Cornerstone™ 130
1/8 m Monochromators

The Oriel® Cornerstone™ 130 is a high performance, economical and user-friendly monochromator – an ideal instrument for research and OEM applications. Oriel has made it easy to choose the right monochromator based on the application, with pre-configured models to fit most needs. Selecting a Cornerstone 130 model is based upon:

- Wavelength range of interest
- Input and output slit type
- Desired computer interface

WHAT'S INCLUDED

Each Cornerstone 130 monochromator includes:

- Two diffraction gratings, installed and aligned
- Electronic shutter at input port
- A choice of micrometer adjustable slits or fixed slit holders at the input and output ports
- A choice of electronics interface for GPIB/RS232 or USB communication
- A hose barb to purge the instrument compartment for measurements below 180 nm (actual capability is grating configuration dependent)
- LabVIEW™ based utility software
- Application Programming Interface (API) for LabVIEW™ with examples
- MonoTerm low-level command software
- Certificate of Calibration
- Monochromator Power Supply
- Line cords (U.S. and Europe)
- User's manual

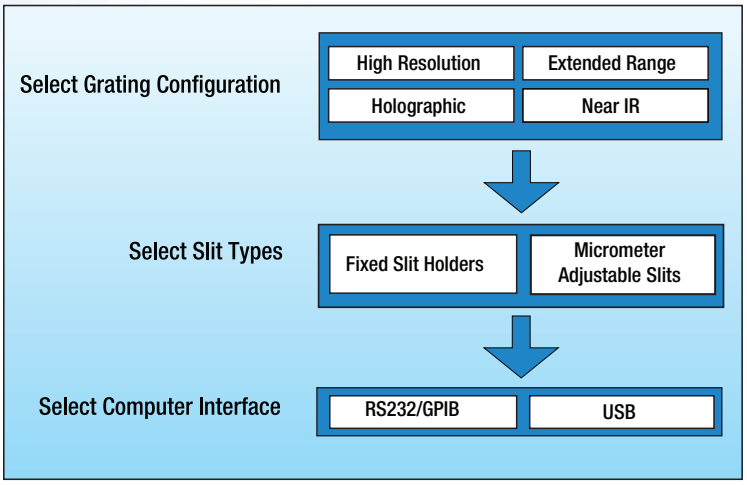
For monochromators featuring fixed slit holders, a variety of fixed slit sizes are available. The input and output slits should be the same size (ordered separately).

The Cornerstone 130 Monochromator is available in a number of different configurations. The model shown here uses micrometer adjustable slits at the input and output port, providing flexibility and high throughput.

- Models available for UV to NIR applications
- Motorized wavelength and grating selection
- Choice of micrometer adjustable slits or fixed slits
- Interfaces USB, RS232, GPIB or optional hand controller
- Includes utility software at no extra cost

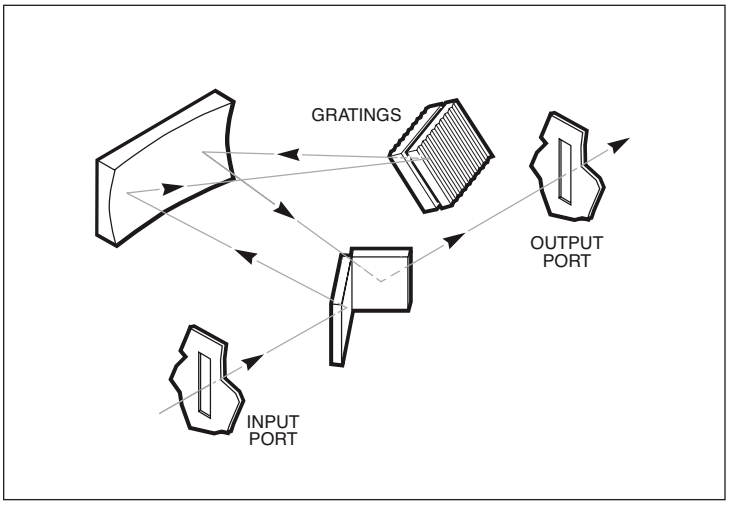
Newport®

Selecting a Cornerstone™ 130 Monochromator



OPTICAL DESIGN

The optical design of the Cornerstone 130 is based on an out-of-plane version of an Ebert-Fastie monochromator. The input and output ports are in line with each other, simplifying system alignment. The optical configuration is designed to ensure high resolution and maximum throughput. This F/3.7 monochromator is optimized to provide excellent stray light rejection while minimizing aberrations. A high precision motor is used to select the desired wavelength and switch between diffraction gratings quickly, without sacrificing performance.



