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Model 2010 Series

Air-Cooled Argon Ion Laser System

Models 2011, 2012, 2013 and 2014

Installation and Operation Manual

uniphase

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Preface

Thank you and congratulations for selecting one of the Uniphase's rugged and reliable Model 2010 Series Air-Cooled Argon Ion Laser Systems. The Model 2010 Series includes the Models 2011, 2012, 2013 and 2014 Laser Systems.

This manual contains installation and operation instructions for the system and is divided into four sections as follows:

Preface. Contains warranty information along with a variety of safety considerations.

Chapter 1 — General Information. Contains a description of the equipment, unpacking and inspection instructions, and specifications.

Chapter 2 — Installation. Contains installation instructions describing how to locate the units, connect them and wire them for different modes of operation.

Chapter 3 — Operation. Describes the operational modes possible with the laser system.

How to Use this Manual

If you have just taken delivery of the laser system, please read the Preface, General Information and Installation sections. If you are installing the equipment, read the Installation section. See Operation when you are ready to operate the equipment.

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Warranty

Uniphase warrants the plasma tube of the laser to be free from defects in materials and workmanship for 5,000 hours of operation at or below specified power or 12 months from the date of shipment, whichever occurs first. All other components of the laser and power supply are warranted to be free from defects in materials and workmanship for 12 months from the date of shipment.

If any item of the laser fails during the warranty period specified above, return the item freight prepaid to Uniphase. Uniphase will, at its option, repair or replace the defective item and return it freight prepaid to your facility.

After the expiration of the warranty period specified above, Uniphase will, provided the defective item is returned to Uniphase, repair the item on a time and materials cost basis. The item will be shipped back to you at your expense.

Uniphase Assistance

For assistance contact:

UNIPHASE
163 Baypointe Parkway
San Jose, CA 95134
Tel (408) 434-1800
Fax (408) 433-3838

UNIPHASE, LTD.
2 Viewpoint, Babbage Road
Stevenage Hertfordshire
SG1 2EQ England
Tel 44 (01438) 745055
Fax 44 (01438) 742490

UNIPHASE VERTRIEBS - GmbH
Arbeostrasse 5, D-85386 Eching/Munich
P.O. Box 1128, D-85378 Eching/Munich
Germany
Tel 49 (089) 3196026
Fax 49 (089) 3193002

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Safety Considerations

This manual contains the following safety notices:

- Descriptions of safety symbol markings.
- Warning and caution symbols to denote operations that could cause injury to personnel or damage to equipment.
- Laser safety precautions to avoid possible exposure to laser and collateral radiation in excess of the applicable emission limits.

Warning and Caution Symbols

Warning

When you see a warning, it denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in *injury or death*. Do not proceed beyond a warning until the indicated conditions are fully understood and met.

Caution

When you see a caution, it denotes a hazard. It calls attention to an operating procedure practice, or the like, which, if not correctly performed or adhered to, could result in damage to or *destruction of part or all of the product*. Do not proceed beyond a caution until the indicated conditions are fully understood and met.

Laser Safety Precautions

The Uniphase Models 2011, 2012, 2013 and 2014 comply with the Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968 (Title 21, code of Federal Regulations, Chapter 1, Sub-chapter J, Section 1040) as they apply to laser products (except medical products). This product falls into Class IIIb.

The protective housing of this laser product should always be in place during normal laser operation. Removal of the protective housing can expose the user unnecessarily to Class IIIb Argon laser power up to 500 mW (100 mW for the 2012). Removal of the protective housing should be performed only by trained service personnel.

During installation and operation of this product, the use of protective eyewear or other precautionary procedures depends on the conditions of use and the amount of visual function required for the installation or operation procedure. Consult user standards such as ANSI, ACGIH, or OSHA for guidance.

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Optical Safety

The laser is a source of intense light having characteristics that are very different from the light emitted from conventional light sources. The user must be aware of these characteristics of laser light and the proper safety precautions before attempting to operate the laser.

The energy level of the laser beam is high enough to cause serious injury to the eye with probable loss of vision if the beam were to pass directly into the eye.

Because the laser beam is collimated and coherent, the energy in the beam remains high and dangerous even at great distances from the laser.

Electrical Safety

The electrical safety hazards of ion laser systems should not be ignored, as they are as great as other electrical systems operating from AC power lines. The voltages involved and the current available have the potential to cause fatal electric shock. Although Uniphase Model 2010 Series lasers conform to OSHA electrical requirements and additional safety features have been included in their design, the following safety precautions should be noted and observed:

1. Your laser is intended for operation only with the laser head and power supply covers in place.
2. For the sake of safety, NEVER depend on any electrical safety device or interlock, but carefully make other determinations that all power is off and components are de-energized before working on the electrical connections of the laser system.
3. Do not allow anyone to perform electrical maintenance on the laser, except those personnel who are familiar with Uniphase lasers and who are trained to service them.

Warning — High Voltages

The laser head and power supply of this laser product contain electrical circuits operating at HIGH VOLTAGE.

Whenever access to the interior of the laser head or power supply is necessary: TURN THE POWER SUPPLY OFF AND DISCONNECT FROM THE POWER SOURCE, WAIT 5 MINUTES BEFORE ACCESS.

When access to the laser head or power supply is necessary and laser operation is necessary:

EXERCISE EXTREME CAUTION TO AVOID CONTACT WITH HIGH VOLTAGE. THIS IS A LINE OPERATED POWER SUPPLY. IT IS NOT ISOLATED FROM THE INPUT POWER LINE. THESE HIGH VOLTAGES ARE LETHAL.

Users of the Model 2010 Series laser systems should be aware that operating the product without due regard to these precautions, or in a manner that is not in compliance with procedures recommended here, may cause an unsafe condition.

Insulation Category (Over Voltage Category)

Insulation Category is II.

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Safety Recommendations for Using the Laser

When operating the laser system, it is recommended that you observe the following safety precautions:

1. Always have the power supply cover and the laser head cover in place when the laser is connected to line power.
2. Limit access to the laser to those familiar with the equipment. Keep the laser out of the hands of inexperienced or untrained personnel.
3. When the laser is on and the output beam is not being terminated in an experiment or optics system, the beam should be blocked.
4. **NEVER LOOK DIRECTLY INTO THE MAIN LASER BEAM. NEVER SIGHT DOWN A BEAM INTO ITS SOURCE.**
5. Do not allow reflective objects to be placed in the laser beam. Laser light scattered from a reflective surface can be as damaging as the original beam. Even objects such as rings, watchbands, and metal pens or pencils can be hazardous.
6. Turn laser power down to a low level to minimize intensity of accidental stray reflections or refractions when aligning a chain of optical components in the laser beam.
7. Set up experiments so that the laser beam is NOT at eye level.
8. Post warning signs and limit access to the laser area when the laser is in operation.
9. Even when wearing laser safety glasses, there are two hazards that exist while operating CW (continuous-wave) ion lasers:
    a. The glasses make the beam itself invisible, therefore increasing the danger of skin burns.
    b. Laser glasses may not afford enough protection if a very powerful beam is viewed directly.
10. NEVER LEAVE THE LASER *ON*, *OPEN*, AND *UNATTENDED!*

Warning

THE LASER PLASMA TUBE CONTAINS BERYLLIA CERAMIC, WHICH IS HAZARDOUS WHEN POWDERED AND INHALED. IF THE LASER TUBE IS BROKEN, WET THE PIECES AND SEAL THEM IN A PLASTIC BAG. IT WILL THEN BE NECESSARY TO DISPOSE OF THE BERYLLIUM OXIDE ACCORDING TO APPLICABLE REGULATIONS.

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Compliance Features

Saftey compliance features that are incorporated into the Model 2010 Series laser components are listed below. These features are listed here for your familiarization and are explained in greater detail in the Installation and Operation chapters of this manual.

Protective Housing

The housing on the laser head is designed to limit access to the admissable emission limits of Class IIIb lasers (see the paragraph "Beam Attenuator" below).

Remote Control Connector

A remote control connector (DB25), located on the front of the power supply, enables the customer to monitor and control the laser from a remote source, and provides startup/shutdown safety. When this connector is removed, the power supply will not operate due to the safety interlock (pins 1 and 3) being open. Also, if the unit is on and the interlock opens, AC power must be removed (unplugged from source). Be aware that 10 VAC (2111, 2112 and 2114 Power Supplies) or 5 VAC (2111A/2111B, 2112A/2112B and 2114A/2114B Power Supplies) is present across pins 1 and 3, and plus and minus 15 VDC are present at pins 13 and 12. (For Power Supply 2113 be aware that 24 VAC is present across pins 1 and 3, and plus and minus 15 VDC are present at pins 13 and 12.)

Key Control

The power supply is activated when the KEY switch is turned to ON. A 30 to 45 second time delay occurs before the laser light is activated. Note that the key cannot be removed when the switch is turned to ON. See the Operation chapter for information on the key switch.

Warning

Line voltage is present at the laser head whenever the AC line is connected.

Power On Indicator

A POWER ON indicator lights immediately when the power supply is connected to the AC line. See the Operation chapter for a discussion of this indicator.

Interlock Indicator

An INTERLOCK indicator will light when interlock remote pins 1 and 3 are shorted together and a laser head is connected to the power supply.

Beam Shutter

A beam shutter, located on the output end of the laser head, is designed to block the laser beam.

Warning

At all times during installations, operation, maintenance, or service of the laser, avoid all unnecessary exposure to laser light or collateral radiation in excess of the accessible emission limits listed in Performance Standards for Laser Products, 21CFR 1040.10 (d).

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Safety Labels

The safety labels shown below are located on the laser systems.



Located on the top of the rear panel near the center of the 2211. Located on the side of the laser head on the 2212, 2213 and 2214.



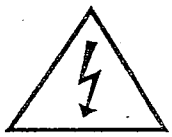
Located on the cover above the shutter on the 2211. Located front of the laser head near the shutter control on the 2212, 2213 and 2214.



Located on the laser head above the beam aperture.



Located on the top cover of the 2211 and the start module on the 2212, 2213 and 2214.



Located on the top cover of the 2211 and the start module on the 2212, 2213 and 2214.

Additional Laser Safety Informational Sources

Sources for additional information and assistance on laser safety are:

Director (HFX-400)
Division of Compliance
Bureau of Radiological Health
5600 Fishers Lane
Rockville, MD 20857
(Regulations and Requirements)

Laser Institute of America
400 Executive Park Drive
Cincinnati, OH 45241
(Safety Guides)

American National Standards Institute, Inc.
1430 Broadway
New York, NY 10018
(Safety Guides)

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Declaration of Conformity

Equipment name/type number

Air-cooled Argon ion laser systems, Model 2010 Series (Power Supply Series 211X Y plus Laser Head 221X)

Manufacturer

Uniphase Corporation, 163 Baypointe Parkway, San Jose, California 95134 USA

European Representative

Uniphase Vertriebs-GmbH, Arbeostrasse 5, D-85386 Eching/Munich Germany

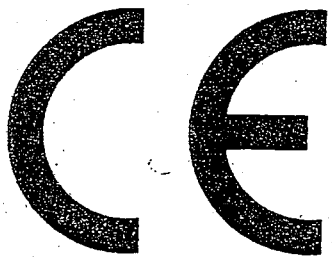
Applicable Directives

89/336/EEC

Applicable Standards

Conformity of this product is based on European standards EN55011/03.91, EN50082-2/03.95

We hereby declare that the equipment model series identified above conforms to the specified Directives and Standards. CE marking was first affixed to the products during 1996.



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Chapter 1 - General Information

This chapter contains general information covering the Model 2010 Series Argon Ion Laser Systems, and includes the following:

- Description
- Equipment supplied
- Unpacking and inspection
- Repacking for shipment
- Support strategy
- Specifications

Description

The Model 2010 Series Argon Ion Laser Systems consist of a Model 2210 Series Laser Head with fan and a Model 2110 Series Power Supply. Specific model numbers are shown in Table 1-1.

Model 2011 Laser System	
Laser Head	**Model 2211**
Power Supply	**Model 2111 Series Power Supply**
Model 2012 Laser System	
Laser Head	**Model 2212**
Power Supply	**Model 2112 Series Power Supply**
Model 2013 Laser System	
Laser Head	**Model 2213**
Power Supply	**Model 2113 Power Supply**
Model 2014 Laser System	
Laser Head	**Model 2214**
Power Supply	**Model 2114 Series Power Supply**

Table 1-1. Model 2010 Series Laser Systems

For clarity's sake throughout the manual we will distinguish between the various laser system models when necessary

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Model 2211 Laser Head

The Model 2211 Laser Head is a rectangular type. This design provides the following advantages:

- Cool air is drawn through opening vents located on the side of the laser head and exhausted out the top.
- Mirror assemblies are vacuum sealed directly to the plasma tube thus eliminating intracavity spaces and contaminated optics.
- Metal ceramic construction with a beryllium oxide bore provides extremely rigid stability and longer tube life.
- Brazed-on heat sink fins give better heat transfer and improved stability.

Model 2212, 2213 and 2214 Laser Heads

The Model 2212, 2213, 2214 Laser Heads are a cyclindrical type. This design provides the following advantages:

- Axial cooling is accomplished with the external fan and duct assembly. Cool air is drawn through opening vents located around the outside of the front of the laser head. The fan can be mounted at any convenient location away from the laser head.
- Mirror assemblies are vacuum sealed directly to the plasma tube thus eliminating intracavity spaces and contaminated optics.
- Metal ceramic construction with a beryllium oxide bore provides extremely rigid stability and longer tube life.
- Brazed-on heat sink fins give better heat transfer and improved stability.

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Model 2110 Series Power Supply

The Model 2110 Series Power Supplies (2111, 2111A, 2111B, 2112, 2112A, 2112B, 2113 , 2114, 2114A, 2114B) are high efficiency switching-regulator units.

Features of the power supplies include:

- The elimination of wire harnessing promotes high reliability.
- Modular printed circuit design simplifies servicing. All active components are mounted on plug-in circuit boards.
- LEDs mounted on the printed-circuit boards aid in monitoring operation of the power supply.
- Control of the system can be achieved remotely from a host system via the remote interface plug (DB25) located on the front panel of the power supply.
- The optional remote interface controller, Model 2501, 2500, or 2499, allows the user to monitor and control output power and tube current from the remote interface of the 2110 Series Power Supplies. The Model 2500 controller can be used while the host system is connected to the power supply via the remote interface. The Model 2501 and 2499 do not have a host system remote interface.

Operating Modes

The Model 2010 Series Laser Systems can be operated in "light control" mode or "current control" mode. In light control mode, the laser light output power is held constant by changing the laser tube current via a light monitoring feedback loop. In current control mode, the tube current is held constant but the laser light output power can vary due to temperature changes, etc. Current control is used to test/troubleshoot the product.

The modes of operation can be controlled remotely as follows:

Remote Current Control

In remote current control mode, laser tube current is controlled through the remote connector via a remote voltage source, which may be a separate power supply or a potentiometer connected as described in chapter 2.

Remote Light Control

In remote light control mode, laser output power is controlled through the remote connector via a remote voltage source, which may be a separate power supply or a potentiometer connected as described in chapter 2.

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Equipment Supplied

This section contains specific information for each model: 2011, 2012, 2013 and 2014.

Model 2011

The Model 2011 consists of the following equipment:

- Model 2211 Argon Ion Laser Head (incorporates a Model 2301 Argon Ion Laser Tube).
- Model 2111, 2111A, or 2111B Power Supply.
- Installation and Operation Manual (this manual).

The following ***optional equipment*** can be ordered from Uniphase:

- Remote Interface Controllers, part numbers 2500, 2499, and 2501.

Model 2012

The Model 2012 consists of the following equipment:

- Model 2212 Argon Ion Laser Head (incorporates a Model 2312 Argon Ion Laser Tube).
- Model 2112, 2112A, or 2112B Power Supply.
- Fan and Duct Assembly.
- Installation and Operation Manual (this manual).

The following ***optional equipment*** can be ordered from Uniphase:

- Remote Interface Controllers, part numbers 2500, 2499, and 2501.
- V-Block (small), part number 006-038.
- V-Block (large), part number 006-039.

Model 2013

The Model 2013 consists of the following equipment:

- Model 2213 Argon Ion Laser Head (incorporates a Model 2303 Argon Ion Laser Tube).
- Model 2113 Power Supply.
- Fan and Duct Assembly.
- Installation and Operation Manual (this manual).

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The following ***optional equipment*** can be ordered from Uniphase:

- Remote Interface Controllers, part numbers 2500, 2499, and 2501.
- V-Block (small), part number 005-980.
- V-Block (large), part number 005-981.

Model 2014

The Model 2014 consists of the following equipment:

- Model 2114, 2114A, or 2114B Power Supply.
- Fan and Duct Assembly.
- Installation and Operation Manual (this manual).

The following ***optional equipment*** can be ordered from Uniphase:

- Remote Interface Controllers, part numbers 2500, 2499, and 2501.
- V-Block (small), part number 006-038.
- V-Block (large), part number 006-039.

Inspection

Before unpacking the Model 2010 Series components, inspect the shipping cartons for evidence of damage. If any carton appears to be damaged, file a claim immediately with the freight carrier. After unpacking, inspect each item carefully for evidence of damage. If any item appears to be damaged, file a claim immediately with the freight carrier. It is recommended that you retain the original shipping carton and packing material in case any Model 2010 Series item has to be returned to Uniphase. Most shipping damage occurs when the item is not shipped in the original shipping container.

Repacking for Shipment

If it is ever necessary to repack any Model 2010 Series item for reshipment, use the original carton and packing material, if available. If the original carton and material are not available, use a similar carton and pack the item(s) in suitable packing material, or contact Uniphase for a container.

