

UV-Vis Spectrophotometer

# UV-1900i Plus



# User-friendly, Earth-friendly

Since its launch, the UV-1900 series has been widely appreciated not only for its spectral measurement performance, but also for its user-friendly operation and expandability.

The UV-1900i Plus reduces the use of virgin plastics by adopting exterior panels made from resin containing 50 % recycled material, contributing to resource circulation and a reduction in greenhouse gas emissions.

The UV-1900i Plus is an example of Shimadzu Corporation's efforts to provide solutions that support the realization of a decarbonized society.

## Connecting Design to the Future

- Realizing a user-friendly and earth-friendly laboratory environment
- Easy-to-use touch-screen display
- Faster response speed with adoption of a new CPU

## Various Functions for Comfortable Daily Measurement

- User support with assist and shutdown/wakeup functions

## High Performance to Meet Diverse Needs

- The instrument is equipped with an ultra high-speed scan, which can acquire a spectrum in a few seconds, with the lowest level of stray light and noise in its class
- Validation functions enable checks in accordance with Pharmacopoeia (JP/USP/EP) to be performed easily



# Connecting Design to the Future

## Realizing a user-friendly and earth-friendly laboratory environment

### Introduction of sustainable materials

The external panel of the UV-1900i Plus is produced using recycled materials sourced from end-of-life products. This process of resource circulation reduces the use of virgin plastics, contributing to lower greenhouse gas emissions.

### Optimization of packaging

By optimizing the volume, weight, and overall structure of product packaging, we help reduce transportation costs and the associated environmental impact.

For a smart and environmentally friendly lab.

## Smart Eco Lab



### Shortening system set-up time

By combining the Wakeup function with the Startup validation function the entire process—from system startup to performance verification—can be performed automatically. This automation reduces both user time and labor, as it eliminates the need to remain nearby during setup.

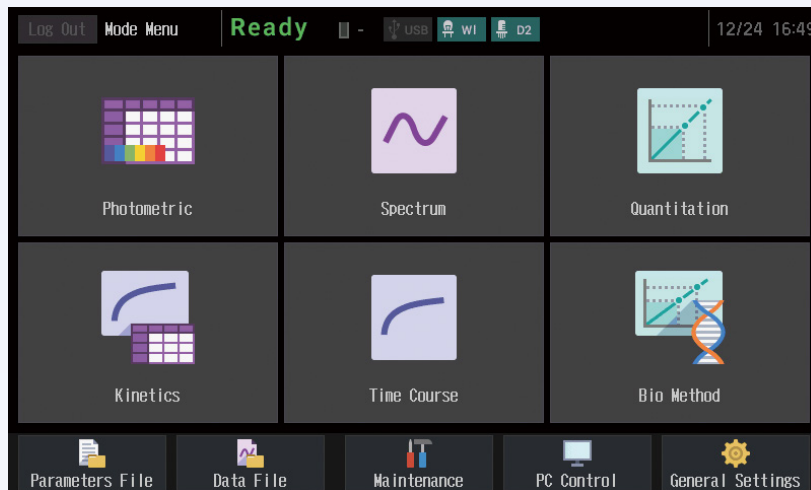
### Reduced energy consumption

The Shutdown/Wakeup function enables the system to automatically enter mode after completing an analysis or before starting the next analysis. During sleep mode, energy consumption is minimized, reducing power usage by more than 85 % compared to normal operation (without the Shutdown/Wakeup function).

## Easy-to-Use Interface

### Grasp the Current Status and Operating Procedures at a Glance

The UV-1900i Plus on-screen user interface includes large, easy-to-see icons deployed on a black background, so the instrument settings are evident at a glance. In addition, the large, easy-to-see icons improve intuitive understanding, which enables users to quickly become familiar with operations. Furthermore, the user interface is designed to minimize transitions between windows, so users do not get confused during operations. The system also features a faster response speed by adopting a new CPU. Display languages are available in eight languages (Japanese, English, Chinese, Spanish, Portuguese, German, French, Russian).



The instrument is equipped with stylus pen. Operation can be performed with this pen or a finger.

\* The background color of the operation screen can also be set to white.

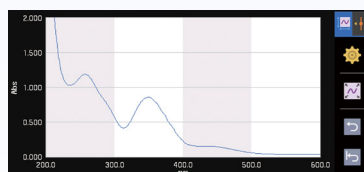
## Multiple Measurement Modes

UV-1900i Plus has six basic measurement modes, which offer the optimal solution for a variety of measurements.

No.	Sample Name	Abs	K + Abs	8/8
001	SAMPLE1	2.401	2.4000	
002	SAMPLE2	0.101	0.1014	
003	SAMPLE3	0.762	0.7618	
004	SAMPLE4	2.823	2.8234	
005	SAMPLE5	1.213	1.2127	
006	SAMPLE6	1.577	1.5765	
007	SAMPLE7	0.452	0.4517	
008	SAMPLE8	0.203	0.2023	

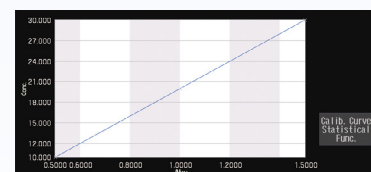
### Photometric

Measures the photometric value at a single wavelength or multiple (up to eight) wavelengths.



### Spectrum

Measures a sample spectrum using wavelength scanning.



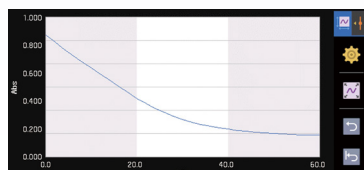
### Quantitation

Generates a calibration curve from the measurement of standards, and then calculates the concentrations of unknowns.

No.	Sample Name	Init (Abs)	AMain Activity	2/2
001	SAMPLE1	0.9386	0.6813	0.5723
002	SAMPLE2	1.0489	0.6451	0.5413

### Kinetics

Measures absorbance changes as a function of time, and obtains the enzymatic activity values. The kinetics measurement method or the rate measurement method can be selected.



