



**Fully Automated
Imaging Spectrometer
User Manual**



Part Number 81092 – Revision 2



HORIBA JOBIN YVON


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Preface

This manual explains how to setup, operate, troubleshoot and maintain your iHR Series Spectrometer and describes all instrument specifications. Information is also provided regarding the minimum requirements necessary for successful operation and optimum performance.

Depending on the purchased system configuration, your system may contain more than one HORIBA Jobin Yvon operating manual. The general guidelines presented below may assist you in finding the specific manual that is the most informative on a particular subject:

- Each manual generally covers a specific product along with the features and accessories particular to and/or contained within that product.
- Accessories that can be applied to other products are normally covered by separate documentation.
- Software that is exclusively used with one instrument or system is covered in the manual for that product.
- Software that can be used with a number of products is covered in its own manual.
- If you are reading about a product that interacts with other products, you will be referred to additional documentation as necessary.

Chapter 1: Instrument Description and Specifications

Introduction

iHR Series spectrometers are automated, triple grating spectrometers available with a 320 mm focal length (f/4.1 aperture) or a 550 mm focal length (f/6.4 aperture). Designed for multi-channel CCD spectroscopy, these spectrometers are ideal for a variety of research applications, including:

- Fluorescence
- Raman Spectroscopy
- Photoluminescence
- Emission
- NIR Spectroscopy
- Microscopy

iHR Series spectrometers feature a 150 nm to 15 μ m wavelength range (depending on the grating and detector used), and excellent wavelength resolution (better than 0.06 nm for the iHR320 and 0.025 nm for the iHR550 using a 1200 gr/mm grating). Other features include high-precision automated slits, a high-precision stepper drive, and a USB 2.0 computer interface.

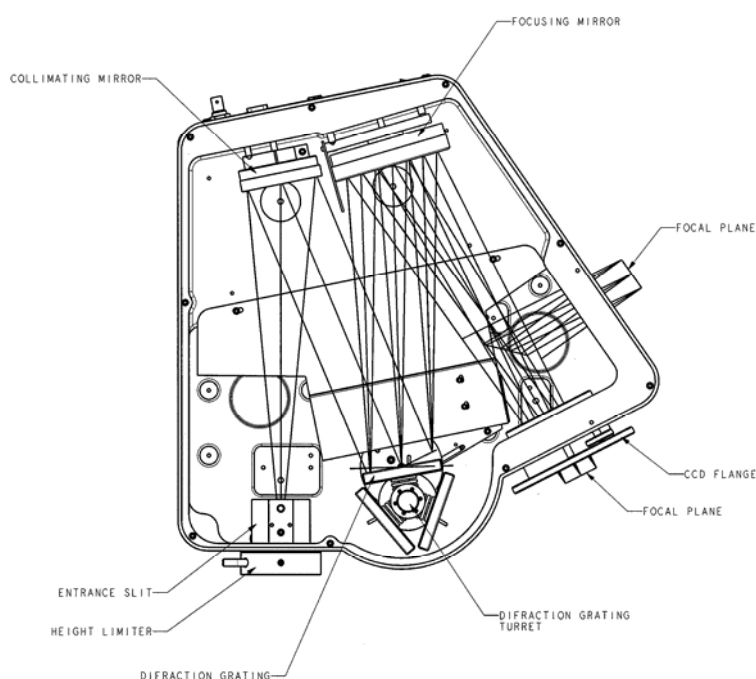
The drive mechanism of the iHR allows for rapid and precise scanning, offering a user selectable step size. The on-axis triple grating turret, mounted on the drive, supports three gratings which are rotated automatically via software.

The iHR may be equipped with an internal, six-position filter wheel accessory. An interface is also provided to support an external filter wheel accessory. Other available options include an internal shutter, and dual multi-channel detector support. Tapped holes located on the entrance and exit slits make the iHR compatible with most HORIBA Jobin Yvon accessories and standard C-mount interfaces.

Table I. iHR320 and iHR550 Specifications

Specifications*			
Model		iHR320	iHR550
Focal Length		320 mm	550 mm
Entrance Aperture Ratio		f/4.1	f/6.4
Spectral Range		150 nm to 1500 nm with 1200 gr/mm grating 150 nm to 40 μ m with additional gratings	
Grating Size		68 mm x 68 mm	76 mm x 76 mm
Number of Gratings on Turret		3	
Flat Field Size		30 mm x 12 mm	
Spectral Resolution		0.06 nm	0.025 nm
Wavelength Position Accuracy		± 0.20 nm	
Wavelength Repeatability		± 0.075 nm	
Spectral Dispersion		2.35 nm/mm	1.37 nm/mm
Magnification		1.1	
Stray Light		5×10^{-4}	1×10^{-4}
Scan Speed (increasing wavelength)		159 nm/s	
Minimum Drive Step Size		0.002 nm	
Computer Interface		USB 2.0 (USB 1.1 Compatible)	
Dimensions	Length	416.97 mm (16.42 in)	647.98 mm (25.51 in)
	Width	421.65 mm (16.60 in)	459.59 mm (18.09 in)
	Height	192.41 mm (7.575 in)	192.51 mm (7.579 in)
	Optical Axis Height	98.43 mm (3.875 in)	
Nominal Weight		20 kg (45 lb)	28 kg (62 lb)

All specifications given for 1200 gr/mm grating at 435 nm. Specifications are subject to change without notice.

**Figure 1.** Optical Design of the iHR320

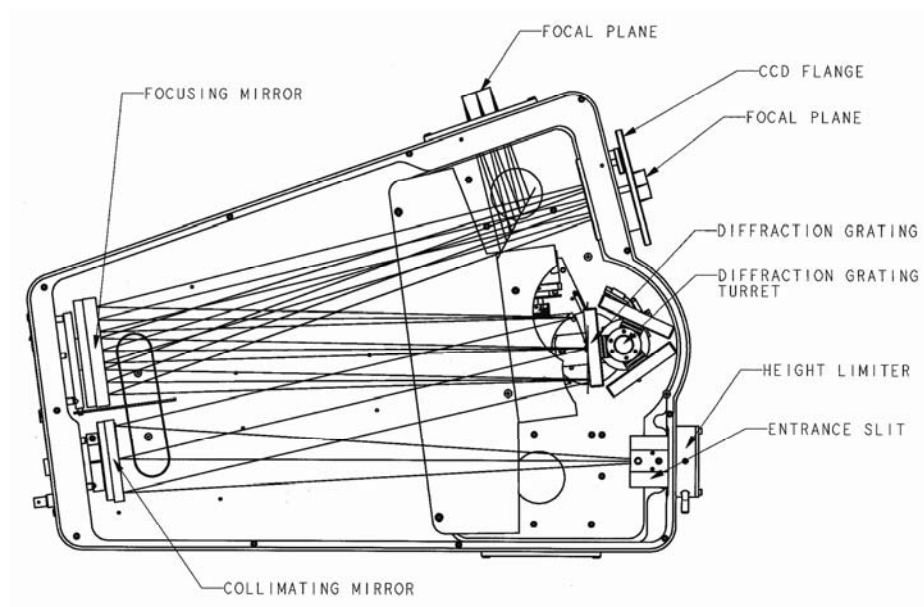


Figure 2. Optical Design of the iHR550

Chapter 2: Instrument Requirements

The iHR has minimum system requirements that are necessary for successful operation and optimum performance. This section covers issues related to instrument attributes such as physical environment, safety and general maintenance.

Input Power Requirements

The iHR operates from a 24 V DC input. This is provided by the universal input (100 V—240 V, 1.6 A), 24 V DC @ 2.1 A output external brick power supply (P/N 964007) supplied with the instrument. The power supply is plugged into a standard wall outlet using a standard three-conductor power cord (P/N 98015 for 110 V or P/N 98020 for 220 V).

Environmental Requirements

The iHR should be placed on a sturdy table or laboratory bench with enough room for any detectors, optional accessories and PC that will be part of the system configuration.

The instrument should be kept in an atmosphere free of dust, corrosives, and smoke. It should be placed in an area with a temperature constant of ± 2 °C as maintaining a stable environment is essential for achieving optimum results.

Computer Requirements

The iHR provides a USB interface with a built in USB 2.0 hub for communications with a host computer. It also provides a additional USB port for connecting to a downstream USB device.






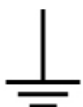




The iHR is controllable with HORIBA Jobin Yvon's Spectrometer Utilities program, SynerJY[®] data acquisition software, or with LabVIEW[®] VIs. Computer requirements for the iHR are:

- One free USB port for USB communications
- Meets the requirements specified by the user's operating system
- Meets the requirements specified by the user's software

Safety Symbols

Please refer to the table below to locate and identify the important safety symbols on the instrument and supporting equipment.

Table II. Safety Symbols

Symbol	Name	Meaning
	Caution	Refer to the instruction manual in order to protect against damage to the product.
	Hazardous voltage	Caution, risk of electrical shock.
	Hot-surface	Caution, hot surface.
	Cryogenic surface	Caution, severe burn
	Disconnect before servicing	Disconnect instrument from mains before servicing.
	Earth (ground) terminal	Indicates a circuit-common connected to grounded chassis.
	Protective earth (ground) terminal	
	Alternating current	
	On (supply)	
	Off (supply)	

Safety Requirements

The following precautions should be observed to prevent possible damage to the iHR:

- Do not connect or disconnect any cables to or from the iHR when the instrument is powered on.
- Keep the grating in a closed instrument or storage container at all times.
- Do not touch the grating surface.

CAUTION



Never touch the grating surface – not even with lens tissue. Damage can easily occur and degrade performance. Such damage is not covered by warranty. Fingerprints on a grating surface cause permanent damage. If fingerprints get on the grating surface, do not attempt to clean them.

General Maintenance Requirements

Users are recommended to periodically clean the external surfaces of the iHR by wiping them down with a clean, damp cloth. This procedure should only be performed on external surfaces. Do not use any solvents, soaps, or abrasives when cleaning as these products can damage surface finishes.

While the mirrors and gratings of the iHR require no routine maintenance, it is important to exercise care to prevent damage to their surfaces. Should dust particles accumulate on the grating surface, it is better to leave them rather than risk possible surface damage caused by cleaning.

Chapter 3: Setup

Setup Overview

Before the operational power-up phase, you must setup your iHR spectrometer and all accompanying components. The installation of your HORIBA Jobin Yvon spectrometer and application software has several separate stages that must be completed for the system to operate properly. Please follow the steps in the order listed below for proper installation and startup. Additional procedures for mounting accessories to the iHR are located in Appendix D.

- Unpacking and Equipment Inspection
- Installing the Tilt Feet
- Installing the Grating
- Installing a CCD Detector (optional)
- Installing USB Spectrometer Utilities Software
- Connecting Electrical Interface Cables

Note: The HORIBA Jobin Yvon warranty on the iHR does not cover damage to the system's optical components that arises as a result of improper handling.

Unpacking and Equipment Inspection

Carefully unpack your iHR spectrometer, examining each component for possible shipping damage. Figure 3 below depicts the individual iHR components.



Figure 3. iHR Components (iHR320 pictured)

Table III. Individual Components for the iHR320

Item #	Component Description		HORIBA Jobin Yvon Part Number
1	iHR Spectrometer		iHR320, iHR550
2	CCD Resolution Flange*		MAI-IR
3	Tilt Feet (4)		992024
4	Shielded USB Communications Cable, A to B		980087
5	24 V AC to DC Power Supply		964007
6	Power Cord	CEE 7/7 to CEE-22 (220 V)	98020
		NEMA 5-15 to CEE-22 (110 V)	98015
7	Metric accessories kit	Includes metric allen key set and metric screws	992029
8	iHR User Manual		81092
9	HORIBA Jobin Yvon USB Spectrometer Utilities CD		CSW-USB-SUPPORT-MONO

* Included only with units configured for spectrograph operation.

Installing the Tilt Feet

1. Locate the four tilt feet (P/N 992024) shipped with the iHR.
2. Screw the tilt feet into the four M8 tapped holes located at the base of the instrument (see Figure 4 for iHR320 and Figure 5 for iHR550). The height and tilt of the unit can be set by adjusting the feet.
3. When the height and tilt of the instrument are satisfactory, lock the feet into place by tightening the nuts of the feet against the body of the unit.

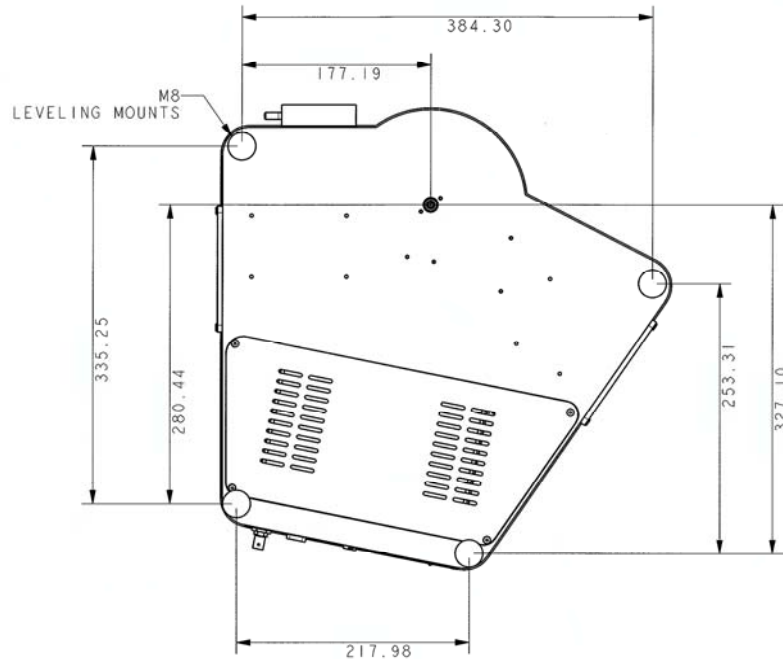


Figure 4. Bottom View of iHR320 Showing Mounting Hole Locations

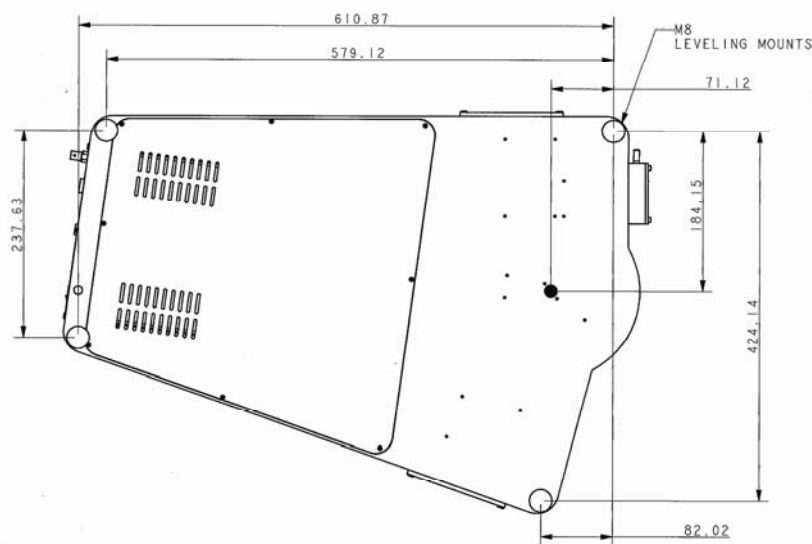


Figure 5. Bottom View of iHR550 Showing Mounting Hole Locations

Installing the Grating

1. Using a Phillips Head screwdriver, loosen the three screws of iHR turret cover and remove the turret cover.
2. Unscrew and remove the top of the grating shipping container. Carefully remove the grey foam collar.
3. Grasp the turret by the metal thumbscrew and unscrew it from its mount. Please note that the shaft of the turret will wobble slightly until it is installed in the instrument.
4. Holding the thumbscrew, lift the turret up and out of the container, being careful not to touch the face of any of the gratings.
5. Place the turret into the spectrometer grating drive, rotating it until it “drops” into place (the three points of the turret will fit into the three notches on the base of the drive).
6. When the grating turret is securely positioned, tighten the thumbscrew by hand until it is finger-tight (**do not over-tighten**).



