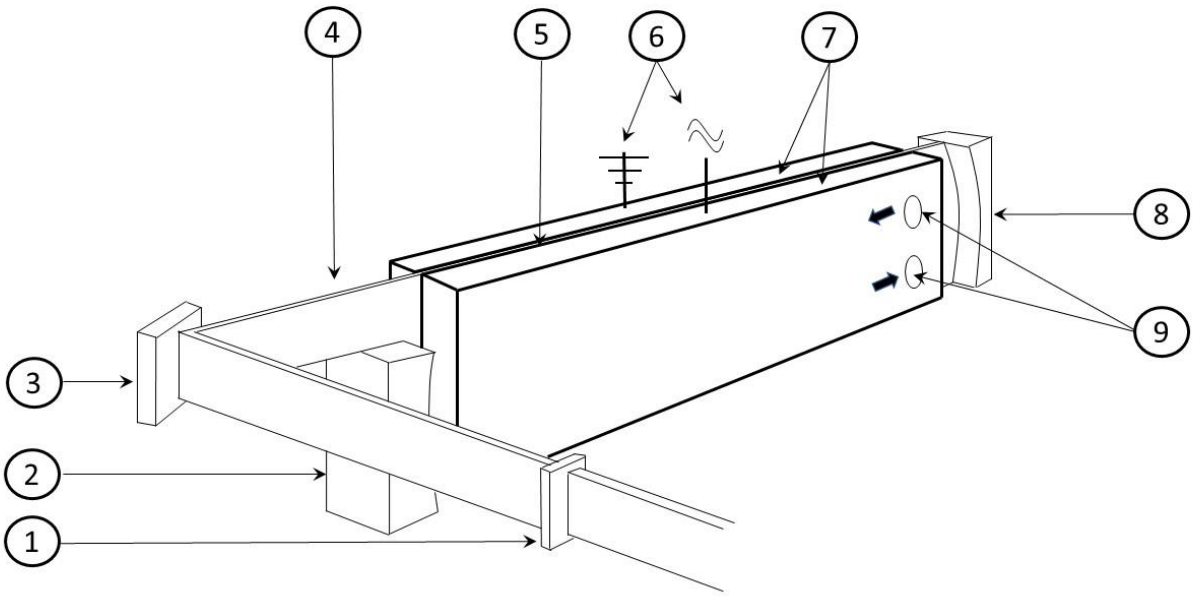
This document contains technical and operational instructions for the laser system.

For safety instructions and precautions please refer to safety manual 906-0251-xx.

Operation of the OEM 100iX

The OEM 100iX laser is a high-frequency excited, diffusion-cooled CO_2 Slab Laser designed for industrial use as a cutting, welding or marking tool.

The figure below shows the principle of operation of the Slab laser. A laser gas discharge (active zone) (5) is established between the wave guiding electrodes (7) by a radio frequency voltage (6). The rear mirror (8) and output mirror (2) form the optical resonator. The laser beam (4) is produced within the resonator and is emitted through a window (1) in the laser resonator vessel after being turned through 90 degrees using a planar turning mirror (3). Water (9) is used to cool the electrodes.



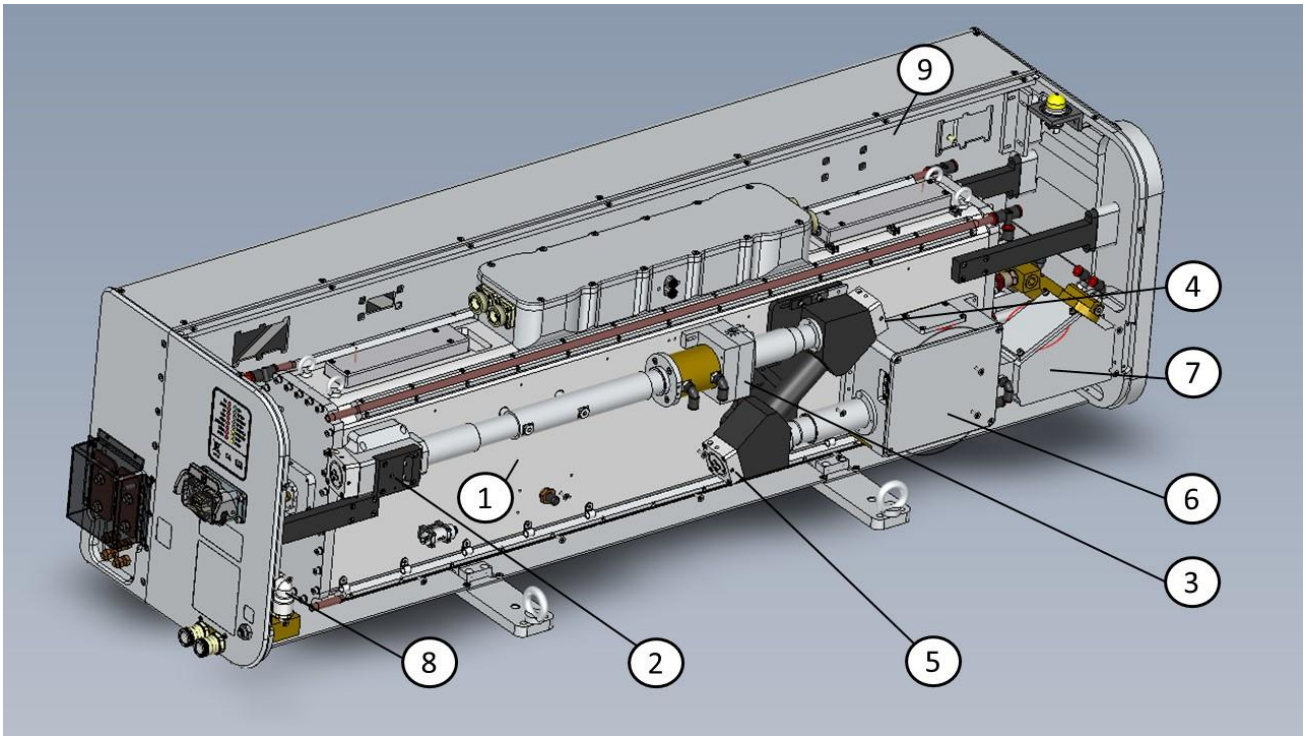
Diffusion Cooled Slab Laser Layout

Due to the nature of the electrodes in a slab laser, the emitted laser beam diverges at different rates in the x (waveguide) and the y (free space) directions. In order to make the beam circular it is necessary to reshape the output beam using reflective correction optics. This is achieved by using a combination of cylindrical and spherical optics.

In the free space direction there are also diffraction effects from outcoupling the beam around the edge of the resonator output optic. This produces secondary lobes on the main output beam that need to be scraped or filtered out. This is achieved by the use of a spatial filter.

After beam correction and spatial filtering, the beam quality from the slab laser is ideal for any material processing operation that requires excellent mode quality and beam stability.

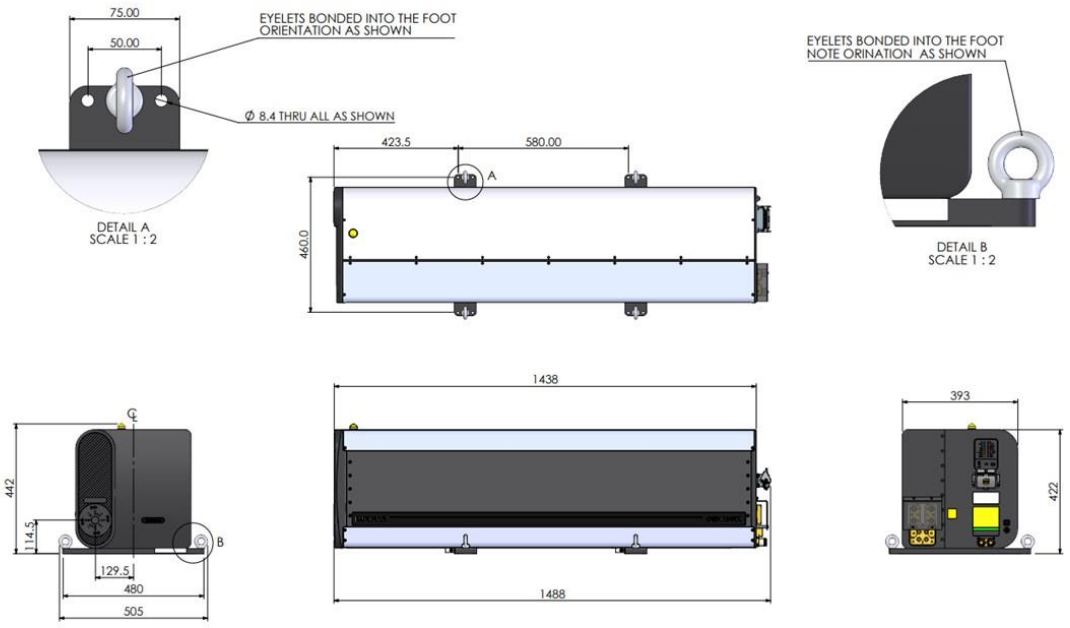
Laser Head Layout



Laser Head Layout

After exiting the laser resonator vessel (1), the beam is turned through 90 degrees and focussed using mirrors inside the turning block (2), the beam then passes through the spatial filter (3). The Spatial Filter is used to scrape off any unwanted 'free space' secondary lobes on the laser beam. After exiting the Spatial Filter, the beam enters the Z-fold Module. Here, the first turning mirror (cylindrical element) (4) matches the different divergences in the beam to make it circular and then deflects the beam to the second turning mirror (spherical mirror) (5), which both collimates and directs the beam through the Shutter-Diode Box (6) and on to the Final Output Window (7). The Final Output Window is also a beam splitter that takes a small portion of the laser beam power onto a detector that is used for power feedback control. The Laser Tube and Spatial Filter are both water-cooled. The water flow is monitored by a Flow Sensor (8) and the RF power supply (9) is integrated with the laser.

Technical Specification



Laser Head Dimensions

A. Laser Head (includes integrated RF power supply)

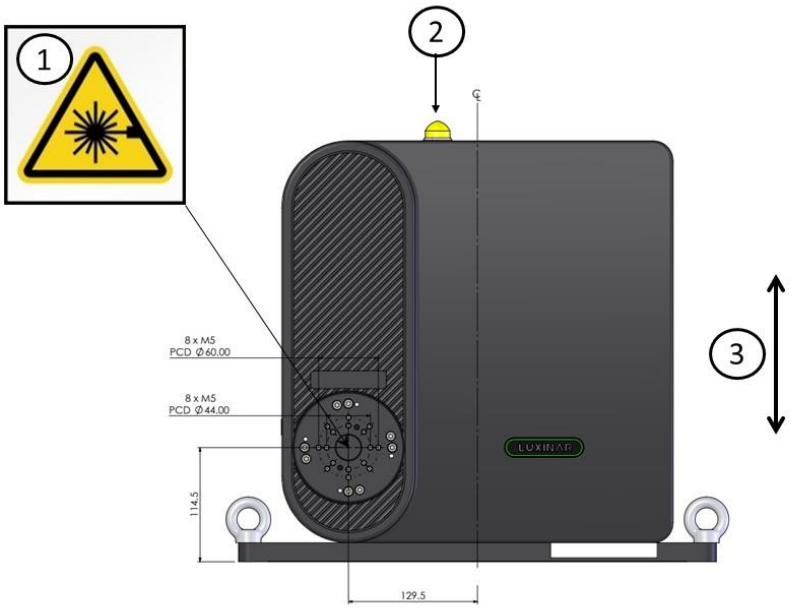
Laser Tube	Sealed Cavity RF excited Diffusion Cooled Slab Carbon Dioxide Laser
Excitation Frequency	81 MHz
Expected Tube Lifetime	(At rated power) >20000 hrs continuous running
	(This is an expected lifetime figure and not a guarantee)
Rated Output Power	1000 Watts

(Guaranteed at 20°C coolant temperature 50µs pulse width and 60% duty cycle. Allow 0.8% per °C power decline for coolant temperatures up to 30°C)

Power Range (typical)	50 – 1000 Watts At 50µs maximum duty (12kHz)
Peak Power (maximum)	2520 Watts (@PW >50µs)
Typical Power Stability	± 3.0% / ± 1% (with power feedback)
Guaranteed Power Stability	± 5% / ± 2% (with power feedback)
Pulsed Frequency	0-130 kHz
	(Full modulation depth up to 10 kHz. Higher frequencies for quasi-CW operation)
Pulse Width	2 – 400µs
Pulse Energy	40 – 800mJ

Pulse Rise/Fall Time	<60µs
External Dimensions (mm)	1488(L) x 505(W) x 442(H)
Weight	200 kg (subject to change)

B. Laser Output Aperture and Beam Characteristics



Laser Head Beam Aperture. (1) Laser Output Aperture, (2) Emission warning light, (3) Linear polarization vector

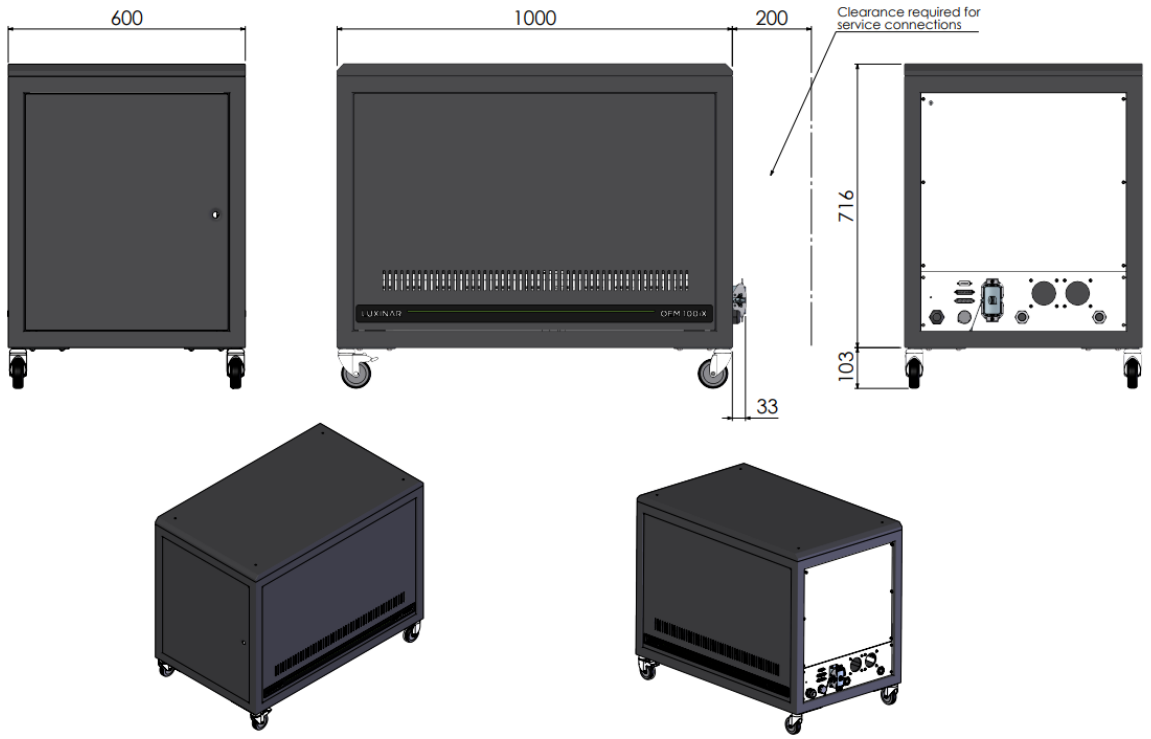
Beam Quality Factor	k>0.87 or M^2 <1.15
Beam Divergence	<1.75mrad (1 to 10m)
Beam Ellipticity	<1.1:1
Beam Pointing Stability	<250µrad (half angle)
Beam Diameter at output	11.2 ± 1.0mm ($1/e^2$)
	(Refer to Typical Performance data for beam propagation)
Wavelength	Typically 10.6um (range 10.45 – 10.7µm)
Polarisation	Linear (purity >100:1)
	(Perpendicular to base of laser head)
MPE	1000 $J.m^{-2}$ (Refer to Appendix)
NOHD	2100m (Refer to Appendix)
Optional safety shutter	Refer to Section 5
Optional pilot diode beam	Refer to Section 5

C. Integrated RF Power Supply Details

External Dimensions (mm)	1397(L) x 145(W) x 418(H)
Weight	64kg
Output Frequency	81MHz
Output Power	16kW average (26.5kW peak)
Input Voltage	50V dc ± 1%
Input Current	500A (max RMS)
Input Power	25kW (max.)
Pulse Width	2 - 400µs
Duty Cycle	Single Pulse to 60%
Frequency	0 – 130kHz

D. DC unit 016-0028-00 / 016-0038-00 (as supplied by Luxinar, includes controller unit)

NOTE This equipment is designed for OVERVOLTAGE CATEGORY II as defined within the safety manual.



Luxinar Supplied DC Unit with Integrated Controller. (1) Space required for connections

External dimensions	1000(L) x 600(W) x 820(H)
Weight for 016-0028-00	170kg (191kg with 5m DC cables)
Weight for 016-0038-00	123.5kg (144.5kg with 5m DC cables)
Input voltage range for 016-0028-00	400-480VAC ± 10% 3 phase 50/60Hz
Input voltage range for 016-0038-00	380-480VAC ± 10% 3 phase 50/60Hz
External fusing requirement	3 x63A
Output voltage	50V
Maximum output power for 016-0028-00	32kW
Maximum output power for 016-0038-00	33kW
Earth leakage current for 016-0028-00	<16mA
Earth leakage current for 016-0038-00	<24mA
DC cable length (customer specified)	1 to 12m in metre lengths as dual-cables

E. RF Cables (between the Laser Head Module and the RF Power Supply Unit – 4 cables per system)

Cable Type	Coaxial Double Shielded
Cross section diameter	15mm
Static minimum bend radius	152mm
RF connector torque setting	25Nm (18.45 ft-lb.)
Cable length	Fixed length

F. Mobile Control Unit (optional)

Dimensions (mm)	220(L) x 115(W) x 51(H)
Weight (Kg)	0.72 (with Cable)
Cable length	3m or 6m (Customer specified)

G. Environmental Specification (Laser Head and DC unit)

NOTE **This equipment is designed for indoor use only and pollution degree 2 as defined within the safety manual.**

Ambient temperature	+5 to +40°C (+41 to +104°F)
Storage temperature	+5 to +70°C (+41 to +158°F)

Humidity	10 to 85% relative humidity (Non-condensing)
Altitude	< 2000m

Water Cooling Requirements

WARNING! To avoid condensation forming on the resonator beam delivery optics, power supply units and electronic components, the temperature of the cooling water must be kept above the dew point.

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

Look-up table showing required minimal coolant temperatures (above the dew point) to avoid condensation with respect to Ambient Temperature (°C) and Relative Humidity (%).

Laser head

Heat Load	20kW max
Coolant flow rate	20 litres/min (recommended)
	16 litres/min (minimum, system disables below this level)
	25 litres/min (maximum)
Coolant temperature	19 – 24°C ± 1°C or 24 – 30°C ± 1°C as specified by customer. Must be above dew point
Coolant pressure	> 4.0 bar (58 psi) < 6.0 bar (88 psi)
In line filter	100µm
Connections	16mm Push fit
Barb fittings supplied with Spares kit	½" BSP-parallel compatible with 19mm I.D. flexible hose

Please refer to document 906-0202-99 for the minimum coolant temperature tables.

Heat Load	5kW max
Coolant flow rate	12 litres/min (recommended)
	10 litres/min (minimum, DC PSU disables below this level)
	25 litres/min (maximum)
Coolant temperature	19 – 30°C ± 1°C. Must be above dew point
Coolant pressure	> 4.0 bar (58 psi) < 6.0 bar (88 psi)
In line filter	100µm
Connections	16mm Push fit
Barb fittings supplied with Spares kit	½" BSP-parallel compatible with 19mm I.D. flexible hose

Cooling Water Specification

General Information

External cooling circuit materials must be chosen to avoid corrosion. Do not use aluminium, zinc, and mild steel or cast-iron materials in the cooling circuit. Suitable materials are stainless steel, copper, copper alloys and opaque plastics. To prevent bacteria formation in the cooling circuit, only use tubing that is impervious to light.

WARNING! When storing or transporting the system, the water-cooling pipes must be drained and blown out with compressed air to prevent the possibility of freezing and damage to the cooling circuit. To prevent damage to flow sensors the compressed gas pressure should be limited to 2bar.

Requirements and Additives

To ensure trouble-free operation of the laser and to prevent corrosion in the cooling circuit, the following requirements must be complied with:

A. Quality of the Cooling Water

Use only de-mineralised, de-ionised or distilled water with an anti-corrosion additive. Ensure that the following limits on the water quality are met:

Conductivity of water	< 1000 µS/cm
Total Hardness	< 10 ppm
pH value of the water	7 – 8.5
Bacteria level	<1000 cfu/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 Sales and Service office.

B. Suspended Particles

To remove particulate contamination, a filter with a pore size of 100 µm must be used. The filter should be located as close as possible and in line with the cooling water inlet of the laser head and should be regularly checked for blockage and cleaned or replaced where necessary. This is particularly important after bacterial growth has been detected and treatment applied.

C. Corrosion and Germ Formation Inhibitors

To prevent germ 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, selection of which will depend on the total volume of the cooling water circuit to be used:

Volume 50 – 199 litres Order No.: 480-Luxinar 20.88

Volume 200 – 350 litres Order No.: 480-Luxinar 60.88

Volume 351 – 500 litres Order No.: 480-Luxinar 100.88

To order the water treatment kits, contact NALCO directly at:

Nalco Deutschland GmbH

Solmsstr. 41

60486 Frankfurt, Germany

Tel: +49 (0) 69 7934218

Fax: +49 (0) 69 7934246

Email: egerlach@nalco.com

Please note that the water treatment kit must be ordered from NALCO in Germany and they are equipped to ship the kits worldwide.

Additional notes for the NALCO water treatment kits:

- Expiration date: 2 years
- Storage temperature: between 0 °C and +25 °C
- Disposal of used material: Ensure that disposal of all the materials used in this product is conducted according to all local, State and Federal Rules and Regulations

WARNING! Always use the correct safety goggles when handling chemicals used in NALCO water treatment kit.

Completely empty both inhibitor bottles which are included with the NALCO kit into the cooling water reservoir tank:

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 germs (algae and slime) from the water circuit.

Additional Notes:

- The use of other inhibitors, biocides and other substances or hardness stabilisers other than the specialist NALCO kit is strictly forbidden.
- Test kits are not necessary
- After mixing the NALCO chemicals with the cooling water, the pH value should be between 6.5 and 9.0

After 6 months of running the cooling system, drain off the cooling water and then refill with new water as specified above and treat the system using the appropriate NALCO kit specified above. Ensure that disposal of all the materials used in this product is conducted according to all local, State and Federal Rules and Regulations.

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

D. Contaminated Cooling Water

If the cooling water is contaminated with bacteria or has been treated with other chemicals it will be necessary to clean the cooling circuit using the following procedure:

1. Drain off the contaminated cooling water
2. Ensure that disposal of all the materials used in this product is conducted according to all local, State and Federal Rules and Regulations
3. Flush the cooling water circuit with tap water by filling and draining once only
4. Mix tap water with demineralised water in a 1:1 ratio and fill the cooling water circuit
5. Add the NALCO water treatment kit and mix well with the cooling water.
6. Drain off the cooling water after operating the system for between 2 and 4 days
7. Flush the cooling water circuit twice
8. Fill the cooling water circuit with the appropriate quality of water as described above and add the appropriate NALCO water treatment kit as described above.

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

E. Frost Protection

If the cooling system or chiller which supplies the cooling for the laser head is located in an area where the temperature may drop below 0°C, then the cooling water circuit must be equipped with a winter proof heating tank to prevent the cooling water temperature dropping below 15°C.

WARNING! The NALCO water treatment kit must not be used with anti-freeze as chemical reactions will cause damage to the laser and the cooing circuit.

Purge Gas Specification

The OEM 100iX laser head beam correction is sealed to IP66 to the Final Output Window. All electronics modules / connectors within the laser head are also sealed to IP66. Covers that are fitted over the laser head are only intended as a measure to prevent dust forming on the external surfaces of the beam correction and electronics modules / connectors.

During operation, humidity levels inside the sealed laser head beam correction can increase owing to changes in temperature. Water vapour can then absorb the laser energy and cause laser power fluctuations and steering of the laser beam. It may therefore be required that from time to time the laser head beam correction is purged. Similar issues can arise in the customer's external beam delivery, which should be sealed to the laser head. Volatiles and dust can also enter into the customer's beam delivery if not sealed to IP66. This type of contamination also needs to be removed in order that performance and optical surfaces in the external delivery are maintained.

Note that chiller water used to cool the laser head should be set to temperatures to avoid condensation on pipe work, etc. i.e. set above dew point.

The purge gas should be clean, dry and non-flammable e.g. nitrogen, air, etc.

The purge gas should be supplied at a pressure of approximately 2 psi, and at a rate of approximately 1 litre per minute, using 6mm (or 1/4") polyethylene tubing. The tubing connects directly to the 'push in' type fitting on the rear panel of the laser head.

Note that the 'red' blanking plug should not be removed from the 'push-in' fitting when purge gas is not in use. Removal of the plug will expose a contamination path into the laser head.

The inlet to any air compressor system should be kept away from any fume or debris contamination sources such as the laser processing zone or the exhaust port of any process gas/debris extraction unit.

Nitrogen Purge Gas Specification

Purity	$\geq$ 4.6 (O_2 ≤ 3vppm, H_2O ≤ 2vppm)
Pressure	1 to 3 psig (0.07 to 0.21 bar)
Flow Rate	1 to 2 l/min

Air Purge Gas Specification

Oil	$\leq$ 0.005 mg/m^3
Water	$\leq$ 0.05 g/m^3
Particles	$\leq$ 0.05 µm
Pressure	1 to 3 psig (0.07 to 0.21 bar)
Flow Rate	1 to 2 l/min

For more information on air purification options contact the local Luxinar/Distributor sales department.

Enquiries

Every effort has been made to ensure that the information in this manual is correct; however, components may be subject to design changes and upgrading, from time to time.

