



SCX 35

Sealed CO₂ laser source

User manual

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Please note that while every effort has been made to ensure that the data given in this document is accurate, the information, figures, illustrations, tables, specifications and schematics contained herein are subject to change without notice. The most recent additions and supplementary information are given in the Additional Information Section in this manual.

SCX 35

Luxinar Ltd.
Meadow Road
Bridgehead Business Park
Kingston Upon Hull
HU13 0DG
U.K.

Tel: +44 (0) 1482 650088

www.luxinar.com

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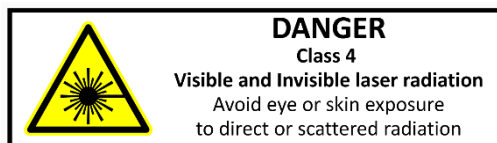
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Safety Information



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

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

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

Important!

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

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

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



Section 1

Installation

It is strongly recommended that any personnel who are involved with the installation, operation or maintenance of this laser equipment should first read and fully understand the contents of this manual and in particular the Safety Instructions and Precautions



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

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, inform both Luxinar and the relevant shipping company before taking any other action

Unpacking

1. Cut the bands on the outside of each of the two packing boxes. Open the box lids and remove the cardboard outer packaging
2. Remove the cables, spares kit and documents in the top section of the Laser Head box and store in a secure location in preparation for installation. If a Luxinar Control Unit was ordered it will be located in a compartment within the packaging at one end of the Laser Head box
3. Now remove the top and side sections of the support packaging to reveal the Laser Head and in the other box the Power Supply Unit
4. Check all the components for signs of damage. If any damage has occurred, 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



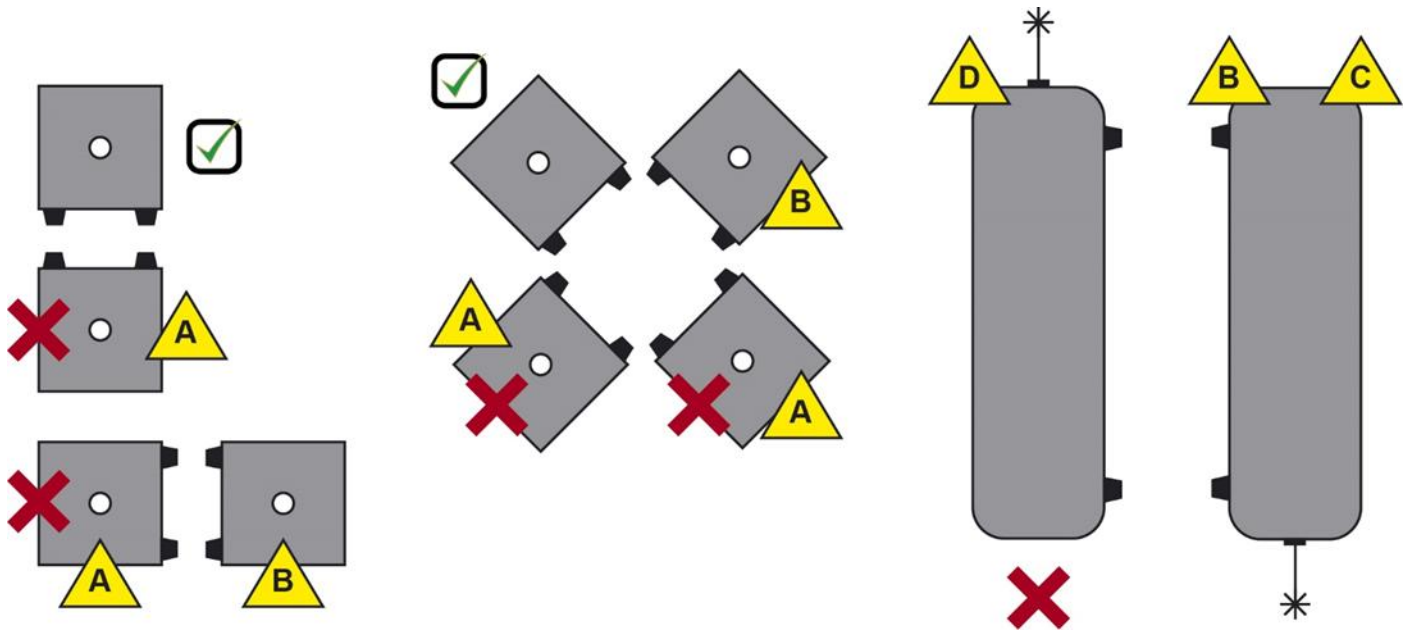
Do NOT under any circumstances use the power sensor unit as a lifting point when moving the laser. Any force placed on the power sensor could misalign the output of the laser which may in turn have an adverse effect on both the output power and mode quality

Mechanical Considerations

The Laser Head should be secured using M8 bolts, flat washers and spring washers through the eight 8.5mm diameter clearance holes on the two brackets fixed to the base of the module. See [Page 45](#) for the recommended holes to use for fixing the Laser Head. See also Technical Specification on [Page 37](#) of this manual for dimension and weight information

Orientation

The Laser Head assembly must be secured in a correct orientation as shown by a tick in the diagram below. This is to ensure that the laser tube output window is protected from any dust or debris that may contaminate the optic during normal operation or during a service intervention. The orientation is also important to ensure that the electro-mechanical safety shutter will operate correctly and reliably. If in doubt, please contact the local Distributor sales office



Correct Orientation for the laser head assembly

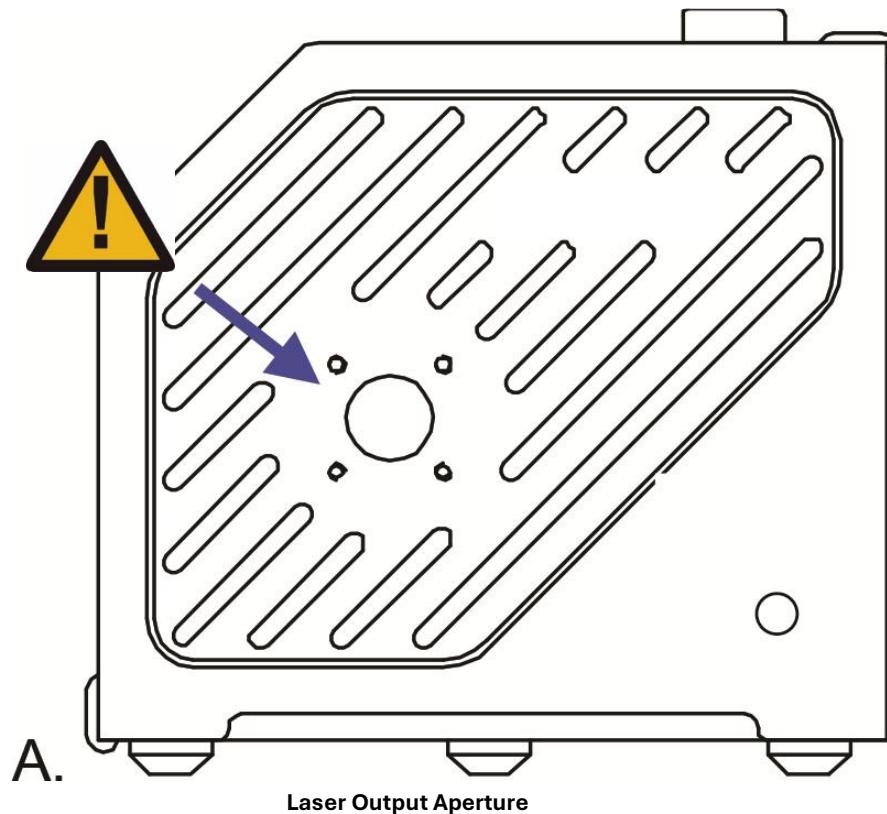
Notes:

- A. Gravity may prevent shutter from opening/closing fully
- B. Not recommended for health and safety reasons. Mounting the Laser Assembly in this orientation may have an effect on the ability of the laser shutter to close successfully under gravity in the unlikely event of a solenoid failure
- C. In this orientation optical surfaces within the Laser Assembly sit horizontal and can easily collect dust which leads to reduced optic lifetime, especially when there is a risk of contamination within the Laser Assembly
- D. Laser MUST NOT be orientated in this direction. Continual use when laser mounted vertically in this orientation can result in premature failure of the laser tube output window

Laser Output Aperture



CAUTION! CLASS 4(IV) LASER RADIATION EMITTED FROM THE APERTURE SHOWN BELOW



Cooling

The Laser Head, RF and DC Power Supplies, and the Power Sense Unit all require water cooling. The cooling specification is given on [Page 39](#). Fitting sizes are as follows:

The SCX 35 laser assembly: 3/8" BSP, Female

Combined DC/RF unit: 3/8" BSP, Female

DC Power Supply (Luxinar-supplied): 10mm copper pipe

RF Power Supply: 10mm copper pipe

12mm external diameter pipes can be used with adapters supplied in the spares kit. Spare fittings are supplied in the Spares Kit. The recommended route and flow direction for the water cooling is given in Appendices 3 and 4. It is recommended that the Power Sense Unit (if fitted) cooling is connected in series with the Laser Head.

The Laser Head and Power Supply Unit have 'Water In' and 'Water Out' labels to indicate which connections to use – the water flow is monitored by a direction-sensitive flow switch inside the Laser Head. To remove particulate contamination, a filter with a pore size of 100µm must be used. This filter should be located as close as possible and in line with the cooling water inlet of the Laser Head.

Note that where a closed cycle water cooler or chiller is used, corrosion inhibitors should be added to the coolant – details are given on [Page 39](#).

Cooling water should 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 should be adjusted and maintained above the dew point to avoid condensation on the laser optics and electronic components

The Laser Head, Power Sense unit, and its Power Supplies should always be drained of any cooling fluid before shipping or transportation of the system. This will prevent possible freezing of the liquid and the consequential damage to the internal water pipes inside the Laser Head and the Power Supplies

Damage due to insufficient coolant water flow, corrosion, condensation or freezing is not covered by the warranty for the laser system. The system must be fully drained prior to shipping the system. Failure to do so will void the warranty

The Power Supply Unit contains a DC Power Supply that is air-cooled. Ensure 100mm clearance at front and rear of the power supply to allow unrestricted air flow

Purge Gas

For the purge gas requirements and specification please refer to [Page 36](#) of this manual

Where used, the purge gas should be supplied at a pressure of approximately 2 psig, and at a rate of approximately 1 litre per minute, using 6mm 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 air is not used. Removal of the plug will create a potential contamination path into the Laser Head

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

Bank Capacitors

If the DC power supply is provided by the user, then bank capacitors will most likely be needed for the storage of energy. The pulsed nature of the RF Power Supply's current draw can cause problems with the DC supply voltage regulation control loop – leading to instability and possible damage. Bank capacitors may be fitted local to the DC power supply and/or at the RF power supply terminals – some experimentation may be required for best results.

In either case, it is not recommended to employ 'remote sensing' in an attempt to compensate for long DC cable resistance - use cables of sufficient cross-sectional area instead. The capacitors should be rated at a minimum working voltage of 63VDC, and be of a 'high ripple current' type. Suitable bank capacitors can be purchased from Luxinar – please contact Luxinar Sales Department for more information.

Electrical Interfacing

The Laser Head and Power Supply Unit are connected together by various cabling and remote connectors. The customer will need to supply control signals to operate the laser and will also need to monitor various output signals for status information

When connecting the mains supply to the Power Supply Unit ensure that the supply, fusing, cabling and any isolation switch meets the specification given in the appropriate Appendix.

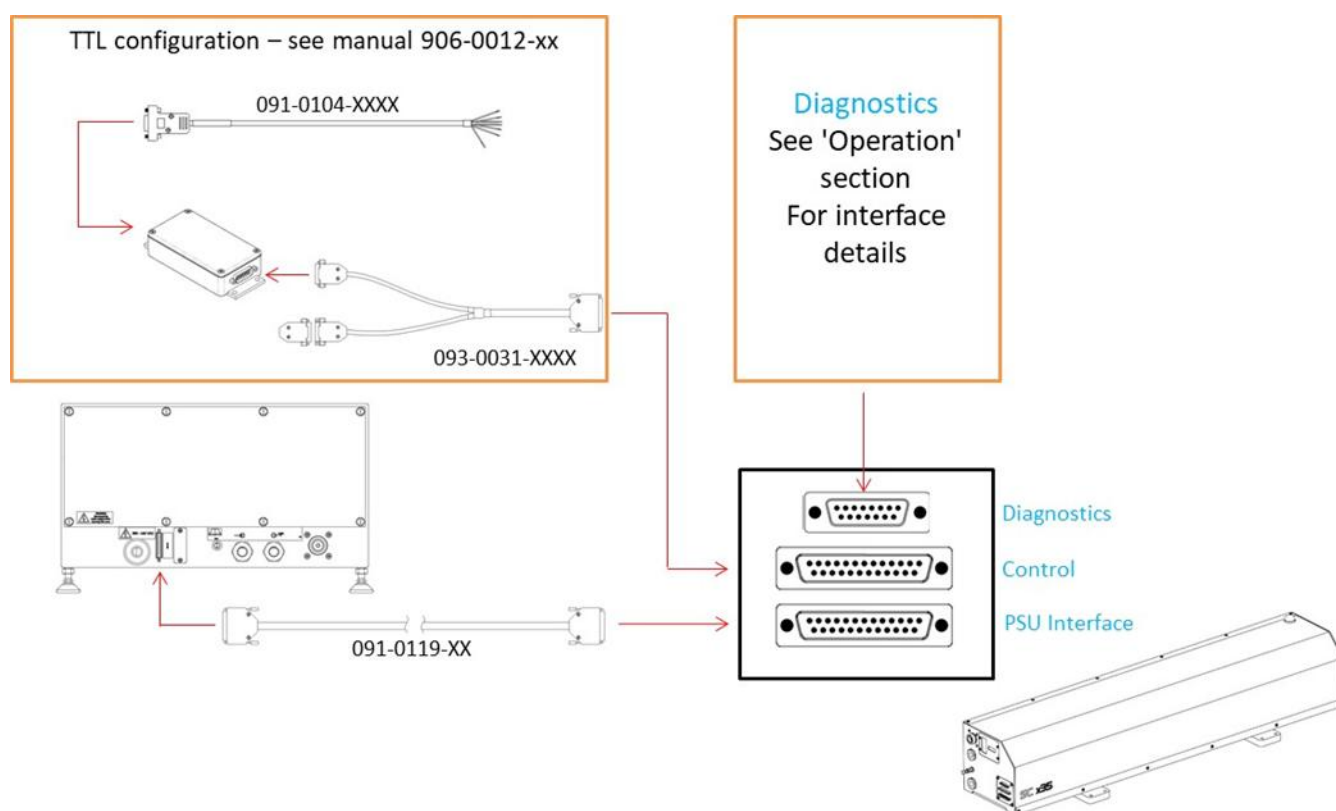
The Power Supply Unit must also be connected to a three-phase supply having a Protective Earth connection (or 'ground')

Basic Configurations

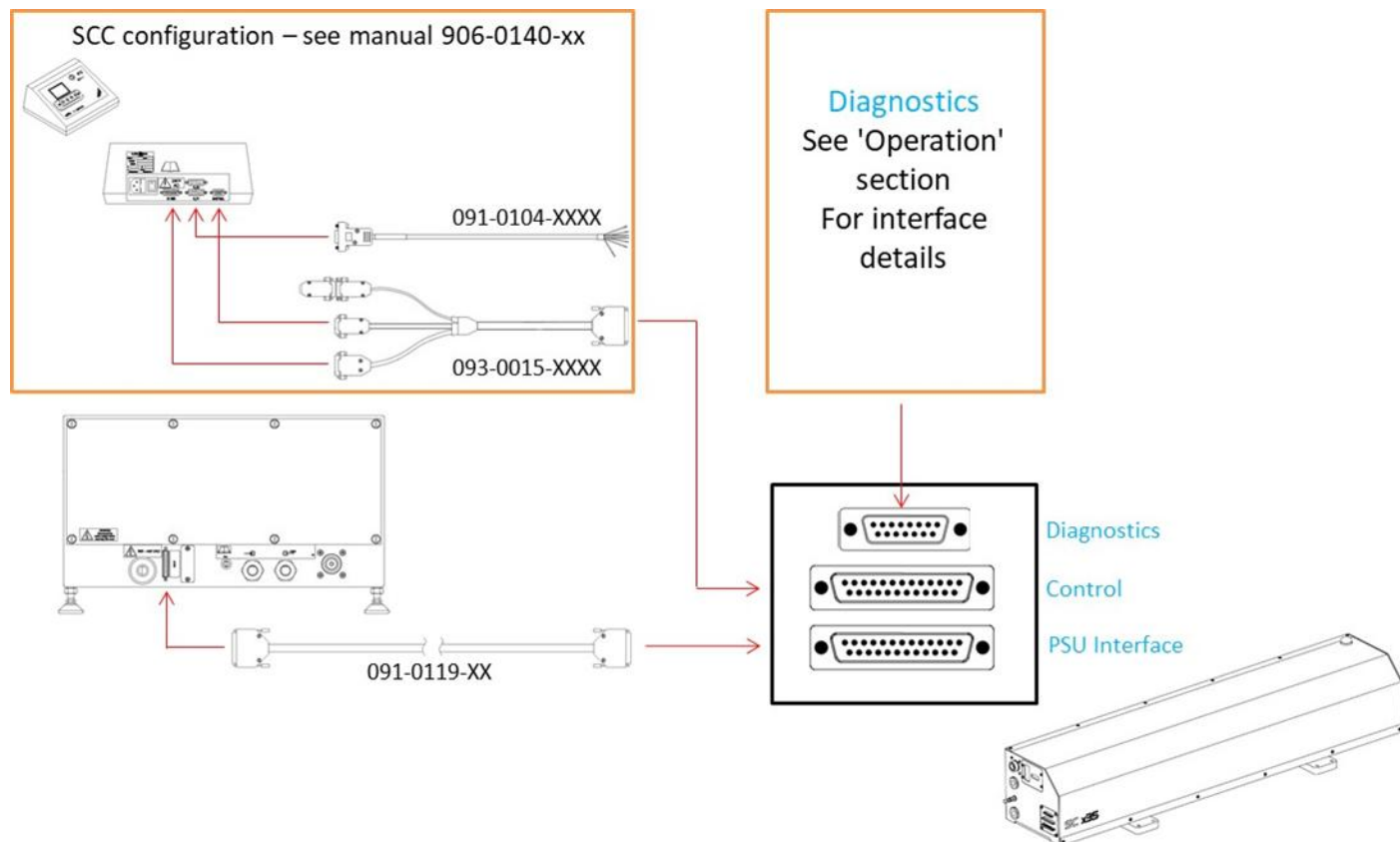
The SCX 35 Laserhead can be connected to its RF and DC Power Supply in one of three ways:

- For maximum convenience, the DC power supply and RF power supply can be supplied in a common cabinet, with appropriate interconnections already made – Luxinar part number **016-0025-00**.
- Where more flexibility of installation is required, the RF power supply can be supplied separately, together with a Luxinar-approved DC power supply – Luxinar part number **005-0646-00**.
- As b), but with a user-supplied DC power supply. In this case, the user is responsible for the correct specification and operation of the DC power supply.