Figure 6. iHR320 Showing Turret Cover Screws



Figure 7. Inserting the Grating Turret **Figure 8.** Tightening the Grating Turret

7. Replace the turret cover and tighten the cover screws.

CAUTION



Over-tightening of the grating turret thumbscrew may cause permanent damage to the drive mechanism of the iHR. Such damage is not covered by warranty.

Note: The triple grating turret is software controlled and is rotated by programmatic means.

If you are experiencing difficulty in the installation or removal of the grating turret or require any additional assistance, please contact your HORIBA Jobin Yvon Customer Service representative.

Installing a CCD Camera (Optional)

iHR Spectrograph models purchased with HORIBA Jobin Yvon CCD cameras are shipped with the CCD flange already attached to the camera. HORIBA Jobin Yvon CCDs are focused and aligned at the factory and when installed in the iHR, using the procedure below, should be properly aligned and require no further adjustments. If using a CCD not manufactured by HORIBA Jobin Yvon, the flange will require mounting to the CCD (refer to the CCD Flange Mounting Procedure in Appendix D). Mount the CCD/flange assembly to the iHR as follows:

1. Insert the tube of the CCD flange into the CCD port of the iHR. Make sure that the flange pin is aligned with the corresponding slot.
2. Push the flange into the iHR until it stops.
3. The flange will touch the focus wheel. Rotate the CCD clockwise until it stops.
4. Tighten the flange clamp using a 2.5 mm allen key.

Refer to Chapter 4: CCD Focus and Rotation Adjustment Mechanisms for more details on positioning the CCD camera.

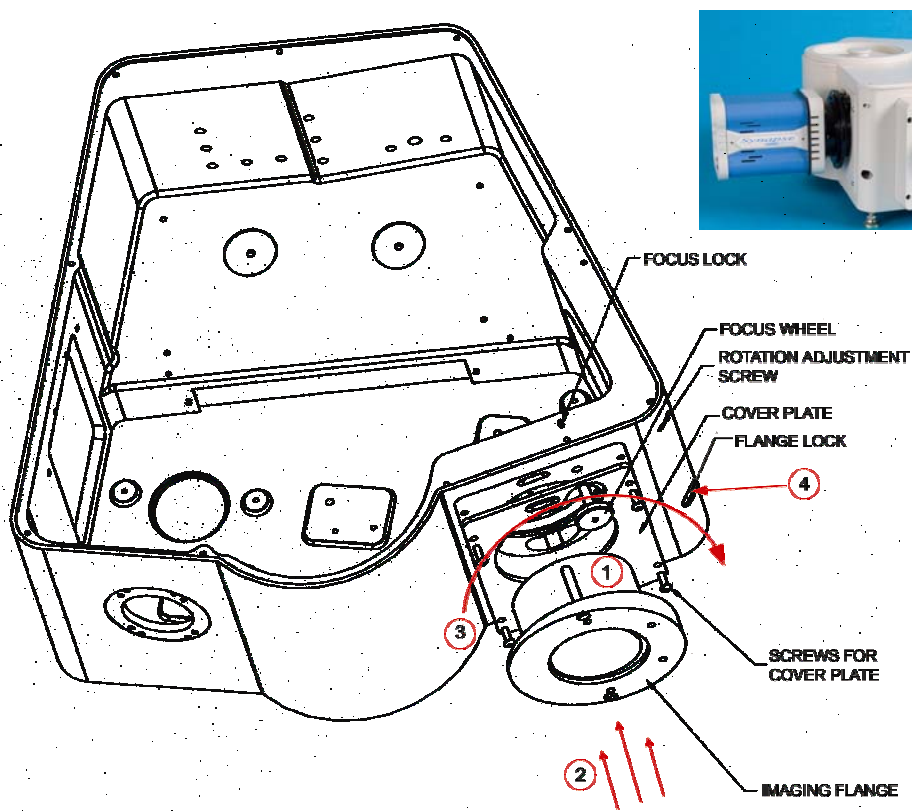


Figure 9. Installation of the CCD Flange (Imaging Flange Pictured)

Installing the USB Spectrometer Utilities Software

Note: If using application software other than USB Spectrometer Utilities, follow the installation procedure provided with that software.

5. Start Windows if you have not already done so. Make sure all programs are closed.
6. Insert the CD labeled **USB Spectrometer Utilities** (P/N CSW-USB-SUPPORT-MONO) into your CD-ROM drive. If Autorun is enabled installation will begin automatically. If Autorun is not enabled, execute the **Setup.exe** file by selecting **My Computer>USB Utility>Setup.exe**.
7. The InstallShield Wizard dialog box appears. Click **Next**.
8. Click **Next** to accept the default destination location (**C:\Program Files\Jobin Yvon**) or click **Browse** to select a different location.
9. Review the current settings then click **Next** to continue the installation.
10. When the installation is complete, click **Finish**. Remove the CD from the CD-ROM drive.

Connecting Electrical Interface Cables

1. Connect the 5-pin din connector of the 24 V AC to DC power supply (P/N 964007) to the power connector interface located on the back panel of the iHR320.
2. Connect the female end of the power cord (P/N 98015 for 110 V or P/N 98020 for 220 V) to the power supply.
3. Plug the wall outlet end of the power cord into a properly grounded outlet to provide a chassis-to-earth ground.
4. Locate a USB port on your computer and connect the USB communications cable (P/N 980076) (A end) to the computer.
5. Connect the other end of the USB cable (B end) to the USB interface located on the back panel of the iHR.

Note: The first time that the unit is connected to the computer, Windows[®] will detect a new USB device and automatically install the appropriate driver (see Chapter 4: Operation).



Figure 10. iHR Electrical Interfaces (Back Panel)

Chapter 4: Initial Power-up and Operation

This chapter covers the steps necessary to initially power-up and operate the iHR. In addition, detector head issues related to proper CCD focus and alignment to a spectrograph are discussed in detail.

The topics listed below provide information about the capabilities and functions of your iHR.

- Operation Modes
- External Interfaces
- Drive Operation
- Triple Grating Turret
- Slit Adjustments
- Dual Exit and Entrance Port Operation
- CCD Rotation and Adjustment Mechanisms
- Internal Filter Wheel Operation

To power-up and operate your spectrometer, please follow the steps in the order listed below. Please note that the included USB Spectrometer Utilities programs only allow you to control your spectrometer and are not equipped to control detectors and/or accessories. SynerJY[®] spectroscopic applications software is recommended for the control and integration of additional system components.

- Initial Power-up
- Configuring Hardware
- Controlling the iHR

iHR Operation Modes

The iHR is extremely versatile, and can be customized to accommodate most applications. Selection of entrance and exit ports, gratings, and spectroscopic accessories allows you to tailor the iHR specifically to your experiment. The spectrometer is controllable via the accompanying USB Spectrometer Control Software (P/N CSW-USB-SUPPORT-MONO) as well as with SynerJY[®], SynerJY[®] Software Development Kit, or LabVIEW[®] VIs.

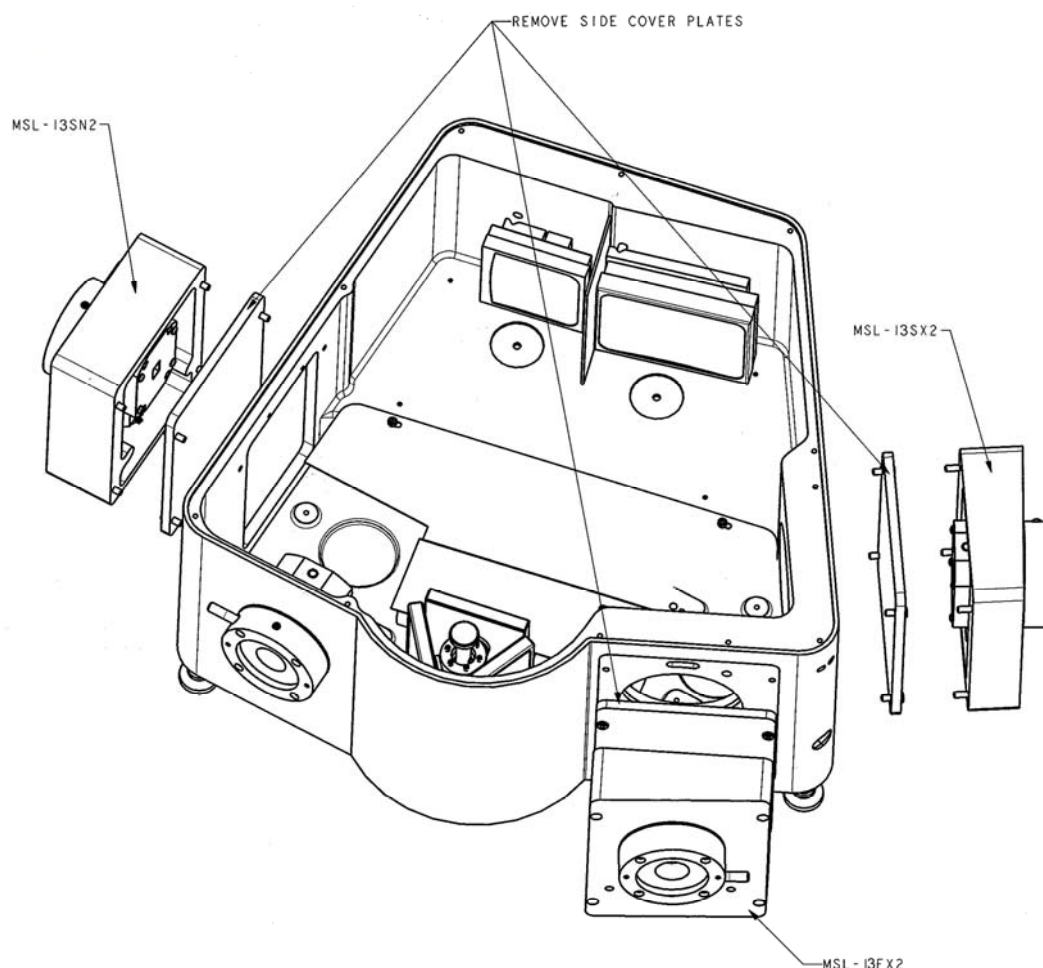


Figure 11. iHR Entrance and Exit Port Options

Spectrograph Operation

iHR units equipped to operate as spectrographs have at least one entrance slit and a CCD flange. Options for a side entrance and side exit are also available. When taking measurements with a spectrograph, the light to be analyzed is diffracted by the grating and dispersed across the exit focal plane. An array detector such as a 2D CCD or linear InGaAs array mounted at the exit is used to measure, or take a snapshot of, a range of wavelengths. The grating position for a particular wavelength range is identified by the center wavelength position. Data for a 2D detector may be recorded for each individual pixel, as an image, or with the vertical pixels in each pixel column summed, as a spectrum.

Monochromator Operation

iHR units equipped to operate as monochromators are configured with an entrance and an exit slit. Options are available for a side exit slit and a side entrance slit. As the name suggests, a monochromator is used to select a single wavelength of light. Here are four typical applications for the iHR when configured as a monochromator:

- **Scanning monochromator** – The instrument can be used to measure the spectral output of emitted light. The light can come from the sun, a laser diode, a glow discharge, etc.
- **Tunable light source** – With a broadband light source directly coupled to the entrance slit, the iHR can provide a specific bandpass (range of wavelengths) at the exit. Changing the slit width will vary the spectral bandpass.
- **Spectral filter** – The iHR can be used to select a particular bandpass of light, at different user-selected wavelengths.
- **Fixed wavelength measurement** – The iHR, when set to a fixed wavelength and bandpass with a single channel detector coupled to the exit slit, can monitor variations in an incoming light signal, such as laser power.

Description of External Interfaces and Controls

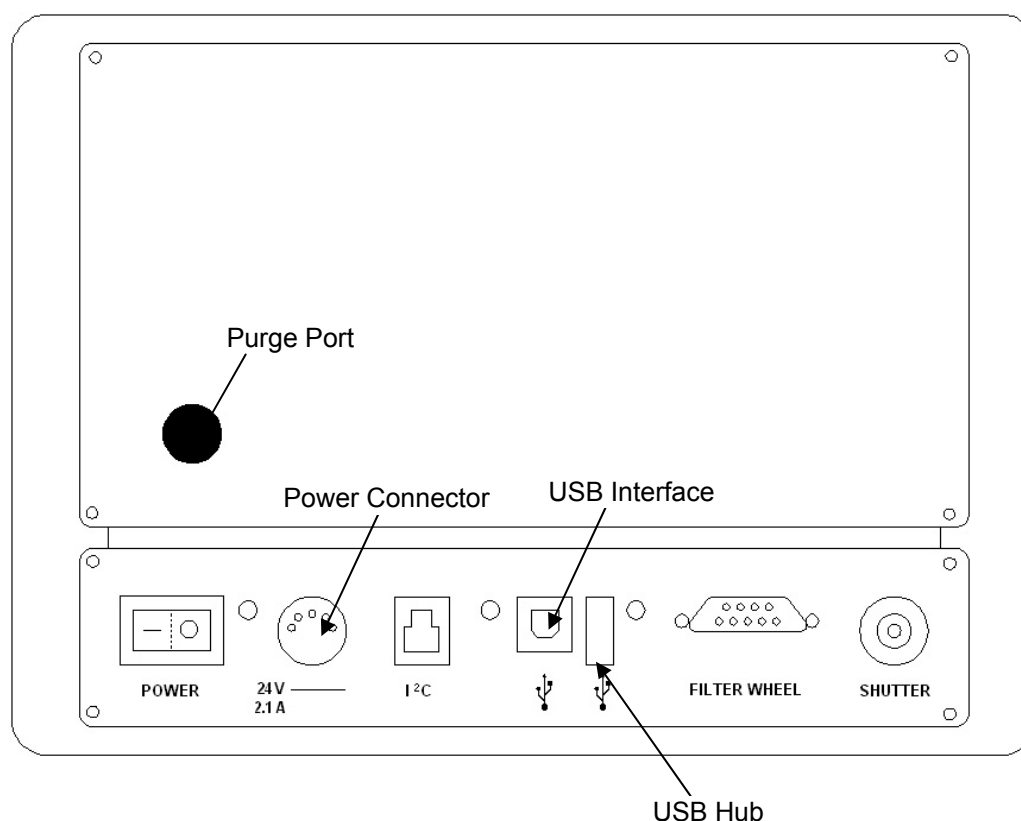


Figure 12. iHR External Interfaces

USB Interface – Accepts the standard USB-B end of USB Communications Cable, allowing USB 2.0 communications between the iHR and the operating computer.

