Spectra-Physics

MODEL 155, 155A & 155C
HELIUM-NEON LASER

Instruction Manual

LASER PRODUCTS DIVISION

1250 W. Middlefield Road, Mountain View, CA 94042-7303
Siemensstrasse 20, D-6100 Darmstadt-Kranichstein, West Germany

Part Number 230000-058A (revised 2/83)

FOREWORD

This instruction manual includes the Models 155, 155A and 155C. These models are identical products in operation and generate output power of less than 1 mW, the only power range approved by the Bureau of Radiological Health for educational or demonstration purposes. The Model 155A, unlike the Models 155 and 155C, includes a 1" - 32 threaded accessory bezel for mounting of special optics and a 1/4" - 20 mounting bracket for supporting the laser on a standard optical post. The 155C is specifically approved for import into Canada, and affixed with a Canadian Radiation Warning Logotype, as shown in this manual (see Laser Safety).

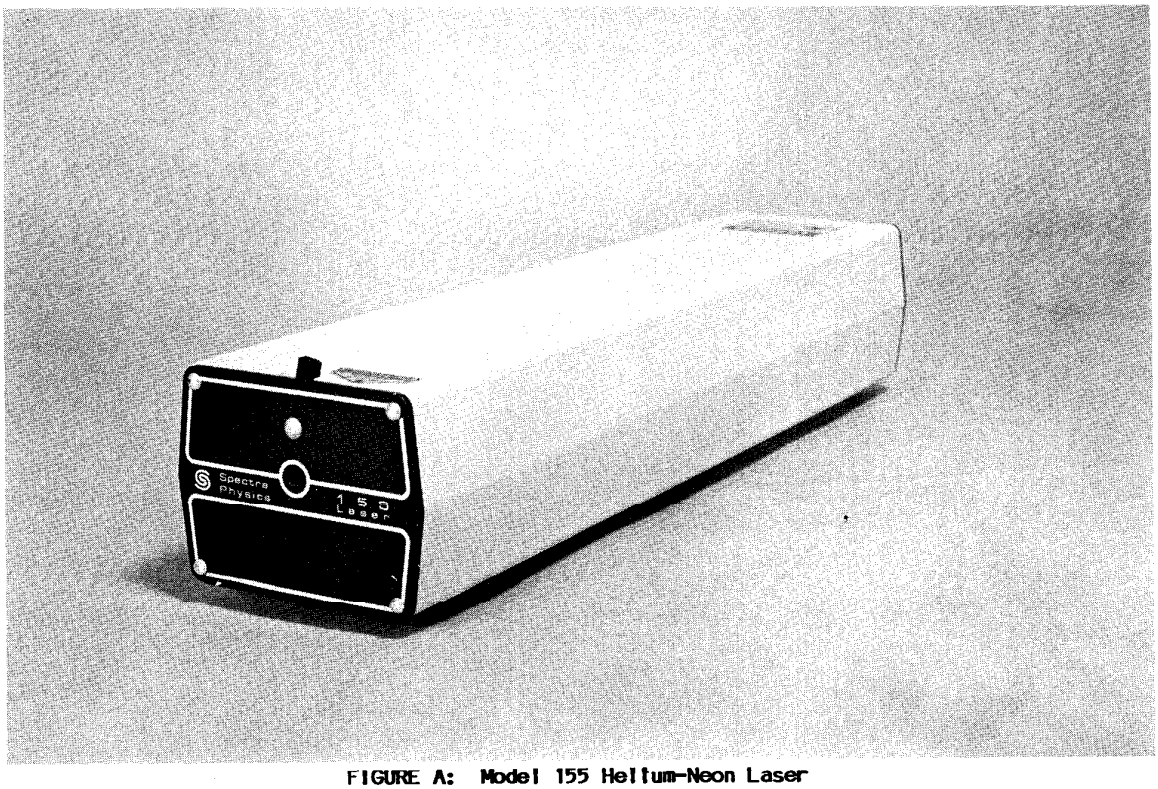


FIGURE A: Model 155 Heltum-Neon Laser

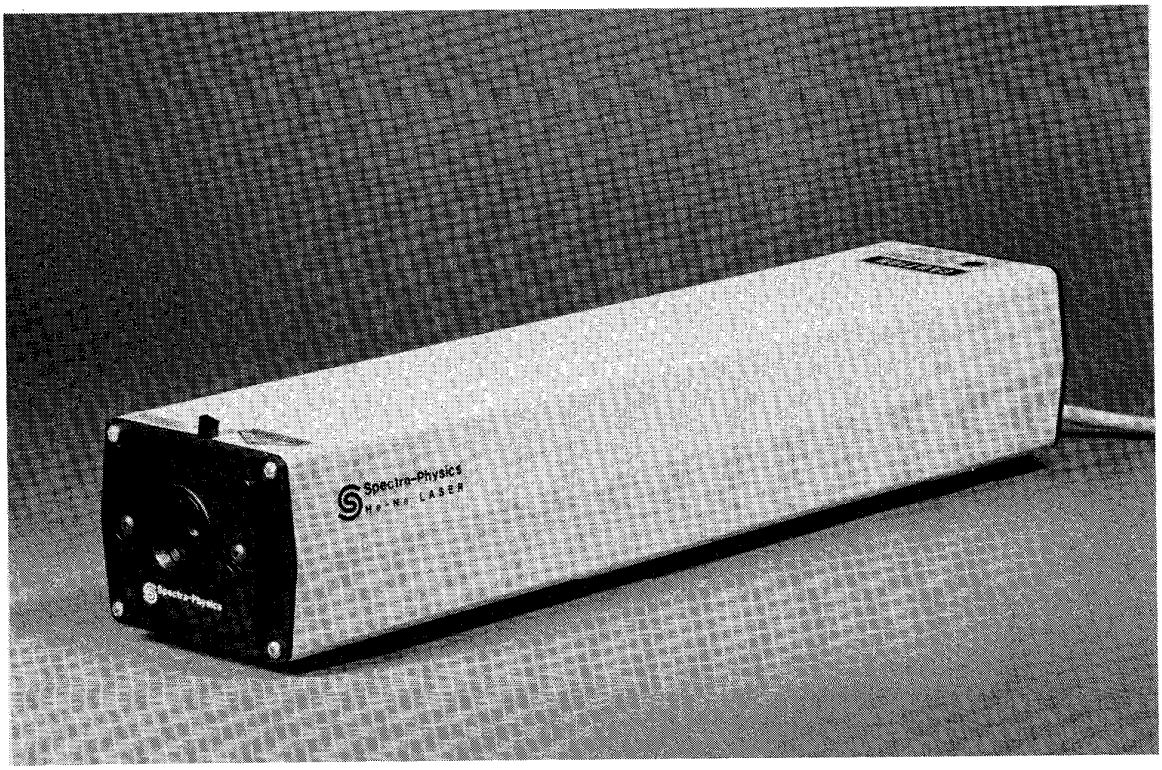


FIGURE B: Model 155A Heltum-Neon Laser

TABLE OF CONTENTS

INTRODUCTION

SPECIFICATIONS.....1-3

LASER SAFETY

SAFETY RECOMMENDATIONS FOR LASER USE.....2-1
MAINTENANCE STEPS NECESSARY TO KEEP THIS LASER PRODUCT
IN COMPLIANCE WITH 21 CFR 1040.10 & 1040.11.....2-1

