Fluorescence Spectrophotometer
F-7100

HITACHI
Inspire the Next

F-7100

Hitachi High-Tech Science Corporation

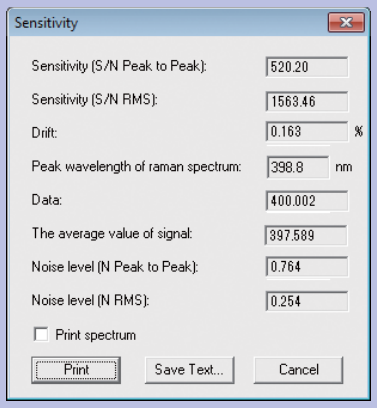
Increased sensitivity achieved via optimized optical detection system and ultra-bright Xenon lamp

F-7100

F-7100 is the evolution of the robust and reliable F-7000 with the latest optical technology and improved analytical performance.

Enhanced Optical System

- Increased excitation luminance
- Improved emission detection sensitivity
- Optimized signal processing



Example of S/N measurement result

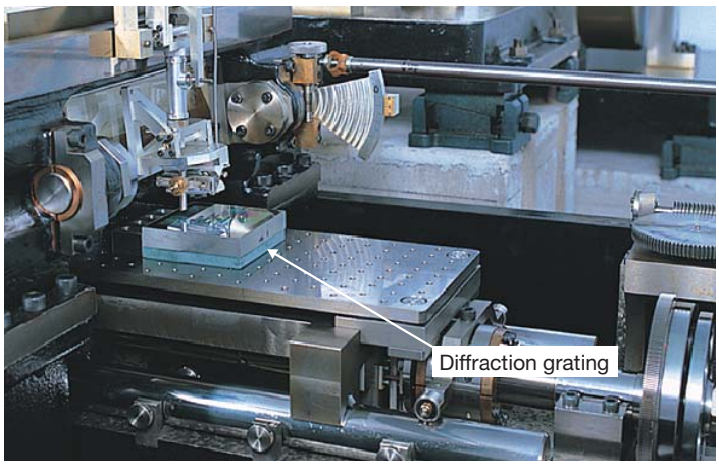
The automatic sensitivity (S/N) measurement via Raman scattering of water demonstrates "Best-in-Class" analytical sensitivity.

Technologies Supporting Hitachi Fluorescence Spectrophotometers

Precision Machining Technology resulting in bright optics.

Advanced Electric Circuit Technology for high-speed processing.

Controlled System Technology ensures high accuracy.



Diffraction grating manufactured using a ruling engine

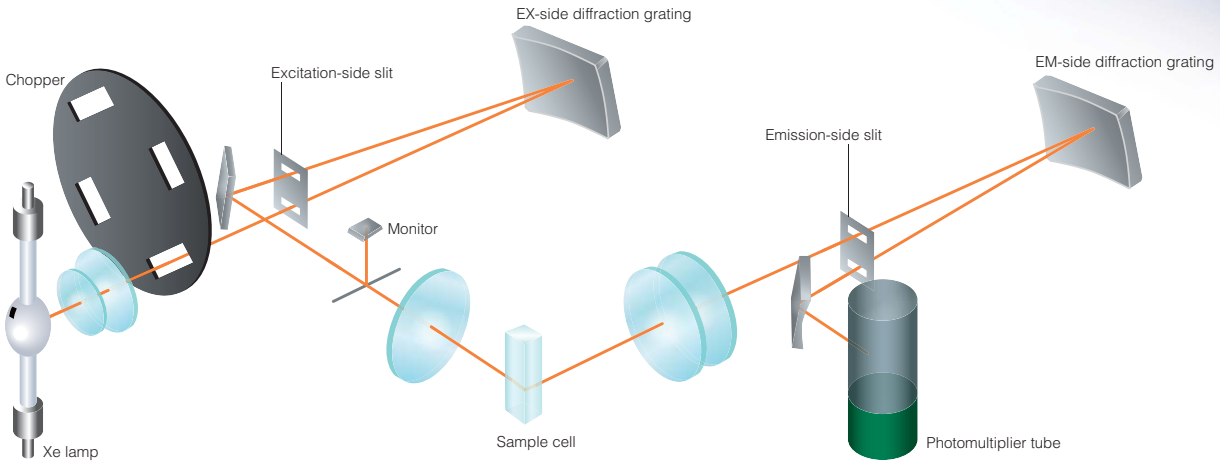
■ Stigmatic concave diffraction grating, mechanically ruled, resulting in a very bright monochromator of F-number 2.2.

Ruling engine.
A dividing engine for ruling diffraction gratings, invented in 1880s by Henry Augustus Rowland of Johns Hopkins University.
Compared to a holographic grating, mechanically ruled gratings have the following advantages:

(1) Mirror-finished groove surface results in high diffraction efficiency.
(2) Groove spacing required for aberration correction can be adjusted, making it possible to have a greater correction effect. These characteristics of mechanically ruled gratings work well to create an excellent monochromator.

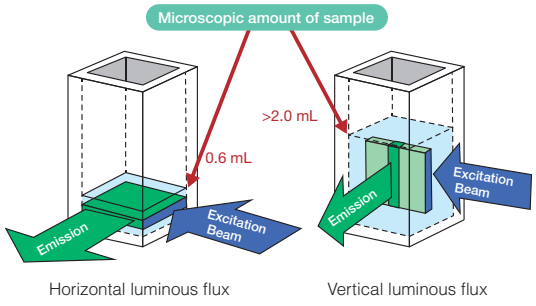
Optical System of F-7100

A highly efficient and reliable optical system has been achieved using a stigmatic concave diffraction grating



Schematic drawing of the optical system for F-7100 Fluorescence Spectrophotometer

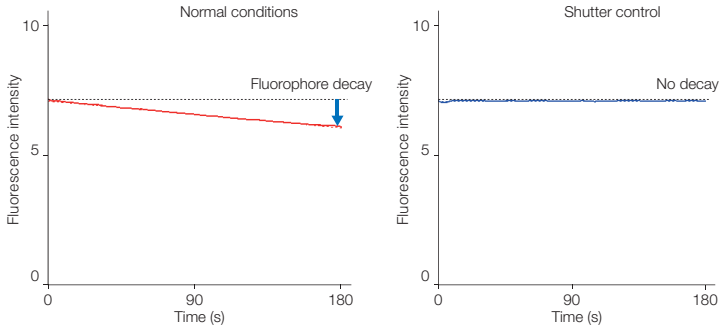
Horizontal Light Beam Ideal for Micro-measurement



Horizontal vs. Vertical luminous flux

With an optical system employing a horizontal slit orientation, a measurement can be made with a sample as small as 0.6 mL, even when a 10 mm rectangular cell is used. Accessories such as cell spacers are not necessary. Furthermore, there are no slit restrictions. Use of a micro cell further reduces the required amount of sample to 0.2 mL. Use of a micro cell with a micro cell holder (4J1-0133) enables measurement of a sample volume of 0.1 mL or less.
In addition, the vertical slit orientation results in lower observed light flux density due to the slit shape, whereas a horizontal orientation allows observation of higher light density. Therefore, measurements with higher sensitivity are possible with smaller sample quantities.

Automatic Shutter Control Function for Minimizing Sample Deterioration

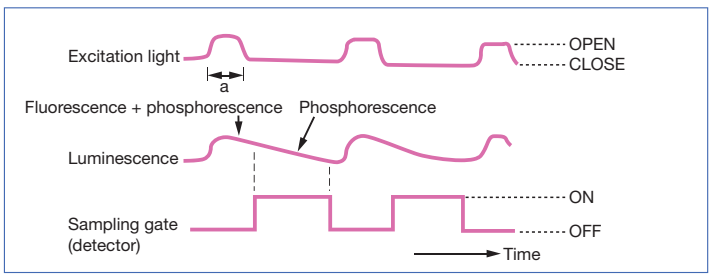


Comparison of decay with or without shutter control in time scan measurement

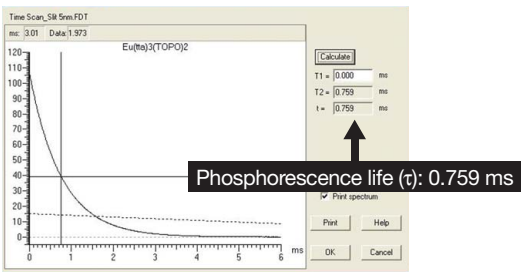
Automatic shutter control (1) - Automatic shutter opening and closing -
The shutter control function keeps the shutter closed while measurements are not being made, in order to prevent sample deterioration caused by excitation light. The shutter automatically opens when the measurement is started and closes immediately after the measurement is completed.

Automatic shutter control (2) - Pulse irradiation and synchronous detection functions (Time scan measurement) -
Small slit widths are sometimes used for time scan measurements of samples in which fluorescence intensity decreases with intense light irradiation. However, a small slit does not allow highly sensitive measurements. For samples that readily degrade, the shutter control function in the time scan measurement mode enables a highly sensitive measurement by using pulsed excitation light and synchronous detection of fluorescence.

