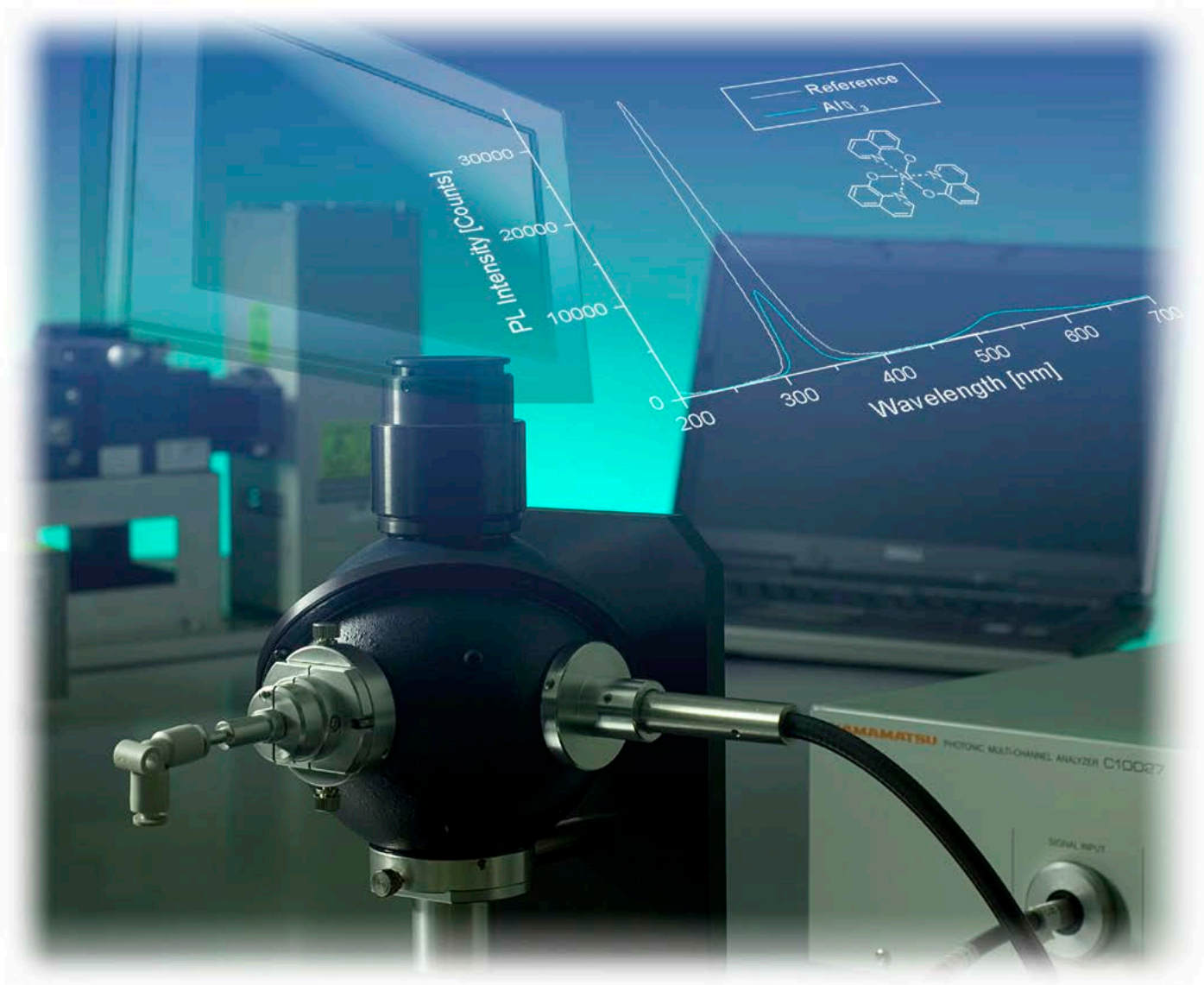


# Measurement System series for Organic LED Materials

Providing a variety of measurement needs from the development of organic LED materials to the development of flat panels.



Hamamatsu Photonics provides a variety of solutions by combining low-light detection, spectroscopic measurement, optical measurement and image processing technologies. The measurement system series for organic LED materials respond to a variety of needs in organic LED research and production fields, from materials development to device development.

## Line-up in our measurement system series for research in the organic LED field

### Absolute PL quantum yield spectrometer C9920-02, -02G, -03, -03G

Measurement of the luminous efficiency of a organic LED material using photoluminescence (PL).