INSTALLATION AND OPERATION

UNPACKING.....3-1
INSPECTION.....3-1
MODEL 155, 155A AND 155C COMPONENTS.....3-1
OPERATION.....3-1
ATTACHMENT AND ALIGNMENT OF ACCESSORIES (MODEL 155A ONLY).....3-1
MOUNTING THE LASER (MODEL 155A ONLY).....3-2
CIRCUIT DESCRIPTION.....3-2

MAINTENANCE AND TROUBLESHOOTING

TROUBLESHOOTING.....4-1
- No Emission Indicator Light.....4-1
- Lights, No Output Beam.....4-1

CHANGING THE PLASMA TUBE.....4-1
PARTS LISTS
- Power Supply PC Board Assembly.....4-2
- Plasma Tube-Power Supply Assembly.....4-5
- Rear Panel Assembly.....4-6
- Final Assembly.....4-9

CUSTOMER SERVICE

WARRANTY.....5-1
RETURN OF THE INSTRUMENT FOR REPAIR.....5-1
SERVICE CENTERS.....5-1
FIELD SERVICE OFFICES.....5-2

LIST OF FIGURES

A: Model 155 Helium-Neon Laser.....iii
B: Model 155A Helium-Neon Laser.....iii
C: Model 155 Plasma Tube Diagram.....1-1
D: Model 155 Warning Labels.....2-2
E: Radiation Control Drawing.....2-2
F: Schematic Diagram.....3-2
G: Rear Panel Assembly Drawing.....4-3
H: Plasma Tube/Power Supply Assembly Drawing.....4-4
I: Power Supply PC Board Assembly Drawing.....4-7
J: Final Assembly Drawing.....4-8

INTRODUCTION

The name LASER is actually an acronym which stands for Light Amplification by Stimulated Emission of Radiation. Although this describes the production of laser light to the scientist, most people desire a more thorough explanation. In order to understand the operation of the laser, it is first necessary to understand how light is produced from electrons.

In all atoms, electrons usually occupy well-defined orbits around the nucleus. Although these electrons can be excited to higher energy states, they will eventually fall back into their normal or ground state; when they do, they emit radiation. If the difference between the excited state and the ground state is within certain limits, the radiation is visible as light. This change in state is called an energy transition, and the radiation from a single transition is called a photon.

In a conventional light bulb, tungsten atoms are excited by an electric current. The transition back to the ground state is random, and photons are emitted in all directions - each with a different frequency, phase, and energy.

We get laser action when many electrons make the same energy transition at the same time. This can occur when many of the same kind of atoms are excited in a small area. Then when one transition occurs, and a photon is emitted, the photon is likely to collide with another excited atom. This collision produces two photons which are like twins, they are identical in frequency, phase, energy, and direction. When this happens on a large scale, laser light is produced.

In a Helium-Neon laser, the desired transition occurs in the Neon atoms. The Helium helps to excite the neon. An electric current passed through the laser tube easily excites the helium atoms; when these collide with the Neon atoms, energy is transferred, and the Neon atoms are left excited.

By enclosing the gas in a sealed tube with mirrors on both ends, the photons released in neon energy transitions are reflected back and forth. These photons collide with other excited neon atoms and more photons are released. These collisions build up until there is a continuous flow of photons producing a very intense beam of coherent light along the axis of the tube.

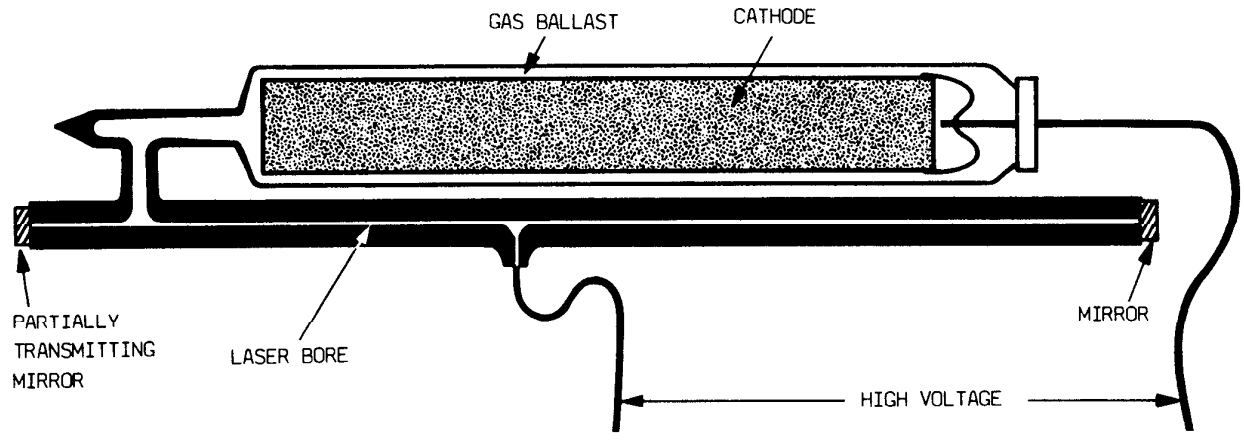


FIGURE C: Model 155 Plasma Tube

To get the beam out of the laser tube, one of the mirrors is partially transmitting; while it reflects most of the light back, it lets a small portion through; this is the beam you see (Figure 1).

The basic principles of laser operation were predicted by Schawlow and Townes in 1958, and in 1960 the first operating laser was developed. Shortly after that, Spectra-Physics was organized to produce lasers for commercial use. In 1962 our first laser was offered to the public.

Since that time, thousands of Spectra-Physics lasers have been sold for applications ranging from aligning storm and sanitary drain pipes to teaching optics in science classes. Light from our lasers has been bounced off the moon, used for eye surgery, and used to measure the height of ocean waves. Your laser, although of low power, exhibits the same properties that made these applications possible.

