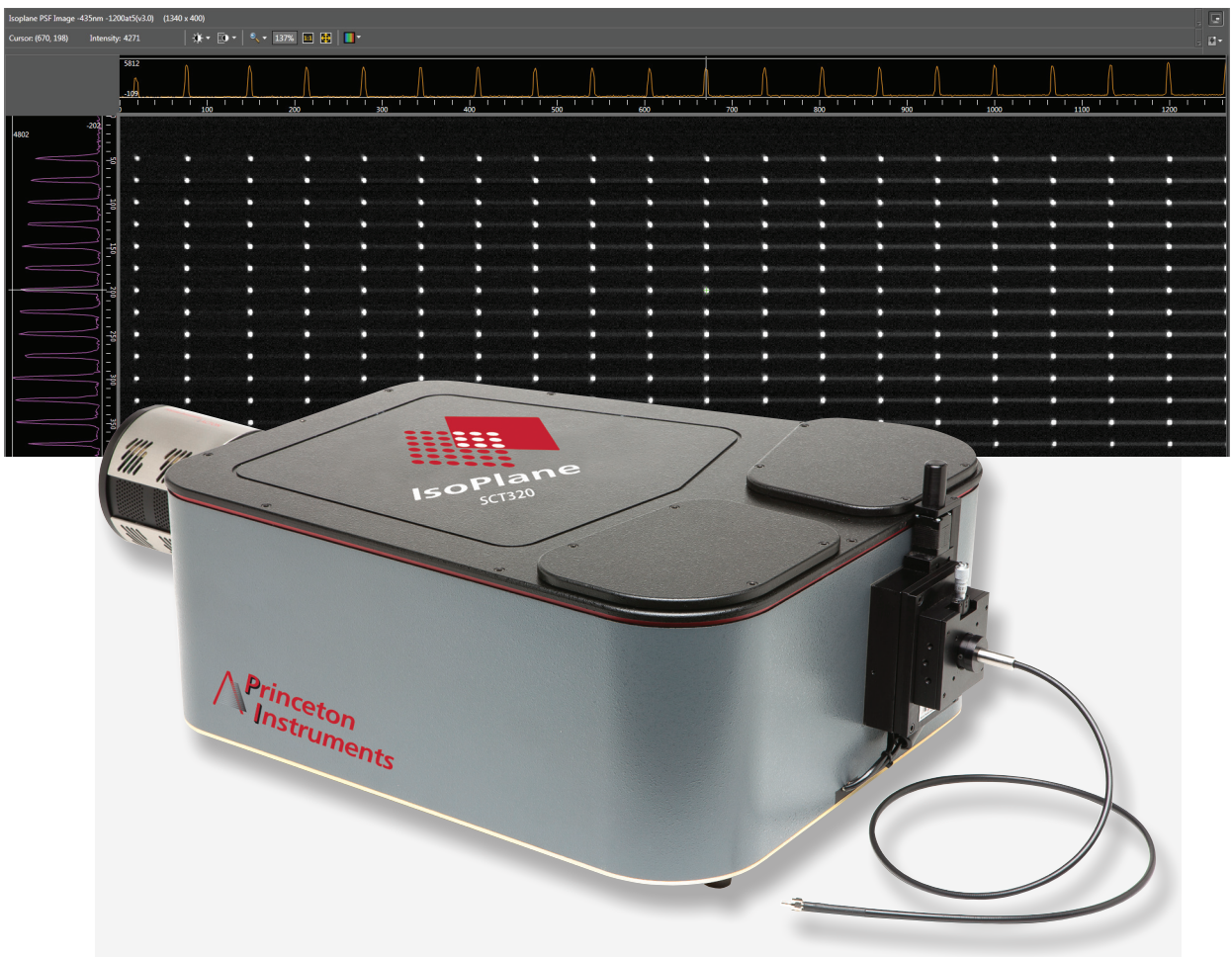
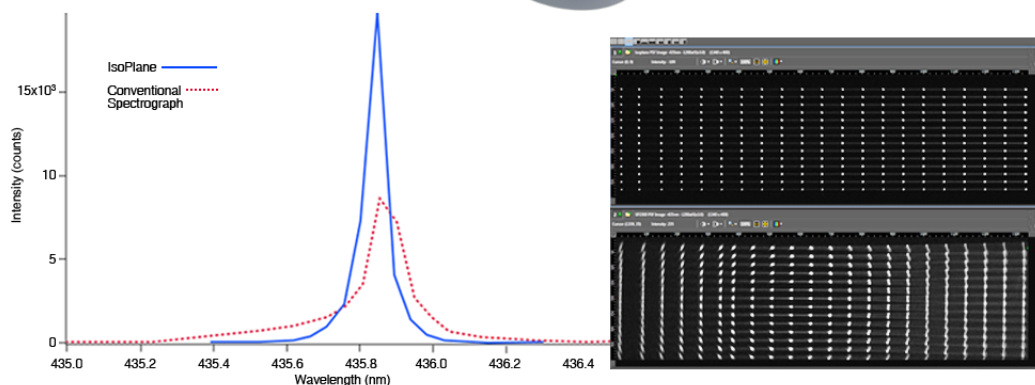


IsoPlane Manual



 **Princeton
Instruments**

IsoPlane[®] SCT 320 User's Manual



0.320 Meter Focal Length Triple Grating Image Spectrograph



Revision History

Issue	Date	List of Changes
Issue 2	August 18, 2014	Issue 2 of this document incorporates the following changes: <ul style="list-style-type: none">• Updated Section 5.6, Focal Plane Adjustments, to clarify focal plane adjustments;• Added Appendix B, Camera Adapters• Removed CLI Programming Appendix;• General reorganization .
1.C	July 10, 2013	Issue 1.C of this document incorporates the following changes: <ul style="list-style-type: none">• Updated graphics to remove lightpath.
1.B	May 8, 2013	Issue 1.B of this document incorporates the following changes: <ul style="list-style-type: none">• Updated Declaration of Conformity;• IsoPlane is now a registered trademark;• Added MicroSpec to Appendix C, Accessories.
1.A	October 9, 2012	This is the initial release of this document

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Chapter 1: IsoPlane[®] SCT 320 Description

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, contact the Princeton Instruments customer service department. Refer to [Contact Information](#) on page 82 for complete contact information.

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](#) illustrates a typical IsoPlane SCT 320.

Figure 1-1: IsoPlane SCT 320



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1.1 Standard Equipment

The following items are included as standard equipment with every IsoPlane system:

- External power supply;
- Data interface cables;
- Grating Turret.

1.1.1 External Power Supply

Figure 1-2 illustrates a typical IsoPlane power supply with an inset providing the pin locations for the power connector. Refer to Table 1-1 for specific pinout information.

Figure 1-2: IsoPlane Power Supply



Table 1-1: IsoPlane Power Connector Pinout Information

Pin Number	Definition
1	+5V
2	GND
3	GND
4	+24

1.1.2 Data Cables

The following computer cables are included 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 the host system, contact Princeton Instruments about obtaining a custom cable. If you have facilities for building a custom cable, refer to the RS-232 pin assignments listed in Table 1-1. Additional information is available in [Appendix D, RS-232 Interface](#), on page 71.

1.1.3 Grating Turret

Each IsoPlane is shipped with, and includes, one grating turret.



NOTE:

Additional turrets are available from Princeton Instruments. Refer to [Section C.2, Triple-Grating Turrets](#), on page 63, for ordering information.

1.2 Optional Accessories

The following optional accessories are available for purchase for use with the IsoPlane system:

- Data Acquisition Software

The following data acquisition software is available for purchase from Princeton Instruments:

- 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.

- 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 SpectraPro Series spectrometers. This software control extends to all instrument options, such as multiple gratings, multiple entrance and exit ports, and motorized slits.

- 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.

- Entrance Slit Accessories;

Refer to [Chapter 2, Entrance Slit Accessories](#), on page 11, for additional information about the installation and removal of entrance slit accessories.

Refer to [Section C.1, Slit Assemblies](#), on page 63 for part number and ordering information for available slit accessories.

- Triple Grating Turrets;

Refer to [Chapter 3, Grating Turrets](#), on page 15, for additional information.

Refer to [Section C.2, Triple-Grating Turrets](#), on page 63 for part number and ordering information for available triple-grating turrets.

- Internal Shutter;

Refer to [Chapter 4, Internal Shutter](#), on page 25, for additional information.

- Light Sources;

Refer to [Section C.3, Light Sources](#), on page 63, for part number and ordering information.

- Detectors;

Refer to [Section C.4, Detectors and Accessories](#), on page 65, for part number and ordering information.

- Microscope Interface;

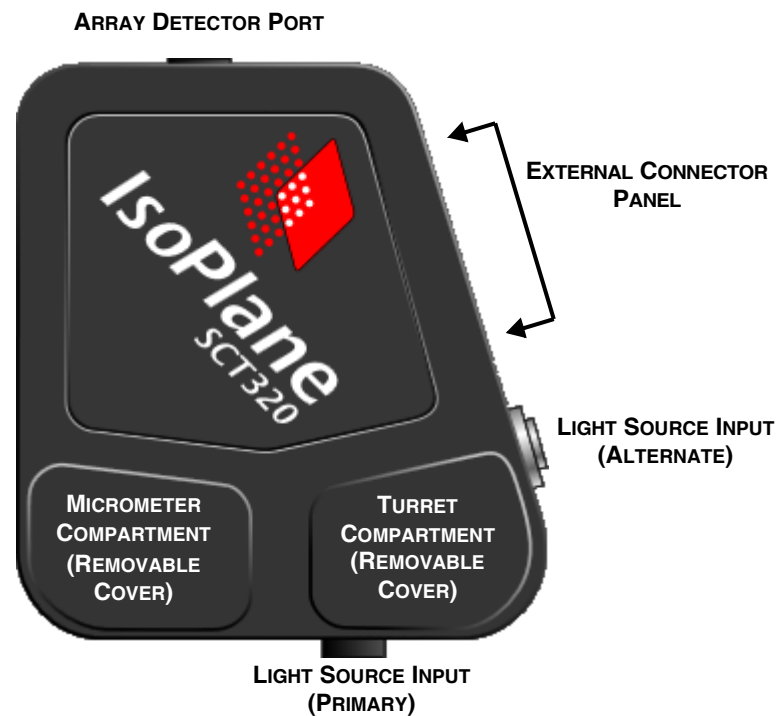
Refer to [Section C.5, Microscope Interface](#), on page 66, for part number and ordering information.

- Filters;
Refer to [Section C.6, Filter Wheels and Order Sorting Filter Assemblies](#), on page 67, for part number and ordering information.
- Fiber Optic Light Guides;
Refer to [Section C.7, Fiber Optic Light Guides](#), on page 68, for part number and ordering information.
- Data Cables.
Refer to [Section C.8, Data Cables](#), on page 69, for part number and ordering information.

1.3 Connectors, Ports, and Major Components

[Figure 1-3](#) illustrates a typical IsoPlane spectroscope with its connectors, ports, and major components identified.

Figure 1-3: IsoPlane Connectors, Ports, and Major Components



4411-0143_0026

1.3.1 External Connector Panel

Figure 1-4 illustrates the indicators, interfaces, and associated connectors found on the External Connector panel.

Figure 1-4: External Connectors



The following interfaces are accessible through this connector panel:

- **FILTER**
Filter driver connection required for an Acton FA-2448 Filter Wheel.
- **SHT TTL**
SHT TTL connection for TTL control of shutter.
- **DSP**
DSP connector used to connect two spectrographs as doubles.
- **COM**
This yellow LED flashes to indicate that the IsoPlane is successfully communicating with the host computer.
- **READY**
This Green/Yellow LED indicates the operational status of the IsoPlane spectrograph/system:
 - Green
Indicates that the system has been initialized;
 - Yellow
Indicates that the system is busy.
- **RS-232**
RS-232 connection to the host computer. Refer to [Appendix D, RS-232 Interface](#), on page 71 for additional information about using this interface.
- **USB**
USB connection to the host computer.
- **USB HUB**
USB Hub 1.1 compatible.
- **POWER**
External power connector. The external power supply provides the following voltages to the IsoPlane:
 - +5 V_{DC}
 - +24 V_{DC}.

Refer to [Section 1.1.1, External Power Supply](#), on page 6 for additional information.

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Chapter 2: Entrance Slit Accessories

Princeton Instruments offers a full range of spectrograph accessories that mount directly to the IsoPlane's manual or motorized entrance slit assembly.

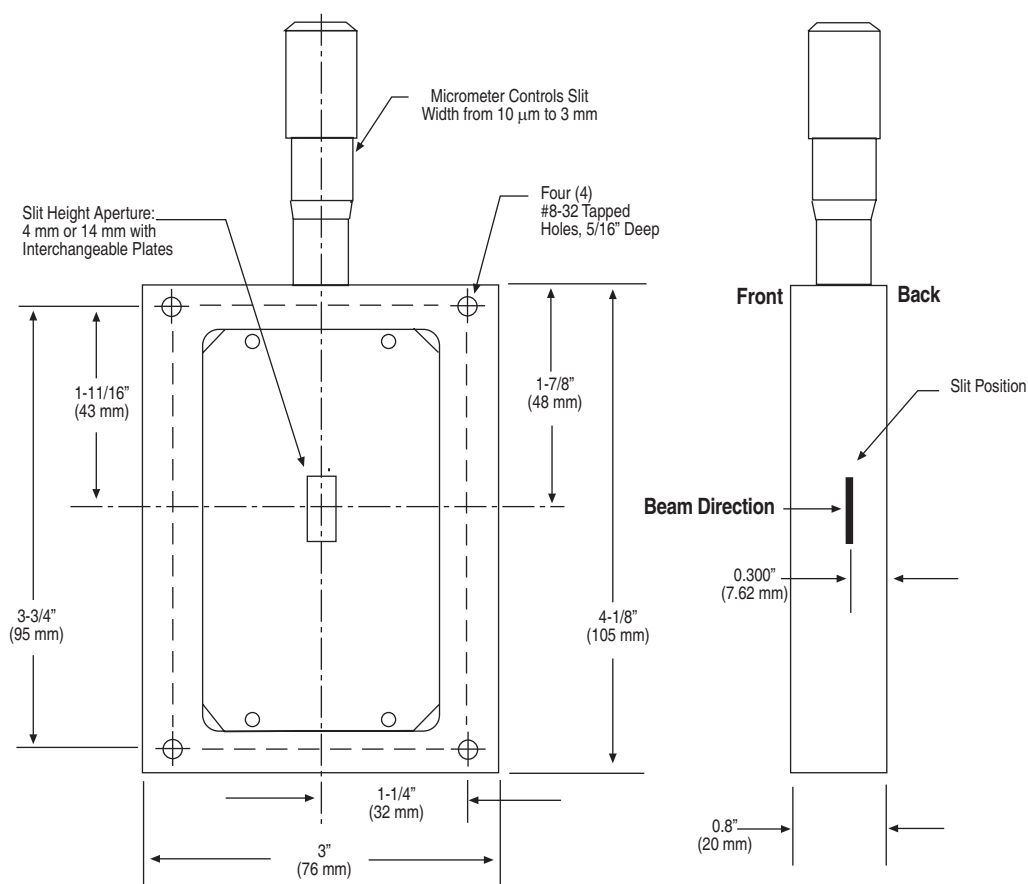


NOTE:

Princeton Instruments spectroscopy accessories include customized installation procedures for their proper mounting and operation. Always refer to accessory-specific documentation for complete installation and operation information.

Figure 2-1, which illustrates a manual slit assembly, may be helpful when mounting an accessory to the IsoPlane.

Figure 2-1: Typical Manual Slit Assembly



4411-0143_0041

2.1 Mount an Accessory

In general, the procedure to mount an accessory to the entrance slit is:

1. Place the accessory directly against the face of the slit body.
2. Using four (4) 8-32 screws typically 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.

2.2 Slit Width Adjustments for Manual Slits



NOTE:

Information in this section applies to the following manual slit models:

- 716-1 Manual Bilateral Slit;
- 716-MS Kinematic Slit.