### Time Course

Measures changes over time in photometric values at a specified wavelength.

Results	3/13
A1( 250.0) = 0.3269	
A2( 230.0) = 0.3094	
A3( 320.0) = 0.1501	
Abs Ratio = 1.1099	
DNA Conc. = 8.1265	
Protein Conc. = 15.750	

### Biomethod

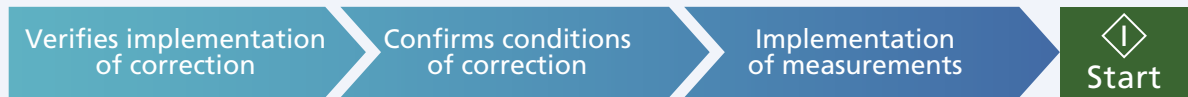
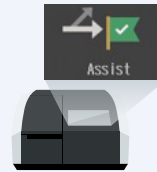
Quantifies DNA or protein concentrations.

# Various Functions for Comfortable Daily Measurement

## Assist Function



The instrument assists the user to ensure that measurements are performed using the correct procedure.\*1



Checks whether or not baseline correction, auto zero correction or cell blank correction has been performed and informs the user if it has not been.

Informs the user if the last correction performed is not appropriate for the planned measurement.

Informs the user if the UV-1900i Plus is not ready to begin measurement and when starting measurements and 100 %T (0 Abs) corrections.

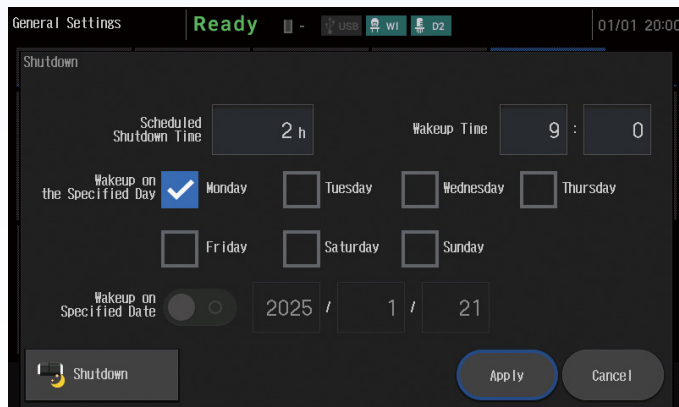
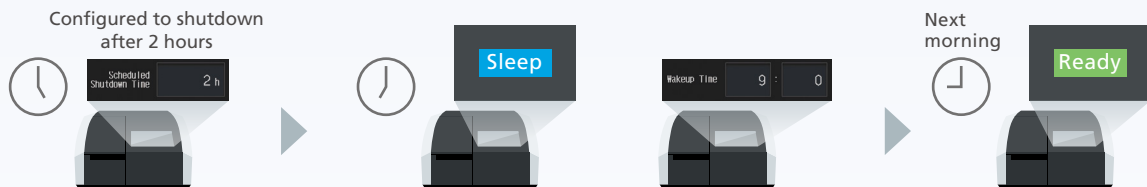
\*1 This function can be enabled/disabled.

## Shutdown Function

The shutdown function puts UV-1900i Plus to sleep after it's been used, or after a certain period of time. Putting the instrument into sleep mode limits power consumption by the lamps and motors, reducing consumption by more than 85 % compared to the normal standby state.

## Wakeup Function

Automatically wakes up a sleeping UV-1900i Plus at a specified time. This function eliminates the need for analysts to wait for it to warm up, allowing them to be more productive.



This product is certified as Shimadzu's Eco-Products Plus. Reduced power consumption by 60 % compared with conventional Shimadzu's products. (Assuming 8 hours operation/day × 5 days/week)



- Automated support functions utilizing digital technology, such as M2M, IoT, and Artificial Intelligence (AI), that enable higher productivity and maximum reliability.
- Allows a system to monitor and diagnose itself, handle any issues during data acquisition without user input, and automatically behave as if it were operated by an expert.
- Supports the acquisition of high quality, reproducible data regardless of an operator's skill level for both routine and demanding applications.

## Startup Validation Function

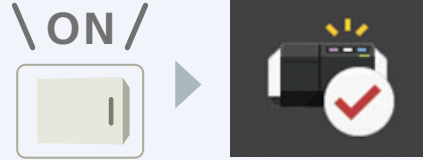
Instrument performance checks can be performed automatically when the instrument is turned ON.\*2

This enables even more reliable instrument operation.

It can also be implemented in combination with the Wakeup function.

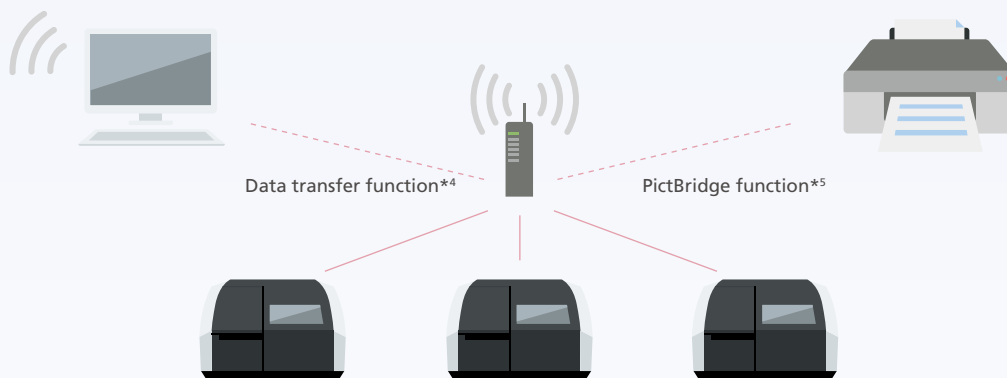
\*2 This function can be enabled/disabled.

