

Hitachi Fluorescence Spectrophotometer

# F-7000



# F-7000



Designed to Meet Your Needs for  
High-Quality Analytical Instrumentation.

## Hitachi's Superior Fluorescence Technology Has Created a New Generation of Fluorescence Spectrophotometers.

High S/N Ratio, Ultra-Fast Scanning, Compact Design,  
Multiple Accessories



High sensitivity measurement (S/N 800 RMS)  
(equivalent to S/N 250 peak to peak)

60,000 nm/min ultra-high scanning speed,  
ideal for 3-D measurement.

Compact design (approx. 2/3 the size of the F-4500)

A wide range of accessories accommodating  
various applications

Outstanding  
Performance  
supported by Superb  
Manufacturing  
Technologies

Sensitivity, Scan Speed,  
3-D Measurement,  
and more....

P.3~4

Extensive  
Application  
Capabilities

Industrial Materials,  
Pharmaceutical, and  
Biotechnology.

P.5~6

Easy-to-Use  
Software

P.7~8

A Wide Range of  
Accessories

P.9~10

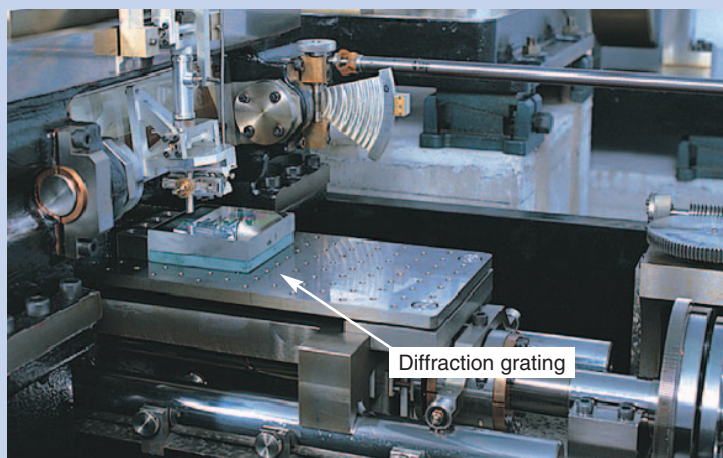


## Technologies Supporting Hitachi Fluorescence Spectrophotometers

**Precision Machining Technology**  
resulting in bright optics.

**Advanced Electric Circuit Technology**  
for high-speed processing.

**Controlled System Technology**  
ensures high accuracy.



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

Ruling engine.

A dividing engine for ruling diffraction gratings, invented in 1880s by Henry Augustus Rowland of Johns Hopkins University.

Compared to a holographic grating, mechanically ruled gratings have the following advantages:

- (1) Mirror-finished groove surface results in high diffraction efficiency.
- (2) Groove spacing required for aberration correction can be adjusted, making it possible to have a greater correction effect.

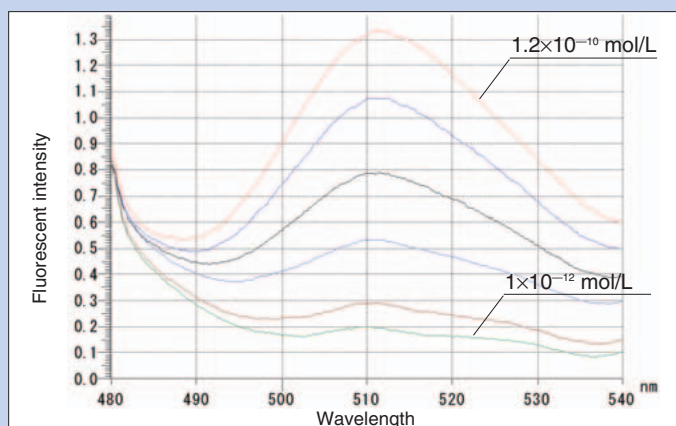
These characteristics of mechanically ruled gratings work well to create an excellent monochromator.

## F-7000 Performance Supported by Technology

■ **High S/N: 800 (RMS), 250 (Peak to Peak)**

■ **Detection limit of fluorescein**

Due to enhanced sensitivity, the F-7000 Fluorescence Spectrophotometer can detect fluorescein concentrations one digit lower than its predecessor, the Model F-4500. The improved S/N ratio provides greater capabilities for trace-sample measurements.

