

Hitachi HighTech

HITACHI

F-2700

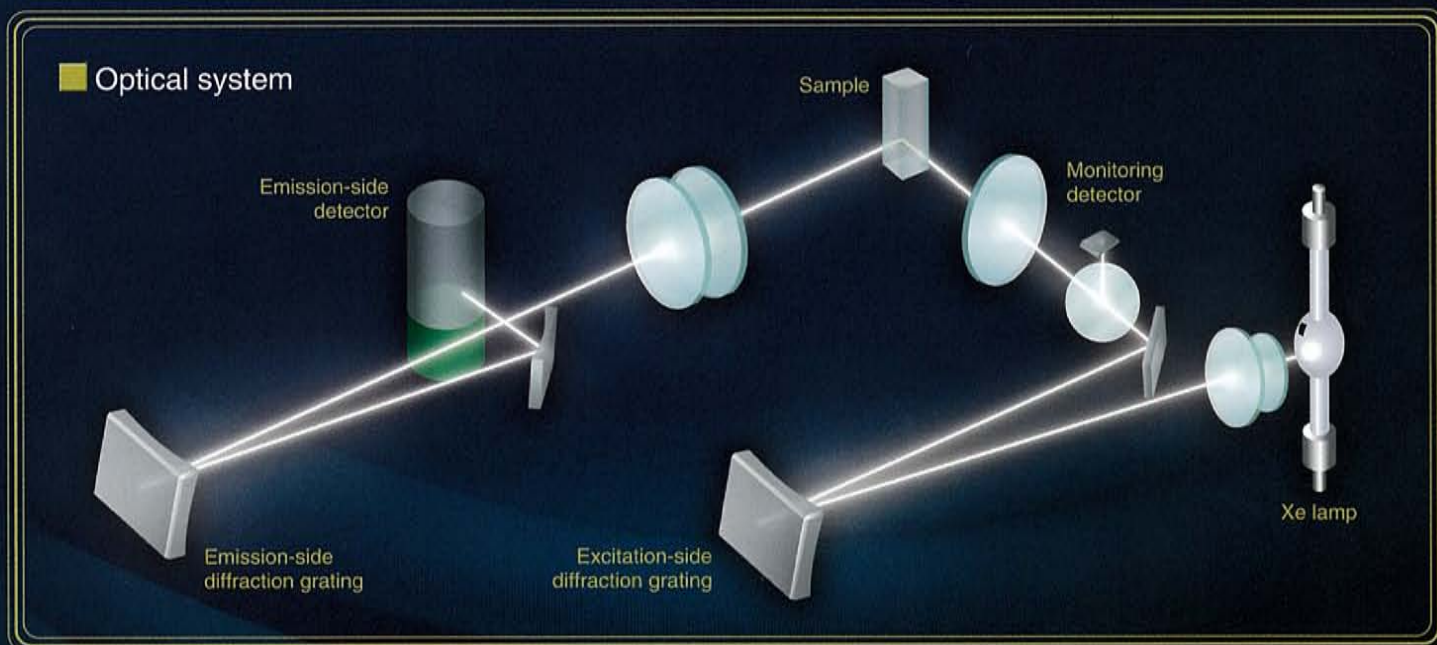
Hitachi Fluorescence Spectrophotometer



Debut of a small fluorophotometer that brings HITACHI technologies together!

The F-2700 Fluorescence Spectrophotometer affords the highest performance, functionality, and operability in its class.

This compact fluorophotometer offers a full range of Hitachi's latest technologies accommodating a wide range of applications.



Accurate zero-point correction function with a wide dynamic range

Reliable technology supporting user measurements

The highest detection sensitivity in its class

(S/N 800 or above)

The result of using a highly efficient optical system

Standard operating panel

PC control is optional. Text input is simple and easy using the large keypad.

Automatic performance monitoring

A variety of accessories



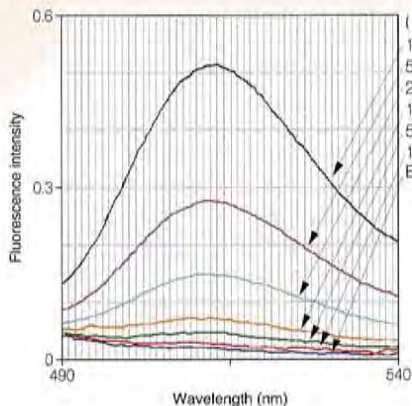
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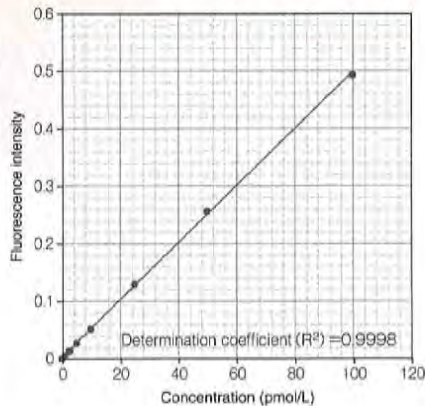
What do you expect from a fluorescence spectrophotometer ?

HITACHI responds to a wide range of needs.

High-sensitivity measurement — the highest detection sensitivity in its class (S/N 800 or above)



Fluorescence spectrum for each fluorescein solution with very low concentration

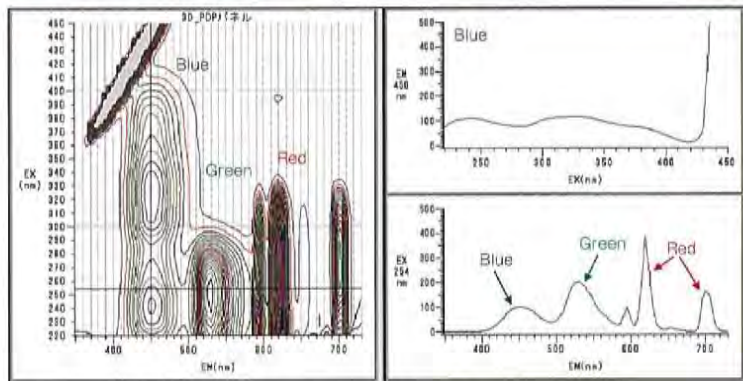


Calibration relationship of very low concentration fluorescein solution

HITACHI's unique high-efficiency diffraction grating and low-noise detection system allow for the measurement of very low concentrations, resulting in a system that effectively measures small amounts of ingredients or samples. The acquired fluorescence intensity is displayed in the range from 0.001 to 9999.