The performance check items that can be used with this function are as follows: wavelength accuracy (D2), wavelength repeat accuracy (D2), degradation, noise level, baseline flatness, baseline stability (drift), [EP] Control of Wavelength Accuracy (D2), and [USP] Control of Wavelengths (D2).



## Network Connectivity Function

Data can now be transferred to a PC via a network. With wireless printing, multiple UV units can print from a single printer.\*3 (A router and other network equipment must be installed to use a network.)



\*3 A router with wireless function is required.

\*4 Optional expanded memory is required. The instrument is not compatible with control via a network.

\*5 A PictBridge compatible printer is required.

## Bar-Code Reader and Keyboard Entry Function

Sample names and numerical values can be entered by a bar-code reader or from the keyboard.

This saves time when entering sample names for a multi-sample analysis, and prevents sample misidentification and other human errors.\*6



\*6 Use a bar-code reader and keyboard with a USB connection.

No.	Sample Name	Abs	K × Abs	2/2
001	SAMPLE1	0.077	0.0773	
002	SAMPLE2	0.093	0.0926	

Additional interface details: Parameters, Attachments, Photo. Table, K Factor [ 1.0000], 550.0 nm, 0.087 Abs, Recalc., Save Table, Load Table, Print, Auto Zero, Base Corr., Start.

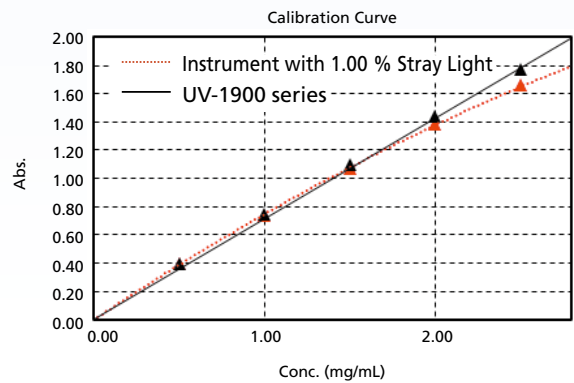
# High Performance to Meet Diverse Needs



## Low Stray Light

Linearity will be lost in the high absorbance region due to stray light. UV-1900 series is equipped with Low Stray Light Diffraction Gratings, achieve "best-in-class" low stray light. Stray light is at 0.5 % max. (198 nm), making accurate measurements possible at 1 Abs or more, even in the ultraviolet region. In addition, high-concentration samples can be quantified accurately.

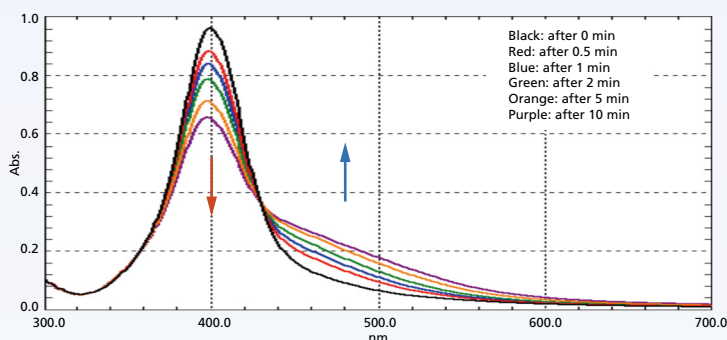
The figure on the right is a calibration curve for acetic acid, created with absorbance at 200 nm. The correlation coefficient is 0.9998 and correct measured values are obtained even with high-concentration samples.



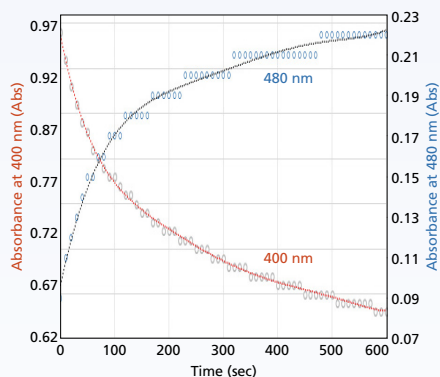
## Ultra-Fast Scan

Spectra can be acquired as fast as 29,000 nm/min. Ultra-fast scanning is effective for tracking chemical reactions in a short time. In addition to the absorbance change at specified wavelengths, spectra can be acquired in a short time with the UV-1900i Plus. Therefore, more detailed behavior can be investigated by observing spectra with the UV-1900i Plus.

The figures below show the analysis of the particle agglomeration process when salts are added to silver nanoparticles. Measurements of the 300 to 700 nm region were performed in ultra-fast scan mode. In addition to the decrease of absorbance at 400 nm and the increase of absorbance at 480 nm, the temporal changes of spectra can be observed.



Absorption Spectra of Silver Nanoparticles



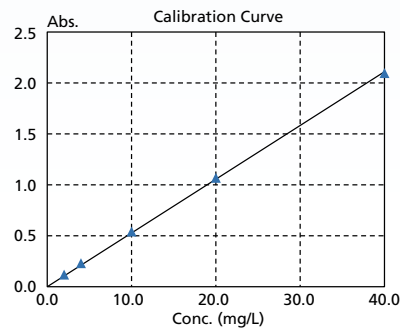
Temporal Changes of Absorbance at 400 and 480 nm

## High Reproducibility and Repeatability Accuracy

The photometric repeatability accuracy is 0.0002 Abs max. (0.5 Abs and 1.0 Abs). As a result, variance in the measurement results is suppressed, enabling more accurate quantitation and the detection of low-concentration samples.

The figure on the right is a calibration curve for caffeine, created with absorbance at 273 nm. The calibration curve has an  $Abs = 0.0528 \text{ Conc}$ . The lower limit of quantitation determined from the standard deviation is 0.0051 mg/L.

No.	Absorbance of Blank Solution (273 nm)
1	-0.00001
2	0.00001
3	-0.00002
4	0.00002
5	0.00001
6	-0.00003
7	0.00001
8	-0.00004
9	0.00001
10	0.00005
Standard Deviation $\sigma$	0.000025



Note: One method of determining the lower limit of quantitation is to use ten times the standard deviation. This is an actual measured value and is not guaranteed.