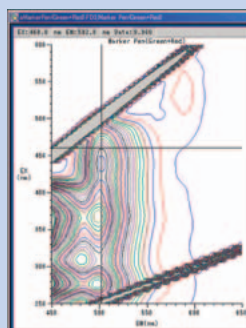


■ **3-D Measurement**

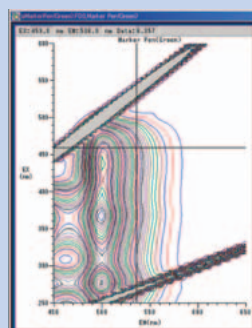
■ **Data of fluorescent marker pen**

A 3-dimensional fluorescence spectrum can clearly distinguish slight differences that a 2-dimensional spectrum cannot detect.

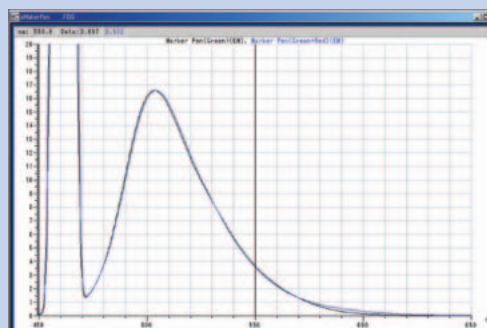
Measurements can now be carried out with higher accuracy than before.



3-dimensional spectrum of fluorescent marker pen (green x red)



3-dimensional spectrum of fluorescent marker pen (green)

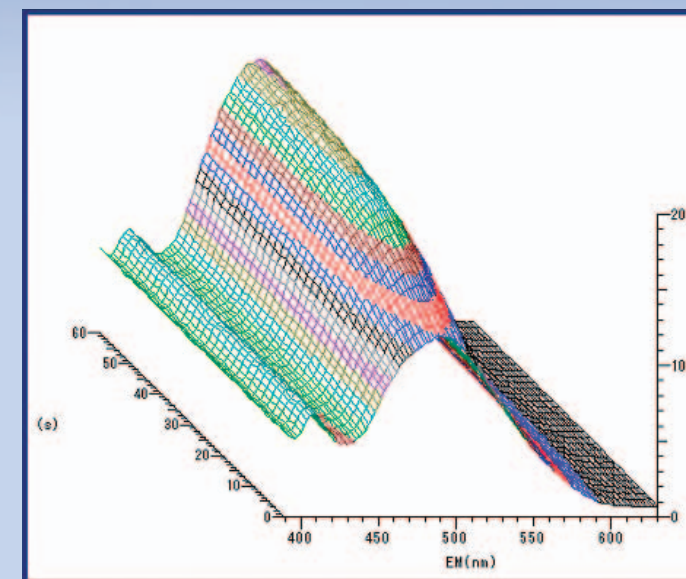


2-dimensional spectrum (excitation wavelength 460nm)

■ **High-Speed Scan at 60,000nm/min**

■ **Example of reaction tracing with a spectrum**

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.

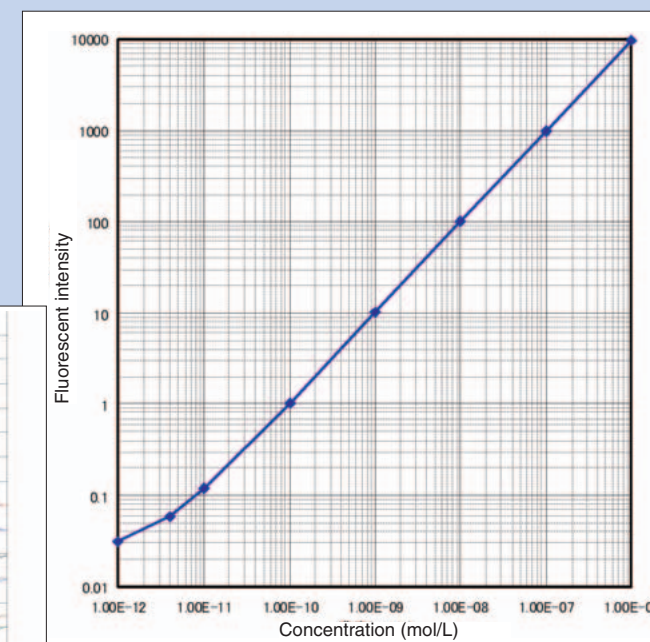
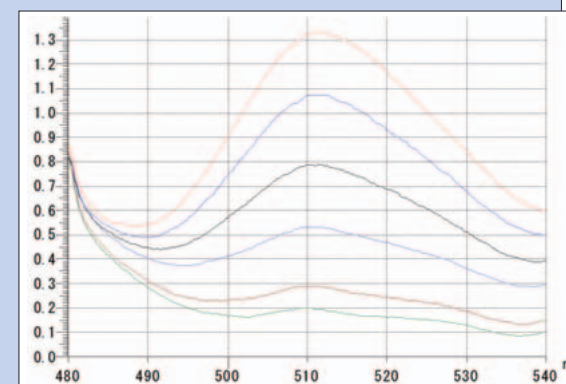


3-dimensional time scan spectrum of coumarin for environmental applications

■ **Measures up to 6-digit concentration values**

■ **Calibration curve and spectrum overlay of fluorescein**

The automatic gain change-over function, a technique unique to Hitachi fluorescence spectrophotometers, has made it possible to generate calibration curves using up to 6-digit concentration values. An unknown sample can be quantitatively analyzed without additional sample preparation.