### External quantum efficiency measurement system C9920-12

Measurement of luminous efficiency using current excitation of a organic LED device.

### Light distribution measurement system C9920-11

Measurement of brightness and emission angle distribution in a organic LED device.

### Picosecond fluorescence lifetime measurement system C11200

Measurement of fluorescent and phosphorous lifetimes.

### Time-resolved absorption spectrum analyzing system

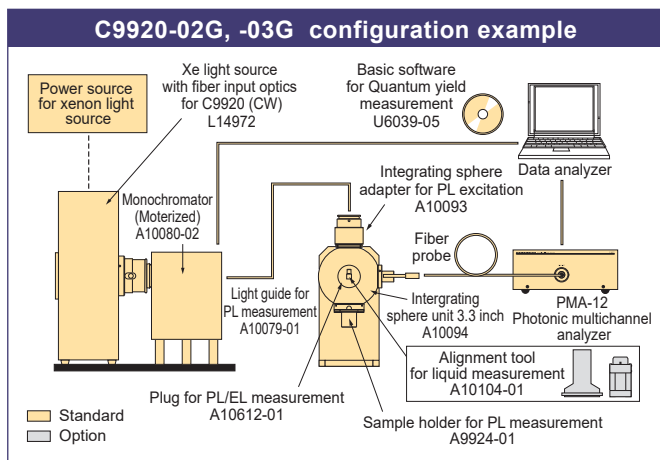
Measurement of transient absorption spectra in organic LED materials.

The C9920 series, which is built around the Multichannel Detector, can make various measurements such as PL quantum yield and external quantum efficiency, as well as light distribution and brightness.

## Absolute PL quantum yield spectrometer C9920-02, -02G, -03, -03G

The absolute quantum yield for light emissions is measured using a photoluminescence method. Excitation at various wavelengths is possible by means of xenon lamp and monochromator.

The Absolute PL quantum yield spectrometer C9920-02, -02G, -03, -03G measures the absolute quantum yield for light emissions using a photoluminescence method (PL method in the following). The device is made up of an excitation light source that uses a stable xenon light source (monochromator), a nitrogen gas-flow capable integrating sphere and a PMA multichannel detector capable of simultaneously measuring multiple wavelengths that have been corrected for wavelength sensitivity.



### Features

- Absolute quantum yield measurement of light emitting materials by PL method
- Measures total flux by incorporating an integration sphere
- Measurements with ultra-high sensitivity and high signal-to-noise ratio
- For thin films, solutions and powder samples
- Temperature control (Target samples: powders, up to 300 C°)
- Automatic control of excitation wavelength (C9920-02G, -03G)
- Various of analysis functions
  - Quantum yield measurement
  - Excitation wavelength dependability (C9920-02G, -03G)
  - Emission spectrum
  - PL excitation spectrum (C9920-02G, -03G)

