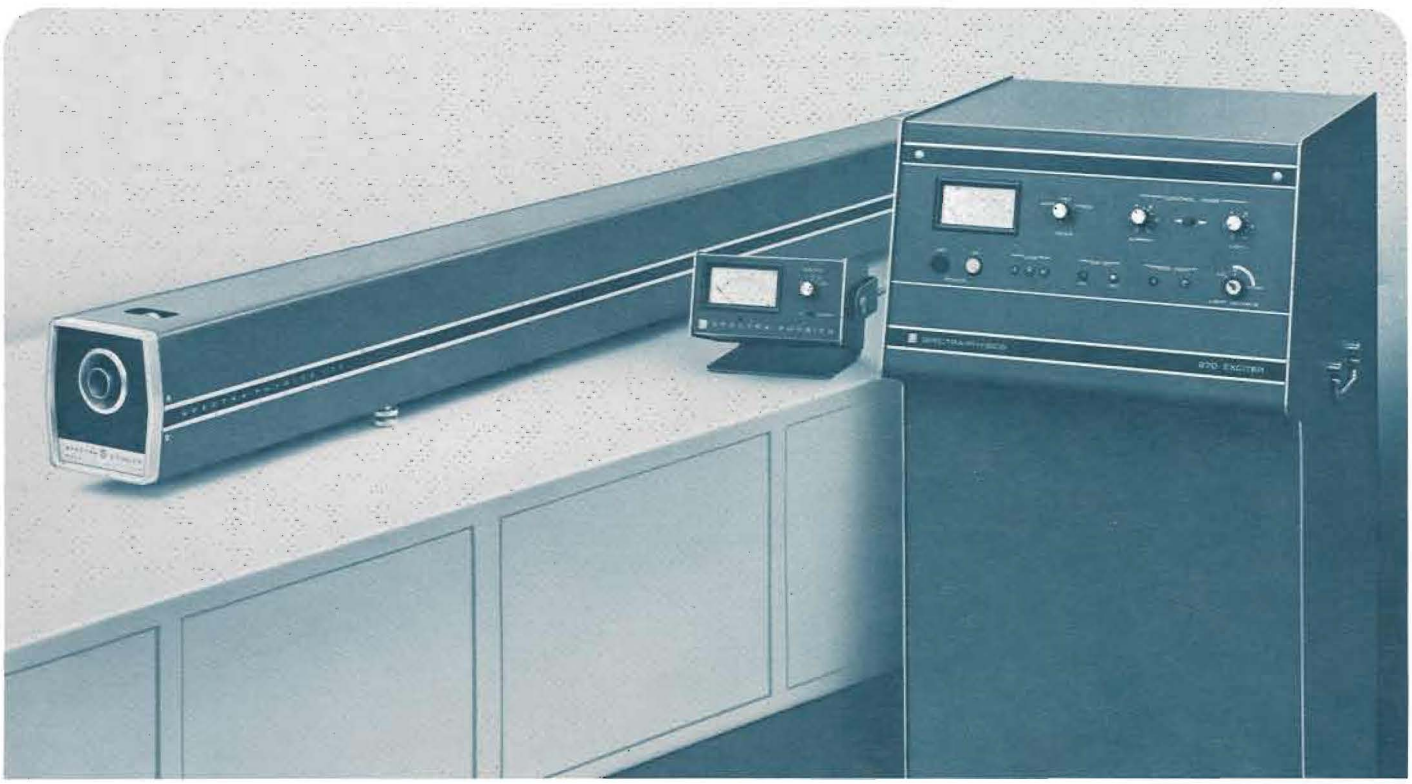
Data Sheet

Model

# 170 Ion Laser

Spectra-Physics 1250 West Middlefield Road Mountain View, California 94042 Telephone (415) 961-2550



## FEATURES

**Highest Available CW Power**—all-line powers of 10 and 15 watts

**Full Control of the Output**—wavelength and power

- Adjustable intra-cavity aperture assures true $TEM_{oo}$ output power at every wavelength selected.
- Snap-in mirror and prism mounts facilitate enhancement of special lines.
- Convenient mirror controls for finger-tip wavelength selection.
- Output power continuously adjustable by operator.
- Intra-cavity space available for intra-cavity experiments.

**Maximum Stability in Frequency and Power**

- Built-in light stabilizer assures stable output power to ±0.5%.
- Temperature compensated resonator structure and prism mount.
- Etalon accessory available for long coherence length applications.