Please direct any questions or comments on this manual to Luxinar Ltd, Customer Services Department, stating the part number and revision given at the bottom of this page.

Immediate response, to any service enquiries, can be achieved by contacting the relevant Distributor Service Office.

Always identify the instrument, by both the model number and the serial number, in all correspondence. This information is contained on the serial number panel, which is located on the rear flange of the Laser Head Housing.

Warranty Information

All special warranty terms, e.g. Laser tubes, etc., are contained in the OEM System warranty terms that are current, when the system is purchased. Copies of the OEM System Warranty Terms can be obtained from Luxinar - only warrants to the original purchaser and only at the original location.

Major sub systems manufactured by other firms but integrated into systems are covered by the original manufacturer's warranty. In order to comply with this warranty, all internal adjustments or hardware/software modifications and servicing of the system must be made by a Luxinar certified field engineer or with the express written permission of Luxinar Ltd., Service Department.

The warranty does not cover misuse of the equipment, negligence or accidental damage. Please also note that damage due to laser beam back reflection, insufficient coolant water flow, corrosion, condensation or freezing of water pipes is also not covered by the warranty for the system.

Please consult **Cooling Water Specification** on page 5 for more information on these issues.

The liability of Luxinar, under valid warranty claims, is limited to repair or replacement at Luxinar's facility, or purchaser's place of business (or, if practicable, a refund of the purchase price), all at the discretion of Luxinar unless otherwise specified by law, in the country where the equipment was sold.

Luxinar cannot accept liability for any other costs associated with down time due to misalignment, failure or servicing of the system.

Warranty Shipments, Returns and Adjustments

Warranty claims must be made promptly and must be received by Luxinar, during the applicable warranty period.

If it becomes necessary to return a product for repair and/or adjustment, authorisation from Luxinar for the return and instructions as to how and where these products should be shipped must be obtained from the Service Department.

Service Department
Luxinar Ltd.
Meadow Road
Bridgehead Business Park
Kingston Upon Hull
HU13 ODG
U.K.

Email aftersales@luxinar.com
Telephone: 44 (0) 1482 650088

Note: Drop the 0 for international calls (UK country code is 44)

Service and Repair

Servicing or calibration of the system may only be carried out by trained Service Engineers or customers who have undertaken and passed a Luxinar approved service training course. Details of training courses and servicing can be obtained from the local Distributor Service Office.

Section 2

Installation and Start-Up

Delivery Check

An itemised list of the ordered equipment is provided by Luxinar on delivery. Check the equipment against the list to ensure that all items are present. If any equipment is missing inform Luxinar immediately.

Check the outside of the packing boxes for obvious signs of damage or change 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 and the relevant shipping company, before taking any other action.

Unpacking

1. Cut the bands on the outside of the two packing boxes. Open the box lids and remove the cardboard outer packaging.
2. Remove the cables, spares kit, documentation and store in a secure location in preparation for installation.
3. Now remove the top and side sections of the support packaging
4. Check all the components for signs of damage. If any damage has occurred in transit, inform both Luxinar and the relevant shipping company before taking any other action.
5. Carefully lift each component out of the packaging. Note that this will require the correct lifting equipment for the weights involved.
6. Place each component on a clean, flat, dry surface in preparation for installation.

Lifting OEM 100iX Laser Head

Sign shows this is NOT a lifting point. The only lifting points are on the Laser head feet

The Four M10 eyelets (screwed and bonded) into the laser head feet MUST BE USED for lifting in conjunction with 4 shackles and 4 strops. All four lifting points must be used together to lift the laser head.

WARNING! NEVER attempt a manual lift of the Laserhead.

WARNING! NEVER attempt to lift the Laser Head by the end flanges or casework. The unit may only be lifted from the feet using the appropriate equipment.

WARNING! Do not attempt to lift the Laser Head into a vertical orientation using eyelets attached to the laser head feet.

Lifting of the 200kg laser head should only be attempted using the appropriate lifting equipment. **Under no circumstances should a manual lift be attempted.** Rules and regulations regarding lifting vary by region and it is therefore the responsibility of the customer to understand the rules within their region and ensure that all equipment is certified for operation.

Care should be taken to avoid scratching or damaging the laser head when lifting, and the use of 4 strops rather than chains is needed for this.

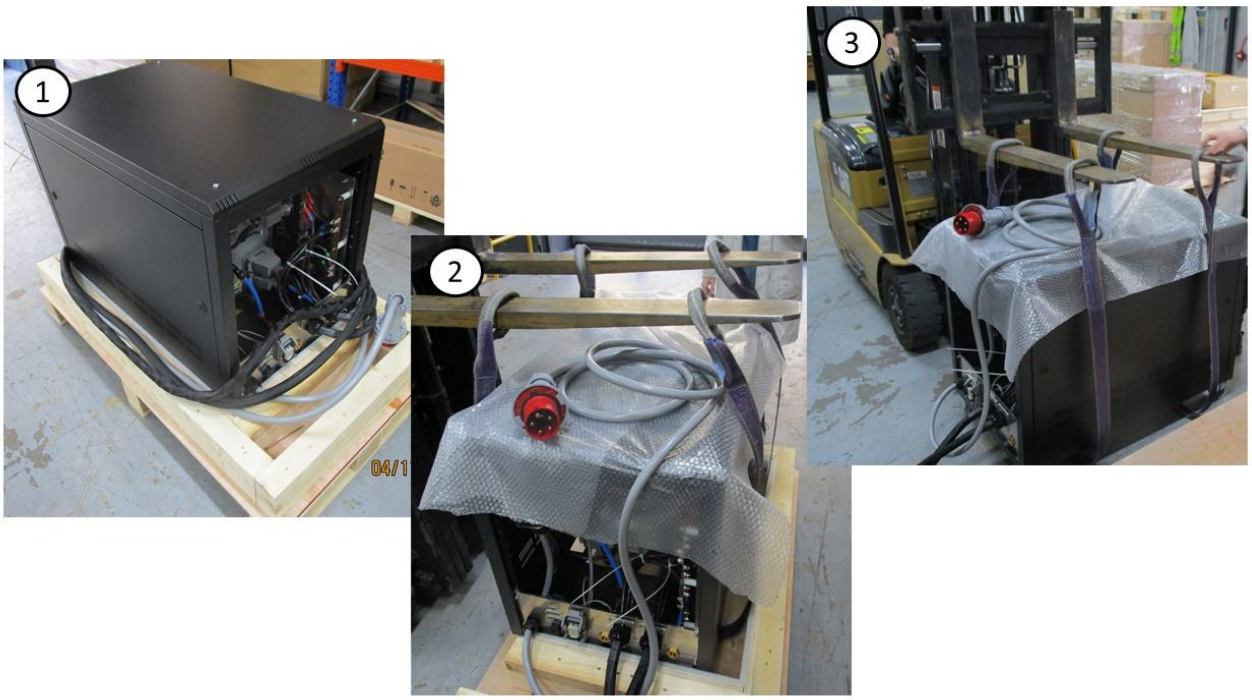
Correct attachment of strops to lift system from shipping box and to assist installation. (1) Shipping bolts removed from system feet and shackles and strops fitted. (2) Correct lifting of system out of shipping box using 4 strops

If having to lift the Laser head from a single point above the laser, **a spreader bar will be needed** to prevent the strops from crushing the sides of the casework

There is no facility for lifting the laser head into a vertical orientation. If needing to install the laser head in a vertical orientation, it must first be attached to a mounting plate resting on the floor, see 'Mounting the Laser Head'. The complete assembly must then be lifted into position using lifting equipment attached directly to the mounting plate. Care should be taken to avoid the end of the laser head coming in contact with the floor when lifting the assembly into the vertical.

Lifting OEM 100iX DC Controller Cabinet 016-0028-00 / 016-0038-00

Lifting of the 191kg DC Controller cabinet and cables out from the shipping box should only be attempted using the appropriate lifting equipment. Under no circumstances should a manual lift be attempted. Rules and regulations regarding lifting vary by region and it is therefore the responsibility of the customer to understand the rules within their region and ensure that all equipment is certified for operation.



Correct attachment of 2 strops to lift cabinet from shipping box. (1) Removal of outer packaging (2) Removal of shipping box side panel to allow fitting of strops underneath cabinet. (3) Removal and placement of Cabinet outside of shipping box

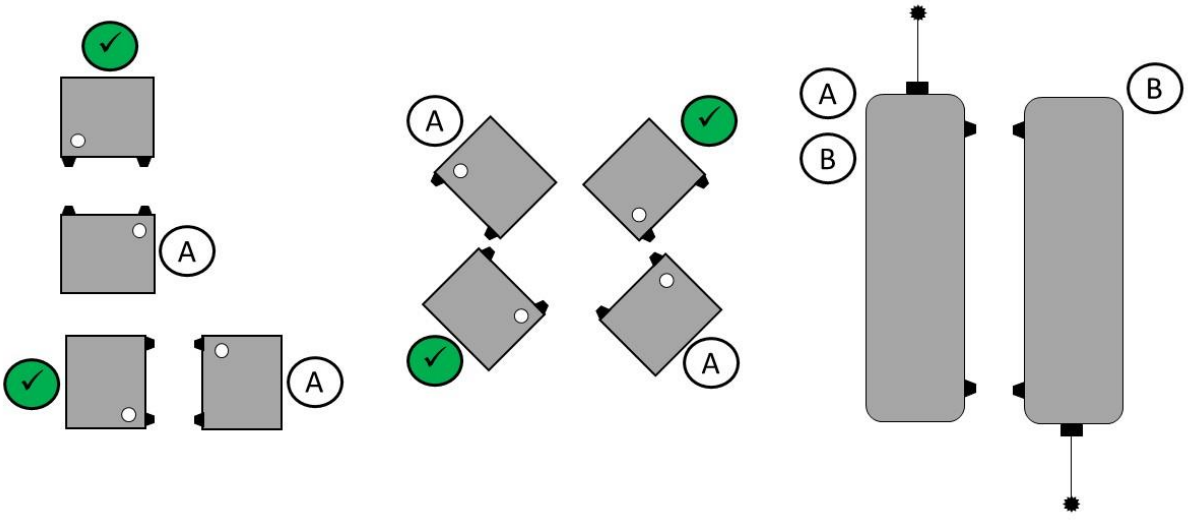
WARNING! NEVER attempt a manual lift of the DC Controller cabinet.

Installation

WARNING! 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 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.

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.

Correct Orientation of Laser Head



Laser Head Orientation Diagram

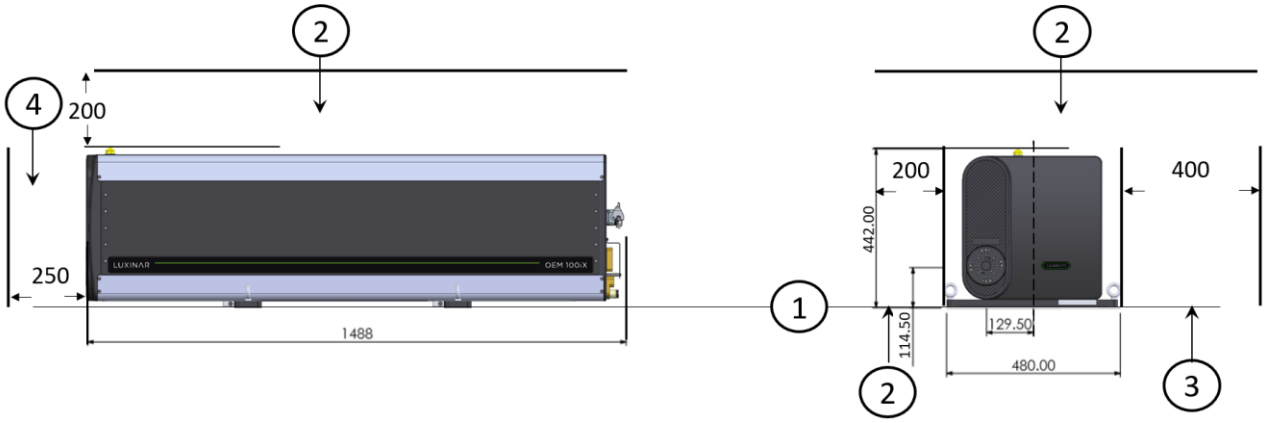
A. Not recommended for health and safety reasons when optional laser safety shutter fitted. Mounting the laser head in this orientation may have an effect on the ability of the shutter to close successfully under gravity in the unlikely event of a solenoid failure.

B. In this orientation, mirror surfaces within the laser head sit horizontal and can collect dust particles leading to reduced optic lifetime, especially when there is a risk of contamination.

Access to the Laser Head

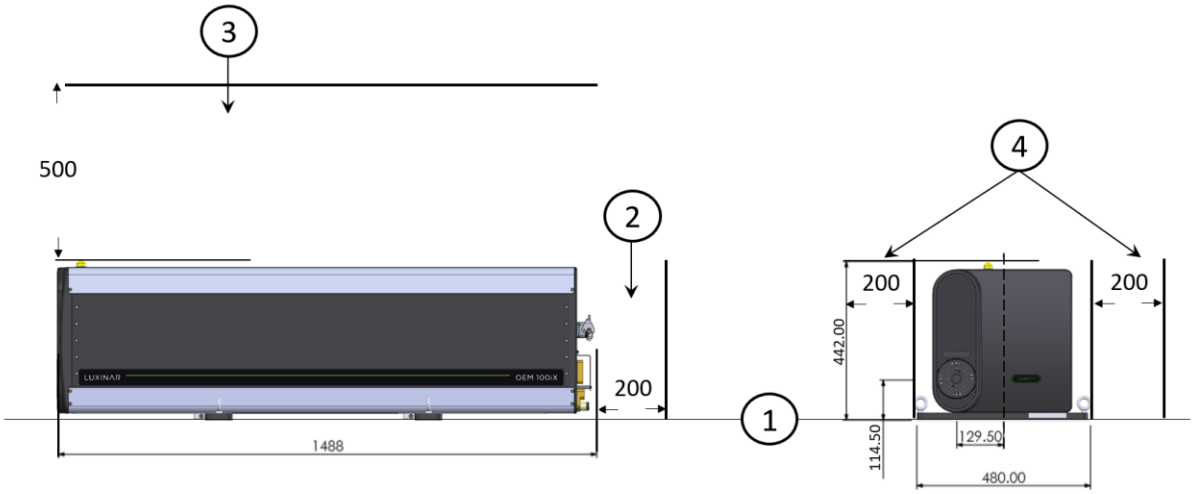
Servicing of the OEM100iX laser head RF power supply and beam delivery requires access to both sides of the laser head.

In confined installations, provision of reference locations for the laser head feet are recommended, enabling the laser head to be removed and serviced, and then re-installed with minimal realignment to the customer's beam delivery.



Recommended Clearance for Maintenance. (1) Customer mounting surface, (2) for removal of system covers, (3) for access to RF PS / removal and replacement of RF PS – **TO ONLY BE PERFORMED BY TRAINED LUXINAR STAFF**, (4) for removal of final optic through the front of the laser head

Installation requires minimal clearances to move the laser head into position using the lifting slings, and for interfacing of power, cooling and control.



Minimum Required Clearance for Laser Installation. (1) Customer mounting surface; (2) for interfacing laser, (3) for lifting laser, (4) for removal of lifting slings

Mounting the Laser Head

The laser head should be mounted and bolted into the appropriate positions within the processing machinery, taking into account the dimensions shown within the figure in 'Technical Specification'. All dimensions shown are in mm unless stated otherwise.

The laser head should be secured using all eight 8.4mm diameter securing through holes on the two feet fixed to the base of the laser head using M8 bolts, flat and spring washers.

Typical Operating Parameters

a. Mains Voltage

- 400 ±10% V AC 3 Phase

b. Water Flow Sensor Levels

- Recommended water flow 20l/min (12l/min for DC Controller Cabinet)
- Laser Operation Cut-off at 16l/min (10l/min for DC Controller Cabinet)
- Maximum water flow 25l/min

c. DC Output Voltage

- Operation Voltage 50V ± 2%
- Laser operation is inhibited outside of these voltages

d. RF Pulse width and Duty cycle

- Pulse Width 2-400µs
- Duty Cycle 60%
- Frequency 0-130khz

WARNING! At operational frequencies between 400Hz to 500Hz, 800Hz to 1000Hz, 1150Hz to 1250Hz, 1450-1550Hz and 1950Hz to 2050Hz mechanical and acoustic resonance may occur causing an unpleasant sound and there can be an effect on the quality of the beam.

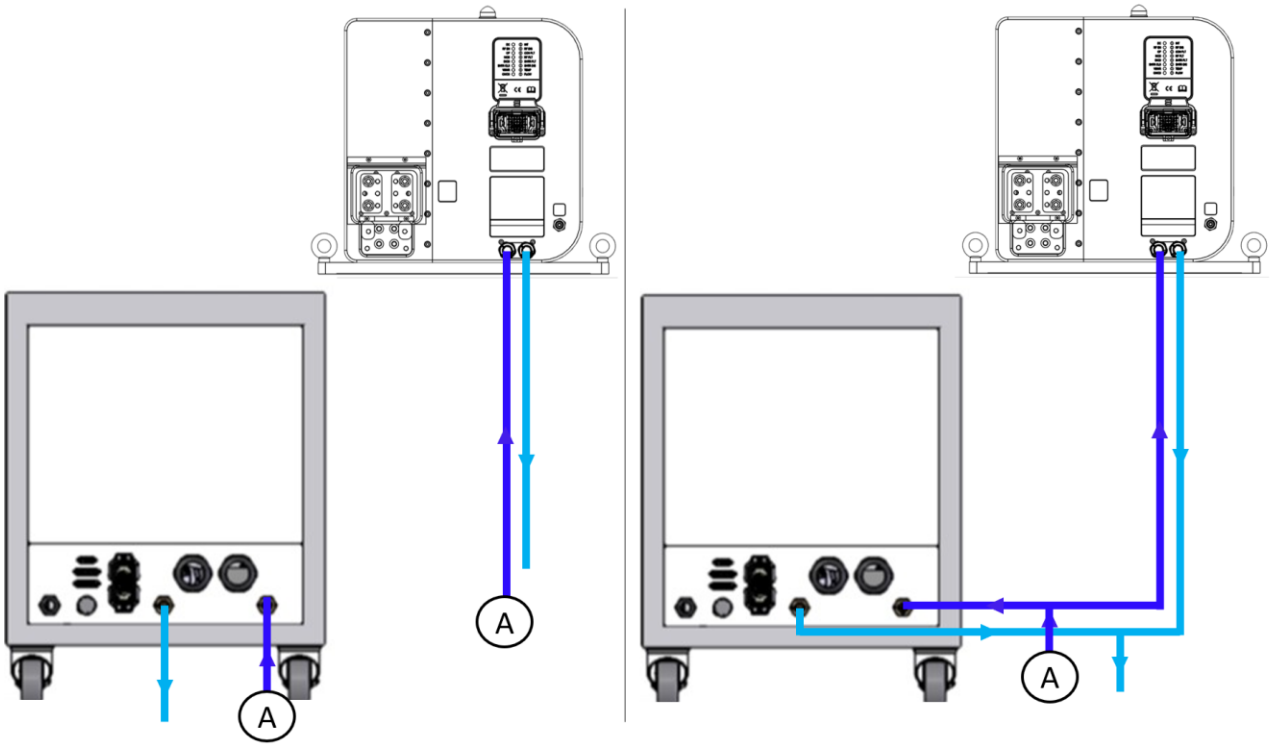
Please refer to Section 7 of this manual for the Acoustic Zone graph.

Water Cooling

The Laser Head and DC unit require water-cooling, please refer to 'Technical Specification' for details regarding cooling requirements. Both have been labelled to indicate inlet and outlet connections. Water flow rate is monitored by direction sensitive flow sensors located inside the Laser Head and DC unit.

The DC power supply can by connected in parallel with the laser head, or on a separate supply in order to achieve the required flow rate as shown in figure below. A 100um particle filter, denoted (A) should be positioned before the inlet to both the laser head and the DC unit.

NOTE: To correctly seal with the push-in fittings supplied with the laser system and DC power supply unit (Luxinar part number 405-0310-00), ensure the hoses push into the correct depth of 29mm ± 1mm.



Water Flow Direction and Position of the 100µm Particle Filter (A) for Separate and Parallel Cooling of Laser Head and DC Unit 016-0028-00 / 016-0038-00

Note that where a closed cycle water cooler or chiller is used, corrosion inhibitors must be added to the coolant – details are given in Section 1 'Cooling Water Specification.'

WARNING! Cooling water must be maintained at or above the minimum required flow rate to ensure sufficient cooling of the laser and its power supplies. In addition, the cooling water temperature must be adjusted and maintained above the dew point to avoid condensation forming on the laser optics and electronic parts.

Damage due to insufficient water-cooling flow, corrosion, condensation or freezing is not covered by the warranty for the laser system.

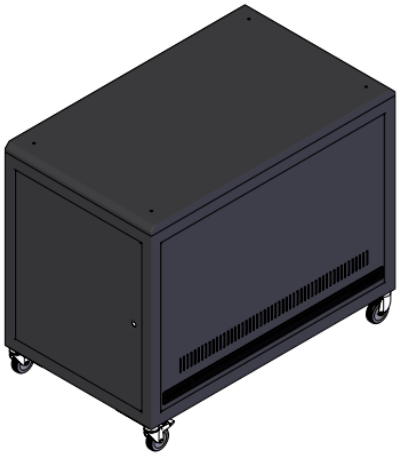
WARNING! The Laser Head and DC Unit must always be drained of any water-cooling fluid before shipping or transportation. This will prevent possible freezing of the liquid and the consequential damage to the internal water pipes inside the Laser Head and the DC unit. To prevent damage to flow sensors the compressed gas pressure should be limited to 2bar.

Standalone OEM 100iX three-phase DC PSU, 016-0028-00

Note: This equipment is designed for indoor use only, pollution degree 2 and overvoltage category II as defined within EN 61010-1:2010+A1:2019

General description

The OEM 100iX three-phase DC PSU is a free-standing AC to DC, 30kW water cooled power supply.



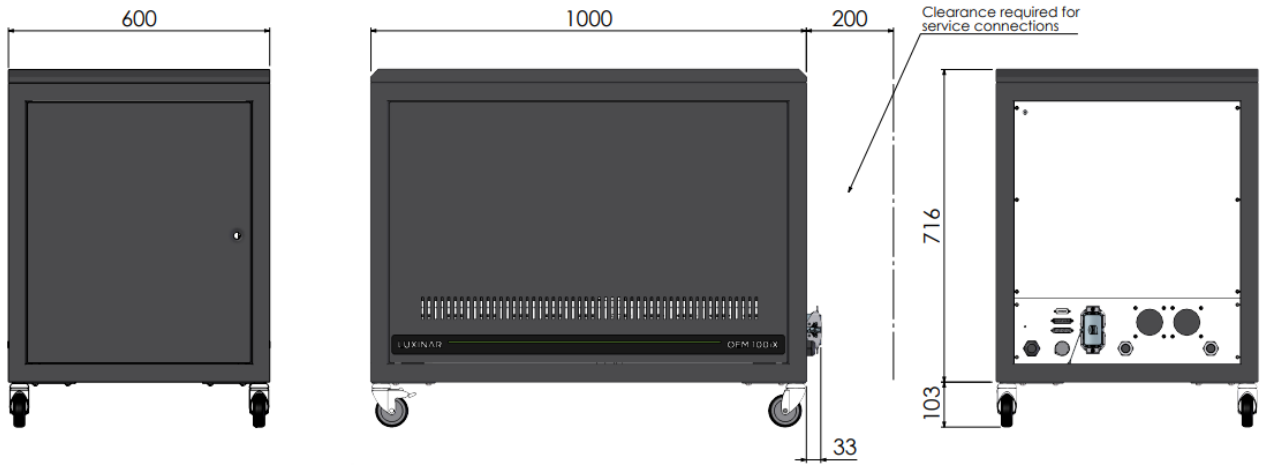
OEM 100iX DC PSU, 016-0028-00

Dimensions	**600x1000x820**
Weight	**170kg (191kg with 5m DC Cables)**
Coolant type	**Demineralised, deionised or distilled water with corrosion inhibitor and anti-bacterial additive**
Coolant pipe	**½" BSP parallel**
Coolant flow rate	**> 10 litres/min (minimum)**
Protection class	**IP21**

WARNING

Heavy equipment — risk of severe lumbar injury

The weight of the DC power supply exceeds the single person lift limit of 18kg, as specified in EN 61010-1:2010+A1:2019. Ensure a minimum of two people lift the power supply or that suitable lifting equipment is employed.