### Specifications

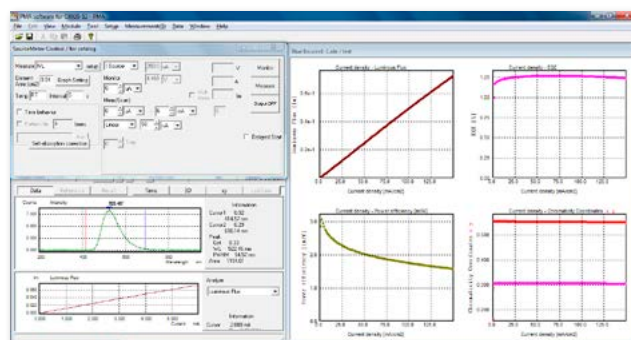
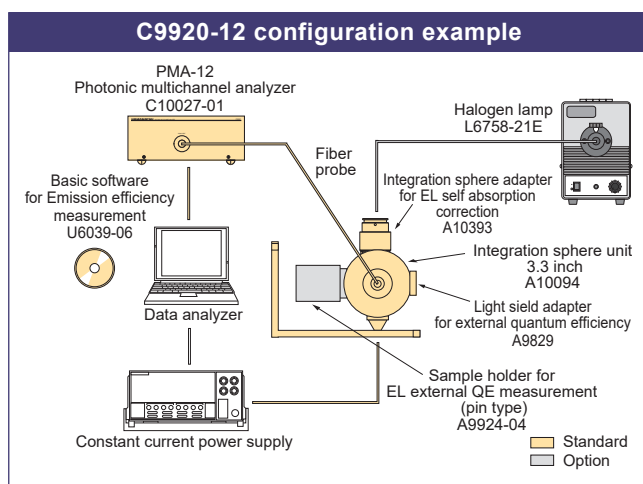
| Type number   | C9920-02  | C9920-02G                               | C9920-03             | C9920-03G                               |
|---|---|---|----------------------|---|
| PL measurement wavelength range                       | 300 nm to 950 nm  |   | 400 nm to 1100 nm    |   |
| Monochromatic light source (150 W xenon light source) |   |   |                      |   |
| Excitation wavelength                                 | 250 nm to 800 nm  | 250 nm to 950 nm                        | 375 nm to 800 nm     | 375 nm to 1000 nm                       |
| Bandwidth   | 10 nm or less (FWHM)  | Approx. 2 nm to 5 nm (Varies with slit) | 10 nm or less (FWHM) | Approx. 2 nm to 5 nm (Varies with slit) |
| Degradation prevention of the sample by light         | Excitation light interception by the mechanical shutter   |   |                      |   |
| Excitation wavelength control                         | Manual  | Automatic control                       | Manual               | Automatic control                       |
| Multichannel spectroscope                             |   |   |                      |   |
| Measurement wavelength range                          | 200 nm to 950 nm  |   | 350 nm to 1100 nm    |   |
| Wavelength resolution                                 | < 2 nm  |   | < 2.5 nm             |   |
| Sample holder (Option)                                |   |   |                      |   |
| Thin film   | Using Laboratory dish without caps (5 pieces) A10095-01 (not including a substrate)                                       |   |                      |   |
| Powder  | Using Laboratory dish with caps (5 pieces) A10095-03  |   |                      |   |
| Solution  | Using Alignment tool for liquid measurement A10104-01 or Side-arm cell (3 pieces) A10095-02                               |   |                      |   |
| Temperature control                                   | RT* to +300 °C by using Sample holder for temperature control A13924-03 with Controller for temperature control C13923-01 |   |                      |   |

\*RT: Room temperature

## External quantum efficiency measurement system C9920-12

Highly precise measurement of emission efficiency does not depend on the emission angle distribution characteristics by using an integrating sphere.

The External quantum efficiency measurement C9920-12 is a device for measuring the external quantum efficiency of a sample by exciting the LED device with current (voltage) and measuring the number of emitted photons. Measurements of emissions versus the current applied can be made, inclusive of elements related to the efficiency, such as absorption by the organic LED material layer and glass substrate, and reflective mirror efficiency.

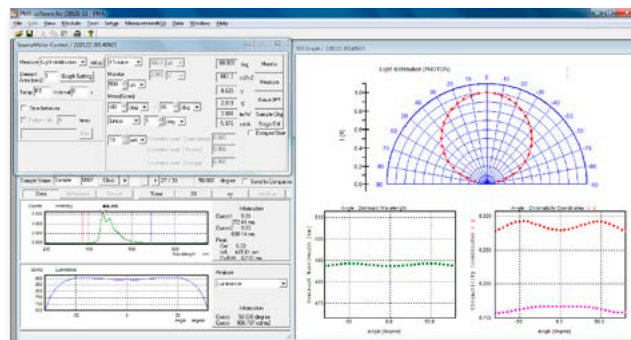
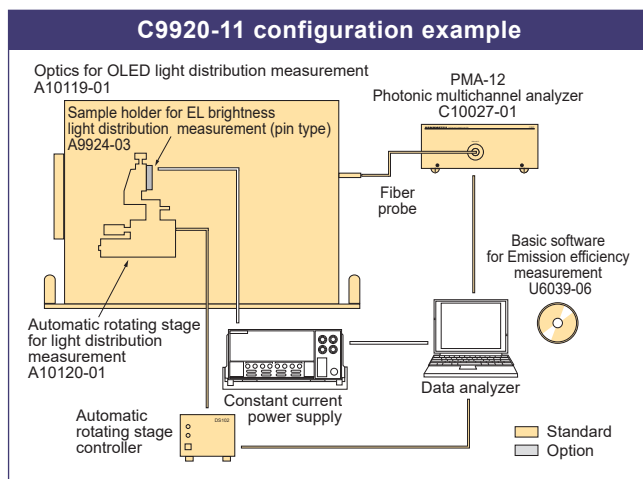


Minimum current/voltage value, maximum current/voltage value, current/voltage value steps and the like can be set in window at the upper left of the display screen. Raw measurement data is displayed in the window at the lower left of the display screen. Sample monitoring measurements, data during a measurement and the like are displayed. Various graphs can be displayed in the figures on the right side of the display screen.