**Ultimate in Design, Construction, and Reliability**

- Stabilite™ heat-shielded resonator structure provides state-of-the-art stability during environmental temperature changes; decouples the optical cavity from stresses originating in laser cover and optical bench; and sharply reduces microphonic frequency shifts (FM noise) in the laser output.
- BeO plasma tube provides long service-free life; combines maximum power and maximum cooling with small size; extends time between gas fills; and minimizes effect of plasma pressure on long-term power stability.
- Operator-controlled, electronically monitored gas fill system with excellent pressure resolution.
- Fully regulated power supply automatically accommodates and compensates for line voltage changes between 425 and 495 volts.
- Solenoid separate from plasma tube to facilitate easy maintenance.
- Full one-year warranty.

# Model 170 Ion Laser

## Greater Power

The Spectra-Physics Model 170 Ion Laser has been engineered for maximum output power while retaining that optimum combination of reliability, stability, convenience, and size characteristic of existing Spectra-Physics ion lasers. Extensive experience in engineering design and manufacturing has been combined with careful attention to detail to make the Model 170 the most advanced of a line of market-proven argon-ion lasers.

The versatile Model 170 ion laser is capable of single line operation at seventeen different lines with single line powers ranging from ten milliwatts to 6 watts. For greater total output power, the Model 170 can be made to operate in many lines simultaneously. The Model 170-00 provides over 10 watts – the Model 170-03 15 watts – of multi-wavelength power over the full warranty period.

## Greater Application

The Model 170 is ideal for applications requiring highest available CW laser output power. It can provide optical pumping for over two watts of tunable dye laser output. It opens up new possibilities in Raman, Brillouin, and other scattering experiments. With the installation of the Model 589 Etalon in the intracavity space, the Model 170 can provide a stable, high-power, excitation line width of less than 0.001 $cm^{-1}$. Used in this configuration with an iodine vapor cell for Raman Spectroscopy, the Model 170 can provide the user with the ability to resolve Raman scattering as close as 1 to 3 $cm^{-1}$ to the Rayleigh line. Holography and interferometry applications requiring very long coherence lengths (tens of meters) are ideal for the high-power, single-frequency operation of the Model 170 with the Model 589 Etalon.

The Model 170 offers a greater number of available wavelengths to which a variety of recording film is sensitive. Applications in data storage and recording are increasing.

The greater abundance of wavelengths with higher powers in the ultra-violet and near ultra-violet enhances the desirability of the Model 170 for molecular excitation and particle scattering research.

The Model 170 is rapidly becoming the laser of intense interest for the precision cutting and trimming applications of the film resistor and semiconductor devices industries. CW operation and higher power lines near the ultra-violet promise distinct advantages when using the Model 170, rather than infrared pulsed lasers, in these applications.

## Model 170 Ion Laser System

The Model 170 Ion Laser System consists of the 170 Laser Head, the 270 Exciter, and the separate power meter. A detachable 12-foot umbilical which contains all the power and control cables and the water cooling lines, connects the head to the exciter but allows them to be transported separately. The meter has its own detachable 6-foot (1.8 m) cable which allows it to be placed at any convenient location in the laboratory.

**270 EXCITER** The 270 Exciter contains all the electronics necessary to power and control the Model 170. Although designed to stand alone, screw holes are provided on the 270 Exciter for rack mounting if desired. The 270 Exciter connects directly to a three-phase, 460-volt line. The stabilization and control circuits are similar to those proven in other Spectra-Physics ion lasers which insure the highest reliability and performance.

**170 LASER HEAD** The 170 Laser Head is designed to a minimum size and weight, taking full advantage of the superior operating characteristics of the BeO plasma tube. The head contains the Stabilite™ optical cavity resonator structure, the solenoid, and the plasma tube. An extra 1 foot (30 cm) of space is provided in the cavity for the installation of etalons and other accessories or apparatus for an experiment, such as a gas cell for Raman Spectroscopy.


**Figure 1** 270 Exciter with Explanation of Controls

METER Control Knob
a. Tube operating current
b. Regulation range of exciter
c. Tube pressure

CURRENT Control Knob

LIGHT Control Knob

CONTROL MODE Switch. Activates either current control or light control circuits.

POWER switches and indicators. Push button switches start or stop laser. OFF switch lights red. ON switch amber when active.

LINE Indicator Lights. These three lights indicate that all three phases of power line are operating properly.

WATER ON light indicates a satisfactory flow-rate. WATER HOT light indicates a laser shut-off because of overheating of exhaust water.

PRESSURE CONTROL button fills the plasma tube when necessary as indicated by PRESSURE CONTROL light.

LIGHT ACTUATE. Key switch will operate a safety shutter for personal safety.

# Provides Full Control of Output

## Output Power Control

For applications which require less than maximum power or for the initial visual alignment of an experiment, the plasma tube current can be reduced to provide output power levels as low as a few milliwatts.