Phosphorescence Measurement Capability



Principle of phosphorescence measurement



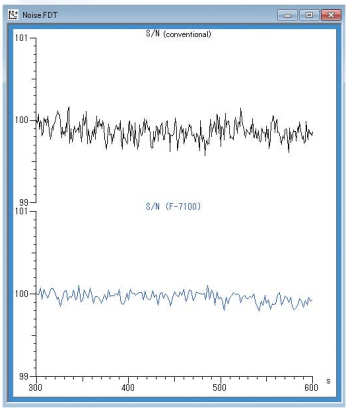
Phosphorescence life measurement of $Eu(tta)_3(TOPO)_2$ complex

Fluorescence and phosphorescence phenomena overlap in fluorescence spectra generated with a fluorescence spectrophotometer that use continuous light from a xenon lamp as a light source. As shown in the diagram, the F-7100 is capable of separating the phosphorescence component using difference in fluorescence and phosphorescence lifetimes.
In the phosphorescence measurement mode, the chopper rotates to irradiate the sample with only the “a” portion of the excitation light (noted in the diagram above) to enable the detection of phosphorescence which appears as afterglow following the extinction of the excitation light.

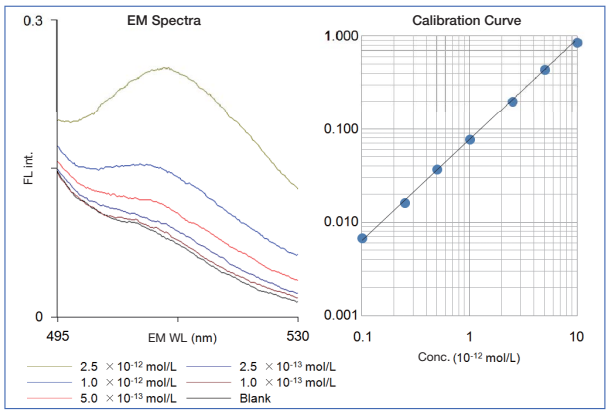
The diagram above shows an example of phosphorescence lifetime measurement of the $Eu(tta)_3(TOPO)_2$ complex. With the F-7100, the analysis of phosphorescence lifetimes on the order of 1-ms can be performed at room temperature without special accessories.

F-7100's Performance Supported by Technology
- Arrival of a World-class Fluorescence Spectrophotometer -

"Best-in-Class" Analytical Signal-to-Noise



Comparison of S/N with conventional instruments



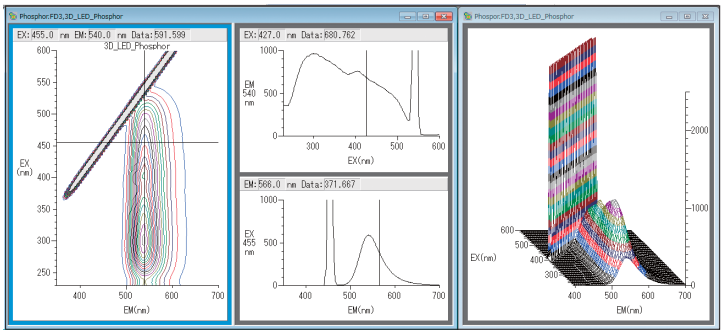
Example of High Sensitivity Analysis (Fluorescein)

The S/N of the Raman scattering of water is compared with that of conventional instruments*1 (diagram on the left). Due to its enhanced sensitivity (1.5x higher), weak signals can be detected with very low noise levels. This is also observed in high-speed scanning, which is a widely-utilized function of the F-7000 series.

An example of the high sensitivity analysis of fluorescein is shown (diagram on the right). The F-7100 detected fluorescence on the order of $1x10^{-13}$ mol/L (sub-picomol) compared with a blank sample (purified water); a useful calibration was obtained in the ultra-trace range.

*1 Conventional instrument: F-7000 Fluorescence Spectrophotometer

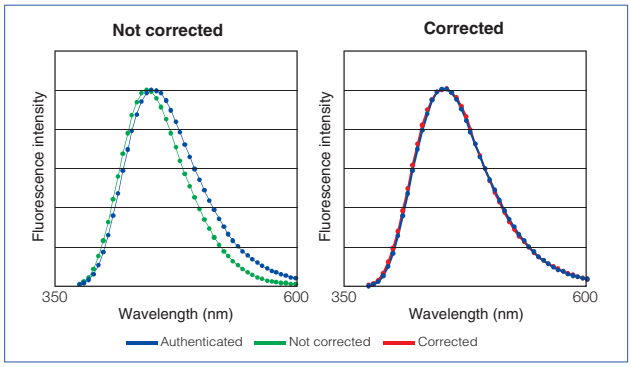
3-D measurement



3-D fluorescence spectra of a YAG fluorescent substance used in white LEDs

3-D fluorescence spectral measurement is very effective for examining the relationship between the excitation and emission wavelengths of a sample. In addition, this measurement is also effective for finding the most sensitive emission/excitation wavelength and for examining small differences among similar samples. In addition to the high-speed scan rate of 60,000 nm/min, the F-7100 is capable of rapid measurement of 3-D fluorescence spectra with time-reduction control. The three-dimensional excitation and emission spectra obtained may be observed and stored as 2-D data for any wavelength selected.

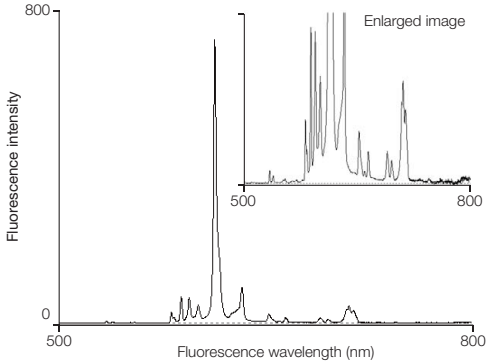
Spectrum correction



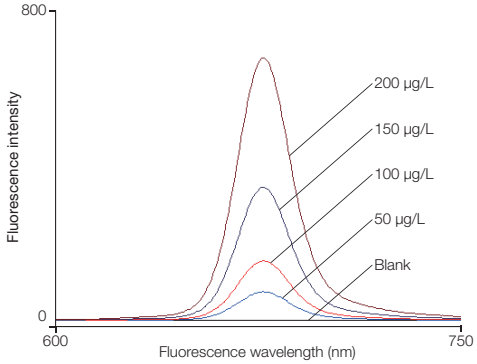
Fluorescence spectra of NIST SRM 936a (quinine sulfate)

Raw spectra are corrected based on the characteristics inherent to the light source and the detectors of each spectrometer. Corrections are applied upon comparison with spectra obtained from other measurement systems as well as quantum yield measurements. The F-7100 is capable of obtaining corrected spectra in the wavelength range of 200 to 800 nm, for either the excitation or emission side. Users can access this instrument function from a special menu on the software. Stable measurements of corrected spectra are possible even after long-term use of the instrument.

Multistage slit



Fluorescence spectrum of Y_2O_3: Eu
(Fluorescence-side slit: 1 nm)

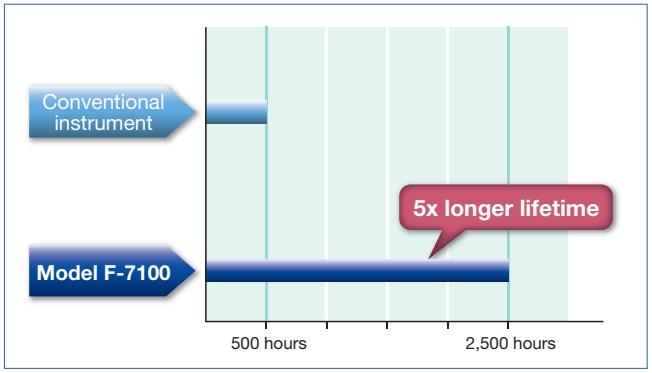


Fluorescence spectrum of low concentration chlorophyll
(Fluorescence-side slit: 20 nm)

The multistage slit has five widths between 1 and 20 nm. Using the smallest slit width (1 nm), high-resolution measurement can be performed with high S/N sensitivity in samples with sharp emission lines.
Using a small slit width results in lower light intensity and can therefore make data unstable due to larger noise; however, increased sensitivity makes the F-7100 capable of obtaining stable data even around the zero-point.
Using the largest slit width (20 nm), high-sensitivity measurement can be performed in samples with wider peaks.
The multistage slit can accommodate a wide range of measurement needs.