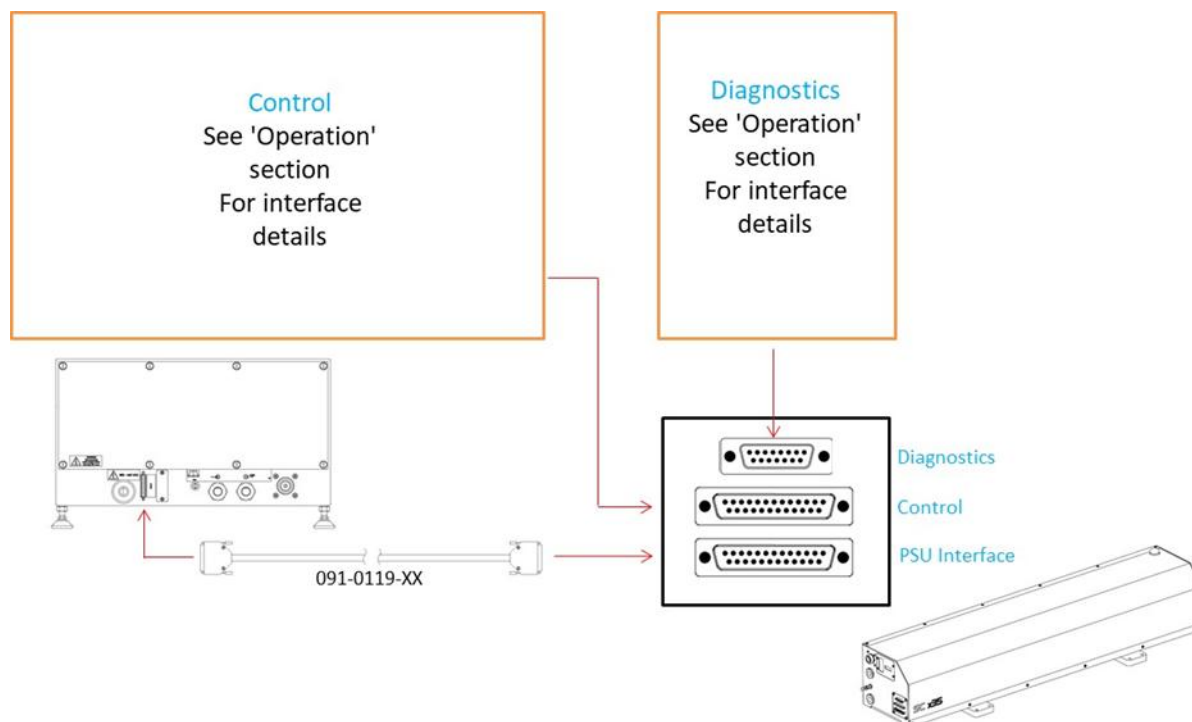
The following diagrams show the basic electrical interconnections for these configurations. Further information can be found in the relevant manual sections and appendices.



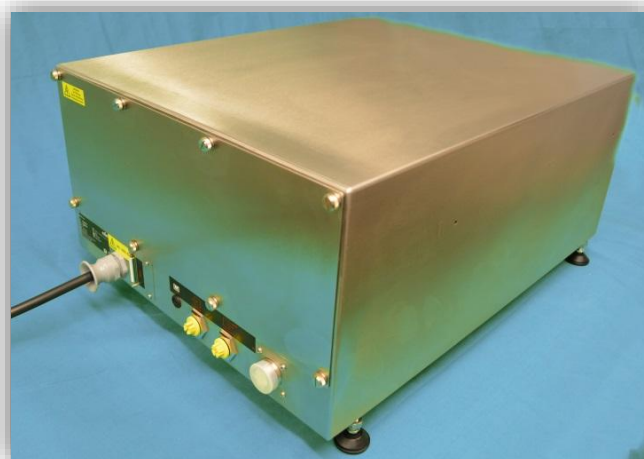
SCX 35 Operation using 016-0025-00 in TTL Configuration



SCX 35 Operation using 016-0025-00 in SCC Configuration



Component Parts – general views and connections



**Mains
Inlet**

**Control
Port**

**Fuse
(Interface)**

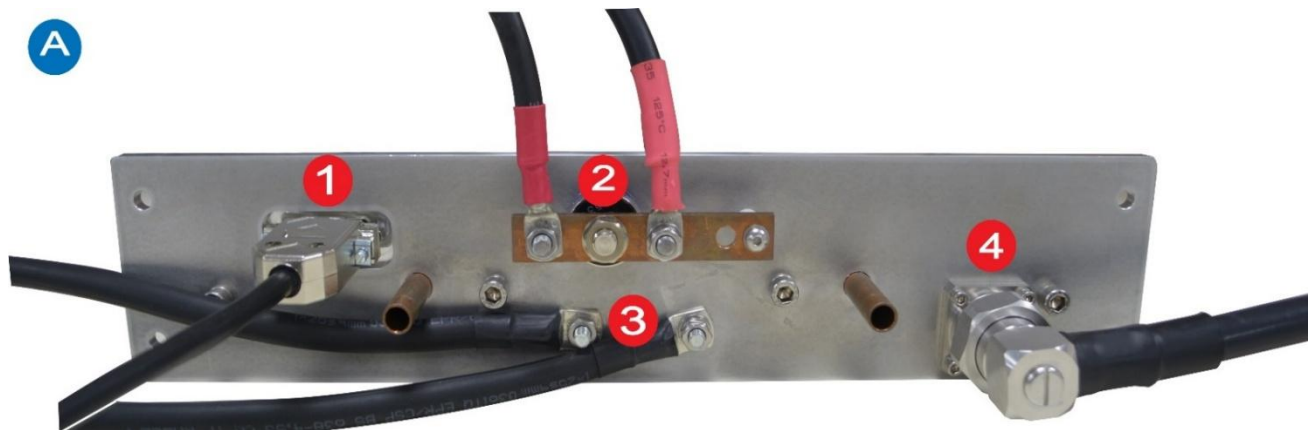
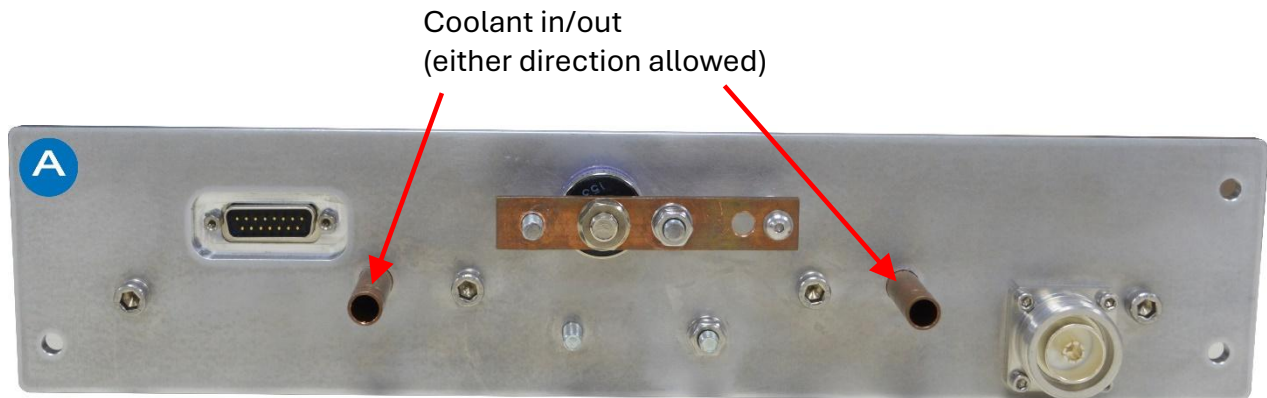
**Coolant
In**

**Coolant
Out**

**RF
Out**

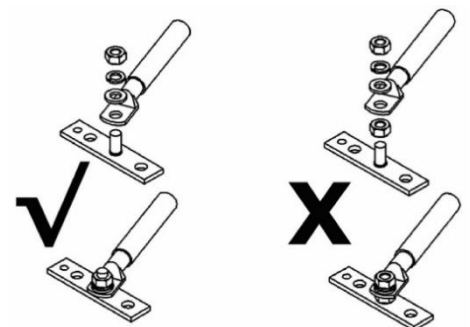
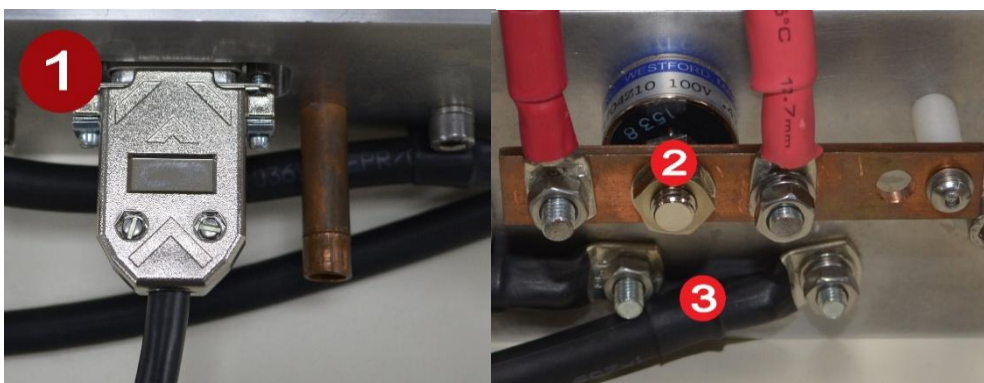
016-0025-00 Combined RF and DC Power Supply – general view

Connections at the RF Power Supply



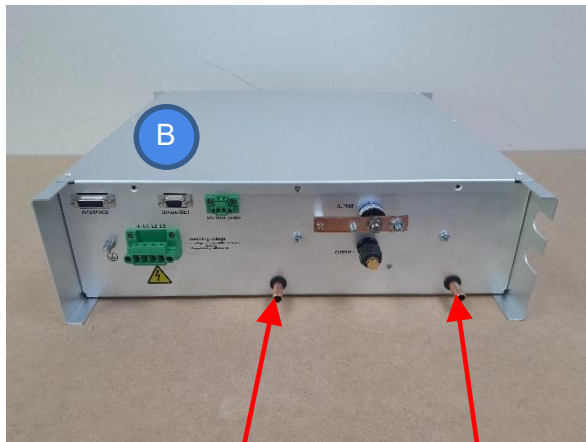
A RF PSU

- ① MODULATION INPUT
- ② +50V CONNECTION(S)
- ③ 0V CONNECTION(S)
- ④ RF CABLE



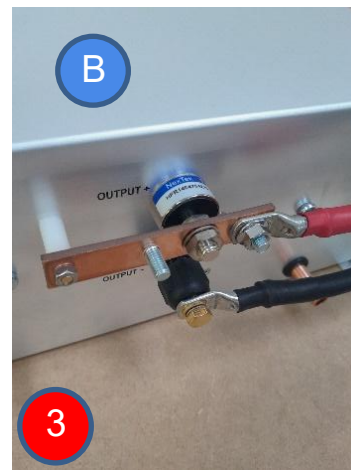
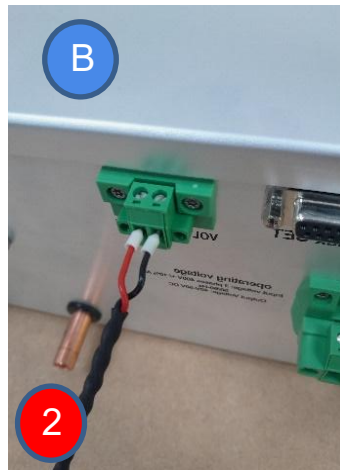
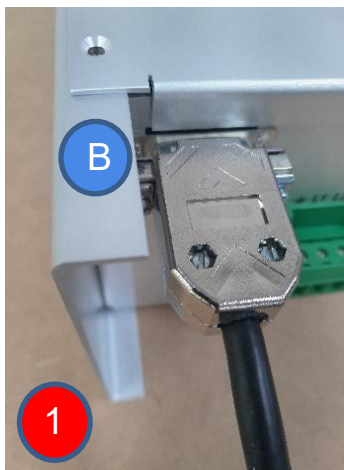
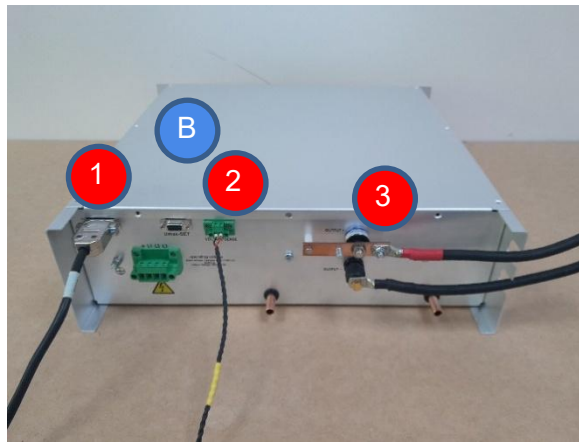
- All chassis metalwork is connected to the DC power supply negative (0V) ③
- Do not loosen or connect directly to the feedthrough filter at ② - use the M6 studs only
- Tighten M6 fixings to 10Nm
- Tighten the RF cable connector to 25Nm

Connections at Luxinar DC Power Supply (005-0646-00)



Coolant
out

Coolant
in



DC PSU



DC PSU CONTROL CABLE



+50V MONITORING CABLE



DC OUTPUT CABLES

- All chassis metalwork is connected to the DC power supply negative (0V)
- Do not loosen or connect directly to the feedthrough filter at ③ - use the M6 studs only
- Tighten all output cable M6 fixings to 10Nm

Section 2

Operation of the SCX 35

Signal Interfacing

The details given below show the connection details for the 25-way Control and PSU Interface Cables and the 15-way Diagnostics Cable (Remote Connectors)

Essential connections and signal inputs to operate the laser are as follows:

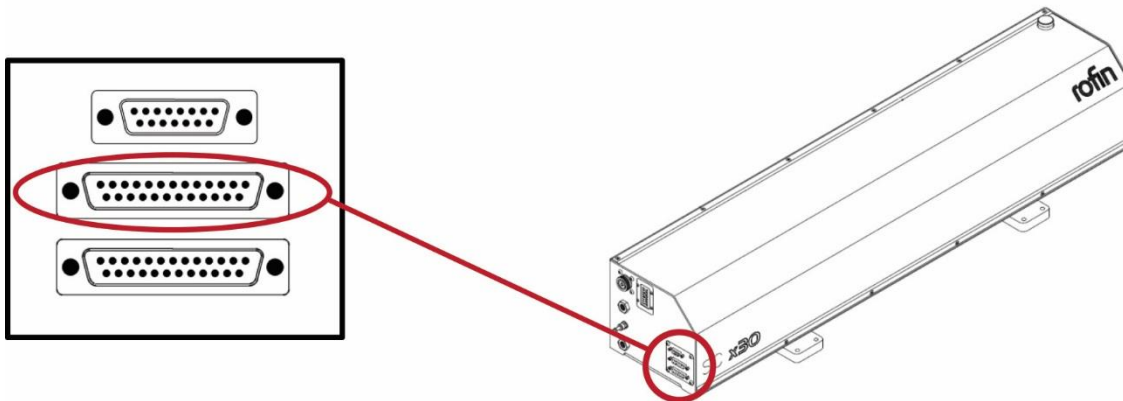
RF Cable - (Laser Head to RF Power Supply Unit)

Connect the RF cable. Ensure that the hex fittings at each end of the cable are securely tightened using a spanner to prevent any possibility of poor RF connection and potential loosening of the connectors during operation of the laser – DO NOT OVERTIGHTEN THE CONNECTORS. Torque settings for the RF cable is 25Nm

25 Way D-Type - PSU Interface Cable (Laser Head to Power Supply)

Cable 091-0119-xx is supplied with the system and must be connected between the Laser Head Module and the Power Supply Interface. The length supplied will be determined by the RF cable length

25 Way D-Type Control Interface Details



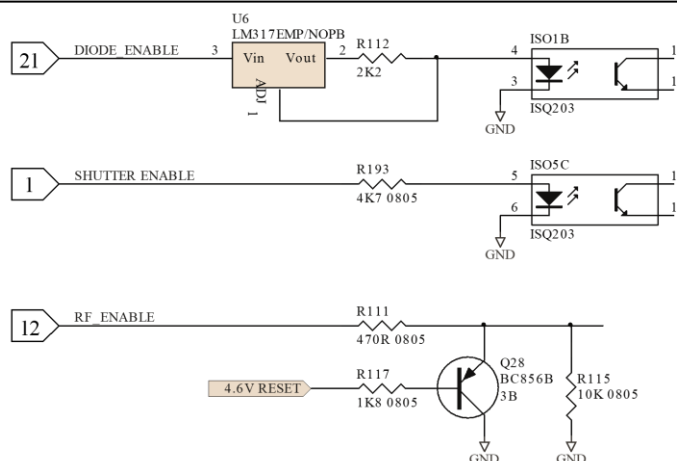
Minimum Interface Connections (Control)

- Enable the External Interlock by connection Pin.19 to Pin.20
- Connect a 5V RF Enable signal to Pin.12
- Connect a 5-24V Shutter Enable signal to Pin.1
- Connect a 5-24V Diode Enable signal to Pin.21 (optional)
- Connect the required modulation signals (RS422) to pins Pin.13 & Pin.14
(Only required when running in External PWM mode)
- The Product Trigger signal, connected to Pin.24, should be switched to 0V (Ground)
(Trigger signal only required when operating in Internal Control modes)

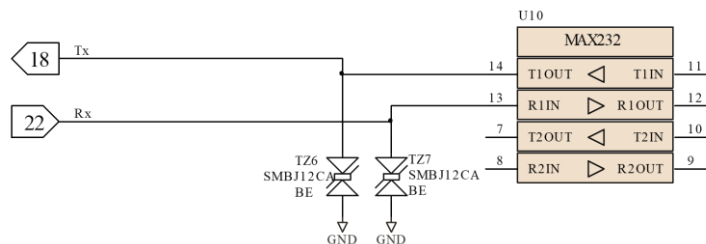
SCX 35 I/O Details Control

Pin No.	Function	I/O Type	Voltage Range
1	Shutter Enable	Input	0V / 5 > 24V
2	User Indicator	Open Collector	active low - 10mA current source
3	Shutter Open	Open Collector	active high - 10mA current source
4	Ground	Ground	
5	Shutter Closed1	Open Collector	active high - 10mA current source
6	Ground	Ground	
7	DC Voltage OK	Open Collector	active low - 10mA current source
8	Emission Lamp Healthy	Open Collector	active low - 10mA current source
9	not used		
10	Reflected RF signal	Output	0 > 5V Analogue
11	Forward RF signal	Output	0 > 5V Analogue
12	RF Enable	Input	0V / 5V
13	+Modulation Input	RS422 Input (+)	0V to 5V
14	-Modulation Input	RS422 Input (-)	5V to 0V
15	Over Modulation	Output	active low
16	+VSWR Status	RS422 Output (+)	0.5V to 3.5V
17	-VSWR Status	RS422 Output (-)	3.5V to 0.5V
18	RS232 Tx	RS232 Output	-6V to +6V
19	External Interlock		return to PIN 20
20	External Interlock rtn		return to PIN 19
21	Diode Enable	Input	0V / 5 > 24V
22	RS232 Rx	RS232 Input	-6V to +6V
23	not used		
24	Product Trigger	Input	0V
25	Ground	Ground	

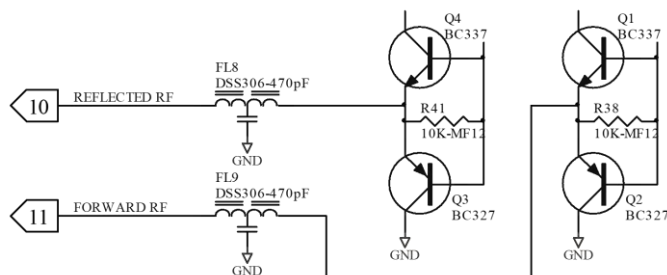
Enable Signals



RS232 Signals



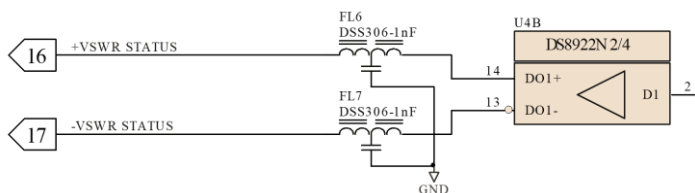
RF output Signals



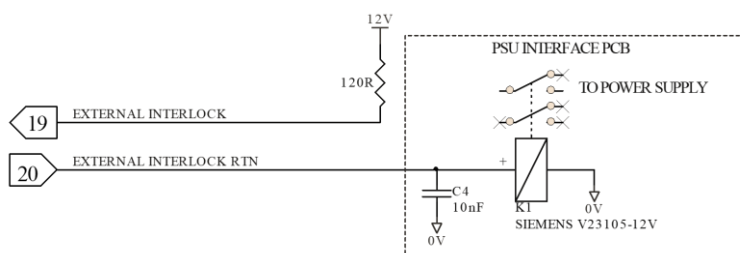
Product Trigger (optional)