There have been many stories in the popular press regarding spectacular application of laser light - about how it can drill holes in diamonds and vaporize metals. Although very powerful ruby and Carbon Dioxide lasers can be used for these purposes, this Helium-Neon laser is quite different. It produces one-half of one-thousandth of one watt (0.0005 watt). You can work with it with absolute safety to your skin and clothes.

Nevertheless, the laser, like the sun, is an intense light source; common sense dictates that you never stare directly into the laser beam or position it such that others may look directly into it.

However, you can view the laser beam striking an object such as a wall or screen with complete safety. You need only to avoid the direct beam and its reflection in a mirror or other highly polished surface.

Laser light differs from ordinary light in several important and useful respects.

The laser beam is highly collimated. That is, the beam spreads very little after being emitted from the laser tube; its divergence is low. A conventional light bulb emits light in all directions, and its energy is quickly dissipated. However, laser light can be directed in a narrow beam for great distances. As the beam leaves the laser it is about 1/16 inch in diameter; 20 feet away, it will have spread to only about 1/4 inch.

Laser light is also very intense. Because of the low divergence and small spot size, the direct beam from your 0.5 milliwatt (0.0005 watt) laser is more intense than the light from a 100 watt light bulb; you can see the spot from the laser beam even with the lights on. Light intensity is measured in terms of power per unit area. Your laser produces 0.5 mW of radiant power over an area of about 2 square millimeters; this is an intensity of 0.025 watts/cm^2. For comparison the intensity of the sun is about 0.135 watts/cm^2.

While the light from the sun is more intense, it is made up of many different colors. The primary light from your laser, however, is monochromatic, or made up of one single color - bright red. Its wavelength is 632.8 nanometers (0.0000006328 meters). Because of this, you will still see the red spot produced by the laser beam even in bright sunlight. The monochromatic nature of laser light can be likened to the single frequency of a tuning fork or an electronic sine-wave generator. Although the primary light output of your laser is at 632.8 nm, there is also noticeable discharge light in the blue and green wavelengths, a characteristic of He-Ne lasers.

Besides being monochromatic, laser light is coherent. This means that, in addition to having only a single wavelength, all the light at a particular point in the beam at a particular instant in time also has the same phase, amplitude, and direction. The low divergence of the laser beam is largely a result of its coherence and the construction of the laser tube itself.

SPECIFICATIONS

Output Power	0.4 mW - 0.76 mW
Wavelength	632.8 nm, Visible red
Plasma Tube	060-4
Spatial Mode	TEM_{00}
Polarization	random
Longitudinal Mode Spacing (c/2L)	550 MHz
Beam Diameter, at $1/e^2$ points	0.9 mm
Beam Divergence	1.0 mrad full angle
Amplitude Noise (1 kHz to 100 kHz)	0.3% rms
Amplitude Ripple (10Hz to 1 kHz)	0.5% rms
Long Term Power Drift (12 hours)	2.5%
Input Voltage[1]	100/115/220±10% VAC 50/60 Hz
Power at Turn-on	0.35 mW
Warm-up Time to Full Power	15 minutes
Operating Temperature	10 to 40°C
Storage Temperature	-20 to 60°C
Power Requirement	22 W
Weight	1.8 kg
Dimensions 155 & 155C	67x88x253 mm
Dimensions 155A	84x88x400 mm
BRH Class	II

LASER SAFETY

Please read this section of the manual carefully before installing or operating your laser.

The protective housing of this laser product is not intended to be removed by the user. It is recommeded that any maintenance or service requiring access to the interior of the laser be performed only by a Spectra-Physics representative.

Follow the instructions contained in this manual for proper installation and operation of your laser.

Use of protective eyeware or other protective procedures in the use of this product depends on the conditions of use, visual function required, and type of user product. In the United States, consult user standards of the American National Standards Institute (ANSI), the American Conference of Governmental Industrial Hygienists (ACGIH), or the Occupational Safety and Health Act (OSHA) for guidance.

WARNING - HIGH VOLTAGES

This laser product contains electrical circuits operating at high voltages. These voltages can be deadly.

WARNING

At all times during installation, operation and maintenance of your laser, avoid all unnecessary exposure to laser or collateral radiation[1] in excess of the accessible emission limits listed in the Federal Register, Volume 40, No. 148, July 31, 1975: Tables I-A, I-B, I-C and III.

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Spectra-Physics manufactures many different lasers. Their maximum radiant powers vary from a few microwatts to tens of watts. Lasers producing higher output powers normally present a potentially greater safety hazard. Laser users should be especially careful with lasers which produce pulsed or invisible ouput. The following general laser safety precautions are especially important.

SAFETY RECOMMENDATIONS FOR LASER USE

1 Never look directly into the laser beam.

2 Set up experiments so the laser beam is either above or below eye level.

MAINTENANCE STEPS NECESSARY TO KEEP THIS LASER PRODUCT IN COMPLIANCE WITH 21 CFR 1040.10 AND 1040.11

This laser product complies with Title 21 of the United States Code of Federal Regulations, Chapter I, Subchapter J, Parts 1040.10 and 1040.11, as applicable. To maintain compliance with these regulations, once a year, or whenever the product has been subjected to adverse environmental conditions such as fire, flood, mechanical abrasion, solvent spillage, etc:

1 Check to see that all features of the product listed on the radiation control drawing in this section (emission indicators, beam attenuators, etc.) are functioning properly and all required labels are firmly in place.

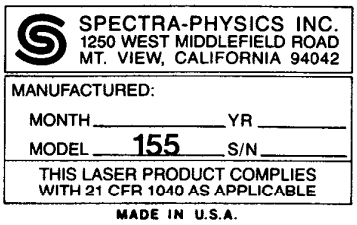
2 Verify that, when the laser productr is operated, a visible signal is provided during emission of accessible laser radiation in excess of the accessible emission limits of Class I[2].

3 Verify that the beam attenuator is capable of prohibiting access to laser radiation in excess of the accessible emission limits of Class I[2].

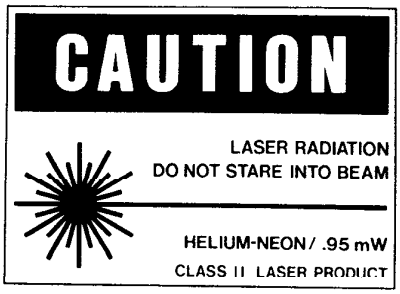
---

[1] Collateral radiation is "any electronic product radiation, except laser radiation, emitted by a laser product as a result of or necessary for the operation of a laser incorporated into that product." (21 CFR 1040.10(b) 9)

[2] 0.39 microwatts for CW operation where output is limited to the range of 400 to 1400 nm.