Superior Technology Behind Your Measurements

Industry Leading Lamp Lifetime - Light source with 5x*2 longer lifetime compared to conventional instruments -



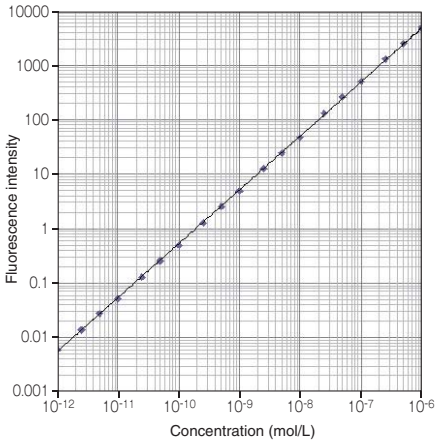
Comparison of lamp lifetimes

Lifetime of 2,500 hours*3

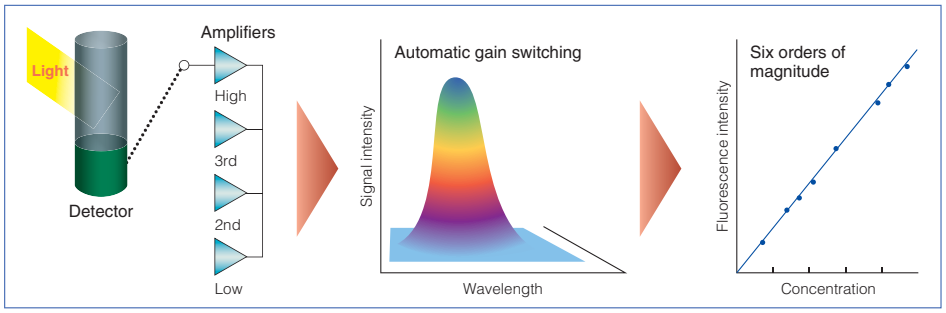
With the introduction of the new Xe lamp and the improved lamp ignition power source, both luminance and lamp lifetime were increased.
Increased lamp lifetime reduces operating Cost-of-Ownership and instrument service time.

*2 Compared with the service life (recommended replacement interval) of the standard Xe lamp (PN: 650-1500) used in the F-7000 fluorescence spectrophotometer.
*3 As the service life (recommended replacement interval) of the F-7100-specific Xe lamp. (Warranty period for free replacement due to lamp failure is up to 6 months or 500 hours.)

Wide photometric range - the dynamic range has 6 or more orders of magnitude -

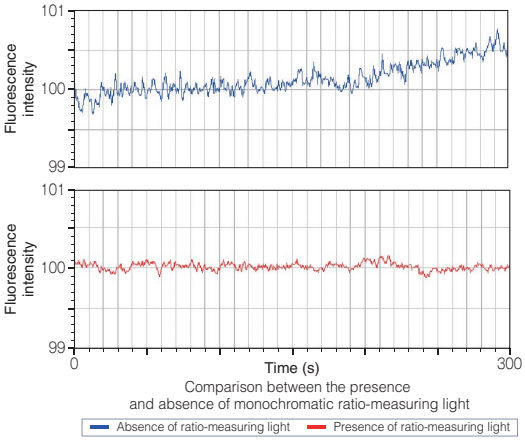


Calibration curve of fluorescein (dynamic range)

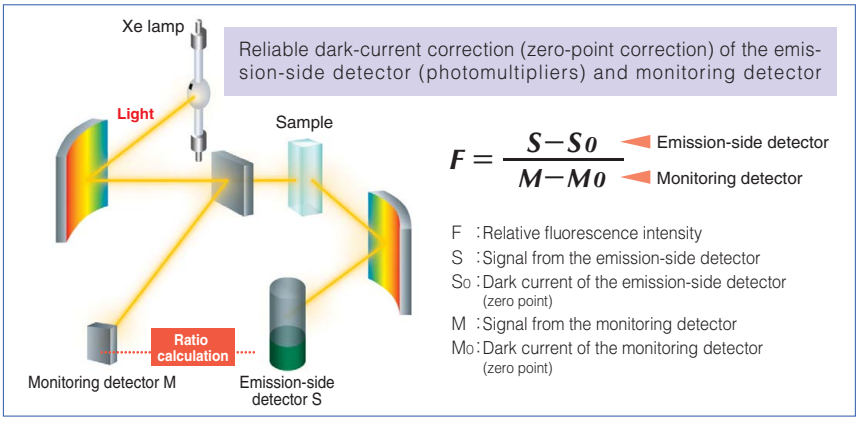


Hitachi fluorescence spectrophotometers have a dynamic range with 6 or more orders of magnitude, resulting from our unique circuit-processing technology.
Because Hitachi fluorescence spectrophotometers can switch gains (amplifiers) automatically, measurements can be performed from low to high fluorescence intensity under the same conditions. The elimination of the need to perform difficult sensitivity adjustments is an advantage featured only with Hitachi fluorescence spectrophotometers. Our fluorescence spectrophotometers are equally adept at quantum yield measurement where strong scattered light and weak fluorescence are measured under the same conditions, as well as other measurements that require a large dynamic range.

Accurate zero-point correction - Hitachi zero-point correction in detector monitoring and reliable measurement of weak fluorescence -



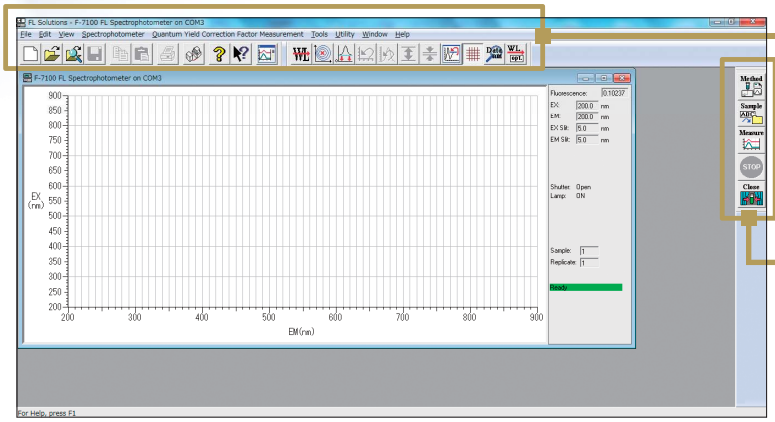
Comparison between the presence and absence of monochromatic ratio-measuring light



Through the use of a monochromatic light monitoring ratio calculation, the monitoring detector performs corrections according to changes in the light source, resulting in outstanding stability.
In addition, dark-current correction is accurately performed during signal processing, because both the monitoring detector and emission-side detector can obtain a zero point. This accurate zero-point correction is effective in measurement of both weak ultraviolet excitation spectra and weak emission spectra.

FL Solutions Responds to a Wide Range of Needs

Very simple operation! Samples can be measured in three steps



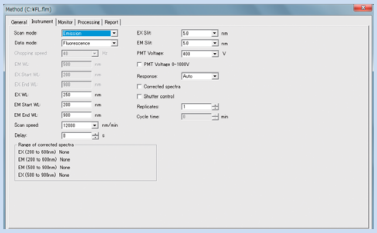
Utility icons are placed at the top of the interface.

Operation is performed by clicking on the icons positioned on the right side of the window.

1 Specify analysis conditions

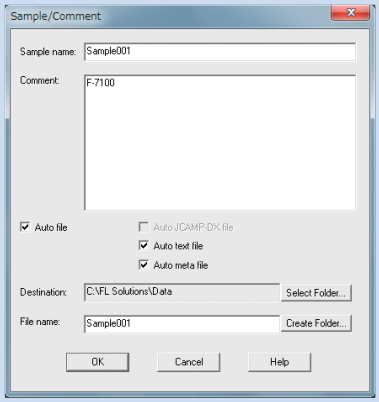
Select one measurement mode, and specify the analysis conditions.

Measurement modes :
Wavelength scanning, Time scan, Photometry, and 3-D Scan



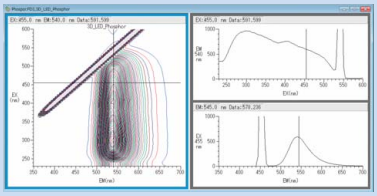
2 Set up a sample

Input a sample name, comments, file name, and destination for storage.

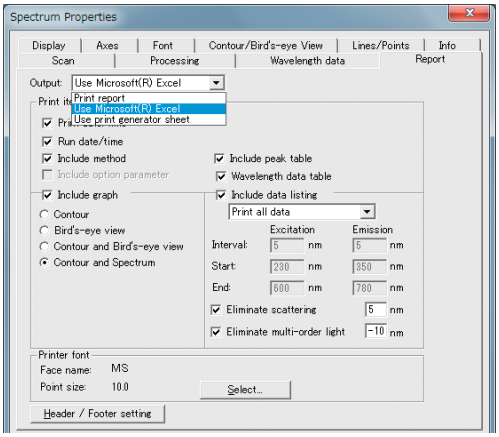


3 Start the measurement

Measurement is started, and the generated data are stored onto the specified file automatically. Data can also be printed out.



DDE and OLE functions support the preparation of analysis reports



DDE : Dynamic Data Exchange

Data on measurement results can be transferred to the spreadsheet software, Microsoft Excel at one click of a button.

OLE : Object Link Embedding

Using commercially available software such as Microsoft Word, spectrum data can be edited into a form suitable for analysis reports.

Batch file conversion

Data files can be converted into ASCII text files, graphics metafiles, or JCAMP-DX files via batch processing.

