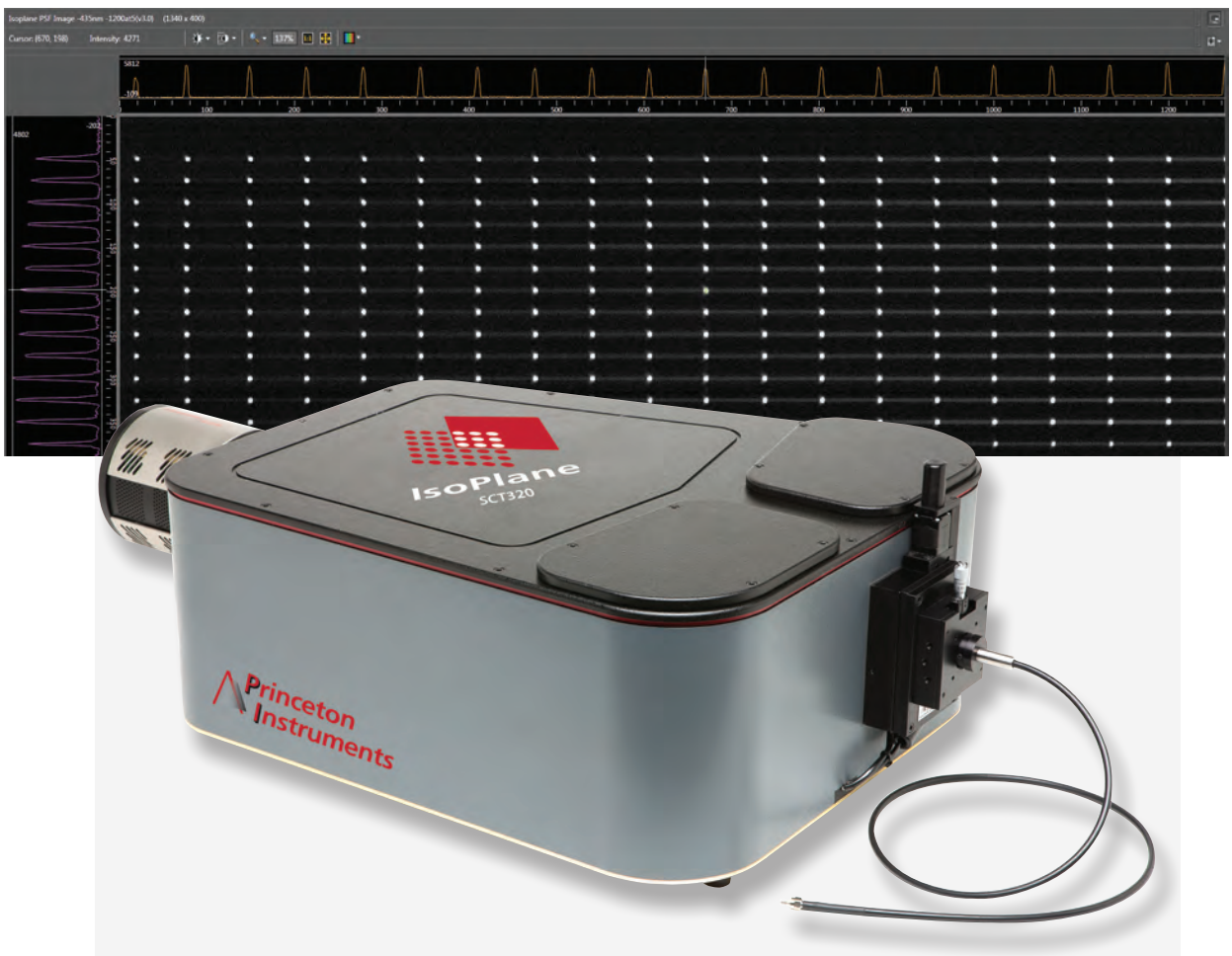
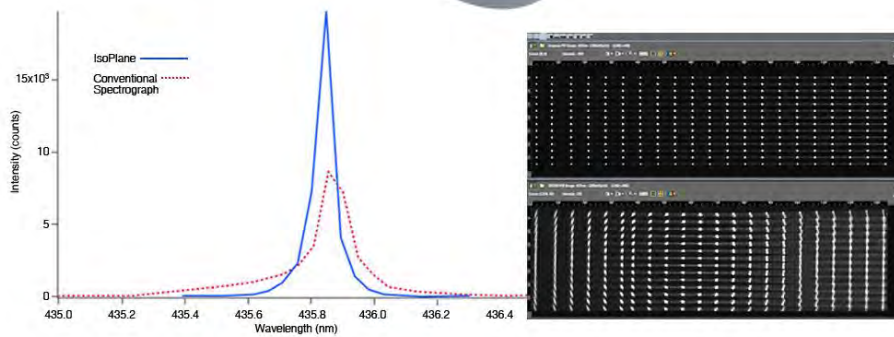


IsoPlane Manual



 **Princeton
Instruments**

IsoPlane[®] SCT 320 Manual



0.320 Meter Focal Length Triple Grating Imaging Spectrograph



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Chapter 1 IsoPlane® SCT 320 Description

1.1 Introduction

This manual is intended to help you set up and operate your new IsoPlane SCT 320 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 customer service department at techsupport@princetoninstruments.com or 800-874-9789 / 609-587-9797.

1.2 IsoPlane SCT 320 Description

The IsoPlane SCT 320 (IsoPlane) is a 320 mm focal length spectrograph. Its advanced optical design reduces astigmatism to zero, increasing spatial and spectral resolution dramatically over traditional spectrographs. Large-diameter optics and interchangeable triple-grating turrets permit operation from the UV to NIR with extremely low light levels at high, low or intermediate spectral resolution. IsoPlane includes 32-bit microprocessor controlled scanning, built-in USB and RS-232 interfaces, and a micrometer-controlled entrance slit. In addition, it has a direct digital grating scan mechanism with full wavelength and grating control capabilities. The IsoPlane works seamlessly with Princeton Instruments' industry-leading CCD, EMCCD, ICCD and InGaAs array detectors and Princeton Instruments' LightField® with IntelliCal™ and WinSpec data acquisition software packages.



Figure 1-1. Light Path within the IsoPlane SCT 320

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Chapter 2 IsoPlane Setup


2.1 Unpacking and Inspecting

Carefully unpack and examine the IsoPlane and any purchased accessories.

Notes:

1. Report any damage immediately to the carrier and to Princeton Instruments.
2. Save all packing material.

2.2 Initial Setup Procedure

1. Position the IsoPlane where it will be used.
2. Connect the power supply shipped with the IsoPlane to the POWER connector on the side of the IsoPlane. This power supply provides +5 volts DC for the control logic and +24 volts DC for the motor drives. 
3. With the power supply switch in the off position, connect the line cord provided with the IsoPlane to the power supply and the AC line. The power supply will operate with line voltages between 100 and 240 volts AC, 50/60 Hz.
4. The IsoPlane is designed to be controlled primarily through Princeton Instruments LightField or WinSpec data acquisition and control software when operated with a Princeton Instruments detector. Connect the USB port of the IsoPlane to the USB port on the control computer using the USB cable provided. RS-232 may also be used if a USB port is not available.
5. Install the grating turret that is shipped in the same shipping box with the IsoPlane but is packaged outside the IsoPlane housing to protect the gratings during shipment. See *Section 2.7 Turret Installation* (starting on page 12) for detailed installation instructions.
6. Turn on the power switch on the IsoPlane power supply and the IsoPlane should initialize to zero wavelength. See the instructions in Chapter 3 for operation with Princeton Instruments software.

2.2.1 Optional Software Packages

The following software packages are some of the other software packages available for purchase from Princeton Instruments.

2.2.1.1 LightField®

The IsoPlane is supported by LightField® 4.2, a 64-bit data acquisition platform for spectroscopy and imaging. Light Field combines complete control over Princeton Instruments' spectrographs and detectors with easy-to-use tools for experiment setup, data acquisition, and post-processing.

2.2.1.2 WinSpec

WinSpec is a 32-bit data acquisition platform that has been optimized specifically for digital spectroscopy. WinSpec provides complete control over the IsoPlane and all other Acton Series spectrometers. This software control extends to all instrument options, such as multiple gratings, multiple entrance and exit ports, and motorized slits.

2.2.1.3 SpectraSense™

SpectraSense is a comprehensive spectral acquisition and data treatment package. It is designed to work exclusively with Princeton Instruments products and accessories including the SpectraHub Detector Interface. SpectraSense software will control and acquire data from both single channel detection systems, which require scanning of a monochromator, and CCD-based detection systems that may or may not require repositioning of a spectrograph.

2.2.2 Controlling the IsoPlane at the Command Level

Although it requires more programming on the user's part, the IsoPlane can also be controlled with direct commands through its USB port or RS-232 port. This operation is described in *Appendix A Using the Monochromator Control Software* (starting on page 39.)

2.3 Computer Interface Connectors: USB and RS-232



Figure 2-1. Details of the RS-232, USB, and Power Connections on the IsoPlane

2.3.1 Cables and Connections for IsoPlane

The following computer cables are supplied with the IsoPlane:

- 3650-USB-06 USB Cable Type A to Type B.
- CC-499-2 IBM AT or compatible 9-pin female (DB9S) connector to 9-pin male connector (DB9P).

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 RS-232 pin assignments shown in Table 2-1. See also Appendix B.

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

Table 2-1. RS-232 Computer Interface Pin Arrangement

2.3.2 Terminal or RS-232 Port Settings

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.

2.4 Power Supply with Input Cable



Figure 2-2. Power Supply

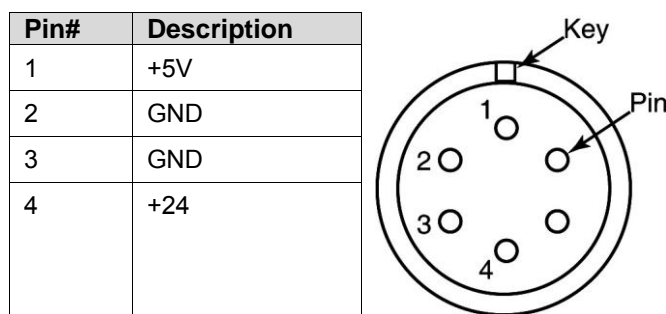


Table 2-2. IsoPlane Power Connector Pin Arrangement

2.5 Internal Shutter

The IsoPlane has an optional internal shutter. If the shutter is installed, it is located in the Turret Compartment and is mounted to the spectrograph wall. Its shutter cable plugs into a keyed 2-pin shutter connector in the floor of the IsoPlane. The external connector is below the detector mounting plate and can be connected via a shutter cable to a detector with a SHUTTER connector. If a detector does not have a SHUTTER connector (PI-MAX detectors, for example), the Princeton Instruments SHC-EXT Shutter Control Box can be used to control the opening and closing of the internal shutter. If the control box is not available, the internal shutter can be removed. Instructions for installing and removing the internal shutter assembly are provided in Sections 2.13.1 and 2.13.2, respectively.



2.6 Mounting Accessories to an IsoPlane Slit Assembly

All Princeton Instruments spectroscopy 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 spectrograph accessories mount directly to the IsoPlane entrance slit assembly (manual or motorized). To assist you in mounting accessories, a drawing

of the manual slit assembly has been provided in Appendix F. The general procedure for mounting an accessory to the slit is as follows:

1. Place the accessory directly against the face of the slit body.
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 the source to the slit.

2.7 Turret Installation

If you have just received an IsoPlane spectrograph, you will need to install the grating turret. The grating turret has been shipped in the same shipping box with the IsoPlane but is packaged in a plastic container outside the IsoPlane housing to protect the gratings during shipment.

CAUTION

1. The optical surfaces in the spectrograph are extremely delicate and can be permanently damaged by contact with solid objects as well as with most liquids and aerosols.
2. **DO NOT TOUCH optical surfaces with anything.** Wear thin protective powderless gloves to minimize damage from body oils if you accidentally touch any optical surface, especially the grating.
3. Avoid talking or sneezing near optical surfaces. Do not breathe directly on them.

The following procedure is for the initial installation of a grating turret. Observe proper optical handling procedures.

Note: See *Section 2.15 Turret Interchange* (starting on page 25) for instructions on changing from one turret assembly to another.

1. Locate the storage container with the grating turret to be installed.
2. Become familiar with the components as labeled on Figure 2-4, Figure 2-5, Figure 2-6 and Figure 2-8.
3. Using the 9/64" hex wrench, remove the four Turret Compartment cover screws and remove the cover. Become familiar with the grating turret and its components.
4. Before removing the grating turret from the shipping container, use a 3/32" hex wrench to loosen the three set screws on the bottom of the container (about 1 turn).
5. Then remove the cover from the shipping container, grasp the Center Torque Screw and turn it counter-clockwise until the turret can be lifted straight up.
6. Locate the hole near the edge between gratings on the grating turret assembly (see Figure 2-5).