Optical configuration of the Cornerstone 130 Monochromator

STRAY LIGHT REJECTION

Stray light may have a variety of origins. Its presence may be caused by a wide variety of design and manufacturing factors. The level of stray light due to the dispersed radiation inside the monochromator is affected by the design of the instrument, its baffles and interior finish. The Cornerstone 130 incorporates a sophisticated design, proven materials, and a quality manufacturing system to ensure high stray light rejection.

The amount of stray light measured on top of true signal will depend on many experimental factors as well as the performance of the instrument. When comparing stray light specifications, it is important to compare values that were measured under identical circumstances. The spectral distribution of the source and the response of the detection system are often the dominant factors when determining a stray light value.

GRATINGS

The choice of gratings for any spectroscopic system depends on the application and must be made as one step in an iterative process of system design. The radiation source, radiation detector, polarization of radiation, spectral range of interest and desired resolution all play a role in grating selection. Two gratings are installed into the Cornerstone 130 monochromator. In general, the grating with the highest efficiency is chosen at a particular wavelength. The optional Oriel TracQ Basic Data Acquisition and Radiometery Software allows users to set up a specific grating switchover wavelength, so the most appropriate grating will automatically be chosen while performing a scan over a range of wavelengths.

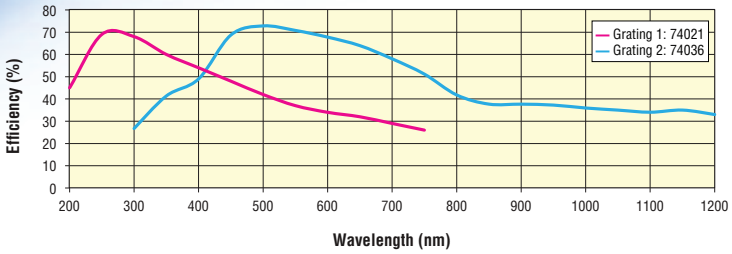
Richardson Gratings™ inside

The Cornerstone 130 monochromators feature diffraction gratings produced by Richardson Gratings™. Both Oriel Instruments and Richardson Gratings are part of the Newport family of brands, and have a long history of working together to design monochromators that are appropriate for a wide variety of applications.

Configuration	Grating 1 Line Density	Grating 2 Line Density	Primary Wavelength Range
High Resolution	2400 lines/mm	1200 lines/mm	200 to 1200 nm
Holographic	1200 lines/mm	1800 lines/mm	200 to 1000 nm
Extended Range	600 lines/mm	600 lines/mm	300 to 2200 nm
Near Infrared	600 lines/mm	300 lines/mm	650 to 2200 nm

Grating Efficiency Curves

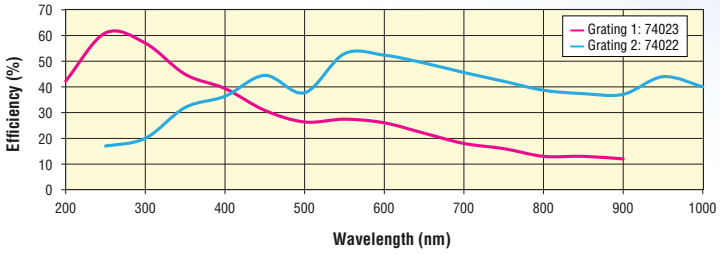
Cornerstone™ 130 Monochromator High Resolution Configuration



The efficiency curve above is relative (not absolute) and was measured using an in-plane near Littrow configuration. Please use the curves as a guide and not as absolute data. Grating diffraction is dependent on the polarization of the radiation incident on the grating.

