

MONOCHROMATORS AND MODULES

Monochromators
Lamp Modules
Stepping Motor Controller
Sample Compartment
Detectors
**Optical & Spectro-
Photometric Assemblies
and Systems**

**For Applications
in:**
Analytical Chemistry
Physics
Life Sciences
Engineering
Communications

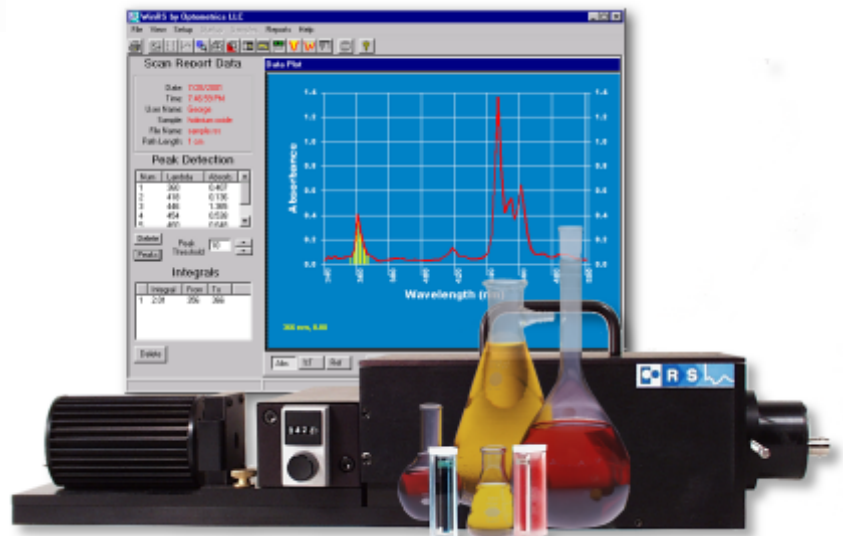


Table of Contents

Monochromator Design & Operation	1
Optical Coatings	2
Standard Mini-Chrom	3
Digital Mini-Chrom	4
Scanning Mini-Chrom	4
Scanning Digital Mini-Chrom	5
Models Available and Resolution	6
Long Pass Cut-On Filters	7
Monochromator Accessories Ordering	8
Tungsten Source Module	9
Sample Compartment	10
Specular Reflectance Accessory	10
Stepping Motor Controllers	11
Detector Modules	12
Fiber Optic Module	14
MLM-2 Monochromatic Light Module ...	15
RS System	16



Optometrics Corp has manufactured over 20,000 Mini-Chrom monochromators since their initial introduction in 1978. The majority have been incorporated into a variety of analytical and biomedical instruments made and marketed by leaders in their respective fields.

Mini-Chrom monochromators are currently being used as the principal optical assembly in numerous types of instruments and analyzers. When not integrated into other manufacturers' products, Mini-Chroms are used in basic and applied research projects in industrial, government and university laboratories. The combination of excellent performance, low cost and small size has contributed to the widespread use of the Mini-Chrom.

In addition, Optometrics manufactures light sources, detectors and stepping motor controllers that are compatible with Mini-Chroms, allowing you to build a spectrophotometric system for your specific needs.

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MONOCHROMATORS & MODULES

MONOCHROMATOR DESIGN & OPERATION

Mini-Chroms are compact, in-line Fastie-Ebert monochromators with a 74 mm pathlength, applicable for general spectroscopy or for use as a component in a system. All incorporate one of a wide selection of replicated gratings from the UV to IR (ruled or holographic) and gratings are also available with aluminum or gold coatings depending upon application. All monochromators also include a set of fixed, interchangeable entrance and exit slits. Optional sets of slits are available to optimize either resolution or throughput.

The small size of the Mini-Chrom still results in resolution comparable to that of many larger, more costly, conventional monochromators.

Mini-Chroms are available in four types: Standard, Digital, Scanning and Scanning Digital. The primary differences in the four types relate to how the wavelength is selected and displayed. Each type is available in several wavelength ranges from the ultraviolet to the near infrared.

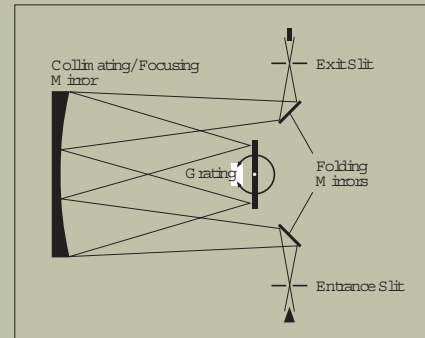
OPERATION

All Mini-Chroms are optically identical Fastie-Ebert in-line monochromators with an effective aperture of $f/3.9$ and 74 mm focal length. As shown in the optical diagram, polychromatic radiation is focused at the entrance slit and reflected by a folding mirror onto a spherical collimating/focusing mirror. This mirror collimates the radiation and directs it onto the grating, where it is diffracted. Once separated into a spectrum, the radiation is directed back to the collimating/focusing mirror, after which a segment of the dispersed radiation is focused at the exit slit via a second folding mirror. The wavelength of monochromatic radiation exiting the instrument is dependent upon the angular position of the grating. A sine drive mechanism is used to rotate the grating, either manually or via a stepping motor, so that discrete wavelengths are sequentially focused at the exit slit in a linear fashion.

Optimal throughput and wavelength accuracy are attained only if the Mini-Chrom is operated under the following guidelines:

BEAM GEOMETRY AND ALIGNMENT

To ensure maximum wavelength accuracy and system throughput, the effective aperture of the input beam must be $f/3.9$ or greater. If the input radiation has a faster (less than $f/3.9$) effective aperture, the input folding mirror will be overfilled and stray light will increase significantly. In addition, the converging (input) beam must be normal (perpendicular) to the plane of the entrance slit. Failure to align the beam properly with the entrance slit will adversely affect both throughput and resolution (see page 9 for a pre-aligned visible source).



OPTICAL DIAGRAM

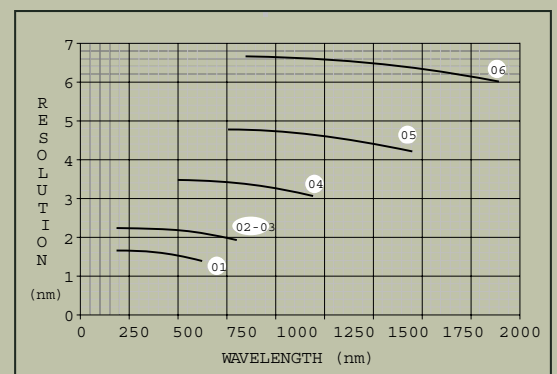
RESOLUTION

Resolution is a quantifiable indicator of the spectral purity of radiation exiting the monochromator. It is a function of the focal length of the monochromator, the dispersion of the grating and the width of the entrance and exit slits. In Mini-Chroms, only the slit widths are variable.