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

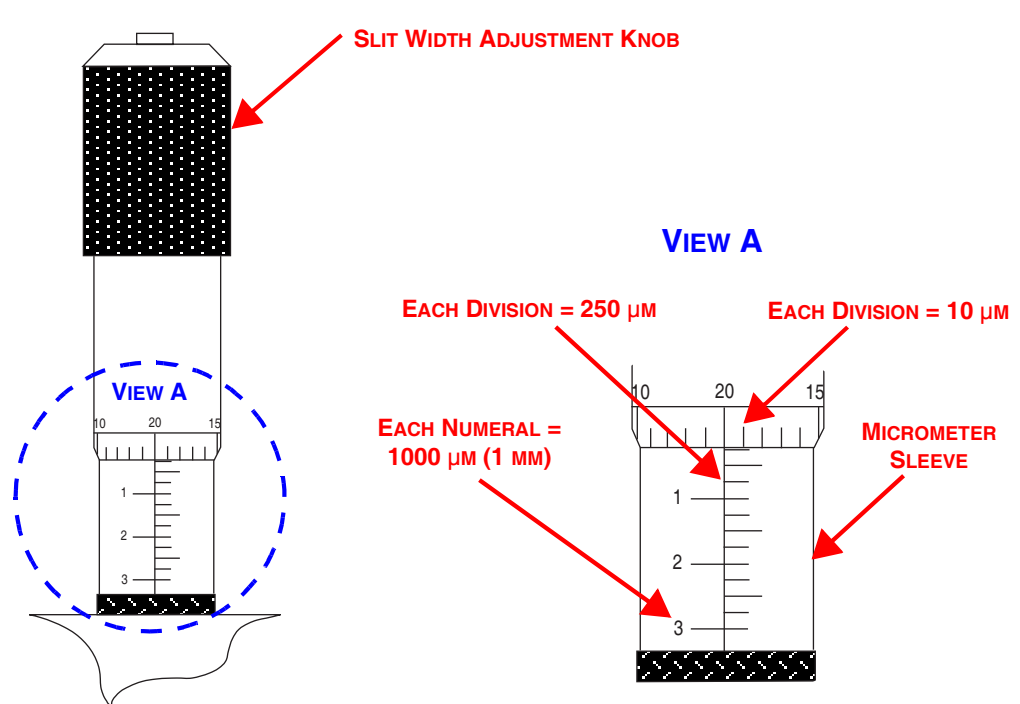
Each clockwise revolution of the micrometer knob increases the slit width 0.25 mm (250 μm .) For maximum reproducibility, the slit width should be set in a clockwise direction (i.e., increasing slit widths,) each time it is changed. See [Figure 2-2](#) and [Figure 2-3](#).



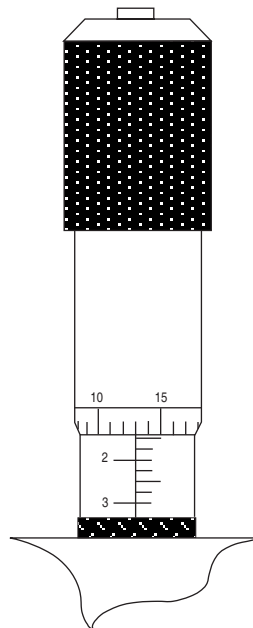
CAUTION!

The micrometer knob should not be rotated below a reading of 0.00 nor above 3.00. A micrometer setting of less than 0.010 mm (10 μm) should not be used, because a stop is provided to prevent the slit jaws from contacting each other.

Damage may occur if slit jaws are opened more than 3.0 mm.

Figure 2-2: Typical Slit Width Micrometer Settings: Width = 200 μm (0.200 mm)

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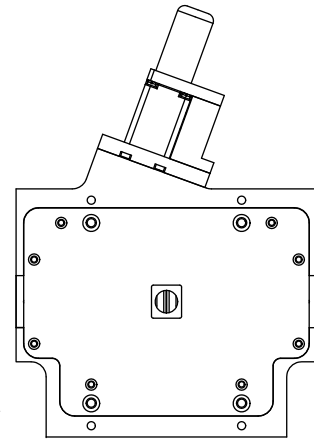
Figure 2-3: Typical Slit Width Micrometer Settings: Width = 1380 μm (1.380 mm)

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2.3 Slit Width Adjustments for Motorized Slits

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 12 mm 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 energized only when you send a command via the software to control it. When spectrograph power 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.



4411-0143_0020

Chapter 3: Grating Turrets

This chapter provides information about the installation and removal of grating turrets on an IsoPlane spectrograph.

3.1 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.

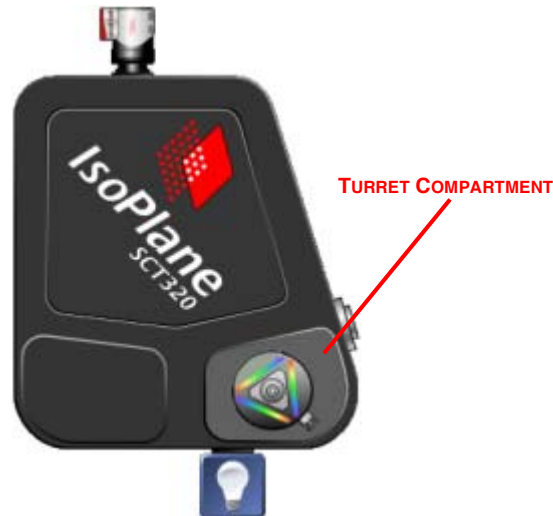


CAUTION!

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.
-

Figure 3-1 identifies the location of the Grating Turret for an IsoPlane.

Figure 3-1: IsoPlane Showing Grating Turret Location



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Perform the following procedure to install a grating turret into an IsoPlane unit:

**CAUTION!**

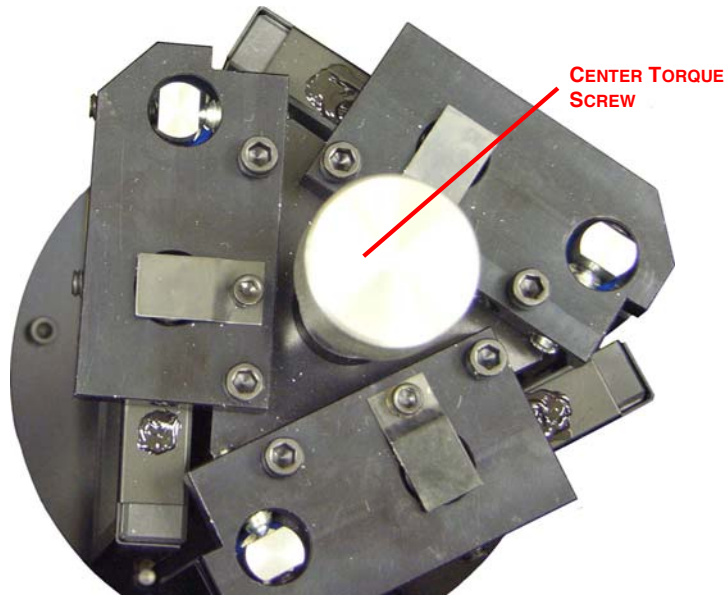
Observe proper optical handling procedures.

**REFERENCES:**

Refer to [Section 3.3, Turret Interchange](#), on page 21 for information about replacing one turret assembly with another.

1. Locate the storage container with the grating turret that is to be installed.
2. 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.
3. 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.)
4. 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. See [Figure 3-2](#).

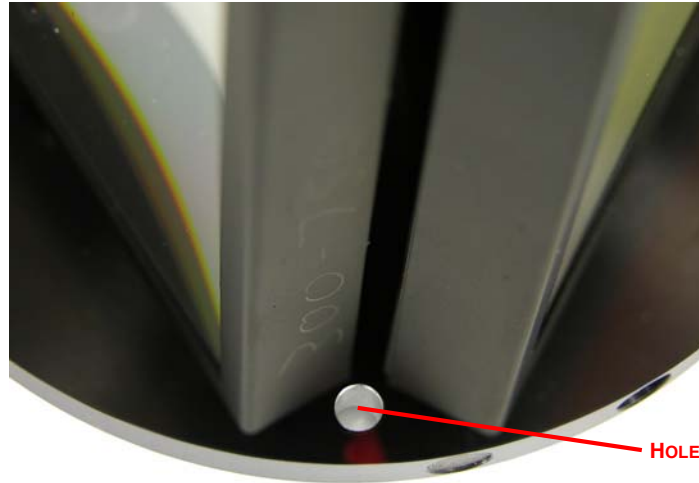
Figure 3-2: Center Torque Screw



4411-0143_0007

5. Locate the hole near the edge between gratings on the grating turret assembly. See [Figure 3-3](#).

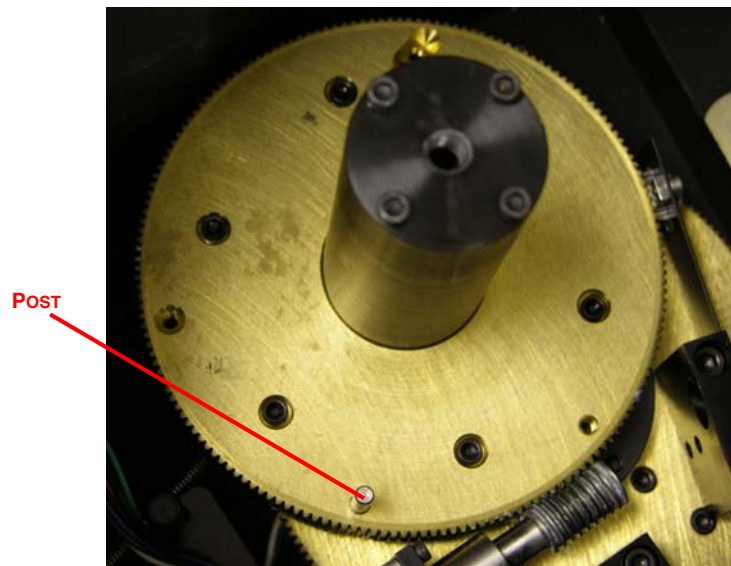
Figure 3-3: Location of Hole on Turret Grating Assembly



4411-0143_0008

6. Locate the vertical post on the Grating Spindle Assembly. See [Figure 3-4](#).

Figure 3-4: Location of Post on Grating Spindle Assembly



4411-0143_0009

7. Carefully lower the turret into the compartment. See [Figure 3-5](#).

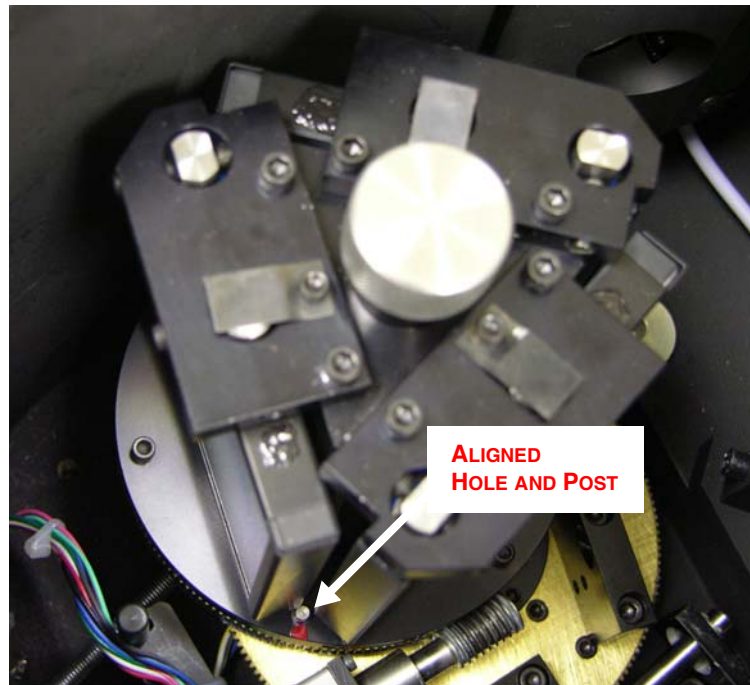
Figure 3-5: Lowering Turret into Turret Compartment



4411-0143_0010

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 3-6](#).

Figure 3-6: Turret Installed with Hole and Post Aligned



4411-0143_0011

9. Verify 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.

3.2 Remove a Turret

**CAUTION!**

When removing a turret, be aware of, and adhere to, the following guidelines:

- 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.
- **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.
- Avoid talking or sneezing near optical surfaces. Do not breathe directly on them.

Perform the following procedure to remove the grating turret from an IsoPlane's turret compartment:

**CAUTION!**

Observe proper optical handling procedures.

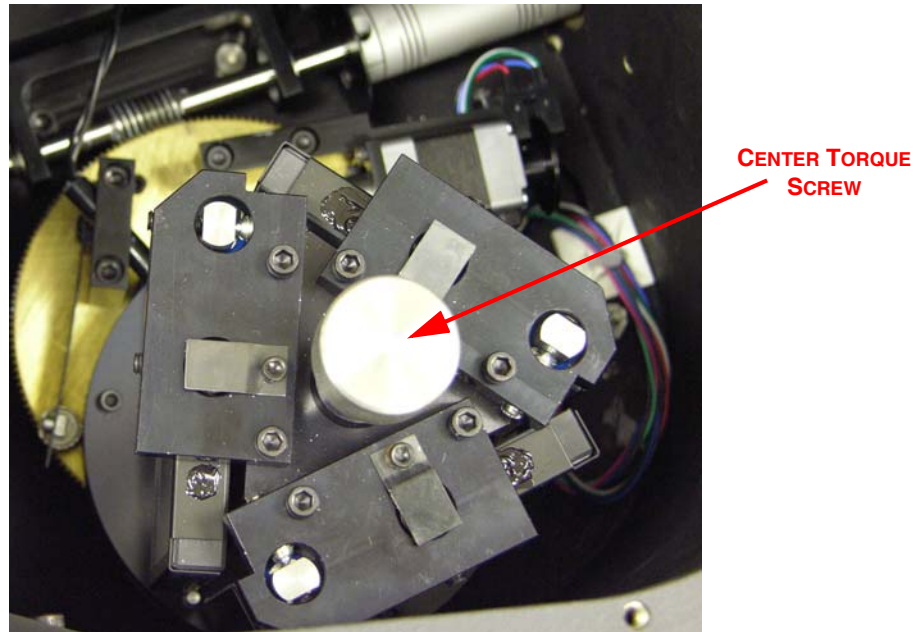
1. Scan the instrument to Grating #1 and a Center Wavelength of 0 nm.
2. Use a 9/64" hex wrench to remove the four (4) turret compartment cover screws and remove the cover.

3. Carefully hand-loosen the center torque screw. See [Figure 3-7](#).

**CAUTION!**

Use extreme care so as not to touch the grating surfaces.

Figure 3-7: Grating Turret: Center Torque Screw



4. Grasp the center torque screw and carefully lift the grating turret straight up off the grating spindle assembly. If the turret cannot be lifted up, the center torque screw may need to be loosened a bit more. See [Figure 3-8](#).

Figure 3-8: Removing the Grating Turret from the Grating Compartment



5. Place the removed grating turret assembly into the original protective container in which it was shipped
6. If a shutter assembly is not being installed or removed, or if a different turret is not being installed, replace the turret compartment cover.
7. Replace the four (4) turret compartment cover screws and use a 9/64" hex wrench to tighten them.

3.3 Turret Interchange



CAUTION!

The information included in this section is applicable **ONLY** if more than one turret has been ordered for use with an IsoPlane. If the IsoPlane is equipped with only one turret, the information within this section should never be required.

The IsoPlane is supplied with one on-axis mounted triple grating turret assembly, but up to three (3) additional grating turrets may be ordered for use with the spectrograph. If multiple turrets are available, the built-in sensing mechanism will automatically identify which grating turret has been installed. You may, however, want to label the turrets (for example, with the spectral range used.)



CAUTION!

When handling a turret, be aware of, and adhere to, the following guidelines:

- 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.
- **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.
- Avoid talking or sneezing near optical surfaces. Do not breathe directly on them.

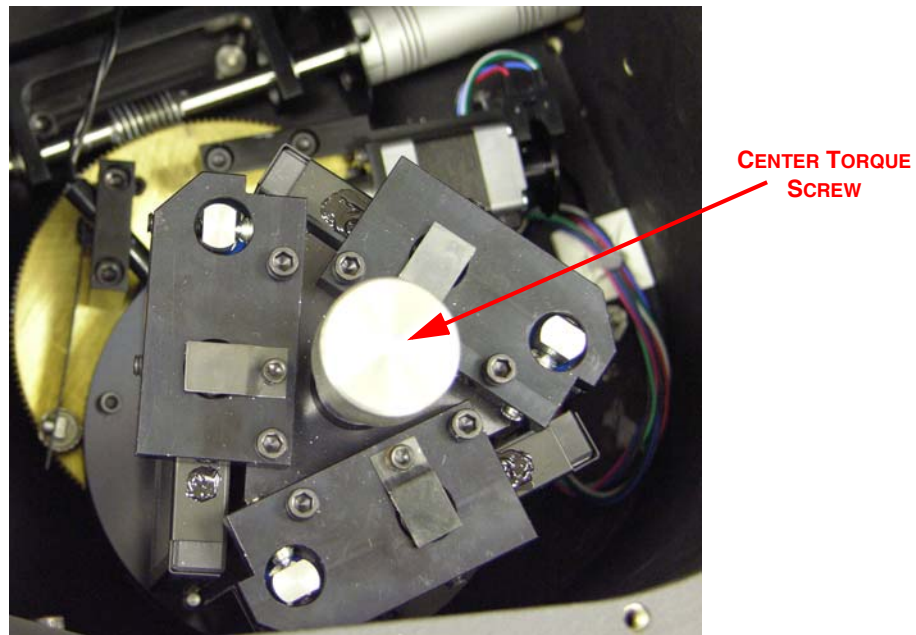
Perform the following procedure to interchange grating turrets:



CAUTION!

Observe proper optical handling procedures.

1. Locate the storage container with the new grating turret to be installed.
2. Scan the instrument to Grating #1 and a Center Wavelength of 0 nm.
3. Use a 9/64" hex wrench to remove the four (4) turret compartment cover screws and remove the cover. Become familiar with the grating turret and its components.
4. Loosen the center torque screw. See [Figure 3-9](#).

