Hitachi Ratio Beam Spectrophotometer

U-5100

ECO-FRIENDLY & CLEAN

For a Beautiful Earth

The concept underlying Hitachi's U-5100 UV-Visible Spectrophotometer is ECO-FRIENDLY & CLEAN.
The U-5100 delivers a compact, lightweight package with remarkable power savings and a long life light source.
The U-5100 incorporates every aspect of the technological features of Hitachi's reliability-proven spectrophotometers while achieving our ultimate goal —

the creation of a new spectrophotometer that is both ECO-FRIENDLY & CLEAN and provides SUPERIOR PERFORMANCE.

* This display is simulated screen.

Hitachi High-Tech
HITACHI

ECOLOGY

Long life light source:
Xenon flash lamp Energy saving design ▶ P3

DESIGN

User-friendly interface
A compact, lightweight design ▶ P3

PERFORMANCE

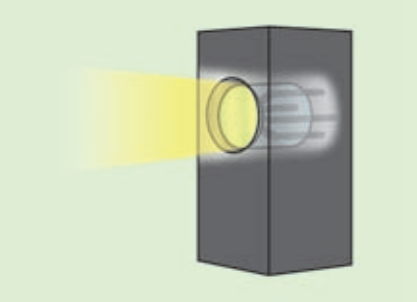
Ratio-beam optical system
Automated 6-cell turret ▶ P4

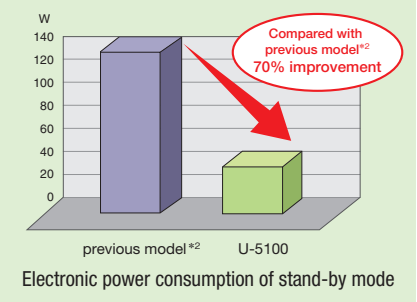
EASY OPERATION

Automated 6-cell turret equipped as standard ▶ P5
Easy-to-use guidance display
Multi-language display and an export program ▶ P6
PC-based instrument control and data processing ▶ P7

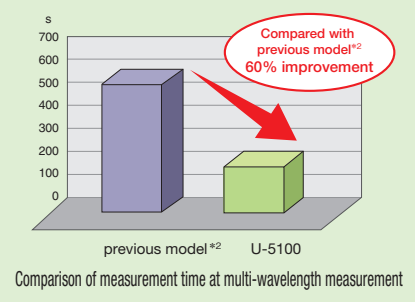
ECOLOGY

Environmental friendly Xe Flash Lamp is a low-power consumption, long-life light source.





Electronic power consumption of stand-by mode



Comparison of measurement time at multi-wavelength measurement

Adoption of a Xenon flash lamp

The adoption of a Xenon flash lamp, a long life lamp*1, eliminates the need for periodic lamp replacement that was necessary in previous models.

Energy-saving design

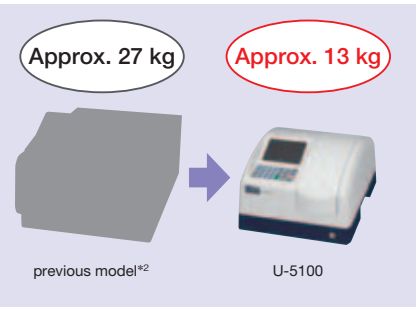
Through control of the Xenon flash lamp that emits pulses only during measurement, power consumption is reduced by 70% compared with previous model.

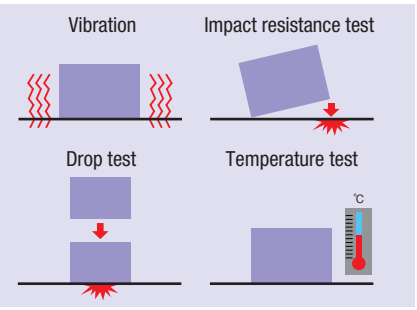
Reduced measurement time

The automatic switching of 6 cells by using an automatic 6-cell turret and a high-speed driving (12,000 nm/min) deliver a substantial reduction in measurement time (approximately 60% reduction). The examples shown in the figure compare*3 the amount of time required to measure 100 samples (5 wavelengths x 20 samples) with a previous model*2, based on biological analysis and quality control on food products.