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Support Strategy

Uniphase will repair or replace any defective Model 2010 Series item for a period as specified below:

- Model 2300 Series Argon Ion Laser Tube:

  A period of 5000 hours of operation at or below specified power or 12 months from the date of shipment, whichever occurs first.

- Model 2210 Series Argon Ion Laser Head and Model 2110 Series Power Supply:

  A period of 12 months after delivery.

Return the defective unit prepaid to Uniphase. See the address on the Warranty page of this manual (page vii). Uniphase will pay the return shipping costs. Note that any attempt by the user to repair any Model 2010 Series item during the above warranty period will void the warranty.

After the warranty period, if you are unable or do not wish to repair any item, return it prepaid to Uniphase for repair. Uniphase will repair the item on a time and material cost basis, and ship it back to you at your expense.

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Specifications

Specifications of the Model 2010 Series are presented in Table 1-2. Dimensional drawings are shown in figures 1-1 through 1-9.

Table 1-2. Specifications

Features

- Integral-mirror, metal-ceramic construction
- Hands-off operation
- Ultra-low noise operation
- Fast warm up
- Field-proven rugged construction
- Ultra-stable resonator design
- Superior beam pointing stability
- Extended lifetime
- Cylindrical packaging (the Model 2211 laser head has rectangular packaging)
- Symmetrical axial air flow
- Vibration isolation

Output Power

Model 2011	10SL	10 mW
	20SL	20 mW
	30SL	30 mW
	10GL	10 mW
	15GL	15 mW
	20GL	20 mW
	4VL	4 mW
	5VL	5 mW
	6VL	6 mW
	10BL	10 mW
	20BL	20 mW
	30BL	30 mW
	25ML	25 mW
	40ML	40 mW
	65ML	65 mW
	100MLM	100 mW
Model 2012	2GL	2 mW
	4SL	4 mW
	5BL	5 mW
	10ML	10 mW

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Table 1-2. Specifications (continued)

Output Power

Model 2013	75SL	75 mW
	75GL	75 mW
	15VL	15 mW
	150ML	150 mW
	300MLM	300 mW
Model 2014	10SL	10 mW
	20SL	20 mW
	30SL	30 mW
	10GL	10 mW
	15GL	15 mW
	20GL	20 mW
	4VL	4 mW
	5VL	5 mW
	6VL	6 mW
	10BL	10 mW
	20BL	20 mW
	30BL	30 mW
	25ML	25 mW
	40ML	40 mW
	65ML	65 mW
	100MLM	100 mW

Optical Specifications

Beam Diameter:

Model 2011 System

TEM_{00} (mm @ $1/e^2 \pm 5\%$):	0.67
Multimode (mm @ $1/e^2 \pm 15\%$):	1.0

Model 2012 System

TEM_{00} (mm @ $1/e^2 \pm 5\%$):	0.62

Model 2013 System

TEM_{00} (mm @ $1/e^2 \pm 5\%$):	0.65
Multimode (mm @ $1/e^2 \pm 15\%$):	1.0

Model 2014 System

TEM_{00} (mm @ $1/e^2 \pm 5\%$):	0.69
Multimode (mm @ $1/e^2 \pm 15\%$):	1.0

Beam Divergence:

TEM_{00} (mrad $\pm$ 5%):	0.95
Multimode (mrad $\pm$ 15%):	3.0

Minimum Polarization Ratio: 250:1

(All models linearly polarized except multimode versions.)

Beam Pointing Stability (over 2 hours):

Temperature Range $\pm$ 3 °C

After Warmup (microradians): < $\pm$ 30 °C

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Table 1-2. Specifications (continued)

Power Supply Specifications

Amplitude Fluctuations (2010 Series):
Maximum Noise

(P-P, 20 Hz - 300 Hz):	0.1%
(P-P, 20 Hz - 20 KHz):	1.0%
(RMS, 20 Hz - 2 MHz):	1.0%

Amplitude Fluctuations (2010A/2010B Series):
Maximum Noise

(P-P, 20 Hz - 300 Hz):	0.1%
(P-P, 20 Hz - 20 KHz):	2.0%
(RMS, 20 Hz - 2 MHz):	1.0%

Maximum Drift:
(light control mode, over 2 hours): 1.0%

Maximum Warm-up Time: 5 minutes

Input Power

Voltage (VAC ± 10%):	**100,**	**120,**	**200,**	**208,**	**220,**	**240**
Frequency (Hz):						47-63
Phase:						Single
Maximum Line Current (amps):						
with 2211 or 2214 -10SL, -20SL, -10GL, -15GL -10BL, -20BL, -25ML, -40ML -4VL, -5VL Heads	20	17	12	12	10	10
with 2211 or 2214 -30SL, -20GL, -30BL, -65ML, -6VL, -100MLM Heads	23	19	13	13	12	11
with 2212 Heads	12	10	8	7	7	6
with 2213 Heads	N/A	N/A	27	26	25	23

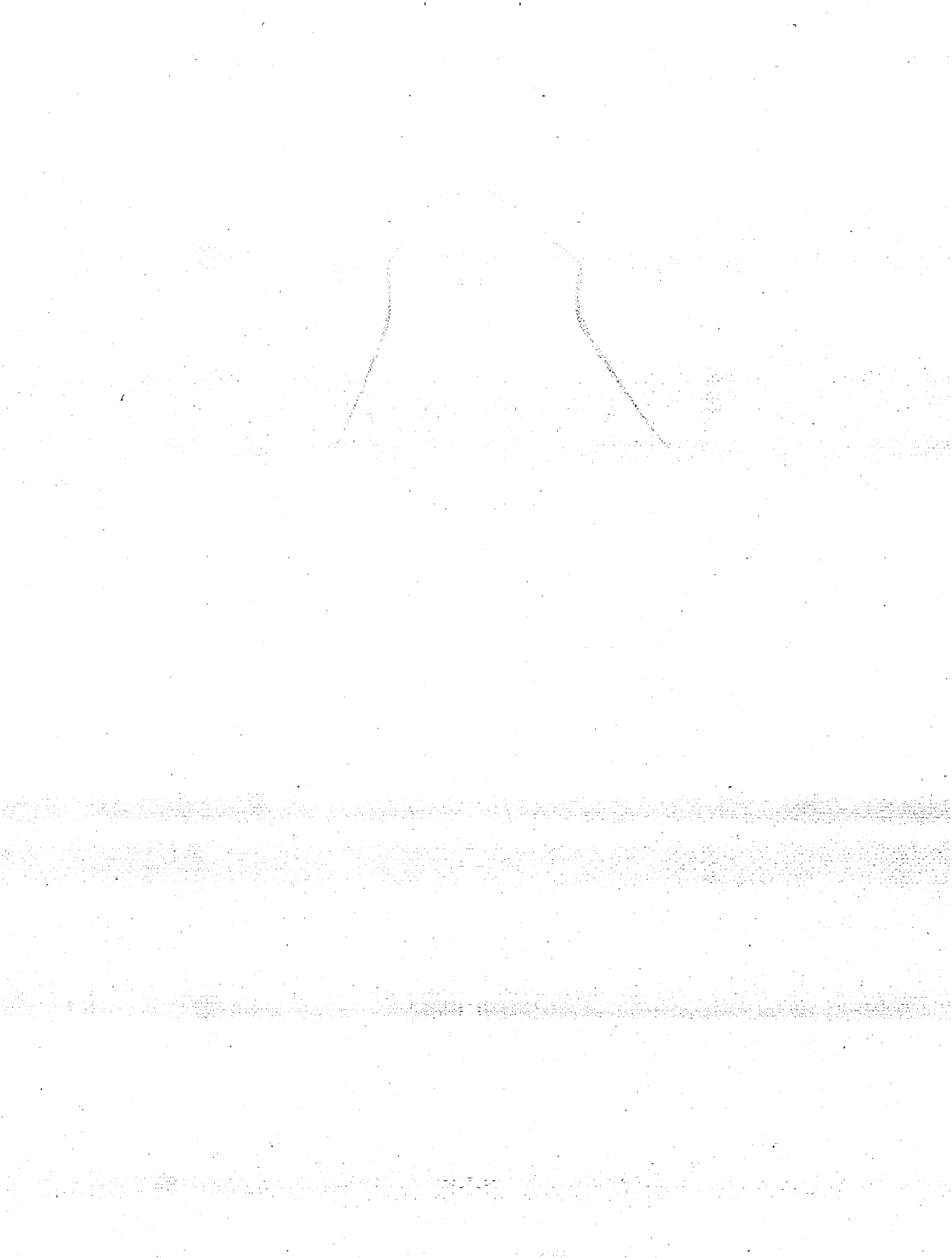
Input power must be specified when ordering the system; however, if power requirements change, refer to "Connecting AC Power," in chapter 2, for switch and jumper settings.

Environmental Specifications

Operating:

Temperature:	4° C to 40° C
Altitude:	0 to 3,048 meters (0 to 10,000 feet)
Relative Humidity (without condensation):	0 to 100%
Shock	25 g for 11 msec

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Table 1-2. Specifications (continued)

Physical Specifications

Model 2213

Model 2213 Argon Ion Laser Head

Size:	See figure 1-5 or 1-6
Weight:	5.9 kg (13 pounds)

Model 2113 Power Supply

Size:	See figure 1-7
Weight:	12.2 kg (27 pounds)

Squirrel Cage Fan for Model 2213, Part Number 005-688

Size:	See figure 1-6
Weight:	4.1 kg (9 pounds)

Nominal air flow is 115 CFM. Use Model INB412 McLean Engineering or equivalent fan rated for 185 CFM free air and typical pressure head of 1.8 inches of water.

Model 2214

Model 2214 Argon Ion Laser Head

Size:	See figure 1-3 or 1-4
Weight:	3.4 kg (7.5 pounds)

Model 2114 Power Supply

Size:	See figure 1-7
Weight:	12.2 kg (27 pounds)

Model 2114A and 2114B Power Supply

Size:	See figure 1-8
Weight:	8.6 kg (19 pounds)

Squirrel Cage Fan for Model 2214, Part Number 005-570 (110V), 005-688 (220V)
Models 2014-30SL, -20GL, -30BL, -65ML, -4VL, -5VL, -6VL, -100MLM

Size:	See figure 1-9
Weight:	4.1 kg (9 pounds)

Nominal air flow is 65 CFM. Use Model INB412 McLean Engineering or equivalent fan rated for 185 CFM free air and typical pressure head of 1.8 inches of water.

Squirrel Cage Fan for Model 2214, Part Number 005-568 (110V), 005-938 (220V)
Models 2014-10SL, -20SL, -10GL, -15GL, -10BL, -20BL, -25ML, -40ML,

Size:	See figure 1-4
Weight:	2.73 kg (6 pounds)

Nominal air flow is 52 CFM. Use Dayton Model 4C442 or equivalent fan rated for 140 CFM free air and typical pressure head of 0.95 inch of water.

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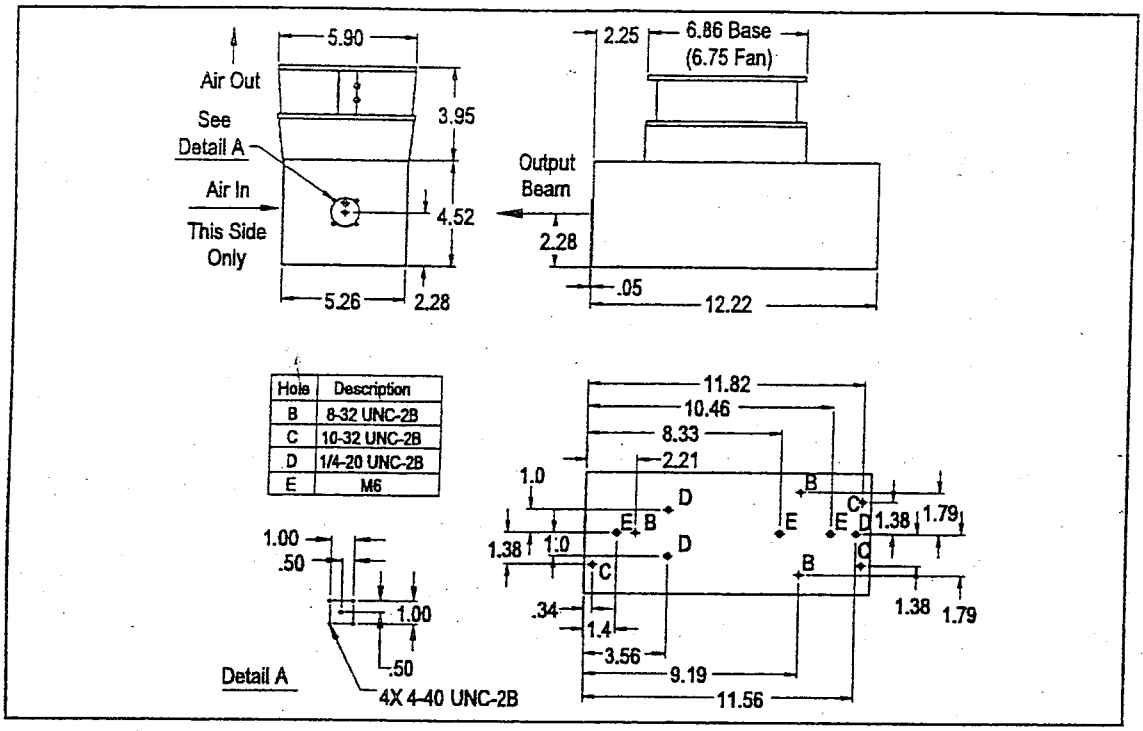


Figure 1-1. Model 2211 -30SL, -20GL, -30BL, -65ML, -100MLM, -4VL, -5VL, -6VL Laser Head Dimensional Drawing

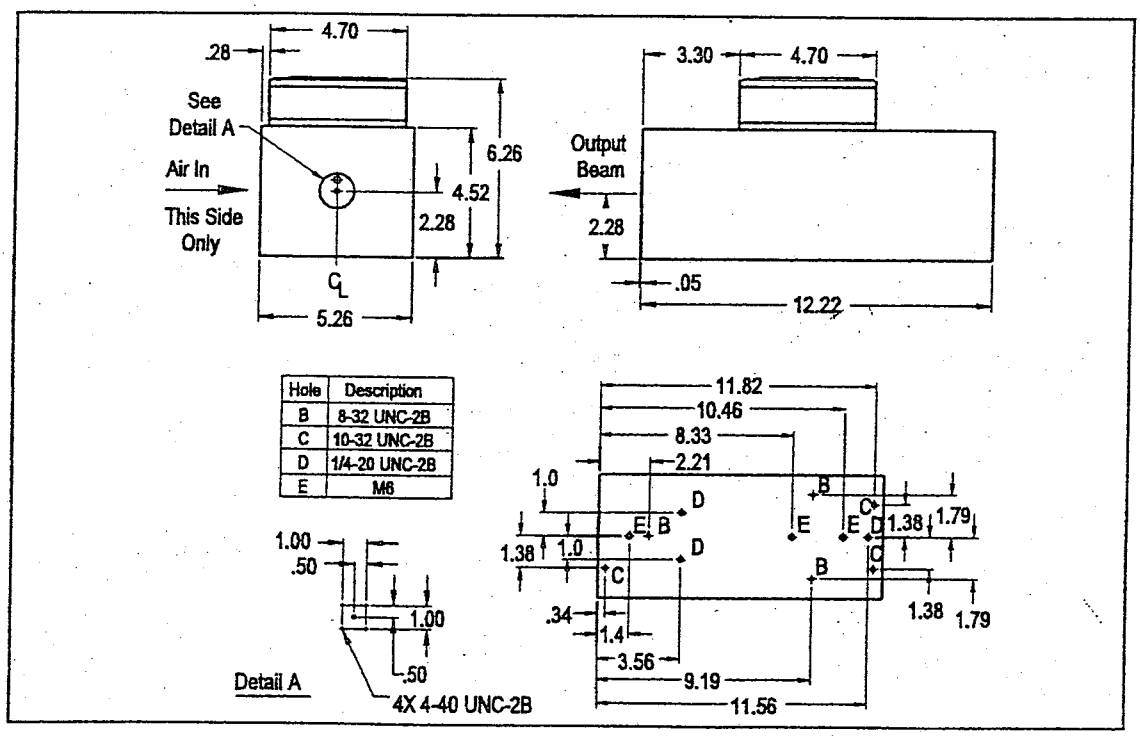


Figure 1-2. Model 2211 -10SL, -20SL, -10GL, -15GL, -10BL, -20BL, -25ML, -40ML Laser Head Dimensional Drawing

