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Operating Instructions Princeton Instruments Model VM-502 0.2 Meter Vacuum Monochromator



VM-502 s/n:
SD3 s/n:

Rev. 5.0

PRINCETON INSTRUMENTS CORPORATION
VM-502
Operating Instructions

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Section I. General Description

1.1 Description

The Princeton Instruments Model VM-502 is a nominal 0.2 meter vacuum scanning monochromator, with an optimum wavelength range in the vacuum ultraviolet region. However, with other gratings and coatings, the instrument is useful from the extreme UV to the infrared.

The Model VM-502 is designed to use an aberration-corrected concave holographic grating, which provides an aperture ratio of f/4.5.

The Model VM-502 is set up as specified in the conventional "V" configuration (Model VM-502-V), in a straight through configuration (Model VM-502-S), or a combination of both (Model VM-502).

1.2 Specifications

Specifications are with standard 1200 G/mm gratings unless otherwise noted.

Focal Length: Nominal 0.2 meters

Optical System: Aberration-corrected concave holographic grating

Aperture Ratio: Nominal f/4.5

Reciprocal Linear Dispersion: Nominally 4.0 nm/mm, with 1200 G/mm grating in the first order

Wavelength Range: Mechanical scanning range is zero order to 546.1 nm, with a 1200 G/mm grating. Low wavelength limit is dependent upon light source and detector; typically less than 30 nm

Grating Coating: Standard coating is Princeton Instruments #1200 VUV Aluminum and MgF₂, with reflectance of 80% typical at 121.6 nm. Iridium coatings are optional for the extreme UV, and are supplied if specified

Grating Holder: The grating holder is kinematically mounted in the instrument, allowing gratings to be interchanged without requiring realignment. Each grating holder contains the classical grating adjustments for initial alignment of the grating to the instrument

Scanning Mechanism: A sine drive mechanism provides a linear wavelength change with the rotation of a precision lead screw. A Model SD3 controller is provided for scanning drive control using a computer (customer provided).

Slits: Standard bilateral slits are supplied and are adjustable from 5 micrometers to 3 millimeters. A precision micrometer provides for slit adjustment under vacuum conditions, and is graduated in 10 micrometer increments. The slit height is adjustable from 0 to 20 mm.

If specified, standard fixed width slits 1m high are supplied to customer's specified width.

Movable Diverter Mirror (optional): A movable diverter mirror is provided to divert the beam from the V slit position to the straight through position. A knob in the instrument cover allows the mirror to be moved under vacuum conditions

Slit Chamber Isolation Valve (optional): Vacuum valves are provided to isolate the slit chambers from the main instrument chamber. Ports (1/8 NPT) are provided in the slit chambers for gauge and roughing accessories

Air Inlet Valve (optional): An air inlet valve is located in the instrument housing to vent the instrument to atmospheric pressure.

Section II. **Instrument Setup**

2.1 General Description:

The instrument is shipped completely assembled, tested and ready for immediate installation. If the instrument is to be stored before use, contact Princeton Instruments for storage instructions. For shipping purposes, some optical components are covered, and mechanical components are tied or placed in specific positions. The following procedure is recommended to prepare the instrument for use.

2.2 Unpacking and Inspection:

Carefully unpack and examine both the VM-502 monochromator and the scan controller unit. If there is any indication of physical damage, report the condition immediately to the carrier and Princeton Instruments. Save all packing material.

2.3 Removal of Protective Cover and Shipping Ties:

To remove the protective cover on the optical component and the shipping tie, the instrument must be vented and the cover removed. This should be done only by personnel familiar with optical surfaces and instrumentation.

1. Locate the air inlet valve in the instrument housing. Remove the protective cap. Connect the air inlet valve to a dry nitrogen tank if possible. Open the air inlet valve slowly by rotating the handle until it is in line with the valve body.
2. Remove the instrument cover by rotating the two cover knobs until they are loose, and lift off the cover.

CAUTION: THE OPTICAL SURFACE IS NOW EXPOSED--DO NOT TOUCH, TALK, OR BREATHE OVER THE OPTICAL SURFACES!

3. If the instrument is equipped with a movable diverter mirror, it is held in position with rubber bands for shipment. Locate the rubber bands holding the movable diverter mirror in position; cut and remove these rubber bands.
4. A protective cover is attached to the grating mask with rubber bands. Verify that all rubber bands are removed from the chamber. Remove the shipping grating cover.

NOTE: Save this cover to protect the grating if interchanging gratings.