DESIGN

User-friendly, compact, lightweight design





Pursuit of ease of use

A large, clearly displayed 6-inch LCD is mounted in a simple, arch-shaped form. Cells can be loaded easily from the front of the instrument.
The operation panel has a soft keypad that is easy to press, making continuous key operations easy. Letter keys used for character input, such as assigning a file name, are designed to be as easy to use as those on cell phones.

Compact, lightweight design

The U-5100 features a 38% smaller footprint, and the 52% less in weight compared with the previous model*2, which makes it easier to secure an adequate installation space.

Implementation of strict quality checks

Hitachi' s spectrophotometers undergo rigorous quality checks, and the compact, lightweight U-5100 is no exception*4. The U-5100 Maintains the tradition of reliability, for which Hitachi spectrophotometers are well-known.

*1 It is assumed ten years under the measurement condition of 1 wavelength, 300 measurements/days, 240 days/year. (Warranty period is one year after installation)
*2 Hitachi Ratio-Beam Spectrophotometer U-1900 *3 Measurement time does not include the amount of time required to load a cell on a holder or a turret.

PERFORMANCE

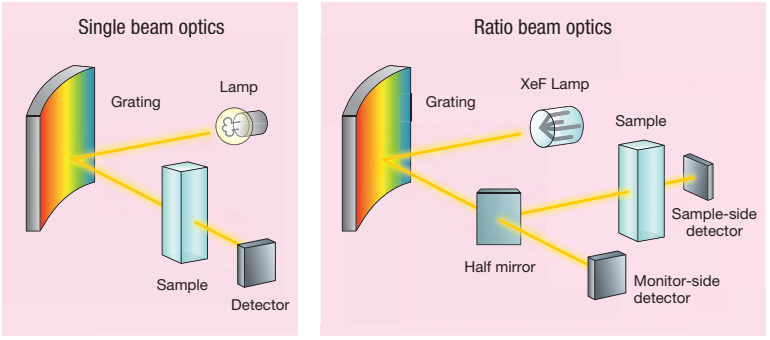
Compact yet high-performance system with the best baseline stability in its class

The ratio-beam optical system

The ratio-beam optical system incorporated in the U-5100 has a solid track record. This optical system diverts a part of the beam with a half mirror for use by another detector separate from the one used for sample measurements and compensates for changes in energy in the light source. This feature realizes an excellent baseline stability, the highest of its kind in this class of instruments*5 .
In particular, compared with single-beam optical system equipment, the U-5100 provides superior baseline stability during long hours of measurement.

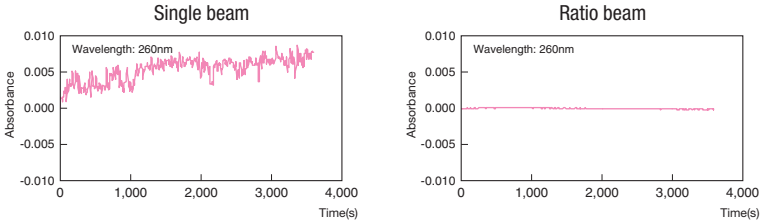
Furthermore, by minimizing the number of mirrors used within, a bright optical system has been created.
In addition, reducing the number of mirrors that deteriorate quickly slows the reduction of beam intensity caused by mirror deterioration.

Comparison of optics



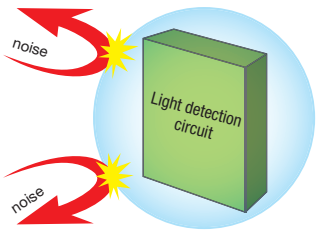
∗ These diagrams represent design concepts, not actual optical system structures.