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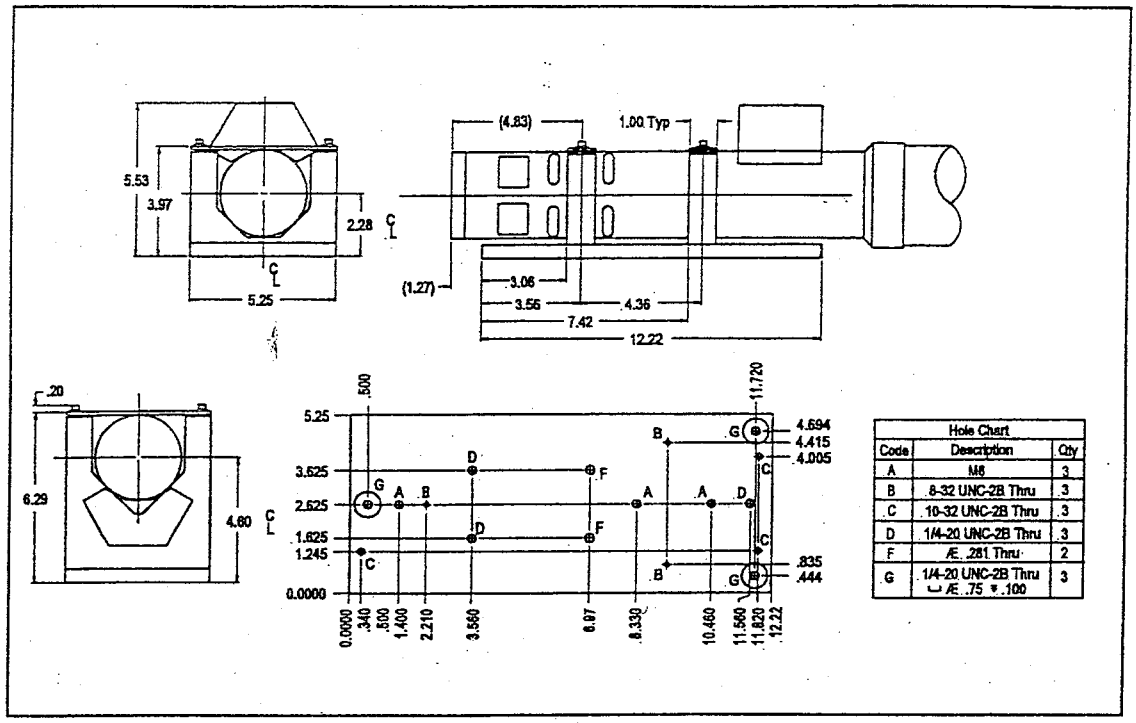


Figure 1-3. Optional 2212 and 2214 Laser Head Mounting Assemblies

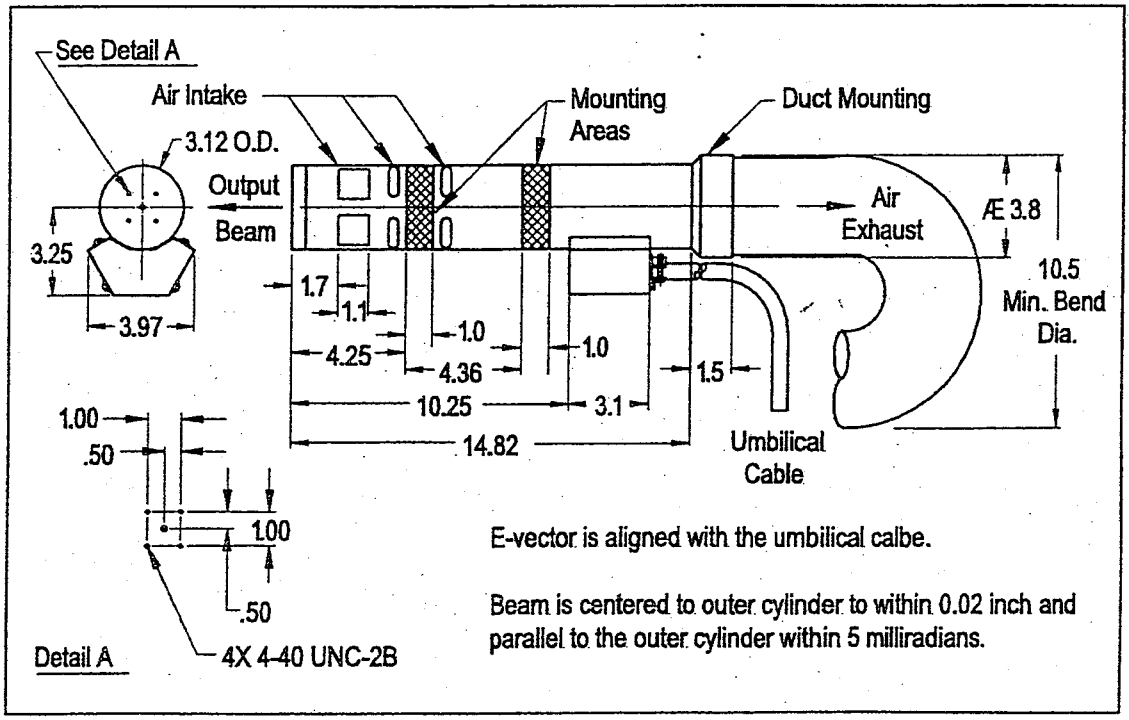


Figure 1-4. Model 2212 and 2214 Laser Head Dimensional Drawing

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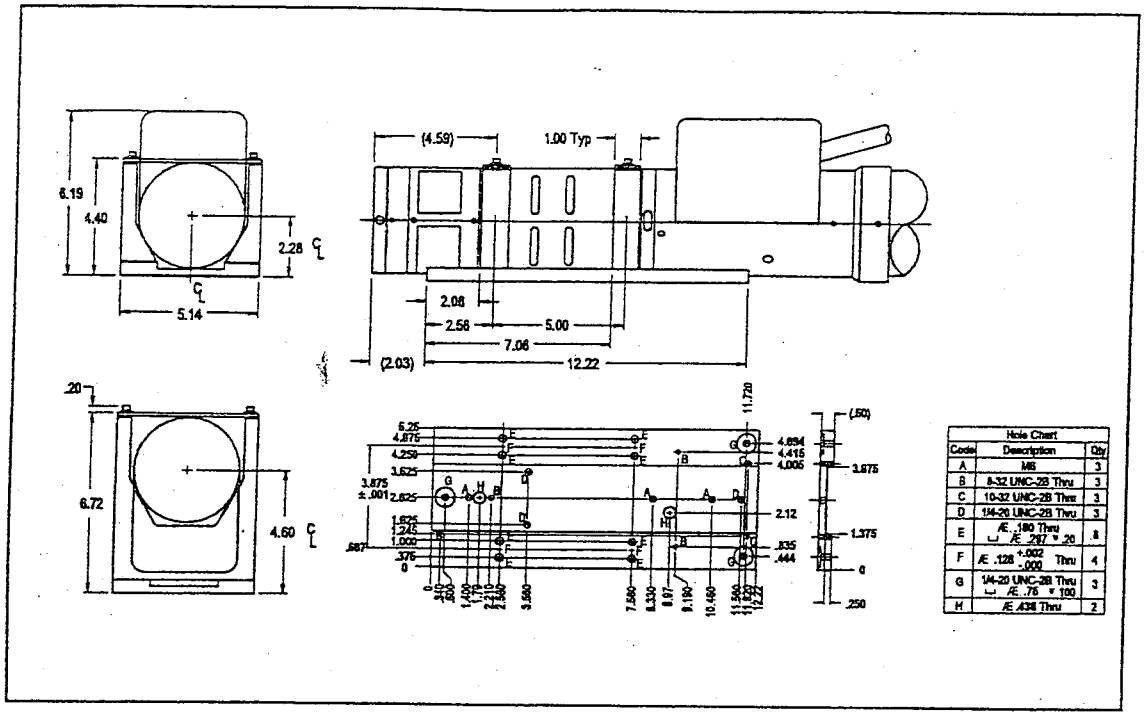


Figure 1-5. Optional 2213 Laser Head Mounting Assemblies

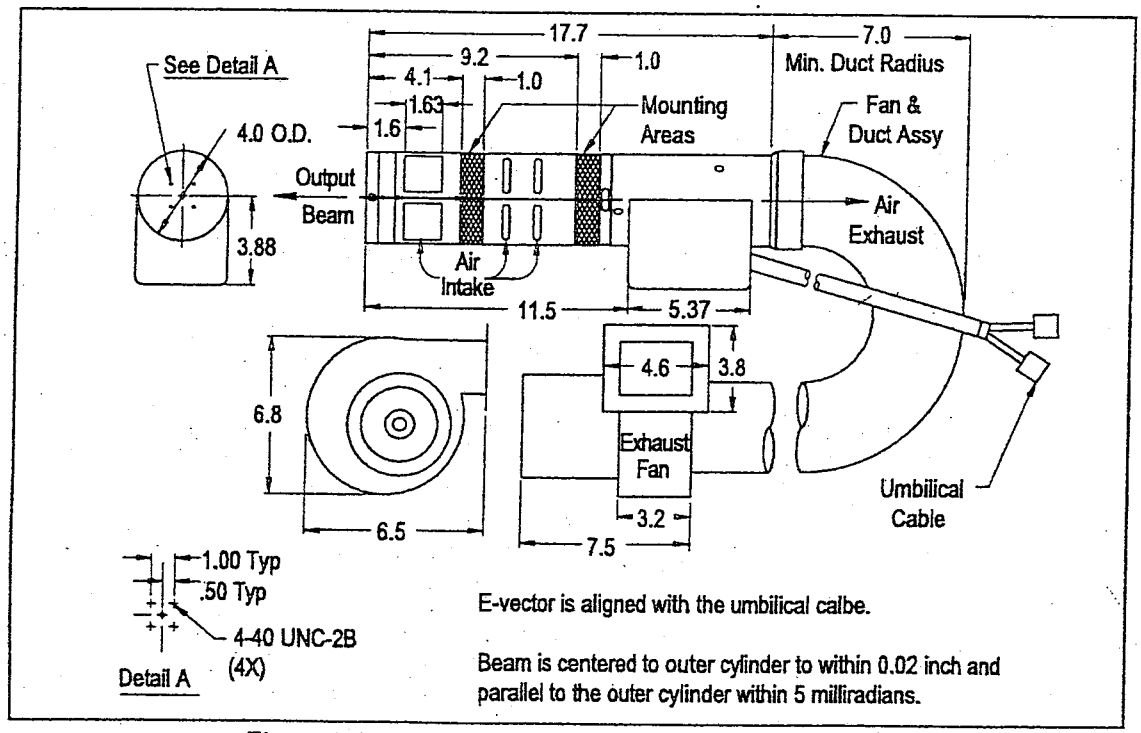


Figure 1-6. Model 2213 Laser Head Dimensional Drawing

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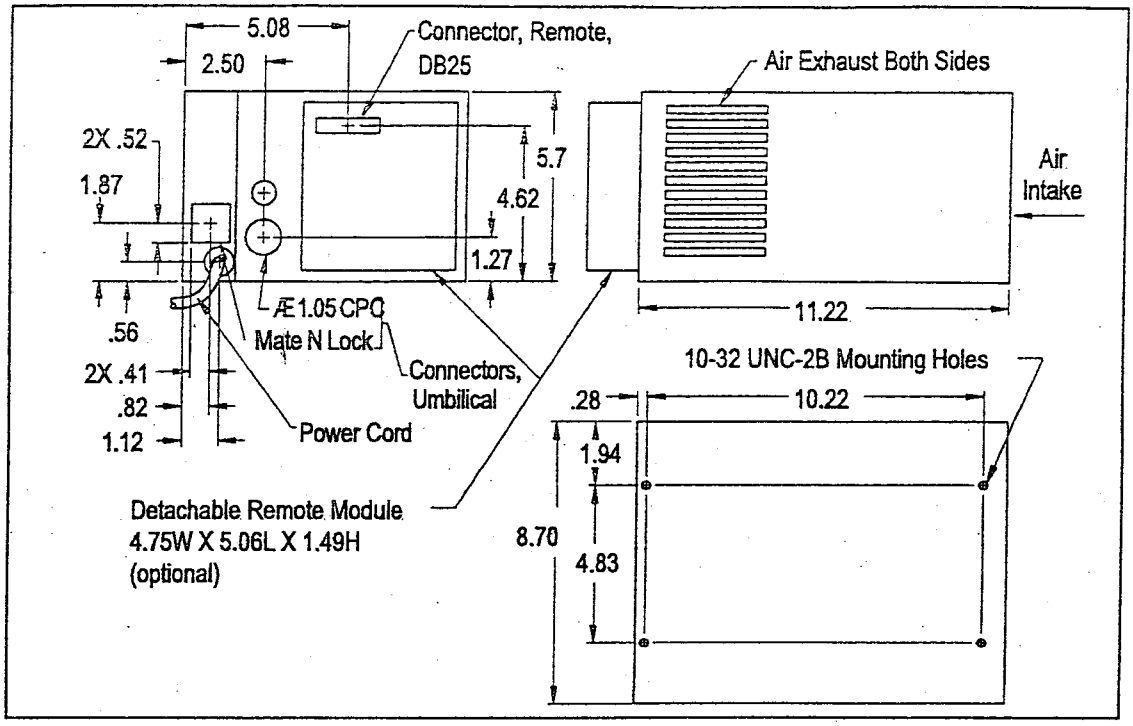


Figure 1-7. Model 2110 Series Power Supply Dimensional Drawing

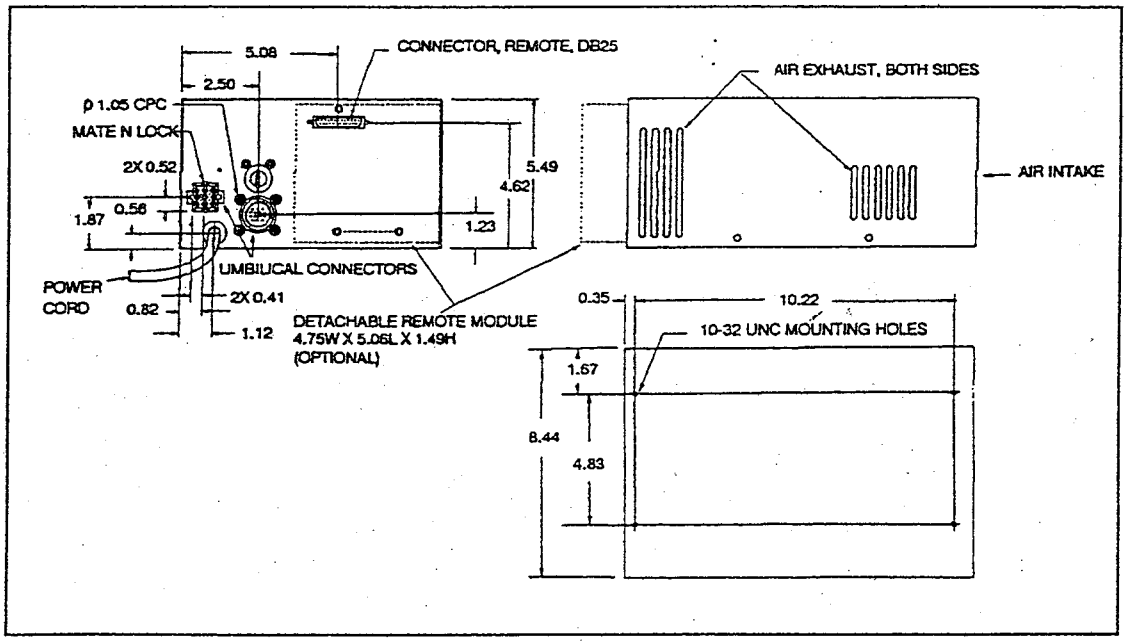


Figure 1-8. Model 2110A/2110B Series Power Supply Dimensional Drawing

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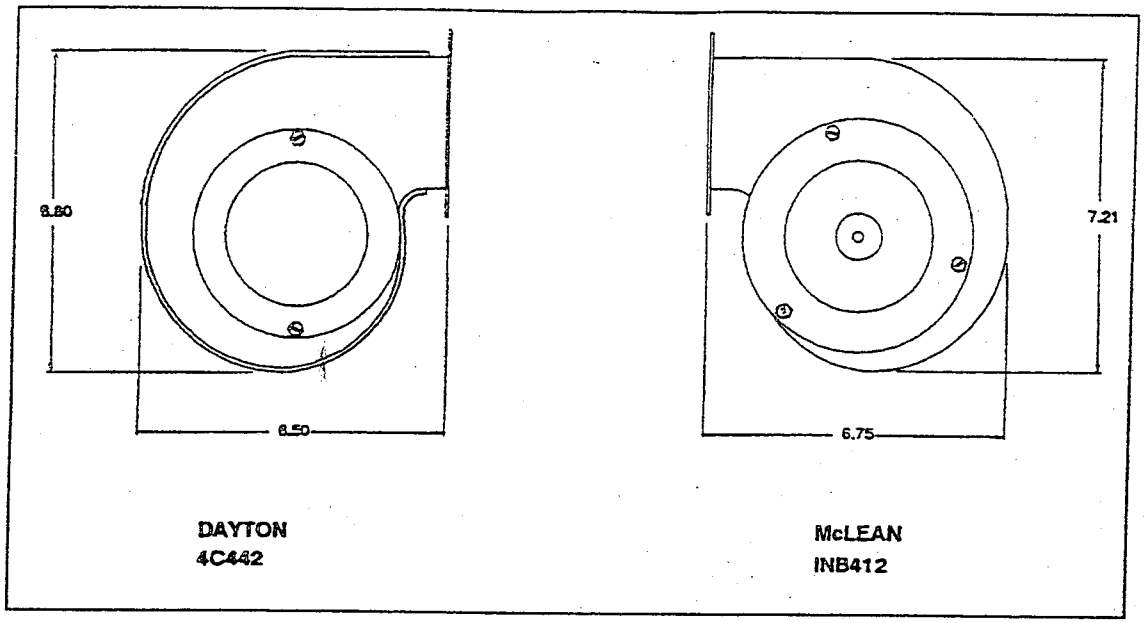


Figure 1-9. Model 2212, 2213 and 2214 Fan Dimensional Drawing

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Chapter 2 - Installation

This chapter provides the following installation information for the Model 2010 Series:

- Mounting
- Connecting the units
- Configuring the power supply
- Fan and duct assembly (not applicable for Model 2011)

Mounting

Before mounting any of the Model 2010 Series units, decide on a suitable location. Consider the following guidelines when selecting a location:

- The location should be as clear as possible of dust.
- Select an environment that does not exceed the specifications for temperature, humidity, altitude, etc., as listed in Table 1-2 in chapter 1.
- Locate the Model 2010 Series laser head and power supply in an area that provides a free flow of cooling air. For example, do not locate the power supply with its sides against a wall or other flat surface that would restrict the air flow through the vents on the sides.
- Make sure that the appropriate AC power is available, as specified for the system purchased.
- Maximum penetration of the power supply mounting screws must not exceed 0.187 inch.