Resolution is inversely proportional to slit width, i.e. as slit width decreases, resolution increases. Throughput, however, varies directly with the square of the slit width. Halving the width of a slit will therefore decrease throughput by a factor of four. Resolution is also affected by wavelength, but to a much lesser extent than changing the slits.

CHANGING SLITS

Changing the slit assemblies in any Mini-Chrom takes only a few seconds and no tools. The slit assembly consists of a precision slit photo etched in a black oxide coated brass disc, a slit spacer, slit cover and two banana plugs. The banana plugs allow the assembly to be easily inserted or removed while assuring alignment of the slit with the monochromator. Note: Slits should always be changed in pairs.



MONOCHROMATOR Resolution VS. wavelength by model number (using 300 μ slits)

MONOCHROMATORS & MODULES

GENERAL SPECIFICATIONS - MONOCHROMATORS

Specifications that apply only to a specific type of Mini-Chrom are listed following the description of each type.

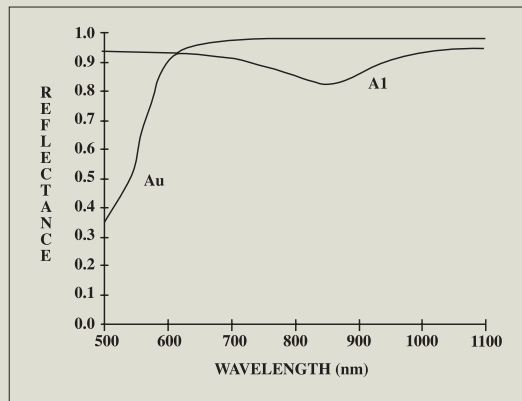
f Number	3.9
Focal Length	74 mm
Grating	2 cm square
Slits	see page 6
Stray Light:	
Models with holographic gratings ¹	≤ 0.003%
Models with ruled gratings ²	≤ 0.02%
Wavelength Accuracy (as a % of wavelength) ...	± 0.2%
Wavelength Reproducibility	± 0.15%
Wavelength Readability	0.2 nm
Dimensions	Type dependent

NOTE: Wavelength accuracy is given as a percentage of wavelength. This means that at 400 nm, the accuracy would be 400 nm ± 0.2% or 400 nm ± 0.8 nm. At 800 nm, the accuracy in the same Mini-Chrom would be 800 nm ± 0.2% or 800 nm ± 1.6 nm.

¹ measured 10 nm from 632.8 nm (HeNe laser line).
² measured 20 nm from 1265.6 nm (second order HeNe laser line).

OPTICAL COATINGS

All optical surfaces in the Mini-Chroms are coated with aluminum which has a high reflectance throughout the UV-VIS-NIR spectral range. Aluminum does, however, exhibit a decrease in reflectance at approximately 850 nm. If your application requires maximum efficiency in this area, an optional gold coating on all optical surfaces may be required. Note that the reflectance of gold falls to very low levels below 600 nm.



REFLECTANCE VS. WAVELENGTH OF ALUMINUM AND GOLD COATED OPTICS

MONOCHROMATORS & MODULES

STANDARD MINI-CHROM



The Standard Mini-Chrom (MC) is a manual unit which utilizes a micrometer for wavelength selection and read-out. Turning the micrometer head causes, via a precision sine bar drive, rotation of the diffraction grating which positions the desired wavelength at the exit slit.

Wavelength in nanometers (nm) is read directly from the micrometer head in models 01, 02, 03 and 04. Near infra-red models (05 and 06) require the micrometer reading to be doubled, to 2 nm per division, for wavelength selection and readout.

Standard Mini-Chroms are used in a variety of applications that require an inexpensive, small yet high performance monochromator. They are used in physics, chemistry, engineering and the life sciences for research, development and teaching. Overall dimensions in mm: 150 x 59 x 49; Weight 0.5 Kg (1.1 lbs).

The addition of a reticle and comparator converts the Standard visible Mini-Chrom (model 03) to a hand held spectrograph. The unit (cat. no. 6-0109) can be used to identify the emission lines of various elements such as Hg and Na from a fluorescence or discharge lamp. Removal of the comparator and reticle converts the hand held spectrograph back to a standard Mini-Chrom.

STANDARD MINI-CHROM

CATALOG NO.	MODEL	WAVELENGTH RANGE
6-0101	MC1-01	190 nm - 650 nm
6-0102	MC1-02	200 nm - 800 nm
6-0103	MC1-03	300 nm - 800 nm
6-0104	MC1-04	500 nm - 1.2 μ
6-0105	MC1-05	750 nm - 1.7 μ
6-0106	MC1-06	850 nm - 2.2 μ
6-0107	MC1-05G	750 nm - 1.7 μ
6-0108	MC1-06G	850 nm - 2.2 μ
6-0109	MC1-03S	300 nm - 800 nm

Models 05G and 06G utilize gold coated optics for superior reflectance in the NIR.
 Models 03S include a comparator and reticle for use as a hand-held spectrograph.

MONOCHROMATORS & MODULES

DIGITAL MINI-CHROM

The Digital Mini-Chrom (DMC) is a manually operated monochromator that utilizes a digital counter for wavelength selection. Rotation of the dial causes, via a precision lead screw/sine bar mechanism, rotation of the diffraction grating which positions the selected wavelength at the exit slit. Wavelength is read directly in nanometers (nm) from a counter on models 01, 02, 03

and 04. Near infrared models (05 and 06) require the counter reading to be doubled, to 2 nm per division, for wavelength selection and readout. Overall dimensions in mm: 139 x 59 x 49; Weight: 0.7 Kg (1.5 lbs).

WAVELENGTH READABILITY

The wavelength on all Digital Mini-Chroms can be selected and read to 0.2 nm.

DIGITAL MINI-CHROM

CATALOG NO.	MODEL	WAVELENGTH RANGE
6-0401	DMC1-01	190 nm - 650 nm
6-0402	DMC1-02	200 nm - 800 nm
6-0403	DMC1-03	300 nm - 800 nm
6-0404	DMC1-04	500 nm - 1.2 μ
6-0405	DMC1-05	750 nm - 1.7 μ
6-0406	DMC1-05G	750 nm - 1.7 μ
6-0407	DMC1-03S	300 nm - 800 nm
6-0408	DMC1-06	850 nm - 2.2 μ
6-0409	DMC1-06G	850 nm - 2.2 μ

SCANNING MINI-CHROM

The Scanning Mini-Chrom monochromator (SMC) is designed to be driven by stepping or servocontrolled motors. No wavelength readout is provided. All models utilize a precision lead screw/sine bar mechanism to rotate the diffraction grating and sequentially position the selected wavelength(s) at the exit slit. Rotation of the drive shaft in a clockwise direction proportionately increases the wavelength of radiation at the exit slit. Scanning Mini-Chroms are used in applications requiring either single or repetitive scans of wavelength intervals or the sequential selec-

tion of discrete wavelengths. To prevent mechanical damage due to inadvertently exceeding wavelength limits, all Scanning Mini-Chroms are supplied with dual photosensors that function as high and low limit switches. Overall dimensions in mm: 95 x 59 x 49; Weight 0.45 Kg (1.0 lb).

