Hitachi High-Tech
HITACHI

F-7000/2710

Hitachi Fluorescence Spectrophotometer

Hitachi, The Value Leader in Fluorescence Spectroscopy

F-7000

The Hitachi F-7000 Fluorescence Spectrophotometer surpass the competition with its superior performance, functionality, and reliability. Designed to the F-7000's ultra high sensitivity and high-speed scanning provide unparalleled performance.

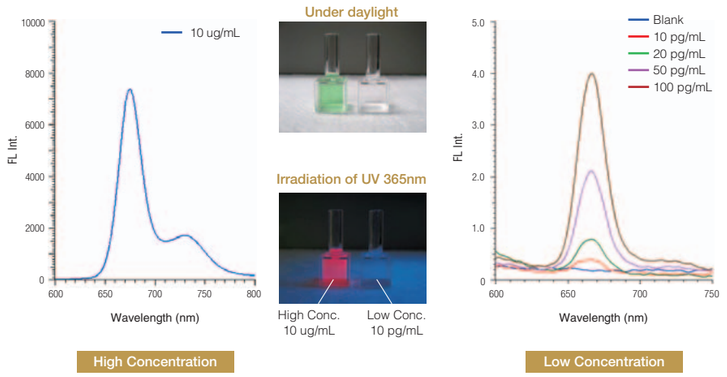
Feature 1 Ultra High-sensitivity (S/N 15,000)

Feature 2 Ultra High-Scanning speed (60,000 nm/min) ideal for 3-D measurement

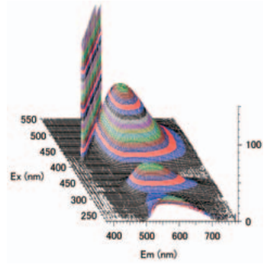
Feature 3 Wide photometric range (6 or more order of magnitude)

Feature 4 A wide variety of accessories for various application such as a 96-well microplatereader

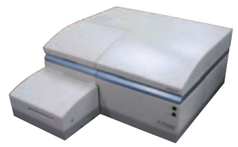
Measurement of ultra trace level of Chlorophyll a (Example of Ultra High-sensitivity)



3-D Measurement spectrum



Microplate reader accessory



F-2710

The Hitachi F-2710 Fluorescence Spectrophotometer affords the highest performance, functionality, and operability in the entry class.
It is ideal choice for a wide range applications from teaching to biotech and material research.

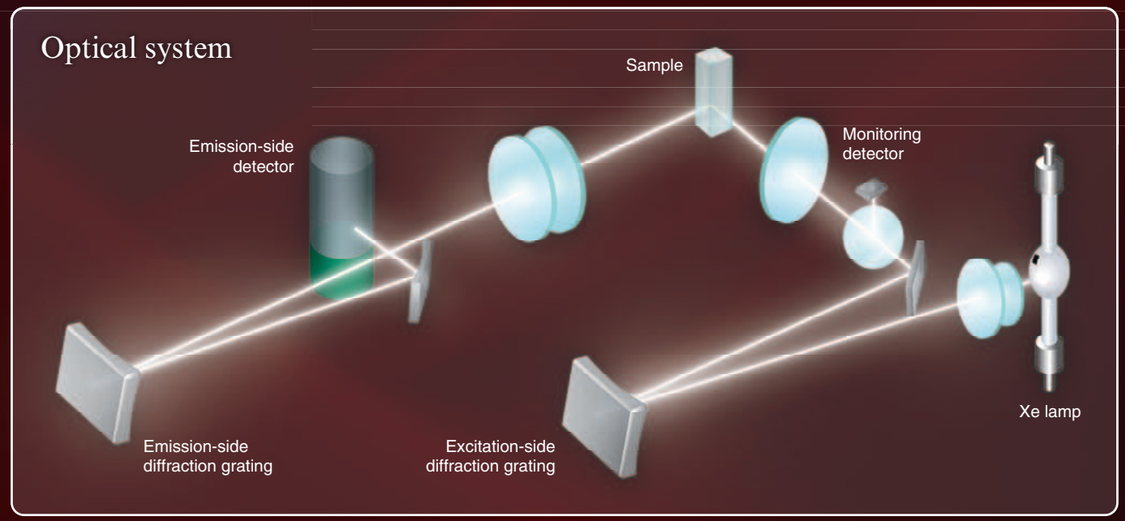
Feature 1 High-sensitivity (S/N 10,000)

Feature 2 High-Scanning speed (12,000 nm/min)

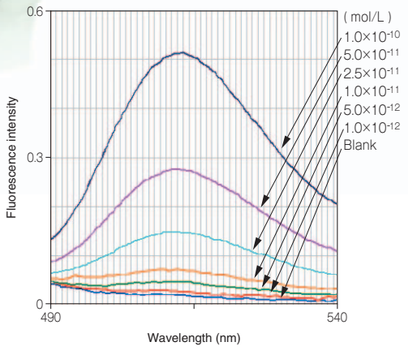
Feature 3 Wide photometric range (6 or more order of magnitude)

Feature 4 FL Solutions Program is standard accessory (including 3-D measurement program)

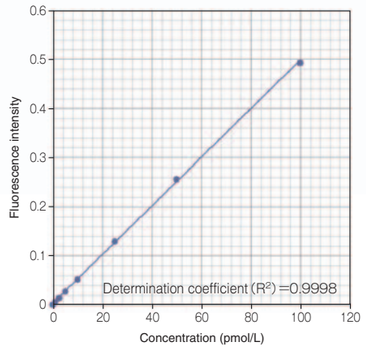
Optical system



F-7000 / F-2710 High-sensitivity measurement — The highest detection sensitivity



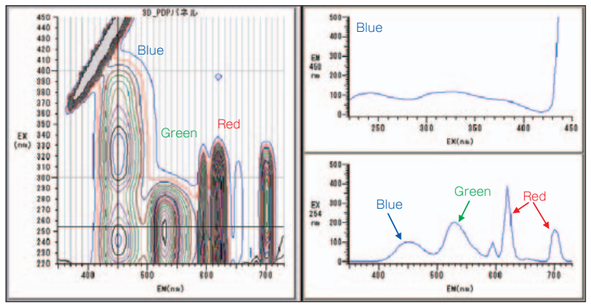
Fluorescence spectrum for each fluorescein solution with very low concentration



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 x 10^{-12} mol/L, can be detected. As shown here, the F-7000 and F-2710 produces a superior calibration relationship with a coefficient of determination of 0.9998 in the very low concentration range from 1 x 10^{-12} to 1 x 10^{-10} mol/L.