# Enables Compliance with ER/ES Regulations and Stronger Data Management

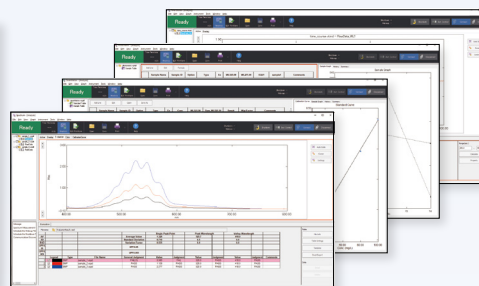
## LabSolutions™ UV-Vis Software



Enables higher productivity and provides for a more convenient analytical environment.

### Startup

Different measurement applications can be started from the application launcher. Extensive UV validation software programs supporting instrument performance checks as well as optional software programs for special analyses are also available, so various measurements can be intuitively performed.

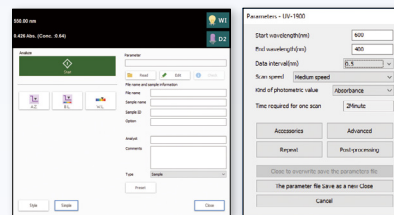


Four Measurement Mode Windows

### Setting Parameters

#### Instrument Control Panel

Instrument parameter settings can be specified via panels that are separate from the measurement window. The control panels include various functionality that is laid out for superior visibility. Each measurement window connects seamlessly to the corresponding parameter settings window.



#### Presets (Spectrum and Time Course)

When multiple samples are measured, the sample information can be configured in advance.

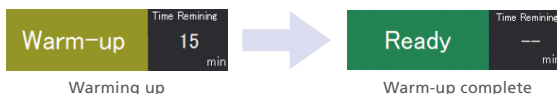
Type	Sample Name	Sample ID	# of PV's	File Name	Parameter	Comments
Spectrum	SampleNo001	Sample001	One	AutoF_Spec001	UV-Vis	
Spectrum	SampleNo002	Sample002	One	AutoF_Spec002	UV-Vis	
Spectrum	SampleNo003	Sample003	One	AutoF_Spec003	UV-Vis	
Spectrum	SampleNo004	Sample004	One	AutoF_Spec004	UV-Vis	
Spectrum	SampleNo005	Sample005	One	AutoF_Spec005	UV-Vis	
Spectrum	SampleNo006	Sample006	One	AutoF_Spec006	UV-Vis	
Spectrum	SampleNo007	Sample007	One	AutoF_Spec007	UV-Vis	
Spectrum	SampleNo008	Sample008	One	AutoF_Spec008	UV-Vis	
Spectrum	SampleNo009	Sample009	One	AutoF_Spec009	UV-Vis	
Spectrum	SampleNo010	Sample010	One	AutoF_Spec010	UV-Vis	
Spectrum	SampleNo011	Sample011	One	AutoF_Spec011	UV-Vis	
Spectrum	SampleNo012	Sample012	One	AutoF_Spec012	UV-Vis	
Spectrum	SampleNo013	Sample013	One	AutoF_Spec013	UV-Vis	
Spectrum	SampleNo014	Sample014	One	AutoF_Spec014	UV-Vis	
Spectrum	SampleNo015	Sample015	One	AutoF_Spec015	UV-Vis	
Spectrum	SampleNo016	Sample016	One	AutoF_Spec016	UV-Vis	
Spectrum	SampleNo017	Sample017	One	AutoF_Spec017	UV-Vis	
Spectrum	SampleNo018	Sample018	One	AutoF_Spec018	UV-Vis	
Spectrum	SampleNo019	Sample019	One	AutoF_Spec019	UV-Vis	
Spectrum	SampleNo020	Sample020	One	AutoF_Spec020	UV-Vis	
Spectrum	SampleNo021	Sample021	One	AutoF_Spec021	UV-Vis	
Spectrum	SampleNo022	Sample022	One	AutoF_Spec022	UV-Vis	
Spectrum	SampleNo023	Sample023	One	AutoF_Spec023	UV-Vis	
Spectrum	SampleNo024	Sample024	One	AutoF_Spec024	UV-Vis	
Spectrum	SampleNo025	Sample025	One	AutoF_Spec025	UV-Vis	
Spectrum	SampleNo026	Sample026	One	AutoF_Spec026	UV-Vis	
Spectrum	SampleNo027	Sample027	One	AutoF_Spec027	UV-Vis	
Spectrum	SampleNo028	Sample028	One	AutoF_Spec028	UV-Vis	
Spectrum	SampleNo029	Sample029	One	AutoF_Spec029	UV-Vis	
Spectrum	SampleNo030	Sample030	One	AutoF_Spec030	UV-Vis	

### Instrument Check

#### Assist Function\* ANALYTICAL INTELLIGENCE

The user can tell at a glance if the instrument has finished warming up. Also, the user is notified when attempting to implement measurements without making necessary corrections, thereby supporting appropriate analysis work.

\* This function can be enabled/disabled.



From Measurement to Data Output

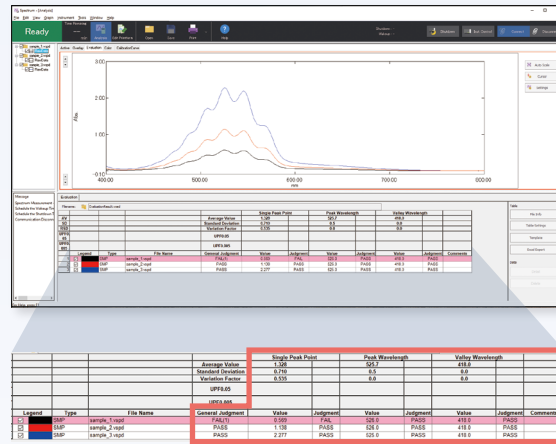
### Improved Productivity of Data Analysis Operations

Data analysis and data output operations can be performed at the same time as data measurement. Time spent outputting or analyzing data can also be reduced by simultaneously sending data to an Excel® spreadsheet in real time or saving data as text. The software can also automatically perform postprocessing of measured data, such as processing/correcting spectra, and perform pass/fail judgments of measurement results (automatic spectral evaluation).