5. Replace the instrument cover after checking the o-ring and mating surface for cleanliness.

NOTE: If the instrument has a movable diverter mirror, make sure that the diverter mirror and the control knob on the cover align before replacing the instrument cover. Refer to Section 3.5 for more information

6. Close the air inlet valve by rotating the handle 90° to the valve body.

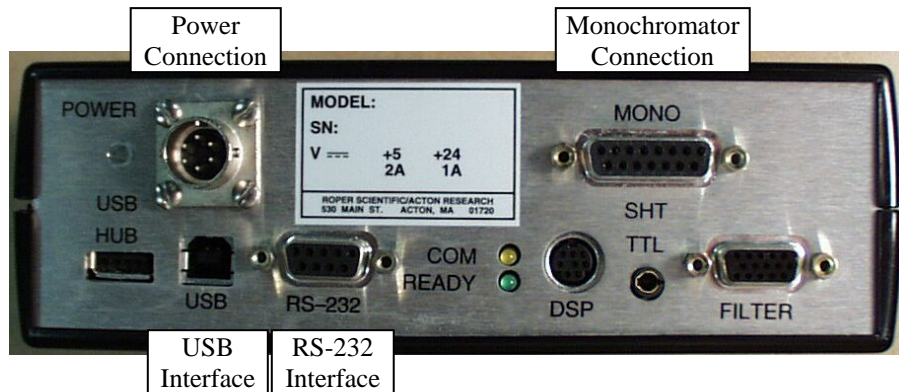
2.4 Pumping System Mounting:

The instrument is now ready for mounting to a pumping system. The VM-502 and Pumping Port Size drawings (pages 18 and 19, respectively) show the location and dimensions of a pumping port in the instrument base. The instrument may be supported by the pumping port or by the three pads provided.

CAUTION: DO NOT APPLY EXCESS PRESSURE BETWEEN THE PUMPING PORT AND THE THREE PADS PROVIDED ON THE BASE OF THE INSTRUMENT!

2.5 SD3 Connections:

The figure below shows the cable connections necessary for operation from a computer through the RS-232 or USB port.



1. Locate the SD3 controller, two interconnecting cables, the power supply and power cable.
2. Connect the motor drive cable between the 15 pin D connector (J1) on the monochromator and the 15 pin D connector (MONO) on the SD3-502.

Pin #-Monochromator	Description	Pin #-SD3
1	Motor – A1	1
2	Motor – A2	2
3	Motor – B1	3
4	Motor – B2	4
5	Open	5
6	Shield–(Controller Only)	6
7	Interrupt Module +5V	7
8	Interrupt Module GND	8
9	Interrupt Module 1 LED K	9
10	Interrupt Module 2 LED K	10
11	Interrupt Module 1 LED A	11
12	Interrupt Module 1 OUT WORM	12
13	Interrupt Module 2 LED A	13
14	Interrupt Module 2 OUT MOTOR	14
15	Open	

Table 1: J1 - Motor Drive Connector at Monochromator and SD3-502

3. Make sure that power supply is switched OFF and connect it to POWER connector on the SD3. Connect the line cord provided with the SD3 to the power supply and the AC line. The power supply will operate with line voltages between 100 and 250 volts AC 50/60 Hz and provides +5 volts DC for the SD3 control logic and +24 volts DC for the motor drives.

Pin #	Description
1	+5V
2	GND
3	GND
4	+24V

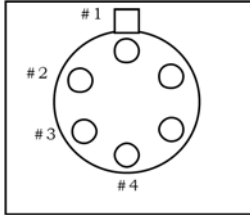


Table 2: Power Input Pin Arrangement:

4. Connect the SD3 to a computer.
 - Computer: Use one of the two-supplied computer cables:
 - RS-232 IBM PC or compatible 9-pin female (DB9S) connector to 9-pin male connector (DB9P).
 - USB USB Cable Type A to Type B.

NOTE: If neither of these cables is compatible with your system, consult Princeton Instruments for a custom cable. If you have facilities for constructing a custom cable, use the RS232 pin arrangement shown in Table 3.

Pin #	Description
1	open
2	RD data from SD3 to computer
3	TD data from computer to SD3
4	open
5	ground
6	open
7	RTS
8	CTS
9	open

Table 3: RS232 Computer Interface Pin Arrangement:

5. For RS232 communication, set up the terminal or RS232 computer port as follows: 9600 baud, 8 data bits, no parity, 1 start bit, 1 stop bit.

2.6 Software Installation:

Each VM-502 monochromator ships with the Actono Monochromator Control Software CD. If you have not purchased Princeton Instruments' SpectraSense or WinSpec/32 software, use this CD to install the Monochromator Control Software on your computer. The following instructions briefly describe the installation process. For greater detail, refer to the Monochromator Control Software manual on the CD.

1. Locate your Monochromator Control Software CD.
2. Exit any programs you are running to avoid conflicts during the installation.
3. Insert the CD. Windows should automatically detect the autostart program and begin the installation process. If it does not, click on the **Start** button and go up to **Run**. Click on the **Browse** button, find the directory that contains **Autorun.exe**, and then click on **Open**. Click on **OK**.
4. Install Acton Control.
5. After the installation is complete, restart your computer.

If you have received SpectraSense and are planning to use it to control the system, the following instructions briefly describe the software installation process. For greater detail, refer to the SpectraSense manual on the CD.

1. Locate the SpectraSense Software CD (it is not necessary to install the Monochromator Control Software since it has been incorporated into the SpectraSense software).
2. Exit any programs you are running to avoid conflicts during the installation.
3. Place the SpectraSense CD-ROM in the drive. Click on the **Start** button, go up to **Run**. Click on the **Browse** button and find the drive and directory that contains Autorun.exe. Click on **Autorun.exe** and then **Open**. Click on **OK**.
4. An installation panel will appear. Click on the install button that is appropriate for your operating system.
5. Follow the directions on the screen to complete the installation.
6. After the installation is complete, restart your computer.