Even with low fluorescence intensity a superior calibration relationship can be achieved, and very small amounts of fluorescein, on the order of 1×10^{-12} mol/L, can be detected. As shown here, the F-2700 produces a superior calibration relationship with a coefficient of determination of 0.9998 in the very low concentration range from 1×10^{-12} to 1×10^{-10} mol/L.

3-D measurement

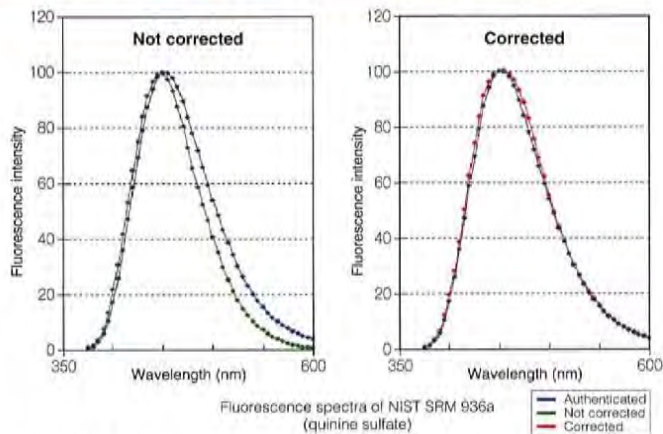


3-D fluorescence spectra is displayed in the plasma display panel

Three-dimensional fluorescence spectra 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 smaller differences among similar samples. The obtained three-dimensional excitation and emission spectra may be observed and stored as two-dimensional data for any wavelength.

※ Measurement of three-dimensional spectra requires PC control.

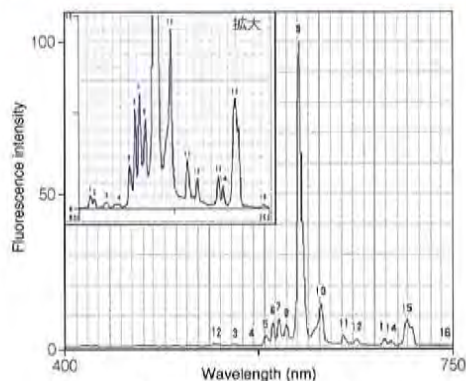
Spectrum correction



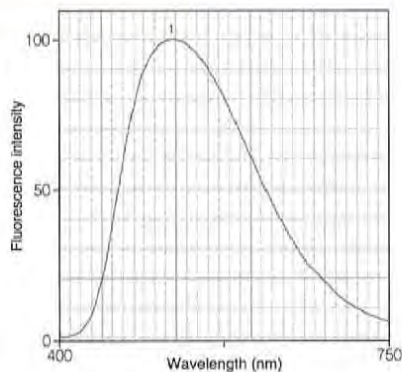
Raw spectra are corrected in view of the wavelength characteristics derived from the light source and the detectors of the spectrum measurement system. Corrections are applied upon comparison with spectra obtained from another measurement system, and quantum yield measurements. According to the options, the F-2700 corrects spectra located in the wavelength range from 220 to 800 nm, on either the excitation or emission side.

※ Spectral correction requires PC control.

Multistage slit



Fluorescence spectrum of Y₂O₃:Eu (fluorescence-side slit: 2.5 nm)

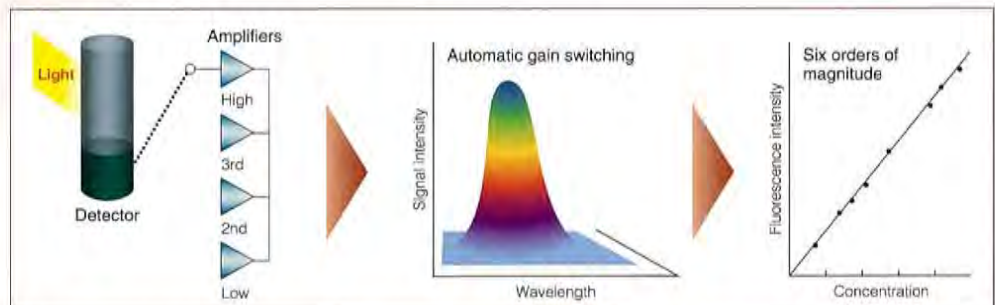
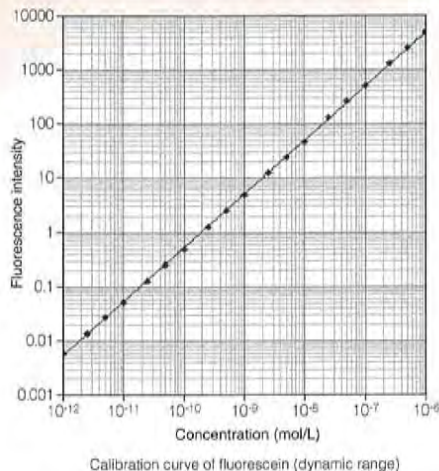


Fluorescence spectrum of a YAG fluorescence substance (fluorescence-side slit: 20 nm)

The multistage slit has four widths between 2.5 and 20 nm. Using the smallest slit width (2.5 nm), high-resolution measurement can be performed with high S/N sensitivity in samples with sharper emission lines. Using the largest slit width (20 nm), high-sensitivity measurement can be performed in samples with wider peaks.