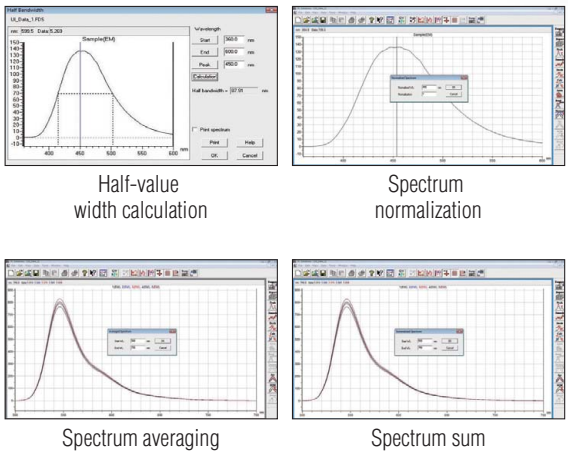
Many different data-processing functions

- four new data-processing functions have been added to the conventional functions of its predecessor, the F-7000 -

Conventional data-processing functions

New data-processing functions

Half-value width calculation | Spectrum normalization | Spectrum averaging | Spectrum sum

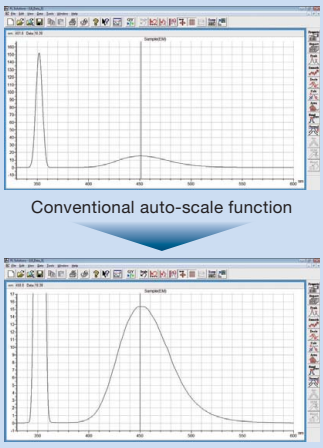


Half-value width calculation | Spectrum normalization | Spectrum averaging | Spectrum sum

In addition to the conventional data-processing functions—peak detection, smoothing, differentiation, four basic arithmetic operations, area calculation, and lifetime calculation, four new functions are now available.

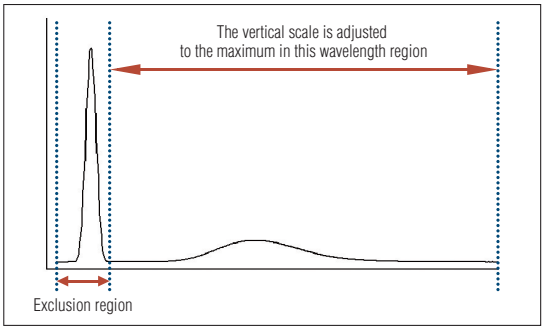
The half-value width calculation function can provide half-value widths of spectra, and support characteristic evaluations of de novo synthesized fluorescence substances.
The spectrum normalization function can perform normalization with the fluorescence intensity at any wavelength at one touch of a button, useful for comparing the spectral shapes of fluorescence at different intensities.
The spectrum averaging and sum functions are effective in the evaluation of multiple spectra.

Advanced auto-scale functions - one-touch scale adjustment for fluorescence -



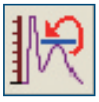
Conventional auto-scale function

Fluorescence auto-scale function



Scattered light is seen at the same wavelength as excitation wavelength and the spectral width depends on the designated slit width. The emission has a longer wavelength than the excitation light. The fluorescence auto-scale function can adjust the scale to show the peaks appearing in the long-wavelength region, excluding the wavelength region of the excitation light.

Fluorescence auto-scale function



The exclusion regions for scattered and other lights are automatically determined from the measurement conditions. The scale is optimized on the basis of the fluorescence wavelength region alone.

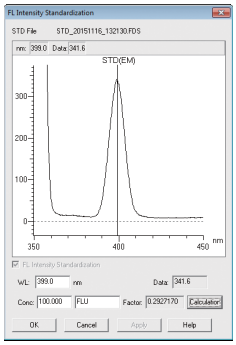
Real-time auto-scale function

During spectrum measurement, the scale can be optimized by the auto-scale function, as needed. It is not necessary to input the scale range before starting a measurement.

Scale return icon

A temporarily enlarged or reduced scale may be restored to the previous condition, at one touch of a button.

FL intensity standardization to correct for fluorescence intensity variation over time and between instruments



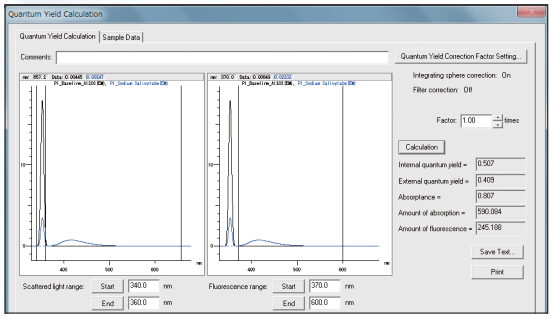
Window for fluorescence intensity standardization

The variations in the fluorescence intensity over time and between instruments can be corrected. Fluorescence intensity is affected by changes in lamp brightness, room temperature, optical system, etc. The fluorescence intensity of the standard sample is measured, and the sample fluorescence intensity is converted to the fluorescence intensity relative to the standard sample. This standardization is also used for the intensity comparison between different instruments, including the analysis of humic substances in environmental water (conversion to quinine sulfate), the analysis of chlorophyll in water (conversion to fluorescein), and the specified value for reagent purity (conversion to quinine sulfate).

A variety of systems for many fields

Material field

System for the quantum yield measurement of powder samples - fluorescent quantum yield measurement of sodium salicylate -



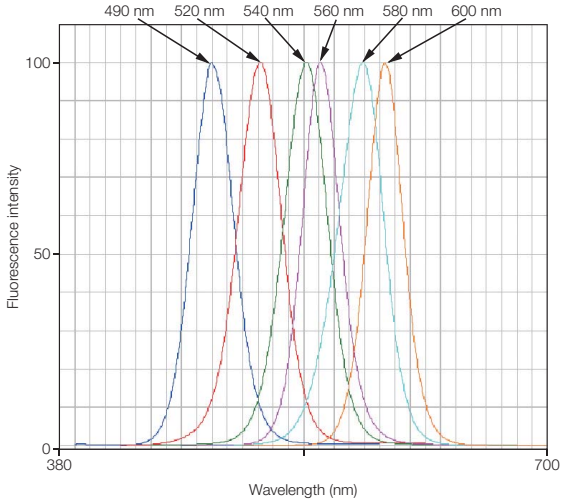
Results of the fluorescent quantum yield measurement of sodium salicylate

Options

- Quantum yield measurement unit
- R928F photomultipliers
- Spectrum correction kit
- Sub-standard light source
- Filter set

Fluorescence quantum yield measurements are performed to evaluate the emission efficiency of organic EL materials, fluorescent substances for white LEDs, quantum dots, fluorescence probes, etc.
With this system, quantum yield can be measured for samples in powder form. The quantum yield measurement unit consists of a 60 φ integrating sphere attachment, powder-sample cell, standard white plate, and quantum yield calculation program. The R928F photomultipliers and sub-standard light source for correction are used for measurements in the long wavelength region of 600 nm or more. The cut filter is used when the spectrum of secondary illumination from scattered light overlaps with the fluorescence spectrum of a sample. The fluorescence quantum yield obtained for sodium salicylate was 0.507.

System for spectrum correction - measurement of the fluorescence spectra of Cd/Se quantum dots -



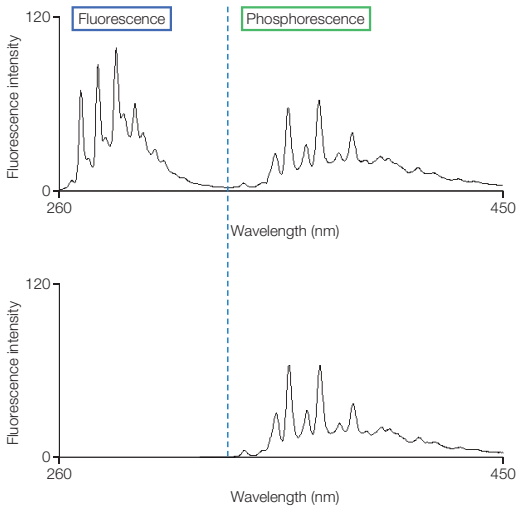
Fluorescence spectra of Cd/Se quantum dots

Options

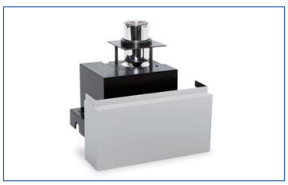
- R928F photomultipliers
- Sub-standard light source
- Filter set

The lamps, detectors, and optical elements of a fluorescence spectrophotometer have wavelength characteristics. The raw spectral data reflect the wavelength characteristics inherent in the apparatus. Therefore, in quantum yield measurements, either a spectral correction or a comparison with reference spectra obtained from another instrument is required.
The spectrum correction kit (rhodamine B method) is employed for correction of spectra in the region of 200 to 600 nm. A spectral correction kit is provided as an accessory with the F-7100. The sub-standard light source is used for correction of spectra in the region of 600 nm or more. The fluorescence spectra of Cd/Se quantum dots were measured. Quantum dots, consisting of semiconductor materials just a few nanometers in diameter, have attracted attention because of their unique ability to control fluorescence wavelength via diameter. They are being incorporated into fluorescence probes and solar cells. Spectral correction helps to obtain accurate fluorescence properties for these materials.