If you will be using Princeton Instruments WinSpec/32 software, the following instructions briefly describe the software installation process. For greater detail, refer to the WinSpec and the Monochromator Control Software manuals.

1. Locate your WinSpec/32 CD and your Monochromator Control Software CD.
2. To avoid conflicts during the installation, exit any programs you are running.
3. Insert the WinSpec/32 CD. Windows should detect the autostart program and begin the installation process.
4. Click on the program you want to install. In most cases, this will be WinSpec/32.
5. When asked, choose "AutoPCI" as the communications type.
6. After the installation is complete, restart your computer.
7. After restart, insert the Mono Control Software CD and install the monochromator control software.
8. After the installation is complete, restart the computer.

2.7 System Operation

It is important that the VM-502 be connected to the computer and be initialized before the controlling software is started.

- If the VM-502 is part of a system that includes a Princeton Instruments SpectraHub Detector Interface and a single point detector such as a PMT or a Silicon Diode detector, then the entire system will be controlled through the Princeton Instruments SpectraSense software. The software automatically detects the VM-502 and sets up all necessary parameters for its operation.
- If the VM-502 is part of a system that includes a Princeton Instruments CCD camera, the system is then controlled either through SpectraSense software mentioned above or through Princeton Instruments WinSpec software. If using WinSpec, you must set up the Spectrograph parameters by selecting AM505 in "Define Spectrograph" and by setting the focal length to 200 mm, the included angle to 64 degrees and the detector angle to 32.5 degrees in calibration. Follow the instructions in the WinSpec manual for CCD calibration.

Now that you have completed the hardware and software installations, refer to **Section III. Instrument Operation** for information about operating, adjusting, or changing various VM-502 hardware assemblies and components. See **Section IV. Controlling the VM-502 with the SD3 SpectraDrive Controller** and the Monochromator Control Software for software-control information. For additional information about maintaining the VM-502, see **Section V Care of the Instrument**.

Section III. Instrument Operation

3.1 Bilateral Slit Assemblies:

1. **Slit Width:** The slit width of each bilateral slit assembly is adjustable from 0.005 millimeters to 3 millimeters (5 to 3,000 micrometers) by a micrometer knob located on the slit housing. The micrometer knob is graduated in 0.01 millimeter (10 micrometer) increments.

One counterclockwise revolution of the micrometer knob increases the slit width 0.25 millimeters (250 micrometers). For maximum reproducibility, the slit width should be set in a counterclockwise direction (increasing slit widths) each time it is changed.

The micrometer knob should not be rotated below a reading 0.00 or above a reading of 3.00. A micrometer setting of less than 0.005 millimeters (5 micrometers) cannot be used, because a stop is provided to prevent the slit jaws from touching each other.

2. **Slit Height:** The slit height is controlled by a pair of horizontal baffles located in the slit housing, and must be set up prior to mounting a pair of graduated blocks, located in the slit housing. The graduations on the blocks are 1 mm apart, with the center graduation being the widest. To adjust the baffles, loosen the screws at each end of the horizontal baffles, loosen the screws at each end of the horizontal baffle and set the baffles to 1/2 the total desired slit height above and below the center graduation.
3. Optional Adapters are available for use with Princeton Instruments CCD Cameras. Cameras are available that will allow operation down to the VM-502 lower wavelength limit of 30 nm.

NOTE: In most optical systems, resolution deteriorates with increasing slit height; therefore, if maximum resolution is required, slits of one to four millimeters should be used.

3.2 Fixed Width Slit Assemblies: (optional)

Slit apertures 1 cm high and with a fixed width are provided. The width of each slit is marked on each fixed slit assembly. The fixed slit assemblies are removable from the slit housing and are precisely aligned to a master slit for each interchange and precise alignment.

3.3 Grating and Holder Assembly:

The grating holder assembly is kinematically mounted onto a rotary table in the instrument vacuum chamber. Therefore, after initial alignment, the assembly can be removed and replaced without alignment.

To remove the grating holder assembly from the instrument, the following procedure is recommended:

1. Make sure that the instrument is at atmospheric pressure.
2. Remove the instrument cover by rotating the two cover knobs counterclockwise until the screws are loose. Remove the cover.

**CAUTION: THE GRATING IS NOW EXPOSED--DO NOT TOUCH, TALK, OR
BREATHE ON THE GRATING!**

3. Place the shipping grating cover supplied over the face of the grating. Loosen the one 8-32 clamp screw in the base of the grating assembly and remove the complete grating holder assembly.

Reverse the procedure when reinstalling the grating assembly.

NOTE: To ensure proper positioning, make sure that the grating assembly is properly seated before tightening the 8-32 clamp screw. The clamp screw should be tightened the same torque to ensure proper positioning.

CAUTION: If the instrument has a movable diverter mirror, make sure that the diverter mirror and the control knob on the cover align before replacing the instrument cover. Refer to Section 3.5 for more information.

