

 $\frac{\text{UV-VIS-NIR Spectrophotometer}}{\text{UV-3600}}$



UV-VIS-NIR Spectrophotometer





High sensitivity, high resolution, and an ultra-low stray-light level achieved with the latest technology lead the way to new solutions.

High Sensitivity

We developed the first UV-VIS-NIR spectrophotometer in the world with three detectors. These consist of a PMT (photomultiplier tube) for the ultraviolet and visible regions and an InGaAs detector and a cooled PbS detector for the near-infrared region. With conventional instruments, there is a drop in sensitivity in the crossover between the regions covered respectively by the PMT and the PbS detector. Using an InGaAs detector to cover this region, however, ensures high sensitivity across the entire measured wavelength range. The 1,500-nm noise level does not rise above 0.00003 Abs, which is the lowest level in the world.

High Resolution, Ultra-Low Stray-Light, and Wide Wavelength Range

Using a high-performance double monochromator makes it possible to attain an ultra-low stray-light level (0.00005% max. at 340 nm) with a high resolution (maximum resolution: 0.1 nm). The wide wavelength range of 185 to 3,300 nm enables measurement over the ultraviolet, visible, and near-infrared regions. This instrument can perform spectrophotometry for a variety of different fields.

Wide Range of Optional Accessories

Using a large, multi-purpose sample compartment or an integrating sphere attachment enables the measurement of solid samples, and the ASR-series absolute specular reflectance attachments, for which measurement precision is assured, can be used to perform absolute specular reflectance measurement with a high level of precision. Also, a thermoelectrically temperature controlled cell holder or a microscopic cell holder can be installed and used to handle a wide range of measurement applications.

High Sensitivity

The UV-3600 can handle measurement with highly precise transmittance and reflectance, and uses three detectors to handle a range going from the ultraviolet region to the near-infrared region. The level of sensitivity for the near-infrared region has been increased significantly by using an InGaAs detector and a cooled PbS detector for this region. Spectra can be obtained for the entire range, from the ultraviolet region to the near-infrared region, with a high level of sensitivity and precision.



Relationship between Detectors and Measurable Range

165	nm 380	nm 780	nm	3300 n
	UV	Visible		NIR
РМТ		165 to 1000 nm		
InGaAs			700 to 1800 nm	
PbS				1600 to 3300 nm

Switching between the photomultiplier tube and the InGaAs detector is possible in the range 700 to 1,000 nm (the default switchover wavelength is 830 nm). Switching between the InGaAs detector and the PbS detector is possible in the range 1,600 to 1,800 nm (the default switchover wavelength is 1,650 nm).

Comparison between Two-Detectors and Three-Detectors Measurements

With the UV-3600, an InGaAs detector is used in addition to a PMT (photomultiplier tube) and a cooled PbS detector. In comparison with a conventional two-detector instrument (i.e., equipped with only a PMT and a PbS detector), the noise level in the InGaAs detector range (900 to 1,600 nm) is significantly reduced.

The figure on the right shows transmittance spectra for water measured with the UV-3600 (InGaAs detector and cooled PbS detector) and a conventional instrument (PbS detector) in the range 1,370 to 1,600 nm. It can be seen that the noise level is significantly less with the UV-3600. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)



High-Accuracy Measurement with Minimized Detector Switchover Noise and Bump

Noise and bump caused by switching detectors is minimized to assure accurate measurement. Noise or bump is hardly observed even when using a transmission cell with a long optical path of 50 or 100 mm.



The figures above on the left and right are, respectively, transmittance spectra for ethylbenzene (obtained using a cell with an optical path of 100 mm) and cyclohexane (obtained using a cell with an optical path of 10 mm). There is hardly any level difference at the respective detector changeover wavelengths (870 and 1,650 nm).

High Resolution, Low Stray-Light Level, and Wide Wavelength Range

High-Resolution Spectra of Benzene Gas



The spectrum shown on the left was obtained by enclosing benzene gas in a cell with an optical-path length of 10 mm and performing measurement. The spectral bandwidth is 0.1 nm. The triplet in the neighborhood of 250 nm (enlarged above) can be observed clearly. This instrument allows high-resolution spectra to be measured with little noise.

Ultra-Low Stray-Light Level of 0.00005% Max. (340nm)



The figure above on the left is a spectrum for aqueous NaNO₂ solution, and the figure on the right shows an enlarged view of the neighborhood of 340 nm. In the figure on the right, the red spectrum is for aqueous NaNO₂ solution and the blue spectrum is the 0% line obtained when a shutter block is inserted on the sample-beam side. The UV-3600 achieves an ultra-low stray-light level of less than 0.00005% at 340 nm. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)

Linearity Up To Absorbance Level 6



The figure on the far left shows spectra obtained by measuring aqueous KMnO4 solution at six concentration levels. A mesh filter was inserted on the reference-beam side and a differential method was used to perform measurement up to absorbance level 6. Using negative absorbance enables measurement with little noise, even at high absorbance levels. The figure on the near left shows the calibration curve for aqueous KMnO4 solution, and shows that linearity is maintained up to absorbance level 6. The UV-3600 is equipped with a high-performance, grating-grating double monochromator, and achieves a low stray-light level with high resolution. The wavelength range is 185 to 3,300 nm. This instrument can perform spectrometry for various types of sample, ranging from samples requiring a high resolution, such as gas, to high-concentration liquid samples.