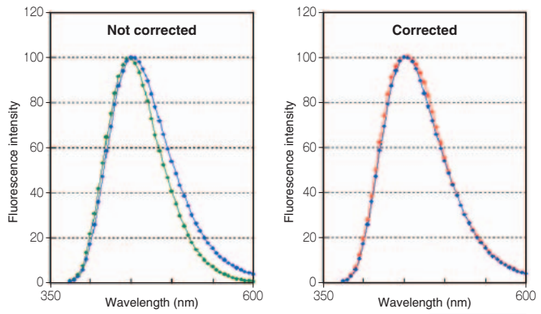
F-7000 / F-2710 3-D measurement



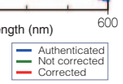
3-D fluorescence spectra is displayed in the plasma display panel

3-D 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 3-D excitation and emission spectra may be observed and stored as 2-D data for any wavelength.

F-7000 / F-2710 Spectrum correction

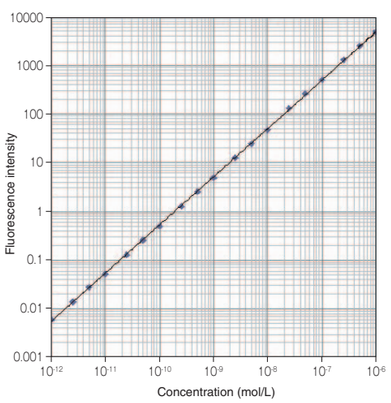


Fluorescence spectra of NIST SRM 936a (quinine sulfate)

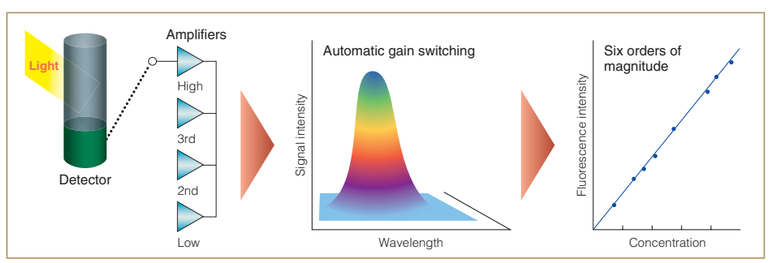


Raw spectra are corrected in view of the wavelength characteristics derived from the light source and the detectors of the spectrum measurement system. Corrections are applied upon comparison with spectra obtained from another measurement system, and quantum yield measurements.

F-7000 / F-2710 Wide photometric range — The dynamic range has 6 or more orders of magnitude —

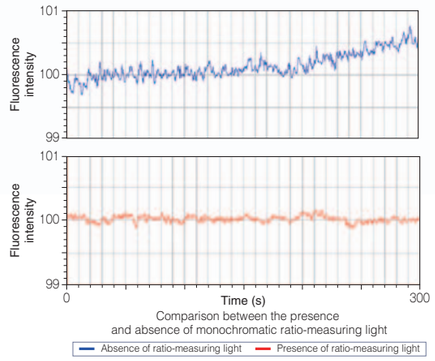


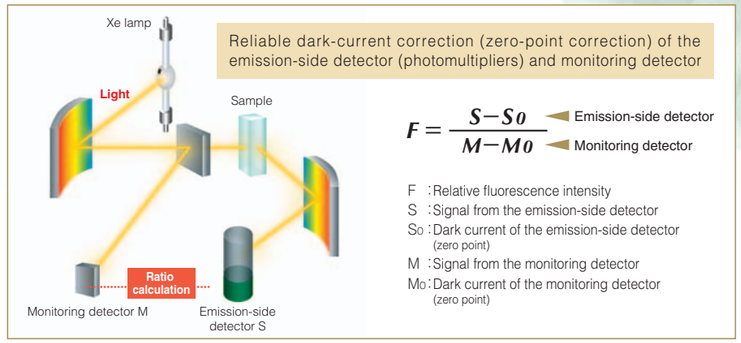
Calibration curve of fluorescein (dynamic range)



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.

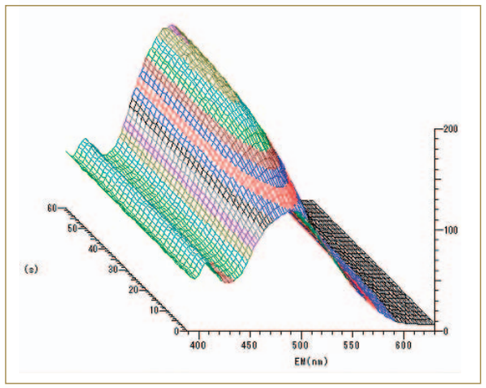
F-7000 / F-2710 Accurate zero-point correction — HITACHI zero-point correction in detector monitoring and reliable measurement of weak fluorescence —





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.

F-7000 High-Speed Scan at 60,000 nm/min — Example of reaction tracing with a spectrum

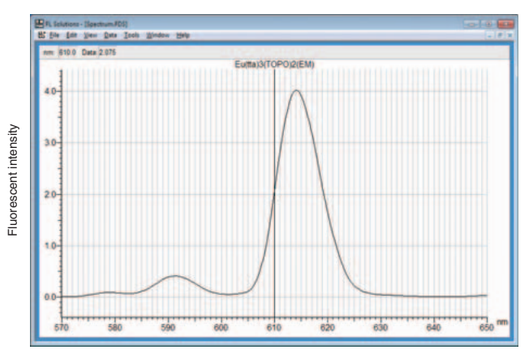


3-D time scan spectrum of coumarin for environmental applications

The fast-speed scanning enables users to carry out measurements that have been difficult with conventional instruments. In this example, an isomerization process of coumarin in kerosene was traced by spectrum measurement at 2-second intervals and displayed as a 3-D time-scan spectrum. This is a new function in the F-7000.
Previously, a quick reaction which occurs within 1 minute could be measured only by using the fixed-wavelength method. The F-7000 is capable of following such a quick reaction because of its fast scanning, measuring the entire wavelength range within 1 second.

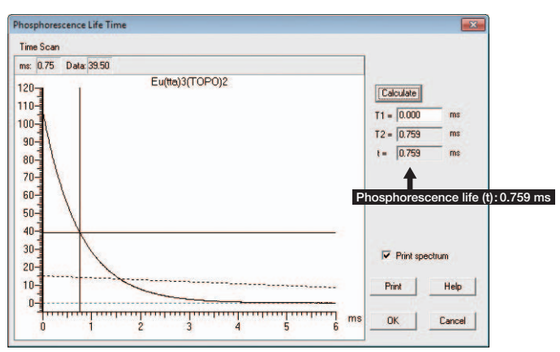
F-7000 Phosphorescence measurement — Rare earth element complex (Eu chelate)

The example below shows the phosphorescence spectrum and lifetime measurement of the Eu $(tta)_3$ $(TOPO)_2$ complex, a rare earth element.



