HORIBA Scientific

M Series II Spectrometer

Operation Manual
Part number J81113 rev. C

M Series II Spectrometer

Operating Manual

www.HORIBA.com

Rev. C

JOBIN YVON Technology

HORIBA Scientific

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1: Introduction

About the M Series II spectrometer

The M Series II is a group of high-performance, research spectrometers with long focal length. The 1000M features a 1000 mm focal length with *f*/8 aperture. The 1250M has a 1250 mm focal length. Designed for experiments that require extremely low light-levels, the M Series II delivers unmatched spectral resolution for a variety of research applications, including:

- Raman
- Plasma emission
- Photoluminescence
- LIBS (Laser-induced breakdown spectroscopy)
- LIPS (Laser-induced plasma spectroscopy)
- LIF (Laser-induced fluorescence spectroscopy)

M Series II spectrometers feature a 150 nm to 15 µm wavelength-range (depending on the grating and detector used). A fine step-size of 0.00025 nm allows full resolution to be obtained while delivering superb accuracy (± 0.05 nm) and repeatability (± 0.005 nm). Other features include high-precision micrometer slits, a high-precision stepper drive, and a USB 2.0 computer interface.

Dual entrance and exit ports, with selectable swing mirrors, enhance the versatility and flexibility of the M Series II. This dual exit-port option allows for simultaneous mounting of two detectors. Data-acquisition can also be automated from two different optical setups by toggling between entrance ports. The M Series II is compatible with HORIBA Scientific's complete library of interchangeable gratings, CCDs, full line of single-channel detectors, PMTs, and accessories.

Note: *Keep this and the other reference manuals near the system.*

Chapter overview

Disclaimer

By setting up or starting to use any HORIBA Instruments Incorporated product, you are accepting the following terms:

You are responsible for understanding the information contained in this document. You should not rely on this information as absolute or all-encompassing; there may be local issues (in your environment) not addressed in this document that you may need to address, and there may be issues or procedures discussed that may not apply to your situation.

If you do not follow the instructions or procedures contained in this document, you are responsible for yourself and your actions and all resulting consequences. If you rely on the information contained in this document, you are responsible for:

- Adhering to safety procedures
- Following all precautions
- Referring to additional safety documentation, such as Material Safety Data Sheets (MSDS), when advised

As a condition of purchase, you agree to use safe operating procedures in the use of all products supplied by HORIBA Instruments Incorporated, including those specified in the MSDS provided with any chemicals and all warning and cautionary notices, and to use all safety devices and guards when operating equipment. You agree to indemnify and hold HORIBA Instruments Incorporated harmless from any liability or obligation arising from your use or misuse of any such products, including, without limitation, to persons injured directly or indirectly in connection with your use or operation of the products. The foregoing indemnification shall in no event be deemed to have expanded HORIBA Instruments Incorporated's liability for the products.

HORIBA Instruments Incorporated products are not intended for any general cosmetic, drug, food, or household application, but may be used for analytical measurements or research in these fields. A condition of HORIBA Instruments Incorporated's acceptance of a purchase order is that only qualified individuals, trained and familiar with procedures suitable for the products ordered, will handle them. Training and maintenance procedures may be purchased from HORIBA Instruments Incorporated at an additional cost. HORIBA Instruments Incorporated cannot be held responsible for actions your employer or contractor may take without proper training.

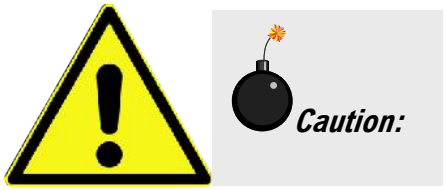
Due to HORIBA Instruments Incorporated's efforts to continuously improve our products, all specifications, dimensions, internal workings, and operating procedures are subject to change without notice. All specifications and measurements are approximate, based on a standard configuration; results may vary with the application and environment. Any software manufactured by HORIBA Instruments Incorporated is also under constant development and subject to change without notice.

Any warranties and remedies with respect to our products are limited to those provided in writing as to a particular product. In no event shall HORIBA Instruments Incorporated be held liable for any special, incidental, indirect or consequential damages of any kind, or any damages whatsoever resulting from loss of use, loss of data, or loss of profits, arising out of or in connection with our products or the use or possession thereof. HORIBA Instruments Incorporated is also in no event liable for damages on any theory of liability arising out of, or in connection with, the use or performance of our hardware or software, regardless of whether you have been advised of the possibility of damage.

Safety summary

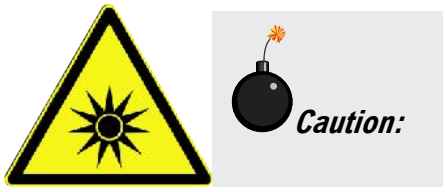
The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of instrument. HORIBA Instruments Incorporated assumes no liability for the customer's failure to comply with these requirements. Certain symbols are used throughout the text for special conditions when operating the instruments:

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or similar that, if incorrectly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met. HORIBA Instruments Incorporated is not responsible for damage arising out of improper use of the equipment.



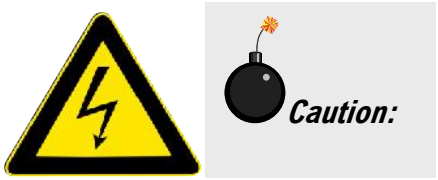
A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or similar that, if incorrectly performed or adhered to, could result in damage to the product. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met. HORIBA Instruments Incorporated is not responsible for damage arising out of improper use of the equipment.

Ultraviolet light! Wear protective goggles, full-face shield, skin-protection clothing, and UV-blocking gloves. Do not stare into light.



Intense ultraviolet, visible, or infrared light! Wear light-protective goggles, full-face shield, skin-protection clothing, and light-blocking gloves. Do not stare into light.

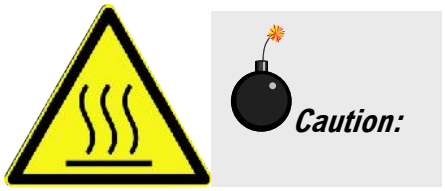
Extreme cold! Cryogenic materials must always be handled with care. Wear protective goggles, full-face shield, skin-protection clothing, and insulated gloves.



Risk of electric shock! This symbol warns the user that un-insulated voltage within the unit may have sufficient magnitude to cause electric shock.

Danger to fingers! This symbol warns the user that the equipment is heavy, and can crush or injure the hand if precautions are not taken.

This symbol cautions the user that excessive humidity, if present, can damage certain equipment.



Hot! This symbol warns the user that hot equipment may be present, and could create a risk of fire or burns.

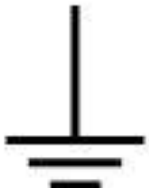
Read this manual before using or servicing the instrument.

Wear protective gloves.

Wear appropriate safety goggles to protect the eyes.

Wear an appropriate face-shield to protect the face.

Disconnect instrument from wall outlet (mains) before servicing.



Earth (ground) terminal; indicates a circuit-common connected to grounded (earthed) chassis.

Protective earth (ground) terminal.

Alternating current.

On (electrical supply).

Off (electrical supply)

General information is given concerning operation of the equipment.

Risks of ultraviolet exposure

Caution: *This instrument is used in conjunction with ultraviolet light. Exposure to these radiations, even reflected or diffused, can result in serious, and sometimes irreversible, eye and skin injuries.*

Overexposure to ultraviolet rays threatens human health by causing:

- *Immediate painful sunburn*
- *Skin cancer*
- *Eye damage*
- *Immune-system suppression*
- *Premature aging*

Do not aim the UV light at anyone.
Do not look directly into the light.
Always wear protective goggles, full-face shield and skin protection clothing and gloves when using the light source.

- Light is subdivided into visible light, ranging from 400 nm (violet) to 700 nm (red); longer infrared, "above red" or > 700nm, also called heat; and shorter ultraviolet radiation (UVR), "below violet" or < 400nm. UVR is further subdivided into UV-A or near-UV (320–400 nm), also called black (invisible) light; UV-B or mid-UV (290–320 nm), which is more skin penetrating; and UV-C or far-UV (< 290 nm).

- Health effects of exposure to UV light are familiar to anyone who has had sunburn. However, the UV light level around some UV equipment greatly exceeds the level found in nature. Acute (short-term) effects include redness or ulceration of the skin. At high levels of exposure, these burns can be serious. For chronic exposures, there is also a cumulative risk of harm. This risk depends upon the amount of exposure during your lifetime. The long-term risks for large cumulative exposure include premature aging of the skin, wrinkles and, most seriously, skin cancer and cataract.

- Damage to vision is likely following exposure to high-intensity UV radiation. In adults, more than 99% of UV radiation is absorbed by the anterior structures of the eye. UVR can contribute to the development of age-related cataract, pterygium, photodermatitis, and cancer of the skin around the eye. It may also contribute to age-related macular degeneration. Like the skin, the covering of the eye or the cornea, is epithelial tissue. The danger to the eye is enhanced by the fact that light

can enter from all angles around the eye and not only in the direction of vision. This is especially true while working in a dark environment, as the pupil is wide open. The lens can also be damaged, but because the cornea acts as a filter, the chances are reduced. This should not lessen the concern over lens damage however, because cataracts are the direct result of lens damage.

Burns to the eyes are usually more painful and serious than a burn to the skin. Make sure your eye protection is appropriate for this work. NORMAL EYEGLASSES OR CONTACTS OFFER VERY LIMITED PROTECTION!

Caution: *UV exposures are not immediately felt. The user may not realize the hazard until it is too late and the damage is done.*

Training

For the use of UV sources, new users must be trained by another member of the laboratory who, in the opinion of the member of staff in charge of the department, is sufficiently competent to give instruction on the correct procedure. Newly trained users should be overseen for some time by a competent person.

Additional risks of xenon lamps

Warning: *Xenon lamps are dangerous. Please read the following precautions.*

Among the dangers associated with xenon lamps are:

- Burns caused by contact with a hot xenon lamp.
- Fire ignited by hot xenon lamp.
- Interaction of other nearby chemicals with intense ultraviolet, visible, or infrared radiation.
- Damage caused to apparatus placed close to the xenon lamp.
- Explosion or mechanical failure of the xenon lamp.

Visible radiation

Any very bright visible light source will cause a human aversion response: we either blink or turn our head away. Although we may see a retinal afterimage (which can last for several minutes), the aversion response time (about 0.25 seconds) normally protects our vision. This aversion response should be trusted and obeyed. NEVER STARE AT ANY BRIGHT LIGHT-SOURCE FOR AN EXTENDED PERIOD. Overriding the aversion response by forcing yourself to look at a bright light-source may result in permanent injury to the retina. This type of injury can occur during a single prolonged exposure. Excessive exposure to visible light can result in skin and eye damage.