### Automatic Spectral Evaluation (Spectral Evaluation Function)



By specifying various evaluation criteria for measurement results, spectra judgments can be made automatically. In the report creation window, reports can either be prepared based on a previously specified report format or freely laid out based on various parameters, data, or other elements.



Data Management

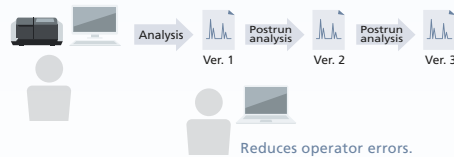
### Robust Data Management Functions

In addition to regular file management in folders on a PC, solutions for saving data in a database with sophisticated security functionality and compliance with ER/ES-related regulations are also available.

#### Supported Software

LabSolutions DB UV-Vis, LabSolutions CS UV-Vis

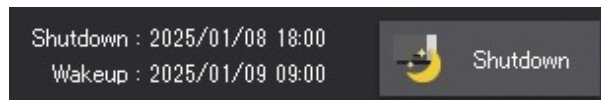
Managing data in a database can prevent the overwriting or deletion of analysis data. Furthermore, during postrun analysis, the data can be managed using version numbers, so there are no concerns about overwriting the data.



Shutdown

### Shutdown/Wakeup Functions

The UV-1900i Plus shutdown function can also be used from the software. The instrument can shut down or automatically wake up in accordance with settings specified by LabSolutions UV-Vis. After a long period of measurement, the instrument and software can automatically shut down.



## Reliable LabSolutions Software

In addition to LabSolutions UV-Vis, which provides basic functionality, Shimadzu offers LabSolutions DB UV-Vis and LabSolutions CS UV-Vis to meet the requirements of ER/ES regulations.

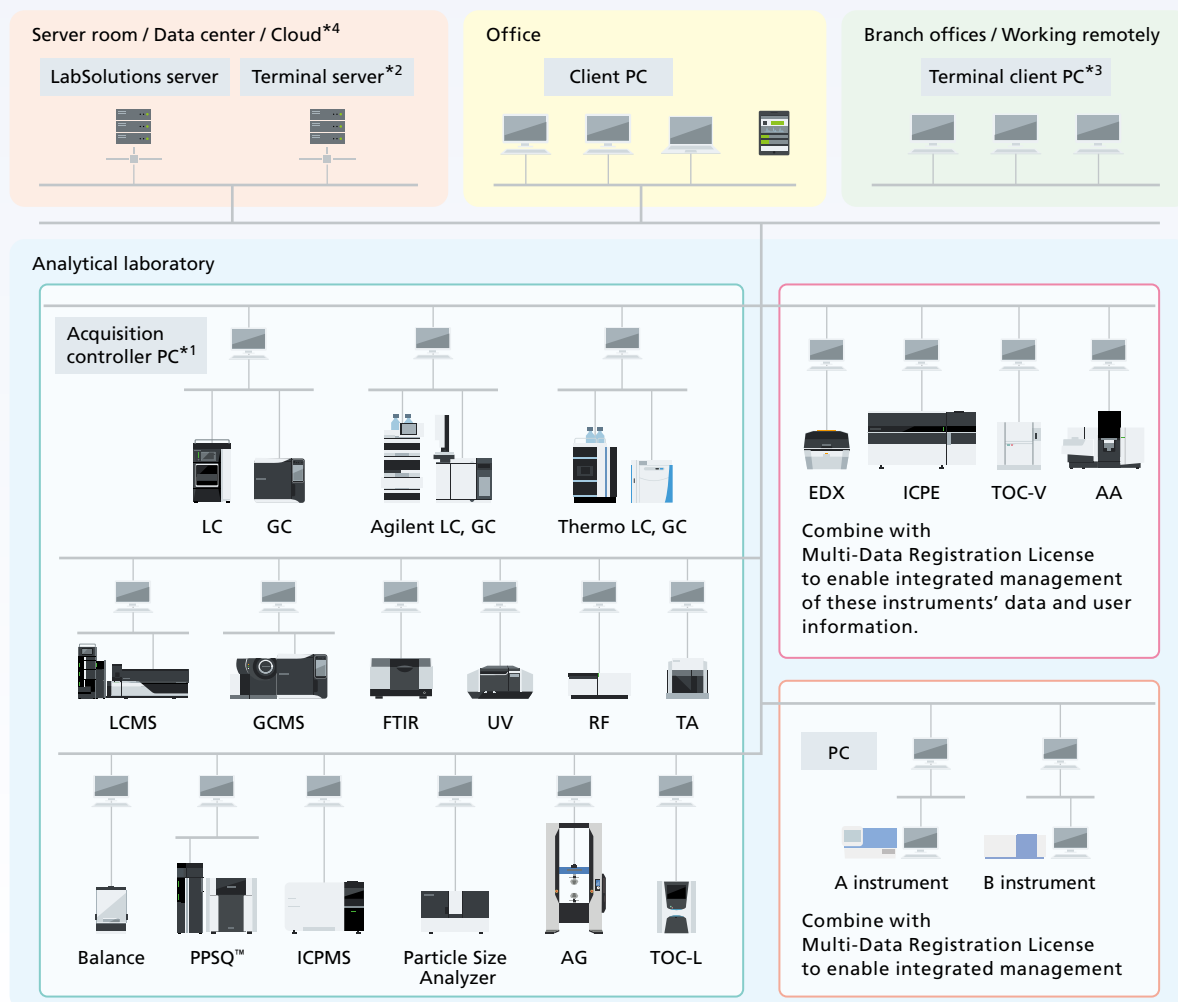
### LabSolutions DB UV-Vis

LabSolutions DB UV-Vis allows for secure data management by integrating a data management function with LabSolutions UV-Vis. Compliant with ER/ES regulations, the software is optimally configured for customers using a PC. It is recommended for facilities that do not require network connections and want to be ER/ES compliant.