Grating Efficiency Curves

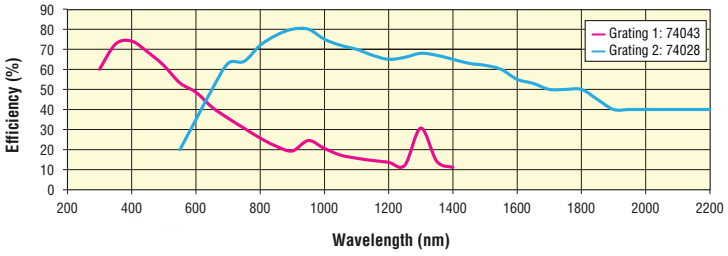
Cornerstone™ 130 Monochromator Holographic Grating Configuration



The efficiency curve above is relative (not absolute) and was measured using an in-plane near Littrow configuration. Please use the curves as a guide and not as absolute data. Grating diffraction is dependent on the polarization of the radiation incident on the grating.

Grating Efficiency Curves

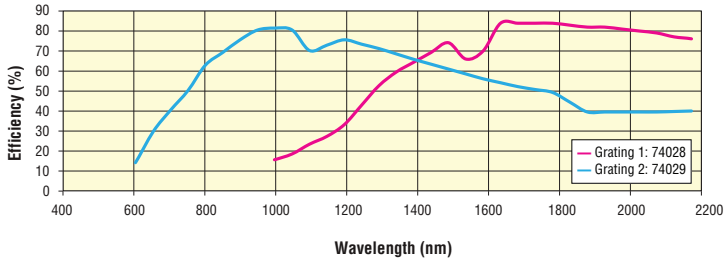
Cornerstone™ 130 Monochromator Extended Range Configuration



The efficiency curve above is relative (not absolute) and was measured using an in-plane near Littrow configuration. Please use the curves as a guide and not as absolute data. Grating diffraction is dependent on the polarization of the radiation incident on the grating.

Grating Efficiency Curves

Cornerstone™ 130 Monochromator Near Infrared Configuration



The efficiency curve above is relative (not absolute) and was measured using an in-plane near Littrow configuration. Please use the curves as a guide and not as absolute data. Grating diffraction is dependent on the polarization of the radiation incident on the grating.

SLITS

To operate any monochromator, slits are required at the input and output port. These need to be the same width and height at both ports. The slits offered with the Cornerstone 130 all have a 1.5-inch male flange, allowing it to be easily connected to the wide variety of available Oriel instruments and accessories.

The resolution of the monochromator is related to the grating dispersion – a function of the grating design – and the slit width. Resolution at the blaze wavelength of the grating is calculated to be the reciprocal dispersion x the slit width.

Available configurations:

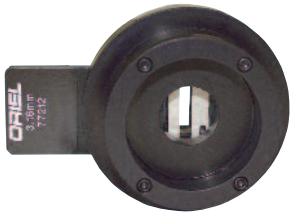
- Fixed slit holders (fixed slits sold separately)
- Micrometer adjustable slits

The fixed slits slide into the holders at the input and output port. The width and height cannot be adjusted, but may be individually replaced with other slit sizes. Fixed slits are a low cost alternative with excellent repeatability. They are a good choice when only a few slit sizes are required. They are sold separately to allow customized choices based on the needs of the application. When ordering, be sure to purchase two fixed slits of the same model – one for the input port, and the other for the output port.

Fixed Slit Model	Width	Height
77222	10 µm	2 mm
77220	25 µm	3 mm
77219	50 µm	6 mm
77218	120 µm	18 mm*
77217	280 µm	18 mm*
77216	600 µm	18 mm*
77215	760 µm	18 mm*
77214	1.24 mm	18 mm*
77213	1.56 mm	18 mm*
77212	3.16 mm	18 mm*
77211	6.32 mm	18 mm*

*Actual slit height is 18 mm, usable height is 12 mm.

Fixed slit holder without the slit installed.