3.4 Air Inlet Valve: (optional)

An air inlet valve is supplied to bring the main instrument chamber to atmospheric pressure, and is located in the instrument housing. The valve is open when the handle is in line with the valve body, and closed when the handle is at 90° to the valve body.

CAUTION: Make sure that the vacuum system is in the proper mode before opening air inlet valve!

3.5 Movable Diverter Mirror: (optional)

A movable diverter mirror diverts the beam from the “V” slit position to the straight through slit position. A knob on the instrument cover indexes the mirror to either the “S” or “V” position. The “V” position, positions the mirror out of the beam, and the “S” position diverts the beam to the straight through slit position. To change the mirror position, gently rotate the knob to the desired “S” or “V” position; a click will be heard and felt when the mirror indexes into position.

NOTE: When the instrument cover is replaced, make sure that the diverter mirror and its control knob are set to the same “S” or “V” position for proper engagement of the mirror and knob control arm.

3.6 Slit Chamber Isolation Valves: (optional)

Vacuum valves are located in the slit housing to isolate the slit chamber from the main instrument chamber. A valve control knob is located on the top of each slit housing. The valve is open when the knob is in line with the optical beam and closed when the knob is in line with the silver dot on the slit housing. (approximately 80 degrees to the beam).

CAUTION: Never vent the main instrument chamber with the slit chamber isolation valves closed. Never open the slit chamber isolation valve with the main instrument chamber under vacuum and the slit chambers at atmospheric pressure. When the main instrument chamber is under vacuum, the slit chambers must be evacuated to 200 Torr or less before the slit chamber isolation valves can be opened.

3.7 Slit Chamber Air Inlet Valves: (optional)

An air inlet valve is supplied to bring the slit chamber to atmospheric pressure and is located on the side of the slit housing. The valve is open when the handle is in line with the valve body, and closed when the handle is 90 degrees to the valve body.

CAUTION: Make sure that the isolation valve is closed
before opening slit chamber air inlet valve!

3.8 Slit Chamber Roughing Valves: (optional)

A slit chamber roughing valve is supplied for connection to an auxiliary mechanical pump for rough pumping of the slit chamber. The valve is open when the handle is in line with the valve body, and closed when the handle is 90 degrees to the valve body.

CAUTION: Make sure that the isolation valve and the air inlet valve are closed
before opening roughing valve!

Section IV.

Controlling the VM-502 with the SD3 SpectraDrive Controller

4.1 Description

The Princeton Instruments SD3 SpectraDrive Controller is used with the Acton VM Monochromators in conjunction with Acton Monochromator Control Software to provide the electronic drive for wavelength positioning, diverter mirror control and filter positioning. The SD3 also provides the link between the monochromator and the computer. Both USB and RS-232 are supplied as standard interfaces.

4.2 Controlling the VM-502 Monochromator with Acton Software

The Monochromator Control Software is normally installed in the directory C:\Program Files\Acton. This directory contains the subdirectory Bin. The Bin directory contains the executable code. There will normally be a Acton icon on the desktop that can be used for starting the software. If this icon is not on the desktop, go to the Acton Bin directory and start the software. When the Monochromator Control software loads, there is a main screen with selections for operating the monochromator and various setup functions. Click on the Operation box and a screen will come up which allows for basic control of the monochromator wavelength. All functions of this software are described in the Monochromator Control Software manual supplied on the Monochromator Control Software install CD.

4.3 Controlling the VM-502 Monochromator with User-Generated Software or LabVIEW

The Monochromator Control Software install disk contains a folder named Acton_SDK. This folder contains DLLs with example code in Delphi, Visual Basic, C++ and LabVIEW as well as a folder with examples for use of the COM interface.

4.4 Controlling the VM-502 Monochromator at the Command Level

Although it requires more programming on the user's part, the SD3 can also be controlled with direct commands through its USB port or RS-232 port. The same command set, listed below, is used for both RS232 and USB.

Commands can be sent as single commands or grouped in strings of commands. All commands are single words (contain no spaces) and all commands in a string are separated by at least one space. Parameters, if needed, precede the command and are separated from the command by at least one space (e.g. 546.7 GOTO).

For RS232 operation, the port setup is 9600 baud, 8 data bits, 1 stop bit and no parity. A convenient tool for trying out this mode of operation is the program HyperTerminal supplied with the Windows operating system. The USB port with the driver supplied also shows up as and is treated like a com port – although a very fast one. All commands or strings of commands must be terminated with a carriage return (0D hex). The SD3 responds to a command when the command has been completed by returning the characters **OK** followed by carriage return and line feed (hex ASCII sequence 20 6F 6B 0D 0A). The default condition is to echo each character that is sent to the SD3 with the RS-232 interface and to not echo the commands when using the USB interface. When sending a command or string of commands, it is important to wait for the SD3 to complete the processing of that command string before sending another command.

