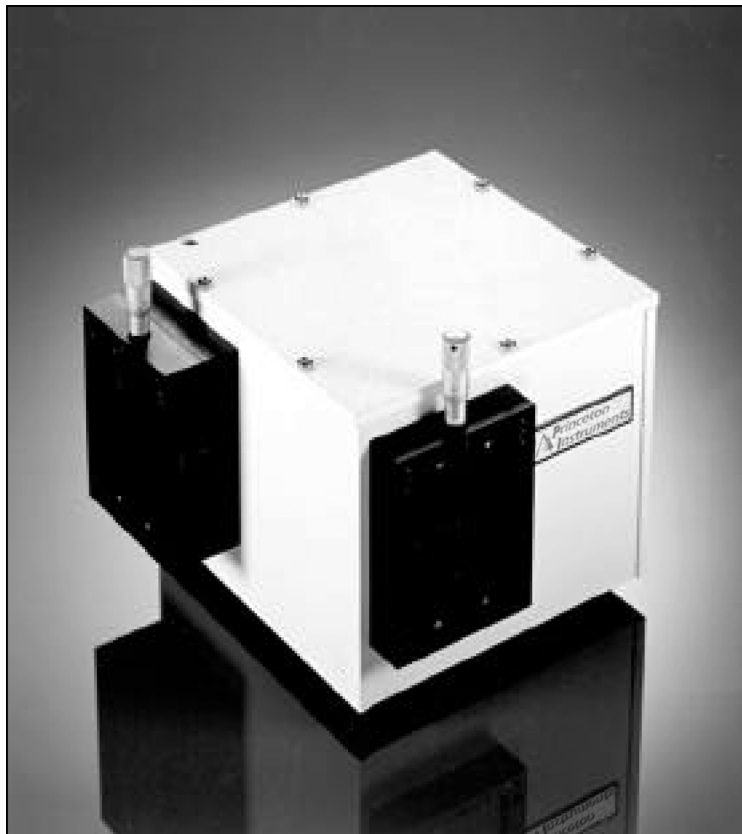




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## Operating Instructions Acton SP-150



**0.150 Meter Focal Length Dual Grating  
Imaging Monochromator / Spectrograph**

# Acton SP-150 Operating Instructions

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## **Section I: Brief Introduction and SP-150 Description**

### **Brief Introduction:**

This instruction manual is intended to assist you in set-up and operation of your new Acton SP-150 monochromator/spectrograph. Even if you are an experienced user of spectroscopic equipment, we suggest that you follow the manual (at least initially) to insure proper setup and operation. If you have any questions about the information contained in this manual, please feel free to contact the Princeton Instruments service department.

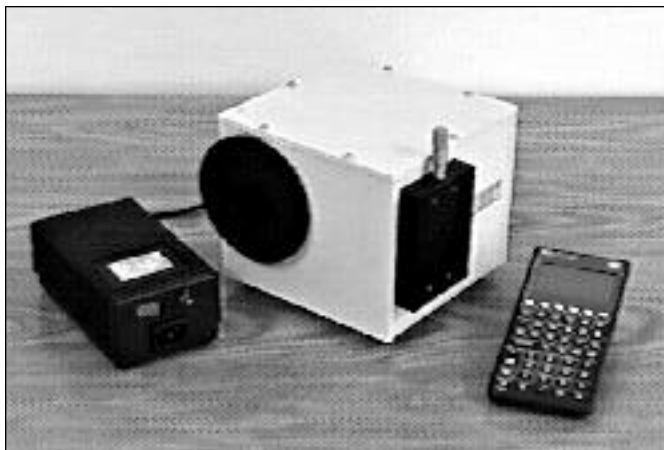
### **SP-150 Description:**

The SP-150 is a 150mm focal length monochromator/spectrograph. It features an astigmatism-corrected optical system, dual indexable gratings and interchangeable grating turrets. The SP-150 includes a direct digital grating scan mechanism with full wavelength scanning capabilities, plus built-in RS-232 and IEEE-488 computer interfaces. Three standard models are available:

**Model SP-150-M:** Monochromator version of the SP-150.

**Model SP-150-S:** Spectrograph version of the SP-150.

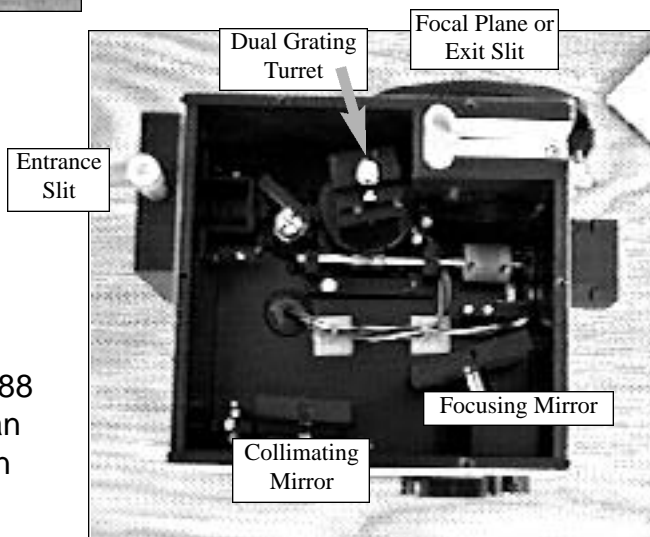
**Model SP-150-MS:** Monochromator and Spectrograph version of the SP-150.



**SP-150 shown  
with optional Model 150-749  
Remote Scan Controller  
and Power Supply**

### **Inside the SP-150:**

Cylindrical field correction, or added vertical power introduced by a toroidal mirror, results in an astigmatism-corrected optical system capable of multi-channel spectroscopy. A stepping motor based direct digital scanning system is standard, with control electronics built-in. RS232 and IEEE488 interfaces for computer control are included, plus an optional remote scan controller with dedicated scan control software is available for operating the SP-150.



**Basic Optical Layout**

## **Section II: SP-150 Specifications**

**NOTE: Each SP-150 is operated for at least 15 minutes prior to calibration to insure optimum stability. End users should follow this practice if their application calls for optimum stability & reproducibility.**

**Optical System:** Astigmatism-Corrected Czerny-Turner

**High Throughput:** Grating remains fully illuminated throughout the entire scanning range

**Focal Length:** 150mm

**Aperture Ratio:** f/4

**Stray Light:**  $<5 \times 10^{-4}$

**Resolution:** 0.4nm or better with 10 $\mu$ m wide by 4mm high slits and a standard 1200g/mm grating (200 $\mu$ m wide slits provide a 1.0nm bandpass with a 1200g/mm grating)

**Reciprocal Linear Dispersion:** 5nm/mm (nominal) with a 1200g/mm grating

**Focal Plane Area:** 10mm high X 25mm wide

**Wavelength Scanning System:** Direct digital scanning system with CMOS-based microprocessor. Provides maximum grating rotation and linear (constant nm/min.) wavelength scanning controlled by computer or Model 150-749 remote scan controller.

**Scanning Range:** 0-1400nm with a 1200g/mm grating. 0-2800nm with a 600g/mm grating.

**Wavelength Accuracy:**  $\pm 0.25$ nm with a 1200g/mm grating

**Wavelength Repeatability:**  $\pm 0.05$ nm with a 1200g/mm grating

**Computer Interface:** The SP-150 includes RS-232 and IEEE-488 computer compatibility.

**Slits:** Fixed or bilaterally adjustable slits are available from 10 $\mu$ m to 3mm widths. Available slit heights are 4mm and 14mm. 4mm is normally provided with monochromators, while 14mm height is intended for spectrographs.

**Dual Indexable Gratings:** Two gratings can be mounted in the SP-150 at the same time, and selected by push-button using the Model 150-749 scan controller, or by computer. It takes 20 seconds to index a new grating into operating position.

**Wavelength Readout:** The Model 150-749 remote scan controller provides correct wavelength readout in nanometers for any grating installed. Wavelengths can also be read by computer.

**Conversion from Spectrograph to Monochromator:** The SP-150 is designed for easy conversion from monochromator to spectrograph. Conversion time is less than 60 seconds and can be completed in the field.

**Electrical Requirements:** The SP-150 runs on 100 - 240 VAC, 50 - 60 Hz, automatically selected by the power supply.

### Section III: Instrument Setup

#### Section III-A: Unpacking and Inspection

Carefully unpack and examine the SP-150 and any accessories purchased.

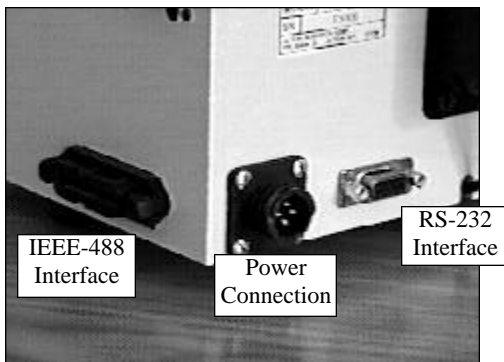
**Note:** Report any damage immediately to the carrier and to Princeton Instruments, and save all packing material.

#### Section III-B: Connecting the SP-150 Monochromator/Spectrograph to the Optional Model 150-749 Remote Scan Controller or Computer

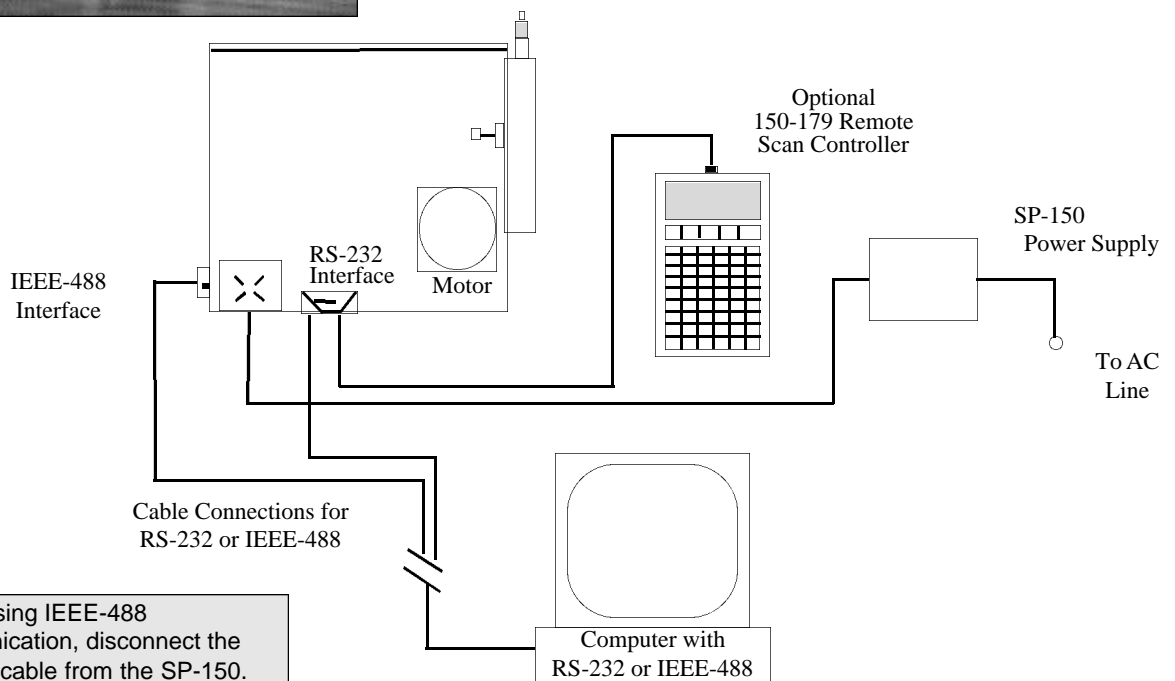
The SP-150 is designed for operation by computer using RS-232 or IEEE-488, or by using the optional Model 150-749 Remote Scan Controller. Either method of control enables wavelength scanning at a pre-set linear scan rate, change of scanning speeds, indexing of gratings, rapid GOTO wavelength positioning, change of grating turrets if available, and “jog” wavelength positioning. The diagram below shows the cable connections necessary for operation of the SP-150 with the optional Model 150-749 remote scan controller, or by computer using RS-232 or IEEE-488 connections. Sections in this manual describe actual operating instructions for the SP-150

#### SP-150 Cable Connections:

##### Optional 150-749 Remote Scan Controller, RS-232, or IEEE-488



Details of the RS-232, IEEE-488, and Power Connections on the SP-150



**NOTE:** When using IEEE-488 communication, disconnect the RS-232 cable from the SP-150.

### Section III-C: Cables and Connections for SP-150


Princeton Instruments offers the following computer cables as options:

- CC-499-1 IBM PC or XT compatible  
25 pin female ( DB25S) connector to 9 pin male connector ( DB9P).
- CC-499-2 IBM AT or compatible  
9 pin female ( DB9S) connector to 9 pin male connector ( DB9P).
- CC-499-3 Computer terminal type  
25 pin male ( DB25S) connector to 9 pin male connector ( DB9P).
- CC-499-4 9-pin cable for Macintosh computer
- CC-499-5 IEEE-488 cable, 4 meters long

If none of these cables are compatible with your system, consult Princeton Instruments for a custom cable. If you have facilities for constructing a custom cable, use the RS-232 pin arrangement shown in Table 1, or the IEEE-488 pin arrangement shown in Table 2. See also Appendix B.