Fixed slit holder with a slit installed (slits ordered separately).

A micrometer adjustable slit assembly is continously variable from fully closed to 3mm width. The narrowest practically achievable width is 4 µm. A height adjustment slide allows variation in the height from 2 to 12 mm. Benefits of the micrometer adjustable slits are flexibility and high throughput. Please note that optimum spectral resolution for any monochromator is obtained with short, narrow slits. This type of slit is designed primarily for versatility and convenience in changing resolution and throughput; fixed slits should be used for the utmost accuracy and repeatability, especially at high resolution.

Micrometer adjustable slit assembly. The slide shown on the right is used to adjust the height and the micrometer adjusts the width of the slit. Note that the input and output slits should be set to the same width and height.

SOFTWARE INTERFACES

LabVIEW-based utility software is included at no extra cost with all Cornerstone models to control both the monochromator and filter wheel accessory. The utility software provided with the monochromator includes USB drivers for Windows 7 or 10 32-bit and 64-bit operating systems. The software can also control the instrument through an RS232 or GPIB connection.

Oriel's optional TracQ Basic Data Acquisition and Radiometery Software is an instrument control package that includes data acquisition and processing. TracQ Basic allows users to acquire spectroscopic measurement data quickly and easily, without requiring any programming knowledge. TracQ Basic is true radiometry software, which enables users to acquire basic voltage measurements or use the built-in algorithms for spectroscopic measurements. Data acquisition and processing occurs in real time.

TracQ Basic is an application integrating Oriel monochromators with various detection instruments, such as the Newport Optical Power and Energy Meters, 1936-R and 2936-R, 1918-R and LIDA-SRS-KIT. Software prompts guide users through the measurement process. Instruments are controlled and scan parameters are set up through simple, intuitive dialog boxes. The front panel of the software allows one to see instrument status, present wavelength, signal reading and the selected wavelength units.

An intuitive command set is provided for those wishing to create their own programming. A list of these commands is provided in the user's manual included with the monochromator. Commands are simple to use. For example, to query the wavelength, enter "WAVE?" The command to close the shutter is "SHUTTER C".

For those users who are developing their own LabVIEW™ based programs, an Application Programming Interface (API) document is included with the instrument. The Oriel MonoTERM utility is also provided for sending low-level commands to the monochromator. This is very convenient for assisting programmers in their software development efforts. The MonoTERM utility was developed in National Instruments LabVIEW. It's open source code, so it may be used to provide LabVIEW programming examples.

COMMUNICATION METHODS

Models are available with the following computer interfaces:

- RS232 and GPIB
- USB 2.0

The utility software provided with the monochromator includes USB drivers for Windows 7 or 10 32-bit and 64-bit operating systems. A legacy version of the utility software is available for Windows XP upon request. GPIB communication offers the distinct advantage of being able to connect multiple devices to a single GPIB port, provided the computer contains a GPIB adapter card. Both GPIB and RS232 communication methods simplify low-level communications, as there is no driver or dll file.

Cornerstone 130 USB models include a USB 2.0 A/B cable (Model 70044). For RS232/GPIB monochromators, cable 70040 (RS232) or 70038 (GPIB) may be ordered separately. For those who desire the simplicity of GPIB or RS232 communication but have only USB ports available, a number of GPIB/USB and RS232/USB converter cables are commercially available.

All models include a connector to utilize the optional Model 74009 Hand Controller. With this item, there is no need to install software or use a computer. This dedicated interface is designed specifically for use with Oriel's Cornerstone series monochromators. There is no need to memorize commands or key sequences. The 24 keys are clearly labeled with functions like "Shutter", "Go Wave" and "Filter". The backlit LCD display provides information on the grating selection, line density, active filter position, current wavelength and shutter status. Using the Hand Controller is intuitive and provides access to nearly all the functionality of the Cornerstone.

The Model 74009 optional hand controller is compatible with all Cornerstone 130 monochromators.

