



SR Series

Sealed CO₂ laser sources

User manual

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SR Series

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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Aftersales contact details

Luxinar Ltd
Meadow Road
Bridgehead Business Park
Kingston upon Hull
HU13 0DG
U.K.
Tel.: +44 (0) 1482 650088
www.luxinar.com
For Aftersales Service, contact: aftersales.uk@luxinar.com
For Parts, contact: parts.uk@luxinar.com

Iradion Laser GmbH
Justus-von-Liebig-Ring 8
82152 Krailling
Germany
Tel.: +49 (0)40 883624-60
www.luxinar.com/de

Luxinar Ltd (Italy branch office)
Via Pavia 11/B
10098 Rivoli
Torino
Italy
Tel.: +39 (0)11 19118353
www.luxinar.com/it

Luxinar Ltd (Korea branch office)
#409, A-dong (Bundang Suji U-Tower)
767, Sinsu-ro, Suji-gu, Yongin-si, Gyeonggi-do
Republic of Korea 16827
Tel.: +82 (0)31 546 0861
www.luxinar.com/ko

Luxinar Laser Technology (Shanghai) Co., Ltd (China)
Room 101, 1st Floor,
Bldg.11, Sunland South Area,
800# Qifan Road,
Pudong, Shanghai, China 200137
Tel.: +86 21 6836 2938
www.luxinar.com/zh-CN

Luxinar Inc (USA)
1 Technology DR
Uxbridge
MA 01569
USA
Tel.: +1 (0)586 291 2709
www.luxinar.com

Warranty shipments, returns and adjustments

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

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

Service and Repair

Servicing or calibration of the system can only be carried out by trained Luxinar service engineers or customers who have undertaken and passed a Luxinar approved service training course.

Details of training courses and servicing can be obtained from the local Luxinar Aftersales address.

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Preface

Audience

This manual should be read by all personnel who install or operate SR series lasers.

Important!

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

The SR series is designed and sold for use in Original Equipment Manufacturer (OEM) systems and is not to be used as a stand-alone laser. The OEM is responsible for compliance with all applicable safety regulations.

Other publications

- Luxinar part number 906-0251-xx; Safety manual
- Luxinar part number 906-0109-00; Serial interface specification
- Luxinar part number 906-0104-xx; Optical isolation (ATFR)
- Luxinar part number 906-0202-99; Chiller water temperature tables

How to use this manual

The following conventions are used in this manual

Admonitions

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

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

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

DANGER

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

WARNING

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

CAUTION

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

Connector labels and signal names

Connector labels and signal names are shown in bold serif font to aid identification. For example; **RF Enable**, **external interlock**

Cross-reference and links

Cross references and links are highlighted in green and show the chapter or section to which they refer. For example: Safety information is contained in **Section 1**.

Section 1

Safety

General safety information

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

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

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

Important!

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

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

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



Label locations

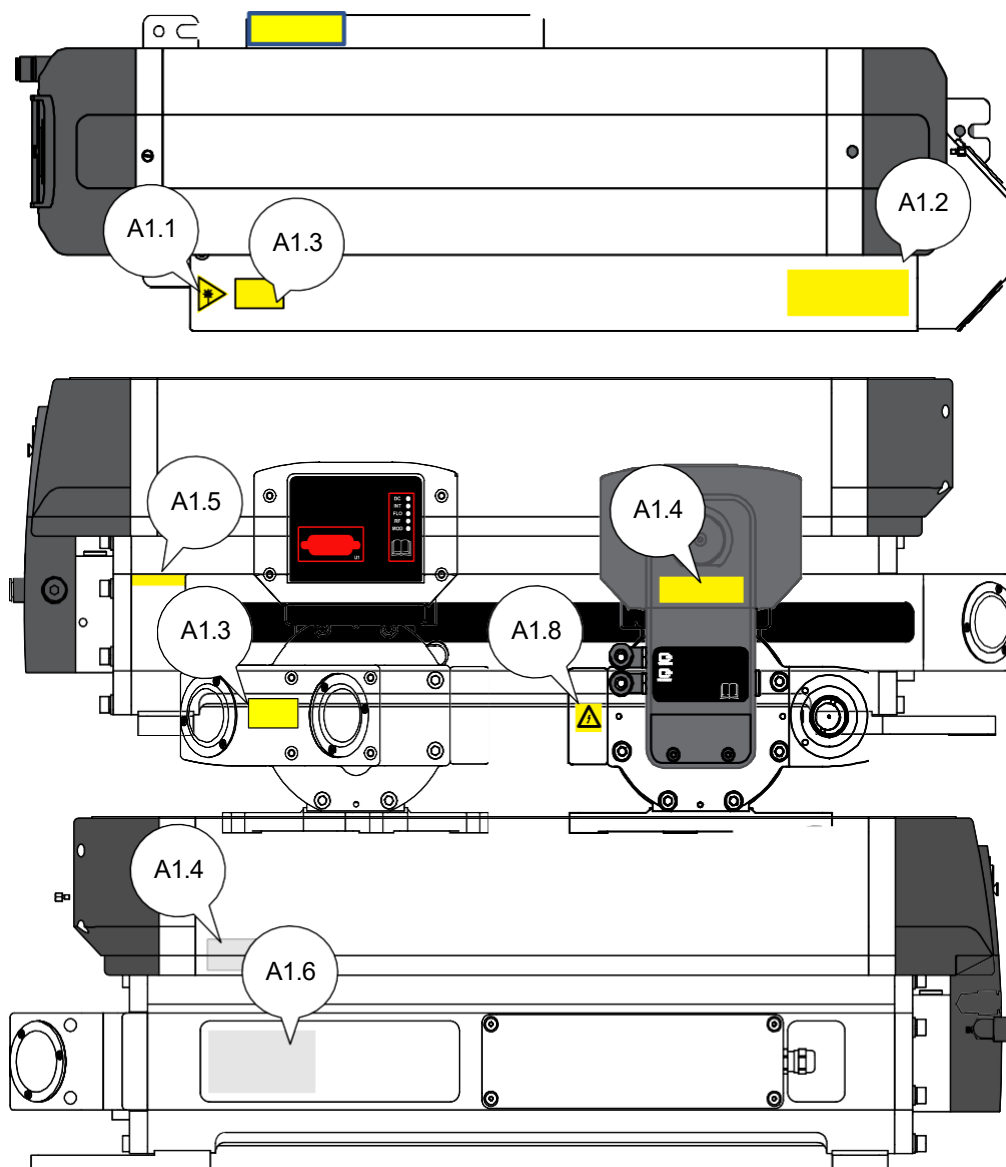


Figure 1 - Location of safety labels - standard laser

Labels

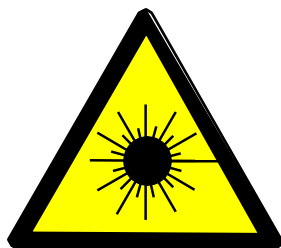


Figure 2 - A1.1 — Laser hazard

Table 1 - Label A1.2 — Class 4 laser without diode option

DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 290W AVERAGE POWER: 190W 	DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1240W AVERAGE POWER: 370W 
Figure 3 - SR 08s	Figure 4 - SR 10e
DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 890W AVERAGE POWER: 300W 	DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 860W AVERAGE POWER: 330W 
Figure 5 - SR 10i	Figure 6 - SR 10x
DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1870W AVERAGE POWER: 520W 	DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1240W AVERAGE POWER: 420W 
Figure 7 - SR 15e	Figure 8 - SR 15i
DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 570W AVERAGE POWER: 380W 	DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1260W AVERAGE POWER: 490W 
Figure 9 - SR 15s	Figure 10 - SR 15x
DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1770W AVERAGE POWER: 590W 	DANGER INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1750W AVERAGE POWER: 680W 
Figure 11 - SR 25i	Figure 12 - SR 25x

Table 2 - Label A1.2 — Class 4 laser with diode option

DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 290W AVERAGE POWER: 190W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 	DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1240W AVERAGE POWER: 370W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 
Figure 13 - SR 08s	Figure 14 - SR 10e
DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 890W AVERAGE POWER: 300W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 	DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 860W AVERAGE POWER: 330W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 
Figure 15 - SR 10i	Figure 16 - SR 10x
DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1870W AVERAGE POWER: 520W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 	DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1240W AVERAGE POWER: 420W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 
Figure 17 - SR 15e	Figure 18 - SR 15i
DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 570W AVERAGE POWER: 380W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 	DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1260W AVERAGE POWER: 490W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 
Figure 19 - SR 15s	Figure 20 - SR 15x
DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1770W AVERAGE POWER: 590W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 	DANGER VISIBLE AND INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION CLASS 4 LASER PRODUCT IEC/ EN 60825-1: 2014 MAIN CO2 LASER BEAM WAVELENGTH: 9µm - 12µm PULSE DURATION: 400µs PEAK POWER: 1750W AVERAGE POWER: 680W LASER DIODE POINTER WAVELENGTH: 635+/-10nm AVERAGE POWER: <4mW 
Figure 21 - SR 25i	Figure 22 - SR 25x

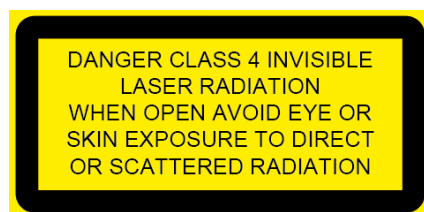


Figure 23 - Label A1.3 — Non-interlocked panel without diode option

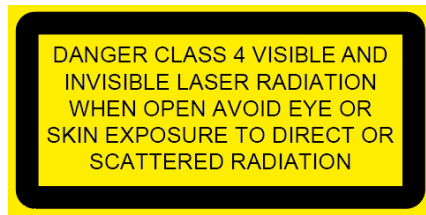


Figure 24 - Label A1.3 — Non-interlocked panel with diode option

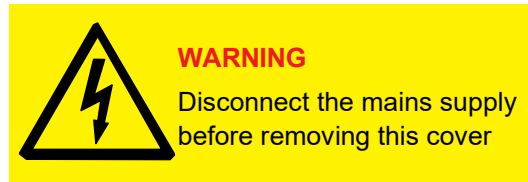


Figure 25 - Label A1.4—DC voltage warning

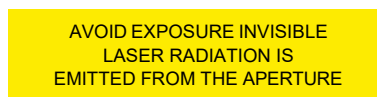


Figure 26 - Label A1.5 — Laser aperture without diode option

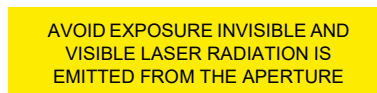
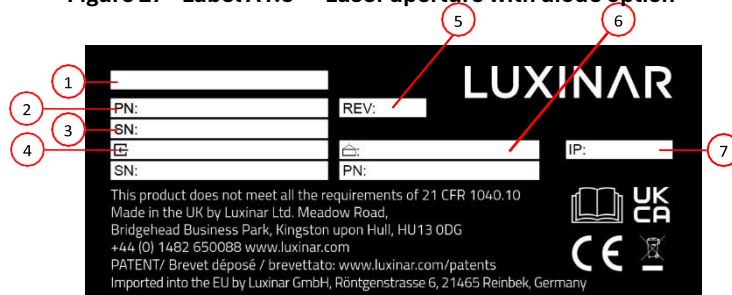


Figure 27 - Label A1.5 — Laser aperture with diode option



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

Figure 28 - Label A1.6—Product identification and certification



Figure 29 - Label A1.8 — Electrical hazard

Maximum Permissible Exposure and Nominal Ocular Hazard Distance

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

The MPEs given in the following tables 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 tables 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 tables 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."

SR 08s

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000
NOHD (m)	325	300	325

SR 10e

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	-	-	1000
NOHD (m)	-	-	425

SR 10i

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000
NOHD (m)	400	375	400

SR 10x

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	-	-	1000
NOHD (m)	-	-	450

SR 15e

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	-	-	1000
NOHD (m)	-	-	550

SR 15i

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000
NOHD (m)	525	525	450

SR 15s

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000
NOHD (m)	500	500	450

SR15x

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	-	-	1000
NOHD (m)	-	-	500

SR 25i

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	1000	1000	1000
NOHD (m)	600	600	575

SR25x

Wavelength (µm)	10.6	10.25	9.3
MPE (W/m ²)	-	-	1000
NOHD (m)	-	-	625

Decommissioning and disposal

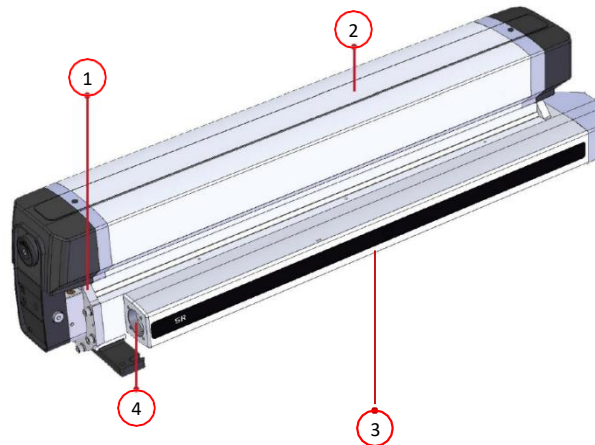
Dispose of the system according to appropriate local regulations.



Section 2

General Description

Laser head



1. Laser assembly
2. RF power supply
3. Internal beam delivery (correction optics)
4. Laser output

Figure 30 - SR series laser head

SR series lasers comprise a laser tube, integrated RF power supply unit and a finely tuned optical correction system packaged within a robust aluminium casing. The laser tube is RF-excited and has a diffusion cooled sealed cavity. All have an excitation frequency of 81MHz and an expected tube lifetime greater than 20000 hours. There are ten models offering different output powers.

- **SR 08s**
Up to 80W average power, 110W peak power
- **SR 10e**
Up to 115W average power, 330W peak power
- **SR 10i**
Up to 125W average power, 315W peak power
- **SR 10x**
Up to 105W average power, 235W peak power
- **SR 15e**
Up to 160W average power, 460W peak power
- **SR 15i**
Up to 175W average power, 440W peak power
- **SR 15s**
Up to 160W average power, 215W peak power
- **SR 15x**
Up to 150W average power, 335W peak power
- **SR 25i**
Up to 250W average power, 630W peak power

- **SR 25x**

Up to 210W average power, 465W peak power

Three versions of the SR series lasers are available:

- Standard version with direct beam output and basic control interface.
- Shutter version, including a safety shutter, more control interface modes and a laser diode pointer.
- Power feedback version, including a power feedback detector and closed loop control circuit in addition to a safety shutter, more control interface modes and a laser diode pointer. (Power feedback only available on SR 10i, SR 15i and SR25i models)

DC power supply (optional)

Refer to Appendix 8 for details of Luxinar DC power supplies

Industrial control unit (optional)

Contact Luxinar for more details of control options.

Beam delivery

The SR series can be supplied with an ATFR (Absorbing Thin-Film Reflector) optical isolation assembly to protect the system from back reflection. The device attaches directly onto the output end of the beam delivery cover using an adapter.

For shutter and power feedback versions, the isolation assembly must be mounted within the end user's beam delivery.

Refer to manual part number 906-0104-xx; Optical isolation (ATFR) for fitting instructions.

Specifications

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

RF power supply

Table 3 - RF power supply characteristics

Model	SR 08s	SR 10i	SR 10x	SR 10e	SR 15s
DC input (RF)	50V ± 2%				
DC input (RF) load capacitance	23mF	26mF	26mF	60mF	54mF
DC input (RF) maximum average current	29A	42A	49A	50A	58A
Peak RF output power (envelope)	1.32kW	2.6kW	2.6kW	3.6kW	2.6kW
Maximum average RF output power	1.1kW	1.56kW	1.82kW	1.8kW	2.1kW
Duty cycle	80%	60%	70%	50%	80%
Pulse width range	2–400µs				
Frequency range	0–130kHz				

Table 4 - RF power supply characteristics

Model	SR 15i	SR 15x	SR 15e	SR 25i	SR 25x
DC input (RF)	50V ± 2%				
DC input (RF) load capacitance	60mF	60mF	47mF	47mF	47mF
DC input (RF) maximum average current	60A	70A	77A	92A	107A
Peak RF output power (envelope)	3.6 kW	3.6kW	5.3kW	5.3kW	5.3kW
Maximum average RF output power	2.16kW	2.52kW	2.65kW	3.18kW	3.17kW
Duty cycle	60%	70%	50%	60%	70%
Pulse width range	2–400µs				
Frequency range	0–130kHz				

Dimensions

Table 5 - External dimensions (including RF power supply)

Model	SR 08s	SR 10i	SR 10x	SR 10e	SR 15s
Standard laser (LxWxH) (mm)	659x198x222	659x198x222	659x198x222	879x198x222	879x198x222
Laser with shutter module option (LxWxH) (mm)	-	723x198x222	723x198x222	943x198x222	943x198x222
Laser with power feedback option (LxWxH) (mm)	-	723x251x222	-	-	-

Table 6 - External dimensions (including RF power supply)

Model	SR 15i	SR 15x	SR 15e	SR 25i	SR 25x
Standard laser (LxWxH) (mm)	879x198x222	879x198x222	941x198x222	941x198x222	941x198x222
Laser with shutter module option (LxWxH) (mm)	943x198x222	943x198x222	1005x198x222	1005x198x222	1005x198x222
Laser with power feedback option (LxWxH) (mm)	943x251x222	-	-	1005x251x222	-

Weights

Note: All weights are approximate.

Table 7 - Weight (including RF power supply)

Model	SR 08s	SR 10i	SR 10x	SR 10e	SR 15s
Standard laser	22kg	22kg	22kg	32kg	32kg
Laser with shutter or power feedback module option	—	24kg	24kg	34kg	34kg

Table 8 - Weight (including RF power supply)

Model	SR 15i	SR 15x	SR 15e	SR 25i	SR 25x
Standard laser	32kg	32kg	34kg	34kg	34kg
Laser with shutter or power feedback module option	34kg	34kg	36kg	36kg	36kg

Cooling system

SR series lasers require a temperature stabilised recirculating coolant circuit in order to operate correctly.

The preferred coolant is deionised water or deionised water with anti-bacterial additive. See [Appendix 5](#).

Important!

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

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

Table 9 - Minimum laser resonator coolant temperatures

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

Table 10 - Coolant specification

Model	SR 08s	SR 10i	SR 10e	SR 15s
Minimum flow rate (L/min)	4	5	5	5
Recommended flow rate (L/min)	5	6	6	6
Maximum pressure	6.0bar (88psi)			
Dissipation	1.4kW	3kW	3.1kW	3.5kW
Required refrigeration capacity	1.8kW	3.1kW	3.3kW	3.6kW
Coolant temperature	19–30°C (Optimum temperature 21°C. Allow 1% output power drop per 1°C increase.) Refer to document 906-0202-99 for more details.			

Table 11 - Coolant specification

Model	SR 15i	SR 15x	SR 15e	SR 25i	SR 25x
Minimum flow rate (L/min)	5	5	5	5	5
Recommended flow rate (L/min)	6	6	6	6	6
Maximum pressure	6.0bar (88psi)				
Dissipation	4kW	4.3kW	4.7kW	5.2kW	6.5kW
Required refrigeration capacity	4kW	4.3kW	4.7kW	5.2kW	6.5kW
Coolant temperature	19–30°C (Optimum temperature 21°C. Allow 1% output power drop per 1°C increase.) Refer to document 906-0202-99 for more details.				

Optics purge gas

Table 12 - Optics purge gas specification

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

Environmental specifications

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

Table 13 - Environmental specifications

Ambient working temperature	5–40°C
Storage temperature (with drained cooling circuit)	-10 to +70°C
Relative humidity (non-condensing)	10–85%
Maximum altitude	< 2000m
IP rating	66

Important!

The IP66 rating refers to the laser head and RF power supply only. This sealing is intended to prevent dust and condensation from forming on sensitive components. DC power supplies (see [Appendix 8](#)) are not sealed to the same extent. It is important that DC power supplies are not situated in an environment where condensation or conductive debris may deposit on sensitive electronic components.

Performance

Table 14 - SR series output characteristics

Model	SR 08s	SR 10i	SR 10x	SR 10e	SR 15s
Output wavelength	10.6µm	10.6µm	9.3µm	9.3µm	10.6µm
For additional and alternative wavelength specification, refer to Appendix 4					
Rated average power range ⁽¹⁾	5–80W	5–125W	5–105W	5–115W	10–160W
Peak power	110W	315W	235W	330W	215W
Minimum shipment power ⁽²⁾	96W	150W	126W	138W	192W
Pulse energy	3–50mJ	5–100mJ	4–70mJ	6–110mJ	5–95mJ
Typical open loop power stability	< ± 4.5% (@ 50µs pulse width & 60% duty)	< ± 4.5% (@ 50µs pulse width & 60% duty)	< ± 5% (@ 50µs pulse width & 60% duty)	< ± 3% (@ 50µs pulse width & 50% duty)	< ± 3% (@ 50µs pulse width & 60% duty)
Guaranteed open loop power stability	± 7%	± 7%	± 8%	± 6%	± 6%
Typical power stability with power feedback option	—	<± 1%	—	—	—
Guaranteed power stability with power feedback option ⁽³⁾	—	<± 2% of rated power ± 2W at all power levels	—	—	—
Optical pulse rise time (10–90%)	100µs	60µs	60µs	60µs	90µs
Optical pulse fall time (90–10%)	100µs	60µs	60µs	60µs	90µs
Excitation frequency	81mHz				
Expected tube lifetime	20000 hours				
Beam diameter (1/e ²) at the laser output optic	6.8 ± 0.5mm	6.0 ± 0.5mm	6.3 ± 0.5mm	6.5 ± 0.5mm	6.3 ± 0.5mm
M ² (K)	<1.2 (> 0.833)				
Beam divergence	< 2mrad — full angle far field				
Beam ellipticity	< 1.2:1				

Pointing stability	< 0.25mrad (half angle)
Polarisation	Linear parallel to the laser base

1. Mean power at maximum duty cycle
2. Mean power at maximum duty cycle
3. After settling period

Table 15 - SR series output characteristics

Model	SR 15i	SR 15x	SR 15e	SR 25i	SR 25x
Output wavelength	10.6µm	9.3µm	9.3µm	10.6µm	9.3µm
For additional and alternative wavelength specification, refer to Appendix 4					
Rated average power range ⁽⁴⁾	10–175W	10–150W	10–160W	15–250W	10–210W
Peak power	440W	335W	460W	630W	465W
Minimum shipment power ⁽⁵⁾	210W	180W	192W	300W	252W
Pulse energy	7–140mJ	6–105mJ	8–155mJ	10–200mJ	8–145mJ
Typical open loop power stability	< ± 3% (@ 50µs pulse width & 60% duty)	< ± 3% (@ 50µs pulse width & 60% duty)	< ± 4% (@ 50µs pulse width & 50% duty)	< ± 3% (@ 50µs pulse width & 60% duty)	< ± 4% (@ 50µs pulse width & 60% duty)
Guaranteed open loop power stability	± 6%	± 6%	± 6%	± 6%	± 6%
Typical power stability with power feedback option	<± 1%	—	—	<± 1%	—
Guaranteed power stability with power feedback option ⁽⁶⁾	<± 2% of rated power ± 2W at all power levels	—	—	<± 2% of rated power ± 3W at all power levels	—
Optical pulse rise time (10–90%)	60µs	60µs	60µs	60µs	60µs
Optical pulse fall time (90–10%)	60µs	60µs	60µs	60µs	60µs
Excitation frequency	81mHz				
Expected tube lifetime	20000 hours				

Beam diameter (1/e ²) at the laser output optic	6.8 ± 0.5mm	6.0 ± 0.5mm	6.3 ± 0.5mm	6.5 ± 0.5mm	6.3 ± 0.5mm
M ² (K)	<1.2 (> 0.833)				
Beam divergence	< 2mrad — full angle far field				
Beam ellipticity	< 1.2:1				
Pointing stability	< 0.25mrad (half angle)				
Polarisation	Linear parallel to the laser base				

Note: For the power feedback version, the beam will be tilted downward in the vertical plane by $2.8 \pm 0.4\text{mrad}$. In the horizontal plane the beam may have an angular deviation from the optical centre-line of up to $\pm 1.75\text{mrad}$.

Laser diode pointer option


WARNING


Class 3R visible laser radiation

Avoid eye exposure to direct and scattered radiation.

Table 16 - Laser diode pointer specification

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

Section 3

Operation

Overview of operating modes

Table 17 - SR series control feature overview

	Standard version	Shutter version	Powerfeedback version
<i>Control modes</i>			
External PWM mode OEM user supplied Pulse Width Modulation (PWM) for RF modulation	Default	Default	Default
Internal open loop control mode	X	X	✓
Internal closed loop control mode	X	X	✓
Internal NC power control mode	X	X	✓
Internal PWM power control mode	X	X	✓
<i>Signals</i>			
RF Enable	✓	✓	✓
Interlock	✓	✓	✓
Shutter enable	X	✓	✓
Laser diode pointer enable	X	✓	✓
Trigger	X	X	✓
RS232 control commands	X	✓	✓
<i>Compatibility</i>			
Compatible with TTL converter option ⁽¹⁾	✓	✓	✓
Compatible with industrial controller ⁽²⁾	✓	✓	✓

General considerations before starting the laser

- Ensure that the beam path is free from obstructions.
- If the machine is in a maintenance or installation situation with machine guards removed, check that there are no personnel within the area and that safety warning notices are prominently displayed.
- Ensure all interlocks are operating correctly.
- Verify that the material to be processed is suitable for CO2 laser processing.
- Verify that the material to be processed is correctly positioned and ready for processing.

Start-up

1. Ensure that all machine safety features are present and activated.

If the machine is in maintenance mode with enclosure panels removed, ensure that the area surrounding the machine complies with local laser safety regulations and that laser safety warning notices are displayed prominently. All persons in the area must wear laser protection eyewear.

1. For details of the TTL converter option, refer to [Appendix 7](#)
2. For details of industrial controller programming modes, refer to [Appendix 1](#)



Risk of injury to eyes and exposed skin

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

2. Turn on the coolant circulating system and check for correct flow and temperature.
3. Turn on the optics purge gas.
4. Verify that all interlocks are closed.
5. Switch on mains power to the laser and controller.
6. Set the operating parameters on the machine controller.
7. Enable the RF power supply (all versions).
8. Enable the shutter (shutter version and power feedback version only).
9.
 - Apply a pulse modulation signal (Standard version only).
 - Apply a trigger signal (power feedback version only).

Important!

Certain pulsing regimes can cause acoustic resonance phenomena that perturb beam pointing characteristics. See [Appendix 2](#) for parameters to avoid.

Shutdown

1.
 - Remove the pulse modulation signal (Standard version only).
 - Remove the trigger signal to disable laser output. (power feedback version only).
2. Close the shutter (shutter version and power feedback version only).
3. Disable the RF power supply. (all versions).
4. Switch off mains power to the laser and controller.
5. Turn off the optics purge gas.
6. Turn off the coolant circulating system.

Emergency stop

An emergency stop is initiated by the OEM machine. The machine should automatically:

- Remove the trigger signal (power feedback version only).
- Close the shutter (shutter version and power feedback version only).
- Remove the **RF enable** signal (all versions).
- Break the laser interlock circuit.

Important!

For the power feedback version, the laser will not restart unless the trigger signal is removed and re-applied. Control signal timings must be respected when restarting.

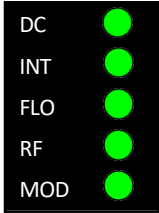
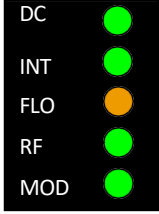
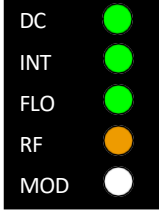
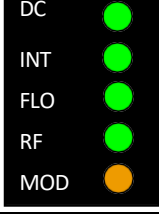
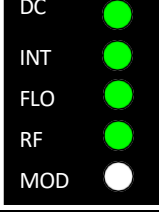
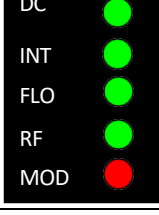
See [section 8](#).

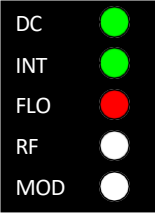
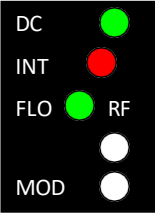
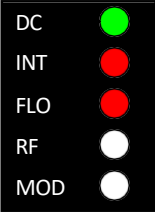
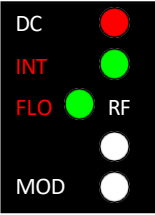
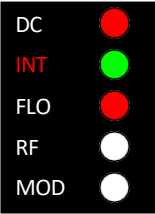
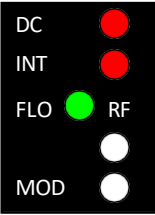
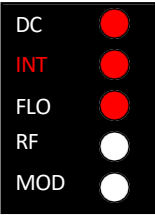
Section 4

Diagnostics and troubleshooting

Status indicator diagnostics – all lasers

Table 18 - Status indicator diagnostics — all lasers

Indicator display	Status	Action
	Normal operation. Laser enabled.	No action required.
	Coolant flow is below the minimum recommended rate. See page 18	- Check the coolant flow rate. - Check for blockages or restrictions in the cooling system pipes.
	No RF Enable signal.	Check the RF Enable signal.
	The modulation input is not within the specified limits.	Check the modulation signal. See Section 2 .
	No modulation input.	Check the modulation signal. See Section 2 .
	VSWR fault.	- If the indicator is intermittently red, check the pre-ioniser fuse. See Section 5. - If the problem persists, contact Luxinar Aftersales.

Indicator display	Status	Action
	Coolant flow is below the required minimum.	Provide the required minimum coolant flow rate to the system. See section page 18 .
	No interlock signal.	Check for open machine interlocks.
	- No interlock signal. - No coolant flow.	- Check for open machine interlocks. - Provide the required minimum coolant flow rate to the system. See section page 18
	The DC supply voltage is not within the specified limits.	Provide the required DC input voltage. See page 18
	- The DC supply voltage is not within the specified limits. - The coolant flow rate is below the required minimum.	- Provide the required DC input voltage. See page 16 - Provide the required minimum coolant flow rate to the system. See page 18
	- The DC supply voltage is not within the specified limits. - No interlock signal.	- Provide the required DC input voltage. See page 16 - Check for open machine interlocks.
	- The DC supply voltage is not within the specified limits. - No interlock signal - The coolant flow rate is below the required minimum.	- Provide the required DC input voltage. See page 16 - Provide the required minimum coolant flow rate to the system. See page 18 - Check for open machine interlocks.

	The DC supply is not present. - Check the DC power supply connection to the RF power supply. - Check the DC power supply
--	--

Status indicator diagnostics — lasers with shutter and power feedback

Table 19 - Status indicator diagnostics — lasers with shutter and power feedback

Indicator display	Status	Action
	External Modulation mode selected. - Diode pointing laser disabled.⁽¹⁾ - Shutter open.	Normal system operation for External Modulation mode.
	Internal Modulation mode selected. - Diode pointing laser disabled.⁽²⁾ - Shutter open.	Normal system operation for Internal Modulation mode.
	External Modulation mode selected. - Diode pointing laser disabled. - Shutter closed.	- Apply a high (5–24V) signal to U1, pin 21 to enable the diode pointing laser. - Apply a high (5–24V) signal to U1, pin 1 to enable the shutter.
	External Modulation mode selected. - Diode pointing laser enabled. - Shutter closed.	Apply a high (5–24V) signal to U1, pin 1 to enable the shutter.
	External Modulation mode selected. - Diode pointing laser enabled. - Shutter fault.	Contact Luxinar Aftersales.
	Internal Modulation mode selected. - Diode pointing laser disabled. - Shutter closed.	- Apply a high (5–24V) signal to U1, pin 21 to enable the diode pointing laser. - Apply a high (5–24V) signal to U1, pin 1 to enable the shutter.
	Internal Modulation mode selected. - Diode pointing laser enabled. - Shutter closed.	Apply a high (5–24V) signal to U1, pin 1 to enable the shutter.
	Internal Modulation mode selected. - Diode pointing laser enabled. - Shutter fault.	Contact Luxinar Aftersales.

