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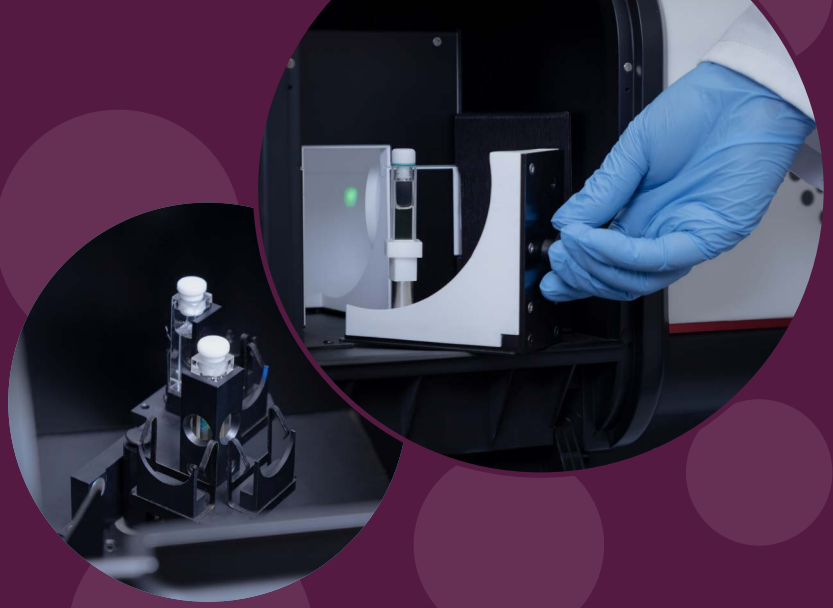


FS5
Sample Modules

Accessories Guide

edinst.com

Contents

Sample Modules

Sample Accessories

Introduction

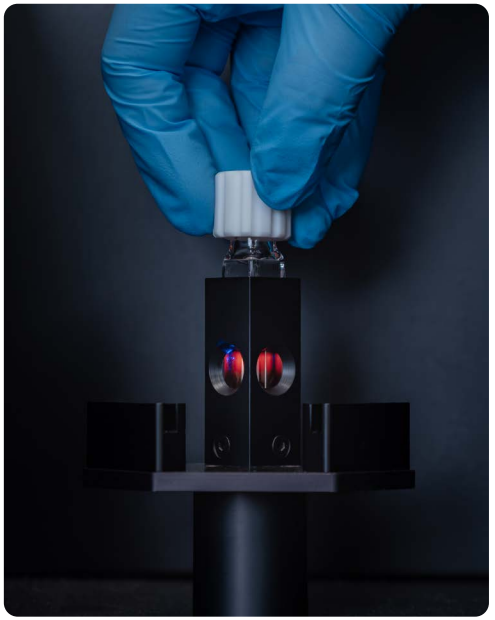
Sample modules are available for every application of the FS5 spectrofluorometer.

Swapping modules takes just a few seconds and they are automatically recognised by the software.

The modules can be purchased as an upgrade for an existing FS5.

Two types are offered:

- **SC** is a full sample module
- **SCA** is a sample accessory that fits into an SC sample module



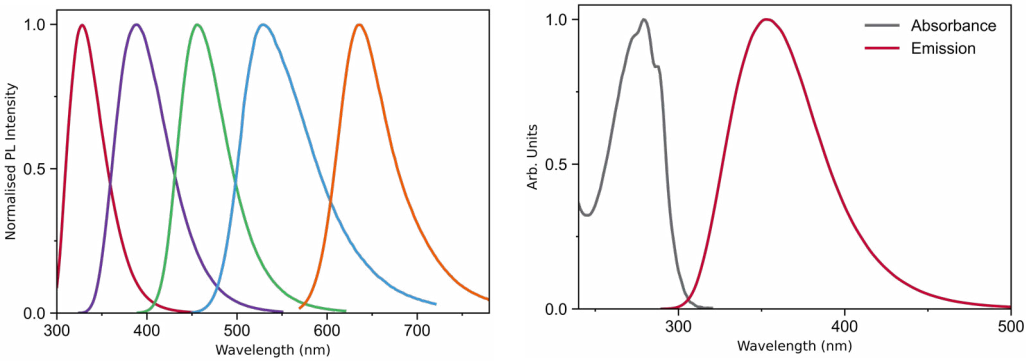
SC-05 Standard Cuvette Holder

The SC-05 serves as the standard sample holder for the FS5.
Fitted with a cuvette holder for photoluminescence and transmission measurements of liquid samples. It can be customised with SCA accessories that expand its capabilities to measure powders and films.

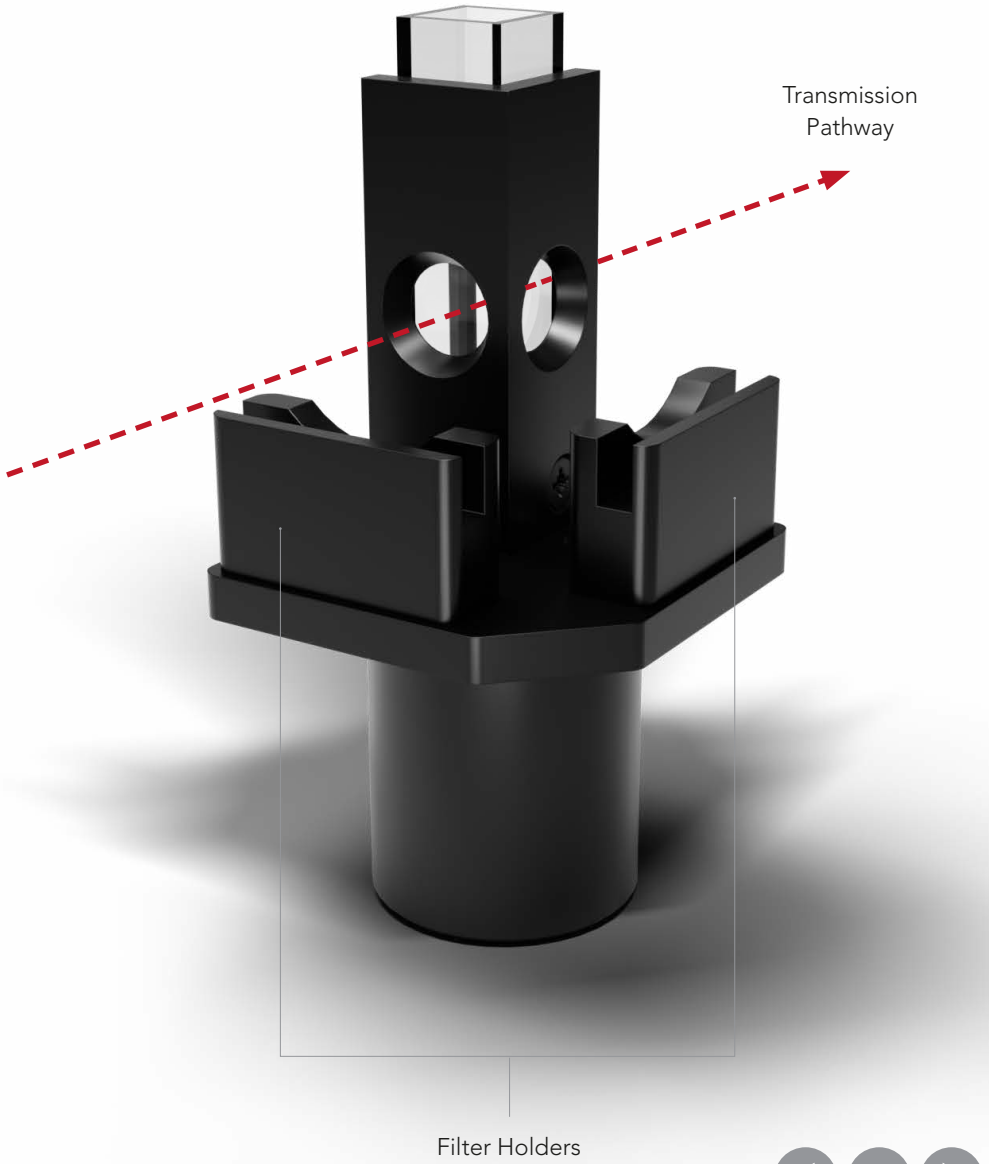
Features:

- Highly customisable; suitable for a broad range of sample types
- Built-in holders for long pass filters for scattering samples
- Accessories: SCA-1, SCA-2, SCA-3, SCA-6 and SCA-7
- Z height (distance from cuvette base to beam) is 15 mm

Measurement Examples



Left: Photoluminescence spectra of fluorescent standards that have been certified by the Bundesanstalt für Materialforschung und –prüfung (BAM). **Right:** Absorbance and emission of NATA in PBS buffer.



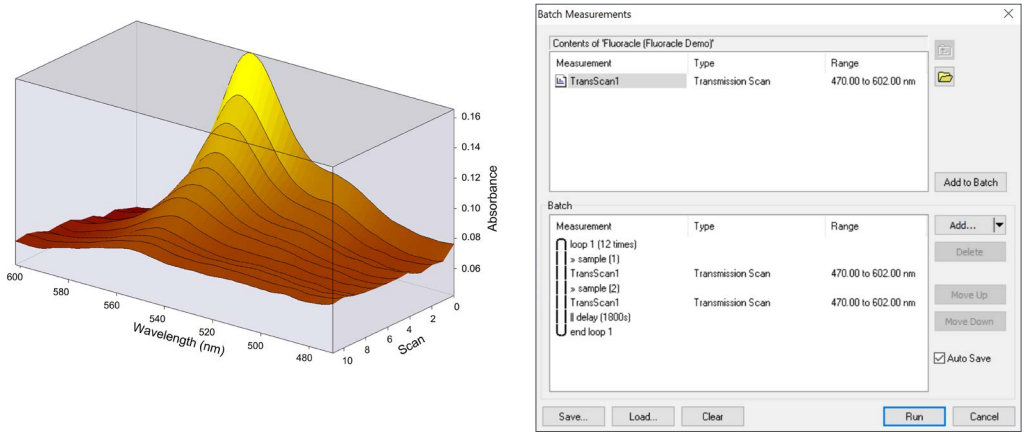
SC-06 Two-Position Cuvette Holder

Designed for enhanced efficiency, the SC-06 dual-position cuvette holder for the FS5 enables fully automated photoluminescence and transmission measurements of two liquid samples. Fluoracle's batch mode (FluoAuto) allows different measurement routines to be programmed for each cuvette, streamlining complex workflows. Automated absorbance measurements are easily achieved by placing a blank solution in one position.

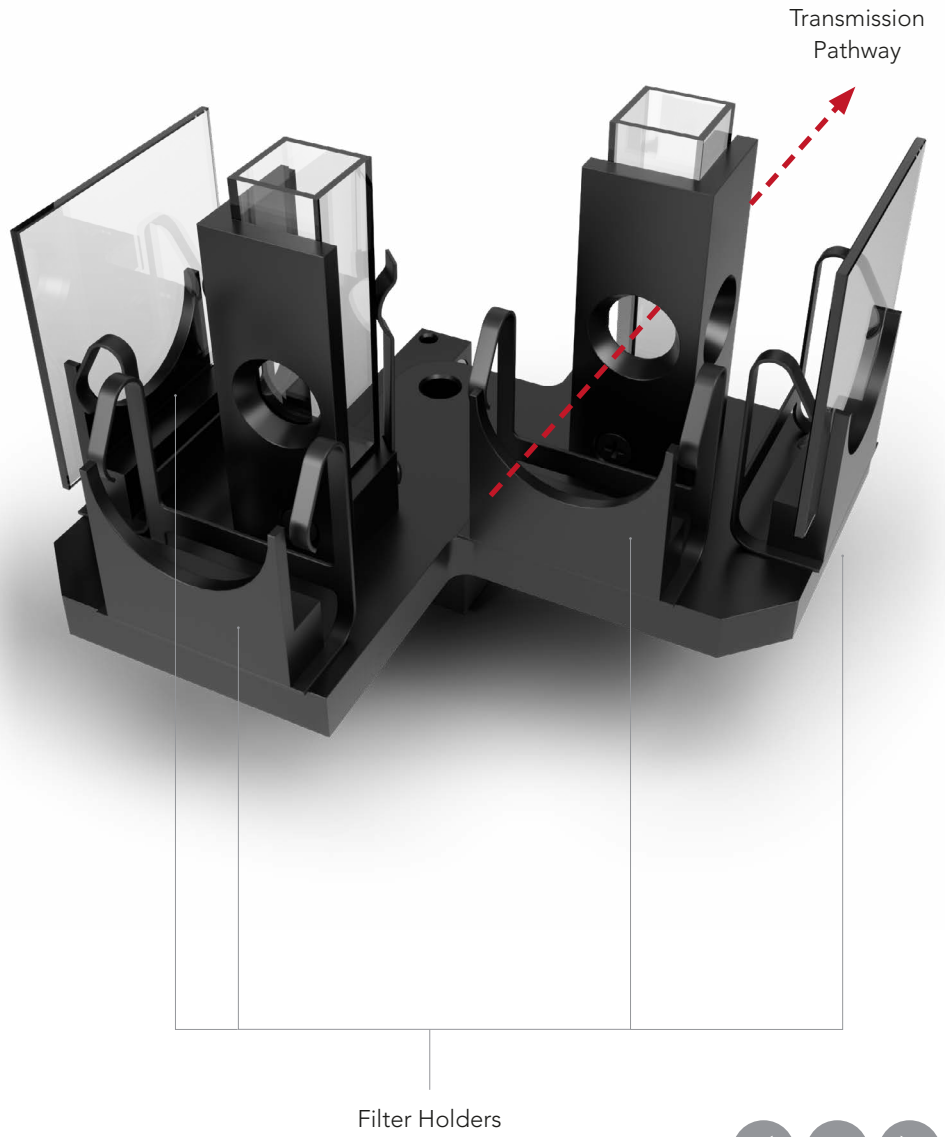
Features:

- Absorption measurement wizard included in software
- Both sample positions have built-in excitation and emission filter holders
- Accessories: SCA-3
- Z height is 15 mm

Measurement Examples



Left: Absorbance spectra of a rhodamine dye solution after addition of NaOCl acquired automatically with SC-06 (30 minutes between spectra). **Right:** Batch measurement setup to acquire the data shown on the left.