OEM 100iX DC PSU, Dimensions

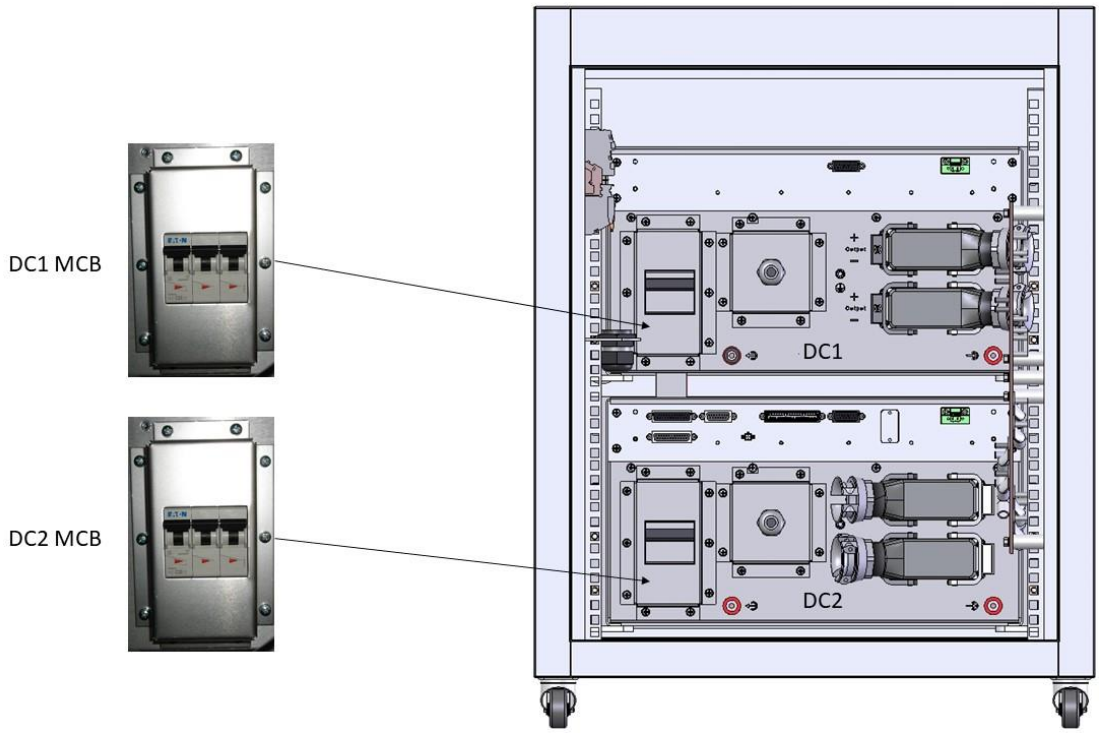
Technical specification

Mains input voltage range	**400-480 (±10%) VAC three-phase***
Mains input frequency range	**50/60 Hz**
Mains input maximum current	**41A @ 480 VAC (per phase)** **50A @ 400 VAC (per phase)**
Mains AC inrush current (max)	**52A (softstart)**
AC Power consumption (max)	**34 kW**
Efficiency	**88%**
Output voltage (DC)	**50V ±2V**
Output current (max)	**640A**
Output power (max)	**32 kW**
Earth leakage	**< 16mA**

WARNING! **No neutral connection is required. Connection of the supply to a neutral will cause irreparable damage. Please note this damage is not covered by the warranty for the laser system and as such, it is the responsibility of the system integrator to ensure that the mains connections are correct before operating the laser system.**

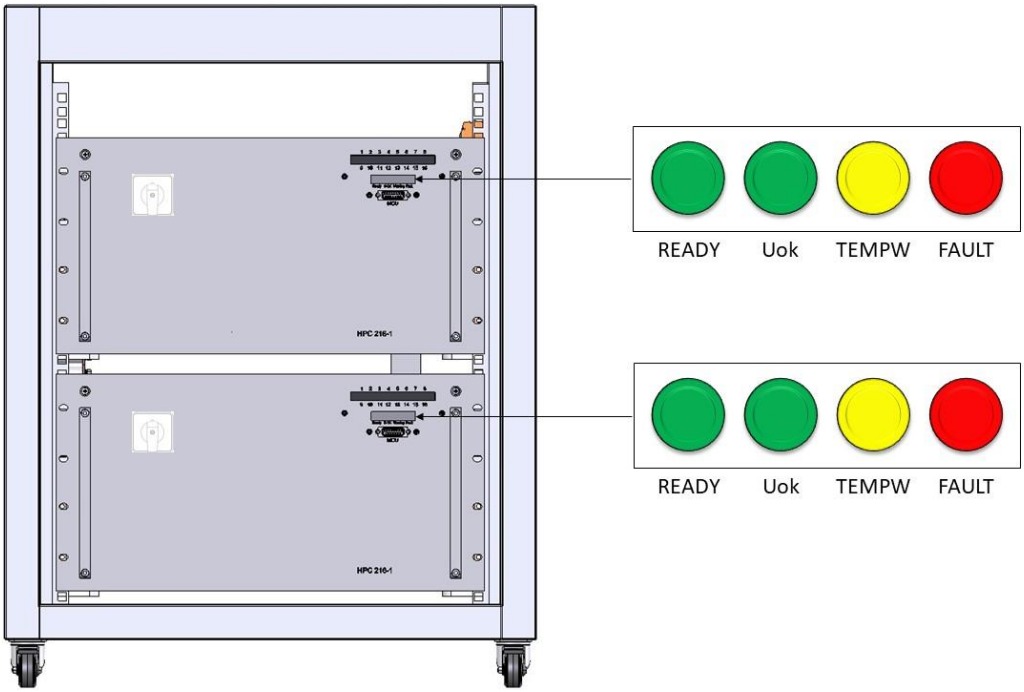
MCB DC PSU Protection. Applicable to 016-0028-00 only

Inside the DC unit, are 2 power supplies. Each power supply mains input is protected by a 32A MCB. For correct operation, the MCB levers should be in the up position, with the red arrow symbols showing. Please contact Luxinar if at any stage, these MCBs trip.

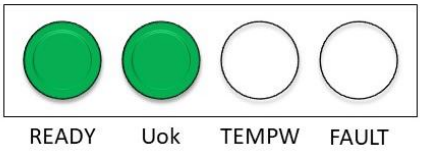
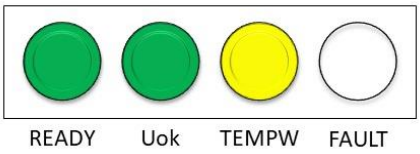
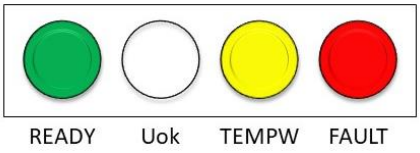
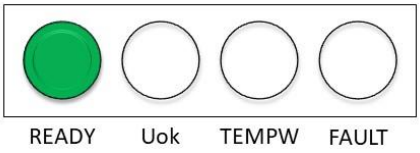
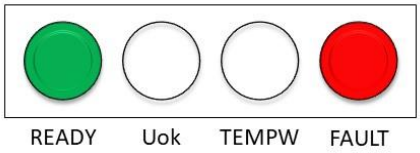
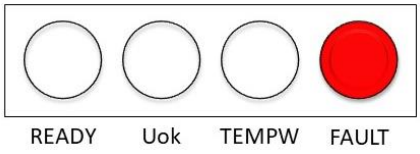


MCB locations for 016-0028-00

The control electronics can be turned on and off with the switch on the front of the DC power supply. The system status and power supply status can be determined by the LEDs on the front of the DC power supply.



DC PSU status LEDs for 016-0028-00

	Correct operation. Mains input present/correct 50V DC enabled
	Power supply temperature warning. Check coolant flow rate and temperature. 50V DC is still enabled, but will turn off if temperature gets higher.
	Power supply temperature fault. Turn off and allow 5 minutes to cool. Check coolant flow rate and temperature. 50V DC is disabled. Please contact Luxinar.
	50V DC is disabled Check interface cables.
	50V DC is disabled. Unplug the DC cables from the laser head, and check 50V is within limits when enabled. Please contact Luxinar.
	50V DC is disabled. Check mains supply connections. Ensure mains voltage is within the limits.

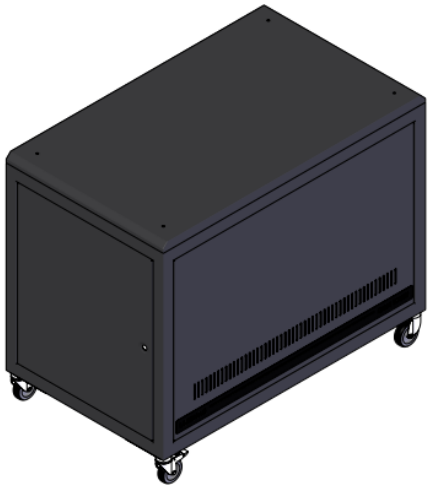
DC PSU LED Fault Warnings for 016-0028-00

Standalone OEM 100iX three-phase DC PSU, 016-0038-00

Note: This equipment is designed for indoor use only, pollution degree 2 and overvoltage category II as defined within EN 61010-1:2010+A1:2019

General description

The OEM 100iX three-phase DC PSU is a free-standing AC to DC, 33kW water cooled power supply.



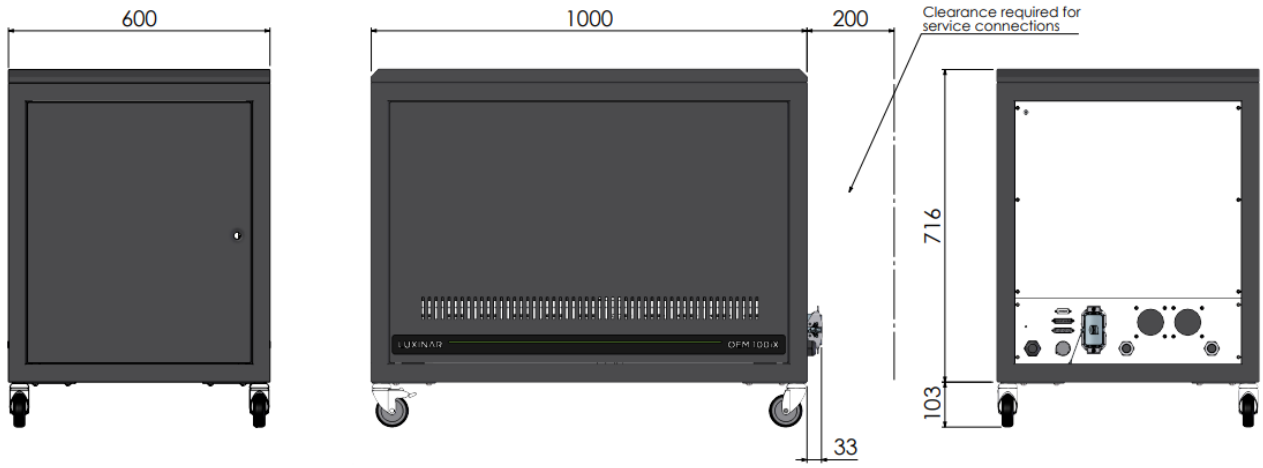
OEM 100iX DC PSU, 016-0038-00

Dimensions (mm)	**600x1000x820**
Weight	**123.5kg (144.5kg with 5m DC Cables))**
Coolant type	**Demineralised, deionised or distilled water with corrosion inhibitor and anti-bacterial additive**
Coolant pipe	**½" BSP parallel**
Coolant flow rate	**> 10 litres/min (minimum)**
Protection class	**IP21**

WARNING

Heavy equipment — risk of severe lumbar injury

The weight of the DC power supply exceeds the single person lift limit of 18kg, as specified in EN 61010-1:2010+A1:2019. Ensure a minimum of two people lift the power supply or that suitable lifting equipment is employed.



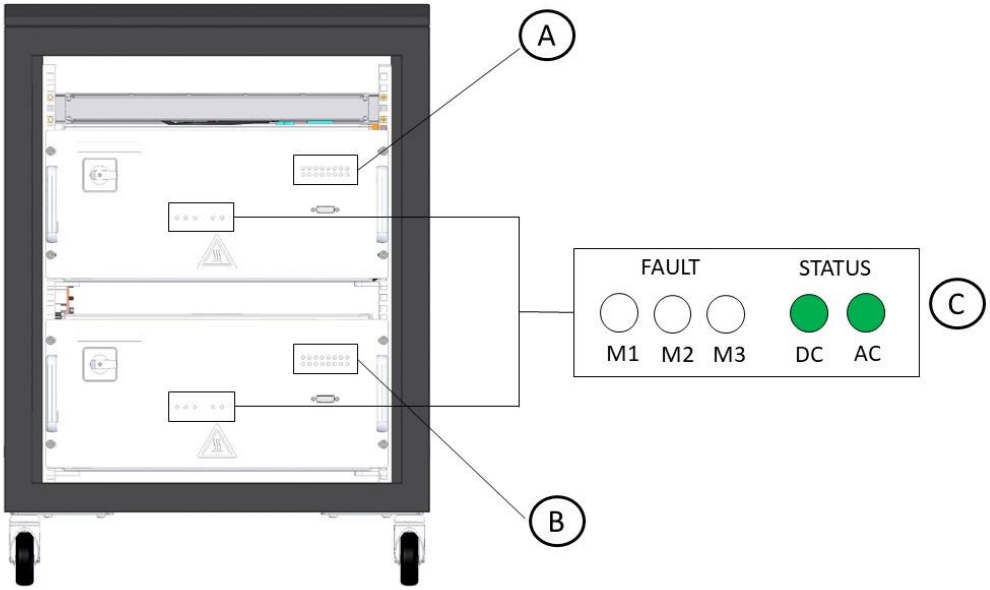
OEM 100iX DC PSU, Dimensions

Technical specification

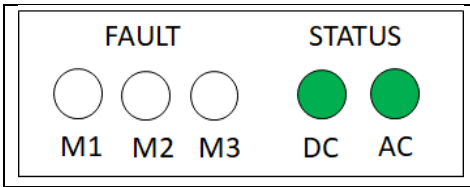
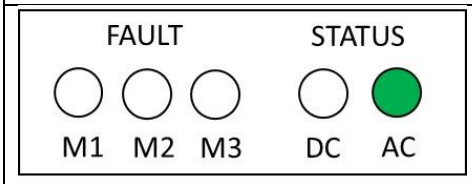
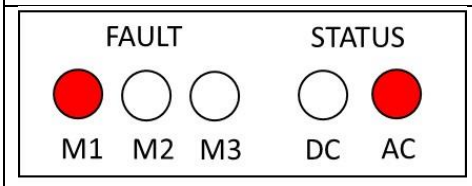
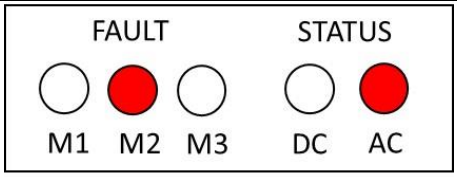
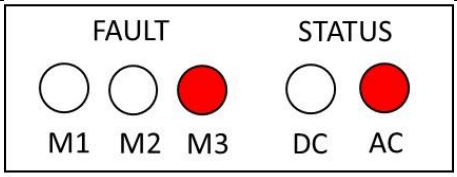
Mains input voltage range	**380-480 (±10%) VAC three-phase***
Mains input frequency range	**50/60 Hz**
Mains input maximum current	**45A @ 480 VAC (per phase)** **57A @ 380 VAC (per phase)**
Mains AC inrush current (max)	**160A**
AC Power consumption (max)	**35.5kW**
Efficiency	**93%**
Output voltage (DC)	**50V ±2V**
Output current (max)	**660A**
Output power (max)	**33 kW**
Earth leakage	**< 24mA**

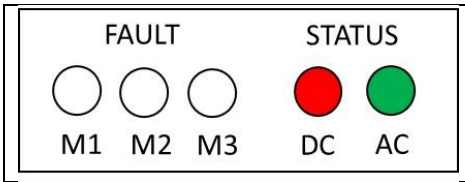
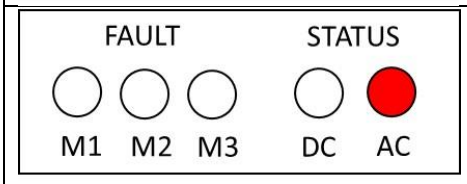
WARNING! No neutral connection is required. Connection of the supply to a neutral will cause irreparable damage. Please note this damage is not covered by the warranty for the laser system and as such, it is the responsibility of the system integrator to ensure that the mains connections are correct before operating the laser system.

The control electronics can be turned on and off with the switch on the front of the DC power supply. The system status and power supply status can be determined by the LEDs on the front of the DC power supply.



DC PSU status LEDs for 016-0038-00. (A) Refer to System Status LEDs in Section 3. (B) Not in use. (C) Refer to Table 'DC PSU LED Fault Warnings for 016-0038-00'

	Correct operation. Mains input present/correct 50V DC enabled
	Correct operation. Mains input present/correct 50V DC not enabled
	Please contact Luxinar.
	Please contact Luxinar.
	Please contact Luxinar.

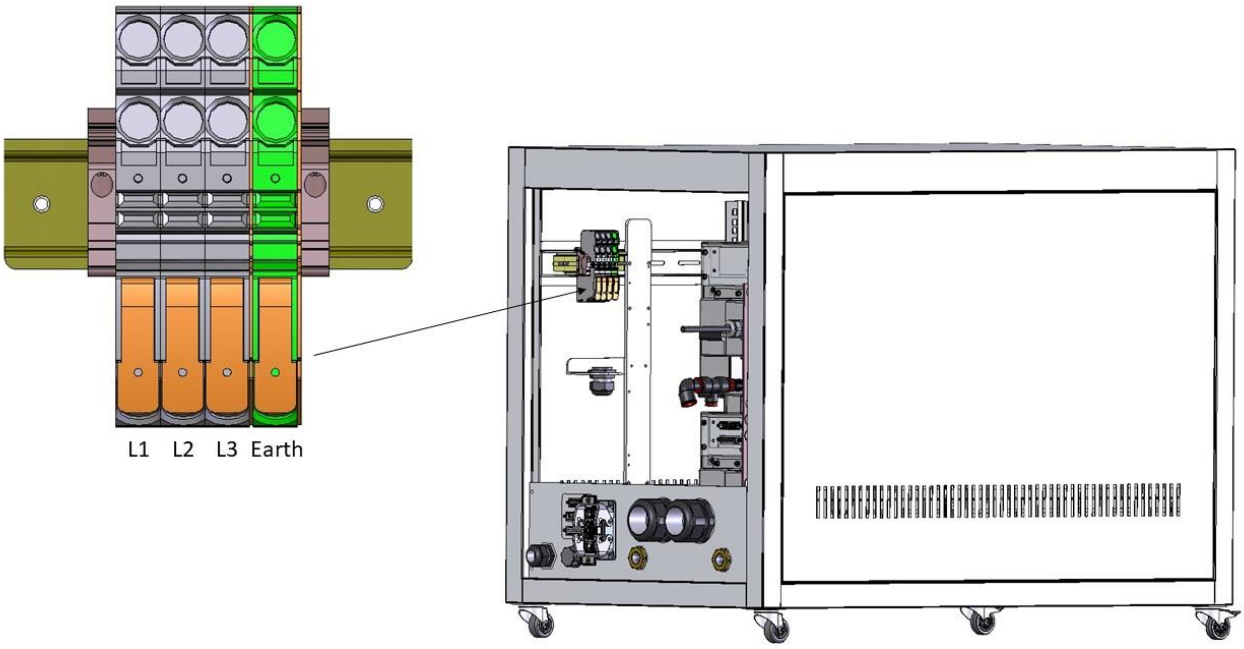
	Please contact Luxinar.
	Please contact Luxinar.

DC PSU LED Fault Warnings for 016-0038-00

Mains Cable Connection to DC Unit – additional information

The power supply is provided with an adequately rated mains cable. If the mains cable needs to be replaced with a different cable, ensure the replacement cable is of the correct rating for the power supply.

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.



3-Phase Wiring Connections

Earth connection is essential. Ensure the earth wire is connected before connecting the supply.

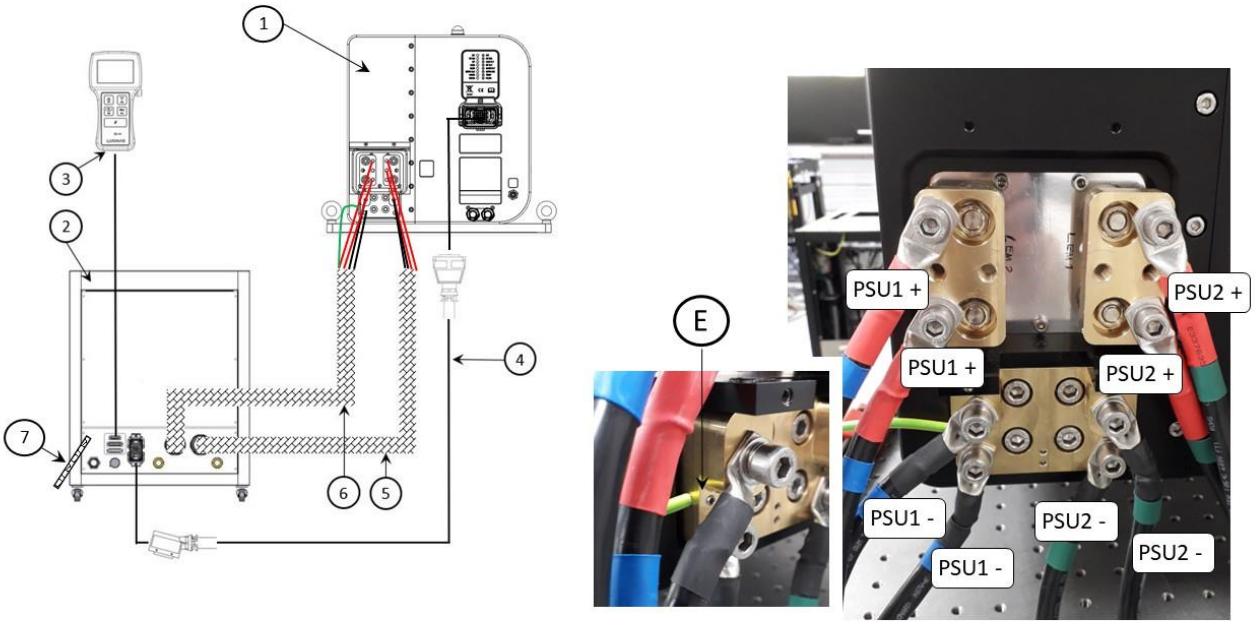
Remove the rear panel from the DC unit. Locate the mains terminal block (shown above). Pull the orange lever up until it clicks, then push the lever back to release the cable. Insert the new cable and ensure the orange levers are pushed flat.

WARNING! As of 1st July 2015, to comply with BSI 7671:2008+A3:2015 Low Voltage Directive, the colour codes for three-phase cabling change to harmonise wiring practices in Europe. The new colour code scheme is shown below.

L1	Brown
L2	Black
L3	Grey
N	Blue
Earth	Green and yellow

Power and Control Connections

Note: It is a requirement that 2 DC cables are used for all DC cable lengths. Live DC connection points at laser head must be shielded.



Power and control connections for DC cables. Insert shows Earth bonding connection (E). Plastic shield removed

1. Laser Head unit
2. 016-0028-00 / 016-0038-00 Water-Cooled DC Power Supply and integrated controller
3. 009-0156-XX Mobile Control Unit (optional)
4. 093-0122-XXXX Control cable
5. 093-0130-XXXX DC Cable (1-9m) 093-0131-XXXX (10-12m)
6. 093-0123-XXXX DC Cable (1-9m) 093-0124-XXXX (10-12m) with earth bonding
7. 091-1067-00 ground braid lead

DC connections showing the plastic shield fitted

Important!
Under certain conditions, it may be possible for high voltage and current cables to emit noise energy levels that may interfere with control signal cables. To eliminate the possibility of interference, cables carrying control signals should be routed along a different path to power cables.

NOTE: This equipment conforms to regulatory emissions standards when the DC power supply's chassis ground-stud is connected to a normative reference ground plane. To do this, ensure ground-stud is connected to the installation's frame ground, using the 50cm length (or shortened if required) braided lead 091-1067-00 supplied in Spares Kit 010-0167-00.

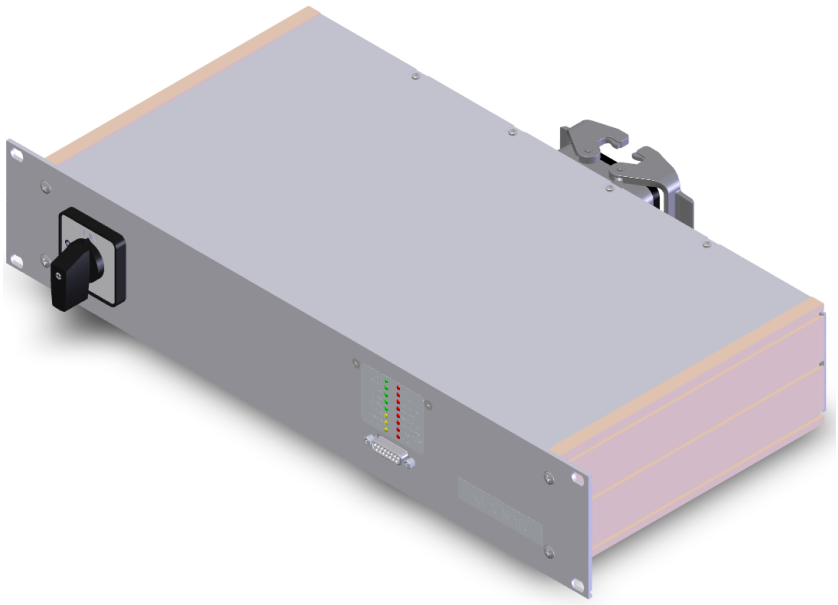
Connection of braided lead 091-1067-00 to ground stud at rear of DC PSU. Connect opposite end of braided lead to the end-user's installation frame ground

OEM-sourced DC power supply and Luxinar stand-alone controller

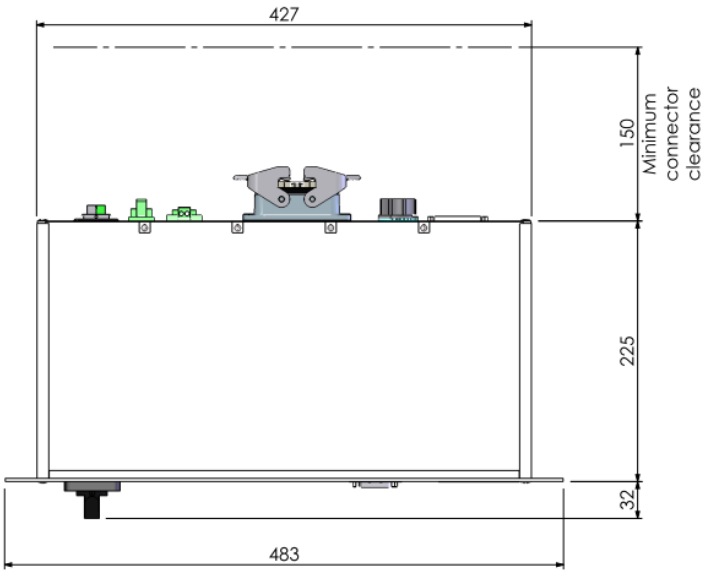
Note: This equipment is designed for indoor use only, pollution degree 2 and overvoltage category II as defined within EN 61010-1:2010+A1:2019

General description

The OEM 100iX stand-alone controller is free-standing/rack mountable and must be used to interface the laser system to the OEM-sourced DC power supply.