Baseline comparison

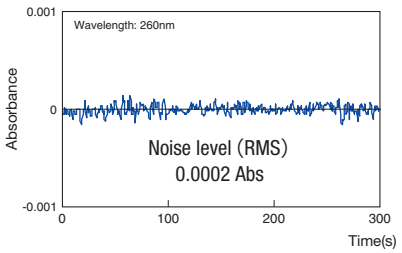


The lowest noise realized by the newly developed light detection circuits: Top of its class *5.

Incorporating newly developed light detection circuits, the U-5100 offers low-noise performance, the best of its kind in this class of instruments*5.
When measuring low-concentration samples with a low absorbance, the system demonstrates high stability.

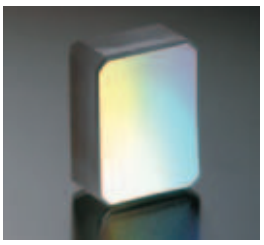


The new light detection circuit reduces noise significantly



Equipped with an aberration-corrected concave diffraction grating

The U-5100 is equipped with an aberration-corrected concave diffraction grating developed by utilizing Hitachi' s unique technology. The U-5100 achieves a high degree of resolution through the removal of astigmatic aberration inherent in the Seya-Namioka monochrometer, the most prevalent type of concave diffraction grating.



Concave Diffraction Grating

Performance validation function

This feature allows you to verify the performance of the system easily. Based upon six performance validation parameters, such as “wavelength accuracy,” the system provides automatic validation and prints results.
When used in an ISO-certified laboratory, it is important to be able to perform system validations automatically. This makes the U-5100 suitable for use under stringent regulatory requirements.

∗4 Hitachi does not guarantee no damage or malfunction when the product is exposed to any of these conditions. Any shock or extreme environmental condition may cause the product to stop functioning properly.
∗5 Investigation conducted by Hitachi High Technologies Corporation on systems sold in Japan as of January 2010

EASY OPERATION

Stand-alone

Performing at a Higher Level

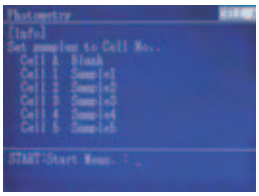
The standard automatic 6-cell turret makes performing measurements a breeze.

As part of its standard configuration, the system is equipped with a 6-cell turret which accommodates up to six 10-mm rectangular cells. The system can measure a maximum of six calibration solutions and sample solutions *6, reducing the measurement time and improving the efficiency of your lab.

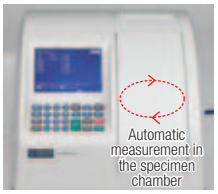
6-cell turret

Cell-position guidance display

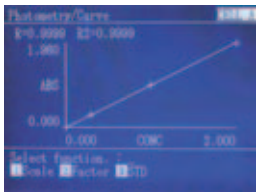
When using the 6-cell turret for automatic sample measurements, the screen displays sample positions and type of sample to be placed for measurement.
For example, when performing a quantitative measurement, the operator can set a calibration or sample solution while checking the "guide on the sample position".
Even those users who are new to a spectrophotometer can easily set a cell.



Guidance on a sample loading position

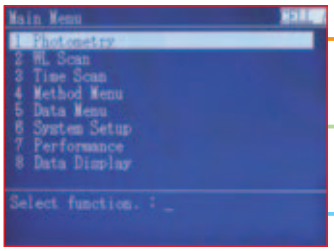


Automatic measurement using a 6-cell turret



Measurement result (calibration curve)

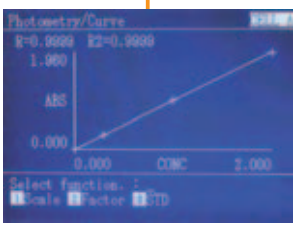
The measurement menu provides the following items, with user-selectable modes:



Photometry
Time Scan
Wavelength Scan
Data Display

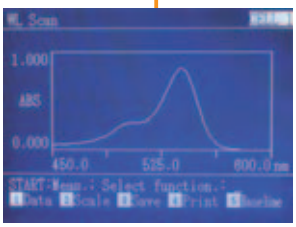
Method Menu (up to 50 parameters can be saved)
Data Menu (up to 30 data items can be saved)

System Setup
Performance Check



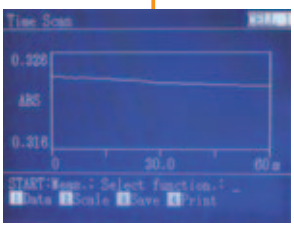
Photometry

By measuring a standard solution and creating a calibration curve, users can perform quantitative analyses on unknown samples. Alternatively, quantitative analysis can be accomplished through the input of coefficients.In addition, the system supports multi-wavelength measurement up to six wavelengths to measure absorbance or transmittance, as well as ratio calculations (calculates the purity of DNA by computing the ratio between two wavelengths (A_{260}/A_{280} and A_{260}/A_{230})).



Wavelength Scan

Over the 190 to 1100 nm range, the system can measure absorption spectra and transmission spectra.
After the measurements, the user can verify the spectral data in great detail by using the peak detection function, the tracing function, the expansion of the abscissa, the ordinate, and the reduced display.



Time Scan

Photometric value (absorbance/transmittance) at a fixed wavelength can be measured in a desired measurement time from 60 to 99900 seconds.
This feature can be used to measure the decomposition of the sample from a change in absorbance or the analysis of enzyme reactions.

Data Display

This is a useful mode for the measurement of either absorbance or transmittance at a single wavelength while reading the results. Wavelength and photometric values can be displayed in large characters.

*6 Including samples for setting an auto zero (the operation of adjusting the absorbance to zero)

Stand-alone

Standard performance validation and automatic calibration functions assure data reliability.

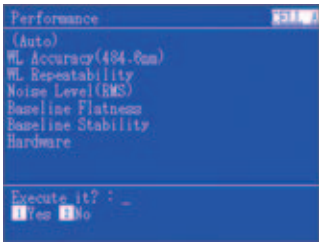
Automatic self-test at each power on.
In addition, the performance validation display allows you to check the results of the automatic validation function, and to check each of six performance validation parameters, assuring a highly reliable system.

Performance validation

This feature allows you to verify the performance of the system in terms of the following six performance validation parameters:

- Wavelength accuracy
- Baseline flatness
- Wavelength setting repeatability
- Baseline stability
- Noise level
- Hardware (RAM, ROM, lamp, and wavelength scan system)

Screen at power on time



Performance Validation Screen

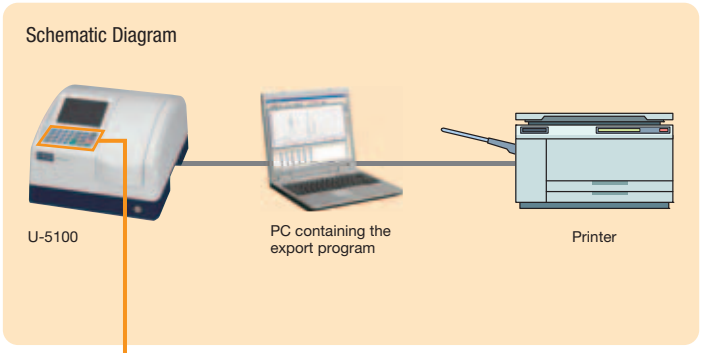
Standard configuration includes multi-language support

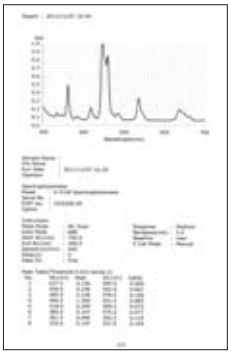
The display language on the model U-5100 can be selected from Japanese, English, Chinese (Simplified), and German.
Multi-language support is available for your convenience.