### LabSolutions CS UV-Vis

LabSolutions CS, which is freely accessible to the analysis network, can be connected to LabSolutions UV-Vis, eliminating the need for connecting a PC to the instrument. Since all the data are managed on a server, LabSolutions CS UV-Vis can be read from any personal computer on a network. It is recommended for facilities that have a large number of users, manage data in a database, and want to be ER/ES compliant.



\*1 The acquisition controller PC controls analytical instruments.

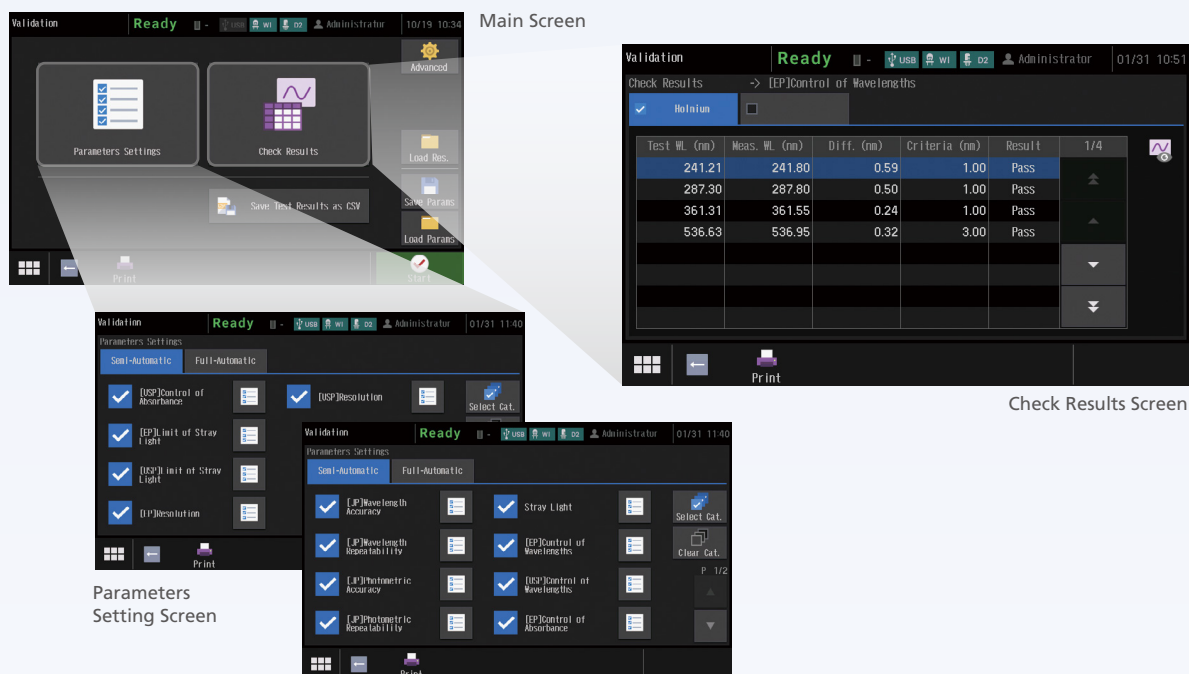
\*2 A terminal server is a server for using terminal services. Users can view data reports and perform electronic signature operations through terminal services. It is ideal for remote connections because of the low network load. Only LC, GC, LCMS, and GCMS support analysis and post-run operations through terminal services.

\*3 If a terminal service is used, LabSolutions software does not need to be installed on client PCs or tablets.

\*4 Servers can be built on various clouds (IaaS). AWS (Amazon Web Services), Microsoft® Azure®, GCP™ (Google Cloud Platform™)

## Validation Functions Compliant with JP, USP, and EP (Touch-screen Display)

This instrument can run checks not only for nine JIS items, but also those stipulated in the Japanese Pharmacopoeia (JP), United States Pharmacopoeia (USP), and European Pharmacopoeia (EP). The UV-1900 series also complies with the hardware specifications required by each Pharmacopoeia. In addition, the check conditions can be saved. As a result, checks can be performed easily just by calling them up as needed. Check results can also be saved.



## Security Functions

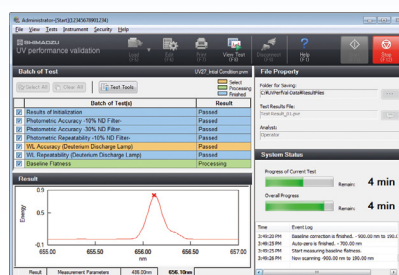
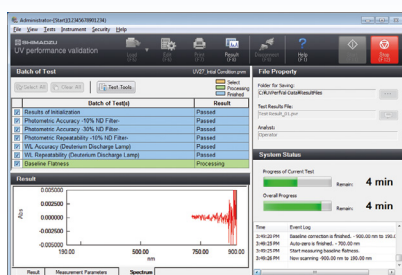
It includes security features that restrict functionality based on user level, allowing three levels of user authority—Administrator, Developer, and Operator—to be assigned to instrument users.

## Resolution of 1 nm, the Highest in its Class

In addition to achieving a resolution of 1 nm, the highest in its class, by using a monochromator with a Czerny-Turner mounting, the UV-1900i Plus also features a compact, bright optical system. The instrument is more than capable of meeting the wavelength resolution required in the USP and EP.

## Compatible with Validation from PC Software

UV validation software (limited function edition) is included as standard. Using this software, inspections can be implemented as stipulated for 9 items in JIS and the JP. If optional UV validation software (USP/EP compatible edition) is added, examinations can be implemented as stipulated in the USP and EP.