■ **Other functions**

- Automatic pre-scan function optimized for unknown sample measurement
- High-resolution multi-stage slit with a resolution as small as 1nm
- Ratio photometry (0 point correction) ensuring stable measurements
- Shutter control for minimizing sample deterioration



## Application Capabilities Unique to Hitachi

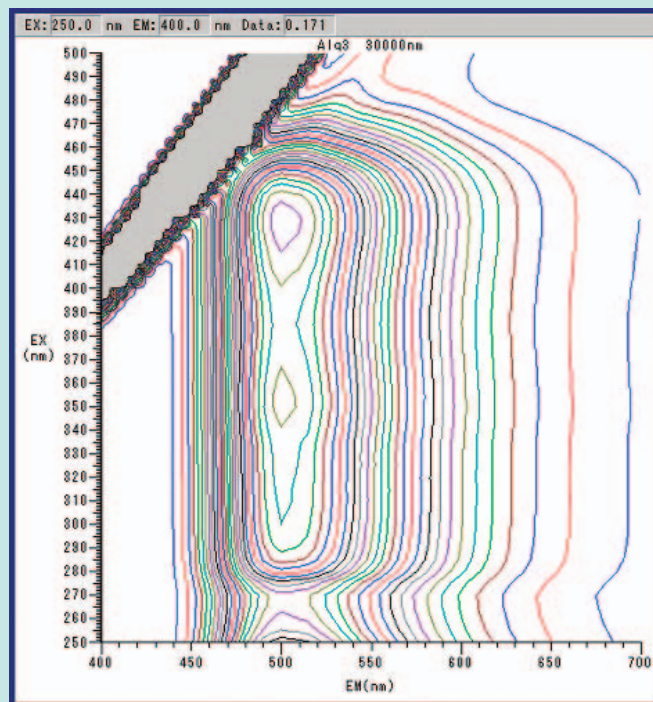
### Industrial Material Field

#### Measurement of fluorescent materials

##### Organic EL material

In this example, the F-7000 was used to analyze the luminescent characteristic of trisaluminum complex powder used as a luminescent material for organic EL display. A solid sample holder, its powder cell, the photomultiplier R928F, and the filter set were used.

Scan speed: 12,000nm/min  
 Excitation slit: 5.0nm  
 Emission slit: 5.0nm  
 Photomultiplier voltage: 400V  
 Response: Automatic  
 Spectrum correction: Activated  
 Beam-cut filter (UV-39) used  
 Photomultiplier R928F used



The acquisition of these data was made possible by the 3-D measurement function and high-speed scanning capability of the F-7000.