USB Status LED – Illuminates green to indicate that USB communications exist between the iHR and the operating computer.

USB Hub – Built-in USB 2.0 hub that allows for easy expansion of HORIBA Jobin Yvon systems (using a standard USB-A connector) without the need for an external USB expansion hub.

USB Hub Status LED – Illuminates green to indicate that USB communications exist between the iHR and some external device interfaced to the iHR via the USB Hub.

Power Status LED – Illuminates green to indicate that the unit is powered on.

Power Connector – Receptacle that connects the 24 V AC to DC power supply to the iHR via a 5-pin din connector, supplying power to the unit.

Shutter Connector – Provides the user the option of connecting a shutter cable to the iHR via a BNC connection.

External I²C – Allows the iHR to communicate with end-user specific, slave I²C devices when required. This two-wire, synchronous, serial interface supports bi-directional data transfers.

External Filter Wheel – Establishes communications between a HORIBA Jobin Yvon external filter wheel and the iHR.

Drive Operation

The iHR utilizes a precision worm/wheel gear drive mechanism under stepper motor control which enables a user to drive precisely to a given wavelength or scan over a wavelength range. The drive has a scan range of 0 nm to 1500 nm (for a 1200 gr/mm grating). The wavelength resolution of the drive is user selectable with a minimum step size of 0.002 nm (with a 1200 gr/mm grating). The drive must be initialized upon powering up. The initialization process precisely homes the drive mechanism, allowing for very accurate and repeatable wavelength settings. The drive will hold position indefinitely as long as the unit is power up. If the system is powered down, there can be a small shift in drive position.

The drive requires no backlash correction when moving in the direction of increasing wavelength. We therefore recommend that users scan from lower to higher wavelengths. When the system is directed to move from a higher wavelength to a lower wavelength, an automatic backlash correction is performed. Although the wavelength accuracy and precision of the drive is unaffected, the backlash operation adds additional time to the scan.

When moving from lower to higher wavelength, the drive scan speed is approximately 159 nm/ sec.

Triple Grating Turret

The iHR's unique turret design allows it to maintain on-axis grating rotation during scanning, delivering superior optical performance. The triple grating turret supports three gratings; rotation is controlled by a single stepper motor. Grating selection is software controlled. The operation for changing the grating is automated and takes approximately 30 seconds per grating.

Additional turrets may be purchased for the iHR320 and iHR550. The grating turret is kinematically mounted allowing the user to interchange turrets without the need for realignment.

Slit Adjustments

The slits of the iHR are fully automated. The width of the slit opening is controlled via software. Having the proper slit width is critical as it directly affects the throughput and wavelength resolution of the system. The slit height also has an effect on resolution and throughput, although to a lesser extent. Slit height is manually adjusted by a height limiter. See Chapter 5: System Performance for a more complete discussion of this topic.

Automated Slits

The motorized, adjustable slits of the iHR are controlled remotely by computer. Slit width is continuously adjustable from 0 mm to 2 mm or 0 mm to 7 mm (optional).

The height limiter controls the slit height and has three settings: closed, 1 mm, and open. The detents of the actuator are used as a guide for setting the height limiter.

To open the height limiter completely, pull the actuator out until it stops. For a 1 mm opening, push the actuator to the first detent. To close the height limiter, push the actuator in until it stops. Closing the height limiter provides a useful way to block the input light in order to take a dark level reading.

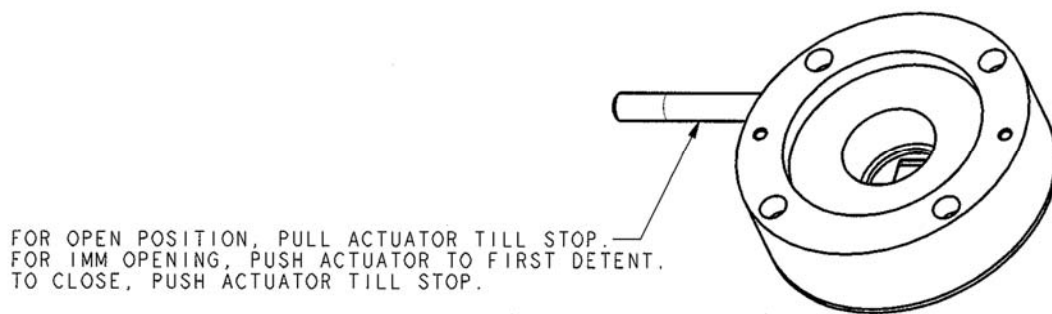


Figure 13. Slit Height Limiter

Dual Entrance and Exit Port Operation

The iHR offers optional dual entrance port and dual exit port configurations. The exit ports can be equipped with either an automatic slit or a CCD flange. The addition of a second exit port allows for dual detector mounting. Spectral output is switched from the front exit port to the side exit port via a computer controlled swing mirror. Similarly, equipping the system with dual entrance ports allows for the mounting of two optical inputs which are also selectable via software.

CCD Focus and Rotation Adjustment Mechanisms

The iHR provides mechanisms for precise adjustment of the focus and rotational alignment of a CCD camera. The adjustments consist of the CCD focus wheel, the focus lock set screw, the CCD rotation adjustment screw, and the CCD flange lock.

Note: For installation of a HORIBA Jobin Yvon CCD or array detector delivered with an iHR spectrograph, see the Installation of the CCD Camera section of Chapter 3.

1. Using a 2.5 mm allen key, loosen the M3 cap head screw on the flange lock by turning the allen key counter-clockwise. This screw is accessed through the flange lock hole in the side of the unit. Note that when the flange lock is loose, the CCD flange is free to slide in and out of the unit.
2. Using a 2 mm allen key, remove the 9 M3 button head screws which secure the top cover of the unit and remove the top cover.
3. Using a 1.5 mm allen key, loosen the focus lock set screw (M3).
4. Replace the top cover.

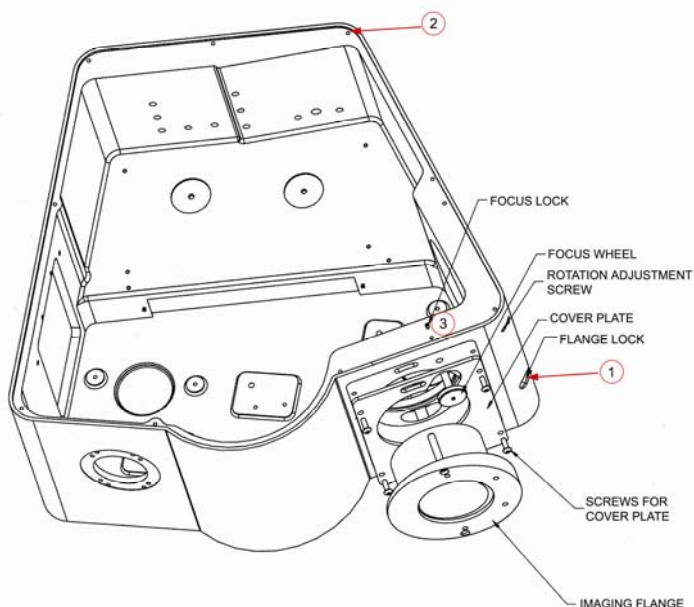


Figure 14. CCD Rotation and Adjustment Mechanisms

5. The CCD focus wheel and rotation adjustment screw are free to move. The CCD focus wheel, touching the inside face of the CCD flange, acts as a focus stop for the CCD flange. The CCD rotation adjustment screw, touching the pin on the CCD flange, acts as a rotation stop for the CCD flange.
6. To adjust the focus of the CCD camera, rotate the focus wheel with your fingers to drive the CCD flange out from the body. To bring the camera focus in, it is necessary to hold the camera against the wheel while rotating the focus wheel.
7. To adjust the rotation of the CCD camera, insert a 1.5 mm allen key into the hole in the side of the unit to engage the CCD rotation adjustment set screw. Turning the screw into the body (clockwise) will push against the pin on the CCD flange rotating the camera. To rotate in the opposite direction, you need to turn the camera against the rotation adjustment screw while turning the screw counter-clockwise.
8. When the focus and rotation of the camera are properly set, tighten the flange lock to clamp the CCD flange in position.

The focus wheel can now be locked in its current positions by removing the top cover and tightening the focus lock set screw. If it is necessary to remove the CCD for some reason, simply loosen the flange lock set screw and remove the CCD. This Quick-Align CCD adapter mechanism allows easy replacement of the CCD with minimal realignment.

Internal Filter Wheel Operation

The iHR offers both internal and external filter wheel options. The internal filter wheel option for the iHR holds up to 6, one-inch circular filters. Filter selection is computer controlled. The internal filter wheel and filters must be purchased with the system (because an internal glass filter introduces a slight shift in focus, the filters must be present when the system is aligned). HORIBA Jobin Yvon offers a standard set of cut-on filters. For customers wanting to install their own filters, see the “Filter Installation” procedure of Appendix D.

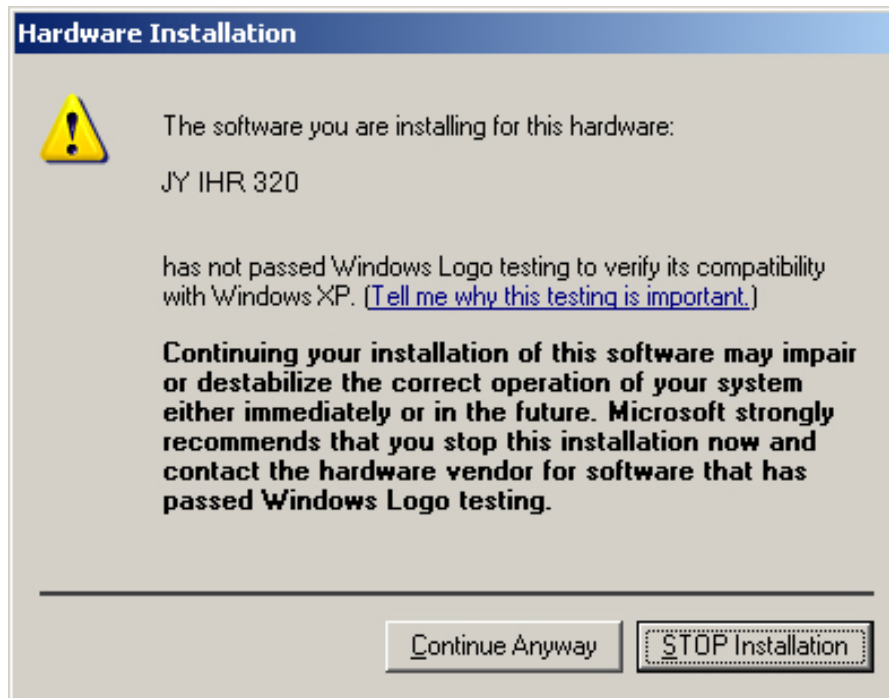
Note: The presence of internal filters can also produce a slight shift in wavelength. This wavelength error can be removed by following the wavelength calibration procedure.

Initial Power-up

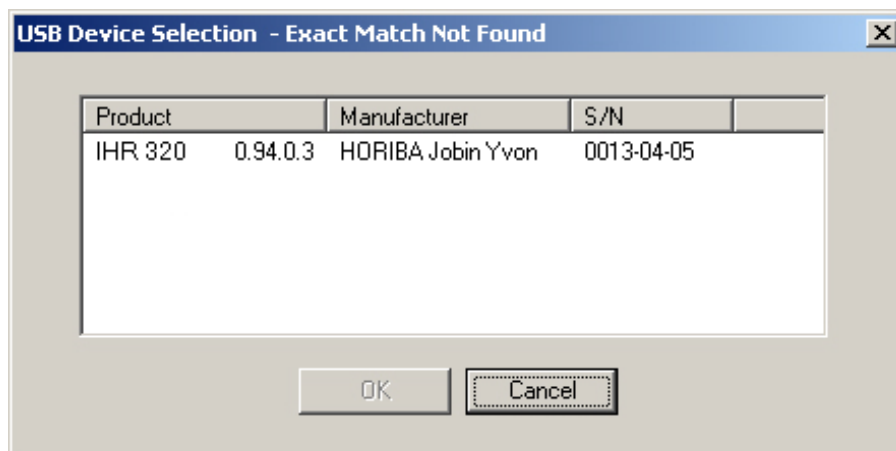
1. Check that all system cables interfacing to and from the iHR are properly connected.
2. Make sure that all software has been installed before the unit is turned on.
3. Verify that the unit, computer, and any additional supporting equipment are connected properly to AC input power.
4. Set the power switch on the back of the unit to the **ON** (“I” symbol) position. The computer will recognize that a new USB device has been powered up and is connected to the computer.
5. The **New Found Hardware Wizard** opens. Click **Next**.



6. As the iHR software is loaded, a warning that the software has not passed Windows Logo Testing appears. All HORIBA Jobin Yvon recommended software has been fully checked for compatibility issues and will not interfere with the correct operation of your system. Click **Continue Anyway**.



7. When the software installation is complete, click **Finish**.
8. The first time the iHR is used, the **USB Device Selection** window opens. Click on your iHR model name (**iHR320....or iHR550...**) to highlight the displayed text, then click **OK**. If more than one iHR is listed for your model, chose the correct one based on serial number.