Language Switching Screen

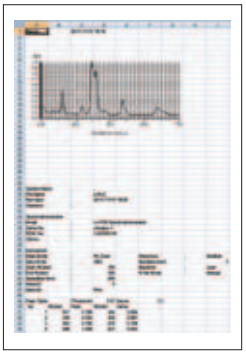
Exporting program

By connecting the model U-5100*7 to a PC containing the export program (P/N 3J2-0290), through the USB interface*8 cable (P/N 3J2-0330), measured data can be output to a printer on the PC or saved in PC files in Microsoft® Excel® format. Once the desired output parameters are specified, output proceeds by simply pressing the PRINT key on the operation panel of the instrument.

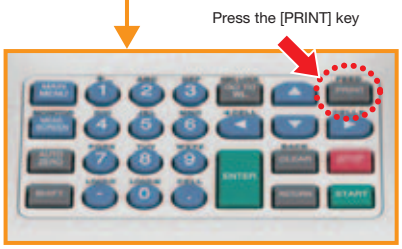




A printout through the PC



An output file in Excel® format



Operation panel on the model U-5100

PC Specifications

Running OS	Windows® 7 Professional, (32 bits)
CPU	CPU that supports OS
Memory	1 GB or more, 2 GB is recommended
Hard disk	Free space of 5 GB or more
Display	Resolution of 1,024 × 768 pixels or higher
CD-ROM drive	A drive with a speed of 24x or more is recommended
Interface	USB 1.1/2.0
Others	Microsoft® Office 2007

*7 The firmware (P/N 3J2-5300-05) or later updates are required for the export program. Please contact us for a firmware update for models released earlier than September 2010.
*8 Notice that a single PC can support only a single spectrophotometer, not multiple spectrophotometers.

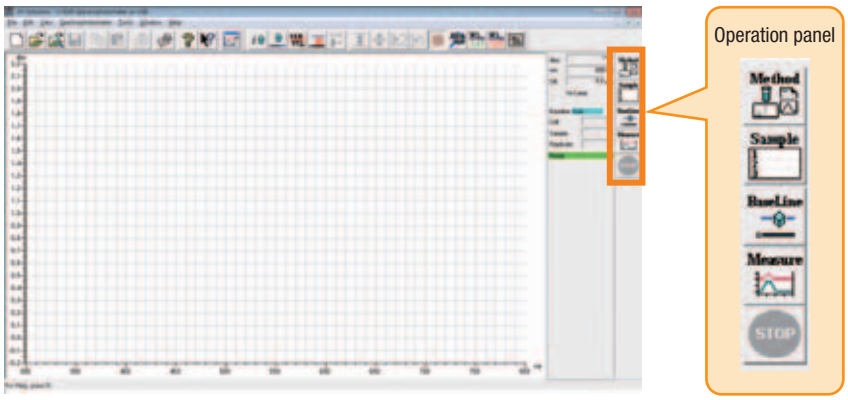
PC control

PC-based instrument control and data processing

The U-5100 spectrophotometer can be controlled from a PC using the applications program UV Solutions from Hitachi. The U-5100 is connected to the PC through an USB interface*9.
In addition to the standalone functions, such as photometry, wavelength scan, and time scan, a variety of data processing and copy / paste / export functions to Microsoft® Word® and Microsoft® Excel® are available, supporting your preparation of presentation materials and reports.

Simple operation flow

The measurement operation buttons are arranged on the right side, and a measurement run can be completed in four steps.



Initial Screen of the UV Solutions Program

Setting of Analysis Parameters

Select a measurement mode, and specify the analysis parameters

Sample Measurement

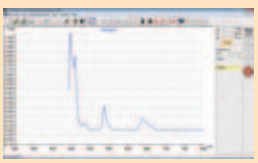
Enter sample name, comment, file name, and destination