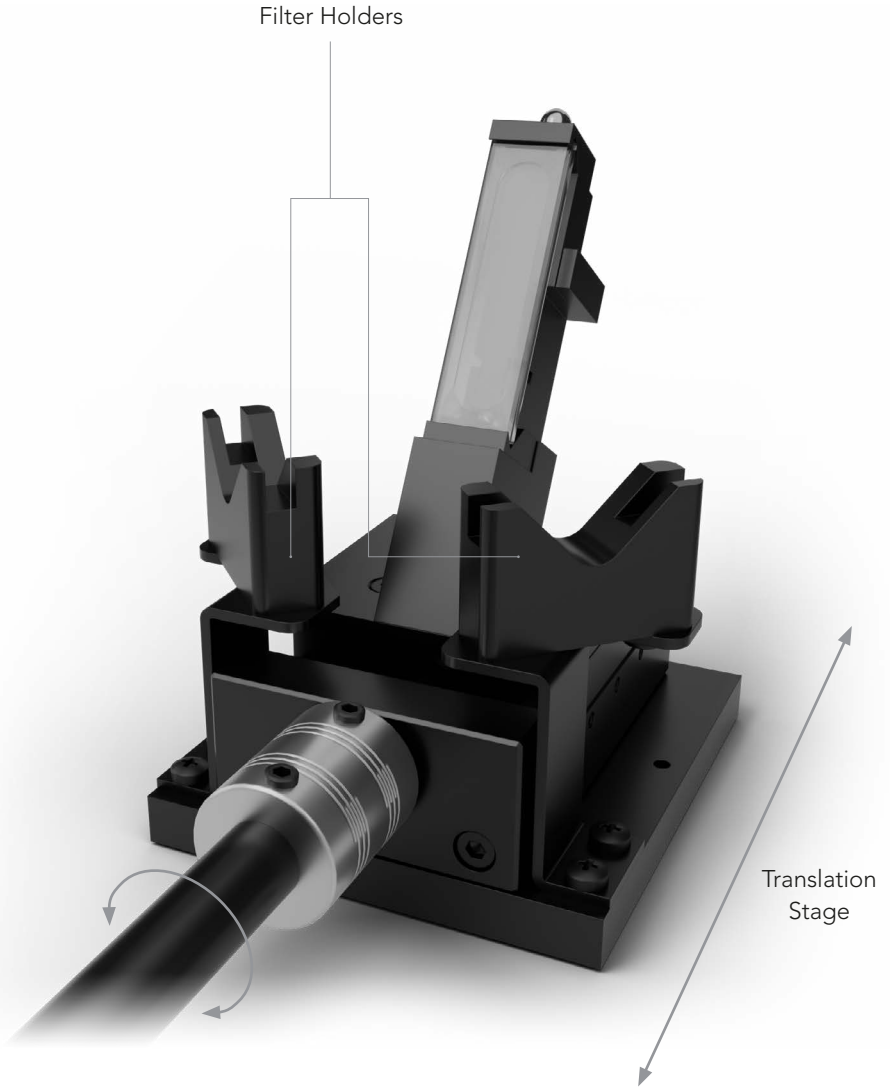


SC-10 Front-Face Sample Holder – Vertical

Optimised photoluminescence measurements for film and powder samples, plus reliable front-face emission analysis for strongly absorbing solutions – all made possible by the SC-10 Sample holder module.

Features:

- Sample holder is mounted on an externally adjustable 25 mm linear translation stage, allowing accurate sample positioning
- Built-in holders for long pass filters for scattering samples



Sample Holder Inserts

Adjustable screw clamp for holding small crystals or pellet samples.

Max. dim.:
10 x 10 mm^2

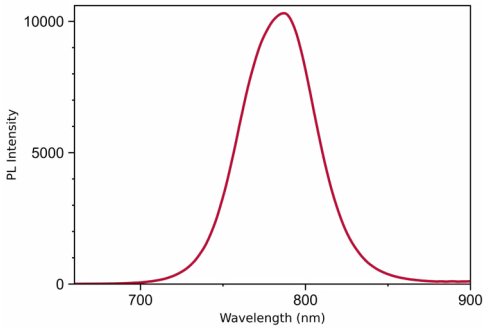
Min. dim.:
2 x 2 mm^2

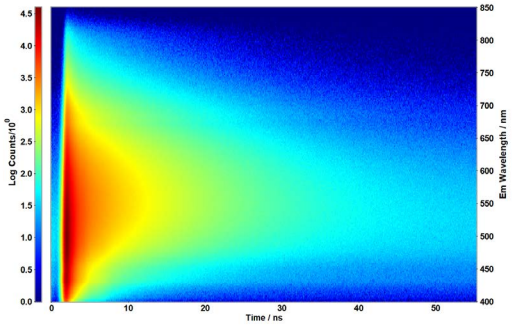
Spring clamp with:

(a) quartz demountable cuvette for powders (35 x 7 x 1 mm^3)

(b) quartz slide for planar samples (45 x 12 mm^2)

Measurement Examples





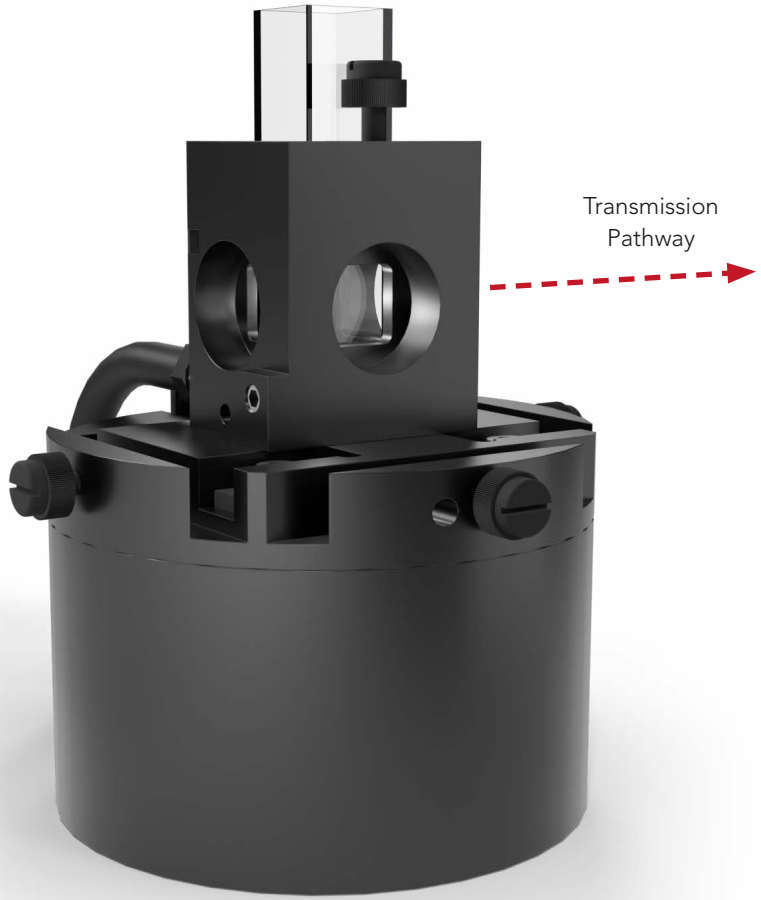
Left: Photoluminescence spectrum of $CH_3NH_3PbI_3$ (MAPI) perovskite thin-film on a quartz substrate, excited above bandgap at 550 nm. **Right:** Time-resolved emission spectrum (TRES) of 2D $MAPbBr_3$ perovskite powder, excited above bandgap at 375 nm.

SC-20 Temperature Controlled Holder – Circulator

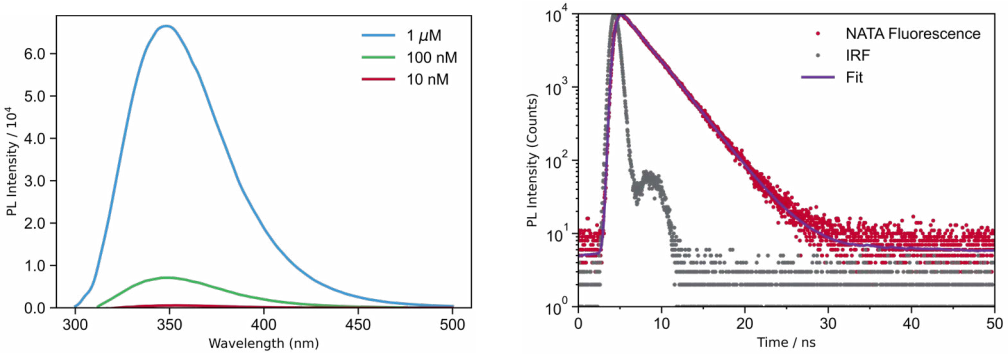
Best suited for mainaining a static temperature, the SC-20 is temperature controlled through an external circulator for photoluminescence and transmittance measurements of liquid samples in cuvettes. For example, in biological studies that require a consistent temperature of 37.5 °C.