ADDITIONAL SPECIFICATIONS

Drive Hysteresis. 3.6 deg typ., 14 deg max.

Models 05G and 06G utilize gold coated optics for superior reflectance in the NIR.

SCANNING MINI-CHROM

CATALOG NO.	MODEL	WAVELENGTH RANGE
6-0201	SMC1-01	190 nm - 650 nm
6-0202	SMC1-02	200 nm - 800 nm
6-0203	SMC1-03	300 nm - 800 nm
6-0204	SMC1-04	500 nm - 1.2 μ
6-0205	SMC1-05	750 nm - 1.7 μ
6-0206	SMC1-06	850 nm - 2.2 μ
6-0207	SMC1-05G	750 nm - 1.7 μ
6-0208	SMC1-06G	850 nm - 2.2 μ

MONOCHROMATORS & MODULES

SCANNING DIGITAL MINI-CHROM

The Scanning Digital Mini-Chrom (SDMC) includes an integral stepping motor which can be controlled by a calibrated drive such as the PCM-01 via a 15-pin connector. The SDMC is similar to the Digital Mini-Chrom in that it includes a four digit counter for wavelength readout and a dial for manual wavelength selection. For near infrared models (05 and 06), the four digit counter reading must be doubled, to 2 nm per division, for wavelength selection and readout. Dual photosensors that function as high and low limit switches are included for use in the scanning model. The Scanning Digital Mini-Chrom can be used for all applications that require the convenience of a built-in wavelength readout as well as applications requiring scanning to a selected wavelength or over a wavelength interval. Overall dimensions in mm: 197 x 59 x 49; Weight 0.9 Kg (1.9 lbs).

SCANNING DIGITAL MINI-CHROM

CATALOG NO.	MODEL	WAVELENGTH RANGE
6-0501	SDMC1-01	190 nm - 650 nm
6-0502	SDMC1-02	200 nm - 800 nm
6-0503	SDMC1-03	300 nm - 800 nm
6-0504	SDMC1-04	500 nm - 1.2 μ
6-0505	SDMC1-05	750 nm - 1.7 μ
6-0506	SDMC1-05G	750 nm - 1.7 μ
6-0507	SDMC1-06	850 nm - 2.2 μ
6-0508	SDMC1-06G	850 nm - 2.2 μ

Models 05G and 06G utilize gold coated optics for superior reflectance in the NIR.

WARRANTY

Optometrics warranties all products against defects in materials and workmanship for one year from the date of purchase with the exception of light sources which are warranted for three (3) months. Optical components are warranted for one year against performance defects only. Cosmetic defects that do not affect performance are not covered under this warranty.

Optometrics is not liable for any consequential or incidental damage arising from the sale of its product(s). In any event, liability shall not exceed the invoice value of the product(s) sold. Accidental damage, neglect, unreasonable use, attempted service, calibration, adjustments or cleaning not explicitly called for in an instruction manual voids the Optometrics warranty.

Optometrics makes no warranty other than described above for its products or for their performance in a specific application.

MONOCHROMATORS & MODULES

MODELS AVAILABLE AND RESOLUTION

GRATING MODEL	SPACING/BLAZE AND TYPE	LINEAR DISPERSION (nm/mm)	WAVELENGTH RANGE	RESOLUTION* (nm) FOR SLIT WIDTHS OF:					
				50 μ	100 μ	150 μ	300 μ	600 μ	1 mm
01	2400/250 nm Holographic	5.54	190 - 650 nm	0.28	0.55	0.83	1.66	3.32	5.54
02	1800/250 nm Holographic	7.41	200 - 800 nm	0.37	0.74	1.11	2.22	4.44	7.41
03	1800/500 nm Holographic	7.21	300 - 800 nm	0.36	0.72	1.08	2.16	4.32	7.21
04	1200/750 nm Ruled	11.29	500 nm - 1.2 μ	0.56	1.13	1.69	3.39	6.77	11.29
05	830/1.2 μ Ruled	15.42	750 nm - 1.7 μ	0.77	1.54	2.31	4.63	9.25	15.42
06	600/1.6 μ Ruled	21.45	850 nm - 2.2 μ	1.07	2.14	3.22	6.43	12.87	21.45

* Resolution = (Slit Width) x (Linear Dispersion)

SLIT SETS

Your choice of a pair of slits are included with each Mini-Chrom. Additional slit sets can be purchased to optimize resolution or throughput. Slits are available in 50, 100, 150, 300, 600 microns and 1mm widths, all 4 mm in height.

HIGHER ORDER BLOCKING FILTER ASSEMBLY

Required to block higher order ($\lambda/2$, $\lambda/3$, $\lambda/4$, etc.) radiation. Higher order blocking filters are Optometrics' Long Pass Cut-On filters (see page 7) in an assembly which includes the monochromator slit. Plugs directly into the Mini-Chrom monochromator.

MONOCHROMATOR APERTURE ADAPTER

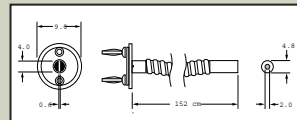
Adapter converts slit(s) aperture to SMA connector compatible with Amphenol 905 series fiber optic connectors.

HOLMIUM CALIBRATION FILTER

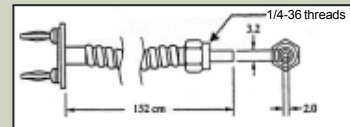
Comprised of 2.5 mm thick holmium oxide glass epoxied in a metal holder, the cell holder fits in all spectrophotometers that accept standard 1 cm square cells. A reference scan showing calibration wavelengths from 350 nm to 800 nm is included. A comparison between the reference scan and the indicated wavelength takes only a few seconds.

FIBEROPTIC CABLE

The F. O. Cable plugs directly into the Mini-Chrom, functionally replacing the exit slit. It is supplied with a 600 micron slit assembly for use on the entrance side. The other end of the cable terminates in a conventional circular bundle. The cable is 152 cm (5 feet) long with a rectangular (4.0 x 0.6 mm) fiber array and slit adapter on one end and a 2.0 mm diameter bundle on the other. Non-standard cable configurations are available on request.