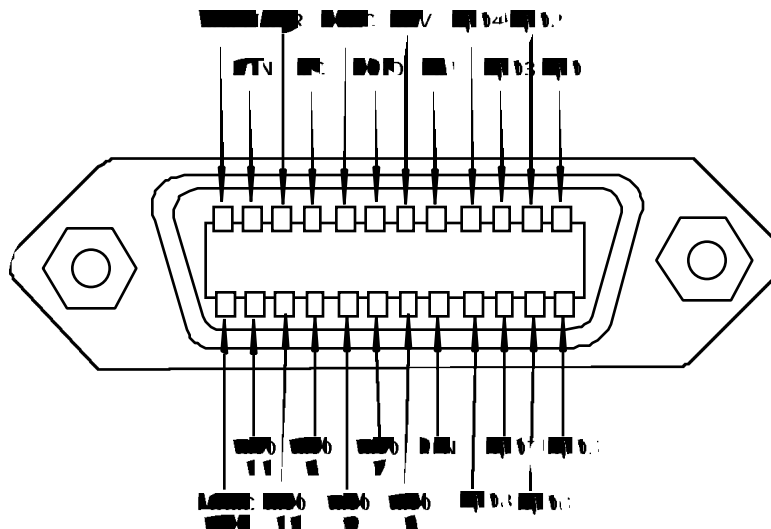
**Table 1: RS-232 Computer Interface Pin Arrangement:**

pin #	description
1	open
2	RD data from SP-150 to computer
3	TD data from computer to SP-150
4	open
5	ground
6	open
7	RTS
8	CTS
9	open


 connect these two pins together

A terminal or RS-232 computer port must be set up as follows: 9600 baud, 8 data bits, no parity, 1 start bit, 1 stop bit.

**Table 2: IEEE-488 Computer Interface Pin Arrangement:**



### Section III-D: Mounting Accessories to the SP-150 Slit Assemblies

All Acton accessories come with their own set of instructions for proper mounting and operation. The instructions below are only general information. Please refer to the individual instructions for detailed information.

**Accessories:** The full range of Acton series accessories mount directly to the SP-150 slit assemblies. A drawing of the standard slit assemblies can be found in the Appendices Section to assist you in mounting accessories. To mount an accessory to the slit, the general procedure is as follows:

1. Place the accessory directly against the face of the slit body. Light sources normally mount on the entrance slit, detectors on the exit slit. Other accessories such as fiber bundles normally mount on the entrance slit, but are also compatible with the exit slit.
2. Using four (4) 8-32 screws normally provided with the accessory, secure the accessory to the slit body.

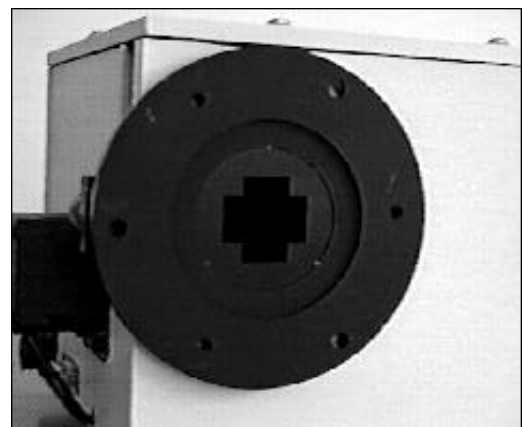
Light sources fitted with light collection/focusing optics are normally factory aligned to the standard slit.

**Note:** In some instances with light sources, there is limited access to the bottom two screw holes. In this case, Princeton Instruments provides special slotted holes in the light source housing to facilitate mounting of the source to the slit.

### Section III-E: Mounting Focal Plane Detectors to the SP-150 Spectrograph

Refer to the SP-150 schematic found in the Appendices Section. This shows details of the standard spectrograph, along with details about the mounting flange for array detectors.

The standard mounting flange for CCDs and diode arrays accommodates detectors with two different bolt circles. There are three (3) equally spaced 10-32 tapped holes on a 3.60" bolt circle, and three (3) equally spaced holes on a 3.88" bolt circle designed to accept 10-32 button head screws. A set of special cross-shaped baffles are mounted in the array detector mounting flange to define the focal plane area and reduce potential stray light. This unique baffle shape permits mounting of many different array detectors.



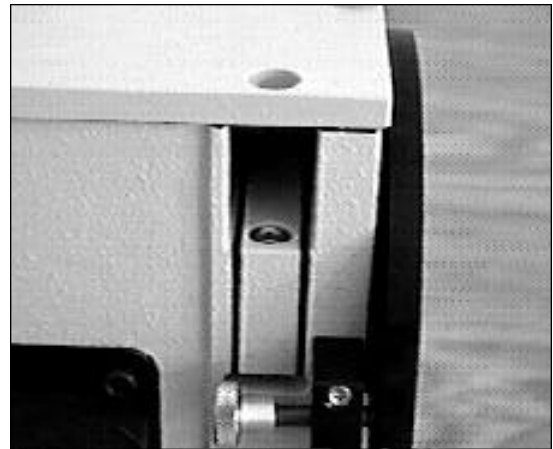
**Standard Array Detector  
Mounting Flange**

To mount an array detector to the SP-150, use the following procedure:

1. The array detector mounting flange is attached to a sliding tube, which fits inside a unique split clamp arrangement.
2. Loosen the split clamp and gently slide the array detector mounting flange all the way out of the SP-150 housing. Make sure that the sliding tube and o-ring are kept clean.

**Note:** At this point it is very important to check the focal plane distance of the array detector. This is the distance from the front mounting surface of the array detector to the actual CCD or diode array element. Because array detector focal distances vary, the correct distance is crucial in order to determine if a spacer is required for proper focus. Generally, a spacer is required if the detector focal plane distance is between 0.340" to 0.670". This spacer is normally provided with spectrographs. If the detector focal plane distance falls between 0.670" and 1.00", then no spacer is required.

3. Position the array detector mounting flange against the array detector, and match the hole patterns. When correctly positioned, the baffles should be square to the array detector. If it does not align properly, contact Princeton Instruments.
4. Fasten the array detector mounting flange to the detector, then carefully slide this assembly back into the SP-150 housing.
5. Re-tighten the split clamp to secure the detector assembly.



View of Split Clamp Assembly

**Refer to Section IV-E for focusing procedures for array detectors.**



### Section III-F: Slit Width Adjustments in the Model 716 Bilateral Slits

The slit width of each bilateral slit assembly (716 type) is adjustable from 0.010 millimeters to 3 millimeters (10 to 3,000  $\mu\text{m}$ ) by a micrometer knob located on the top of the slit housing. The micrometer knob is graduated in 0.010 millimeter (10  $\mu\text{m}$ ) increments.

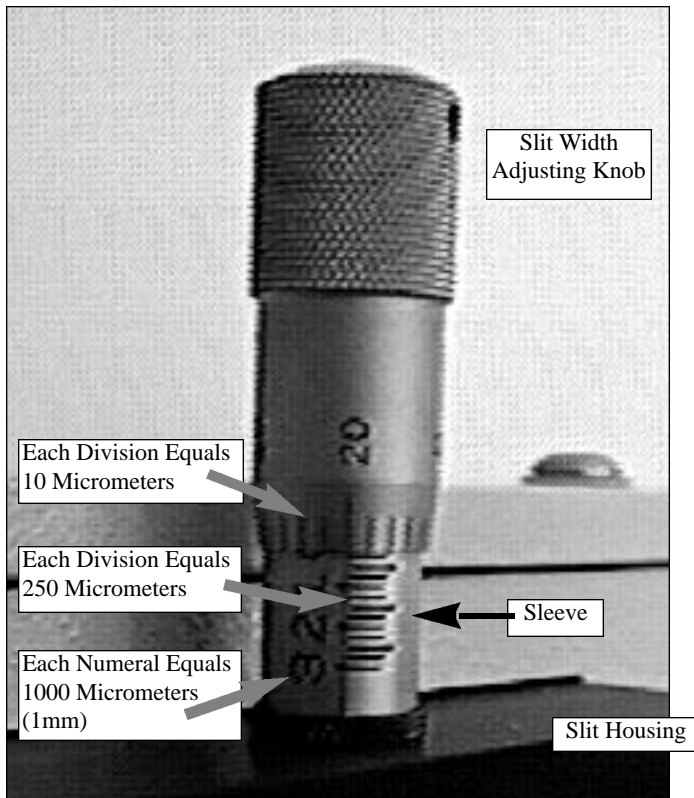
Each clockwise revolution of the micrometer knob increases the slit width 0.25 millimeters (250  $\mu\text{m}$ ). For maximum reproducibility, the slit width should be set in a clockwise direction (increasing slit widths) each time it is changed. Refer to the drawing below.

The micrometer knob should not be rotated below a reading of 0.00 or above 3.00. A micrometer setting of less than 0.010 millimeters (10  $\mu\text{m}$ ) should not be used, because a stop is provided to prevent the slit jaws from contacting each other.