System for measurement of cryogenic samples - emission spectra at low temperatures -



Fluorescence and phosphorescence spectra of benzene
(the upper) Fluorescence measurement mode,
(the lower) Phosphorescence measurement mode



Options

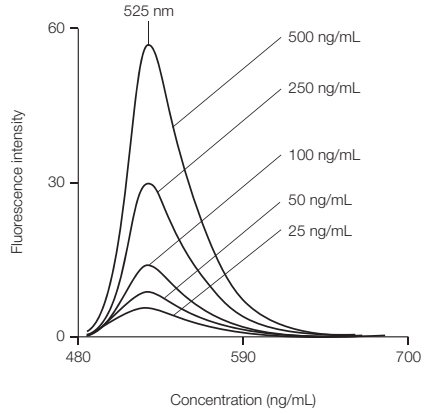
- Attachment device for low temperatures

Using low temperature accessory, fluorescence analysis may be performed down to liquid nitrogen temperature (-196 ˚C). Samples may then be measured for fine structures that do not appear at room temperature.
Samples are frozen within a synthetic-silica sampling tube immersed in a Dewar flask filled with liquid nitrogen.
Either the 5 mm or 8 mm OD test tube (included) can be selected, according to the sample volume and sensitivity.

The F-7100 is equipped with a phosphorescence measurement mode, in which the chopper rotates to irradiate the pulsed excitation light onto a sample to enable the detection of phosphorescence which appears as afterglow following the extinction of the excitation light. Phosphorescence on the order of 1 ms can be measured.
As an example of phosphorescence measurement, the fluorescence and phosphorescence spectra of benzene at liquid nitrogen temperature (using the low temperature accessory) are shown in the figure. Fluorescence and phosphorescence, both of which are included in the fluorescence spectrum, are indistinguishable from these data. Phosphorescence measurement data shows only the phosphorescence component by excluding the fluorescence component.

Biological field

Microplate measurement system - measurement of DNA using PicoGreen -



Fluorescence spectra of 100-µL solutions with PicoGreen
[Using a micro cell with a micro cell holder (4J1-0133)]

Options

・Micro-plate accessory

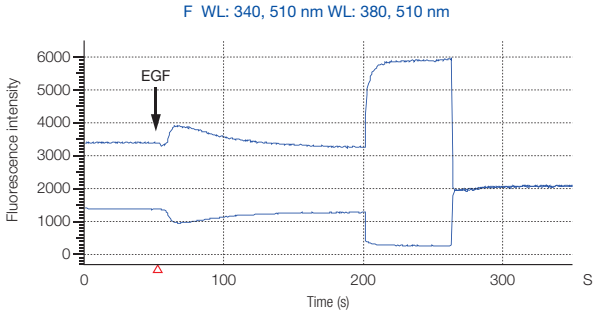
Wavelength spectra, time scan measurements, quantitative calculation, and 3-D fluorescence spectra of 96-well microplates can be obtained. Multi-sample measurement throughput can be greatly improved.
Standard cells (10 mm rectangular geometry) can also be measured in addition to microplate measurements. Measurement can be made from a sample amount of 300 µL when using a microplate.
Double-stranded DNA assay reagent, PicoGreen can selectively quantify double-stranded DNA with high sensitivity, without being affected by RNA, single-stranded DNA, proteins, or other molecules present in the sample. It is suitable for measurement of a template amount of DNA sequencer and PCR.

Compatible microplate	96 wells (400 µL, flat bottm) ・Prepare microplates separately*4.
Measuring speed	96 wells/60 s (in kinetics measurement mode)
Thermostatic function	Thermostatic water bath connectable 5 to 60 °C (Thermostatic water bath separately available)
Weight	8 kg
Dimensions (mm)	290 (W) × 420 (D) × 230 (H) When mounted in F-7100 : 620 (W) × 730 (D) × 300 (H) (excluding protrusions)

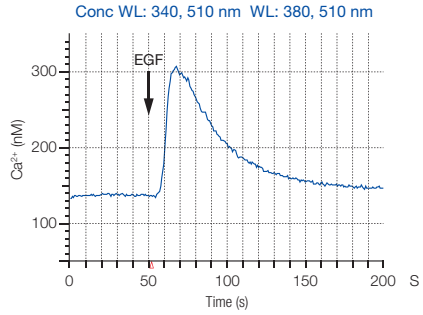
*4 Compatible microplates are commercially available ones having 96 wells.
Background fluorescence level may be high depending on a selected microplate.

PicoGreen: Invitrogen Quant-iT PicoGreen dsDNA Assay Kit
"PicoGreen", "Invitrogen", and "Quant-iT" are registered trademarks or trademarks of Thermo Fisher Scientific or its subsidiaries in the United States and other countries.

System for measurement of calcium in cell



The change in fluorescence intensity of two wavelengths over time when EGF is administered to COS-7



Change in intracellular Ca^{2+} concentration when EGF is administered to COS-7

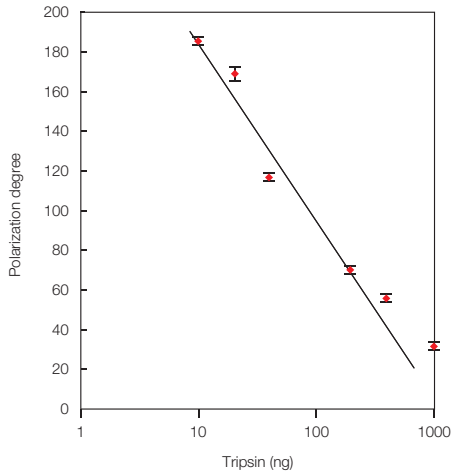
Options

・Intracellular cation measurement accessory

Fura2-AM is a typical reagent for measuring intracellular Ca^{2+} concentration. This reagent has five acetoxymethyl functional groups and can permeate membranes. When mixed into a cell suspension, Fura2-AM enters the cell and is hydrolyzed into Fura 2 by intracellular acetyl esterase.
Fura 2 has calcium-binding ability and causes the peak of the excitation wavelength to blueshift by binding.
Taking advantage of this phenomenon, two wavelengths are measured to obtain ratios of fluorescence intensities to cancel out factors such as dye concentration, intensity of the light source, and size of the cell. Utilizing a wavelength drive speed of 60,000 nm/min, the F-7100 can measure multiple wavelengths almost simultaneously.

The change in fluorescence intensities of two wavelengths over time when EGF (epidermal growth factor) is injected to COS-7 cells (extracted from a monkey's kidney) and changes in Ca^{2+} concentration converted from the fluorescence intensities are shown here. The sample was a cultivated cell fluorescence-labeled by Fura2-AM. The change in Ca^{2+} concentrations in the live cell was also measured.
The result confirms the appearance of the EGF receptor in COS-7.

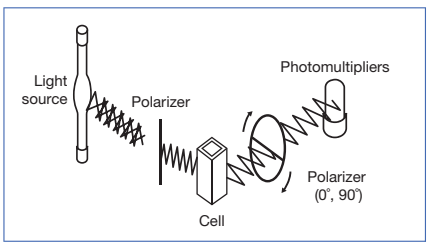
System for measurement of fluorescence polarization



Measurement of protease activity
by fluorescence polarization

Options

・Automatic polarization accessory
・Polarization accessory



Fluorescence polarization

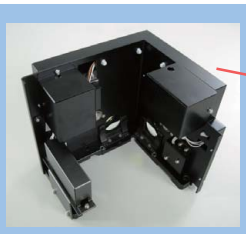
Fluorescence polarization was first introduced in 1926 by Perrin in France, and its wide application to the field of biochemistry started in the late 1970s. This method is simple, quick, and highly sensitive; therefore, it has been implemented for several practical applications, including quantitative determination of drug concentrations in blood and measurements of antigen-antibody reaction or enzyme activity using specialized instruments.
The enzymatic activity of trypsin was measured here by using EnzChek Polarization Assay Kit for Proteases. The degree of change in polarization when casein is hydrolyzed by trypsin, a protease, was studied with the fluorescent-labelled casein included in the kit. BODIPY FL-Casein (excitation wavelength/fluorescence wavelength = 505/513 nm) served as the substrate.

"EnzChek" is a registered trademark or trademark of Thermo Fisher Scientific or its subsidiaries in the United States and other countries.