Model 2210 Series Laser Heads

The Model 2210 Series Laser Heads are shown in figures 1-1 through 1-6. Refer to these figures for physical dimensions and mounting holes. The V-block base plate (or head base plate for Model 2211) has a variety of hole patterns, enabling users to replace products made by other manufacturers.

Caution

Although the head is equipped with a thermal cutout it is not recommended to run it without the fan in operation.

When mounting the laser head, observe the following:

- Allow sufficient clearance to operate the shutter at the front of the laser head.
- Provide enough room for cooling air circulation.

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Other than cooling air considerations, no special mounting requirements are necessary for the power supply. It can be mounted on any flat surface as long as there is enough room around the supply for cooling air circulation. The power supply can be bolted down if desired; see chapter 1, figures 1-7 and 1-8 for the physical dimensions and mounting holes of the power supplies. An AC power source, as specified for the system, should be within a reasonable distance.

Wiring the Model 2010 Series

Warning

Make sure the AC power plug is disconnected before attempting to wire the Model 2010 Series system.

As noted in the chapter 1, the Model 2010 Series is operated in remote mode. A DB-25 female remote connector is furnished with the power supply so that you can wire the Model 2010 Series for different types of operation.

The layout of the pins on the remote connector is shown in figure 2-1. Functions of the pins are listed in table 2-1. As shown in table 2-1, several of the pins are normally jumpered together to perform specific functions.

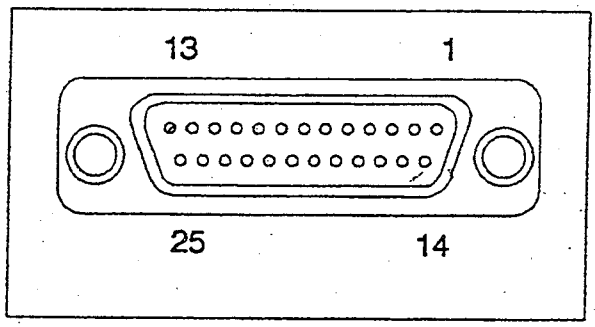


Figure 2-1. Remote Connector Pins as Viewed from Front of Power Supply

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Table 2-1. Remote Connector Pin Functions

Function	Pin Numbers	Comments
Laser Output Power Control [1] (light)	Pin 7 Apply +V Pin 11 Return	Apply 0 to 15 VDC. Calibration = 100 mV/mW. 10 KΩ input impedance.
Laser Current Control	Pin 6 Apply +V Pin 11 Return	Apply 0 to 6.0 VDC. [2] Calibration = 0.5 V/A. 10 KΩ input impedance.
Laser Output Power Monitor	Pin 8 + Output V Pin 11 Return	0.1 V/mW. [3] 0 to 12 VDC.
Laser Current Monitor	Pin 9 + Output V Pin 11 Return	0.1 V/Amp. 0 to 6.0 VDC.
Laser IDLE/RUN	Pin 4 + Pin 11 Return	Pin 4 is at +15 VDC for RUN. Ground for IDLE. Pin 4 current is 3 mA.
Laser Discharge ON/OFF	Pin 2 + Pin 11 Return	Pin 2 is at ground for OFF. +15 VDC for discharge ON. Pin 2 current is 3 mA.
Note: There is a 40 second delay on power up or on discharge on.		
Current or Light Control	Pin 5 + Pin 11 Return	Pin 5 is at +15 VDC for light control. Ground for current control. Pin 5 current is 3 mA.
DC Power Supplies	Pin 13 = +15 VDC Pin 12 = -15 VDC Pins 10, 11, 14, 20 thru 22, and 24 are Returns	20 mA available. 20 mA available. B common for the 2013
Chassis Ground	Pin 25	
Interlock [4]	Pin 1 Pin 3	10 VAC (2110), 5 VAC (2110A,2110B),100 mA shorted. [5] These pins must be shorted before laser will operate.

[1] For the 300MLM, calibration = 10 mV/mW; for the 15VL, calibration = 100 mV/mW.

[2] For the 2013 apply 0 to 6.5 VDC.

[3] For the 2013 30 mV/mW.

[4] In compliance with CDRH regulations, any breaking of the interlock circuit causes a permanent laser shutdown. To restart after re-establishing the interlock circuit, turn the AC main power OFF for approximately 10 seconds, then turn back ON.

[5] For the 2013 24 VAC, 100mA shorted.

All electrical specifications are ±5%.

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Laser Functions

Interlocks

Several electrical safety interlocks are incorporated into the Model 2010 Series. These interlocks are wired in a series circuit so that opening any one connection prevents the laser from starting (lasing), or if started, causes it to stop lasing. The green lamp at the front of the power supply will indicate the interlock is complete.

Note

The key switch is not part of the interlock circuit but needs to be turned ON in order for the laser to start.

The interlock circuit is a system safety circuit that prevents laser light discharge under certain conditions. The interlock circuit ensures that the following conditions exist before allowing current to flow through the laser tube:

1. AC power is applied to the power supply.
2. Remote plug pins 1 and 3 are shorted together
3. The umbilical cable is connected
4. The laser tube is not over heated.

If the laser is lasing and any one of the above conditions change, the interlock circuit will stop laser light discharge. After the correction of an interlock shutdown, AC power must be removed.

Model 2110 Series: with this model, it will always be necessary to remove and reconnect AC power. The model 2110 series power supply will operate certain class IV lasers and this safety requirement is mandated by CDRH.

Model 2110A/2110B Series: With these models, it is still necessary to remove and reconnect AC power. Although the 2110A/2110B series power supplies will not operate class IV lasers, the latching interlock function is maintained. Please contact Uniphase for information on defeating this function.

During an interlock shutdown, DC and AC voltages will be present in the power supply and laser head. Note that *the interlock circuit should not be used as a laser on/off switch.*

Warning

Line voltage is present at the laser head whenever the AC line is connected.

Some customer applications may require certain covers and/or doors to be included in the interlock safety circuit. This can be accomplished by wiring the appropriate switches in a series loop between remote plug pins 1 and 3.

The interlock circuit is shown in figure 2-2 for the 2110 Series Power Supply and in figure 2-3 for the 2110A and 2110B Series Power Supply.

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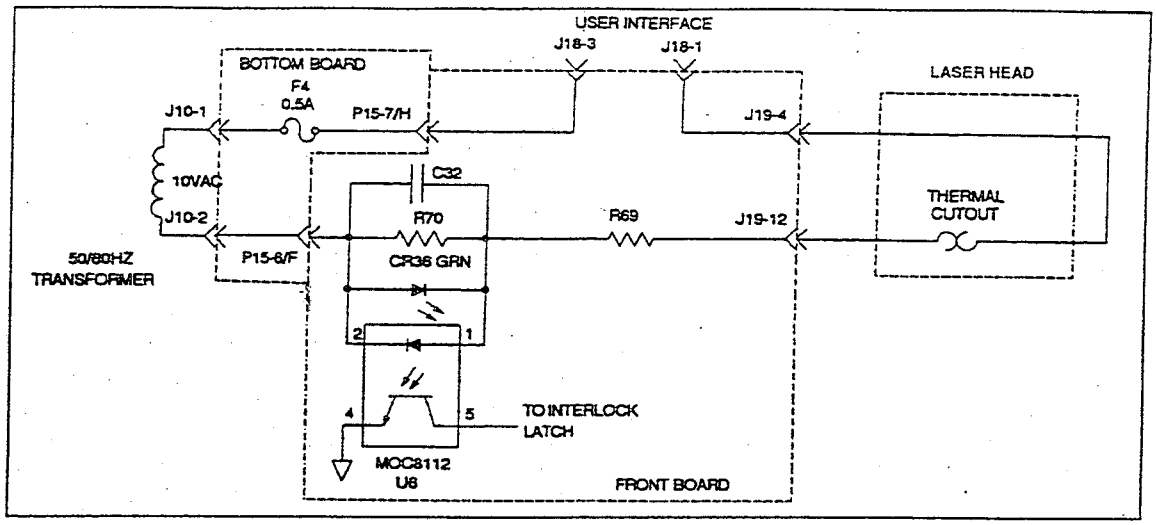


Figure 2-2. Model 2110 Series Power Supply Interlocks

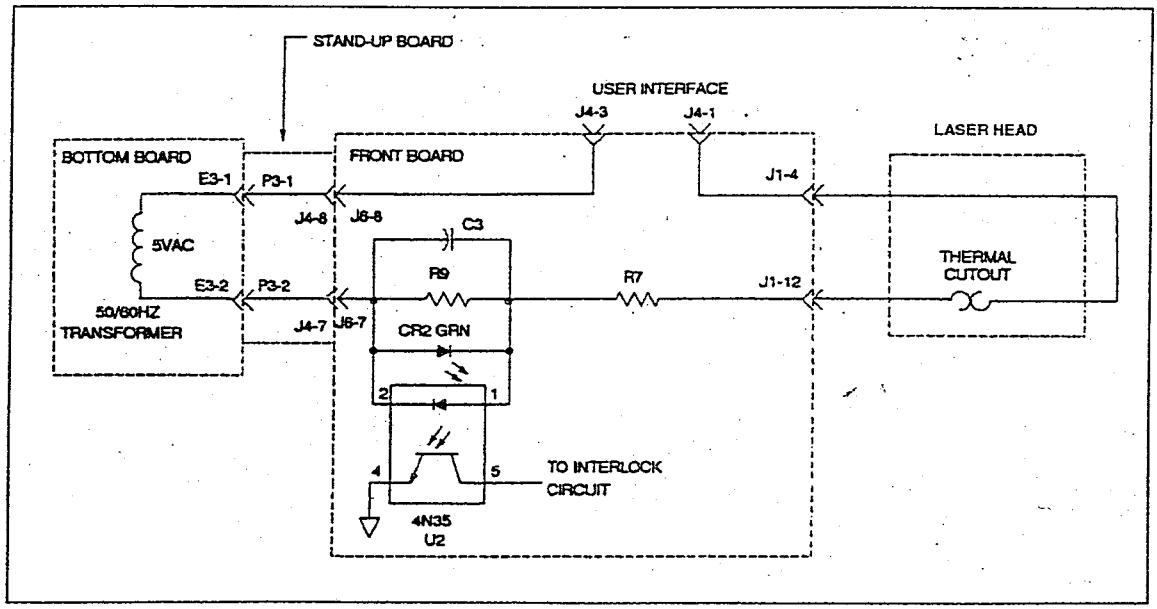


Figure 2-3. Model 2110A/2110B Series Power Supply Interlocks

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The various interlocks are described in the following paragraphs:

- 50/60 Hertz transformer: the 50/60 Hz transformer is located in the Power Supply and supplies 10 VAC (2110 Series), or 5 VAC (2110A/2110B Series) for the interlock circuit.
- 0.5 Amp Pico fuse (F4) is located on the bottom board.
- The KEY switch is located on the front panel of the power supply. The switch, when open, does not allow the laser to run. Note that the switch is not part of the interlock.
- The user interface connections are located in the remote connector (J18 for the 2110 Series power supply; J4 for the 2110A and 2110B Series power supplies) on the front panel. These connections, pins 1 and 3, must be shorted for the laser to operate.
- The 2110 Series front board components shown in figure 2-2 are part of the interlock latch circuit. When the interlock circuit is broken during the operation of the laser, the interlock latch is set and disables the power supply, until the AC voltage is removed and reapplied. This in compliance with CDRH requirements.
- The 2110A/2110B Series front board components shown in figure 2-3 are part of the interlock circuit. Note that when the interlock circuit is broken during the the operation of the laser, the power supply is disabled, but when the broken interlock circuit is corrected, the power supply will restart the laser *without* removing and reapplying AC power.
- The thermal cutout is located in the 2210 Series laser head and will open the interlock circuit, if the laser head temperature exceeds safe operating levels.

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± 15 VDC Power Supply "B" Ground

The ± 15 VDC Secondary Power Supplies, see figure 2-4 for the 2110 Series power supply and figure 2-5 for the 2110A and 2110B Series Power Supplies, are located on the bottom board and are available to the user at the DB25 remote connector, J18, (2110 Series) or J4 (2110A and 2110B Series) on the front panel.

B common is referenced to chassis ground by a 1 MΩ resistor in parallel with a 0.1 µF, 50 V film capacitor.

The Secondary Supplies provide power to the front board. If the 20 mA maximum on the remote plug connections, pins 12 and 13, is exceeded, the supplies will be loaded down and affect the performance of the supply.

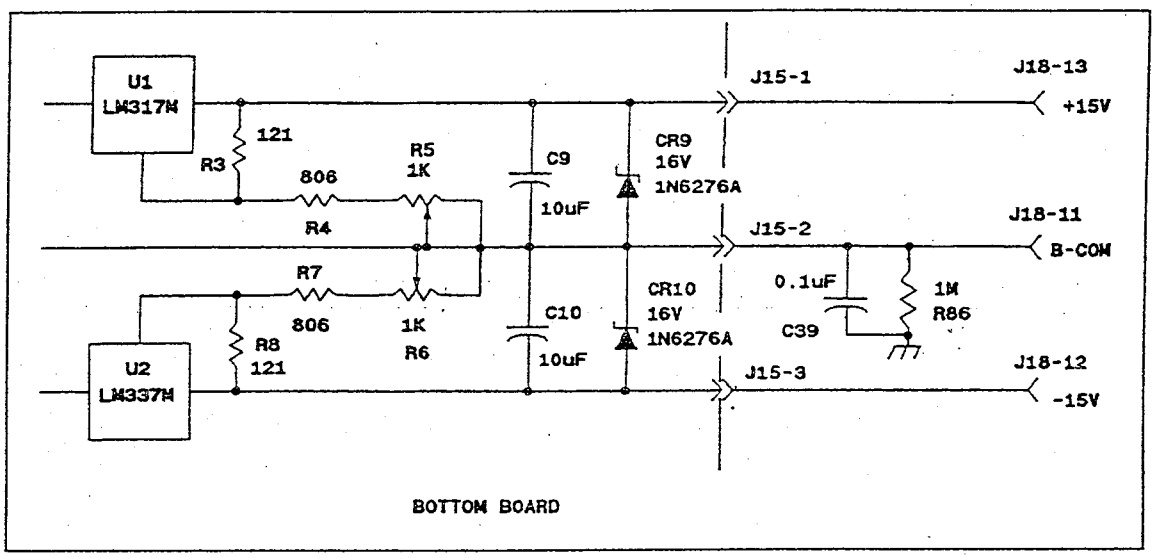


Figure 2-4. ±15 VDC Secondary Power Supplies, Model 2110 Series

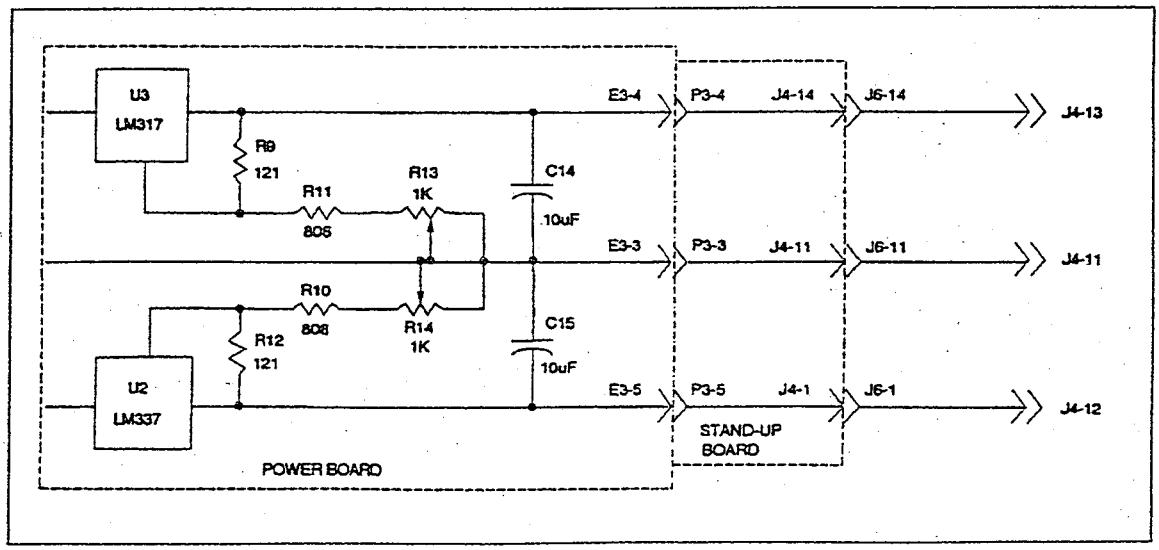


Figure 2-5. ±15 VDC Secondary Power Supplies, Model 2110A and 2110B Series

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Idle Function

The idle function, located on the front PCB, is used to lower the laser tube output power to minimum and prolong laser tube life. Minimum tube current level is approximately 4 amps. Using the idle function, whenever possible, will prolong the laser tube life, while maintaining the tube at operating temperature. Idle also allows you to align optics or set up experiments while the laser light output is at a lower, safer level. While in idle, the laser operates as in current control mode. To use the idle function, remote plug pin 4 must be connected to pin 20 ("B" ground). This can be accomplished using a remote switch or a manual jumper. The removal of the connection between remote plug pin 4 and pin 20 immediately returns the laser to the previously set power level and operating mode. Time from full power to idle is approximately 1 millisecond.