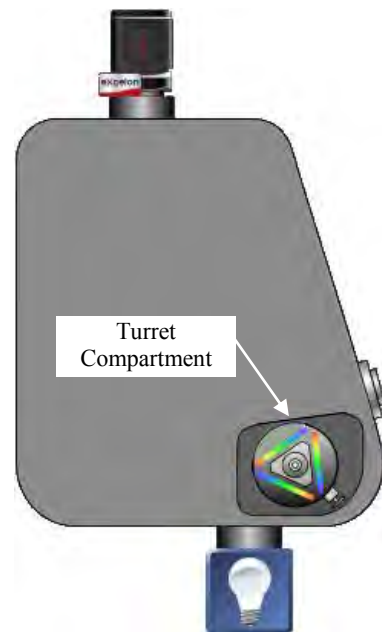


Figure 2-3. Turret Compartment

7. Locate the vertical post on the Grating Spindle Assembly (see Figure 2-6).
8. Position the grating turret on the grating spindle so the hole in the turret assembly aligns with the post in the turret assembly as shown in Figure 2-8.
9. Make sure the turret is properly seated.
10. Tighten the Center Torque Screw until it clicks. This sets the torque on the spindle correctly.
Note: You cannot overtighten this screw. It is designed to slip once the correct torque is attained.
11. Place the Turret Cover on the spectrograph. Replace and tighten all of the cover screws.
12. Replace the plastic cover on the storage container and store it in a safe location.
13. Plug the power supply into an outlet and connect the supply to the IsoPlane. Turn on the IsoPlane to allow for auto-identification of the grating turret. Note that if the power supply is on while a turret is being installed, the IsoPlane should always be re-started afterwards.

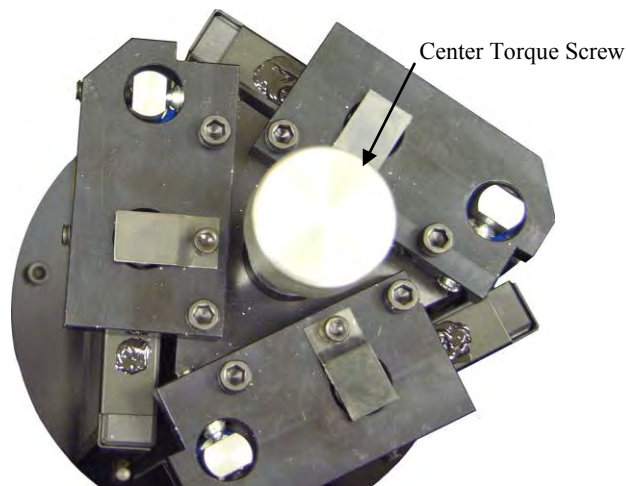


Figure 2-4. Center Torque Screw

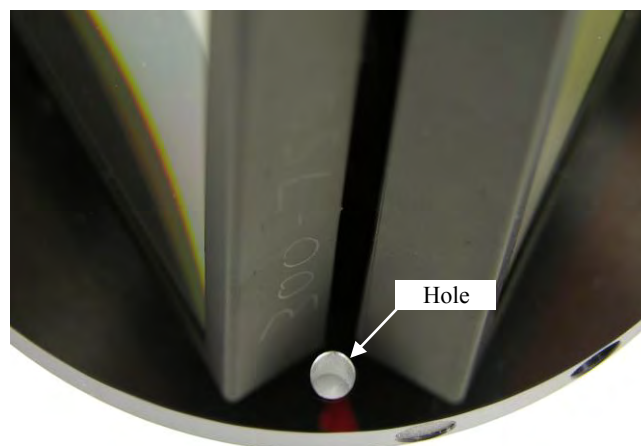


Figure 2-5. Location of Hole on Turret Grating Assembly

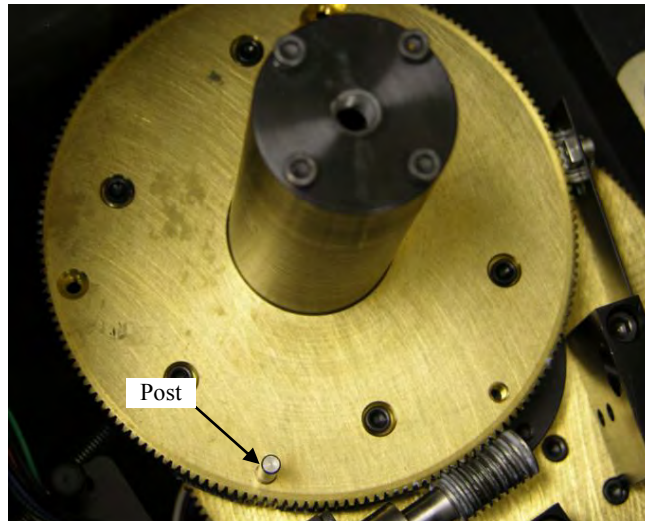


Figure 2-6. Location of Post on Grating Spindle Assembly



Figure 2-7. Lower Turret into the Turret Compartment

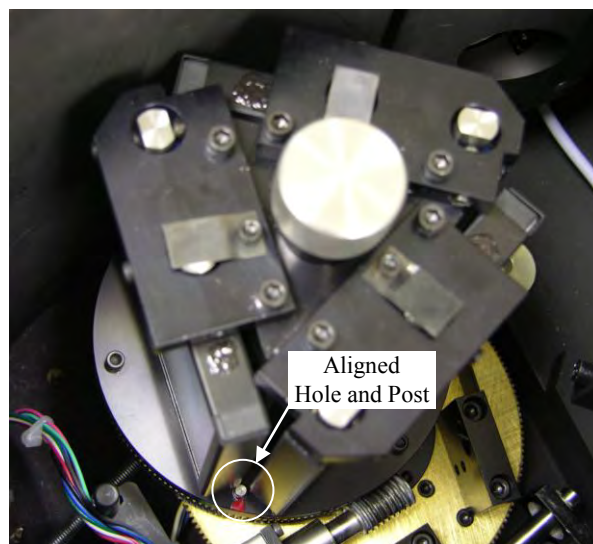


Figure 2-8. Turret Installed (Hole and Post Aligned)

2.8 Array Detector Mounting Instructions

2.8.1 Introduction

The standard mounting plate for CCDs, FPAs, and diode arrays accommodates detectors with a slotted flange or mounting holes aligned on a 3.60" bolt circle pattern. There are six (6) equally spaced #10-32 tapped holes on a 3.60" bolt circle designed to accept #10-32 hex head screws.

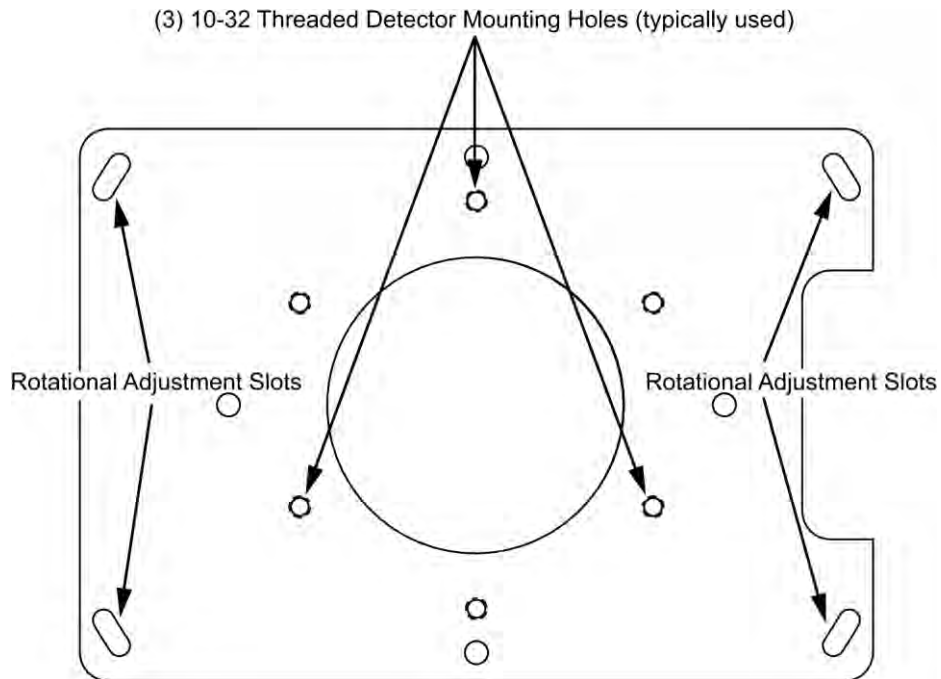
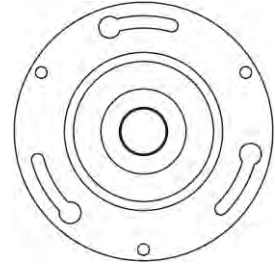


Figure 2-9. Mounting Plate

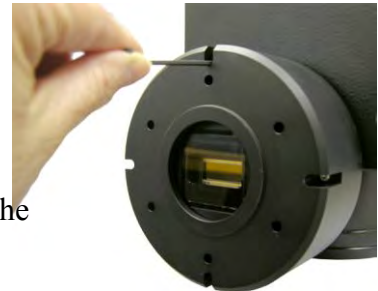
2.8.2 Mounting an Array Detector to the IsoPlane

The array detector mounting plate is mounted to the entrance port of the IsoPlane.

1. Remove the shipping cover from the mounting plate.
2. If the detector has a three-slotted flange (3.60" bolt circle):
 - a. If the detector has a three-slotted flange, screw three #10-32× 1/2 hex head bolts into the plate and leave 1/4" of thread exposed.
 - b. Mount the detector to the plate and position the detector so the text on the back of the detector is right-reading (i.e., not upside-down). The exception to this orientation is the PI-MAX2: 1024x256 which should be mounted with the text upside-down.
 - c. Tighten down the bolts with a 5/16" open end wrench.



3. If the detector is a PyLoN or SPEC-10 LN detector without shutter, you will need to remove the shroud at the front of the detector, mount the shroud to the plate, and then resecure the shroud to the detector. It may be easier to remove the mounting plate from the IsoPlane for this operation.



- a. Using a 3/32" ball head hex wrench, remove the 4 socket head screws that secure the shroud to the nose of the detector.
- b. Carefully slide the shroud off.
- c. Remove the mounting plate from the IsoPlane.
- d. Place the front of the shroud against the front of the plate and orient the nose until the appropriate hole pattern matches the mounting holes on the plate.
- e. From the inside of the shroud screw three 10-32 x 1/4", flat head stainless steel screws through the shroud and into the mounting plate.
- f. Carefully mount the shroud and plate assembly onto the front of the detector and resecure the shroud with the previously removed 4 socket head screws.
- g. Re-mount the plate to the IsoPlane. The detector should be upright.

Note: Refer to the detector's system manual for specific instructions on how to mount the array detector to the mounting plate. These instructions vary with the detector nose design.

2.8.3 Rotational Alignment

This general procedure assumes that you have already mounted the array detector to the exit port of the spectrograph and that there is a light source at the entrance port. The basic actions are listed below. Refer to Chapter 3 of this manual for detailed LightField and WinSpec instructions for performing this function. For other application software, refer to that software's manual or help file.

1. Make sure the computer interface cables (for the spectrograph and detector) are connected.
2. Verify that the power supplies are plugged into an AC source and are connected to the spectrograph and detector.
3. Turn on the power to the spectrograph and the detector.
4. Start the application software.
5. Loosen the rotation adjustment screws (see Figure 2-9) enough that you can rotate the detector. The mounting plate holes are slotted to allow about 4° of rotational positioning.
6. If background subtraction is an available function, acquire a background to be applied while data are acquired.
7. Turn on the light source and begin continuous data acquisition.
8. While viewing the data being acquired, rotate the detector until you obtain the sharpest peaks or, if in imaging mode, the spectral lines are perpendicular in the image.
9. Tighten the mounting screws.
10. Confirm that the data still show sharp peaks or perpendicular spectral lines.

2.8.4 Focusing the Spectrometer

The basic actions for focusing the spectrometer are listed below. This general procedure assumes that you have already mounted the array detector to the exit port of the spectrograph and that there is a light source at the entrance port. Refer to Chapter 3 of this manual for detailed LightField and WinSpec instructions for performing this function. For other application software, refer to that software's manual or help file.

1. Using a 9/64" hex wrench, unscrew the four screws that secure the Micrometer Compartment cover (see Figure 2-10).
2. Set the screws aside.
3. Remove the Micrometer Compartment cover and set it aside.
4. Using a 5/64" hex wrench, loosen the locking set screw shown in Figure 2-11.
5. While continuously acquiring data from a spectral line source, adjust the micrometer until the half width of the peak is at a minimum. Note that as focus is improved, the intensity of the spectral line will increase. It is important to adjust the acquisition time to keep the entire spectral line on scale.
6. Tighten down the locking set screw.
7. Place the Micrometer Compartment cover on the spectrograph. Replace and tighten all of the cover screws.

