nLIGHT

High-Power Semiconductor Lasers

INSTALLATION MANUAL

*n*POWER™ | 7200 Laser Electronics Rack

*n*LINE™ | 260 Optical Head

LINE BEAM SYSTEM | 7200:260

April 2012

PROPRIETARY INFORMATION

Copyright

Trademarks

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SUPPORT

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Additional Documentation

This manual is part of the Line Beam System | 7200:260 manual suite listed below:

CONTROL NUMBER	TITLE
EX-OM-0003	Line Beam System | 7200:260 Operators Manual
EX-OM-0004	Line Beam System | 7200:260 Installation Manual
EX-OM-0005	Line Beam System | 7200:260 Service Manual

Figure 1: Line Beam System | 7200:260 Manuals

Warranty

*n*LIGHT Photonics offers a limited warranty to ensure customer satisfaction. For complete details, please contact your *n*LIGHT sales representative.

ABOUT THIS MANUAL

This manual provides important product and safety information, as well as basic operating procedures. A current version of this manual must be kept in close proximity of the product and made readily available to service technicians at all times.

Revision History

REV	DATE	DESCRIPTION	INITIALS

Figure 2: Revision History

Disclaimer

While all efforts have been made to ensure the accuracy and validity of information contained in this document, *n*LIGHT Photonics Corporation assumes no responsibility and disclaims all liability for any errors and/or omissions that may be contained herein.

Due to possible changes and/or updates to component design and software application, this document, completely or in part may become obsolete or out-of-date until a subsequent revision is released by *n*LIGHT Photonics Corp.

*n*LIGHT may make changes to specifications, product descriptions, and documentation at any time, without notice.

Export Classification: EAR99: This document contains technical data subject to the Export Administration Regulations. Diversion contrary to US law prohibited.

Symbols

To ensure safe and proper use of *n*LIGHT products, the following document symbols are used throughout this manual to highlight important safety and product information. Symbols may be used alone to indicate the pre-defined conditions listed below.

Operators, buyers, and technicians must observe each occurrence of these symbols as they appear throughout this document. Failure to do so may result in serious product damage and/or physical injury or death.

SYMBOL	DESCRIPTION
	**NOTE:** Useful tips and information
	**FIRE:** Possible fire hazard
	**ELECTROSTATIC DISCHARGE** : Observe the necessary precautions to prevent ESD where this symbol appears.
	**IMPORTANT:** Important safety or product information
	**CRITICAL:** VERY important product and/or safety information
	**IEC WARNING**: Laser radiation hazard
	**DANGER:** Possible dangerous conditions
	**HIGH VOLTAGE:** Risk of electrical shock
	**ATTENTION:** Possible hazardous conditions
	**LASER EYE PROTECTION:** REQUIRED where this symbol appears
	**CLEANROOM NITRILE GLOVES:** REQUIRED where this symbol appears
	**CLEAN ROOM SUIT:** REQUIRED where this symbol appears

Figure 3: Document Symbols

PRODUCT SAFETY

Laser beams are powerful enough to burn skin, clothing, and most surfaces. They can ignite volatile substances such as alcohol, gasoline, ether, and other solvents, and can damage the light-sensitive elements in video cameras and photodiodes.

Laser Classification

Based on US Federal and International safety regulations, laser products and systems must be classified based on output/energy and wavelength.

In accordance with classifying standards and criteria set forth by US Federal and International regulatory agencies, the Line Beam System | 7200:260 is designated as a Class 4 beam laser, as it is designed to emit radiation in the infrared part of the spectrum at 975 nm.

Class 4 lasers are high power (c.w. >500mW or pulsed >10J/cm²) devices. Some examples of Class 4 laser use are surgery, research, drilling, cutting, welding, and micromachining.

The direct beam and diffuse reflections from Class 4 lasers can be hazardous to the eyes and skin. Class 4 laser devices can also be a fire hazard depending on the reaction of the target when struck.

The Line Beam System | 7200:260 also generates a visible, low power beam to assist optical alignment. The alignment beam emits Class 2 laser emission.

Laser Safety

For the safe use of this product, operators, technicians, users, and all individuals working inside the designated laser control area must be keenly aware of the dangers associated with Class 4 laser operation and the safety measures required to avoid injury.

Operators and technicians must be adequately trained in laser safety per US Federal and International safety standards and regulations. This training can be provided by the Manufacturer, the Operator, or from a recognized laser safety expert. Training procedures should be documented whenever possible.

Trainers and laser safety experts must be specifically acquainted with Class 4 laser systems and able to recognize the dangers and risks of operating a high-powered beam laser.

Safety Guidelines

This product must be used ONLY in the manner for which it is intended by the manufacturer. Operators must ALWAYS observe the warnings and precautions provided throughout this manual.

Damages and/or injuries resulting from improper use or care of *n*LIGHT product(s), and/or the failure to comply with applicable governing regulations, and/or failure to adhere to the guidelines provided herein, absolve the manufacturer of all liability.

- ONLY qualified personnel are authorized to install, operate, and service this product.
- NEVER remove protective covers from the Optical Head.
- ALWAYS wear *Personal Protective Equipment* (PPE) to prevent radiation exposure.
- ALWAYS limit access to the laser control area to authorized and full-trained personnel ONLY.
- ALWAYS use a beam stop of appropriate material to terminate any potentially hazardous laser beams.
- ALWAYS use diffusely reflecting materials near the beam, where appropriate.
- ALWAYS provide appropriate laser protective eyewear to personnel within the laser controlled area.
- NEVER use interlocks to shut down the system except in an emergency.

EYE SAFETY

LASER EYE PROTECTION IS REQUIRED WHEN OPERATING ALL CLASS 4 LASERS.

Class 4 laser output can be invisible to the naked eye. Direct ocular interception of the laser output beam can cause serious eye damage or blindness.

- ALWAYS wear laser eye protection when operating the laser.
- ALWAYS wear laser eye protection inside the laser control area.
- NEVER look directly into the laser output port.
- NEVER set up or align laser and optical components at eye level.
- ALWAYS ensure eyewear provides sufficient protection based on radiation emission and wavelengths (see Eyewear Selection Chart below).

Simplified Method For Selecting Laser Eye Protection For Viewing Wavelengths Between 400 And 1400nm									
Q-Switched Lasers (1 ns to 0.1 ms)		Non-Q-Switched Lasers (0.4 ms to 10 ms)		Continuous Lasers (0.25 s to 10 s)		Continuous Lasers Greater than 3 hours		Attenuation	
Output Energy (J)	Beam Radiant Exposure (J-cm-2)	Laser Output Energy (J)	Beam Radiant Exposure (J-cm-2)	Power Output (W)	Beam Irradiance (W·cm-2)	Power Output (W)	Beam Irradiance (W·cm-2)	Attenuation Factor	OD
10	20	100	200	NR	NR	NR	NR	100,000,000	8
1.0	2	10	20	NR	NR	NR	NR	10,000,000	7
10-1	2 x 10-1	1.0	2	NR	NR	1.0	2	1,000,000	6
10-2	2 x 10-2	10-1	2 x 10-1	NR	NR	10-1	2 x 10-1	100,000	5
10-3	2 x 10-3	10-2	2 x 10-2	10	20	10-2	2 x 10-2	10,000	4
10-4	2 x 10-4	10-3	2 x 10-3	1.0	2	10-3	2 x 10-3	1,000	3
10-5	2 x 10-5	10-4	2 x 10-4	10-1	2 x 10-1	10-4	2 x 10-4	100	2
10-6	2 x 10-6	10-5	2 x 10-5	10-2	2 x 10-2	10-5	2 x 10-5	10	1
NR = Not Recommended									

Figure 4: Laser Protective Eyewear Selection Chart

Safety Features

In accordance with US Federal and international safety regulations and requirements, including IEC EN60825-1, the Line Beam System | 7200:260 is equipped with the following engineering controls/safety features:

- Protective Housing
- Protective Housing Interlock
- Master Switch Control
- Optical Viewing System Safety
- Beam Stop or Attenuator
- Laser Activation Warning System
- Remote Interlock Connector
- Laser Safety Labels

PROTECTIVE HOUSING

A protective housing is required for all classes of lasers except at the beam aperture. In some cases, the walls of a properly enclosed room can be considered as the protective housing for an open beam laser.

Accordingly, the *n*LINE | 260 Optical Head and *n*POWER | 7200 Laser Electronics Rack are securely enclosed by Protective Housings to safeguard operators, technicians, and others working within the laser controlled area from Class 4 radiation exposure.

PROTECTIVE HOUSING INTERLOCKS

Interlocks, which cause beam termination or reduction of the beam to MPE levels, must be provided on all panels intended to be opened during operation and maintenance of all Class 3B and Class 4 lasers. The interlocks are typically connected to a beam shutter. The removal or displacement of the panel closes the shutter and prevents possible exposure.

Under the requirements of the ANSI Z 136 Standard, for embedded Class 3B and Class 4 lasers only, the interlocks are to be "fail-safe." This usually means that dual, redundant, electrical series-connected interlocks are associated with each removable panel.

The Line Beam System | 7200:260 is equipped with five Protective Housing Interlocks, 2 inside the Line Beam Head, and 3 inside the Laser Electronics Rack.

MASTER SWITCH CONTROL

All Class 4 lasers and laser systems require a master switch control. The switch can be operated by a key or computer code. When disabled (key or code removed), the laser cannot be operated. Only authorized system operators are to be permitted access to the key or code.

The Line Beam System | 7200:260 is equipped with two security key switches located inside the:

1. AC Power Distribution
2. *n*POWER IntelliSync Enclosure

OPTICAL VIEWING SYSTEM SAFETY

Interlocks, filters, or attenuators are to be incorporated in conjunction with beam shutters when optical viewing systems such as telescopes, microscopes, viewing ports, or screens are used to view the beam or beam-reflection area. For example, an electrical interlock could prevent laser system operation when a beam shutter is removed from the optical system-viewing path. Such optical filter interlocks are required for all lasers, except Class 1.

BEAM STOP OR ATTENUATOR

Class 4 lasers require a permanently attached beam stop or attenuator, which can reduce the output emission to a level at or below the appropriate MPE level when the laser system is on "standby." Such a beam stop or attenuator is also recommended for Class 3B lasers.

LASER ACTIVATION WARNING SYSTEM

An audible tone or bell and/or visual warning (such as a flashing light) are recommended as area controls for Class 3B laser operation. Such a warning system is mandatory for Class 4 lasers. Such warning devices are to be activated upon system start-up and are to be uniquely identified with the laser operation. Verbal "countdown" commands are an acceptable audible warning and should be a part of the SOP.

REMOTE INTERLOCK CONNECTOR

All Class 4 lasers or laser systems must have a remote interlock connector to allow electrical connections to an emergency master disconnect ("panic button") interlock or to room, door or fixture interlocks. When open circuited, the interlock shall cause the accessible laser radiation to be maintained below the appropriate MPE level. The remote interlock connector is also recommended for Class 3B lasers.

LASER PRODUCT SAFETY LABELS

United States Federal and international laser safety standards require all Class 4 laser components to be properly labeled by the manufacturer.

Optical Head

Accordingly, the following safety and warning labels are affixed to the *n*LINE | 260 Optical Head prior to shipping:

Figure 5: Optical Head Safety Labels

Laser Electronics Rack

The following safety and warning labels are affixed to the *n*POWER™ | 7200 Laser Electronics Rack:

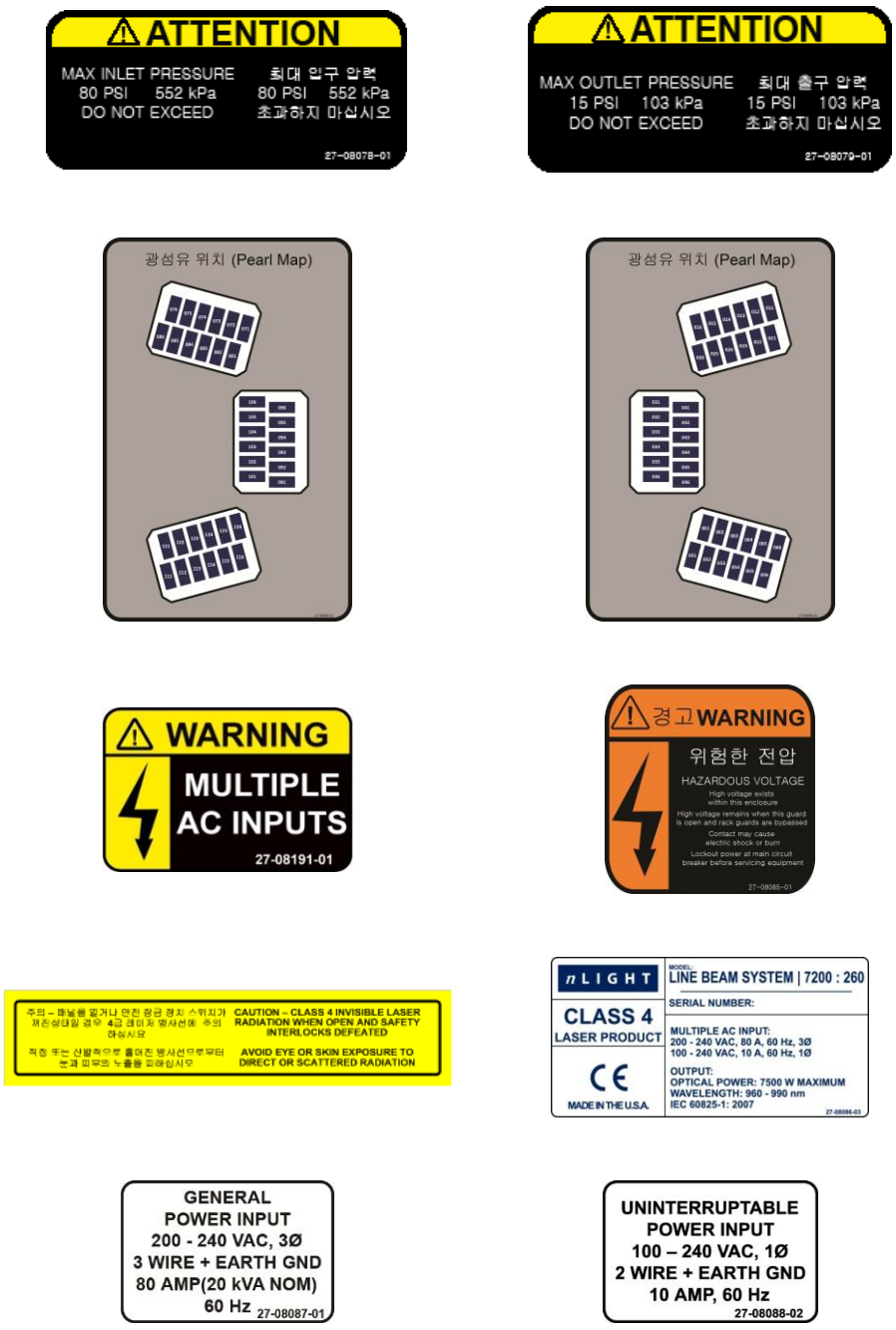

Figure 6: Laser Electronics Rack Safety Labels

GETTING STARTED

This section of the Line Beam System | 7200:260 Installation Manual provides the following detailed information:

1. Inspecting the Shipment(s)
2. Unpacking the Laser Electronics Rack
3. Unpacking the Line Beam Optical Head
4. Unpacking the Projection Relay

Inspecting the Shipment

The Line Beam System | 7200:260 is shipped in three separate wooden crates containing:

1. *n*POWER™ | 7200 Laser Electronics Rack
2. *n*LINE™ | 260 Line Beam Optical Head
3. Projection Relay

Installation of the Line Beam System | 7200:260 begins on page 25.

nPOWER Laser Electronics Rack

nLINE Optical Head

Projection Relay

Figure 7: Line Beam System | 7200:260 Shipping Containers

Continues on next page…

IMPACT INDICATORS

Actual Impact Indicators may vary from those pictured here.

Prior to shipping, several impact indicators are affixed to the interior and exterior of the crates containing the Optical Head and Laser Electronics Rack (6-8 each). Upon delivery, be sure to examine the impact indicators affixed to the outside of each crate for any evidence of improper handling or tampering. Document, photograph, and **immediately** report ANY findings to *n*LIGHT Photonics, US Headquarters.

Drop-n-Tell

YELLOW-Rough Handling

RED-Rough Handling

Figure 8: Impact Indicators

Unpacking the Optical Head

The crate containing the Optical Head is partitioned into three sections. The middle section contains the Optical Head inside an ESD bag as shown below.

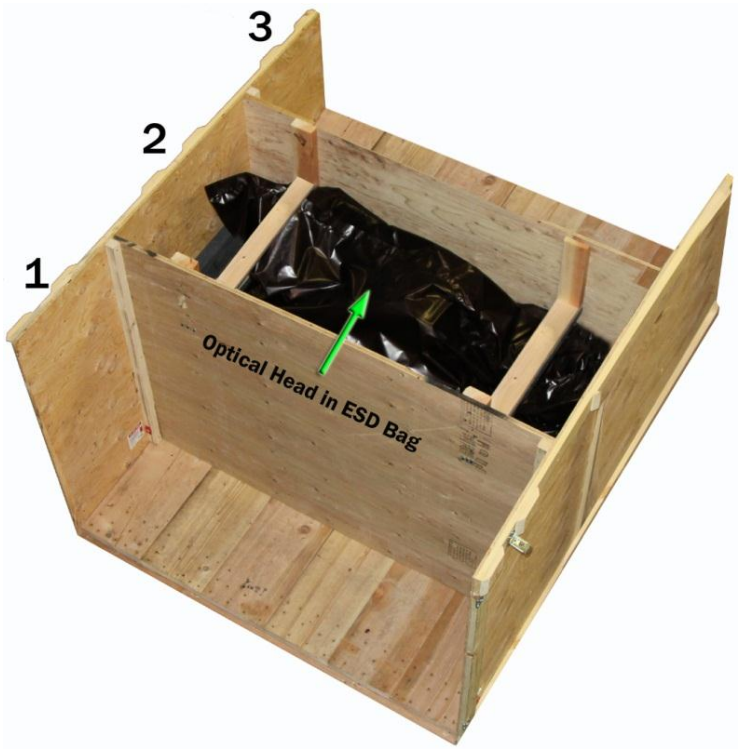

Figure 9: Optical Head Shipping Crate – Overhead View

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Unpacking the Optical Head

Continued...

Exact location of impact indicators may vary per shipment.

Be sure to document and photograph any damages as you continue to unpack the shipment. Report all damages to the shipping carrier and contact nLIGHT IMMEDIATELY.

BEFORE YOU BEGIN

✓ Be sure to thoroughly inspect impact indicators affixed to the outside of the crate prior to unpacking the Optical Head.

STEP	DESCRIPTION
1.	Cut and remove binding straps from the crate containing the Optical Head.
2.	Remove top and side panels from the crate.
3.	Examine impact indicators affixed to the inside of the crate for evidence of mishandling and/or tampering. *a. Report any findings to nLIGHT Photonics US Headquarters IMMEDIATELY.*

Figure 10: Interior Impact Indicator Location Example

4.	Verify the crate contains the parts and accessories listed on the accompanying packing slip. *a. Report any shortage to nLIGHT Photonics US Headquarters.*
5.	Remove wooden supports from the crate, and open the ESD bag.

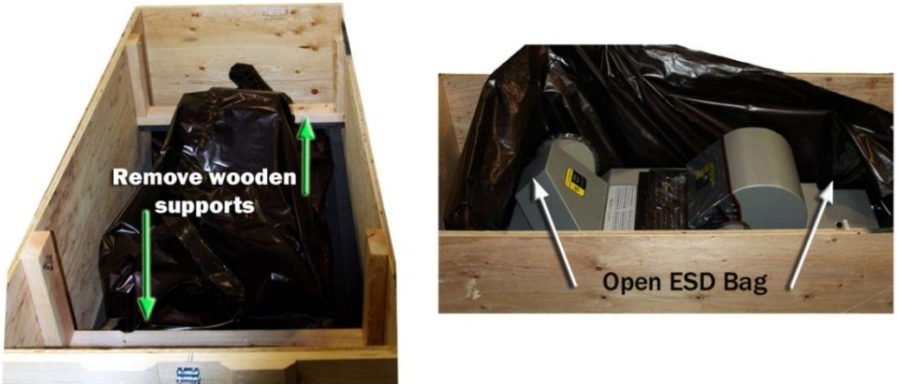

Figure 11: Unpacking the Optical Head

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Unpacking the Optical Head

Continued...

All equipment and hardware (hooks, bolts, lifts, slings, chains, etc.) must have a minimum capacity of 1360 kg (approx. 3000 lbs.).

Steel lifting bar and chain is typically provided with initial shipment

STEP	DESCRIPTION
6.	Notice the three eye bolts mounted on the Optical Head (numbered below).

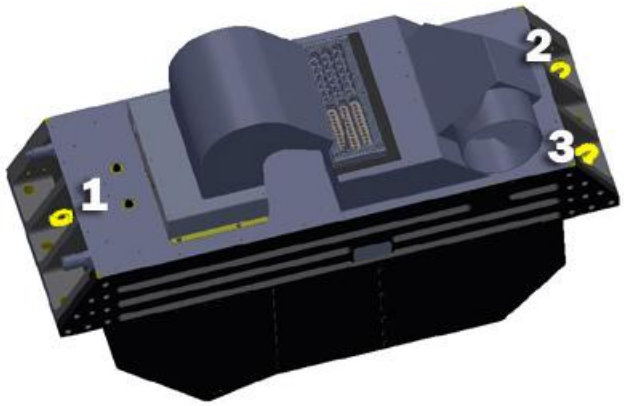

Figure 12: Optical Head Eye Bolts

7.	Secure steel lifting bar and chains to forklift or crane using nylon straps or other heavy-duty lifting apparatus as shown in Figure 13 and Figure 14.

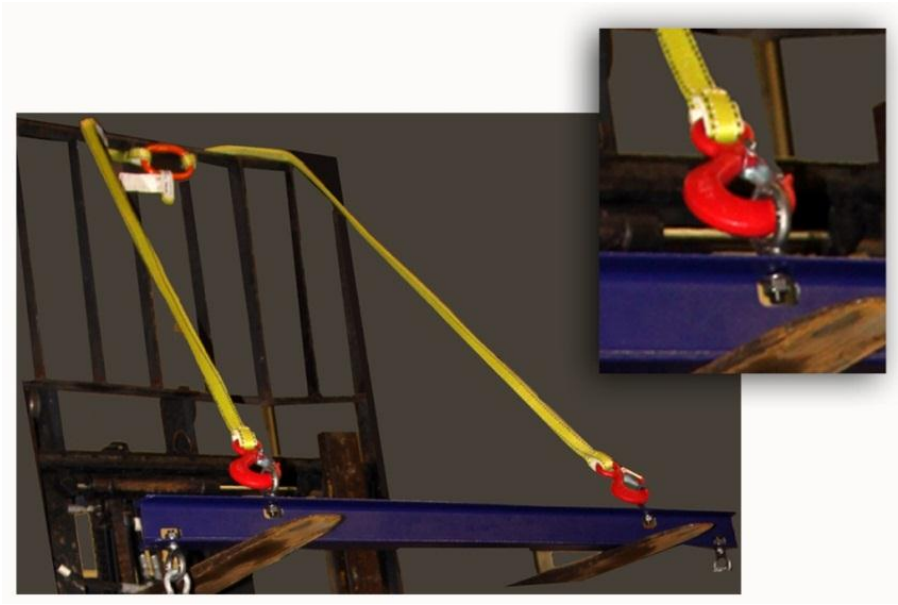

Figure 13: Securing Lift Bar

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Unpacking the Optical Head

Continued…

All equipment and hardware (hooks, bolts, lifts, slings, chains, etc.) must have a minimum capacity of 1360 kg (approx. 3000 lbs.).

STEP	DESCRIPTION
8.	Fasten chains to the eye bolts, and VERY slowly and carefully lift the Optical Head out of the crate. *a. Adjust chain links as necessary to keep the Optical Head level at all times.* *b. Place a soft, protective covering between hooks and Optical Head to avoid damage. See below.*

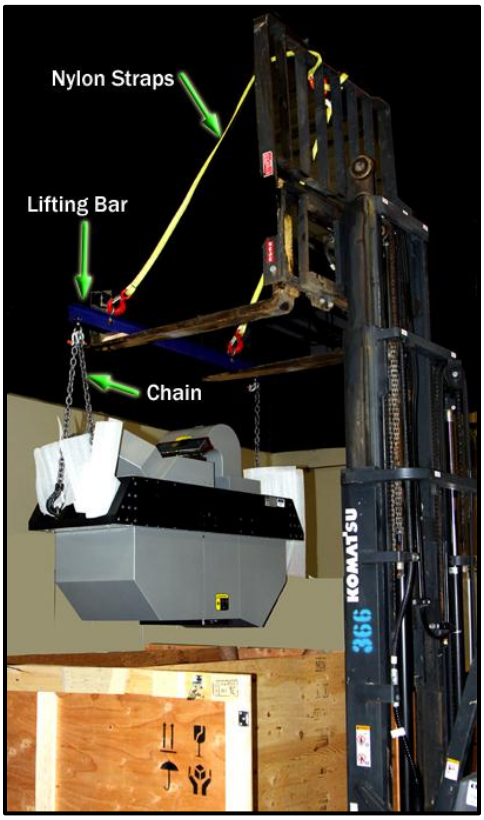

Figure 14: Lifting Optical Head from Crate

9.	Place Optical Head onto rolling cart, and move to a designated cleanroom.

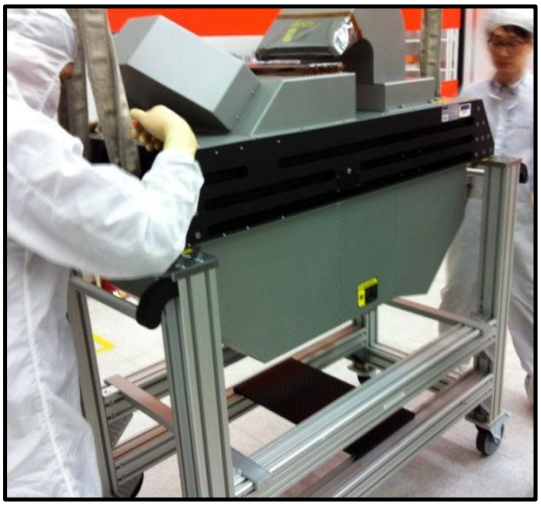

Figure 15: Moving Optical Head

Unpacking the Electronics Rack

Be sure to document and photograph any damages as you continue to unpack the shipment. Report all damages to the shipping carrier and contact nLIGHT IMMEDIATELY.