Figure 3-9: Grating Turret: Center Torque Screw

4411-0143_0024

**CAUTION!**

Use extreme care so as not to touch the grating surfaces.

5. Grasp the center torque screw and carefully lift the grating turret straight up off the grating spindle assembly. If the turret cannot be lifted up, the center torque screw may need to be loosened a bit more. See [Figure 3-10](#).

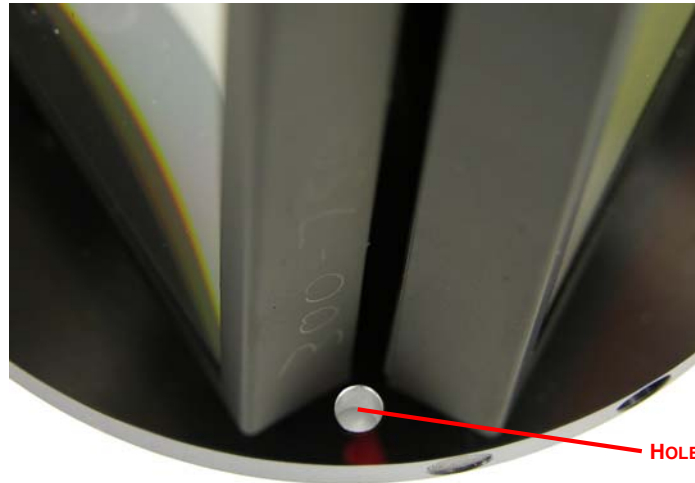
Figure 3-10: Removing the Grating Turret from the Grating Compartment

4411-0143_0025

6. Carefully place the removed grating turret assembly into the original protective container in which it was shipped. Be sure to align the post and hole. Tighten the center torque screw and use a 3/32" hex wrench to tighten the three (3) set screws on the bottom of the container approximately one turn.

7. Before removing the replacement grating turret from its shipping container, use a $3/32$ " hex wrench to loosen the three (3) set screws on the bottom of the container approximately one turn.
8. Remove the cover from the shipping container, grasp the center torque screw, and turn it counterclockwise until the turret can be lifted straight up.
9. Locate the hole near the edge between gratings on the grating turret assembly. See [Figure 3-11](#).

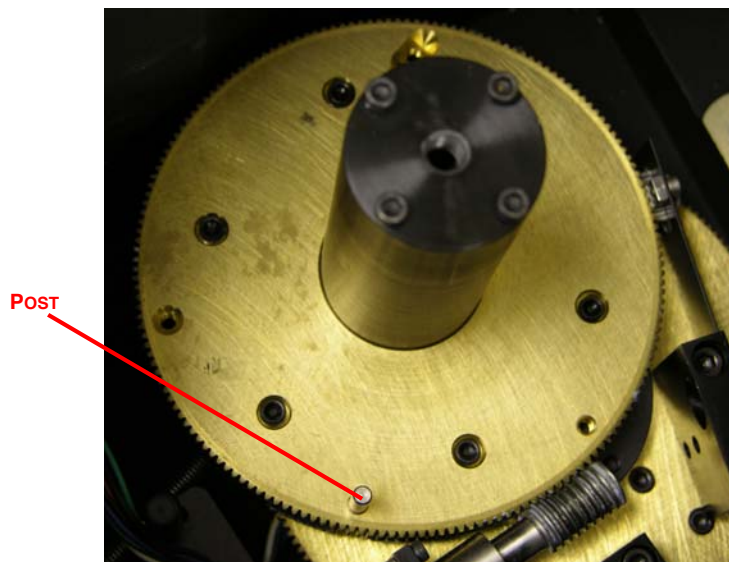
Figure 3-11: Location of Hole on Turret Grating Assembly



4411-0143_0008

10. Locate the vertical post on the grating spindle assembly. See [Figure 3-12](#).

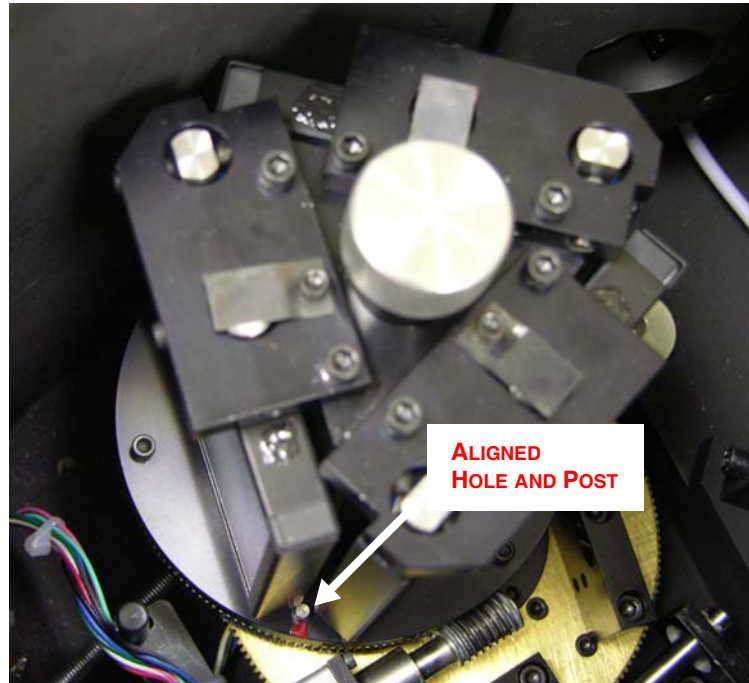
Figure 3-12: Location of Post on Grating Spindle Assembly



4411-0143_0009

11. 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 3-13](#).

Figure 3-13: Turret Installed with Hole and Post Aligned



4411-0143_0011

12. Verify that the turret is properly seated.
13. Tighten the center torque screw until it clicks. This sets the torque on the spindle correctly.



NOTE:

This screw cannot be over-tightened. It is designed to slip once the correct torque has been attained.

14. Place the Turret Cover on the spectrograph. Replace and tighten all cover screws.
15. If the IsoPlane's power supply is on, restart the IsoPlane to initiate the automatic identification of the new grating turret.
If the power supply is off, the automatic identification will be initiated once the power supply is turned on.

Chapter 4: 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 (e.g., PI-MAX detectors,) 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.



4411-0143_0005



REFERENCES:

For information about the installation and removal of the internal shutter assembly, refer to:

- [Section 4.1.1, Install an Internal Shutter](#), on page 26,
- [Section 4.1.2, Remove an Internal Shutter](#), on page 27.

4.1 Internal Shutter Installation/Removal

An IsoPlane may be ordered with an optional internal shutter at the entrance slit. This shutter is controlled by either:

- A detector via a shutter cable from the detector's Shutter connector to the Shutter connector on the IsoPlane, or
- A Shutter Control box (Model SHC-EXT) available from Princeton Instruments.

This section provides procedures for the installation and removal of an internal shutter.



4411-0143_0021

4.1.1 Install an Internal Shutter

Perform the following procedure to install an internal shutter:

1. Using a 9/64" hex wrench, unscrew the four (4) 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. Carefully remove the grating turret. Refer to [Section 3.2, Remove a Turret](#), on page 19 for complete information.

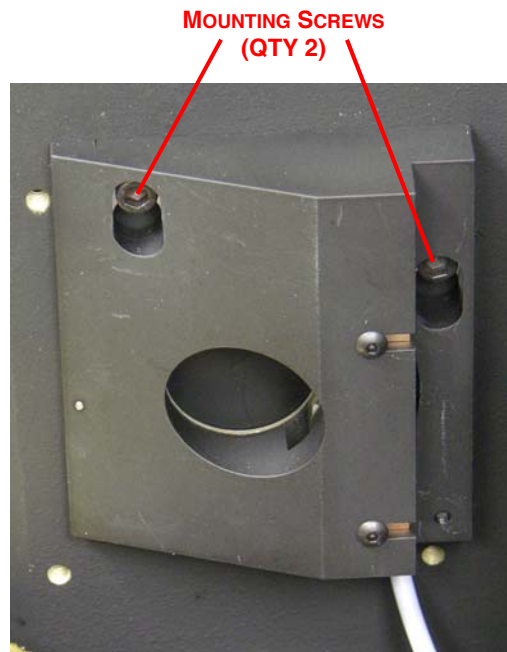


CAUTION!

Exercise extreme caution when handling the grating turret so as not to touch the grating surfaces.

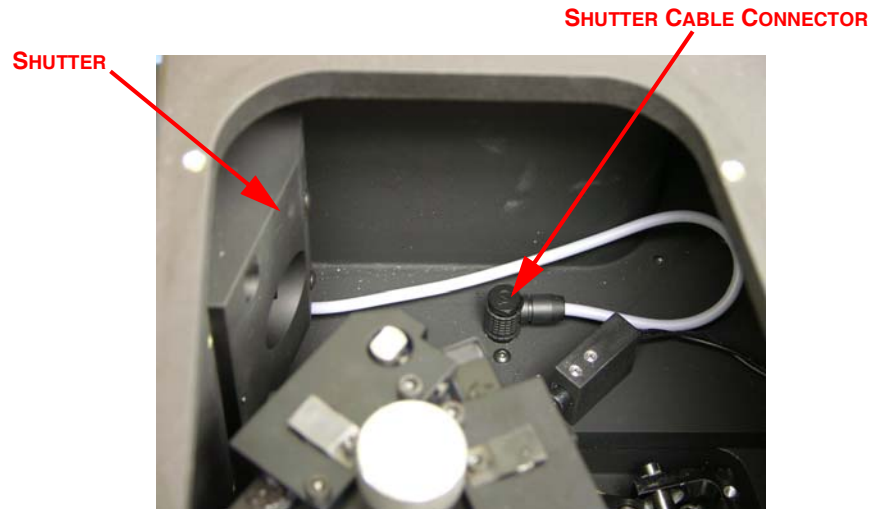
3. Mount the shutter assembly on the two socket head screws above the entrance slit. If necessary, back the screws out approximately five turns in order to allow the slots to slip over the mounting screws. See [Figure 4-1](#).

Figure 4-1: Mounting an Internal Shutter Assembly on an IsoPlane



4411-0143_0022

4. Use a 9/64" hex wrench to tighten down the two screws.
5. Connect the shutter cable to the connector in the floor of the IsoPlane. Verify that the connector on the cable aligns with the connector in the floor. See [Figure 4-2](#).

Figure 4-2: Connecting Internal Shutter

4411-0143_0023

6. Carefully install the grating turret. Refer to [Section 3.1, Turret Installation](#), on page 15 for complete information.

**CAUTION!**

Exercise extreme caution when handling the grating turret so as not to touch the grating surfaces.

7. Place the Turret Compartment cover on the IsoPlane. Install and tighten all cover screws.

4.1.2 Remove an Internal Shutter

When using a PI-MAX detector (or other detector without an external shutter control connector) and the IsoPlane has an internal shutter, it is necessary to either 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.

Perform the following procedure to remove an internal shutter from an IsoPlane:

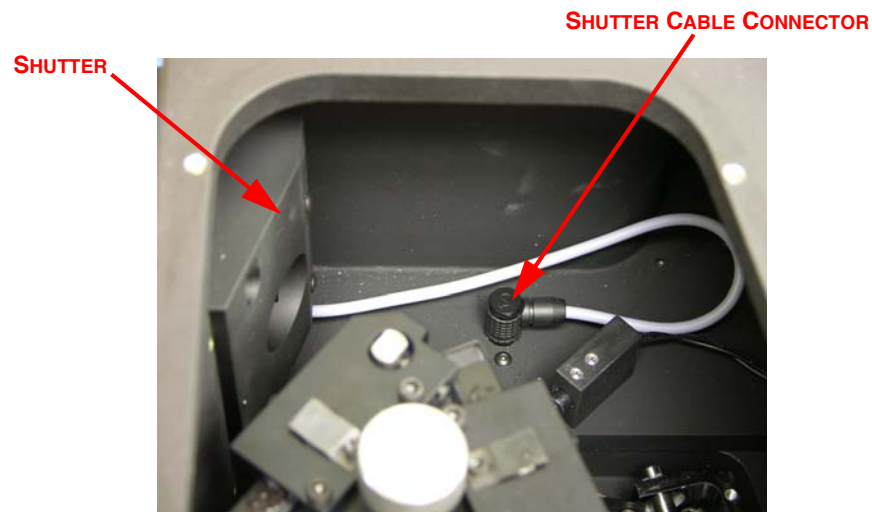
1. Using the 9/64" hex wrench, unscrew the four (4) socket head screws that secure the turret compartment cover to the top of the IsoPlane. Lift the cover and screws off of the IsoPlane and set them aside.
2. Carefully remove the grating turret and place it in a safe place. Refer to [Section 3.2, Remove a Turret](#), on page 19 for complete information.

**CAUTION!**

Exercise extreme caution when handling the grating turret so as not to touch the grating surfaces.

3. Reach into the compartment and disconnect the connector on the shutter cable from the connector mounted to the base of the IsoPlane by pulling it straight up. See [Figure 4-3](#)

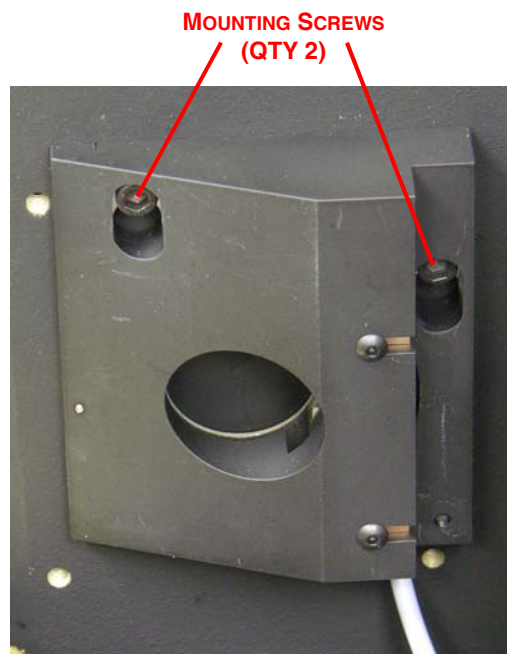
Figure 4-3: Disconnecting Internal Shutter



4411-0143_0023

4. Use a 9/64" hex wrench to loosen, but not remove, the two hex head socket screws that secure the shutter housing to the wall of the IsoPlane. See [Figure 4-4](#).

Figure 4-4: Mounting an Internal Shutter Assembly on an IsoPlane



4411-0143_0022

5. Carefully slide the shutter up and off the two mounting screws to remove it. Place the shutter in a safe location for storage.
6. Using the 9/64" hex wrench, tighten the two mounting screws so that they are snug and will not accidentally fall out.
7. Carefully install the grating turret. Refer to [Section 3.1, Turret Installation](#), on page 15 for complete information.

**CAUTION!**

Exercise extreme caution when handling the grating turret so as not to touch the grating surfaces.

8. Place the turret compartment cover on the IsoPlane.
9. Install and tighten all cover screws.

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Chapter 5: IsoPlane Setup

This chapter provides information about the initial setup and configuration of an IsoPlane spectrograph.



REFERENCES:

For detailed information about the operation of an IsoPlane spectrograph, refer to [Chapter 6, Operation](#), on page 43.

5.1 Unpack and Inspect Equipment

Carefully unpack and examine the IsoPlane and all purchased accessories.



NOTES:

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

5.2 Initial Setup Procedure

Perform the following procedure to setup the IsoPlane for the first time:

1. Position the IsoPlane where it will be used.
2. Connect the power supply shipped with the IsoPlane to the **POWER** connector located on the side of the IsoPlane. See [Figure 5-1](#).

Figure 5-1: External Connector Panel



The power supply provides +5 V_{DC} for the control logic and +24 V_{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 V_{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.

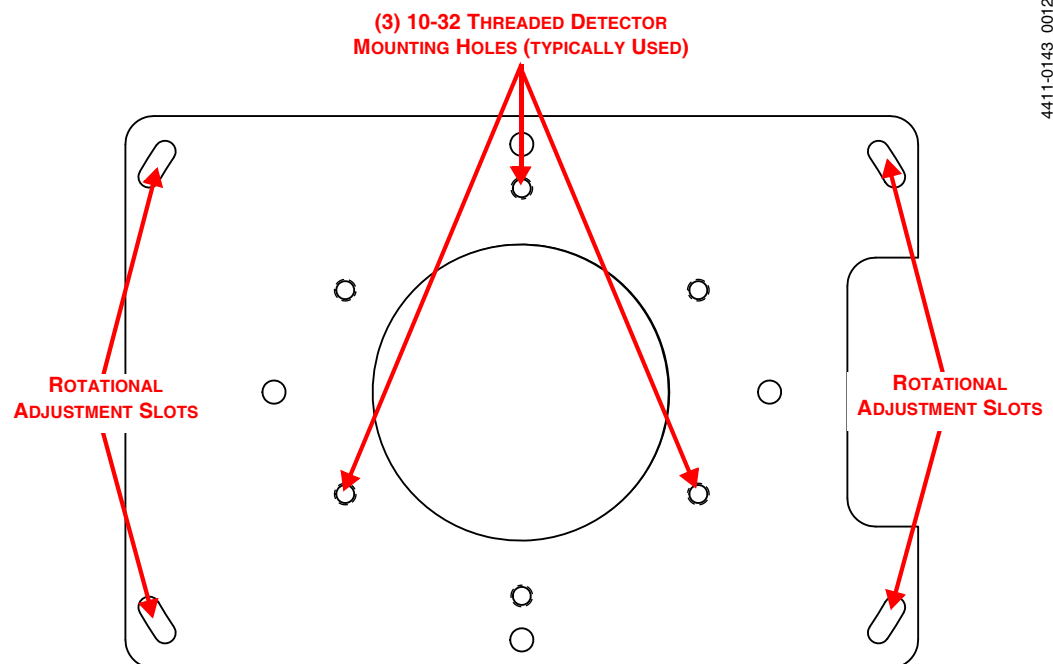
The RS-2332 interface may also be used if a USB port is not available. If using the RS-232 interface, configure the appropriate port on the host computer as described in [Section D.1, Communication Configuration Settings](#), on page 71.