Covers Wide Wavelength Range from Ultraviolet to Near-Infrared

The wide wavelength range of 185 to 3,300 nm enables measurement over the ultraviolet, visible, and near-infrared regions. Spectra exhibiting little noise can also be obtained over a wide range of wavelengths.







The figure on the left shows a spectrum obtained by measuring toluene in the range 185 to 3,300 nm using a cell with an optical-path length of 2 mm. Spectra in the ultraviolet, visible, and near-infrared regions can be obtained.

The figure on the left shows the spectrum for a low-transmittance film on a silica wafer in the range 200 to 1,600 nm. Although the film is a special type of film with a transmittance of almost zero, it has been measured with high precision and little noise. (A mesh filter is used on the reference-beam side to maintain balance with the sample-beam side.)

Molecules of alcohol such as 1-butanol are thought to consist of a mixture of non-hydrogen-bonded isolates and aggregates formed through relatively weak hydrogen-bonding between OH groups.

As the temperature rises, the hydrogen-bonding becomes weaker and the aggregates separate into isolates.

The figure on the left shows near-infrared spectra for 1-butanol obtained at 20°C, 40°C, and 60°C. The peaks in the neighborhood of 1,400 nm that become larger as the temperature increases are OH peaks for a non-hydrogenbonded isolate. The peaks in the neighborhood of 1,600 nm that become smaller as the temperature increases are OH peaks for a hydrogen-bonded aggregate.

UVProbe Software

All-In-One Software

UVProbe is an all-in-one software package equipped with the following four functions:

- Spectrum module
- Photometric module (quantitation)
- Kinetics module (time-course measurement)
- Report generator

Each can be easily operated from its own special screen. In addition to a wealth of data processing functions, including peak detection and area calculations, the software is equipped with security functions to configure operational authority user by user, as well as data audit trail and equipment audit trail functionality.

Spectrum Module

Kinetics Module

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 $\frac{1}{v} = \frac{K_{m}}{V_{max}} \frac{1}{[S]} + \frac{1}{V_{max}}$

-D-Cell B



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Photometric Module



Report Generator



The report generator provides the freedom to arrange graphs, tables, etc. to suit users' needs. The thickness and color of graph lines, as well as font size, can now be specified. Pasting labels on graphs and editing text is as easy as can be, allowing the user to effectively print comments along with the analysis results.

nk 💷 Auto Zero 💻 I



A Variety of Data Processing and Calculation Functions

- Data processing operations, such as peak detection and area calculation, and data conversion operations, such as differentiation and interpolation, can be applied to spectra and time-course data.
- With the kinetics module, the Michaelis constant (Km) or the maximum response speed (Vmax) can be calculated and plotted.



Calculation Expressions and QA/QC Functions

- With the photometric module, calculation expressions can be defined for measurement results.
- Judgment expressions can be created for photometric values and calculation results.



GLP/GMP Support

- Security Functions The use of functions can be restricted according to the user level.
- Audit Trail Function Details of processes (e.g., baseline correction) that affect measurement data are tracked in the instrument's history.
- Data History Function If a change is made to measurement data, a history of this is added to the data.

Support for DNA/RNA/Protein Quantitation Methods as Standard

The table on the right shows protein/DNA quantitation methods included as standard with UVProbe. In addition to Lowry, BCA, Bradford, Biuret and other typical protein quantitation methods, the software supports a variety of DNA guantitation methods. A significant feature of UVProbe is that it provides the user with the opportunity to create different quantitation methods for samples other than protein/DNA.



WL588.0 WL506.0 WL375.0 WL578.0_400.0 Pf



UV Direct Measurement (280 nm)	Biuret method
DNA (double-stranded)	Lowry method
DNA (single-stranded)	Bradford method
DNA260, 230 with background correction	260/280 ratio with background correction
DNA260, 280 with background correction	260/280 ratio with no background correction
BCA Method	RNA quantitation method

ц. і	File Edit View	Graph Op	perations In	strument T	ools Window	v Help		-	8
Sam	ple Table - (A	ctive)							
	Sample ID	WL260.0	WL230.0	WL320.0	corr260	corr230	DNA_equ1	Protein	
1	8	1.354	1.130	0.050	1.304	1.080	60.268	98.797	
2	b	0.674	0.558	0.050	0.624	0.508	20.071	45.665	
3	c	0.360	0.287	0.032	0.328	0.255	15.217	21.803	
4	d	0.553	0.458	0.039	0.514	0.417	23.788	37.350	

Optional Software

UVProbe Agent Software (P/N 206-21550-91)

The UVProbe Agent, which was developed for Shimadzu UV-VIS spectrophotometers, is used to automatically transfer and store the data acquired, or the results of performing data processing with the UVProbe software, to a general-purpose database, and to perform operations related to high-security data management and electronic signatures. This makes it possible for UVProbe to attain compliance with FDA 21 CFR Part 11. The UVProbe Agent is network-compatible; therefore, by installing other Agent software for corresponding analytical instruments, such as HPLC or FTIR spectrophotometers, data from all analytical instruments can be integrally managed at a server PC and browsed at client PCs.

