Hitachi High-Tech
HITACHI

Hitachi UV-VIS-NIR Spectrophotometer

UH4150

Model U-4100, the expert in solid-phase spectrophotometry, has advanced even more.

Now, Model UH4150 has emerged inheriting the reliability of the U-4100 Spectrophotometer, which boasts the total number of shipments more than 1,500*1 units.

*1 Models U-4000 and U-4100 as of October 2012

Feature

Small signal level differences at detector switching afford highly accurate measurements even when the wavelength of detector is being switched.

Low stray light and low polarization characteristics are attained with Hitachi's high-performance prism-grating double monochromator system.

Collimated light beam allows accurate measurement of reflected light and scattered light.

NEW

A wide variety of detectors affords the selection of detectors suitable for measurement objectives.

NEW

New ergonomic design has been adopted.

Compatible with many of the U-4100 accessories.

NEW

Higher throughput than Model U-4100.

System Lineup

Integrating Sphere Detection System

A variety of 60 mm integrating spheres are available.
As optional items, we offer 150 mm integrating spheres or Continuously Variable Angle Absolute Reflectance accessories (60 mm standard integrating sphere is shown here).

Direct Light Detection System

The direct light detector is built in the spectrophotometer.
The direct light detector can be replaced with other optional detectors, such as various Integrating Spheres and Continuously Variable Angle Absolute Reflectance accessories.

Contents

OPTICAL SYSTEM

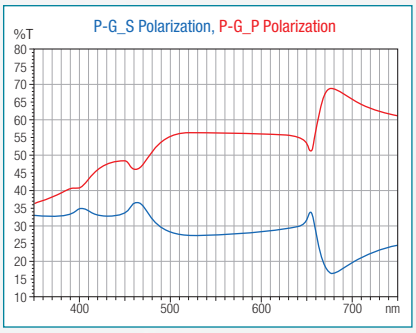
Optical System Suitable for Measurement of Optical Characteristics of Solid Samples

Double Monochromator Prism-Grating Optical System

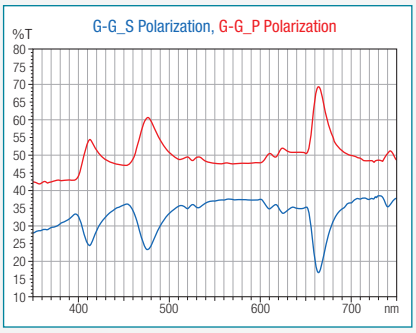
Offering low polarization effects and low noise measurements

The UH4150 adopts a prism-grating (P-G) double monochromator optical system, continuing the established reputation of the U-4100 optical system. Large changes in light intensity of the S and P polarization are less likely for the prism-grating (P-G) system than for the generally used grating-grating (G-G) system. The UH4150 offers low noise measurements, even for low transmittance and reflectance samples.

Comparison of Polarization Characteristics

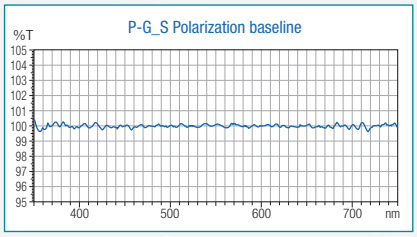


Prism-Grating Unit (Model UH4150)

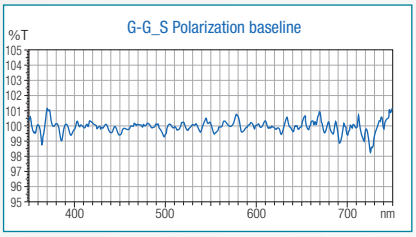


Grating-Grating Unit *2

Comparison of Baseline of S-Polarization

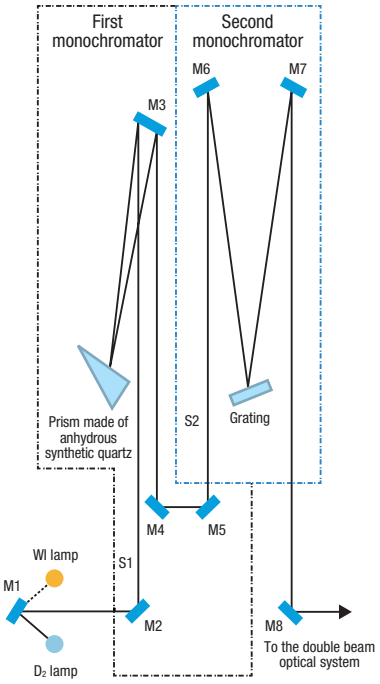


Prism Grating Unit (Model UH4150)



Grating-Grating Unit *2

As shown above, the baseline for a P-G optical systems is more stable relative to a G-G system due to smoother polarization characteristics of the P-G system across the range of wavelengths. Additionally, the smaller loss of light intensity in the P-G system results in lower measurement noise.



First monochromator:
Littrow-type prism

Second monochromator:
2 Switchable gratings of Czerny-Turner mounting

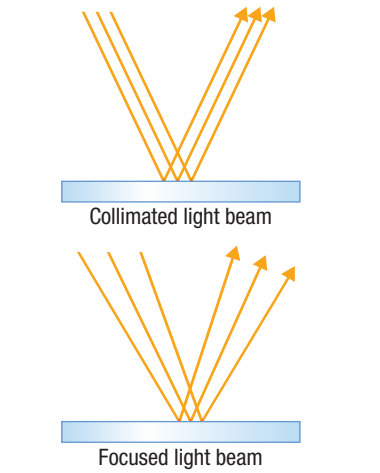
Outline of UH4150 Monochromator

Collimated Light Beam advantage

High-accuracy specular reflectance measurement

The incident angle is important for the measurement of specular reflectance of solid samples. For focused light beam, the incident angle varies depending on the lens's focal length, etc. Consequently, the values of simulation of design of optical thin films, such as dielectric multilayer film and prism, would differ from actual measured values.
In the case of a collimated light beam, however, the incident angle is always the same with respect to the sample, leading to a highly accurate measurement of specular reflectance. Moreover, the collimated light beam is useful for the evaluation of diffusivity (haze) and the measurement of transmittance of lenses.