Visible light sources that are not bright enough to cause retinal burns are not necessarily safe to view for an extended period. In fact, any sufficiently bright visible light source viewed for an extended period will eventually cause degradation of both night and color vision. Appropriate protective filters are needed for any light source that causes viewing discomfort when viewed for an extended period of time. For these reasons, prolonged viewing of bright light sources should be limited by the use of appropriate filters.

The blue-light wavelengths (400–500 nm) present a unique hazard to the retina by causing photochemical effects similar to those found in UV-radiation exposure.

Infrared radiation

Infrared (or heat) radiation is defined as having a wavelength between 780 nm and 1 mm. Specific biological effectiveness “bands” have been defined by the CIE (Commission Internationale de l’Eclairage or International Commission on Illumination) as follows:

• IR-A (near IR) (780–1400 nm)
• IR-B (mid IR) (1400–3000 nm)
• IR-C (far IR) (3000 nm–1 mm)

The skin and eyes absorb infrared radiation (IR) as heat. Workers normally notice excessive exposure through heat sensation and pain. Infrared radiation in the IR-A that enters the human eye will reach (and can be focused upon) the sensitive cells of the retina. For high irradiance sources in the IR-A, the retina is the part of the eye that is at risk. For sources in the IR-B and IR-C, both the skin and the cornea may be at risk from "flash burns." In addition, the heat deposited in the cornea may be conducted to the lens of the eye. This heating of the lens is believed to be the cause of so called "glassblowers' " cataracts because the heat transfer may cause clouding of the lens.

- Retinal IR Hazards (780 to 1400 nm): possible retinal lesions from acute high irradiance exposures to small dimension sources.
- Lens IR Hazards (1400 to 1900 nm): possible cataract induction from chronic lower irradiance exposures.
- Corneal IR Hazards (1900 nm to 1 mm): possible flashburns from acute high irradiance exposures.

Who is likely to be injured? The user and anyone exposed to the radiation or xenon lamp shards as a result of faulty procedures. Injuries may be slight to severe.

2: Getting Started

Unpacking and inspection

Carefully unpack your M Series II spectrometer, examining each component for possible shipping damage. Prior to shipment, your spectrometer was inspected and found to be free of mechanical and electrical defects. Upon acceptance, the carrier assumes responsibility for its safe arrival. Should you receive this instrument in a damaged condition, apparent or concealed, it must be noted on the freight bill or express receipt and signed by the carrier's agent. Failure to do so could result in the carrier refusing to honor the claim. Upon filing a claim, notify HORIBA Scientific.

Table I. Individual Components for the M Series II

Item #	Description		Part Number
1	Spectrometer		1000M Series II or 1250 M Series II
2	Grating mask set		J24700
3	Array adapter*		J1497
4	Leveling feet (set of three)		J22420
5	Leveling-foot pads (set of three)		J23219
6	Shielded USB communications cable, A to B		J980087
7	24 V AC-to-DC power supply		J964007
8	Power cord	CEE 7/7 to CEE-22 (220 V)	J98020
		NEMA 5-15 to CEE-22 (110 V)	J98015
9	Metric accessories kit	Includes set of metric Allen keys and metric screws	J992029
10	M Series II Operation Manual		J81113
11	HORIBA Scientific USB Spectrometer Utilities CD		CSW-USB-SUPPORT-MONO

* Included option with units configured for spectrograph operation.

Input power requirements

The M series II operates from a 24 V DC input. This is provided by the external brick power supply (J964007) with universal input (100 V–240 V, 1.6 A), and 24 V DC at 2.1 A output supplied with the spectrometer. The power supply is plugged into a standard wall outlet (mains) using a standard three-conductor power cord (J98015 for 110 V or J98020 for 220 V).

Caution: *Do not substitute any other power supply for that which is supplied with the instrument. To do so may cause severe damage to the instrument.*

Environmental requirements

Place the M Series II on a sturdy table or laboratory bench with enough room for any detectors, optional accessories, and host computer that will be part of the system configuration.

Keep the instrument in an atmosphere free of dust, corrosives, and smoke. The recommended operating temperature range is 20–30°C (68–86°F). Place it in an area with a temperature constant to within ± 2°C, for maintaining a stable environment is essential to achieve optimum results.

Note: *For optimum performance, keep the ambient temperature between 20 and 30°C.*

Computer requirements

The M Series II includes a USB interface with a built-in USB 2.0 hub for communications with a host computer. It also contains an additional USB port for connecting to a downstream USB device.

The M Series II can be controlled with HORIBA Scientific's Spectrometer Utilities program, SynerJY® data-acquisition software, or with LabVIEW™ VIs. Computer requirements for the M Series II 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 requirements

Do not connect or disconnect any cables to or from the M Series II when the instrument is powered on.

Caution: *Connecting or disconnecting cables while the instrument is powered on can cause irreparable damage to the instrument. Such damage is not covered by warranty.*

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

We recommend that you periodically clean the external surfaces of the M Series II by wiping them down with a clean, damp cloth. Perform this procedure only on external surfaces. Do not use any solvents, soaps, or abrasives when cleaning, for these products can damage surface finishes.

While the mirrors and gratings of the M Series II 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.

Set-up

Installing the leveling feet

Warning: *Watch your fingers! The equipment is very heavy and can crush or hurt you if it falls on you.*

1. Locate the three leveling feet (J22420) shipped with the M Series II.
2. Screw the leveling feet into the three M8 tapped holes at the base of the instrument.
3. Set the height of the unit by adjusting the feet.
4. Lock the feet into place by tightening the nuts of the feet against the body of the unit.
5. Pace the pads under the legs.

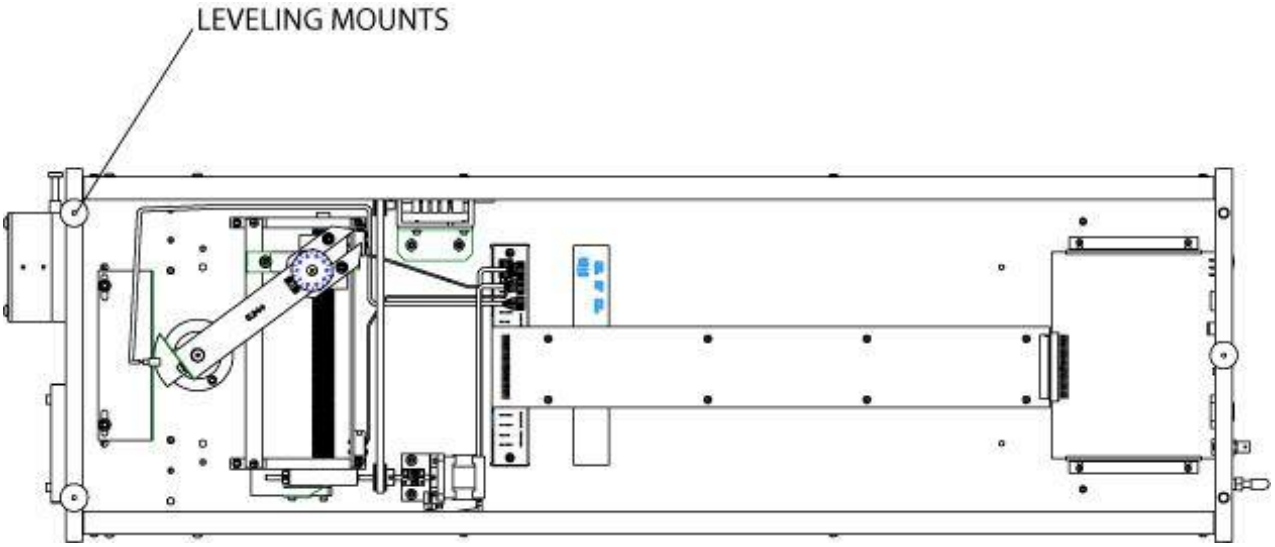


Figure 1. Bottom View of 1000M Showing Mounting-Hole Locations

Installing the grating

1. Loosen the four thumbscrews of the M Series II hatch cover, and remove the cover.

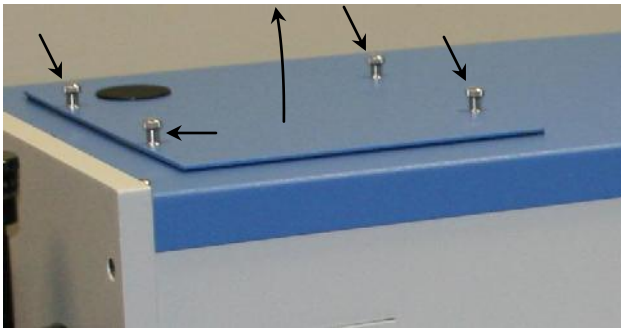


Figure 2. 1000M Grating Hatch Cover

2. Carefully remove the grating from the shipping container.
3. Grasp the grating by the handle and place it firmly on the backing-plate hook just below the center of the grating backing-plate.