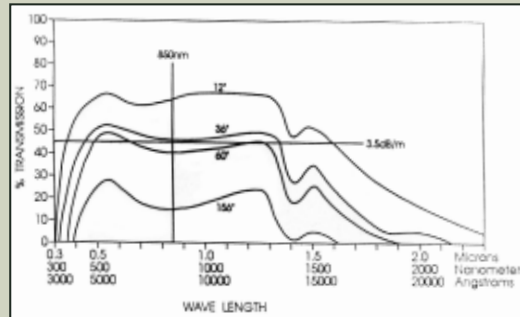


Standard Fiber Optic Bundle



Fiber Optic Bundle with SMA 905 Stainless Steel Connector

For applications below 400 nm, quartz fibers are available as special order items.



Typical transmission for 1/8" bundles of glass fibers in 12", 36", 60" and 156" lengths

MONOCHROMATORS & MODULES

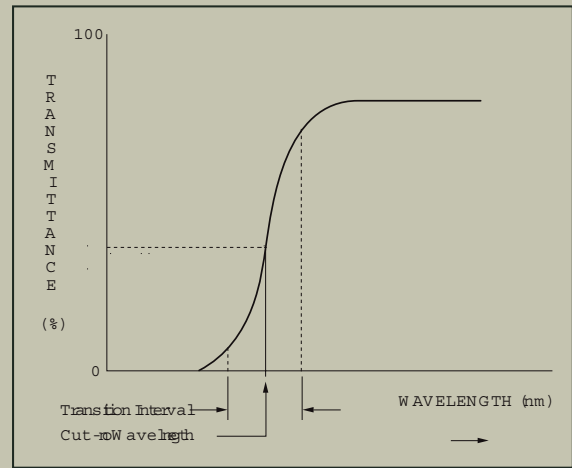
LONG PASS CUT-ON FILTERS

Long pass cut-on filters are used to prevent higher order radiation from the grating monochromator from entering the sample compartment. Optometrics' long pass cut-on filters are cored from selected color glasses which transmit radiation above and block radiation below a specified wavelength. The wavelength interval (transition interval) from blocking to maximum transmission is sharp, typically 25 to 35 nm. Long pass cut-on filters are identified by a cut-on wavelength, i.e. the wavelength at 50% of maximum transmission.

Long pass cut-on filters have an average high transmission of 85% from 15 to 20 nm above their cut-on wavelength to 2000 nm. Attenuation of radiation below the cut-on wavelength is due to absorption of the colorants in the glass and the thickness of the glass. Superior blocking in Optometrics' filters (0.001%) is due to the use of 3 mm thick color glass.

Optometrics' long pass cut-on filters are all epoxied in a black metal ring for easy mounting and handling and are 25.4 mm dia. x 9.65 mm thick. The cut-on wavelength is marked on all filters. Designed to mount directly in the Optometrics' sample chamber (see page 10).

*Note that Mini-Chrom models 04 and 05 would require two filters to cover their entire wavelength range.



CUT-ON FILTER TERMINOLOGY

GENERAL SPECIFICATIONS

Cut-on Wavelength ± 5 nm
 Blocking (Short wavelengths) 0.001%
 Transmission (High • average) 85%
 Transmission Range Cut-on to 2000 nm

Dimensions and Tolerances:
 Diameter (Mounted) 25.4 mm \pm 0.25 mm
 Thickness (Mounted) 9.65 mm \pm 0.15 mm
 Clear Aperture 20.0 mm \pm 0.25 mm

LONG PASS CUT-ON FILTERS		
CATALOG NO.	MINI-CHROM MODEL NO.	CUT-ON WAVELENGTH (nm)
7-1201	01	375
7-1202	02	420
7-1203	03	420
7-1204	04*	630
7-1205	05*	1200
7-1206	06	1200

MONOCHROMATORS & MODULES

ORDERING INFORMATION

For more information, contact Optometrics Corp. at sales@optometrics.com.
 Quantity discounts are available and OEM inquiries are welcome.

MONOCHROMATOR ACCESSORIES

CATALOG NO.	SLITSET DIMENSIONS
6-9001	50 μ x 4 mm
6-9002	100 μ x 4 mm
6-9003	150 μ x 4 mm
6-9004	300 μ x 4 mm
6-9005	600 μ x 4 mm
6-9006	1 mm x 4 mm

CATALOG NO.	ACCESSORY DESCRIPTION
6-9200	Monochromator Aperture Adapter
9-5000	Holmium Oxide Filter Holder and reference scan
7-2505	Fiber Optic Cable without SMA Connector
7-2506	Fiber Optic Cable with SMA Connector

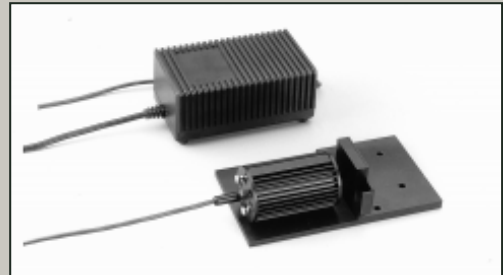
HIGHER ORDER BLOCKING FILTER ASSEMBLY	CATALOG NO.	MODEL NO.	CUT-ON λ
Assembly includes slit. Specify slit size by including last two digits from slit set catalog numbers above . For example, a blocking filter assembly for a model 03 Mini-Chrom including a 600 μ slit is catalog no. 6-9305. *Mini-Chrom Models 04 and 05 would require two filters to cover their entire wavelength range	6-91XX	01	375 nm
	6-92XX	02	420 nm
	6-93XX	03	420 nm
	6-94XX	04*	630 nm
	6-95XX	05*	1200 nm
	6-96XX	06	1200 nm

LONG PASS CUT-ON FILTERS	CATALOG NO.	MINI-CHROM MODEL NO.	CUT-ON λ
Optometrics' long pass cut-on filters are all epoxied in a black metal ring for easy handling and mounting in our sample chamber and are 25.4 mm dia. x 9.65 mm thick. The cut-on wavelength is marked on all filters.	7-1201	01	375 nm
	7-1202	02	420 nm
	7-1203	03	420 nm
	7-1204	04	630 nm
	7-1205	05	1200 nm
	7-1206	06	1200 nm

MONOCHROMATORS & MODULES

TUNGSTEN SOURCE MODULE

The Tungsten Source Module includes a 20W tungsten halogen lamp in a quartz envelope, a lamp housing, shutter assembly and variable aperture assembly on a base plate and a regulated 12V DC power supply. Halogen compounds in the lamp recycle tungsten deposited on the inside of the envelope back to the filament. This cycling of tungsten prevents the gradual degradation of the lamp output, particularly in the ultraviolet and increases the life of the lamp. The module can be used as a visible and near infrared source (340 nm to 3 μ) or as a building block to construct a variety of spectrophotometric systems. The module has provisions for attaching a Mini-Chrom monochromator and/or an adapter plate. The addition of a Mini-Chrom converts the Tungsten Source Module to a compact and versatile monochromatic light source. A quartz lens in the lamp housing focuses radiation from the tungsten lamp onto the entrance slit of the Mini-Chrom, obviating the need for additional optics and time consuming alignment. With an adapter plate, the module can be easily attached to the Optometrics sample compartment (see page 10). A silicon detector (see pages 12 and 13) can then be added,



TUNGSTEN SOURCE MODULE

resulting in a manual spectrophotometer or fluorometer. Overall dimensions in mm: 203 x 114 x 62; Weight 0.9 Kg (2.0 lbs).