With a focused light beam, the incident angle differs at the center of the light beam and on the outside of the light beam. Also, the optical system is more complex, because the light beam must be regulated by using the lens and mirror to minimize beam divergence.



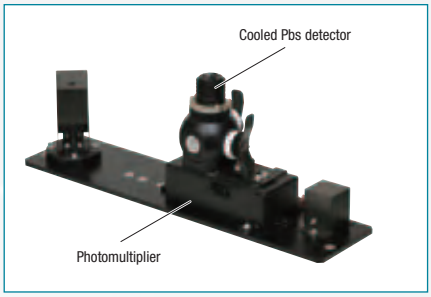
Specular Reflectance measurement example

*2 Ultraviolet Region measurement system of Model U-4100

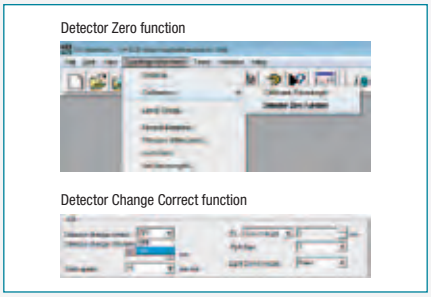
Difference at Detector Switching due to Signal Level Suppression

Improved accuracy in the visible to near infrared spectral region

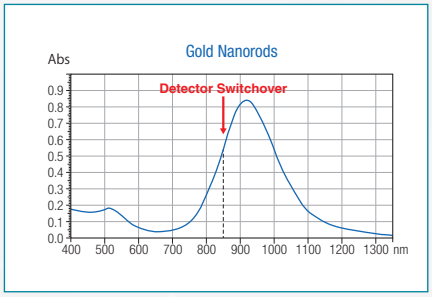
Multiple detectors are installed in the integrating sphere to perform measurement over a wide range of wavelengths, from ultraviolet to visible to near infrared regions. The changes in photometric values at detector switching (from signal level differences) are minimized due to a design utilizing Hitachi's expertise in integrating sphere construction, signal processing technologies, etc.



Appearance of Integrating Sphere



Screen for Setting Detector Zero function and Detector Change Correct function



Example of Measured Data around the Wavelength of Detector Switching (Absorption spectrum of Gold Nanorods)

The integrating sphere houses a photomultiplier for UV and visible regions, and a cooled PbS detector for near infrared region. We care in manufacturing much about details, including the arrangement of detectors, baffle configuration on the inner surface of the integrating sphere, and process of multilayer coating of barium sulfate on the inner surface.

The signal level difference at the selected detector switchover wavelength is reduced by using the Detector Zero function.
Additionally, when measuring samples causing greater signal level difference, such as uneven samples, the Detector Change Correct function is also useful.
The detector switchover wavelength is also changeable for additional flexibility.

SAMPLE COMPARTMENT

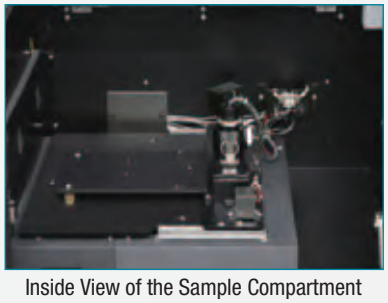
Large Sample Compartment Suitable for Placing Solid Samples

Large Sample Compartment of 680 (W) × 470 (D) × 300 (H) mm

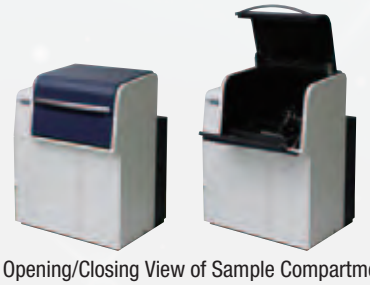
Capability to handle large samples, flexibility in using accessories, and improved operation

The capacity of the sample compartment is about twice that of the standard sample compartment system of the model U-4100. Samples such as sheet glass and building material can be placed non-destructively (maximum sample size: 430 × 430 mm).
Additionally, large accessories containing moving parts, such as the variable angle absolute reflectance accessory can be mounted.

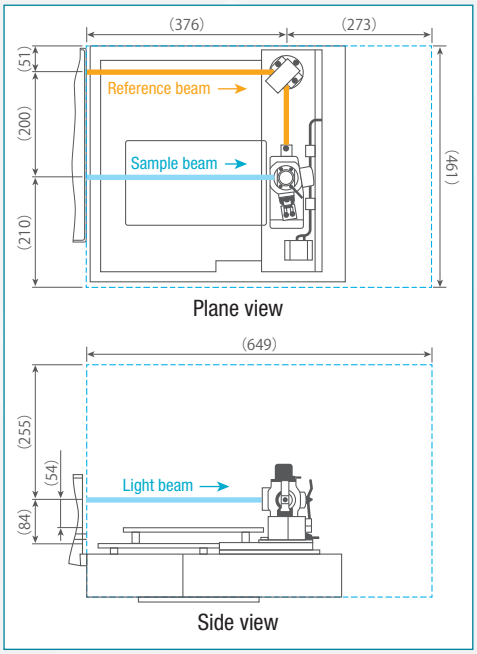
The door of sample compartment is modified to improve the operation. An ergonomic design is adopted by taking into account the operation of replacing samples and accessories.