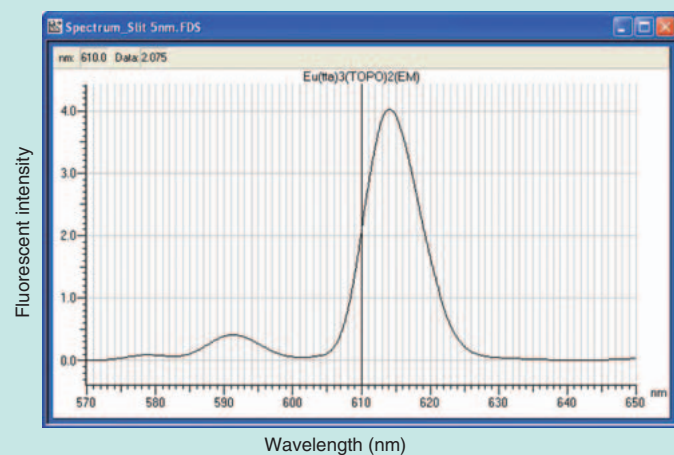
### Pharmaceutical Field

#### Phosphorescence measurement

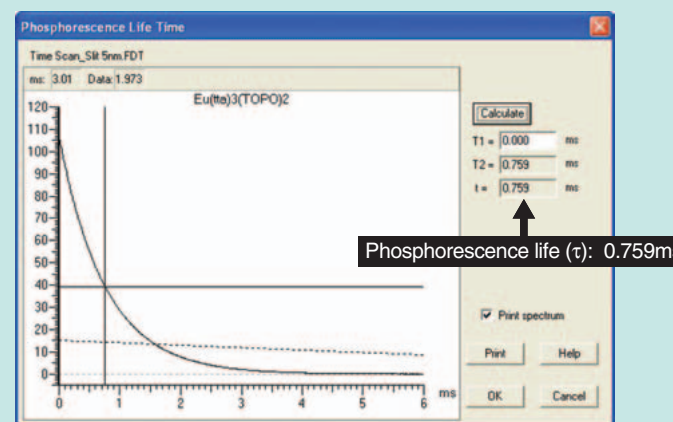
##### Rare earth element complex (Eu chelate)

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

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



Phosphorescence spectrum measurement of  $\text{Eu}(\text{tta})_3(\text{TOPO})_2$  complex



Phosphorescence life measurement of  $\text{Eu}(\text{tta})_3(\text{TOPO})_2$  complex

### Biological Field

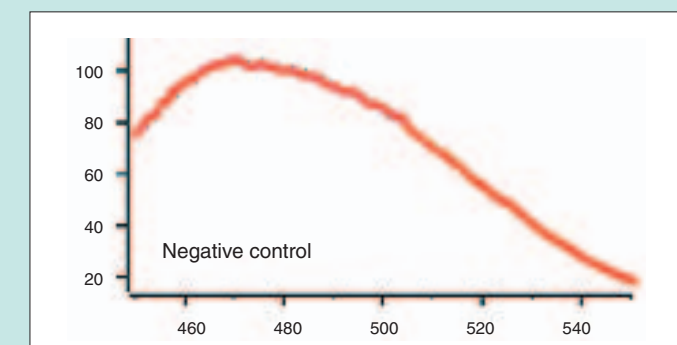
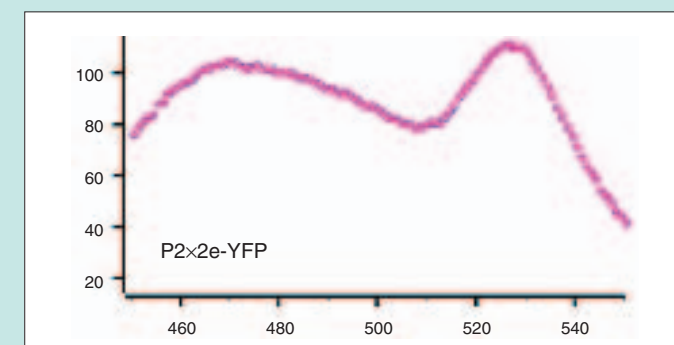
#### Measurement of intermolecular actions

##### FRET (Fluorescence Resonance Energy Transfer) and BRET (Bioluminescence Resonance Energy Transfer)

The Model F-7000 can measure the intermolecular activities such as FRET and BRET. Shown below are fluorescence spectra presenting the interactions between the sub-

unit proteins of an ATP-active purine receptor.

Data provided by Mr. Takaaki Koshimizu, Kyoto University Graduate School of Pharmaceutical Sciences – Genomic Drug Discovery Science.



#### Measurement of calcium in cell

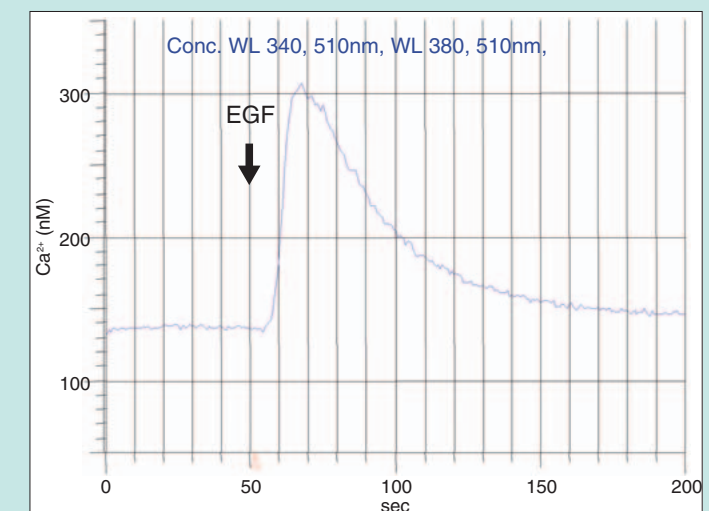
##### Ca<sup>2+</sup> concentration in cells

With the optional intercellular calcium measurement accessory, the F-7000 can measure fluorescence intensity values at two wavelengths in EGF-injected COS-7 cells (extracted from a monkey's kidney), and calculate the concentrations of  $\text{Ca}^{2+}$ .