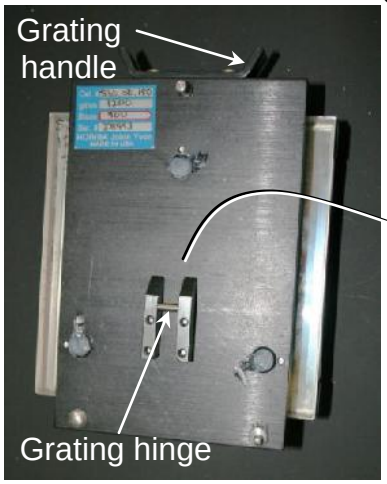


Figure 3. Grating handle and hinge

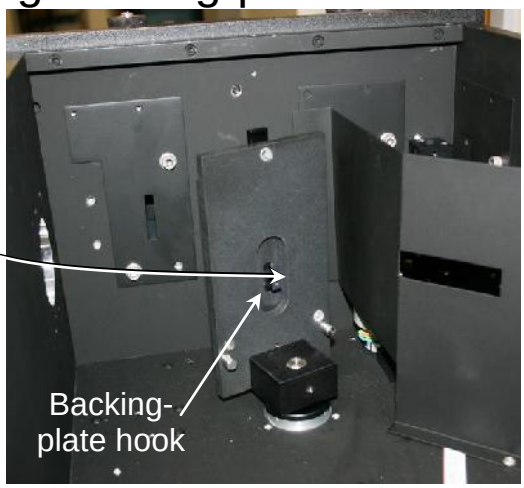


Figure 4. Backing-plate hook

4 When the grating turret is securely positioned, press the backing-plate tab down to secure the grating.

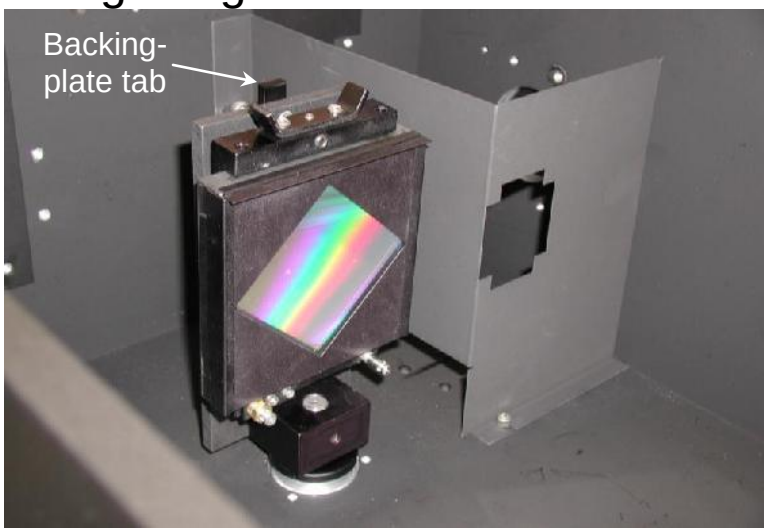
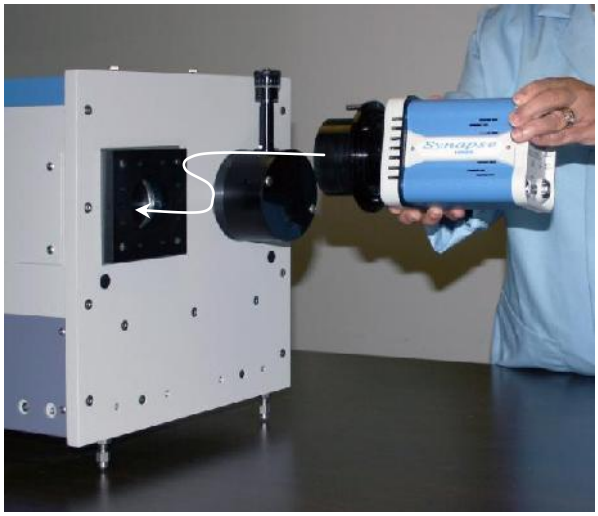


Figure 5. Backing-plate tab

5 Replace the hatch cover and tighten the cover screws.

If you have difficulty in the installation or removal of the grating or require any additional assistance, please contact your HORIBA Scientific Customer Service representative.

Installing a CCD camera (optional)



M Series II Spectrograph models purchased with HORIBA Scientific CCD cameras are shipped with the CCD flange already attached to the camera. HORIBA Scientific CCDs are focused and aligned at the factory. When pre-installed in the M Series II, using the procedure below, the CCDs should be properly aligned and require no further adjustments. Mount the CCD/flange assembly to the M Series II as follows:

1. Insert the tube of the CCD flange into the (square) CCD port of the M Series II.
2. Align the circumferential line on the CCD flange with the CCD port.
3. Align the hashmark on the CCD flange with the hashmark on the body of the CCD port.
4. Tighten the set screw.
5. See Chapter 3 for instructions for proper focus and alignment of CCD (typical 2–3 pixel FWHM).

Installing the USB Spectrometer Utilities software

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

1. Start Windows® if you have not already done so.
   Make sure all programs are closed.
2. Insert the CD labeled USB Spectrometer Utilities (CSW-USB-SUPPORT-MONO) into the CD-ROM drive on the host computer.
   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.

   The **InstallShield Wizard** dialog box appears.
3. Click the Next > button.
4. Click the Next > button to accept the default destination location (C:\Program Files\Jobin Yvon), or click the Browse button to select a different location.
5. Review the current settings, then click the Next > button to continue the installation.
6. When the installation is complete, click the Finish button.
7. 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 (J964007) to the power connector on the back panel of the M Series II.

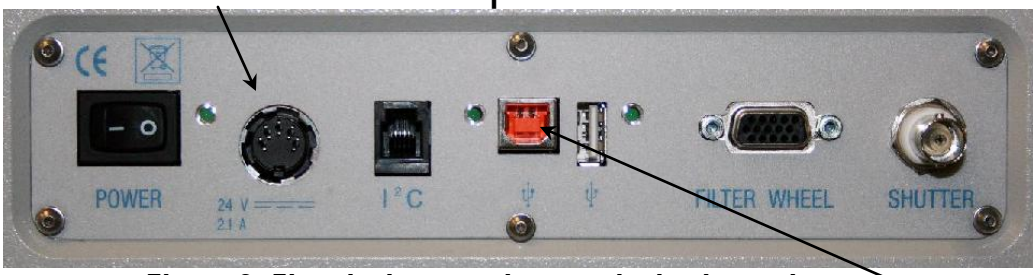


Figure 6. Electrical connections on the back panel

2. Connect the female end of the power cord (J98015 for 110 V, or J98020 for 220 V) to the power supply.
3. Plug the wall-outlet end of the power cord into a properly grounded outlet (mains) to provide a chassis-to-earth ground.
4. Connect the A end of the USB communications cable (J980076) to the USB port on the host computer.
5. Connect the other end of the USB cable (B end) to the USB port on the back panel of the M Series II.

Note: *The first time that the unit is connected to the host computer, Windows® detects a new USB device and automatically installs the appropriate driver (see Chapter 4: Operation).*

3: Operation

Operation modes

The M Series II is extremely versatile, and can be customized to accommodate a variety of applications. Selection of entrance and exit ports, gratings, and spectroscopic accessories allows you to tailor the M Series II specifically to your experiment. You can control the spectrometer via the accompanying USB Spectrometer Control Software (CSW-USB-SUPPORT-MONO) as well as with SynerJY®, SynerJY® Software Development Kit, or LabVIEW™ VIs.

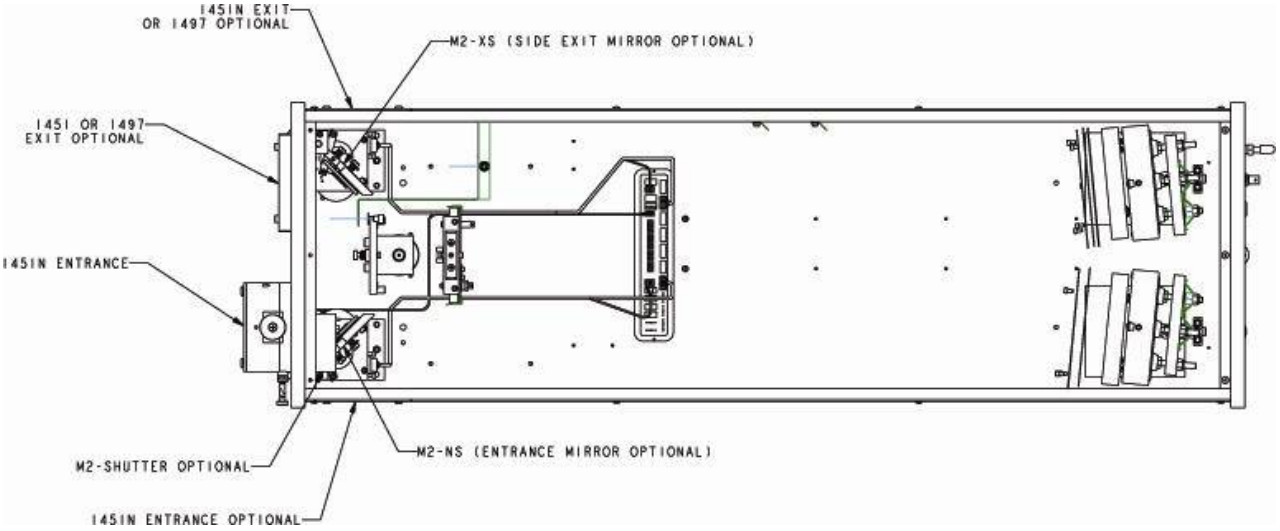


Figure 7. 1000M Entrance- and exit-port options

Spectrograph mode

M Series II 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 position of the center wavelength. 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 mode

M Series II 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 M Series II 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 M Series II can provide a specific bandpass (range of wavelengths) at the exit. Changing the slit-width varies the spectral bandpass.
• Spectral filter	The M Series II can be used to select a particular bandpass of light, at different wavelengths of your choice.
• Measurement at a fixed wavelength	The M Series II, 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.

External interfaces and controls

Figure 8. M Series II External Interfaces

USB port	Accepts the standard USB-B end of USB communications cable, allowing USB 2.0 communications between the spectrometer and the host computer.
USB status LED	Illuminates green to indicate that USB communications exist between the spectrometer and the host computer.
USB Hub connector	Built-in USB 2.0 hub that allows for easy expansion of HORIBA Scientific systems (using a standard USB-A connector) without the need for an external USB expansion hub.

Caution: *Use the USB hub ONLY for low-current devices. This jack is not recommended to connect to Synapse®, Symphony® II, or another iHR.*

USB Hub status LED	Illuminates green to indicate that USB communications exist between the spectrometer and some external device connected to the spectrometer 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 spectrometer 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 spectrometer via a BNC connection.
External I^2C connector	Not used; for future development.
FILTER WHEEL	Establishes communications between a HORIBA Scientific external filter wheel and the spectrometer.

Drive operation

The M Series II uses 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 Å to 15 000 Å (0–1500 nm) for a 1200 gr/mm grating. The wavelength resolution of the drive is user-selectable with a minimum step size of 0.000 25 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 on. 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 10 nm/s.

Grating

The M Series II is equipped with one 110 mm × 110 mm interchangeable grating. The kinematic grating can be interchanged quickly and easily without the need for realignment. An optional 120 mm × 140 mm grating is also available for the 1250M Series II.

Grating mask set

A grating mask set (J24700) containing two masks is provided with all M Series II spectrometers to help optimize results under certain conditions. The center-block grating mask blocks the horizontal center of the grating to reduce or remove rediffracted light, especially that caused by a 600 gr/mm grating in the UV region. The diamond-shaped grating mask is used to obtain high resolution, and is used when running resolution tests on all M Series II spectrometers. You can obtain the Full Width Half Maximum (FWHM) resolution specification only by using this mask on the 110 × 110 mm grating. This mask must be attached when running resolution scans (regardless of the grating's groove-density). If you are concerned with obtaining maximum throughput, use no mask.