Dimensions (mm) L×W×H	**483×255×88 (2U)**
Weight	**3.5kg**
Protection class	**IP51**



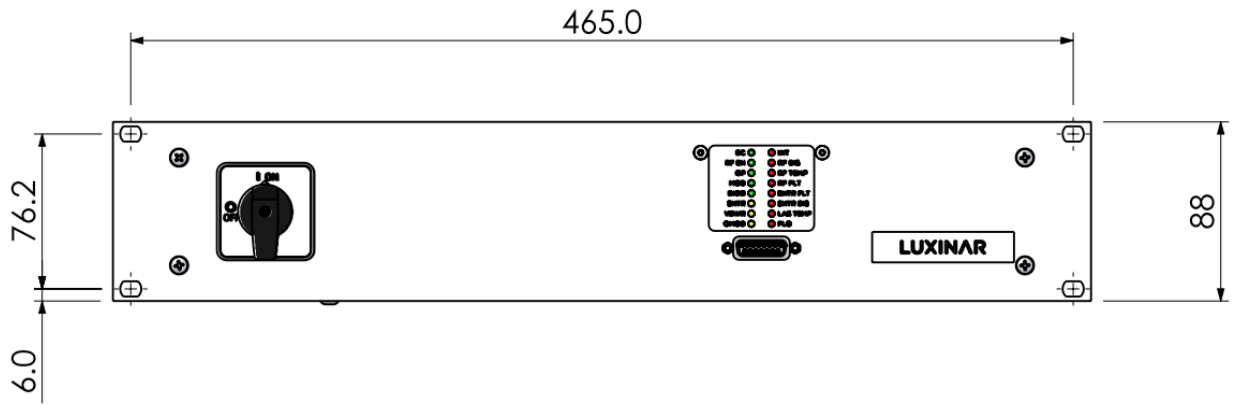
Electrical specification

Input voltage (AC)	**380-480VAC (50/60Hz) three-phase***
AC input fuse rating (per phase)	**0.5A**
AC inrush current (max)	**5A**
Input voltage (DC)	**50V ± 2%**
DC input current	**1A**
Power factor	**> 0.90**
Earth leakage current	**< 1mA**

WARNING! **No neutral connection is required. Connection of the supply to a neutral will cause irreparable damage. Please note this damage is not covered by the warranty for the laser system and as such, it is the responsibility of the system integrator to ensure that the mains connections are correct before operating the laser system.**

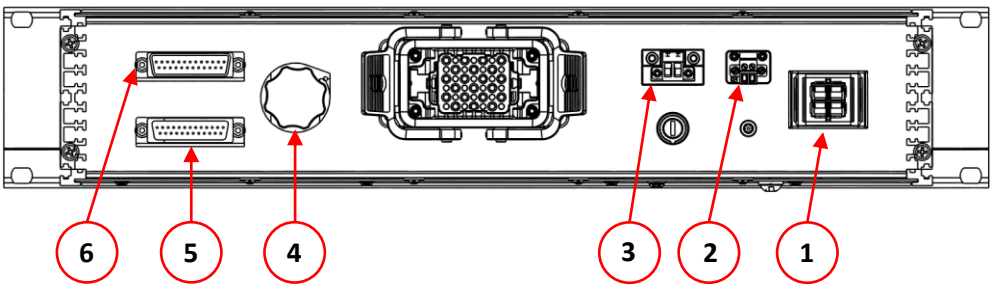
Installation

Using suitable fasteners, mount the controller using the four mounting holes shown below.



Interface connections

The controller requires user interface connections for correct operation.



1. Mains AC power connector
2. DC enable output connector (volt free relay contacts. Optional)
3. 50VDC input connector

4. Ethernet connector (optional) - see section 3 of 906-0235-00
5. U1 interface - see section 3 of 906-0235-00
6. U2 interface - see section 3 of 906-0235-00

Mains AC power connections

The power supply is provided with a 1.5mm² mains supply cable. If this cable needs to be replaced with a longer cable, ensure the replacement cable is of the correct rating.

A pre-configured two-phase and earth cable (part number 091-0359-00) is supplied with the controller. Wires are identified as L1 and L2.

Important!

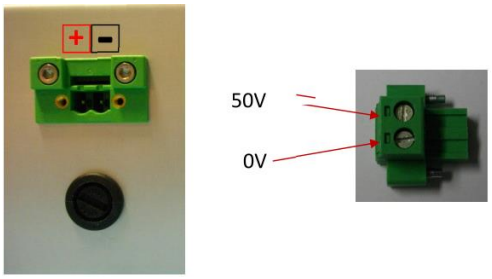
An earth connection is essential. Ensure that the earth wire is connected before connecting the mains supply.

DC enable output connector (optional). Phoenix part number 1850851

A volt-free relay contact is provided to allow the controller to enable and disable the 50V power supply if required. As part of the safety features on the OEM 100iX, if a potential error develops the control electronics will attempt to disable the 50VDC power supply allowing the laser to turn off into a safe state. The internal relay type is NEC EA2-12NU.

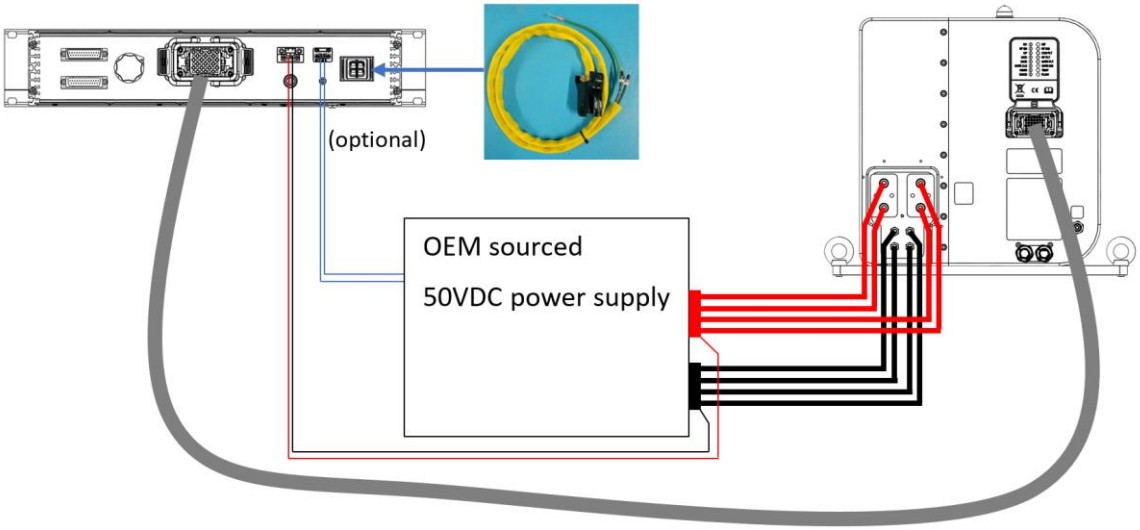
50VDC input connector. Phoenix connector 1777989

The controller requires 50VDC from the power supply to monitor and to drive aspects of the OEM 100iX electronics. This is required and must be provided on the two-way plug provided on the controller. The 50V input is protected by a 1A fuse (located below the connector).



Controller system connections

For correct operation, the controller must be connected as shown.

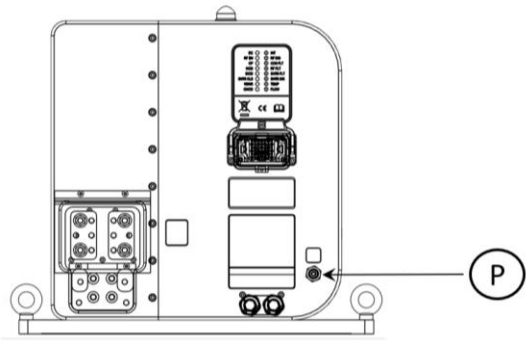


Gas Purge of Laser Head

Where used, the purge gas must be supplied at a pressure of approximately 2 psig, and at a rate of approximately 1 litre per minute, using 6mm (or 1/4") polyethylene tubing. The tubing connects directly to the 'push in' type fitting, on the rear panel of the Laser Head. Please refer to Section 1 regarding gas purge specifications.

Please refer to details given in Section 1 'Purge Gas Specification' regarding purge gas quality.

WARNING! The 'red' blanking plug must not be removed from the 'push-in' fitting where purge air is not used. Removal of the plug will expose a contamination path into the Laser Head.



Gas Purge Plug (P)

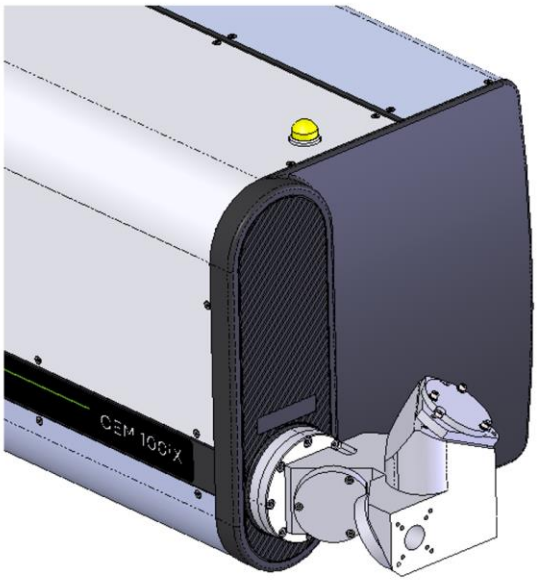
Back Reflection of the Laser Beam

Laser light can be reflected back from a work piece or its supporting fixture on material processing equipment. For example, if plastic sheet is cut on an aluminium backing plate, a large fraction of the laser beam power could be reflected from the supporting aluminium back into the beam delivery and the laser head once the laser has cut through the plastic sheet.

Systems that are used to cut metals or other reflective materials or which have a metal supporting fixture for the work piece should be fitted with a back reflection optical isolator that prevents reflected beams from entering the laser head. Back reflection optical isolators are commercially available from beam delivery component suppliers and Luxinar. Please contact the local office or its Distributor for more details on optical isolators.

WARNING! Back reflections can damage beam delivery optics and, even worse, destroy the cavity optics of the laser itself thereby rendering the laser inoperative.

Please note: Back reflection damage is not covered by the warranty for the laser system and as such, it is the responsibility of the system integrator to protect the laser from back reflection.



Mounting of Luxinar straight through ATFR back reflection optical isolator, see Section 5 for more details

Laser Power Measurement

The OEM 100iX is fitted as standard with an internal power sensor that allows the customer to monitor laser power. However, a customer may wish to run the laser into their own power-head.

WARNING! Irradiance levels in the collimated output beam will exceed the damage threshold of most commercially available power-heads that measure up to 5kW.

It is advised the customer calculates the laser beam Irradiance prior to taking a laser power measurement, particularly if running at close to full power (maximum duty). For this calculation, laser beam size can be found in Section 7 'Beam Propagation' and an upper limit of 1600W laser power should be assumed running in pulsed mode.

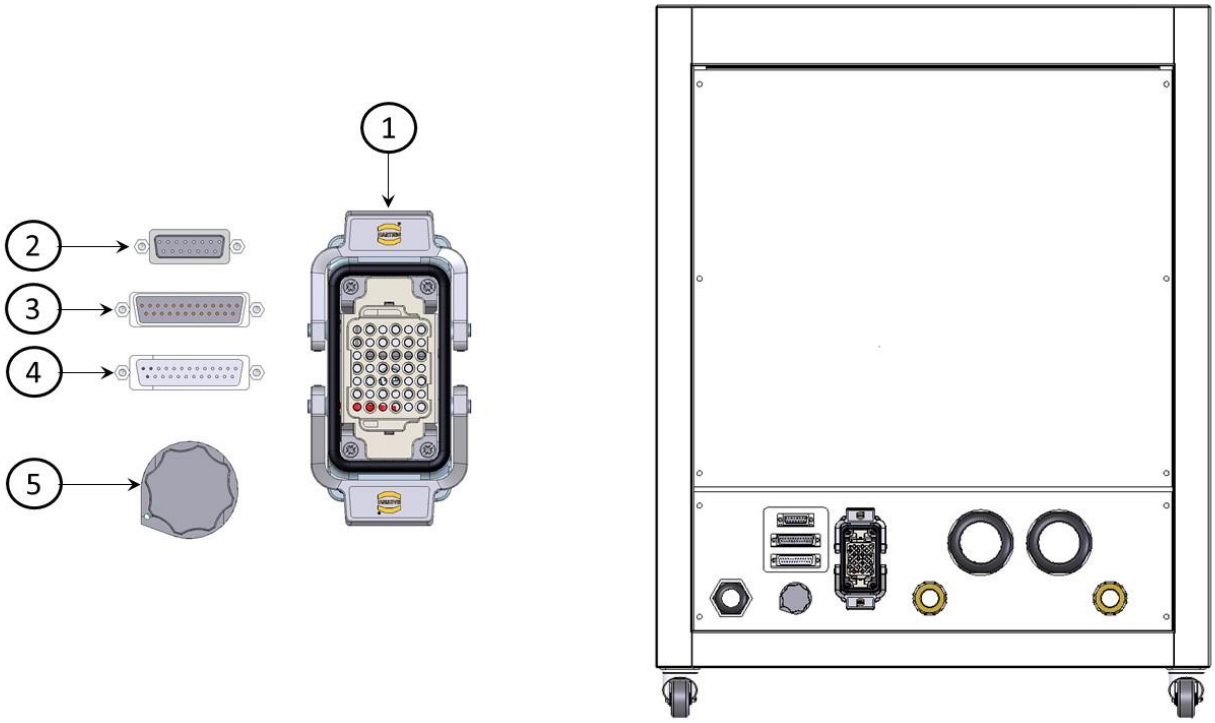
Note: It is important the calculation is performed exactly as set-out by the power-head manufacturer, and the damage threshold value correct for the operating wavelength of the laser.

If required a suitable beam expander placed before the customer power-head can be used to reduce the Irradiance level below the power-head's damage threshold.

Section 3

Control

Interface connections general information



DC PSU interface connections 016-0028-00 / 016-0038-00

1. Laser head interface.
   Connects directly to the laser head. No user interface required.
2. MCU connection.
   Connects directly to the MCU (optional). No user interface required.
3. User port2 (U2)
   Contains I/O signals used to monitor/interface to the system. User interface required.
4. User port1 (U1)
   Contains I/O signals used to monitor/interface to the system. User interface required.
   Can be set to 100iX IO (standard), or SCX IO (needs to be factory set)
5. Ethernet connection.
   Connects directly to an ethernet port (software installation required).

U1 – Standard OEM 100iX Operation

The following connections and information will enable basic OEM 100iX system operation.

WARNING! The user should read and understand the safety manual and all relevant local safety standards in regards to the safe operation of the laser system.

Minimum connection details are provided to illustrate the essential connections required for system operation. The user is advised that these signals should only be used when testing the laser system.

Under normal system operation, minimum connections should only be used in conjunction with the required safety interface connections as stated in the relevant safety standards.

User Interface Detail – U1

Pin	Function	I/O type	Description	Voltage range
1	Program 4	I	Remote program selector Bit 4.	5-24V @ 10mA
2	Shutter Enable	I	Enables operation of the shutter (if fitted)	5-24V @ 10mA
3	Program 1	I	Remote program selector Bit 1.	5-24V @ 10mA
4	12V	O	User 12V	12V @ 300mA
5	NC Voltage	I	Only required if system is in NC Control mode.	0 – 10V
6	Ground	G	Ground reference for I/O pins	
7	Tx	O	RS232 Transmit pin	± 10V
8	Trigger	I	Used to fire the laser in any of the internal modes.	5-24V @ 10mA
9	External Interlock out	O	Connected to Pin 21	12V @ 300mA
10	Relay 1(NO)	O	VSWR Status (NO)	30Vdc@1Amax
11	Laser Enable	I	Only used when system is in Auto mode.	5-24V @ 10mA
12	Shutter Open	O	Shutter open position sensor. Open Drain.	<30V @ 50mA (max)
13	Laser On	O	Laser ready to fire. Open Drain.	<30V @ 50mA (max)
14	External PWM	I	Only used when system is in External PWM mode.	5-24V
15	Shutter Closed 2	O	Shutter Closed position sensor. Open Drain.	<30V @ 50mA (max)
16	Program 2	I	Remote program selector Bit 2.	5-24V @ 10mA
17			Not used	
18	Program 3	I	Remote program selector Bit 3.	5-24V @ 10mA
19	Ground	G	Ground reference for I/O pins	
20	Rx	I	RS232 Receive pin	± 10V
21	External Interlock rtn	I	Must be connected to pin 9	5-24V @ 10mA
22	Relay 1(P)	O	VSWR Status (P)	30Vdc@1Amax
23	Shutter Control	I	Only used when system is in Auto mode.	5-24V @ 10mA
24	Laser Diode Enable	I	Enables operation of the Laser diode (if fitted)	5-24V @ 10mA
25	Shutter Closed 1	O	Shutter Closed position sensor. Open Drain.	<30V @ 50mA (max)

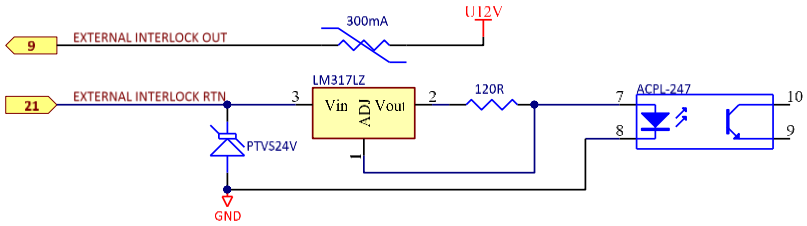
I Input O Output G Ground

U1 (OEM 100iX)

Please note that this interface is the standard interface offered to the customer.

External Interlock input (Pin 21)

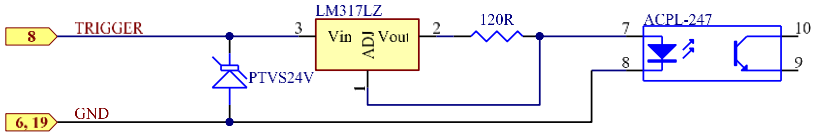
This input signal is always required and is part of the system safety channel. This enables the electronics to turn on the DC PSU and open the shutter (if fitted). Removing this signal will turn off the DC PSU and close the shutter, stopping the laser firing.



A voltage input of 5-24V is required on pin 21/U1. A 12V source is available on pin 9/U1 and can be linked to pin 21/U1.

Trigger input (Pin 8)

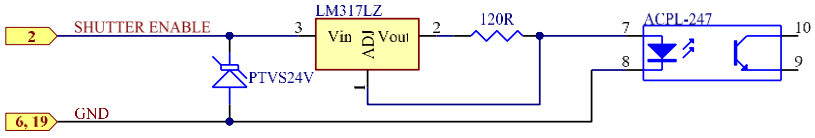
This input signal is required to fire the laser in all internal modes of operation. A transition of low to high is required to fire the laser if operation is stopped and needs to be restarted.



To enable, a voltage input of 5-24V is required on the trigger pin. A 12V source is available on pin 4/U1.

Shutter Enable input (Pin 2)

On systems where the internal safety shutter is fitted, this input signal is required to enable the operation of the shutter. The shutter can only be opened by the electronics, but can always be closed by removing the signal from this pin.

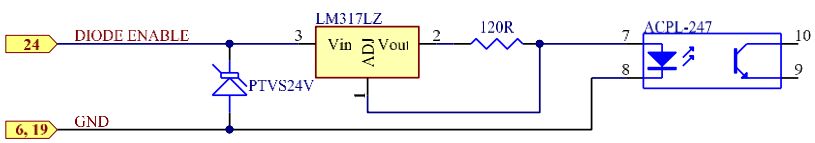


To enable, a voltage input of 5-24V is required on the shutter enable pin. A 12V source is available on pin 4/U1.

Laser Diode Enable input (Pin 24)

On systems where the internal safety shutter and diode pointer is fitted, this input can be used to show the location of the laser beam without actually firing the laser. The shutter must be in the closed position for the laser diode light to be visible.

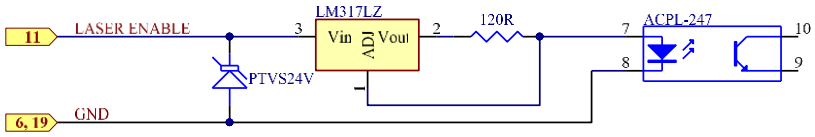
Note: When the shutter is opened, the laser diode is turned off by the control electronics.



To enable, a voltage input of 5-24V is required on the Laser Diode Enable pin. A 12V source is available on pin 4/U1.

Laser Enable input (Pin 11) – Only active when system operation is set to Auto Mode.

This input will take the system in and out of standby mode without using the MCU.

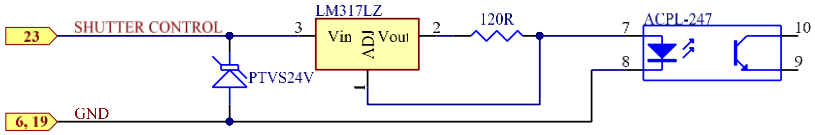


To enable, a voltage input of 5-24V is required on the Laser Enable pin. A 12V source is available on pin 4/U1.

Shutter Control input (Pin 23) – Only active when system operation is set to Auto Mode.

This input will operate the internal safety shutter (if fitted) without using the MCU.

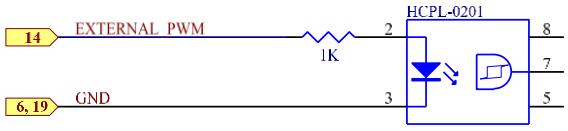
Note: The shutter enable input (Pin 2) is still required (if internal safety shutter is fitted).



To enable, a voltage input of 5-24V is required on the Shutter Control pin. A 12V source is available on pin 4/U1.

External PWM input (Pin 14) – Only active when system operation is set to External PWM mode.

In this mode the user can enter their own modulation input signal to control the laser output power.



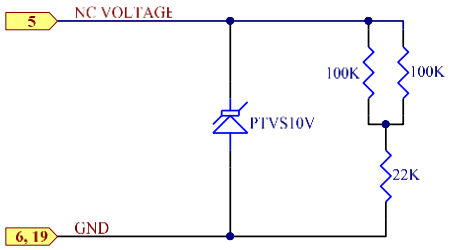
If parameters exceed the pre-set limits of the system, an over modulation signal is generated and the modulation signal seen by the system is limited by the electronics.

Frequency max = 130kHz, Duty max = 60%, PW max = 400µS, PW min = 2µS.

Note: With External PWM selected, the trigger input is not required. If a valid PWM signal is received, and the shutter is open the laser will fire.

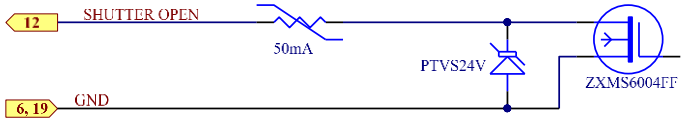
NC Voltage input (Pin 5) – Only active when the system operation is set to NC Power mode.

With NC Power mode selected, the user can control the laser output power set, by applying 0-10V on this pin. A voltage of <1V will stop the system from firing.



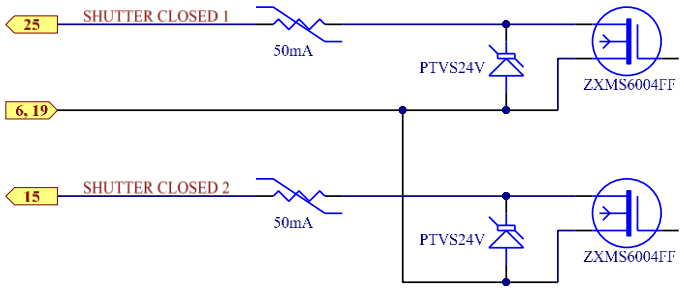
Shutter open output (Pin 12)

On systems where the internal safety shutter is fitted, this signal is used to monitor the open position of the internal shutter. The signal is open drain, and is active High.



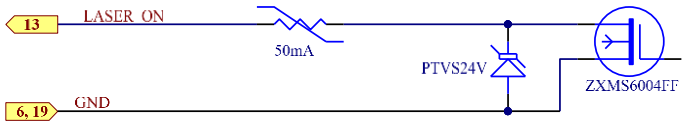
Shutter closed 1 & 2 outputs (Pins 25 & 15)

On systems where the internal safety shutter is fitted, these signals are used to monitor the closed positions of the internal shutter. The signals are open drain, and are active High.



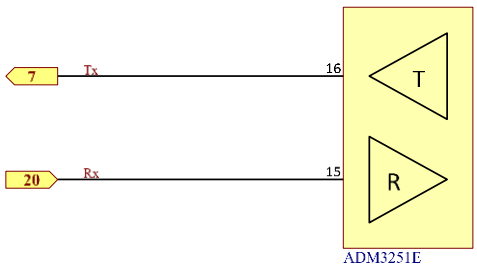
Laser on output (Pin 13)

When the system is in run mode and ready to fire, this signal changes state. The signal is open drain, and is active High.



RS232 communications (Pins 7 & 20)

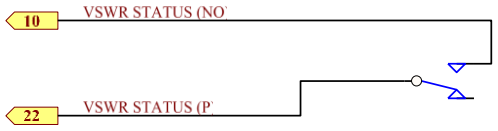
This can be used to communicate with an external PC for monitoring of the system.



See serial interface specification manual (906-0109-00).

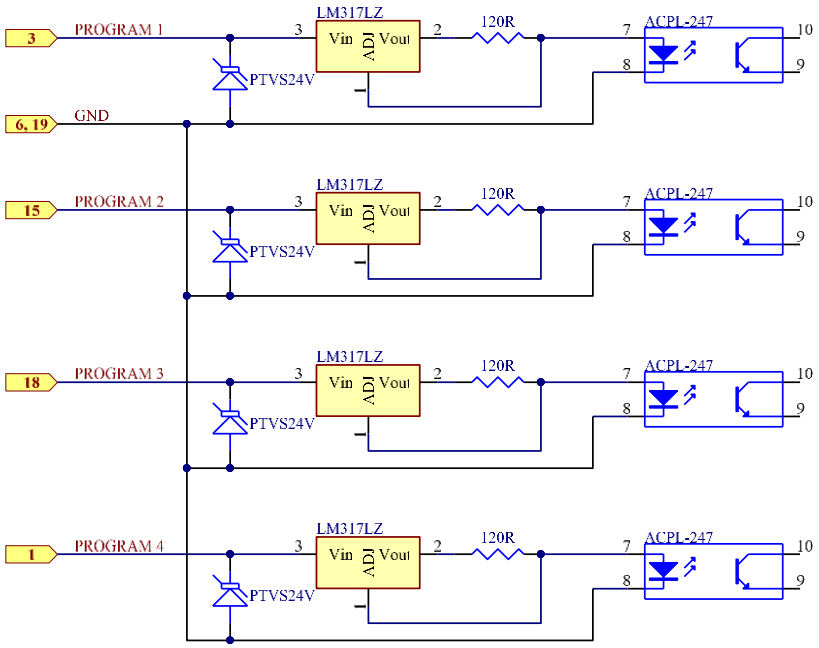
VSWR Status output (Pins 10 & 22)

The VSWR signal is used to monitor the health of the system. If a problem occurs, this signal becomes active. This is a volt free relay contact in a normally open state, and when active will close.