SPECIFICATIONS

Lamp Power Supply:
 Line regulation 0.1%
 Load regulation 1%
 Ripple 1 mV RMS Max.
 Input Voltages 105-126V AC, 60 Hz
 210-252V AC, 50 Hz
 Output 12V DC/ 2 A
 (3 A start-up surge)
 Internal overcurrent protection provided.

Lamp:
 Type Tungsten halogen in quartz envelope
 Power 20 W
 Color temperature 3200° K
 Nominal life 500 hours
 Spectral output 340 nm - 3 μ
 Connector G-4 plug-in

CATALOG NO.	TUNGSTEN SOURCE MODULE
7-1110	Tungsten Source Module with Regulated power supply for 105-125V AC.
7-1125	Tungsten Source Module with Regulated power supply for 210-225V AC.
7-1130	Adapter plate for attaching Tungsten Source Module to sample compartment.
7-1120	20W tungsten halogen lamp replacements (package of two).

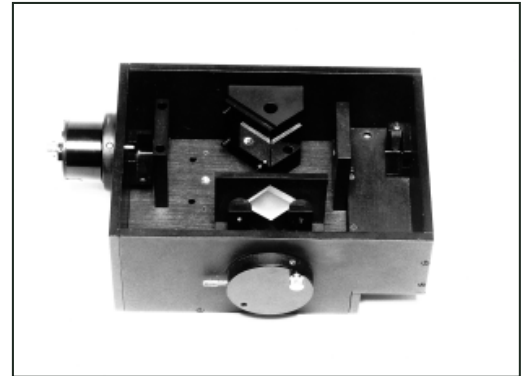
MONOCHROMATORS & MODULES

SAMPLE COMPARTMENT

The versatile Optometrics Sample Compartment accepts standard 1 cm square cells or solid samples up to 50 x 50 x 10 mm. A quartz lens focuses incident radiation in the center of the cell or on the front surface of a solid sample depending on the position of the sample stage. Two additional quartz lenses focus transmitted, reflected or emitted radiation at the in-line or 90 degree detector ports. A filter holder, which accepts Optometrics' 25.4 mm diameter filters, is attached to the inside of each port.

When measuring the percent transmittance or absorbance of a solution or a transparent solid sample, the sample stage and detector are positioned in-line. Fluorescence or nephelometric measurements are made with the detector positioned 90 degrees to the incident radiation. Reflectance measurements from solid samples require rotating the sample stage 45 degrees and placing the detector 90 degrees to the incident radiation (see Optical Path Configuration drawing on page 11). Overall dimensions in mm: 218 x 168 x 92; Weight 2.5 Kg (5.4 lbs.)

(For information on detectors that plug into the sample compartment see pages 12-13. If monochromatic radiation is required, our Tungsten Source Module (page 9) and either a



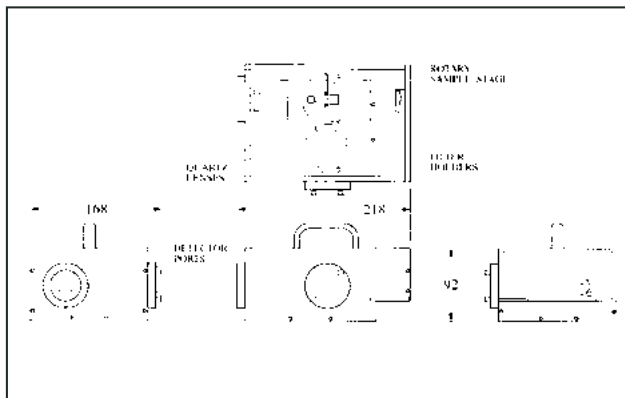
SPECULAR REFLECTANCE SAMPLE COMPARTMENT WITH OPTIONAL DETECTOR

Digital or Scanning Digital Monochromator (pages 4-5) can be attached directly to the Sample Compartment.)

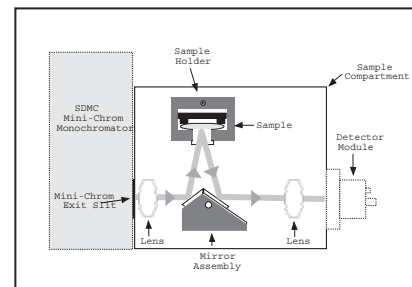
SPECULAR REFLECTANCE ACCESSORY

The specular reflectance accessory mounted in the sample compartment is designed to measure the reflectance of solid samples such as mirrors, paint samples, etc. The reflectance accessory is pre-mounted in the Optometrics sample compartment, which aligns directly to the exit port of an Optometrics Mini-Chrom monochromator. Monochromatic light from the exit slit of the monochromator is reflected onto the sample, which is held in position by a spring-loaded mount. The angle of incidence at the sample is 11 degrees. Light from the sample is reflected to the exit port of the sample compartment. A detector is placed at the exit port to measure the amount and hence the reflectance from the sample.

The standard sample compartment (this page) can be used for samples requiring 45 degree reflectance measurements whereas the Specular Reflectance Accessory is designed for measurements requiring an 11 degree angle of incidence. Maximum sample size is 7 x 14 cm.

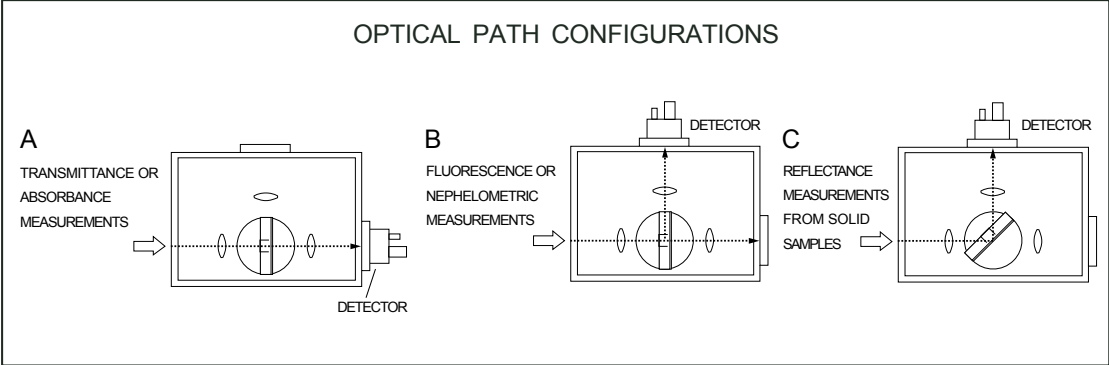


OVERALL DIMENSIONS IN MILLIMETERS



SPECULAR REFLECTANCE SAMPLE COMPARTMENT

MONOCHROMATORS & MODULES



CATALOG NO.	SAMPLE COMPARTMENT
7-1200	Sample Compartment with three 1" focal length quartz lenses, three filter holders, two detector ports, rotary sample stage and sample holders.