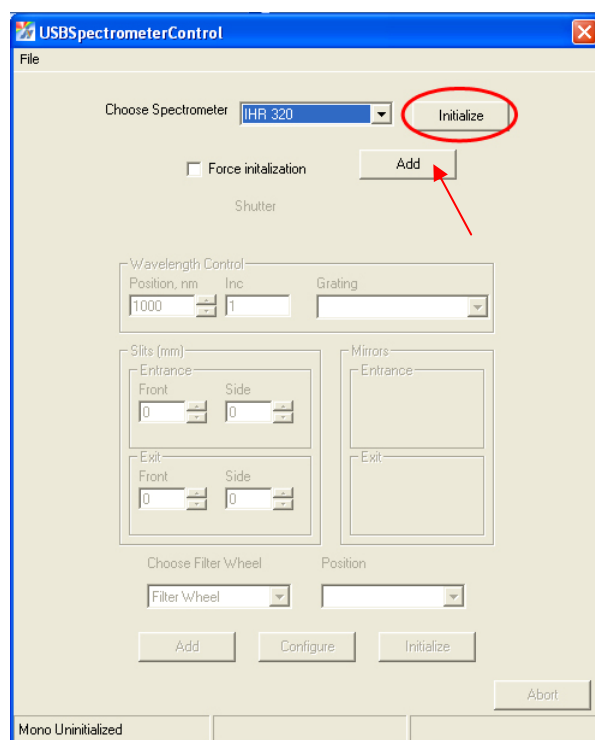
Configuring Hardware

If you received your copy of USB Spectrometer Utilities with your iHR, the software has already been preconfigured to find and control your spectrometer. Once the spectrometer is identified, you must create a hardware configuration. To configure hardware:

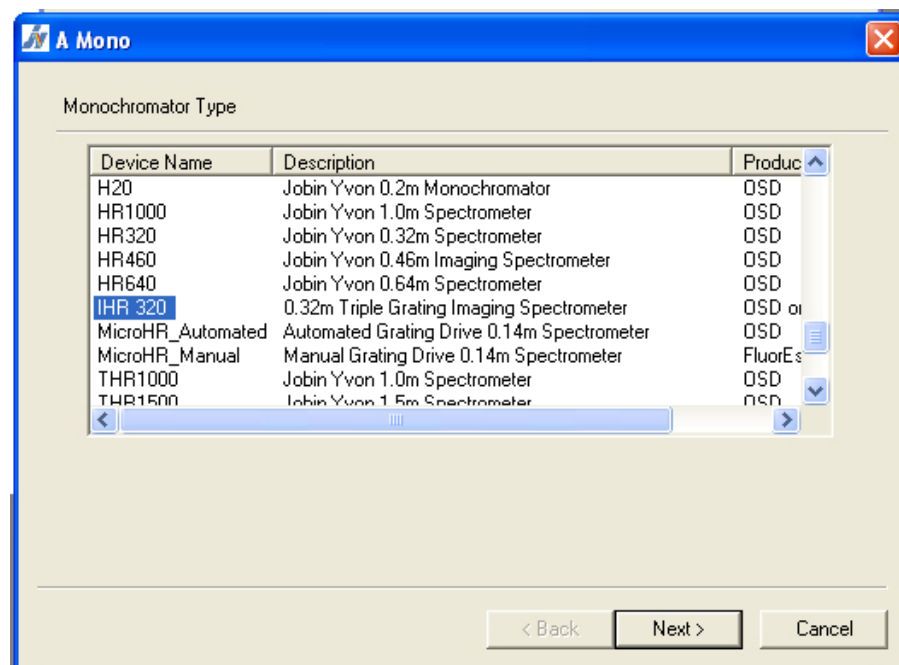
1. The **USB Device Selection** dialog box appears the first time the spectrometer is used, indicating that an exact hardware match has not been found. It lists all of the compatible hardware, i.e. spectrometers, attached to your computer. Highlight the hardware description that matches your iHR and click **OK**. If more than one iHR is listed, choose the correct one based on serial number.
2. To configure using USB Spectrometer Utilities software, select **Start >Programs>Jobin Yvon>USBSpectrometerControl**. The USB Spectrometer Control program allows you to initialize the instrument as well as enter and/or change the wavelength position, mirror position, and control slits. It also allows you to configure and change the filter wheel position if your iHR is equipped with an internal filter wheel. If using SynerJY software, refer to the **Hardware Configuration** topics located in the *SynerJY Installation Guide* and Help file.

Note: The USB Spectrometer Control program only allows you to configure your spectrometer (and optional internal filter wheel) and is not equipped to create hardware configurations for detectors and/or accessories. You must use SynerJY or the software provided with your detector to create a system configuration.

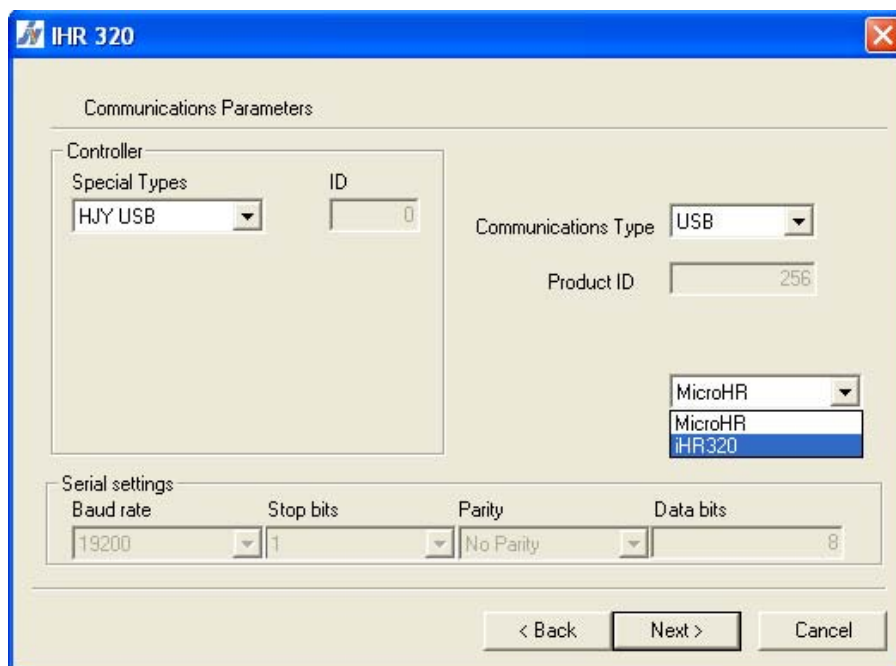
3. If adding a new spectrometer, select the appropriate model from the **Choose Spectrometer** drop-down list and click **Initialize**; proceed to Step 10. If you are installing a new version of USB Spectrometer Utilities, your spectrometer will not be available in the **Choose Spectrometer** drop-down list; click **Add**.



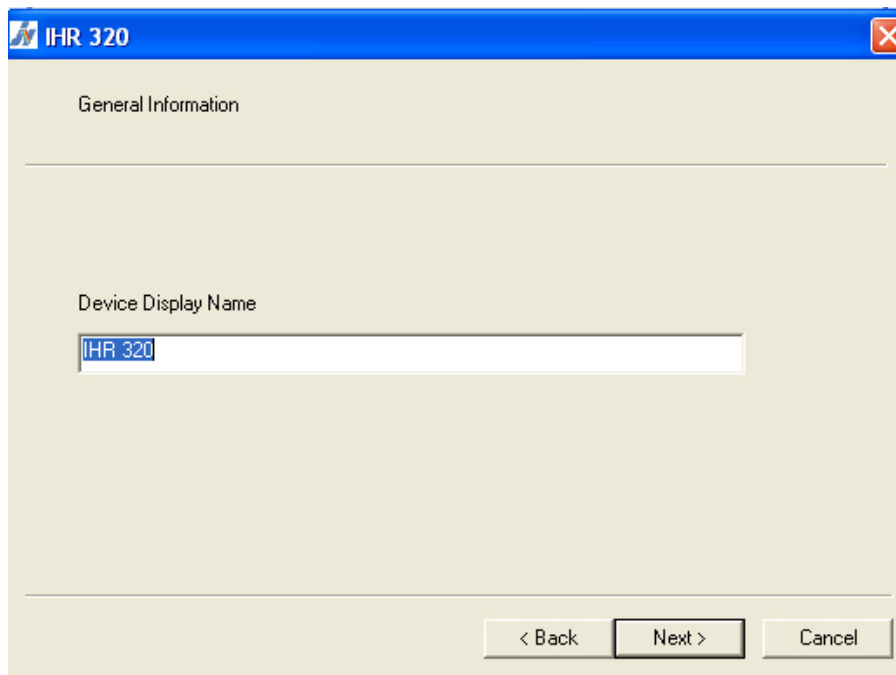
4. Select iHR320 or iHR550 from the **Device Name** list and click **Next**.



5. Enter the **Communications Parameters** for the device. Select **HJY USB** as the **Controller**, **USB** as the **Communications Type** and select **iHR320** or **iHR550**. Click **Next**.

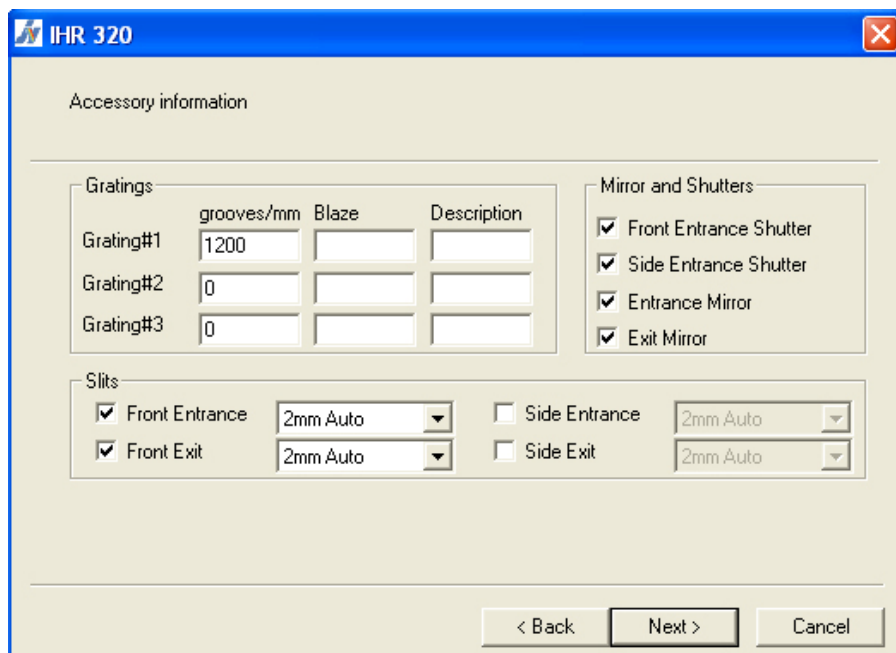


6. Type in the **Device Display Name** (the model name appears as the default) and click **Next**.



7. Specify your **Accessory information** and click **Next**. Accessory information is dependent on your specific slit configuration and selected gratings. Please note that deselecting any of the check box fields will render them inactive when the configuration is initialized.

Note: The grating information specific to your iHR is listed on the back of the unit.



The screenshot shows a software window titled "IHR 320" with a blue header bar. The main area is titled "Accessory information". It contains three sections: "Gratings", "Slits", and "Mirror and Shutters".

Gratings: A table with columns "grooves/mm", "Blaze", and "Description".

	grooves/mm	Blaze	Description
Grating#1	1200		
Grating#2	0		
Grating#3	0		

Slits: A section with four rows, each with a checkbox and a dropdown menu.

Checkbox	Label	Value
<input checked="" type="checkbox"/>	Front Entrance	2mm Auto
<input checked="" type="checkbox"/>	Front Exit	2mm Auto
<input type="checkbox"/>	Side Entrance	2mm Auto
<input type="checkbox"/>	Side Exit	2mm Auto

Mirror and Shutters: A section with four checkboxes.

Checkbox	Label
<input checked="" type="checkbox"/>	Front Entrance Shutter
<input checked="" type="checkbox"/>	Side Entrance Shutter
<input checked="" type="checkbox"/>	Entrance Mirror
<input checked="" type="checkbox"/>	Exit Mirror

At the bottom, there are three buttons: "< Back", "Next >", and "Cancel".

8. A summary of the device configuration displays. Click **Apply** to continue. You will return to the main screen.
9. Select the spectrometer that was just added from the **Choose Spectrometer** drop-down list then click **Initialize**.
10. If your iHR contains an internal filter wheel, you will be guided through the filter wheel configuration. For the filter wheel **Communication Parameters**, set **HJY USB** as the **Controller**, **USB** as the **Communications Type** and select **iHR320** or **iHR550**.
11. Enter the appropriate **Wavelength Control**, **Slits**, and **Mirrors** information. Please note that these fields are only accessible after spectrometer initialization.

Controlling the iHR

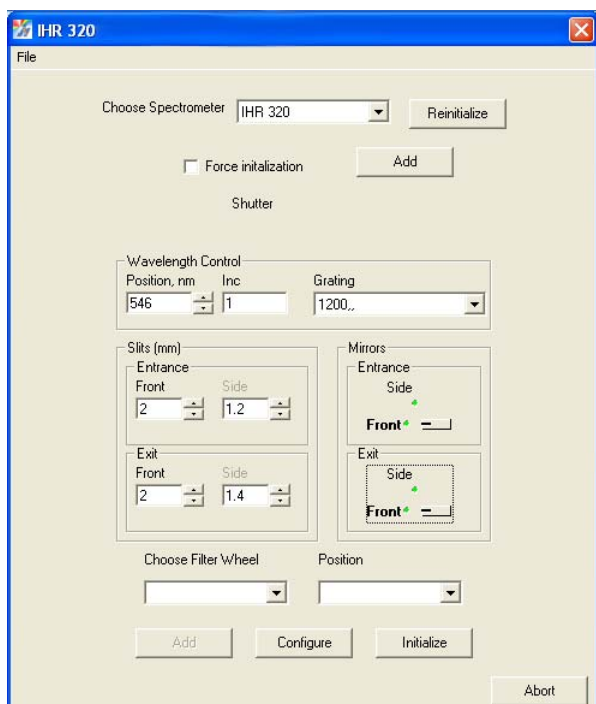
The USB Spectrometer Utilities CD supplied with the iHR contains two programs that can be used together to control the spectrometer:

- The USB Spectrometer Control program allows you to enter and/or change the wavelength position, mirror position, control slits, and change filter wheel position (if your iHR is equipped with an internal filter wheel).
- The USB Mono Config program allows you select the appropriate grating as well as change the offset.

Note: USB Spectrometer Utilities programs only allow you to control your spectrometer (and optional internal filter wheel) and are not equipped to control detectors and/or accessories. You must use SynerJY or the software provided with your detector to control additional system components.

