621 SERIES
LASER WAVELENGTH METER

Reliable accuracy gives you greater confidence in your experimental results.

For laser applications such as high-resolution spectroscopy, photochemistry, cooling/trapping, and optical remote sensing, accurate wavelength information is critical. However, the exact wavelength of tunable lasers and laser diodes is not known a priori. Therefore, it is necessary to measure laser wavelength to ensure the most meaningful experimental results.

The best way to determine the absolute wavelength of CW lasers is with the 621 Laser Wavelength Meter from Bristol Instruments. This system provides real-time laser wavelength information with an accuracy that is guaranteed by continuous calibration with a built-in wavelength standard. The result is the reliable accuracy that is required for the most demanding applications.

FEATURES

Absolute wavelength accuracy as high as ± 0.2 parts per million.

Built-in wavelength standard for continuous calibration.

Operation from 350 nm to 5.0 μm.

Measurement rate as high as 10Hz.

Measures absolute optical power to an accuracy of ± 15%.

Displays wavelength (nm), wavenumber (cm^{-1}), or frequency (GHz).

Easy to integrate into experiment for automatic wavelength reporting and control.

Convenient pre-aligned fiber-optic input or free-space aperture for IR wavelengths.

Input power requirement as low as 10 μW.

Straightforward operation with PC using high-speed USB interface.

Includes software for custom or LabVIEW programming.

Bristol Instruments

It's Our Business To Be Exact!

RELIABLE ACCURACY = GREATER CONFIDENCE

The 621 Series Laser Wavelength Meter provides reliably accurate information for researchers who need to know the exact wavelength of their CW laser. The 621 system employs optical interferometry to measure absolute wavelength to the highest guaranteed accuracy. What's more, this is accomplished with an unprecedented level of reliability and convenience.

Two versions of the 621 Laser Wavelength Meter are available. The model 621A is offered for the most demanding experiments, measuring absolute laser wavelength to the highest accuracy of ± 0.2 parts per million (± 0.0002 nm at 1000nm). For experiments that are less exacting, the model 621B is a lower-priced alternative. This system measures laser wavelength to an accuracy of ± 0.75 parts per million (± 0.00075 nm at 1000 nm).

Bristol Instruments Wavelength Meters Let You:

- **Measure absolute wavelength of CW lasers to highest accuracy available**
- **Verify laser wavelength in real-time**
- **Report and control laser wavelength automatically**
- **Set laser precisely to an important wavelength**

GUARANTEED ACCURACY

The most important aspect of a laser wavelength meter is its accuracy. Bristol Instruments guarantees this specification by taking into account all factors that can affect wavelength measurement.

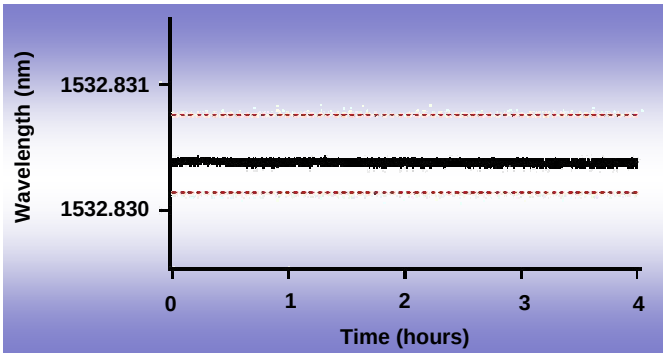
Wavelength accuracy is quantified by Bristol Instruments using the NIST definition for expanded uncertainty. Components of error arising from both systematic and random effects are included. Systematic errors result in an offset between the measured value and the true value. Random errors result in measurements that have a statistical distribution associated with short-term measurement repeatability.

The 621 system is designed to address both types of uncertainty. Continuous calibration with a built-in wavelength standard corrects for potential sources of systematic error. Random errors are minimized with a unique Michelson interferometer design.

CONTINUOUS CALIBRATION

To achieve the reliable accuracy that is expected from Bristol Instruments, the model 621 is continuously calibrated with a built-in HeNe laser wavelength standard. The HeNe laser is an ideal reference source because its wavelength is well-known and fixed by fundamental atomic structure.

To measure absolute wavelength to the highest accuracy of ± 0.2 parts per million, the 621A system uses a stabilized single-frequency HeNe laser as a wavelength reference. This laser is stabilized using a very reliable balanced longitudinal mode technique. A standard HeNe laser is used with the model 621B to achieve a ± 0.75 parts per million accuracy.



Continuous wavelength data from a 621A system measuring a DFB laser locked to an absorption line of acetylene. The accuracy specification of ± 0.2 parts per million is shown by the dashed lines.

EXCEPTIONAL REPEATABILTY

The small variation between consecutive wavelength measurements of the model 621 is well within the specified accuracy limits. This exceptional repeatability is due to a rigorous understanding of Michelson interferometer technology, and how it is applied to laser wavelength measurement.