Adjusting the slit

The slit mechanisms for the M Series II provide a means for controlling both the width and height of the slit opening. The slit-width is the more critical dimension for 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). See Chapter 4: System Performance for a more complete discussion of this topic.

Micrometer slits

The M Series II micrometer slit provides a continuously adjustable slit-width from 0 mm to 3 mm. The micrometer scale provides an accurate, repeatable means for setting the slit-width. The scale reading is in millimeters with the fine lines representing 2 µm increments. Although the slit-width can be set to 0, we recommend that the slit-width be set to a minimum of 6 µm for the 1000M and 3 µm for the 1250M.

Figure 9. Micrometer Slit

Caution: *There is a hard stop built into the micrometer to limit the maximum opening to 3 mm to prevent damage to the slit mechanism.* ***Do not try to force the slit beyond this stop.***

Dual entrance and exit port operation

The M Series II offers optional dual entrance port and dual exit port configurations. The front exit port may be equipped with either a slit or array adapter. The side exit port may be equipped with a slit only. The addition of a second exit port allows for mounting of two detectors. 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 port allows you to mount two optical inputs which are also selectable via software.

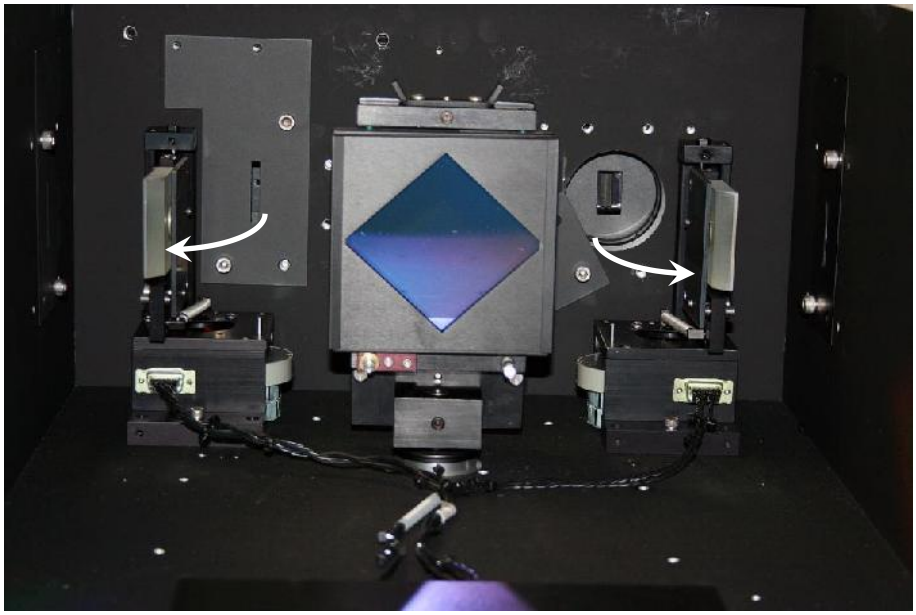


Figure 10a. Swing mirrors out, to use front entrance and exit ports.

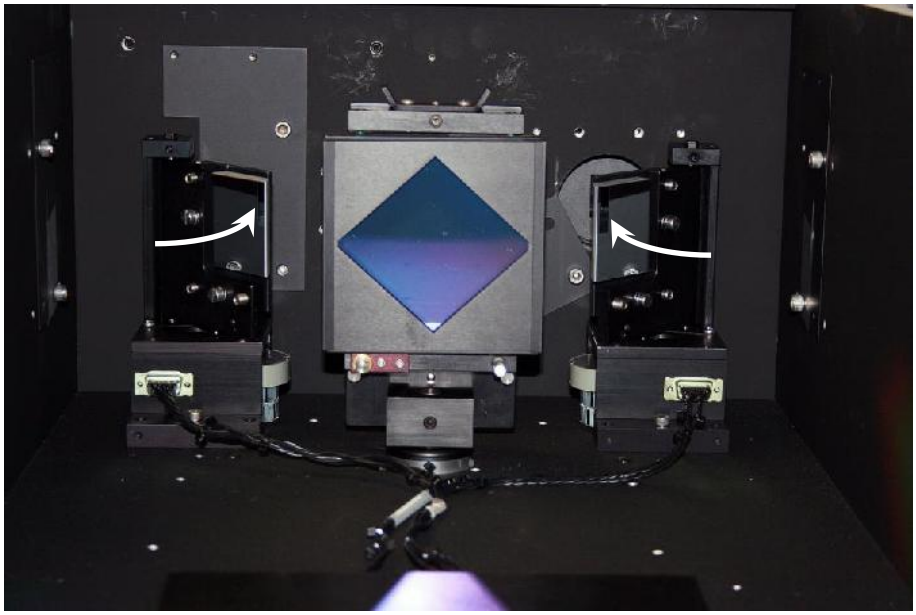


Figure 10b. Swing mirrors in, to use side entrance and exit ports.

Initial power-up

1. Check that all system cables to and from the M Series II are properly connected.
2. Make sure that all software has been installed before the unit is turned on.
3. Verify that the unit, host computer, and any additional supporting equipment are connected properly to AC input power (mains).
4. Set the power switch on the back of the unit to ON (“I” symbol).

The host computer recognizes that a new USB device has been powered up and is connected to the computer.

The **New Found Hardware Wizard** opens.

5. Click the Next button.

As the M Series II software is loaded, a warning that the software has not passed Windows Logo Testing appears. All HORIBA Scientific recommended software has been fully checked for compatibility issues and will not interfere with the correct operation of your system.

6. Click the Continue Anyway button.
7. When the software installation is complete, click the Finish button.

The first time the spectrometer is used, the **USB Device Selection** window opens.

8. Click on your M Series II model name (1000M…. or 1250M….) to highlight the displayed text, then click the OK button.

If more than one code 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 M Series II, 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.

2 Highlight the hardware description that matches your spectrometer and click the OK button.

If more than one M Series II is listed, chose the correct one based on serial number.

3 To configure using USB Spectrometer Utilities software, select Start >Programs>Jobin Yvon>USBSpectrometerControl.

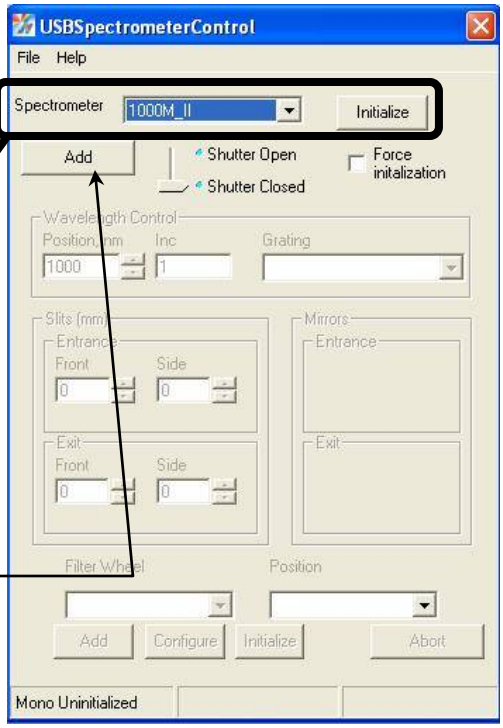
The USB Spectrometer Control program allows you to initialize the instrument as well as enter and/or change the wavelength position, mirror position, and control slits. If using SynerJY® software, refer to the Hardware Configuration topics in the *SynerJY® User's Guide* and Help file.

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

The **USBSpectrometerControl** window appears:

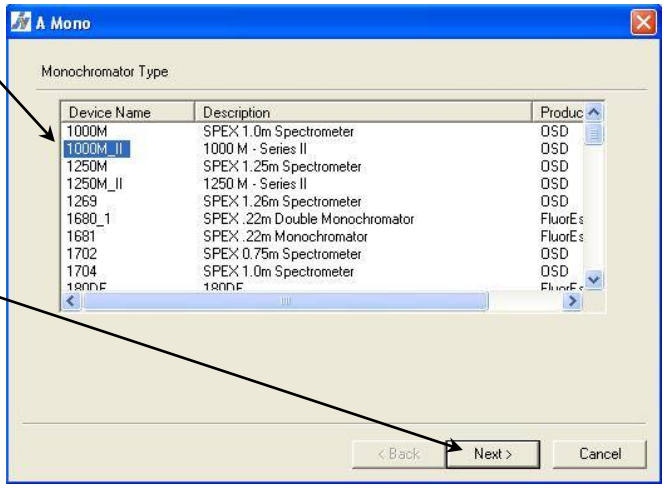
4 If you are adding a new spectrometer, select the appropriate model from the Spectrometer drop-down list and click the Initialize button; proceed to Step 10.

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 the Add button.



The **A Mono** window appears:

5 Select 1000M_II or 1250M_II from the Device Name list and click the Next > button.

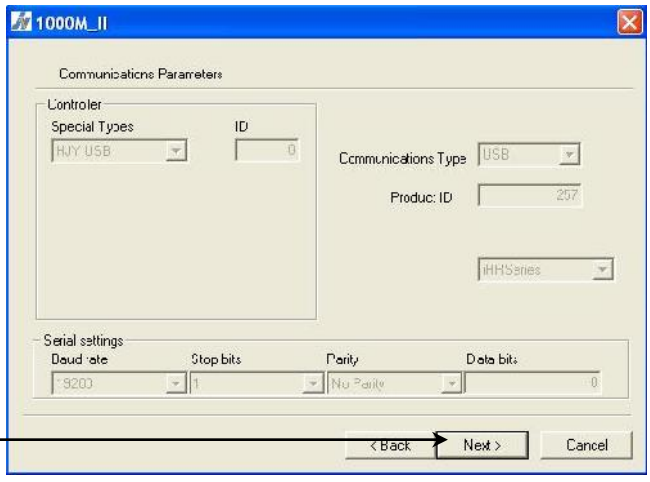


The **1000M_II** or **1250M_II** window appears:

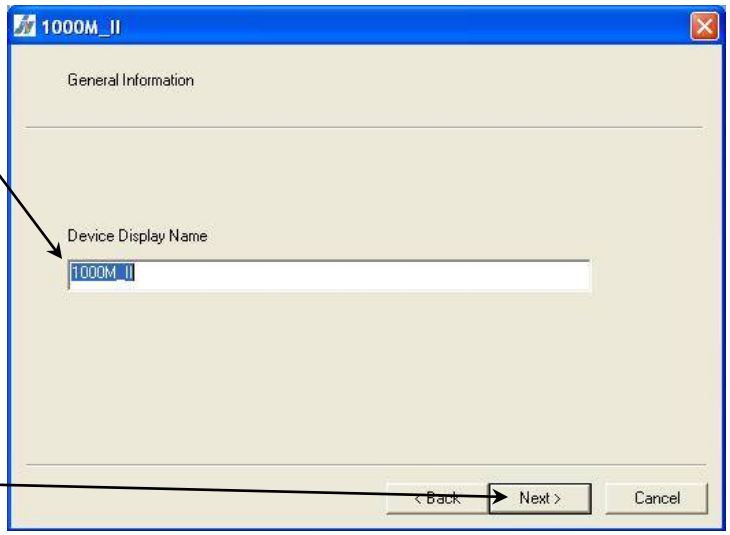
6 Enter the Communications Parameters for the device.

