Hitachi Spectrophotometer

U-3900/3900H

Hitachi High-Technologies

U-3900/3900H

HITACHI

Spectrophotometer Meeting a Wide Range of Analytical Needs from Liquid to Solid Sample Measurements

- Measurable over a broad absorbance range thanks to low stray light and low noise.
  (Model U-3900: -3.8 to 3.8 Abs, 0 to 300%T Model U-3900H: -5.5 to 5.5 Abs, 0 to 300%T)
- Stable monochromator in double beam optics
  (Baseline flatness Model U-3900 : within ±0.0003 Abs, Model U-3900H : within ±0.0004 Abs)
- Simple instrument control and diversified quantitative analysis supported by UV Solutions program for U-3900 (in connection with PC)
- A full range of accessories for covering both liquid and solid sample measurements

Single monochromator

U-3900

Stray light : 0.015% or less
Photometric range : -3.8 to 3.8 Abs

Two types available for selection according to sample and application purpose.
Usable over an extensive field including analyses of water quality, the environment, biotechnology, drug manufacture and materials.

Double monochromator

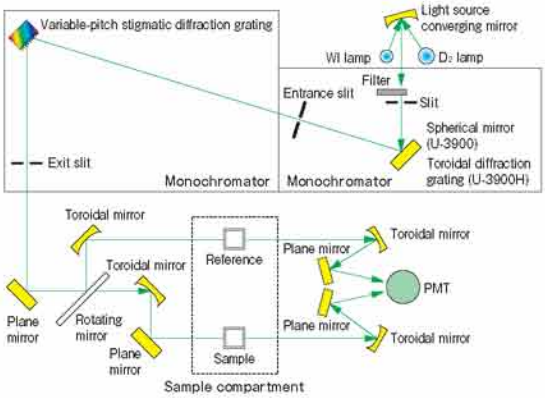
U-3900H

Stray light : 0.00025% or less
Photometric range : -5.5 to 5.5 Abs

Adoption of Stigmatic Concave Diffraction Grating

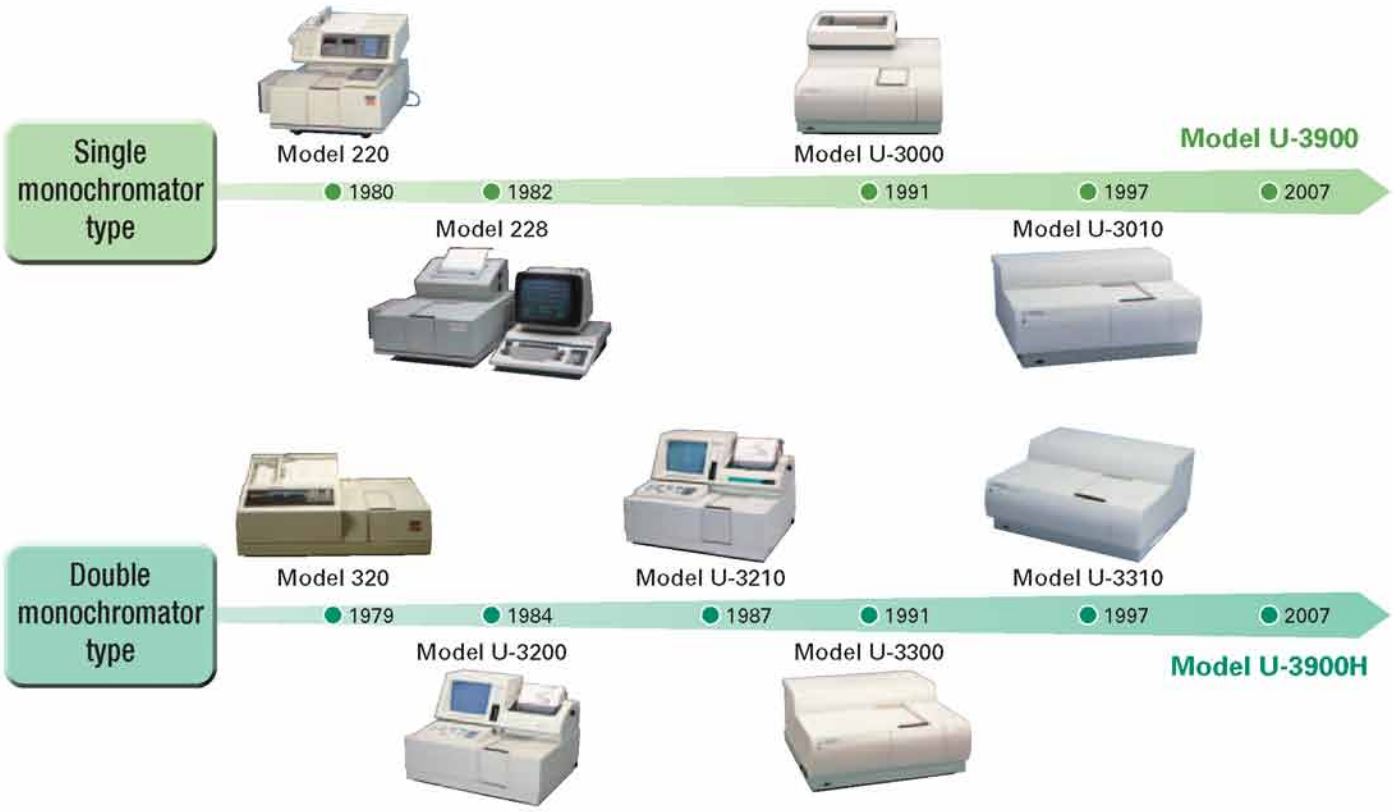
Hitachi Model U-3900/U-3900H spectrophotometer adopts a Seya-Namioka mount monochromator and a stigmatic concave diffraction grating.
Because a concave diffraction grating is usable for both converging and dispersing light, it allows composition of an optical system with a small number of mirrors.
In this design, loss of light and aberration are suppressed, so a bright optical system can be configured.