Access Control and User Management

As with UVProbe, user access to the program is centrally managed by a user-authentication server without depending on the OS, enabling a level of access control that complies with FDA 21 CFR Part 11. It is also possible to restrict the functions that can be executed by authenticated users on an individual basis, eliminating the possibility of unauthorized users making erroneous changes to settings.

Security and Audit Trails

All saved electronic records are stored and managed in a database, ensuring the original data is not lost when records are changed. Also, the contents of system usage records and records of changes made to data registered in the database are recorded together with the date and the name of the person concerned.

Data Integrity and Electronic Signatures

Data is automatically stored in the database and is not deleted. This data can be easily restored, allowing it to be displayed or reanalyzed as necessary. Also, electronic signatures can be applied to electronically recorded data; this data is linked to analytical data, and the name of the signer, the date of the signature, and the reason for the signature are saved.

Applicable OS: Windows 7 Professional



This software works with the S-1700 and accumulates temperatureversus-absorbance curve data at the PC to analyze the Tm (melting temperature) of nucleic acids such as DNA and RNA.

Applicable OS: Windows 7 Professional

Note: An RS-232C cable (P/N 200-86408) is needed to connect the PC to the S-1700.





Note: UVProbe software Ver. 2.00 or later is required.



Color Measurement Software

This software calculates color values of the measurement sample from the spectrum measured.

Calculable Items

Tristimulus value (XYZ), chromaticity coordinates (xy), Hunter color coordinate system/color difference formula, CIELAB color coordinate system/color difference formula, Yellowness/after-yellowing, whiteness, whiteness B (blue reflectance), Munsell, metamerism, three attributes from CIELUB and their difference, primary wavelength, excitation purity

- The software is fully equipped with convenient graphic functions including chromaticity diagrams and enlarged color-difference views.
- It provides a wealth of recalculation functions, enabling items and conditions with respect to the spectra obtained to be changed for recalculation.
- The visual field (2°, 10°) and the illumination (A, B, C, D65, F6, F8, and F10) are freely selectable. In addition, the user can configure particular weighting coefficients, enabling calculations with respect to any illumination. The configured illumination can also be saved.
- Standard white plate values can be configured, enabling corrected calculations.
- Standard samples can be freely specified, enabling color-difference calculations.
- Thickness conversion calculations are possible with respect to glass, filters, and other transmissive materials.
- The average and standard deviation of multiple data points can be calculated.
- Up to 100 data points can be shown.

Note: This software runs on Windows 7 Professional





Lab chromaticity diagram display window

Film Thickness Measurement Software (P/N 206-66877)

This software measures the thickness of thin films from the wavelengths of peak (or valley) interference waveforms overlapping the spectrum. The film thickness is measured through optical methods without physical contact.

- The film thickness is calculated from linear regression by applying the method of least squares to the wavelengths of the multiple peaks and valleys automatically detected. (The thin film's refractive index and the angle of incidence must be configured as calculation conditions.)
- The calculation conditions can be changed with respect to the measured spectra, enabling recalculation.
- A range can be set for use in the calculations while checking the spectral interference waveform onscreen.
- The measurable film thickness range is (minimum measured wavelength)/n to 50 × (maximum measured wavelength)/n. (Reference value)

Note: This software runs on Windows 7 Professional



Recalculation window

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Accessories

Cells

Description	Optical Path (L)	Required Sample Volume	Туре	Fused Silica (S)	Glass (G)
	10 mm	2.5~4.0 mL	1	200-34442	200-34565
6 II	20 mm	5.0~8.0 mL		200-34446	200-34446-01
Square cell	50 mm	12.5~20.0 mL	6	200-34944	200-34944-01
	100 mm	25.0~40.0 mL		200-34676	200-34676-01
Square cell with stopper	10 mm	2.5~4.0 mL	2	200-34444	200-34444-01
Semi-micro cell	10 mm	1.0~1.6 mL	③ *1	200-66501	200-66501-01
Semi-micro black cell	10 mm	1.0~1.6 mL	3 ' *1	200-66551	
Supermicro black cell	5 mm	25~100 μL	7' *2	208-92116	
	10 mm	50~200 μL	⑦ *2	200-66578-11	
Micro black cell	10 mm	50∼400 µL	(8) *2	200-66578-12	
	10 mm	3.8 mL		200-34448 (silica window)	200-34448-01 (glass window)
Culindrical call	20 mm	7.6 mL		200-34472(//)	200-34472-01 (//)
Cylindrical cell	50 mm	19.0 mL	4	200-34473-01 (//)	200-34473-03 (//)
	100 mm	38.0 mL		200-34473-02(//)	200-34473-04 (//)
	1 mm	0.3~0.4 mL		200-34660-01	200-34662-01
Short path cell	2 mm	0.5~0.8 mL	5	200-34655	200-34662-11
	5 mm	1.3~2.0 mL		200-34449	200-34449-01



Note *1 With a 5 mm slit, the cell holder with micro cell mask (P/N 204-06896) is required. *2 The supermicro cell holder (P/N 206-14334) is required.

Film Holder (P/N 204-58909)

Used in transmittance measurement of thin samples such as films and filters. Holds thin samples, such as films and filters, for analysis.