The sample was a cultivated cell fluorescence-labeled by Fura2-AM.

The change in  $\text{Ca}^{2+}$  concentrations in the live cell was also measured. During this analysis, the EGF receptor appeared in the COS-7 as the  $\text{Ca}^{2+}$  level increased due to EGF injection.

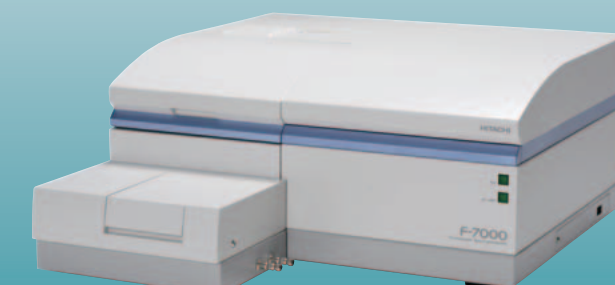
The Model F-7000 can measure biological samples with higher sensitivity and speed.



#### Micro-plate Accessory

##### Features

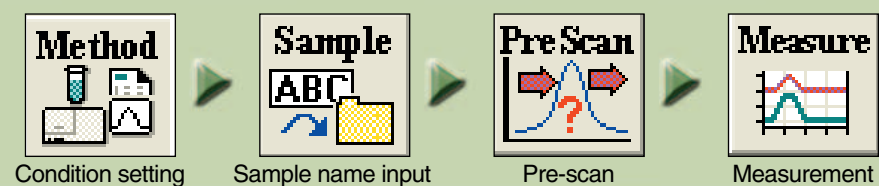
- Automatic measurement using a 96 well microplate is available.
- Used as an autosampler, allows wavelength scan, time scan, and 3-dimensional measurement.
- Can be used in conjunction with the polarization accessory.



## Easy-to-Use Software with Powerful Functionality

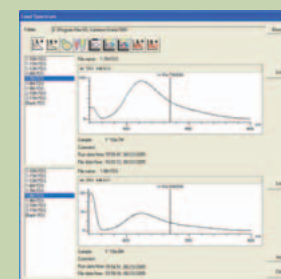
The FL Solutions Software is a powerful tool for analysts to use a Hitachi F-7000 fluorescence spectrophotometer efficiently at their command and thereby generate the necessary reports.