Baseline Measurement, Auto-zero Measurement

Run the baseline correction function, or the auto-zero function

Screen during an auto-zero run

Measurement Start



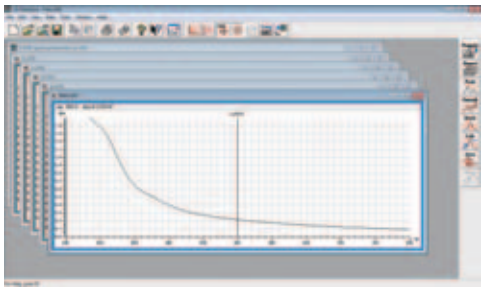
Sample Measurement Screen (Spectrum)

Automatic wavelength scan measurements using the automated 6-cell turret

In addition to the standalone function for automatic measurement, the UV Solutions program allows automatic measurements of up to 6 sample solutions*10, including baseline correction samples, helping to improve work efficiency by reducing the amount of time required for measuring absorption/transmission spectra

Specify measurement parameters, and then load a sample to each cell

Measure Press the button to run the method



Measurement results

*9 The firmware (P/N 3J2-5300-03) or later updates are required for the UV Solutions program. Please contact us for a firmware update for models released earlier than August 2010.
*10 Including samples to be used for the auto-zero function (correction needed to adjust the zero level of absorbance).

ACCESSORIES

Auto sipper (P/N 3J2-0105)

The automatic sipper takes a sample from a test tube and can automatically measure it.

Minimum sample volume	0.6 mL
Carryover	1% maximum
Cell size	Approx. 50 µL

Single cell holder (P/N 3J2-0110)

Use this holder to measure with a square cells with a 10-mm optical path.
Accommodates one cell.

Rectangular long path cell holder (P/N 3J2-0111)

Use this holder to measure with a square cell with 10, 20, 30, 40, 50, or 100-mm optical paths. Accommodates one cell. The use of cells with long optical paths allows the measurements of low-concentration samples at a high degree of sensitivity.

Micro cell

Micro cells are available for small-sample-volume analysis.
Requires a single cell holder (P/N 3J2-0110) and a mask for micro cell (P/N 200-1537).

Description	P/N	Capacity	Optical path length
Micro quartz cell , 10 mm	124-0357	340 to 600 µL	10 mm
Black quartz micro cell, 10 mm	200-0551		

Ultra-micro volume sample measurement

Ultra-micro volume cells are available for trace analysis. Requires a single cell holder (P/N 3J2-0110) and a Mask for trace sample cell (P/N 3J2-0132).

Description	P/N	Capacity	Optical path length
1.5 µL trace sample cell	3J2-0120	1.5 to 4.0 µL	1 mm
12 µL trace sample cell	3J2-0121	12 to 40 µL	5 mm
50 µL trace sample cell	3J2-0122	50 to 90 µL	10 mm

Add-on application programs available for the UV Solutions program

Nucleic Acid Measurement program (P/N 3J2-0316)

Helps to verify the extraction and purification of DNA, RNA, and other nucleic acids, which are indispensable for genetic research.
Photometric data (at 230, 260, and 280 nm) and calculated results (A_{260}/A_{280} ratio, nucleic acid concentration, protein concentration, and molar concentration) can be displayed collectively, improving the efficiency of purification work.

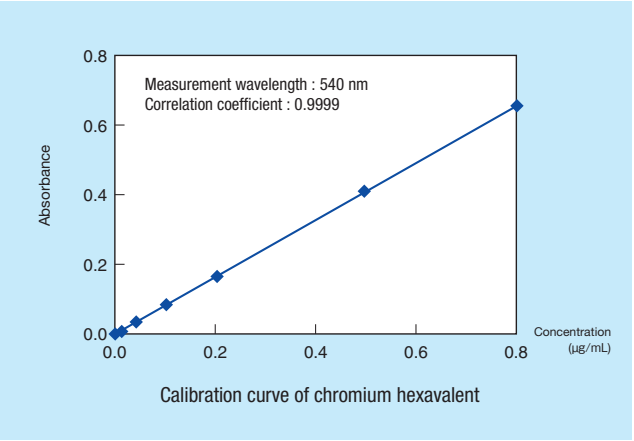
Report Generator program (P/N 3J2-0312)

Allows customization of data reports.
Report items and the size and placement of comments and graphs can be customized. A spreadsheet function is also available for automatic calculations using measured data.
Customized reports can be edited and saved as templates. Automatic printout after measurement using a template is also available.