1. The diode pointing laser is internally disabled once the shutter is open.

2. The diode pointing laser is internally disabled once the shutter is open.

Section 5

Routine maintenance

The SR series has been designed to be low maintenance. Internal routine maintenance procedures are not required. The system's sealed construction and limited number of moving parts ensure trouble-free and reliable operation.

General cleaning



WARNING



Laser radiation and electrical hazards

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser radiation exposure. This is a Class 4 (Class IV) laser and the beam is invisible to the eye.

Please review all safety instructions and precautions given in the Safety chapter before attempting to operate or service this system.

- 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 or onto the output window or final beam delivery optic.

Pre-ioniser fuse replacement



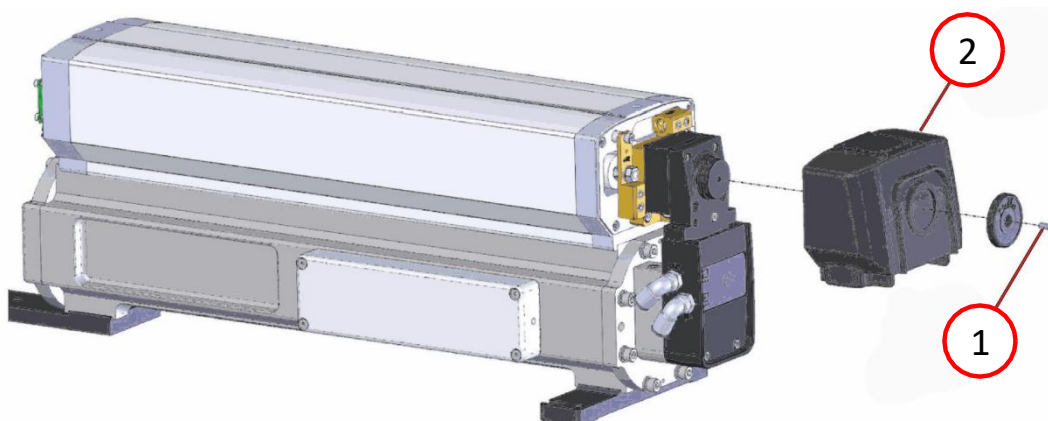
DANGER



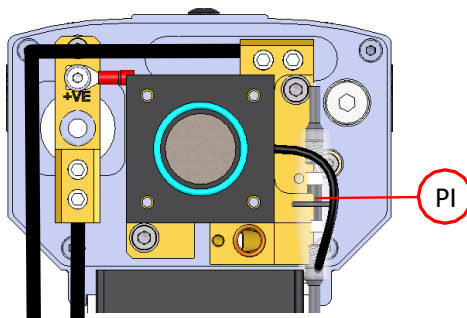
Risk of electric shock

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

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



3. Remove the faulty fuse (PI).



4. Fit a replacement fuse of the same size and type.
Fuse specification: 20mm, T1A250V (Luxinar part number 552-0007-00).
5. Replace the cover and secure it with the fixing screw. Care should be taken when fitting the cover. Ensure the pre-ioniser cable is not trapped or crushed when fastening.

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

Cooling system contamination

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

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

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

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

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 circuit must either be equipped with a winter-proof heating tank to prevent the cooling water temperature dropping below 15°C or the coolant must contain glycol antifreeze. For coolant details refer to [Appendix E](#).

Section 6

Installation

Installation procedure

Before unpacking the laser, prepare for the installation by making sure that the required equipment, resources and materials are available. Carefully inspect the package contents for shipment damage and notify Luxinar immediately if any damage is found.

Ensure that the following are available before starting installation:

- The means to transport and lift the laser into position. See [page 18](#) for equipment weights.
- A flat surface with prepared fixing locations to match the laser mounting feet. See [page 33](#).
- A DC power supply supplied by Luxinar or sourced locally.
- A beam delivery system and support brackets with a prepared connection for the laser output window mounting point
- A source of cooling water or a chiller for laser cooling. See [page 36](#).
- A source of high purity nitrogen or compressed air to provide a positive purge pressure for the laser optics. See [page 37](#)
- An emergency stop interlock circuit.
- Laser control interface circuitry.

Perform the following steps to install the laser:

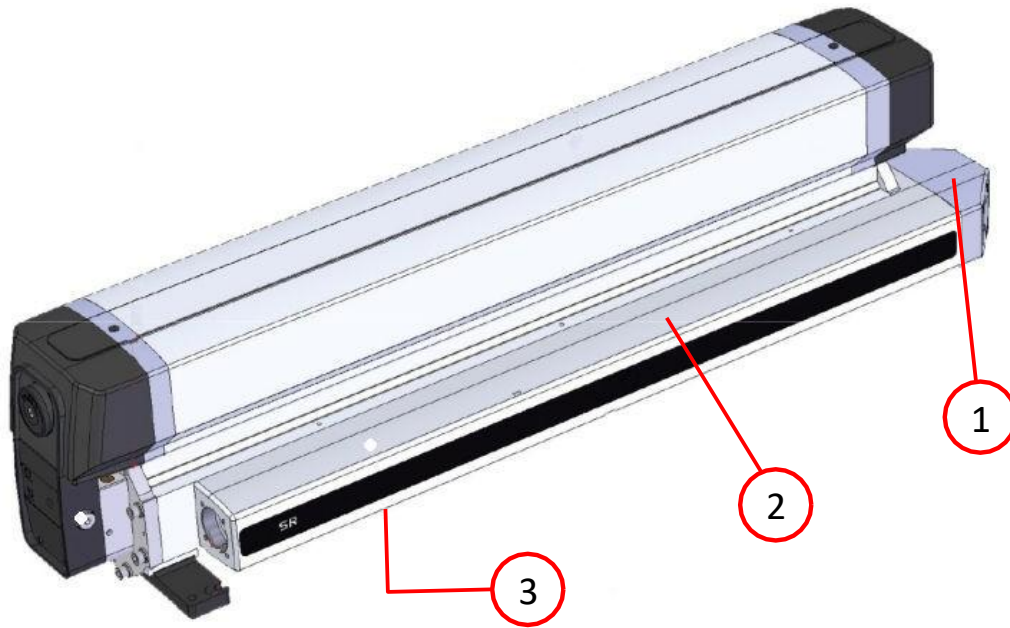
1. Carefully unpack the laser and place it on the prepared mounting surface, then fasten it in place using M8 bolts. Do not remove the protection cap from the laser output window at this stage.
See [page 33](#).



Heavy equipment — risk of severe lumbar injury

The weight of the laser head 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 laser head or that suitable lifting equipment is employed.

Suitable lifting points are the base of the laser resonator, the beam turning block and the internal beam delivery module cover. Do not lift using the power feedback or shutter modules, if fitted, as this can cause optical misalignment with a reduction in power or mode quality.



- 1 Beam turning block
- 2 Internal beam delivery module cover
- 3 Laser resonator base

Figure 31 - Laser head lifting points

2. Connect the laser to the cooling water source or chiller using 10mm OD tubing (see [page 36](#)). To connect the cooling tubing:
 - a. Push the tube into the connector until it reaches the stop. Pull back on the tube to ensure that the connector has gripped the tube firmly.
 - b. To remove the tube, press the release ring on the end of the connector end and pull out the tube.
3. Connect the optics purge gas supply using 6mm OD tubing (see [page 37](#)). To connect the gas purge tubing:
 - a. Push the tube into the connector until it reaches the stop. Pull back on the tube to ensure that the connector has gripped the tube firmly.
 - b. To remove the tube, press the release ring on the end of the connector end and pull out the tube.
4. Connect the laser to the DC power supply.



DANGER

Exposed terminals — risk of electrocution

Switch off and disconnect the equipment from the mains electrical supply before exposing electrical terminals. Only trained and authorised personnel should make electrical connections.

5. Connect the DC power supply to the mains. See [page 38](#).
6. Connect the emergency stop interlock circuit.
7. Connect the control interface circuitry.
8. Remove the red output window protection cap and store it in a safe place for use when transporting the system.
9. Test the laser output before fitting the beam delivery.

Place a suitable beam block or power monitoring device in the beam path. Do not place it close to optical surfaces to avoid risk of contamination by evaporated material. Be aware that the beam blocking material may create dangerous reflections.


WARNING


Hazardous laser radiation

Always wear protective eye wear matched to the emission wavelength and output power of the laser. Instruct all personnel in the vicinity to wear identical protective eyewear.

10. Mount the beam delivery and connect it to the laser output window using the prepared connector. See [page 39](#).

Unpacking, mounting and connections

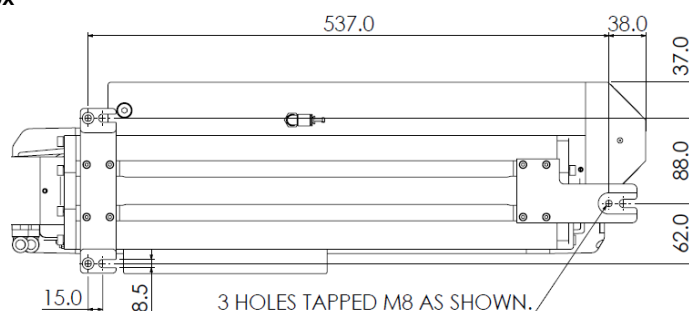
Refer to [page 16](#) for details of weights and dimensions.

Mechanical fixing

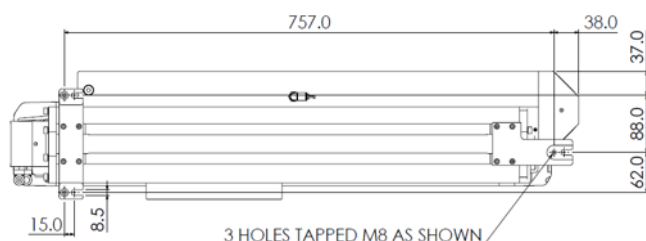
Secure the laser to the host machine using the three mounting feet on the base. Each mounting foot has an M8 threaded hole and an open-ended slot suitable for an M8 bolt.

Mounting position dimensions are shown in the following figures.

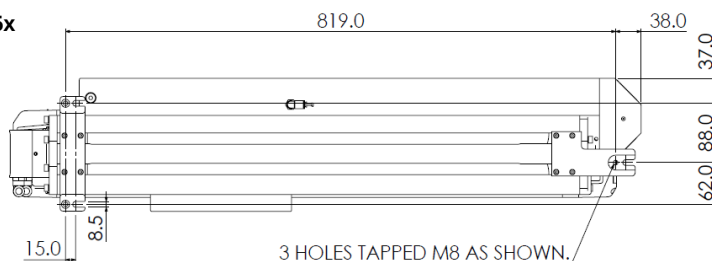
SR 08s, 10i, 10x



SR 10e, 15i, 15s, 15x



SR 15e, 25i, 25x



To ensure correct operation of the standard version, it must be mounted in one of the approved orientations identified by the check mark in the following figure.


WARNING


Risk of shutter malfunction or failure

For shutter and power feedback versions, the A orientations must not be used. Safe operation of the shutter requires that the laser is mounted horizontally with the feet underneath.


CAUTION


Risk of optical damage due to vertical orientation

Vertical mounting, as shown by orientations B and C, can result in premature failure of laser optics and should be avoided. Mounting with the output window on top of the laser, shown in orientation B, is totally prohibited.

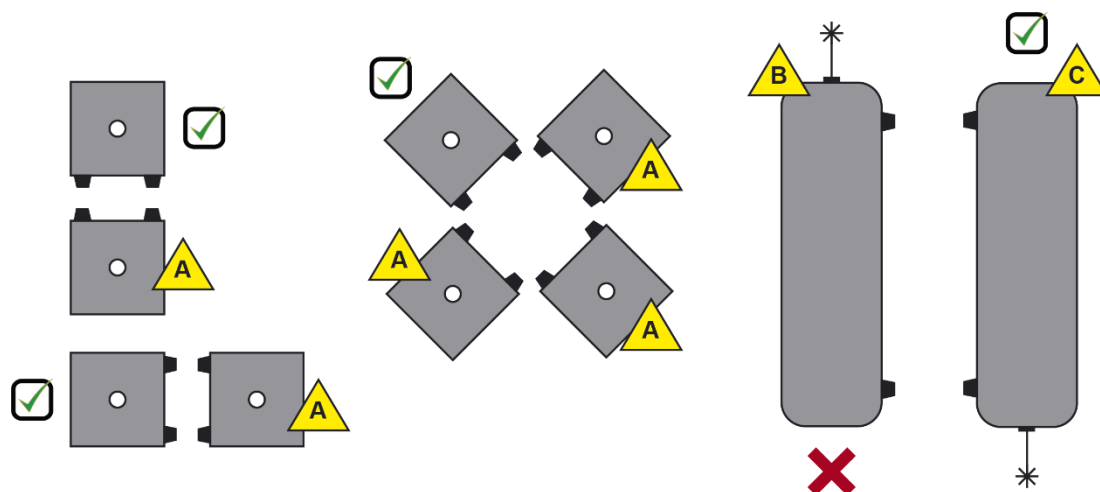
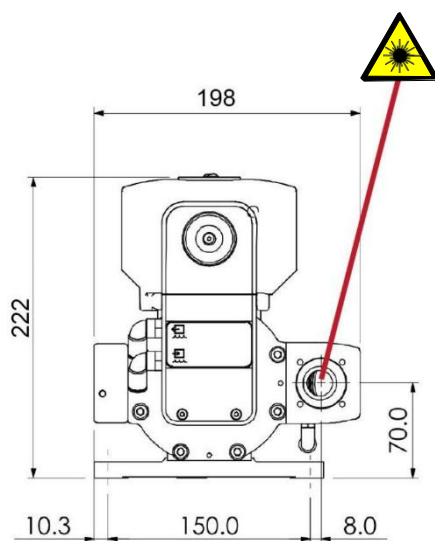


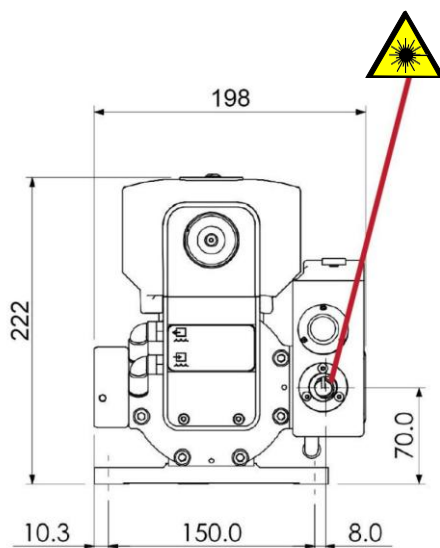
Figure 32 - Correct and incorrect mounting orientations

Laser output aperture location

Standard version :

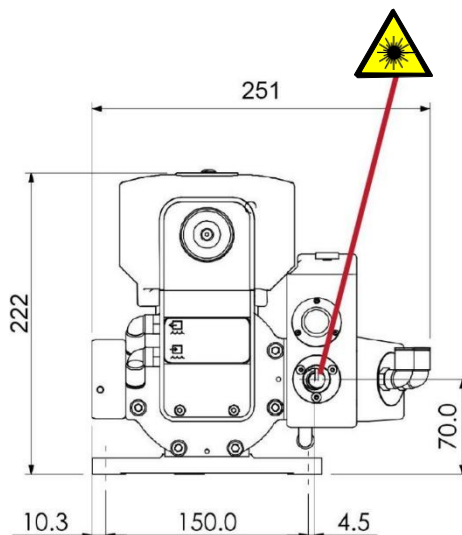


Shutter version :



Power feedback version:

For the power feedback version, the axis of the output beam is offset in the horizontal plane when compared with the standard version or shutter version. The horizontal beam axis with respect to the mounting feet is shown in the following figure.



Note: For the power feedback version, the beam will be tilted downward in the vertical plane by $2.8 \pm 0.4\text{mrad}$. In the horizontal plane the beam may have an angular deviation from the optical centre-line of up to $\pm 1.75\text{mrad}$.

Coolant connections and pipework

If the optional Luxinar DC power supply is fitted, the coolant must flow through the power supply before the laser.

For the shutter and power feedback versions, the coolant enters the laser via the shutter module.

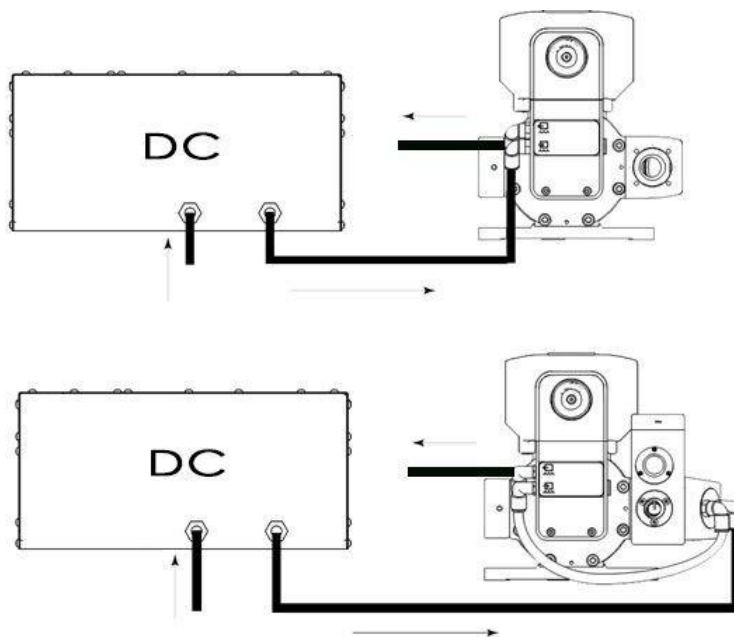
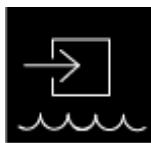


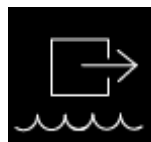
Figure 33 - Coolant connections and flow direction

Coolant inlet and outlet connectors are marked with the following symbols (direction depends on the label location):

- **Coolant in**



- **Coolant out**



Important!

Materials used in the external cooling circuit must be chosen to avoid corrosion. Never use aluminium, zinc, mild steel or cast iron components. Suitable materials are stainless steel, copper, copper alloys and opaque plastics. Only use pipework that is impervious to light in order to reduce the possibility of bacterial contamination of the cooling system.

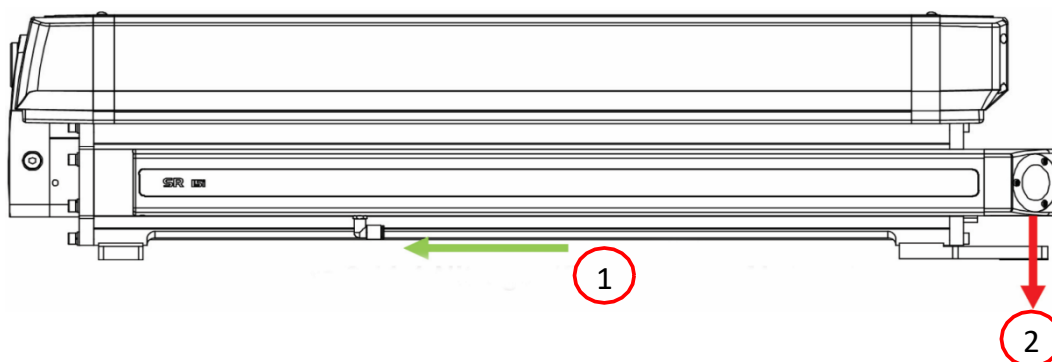
The coolant temperature must be kept above the dew point in order to prevent formation of condensation on internal laser components.

Completely drain the cooling system before shipment or storage.

Beam delivery optics purge gas

If the internal or external beam delivery is contaminated with fumes, water vapour or debris then these contaminants can absorb the laser energy and cause laser power fluctuations and steering of the laser beam. In severe cases, laser optics can be contaminated and damaged.

The laser internal beam delivery is fitted with an optics purge system for use with contaminant-free compressed air or nitrogen.



- 1 Purge gas input connector
- 2 Purge gas exhaust

Figure 34 - Internal optics purge gas connector

A non-return check valve is fitted to the internal beam delivery. The check valve opens and allows the excess purge pressure to escape.

Once the purge pressure has dropped to the correct pressure, the valve will close automatically, preventing dust, moisture and contaminants from entering the optical system.

Electrical power connections

The laser requires a 50VDC power supply, either supplied locally or available from Luxinar. For specifications refer to [page 16](#). The connecting cable cross-section depends on the laser model and cable length. Refer to the following table for cable selection:

Table 20 - Maximum lengths of DC power supply cables

Model	16mm ² cross-section	25mm ² cross-section
SR 08s	15m	23m
SR 10i	10m	16m
SR 10x	8m	13m
SR 10e	8m	13m
SR 15s	7m	11m
SR 15i	7m	10m
SR 15x	5m	10m
SR 15e	6m	10m
SR 25i	5m	8m
SR 25x	4m	7m



DANGER

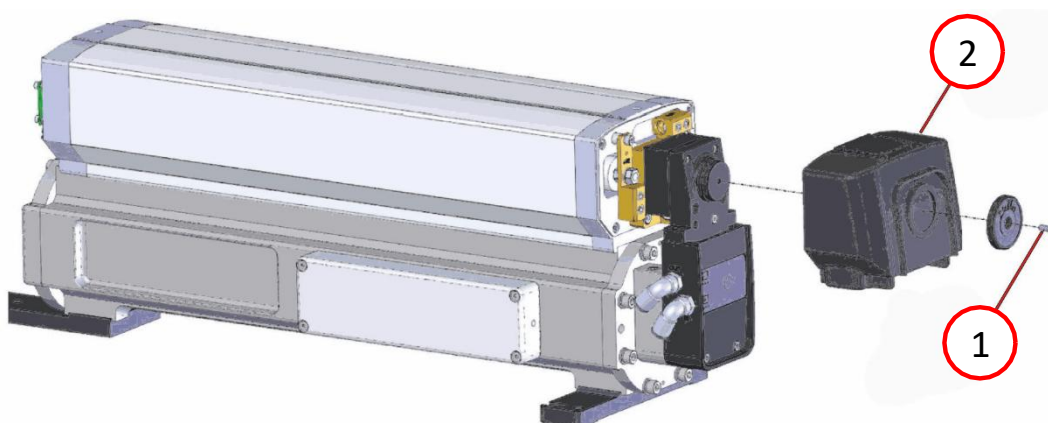
Risk of electric shock or severe damage to the equipment

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

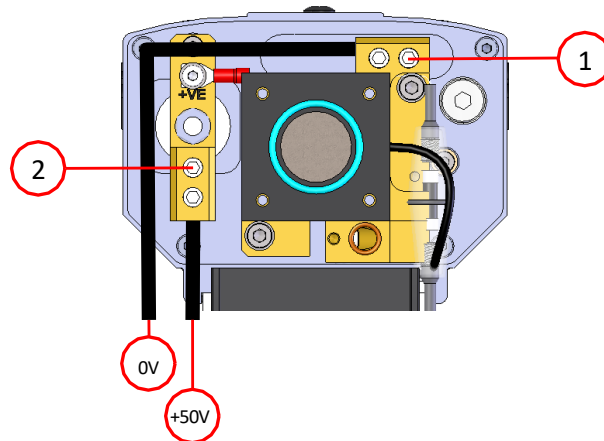
Respect the polarity of the terminals on the power supply and the laser.

To connect the cables to the laser:

1. Remove the cover (2) from the rear end of the laser by unscrewing the securing screw (1).



The terminals are marked as **+VE(2)** and **Ground(1)**.



1. Clamp the cables securely in the terminals using the two clamp screws on each terminal.
2. Replace the cover and secure it with the securing screw. Care should be taken when fitting the cover. Ensure the pre-ioniser cable is not trapped or crushed when fastening.

Beam delivery



Risk of damage to the laser output window mount

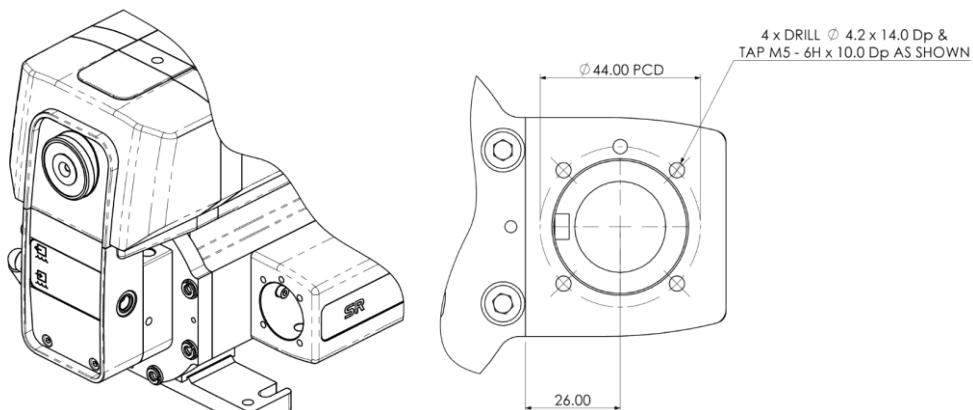
The laser output window mount is not capable of supporting a beam delivery. Always provide strong and stable mechanical support for the beam delivery and other external optics.

Important!

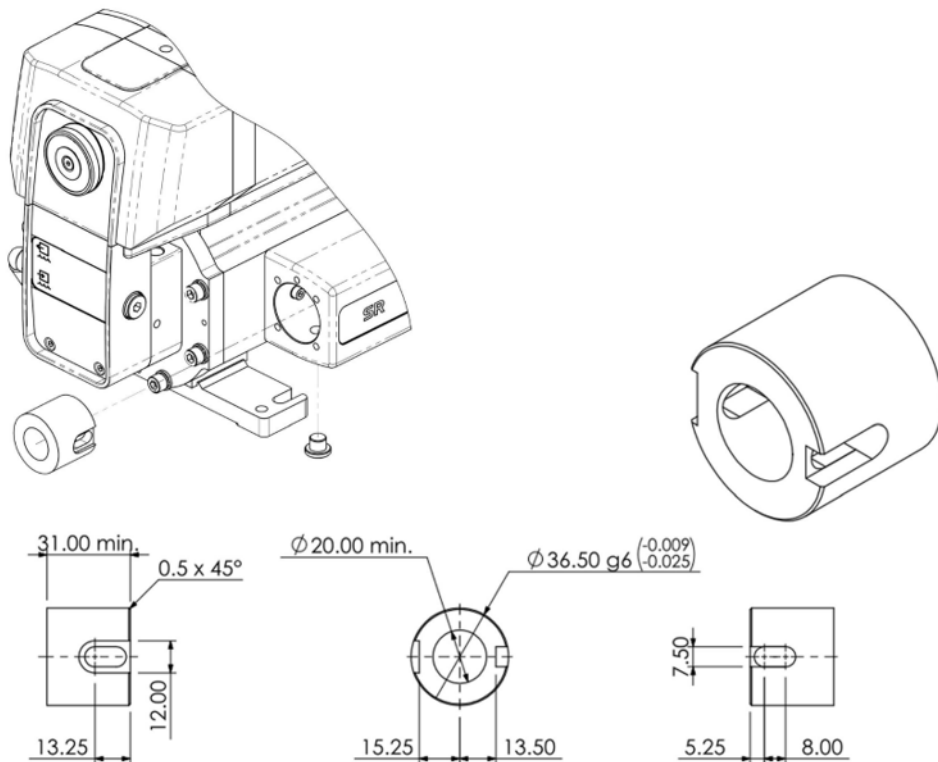
Remove the blanking cap from the output window before attempting to attach the beam delivery. Care should be taken when fitting the cover.

There are two approved methods for attaching the beam delivery system to the laser output:

1. Attach the beam delivery to the four M5 mounting holes on the output window mount.



2. Insert the beam delivery tube directly into the output window mount and secure it by an M6 grub screw.



Note: Shutter and power feedback versions have a visible light laser diode pointer to assist with beam delivery alignment. The rated power of the laser diode pointer is 4mW.

Take appropriate precautions when using the laser diode pointer to align the beam delivery.



WARNING

Class 3R visible laser radiation

Avoid eye exposure to direct and scattered radiation.

Section 7

Transport and recommissioning

Before transporting the laser, observe the following precautions:

- Completely drain the laser cooling system to prevent damage during shipping. Use clean compressed air, at a maximum pressure of 2bar, to blow out all traces of coolant in the cooling system pipework.
Failure to remove coolant from the system prior to transport can cause damage to the laser. Damage caused in this way will invalidate the warranty.
- If the external beam delivery has been removed, replace the output window protection cap to prevent damage or contamination during shipping.

Section 8

Interfacing

User interface connections for SR series lasers are made through the 25-pin and 15-pin connectors on the rear panel. Pin connections depend on the laser version.

Important!

Under certain conditions, it may be possible for power cables carrying high voltages and currents to emit electrical noise levels that may interfere with control cable signals.

To eliminate the possibility of interference, control signal cables must be screened and routed along a different path to power cables.

Standard version

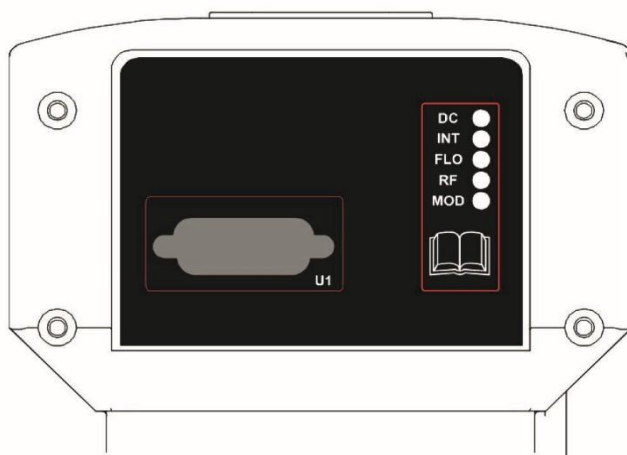
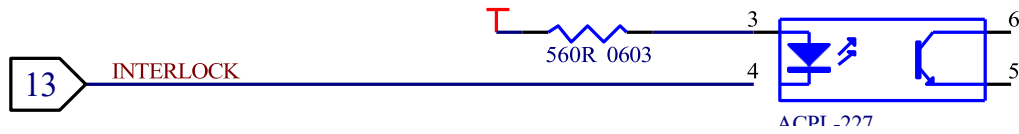


Figure 35 - Standard laser — U1 connector location

Table 21 - Standard laser — U1 pin designations

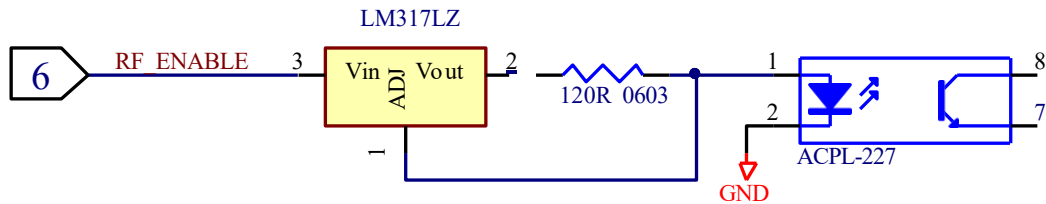
Pin N°	Function	I/O type	Signal
1	VSWR status -	RS422 output -	3.5–0.5V
2	VSWR status +	RS422 output +	0.5–3.5V
3	Overmodulation	Output	0.5/5V
4	Modulation input -	RS422 input -	5–0.5V
5	Modulation output +	RS422 input +	0.5–5V
6	RF enable	Input	0V/5V to 24V
7	FWD VSWR signal	Output	0–3V analogue
8	REF VSWR signal	Output	0–3V analogue
9	RF fault	Output, open drain	5–24V @ 50mA
10	DC fault	Output, open drain	5–24V @ 50mA
11	Coolant flow fault	Output, open drain	5–24V @ 50mA
12	Laser ready	Output, open drain	5–24V @ 50mA
13	Interlock	Input	Return/connect to ground
14	Not used	—	—
15	Signal ground (0V)	—	—

Interlock



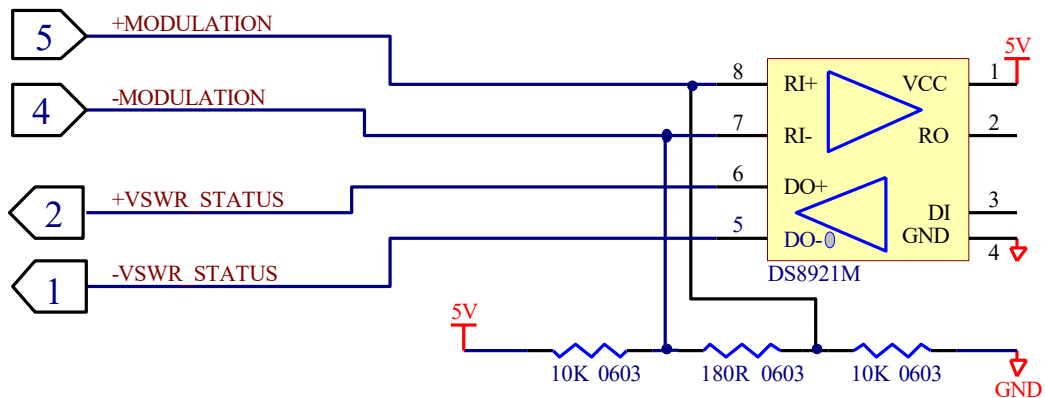
Pull the input low to enable to laser.

