

# QE65000

Scientific-Grade Spectrometer



## New Optical Bench Enhancements Produce Lower Stray Light and Improved Dynamic Range

Our QE65000 Scientific-grade Spectrometer combines the power of a back-thinned FFT-CCD detector with advances in a proprietary optical bench coating and other components to provide high sensitivity and superior dynamic range for a host of low-light level applications. Add the spectrometer's onboard thermoelectric cooler to the mix, and the QE65000 presents an ideal option for applications such as fluorescence, Raman analysis and DNA sequencing.

## About the Improved QE65000

Our best spectrometer has just gotten better! We've improved our QE65000 to give you unmatched performance and have made optical bench enhancements that provide even greater value: customized optics to improve response in the UV and Shortwave NIR regions; a proprietary low BRDF coating to improve stray light performance and unit-to-unit reproducibility; and additional optical bench order-sorting filter options to prevent second- or third-order effects in certain grating configurations.

## Quantum Efficiency to 90%

The QE65000 uses the Hamamatsu S7031-1006 back-thinned FFT-CCD detector, which has peak quantum efficiency of ~90% (and QE of 65% at 250 nm). Back-thinned FFT-CCD detectors have great UV response, great signal-to-noise characteristics and wide dynamic range, making them especially suited for low-light level applications. What's more, that inherent UV response eliminates the need for UV-sensitive detector coatings that can be difficult to apply with batch-to-batch consistency.

The QE65000 is a modular spectrometer that can be configured for a variety of high-sensitivity applications. By combining different filter, slit and grating options, users can optimize systems for their unique setups. A full range of light sources, fibers and accessories complete each system.

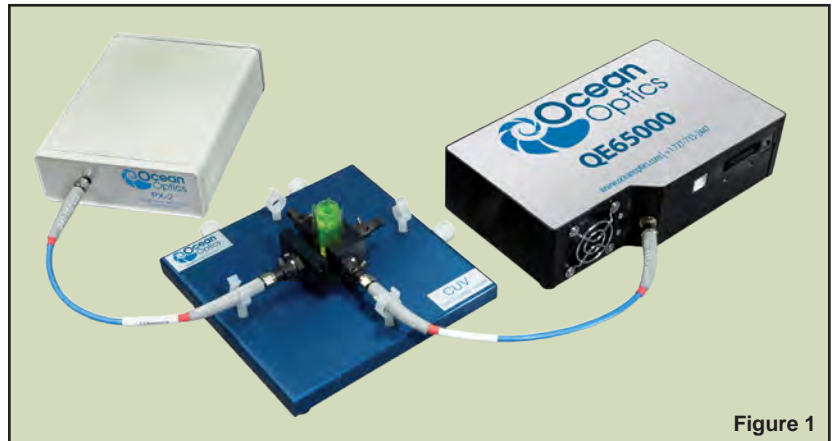


Figure 1

In Figure 1, we've used the QE65000 as part of a system for fluorescence and absorbance measurements. For fluorescence, our PX-2 Pulsed Xenon Source (at left in image) excites your cuvette-based sample in the CUV-ALL 4-Way Cuvette Holder. Adding LVF Linear Variable Filters to the holder allows users to spectrally shape the excitation energy from the PX-2. Optical fibers are positioned at 90° for fluorescence or directly across each other for straight-through absorbance measurements. In an absorbance setup, you likely would switch out the PX-2 for an illumination source such as our DH-2000-BAL Deuterium Tungsten Halogen Source.



Figure 2

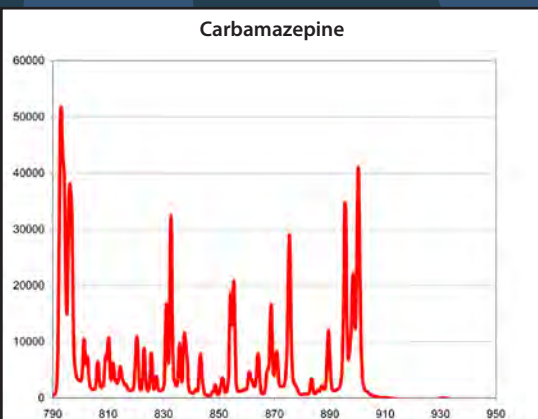
In Figure 2, the QE65000 anchors a modular, probe-based Raman system. You'll note a bifurcated optical probe with one leg coupled to a 785 nm laser (in middle of photo) and the other to the spectrometer. The QE65000 is an excellent option for Raman analysis, thanks to its TE-cooled detector, which results in very low dark noise and allows you to set the integration time of the spectrometer at up to 15 minutes with little spectral distortion. Depending on the choice of slit and grating, optical resolution of ~8 cm<sup>-1</sup> is possible.