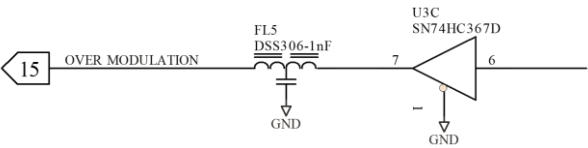
VSWR status Output (RS422)



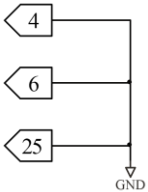
External Interlock



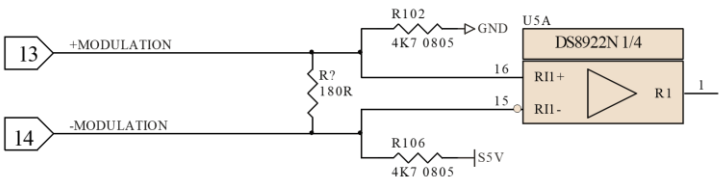
**Over
modulation**



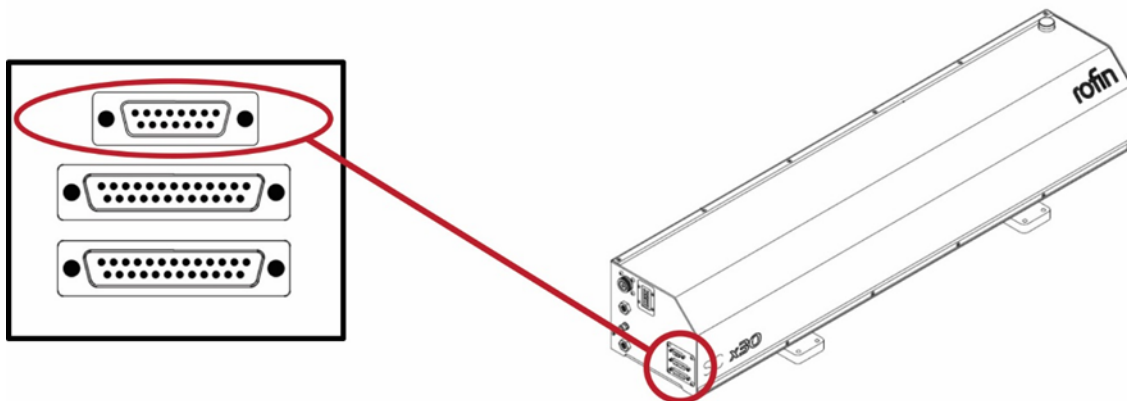
**Ground
connection**



**Modulation
Input
Signal
(RS422)**

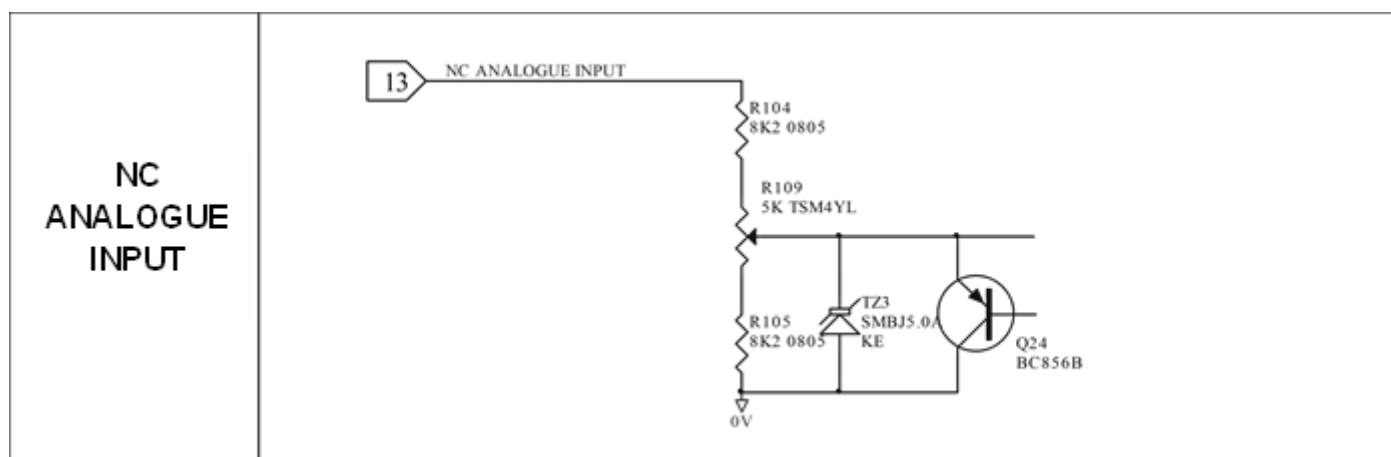


15 Way D-Type Diagnostics Interface Details

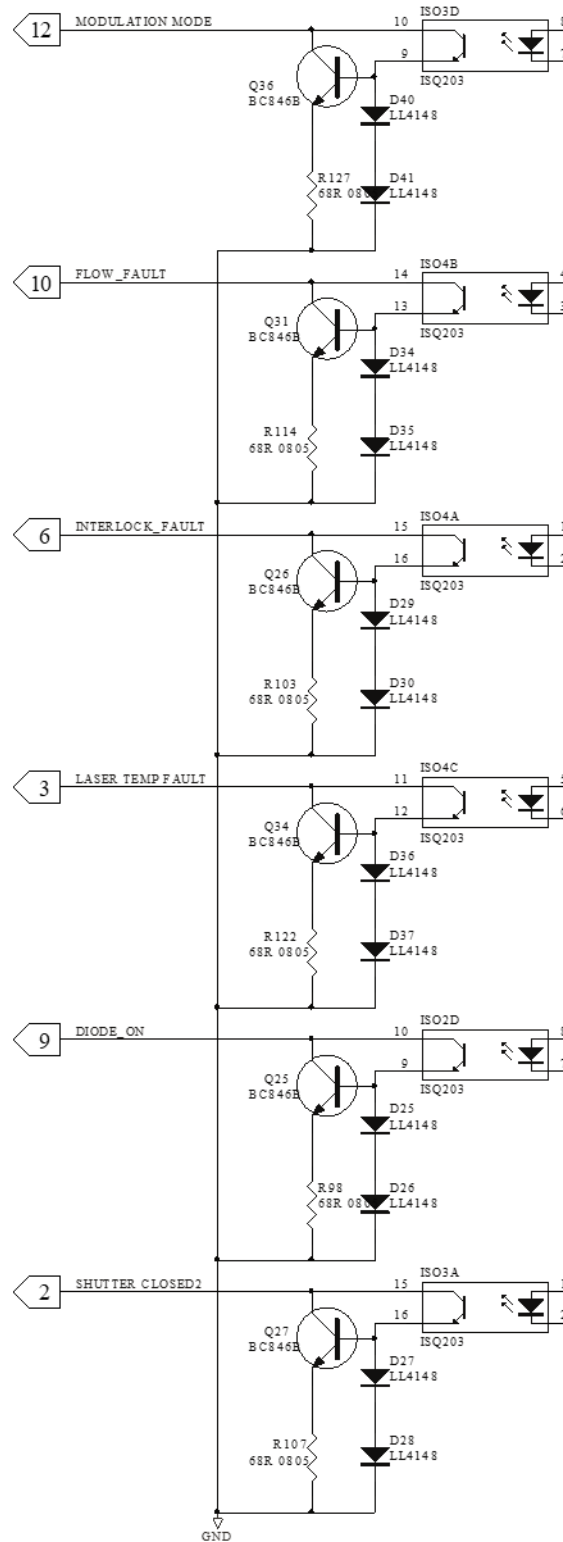


Diagnostics

Pin No.	Function	I/O Type	Voltage Range
1	Not used		
2	Shutter Closed2	Open collector	
3	Laser Temperature Fault	Open collector	
4	Output 3	Open collector	
5	RF Temperature Fault	Open collector	
6	External Interlock Fault	Open collector	
7	External Interlock Return		
8	Ground		
9	Diode ON (where fitted)	Open collector	
10	Water Flow Fault	Open collector	
11	Output 2		
12	Modulation Mode	Open collector	
13	NC Analogue Input		0 > 10V
14	External Interlock		
15	Ground		



Status Monitoring Signals



Emergency Shut Off Switch

The integrator is required to provide an emergency shut off switch on their machinery as specified by the laser safety standard EN 60825. It is recommended that the End User adds the facility for an emergency shut off switch to the control panel for the laser equipment

This switch should be of the red 'mushroom' type with force make/force break contacts and approved to the relevant electrical standards

Power On/Off Key Switch

It is also recommended that the end user adds the facility for a power on/off key switch, such that the system can be switched off and the key removed when the laser is not in operation

Manual Restart

It is a statutory requirement of 21 CFR 1040.10 that the laser output should not be restored automatically if the mains power fails or an interlock is broken and then reset

This is also a requirement of EN 60825, where a remote interlock connection is being used as a safety interlock on an access panel of a protective enclosure that when removed will change the class of the installed system to a Class 4 (Class IV) laser product. The end user must provide for a manual restart mechanism under these circumstances

It is also recommended that the other input / outputs are used for complete fault and status monitoring e.g. water flow, laser not struck, etc. This includes the serial control protocol.

The operating procedure describes procedures for restoring laser operation after a fault condition has been cleared

Additional Control Signal Notes:

VSWR Status – Pin 16 & 17

The RF Power Supply is specified for operation into loads of up to 2.1 VSWR (Voltage Standing Wave Ratio). However, internal monitoring of the reflected power protects the power supply from potentially dangerous load conditions – e.g., the laser will not strike. If a load problem is detected then the RF power supply is shut down for a period of 1ms i.e., no laser output. Following that period any further modulation pulses will be allowed to operate the RF power supply providing that the load problem is removed. If the problem persists then the 1ms shut down periods will be repeated

The VSWR output status can be monitored on pins 16 & 17 of the 25-way D type connector (Control Cable). Over Modulation Status – Pin 15

The maximum duty cycle for the power supply is limited to a predetermined value (e.g., 60%) with a maximum pulse on time (e.g., 400µs). If the modulation input for either of these values is exceeded, then the RF output power will be limited to a safe operating level. See [Page 28](#) for the pulse width, duty cycle and frequency limits. The following rules are applied:

- any pulse > maximum allowed pulse width is truncated to 400µs
- any pulse < minimum allowed pulse width is blocked i.e., there will be no laser output for pulse widths that are less than the minimum allowed pulse width
- any modulation frequency > maximum allowed frequency is blocked i.e., there will be no laser output for frequencies greater than the maximum allowed frequency
- any pulse that is > (1/f) x maximum duty cycle, is truncated to (1/f) x maximum duty cycle

E.g., At 25KHz the maximum pulse width allowed is 24µs (60% duty)

At 25kHz, any pulse of >24µs will be truncated to 24µs

Trigger Input – Pin 24

This logic input is used in Internal Closed Loop mode (**Power Feedback Version Only**), or Internal Open Loop mode. When it is connected to 0V, the internal pulse width modulation (PWM) generator is started. In External PWM mode there is no effect.

An alternative trigger method is to use the serial Start Laser command

RF Forward and Reflected Power Monitor – Pins 11 & 10

The forward and reflected RF power signals are analogue representations of the RF power loaded into and reflected from the laser tube. These signals can be used to monitor the status of correct RF power delivery to the laser tube i.e., an unstruck laser will have a high reflected signal

In general, the ratio of reflected to forward signal should be less than 0.3. Typically, the signals on pins 11 and 10 will be less than 10V DC

RF Enable – Pin 12

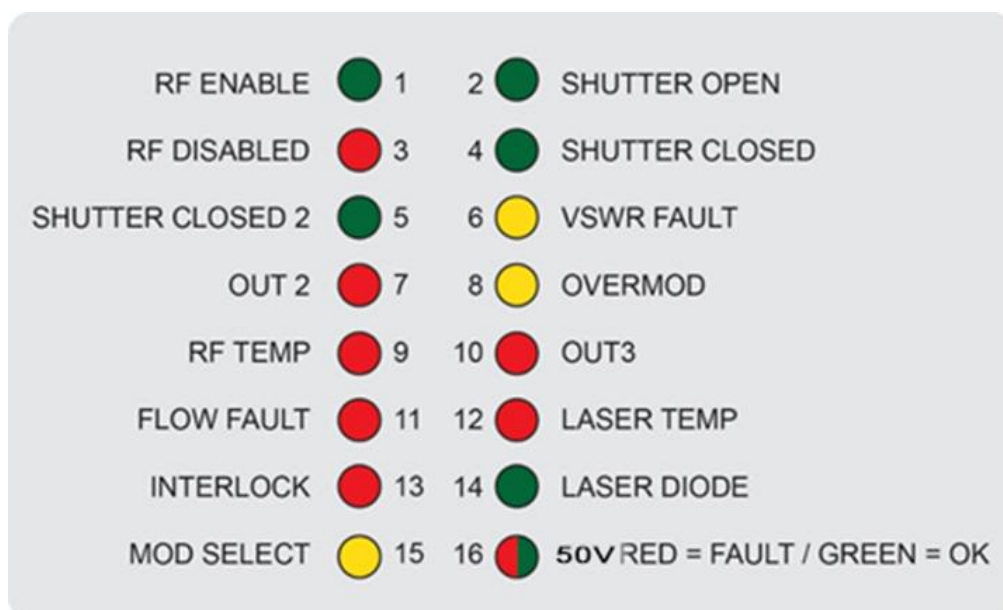
A 5V DC level is required to enable the RF Power Supply. Note that after the signal is applied there is a 500ms delay before the power supply is enabled. This signal can be used to switch off the power supply, irrespective of the state of the modulation input e.g., for safety interlocks

In normal operation, the 5V DC level must be applied at least 500ms before any modulation input to ensure the required laser output. Note that there can be no laser output without the modulation input signals

Status LEDs

There are sixteen status LEDs located on the rear flange of the Laser Head. These are intended as a visual diagnostic aid for the current status of the system. Any red LED will disable the laser. Yellow indications are warning LEDs but will not disable operation.

Green LEDs indicate correct operation



Status LEDs

LED	Function	Colour	Description
1	RF Power Supply Enabled	Green	On = RF Enabled Off = RF Disabled or internally disabled by the laser software
2	Shutter Open	Green	On = Shutter Open Off = Shutter Closed
3	RF Power Supply Disabled by the internal controller	Red	On = Internal fault Off = No fault
4	Shutter Closed	Green	On = Shutter Closed Off = Shutter Open
5	Shutter Closed 2	Green	On = Shutter Closed Off = Shutter Open
6	RF VSWR Status	Yellow	On = RF VSWR fault Off = No Fault
7	Internal use		
8	RF Over Modulation	Yellow	On = Modulation signal not within the specified limits Off = Modulation within the specified limits
9	RF Power supply Over Temperature	Red	On = RF PSU internal temperature limits exceeded Off = RF PSU internal temperature within limits
10	Internal use		
11	No Water Flow	Red	On = Water flow fault Flashing = Low water flow Off = Water flow OK
12	Laser Over Temperature	Red	On = Laser tube temperature limit exceeded Off = Laser tube temperature OK
13	External Interlock Open	Red	On = External interlock circuit fault Off = Internal interlock circuit OK
14	Laser Diode Enabled	Green	On = Laser Diode enabled Off = Laser Diode disabled
15	Modulation Select	Yellow	On = Internal modulation enabled Off = External modulation enabled On during external modulation mode indicates the modulation been disabled by the laser software.
16	DC Power Supply OK	Green/ Red	Red = DC Supply voltage not within specified limits. Green = DC Supply voltage within specified limits.

The status display LEDs used for the RF enable signal, shutter status signal, VSWR and Over Modulation signals can indicate specific fault conditions. The tables below give details of how each of the specific LED combinations should be interpreted

LED 1 RF Enable	LED 3 RF Enable Disabled	Description
OFF	OFF	User has disabled the RF Power supply
OFF	ON	RF PSU has been disabled by the laser software.
ON	OFF	RF Power supply enabled
ON	ON	Not Used

LED 6 VSWR	LED 8 Over modulation	Description
OFF	OFF	Modulation signal OK
OFF	ON	Modulation signal outside of specified limits
ON	OFF	VSWR signals-+ outside of specified limits
ON	ON	RF Power supply fault

LED 2 Detecting Open Position 1	LED 4 Detecting Closed Position 1	LED 5 Detecting Closed Position 2	Interpretation
ON	OFF	OFF	Shutter Open
OFF	ON	ON	Shutter Closed
OFF	OFF	OFF	General Power Down/Open Sensor Fault
OFF	OFF	ON	Shutter Closed Sensor Failure
ON	OFF	ON	Shutter Closed Sensor Failure
OFF	ON	OFF	Shutter Closed Sensor Failure
ON	ON	OFF	Shutter Closed Sensor Failure
ON	ON	ON	General Sensor Fault/Open Sensor Fault

If you require further assistance in regards to the status LEDs, please contact the Luxinar Aftersales Department (see [page 75](#) for contact details). It is advisable to record the status of all the LEDs before contacting the Luxinar Aftersales Department, as this will provide more information for a Service Engineer

Modulation Input Parameters

The modulation input signals should be adjusted for the desired output power as shown in the Output Power vs Duty Cycle graph included with the warranty documentation for the system

The modulation signals should be adjusted to remain within the following limits:

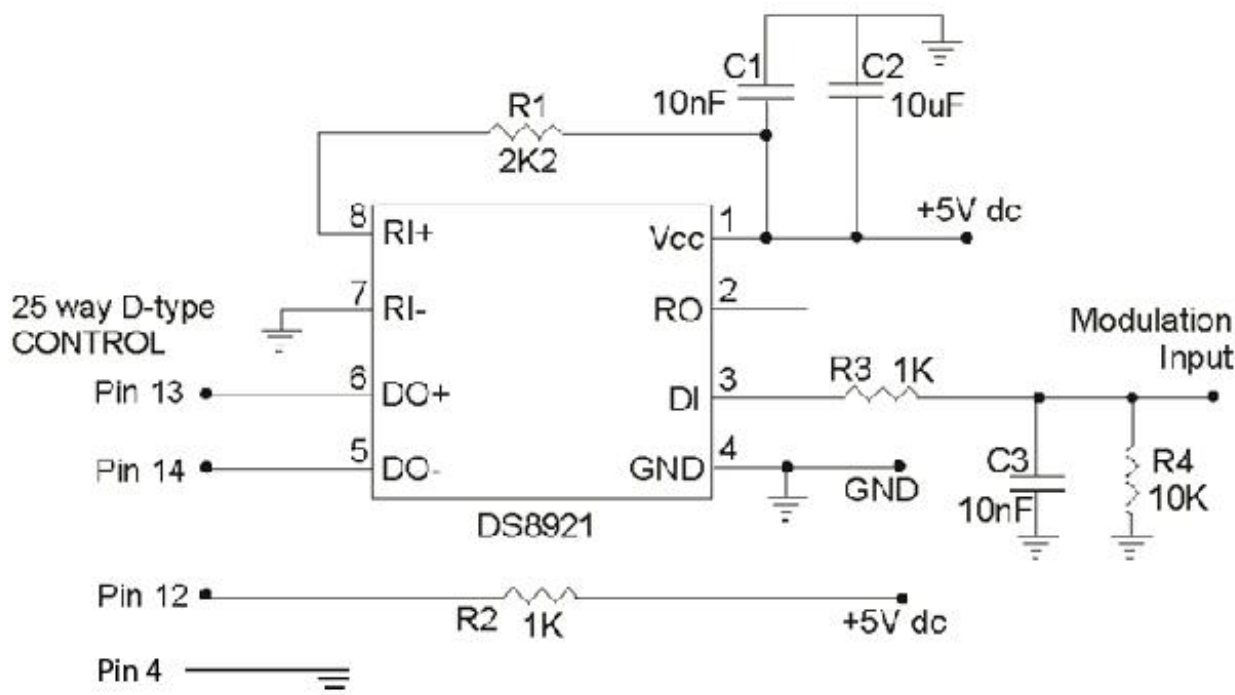
Pulse width limits	2 μ s to 400 μ s
Duty cycle	60%
Frequency	up to 130kHz