Program inputs (Pins 1, 3, 16 & 18)

For each mode of operation, the user can define a total of 16 programs to match their own requirements. The required program can then be selected using a combination of the 4 program input lines. If the inputs are left unconnected, the controller will select the default program 00.

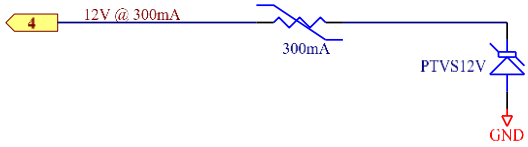


B4 Program 4	B3 Program 3	B2 Program 2	B1 Program 1	Program Number
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15

Note: To enable, a voltage input of 5-24V is required on the Program pins. A 12V source is available on pin 4/U1.

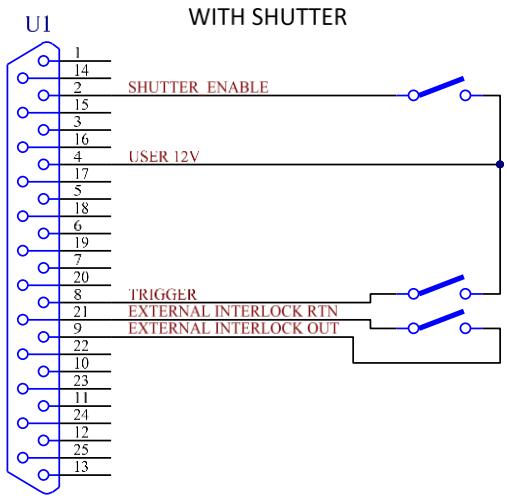
Voltage output (Pin 4)

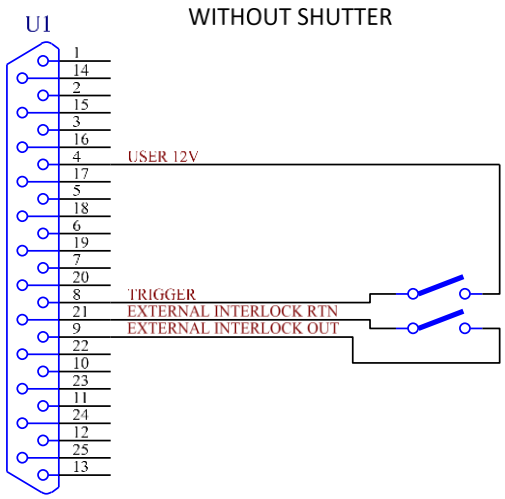
A 12V @ 300mA voltage source is available if required to interface to the user I/O on U1 and U2.



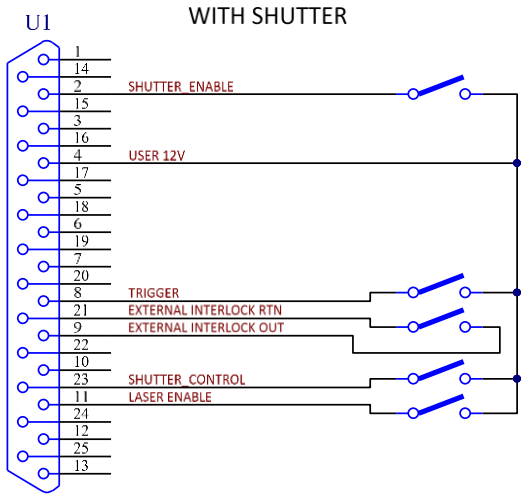
Minimum connections (Internal modes)

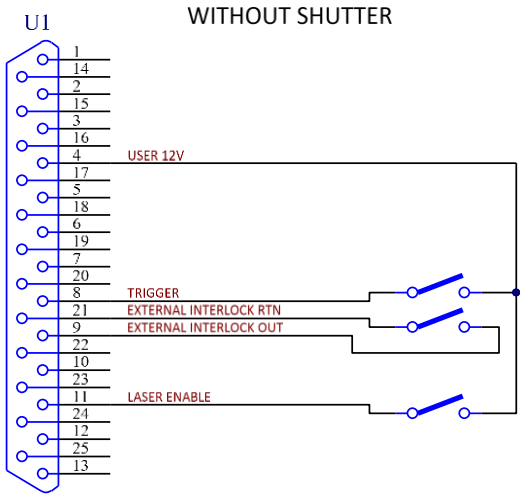
Minimum connection details are provided to illustrate the essential connections required for system operation. The user is advised that these signals should only be used when testing the laser system.
Under normal system operation, minimum connections should only be used in conjunction with the required Safety interface connections as stated in the relevant safety standards.



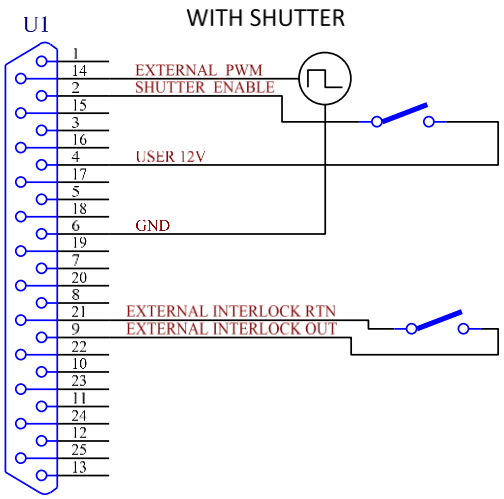


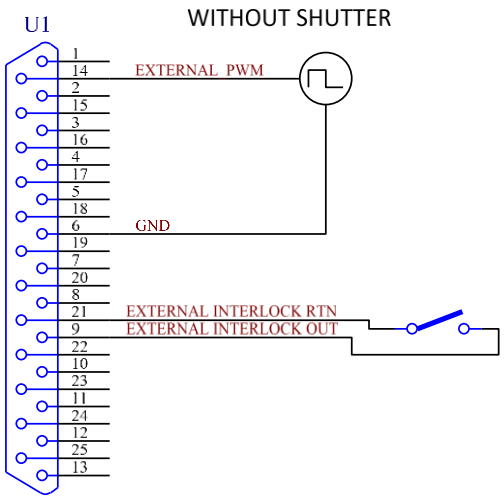
Minimum connections (Auto mode)





Minimum connections (External PWM mode)





U1 – SCX IO Operation

The following connections and information will enable basic OEM 100iX system operation in SCX 30 Emulation mode.

WARNING! The user should read and understand the safety manual and all relevant local safety standards in regards to the safe operation of the laser system.

Minimum connection details are provided to illustrate the essential connections required for system operation. The user is advised that these signals should only be used when testing the laser system.

Under normal system operation, minimum connections should only be used in conjunction with the required safety interface connections as stated in the relevant safety standards.

User Interface Detail – U1

Pin	Function	I/O type	Description	Voltage range
1	Shutter Enable	I	Enables operation of the shutter (if fitted)	0V/ 5-24V @ 10mA
2	n/c		Not used	
3	Shutter Open	O	Shutter open position sensor. Open Drain.	<30V @ 50mA (max)
4	Ground	G	Ground	
5	Shutter Closed 1	O	Shutter Closed position sensor. Open Drain.	<30V @ 50mA (max)
6	Ground	G	Ground	
7	DC Status	O	50V PSU monitor. Open collector	<30V @ 50mA (max)
8	Emission Lamp	I	Emission lamp monitor. Open collector	5-24V @ 10mA
9	n/c			
10	n/c			
11	n/c			
12	RF Enable	I	Enables operation of the RF PSU	0V/ 5-24V @ 10mA
13	Modulation+	I	RS422 modulation input	0.5-5V
14	Modulation-	I	RS422 modulation input	5-0.5V
15	Over Modulation	O	Modulation status monitor. Active low	0 or 5V
16	VSWR status+	O	RS422 VSWR status output	0.5-3.5V
17	VSWR status-	O	RS422 VSWR status output	3.5-0.5V
18	Tx	I	RS232 Transmit pin	± 10V
19	External Interlock out	O	Connect to pin 20	12V @ 300mA
20	External interlock rtn	I	Must be connected to pin 19	5-24V @ 10mA
21	Diode enable	I	Enables operation of the laser diode (if fitted)	0V/ 5-24V @ 10mA
22	Rx	O	RS232 Receive pin	± 10V
23	Shutter Closed2	I	Shutter Closed position sensor. Open Drain.	0V/ 5-24V @ 10mA
24	Trigger	I	Used to fire the laser in any of the internal modes.	0V/ 5-24V @ 10mA
25	Ground	G	Ground	

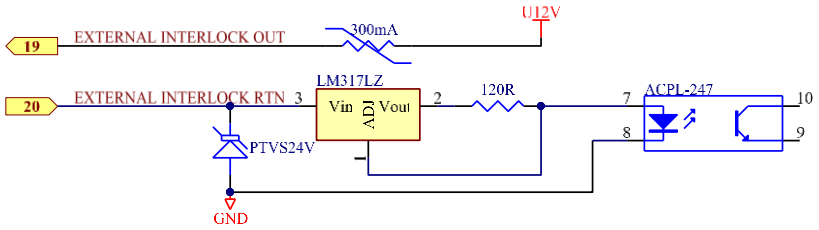
I Input O Output G Ground

U1 (SCX 30 emulation)

Please note that this interface is the standard interface offered to the customer.

External Interlock input (Pin 20)

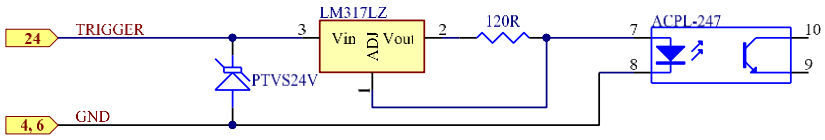
This input signal is always required and is part of the system safety channel. This enables the electronics to turn on the DC PSU and open the shutter (if fitted). Removing this signal will turn off the DC PSU and close the shutter, stopping the laser firing.



A voltage input of 5-24V is required on pin 20/U1. A 12V source is available on pin 19/U1 and can be linked to pin 20/U1.

Trigger input (Pin 24)

This input signal is required to fire the laser in all internal modes of operation. A transition of low to high is required to fire the laser if operation is stopped and needs to be restarted.

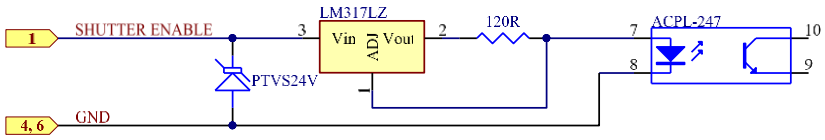


To enable, a voltage input of 5-24V is required on the trigger pin. A 12V source is available on pin 19/U1.

Note. When in SCX 30 emulation mode, the trigger can only be used in engineering mode.

Shutter Enable input (Pin 1)

On systems where the internal safety shutter is fitted, this input signal is required to enable the operation of the shutter. The shutter can only be opened by the electronics, but can always be closed by removing the signal from this pin.

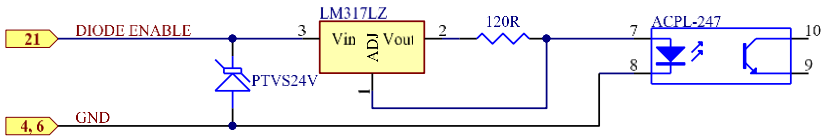


To enable, a voltage input of 5-24V is required on the shutter enable pin. A 12V source is available on pin 19/U1.

Laser Diode Enable input (Pin 21)

On systems where the internal safety shutter and diode pointer is fitted, this input can be used to show the location of the laser beam without actually firing the laser. The shutter must be in the closed position for the laser diode light to be visible.

Note: When the shutter is opened, the laser diode is turned off by the control electronics.

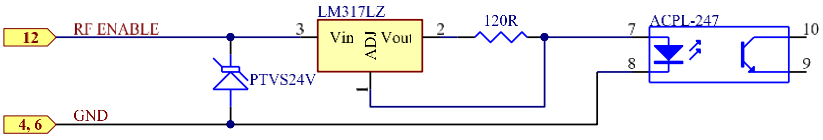


To enable, a voltage input of 5-24V is required on the Laser Diode Enable pin. A 12V source is available on pin 19/U1.

RF Enable input (Pin 12)

This input signal is always required in SCX 30 emulation mode. This enables the control electronics to turn on the RF PSU. Without this signal, there can be no laser output.

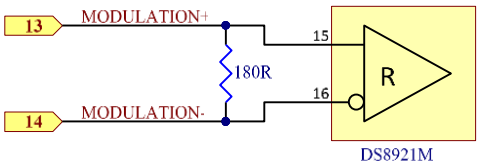
Note: In any fault mode, the RF is disabled by the electronics.



To enable, a voltage input of 5-24V is required on the Laser Diode Enable pin. A 12V source is available on pin 19/U1.

RS422 modulation input (Pins 13 & 14)

Modulation input to fire the laser. In SCX 30 emulation mode a RS422 modulation input is required and must be kept within the parameter set for the laser model.

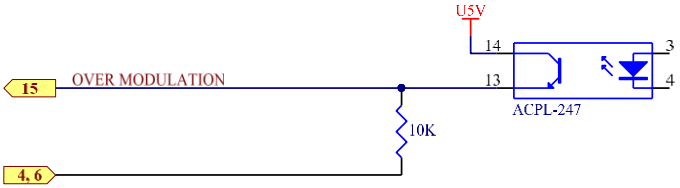


Pulse width (PW) range: Below the minimum PW level, laser output will stop. Above the maximum PW level, laser output will be limited to the maximum PW level.
Frequency range. Above the maximum level, laser output will stop.
Duty cycle limit. Above the maximum duty cycle level, laser output will be limited to the maximum duty cycle limit.

Exceeding any of these levels will result in an over modulation warning.

Over modulation output (Pin 15)

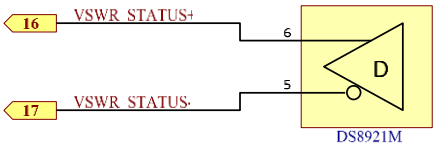
If the modulation input pulses fall outside the parameters set for the laser model, an over modulation warning is issued.



Active low indicates an over modulation warning.

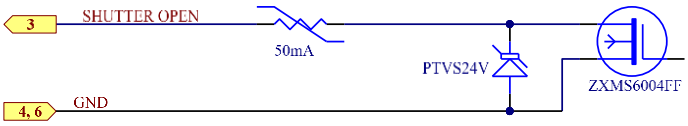
RS422 VSWR status output (Pins 16 & 17)

The RF PSU and laser tube are monitored for correct operation. If a problem occurs, this signal becomes active, and the laser output power is reduced.



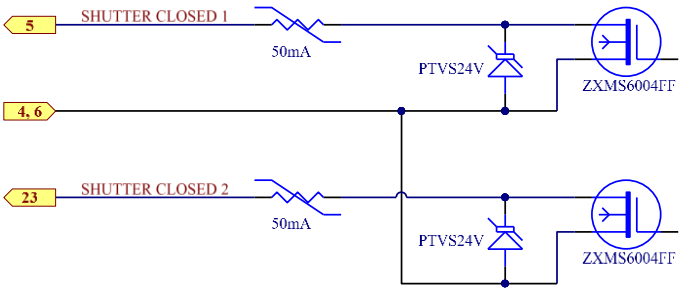
Shutter open output (Pin 3)

On systems where the internal safety shutter is fitted, this signal is used to monitor the open position of the internal shutter. The signal is open drain, and is active High.



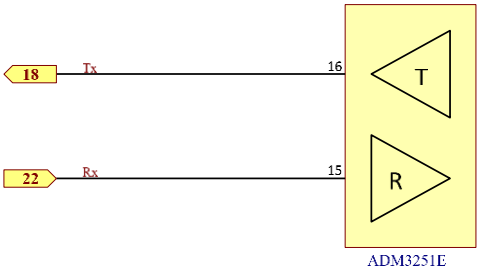
Shutter closed 1 & 2 outputs (Pins 5 & 23)

On systems where the internal safety shutter is fitted, these signals are used to monitor the closed positions of the internal shutter. The signals are open drain, and are active High.



RS232 communications (Pins 18 & 22)

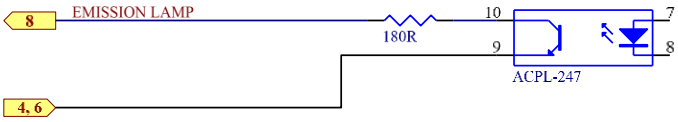
This can be used to communicate with an external PC for monitoring of the system.



See serial interface specification manual (906-0109-00).

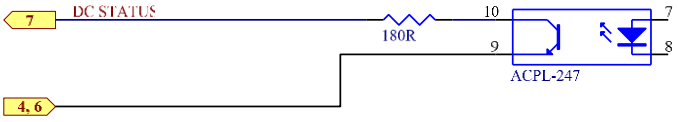
Emission Lamp status (Pin 8)

The emission lamp on top of the system is to indicate to the user that the laser can potentially fire. The emission lamp is turned on when 50VDC is detected. The emission lamp is monitored for correct operation. If a fault occurs where the lamp is turned off when is should be on, this circuit becomes active.



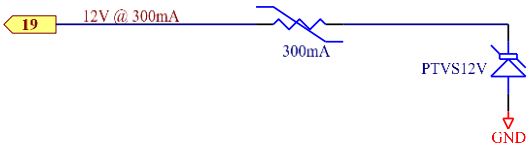
DC Status (Pin 7)

The 50VDC power supply is monitored for correct operation. If the 50VDC supply falls outside the predetermined values set, the system will turn off, and this circuit becomes active.



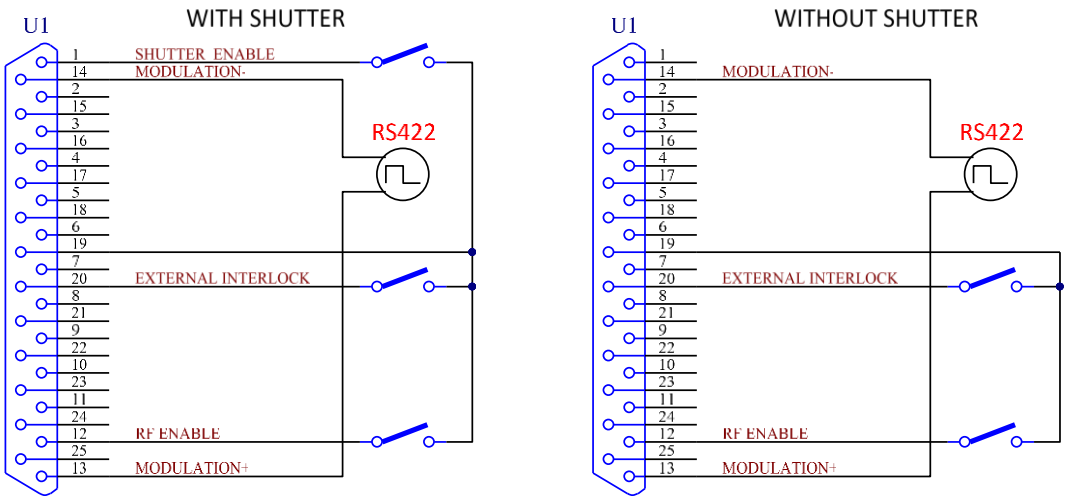
Voltage output (Pin 19)

A 12V @ 300mA voltage source is available if required to interface to the user I/O on U1 and U2.



Minimum connections (Internal modes)

Minimum connection details are provided to illustrate the essential connections required for system operation. The user is advised that these signals should only be used when testing the laser system.
Under normal system operation, minimum connections should only be used in conjunction with the required
Safety interface connections as stated in the relevant safety standards.



U2 – Standard OEM 100iX Operation

The following connections and information will enable basic OEM 100iX system operation.

WARNING! The user should read and understand the safety manual and all relevant local safety standards in regards to the safe operation of the laser system

Minimum connection details are provided to illustrate the essential connections required for system operation. The user is advised that these signals should only be used when testing the laser system

Under normal system operation, minimum connections should only be used in conjunction with the required safety interface connections as stated in the relevant safety standards.

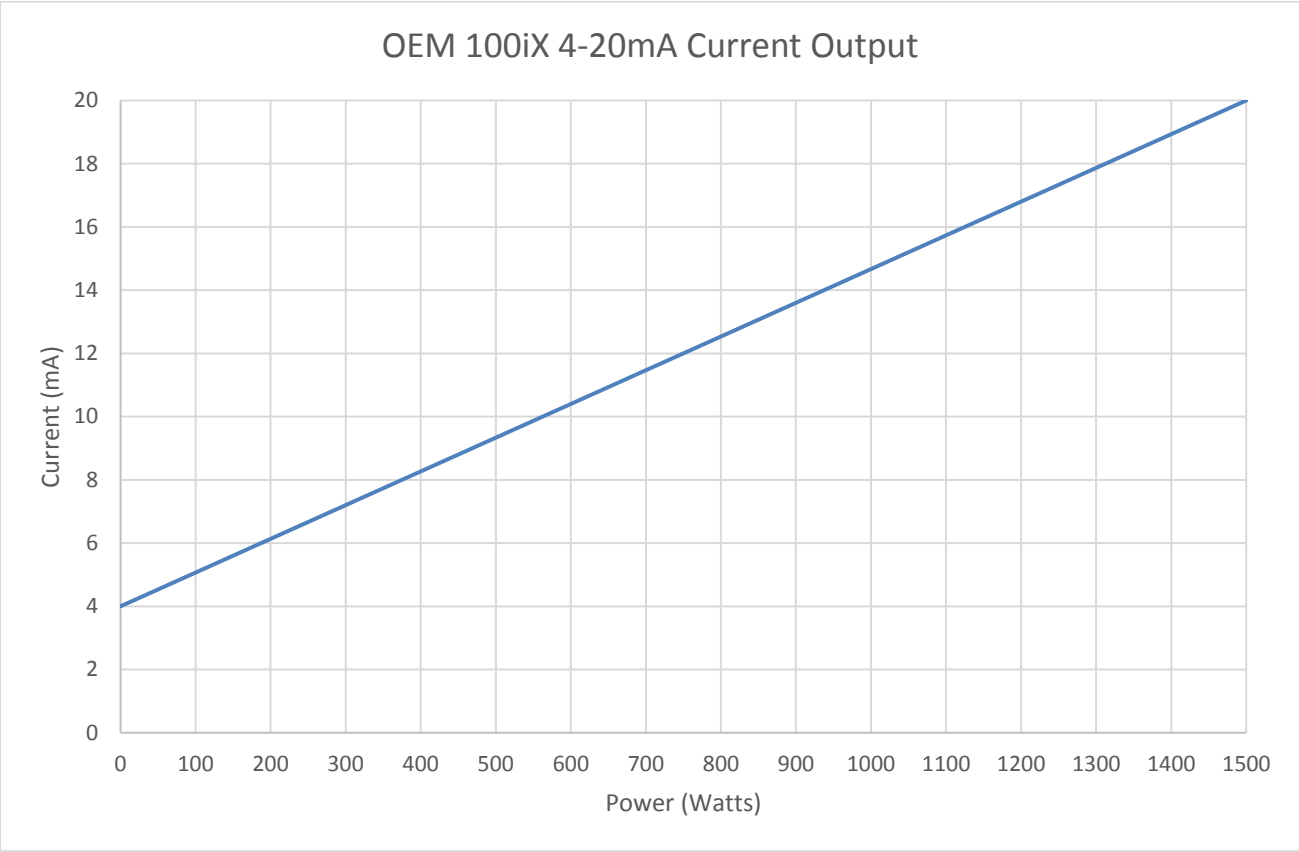
User Interface Detail – U2

Pin	Function	I/O type	Description	Voltage range
1	4-20mA RTN	O	4-20Ma current	
2	VSWR status+	O	RS422 VSWR status output	0.5-3.5V
3	VSWR status-	O	RS422 VSWR status output	0.5-3.5V
4	DC Status	O	50V PSU monitor. Open collector	5-24V @ 10mA
5	Emission lamp	O	Emission lamp monitor. Open collector	5-24V @ 10mA
6				
7				
8	GND	G	GND reference for I/O pins	
9	Relay 1(NO)	O	VSWR Status relay contact (Normally Open) – Volt free	
10	Relay 1(NC)	O	VSWR Status relay contact (Normally Closed) – Volt free	
11	Relay 2 (P)	O	Laser Ready relay contact (Pole) – Volt free	
12	Relay 3(NO)	O	System Enable relay contact (Normally Open) – Volt free	
13	Relay 3(NC)	O	System Enable relay contact (Normally Closed) – Volt free	
14	4-20mA Vin	O	4-20mA current I/O	
15				
16				
17				
18				
19				
20				
21	GND	G	GND reference for I/O pins	
22	Relay 1(P)	O	VSWR Status (Pole)	
23	Relay 2 (NO)	O	Laser Ready relay contact (Normally Open) – Volt free	
24	Relay 2 (NC)	O	Laser Ready relay contact (Normally Closed) – Volt free	
25	Relay 3(P)	O	System Enable relay contact (Pole) – Volt free	

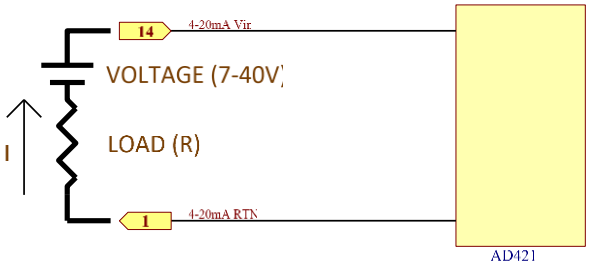
I Input O Output G Ground

4-20mA Current output (Pins 1 & 14)

A loop-powered 4-20mA current output circuit, shown in figure 28 is available on pins 1 and 14 of USER PORT 2. Using Chart 1, the laser power output (Watts) can be mapped against the 4-20mA signal.



