



TELEDYNE PRINCETON INSTRUMENTS
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IsoPlane® 160 System Manual



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Revision History

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Issue 2	April 9, 2019	Issue 2 of this document incorporates the following changes: <ul style="list-style-type: none">• Rebranded as Teledyne Princeton Instruments
Issue 1	July 11, 2014	This is the initial release of this document

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Chapter 1: About this Document

This document is intended to provide the information and procedures necessary to set up and operate an IsoPlane 160 spectrograph. Even experienced users of spectroscopic equipment should review the information included in this document to insure proper setup and operation. If you have any questions about the information contained in this manual, contact the Teledyne Princeton Instruments customer service department. Refer to [Contact Information](#) on page 72 for complete contact information.

1.1 Intended Audience

This manual is intended to be used by scientists and other personnel responsible for the installation, setup, configuration, and acquisition of imaging data collected using an IsoPlane 160 spectrograph.

This document provides all information necessary to safely install, configure, and operate the IsoPlane 160, beginning with the system's initial installation.

1.2 Related Documentation

[Table 1-1](#) provides a list of related documentation and user manuals that may be useful when working with the IsoPlane 160 camera system. To guarantee up-to-date information, always refer to the current release of each document listed.

Table 1-1: Related Documentation

Document Number	Document Title
4411-0048	WinSpec 2.6 Spectroscopy Software User Manual
4411-0125	LightField® 4.8 User's Manual
4411-0147	LightField 5 User's Manual
4410-0033	Spectrometer Alignment Procedure ^a
	Teledyne Acton Research Monochromator Control Software for Windows ^a
—	Camera-specific User's Manual

a. Required when using a motorized slit assembly.

Teledyne Princeton Instruments maintains updated documentation and user manuals on their FTP site. Visit the Teledyne Princeton Instruments FTP Site to verify that the most recent user manual is available and being referenced:

[ftp://ftp.piacton.com/Public/Manuals/Princeton Instruments](ftp://ftp.piacton.com/Public/Manuals/Princeton_Instruments)

<ftp://ftp.piacton.com/Public/Manuals/Acton>

1.3 Document Organization

This manual includes the following chapters and appendices:

- [Chapter 1, About this Document](#)
This chapter provides information about the organization of this document, as well as related documents, safety information, and conventions used throughout the manual.
- [Chapter 2, IsoPlane 160 Overview](#)
This chapter provides an overview and introduction to the IsoPlane 160 spectrometer.
- [Chapter 3, Entrance Slit Accessories](#)
Provides information and procedures for installing, removing, and using entrance slits and accessories.
- [Chapter 4, Grating Turrets](#)
Provides information and procedures for installing, removing, and using Grating Turrets.
- [Chapter 5, Internal Shutter](#)
Provides information and procedures for installing, removing, and using an internal shutter.
- [Chapter 6, IsoPlane 160 Setup](#)
Provides information and procedures for the initial setup of an IsoPlane 160 spectrograph.
- [Chapter 7, Operation with LightField](#)
Provides information and procedures for the initial focusing and alignment of the IsoPlane 160 spectrograph when using LightField.
- [Chapter 8, Operation with WinSpec](#)
Provides information and procedures for the initial focusing and alignment of the IsoPlane 160 spectrograph when using WinSpec.
- [Appendix A, Accessories](#)
Provides specifications and ordering information for accessories that are compatible with the IsoPlane 160.
- [Appendix B, RS-232 Interface](#)
Provides technical information, including pinout diagrams, for RS-232 cables.
- [Appendix C, Outline Drawings](#)
Provides mechanical drawings of the IsoPlane 160.
- [Warranty and Service](#)
Provides certification and warranty information for the IsoPlane 160. Contact information is also provided.

1.4 Safety Information

Before turning on the power supply, the ground prong of the power cord plug must be properly connected to the ground connector of the wall outlet. The wall outlet must have a third prong, or must be properly connected to an adapter that complies with these safety requirements.



WARNINGS!

1. If the IsoPlane 160 camera system is used in a manner not specified by Teledyne Princeton Instruments, the protection provided by the equipment may be impaired.
2. If the wall outlet is damaged, the protective grounding could be disconnected. Do *not* use damaged equipment until its safety has been verified by authorized personnel. Disconnecting the protective earth terminal, inside or outside the apparatus, or any tampering with its operation is also prohibited.

Inspect the supplied power cord. If it is not compatible with the power socket, replace the cord with one that has suitable connectors on both ends.



WARNING!

Replacement power cords or power plugs must have the same polarity and power rating as that of the original ones to avoid hazard due to electrical shock.

1.4.1 Safety Related Symbols Used in this Manual



CAUTION!

The use of this symbol on equipment indicates that one or more nearby items should not be operated without first consulting the manual. The same symbol appears in the manual adjacent to the text that discusses the hardware item(s) in question.



WARNING! RISK OF ELECTRIC SHOCK!

The use of this symbol on equipment indicates that one or more nearby items pose an electric shock hazard and should be regarded as potentially dangerous. This same symbol appears in the manual adjacent to the text that discusses the hardware item(s) in question.

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Chapter 2: IsoPlane 160 Overview

The IsoPlane 160 is a compact, high performance imaging spectrograph designed to provide high spectral resolution with low astigmatism. The advanced optical design reduces astigmatism to 100 μm or less over a 26 mm wide focal plane, increasing spatial resolution dramatically over traditional Czerny-Turner spectrographs. It features a compact design, with a footprint about the same area as an 8.5" x 11" sheet of paper. The IsoPlane 160 includes 32 bit microprocessor controlled scanning, a built-in USB interface, direct digital on-axis grating drive with full wavelength and grating control capabilities. This state-of-the-art spectrograph works seamlessly with Teledyne Princeton Instruments' industry-leading CCD, EMCCD, ICCD and InGaAs array detectors as well as Teledyne Princeton Instruments' LightField with IntelliCal and WinSpec data acquisition software packages.

Figure 2-1 shows a standard IsoPlane 160.

Figure 2-1: IsoPlane 160 Spectrometer



4411-0148_0001

2.1 Standard Equipment

The following items are included as standard equipment with every IsoPlane 160 system:

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

2.1.1 External Power Supply

Figure 2-2 illustrates a typical IsoPlane 160 power supply with an inset providing the pin locations for the power connector. Refer to Table 2-1 for specific pinout information.

Figure 2-2: IsoPlane 160 Power Supply



Table 2-1: IsoPlane 160 Power Connector Pinout Information

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

2.1.2 Data Cables

The following computer cables are included with the IsoPlane 160:

- 3650-USB-06 USB Cable Type A to Type B.

If this cable is not compatible with the host system, contact Teledyne 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 2-1. Additional information is available in Appendix B, RS-232 Interface, on page 65.

2.1.3 Grating Turret

Each IsoPlane 160 is shipped with, and includes, one grating turret.

**NOTE:**

Additional turrets are available from Teledyne Princeton Instruments. Refer to [Section A.2, Triple Grating Turrets](#), on page 61, for ordering information.

2.2 Optional Accessories

The following optional accessories are available for purchase for use with the IsoPlane 160 system:

- Data Acquisition Software
The following data acquisition software is available for purchase from Teledyne Princeton Instruments:
 - LightField®
The IsoPlane 160 is supported by LightField 4.8 or higher. LightField is a 64-bit data acquisition platform for spectroscopy and imaging. Light Field combines complete control over Teledyne 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 160 and all other Teledyne Acton Research 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 Teledyne 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 3, Entrance Slit Accessories](#), on page 17, for additional information about the installation and removal of entrance slit accessories.
Refer to [Section A.1, Slit Assemblies](#), on page 61 for part number and ordering information for available slit accessories.
- Triple Grating Turrets;
Refer to [Chapter 4, Grating Turrets](#), on page 21, for additional information.
Refer to [Section A.2, Triple Grating Turrets](#), on page 61 for part number and ordering information for available triple-grating turrets.
- Internal Shutter;
Refer to [Chapter 5, Internal Shutter](#), on page 33, for additional information.

- Filters;
Refer to [Section A.3, Filter Wheels and Order Sorting Filter Assemblies](#), on page 62, for part number and ordering information.
- Fiber Optic Light Guides;
Refer to [Section A.4, Fiber Optic Light Guides](#), on page 63, for part number and ordering information.
- Data Cables.
Refer to [Section A.5, Data Cables](#), on page 64, for part number and ordering information.

2.3 Connectors, Ports, and Major Components

[Figure 2-3](#) illustrates the indicators, interfaces, and associated connectors found on the External Connector panel.

Figure 2-3: External Connectors



The following interfaces are accessible through this connector panel:

- FILTER
Filter driver connection required for an Teledyne Acton Research FA-2448 Filter Wheel.
- SHT TTL
SHT TTL connection for TTL control of shutter.
- DSP
DSP connector used to connect two spectrographs as a double monochromator (NA).
- COM
This yellow LED flashes to indicate that the IsoPlane 160 is successfully communicating with the host computer.
- READY
This Green/Yellow LED indicates the operational status of the IsoPlane 160 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 B, RS-232 Interface](#), on page 65 for additional information about using this interface.
- USB
USB connection to the host computer.

- **USB HUB**
USB Hub 1.1 compatible.
- **SHUTTER**
Allows the camera's shutter control port to connect directly to the IsoPlane 160 internal shutter. Cable required.
- **POWER**
External power connector. The external power supply provides the following voltages to the IsoPlane 160:
 - +5 V_{DC}
 - +24 V_{DC}.Refer to [Section 2.1.1, External Power Supply](#), on page 12 for additional information.

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Chapter 3: Entrance Slit Accessories

Teledyne Princeton Instruments offers a full range of spectrograph accessories that mount directly to the IsoPlane 160's manual or motorized entrance slit assembly.

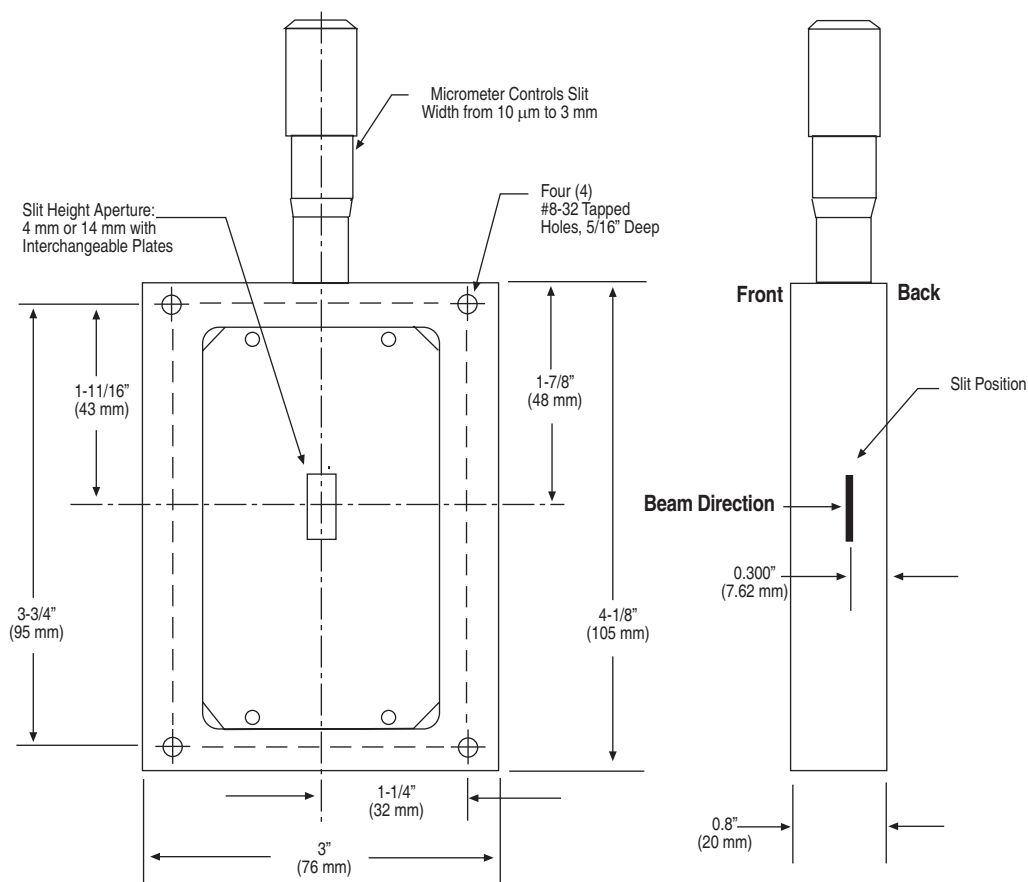


NOTE:

Teledyne 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 3-1, which illustrates a manual slit assembly, may be helpful when mounting an accessory to the IsoPlane 160.