5. Install the grating turret that has been shipped in the same shipping box with the IsoPlane but is packaged outside the IsoPlane housing to protect the gratings during shipment. Refer to [Section 3.1, Turret Installation](#), on page 15 for complete installation information.
6. Turn on the power switch on the IsoPlane power supply and the IsoPlane should initialize to zero wavelength. Refer to [Chapter 6, Operation](#), on page 43 for complete information about operating the IsoPlane using Princeton Instruments' software.

5.3 Array Detector Mounting Instructions

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. See [Figure 5-2](#).

Figure 5-2: Typical Mounting Plate

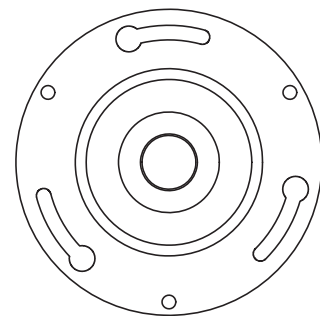


5.3.1 Mount an Array Detector to the IsoPlane

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

Perform the following procedure to mount an array detector to an IsoPlane

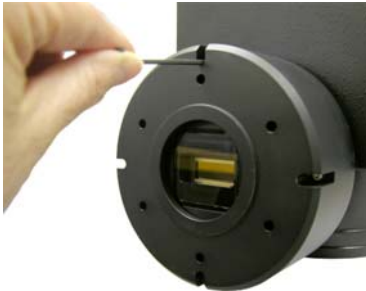
1. Remove the shipping cover from the mounting plate.
2. If the detector has a three-slotted flange (3.60" bolt circle,) perform the following procedure to mount the detector:
 - a. Screw three (3) #10-32 x 1/2 hex head bolts into the plate. Leave 1/4-inch of thread exposed.



- b. Mount the detector to the plate and position the detector so the text on the back of the detector is readable (i.e., not upside-down.)

**NOTE:**

The exception to this text-orientation is the PI-MAX2: 1024x256 which should be mounted so that the text is upside-down.

- c. Use a 5/16" open end wrench to tighten each of the three (3) screws.
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 four (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 so that the appropriate hole pattern matches the mounting holes on the plate.
 - e. From the inside of the shroud screw three (3) 10-32 x 1/4", flathead 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 four (4) socket head screws.
 - g. Mount the plate to the IsoPlane. The detector should be upright.

**NOTE:**

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

5.4 Rotational Alignment

This 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 procedure is provided in this section. Refer to [Chapter 6, Operation](#), on page 43 for specific LightField and WinSpec instructions for performing a rotational alignment. For other application software, refer to the specific software's manual or help file.

Perform the following procedure to rotationally align the detector:

1. Verify that 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.

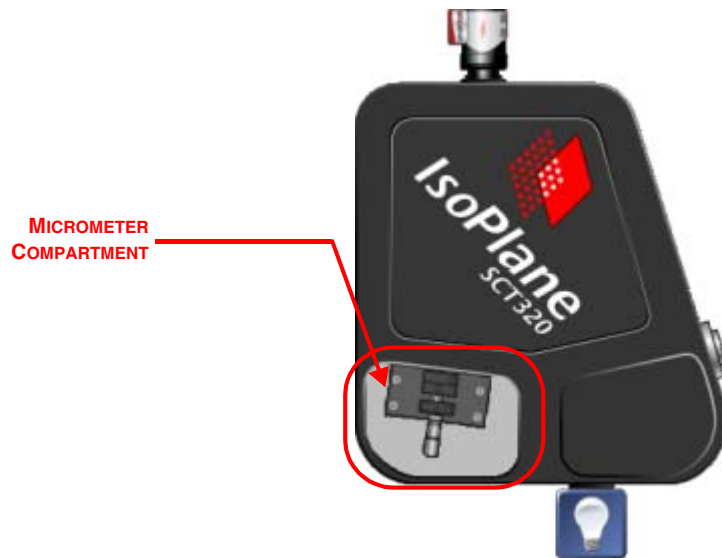
4. Launch the application software.
5. Loosen the rotation adjustment screws (see [Figure 5-2](#)) sufficiently that you can rotate the detector. The mounting plate holes are slotted to allow approximately 4° of rotational positioning.
6. If background subtraction is an available function, acquire a 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.

5.5 Focus 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 (4) screws that secure the Micrometer Compartment cover. See [Figure 5-3](#).

Figure 5-3: Micrometer Compartment Location

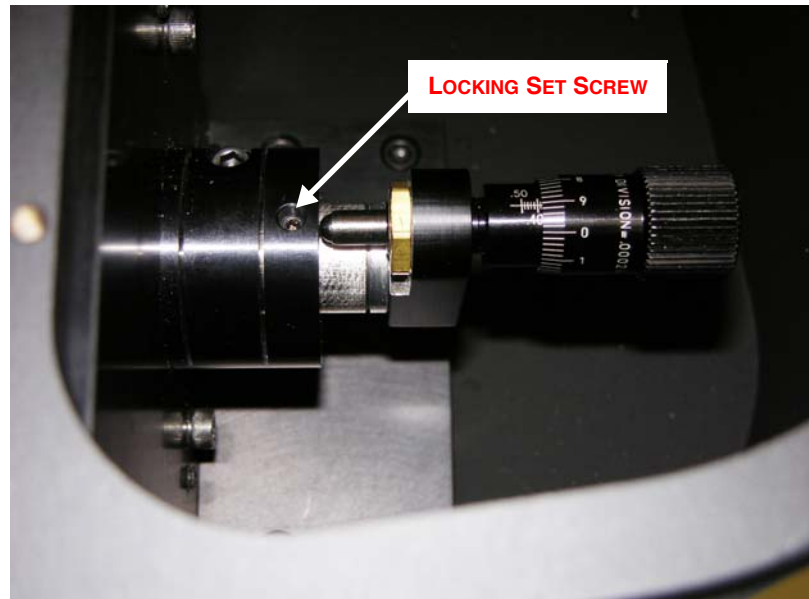


4411-0143_0014

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 5-4](#).

Figure 5-4: Micrometer Locking Set Screw



4411-0143_0015

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.

5.6 Focal Plane Adjustments



CAUTION!

The procedure described in this section should **ONLY** be performed by someone experienced in aligning optical components and assemblies.

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 off-center from 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 vertical and horizontal alignment of the exit beam can be adjusted using procedures in this section.

During these adjustment procedures, 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's position as adjustments are 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.

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 when 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 4 mm high image as a guide when positioning the exit focal plane.

Refer to the following sections for information and procedures about the following focal plane alignment adjustments:

- [Section 5.6.1, Vertical Alignment Procedure](#), on page 36;
- [Section 5.6.2, Horizontal Alignment Procedure](#), page 38.

5.6.1 Vertical Alignment Procedure

When the vertical alignment is off-center, the preferred method of correcting the alignment is **ALMOST ALWAYS** to adjust the vertical positioning of the image being input to the system by translating the lens/fiber up or down. If adjusting the input image fails to correct the vertical alignment, only then should mirror adjustments be attempted.

5.6.1.1 Mirror Adjustment Procedure

A mirror adjustment should be performed **ONLY** after attempts to correct vertical alignment by adjusting the input image have failed.



CAUTION!

This procedure should **ONLY** be performed by personnel with experience in aligning optical components and assemblies.

Vertical adjustments are achieved by incrementally adjusting the two vertical alignment screws illustrated in [Figure 5-5](#).



NOTE:

Depending on the date of manufacture of the IsoPlane unit, the two vertical alignment adjustment screws **MAY** be located to the left of the micrometer. See [Figure 5-5](#).

Figure 5-5: Vertical Alignment Adjustment Set Screws**NOTE:**

DEPENDING ON THE DATE OF MANUFACTURE, THE TWO VERTICAL ALIGNMENT SCREWS MAY BE LOCATED IN THIS AREA.



VERTICAL ALIGNMENT
ADJUSTMENT SET SCREW

VERTICAL ALIGNMENT
ADJUSTMENT CAP SCREW

4411-0143_0016

**CAUTION!**

When performing this procedure, be aware of, and adhere to, the following guidelines:

- Each adjustment made to the Cap and Set Screws should be incremental, no more than approximately 1/8 turn in either direction.
- If the Cap Screw is turned 1/8 turn clockwise, turn the Set Screw 1/8 turn counterclockwise.
- Similarly, if the Cap Screw is turned 1/8 turn counterclockwise, turn the Set Screw 1/8 turn clockwise.
- A series of incremental adjustments is recommended.
- At the end of the procedure the Cap and Set Screws should be tight.

The following tools are required to perform this procedure:

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

Perform the following procedure to adjust/fine-tune the vertical alignment:

1. Remove the Micrometer Compartment cover (see [Figure 5-3](#)) to access the height adjustment screws illustrated in [Figure 5-5](#).

2. 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.

**CAUTION!**

Adjust **ONLY** the cap and set screw specified in [Figure 5-5](#).

Adjustments to other screws may result in severe misalignment of the instrument.

If the image is still positioned too high, continue making incremental adjustments to the Cap and Set Screws until the image is properly centered.

3. If the image is **LOW**, alternately loosen the Set Screw and tighten the Cap Screw until the image is centered.

**CAUTION!**

Adjust **ONLY** the cap and set screw specified in [Figure 5-5](#).

Adjustments to other screws may result in severe misalignment of the instrument.

If the image is still positioned too low, continue making incremental adjustments to the Set and Cap Screws until the image is properly centered.

5.6.2 Horizontal Alignment Procedure

The procedure for horizontally aligning an image depends on the specific camera adapter being used.

- Systems equipped with a Sliding Spec Flange Mount must use the procedure described in [Section 5.6.2.1, Systems Equipped with the Sliding Spec Flange Adapter](#).

**REFERENCES:**

Refer to [Section B.1, Sliding Spec Flange Mount](#), on page 57 for additional information about this adapter.

- Systems equipped with any other camera adapter are aligned using the procedure described in [Section 5.6.2.2, Systems Equipped with a NON-Sliding Spec Flange Adapter](#), on page 39.

5.6.2.1 Systems Equipped with the Sliding Spec Flange Adapter

For systems equipped with the Sliding Spec Flange adapter, **ALL** horizontal alignment adjustments are to be done by adjusting the camera's positioning on the IsoPlane by performing the following procedure:

1. Loosen, but do not remove, the four screws securing the Sliding Spec Flange adapter to the IsoPlane.
2. Carefully slide the adapter horizontally to shift the camera's position on the IsoPlane.
3. Acquire an image, and check the horizontal alignment.
4. If necessary, repeat step 2 and step 3 until the image is properly aligned with the camera's sensor.
5. Once the image is properly aligned, tighten the four screws on the Sliding Spec Flange mount.

5.6.2.2 Systems Equipped with a NON-Sliding Spec Flange Adapter

A mirror adjustment should be performed ONLY after attempts to correct vertical alignment by adjusting the input image have failed.

Horizontal adjustments are made by adjusting the pair of push-pull horizontal alignment screws as shown in Figure 5-6.

Figure 5-6: Horizontal Alignment Adjustment Screws



4411-0143_0016



NOTE:

Depending on the date of manufacture of the IsoPlane unit, the placement of the two Horizontal Alignment Adjustment screws MAY be reversed.



CAUTION!

When performing this procedure, be aware of, and adhere to, the following guidelines:

- Each adjustment made to the Cap and Set Screws should be incremental, no more than approximately 1/8 turn in either direction.
- If the Cap Screw is turned 1/8 turn clockwise, turn the Set Screw 1/8 turn counterclockwise.
- Similarly, if the Cap Screw is turned 1/8 turn counterclockwise, turn the Set Screw 1/8 turn clockwise.
- A series of incremental adjustments is recommended.
- At the end of the procedure the Cap and Set Screws should be tight.

The following tools are required to perform this procedure:

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

Perform the following procedure to adjust/fine-tune the horizontal alignment:

1. If necessary, remove the Micrometer Compartment cover (see [Figure 5-3](#)) to access the height adjustment screws illustrated in [Figure 5-6](#).
2. If the image is off-center to the **LEFT**, alternately loosen the right-hand screw and tighten the left-hand screw until the image is centered about the center column of the camera.



CAUTION!

Adjust **ONLY** the two screws specified in [Figure 5-6](#).

Adjustments to other screws may result in severe misalignment of the instrument.

If the image is still positioned too far to the left, continue making incremental adjustments to these two screws until the image is properly centered.

3. If the image is off-center to the **RIGHT**, alternately loosen the left-hand screw and tighten the right-hand screw until the image is centered.



CAUTION!

Adjust **ONLY** the two screws specified in [Figure 5-6](#).

Adjustments to other screws may result in severe misalignment of the instrument.

If the image is still positioned too far to the right, continue making incremental adjustments to these two screws until the image is properly centered.

5.7 Single-Point Detector Mounting Instructions

Single-point detectors (e.g., a 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.

Perform the following procedure to mount a single-point detector:

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 that has already been mounted to the tapered mounting plate at the exit port so its four mounting holes are properly aligned with the tapped mounting holes on the slit assembly.
3. Use a 9/64" hex wrench to tighten four (4) 8-32 mounting screws.

The detector should now be mounted correctly.



4411-0143_0017

5.8 Spectrometer Calibration

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

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Chapter 6: Operation

This chapter provides information about enabling 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. Additional information about operating the system can be found in the appropriate software manual or help file.

WARNINGS!

1. A PyLoN with an internal shutter **CANNOT** be used with an IsoPlane spectrograph.
 2. A SPEC-10 with an internal shutter **CANNOT** be used with an IsoPlane spectrograph.
 3. 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 must be removed. Alternatively, a Princeton Instruments SHC-EXT Shutter Control Box may be used to control the opening and closing of the IsoPlane's internal shutter. Refer to [Chapter 4, Internal Shutter](#), on page 25 for additional information.
-

6.1 Pre-Operation Checks

Before launching the data acquisition software (i.e., LightField or WinSpec,) verify 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.

6.2 Initialization

When power is turned on to the IsoPlane, it initializes to a wavelength of 0.0 nm for grating number 1. If power to the IsoPlane is switched off and then on again, it will reinitialize. Initialization gives the system a reference, or starting position to keep track of wavelength position, grating location, and other parameters. Alternative startup parameters can be programmed if the factory defaults are not appropriate. Refer to [Appendix E, Monochromator Control Software](#), on page 73 for additional information.

6.3 Using LightField

Launch LightField after verifying that the detector and IsoPlane are both connected to the host 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:

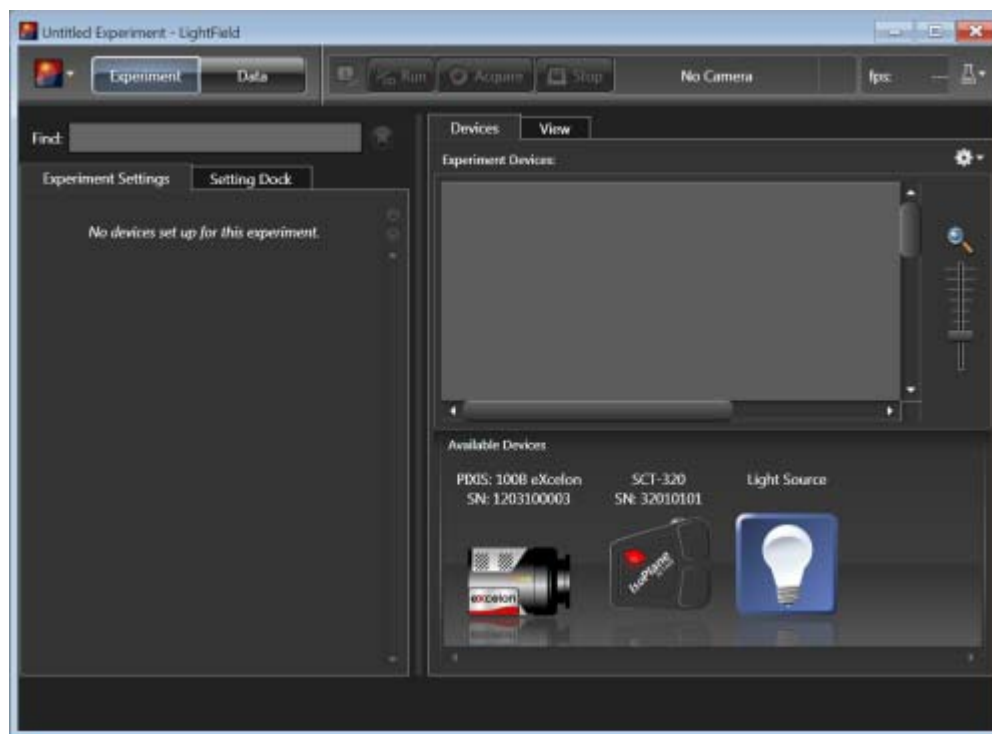
If the IsoPlane (SCT 320) icon is the only device in the Experiment Devices panel, the Spectrograph expander will be the only expander in the list. When you drag a detector into the panel, the Calibration expander and all of the detector- related expanders will be displayed.

