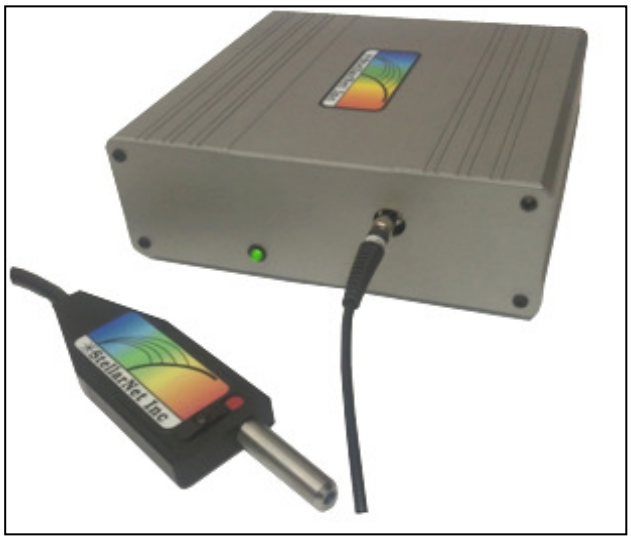
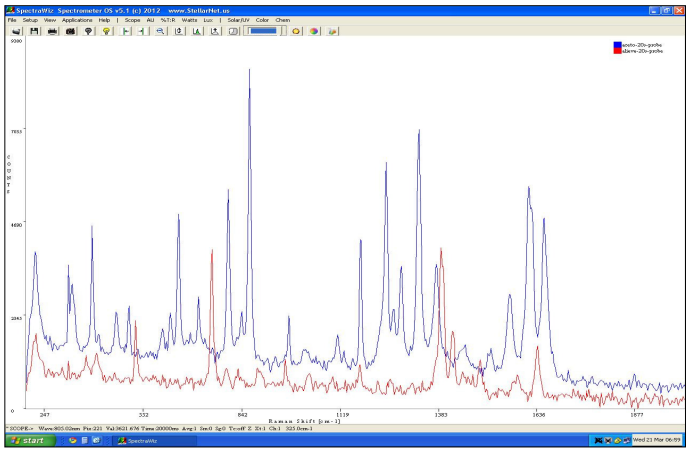
Raman Spectrometers

➢ Raman Spectroscopy Instrumentation



- Our Raman spectrometers are ruggedized miniature spectrometers configured specifically for Raman spectroscopy applications using 785nm lasers
- Enhanced optics allow for extreme sensitivity and extra low stray light values down to 0.05%
- High Resolution models available down to 4 cm^{-1} with options for maintaining S/N with TEC cooling
- Compact size & seriously Rugged for portable and field applications. Metal enclosures are extremely durable!



Raman-HR spectra of Aleve and Acetaminophen

➢ Raman Spectrometer Features

- Low cost - Ruggedized - High performance
- Shock proof - Permanently aligned optics
- Standard Fiber interface to Raman probes
- SpectraWiz Software and SDK included Free
- Simple USB2 interface to Netbook & PC's
- Suitable for lab, process, or field applications

Spec	Raman configured spectrometers		
Optical Resolution:	4 cm^{-1} or 8 cm^{-1}	Dimensions:	1x3x5 inch
Signal to Noise:	1000:1	Weight:	14 ounces
Detector Type:	Enhanced CCD with 2048 pixels	Power Consumption:	<100mA , USB powered
Diffraction Gratings:	1200 g/mm with gold surface	Fiber Optic Input:	SMA905
Spectral Range @785nm	200-2200 cm^{-1} -or- 200-3200 cm^{-1}	Interface:	USB-2
Stray Light:	<0.05%	Operating Systems:	WinXP, Vista, Win7 (32/64-bit)
Exposure Times:	to 20sec -or- to 60 sec w/ TEC	Software:	SpectraWiz, LabView,