Figure 3-1: Typical Manual Slit Assembly



4411-0148_0005

3.1 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, Teledyne Princeton Instruments provides special slotted holes in the light source housing to facilitate mounting the source to the slit.

3.2 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.

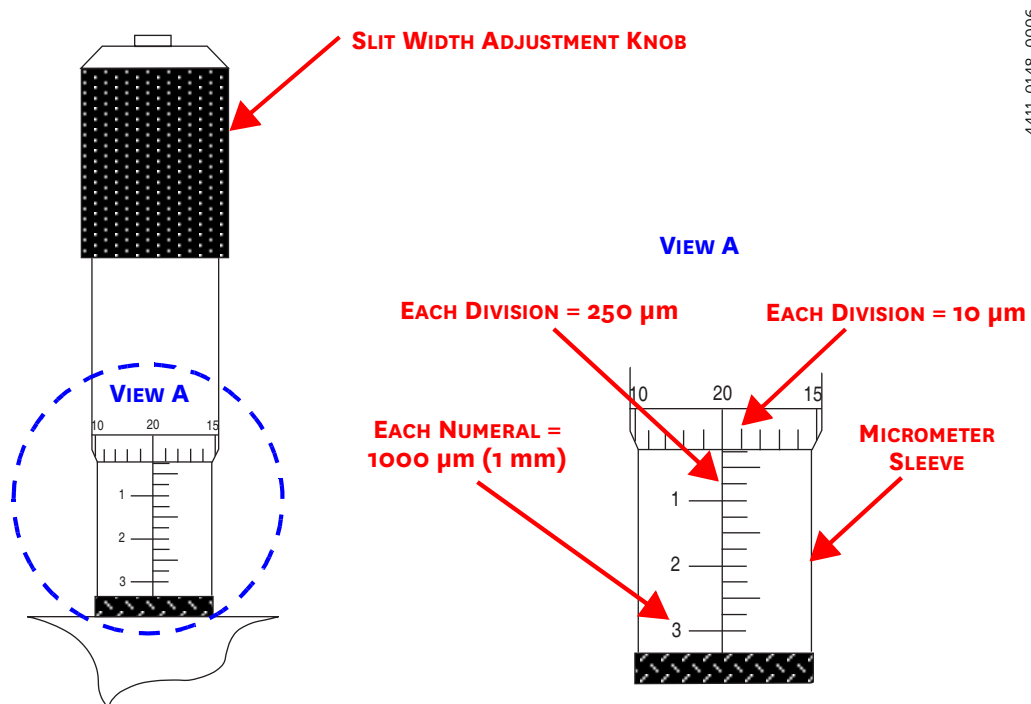
Each clockwise revolution of the micrometer knob increases the slit width 0.25 mm (250 μm .) For maximum reproducibility, the slit width should be set in a clockwise direction (i.e., increasing slit widths,) each time it is changed. See [Figure 3-2](#) and [Figure 3-3](#).



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 3-2: Typical Slit Width Micrometer Settings: Width = 200 μm (0.200 mm)

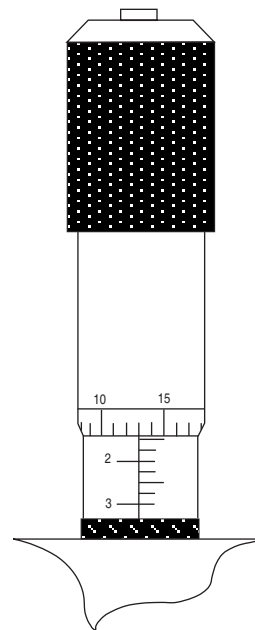
4411-0148_0006

Figure 3-3: Typical Slit Width Micrometer Settings

4411-0148_0007

WIDTH = 0.010 mm (10 μm)

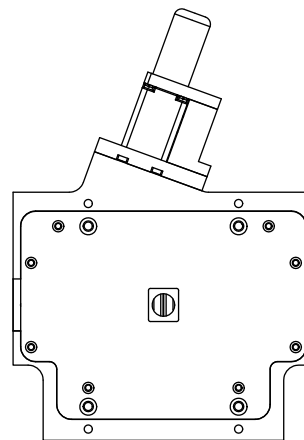
4411-0148_0008

WIDTH = 1.380 mm (1380 μm)

3.3 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 718-1 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.



4411-0148_0009



REFERENCES:

When using a motorized slit with the IsoPlane 160, refer to the following documents for information about aligning and centering motorized slits:

- Technical note [Teledyne Acton Research Monochromator Control Software for Windows^a](#);
- Document number [4410-0033, Spectrometer Alignment Procedure](#).

Refer to [Table 1-1](#) on page 7 for information about obtaining these documents.

Chapter 4: Grating Turrets

This chapter provides information about the installation and removal of grating turrets on an IsoPlane 160 spectrograph.

4.1 Turret Installation

If you have just received an IsoPlane 160 spectrograph, you will need to install the grating turret. The grating turret has been shipped in the same shipping box with the IsoPlane 160 but is packaged in a plastic container outside the IsoPlane 160 housing to protect the gratings during shipment.

Figure 4-1: Typical Grating Turret Shipping and Storage Container



4411-0148_0022



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 powder free 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.
-

Perform the following procedure to install a grating turret into an IsoPlane 160 unit:

**CAUTION!**

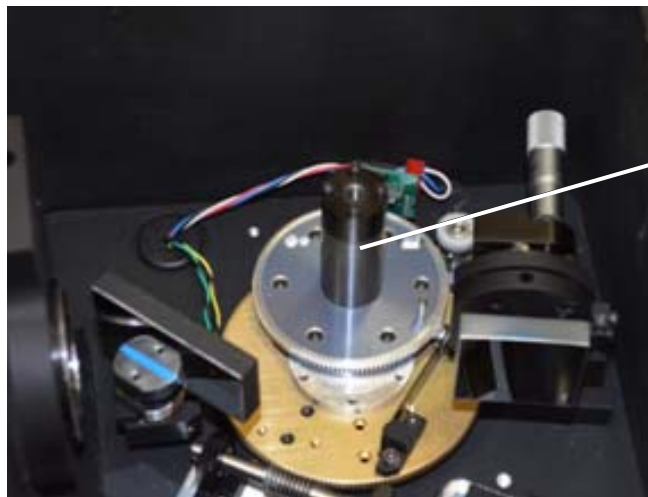
Observe proper optical handling procedures.

**REFERENCES:**

Refer to [Section 4.3, Turret Interchange](#), on page 28 for information about replacing one turret assembly with another.

1. Locate the storage container with the grating turret that is to be installed.
2. Remove the instrument cover screws and remove the cover. Become familiar with the grating spindle and its components shown in [Figure 4-2](#)

Figure 4-2: Grating Spindle



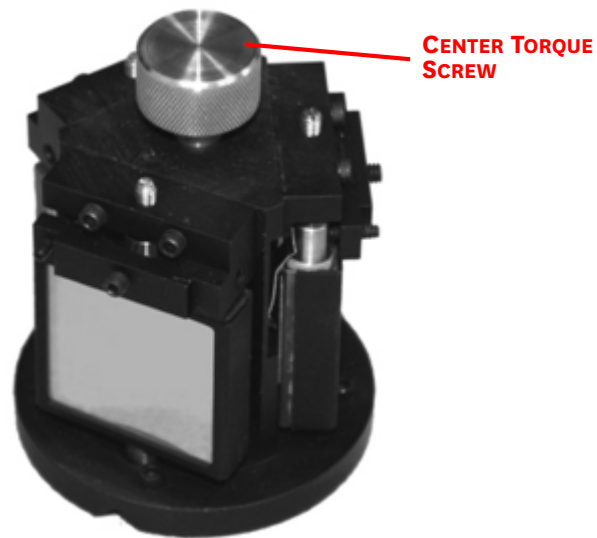
**GRATING
SPINDLE**

4411-0148_0015

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 (approximately 1/2 to 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 4-3](#).

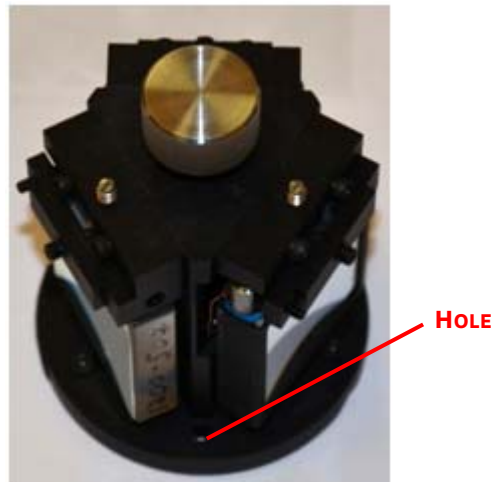
Figure 4-3: Center Torque Screw



4411-0148_0010

5. Locate the hole near the edge between gratings on the grating turret assembly. See [Figure 4-4](#).

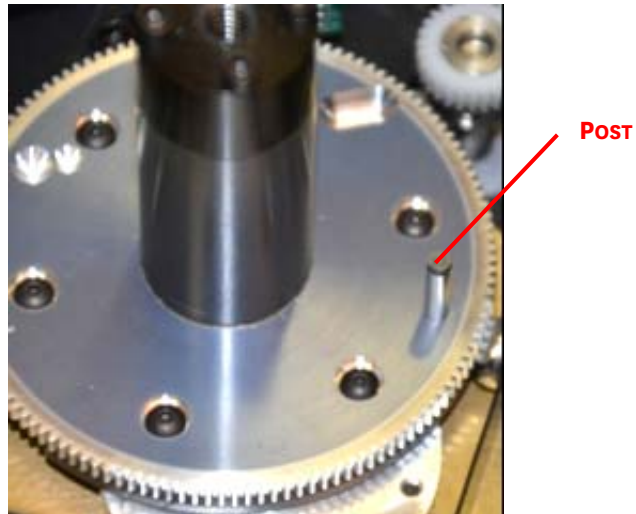
Figure 4-4: Location of Hole on Turret Grating Assembly



4411-0148_0011

6. Locate the vertical post on the Grating Spindle Assembly. See [Figure 4-5](#).

Figure 4-5: Location of Post on Grating Spindle Assembly



4411-0148_0012

7. Carefully lower the turret into the compartment. See [Figure 4-6](#).

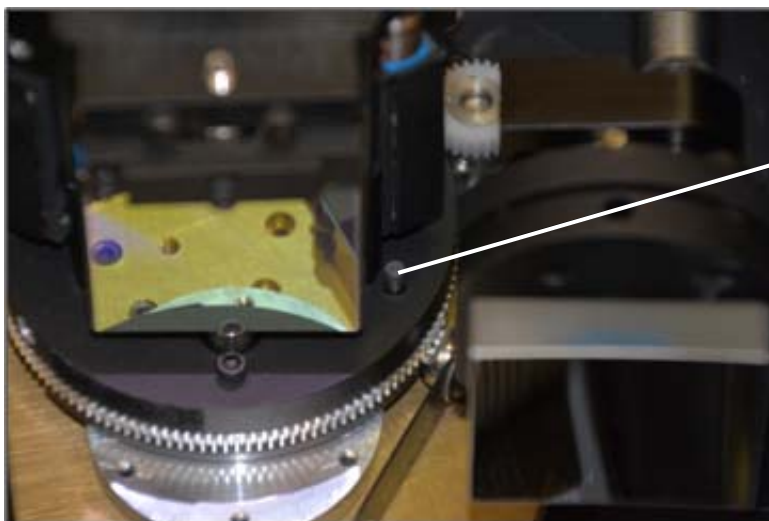
Figure 4-6: Lowering Turret into Turret Compartment



4411-0148_0013

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 4-7](#).