RF enable



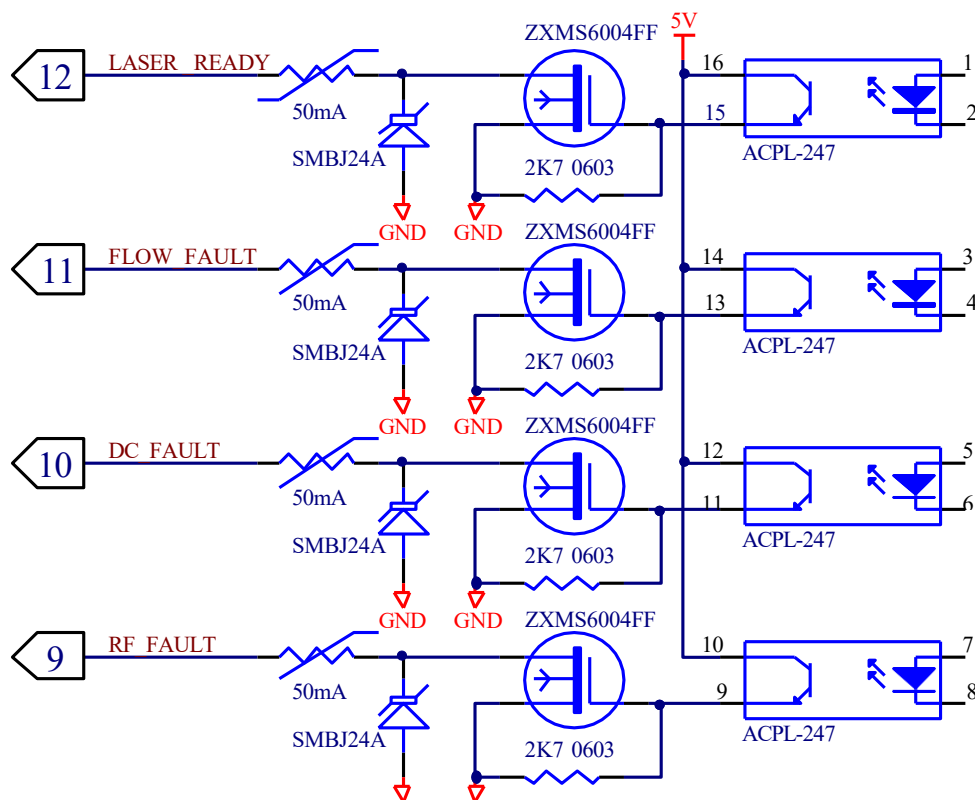
Pull the input high (5–24V) to enable the laser.

Modulation input 7 VSWR status



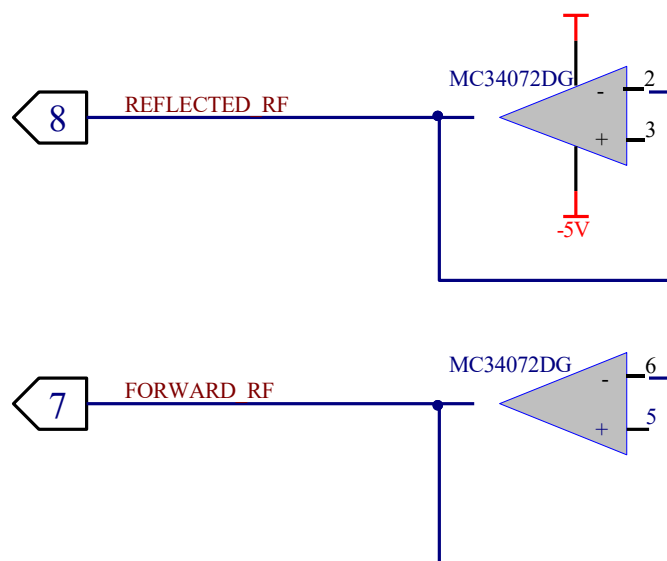
- Modulation input (pins 4 and 5, RS422)**
 Modulation input to fire the laser. Must be kept within the parameter set for the laser model.
 Plse Width (PW) range: Below the minimum PW level, laser output will stop. Above the maximum PW level, laser output will be limited to the maximum PW level.
 Frequency range: Above the maximum level, laser output will stop.
 Duty cycle: Above the maximum level, laser output will be limited to the maximum duty cycle limit. Exceeding any of these levels will result in Over Modulation.
- VSWR status output (pins 1 and 2, RS422)**
 RF power supply or laser tube problem. Laser output is reduced.

Status monitoring signals



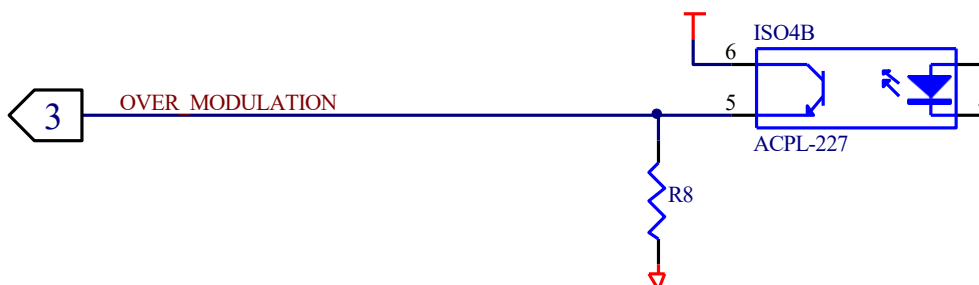
Operating condition	Laser ready (pin 12)	Flow fault (pin 11)	DC fault (pin 10)	RF fault (pin 9)
Normal operation	Low	High	High	High
No RF enable signal	High	High	High	High
Modulation signal not within specified limits	Low	High	High	High
No modulation signal	Low	High	High	High
VSWR fault	Low	High	High	High
RF power supply fault	Low	High	High	Low
Coolant flow fault	High	Low	High	High
Interlock fault	High	High	High	High
Interlock and coolant flow faults	High	High	High	High
DC supply fault	High	High	Low	High
DC supply and coolant flow faults	High	Low	Low	High
DC supply and interlock faults	High	High	Low	High
DC supply, interlock and coolant flow faults	High	Low	Low	High
DC supply not present	High	High	High	High

RF forward and reflection signal monitoring



- **RF forward output (pin 7, analogue)**
Signal proportional to the forward RF voltage
- **RF reflected output (pin 8, analogue)**
Signal proportional to the reflected RF voltage

Overmodulation



Active low output indicates over modulation.

Shutter and power feedback versions

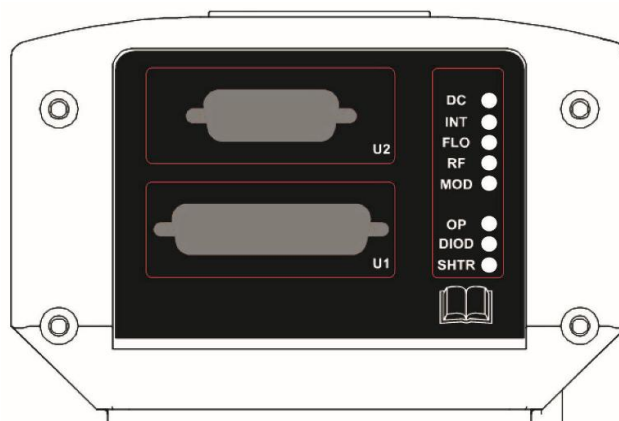
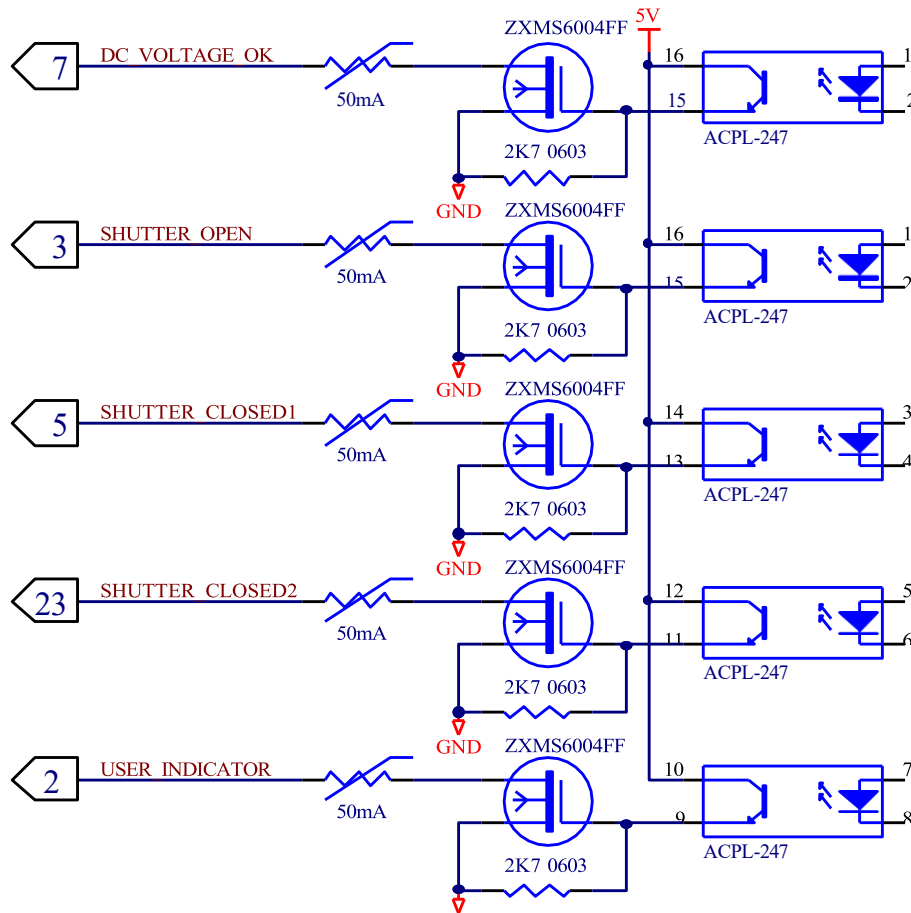


Figure 36 - Shutter and power feedback version — U1 and U2 connector locations

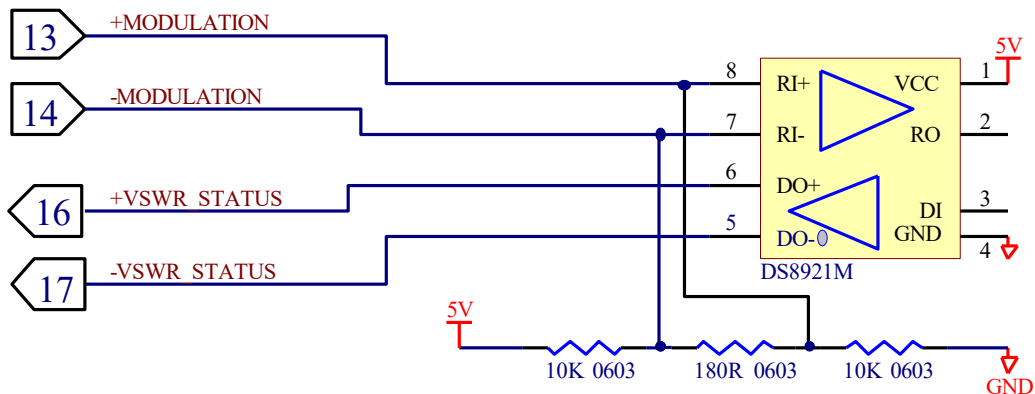
Table 22 - Shutter and power feedback versions — U1 pin designations

Pin N°	Function	I/O type	Signal
1	Shutter enable	Input	5–24V
2	User indicator	Output open drain	5–24V @ 50mA
3	Shutter open	Output open drain	5–24V @ 50mA
4	Ground	Ground	—
5	Shutter closed 1	Output open drain	5–24V @ 50mA
6	Ground	Ground	—
7	DC voltage OK	Output open drain	5–24V @ 50mA
8	—	—	—
9	—	—	—
10	Reflected RF signal	Output, open drain	0–3V analogue
11	Forward RF signal	Output, open drain	0–3V analogue
12	RF enable	Input	0V / 5–24V
13	+ Modulation input	RS422 input (+)	0–5V
14	- Modulation input	RS422 input (-)	5–0V
15	Overmodulation	Output, open drain	0–5V
16	+ VSWR status	RS422 output (+)	0.5–3.5V
17	- VSWR status	RS422 output (-)	3.5–0.5V
18	TX	RS232 output	-6 to +6V
19	External interlock return	Input	5–24V
20	External interlock	Output	5V @ 50mA
21	Diode enable	Opto-isolated input	5–24V
22	RX	RS232 input	-6 to +6V
23	Shutter closed 2	Output open drain	5–24V @ 50mA
24	Product trigger	Input	0V
25	Ground	Ground	—

Status monitoring signals

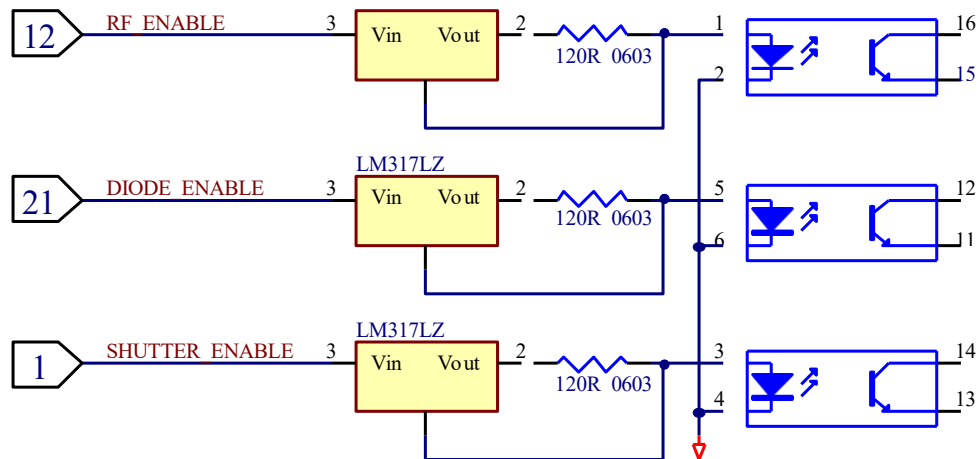


Monitoring input and VSWR status



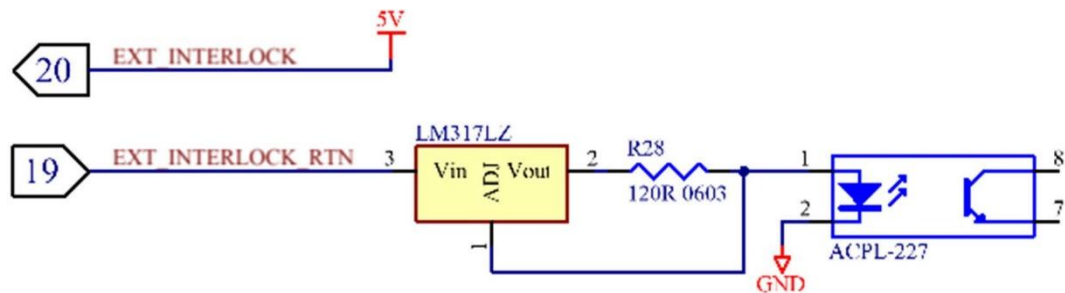
- Modulation input (pins 13 and 14, RS422)**
 Modulation input to fire the laser. Must be kept within the parameter set for the laser model.
 Pulse Width (PW) range: Below the minimum PW level, laser output will stop. Above the maximum PW level, laser output will be limited to the maximum PW level.
 Frequency range: Above the maximum level, laser output will stop.
 Duty cycle: Above the maximum level, laser output will be limited to the maximum duty cycle limit. Exceeding any of these levels will result in over modulation.
- VSWR status output (pins 16 and 17, RS422)**
 RF power supply or laser tube problem. Laser output is reduced.

Enable Signals

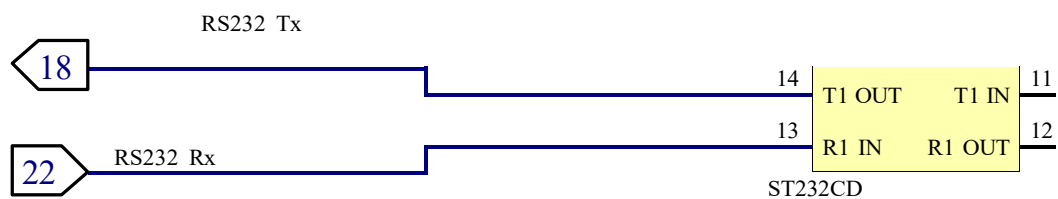


- **RF enable (pin 12)**
Pull the input high (5–24V) to enable the laser.
- **Diode enable (pin 21)**
Pull the input high (5–24V) to switch on the pointing laser.
- **Shutter enable (pin 1)**
Pull the input high (5–24V) to enable the shutter.

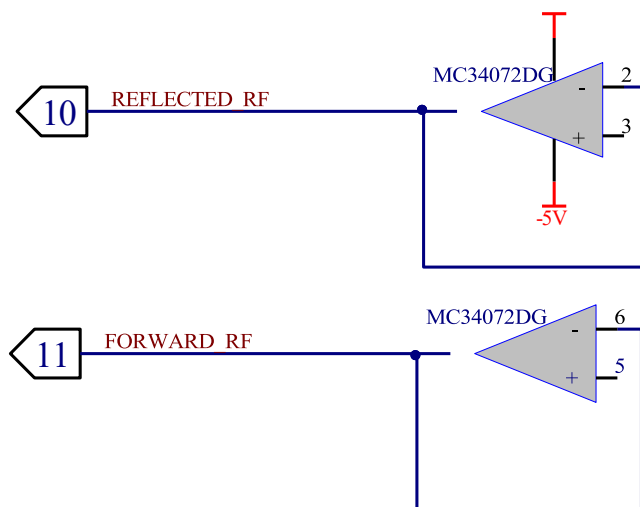
External interlock



RS232 signals

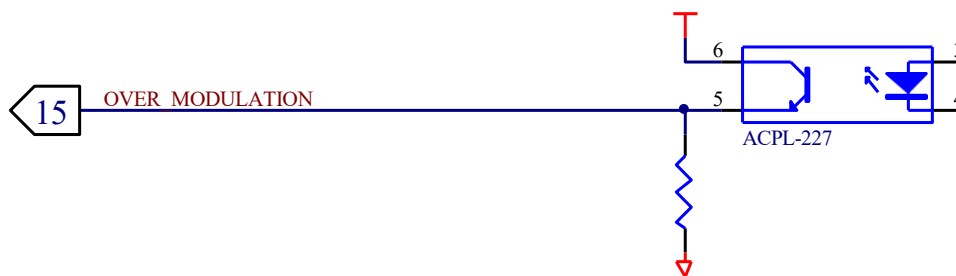


RF forward and reflection signal monitoring



- **RF forward output (pin 11, analogue)**
Signal proportional to the forward RF voltage.
- **RF reflected output (pin 10, analogue)**
Signal proportional to the reflected RF voltage.

Overmodulation



Active low output indicates overmodulation

Ground connection

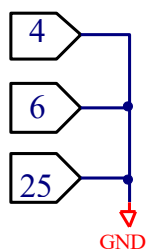
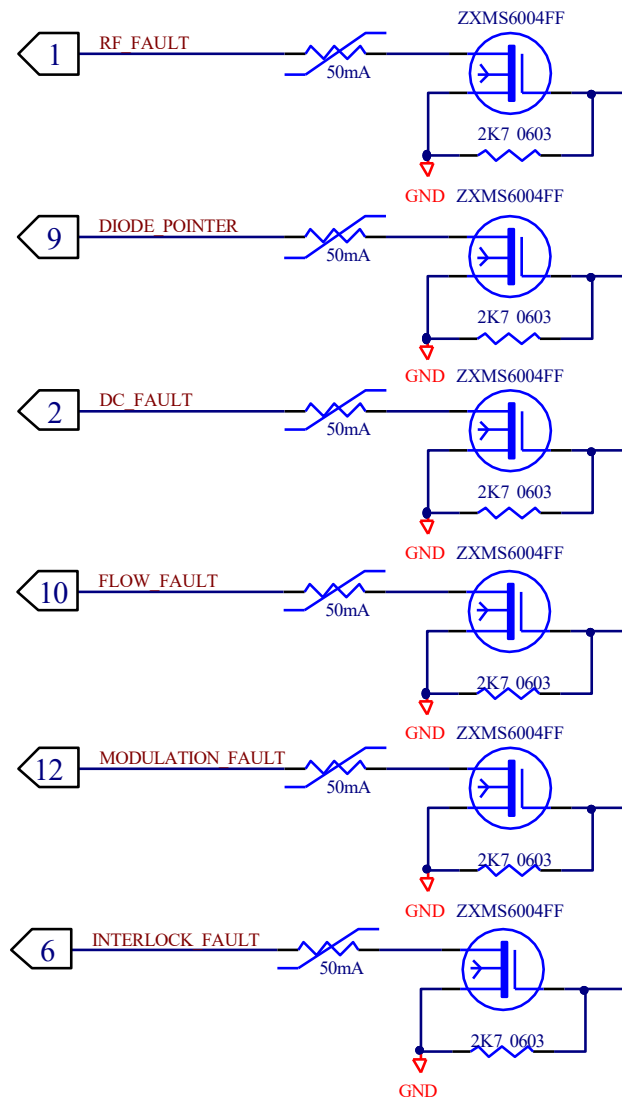


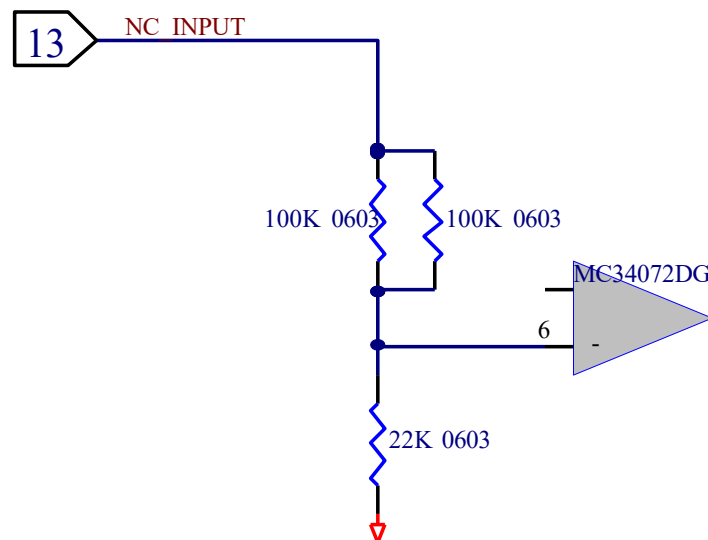
Table 23 - Shutter and power feedback versions — U2 pin designations

Pin N°	Function	I/O type	Signal
1	RF fault	Output	5–24V @ 50mA
2	DC fault	Output	5–24V @ 50mA
3	—	—	—
4	—	—	—
5	—	—	—
6	Interlock fault	Output	5–24V @ 50mA
7	Ground (0V)	Ground	—
8	Ground (0V)	Ground	—
9	Diode enabled	Output	5–24V @ 50mA
10	Flow fault	Output	5–24V @ 50mA
11	—	—	—
12	Modulation fault	Output	5–24V @ 50mA
13	NC input	Input	0–10V
14	—	—	—
15	Ground (0V)	Ground	—

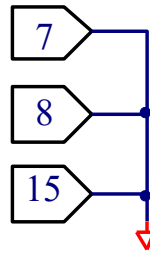
Diagnostic signals



NC input



Ground connection



Minimum interface connections for laser output

Standard version

- Enable the **external interlock** by connecting U1, pin 13 to ground.
- Enable **RF Enable** by applying 5–24V to U1, pin 6.
- Apply the required modulation input (RS422) to U1, pins 4 & 5.
- Connect U1 pin 15 to ground.

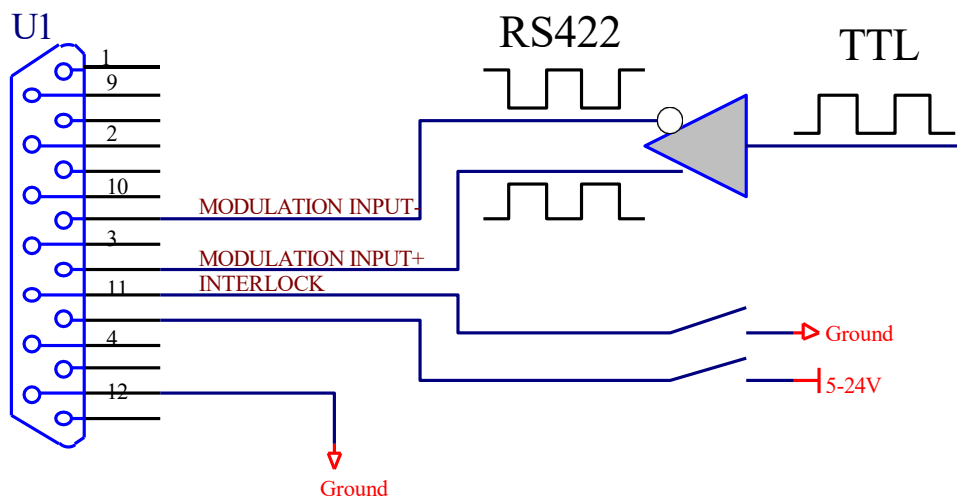


Figure 37 - Standard version — minimum interface connections

Shutter and power feedback versions

- Enable the **external interlock** by connecting an interlock switch between U1, pins 19 and 20.
- Enable **RF Enable** by connecting 5–24V to U1, pin 12.
- Enable **Shutter Enable** by applying a 5–24V signal to U1, pin 1.
- Enable **Diode Enable** by applying a 5–24V signal to U1, pin 21 (for lasers fitted with the optional diode pointing laser).
- When operating in external PWM mode, apply the required modulation signal (RS422) to U1, pins 13 & 14.
- When operating in Internal Control mode, enable the **Trigger** by connecting U1, pin 24 to ground.

Important!

The **Trigger** signal must be switched to ground to enable laser operation but must *not* be permanently connected to ground. If laser operation is interrupted, a transition in the **Trigger** signal must be received in order to restart the laser.

- When running in Internal Control mode, connect the RS232 Tx and Rx on U1, pins 18 & 22 to the remote terminal.
- Connect U1, pin 25 to ground.

Note: The laser is shipped in PWM mode.

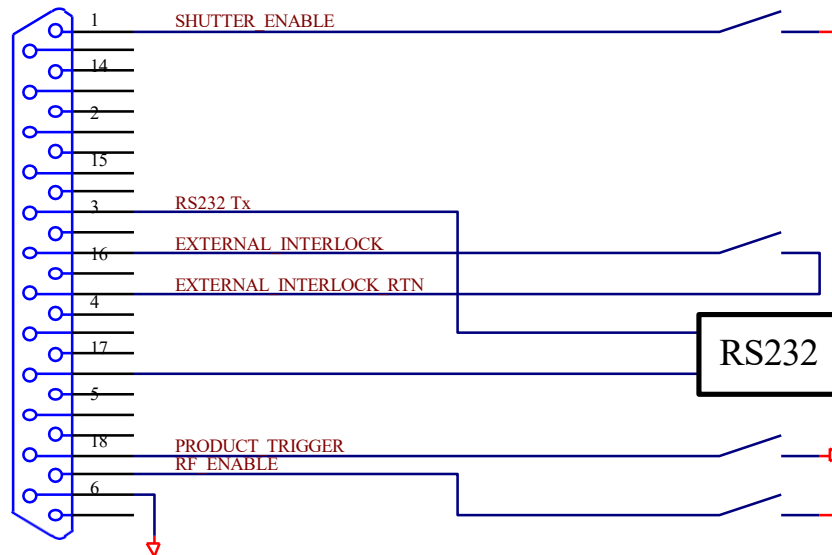


Figure 38 - Shutter and power feedback versions — minimum interface connections

Open drain output usage

Open drain status outputs require a pull-up resistor and voltage source (5–24V) to be connected to the monitored output. When the signal becomes active, the output falls to 0V.

The following diagram shows a typical connection.

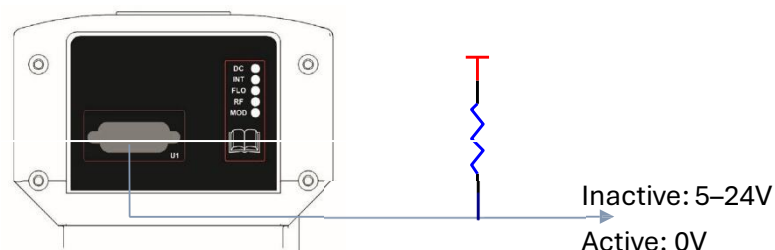


Figure 39 - Typical open drain output connection

Control signal startup timing for shutter and power feedback versions

The following control signal timings must be respected when starting up shutter and power feedback versions.

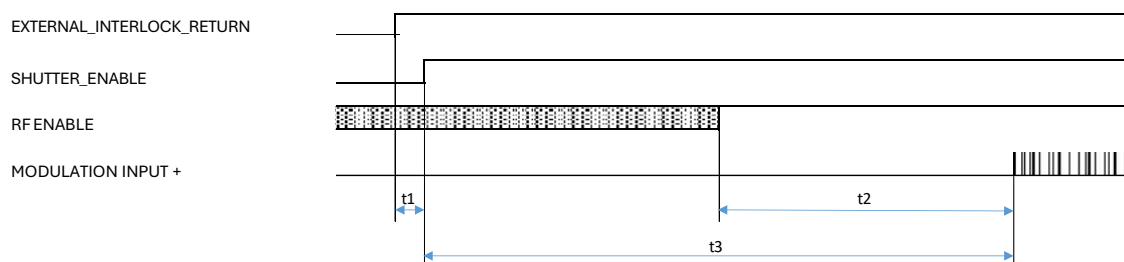


Figure 40 - Control signal startup timing

t1	EXTERNAL_INTERLOCK return to SHUTTER_ENABLE setup time	≥ 10 ms
t2	RF_ENABLE to Modulation setup time	≥ 100 ms
t3	SHUTTER_ENABLE to Modulation setup time	≥ 200 ms

The dual channel safety critical approach [EN:13849 Performance Level D] requires the system to react to system conditions as follows:

- When the **EXTERNAL_INTERLOCK** is disabled, **SHUTTER_ENABLE** and **RF_ENABLE** must also be disabled by the machine controller.
- When restarting the system with **EXTERNAL_INTERLOCK** enabled, the control signal startup timing sequence must be followed.

Status indicators

The operational status of the laser is displayed by status indicator lamps on the laser rear panel.