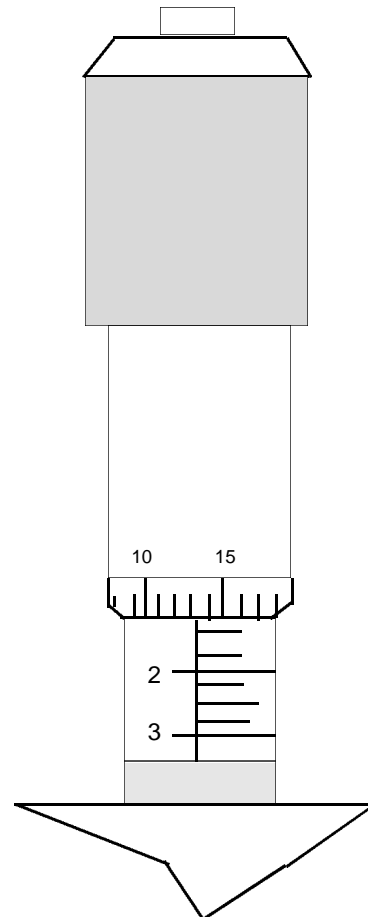
**Note: Damage May Be Done If Slit Jaws Are Opened Wider Than 3.0mm.**

#### Slit Width Micrometer Settings

Slit Width Adjustable from  
10 Micrometers to  
3000 Micrometers (3mm)



**Slit Width Setting:  
200 Micrometers (0.200mm)**



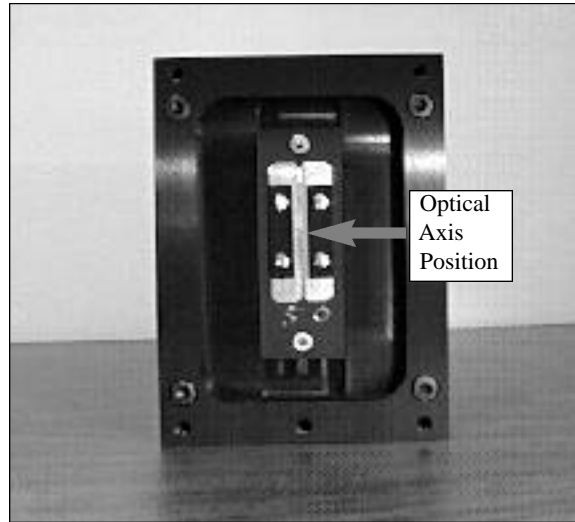
**Slit Width Setting:  
1380 Micrometers (1.38mm)**

## Section III-F Continued: Interchanging Fixed Width Slit Plates in the Model 715 Fixed Slit Assemblies

If your SP150 was purchased with the Model 715 type fixed slit assemblies, the following procedure should be followed in order to change slit widths. First, at least one additional fixed slit plate, Model 715-4-XX or 715-14-XX, must be available to permit changing widths in the 715 type slit assemblies.

### Changing Fixed Slit Plates in the 150-715-1 and 150-715-2 Assemblies:

1. Remove any accessories from the slit body.
2. Using an allen wrench, loosen the two slit plate screws which hold the slit plate to the slit body. Remove the slit plate without contacting the slit blades. Store the removed slit in a clean, dry area.

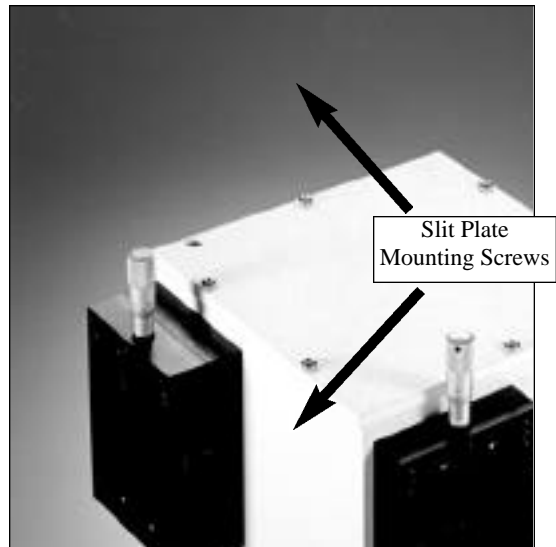


Standard Model 715 Fixed Slit Assembly  
Note Optical Axis Position

**Note:** Align the new slit plate to the SP-150 optical axis by orienting it so that the slit width label is upright and readable. When correctly mounted, the slits are off-centered height-wise, slightly above the center of the slit body. See the slit assembly drawing in the appendices section for details, or pictures on this page for reference.

3. Place the new slit plate in the slit body and secure it in position using the slit plate screws. The cone shaped holes in the slit plate are designed to align the slits to the optical system.

4. The slit width has now been changed.



Fixed Width Slit Plate  
Note Orientation for Correct Installation

## Section IV: SP-150 Operation

### Section IV-A: Initialization

When power is turned ON to the SP-150, it initializes to a wavelength of 0.0nm for grating number 1. If the power is switched OFF and then ON again to the SP-150, it will initialize. Initialization gives the system a reference, or starting position to keep track of wavelength position, grating location, and other parameters. Alternative start-up parameters can be programmed if the factory defaults are not suitable (See Appendix A).

### Section IV-B: Using the Optional Model 150-749 Remote Scan Controller

The Model 150-749 is a Remote Scan Controller (referred to as “controller” for the remainder of this manual) for the SP-150 Monochromator/Spectrographs. Functions include scanning of wavelengths, GOTO for rapidly moving the monochromator to a specific center wavelength, indexing of gratings, and interchanging of grating turrets. It consists of an H-P Model HP 48G Graphics Calculator with RS-232 Interface, and Acton-written scan control software. The controller is programmed with all the instrument scan functions displayed as convenient menu items, with simple keystrokes enabling any of the scan functions to be performed.

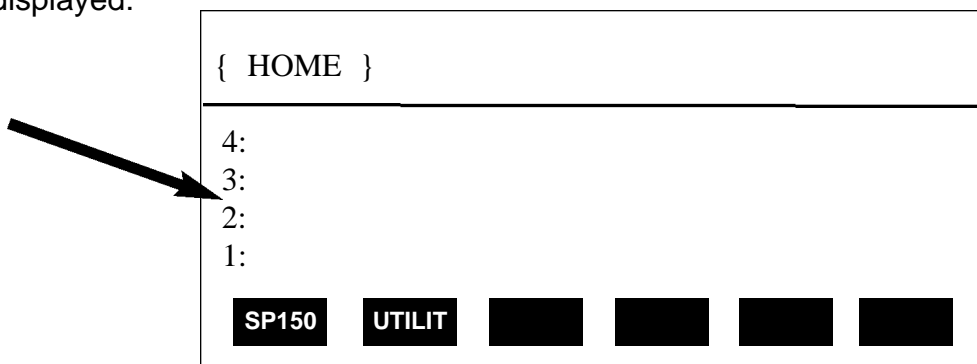
The controller is connected to the SP-150 through the standard RS-232 port with the cable provided. It is designed to send commands and receive information about the specific SP-150 it is attached to, therefore a single controller can be used with many different instruments (one at a time, however). When the power is switched OFF and then ON again to the SP-150 and the controller, the SP-150 will initialize. If the controller power is switched OFF then ON again, and the SP-150 power is left ON, the the controller will return to the last menu selected.

#### Battery Power Management Feature:

If the controller is not used for a few minutes, the LCD screen will turn off to save battery power. If this happens, simply press the ON button to return to the menu you were using.

#### Operation of the Controller with the SP-150:

With the controller connected to the SP-150, turn the power ON first to the SP-150 and allow it to initialize. Then turn the power on to the 150-749 controller. The following menu should be displayed:



If the above menu **does not** appear (for example, if the controller was operated in the calculator mode), press the RIGHT FUNCTION KEY (➡), followed by the LIBRARY key, then select SP150. When the above menu is displayed, press the white key below the **SP150** function to begin operation (see Appendices Section for use of the "UTILIT" functions). The following menu will be shown:

Acton	
SP-150	
Wavelength=	0.0nm
Scan to	0.0nm
Rate=	100.0 nm/min
Grating #1	1200 g/mm
Jog Incr	1.00nm
<div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span style="background-color: black; color: white; padding: 2px 5px;">GOTO</span> <span style="background-color: black; color: white; padding: 2px 5px;">SCAN</span> <span style="background-color: black; color: white; padding: 2px 5px;">SPEED</span> <span style="background-color: black; color: white; padding: 2px 5px;">GRAT</span> <span style="background-color: black; color: white; padding: 2px 5px;">TURR</span> <span style="background-color: black; color: white; padding: 2px 5px;">QUIT</span> </div>	

Main Menu

All functions of the SP-150 are accessed while the controller displays the Main Menu.

**Note:** When entering a number for GOTO, SCAN or SPEED, the controller will accept an integer or a number to the nearest tenth of a nanometer (nm). If you enter a number with hundredths or lower, it rounds up to the nearest tenth nanometer.

**GOTO Menu:**

Press the white key below the GOTO command. The following menu will appear (with a flashing arrow next to the **Enter wavelength** line):

{ HOME }	PRG
<p>Go To:</p>  <p>Enter Wavelength</p> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="background-color: black; width: 30px; height: 20px;"></div> <div style="background-color: black; width: 30px; height: 20px;"></div> <div style="background-color: black; width: 30px; height: 20px;"></div> <div style="background-color: black; width: 30px; height: 20px;"></div> <div style="background-color: black; width: 30px; height: 20px;"></div> <div style="background-color: black; width: 30px; height: 20px;"></div> </div>	

Key in the desired wavelength (in nm) and then push the <ENTER> key (ex: 500 <ENTER>). The SP-150 will then run at the maximum motor speed to the selected wavelength and display this interim menu.

Acton	
SP-150	
Wavelength=	234.5nm
Scan to	500.0nm
Rate=	100.0 nm/min
<div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span style="background-color: black; width: 30px; height: 20px;"></span> <span style="background-color: black; width: 30px; height: 20px;"></span> <span style="background-color: black; width: 30px; height: 20px;"></span> <span style="background-color: black; width: 30px; height: 20px;"></span> <span style="background-color: black; width: 30px; height: 20px;"></span> <span style="background-color: black; width: 30px; height: 20px;"></span> </div>	

GOTO Interim Menu

After the GOTO command is completed, the Main Menu will appear again showing the new center wavelength (in a monochromator this is the wavelength at the exit slit, in a spectrograph it is the center of the focal plane).

```
Acton
SP-150
Wavelength=      234.5nm
Scan to          500.0nm
Rate=            100.0 nm/min
Grating #1      1200g/mm
Jog Incr         1.00nm
```

**GOTO** **SCAN** **SPEED** **GRAT** **TURR** **QUIT**

Main Menu

### SCAN Menu:

SCAN moves the SP-150 to a desired wavelength at a pre-set scanning rate in nanometers per minute. To use the SCAN menu function, press the white key under the SCAN command while in the Main Menu. The following menu will appear (with a flashing arrow after Enter wavelength):

```
{ HOME }
```

---

```
Scan to:
Enter Wavelength
```

■ ■ ■ ■ ■ ■

SCAN Menu

As with GOTO, key in the desired wavelength (in nm) followed by <ENTER>. The SP-150 will scan to the selected wavelength at the preset scanning rate. To change the scanning rate, see the **SPEED (Scanning Rate)** instructions following this section. The controller will continue to update the wavelength display as scanning takes place. When the scanning is complete, the controller returns to the Main Menu with updated information:

```
Acton
SP-150
Wavelength=      100.0nm
Scan to          100.0nm
Rate=            100.0 nm/min
Grating #1      1200g/mm
Jog Incr         1.00nm
```

**GOTO** **SCAN** **SPEED** **GRAT** **TURR** **QUIT**

Main Menu

### SPEED (Scanning Rate) Menu:

To change the wavelength scanning speed of the SP-150, press the white key below the SPEED function in the Main Menu. The following menu will be displayed (with a flashing arrow after Enter speed):

{ HOME }	PRG
Enter speed	
■ ■ ■ ■ ■ ■	

SCAN Menu

Key in the desired scanning speed in nm/min then press <ENTER> (ex: 200.0 <ENTER>). If you enter a wavelength above the maximum scanning speed for a specific grating, the SP-150 and controller will default to the maximum scanning speed allowed for the specific grating. The controller will return to the Main Menu with updated scan speed, as shown in the menu below:

Acton	
SP-150	
Wavelength=	100.0nm
Scan to	100.0nm
Rate=	200.0 nm/min
Grating #1	1200g/mm
Jog Incr	1.00nm
GOTO SCAN SPEED GRAT TURR QUIT	

Main Menu

### GRAT (Grating Change) Menu:

Use the GRAT menu to index a desired grating into the operating position (only if there is more than one grating installed in your SP-150). From the Main Menu, press the white key below the GRAT command. This will display a menu that shows the available gratings for the turret currently installed, with a dot (■) indicating the grating currently in operating position. For example:

Grating:	
■ 1	1200g/mm BLZ=500nm
2	300g/mm BLZ=500nm
1 2 ■ ■ ■ QUIT	

GRAT Menu

This menu shows that Grating #1 (1200g/mm, blazed at 500nm) is in the operating position. To select grating #2, press the white button under the number 2 on the display. During the 20 seconds required for a grating change, the controller displays "Changing Grating". When the change is complete, the dot (■) appears next to the #2 grating. To return back to the Main Menu, press the white key below the QUIT function. The Main Menu will now display the new grating.