USB Spectrometer Control

1. Make sure your hardware is configured. Select **Start>Programs>Jobin Yvon>USBSpectrometerControl**.
2. Set the fields to the desired settings.
 - **Wavelength Control** moves the spectrometer to the specified wavelength (in nm), allowing for an incremental increase or decrease.
 - **Slits** allows for adjustment of the slit width (in mm). The **Slits** options are: **Front Entrance**, **Front Exit**, **Side Entrance**, and **Side Exit**. Click on slit text boxes and type in the appropriate values.
 - The **Grating** field shows the grating that has been specified by the hardware configuration. Clicking the **Grating** drop down box displays other grating types that are available with the active monochromator.
 - **Mirrors** allows the user to adjust the mirrors at the Entrance and Exit Slits in accordance with the Hardware Configuration. Click **Side** or **Front** to adjust the mirrors for the **Entrance Slit** and **Exit Slit**. The selected position appears in bold and the mirror icon moves to reflect the selection.



USB Mono Configuration

1. Make sure your hardware is configured. Select **Start>Programs>Jobin Yvon>USBMonoConfig**.
2. Select the tab for the parameter that you want to adjust and enter the appropriate information. Tabs are available for:
 - **Mono** – Select the active spectrometer.
 - **Grating** – Select the grating from the gratings available for the active spectrometer; perform grating calibration procedure.
 - **Drive Correction Table** – Perform drive correction/offset.
 - **Filter Wheel** – Select and enable internal filter wheel.
 - **Slits** – Specify frequency, maximum step size, and backlash.
 - **Mirrors** – Enable mirrors.
 - **Other** – Enter shutter information.

The screenshot shows the 'Gratings' tab of the 'USB Mono Config' software. The interface has a top navigation bar with three main sections: 'Slits', 'Mirrors', and 'Other'. Under 'Slits', there are sub-tabs for 'Mono' and 'Gratings'. Under 'Mirrors', there is a 'Drive Correction Table' sub-tab. Under 'Other', there is a 'Filter Wheel' sub-tab. The 'Gratings' sub-tab is currently selected. Below the navigation bar, there is a dropdown menu labeled 'Grating #1' and a button labeled 'Calibrate Grating...'. Below these, there is an 'Info' section containing two input fields: 'Step Offset' with the value '0' and 'Groove Density' with the value '1200'. Below the 'Info' section, there is a 'Coefficients' section containing six input fields arranged in two columns: 'Coef1', 'Coef2', 'Coef3' on the left and 'Coef4', 'Coef5', 'Coef6' on the right. All coefficient fields have the value '1' entered.

Slits		Mirrors	Other
Mono	Gratings	Drive Correction Table	Filter Wheel

Grating #1

Info

Step Offset Groove Density

Coefficients

Coef1	<input type="text" value="1"/>	Coef4	<input type="text" value="1"/>
Coef2	<input type="text" value="1"/>	Coef5	<input type="text" value="1"/>
Coef3	<input type="text" value="1"/>	Coef6	<input type="text" value="1"/>

3. After all parameters are specified, click **Write** to store the entered values.
4. Click **OK** to exit USB Mono Config.

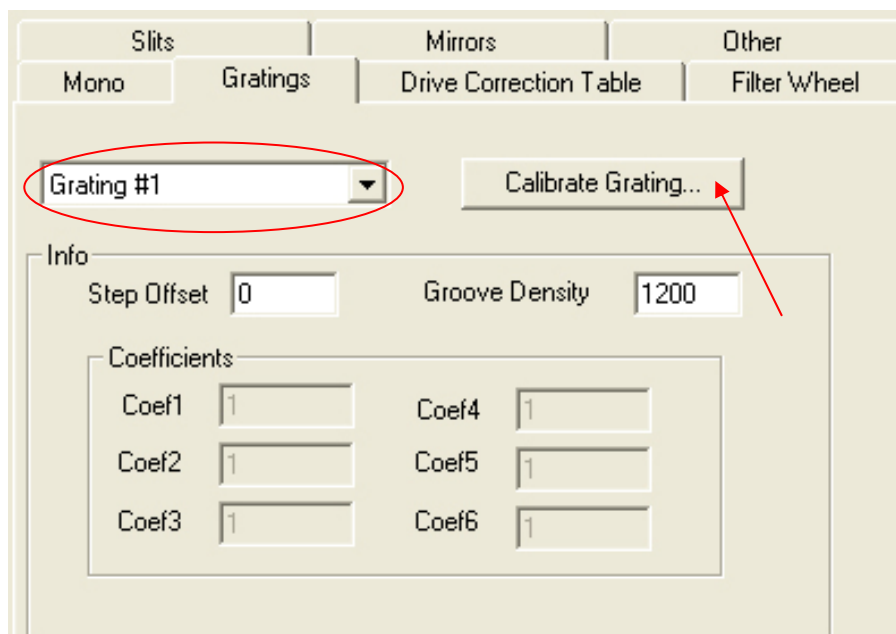
Calibrating the Grating using USB Spectrometer Utilities

The “Grating Calibration” procedure serves as an initial check, prior to running an experiment, that your system's monochromator is properly calibrated and aligned.

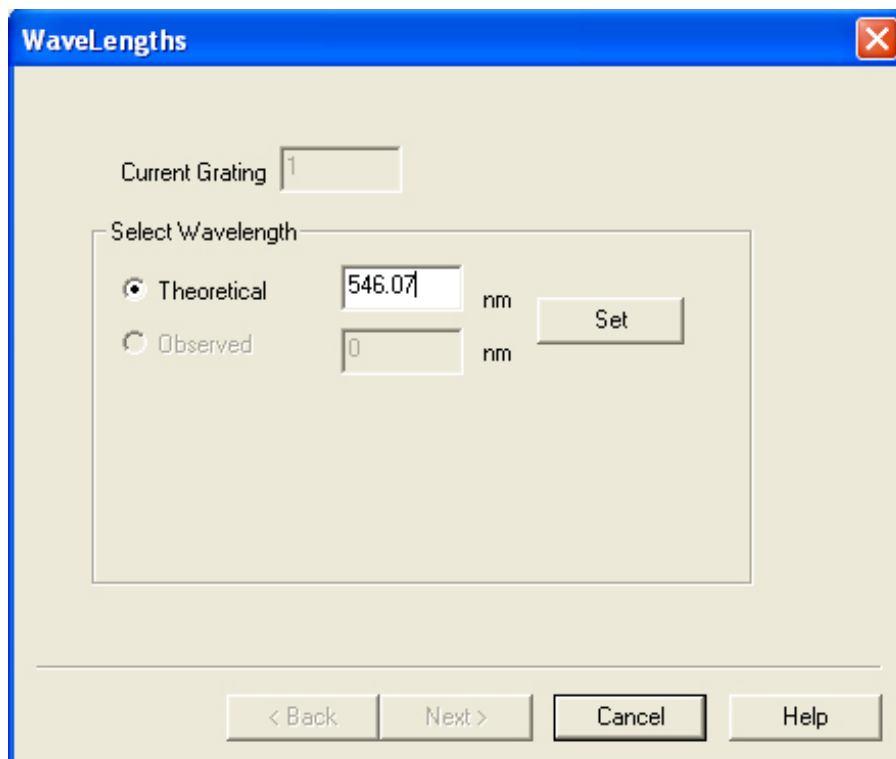
Note: You must use the software provided with your detector (in conjunction with USB Spectrometer Utilities) to collect a spectrum and determine the peak pixel position corresponding to the reference peak. If using SynerJY, refer to the “Monochromator Calibration” procedure of the Help file.

1. Set up a calibration source, such as a Mercury lamp, on the front entrance slit of the iHR.
2. Make sure your detector is mounted to the exit port.
3. Select **Start>Programs>Jobin Yvon>USBSpectrometerControl**.
4. Set the slit width to a minimum (~ 0.01 mm) and manually adjust the height limiter to 1 mm.
5. Set the **Position** to a reference wavelength value (such as a Mercury line at 546.07 nm).
6. Start the detector software, and follow the appropriate procedure for using an (a) CCD or other array detector or (b) single channel detector (PMT, DSS, or Lock-in).
 - a. Set the **X-axis** to display in **Pixels**. Collect a spectrum and note the peak pixel position corresponding to the reference peak. If the iHR is calibrated correctly, the peak pixel position should be at the center pixel of the CCD chip (for example, for a 1024 pixel wide CCD chip, the peak should appear at pixel 512).

If the peak does not appear at the central pixel, change the center wavelength position until the peak appears in the center of the chip. Record the observed position of the reference peak.
 - b. Scan the grating in the region of the reference peak until the detector reads the maximum signal. Record the observed position of the reference peak.
7. Select the **Gratings** tab then select the **Grating #** you are calibrating from the drop-down list.



8. Click **Calibrate Grating**. The **WaveLengths** window opens.
9. Type in the **Theoretical** peak value then click **Set**.



10. Click the **Observed** radio button and enter the observed reference peak value then click **Set**.
11. Click **Next**.
12. Click **Done** to accept the calibration offset or click **Cancel** to discard the change. The grating calibration will be saved to memory.

Chapter 5: System Performance

Diffraction Grating Groove Density and System Performance

The iHR320 and iHR550 have been designed to accommodate a wide range of interchangeable diffraction gratings. The choice of gratings provides the single most important means of tailoring the performance of the iHR to your specific application. The grating tables below show how the groove density of the grating affects some important performance characteristics.

Table IV. Grating Table for the iHR320

Groove Density (gr/mm)	Typical Linear Dispersion (nm/mm)	Typical Array Resolution (nm)*	Typical Spectral Coverage (nm)*	Scan Range (nm)*
2400	1.17	$\leq .075$ nm	31	0 – 750
1800	1.57	$\leq .1$ nm	41	0 – 1000
1200	2.35	$\leq .15$ nm	62	0 – 1500
900	7.00	$\leq .2$ nm	83	0 – 2000
600	4.70	$\leq .3$ nm	124	0 – 3000
300	9.4	$\leq .6$ nm	248	0 – 6000
150	18.8	≤ 1.2 nm	496	0 – 12000

Table V. Grating Table for the iHR550

Groove Density (gr/mm)	Typical Linear Dispersion (nm/mm)	Typical Array Resolution (nm)*	Typical Spectral Coverage (nm)*	Scan Range (nm)*
2400	0.685	$\leq .045$ nm	18.2	0-750
1800	0.91	$\leq .06$ nm	24.3	0-1000
1200	1.37	$\leq .09$ nm	36.5	0-1500
900	1.83	$\leq .12$ nm	48.6	0-2000
600	2.74	$\leq .18$ nm	73	0-3000
300	5.48	$\leq .36$ nm	146	0-6000
150	10.96	$\leq .72$ nm	292	0-12000

*All specifications given for 1200 g/mm grating at 435 nm and are subject to change without notice (26 μ m wide pixels and 12 μ m entrance slit).

A more detailed explanation of these performance characteristics follows:

- **Linear Dispersion** – The spectral dispersion is a fundamental characteristic of the spectrograph and directly affects spectral resolution, coverage and wavelength range. Note that these are typical values as the spectral dispersion will vary somewhat depending on the operating wavelength.
- **Array Resolution** – The Full Width at Half Maximum (FWHM) wavelength resolution of a spectral line on a focal plane with 26 μm pixels.
- **Spectral Coverage** – The wavelength range covered by a 26.7 mm focal plane array.
- **Spectral Range** – The range of the wavelength drive.

Slit Settings and Bandpass

The slit settings directly affect the spectral resolution and throughput of the system. Table VI and Table VII show the relation of slit width to spectral bandpass under the specified conditions.

Table VI. iHR320 Slit Width vs. Bandpass

Slit Width	Bandpass (nm)*
80 μm	0.188
0.1 mm	0.235
0.2 mm	0.470
0.5 mm	1.175
1.0 mm	2.35
2.0 mm	4.7
4.0 mm	9.4

Table VII. iHR550 Slit Width vs. Bandpass

Slit Width	Bandpass (nm)*
80 μm	0.110
0.1 mm	0.137
0.2 mm	0.274
0.5 mm	0.685
1.0 mm	1.37
2.0 mm	2.74
4.0 mm	5.48

*For spectrograph configuration, the pixel size in the array detector limits the instrument bandpass.

For entrance slit widths above 50 μm , the bandpass is defined by the following formula:

- $\text{BP} = \text{Linear Dispersion} \times \text{Exit Slit Width}$ *or* $\text{Image of Entrance Slit Width}$ (whichever is greater).
- $\text{BP (spectrograph)} = \text{Linear Dispersion} \times (\text{Pixel Width} \times 3 \text{ Pixels})$ *or* $\text{Entrance Slit Width}$ (whichever is greater)

Slit height also has an effect on bandpass, although this only becomes a factor when operating at a bandpass below 1 nm. When better resolution or bandpass is required, and signal strength is not an issue, it is desirable to set the height limiter to the 1 mm setting.

For additional information regarding the relationship between slit width and bandpass see section 2.12 of the online tutorial “The Optics of Spectroscopy” (<http://www.jobinyvon.com/usadivisions/OOS/>).

Stray Light Rejection

The iHR has been designed to minimize any stray light reaching the focal plane. The optical cavity includes blackened baffles and masks to trap unwanted light. In addition, the optical design of the iHR is free from re-diffracted light (re-diffracted light is a source of stray light that involves multiple reflections off the optical components themselves and is therefore very difficult to mask).

In addition to these design features, here are some measures that the user can take to reduce stray light:

- Keep the $f/\#$ of the illumination at or above (narrower cone angle) the $f/\#$ of the iHR spectrograph (iHR320 $f/\#$ = 4.1, iHR550 $f/\#$ = 6.4).
- Use holographic instead of ruled gratings.
- Select a grating with a blaze angle optimized for your application.
- Use an order sorting filter to remove higher orders of unwanted light. For example, when the grating is set to 600 nm, the second order of 300 nm light will also be diffracted at the same position; to remove this unwanted light, a 550 nm long pass filter can be used as an “order sorting filter” to remove higher orders of light with wavelengths lower than 550 nm. The AFW-IHR internal filter, offered as an optional accessory for the iHR, is recommended for this purpose. See the online tutorial “The Optics of Spectroscopy” for additional information (<http://www.jobinyvon.com/usadivisions/OOS/>).

Chapter 6: Troubleshooting

Following installation, some applications may require special attention for optimal system performance (see also Chapter 5: System Performance). The following troubleshooting tips are provided to help you maximize experimental results by resolving any potential problem. If you are not able to resolve the problem, please contact HORIBA Jobin Yvon.

Unit Fails to Turn On

If the unit fails to turn on, check that:

- The power cord is connected to the power supply.
- The power cord is plugged into a live outlet.
- The 5-pin din connector of the power supply is securely connected to the Power Connector interface of the iHR.

Spectrometer Does not Respond to any Commands

If the spectrometer is powered on, but is not responding to any commands, check that:

- All external cables are connected (see the Connecting Electrical Interface Cables section of Chapter 3).
- The system's software or firmware configuration matches the actual hardware configuration. Refer to the software documentation for more information on creating, editing, or loading a hardware configuration.
- The USB port of your computer is working properly.