BEFORE YOU BEGIN

✓ Be sure to examine the impact indicators affixed to the outside of the crate before you unpack the Laser Electronics Rack.

STEP	DESCRIPTION
1.	Unscrew and remove the top and front panels from the wooden crate containing the Laser Electronics Rack. *a. Remaining panels (3) are bound together, and can be removed as one piece.*
2.	Carefully cut and remove ESD bag from the Rack.
3.	Examine impact indicators affixed to the Laser Electronics Rack for any trace of mishandling and/or tampering. *a. Report any findings to nLIGHT Photonics US Headquarters IMMEDIATELY.*
4.	Remove all wooden supports securing the Rack to the pallet.

Figure 16: Laser Electronics Rack wrapped in ESD Bag

Continues on next page…

Unpacking the Electronics Rack

Continued…

***DO NOT** remove protective wrap until the Rack is moved into a suitable environment.*

All equipment and hardware (hooks, bolts, lifts, slings, chains, etc.) must have a minimum capacity of 1360 kg (approx. 3000 lbs.).

STEP	DESCRIPTION
5.	Secure nylon straps or other lifting apparatus to each of the four eye bolts on top of the Rack as shown below.
6.	CAREFULLY lift the Laser Electronics Rack from the pallet using a forklift or crane.

Figure 17: Lifting the Laser Electronics Rack

7.	Carefully set the Laser Electronics Rack on the ground, and roll it into a designated clean room.
8.	Remove protective wrap from Rack once inside the clean room.

PERMANENTLY CONNECTED EQUIPMENT and multi-phase equipment shall employ a switch or circuit breaker as the means for disconnection. The switch or circuit-breaker shall be included in the building installation; it shall be in close proximity to the equipment and within easy reach of the operator; it shall be marked as the disconnecting device for the equipment.

Unpacking the Projection Relay

All equipment and hardware (hooks, bolts, lifts, slings, chains, etc.) must have a minimum capacity of 1360 kg (approx. 3000 lbs.).

STEP	DESCRIPTION
1.	Cut and remove and binding straps from the wooden crate containing the Projection Relay.
2.	Remove top panel from the crate.
3.	Remove all three wooden supports from the top of the Projection Relay (numbered in Figure 18).

Figure 18: Projection Relay Shipping Crate

4.	Fasten nylon straps or other heavy-duty lifting apparatus to eye bolts, and carefully lift the Projection Relay out of the crate with a forklift or crane.
5.	Carefully set the Projection Relay onto a suitable stand/cart, and move into the designated cleanroom.

Figure 19: Moving Projection Relay into Cleanroom

INSTALLATION

Remaining sections of this manual cover the following:

Installation Requirements

- ALWAYS ensure the beam path of the laser is secured above or below eye level for any standing or seated position in the facility.
- ALWAYS ensure the mains disconnect is clearly marked and within immediate reach of the operator at all times.
- ALWAYS install the Laser Electronics Rack in close proximity of the mains disconnect circuit breaker or switch.
- ALWAYS verify all cables, hoses, and fittings are properly/securely connected before starting the Line Beam System.
- NEVER use damaged cables or hoses before system start-up the Defective cables, hoses, and fibers must be replaced immediately. The laser should be shut down in the interim.
- ALWAYS cover/block windows, doorways, open portals, etc. to reduce escaping laser beams below appropriate ocular MPE level.
- NEVER operate the laser near flammables, explosives, or volatile solvents such as alcohol, gasoline, or ether.
- ALWAYS ensure the laser control area is adequately ventilated.
- For proper handling of Optic Fibers, please refer to the **Line Beam System |720-260 Service Manual EX-OM-0005.**

Installing the Optical Head

STEP	DESCRIPTION
1.	Mount Optical Head Stage onto Host Machine.
2.	Use forklift or crane to lift Optical Head onto the Stage.

Figure 20: Mounting Optical Head onto Host Machine

3.	Use forklift or crane to lower Safety Dome onto the Optical Head. *a. Installation is now complete.*

Figure 21: Covering Optical Head with Safety Dome

Setting Up the Laser Electronics Rack

All equipment and hardware (hooks, bolts, lifts, slings, chains, etc.) must have a minimum capacity of 1360 kg (approx. 3000 lb.).

PERMANENTLY CONNECTED EQUIPMENT and multi-phase equipment shall employ a switch or circuit breaker as the means for disconnection. The switch or circuit-breaker shall be included in the building installation; it shall be in close proximity to the equipment and within easy reach of the operator; it shall be marked as the disconnecting device for the equipment.

STEP	DESCRIPTION
1.	Situate the Laser Electronics Rack so that it is positioned within 10 meters (approx. 32 feet) of the Optical Head.
2.	Secure the Laser Electronics Rack to the floor using seismic bracing that can support up to 1360 kg (3000 lbs.).

Figure 22: Seismic Bracing Example

3.	Adjust each of the four stabilizing feet as necessary to level the Rack. *a. Setup is now complete.*

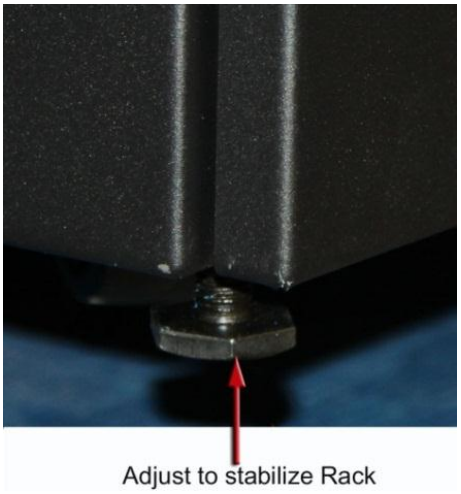

Figure 23: Leveling the Rack

Installing the Projection Relay

STEP	DESCRIPTION
1.	Load Projection Relay into Host Machine.

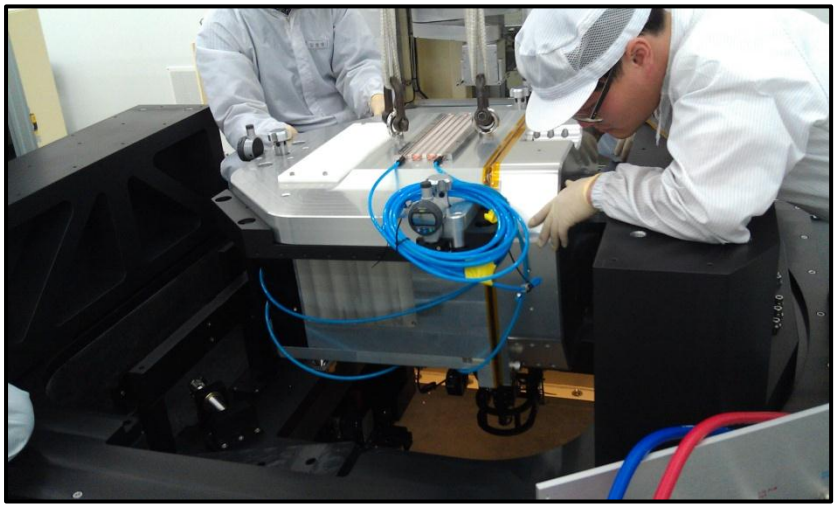

Figure 24: Installing the Projection Relay

2.	Stop the Data Logger by placing a shorting clip between the electrodes as shown below.
3.	Remove the Data Logger from the Projection Relay, and set aside to be returned to the vendor. *a. Installation is now complete.*

Figure 25: Data Logger

Installing Fiber Management System

STEP	DESCRIPTION
1.	Mount pairs of active fiber clips to the entrance and exit of the Fiber Management System (FMS).
2.	Mount pairs of passive fiber clips onto every cross brace between the active fiber clips

Figure 26: Setting Up Fiber Management System

Continues on next page…

Installing Fiber Management System

Continued…

STEP	DESCRIPTION
3.	Add wire jumpers to LEFT end of active fiber clip pair as shown above.
4.	Add wire between active fiber clips.
5.	Add connectorized wire harness to RIGHT side of active fiber clip pairs.
6.	Route wire into the groove of the extruded aluminum frame and secure in place with pieces of groove covering.
7.	Use multimeter to test curcuit to ensure it is closed.

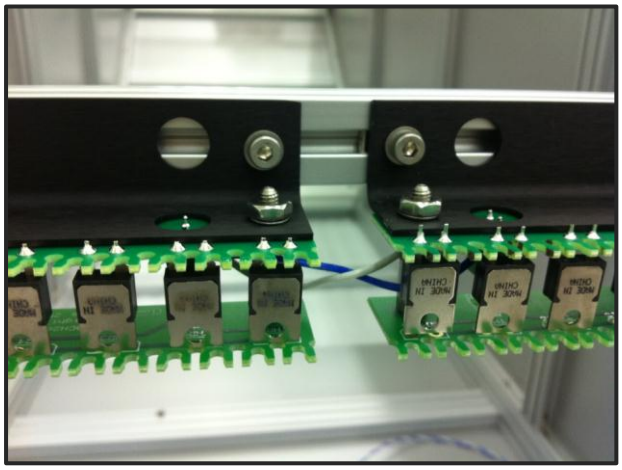

Figure 27: Active Fiber Clips

8.	Mount Fiber Management System above the Safety Dome. *a. Installation is now complete.*

Figure 28: Host Fiber Management System

Installing Optic Fibers

ALWAYS handle Optic Fibers with EXTREME care. DO NOT bend, pull, or twist fiber optic cables.

For proper handling and maintenance of Optic Fibers, please refer to the Line Beam System |720-260 Service Manual (EX-OM-0005).

STEP	DESCRIPTION
1.	Remove covers from both fiber shipping trays on the Laser Electronics Rack (4 screws each). *a. Have someone hold the tray while you remove the screws.*

Figure 29: Fiber Shipping Trays

2.	CAREFULLY uncoil fiber optic cable from the first shipping sleeve.

Figure 30: Preparing Fibers for Installation

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Installing Optic Fibers

Continued…

For proper handling and maintenance of Optic Fibers, please refer to the Line Beam System |720-260 Service Manual (EX-OM-0005).

STEP	DESCRIPTION
3.	GENTLY press the fiber into the respective position on the first fiber clip in the fiber management system. *a. Be sure to leave a little slack between the first fiber clip and Rack.*
4.	Allow fiber to drop between the passive fiber clips to take up the excess fiber.

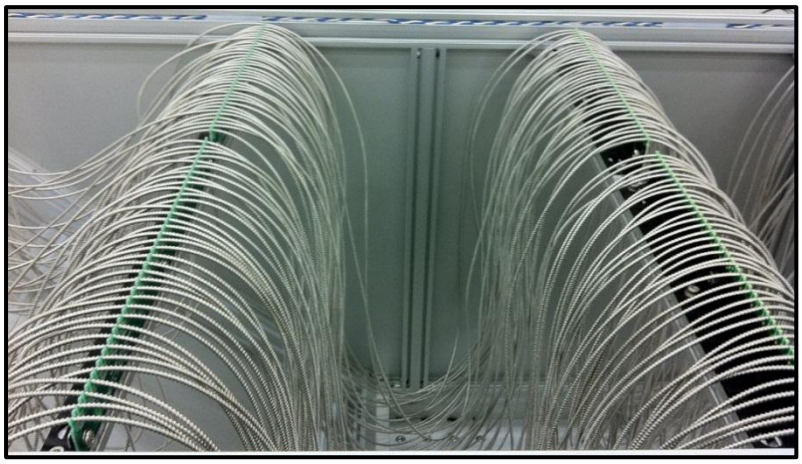

Figure 31: Routing Fibers in Host FMS

5.	GENTLY press fiber into all remaining fiber clips until the second to last clip is reached. *a. Be sure the fiber is routed underneath external cross bars.*

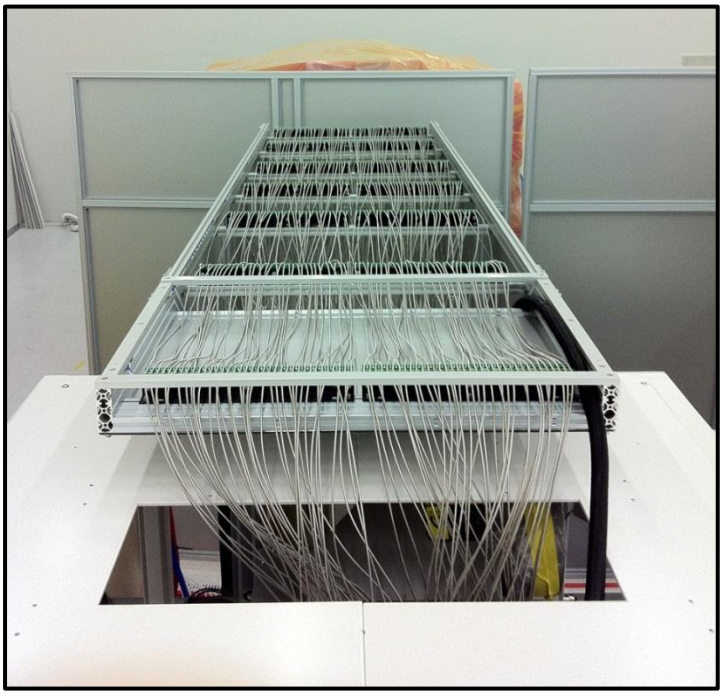

Figure 32: Completed External FMS

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Installing Optic Fibers

Continued…

When replacing or removing fibers, always place a cap on the collimator, and insert a plug into the manifold port to avoid damage from exposure.

