

**164**

Ion Laser

Spectra-Physics



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Features

- 2 watts or 4 watts argon — all lines. Krypton and mixed gas options.
- Stable output power — to $\pm 0.5\%$
- BeO tube — for long life, resistance to bore erosion, stable tube pressure, hundreds of hours between gas fills.
- Small size, light weight.
- Built-in prism wavelength selection.
- Built-in power meter.
- Stabilite™ resonator construction.
- Snap-in mirror and prism mounts.
- Adjustable intra-cavity aperture — true TEM₀₀ power obtainable at all wavelengths.
- Adjustable magnetic field for maximum power at all wavelengths.
- Output power continuously adjustable down to a few milliwatts.
- High resolution gas fill system.
- Fully regulated power supply — no transformer taps.
- Full one-year warranty.

The Spectra-Physics Model 164 Ion Laser System has been engineered to provide you with the optimum combination of output power, size, stability, convenience, and reliability at a modest cost. Spectra-Physics'

traditional attention to detail in engineering design and manufacturing makes the Model 164 truly a premium quality ion laser.

The Model 164 is ideal for applications in the fields of Raman spectroscopy, holography, data recording and retrieval, eye surgery, dye laser pumping, biological experiments, general laboratory use, and wherever the intense power of the ion laser is required.

The Model 164 Ion Laser System consists of the Model 164 Laser Head and the Model 265 Power Supply connected by an umbilical containing power cables and water cooling lines. A large number of operating features have been built into the 164; and argon and krypton gas fill options and accessories make the 164 a truly versatile ion laser system.

Model 164 Laser Head

The Model 164 Laser Head was designed to a minimum size and weight to take full advantage of the superior operating characteristics of the BeO plasma tube. The 164 laser head contains the optical cavity, Stabilite™ resonator structure and the BeO plasma tube. The entire top cover may be easily removed for service or inspection. Four adjustable feet with locking thumbnuts will mate the 164 to almost any surface.

Built-in Light Stabilizer

The light stabilizer will be useful to almost all users and is a standard 164 feature. Light stabilization is selected with a front panel switch and allows you to obtain constant output power to within $\pm 0.5\%$ throughout the entire day—or week, if necessary.

A beam splitter and silicon photodetector sample the output beam and through feedback-control electronics, the plasma tube current is automatically adjusted to maintain a constant output power.

BeO Plasma Tube

BeO is the optimum material for ion laser plasma tubes and is used in the Model 164. High thermal conductivity, resistance to the high ion laser bore temperatures, and low gas clean-up rate are the advantageous properties of BeO. These properties of BeO provide the following advantages (over older-style graphite tubes) to the user of the 164:

- a) Long life tubes with no chance of bore dust accumulating on the windows.
- b) A need to operate the gas fill only every 400 to 1000 hours. Since output power changes with pressure this ensures long-term power stability.
- c) Allows a small light-weight laser head design.

- d) The tube runs very cool and helps the 164 have . . . excellent output power stability . . . turn-on power of over 75% . . . typical warmup times of 10 minutes to the 95% power point.
- e) The cool tube surface ensures that there will be no local boiling.

The gas refill system on the Model 164 tube is simple, reliable and contains enough gas to allow well over 5000 tube operating hours. Gas refilling is accomplished with a key-operated switch on the front panel of the power supply. A slow fill rate allows the user to fill to exactly the desired pressure which is monitored on the front panel meter. This high resolution fill system is especially important in krypton and mixed-gas tubes where small changes in tube pressure substantially affect the output power.

Stabilite™ Resonator Structure

Ultra-stable resonator design is characteristic of all Spectra-Physics lasers and the Model 164 is no exception. The basic resonator concepts initially developed at Spectra-Physics in the Stabilite™-type resonator are employed.

The Stabilite™ resonator structure ensures the user of continuous alignment of the mirrors and plasma tube resulting in a very stable output power, high turn-on power and short warm-up times. The user can count on obtaining the same output power day-to-day and week-to-week without having to adjust the mirror controls. Less than 10 minutes of warmup time is typically required in the morning to obtain 95% of preset output power.

The basic resonator is constructed of a L-shaped aluminum bar and directly driven mirror mounts. The entire resonator structure is kinematically mounted so that all thermal/mechanical stresses applied to the feet or outer structure are entirely relieved and do not disturb the mirrors or plasma tube alignment.