Monochromator Wavelength Movement Commands

GOTO	Goes to a destination wavelength at maximum motor speed. Accepts destination wavelength in nm as a floating point number with up to 4 digits after the decimal point or whole number wavelength with no decimal point.
<GOTO>	Same as GOTO (For compatibility with software written for previous Acton models.)
NM	Goes to a destination wavelength at constant nm/min rate specified by last NM/MIN command. Accepts destination wavelength in nm as a floating point number with up to 4 digits after the decimal point or whole number wavelength with no decimal point.
<NM>	Same as NM (For compatibility with software written for previous Acton models.)
>NM	Similar to NM except it returns control to user immediately rather than waiting for Completion of monochromator wavelength move. Can be used with ? NM or MONO-?DONE below. This command must be terminated with MONO-STOP listed below. NOTE: Use the NM command when communication with the monochromator during the scan is not required.
?NM	Returns present wavelength in nm to 0.01 nm resolution with units nm appended. e.g. ?NM 300.00 nm
MONO-?DONE	Used with >NM command to determine if monochromator has reached the destination. Returns 0 if move is not complete, 1 if move is complete.
MONO-STOP	Stops the monochromator wavelength move after use of the >NM command.
NM/MIN	Sets constant scan rate in nm/min to 0.01 nm/min resolution. e.g. 10.0 NM/MIN
?NM/MIN	Returns present scan rate in nm/min to 0.01 nm/min resolution with units nm/min appended. e.g. ?NM/MIN 100.00 nm/min

Grating Control Commands:

NOTE: These Grating Control Commands are used for all Acton series Monochromators. The VM-502 has a limited selection of concave gratings. When manually changing gratings, it is necessary to also select the grating number in Monochromator Control software, SpectraSense, or WinSpec to allow the correct grating parameters to be used.

GRATING	Recalls parameters for the specified grating from non-volatile memory. Up to nine (9) gratings are allowed. This command takes a grating number from 1 - 9. e.g. 3 GRATING
?GRATING	Returns the number of the grating presently being used numbered 1-9.
?GRATINGS	Returns the list of installed gratings with position, groove density and blaze. The present grating is specified with an arrow.

The following command is used for grating installation by Acton part #:

INSTALL Installs new grating parameters into the non-volatile memory of the monochromator. Uses the part # of the grating to specify the parameters.

e.g. 1-120-500 5 INSTALL places a 1200 g/mm grating blazed at 500 nm into the second grating position on #5.

The following commands are used for grating installation by grating parameters:

SELECT-GRATING Specifies the grating number to be installed 1 - 9.

G/MM Specifies groove density of grating to be installed in g/mm.

e.g. 1200 G/MM

BLAZE Specifies the blaze wavelength and units of the grating to be installed with 7 characters of the user's choice. Unlike other commands, this command is issued before the parameters. After the command is issued, the SD3 responds with " ". Seven characters are then entered (these may be numbers, letters, spaces or special characters).

UNINSTALL Used to remove a grating and its parameters from the SD3 non-volatile memory e.g. 3 UNINSTALL

Calibration Commands:

INIT-OFFSET	<p>Sets the offset value for the designated grating. Default values are 25600 for all gratings. The grating designator used with this command is grating# - 1.</p> <p>e.g. 25590. 0 INIT-OFFSET for setting offset on grating #1.</p> <p>NOTE: This command requires a decimal point after the offset value.</p> <p>For the new parameters of this command to take effect, the monochromator must be initialized with the MONO-RESET command or by turning the power off and back on.</p>
INIT-GADJUST	<p>Sets grating adjustment value for the designated grating. Default values are 10000 for all gratings. The limits on the parameter for this command are +/- 1000 for all gratings. The grating designator used with this command is the grating # - 1.</p> <p>e.g. 9993 1 INIT-GADJUST for setting gadjust on the second grating.</p> <p>NOTE: No decimal point is used with this command. For the new parameters of this command to take effect, the monochromator must be initialized with the MONO-RESET command or by turning the power off and back on.</p>
MONO-EESTATUS	<p>Returns setup and grating calibration parameters for all gratings.</p>
RESTORE FACTORY SETTINGS	<p>Returns all parameters including grating calibration parameters to the original factory calibrated settings.</p> <p>NOTE: This command will overwrite any calibration parameters set by the user.</p>
MONO-RESET	<p>Initializes the monochromator. Necessary after using INIT-OFFSET or INIT-GADJUST.</p>
HELLO	<p>Same as MONO-RESET. Used to maintain compatibility with existing applications.</p>
MODEL	<p>Returns model number of the monochromator.</p> <p>e.g. MODEL VM-502</p>
SERIAL	<p>Returns serial number of the monochromator.</p> <p>e.g. SERIAL 37480263</p>

The following are the Start-Up parameters and their default values:

Default Values:

GRATING	#1
WAVELENGTH	0.0 nm
SCAN SPEED	200.0 nm/min
INIT-WAVELENGTH	Sets an initial wavelength for the SD3 after initialization. e.g. 435.84 INIT-WAVELENGTH
INIT-SRATE	Sets an initial scan rate for the SD3. e.g. 200.0 INIT-SRATE

Section V. **Care of the Instrument**

5.1 Main Chamber (Instrument)

The main chamber should be kept sealed at all times, and under vacuum if possible. Only vacuum-compatible material should be exposed to the vacuum of the instrument. When operating the instrument in the vacuum ultraviolet region, the vacuum should be better than 5×10^{-5} Torr.