### TURR (Turret Change) Menu:

The SP-150 comes with standard self-aligning, interchangeable grating turrets. If your SP-150 has been purchased with more than one turret (up to three turrets are possible for a total of six gratings), you must input the appropriate turret number using the TURR menu, each time a turret is changed. For example, if you switch from turret #1 to turret #2, use the TURR Menu to let the software know you made the change. This enables the SP-150 and controller to scan correctly and provide correct wavelength display.

To select the **Turret Change Menu** from the Main Menu, press the white key below TURR on the controller display. The TURR menu displays, with a dot (■), which grating turret is currently installed in the SP-150, along with available turrets. A display of "Not Inst" means that no gratings have been installed in the specified turret position. For example, the following menu shows that turret #1 is installed with Grating #1 (1200g/mm) and Grating #2 (300g/mm). It also shows that turret #2 is available, and that #3 is not installed. To input the correct turret information, press the white key below the numbers 1, 2, or 3 (in this case, nothing will happen if you select turret 3).

Turret:		Grat #1	Grat #2
■	1	1200g/mm	300g/mm
	2	600g/mm	150g/mm
	3	Not Inst	Not Inst

1	2	3			QUIT
---	---	---	--	--	------

TURR Menu

Press the key below the QUIT function to return to the Main Menu. To interchange turrets in the SP-150, see Section IV-G Interchanging Grating Turrets.

### JOG Instructions:

The controller for the SP-150 allows the user to change wavelengths without accessing GOTO or SCAN, and without keying in a destination wavelength. This function is useful for rapidly scanning from one wavelength region to another, searching for the peak of a line, or accurately positioning a source image on an array detector. This function is called JOG, and it can be accessed at any time that the other functions (GOTO, SCAN, etc.) are not in operation. The controller has four direction keys marked with arrow indicators (▲, ▼, ◀, and ▶). JOG operates by moving the SP-150 in wavelength increments ranging from 0.1nm to 1000nm, and also in "single motor step" increments. Pressing the UP arrow (▲) increases the JOG increment a factor of 10 each time it is pressed, while the DOWN arrow (▼) decreases the increment a factor of 10. To access the single motor step JOG, press the DOWN arrow (▼) until the increment setting decreases below 0.1nm.

JOG direction is controlled by the arrow keys marked (◀ and ▶). To JOG to increasing wavelengths (by the increment chosen), press the (▶) key. To JOG to decreasing wavelengths, press the (◀) key. If you press either key more than once, the SP-150 will move the preset JOG increment multiplied by the number of times the key is pressed. The maximum wavelength possible depends on the grating in the operating position (1500nm maximum with a 1200g/mm grating, 3000nm maximum with a 600g/mm grating, etc.). The minimum wavelength possible is -10nm for all gratings.

## Section IV-C. Operating the SP-150 Using a Computer

The SP-150 monochromator or spectrograph can be controlled from an RS-232 terminal or from a computer using RS-232 or IEEE-488. The same command set, listed below, is used for RS-232 or IEEE-488 control.

Commands can be sent as single commands or grouped into 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 RS-232 operation, the port set-up is 9600 baud, 8 data bits, 1 stop bit and no parity. All commands or strings of commands must be terminated with a carriage return (0D hex). The SP-150 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 SP-150. If no echo is desired, the command **NO-ECHO** will suppress the echo. The command **ECHO** will return the SP-150 to the default echo state.

When using the IEEE-488 or GPIB interface, the default device address is 11. The device address can be set to any value from 1 to 30 using the command **SET-ID**.

(ex: **5 SET-ID** sets the GPIB address of the SP-150 to 5).

The command **?ID** is used to read back the IEEE address. The optional Model 150-749 can also set the device address. Each command or string of commands must be terminated with a carriage return (0D hex)). **NOTE:** This must be a carriage return character only and not a carriage return with line feed. The SP-150 controls bits in the IEEE-488 status byte which can be read from the IEEE-488 controller.

### IEEE-488 Status Byte Bits:

<b>Bit 0</b>	0 = command is being processed 1 = SP-150 ready for another command
<b>Bit 1</b>	0 = no errors 1 = SP-150 detected an error in the command
<b>Bit 7</b>	0 = no response or response has been read 1 = SP-150 generated a response which is now ready to be sent

### SP-150 Commands:

<u>Command</u>	<u>Function</u>	<u>Example</u>
<b>NM/MIN</b>	Sets scan speed	100.0 NM/MIN (this sets the scan rate to 100nm per/min)
<b>NM</b>	Scans to destination wavelength to nearest 0.1nm at selected scan rate.	250.0NM (this causes the SP-150 to scan to 250 nm)



**GOTO** Goes to destination wavelength to nearest 0.1nm at selected scan rate. **250.0 NM** (causes the SP-150 to go to 250 nm)

**NM/JOG** Sets the Jog Increment to the nearest 0.01nm. Two digits after the decimal point are required. **50.00 NM/JOG** (causes a Jog increment of 50.0nm, used by JOG-UP or JOG-DN)

**JOG-UP** Moves the pre-set jog increment toward increasing wavelengths.

**JOG-DN** Moves the pre-set jog increment toward decreasing wavelengths.

The following two commands are used when it is necessary to move to a wavelength with greater motor step resolution than the NM or GOTO command. Note that this will not necessarily provide better optical resolution.

**<NM>** Scans to destination wavelength to nearest 0.01nm at the selected scan rate. **500.00 <NM>** (causes the SP-150 to scan to 500nm)

**<GOTO>** Goes to destination wavelength to nearest 0.01nm at maximum speed. **500.00 <GOTO>** (causes the SP-150 to move to 500nm at max. motor speed)

**GRATING** Selects either the first or second grating on the selected turret. Requires approximately 20 seconds. **2 GRATING** (indexes grating #2 into position. Moves to the same wavelength as the prev. grating or 200nm default if wavelength is not accessible by the selected grating.)

**TURRET** Selects parameters for the gratings on turret 1, 2 or 3. **2 TURRET** (selects parameters for turret #2)

**?NM** Sends the current wavelength to the computer or terminal with the format 250.0

**?NM/MIN** Sends the present scan speed to computer or terminal with the format 100.0

**?GRATING** Sends the present grating position (1 or 2) on the selected turret to the computer or terminal

**?GRATINGS** Sends the groove spacing and blaze wavelength of each grating position 1 through 6 (2 grating positions for each of 3 turrets) to the computer or terminal.

**?TURRET** Sends the selected turret number (1, 2, or 3) to the computer or terminal.

**?TURRETS** Sends the groove spacing of each grating for each turret to the computer or terminal.

**Note:** Commands must be entered exactly as described above, including all decimal points, number of digits after the decimal point and spacing between commands.

## Selecting Alternate Start-Up Parameters

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

<b>GRATING</b>	#1
<b>WAVELENGTH</b>	0.0 nm
<b>SCAN SPEED</b>	100.0 nm/min

Each of the above may be changed through the RS-232 port or IEEE-488 port using the following commands. These values are stored in non-volatile memory and will be in effect after the next power-up.

**INIT-GRATING** Selects which of the two gratings on the installed turret the SP-150 will go to after finding 0.0 nm on the first grating. (e.g. **2 INIT-GRATING** selects the second grating as the default)

**INIT-WAVELENGTH** Sets an initial wavelength for the SP-150 after initialization. (e.g. **435.84 INIT-WAVELENGTH** Notice that two digits after the decimal point are required)

**INIT-SRATE** Sets an initial scan rate for the SP-150. (e.g. **500.00 INIT-SRATE** Notice that two digits after the decimal point are required)

The following command is used to return all grating parameters and start-up parameters to the original factory settings.

**Note:** Any gratings installed at a later date (after initially receiving the SP-150) will be erased from memory using this “restore command”.

## RESTORE-FACTORY-SETTINGS

#### Section IV-D: IEEE -488 Interface for SP-150 Monochromators and Spectrographs

The IEEE-488 interface allows control of an Acton series monochromator from the IEEE-488 bus. All of the commands and status requests described in Section C, *Operation from External Computer*, are available through the IEEE-488 option. The following standard interface functions are provided:

SH1, AH1, T2, L2, SR1, RL1 (NOTE: The local lockout command is not accepted but the front panel is automatically locked out when the monochromator controller has been addressed as a talker or a listener), PP0, DC0, C0

The GPIB device identifier or address may be sent through the RS-232 or IEEE-488 ports. The factory set device address is 11 and may be changed with the command SET-ID through the GPIB or RS-232 ports (e.g. 5 SET-ID <CR> would set the device address to 5). This device address will remain as set until another SET-ID command is issued. It is not affected by power off or reset. The command ?ID will report back the current device address.

To get into remote operation from the IEEE-488 bus, the SP-150 must be in local mode. Power up the SP-150 without anything connected to its RS-232 port. When the SP-150 is then addressed as a listener or a talker through the IEEE-488 bus, the monochromator will then be in remote.

To return to RS-232 operation, attach the Model 150-749 remote scan controller or a computer serial cable to the RS-232 port of the SP-150, then turn the power ON to the SP-150.

The last byte of each command string to the SP-150 must be a <CR> (hex 0D). The end message (EOI line) is accepted but not required. When the SP-150 is a talker, each string sent back to the controller ends with a <LF> (hex 0A) with the EOI line set. **Note:** This must be a carriage return only and not a carriage return and line feed.

The SP-150 will issue a service request based upon the contents of the service request mask which is set by the SET-MASK command and read by the ?MASK command. The bits of the mask are as follows:

- bit 0    previously sent command is complete
- bit 1    previous command generated an error
- bit 7    previous command generated a response which is  
          now ready to be sent

The default value for the service request mask is 0, therefore, no service request is generated. To change the mask to generate a service request on error or response ready, for example, issue the command 130 SET-MASK <CR>. This new value is reset to the default value on reset or power-up.

The SP-150 responds to a serial poll with a status byte that uses the same bit pattern as the service request mask shown above.

The following pages list five example programs in BASIC using the IEEE-488 option. Examples one and two are based upon the PC-488 board and software from Capital Equipment Corp. as the controller and examples A, B and C are based upon the PC-II A board from National Instruments. The first part of the code as well as some of the instructions are unique to the individual boards but are similar to those used with other controllers. Examples 1 and A send the monochromator to 253.7 nanometers and then return control to the SP-150 front panel. Examples 2 and B request the wavelength from the SP-150. These two programs assume the service request mask is set to the value (130 decimal) so that a service request is generated when the SP-150 has data to send to the controller. The program starts a serial poll and prints the status byte and data from the SP-150. Example C reads the monochromator or spectrograph wavelength with the service request mask set to the default value of 0.