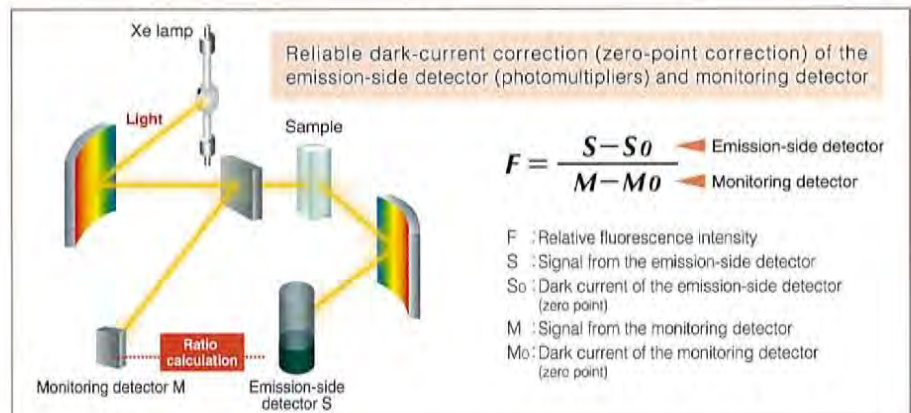
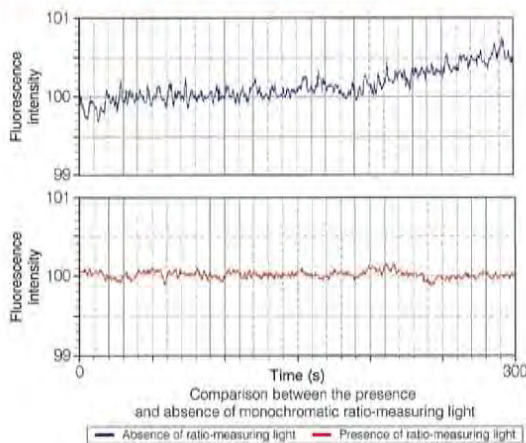
Superior technology behind your measurements
 Resulting from years of experience in building reliable spectrophotometers.

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



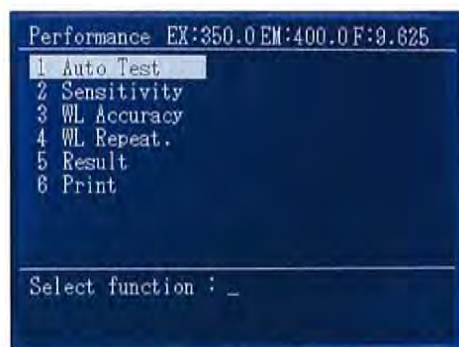
HITACHI fluorescence spectrophotometers have a dynamic range with 6 or more orders of magnitude, resulting from our unique circuit-processing technology. Because Hitachi fluorescence spectrophotometers can switch gains (amplifiers) automatically, measurements can be performed from low to high fluorescence 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 —

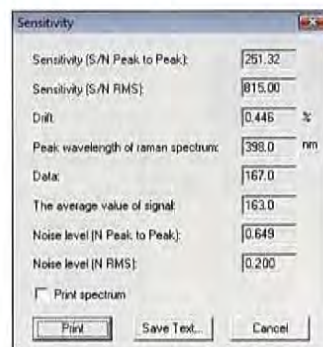


Through the use of a monochromatic light monitoring ratio calculation, the monitoring detector performs corrections according to changes in the light source, resulting in outstanding stability. In addition, dark-current correction is accurately performed during signal processing, because both the monitoring 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.

Standard function to confirm performance



Stand-alone mode menu



PC-operation mode menu and result display

A validation function is built in, which conforms to the General Rules for Fluorometric Analysis of the Japanese Industrial Standards (JIS K 0120).

In the stand-alone mode, a series of tests are conducted in a fully automatic manner; there is no need to remove jigs, etc. Data results can be stored and printed after a performance check.

The following can be confirmed:

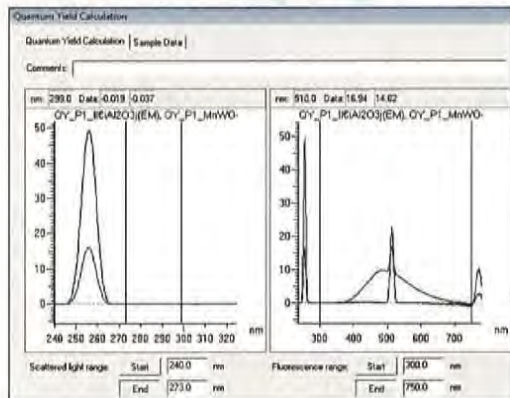
- Sensitivity
- Stability
- Wavelength accuracy (excitation side/emission side)
- Wavelength repeatability (excitation side/emission side)

A variety of systems for many fields

Material field

System for the quantum yield measurement of powder samples

— fluorescent quantum yield measurement of $MgWO_4$ —



Results of the fluorescent quantum yield measurement of $MgWO_4$



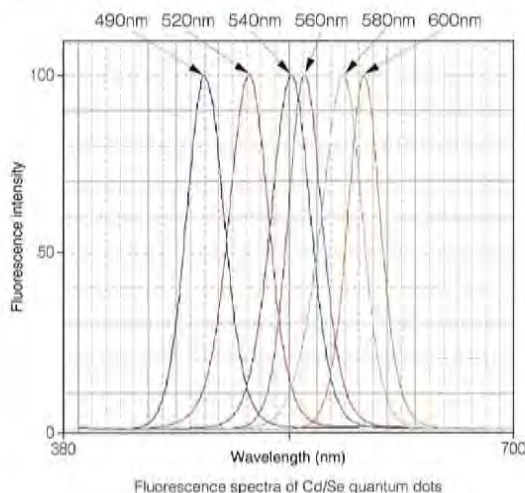
Options

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

The fluorescence quantum yield measurement is performed to evaluate the emission efficiency of organic EL materials, 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 phi-integrating sphere attachment, powder-sample cell, standard white plate, and quantum yield calculation program. In addition to these components, the spectrum correction kit is required. The R928F photomultipliers and sub-standard light source for correction are used for measurement in the long-wavelength region from 600 nm or more. The cut filter is used when the spectrum of secondary light from scattered light overlaps with the fluorescence spectrum of a sample. We have obtained a fluorescence quantum yield of 0.81 for $MgWO_4$, a fluorophore for lamps.