Simplified schematic diagrams of the idle circuit is shown in figures 2-6 (2110 power supply) and 2-7 (2110A and 2110B power supplies).

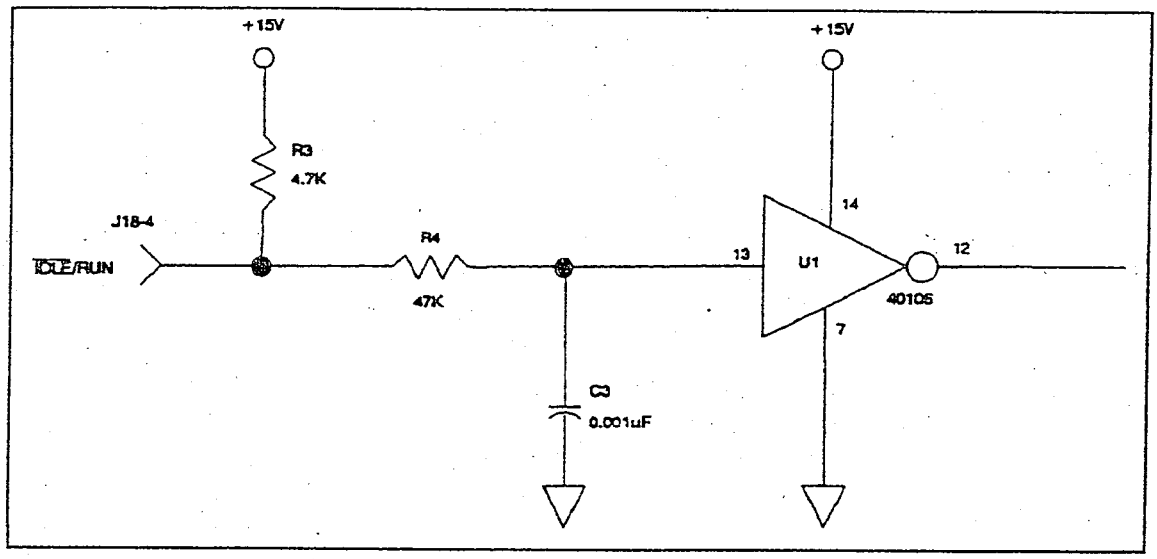


Figure 2-6. Idle Circuit, Model 2110 Series Power Supply

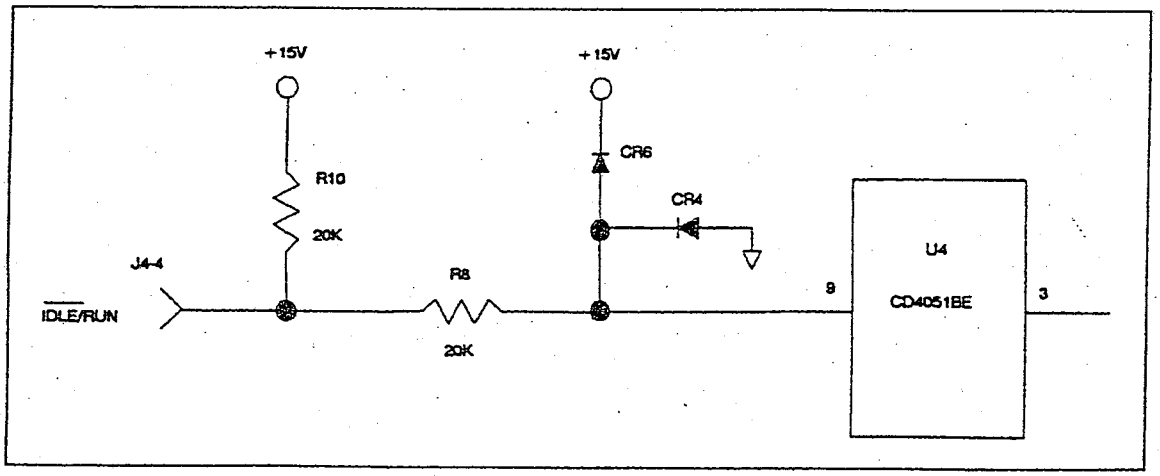


Figure 2-7. Idle Circuit, 2110A and 2110B Power Supplies

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Discharge ON\OFF Circuit

The discharge ON/OFF circuit, located on the front PCB, is used to turn the laser tube current on or off. To turn on the tube current, +15 VDC is applied to pin 2 of the remote connector, by using either pin 13 or a remote system controller. After a 20-second delay, as required by CDRH, a start pulse command will be issued to the tube.

Simplified diagrams of the discharge ON/OFF circuit is shown in figures 2-8 (2110 power supply) and 2-9 (2110A and 2110B power supplies).

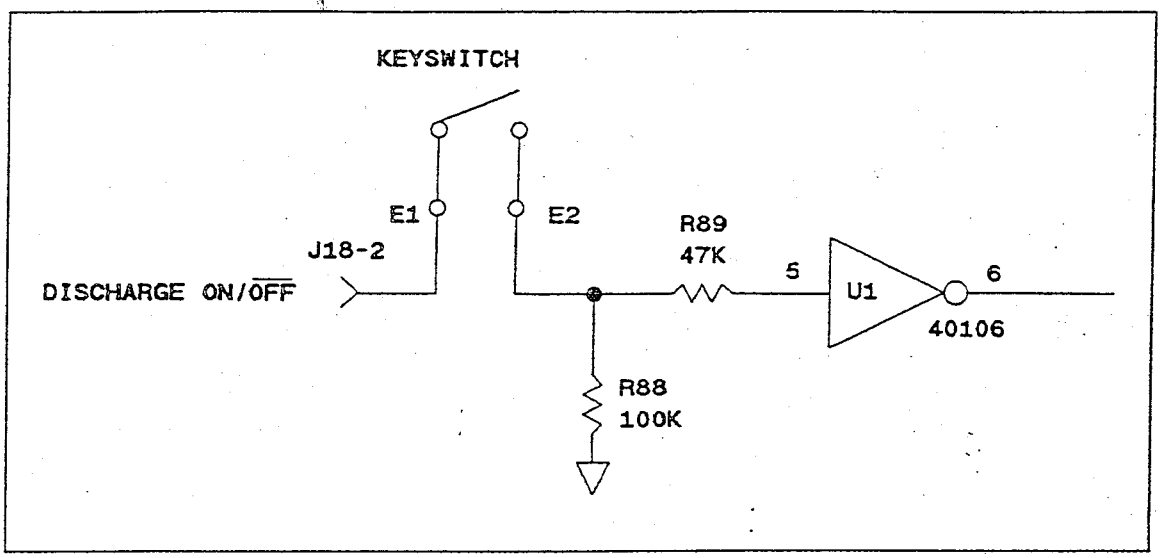


Figure 2-8. Discharge ON/OFF Circuit, Model 2110 Series Power Supply

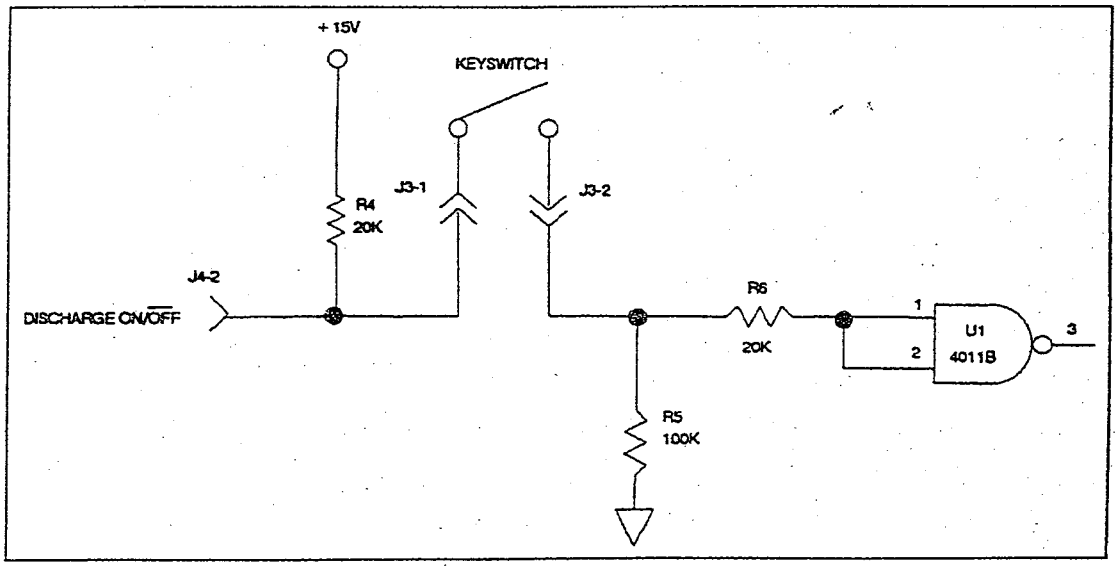


Figure 2-9. Discharge ON/OFF Circuit, Model 2110A and 2110B Series Power Supplies

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Power Monitor

The output power (light) of the laser tube can be monitored by measuring the voltage between pin 8 of the remote plug and pin 20 ("B" ground). Each tenth (0.1) of a volt measured is equal to one (1.0) milliwatt of laser output power. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.) This voltage can be used by a properly designed computer interface to monitor the laser operation.

Simplified diagrams of the power monitor circuit are shown in figures 2-10 (2110 power supply) and 2-11 (2110A and 2110B power supplies).

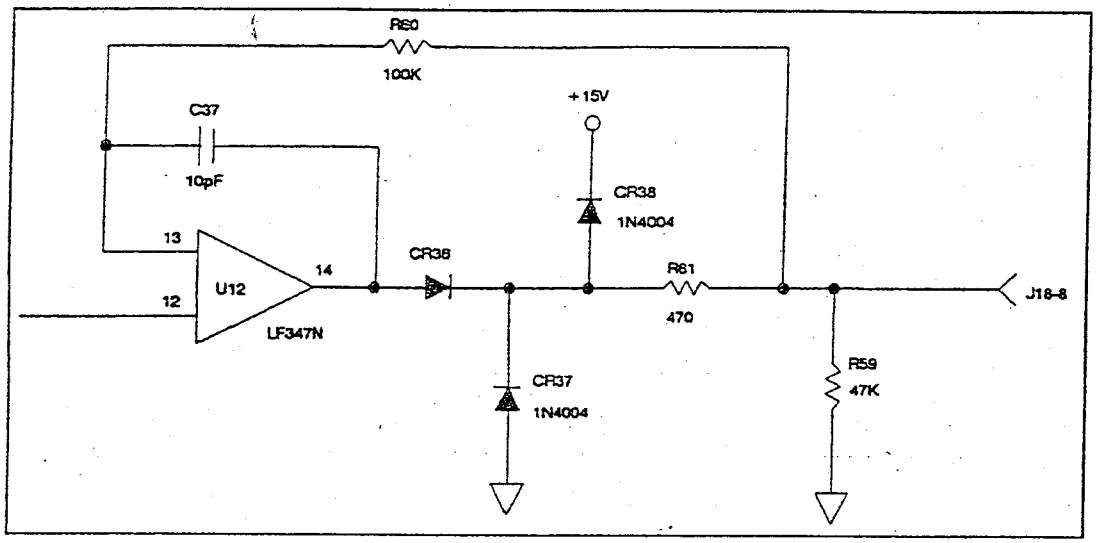


Figure 2-10. Power Monitor Circuit, Model 2110 Series Power Supply

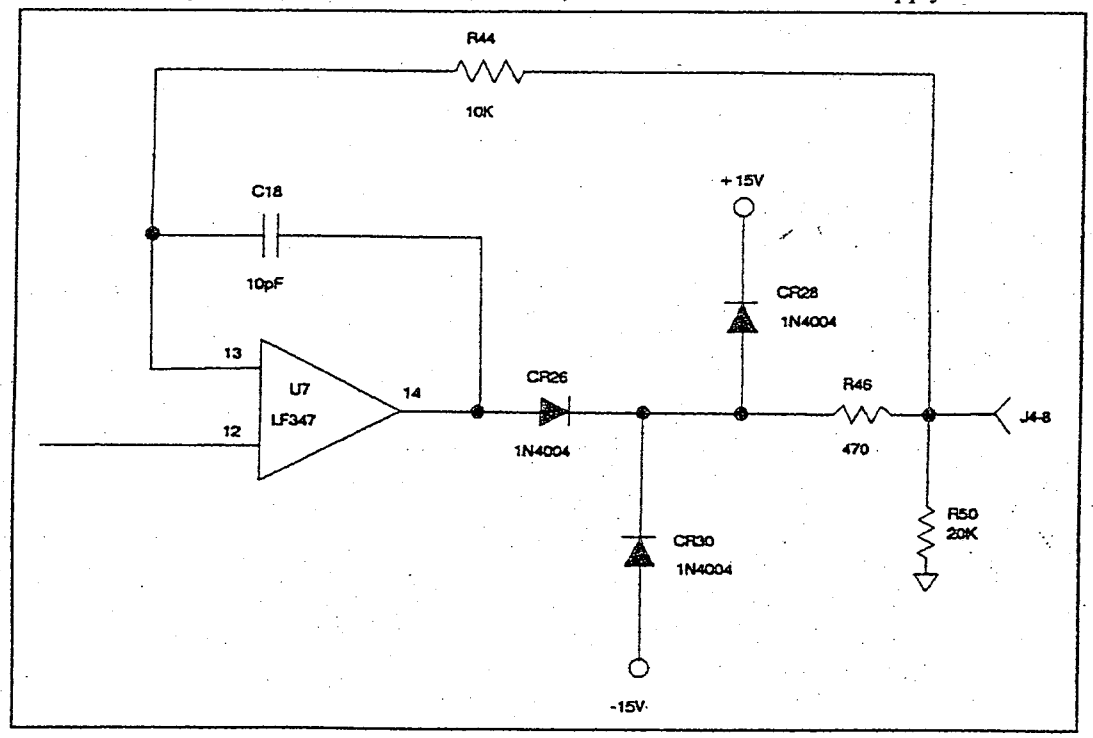


Figure 2-11. Power Monitor Circuit, Model 2110A/2110B Series Power Supplies

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Current Monitor

Laser tube current can be monitored by measuring the voltage between pins 9 and 20 ("B" ground) of the remote plug. See figures 2-12 and 2-13. Each tenth (0.1) of a volt is equal to one (1.0) amp of tube current. One of the functions of the current monitor is to help determine when the laser tube is nearing its "end of life".

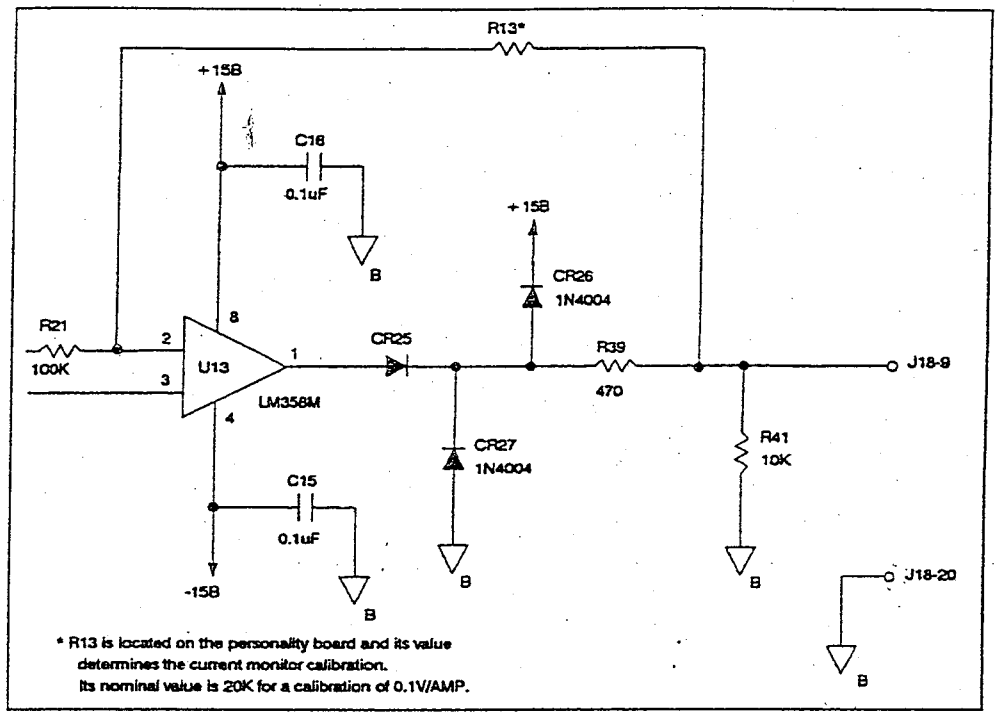


Figure 2-12. Current Monitor Circuit, Model 2110 Series Power Supply

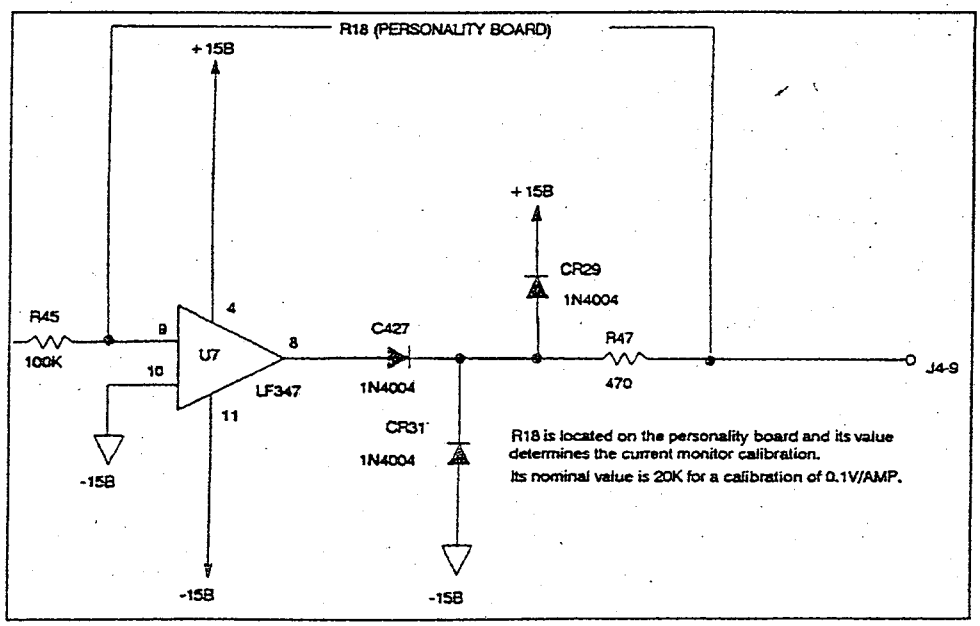


Figure 2-13. Current Monitor Circuit, 2110A/2110B Power Supplies

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Remote Mode

The Model 2010 Series is operated in remote light control or remote current control modes. Power for the modes of operation can be obtained from the power supply's internal 15 VDC, or from an external 15 VDC source. The input voltage determines the laser tube output power. The ratio is 0.1V input = 1mW output. For example, an input voltage of 0.7V produces a 7mW output. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.)