Stable Optics with Double Beam



As a light source, a WI lamp (visible region) and a D2 lamp (ultraviolet region) are provided for selective use according to measuring wavelength range.
Double beam optics is adopted for ensuring stable measurements, in which the monochromatic beam selected with a monochromator is split into reference beam and sample beam with a rotating mirror (sector mirror) and the beams are directed into the sample compartment. In one model, the U-3900, a spherical mirror is used before the entrance slit. In the other model, the U-3900H, a grating is used before the entrance slit.

Since the Model 320 was launched in 1979, Hitachi medium-size spectrophotometers have been employed by customers in 25 countries.



Hardware

Hardware structure with priority given to ease of operation.

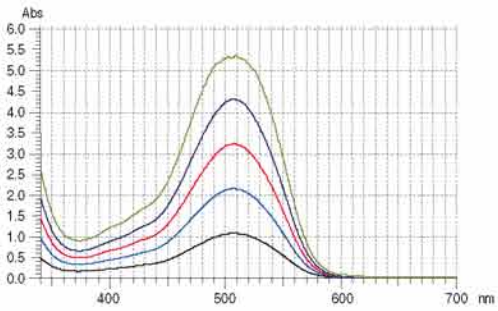
Hardware structure attaching greater importance to ease of operation

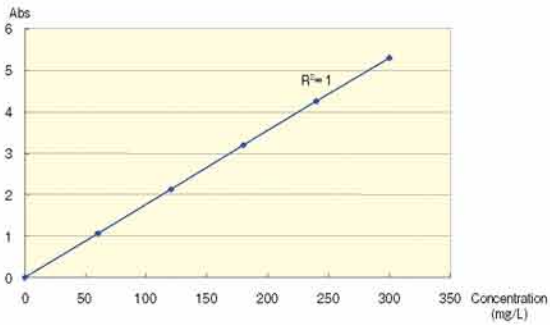
USB communication is adopted between the spectrophotometer and PC. And, because the top face of the spectrophotometer is flat, a notebook PC can be mounted on it. Therefore, the spectrophotometer and PC can be connected promptly.

Incorporation of double monochromator

Due to mounting of a double monochromator which uses Hitachi's original stigmatic concave diffraction grating, an excellent linearity is ensured up to high concentrations. Hence, highly reliable quantitative analysis is possible.

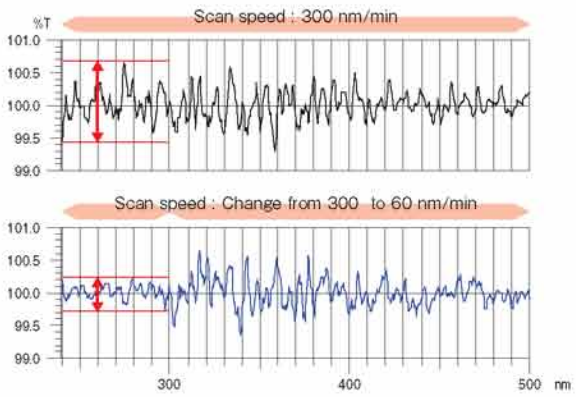
Model : U-3900H
Scan speed : 300 nm/min
Slit : 2 nm





Measurement with change in scan speed for ultraviolet region

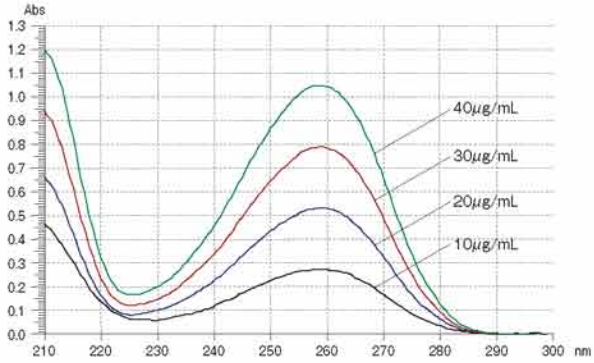
Scan speed is changeable for the ultraviolet region. In this wavelength region, noise can be reduced by slowing down the scan speed. Owing to this feature, a noise-suppressed spectrum is obtainable over the entire range from visible to ultraviolet region by a single scan.



Effective in trace sample measurement

Satisfactory measurement is achievable even with 5, 25 and 50 µL micro-sample cells because the beam is finely converged in the sample compartment.
Shown here are spectra determined in the ultraviolet region by measuring nucleic-acid adenosine with a micro-sample cell (internal volume 25 µL). A high S/N ratio was obtained.