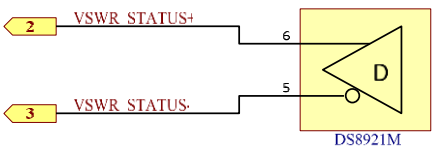
Laser head power versus current output signal (4-20mA)



Connect Voltage and load resistor as shown in Figure A3.8. Ensure the Load resistor will give 20mA at the voltage used. R = V/I.

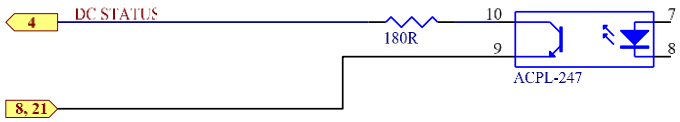
RS422 VSWR status output (Pins 2 & 3)

The RF PSU and laser tube are monitored for correct operation. If a problem occurs, this signal becomes active, and the laser output power is reduced.



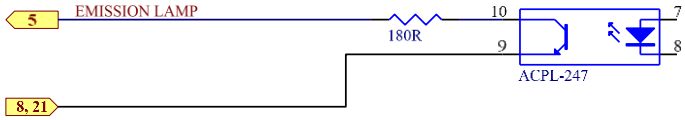
DC Status (Pin 4)

The 50VDC power supply is monitored for correct operation. If the 50VDC supply falls outside the predetermined values set, the system will turn off, and this circuit becomes active.

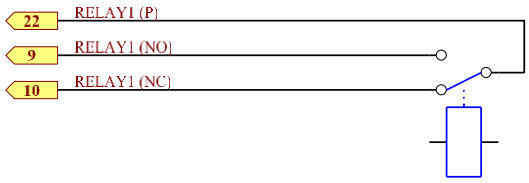


Emission Lamp (Pin 5)

The emission lamp on top of the system is to indicate to the user that the laser can potentially fire. The emission lamp is turned on when 50VDC is detected. The emission lamp is monitored for correct operation. If a fault occurs where the lamp is turned off when is should be on, this circuit becomes active.

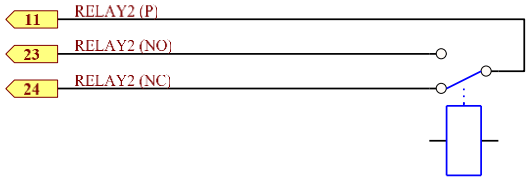


Relay 1 output (Pins 9, 10 & 22) – VSWR status



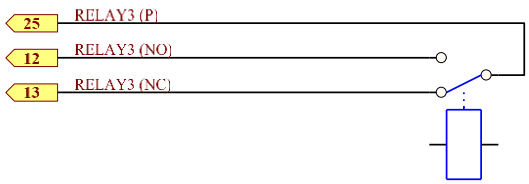
The VSWR signal is used to monitor the health of the system. If a problem occurs, this signal becomes active. This is a volt free relay contact in it normally open state, and when active will close.

Relay 2 output (Pins 11, 23 & 24) – Laser Ready



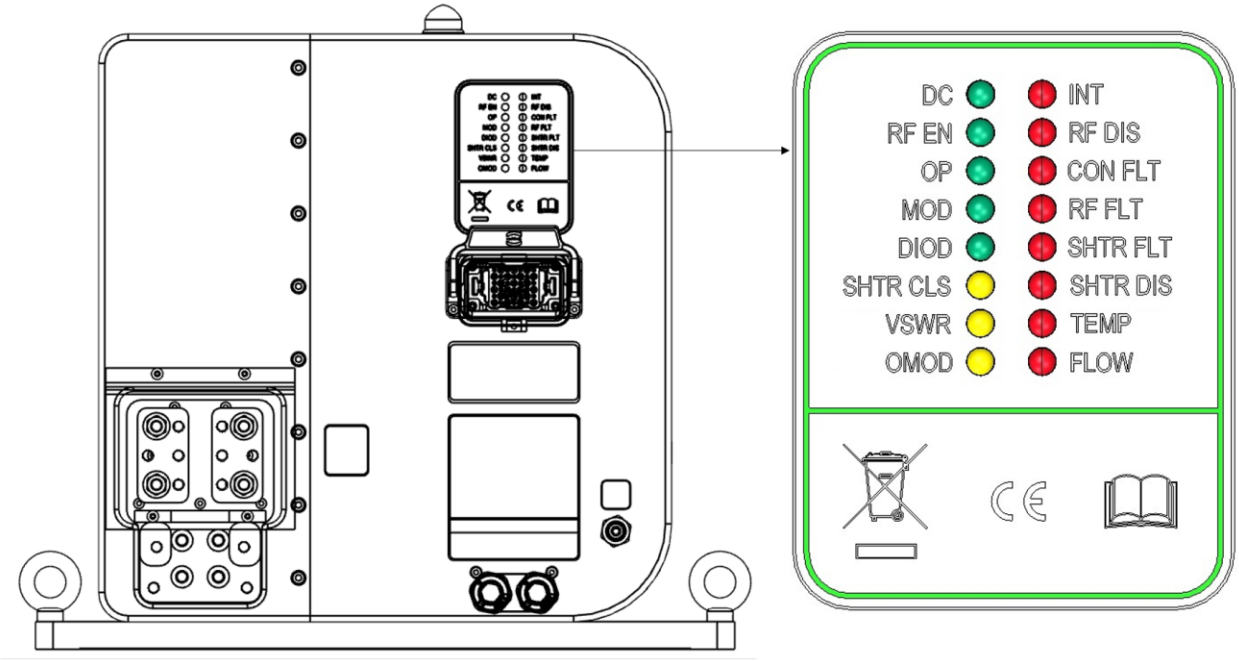
The laser ready signal is used to indicate when the system is ready to fire (DC is enabled and the shutter is open).

Relay 3 output (Pins 12, 13 & 25) – System Enabled



The system enable signal is used to indicate when no faults are detected.

System status LEDs.



Laser head LED diagnostics (also displayed on Luxinar supplied DC cabinet 016-0038-00)

Green LEDs are used to indicate correct operation.
Orange LEDs are used to indicate warnings. Corrective action required.
Red LEDs are used to indicate faults (laser will not fire). Corrective action required.

1. DC – 50V DC status LED

Internal circuitry monitors the 50V DC input. If the voltage measured falls outside predetermined values, the laser will turn off.
Red = Fault (or DC not turned on), Green = OK.

2. RF EN – RF enabled LED

Used to indicate that the system is on and ready to fire. Green = Enabled, Off = disabled.

3. OP – Operation mode LED

Used to indicate which mode of operation the system is in. Green = Internal mode, Off = External mode

4. MOD – Modulation present LED

Used to indicate when the system is in run mode and the modulation signal is applied to the system.
Green = Modulation Present, Off = no modulation present.

5. DIOD – Laser diode pointer LED

Used to indicate when the diode pointer fitted to the system (If fitted) is on.
Green = On, Off = Off (note. When the shutter is open, the laser diode pointer is turned off)

6. SHTR CLS – Shutter closed status LED

Used to indicate when the internal safety shutter (if fitted) position is in the closed state.
Orange = closed, off = Open (or internal safety shutter not fitted).

7. VSWR – VSWR status LED

Used to indicate a fault has occurred within the system. Laser power will be reduced.
Contact Luxinar.

8. OMOD – Over modulation LED

Used to indicate if the modulation input pulses has fallen outside the parameters set for the system.
Corrective action required.

9. INT – Interlock status LED

Used to indicate the status of the external interlock to the system.
Red = not connected, off = connected.

10. RF DIS – RF disabled LED

Used to indicate that the electronics has disabled the RF. Corrective action required.

11. CON FLT – Not used
12. RF FLT – Used to indicate a fault with the RF PSU (e.g. Pallet Fault).
13. SHTR FLT – Shutter fault LED

Used to indicate the internal safety shutter is working correctly (if fitted).
Red = error (contact Luxinar), Green = correct operation.

14. SHTR DIS – Shutter disabled LED

Used to indicate the shutter enable status.
Red = not enabled (note. Shutter cannot be opened), off = enabled.

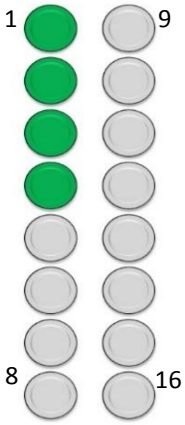
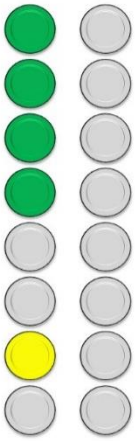
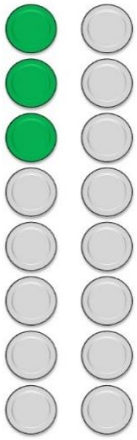
15. TEMP – Temperature fault LED

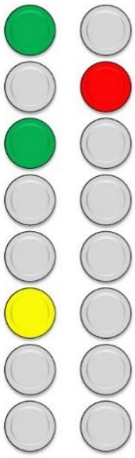
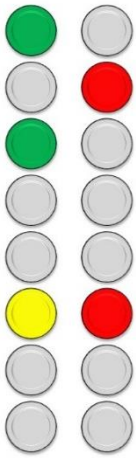
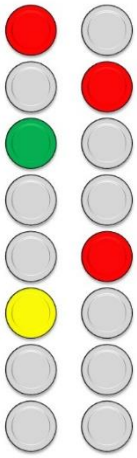
Used to indicate the temperature of the system.
Red = too hot (contact Luxinar), off = temperature OK.

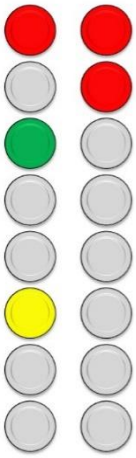
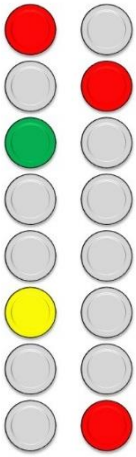
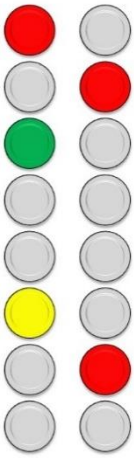
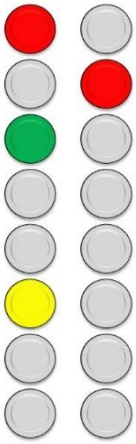
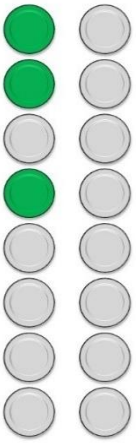
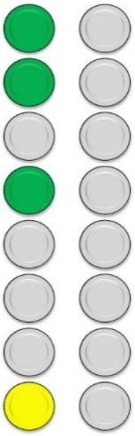
16. FLOW – Coolant flow fault LED

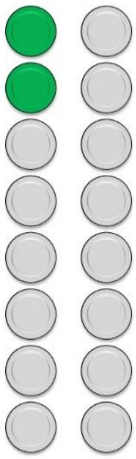
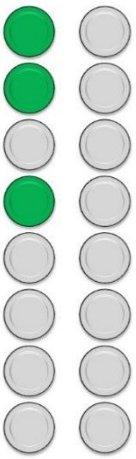
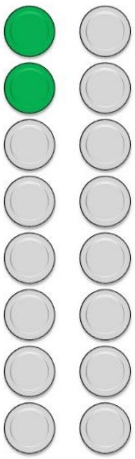
Used to indicate the flow through the system is within pre-set values.
Red = outside limits, off = flow within limits

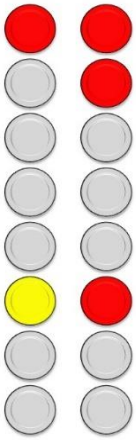
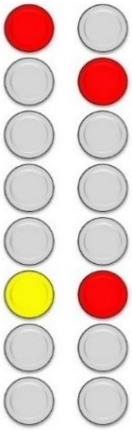
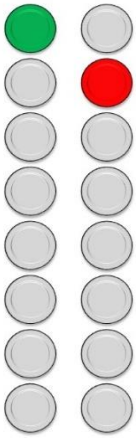
LED Display

(internal mode) Laser is firing		(internal mode) Laser is firing		(internal mode) Laser not firing	
	Correct operation.		VSWR error. Contact Luxinar.		Trigger signal required. A transition from low to high is required on U1 pin 8. If running in NC Power mode, a voltage >1V is also required to enable internal modulation.

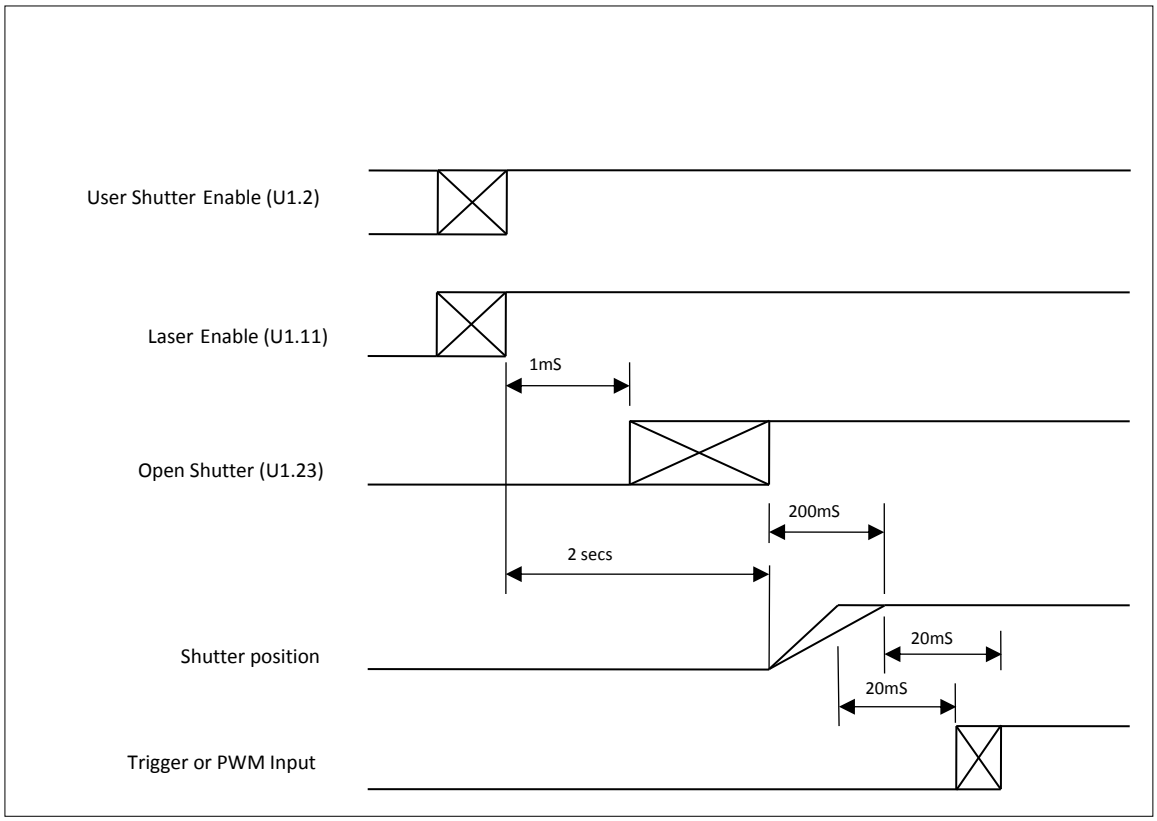
(internal mode) Laser not firing		(internal mode) Laser not firing		(internal mode) Laser not firing	
	Shutter closed. A command is required to open the shutter. If Auto mode is enabled, then a transition from low to high is required on the Shutter control input on U1 pin 23.		Shutter disabled. Shutter enable input on U1 pin 2 is not connected to a voltage source.		Shutter fault. An error has occurred with the internal safety shutter. Contact Luxinar.

(internal mode) Laser not firing		(internal mode) Laser not firing		(internal mode) Laser not firing	
	Interlock fault. Interlock input on U1 pin 21 is not connected to a voltage source.		Flow fault. Flow to the system is below the minimum required. Check flow rate and flow direction.		Temperature fault. The internal temperature of the system it too high. Check the temperature of the flow to the system. Contact Luxinar.
(internal mode) Laser not firing		(external PWM) Laser is firing		(external PWM) Laser is firing	
	System in standby. A command is required to enable the system. If Auto mode is enabled, then a transition from low to high is required on U1 pin 11. 50V DC voltage fault. Check voltage.		Correct operation		Over modulation Check external PWM parameters.

(external PWM) Laser not firing		(SCX 30 emulation) Laser is firing		(SCX 30 emulation) Laser not firing	
	External PWM not present. Check TTL connection on U1 pin 14.		Correct operation		External PWM not present. Check RS422 connections on U1 pins 13 & 14.

(SCX 30 emulation) Laser not firing		(SCX 30 emulation) Laser not firing		(SCX 30 emulation) Laser not firing	
	Interlock fault. Interlock input on U1 pin 20 is not connected to a voltage source.		Shutter disabled. Shutter enable input on U1 pin 1 is not connected to a voltage source.		RF disabled. RF enable input on U1 pin 12 is not connected to a voltage source.

Automode Timing Diagrams



General timing diagram

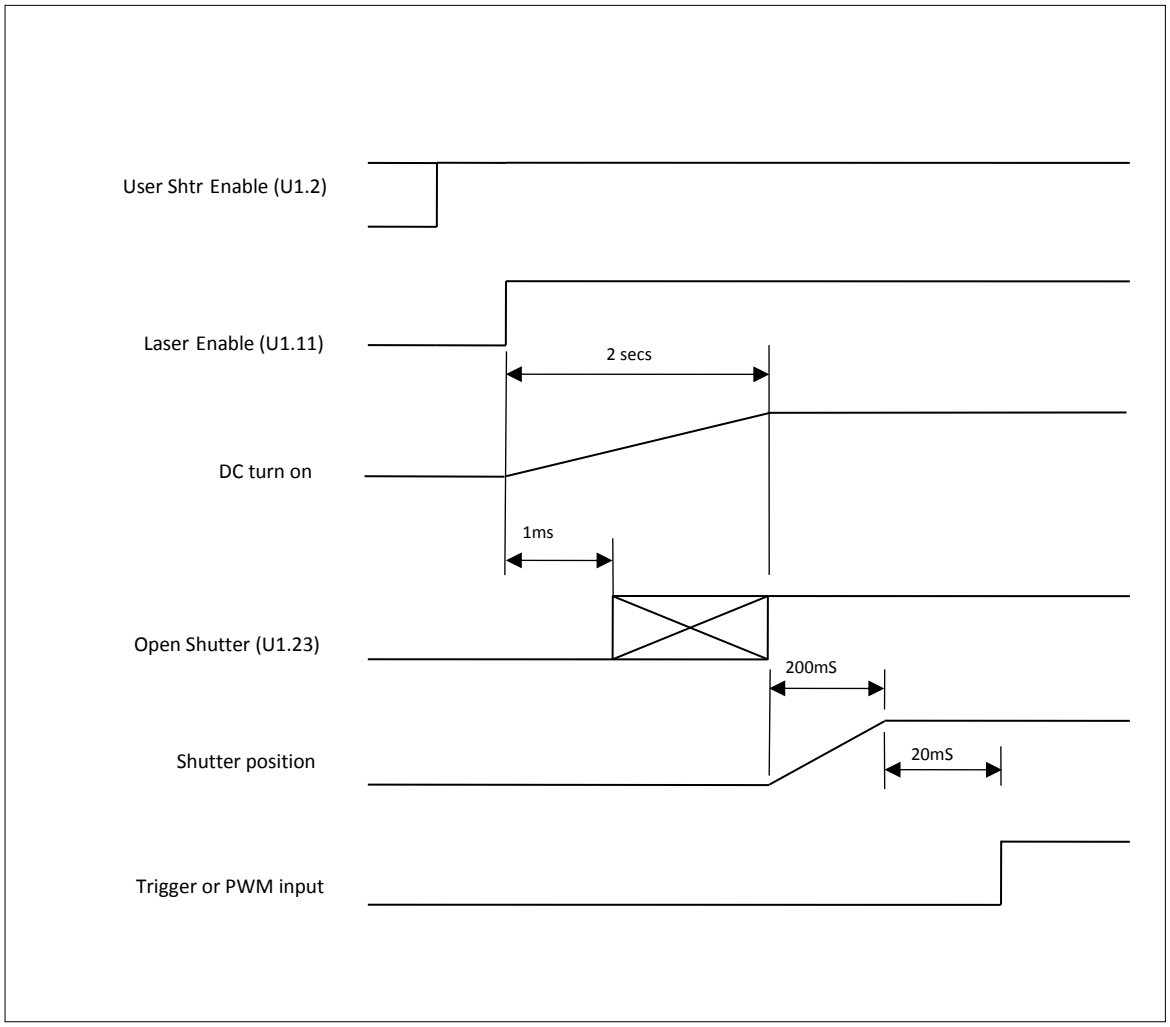
User Shutter Enable (U1.2) can be high or low at power on.

If User Shutter Enable (U1.2) is low it can be taken high at any point before or after Laser Enable (U1.11).

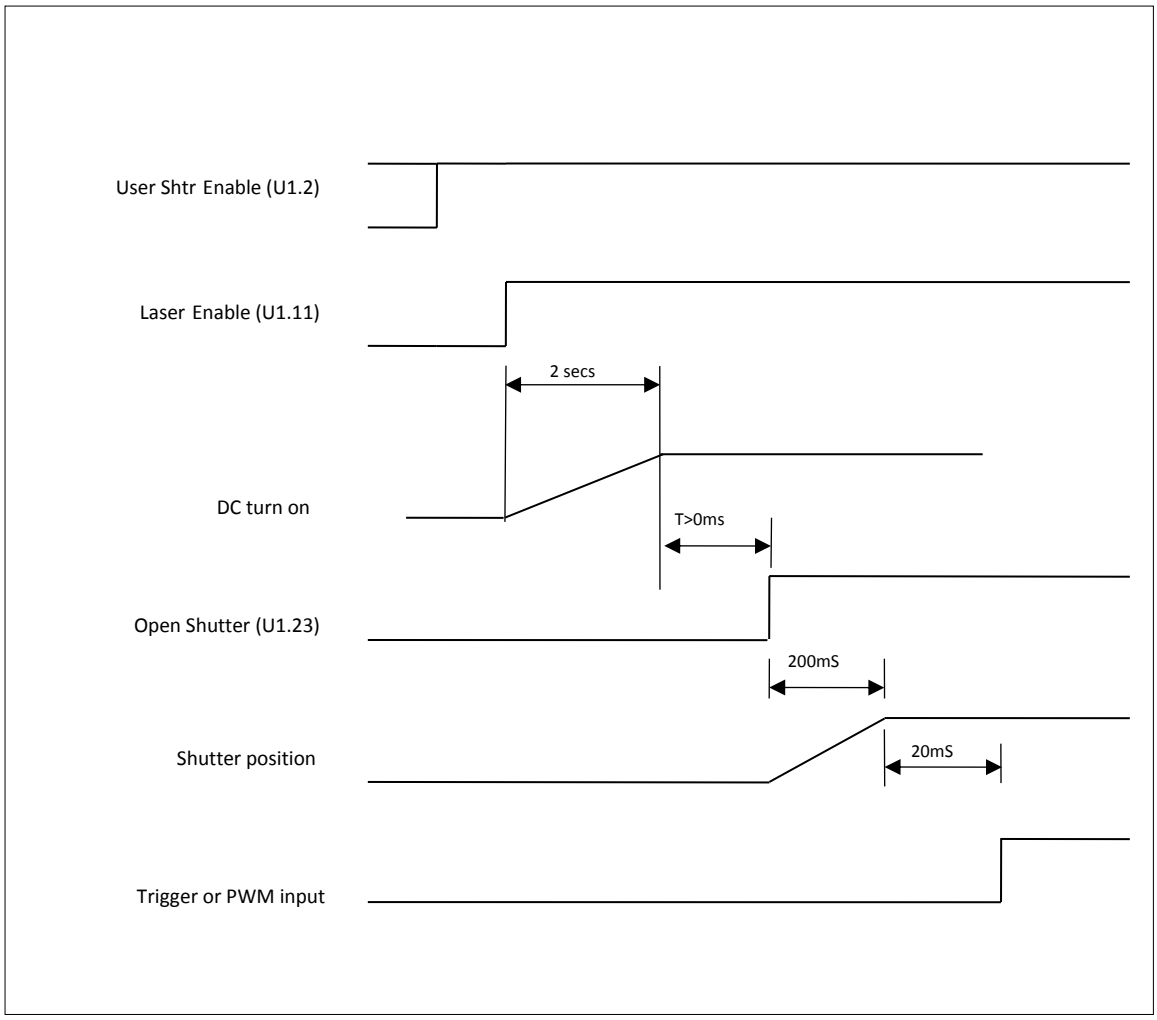
Laser Enable (U1.11) will take the system from standby mode to execute mode and enable the DC power supply. The DC power supply takes 2 seconds to turn on fully.

Open Shutter (U1.23) should be applied at least 1mS after Laser Enable (U1.11). The shutter will start to open when the controller detects the DC is fully on, see fig 27.

If the Open Shutter (U1.23) signal is applied after the DC is fully on then the shutter will start to open immediately after the signal is applied, and be fully open 200mS after the signal is applied, figure 28.



"Open shutter" command in DC turn-on period



"Open shutter" command after DC turn-on period

NC power

When operation is set to NC power, a voltage of 0-10V must be applied to the NC Voltage pin on user port 1 (Pin5/U1). The maximum power is set by the value entered on the MCU, and is varied by the NC voltage input. Any voltage below 1V turns off the output. Any voltage above 10V is ignored and is seen as 10V.

Note: Trigger input is still required before any laser output is achieved.