At certain pulse frequencies there can be mechanical resonance effects that in turn cause unpleasant acoustical resonance or noise. These particular frequencies should be avoided and are at approximately 1.5kHz and 3.0 kHz for the LUXINAR SCX 35 laser system

RS422 Interfacing

The differential RS422 signals used for driving the modulation input of the RF Power Supply can be achieved in a number of ways

The following is a suggested circuit for producing the signals from a single square wave modulation input signal. Note that the circuit also supplies the 5V DC RF Enable signal. A 0 – 5V composite output signal will be produced on pins 13 and 14. The device used (DS8921) is an RS422 driver from National Semiconductor



Modulation Input Circuit

RF Cable

The RF cable is manufactured to a matched cable length and cannot be altered by the customer. A variety of different lengths are available to order from Luxinar. If the standard length supplied is not suitable, please contact your nearest Luxinar Sales Office or Distributor with details of your preferred cable length

As a general rule, cables are available in various lengths up to approximately 10m. Contact your nearest Luxinar /Distributor sales office for more information. Note that right angle RF connectors and/or converters are also available

For applications where the RF cable remains static e.g., a fixed installation, the system integrator should ensure that any bends in the cable are not reduced below the minimum bend radius specified for the particular RF cable used

For applications where the Laser Head is moving e.g., robotic installation, the RF cable will have a finite lifetime which depends on the number of bends that the RF cable experiences and the smallest bend radius that is required. As the bend radius is reduced, the lifetime of the cable will become shorter. In these cases, the system integrator should allow for RF cable replacement as a maintenance requirement

When installing RF cables, the following general good practice guidelines should be observed:

- Use the shortest length of RF cable possible
- Allow as large a bend radius on the cable as possible. Pay close attention to the minimum bend radius specification for the cable
- When the cable is connected to the RF Power Supply and the Laser Head, ensure that the connectors at either end of the cable are not over stressed i.e. do not try to bend the cable as soon as it exits the connector. Note that right angle RF connectors and/or converters are available for the cable and may help to alleviate this installation issue
- Do not hard clamp the RF cable with 'cable ties' or other clamping devices – allow free movement of the cable
- Do not run the RF cable with other cables or water pipes – use a separate track for RF cable
- Always ensure that the RF connectors are tightened to the required torque setting

In addition, for moving applications:

- Ensure that the RF cable can move freely over the full range of motion of the system with no danger of abrasion to the cable
- Where possible, allow the RF cable to move and bend freely to avoid repeated bending of the cable in the same position.
- Ensure that the RF cable is oriented or positioned to avoid twisting of the cable along its axis

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 backing plate into the beam delivery and the Laser Head once the laser has cut through the plastic sheet



These back reflections can damage beam delivery optics and potentially damage the cavity optics of the laser itself thereby rendering the laser inoperative

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. Please contact the local Luxinar office or its Distributor for more details on optical isolators

Please note that 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

Analogue Output Port (Power Feedback Version Only)

The power sense head features a BNC connector. This provides an analogue voltage scaled to 1V=100W (unloaded). The ground is connected to the system 0V on the User Interface connector, and the output impedance is 50 ohms. Do not attempt to introduce power into this output. This output is active in all operating modes

NC (Numerical Control) Analogue Control Port (Power Feedback Version Only)

This input on the D15 connector (pin 13) allows an external voltage to control the power demand, instead of a serial message. In NC Mode, the user may apply a voltage from 0V to 10V. (1V to 10V is the active range.)

Operating Modes

There are 4 modes offered on the product, and switching between them is achieved solely through serial port commands. A list of these is given below. (Please refer to document 906-0109-00 for details of serial port protocols)

External PWM (Pulse Width Modulation) mode

This is used with an external modulation source, e.g., a Luxinar SC Controller, or a pulse generator and a TTL converter unit. The mark/space duty of the supplied waveform controls the power output of the laser, within its modulation limits

Power can be sensed while this mode is in operation and readings obtained through the serial port
The trigger input is not used in this mode

Note: *The system is shipped in External PWM mode*

Serial commands may be used to interrogate the laser (or change mode) but will not otherwise affect the power output or operate the shutter

The RF Enable input must be high (5V) to operate the RF Amplifier
The Shutter Enable signal must be in the high state to open the shutter

If an error condition should occur, for example, a low water flow, the laser will assert an RF Disable condition, stopping modulation output to the RF Amplifier and closing the shutter
Certain errors can only be reset by a rising edge to RF Enable, for example if the shutter failed to open or failed to close

Trigger delay is not available in this mode

See 'protection scheme', on [Page 32](#)

Internal Open Loop mode (Power Feedback Version Only)

Internal modulation is generated using a pulse width or frequency as selected by a serial command
The power demand is set through a serial command request

The operator has a choice of selecting either

(1) POWER and FREQUENCY

or

(2) POWER and PULSE WIDTH

Requests are limited to the following ranges:

- Power 25 to 350 Watts
- Frequency 1 to 130 kHz
- The minimum pulse width 2 to 400 microseconds

Note: The actual frequency used or pulse width used may be adapted

The pulse width or frequency emitted is adapted from known characteristics of the laser to attempt a best match to the power demanded

In this mode the controller does not vary the modulation after starting the emission

The RF Enable input must be in a high state to operate the laser

The Shutter Enable signal is used in conjunction with the software command to open the shutter. The shutter enable input must be in the high state for the software command to operate the shutter

The trigger input or a software command may be used to start the laser. See the Trigger Delay section on next page

If a fault condition occurs, the laser stops operating and shutter closes. The fault should be investigated and rectified

The following procedure will return the laser to an operating condition

Send commands "Goto Standby", "Goto Run", "Open Shutter", and "Start Laser" - or activate the Trigger signal (to 0V).

Internal Closed Loop mode. (Power Feedback Version Only)

Internal modulation is generated as above, but a PID feedback algorithm attempts to periodically make fine adjustments to either

the pulse width or frequency to attempt to deliver the power demanded. The emitted pulse width is limited to 3 microseconds

The trigger input or a software command may be used to start the laser

RF and shutter enables function as in Open Loop mode

See notes 'protection scheme' on next page

Power & PW/frequency Mode with NC Operation (Power Feedback Version Only)

In NC (Numerical Control) mode, the user may specify the power (up to 350W) and either pulse width or frequency. An analogue control voltage can vary the power up to the user specified limit. The minimum power request is 25W and is selected by applying 1V to the NC input

Applying less than 1V disables the modulation

If 10V is applied the user specified power is demanded. Between these voltages the scaling is proportional and the reaction time in the modulation is typically under 20ms

For any change of the control voltage, the power output will stabilize within 250ms. However, the modulation will change in less than 20ms

Trigger Delay Facility (Power Feedback Version Only)

If running any of the internal modes, a trigger delay feature is available. A delay may be inserted between the active edge of the trigger and start of modulation. This is available in 1 millisecond increments from 0ms to 50000ms (50 seconds.)

If the trigger is cancelled during the delay period, the laser will not fire

Modulation ends when the trigger is cancelled

Note that the active edge is a signal changing from high to low

Protection scheme

Some conditions will cause the laser to stop running for reasons of self-protection. Internal modulation will stop and the shutter closes

The status lamps will help identify the reason. Usually, LED3 will illuminate to indicate the RF is Disabled

Once an error is rectified, the reset procedures mentioned in the modes section will clear the fault condition and the laser may be restarted

External Interlocks

This is a low voltage looped signal and would be connected to one or more emergency stop switches. Do not use this signal to power any other equipment

Water Flow Low

The water flow into the laser system is measured and monitored. If it falls below a pre-set level the laser will be disabled

Laser Temperature

An internal temperature switch confirms the laser tube temperature is normal. If too warm, the laser is prevented from operating.

DC Supply voltage out of range

Normally the DC supply is 50V, but if excess or insufficient levels are seen the RF signal is disabled

RF temperature

The RF Amplifier also contains a temperature sense switch that is monitored by the controller. If too warm, the laser is disabled

Shutter Error

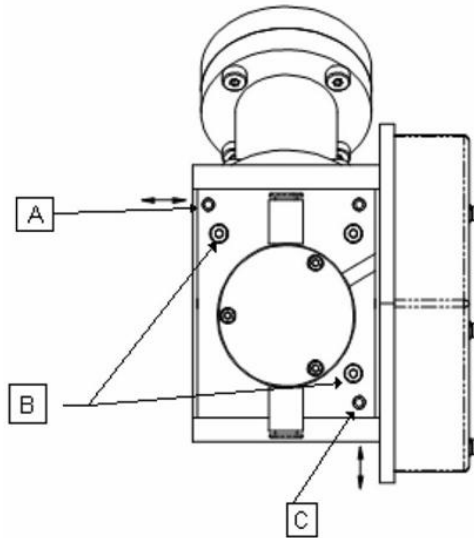
If the shutter remains in neither the open nor closed positions for more than a fraction of second, it is interpreted as an error and the system will stop. Shutter errors can be cancelled by a rising RF Enable signal.

Control Limits (Power Feedback Version Only)

If in Internal Closed Loop mode and the control algorithm finds that no adjustment of width or frequency will be sufficient, then after several adaptive cycles, the laser is disabled.

Beam Alignment (Mk1 Only)

The power sensor contains a mirror system that turns the beam from horizontal exit to vertically down. There are 3 trimming screws to make fine adjustments, as shown in the figure below.



Adjustment screws on the Power Sense Unit

A: Mirror adjustment Screw (Horizontal) B: Mirror Plate locking Screws C: Mirror Adjustment Screw (Vertical)

1. To adjust the laser beam position first slacken the mirror plate locking screws 'B'
2. Use the mirror adjustment screws 'A' and 'C' to adjust the vertical and horizontal position of the beam
3. Once the beam position has been correctly adjusted retighten the mirror plate locking screws 'B', DO NOT over-tighten the screws

To assist in adjustment without using the laser in a high power mode, the laser diode may be enabled. This identifies the centre of the infra-red beam for short range use.

Laser Diode Operation

The internal laser diode may be enabled by applying 5V to the Diode Enable pin (21) on the User Interface connector. Laser diode pointer only visible when shutter is closed.

Front Mounted connector (Power Feedback Version Only)

The Power Feedback Module now connects to the front output panel of the system. For more information on this connector refer to Singal interfacing.

Section 3

Maintenance

General Information

The Luxinar SC range of systems, have been designed to be low maintenance processing lasers. There is no requirement for internal routine maintenance procedures

The system's sealed construction and limited number of moving parts ensures trouble free and reliable operation

For the longevity of the laser, we recommend that the output window is protected from exposure to dust and any other form of contaminants, such as oil, condensation etc



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 at the beginning of this manual (Safety) before attempting to operate or service the system. Always ensure that the laser system is switched off and isolated from the mains supply before attempting any cleaning or maintenance procedures

Optical Surfaces

The information contained in this section is intended to be used as a general guideline for cleaning optical grade materials

It is strongly recommended that a thorough understanding of this section be attained before any optic cleaning or handling procedures are attempted

Peak performance and efficiency of optical systems is only possible when the surfaces of the optical components are absolutely free of contamination

For example, a film of oily substance or specks of dust can substantially reduce the performance of the system. In most cases this will be seen as a gradual deterioration in the intensity of the beam on the target material i.e., slower cutting speed

This section is designed to introduce correct and safe methods for the cleaning of optical components



Optical surfaces can be irreparably damaged by seemingly harmless debris or lint

Output Window



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

The only externally exposed optical surface on the Luxinar SC system is the output window or lens.

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. In extreme cases this may permanently damage the optic and its coatings.

If removed improperly permanent damage can be caused.

Switch off the laser system and isolate from the mains supply

Remove any beam delivery or beam shroud which is attached to the front flange of the Laser Head and inspect the output optic.

Clean if necessary, observing the methods described in the following. Do not remove the optic from its holder during the cleaning process

Optics Cleaning Materials

Lens tissue (first quality).

Tissues (non perfumed for rough work, wiping hands, etc)

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 Optical Surfaces

Hands should be thoroughly washed to remove all oils, perspiration and grit. Lint free gloves must be worn to prevent contamination of the optic

If there is visible dust, lint or other solid matter on the optics surface, gently blow it off with a photographic blower brush

Coated optics require careful handling, even the type labelled 'hard-coated'

If the 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 pad should then be drawn across the surface in one smooth stroke using very light pressure. The soiled pad must then be discarded

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

Where severe contamination has permanently damaged the optic, contact a Service Engineer

Purge Gas Supply

A purge gas supply may be required when the system is operated in humid or very dusty environments. Contamination of the optics will result in optics damage and a reduction in the optical output power from the Laser Head

If the internal or external beam delivery is contaminated with fume, water vapour or debris then 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 on Page 44 of this manual

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 mains 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 cabinets, etc

Take care not to allow entry of water into any of the electrical cabinets and ensure no water or cleaning fluid comes into contact with the output window / lens on the Laser Head



Section 4

Technical Specification

Laser Head Details

Laser Tube	Sealed Cavity, RF excited, Diffusion Cooled, Slab Carbon Dioxide Laser
Excitation Frequency	81 MHz
Expected Tube Lifetime	>10,000 hrs continuous running (at rated power) (this is an expected lifetime figure and not a guarantee)
Output Power	350 Watts Guaranteed at 20°C coolant temperature 400µs pulse width at 60% duty cycle. Allow 1.0% per °C power decline for coolant temperatures up to 30°C
Power Range	20 - 350 Watts
Peak Power	> 880 Watts
Power Stability	± 5.0% Typical ±7.0% Guaranteed ± 1% (With active stabilization) Typical ±2.0% Guaranteed
Pulsed Frequency	Up to 130kHz (Quasi-CW operation) (Full modulation depth below 10kHz)
Pulse Duration	2µs to 400µs
Max Duty Cycle	60%
Pulse Energy	14mJ to 280mJ
Pulse Rise/Fall Time	<60µs
External Dimensions (mm)	1178(L) x 263(W) x 232.5(H)
Weight	63 kg

Laser Beam Characteristics

M ² (K)	<1.2 (>0.83)
Beam Divergence	<2mrad (full angle)
Beam Ellipticity	<1.20:1
Beam Pointing Stability	<0.25 µrad (half angle)
Beam Diameter (1/e ²) For standard beam correction	7± 0.5mm
Wavelength	Refer to Appendix
Polarisation	Linear (45 degrees to base), purity > 100:1

Laser diode pointer specification



Warning – Class 3R visible laser radiation. Avoid exposure to direct and scattered radiation

Wavelength	635± 10nm
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

RF Power Supply

Output Frequency	81MHz
Output Power	7.2kW average (12kW peak)
Input Voltage	50V DC ± 2%
Input Current (average)	144 Amps (max RMS)
Input Current (peak)	240 Amps Peak @ 50% duty cycle
RF Cable (connects between the Laser Head Module and the Power Supply Unit)	
Cable Type	Coaxial Double Shielded
Diameter	15mm
Static minimum bend radius	52mm – for a static cable
Dynamic minimum bend radius	400mm – for a moving cable
RF connector torque setting	25Nm (18.45 ft-lb)
Cable length	Depends on customer order. In general, specific lengths are available from approximately 1 to 10m. For more information on RF cable properties and lengths contact your local Distributor Sales Office

Cooling Requirements

Heat Load	8kW max
Coolant flow rate	≥6 litres/min
Coolant temperature	19 – 25°C (± 1°C from coolant setting)
Coolant pressure	> 3.0 bar (44 psi) < 6.0 bar (88 psi)
In line filter	100µm

For more detailed information on the Cooling Water Specification see [Page 41](#)

Environmental Specification

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

Ambient temperature	+5 to +40°C (+41 to +104°F)
Storage temperature*	-10 to +70°C (+14 to +158°F)
Humidity	10 to 85% relative humidity (non-condensing)
Altitude:	< 2000m
IP Rating	IP54

* note that when storing or transporting the system, the water cooling pipes must be drained, then purged with compressed air to prevent the possibility of freezing and damage to the cooling circuit

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

Hour Counter (where fitted)

Counter range (hrs)	0 to 99,999
Resolution (hrs)	0.1

Note: The hour counter is a visual aid for assessing the number of hours that the Laser Head Module has been operational, the counter cannot be reset. The hour counter will start to increment as soon as the RF enable signal is active - for more information on the RF Enable Signal, refer to [page 59](#).

Cooling Water Specification

General Information

External cooling circuit materials must be chosen to avoid corrosion. Do not use aluminium, zinc, mild steel or cast iron materials in the cooling circuit. Suitable materials are stainless steel, copper, copper alloys and opaque plastics. To prevent germ formation in the cooling circuit only use tubing that is impervious to light. To avoid condensation forming on the resonator and beam delivery optics, the temperature of the cooling water must be kept above the dew point

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:

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 the 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

Suspended Particles

To remove particulate contamination, a filter with a pore size of 100µm 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

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-WTK-YM20.88	(In Netherlands 480-WTK-YM20NL)
Volume 200 – 350 litres	Order No.: 480-WTK-YM60.88	(In Netherlands 480-WTK-YM60NL)
Volume 351 – 500 litres	Order No.: 480-WTK-YM100.88	(In Netherlands 480-WTK-YM100NL)

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

Nalco Deutschland GmbH,
Solmsstr. 41,
60486 Frankfurt,
Germany

M +49 (0)1702250338 T +49 (0)7143 404162 E slund@nalco.com

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

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 the NALCO water treatment kit

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

- NALCO 73199 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, 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

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

- 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 in a 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

Frost Protection

If the cooling system or chiller which supplies the cooling for the laser system 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

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

Germ Formation in the Cooling Water

If the water system becomes contaminated with germs (algae and slime) then it will become necessary to treat the system to remove the bacteria. The germ contamination level can be checked using a test kit to ensure a bacteria level of <1000 cfu/ml is not exceeded

The addition of the Biocide NALCO 77352 (manufactured by NALCO) removes bacteria (algae and slime) from the cooling water and the cooling water circuit. NALCO 77352 is supplied as a liquid and the concentration to be used is: 150 ppm in the cooling water e.g., 1.5ml per 10 litres of coolant liquid – take care not to overdose the system

After addition of the biocide additive, the system should be run for 48 hours and then the germ contamination level should be checked again using a test kit

Pay particular attention to the instructions of the manufacturer of NALCO 77352 Biocide

Frost Protection

If you wish to add anti-freeze to the cooling water, please note that the addition of additives will affect the cooling characteristics of the water and can reduce the effectiveness and efficiency of any chiller that is used. (Pay particular attention to the instructions of the anti-freeze manufacturer). In this case, please consult LUXINAR. A combination of anti-freeze and corrosion inhibitors may result in undesired chemical reactions. Luxinar recommends NALCO 73199 mixed with pure ethylene glycol or the use of an inhibited anti-freeze based on glycol. Please consult Luxinar for further information and advice on frost protection

NALCO products are available in most countries around the world but if they are not obtainable for some reason, the inhibited anti-freeze Dowtherm SR-1 produced by Dow Chemical can be used in a concentration of 20% - 35% by volume. Do not use less than 20% by volume as the corrosion protection will not be effective. Concentrations of less than 10 % by volume can lead to the formation of highly corrosive glycol acids. If Dowtherm SR-1 is used, there is no need to add biocides or hardness stabilizers

If none of the above additives are available, a comparable product from alternative suppliers can be considered, provided that it meets the required specification to protect against the formation of corrosion, boiler scale deposit and algae growth. We would strongly advise that you check with Luxinar prior to using alternative suppliers

Suggested Additive Suppliers:

NALCO 73199 Corrosion Inhibitor and NALCO 77352 Biocide Nalco European Operations Leiden, The Netherlands
M +49 (0)1702250338 T +49 (0)7143 404162 Web www.nalco.com

DOWTHERM SR1 Albion Chemical Distribution Cleckheaton, UK

Tel +44 1274 864444

Fax +44 1274 851252

Web www.dow.com

Purge Gas

The SCX 35 Laser Head is sealed with a rubber gasket material between the main structure and the external and internal system covers. In relatively clean environments, these seals will normally prevent dust, fume and debris contamination of the optics and other parts inside the Laser Head

If the internal or external beam delivery is contaminated with fume, water vapour or debris then these contaminants can absorb the laser energy and cause laser power fluctuations and steering of the laser beam

Where contamination is suspected to be an issue, the system may require a clean, dry and non-flammable purge gas supply for slight pressurisation of the Laser Head and/or the external beam delivery