Built-in Power Meter

Each 164 is provided with a built-in power meter which continuously monitors output power. The front panel meter on the 265 Power Supply provides either 1W or 5W full-scale power readings. The meter is calibrated for 514.5 nm and a calibration curve for other wavelengths is provided with each instrument. Accuracy of the power readings is $\pm 5\%$.

Wavelength Selection — Mirrors and Prisms

The Model 164 has been designed to provide simple, quick mirror changes so that the user can always use optimum reflective coatings from the UV to the far red.

All optics used in the 164 are fabricated from highest grade fused silica and suprasil and all reflective surfaces are Spectra-Physics' ultra-hard, low-loss dielectric coatings.

Changing optics is easy in the 164. The mirrors and prisms are mounted in snap-in bayonet mounts which can be changed in a few seconds. The bayonet mirror and prism holders make an O-ring seal upon insertion to insure a hermetically-tight dust-free space between the window and mirror. A storage cap with O-ring seal is provided for the mirror holders not in use.

The Vertical and Horizontal thumbwheel controls, internal at the rear of the laser head, provide wavelength selection and fine tuning of laser power through directly-driven mirror mounts. For the experienced laser tuner, screwdriver adjustments of angular position of the mirrors are also available on the output mirror end of the laser head.

Adjustable Magnetic Field

To obtain the maximum power and minimum noise at many of the ion laser wavelengths, it is essential to vary the magnetic field in the tube bore. Front panel control on the 265 Power Supply adjusts the magnetic field from 500 to 1000 gauss. The weaker argon lines, such as 472.7 nm and 465.8 nm, can be enhanced by 40 to 60% by lowering the field value. The value of the adjustable magnetic field is even greater when using a krypton version of the 164 as some of the lines can be enhanced by 30% to 80%, by lowering the field value. For example, the strong red line at 647.1 is enhanced by about 30% and an 80% improvement can be realized in the line at 520.8 nm.

Intra-Cavity Aperture

The Model 164 tube is designed for optimum output power at all wavelengths and is supplied with an adjustable intra-cavity aperture to insure that you can obtain true TEM₀₀ performance at all wavelengths. If TEM₀₀ performance is not required, you may obtain an increase in power of 10% to 30% by opening the aperture full.

Water Cooling System

The 164 requires tap water for cooling of the transistor passbank in the 265 Power Supply, the magnetic field solenoid in the 164 head and the BeO tube. The cooling system has been conservatively designed to operate with water temperatures as high as 35°C and requires a flow rate of 2.2 gpm at 25 psi.

265 Power Supply

The Model 265 Power Supply is conservatively designed to be a reliable, trouble-free, long-life supply. It is quite small and light weight considering its power capability and functions.

The Model 265 works directly from a three-phase 208V line and is fully regulated to provide constant laser performance and reliable power supply operation through line voltage changes from 190V to 225V.

The fully-regulated power supply design is what you should expect from any well-designed instrument and is definitely an advance over older ion laser power supply designs which use buck-boost transformers where the user must change transformer taps as his line voltage changes, or suffer performance or reliability degradations. The fully-regulated design is substantially more convenient and reliable for you, the laser user.

The 265 is designed for ease of maintenance, both the top and bottom covers are easily removed by turning two twist screws and lifting off the cover. Transistors are socket mounted for ease of changing. The transistor passbank is hinged and swings up to allow free access to internal components. The 265 is supplied with a 15-foot power cable.

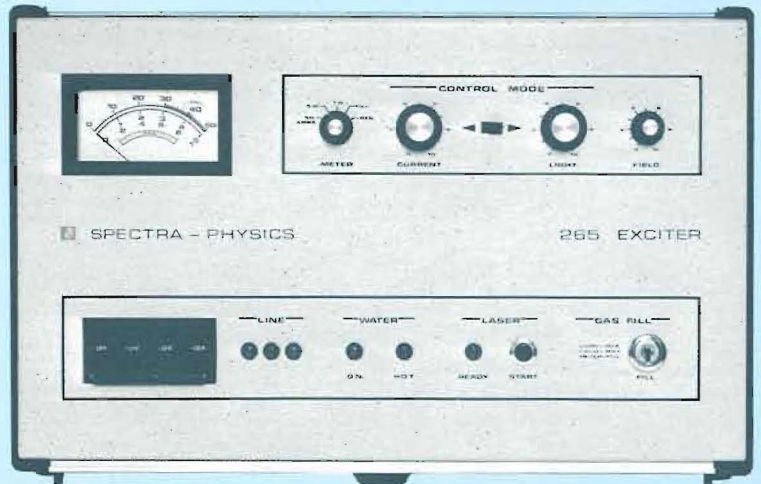
Self-Protect Features

The 164 system may be operated unattended because of the many self-protection features in its design. Among these are:

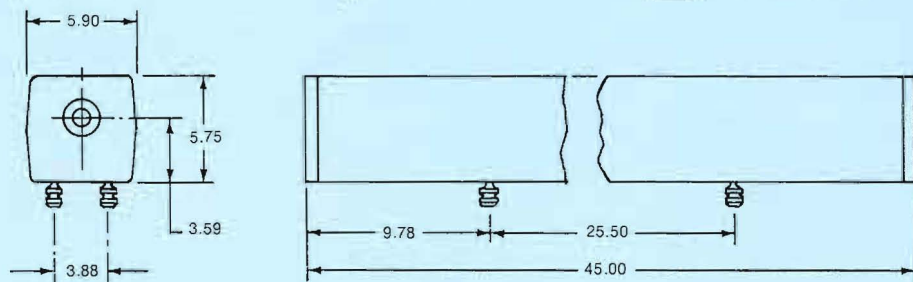
- a) A thermal cutout for protection if exhaust water temperature becomes too hot.
- b) A flow rate cutout for protection if inlet water flow rate drops below a safe level.
- c) Individually fused power transistors which protect the power supply circuitry from catastrophic failure.
- d) A voltage cutout for protection if tube voltage becomes either too high or too low.

FRONT PANEL CONTROLS

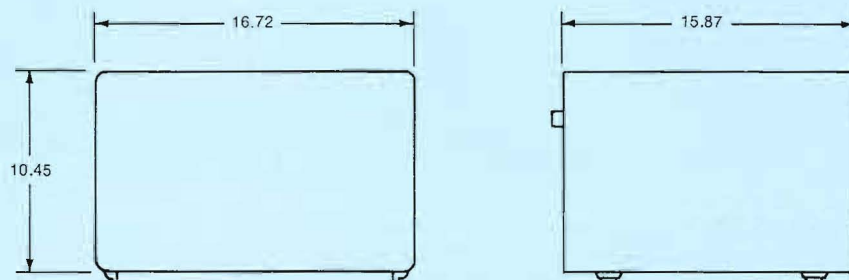
1. **METER CONTROL KNOB** Five positions display:
 - a) Tube Operating Current from 0-50 amperes.
 - b) Output Power, 5 watts full scale, 514.5 nm.
 - c) Output Power, 1 watt full scale, 514.5 nm.
 - d) Tube Pressure.
 - e) Regulation range of power supply.
2. **CURRENT CONTROL KNOB**
3. **LIGHT CONTROL KNOB** Adjusts the operating level of the automatic light stabilizer.
4. **CONTROL MODE SWITCH** For selection of current control or Light control mode of operation.
5. **FIELD CONTROL KNOB** Adjusts plasma tube magnetic field between 500 and 1000 gauss.
6. **GAS FILL SWITCH** The key-operated switch opens the solenoid valve between the tube and the gas reservoir.
7. **INDICATORS** The three **LINE** lights indicate that all three phases of the power line are properly connected and operating. The **WATER ON** light indicates a satisfactory water flow rate. The **HOT** light indicates a laser shut-off because of high temperature in the exhaust water. The **READY** lamp lights when the filament has reached the proper temperature and the tube can be started with the **START** button.
8. The three-phase circuit breaker is used for the **ON-OFF** switch and for overload protection.



Model 164



Model 265 Exciter



WARRANTY

The Spectra-Physics 164 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.

Specifications

Model 164 Ion Laser System

Output Power (All Output Power TEM₀₀)