Features:

- Temperature range*: -10°C to + 60°C
- Supplied with 3.5 mm internal diameter tubing
- Built-in magnetic stirrer
- Accessories: SCA-2, SCA-3, SCA-6
- Z height is 14 mm



Measurement Examples



Microvolume fluorescence study of N-Acetyl-L-tryptophanamide (NATA) at 37°C and pH 7.4. **Left:** Fluorescence spectrum of NATA at three concentrations with 700 µl sample volume. **Right:** Fluorescence decay of NATA recorded using TCSPC. The data was fit with a monoexponential using Fluoracle, revealing a lifetime of 3 ns.

Specifications

Temperature Range (°C)*	-10 to +60
Temperature Control	Manual (recorded by Fluoracle)
Stirrer Control	Controlled by Fluoracle

*Operation below the dew point (~ 5 °C) requires dry gas purging.

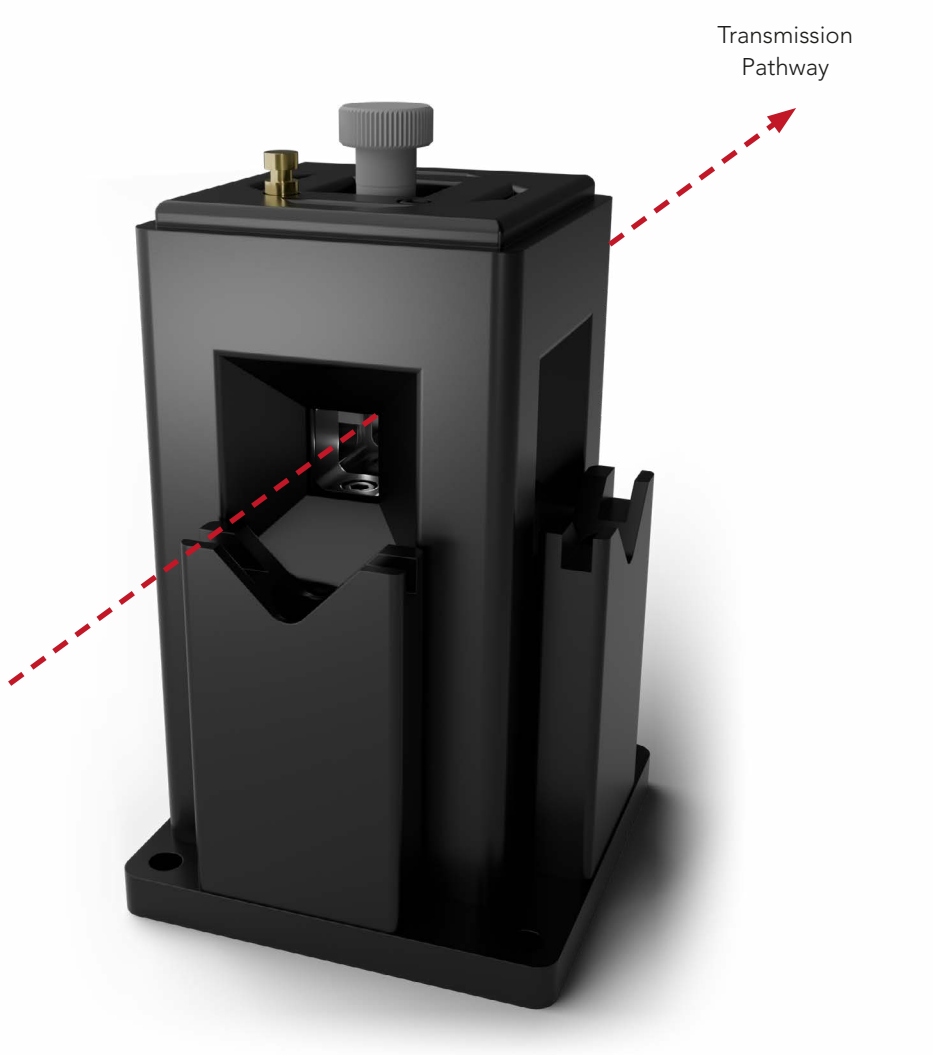
SC-24/25/26 Temperature Controlled Holder – TE Cooled

Temperature-controlled cuvette holders SC-24/25/26 enable precise photoluminescence and transmittance measurements of solutions.

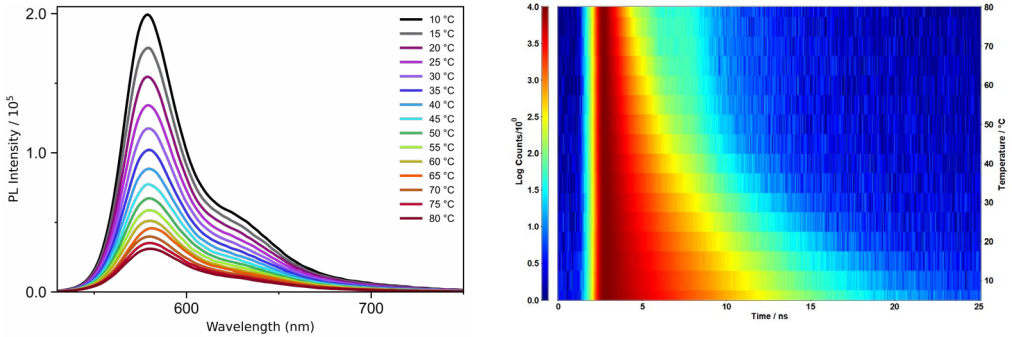
Full temperature control through Fluoracle allows automatic generation of variable-temperature spectral and lifetime maps.

Features:

- Temperature range: -50°C to +150°C (model dependent)
- Built-in magnetic stirrer
- Accessories: SCA-2, SCA-3, SCA-6
- Temperature change in batch mode
- Z height is 15 mm



Measurement Examples



Left: Automatic variable temperature emission scan of Rhodamine-B in H_2O over a temperature range of 10°C to 80°C.
Right: Automatically acquired temperature lifetime map of Rhodamine-B emission in H_2O. The fluorescence lifetime decreases with increasing temperature due to the increasing mobility of the diethylamino groups.

Specifications

Temperature Range (°C)	SC-24*: - 50°C to +150°C SC-25*†: -35°C to +105°C SC-26*†: -35°C to +150°C
Temperature Stability (°C)	± 0.02
Stirrer Control	400 – 4000 RPM
Temperature Control	Automatic (controlled and recorded by Fluoracle)

*Operation below the dew point (~5°C) requires dry gas purging.
†Operation below -10°C requires cooled circulating fluid in addition to dry gas purging. Operation below -20°C requires a windowed jacket (SCA-4) in addition to cooled circulating fluid and dry gas purging.