CATALOG NO.	SPECULAR REFLECTANCE SAMPLE COMPARTMENT
8-0050	Specular Reflectance Accessory mounted in Sample Compartment. Can be used with any of the Modular RS systems (pages 16-17).



PCM-01 STEPPING MOTOR CONTROLLER

STEPPING MOTOR CONTROLLER

The PCM-01 is a modular component, ideally suited for driving the Optometrics LLC line of Scanning Digital Monochromators.

Using a personal computer, the operator can move the monochromator to a specific wavelength and scan over a wavelength range. The PCM-01 application program can be used with Windows 95 or 98.

When a terminal is used to drive the monochromator, the user can access over 25 commands that control a variety of operations of the grating drive (e.g. including the distance to be moved, the initial and final velocities of the move, the acceleration, the time period for pauses, etc.). Commands can be sent at any time, even when the motor is operating. The motor controller board includes over 2,000 bytes of non-volatile memory to store complex motion control programs.

Six different Scanning Digital Monochromators are available for use with the PCM-01. Each monochromator is fitted with a pair of entrance and exit slits specified by the user. Additional slits can be ordered separately (see pages 6 and 8).

MONOCHROMATORS & MODULES

STEPPING MOTOR CONTROLLER

SPECIFICATIONS

Motor Drive:	Communications:	I/O Connections:
Type Bi-polar	Operating Mode Single and party line	Limits Limit A
No. of phases 2	Interface RS-232 Limit B
Step Modes Full and half	Baud Rate 9600	Moving
Step Rate 16-23,000/second	Data Bits 8	Go
Max Step Range $\pm 8,388,607$ steps	Stop Bits 1	Soft Stop
Max Current 1.2 amps/phase	Parity None	LogicCom
Voltage 24 vdc	Flow Control XON/XOFF	Memory:
Motor Leads 4, 6 or 8		Non-Volatile 2048 bytes

CATALOG NO.	STEPPING MOTOR CONTROLLER
7-2000	PCM-01 Stepping Motor Controller. Includes RS-232, I/O and SDMC cables. 110V AC, 60Hz.
7-2001	PCM-01 Stepping Motor Controller. Includes RS-232, I/O and SDMC cables. 220V AC, 50Hz.

DETECTOR MODULES

Optometrics' Silicon Detector Modules are designed for direct mounting on Mini-Chrom monochromators or in either aperture of the standard Sample Compartment. The modules are compact, low cost, simple to mount and require no user alignment. The silicon detectors have a wide spectral response (200 nm to 1100 nm) with a peak response at approximately 900 nm. The detectors cover the UV-VIS-NIR spectral region and are used extensively as components in analytical and biomedical instrumentation, and in research, teaching and quality control. In addition to their wide spectral response, photocells have excellent linearity and signal-to-noise ratios.

The Detector Module consists of a mounted silicon photodiode, an integral low noise, high speed and exceptionally high stability operational amplifier and a slit assembly in a rugged housing. Mounting is facilitated by a pair of banana plugs on the slit assembly. When exposed to electromagnetic radiation of sufficient energy, photocells generate an electrical signal. The signal is the result of a photon induced difference in potential between the P and N layers within the photocell, i.e. the photo-voltaic effect. The signal is proportional to the energy of the impinging radiation and varies as a function of wavelength. The Silicon Detector Module incorporates a photocell with low dark current, a fast response time, a quartz window and thin P-layer for an enhanced response to ultraviolet radiation.



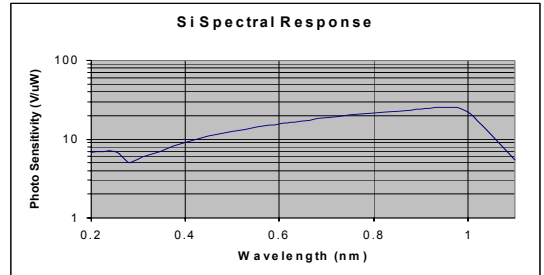
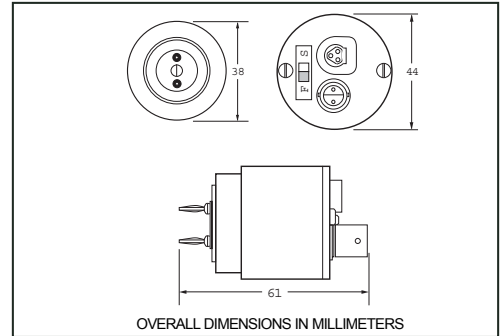
A slide switch enables the selection of the time constant and "fast" for the recording (RS) spectrophotometer and computer data acquisition.

Power to the modules ($\pm 15V$ DC) can be supplied with a wall mounted power supply (for 115V AC) or by an external power supply (for 230V AC).

MONOCHROMATORS & MODULES



DETECTOR MODULE MOUNTED ON MINI-CHROM MONOCHROMATOR



SPECIFICATIONS

Detector Module with Silicon Photodiode:

Detector Type	UV enhanced Silicon
Spectral Range	200 nm to 1.1 μ
Peak Response	950 nm \pm 50 nm
Photosensitive Area	5.9 mm sq.
Output Signal	0 to 14V DC full scale
"Slow" Time Constant	50mSec.
Cut-off Frequency	3 Hz
"Fast" Time Constant	10mSec.
Cut-off Frequency	15 KHz
Radiant Sensitivity (A/W):	0.1 @ 254 nm (Hg)
	0.38 @ 632.8 nm (HeNe)
	0.5 @ 930 nm (GaAs)

CATALOG NO.	DETECTOR MODULES
7-1302	Silicon photodiode with wall mounted power supply (115V AC TO \pm 15 V DC)
7-1303	Silicon photodiode with adapter cable for connection to a \pm 15 V DC power supply
7-1310	Silicon photodiode with wall mounted power supply (230V AC TO \pm 15 V DC)

CATALOG NO.	SLIT SIZE	DETECTOR ACCESSORIES	CATALOG NO.	SLIT SIZE
Slit assemblies for the Detectors when used with Mini-Chrom Monochromators				
7-1304	With 50 μ x 4 mm slit		7-1305	With 100 μ x 4 mm slit
7-1306	With 150 μ x 4 mm slit		7-1307	With 300 μ x 4 mm slit
7-1308	With 600 μ x 4 mm slit		7-1309	With 1 mm x 4 mm slit

MONOCHROMATORS & MODULES

VARIABLE WAVELENGTH FIBER OPTIC MODULE

Optometrics' Variable Wavelength Fiber Optic Module is a rugged, low cost compact instrument that produces monochromatic light out of a fiber optic bundle. Operation is as simple as turning on the lamp and rotating a dial until the desired wavelength appears on the four digit counter. The module can be used for remote spectroscopic sensing or in any application requiring monochromatic radiation that cannot be obtained easily by conventional methods.