Model : U-3900
Scan speed : 300 nm/min
Slit : 2 nm



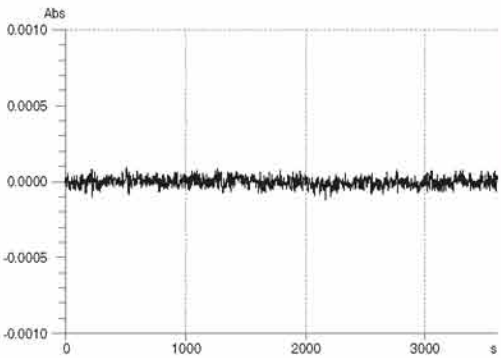
Ease of maintenance (in lamp replacement)

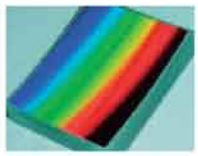
Lamp cable is connected by means of a socket, so each lamp can be removed or inserted without using a tool such as flat-head screwdriver.

Stable baseline

The Model U-3900 series assures a stable baseline in a wavelength range from 190 to 850 nm. (Baseline flatness Model U-3900 : within ±0.0003 Abs, Model U-3900H : ±0.0004 Abs)
Data can be measured stably even in a long-time measurement of enzyme activity, etc.

Model : U-3900
Slit : 2 nm
Wavelength : 500 nm

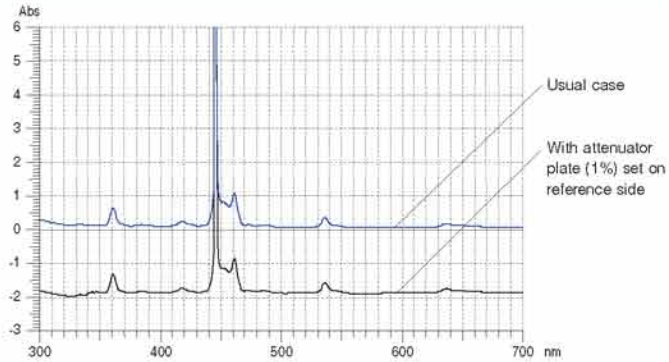




Original differential feedback system

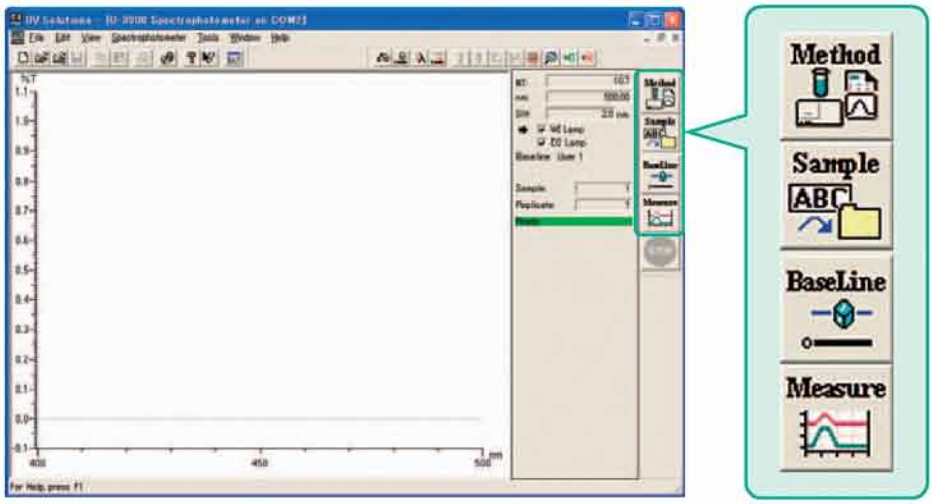
Sample signal, reference signal and zero point rise are always monitored and photomultiplier voltage is changed so that the sample or reference signal, whichever larger, becomes constant, whereby minus absorbance can be measured. Also, measurement in a broad dynamic range is allowed, e.g., difference spectrum measurement with different samples set on reference and sample sides.

Model : U-3900H
Scan speed : 300 nm/min
Slit : 2 nm



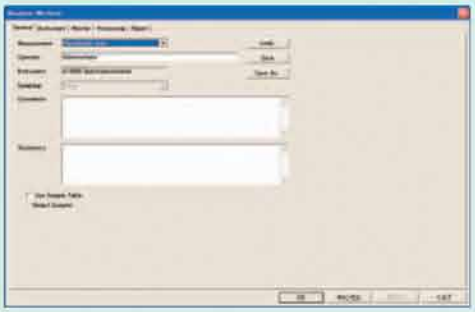
Software

"UV Solutions for U-3900" program has been prepared for efficient instrument control and various quantitations.
A series of operations from analysis method setup to data processing can be initiated by clicking each button.



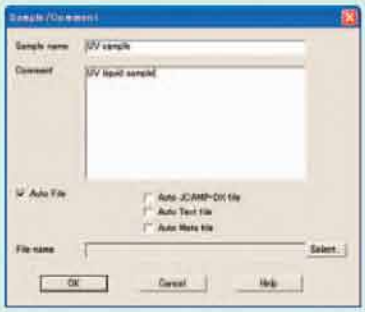
Analysis method setup window

Clicking this button enables the user to set analytical conditions such as measurement mode, measurement range and scan speed.