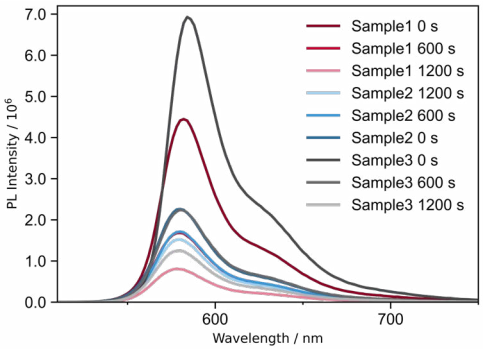
SC-27 4-Position Temperature Controlled Holder – TE Cooled

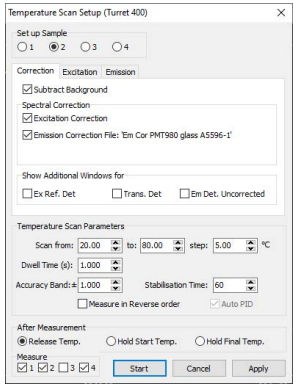
Measure up to four samples with fully software-controlled positioning with the SC-27 module. Obtain temperature-dependent photoluminescence and transmittance measurements of liquid samples, with spectral and lifetime maps automatically generated by Fluoracle.

Features:

- Built-in magnetic stirrer (same speed in all cuvettes)
- Accessories: SCA-2, SCA-3, SCA-6
- Temperature and sample change in batch mode
- Z height is 15 mm

Measurement Examples





Left: Automatic kinetic emission study of Rhodamine-B emission bleaching at different concentrations, acquired in batch mode. **Right:** Single point temperature scan setup wizard for multiple samples.

Specifications

Temperature Range (°C)*	-40 to +105 (same in all cuvettes)
Temperature Stability (°C)	± 0.02
Stirrer Control	400 – 4000 RPM
Temperature Control	Automatic (controlled and recorded by Fluoracle)

*Operation below the dew point (~5°C) requires dry gas purging. Operation below -10°C requires cooled circulating fluid in addition to dry gas purging.

SC-30 Integrating Sphere

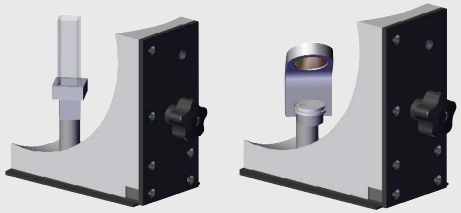
Easily measure absolute quantum yields (QY) for solutions, films, and powders with the SC-30 module's 150 mm integrating sphere. QY is quickly calculated using Fluoracle's QY Wizard, and absorptance of scattering samples can also be determined through reflectance scans.

Features:

- Simple QY calculation using the inbuilt software wizard
- Electroluminescence sample holder available (SCA-8)

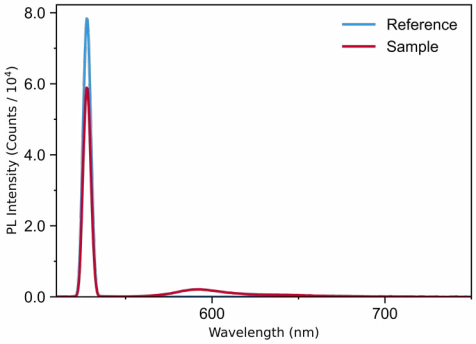
Cuvette and Powder Holders:

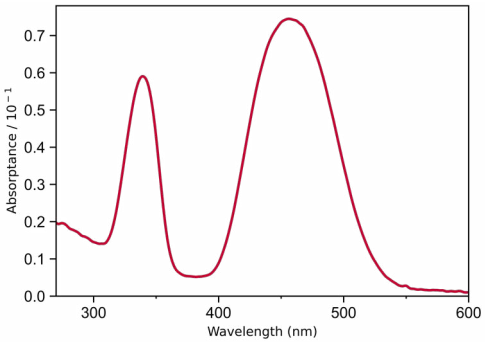
- The sphere is supplied with two quartz cuvettes (10 mm path length), two powder sample trays* (ø12 x 2 mm), and two blanking plugs.
- The powder holder has two positions, for direct and indirect excitation



*Additional or custom sample holders available upon request

Measurement Examples





Left: Measurement of absolute fluorescence quantum yield of Rhodamine 101 in ethanol. The scatter of the solvent is shown in blue and the scatter and emission of the Rh 101 in red. **Right:** Absorptance spectrum of a cerium-doped YAG phosphor recorded by synchronously scanning the emission and excitation monochromators and measuring the change in reflectance. The absorptance spectrum is then automatically calculated by Fluoracle.

SC-41 Microplate Reader

Rapidly screen fluorescent samples with the SC-41 Microplate Reader. Measuring plates of up to 384 wells, Fluoracle software fully automates the excitation, emission and lifetime scanning of each well.

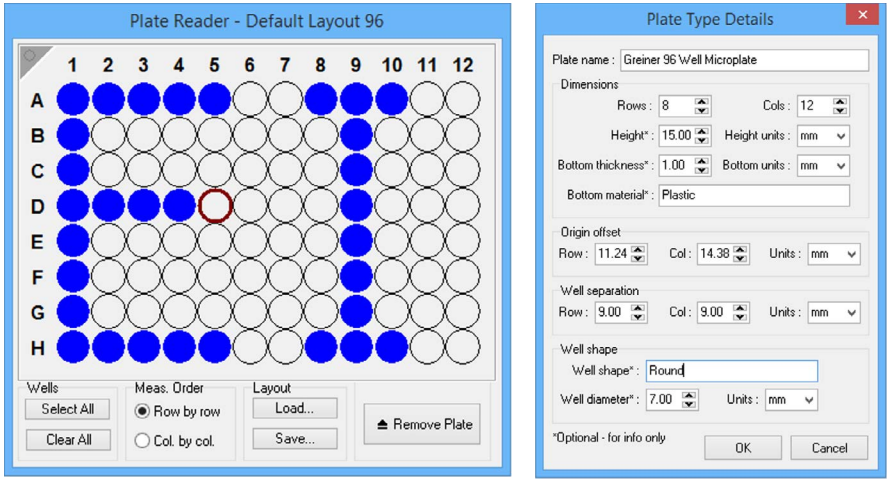
Features:

- Automatic spectral and lifetime scans of each well
- Custom well geometries can be defined and saved for later use
- Plates of up to 384 wells can be measured
- Requires black fluorescence plates with opaque bottom

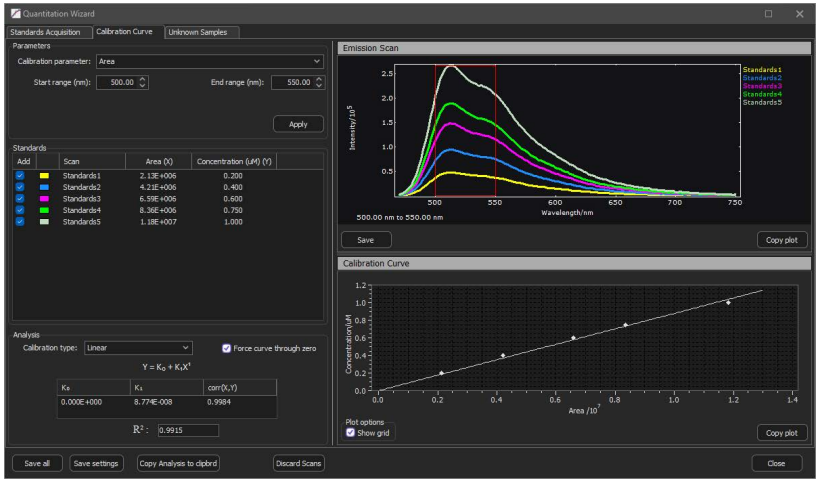
Spectral Coverage

Excitation	200 nm – 1000 nm
Emission	400 nm – 2000 nm

Plate Reader Interface in Fluoracle



Left: Plate reader user interface in Fluoracle. The wells highlighted in blue are those selected for measurement. **Right:** Custom microplate layouts can be easily defined using the wizard and saved for later measurements.