6.3.1 Define the Detector and Spectrograph

Perform the following procedure to define a detector and spectrograph:

1. After LightField opens, an icon representing the detector should be visible within the **Available Devices** area. In [Figure 6-1](#), the detector is a PIXIS:100B eXcelon®.

Figure 6-1: Typical LightField Available Devices Panel



4411-0143_0028

2. Drag the desired icon into the **Experiment Devices** area. See [Figure 6-2](#).

Figure 6-2: Typical LightField Experiment Settings Stack and Experiment Devices

3. 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.
4. On the **Shutter** expander, select **Shutter Mode: Normal**. See [Figure 6-2](#).
5. Open the Spectrometer expander and select the appropriate grating. See [Figure 6-2](#). In this case, the 300 g/mm, Blaze: 750 grating has been selected and the center wavelength has been set to 500 nm for a Mercury lamp. When using a broadband source, use 0.0 nm.

**TIP:**

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.

6.3.2 Alignment

Since detectors are mounted directly to the mounting plate on an IsoPlane, the rotational alignment and focusing operations differ from the way these operations are performed for Acton SpectraPro Series spectrographs.

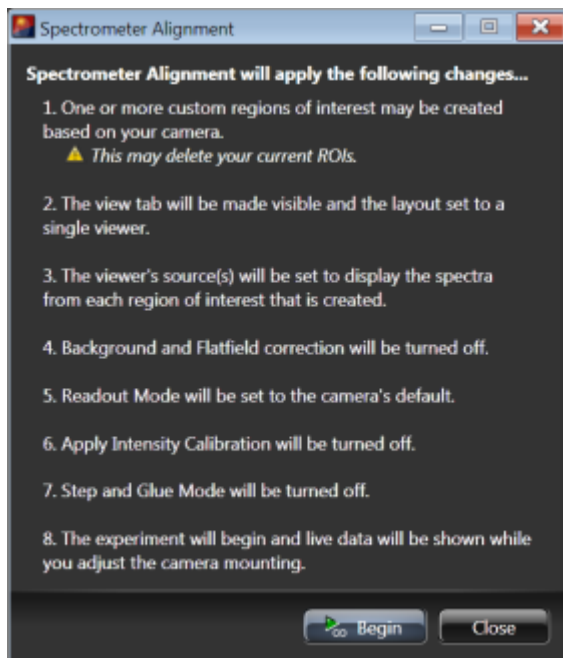
**NOTE:**

The following information assumes familiarity with the locations of the mounting plate, Micrometer Compartment, and the locking set screw. If not, refer to earlier sections of this manual.

Perform the following procedure to align the system:

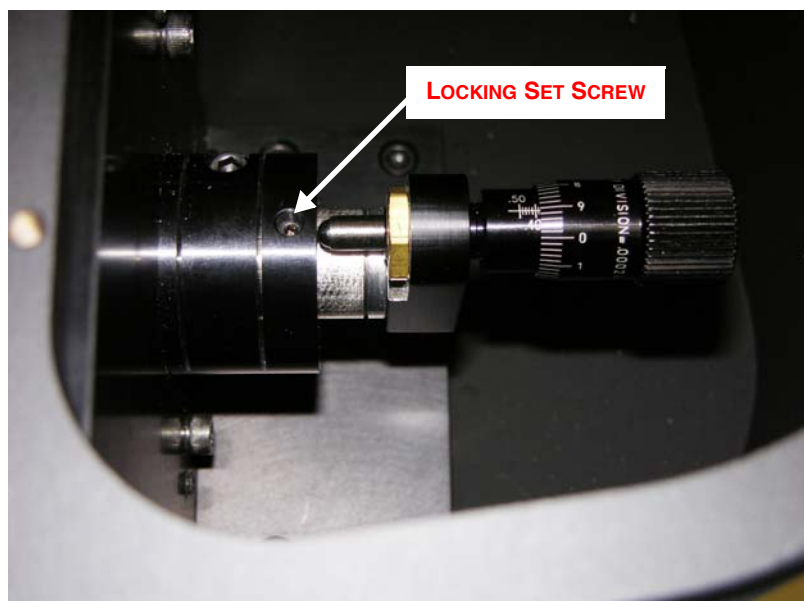
1. Mount a light source (e.g., a Princeton Instruments Hg and Ne/Ar Dual Switchable light source,) in front of the entrance slit.
2. With the IsoPlane properly connected to the computer, turn on the power and wait for the spectrograph to initialize.
3. When using an LN-cooled detector, verify that the Dewar has been properly filled with LN.
4. With the detector mounted to the spectrograph and connected to the computer, turn power on and wait for the detector to initialize.
5. Launch LightField.
6. Drag the icons for the desired detector and the IsoPlane into the **Experiment Devices** area.
7. Configure the spectrograph as follows:
 - When using a mercury source, configure the spectrograph to 500 nm.
 - When using a broadband source, configure the spectrograph to 0.0 nm.
8. Wait until the detector locks at its default temperature.
9. Using a 9/64" hex wrench, loosen the four (4) screws at the corners of the detector mounting plate.
10. Select the **Align Spectrometer** function from the **Experiment** menu to open the **Spectrometer Alignment** dialog.

This dialog, illustrated in [Figure 6-3](#), describes the changes that LightField will make to the current setup to assist in performing rotational alignment of the array to the spectrograph's optics. When the **Begin** button is clicked, the modifications are made and continuous live data will be displayed as the detector is rotated.

Figure 6-3: Typical Spectrometer Alignment Dialog

4411-0143_0030

11. Click on the peak that is to be monitored for the alignment. This will display the data cursor which can be positioned at the top of the peak. Since the data cursor spans the ROIs (graphs,) the data cursor can be used as a vertical reference.
12. Slowly rotate the camera until the peaks align in all of the ROIs.
Alternatively, 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.
13. After completing the rotational alignment, click the **Stop** button.
14. Tighten the four (4) mounting plate screws.
15. Use a 9/64" hex wrench to remove the cover from the Micrometer Compartment on the IsoPlane.
16. Use a 3/32" hex wrench to loosen the micrometer locking set screw located in the micrometer compartment. See [Figure 6-4](#).

Figure 6-4: Micrometer Locking Set Screw

4411-0143_0015

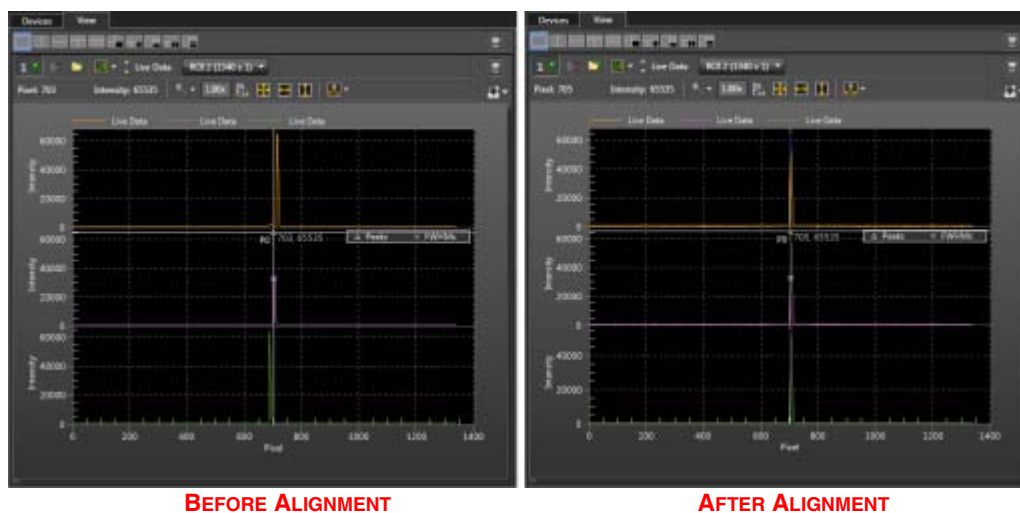
17. Click **Run**, and, while continuously acquiring data, adjust the micrometer until:

- The intensity level has been maximized, and
- The FWHM for a selected peak or peaks has been minimized.

**NOTE:**

The **Peak Find** function for the graph selected by the cursor is automatically turned on to assist in identifying peaks and viewing FWHM widths.

Figure 6-5 shows before and after alignment graphs.

Figure 6-5: Typical Alignment Helper Views: Rotational Alignment

4411-0143_0031

18. Once properly aligned, tighten the micrometer locking set screw.
19. Place the Micrometer Cover on the spectrograph.
20. Replace and tighten the four (4) cover screws.
21. Stop data acquisition.

6.4 Using WinSpec

After verifying that the detector and IsoPlane are connected to the computer and are both turned on, Launch WinSpec. WinSpec should automatically identify the detector that is to be used, and a dialog for selecting the detector for the experiment should be displayed. In addition, WinSpec must be instructed/configured to use IsoPlane.

6.4.1 Select the Detector

**NOTE:**

When using an LN-cooled detector, the Dewar should be filled while the detector is ON.

Perform the following procedure to select the desired detector:

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 the **Launch Camera Detection Wizard...** button on the **Controller/CCD** tab to launch the wizard.
2. On the **Welcome** dialog, leave the checkbox unselected and click **Next >**. See [Figure 6-6](#).

Figure 6-6: Typical Camera Detection Wizard: Welcome Dialog



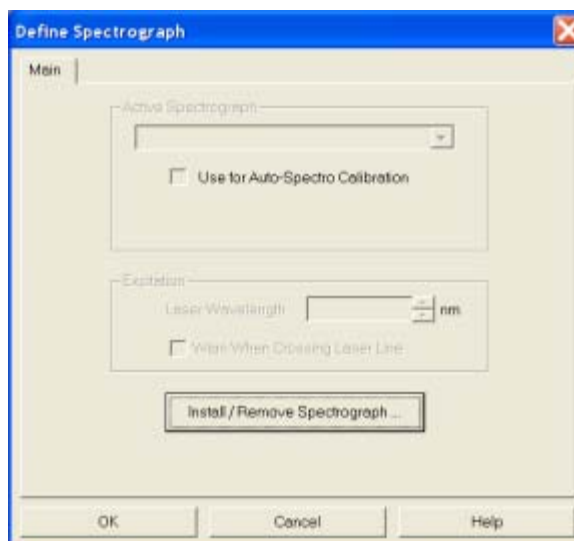
3. Follow the instructions on the dialogs to complete the initial hardware setup. The wizard enters default parameters on the **Hardware Setup** dialog tabs and provides an opportunity to acquire a test image to verify that the system is working properly.
4. When using an LN-cooled detector, fill the Dewar while the detector is powered on.

6.4.2 Define the Spectrograph

Perform the following procedure to configure WinSpec with the desired spectrograph:

1. From the application's menu bar, open the **Spectrograph** menu and select **Define**.
2. On the **Define Spectrograph** dialog, click on the **Install/Remove Spectrograph** button.

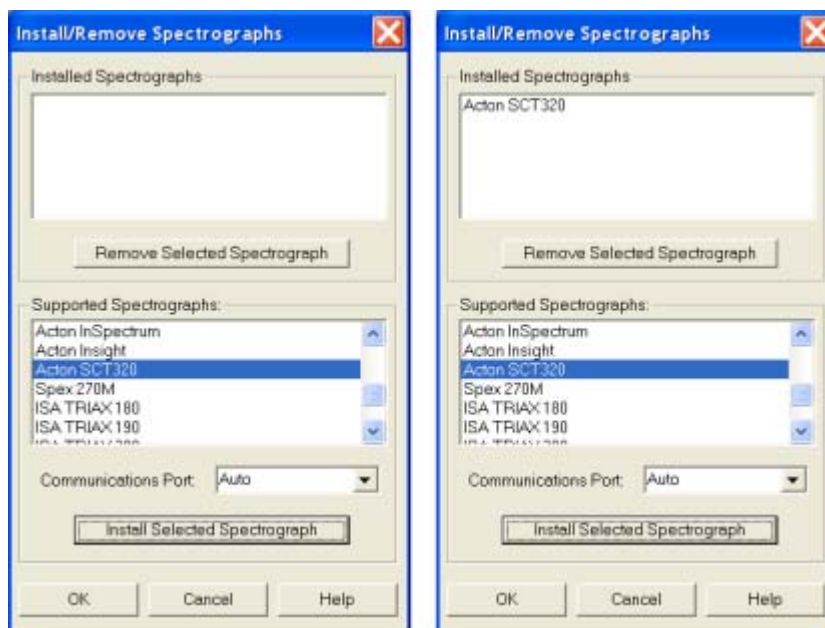
Figure 6-7: Typical Define Spectrograph Dialog



4411-0143_0033

3. On the **Install/Remove Spectrograph** dialog, scroll through the list of supported spectrographs, select **Acton SCT 320**, click **Install Selected Spectrograph**, and click **OK** to return to the **Define Spectrograph** dialog. See [Figure 6-8](#).

Figure 6-8: Typical Install/Remove Spectrograph Dialogs



4411-0143_0034

4. To verify that WinSpec recognizes the specified spectrograph, click **Do Hardware Initialize**. You should hear the turret moving.

Figure 6-9: Typical Define Spectrograph Dialog: Acton SCT 320 Active



5. Once the spectrograph has been identified within WinSpec, the next step is to align the spectrograph optics to the detector. Proceed to [Section 6.4.3, Alignment](#), on page 52.

6.4.3 Alignment

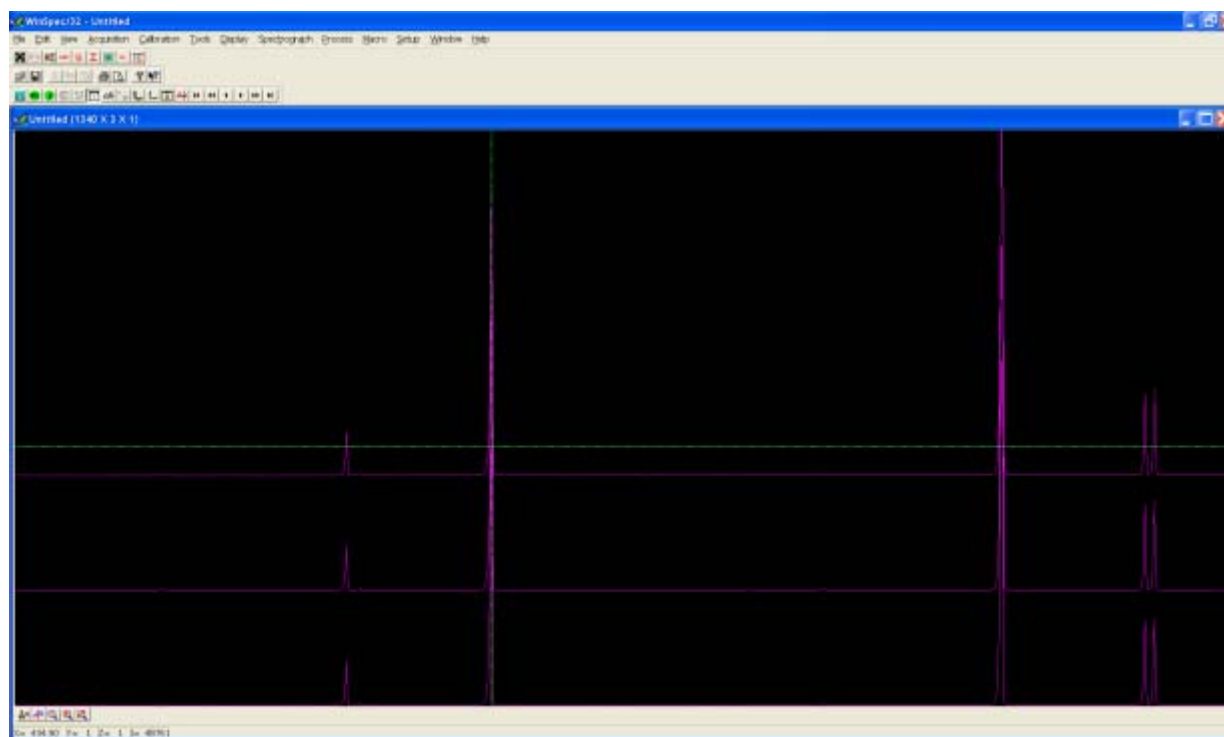
The initial alignment procedure described in this section assumes:

- The detector and spectrograph have already been connected and turned on;
- WinSpec has been launched and is running;
- The detector and spectrograph have been identified/configured within WinSpec.

After initially aligning the optics, the alignment procedure can be repeated, if desired, to fine-tune the alignment.

Figure 6-10 illustrates a properly aligned system.