Figure 4-7: Turret Installed with Hole and Post Aligned



POST INSERTED
THROUGH HOLE
IN TURRET ASSEMBLY

4411-0148_0014

9. Verify the turret is properly seated.
10. Tighten the center torque screw until it clicks. This sets the torque on the spindle correctly.



CAUTION!

Do not contact the gratings!



NOTE:

You cannot over tighten this screw. It is designed to slip once the correct torque is attained.

It may be helpful to hold the top triangular plate of the turret to keep it from spinning while tightening the torque screw. Exercise caution when doing this and do not contact the grating surfaces.

11. Place the 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 160. Turn on the IsoPlane 160 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 160 should always be re-started afterwards.

4.2 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 powder free 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 160's turret compartment:



CAUTION!

Observe proper optical handling procedures.

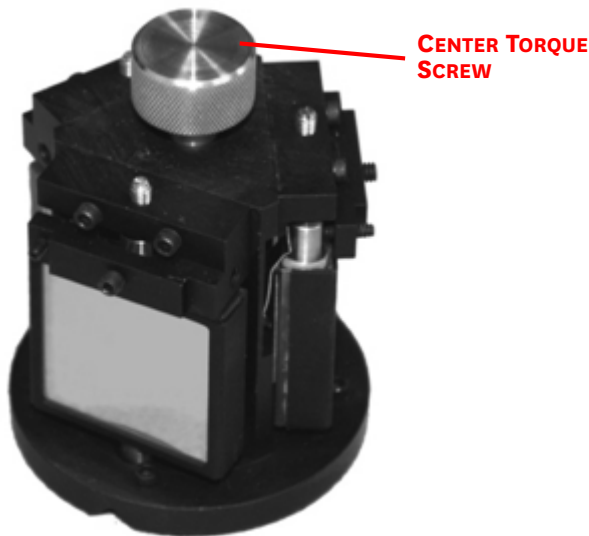
1. Scan the instrument to Grating #1 and a Center Wavelength of 0 nm.
2. Remove the IsoPlane 160's cover.
3. Carefully hand-loosen the center torque screw. See [Figure 4-8](#).



CAUTION!

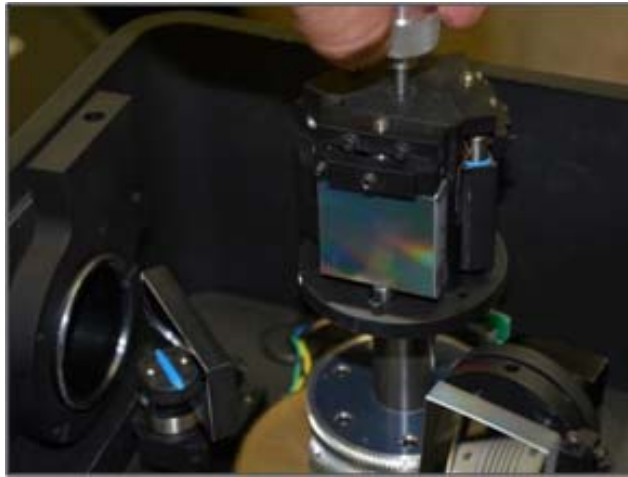
Use extreme care so as not to touch the grating surfaces.

Figure 4-8: 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 4-9](#).

Figure 4-9: Lifting the Grating Turret Out of the Optical Chamber



4411-0148_0016

5. Place the removed grating turret assembly into the original protective container in which it was shipped.
6. If a different turret is not being installed, replace the IsoPlane 160's cover and secure it with the original screws.

4.3 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 160. If the IsoPlane 160 is equipped with only one turret, the information within this section should never be required.

The IsoPlane 160 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 powder free 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. Remove the IsoPlane 160's cover.

4. Loosen the center torque screw. See [Figure 4-10](#).

Figure 4-10: Center Torque Screw



4411-0148_0010

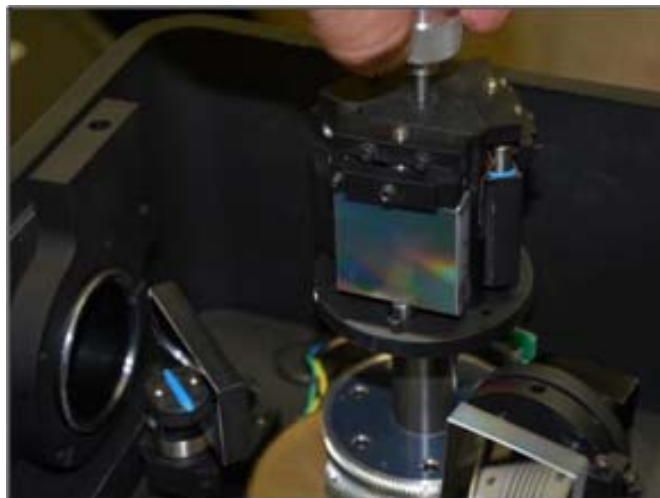


CAUTION!

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 4-11](#).

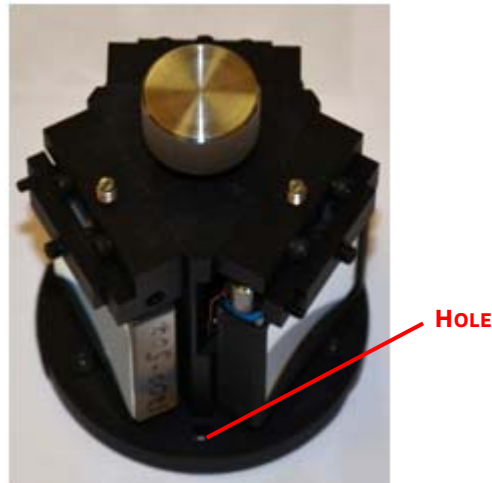
Figure 4-11: Lifting the Grating Turret Out of the Optical Chamber



4411-0148_0016

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. Replace the plastic cover and store the container in a safe place.
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 4-12](#).

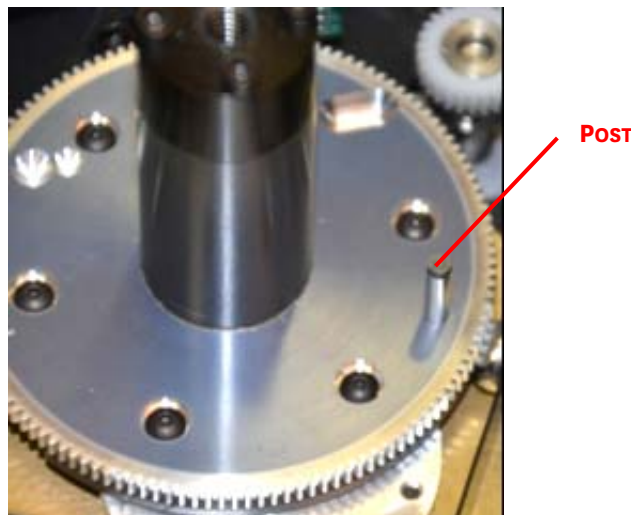
Figure 4-12: Location of Hole on Turret Grating Assembly



4411-0148_0011

10. Locate the vertical post on the grating spindle assembly. See [Figure 4-13](#).

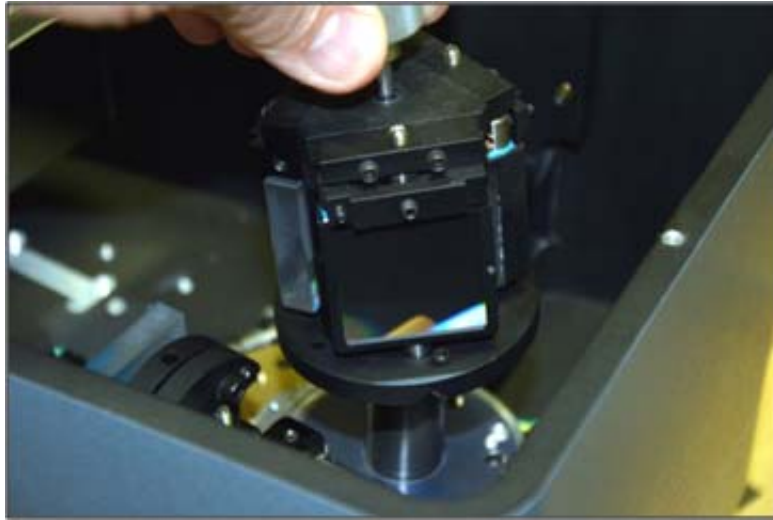
Figure 4-13: Location of Post on Grating Spindle Assembly



4411-0148_0012

11. Carefully lower the turret into the compartment. See [Figure 4-6](#).

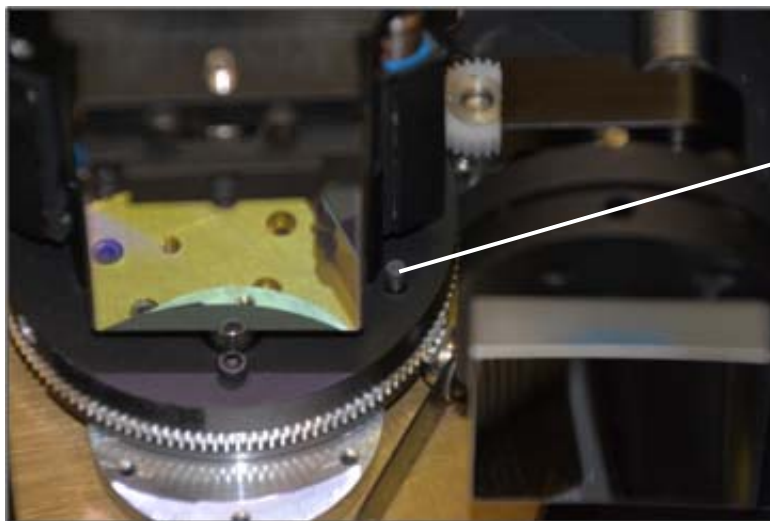
Figure 4-14: Lowering Turret into Turret Compartment



4411-0148_0013

12. Position the grating turret on the grating spindle so the hole in the turret assembly aligns with the post in the turret assembly as shown in [Figure 4-15](#).

Figure 4-15: Turret Installed with Hole and Post Aligned



**POST INSERTED
THROUGH HOLE
IN TURRET ASSEMBLY**

4411-0148_0014

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

**CAUTION!**

Do not contact the gratings!

**NOTE:**

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

15. Place the cover on the spectrograph. Replace and tighten all cover screws.
16. If the IsoPlane 160's power supply is on, restart the IsoPlane 160 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 5: Internal Shutter

The IsoPlane 160 has an optional internal shutter. If the shutter is installed, it is located inside the optics chamber mounted to the spectrograph wall behind the entrance slit. See [Figure 5-1](#).

Figure 5-1: Typical IsoPlane 160 Internal Shutter



4411-0148_0017

The shutter plugs into a keyed 2 pin connector in the floor of the IsoPlane 160 and secures with a single captive screw. The external connector is located at the right side of the exit port and can be connected via a shutter cable to a detector with a SHUTTER connector. See [Figure 5-2](#).

Figure 5-2: IsoPlane 160 SHUTTER Port



4411-0148_0018

If a detector does not have a SHUTTER connector (e.g., PI-MAX detectors,) the Teledyne 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.



REFERENCES:

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

- [Section 5.1.1, Install an Internal Shutter](#), on page 35,
- [Section 5.1.2, Remove an Internal Shutter](#), on page 36.