Item	Description	
Raman-SR	Raman Standard Resolution for 200-3200 cm^{-1} @ 785nm with 8 cm^{-1} resolution via CCD	
Raman-HR	Raman High Resolution for 200-2200 cm^{-1} @ 785nm with 4 cm^{-1} resolution via CCD	
Raman-HR-TEC	Raman High Resolution for 200-2200 cm^{-1} @ 785nm with 4 cm^{-1} resolution via CCD with Thermo Electric Cooler (TEC) for best S/N with detector integration times > 10 seconds	
Raman-HR-TEC-IG	Raman High Resolution for 200-2200 cm^{-1} @ 1064nm with 8 cm^{-1} resolution via PDA with TEC cooled 1024 pixel InGaAs photodiode array. Minimize fluorescence via1064nm laser!	

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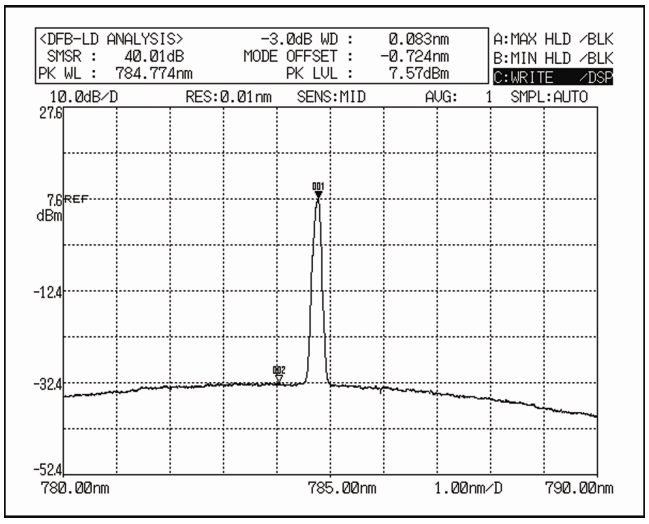
Please contact us about availability of additional laser frequencies used for Raman such as 532 / 647 / 830 / 1064nm.

Spectrum Stabilized Raman Laser Subsystems

➢ Laser Subsystem Features

- >350 mW Fiber Coupled Output Power
- Spectral Linewidth < 0.15 nm
- Ultra-narrow Spectral Linewidth option 1 cm^{-1}
- Temperature Stabilized Spectrum (< 0.007 $nm/^0C$)
- Low Power consumption (< 5.5 W)
- 40 dB SMSR Typical
- 3" x 2.5" x 0.69" Package Weighing < 4 oz



Typical Spectral Plot

Laser features high output power with narrow spectral bandwidth. The laser's stabilized peak wavelength remains "locked" regardless of case temperature (-10 to +55 deg. C). Devices can be spectrally tailored to suit application needs and offer side mode suppression ratios (SMSRs) better than 40 dB, thereby providing extremely high signal to noise ratio and making these sources ideal for Raman spectroscopy and pump laser applications. The laser is integrated with high performance laser drive and temperature control electronics in a compact package weighing less than 4 oz.

Parameter	Unit	Min	Typ	Max	Notes
Optical output power	mw	350	375		
Output power stability	%		± 1		
Peak wavelength	nm	784.5	785	785.5	
3 dB bandwidth (FWHM)	nm		0.1	0.15	
Peak wavelength drift	nm			± 0.10	over life
Optical signal-to-noise ratio (SMSR)	dB	35	45		
Warm-up time	sec			10 / 1.5	cold/warm start

Item	Description	
	Miniature Laser Subsystems for Raman Spectroscopy	
SSR-Laser-785-350	Spectrum Stabilized Laser Subsystem @ 785nm with <4 cm^{-1} resolution, 350mw	
SSR-Laser-785-500	Spectrum Stabilized Laser Subsystem @ 785nm with <4 cm^{-1} resolution, 500mw	

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Laboratory Laser Source for Raman Spectroscopy

Designed for use in the laboratory, the user configurable **Lab-LS** laser system provides a turn-key solution with integral laser drive and TEC control electronics, and offers the user the ability to adjust the laser drive current from either the front panel or remotely.