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

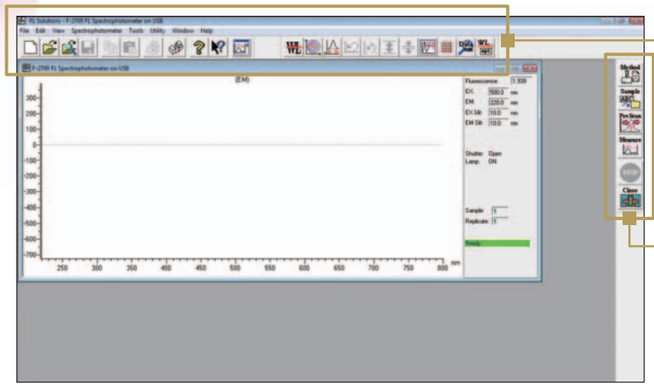
With the F-7000, the analysis of phosphorescence life of 1 ms order can be performed at room temperature without special accessories.



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

FL Solutions supports various measurements

F-7000 / F-2710 Very simple operation! Samples can be measured in three steps



Utility icons are placed at the top of the interface.

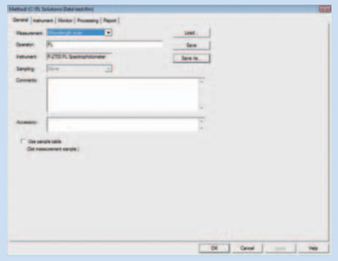
Operation is performed by clicking on the icons positioned on the right side of the window.

1 Specify analysis conditions

Method

Select one measurement mode, and specify the analysis conditions.

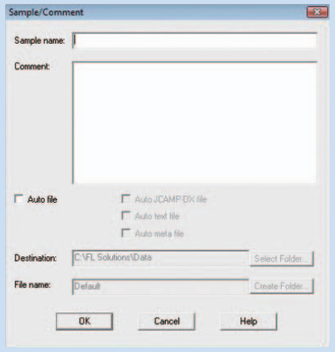
Measurement modes :
Wavelength scanning, Time scan, Photometry, and 3-D Scan



2 Set up a sample

Sample

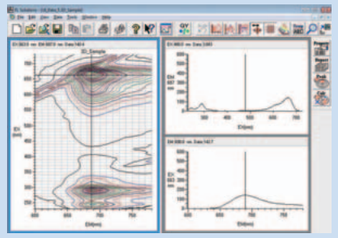
Input a sample name, comments, file name, and destination for storage.



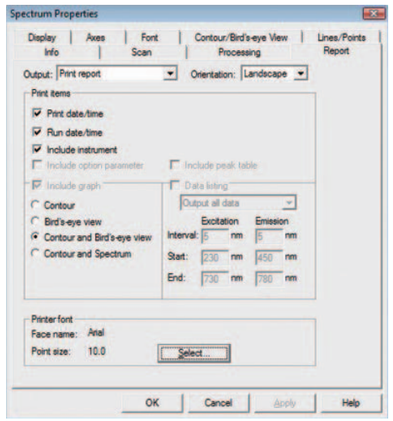
3 Start the measurement

Measure

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



F-7000 / F-2710 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!

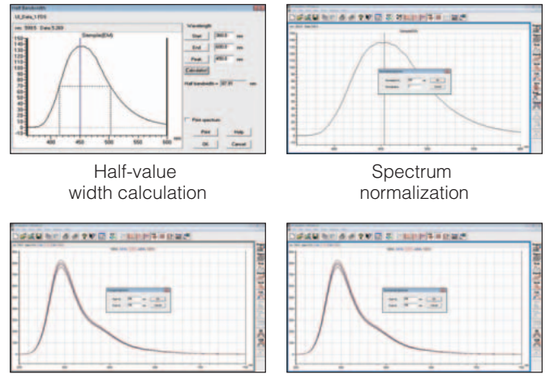
F-2710 Many different data-processing functions

— 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

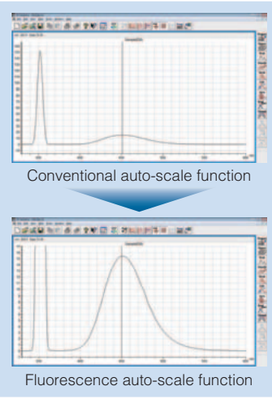
Half-value width calculation | Spectrum normalization | Spectrum averaging | Spectrum sum

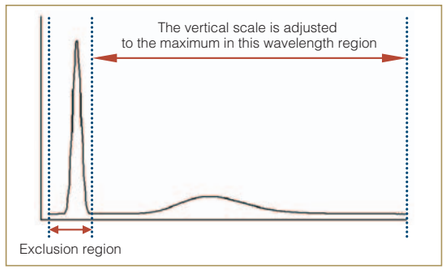


In addition to the conventional data-processing functions-peak detection, smoothing, differentiation, four basic arithmetic operations, area calculation, and lifetime calculation, four new functions are now available.

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.

F-2710 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

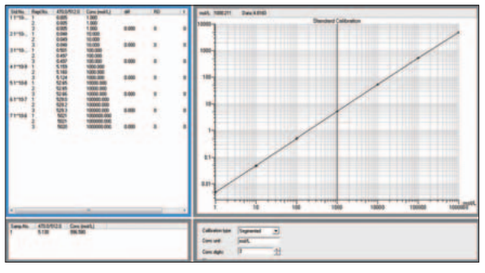
During spectrum measurement, the scale can be optimized by the auto-scale function, as needed. It is not necessary to input the scale range before starting a measurement.

◆ Scale return icon

Scale

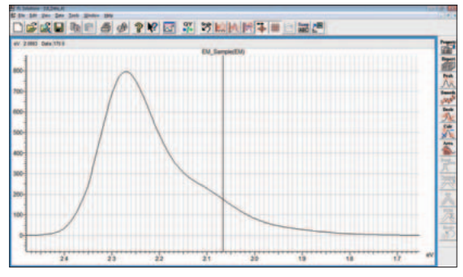
A temporarily enlarged or reduced scale may be restored to the previous condition, at one touch of a button.