Select HJY USB as the Controller, USB as the Communications Type and select 1000M or 1250M.

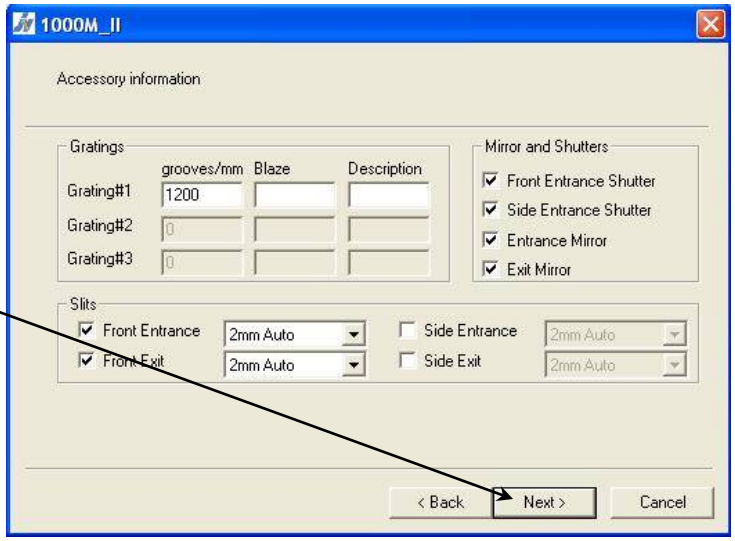
7 Click the Next > button.



8 Enter the Device Display Name (the model name appears as the default) and click the Next > button.



9 Specify your Accessory information and click the Next > button.



Note: *The grating information specific to your M Series II is listed on the back of the unit. The spectrometer should be configured for use with one grating.*

Accessory information is dependent on your specific slit-configuration and selected gratings. Deselecting any of the check box fields renders them inactive when the configuration is initialized.

A summary of the device configuration displays.

10 Click the Apply button to continue.

You return to the main screen.

11 Select the spectrometer that was just added from the Spectrometer drop-down list, then click the Initialize button.

12 Enter the appropriate Wavelength Control, Slits, and Mirrors information.

These fields are only accessible after initialization of the spectrometer.

Controlling the M Series II

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

USB Spectrometer Control program	Enter and change the wavelength position, mirror position, control the slits, and change filter-wheel position (if your spectrometer is equipped with a filter wheel).
USB Mono Config program	Select the appropriate grating as well as change the offset.

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

USB Spectrometer Control

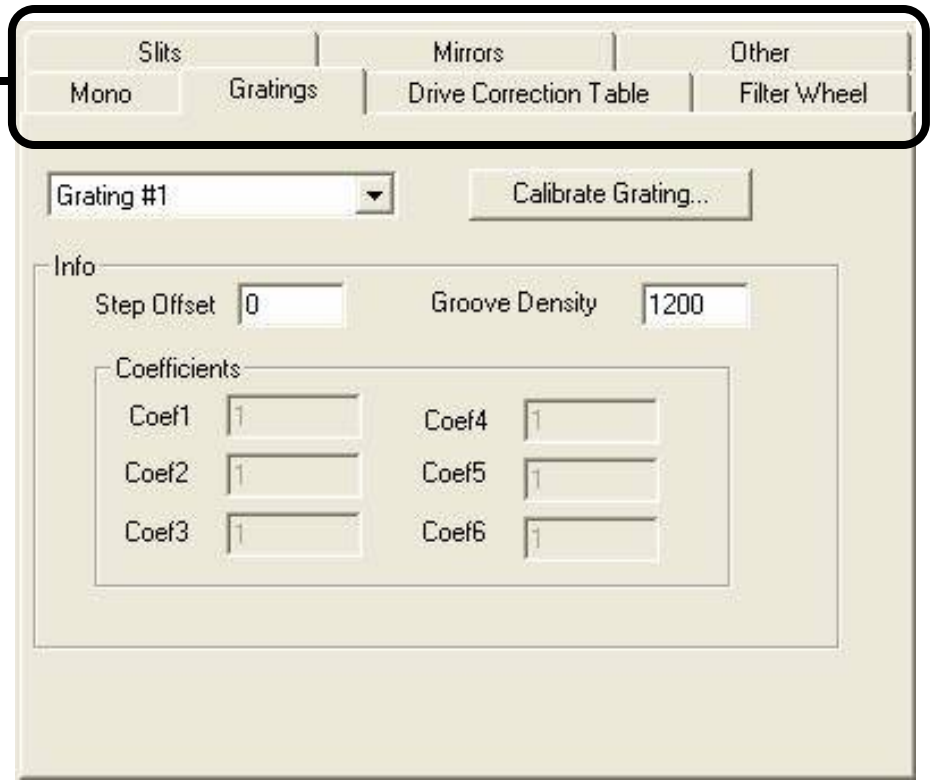
1. Make sure your hardware is configured.
2. Select Start>Programs>Jobin Yvon>USBSpectrometerControl.
3. Set the fields to the desired settings.
   - Wavelength Control moves the spectrometer to the specified wavelength (in nm), allowing for an incremental increase or decrease.
   - The Grating field 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.
   - The Mirrors area allows you to adjust the mirrors at the entrance and exit ports 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 illustrate the selection.

USB Mono Configuration

1. Make sure your hardware is configured.
2. Select Start>Programs>Jobin Yvon>USBMonoConfig.

3 Select the tab for the parameter that you want to adjust, and enter the appropriate information.

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 and offset.
Filter Wheel	Select and enable filter wheel.
Slits	Specify frequency, maximum step-size, and backlash.
Mirrors	Enable mirrors.
Other	Enter shutter information.



4 After all parameters are specified, click the Write button to store the entered values.

5 Click the OK button to exit USB Mono Configuration.

Calibrating the grating using USB Spectrometer Utilities

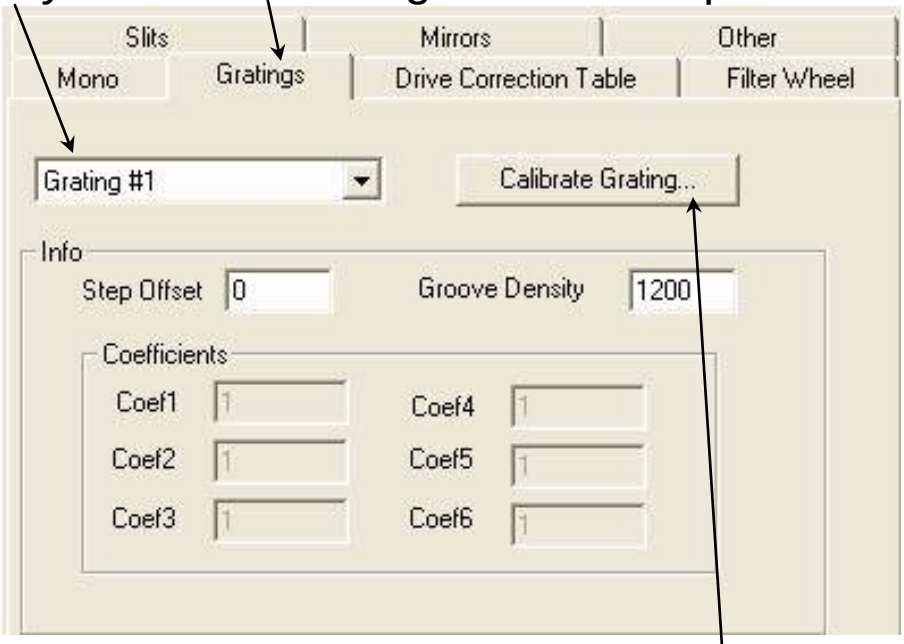
The Grating Calibration procedure serves as an initial check, prior to running an experiment, that your system's monochromator is properly calibrated and aligned.

Note: *You must use the software provided with your detector (together with USB Spectrometer Utilities) to collect a spectrum and determine the pixel-position of the peak 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.
2. Make sure your detector is mounted onto the exit port.
3. Select Start>Programs>Jobin Yvon>USBSpectrometerControl.
4. Adjust the micrometer slit-width to a minimum (~0.01 mm) and manually adjust the height 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 amplifier).
    a. For a CCD or other array detector:
    Set the *x*-axis to display in Pixels. Collect a spectrum and note the peak pixel position corresponding to the reference peak. If the M Series II 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 For a single-channel detector:
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.

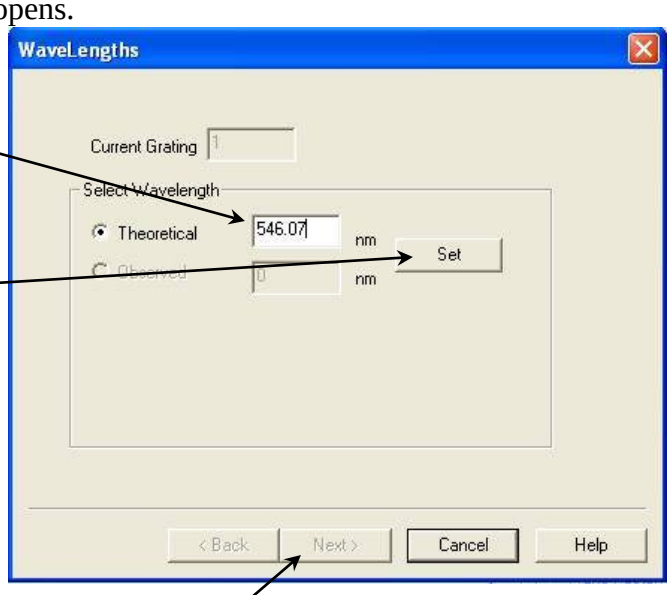
7 Select the Gratings tab, then select the Grating # you are calibrating from the drop-down list.