Sample information setting

Clicking this button allows setting of detailed information about a sample to be measured, data saving location, etc.



Baseline measurement

Baseline measurement procedure can be started by clicking this button.
Upon measurement, data after baseline correction is obtainable.

Measurement start

Measurement can be started by clicking this button.

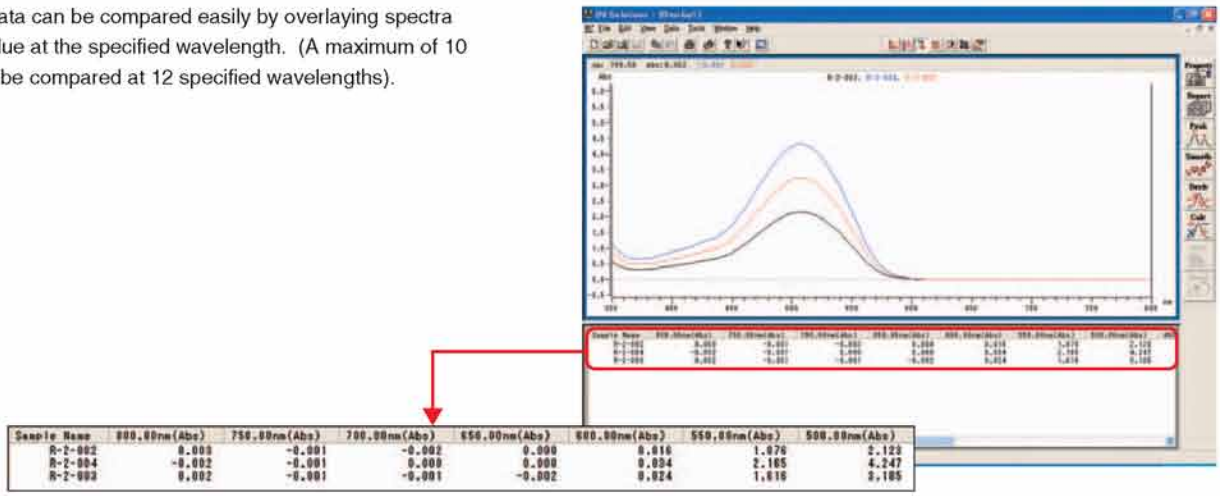
Reporting

Data file can be output in a report format by clicking this button.

Enriched functions such as data comparison and preview are supported by UV Solutions for U-3900.

Easy comparison of measured data

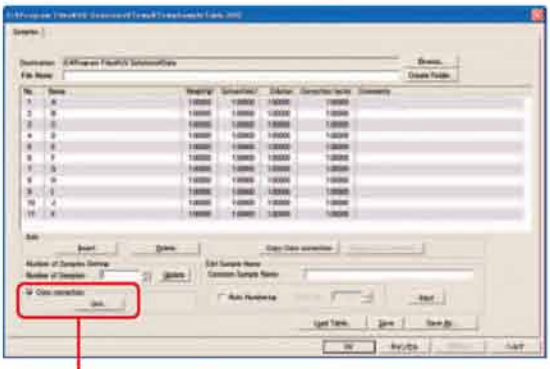
Measured data can be compared easily by overlaying spectra or in Abs value at the specified wavelength. (A maximum of 10 spectra can be compared at 12 specified wavelengths).

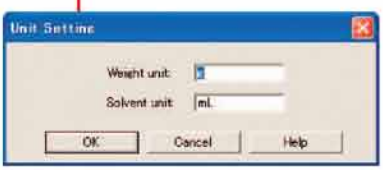


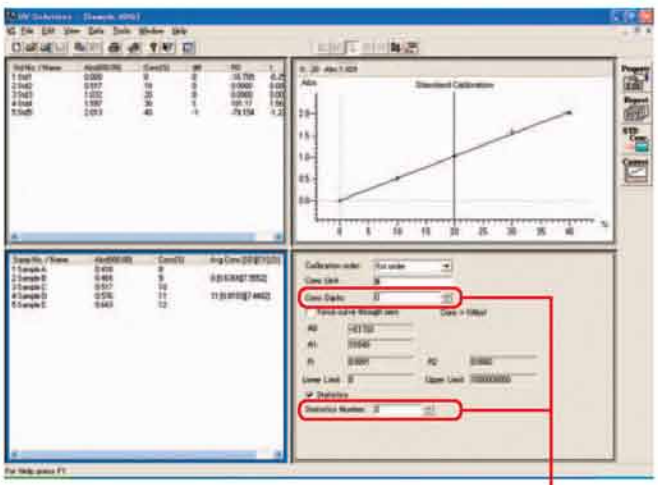
Sample Name	800.00nm(Abs)	750.00nm(Abs)	700.00nm(Abs)	650.00nm(Abs)	600.00nm(Abs)	550.00nm(Abs)	500.00nm(Abs)
R-2-002	0.000	-0.001	-0.002	0.000	0.816	1.676	2.123
R-2-004	-0.002	-0.001	0.000	0.000	0.034	2.165	4.247
R-2-003	0.002	-0.001	-0.001	-0.002	0.024	1.616	3.185

Factor of data processing (quantitation) changeable

"Correction factor," "decimal digits of concentration" and "concentration unit" are settable on the sample table window. Setting can be determined in consideration of a sample to be measured, its concentration, etc.