F-2710 Addition of new scale functions



log scale (vertical axis)

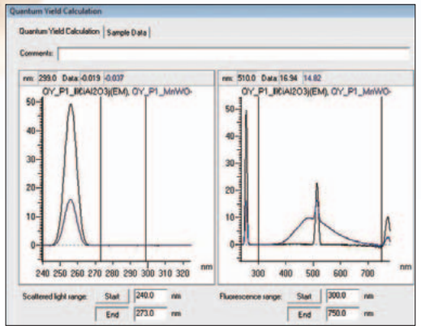
Measurement results may be confirmed on a log scale. Due to the dynamic range, a calibration curve may be drawn over a wide range.



eV scale (horizontal axis)

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

F-7000 / F-2710 System for the quantum yield measurement of powder samples — Fluorescent quantum yield measurement of $MgWO_4$ —



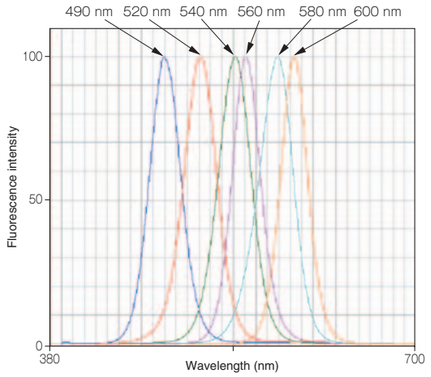
Results of the fluorescent quantum yield measurement of $MgWO_4$

Accessories

- Quantum yield measurement unit 5J0-0148 / 4J1-0139
- R928F photomultipliers 650-1246
- Spectrum correction kit included in F-7000 / 4J1-0137
- Sub-standard light source 5J0-0135 / 4J1-0145 (115V) 5J0-0136 / 4J1-0135 (220-240V)
- Filter set 5J0-0151

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.

F-7000 / F-2710 System for spectrum correction — Measurement of the fluorescence spectra of Cd/Se quantum dots —



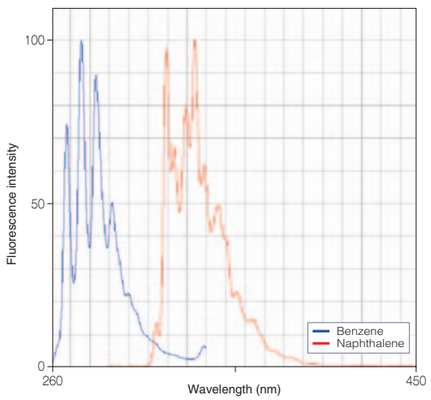
Fluorescence spectra of Cd/Se quantum dots

Accessories

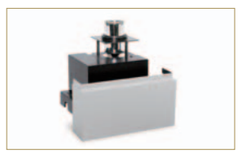
- R928F photomultipliers 650-1246
- Spectrum correction kit included in F-7000 / 4J1-0137
- Sub-standard light source 5J0-0143 / 4J1-0145 (115V) 5J0-0144 / 4J1-0135 (220-240V)
- Filter set 5J0-0151

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.

F-7000 / F-2710 System for measurement of cryogenic samples — Emission spectra at low temperatures —



Emission spectra of cryogenic benzene and naphthalene



Accessories

- Low Temp. Acc 5J0-0112 / 4J1-0105

Using the attachment device for low temperatures, fluorescence analysis may be performed at the temperature of liquid nitrogen (-196°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.

Part Number notation for Accessories in this brochure

-* / ***-****
for F-7000 for F-2710 for F-7000 and F-2710

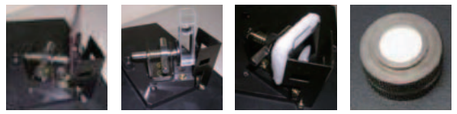
F-7000 / F-2710 Fluorescence Analysis of a Plate Sample from a Plasma Panel Display

An example of measuring fluorescence spectra of a plasma panel display using a solid-sample holder.

Accessories

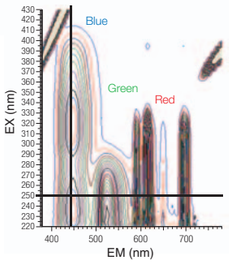
- Solid-sample holder 650-0161

<Example of setting up sample>



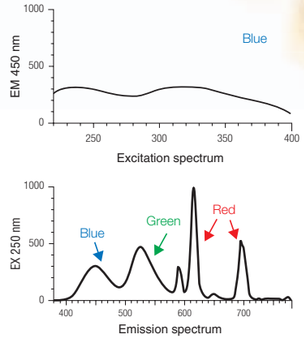
3-D Fluorescence Spectra

The figure shows results of a 3-D measurement on a plasma display panel. On each excitation wavelength, blue, green, and red spectra are observed. The F-7000 featuring a high scanning speed can obtain the data shown on the right in as little as 1.5 minutes.
3-D assay presents a great deal of information from a single sample preparation process, thus reducing the amount of time required to run measurements. The ultra-high speed scanning of the F-7000 can be a powerful tool for the measurement of samples that change with time.



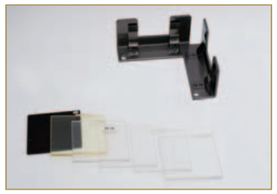
Excitation and Fluorescence Spectra

Results of a 3-D measurement can also be represented in 2-D data. The graphs below show excitation and emission spectra of a plasma display. It presents spectra at specific wavelengths.By using the blue, green, red spectra data represented in 2-D, the technique can be applied to the measurement of fluorescent colors (fluorescence chromaticity coordinates).



F-7000 / F-2710 Removing secondary light

In surface light measurements, multi-order light, including second-order light, that is produced by light scattering interferes with the measurement. An effective tool for removing multi-order light is a cut filter. Fluorescence is based on the principles of Stokes, which can be observed at longer wavelengths than the excitation light.

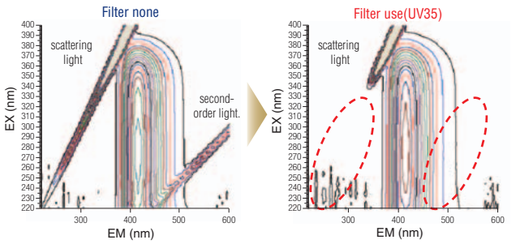


Accessories

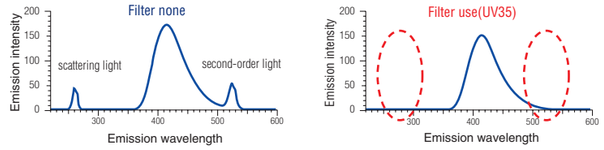
- Filter set 5J0-0151

Effects of a cut filter

The graphs below show the effects of using a cut filter based on sodium salicylic acid (powder) data. The filter (UV35) cuts the scattered light that would otherwise enter the detector and suppresses the occurrence of second-order light.