Inside View of the Sample Compartment



Opening/Closing View of Sample Compartment



Dimensions of Sample Compartment

Compatibility with Model U-4100

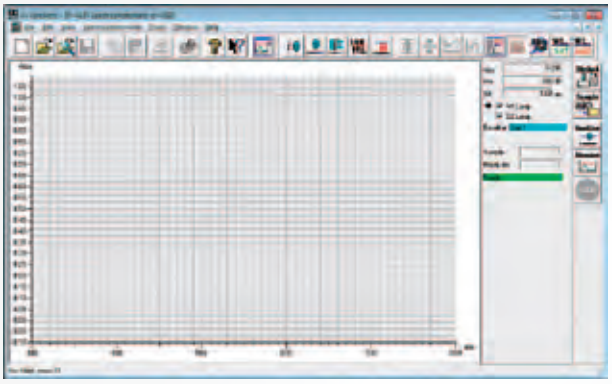
Accessories common to both models

Common accessories are available for both models.
Accessories used with Model U-4100 can also be used with Model UH4150*3. Since the accessories are removable, they help to accommodate a wider range of measurement types. For details of accessories, please see the accessories brochure.

Lineup of Accessories

Software common to both models

UV Solutions Ver. 4.2 is used to control the UH4150. The user interface is the same as the one used with the U-4100. Version 4.2 can open data acquired with the U-4100 to perform data processing.
Also, since analytical conditions (parameters) are common, measurement under identical parameters is possible.



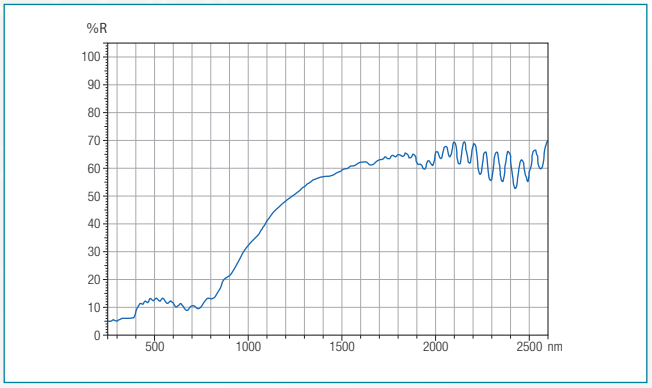
Screen of UV Solutions Program

Advancements from Model U-4100

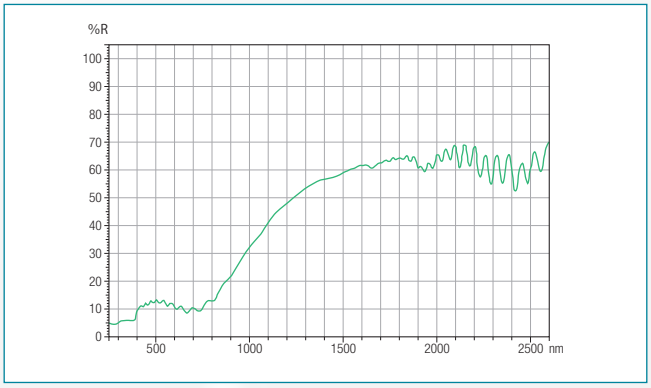
Improved measurement throughput

While maintaining the high-performing optical system of the model U-4100, the UH4150 provides higher throughput measurements. In the previous model, a scan speed of 600 mm/min was necessary for a measurement using a data interval of 1 nm. With Model UH4150, you can measure at 1 nm intervals while using a scan speed of 1,200 nm/min, reducing the measurement time significantly.*4 The UH4150 measures from 240 to 2,600 nm in approximately two minutes. It is effective for samples requiring measurement in UV-VIS-NIR wavelength range, such as Solar Reflective Materials.

Comparison of Spectral data using Scan Speed of 600 nm/min and 1,200 nm/min with Data Interval of 1 nm



Reflectance Spectrum of Solar Reflective Material using Scan Speed of 600 nm/min



Reflectance Spectrum of Solar Reflective material using Scan Speed of 1,200 nm/min

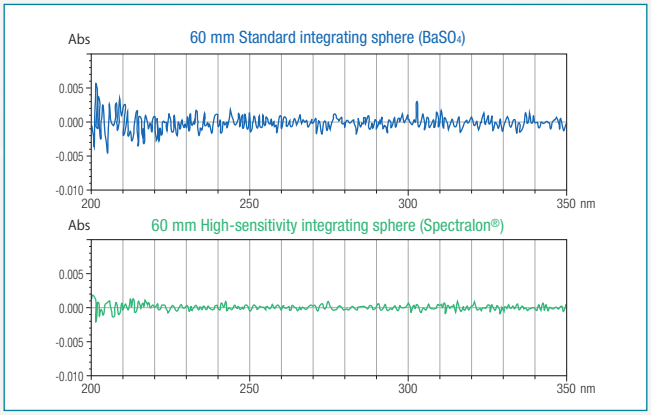
*3 Some accessories are not common. Modification or cable replacement is necessary for replacement of detector-related accessories.
*4 Please set up appropriate measurement parameters including scan speed for your sample property and measurement purpose.

Increased Offering of Detectors

Selection® of an integrating sphere suitable for the measurement objectives, allows configuring the optimum optical system.

Eight types of integrating spheres of different materials, sizes, and shapes are available.*5 *6
Refer to the accessories brochure for details.

Lineup of Detectors



Baseline Comparison for Different Integrating Sphere Materials

Material

Both the wavelength range and noise level depend on the white material coating on the inner surface of the integrating sphere. The 60 mm standard integrating sphere is coated with Barium sulfate, offering a wavelength range from 240 nm to 2,600 nm. The 60 mm high-sensitivity integrating sphere's coating material is Spectralon® allowing low noise measurement in the wavelength range of 190 nm to 2,600 nm.

Size

The 150 mm integrating sphere has a smaller opening ratio than the 60 mm integrating sphere, and is useful in measurement of diffuse reflectance and total reflectance of samples having a high diffusivity, as well as in color analysis.

Shape

A 60 mm integrating sphere, equipped with a rear port, allows measurement of total reflectance and diffuse reflectance.
A 150 mm integrating sphere, using an optical trap, alternatingly measures total reflectance and diffuse reflectance.
A full sphere affords highly accurate transmittance measurement of lenses. Detector accessories allow measurement of transmittance and absorbance of liquid samples, transparent substrate samples, etc. for a wide range of wavelengths from 190 nm to 3,300 nm.