The intra-cavity aperture is also useful as a mechanism to reduce output power. Some users prefer this method over that of reducing plasma tube current because there is no change in the thermal characteristics of the laser as will occur when the tube current is reduced.

Neither beam position nor beam angle is changed when decreasing output power by either the current control or intra-cavity aperture methods.

## Mirrors and Prisms

The mirror holders and mounts used in the Model 170 are nearly identical to these proven reliable and convenient in the smaller Model 165 Ion Laser. The "bayonet" holders make dust proof seals upon insertion to insure contamination-free optical surfaces. The entire optical cavity remains sealed against dust and vapor when the mirrors are in place. Storage caps are provided to protect mirror holders not in use. This freedom from optical contamination assures greater power and dependability for the user. Quick mirror changes can be made with little or no realignment required. Hence, single-wavelength or multiwavelength operation is easily selected.

Spectra-Physics provides mirrors for the Model 170 with coatings optimized for maximum power in several spectral regions from the ultraviolet to the green. All optics are made from the highest grade fused silica and suprasil. All reflective surfaces are Spectra-Physics' hard, durable, low loss dielectric coatings.

## Wavelength Controls

Wavelength selection controls and wavelength readout are mechanically isolated thumbwheels allowing 1.0 nm resolution. External thumbwheels, flush with the top cover and conveniently located away from the output beam, provide fine tuning control of the orientation of the rear mounting plate (wavelength selector) through reduction gears. The Model 170 has been engineered for convenient control of all laser cavity parameters. All power control adjustments are completely orthogonal, allowing power optimization in a convenient, straightforward fashion.

## Power Meter

The Model 170 power meter continuously monitors the output power on any of five ranges from 0.3 watts to 30 watts in either the visible or ultraviolet. A filter compensates for the varying wavelength sensitivity of the detector providing meter readings which are accurate over the entire wavelength range of the Model 170. The meter is calibrated at 514.5 nm and calibration factors for other wavelengths are provided with each instrument.

The power meter can be placed or mounted anywhere in the laboratory. The meter has a 6 foot (1.8 m) cord which connects to a jack in the laser head.

## Intra-Cavity Work Space

A 1 foot (30 cm) long section of the optical cavity is available to the user for intra-cavity experiments. The intra-cavity space has its own separate cover to facilitate access. The plasma tube is firmly mounted to positioning brackets so that the tube will not be disturbed when the intra-cavity apparatus is installed. The design provides substantial protection to the Brewster windows as well.

## Convenient Mounting Design

The Model 170 Laser Head is supported by four adjustable feet with locking thumb nuts which will mate the laser head to almost any surface.

As an additional convenience, the umbilical connecting the laser head with the exciter is equipped with quick-disconnect fittings at the exciter. This design allows the head to be disconnected from the exciter while the head is being mounted or transported.

A threaded accessory mount, 1"-32 thread, on the output end of the laser head will accept standard Spectra-Physics accessories, such as spatial filter, a beam expanding and collimating telescope, a focusing lens for concentrating the beam, a broadband polarization rotator, a spectrum analyzer head, or a separate power meter head.

Since much greater power levels are available with the Model 170 Ion Laser, greater care must be exercised when accessories are selected and used to insure that no damage will occur to the accessories when the Model 170 is operated. Contact Spectra-Physics Sales Department for additional information.

## Gas Fill System

The Model 170 provides the user with a carefully interlocked, electronically monitored gas fill system. The system is easily used and the interlocks prevent misuse and guard against overfill. Low tube pressure is indicated by a signal light on the front panel of the Model 270 Exciter. Simultaneously the gas fill electronics are switched on. Pushing the gas fill button will allow the tube to be filled automatically. When the proper gas pressure is obtained, the signal light switches off and the fill circuit is deactivated. The gas fill system contains enough gas to allow well over 5000 tube operating hours.

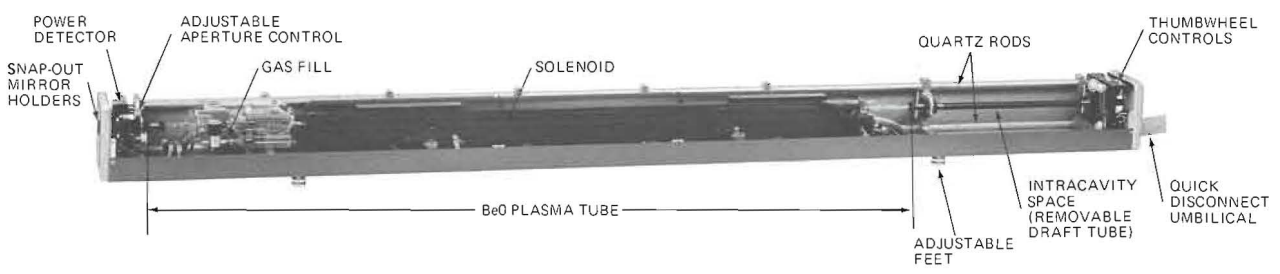



**Figure 2** Model 170 Laser Head with cover removed.

# Maximum Stability in Frequency and Power

## Built-In Frequency Stability

The stabilite™ resonator structure combines the rigidity and high thermal conductivity of aluminum with the length and angular stability of low expansion fused quartz rods. Bi-metallic temperature compensation is designed into this structure to further reduce the effect of quartz expansion and contraction with changing temperature. In addition, the prism mount is designed with bi-metallic compensation to null the effects of refractive index changes associated with changing ambient temperature.