Figure 6-10: Typical WinSpec Rotational Alignment View



Perform the following procedure to rotationally align the system:



NOTE:

When using an LN-cooled detector, fill the dewar after the detector has been powered on.

1. Mount a light source (e.g., a Princeton Instruments Hg and Ne/Ar Dual Switchable light source,) in front of the entrance slit.
2. From the application's menu bar, open the **Spectrograph** menu, select **Move**, select the grating to be moved, and configure it as follows:
 - If using a Mercury lamp, move it to 500 nm;
 - If using a broadband source, move it to 0.0 nm.

See Figure 6-11.

Figure 6-11: Typical Move Spectrograph Dialog: Gratings Tab

4411-0143_0037

3. Set the slit to a minimum of 10 μm .

**NOTE:**

If necessary, adjust the Exposure Time to maintain optimum (i.e., near full-scale,) signal intensity.

4. Wait until the detector locks at its default temperature.

**NOTE:**

When using an LN-cooled detector, fill the dewar after the detector has been powered on.

5. Turn on Focus mode.
6. Perform the following procedure to adjust the rotation alignment:
 - a. Use a 9/64" hex wrench to loosen the four (4) screws at the corners of the detector mounting plate.
 - b. While watching a live display of the spectrum displayed as a graph, select a peak to monitor.
 - c. Carefully, and slowly, rotate the detector. Up to 4 degrees of rotation is possible.
The width of the selected peak will vary from broad to narrow and back to broad.
The detector is properly aligned when it is set for the narrowest achievable width.

Two alternate methods for rotationally aligning the system are:

 - a. Capture an image and display the horizontal and vertical cursor bars. Compare the vertical cursor bar with the line shape on the screen. Rotate the detector until the line shape on the screen is parallel with the vertical bar.

- b. Using the **Experiment Setup|ROIs** tab configure three 10-row ROIs as follows:
- One ROI at the top of the array;
 - One ROI in the middle of the array;
 - One ROI at the bottom of the array

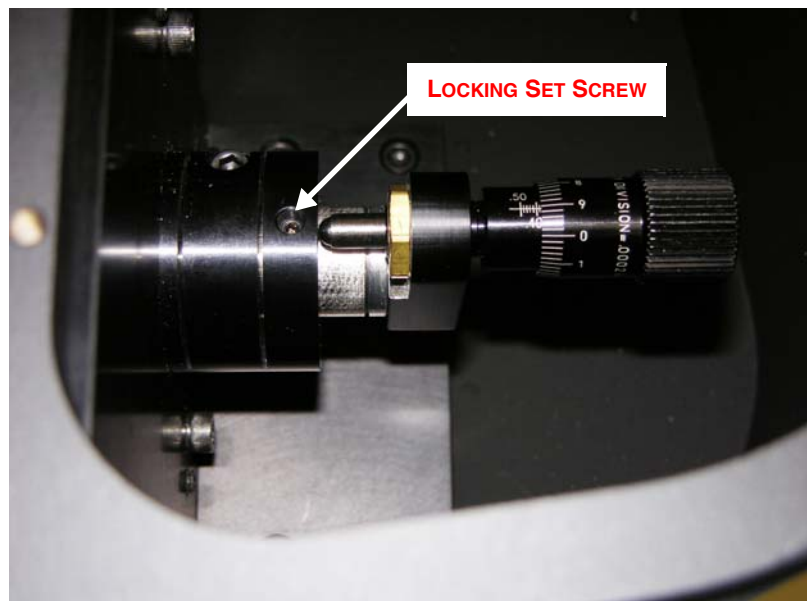
Configure the data display on the **Display Layout** dialog as follows:

- **3d Graph** is selected on the **General** tab;
- The **Z Axis Endpoints** on the **3D Layout** tab are **%X = 0** and **% Y = 40**;
- The **Save as Default** check box is checked.

Click **OK**. While running in **Focus** mode, three stacked graphs should be visible. 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. Use a 9/64" hex wrench to remove the cover from the Micrometer Compartment on the IsoPlane.
9. Use a 3/32" hex wrench to loosen the micrometer locking set screw located in the micrometer compartment. See [Figure 6-12](#).

Figure 6-12: Micrometer Locking Set Screw



4411-0143_0015

10. While continuously acquiring data, adjust the micrometer until:
 - The intensity level has been maximized, and
 - The FWHM for a selected peak or peaks has been minimized.
11. Once properly aligned, tighten the micrometer locking set screw.
12. Place the Micrometer Cover on the spectrograph.
13. Replace and tighten the four (4) cover screws.
14. Stop data acquisition.

Appendix A: Grating Information

Refer to [Table A-1](#) for information about available gratings for an IsoPlane¹.



NOTE:

Standard gratings measure 68 mm x 68 mm.

Table A-1: Available Gratings

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 ^a	I3-120-HVIS-P	
1200	500 nm	I3-120-500-P	
1200	750 nm	I3-120-750-P	
1800	Blazed Holographic UV ^b	I3-180-HUV-P	933 nm
1800	500 nm	I3-180-500-P	
2400	Holographic VIS ^a	I3-240-HVIS-P	700 nm

a. Optimum range for this grating is from 450 nm to the upper mechanical limit.

b. Blazed Holographic, 190 nm - 450 nm, optimum range.

1. IsoPlane[®] is a registered trademark of Roper Scientific, Inc.

A.1 Ordering Information

Orders accepted subject to current pricing.

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

All orders subject to new customer approval.

MasterCard/VISA

MasterCard and VISA accepted for purchases.

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 fax orders to:

FAX: 978-263-5086

Please include complete name and address with these orders.

Written Orders

Submit all written orders to our mailing address:

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

Appendix B: Camera Adapters

This appendix provides detailed information about the following camera adapters available for use with an IsoPlane system:

- Sliding Spec Flange Mount [P/N: 9000-469-01];
- PyLoN Camera Mount [P/N: 9000-469];
- C-Mount Camera Mount [P/N: 9000-576];
- Special Spec Flange Mount [P/N: 9000-469-03].

Typically, an IsoPlane system is shipped with a 9000-469-01, Sliding Spec Flange Mount, although any of the others mounts listed may be selected when ordering the system.

B.1 Sliding Spec Flange Mount

The Sliding Spec Flange mount, part number 9000-469-01, is used with the following cameras:

- PIXIS Family;
- PI-MAX Family;
- PyLoN-IR;
- ProEM 1600.

This camera adapter is shipped with most IsoPlane systems. It enables both horizontal and rotational adjustments to be made to camera positioning.

Figure B-1: Typical 9000-469-01 Sliding Spec Flange Mount: Front View

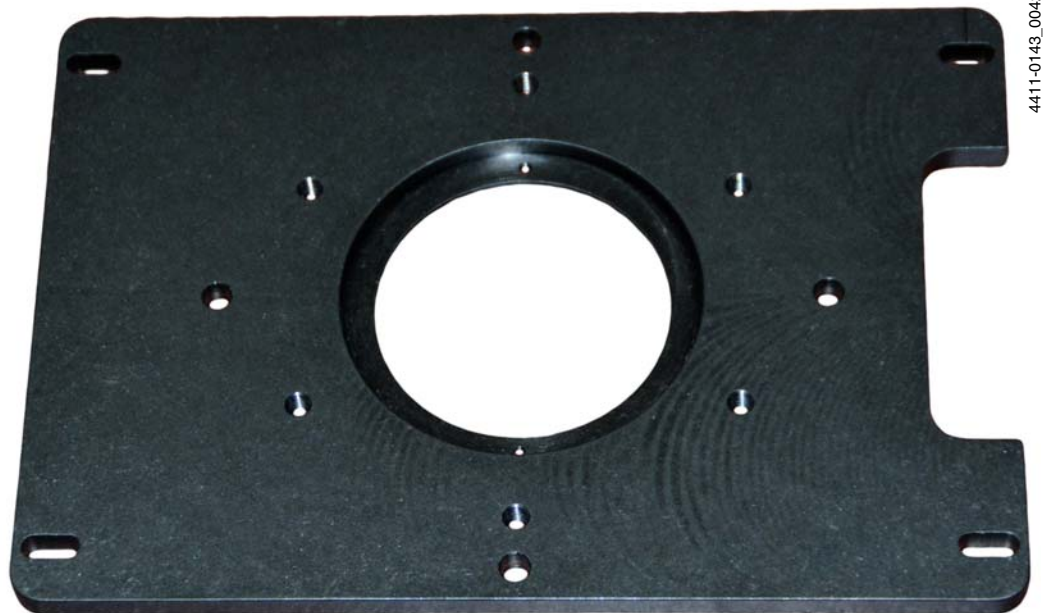
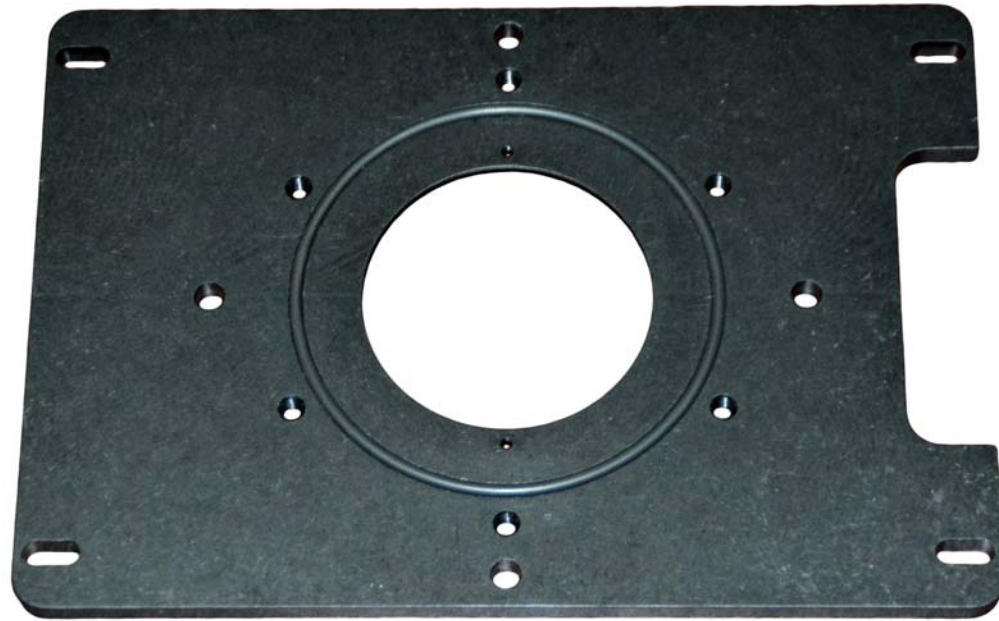
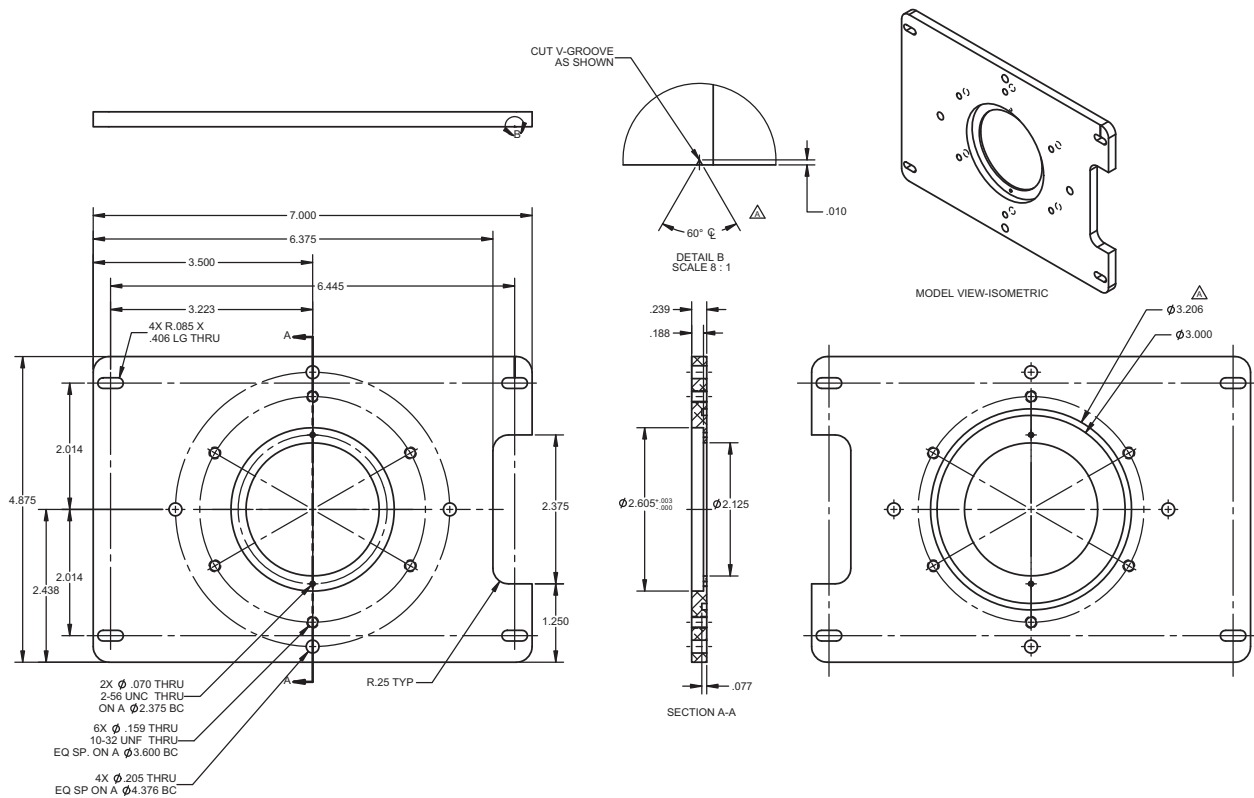


Figure B-2: Typical 9000-469-01 Sliding Spec Flange Mount: Rear View

4411-0143_0043

Figure B-3: 9000-469-01 Sliding Spec Flange Mount: Mechanical Drawing and Dimensions

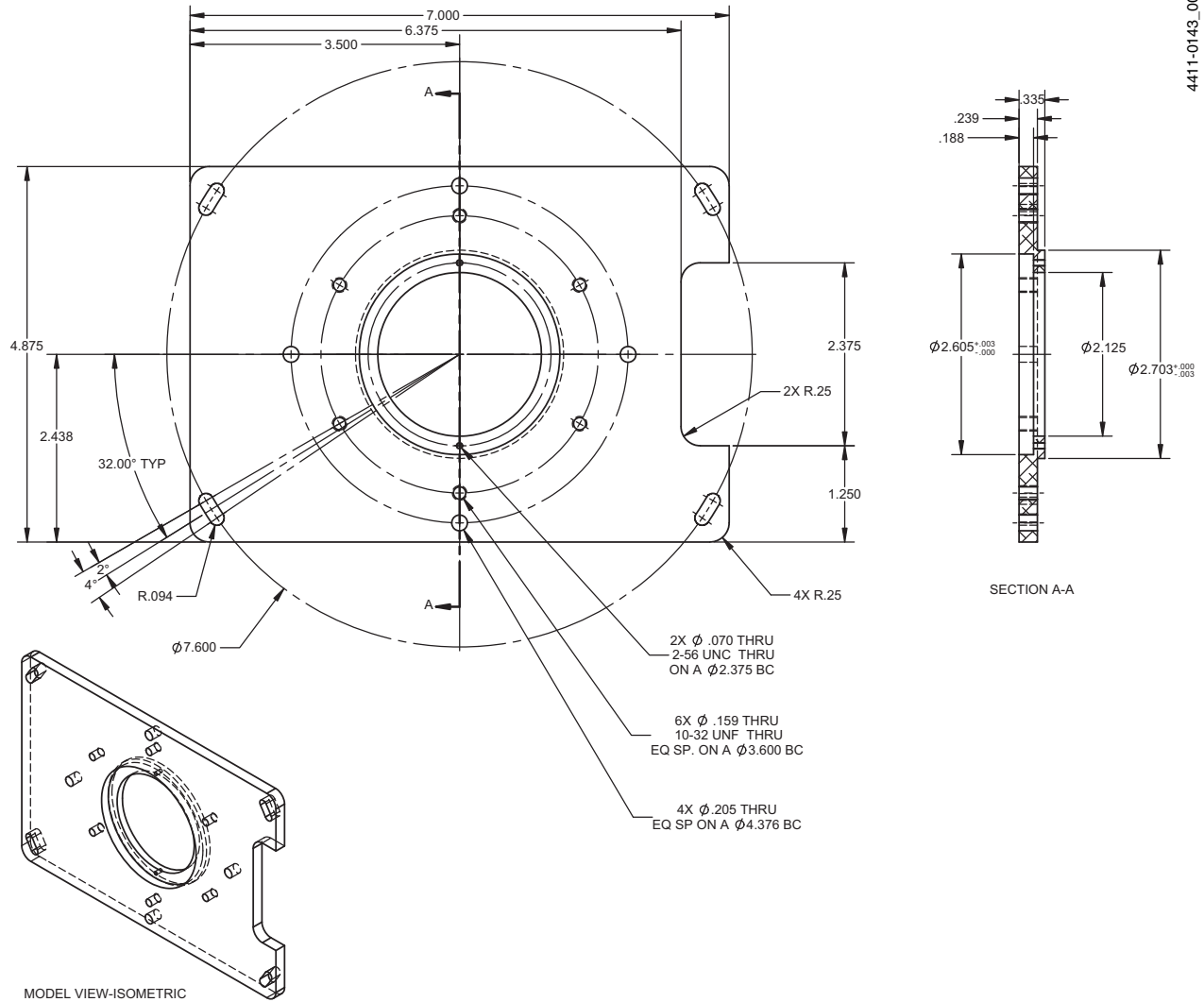
4411-0143_0044

B.2 PyLoN Camera Adapter

The PyLoN camera adapter, part number 9000-469, is used exclusively with the PyLoN family of cameras. It allows rotational adjustments to be made to the camera's positioning.