Calibration curve built from concentration standards measured in SC-41.

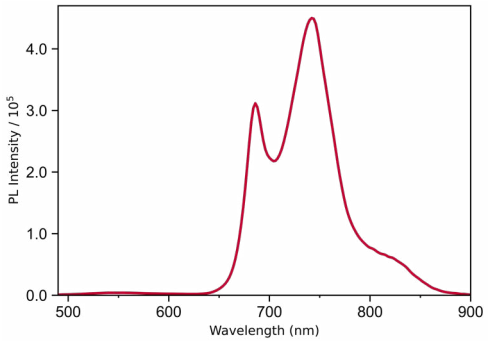
SC-50 Optical Fibre Launcher

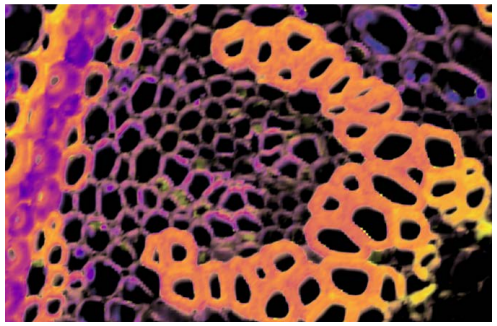
The SC-50 module couples the excitation and emission monochromators of the FS5 to optical fibres. The module is useful for remote sensing of large samples, or coupling to a microscope for fluorescence imaging.

Fibre Options:

- Bifurcated fibre bundle (BIF)
- SMA terminated fibres (SMA)
- FC terminated fibres (FC)
- Liquid light guides (LLG)

Measurement Examples





Left: Emission spectrum of chlorophyll within a leaf, measured in a front face geometry with the bifurcated fibre option.
Right: FLIM map of *convallaria* acquired in MicroPL accessory coupled to FS5 with a liquid light guide.

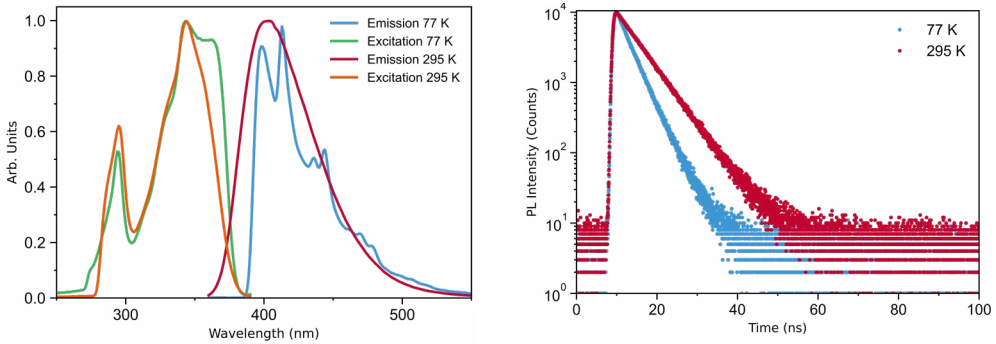
SC-70 Liquid Nitrogen Dewar

Offering a lower cost alternative to traditional cryostats, the SC-70 module is for measuring photoluminescence of solid samples and liquids at cryogenic temperatures. The sample is held within a quartz tube (4 mm ID) immersed in liquid nitrogen.

Features:

- Sample temperature is 77 K
- Hold time: 1 hour without refilling
- Built-in holders for long pass filters for scattering samples

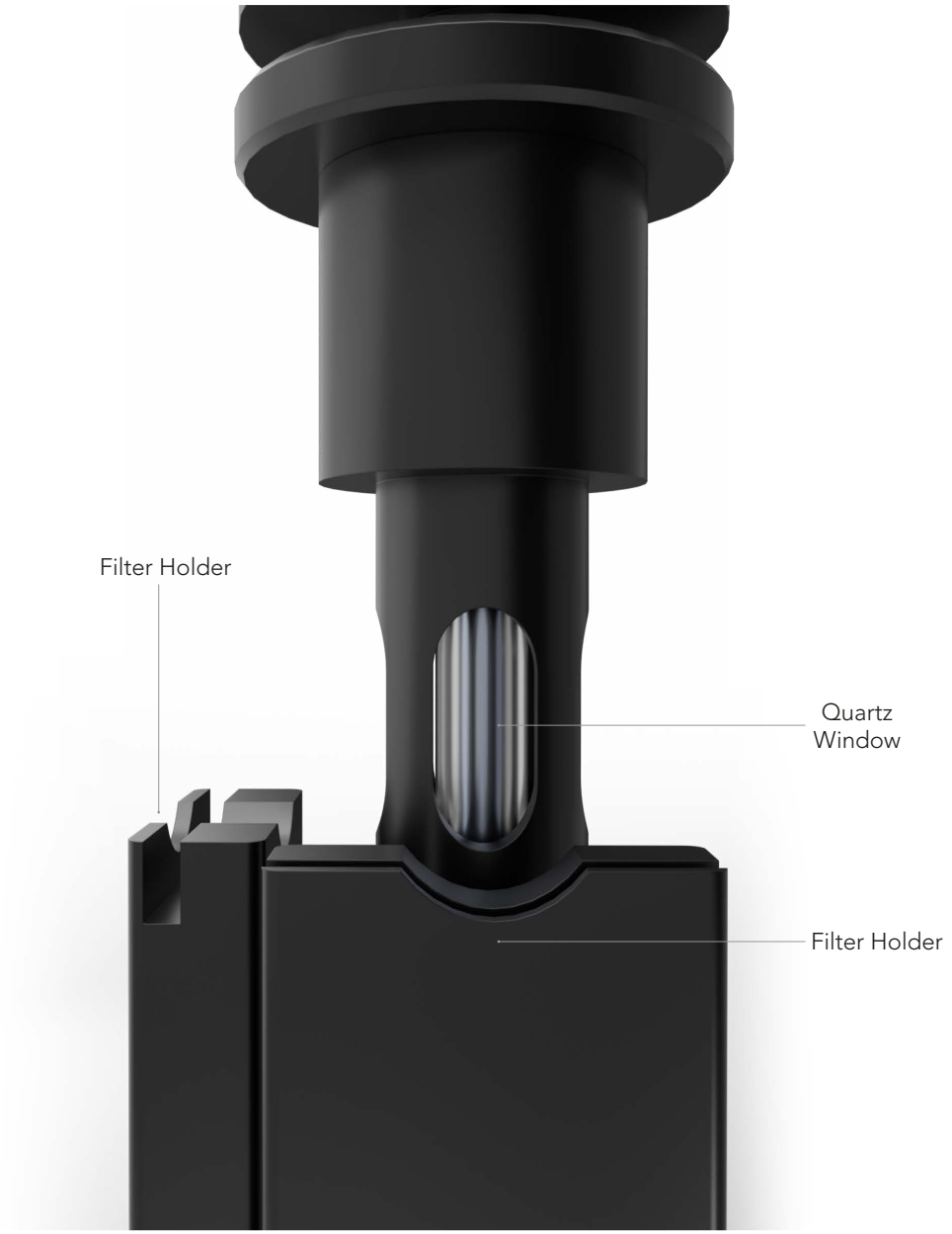
Measurement Examples



Left: Excitation and emission spectra of a small molecule OLED emitter at 77 K and 295 K. **Right:** Photoluminescence decays of the OLED emitter at 77 K and 295 K recorded using time correlated single photon counting (TCSPC).