※ Quantum yield measurement requires PC control

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



Fluorescence spectra of Cd/Se quantum dots



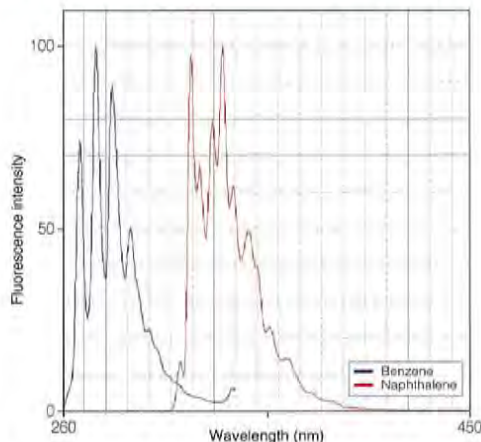
Options

- R928F photomultipliers
- Spectrum correction kit
- Sub-standard light source
- Filter set

The lamps, detectors, and optical elements of a fluorescence spectrophotometer have wavelength characteristics. The raw spectrum data reflect the wavelength characteristics inherent in the apparatus. Therefore, in quantum yield measurements, either a spectrum correction or a comparison with reference spectra obtained from another apparatus is required. The spectrum correction kit (rhodamine B method) and the sub-standard light source are employed for correction of spectra in the region from 220 to 600 nm and 600 nm or more, respectively. We measured the fluorescence spectra of Cd/Se quantum dots. Quantum dots, comprised of semiconductor materials several nanometers in diameter, have attracted attention because of their unique ability to control the fluorescence wavelength via diameter, and are being applied to fluorescence probes and solar cells. The spectrum correction helps to obtain accurate fluorescence properties.

※ Spectrum correction requires PC control

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



Emission spectra of cryogenic benzene and naphthalene



Option

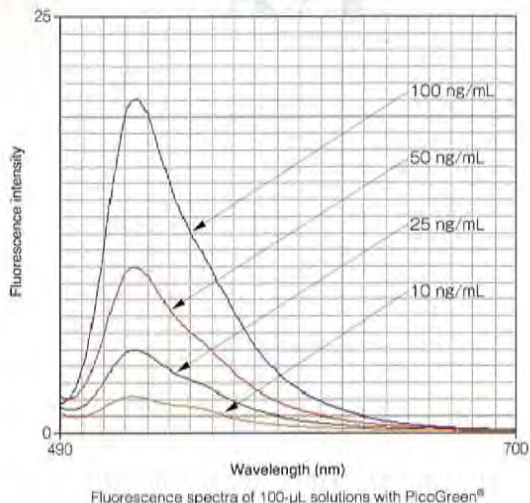
- Attachment device for low temperatures

Using the attachment device for low temperatures, fluorescence analysis may be performed at the temperature of liquid nitrogen ($-196^{\circ}C$). Samples may then be measured for fine structure not appearing at ordinary temperatures. The sample is frozen within a synthetic-silica sampling tube immersed in a Dewar vessel filled with liquid nitrogen. An included sampling tube may be used; either 5 mm or 8 mm in outer diameter can be selected, according to the sample volume and sensitivity.

Biological field



System for measurement of very small sample amounts — measurement of DNA with PicoGreen® —



Option
• Microcell holder

In the biological field, samples such as DNA often cannot be obtained in sufficient amounts. Therefore, equipment that measures trace amounts of samples is desired. By using the F-2700 along with the microcell holder a sample amount as small as 100 µL can be measured.

The figure on the left shows the measurement of double-stranded DNA with PicoGreen®.

PicoGreen® can individually quantify double-stranded DNA with high sensitivity, without being affected by RNA. PicoGreen® can also quantify single-stranded DNA, proteins, or other molecules coexisting in the sample.

Low noise spectra can be obtained from a sample amount as small as 100 µL. This system is most suitable for the confirmation of spectral shapes.

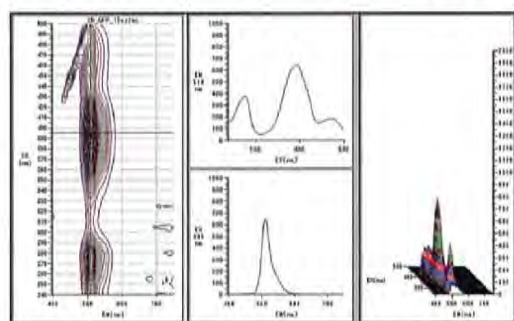
In the determination of detection sensitivity and quantification accuracy, the microcell may be used for a minimal sample volume of 200 µL (standard type, P/N650-0116; low-scattering type, P/N650-0171).

Even with the microcell, high sensitivity similar to the 10mm cell can be achieved.

※Micro cell is required.



System for measurement under constant temperature — measurement of green fluorescent protein (GFP) —



Three dimensional fluorescence spectra of GFP



Options
• Stirrer-equipped thermostat cell holder
• Microcell

Typically, an increase in the temperature of a sample by 1°C causes a decrease in its fluorescence intensity by 1 to 2%. In addition, in the biological field, samples are measured in a similar condition to in vivo environment. Highly temperature-dependent samples and biological specimens should be measured under constant temperature using a thermostat cell holder.

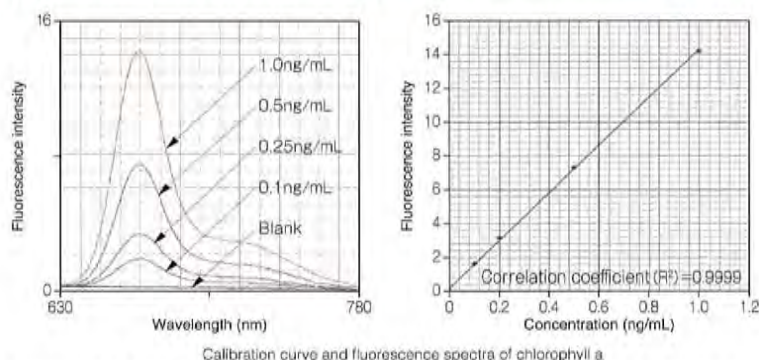
The example shown here displays the fluorescence properties of green fluorescent protein (GFP). GFP is a fluorescent protein existing in Aequorea victoria, which is essential for measurements of intermolecular interactions (FRET, BRET), bioimaging studies, etc.

We measured the three-dimensional fluorescence spectra of GFP using the microcell with a stirrer. Since the sample solution is stirred with a magnetic stirring bar, measurements can be conducted with a greater accuracy in temperature.

Environmental field



Measurement of chlorophyll a

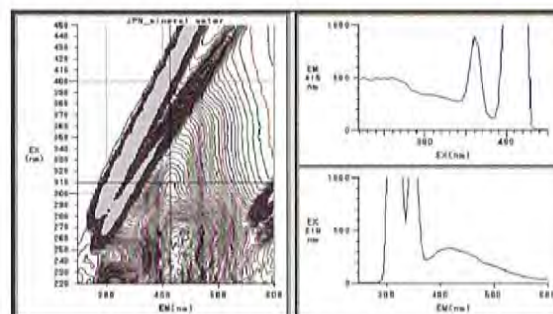


Calibration curve and fluorescence spectra of chlorophyll a

Chlorophyll a is used for the quantification of aquatic phytoplankton, and is measured as a bioactivity index.