STEP	DESCRIPTION
6.	Remove SMA cap from fiber, and verify correct serial number.
7.	Visually inspect the optical surface of the fiber with a fiber scope and clean if necessary. a. *Refer to the Line Beam System | 7200:260 Service Manual for proper inspection and fiber cleaning techniques.*
8.	Remove any protective covers from the fiber ports on the manifold.
9.	Referring to the following Fiber Map, match fibers (numbered on cap) with ports on Fiber Manifold.

Figure 33: Fiber Map

Fiber Map is also affixed to the Optical Head, near the Fiber Manifold.

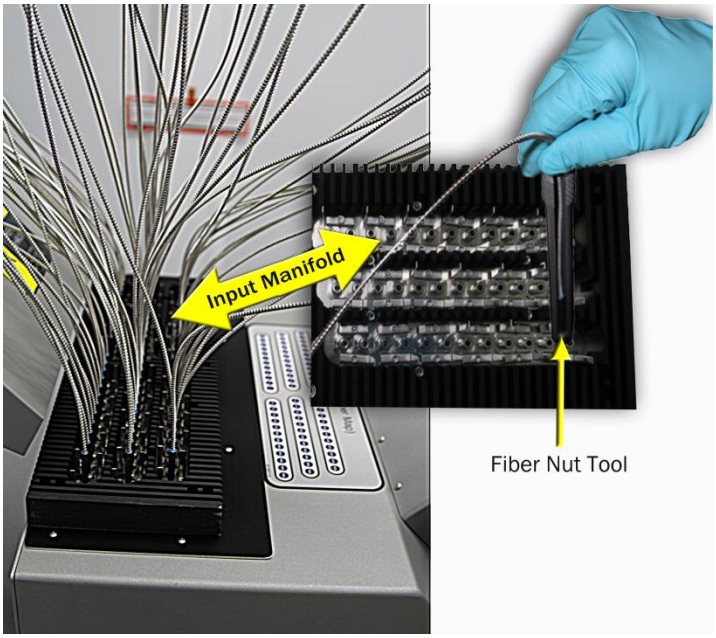
Continues on next page….

Installing Optic Fibers

Continued…

ALWAYS handle Optic Fibers with EXTREME care. DO NOT bend, pull, or twist fiber optic cables.

For proper handling and maintenance of Optic Fibers, please refer to the Line Beam System |720-260 Service Manual (EX-OM-0005).

STEP	DESCRIPTION
10.	Load Optic Fiber into Fiber Nut Tool as shown in Figure 34.
11.	Insert fiber into respective port on the Input Manifold (matching numbered caps with numbered ports), and tighgten in place using the Fiber Nut Tool.
	 *Figure 34: Installing Fibers into Manifold*
12.	Repeat Steps 2 through 11 for remaining 71 fibers.
13.	Secure the fiber in the last fiber clip making sure there is enough slack between the LBH and last fiber clip.
14.	Take up remaining excess fiber between passive fiber clips and secure the fiber in the second to last fiber clip. *a. Installation is now complete.*

Installing the Light Tower

STEP	DESCRIPTION
1.	Unscrew and remove the RIGHT Rack Guard from the Laser Electronics Rack to access the slotted Light Tower Bracket (screws numbered 1-8 below).

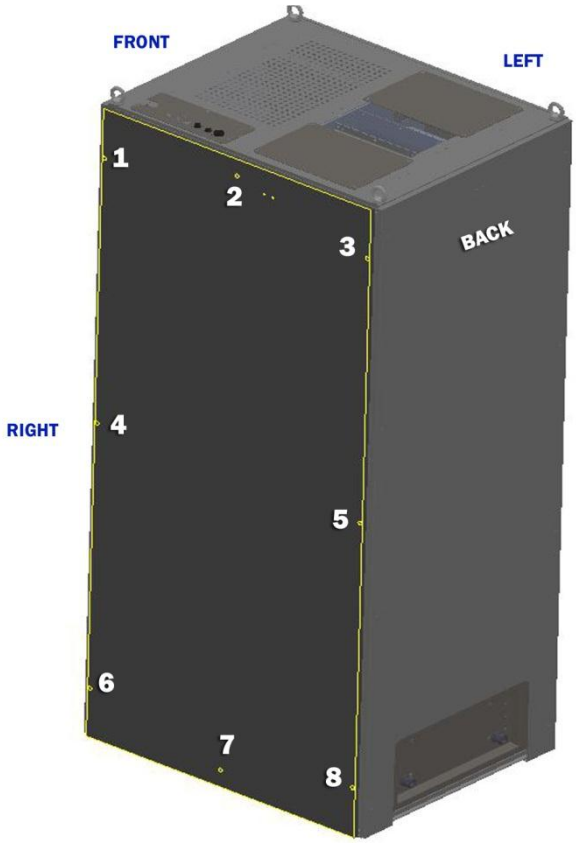


Figure 35: Removing RIGHT Rack Guard

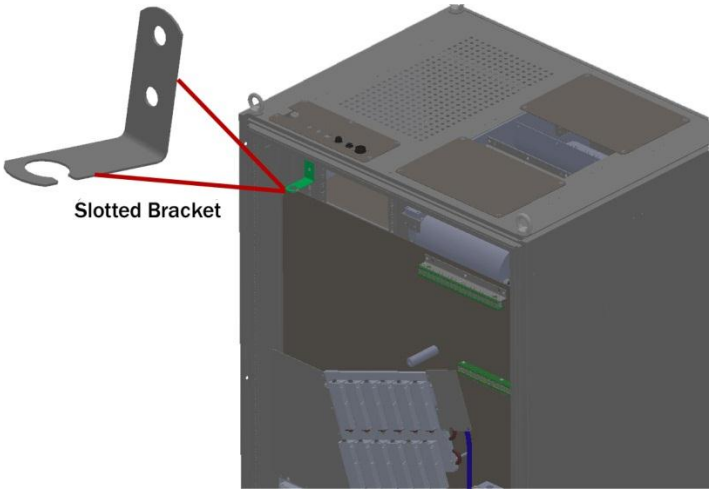


Figure 36: Slotted Bracket

Continues on next page…

Installing the Light Tower

Continued…

STEP	DESCRIPTION
2.	Carefully route the Light Tower and Cable through the front opening on top of the Laser Electronics Rack.

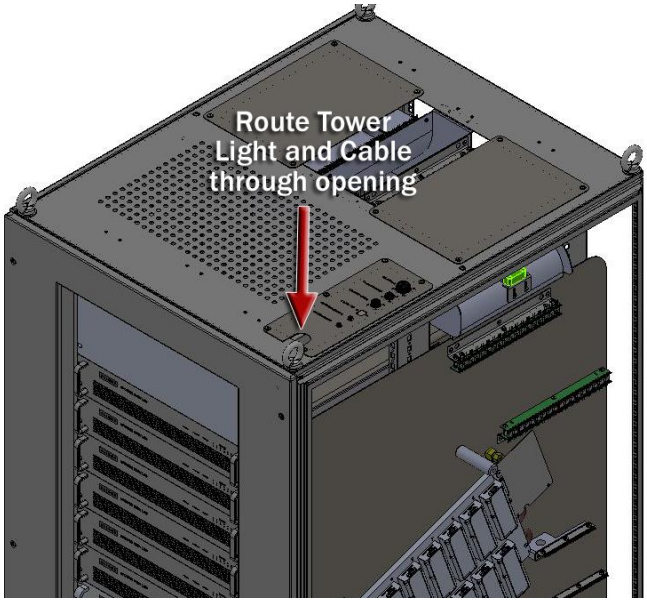


Figure 37: Routing Tower Light and Cable into Rack

3.	Slide the Light Tower into the opening on the slotted bracket, so that the bracket is situated between the two washers and hex nuts.

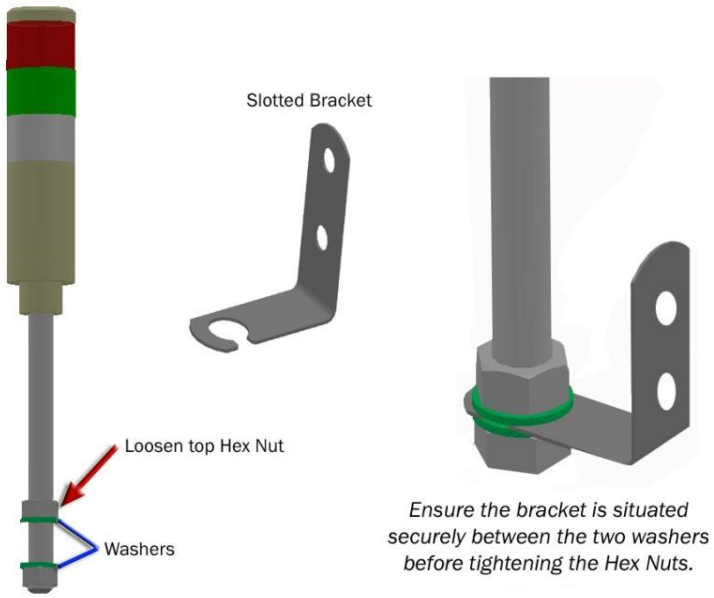


Figure 38: Mounting Light Tower to Bracket

Continues on next page…

Installing the Light Tower

Continued…

Once mounted, ensure the Light Tower is visible from the Optical Head.

STEP	DESCRIPTION
4.	Tighten hex nuts to bracket to secure the Light Tower in place.

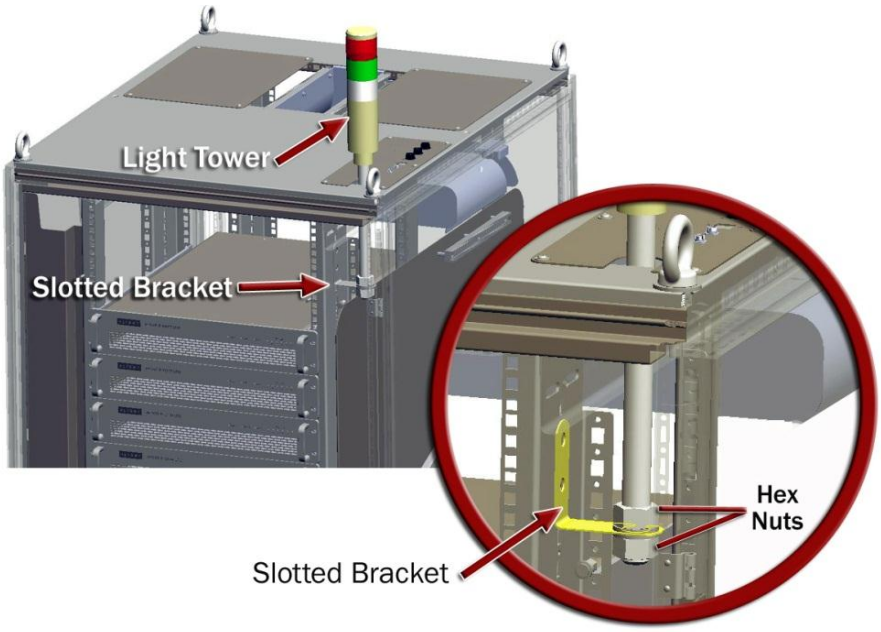


Figure 39: Securing Light Tower to Bracket

5.	Connect the Light Tower Cable to the Extension Cable inside the Laser Electronics Rack as shown below.

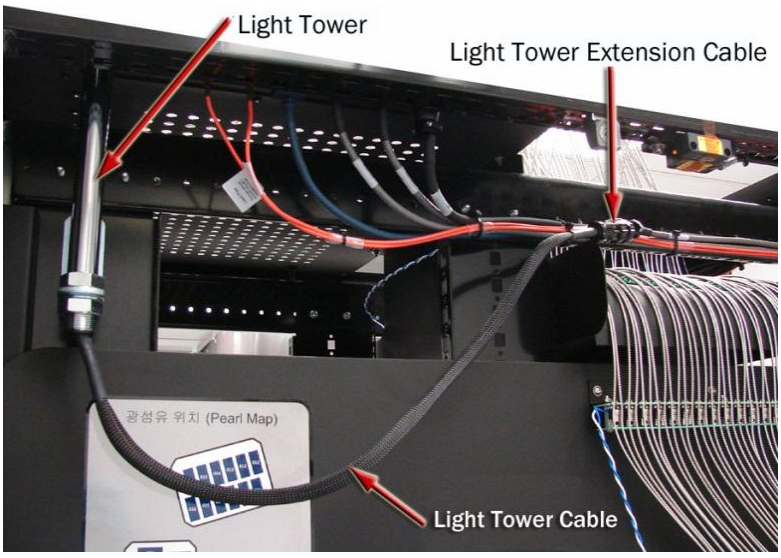


Figure 40: Connecting Light Tower Power Cable

6.	Return Rack Guard to the Laser Electronics Rack, and secure in place using original screws (8). *a. Installation is now complete.*

Installing the Omni*Aire* 600V HEPA Filtration System

STEP	DESCRIPTION
1.	Slide the Filtration System Duct onto the Omni*Aire* Blower, and secure in place with a hose clamp provided in the installation kit.