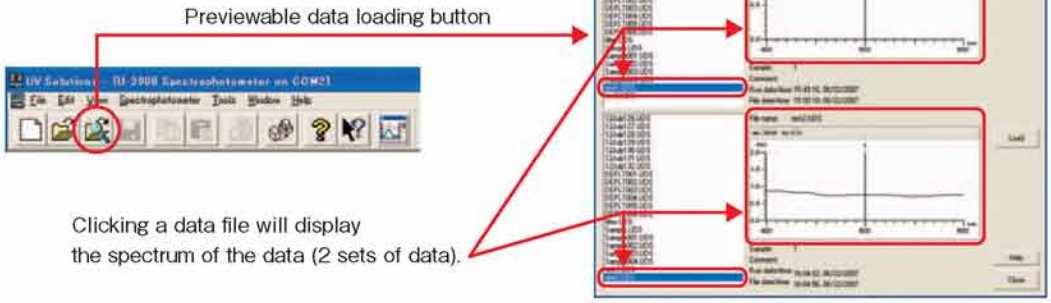




On the data processing window, factors such as "decimal digits of concentration" can be set.

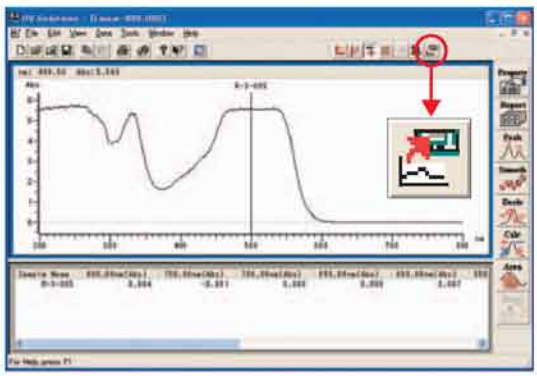
File loading function with preview

Using a tool button for file loading with preview, max. two sets of data can be previewed without opening data files.



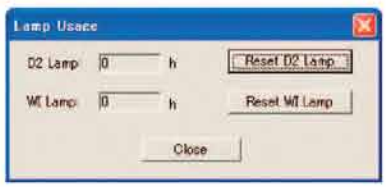
Reuse of analysis method for measured data

When it is desired to carry out measurement by the same analysis method as used for the already measured data, the "Apply analysis method" button is usable. The analysis method can be loaded and applied to a new measurement by clicking this button.



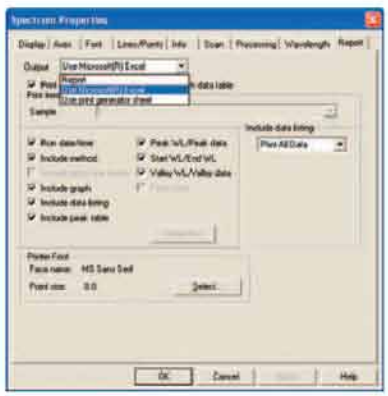
Control of lamp ON time

Total operation (ON) time of the WI and D_2 lamps used in the U-3900 series can be checked on the software. This time counting is usable as a reference for judging the replacement time point for each lamp.



Measured data exportable to commercially available software

Data such as measured spectrum can be pasted to Microsoft® Word and Microsoft® Excel, and converted into an ASCII text file. Using such software, a report form can be edited.



Accessories Expediting Application to Multi-Sample Measurement, Micro-volume Sample and Many Others

Micro cell holder
(P/N 122-0060)

Suitable for micro-sample measurement in medical and biochemical fields.

Specifications

Wavelength range	220 to 800 nm
Repeatability in cell placement	Within ±0.3%T
Baseline flatness	Within ±0.0025 Abs (when using 50 µL micro-sample cell)

Micro-sample cell

The following cells are usable for the above-mentioned micro-sample cell holder.

Part No.	Part name	Capacity	Optical path length
130-0622	50 µL cell	50 µL	10mm
130-0623	25 µL cell	25 µL	5mm
130-0621	5 µL cell	5 µL	0.5mm

Auto sipper
(P/N 2J1-0105)

This computer-controlled sample sipper is provided with a sample recovery function and other versatile functions. In combination with an autosampler, this unit makes it possible to carry out automated labor-saving analysis.

Specifications

Minimum sample volume	0.6 mL
Carryover	1% or less
Cell capacity	Approx. 50 µL
Optical path length	10 mm
Reference beam side	10 mm rectangular cell mountable

Electronic thermostatted auto sipper
(P/N 2J1-0106)

The flow cell section is maintained at a constant temperature level under accurate control.