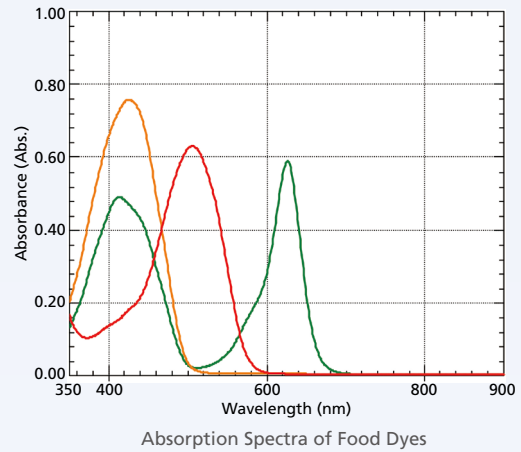
- Inspection results can not only be printed but also saved to a file, so the results can be called up later for confirmation.
- The inspection parameters can also be saved to separate files for periodic and routine inspections, and then called up for use.
- The user can select confirmation of instrument performance indicators as per JIS K0115 General rules for molecular absorptiometric analysis, as well as the general test methods in the JP. (Order inspection jigs and reagents separately.)

Note: Optional validation software is required to support the USP and EP.

# Applications

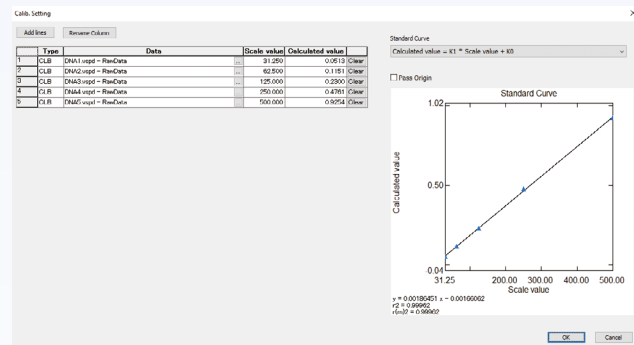
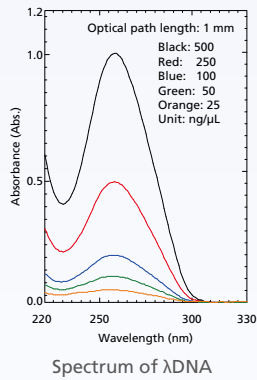
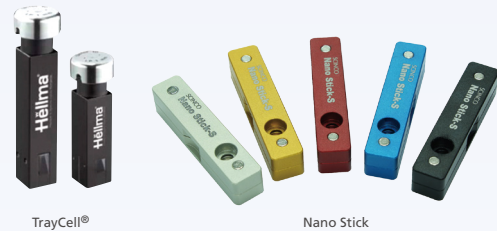
## Foods

This is an example of the analysis of food dyes. By using ultra-fast scan mode, the time needed for routine spectral checks can be shortened. The 350 nm to 900 nm region can be measured at 1 nm intervals in approx. 4 seconds.



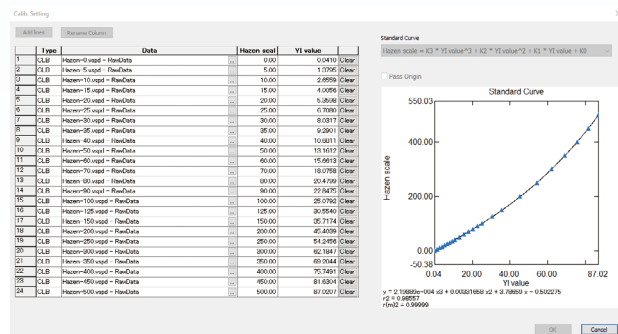
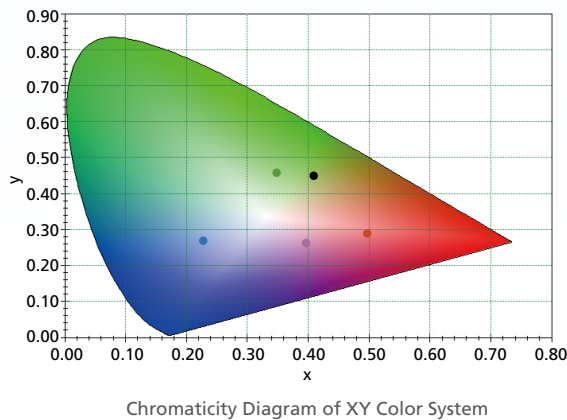
## Pharmaceuticals and Life Sciences

This is an example of the analysis of  $\lambda$ DNA. Trace quantities (on the order of a few  $\mu$ L) can be measured by combining the instrument with Nano Stick and TrayCell<sup>®</sup>. Using TrayCell, a calibration curve for 4  $\mu$ L of  $\lambda$ DNA was obtained in the range between 25 ng/ $\mu$ L and 500 ng/ $\mu$ L.



## Chemistry

Materials can be confirmed quantitatively by using LabSolutions UV-Vis and color measurement software. LabSolutions UV-Vis color software shows the chromaticity diagram of the XY color system or Hazen color.



# Accessories

## Expanded Memory (P/N 207-23119-41)

The UV-1900i Plus main unit can store up to 999 sets of data. The saved data can be read out from a PC. (A network connection is required for data readout.)

## Film Holder (P/N 204-58909)

Used in transmittance measurement of thin samples such as films and filters. It holds the samples for analysis.



## 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.

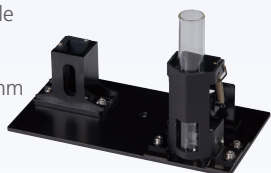


## Test Tube Holder (P/N 207-23510-41)

Holds test tube instead of sample compartment.

- Outside diameter:  $\varnothing$ 15 to 22 mm
- Height: 75 to 115 mm

Note: Test tube is not included.



## CPS-100 Cell Positioner, Thermoelectrically Temperature Controlled (P/N 206-29500-42, -43, -58)

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.