Lineup of Detectors

Description		P/N	Sphere coating	Wavelength Range
Integrating Sphere Detectors*5	60 mm Standard Integrating Sphere (for both total reflectance and diffuse reflectance)	1J1-0120	Barium sulfate ($BaSO_4$)	240 - 2,600 nm
	60 mm Standard Integrating Sphere (for total reflectance)	1J1-0121	Barium sulfate ($BaSO_4$)	240 - 2,600 nm
	60 mm Standard Full Integrating Sphere	1J1-0122	Barium sulfate ($BaSO_4$)	240 - 2,600 nm
	60 mm High-sensitivity Integrating Sphere for Reflectance Measurement	1J1-0123	Spectralon®	190 - 2,600 nm
	60 mm High-sensitivity Full Integrating Sphere	1J1-0124	Spectralon®	190 - 2,600 nm
	150 mm Standard Integrating Sphere with Optical Trap	1J0-0212	Barium sulfate ($BaSO_4$)	350 - 750 nm
	150 mm High-sensitivity Integrating Sphere with Optical Trap	1J1-0126	Spectralon®	240 - 2,500 nm
	Continuously Variable Angle Absolute Reflectance Accessory for standard size samples	1J1-0131	Barium sulfate ($BaSO_4$)	240 - 2,000 nm
	Continuously Variable Angle Absolute Reflectance Accessory for micro samples	1J1-0132	Barium sulfate ($BaSO_4$)	340 - 2,000 nm
Direct Light Detection System*6		An integrating sphere is not used		185 - 3,300 nm

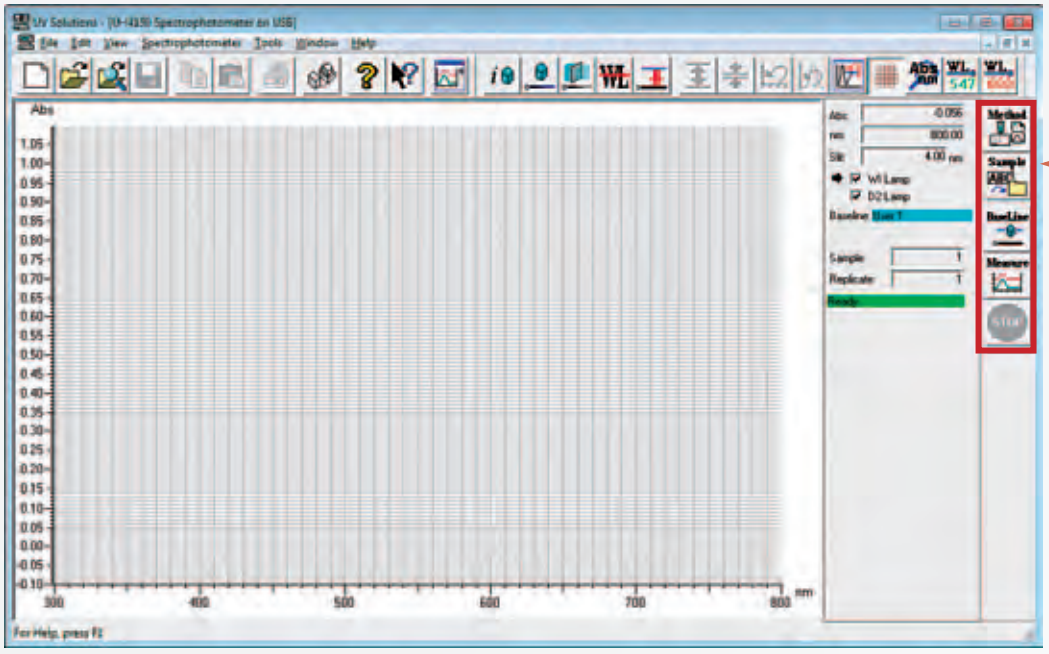
*5 Integrating Sphere Detection System
Either one of the above 60 mm integrating sphere must be included in the purchase of the spectrophotometer for calibration and performance check.

*6 Direct Light Detection System
The direct light detector, which is built in the spectrophotometer, will be used for calibration and performance check.
To change the detector built in the spectrophotometer, purchase either of the above integrating sphere detectors.

User Friendly Interface for Peace of Mind

Simple operation flow

Measurement operation buttons are arranged on the right side. There are four basic operations to complete a measurement.



Starting Screen of UV Solutions Program

Analytical Conditions Setting

Select a desired measurement mode, and set desired analytical conditions.

Screen for setting analytical conditions

Sample Measurement

Set the sample name, desired comment, file name, and save location.

Screen for entering sample information

Baseline / Auto-zero Measurement

Run baseline correction or auto-zero.

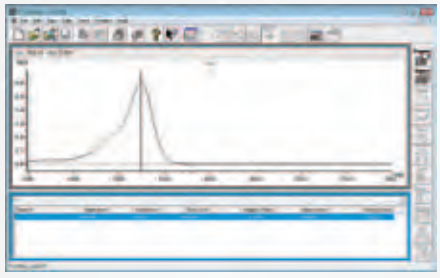
Screen during Auto-zero Measurement

Start Measurement

Sample Measurement Screen (Spectrum)

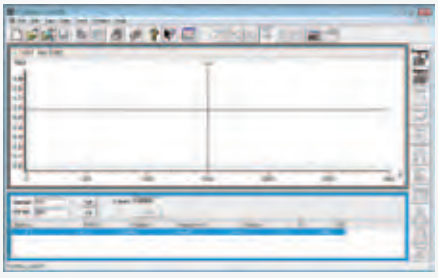
Data Processing Examples

Spectrum Measurement



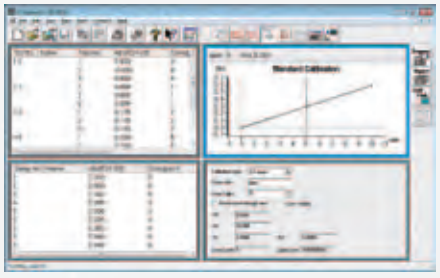
The peak table can be superimposed on the same screen.