5.2 Bilateral Slits

The knife edges that form the slit aperture are mounted on Ball Slides and therefore require no lubrication. Nothing should contact the slit jaws directly; the slides are spring-loaded to prevent damage, thus their positions can be changed if they are contacted directly.

5.3 Scanning Mechanism

The precision drive screw is located in the instrument base and should be lubricated every 6 months with the oil supplied.

5.4 Optical Surfaces

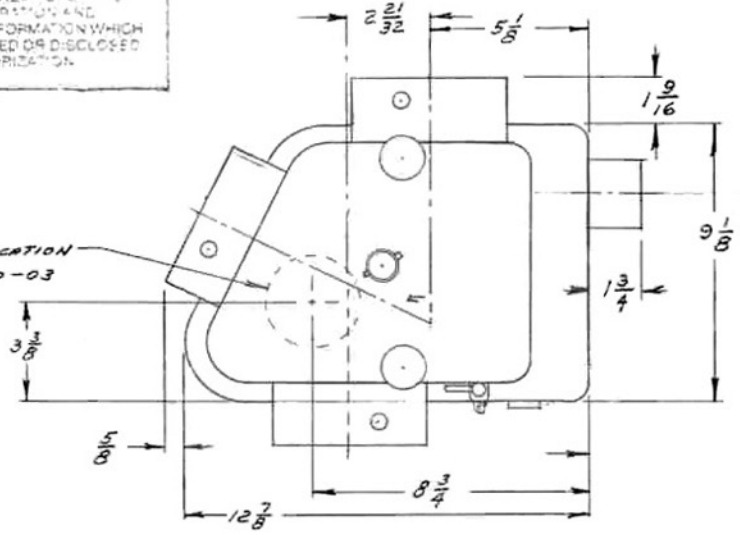
The optical surfaces are extremely delicate and can be permanently damaged by mechanical contact with anything. Do not touch, talk or breathe over the optical surfaces. After long periods of use, the optical surfaces become contaminated and therefore have a drastically reduced efficiency. Princeton Instruments can generally re-coat the optical components and obtain their original efficiency, depending of course on the condition of the surfaces. Please contact Princeton Instruments directly if you believe the optical surfaces are contaminated or damaged.

Appendix A.
Drawings and Schematics

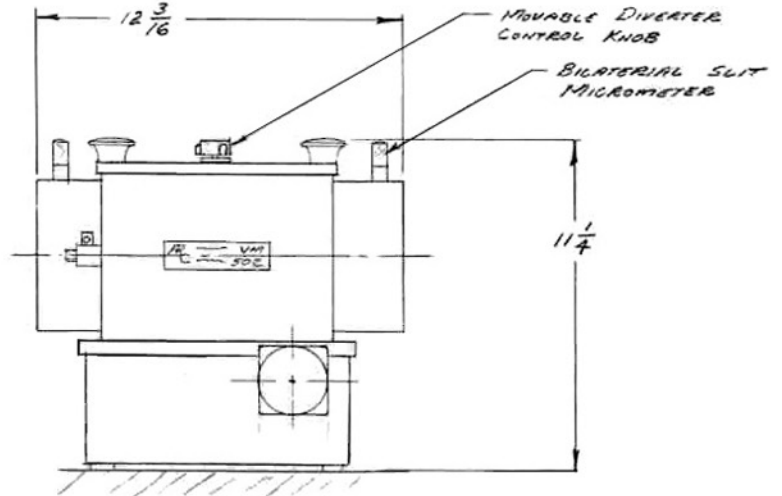
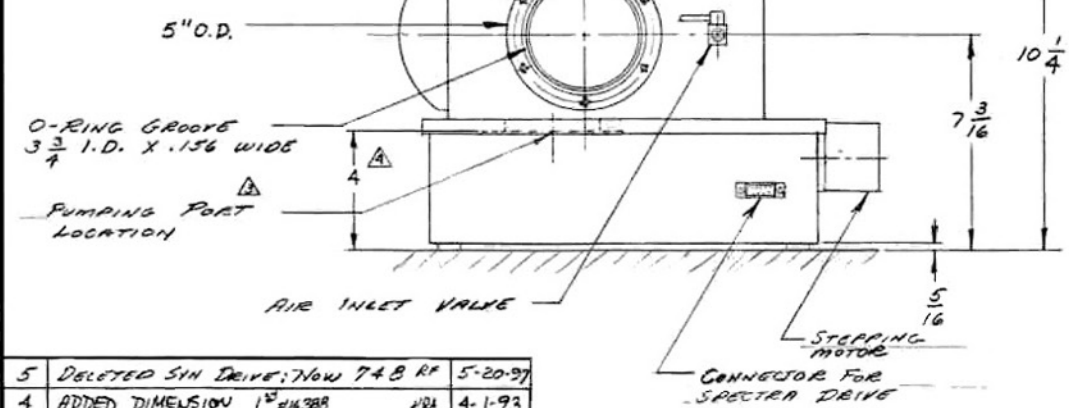
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NOTE: ALL DIMENSIONS ARE IN INCHES AND APPROXIMATE

PUMPING PORT LOCATION
SEE DWG 8502-050-03
FOR DIMENSIONS



(6) 1/4"-20 TAPPED HOLES ON A 4 1/2" DIA. B.C.