The idle and shutdown functions are operational in remote mode.

Remote Light Control

External Power Source

To wire the remote connector for remote light control using an external 15 VDC source of power, proceed as follows:

1. Remove the jumper, if connected, from pins B COM and 5 on the remote connector.
2. Connect a jumper between pins 1 and 3 on the remote connector.
3. Connect a variable voltage source (0 to 15 VDC) between pin 11 (negative) and pin 7 (positive) on the remote connector. Do not exceed 15 volts. An input voltage of 0.1V will produce 1mW of output power. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.)
4. Connect a jumper between pins 2 and 13 on the remote connector.

The connections for an external power source are illustrated in figure 2-14.

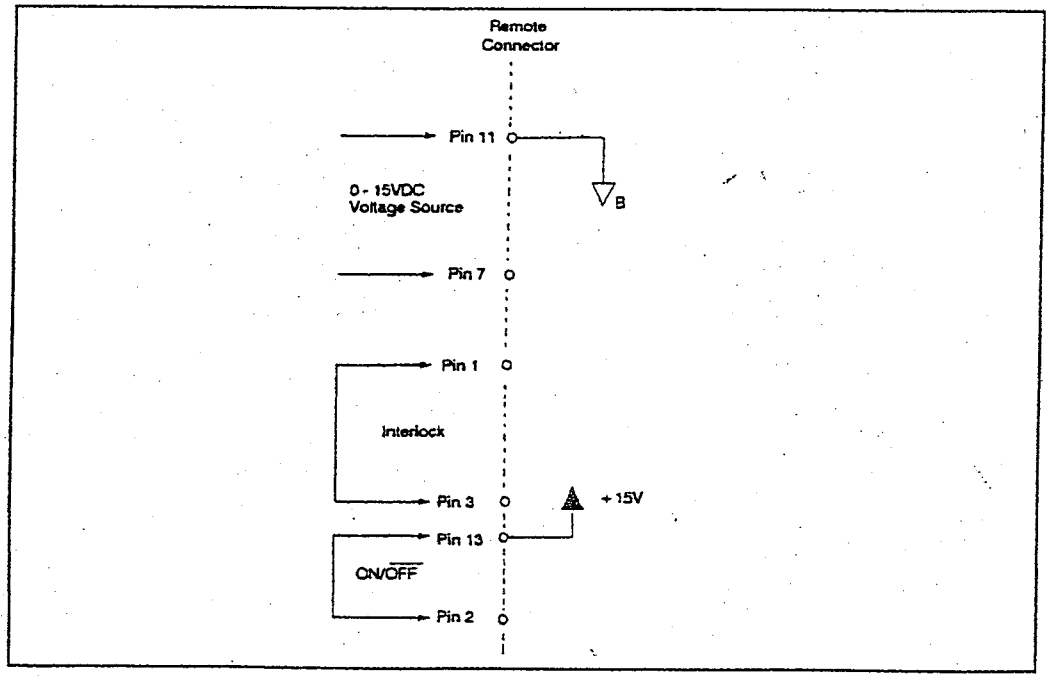


Figure 2-14. Remote Light Control Connections Using External Power Source

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Internal Power Source

To wire the remote connector for remote light control using the power supply's internal 15 VDC source, proceed as follows:

1. Remove the jumper, if connected, from pins 20 and 5 on the remote connector
2. Connect a jumper between pins 1 and 3 on the remote connector.
3. Connect a linear potentiometer (1K ohm minimum resistance) between pins 11, 7, and 13 as illustrated in figure 2-15. Note that 0.1V input voltage between pins 11 and 7 will produce 1.0mW of laser output power. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.)
4. Connect a jumper between pins 2 and 13 on the remote connector.

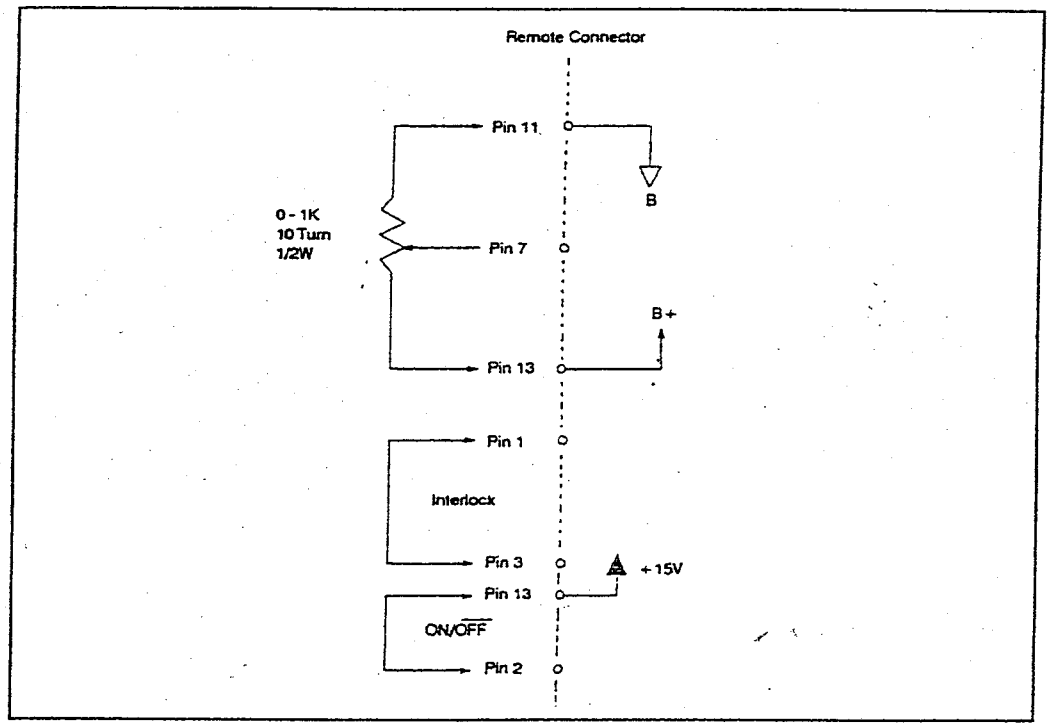


Figure 2-15. Remote Light Control Connections Using the Power Supply

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Remote Current Control

External Power Source

To wire the remote connector for remote current control using an external 15 VDC source of power, proceed as follows:

1. Connect a jumper between pins 22 and 5 on the remote connector.
2. Connect a jumper between pins 1 and 3 on the remote connector.
3. Connect a variable voltage source (0 to 15 VDC) between pin 11 (negative) and pin 6 (positive) on the remote connector. Do not exceed 15 volts. An input voltage of 0.5V will produce an output current of 1A. The power supply minimum current is 4 amps, thus the output power will not increase until more than 2 volts is applied to the appropriate pins.
4. Connect a jumper between pins 2 and 13 on the remote connector.

The connections are illustrated in figure 2-10.

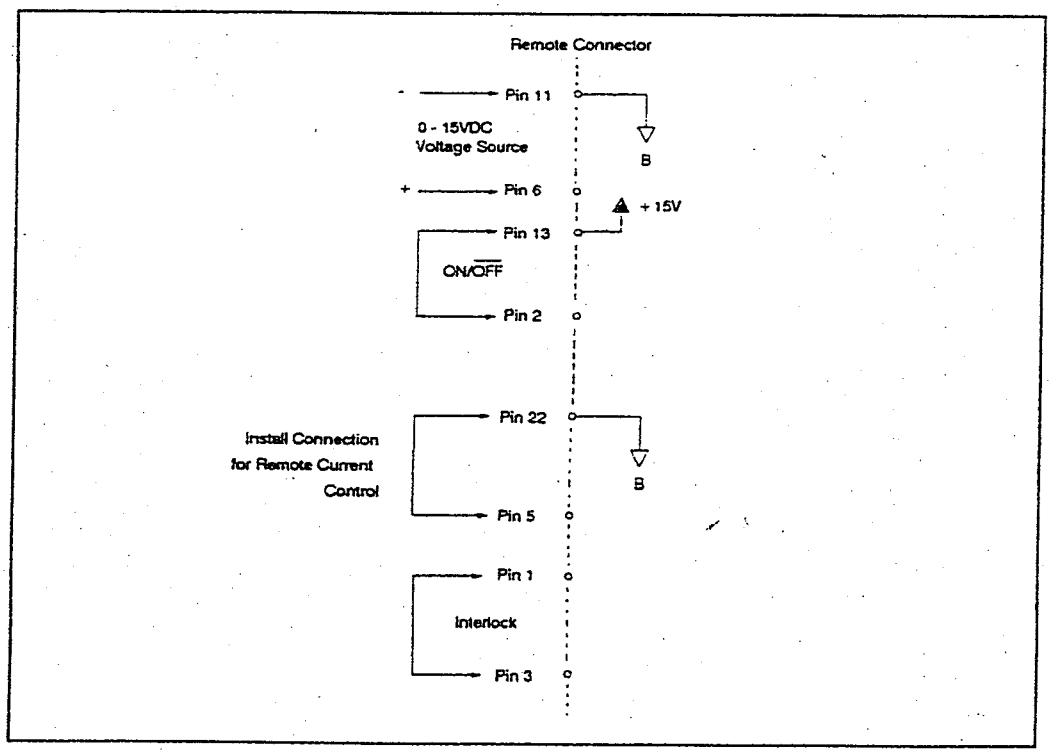


Figure 2-16. Remote Current Control Connections Using External Power Source

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Internal Power Source

To wire the remote connector for remote current control using the power supply's internal 15 VDC source, proceed as follows:

1. Connect a jumper between pins 22 and 5 on the remote connector.
2. Connect a jumper between pins 1 and 3 on the remote connector.
3. Connect a 1K linear potentiometer (1K ohm minimum resistance) between pins 11, 6, and 13 as illustrated in figure 2-17.
4. Connect a jumper between pins 2 and 13 on the remote connector.

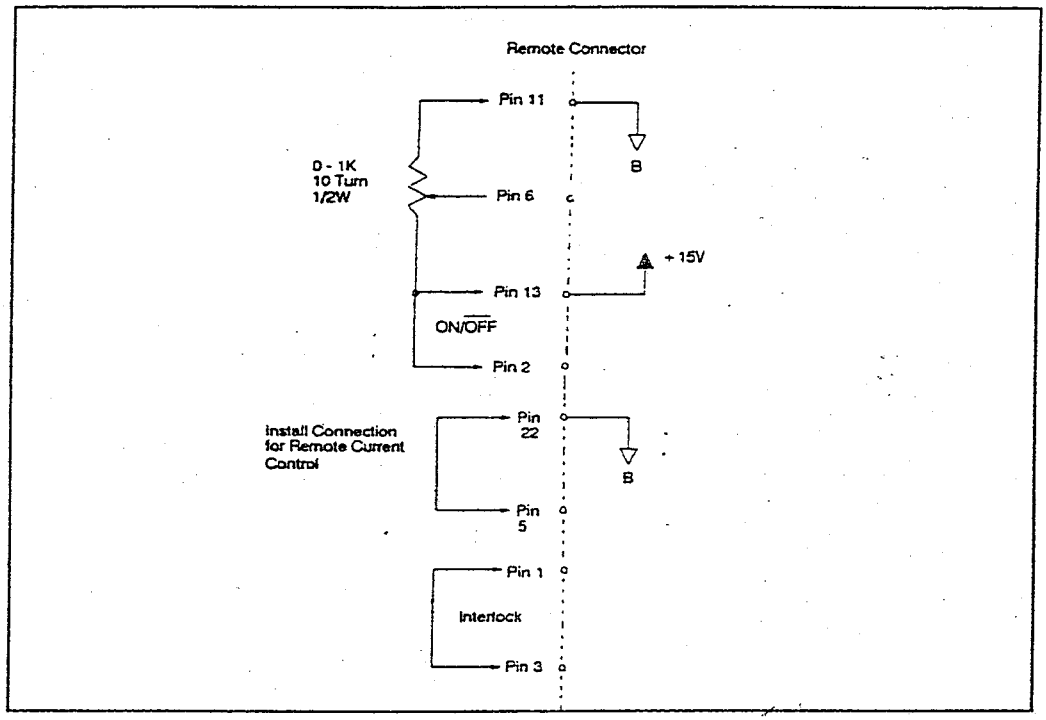


Figure 2-17. Remote Current Control Connections Using the Power Supply

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Connecting the Umbilical Cable

The umbilical cable connects the laser head to the power supply. One end of the umbilical connector is permanently attached to the laser head through a strain-relief adapter. The other end of the cable connects to the power supply and consists of two parts:

- A 14-pin female connector that plugs into the bottom connector on the front of the power supply. See figure 2-18.
- A 9-pin male connector that connects to the high-voltage plug on the front of the power supply. See figure 2-18.

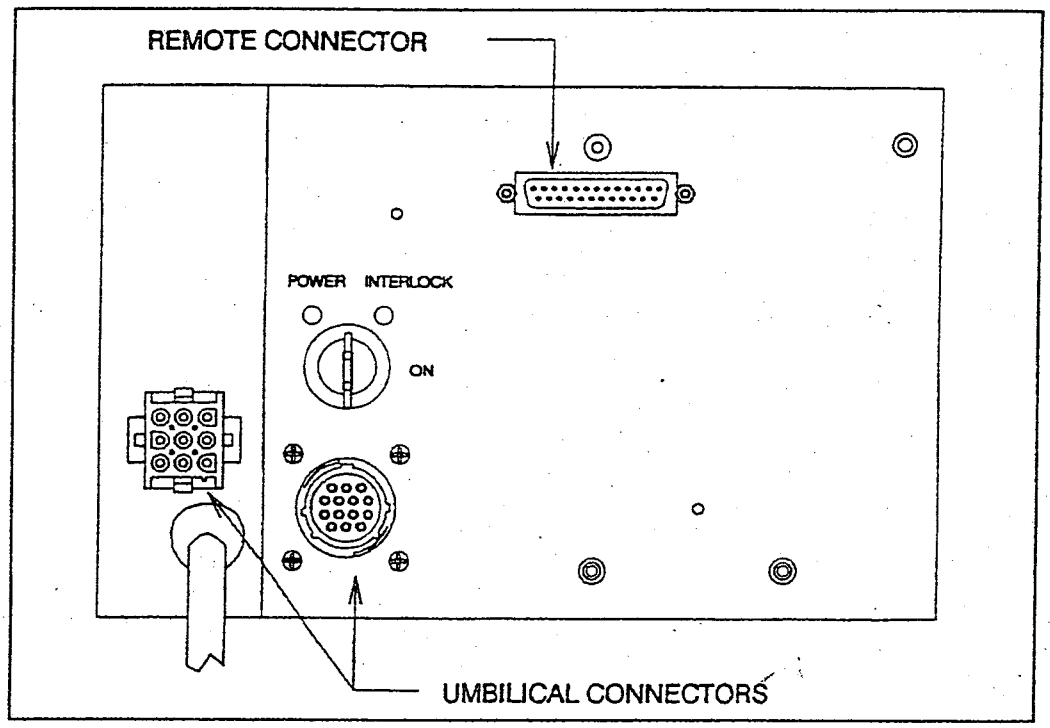


Figure 2-18. Power Supply Front Panel

Both connectors are keyed to prevent improper insertion. Connect the umbilical cable to the power supply by inserting the 14-pin connector into the matching plug and rotating the knurled ring clockwise. Plug the 9 pin male connector into the high-voltage plug. Be sure to seat the connector all the way into the plug and install the mounting screws.