Shutter monitoring

The OEM 100iX safety shutter unit includes 3 shutter position sensors. 1 sensor for monitoring the open position and 2 sensors for monitoring the shutters closed position. These are monitored internally by the control electronic, and will stop the laser firing on fault detection. These sensor outputs are also available for the user to monitor.

Sensor 1 Shutter Open	Sensor 2 Shutter Closed1	Sensor 3 Shutter Closed2	Interpretation
0	0	0	Shutter open sensor fault / System disabled
0	0	1	Shutter closed1 sensor fault / System disabled
0	1	0	Shutter closed2 sensor failure
0	1	1	Shutter is closed/Correct operation
1	0	0	Shutter is open/Correct operation
1	1	1	Sensor fault

Shutter sensor signals

Incorrect Factory set-up

The OEM 100iX controller is factory set to the correct operational mode for the customer, for instance 'SCX 30 emulation'. If in the unlikely event the set-up is incorrect, you may need to access the inside of the controller in order to reconfigure. For this Luxinar will provide a detailed step by step guide.

DANGER! Before removing the control unit from the DC power supply cabinet, please ensure that the system is isolated from the mains supply. Hazardous Energy levels are present at the rear of the controller which may cause serious injury and irreparable damage to the DC power supply and controller.

Section 4

Maintenance

General Information

Luxinar laser systems have been designed to be low maintenance processing lasers. There are no requirements for internal routine maintenance procedures.

The system's sealed construction and limited moving parts ensure trouble free and reliable operation.

Final Optic

The only optical item that will require periodic inspection and possible cleaning is the final optic which is a Zinc-Selenide window inclined at Brewster's angle.

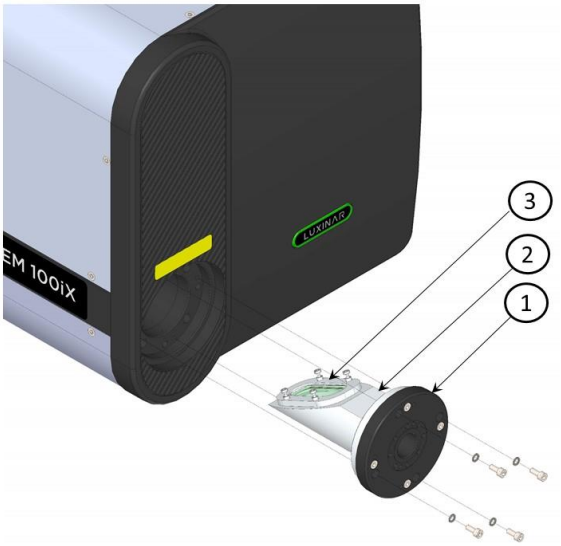
The frequency of inspection and cleaning will depend on how the system is integrated into the customer's machine and more importantly, how well the final optic is protected from dust and other forms of contamination.

Removal of the Final Optic

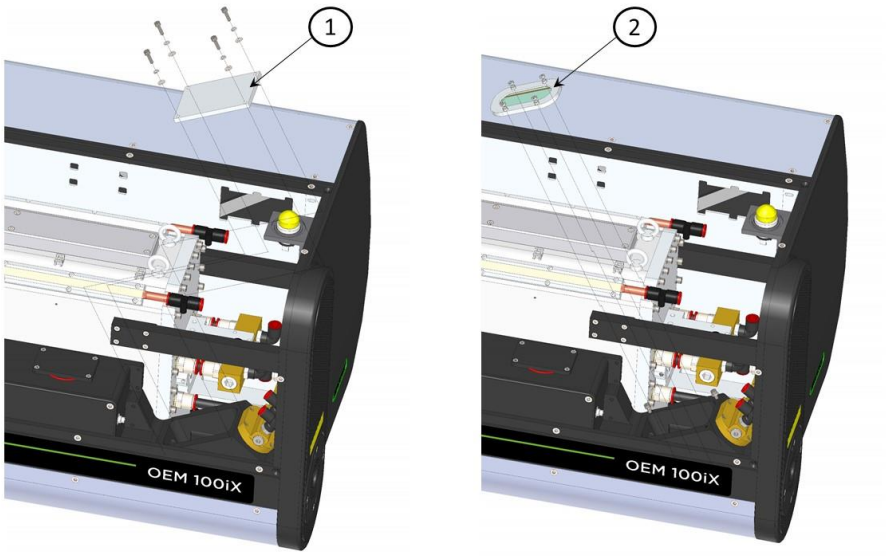
There are 2 ways to access the window. Firstly, it can be removed as part of the Brewster assembly from the front of the laser head. Alternatively, it can be accessed from the side having removed the laser head cover. The window is bonded into its metal frame to make handling easier. Do not attempt to remove the window from its frame.

WARNING! 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 the safety manual before attempting to operate or service the system.

Always ensure that the system is switched off and isolated from the main power source before attempting any cleaning procedures.



Removal of Final Optic for maintenance via the front of the laser. Remove the screws from the circular exit flange (1) as shown. Draw out the Brewster window assembly (2). Remove the bonded window in its frame (3) from the Brewster assembly, loosening the 4 captive screws.



Removal of Final Optic for maintenance via the side of the laser. Remove the main Laser head cover, remove the cover plate (1) followed by the bonded window in its frame, loosening the 4 captive screws.

Care should be taken to prevent dust ingress into the Laser head beam delivery when the final optic is removed for maintenance.

NOTE: Replace the Brewster assembly with the Brewster window facing up, as shown above. Failure to do so will prevent power sampling and may affect the beam quality.

NOTE: Replace the bonded window in its frame onto the Brewster assembly in the correct orientation by ensuring the arrow marker that's engraved onto the frame is pointing into the laser system. Failure to do this will result in the beam no longer exiting the Laser head at right-angles to the exit flange.

Final Optic Surface Contamination

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 light scattering and in extreme cases this may permanently damage the optic and its coatings.

If removed improperly, they can cause permanent damage.

Only clean if necessary, observing the methods and requirements described in the following.

Optic Cleaning Materials

Lens tissue (high quality).

Tissues (unscented for wiping hands and other rough work).

Disposable lint-free gloves.

Solvents (highest purity, preferably anhydrous): Methanol, Ethanol, Isopropyl Alcohol.

Photographic blower brush.

Containers of various sizes, stainless steel or glass, of volume appropriate to the objects being cleaned.

Cleaning the Final Optic

Hands should be thoroughly washed to remove all oils, perspiration and grit. The hands should then be rinsed free of soap. Lint free gloves can be used for added protection of the optic.

The optic requires very careful handling.

If dust particles, lint or other solid matters are visible on the optical surface, gently blow the optic with a photographic blower brush.

If the optical surfaces are not badly contaminated, cleaning can be done fairly easily, a fresh sheet of lens tissues folded to form a pad several layers thick. Its size will be a compromise between fully covering the diameter or width of the surface and being too large to clean evenly.

Enough optical grade solution to just dampen the pad should be applied with a medicine type dropper. The soiled pad must then be discarded.

Repeat as necessary, using a clean pad for each stroke. Using clean pads will reduce the possibility of scratching the optical coating.

When the optic is clean, replace the optic and lens and connect purge gas to the Laser head beam delivery.

Where severe contamination has permanently damaged the optic, contact the Luxinar After Sales team to purchase a new optic (this will come bonded into its frame).

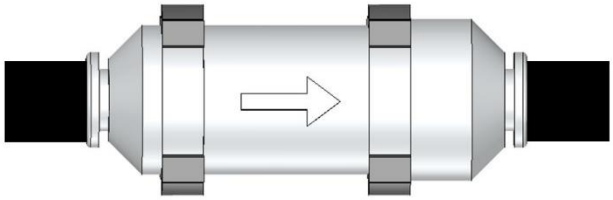
Purge Gas Supply

If the Laser Head or customer external beam delivery is contaminated with fumes, water vapour or debris, these contaminants can absorb the laser energy and cause laser power fluctuations and steering of the laser beam.

To prevent this contamination, a clean, dry and non-flammable gas supply is recommended in humid or very dusty environments to provide slight positive pressure inside the Laser Head. The purge gas requirements and recommended specification are given in Section 1 'Purge Gas Specification.'

WARNING! Damage caused by contaminated air supplies is not covered by the warranty for the laser system and as such, it is the responsibility of the system integrator to ensure correct and adequate purge gas supply are installed where required.

The system comes supplied with an internal purge gas filter



Laser Head Gas Purge Filter

If the filter becomes discoloured or contaminated, the purge gas supply should be checked and the filter should be replaced immediately. Replacement filters are available from the Luxinar After Sales Team part number 402-0006-00.

Refer to the relevant manufacturer's instructions for maintenance of the purge gas supply and any associated equipment.

General Cleaning

Always ensure that the system is switched off and isolated from the main's supply before attempting any cleaning procedures.
The external surfaces of the system can be cleaned with a mild detergent. It is advisable to use a damp cloth to facilitate the cleaning of the external covers, etc.

Take care not to allow entry of water into the Laser Head or the DC cabinet.

Section 5

Optional Components

Safety Shutter

The optional safety shutter can be operated to block off the laser beam. The shutter has been designed as a safety device and is NOT intended to operate as a continuous beam blocking device or process shutter.

When the safety shutter is operated, a copper blade deflects the beam into a beam dump inside the shutter assembly. As the beam dump absorbs all of the energy from the laser beam, it can become very hot if the laser is run continuously with the shutter in the closed position.

Interlocking and operational architecture of the system is designed such that the beam is disabled whenever the shutter is in the closed position. In addition, the shutter open and closed positions are monitored using independent opto-sensors.

Pilot diode beam

WARNING! The Diode Pilot Laser is a Class 3R 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 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.

The pilot laser is a red diode source operating at 635nm and a power not exceeding 4mW. It is a Class 3R device. The beam from the diode has been factory aligned to lie along the same beam path as the laser head CO_2 beam. Centroids for the 2 beams are within 0.5mm at the laser head exit, and 1mm at 10m from the laser head.

Note: The pilot diode beam can only be installed when the laser head has the optional safety shutter fitted. Diode light is only emitted from the laser head aperture when the safety shutter is in the closed position.

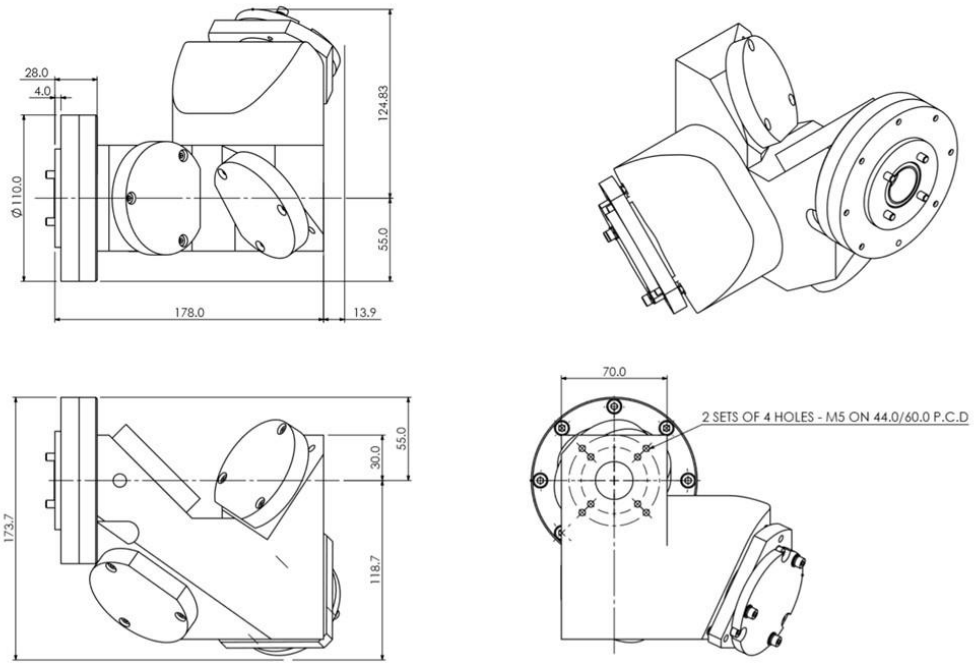
Pilot diode laser specification

Wavelength	635 ± 10nm @ 25°C
Maximum output power	4mW
Power stability	5% @25°C
Divergence	> 2.5mrad
Beam diameter (at the output aperture)	0.25mm
Pointing stability	< 0.2mrad per °C

Optical Isolation unit (ATFR)

To protect the Laser head from damaging levels of back reflection, an optical isolation unit or ATFR device can be purchased from Luxinar. The device attaches directly to the exit of the Laser head and converts the light from linear to circularly polarised. Light reflected back towards the laser is absorbed by the ATFR mirror within the device, allowing only a few percent through to the laser head. The 'straight through' design incorporates 4 mirrors so that the beam exiting the unit, sits on its original axis exiting the Laser head.

A full explanation of how the device operates is given in the manual supplied with the device.



ATFR straight through device

Section 6

Trouble Shooting

General Information

Before attempting any fault diagnosis on the laser system, the process area should be cleared of the following:

- Non-essential processing material.
- Non-essential staff.
- Non-essential tools and equipment.

It is also good practice to:

- Ensure the system safety shutter is closed, where possible.
- Ensure the beam path is clear of any flammable items.

Fault Codes

The following table shows the pre-programmed OEM 100 iX fault codes, along with a list of possible causes.

If the actions listed below do not solve the problem, contact your local Service department for further advice.

Error Code	Description	Action
01	Shutter Error	Replace Shutter module. Contact Luxinar aftersales
02	Emission Lamp Fail	1. Check the emission lamp loom for damage 2. Emission lamp array faulty (Replace)
03	DC Voltage Low	1. Check the PSU status LED's (if using a Luxinar supplied DC PSU) 2. Check the DC Output Voltage 3. Replace DC module as required
04	DC Voltage High	1. Check the PSU status LED's (if using a Luxinar supplied DC PSU) 2. Check the DC Output Voltage 3. Replace DC module as required
05	DC Current too high	1. Check Error log for previous problems* 2. Record the output power and performance of the system and contact aftersales s
06	Emergency Stop	Contact Luxinar aftersales
07	External Interlock	1. Check all cable connections between the Laser Head and the PSU/Control unit 2. Link the External Interlock Pins 9 and 21** on U1. If the fault clears, check the operation of all the external interlocks connected to the system Note: Linking these pins together will isolate the laser from the external interlock circuit.
08	Laser Head Disconnected	Ensure the umbilical is connected between the Laser Head and the Controller; also check the cable is free from damage
09	Laser Head Disabled	Check the Fault history for last error
10	RF Over temp	1. Check all water connections for leaks 2. Check that all the System components are connected 3. Check the inline water filter for blockages, (Replace where necessary.) 4. Check that the chiller unit is filled to the correct level and the output pressure is within the guidelines
11	T1 (Spatial Filter) Over temp	
12	T2 (Shutter) Over temp	
13	LaserHead Water Flow Low	

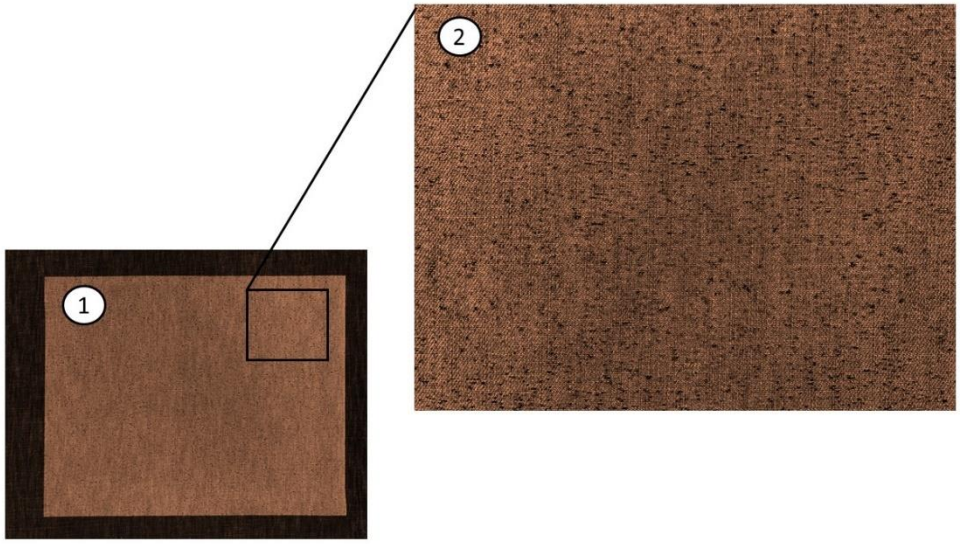
14	LaserHead Water Flow Fault	5. Check that all coolant pipes diameters are as specified and also check the pipes are undamaged 6. Check the temperature of the coolant liquid and the ambient temperature of the area are within the guidelines
15	VSWR	1. Check the RF Cables are connected securely and in the correct positions 2. Check the RF Cables have not been damaged
16	Over Modulation: External Operation	Check the External Input Modulation Signal is within the typical operating parameters described in the Operating manual
	Over Modulation: Internal Operation	1. Test the system using Engineering mode 2. Check PID Control parameters* 3. Test System with adaptive control switched off
17	Laser Power Low	1. Check quality of output mode 2. With the system isolated from the mains supply, check the condition of the output lens and beam delivery mirrors for signs of damage 3. Check the laser system for any signs of external damage 4. Check the RF cables are correctly connected 5. Purge laser system using a purge gas supply 6. Test the system with a calibrated power meter
18	Laser Power High	Test the system with adaptive control switched off, if the fault clears reset the PID Correction tables*
19	At control Limit	Test the system with adaptive control switched off, if the fault clears reset the PID Correction tables*
20	CanBus Fault	1. Check all control cables are correctly attached and free from damage 2. Restart the system, if problem persists contact Service
21	User PWM limited	Check the External Modulation Signal is within the typical operating parameters
22	Memory Error	Internal memory corruption has been detected. The controller will reset the effected values to a default state. If the fault persists contact Luxinar aftersales
23	Unused	Not applicable
24	LaserHead Comms	A communication issue has been detected with the LaserHead controllers. The system controller will attempt to re-establish communications automatically. If the fault persists contact Luxinar aftersales
25	Pallet Fault	
26	RF Comms	A communication issue has been detected with the RF controllers. The system controller will attempt to re-establish communications automatically. If the fault persists contact Luxinar aftersales
27	Laser Thermal	
28	RF Voltage Low	The voltage monitored in the RF is below the acceptable range.
29	RF Voltage High	The voltage monitored in the RF is above the acceptable range.
30	LaserHead Flow High	The coolant flow through the LaserHead is above the maximum allowed limit.
31	DC PSU Flow Low	The coolant flow through the DC PSUs is below the minimum allowed limit.
32	DC PSU Flow High	The coolant flow through the DC PSUs is above the maximum allowed limit.

* - For information on using the OEM 100 iX controller, please refer to 906-0106-00

** - Pins 19 and 20 if system is operating in SC x30 Emulation Mode

The following describe some common Laser Machining Issues. A Summary table lists Root causes, Issues and Actions.

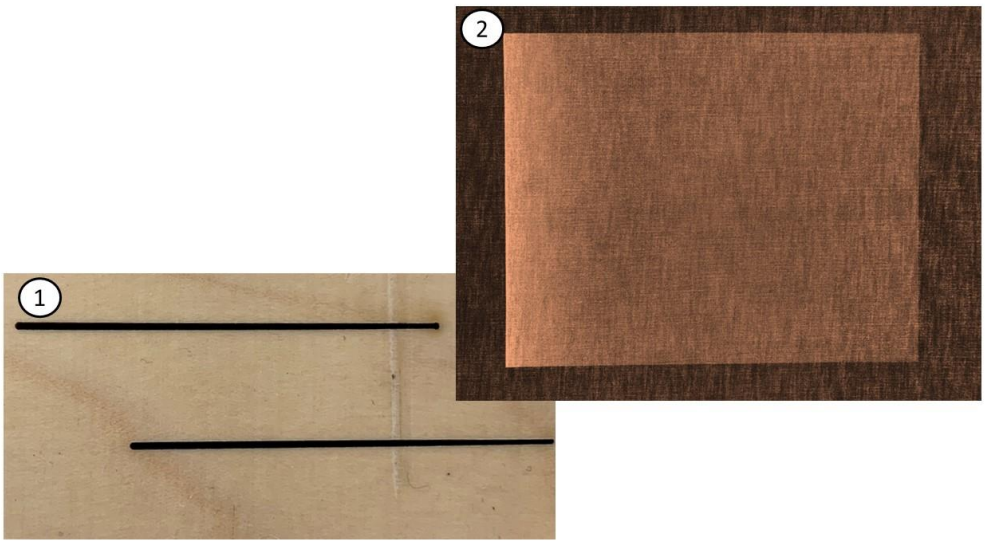
Fluctuations in intensity at the workpiece



Fluctuations in intensity at the workpiece: (1) Marked uniform pattern in textile. (2) Zoom to show instability in the marking result

Focus beam height changing

When optics in the customer beam delivery heat and distort they can move the focus position at the workpiece. Machining is as expected at turn-on, but then progressively gets poorer over a few seconds, as if the Laser head is dropping in power.

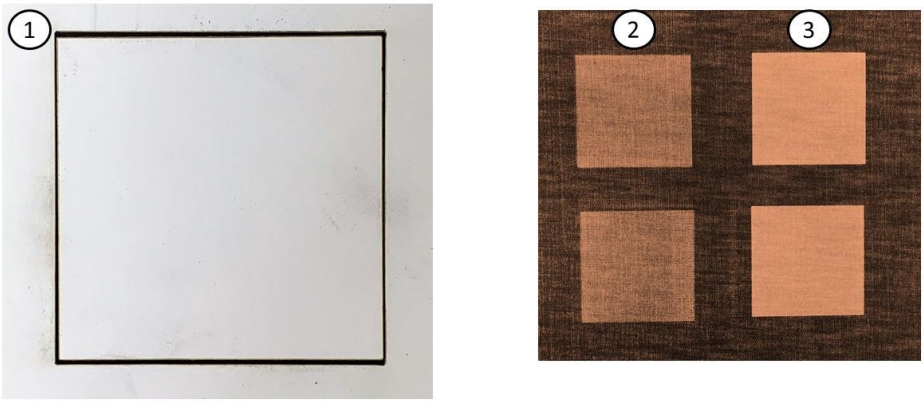


Focus height changing: (1) Kerf width changing in Die board. (2) Intensity reduction in a uniform box pattern marked in textile

A diagnosis of focus beam height changing is moving the focus height at the workpiece to observe poor machining at turn-on that then improves as the process runs.

Directionality

When kerf width or marking intensity is changing with machining direction, this directionality can be for a number of reasons, including beam distortion giving rise to an elliptic or distorted focus, or misalignment through a cutting head nozzle.



Directionality: (1). Kerf width changes when cutting panels in vertical and horizontal directions. (2). Uniform box patterns marked in textile scanned horizontal versus (3) vertical

Low Machining Speed

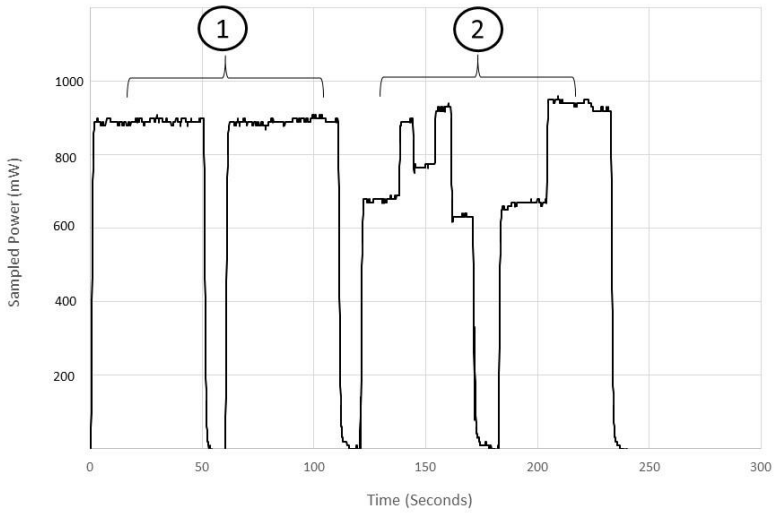
Line speeds at lower powers can be used to predict an expected line speed at a higher power. When speeds are not at the expected level, there can be various reasons, including optics distorting, back reflections causing mode size changes etc.

Beam Distortion

There are many causes for beam distortion, including misalignment through the customer beam delivery, contamination and clear apertures being too small. At higher powers, light absorbed by moisture in the air can lead to heating of the air and distortion of the beam, requiring constantly moving air in the beam delivery or purging with dry nitrogen.

Unstable Power

All lasers have a natural variation in power with running time, commonly known as laser power signature. However, certain issues, for instance feedback from the workpiece, can cause larger and erratic fluctuations in power than signature alone.



Sampled power (mW) versus time (Seconds) taken using a beam splitter placed in the customer beam delivery to sample a small fraction of power when running repeated patterns lasting ~50 seconds. (1) With the beam blocked by a power meter placed after the beam splitter (2) Running the machining process

Note: Small Back Reflections from the surface of an external power sensor can contribute to poor power stability; for this reason, external power heads should always be tilted to the beam by ~5 degrees.