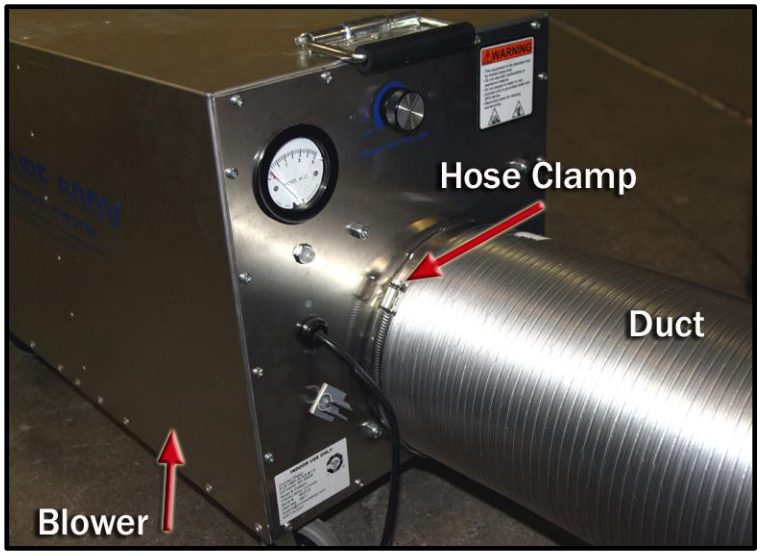


Figure 41: Filtration System Duct Installation

2.	Use the remaining hose clamp to secure the opposite end of the Duct to the *Blower Duct Interface* on the Optical Head.

	Supplied parts and accessories may vary from those pictured.

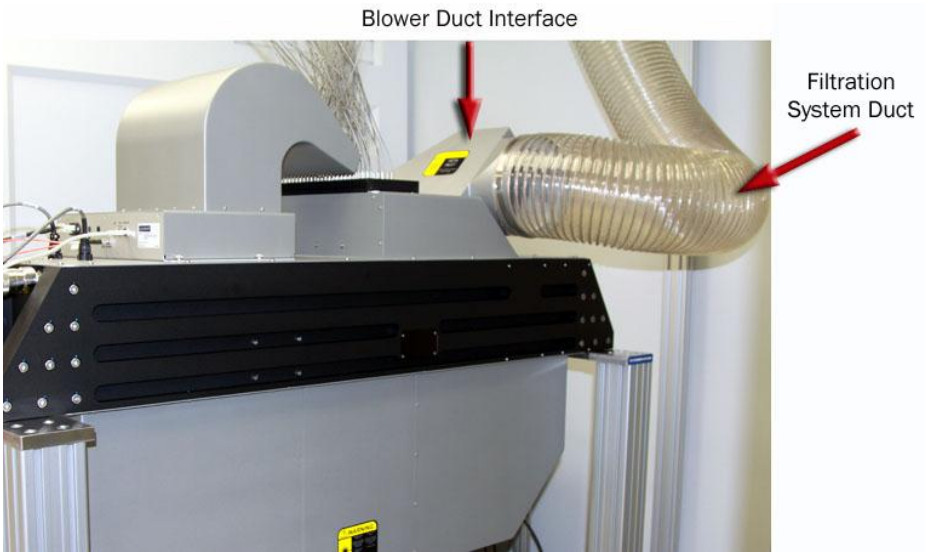


Figure 42: Filtration System Installation

3.	Plug Blower power cable into a 230V/60Hz electric al power source. *a. Installation is now complete.*

Connecting the Cooling System

*Supplied coolant must be a mixture of **distilled or filtered water and industrial inhibited ethylene glycol mix at 80-90% water by volume.***
For Cooling System Performance Specifications, see page 53.

STEP	DESCRIPTION
1.	Drop drain tube into facility drain system.
2.	Connect facility coolant supply to the INPUT/OUTPUT connectors on the back of the Laser Electronics Rack (see below).

For Cooling System Performance Specifications see page 53

While facing the backside of the Rack:
- ✓ **INPUT** supply is to the LEFT
- ✓ **OUTPUT** supply to the RIGHT

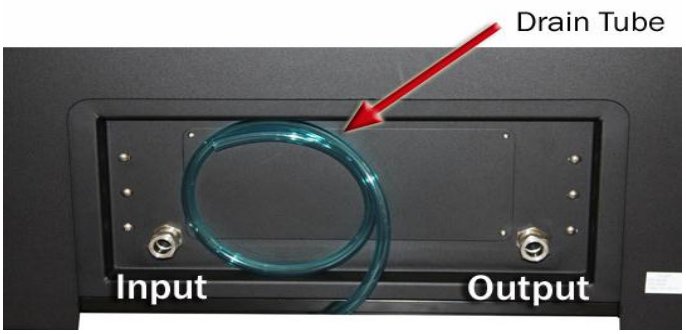


Figure 43: Laser Electronics Rack Coolant Connections

3.	Connect facility coolant supply to the INPUT/OUTPUT connectors on the Optical Head as shown below.

For steps to adjust/regulate coolant flow pressure, please refer to the Line Beam System | 7200:260 Service Manual (EX-OM-0005).

While facing the INPUT/OUTPUT valves on the LBH:
- ✓ **INPUT** supply is to the LEFT
- ✓ **OUTPUT** supply to the RIGHT

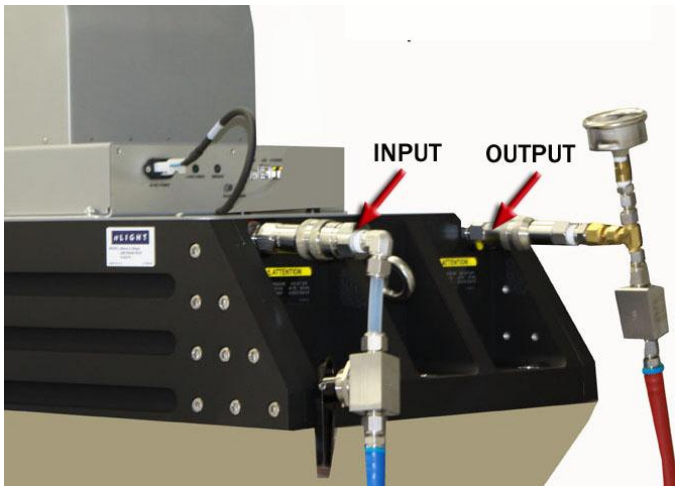
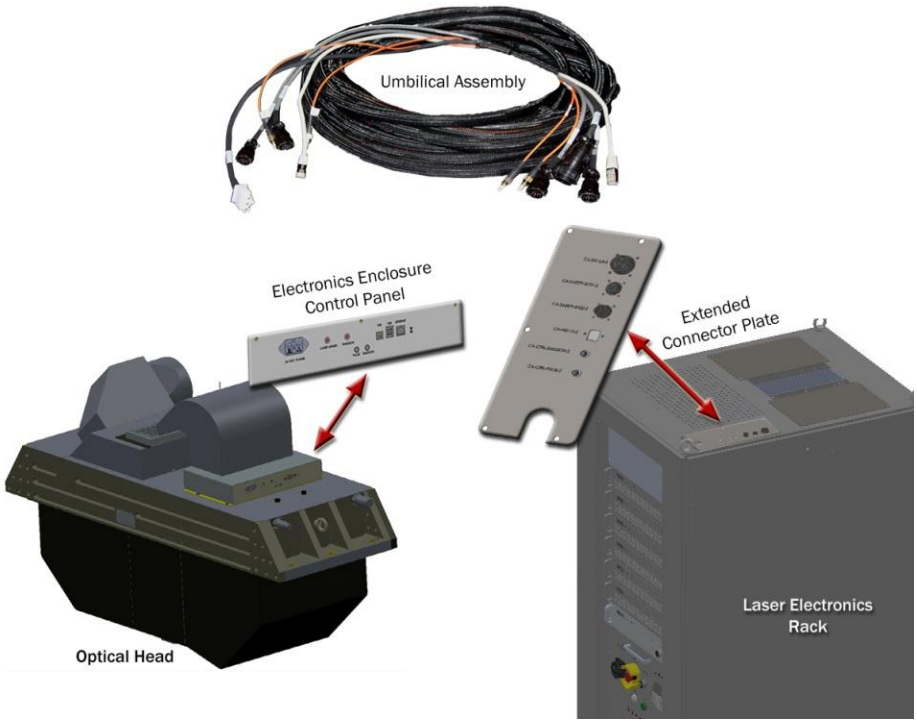


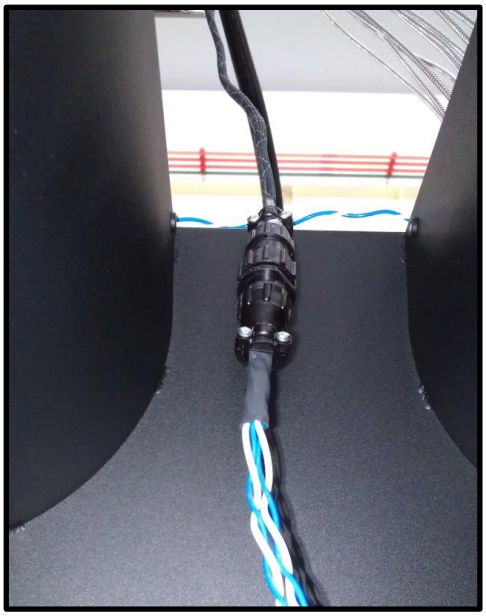
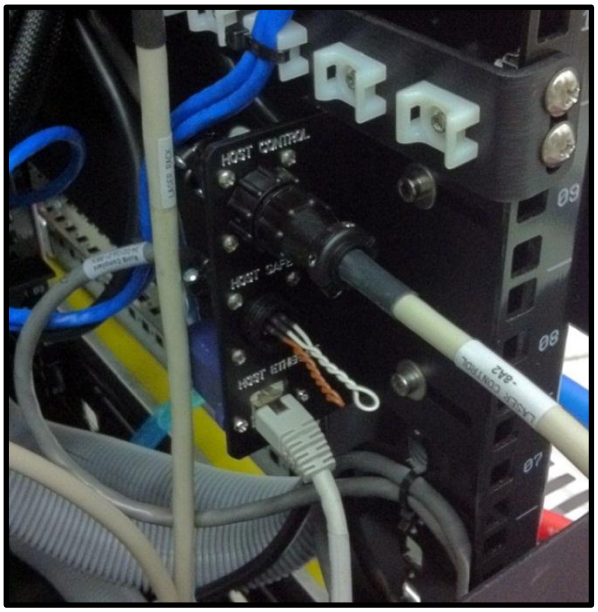
Figure 44: Optical Head Coolant Connections

4.	Installation is now complete.

Installing the Umbilical Assembly

STEP	DESCRIPTION
1.	Remove any protective covers from the Electronics Enclosure on the Optical Head and Connector Plate on top of the Laser Electronics Rack.
2.	Refer to the wiring diagram on page 54 to connect the Umbilical Assembly to the Electronics Enclosure and the Connector Plate.
	 *Figure 45: Umbilical Assembly Connections*
3.	Installation is now complete.

Connecting to the Host Machine

STEP	DESCRIPTION
1.	Connect Fiber Interlock Cable from the Fiber Management System to the Laser Electronics Rack connector as shown below.
	
	Figure 46: Interlock Connection
2.	Plug the Laser Control Cable into the Host Control port inside the Laser Electronics Rack as shown in Figure 47.
3.	Insert plug into Host Safety Circuit port.
4.	Connect Ethernet Cable to the Host Ethernet port.
	
	Figure 47: Host Connections
5.	Installation is now complete.

Installing AC Power Distribution Cables

PERMANENTLY CONNECTED EQUIPMENT and multi-phase equipment shall employ a switch or circuit breaker as the means for disconnection. The switch or circuit-breaker shall be included in the building installation; it shall be in close proximity to the equipment and within easy reach of the operator; it shall be marked as the disconnecting device for the equipment.

STEP	DESCRIPTION
1.	Remove screws from the front access panel of the AC Power Distribution Enclosure (numbered below).