 Sample Size Minimum:
 16 (W) × 32 (H) mm Maximum:
 80 (W) × 40 (H) × 20 (t) mm



Four-Cell Sample Compartment Unit

(P/N 206-23670-91)

Accommodates 4-cell holders of various types.

 Incorporates a 4-cell holder for 10-mm square cells.



Rotating Film Holder (P/N 206-28500-41)

This film holder can rotate samples in a plane centered on the optical axis. Polarizers Type I, II, and III can be attached. The Large Polarizer Set cannot be used.

• Sample size: 33 mm × 30 mm × 2 mm thick



Multi-Cell Sample Compartment

(P/N 206-69160-01)

Holds up to six 10-mm square cells on the sample side. No temperature control capability.

• Number of cells: 6 on the sample side 1 on the reference side Note: Cells are not included.



Universal Rectangular Cell Holder,

Four-Cell Type (P/N 204-27208)

Holds four rectangular cells with an optical path length of

10, 20, 30, 50, 70, or 100 mm.

Note: The Four-Cell Sample Compartment unit (P/N 206-23670-91) is required. When a rectangular, long-path cell is used on the reference side, its holder (P/N 204-28720) is additionally required.



Long-Path Rectangular

Cell Holder (P/N 204-23118-01)

Holds two rectangular cells with an optical path length of 10, 20, 30, 50, 70, or 100 mm.

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Super Micro Cell Holder (P/N 206-14334)

Holds supermicro cells for measurement of extremely small volume samples. The cell height is adjustable, and the required sample volume can be adjusted in the range

of 50 to 200 µL, depending on the type of black cell used.

 Applicable cells: ⑦, ⑦', and ⑧ in the list of cells on page 12. Cells are not included.
 Mask: Choice of 1.5 (W) × 1 (H) mm or 1.5 (W) × 3 (H) mm

3-µL Capillary Cell Set for Ultramicro Volume Measurement (P/N 206-69746)

Recommended for small-volume and precious samples, such as in biological applications. Solution sample is aspirated into the capillary cell and the cell is set in the capillary adapter cell, where it is analyzed. The holder is the same size as a 10-mm square cell and can be mounted to the standard cell holder.

 \bullet The minimum sample volume required: 3 μL when tube closure is used (theoretical value)

Supplied with 100 capillaries (made of quartz) and a tube closure
 Inner diameter of capillary: 0.5 mm

Note: Usually, the effective optical path length is approximately one-twentieth of a 10-mm square cell.

Reference-Side Rectangular Long-Path Absorption Cell Holder (P/N 204-28720)

If using a 4-cell-type universal rectangular cell holder, only use a reference-side cell holder if necessary.



Cylindrical Cell Holder (P/N 204-06216-02)

Holds two cylindrical cells with an optical path length of 10, 20, 50, or 100 mm.



Micro Cell Holder with Mask (P/N 204-06896)

Required when using semi-micro cells or micro cells with an optical path width of 3 mm or less. (The mask width can be adjusted.)





Accessories

8/16-Series Micro Multi-Cell

Cell Holders

Model	P/N
8/16 Series Micro Multi-cell Holder MMC-1600	206-23680-91
8/16 Series Constant-Temperature Micro Multi-cell Holder MMC-1600C	206-23690-91

This cell holder holds one micro multi-cell, either 8 or 16 cell, for micro-volume measurement. Two types of micro multi-cell holders are available: the standard type (MMC-1600) and the constant-temperature water circulation type (MMC-1600C).

Applicable temperature range: 10 °C to 60 °C (C type)

• Temperature deviation between circular water and cell: max. 3 °C (C type)

Temperature stabilizing time: 15min or less (C type)

Micro Multi-Cells

Model	P/N
8-series Micro Multi-cell; optical path length: 10 mm; cell volume: 100 μ L	208-92089
16-series Micro Multi-cell; optical path length: 10 mm; cell volume: 100 μL	208-92088
8-series Micro Multi-cell; optical path length: 5 mm; cell volume: 50 µL	208-92086
16-series Micro Multi-cell; optical path length: 5 mm; cell volume: 50 µL	208-92085

There are two types of micro multi-cells available in both the 8-series and 16-series models: a 50μ L type and a 100μ L type. The cell intervals of the 8-series micro multi-cells are applicable for use with 8 × 12-well microplates and 8-channel pipettes. Microplate samples aspirated into multi-channel pipettes can be injected directly into the cells for measurement.

CPS-100 Cell Positioner, Thermoelectrically Temperature Controlled (P/N 206-29500-**)

This attachment permits measurement of up to six sample cells under constant-temperature conditions. Combination of this attachment and the Kinetics mode provides measurement of temperature-sensitive enzyme kinetics of one to six samples.

• Number of cells: 6 on the sample side (temperature-controlled)

1 on the reference side (temperature not controlled) • Temperature control range: 16°C to 60°C

Temperature display accuracy (difference from the true value): ± 0.5°C
 Temperature control precision (variation of temperature): ± 0.1°C
 Ambient temperature: 15°C to 35°C

Note: Square cells (P/N 200-34442) are not included, please purchase separately. A USB adapter CPS (P/N 206-25234-91) is required.

TCC-100 Thermoelectrically Temperature Controlled Cell Holder (P/N 206-29510-**)

Uses Peltier effect for controlling the sample and reference temperature, so no thermostated bath or cooling water is required.