8 Click the Calibrate Grating… button.
The **WaveLengths** window opens.

9 Enter the Theoretical peak value, then click the Set button.

10 Click the Observed radio button, and enter the observed reference peak value, then click the Set button.



11 Click the Next > button.

12 Click the Done button to accept the calibration offset, or click the Cancel button to discard the change.

The grating calibration is saved to memory.

4: System Performance

Diffraction-grating groove density and system performance

The M Series II has 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 M Series II to your specific application. The grating tables below show how the groove density of the grating affects some important performance characteristics.

Table II. Grating Table for the M Series II

Groove density (gr/mm)	Typical spectral dispersion (nm/mm)		Resolution[1] (nm)		Scanning range[2] (nm)
	1000M	**1250M**	**1000M**	**1250M**	
1200	0.8	0.65	0.008	0.006	0–1500
600	1.6	1.3	0.016	0.012	0–3000
300	3.2	2.6	0.032	0.024	0–6000
150	6.4	5.2	0.064	0.048	0–12 000

[1]All specifications given for 1200 gr/mm grating at 435 nm with 6 µm slits and 1 mm height limiter, and are subject to change without notice. All values for other gratings are approximate.

[2]Recommended range is up to 80% of maximum value of scanning range.

What these performance characteristics mean:

Spectral dispersion — The spectral dispersion is a fundamental characteristic of the spectrograph and directly affects spectral resolution, coverage, and wavelength range. These are typical values, for the spectral dispersion varies somewhat depending on the operating wavelength.

Resolution — The Full Width at Half Maximum (FWHM) wavelength resolution of a spectral line on a focal plane with 26 µm pixels.

Scanning 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 III shows the relation of slit width to spectral bandpass under the specified conditions.

Table III. Slit Width vs. Bandpass

Slit-width	1000M Bandpass (nm)	1250M Bandpass (nm)
0.080 mm (80 µm)	0.064	0.052
0.1 mm	0.08	0.065
0.2 mm	0.16	0.13
0.5 mm	0.40	0.325
1.0 mm	0.80	0.65
2.0 mm	1.6	1.3
3.0 mm	2.4	1.95

*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:

- BP = Linear Dispersion × Exit Slit Width or Image of Entrance Slit Width (whichever is greater).
- BP (spectrograph) = Linear Dispersion × (Pixel Width × 3 Pixels) or 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.horiba.com/us/en/scientific/products/optics-tutorial/).

Stray-light rejection

The M Series II 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 M Series II 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 you can take to reduce stray light:

- Keep the *f*/# of the illumination at or above (narrower cone angle) the *f*/# of the M Series II (1000M *f*/# = *f*/8; 1250M *f*/# = *f*/11, or *f*/9 with larger-grating option).
- 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 you can use a 550 nm long-pass filter as an “order-sorting filter” to remove higher orders of light with wavelengths lower than 550 nm. Filter wheels are offered as an optional accessory for this purpose. See the online tutorial “The Optics of Spectroscopy” for additional information (http://www.horiba.com/us/en/scientific/products/optics-tutorial/).

5: Mounting Accessories to the M Series II

Introduction

A wide range of accessories can be used with M Series II spectrometers. Most accessories can be mounted directly to the slit assembly or to the slit assembly via an adapter.

Table IV. Available Accessories for the M Series II

Accessory	Part number	Adapters required
Array adapter	J1497	
Micrometer adjustable front entrance slit, 0–3 mm in 2 µm steps	1451N	J25622
Automated side entrance mirror	MS-NS	
Micrometer adjustable front exit slit, 0–3 mm in 2 µm steps	1451X	J25677
Automated side exit mirror	MS-XS	
110 mm × 110 mm grating holder	J33583	
120 mm × 140 mm grating holder[2]	GM-1250M-120X140	
100 W tungsten-halogen light source in LSH-series housing with focusing mirror, *f*/4.5	LSH-100	LSH-A270, J351887
250 W tungsten-halogen light source in LSH-series housing with focusing mirror, *f*/4.5	LSH-250	LSH-A270, J351887
Globar® light source with IR pencil emitter in LSH-series housing with focusing mirror, *f*/4.5	LSH-GB	LSH-A270, J351887
Enclosed compact chopper designed for use with AFW-C6P(M)	ACH-C	J35926, LSH-C
Manual six-position filter wheel: up to six 1″ (2.5 cm) diameter filters	AFW-C6P	J35926, LSH-C
SampleMax VIS – Lens-based universal sample[1]	ASC-VIS	ASC-1451
SampleMax UV – Lens-based universal sample[1]	ACS-UV	
Solid-sample holder for SampleMax[1]	ASC-SSOL	Requires ASC-VIS or ASC-UV
DSS detectors	Large variety of single channel detectors from	Contact factory

	visible to IR (20 um)	
DSS detector interface	1427C	
PMT detector	1911G	
PMT detector with built-in high voltage	DPM-HVM	
Fiber Adapter	1700F	

[1]For use in 1000M only; requires additional lenses for *f*/#-matching.
[2]For use in 1250M only.

LSH Series lamp housings

1. Mount the LSH-A270 adapter onto the LSH lamp housing (LSH-250, LSH-100, or LSH-GB) using two M3 × 10 mm cap-head screws.
2. Mount the J351887 adapter onto the M Series II slit-assembly.
3. Mount the LSH lamp housing, via the LSH-A270 adapter, onto the J351887 adapter using two M3 × 10 mm cap-head screws.

SampleMax

Note: *The SampleMax accessory is compatible with the 1000M only.*

1. Mount the ASC-1451 adapter to the M Series II slit-assembly.
2. Remove the SampleMax sample-compartment cover to gain access to the four screws that secure the mounting adapter to the wall of the sample compartment.
3. Remove the mounting adapter.
4. Using two M3 × 10 mm cap-head screws, secure the mounting adapter to the mounted ASC-1451 adapter.
5. Using the four screws previously removed, re-secure the mounting adapter to the SampleMax.

Note: *The SampleMax comes with two lenses of 40 mm focal length. These lenses are not optimal for aperture-matching with a 1000M. Other options include 100 mm and 80 mm focal-length lenses.*

ACH-C Optical Chopper

The J35926 adapter is a required accessory for mounting the chopper head onto the spectrometer slit.

1. Mount the J35926 adapter onto your spectrometer slit-assembly if it has not yet been mounted.
2. Screw the chopper head to the J35926 adapter of your spectrometer using the knurled nut attached to the chopper cover.

1427C Detector Housing

1. With 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 though the flange.
2. Mount the front end of the housing onto the appropriate exit slit using two 6-32″ mounting screws.
   The screws pass though the two inner mounting holes of the flange (see Figure 23).
3. Reassemble the 1427C 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 1427C 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.

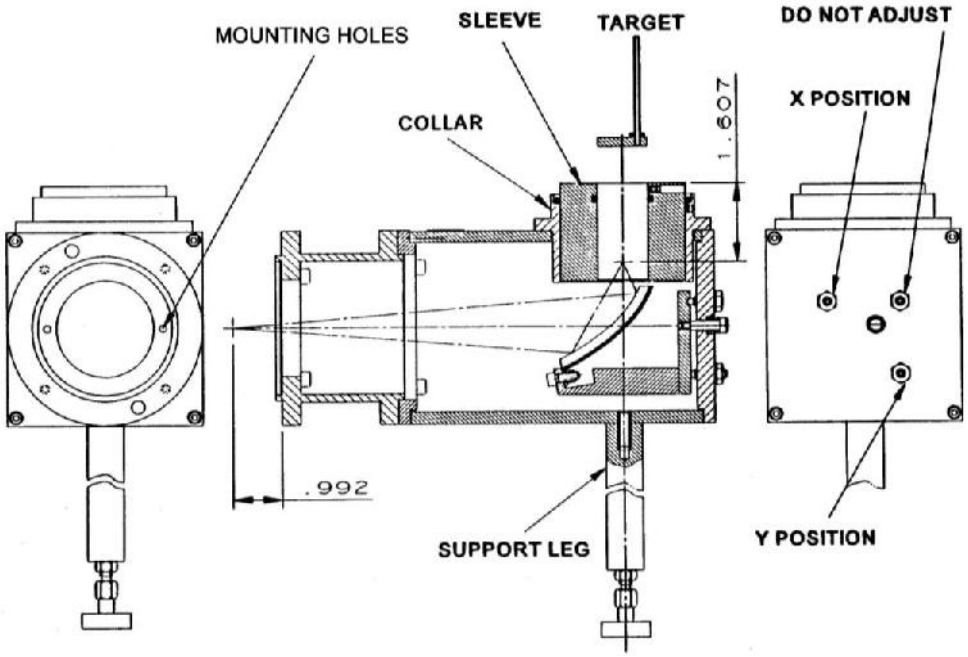


Figure 10. 1427C Detector Housing

CCD flange to CCD

The CCD flange (J1497) is designed to attach to HORIBA Scientific CCD cameras. To accommodate other CCD cameras, contact the HORIBA Scientific Sales Department.

1. Place the CCD flange over the end of the CCD 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 counterbored holes on the CCD flange.
2. Attach the flange to the camera using three 3/8″ long 8-32 flat-head screws.