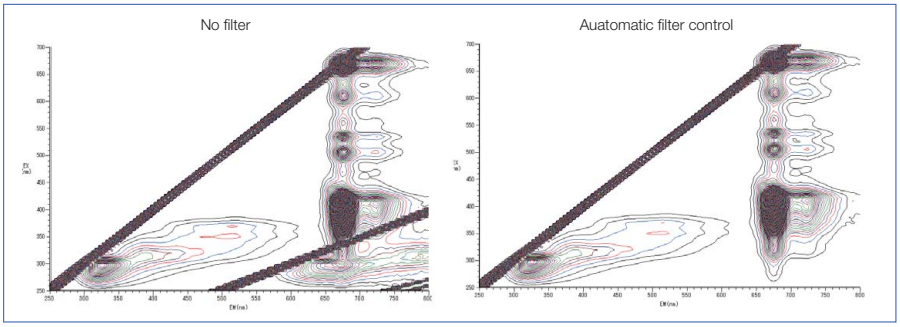
Reliable Support for the Much-talked-about Fluorescence Fingerprint Measurement

System for measurement of fluorescence fingerprint

Automatic filter accessory



External appearance of the automatic filter accessory (P/N 5J0-0158)



3-D Fluorescence spectra of olive oil

Options

・Automatic filter accessory

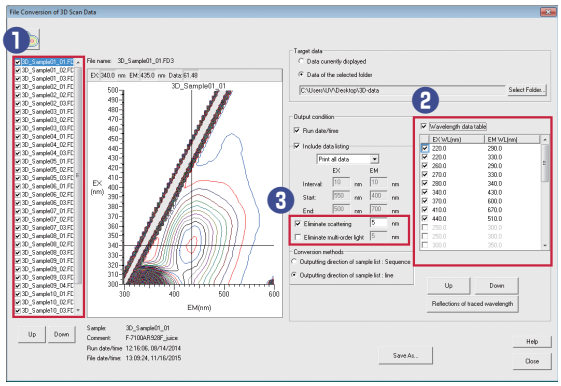
■ Automatic filter control function

A spectrum without the effects of higher-order light (1/2, 1/3, 2, 3 ...-order light) can be obtained with automatic insertion of a filter suited to the measurement conditions.

■ Time reduction control of 3-D measurement (automatic filter control)

Typically, wavelength scanning is interrupted for insertion of a filter; however, this instrument separately obtains spectra with and without a filter and creates composite data after the measurements to reduce measurement time.

Enhanced report output function to support multivariate analyses such as fluorescence fingerprint analysis



Window of file conversion of 3D scan data

❶ File conversion of 3D scan data

Collective output of multiple 3D fluorescence spectral data to Excel. Output Rows and Columns can be transposed, if needed.

❷ Applicable to the 3D measurement results of the wavelength data table

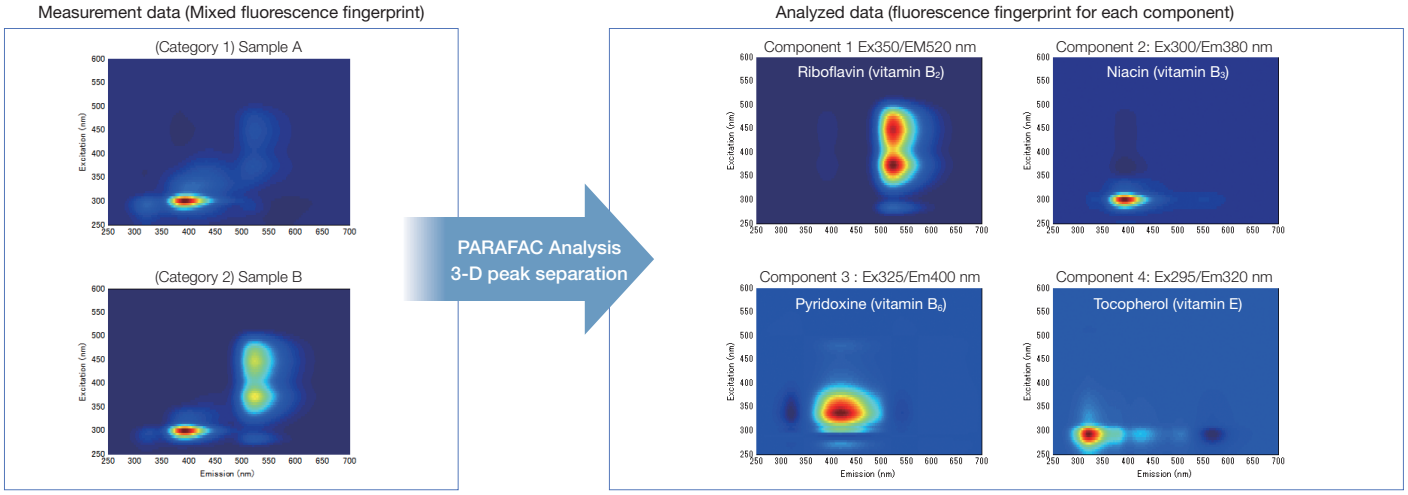
By registering the wavelengths to be focused in the wavelength data table, only the required wavelengths are exported to the Excel sheet.

❸ Data output of eliminate scattering, Eliminate multi-order scattering

For the multivariate analysis of 3D fluorescence spectral data, the setting to exclude the unnecessary scattered light or the data from the secondary light region is available.

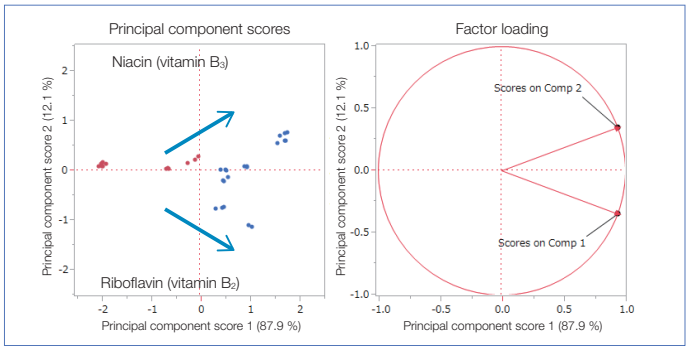
PARAFAC Analysis

A wide range of data processing is possible using commercially available multivariate analysis software. In general, a spectrum obtained for fluorescence fingerprinting contains mixed components. By performing PARAFAC (parallel factor analysis), peaks of three-dimensional fluorescence spectra can be separated to the specified number of components [using Solo 8.1.1 (Eigenvector Research, Inc., USA)]. Since it is compatible with the text data output format used by FL Solutions, PARAFAC analysis can be performed easily. The ratio (score) of each component can be displayed to represent the quantities contained in each sample.



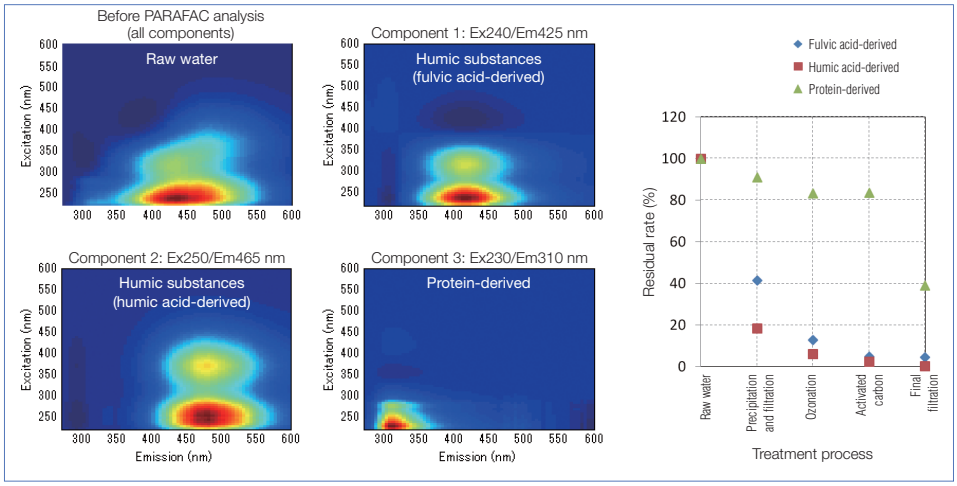
We measured the fluorescence fingerprint of two types of drinks. The fluorescence fingerprints were separated into four components by PARAFAC analysis. From the excitation and emission wavelengths of each component, it was determined that component 1 is riboflavin (vitamin B_2), component 2 is niacin (vitamin B_3), component 3 is pyridoxine (vitamin B_6), and component 4 is tocopherol (vitamin E).

Principal component analysis



Multiple samples were based on riboflavin and niacin in high concentrations and high fluorescence intensity. Principal component scores 1 and 2 obtained by PARAFAC analysis were used for the principal component analysis. The diagram on the left shows the results of the calculation.
JMP 12.2 (SAS Institute Inc., Cary, NC, USA) was used for the analysis. The factor loading diagram indicates that the principal component score 1 is proportional to the total amount of components 1 and 2. For principal component score 2, the negative values are related to component 1, while the positive values are related to component 2.
This analysis technique can be applied for discriminant analysis of unknown samples as well as quality control.