Standard version

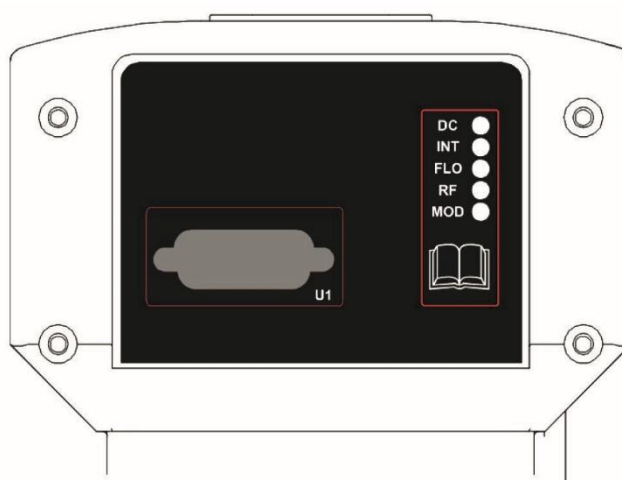


Figure 41 - Standard version status indicators

Indicator name	Status monitored
DC	DC PSU
INT	Interlock
FLO	Coolant flow
RF	RF
MOD	Modulation

If a standard laser experiences any error, the laser will restart automatically once the error has been rectified.

Shutter and power feedback versions

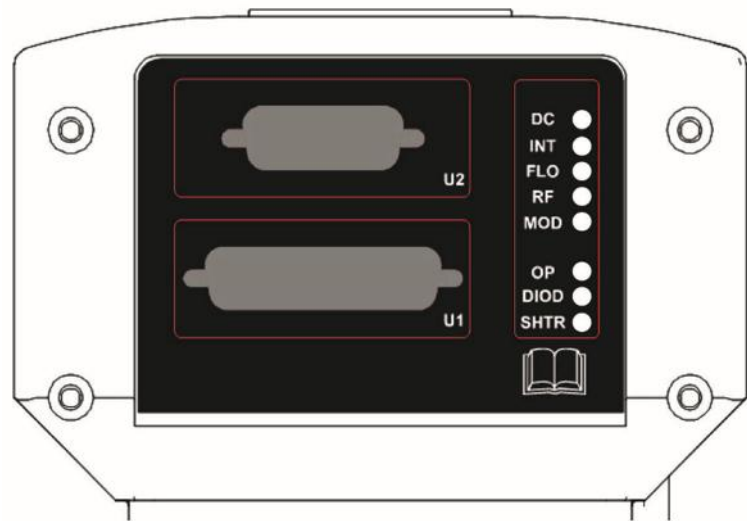


Figure 42 - Laser with power feedback and shutter status indicators

Indicator name	Status monitored
DC	DC PSU
INT	Interlock
FLO	Coolant flow
RF	RF
MOD	Modulation
OP	Operation mode
DIOD	Diode laser
SHTR	Shutter

If a laser with power feedback and shutter experiences DC, interlock, coolant flow or shutter fault errors, laser output will terminate and the shutter will close. Once the error has been rectified, a **Shutter_Enable** signal must be re-applied in order to restart the laser.

Appendix 1

Power feedback programming

Control modes

External Pulse Width Modulation (PWM) mode

External PWM mode controls laser output power using a signal from a modulation source supplied by the user. The mark-space ratio of the signal waveform controls the output power, within the modulation limits of the laser.

Note: This is the default operating mode. The laser is shipped with this mode activated.

The key control features of this mode are:

- RS232 commands may be used to interrogate the laser (or change mode) but will not otherwise affect the power output.
- The trigger input is not used in this mode.
- The trigger delay is not available in this mode.
- The **RF Enable** input must be high (5V) to activate the RF amplifier.
- The **Shutter Enable** signal must be high in order to activate the shutter.
- If an error condition occurs, for example, a low water flow, the laser will fall back to an **RF Disable** condition, disabling modulation input to the RF Amplifier and closing the shutter.

Certain errors can be reset by applying a rising edge signal to the **RF Enable** input. For example, if the shutter failed to open or failed to close.

Internal open loop mode

RF modulation is controlled by varying the pulse-width or frequency using RS232 commands. Power demand is also set using an RS232 command.

Laser power output is controlled by one of two parameter combinations:

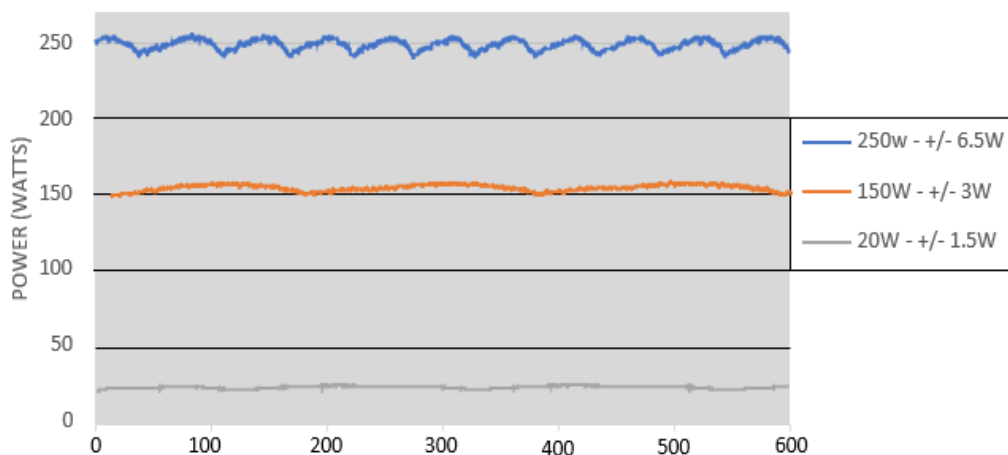
- Vary power demand and frequency.
- Vary power demand and pulse width.

Input parameters depend on the laser model.

The key control features of this mode are:

- The controller does not vary the modulation.
- The trigger input or a software command may be used to start the laser.
- The **RF Enable** input must be high (5V) to activate the RF amplifier.
- The **Shutter Enable** signal must be high in order to activate the shutter.
- If a fault condition occurs, the laser stops operating and the shutter closes.
- Errors can be reset by sending RS232 commands **Goto Standby**, **Goto Run**, or **Start Laser**.

Alternatively, the trigger input can be switched to low (0V).



Internal closed loop mode

Laser output power is controlled using the same input signals as internal open loop mode but with the addition of a feedback signal from the power feedback module. The closed loop algorithm applies fine adjustments to either pulse width or frequency in order to stabilise laser output power at the demanded level.

The key control features of this mode are:

- The controller automatically varies the laser modulation to control the laser power.
- The trigger input or a serial command may be used to start the laser.
- The **RF Enable** input must be high (5V) to activate the RF amplifier.
- The **Shutter Enable** signal must be high in order to activate the shutter.
- If a fault condition occurs, the laser stops operating and the shutter closes.
- Errors can be reset by sending RS232 commands **Goto Standby**, **Goto Run**, or **Start Laser**.
Alternatively, the trigger input can be switched to low (0V).

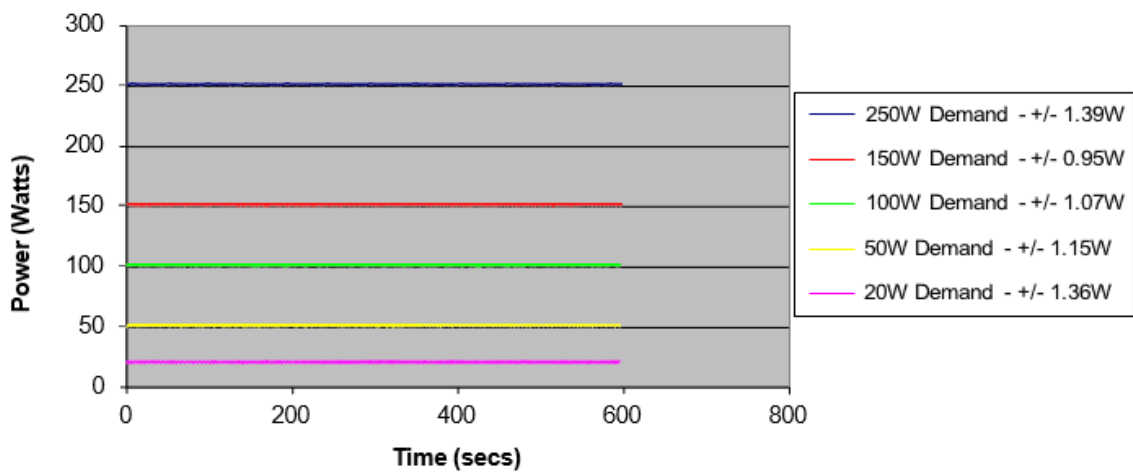


Figure 44 - Typical closed loop mode performance

NC power control mode

Laser output power is changed by varying the voltage on the NC input, connector U2, pin 13. The power can be controlled linearly from 20W up to the maximum selected in the current program. One volt will give 20W and the maximum ten volts will give the maximum power defined by the user. During NC power control operation, the minimum output power is 20W. If the control voltage falls below one volt, or below the minimum power threshold, the laser will switch off. In NC power control mode, Closed loop feedback is used to stabilise the selected power level.

- The controller varies the modulation to control the power level in response to the NC demand input.
- The trigger input or a serial command may be used to start the laser.
- The **RF Enable** input must be high (5V) to activate the RF amplifier.
- The **Shutter Enable** signal must be high in order to activate the shutter.
- If a fault condition occurs, the laser stops operating and the shutter closes.
- Errors can be reset by sending RS232 commands **Goto Standby**, **Goto Run**, or **Start Laser**.
Alternatively, the trigger input can be switched to low (0V).

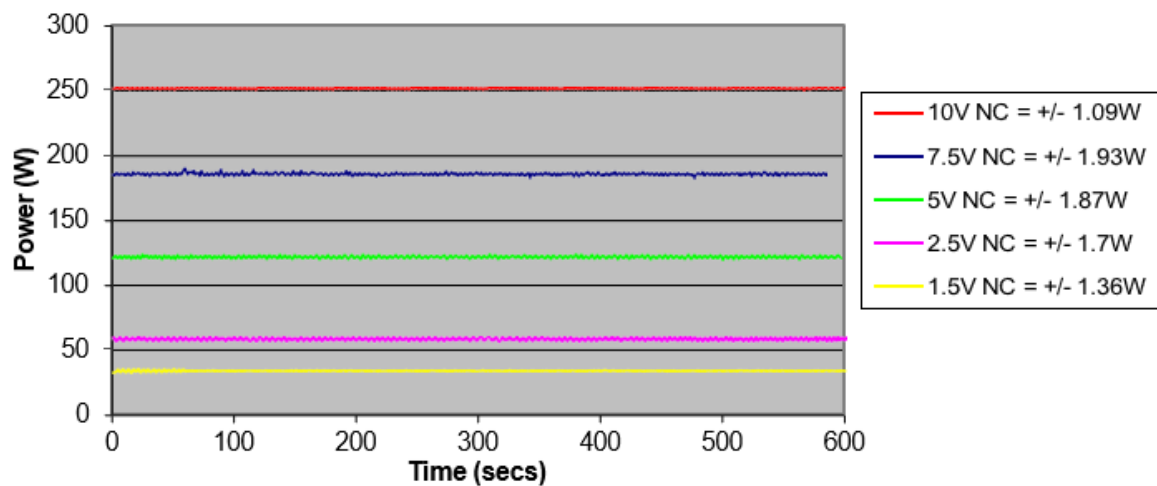


Figure 45 - Typical NC mode performance

Overview of controllers

OEM-supplies controller

For fully integrated machines, the machine controller also controls and monitors the laser directly. For full interfacing details see [Section 8](#).

RS232 controller (shutter version and power feedback version only)

The machine controller provides serial interface commands using the RS232 protocol. For full details of serial interface commands, refer to the Luxinar serial interface specification (part number 906-0109-00).

OEM-supplied controller with Luxinar TTL converter

In order to minimise the effect of RF interference in the control circuitry, it is required that control connections to the laser are made using the RS422 protocol provided by a Luxinar TTL converter unit. This unit converts 5V TTL signal levels to RS422 levels.

If the user is unable to generate RS422 signals directly, the Luxinar TTL converter will generate the appropriate RS422 signals from a TTL source.

Luxinar industrial controller

The industrial controller is a stand-alone programmable controller that can operate the laser in any of the operating modes. The controller also has additional safety interlock features and programmable pulse output options, including:

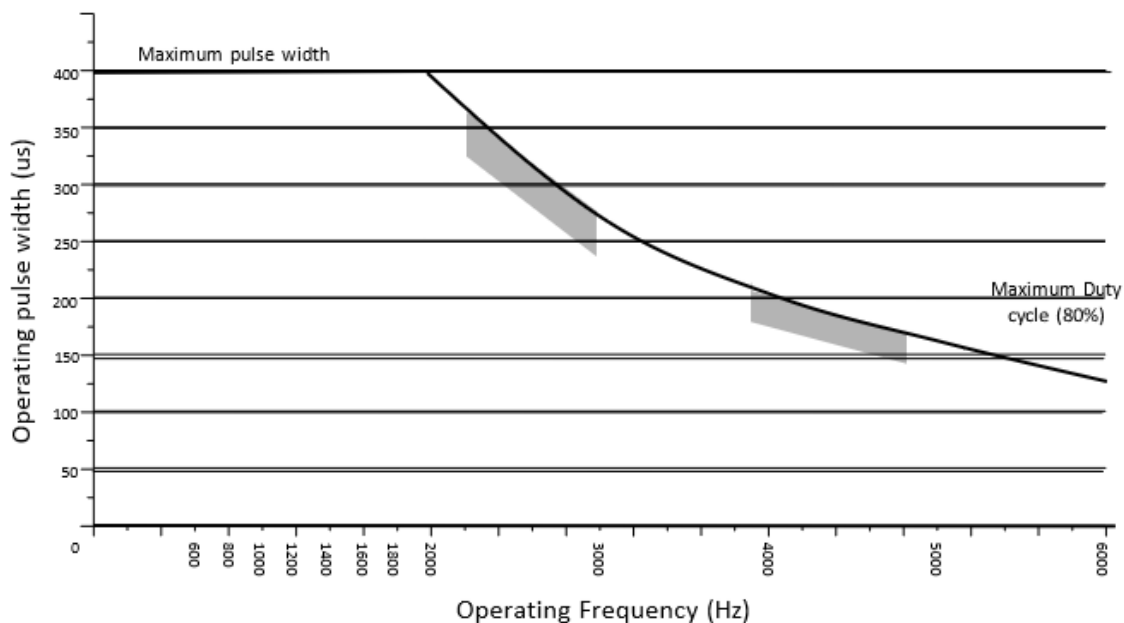
- Continuous
Continuous operation at a set pulse period (PP) and pulse width (PW).
- ToneBurst
Laser output is switched on and off at set intervals in a repetitive sequence.
- StepBurst
Three ToneBurst pulse groups are executed sequentially.
- Perforate
A number of pulses with pre-defined pulse width are executed at intervals triggered by a machine tacho signal.
- Scribe
Groups of pulses with pre-defined pulses are executed at intervals triggered by a machine tacho signal.

Appendix 2

Acoustic zones

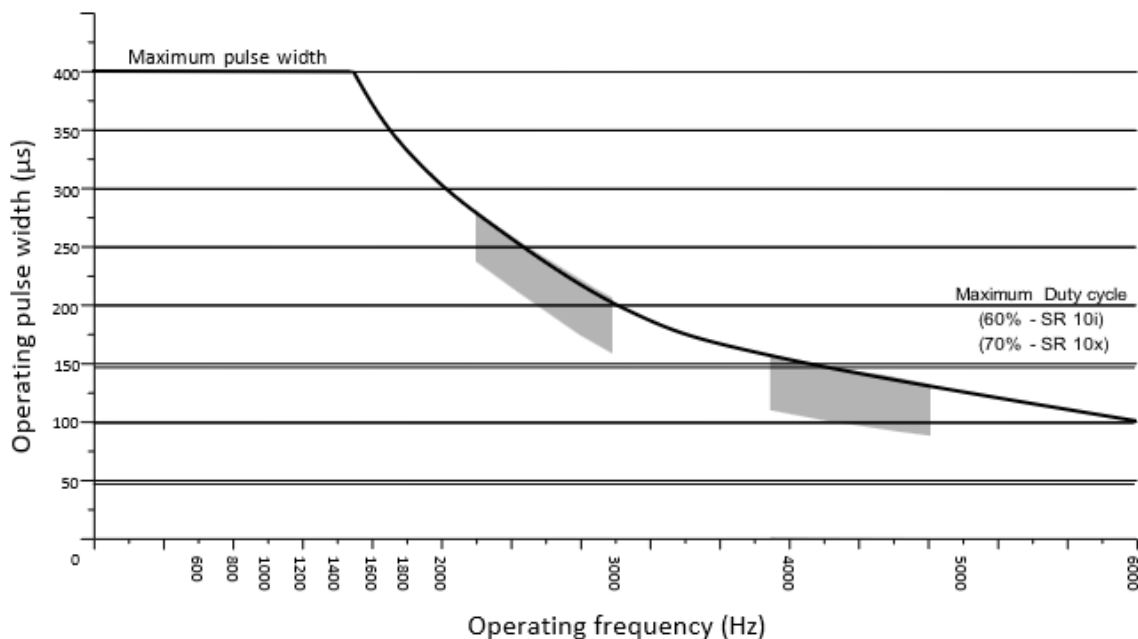
Under certain pulsing regimes, acoustic resonances are set up in the laser which perturb the beam pointing characteristics. To ensure stable beam pointing, avoid operating the laser within the grey shaded areas in the graphs.

SR 08s



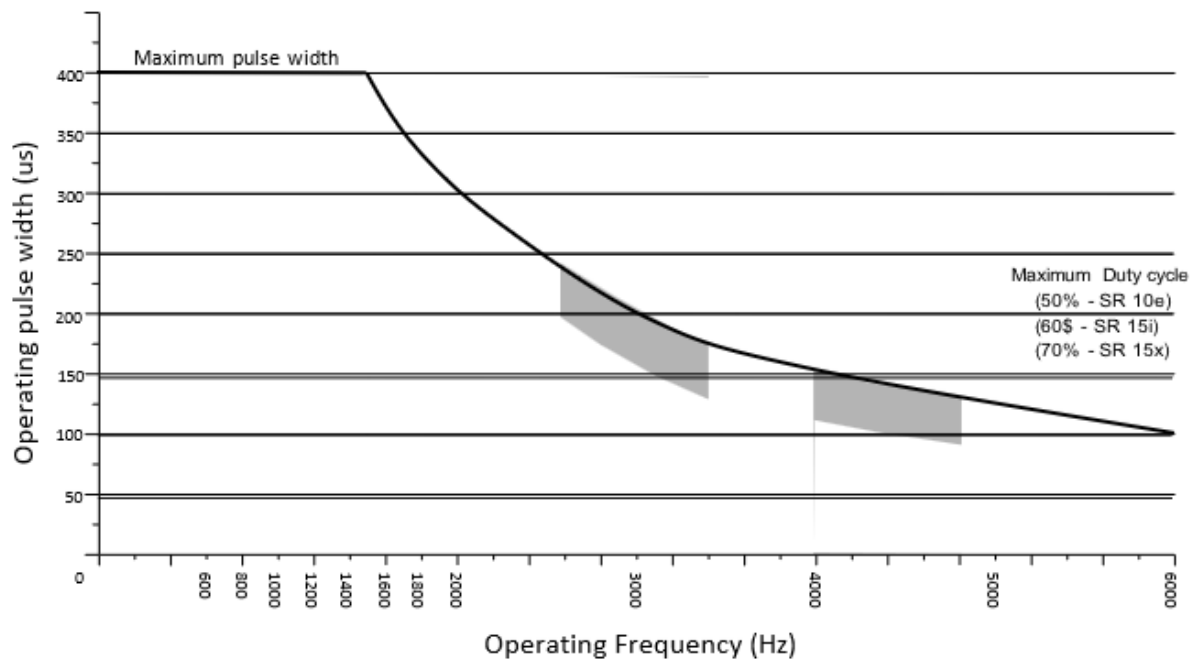
Acoustic Zones where pointing can exceed 0.125mrad (half angle)

SR 10i, 10x



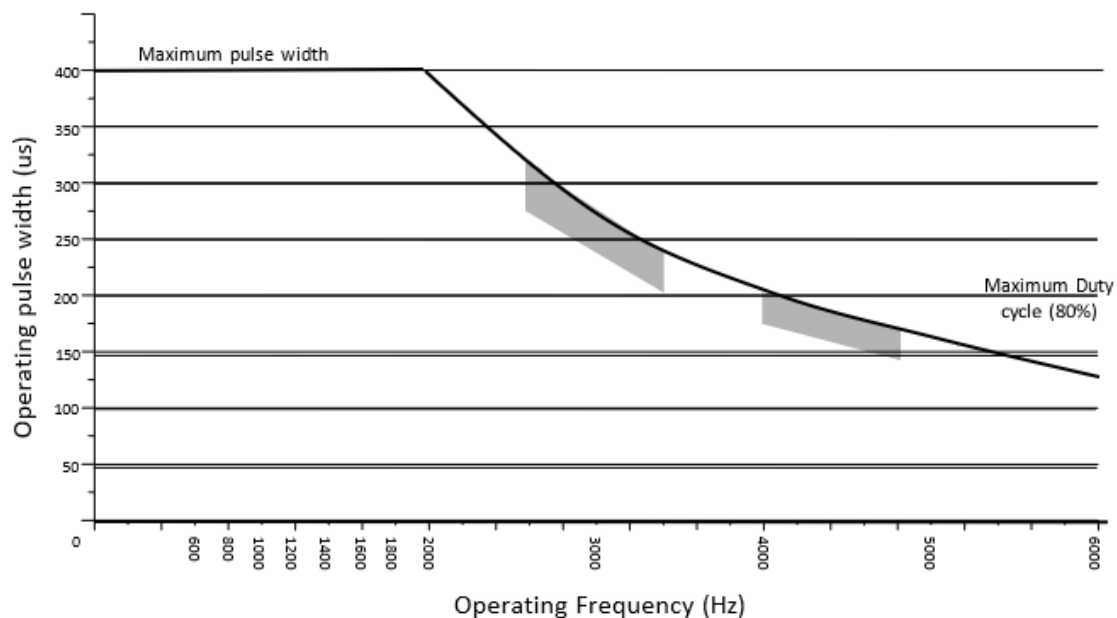
Acoustic zones where pointing can exceed 0.125mrad (half angle)

SR 10e, 15i, 15x



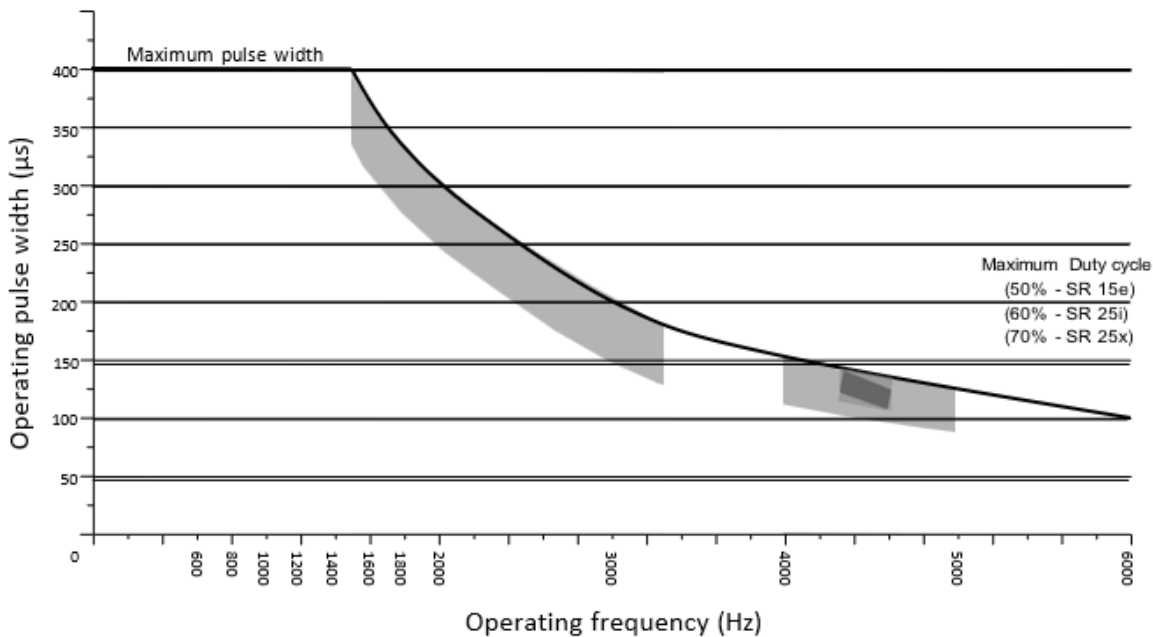
Acoustic Zones where pointing can exceed 0.125mrad (half angle)

SR 15s



Acoustic Zones where pointing can exceed 0.125mrad (half angle)

SR 15e, 25i, 25x



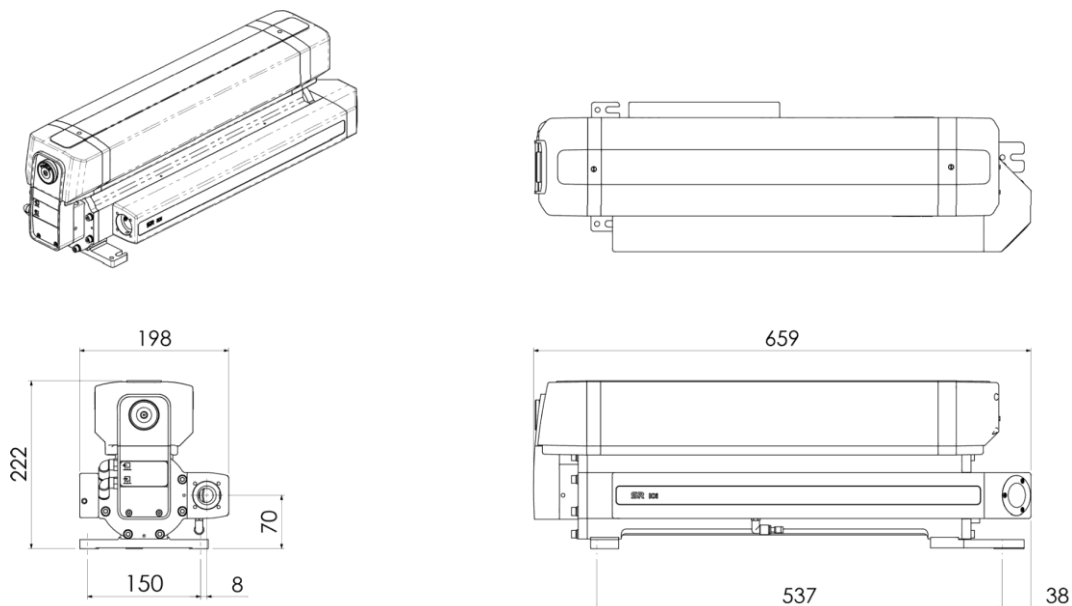
Acoustic zones where pointing can exceed 0.125mrad (half angle)