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

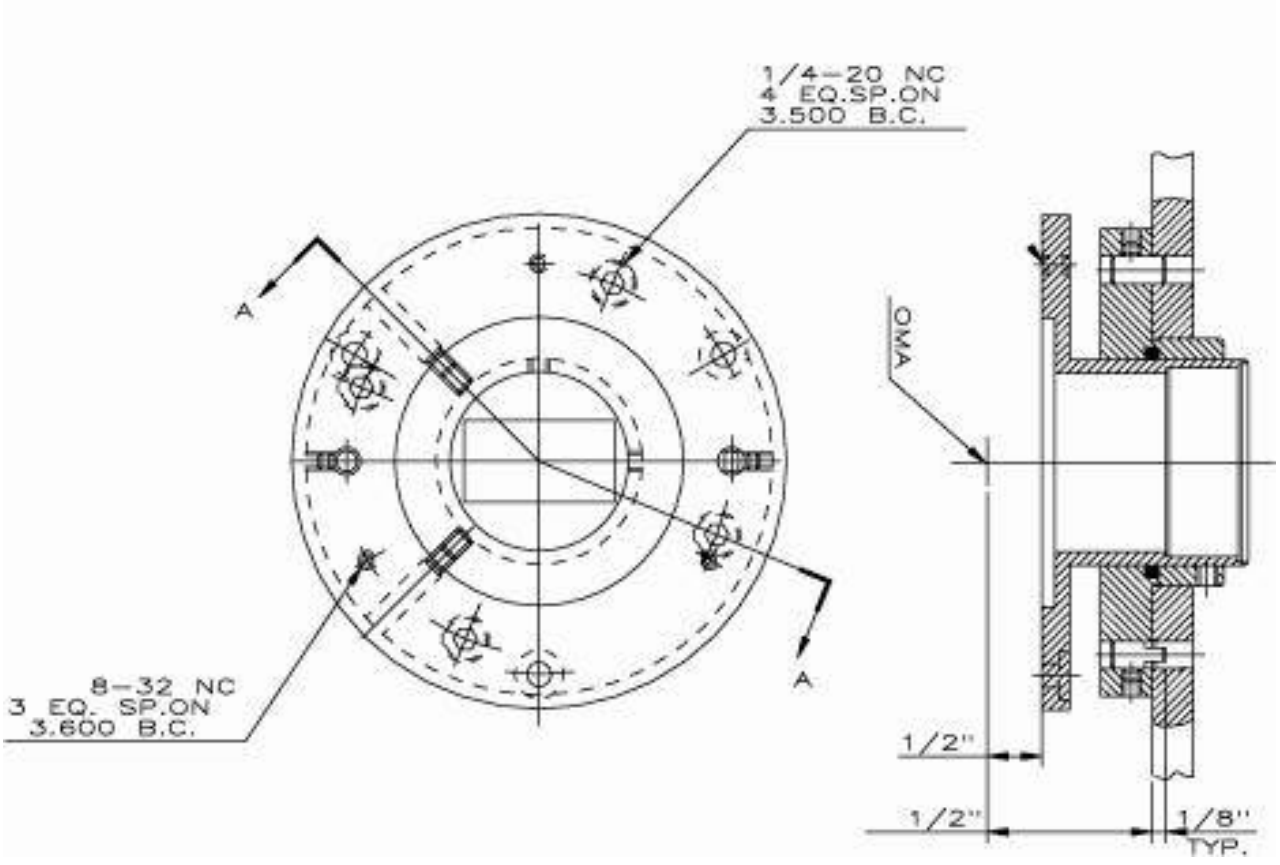


Figure 11. CCD Flange

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 Scientific.

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 (mains).
- The 5-pin DIN connector of the power supply is securely connected to the Power Connector of the M Series II.

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 host 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 you entered must be within valid limits for that drive or function.
- If you purchased software from HORIBA Scientific, 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 M Series II.

Wavelength drive 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 M Series II 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 set-up cable 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.

7: Specifications and Drawings

Specifications

Table V. M Series II Specifications*

		1000M	1250M
Focal length		1 m	1.25 m
Entrance aperture ratio		*f*/8	*f*/11 (*f*/9 with 120 mm × 140 mm grating)
Spectral range		0–1500 nm	0–1500 nm
Grating size		110 mm × 110 mm	110 mm × 110 mm (120 mm × 140 mm also available, ask factory for pricing)
Number of gratings		1	1
Spectral resolution		0.008 nm	0.006 nm
Wavelength position accuracy		± 0.05 nm	± 0.05 nm
Wavelength repeatability		± 0.005 nm	± 0.005 nm
Spectral dispersion		0.8 nm/mm	0.65 nm/mm
Magnification		1	1
Scan speed (increasing wavelength)		10 nm/s	10 nm/s
Minimum drive step-size		0.00025 nm	0.00025 nm
Computer interface		USB 2.0	USB 2.0
Dimensions	Length	109.2 cm (43 in.)	134.6 cm (53 in.)
	Width	34.9 cm (13.75 in.)	45 cm (17.75 in.)
	Height	36.8 cm (14.5 in.)	36.8 cm (14.5 in.)
Nominal weight		72.7 kg (160 lbs.)	96.9 kg (210 lbs.)

*All specifications given for 1200 grooves/mm grating at 435 nm and are subject to change without notice.