Figure 48: AC Power Distribution Enclosure Front Access Panel

2.	Turn GPS Power Switch clockwise to release and open the front access panel.

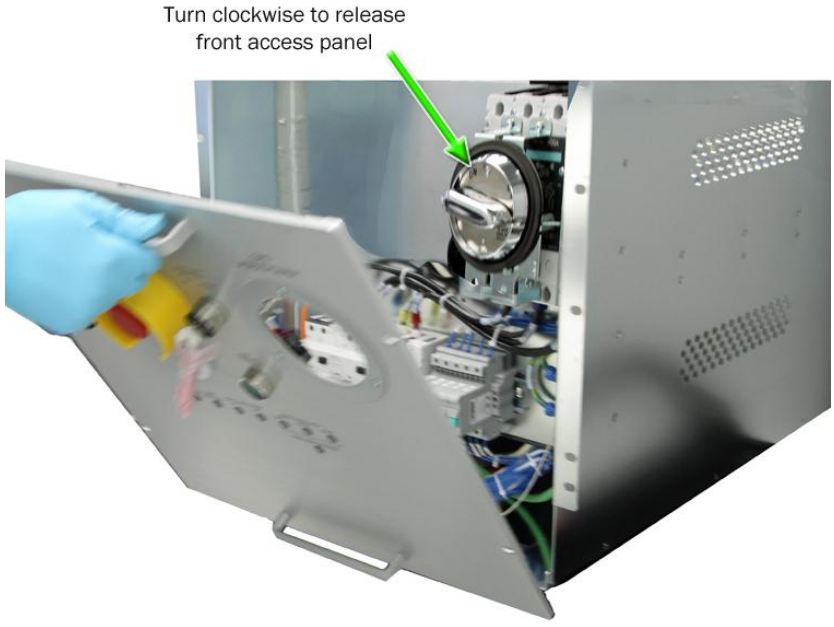


Figure 49: Opening AC Power Distribution Enclosure

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Installing AC Power Distribution Cables

Continued…

STEP	DESCRIPTION
3.	Remove REAR Rack Guard from the Laser Electronics Rack (8 screws).
4.	Route UPS and GPS cables up through the bottom of the Rack, to the back of the AC Power Distribution Enclosure.

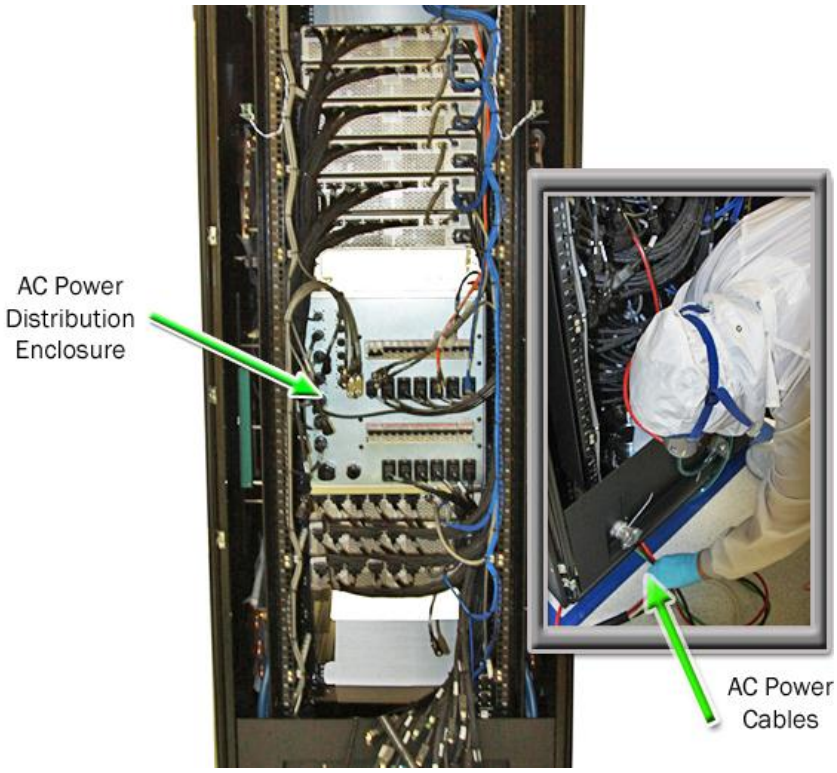

Figure 50: REAR Rack Guard Removed

5.	Thread UPS cable into the socket marked “UPS Power” on the back of the AC Power Distribution Enclosure.

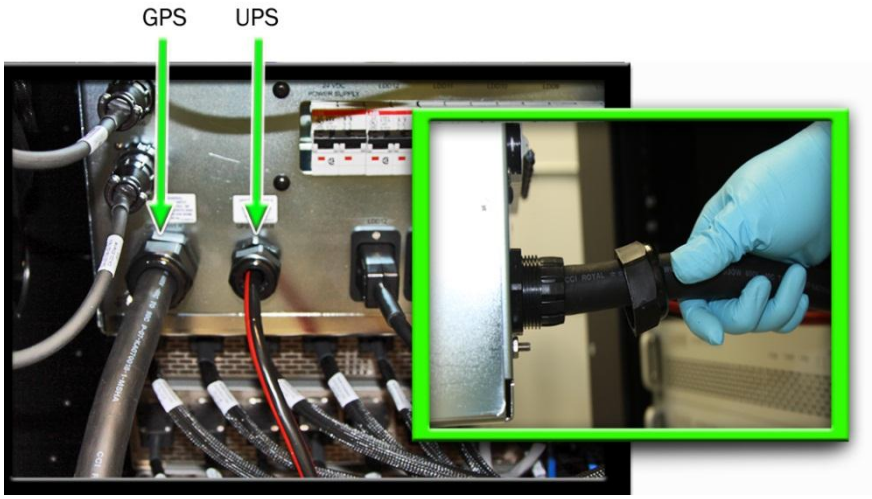

Figure 51: Connecting UPS Cable

Continues on next page…

Installing AC Power Distribution Cables

Continued…

CONNECTING UPS CABLE

STEP	DESCRIPTION
6.	Route UPS cable under the interior panel, to the front access panel of the AC Power Distribution Enclosure.

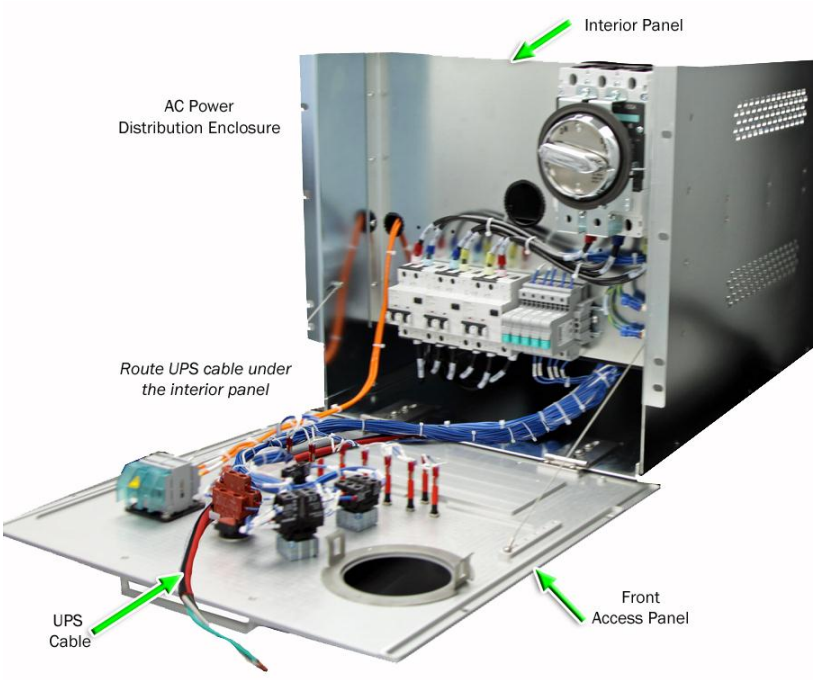

Figure 52: Routing UPS Cables

7.	Remove cover from UPS Switch Contact Block, and loosen terminal screws (3).

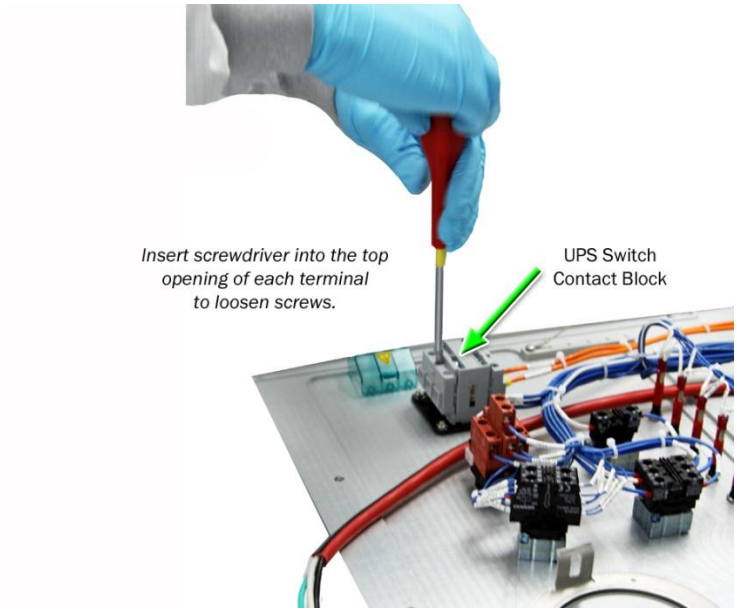

Figure 53: UPS Switch Contact Block

Continues on next page…

Installing AC Power Distribution Cables

Continued…

STEP	DESCRIPTION
8.	Insert UPS Ground wire into the far LEFT terminal on the UPS Switch Contact Block (labeled 1 below), and tighten terminal screw.
9.	Insert NEUTRAL wire into the MIDDLE terminal on the UPS Switch Contact Block (labeled 2 below), and tighten terminal screw.
10.	Insert the HOT wire into the far LEFT terminal on the UPS Switch Contact Block (labeled 3 below), and tighten terminal screw.
11.	Return cover to UPS Switch Contact Block.

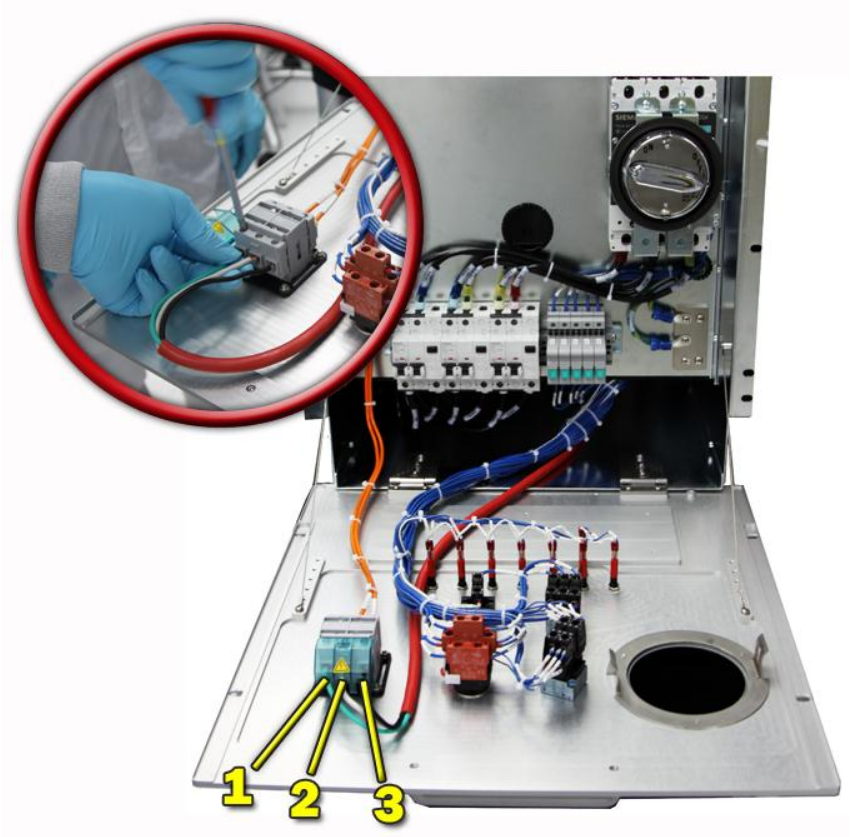

Figure 54: UPS Switch Connections

Continues on next page…

Installing AC Power Distribution Cables

Continued…

CONNECTING GPS CABLE

STEP	DESCRIPTION
12.	Thread GPS cables into the socket marked “GPS Power” on the back of the AC Power Distribution Enclosure. Refer to Figure 51 if necessary.
13.	Route GPS Ground cable under the interior panel.
14.	Secure Ground conductor to the bottom-LEFT post on the Grounding Buss Bar as shown in Figure 55.