The resulting laser design sharply minimizes resonator length change with environmental temperature changes. Single mode frequency stability has been extended to approximately one mode hop per 3°C change in ambient temperature.

## Built-In Light Stabilizer

A standard feature on the Model 170, the light stabilizer has proven invaluable to all Spectra-Physics ion laser users. A beam splitter and a silicon photodetector sample the output beam and provide a signal to feed-back-control electronics which automatically adjust the current to maintain constant output power. In this mode, the Model 170 output power will vary less than ±0.5% over periods of days or even weeks.

## Intra-Cavity Aperture

It is important in many applications that the laser operate in the fundamental $TEM_{oo}$ mode. Whether a laser will resonate only in the lowest order mode depends on the diameter of this mode within the laser. Multimode operation will result unless this diameter is nearly as large as the limiting element in the laser cavity. The shorter wavelengths require smaller diameter cavities.

The wide range of wavelengths available from an ion laser, ultraviolet to far red, makes it impossible to select a single plasma tube diameter that will provide optimum $TEM_{oo}$ power at all lines. To solve this problem, the Model 170 Ion Laser is designed with an adjustable intra-cavity aperture. This adjustable aperture limits the radius of the transverse mode to insure optimal $TEM_{oo}$ performance at any operating wavelength. The aperture is a standard feature on Spectra-Physics ion lasers and utilizes a diffraction loss mechanism to eliminate undesired modes.

The Model 170 is engineered to allow precise alignment of the plasma tube to this aperture and thus insure greatest possible $TEM_{oo}$ output power. If $TEM_{oo}$ performance is not required, the operator may obtain an increase in power of 10% to 30% by fully opening the aperture. The largest multimode power increases are obtained at the shorter wavelengths.

A convenient thumbwheel control smoothly adjusts the aperture diameter from 0.5 mm to 2.5 mm allowing selection of the optimal diameter for each wavelength selected.

## Optical Frequency Selectivity with Spectra-Physics Etalon

The Model 170 Ion Laser is designed with an intra-cavity space which permits intra-cavity installation of a single-frequency etalon. The Model 589 Etalon accessory provides extremely stable, single-frequency output power. The Model 170/589 combination is extremely convenient for applications requiring long coherence lengths or very narrow line widths.

Excellent laser resonator stability is imperative to fully utilize the frequency stabilizing capability of this etalon; the 170 quartz-rod resonator structure is so mechanically and thermally stable that it allows the user to obtain full value from the etalon.

The etalon mount is designed for simple installation and quick alignment in the intra-cavity space provided in the Model 170. Once aligned, the etalon can be removed and reinstalled without alignment.

Orthogonal, fine angular tuning of the etalon allows any single longitudinal mode within the Doppler-broadened gain profile to be selected.