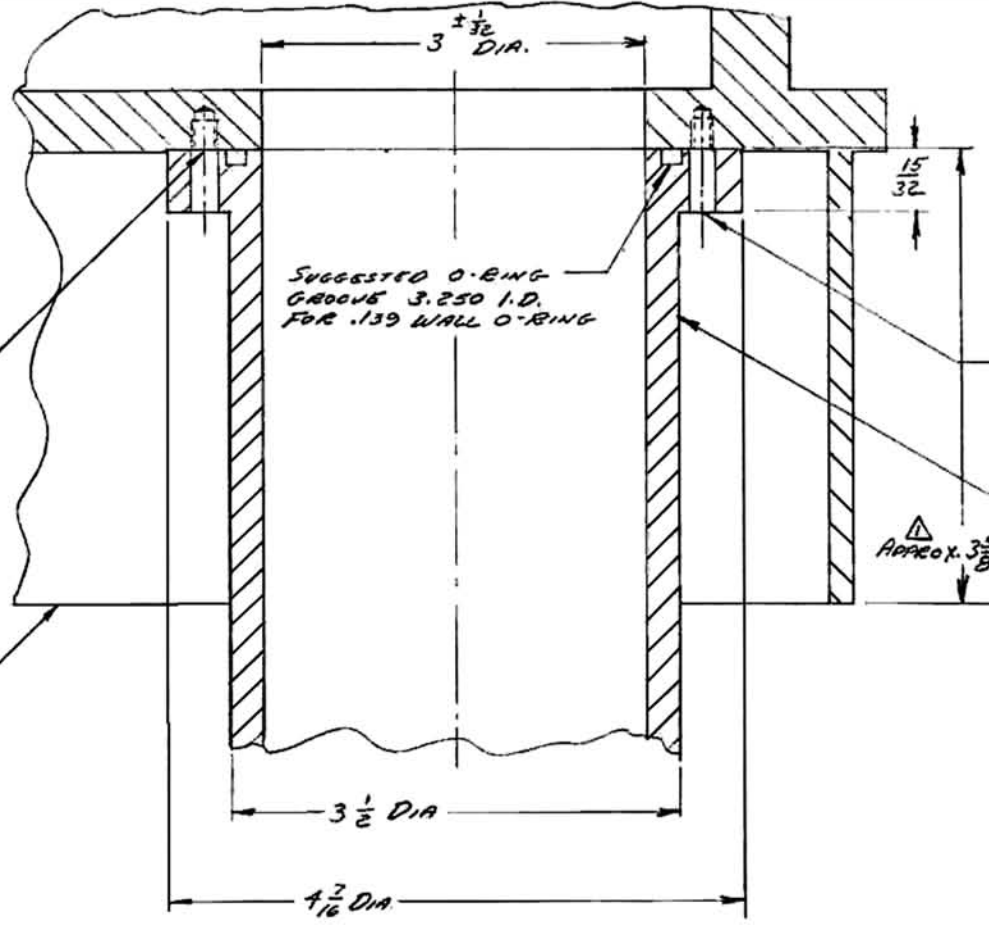
REV	DESCRIPTION	DATE
5	DELETED SYN DRIVE; NOW T4B RF	5-20-97
4	ADDED DIMENSION 1 3/8 IN 388	4-1-93
⚠	ADDED NOTE	5/21/91
⚠	CHANGE SWITCH & LIGHT LOCATION	9/28/79
⚠	ADDED PUMPING PORT LOCATION	12/28/78

SCALE: ~	APPROVED BY	DRAWN BY BKF
DATE: 11/1/78		
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VM 502 PICTORIAL	DRAWING NUMBER 8502-050-02	

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REV.	DESCRIPTION	DATE
△	ADDED DIM.	RF 7/13/02

10-32 TAPPED HOLES $\frac{1}{4}$ " DEEP IN INSTRUMENT BASE
6 HOLES EQUALLY SPACED ON 3.875 DIA. B.C.




SUGGESTED O-RING GROOVE 3.250 I.D. FOR .139 WALL O-RING

SUGGESTED CLEARANCE HOLE .201 DIA.