• Number of cells: One each on the sample and reference sides (temperature-controlled)

- Temperature control range: 7°C to 60°C
- Temperature display accuracy (difference from the true value): ± 0.5°C
- Temperature control precision (variation of temperature): ± 0.1°C

Note: Square cells (P/N 200-34442) are not included, please purchase separately.





• Micro-volume samples can be measured.

- (Minimum sample volume: 50 μL to 100 μL) • Support for commercial microplates and micro
- pipettes(with 8-series micro cells).
- Up to 16 samples can be measured at a time (with 16-series micro cell).





Constant-Temperature Cell Holder (P/N 202-30858-04)

Maintains a sample cell and reference cell at a desired, uniform temperature, by circulating constant-temperature water.

- Temperature range: 5°C to 90°C
- (depends on the performance of the constant-temperature water circulator)
- Cell holder: Accepts a pair of 10-mm square cells.
- Connecting joint outer diameter: 6 mm and 9 mm (two levels)

Constant-Temperature Four-Cell Holder (P/N 204-27206-02)

Maintains four sample cells and a reference cell at a desired, uniform temperature, by circulating constant-temperature water.

- Temperature range: 5°C to 90°C
- (depends on the performance of the constant-temperature water circulator)
- Cell holder: Accepts four 10-mm square cells plus a reference cell
- Connecting joint outer diameter: 9 mm

Note: The Four-Cell Sample Compartment Unit (P/N 206-23670-91) is necessary.

S-1700 Thermoelectric Single-Cell Holder (P/N 206-23900-**)

This cell holder permits setting of a temperature program to increase and decrease the sample cell temperature.

- The thermoelectric system allows prompt control of sample temperature between 0°C and 110°C.
- Temperature increase/decrease speed can be changed using 12 settings, which means the holder can be used in analysis of melting curves for nucleic acids, etc., that occur during quick as well as slow heating (or cooling).
- A stirrer is also provided to ensure uniform temperature distribution throughout the cell.
- Cooling water circulation is required for Peltier element cooling. And though tap water can be used, it is recommended that a commercially available constant-temperature water circulator be used, as the following conditions must be fulfilled to exact maximum performance from the S-1700.

Cooling water specification: 20 ± 2°C Water flow: 4.8 L/min or more.

• Temperature is not controlled at the reference side.



This system obtains a temperature-versus-absorbance curve data, and the Tm Analysis Software analyzes the Tm (melting temperature) of nucleic acids such as DNA and RNA. The system consists of an 8 Series Micro Multi-Cell Holder, Tm Analysis Software, and Temperature Controller. 8 Series Micro Cells, Silicone Cap, and Constant-Temperature Water Circulator for protecting Peltier device are not included. Please purchase separately.

Description	P/N
8 Series Micro Cell Optical Path 10 mm, Sample Volume 100 μL	208-92097-11
8 Series Micro Cell Optical Path 1 mm, Sample Volume 35 μ L	208-92140
Silicone Cap for Micro Cell (24 pcs)	206-57299-91

Temperature control range: 0.0 to 10.0°C

Tm Calculation mode: Average Method, Differential Method

OS: Windows 7 Professional







Cells are not supplied.
 Please use 10-mm square

tight-sealing cells (a Hellma product).

Туре	Optical Path Length	Minimum Sample Volume Required
110-QS-10	10 mm	3.5 mL
115B-QS-10	10 mm	400 µL

• Temperature accuracy in cell (when room temperature is 25°C): Within 0.25°C (0°C to 25°C) Within ± 1% of set value (25°C to 75°C)

Within $\pm 2\%$ of set value (25 C to 75 C) Within $\pm 2\%$ of set value (75°C to 110°C)



Note: Please purchase the constant-water circulator which fulfills specifications below.
Temperature range: 20 ± 2°C, Flow rate:
4.8 L/min or more
Inner diameter of the connecting pipe:
ø8, 10, 12 mm

Accessories

NTT-2200P Constant-Temperature Water Circulator (P/N 208-97263)

Circulates temperature-controlled water to a constant-temperature cell holder.

- Temperature range: Ambient +5°C to 80°C
- Temperature control precision: ± 0.05°C or more
- Maximum pumping rate: 27/31 L/min, 9.5/13 m (50/60 Hz)
- External circulation nozzle: 10.5 mm OD (both outlet and return)
- Tank capacity: About 10 L (9 L during use)
- Safety features: Detection of over-temperature of Upper or Lower limits, Detection of heater wire malfunction, Protection from heating too little circulating water, Detection of sensor malfunction,
- Independent over-heat protection, Over-current circuit protector Standard accessories: Lid with handles, Rubber hose (4 m; inner diameter: 8 mm;
 - outer diameter: 12 mm; quantity: 1), Hose clamps (4 pcs),
 - instruction manual (Japanese and English)
- Dimensions: 270 (W) × 560 (H) × 400 (D) mm
- Power requirements: 100 VAC, 1,250 VA, with 1.7-m power cord and grounded plug

Sipper Unit

Model	P/N	Standard Sample Volume
Sipper Unit 160L (Standard Sipper)	206-23790-91	2.0 mL
Sipper Unit 160T (Triple-Pass Sipper)	206-23790-92	1.5 mL
Sipper Unit 160C (Constant-Temperature Sipper)	206-23790-93	2.5 mL
Sipper Unit 160U (Supermicro Sipper)	206-23790-94	0.5 mL

Four types of sipper units with different flow cell types are available.

