

The River Diagnostics High Performance Optical Module Model HPRM 2500

River Diagnostics Raman systems are based on a core optical module, the High Performance Raman Module (HPRM) Model 2500 (Figure 1). This high-level subsystem is also available to investigators who wish to build up a custom Raman measurement capability by adding a custom-built measurement stage tailored to their own experimental needs.

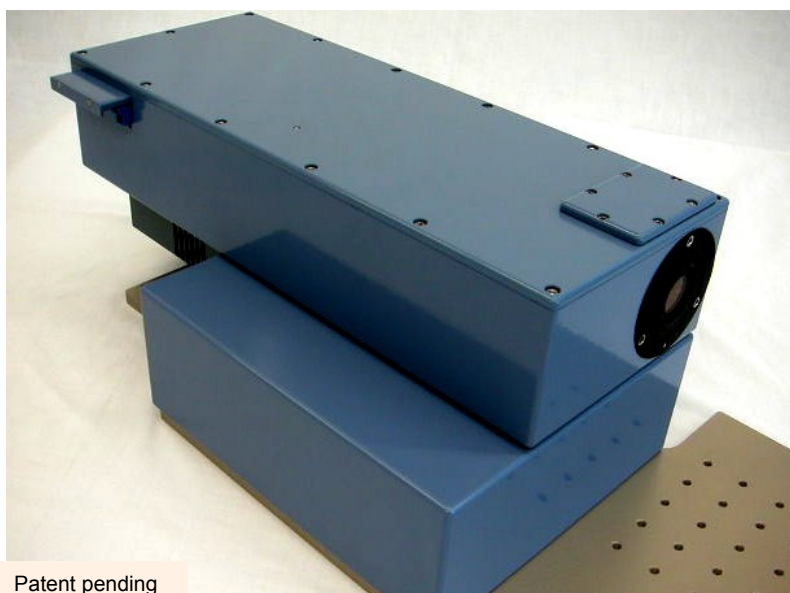


Figure 1

The HPRM 2500 is optimized for the most demanding Raman measurements requiring high spatial resolution. It is optimized to couple to a measurement module using confocal optics.

The HPRM 2500 receives laser light through an optical fiber, shapes and conditions the beam, and supplies the laser light to a measurement stage. From the measurement stage it receives the light that is scattered by the sample under investigation, disperses and measures the spectrum. The 2500 is optimized for confocal signal detection.

An operational system requires a single mode laser suitable for Raman spectroscopy, the HPRM 2500, a measurement stage, and a suitable PC running MS Windows 2000™.

The 2500 is designed to enable easy coupling of any measurement stage. Alignment of the optical pathway to the sample automatically ensures alignment of the signal detection pathway. Customers who build their own measurement stage will be supplied with all information necessary for coupling it to the 2500.

The 2500 is specifically optimized to achieve the highest signal detection efficiency in the 785–1000nm spectral region. Apart from the wavelength dependence of the quantum efficiency of the CCD-camera, signal throughput is virtually wavelength and polarization independent.

Optimal stability has been the guiding principle in the optical design, housing design, and choice of materials. The HPRM 2500 contains no moving optical parts that could affect Raman measurement repeatability.

Signal is collected simultaneously in the Raman spectral range of interest. (The range is ~ 400–2000 cm^{-1} with a 785nm laser or ~2000–4000 cm^{-1} with a 671nm laser. Alternatively, an HPRM version can be supplied to utilize 830nm and 730nm lasers to cover this range.) As an option, the 2500 can be supplied prepared for receiving laser light from either of two lasers to allow coverage of the full spectral range from 400–4000 cm^{-1} while maintaining the same high signal detection efficiency. Communication ports are provided to allow switching between the lasers under computer control.

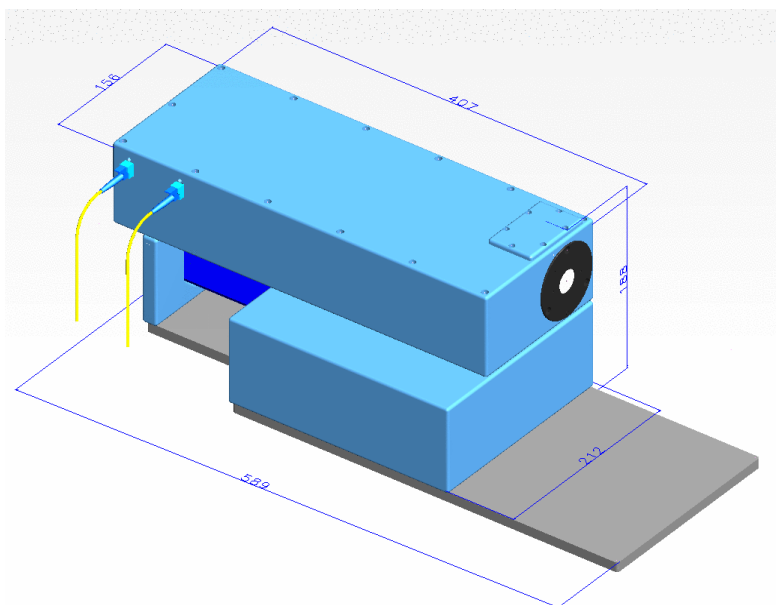


Figure 2: Footprint

The small footprint of the HPRM 2500 allows its use in any standard laboratory environment. It is easily coupled to any measurement stage, allowing great flexibility in configuration. (Dimensions shown in mm.)

The HPRM 2500 includes:

- Fiber coupling for laser. Connectorized polarization maintaining fiber in protective tubing specifically optimized for the HPRM and for the laser wavelengths used.
- Laser beam shaping optics. NIR optimized.
- 25 microns diameter confocal pinhole. For applications in which larger measurement volumes are required, modules can be ordered which include pre-aligned focusing optics and a pinhole of larger diameter. They can be used to replace the standard pinhole with a minimum of realignment required.
- Laser suppression filter with an optical density (O.D.) >8 and a Raman signal throughput >90%
- Spectrometer optimized for the Near Infrared. Specifications:
 - Spectral region coverage: $\sim 400\text{--}4000\text{ cm}^{-1}$ ($\sim 400\text{--}2000\text{ cm}^{-1}$ with a 785 nm laser and $\sim 2000\text{--}4000\text{ cm}^{-1}$ with a 671 nm laser. Optional version available for 730 nm/830 nm laser combination.)
 - Spectral resolution: equal to or better than 5 cm^{-1} throughout the spectral region (using a 25 micron pinhole)
 - Throughput: 75-80% over entire spectral region
- Detector. Equipped with a back-illuminated deep-depletion CCD-camera with 1024 x 128 pixels, air-cooled (no liquid coolant required). Camera control software included.
- System software

Polarization Option:

- Simultaneous measurement. Parallel and perpendicularly polarized Raman spectra are detected simultaneously on different sections of the CCD detector. This enables measurement of depolarization ratios or molecular orientation in a single simultaneous measurement.

Note: The Model 2500 is a class 3B laser device when coupled to the recommended class 3B lasers that emit visible (671 nm) and invisible (785 nm) laser radiation. **Avoid exposure to the beam.**