The purge gas can also be used to prevent condensation on the water cooled optics and other parts inside the Laser Head

Note that when using a chiller for cooling the system, the water temperature should be set to above the dew point avoid condensation on pipe work, etc. Where this is not possible, then the purge gas can be used to prevent condensation inside the Laser Head

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 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 front 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 used. Removal of the plug will create 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:

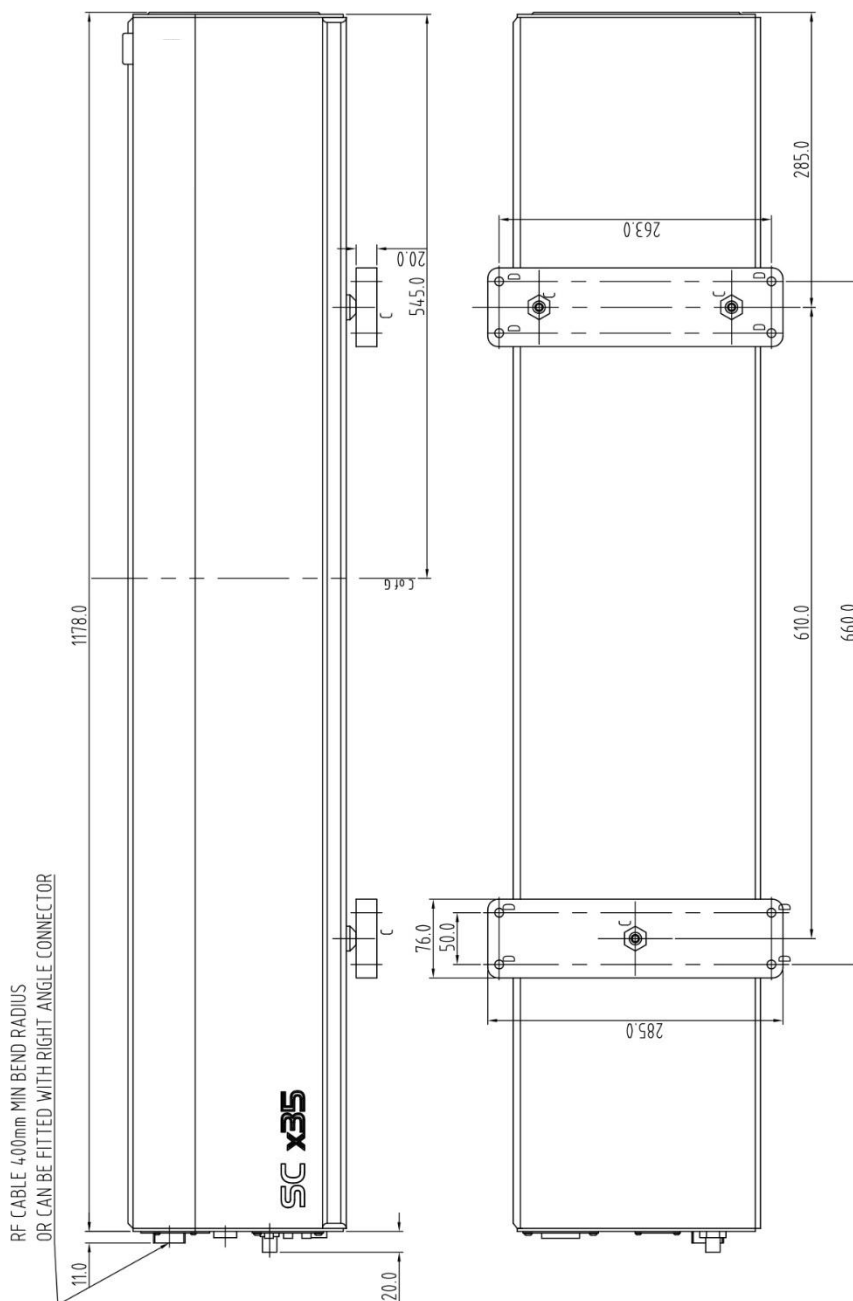
Nitrogen Purity Grade	≥ 4.6 (99.996% purity)
Pressure	1 to 3 psig (0.07 to 0.21bar)
Flow Rate	1 to 2 l/min
Air Purge Gas Specification	
Oil	≤ 0.005 mg/m ³
Water	≤ 0.05 g/m ³
Particles	≤ 0.05 µm
Pressure bar)	1 to 3 psig (0.07 to 0.21
Flow Rate	1 to 2 l/min

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

Fuses

There is only one user-accessible fuse (500mA, anti-surge, 20 x 5mm) on the system. This is either mounted on the 016-0025-00 rear panel – or separately associated with interface PCB 005-0607-00. This fuse also protects the control board in the laser head and the DC power supply for the laser tube's pre-ioniser circuit. Combined RF & DC Power Supply 016-0025-00 also includes a miniature circuit breaker in the mains supply.

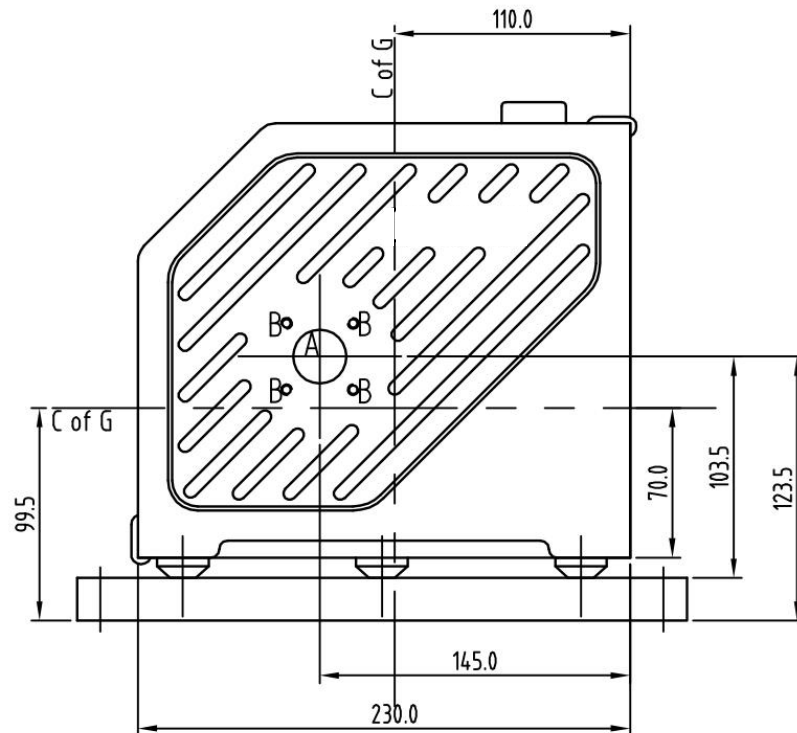
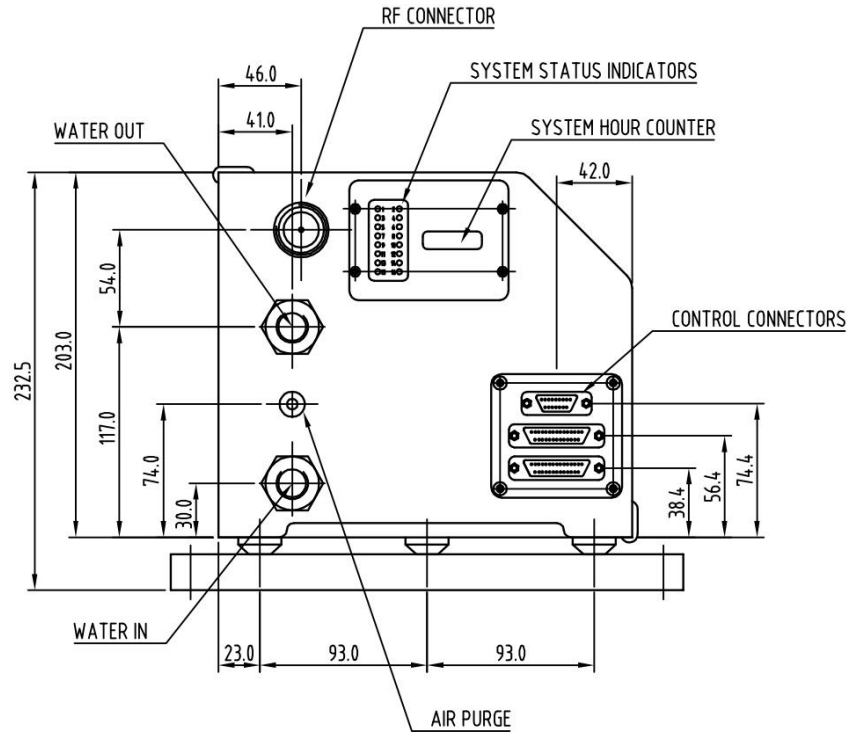
Dimensional drawings and fixing details



Fixings 'C' – 3 off – M10 x 1.5 Tapped (thread depth 15mm)

Fixings 'D' – 8 off – Drilled thro Ø 8.5mm, for M8 bolts

Dimensions and fixing brackets (all dimensions are in millimetres)



Laser Output Plate

Hole 'A' – 1 off – Ø 23.0

Fixings 'B' – 4 off – M5 x 0.8, equi-spaced on a 44.00 P.C.D.

System End Panel Dimensions (dimensions in mm)

Power Sense Unit 1

Depending on your system the following power sense units are provided

These units extend the length of the system by approximately 200mm and are shipped fitted to the laser, including an electrical interconnection to the end-plate of the laser

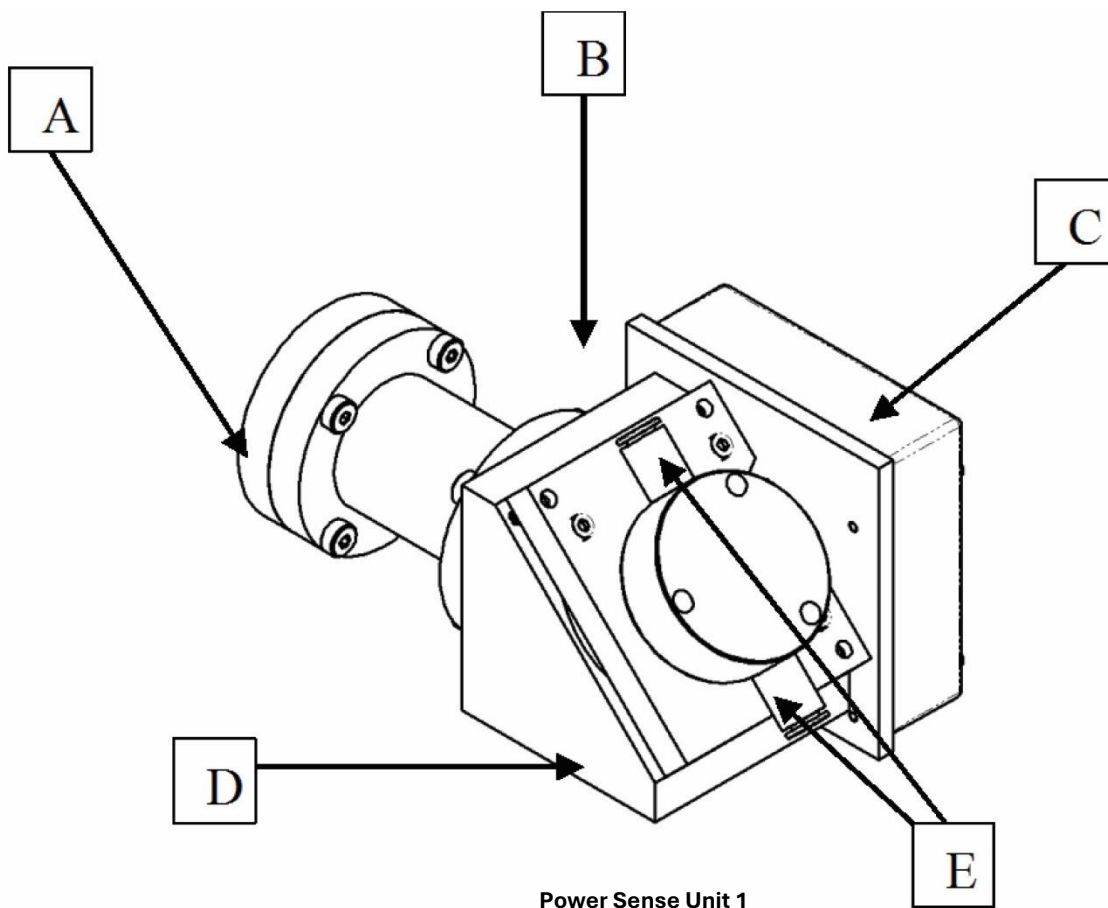
The units consist of a partial mirror, heat sensing device and amplifier electronics. The unit is powered from the main controller via a screened multi-core lead. The same cable carries a voltage signal proportional to the emitted power of the laser back to the controller

The thermal sensor should be provided with a water flow via the 12mm OD quick connect hose adapters

Voltage scaling 1V/100 Watts

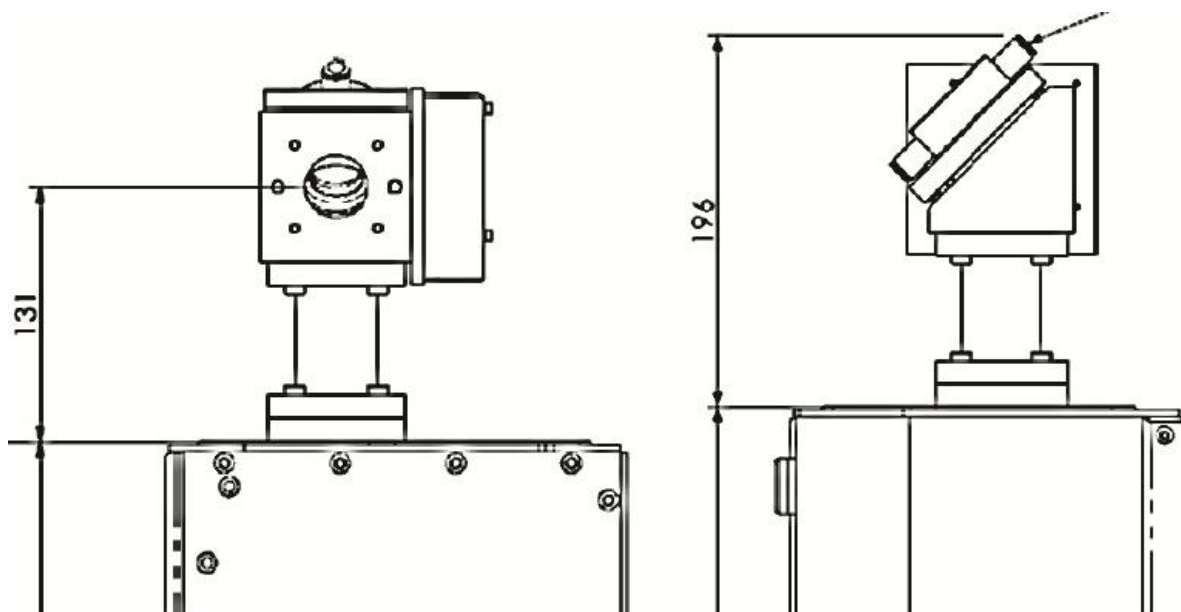
Output source impedance 50 ohms

A screened signal/power cable runs from the enclosure “C” to the end plate of the laser, mating with a 12-pole chassis connector, allowing the power sense unit to be unplugged.

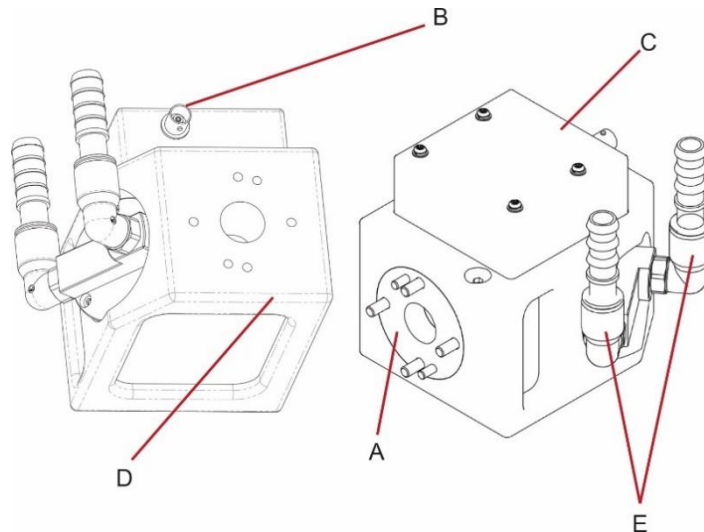


- A** Attachment Flange
- B** Analogue Output (below)
- C** Electronics Housing
- D** Mirror and Sensor housing
- E** Coolant Connections

Insertion loss	< 2%
Beam Orientation (after fitting)	90° to system length, perpendicular to power feedback unit output face
Open aperture diameter	20mm
Weight	< 2.0kg
Laser System	10.6μm
Output Power Range (Watts)	25 to 330
Output Frequency Range	1 to 100 kHz
Input Pulse width Range	2 to 400 microseconds



Power Sense Unit 2



Power Sense Unit 2

- A** Attachment Flange
B Analogue Output (below)
C Electronics Housing
D Mirror and Sensor housing
E Coolant Connections

NOTE: Offset 2.18mm

The Luxinar SCX 35 Power Feedback Module MKII should be included in the main coolant circuit for the laser system.

For further details on the required coolant specifications refer to page 41

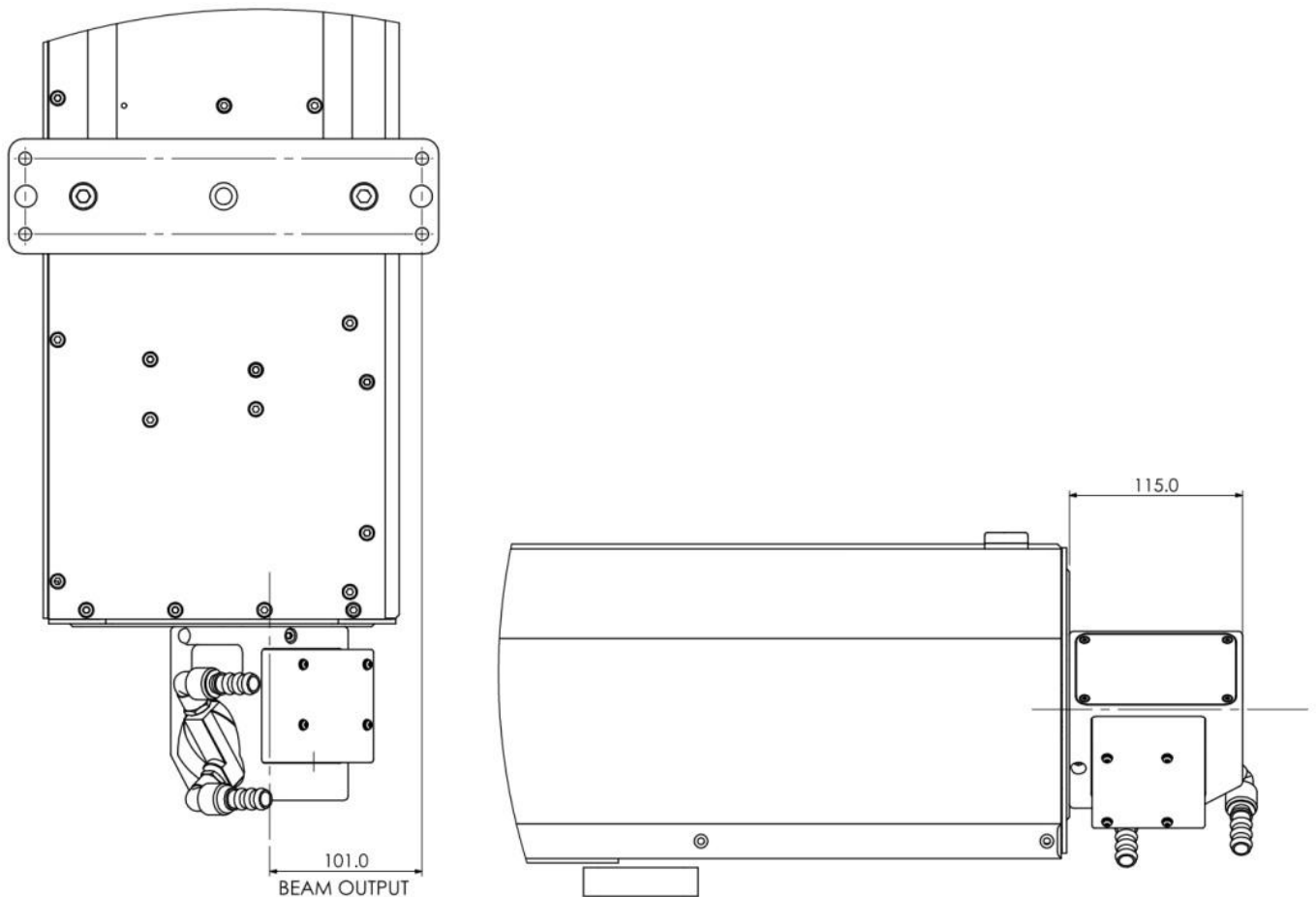


This Luxinar SCX 35 Power Feedback Module MKII extends the length of the system by approximately 120mm and is shipped fitted to the laser. Communication between Luxinar SCX 35 Power Feedback Module MKII and the laser system is provided through a connection located on the output flange of the laser system

The Luxinar SCX 35 Power Feedback Module MKII consists of a partial mirror, heat sensing device and amplifier electronics. The module is powered from the main controller via a screened multi-core lead. The same cable carries a voltage signal proportional to the emitted power of the laser back to the controller

Voltage scaling	1V/100 Watts
Output source impedance	50 ohms
Insertion loss	< 2%
Beam offset (after fitting)	1.8mm parallel to base, 1.8mm perpendicular to base
Open aperture diameter	20mm
Weight	< 2.0kg
Laser System	9.3µm
Output Power Range	25 to 260W
Output Frequency Range	1 to 100 kHz
Input Pulse width Range	2 to 400 µs

A screened signal/power cable runs from the enclosure “C” to the end plate of the laser, mating with a 12-pole chassis connector, allowing the power sense unit to be unplugged.