Wavelength	Gas Fill Options			
	Argon Model 164-00	Krypton Model 164-01	Argon/Krypton Model 164-02	Argon Model 164-03
799.3 nm		30 mW ⁽¹⁾		
793.1 nm		10 mW ⁽¹⁾		
752.5 nm		100 mW ⁽¹⁾		
676.4 nm		120 mW	20 mW	
647.1 nm		500 mW	200 mW ⁽³⁾	
568.2 nm		150 mW ⁽¹⁾	80 mW	
530.9 nm		200 mW ⁽¹⁾	80 mW	
520.8 nm		70 mW ⁽¹⁾	20 mW	
514.5 nm	800 mW		200 mW ⁽³⁾	1400 mW
501.7 nm	140 mW		20 mW	250 mW
496.5 nm	300 mW		50 mW	400 mW
488.0 nm	700 mW		200 mW ⁽³⁾	1300 mW
482.5 nm		30 mW ⁽¹⁾	10 mW	
476.5 nm	300 mW		60 mW	500 mW
476.2 nm		50 mW ⁽¹⁾		
472.7 nm	60 mW			150 mW
465.8 nm	50 mW			100 mW
457.9 nm	150 mW		20 mW	250 mW
454.5 nm				100 mW
351.1 nm + 363.8 nm				20 mW ⁽²⁾
350.7 nm + 356.4 nm		40 mW ⁽²⁾		

- (1) Special optional optics are required to obtain output power on these wavelengths.
 (2) Special optional optics are required to achieve these UV output powers. For information on higher power UV options, please contact your nearest Spectra-Physics representative.
 (3) Multimode power approximately 25% greater.

Optics Supplied:

Model 164-00 and Model 164-03: Output reflector and single-wavelength rear reflector for blue/green wavelengths. Model 164-01 and Model 164-02: Output reflector and single-wavelength rear reflector for red wavelengths. Optics for deep red or blue to yellow wavelengths are optional.

Beam diameter at $\frac{1}{e^2}$ points:

1.5 mm at 514.5 nm; 1.3 mm at 457.9 nm.

Beam divergence: 0.5 milliradians.

Cavity length: 1 meter with 2 mirrors; 1.05 meters with 1 mirror and 1 prism.

Cavity configuration: Long radius.

Bore Material: BeO.

Resonator construction: Stabilite™ construction provides the ultimate in angular stability. Longitudinal member is of aluminum and entire resonator is kinematically isolated from outer case.

Long term output power stability: With Power Stabilizer ON: $\pm 0.5\%$ over 10 hours. With Power Stabilizer OFF: $\pm 3\%$ after 30 minutes warmup.

Noise: (Argon Gas Fill) With Power Stabilizer ON: 10 Hz to 2 MHz—0.2% rms typical. With Power Stabilizer OFF: 10 Hz to 2 MHz—0.5 to 1% rms typical.

Warmup: With Power Stabilizer ON: < 1 second to within 95% of preset power level.

< $\pm 0.5\%$ after 30 minutes.
 With Power Stabilizer OFF:
 > 75% at turn-on.
 > 95% at 30 minutes.

Output polarization: Vertical.

Mirror and prism changes: By snap-in positive positioning mirror holders.

Tube excitation: Current regulated D-C. Regulated to better than $\pm 0.5\%$.

Head mounting: Four adjustable feet. Range of adjustment 1 cm.

Head dimensions:
 5 $\frac{3}{4}$ " x 5 $\frac{3}{4}$ " x 45" (14.6cm x 14.6cm x 114.5cm). Umbilical turning radius requires an additional 4" of space.

Power supply dimensions: 16 $\frac{3}{4}$ " x 10 $\frac{1}{2}$ " x 15 $\frac{7}{8}$ " (42.7cm x 26.7cm x 40.4cm).

Weight: Head 50 lbs. (22.8 kg); Power Supply 70 lbs. (31.8 kg).

Input power requirements: Model 265 Power Supply is fully regulated to accept line voltage variations from 190 to 225V without modifications. 35 amps per line.

Water flow required: 2.2 gallons per minute minimum at 25 psi. Water temperature 35°C maximum.

Model 589 Air Spaced Etalon Optional

Etalon Dimensions.....	15mm dia. x 19mm long
Spacer Material.....	ULE [®] Titanium Silicate
Temperature Coefficient of Spacer.....	$\pm 0.03 \times 10^{-6}$ per °C
Frequency Stability of Etalon.....	18 MHz/°C
Typical Frequency Stability of Model 589 in Model 164 in air- conditioned laboratory.....	8 hours ± 225 MHz 15 minutes ± 100 MHz 10 seconds ± 15 MHz
Window Reflectivity.....	20 $\pm 2\%$
Transmission.....	>99%
Free Spectral Range.....	10 GHz
% of Single Frequency Power to Multi-Frequency Power.....	>50%
Spectral Range.....	450nm-520nm

Prices and specifications subject to change. Export prices slightly higher. Contact home office or local representative for current price information.

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