The following graphs also show data that are extracted from third-order data. It is clear that the occurrence of second-order light that is duplicate to the spectra is also suppressed on the second-order data.



F-7000 / F-2710 Measurement of Quantum Yield for a Solution Sample (relative method)

The fluorescence quantum yield can be determined by comparing the molar absorption coefficient, the wave number integration of fluorescence spectra, and the refractive index of the solvent obtained from the absorption spectra of the sample with a standard substance (fluorescein, quantum yield: 0.85, in this case) with a known quantum yield.

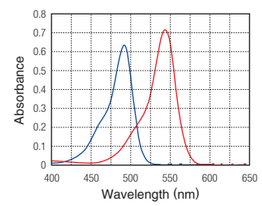
Accessories

- Absorption cell holder 650-0165
- Spectral correction kit included in F-7000 / 4J1-0137
- Sub standard light source 5J0-0143 / 4J1-0145 (115V) 5J0-0144 / 4J1-0135 (220-240V)
- Photomultiplier R928F 650-1246

Measurement of the quantum yield of rhodamine B

In the measurement of absorption spectra, as a first step the absorption spectra from which the influence of fluorescent light has been eliminated should be measured. By conducting synchronized scanning with an absorption measurement cell holder mounted on the equipment, it is possible to measure absorption spectra that are immune to the effects of fluorescence. By using this function, we measured the absorption spectra of fluorescein and rhodamine B, and determined their molar light absorption coefficients.

Absorption spectra determined using an absorption measurement cell holder
Fluorescein: molar absorption coefficient = 8.3×104 (492 nm)
Rhodamine B: molar absorption coefficient = 1.5×104 (492 nm)



Measurement of the quantum yield of rhodamine B

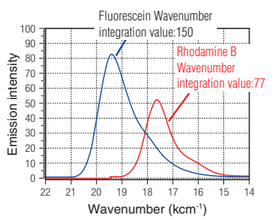
Calculating a wave number integration value from fluorescence spectra requires the true spectra in which the effects of wavelength characteristics of the light source or diffraction lattice have been eliminated.
The models F-7000 and F-2710 permit applying a correction, based on the rhodamine B method, over a 200-600 nm range based on pre-measured and stored wavelength characteristics of the photometer. Furthermore, in the case of samples that have a fluorescence peak on the long wavelength side, the F-7000 can perform 200-800 nm corrections on the fluorescence side by using the photomultiplier R928F as well as a secondary standard light source.
Based on the molar absorption coefficient and the wave number integrated value obtained through the above operations, the quantum yield of a sample is calculated.

Calculation of the relative quantum yield for rhodamine B

Fluorescein			Rhodamine B		
Quantum yield	Q_{st}	: 0.85			
Wave number integrated value	$(Area)_{st}$	: 7.1×10^8	Wave number integrated value	$(Area)_s$	: 1.1×10^8
Molar absorption coefficient (492 nm)	A_{st}	: 8.3×10^4	Molar absorption coefficient (492 nm)	A_s	: 1.5×10^4

Quantum yield of rhodamine B

$$Q_S = \frac{(Area)_s}{(Area)_{st}} \times \frac{A_{st}}{A_s} \times Q_{St} = 0.74$$

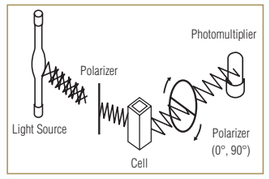


Fluorescence spectrum that converts wavenumber

Biological field

F-7000 / F-2710 Fluorescence Anisotropy

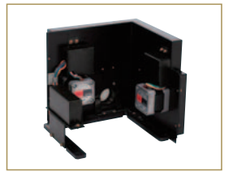
The far-ranging application of fluorescence anisotropy, originally described by Perrin in France in 1926, in the field of biochemistry began during the latter half of the 1970s. On the strength of the simple, rapid, and high-sensitivity nature of the method, fluorescence anisotropy has made inroads into the quantitative analysis of drugs in blood, antigen-antibody reactions, and the assaying of enzyme activity using specialized equipment. More recently, it has been applied to the analysis of nucleic acid hybridization, the quantitative analysis of PCR products, and the assaying of DNA-protein interactions, as well as protein-protein interactions.



Principle of fluorescent polarized light method

F-7000

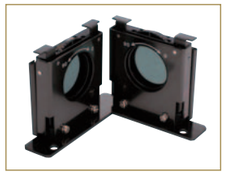
The accessory for automated fluorescence anisotropy is capable of automated calculation and time-dependent changes in polarization while automatically rotating the polarizer element. As such, it can also automatically compute the fluorescence anisotropy and the total amount of fluorescence.
The 5J0-0116 offers a capability to measure fluorescence with a high degree of precision over a 380 - 730 nm visible light range. The 5J0-0115 can measure fluorescence over a 260 - 700 nm UV/visible right range.



Accessories
- Automated polarization accessories
  UV-VIS : 5J0-0137, VIS : 5J0-0138

F-7000 / F-2710

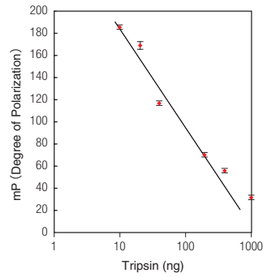
The accessory for fluorescence anisotropy allows the user to measure the degrees of polarization and anisotropy while manually rotating the polarization element.
The 650-0156 offers a capability to measure fluorescence with a high degree of precision over a 380 - 730 nm visible light range. The 650-0155 can measure polarized light over a 260 - 700 nm UV/visible light range.



Accessories
- Polarization accessories
  UV-VIS : 650-0155, VIS : 650-0156

Example of measuring enzymic activity-Fixed quantity of trypsin-

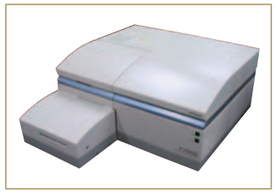
Fluorescence anisotropy permits the high-sensitivity detection and quantitative of enzyme activity. Enzyme activity and the amount of enzymes present can be assayed by the fluorescence-tagging of a macromolecular substrate and by measuring a decrease in the molecular weight of the substrate by the action of a decomposition enzyme as a function of a decrease in P value.
In the example illustrated, we used an EnzChekTM Polarization Assay Kit for Proteases (Molecular Probes Corporation) to assay the enzymatic activity of trypsin. We studied changes in the degree of polarization that occurs when trypsin, which is a protease, decomposes casein, using the fluorescence-tagged casein that is included in the kit (BODIPY FL–casein: excitation wavelength/fluorescence wavelength = 505/513 nm) as a substrate.