SUGGESTED PUMPING ADAPTER $4\frac{1}{2}$ O.D. X 3" I.D. ALUM. TUBING MIN. LENGTH 6 INCHES. MACHING AS SHOWN

APPROX. $3\frac{5}{8}$ "

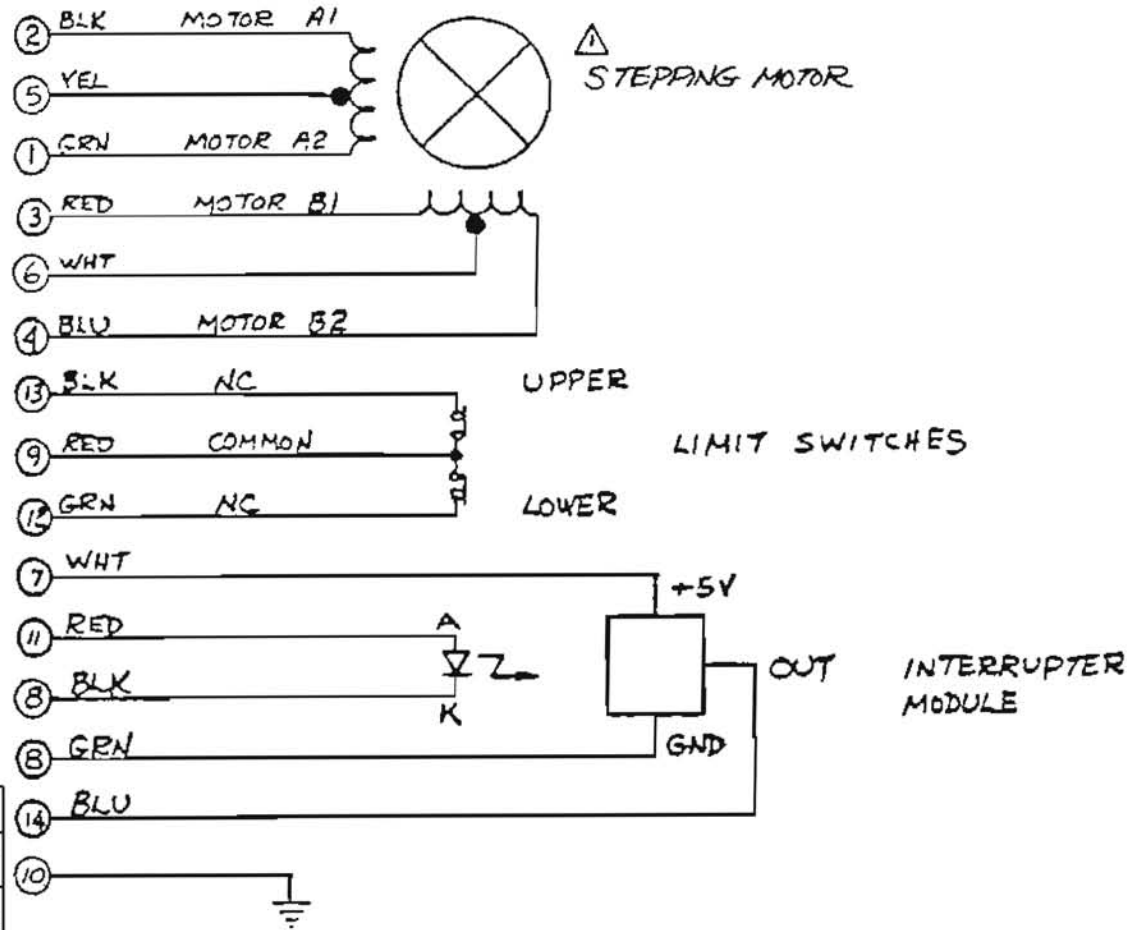
INSTRUMENT BASE

UNLESS OTHERWISE SPECIFIED			MATERIAL	FINISH
DIMENSIONS ARE IN INCHES				
TOLERANCE ON				
FRACTIONS	DECIMALS	ANGLES	SCALE:	DRAWN BY RDF
$\pm \frac{1}{64}$.XX \pm .010	\pm 15 MIN	DATE 12/19/78	NEXT ASSY
	.XXX \pm .005			QTY
MACH. SURFACE 32 MAX. REMOVE ALL BURRS & BREAK SHARP EDGES .010 MAX.			 ACTON RESEARCH CORPORATION	
			BOX 215/525 MAIN ST. ACTON, MA 01720	
DWG. TITLE	SIZE	DWG. NO.	REV.	
PUMPING PORT SIZE	B	8502-050-03	1	

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REV.	DESCRIPTION	DATE
1	WAS VEXTA # PH265M-318	KRA 12-27-90
2	ADDED 507 1 ST #14370 #/N 507124	KRA 12-20-91

NOTES:
 1. COLORS ARE TYPICAL & FOR REFERENCE ONLY
 2. NUMBERS REFER TO PIN #'S IN 15 PIN "D" TYPE CONNECTOR



3	REMOVED 507 1 ST #30425	KRA	11-30-93
REV.	DESCRIPTION	DATE	

UNLESS OTHERWISE SPECIFIED		MATERIAL	FINISH
DIMENSIONS ARE IN INCHES TOLERANCE ON FRACTIONS DECIMALS ANGLES ± 1/16 .xx ± .010 ± 15 MIN .xxx ± .005		SCALE: <i>x</i>	1 ST #12714
MACH. SURFACE 32 ✓ MAX. REMOVE ALL BURRS & BREAK SHARP EDGES .010R. MAX.		DATE 12-17-90	DRAWN BY KRA
DWG. TITLE		SIZE	DWG NO.
SCHEMATIC		A	8748-112-02
USED ON:		REV. 3	

134172

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