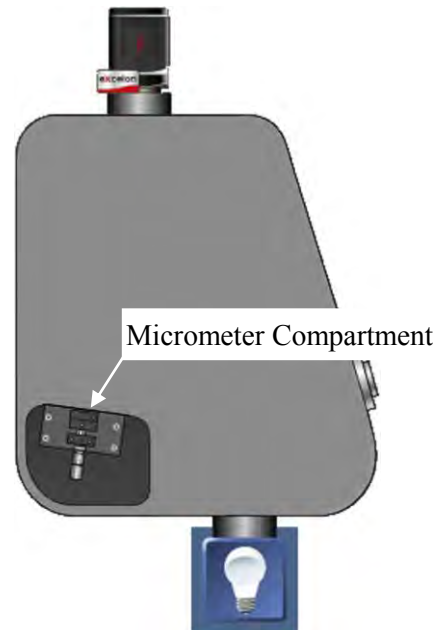


Figure 2-10. Micrometer Compartment Location

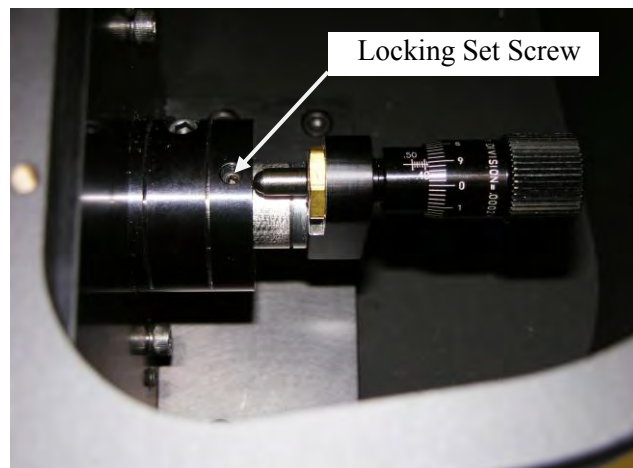


Figure 2-11. Micrometer Locking Set Screw

2.8.5 Height Adjustment of Image Plane

Note: This procedure should only be attempted by someone experienced in aligning optical components and assemblies.

2.8.5.1 Overview

During the manufacturing process, the IsoPlane focal plane is factory-aligned so that it is precisely centered on the optical axis. However, in some instances when a CCD camera is attached, the center pixel of the CCD camera may be located slightly above or below the optical axis of the spectrograph. In most applications this is not critical; however, if it is important to have the exit focal plane image precisely centered on the CCD, the height of the exit beam can be adjusted using the procedure in this section.

If you have an optical fiber and fiber adapter that can precisely center the beam at the center of the IsoPlane focal plane, then that can be used as a guide in positioning the exit focal plane. If the IsoPlane is equipped with a standard 3 mm manual entrance slit or optional 3 mm motorized entrance slit, you can also install the supplied 4 mm high slit baffle and use the 4mm high image as a guide in positioning the exit focal plane. The adjustment is made by adjusting the pair of push-pull vertical alignment screws as shown in Figure 2-12.

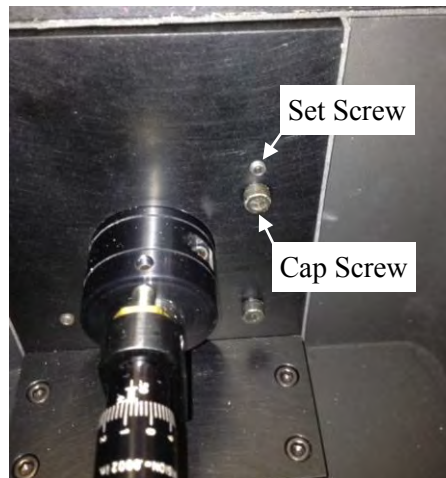


Figure 2-12. Height Adjustment Screws

2.8.5.2 Data Acquisition Mode

During this adjustment procedure, the detector should be running in continuous mode so an image of the source is displayed in the acquisition software. Continuous operation is necessary to provide active feedback of the light source position as adjustments are being made. We recommend using a mercury lamp with a center wavelength of 546.075 nm however other light sources and center wavelengths can be used.

2.8.5.3 Required Tools

- 5/32" hex wrench
- 3/32" hex wrench

2.8.5.4 Adjustment Procedure

1. Remove the Micrometer Compartment cover (Figure 2-10) to access the height adjustment screws (Figure 2-12).
2. Determine if the image is HIGH or LOW on the detector array.
 - a. If the image is HIGH, alternately loosen the Cap Screw and tighten the Set Screw until the image is centered about the center row of the camera.

Notes:

1. CAUTION: ONLY ADJUST THE CAP AND SET SCREWS INDICATED IN Figure 2-12. ADJUSTMENTS TO OTHER SCREWS MAY RESULT IN SEVERE MISALIGNMENT OF THE INSTRUMENT.

2. Adjustments to the Cap and Set Screws should be small, approximately 1/8th-turn or less.
 3. If the Cap Screw is adjusted 1/8th-turn in a counter-clockwise direction, then the Set Screw should be adjusted 1/8th-turn in a clockwise direction.
 4. If the initial adjustment does not move the image far enough on the CCD, repeat the adjustments to the Cap and Set Screws as stated in Notes a.2 and a.3 above.
 5. Several small adjustments are recommended.
 6. At the end of the procedure the Cap and Set Screws should be tight.
- b. If the image is LOW, alternately loosen the Set Screw and tighten Cap Screw until the image is centered.

Notes:

1. CAUTION: ONLY ADJUST THE SET AND CAP SCREWS AS INDICATED IN Figure 2-12. ADJUSTMENTS TO OTHER SCREWS MAY RESULT IN SEVERE MISALIGNMENT OF THE INSTRUMENT.
2. Adjustments to the Set and Cap Screws should be small, approximately 1/8th-turn or less.
3. If the Set Screw is adjusted 1/8th-turn in a counter-clockwise direction, then the Cap Screw should be adjusted 1/8th-turn in a clockwise direction.
4. If the initial adjustment does not move the image far enough on the CCD, repeat the adjustments to the Set and Cap Screws as stated in Notes b.2 and b.3 above.
5. Several small adjustments are recommended.
6. At the end of the procedure the Set and Cap Screws should be tight.

2.9 Single Point Detector Mounting Instructions

Single point detectors (such as the PD-438) mount directly to the optional exit slit with mounting plate assembly of the IsoPlane monochromator. Because the outgoing beam path exits from the focusing mirror at 15 degrees to the housing, the slit assembly is secured to a tapered mounting plate at the exit port.

1. Position the detector so its labels are upright (the optical axis is not vertically centered).
2. Mount the detector directly to the exit slit assembly (already mounted to the tapered mounting plate at the exit port) so its four mounting holes align correctly with the tapped mounting holes of the slit assembly.
3. Insert the four 8-32 mounting screws and use a 9/64" hex wrench to tighten the screws.
4. The detector should now be mounted correctly.



2.10 Spectrometer Calibration

Refer to the application software manual or the software help for information on calibrating the data pixels with wavelengths.

2.11 Slit Width Adjustments in the Model 716-1 Manual Bilateral Slit and the 716-MS Kinematic Slit

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

Each clockwise revolution of the micrometer knob increases the slit width 0.25 millimeters (250 μm). 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 μm) 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 3.0 mm.

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

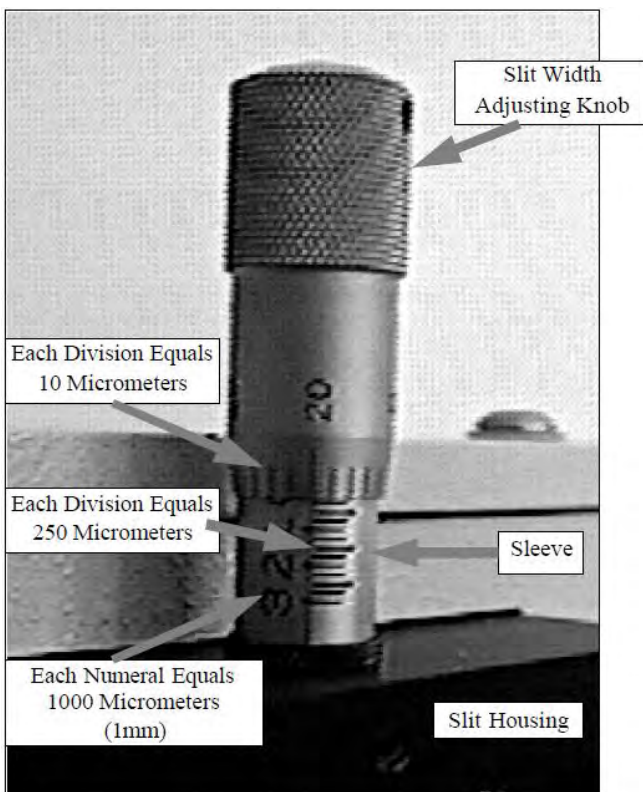


Figure 2-13. Slit Width Setting:
200 Micrometers (0.200 mm)

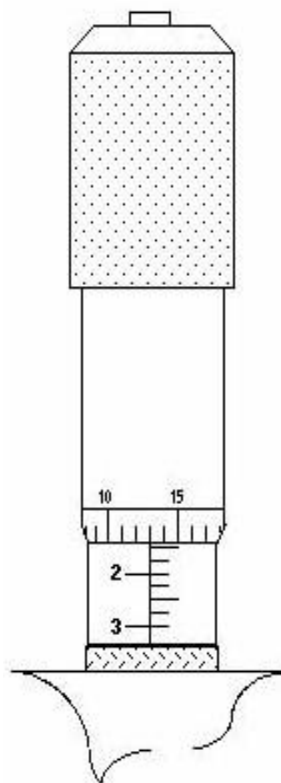
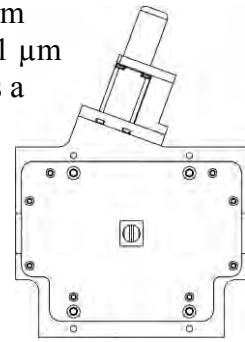


Figure 2-14. Slit Width Setting:
1380 Micrometers (1.38 mm)

2.12 Slit Width Adjustments in the Model 718-1 Motorized 3mm Slit

The Model 718-1 motorized slit assembly is a self-calibrating, 10 μm to 3 mm adjustable bilateral slit. Stepping-motor-controlled adjustments are made in 1 μm increments over the full range. The Model 718-12 motorized slit assembly is a self-calibrating, 10 μm to 12mm adjustable bilateral slit. Stepping-motor controlled adjustments are made in 5 μm increments over the full range.

Full control of the slit, including automated bandpass setting, is integrated into LightField® and SpectraSense™ software. The slit motor is only energized when you send the command via the software to control it. When the power to a spectrograph is turned off, the slit remains in the position to which it was last set. This position is stored in nonvolatile memory allowing slit position to be maintained with power on or off.



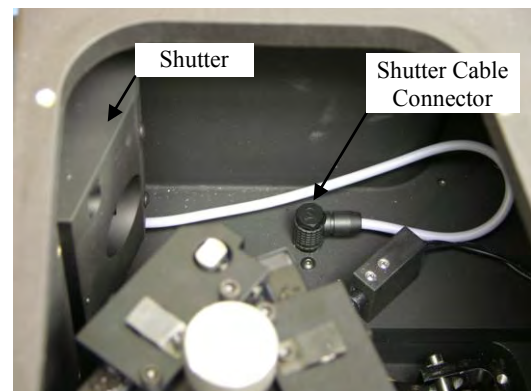
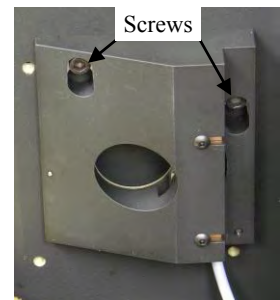
2.13 Internal Shutter Installation/Removal

An IsoPlane may be ordered with an optional internal shutter at the entrance slit. This shutter is controlled either by a detector via a shutter cable from the detector's Shutter connector to the Shutter connector on the IsoPlane or by an Shutter Control box (Model SHC-EXT) available from Princeton Instruments.



2.13.1 Installing an Internal Shutter

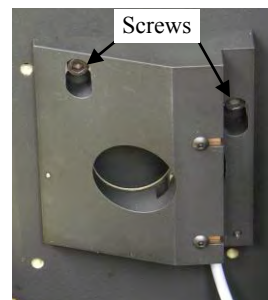
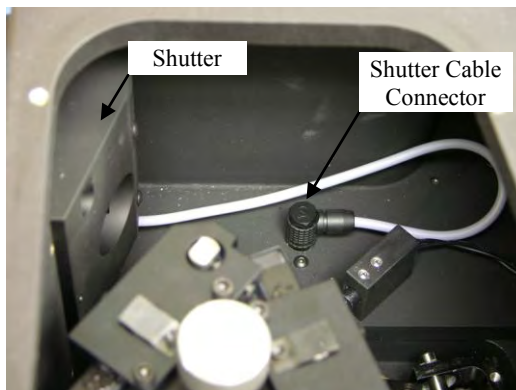
1. Using a 9/64" hex wrench, unscrew the four socket head screws that secure the Turret Compartment cover to the top of the IsoPlane. Lift the cover and screws off of the IsoPlane and set them aside.
2. Remove the grating turret. If you are not sure how to do this, refer to *Section 2.14 Turret Removal* on page 24.
3. **Use extreme care so as not to touch the grating surfaces.**
4. Mount the shutter assembly on the two socket head screws above the entrance slit. You may need to back out the screws about five turns.
5. Use the 9/64" hex wrench to tighten down the screws.
6. Connect the shutter cable to the connector in the floor of the IsoPlane. Make sure the connector on the cable aligns with the connector in the floor.
7. Re-install the grating turret. If you are not sure how to do this, refer to *Section 2.7 Turret Installation* on page 12.
8. Place the Turret Compartment cover on the spectrograph. Replace and tighten all of the cover screws.



2.13.2 Removing an Internal Shutter

If you are planning to use a PI-MAX detector (or other detector without an external shutter control connector) and the IsoPlane has an internal shutter, you will either have to remove the shutter or control the shutter via a Princeton Instruments SHC-EXT external shutter control box if one is available. This is because there is no way for these detectors to keep the shutter open or to open the shutter during an acquisition. The following instructions step through the removal process.