Time-series Measurement



The result of rate calculation can be superimposed on the same screen.

Quantitative Calculation



Calibration curve, information and Sample data are displayed.

Broad Range of Data Processing Functions

In addition to standard functions of peak detection, smoothing, differentiation, basic arithmetic operations, and area calculation, four new functions are available.

Spectral width calculation allows calculating the spectral width at half maximum, and supports the characterization of a latest thin-film.
Spectrum normalization provides one-touch operation to normalize photometric value (%T, %R and Abs) at a desired wavelength, useful for comparing the spectral profiles with different value.
Spectrum Average and Spectrum Sum are highly effective in evaluating multiple spectra.

Original processing functions

Peak detection

Smoothing

Derivative

Four basic arithmetic calculations

Area value

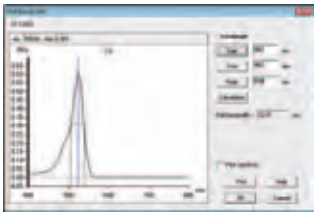
New data processing functions

Spectral Width Calculation

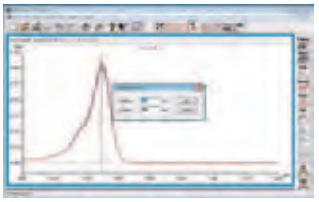
Spectrum Normalization

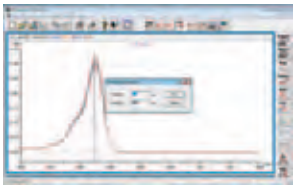
Average Spectrum

Spectrum Sum

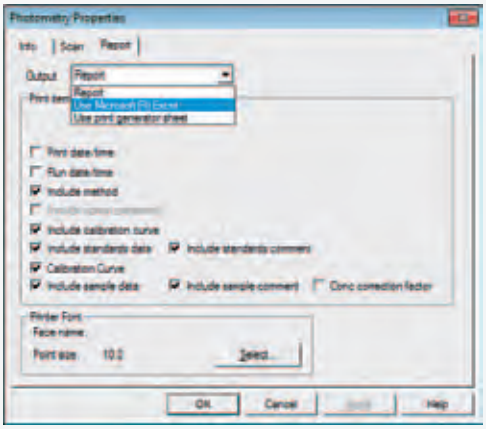

Spectral Width Calculation


Spectrum Normalization


Spectrum Average


Spectrum Sum

Smooth Report Generation



Report generation is supported by DDE and OLE.

◆DDE: Dynamic Data Exchange

One-touch operation allows the exporting the measurement results to the spreadsheet program, Microsoft® Excel®.

◆OLE: Object Link Embedding

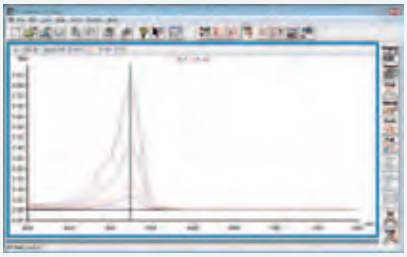
It is possible to copy spectral data into commercial software, such as Microsoft® Word, and to run the software to edit the spectra data.
The use of these programs allows report generation.

◆Batch Processing of File Conversion

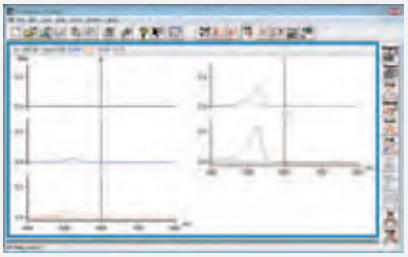
Batch processing of converting into ASCII text files, graph meta files, or JCAMP-DX files is available.

Data Overlay

Overlayed display of measured data is an easy operation.
Automatic overlay immediately after measurement, overlaying data during measurement, or overlaying of saved data is available.


Overlayed Display


Stack Display

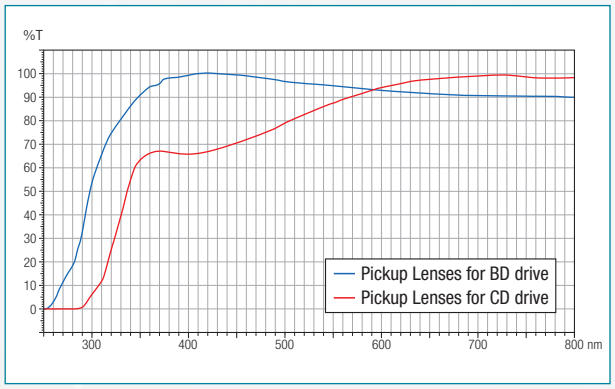

Tile Display

Transmittance Measurement

Select an accessory appropriate to your sample. Below is a measurement example using one of our accessories. For details on accessories, refer to the accessories brochure.

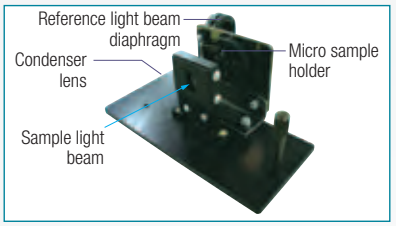
Transmittance Measurement of Micro Samples

The transmittance measurement accessory for micro samples supports the transmission measurement of samples such as micro glass pieces and pickup lenses. This accessory facilitates the placement and measurement of samples by using a condenser lens, a reference light beam diaphragm, and a sample holder.
Note: Requires a sample holder suitable for the shape of a sample to be measured.