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Connecting AC Power

Caution

Make sure all connections are completed and the umbilical cable is connected before connecting AC power to the power supply.

Model 2110 Series Power Supply (for the Model 2113 Power Supply see below)

Plug the AC power connector into the appropriate AC power outlet, as specified for system purchased. The circuit should be protected by a 20-amp circuit breaker.

The Model 2110 Series Power Supply can be configured for 100, 120, 200, 208, 220, or 240 VAC operation. The instructions for configuring the power supply are as follows:

1. Measure the AC input voltage.
2. Unplug the power cord and wait 10 minutes to allow the high-voltage capacitors to discharge.
3. Remove the sheet metal piece that covers the top and one side of the power supply.
4. There is a large metal strap (JP1) on the top PCB. This strap can be located in two positions: parallel to the front panel face (100, 110 or 120 VAC), or perpendicular to the front panel face (200, 208, 220, or 240 VAC).
5. There are two switches (SW1 and SW2) on the top PCB near the front panel face.
6. SW1 is on the right and SW2 is on the left. When SW1 is in the left position, the strap should be parallel to the front panel (100 or 120 VAC). When SW1 is in the right position, the strap should be perpendicular (200, 208, 220, or 240 VAC).
7. When SW2 is in the left position the power supply will operate at 90 to 114 VAC or 180 to 229 VAC, depending on which way JP1 and SW1 are positioned. When switch SW2 is is the right position the power supply will operate at 115 to 132 VAC and 230 to 264 VAC, depending on which way JP1 and SW1 are positioned.
8. Note the configuration for 200 VAC operation in Japan, 208 VAC operation in the USA, and 220 VAC operation in Europe or other countries is the same (JP1 perpendicular, SW1 in the right position, and SW2 in the left position).
9. Turn unit on, check filament voltage (should be 3.1 V ± 0.2 V). The two large lugs on the rear of the tube are the easiest place to measure the filament voltage.

Warning

High DC voltage is present in the cathode whenever the AC line is conneced.

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10. If the filament voltage is not within specification, the line voltage is probably not in specification. This should be verified with the same meter. If the line voltage is not in specification, a transformer may be required.

11. Replace sheet metal covers.

Model 2113 Power Supply

Plug the AC power connector into the appropriate AC power outlet, as specified for system purchased. The circuit should be protected by a 30-amp circuit breaker.

The Model 2113 Power Supply can be configured for 100, 120, 200, 208, 220, or 240 VAC operation. The instructions for configuring the power supply are as follows:

1. Measure the AC input voltage.

2. Unplug the power cord and wait 10 minutes to allow the high-voltage capacitors to discharge.

3. Remove the sheet metal piece that covers the top and one side of the power supply.

4. When SW2 is in the left position the power supply will operate at 180 to 229 VAC. When switch SW2 is is the right position the power supply will operate at 230 to 264 VAC.

Model 2110A Series Power Supply

Caution

Make sure all connections are completed and the umbilical cable is connected before connecting AC power to the power supply.

Plug the AC power connector into the appropriate AC power outlet, as specified for system purchased. The circuit should be protected by a 20-amp circuit breaker.

The Model 2110A Series Power Supply can be configured for 100 or 120 VAC operation. However, the 2011A and 2014A systems will not operate below 106V. The instructions for configuring the power supply are as follows:

1. Measure the AC input voltage.

2. Unplug the power cord and wait 10 minutes to allow the high-voltage capacitors to discharge.

3. Remove the sheet metal piece that covers the top and one side of the power supply.

4. Refer to the transformer on the left side of the power supply. There is a brown wire that connects to one of two taps on this transformer. If the measured voltage is 114 VAC or lower, connect the brown wire to the rear tap. If the measured voltage is 115 VAC or higher, connect the brown wire to the front tap.

5. Replace sheet metal covers.

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Caution

Make sure all connections are completed and the umbilical cable is connected before connecting AC power to the power supply.

Plug the AC power connector into the appropriate AC power outlet, as specified for system purchased. The circuit should be protected by a 20-amp circuit breaker.

The Model 2110B Series Power Supply can be configured for 200, 208, 220 or 240 VAC operation. The instructions for configuring the power supply are as follows:

1. Measure the AC input voltage.
2. Unplug the power cord and wait 10 minutes to allow the high-voltage capacitors to discharge.
3. Remove the sheet metal piece that covers the top and one side of the power supply.
4. Refer to the transformer on the left side of the power supply. There is a brown wire that connects to one of two taps on this transformer. If the measured voltage is 229 VAC or lower, connect the brown wire to the rear tap. If the measured voltage is 230 VAC or higher, connect the brown wire to the front tap.
5. Replace sheet metal covers.

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Model 2210 Series Laser Head *

* Note that this section does not apply to the Model 2211 Laser Head, since it has rectangular laser head..

Because the laser head, shown in figures 2-20 and 2-21, is cylindrical in shape it should be mounted on V-shaped mounting blocks such as those available from Uniphase (Head Mounting Assemblies, see figure 1-1).

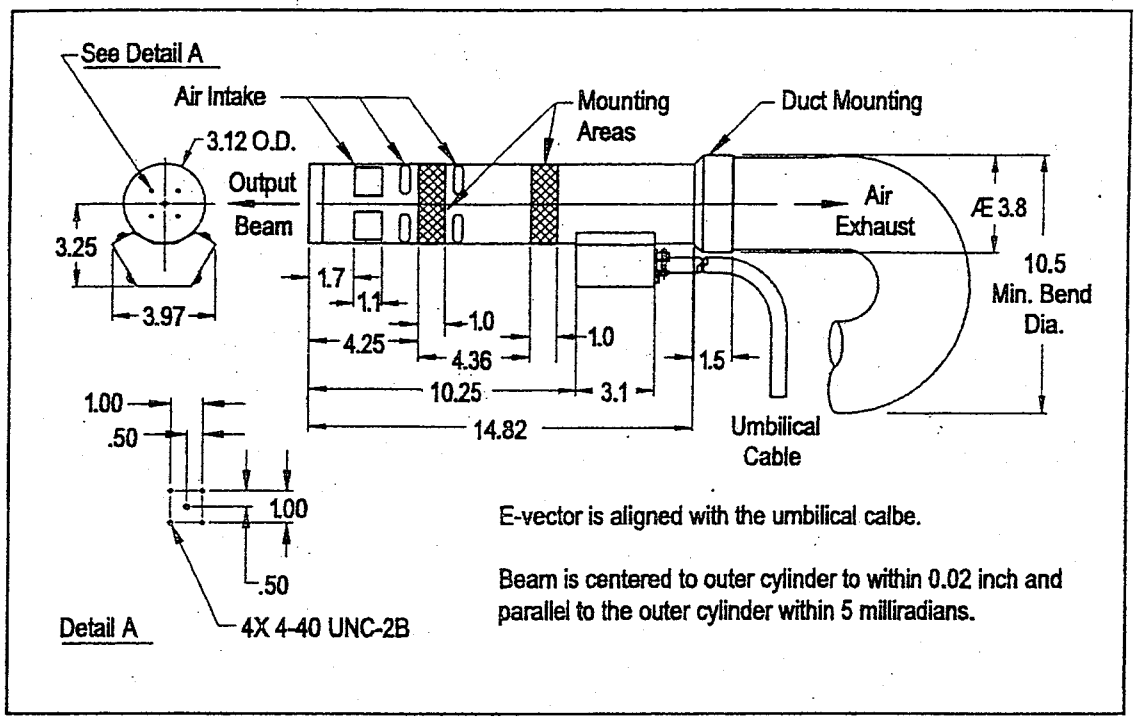


Figure 2-19. Mounting the Model 2212 and 2214 Laser Head

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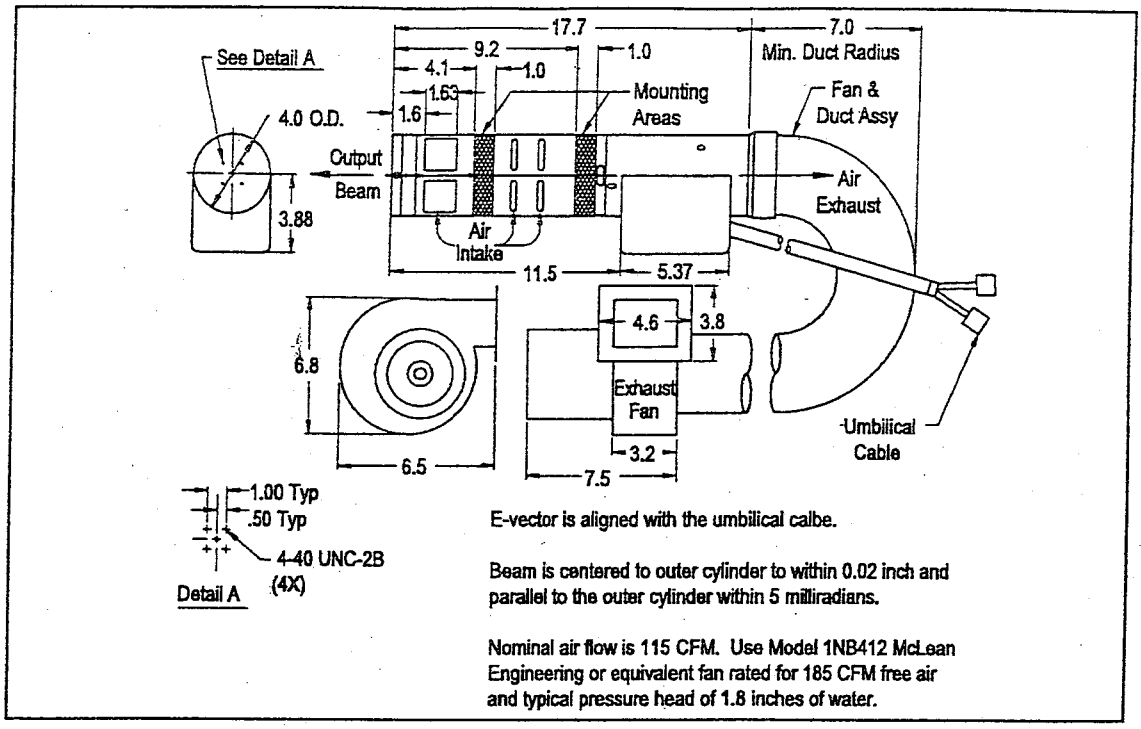


Figure 2-20. Mounting the Model 2213 Laser Head

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Attaching the Fan and Duct Assembly *

* Note that this section does not apply to the Model 2011 Laser System.

Attach the fan and duct assembly to the laser head by sliding the duct assembly into the rear (open end) of the laser head and twisting the duct assembly until the mounting screw on the duct assembly is latched to the laser head. Hand tighten the screw; see figure 2-22.

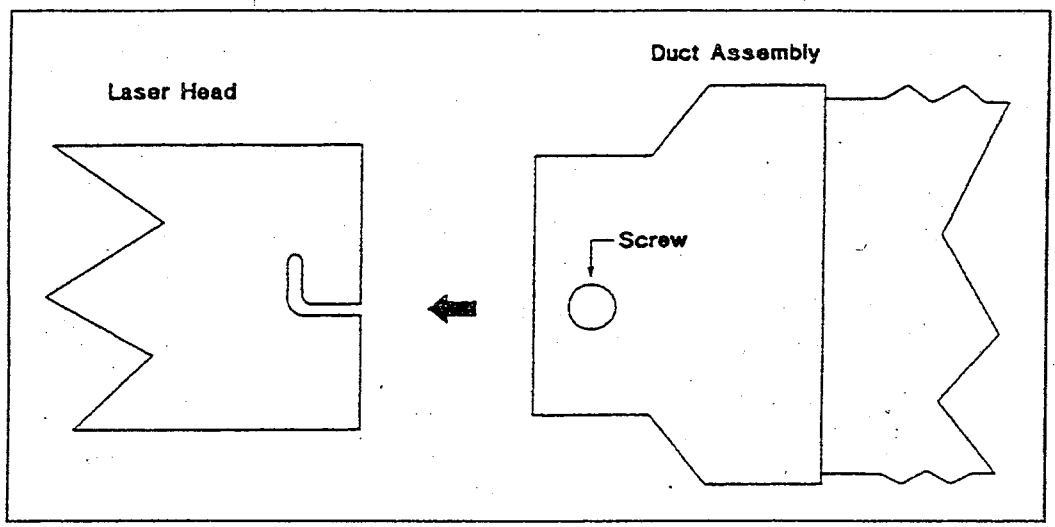


Figure 2-22. Attaching the Duct Assembly to the Laser Head.

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Chapter 3 - Operation

This chapter contains operation information for the Model 2010 Series Laser System:

- Controls and indicators
- Description of operating modes
- Turning on AC power
- Remote light control
- Remote current control

Controls and Indicators

The Model 2010 Series contains operational controls both on the power supply and the laser head. The only indicators are a power on indicator lamp and interlock lamp on the front panel of the power supply.

Model 2110 Series Power Supply Controls and Indicators

All power supply controls and indicators are located on the front panel. See figure 3-1.

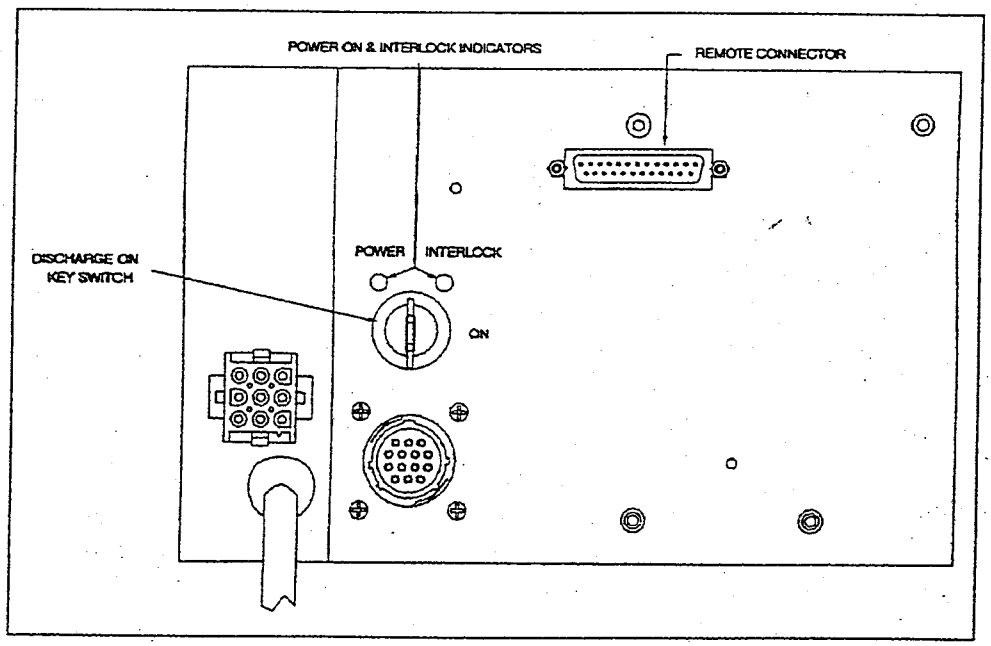


Figure 3-1. Model 2110 Series Power Supply Controls and Indicators

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The controls and indicators are described below.

DISCHARGE ON Key Switch.

The **DISCHARGE ON** switch, operated by a key, allows DC power to be applied to the laser head. AC filament voltage is always present at the head when line voltage is applied to the power supply. A time delay circuit provides a 30- to 45-second safety period before the laser light comes on.

Warning

High DC voltage is always present at the laser head when the AC line is conneced.

POWER ON Indicator

The **POWER ON** indicator lights when the Model 2110 Series Power Supply is plugged in and signals that AC power is applied to the power supply.

INTERLOCK Indicator.

The **INTERLOCK** indicator lights when:

1. AC power is applied to the power supply.
2. Remote plug pins 1 and 3 are shorted together.
3. The umbilical cable is connected.
4. The laser tube is not overheated.

Model 2210 Series Laser Head Controls

The only control on the laser head is a shutter control. It is manually operated and located at the front of the laser head. This control opens and closes the shutter on the front of the laser head, thus allowing the laser light beam to exit the head.

Applying AC Power

Warning -- High Voltages

The laser head and power supply of this laser product contain electrical circuits operating at HIGH VOLTAGE.

Whenever access to the interior of the laser head or power supply is necessary, DISCONNECT THE POWER SUPPLY FROM THE POWER SOURCE AND ALLOW 10 MINUTES FOR THE HIGH-VOLTAGE CAPACITORS TO DISCHARGE.

When access to the laser head or power supply is necessary and laser operation is necessary:

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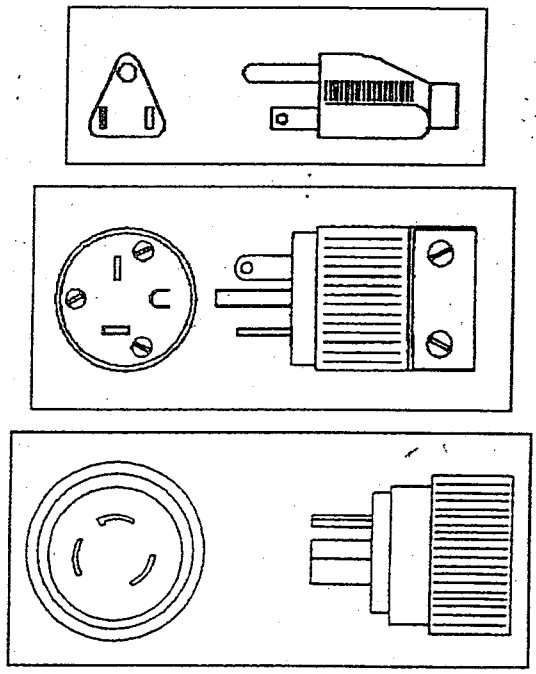
EXERCISE EXTREME CAUTION TO AVOID CONTACT WITH HIGH VOLTAGES. THIS IS A LINE OPERATED POWER SUPPLY. IT IS NOT ISOLATED FROM THE INPUT POWER LINE. THESE HIGH VOLTAGES ARE LETHAL.