### Basic Flow of Operations

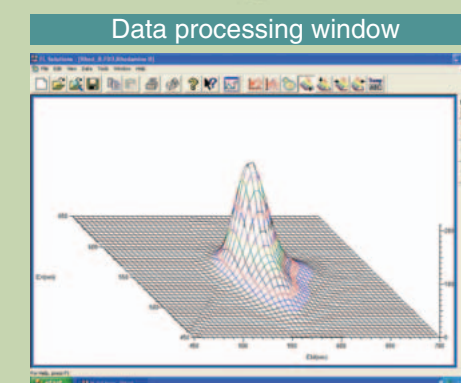
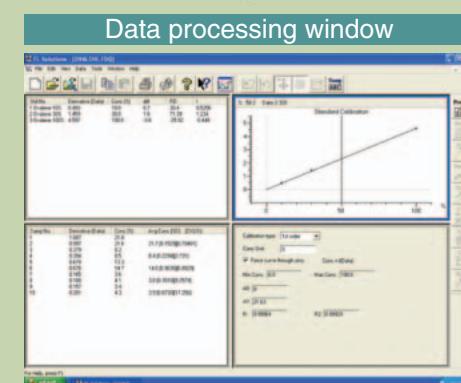
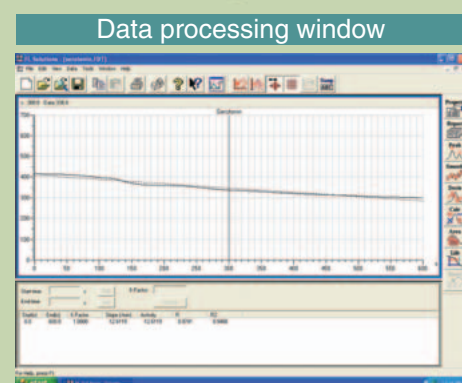
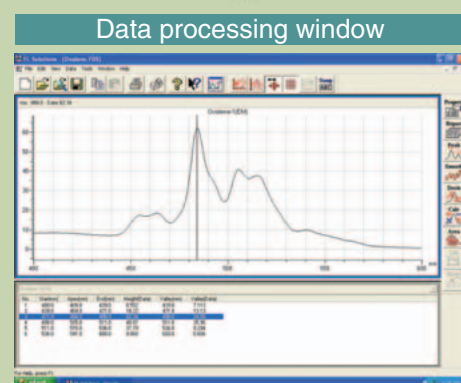
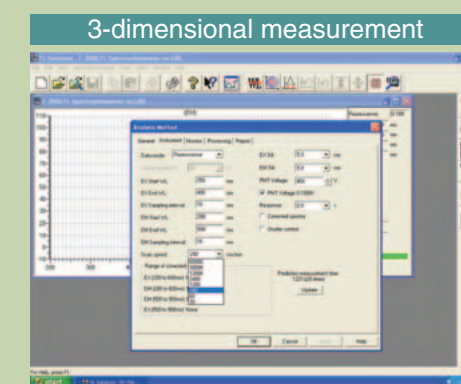
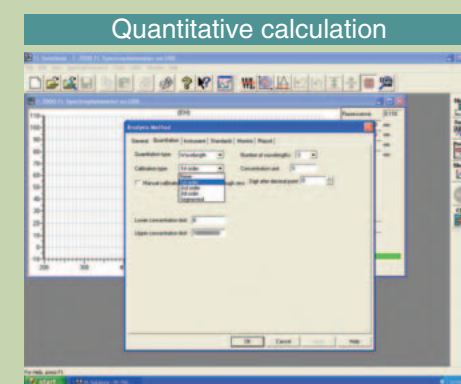
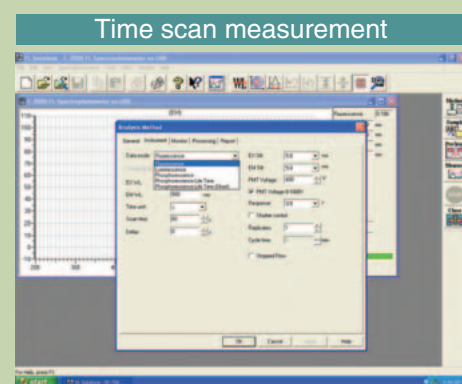
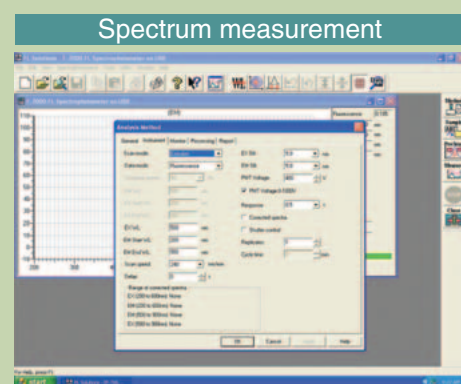
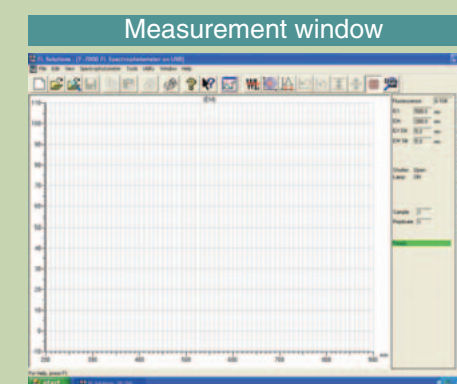
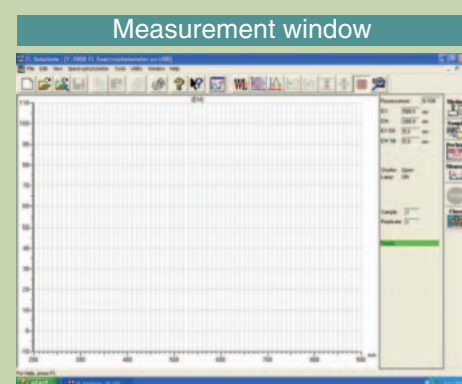
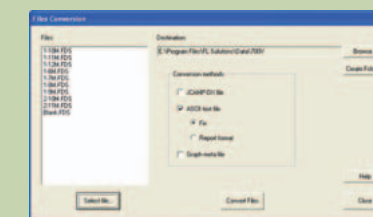


### New functions

■ **Spectrum readout with preview**  
Just by selecting a file name, the contents can be checked without opening the data.



■ **Collective file conversion**  
Multiple files can be converted simultaneously.