Optical design

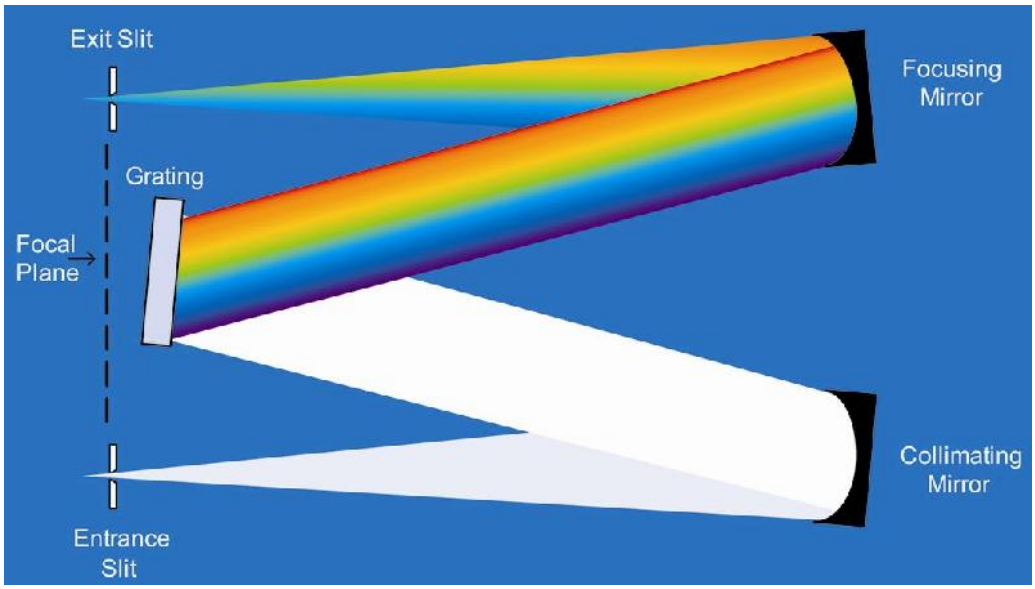


Figure 12. Optical Design of the Series M

Technical drawings

1000M Spectrometer

Note: *All drawings are shown in inches unless otherwise indicated.*

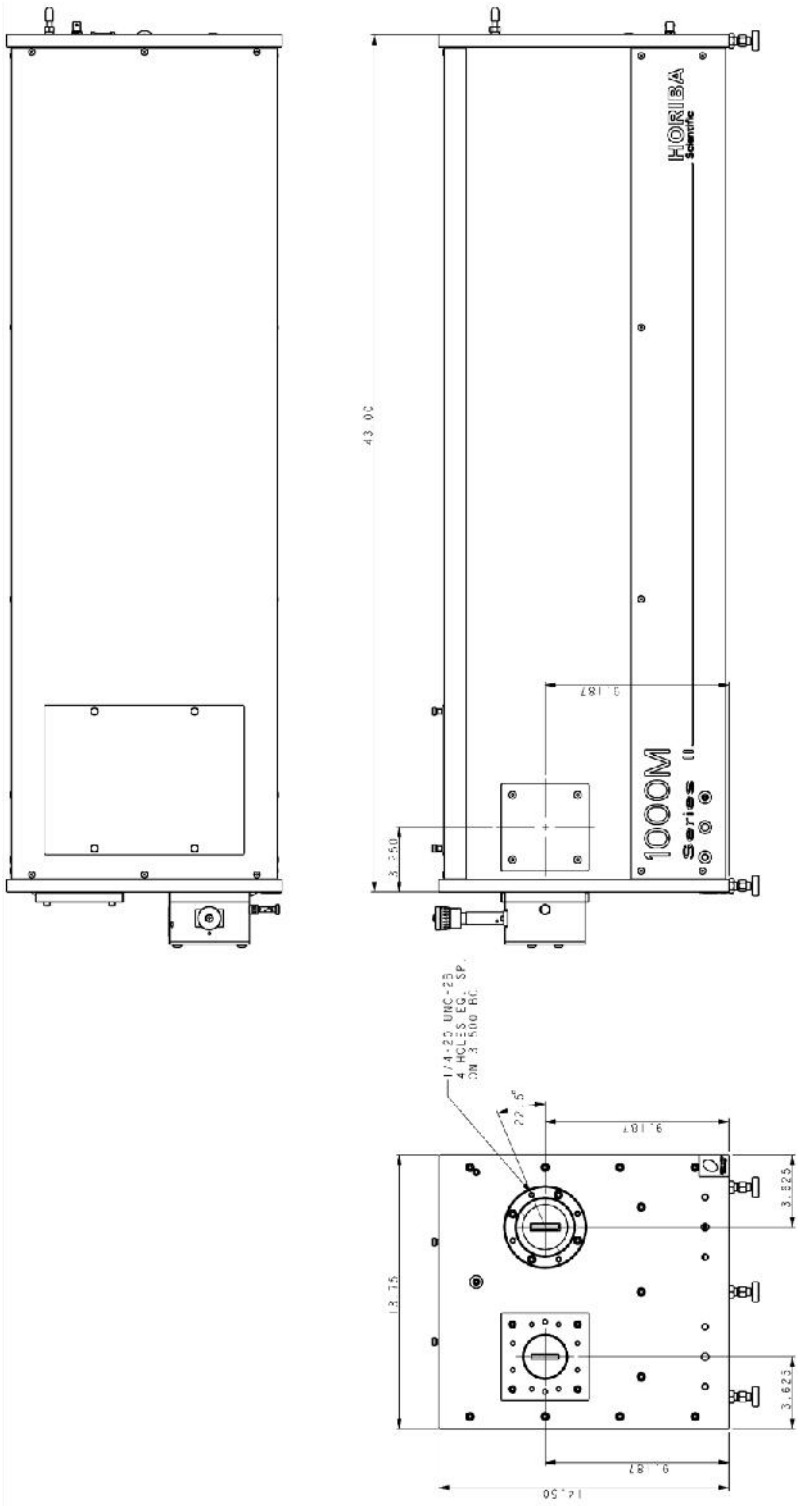


Figure 13. 1000M dimensions

1250M Spectrometer

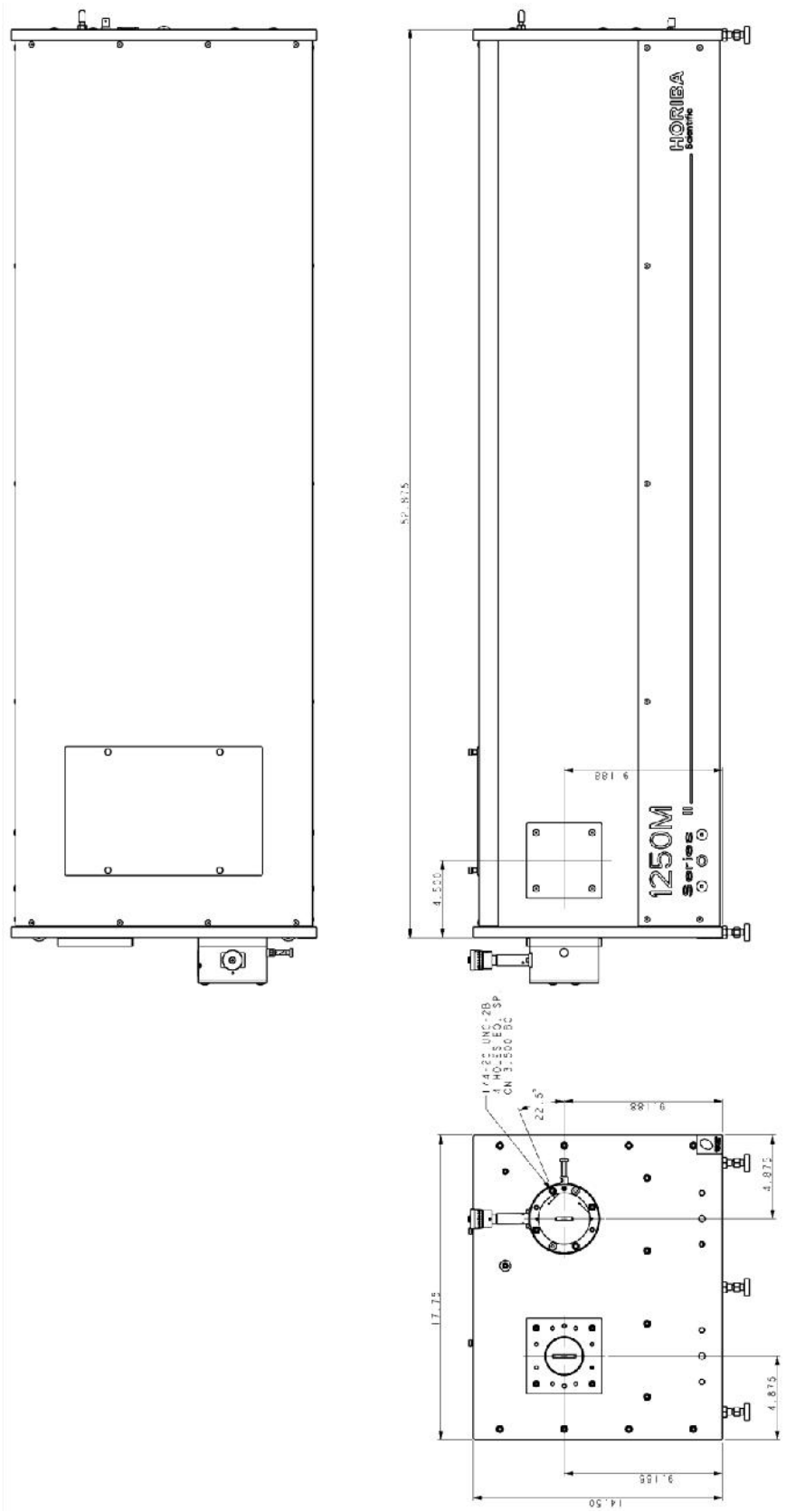


Figure 14. 1250M dimensions

Entrance slit

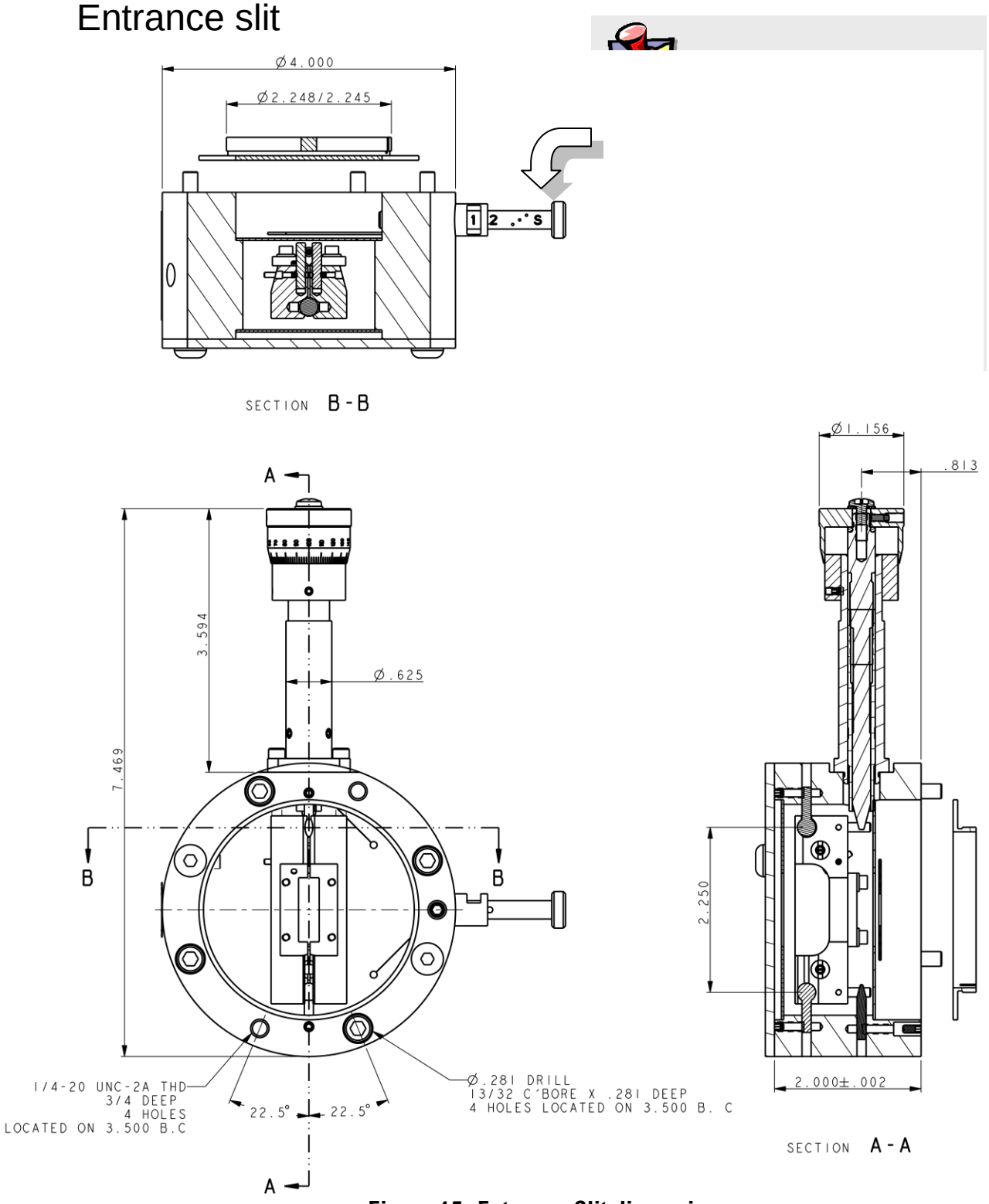


Figure 15. Entrance-Slit dimensions

8 : Service Information

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 inside of this manual. Service for out-of-warranty instruments is also available, for a fee. Contact HORIBA Instruments Incorporated 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.

In the USA:
HORIBA Instruments Incorporated
3880 Park Avenue
Edison, New Jersey 08820
USA
Tel: +1-732-494-8660 Ext. 160
Fax: +1-732-494-9796
Email:
service.jyus@horiba.com

In France:
Jobin Yvon SAS
16-18 rue du Canal
91165 Longjumeau Cedex
France
Tel: +33 (0) 1 64 54 13 00
Fax: +33 (0) 1 69 09 93 19

Worldwide:
+1-877-546-7422
China: +86 (0) 10 6849 2216
Germany: +49 (0) 89 462317-15
Italy: +39 (0) 2 57603050
Japan: +81 (0) 3 58230141
UK: +44 (0) 20 8204 8142

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 Instruments Incorporated manufactured components that have been repaired, altered or installed by anyone not authorized by HORIBA Instruments Incorporated 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.

9 : CE Declaration of Conformity

Manufacturer: HORIBA Instruments Incorporated

Address: 3880 Park Avenue
Edison, NJ 08820, USA

Product Name: 1000M Spectrometer, 1250M Spectrometer
Model Names: 1000M Series II, 1250M Series II
Product Options: All options and customized products based on the above.

Conforms to the following Standards:
Safety: EN 61010-1: 2001
EN 61010-1: 2001/AC: 2002
EMC: EN 61326-1: 2006 (Emissions & Immunity)

Supplementary Information

The product herewith complies with the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC.

The CE marking has been affixed on the device according to Article 8 of the EMC Directive 2004/108/EC.

The technical file and documentation are on file with HORIBA Instruments Incorporated.

Salvatore Atzeni
Vice-President, Retail Engineering

HORIBA Instruments Incorporated
Edison, NJ 08820
USA
Oct 7, 2011

Table VI. Applicable CE Compliance Tests and Standards

Tests	Standards
Emissions, Radiated/Conducted	EN 55011: 2006
Radiated Immunity	IEC 61000-4-3: 2006
Conducted Immunity	IEC 61000-4-6: 2008
Electrical Fast Transients	IED 61000-4-4: 2004
Electrostatic Discharge	IEC 61000-4-2: 2008
Voltage Interruptions	IEC 61000-4-11: 2004
Surge Immunity	IEC 61000-4-5: 2005
Magnetic Field Immunity	IEC 61000-4-8: 2009
Harmonics	IEC 61000-3-2: 2006
Flicker	IEC 61000-3-3: 2008
Safety	EN 61010-1: 2001 EN 61010-1: 2001/AC: 2002

10: Index

Key to the entries:

Times New Roman font	subject or keyword
Arial font	command, menu choice, or data-entry field
Arial Condensed Bold font	dialog box
`Courier New font`	file name or extension

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HORIBA
Scientific

3880 Park Avenue, Edison, New Jersey 08820-3012, USA
www.horiba.com/scientific

[Design Concept]

The HORIBA Group application images are collaged in the overall design.
Beginning from a nano size element, the scale of the story develops all the way to the Earth with a gentle flow of the water.