PRECISE INTERFEROMETER TECHNOLOGY

Several methods are available to measure laser wavelength. Bristol Instruments uses optical interferometry for the model 621 because such techniques have proven to be the most precise and reliable for wavelength measurement instrumentation.

A Michelson interferometer is used to generate information from the interference of two beams that originate from the same source. The optical input is split between a fixed path and a path that is smoothly changing in length. Both beams are reflected and recombined to produce an interference pattern that is a consequence of the changing phase relationship between the beams. The model 621 generates interference patterns simultaneously from the laser under test and from a built-in HeNe reference laser. By comparing these interference patterns, the wavelength of the laser under test can be determined accurately.

OPERATION

INTEGRATES DIRECTLY INTO AN EXPERIMENT

The 621 Laser Wavelength Meter provides real-time wavelength information because it becomes part of the experiment. The 621 system operates with a PC running under Windows Vista or XP. Wavelength is calculated and then transferred to a PC using a convenient USB interface. Software is provided to control measurement parameters and to report data.

	VIS	NIR	IR
WAVELENGTH RANGE	350 - 1100 nm	500 - 1700 nm	1.0 - 5.0 μm
621A WAVELENGTH ACCURACY	± 0.2 ppm ± 0.0001 nm @ 500 nm ± 0.004 cm^{-1} @ 20,000 cm^{-1} ± 0.12 GHz @ 600 THz	± 0.2 ppm ± 0.0002 nm @ 1,000 nm ± 0.002 cm^{-1} @ 10,000 cm^{-1} ± 0.06 GHz @ 300 THz	± 0.2 ppm ± 0.0008 nm @ 4,000 nm ± 0.0005 cm^{-1} @ 2,500 cm^{-1} ± 0.015 GHz @ 75 THz
621B WAVELENGTH ACCURACY	± 0.75 ppm ± 0.0004 nm @ 500 nm ± 0.015 cm^{-1} @ 20,000 cm^{-1} ± 0.45 GHz @ 600 THz	± 0.75 ppm ± 0.00075 nm @ 1,000 nm ± 0.0075 cm^{-1} @ 10,000 cm^{-1} ± 0.225 GHz @ 300 THz	± 0.75 ppm ± 0.003 nm @ 4,000 nm ± 0.002 cm^{-1} @ 2,500 cm^{-1} ± 0.06 GHz @ 75 THz

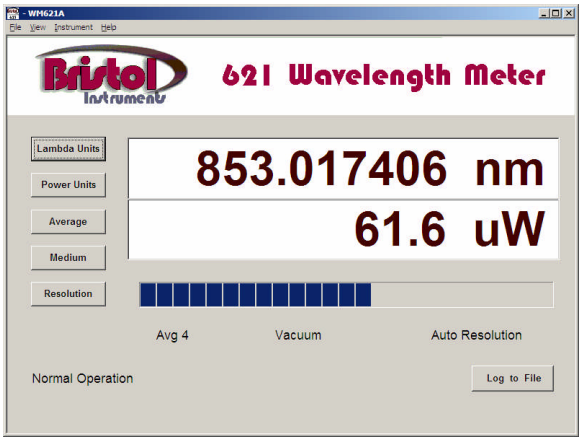
BROAD WAVELENGTH COVERAGE

The model 621 is available in three broad wavelength configurations to satisfy virtually any experimental requirement. These ranges are the VIS (350 - 1100 nm), NIR (500 - 1700 nm), and IR (1.0 - 5.0 μm).

CONVENIENT LASER INPUT

A laser under test enters the VIS and NIR versions of the model 621 through a pre-aligned FC/PC fiber-optic input connector. This ensures optimum alignment of the laser beam to the instrument's interferometer resulting in uncompromised accuracy. With fiber-optic input, the 621 system can be placed in an out of the way location, thereby conserving valuable "optical real-estate." For free beam lasers, Bristol Instruments offers the LC-1 Fiber-Optic Input Coupler, a simple way to launch a laser beam into fiber.

Since fiber is not readily available for infrared wavelengths, the laser under test enters the IR version of the model 621 through a 2 mm input aperture. To facilitate alignment to the instrument, the internal HeNe reference laser is emitted from the input aperture as a visible tracer beam. The laser under test is simply superimposed on the tracer beam to optimize alignment.



Windows-based display reporting laser wavelength and power, and showing a relative power intensity bar-graph.

HIGH SENSITIVITY

The minimum input signal required by the 621 system is as low as 10 μW. Therefore, only a small portion of the laser under test needs to be diverted from an experiment.