Analogous compounds, such as pheophytin a can also be individually measured with high sensitivity by the fluorescence method, due to their difference in excitation and emission spectra.

Measurement of humic substances



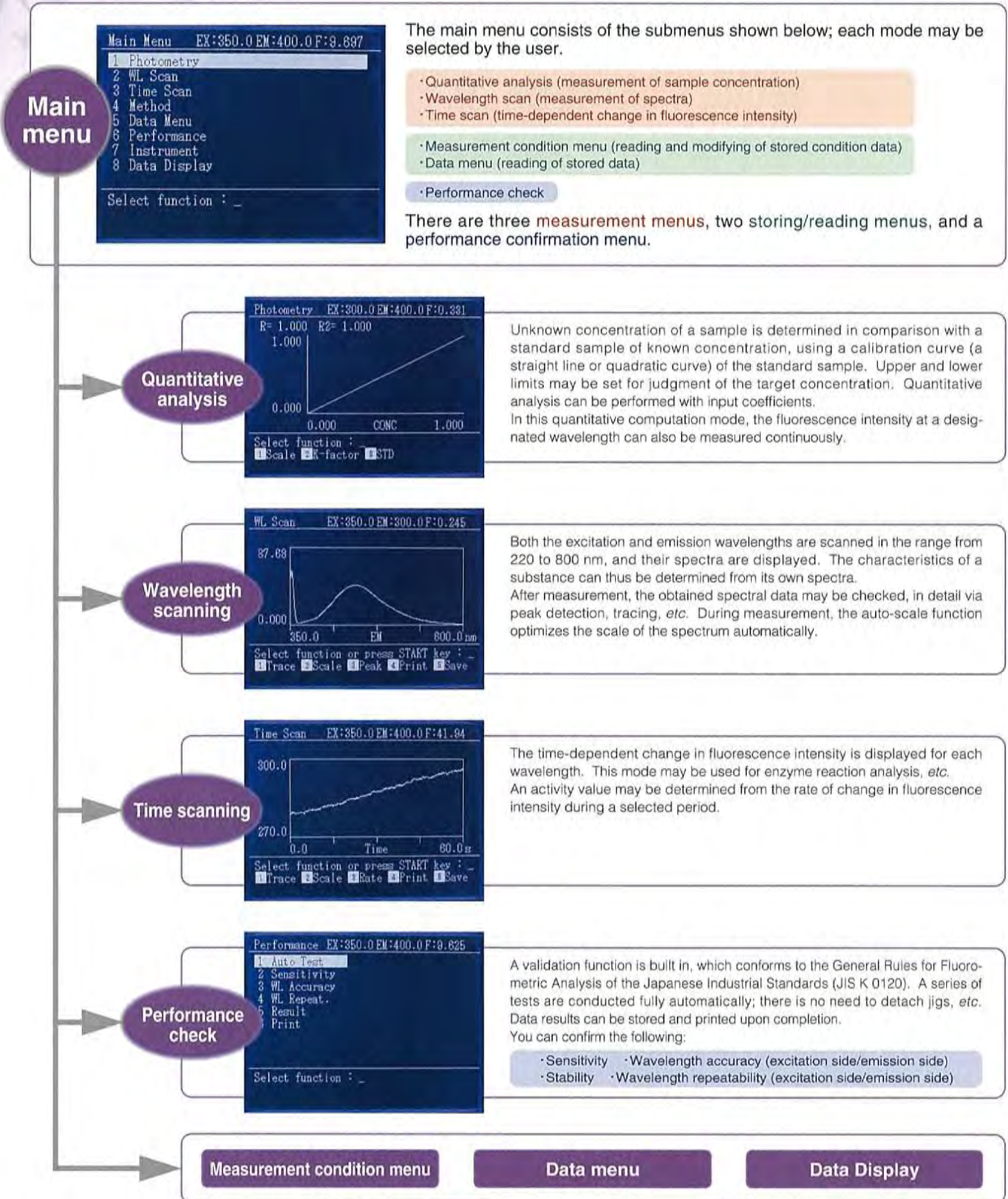
Three dimensional fluorescence spectra of humic substances in mineral water

Humic substances are measured as an index of the organic compounds existing in water.

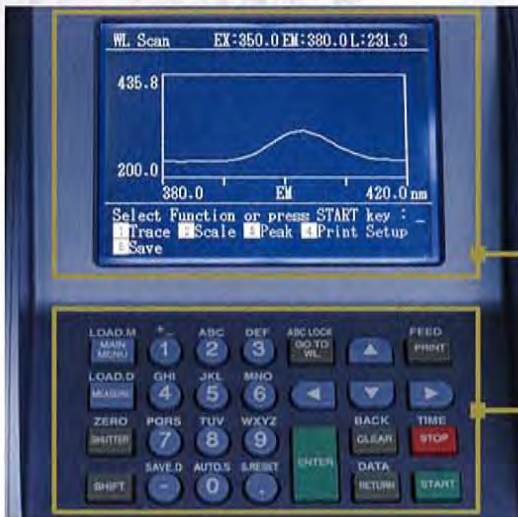
With a very high sensitivity of the F-2700, it is possible to measure organic compounds existing in mineral water at very low concentrations.

PC-less operation saves working space

Sophisticated measurement functions with simplified operation



Large high-resolution LCD displays data clearly!



Easy-to-use interface!