The stepping motor-driven peristaltic pump ensures reliable and smooth aspiration of sample solution.

(Direct driving is possible from the UV-3600 so no interface is required.)

Note: The use of a Solenoid Valve (Fluoropolymer) (P/N 204-06599-01) and the SWA-2 Sample Waste Unit (P/N 206-23820-91) are recommended when strong acids, strong alkalis, or organic solvents are to be measured.

Syringe Sipper

Model	P/N
Syringe Sipper N (Normal temperature type)	206-23890-91
Syringe Sipper CN (Constant temperature, water circulator type)	206-23890-92

The sipper unit employs a syringe-pump system. The liquid-contact surfaces are composed of Fluoropolymer, glass, or quartz, imparting excellent chemical resistance and ease of maintenance, and allowing measurement of almost any sample type. Further, the extremely high repeatability of sipping volume (repeat precision: \pm 0.03 mL) makes it ideal when performance validation is required.

Note: Flow cell available separately. Choose from the recommended flow cells listed below.

Recommended Flow Cells					
Cell Type P/N Optical Path Length Dimensions of Aperture Standard Required Sample Volum					
Square (ultra-micro)	208-92114	10 mm	ø2 mm	0.9 mL	
Square (micro)	208-92113	10 mm	ø3 mm	1.0 mL	
Square (semi-micro)	208-92005	10 mm	11 (H) × 3.5 (W) mm	5.0 mL	

• The type of flow cell can be selected in accordance with the application.

• The flow cell can be changed independently for excellent ease of maintenance.

• Circulated-water temperature range: ambient to 60°C (CN type)

Note: If a square flow cell (micro or supermicro) is used, attaching mask R (P/N 206-88679) to the reference cell holder is recommended to balance the light intensity.









ASC-5 Auto Sample Changer (P/N 206-23810-**)

Combine with a Sipper 160 to build an automated multisample spectrophotometry system.

• The aspirating nozzle is programmed to move in the X, Y, and Z (vertical) directions.

• Up to 8 sets of operational parameters, including the sizes of racks and the numbers

of test tubes, may be memorized in the battery back-up protected files. • Up to 100 test tubes may be set together on the rack.

• op to too test tabes may be set together on the rack.

Note 1: An ASC USB adapter (P/N 206-25235-91) is required.

Note 2: A commercially available test tube stand, with a footprint smaller than 220 × 220 mm, is applicable.

10-mm Micro Flow-thru Cell with Holder (P/N 204-06222)

5-mm Micro Flow-thru Cell with Holder (P/N 204-06222-01)

P/N	Optical Path Length	Volume
204-06222	10 mm	0.3 mL
204-06222-01	5 mm	0.15 mL

Used for the continuous analysis of samples such as the liquids produced by column chromatography.

• Inner diameter of tube: 1 or 2 mm

Front Panel with Holes (P/N 204-27588-03)

Allows the tubes of a flow cell, for example, to be connected through the front panel of the instrument.

Flow-Thru Cell for HPLC (P/N 206-12852)

With this flow-thru cell attached, the spectrophotometer can be used as a variable-wavelength UV-VIS detector for an HPLC system.

- Inner diameter: 1 mm; Optical path length: 10 mm; Inner volume: 8 µL
 Flow-thru cell on the sample side and cell holder with a mask on the
- reference side. • SUS tube: Outer diameter: 1.6 mm; Inner diameter: 0.3 mm









Accessories

ISR-240A Integrating Sphere Attachment, 60 mm dia. (P/N 206-23860-91)

This attachment is used for measurement of diffuse, total and reflectance and measurement of transmission of liquid or solid sample.

- Wavelength range: 240 to 800 nm
- Integrating sphere: 60 mm in inner diameter, equipped with a photomultiplier.
- Maximum size of reflection sample: 40 × 70 mm wide, 10 mm thick or 70 × 70 mm wide, 5 mm thick.
- Incident angle: 0 deg.



ISR-3100 Integrating Sphere Attachment, 60 mm dia. (P/N 206-23851-91)

This attachment is used for measurement of diffuse/specular reflectance and measurement of transmission of liquid or solid sample.

- Wavelength range: 220 to 2600 nm
- Integrating sphere: 60 mm in inner diameter, equipped with a photomultiplier and a PbS cell.
- Maximum size of reflection sample: About 100 mm dia. × 15 mm thick
- Incident angle: 0 deg. / 8 deg.



Reference cell for transmission measurement - Reference beam Sample cell for transmission measurement - Sample beam

LISR-3100 Integrating Sphere Attachment, 150 mm dia. (P/N 206-23862-92) LISR-2100 Integrating Sphere Attachment, 150 mm dia. (P/N 206-23862-91)

This attachment is used for measuring reflection spectra of solid samples, such as powders, papers, and cloth. This is also used for transmission measurement of solution and solid samples, featuring high stability, excluding the influence of the state of the sample surface.

The accessory is ideally suited for color measurement.