Acoustic zone where can exceed 0.25mrad (half angle) 4450 ±150Hz

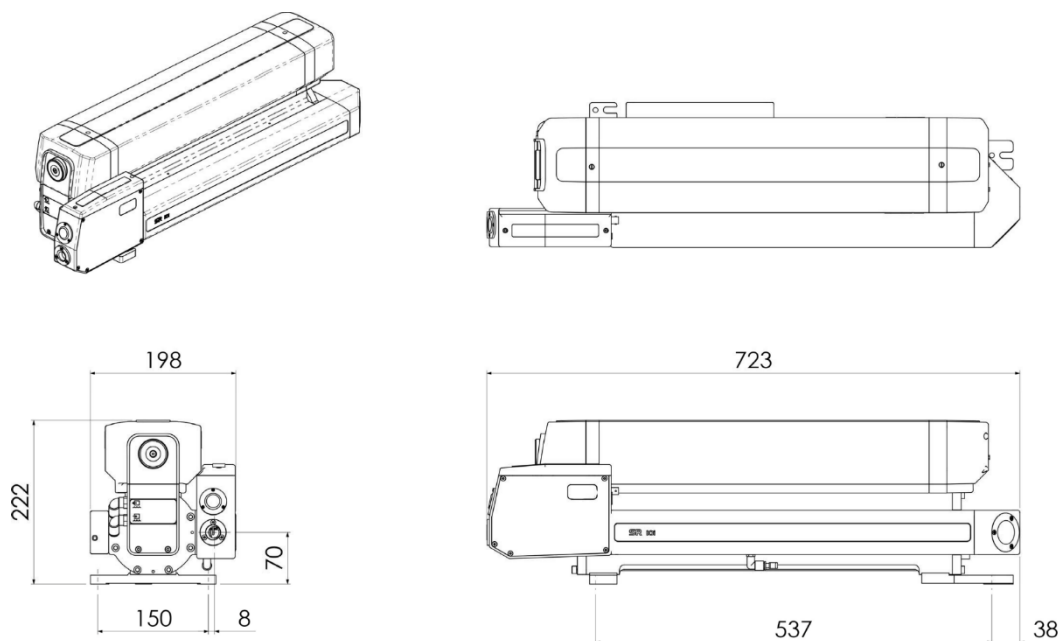
Appendix 3

Dimensional drawings

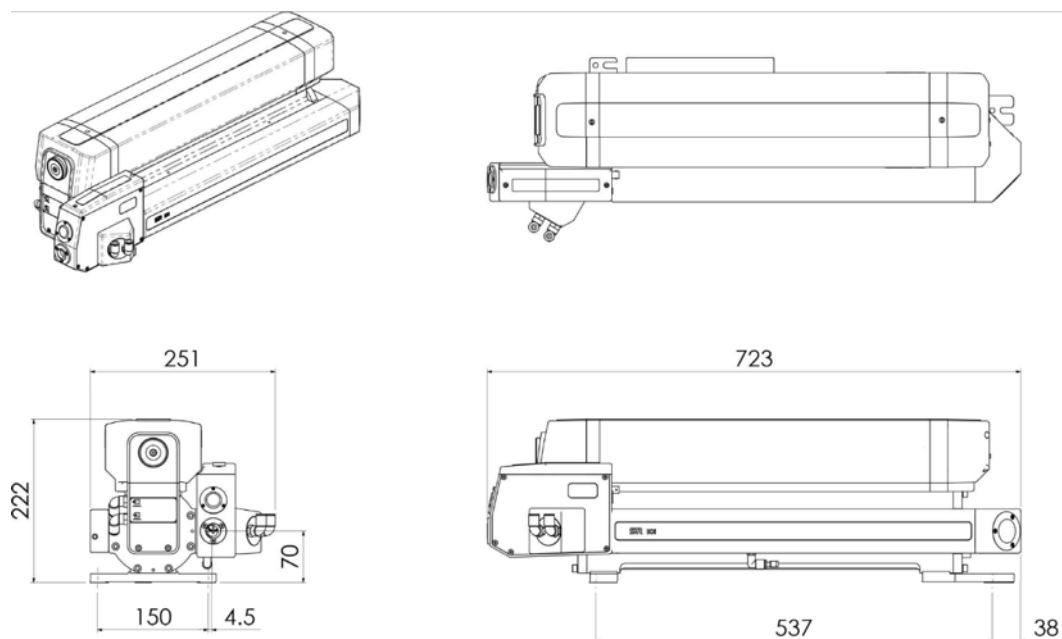
SR 08s, 10i, 10x — Standard version



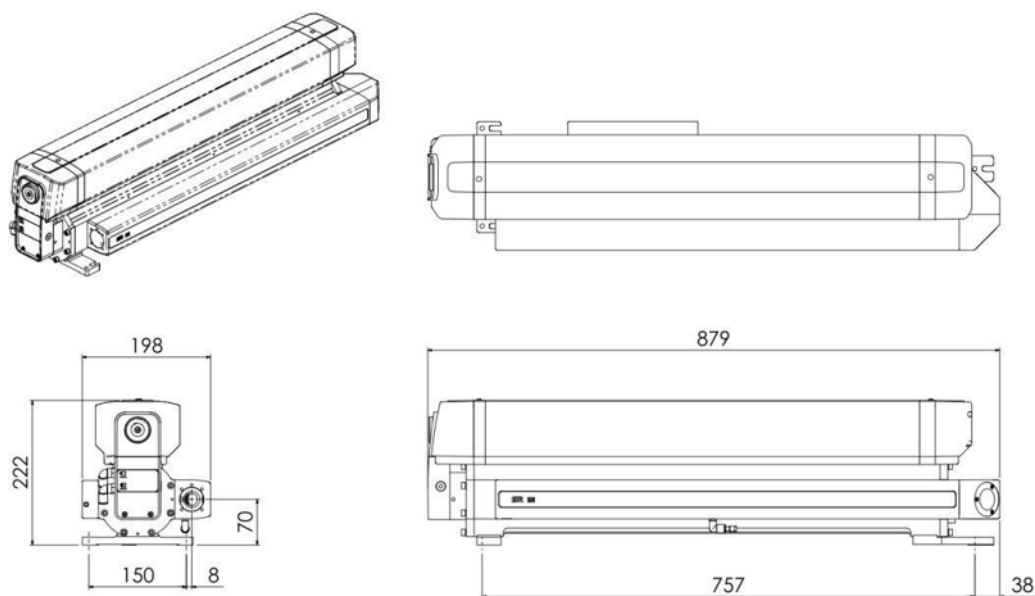
SR 08s, 10i, 10x — Shutter version



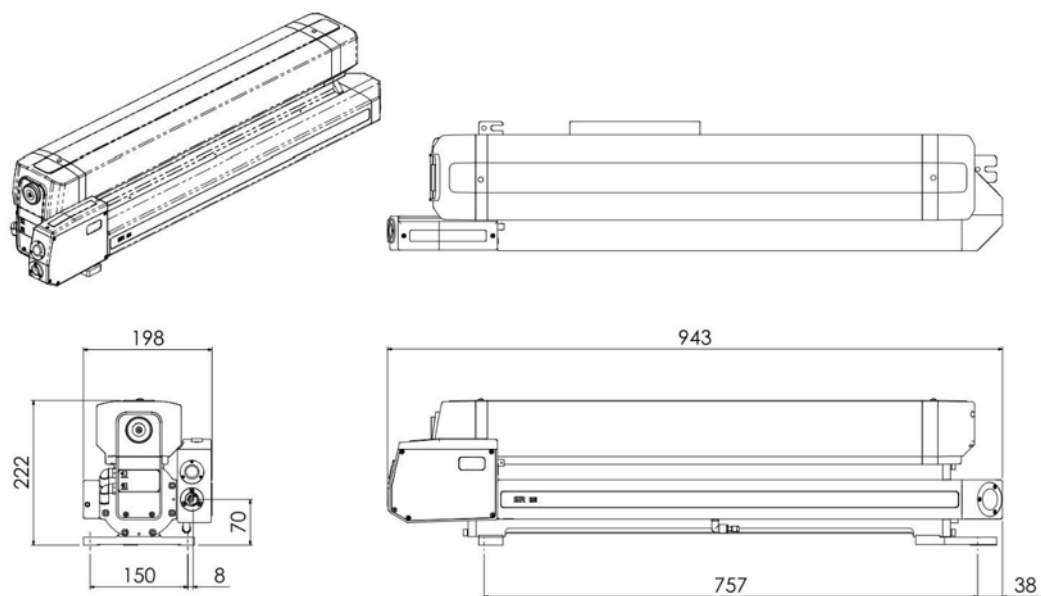
SR 10i — Power feedback version



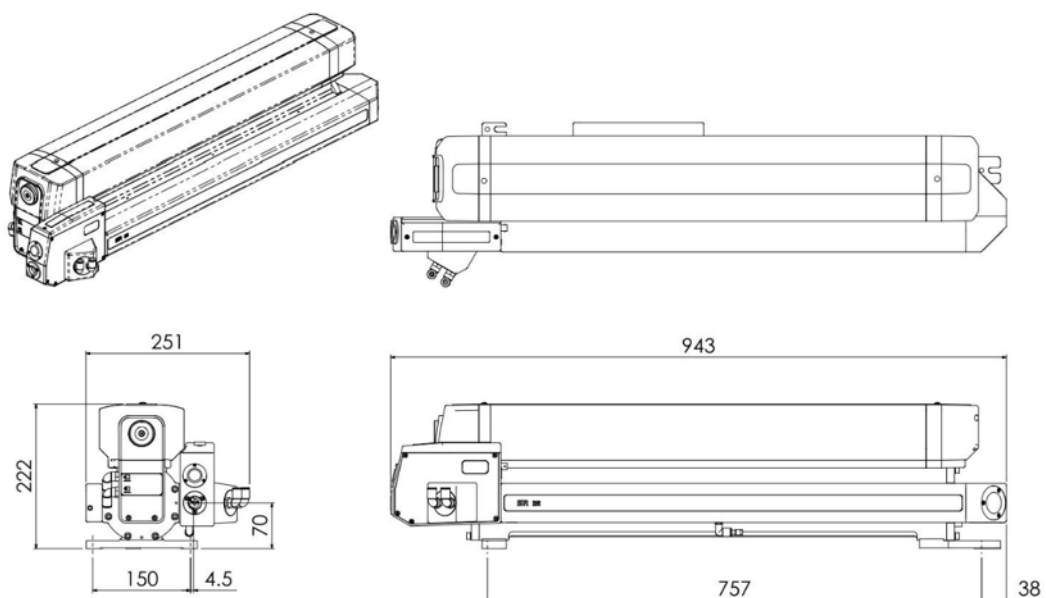
SR 10e, 15i, 15s, 15x — Standard version



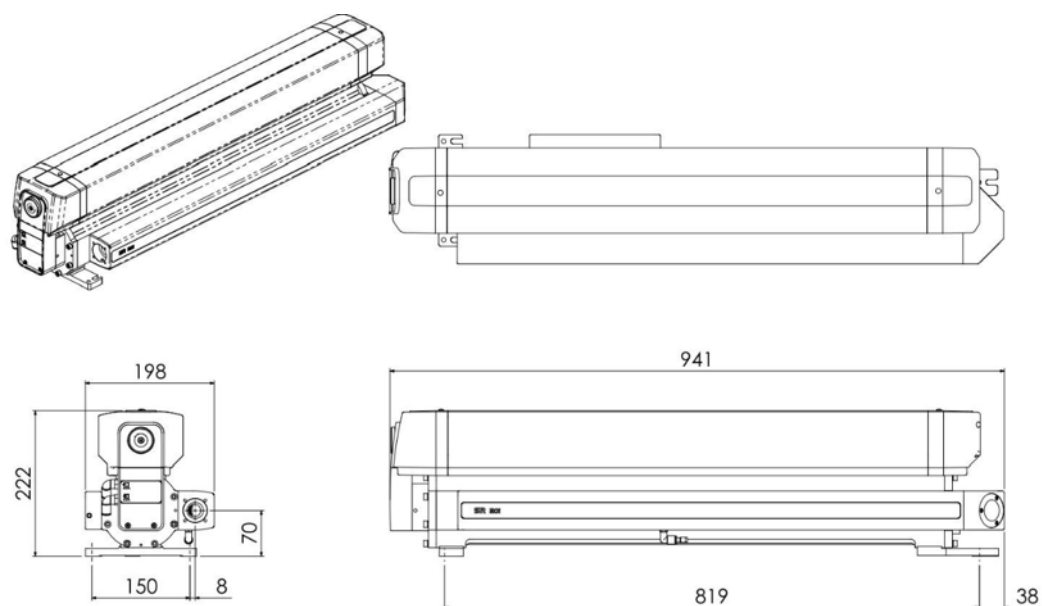
SR 10e, 15i, 15s, 15x — Shutter version



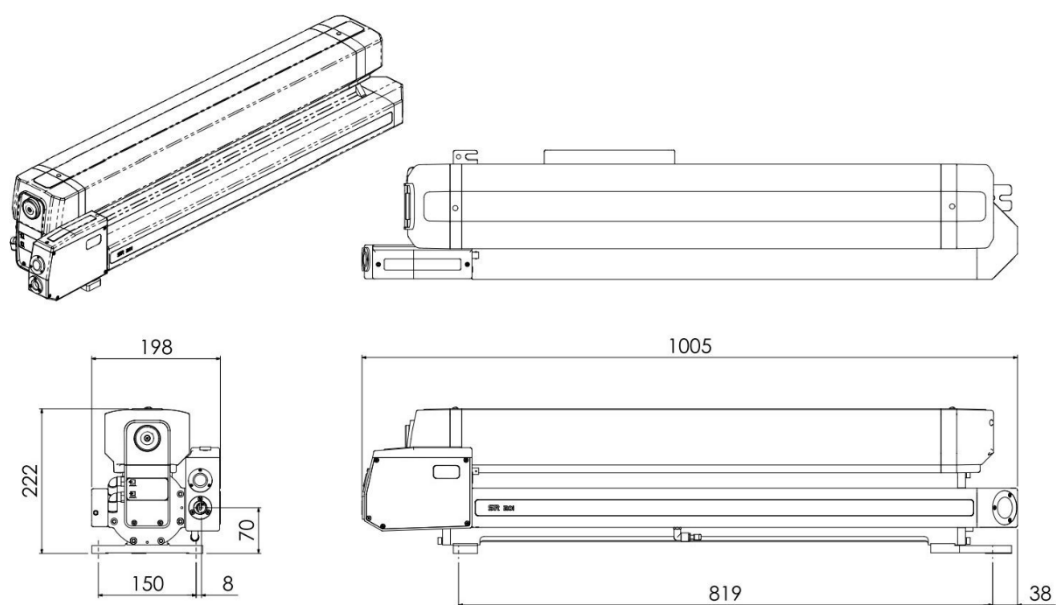
SR 15i — Power feedback version



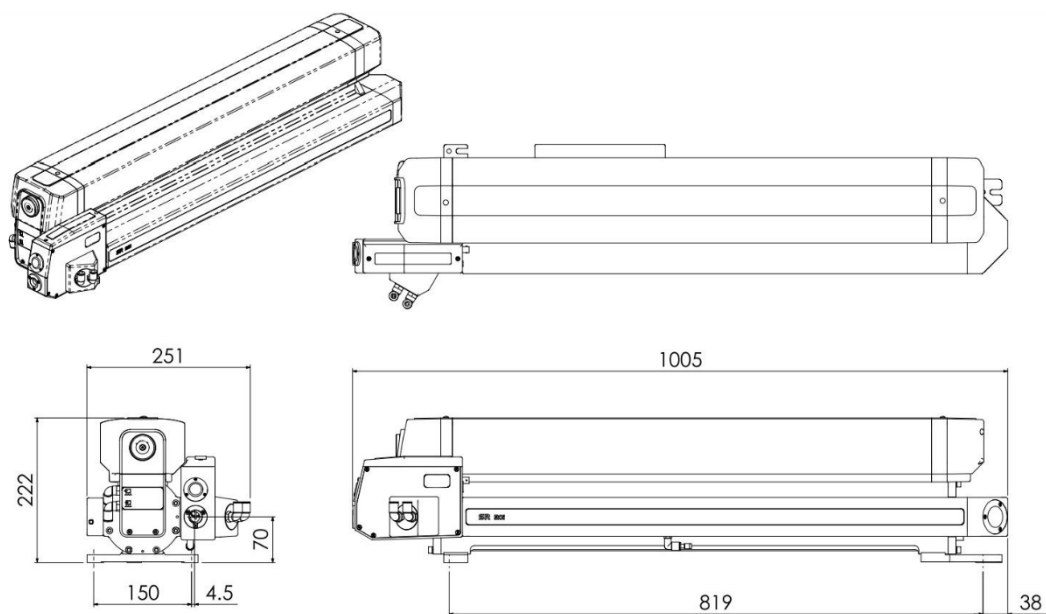
SR 15e, 25i, 25x — Standard version



SR 15e, 25i, 25x — Shutter version



SR 25i — Power feedback version



Appendix 4

Alternative wavelength specifications

The standard operating wavelength for Luxinar CO2 lasers is 10.6µm. The SR series can be supplied in a range of alternative operating wavelengths. If an alternative wavelength is required, this must be specified at the time of ordering.

SR08s

Wavelength (µm)	10.6	10.25	9.3
Wavelength range	10.6, 10.17 – 10.7µm Predominantly 10.45 – 10.7µm	10.17 – 10.33µm	9.2 – 9.35µm
<i>Output power</i>			
Power range ⁽¹⁾	5 – 80W	5 – 72W	5 – 60W
Typical power stability (long term)	± 4.5%	± 4.5%	± 5%
Guaranteed power stability (long term)	± 7%	± 7%	± 8%
Peak power ⁽²⁾	110W	95W	80W
Minimum shipment power ⁽³⁾	96W	86W	72W
<i>Pulsed mode and beam</i>			
Energy	3 – 50mJ	2 – 45mJ	2 – 35mJ
Beam diameter @ (1/e ²)	6.0 ± 0.5mm	6.0 ± 0.5mm	6.0 ± 0.5mm

SR 10e

Wavelength (µm)	9.3
Wavelength range	9.2 – 9.35µm
<i>Output power</i>	
Power range ⁽⁴⁾	5 – 115W
Typical power stability (long term)	± 3%
Guaranteed power stability (long term)	± 6%
Peak power ⁽⁵⁾	330W
Minimum shipment power ⁽⁶⁾	138W
<i>Pulsed mode and beam</i>	
Energy	6 – 110mJ
Beam diameter @ (1/e ²)	6.0 ± 0.5mm

1. Mean power at maximum duty cycle
2. Depending on frequency
3. 400µs pulse width at maximum duty
4. Mean power at maximum duty cycle
5. Depending on frequency
6. 400µs pulse width at maximum duty

SR 10i

Wavelength (µm)	10.6	10.6 Band select	10.25	9.3
Wavelength range	10.6, 10.17 – 10.7µm Predominantly 10.45 – 10.7µm	10.45 – 10.7µm	10.17 – 10.33µm	9.2 – 9.35µm
<i>Output power</i>				
Power range ⁽⁷⁾	5 – 125W	5 – 125W	5 – 110W	5 – 95W
Typical power stability (long term)	± 4.5%	± 4.5%	± 4.5%	± 5%
Guaranteed power stability (long term)	± 7%	± 7%	± 7%	± 8%
Peak power ⁽⁸⁾	315W	315W	275W	240W
Minimum shipment power ⁽⁹⁾	150W	150W	132W	114W
<i>Pulsed mode and beam</i>				
Energy	5 – 100mJ	5 – 100mJ	5 – 90mJ	4 – 75mJ
Beam diameter @ (1/e ²)	6.0 ± 0.5mm	6.0 ± 0.5mm	6.0 ± 0.5mm	6.0 ± 0.5mm

SR 10x

Wavelength (µm)	9.3
Wavelength range	9.2 – 9.35µm
<i>Output power</i>	
Power range ⁽¹⁰⁾	5 – 105W
Typical power stability (long term)	± 5%
Guaranteed power stability (long term)	± 8%
Peak power ⁽¹¹⁾	235W
Minimum shipment power ⁽¹²⁾	126W
<i>Pulsed mode and beam</i>	
Energy	4 – 70mJ
Beam diameter @ (1/e ²)	6.0 ± 0.5mm

SR 15e

Wavelength (µm)	9.3
Wavelength range	9.2 – 9.35µm
Output power	
Power range ⁽¹³⁾	10 – 160W
Typical power stability (long term)	± 3%
Guaranteed power stability (long term)	± 6%
Peak power ⁽¹⁴⁾	460W
Minimum shipment power ⁽¹⁵⁾	192W
Pulsed mode and beam	
Energy	8 – 155mJ

- 7. Mean power at maximum duty cycle
- 8. Depending on frequency
- 9. 400µs pulse width at maximum duty
- 10. Mean power at maximum duty cycle
- 11. Depending on frequency
- 12. 400µs pulse width at maximum duty
- 13. Mean power at maximum duty cycle

SR 15i

Wavelength (µm)	10.6	10.25	9.3
Wavelength range	10.6, 10.17 – 10.7µm Predominantly 10.45 – 10.7µm	10.17 – 10.33µm	9.2 – 9.35µm
Output power			
Power range ⁽¹⁶⁾	10 – 175W	10 – 155W	5 – 130W
Typical power stability (long term)	± 3%	± 3%	± 3%
Guaranteed power stability (long term)	± 6%	± 6%	± 6%
Peak power ⁽¹⁷⁾	440W	390W	330W
Minimum shipment power ⁽¹⁸⁾	210W	186W	156W
Pulsed mode and beam			
Energy	7 – 140mJ	7 – 125mJ	6 – 105mJ
Beam diameter @ (1/e ²)	6.8 ± 0.5mm	6.8 ± 0.5mm	6.0 ± 0.5mm

SR15s

Wavelength (µm)	10.6	10.25	9.3
Wavelength range	10.6, 10.17 – 10.7µm Predominantly 10.45 – 10.7µm	10.17 – 10.33µm	9.2 – 9.35µm
<i>Output power</i>			
Power range ⁽¹⁹⁾	10 – 160W	5 – 144W	5 – 120W
Typical power stability (long term)	± 3%	± 3%	± 3%
Guaranteed power stability (long term)	± 6%	± 6%	± 6%
Peak power ⁽²⁰⁾	215W	195W	160W
Minimum shipment power ⁽²¹⁾	192W	173W	144W
<i>Pulsed mode and beam</i>			
Energy	5 – 95mJ	5 – 90mJ	4 – 70mJ
Beam diameter @ (1/e ²)	6.8 ± 0.5mm	6.8 ± 0.5mm	6.0 ± 0.5mm

- 14. Depending on frequency
- 15. 400µs pulse width at maximum duty
- 16. Mean power at maximum duty cycle
- 17. Depending on frequency
- 18. 400µs pulse width at maximum duty
- 19. Mean power at maximum duty cycle
- 20. Depending on frequency
- 21. 400µs pulse width at maximum duty

SR 25i

Wavelength (µm)	10.6	10.25	9.3
Wavelength range	10.6, 10.17 – 10.7µm Predominantly 10.45 – 10.7µm	10.17 – 10.33µm	9.2 – 9.35µm
<i>Output power</i>			
Power range ⁽²⁵⁾	15 – 250W	10 – 225W	10 – 185W
Typical power stability (long term)	± 3%	± 3%	± 4%
Guaranteed power stability (long term)	± 6%	± 6%	± 6%
Peak power ⁽²⁶⁾	630W	565W	465W
Minimum shipment power ⁽²⁷⁾	300W	270W	222W
<i>Pulsed mode and beam</i>			
Energy	10 – 200mJ	9 – 180mJ	8 – 150mJ
Beam diameter @ (1/e ²)	6.5 ± 0.5mm	6.5 ± 0.5mm	6.3 ± 0.5mm

SR 25x

Wavelength (μm)	9.3
Wavelength range	9.2 – 9.35μm
<i>Output power</i>	
Power range ⁽²⁸⁾	10 – 210W
Typical power stability (long term)	± 4%
Guaranteed power stability (long term)	± 6%
Peak power ⁽²⁹⁾	465W
Minimum shipment power ⁽³⁰⁾	252W
<i>Pulsed mode and beam</i>	
Energy	8 – 145mJ
Beam diameter @ (1/e ²)	6.3 ± 0.5mm

22. Mean power at maximum duty cycle

23. Depending on frequency

24. 400μs pulse width at maximum duty

25. Mean power at maximum duty cycle

26. Depending on frequency

27. 400μs pulse width at maximum duty

28. Mean power at maximum duty cycle

29. Depending on frequency

Appendix 5

Coolant requirements and additives

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

Coolant quality

Table 24 - Coolant quality

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

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

Suspended particle removal

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

Corrosion and anti-bacterial inhibitor

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

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

Circuit volume	Reference
50–199L	Order No.: 480-WTK-YM20.88
200–350L	Order No.: 480-WTK-YM60.88
351–500L	Order No.: 480-WTK-YM100.88

Order water treatment kits directly from NALCO at:

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

NALCO are equipped to ship kits worldwide.

- **Expiration period**

Two years

- **Storage temperature**

0–25°C

- **Disposal of used material**

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

- **Instructions for use**

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



WARNING



Risk of injury to eyes

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

- NALCO 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 organic contamination (algae and slime) from the water circuit.

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

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

- **Cooling system maintenance**

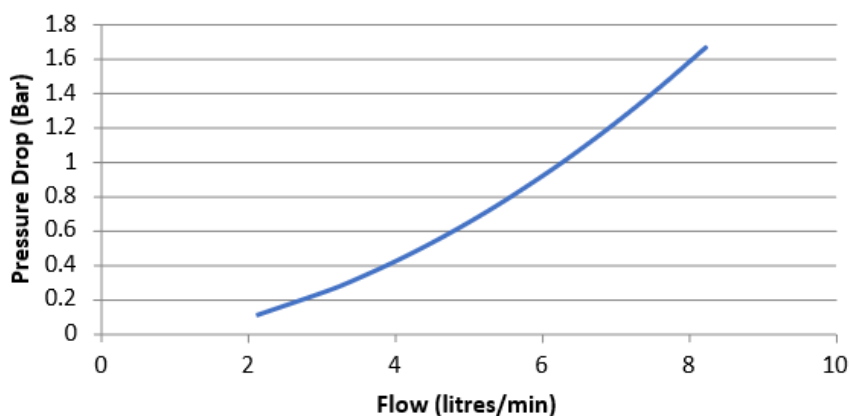
After six months of operation, drain off the coolant and refill with fresh water treated with the appropriate NALCO kit or equivalent anti-bacterial product, as specified in [Table 24](#).

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

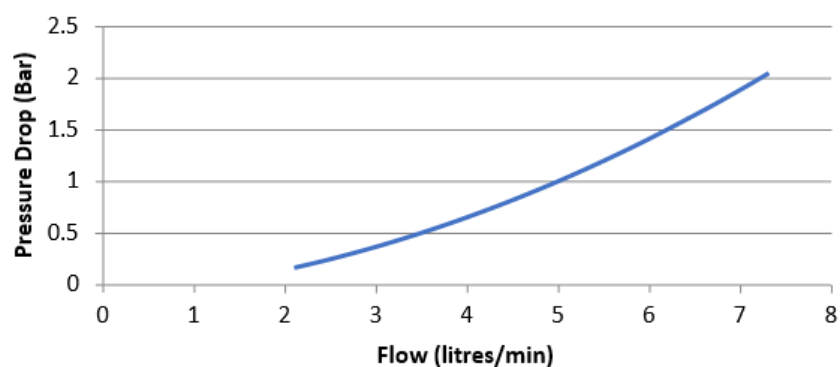
Appendix 6

Cooling system pressure drop curves

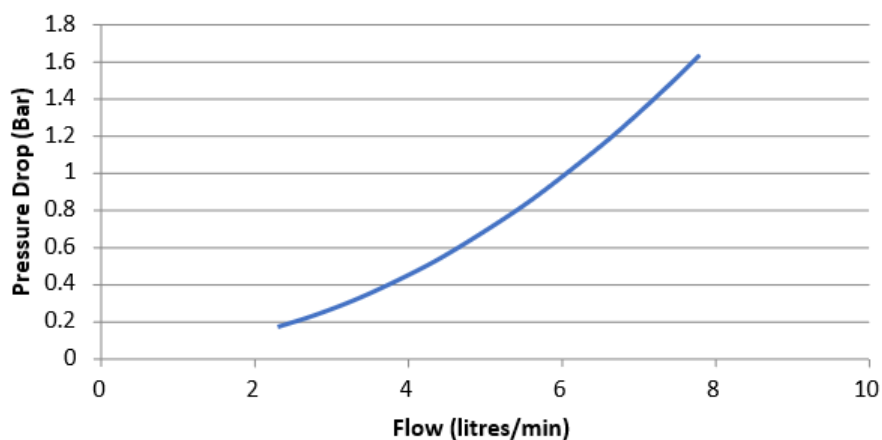
SR 08s,10i, 10x — Standard version



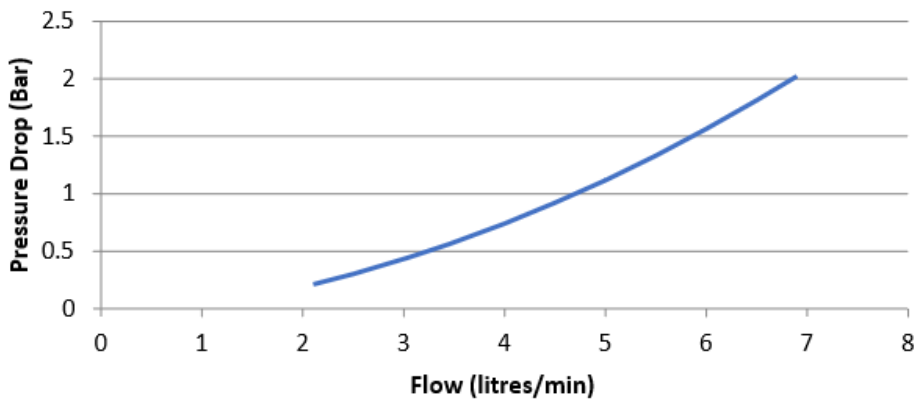
SR 10i — Shutter and power feedback versions



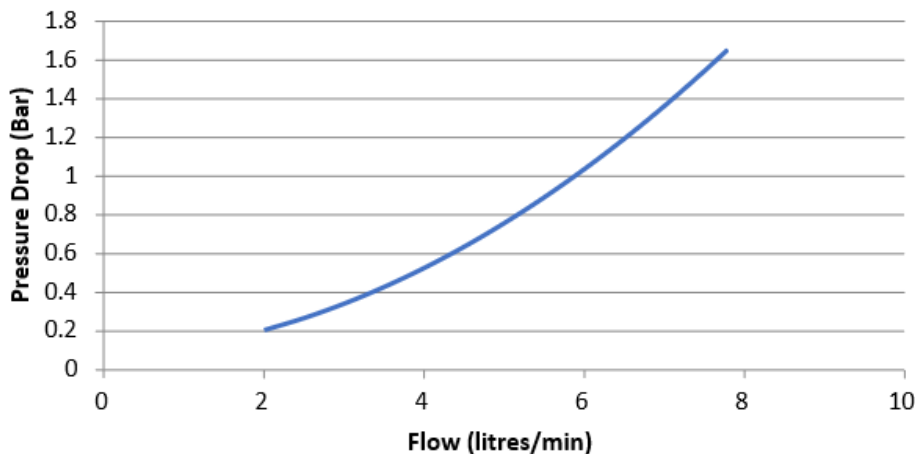
SR 10e, 15i, 15s, 15x — Standard version



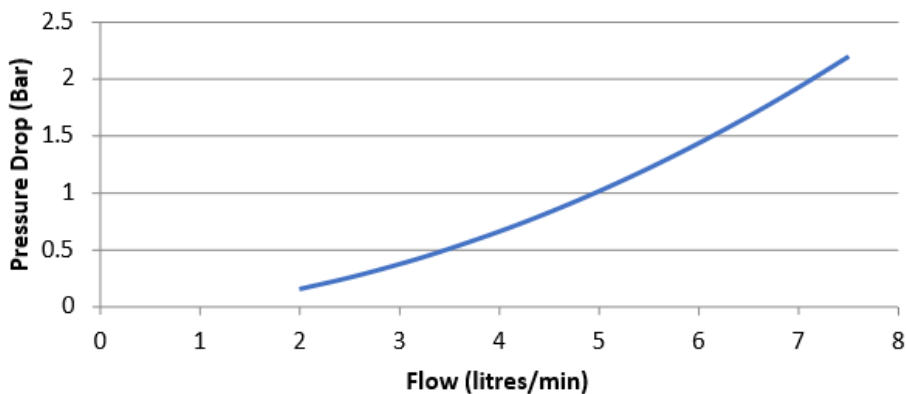
SR 15i — Shutter and power feedback versions



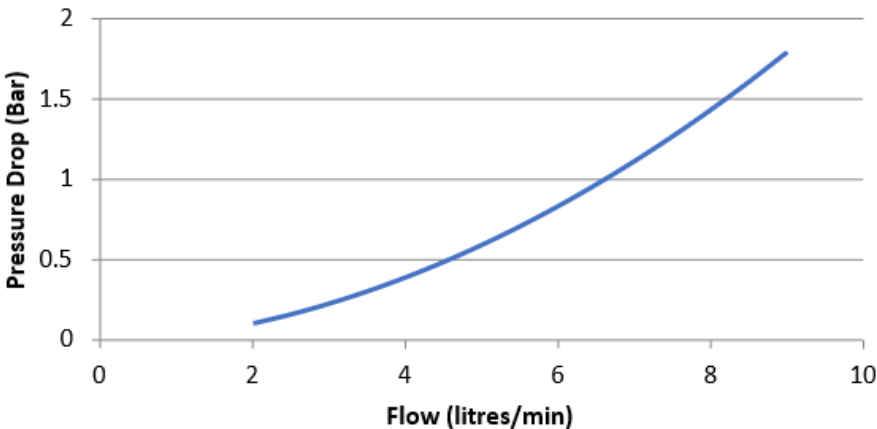
SR 15e, 25i, 25x — Standard version



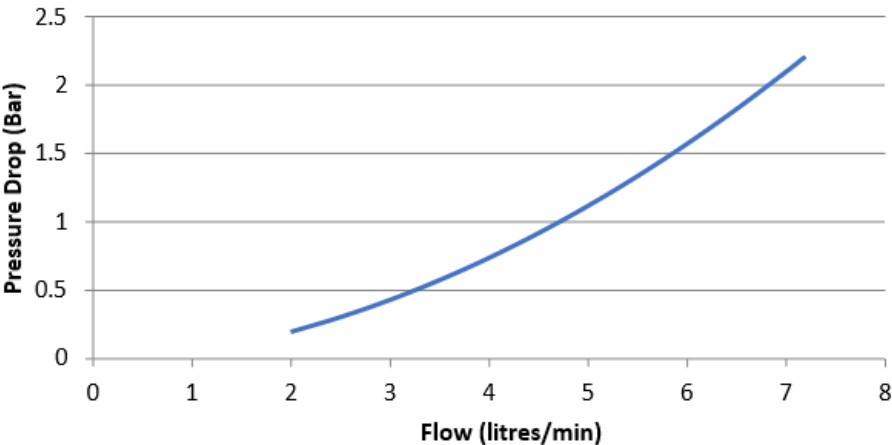
SR 25i — Shutter and power feedback versions



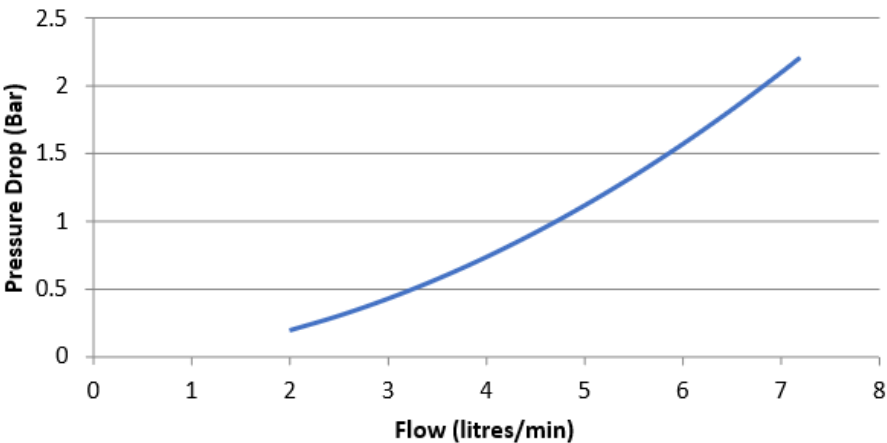
SR 10i DC and DC 3kW power supply



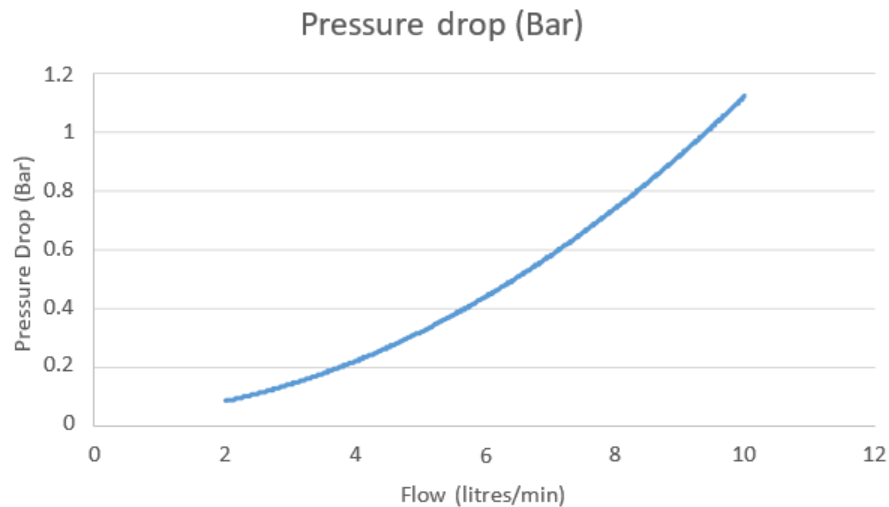
SR 15 (DC SR 20) power supply



SR 25i DC power supply



SR 25i DC power supply (016-0035-00)



Appendix 7

TTL to RS422 converter

The optional TTL converter changes the voltage levels from the OEM machine to the required levels for correct operation of the SR system.