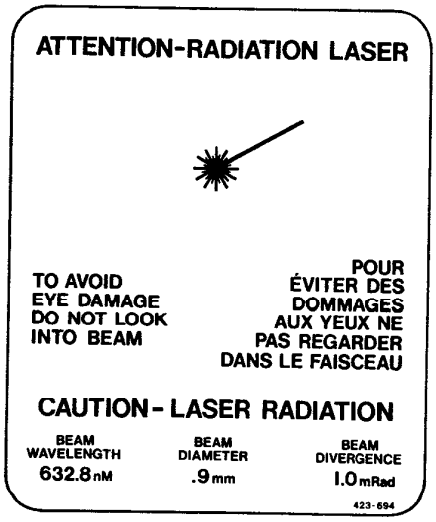


Certification Label



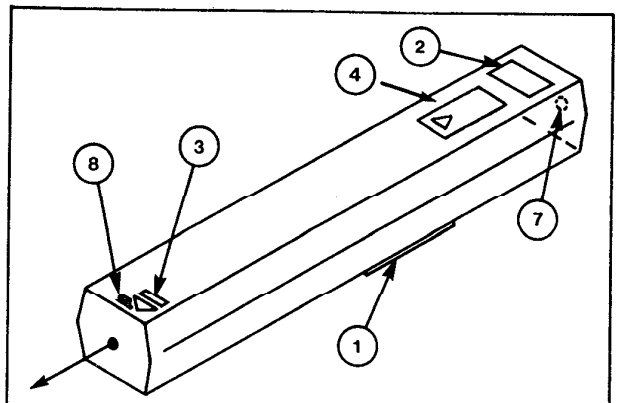
Warning Logotype

Aperture Label



Canadian Warning Logotype

FIGURE D: Model 155 Warning Labels



Model 155 Laser Radiation Control Drawing

DRAWING KEY

Laser Safety Feature	Location
Certification and Identification Label	1
Warning Logotype Label	2
Aperture Label	3
Canadian Radiation Label	4
Laser Radiation Emission Indicator	7
Beam Attenuator	8

FIGURE E: Radiation Control Drawing

UNPACKING

The Model 155, 155A and 155C lasers are carefully packed for shipment. IF THE PACKING CONTAINER IS DAMAGED, HAVE THE SHIPPER'S AGENT PRESENT FOR UNPACKING. Unpack the unit carefully and save the padding and container in case the unit must be returned for maintenance or service.

INSPECTION

The Model 155, 155A and 155C laser should be inspected as soon as possible after it is received. Look for dents, scratches, or other evidence of damage. If you observe any damage, immediately file a claim against the carrier and notify your nearest Spectra-Physics representative. Spectra-Physics will arrange for repair without waiting for claim settlement. Spectra-Physics' invoice is still due and payable.

MODEL 155, 155A AND 155C COMPONENTS

The Model 155/155A/155C laser consists of the following major components:

- o Plasma tube (see Figure 1)
- o Power supply
- o Protective housing
- o ON/OFF switch
- o Beam attenuator
- o Laser radiation emmission indicator
- o Power cord

OPERATION

Operation of the Model 155, 155A and 155C laser issimple and straightforward.

1 Point the laser toward a dull surface in a direction that will not intercept anyone's line of vision.

2 Remove the tape covering the output aperture. When the laser is not in use, it is advisable to replace the tape to avoid contamination of the outside surface of the neutral density filter by dust.

3 Leave the beam attenuator in the CLOSED position.

4 Connect the power cord to a 115 V 50/60 Hz receptacle (220 V for European models). Line variations of up to ±10% are tolerable, but they may cause some variation of output power.

NOTE

The input power cord has a 3-pronged plug. To avoid a possible shock hazard, the gound prong must be connected to earth ground.

5 Turn the ON/OFF switch to ON.

6 The emission indicator should light, inditing that power has been applied to the laser.

7 Move the beam attenuator to the OPEN position.

8 A thin red beam of light should be coming from the output aperture of the laser. If the red output beam does not appear within a few seconds, go to TROUBLESHOOTING.

ATTACHMENT AND ALIGNMENT OF ACCESSORIES (MODEL 155A ONLY)

Various optical accessories (e.g., telescopes) be used with your Model 155A. A bezel has been attached to the front of the laser on which to mount such accessories, and was tapped with a UNEF 2B thread for standard mounting. To attach an accessory, screw it into the mounting hole the bezel.

After attachment, you may need to align the accessory with the plasma tube. Use the 5/64" hex wrench supplied with your laser to loosen setscrews near the accessory mounting hole (one on each side). This will allow considerable horizontal and vertical movement of the accessory. When proper alignment occurs, tighten the Allen screws.

MOUNTING THE LASER (MODEL 155A ONLY)

A 1/4-20 mounting bracket is supplied beneath the laser. For the most stable mounting, attach the laser to a 1/4-20 thread optical post.

CIRCUIT DESCRIPTION

WARNING - HIGH VOLTAGES

> This laser product contains electrical circuits operating at high voltages. These voltages can be deadly.

Input power is transmitted through the line cord, fuse F100, and ON/OFF switch S100 to high voltage transformer T100, also lighting the incandescent emission indicator. High voltage transformer T100 primaries are connected in series for 220 V operation or in parallel as shown for 115 V operation. Taps 2 and 5, rather than 3 and 6, are used for 100 V operation.

The secondary of T100 provides 1245 VAC across terminals 1 and 2. This is rectified by half-wave diode rectifier CR100 producing a peak (no load) voltage of 1700 VDC, filtered by R-C filter network capacitors C103, C104, C105, and resistors R100, R101, R102, and R103.

When the Model 155, 155A and 155C is initially turned ON, the plasma tube, whose anode is connected to point A and cathode to point C, is not ionized and therefore not conducting. An initial high voltage is required to ionize the gas in the plasma tube. This high voltage is provided by the start boost circuit consisting of capacitors C100, C101, C106 and diodes CR101, CR102, and CR103. The start boost circuit provides a voltage at its output about 1000 volts higher per stage than the input voltage. Since there are three stages, the output of this circuit at point A (the anode of the plasma tube) is about 3000 + 1700 volts = 4700 volts. This voltage appears as a short pulse and voltage decreases as the tube conducts. Voltage across the plasma tube under normal operating conditions is about 1000 VDC. Additional components of the circuit are ballast resistor R104, current regulating transistor Q100, and current sampling resistor R105.