1. Using the 9/64" hex wrench, unscrew the four socket head screws that secure the Turret Compartment cover to the top of the IsoPlane. Lift the cover and screws off of the IsoPlane and set them aside.
2. Remove the grating turret. If you are not sure how to do this, refer to *Section 2.14 Turret Removal* on page 24.
3. **Use extreme care so as not to touch the grating surfaces.**
4. After removing the turret and placing it in a safe location, reach into the compartment and unplug the connector on the shutter cable from the connector mounted to the base of the IsoPlane by pulling it straight up.
5. Using the 9/64" hex wrench, loosen but do not remove the two hex head socket screws that secure the shutter housing to the wall of the IsoPlane.
6. Lift up and pull out on the shutter to remove it.
7. Store it in a safe location.
8. Re-install the grating turret. If you are not sure how to do this, refer to *Section 2.7 Turret Installation* on page 12.
9. Place the Turret Compartment cover on the spectrograph. Replace and tighten all of the cover screws.



2.14 Turret Removal

CAUTION

1. The optical surfaces in the spectrograph are extremely delicate and can be permanently damaged by contact with solid objects as well as with most liquids and aerosols.
2. **DO NOT TOUCH optical surfaces with anything.** Wear thin protective powderless gloves to minimize damage from body oils if you accidentally touch any optical surface, especially the grating.
3. Avoid talking or sneezing near optical surfaces. Do not breathe directly on them.

The following procedure is recommended for removing the grating turret from the IsoPlane's Turret Compartment. Observe proper optical handling procedures.

1. Scan the instrument to Grating #1 and a Center Wavelength of 0 nm.
2. Using the 9/64" hex wrench, remove the four Turret Compartment cover screws and remove the cover.
3. Loosen the Center Torque Screw (see Figure 2-15).
4. **Use extreme care so as not to touch the grating surfaces.** Grasp the Center Torque Screw and lift the grating turret straight up off the grating spindle assembly (see Figure 2-16). If the turret cannot be lifted up, you may need to loosen the Center Torque Screw more.
5. Put the removed grating turret assembly into the protective container it was shipped in.

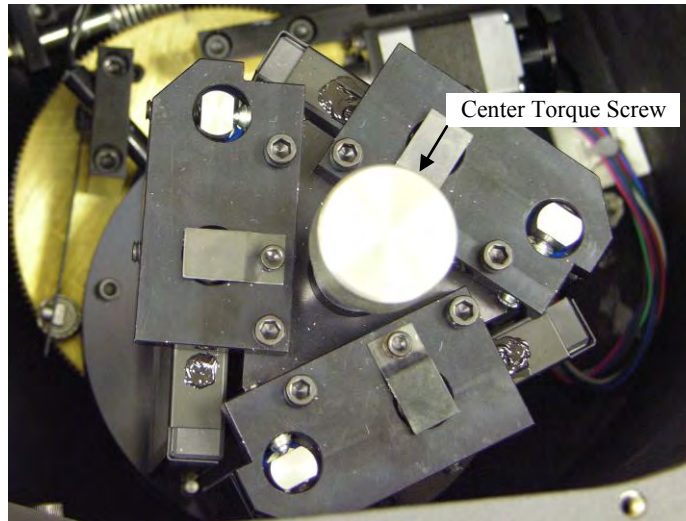


Figure 2-15. Center Torque Screw



Figure 2-16. Lift Turret up out of the Turret Compartment

6. If you are not installing/removing a shutter assembly or installing a different turret, replace and secure the Turret Compartment cover.

2.15 Turret Interchange

Read and follow the instructions in this section only if you have ordered more than one turret for the IsoPlane. Otherwise, you never have to interchange turrets.

The IsoPlane is supplied with one on-axis mounted triple grating turret assembly, but you may order up to three (3) grating turrets for the spectrograph. If you have multiple turrets (2 or 3), the built-in sensing mechanism will auto-identify for the software which grating turret is installed. You may, however, want to label the turrets (for example, with the spectral range used).

CAUTION

1. The optical surfaces in the spectrograph are extremely delicate and can be permanently damaged by contact with solid objects as well as with most liquids and aerosols.
2. **DO NOT TOUCH optical surfaces with anything.** Wear thin protective powderless gloves to minimize damage from body oils if you accidentally touch any optical surface, especially the grating.
3. Avoid talking or sneezing near optical surfaces. Do not breathe directly on them.

The following procedure is recommended for interchanging grating turrets. Observe proper optical handling procedures.

1. Locate the storage container with the new grating turret to be installed.
2. Become familiar with the components as labeled on Figure 2-17, Figure 2-19, Figure 2-20, and Figure 2-21.
3. Scan the instrument to Grating #1 and a Center Wavelength of 0 nm.
4. Using the 9/64" hex wrench, remove the four Turret Compartment cover screws and remove the cover. Become familiar with the grating turret and its components.
5. Loosen the Center Torque Screw (see Figure 2-17).

6. **Use extreme care so as not to touch the grating surfaces.** Grasp the Center Torque Screw and lift the grating turret straight up off the grating spindle assembly (see Figure 2-18). If the turret cannot be lifted up, you may need to loosen the Center Torque Screw more.
7. Put the removed grating turret assembly into the protective container it was shipped in (align the post and hole). Tighten the Center Torque screw and then use a 3/32" hex wrench to tighten the three set screws on the bottom of the container (about 1 turn).
8. Before removing the replacement grating turret from its shipping container, use a 3/32" hex wrench to loosen the three set screws on the bottom of the container (about 1 turn).
9. Then remove the cover from the shipping container, grasp the Center Torque Screw and turn it counter-clockwise until the turret can be lifted straight up.
10. Locate the hole near the edge between gratings on the grating turret assembly (see Figure 2-19).
11. Locate the vertical post on the Grating Spindle Assembly (see Figure 2-20).
12. Position the grating turret on the grating spindle so the hole in the turret assembly aligns with the post in the turret assembly as shown in Figure 2-21.
13. Make sure the turret is properly seated.
14. Tighten the Center Torque Screw until it clicks. This sets the torque on the spindle correctly.
Note: You cannot overtighten this screw. It designed to slip once the correct torque is attained.
15. Place the Turret Cover on the spectrograph. Replace and tighten all of the cover screws.
16. Put the removed grating turret into the storage container: align the hole in the grating turret assembly with the vertical post on the bottom plate of the shipping container, and tighten the Center Torque Screw until it clicks. Replace the plastic cover and store the container in a safe location.
17. If the IsoPlane's power supply is on, re-start the IsoPlane to allow auto-identification of the new grating turret. If the power supply is off, the auto-identification will occur the next time you turn the supply on.

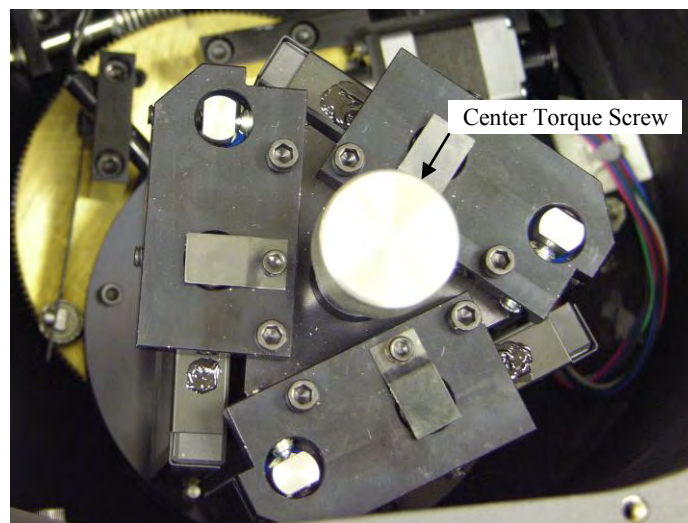


Figure 2-17. Center Torque Screw



Figure 2-18. Lift Turret up out of the Turret Compartment

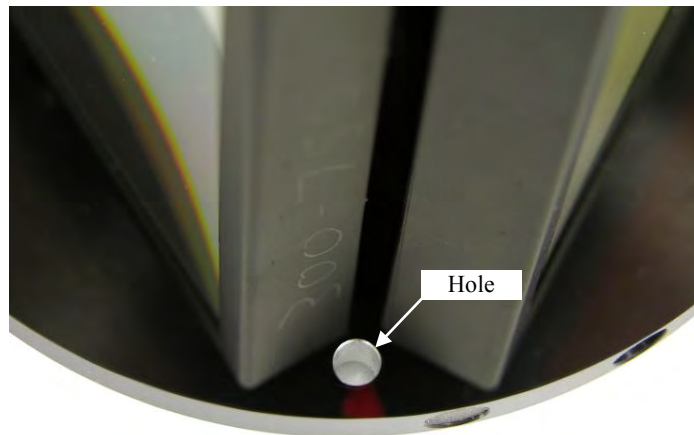


Figure 2-19. Location of Hole on Turret Grating Assembly

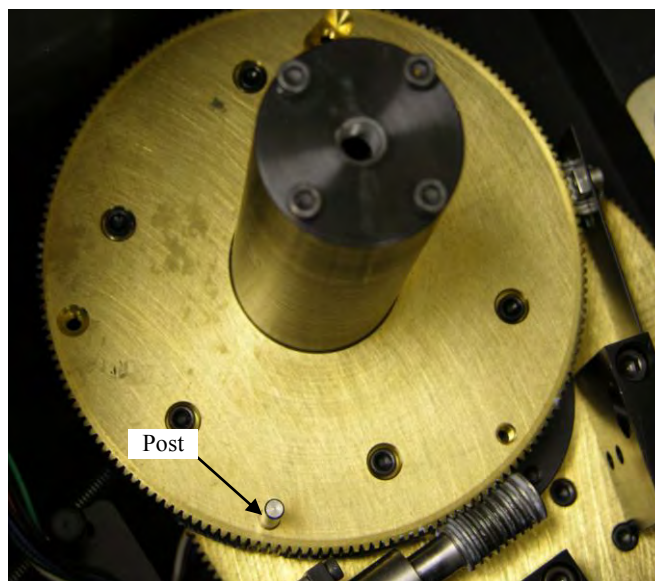


Figure 2-20. Location of Post on Grating Spindle Assembly

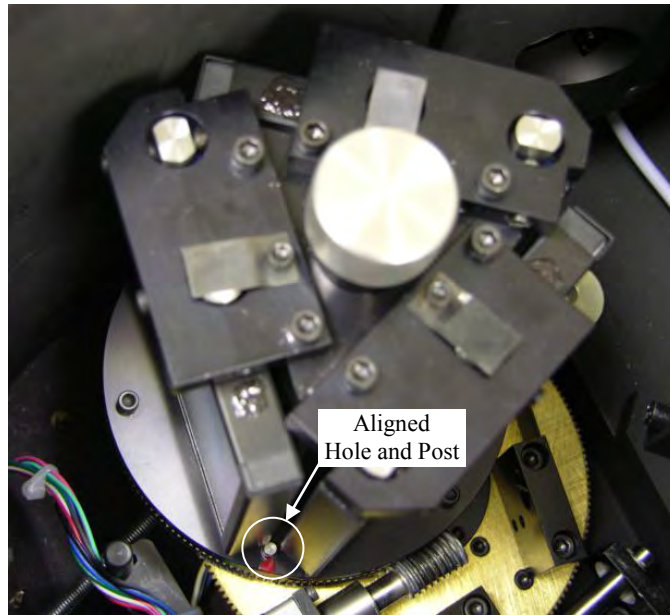


Figure 2-21. Turret Installed (Hole and Post Aligned)

Chapter 3 Operation

3.1 Introduction

This chapter reviews how to enable the control of an IsoPlane and Princeton Instruments detector by either the LightField (64-bit) or WinSpec (32-bit) software. This chapter also points out how to perform alignment using the software. Further information about operating the system can be found in the appropriate software manual or help file.

Warnings:

1. A PyLoN with an internal shutter or a SPEC-10 with an internal shutter **CANNOT** be used with an IsoPlane spectrograph.
2. If the detector has a flange mount and has an internal shutter, **DO NOT USE** the **Shutter** connector to drive a shutter internal to an IsoPlane. If both the detector and spectrograph have shutters, the IsoPlane shutter will have to be removed or a Princeton Instruments SHC-EXT Shutter Control Box can be used to control the opening and closing of the IsoPlane's internal shutter. See "***Internal Shutter***" on page 11 and "***Internal Shutter Installation/Removal***" page 22 for more information.

3.2 Pre-Operation Checks

Before starting the operating software (LightField or WinSpec, for example), confirm that:

- The detector is mounted to the IsoPlane.
- The detector and IsoPlane are connected to the computer via the appropriate communications cables.
- The detector and IsoPlane are powered on.
- If the detector is LN-cooled, the Dewar has been filled.

3.3 Initialization

When power is turned ON to the IsoPlane, it initializes to a wavelength of 0.0 nm for grating number 1. If the power is switched OFF and then ON again to the IsoPlane, it will re-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).

3.4 LightField

Start LightField after making sure the detector and IsoPlane are connected to the computer and are turned on. When LightField boots it will look for available devices and will load their icons in the **Available Devices** panel. Before you can design a new experiment or run an existing one, the appropriate device icons must be dragged into the **Experiment Devices** panel. Once there is at least one device, the **Experiment Settings** panel will be populated with expanders for groups of experiment settings.

Note: If the IsoPlane (SCT-320) icon is the only device in the **Experiment Devices** panel, the **Spectrograph** expander will be the only expander in the list. When you drag a detector into the panel, the **Calibration** expander and all of the detector-related expanders will be displayed.