Principle of fluorescent polarized light method

F-7000 Microplate accessory

The microplate accessory permits the direct assaying using the F-7000 of a sample applied to a microplate.
The accessory lends itself to automation for assaying as a microplate reader or an auto-sampler based upon the use of microplates.



Accessories
- Microplate accessory
  5J0-0118※1

Compatible microplate	96 well wells (40 µL, flat bottom)
Measuring speed	96 wells/60 s (in kinetics measurement mode)
Thermostatic function	Thermostatic water bath connectable 5 to 60℃ (Thermostatic water bath separately available)
Dimensions (mm)	290 (W) × 420 (D) × 230 (H) When mounted in F-7000 : 620 (W) × 730 (D) × 300 (H) (excluding protrusions)
Weight	8kg

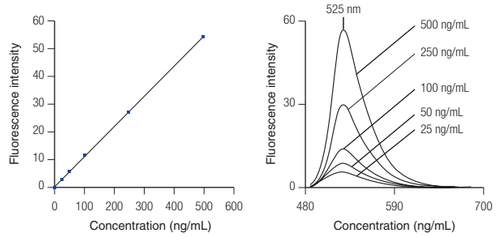
※1: Compatible microplates are commercially available ones having 96 wells. Background fluorescence level may be high depending on a selected microplate.

Features of the microplate accessory

- Effective for the assaying of multi-specimen samples : compatible with 96-well microplates
- High-sensitivity assaying : Detection sensitivity : 5×10-11 mol/L (fluorescein)
- High-throughput assaying : 96 wells/60 seconds
- Wide dynamic range : 6 digits or higher

Example of PicoGreen® assay

The PicoGreen® can assay double-strand DNA, specifically and in high sensitivity, in a manner immune to the effects of RNA, single-strand DNA or proteins present in the sample. As such, the system is well-suited for the assaying of template amount in a DNA sequencer or PCR.
The use of the microplate accessory supports high-throughput measurement operations.



F-7000 Automated 4-cell turret

The Turret permits the measurement of each cell by setting four cells, 10 mm on the edge, and by automatically switching the cells. The Turret, operable from the PC, can be a powerful tool for the assaying of samples that change as a function of time, over long periods of time.
The Turret can be useful the assaying of multiple samples, such as in assaying enzymatic activity.

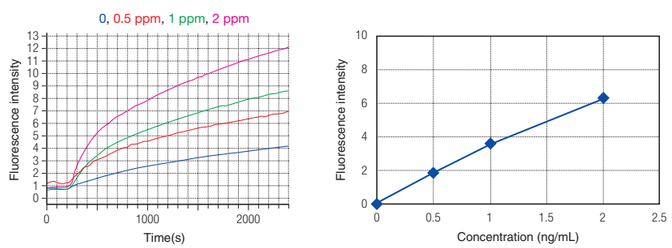
Accessories
- Automated 4-cell turret accessory
  5J0-0120

Example of assaying ethanol using the enzyme method

The action of alcohol dehydrogenase (ADH) converts ethanol to acetaldehyde. In this reaction, NAD^+ changes to NADH. Based on the fluorescence intensity of the NADH, the ethanol can be quantitated. Because the reaction does not proceed completely, the reaction is promoted by converting acetaldehyde to acetic acid by means of AL-DH.

$$\text{Ethanol} + NAD^+ \xrightleftharpoons{\text{ADH}} \text{Acetaldehyde} + NADH + H^+$$

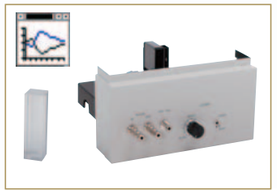
$$\text{Acetaldehyde} + NAD^+ + H_2O \xrightleftharpoons{\text{Al-DH}} \text{Acetic acid} + NADH + H^+$$



F-7000 / F-2710 Assaying of In-Situ Ca^{2+}

A typical reagent for the assaying of the concentration of Ca^{2+} in cells is Fura2-AM. The reagent, carrying five acetoxymethyl groups, has membrane permeability. When mixed in a cellular suspension, Fura2-AM is taken up into the cells. When broken down by acetylesterase in cells, Fura2-AM is converted into Fura2. Fura2 has a Ca^{2+} bonding capacity. When bonded, the peak of the excitation wavelength significantly undergoes a blue shift. By conducting a two-wavelength assaying using this fact and by taking the ratio of fluorescence intensities of two wavelengths, factors can be cancelled out such as the concentration of pigments, the strength of the light source, and the size of cells.
The F-7000, with a wavelength mobility speed of 60,000nm/min, can perform multi-wavelength measurements virtually simultaneously. In addition, because it can accommodate up to four wavelengths, the F-7000 can assay such calcium indicators as Indo-1 and Fluo-3 beyond Fura2, as well as multi-dye samples based on pH, magnesium, and zinc indicators at any wavelength. The F-7000 is also capable of performing coagulation assaying simultaneously based on Ca^{2+} concentration and scattered light, using platelets as a sample.

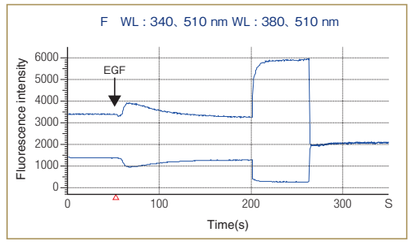
The accessory can be used for the assaying of cellular Ca^{2+} concentrations in cells.
The accessory is comprised of a thermostat cell holder equipped with a stirrer, a micro-sampling assembly, microcells, and a cellular calcium assay program.



Accessories
- Cellular Ca^{2+} assay accessory
  5J0-0145 / 4J1-0141

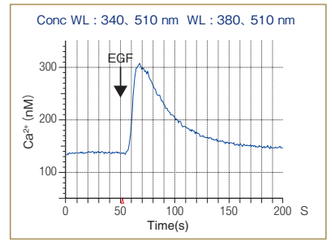
Example of assaying cellular Ca^{2+}

Cellular Ca^{2+} plays a critical role as a second messenger in the information transmission path that conveys signals acquired by a receptor present in the cell membrane into the nucleus. For this reason, cellular Ca^{2+} concentrations are frequently assayed as an indicator of ligand indicator for receptors, including G protein. By using this system, it is possible to monitor the instantaneous reactions that occur in living cells, without missing a beat.