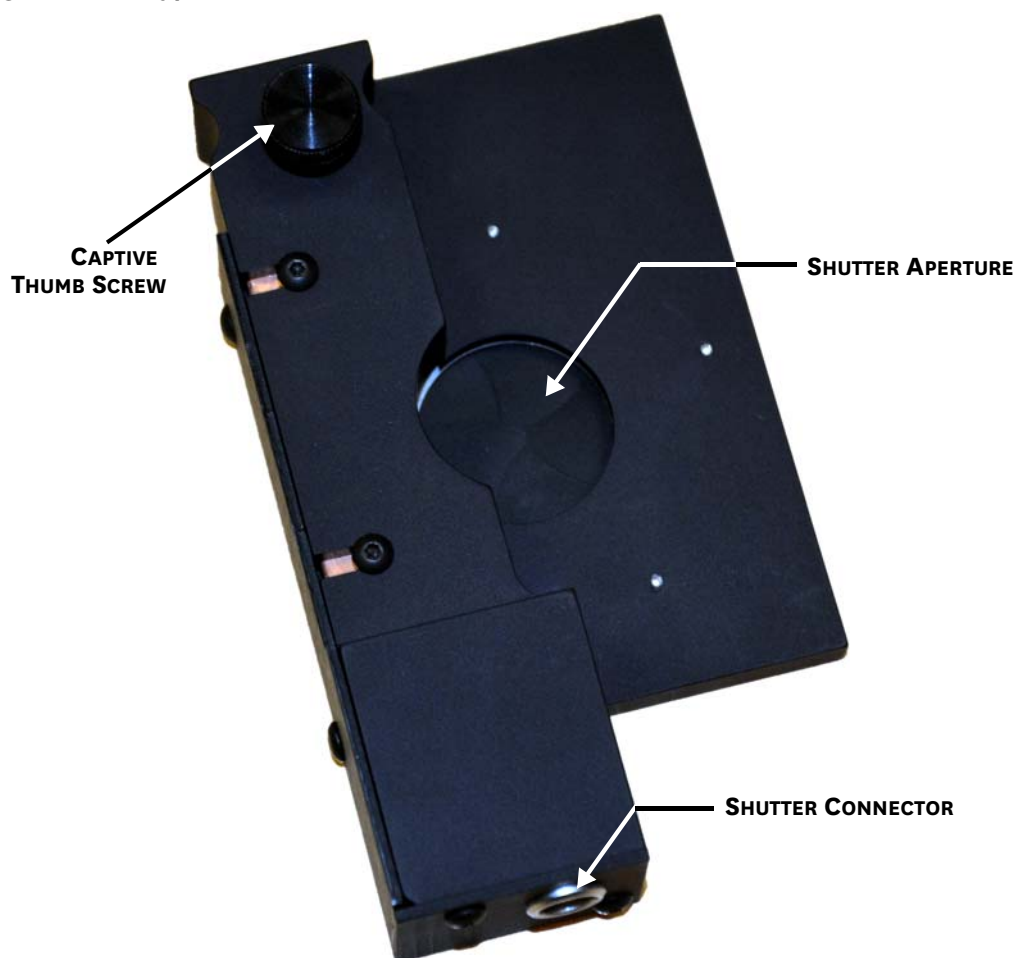
5.1 Internal Shutter Installation/Removal

An IsoPlane 160 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 160, or
- A shutter control box (Model SHC-EXT) available from Teledyne Princeton Instruments.

[Figure 5-3](#) illustrates a typical internal shutter and identifies major components.

Figure 5-3: Typical Internal Shutter



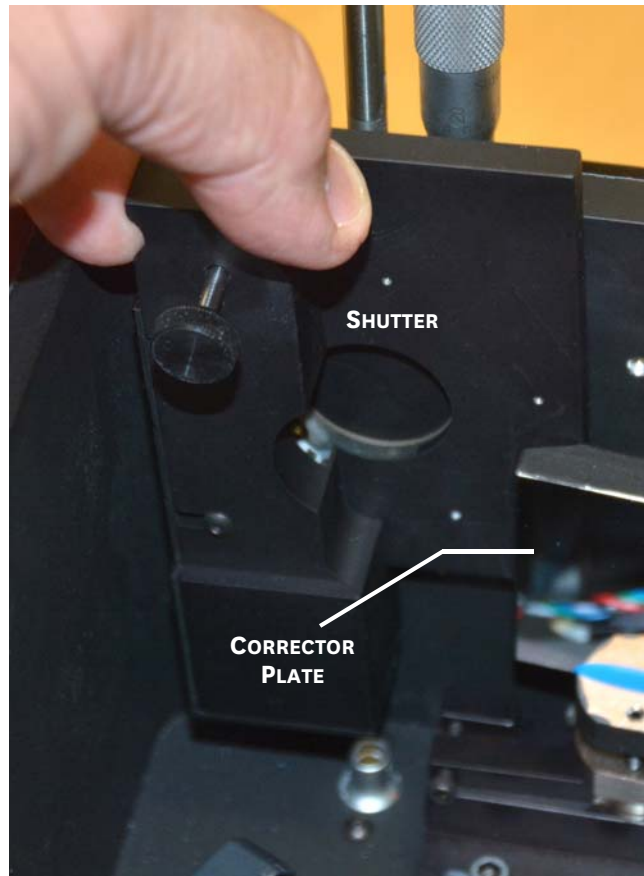
This section provides procedures for the installation and removal of an internal shutter.

5.1.1 Install an Internal Shutter

Perform the following procedure to install an internal shutter:

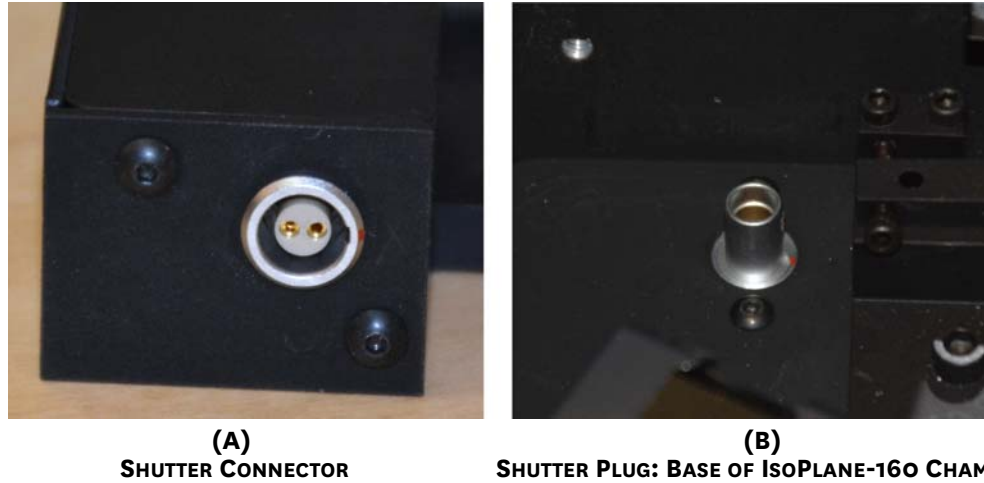
1. Remove the cover from the IsoPlane 160.
2. Carefully insert the shutter assembly behind the corrector plate against the chamber's side wall. See [Figure 5-4](#).

Figure 5-4: Mounting an Internal Shutter Assembly on an IsoPlane 160



3. The shutter includes a 2-pin connector that is designed to insert directly into a plug in the base of the IsoPlane 160's chamber. See [Figure 5-5](#).

Figure 5-5: Connecting Internal Shutter



Perform the following procedure to connect the shutter to the IsoPlane 160:

- a. Align shutter connector on bottom of the shutter ([Figure 5-5](#), view A,) with the plug in the base of the IsoPlane 160 optical chamber ([Figure 5-5](#), view B).
- b. Carefully press the shutter into position.



CAUTION!

Do not apply excessive force to press the shutter into place.

4. Tighten the red captive thumb screw on the shutter assembly to secure the shutter to the interior side wall of the IsoPlane 160's chamber.
5. Replace the cover on the IsoPlane 160.

5.1.2 Remove an Internal Shutter

When using a PI-MAX detector (or other detector without an external shutter control connector) and the IsoPlane 160 has an internal shutter, it is necessary to either remove the shutter or control the shutter via a Teledyne 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 160:

1. Remove the cover from the IsoPlane 160.
2. Loosen the red captive thumbscrew.
3. Carefully remove the shutter by sliding it out vertically from within the IsoPlane 160's optical chamber.



CAUTION!

Do not contact the shutter blades.

4. Replace the IsoPlane 160's cover.
5. Store the shutter in a safe location.

Chapter 6: IsoPlane 160 Setup

This chapter provides information about the initial setup and configuration of an IsoPlane 160 spectrograph.



REFERENCES:

For information about the operation of an IsoPlane 160 spectrograph with data acquisition software, refer to:

- [Chapter 7, Operation with LightField](#), on page 47.
- [Chapter 8, Operation with WinSpec](#), on page 53.

When using different application software, refer to the manufacturer's user's manual and/or help file.

6.1 Unpack and Inspect Equipment

Carefully unpack and examine the IsoPlane 160 and all purchased accessories.



NOTES:

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

6.2 Initial Setup Procedure

Perform the following procedure to setup the IsoPlane 160 for the first time:

1. Position the IsoPlane 160 where it will be used.
2. Connect the power supply shipped with the IsoPlane 160 to the POWER connector located on the side of the IsoPlane 160. See [Figure 6-1](#).

Figure 6-1: External Connector Panel



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

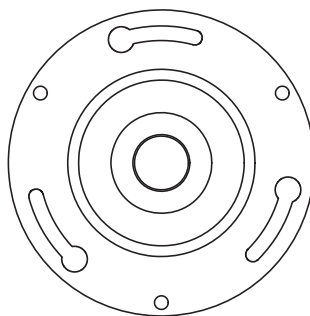
3. With the power supply switch in the off position, connect the line cord provided with the IsoPlane 160 to the power supply and the AC line. The power supply will operate with line voltages between 100 V_{AC} and 240 V_{AC}, 50/60 Hz.
4. The IsoPlane 160 is designed to be controlled primarily through Teledyne Princeton Instruments' LightField® or WinSpec data acquisition and control software when operated with a Teledyne Princeton Instruments detector. Connect the USB port of the IsoPlane 160 to the USB port on the control computer using the USB cable provided.

5. Install the grating turret that has been shipped in the same shipping box with the IsoPlane 160 but is packaged outside the IsoPlane 160 housing to protect the gratings during shipment. Refer to [Section 4.1, Turret Installation](#), on page 21 for complete installation information.
6. Turn on the power switch on the IsoPlane 160 power supply and the IsoPlane 160 should initialize to zero wavelength. Refer to [Chapter 7, Operation with LightField](#), on page 47 for complete information about operating the IsoPlane 160 using Teledyne Princeton Instruments' software.

6.3 Array Detector Mounting Instructions

The standard sliding tube adapter accommodates detectors with a slotted flange (see [Figure 6-2](#)) or mounting holes aligned on a 3.60" bolt circle pattern.

Figure 6-2: Typical Slotted Flange



4411-0148_0024

The adapter includes three (3) equally spaced #10-32 tapped holes on a 3.60" bolt circle designed to accept #10-32 hex head screws. [Figure 6-3](#) shows a typical IsoPlane 160 sliding tube.

Figure 6-3: IsoPlane 160 Sliding Tube



4411-0148_0023

Refer to the following sections for specific mounting procedures:

- [Section 6.3.1, Standard Spectroscopy Mount](#);
- [Section 6.3.2, PyLoN or Spec-10](#);
- [Section 6.3.3, C-Mount Detectors](#).

6.3.1 Standard Spectroscopy Mount

A sliding tube camera adapter is located at the exit port of the IsoPlane 160. The sliding tube is designed for detectors without shutters. The adapter includes a spacer that must be used with the following cameras:

- PIXIS;
- ProEM-1600;
- NIRvana;
- PyLoN.

**NOTE:**

When using a PI-MAX camera, remove the spacer using a 5/32" hex wrench.

Perform the following procedure to mount a compatible camera to the IsoPlane 160 using the standard spectroscopy mount:

1. Remove the shipping cover from the sliding tube.
2. If the detector uses a three-slotted flange (3.60" bolt circle, as shown in [Figure 6-2](#)), screw three (3) #10-32x $\frac{1}{2}$ hex head bolts into the sliding tube, making sure $\frac{1}{4}$ -inch of thread remains exposed.
3. Mount the detector to the sliding tube.
4. Tighten all bolts using a 5/16-inch open end wrench.
5. Insert the sliding tube into the IsoPlane 160 and secure the split clamp. The detector should be upright.

6.3.2 PyLoN or Spec-10

If the detector is a PyLoN or SPEC-10 LN detector without shutter, the shroud at the front of the detector must be removed and mounted to the plate. The shroud must then be attached to the detector.