Measurement Example of Pickup Lenses

Transmittance Measurement System for Micro Samples (P/N 1J0-0204)



Accessory Appearance

Specifications

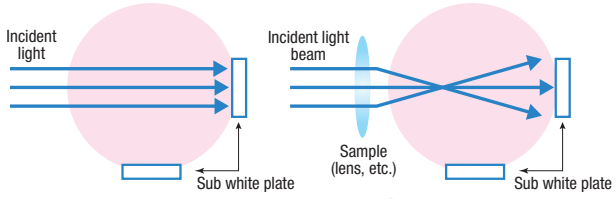
Mask Type	Applicable Sample Sizes
ø3 mm Mask (supplied standard)	ø5 - ø20, 3 mm or less thick
ø1 mm Mask (optional)	ø3 - ø20, 3 mm or less thick

* It is necessary to replace the light source mask with the supplied ø4-mm light source mask.

Transmittance Measurement of Lenses

For the transmittance measurement of samples such as lenses, which have a focus, the incident light passing through the sample diverges broadly as shown below. When using a four-port type standard integrating sphere*7, if it is larger than the size of the sub white plate, measurement errors may occur due to the difference in reflectance between the $BaSO_4$ coating of the integrating sphere and the Al_2O_3 material of the reference white plate. If this is the case, using a 60 mm standard full integrating sphere can remove the measurement errors.

Illustration of Lens Sample Measurement Using four-port type Standard Integrating Sphere*7

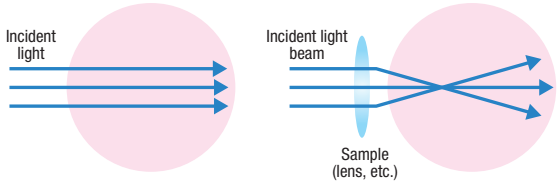


Baseline correction

Sample measurement

The measurement error might arise because the light might overfill the white plate due the lens effect.

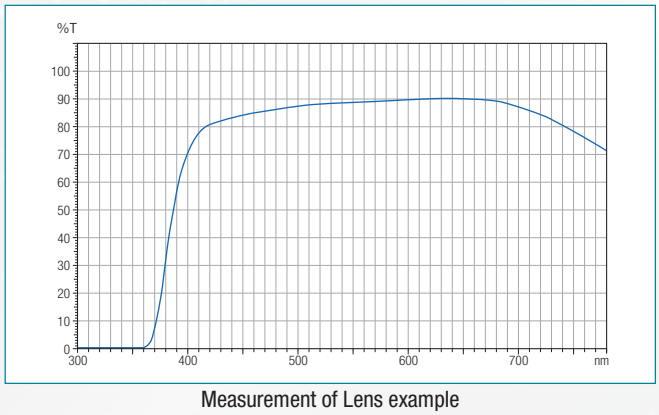
Illustration of Lens Sample Measurement Using Standard Full Integrating Sphere



Baseline correction

Sample measurement

The uniform material of the inner surface of integrating sphere is suitable for lens measurement.



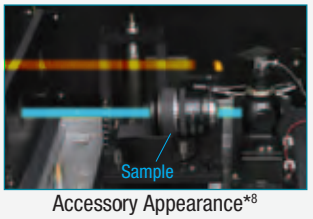
Measurement of Lens example

60 mm Full Integrating Sphere (P/N 1J1-0122)

Specifications

Wavelength range	240 - 2,600 nm

Large Lens measurement accessory (P/N 134-0203)



Accessory Appearance*8

Specifications

Incident angle	0°
Measurement method	Transmittance measurement
Sample size	ø50- ø200 mm, length: up to 300 mm

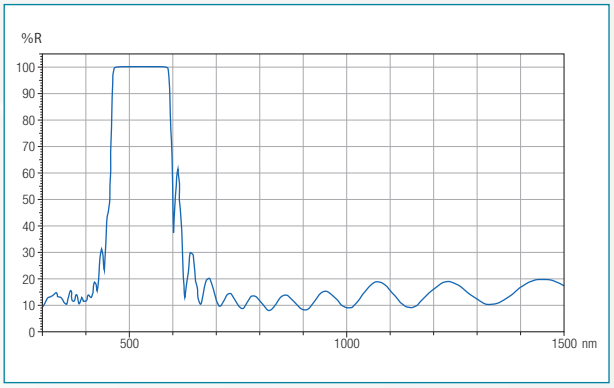
*7 The four-port type Standard Integrating sphere as follows: P/N 1J1-0120, 1J1-0121 60 mm Standard Integrating Spheres
*8 Image above does not represent actual beams.

Reflectance Measurements

Select an accessory appropriate for your measurement requirements, such as specular reflectance, diffuse reflectance, or total reflectance.

Specular Reflectance Measurement

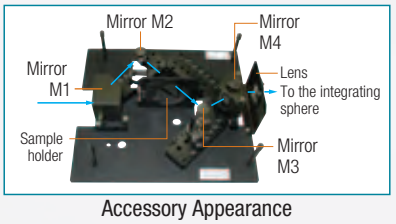
Specular reflectance measurement of samples such as mirrors and optical thin films is possible using the variable angle absolute reflectance accessory. This accessory can also be used for absolute reflectance measurement using the V-N method. Additionally, transmittance measurements at a desired incident angle at the same point as for reflectance measurement are also possible.