The module has a digital readout for easy set point adjustment, an independent master power key switch and laser enable switch, a remote interlock, and an Emergency Power Off (EMO) pushbutton.

The **Lab-LS** can be ordered with SMA905 or FC/PC or FC/APC bulkhead for easy patch cord attachment. The unit comes complete with an integral AC/DC power supply.

User interchangeable Lab-LS laser modules can be ordered with a variety of standard Raman wavelengths with either single mode (Polarization Maintaining) or multi-mode fiber coupled output.

The **Lab-LS** is a controller mainframe that lets you change in and out laser subsystem modules at will. This fully turn-key unit is **UL/CE & IEC approved**. The **Lab-LS** system provides the ability to adjust laser output power by turning a dial on the front panel and reading out the LED readout.

The small size and AC/DC operating power allows for great portability and use around the Lab or in the Field! The ultimate benefit is having a laser source that can be quickly switched to handle a different Raman wavelength for excitation. A specific sample type may have too much fluorescence at 785nm, however swapping to a 1064nm laser subsystem solves this problem.

Item	Description	
Lab-LS-785	Laboratory Laser Source mainframe with one SSR-Laser-785-350	
SSR-Laser-785-350	Additional Laser Subsystem @ 785nm with <4 cm^{-1} resolution, 350mw	
SSR-Laser-785-500	Additional Laser Subsystem @ 785nm with <4 cm^{-1} resolution, 500mw	

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Raman Spectroscopy Accessories

➢ Portable Laser with Vial Holder

- 785nm Laser configured with ½" vial holder
- Battery powered in Ruggedized metal case
- Raman Laser line 0.2nm FWHM over 50-100 deg F
- 350 / 499mWatt adjustable power
- SMA 905 output to spectrometer
- Integrating sphere collection assembly holds ½" round sample vials
- Screw top vials handle both liquid and powder and small solids such as pills
- Small size 2x4x6 inch with 2x2x2 inch sphere

RamuLaser Accessory for Probe or ½" Vials

➢ Portable Laser for Probe

- 785nm Laser attaches to Raman probe via standard FC/APC connector
- Battery powered in Ruggedized case
- Raman Laser line 0.2nm FWHM 350 / 499mWatt adjustable power

➢ Raman Probe

- Connects to 785nm Laser accessory via FC/APC fiber optic connector and spectrometer via SMA 905
- Rigid probe length is 100mm with integrated Raman filters for 200 cm-1 and f/2 collection optics
- Excitation fiber is 100um diameter and read fiber to spectrometer is 600um core diameter
- Probe diameter is 4mm with 2 meter fiber length and has laser blocking switch for simple reference
- Integrated filters for laser line (with O.D. > 6) and notch filter to remove quartz spectral contributions
- Working distance to sample is 4.5mm with field depth of +/- 1mm for penetration of sample containers Includes probe holder for solids like pills or vials (½ inch diameter with lids) for liquids and powders

Item	Descriptions for Raman Spectroscopy Accessories	
RamuLaser- Vial	Portable Raman Laser for 785nm with 350/499mW adjustable output and integrated vial holder with integrating sphere collected optics. Includes integrated LI battery with charger for 8 hour operation.	
RamuLaser- Probe	Portable Raman Laser for 785nm with 350/499mW adjustable output and FC/APC attachment for standard Raman probe. Includes integrated LI battery with charger for 8 hour operation.	
Raman- Probe-785	Attaches to laser via FC/APC and spectrometer via SMA 905, has integrated Raman filters and optics with working distance of 4.5mm to sample, configured for 785nm laser	