The module is comprised of a 20 watt tungsten halogen source, a digital or scanning digital monochromator and a five foot fiber optic bundle. The fiber bundle end is formed into a rectangular array that plugs directly into the monochromator, functionally replacing the exit slit. It is supplied with a 600 micron slit assembly for use on the entrance side. The other end terminates in a conventional circular bundle. Choose either the Digital Mini-Chrom or the Scanning Digital Mini-Chrom monochromator (pages 4-5).



Each type of monochromator is operable over one of three wavelength intervals: 340 to 800 nm, 500 to 1200 nm or 750 to 1700 nm.

VARIABLE WAVELENGTH FIBER OPTIC MODULE

Wavelength Range	Monochromator Model SMA Connector Step Motor Controller Voltage	Digital	Digital	Scanning Digital	Scanning Digital	Scanning Digital	Scanning Digital
		Yes No	No No	Yes No	No No	Yes Yes	No Yes
		Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.	Catalog No.
340-800 nm	105-125 V AC	7-2530	7-2532	7-2630	7-2634	7-2635	7-2636
	210-252 V AC	7-2531	7-2533	7-2631	7-2633	7-2637	7-2638
500-1200 nm	105-125 V AC	7-2540	7-2542	7-2640	7-2644	7-2645	7-2646
	210-252 V AC	7-2541	7-2543	7-2641	7-2643	7-2647	7-2648
750-1700 nm	105-125 V AC	7-2550	7-2552	7-2650	7-2654	7-2655	7-2656
	210-252 V AC	7-2551	7-2553	7-2651	7-2653	7-2657	7-2658

MONOCHROMATORS & MODULES

MLM-2 MONOCHROMATIC LIGHT MODULE

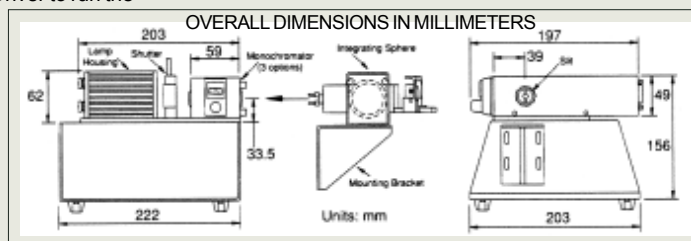
Optometrics' Monochromatic Light Module (MLM-2) offers a low-cost, high performance alternative for spectroscopy applications requiring easy component integration. The MLM-2 was developed for use in research, teaching and quality control but can also be used as a component in a variety of sophisticated analytical and biomedical equipment such as HPLC detectors, UV-VIS-NIR spectrophotometers and clinical chemistry analyzers. It is ideally suited for quick and easy changing of monochromators, sample compartments and detectors. Three (3) choices of wavelength ranges are available, from 300 nm to 1.7 microns. The MLM-2 is CE Approved.

The MLM-2 consists of:

- Tungsten light source and power supply;
- Variable aperture assembly and shutter;
- Scanning Digital Mini-Chrom Monochromator;
- Integrated Stepper Motor Controller and Driver to run the scanning monochromator;
- Windows®-based software to easily control wavelength scanning and selection;
- Built-in Wavelength Scanning
- 3 Choices of Wavelength Ranges, from 300 nm to 1.7 microns
- Includes Tungsten Light Source and Variable Aperture
- Software to Control Scanning Models Via Stepper Motor



The lamp, variable aperture and monochromator are conveniently mounted to a removable baseplate which can be removed from the base and connected with the 6 foot extender cables included with the MLM-2.



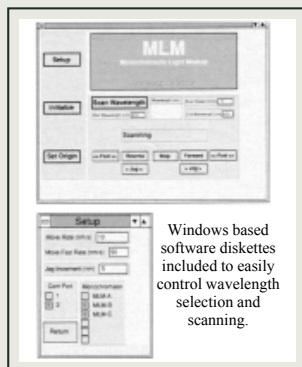
SCANNING SPECIFICATIONS

Stepper Motor: 400 steps per revolution Scanning Speeds:
 Scanning Resolution: Minimum: 0.313 nm/min (0.625 for Model B,C)
 nm/rev: 50 (100 for Model B,C) Maximum: 250nm/sec (500 for Model B,C)
 half step: 0.063 nm (0.125 for Model B,C)
 half step multiplier: 16 (8 for Model B,C)

LAMP SPECIFICATIONS

Type: 20 W Tungsten halogen in quartz envelope
 Color Temperature: 3200° K
 Spectral Output: 340 to 3000 nm
 Nominal Life: 500 hours

For more information, see Monochromator specifications (pages 1-6).



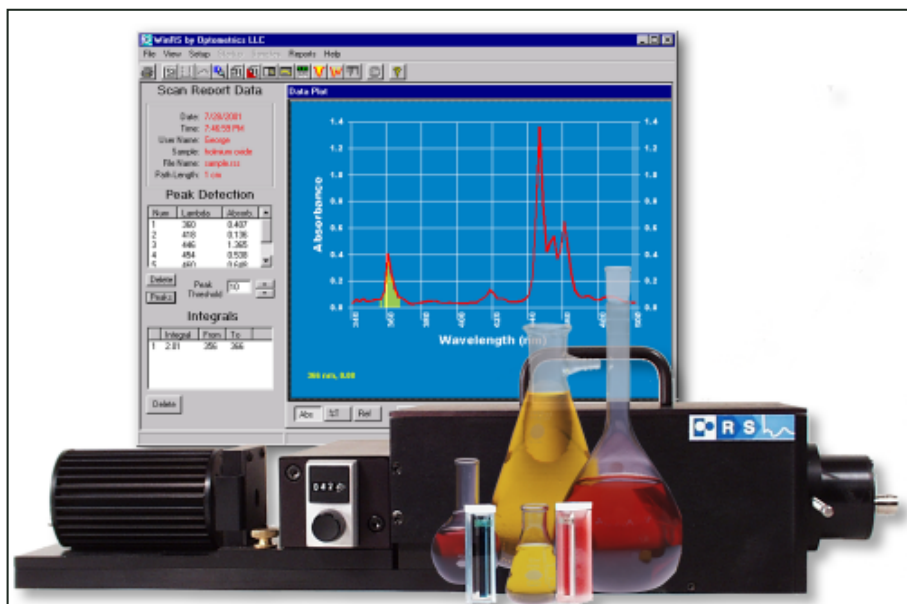
The MLM-2 can be programmed via a CRT, serial keyboard or computer through an RS-232 interface and comes with Windows®-based software to easily control wavelength scanning and selection. Over 25 different commands are available including initial and final velocities, move distance, ramp slope, half or full step operation, time-out pauses, etc. with stepping speeds of from 5 to 15,000 steps per minute. Data can be sent or received at any time during operation.