- LISR-3100 240 to 2400 nm; LISR-2100 240 to 800 nm
- Integrating sphere: LISR-3100 150 mm in inner diameter, equipped with a photo-multiplier and a PbS cell; LISR-2100 150 mm in inner diameter, equipped with a photo-multiplier.
- Space to mount reflection sample: About 150W × 170H × 30T mm
- Incident angle: 7 deg.

Specular Reflectance Measurement Attachment (5° Incident Angle) (P/N 206-14046)

The technique of specular reflectance measurement is often applied to the examination of semiconductors, optical materials, multiple layers, etc., relative to a reference reflecting surface. The 5° incident angle minimizes the influence of polarized light. Thus, no polarizer is required in measurement ... the operation is quite simple.

 Samples as large as 100 (W) × 160 (D) × 15 (T) mm can be readily measured. The minimum size is 7 mm in diameter.

 Sample placement is easy - just set it on a holder with the measuring surface down.

Powdered Sample Holder (P/N 206-89065-41)

This powdered sample holder is for attachment to an integrating sphere. It can be attached to all integrating spheres.

• Capacity of 0.16 mL, 3 included





Structure



Wavelength range:

MPC-3100 Multi-Purpose Large-Sample Compartment (P/N 206-23831-91)

This multi-purpose sample compartment allows measurement of various shaped samples to obtain both reflection and transmission spectra. An integrating sphere is built-in to ensure accurate measurement of solid samples.

- Wide wavelength range: 240 to 2600 nm
- Maximum sample size:
- Transmission 305 mm dia. ~50 mm thick or 204 mm dia. ~300 mm long Reflection 305 mm dia. ~50 mm thick
- Original S-beam/R-beam switching function allows reflection measurement using incidence angles of 0 deg. and 8 deg. without leaning the sample.
- The V stage is built-in. The sample position can be freely adjusted both forward and backward as well as up and down.

Note 1: A separate space must be provided for the personal computer.

- Note 2: A small table for the MPC-3100 must be provided separate from that for the UV-3600. Table dimensions: Able to accommodate MPC-3100 unit (580W × 420D mm)
 - Table height: Within +8 ~ -15 mm of the UV-3600 table height

Accessories for MPC-3100

Absolute Reflectance Attachment

Model	P/N
ASR-3105 Absolute Reflectance Attachment, 5°	206-16817
ASR-3112 Absolute Reflectance Attachment, 12°	206-16100
ASR-3130 Absolute Reflectance Attachment, 30°	206-15001
ASR-3145 Absolute Reflectance Attachment, 45°	206-15002

These accessories are intended for use with the MPC-3100 Sample

Compartment, and require the BIS-3100 Sample Base Plate-Integrating Sphere Set (P/N 206-17059). At larger angles of incidence (30°, 45°), a polarizer is also required.

- Measurement wavelength range: 300 to 800 nm
- Accuracy: with respect to 90 % reflectance samples
- Incidence angle 5°: ±1.5 % Incidence angle 12°: ±1.0 %
- Incidence angle 30°, 45°: ±2.5 %
- 100 % level sample setting: The sample measurement optical path can be switched using the single-touch V-N method.
- Approximate sample size: 25 to 200 mm dia.. or 20 to 150 mm square, up to 30 mm thick
- Note: The BIS-3100 Sample Base Plate-Integrating Sphere Set (P/N 206-17059) is required for mounting these absolute specular reflectance attachments.

BIS-3100 Sample Base Plate Integrating Sphere Set (P/N 206-17059)

This is used to install an absolute specular reflectance attachment to the MPC-3100.

Large Polarizer Set,

Polarizer Type I, Type II, Type III, Polarizer Adaptor Set

Polarizers are needed to obtain highly precise absolute reflectance at large incident angles without effecting the polarization characteristics. The Polarizer Adaptor set (P/N 206-15693) is required for the Polarizer Type I, Type II and Type III.

	P/N	Effective Diameter	Wavelength Range
Large Polarizer Set	206-15694	20mm	250 to 2500nm
Polarizer Type I	206-13236-01	18mm	400 to 800nm
Polarizer Type II	206-13236-02	17mm	260 to 700nm
Polarizer Type III	206-13163	11mm	260 to 2500nm