Spectrometer Responds Only to Some Commands

If the spectrometer is powered on, and responds only to some commands, check that:

- The failing command is valid. The parameters entered must be within limits for that drive or function.
- If you purchased software from HORIBA Jobin Yvon, refer to the provided software documentation to check that the device you want to control is configured properly.
- If you are running your own software, stop your program and load the software provided with the system to see if the device in question can be controlled.
- Your computer meets the requirements specified by the software you are using to operate the iHR.

Wavelength Drive and/or Accessories do not Move

If the spectrometer is powered on, but the wavelength drive and/or accessories are not moving, check that:

- The grating is working properly: With the power off, remove the turret cover of the iHR and gently move the turret partially through its range of motion. When the system is powered, the device should return to its home position.
- All external cables are connected (see the Connecting Electrical Interface Cables section of Chapter 3).
- You pay particular attention to interfacing setup connections and parameters if you are using your own software/program.

Background Signal Very High, Background Reduced when Room Lights are Turned Off

If the background signal appears very high, and is reduced when the room lights are turned off, check that:

- All covers are securely in place.
- The area between the source or sample and the entrance slit is enclosed, and light tight. Block the entrance slit as a test.
- All openings and screw holes are plugged.

Noisy Signal

If the signal appears very noisy, check that:

- There are no light leaks (see the section on Stray Light Rejection in Chapter 5).
- If turning off the spectrometer reduces noise, rearrange power connections to be sure the spectrometer, source, and detector are tied to the same ground and, if possible, the same power circuits.

Appendix A: Dimensional Drawings

Note: All drawings are shown in millimeters unless otherwise indicated.