## Program Listing

```
1      ' Example program 1: send monochromator to a wavelength
10     DEF SEG=&HC400                                ' memory segment for PC<>488
20     INITIALIZE=0                                  ' offsets for PC<>488 routines
30     TRANSMIT=3 : RECEIVE=6
50     SEND=9 : SPOLL=12 : ENTER=21
60     MY.ADDRESS%=21 : LEVEL%=0                    ' make PC a controller at address 21
70     CALL INITIALIZE (MY.ADDRESS%,LEVEL%)
80     MONO%=11                                       ' monochromator address is 11
81     T$="UNT UNL MTA LISTEN"+STR$(MONO%)          ' listen
82     CALLTRANSMIT (T$,STATUS%)
83     IF STATUS%<>0 THEN PRINT " status =";STATUS%  : STOP
84     T$="DATA '253.7 NM' 13"                        ' send grating to 253.7 nm
85     CALLTRANSMIT (T$,STATUS%)
86     IF STATUS%<>0 THEN PRINT " status = "; STATUS% : STOP
90     T$="DATA 13 GTL"                                ' go to local
95     CALL TRANSMIT (T$,STATUS%)
97     IF STATUS%<>0 THEN STOP
100    END
```

```
1      'Example 2: request wavelength, wait for SRQ, serial poll
2      '      service request mask = 130 ( 82 hex )
10     DEF SEG=&HC400
20     INITIALIZE=0                                  ' offsets for PC<>488 routines
30     TRANSMIT=3 : RECEIVE=6
50     SEND=9 : SPOLL=12 : ENTER=21
60     MY.ADDRESS%=21 : LEVEL%LEVEL%0              ' make PC a controller at address 21
70     CALL INITIALIZE (MY.ADDRESS%,LEVEL%)
80     MONO%=11                                       ' monochromator address is 11
81     T$="UNT UNL MTA LISTEN"+STR$(MONO%)          ' listen
82     CALLTRANSMIT (T$,STATUS%)
83     IF STATUS%<>0 THEN PRINT "status =";STATUS%  : STOP
90     T$="DATA '?NM' 13"                                ' ask for position
91     CALLTRANSMIT (T$.STATUS%)
92     IF STATUS%<>0 THEN PRINT " status=":STATUS%  : STOP
115    '--- now, wait for SRQ status bit---
125    IF (INP(&H2BA) AND &H40)=0 THEN 125
131    ' -- SRQ has occurred, now read the result
133    CALL SPOLL (MONO%,POLL%.STATUS%)
134    IF STATUS%<>0 THEN PRINT " status =";STATUS%  : STOP
135    PRINT" serial poll = ";POLL%
136    T$="UNL MLA"
137    CALLTRANSMIT (T$,STATUS%)
138    IF STATUS%<>0 THEN PRINT " status =":STATUS%  : STOP
140    T$="TALK"+STR$(MONO%)
141    CALL TRANSMIT (T$.STATUS%)
142    IF STATUS%<>0 THEN PRINT " status=":STATUS%  : STOP
147    R$=SPACE$(255)                                    'get up to 255 characters from device
150    CALL RECEIVE (R$,LENGTH%,STATUS%)
160    IF STATUS%<>0 THEN PRINT "status =";STATUS%  : STOP
170    PRINT " data received ";LEFT$(R$,LENGTH%);""
180    T$="UNT UNL MTA LISTEN "+STR$(MONO%)          ' listen
181    CALLTRANSMIT (T$,STATUS%)
182    IF STATUS%<>0 THEN PRINT " status=":STATUS%  : STOP
250    END
```

```

1 CLEAR ,59000! : IBINIT1=59000! : IBINIT2=IBINIT1+3 : BLOAD "bib.m", IBINIT1
2 CALL IBINIT1 (IBFIND,IBTRG,IBCLR,IBPCT,IBSIC,IBLOC,IBPPC,IBBNA,IBONL,IBRSC,IB
SRE,IBRSV,IBPAD,IBSAD,IBIST,IBDMA,IBEOS,IBTMO,IBEOT,IBRDF,IBWRTF,IBTRAP)
3 CALL IBINIT2 (IBGTS,IBCAC,IBWAIT,IBPOKE,IBWRT,IBWRTA,IBCMD,IBCMDA,IBRD,IBRDA,
IBSTOP,IBRPP,IBRSP,IBDIAG,IBXTRC,IBRDI,IBWRTI,IBRDIA,IBWRTIA,IBSTA%,IBERR%,IBCNT%)
10 REM Example A: send monochromator to a wavelength
20 UDNAME$="SP275"
30 CALL IBFIND (UDNAME$, UD%)
35 REM check for error on ibfind call
40 IF UD% < 0 THEN GOTO 200
45 REM send command to sp275
50 WRT$="253.7 nm" + CHR$ ($HD)
60 CALL IBWRT (UD%,WRT$)
65 REM check for error on function call
70 IF IBSTA% < 0 THEN GOTO 300
75 REM go to local at monochromator
78 FOR I=1 TO 100 : NEXT I
80 CALL IBLOC (UD%)
85 REM check for error on function call
90 IF IBSTA% < 0 THEN GOTO 300
100 GOTO 500
200 REM ibfind error
205 PRINT "ibfind error": STOP
300 REM function call error
305 PRINT "gpib function call error" : STOP
500 END

```

```

1 CLEAR ,59000! : IBINIT1=59000! : IBINIT2=IBINIT1+3 : BLOAD "bib.m", IBINIT1
2 CALL IBINIT1 (IBFIND,IBTRG,IBCLR,IBPCT,IBSIC,IBLOC,IBPPC,IBBNA,IBONL,IBRSC,IBSRE,
IBRSV,IBPAD,IBSAD,IBIST,IBDMA,IBEOS,IBTMO,IBEOT,IBRDF,IBWRTF,IBTRAP)
3 CALL IBINIT2 (IBGTS,IBCAC,IBWAIT,IBPOKE,IBWRT,IBWRTA,IBCMD,IBCMDA,IBRD,IBRDA,
IBSTOP,IBRPP,IBRSP,IBDIAG,IBXTRC,IBRDI,IBWRTI,IBRDIA,IBWRTIA,IBSTA%,IBERR%,IBCNT%)
10 REM Example B: request wavelength, wait for data ready, read wavelength
15 REM using National PCIIA board with EOS byte = hex 0A
17 REM Service request mask = 0
20 UDNAME$="SP275"
30 CALL IBFIND (UDNAME$,UD%)
35 REM check for error on ibfind call
40 IF UD% < 0 THEN GOTO 200
45 REM send command to sp275
50 WRT$= "?NM " + CHR$(&HD)
60 CALL IBWRT (UD%,WRT$)
65 REM check for error on function call
70 IF IBSTA% < 0 THEN GOTO 300
113 REM PRINT "IBSTA% = "; IBSTA%
116 CALL IBRSP (UD%,SPR%)
118 IF ( (SPR% AND 129) <> 129 ) THEN 116
125 PRINT "SPR = "; SPR%
130 RD$=SPACE$(255)
140 CALL IBRD (UD%,RD$)
145 IF IBSTA% < 0 THEN GOTO 300
150 PRINT " data received ="; LEFT$(RD$,IBCNT%);
160 REM PRINT " status = "; IBSTA%
170 GOTO 500
200 REM ibfind error
205 PRINT "ibfind error": STOP
300 REM function call error
305 PRINT "goib function call error" : STOP
500 END

```

```

1  CLEAR ,59000! : IBINIT1=59000! : IBINIT2=IBINIT1+3 : BLOAD "bib.m",IBINIT1
2  CALL IBINIT1 (IBFIND,IBTRG,IBCLR,IBPCT,IBSIC,IBLOC,IBPPC,IBBNA,IBONL,IBRSC,IBSRE,
   IBRSV,IBPAD,IBSAD,IBIST,IBDMA,IBEOS,IBTMO,IBEOT,IBRDF,IBWRTF,IBTRAP)
3  CALL IBINIT2 (IBGTS,IBCAC,IBWAIT,IBPOKE,IBWRT,IBWRTA,IBCMD,IBCMDA,IBRD,IBRDA,
   IBSTOP,IBRPP,IBRSP,IBDIAG,IBXTRC,IBRDI,IBWRTI,IBRDIA,IBWRTIA,IBSTA%,IBERR%,
   IBCNT%)
10  REM Example C: request wavelength, do serial poll, read wavelelngth
15  REM using National PCIIA board with EOS byte = hex 0A
17  REM Service request mask = 130 ( 82 hex )
20  UDNAME$="SP275"
30  CALL IBFIND (UDNAME$,UD%)
35  REM check for error on ibfind call
40  IF UD% < 0 THEN GOTO 200
45  REM send command to sp275
50  WRT$= "?NM " + CHR$(&HD)
60  CALL IBWRT (UD%,WRT$)
65  REM check for error on fuction call
70  IF IBSTA% < 0 THEN GOTO 300
75  REM wait for RQS
90  MASK%=&H4800
100 Call IBWAIT (UD%,MASK%)
105  REM check for error or timeout
110 IF (IBSTA% AND &HC000) <> 0 THEN GOTO 300
113 REM PRINT "IBSTA% = "; IBSTA%
116 CALL IBRSP (UD%,SPR%)
117  PRINT "SPR = "; SPR%
120 REM read wavelength from monochromator
130 RD$=SPACE$(255)
140  CALL IBRD (UD%,RD$)
145 IF IBSTA% <0 THEN GOTO 300
150 PRINT " data received = "; LEFT$(RD$,IBCNT%);
160 REM PRINT " status = "; IBSTA%
170  GOTO 500
200 REM ibfind error
205 PRINT "ibfind error": STOP
300 REM function call error
305 PRINT "gpib function call error" : STOP
500 END

```

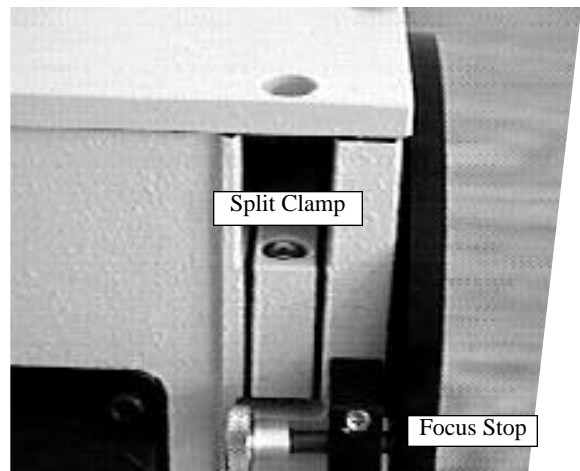
## Section IV-E: Focusing and Alignment of Array Detectors

With the CCD or diode array properly mounted to the SP-150 using the procedure detailed in Section III-E, use the following procedure to align and focus the array detector to the SP-150 optical system. We assume that the array detection system is running for the following procedure.

1. Mount a light source such as a mercury pen-ray type to the entrance slit of the SP-150. Princeton Instruments offers a standard mercury lamp, Model MS-416, designed for this purpose. Any light source with line output can be used. If there are no “line” sources available, it is possible to use a broadband source such a tungsten for the alignment. If this is the case, use only a wavelength setting of 0.0nm for alignment purposes.
2. With the SP-150 properly connected to a controller (computer or Model 150-749 remote scan controller), turn the power ON and move the spectrograph to a wavelength of 435.8nm if using a mercury lamp, or 0.0 for a broadband source, or another wavelength corresponding to a spectrum produced by a different “line” source.

**If the SP-150 is not connected to a controller, please return to Section III-B or III-C. If you are unfamiliar with operation of the SP-150, refer to Section IV-B or IV-C.**

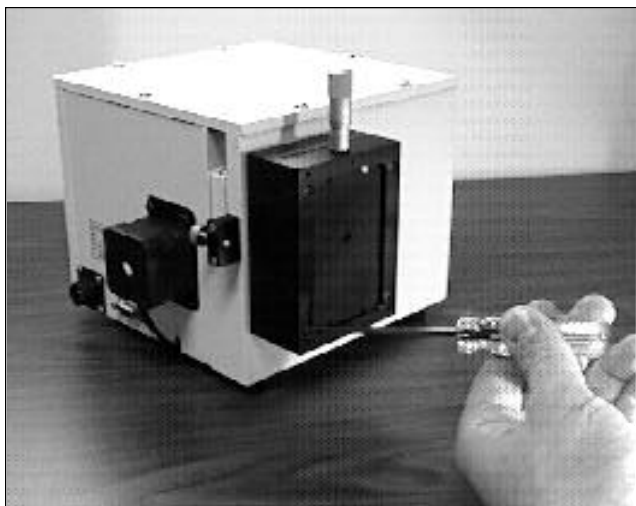
3. With the array detector operating, check the image of the light source if running in an imaging mode with a CCD. Otherwise check the line intensity and shape.
4. Loosen the split clamp and slowly move the array detector IN or OUT until sharpest image is achieved, or sharpest line is achieved.
5. Move the focus-stop screw until it just contacts the array detector mounting flange. This enables you to rotate the detector without changing the focus position.
6. When best focus is achieved, tighten the split clamp to secure the detector.
7. At this time the array detector is aligned to the SP-150 for best spectral resolution. The light source can be remove if desired, and replaced by fiber optics or other light sources.
8. If fibers or other imaging input optics are used to bring light into the SP-150, they will require adjustment along the optical axis to achieve best vertical image quality.