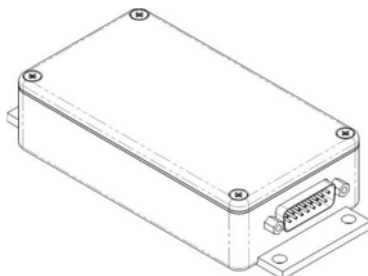


Figure 46 - TTL to RS422 converter unit

Mounting

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

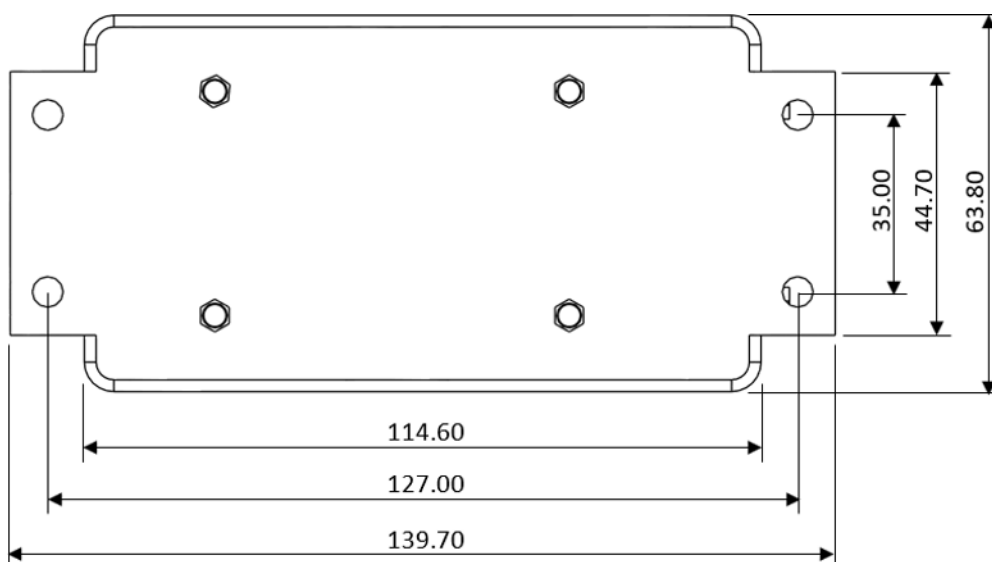
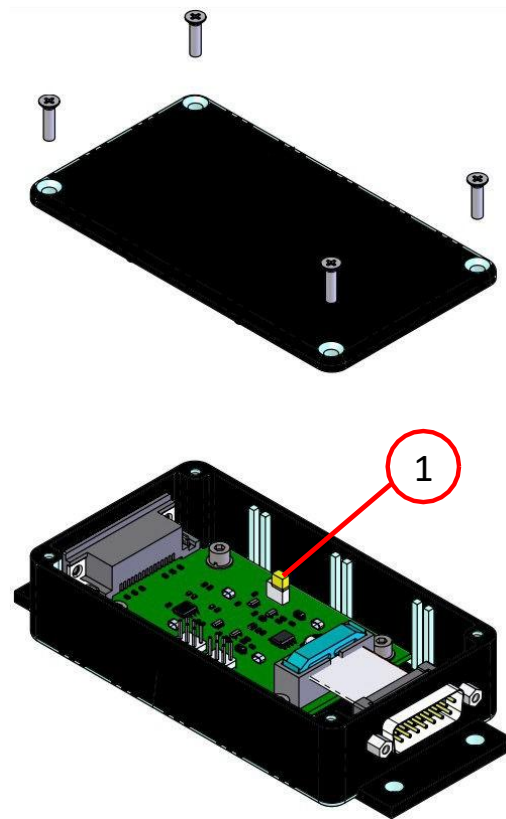


Figure 47 - TTL to RS422 converter mounting holes

Configuration

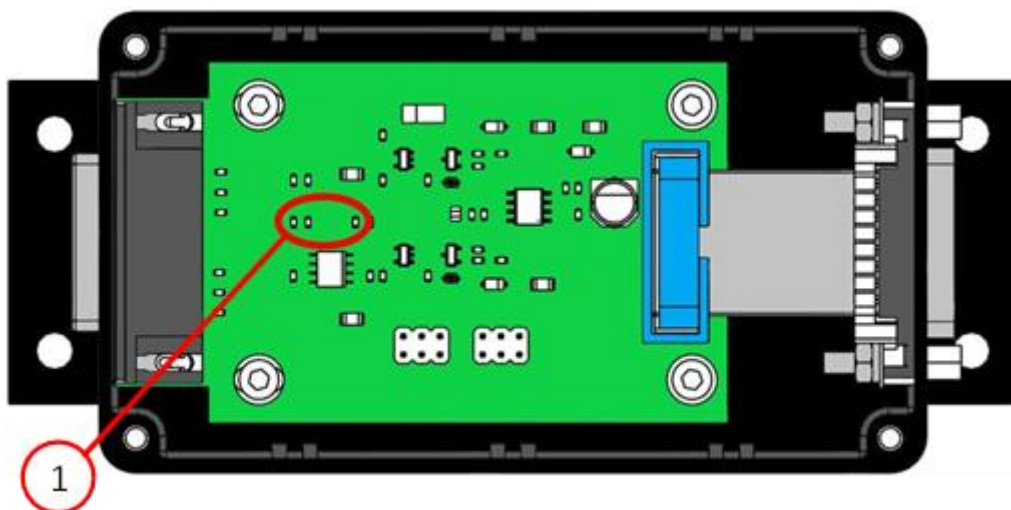
The TTL to RS422 converter contains a switch for internal or external **RF Enable** signal. If the switch is set to the EXT position, the user must provide an **RF Enable** signal on pin 6 (091-0104-XX).



1 RF Enable switch location

Figure 48 - RF Enable switch location

Diagnostic LED operation



1 Diagnostic LED locations

Figure 49 - Diagnostic LED location

Table 25 - Status indicator diagnostics — all lasers

LED	Description
RF EN	RF Enable signal present ⁽¹⁾
5V	TTL box is powered ⁽²⁾
MOD	Modulation signal present ⁽³⁾
RF ENABLE switch	The TTL box contains a switch to enable or disable the required RF Enable signal

Interfacing

The cables supplied with the converter are dependant on the laser configuration.

Standard version

- Cable, part number 093-0013-XXXX, connecting the U1 laser interface connector to the TTL unit.
- Cable, part number 091-0104-XX, connecting the OEM machine to the TTL unit.

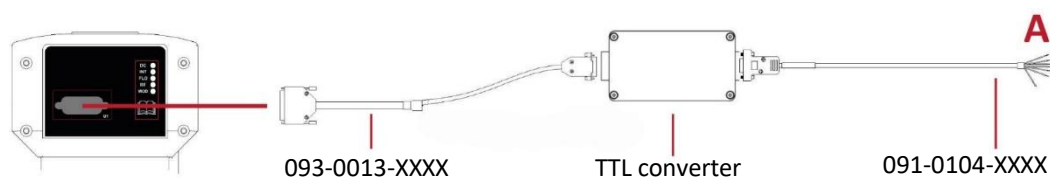


Table 26 - TTL unit cable (A)

Pin N°	Function	Colour	Signal type	009-0184-00	009-0456-00
1	VSWR status -	Red	RS422 output	See 8.1	See 8.1
2	VSWR status +	Blue	RS422 output	See 8.1	See 8.1
3	Over modulation	Green	Output	See 8.1	See 8.1
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 8.1	See 8.1
8	RF Reflected Power	Violet	Output	See 8.1	See 8.1
9	RF Fault	Orange	Output	See 8.1	See 8.1
10	DC Fault	Pink	Output	See 8.1	See 8.1
11	Flow Fault	Turquoise	Output	See 8.1	See 8.1
12	Laser Ready	Grey	Output	See 8.1	See 8.1
13	Interlock (return to ground)	Red/blue	Input	See 8.1	See 8.1
14	Not connected	Green/red			
15	Voltage supply (rtn)	Yellow/red	Supply input (rtn) 0V		0V

Shutter and power feedback version

- Cable, part number 093-0098-XXXX, a Y-cable connecting the U1 laser interface to the TTL unit with a 15-pin D-connector connecting the OEM machine directly to the U1 laser interface. A mating D-connector is supplied in order to make
- Cable, part number 091-0104-XX, connecting the OEM machine to the TTL unit.

3. Must be present for correct laser operation

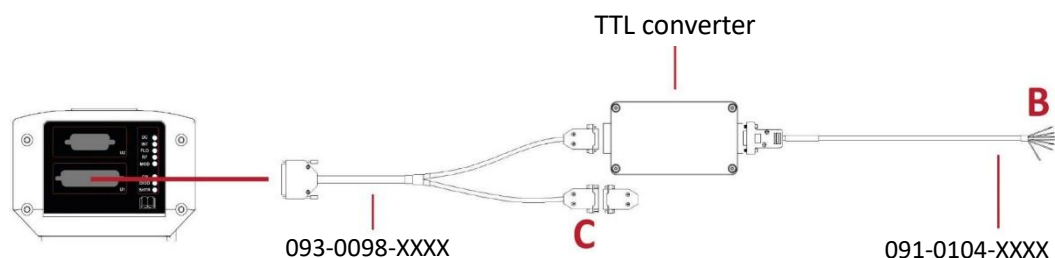


Table 27 - TTL unit cable (B)

Pin N°	Function	Colour	Signal type	009-0184-00	009-0456-00
1	VSWR status -	Red	RS422 output	See 8.2	See 8.2
2	VSWR status +	Blue	RS422 output	See 8.2	See 8.2
3	Over modulation	Green	Output	See 8.2	See 8.2
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 8.2	See 8.2
8	RF Reflected Power	Violet	Output	See 8.2	See 8.2
9	Signal ground (0V)	Orange	Output	See 8.2	See 8.2
10	Signal ground (0V)	Pink	Output	See 8.2	See 8.2
11	Signal ground (0V)	Turquoise	Output	See 8.2	See 8.2
12	Signal ground (0V)	Grey	Output	See 8.2	See 8.2
13	Signal ground (0V)	Red/blue	Ouput	See 8.2	See 8.2
14	Signal ground (0V)	Green/red	Ouput	See 8.2	See 8.2
15	Voltage supply (rtn)	Yellow/red	Supply input (rtn) 0V		0V

Table 28 - Y-cable U1 laser interface to 15-pin D-connector (C)

Pin N°	Function	Signal type
1	Shutter Enable	Input
2	User indicator	Output
3	Shutter open	Output
4	Ground	—
5	Shutter closed 1	Output
6	DC voltage OK	Output
7	Shutter closed 2	Output
8	Product trigger	Input
9	External interlock	Interlock
10	External interlock return	Interlock
11	Ground	Output
12	Screen	Output
13	RS232 TX	Output
14	RS232 RX	Input
15	Diode enable	Input

Appendix 8

DC power supply option

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

DC 3kW single-phase DC power supply

General description

The DC 3kW is a 3U, 19" rack mountable, DC 3kW power supply. (PSU)

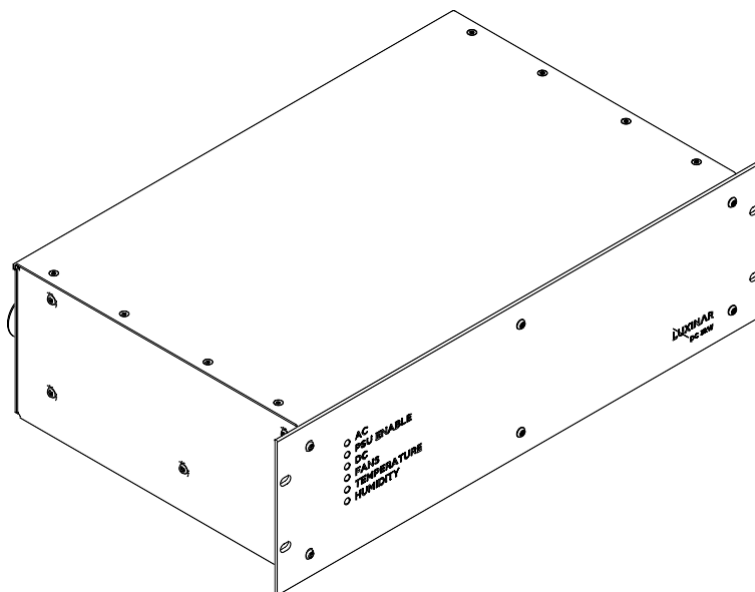
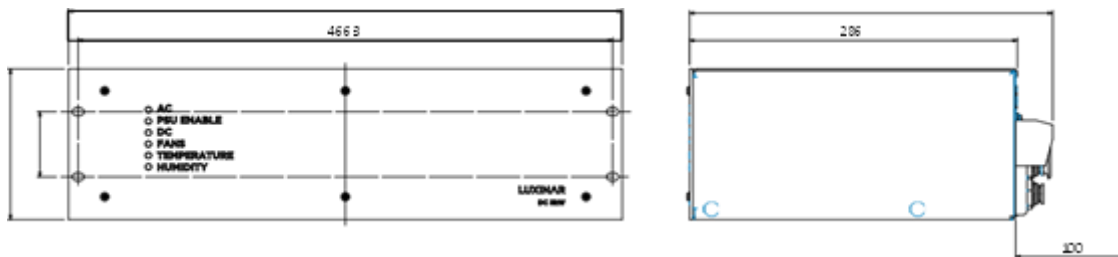


Figure 50 - DC 3kW single-phase DC power supply

Specification

Table 29 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	483x286x132 (3U rack height)
Weight	11kg
Coolant type	Deionised water with anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Refer to page 18 .



1 Clearance for cabling and coolant pipes

Figure 51 - Overall dimensions

Table 30 - Electrical specifications

DC 3kW	
Input voltage range	230VAC $\pm$ 10% (single/bi-phase)
Mains input frequency range	50–60Hz
Mains input fuse rating	20A
AC inrush current (max.)	60A
Output voltage (DC)	50V
Output current (max.)	62.5A
Power factor	> 0.90 at full power
Power consumption (max.)	3kW at pulsed full power
Earth leakage current	< 4mA

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, mount the power supply within the OEM machine racking using the four mounting holes shown in the following figure.

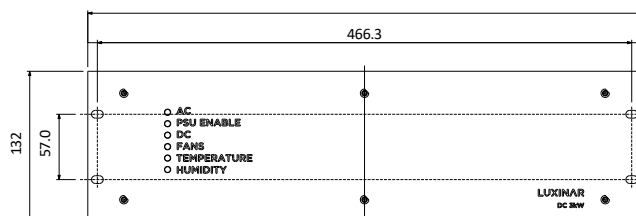


Figure 52 – Fixing locations

Mains AC power connections

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

Note: The **L1** and **L2** terminals are internally fused by 16A μ R fuses.



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 cable:

1. Remove the access panel on the rear of the power supply by unfastening the four fixing screws.

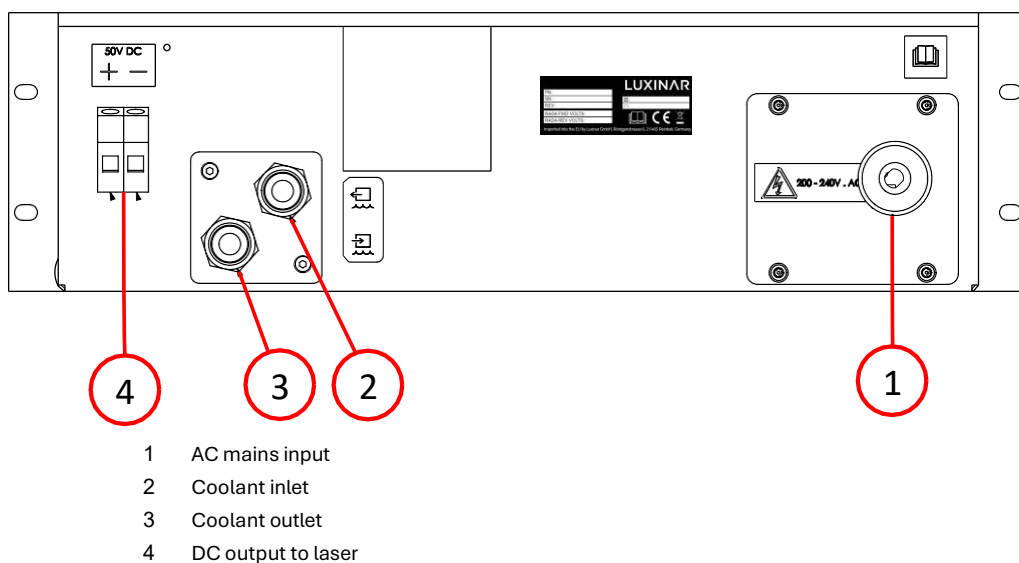
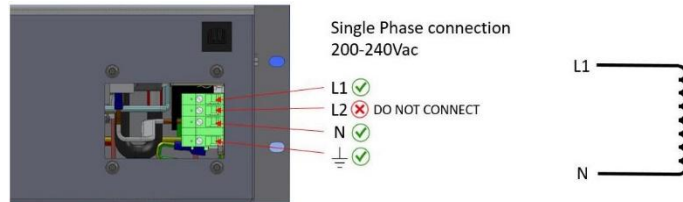


Figure 53 - AC mains connection point

2. Remove the supplied cable from the connector. and replace it with the alternative cable in either single or bi-phase configuration.

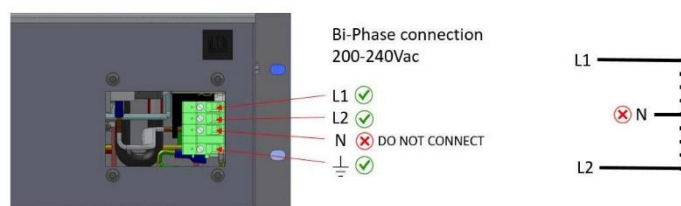
- **Single phase configuration**

Connect the phase to the **L1** terminal and neutral to the **N** terminal. Do not use the **L2** terminal.



- **Bi-phase connection**

Connect phase 1 to the **L1** terminal and phase 2 to the **L2** terminal. Do not use the **N** terminal.



Important!

Ensure that the earth connection is well-made in both cases.

DC laser supply cables

DC power cables must be securely fitted to the connectors provided on the rear of the power supply and on the laser system.

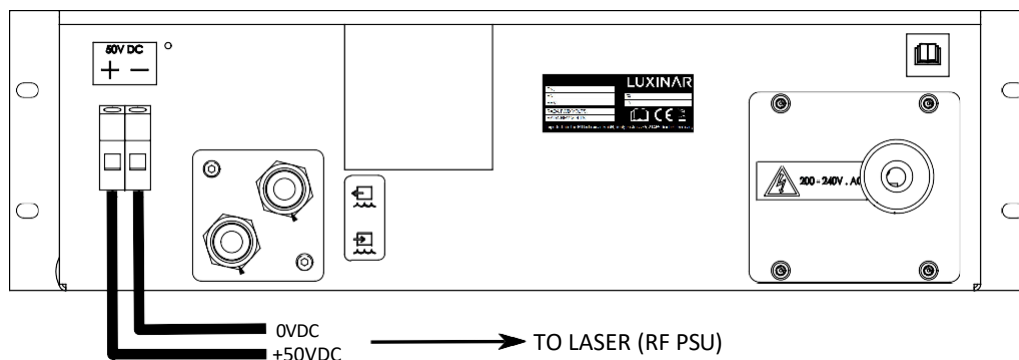


Figure 54 - DC cable connections

DC power cables of the correct specification can be supplied by Luxinar.

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 circuit. The coolant connections are located on the rear of the power supply. See [page 36](#).

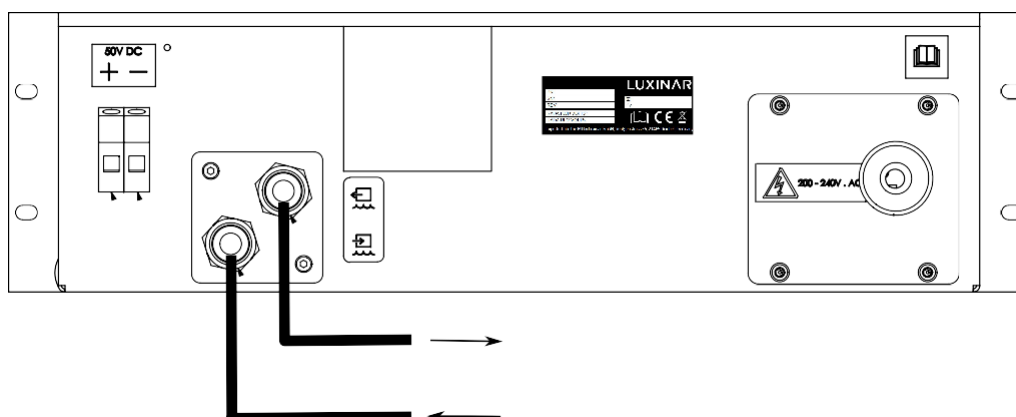
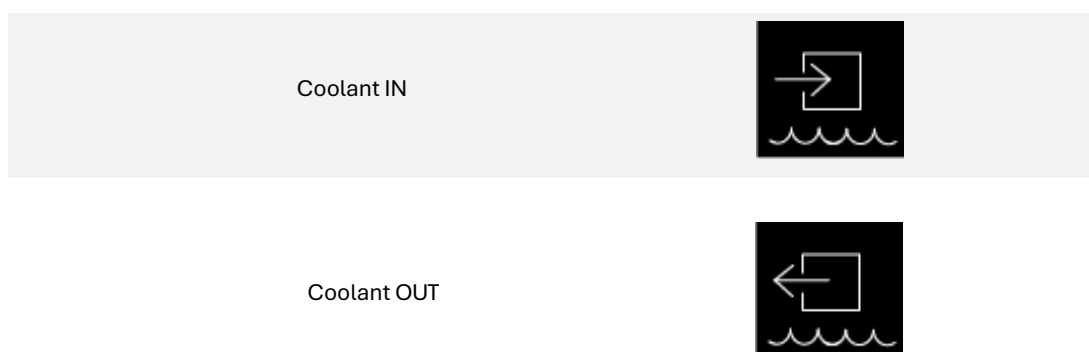


Figure 55 - Coolant connectors

The coolant inlet and outlet connectors are labelled as shown below.



Operation

The power supply has no user controls. When powered up, it will automatically carry out diagnostic checks. If no faults are detected, the status indicators on the front panel all display green and the DC output is enabled. 50VDC will be present.

If faults are detected, one or more status indicators will be off or displaying red/amber. For a status indicator explanation, refer to the following table.

Indicator	Status definition
AC	☐ No AC voltage ☒ AC input OK ☒ AC voltage out of range
PSU ENABLED	☐ PSU disabled ☒ PSU enabled
DC	☐ DC module off ☒ DC module OK ☒ DC module fault
FANS	☐ Internal fans off ☒ Internal fans OK ☒ Internal fans fault
TEMPERATURE	☒ Temperature OK ☒ Temperature too high
HUMIDITY	☐ Humidity sensor not fitted ☒ Humidity OK ☒ Humidity too high

SR 08s / SR 10i DC power supply (005-0608-00)

General description

The SR 08s / 10i is a 3U, 19" rack mountable AC to DC liquid-cooled power supply. (PSU).

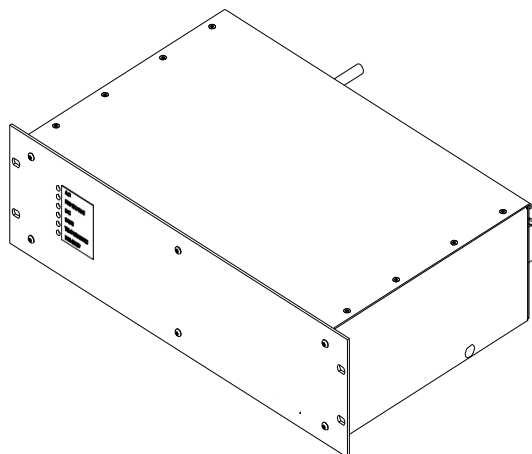


Figure 56 - SR 08s / 10i power supply

Specification

Table 31 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	317x483x132 (3U rack height)
Weight	11kg
Coolant type	Demineralised, deionised or distilled water with corrosion inhibitor & anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Refer to page 18 .

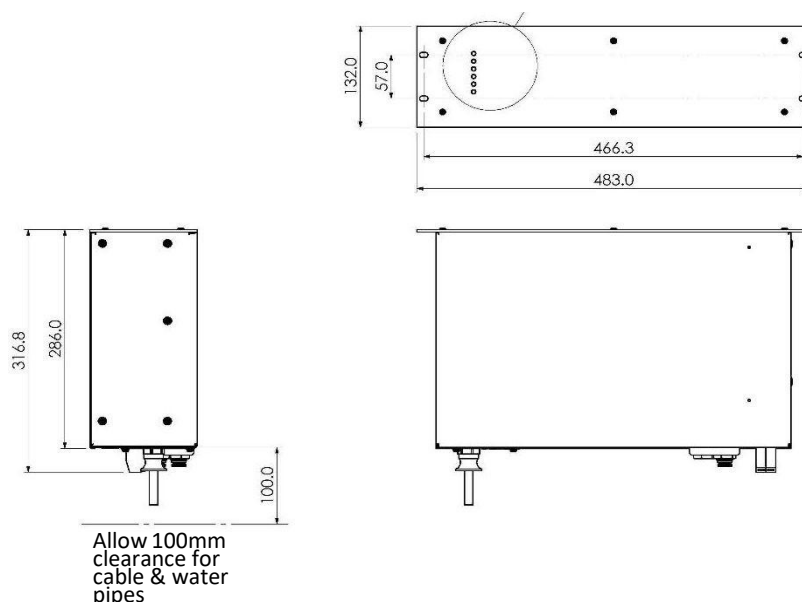


Figure 57 - Overall dimensions

Table 32 - Electrical specifications

SR 10i	
Input voltage range	230VAC $\pm$ 10% (single/bi-phase)
Mains input frequency range	50–60Hz
Mains input fuse rating	16A
AC inrush current (max.)	60A
Output voltage (DC)	50V $\pm$ 1V
Output current (max.)	48A
Power factor	> 0.95 at full power
Power consumption (max.)	2.4kW at pulsed full power
Earth leakage current	<2mA

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, mount the power supply within the OEM machine racking using the four mounting holes shown in the following figure.

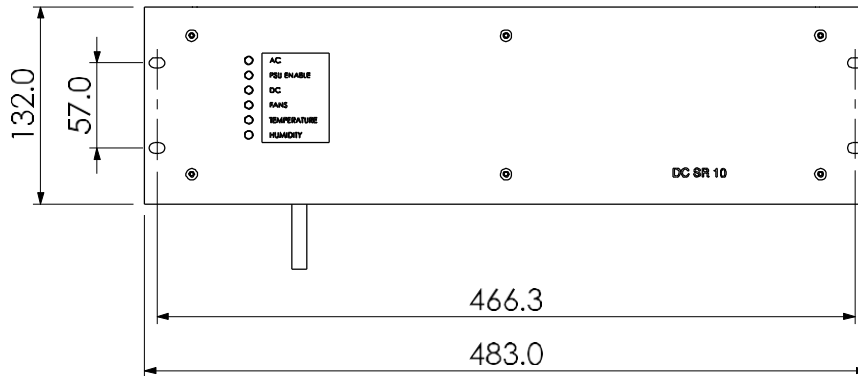


Figure 58 - Fixing locations

Mains AC power connections

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

Note: The **L1** and **L2** terminals are internally fused by 16A UR fuses.



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 cable:

1. Remove the access panel on the rear of the power supply by unfastening the four fixing screws.



Figure 59 - AC power connection point

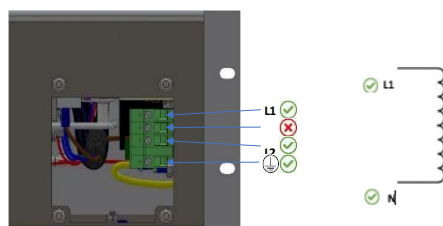
- Remove the supplied cable from the connector and replace it with the longer cable in either single or bi-phase configuration.

Important!

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

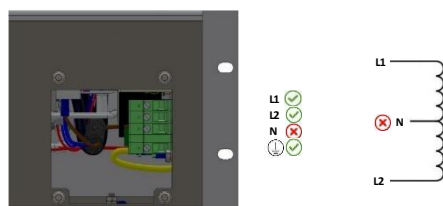
• Single phase configuration

Connect the phase to the **L1** terminal and neutral to the **N** terminal. Do not use the **L2** terminal.



• Bi-phase connection

Connect phase 1 to the **L1** terminal and phase 2 to the **L2** terminal. Do not use the **N** terminal.



DC laser supply cables

DC power cables must be securely fitted to the connectors provided on the rear of the power supply and on the laser system. DC power cables of the correct specification can be supplied by Luxinar.

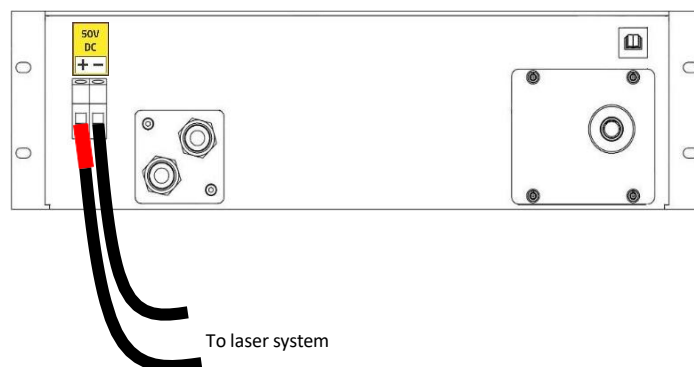


Figure 60 - DC cable connections

Terminal 1	+ 50VDC
Terminal 2	-0VDC

DC power cables of the correct specification can be supplied by Luxinar.

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 circuit. The coolant connections are located on the rear of the power supply. See [page 36](#)

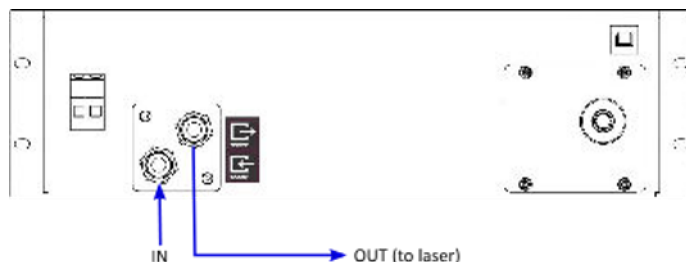


Figure 61 - Coolant connectors

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

Coolant IN		
Coolant OUT		

Operation

The power supply has no user controls. When powered up, it will automatically carry out diagnostic checks. If no faults are detected, the status indicators on the front panel all display green and the DC output is enabled. 50VDC will be present.

If faults are detected, one or more status indicators will be off or displaying red/amber. For a status indicator explanation, refer to the following table

Indicator	Status definition
AC	- No AC voltage - AC input OK - AC voltage out of range
PSU ENABLED	- PSU disabled - PSU enabled
DC	- DC module off - DC module OK - DC module fault
FANS	- Internal fans off - Internal fans OK - Internal fans fault
TEMPERATURE	- Temperature OK - Temperature too high
HUMIDITY	- Humidity sensor not fitted - Humidity OK - Humidity too high

SR 15s / SR 15i DC power supply (005-0580-00)

General description

The SR 15s / SR 15i DC PSU is a free-standing AC to DC liquid-cooled power supply (PSU).