MOTORIZED FILTER WHEEL ACCESSORY CONTROL

The Cornerstone 130 is capable of automatically controlling an optional filter wheel, Model 74010. It is also able to interface with the motorized filter wheel included with Oriel's APEX2 light sources. These filter wheels hold up to six 1-inch [25.4 mm] diameter filters. Neutral density filters can be used for intensity adjustment. Order sorting filters may be installed to block higher order diffraction. Click on the Tech Notes tab for more information on higher order diffraction.

The filter wheel can be mounted to the male flanges of the monochromator slits or slit holders. The filters are mounted external to the monochromator. Thus, the refractive index and thickness of the filters do not significantly affect the focal distance to the collimating mirror inside the monochromator. With internal filters, this distance would be different for every wavelength and every filter, and would therefore adversely affect resolution. The Cornerstone 130 is designed and manufactured to have errors of only a fraction of a millimeter in the focal distance. Positioning the filters externally, usually before the input slit, has only a slight effect on the light throughput. Since the slit acts as a secondary source, the focal distance is not affected.

MOUNTING

The Cornerstone 130 monochromator's compact design requires little space. Mounting plates are available to fasten the instrument to an optical table, and to couple with Oriel's popular Research Lamp Housings and APEX2 light sources. Threaded holes on the mounting surface also allow rod mounting of the Cornerstone 130.

The 74006 Mounting Plate is used to secure a Cornerstone 130 Monochromator to an inch or metric optical table. The ability to mount the monochromator simplifies setup and alignment of the optical system. The mounting plate also helps ensure consistent results over time, as the monochromator cannot be accidentally moved out of position. The plate adds 0.25 inch [6.35 mm] to the optical height.

The 74017 Mounting Kit connects the Cornerstone 130 monochromator to an arc lamp or quartz tungsten halogen light source. This kit is compatible with Oriel's Research Lamp Housings (50 to 500 watt series). It includes a base plate, a flexible light shield, a 1.5-inch diameter focusing lens and lens holder. All the hardware required to mount the lamp housing and monochromator to the base plate is provided. The mounting kit's base plate comes with four adjustable leveling feet. The feet may be removed to secure the base plate to an inch or metric optical table.

Slit Width vs. Resolution

All monochromators featuring fixed slit holders require fixed slits to be installed at the input and output ports. Fixed slits are ordered separately, and should be the same size at the input and output ports.

Micrometers adjustable slits allow for continuous variation of the width and height. Use the table below for guidance on resolution vs. slit width. For slit widths not specified in the table, multiply the micrometer adjustable slit width setting (mm) by the reciprocal disperion (nm/mm) to calculate the resolution for each grating.

Resolution is calculated for each grating at the grating's blaze wavelength, i.e. the wavelength with the greatest efficiency. Actual performance is determined by the monochromator wavelength accuracy, precision and calibration. Newport suggests having the monochromator recalibrated annually by a qualified service technician.

Micrometer Adjustable Slit

Width Range	4 µm to 3 mm
Height Range	3 to 12 mm
Repeatability	±10 µm
Accuracy	±10 µm (width from 4 µm to 250 µm) ±5% (width from 250 µm to 3 mm)