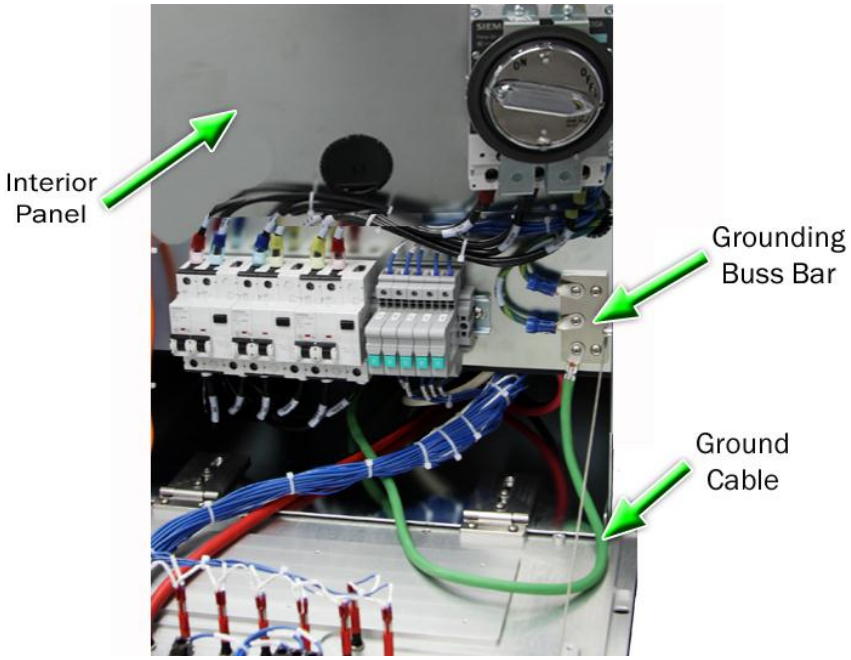

Figure 55: Connecting GPS Ground Cable

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Installing AC Power Distribution Cables

Continued…

STEP	DESCRIPTION
15.	Thread the remaining three GPS cables through the center opening on the interior panel.

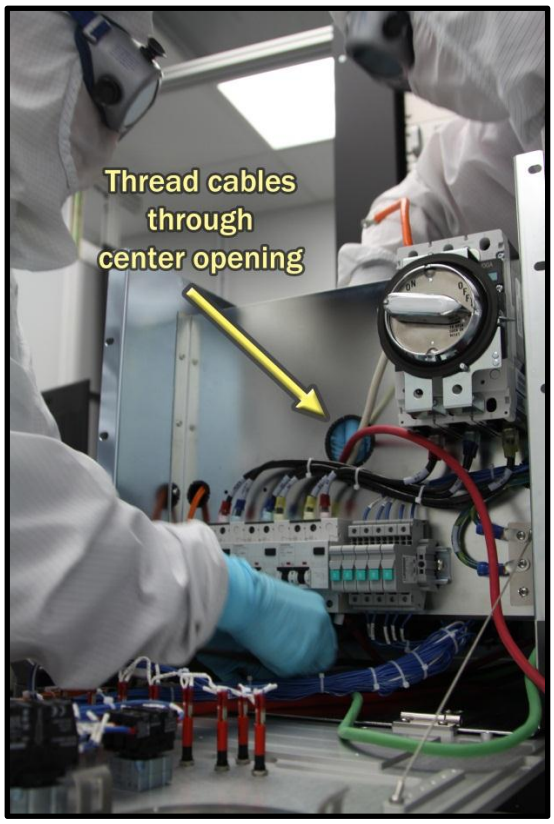

Figure 56: Routing GPS Cables

Continues on next page….

Installing AC Power Distribution Cables

Continued…

STEP	DESCRIPTION
16.	Loosen each of the terminal screws on the GPS Main Circuit Breaker. *a. Insert screwdriver through front opening of each terminal.*
17.	Beginning LEFT to RIGHT, connect all three wires to the GPS Main Circuit Breaker, and tighten terminal screws. *a. Wires can be connected in any order. Phase orientation is irrelevant.* *b. Position each conductor BEHIND the washer before tightening screws.*

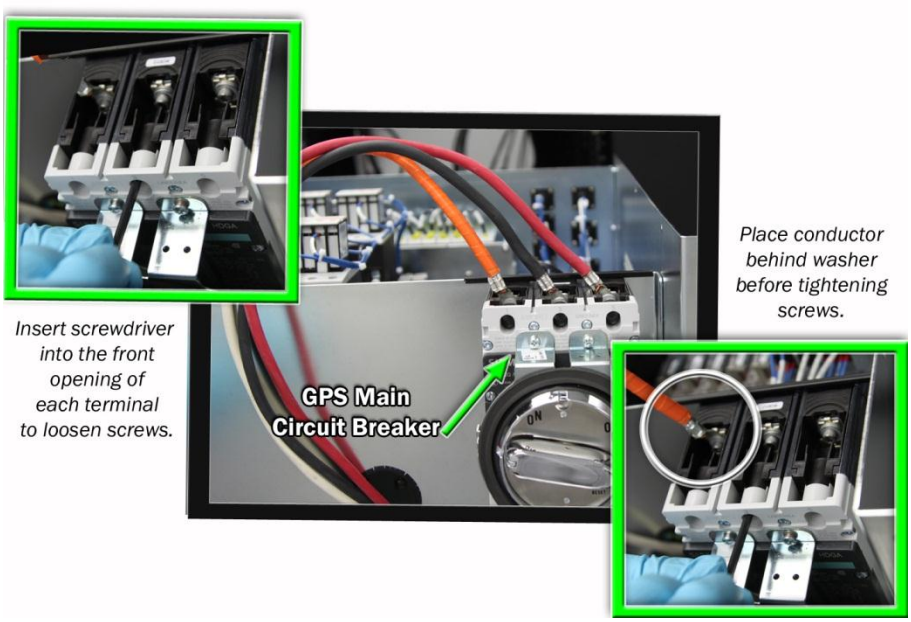

Figure 57: GPS Main Circuit Breaker Connections

Continues on next page…

Installing AC Power Distribution Cables

Continued…

PERMANENTLY CONNECTED EQUIPMENT and multi-phase equipment shall employ a switch or circuit breaker as the means for disconnection. The switch or circuit-breaker shall be included in the building installation; it shall be in close proximity to the equipment and within easy reach of the operator; it shall be marked as the disconnecting device for the equipment.

STEP	DESCRIPTION
18.	Tuck excess cable into the Enclosure, clear of any sharp edges.
19.	Raise front access panel, and turn GPS Power Switch counter-clockwise to lock the panel in place.
20.	Secure front access panel in place using original screws (4).

Figure 58: Securing Front Access Panel

4.	Use 4 to 6 cable ties to secure both cables to the cable clips mounted on the inside of the Laser Electronics Rack as shown below. *a. Installation is now complete.*

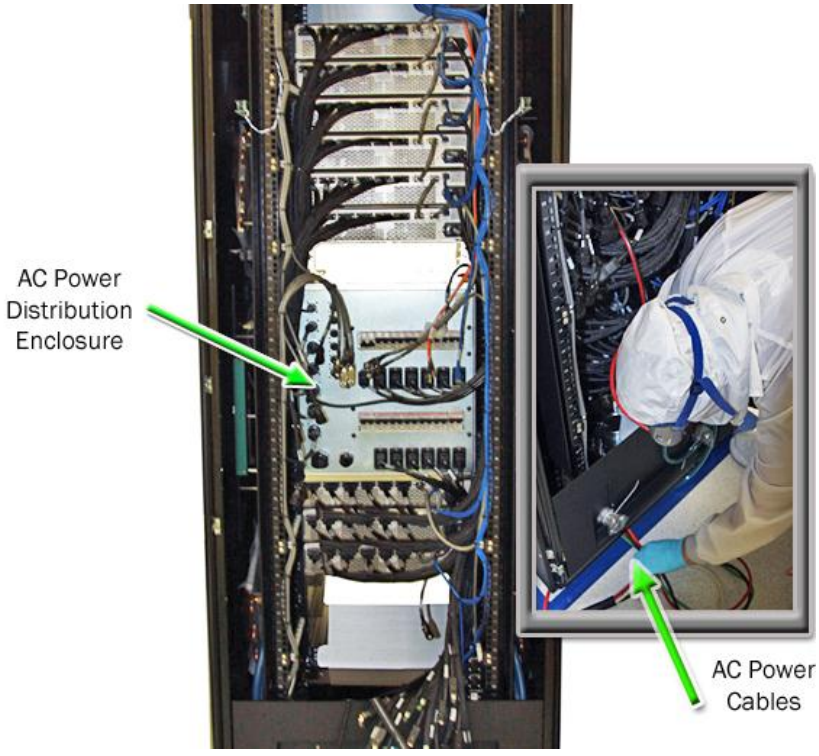

Figure 59: Securing AC Power Cables Inside Rack

GLOSSARY OF TERMS

TERM	DEFINITION
LBH	Line Beam Head
SBC	Single Board Computer
Host Control/ Controller	Refers to the Host/Customer control system.
Manufacturer	The Manufacturer is the legal entity specified on the nameplate of the equipment delivered to the customer. The manufacturer can be held liable for damages that are clearly due to errors during the manufacturing process.
Buyer	The Buyer is a person or company who can testify by the lawful acquisition of the laser system. The buyer may not be the user or operator.
Operator	An Operator is a person, whose firm owns and is in possession of the laser system. The system should not be used by anyone except the operator, or other operators in the company that owns the laser system. The operator is always responsible for the operation of the laser system.
Unfinished Machine	An Unfinished Machine is a machine that can be purchased from a dealer or manufacturer that is not suitable for direct use. The machine has mechanical deficiencies and or safety deficiencies that prevent the safe and proper operation. Anyone who buys an unfinished machine must insure that the completed system is checked before commissioning, and that provisions have been made to ensure the safe use of the finished machine.
Finished Machine	A Finished Machine is one thing that can be purchased by the dealer or manufacturer and is suitable for direct use. This is ensured by the manufacturer, and is demonstrated by the manufacturer by the visibility of the CE marking on the machine. This labeling certifies that the product meets the safety standards and that all other applicable standards are met for safe and proper machine operation.
Inspection	An Inspection is the assessment of the current state of the machine. An inspection MUST be performed by qualified personnel ONLY.
Maintenance	Maintenance refers to routine, systematic practices recommended by the manufacturer to maintain product performance, such as scheduled inspection, cleaning, etc. Maintenance does not equate to Service.
Service	Service refers to work performed by qualified personnel, such as troubleshooting and repair. Service performed on *n*LIGHT products by unauthorized personnel releases *n*LIGHT from all liability therein. Service does not equate to Maintenance.
Warranty	The Warranty is the legal basis for the action and between the buyer and manufacturer. Manufacturer provides to the legal obligations of additional services and the repair of the system to a functional state.

Figure 60: Glossary of Terms

APPENDIX A – SPECIFICATIONS

Laser Electronics Rack

PERFORMANCE SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Maximum Operating Temperature	140°F (60°C)
Ventilation Requirements	16990 LPM (600 CFM)
Maximum Operating Altitude	2500 Meters (8202 ft)

Figure 61: Laser Electronics Rack – Performance Specifications

PHYSICAL CHARACTERISTICS

SPECIFICATION	PERFORMANCE
Dimensions (with Light Tower)	2.5m X 813mm X 1041mm (8'H X 32"W X 41"D)
Weight (uncrated)	Approx. 1134 kg (2600 lbs.)

Figure 62: Laser Electronics Rack – Physical Characteristics

AC POWER DISTRIBUTION SPECIFICATIONS

SPECIFICATION	UPS	GPS
Voltage	208 VAC	220 VAC
Current	1 kVa (10 AMP)	20 kVa (80 AMP)
Frequency	60 Hz	60 Hz
Distribution/Load	1 Ø	3 Ø
Cable Type	SOOW or equivalent	SOOW or equivalent
Cable Size	14 AWG	4 AWG

Figure 63: AC Power Distribution Specifications

SPECIFICATIONS *Continued…*

Optical Head

PERFORMANCE SPECIFICATIONS

SPECIFICATION	PERFORMANCE
Power Density (Peak Power)	10kW/cm2
Center Wavelength	976nm +/- 10nm
Working Distance (WD)	127 +/-2mm from bottom of LBH window frame
Uniformity	95% (>98% in interval 1mm)
Beam Length	260mm
Beam Width	200µm +/- 25µm (FWHM)
Depth of Focus (DOF)	≥ +/- 1mm

Figure 64: Optical Head Performance Specifications

OPERATING TEMPERATURES

COMPONENT	MAX	WARNING
Laser Diodes	104°F (40°C)	95°F (35°C)
Main Beam PD	140°F (60°C)	122°F (50°C)
Fiber Manifold	140°F (60°C)	122°F (50°C)
Beam Shaper	140°F (60°C)	122°F (50°C)
Beam Dump	140°F (60°C)	122°F (50°C)
CPU Air	140°F (60°C)	122°F (50°C)

Figure 65: Optical Head Operating Temperatures

SPECIFICATIONS *Continued…*

Cooling System

To maintain optimal performance and to avoid damaging the Cooling System, supplied coolant must be comprised of **distilled or filtered water and industrial inhibited ethylene glycol mix at 80-90% water by volume.**

PERFORMANCE SPECIFICATION

LASER ELECTRONICS RACK	
SPECIFICATION	PERFORMANCE
NOMINAL Flow Rate	15 LPM (4.0 GPM)
MINIMUM Flow Rate	13 LPM (3.5 GPM)
Pressure Drop	345-414 kpa (50-60 psi) at 15 LPM (4.0 GPM)
Inlet Pressure	Not to exceed 552 kpa (80 psig)
Outlet Pressure	Not to exceed 103 kpa (15 psig)
Temperature	68°F (20°C) maximum
Connection	19mm (.75”) OD tubing/Swagelok-type
Cooling Capacity	7500 W minimum
OPTICAL HEAD	
SPECIFICATION	PERFORMANCE
NOMINAL Flow Rate	9.4 LPM (2.5 GPM)
MINIMUM Flow Rate	7.5 LPM (2.0 GPM)
Pressure Drop	414 kpa (60 psi) at 9.4 LPM (2.5 GPM)
Inlet Pressure	Not to exceed 552 kpa (80 psig)
Outlet Pressure	Not to exceed 103 kpa (15 psig)
Temperature	68°F (20°C) maximum
Connection	Quick Disconnects
Cooling Capacity	7500 W minimum