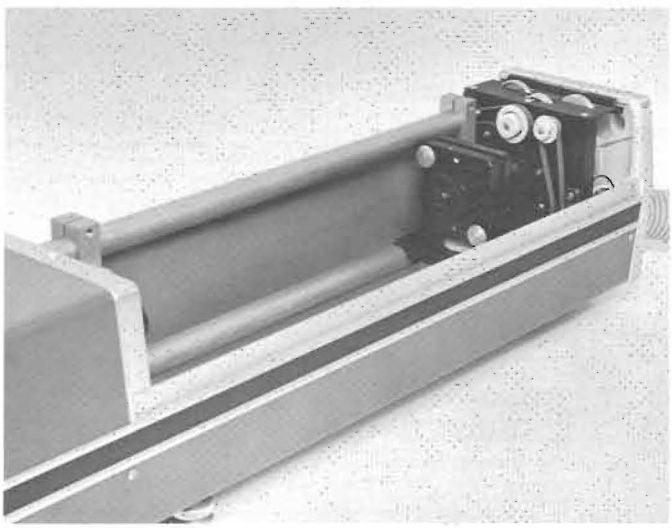


**Figure 3** Intra-Cavity Space with 589 Etalon installed for Single Frequency Operation

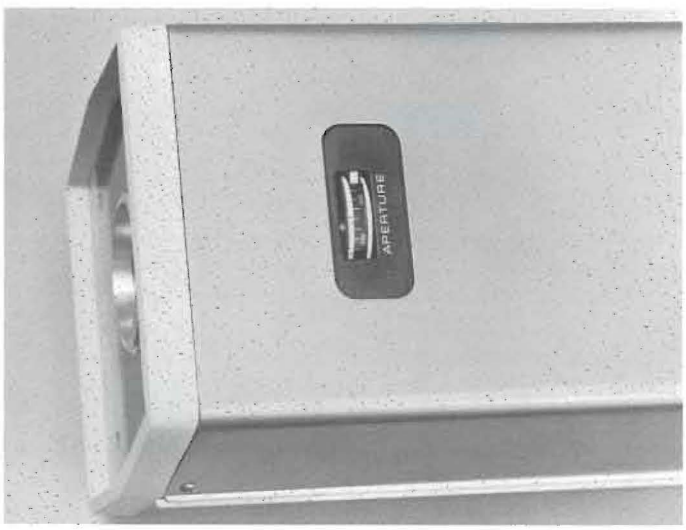



**Figure 4** Intra-Cavity Aperture Control for Power and Single Mode Selection

# Ultimate Reliability Through Design and Construction

## Stabilite Resonator Structure

The Model 170 uses an extended version of the frequency stable, thermally compensated quartz rod resonator structure used in the field-proven Spectra-Physics Model 165. Utilizing the low thermal expansion coefficient of quartz and the excellent thermal-characteristics of aluminum shields and heat flow plates, this design provides maximum angular and longitudinal stability. The resonator structure supports end plates which hold the mirrors and define the optical cavity. The end plates are held solidly against the quartz rods with stiff springs to minimize microphonic frequency shifts (FM noise) in the laser output. Ultimate length stability is accomplished by bimetallic length compensation which reduces the overall coefficient of expansion of the optical cavity to zero. Additional thermal compensation in the prism wavelength selector insures the most stable single longitudinal mode operation available.

## Kinematic Isolation of Optical Cavity

As in all Stabilite™ resonators, the structure is kinematically mounted so that thermal or mechanical stresses do not disturb the mirrors or plasma tube alignment.

Three spherical bearings kinematically isolate the entire optical cavity from mechanical stress applied to the outer case, end plates, or feet. The three spherical bearings also relieve any thermally generated mechanical stresses originating in the resonator structure. The stability of the three-bearing design has been proven in such ultra-stable lasers as the Spectra-Physics 165 Argon-Ion Laser. See Figure 5.

## BeO Plasma Tube

Beryllium oxide has long been recognized throughout the ion laser industry as the state-of-the-art plasma tube material. The superior plasma tube characteristics of this material have been publicized by recognized laser designers even by those who haven't been able to master the BeO tube technology. Spectra-Physics' mastery of the BeO Plasma Tube fabrication processes and techniques is demonstrated in the delivery of more than one thousand superbly operating tubes and superb life test data. The high thermal conductivity of the material results in more efficient cooling of the plasma. No local boiling occurs as can occur in graphite tubes, hence microphonics are reduced and a narrower single mode line width is available. Cool operation of the plasma tube results in more power for a given current than can be obtained from other bore material designs. The superb strength of the material, assuring no change in optical path, high resistance to bore tube erosion at the high ion laser bore temperatures and the low gas clean-up rate, hence longer times between gas fills, are persuasive arguments favoring use of this material for plasma tubes.

The Model 170 plasma tube offers all the advantages inherent in the BeO material - improved cooling, lighter weight, smaller size, less gas clean up, reduced sensitivity of power output to tube pressure changes, faster warm up, quieter operation and improved tube strength.

## Cooling System

The Model 170 requires water for cooling its transistor pass bank, magnetic field solenoid and the BeO plasma tube. The cooling system is conservatively designed to operate with water temperature as high as 35°C at a differential water pressure of 65 psi when operating at full power.

Water supplies differ widely in electrical conductivity. Contact Spectra-Physics for details to insure use of any palatable water supply.

Cooling water connectors at the Model 270 Exciter are standard hose fittings. Spectra-Physics provides hoses and a filter to remove debris from the tap water with each unit.

## Self-Protect Features

The Model 170 is designed for long term continuous use. Many self-protect features are included to allow unattended laser operation without danger to the laser system. Water temperature and water flow sensors have been engineered into the Model 270 Exciter which can cut off power. The Exciter components are protected by fuses, spark gaps, and by-pass circuits from line overvoltages or component failure.