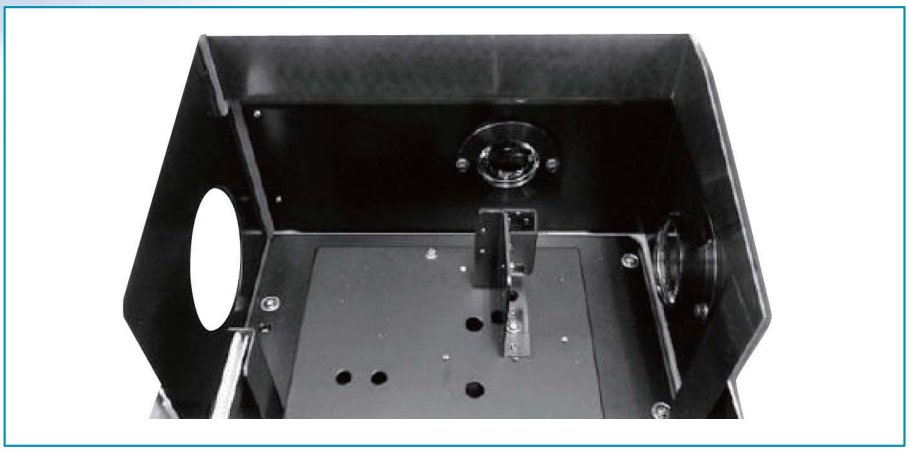
Measurement of humic substances



PARAFAC analysis of purified water and material removal rate in each treatment process

Organic material exists in the aquatic environment mainly in the form of dissolved organic matter (DOM), and it play a variety of roles in aquatic ecosystems. Three-dimensional fluorescence spectra can detect slight differences in peaks and spectral shapes of different samples. Therefore it is considered an effective measurement method for characterization of varieties of dissolved organic matter in the water.
In this study, samples were obtained in each process stage of a water purification plant to verify how much dissolved organic matter is eliminated. PARAFAC analysis was performed to separate peaks into three components: fulvic acid-derived, humic acid-derived, and protein-derived. Residual ratios of dissolved organic matter in each process were calculated based on the scores of each component. The results show that a large portion of the fulvic acid- and humic acid-derived components was eliminated during the precipitation and filtration process, whereas the protein-derived component remained until the final filtration process, following the activated carbon treatment.

A Wide Variety of Accessories to Address Every Application



User-friendly, large sample compartment

With more than 30 accessory options available, the F-7100 brings the most advanced technology in fluorescence analysis to research laboratories.
These accessories help you handle a wide range of demanding measurements and applications. Our accessory lineup includes Auto Sampler, Sipper, Turret, and many other categories designed to meet your analytical needs and improve the efficiency of your lab.

Cell holder

Solid sample holder
5J0-0152

Optimizes the measurement of solid samples, powder samples, or highly concentrated solutions. It is designed to prevent the specular reflection from
the sample surface from entering the emission monochromator. Includes a powder cell.

sample thickness	Within 13 mm

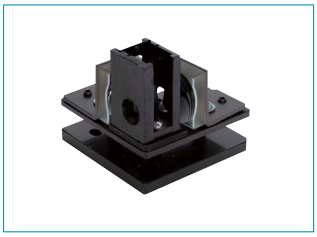
(a powder cell is included)

Absorption cell holder
650-0165

Used for measuring absorbance.
Allows to measure absorbance without influence from fluorescence due to the simultaneous scanning using the excitation and emission wavelengths
(in synchronous spectrum measurement mode).

Compatible cells	10 mm rectangular cell

(Cell is not included)



High sensitivity cell holder
5J0-0124

Doubles sensitivity when used with the 10 mm rectangular cell. Compatible with the 10 mm rectangular cell (not included.)

Compatible cells	10 mm rectangular cell

(Cell is not included)

Micro cell holder
4J1-0133

Used to mount a commercially available micro cell.
＊Cannot be used with a stirrer.

Compatible cells (Starna. Inc.)	Fluorescence cell 3-3.45 Adapter FCA3

(Cell and adapter are not included)

Filter, Attenuator

Automatic Filter Accessory
5J0-0158

Spectra without the effects of higher-order light (1/2, 1/3, 2, 3 ...-order light) can be obtained with automatic insertion of a filter suited to the measurement conditions.

Filters	Excitation side: 3 (WG295, Y44, Y50) Emission side: 3 (WG295, L42, Y52)
Number of installable filters*5	Excitation side: 6 (air for one position) Emission side: 6 (air for one position)

＊5 Additional filters are supplied separately by special order. Additional filters are selected manually by turning off the automatic filter control function.

Filter set
5J0-0151

Cutoff filters can help remove 2nd order wavelengths which cause false peaks. In addition, filters can be used in the excitation and / or emission beam helping to reduce interference bands. The following filters are included

Corning 9863	Band pass filter from 250 to 390 nm only.
WG-295, WG-320, L-37, GG-395, L-42	Cut off filter for the wavelengths shorter than 295, 320, 370, 395, and 420 nm respectively.

Attenuator Set, Fluorescence
251-0081

Used for highly fluorecent materials that need to be analyzed without dilution or by cutting down the source or fluorescence energy.
The set consists of one each 4 %, 8 %, 11 %, 15 %, 23 % and 33 %T screens.

Polarization

Polarization Acc. for UV/VIS 650-0155
Polarization Acc. for VIS 650-0156

Used to measure the polarization angle in the UV/ visible region (with 650-0155) and in the visible region (with 650-0156).
The 650-0156 provides a higher accuracy in the visible region.

Wavelength range	260～700 nm (650-0155) 380～730 nm (650-0156)

Automatic Polarization accessory (5J0-0137, 5J0-0138)

Used in the measurement, calculation, and recording of data for degree of fluorescence polarization and fluorescence anisotropy. Optimized for the measurement of antigen-antibody reactions, biological cells, proteins, enzymes, and other samples in the medical and biochemical fields.

Wavelength range	380 - 730 nm (5J0-0137) 260 - 700 nm (5J0-0138)
Polarizer rotation	0 to 90° automatic repetitive rotation on both excitation and emission sides
Measured items	Change of fluorescence polarizationangle vs. time, fluorescence polarization angle, fluorescence anisotropy

Multiple Sample Measurement

Sample sipper accessory 5J0-0123

Streamlines successive operations of sample sipping, measurement and result printout. Effective for automatic measurement of liquid samples in quality control and clinical chemical analysis.

Cell capacity	Approximately 180 µL	
Carryover	2 % or less	
	Conditions	Sample : 1 mg/L quinine sulfate Blank : 0.1 mol/L dilute sulfuric acid Sipping quantity : 2.5 mL

8-turret cell holder 250-0333

For effective multi-sample measurements. Allows selection of up to eight 10 mm rectangular cells/test tubes for rapid quantitative analysis.

Compatible cells	10 mm rectangular cell, Test tube (outer diameter 10/12 mm and height 105 mm or less)
Cell capacity	3 % or less (when using the same sample and cell)

(Cell is not included)

4-turret cell holder 250-0339

For quantitative analysis when using 10 mm rectangular cells.

Compatible cells	10 mm rectangular cell
Error due to cell changeover	3 % or less (when using the same sample and cell)

(Cell is not included)

Automatic 4-turret sample compartment 5J0-0140

Up to four 10 mm rectangular cells can be automatically switched for rapid quantitative analysis.

Compatible cells	10 mm rectangular cell, Test tube (outer diameter 10/12 mm and height 105 mm or less)
Cell capacity	3 % or less (when using the same sample and cell)

(Cell is not included)

Micro-plate Accessory 5J0-0139

Wavelength spectra, time scan measurements, quantitative calculation and 3-D fluorescence spectra of 96-well microplates can be obtained. Multi-sample measurement throughput can be improved by this technique. Standard cells (10 mm rectangular cell) can also be measured in addition to the microplate measurements. Measurements can be made from a sample volume as small as 300 µL when using a microplate.

Compatible microplate	96 wells (400 µL, flat bottm) ・Prepare microplates separately*4.
Measuring speed	96 wells/60 s (in kinetics measurement mode)
Thermostatic function	Thermostatic water bath connectable 5 to 60 °C (Thermostatic water bath separately available)
Weight	8 kg
Dimensions (mm)	290 (W) × 420 (D) × 230 (H) When mounted in F-7100 : 620 (W) × 730 (D) × 300 (H) (excluding protrusions)

＊4 Compatible microplates are commercially available ones having 96 wells.
Background fluorescence level may be high depending on the selected microplate.

Wavelength extension

Photomultiplier R928F
650-1246

Enables fluorescence measurements in a wavelength range of 220 to 900 nm (220 to 750 nm with the standard photomultiplier).

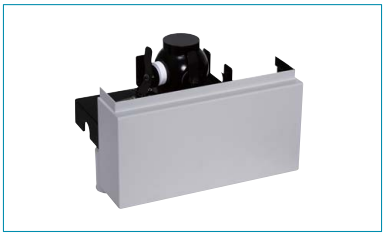
Spectrum correction

Substandard light source
5J0-0135:115 V / 5J0-0136:220 V / 5J0-0530:Taiwan

Used for a wide range spectral correction by combining Spectral correction accy. kit and photomultiplier R928F (650-1246).

Correction range (both EX and EM)	500 ～ 800 nm (with photomultiplier R928F)

Quantum yield measurement unit



Quantum yield measurement unit
5J0-0148

Enables the measurement of the quantum yield of powder samples. This unit consists of 60 phi integrating sphere, powder cell, standard white plate, and quantum yield program. Photomultiplier R928F (650-1246) and sub standard light source (4J1-0135/0145) are required for full range measurements from 240 to 800 nm, but not included.