Specifications (reference beam side not temperature-controlled)

Minimum sample volume	0.6 mL
Carryover	1% or less
Cell capacity	Approx. 50 µL
Optical path length	10 mm
Setting temperature	20 to 40°C
Setting accuracy	Within ±0.5°C
Reference beam side	10 mm rectangular cell mountable

AS-1010 autosampler
(P/N 2J1-0121/0122)

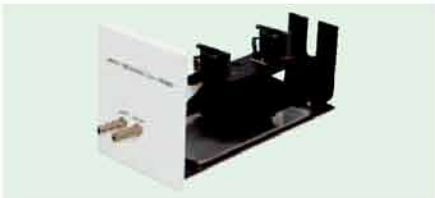
This unit is used for multiple-sample measurement in combination with an auto sipper or in flow injection analysis. A suction needle can be moved in three directions X, Y and Z.

Specifications (sample tube not included)

Sample tube size	Outside diameter 15 mm, height 105 mm (option required)
	Outside diameter 12 mm, height 105 mm

Water circulated cell holder
(P/N 210-2111)

Water from a thermostatic oven is circulated through this cell holder to maintain a sample cell at a constant temperature.
(Temperature control : R and S)



Specifications (circulatory thermostatic oven and cell not included)

Operating temperature range	Room temperature to 40°C
Temperature stability	Within ±0.3°C

Electronic thermostatted cell holder
(P/N 131-0306/0307)

This cell holder comes standard with an incorporated magnet stirrer. The temperature of sample in a cell is maintained at a constant level, and a temperature value down to 0.1°C can be indicated. Since this unit is of electronic thermostatted type with forced air cooling, quick heating and cooling can be performed without a water circulating thermostatic oven.
(Temperature control : S only)

Specifications

Temperature range	10°C to 60°C (settable in increments of 0.1°C, under condition of 25°C room temperature)
Temperature control accuracy	Within ±2°C (*) (difference between set temperature and actual sample temperature)
Temperature stability	Within ±0.5°C (*)
Applicable cell	10 mm cell (cell not supplied)

* : Room temperature : 25°C, sample : distilled water

Electronic thermostatted cell holder
(P/N 131-0301/0302)

In protein and nucleic acid melting measurement, sample temperature can be changed continuously to determine variation in absorbance. Being of an electronic thermostatted type, this cell holder is capable of quick heating and cooling. Sample temperature can be increased and decreased isothermally. Because this holder is equipped with a stirrer, the internal cell temperature can be kept uniform. (Temperature control : R and S)

Specifications (circulatory thermostatic oven not included)

Applicable cell	10 mm cell (not included in this unit)
Temperature range	0°C to 100°C (settable in increments of 0.1°C)
Temperature control accuracy	Within ±2°C (*) (difference between set temperature and actual sample temperature)
Temperature stability	Within ±0.5°C (*)
Provided with an isothermal regulating function	

* : Room temperature : 25°C, sample : distilled water, circulatory water temperature : 22°C
Setting temperature : 10°C to 60°C
A circulatory thermostatic oven needs to be prepared separately.

Micro flow cell unit
(P/N 210-2113)

Suitable for continuous measurement of a micro-quantity of sample.

Specifications

Cell capacity	70 µL
Optical path length	10 mm (quartz flow cell used)
Connection tubing	Teflon tube of outside diameter 2 mm and inside diameter 1 mm

Flow cell unit
(P/N 210-2173)

The inside of this cell is structured to minimize stagnation of liquid and adhesion of air bubbles.

Specifications

Cell capacity	600 µL
Optical path length	5 mm (quartz flow cell used)
Connection tubing	Teflon tube of outside diameter 4 mm and inside diameter 3 mm
Reference beam side	5 mm rectangular cell (standard accessory)

LC flow cell unit
(P/N 210-2131)

A flow cell especially designed for liquid chromatography.

Specifications

Cell capacity	8 µL
Optical path length	8 mm (quartz flow cell used)
Baseline flatness	±0.001 Abs (200 to 350 nm) ±0.002 Abs (190 to 850 nm)

6-cell positioner with temperature control
(P/N 2J1-0103/0104)

Six 10 mm cells can be mounted on the sample beam side, and they can be changed over automatically at certain intervals. (Temperature control : S only)

Specifications

Repeatability in cell changeover	Within ±0.5% (at 100%T)
Applicable cell	10 mm cell (not included in this unit)
Setting temperature	20 to 40°C

Tandem cell holder
(P/N 210-2115)

A maximum of three 10 mm cells can be mounted on each of the sample and reference beam sides. Sample temperature can be maintained at a constant level by circulating temperature-regulated water through the cell holder section. (Temperature control : R and S)

Specifications (not including circulatory thermostatic oven and cell)

Temperature range	15 to 40°C
Temperature stability	±0.3°C

4-position rectangular long-path cell holder
(P/N 150-0940)

Four rectangular long-path absorption cells can be mounted on the sample beam side, and they can be changed over externally.

Specifications

Cell length	100 mm, 50 mm to 10 mm cells applicable

5-position turret cell holder
(P/N 210-2110)

Five 10 mm rectangular cells can be mounted on the sample beam side, and a micro-cell mask (200-1537, 200-1538) can be inserted in each cell holder. (Cells and micro-cell mask are not included.) It is recommended to prepare a set of five cells.