iHR320

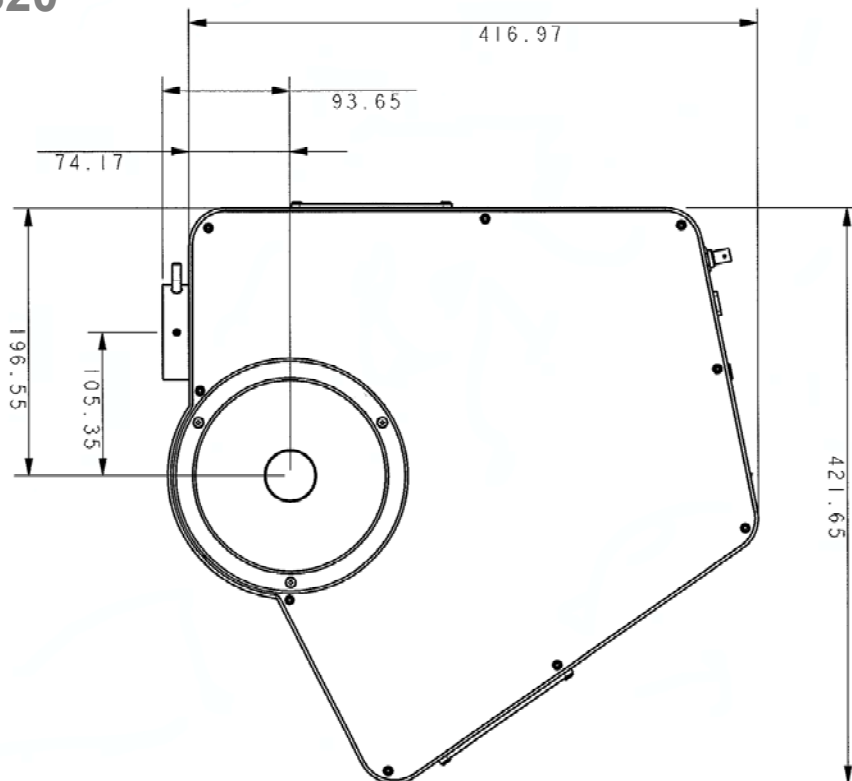


Figure 15. iHR320 Dimensions, Top View

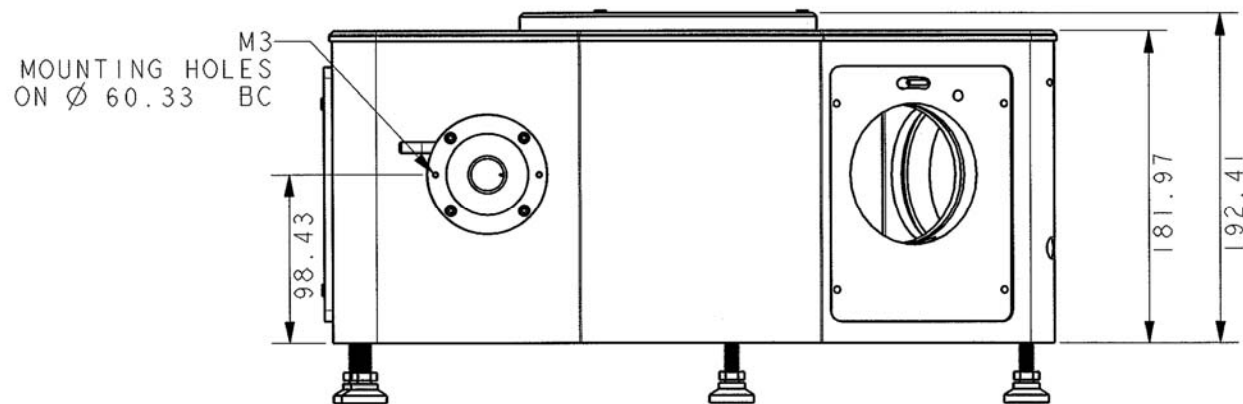


Figure 16. iHR320 Dimensions, Front View

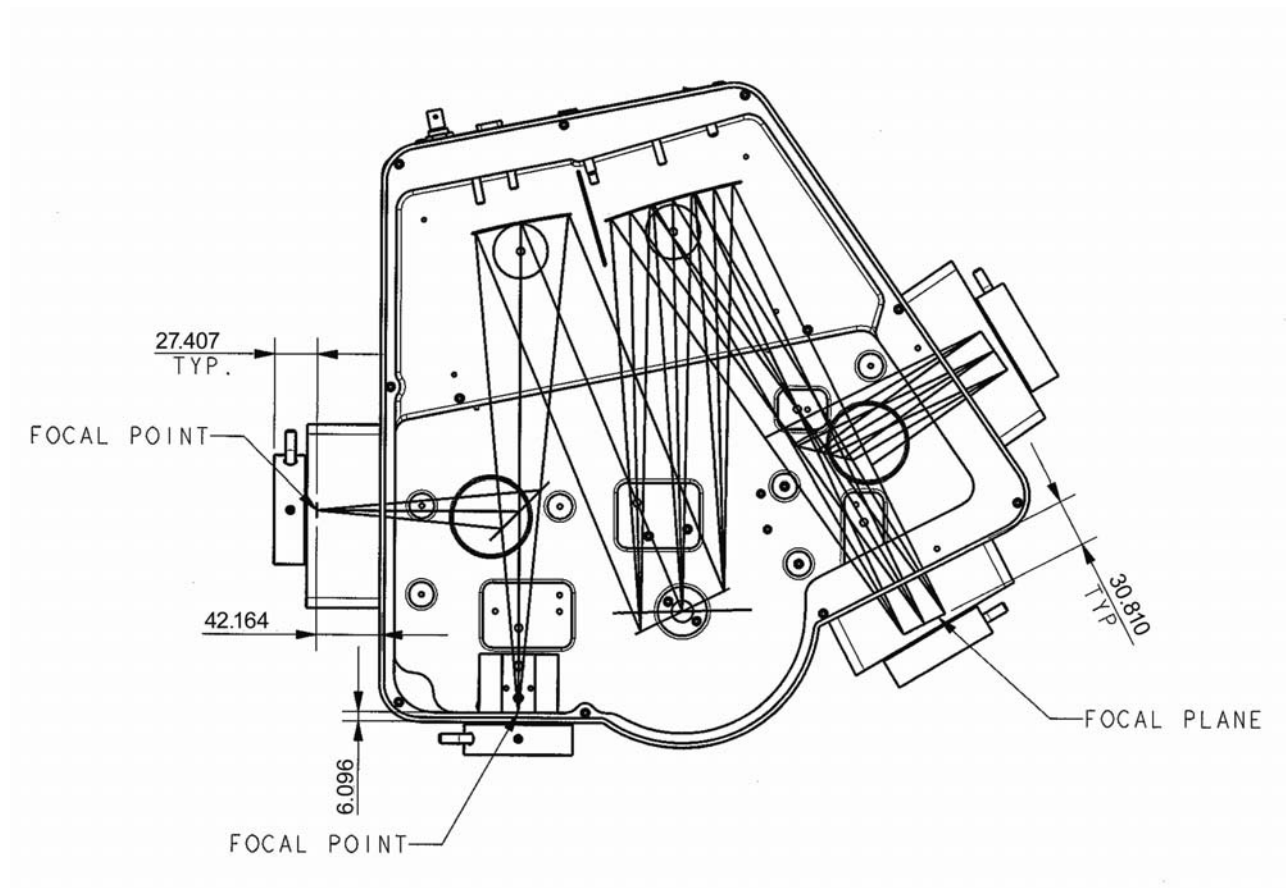


Figure 17. iHR320 Top View, Showing Slits and Focal Plane

iHR550

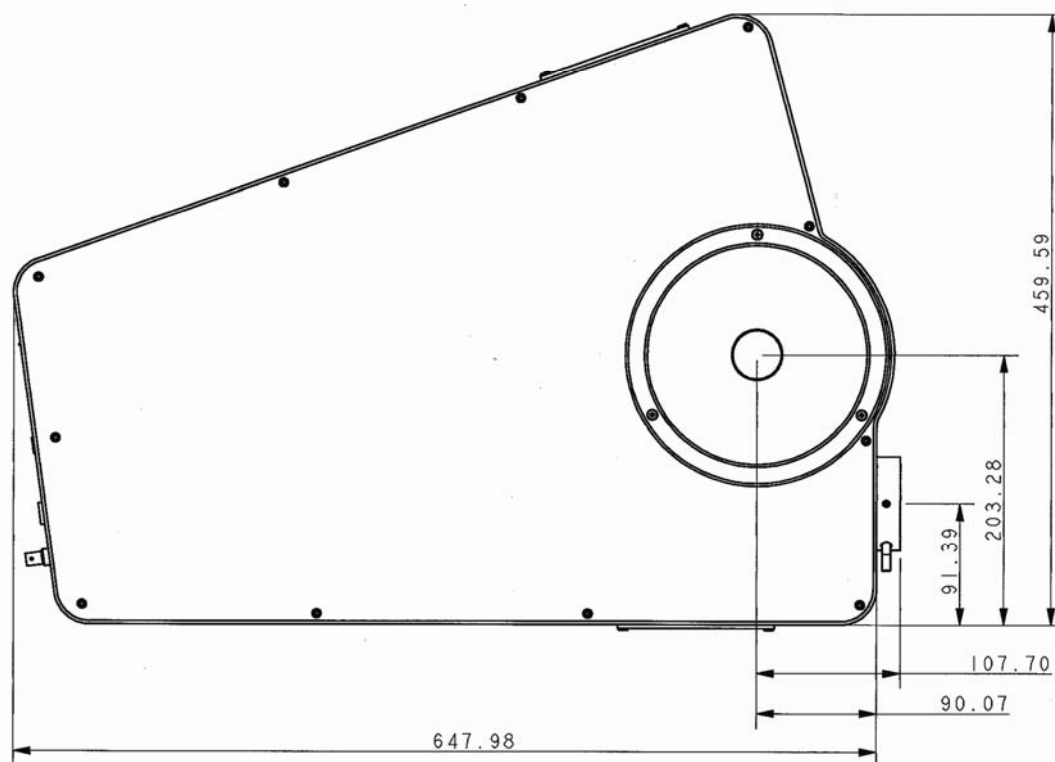


Figure 18. iHR550 Dimensions, Top View

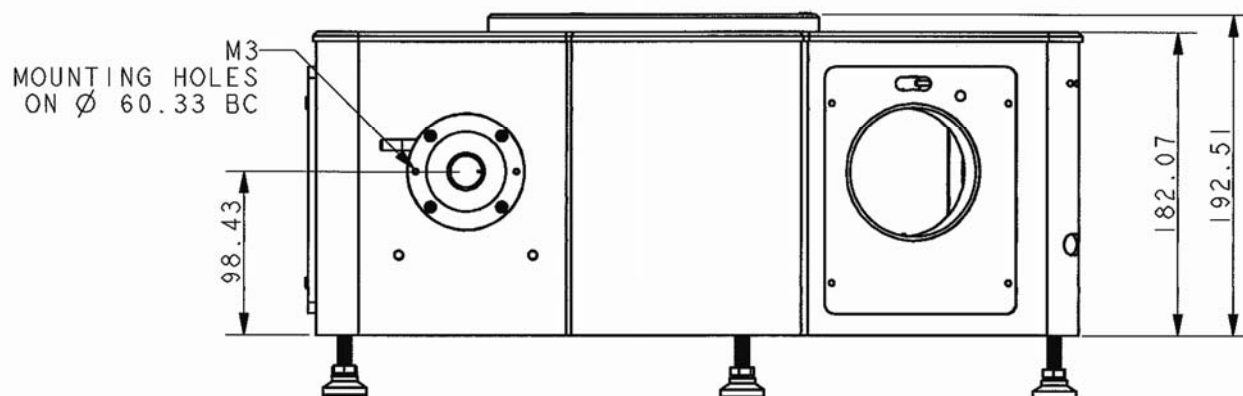


Figure 19. iHR550 Dimensions, Front View

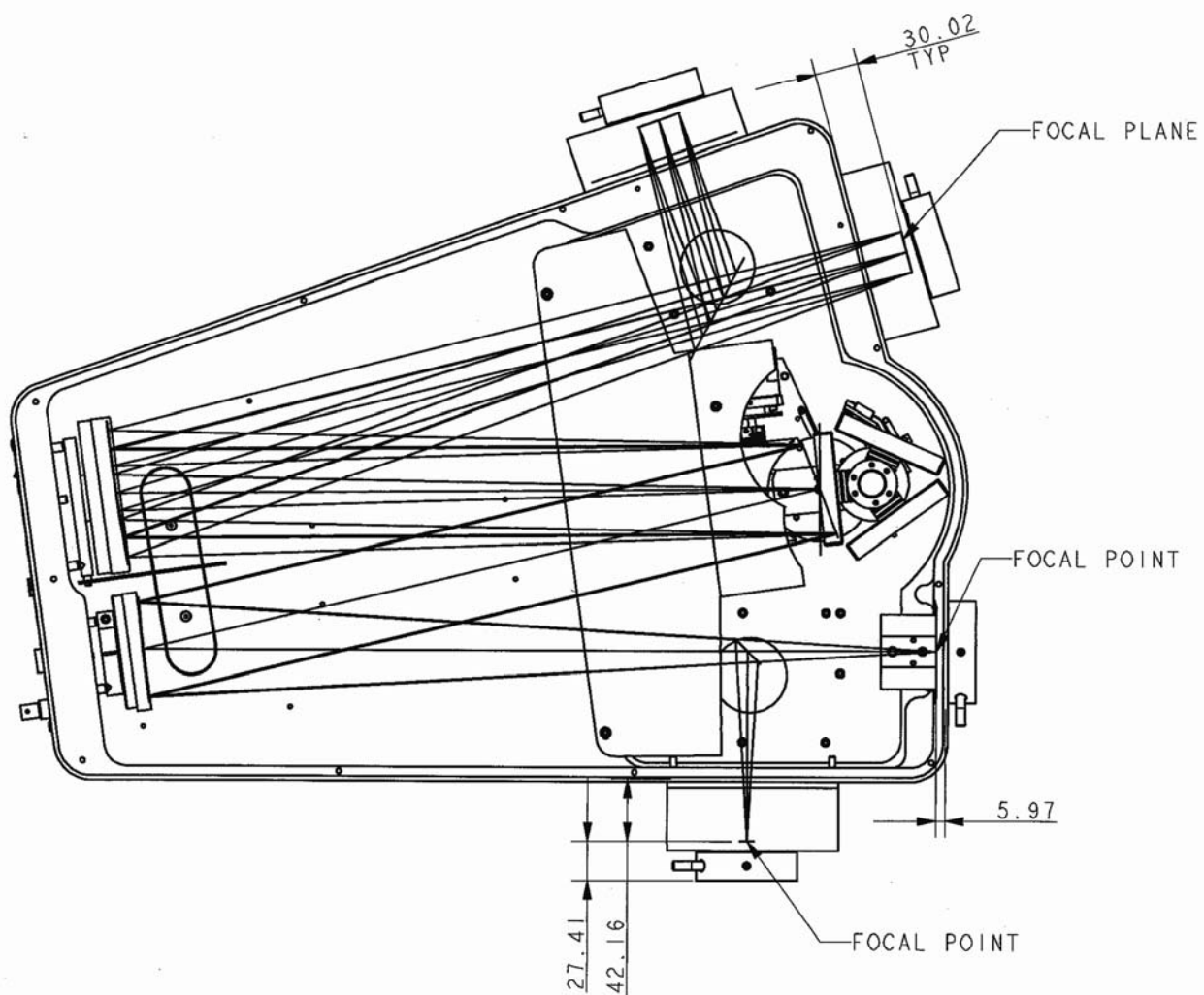


Figure 20. iHR550 Top View, Showing Slits and Focal Plane

Appendix B: Accessories Listing

Table VIII. Available Accessories for the iHR

Accessory	Part Number*	Adapters Required
Resolution array adapter	MAI-IR	
Imaging array adapter	MAI-II	
Computer controlled front entrance slit, 0-2 mm in 2 μ m steps	MSL-I3FN2	
Computer controlled side entrance slit, 0-2 mm in 2 μ m steps	MSL-I3SN2	
Computer controlled front exit slit, 0-2 mm in 2 μ m steps	MSL-I3FX2	
Computer controlled side exit slit , 0-2 mm in 2 μ m steps	MSL-I3SX2	
Motorized swing away entrance mirror	MSL-IANM	
Motorized swing away exit mirror	MSL-IAXM	
Grating mount	GMI68	
Internal CCD shutter for front entrance port	MSH-ICF	
Internal CCD shutter for side entrance port	MSH-ICS	
IHR320 internal filter wheel	AFW-IHR	
C-mount flange, female	CF-IHR	
C-mount flange, male	CM-IHR	
M28 thread type adapter	M28-IHR	
Fiber entrance adapter, SMA	OFASMA-IHR	
Fiber mount with x-y adjust, 10 mm and 1/4" ferrule	AFO-XY	
100 W Tungsten-Halogen light source in LSH series housing with focusing mirror, f/6	LSH-100	LSH-A270, LPS-250
250 W Tungsten-Halogen light source in LSH series housing with focusing mirror, f/6	LSH-250	LSH-A270, LPS-250
Adapter to mount LSH series housing directly to slits	LSH-A270	
Global light source with IR pencil emitter in LSH series housing with focusing mirror, f/6	LSH-GB	LSH-A270, LPS-250
Adapter to mount LSH housing to an ACH-C chopper	LSH-C	

Appendix B: Accessories Listing

Accessory	Part Number*	Adapters Required
Enclosed compact chopper designed for use with AFW-C6P(M).	ACH-C	
Manual 6 position filter wheel – up to 6 1" diameter filters.	AFW-C6P	
SampleMax VIS – Lens based universal sample	ASC-VIS	
SampleMax UV– Lens based universal sample	ACS-UV	
Solid sample holder for SampleMax	ASC-SSOL	Requires ASC-VIS or ASC-UV
DSS detectors	Contact Factory	
DSS detector interface	1427B	
PMT detectors	Contact Factory	
450W Xe lamp housing	FL-1039	FL-450XOFR
Ozone-free Xe bulb	FL-450XOFR	FL-1039

Appendix C: CE Declaration of Conformity

According to ISO/IEC Guide 22 and EN 45014

Manufacturer: HORIBA Jobin Yvon

Address: 3880 Park Avenue
Edison, NJ 08820, USA

Product Name: iHR Imaging Spectrometer
Model Names: iHR320, iHR550
Product Options: All options and customized products based on the above.

Conforms to the following European Directives:

The product herewith complies with the requirements of “CE Directive” 93/68/EEC, the “Low Voltage Directive” 73/23/EEC, and the “EMC Directive” 89/336/EEC and 92/31/EEC and carries the CE Marking accordingly.

Safety:
EN 61010-1: 06/2001

EMC:
Emissions
EN 55011 (Radiated & Conducted Emissions)

Immunity
EN 61000-4-2 (ESD)
EN 61000-4-3 (Radiated Immunity)
EN 61000-4-4 (EFT)
EN 61000-4-6 (Surge)
EN 61000-4-8 (Conducted Immunity)
EN.61000-4-11 (Mains Voltage Dips & Interrupts)

Other:
EN 61000-3-2 (Harmonic Emission)
EN 61000-3-3 (Flicker)
Ground Continuity
Dielectric Strength

Vice-President

HORIBA Jobin Yvon
Edison, NJ 08820
USA
September 20, 2005

Appendix D: Mounting Accessories to the iHR

Slit Mounting Holes

Tapped holes on the slit body provide an easy means of attaching accessories to the iHR. They are also useful for interfacing the iHR with the customer's experiments and equipment. When interfacing with the iHR, it is important to know the distance from the mounting face of the slit body to the slits:

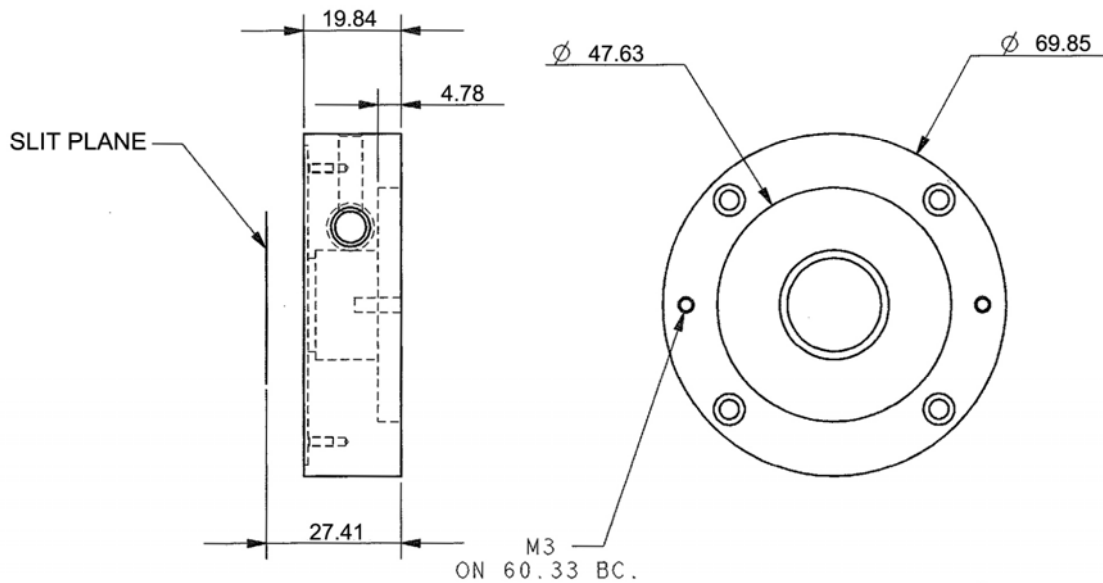


Figure 21. Slit Mounting Hole Locations (in mm)

Accessories

A wide range of accessories can be used with iHR Series spectrometers. Most accessories can be mounted directly to the slit assembly or to the slit assembly via an adapter. The following are procedures for mounting commonly used accessories to an iHR.

Female C-mount Adapter

When attached to the slit assembly, this C-mount adapter provides a mounting surface with the standard female C-mount thread. To attach the C-mount adapter, place the C-mount adapter against the slit assembly and use four M3 x 10 mm flat head screws to attach the adapter to the slit as shown below.

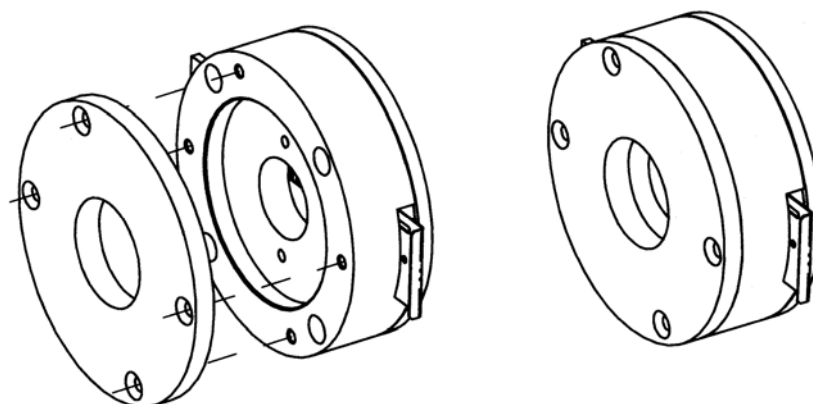


Figure 22. Attachment of C-mount Adapter to Slit

Male C-mount Adapter

The male C-mount adapter allows for the coupling of any camera with a C-mount interface to the iHR. This adapter provides the standard male C-mount thread. To use this adapter:

1. Screw the flange onto your camera.
2. Insert the flange into the iHR.
3. Slide the camera/flange assembly in or out to focus the spectral output on the camera focal plane and rotate the camera/flange assembly to align the spectral output to the camera focal plane.
4. When the camera is properly aligned and focused, use a 2.5 mm allen key to tighten the flange lock and secure the camera in place.

LSH Series Lamp Housings

1. Mount the LSH-A270 adapter to the LSH lamp housing (P/N LSH250, LSH100, or LSH-GB) using two M3 x 10 mm cap head screws.
2. Mount the LSH lamp housing, via the LSH-A270 adapter, to the iHR slit assembly using two M3 x 10 mm cap head screws.

SampleMax

1. Remove the SampleMax sample compartment cover to access the four screws that secure the mounting adapter to the wall of the sample compartment.
2. Remove the mounting adapter.
3. Using two M3 x 10 mm cap head screws, secure the Mounting Adapter to the iHR slit assembly.
4. Using the four screws previously removed, re-secure the Mounting Adapter to the SampleMax.

ACH-C Optical Chopper

The M28 adapter (P/N MHR-M28) is a required accessory for mounting the chopper head to the spectrometer slit.

1. Mount the M28 adapter to your spectrometer slit assembly if it has not yet been mounted.
2. Screw the chopper head to the M28 adapter of your spectrometer using the M28 knurl nut attached to the chopper cover.

1427B Detector Housing

1. Using a 7/64" hex key, remove the four screws on the front of the housing and remove the front end of the housing (the housing must be partially disassembled to allow two 6-32" mounting screws to pass through the flange).
2. Mount the front end of the housing to the appropriate exit slit using two 6-32" mounting screws. The screws pass through the two inner mounting holes of the flange (see Figure 23).
3. Reassemble the 1427B by using the four 7/64" screws to attach the rear of the housing to the front of the housing.
4. Position the support leg provided with the 1427B to secure the housing; use the 1/4"-20 set screws to adjust the length of the leg.
5. Adjust the leveling foot of the leg to the proper height.

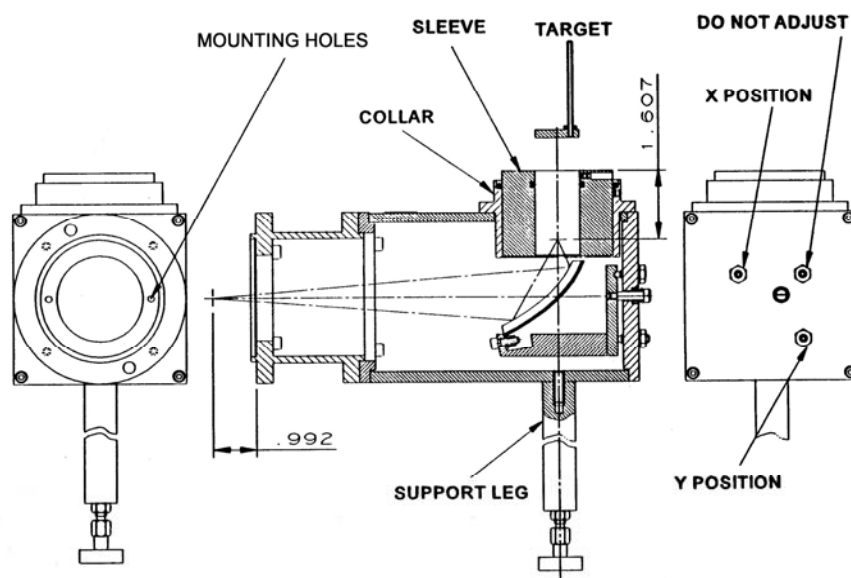


Figure 23. 1427B Detector Housing

XY Fiber Optic Mount

1. Mount the XY Fiber Optic Mount (P/N AFO-XY) transfer plate to the slit assembly using two M3 flat head screws (see Figure 24). Two 6/32" flat head screws will be left over as two sets of screws are provided.