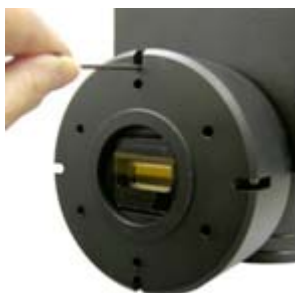
**NOTE:**

It may be easier to remove the sliding tube from the IsoPlane 160 for this operation.

Perform the following procedure to mount a PyLoN, Spec-10, or other shutterless array detector to an IsoPlane 160:

1. 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. See [Figure 6-4](#).

Figure 6-4: Removing Shroud from Nose of a Shutterless Detector



2. Carefully slide the shroud off.
3. Remove the sliding tube from the IsoPlane 160.

**NOTE:**

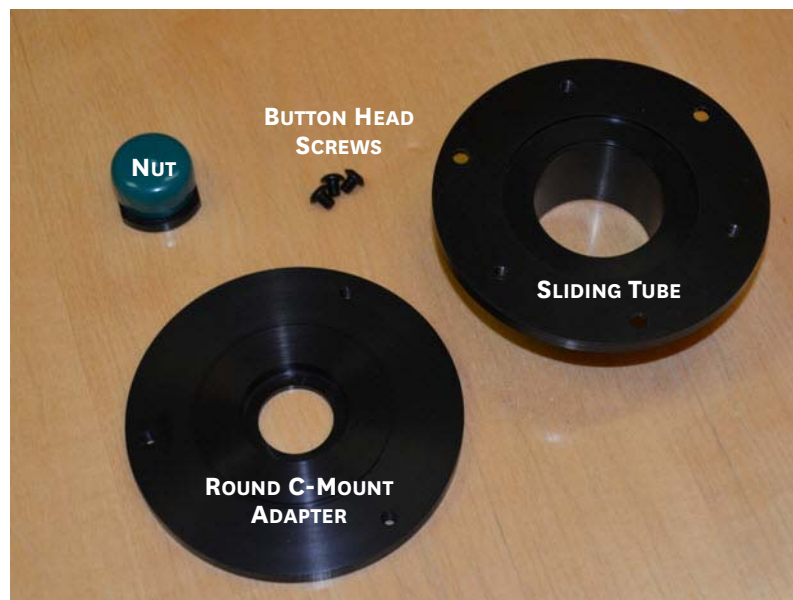
Keep the spacer on the sliding tube for PyLoN and Spec-10 cameras.

4. Place the front of the shroud against the front of the sliding tube and orient the nose so that the appropriate hole pattern matches the mounting holes on the sliding tube.
5. From the inside of the shroud screw three (3) 10-32 x 1/4", flathead stainless steel screws through the shroud and into the sliding tube.
6. Carefully mount the shroud and sliding tube assembly onto the front of the detector and re-secure the shroud with the previously removed four (4) socket head screws.
7. Insert the sliding tube to the IsoPlane 160 and secure the split clamp. The detector should be upright.

6.3.3 C-Mount Detectors

Figure 6-5 identifies the items included in the C-Mount adapter kit.

Figure 6-5: Typical C-Mount Adapter Kit with Sliding Tube



4411-0148_0026

Perform the following procedure to mount cameras using a C-mount:

1. Remove the shipping cover from the sliding tube.
2. Remove the sliding tube from the IsoPlane 160.
3. It is strongly recommend that the round C-Mount adapter be attached to the camera first using the nut provided.

4. From the rear of the sliding tube, attach the camera/C-Mount adapter assembly to the sliding tube using the three (3) #10-32 button head screws provided in the kit. See [Figure 6-6](#) (camera has not been attached to the C-mount adapter in this view.)

Figure 6-6: Attaching C-Mount Adapter to the Sliding Tube



4411-0148_0027

5. Insert sliding tube with camera into the IsoPlane 160 and secure the split clamp. The detector should be upright.

6.4 Single Point Detectors

Single point detectors (e.g., the PD-438,) mount directly to the optional exit slit of the IsoPlane 160 monochromator.

Perform the following procedure to mount a single point detector to an IsoPlane 160:

1. Position the detector so the label is upright



NOTE:

The optical axis is not vertically centered.

2. Mount the detector directly to the exit slit assembly so the four mounting holes align correctly with the tapped mounting holes of the slit assembly.
3. Insert the four (4) #8-32 mounting screws and use a 9/64-inch hex wrench to tighten each of the screws.
4. The detector is now mounted correctly.

6.5 Focus the Spectrometer

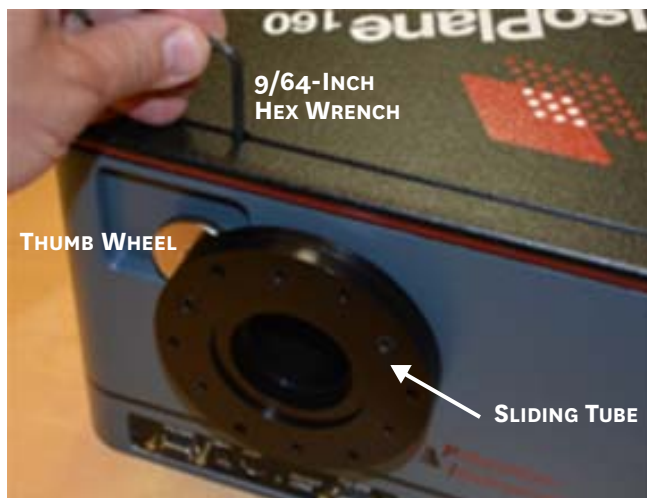
This procedure assumes:

- An array detector has been mounted to the exit port of the spectrograph, and
- There is a light source at the entrance port. Teledyne Princeton Instruments' IntelliCal Dual Hg/NeAr Source is recommended.

Perform the following procedure to focus the IsoPlane 160 spectrometer:

1. Loosen the split clamp using a 9/64-inch hex wrench. See [Figure 6-7](#).

Figure 6-7: Focusing an IsoPlane 160 Spectrometer



4411-0148_0028

2. Launch the application software.



REFERENCES:

For additional information and procedures, refer to:

- [Chapter 7, Operation with LightField](#), on page 47.
- [Chapter 8, Operation with WinSpec](#), on page 53

When using different application software, refer to the manufacturer's user's manual and/or help file.

3. While continuously acquiring data from a spectral line source, adjust the sliding tube (identified in [Figure 6-7](#),) until the half width of the peak is at a minimum. Use the thumb wheel (identified in [Figure 6-7](#),) to help set the correct focus position.



NOTE:

As focus improves, the intensity of the spectral line will increase. It is important to adjust the acquisition time to keep the entire spectral line on scale.

4. Tighten the split clamp when the best focus has been achieved.



NOTE:

It is recommended that the thumb wheel remain in place against the sliding tube to act as a focus stop when performing rotational adjustments described in [Section 6.6, Rotational Alignment](#).

6.6 Rotational Alignment

This procedure assumes:

- An array detector has been mounted to the exit port of the spectrograph.
- There is a light source at the entrance port. Teledyne Princeton Instruments' IntelliCal Dual Hg/NeAr source is recommended.
- The system has been successfully focused. Refer to [Section 6.5, Focus the Spectrometer](#), on page 42.

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.



REFERENCES:

For additional information and procedures, refer to:

- [Chapter 7, Operation with LightField](#), on page 47.
- [Chapter 8, Operation with WinSpec](#), on page 53.

When using different application software, refer to the manufacturer's user's manual and/or help file.

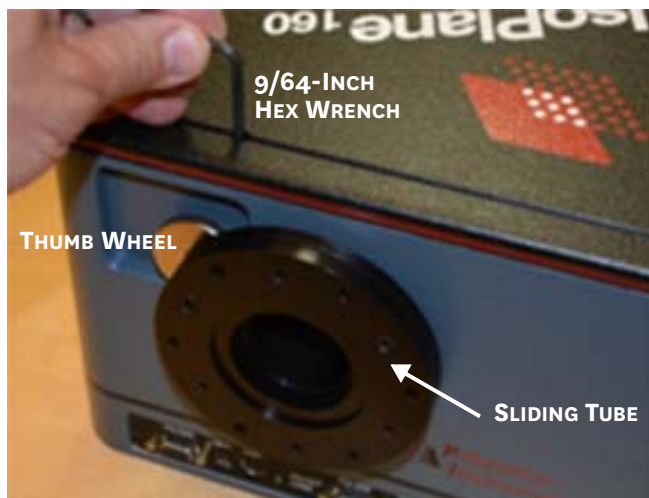
5. Loosen the split clamp sufficiently so that the detector can be rotated. See [Figure 6-8](#).



NOTE:

Keep the thumb wheel against the sliding tube to maintain focus while adjusting rotation.

Figure 6-8: Rotationally Aligning an IsoPlane 160 Spectrometer



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 parallel to the CCD's pixel columns.
9. Tighten the split clamp.
10. Confirm that the data still show sharp peaks or perpendicular spectral lines.

6.7 Image Plane Offset Adjustment



CAUTION!

This procedure should only be performed by someone experienced in aligning optical components and assemblies.

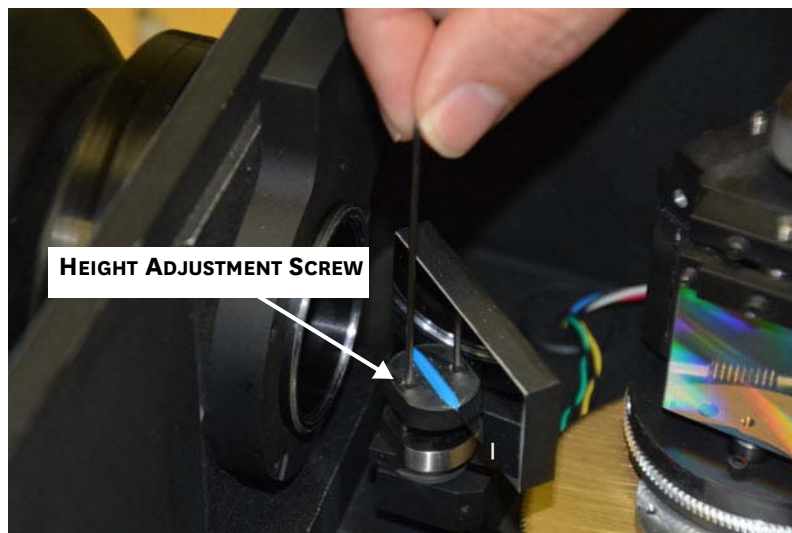
When manufactured, the IsoPlane 160 focal plane is factory-aligned so that it is precisely centered on the optical axis. However, in some instances when a CCD camera is attached, the center pixel of the CCD camera may be located slightly above or below the optical axis of the spectrograph. In most applications this is not critical. However, if it is important that the exit focal plane image be precisely centered on the CCD, the offset of the exit beam can be adjusted.

Preferred methods of adjusting the offset of the exit beam include:

- If an optical fiber and adapter are available that can precisely center the beam at the center of the IsoPlane 160 focal plane, then they can be used as a guide when positioning the exit focal plane.
- If the IsoPlane 160 is equipped with a standard 3 mm manual entrance slit or an optional 3 mm motorized entrance slit, the supplied 4 mm high slit baffle can be installed and the 4 mm high image used as a guide to position the exit focal plane.

However, if the exit beam remains vertically misaligned, additional image offset adjustments can be made by adjusting the Height Adjustment Screw on the Beam-Diverter Mirror (shown in [Figure 2-1](#) on page 11.) [Figure 6-9](#) shows the location of the adjustment screw.

Figure 6-9: Height Adjustment Screw



6.7.1 Precautions



CAUTION!

The IsoPlane 160 cover must be removed in order to make offset adjustments. This exposes the camera to room light and also puts the optics at potential risk if not properly handled.

This procedure requires using tools in very close proximity to the surface of the Exit Beam-Diverter mirror (i.e., ~5 mm.) Exercise extreme care and do not contact the mirror surface as permanent damage will result.