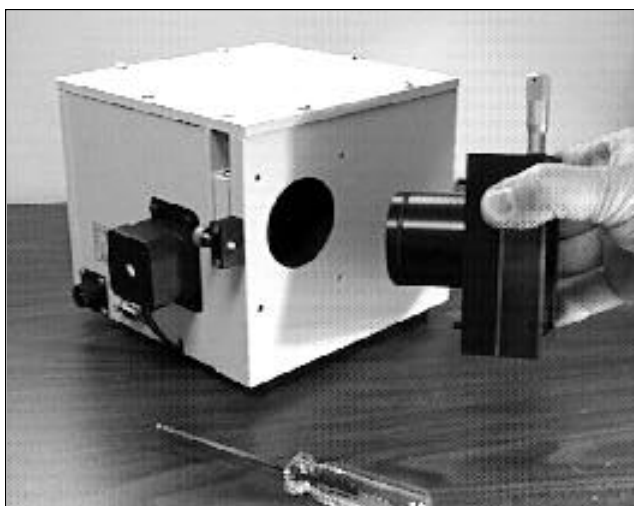


## Section IV-F: Converting the SP-150 from Monochromator to Spectrograph, or Spectrograph to Monochromator

**Monochromator to Spectrograph:** This procedure requires that you have the monochromator version, Model SP-150-M, plus the array detector mounting flange (Model SP-150-MS includes these items).

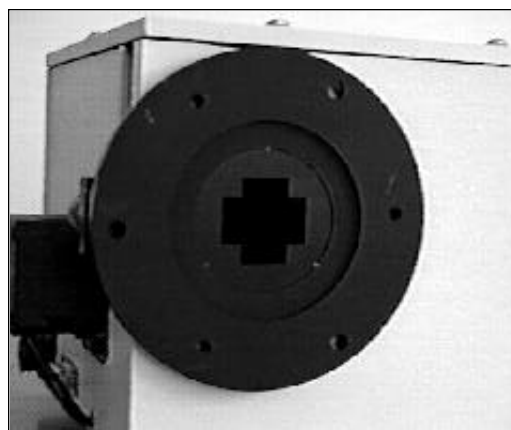


Removal of the 8-32 Screws Securing the Exit Slit to the SP-150 Housing



Sliding the Exit Slit, With Sliding Tube, Out of the SP-150 Housing

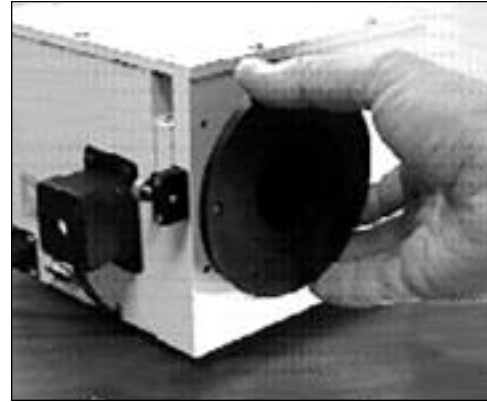
1. Loosen the split clamp.
2. Remove the four (4) 8-32 socket head cap screws (SHCS) which secure the exit slit to the SP-150 housing. Details of the slit assemblies can be found in the drawing located in the Appendices Section.
3. Gently slide the slit assembly out of the SP-150 housing and store in a clean, dry area. The exit slit assemblies are attached to a sliding tube which is removed along with the slit body.
4. Slide the array detector mounting flange into the SP-150 housing so that it rests against the housing. It may be necessary to turn the focus-stop screw counter clockwise so that it does not interfere with the array detector mounting flange.
5. The SP-150 has now been converted from monochromator to spectrograph.
6. Refer to Sections III-E "Mounting Array Detectors..." and IV-E "Focus and Alignment..." for actual mounting, alignment, and focus of array detectors.



Array Detector Mounting Flange Mounted in Place of the Exit Slit

**Spectrograph to Monochromator:** This procedure requires that you have the spectrograph version, Model SP-150-S, plus the Model 150-716-2 exit slit assembly (SP-150-MS includes these items).

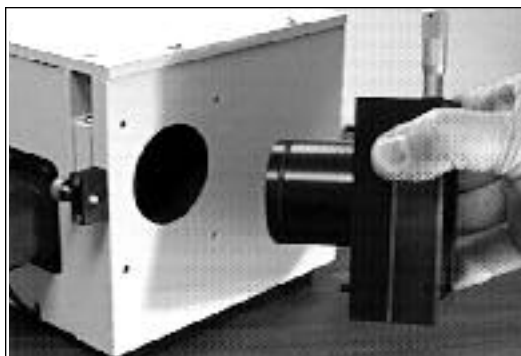
1. Loosen the split clamp and gently slide the array detector mounting flange out of the SP-150 housing.
2. Remove the array detector if attached, then store the array detector mounting flange in a clean, dry place.
3. Locate the Model 150-716-2 exit slit assembly, then gently slide it into the SP-150 housing until it rests against the housing. Exit slit assemblies are attached to a sliding tube to fit the SP-150 housing with split clamp arrangement.
4. Using four (4) 8-32 socket head cap screws (SHCS), secure the slit assembly against the SP-150 housing. There are four (4) tapped holes in the SP-150 housing to facilitate mounting the exit slit. Tightening the split clamp assembly is not crucial, but good practice.



**Sliding the Array Detector Mounting Flange Out of the SP-150 Housing**

**Note:** The slit aperture is slightly offset in the slit assembly. Orientate it so that the aperture is on the upper side when properly mounted. On the bilateral slits, the micrometer points upward. On the fixed slit assemblies you should be able to read the slit width marking (it will be upright). Refer to the drawing in the appendices section of this manual for correct orientation if necessary.

5. The SP-150 has now been converted from spectrograph to monochromator .



**Sliding the Exit Slit Assembly, With Sliding Tube, Into the SP-150 Housing**



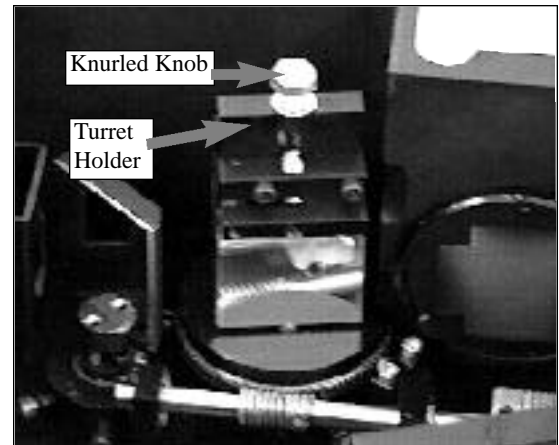
**Securing the Exit Slit Assembly to the Housing Using Four (4) 8-32 Screws**

## Section IV-G: Interchanging Grating Turrets

**Caution:** Optical surfaces of gratings and mirrors are extremely delicate and can be permanently damaged by contact with anything. Do not touch, talk, or breathe on or over the gratings, or optical surfaces inside the SP-150.

General: Every SP-150 is supplied with kinematically mounted grating turrets to permit easy removal and interchanging of grating turrets without re-alignment of the instrument. To interchange turrets, use the following procedure:

1. Locate the container holding the new turret.
2. Move the SP-150 to a wavelength of 0.0nm for grating number one, or the lowest grating number on the turret installed.
3. Remove the SP-150 cover. Refer to \_\_\_\_\_ the caution above.
4. Turrets are held in position by a single screw with a knurled knob located at the top of the turret (see picture). Turn the knurled screw in a counter clockwise direction until it disengages from the kinematic mount. The screw is spring loaded and captive in the turret.
5. Lift the grating turret straight out of the housing, taking great care not to allow anything to make contact with the gratings. Grasp the screw and/or top portion of the grating turret when handling the grating turrets.
6. Place the removed grating turret on a clean, dry surface.
7. Remove the cover from the grating turret storage container. Remove the grating turret from the storage by loosening the knurled screw. This is similar to Step 4 above.
8. With extreme care, place the new grating turret on the kinematic mount inside the SP-150 housing. The kinematic mount only will accept the turret in one orientation. Normally this will be when the lowest grating number is facing the concave mirrors inside the housing. (Remember that you previously scanned to 0.0nm for the lowest grating number.)
9. Using your index finger and thumb, simultaneously push straight down and turn the knurled screw clockwise to engage the kinematic mount. When the screw engages the tapped hole, continue to turn it clockwise until the turret is secured. Don't over-tighten!
10. Replace and secure the SP-150 cover. Place the previously removed grating turret in the turret storage container, and secure it using the knurled screw.
11. At this point you must tell the SP-150 what turret is currently installed, so that the correct calibration information can be used for those specific gratings. Refer to Section IV-B or IV-C to complete the turret installation procedure.



**Dual Grating Turret Mounted  
Inside the SP-150**

## Section V. Appendices and Schematic Drawings

### Appendix A: Selecting Alternate Start-Up Parameters

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

<b>GRATING</b>	#1
<b>WAVELENGTH</b>	0.0 nm
<b>SCAN SPEED</b>	100.0 nm/min

Each of the above may be changed through the RS-232 port or IEEE-488 port using the following commands. These values are stored in non-volatile memory and will be in effect after the next power-up.

<b>INIT-GRATING</b>	Selects which of the two gratings on the installed turret the SP-150 will go to after finding 0.0 nm on the first grating. (e.g. 2 <b>INIT-GRATING</b> selects the second grating as the default)
<b>INIT-WAVELENGTH</b>	Sets an initial wavelength for the SP-150 after initialization. (e.g. 435.84 <b>INIT-WAVELENGTH</b> Notice that two digits after the decimal point are required)
<b>INIT-SRATE</b>	Sets an initial scan rate for the SP-150. (e.g. 500.00 <b>INIT-SRATE</b> Notice that two digits after the decimal point are required)

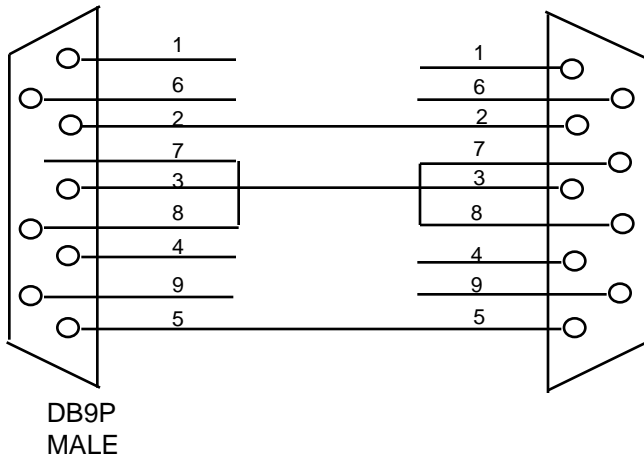
The following command is used to return all grating parameters and start-up parameters to the original factory settings.

#### **RESTORE-FACTORY-SETTINGS**

Note that any gratings installed at a later date (after initially receiving the SP-150) will be erased from memory using this “restore command”.