Calculation of Resolution Based on Fixed Slit Selection

Fixed Slit	Slit Width	Grating 1	Grating 2	Grating 1	Grating 2	Grating 1	Grating 2	Grating 1	Grating 2
		High Resoultion Configuration		Holographic Configuration		Extended Range Configuration		VIS-NIR Configuration	
77222	10 µm*	0.03 nm	0.35 nm**	0.07 nm	0.04 nm	0.13 nm	0.13 nm	0.13 nm	0.26 nm
77220	25 µm*	0.08 nm	0.25 nm**	0.17 nm	0.10 nm	0.33 nm	0.33 nm	0.33 nm	0.65 nm
77219	50 µm*	0.17 nm	0.50 nm**	0.34 nm	0.21 nm	0.67 nm	0.65 nm	0.65 nm	1.3 nm
77218	120 µm	0.40 nm	0.79 nm	0.80 nm	0.49 nm	1.60 nm	1.56 nm	1.56 nm	3.1 nm
77217	280 µm	0.92 nm	1.8 nm	1.9 nm	1.1 nm	3.72 nm	3.64 nm	3.64 nm	7.3 nm
77216	600 µm	2.0 nm	4.0 nm	4.0 nm	2.5 nm	7.98 nm	7.80 nm	7.80 nm	16 nm
77215	760 µm	2.5 nm	5.0 nm	5.1 nm	3.1 nm	10.1 nm	9.88 nm	9.88 nm	20 nm
77214	1.24 mm	4.1 nm	8.2 nm	8.3 nm	5.1 nm	16.5 nm	16.1 nm	16.1 nm	32 nm
77213	1.56 mm	5.1 nm	10 nm	10 nm	6.4 nm	20.7 nm	20.3 nm	20.3 nm	41 nm
77212	3.16 mm	10 nm	21 nm	21 nm	13 nm	42.0 nm	41.1 nm	41.1 nm	82 nm
77211	6.32 mm	21 nm	42 nm	42 nm	26 nm	84.1 nm	82.2 nm	82.2 nm	164 nm

* For slits with widths of 50 µm or less, abberations begin to play a role in the actual achievable resolution. The values noted above, unless otherwise stated, are calculations based on the slit widths and grating dispersions.
** Empirically measured resolution values shown which differ from calculations due to abberations present when using narrow slit widths.

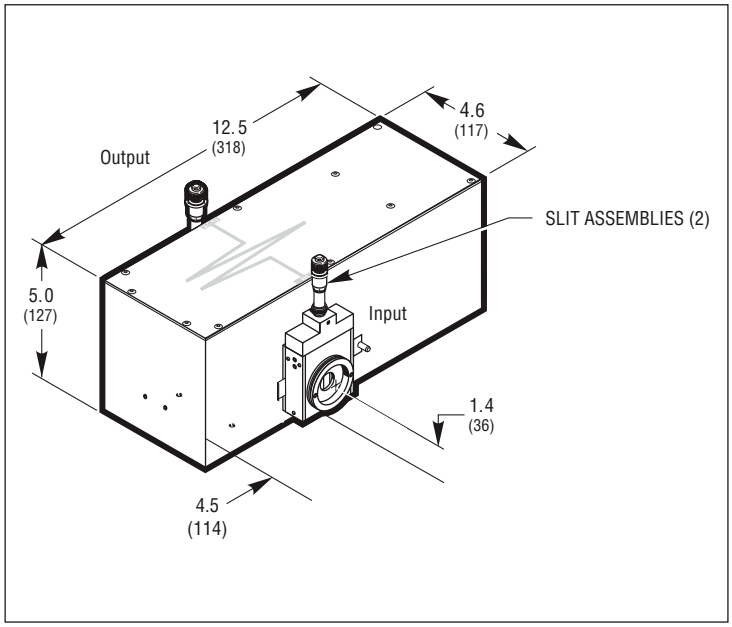
Grating Properties

Configuration	Grating Position	Type	Groove Density (lines/mm)	Blaze Wavelength (nm)	Reciprocal Dispersion (nm/mm)
High Resolution	#1	Ruled	2400	250	3.3
	#2	Ruled	1200	500	6.6
Holographic	#1	Holographic	1200	250	6.7
	#2	Holographic	1800	500	4.1
Extended Range	#1	Ruled	600	400	13.3
	#2	Ruled	600	1000	13.0
Near IR	#1	Ruled	600	1000	13.0
	#2	Ruled	300	2000	26