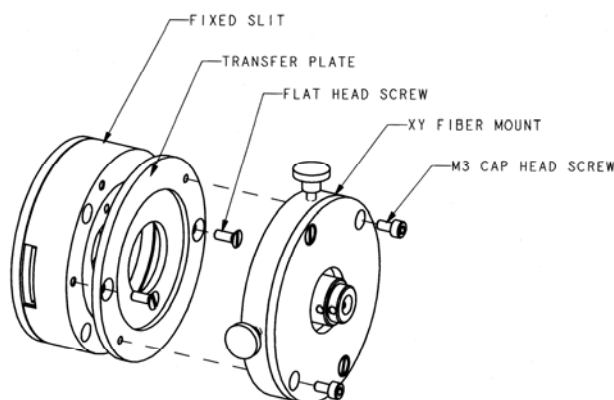


Figure 24. Mounting the XY Fiber Optic Mount Transfer Plate to a Slit Assembly

2. Using two M3 cap head screws, attach the XY fiber mount to the transfer plate.
3. If using a 10 mm fiber, remove the 1/4" ferrule adapter by loosening the M3 set screw that holds the adapter sleeve in place.
4. Use the thumb screws of the fiber mount to adjust fiber position. Once the fiber is correctly positioned, adjust the M3 locking set screw to secure the fiber in place (see Figure 25).

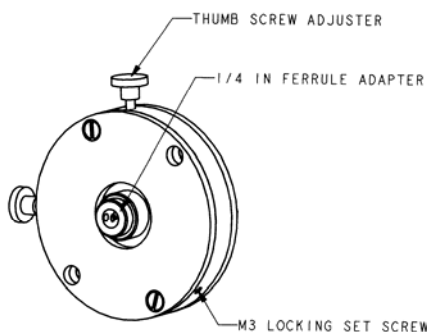


Figure 25. XY Fiber Optic Mount Adjustments

CCD Flange to CCD

The CCD imaging flange (P/N MAI-II) and resolution flange (P/N MAI-IR), are designed to attach to HORIBA Jobin Yvon CCD cameras. To accommodate other CCD cameras, please contact the HORIBA Jobin Yvon Sales Department. To attach the flange to a HORIBA Jobin Yvon camera:

1. Place the CCD flange over the end of the camera and rotate it so that the rectangular mask on the CCD flange is square to the camera body and the three tapped holes in the camera face line up with the three counter bore holes on the CCD flange.
2. Attach the flange to the camera using three, 3/8 in long 8/32 flat head screws.

Refer to Chapter 3: Installation of the CCD Camera for installation instructions.

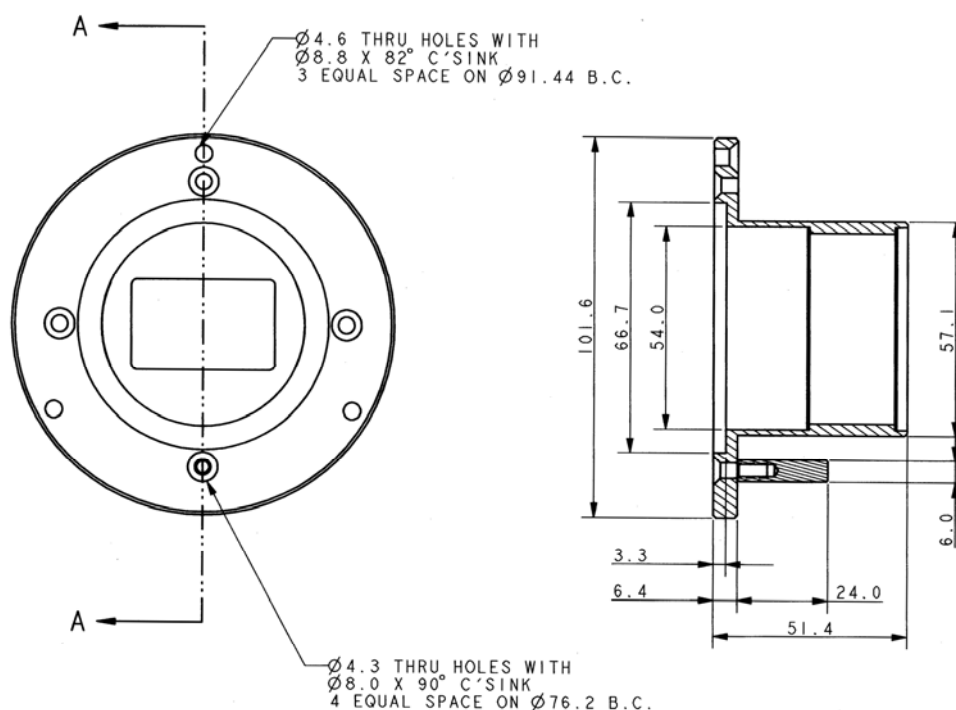


Figure 26. CCD Flange

Shutter Replacement Procedure

1. Remove the top cover
 - a. Loosen and remove the nine M3 cap head screws on the top cover.
2. Remove the baffle cover.
 - a. If the unit has side entrance or exit fold mirrors, set the mirrors for front entrance and exit operation via software. The mirrors now lie against the sides of the housing.
 - b. Remove the two M3 cap head screws and two Phillips head screws that secure the cover.
 - c. Now carefully lift the baffle cover out of the spectrometer housing. You must rotate the cover slightly to do this.
3. Remove the old CCD shutter.
 - a. If you are replacing the side entrance shutter, you must first command the entrance fold mirror for side entrance operation. This moves the mirror away from the side wall allowing access to the shutter.
 - b. Power the system down.
 - c. Trace the shutter cable back to the electronic connector board.
 - d. Note the location of the shutter cable. You will need to know where to plug in the new shutter.
 - e. Unplug the shutter cable.
 - f. Loosen the two M3 cap head screws that secure the shutter assembly.
 - g. Remove the shutter assembly.
4. Install the new shutter assembly.
 - a. For a front entrance slit, place the new front entrance shutter assembly on the front entrance slit.

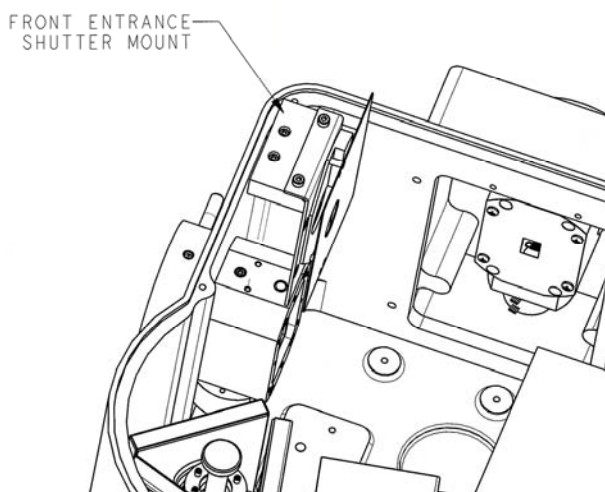


Figure 27. Front Entrance Shutter Mount

- b. For a side entrance slit, place the new slide entrance shutter assembly against the side entrance wall so the mounting holes on the mounting plate line up with the tapped holes on the side wall of the housing.
- c. Install the two M3 cap head screws in the new shutter assembly and tighten them to secure the shutter in place.

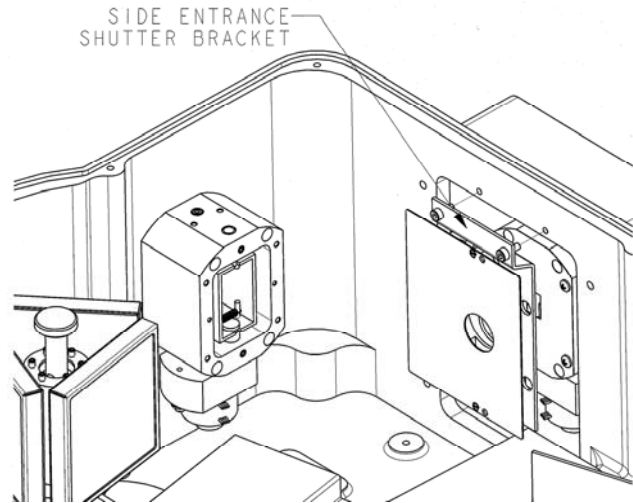


Figure 28. Side Entrance Shutter Mount

- d. Dress the cable along the bottom of the unit.
 - e. Plug the shutter connector into the appropriate location on the electronics connector board. If you are not sure of the correct location, there is a connector diagram on the back of the baffle cover which indicates the correct location for the shutter.
- 5. Replace the baffle cover.
 - 6. Replace the top cover.

Filter Installation for Internal Filter Wheel

1. Remove the top cover
 - a. Loosen and remove the nine M3 cap head screws on the top cover.
2. Remove the filter wheel from the filter wheel motor shaft.
 - a. If your system has a CCD shutter on the entrance slit, you will first need to temporarily remove the shutter assembly from the entrance slit to make room for the removal of the filter wheel. To do this, loosen the two M3 set screws on the top of the shutter block assembly and lift the shutter assembly up out of the way. You do not need to disconnect the shutter cable to do this.

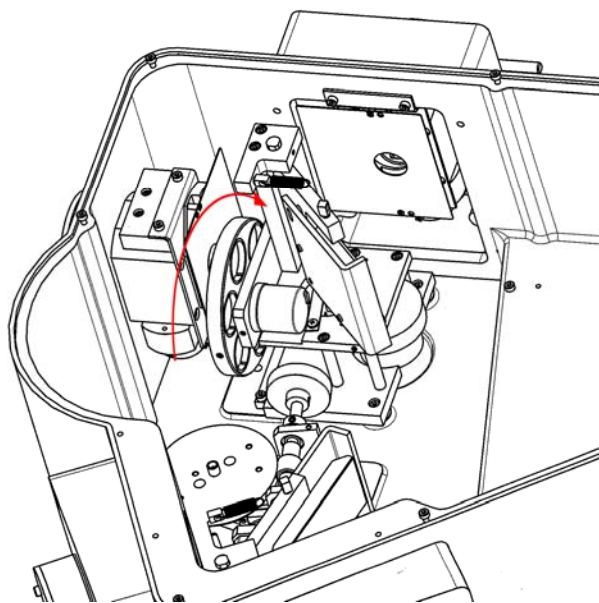


Figure 29. Placement of Internal Filter Wheel

- b. The filter wheel is secured to the motor shaft with two M3 set screws. Loosen these two set screws. If necessary, gently rotate the filter wheel by hand to gain access to the screw holes.
 - c. Slide the filter wheel off of the shaft and remove it from the unit.
3. Install new filters.
 - a. Locate the desired filter hole location and remove the retaining ring from the hole.
 - b. Insert the new filter into the hole and press the retaining ring in behind it to secure it in position. To avoid touching the filter, use lens tissue to press in the retaining ring. Be sure the retaining ring is pressed all the way in so that the filter is not loose.

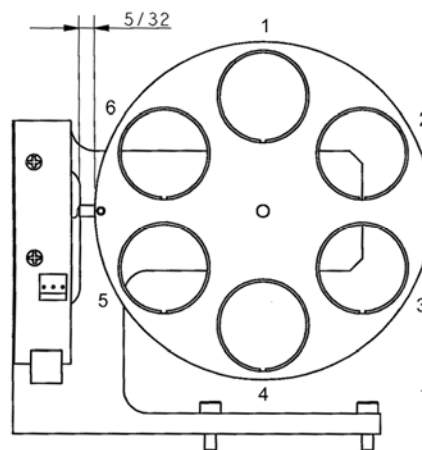


Figure 30. Filter Positions

4. Replace the filter wheel back on the filter wheel motor shaft.
 - a. Slide the filter wheel back onto the motor shaft. The beveled face of the wheel should face away from the entrance slit.
 - b. Tighten the two M3 set screws to secure the filter wheel to the motor shaft.
5. Replace the top cover.

Service Policy

If you need assistance in resolving a problem with your instrument, contact our Customer Service Department directly, or if outside the United States, through our representative or affiliate covering your location.

Often it is possible to correct, reduce, or localize the problem through discussion with our Customer Service Engineers.

All instruments are covered by warranty. The warranty statement is printed on the inside back cover of this manual. Service for out-of-warranty instruments is also available, for a fee. Contact HORIBA Jobin Yvon or your local representative for details and cost estimates.

If your problem relates to software, please verify your computer's operation by running any diagnostic routines that were provided with it. Please refer to the software documentation for troubleshooting procedures. If you must call for Technical Support, please be ready to provide the software serial number, as well as the software version and firmware version of any controller or interface options in your system. The software version can be determined by selecting the software name at the right end of the menu bar and clicking on "About." Also knowing the memory type and allocation, and other computer hardware configuration data from the PC's CMOS Setup utility may be useful.

In the United States, customers may contact the Customer Service department directly. From other locations worldwide, contact the representative or affiliate for your location.

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If an instrument or component must be returned, the method described on the following page should be followed to expedite servicing and reduce your downtime.

Return Authorization

All instruments and components returned to the factory must be accompanied by a Return Authorization Number issued by our Customer Service Department.

To issue a Return Authorization number, we require:

- The model and serial number of the instrument
- A list of items and/or components to be returned
- A description of the problem, including operating settings
- The instrument user's name, mailing address, telephone, and fax numbers
- The shipping address for shipment of the instrument to you after service
- Your Purchase Order number and billing information for non-warranty services
- Our original Sales Order number, if known
- Your Customer Account number, if known
- Any special instructions

Warranty

For any item sold by Seller to Buyer or any repair or service, Seller agrees to repair or replace, without charge to Buyer for labor or materials or workmanship of which Seller is notified in writing before the end of the applicable period set forth below, beginning from the date of shipment or completion of service or repair, whichever is applicable:

- a. New equipment, product and laboratory apparatus: 1 year with the following exceptions:
 - i) Computers and their peripherals
 - ii) Glassware and glass products.
- b. Repairs, replacements, or parts – the greater of 30 days and the remaining original warranty period for the item that was repaired or replaced.
- c. Installation services – 90 days.

The above warranties do not cover components manufactured by others and which are separately warranted by the manufacturer. Seller shall cooperate with Buyer in obtaining the benefits of warranties by manufacturers of such items but assumes no obligations with respect thereto.

All defective items replaced pursuant to the above warranty become the property of Seller.

This warranty shall not apply to any components subjected to misuse due to common negligence, adverse environmental conditions, or accident, nor to any components which are not operated in accordance with the printed instructions in the operations manual. Labor, materials and expenses shall be billed to the Buyer at the rates then in effect for any repairs or replacements not covered by this warranty.

This warranty shall not apply to any HORIBA Jobin Yvon manufactured components that have been repaired, altered or installed by anyone not authorized by HORIBA Jobin Yvon in writing.

THE ABOVE WARRANTIES AND ANY OTHER WARRANTIES SET FORTH IN WRITING HERIN ARE IN LIEU OF ALL OTHER WARRANTIES OR GUARANTEES EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR PURPOSE OR OTHER WARRANTIES.

The above shall constitute complete fulfillment of all liabilities of Seller, and Seller shall not be liable under any circumstances for special or consequential damages, including without limitation loss of profits or time or personal injury caused.

The limitation on consequential damages set forth above is intended to apply to all aspects of this contract including without limitation Seller's obligations under these standard terms.

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