It is imperative that the following guidelines be understood and followed in order to protect IsoPlane 160 optics as well as the camera:

- **NEVER** talk or breathe over the optics or gratings. Moisture or spit from your breath can damage the surface of optics or gratings.
- **NEVER** contact the optics or grating surfaces. This will permanently damage optical surfaces.
- Stop camera acquisition before removing the IsoPlane 160 cover.
Image acquisition must be STOPPED before removing the IsoPlane 160 cover and attempting to make any height adjustments.
This is particularly critical when using an intensified camera that could become damaged if exposed to room light.
Once an offset adjustment has been made, replace the IsoPlane 160 cover and start image acquisition to determine/verify the change in offset on the CCD.
- Light Source: Teledyne Princeton Instruments recommends using a mercury lamp with a center wavelength of 546.075 nm. However, other light sources and center wavelengths can be used,

6.7.2 Required Tools

The following tools are required in order to adjust the offset of the exit beam:

- 1/16-inch hex wrench;
- Screwdriver.

6.7.3 Adjustment Procedure



CAUTION!

The IsoPlane 160 cover must be removed in order to make offset adjustments. This exposes the camera to room light and also puts the optics at potential risk if not properly handled.

This procedure requires using tools in very close proximity to the surface of the Exit Beam-Diverter mirror (i.e., ~5 mm.) Exercise extreme care and do not contact the mirror surface as permanent damage will result.



REFERENCES:

Some steps of this procedure require that the detector be running in imaging mode to acquire an image. For additional information and procedures, refer to:

- [Chapter 7, Operation with LightField](#), on page 47.
- [Chapter 8, Operation with WinSpec](#), on page 53.

When using different application software, refer to the manufacturer's user's manual and/or help file.

Perform the following procedure to adjust the offset of the exit beam on the image plane:

1. Launch the data acquisition software and acquire an initial image of the light source.
2. Make note of the current image position.
3. Halt image acquisition.
4. Remove the IsoPlane 160's cover and locate the height adjustment screw (see [Figure 6-9](#) on page 44.)
5. Use the 1/16-inch hex wrench to turn the height adjustment screw no more than 1/8-turn **clockwise**.



NOTE:

The exact amount of screw rotation required depends on how large the offset is. Teledyne Princeton Instruments recommends making a series of small screw rotational adjustments in order to avoid equipment damage.

6. Replace the IsoPlane 160's cover.
7. Acquire another image, and determine the new offset level.
 - If the offset has been reduced but additional adjustments are necessary, repeat step 3 through step 7 until the image is adequately centered on the CCD.
 - If the offset has increased or the image has overshot the center of the CCD, perform step 3 through step 7 but instead, turn the height adjusting screw **counterclockwise**.
8. Once the image is adequately centered on the camera's CCD, replace the IsoPlane 160's cover and secure it with the appropriate hardware.

Chapter 7: Operation with LightField

This chapter provides general information and procedures necessary to operate an IsoPlane 160 and Teledyne Princeton Instruments detector with LightField data acquisition software.



NOTE:

LightField 4.8 or higher is required for operation of the IsoPlane 160.

The IsoPlane 160 incorporates new firmware that dramatically improves wavelength scanning accuracy and repeatability. This firmware update works seamlessly with all Teledyne Princeton Instruments software. However it may not be compatible with other manufacturers' systems. Please contact Teledyne Princeton Instruments with any questions.

For complete information about using LightField, refer to the release-specific LightField User's Manual listed in [Table 1-1](#) on page 7.

7.1 System Setup and Initialization



NOTE:

Before launching LightField, verify that:

- The detector is mounted to the IsoPlane 160.
- The detector and IsoPlane 160 are connected to the computer via appropriate communications cables.
- The detector and IsoPlane 160 are powered on.

When power is turned on, the IsoPlane 160 initializes to a wavelength of 0.0 nm for grating number 1. If power to the IsoPlane 160 is cycled, it reinitializes. Initialization gives the system a reference, or starting position, to keep track of wavelength position, grating location, and other parameters.

After verifying that the detector and IsoPlane 160 are both connected to the host computer and are turned on, launch LightField. When LightField boots it will look for available devices and will load their icons in the Available Devices panel. Before designing a new experiment or running 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 160 is the only device in the Experiment Devices panel, the Spectrograph expander is the only expander shown. Once a detector is dragged into the panel, the Calibration expander and all detector- related

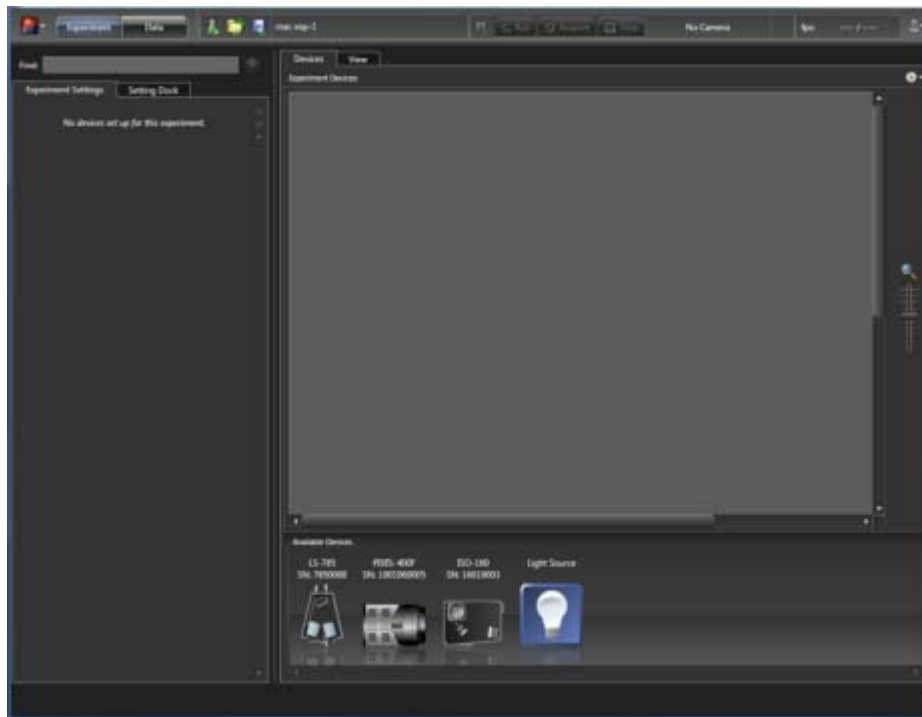
expanders are displayed.

7.2 Define the Detector and Spectrograph

Perform the following procedure to define the IsoPlane 160 and a corresponding detector:

1. After LightField has been launched, icons representing the IsoPlane 160 and detector should be visible within the Available Devices area.
In [Figure 7-1](#), the detector is labeled PIXIS:400F and the IsoPlane 160 is labeled ISO-160.

Figure 7-1: Typical LightField Available Devices Panel



4411-0148_0030

2. Drag these icons into the Experiment Devices area.
3. Move the detector to the exit port location of the IsoPlane 160 icon.



NOTE:

The display for the interface between the detector and IsoPlane 160 turns green and the camera automatically orients itself to the exit port of the IsoPlane 160 when the mouse is released.

4. Drag the Light Source icon from the Available Devices panel to the Experimental Devices panel.

5. Drag the light source icon to the entrance port of the IsoPlane 160. Again, the interface will turn green and when the mouse is released, a representation of rays will fill the spectrograph. See [Figure 7-2](#).

Figure 7-2: Typical LightField Experiment Devices Panel: Detector, IsoPlane 160, Light Source



4411-0148_0031

6. 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.
7. On the Shutter expander, select Shutter Mode: Normal.
8. Open the Spectrometer expander and select the appropriate grating. See [Figure 7-2](#). In this example, the 1200 g/mm, Blaze: 500 grating has been selected and the center wavelength has been set to:
 - 435.8 nm for a Mercury lamp, or
 - 0.0 nm for a broadband source.



NOTE:

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 435.8 nm as the spectral line.

7.3 Focus

Perform the following procedure to focus the system:

1. Mount a light source (e.g., a Teledyne Princeton Instruments IntelliCal dual Hg/NeAr source,) in front of the entrance slit.
2. With the IsoPlane 160 properly connected to the computer, turn on the power and wait for the spectrograph to initialize.
3. With the detector (e.g., a PIXIS,) mounted to the spectrograph and connected to the computer, turn power on and wait for the detector to initialize.
4. If necessary, launch LightField.
5. Drag the icons for the PIXIS and the IsoPlane 160 into the Experiment Devices area.
6. Configure the spectrograph as follows:
 - When using a mercury source, configure the spectrograph to 435.8 nm.
 - When using a broadband source, configure the spectrograph to 0.0 nm.
7. Using a 9/64" hex wrench, loosen the split clamp. See [Figure 7-3](#).

Figure 7-3: Focusing an IsoPlane 160 Spectrometer



4411-0148_0028

8. Wait until the detector locks at its default temperature.
9. Click Run and, while continuously acquiring data, adjust the sliding tube until the intensity level of a selected peak (or peaks) has been maximized. Use the thumb wheel to assist in focus adjustments.
10. Keep the thumb-wheel against the sliding tube to allow rotational adjustments without changing focus.

7.4 Rotational Alignment

Perform the following procedure to rotationally align the system:

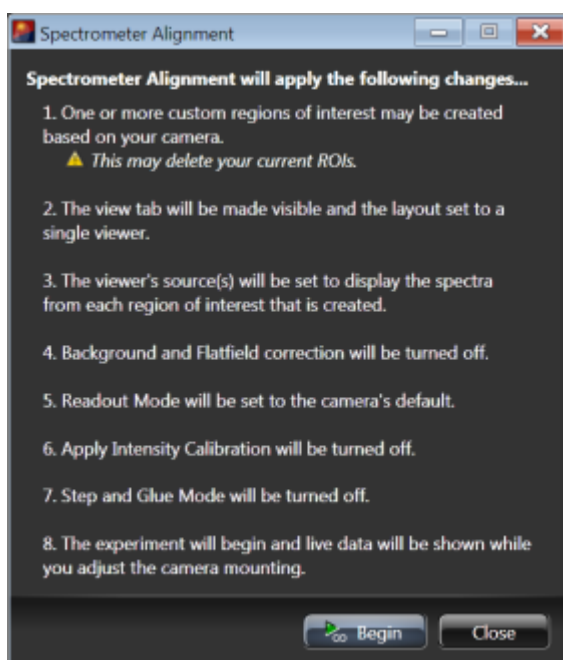
1. If not already loose, use a 9/64" hex wrench to loosen the split clamp. See [Figure 7-3](#).
2. While watching a live display of the spectrum, choose a peak to monitor and then rotate the detector. The peak will go from broad to narrow and back to broad. Leave the detector rotation set for the narrowest achievable peak.

Two alternate methods of rotationally aligning the system are also supported:

- After acquiring an image, display the horizontal and vertical cursor bars. Compare the vertical bars with the line shape on the screen. Rotate the detector until the line shape on the screen is parallel with the vertical bars.
- Select Experiment Menu ► Align Spectrometer.

The Spectrometer Alignment dialog, illustrated in [Figure 7-4](#), is displayed. It 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 7-4: Typical Spectrometer Alignment Dialog



4411-0148_0032

3. Once the system has been rotationally aligned, halt data acquisition.
4. Tighten the sliding tube.

The system is now ready for experiment design, configuration, and data acquisition.



REFERENCES:

For complete information about using LightField, refer to the release-specific LightField User's Manual listed in [Table 1-1](#) on page 7.

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Chapter 8: Operation with WinSpec

This chapter provides general information and procedures necessary to operate an IsoPlane 160 and Teledyne Princeton Instruments detector with WinSpec data acquisition software.



NOTE:

The IsoPlane 160 incorporates new firmware that dramatically improves wavelength scanning accuracy and repeatability. This firmware update works seamlessly with all Teledyne Princeton Instruments software. However it may not be compatible with other manufacturers' systems. Please contact Teledyne Princeton Instruments with any questions.

For complete information about using WinSpec, refer to the WinSpec User's Manual listed in [Table 1-1](#) on page 7.