## Brewster Windows

The plasma tube is terminated at each end by a Schlieren-quality, fused-silica Brewster's Angle window. These windows are fused to the tube allowing a high temperature bake-out of the entire tube during processing. The result is a clean, contamination free tube with long operating life and shelf life.

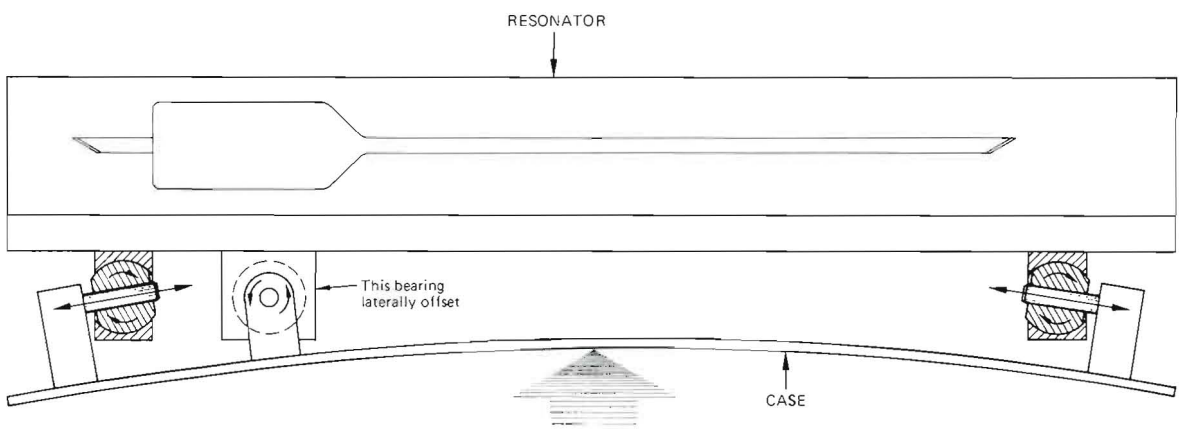



**Figure 5.** Detail of the bearing shows how stress applied to the case is relieved and not transmitted to the resonator structure.

# Model 170 Ion Laser System Specifications

## AVAILABLE OUTPUT POWER (Watts) — All Output Power $TEM_{oo}$

| Wave Length In Nano-Meters | MODEL 170-00 (40 Amps) | | | | MODEL 170-03 (50 Amps) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | SINGLE LINE OPERATION | | SIMULTANEOUS OPERATION | | SINGLE LINE OPERATION | | SIMULTANEOUS OPERATION | | |
| | Standard Optics[4] | Special Optics | Standard Optics[4] | U.V. Optics[3] | Standard Optics[4] | Special Optics | Standard Optics[4] | Special Order[5] | U.V. Optics[3] |
| 528.7 | | 0.8[1] 0.8watts | | | | 1.3[1] 1.3watts | | | |
| 514.5 | 4.0 | | 3.7 | | 6.0 | | 5.3 | | |
| 501.7 | 0.5 | | 0.5 | | 0.7 | | 1.0 | | |
| 496.5 | 1.2 | | 1.0 | | 1.5 | | 1.65 | | |
| 488.0 | 3.2 | | 3.2 | | 5.0 | | 4.6 | | |
| 476.5 | 1.0 | | 1.2 | | 1.5 | | 1.8 | | |
| 472.7 | 0.2 | 0.4[2] | | | 0.5 | 0.8[2] | .05 | | |
| 465.8 | 0.1 | 0.3[2] | | | 0.3 | 0.5[2] | | | |
| 457.9 | 0.3 | 0.8[2] | 0.5 10watts | | 0.5 | 1.2[2] | 0.6 15watts | | |
| 454.5 | 0.1 10watts | 0.2[2] 1.7watts | | | 0.2 15watts | 0.5[2] 3.0watts | | | |
| 379.5 | | | | | | | | .01 | |
| 363.8 | | | | .07[6] | | | | | .35[6] |
| 351.4 | | | | | | | | | .05[6] |
| 351.1 | | | | .07[6] .14watts | | | | | .30[6] |
| 335.8 | | | | | | | | .005 | |
| 334.5 | | | | | | | | .015 .03watts | |
| 333.6 | | | | | | | | | .04[6] .74watts |

1) Order: Output mirror 610-3 in beamsplitter assembly 0407-0170 and high reflector 010-13 in prism holder assembly 0407-0090 for 528.7 nm emission.

2) Order: Output mirror 140-6 in beamsplitter assembly 0407-0170 and high reflector 010-10 in prism holder assembly 0407-0090 for blue wavelength enhancement.