Zoom lens set inside the MPC-3100







ASR-3112 attached on the BIS-3100



Specifications

Hardware

Wavelength range	185 to 3,300 nm		
Spectral bandwidth	8 steps in ultraviolet and visible regions: 0.1, 0.2, 0.5, 1, 2, 3, 5, 8 nm		
	10 steps in near-infrared region: 0.2, 0.5, 1, 2, 3, 5, 8, 12, 20, 32 nm		
Resolution	0.1 nm		
Wavelength sampling pitch	0.01 to 5 nm		
Wavelength accuracy	Ultraviolet and visible regions: ± 0.2 nm	Near-infrared region: ± 0.8 nm	
Wavelength repeat accuracy	Ultraviolet and visible regions: Within ± 0.08 nm	Near-infrared region: Within \pm 0.32 nm	
Wavelength scanning speed	During wavelength transfer Ultraviolet and visible regions: Approx. 18,000 nm/min	Near-infrared region: Approx. 70,000 nm/min	
	During wavelength scanning Ultraviolet and visible regions: Approx. 4,500 nm/min max. Near-infrared PbS region: Approx. 4,000 nm/min max.	Near-infrared PMT/InGaAs region: Approx. 9,000 nm/min max.	
	(Figures do not include time required for switching.)		
Light-source switching	The light source is switched automatically in accordance with the wavelength. The wavelength at which the light source is switched can be set freely in the range 282 to 393 nm (in 0.1 nm increments).		
Stray light	0.00008% max. (220 nm, Nal)		
	0.00005% max. (340 nm, NaNO2)		
	0.0005% max. (1,420 nm, H2O)		
	0.005% max. (2,365 nm, CHCl3)		
Photometric system	Double beam		
Photometric range	-6 to 6 Abs		
Photometric accuracy	± 0.003 Abs (1 Abs), ± 0.002 Abs (0.5 Abs), determined w	ith NIST930D standard filter	
Photometric repeat accuracy	0.0008 Abs (0 to 0.5 Abs), 0.0016 Abs (0.5 to 1 Abs), determined using 1-second accumulation, taking the maximum deviation over five measurements		
Noise	0.00005 Abs max. (500 nm), 0.00008 Abs max. (900 nm), 0.00003 Abs max. (1,500 nm), determined using RMS values for 1-second responses, 2 nm slit width		
Baseline flatness	± 0.004 Abs (185 to 200 nm), ± 0.001 Abs (200 to 3,000 nm), ± 0.005 Abs (3,000 to 3,300 nm)		
Baseline stability	Within 0.0002 Abs/h (2 hours after power ON, 500 nm, 1-second accumulation)		
Light sources	50W halogen lamp (2,000-hour service life), deuterium lamp (socket type, 2,000-hour service life), built-in mechanism for automatically adjusting the light-source position		
Monochromator	2 × 2 grating-type double monochromator Pre-monochromator: Concave diffraction-grating monochromator Main monochromator: Aberration-corrected Czerny-Turner monochromator The diffraction gratings are high-performance, blazed, holographic gratings.		
Detector	Ultraviolet and visible regions: R-928 photomultiplier tul Near-infrared region: InGaAs photodiode and cooled Pb	be or equivalent S photoconductive element	
Sample compartment	Internal dimensions: 150 (W) × 260 (D) × 140 (H) mm		
Size	1,020 (W) × 660 (D) × 275 (H) mm		
Weight	96 kg		
Operating temperature	15°C to 35°C		
Operating humidity	35% to 80% (with no condensation, 35% to 70% at 30°C or higher)		
Power supply	100/120/220/230/240 VAC, 50/60 Hz		
Power consumption	300 VA (Note)		

Note: A PC (and a power supply for the PC) is required separately.

Part numbers for UV-3600: 206-23000-31, -32, -38 ("-31" denotes the 100V model, "-32" denotes the 120V model, and "-38" denotes the 220, 230, and 240V models.)

Software

Data Acquisition Modes	Spectrum, Kinetics and Photometric	
General	Multitasking (Possible to execute data processing while measurement is being executed.)	
	 Customizable measurement screen layout (wavelengths, data display font and font size, colors, displayed number of rows) 	
	 GLP/GMP compliant (security, history), Real time concentration display 	
Spectrum Mode	Comparison of multiple spectra/relative processing (Note)	
	 Save all processed data with original data set including a history of all manipulations) 	
	 Spectrum enlargement/shrinking, auto scale and Undo/Redo of these operations 	
	• Annotation on spectrum screen.	
Data Processing in	Normalization, Point pick, Peak/Valley detection, Area calculation	
Spectrum Mode	• Transformation: 1st–4th derivatives, Smoothing, Reciprocal, Square root, Natural log, Logarithm power, Abs to %T conversion, Exponential conversion, Kubelka-Munk conversion	
	• Ensemble averaging, Interpolation, data set and constants arithmetic (between spectra, between spectra and constants)	
Photometric (Quantitation) Mode	 Single wavelength, Multi wavelength (includes 1, 2 or 3 wavelengths), Spectrum quantitation (peak, maximum minimum, area, etc. for specified wavelength ranges) 	
	 Multi-point, Single point, K-factor calibration curces (1st, 2nd, 3rd order function fits, pass-through-zero specification) 	
	• Photometric processing with user-defined functions (+, -, ×, /, Log, Exp, etc. functions, including factors)	
	Weight correction, Dilution factor correction and other corrections using factors	
	 Averaging of repeat measurement data 	
	 Simultaneous display of standard table, unknown table and calibration curves 	
	• Display of Pass/Fail indications	
Kinetics (Time Course) Mode	• Comparison/relative data processing of multiple time course data (Note)	
	 Single or double wavelength measurement (difference or ratio) 	
	• Unitary management of sample information includeing original data, sample weight and dilution factors, etc.	
	• Time course spectrum data processing (same as in data processing)	
Report Generator	Preview and print function for customized formats	
	Layout and editing of templates	
	Quick printing using report template	
	Multi-page printout support	
	 Insert data, time, text and drawing objects including lines, circles and rectangles 	
	 Insert spectrum and quantitation data, method and history 	
	Headers and footers easily inserted	
	 Specify graph line thickness (as in all modulules), font style and size 	

Note: A PC (and a power supply for the PC) is required separately.

Dimensions



Space for installing the PC and printer is also required.

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