Section 5

General Information

Operation description of SCX 35

The SCX 35 laser is a high-frequency excited, diffusion-cooled CO₂ Slab Laser, designed for industrial use as a cutting, welding or marking tool

Figure 13 shows the principle of operation of the Slab laser. A laser gas discharge (active zone) (8) is established between the wave-guiding electrodes (9) by a radio frequency voltage (5, 10). The rear mirror (7) and output mirror (3) form the optical resonator. The laser beam (1) is produced within the resonator and is emitted through a window (2). Water (4, 6) is used to cool the electrodes

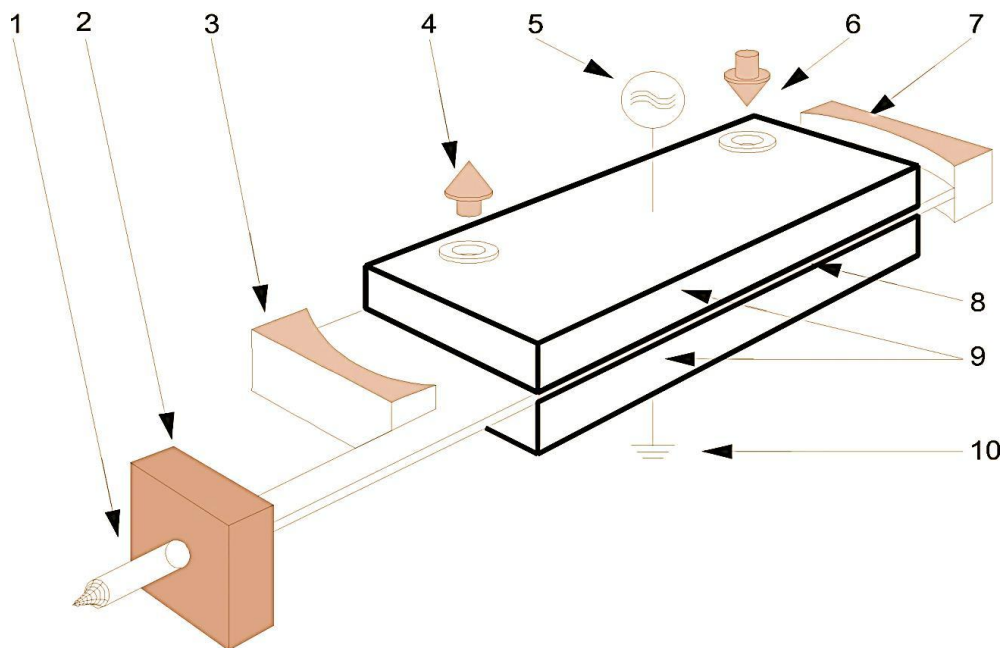


Figure 13 Diffusion Cooled Slab Laser Layout

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 (free space) and the y (waveguide) directions. In order to make the beam round it is necessary to reshape the output beam using reflective correction optics

This can be achieved by using single optical elements or the combination of cylindrical and spherical optics

Depending on the configuration of the resonator there may also be diffraction effects due to the output optic of the resonator. This can produce secondary lobes on the main output beam that need to be removed or filtered out. This is achieved by the use of a spatial filter

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

Laser Head Layout

The layout of the inside of the Laser Head housing is shown below. After exiting the Laser Tube (1), the laser beam is turned through 45 degrees by a plane turning mirror and is then directed onto a spherical turning mirror. Both turning mirrors are contained within the Turning Mirror Module (2). The spherical mirror focuses the beam to a line focus at the Spatial Filter Module (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 Beam Correction Module (4)

Here, a third turning mirror (cylindrical element) corrects the shape of the beam to make it round and the beam is then deflected from another plane turning mirror, which directs the beam towards a Safety Shutter and then the Final Output Window (5)

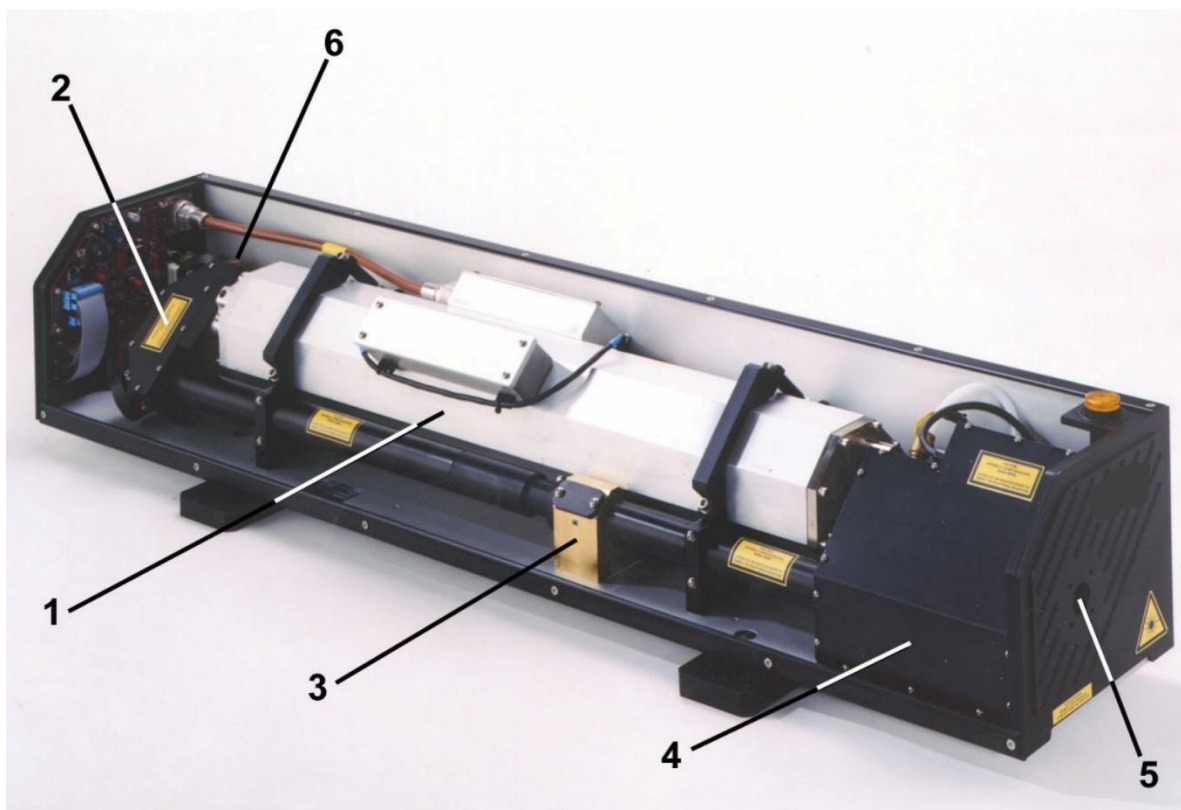
The Safety Shutter is used to block off any unwanted laser output during operation, using a rotary solenoid and a reflective blade.

When in place, the Safety Shutter deflects the beam into a thermal dump

The power sense unit is not shown in the following image. It is fitted to the final output window, position (5)

The Laser Tube, Spatial Filter and Shutter Module are all water cooled and the water flow is monitored by a Flow Switch (6)

The Power Sense Unit is attached onto the main laser assembly at position (5)



Laser Head Layout



Enquiries

Every effort has been made to ensure that the information in this manual is correct; however, components may be subject to change

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

Warranty Information

Luxinar warrants that the product will be free from defects in material and workmanship for twelve (12) months from delivery, if a warranty for the individual product is not specified. All special warranty terms, e.g., Laser tubes, etc., are contained in the SC System warranty terms that are current when the system is purchased. Copies of the SC System Warranty Terms can be obtained from Luxinar

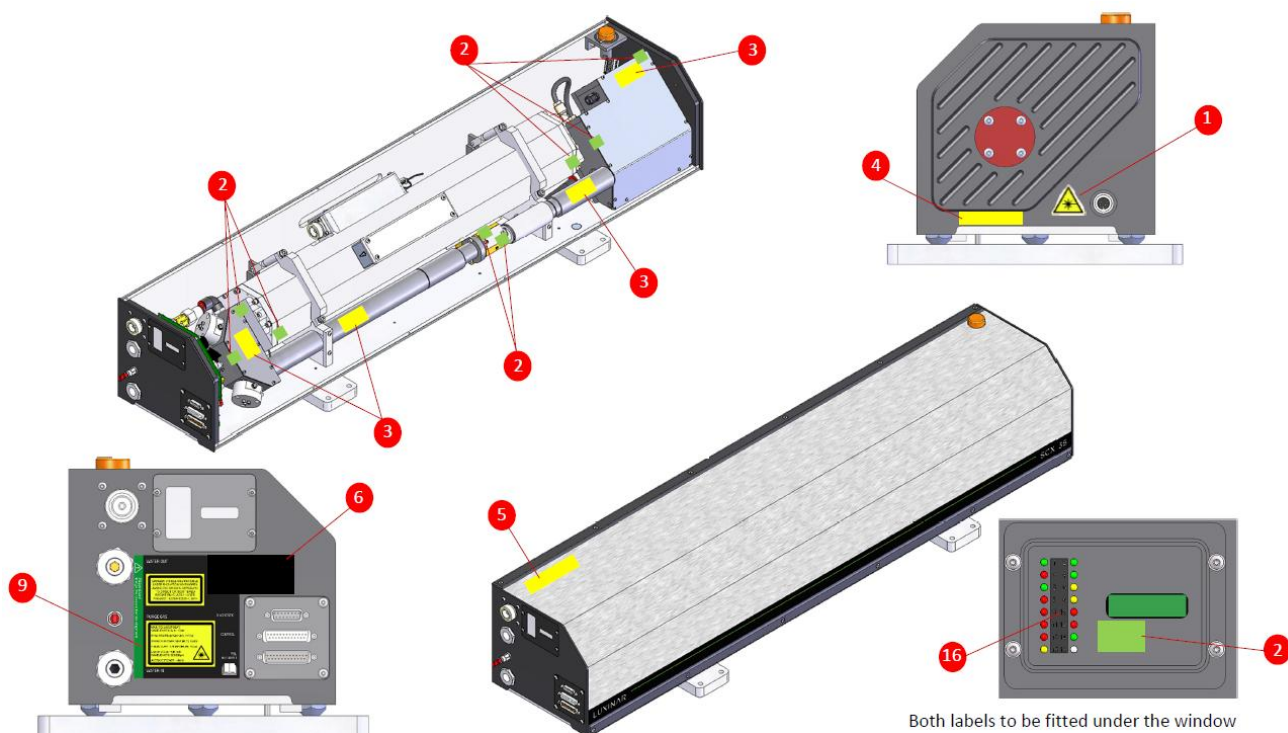
Luxinar only warrants to the original purchaser and only at the original location

Major sub systems manufactured by other firms but integrated into Luxinar 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., Aftersales Department

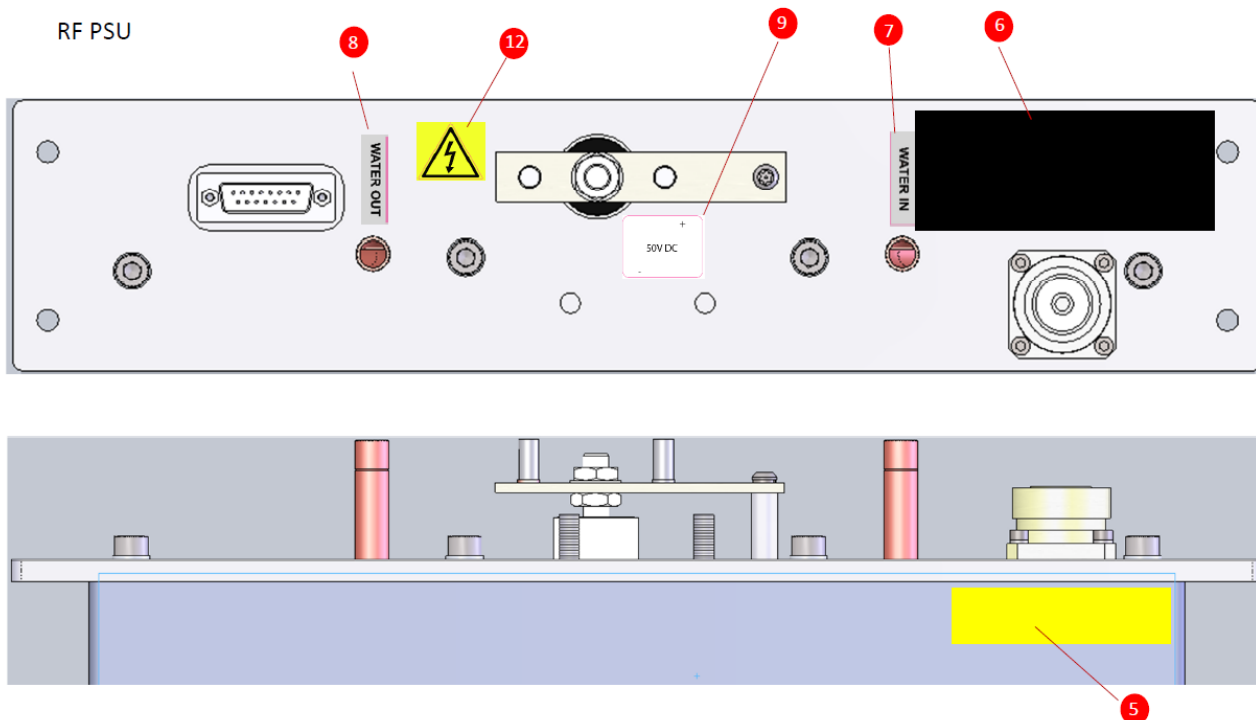
The warranty does not cover misuse of the equipment, negligence or accidental damage. Please also note that damage due to laser beam back reflection, insufficient water-cooling flow, corrosion, condensation or freezing of water pipes is also not covered by the warranty for the system. Please consult the section on Installation and Operation (Section 3) for more

Appendix 1

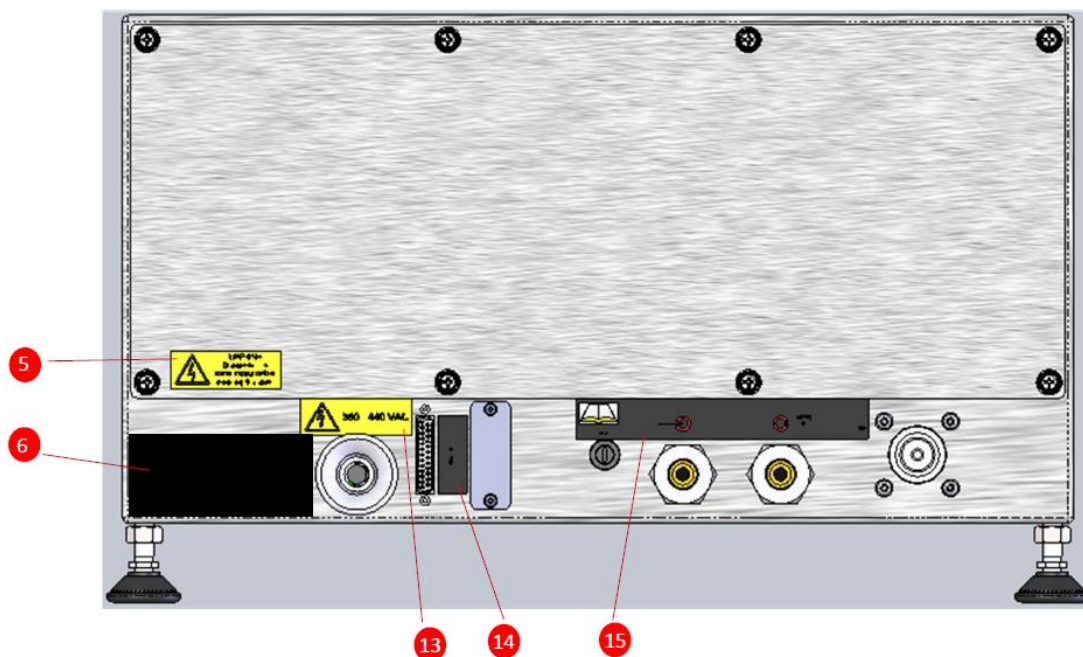
Safety Labels

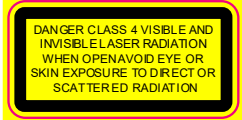
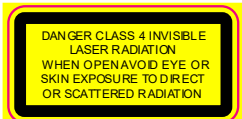
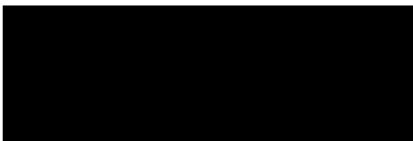


RF PSU



Combined PSU



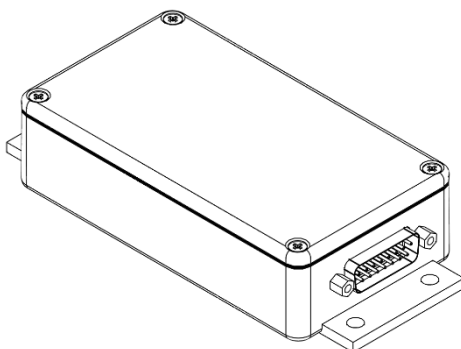
1.	Aperture label	
2.	Warranty void	WARRANTY VOID IF REMOVED
3.	Danger laser beam label	 LABEL C With Diode Pointer or Without Diode Pointer  LABEL D
4.	Aperture exposure label	 With Diode Pointer or  Without Diode Pointer
5.	Warning disconnection	 WARNING Disconnect the mains supply before removing this cover
6.	Serial No. label	
7.	WATER IN	
8.	WATER OUT	
9.	50V	
10.	Laser information and purge warning label combined	With Diode Pointer

11.	Not used		
12	DANGER		
13			
14			
15			
16	LED Label	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	

Appendix 2

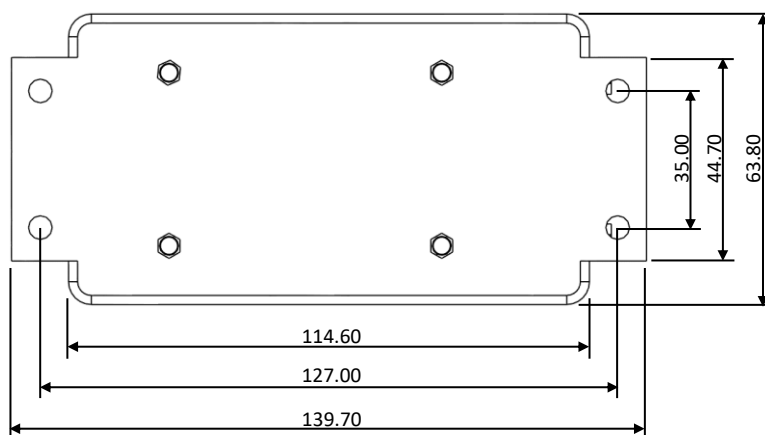
TTL to RS422 converter

A2.1 The optional TTL converter, changes the voltage levels from the OEM machine to the required levels for correct operation of the SCX system.