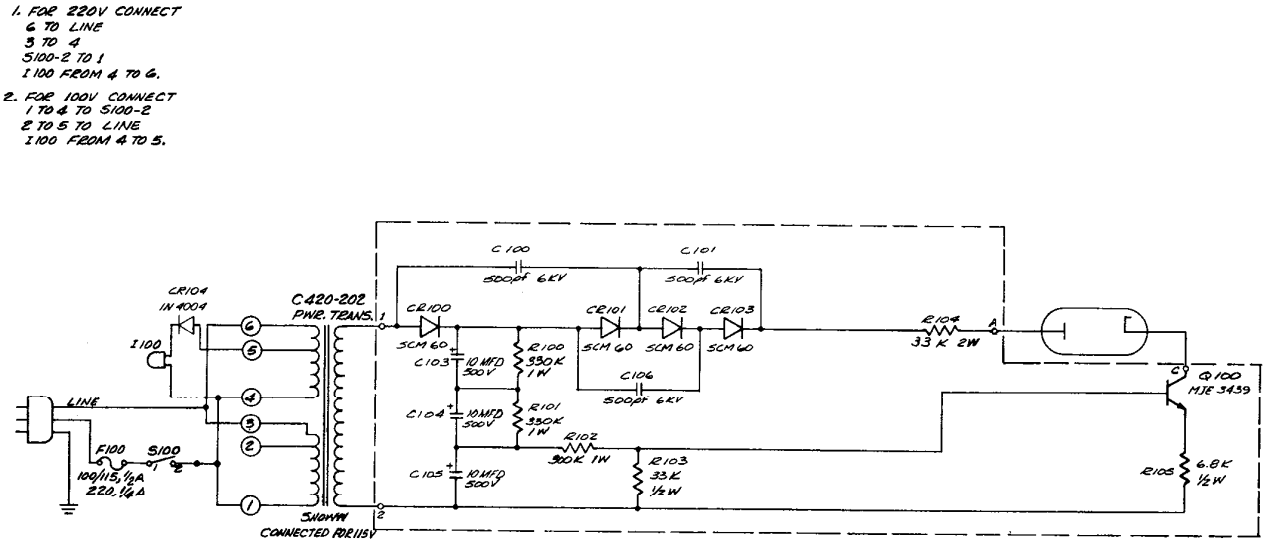


FIGURE F: **Model 155 Schematic Diagram**

MAINTENANCE

The Model 155, 155A and 155C laser is not normally expected to require maintenance. The laser mirror surfaces are inside the glass plasma tube and so are not subject to contamination and cannot be cleaned. It is possible that the outer surface of the neutral density filter could evenutally become contaminated by dust, surface film, or other foreign matter. It is unlikely that contamination would make its way to the outer surface of the output mirror. It is recommended that the beam attenuator be closed when the laser is not in use. This will prevent most contamination.

Contamination of the outer surface of the neutral density filter will not affect actual operation of the laser, but film, if severe enough, could cause output power to drop, and dust causes diffraction effects which show up as distortions of the far field pattern of the output beam.

The outer surface of the neutral density filter, accessible through the output aperture, should be cleaned carefully if necessary. First, use low velocity dry air to remove any loose particles. If this fails to correct the problem, put a small amount of alcohol on a cotton swab, shake it to remove excess alcohol, and sweep it lightly in one direction across the surface. The entire surface need not be clean, since the output beam passes only through the center of the filter.

TROUBLESHOOTING

No Emission Indicator Light

If the laser power cord is connected to the proper source of power and the ON/OFF switch is in the ON position, but the emission indicator light does not turn on, check the fuse located at the rear of the laser. If the laser still does not operate, contact your nearest Spectra-Physics service center.

Emission Indicator Lights, No Output Beam

If the beam attenuator is in the Open position and the emission indicator lights, but the red output beam does not appear within a few seconds, look at the output aperture (DO NOT LOOK DIRECTLY INTO THE LASER). Look for an indication of plasma excitation. If the plasma is lit, there will be a blue light reflecting inside the case. If the plasma is lit but there is no laser output, the tube is defective. If there is no indication of plasma excitation, check the fuse which is located at the rear of the laser. If your laser is still not operating to published specifications, contact your nearest Spectra-Physics service center.

CHANGING THE PLASMA TUBE

The following sequence describes the steps necessary to remove and replace the laser plasma tube. You will need a soldering iron andPhillips screwdriver to do the job. Replacement tubes are available from Spectra-Physics (part #060-4).

CAUTION

Be sure you unplug the main power cord before opening the laser.

1 Remove the 4 screws that hold the rear cover on the laser.

2 Pull the rear cover away from the laser housing. As you do so the transformer (mounted on the cover) and the power supply PC board will emerge.

3 Unsolder the red (anode) and black (cathode) plasma tube leads from the PC board and pull them out of the holes in the PC board.

4 The plasma tube is held in place by two mounting blocks, each of which is secured by two screws. Remove the screws to release the tube from the PC board.

5 Take the mounting blocks off the old tubo and slide them on the replacement tube. Be sure that the O-ring, plasma tube and mounting block halves fit snugly together.

6 Reinstall the plasma tube assembly leaving about 1/16" clearance between the output mirror and the neutral density filter.

7 Feed the plasma tube leads through the holes in the PC board and resolder.

8 If possible, mount the power supply/plasma tube assembly in a clamp that will hold it securely while you measure the output power. Plug the unit in and turn it ON. Be careful!avoid direct exposure to the emitted beam and contact with exposed high voltage terminals!

9 If a power meter is available, measure the output power and adjust to specifications by sliding the neutral density filter across the beam path.

10 You can also measure the tube current between the anode and cathode; it should be 6±1 mA.

11 Clean the output mirror and neutral density filter with methanol.

12 Slide the PC board back into the laser housing making sure that it travels along the grooves provided. Also make sure that the anode does not touch the housing. If you find it necessary to bend it away from the housing, be careful! It is connected directly to the glass plasma tube and undue stress may break the glass, ruining the tube.