Specifications

Temperature Range (K)	77
Temperature Stability (K)	± 0.01
Temperature Control	Manual (not recorded by Fluoracle)
Sample Holder Dimensions	4 mm Internal Diameter
Hold time at 77 K	>1 hour (without refill)



SC-80 Cryostat

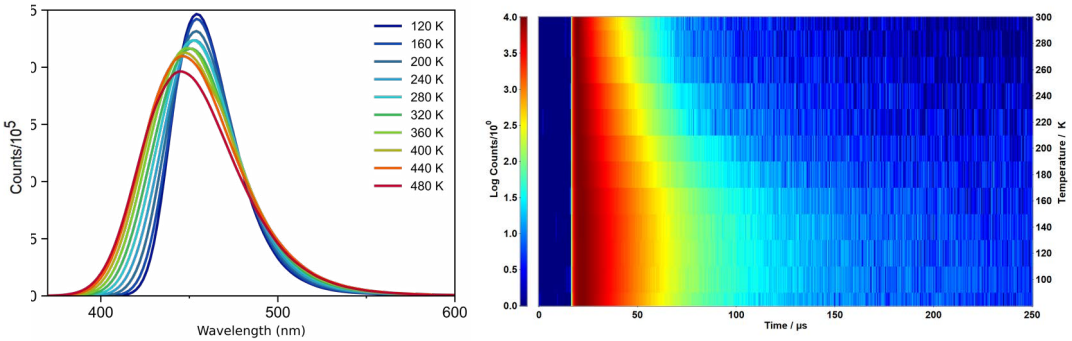
Featuring an integrated Oxford Instruments OptistatDN cryostat, the SC-80 sample module allows temperature-dependent photoluminescence measurements of both solutions and solid samples. Fluoracle provides full temperature control, enabling automatic acquisition of spectral and lifetime temperature maps as well as flexible variable-temperature batch measurements.

Features:

- Option of vacuum or nitrogen atmosphere
- Cuvette (10 mm), plain (19 x 30 mm^2) and optical (19 x 30 mm^2 with Ø15 mm aperture) sample holders included
- Powder sample holder available (N-SK05-PWD)

Sample Holders Included:

Measurement Examples



Left: Automatic variable temperature emission scans of the phosphor $BaMgAl_{10}O_{17}$: Eu, excited at 255 nm. The emission spectrum undergoes a bathochromic shift as the temperature is lowered. **Right:** Automatically acquired lifetime temperature map of Y_2O_3:Er powder. The lifetime decreases with increasing temperature due to thermal quenching.

Specifications

Temperature Range (K)	77 to 500
Temperature Stability (K)	±0.1
Temperature Control	Automatic (controlled and recorded by Fluoracle)
Maximum sample volume	Ø20 mm x 30 mm
Hold time at 77 K	15 hours (without refill)

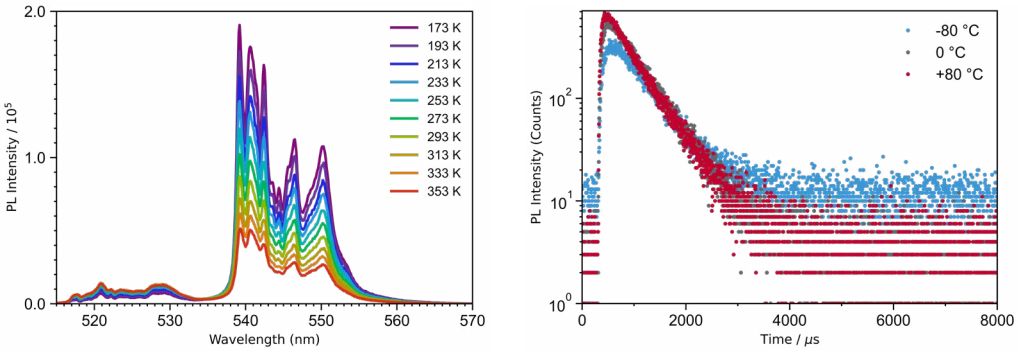
SC-90 Cryostage

Connecting a cryostage to the FS5 via optical fibres, the SC-90 sample module offers flexible configuration of both the cryostage and fibres. Sample temperature is fully controlled through software, enabling automated acquisition of photoluminescence spectra and lifetime maps, as well as efficient variable-temperature batch measurements.

Features:

- Sample temperature from -196 °C to 350 °C or 600 °C
- Options for XY sample position control, electrical probes, vacuum, or infrared range
- Compatible with solid and powder samples

Measurement Examples



Left: Spectral temperature map of $NaY_{0.77}Yb_{0.20}Er_{0.03}F_4$ in cryostage.
Right: Temperature-dependent photoluminescence decays of $NaY_{0.77}Yb_{0.20}Er_{0.03}F_4$ in cryostage.

Specifications

Temperature Range (K)	77 to 623 or 77 to 873
Temperature Stability (K)	± 0.1
Temperature Control	Automatic (controlled and recorded by Fluoracle)
Sample Area	22 mm diameter
Hold time at 77 K	Approx. 4 hours

SCA-1 Solid Sample Holder

Designed for photoluminescence and transmittance measurements of thin-films and powders, the SCA-1 replaces the standard cuvette holder in SC-05.

If transmittance is not required, the SC-10 module is recommended as it offers more accurate and adjustable sample positioning.

Features:

- Photoluminescence and transmittance
- Planar samples are held using spring clamp
  Min Sample Dimensions
  10 x 10 x 0.5 mm^3
  Max Sample Dimensions
  40 x 40 x 7 mm^3
- Powder tray and quartz coverslip with an enclosable volume of 10 x 6 x 1 mm^3 for photoluminescence measurements of powders and crystallites
- Built-in holders for long pass filters for scattering samples

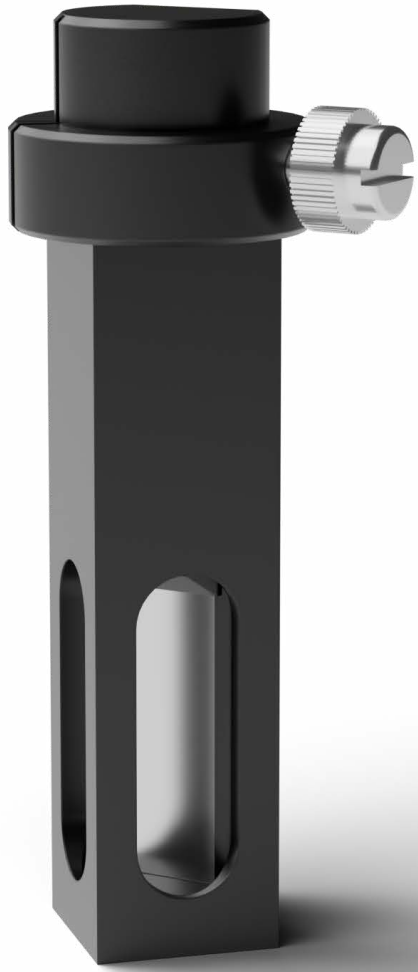
SCA-2 Solid Sample Holder

The SCA-2 enables solid sample measurements with the SC-05, SC-20, SC-24, SC-25 and SC-26 sample modules. It allows quick changes between solid and liquid measurements.

For more accurate and adjustable sample positioning, the SC-10 module is recommended.

Features:

- Photoluminescence only
- Can hold powders and small crystallites with an enclosable volume of 15 x 6 x 1 mm^3



SCA-3 Syringe Port

Ideal for in-situ titration during photoluminescence and transmittance, the SCA-3 is an alternative cover used with the SC-05, SC-20, SC-24, SC-25 and SC-26 modules. It incorporates a feedthrough for syringes and pipettes.