- Interactive communication
- Requiring less key selection
- Short-cut keys

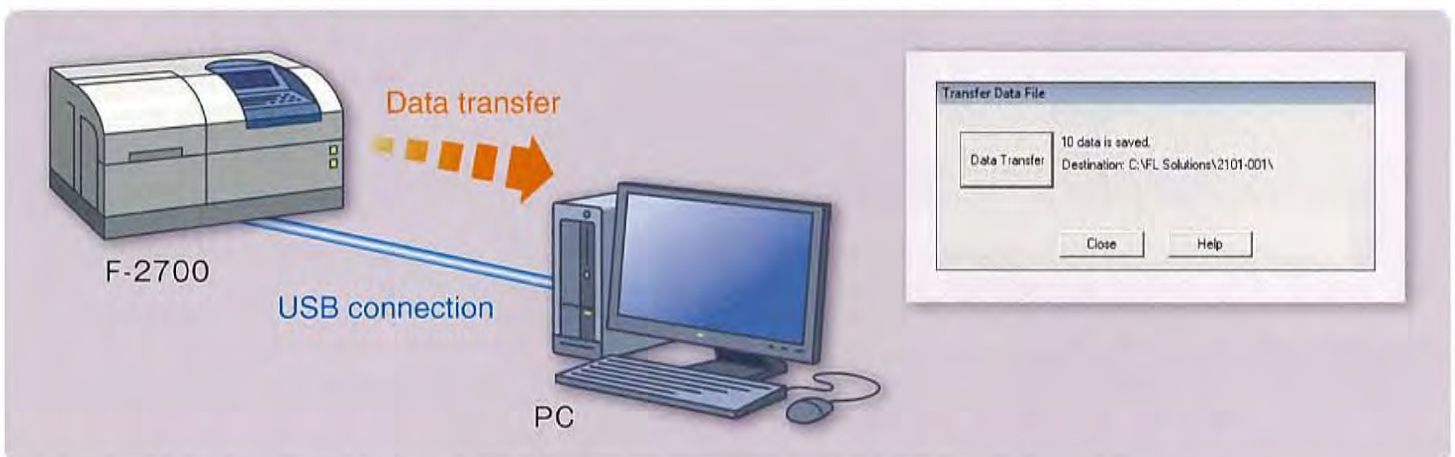
A PC is not required for fluorescence measurements, because the built-in high-resolution LCD displays easy-to-read data.



The keypad has soft and well-defined buttons, which are designed to minimize input errors. The easy-to-use interface enables the user to perform fluorescence analysis without difficult operation.

Storage of data with measurement conditions and results!

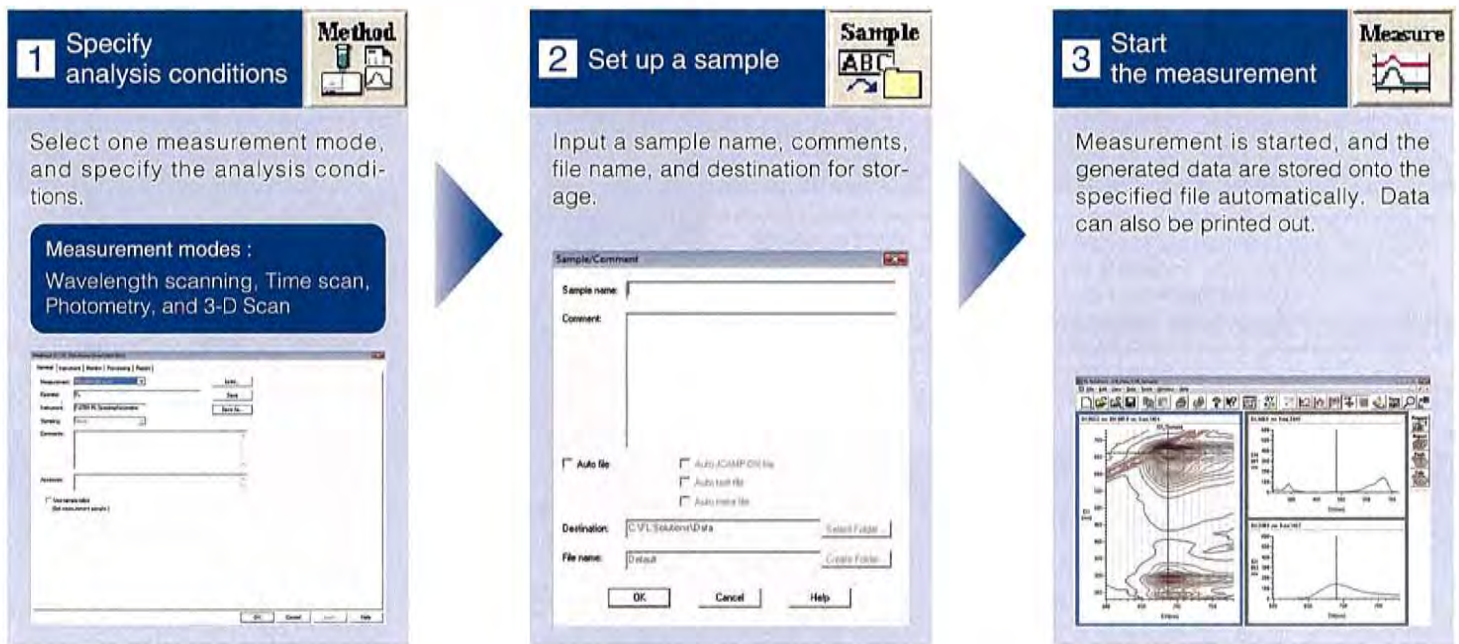
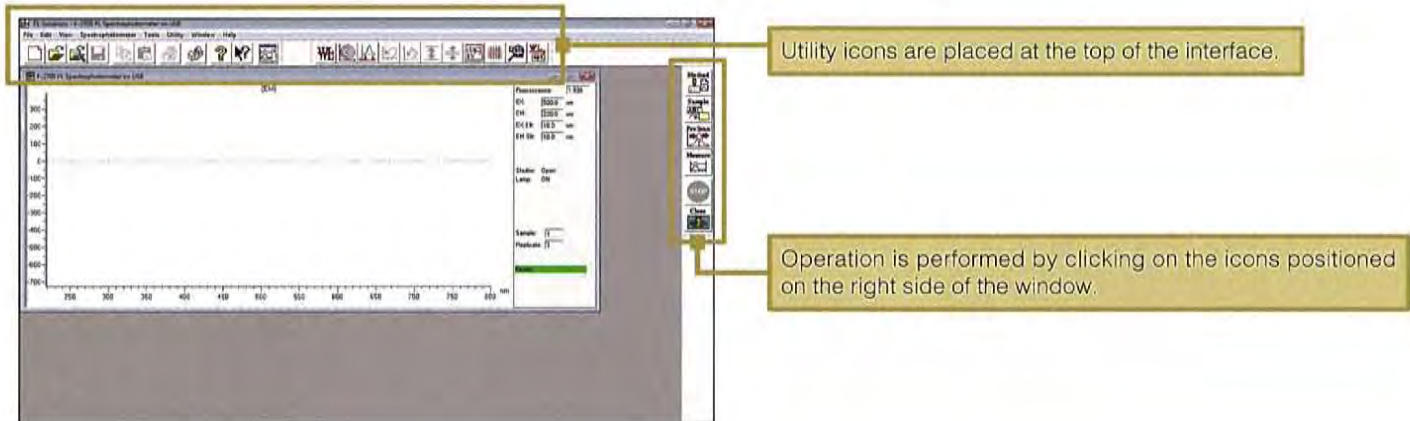
Data can be backed up to a PC via USB connection.