13 Replace the rear cover and secure with the four mounting screws.

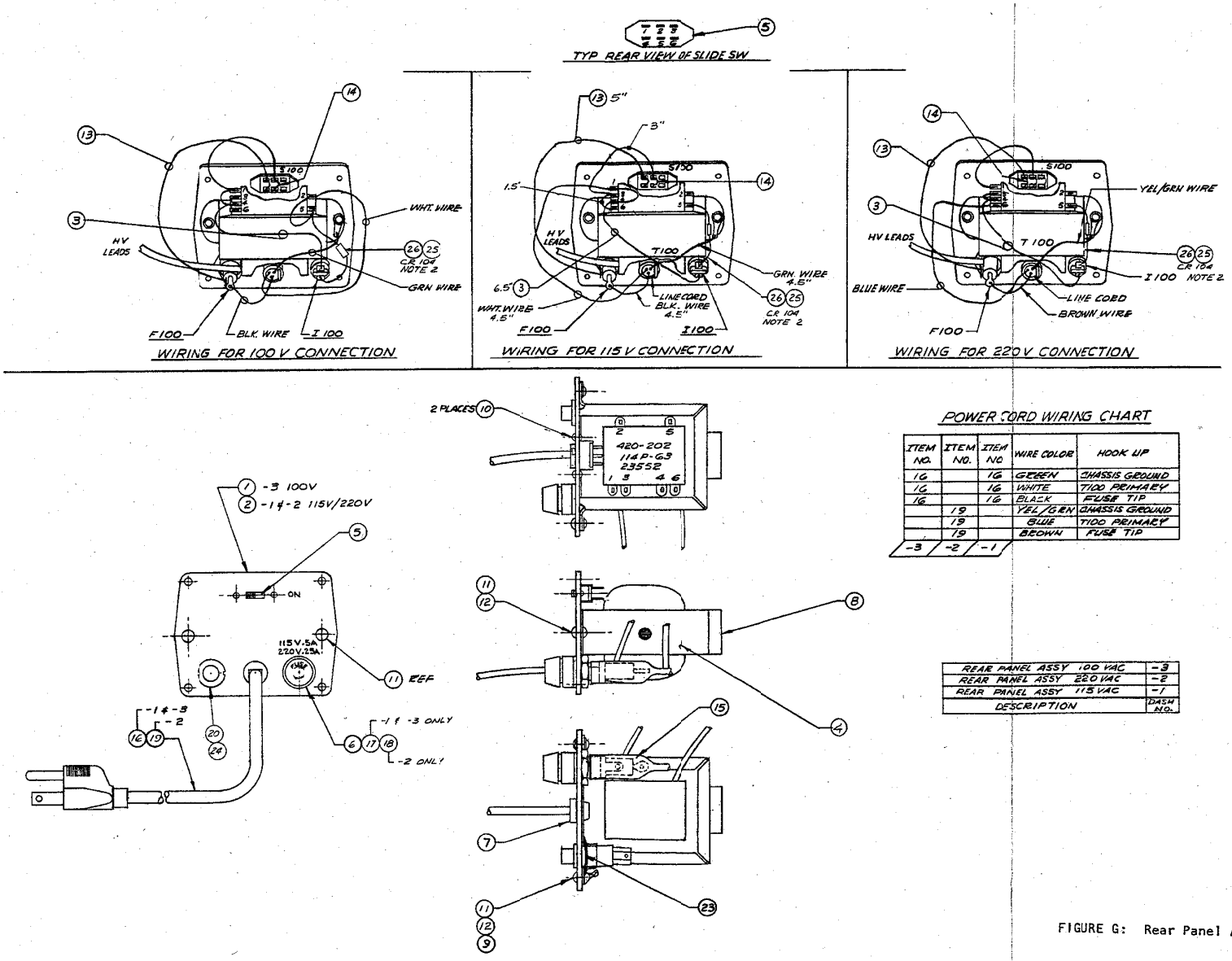
14 Check the output power after the assembly is complete. If the power has dropped appreciably, remove and reinstall the power supply/plasma tube assembly. Check for obstructions of the beam and stresses on the assembly which may cause misalginment.

PARTS LISTS

POWER SUPPLY PC BOARD ASSEMBLY (refer to drawing #408-529)

Unless otherwise noted all resistance values are (ohms).
Unless otherwise noted all capacitance values are µF (microfarad).
Unless otherwise noted all inductance values are H (Henry).

Item #	Sch Ref #	Part #	Description
1		408-317	Model 155 PC Board
2	Q100	4804-1010	Transistor MJE3439
3	CR100,101		
	102,103	4802-0390	Diode
4	C103,104,105	1505-0660	Capacitor 10 500V Electrolytic
5	C100,101,106	1504-0100	Capacitor 500 pF 6kV Disk
6	R104	4708-0500	Resistor 33k 2W 10%
7	R100,101	4707-0620	Resistor 330k 1W 10%
8	R102	4707-0940	Resistor 300k 1W 5%
9	R103	4706-0500	Resistor 33k 1/2W 10%
10	R105	4706-0420	Resistor 6.8k 1/2W 10%



POWER CORD WIRING CHART

ITEM NO.	ITEM NO.	ITEM NO	WIRE COLOR	HOOK UP
16		16	GREEN	CHASSIS GROUND
16		16	WHITE	T100 PRIMARY
16		16	BLACK	FUSE TIP
	19		YEL/GRN	CHASSIS GROUND
	19		BLUE	T100 PRIMARY
	19		BROWN	FUSE TIP
-3	-2	-1		