Example of 45º Specular Reflectance Measurement of Dielectric Multilayer Film

Variable Angle Absolute Reflectance Accessory (10 - 60º) (P/N 134-0116)

Variable Angle Absolute Reflectance Accessory (15 - 65º) (P/N 134-0117)



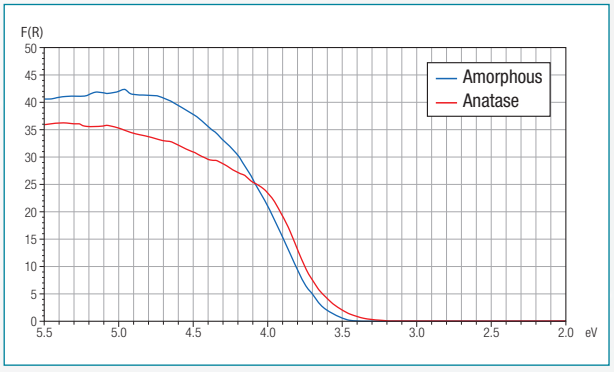
Accessory Appearance

Common Specifications

Incident angle	10 - 60º in increments of 10º (P/N 134-0116) 15 - 65º in increments of 10º (P/N 134-0117)
Sample size	8 × 8 - 90 × 100 mm
Wavelength range	240 - 2,600 nm

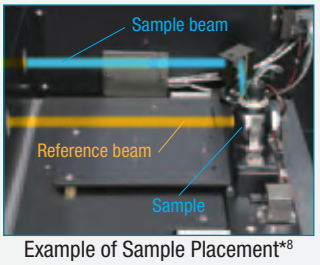
Diffuse Reflectance Measurement

Diffuse reflectance measurement of powder samples, etc. is possible by placing the sample behind the integrating sphere (sample side incident angle of 0º).



Example of Diffuse Reflectance Measurement of Titanium (Ⅳ) Oxide

60 mm Standard Integrating Sphere (for both total reflectance and diffuse reflectance) (P/N 1J1-0120)



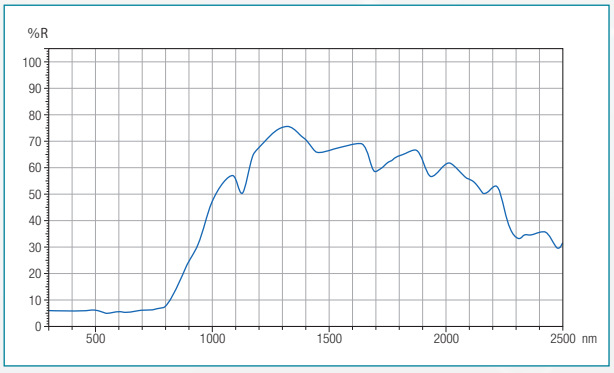
Example of Sample Placement*8

Specifications

Incident angle	0°
Wavelength range	240 - 2,600 nm

Total Reflectance Measurement

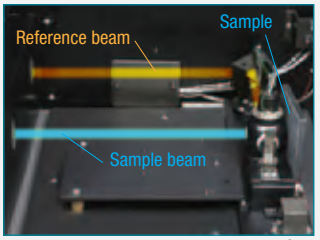
Total reflectance measurement of heat reflecting paint, etc. is possible by placing the sample behind the integrating sphere (sample side incident angle of 8º or 10º). Furthermore, the optional package software*9 is enable to calculate the reflectance of solar radiation automatically in accordance with JIS K5675 (2011).



Example of Total Reflectance Measurement of Solar Reflective Paint

60 mm Standard Integrating Sphere (for both total reflectance and diffuse reflectance) (P/N 1J1-0120)

60 mm Standard Integrating Sphere (for total reflectance) (P/N 1J1-0121)



Example of Sample Placement*8

Specifications

Incident angle	10°
Wavelength range	240 - 2,600 nm

*9 P/N 1J1-0211 Option package program is required.