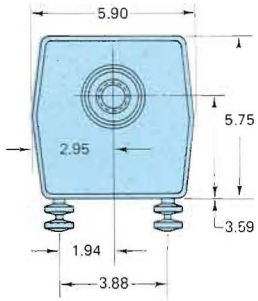
3) Order: Output mirror 140-19 in beamsplitter assembly 0407-0170 and high reflector 020-16 in mirror mount assembly 0407-0210 for U.V. emission.

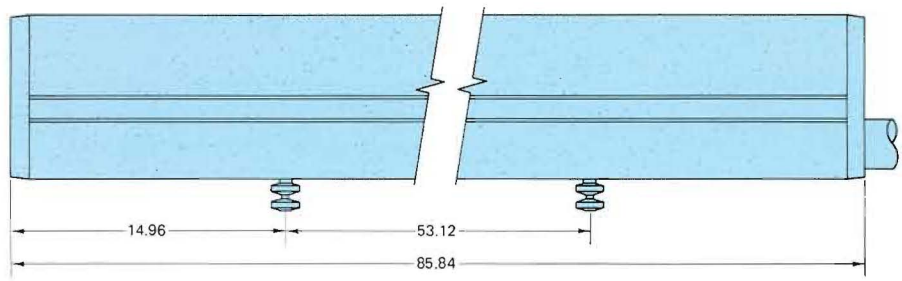
4) Supplied with Standard 170: Output mirror 140-16 in beamsplitter assembly 0407-0170 and high reflector 010-10 in prism holder assembly 0407-0090 and high reflector 020-9 in mirror mount assembly 0407-0210.

5) Special order only, contact factory.

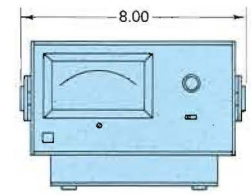
6) The lines listed can not be separated using the prism in the model 170. Line separation can be obtained using a prism in the laser output beam.

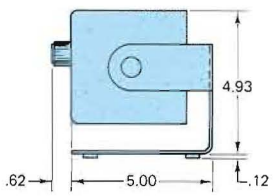
Laser Head



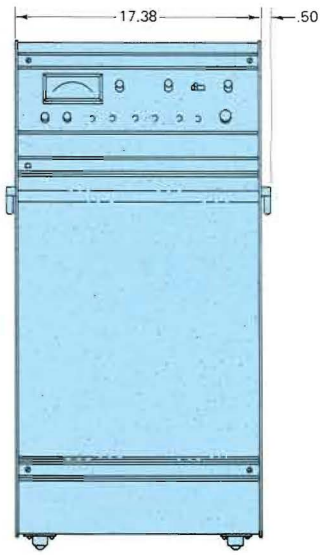



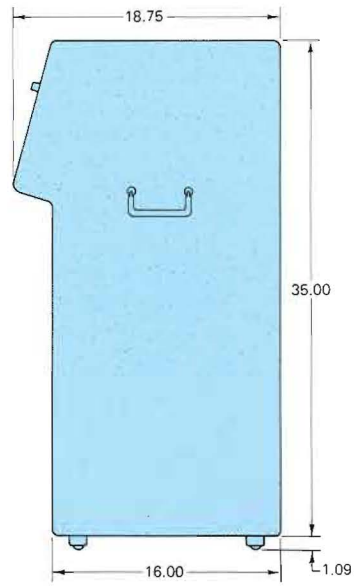

Power Meter




Exciter




All dimensions in inches

## Laser Characteristics

| | |
|---|---|
| **Beam Diameter at $1/e^2$ points** | 1.6mm |
| **Beam Divergence** | 0.6MR @ 514.5 nm |
| **Bore Configuration** | Be0 with separate high conductance return |
| **Resonator Construction** | High conductivity, welded heat shield and low expansion quartz rods – Stabilite™ |
| **Excitation** | Approximately 550V @ 40 to 50 amperes dc |
| **Cavity Length** | 2.09 Meters (nominal) |
| **Longitudinal Mode Spacing ($\frac{C}{2L}$)** | 71.7 MHz |
| **Cavity Configuration** | 6 Meter and ∞ |
| **Noise @ 514.5 nm** | Approximately 1% RMS |
| **Long term output power stability** | With power stabilizer on: ±0.5%<br>With power stabilizer off: ±10% |
| **Weight** | Head: 66 pounds (30 kg); Exciter: 130 pounds (59 kg) |
| **Recommended utility service** | 460±8%, 3-phase, line to line service, 60A/line |
| **Power Consumption** | Approximately 38 KVA maximum at highest line voltage operation, 30 KVA at nominal voltage operation |
| **Cooling Requirements** | Flow rate – greater than 3.5 gal/min (13.25 l/min)<br>Differential water pressure – 65 psi (4.6 kg/cm$^2$)<br>Maximum inlet pressure: 75 psig (5.3 kg/cm$^2$)<br>Maximum drain back pressure: 10 psig (0.7 kg/cm$^2$)<br>Maximum inlet temperature: 35°C<br>Maximum outlet temperature: 79°C |

# Accessories

## Model 370 Dye Laser

For dye laser pumping, the Model 170 has several unique advantages. The Model 370 has been pumped, using the Model 170 Ion Laser, with as much as 20 watts and has yielded over 2.0 watts of tunable output power without cell damage. Direct pumping through a mirror allows utilization of all ion laser lines simultaneously. In addition, there is greater than one watt available at 457.9 nm and nearly one watt at 351.1/363.8 nm for the pumping of dyes which emit in the green, blue or violet.