Root Cause	Observation	Action
Feedback from transmissive optics, beam delivery components or the workpiece	▪ Fluctuations in intensity at the workpiece ▪ Directionality ▪ Low machining speeds ▪ Unstable power	1. Check for scratches, dirt or contaminant on the customer beam delivery optics and the Laser head final optic 2. Ensure the customer beam delivery transmissive optics are tilted 2 to 5 degrees to the beam 3. Check for apertures that can back reflect light 4. Observe in-line power sensor while machining and compare to running directly into a power head at the laser beam exit 5. Consult with Luxinar regarding optical isolation
Contamination in the beam delivery	▪ Fluctuations in intensity at the workpiece ▪ Focus beam height changing ▪ Directionality ▪ Low machining speeds ▪ Beam distortion ▪ Unstable power	1. Check for scratches, dirt or contaminant on the customer beam delivery optics and the Laser head final optic 2. Purge the customer beam delivery 3. Purge the laser head
Lensing / distortion of optics	▪ Focus beam height changing ▪ Low machining speeds ▪ Beam distortion ▪ Unstable power	1. Check for scratches, dirt or contaminant on the customer beam delivery optics and the Laser head final optic 2. Consult with Luxinar regarding suitability of beam delivery optics for OEM100iX incident power 3. Observe effect of moving beam focus into and out of the workpiece
Acoustic beam steering	▪ Directionality ▪ Low machining speeds ▪ Beam distortion ▪ Unstable power	1. Refer to acoustic and power versus pulse frequency data in Section 7 2. Operate in a different pulse frequency range
Clear apertures too small for beam / poor alignment through the beam delivery	▪ Directionality ▪ Low machining speeds ▪ Beam distortion	1. Refer to beam propagation data and measure aperture sizes and mirror clear apertures 2. Remove customer beam delivery and check mode from laser – ideally through focus 3. Check alignment onto mirrors and beam is centred through apertures 4. Check for distortion / stress in customer beam delivery optics. Consult with Luxinar regarding optic mounting methods
Intermittent RF Power	▪ Fluctuations in intensity at the workpiece ▪ Low machining speeds ▪ Unstable power	Check the log history for faults

Customer Applications trouble shooting guidance table

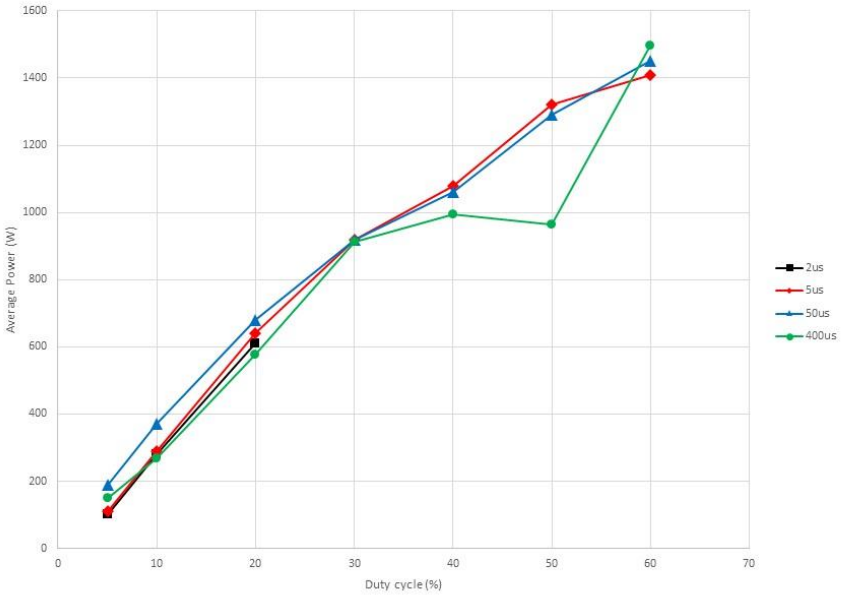
Section 7

Typical Performance Data

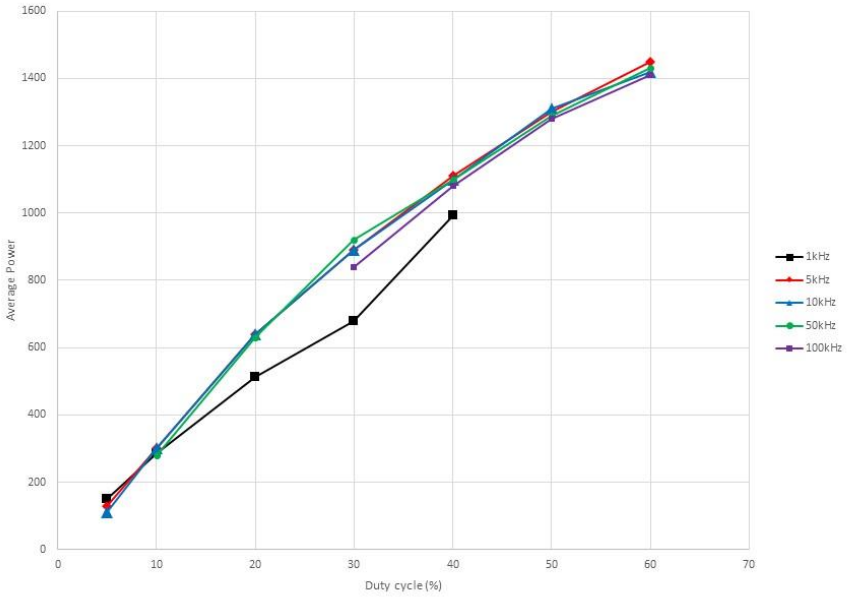
General Information

The following data represent typical performance from the OEM100iX. Data is presented for an average laser optical power at shipment of 1400W at maximum duty cycle and a pulse frequency of 10kHz. Note: The guaranteed average power at shipment for OEM100iX is 1200W.

Power Curves

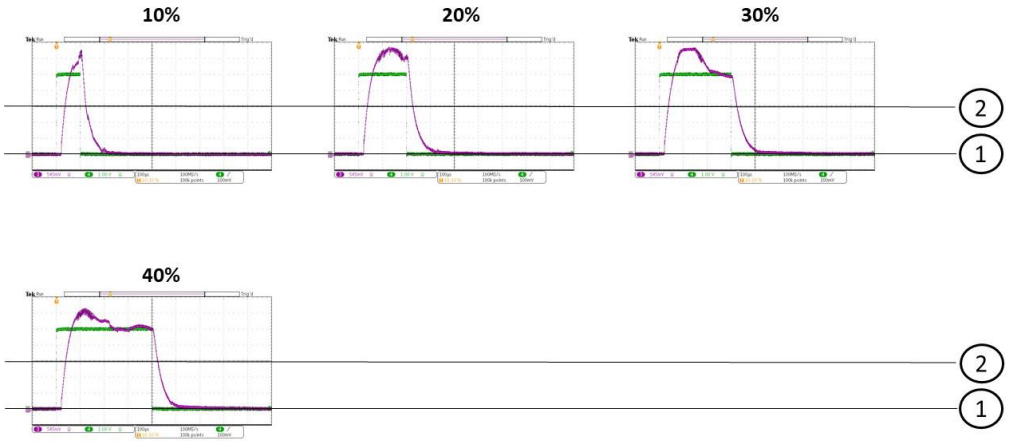


Typical average power (W) versus duty cycle (%) at fixed pulse widths

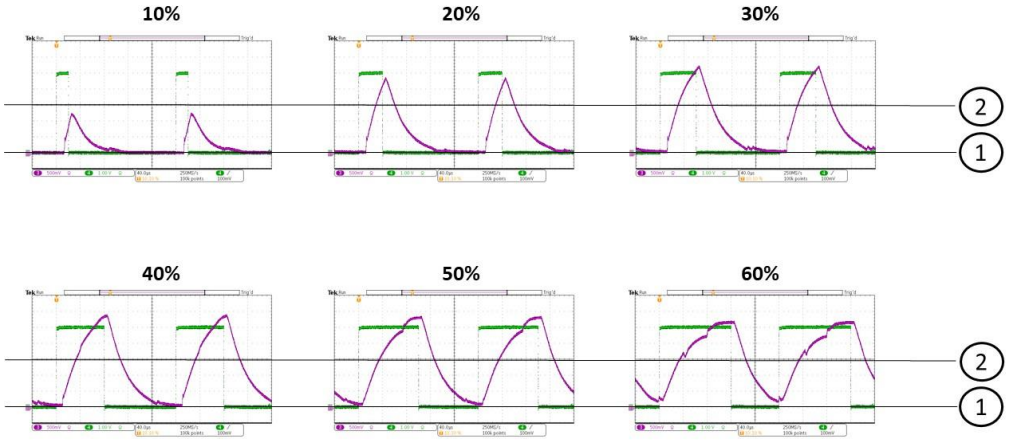


Typical average power (W) versus duty cycle (%) at fixed pulse frequencies

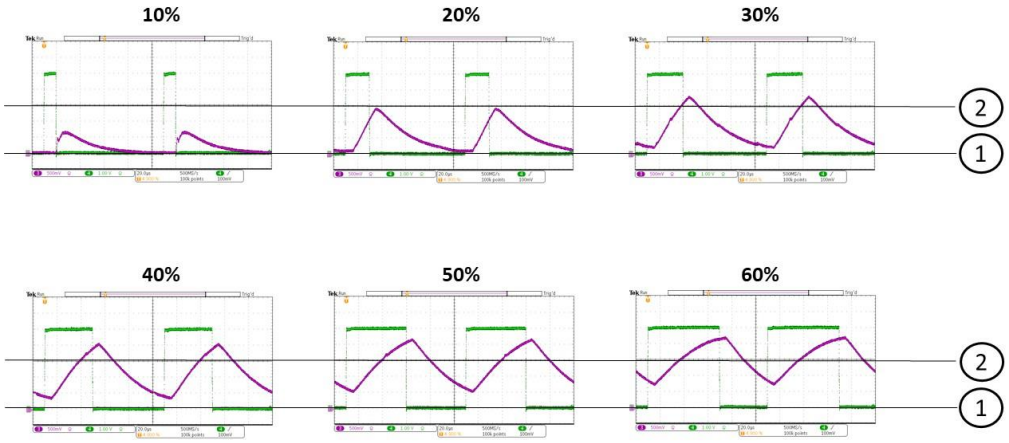
Optical Pulse Shapes



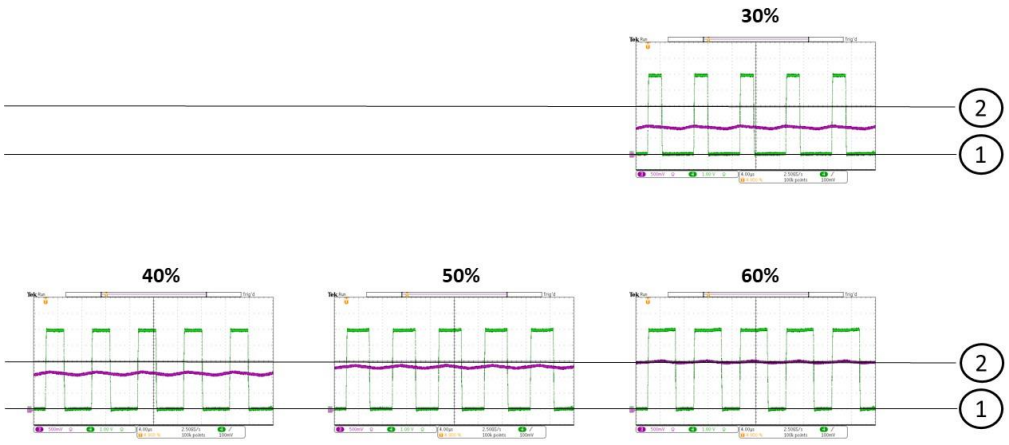
Typical optical pulse shapes recorded at 1kHz pulse frequency (time base 100us) for different duty cycles (%). In green the pulse demand signal, in purple the optical pulse shape. (1) Zero power level. (2) Power level representing 1400W



Typical optical pulse shapes recorded at 5kHz pulse frequency (time base 40us) for different duty cycles (%). In green the pulse demand signal, in purple the optical pulse shape. (1) Zero power level. (2) Power level representing 1400W

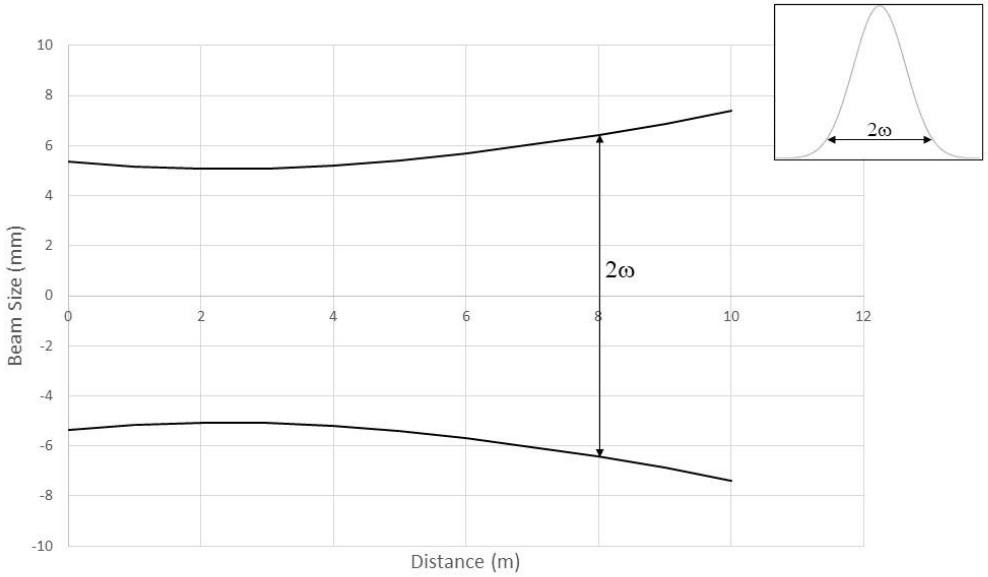


Typical optical pulse shapes recorded at 10kHz pulse frequency (time base 20us) for different duty cycles (%). In green the pulse demand signal, in purple the optical pulse shape. (1) Zero power level. (2) Power level representing 1400W



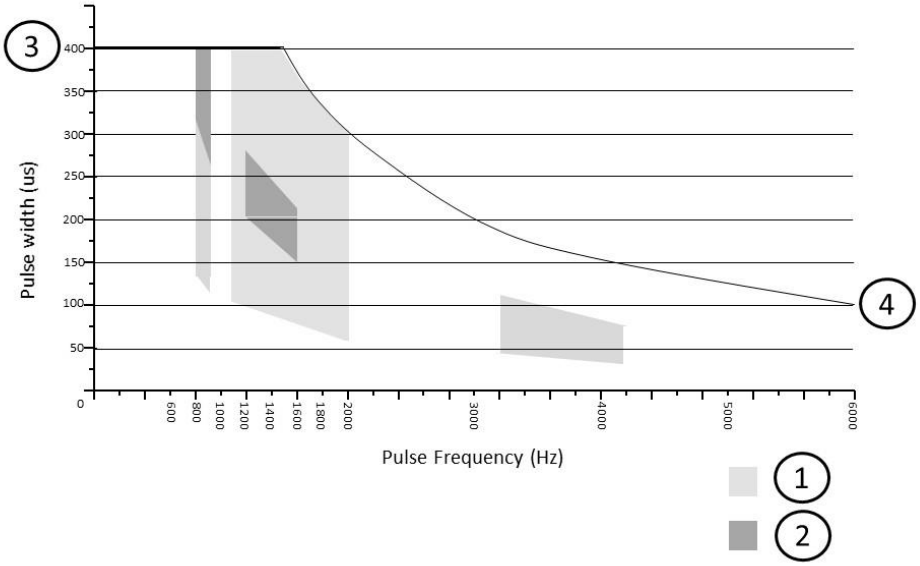
Typical optical pulse shapes recorded at 130kHz pulse frequency (time base 2us) for different duty cycles (%). In green the pulse demand signal, in purple the optical pulse shape. (1) Zero power level. (2) Power level representing 1400W

Beam Propagation

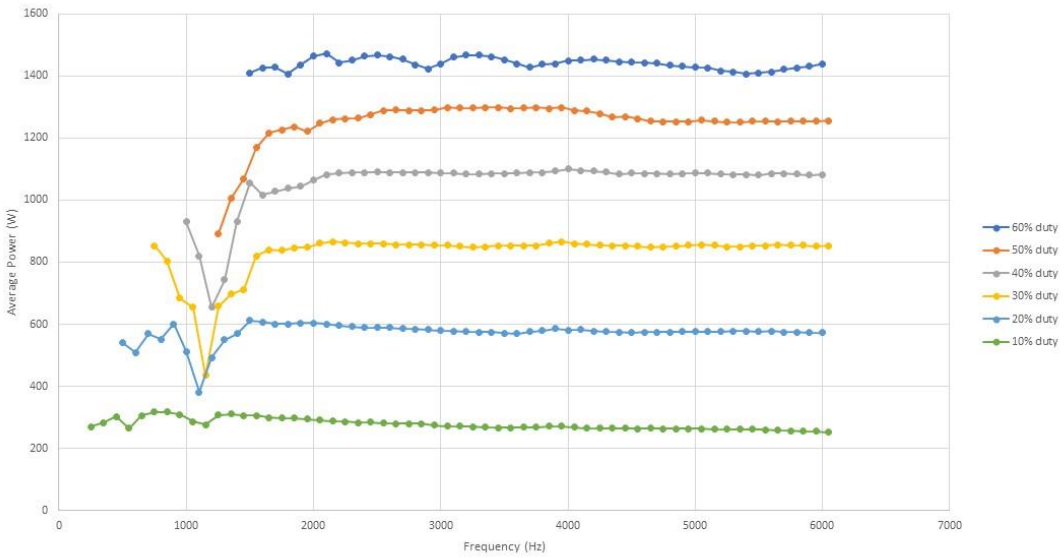


Calculated Beam size (mm) versus Distance (m). Shown at 8m is the 2ω $1/e^2$ beam diameter. Inlay represents the 2ω beam diameter

Acoustic Zones



Acoustic Zones for varying pulse width (us) and pulse frequency (Hz). (1) zones where pointing can exceed 0.06mrad (half angle), (2) zones where pointing can exceed 0.12mrad half angle, (3) maximum pulse width, (4) maximum duty cycle of 60%

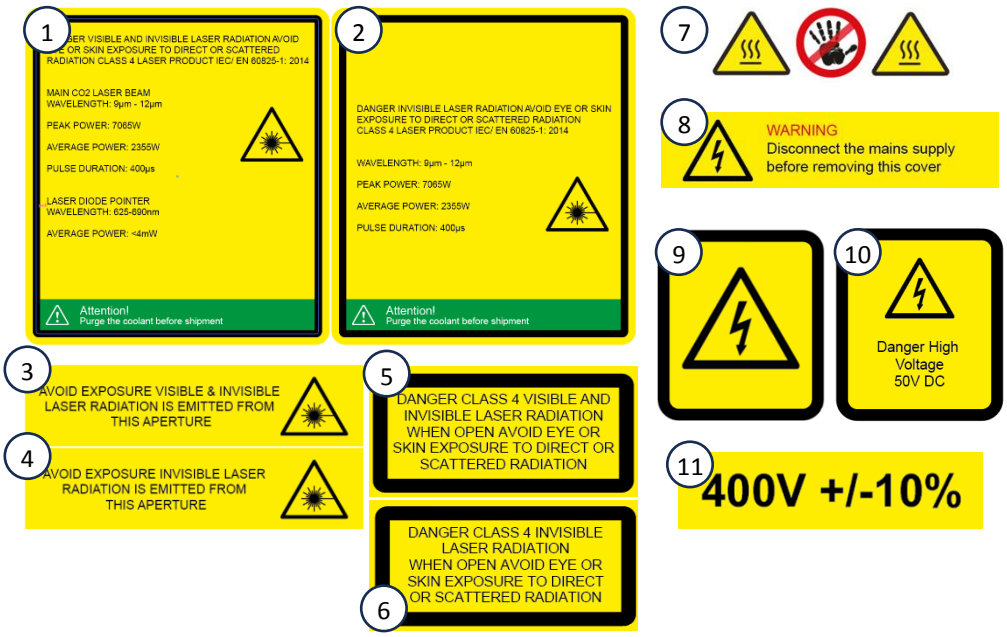


Typical laser average power (W) versus pulse frequency (Hz) at different duty cycles (%) through the acoustic zones

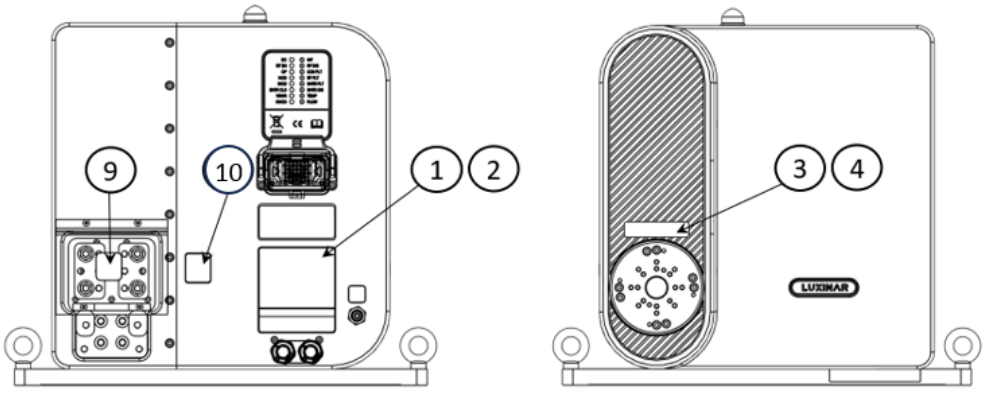
APPENDIX 1

Safety Labels

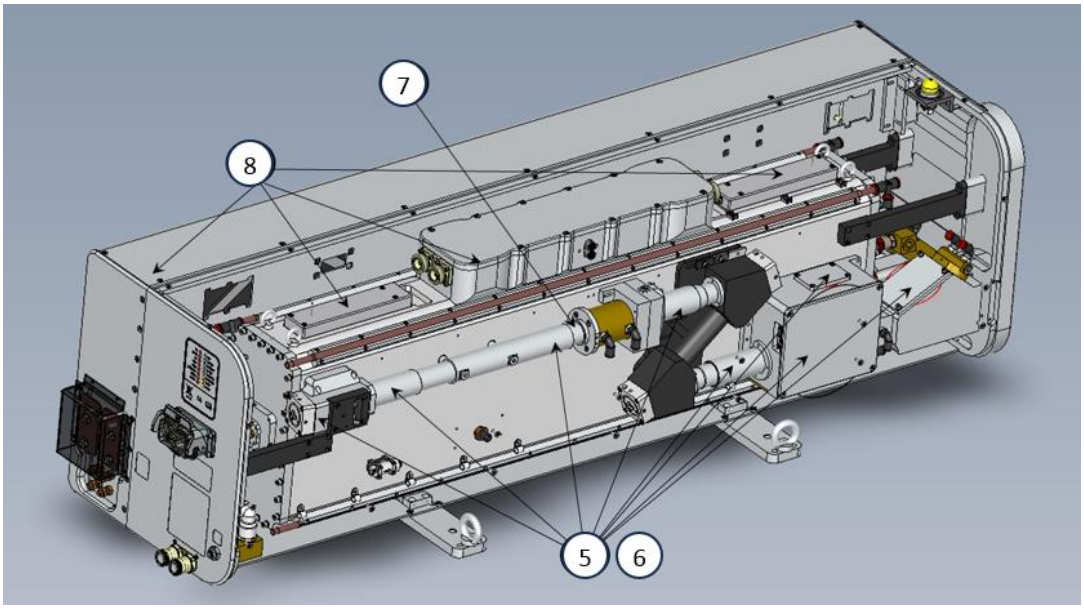
As required by EN60825. Appropriate warning labels have been positioned in specific locations on the system to indicate conditions under which the user could be exposed to laser radiation.



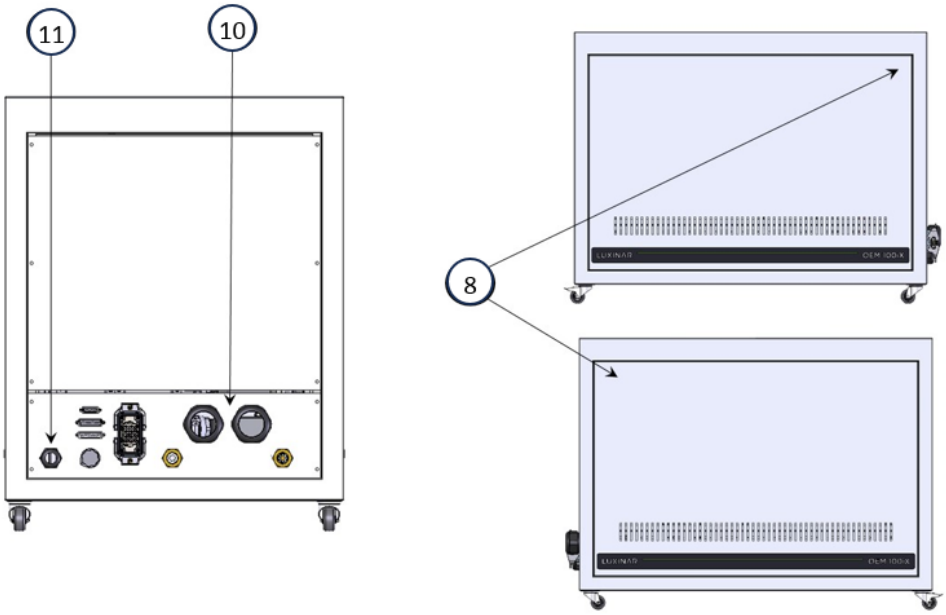
Warning labels. (1) Technical data (optional laser diode pointer fitted). (2) Technical data. (3) Laser aperture warning (optional laser diode pointer fitted). (4) Laser aperture warning. (5) Laser hazard (optional laser diode pointer fitted). (6) Laser hazard. (7) High heat temperature. (8) Mains warning. (9), (10) High voltage warning



Warning label positions on Laser head end flanges



Additional warning label positions



Warning label positions of DC controller cabinet 016-0028-00 / 016-0038-00

APPENDIX 2

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 table below 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 table below.

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 table below are relevant only when the laser is operated without external beam delivery attached. When beam delivery is attached it is the responsibility of the integrator or end-user to recalculate the NOHDs. 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’.

Wavelength (µm)	10.6
MPE (Jm^{-2})	$1000J/m^2$
NOHD (m)	2100

The above MPEs and NOHDs are stated for continuous illumination and maximum average output power.

APPENDIX 3

History of Changes

Revision	Date	Changes
2	22/07/2022	Text updates for Earth Bonding. Figure changes showing lifting eyelets and required wiring for earth bonding and DC PSU ground stud earthing
3	28/11/2022	Earth braid connection to users Earth and updates to DC cables
4	29/11/2022	UKCA marking and safety section updates
5	05/07/2023	Safety label updates
6	01/02/2024	Stand alone controller and updates to DC PSU Specifications
7	13/08/2024	Change to fixed eyelet orientation and front flange fixing hole dimensions
8	27/11/2024	Front and back cover updates

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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