## A Luxurious Array of Accessories for Applications in Extensive Fields

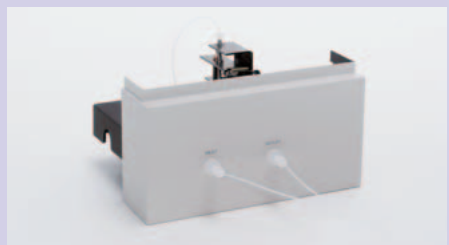
### ■ FLOW CELL UNIT FOR 55uL (250-0331)

### ■ FLOW CELL UNIT FOR 180uL (250-0332)

Provides high sensitivity measurements due to a design that avoids measuring fluorescence near the flow path.

An increased cell capacity is particularly effective for high sensitivity analysis of elements such as catecholamines when measured in combination with a high performance liquid chromatography system.

|               |                                     |
|---------------|-------------------------------------|
| Cell capacity | 55uL (250-0331)<br>180uL (250-0332) |
|---------------|-------------------------------------|



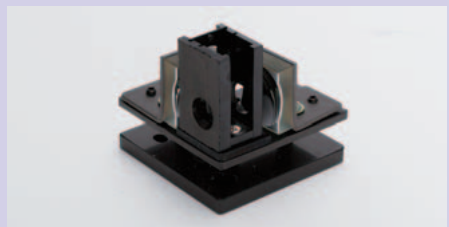
### ■ High sensitivity cell holder (650-0184)

Enhances sensitivity about two fold when used with the 10-mm rectangular cell.

Compatible with the 10-mm rectangular cell (not included)

|                 |                       |
|-----------------|-----------------------|
| Compatible cell | 10mm rectangular cell |
|-----------------|-----------------------|

(Cell must be prepared separately.)



### ■ 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 180mL  |
| Carryover     | 2% or less<br>(Conditions)<br>Sample: 1mg/L quinine sulfate<br>Blank: 0.1mol/L dilute sulfuric acid<br>Sipping quantity: 2.5mL |



### ■ Thermostatic cell holder (250-0330)

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

|                   |           |
|-------------------|-----------|
| Temperature range | 5 to 60°C |
|-------------------|-----------|

(Requires, but does not include a thermostated water bath and a cell)



### ■ 4-turret sample compartment (250-0339)

Ideal for quantitative analysis when using 10-mm rectangular cells.

Max. error due to cell changeover 3%, with the same sample and cell

(Cell must be prepared separately.)



### ■ 8-turret sample compartment (250-0333)

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

|                  |   |
|------------------|---|
| Compatible cells | 10mm rectangular cell   |
|                  | Test tube of outer dia. 10/12mm and height 105mm or less<br>Error due to cell changeover<br>Max. 3% in signal level difference with the same sample and 10mm rectangular cell |

(Cell not included)

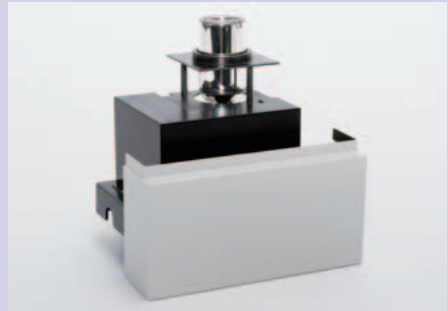


### ■ Low temperature measurement accessory (5J0-0112)

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

|                         |                      |
|-------------------------|----------------------|
| Sample tube             | Outer dia. 5 or 8 mm |
| Measurement temperature | -196°C               |

(liquid nitrogen temperature)



### ■ Absorbance 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 with the 10-mm rectangular cell

(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.

|                            |   |
|----------------------------|---|
| Minimum sample requirement | 2.5mL (10mm rectangular cell),<br>0.4mL (micro-flow cell) |
| Stirrer speed              | 500 to 1,200rpm   |
| Temperature range          | 5 to 60°C   |

Thermostated water bath and cell required, but not included.



### ■ Micro sampling assembly (5J0-0111)

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

### ■ Intracellular Cation measurement program (5J0-0308)

Software for measuring calcium (Ca) in cells. Can be used with pH measurement reagent (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. Reaction process can be simultaneously monitored at multiple wavelengths.

### ■ Filter set (650-0157)

Contains the following filters:

|                                   |   |
|-----------------------------------|---|
| Corning 9863.                     | Band pass filter from 250 to 390nm only.  |
| UV-29, UV-31, UV-35, UV-39, UV-43 | Cut off filters for wavelengths shorter than 290, 310, 350, 390 and 430nm respectively. |



### ■ Long life xenon lamp (150W) (250-1600)

Performance guaranteed life: 500 hours (150 hours in case of standard lamp)



### ■ Solid sample holder (650-0161)

Optimized for 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 is 13mm max.



### ■ Photomultiplier R928F (650-1246)

Enables a fluorescence measuring range of 200 to 900nm (200 to 700nm with standard photomultiplier).