Specifications

Item		Integrating sphere detection system *1		Direct light detection system
Detector Photomultiplier (UV-VIS) and Cooled PbS detector (NIR)		Standard Integrating Sphere (inner coating: $BaSO_4$) •60 mm Standard Integrating Sphere (4-port type) : Incident angle on reflective sample: Sample side: 8°, reference side: 0° •60 mm Standard Integrating Sphere (4-port type) : Incident angle on reflective sample: Sample side and reference side;10° •60 mm Standard Full Integrating Sphere (2-port type)	High-sensitivity integrating sphere (inner coating: Spectralon®) •60 mm High-sensitivity Integrating Sphere (4-port type) :Incident angle on reflective sample: Sample side: 8°, reference side: 0° •60 mm High-sensitivity Full Integrating Sphere (2-port type)	Direct light detector
Setting wavelength range		175 - 3,300 nm		
Measuring wavelength range		240 - 2,600 nm	190 - 2,600 nm	185 - 3,300 nm
Monochromator		Prism-Grating, Double monochromator, Pre-monochromator: Littrow monochromator using a prism, Main monochromator: Czerny-Turner monochromator using Diffraction grating (2 switchable diffraction gratings)		
Sample compartment		Sample compartment located on the table top and constructed to allow large samples Interior dimensions: 680 (W) × 470 (D) × 300 (H) mm, Light beam path length: 200 mm		
Wavelength indication		In units of 0.01 nm		
Slit width indication		UV and visible regions: Automatic control, and selection of a slit width from 0.01 to 2.4 nm in increments of 0.01 nm and from 2.4 to 8.0 nm in increments of 0.02 nm Near infrared region: Automatic control, and selection of a slit width from 0.1 to 20.0 nm in increments of 0.1 nm		
Wavelength accuracy		UV and visible regions: ± 0.2 nm, Near infrared region: ± 1.0 nm, Automatic wavelength calibration function is incorporated		
Wavelength setting repeatability		UV and visible regions: ± 0.1 nm, Near infrared region: ± 0.5 nm		
Wavelength scan speed		Visible region: 0.3, 3, 15, 30, 60, 120, 300, 600, 1,200, and 2,400; Near infrared region: 0.75, 7.5, 37.5, 75, 150, 300, 750, 1,200, 1,500, 3,000, and 6,000 Go to λ: 3,600 nm/min (9,000 nm/min for near infrared region)		
Light source		UV region: Deuterium lamp (mountable by one touch), Visible and near infrared regions: 50 W Tungsten-halogen lamp (long life of 1,000 hours)		
Light source switching wavelength		Automatic switching at a specified wavelength between 325 nm to 370 nm		
Photometric method		Double beam direct ratio photometry (Measurement of negative absorbance or transmittance/reflectance of more than 100% is possible owing to Hitachi-original differential feedback method) UV and visible regions: Negative voltage control method and slit control method; Near infrared region: slit control method and fixed slit method		
Photometric mode		Absorbance (Abs), transmittance (%T), reflectance (%R), reference side energy (E(R))/ sample side energy (E(S))		
Photometric range		Absorbance: -2 to- +5.0 (in units of 0.001 Abs); Transmittance/reflectance: 0 - 999.99 (in units of 0.01%)		
Photometric accuracy		Certified according to NIST SRM 930: ± 0.002 Abs (0 - 0.5 Abs), ± 0.004 Abs (0.5 - 1.0 Abs), ± 0.3%T		
Photometric repeatability		Certified according to NIST SRM 930: ± 0.001 Abs (0 - 0.5 Abs), ± 0.002 Abs (0.5 - 1.0 Abs), ± 0.1%T		
Response		An optimum response is automatically selected under given slit width and wavelength scan-speed.		
Baseline correction		5 channels: System baseline: 1 ch; User baseline: 4 ch		
Baseline flatness	(UV-VIS)	Less than ± 0.002 Abs (240 - 850 nm, slit width; 4 nm, scan speed; 300 nm/min)	Less than ± 2.0%T (190 - 195 nm, slit width; 5 nm, scan speed; 300 nm/min) Less than ± 0.5%T (195 - 850 nm, slit width; 5 nm, scan speed; 300 nm/min)	Less than ± 0.05 Abs (185 - 200 nm, slit width; 2 nm, scan speed; 300 nm/min) Less than ± 0.001 Abs (200 - 850 nm, slit width; 2 nm, scan speed; 300 nm/min)
	(NIR)	Less than ± 0.002 Abs (850 - 2,200 nm, automatic slit width, scan speed; 750 nm/min, PbS sensitivity; 1) Less than ± 0.004 Abs (2,200 - 2,600 nm, automatic slit width, scan speed: 750 nm/min, PbS sensitivity: 1)	Less than ± 0.5%T (850 - 2,600 nm, automatic slit width, scan speed: 750 nm/min, PbS sensitivity: 1)	Less than ± 0.002 Abs (850 - 2,500 nm, automatic slit width, scan speed: 750 nm/min, PbS sensitivity: 1) Less than ± 0.004 Abs (2,500 - 3,300 nm, automatic slit width, scan speed: 750 nm/min, PbS sensitivity: 1)
Noise level		Less than ± 0.00075 Abs (Peak to Peak, 500 nm, slit width: 4 nm, sampling interval: 1 s) Less than ± 0.0005 Abs (Peak to Peak, 1,100 nm, automatic slit width, sampling interval: 1 s, PbS sensitivity: 1)	Less than ± 1.0%T (Peak to Peak, 365 nm, slit width: 5 nm, sampling interval: 1 s) Less than ± 0.1%T (Peak to Peak, 900 nm (PbS), automatic slit width, sampling interval: 1 s, PbS sensitivity: 1)	Less than 0.00004 Abs (RMS, 500 nm, slit width: 2 nm, sampling interval: 1 s) Less than 0.00003 Abs (RMS, 2,000 nm, automatic slit width sampling interval: 1 s, PbS sensitivity: 1)
Baseline stability		Two hours later after power-On: Less than 0.0004 Abs/ 60 minutes (340 nm)		Two hours after power-On: Less than 0.0002Abs/ 60 minutes (500 nm)
Data processing unit		PC: OS; Windows® 7 Professional (32 bit or 64 bit)		
Operating temperature		15 - 35ºC		
Operating humidity		25 - 80% (No condensing, 70% or less under temperatures of 30ºC or higher)		
Physical size, Weight		900 (W) × 760 (D) × 1,180 (H) mm, 160 kg		

* Please ask your dealer system specifications with 150 mm Standard/ High-sensitivity Integrating Sphere or Continuously Variable Angle Absolute Reflectance Accessory.

Functions

	Spectral and Time-series Measurement and Processing	Quantitative Analysis
Spectrometer control	Wavelength drive (Go to λ), 100%T adjustment (auto zero), Automatic wavelength calibration	
Measurement parameters	Measurement condition setting, Condition readout, Condition saving (Number of files, file rewriting / deletion: Arbitrary), Automatic start function (Measurement conditions are automatically set up when the power switch is turned on.)	
	—	Calibration curve condition setting (first to third order, polygonal line), Standard data setting (20 std, 20 points in average)
Measurement start	Repetitive spectral measurement, Repetitive time-series spectral measurement, S/N user-selectable function (Sampling interval setting), UV Scan speed change function	Re-measurement of calibration curve
	Baseline measurement: 5 ch (System baseline: 1 ch, User baseline: 4 ch)	
Data recording and display	Sample name, Comment input, Ruled-line recording ON/OFF, Measurement condition recording ON/OFF	
	Spectral/time-series recording/display, Real-time auto-scale, Spectral data readout, Spectral data saving	Calibration curve recording/display, Data deletion, Data readout , Data saving, Data list printing
Data processing	Scale change (numeric value input, cursor input), Spectral trace, Smoothing, Data printout, Graph axis conversion (Abscissa; nm, kcm^{-1}, eV, THz, Ordinate; Abs, %T, %R, E(S), E(R), ε, log ε), Spectral calculation (4-rule arithmetic calculation/coefficient calculation), Differentiation (first to fourth order), Area calculation, Data resetting, Rate calculation (only for time-series measurement), Spectrum selection, Average spectrum generation, Sum spectrum generation, Normalized spectrum generation, Calculation of spectral bandwidth	Calibration curve trace, Data printing, Sample data deletion, Statistical calculation, Coefficient-of-determination calculation
Others	File conversion (ASCII/ JCAMP), Lamp On time control, Display format setting, Cell length conversion, Data export to Microsoft® Excel®, Graph copying, Windows meta-file saving, Print preview	

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CAUTION: For correct operation, follow the instruction manual when using the instrument.

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NOTICE: The system is For Research Use Only, and is not intended for any animal or human therapeutic or diagnostic use.

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