Figure 66: Cooling System Performance Specifications

APPENDIX B – WIRING DIAGRAMS

Line Beam System Umbilical Assembly

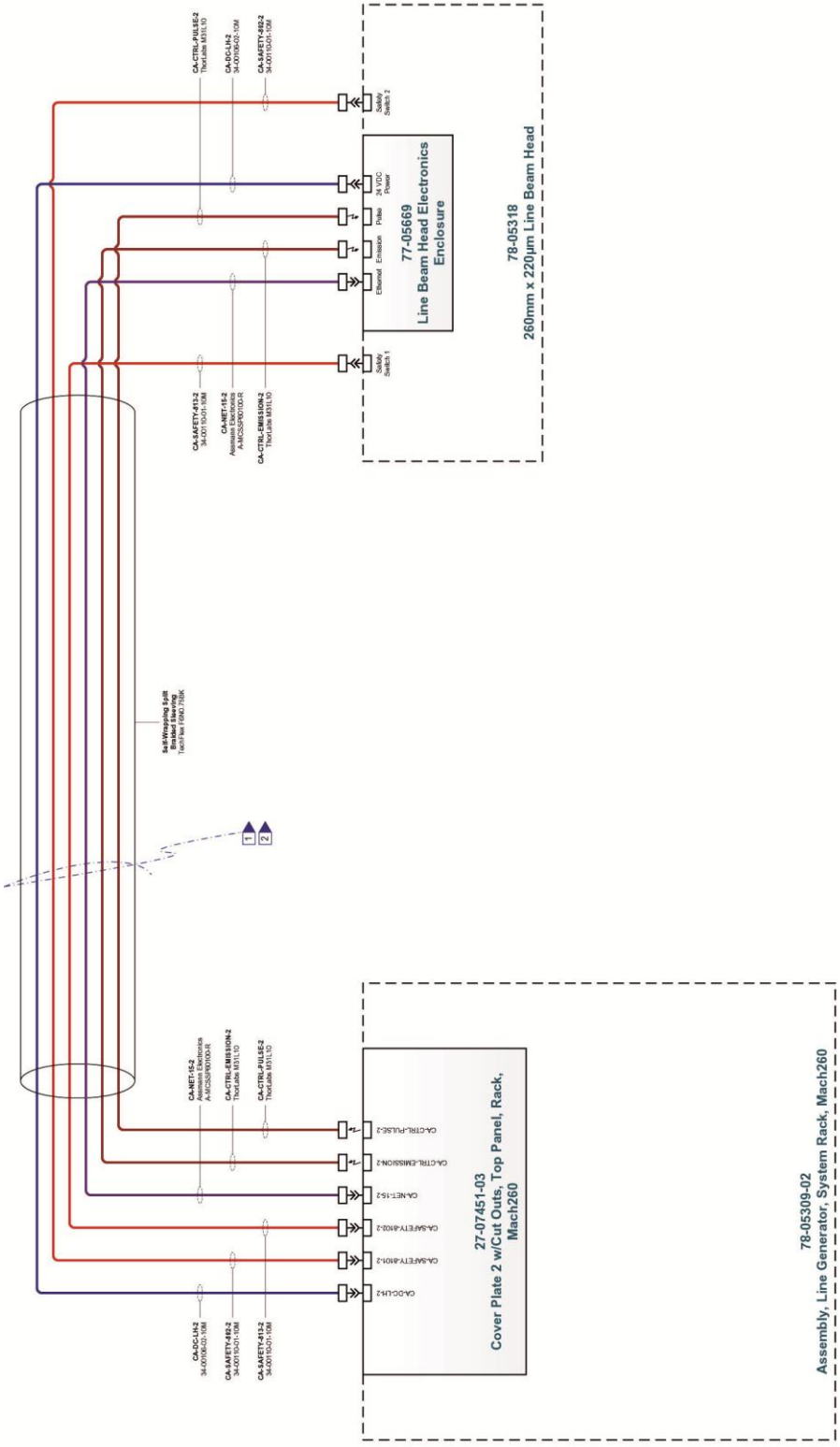

Figure 67: Line Beam System Umbilical Assembly Wiring Diagram

WIRING DIAGRAMS *Continued…*

AC Power Distribution

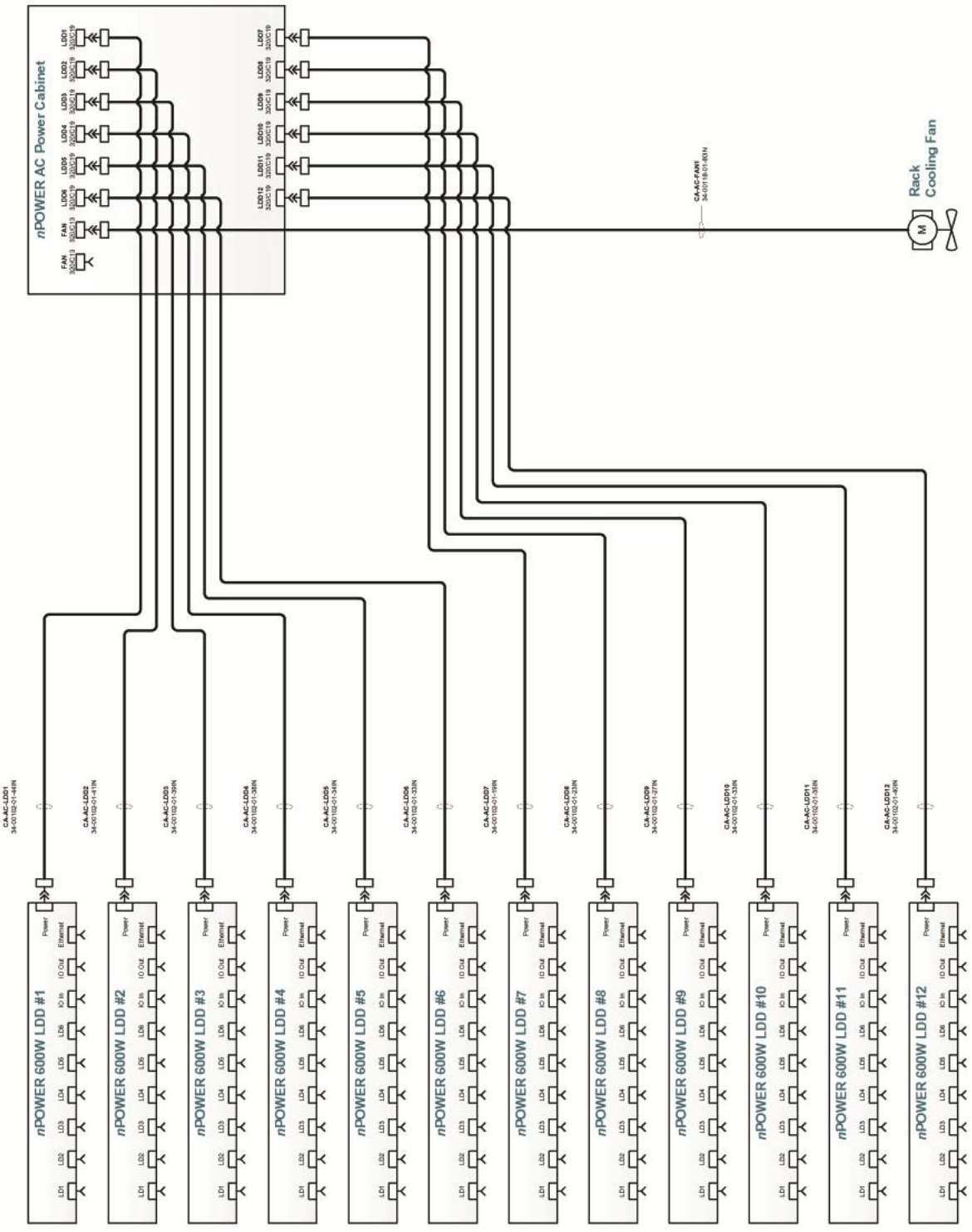

Figure 68: AC Power Distribution Wiring Diagram

APPENDIX C – HOW WE COMPLY

US Federal Safety Regulations

To comply with US Federal safety standards and guidelines, Class 4 laser products must be manufactured to include specific engineering controls/safety features. See page 13 for details.

- ANSI B11.21-1997, Machine Tools Using Lasers for Processing Materials - Safety Requirements for Design, Construction, Care, and Use. A document that is based on the ISO 11553 international standard for manufacturers and users of laser materials processing systems.

International Safety Regulations

- The Line Beam System | 7200:260 complies with the standards and regulations set forth in IEC EN60825-1.
- Safety of Laser Products - Part 1: Equipment classification, requirements, and user's guide. Published in 1994 and amended in 1996, and essentially identical to IEC EN60825-1.
- EN 12626, Safety of Machinery - Laser Processing Machines - Safety Requirements, International Standards Organization, 1997. Essentially identical to requirements in ISO 11553.
- IEC 60825-4, *Safety of Laser Products - Part 4: Safety of laser products - Part 4: Laser Guards,* International Electrotechnical Commission (1997). This provides guidance for manufacturers on the design and testing of materials used to enclose the process zone of laser materials processing systems.

Rights and Responsibilities

- The Buyer is responsible for meeting all applicable regulatory requirements mandated by the country to which this product is exported.
- Buyers of unfinished machinery for use in the European Community must fully conform to Class 4 Laser operation and management standards set forth by the European Commission and the International Electrotechnical Commission.
- The Buyer/Operator is wholly responsible for providing laser safety training to all personnel designated to work on or around the laser system; liability is the sole responsibility of the Buyer/Operator.
- The Operator must provide all designated personnel *Personal Protective Equipment* (PPE).
- The Buyer/Operator is solely responsible for damages and or physical injuries resulting from incorrect use or failure of the product and/or to observe the safety guidelines provided herein.
- The Buyer/Operator must ensure only authorized, fully trained individuals have access to the laser system and laser control area.
- The Buyer/Operator adequately label and limit access to the laser system and laser control area.
- The Buyer/Operator must post appropriate warning signs throughout laser control areas and related entryways.
- The Equipment and Product Safety Act requires Manufacturers to inform operators and users of generally accepted laser operation guidelines and standards, as well as the Occupational Safety and Accident Prevention regulations.
- The Manufacturer is not liable for damage or injuries resulting from incorrect implementation of the device or failure to observe the information contained herein.
- In accordance with US Federal standards and guidelines for the safe use of lasers, including the American National Standards Institute (ANSI 136.1), Class 4 laser products must be manufactured to include specific engineering controls/safety features (See page 13 for details).

APPENDIX D – ADDITIONAL RESOURCES

Regulatory Agencies and Standards Organizations

- **CDRH** - Center for Devices and Radiological Health - An agency within the U.S. FDA which publishes and enforces legal requirements on lasers.
- **IEC** - International Electrotechnical Commission - An organization that publishes international standards on electrical subjects. These are not laws, and the adoption and enforcement of IEC standards are at the discretion of individual nations.
- **ISO** - International Standards Organization - An organization that is equivalent to the IEC, except that the ISO publishes international standards on non-electrical subjects.
- **CEN and CENELEC -** European equivalents of ISO and IEC. CEN and CENELEC standards are typically European Norms (EN), and many are published in response to directives from the European Commission.
- **ANSI** - American National Standards Institute - A U.S. organization that publishes standards for laser users. The ANSI Z136.1 general laser safety standard is not a law, but it forms the basis for state and OSHA requirements for the use of lasers. Other standards in the ANSI Z136 series are intended for specific applications. An ANSI B11 committee publishes standards for machine tool safety.
- **LIA** - Laser Institute of America - An organization which provides laser safety information, including conferences, symposia, publications, and training.

General Laser Safety Standards

- 21 CFR 1040, *Laser Product Performance Standard,* U.S. Center for Devices and Radiological Health (CDRH). Regulations that are mandatory for all laser products sold to end users in the United States.
- IEC 60825-1, *Safety of Laser Products - Part 1: Equipment classification, requirements, and user's guide*. International Electrotechnical Commission (IEC). Published in 1993 and amended in 1997. This provides requirements for manufacturers that are similar to the CDRH laser regulations and user requirements that are similar to those in the ANSI Z136.1 laser safety standard.
- EN60825-1, *Safety of Laser Products - Part 1: Equipment classification, requirements, and user's guide*. Cenelec. Published in 1994 and amended in 1996, and essentially identical to IEC 825-1. Available in English from the British Standards Institute (BSI) in London.

Safe Use of Lasers Standards

- ANSI Z136.1, *Standard for the safe use of lasers*. The basic laser safety document for users of laser products, including manufacturing facilities.
- ANSI Z136.2, Standard for the safe use of optical fiber communication systems utilizing laser diode and LED sources. A document that provides guidance for fiber communication system installers and users with exposure limits that based on the ANSI Z136.1 standard.
- ANSI Z136.3, *Standard for the Safe Use of Lasers in Health Care Facilities*. A document that provides guidance for users of medical lasers with exposure limits that based on the ANSI Z136.1 standard.

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