APPLICATION

Quantitation of hexavalent chromium

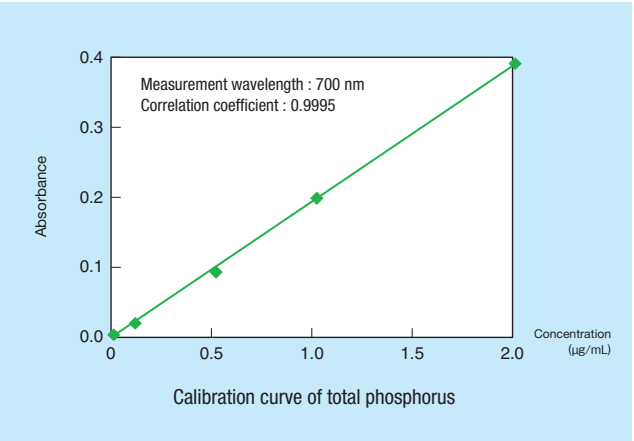
The figure on the right shows an example of quantitative analysis of hexavalent chromium by diphenylcarbazide absorptiometry.
As a result of creating a working curve within 0 to 0.8 µg/mL, a correlation coefficient of 0.9999 was obtained, proving an excellent calibration relationship.
Measuring wavelength: 540 nm
Concentration of standard solution: 0, 0.04, 0.1, 0.2, 0.5, 0.8 µg/mL



Calibration curve of chromium hexavalent

Measurement of total phosphorus

This figure shows an example of quantitative analysis of total phosphorous.
As a result of creating a calibration curve within 0 to 2.0 µg/mL, the correlation coefficient of
0.9995 was obtained, proving an excellent calibration curve relationship.

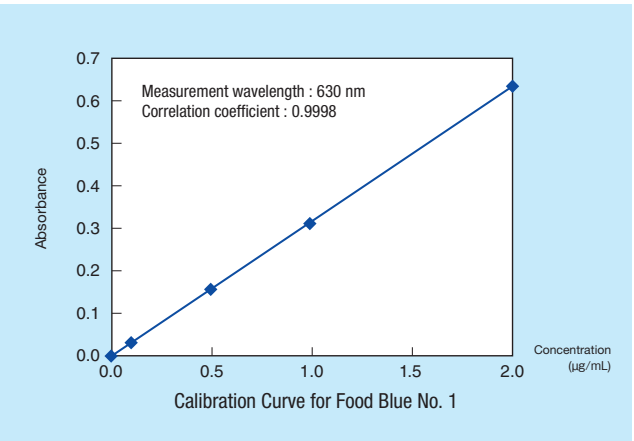


Calibration curve of total phosphorus

Shortened measurement time using the automated 6-cell turret

The figure on the right shows an example of the quantitative analysis of Food Blue No. 1.
As a result of creating a calibration curve within 0.0 to 2.0 µg/mL, a correlation coefficient of 0.9998 was obtained, proving an excellent calibration relationship.
The time needed for the measurement of 15 unknown samples was 140 s with the model U-5100, which is lower by about 45%, compared with the 260 s needed by a previous model*11

The automated 6-cell turret of model U-5100 allows contiguous measurements of six samples without operator intervention and reduces measurement time.



Calibration Curve for Food Blue No. 1

*11 Hitachi Ratio Beam Spectrophotometer U-1900

Advice for Eco Measurement

Our product concept for the model U-5100 is "ECO-FRIENDLY & CLEAN."
Presented below are issues that you may act on,
and advantages that the U-5100 can offer.

Periodic replacement is not needed

The adoption of a Xenon flash lamp contributes to reduced wastes; see page 3 for details.