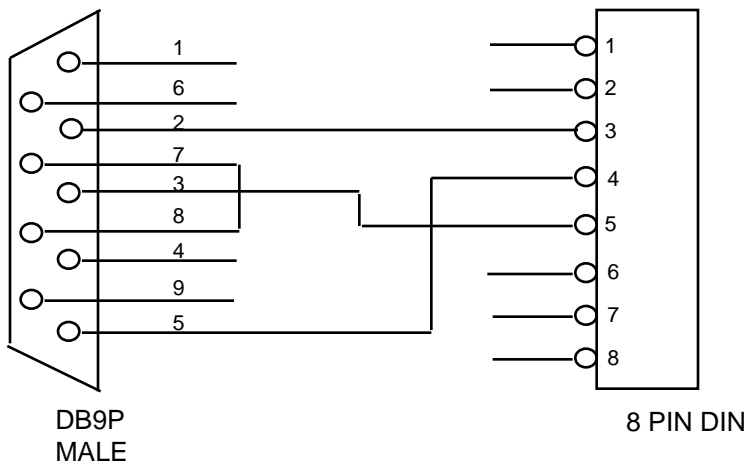
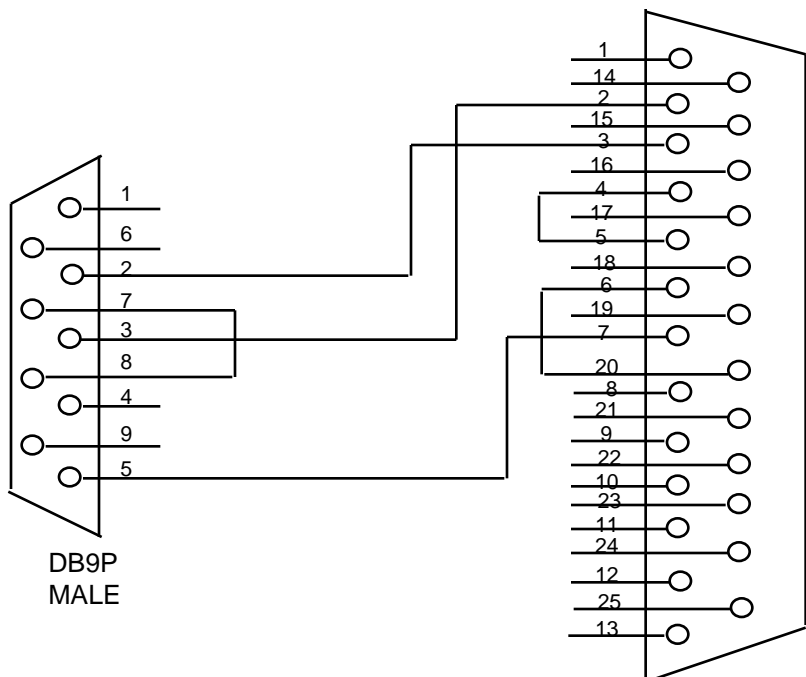
# Appendix B

## Cable Connection Diagrams: SP-150 Monochromators & Spectrographs To Various Computers



**SP-150 to  
PC-AT or Compatible**

**SP-150 to PC-XT  
or Terminal**



**SP-150 to  
Macintosh Computer  
(Modem or Printer Port)**

## Appendix D:

### **Certification**

Princeton Instruments certifies that this instrument was thoroughly tested and inspected and found to meet the specifications furnished by Princeton Instruments when it was shipped from the factory.

### **Warranty**

Princeton Instruments instruments and accessories are warranted for a period of one full year from date of delivery to be free from defects in material and to conform to the specifications furnished by Princeton Instruments. The company's obligation under this warranty is limited to servicing or adjusting an instrument returned to the factory, prepaid, and to repairing or replacing at the factory any part or parts thereof. All purchased items carry the original manufacturers warranty.

Princeton Instruments shall not be liable for consequential damages resulting from accident, alteration, misuse, improper installation, operation on low or excessive voltages or any use in violation of the operating instructions furnished by Princeton Instruments.

If any defect appears within the warranty period, the purchaser shall promptly notify Princeton Instruments. No material will be accepted for repair or replacement without prior authorization from Princeton Instruments. Upon such authorization and in accordance with instructions of Princeton Instruments, parts, materials or equipment for which repair or replacement is requested shall be returned to Princeton Instruments for examination, with shipping charges prepaid by the purchaser. Final determination as to whether a product or part is actually defective rests with Princeton Instruments.

In such cases where necessary repairs are not covered by this warranty, an estimate of repair charges will be submitted to the purchaser before servicing the equipment.

Princeton Instruments reserves the right to make changes or improvements upon its products without imposing any obligations upon itself to install the same upon its products previously manufactured.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Princeton Instruments, and Princeton Instruments neither assumes, nor authorizes any other person to assume for them, other obligations or liability in connection with the sale of equipment manufactured by Princeton Instruments.

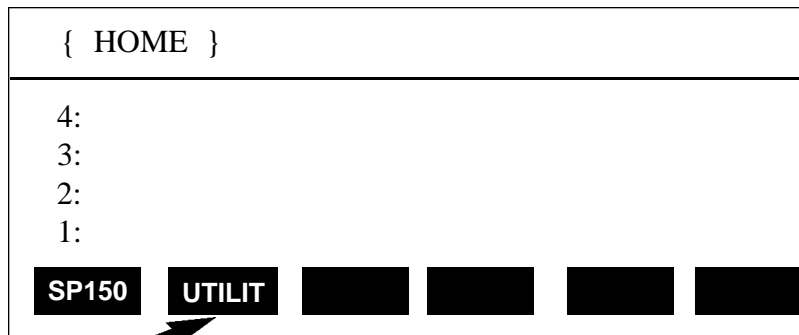
## Appendix E:

### Utility Menu Functions:

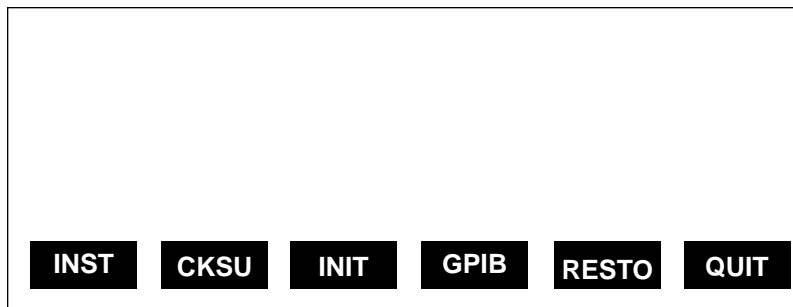
**General:** The UTILIT function contains routines for grating changes, GPIB address changes, restoring factory settings, plus a memory check routine. The UTILIT function is only available on the optional Model 150-749 remote scan controller. These functions are not normally used in day to day operation of the SP-150.

### Accessing the UTILIT Functions:

With the controller connected to the SP-150, turn the power ON to both components. After the SP-150 initializes, the following menu should be displayed: Press the function key below UTILIT to select the utilities functions.

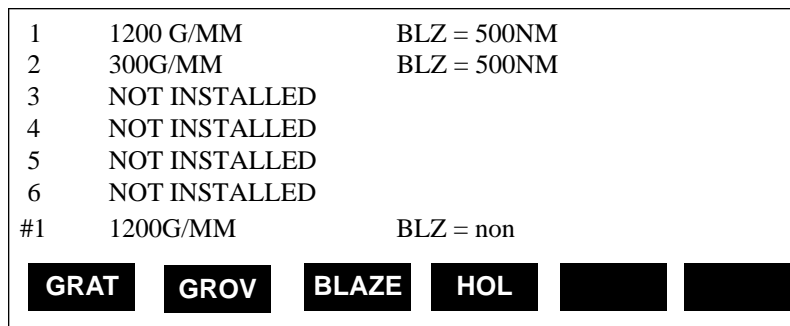


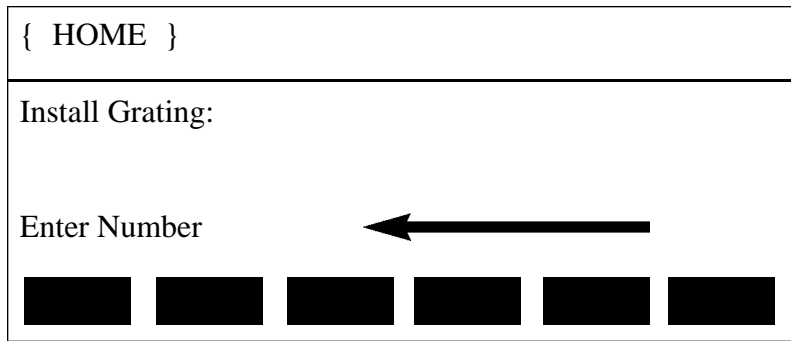
If the above menu **does not** appear (for example, if the controller was operated in the calculator mode), press the RIGHT FUNCTION KEY (➡), followed by the LIBRARY key, then select SP150. When the above menu is displayed, press the white key below the **UTILIT** function to access the utilities. The following menu will be shown:



### INST

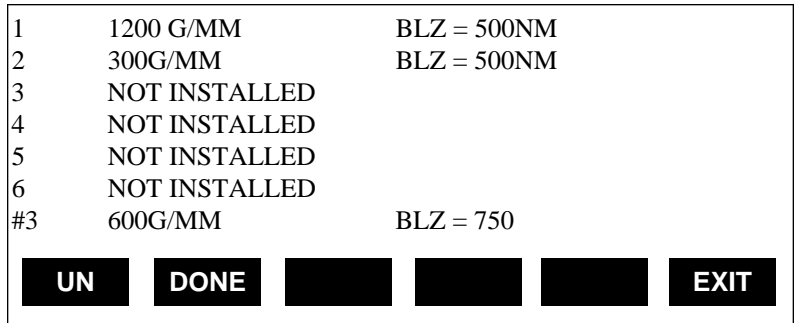
Pressing the function key below the INST label will cause the following install menu to be displayed:





Enter the desired grating number (1-6) and press the enter key. (Note that Grating #3 is the first grating on the second turret and grating #6 is the second grating on the third turret, etc.) The INSTALL menu will be displayed again with the selected grating number at the lower left. Press the function key below GROV to enter the desired groove spacing in grooves / mm using the keypad and enter key as above. Set the blaze wavelength label by pressing the function key below HOL if the grating is holographic or by pressing the function key below BLAZE if the grating is ruled. Enter the desired blaze wavelength as above. To complete the installation, press the NXT key on the right side of the keypad.

The following menu will be displayed:



Select DONE to install the grating as displayed on the line directly above the labels. Select UN to un-install the grating specified on the line directly above the labels. Select EXIT to return to the utilities menu if neither of these selections were made. Selecting INST from the utilities menu followed by the NXT key and then selecting EXIT allows checking the gratings installed without making any changes.

**CKSU**

Pressing the function key below CKSU provides a memory check of the SP-150. A number will be displayed in the lower left corner of the display indicating the checksum of the memory in the SP-150. This number should be the same each time this function is executed indicating memory is operating correctly. This number is displayed for approximately 3 seconds.

**INIT**

Pressing the function key below INIT causes the SP-150 to go through a complete installation. Operationally, this is the same as turning off the power and turning it on again. At the completion of the initialization, the Acton sign on message will be displayed followed by "OK". If any errors in initialization were found, an error message will be displayed.



## **GPIB**

Pressing the function key below GPIB causes the GPIB or IEEE-488 device address to be displayed. A new address can be entered, or pressing ENTER alone will leave the address unchanged. Valid addresses are 1 - 30.