3.4.1 Define the Detector and Spectrograph

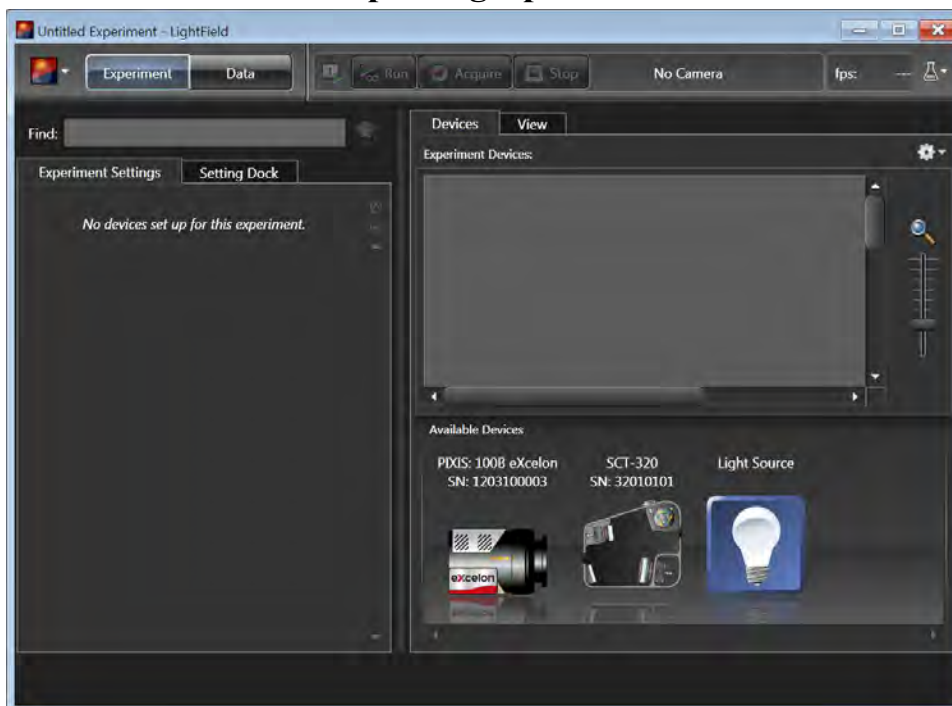


Figure 3-1. LightField Available Devices panel

1. After LightField opens, you should see an icon representing your detector in the **Available Devices** area. In the figure above, the detector is a PIXIS:100B eXcelon®.
2. Drag the icon into the **Experiment Devices** area.



Figure 3-2. LightField Experiment Settings stack and Experiment Devices panel

- Note that the **Experiment Settings** stack on the left now displays several expanders. Because this is a new experiment, the default settings for the detector will be active. The **Status** bar (at the bottom of the window) displays an icon for temperature status.

Temperature status reports the current temperature and whether the set temperature has been reached. Clicking on the icon, opens the **Sensor** expander which is where the set temperature can be changed.

- On the **Shutter** expander, select **Shutter Mode: Normal** (see Figure 3-2).
- Open the **Spectrometer** expander, select the appropriate grating (see Figure 3-2). In this case, the 300g/mm (Blaze: 750) grating was selected and the center wavelength was set to 500 nm for a mercury lamp. Use 0.0 nm if using a broadband source.

Hint: Overhead fluorescent lights produce a mercury spectrum. Use a white card tilted at 45 degrees in front of the entrance slit to reflect overhead light into the spectrograph. Select 500 nm as the spectral line.

3.4.2 Perform Alignment

Because the detector is mounted directly to the mounting plate on the IsoPlane, the rotational alignment and focusing operations are different from the way these operations are performed for an Acton SP Series spectrograph. The following information assumes that you are familiar with the locations of the mounting plate, Micrometer Compartment, and the locking set screw. If not, refer to earlier sections of this manual.

1. Mount a light source such as a Princeton Instruments Hg and Ne/Ar Dual Switchable light source in front of the entrance slit.
2. With the IsoPlane properly connected to the computer, turn the power on, wait for the spectrograph to initialize.
3. With the detector mounted to the spectrograph and connected to the computer, turn on the power and wait for the detector to initialize. If the detector is LN-cooled, the Dewar should be filled.
4. Start the application software. Because you are using LightField, you will need to drag the icons for the detector and the IsoPlane into the **Experiment Devices** area.
5. Set the spectrograph to 500 nm if using a mercury source or to 0.0 nm if using a broadband source.
6. Wait until the detector locks at its default temperature.
7. Using a 9/64" hex wrench, loosen the four screws at the corners of the detector mounting plate.
8. Select the **Align Spectrometer** function from the **Experiment** menu to open the **Spectrometer Alignment** dialog. This dialog describes the changes that LightField will make to the current setup to assist you in performing rotational alignment of the array to the spectrograph's optics. When you click on the **Begin** button, the modifications are made and continuous live data will be displayed as you rotate the detector.

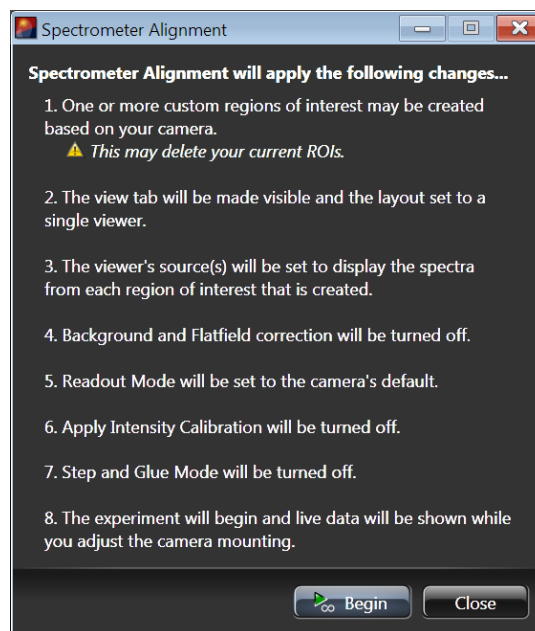


Figure 3-3. Spectrometer Alignment dialog

9. Click on the peak you will be monitoring for the alignment. This will display the data cursor, which you can position at the top of the peak. Since the data cursor spans the ROIs (graphs), you can use the data cursor as your vertical reference.
10. Slowly rotate the camera until the peaks align in all of the ROIs.

Alternatively, you can acquire an image, display the large data cursor, and compare the vertical bar to the line shape on the screen. Rotate the detector until the line shape on the screen is parallel with the vertical bar.
11. After completing the rotational alignment, click on the **Stop** button.
12. Re-tighten the four mounting plate screws.
13. Using a 9/64" hex wrench, remove the cover from the Micrometer Compartment.
14. Using a 3/32" hex wrench, loosen the micrometer locking set screw (see Figure 2-11).
15. Click on **Run**, and while continuously acquiring data, adjust the micrometer until you maximize the intensity level and minimize the FWHM of a selected peak or peaks. Note that the **Peak Find** function (for the graph selected by the cursor) is automatically turned on to help you identify peaks and view FWHM widths.

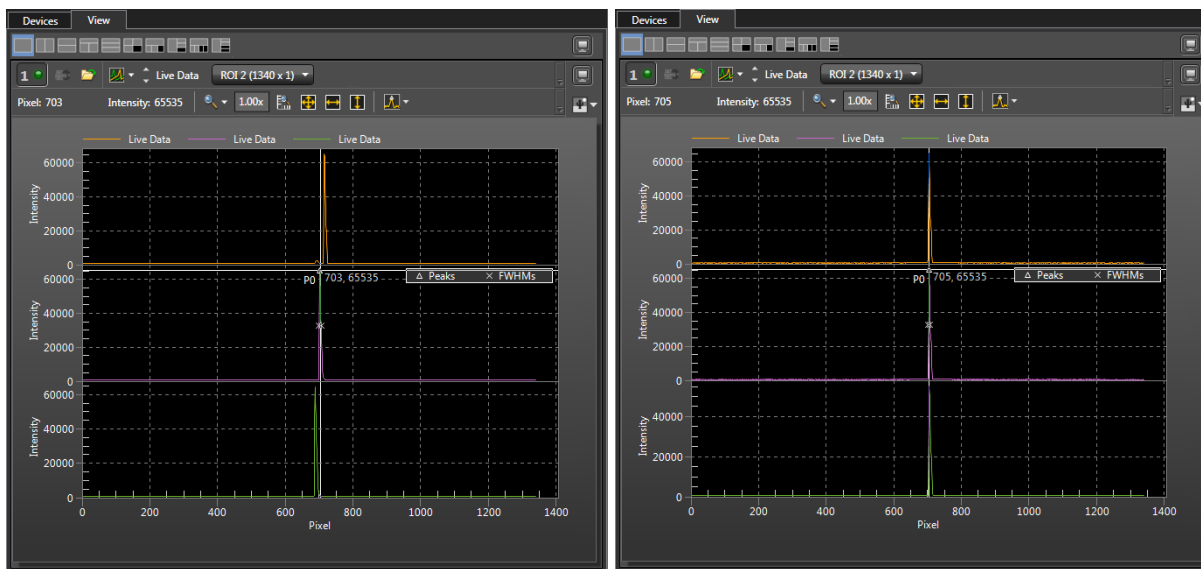


Figure 3-4. Alignment Helper: Before and After Rotational Alignment

16. Tighten down the locking set screw.
17. Place the Micrometer Cover on the spectrograph. Replace and tighten all of the cover screws.
18. Stop acquisition.

3.5 WinSpec

Start WinSpec after making sure the detector and IsoPlane are connected to the computer and are turned on. WinSpec should find the detector and present a dialog for selecting the detector for your experiment. Before you can use the IsoPlane, you must tell WinSpec that it is the spectrograph you will be using.

3.5.1 Select the Detector

Note: If the detector is LN-cooled, the Dewar should be filled while the detector is ON.

1. If this is the first time you have installed WinSpec/32 and a supported detector, the **Camera Detection wizard** will run automatically. Otherwise, if you installing a new detector type, click on the **Launch Camera Detection Wizard...** button on the **Controller/CCD** tab to start the wizard.
2. On the **Welcome** dialog (Figure 3-5), leave the checkbox unselected and click on **Next**.

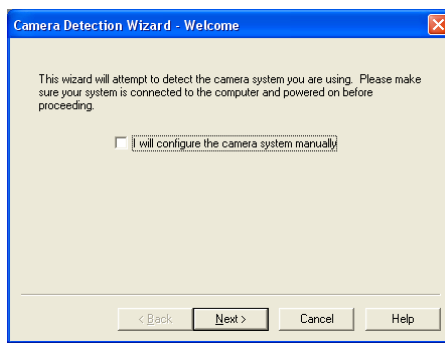


Figure 3-5. Camera Detection Wizard - Welcome dialog

3. Follow the instructions on the dialogs to perform the initial hardware setup: this wizard enters default parameters on the **Hardware Setup** dialog tabs and gives you an opportunity to acquire a test image to confirm the system is working.
4. If the detector is LN-cooled, fill the Dewar while the detector is powered ON.

3.5.2 Define the Spectrograph

1. From the Main menu bar, open the **Spectrograph** menu, and select **Define**.

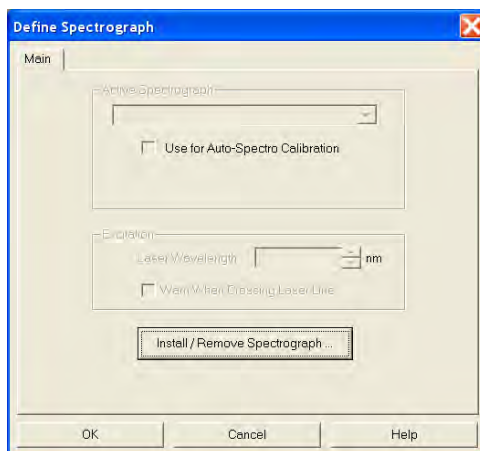


Figure 3-6. Define Spectrograph dialog

2. On the **Define Spectrograph** dialog (Figure 3-6), click on the **Install/Remove Spectrograph** button.
3. On the **Install/Remove Spectrograph** dialog, scroll down the list of supported spectrographs, click on **Acton SCT320**, click on the **Install Selected Spectrograph** button, and then click on **OK** to return to the **Define Spectrograph** dialog.