## Light distribution measurement system C9920-11

Measurements such as brightness for each emission angle, emission spectrum and color coordinates are possible using a rotating stage.

The Light distribution measurement system C9920-11 is a device where the organic LED sample supplied with current (voltage) is placed on a rotating stage and the organic LED device emission brightness, spectrum and emission angle distribution are measured for each of the angle steps that has been set.



Besides angle measurement range and the step for angle measurements, the minimum current/voltage value, maximum current/voltage value and step current/voltage value can be set in window at the upper left of the display screen. Raw measurement data is displayed in the window at the lower left of the display screen. Sample monitoring measurements, data during a measurement are displayed. Various graphs can be displayed in the figures on the right side of the display screen. The graphs specified with a polar plot showing light distribution, can be displayed at the top of the screen.

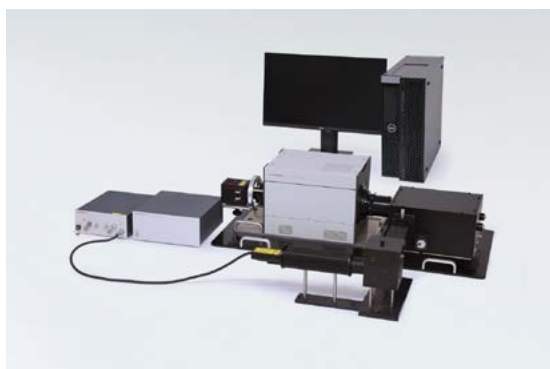
Sample courtesy of Kido Laboratory, Yamagata University

# Providing a variety of solutions by combining low-light observation, spectroscopic measurement, optical measurement and image processing technologies.

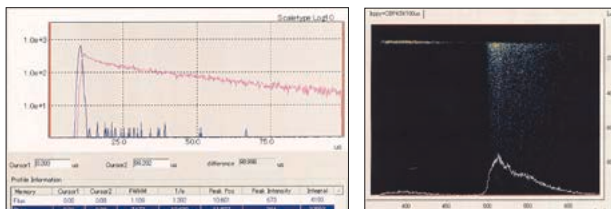
## Picosecond fluorescence lifetime measurement system C11200

### Fluorescence and phosphorescence lifetime measurements

Picosecond to millisecond fluorescence and phosphorescence lifetime are measured with high dynamic range by combining a laser and a streak camera. The results of the measurements are observed as a two-dimensional image made up of a wavelength axis and time axis, so it is possible to visually grasp the lifetimes for each of the fluorescent and phosphorescent components.



#### ● Measurement of time-resolved emission spectrum of phosphorous luminescent materials



▲ Phosphorescence materials Ir(ppy): Fluorescence, phosphorescence and streak image of temporal resolution luminescent spectra of host CBP thin film at 4.5 K

Data courtesy of Prof. Chihaya Adachi,  
Center for Organic Photonics and Electronics Research, Kyushu Univ.

## Time-resolved absorption spectrum analyzing system

### Transient absorption measurement

The sample is irradiated with a laser, and the absorption of transient species is measured by monitoring the transient species produced using a high-output xenon lamp or other lamp.

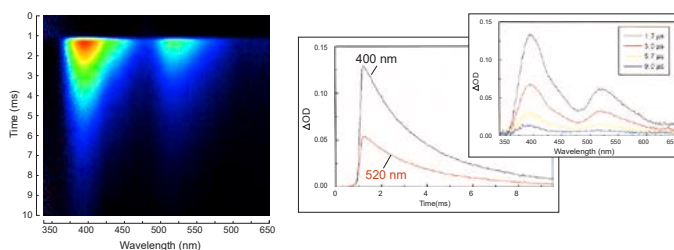
By using a streak camera as the detector, time measurements in the picosecond to millisecond range are possible. This is useful for measurement of intersystem crossing and elucidation of triplet status that are important for phosphorescence materials and the elucidation of the light emission processes and deterioration processes for organic LED materials.

#### [Streak camera specifications]

#### Time-resolved absorption spectrum analyzing system



#### ● Transient Absorption Spectrum of phosphorescence material Btp<sub>2</sub>Ir(acac) in acetonitrile Solution



Data courtesy of Prof. Chihaya Adachi,  
Center for Organic Photonics and Electronics Research, Kyushu Univ.

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