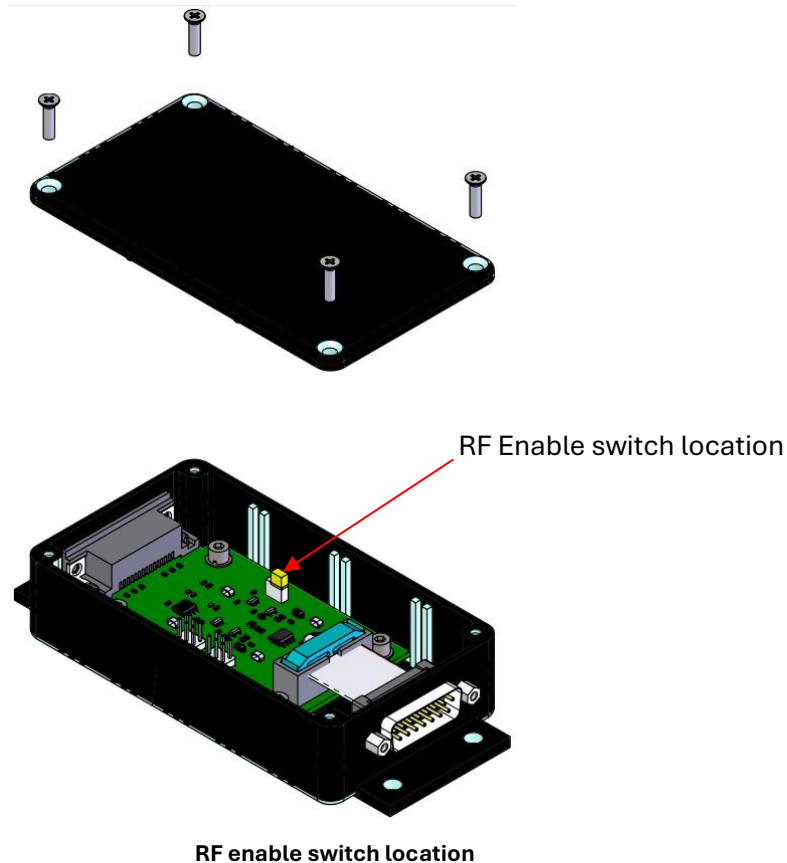
Mounting

Mount the converter unit securely within the OEM machine by means of the four mounting holes on the base

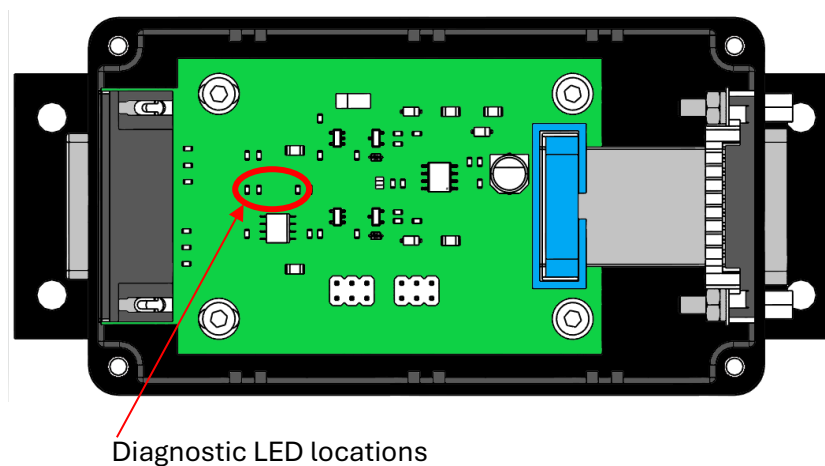


Configuration

The TTL to RS422 converter contains a switch for internal or external RF enable operation. If the switch is set to the EXT position, the user must provide an RF enable signal on pin 6 (091-0104-XX).



Diagnostic LED operation



LED description

RF EN – RF Enable signal present (must be present for correct laser operation)

5V – TTL box is powered (must be present for correct laser operation)

MOD – Modulation signal present (must be present for correct operation)

RF ENABLE switch

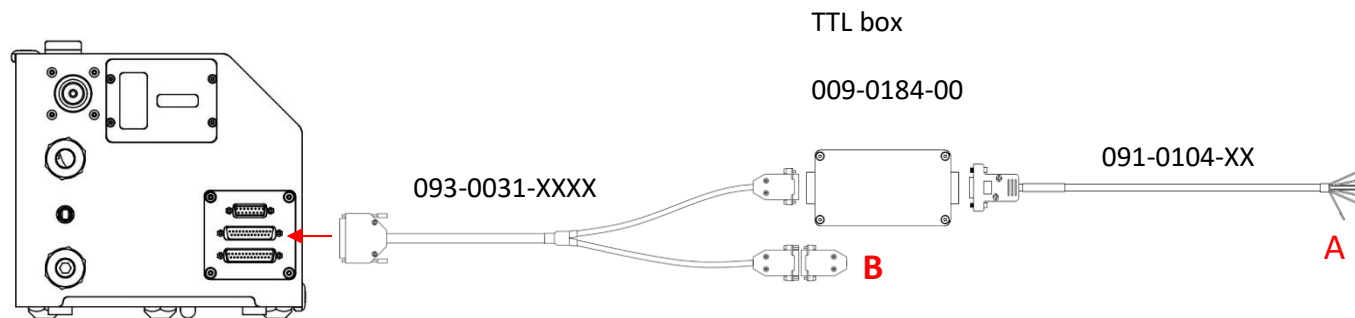
The TTL box contains a switch to enable or disable the required RF Enable signal.

If the switch is set to INT, the RF Enable will be always ON (RF EN LED on).

If the switch is set to EXT, the RF Enable must be provided by the user.

Note: The RF Enable signal provides an important additional safety feature.

Interfacing



Connect the TTL box to the SCX system as shown above.

TTL unit to cable A (091-0104-XX)

Pin No	Function	Wire colour	Signal type	009-0184-00	009-0456-00
1	VSWR status -	Red	RS422 output	See Operating Instructions section	
2	VSWR status +	Blue	RS422 output	See Operating Instructions section	
3	Over modulation	Green	Output	See Operating Instructions section	
4	Laser modulation	Yellow	PWM input	5V	5-24V
5	Voltage supply +	White	Supply input +	5V	5-24V
6	RF enable	Black	Input	5V	5-24V
7	RF Forward power	Brown	Output	See Operating Instructions section	
8	RF Reflected power	Violet	Output	See Operating Instructions section	
9	N/C	Orange			
10	N/C	Pink			
11	N/C	Turquoise			
12	N/C	Grey			
13	N/C	Red/Blue			
14	N/C	Green/Red			
15	Voltage supply (rtn)	Yellow/Red	Supply input (rtn)	GND	GND

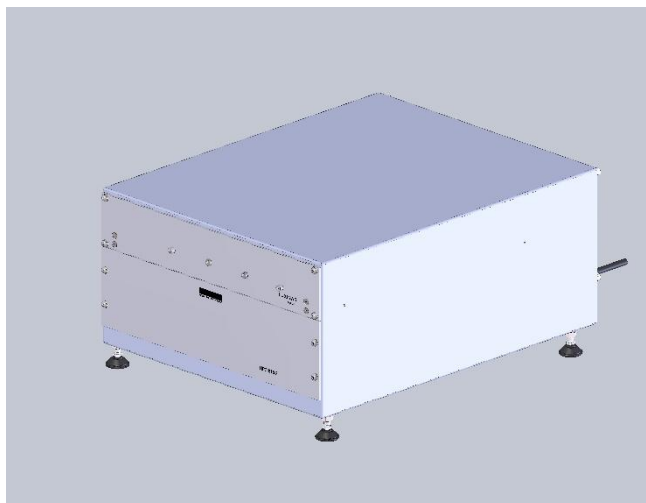
SCX unit to cable B (093-0031-XXXX)

Pin No	Function	Signal type	009-0184-00	009-0456-00
1	Shutter enable	Input	See Operating Instructions section	
2	User indicator	Output	See Operating Instructions section	
3	Shutter open	Output	See Operating Instructions section	
4	GND			
5	Shutter closed1	Output	See Operating Instructions section	
6	DC OK	Output	See Operating Instructions section	
7				
8				
9	Interlock rtn	Output	See Operating Instructions section	
10	Interlock	Output	See Operating Instructions section	
11	GND			
12				
13	RS232 Tx	Output	See Operating Instructions section	
14	RS232 Rx	Output	See Operating Instructions section	
15	Diode enable	Input	See Operating Instructions section	

Appendix 3

Combined SCX 35 RF and DC Power Supply (016-0025-00)

016-0025-00 houses the RF Power Supply together with three-phase DC Power Supply 005-0646-00, in a common cabinet. The required electrical and coolant interconnects are pre-configured, reducing the installation complexity.



SCX 35 combined RF & three-phase power supply (016-0025-00)



WARNING



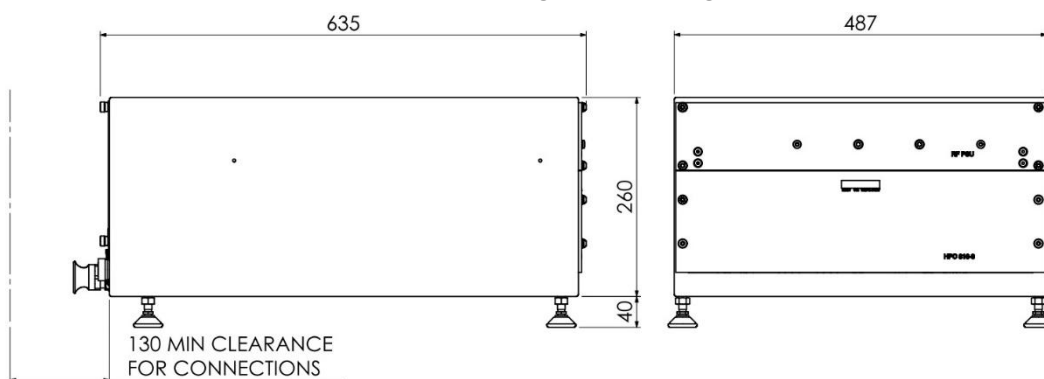
Heavy equipment – risk of severe lumbar injury

The weight of the Combined DC and RF Power Supply exceeds the single person lift limit of 18kg, as specified in EN 61010-1:2010+A1:2019. Ensure that suitable lifting equipment is employed

Specification

Dimensions	635x487x260(+40 with mounting feet)
Weight	60kg
Coolant type	Demineralised, deionised or distilled water with corrosion inhibitor & anti-bacterial additive
Coolant Connections	3/8" BSP Female
Coolant flow rate	≥6 litres/minute
Maximum Coolant Inlet Pressure	6 bar / 88 psi (gauge)
Protection class	IP51

Dimensions, weights and cooling



Overall dimensions (mm)

Mains input voltage range	360-440 VAC three-phase*
Mains input frequency range	50/60Hz
Mains input fuse rating	20A per phase
Main AC inrush current (max.)	20A
Power factor	>0.90 at full power
Power consumption (max.)	7.5kW at full power
Earth leakage current	< 6mA

Electrical specifications

*No neutral connection is required. Connection of this power supply to neutral **will** cause irreparable damage.

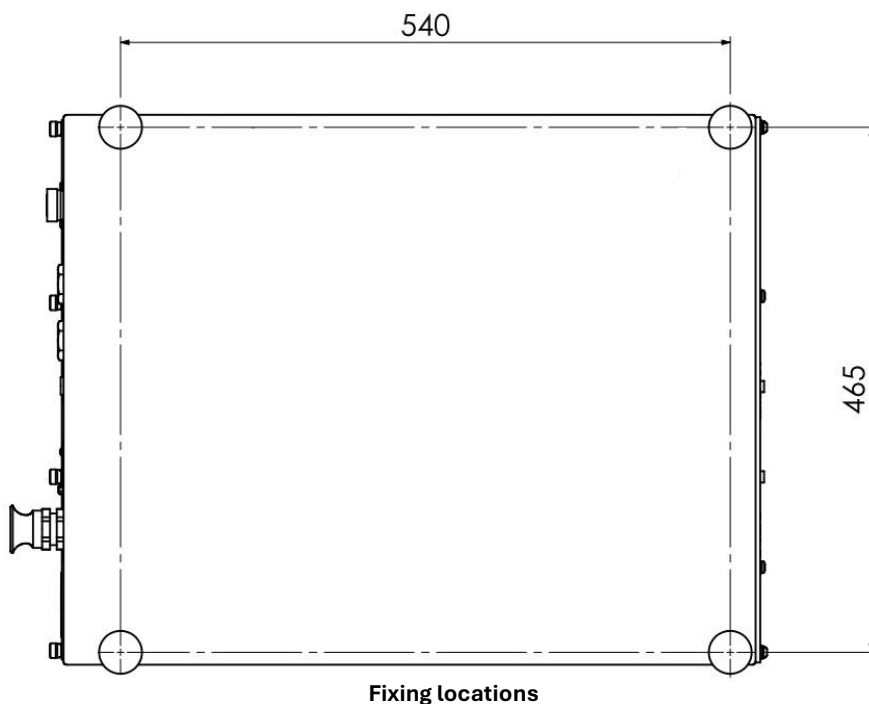
Important!

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.

Installation

Mechanical installation

Using suitable fixings, position the power supply within the OEM machine using the four mounting feet shown in the following diagram.



Mains AC power connection

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.

The power supply is provided with a 4mm² pre-wired mains supply cable. If this cable needs to be replaced with a different cable, ensure the replacement cable is of the correct rating for the power supply.


DANGER


Risk of electric shock or severe damage to the equipment

Ensure that the equipment is disconnected from the mains supply before making this connection.

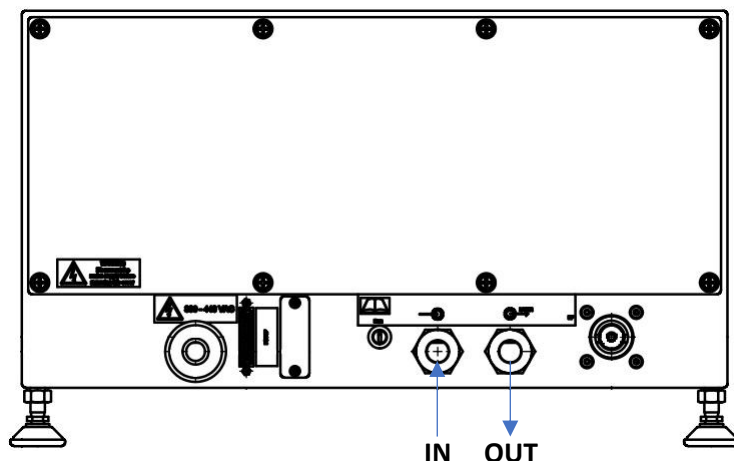
To replace the mains cable, remove the eight retaining thumb-operated screws and withdraw the rear cover panel. Note the existing cable connections at the mains circuit breaker DIN rail, slacken the cable securing gland and disconnect the existing cable. Connect the new mains cable in an identical manner, tighten the cable gland and replace the rear cover panel.

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

Cooling system connections

The power supply requires a liquid cooling source. It is recommended that it is connected in series with the laser system cooling unit.

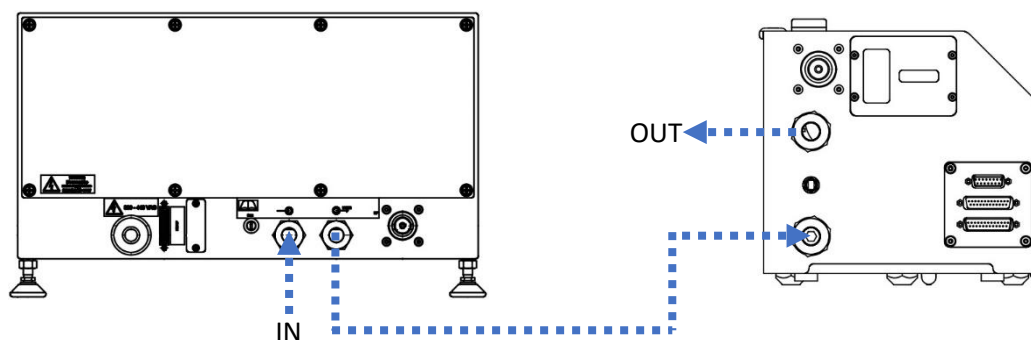
Coolant connections for the power supply are located on the rear of the unit.



Coolant connections

The DC power supply section has internal temperature monitors. If the internal temperature exceeds pre-defined limits, the power supply will shut down.

The inlet and outlet of the coolant supply are clearly marked and must not be confused.



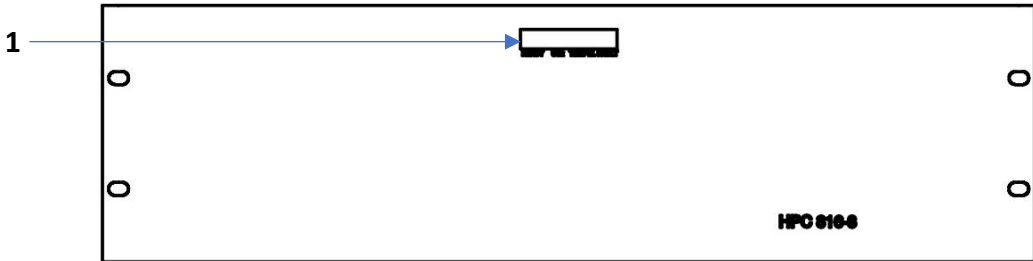
System coolant connection

The coolant inlet and outlet connectors are labelled as shown in the following table.

Coolant IN		
Coolant OUT		

Operation

When powered up, the DC power supply will automatically carry out diagnostic checks. If no faults are detected, then the DC power supply is ready for use.



Front panel

1- Power supply indicators

Power supply indicators

The LED indicators on the front panel provide information about the power supply operating status.

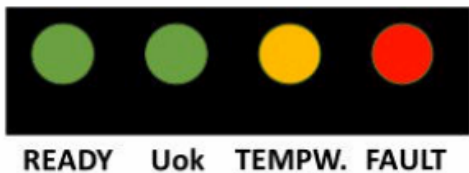


Table 3 - Power supply LED indicators

LED	Meaning
READY	The three-phase mains supply is correctly connected ⁽²⁾
Uok	Once the PSU Enable signal is applied, the DC output will turn on. The output voltage is internally compared to the set reference voltage. If this is correct, the Uok indicator will illuminate ⁽³⁾
TEMPW	This indicator warns that the internal temperature is too high. Check that the coolant flow and temperature are correct. The TEMPW signal is also available as a status signal on pin 8 of the auxilliary interface connector
FAULT	This indicator illuminates when corrective action is required. At the same time DC output is turned off. Switch off the three-phase mains supply to reset the power supply. If Faults are detected, 1 or more status indicators will be off or displaying red/amber. Disconnect and reconnect the mains supply to restart the power supply. Refer to Table 4

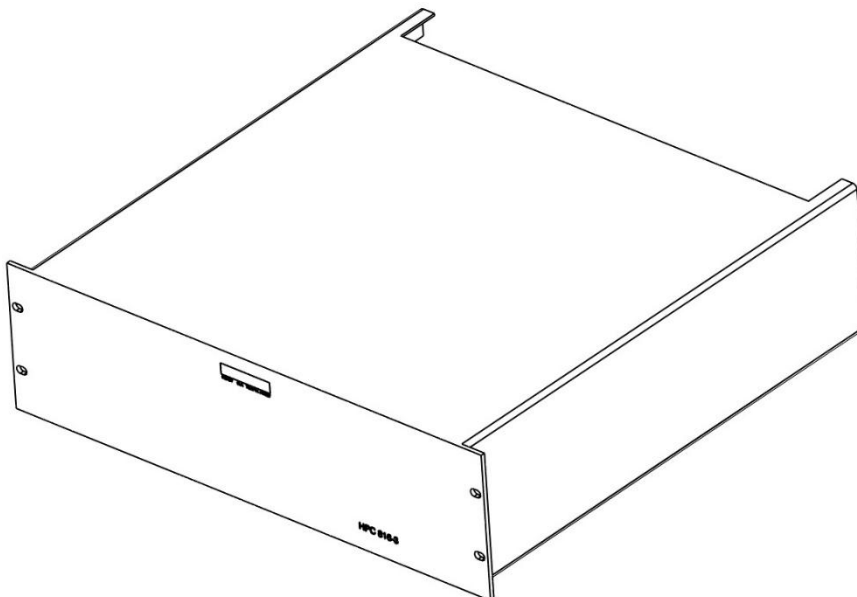
Important!