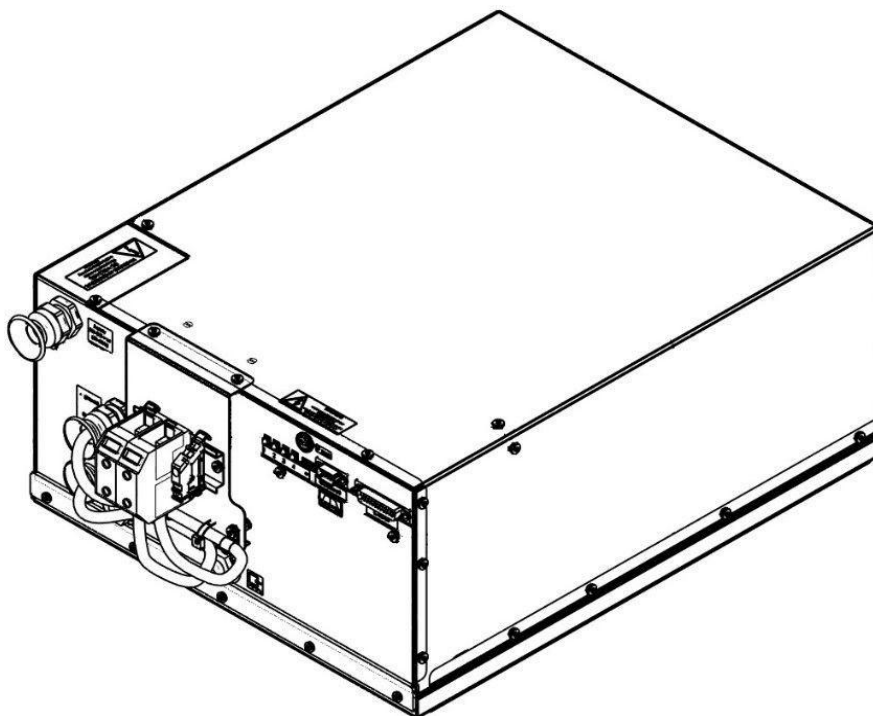


Figure 62 - SR 15s / SR 15i power supply

Specification



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.

Table 33 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	450x371x176
Weight	22kg
Coolant type	Demineralised, deionised or distilled water with corrosion inhibitor & anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Refer to page 18 .

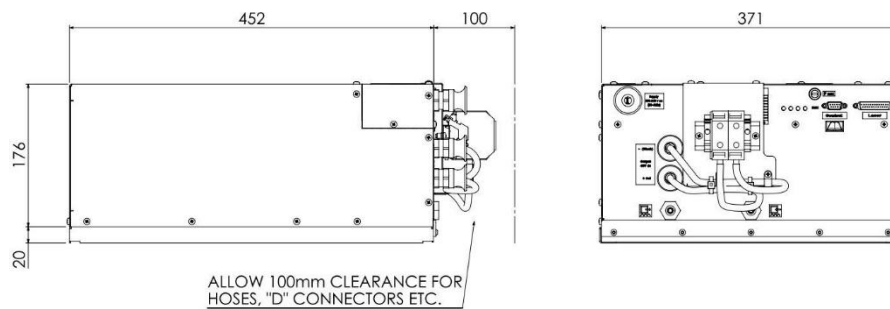


Figure 63 - Overall dimensions

Table 34 - Electrical specifications

SR 15s / 15i	
Input voltage range	230VAC $\pm$ 10% (single/bi-phase)
Mains input frequency range	50–60Hz
Mains input fuse rating	30A
AC inrush current (max.)	120A
Output voltage (DC)	50 $\pm$ 1V
Output current (max.)	96A
Power factor	>0.95 at full power
Power consumption (max.)	4.8kW at pulsed full power
Earth leakage current	<4mA

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, mount the power supply within the OEM machine using any of the 16 mounting holes in the base, as shown in the following figure.

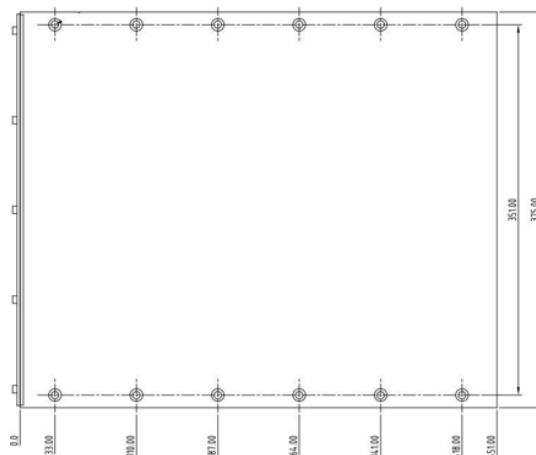


Figure 64 - Fixing locations

Mains AC power connections

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

Note: The **L1** and **L2** terminals are internally fused by 30A 38x10mm UR fuses. The fuses are accessible after removing the cover plate.

There is a T1A 20x5mm fuse for the internal fan in a fuse holder on the front panel.



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 cable:

1. Remove the access panel on the rear of the power supply.

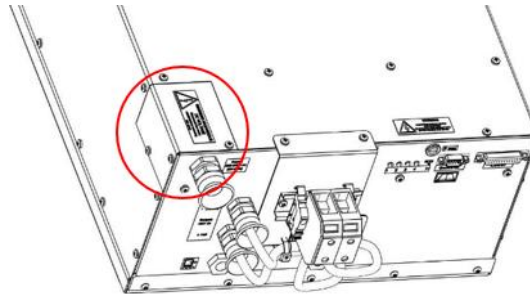


Figure 65 - AC mains supply connection point

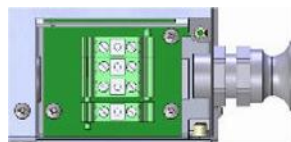
2. Remove the supplied cable from the connector. and replace it with the alternative cable in either single or bi-phase configuration.

Important!

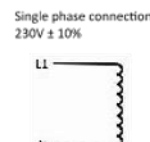
An earth connection is essential. Ensure that the earth wire is connected before connecting the mains supply.

• Single phase configuration

Connect the phase to the **L1** terminal and neutral to the **N** terminal. Do not use the **L2** terminal.



L1 ✓
L2 ✗ DO NOT CONNECT
N ✓
E ✓



- **Bi-phase connection**

Connect phase 1 to the **L1** terminal and phase 2 to the **L2** terminal. Do not use the **N** terminal.



DC laser supply cables

DC power cables must be securely fitted to the connectors provided on the rear of the power supply and on the laser system.

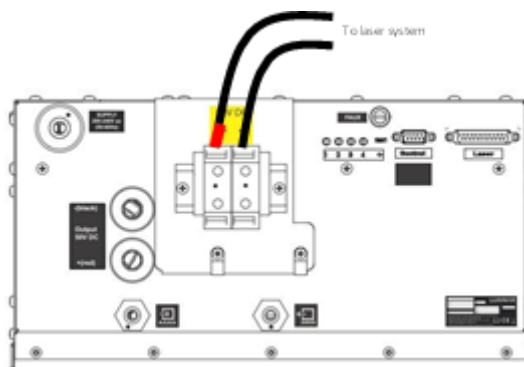


Figure 66 - DC cable connection

DC power cables of the correct specification can be supplied by Luxinar.

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 circuit. The coolant connections are located on the front panel. See [page 36](#).

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

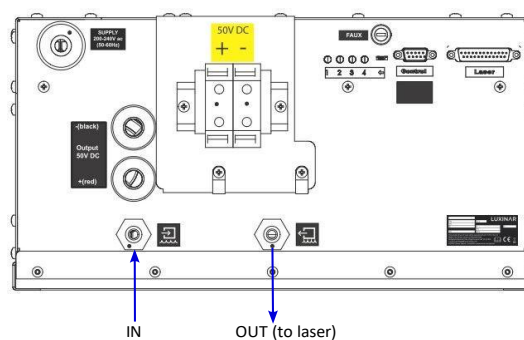


Figure 67 - Coolant connections

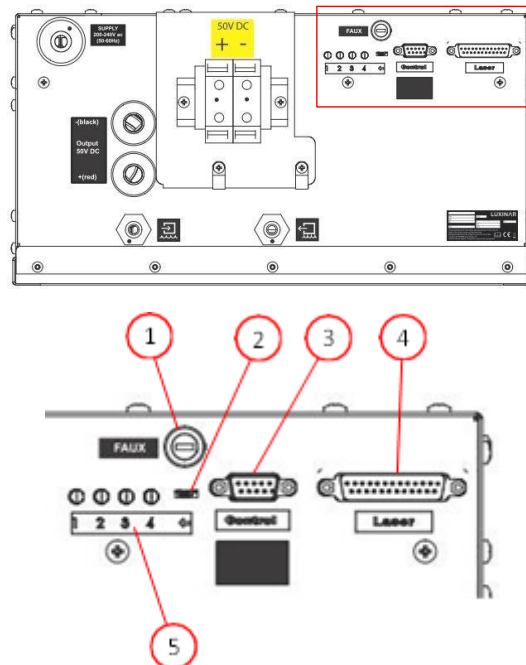
The coolant inlet and outlet connectors are labelled as shown in the following table.

Coolant IN		
Coolant OUT		

Operation

The power supply requires a user input to enable it. When powered up, it will automatically carry out diagnostic checks. If no faults are detected, the DC output is enabled. 50VDC will be present.

User controls and features are located at the top right corner of the front panel as shown below:



- 1 Fuse holder
- 2 Slide switch
- 3 Control connector (9-pin D-connector)
- 4 Laser connector (25-pin D-connector)
- 5 LED status indicators

Figure 68 - Interface connectors and controls

Fuse holder [1]

This contains a 20mm, 2A fuse connected to the 50VDC output. Its function is to protect the internal control electronics in the event of a fault.

Slide switch [2]

The front panel slide switch must be in the left-hand position, as indicated by the arrow, to allow remote enabling on the Laser connector (4).

Control connector (9-pin D-connector) [3]

This connector is not used.

Laser connector (25-pin D-connector) [4]

The DC enable circuit is present on this connector. Link pins 12 and 13 using volt-free contacts, such as a relay, to enable the power supply.

- **Pin 12**
12VDC @ 2mA supply. Link to pin 13 to enable the power supply.
- **Pin 13**
DC enable return signal. Link to pin 12 to enable the power supply.

LED status indicators [5]

There are four status indicators to aid troubleshooting. Refer to section below for details.

Troubleshooting

In normal operation, indicators 1,2 and 4 are on. If faults are detected, one or more of these indicators will be off and indicator 3 will display red.

Indicator number	Status definition
1	 Powered up in standby mode
2	 50V output OK
3	 No fault  Continuous: Temperature fault (module, coolant or dump circuit)  1 flash: Fan fault  2 flashes: Internal PSU module fault  4 flashes: AC mains supply fault (AC voltage below 180V or above 263V)
4	 Power supply output is enabled. <i>50VDC will be present.</i>

SR 25i single-phase DC power supply (005-0595-00)

General description

The SR 25i single-phase power supply is a free-standing AC to DC liquid cooled power supply. (PSU)

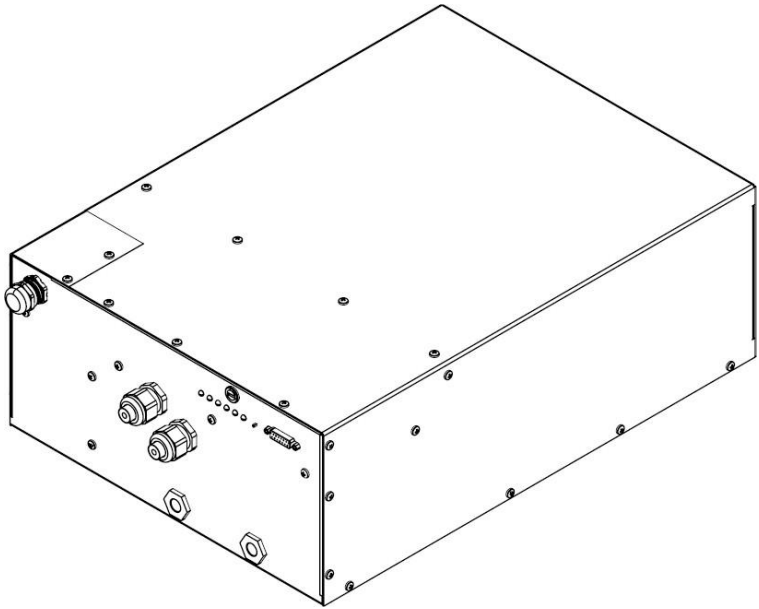


Figure 69 - SR 25i single-phase DC power supply

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.

Table 35 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	511x371x176
Weight	23kg
Coolant type	Deionised water with anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Refer to page 18

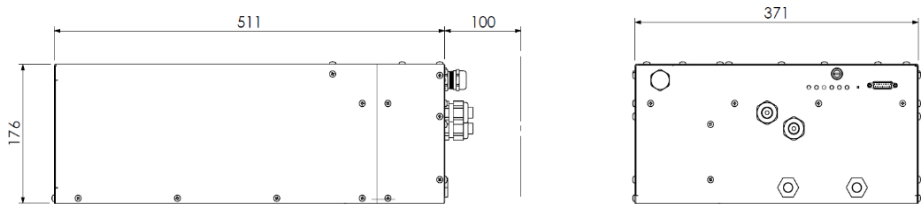


Figure 70 - Overall dimensions

Table 36 - Electrical specifications

SR 25i	
Input voltage range	230VAC $\pm$ 10% (single/bi-phase)
Mains input frequency range	50–60Hz
Mains input fuse rating	40A
AC inrush current (max.)	120A
Output voltage (DC)	50 $\pm$ 1V
Output current	120A
Power factor	>0.95 at full power
Power consumption (max.)	6kW at pulsed full power
Earth leakage current	<4mA

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 M8 screws, mount the power supply within the OEM machine racking by means of the four mounting holes shown in the following figure.

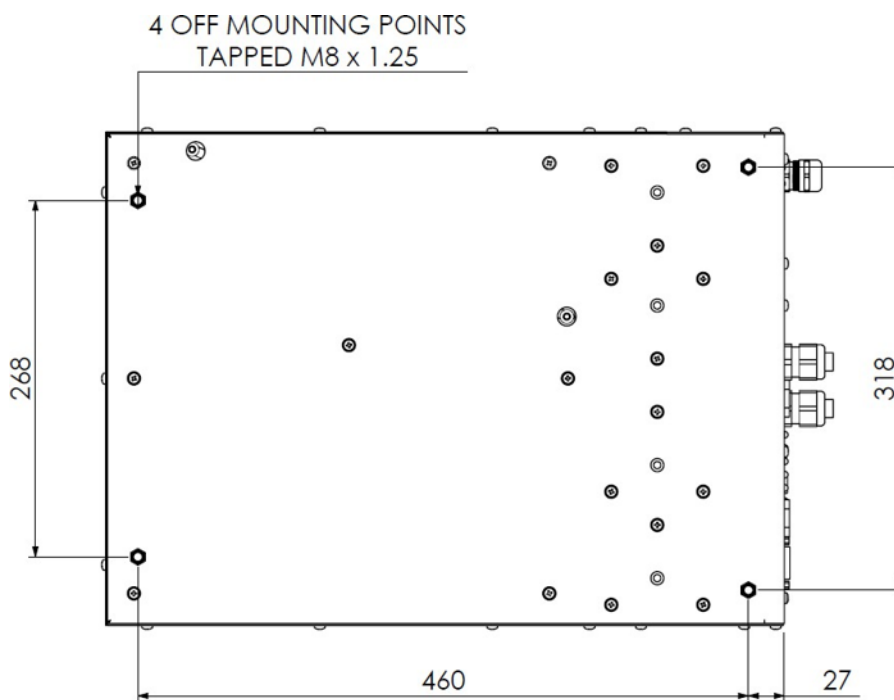


Figure 71 - Fixing locations

Mains AC power connections

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 6mm² mains supply cable. If this cable needs to be replaced with a longer 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 cable:

1. Remove the access panel on the rear of the power supply by removing the seven screws.

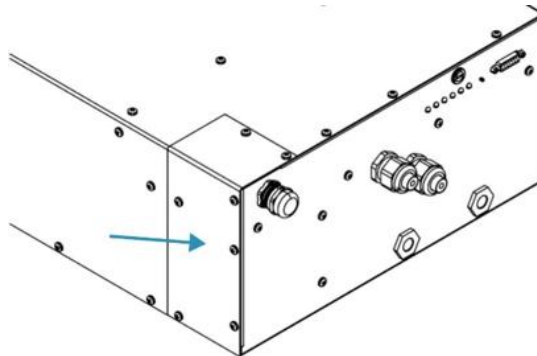


Figure 72 - AC mains power connection point

2. Remove the supplied cable from the connector and replace it with the alternative cable in either single-phase or bi-phase configuration.

Important!

An earth connection is essential. Ensure that the earth wire is connected before connecting the mains supply. For improved EMC performance, Luxinar recommends using a screened cable and terminating the cable screen to the gland.

• Single-phase configuration

Connect the phase to the L1 terminal and the neutral to the N terminal. Do not use the L2 terminal.



- **Bi-phase configuration**

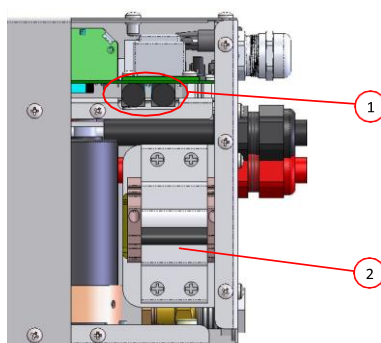
Connect the phase to the **L1** terminal and phase 2 to the **L2** terminal. Do not use the **N** terminal.



AC mains protection device locations

Remove the access panel on the side of the power supply to reveal the AC mains protection devices.

The Miniature Circuit Breaker (MCB) is a 40A type-B device. For correct operation, the reset lever should be in the up position with red visible in the MCB window.



- 1 Mains fuses for internal electronics circuits: 1A
- 2 AC mains input MCB: 40A type-B

Figure 73 - AC mains protection devices

DC laser supply cables

DC power cables must be securely fitted to the connectors provided on the rear of the power supply and on the laser system.

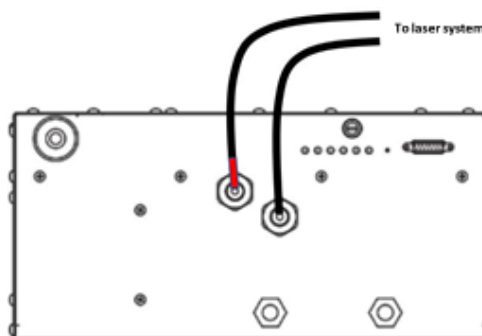


Figure 74 - DC cable connection

DC power cables of the correct specification can be supplied by Luxinar.

DC fuse location

The internal control circuits are powered from the 50VDC output and are protected by a 20mm, 2A fuse located in a fuse holder on the front panel.

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 circuit. The coolant connections are located on the front panel. See [page 36](#).

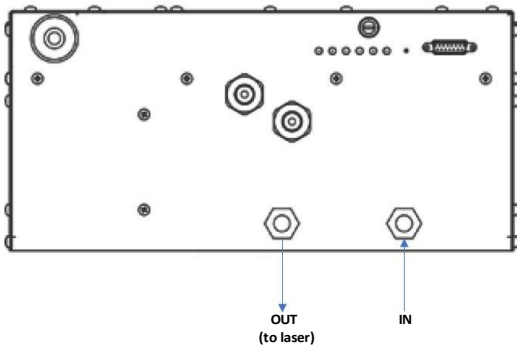


Figure 75 - Coolant connections

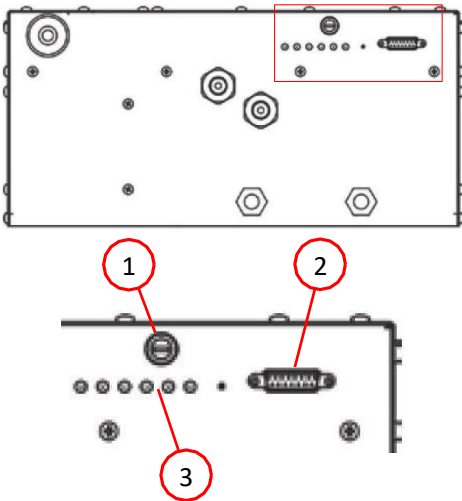
The coolant inlet and outlet connectors are labelled as shown in the following table.

Coolant IN		
Coolant OUT		

Operation

The power supply requires a user input to enable it. When powered up, it will automatically carry out diagnostic checks. If no faults are detected, then the DC power supply is ready for use. 50VDC will be present.

User controls and features are located at the top right corner of the front panel as shown below:



- 1 Fuse holder
- 2 Laser connector (15-pin D-connector)
- 3 LED status indicators

Figure 76 - Interface connector and controls

Fuse holder [1]

This contains a 20mm, 2A fuse connected to the 50VDC output. Its function is to protect the internal control electronics in the event of a fault.

Control connector (15-pin D-connector) [2]

The DC enable circuit is present on this connector. Link pins 13 and 14 using volt-free contacts, such as a relay, to enable the power supply using a remote controller. To permanently enable the power supply, fit the link provided (Luxinar part number 011-0172.00).

- Pin 13**

DC enable return signal. Link to pin 14 to enable the power supply.

- Pin 14**

12VDC @ 10mA supply. Link to pin 13 to enable the power supply.

Important!

Disconnecting the permanent or external link will disable the power supply and turn off the 50VDC output.

Table 37 - Control connector

Pin N°	Function	I/O type	Signal
1	DC_OK	Open-drain	5–24V @ 50mA
2	Reserved	—	—
3	Reserved	—	—
4	WARN_Humidity	Open-drain	5–24V @ 50mA
5	Reserved	—	—
6	Reserved	—	—
7	Reserved	—	—
8	Reserved	—	—
9	FAULT_AC	Open-drain	5–24V @ 50mA
10	FAULT_DC	Open-drain	5–24V @ 50mA
11	FAULT_TEMP	Open-drain	5–24V @ 50mA
12	FAULT_FAN	Open-drain	5–24V @ 50mA
13	DC Enable 1	Volt-free contact	Return to pin 14
14	DC Enable 2	Volt-free contact	12V @ 10mA
15	Signal ground	Ground	—

Note: Open-drain status outputs require a pull-up resistor and a voltage source (5–24V) connected to the monitored output. When the signal becomes active, the output is pulled to 0V.

LED status indicators [3]

There are six status indicators to aid troubleshooting. Refer to [page 98](#) for details.

Troubleshooting

In normal operation, status indicators display green. If faults are detected, at least one indicator will be off or displaying amber or red.



Indicator number	Indicator function	Status definition
1	AC mains voltage status	AC supply voltage is within specified limits. AC supply fault.
2	50V DC enable status	PSU output is enabled. PSU output is disabled.
3	50V DC output status	50V output OK. 50V output is disabled.
4	Power supply temperature status	Temperature is within specified limits. Over-temperature fault on one or more sensors.
5	Power supply internal cooling fan status	Cooling fan is running at normal speed. 50V output is disabled. Cooling fan is stopped or running slowly.
6 ⁽¹⁾	Power supply humidity status	< 90% relative humidity. ≥ 90% relative humidity. ≥ 95% relative humidity.

Note: LED indicators may flash during power up or power down.

SR 25i three-phase DC power supply (016-0027-00)

General description

The SR 25i three-phase power supply is a 3U, 19" rack mountable, AC to DC liquid-cooled power supply. (PSU)

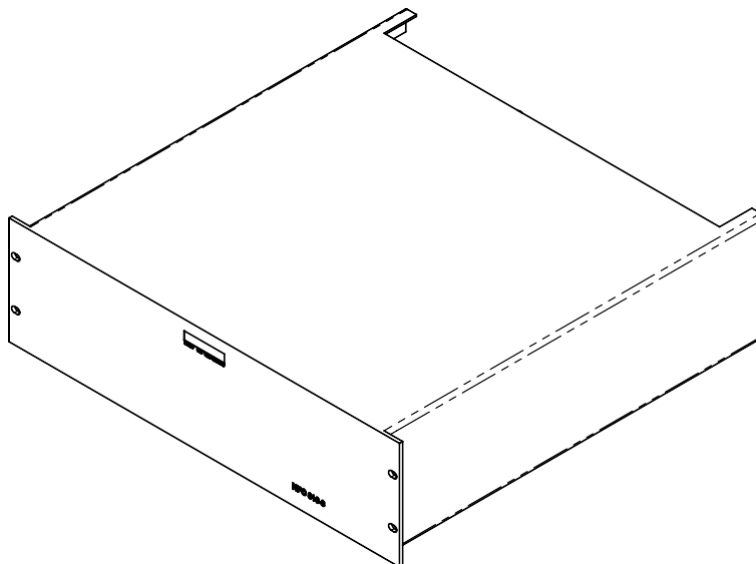


Figure 77 - SR 25i three-phase DC power supply

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.

Table 38 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	466x445x132.5 (3U rack height)
Weight	24kg
Coolant type	Deionised water with anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Refer to page 18
Protection class	IP51

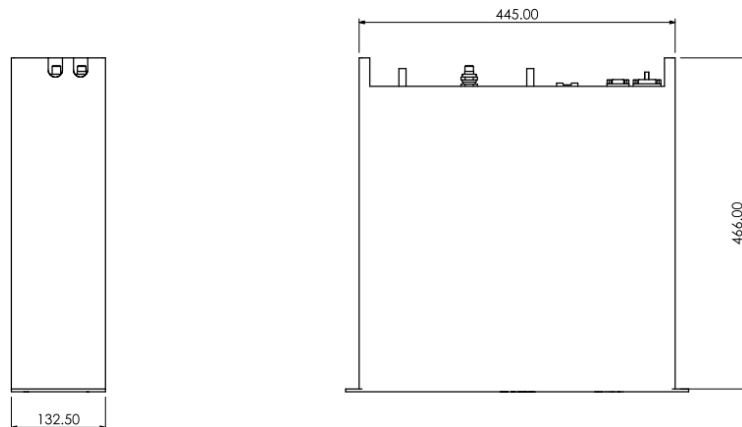


Figure 78 - Overall dimensions

Table 39 - Electrical specifications

SR 25i	
Input voltage range	400VAC $\pm$ 10% (50/60Hz) three-phase ⁽²⁾
Mains input fuse rating	20A
AC inrush current (max)	16A
Output voltage (DC)	50 $\pm$ 1V
Output current	150A
Power factor	>0.90 at full power
Power consumption (max.)	7.5kW at pulsed full power
Earth leakage current	<30mA

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 fasteners, mount the power supply within the OEM machine racking using the four mounting holes shown in the following figure.

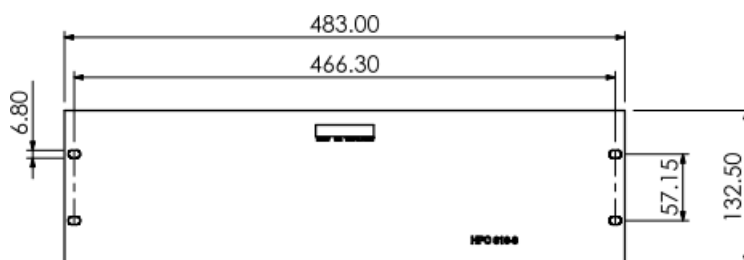


Figure 79 - Fixing locations

2 No neutral connection is required. Connection to neutral will cause irreparable damage to the power supply.

Mains AC power connections

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 mains supply cable. If this cable needs to be replaced with a longer 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** and **L3** terminals on the rear panel of the power supply. See [Figure 83](#). Connect the earth wire to the earth terminal.

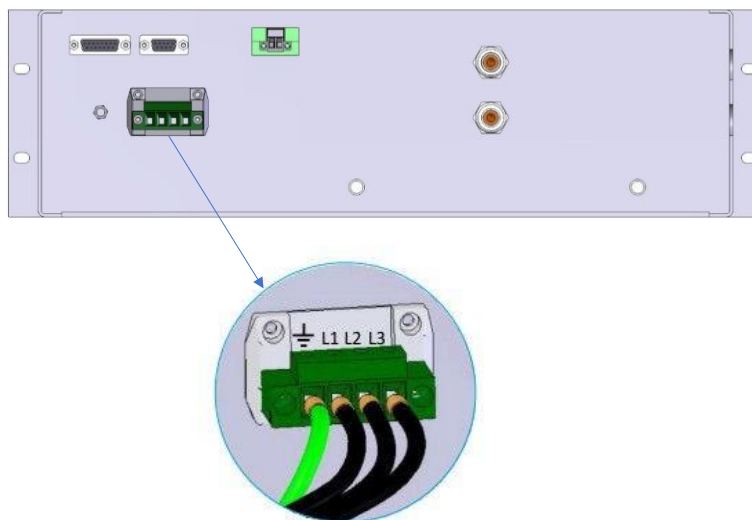


Figure 80 - Three-phase mains supply connection

Important!

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



CAUTION

Risk of irreparable damage to the power supply

Do not connect the power supply to neutral.

DC laser supply cables

DC power cables must be securely fitted to the connectors provided on the rear panel of the power supply and on the laser system. See [Figure 83](#).

Buffer capacitors must be fitted between the power supply and the laser in order to protect the power supply when using high energy pulsing regimes. A 47000µF capacitor assembly (part number 005-0610-00) and 600mm cables are provided with the power supply. Tighten the connection terminals on the capacitor assembly to 10Nm.

Important!

Ensure correct polarity when connecting the capacitors and avoid cross-threading the terminals.

Output + (red)	+50VDC
Output - (blue)	0VDC

DC power cables of the correct specification can be supplied by Luxinar.

Voltage sense connector

Voltage feedback must be provided between the buffer capacitor assembly and the power supply. Connect the provided voltage sense cable (part number 093-0115-0060) from the capacitor assembly to the voltage sense connector on the rear panel. See [Figure 83](#).

Important!

Respect the polarity of the cable. Red +; black -.

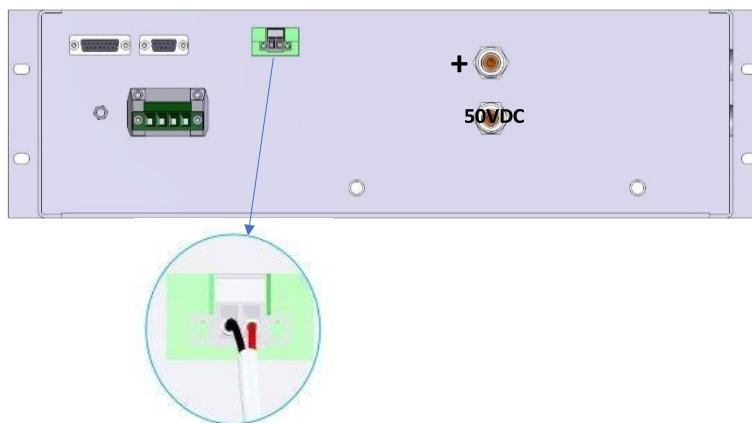


Figure 81 - Voltage sense connector

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 circuit. The coolant connections are located on the rear of the power supply. See [page 36](#) and the following figure.

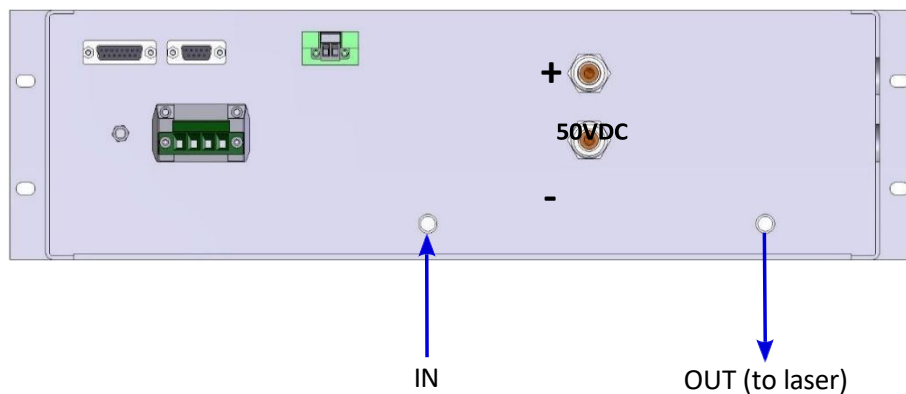


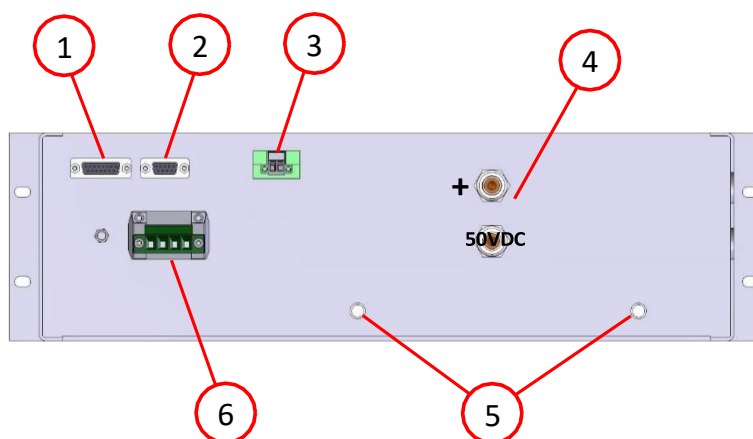
Figure 82 - Coolant connections

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

Coolant IN		
Coolant OUT		

Operation

The power supply requires a user input to enable it. When powered up, it will automatically carry out diagnostic checks. If no faults are detected, then the DC power supply is ready for use. 50VDC will be present.