## **RESTO**

Pressing the function key below RESTO causes the following menu to be displayed:

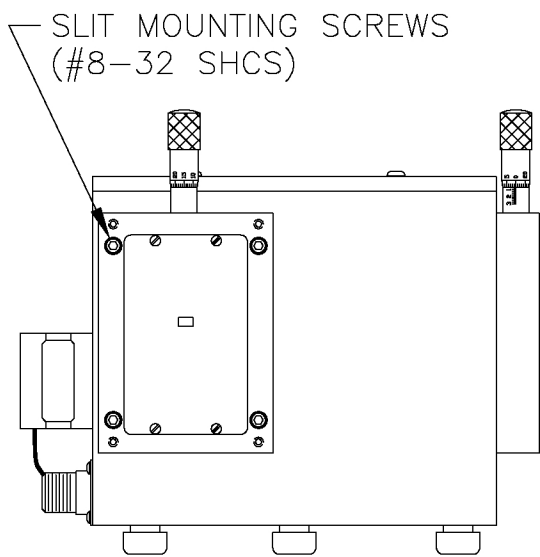
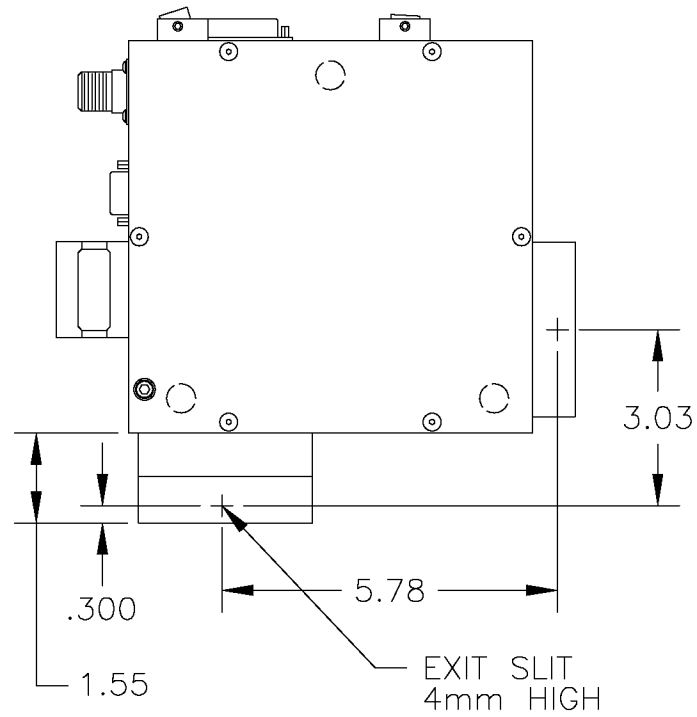
Restore Factory Settings					
Proceed?					
<b>YES</b>					<b>NO</b>

Selecting YES will restore all grating parameters and default initialization settings to the original factory settings. This process takes approximately 20 seconds. Note that any gratings that were installed since receiving the SP-150 will be eliminated from memory and must be re-installed. Selecting NO will make no changes to memory.

Select QUIT to return to the LIBRARY MENU.



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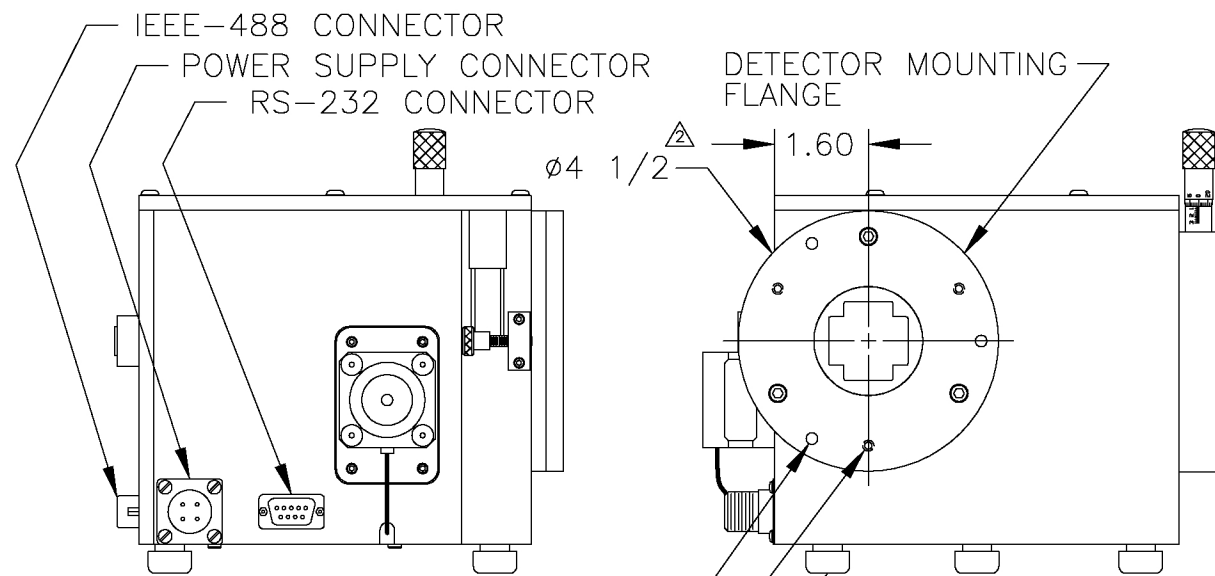
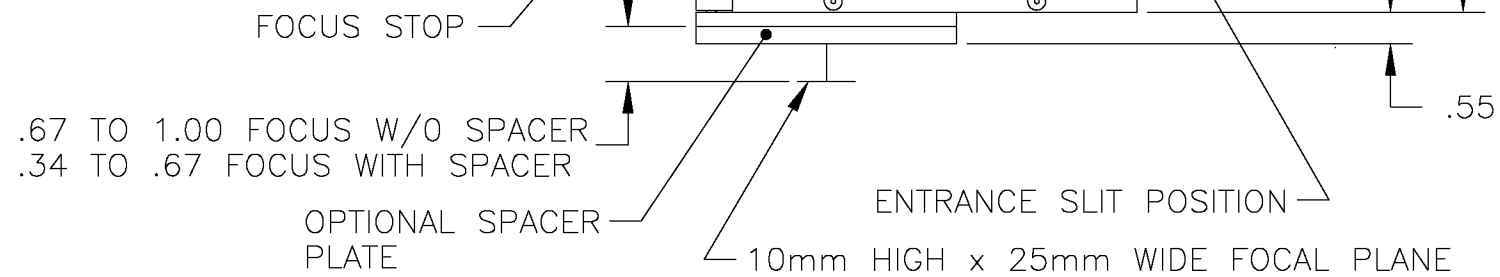


**MODEL SP-150-M  
MONOCHROMATOR**

DIMENSIONS NOT SHOWN SAME AS SPECTROGRAPH

**MODEL SP-150-S  
SPECTROGRAPH**

LOCATION OF THREE (3) SUPPORT PADS ON THE BOTTOM SURFACE WITH #10-32 TAPPED HOLES, 1/4 DP



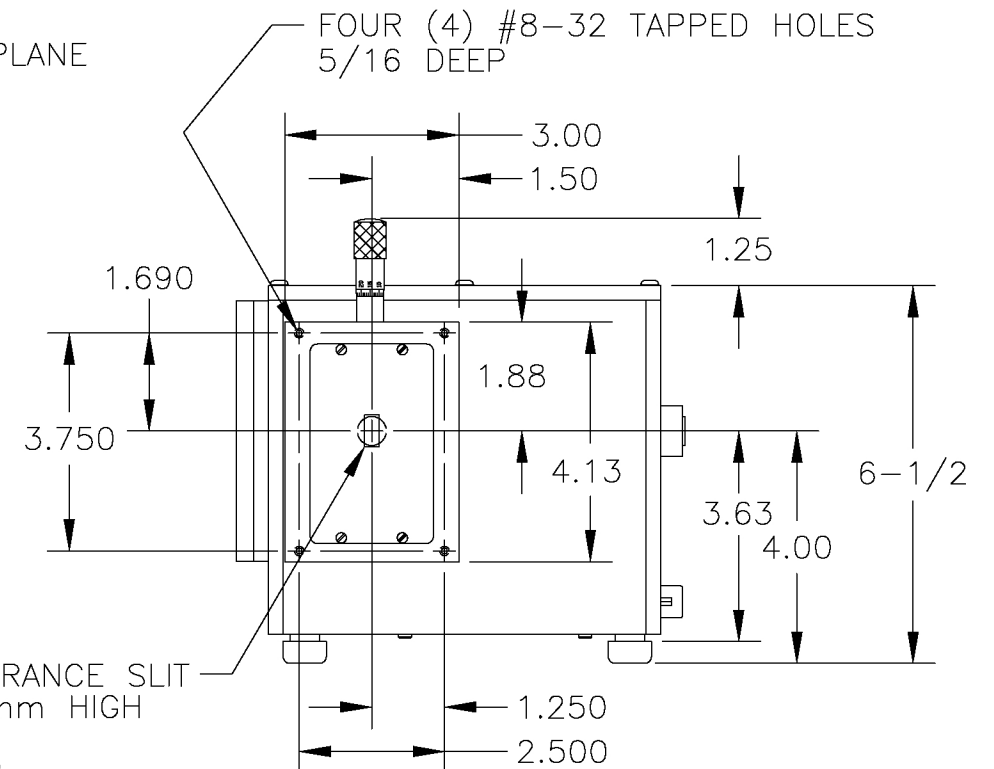
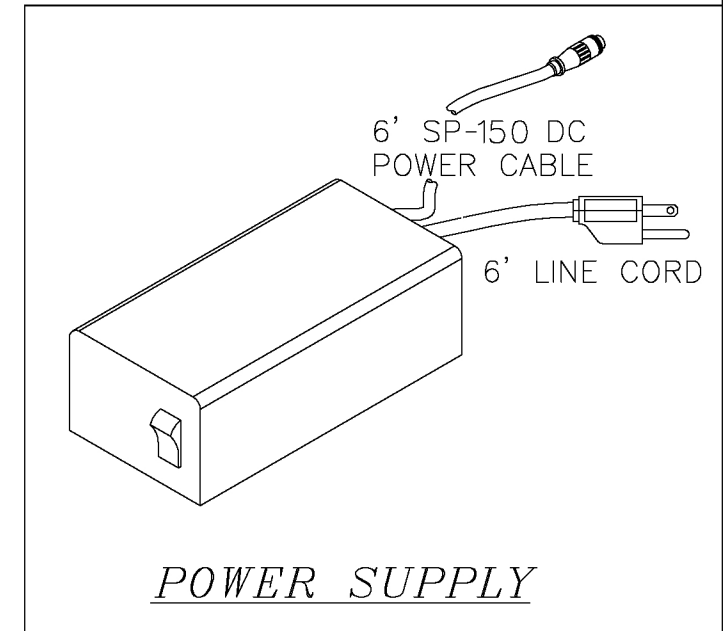
THREE (3)  $\phi$ .201 EQUALLY SPACED HOLES TO ACCEPT #10-32 BUTTON HEAD SCREWS,  $\phi$ 3.88 BC

THREE (3) EQUALLY SPACED #10-32 TAPPED MOUNTING HOLES,  $\phi$ 3.60 BC

**NOTE:**

1.) APPROXIMATE WEIGHT OF THE INSTRUMENT IS 10 LBS (4.5 kg).

REV	DESCRIPTION	DATE
1	NEW POWER SUPPLY	8-7-95
2	ADDED TWO FLANGE DIMENSIONS	2-19-96
3	REMOVED OPTICS	5-20-96



UNLESS OTHERWISE SPECIFIED	SCALE: NONE	DRAWN BY: MEM	
DIMENSIONS ARE IN INCHES	DATE: 7-19-93	QTY: 1	
TOLERANCE ON FRACTIONS $\pm 1/64$	DECIMALS $.XX \pm .010$ $.XXX \pm .005$	ANGLES $\pm 15$ MIN	
DWG. TITLE SP-150	Princeton Instruments	15 DISCOVERY WAY ACTON, MA 01720	
SIZE B	DWG NO. 8415-150-03	REV. 3	