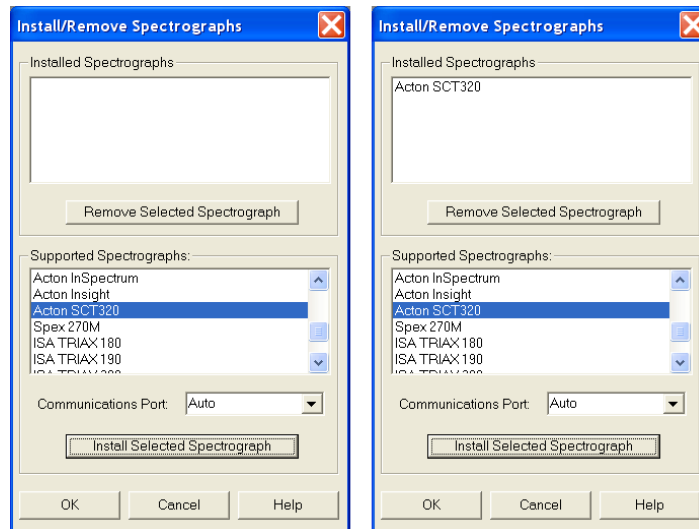


Figure 3-7. Install/Remove Spectrograph dialog

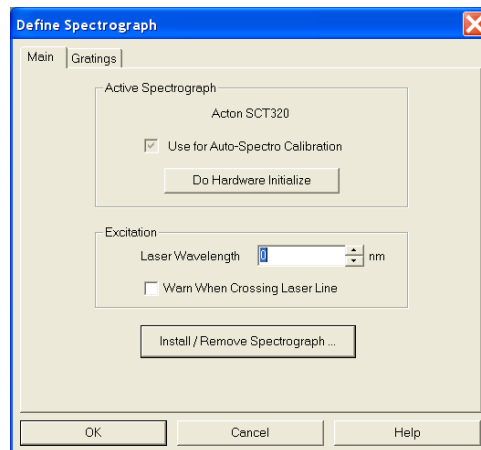
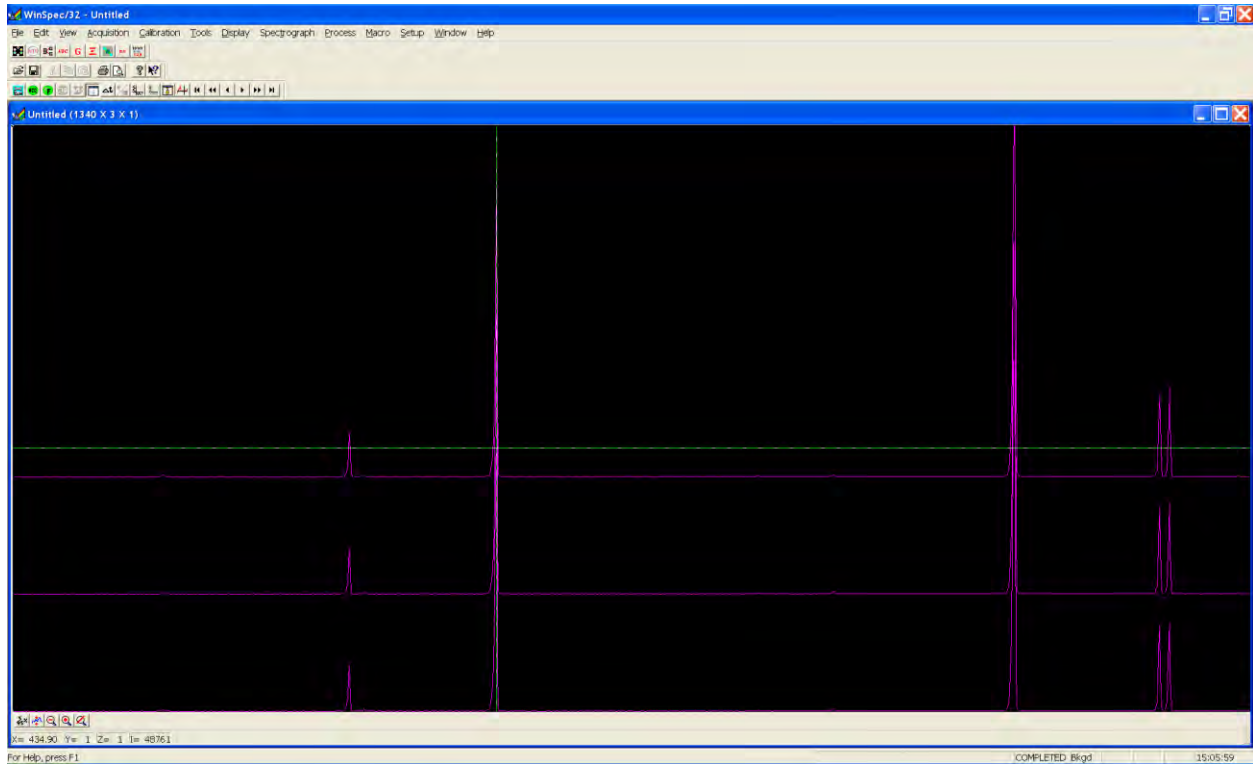


Figure 3-8. Define Spectrograph dialog: Acton SCT320 is Active Spectrograph

4. To confirm that WinSpec recognizes the spectrograph, click on **Do Hardware Initialize**. You should hear the turret moving.
5. Now that you have identified the spectrograph to WinSpec, your next steps should be to align the spectrograph optics to the detector. See “**3.5.3 Perform Alignment**” on the next page.

3.5.3 Perform Alignment

The initial alignment described in this section assumes that you have already connected and turned on the detector and spectrograph, have opened WinSpec, and identified the detector and spectrograph. After you have aligned the optics the first time, you may want to repeat the process to fine tune the alignment.



1. Mount a light source such as a Princeton Instruments Hg and Ne/Ar Dual Switchable light source in front of the entrance slit.
2. From the **Main** menu bar, open the **Spectrograph** menu, select **Move**, choose the grating to be move, and then set it to 500 nm if using a mercury lamp or to 0.0 nm if using a broadband source.



Figure 3-9. Move Spectrograph dialog: Gratings tab

3. Set the slit to 10 μm at a minimum. *If necessary, adjust the Exposure Time to maintain optimum (near full-scale) signal intensity.*
4. Wait until the detector locks at its default temperature. If the detector is LN-cooled, it should have been filled after the detector was powered ON.
5. Turn on **Focus** mode.
6. Adjust the rotation alignment. First, use a 9/64" hex wrench to loosen the four screws at the corners of the detector mounting plate. While watching a live display of the spectrum displayed as a graph, select a peak to monitor and then rotate the detector (up to 4 degrees of rotation are possible). The peak will go from broad to narrow and back to broad. Leave the detector rotation set for the narrowest achievable peak.

Alternatively, take an image, display the horizontal and vertical cursor bars, and compare the vertical bar to the line shape on the screen. Rotate the detector until the line shape on the screen is parallel with the vertical bar.

Another technique is to set up three ROIs (one at the top, middle, and bottom of the array) with 10 rows binned for each via the **Experiment Setup|ROIs** tab, Then change the data display via the **Display Layout** dialog, so that 3d Graph is selected (**General** tab), the Z Axis Endpoints (**3D Layout** tab) are %X = 0 and % Y = 40, and the **Save as Default** check box is checked. Click on **OK**. While running in **Focus** mode, you should see three stacked graphs. Aligning the large cursor with a prominent peak, rotate the detector until the peak aligns with the cursor in all three ROIs.

7. After completing the rotational alignment, tighten the four mounting plate screws.
8. Remove the cover from the Micrometer Compartment.
9. Using a 3/32" hex wrench, loosen the locking set screw.
10. While continuously acquiring data, adjust the micrometer until you maximize the intensity level and minimize the FWHM of a selected peak or peaks.
11. Tighten down the locking set screw.
12. Place the Micrometer Cover on the spectrograph. Replace and tighten all of the cover screws.
13. Then stop acquisition.

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Appendix A Using the Monochromator Control Software

A.1 Introduction

As has been previously mentioned in this manual, the Acton IsoPlane spectrograph can be controlled using Princeton Instruments' LightField, WinSpec, or SpectraSense software. It can also be controlled from a computer using the supplied Monochromator Control software via the RS-232 or USB interface. The information on how to do this is provided in this appendix.

A.2 Install the Monochromator Control Software

Use the install disk shipped with the monochromator to install that software on your computer. The icon for this software on your computer screen is labeled MonoControl.

A.2.1 Monochromator Control Application Software

The Monochromator Control software is a stand-alone Acton software program for basic scanning and calibration. Utilities for grating updates and communications are also included. Normally, the software is installed in the directory C:\Program Files\Princeton Instruments\MonoControl. This directory contains the subdirectories Bin and Data. The Bin directory contains the executable code for the program.

Upon installation, a **Monochromator Control** icon is usually placed on the desktop for starting the software. If this icon is not on the desktop, check for the program in the Windows Start menu\Programs or go directly to the MonoControl\Bin directory and start the software there. When the Monochromator Control software loads, there is a main screen with selections for monochromator operation and for various setup functions. (If the buttons are grayed out, exit the program, connect the IsoPlane, wait for it to initialize, and then restart the program.) Click on the **Operation** button 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.

A.3 Connecting the IsoPlane to the Computer

The IsoPlane is designed for operation by computer using RS-232 or USB, control that enables wavelength scanning at a pre-set linear scan rate, change of scanning speeds, grating selection, rapid GOTO wavelength positioning, change of grating turrets, and "jog" wavelength positioning. Refer to the Monochromator Control software for Windows for operation with a computer.

A.4 Controlling the IsoPlane Spectrograph at the Command Level

Although it requires more programming on the user's part, the spectrograph can also be controlled with direct commands through its USB 1.1 port or RS-232 port. The same command set, listed below, is used for both RS-232 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., 546.07 GOTO).

For RS-232 operation, the port set-up 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 1.1 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 spectrograph 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 spectrograph 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 spectrograph to complete the processing of that command string before sending another command.

A.4.1 Spectrograph 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 3 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 SP series 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 3 digits after the decimal point or whole number wavelength with no decimal point.
<NM>	Same as NM (For compatibility with software written for Acton SP series models.)
>NM	Similar to NM except it returns control to user immediately rather than waiting for completion of spectrograph 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 0.01nm 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 the scan rate in nm/min to 0.01 nm/min resolution with units nm/min.
?NM/MIN	Returns present scan rate in nm/min to 0.01 nm/min resolution with units nm/min.

A.4.2 Grating Control Commands

GRATING Places specified grating in position to the wavelength of the wavelength on the present grating. Up to nine (9) gratings are allowed on three (3) turrets. This command takes a grating number from 1 - 9.

IMPORTANT NOTE: This command assumes that the correct turret is specified by the **TURRET** command. For example, using grating numbers 1, 4 and 7 will place the first grating on the installed turret into that position and call up the parameters for the grating number specified.

?GRATING Returns the number of gratings 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.

TURRET Specifies the presently installed turret or the turret to be installed. e.g., if installing the second turret, issue the command **2 TURRET** to insure using the correct parameters.

?TURRET Returns the correctly installed turret numbered 1 - 3.

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

INSTALL Installs new grating parameters into the non-volatile memory of the IsoPlane monochromator. Uses the part number 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 turret number 2.

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 IsoPlane 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 IsoPlane non-volatile memory.

A.4.3 Slit Width Control Commands (for Motorized Slits only)

- SIDE-EXIT-SLIT** Designates side exit slit to receive slit control commands.
- SIDE-ENT-SLIT** Designates side entrance slit to receive slit control commands.
- MICRONS** Sets the slit width for the designated slit in the range of 10 to 3000 microns to 1 micron resolution.
- ?MICRONS** Returns the slit width setting in microns to the nearest 1 micron.

A.4.4 Additional Commands

- MONO-EESTATUS** Returns setup and grating calibration parameters for all gratings.
- RESTORE-FACTORY-SETTINGS** Returns all parameters, including grating calibration parameters, to the original factory calibrated settings.

Notes:

1. Any gratings installed at a later date (after initially receiving the IsoPlane) will be erased from memory using this “restore command”.
2. This command will overwrite any calibration parameters set by the user.

- MODEL** Returns model number of the spectrograph.
e.g., **MODEL** SCT-320
- SERIAL** Returns serial number of the spectrograph. Format is 8 digits with the first 3 digits being the model number.
e.g., **SERIAL** 32010121

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

Parameter	Default
GRATING	#1
WAVELENGTH	0.0 nm
SCAN SPEED	100.0 nm/min

Table A-1. Start-Up Parameters and Their Default Values

Each of the above may be changed through the RS-232 port or USB 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 IsoPlane 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 IsoPlane 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 IsoPlane.
e.g., 500.00 **INIT-SRATE** Notice that two digits after the decimal point are required.

Appendix B Spectrograph to Computer Cable Connection

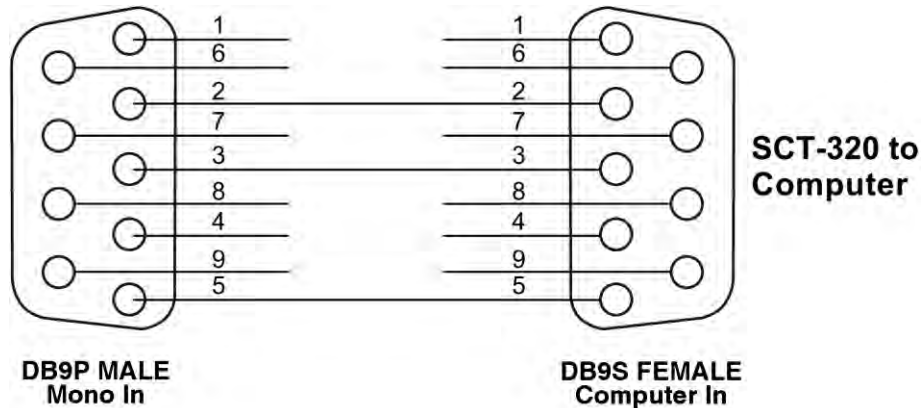


Figure B-1. RS-232 Cable Wiring



Figure B-2. IsoPlane Cable Connectors

- FILTER** Filter driver connection for Acton FA-2448 Filter Wheel.
- SHT TTL** SHT TTL connection for TTL control of shutter.
- DSP** DSP connection to connect two spectrographs as doubles.
- COM** Com light flashes when communicating with the computer.
- READY** Ready light is on when the instrument is ready to operate. (Green light comes on after the instrument initializes. Yellow = busy).
- RS-232** RS-232 connection to computer.
- USB** USB connection to computer.
- USB HUB** USB Hub 1.1 compatible.
- POWER** Power connection +5 and +24 Volts.