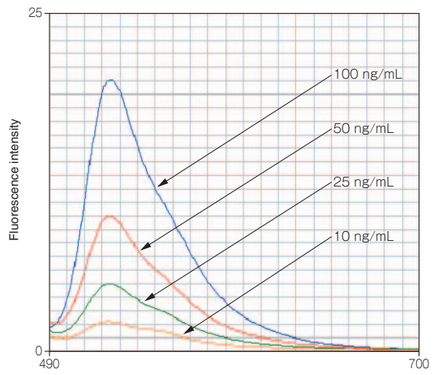
Time-dependent change in 2-wavelength fluorescence intensity when EGF is administered to COS-7

This graph depicts time-dependent changes in 2-wavelength fluorescence intensity after EGF (epithelial growth factor) was administered to COS-7 cells (monkey kidney-derived cells), and the results of converting the data to Ca^{2+} concentration values. The sample, obtained by fluorescence-tagging cultured cells with Fura2-AM, permits the assaying of time-depending changes in cellular Ca^{2+} concentrations *in-situ*.
The results confirmed that the EGF receptor is expressed in the COS-7.



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

F-2710 System for measurement of very small sample amounts — Measurement of DNA with PicoGreen®



Fluorescence spectra of 100 µL solutions with PicoGreen®

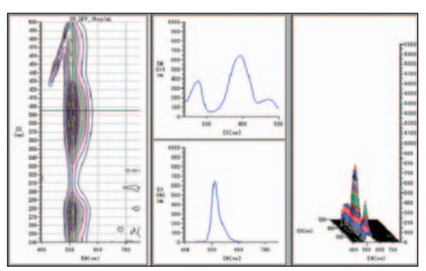
Accessories
- Microcell holder
  4J1-0133

※Cell and adapter are not included.

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-2710 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.

F-7000 / F-2710 System for measurement under constant temperature — Measurement of green fluorescent protein (GFP)

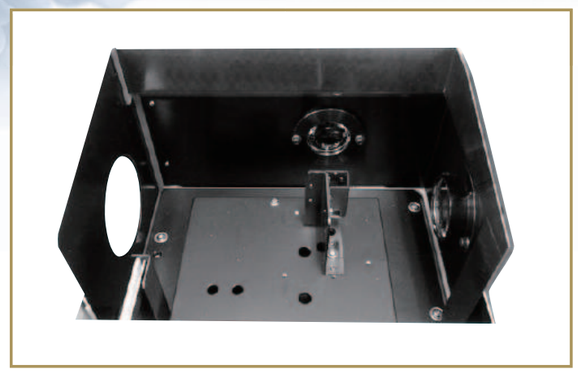

Three dimensional fluorescence spectra of GFP

Accessories
- Thermostatted cell holder with stirrer
  250-0346
- Micro cell
  650-0116

Typically, an increase in the temperature of a sample by 1℃ 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 3-D 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.

Accessories

A Wide Variety of Accessories for Every Application



Sample compartment of F-7000

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

(Cell and adapter are not included)

Polarization

Automatic Polarization accessory for VIS 5J0-0138

Used for the measurement, calculation and data recording of fluorescence polarization angle and fluorescence anisotropy. Optimized for the measurement of antigen-anti body reaction, biological cells, proteins, enzymes, and other samples for 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 polarization angle vs. time, fluorescence polarization angle, fluorescence anisotropy

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)

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 420 nm 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℃

(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℃

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

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℃

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

Low temperature accessory
5J0-0112 / 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 5 mm or 8 mm
Measurement temperature	-196℃ (Liquid nitrogen temperature)

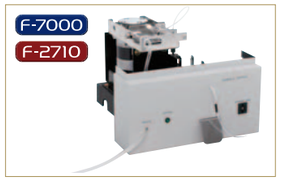
Multiple Sample Measurement

Electronic Thermostatted Cell Holder for F-7000, Constant temperature control 220–240V / 5J0-0142

Effective for the analysis of biochemical samples as temperature can be maintained constant.
It is electrically operated and rapid heating and cooling are possible.

Compatible cells	10 mm rectangular cell
Temperature range	10 to 60℃

Dry gas and cell required, but not included.



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

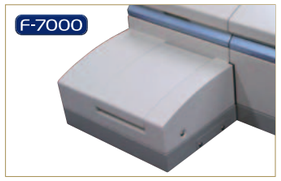
Dry gas and cell required, but not included.

Automatic 4 turret
5J0-0140

Cell position is settable with using FL Solutions software and good for automatic measurement.
This unit is applicable for enzyme activity and samples for bio/life science.

Compatible cell	10mm rectangular cell
Cell changeover	within 3% RSD
Measurement Mode	Automatic 4-turret scan (Time scan)
Control	PC Software (FL Solutions)
Power supply	Power is supplied from main unit, F-7000
Temperature	5 to 35 degree

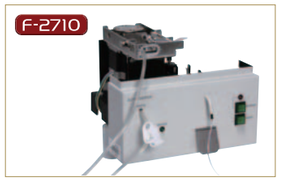
Dry gas and cell required, but not included.



Micro plate reader
5J0-0139

This accessory is categorized as an autosampler for Model F-7000 which uses a microplate and seriously inquired by the customers who have lots of samples to be measured in the biotechnological field, etc.

Measuring speed	96 wells/60 s (in kinetics measurement mode)
Thermostatic function	Thermostatic water bath connectable 5 to 60℃ (Thermostatic water bath separately available)



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
Carryover	2% or less (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)

(Sample tube is not included)

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)

Wavelength extension

Photomultiplier R928F
650-1246

F-7000
Enables fluorescence measurements in a wavelength range of 200 to 900 nm (200 to 750 nm with the standard photomultiplier).

F-2710
Enables fluorescence measurements in a wavelength range of 220 to 800 nm (220 to 730 nm with the standard photomultiplier).

Spectrum correction

Spectral correction accy 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)

Substandard light source
5J0-0135 / 4J1-0145 (115V)
5J0-0136 / 4J1-0135 (220-240V)

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

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

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)

Quantum yield Measurement unit

Quantum yield measurement unit
5J0-0148 / 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 800 nm, but not included.

Intracellular cation measurement program

*This image is for F-2710

Intracellular cation measurement accessory
5J0-0145 / 4J1-0141

This accessory (4J1-0141) includes four components (250-0346, 4J1-0143, 650-0116, 4J1-0311)

*This image is for F-2710

Micro sampling Acc.
5J0-0111 / 4J1-0143

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.)

F-7000 F-2710

Intracellular cation measurement program 5J0-0308 / 4J1-0311

This software is used for measuring calcium (Ca^{2+}) in cells together with pH measurement reagents (such as BCECF) along with Ca^{2+} 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^{2+} concentration is automated.