This is an optional adapter available when ordering an IsoPlane system.

Figure B-4: 9000-469 PyLoN Camera Adapter: Mechanical Drawing and Dimensions



B.4 Special Spec Flange Mount

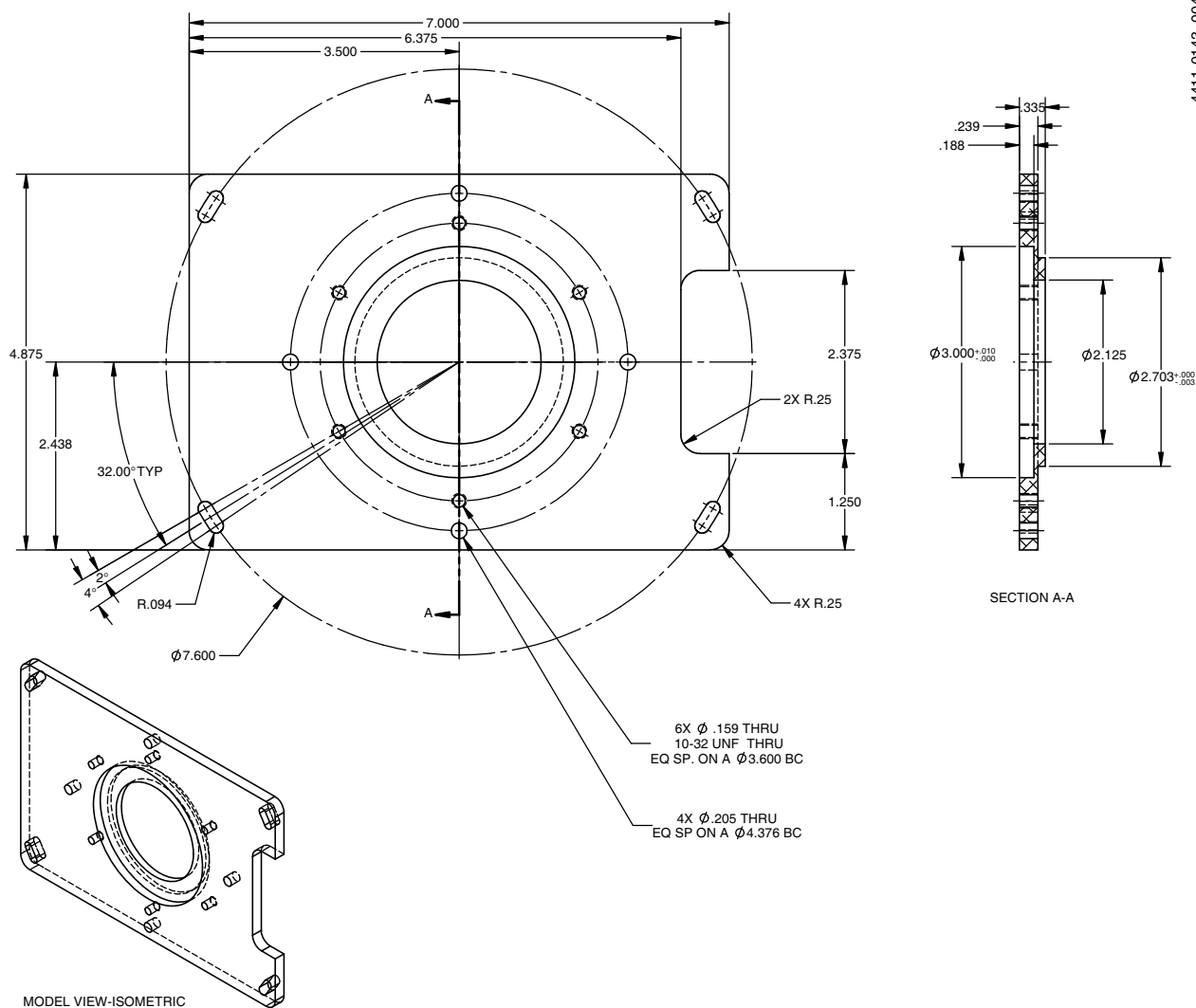
The Special Spec Flange mount, part number 9000-469-03, is used with the ProEM FT cameras.



NOTE:

This mount is currently not a standard part.

Figure B-6: 9000-469-03 Special Spec Flange Mount: Mechanical Drawing and Dimensions



4411-0143_0047

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Appendix C: Accessories

This appendix provides detailed information about accessories available for use with an IsoPlane system.

C.1 Slit Assemblies

Refer to [Table C-1](#) for information about available slit assemblies.

Table C-1: Accessories: Slit Assembly

Part Number	Description
SP-716-1	Bilaterally Adjustable Entrance Slit Assembly Micrometer adjustable widths from 10 μm to 3 mm. Supplied with interchangeable 4.0 mm and 14.0 mm high baffles.

C.2 Triple-Grating Turrets

Refer to [Table C-2](#) for information about available triple-grating turrets.

Table C-2: Accessories: Triple Grating Turret

Part Number	Description
300-483	Interchangeable Triple Grating Turret Optional second and third turrets. Requires gratings. Refer to Appendix A, Grating Information , for information about ordering gratings.

C.3 Light Sources

Refer to [Table C-3](#) for information about available light sources.

Table C-3: Accessories: Light Sources (Sheet 1 of 2)

Part Number		Description
110 V, 60 Hz	220 V, 50 Hz	
MS-416	MS-416-220	Low Pressure Mercury Light Source Includes power supply and mounting flange for Acton series monochromators and spectrographs. Output at typical mercury wavelengths (line output.)
DS-421	DS-421-220	30 W Deuterium Light Source Output wavelengths: 190 nm to 350 nm. Includes housing, power supply, mounting flange, and light collection mirror.

Table C-3: Accessories: Light Sources (Sheet 2 of 2)

Part Number		Description
110 V, 60 Hz	220 V, 50 Hz	
TS-425	TS-425-220	30 W Tungsten-Halogen Light Source Output wavelengths: 350 nm to >2.0 μm Includes housing, power supply, mounting flange, and light collection mirror.
TS-428	TS-428-220	50 W Tungsten-Halogen Light Source Output wavelengths: 350 nm to >2.0 μm Includes housing, AC power supply, mounting flange, variable brightness control, and light collection mirror.
TS-428-DC	TS-428-DC-220	50 W Tungsten-Halogen Light Source Output wavelengths: 350 nm to >2.0 μm Includes housing, regulated DC power supply, mounting flange, variable brightness control, and light collection mirror. Provides output from .
TDS-429	TDS-429-220	Dual Light Source with 30 W Deuterium and 30 W Tungsten-Halogen lamps Output wavelengths: 190 nm to >2.0 μm Includes housing with light collection mirror, mounting flange, and power supply.
XS-433	XS-433-220	75 W Xenon Light Source Output wavelengths: 190 nm to 750 nm (continuous,) with declining output to 2.7 μm . Includes power supply, housing, mounting flange, and light collection mirror.

C.4 Detectors and Accessories

Refer to [Table C-4](#) for information about available detectors and detector accessories.



NOTE:

All detectors include mounting flanges for IsoPlane slit assemblies.

Table C-4: Accessories: Detectors (Sheet 1 of 2)

Part Number	Description
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. Compatible with: <ul style="list-style-type: none"> • Acton photomultiplier tubes: P1, P2, P3; • Customer specified 1-1/8" side window photomultiplier tubes.
PD-439	Universal Photomultiplier Tube Housing For standard 1-1/8" side window photomultiplier tubes. Requires side window PMT, and photometer/power supply for operation. Includes integrated light tight shutter. Compatible with: <ul style="list-style-type: none"> • Acton photomultiplier tubes: P1, P2, P3; • Customer specified 1-1/8" side window photomultiplier tubes.
PD-471	Photomultiplier Tube Housing For 1/8" tubes with built in HV supply. NOTE: Only for SpectraHub.
P1	Side Window Photomultiplier Tube (or equivalent) Wavelength region: 185 nm - 650 nm Fits housings: <ul style="list-style-type: none"> • PD-438; • PD-439; • PD-471.
P2	Side Window Photomultiplier Tube (or equivalent) Wavelength region: 185 nm - 900 nm Fits housings: <ul style="list-style-type: none"> • PD-438; • PD-439; • PD-471.
P3	Side Window Photomultiplier Tube (or equivalent) Wavelength region: 300 nm - 1100 nm Fits housings: <ul style="list-style-type: none"> • PD-438; • PD-439; • PD-471.

Table C-4: Accessories: Detectors (Sheet 2 of 2)

Part Number	Description
SI-440	General-Purpose Single Channel Detector 10 mm diameter active area Wavelengths: 400 nm - 1100 nm Enclosed in housing with the BNC connector.
SI-440-UV	Single Channel Detector UV-enhanced, 10 mm diameter active area Wavelengths: 200 nm - 1100 nm
ID-441	InGaAs Detector Includes pre-amplifier Uncooled version.
ID-441-C	InGaAs Detector Includes pre-amplifier Cooled version. Requires Model 442-1A thermoelectric cooling for operation.
442-1 A	Thermoelectric Cooling System For use with ID-441 InGaAs detector.
SpectraHub	SpectraHub Data Acquisition System 20-bit A-D converter, single channel detector interface. Requires SpectraSense software.

C.5 Microscope Interface

Refer to [Table C-5](#) for information about available microscope interfaces.

Table C-5: Accessories: Microscope Interface

Part Number	Description
MicroSpec	Microscope Interface Allows 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 additional information, refer to the MicroSpec data sheet which is available on the Princeton Instruments website.

C.6 Filter Wheels and Order Sorting Filter Assemblies

Refer to [Table C-6](#) for information about available filter wheels and order-sorting filter assemblies.

Table C-6: Accessories: Filters

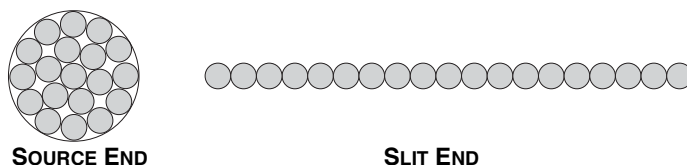
Part Number	Description
FA-2448	<p>Six Position Filter Wheel Assembly</p> <p>Manual sample indexing, holds up to six samples, each of which is 1.0-inch in diameter. Automated via SP Control Cable. Can be used with the IsoPlane.</p> <p>Requires:</p> <ul style="list-style-type: none"> • FA-2448-F Filter Set, or • Customer-supplied filters which are 25 mm (1-inch) in diameter and no more than 5 mm thick.
FA-2448-1	<p>Order Sorting Filter Assembly</p> <p>Manual indexing of filters for elimination of unwanted second order radiation. Automated via SP Control Cable. Can be used with the IsoPlane.</p> <p>Includes the complete FA-2448-F Filter Set mounted in a FA-2448 filter wheel.</p>
FA-2448-2	<p>Motorized Six Position Filter Wheel Assembly</p> <p>Includes stepping motor and FA-2448-4 controller.</p> <p>Enables computer indexing via an RS-232 or USB interface.^a</p> <p>Requires:</p> <ul style="list-style-type: none"> • FA-2448-F Filter Set, or • Customer-supplied filters which are 25 mm (1-inch) in diameter and no more than 5 mm thick.
FA-2448-3	<p>Motorized Order Sorting Filter Assembly</p> <p>Enables computer controlled indexing^a of order sorting filters for elimination of unwanted second order radiation.</p> <p>Includes the complete FA-2448-F Filter Set mounted in a FA-2448 filter wheel.</p>
FA-2448-F	<p>Order Sorting Filter Set</p> <p>Includes the following filters:</p> <ul style="list-style-type: none"> • 320 nm; • 590 nm; • 665 nm; • 715 nm.

a. Host computer with RS-232 or USB interface required.

C.7 Fiber Optic Light Guides

All fiber optic light guides are comprised of 19 fibers, each of which is 200 μm in diameter. The fibers are arranged in a circle at the source end and a line at the slit end. See [Figure C-1](#).

Figure C-1: Fiber Optic Light Guide Fiber Configurations



4411-0143_0038

Refer to [Table C-7](#) for information about available fiber optic light guides.

Table C-7: Accessories: Fiber Optics

Part Number	Description
LG-455-020-1	UV-VIS Fiber Optic Bundle ^a Length: 1.0 m Wavelengths: 190 nm to 1100 nm
LG-455-020-3	UV-VIS Fiber Optic Bundle ^a Length: 3.0 m Wavelengths: 190 nm to 1100 nm
LG-456-020-1	VIS-NIR Fiber Optic Bundle ^a Length: 1.0 m Wavelengths: 400 nm to 2200 nm
LG-456-020-1	VIS-NIR Fiber Optic Bundle ^a Length: 3.0 m Wavelengths: 400 nm to 2200 nm
FC-446-010	Fixed-Position Fiber Adapter A low-cost solution for positioning fiberoptic bundles directly at the entrance port . Accepts 10 mm diameter ferrule.
FC-446-020	Fiber Coupler Provides horizontal translation capability for a 10 mm diameter fiber optic bundle. Accepts 10 mm diameter ferrule.
FC-446-021	Fiber Coupler Provides X-Y Micrometer alignment adjustments. Accepts 10 mm diameter ferrule.
FC-446-030	Imaging Fiber Adapter Designed specifically for Princeton Instruments' 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 functionality.

a. Mount required.

C.8 Data Cables

Refer to [Table C-8](#) for information about available cables.

Table C-8: Accessories: Data Cables

Part Number	Description
CC-499-2	RS-232 Serial Cable 9-pin female to 9-pin male Length: 6 feet (1.82 m)
3650-USB-06	USB cable Type A to B Length: 6 feet (1.82 m)

**NOTE:**

If these cables are not compatible with the system being used, contact Princeton Instruments for information about ordering a custom cable.

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Appendix D: RS-232 Interface

This appendix provides information necessary when using the RS-232 interface for communication between the host computer and an IsoPlane system.

D.1 Communication Configuration Settings

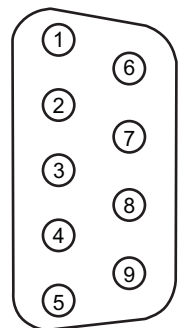
When using RS-232 for communication with the IsoPlane spectrograph, the RS-232 port on the host computer system must be configured as follows:

- 9600 Baud;
- 8 Data Bits;
- No Parity;
- 1 Start Bit;
- 1 Stop Bit.

D.2 Custom Cable Information

This section provides the information necessary to build a custom RS-232 cable to be used with an IsoPlane spectrograph.

Figure D-1: DB9 Connector Pinout



REAR/CABLE VIEW

[Table D-1](#) provides the pinout information for an RS-232 cable that is to be used with an IsoPlane spectrograph.



NOTE:

The pinout information in [Table D-1](#) also serves as a wiring diagram since this cable is a straight through cable.

4411-0143_0027

Table D-1: IsoPlane RS-232 Pin Definitions

DB9 Male Pin Number	Signal Definition	Cable Color	DB9 Female Pin Number
1	No Connection	—	1
2	Rx Data		2
3	Tx Data		3
4	No Connection	—	4
5	Ground	Green	5
6	No Connection	—	6
7	RTS		7
8	CTS		8
9	No Connection	—	9

Appendix E: Monochromator Control Software

As has been previously discussed 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. Information about how to do this is provided in this appendix.

E.1 Install the Monochromator Control 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.

The software is installed using the install disk shipped with the monochromator. Typically, the software is installed in the following directory:

<C:\Program Files\Princeton Instruments\MonoControl>

This directory also includes the following subdirectories:

- **Bin**
The executable code for the program is stored in this subdirectory.
- **Data**

During program installation, a **Monochromator Control** icon is typically placed on the desktop for launching the software. If an icon is not placed on the desktop, the program can be launched using one of the following methods:

- **Windows Start → Programs**
- Navigate directly to the <C:\Program Files\Princeton Instruments\MonoControl\Bin> directory and double-click on the program's executable file.

Once the Monochromator Control software loads, its primary screen provides options for monochromator operation as well as other setup functions.



NOTE:

If these options are grayed out, exit the program and connect the IsoPlane. Once the IsoPlane has been initialized, launch the monochromator control program again.

Clicking the **Operation** button displays a screen from which basic control of the monochromator wavelength is performed.



REFERENCES:

Refer to the Monochromator Control manual included on the software installation CD for complete information.

E.2 Connecting the IsoPlane to a Computer

The IsoPlane has been designed to be operated and controlled by a host computer using the RS-232 or USB interface.