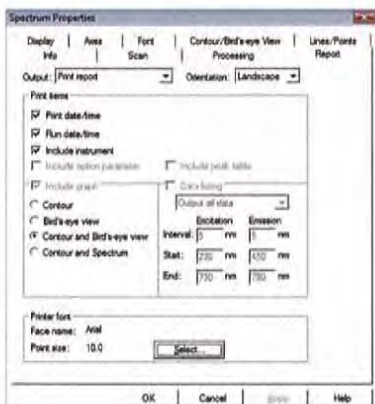
The internal memory of the F-2700 can store up to 50 sets of measurement conditions and 80 sets of measurement result data. Data can be backed up onto a PC via USB connection by using FL Solutions (optional). The FL Solutions program can be run with PC-stored data to perform an overlay of spectra, averaging, and other types of data processing. Export function for Microsoft® Excel®, etc is available.

Additional functionality with PC control
 FL Solutions supports various measurements

Very simple operation! Samples can be measured in three steps.



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.

New functions for improved operability!

Many different data-processing functions

— four new data-processing functions have been added to the conventional functions of its predecessor, the F-2500 —

Conventional data-processing functions



New data-processing functions



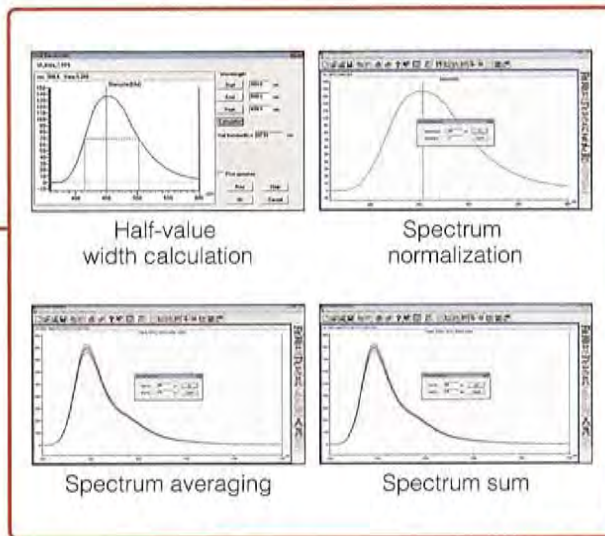
Half-value width calculation Spectrum normalization Spectrum averaging Spectrum sum

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.

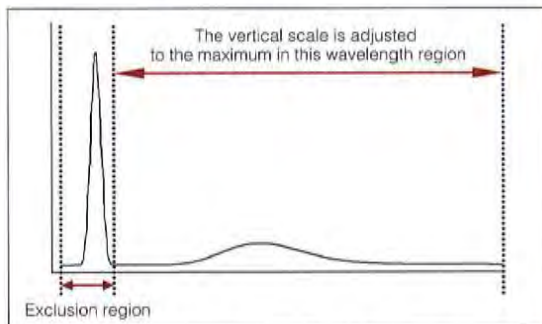
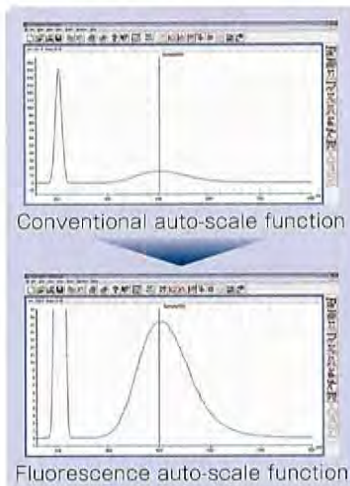
The half-value width calculation function can provide half-value widths of spectra, and support characteristic evaluations of *de novo* synthesized fluorescence substances.

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 —



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



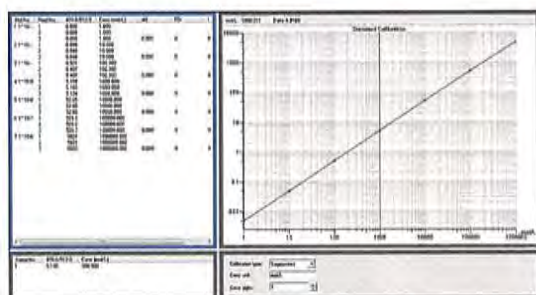
During spectrum measurement, the scale can be optimized by the auto-scale function, as needed. It is not necessary to input the scale range before starting a measurement.

Scale return icon



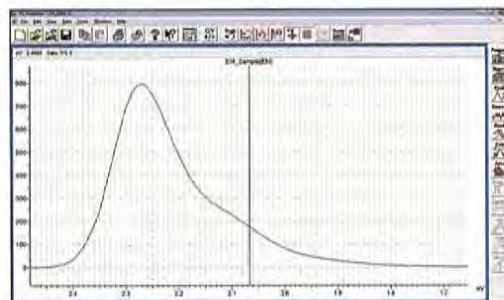
A temporarily enlarged or reduced scale may be restored to the previous condition, at one touch of a button.

Addition of new scale functions



log scale (vertical axis)

Measurement results may be confirmed on a log scale. Due to the dynamic range, a calibration curve may be drawn over a wide range.



eV scale (horizontal axis)

The horizontal axis can display energy (eV) as well as wavelength (nm) and wave value (Kcm^{-1}).

A Wide Variety of Accessories for Every Application



A wide variety of accessories with more than 30 options brings the most advanced technology of the 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, etc, designed to meet your analytical needs and improve the efficiency of your lab.