Part No.	Part name
124-0352	10 mm quartz cell set (five cells in set)
124-0378	10 mm glass cell set (five cells in set)

Rectangular long-path cell holder
(P/N 210-2107)

Rectangular cells having the following optical path lengths are applicable: 10, 20, 30, 40, 50 and 100 mm. The outer width is 12.75 mm.

Rectangular cell

(Note) Absorption cells are not included in the main unit.

Part No.	Part name
123-1004	10 mm quartz cell set (2 cells in set)
123-1010	10 mm glass cell set (2 cells in set)
124-0349	30 mm quartz cell set (2 cells in set)
124-0350	50 mm quartz cell set (2 cells in set)
210-3939	100 mm quartz cell set (2 cells in set)

Examined 10 mm rectangular quartz cell

Optical path lengths measured at 21 points on cell using a three dimensional measuring instrument are indicated down to the fourth decimal place (mm).

Part No.	Part name
210-1462	Examined 10 mm quartz cell (1 cell)

Mask for micro cell

For use of this mask, it is inserted in a 10 mm rectangular cell holder which is standard with the main unit.

Part No.	Remarks
200-1537	Mask width 1.5 mm
200-1538	Mask width 1.2 mm

Cell

Part No.	Part name
124-0357	Micro 10 mm quartz cell (2 cells in set)
200-0551	Black micro 10 mm quartz cell (2 cells in set)

Cylindrical long path cell holder
(P/N 210-2108)

Applicable cylindrical cells are listed below.

Applicable cylindrical cells

123-1023	10 mm quartz cylindrical cell for liquid sample (2 cells in set)
123-1024	10 mm glass cylindrical cell for liquid sample (2 cells in set)
123-1027	20 mm quartz cylindrical cell for liquid sample (2 cells in set)
123-1028	20 mm glass cylindrical cell for liquid sample (2 cells in set)
123-1031	50 mm quartz cylindrical cell for liquid sample (2 cells in set)
123-1032	50 mm glass cylindrical cell for liquid sample (2 cells in set)
123-1035	100 mm quartz cylindrical cell for liquid sample (2 cells in set)
123-1036	100 mm glass cylindrical cell for liquid sample (2 cells in set)
123-1043	10 mm quartz cylindrical cell for gas sample (2 cells in set)
123-1044	10 mm glass cylindrical cell for gas sample (2 cells in set)
123-1047	20 mm quartz cylindrical cell for gas sample (2 cells in set)
123-1048	20 mm glass cylindrical cell for gas sample (2 cells in set)
123-1051	50 mm quartz cylindrical cell for gas sample (2 cells in set)
123-1052	50 mm glass cylindrical cell for gas sample (2 cells in set)
123-1055	100 mm quartz cylindrical cell for gas sample (2 cells in set)
123-1056	100 mm glass cylindrical cell for gas sample (2 cells in set)

Glass filter holder
(P/N 210-2109)

Used for transmittance/absorbance measurement of a solid sheet sample such as glass filter.

Specifications

Sample thickness	0.5 to 5 mm
Sample size	Minimum : 12 x 25 mm Maximum : 55 x 100 mm

Film holder
(P/N 210-2112)

Convenient for measurement of film-shaped samples.

Specifications

Film frame	Width 25 mm, height 30 to 55 mm
Beam aperture	Width 10 mm, height 20 mm

φ150 integrating sphere accessory
(P/N 2J2-0175)

Designed for diffuse reflectance measurement of a solid sample surface and absorbance measurement of a turbid sample. With an aperture ratio as small as 2%, this unit is usable for high-accuracy colorimetric measurement.

Specifications

Wavelength range	350 to 750 nm
100%T line flatness	±0.5%T
Aperture ratio	2%
Light trap	Mountable

φ60 integrating sphere accessory
(P/N 2J2-0176)

Designed for absorbance measurement of a turbid sample and reflection measurement of a solid sample surface.

Specifications

Wavelength range	250 to 800 nm
100%T line flatness	±1%T
Aperture ratio	7.8%
Specular reflection measurement attachment	Standard-equipped

5° specular reflectance accessory
(P/N 2J2-0177)

Using mirror reflection of a sample, relative reflectance is measured with respect to the standard reflection plate (aluminum-evaporated plane mirror). Applicable to film thickness measurement and spectral reflectance measurement.

Specifications

Angle of incidence	5°
Sample area	25 mm in diameter or more

Polarizer holder
(P/N 210-2130)

Sample beam is linearly polarized for measurement of polarization characteristics or a sample is placed between the polarizer and analyzer for measurement of optical rotary power.