LASER BANDWIDTH

The accuracy reported by the model 621 depends on the bandwidth of the laser under test. For the 621A, accuracy of ± 0.2 parts per million is reported when the bandwidth (FWHM) is less than 1 GHz. Laser bandwidth must be less than 10 GHz to achieve the accuracy of ± 0.75 parts per million with the 621B. If the laser under test has a larger bandwidth, the 621 system automatically displays an appropriately reduced resolution so that only significant digits are displayed.

SIMULTANEOUS OPTICAL POWER MEASUREMENT

The VIS and NIR versions of the 621 system measure total optical power in order to provide a more complete analysis of laser performance. The absolute accuracy of the power measurement is ± 15% and can be reported in μW, mW, or dBm.

DISPLAY AND REPORTING

The 621 Laser Wavelength Meter reports data using a simple Windows-based display. Units of wavelength (nm), wavenumber (cm^{-1}), as vacuum or standard air values, or frequency (GHz) can be chosen. Every measurement can be displayed, or a running average can be calculated. In addition, wavelength data can be collected and saved to a file using a *.csv format.

Data can also be transferred using a convenient library of commands for custom or LabVIEW programming.

SPECIFICATIONS

		621A	621B
LASER TYPE		CW only	
WAVELENGTH			
Range		**VIS:** 350 - 1100 nm	**NIR:** 500 - 1700 nm **IR:** 1.0 - 5.0 μm
Absolute Accuracy		± 0.2 parts per million ± 0.0002 nm @ 1,000 nm ± 0.002 cm^{-1} @ 10,000 cm^{-1} ± 0.06 GHz @ 300,000 GHz	± 0.75 parts per million ± 0.00075 nm @ 1,000 nm ± 0.0075 cm^{-1} @ 10,000 cm^{-1} ± 0.225 GHz @ 300,000 GHz
Repeatability (1)	**VIS/NIR** **IR**	± 0.03 parts per million ± 0.06 parts per million	± 0.1 part per million
Calibration		Continuous with built-in stabilized single-frequency HeNe laser	Continuous with built-in standard HeNe laser
Display Resolution		9 digits	8 digits
Units		nm or cm^{-1} (vacuum or standard air), GHz	
POWER (VIS AND NIR)			
Absolute Accuracy (2)		± 15%	
Resolution		2%	
Units		mW, μW, dBm	
OPTICAL INPUT SIGNAL			
Maximum Laser Bandwidth (3)		1 GHz 0.003 nm at 1000 nm 0.03 cm^{-1}	10 GHz 0.03 nm at 1000 nm 0.3 cm^{-1}
Minimum Input (4)	**VIS** **NIR** **IR**	100 μW at 350 nm 300 μW at 500 nm 750 μW at 1.0 μm	20 μW at 650 nm 10 μW at 1500 nm 100 μW at 3.0 μm	75 μW at 1100 nm 50 μW at 1700 nm 1000 μW at 5.0 μm
Maximum Input (5)		10 mW	
MEASUREMENT RATE	**VIS/NIR** **IR**	4 Hz 2.5 Hz	10 Hz 2.5 Hz
OPTICAL INPUT	**VIS/NIR** **IR**	Pre-aligned FC/PC connector (9 μm core diameter) - optional free beam-to-fiber coupler Collimated beam, 2 mm diameter aperture, visible tracer beam exits aperture to facilitate alignment	
COMPUTER REQUIREMENTS		PC running Windows Vista or Windows XP with 1 GHz or higher microprocessor, at least 128 MB of available RAM, USB 1.1/2.0 port, VGA monitor, mouse or other pointing device	
INSTRUMENT INTERFACE		High-speed USB 2.0 interface with Windows-based display program Library of commands for custom and LabVIEW programming	
WARM-UP TIME		< 15 minutes	None
DIMENSIONS AND WEIGHT	**VIS/NIR** **IR**	6.5" W x 5.0" H x 15.0" L (165.1 mm x 127.0 mm x 381.0 mm) 6.5" W x 7.5" H x 15.0" L (165.1 mm x 190.5 mm x 381.0 mm)	14 lbs (6.4 kg) 14 lbs (6.4 kg)
POWER REQUIREMENTS		90 to 260 VAC, 50/60 Hz	

(1) Standard deviation for a 5 minute measurement period after the instrument has reached thermal equilibrium.
(2) Calibration wavelength for VIS version is 633 nm. Calibration wavelength for NIR version is 1533 nm.
(3) Bandwidth is FWHM. When bandwidth is greater, wavelength is automatically reported with reduced resolution.
(4) Sensitivity at other wavelengths can be determined from a graph that is available upon request.
(5) For IR version, the maximum input power level is about 10-15 times the minimum input power level.

Bristol Instruments reserves the right to change the detail specifications as may be required to permit improvements in the design of its products. Specifications are subject to change without notice.

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Call: (585) 924-2620 for more information or visit our website at : www.bristol-inst.com

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