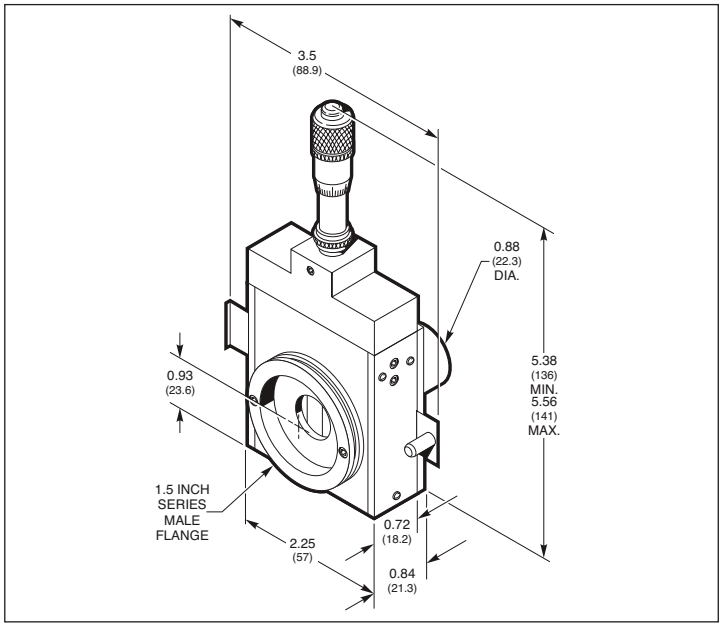
Specifications

Focal Length	130
F/#	F/3.7
Wavelength Selection Method	Motorized
Usable Wavelength Range	180 to 2500 nm, grating dependent
Spectral Resolution	Grating and slit width dependent
Wavelength Accuracy	0.50 nm
Wavelength Precision	0.11 nm
Maximum Slew Rate	350 nm/s with 1200 line/mm grating
Stray Light	0.03%
Ports	1 input port, 1 output port
Shutter Control	Software, Hand Controller, low-level commands
Shutter minimum exposure time	0.2 s
Shutter maximum repetition rate	0.5 Hz
Motorized Filter Wheel Compatibility	Filter Wheel Model 74010, Apex2 Filter Wheel
Utility Software Requirements	Windows 7 or 10, 32-bit or 64-bit operating system (Windows XP compatible software also available)
TracQ Basic Software Compatible	Yes
74009 Hand Controller Compatible	Yes
100-240 VAC, 47-63 Hz	100-240 VAC, 47-63 Hz
Weight	6.9 lb (3 kg)

Wavelength Accuracy: the capability of the monochromator to output the desired wavelength.
Wavelength Precision: the ability of a wavelength to be consistently reproduced and the number of significant digits to which it has been reliably measured.



Dimension drawing of the Cornerstone 130 monochromator. Instruments are configured with micrometer adjustable slits or fixed slit holders, depending on the model.



Dimensional diagram of the Micrometer Adjustable Slit Assembly

ORDERING INFORMATION

Cornerstone 130 Monochromators (RS232/GPIB Models)

Model	High Resolution	Holographic	Extended Range	Near IR	Fixed Slit Holders	Micrometer Driven Slits
CS130-RG-1-FH	•				•	
CS130-RG-1-MC	•					•
CS130-RG-2-FH		•			•	
CS130-RG-2-MC		•				•
CS130-RG-3-FH			•		•	
CS130-RG-3-MC			•			•
CS130-RG-4-FH				•	•	
CS130-RG-4-MC				•		•

Cornerstone 130 Monochromators (USB Models)

Model	High Resolution	Holographic	Extended Range	Near IR	Fixed Slit Holders	Micrometer Driven Slits
CS130-USB-1-FH	•				•	
CS130-USB-1-MC	•					•
CS130-USB-2-FH		•			•	
CS130-USB-2-MC		•				•
CS130-USB-3-FH			•		•	
CS130-USB-3-MC			•			•
CS130-USB-4-FH				•	•	
CS130-USB-4-MC				•		•

RECALIBRATION SERVICES

It is suggested to send the monochromator to Newport anually for recalibration. In addition to this service, Newport is also able to reconfigure the grating selection, slits and communication electronics if desired. Contact a Newport customer service representative for more information.

SPECIAL ORDERS WELCOME

The Cornerstone 130 monochromators feature diffraction gratings produced by Richardson Gratings. Both Oriel Instruments and Richardson Gratings are part of the Newport family of brands, and have a long history of working together to configure special order monochromators for unique applications. Monochromators may be configured with alternative gratings, specially coated gratings or a reflector in place of one grating. Contact an Oriel sales engineer with special order requests.

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