MONOCHROMATIC LIGHT MODULE

CATALOG NO.	GRATING TYPE (GROOVES/MM)	BLAZED (in nm)	WAVELENGTH RANGE (nm)
7-2632	1800, Holographic	500	340-800
7-2642	1200, Ruled	750	500-1200
7-2652	830, Ruled	1200	750-1700

MONOCHROMATORS & MODULES

RS System - Modular VIS-NIR Recording Spectrophotometer



Designed for the research and educational market, the RS System gives you the flexibility to choose the components you need to fit your application. The complete system includes a control module, tungsten lamp module, choice of monochromator and detector and the WinRS software that automates scanning and data capture and provides the spectroscopist with a range of software tools to analyze and store data.

- Design Your Instrument to Match Your Requirements
- Choose From Our Monochromators and Detectors to Build Your System
- WinRS Software Provides Control and Data Analysis

RS Systems are designed around the Mini-Chrom monochromator, a product proven by sales of over 20,000 units to leading manufacturers of analytical and biomedical instrumentation. The simplicity, versatility and low cost of Optometrics' modular units allow the user to "customize" a recording spectrophotometer for a single application or a variety of experiments. Other modular units, under development, will expand current system capabilities.

Detectors and monochromators can be easily changed to enhance overall performance in selected spectral regions.

Basic system includes your choice of Scanning Digital Mini-Chrom Monochromator, Silicon Detector, Sample Chamber or Specular Reflectance Sample Chamber, Tungsten Halogen Light Source, Variable Light Aperture, Control Module with integral stepper motor controller and all required power supplies, Data Acquisi-

tion Board, Adapter plate, all cables, WinRS System Software and full operating manual.

Instrument Features:

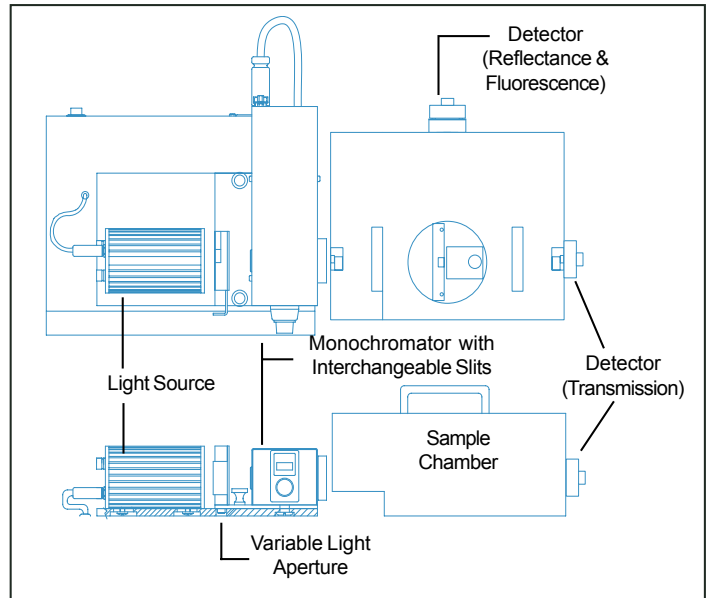
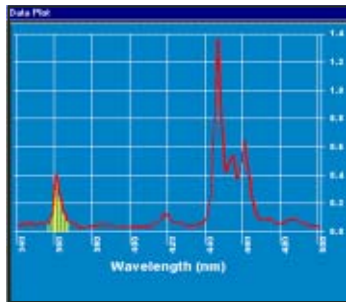
- Wavelength range: 375 nm to 1200 nm
- Interchangeable slits for resolution optimization
- Interchangeable detectors for signal optimization
- Varying detector ports for both in-line and 90° measurements in transmission and reflectance
- Perform reflectance, absorbance, transmission and concentration measurements
- May be used for excitation scanning or fixed wavelength fluorescence

Software Features:

- Quick Read Mode for immediate sample readings
- Wavelength Scanning Mode including 1st and 2nd derivatives, peak pick, peak integration and data smoothing
- Timebase Reading Mode to monitor chemical reactions against time. Includes calculation of reaction rate using linear fit
- Concentration Mode for direct reading of concentration of samples using a standard curve or calculation factor
- Other software features include storage of instrument parameter setup files, data storage and report printouts in both graphical and tabular formats.

MONOCHROMATORS & MODULES

RS System - Modular VIS-NIR Recording Spectrophotometer



Monochromator Characteristics:

Model Number	Grating Spacing	Grating Type	Blaze Wavelength	Wavelength Range
SDMC1-03	1800 g/mm	Holographic	500 nm	300-800 nm
SDMC1-04	1200 g/mm	Ruled	750 nm	500 nm-1.2 μ

Detector Characteristics:

Model	SDM-1
Detector Type	UV enhanced Silicon
Spectral Range	200 nm to 1.1 μ
Peak Response	950 nm ± 50 nm

RS System Specifications

Wavelength range	375 to 1200 nm (depends on monochromator)
Photometric range	-0.3 to 2.50 Abs, 0 to 130% T
Concentration range	0 to 999.99 Conc.
Bandpass	1-2 nm (depends on monochromator)
Monochromator wavelength accuracy	0.2% of wavelength
Monochromator wavelength reproducibility	±0.15%
Noise	<0.0005A peak-to-peak at 500 nm
Zero drift	<0.003A per hour after warm-up at 500 nm
Photometric accuracy	≤0.03A (0 to 0.3A)
(using 930D filters)	≤1% (0.3A to 2.5A)

MONOCHROMATORS & MODULES

RS MODULAR VIS-NIR RECORDING SPECTROPHOTOMER

CATALOG NO.	DESCRIPTION	MINI-CHROM MONOCHROMATOR	WAVELENGTH	DETECTOR RANGE (nm)
8-1100	RS-375 System	SDMC1-03	375-800	Silicon
8-1400	RS-500 System	SDMC1-04	500-1200	Silicon

RS System available from Optometrics with either 110V AC, 60 Hz or 230V AC, 50 Hz.
Please specify required power cord when ordering.

ACCESSORIES

CATALOG NO.	DESCRIPTION
8-1501	WinRS Software V1
8-1511	PCI Data Acquisition Board for RS System, Driver & Cable Assembly
7-2000	PCM-01 Stepping Motor Control & Power Supply, 110V
8-0050	Specular Reflectance Sample Compartment

For additional Detectors, see pages 12-13.

For additional Monochromators, see pages 5-6.

For additional Monochromator Accessories, see pages 6-8.