F-7000

GLP/GMP program 5J0-0307

F-7000

FL Solutions Type S 5J0-0309

Cell

Micro cell
650-0116

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.

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 back ground.

Fluorescence cell 123-1012

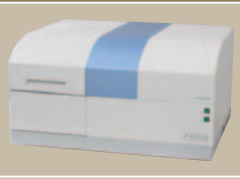
This is a typical fluorescent cell that is made of quartz which has permeability in the ultraviolet and visible region.

Optional accessories

Category	Accessories	F-7000	F-2710
Cell Holder	Solid Sample Holder	650-0161	
	Absorption Cell Holder	650-0165	
	High Sensitivity Cell Holder	5J0-0124	
	Micro Cell Holder	not available	4J1-0133
Polarization	Automatic Polarization Acc. (UV-VIS)	5J0-0137	not available
	Automatic Polarization Acc. (VIS)	5J0-0138	not available
	Polarization Acc. (UV-VIS)	650-0155	
	Polarization Acc. (VIS)	650-0156	
Support	Attenuator Set, Fluorescence	251-0081	
	Filter Set	5J0-0151	
	Analog Output Acc	251-0163	not available
Temperature	Thermostatted Cell Holder	250-0330	
	Thermostatted Cell Holder with Stirrer	250-0346	
	Cell Holder With Programmable Temp Control	5J0-0143 (115 V) 5J0-0144 (220-240 V)	
	Cell Holder With Constant Temp Control	5J0-0141 (115 V) 5J0-0142 (220-240 V)	not available
	Low Temp. Acc.	5J0-0112	4J1-0105
Multiple	Automatic 4-turret	5J0-0140	not available
	8-turret Cell Holder	250-0333	
	4-turret Cell Holder	250-0339	
	Auto Sipper	not available	4J1-0124
	Sample Sipper	5J0-0123	
	Auto Sampler AS-1010	not available	2J1-0121 (115 V) 2J1-0122 (200 V)
	Micro Plate Reader	5J0-0139	not available
Detector	Photomultiplier R928F	650-1246	
Correction	Spectral Correction Accy Kit	included in F-7000	4J1-0137
	Substandard Light Source	5J0-0135 (115 V) 5J0-0136 (220-240 V)	4J1-0145 (115 V) 4J1-0135 (220-240 V)
Flow cell	Flow Cell Unit For 55 µl	250-0331	
	Flow Cell Unit For 180 µl	250-0332	
System	Quantum Yield Measurement Unit	5J0-0148	4J1-0139
	Intracellular Cation Measurement Acc.	5J0-0145	4J1-0141
	Micro Sampling Acc.	5J0-0111	4J1-0143
Software	FL Solutions Program	5J0-0330	4J1-0330
	Intracellular Cation Measurement Program	5J0-0308	4J1-0311
	Report Generator Program	5J0-0306	4J1-0313
	FL Solutions (Type S)*1	5J0-0309	not available
	GLP/GMP Program	5J0-0307	not available
Cell	Fluorescence Cell	123-1012	
	Fluorescence-free Cell	018-1001	
	Micro Cell	650-0116	
	Low Scatter Micro Cell	650-0171	
	Triangular Cell	5J1-1502	
Document	SOP (Draft)	5J1-9105	4J1-9121
	Test Report + SOP Draft	5J1-9106	4J1-9123
	FL IQOQ Draft	5J1-9115	4J1-9125
Lamp	Xe lamp	650-1500	

*1 for windows® XP Pro

F-7000 / 2710 Specifications

Model		F-7000	F-2710
Aspect			
Main feature		• High sensitivity • Automatic Pre-scan function for unknown sample	• Wide dynamic range (6 or more orders of magnitude) • Abundant accessories
		3-D measurement at short time by Ultra-high scanning speed (60,000 nm/min)	Entry-model for all users
Wavelength range		200 to 750 nm and zero-order light (Expandable up to 900 nm with optional detector)	220 to 730 nm and zero-order light (Expandable up to 800 nm with optional detector)
Scan speed		30, 60, 240, 1,200, 2,400, 12,000, 30,000 and 60,000 nm/min	60, 300, 1,500, 3,000 and 12,000 nm/min
Response speed (Response of 0 to 98%)		0.002, 0.004, 0.01, 0.05, 0.1, 0.5, 2, 4 s, and auto	0.04, 0.08, 0.4, 2 s, and auto
Sensitivity (Raman light of water)	Noise : Background	S/N 15,000 or above (RMS)*1	S/N 10,000 or above (RMS)*2
	Noise : Peak	S/N 800 or above (RMS)*3 S/N 250 or above (Peak to Peak)*3	
Light Source		150 W xenon lamp	
Mount		Single monochromator (Grating)	
Optical System		Monochromatic light monitoring ratio calculation	
Resolution		1 nm	2.5 nm
Wavelength drive speed		60,000 nm/min	12,000 nm/min
Wavelength accuracy		±1 nm	±3 nm
Band pass (both EX and EM)		5 steps (1, 2.5, 5, 10, and 20 nm)	4 steps (2.5, 5, 10, and 20 nm)
Detector		Photomultiplier	
Photometric Value range		-9999 to 9999	
Monitor		PC monitor	
Operation		PC operation by FL Solutions Program	
Communication function		USB communication	
Main functions		Wavelength scan (EX, EM) Quantitative measurement Time scan	
		• Pre-scan • Phosphorescence • 3-D measurement • 3-D time-scan spectrum for F-7000	
		Operation by FL Solutions (Spectrum display/ trace/ calculation/ saving/ loading/ print out, Rescalling, Smoothing, Peak detection, Graph axis conversion, Data transfer to Microsoft® Excel®, Word®, File conversion etc.)	
Printer		Printer for Windows®	
Dimensions (W) × (D) × (H)		620 × 520 × 300 (mm)	600 × 503 × 343 (mm)
Weight		Approx. 41 kg	
Power requirements		100, 115, 220, 230 or 240 V 50/60 Hz, 380 VA	100, 115, 220, 230 or 240 V 50/60 Hz, 400 VA

*1 Ex 350 nm, Slit 10 nm, Response 4 s
*2 Ex 350 nm, Slit 10 nm, Response 2 s
*3 Ex 350 nm, Slit 5 nm, Response 2 s

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CAUTION: For correct operation, follow the instruction manual when using the instrument.
NOTICE: Although the information contained herein has been reviewed, Hitachi High-Technologies Corporation makes no warranty or representation as to its accuracy or completeness.
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