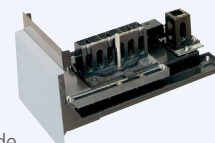
- Number of cells: 6 on the sample side (temperature-controlled)  
1 on the reference side (temperature not controlled)
- Temperature control range: 16 to 60 °C
- Temperature display accuracy (difference from the true value):  $\pm 0.5$  °C
- Temperature control precision (variation of temperature):  $\pm 0.1$  °C
- Ambient temperature: 15 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



## Multi-Cell Sample Compartment (Type-p) (P/N 206-69160-58)

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



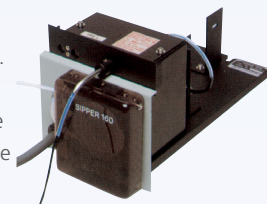
- Number of cells: 6 on the sample side  
1 on the reference side

Note: Square cells are not included, please purchase separately.

## Sipper Unit

Model	P/N	Standard Sample Volume
160L (Standard Sipper)	206-23790-51	2.0 mL
160T (Triple-Pass Sipper)	206-23790-52	1.5 mL
160C (Constant-Temperature Sipper)	206-23790-53	2.5 mL
160U (Supermicro Sipper)	206-23790-54	0.5 mL
160V (50 mm Sipper)	206-23790-56	5.0 mL

Four types of sipper units with different flow cells are available. The stepping motordriven peristaltic pump ensures reliable and smooth aspiration of sample solution.



(Direct driving is possible from the UV-1900i Plus 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 206-23820-58) are recommended when strong acids, strong alkalis, or organic solvents are to be measured.

## TCC-100 Thermoelectrically Temperature Controlled Cell Holder (P/N 206-29510-42, -43, -58)

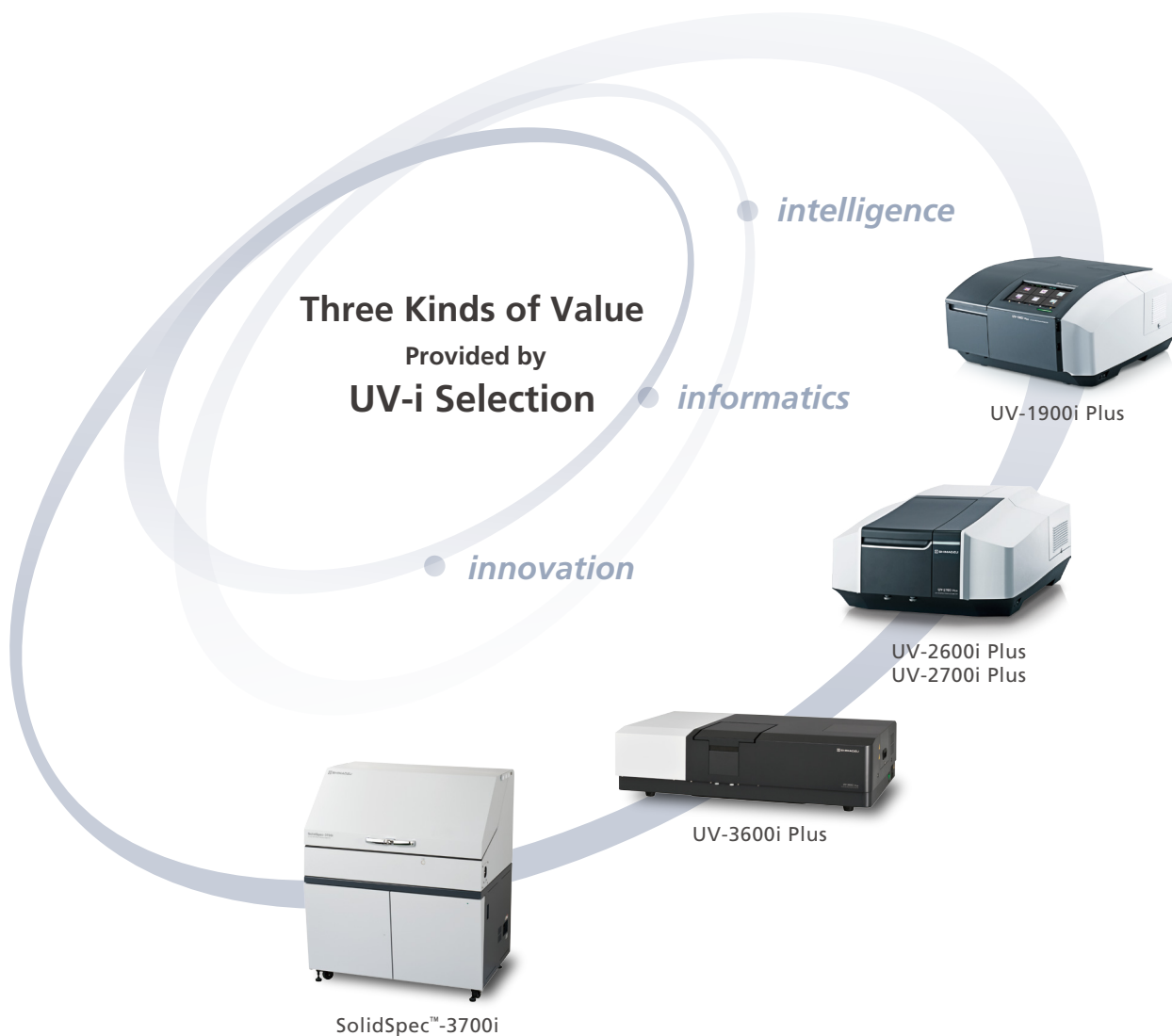
Uses Peltier effect for controlling the sample and reference temperature, so no thermostated bath or cooling water is required.

- Number of cells: One each on the sample and reference sides (temperature-controlled)
- Temperature control range: 7 to 60 °C
- Temperature display accuracy (difference from the true value):  $\pm 0.5$  °C
- Temperature control precision (variation of temperature):  $\pm 0.1$  °C

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



Various other accessories are also available. For details, please refer to the UV-Vis Series Accessories (C101-E180).



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