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Appendix C Accessories Listing

Slit Assembly

SP-716-1 **Bilaterally adjustable ENTRANCE slit assembly** for IsoPlane monochromator or spectrograph. Micrometer adjustable widths from 10 μm to 3 mm. Supplied with interchangeable 4.0 mm and 14.0 mm high baffles.

Triple Grating Turret

300-483 **Interchangeable triple grating turret** for the IsoPlane. Requires gratings. Optional second and third turrets.

Light Sources: Sources with 220 V, 50 Hz area also available in all models.

MS-416 **Low Pressure Mercury Light Source** with power supply and mounting flange for Acton series monochromators and spectrographs. Provides output at typical mercury wavelengths (line output).

DS-421 **30 Watt Deuterium Light Source** with housing, power supply, mounting flange, and light collection mirror. Provides output from 190 to 350 nm.

TS-425 **30 Watt Tungsten-Halogen Light Source** with housing, power supply, mounting flange, and light collection mirror. Provides output from 350 nm to $>2.0 \mu\text{m}$

TS-428 **250 Watt Tungsten-Halogen Light Source** with housing, AC power supply, mounting flange, variable brightness control and light collection mirror. Provides output from 350 nm to $>2.0 \mu\text{m}$.

TS-428-DC **Same as TS-428** with Regulated DC Power Supply.

TDS-429 **Dual Light Source** with 30 watt deuterium & 30 watt tungsten-halogen lamps. Includes housing with light collection mirror, mounting flange, and power supply. Provides combined output from 190 to $>2.0 \mu\text{m}$.

XS-433 **75 Watt Xenon Light Source** includes power supply, housing, mounting flange and light collection mirror. Provides continuous spectral output from 190 nm to 750 nm and declining continuum out to $2.6 \mu\text{m}$.

Detectors and Accessories: All detectors include mounting flanges for IsoPlane slit assemblies.

- PD-438** **Universal Photomultiplier Tube Housing** for standard 1 1/8" side window photomultiplier tubes. Requires side window PMT, and photometer/power supply for operation. Accepts Acton tubes P1, P2 or P3 below, or customer specified 1 1/8" side window PMTs.
- PD-439** Same as PD-438 above, also includes integrated **light tight shutter**.
- PD-471** **Photomultiplier Tube Housing** for 1 /8-inch tubes with built in HV supply. Only for SpectraHub.
- P1** **Side Window Photomultiplier Tube** (or equivalent) for wavelength region 185-650 nm.
Fits PD-438, PD-439, or PD-471 housing.
- P2** **Side Window Photomultiplier Tube** (or equivalent) for wavelength region from 185-900 nm. Fits PD-438, PD-439, or PD-471 housing.
- P3** **Side Window Photomultiplier Tube** (or equivalent) for wavelength region from 300-1100 nm. Fits PD-438, PD-439, or PD-471 housing.
- SI-440** **General-purpose Single Channel Detector** with a 10 mm diameter active area for use from 400 to 1100 nm. Enclosed in housing with the BNC connector.
- SI-440-UV** **Single Channel Detector** with a UV-enhanced, 10 mm diameter active area for use from 200 to 1100 nm operation.
- ID-441** **InGaAs Detector**, includes pre-amplifier, uncooled version.
- ID-441-C** **InGaAs Detector**, includes pre-amplifier, cooled version, requires either Model 442-1A thermoelectric cooling for operation.
- 442-1 A** **Thermoelectric cooling** for ID-441 detectors.
- SpectraHub** **SpectraHub data acquisition system**, 20-bit A-D converter, single channel detector interface. Requires SpectraSense software.

Microscope Interface

- MicroSpec** **Microscope Interface** enables researchers to perform high quality imaging and spectroscopy with a single system. Attaches to a UDP port on an inverted microscope and couples to the IsoPlane SCT 320. For more information, refer to the MicroSpec data sheet on the Princeton Instruments website.

Filter Wheels and Order Sorting Filter Assemblies

- FA-2448** **Six Position Filter Wheel Assembly.** Manual sample indexing, holds up to six samples, each 1.0" diameter; automated via SP Control Cable. Can be used with the IsoPlane. Requires FA-2448-F Filter Set or customer-supplied filters of 25 mm (1 inch) diameter and 5 mm or less in thickness.
- FA-2448-1** **Order Sorting Filter Assembly.** Includes FA-2448-F Filter Set with 320, 590, 665, and 715 nm filters mounted in FA-2448 filter wheel. Manual indexing of filters for elimination of unwanted second order radiation; automated via SP Control Cable. Can be used with the IsoPlane.
- FA-2448-2** **Motorized Six Position Filter Wheel Assembly,** with stepping motor and FA-2448-4 controller. Enables indexing by computer with RS-232 or USB. Requires computer with RS-232 or USB for computerized operation. Set or customer-supplied filters of 25 mm (1 inch) diameter and 5 mm or less in thickness.
- FA-2448-3** **Motorized Order Sorting Filter Assembly.** Includes FA-2448-F Filter Set with 320, 590, 665, and 715 nm filters mounted in FA-2448 filter wheel. Enables computer controlled indexing of order sorting filters for elimination of unwanted second order radiation. Requires computer with RS-232 or USB for operation. Requires FA-2448-F Filter Set.
- FA-2448-F** **Order Sorting Filter Set.** Includes four filters: 320, 590, 665, and 715 nm.
- Fiber Optic Light Guides:** All Fiber optic light guides contain 19 fibers, 200 μm diameter, arranged in a line pattern at the slit end, and round at the source end.
- LG-455-020-1 UV-VIS Fiber Optic Bundle** 1.0 meter long, for 190 nm to 1100 nm. Requires mount.
- LG-455-020-3 UV-VIS Fiber Optic Bundle** 3.0 meter long, for 190 nm to 1100 nm. Requires mount.
- LG-456-020-1 VIS-NIR Fiber Optic Bundle** 1.0 meter long, for 400 nm to 2200 nm. Requires mount.
- LG-456-020-1 VIS-NIR Fiber Optic Bundle** 3.0 meter long, for 400 nm to 2200 nm. Requires mount.
- FC-446-010** **Fixed-Position Fiber Adapter** is a low-cost solution for positioning fiberoptic bundles directly at the entrance port of an IsoPlane spectrograph. Accepts 10 mm diameter ferrule.
- FC-446-020** **Fiber Coupler** with horizontal translation capability for 10 mm diameter fiber optic bundle. Accepts 10 mm diameter ferrule.
- FC-446-021** **Fiber Coupler** with X-Y Micrometer alignment adjustments. Accepts 10 mm diameter ferrule.

FC-446-030 Imaging Fiber Adapter is designed specifically for our imaging spectrographs. The all-reflective design eliminates chromatic aberrations and the aspheric mirror cancels astigmatism, allowing precise imaging of fibers at the spectrograph entrance slit. Includes up/down, left/right screw alignment adjustments. Accepts 10 mm diameter ferrule. Also includes a 0.75" thick spacer to insert an optional FA-2448 series Filter Wheel for order sorting function.

Connecting Cables

CC-499-2 RS232 serial cable, 6 feet (1.82 meters) long, 9-pin female to 9-pin male connectors.

3650-USB-06 USB cable, 6 feet (1.82 meters) long, type A to B connectors.

If the above cables are not compatible with your system, contact Princeton Instruments for a custom cable.

Appendix D Gratings for IsoPlane

Grooves/mm	Blaze Wavelength	Standard Part Number	Mechanical Limit
50	600 nm	I3-005-600-P	
150	500 nm	I3-015-500-P	11.2 μm
150	800 nm	I3-015-800-P	
150	1250 nm	I3-015-1250-P	
300	300 nm	I3-030-300-P	5.6 μm
300	500 nm	I3-030-500-P	
300	750 nm	I3-030-750-P	
300	1000 nm	I3-030-1000-P	
600	300 nm	I3-060-300-P	2.8 μm
600	500 nm	I3-060-500-P	
600	750 nm	I3-060-750-P	
600	1000 nm	I3-060-1000-P	
600	1200 nm	I3-060-1200-P	
1200	300 nm	I3-120-300-P	1400 nm
1200	Holographic VIS ^{††}	I3-120-HVIS-P	
1200	500 nm	I3-120-500-P	
1200	750 nm	I3-120-750-P	
1800	Blazed Holographic UV [†]	I3-180-HUV-P	933 nm
1800	500 nm	I3-180-500-P	
2400	Holographic VIS ^{††}	I3-240-HVIS-P	700 nm

Notes:

[†] Blazed Holographic, 190-450 nm, optimum range

^{††} Optimum range for this grating is from 450 nm to the upper mechanical limit

Standard Gratings are 68 X 68 mm.

Table D-1. Available Gratings

Ordering Information

Electronic Orders

Electronic orders accepted with proper Company Letterhead and complete contact information.

Fax Orders

Orders may be placed by fax with written confirmation. Please include complete name and address with these orders.

FAX: 978-263-5086

Orders accepted subject to current pricing.

All orders FOB Princeton Instruments-Acton or shipping charges & insurance added separately.

All orders subject to new customer approval.

MasterCard / VISA

MasterCard & VISA accepted for purchases.

Written Orders

Submit all written orders to our mailing address:

Princeton Instruments

15 Discovery Way
Acton, MA 01720 U.S.A.

• IsoPlane™ is a trademark of Roper Scientific, Inc. •

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Appendix E Outline Drawings

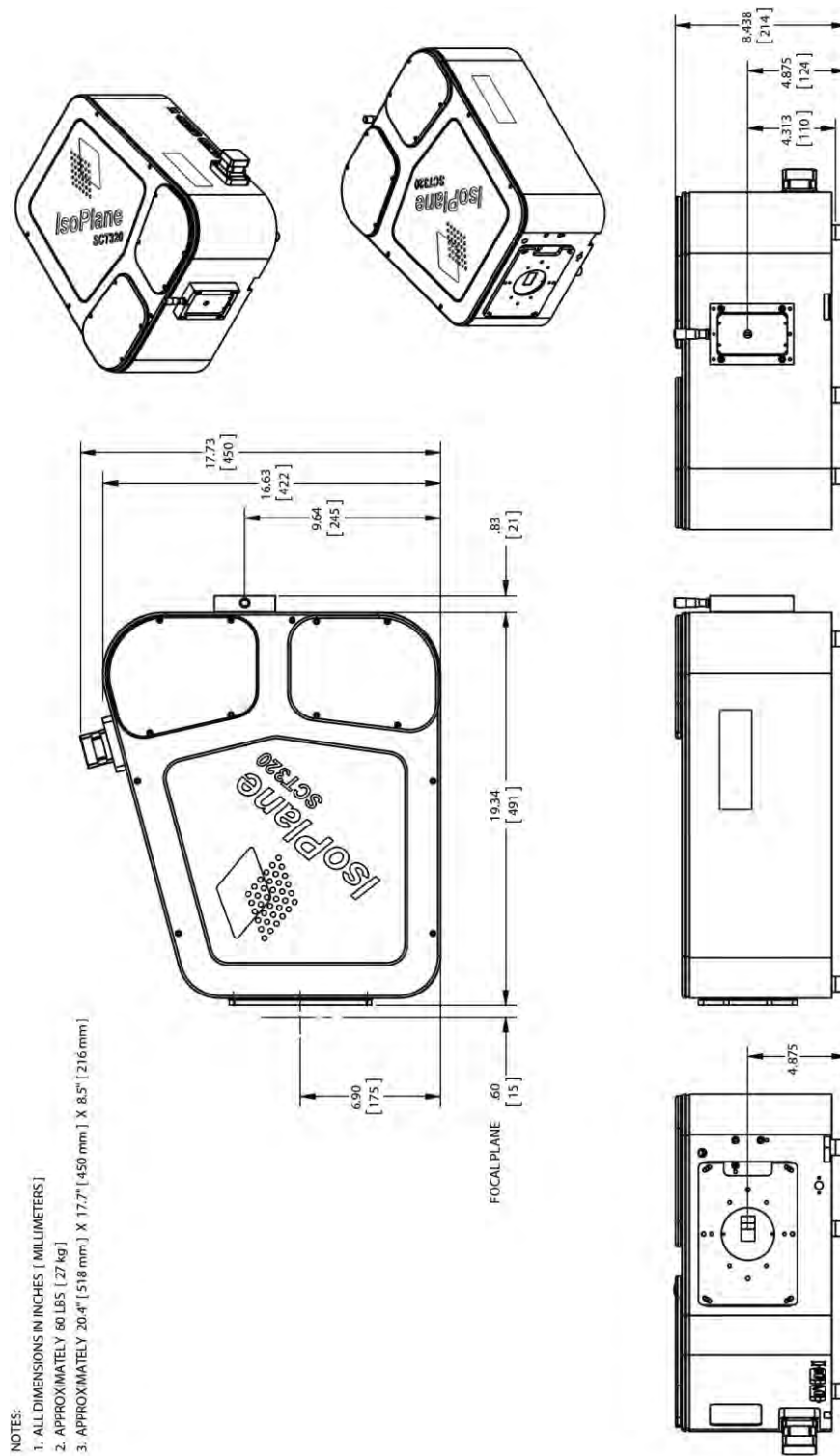


Figure E-1. IsoPlane: 320 with Manual Slit Assembly Outline Drawing

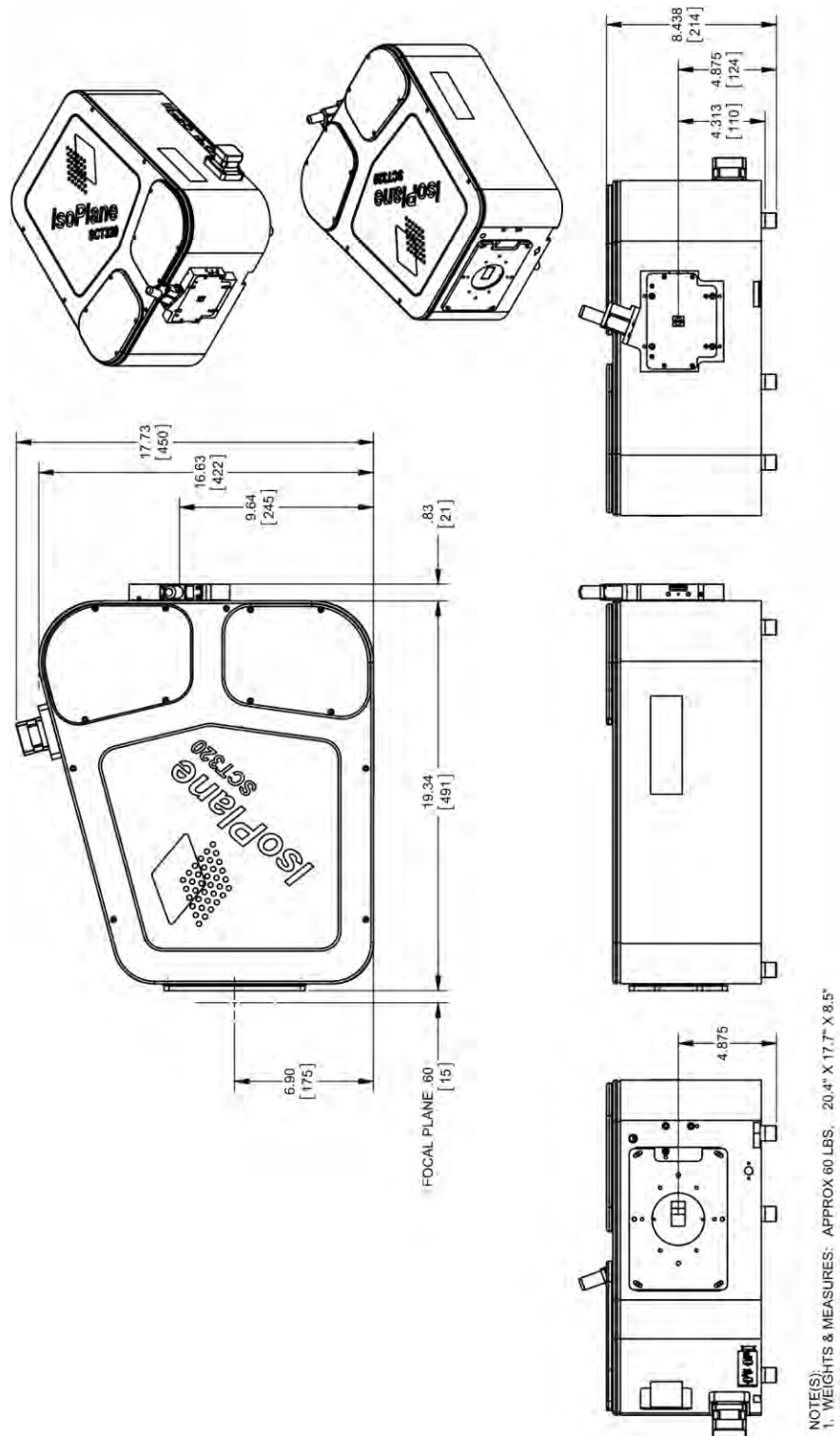


Figure E-2. IsoPlane: 320 with Motorized Slit Assembly Outline Drawing

Appendix F Standard Slit Assembly Drawing

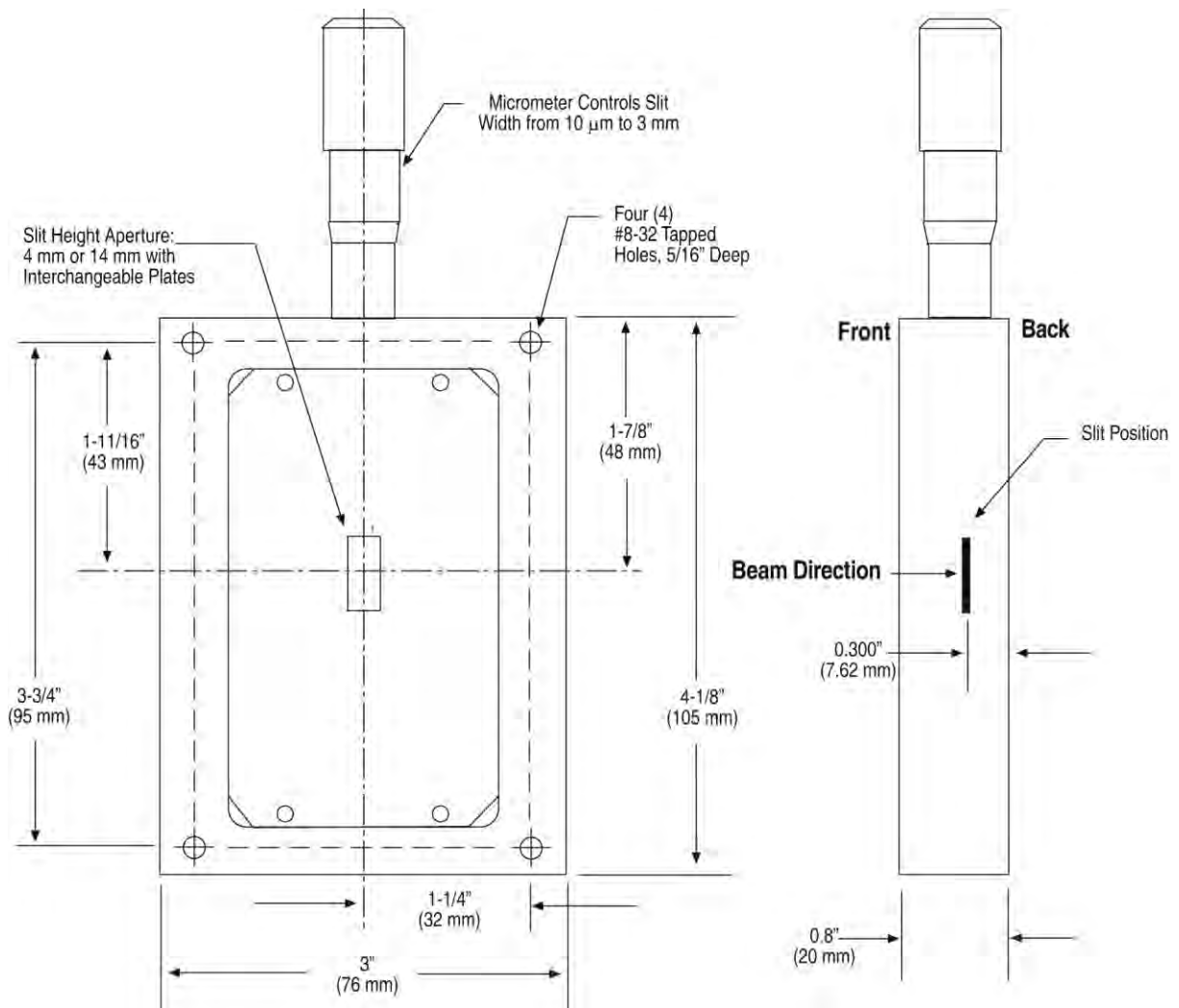
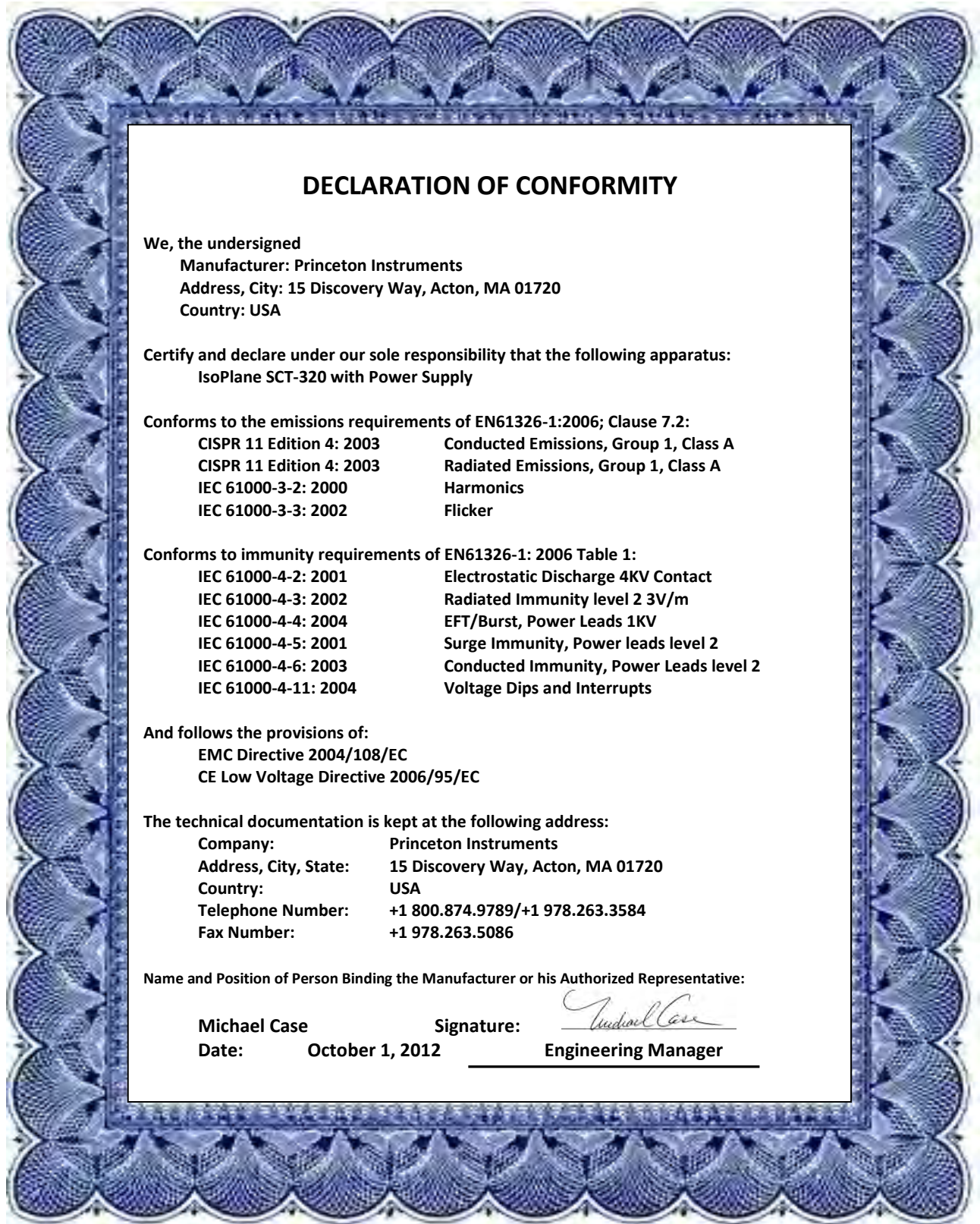


Figure F-1. Standard Slit Assembly Drawing

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Appendix G Declaration of Conformity



DECLARATION OF CONFORMITY

We, the undersigned

Manufacturer: Princeton Instruments
Address, City: 15 Discovery Way, Acton, MA 01720
Country: USA

Certify and declare under our sole responsibility that the following apparatus:
IsoPlane SCT-320 with Power Supply

Conforms to the emissions requirements of EN61326-1:2006; Clause 7.2:

CISPR 11 Edition 4: 2003	Conducted Emissions, Group 1, Class A
CISPR 11 Edition 4: 2003	Radiated Emissions, Group 1, Class A
IEC 61000-3-2: 2000	Harmonics
IEC 61000-3-3: 2002	Flicker

Conforms to immunity requirements of EN61326-1: 2006 Table 1:

IEC 61000-4-2: 2001	Electrostatic Discharge 4KV Contact
IEC 61000-4-3: 2002	Radiated Immunity level 2 3V/m
IEC 61000-4-4: 2004	EFT/Burst, Power Leads 1KV
IEC 61000-4-5: 2001	Surge Immunity, Power leads level 2
IEC 61000-4-6: 2003	Conducted Immunity, Power Leads level 2
IEC 61000-4-11: 2004	Voltage Dips and Interrupts

And follows the provisions of:

EMC Directive 2004/108/EC
CE Low Voltage Directive 2006/95/EC

The technical documentation is kept at the following address:

Company:	Princeton Instruments
Address, City, State:	15 Discovery Way, Acton, MA 01720
Country:	USA
Telephone Number:	+1 800.874.9789/+1 978.263.3584
Fax Number:	+1 978.263.5086

Name and Position of Person Binding the Manufacturer or his Authorized Representative:

Michael Case

Signature:

Date: October 1, 2012

Engineering Manager

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Appendix H Certification and Warranty

Certification

Princeton Instruments certifies that this instrument was thoroughly tested 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 manufacturer's 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

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