If the TEMPW indicator is illuminated and no action is taken and the internal temperature continues to rise, the FAULT indicator will illuminate and the DC output is turned off.

Appendix 4

Optional standalone SCX 35 three-phase DC Power Supply (005-0646-00)

005-0646-00 three-phase DC PSU is a free-standing/rack-mountable AC-to-DC water-cooled power supply.



SCX 35 three-phase power supply

Specification

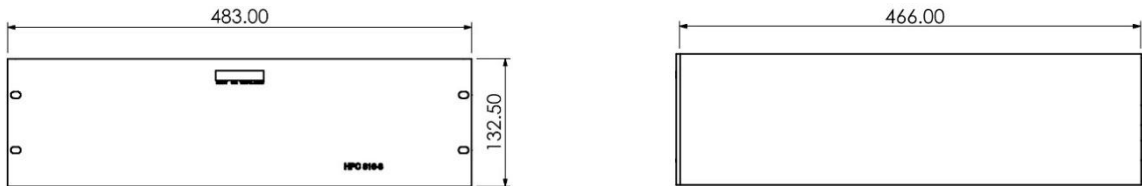

WARNING


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.

Dimensions	430x443x133
Weight	24kg
Coolant type	Demineralised, deionised or distilled water with corrosion inhibitor & anti-bacterial additive
Coolant pipes	Copper, 10mm OD
Coolant flow rate	≥6 litres/minute
Pressure	Maximum 6bar / 88 psi (gauge)
Protection class	IP51

Dimensions, weights and cooling



Overall dimensions

Mains input voltage range	360-440 VAC three-phase*
Mains input frequency range	50/60Hz
Mains input fuse rating	20A per phase
Main AC inrush current (max.)	20A
Output volage (DC)	50V ± 2V
Output current (max.)	150A
Power factor	>0.90 at full power
Power consumption (max.)	7.5kW at full power
Earth leakage current	< 6mA

Electrical specifications

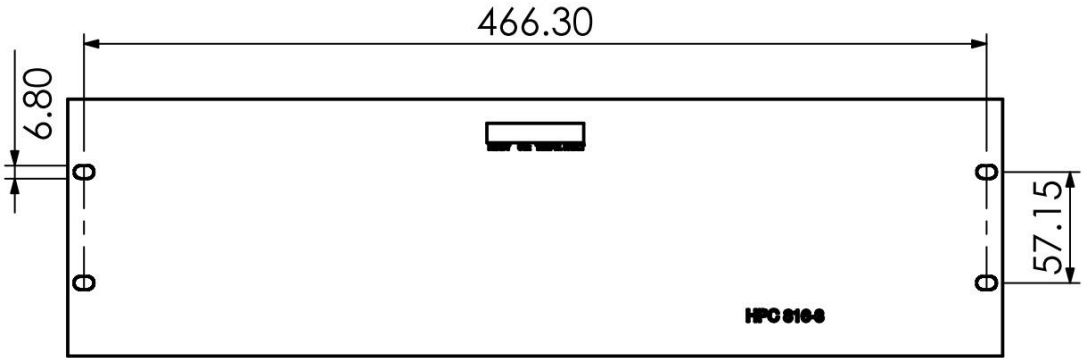
*No neutral connection is required. **Connection of this power supply to neutral will cause irreparable damage.**

Important!

An external disconnect device must be fitted at the time of installation, which 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.

Mechanical installation

Using suitable fixings, mount the power supply within the OEM machine racking using the four mounting holes shown in the following diagram.



Fixing locations

Mains AC power connection

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.

The power supply is provided with 4mm² mains supply cable. If this cable needs to be replaced with a different cable, ensure the replacement cable is of the correct rating for the power supply.



DANGER

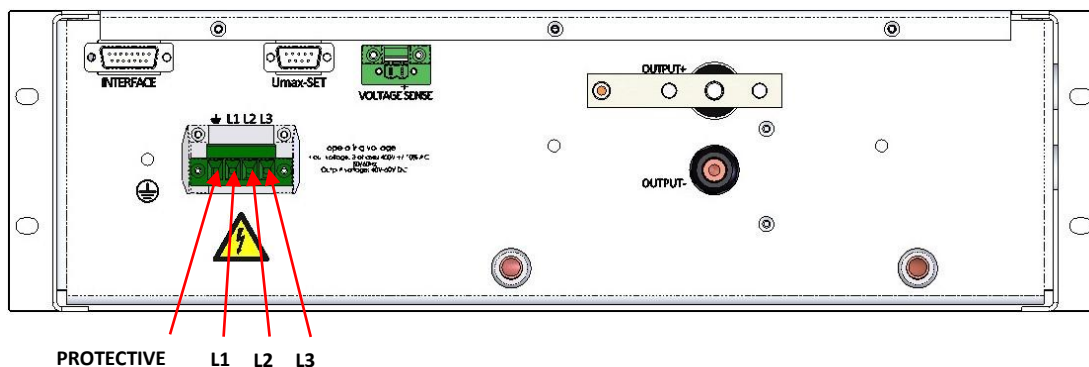
Risk of electric shock or severe damage to the equipment

Ensure that the equipment is disconnected from the mains supply before making this connection.

Connect the three-phase cable to the L1, L2, L3 and Protective Earth (PE) terminals on the rear panel of the power supply.

Ensure that the mains cable is adequately secured, to prevent accidental disconnection. Allow extra 'slack' in the PE conductor – this should be last connection to break, should the mains cable be pulled out accidentally.

A Protective Earth (PE) connection is essential. Ensure the PE wire is connected before connecting the supply.



Three-phase mains supply connection



CAUTION

Risk of irreparable damage to the power supply

Do not connect the power supply to neutral.

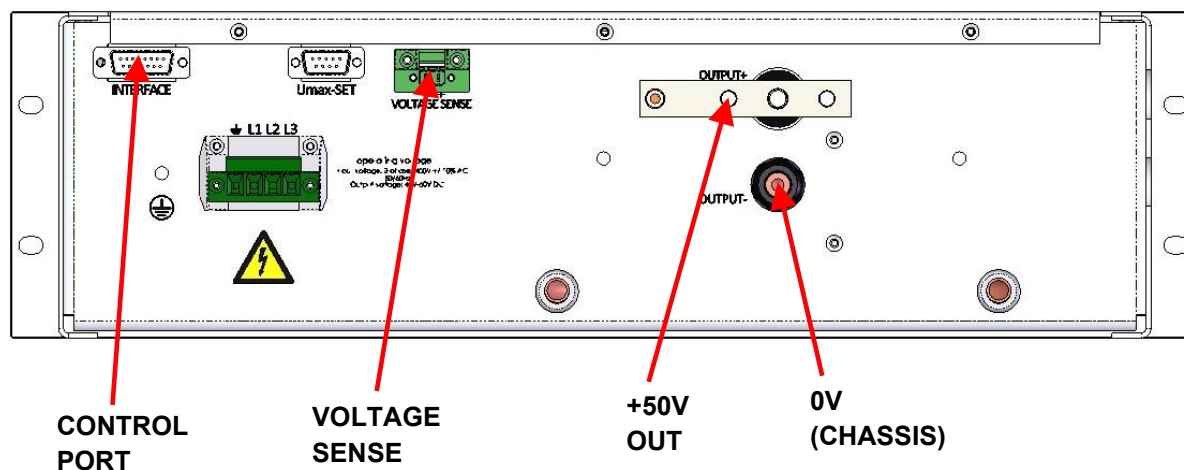
Other Connections

Carefully observe the correct polarity of the output cables – **severe damage will result from reverse-connection.**

The control cable must be securely fitted to the D-sub connector on the rear panel of the power supply.

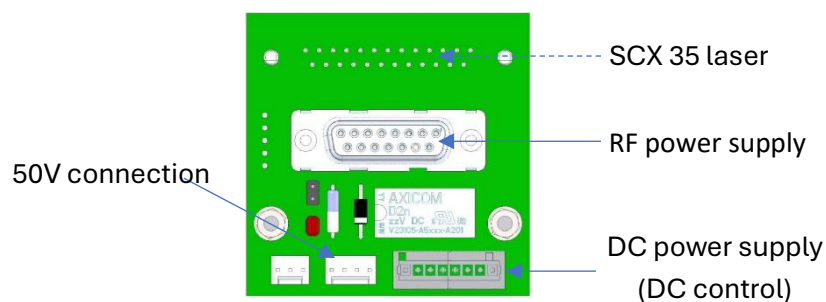
IMPORTANT NOTES:

- The 0V output connection is internally connected to the chassis metalwork. Do not attempt to 'float' the output relative to system ground.
- The 'Voltage Sense' connection must be made at the bank capacitor terminals. Do not attempt 'remote sensing' at the RF Power Supply.

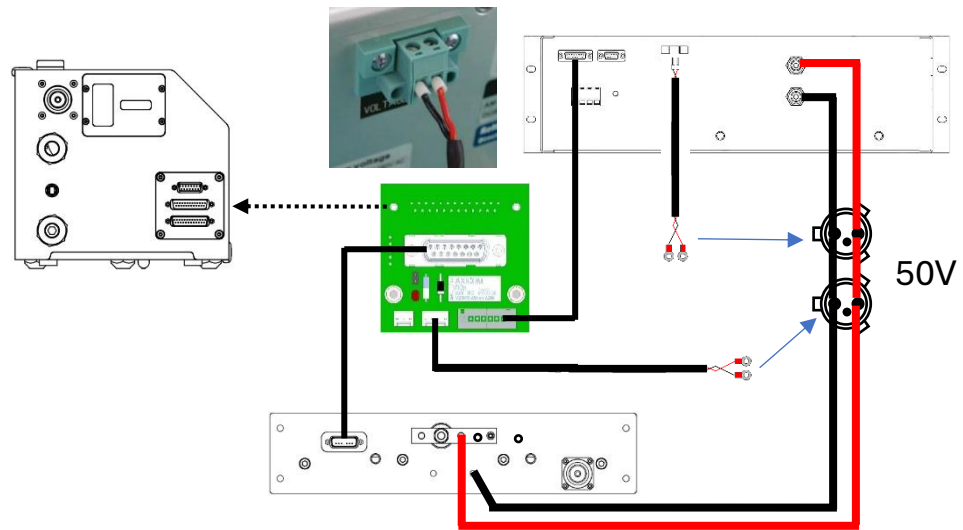


Output and control connections

The DC power supply requires an interface adaptor in order to connect to the SCX 35 laserhead. This is supplied with the power supply and is described as follows:



DC interface (005-0607-00)

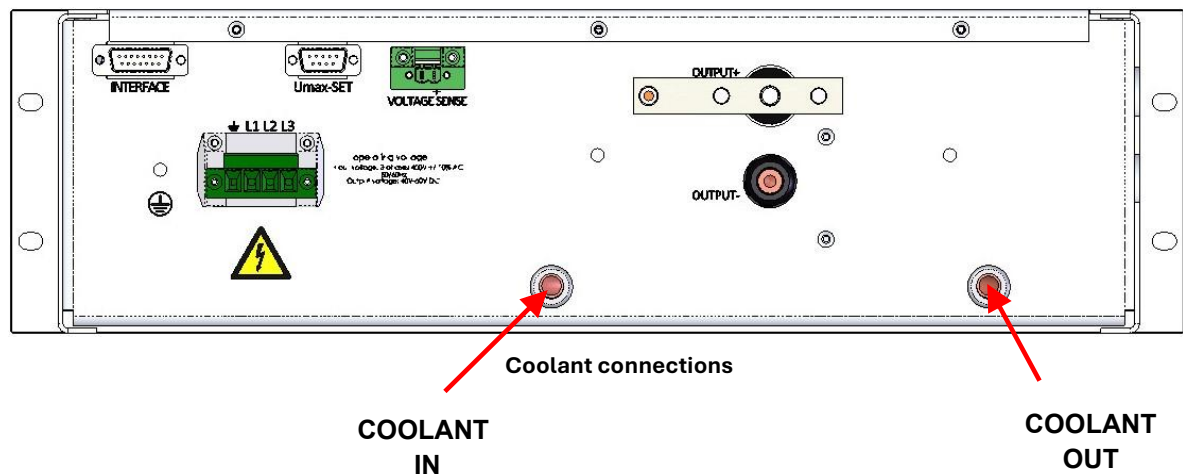


System wiring

Cooling system connections

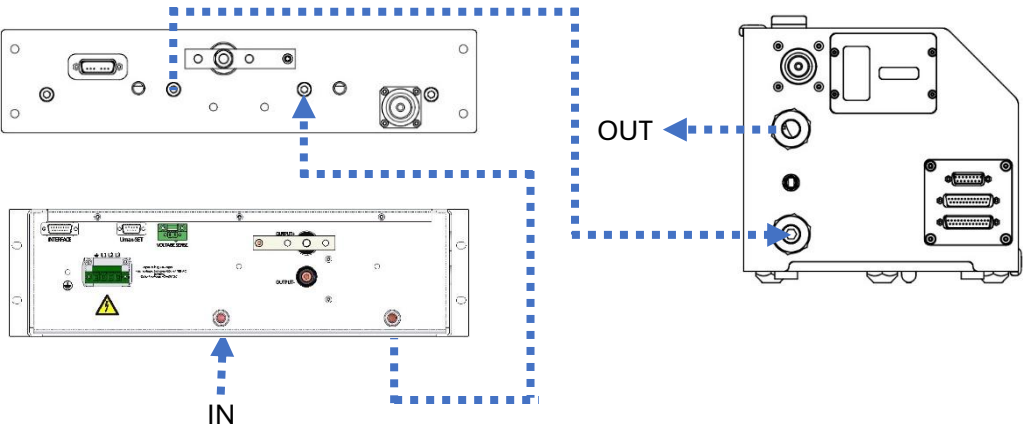
The power supply requires a liquid cooling source. It is recommended that it is connected in series with the laser system cooling unit.

Coolant connections for the power supply are located on the rear of the unit:



The DC power supply has internal temperature monitors. If the internal temperature exceeds pre-defined limits, the power supply will shut down.

The inlet and outlet of the coolant supply are clearly marked and must not be confused.



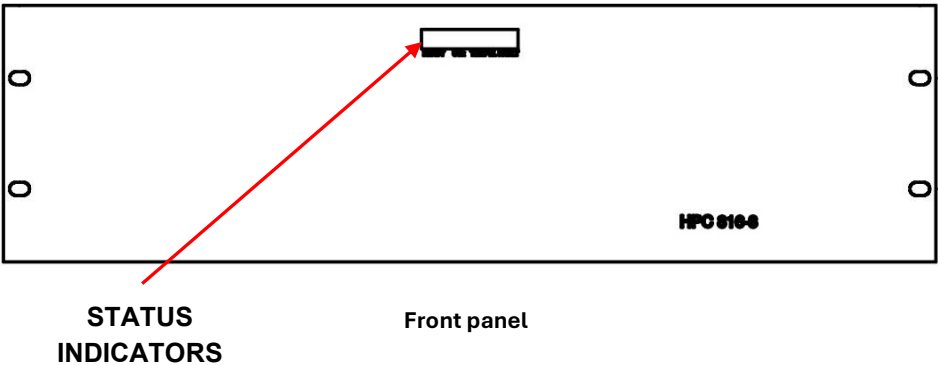
System coolant connection

The coolant inlet and outlet connectors are labelled as shown in the following table.

Coolant IN		
Coolant OUT		

Operation

When powered up, the power supply will automatically carry out diagnostic checks. If no faults are detected, then the DC power supply is ready for use.



Power supply indicators

The LED indicators on the front panel provide information about the power supply operating status.



Table 3 - Power supply LED indicators

LED	Meaning
READY	The three-phase mains supply is correctly connected ⁽²⁾
Uok	Once the PSU Enable signal is applied, the DC output will turn on. The output voltage is internally compared to the set reference voltage. If this is correct, the Uok indicator will illuminate ⁽³⁾
TEMPW	This indicator warns that the internal temperature is too high. Check that the coolant flow and temperature are correct. The TEMPW signal is also available as a status signal on pin 8 of the auxilliary interface connector
FAULT	This indicator illuminates when corrective action is required. At the same time DC output is turned off. Switch off the three-phase mains supply to reset the power supply. If Faults are detected, 1 or more status indicators will be off or displaying red/amber. Disconnect and reconnect the mains supply to restart the power supply. Refer to Table 4

Important!

If the TEMPW indicator is illuminated and no action is taken and the internal temperature continues to rise, the FAULT indicator will illuminate and the DC output is turned off.

Appendix 5

Additional Information

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	10.25	9.3
MPE (Wm ⁻²)	1000	1000	1000
NOHD (m)	650	750	750

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

Wavelength Options Technical Data

The standard operating wavelength for Luxinar lasers is 10.6µm

The SCX 35 can be supplied in a range of different operating wavelengths. If a non-standard operating wavelength is required, this must be specified at the time of ordering. Depending on the operating wavelength, certain characteristics of the laser system can be affected. Below is a list of available wavelengths and their differing characteristics

Wavelength µm	10.6	9.3	10.25
Output Power			
Power Range ¹	20-350W	15-265W	15W-315W
Stability	±7% (±2%) ²	±7% (±2%) ²	±7% (±2%) ²
Peak Power	880W	670W	740W
Laser Beam Quality			
Diameter (1/e ²) @ (laser output)	7±0.5mm	7.0±0.5mm	7.0±0.5mm
Beam Waist. ⁽³⁾	6.5±0.5mm	6.8±0.5mm	6.5±0.5mm
Pulsed Mode			
Energy	14mJ to 280mJ	11mJ to 210mJ	13mJ to 250mJ
Pulse Rise/Fall time	< 60µs	< 60µs	< 60µs

¹ Minimum Power for systems fitted with Power Feedback is 30 Watts

² ±2% Stability is available on systems equipped with power feedback only

³ The beam waist is typically located 1m-2m from the laser

Revision history

Revision	Date	Changes
1	23/07/2018	Specification update in line with Orbs.
2	05/07/2019	Luxinar format.
3	29/01/2020	NOHD table change. Update system serial number.
4	21/01/2021	Updates to labelling.
5	03/06/2021	Standards updated.
6	09/12/2021	Addition of DC PSU.
7	01/02/2022	Purge air specification.
8	13/12/2022	UKCA.
9	09/06/2023	9.3µm specification updates, safety label updates.
10	24/09/2024	Specification updates.
11	27/11/2024	Front and back cover updates.
12	06/12/2024	DC PSU updates.
13	31/01/2025	Labelling updates.
14	11/09/2025	Document re-structuring, removal of obsolete DC PSU and general error corrections
15	13/05/2026	Change part number of recommended coolant in all manuals
16	08/06/2026	Updated to various documents to reflect closure of office in Hamburg and transfer of responsibility to Krailling

SCX 35

Luxinar Ltd.
Meadow Road
Bridgehead Business Park
Kingston Upon Hull
HU13 0DG
U.K.

Tel: +44 (0) 1482 650088

www.luxinar.com