Temperature control accessory

Thermostatic cell holder
250-0330

Temperature-controlled water keeps the temperature of the 10 mm rectangular cell constant. This
holder is suitable for analysis of biochemical samples.

Temperature range	5～60 ˚C

(Thermostatted water bath and a cell are required but not included.)

Thermostatic cell holder with stirrer
250-0346

A magnetic stirrer is used to stir sample solutions to ensure higher thermal accuracy in measurement.

Compatible cells	10 mm rectangular cell
Stirrer speed	500 ～ 1,200 rpm
Temperature range	5～60 ˚C

(Thermostatted water bath and a cell are required but not included.)

Low temperature accessory
5J0-0112

Used for fluorescence/phosphorescence
measurement at a liquid-nitrogen temperature. The micro-structure of a sample which does not appear at normal temperature can be measured with this accessory.

Sample tube	Outer diameter 5 mm or 8 mm
Measurement temperature	-196 ˚C (Liquid nitrogen temperature)

Electronic Thermostatted Cell Holder, Constant temperature control
5J0-0141:115 V / 5J0-0142:220 V / 5J0-0531:Taiwan

Useful for the analysis of biochemical samples, as a constant temperature can be maintained by an electrically operated controller that enables rapid heating and cooling.

Compatible cells	10 mm rectangular cell
Temperature range	0～70 ˚C

(Dry gas and cell required, but not included.)

Cell holder with programmable temperature control
5J0-0142:115 V / 5J0-0144:220 V / 5J0-0532:Taiwan

Temperature can be maintained or changed using the program function.

Compatible cells	10 mm rectangular cell
Temperature range	0～100 ˚C

(Thermostatted water bath and a cell are required but not included.)

Intracellular cation measurement program

Intracellular cation measurement accessory
5J0-0145

This accessory includes four components (250-0346, 4J1-0143, 650-0116, 4J1-0311)

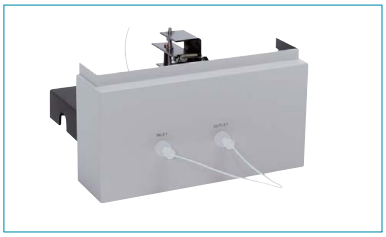
Micro sampling assembly
5J0-0111

Used in combination with the thermostatted cell holder with stirrer (P/N 250-0346). A reagent can be injected by using a micro syringe, without opening the sample compartment. Facilitates the measurement of a reaction process after injecting a reagent.
(Micro syringe is required but not included.)

Intracellular cation measurement
5J0-0361

This software is used for measuring calcium (Ca) in cells together with pH measurement reagents (such as BCECF) along with Ca measurement reagents (Quin 2, Fura 2, Indo 1). Up to 4 sets of measurement wavelengths can be selected, and the entire process from the measurement to the calculation of Ca concentration is automated.

Flow cell



Flow cell unit for 55 µL 250-0331
Flow cell unit for 180 µL 250-0332

Supports high sensitivity measurements with flow cell unit. An increased cell capacity is particularly effective for high sensitivity analysis of elements such as catecholamines when measured in combination with a HPLC system.

Cell capacity	55 µL (250-0331) 180 µL (250-0332)

Cell

Micro cell
650-0113

Low scatter micro cell
650-0171

Used for the measurement of trace samples of about 0.2 mL in size with almost the same sensitivity as those obtained by using a 10-mm cell. The low scatter micro cell using a black quartz mask has a low scatter beam and is effective for high sensitivity analysis of trace samples.

Minimum sample requirement	0.2 mL

Fluorescence cell 123-1012

This is a typical fluorescent cell that is made of quartz which has permeability in the ultraviolet and visible region.

Fluorescence-free cell 018-1001

This fluorescence-free cell uses synthetic quartz with high purity. It is effective for a low concentration measurement lowering fluorescence in the background.

Optional software

Report generator program
5J0-0363

Capable of generating customized reports based on the measurement results. In addition to the typical adjustments such as selection of which items to include in the report, font sizes for the comment section, and graph size and positioning, now even calculations that previously had to be done manually can be executed automatically using the spreadsheet function.

GLP/GMP program
5J0-0362

A program can check that the fluorescence spectrophotometer is operating normally.
It automatically checks sensitivity, stability, baseline correction, and hardware performance.

SPECIFICATIONS

ITEM	DESCRIPTION	
Sensitivity (Raman light of water)	Noise: Background	S/N 20,000 or above*6
	Noise: Peak	1,200 or above*7
Minimum sample volume	0.6 mL (in use of standard 10 mm rectangular cell)*8	
Photometric principle	Monochromatic light monitoring ratio calculation	
Light source	150 W xenon lamp, self-deozonating lamp house	
Monochromator	Stigmatic concave diffraction grating: 900 lines/mm, F2.2 Brazed wavelength: Excitation side 300 nm, emission side 400 nm	
Measuring wavelength range (on both EX and EM)	200 to 750 nm, and zero-order light (Expandable up to 900 nm with optional detector)	
Bandpass	Excitation side: 1, 2.5, 5, 10, 20 nm Emission side: 1, 2.5, 5, 10, 20 nm	
Resolution	1.0 nm (at 546.1 nm)	
Wavelength accuracy	±1 nm	
Wavelength scan speed	30, 60, 240, 1,200, 2,400, 12,000, 30,000, 60,000 nm/min	
Wavelength drive speed	60,000 nm/min	
3D measurement time	3 min*9	
Response	Response from 0 to 98 %: 0.002, 0.004, 0.01, 0.05, 0.1, 0.5, 2, 4 s	
Photometric value range	–9999 to 9999	
Dimensions/weight	Spectrophotometer: 620 W × 520 D × 300 H mm (excluding protrusions)/41 kg	
Working temperature /humidity	15 to 35 °C, 25 to 80 % (condensation not allowed, 70 % or less at 30 °C or higher)	
Power consumption (spectrophotometer)	100, 115, 220, 230, 240 V AC, 50/60 Hz, 380 VA	
FL Solutions program	Standard software	
Data processing unit	PC: Windows	
Printer	Printer compatible with Windows	

*6 EX 350 nm, Slit 10 nm, Response 4 s
*7 EX 350 nm, Slit 5 nm, Response 2 s
*8 Does not require cell spacer; no slit restriction
*9 EX 200 to 750 nm, Sampling interval 10 nm
EM 200 to 750 nm, Sampling interval 10 nm

CE labeled model is available

FUNCTIONS

ITEM	DESCRIPTION
3-dimensional measurement	Contour plotting (fluorescence/phosphorescence), bird's eye view
	Readout of EX/EM spectra from contour
	Peak detection
	Calculation between files (+, –, ×, ÷)
Wavelength scan	Fluorescence/phosphorescence/luminescence spectra
	Synchronous spectra/repetitive measurement/CAT
	Excitation spectrum correction (200 to 600 nm)
	Emission spectrum correction (200 to 600 nm)
	Excitation longer wavelength spectrum correction (500 to 800 nm) Emission longer wavelength spectrum correction (500 to 800 nm) Note: Sub standard light source (option) is necessary.
	Tracing, scale conversion, graph axis conversion
	Smoothing
	Calculation between files (+, –, ×, ÷)
	Differentiation (first to fourth order)
3-dimensional time scan measurement	Contour plotting (fluorescence/phosphorescence), bird's eye view
	Readout of time scan/EM spectra from contour
	Peak detection
	Calculation between files (+, –, ×, ÷)
Time scan measurement mode	Time scan fluorescence/phosphorescence measurement mode (minimum data interval 1.0 ms)
	Phosphorescence attenuation curve measurement
	Rate calculation
	Tracing, scale conversion, graph axis conversion
	Smoothing
	Calculation between files (+, –, ×, ÷)
	Differentiation (first to fourth order)
	Area calculation
Photometry mode	Quantitative analysis (fluorescence/phosphorescence/luminescence)
	Two/three-wavelength calculation
	Calibration curve (linear, quadratic, cubic, polygonal), factor enterable
	Peak ratio, peak area, quantization via differentiation
	Interruption, sample blank measurement, data deletion
	Calibration curve data correction, calibration curve tracing
	Cumulative data averaging
	Statistic calculation
Others	Automatic sensitivity measurement function
	Pre-scan
	Data transport and graph copying to Microsoft Excel
	Print preview function
	FL Intensity Standardization
	File conversion of 3D Scan Data

NOTES 1. A PC set is not supplied as standard equipment.
It should be prepared separately.

Science for a better tomorrow

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CAUTION: For correct operation, follow the instruction manual when using the instrument.
Specifications in this catalog are subject to change with or without notice, as Hitachi High-Tech Science Corporation continues to develop the latest technologies and products for its customers.
NOTICE: The system is For Research Use Only, and is not intended for any animal or human therapeutic or diagnostic use.
These data are an example of measurement; the individual values cannot be guaranteed.

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