Specifications

Wavelength range	400 to 750 nm
Sample area	Minimum 12 mm x 25 mm Maximum 55 mm x 100 mm
Sample thickness	0.5 to 5 mm

Optional program

Part No.	Part name
2J2-0317	GLP/GMP program

U-3900/3900H

Specifications

Model	U-3900	U-3900H
Monochromator	Diffraction grating Single monochromator Seya-Namioka mount	Diffraction grating-diffraction grating Double monochromator Seya-Namioka mount
Wavelength range	190 to 900 nm(*1)	
Spectral bandpass	0.1, 0.5, 1, 2, 4, 5 nm (6 steps)	
Stray light	0.015% (NaI : 220 nm, $NaNO_2$: 340 nm)	0.00025%
Wavelength accuracy	±0.1 nm (at 656.1 nm after wavelength calibration)	
Wavelength setting repeatability	±0.05 nm	
Photometric mode	Abs, %T, %R, E(S), E(R)	
Photometric range	Abs : -3.8 to 3.8 Abs (effective range) %T : 0 to 300%T	Abs : -5.5 to 5.5 Abs(*2) (effective range) %T : 0 to 300%T
Photometric accuracy (checked with NIST SRM930)	±0.002 Abs (0 to 0.5 Abs) ±0.003 Abs (0.5 to 1.0 Abs) ±0.006 Abs (1.0 to 2.0 Abs) ±0.3%T	
Photometric repeatability (checked with NIST SRM930)	±0.001 Abs (0 to 0.5 Abs) ±0.0015 Abs (0.5 to 1.0 Abs) ±0.003 Abs (1.0 to 2.0 Abs) ±0.1%T	
Response	High resolution, Standard	
Baseline flatness	Within ±0.0003 Abs (190 to 850 nm)	Within ±0.0004 Abs (190 to 850 nm)
Baseline stability	Within 0.0002 Abs/hr (at 500 nm, 2 hours after power-on)	
Baseline memory	3 channels (system : 1 channel, user : 2 channels)	
Wavelength scan speed	1.5, 3, 15, 30, 60, 120, 300, 600, 1200, 1800, 2400 nm/min	
Light source	Adjustment-free deuterium lamp (D_2 lamp): Ultraviolet region Adjustment-free tungsten iodine lamp (50 W)(WI lamp) : Visible region	
Light source changeover	Automatic changeover linked with wavelength Changeover wavelength : Selectable in a range of 325 to 370 nm)	
Sample compartment	Beam spacing: 100 mm 120 (W) × 300 (D) × 140 (H) mm	
Detector	Photomultiplier	
Data processing unit	PC: OS Windows® XP Professional SP2	
Dimensions (spectrophotometer main unit)	680 (W) × 692 (D) × 257 (H) mm	
Operating temperature/humidity	Temperature : 15 to 35℃, Humidity: 25 to 85% (non-condensing)	
Weight	45 kg (spectrophotometer main unit)	
Power consumption	100 V AC 50/60 Hz, 300 VA (excluding personal computer and printer)	

UV Solutions program	Standard software

*1: Baseline flatness in a range of 190 to 850 nm
Within ±0.0003 Abs (U-3900)
Within ±0.0004 Abs (U-3900H)
*2: With 1%T light attenuating plate

Software Functions (common to U-3900/U-3900H)

	Wavelength/Time Scan, Measurement and Data Processing	Photometry
Spectrophotometer control	● Wavelength shift (Go to λ) ● 100%T adjustment (auto zero) ● Automatic wavelength calibration ● Detector zero adjustment	
Measuring conditions	● Measuring condition setting ● Condition loading ● Condition saving (desired number of files, file overwriting/deletion possible) ● Automatic start function (measuring conditions automatically set upon startup of software)	
	—	● Condition setting for working curve (1st to 3rd order, segmented line) ● Standard data setting (20 standards, average of 20 data values) ● K factor input
Execution of measurement	● Measurement of spectrum/change with time Repetitive spectrum measurement ● Setting of sampling interval ● Measurement with scan speed changed in ultraviolet region	● Remeasurement of working curve ● Interrupt measurement
	● Baseline measurement (3 channels) (system baseline : 1 channel, user baseline: 2 channels)	
Recording/ Display	● Sample name ● Comment input ● Ruled line printout ON/OFF ● Measuring condition printout ON/OFF	
	● Printout and display of spectrum/ change with time ● Spectrum loading (with preview) ● Spectrum saving ● Spectrum printout/display	● Working curve printout/display ● Data deletion ● Data loading ● Data saving ● Data list printout/display
Data processing	● Rescaling (numerical value input, cursor input) ● Spectrum trace ● Smoothing ● Peak detection ● Data printout (printout of wavelength/time at fixed intervals) ● Graph axis conversion ● Spectral calculation (arithmetic calculation/coefficient calculation) ● Differentiation (1st to 4th order) ● Data reset ● Rate calculation (only in time scan mode) ● Spectrum selection ● Spectrum display window	● Working curve trace ● Working curve erasure ● Data printout ● Sample data erasure ● Statistic calculation ● Calculation of determination coefficient ● Setting of correction coefficient ● Setting of number of decimal places for concentration ● Setting of concentration unit
Miscellaneous	● File conversion (ASCII/JCAMP) ● Setting of number of decimal places for display ● Cell length conversion ● Data transfer/graph copy to Microsoft® Excel ● Print preview ● Display of lamp ON time	

Standard Equipment	Q'ty
Spectrophotometer main unit	1 set
Tools	1 set
Instruction manual	1 set

NOTES: 1. Absorption cells are not included in the standard equipment, and thus should be prepared separately.
2. A PC set is not supplied as standard equipment. It should be prepared separately.

Notice: For proper operation, follow the instruction manual when using the instrument.

Specifications in this catalog are subject to change with or without notice, as Hitachi High-Technologies Corporation continues to develop the latest technologies and products for our customers.

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