8.1 System Setup and Initialization



NOTE:

Before launching WinSpec, verify that:

- The detector is mounted to the IsoPlane 160.
 - The detector and IsoPlane 160 are connected to the computer via the appropriate communications cables.
 - The detector and IsoPlane 160 are powered on.
-

When power is turned on, the IsoPlane 160 initializes to a wavelength of 0.0 nm for grating number 1. If power to the IsoPlane 160 is cycled, it reinitializes. Initialization gives the system a reference, or starting position, to keep track of wavelength position, grating location, and other parameters.

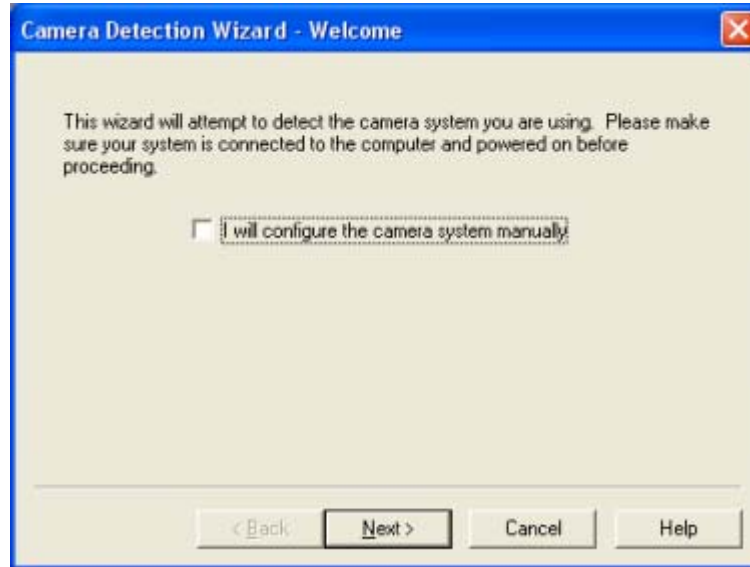
After verifying that the detector and IsoPlane 160 are both connected to the host computer and are turned on, launch WinSpec. WinSpec should automatically identify the detector that is to be used, and a dialog for selecting the detector for the experiment should be displayed. In addition, WinSpec must be instructed/configured to use IsoPlane 160.

8.2 Select the Detector

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 are 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 check box unselected and click Next >. See [Figure 8-1](#).

Figure 8-1: Typical Camera Detection Wizard: Welcome Dialog



4411-0148_0033

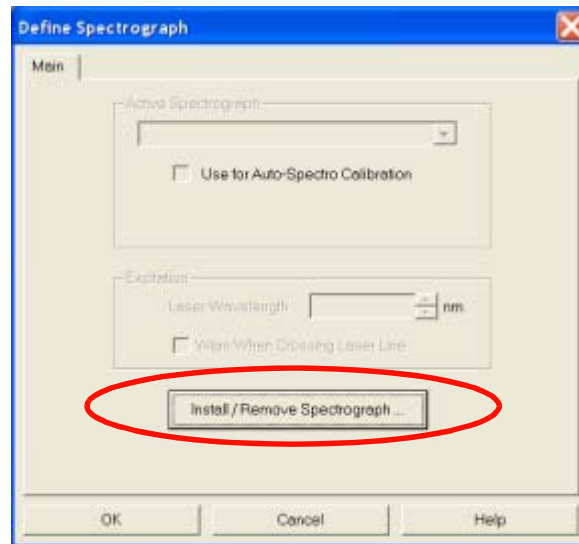
3. Follow the instructions on the dialogs to complete the initial hardware setup. The wizard enters default parameters on the Hardware Setup dialog tabs and provides an opportunity to acquire a test image to verify that the system is working properly.

8.3 Define the Spectrograph

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

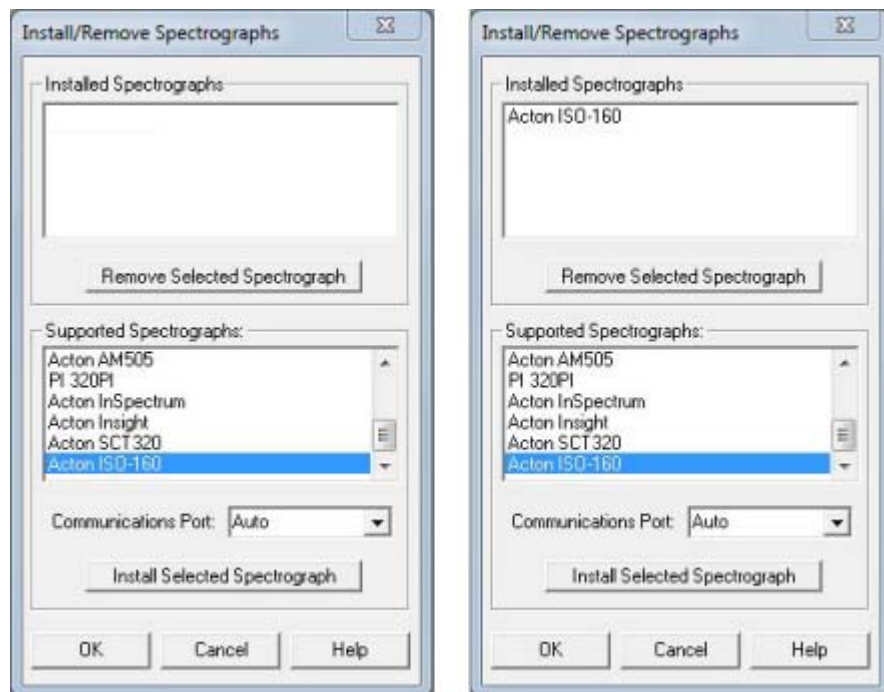
1. From the application's menu bar, open the Spectrograph menu and select Define.
2. On the Define Spectrograph dialog, click on the Install/Remove Spectrograph button. See [Figure 8-2](#).

Figure 8-2: Typical Define Spectrograph Dialog



3. On the Install/Remove Spectrograph dialog, scroll through the list of supported spectrographs, select Acton 160, click Install Selected Spectrograph, and click OK to return to the Define Spectrograph dialog. See [Figure 8-3](#).

Figure 8-3: Typical Install/Remove Spectrograph Dialogs

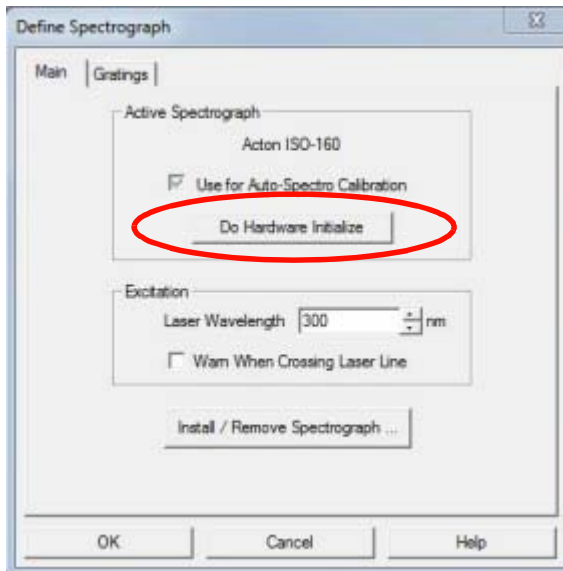


4411-0148_0034

4411-0148_0035

4. To verify that WinSpec recognizes the specified spectrograph, click Do Hardware Initialize. The turret should be heard moving.

Figure 8-4: Typical Define Spectrograph Dialog: Acton IsoPlane 160 Active



4411-0148_0036

5. Once the spectrograph has been identified within WinSpec, the next step is to align the spectrograph optics to the detector. Proceed to [Section 8.4, Alignment](#), on page 57.

8.4 Alignment

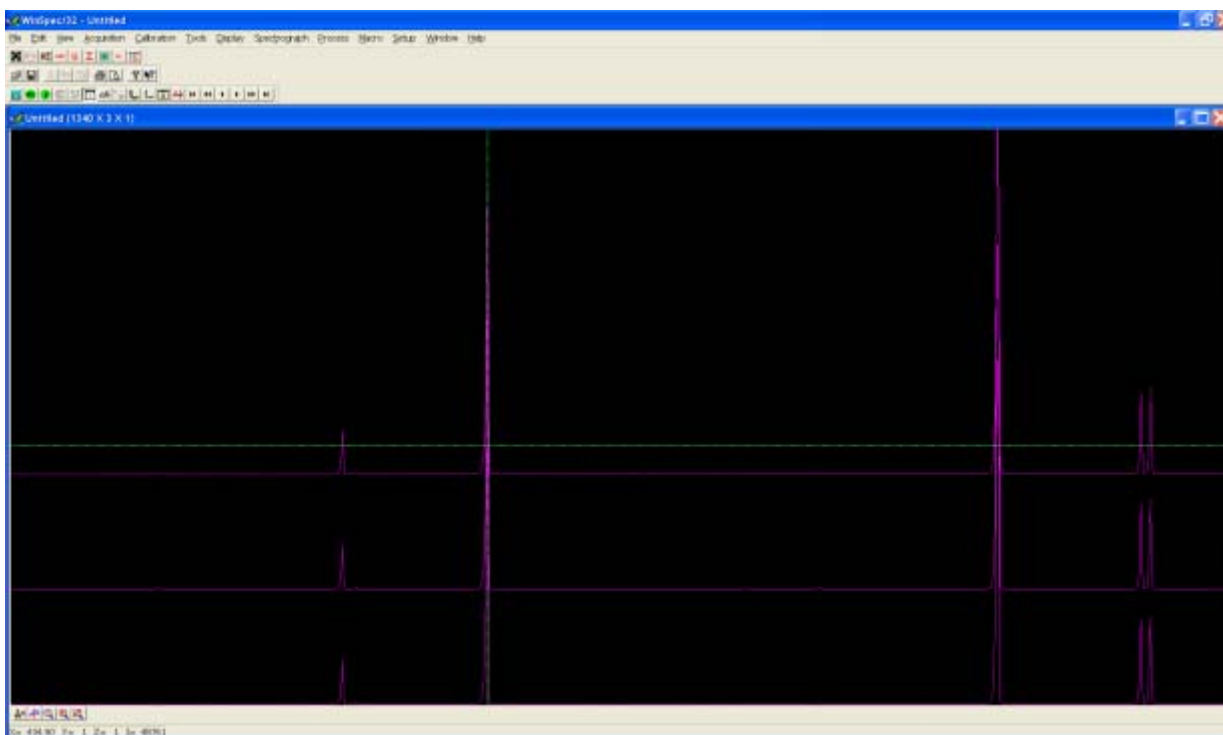
The initial alignment procedure described in this section assumes:

- 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 8-5 illustrates a properly aligned system.

Figure 8-5: Typical WinSpec Rotational Alignment View



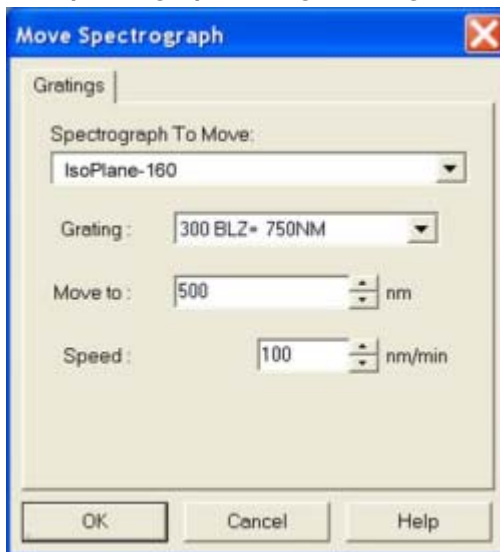
4411-0148_0037

Perform the following procedure to rotationally align the system:

1. Mount a light source (e.g., a Teledyne Princeton Instruments IntelliCal HG/NeAr Dual 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 8-6](#).

Figure 8-6: Typical Move Spectrograph Dialog: Gratings Tab



4411-0148_0038

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.
5. Use a 9/64-inch hex wrench to loosen the split clamp. See [Figure 8-7](#).