IsoPlane operations which can be controlled include:

- Wavelength scanning at a pre-set linear scan rate;
- Change of scanning speeds;
- Grating selection;
- Rapid GOTO wavelength positioning;
- Changing of grating turrets;
- “Jogging” wavelength positioning.

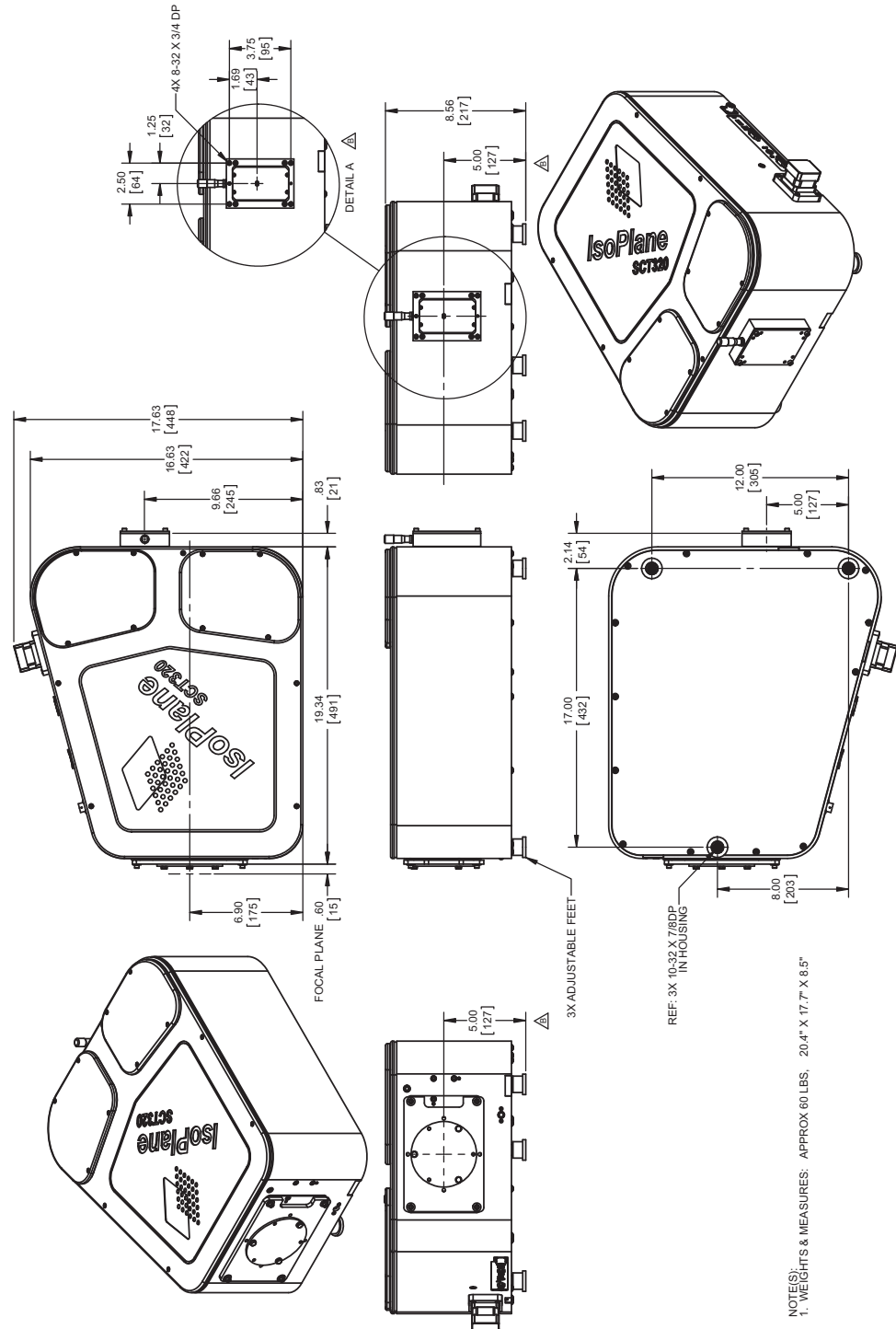


REFERENCES:

Refer to the Monochromator Control software for Windows for complete information about using an IsoPlane with a computer.

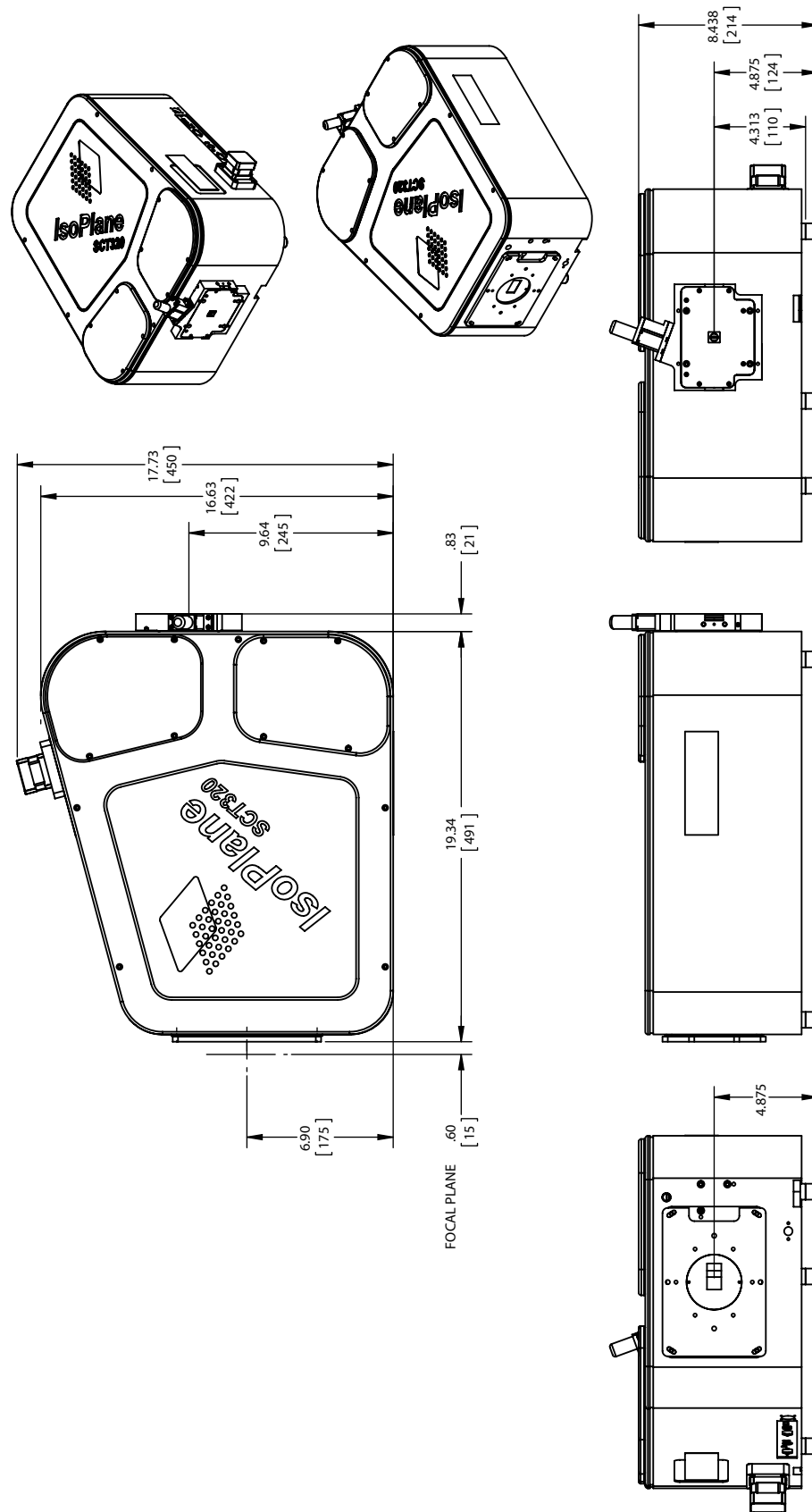
Appendix F: Outline Drawings

Figure F-1: IsoPlane: SCT 320 with Manual Slit Assembly Outline Drawing



4411-0143_0039

Figure F-2: IsoPlane: SCT 320 with Motorized Slit Assembly Outline Drawing



NOTE(S):
 1. WEIGHTS & MEASURES: APPROX 60 LBS. 20.4" X 17.7" X 8.5"

4411-0143_0040

Declaration of Conformity

This section of the IsoPlane system manual contains the declaration of conformity for IsoPlane systems.

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

Warranty and Service

Limited Warranty

Princeton Instruments, a division of Roper Scientific, Inc. ("Princeton Instruments", "us", "we", "our") makes the following limited warranties. These limited warranties extend to the original purchaser ("You", "you") only and no other purchaser or transferee. We have complete control over all warranties and may alter or terminate any or all warranties at any time we deem necessary.

Basic Limited One (1) Year Warranty

Princeton Instruments warrants this product against substantial defects in materials and / or workmanship for a period of up to one (1) year after shipment. During this period, Princeton Instruments will repair the product or, at its sole option, repair or replace any defective part without charge to you. You must deliver the entire product to the Princeton Instruments factory or, at our option, to a factory-authorized service center. You are responsible for the shipping costs to return the product. International customers should contact their local Princeton Instruments authorized representative/distributor for repair information and assistance, or visit our technical support page at www.princetoninstruments.com.

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Princeton Instruments warrants, with the exception of the CCD imaging device (which carries NO WARRANTIES EXPRESS OR IMPLIED), this product against defects in materials or workmanship for a period of up to one (1) year after shipment. During this period, Princeton Instruments will repair or replace, at its sole option, any defective parts, without charge to you. You must deliver the entire product to the Princeton Instruments factory or, at our option, a factory-authorized service center. You are responsible for the shipping costs to return the product to Princeton Instruments. International customers should contact their local Princeton Instruments representative/distributor for repair information and assistance or visit our technical support page at www.princetoninstruments.com.

XP Vacuum Chamber Limited Lifetime Warranty

Princeton Instruments warrants that the cooling performance of the system will meet our specifications over the lifetime of an XP style detector (has all metal seals) or Princeton Instruments will, at its sole option, repair or replace any vacuum chamber components necessary to restore the cooling performance back to the original specifications at no cost to the original purchaser. *Any failure to "cool to spec" beyond our Basic (1) year limited warranty from date of shipment, due to a non-vacuum-related component failure (e.g., any components that are electrical/electronic) is NOT covered and carries NO WARRANTIES EXPRESSED OR IMPLIED.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Sealed Chamber Integrity Limited 12 Month Warranty

Princeton Instruments warrants the sealed chamber integrity of all our products for a period of twelve (12) months after shipment. If, at anytime within twelve (12) months from the date of delivery, the detector should experience a sealed chamber failure, all parts and labor needed to restore the chamber seal will be covered by us. *Open chamber products carry NO WARRANTY TO THE CCD IMAGING DEVICE, EXPRESSED OR IMPLIED.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

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Princeton Instruments warrants the vacuum integrity of “Non-XP” style detectors (do not have all metal seals) for a period of up to twelve (12) months from the date of shipment. We warrant that the detector head will maintain the factory-set operating temperature without the requirement for customer pumping. Should the detector experience a Vacuum Integrity failure at anytime within twelve (12) months from the date of delivery all parts and labor needed to restore the vacuum integrity will be covered by us. Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Image Intensifier Detector Limited One Year Warranty

All image intensifier products are inherently susceptible to Phosphor and/or Photocathode burn (physical damage) when exposed to high intensity light. Princeton Instruments warrants, with the exception of image intensifier products that are found to have Phosphor and/or Photocathode burn damage (which carry NO WARRANTIES EXPRESSED OR IMPLIED), all image intensifier products for a period of one (1) year after shipment. *See additional Limited One (1) year Warranty terms and conditions above, which apply to this warranty.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

X-Ray Detector Limited One Year Warranty

Princeton Instruments warrants, with the exception of CCD imaging device and fiber optic assembly damage due to X-rays (which carry NO WARRANTIES EXPRESSED OR IMPLIED), all X-ray products for one (1) year after shipment. *See additional Basic Limited One (1) year Warranty terms and conditions above, which apply to this warranty.* Responsibility for shipping charges is as described above under our Basic Limited One (1) Year Warranty.

Software Limited Warranty

Princeton Instruments warrants all of our manufactured software discs to be free from substantial defects in materials and / or workmanship under normal use for a period of one (1) year from shipment. Princeton Instruments does not warrant that the function of the software will meet your requirements or that operation will be uninterrupted or error free. You assume responsibility for selecting the software to achieve your intended results and for the use and results obtained from the software. In addition, during the one (1) year limited warranty. The original purchaser is entitled to receive free version upgrades. Version upgrades supplied free of charge will be in the form of a download from the Internet. Those customers who do not have access to the Internet may obtain the version upgrades on a CDROM from our factory for an incidental shipping and handling charge. *See Item 12 in the following section of this warranty ("[Your Responsibility](#)") for more information.*

Owner's Manual and Troubleshooting

You should read the owner's manual thoroughly before operating this product. In the unlikely event that you should encounter difficulty operating this product, the owner's manual should be consulted before contacting the Princeton Instruments technical support staff or authorized service representative for assistance. If you have consulted the owner's manual and the problem still persists, please contact the Princeton Instruments technical support staff or our authorized service representative. *See Item 12 in the following section of this warranty ("[Your Responsibility](#)") for more information.*

Your Responsibility

The above Limited Warranties are subject to the following terms and conditions:

1. You must retain your bill of sale (invoice) and present it upon request for service and repairs or provide other proof of purchase satisfactory to Princeton Instruments.
2. You must notify the Princeton Instruments factory service center within (30) days after you have taken delivery of a product or part that you believe to be defective. With the exception of customers who claim a "technical issue" with the operation of the product or part, all invoices must be paid in full in accordance with the terms of sale. Failure to pay invoices when due may result in the interruption and/or cancellation of your one (1) year limited warranty and/or any other warranty, expressed or implied.
3. All warranty service must be made by the Princeton Instruments factory or, at our option, an authorized service center.
4. Before products or parts can be returned for service you must contact the Princeton Instruments factory and receive a return authorization number (RMA). Products or parts returned for service without a return authorization evidenced by an RMA will be sent back freight collect.
5. These warranties are effective only if purchased from the Princeton Instruments factory or one of our authorized manufacturer's representatives or distributors.
6. Unless specified in the original purchase agreement, Princeton Instruments is not responsible for installation, setup, or disassembly at the customer's location.
7. Warranties extend only to defects in materials or workmanship as limited above and do not extend to any product or part which:
 - has been lost or discarded by you;
 - has been damaged as a result of misuse, improper installation, faulty or inadequate maintenance or failure to follow instructions furnished by us;
 - has had serial numbers removed, altered, defaced, or rendered illegible;
 - has been subjected to improper or unauthorized repair;
 - has been damaged due to fire, flood, radiation, or other "acts of God" or other contingencies beyond the control of Princeton Instruments; or
 - is a shutter which is a normal wear item and as such carries a onetime only replacement due to a failure within the original 1 year Manufacturer warranty.
8. After the warranty period has expired, you may contact the Princeton Instruments factory or a Princeton Instruments-authorized representative for repair information and/or extended warranty plans.
9. Physically damaged units or units that have been modified are not acceptable for repair in or out of warranty and will be returned as received.

10. All warranties implied by state law or non-U.S. laws, including the implied warranties of merchantability and fitness for a particular purpose, are expressly limited to the duration of the limited warranties set forth above. With the exception of any warranties implied by state law or non-U.S. laws, as hereby limited, the forgoing warranty is exclusive and in lieu of all other warranties, guarantees, agreements, and similar obligations of manufacturer or seller with respect to the repair or replacement of any parts. In no event shall Princeton Instruments' liability exceed the cost of the repair or replacement of the defective product or part.
11. This limited warranty gives you specific legal rights and you may also have other rights that may vary from state to state and from country to country. Some states and countries do not allow limitations on how long an implied warranty lasts, when an action may be brought, or the exclusion or limitation of incidental or consequential damages, so the above provisions may not apply to you.
12. When contacting us for technical support or service assistance, please refer to the Princeton Instruments factory of purchase, contact your authorized Princeton Instruments representative or reseller, or visit our technical support page at www.princetoninstruments.com.

Contact Information

Roper Scientific's manufacturing facility for this product is located at the following address:

Princeton Instruments
3660 Quakerbridge Road
Trenton, NJ 08619 (USA)

Tel: 1-800-874-9789 / 1-609-587-9797

Fax: 1-609-587-1970

Customer Support E-mail: techsupport@princetoninstruments.com

For immediate support in your area, please call the following locations directly:

North America 800 899 1144 (toll free) or 609 587 9797

France +33 (1) 60 86 03 65

Germany +49 (0) 89 660 7793

Japan +81 (3) 5639 2741

UK & Ireland +44 (0) 1628 472 346

Singapore +65 6408 6240

China +86 10 659 16460

Otherwise, refer to our Support web page at www.princetoninstruments.com.

An up-to-date list of addresses and telephone numbers is posted on the www.princetoninstruments.com/Support page. In addition, links on this page to support topics allow you to send e-mail based requests to the Customer Support group.

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