Features:

- Light tight feedthrough for syringes and pipettes with up to 12 mm diameter

SCA-6 Stopped-Flow Accessory

The SCA-6 is a stopped-flow accessory for following reaction kinetics by photoluminescence and transmission, with ms time resolution. Available with a choice of two (standard) or three (multimixing) injection syringes.

Features:

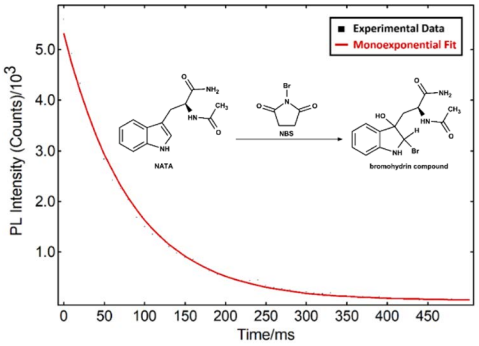
- Silica cuvette with 4 Spectrosil B observation windows with 2 mm and 10 mm path lengths
- Manual control of injection
- Compatible with the SC-05, SC-20, SC-24, SC-25 and SC-26 sample modules

Specifications

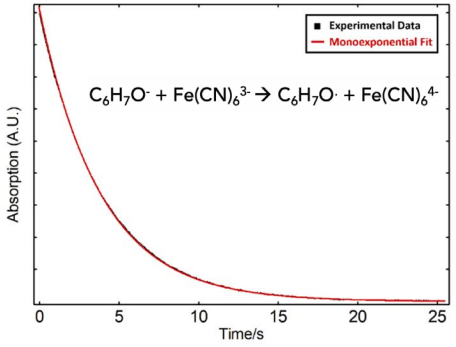
Dead Time (ms)	<10
Time Resolution (ms)	10
Dead Volume (µl)	350 (micro-volume version) or 700 (standard)
Volume per Shot (µl)	100 per reactant
Mixing Ratio	1:1 to 20:1
Chemical Resistance	Very high. Silica and PTFE construction.
Temperature Range (°C)*	5 to 80

*Temperature control is provided by SC-20 or SC-24/25/26 sample modules. SC-20: the circulating fluid is passed through the coolant jacket surrounding the umbilical to the cuvette, ensuring that the reactants are at the chosen temperature prior to injection and mixing. SC-24/25/26: reactants are not preheated and heating occurs in the mixing cuvette only.

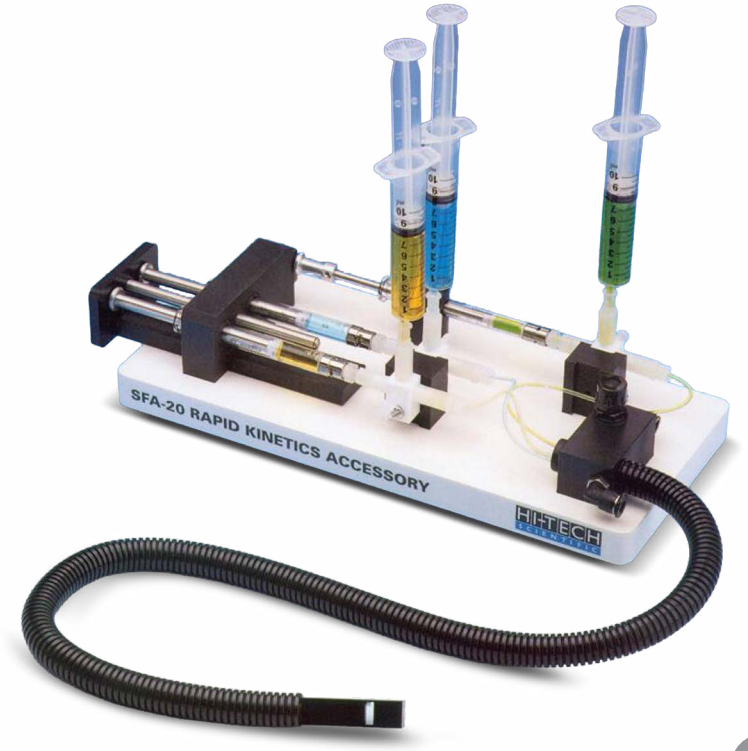
Fluorescence quenching of NATA by NBS



Bleaching of $Fe(CN)_6^{3-}$ by Ascorbic Acid



Left: PL kinetic of NATA quenching recorded using the emission detector of the FS5. λ_{ex} = 280 nm, λ_{em} = 360 nm. The decay was fit with a single monoexponential using Fluoracle, revealing a first order rate constant of 12 s^{-1}.
Right: Absorption kinetic of $Fe(CN)_6^{3-}$ bleaching recorded using the transmission detector of the FS5. λ_{ex} = 420 nm. The decay was fit with a single monoexponential using Fluoracle, revealing a first order rate constant of 0.26 s^{-1}.



SCA-7 Solid Sample Holder with Rotation

Designed for angle-dependent photoluminescence and transmittance of solid samples, the SCA-7 replaces the standard cuvette holder in SC-05.

If angular dependence is not required the SC-10 module is recommended, as it offers more accurate and adjustable sample positioning.

Features:

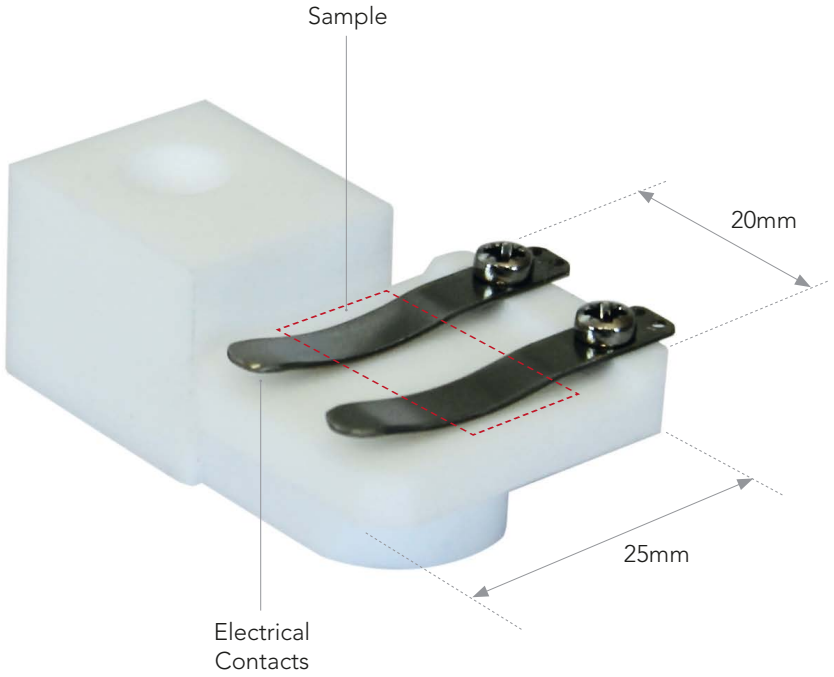
- Photoluminescence and transmittance
- Graduated angular scale for accurate rotation
- Planar samples held using spring clamp.
  Min Sample Dimensions
  10 x 10 x 0.5 mm^3
  Max Sample Dimensions
  40 x 40 x 5 mm^3
- Powder tray and quartz coverslip with an enclosable volume of 10 x 6 x 1 mm^3 for photoluminescence measurements of powders and crystallites
- Built-in holders for long pass filters for scattering samples

SCA-8 Electroluminescence Sample Holder for Integrating Sphere

Used with the SC-30 Integrating Sphere, the SCA-8 enables electroluminescence measurements for solid samples.

Features:

- 25 mm sample tray with two electrical contacts
- Feedthrough for electrical contact wires



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