DESCRIPTION	DASH NO.
REAR PANEL ASSY 100 VAC	-3
REAR PANEL ASSY 220 VAC	-2
REAR PANEL ASSY 115 VAC	-1

FIGURE G: Rear Panel Assembly Drawing

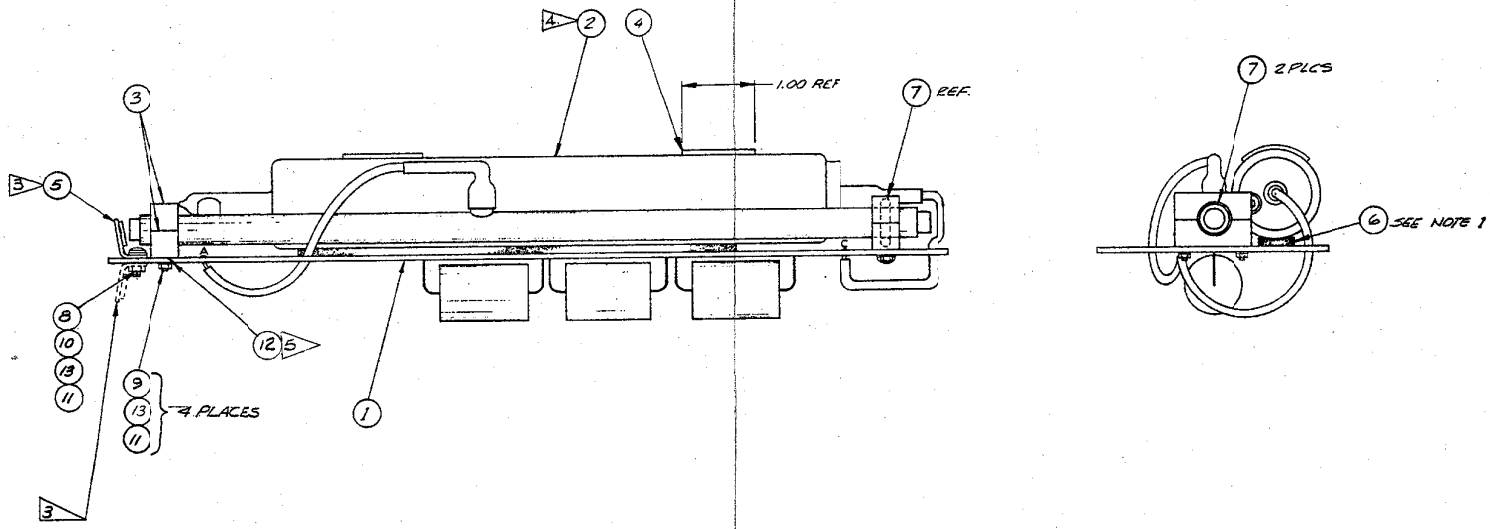


FIGURE H: Plasma Tube/Power Supply Assembly Drawing

PLASMA TUBE-POWER SUPPLY ASSEMBLY (refer to drawing #408-528)

Unless otherwise noted all resistance values are Ω (ohms).
Unless otherwise noted all capacitance values are μF (microfarad).
Unless otherwise noted all inductance values are H (Henry).

Item #	Sch Ref #	Part #	Description
1		408-529	Power Supply PC Board
2		060-0004	060-4 Plasma Tube
3		404-650	Plasma Tube Mount
4		408-363-2	Pad
5		420-579	Filter Assembly
6		408-363-1	Cathode Support Pad
7		2504-0580	O-ring
8		7111-0405	Panhead Screw 4-40x5/16
9		8201-0412	Capscrew 4-40x3/4 Lg
10		2801-0010	Flat Washer #4
11		3207-0200	Locktite #222
12		3207-0540	Locktite #496
13		0007-0477	Kepnut 4-40

REAR PANEL ASSEMBLY (refer to drawing #420-581)

Unless otherwise noted all resistance values are (ohms).
Unless otherwise noted all capacitance values are µF (Microfarad).
Unless otherwise noted all inductance values are H (Henry).

Item #	Sch Ref #	Part #	Description
1		410-334	Rear Panel 100 V
2		408-357	Rear Panel 115 V/220 V
3		6004-0020	Red Wire #22 600V
4		420-202	Multiple Primary Transformer
5		5103-0260	Slide Switch
6		2109-0010	Fuse Holder
7		2503-0820	Strain Relief
8		408-362	Transformer Cushion
9		2103-0170	Terminal Lug Solder
10		2808-0480	Rivet 3/32x3/16 Lg
11		2808-0490	Rivet .158x.383 Lg
12		2801-0190	Washer
13		6004-0100	Black Wire 22 Ga
14		6010-0090	Bare Wire 22 Ga
15		3105-0160	Black Shrink Sleeve
16		6003-0080	Power Cord
17		5101-0080	Fuse 1/2A 250V 3AG
18		5101-0070	Fuse 1/4A 250V 3AG
19		6003-0400	Power Cord 220V
20		3902-0190	Pilot Lamp Assembly
23		2804-1300	Tinnerman Nut
24		423-034	Incandescent Lamp
25		3105-0170	Teflon Tubing
26		4802-0830	Diode 1N4004

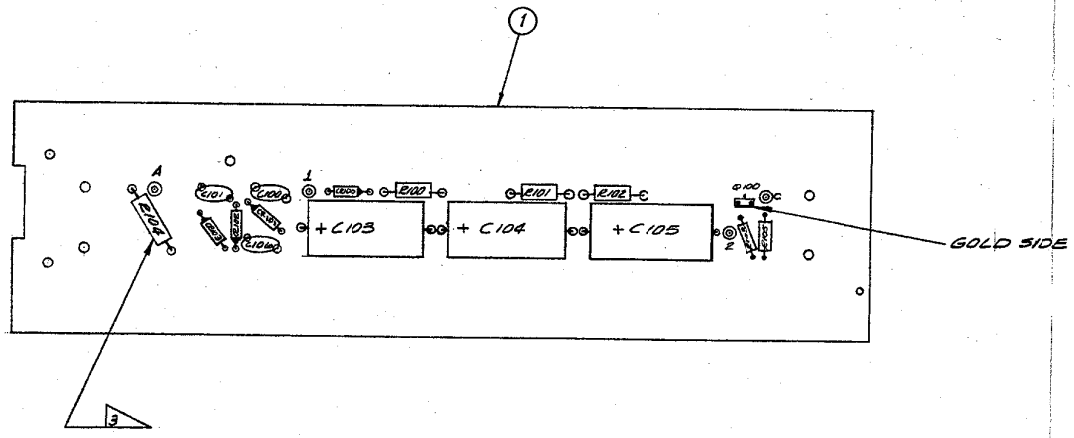


FIGURE 1: Power Supply PC Board Assembly Drawing

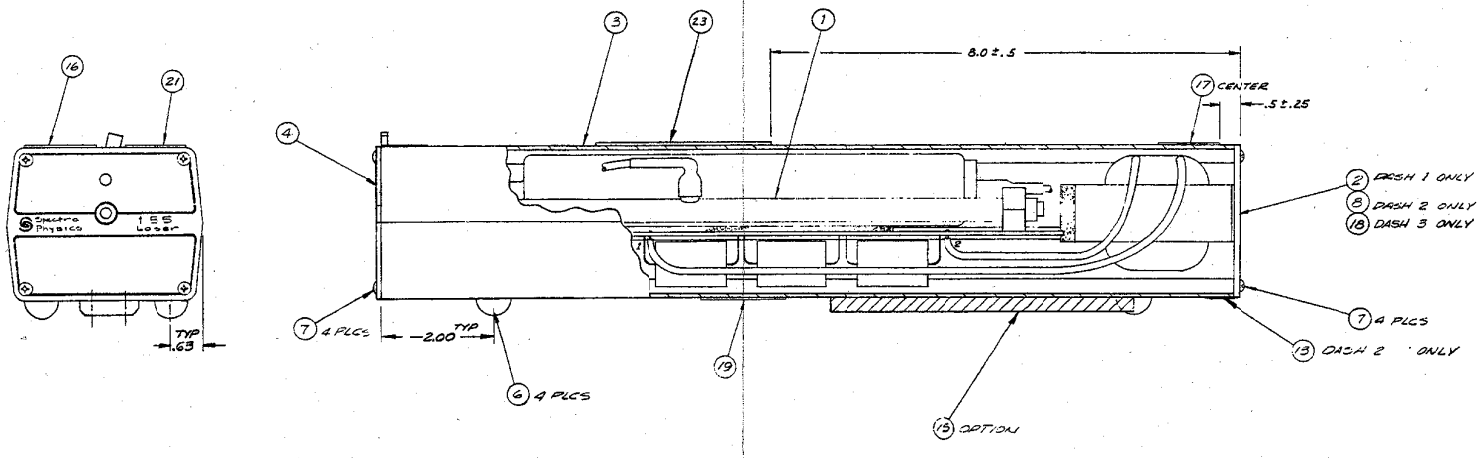


FIGURE J: Final Assembly Drawing

MODEL 155 FINAL ASSEMBLY (refer to drawing #408-531)

Unless otherwise noted all resistance values are Ω (ohms).
Unless otherwise noted all capacitance values are µF (microfarad).
Unless otherwise noted all inductance values are H (Henry).