Figure 8-7: Loosening the Split Clamp



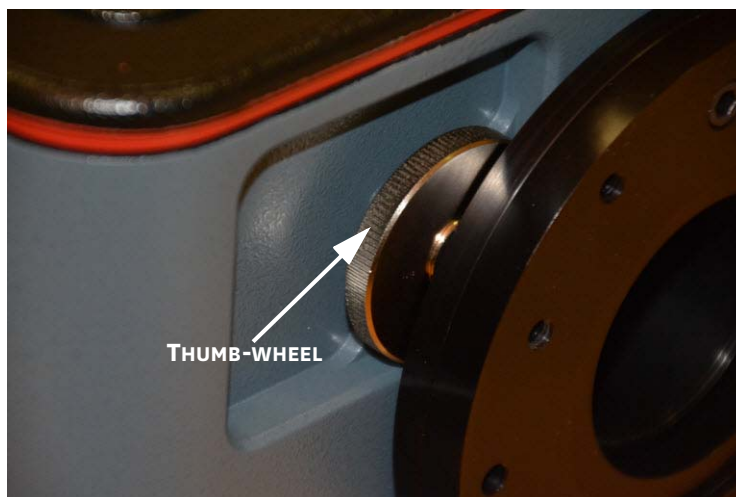
4411-0148_0039

6. Turn on Focus mode.
7. While continuously acquiring data, adjust the sliding tube until the intensity level of a selected peak (or peaks) has been maximized.

**NOTE:**

Use the thumb-wheel to assist in changing the focus position of the sliding tube. See [Figure 8-8](#).

Figure 8-8: Typical IsoPlane 160 Thumb-wheel



4411-0148_0040

8. Next adjust the CCD rotation. The thumb-wheel acts as a focus-stop allowing rotation of the camera without changing focus.
 - a. While watching a live display of the spectrum displayed as a graph, select a peak to monitor and then rotate the camera/sliding tube. The peak will go from broad to narrow and back to broad. Adjust the detector rotation for the narrowest achievable peak.
 - b. Alternatively, take an image of the slit at the 435.8 nm mercury wavelength, display the horizontal and vertical cursor bars, and compare the vertical bar with the image on the screen. Rotate the detector until the image on the screen is parallel with the vertical bar.
 - c. Another technique is to set up three (3) 10-row Regions of Interest on the Experiment Setup ► ROIs tab:
 - One at the top of the array;
 - One in the middle of the array;
 - One at the bottom of the array.Configure the data display via 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 on 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.
9. After completing the rotational alignment, tighten the split clamp.
10. Halt camera acquisition.

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Appendix A: Accessories

This appendix provides detailed information about accessories available for use with an IsoPlane 160 system.

A.1 Slit Assemblies

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

Table A-1: Accessories: Slit Assembly

Part Number	Description
SP-716-1	<p>Bilateral Slit Assembly</p> <p>Kinematically mountable bilateral slit assembly that includes a micrometer for continuously variable slit-width settings from 10 μm to 3 mm.</p> <p>The slit height is controlled by a baffle plate allowing standard 4 mm or 14 mm heights.</p> <p>A customized indexable slit is available for those imaging applications that require a larger area than allowed by the entrance slit of the spectrograph.</p>
MS-718-1	<p>Motorized Slit Assembly</p> <p>Self-calibrating, 10 μm to 3 mm adjustable bilateral slit.</p> <p>Stepping-motor-controlled adjustments are made in 1 μm increments over the full range.</p> <p>Full control of the slit, including automated bandpass setting, is integrated into SpectraSense software. Once the slit has been set, it maintains its position even with the power has been turned off.</p>
SPS-718-12	<p>Motorized Slit Assembly</p> <p>10 μm to 12 mm adjustable bilateral slit.</p>

A.2 Triple Grating Turrets

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

Table A-2: Accessories: Triple Grating Turret

Part Number	Description
9000-800-02	Optional second turret for the IsoPlane 160. Requires gratings.
9000-800-03	Optional third turret for the IsoPlane 160. Purchased after optional second turret. Requires gratings.

A.3 Filter Wheels and Order Sorting Filter Assemblies

Refer to [Table A-3](#) for information about available filter wheels and order sorting filter assemblies.

Table A-3: Accessories: Filters

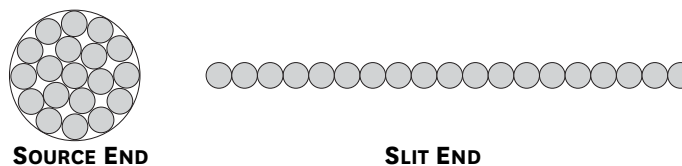
Part Number	Description
FA-2448	<p>Six Position Filter Wheel Assembly</p> <p>Manual sample indexing, holds up to six samples, each of which is 1.0-inches in diameter.</p> <p>Automated via SP Control Cable. Can be used with the IsoPlane 160.</p> <p>Requires:</p> <ul style="list-style-type: none"> • FA-2448-F 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 160.</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.

A.4 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 A-1](#).

Figure A-1: Fiber Optic Light Guide Fiber Configurations



4411-0148_0041

Refer to [Table A-4](#) for information about available fiber optic light guides.

Table A-4: Accessories: Fiber Optics (Sheet 1 of 2)

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 fiber-optic 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-446-021-U	Universal Fiber Adapter Designed to directly couple a fiber to the entrance slit of the IsoPlane 160. Includes X, Y, and Z fiber adjustments, as well as adapters for: <ul style="list-style-type: none"> • 10 mm diameter ferrules; • SMA-905; • FC connectors.

Table A-4: Accessories: Fiber Optics (Sheet 2 of 2)

Part Number	Description
FC-446-030	Imaging Fiber Adapter Designed specifically for Teledyne 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.

A.5 Data Cables

Refer to [Table A-5](#) for information about available cables.

Table A-5: 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 Teledyne Princeton Instruments for information about ordering a custom cable.

Appendix B: RS-232 Interface

This appendix provides information necessary when using the RS-232 interface for communication between the host computer and an IsoPlane 160 system.

B.1 Communication Configuration Settings

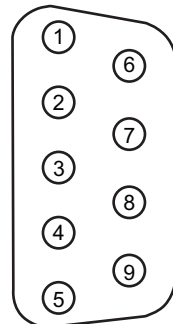
When using RS-232 for communication with the IsoPlane 160 spectrograph, the RS-232 port on the host computer system must be configured as follows:

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

B.2 Custom Cable Information

This section provides the information necessary to build a custom RS-232 cable to be used with an IsoPlane 160 spectrograph.

Figure B-1: DB9 Male Connector Pinout



REAR/CABLE VIEW

[Table B-1](#) provides the pinout information for an RS-232 cable that is to be used with an IsoPlane 160 spectrograph.



NOTE:

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

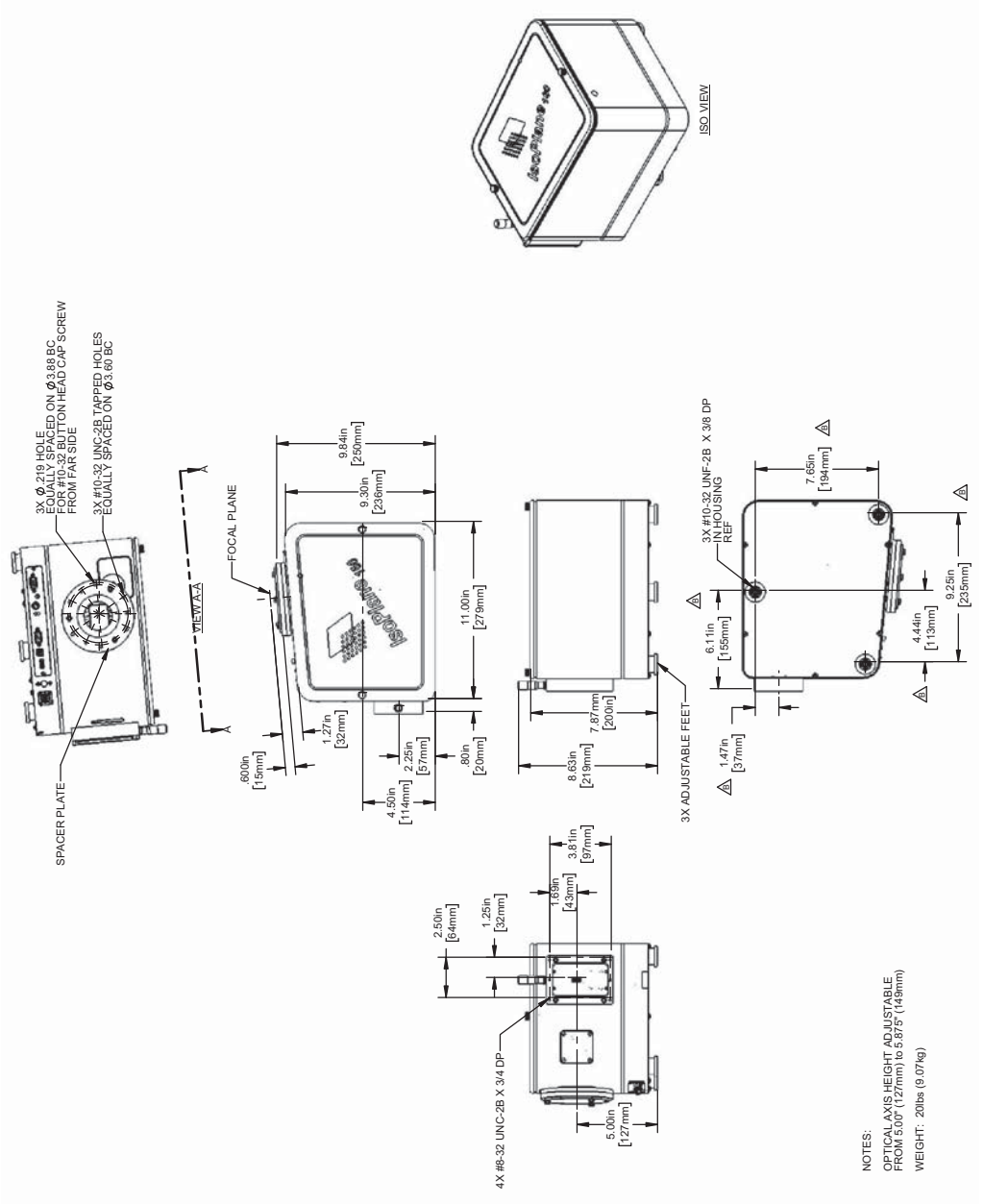
4411-0148_0027

Table B-1: IsoPlane 160 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 C: Outline Drawings

Figure C-1: IsoPlane 160: Outline Drawing



4411-0148_0042

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Warranty and Service

Limited Warranty

Teledyne 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

Teledyne 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, Teledyne 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 Teledyne 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 Teledyne Princeton Instruments authorized representative/distributor for repair information and assistance, or visit our technical support page at www.princetoninstruments.com.

Limited One (1) Year Warranty on Refurbished or Discontinued Products

Teledyne 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, Teledyne 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 Teledyne Princeton Instruments factory or, at our option, a factory-authorized service center. You are responsible for the shipping costs to return the product to Teledyne Princeton Instruments. International customers should contact their local Teledyne 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

Teledyne 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 Teledyne 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

Teledyne 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.

Vacuum Integrity Limited 12 Month Warranty

Teledyne 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. Teledyne 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. *Refer to 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

Teledyne 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. *Refer to 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

Teledyne 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. Teledyne 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. *Refer to Item 12 in [Your Responsibility](#) of this warranty 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 Teledyne 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 Teledyne Princeton Instruments technical support staff or our authorized service representative. *Refer to Item 12 in [Your Responsibility](#) of this warranty 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 Teledyne Princeton Instruments.
2. You must notify the Teledyne 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 Teledyne 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 Teledyne 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 Teledyne Princeton Instruments factory or one of our authorized manufacturer's representatives or distributors.
6. Unless specified in the original purchase agreement, Teledyne 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 Teledyne 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 Teledyne Princeton Instruments factory or a Teledyne 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 Teledyne 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 Teledyne Princeton Instruments factory of purchase, contact your authorized Teledyne Princeton Instruments representative or reseller, or visit our technical support page at www.princetoninstruments.com.

Contact Information

Teledyne Princeton Instruments' manufacturing facility for this product is located at the following address:

Teledyne 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

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