Cell holder



Solid sample holder
650-0161

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

(Cell and adapter are not included)

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 ~ 700nm (650-0155)
380 ~ 730nm (650-0156)

Filter, Attenuator



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 420nm respectively.



Attenuator Set, Fluorescence
251-0081

Used for highly fluorescent 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.

Advanced Technologies Supporting Cutting-Edge Fluorescence Analysis

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
<small>(Thermostatted water bath and a cell are required but not included.)</small>	



**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
<small>(Thermostatted water bath and a cell are required but not included.)</small>	



**Cell holder with programmable
temperature control
5J0-0143 (115V)
5J0-0144 (220-240V)**

Effective for the analysis of biochemical samples as temperature can be maintained or changed by using the program function.

Compatible cells	10 mm rectangular cell
Temperature range	0~100°C
<small>(Thermostatted water bath and a cell are required but not included.)</small>	



**Low temperature accessory
4J1-0105**

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 5mm or 8 mm
Measurement temperature	-196°C (Liquid nitrogen temperature)

Multiple Sample Measurement



**Auto sipper
4J1-0124**

This computer-controlled sample sipper is provided with a sample recovery function and other versatile functions. In combination with an autosampler this accessory provides advanced automation and labor saving in sample preparation.

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



**AS-1010 Auto sampler
2J1-0121 (115V)
2J1-0122 (220-240V)**

In combination with the auto sipper or in flow injection analysis, AS-1010 is used for multiple sample measurement. A suction needle can be moved in three directions X, Y and Z.

Sample tube size	Outer diameter 12 mm, height 105 mm Outer diameter 15 mm, height 105 mm (Option)
<small>(Sample tube is not included.)</small>	



**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)
<small>(Cell is not included.)</small>	



**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)
<small>(Cell is not included.)</small>	

Wavelength extension



**Photomultiplier R928F
650-1246**

Enables fluorescence measurements in a wavelength range of 220 to 800 nm (220 to 730 nm with the standard photomultiplier).

Spectrum correction



**Spectral correction acy Kit
4J1-0137**

Enables a spectral correction from 220 to 600 nm by using Rhodamine B.

Correction range (both EX and EM)	220 ~ 600 nm (with standard photomultiplier)
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**Substandard light source
4J1-0145(115V)
4J1-0135(220-240V)**

Used for a wide range spectral correction by combining Spectral correction acy. kit (4J1-0137) and photomultiplier R928F(650-1246)

Correction range (both EX and EM)	500 ~ 800 nm (with photomultiplier R928F)
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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)
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Quantum yield Measurement unit



**Quantum yield measurement unit
4J1-0139**

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 800nm, but not included.

Intracellular cation measurement program



**Intracellular cation measurement accessory
4J1-0141**

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



**Micro sampling assembly
4J1-0143**

Used in combination with the thermostated 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
program 4J1-0311**

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.

Specifications

Sensitivity	S/N 800 or above (RMS) S/N 250 or above (Peak to Peak) Raman light of water: excitation wavelength, 350 nm; slit width, 5 nm; and response, 2 s
Minimal sample amount	0.6 mL (with use of the standard 10 mm rectangular cell)
Photometric principle	Monochromatic light monitoring ratio calculation
Light source	150-W Xenon lamp (self-deozone lamp house)
Spectrometer	Aberration-corrected concave diffraction grating: 900 lines/mm Blaze wavelength: 300 nm (excitation side), 400 nm (fluorescence side)
Wavelength measurement range (excitation side and emission side)	220 to 730 nm, and zero-order light (wavelength display: 220 to 800 nm, and zero-order light; expandable up to 800 nm with the optional detector)
Wavelength accuracy	± 3 nm
Wavelength scan speed	60, 300, 1500, 3,000, and 12,000 nm/min (12,000 nm/min only under PC control; 1,500 nm/min for prescan)
Response rate	Response of 0 to 98%: 0.04, 0.08, 0.4, and 2 s
Wavelength drive speed	12,000 nm/min
Slit width (both excitation and emission)	2.5, 5, 10, and 20 nm (four stages)
Photometric value range	-9999 to 9999
Dimensions (spectrophotometer)	600 (W) x 503 (D) x 343 (H) mm, excluding protrusions
Weight (spectrophotometer)	Approximately 41 kg
Ambient temperature/humidity	15 to 35°C/25 to 80% (condensation not allowed, 70% or less at 30°C or higher)
Power source (spectrophotometer)	100, 115, 220, 230, and 240 V AC, 50/60 Hz
Power consumption (spectrophotometer)	400 VA
Software control	FL Solutions (optional, PC required)

Functions

Item	Remarks	Stand alone	FL Solutions (under PC)	Item	Remarks	Stand alone	FL Solutions (under PC)	
Quantitation	Quantitative analysis	○	○	Wavelength scan	Area calculation		○	
	2/3-wavelength calculation	○	○		Spectrum normalization		○	
	Calibration curve (linear/quadratic)	○	○		Spectrum averaging		○	
	Peak ratio		○		Half-value width calculation		○	
Wavelength scan	Peak area, quantification by differentiation		○	Time scan	Fluorescence time scan measurement (minimal interval: 0.1 s)	○	○	
	Fluorescence/emission spectra	○	○		Rate calculation	○	○	
	Synchronous spectra/repetitive measurement/CAT		○		Trace, scale conversion	○	○	
	Excitation-side spectrum correction (220 to 600 nm)		○		Graph axis change		○	
	Emission-side spectrum correction (220 to 600 nm)		○		Smoothing		○	
	Excitation-side long-wavelength spectrum correction (500 to 800 nm)		○		File-to-file calculation (addition, subtraction, multiplication, and division)		○	
	Emission-side long-wavelength spectrum correction (500 to 800 nm)		○		Differentiation (linear to biquadratic)		○	
	Note: The sub-standard light source is required.				Area calculation		○	
	Trace, scale conversion	○	○		3-D function	3-dimensional measurement		○
	Graph axis transformation		○		Others	Automatic sensitivity measurement	○	○
Smoothing		○	Measurement of wavelength accuracy and wavelength setting repeatability	○		○		
File-to-file calculation (addition, subtraction, multiplication, and division)		○	Prescan			○		
Differentiation (linear to biquadratic)		○	Data storage capacity (sets)	○ (Up to 50)		○		

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NOTICE: For proper operation and safety, follow the instruction manual when using the instrument.

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

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