The use of different solvents in Model 370 allows the tuning range of Rhodamine 6G to be extended by 33% over single solvent systems.

**Model 370-00** Rhodamine 6G dye in alcohol-water solution tunes from 560 nm to 630 nm and provides the highest power tunable output to date.

**Model 370-01** Rhodamine 6G dye in fluorinated alcohol-water solution tunes from 540 nm to 610 nm.

Spectra-Physics has a continuing research program dedicated to the extension of the Model 370 Dye Laser output to the blue-violet, far red, and near infrared spectral regions.

## Telescope

The Model 332 Spatial Filter and Model 336 Beam Expanding Telescope provide a convenient means for spatial filtering, expanding, collimating or diverging the ion laser output beam. Less than $\lambda/8$ wavelength distortion over the wavelength range of 450 to 650 nm. The lens assemblies are achromatic for convenient operation with tunable laser.

## Spectrum Analyzers

Two different types of Spectrum analyzers recommended for ion lasers are available from Spectra-Physics: the confocal Fabry-Perot Models 420 and 470 Spectrum Analyzers.

The Models 420 and 470 Spectrum Analyzers are each available in 2 and 10 GHz free spectral ranges with resolutions of 10 and 50 MHz respectively.

For use with the Model 170 with etalon, the 420 or 470 is recommended for increased resolution.

## Polarization Rotator

The Model 310-21 Polarization Rotator is a convenient accessory for the precise orientation of the ion laser linear output polarization. The Model 310-21 utilizes a Fresnel Rhomb, which provides a one-half wavelength retardation from 400-700 nm. Unlike birefringent half-wave plates which are useful for only one wavelength, the Model 310-21 maintains its precise output orientation as the ion laser is tuned through the available wavelengths.

## Model 589 Air-Spaced Etalon

The Spectra-Physics Model 589 Air-Spaced Etalon is an accessory for the Model 170 Ion Laser, which allows oscillation only in a single longitudinal mode when the Laser is tuned to the 514.5 nm line. It causes more than 50% of the available energy to go into the selected mode and provides stable mode amplitude through the elimination of mode competition.

The etalon is necessary for applications requiring long coherence length and very narrow line width. By observing the laser output on the oscilloscope of a Spectra-Physics Model 420 Spectrum Analyzer, the Model 589 can be set to select any mode available under the laser gain profile.

The Model 589 has a base designed specifically to mount in the Model 170 Ion Laser. The etalon is designed for easy installation and alignment. Once properly aligned, it can be removed and reinserted in the laser without additional adjustment.

The Model 589 Etalon has stability specifications vastly superior to solid fused silica etalons because reflective surfaces are air-spaced. By using a hollow cylindrical spacer with thin dielectric coated windows at each end, refractive index changes which occur when the ambient temperature changes are virtually eliminated, and the expansion coefficient of the spacer material becomes the primary source of instability. The 589 Etalon utilizes an ultra-low expansion titanium silicate spacer with a temperature coefficient of $\pm 0.03 \times 10^{-6}$ per $^{\circ}C$, resulting in a frequency stability of $\pm 10$ MHz per $^{\circ}C$ change in the temperature of the etalon.

# Offices


**Home Office**
**Spectra-Physics**
1250 West Middlefield Road
Mountain View, California **94042**
(415) 961-2550
TWX 910 379-6941
Telex 348-488

**East Coast Office**
**Spectra-Physics**
366 South Randolphville Road
Piscataway, N.J. 08854
(201) 981-0390
TWX 710 997 9506

**Europe Headquarters:**
Spectra-Physics, International
Alsfelder Strasse 12
61 Darmstadt
West Germany
Phone (06151) 75081
Telex 841-419471


# Warranty

The Spectra-Physics 170 Ion Laser is protected by a one-year warranty. All mechanical, electronic, and optical parts and assemblies, including the plasma tube, are unconditionally warranted to be free from defects in workmanship and material for the first year following delivery.


Spectra-Physics

1250 West Middlefield Road
Mountain View, California 94042





5M-4/75-335-5 NP Printed in U.S.A.