- 1 Control connector (15-pin D-connector)
- 2 Umax — SET (9-pin D-connector)
- 3 Voltage sense connector
- 4 DC output connectors
- 5 Coolant connectors
- 6 Three-phase mains supply connector

Figure 83 - Rear panel connections

Control connector (15-pin D-connector) [1]

The DC enable circuit is present on this connector. Link pins 2 and 6 using volt-free contacts, such as a relay, to enable the power supply using a remote controller. To permanently enable the power supply, fit the link provided (Luxinar part number 011-0172.00).

- **Pin 2**

Signal ground. Link to pin 6 to enable the power supply.

- **Pin 6**

DC output enable. Link to pin 2 to enable the power supply.

Important!

Disconnecting the permanent or external link will disable the power supply and turn off the 50VDC output.

Table 40 - Control connector

Pin N°	Function	I/O type	Signal
1, 5, 9	12V_{ext}	Output	500mA max. current
2, 3, 10, 11	GND _{ext}	—	—
4, 12, 15	Not used	—	—
6	DC output enable	Input	5–24V, 50mA
7	(FLT) FAULT	Open-collector output	FLT = low when: • Temp > 55°C • DC voltage > 59V
8	(TW) TEMPW	Open-collector output	TW = low when Temp > 50°C
13	DC current	—	0...10mA = 0...150A
14	Uok	Open-collector output	Uok = low

Note: Open-drain status outputs require a pull-up resistor and a voltage source (5–24V) connected to the monitored output. When the signal becomes active, the output is pulled to 0V.

Umax — SET (9-pin D-connector) [2]

This connector is reserved for Luxinar trained service personnel and must not be used.

Troubleshooting

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



Figure 84 - LED indicators

READY

The three-phase mains supply is correctly connected.

Note: The power supply uses a soft-start circuit during power up and the **FAULT** indicator will turn on momentarily during this time. This is normal.

If the mains supply is switched on and off too often, the soft-start resistors heat up and the **FAULT** indicator turns on. If this happens, switch off the mains supply and wait for five minutes for the soft-start resistors to cool down.

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 turn on.

Note: If the external voltage is not correct, the DC output is turned off and the **FAULT** indicator turns on. Check the external wiring.

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 auxiliary interface connector.

Important!

If no action is taken and the internal temperature continues to rise, the **FAULT** indicator turns on and the DC output is turned off.

FAULT

This indicator turns on 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, one or more status indicators will be off or displaying red/amber. Disconnect and reconnect the mains supply to restart the power supply. For a status indicator explanation, refer to the following table.

READY	Uok	TEMPW	FAULT	Status definition
				- Power supply ready - DC output enabled - Correct operation
				- Power supply ready - DC output disabled
				- Fault - Mains supply switched on and off too often
				- Warning - Internal temperature > 50°C
				- Fault - Internal temperature > 55°C
				- Fault - Output voltage fault

System connections overview

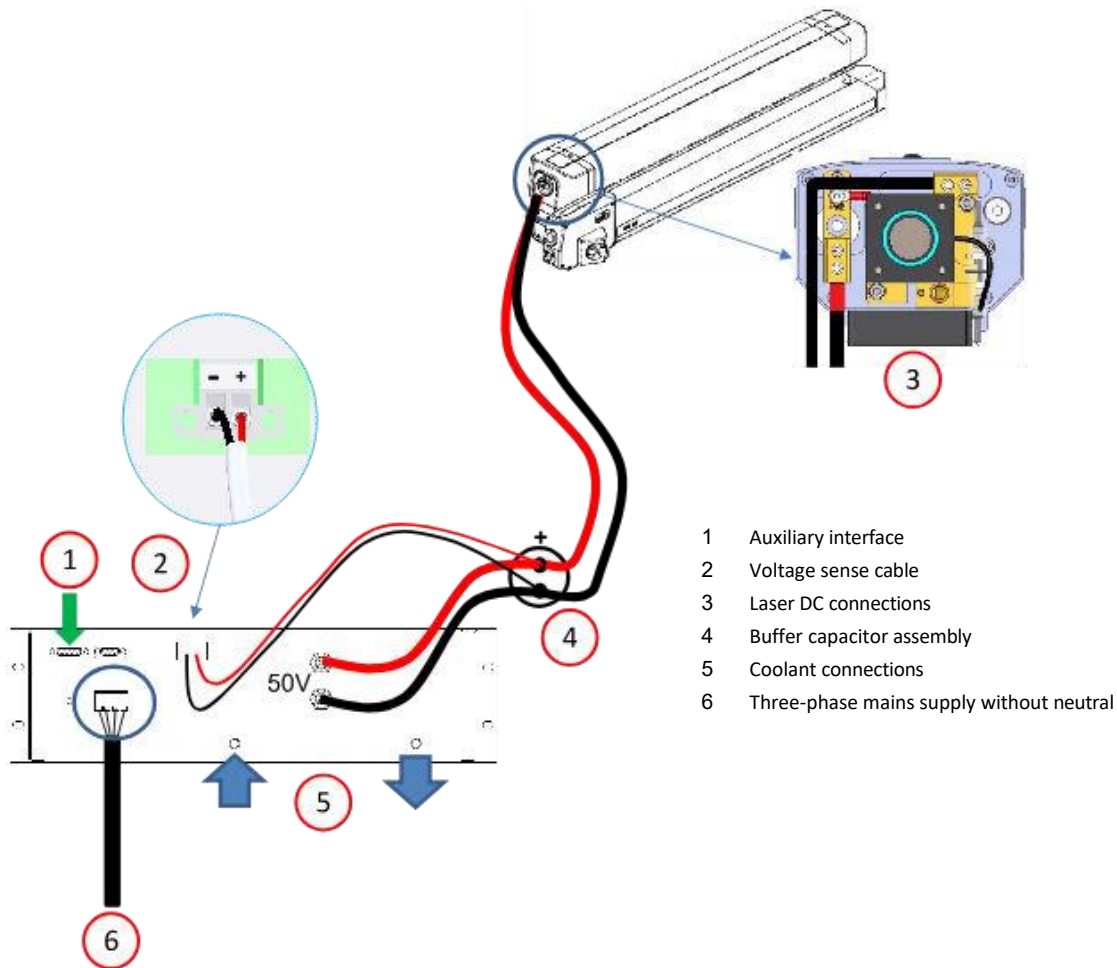


Figure 85 - System connection overview

SR 25i three-phase DC power supply (016-0035-00)

General description

The SR 25i three-phase DC PSU is a free-standing/rack mountable AC to DC water cooled power supply. (PSU)

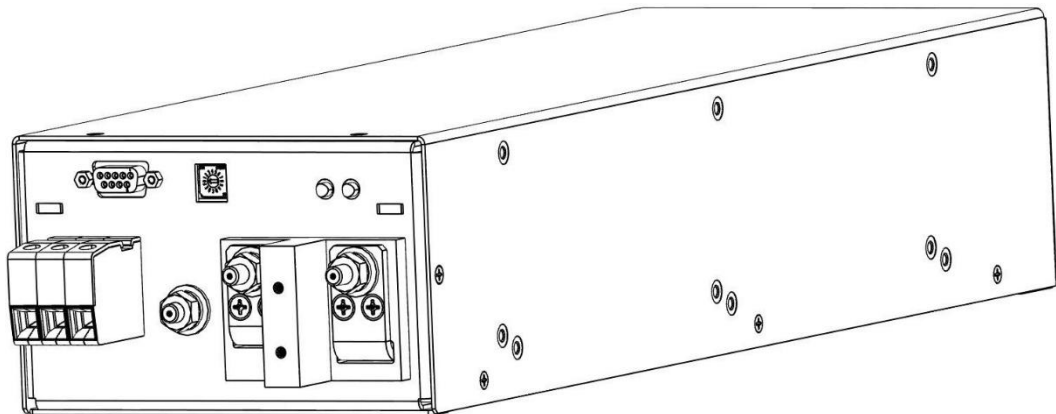


Figure 86 - SR 25i three-phase DC power supply

Specification

Table 41 - Dimensions, weight and cooling

Dimensions (mm) LxWxH	512x149.2x88 (2U rack height)
Weight	7kg
Coolant type	Demineralised, deionised or distilled water with corrosion inhibitor and anti-bacterial additive
Coolant pipe	10mm OD
Coolant flow rate	Min 5.5 l/m Refer to page 18
Pressure	Maximum 6 bar
Protection class	IP21

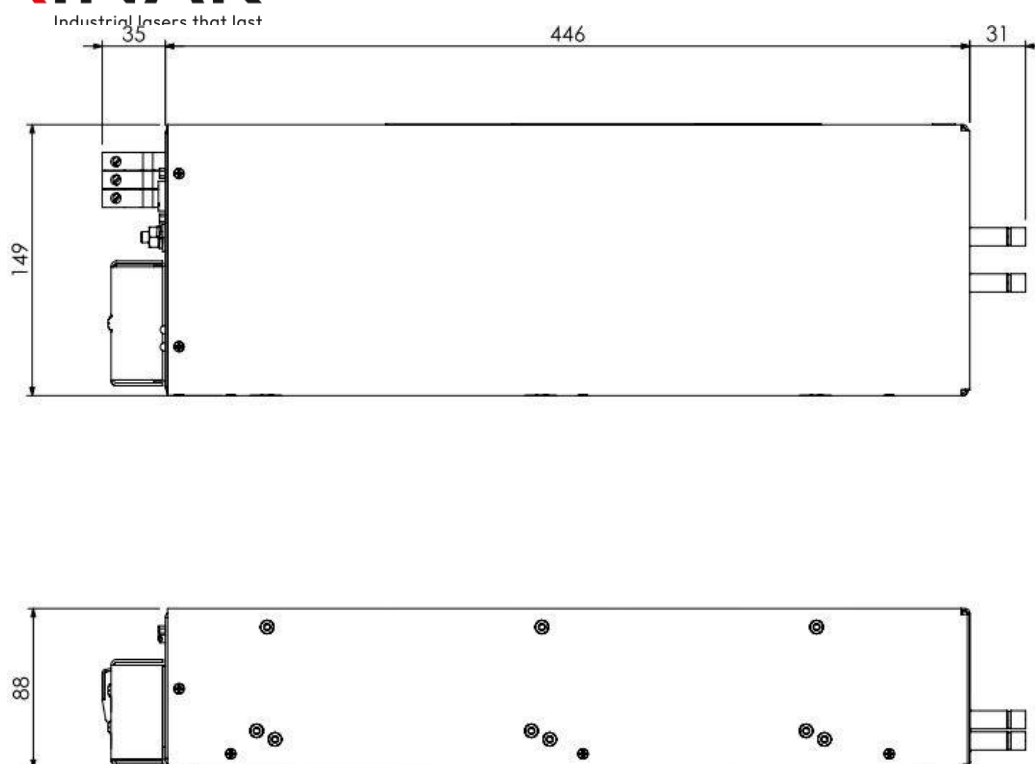


Figure 87 - Overall dimensions

Table 42 - Electrical specifications

SR 25i	
Input voltage range	380-480VAC (47/63Hz) three-phase ⁽³⁾
Mains input fuse rating	16A
AC inrush current (max)	50A
Output voltage (DC)	50 ± 1V
Output current	150A
Power factor	>0.90 at full power
Power consumption (max.)	7.5kW at full power
Earth leakage current	<30mA

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 fasteners, mount the power supply within the OEM machine racking using the six mounting holes shown in the following figure.

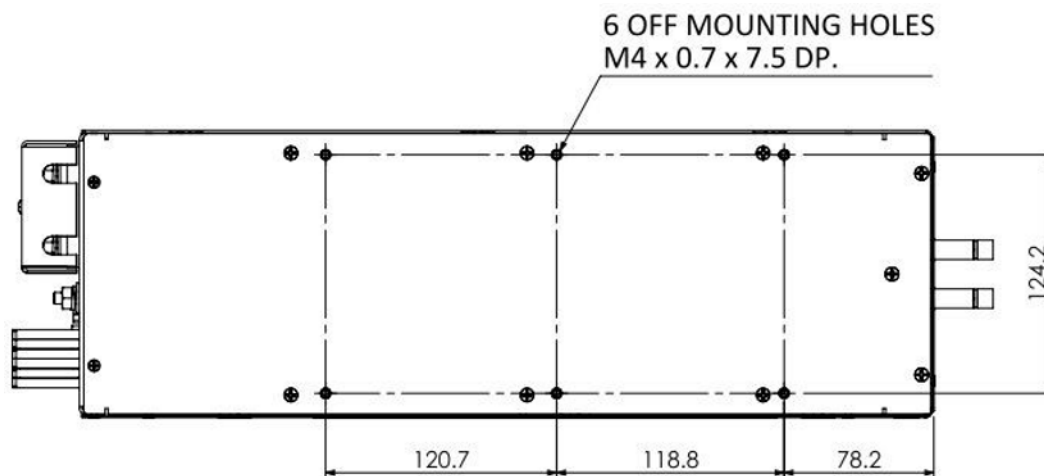


Figure 88 - Fixing locations

Mains AC power connections

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.

3 No neutral connection is required. Connection to neutral will cause irreparable damage to the power supply.

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



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 and L3 terminals on the rear panel of the power supply. Connect the earth cable to the M6 earth stud.

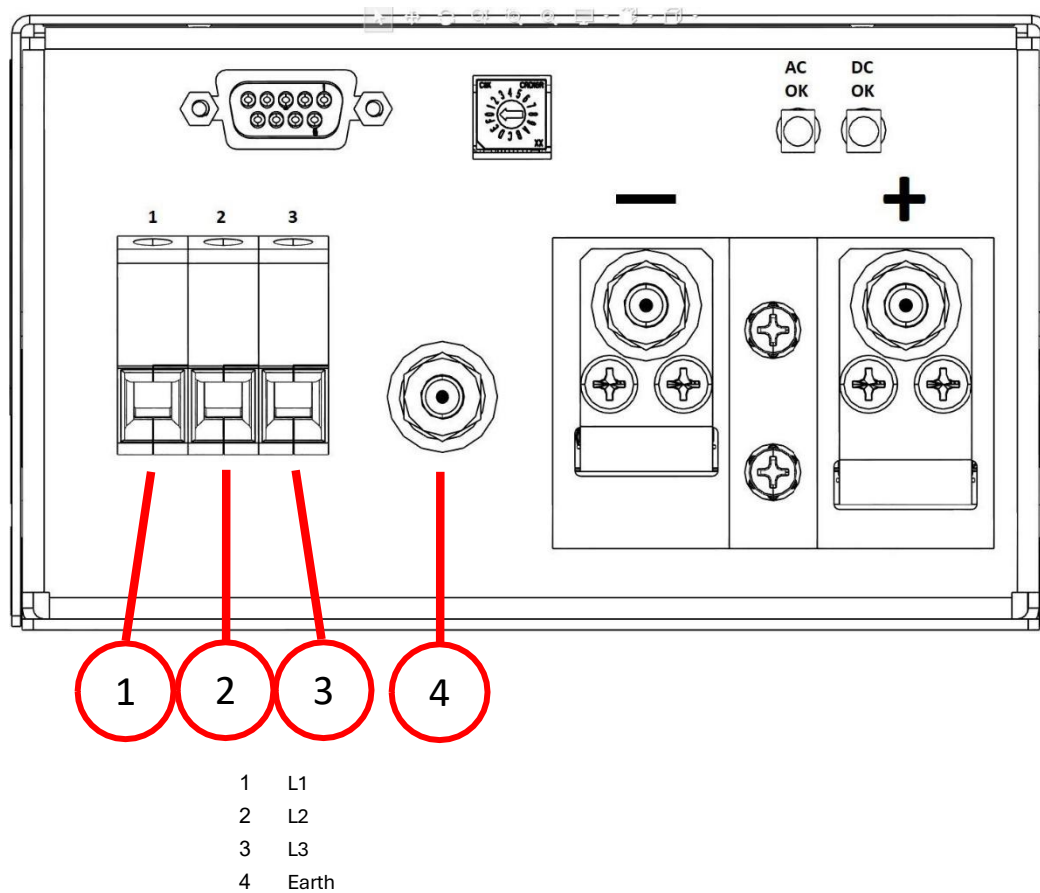


Figure 89 - Three-phase mains supply connections

Important!

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



Risk of irreparable damage to the power supply

Do not connect the power supply to neutral.

For improved EMC performance, the power supply earth stud will need a permanent bond strap connection to earth.

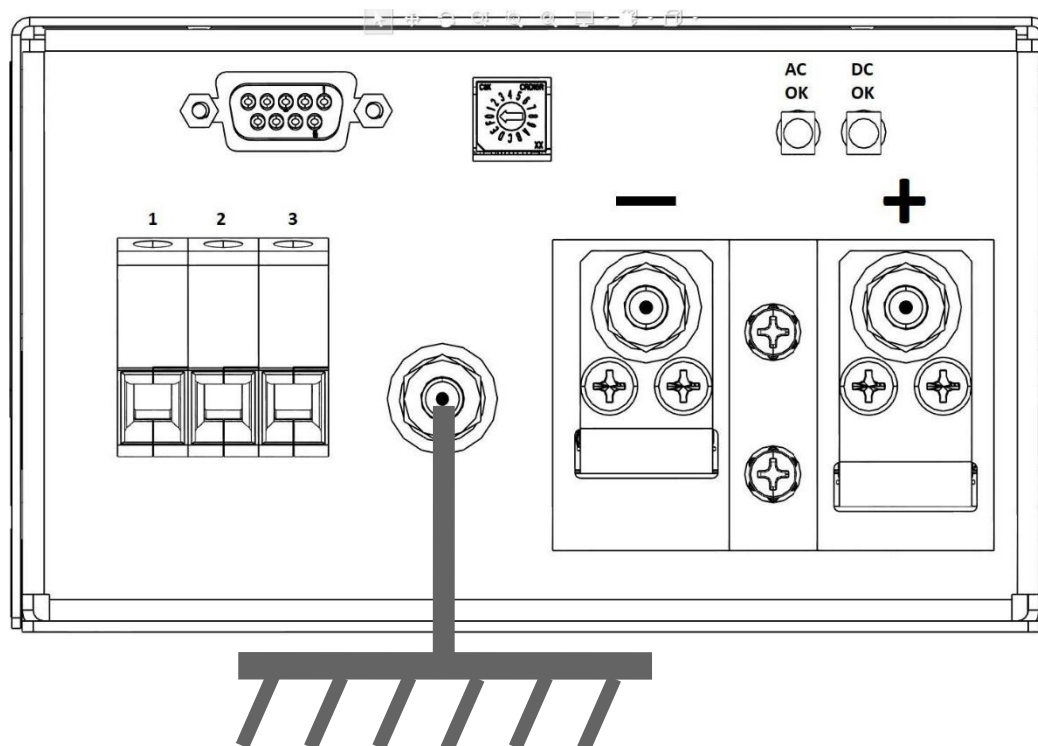


Figure 90 - Three-phase earth connections

DC laser supply cables

DC power cables must be securely fitted to the M6 terminals provided on the rear panel of the power supply.

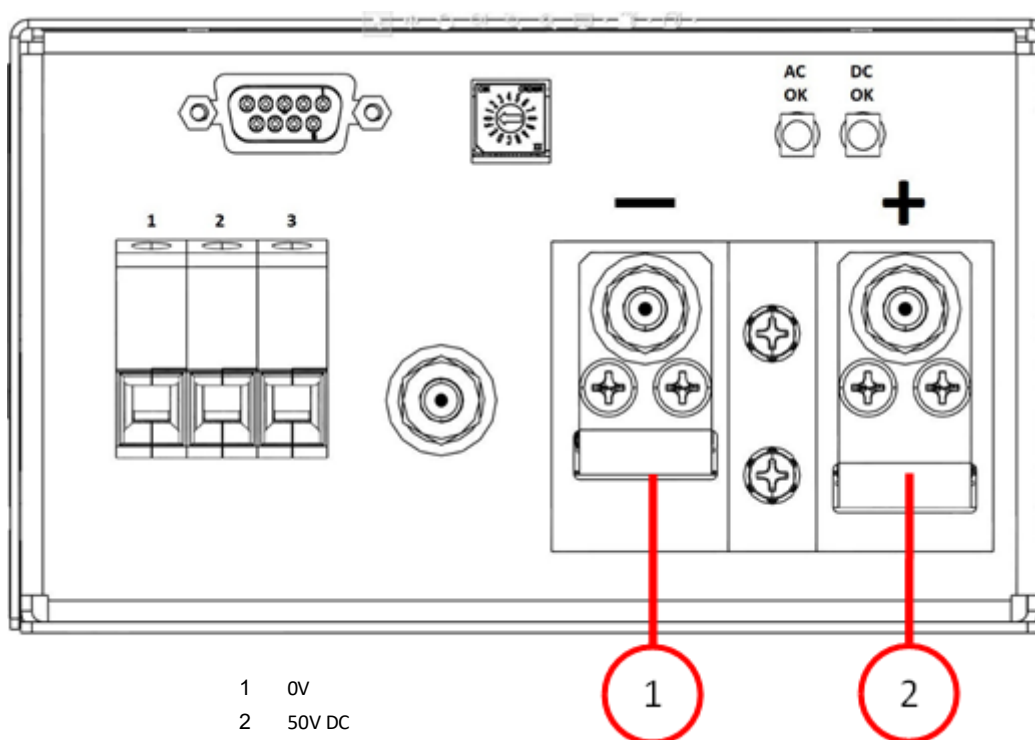


Figure 91 - DC cable connections

Power supply terminal	Terminal
+	50VDC
-	0VDC

Ensure correct polarity of cable when connecting to the power supply terminals. DC power cables of the correct specification can be supplied by Luxinar.

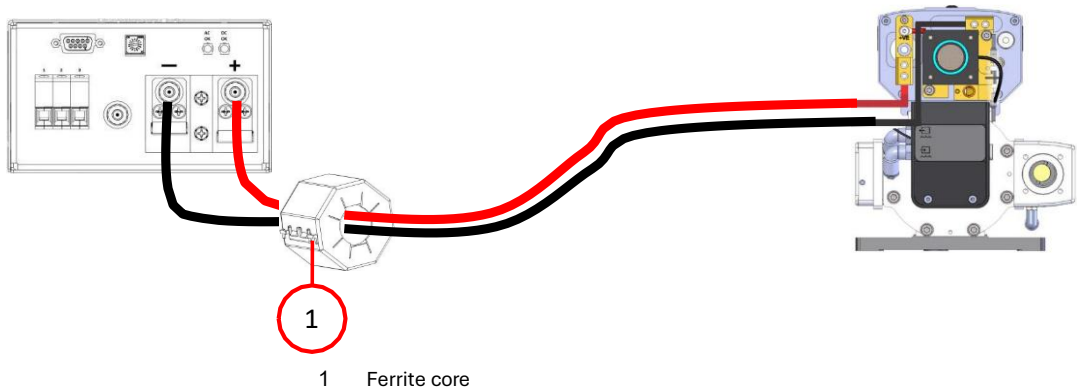


Figure 92 - System wiring

Important!

Ensure correct polarity when connecting the DC PSU to the SR laser system.

For improved EMC performance, a ferrite core (Luxinar 543-0043-00) will need connecting to the DC cables, close to the DC Power supply terminals

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 circuit.

The coolant connections are located on the rear of the power supply.

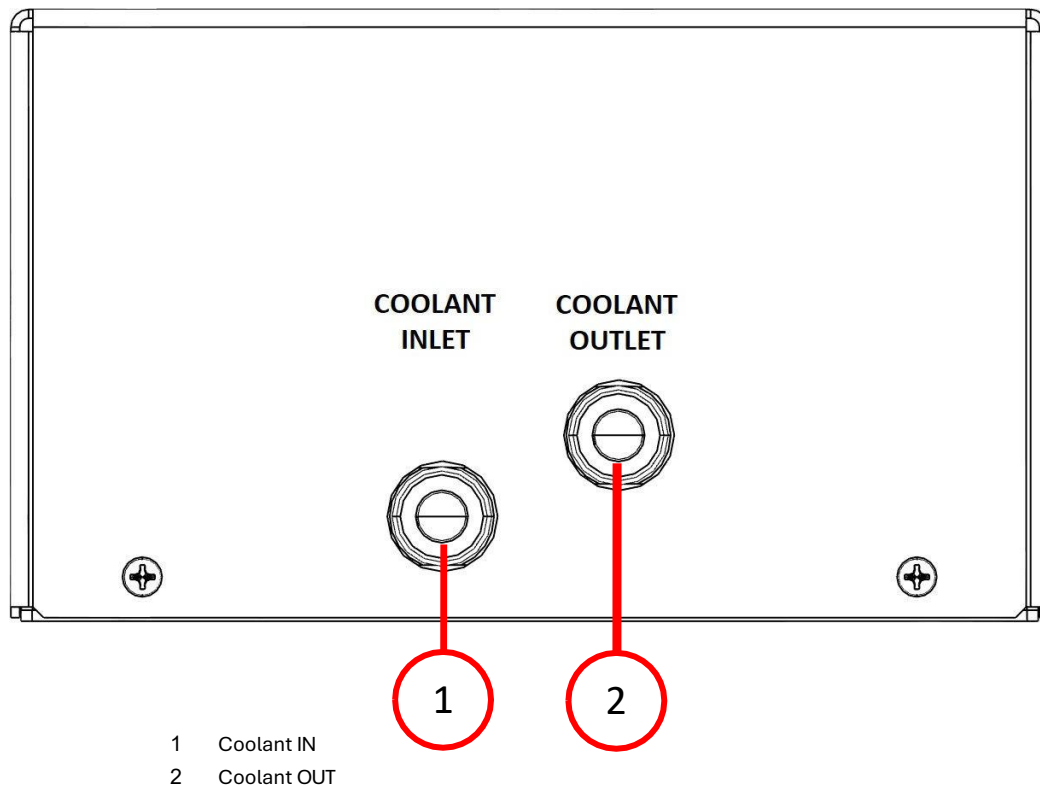


Figure 93 - Coolant connections

Operation

The power supply requires user input to operate. When powered up, the power supply will automatically carry out diagnostic checks. This will take a maximum of 7 seconds to complete. If no faults are detected, then the DC power supply is ready for use.

On the rear of the power supply, there is 1 D-type connector.

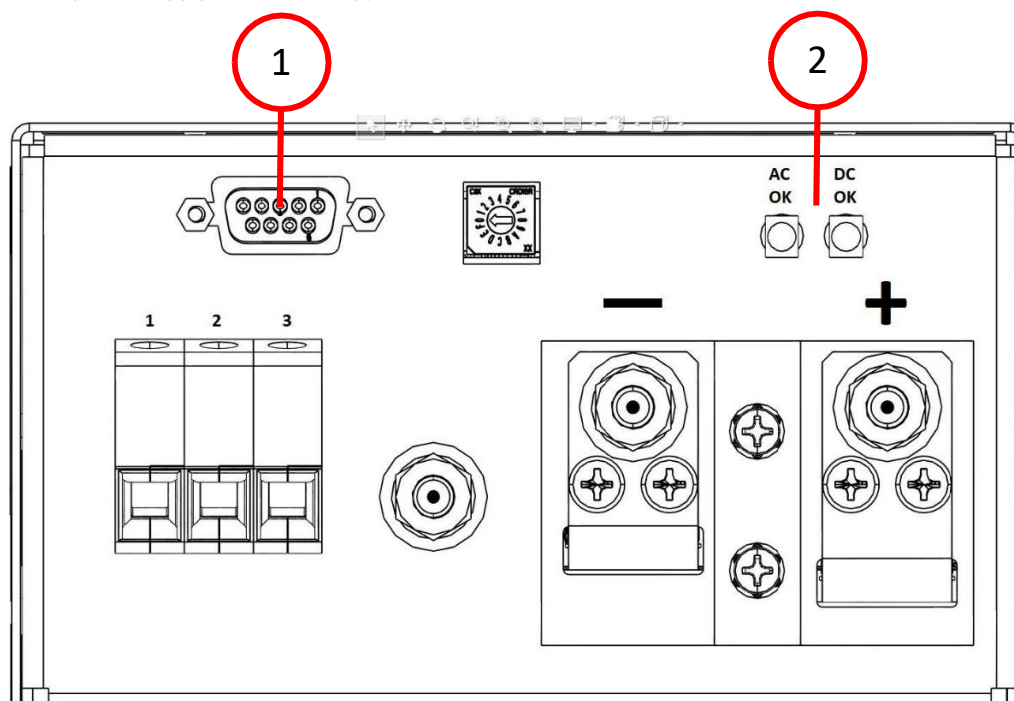


Figure 94 - Rear panel connections

- 1 Interface (9-pin D-connector)
- 2 Power supply indicators

Table 43 - Interface (9 pin D-type)

Pin N°	Function	I/O type	Signal
1	DC_Fault	Output	Open collector
2	EXT_CAN-	Not used	—
3	PSU_Enable	Input	Active Low (return to pin 9)
4	INT_CAN-	Not used	—
5	INT_CAN+	Not used	—
6	Temperature_Fault*	Output	Open collector
7	EXT_CAN+	Not used	—
8	AC_Fault	Output	Open collector
9	RTN		

Note: *Warning. If the internal temperature of the DC power supply exceeds safe operating limits, the 50V will turn off. When the internal temperature of the power supply cools to safe operating conditions, the 50V will turn back on.

To enable the DC output of the power supply, pins 3 and 9 must be linked. Removing the link will turn off the 50V output. It will take <50ms for the output of the DC PSU to reach 50V once PSU enable is made. To permanently enable the 50V output, fit the link provided (Luxinar part number 011-0219-00).

Power supply indicators

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

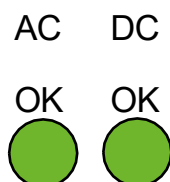


Figure 95 - PSU LED indicators

Table 44 - PSU LED indicators

LED	Colour	Meaning
AC OK	Red	AC input voltage out of range
	Green	AC input voltage within range (correct operation)
	Off	No AC input voltage detected
DC OK	Red	DC output voltage out of range
	Green	DC output voltage present (correct operation)
	Off	DC output voltage disabled

Appendix 9

History of Changes

Revision	Date	Changes
1	26/10/2020	Reorder and modularise content, create common modules, change to XML format.
2	26/07/2021	CR 651483: Addition of maximum single person lifting weight warning and EN61010 statements, update of EN60825 specification title, update of DC power supplies and minor technical corrections and adjustments. Addition of detail for EN55011 compliance statement.
3	17/01/2022	CR 652039: Safety and DC PSU sections updated.
4	15/07/2022	CR 652283: EMC details added to DC PSU section.
5	12/10/2022	CR 652437: Specification updates.
6	28/10/2022	CR 651940: UKCA marking and safety section updates.
7	20/02/2023	CR 652376: Safety label updates and pre-ioniser cable note.
8	31/08/2023	CR 651958: EMC details added to DC PSU section.
9	22/05/2024	CR 651756: TTL Converter section updates.
10	17/12/2024	CR 653090: DC PSU section updates
11	16/06/2025	CR 653731: Specification Updates
12	17/06/2026	CR 654167: Updated to various documents to reflect closure of office in Hamburg and transfer of responsibility to Krailling

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

Tel: +44 (0) 1482 650088

www.luxinar.com