Item #	Sch Ref #	Part #	Description
1		408-528	Plasma Tube-Power Supply Assembly
2		420-581-1	Rear Panel Assembly 115 V
3		420-588	Notched Housing
4		420-549	Shutter Assembly
6		1406-0410	Rubber Stick-on Bumper
7		7411-0406	Self Tapping Screw 4-40x3/8
8		420-581-2	Rear Panel Assembly 220 V
9		4706-0500	Resistor 33k 1/2W 10%
11		6011-0670	Tyrap
15		408-757	Optical Mount
18		420-581-3	Rear Panel Assembly 100V

CUSTOMER SERVICE

At Spectra-Physics, we take great pride in the durability of our products. Considerable emphasis has been placed on controlled manufacturing methods and quality control throughout the manufacturing process. Despite this fact, instruments do break down in operation. We feel that our instruments have favorable service records compared to competitive products and we hope to demonstrate, in the long run, that we provide above-average service to our customers--not only in providing the best equipment for the money, but, in addition, service facilities that get your instrument back into action as soon as possible.

Spectra-Physics maintains major service centers in the United States, Europe and Japan. Additionally, there are field service offices in major United States cities. Call the nearest service center or field service office for assistance.

Replacement parts should be ordered directly from Spectra-Physics. For ordering or shipping instructions or for assistance of any kind, contact your nearest sales office or service center and give the instrument model and serial numbers. Service data or shipping instructions will be promptly supplied.

WARRANTY

Unless otherwise specified, all Spectra-Physics products are warranted to be free from defects in workmanship and materials for one year from the date of shipment. Spectra-Physics will repair or replace instruments which prove to be defective during the warranty period without charge. The obligation of Spectra-Physics is limited to such repair, and does not extend to consequential damages.

Simple maladjustments or unclean optics are frequent causes of poor instrument performance or failure and are excluded from warranty coverage. A service charge will be assessed if an instrument which, when shipped to Spectra-Physics for warranty repair, can be returned to operating condition by routine cleaning or adjustment.

RETURN OF THE INSTRUMENT FOR REPAIR

Contact your nearest Spectra-Physics field sales office, service center, or local distributor for shipping instructions, and forward the instrument prepaid to the destination indicated. Special Spectra-Physics packing boxes designed to securely hold instruments during shipment should be used. If shipping boxes have been lost or destroyed, we recommend that you obtain a new one, for a nominal charge, from Spectra-Physics. Spectra-Physics will only return instruments in Spectra-Physics' containers.

SERVICE CENTERS

WESTERN UNITED STATES

Spectra-Physics, Inc
Laser Products Division
1250 W Middlefield Road
Mountain View, CA 94042

Tel (CA): (415) 961-2550
(other): (800) 227-8054
TWX: (910) 379-6941
Telex: 348488

EASTERN UNITED STATES

Spectra-Physics, Inc
366 S Randolphville Rd
Piscataway, NJ 08854

Tel (NJ): (201) 981-0390
(other): (800) 631-5693
TWX: (710) 997-9506

BENELUX COUNTRIES

Spectra-Physics, B.V.
Prof. Dr. Drogeloiaan
P.O.B. 2264
5600 CG Eindhoven
The Netherlands

Tel: 31(40)451855
Telex: 51668

CANADA, LATIN AMERICA, PACIFIC REGION

Spectra-Physics Int'l
1250 W Middlefield Road
Mountain View, CA 94042

Tel (CA): (415) 961-2550
(other): (800) 227-8054
Telex: 348488
TWX: (910) 379-6941

(Continued)

ENGLAND

Spectra-Physics, Ltd.
17 Brick Knoll Park
St. Albans,
Herts, AL1 5UF
England

Tel: 44(727)30131
Telex: 23578

FRANCE

Spectra-Physics SARL
Avenue de Scandinavie
Z.A. de Courtaboeuf
B.P. 28
91941 Les Ulis Cedex
France

Tel: 33(6)907-9956
Telex: 691-183

JAPAN

Spectra-Physics K.K.
Service Center
1-1-2 Higashiyama 5F
Meguro-Ku
Tokyo 153
Japan

Tel: 81(3)7109711
Telex: 781-246-6976

SWITZERLAND

Spectra-Physics A.G.
Schweizergasse 39
4054 Basel
Switzerland

Tel: 41(61)541154
Telex: 64335

WEST GERMANY

Spectra-Physics GMBH
Siemensstrasse 20
D-6100 Darmstadt-Kranichstein
West Germany

Tel: 49(6151)7080
Telex: 419-471

FIELD SERVICE OFFICES

ALBUQUERQUE, NM	Tel: (800) 227-8054
BOSTON, MA	Tel: (800) 631-5693
CHICAGO, IL	Tel: (800) 631-5693
DAYTON, OH	Tel: (800) 631-5693
HOUSTON, TX	Tel: (800) 631-5693
LOS ANGELES, CA	Tel: (415) 961-2550 x2550
WASHINGTON, DC	Tel: (800) 631-5693

SPECTRA-PHYSICS INSTRUCTION MANUAL - PROBLEMS AND SOLUTIONS

We have provided this form to encourage you to tell us about any difficulties you have experienced in using your Spectra-Physics instrument or its instruction manual - problems or errors which did not require a call or formal letter to our Customer Service Department, but which you feel could be remedied by action on our part. We are always interested in improving our products and manuals, and we appreciate any information you can give us. Thank you.

FROM:

Company or Institution_____

Department_____ Attn:_____

Address_____

City_____ State___ Zip _____

Country_____

Instrument Model Number_____ Serial Number_____

PROBLEM:_____

SUGGESTED SOLUTION(S):_____

MAIL TO:

Spectra-Physics, Inc.
Laser Products Division Technical Publications
1250 W. Middlefield Road M/S 2-10
Mountain View, CA 94042
U.S.A.