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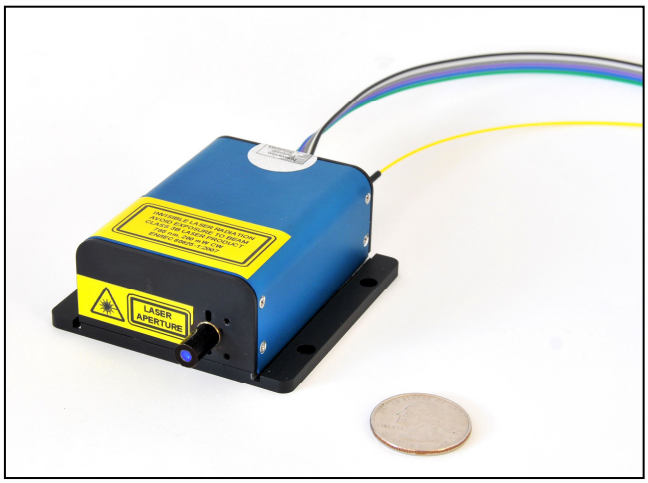
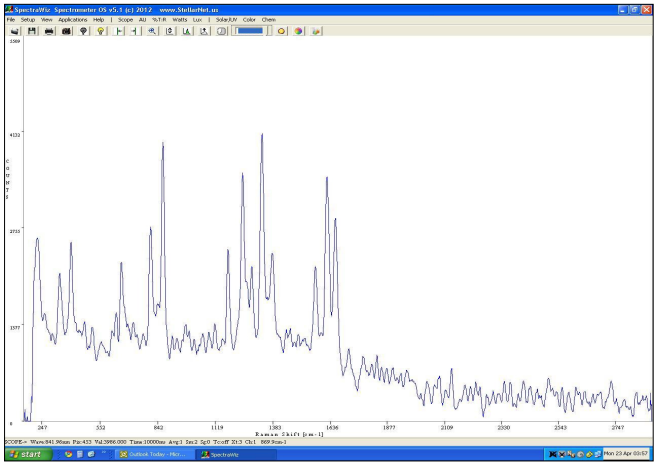
Raman Spectroscopy Accessories

➢ Portable Raman Laser-probe

- 785nm laser-probe with integrated optics
- 100mWatt laser operates on 5VDC
- Raman laser line 0.2nm FWHM
- Ruggedized case with battery power option
- FC to SMA905 fiber to spectrometer included
- 4.2mm focal distance from probe tip
- Ideal for microscope mount or small solid samples such as pills and SERS samples



Portable Raman Laser-Probe for Microscopes and OEM applications



INVISIBLE LASER RADIATION
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT
785 nm, 200 mW CW
EN/IEC 60825-1:2007

This laser module is designed for use as a component or replacement part and is thereby exempt from 21 CFR1040.10 and 1040.11 provisions.

← StellarNet Raman-HR spectra of acetaminophen (Tylenol)

Parameter	Unit	Min	Typ	Max	Notes
Laser Optical output power	mW	100	110		Circularized & collimated output beam w ith <0.7 mm dia (1.5:1 aspect ratio) and <2.5 mrad divergence
Output power stability	%		± 0.5	± 1	
Peak wavelength	nm	784.8	785	785.2	
3 dB bandwidth (FWHM)	nm		<1 MHz	0.02	
Operating Temperature Range (Case)	Deg C	10		40	Case Temperature
Polarization Extinction Ratio	dB	17	20		
Power Consumption	W		2	5	C
Wavelength Stability	Seconds			180	Cold Start - to < 1 w avenumber
				1	Warm Start - to < 1 w avenumber
				3	Warm Start - to < 0.1 w avenumber
Absolute Maximum Ratings					
Laser Module Operational Current	A			1	
Laser Module Operational Voltage	V	4.9	5	5.1	Compliance

Item	Description	
	Raman Accessories for miniature fiber optic spectrometers	
Raman-LaProbe	Portable Raman laser-probe for 785nm, 100mW output power, 0.2nm FWHM laser with integrated collection optics that includes FC-SMA905 fiber optic cable.	

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