To apply AC power to the system:

1. On the front of the power supply, turn DISCHARGE ON key switch to off (counter-clockwise).
2. With a flat-blade screwdriver, open the shutter on the front of the laser head.

Warning

This product is equipped with a 3-wire grounding-type plug (a plug having a third (grounding) pin). This pin will fit only a grounding-type AC outlet. If you are unable to insert the plug into the outlet, contact a licensed electrician to replace the outlet with a properly-grounded outlet.



Do not defeat the purpose of the grounding-type plug.

3. Plug the AC power cord into a suitable outlet. The POWER ON indicator should light.
4. The INTERLOCK indicator should light if interlock is complete. See chapter 2, page 17.
5. Turn DISCHARGE ON key switch to ON. After approximately a 30 to 45 second delay, the laser should start. The delay allows the laser tube cathode to reach its operating temperature and also provides time for the operator to move to a safe area away from the laser.

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Warning

Always have the power supply cover and the laser head cover in place when the laser is connected to the AC outlet.

Limit access to the laser to those familiar with the equipment. Keep the laser out of the hands of inexperienced or untrained personnel.

When the laser is on and the output beam is not being terminated in an experiment or optics system, the beam should be blocked.

NEVER LOOK DIRECTLY INTO THE MAIN LASER BEAM. NEVER SIGHT DOWN A BEAM INTO ITS SOURCE.

Do not allow reflective objects to be placed in the laser beam. Laser light scattered from a reflective surface can be as damaging as the original beam. Even objects such as rings, watchbands, and metal pens or pencils can be hazardous.

Turn laser power down to a low level to minimize intensity of accidental stray reflections or refractions when aligning a chain of optical components in the laser beam.

Set up experiments so that the laser beam is *NOT* at eye level.

Post warning signs and limit access to the laser area when the laser is in operation.

Even when wearing laser safety glasses, there are two hazards that exist while operating CW (continuous-wave) ion lasers:

- **The glasses make the beam itself invisible, therefore increasing the danger of skin burns.**
- **Laser glasses may not afford enough protection if a very powerful beam is viewed directly.**

NEVER LEAVE THE LASER *ON*, *OPEN*, AND *UNATTENDED*!

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Note

A protection circuit is provided in the power supply. This circuit protects against line power surges and current over-loading by shutting off power to the laser tube. To reset the system, you must remove AC power from the power supply (unplug). Then restart the system as described in *Applying AC Power* on page 37.

In the event of an AC power failure, the laser will automatically restart after a 30- to 45-second delay.

Remote Light Control

In the remote light control mode of operation, the laser output power, or light intensity, is adjusted to a desired setting with a remote variable power source (0 to 15 VDC). The voltage source is connected to the system through the remote connector on the front of the power supply (see chapter 2, page 25).

The light intensity is held constant at the selected setting by light monitoring feedback circuitry. This feedback loop varies the laser tube current to compensate for light intensity fluctuations due to ambient temperature changes and electronic noise.

In remote light control mode, either of two sources of power can be used:

- An external 0 to 15 VDC power source
- The internal 15 VDC power from the Model 2110 Series Power Supplies

Connections for both sources of power are presented in chapter 2.

To operate the system in remote light control mode:

1. Make sure the system is wired correctly for this mode of operation. See chapter 2 for wiring instructions.
2. You can read the output power with a laser power meter placed in front of the laser beam or by connecting a voltmeter to pins 8 (+) and 11 (-) of the remote connector. When using a voltmeter, the calibration is 0.1V/mW. For example, a reading of 0.7 volts indicates 7 milliwatts of output power. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.) The accuracy is ± 5%.
3. Set the remote control to the desired power setting.

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Remote Current Control

In the remote current control mode of operation, the current through the laser tube is varied by means of a remote variable power source (0 to 15 VDC). This power source is wired into the system through the remote connector on the front of the power supply.

Remote current control mode holds the laser tube current constant. The light intensity, or output power, of the laser tube changes due to ambient temperature and electronic noise. This mode of operation is used mainly for testing and calibrating the system.

To operate the system in remote current control mode:

1. Make sure the system is wired correctly for this mode of operation. See chapter 2, page 27.
2. You can read the output power with a laser power meter placed in front of the laser beam or by connecting a voltmeter to pins 8 (+) and 11 (-) of the remote connector. When using a voltmeter, the calibration is 0.1V/mW. For example, a reading of 0.7 volts indicates 7 milliwatts of output power. (Model 2013 calibration is 30 mV/mW, except for 2013-300MLM which is 10 mV/mW.) The accuracy is ± 5%.
3. To monitor the laser current, connect a voltmeter to pins 9 (+) and 11 (-) of the remote connector. The calibration is 0.1V/A. Note that the output power can be monitored simultaneously at pins 8 and 11.
4. Set the remote control to the desired current setting.

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Using the Model 2500 Remote Interface Controller

To achieve first operation of the Model 2010 Laser System with the Model 2500 Remote Interface Controller, proceed as follows:

1. Open the aperture at the front of the laser.
2. Make sure that the INTERLOCK switch is in the LOCAL ON position.
3. Connect the power cord of the power supply to an appropriate power outlet.
4. Turn key switch to ON.
5. At the remote interface, under TUBE CURR., push ON. (See figure 3-2).

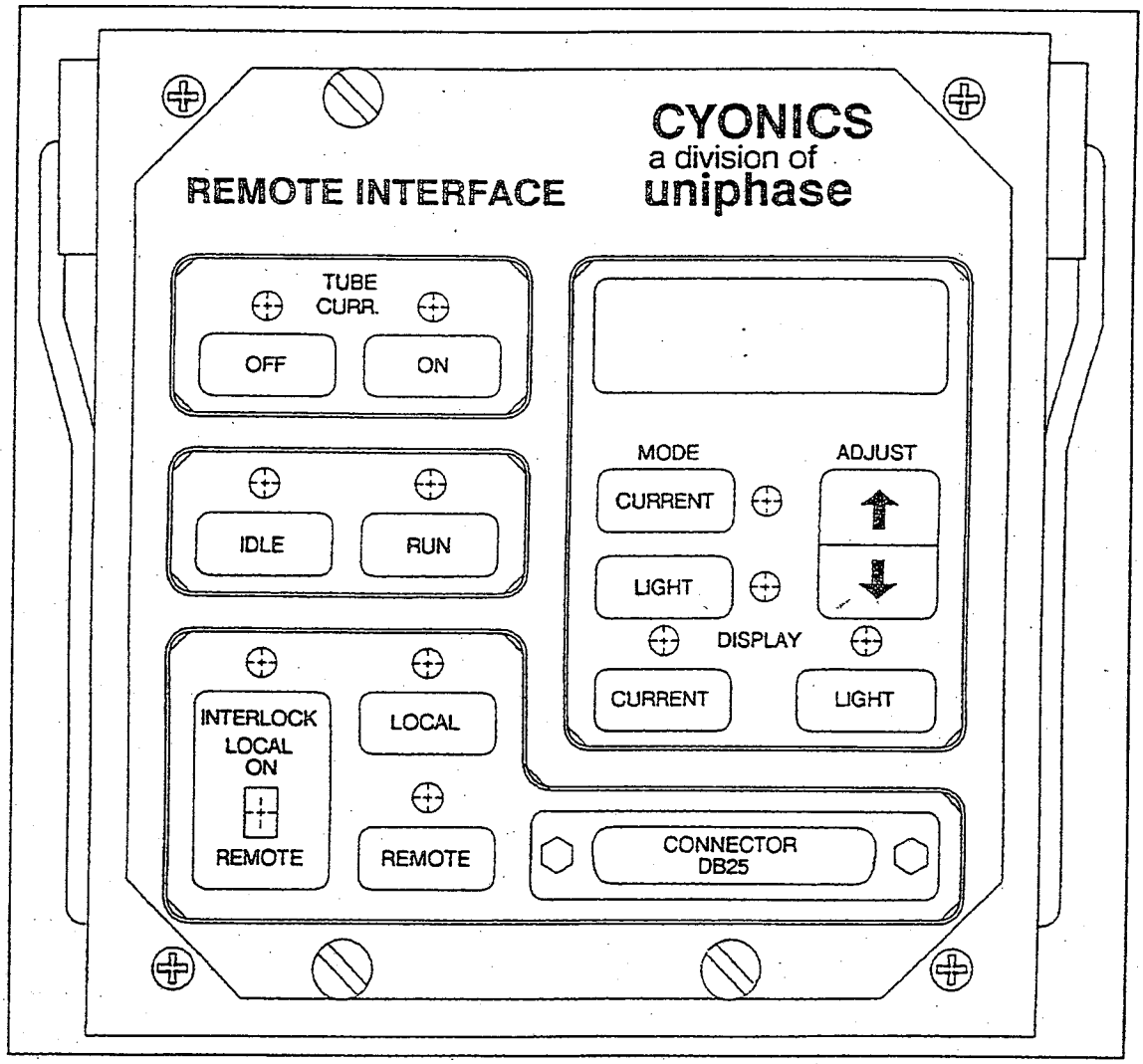


Figure 3-2. Remote Interface Front Panel

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After approximately a 40-second delay, the laser will light. The laser will come on in the "IDLE" mode with a current setting of approximately 4.0 amps. For normal operation, touch the RUN control on the remote interface front panel. Use the up arrow and down arrow controls to increase or decrease the current.

Note

When the laser is at the extreme low or high end of a setting, you must hold down on the arrow control for several seconds to bring the digital circuitry back "on scale." You will then see the meter reading change.

A summary of the remote interface control functions is presented below. For each function except the INTERLOCK slide switch, an LED is lighted to indicate the active function.

TUBE CURR

Used to shut off lasing while maintaining voltage to the cathode filament. When the power supply is first turned on, this function will be OFF. Push ON for normal operation.

IDLE/RUN

Used to operate the laser at a low current setting for extended life. When the power supply is first turned on, this function will be in the IDLE setting. Push RUN for normal operation.

INTERLOCK, LOCAL/REMOTE

The interlock is a safety feature that prevents the laser from activating if all connections in the interlock loop are not made. Part of the loop extends through the DB-25 interface connector to the user's system. If a user system is not connected to the DB-25 connector, the slide switch must be in the LOCAL ON position and the LOCAL control must be activated. If operation of the laser by means of the user's system is desired, move the slide switch to REMOTE and touch the REMOTE control. In this case, the interlock loop must be completed through the user's system. To initiate remote use, you may either depress the key pad marked REMOTE or pulse pin 23 low (0V). To bring control back to local, either depress the key pad marked LOCAL or pulse pin 15 low (0V).

Note

If the interlock loop is opened (with the slide switch or by any other means), the laser will not reactivate until two things are done: 1) The loop must be closed, and 2) the supply must be disconnected from AC power and reconnected again.

MODE

When in the LIGHT control mode, the light output of the laser is being detected and is used to control the current from the power supply. This mode maintains a very stable optical power output. When in the CURRENT control mode, the power supply is simply producing a constant current without regard to the light output.

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DISPLAY

The LIGHT setting displays the optical power output of the laser while the CURRENT setting displays the current supplied to the tube. Switching from one DISPLAY to the other does not affect the MODE setting discussed above.

ADJUST

Used to increase or decrease the meter reading, which may be indicating either current or optical output power depending on which DISPLAY setting is selected. At extreme low or high setting, you may need to hold down on the control for several seconds before the meter reading begins to change.

The laser is designed so that it may be operated from the remote interface, from the user's system, or from both alternately. The DB-25 connectors on the controller cable are a "pass through" arrangement so that you can connect your controller cable to the connector with or without the remote interface in place. If the remote interface is not in place, you need only attach your control cable to the DB-25 connector on the front of the power supply. If the remote interface is already attached to the power supply, you would connect your cable to the female connector at the front of the remote interface.

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Using the Model 2499 or 2501 Remote Controllers

The Model 2499 and 2501 remote controllers are designed to operate with any 2110 or 2110A/2110B Power Supply. Interfacing is done by mating the male DB25 connector at the rear of the controller to the female DB25 connector on the front panel of the power supply. Optionally, the controller may be connected to the power supply using the supplied remote cable.

To achieve first operation of either controller, proceed as follows:

1. Open the aperture at the front of the laser.

Caution

The interlock function on the Model 2499 and 2501 controllers is shorted on the printed circuit board and is not available as a user function. You should use this type of controller only if your application does not require an interlock as a safety feature.

2. Plug the power supply AC cord into an appropriate AC power outlet.
3. Plug the umbilical cord into the power supply. Turn KEY switch ON.
4. At the remote controller, set the ON/OFF switch to ON. Set the RUN/IDLE switch to IDLE.
5. After approximately 40 seconds, the laser will light. The laser will come on in the IDLE mode with a current setting of about 4 amps (depending of the model of the laser head). For normal operation, set the RUN/IDLE switch to RUN, and the LHT/CUR switch to LHT (depending on your intention). The current can be adjusted (when in CURRENT MODE) by the current control potentiometer. The light power can be applied (when in LHT MODE) by adjusting the light control potentiometer.

Summary of Remote Controller Functions

ON/OFF

This function is controlled by the ON/OFF switch. When the switch is OFF, voltage is applied to the laser tube, but the power supply is electronically shut down. The switch must be in the ON position before the laser tube will start.

RUN/IDLE

This function is controlled by the RUN/IDLE switch. When the switch is in the IDLE position, the tube current is limited to 4 amps or less. To operate the laser tube at high power ratings or to adjust the power, the switch must be set on RUN.

LHT/CUR

This function is controlled by the LHT/CUR switch. When the switch is in the LHT (light) mode, the control electronics keeps the light power at a constant output and a servo loop is activated which reduces ligth fluctuations to a low level. When the CUR (current) mode is selected, the current through the tube is constant, but light noise is typically high due to the AC current and voltage that energizes the cathode.

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LHT CONTROL POT

Light power is controlled by this potentiometer (LHT MODE). The Model 2499 has a trim pot on the printed circuit board, the Model 2501 has a panel pot with knob.

CUR CONTROL POT

Tube current is adjusted with this potentiometer (CUR MODE). The model 2499 has a trim pot on the printed-circuit board; the Model 2501 has a panel pot with knob.

CUR MONITOR

This is a test jack with a calibration of 0.1 volt/amp.

LHT MONITOR

This is test jack with a calibration that depends on the tube model.

COM

A test jack that is at SELV (PCB common) potential. The LHT and CUR monitors can be measured with respect to this test jack.

EMISSION INDICATOR

An LED (CR1) will light when the controller is in the ON mode.

Model 2499, General Description

The Model 2499 is a single printed-circuit board (PCB) with components including a DB25 connector at the back of the PCB. This connector is used to interface with the power supply. The functions ON/OFF, RUN/IDLE, and LHT/CUR are controlled by three switches which are located on the PCB and marked appropriately. Light and current levels are required by trimpots located on the PCB.

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Model 2501, General Description

The Model 2501 contains the same PCB as the Model 2499. In addition, it has a sheet metal enclosure and uses panel-mounted potentiometers with knobs.

Light Mode Output Range Selection

The output range of the Models 2499 and 2501 remote controllers is selected by means of a 6-position header (J1) and up to three 2-position shunts. The number and location of the shunts is determined by the calibration factor and specified output of the laser systems. See the table below for the Model 2012 series systems.

On the Model 2499, J1 is located on the component side of the PCB between the ON/OFF and the RUN/IDLE switches. J1, pin 1 is on the right.

On the Model 2501, J1 is located on the circuit side of the PCB and may be accessed by removing the back panel. J1, pin 1 is located on the left side of the header.

Models 2011, 2012, 2014		
OUTPUT POWER	**REMOTE OUTPUT VOLTAGE RANGE**	**SHUNT POSITIONS**
< = 5 mW	0 - 1 V	None
> 5 mW & < = 25 mW	0 - 5 V	J1, pins 1 and 2
25 mW & < = 40 mW	0 - 8.4 V	J1, pins 1 and 2 and pins 3 and 4
> 40 mW	0- 15 V	J1, pins 1 and 2, pins 3 and 4, and pins 5 and 6

Model 2013		
OUTPUT POWER	**REMOTE OUTPUT VOLTAGE RANGE**	**SHUNT POSITIONS**
0 < pwr < = 75 mW	0 - 5 V	J1, pins 1 and 2
75 mW < pwr < = 100 mW	0 - 8.4 V	J1, pins 1 and 2 and pins 3 and 4
100 mW < pwr	0 - 15 V	J1, pins 1 and 2, pins 3 and 4, and pins 5 and 6

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63 Baypointe Parkway, San Jose, CA 95134
el: (408) 434-1800 Fax: (408) 433-3838

NIPHASE LTD., 2 Viewpoint, Babbage Road, Stevenage, Hertfordshire SG1 2EQ England
el: 44 (1438) 745055 Fax: 44(1438) 742490

NIPHASE VERTRIEBS-GmbH, Arbeostrasse 5, D-85386 Eching/Munich Germany
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163 Baypointe Parkway, San Jose, CA 95134
Tel: (408) 434-1800 Fax: (408) 433-3838

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