## Thermoelectric Cooler for Long Integration Times

The QE65000's TE-cooled detector features low noise and low dark signal, which enables low-light level detection and integration times from 8 milliseconds to as long as 15 minutes, with virtually no spectral distortion. Stability is  $\pm 0.1$  °C of set temperature in less than two minutes. The lowest set point for the TE cooler is 40 °C below ambient, to -15 °C.

## QE65000 Optical Bench Options

The QE65000 Spectrometer can be configured with your choice of gratings, entrance aperture (slit) sizes, order sorting filters and other optical bench accessories, to optimize the spectrometer for your application. For example, you can select from among multiple gratings across the UV-NIR, or choose our HC-1 composite grating for broad wavelength coverage. Slits are 1-mm high and available in widths ranging from 5  $\mu$ m to 200  $\mu$ m. Also, additional variable bandpass order-sorting filters are available with the new QE65000, allowing users the flexibility of setting the starting wavelength at 50-nm intervals between 200 nm and 400 nm.



<b>Physical</b>	
Dimensions:	182 mm x 110 mm x 47 mm
Weight:	1.18 kg (without power supply)
<b>Detector</b>	
Detector:	Hamamatsu S7031-1006
Detector range:	200-1100 nm
Pixels:	1024 x 58 (1044 x 64 total pixels)
Pixel size:	24 $\mu$ m <sup>2</sup>
Pixel well depth:	300,000 electrons/well, 1.5 m elec/column
Sensitivity:	22 electrons/count all $\lambda$ ; 26 photons/count @ 250 nm
Quantum efficiency:	90% peak; 65% at 250 nm
<b>Optical Bench</b>	
Design:	f/4, Symmetrical crossed Czerny-Turner
Focal length:	101.6 mm input and output
Entrance aperture:	5, 10, 25, 50, 100 or 200 $\mu$ m wide slits or fiber (no slit)
Grating options:	Multiple grating options, UV through Shortwave NIR
HC1 grating:	Provides 200-1050 nm range (best efficiency)
OFLV filter options:	OFLV-QE (200-950 nm); OFLV-QE-250 (250-1000 nm); OFLV-QE-300 (300-1050 nm); OFLV-QE-350 (350-1100 nm); OFLV-QE-400 (400-1150 nm)
Other filter options:	Longpass OF-1 filters
Fiber optic connector:	SMA 905 to 0.22 NA single-strand optical fiber
<b>Spectroscopic</b>	
Wavelength range:	Grating dependent
Optical resolution:	$\sim 0.14$ -7.7 nm (FWHM)
Signal-to-noise ratio:	1000:1 (at full signal)
A/D resolution:	16 bit
Dark noise:	3 RMS counts
Dynamic range:	$7.5 \times 10^9$ (system), 25000:1 for a single acquisition
Integration time:	8 ms-15 minutes
Stray light:	<0.08% at 600 nm; 0.4% at 435 nm
Corrected linearity:	>99%
<b>Electronics</b>	
Power consumption:	500 mA @ 5 VDC (no TE cooling); 3.5 A @ 5 VDC (with TE cooling)
Data transfer speed:	Full scans to memory every 8 ms with USB 2.0 port, 18 ms with USB1.1 port, 300 ms with serial port
Inputs/Outputs:	10 onboard digital user-programmable GPIOs (general purpose inputs/outputs)
Breakout box:	Yes, HR4-BREAKOUT
Trigger modes:	4 modes
Gated delay feature:	Yes
Connector:	30-pin connector
Power-up time:	<5 seconds
Dark current:	4000 e-/pixel/sec @ 25 °C; 200 e-/pixel/sec @ 0 °C

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