Waste reduction

Rapid measurement

Automatic measurements contribute to improving the efficiency of your lab; see page 5 for details.

Power savings and CO_2 reduction

Low power consumption

The Xenon lamp emits light only during measurement, contributing to power savings; see page 3 for details.

Power savings and CO_2 reduction

The model U-5100 will help you by performing "eco measurement" for a beautiful Earth

Specifications

Optics	Seya-Namioka mount monochromator, ratio beam
Wavelength range	190 to 1,100 nm
Concave diffraction grating	Grooves 600 / mm
Spectral bandpass	5 nm
Stray light	0.07% or less
Wavelength accuracy	±1 nm (484.6 nm)
Wavelength setting repeatability	±0.5 nm
Photometric range	Abs: −3.000 to 3.000 Abs
	0 to 300%T
	Conc: 0.000 to 9.999
Photometric accuracy (certified according to NIST SRM 930)	±0.003 Abs (0 to 0.5 Abs)
	±0.005 Abs (0.5 to 1.0 Abs)
Photometric repeatability (certified according to NIST SRM 930)	±0.002 Abs (0 to1.0 Abs)
Wavelength scan speed	40, 100, 200, 400, 800, 1,200, 2,400 nm / min
Baseline stability	0.0007 Abs/h (260 nm, 2 hours after power-on)
Noise level	0.0002 Abs or less (RMS, 260 nm, 0 Abs)
Baseline flatness	±0.01 Abs (200 to 950 nm)
Light source	Xenon(Xe) flash lamp
Detector	Silicon photodiode×2
Display	LED with backlight 120 mm×90 mm 320 dot×240 dot
Cell holder	6 cell turret (Automatic) standard, (Single cell holder is optional.)
Languages	Japanese, English, Simplified Chinese, and German for stand-alone
	Japanese and English for UV Solutions program (PC control)
Printer I/F	Centronics interface (Parallel interface)
PC I/F	USB 2.0 (USB connection)
Size (main unit)	355 (W)×425 (D)×235 (H) mm
Operating temperature	15 to 35℃
Operating humidity	25 to 80% (condensation unallowable, within 70% at 30℃ or higher)
Weight (main unit)	13 kg
Power supply/Power consumption	100, 115, 220, 230, 240 V 50/60 Hz 60 VA

Main software functions

Item	Description	Stand-alone	UV Solutions (PC Control)
Photometry	Calibration curve (straight line, linear coefficient)	○	○
	Calibration curve (quadratic or cubic curve, quadratic or cubic coefficients, line graph)		○
	Automatic measurement using the automated 6-cell turret	○	○
Wavelength scan	Absorbance, transmittance	○	○
	Automatic measurement using the automated 6-cell turret		○
	Peak/valley detection	○	○
	Smoothing	○	○
	Graph axis switching function		○
	Numerical spectral comparison		○
	Differentiation		○
	Area calculation function		○
Time scan	Absorbance, transmittance	○	○
	Smoothing	○	○
	Rate calculation function		○
Multi-wavelength measurement	Absorbance, transmittance	○	○
	Automatic measurement using the automated 6-cell turret	○	○
Others	Save function for measurement parameters	50 test	○
	Save function for measured data	30 data sets	○
	Automatic start function under a set of specified conditions	○	○
	Auto wavelength calibration function	○	○

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

NOTICE: Although the information contained herein has been reviewed, Hitachi High-Technologies Corporation makes no warranty or representation as to its accuracy or completeness.

Specifications in this catalog are subject to change with or without notice, as Hitachi High-Tech Science Corporation continues to develop new technologies and products for our customers. Not all products are available in all countries. Please contact your local sales representative for details.

Hitachi High-Technologies Corporation

Tokyo, Japan
www.hitachi-hitec.com/global/science/
24-14, Nishi-shimbashi 1-chome, Minato-ku Tokyo 105-8717, Japan
For technical consultation before purchase, please contact:
contact@nst.hitachi-hitec.com

Printed in Japan (H) **HTB-E063S** 2014.1