### ■ Sub standard light source (115V) (5J0-0135)

### ■ Sub standard light source (220-240V) (5J0-0136)

Required for correction of emission spectrum at longer wavelengths.

|                                |   |
|--------------------------------|---|
| Emission side correction range | 200 to 800nm<br>(200 to 600nm with standard light source) |
|--------------------------------|---|

(Requires Photomultiplier R928F (650-1246).)

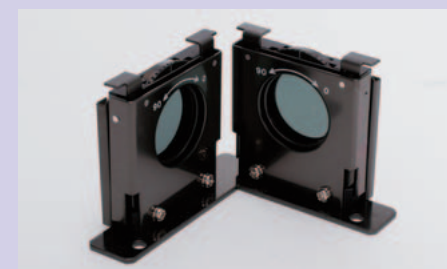


### ■ Polarization accessory for UV/VIS (650-0155)

### ■ Polarization accessory for VIS (650-0156)

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

|                  |  |
|------------------|--|
| Wavelength range | 260 to 700nm (650-0155)<br>380 to 730nm (650-0156) |
|------------------|--|

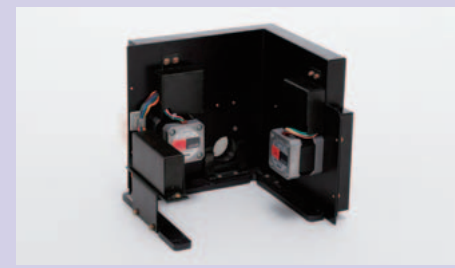


### ■ Automatic Polarization accessory for UV/VIS (5J0-0137)

### ■ 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 - 730nm (5J0-0137)<br>260 - 700nm (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 |



### ■ Micro cell (650-0116)



### ■ Low scatter micro cell (650-0171)

Used for the measurement of trace samples of about 0.2mL with almost the same sensitivity as that obtained by using a 10mm cell.

The low scatter micro cell using a black quartz mask has a low scatter beam and is effective for high sensitivity analysis of trace samples.

|                       |               |
|-----------------------|---------------|
| Minimum sample volume | approx. 0.2mL |
|-----------------------|---------------|



### ■ Report generator program (5J0-0306)

Used to customize measurement reports. In addition to allowing user selection of size and position of report items, comments font, and graphs, calculations could be automatically executed using the spreadsheet function.

## ● SPECIFICATIONS

| ITEM  | DESCRIPTION   |
|---|---|
| Sensitivity                                       | S/N 800 or better (RMS)<br>using Raman band of water<br>S/N 250 or better (Peak to Peak)<br>Excitation wavelength 350nm, bandpass 5nm,<br>response 2s |
| Minimum sample volume                             | 0.6mL (in use of standard 10mm rectangular cell)  |
| Photometric principle                             | Monochromatic light monitoring ratio calculation  |
| Light source                                      | 150W xenon lamp, self-deozonating lamp house  |
| Monochromator                                     | Stigmatic concave diffraction grating: 900<br>lines/mm, F2.2<br>Braze wavelength: Excitation side 300nm,<br>emission side 400nm                       |
| Measuring wavelength range<br>(on both EX and EM) | 200 to 750nm, and zero-order light<br>(Expandable up to 900nm with optional detector)   |
| Bandpass  | Excitation side: 1, 2.5, 5, 10, 20nm<br>Emission side: 1, 2.5, 5, 10, 20nm  |
| Resolution  | 1.0nm   |
| Wavelength accuracy                               | 1nm   |
| Wavelength scan speed                             | 30, 60, 240, 1,200, 2,400, 12,000, 30,000,<br>60,000nm/min  |
| Wavelength drive speed                            | 60,000nm/min  |
| Response  | Response from 0 to 98%:<br>0.002, 0.004, 0.01, 0.05, 0.1, 0.5, 2, 4 s   |
| Photometric value range                           | -9999 to 9999   |
| Data processing unit                              | PC: Windows <sup>®</sup> XP Professional  |
| Printer   | Printer compatible with Windows <sup>®</sup> XP   |
| Dimensions/weight                                 | Spectrophotometer: 620 W × 520 D × 300 H mm<br>(excluding protrusions)/41kg   |
| Working temperature<br>/humidity                  | 15 to 35°C, 45 to 80% (condensation not<br>allowed, 70% or less at 35°C or higher)  |
| Power consumption<br>(spectrophotometer)          | 100, 115, 220, 230, 240 V AC, 50/60 Hz, 380 VA  |
| FL Solutions program                              | Standard software   |

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## ● FUNCTIONS

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

NOTICE: For proper operation, 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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