671 Series

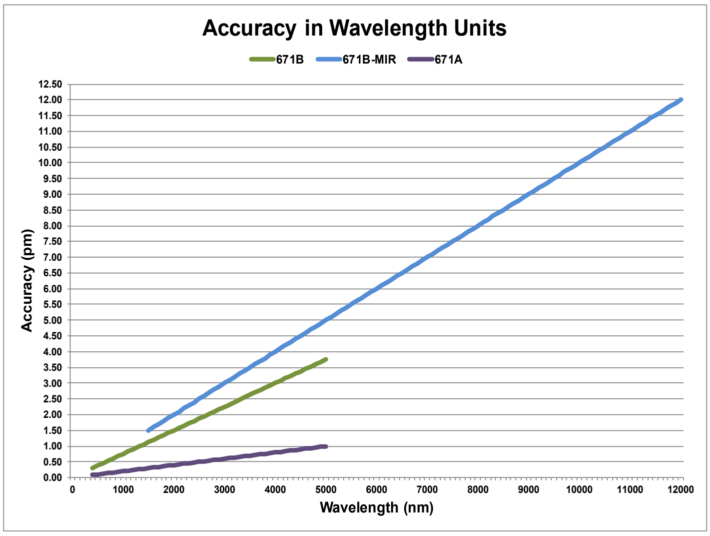
LASER WAVELENGTH METER

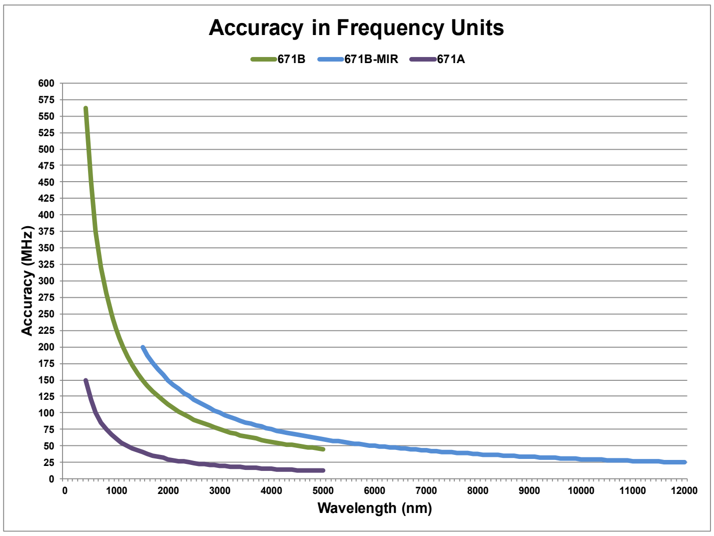
Using proven **Michelson interferometer-based design** gives you **reliable accuracy** as high as ± 0.2 parts per million for **greater confidence** in your experimental results.

The [**671 Series Laser Wavelength Meter**] **is ideal for scientists and engineers who need to know the exact wavelength of their CW laser. The 671 system employs a proven Michelson interferometer-based design to measure laser wavelength to an accuracy as high as ± 0.0001 nm. What's more, this is accomplished with an unprecedented level of reliability, versatility, and convenience.**

LASER WAVELENGTH MEASUREMENT

Two versions of the 671 Laser Wavelength Meter are available. The model 671A is offered for the most demanding experiments, measuring laser wavelength to the highest accuracy of ± 0.2 parts per million. For experiments that are less exacting, the model 671B is a lower-priced alternative with a wavelength accuracy of ± 0.75 parts per million. The MIR version of the model 671B has a wavelength accuracy of ± 1 part per million.





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 671 Laser Wavelength Meter 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 robust Michelson interferometer design.

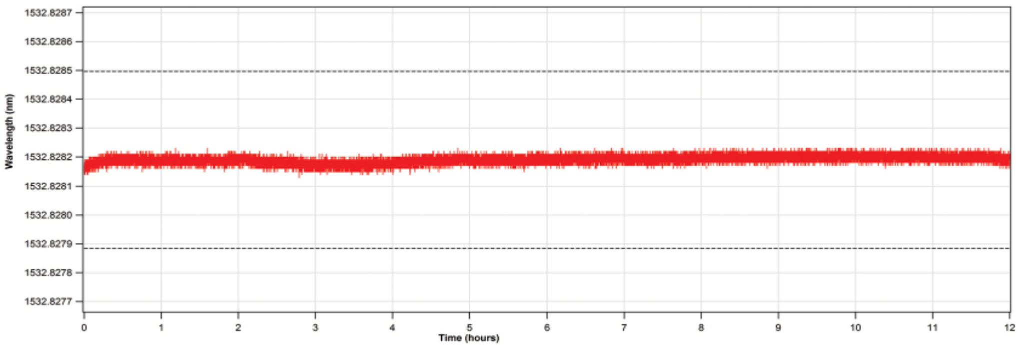
Continuous Calibration

To ensure the most meaningful experimental results, the wavelength accuracy specifications are guaranteed by continuous calibration with a built-in HeNe laser. This is an ideal reference source because its wavelength is well-known and fixed by fundamental atomic structure. To achieve the highest accuracy of ± 0.2 parts per million, the 671A system uses a single-frequency HeNe laser that is stabilized using a precise balanced longitudinal mode technique. A standard HeNe laser is used as the wavelength reference in the model 671B to achieve an accuracy of ± 0.75 parts per million.

Exceptional Repeatability

The design of the 671 Laser Wavelength Meter is based on a unique expertise in Michelson interferometer technology and how it is applied to laser wavelength measurement. This results in exceptional measurement repeatability which ensures that all wavelength measurements are well within the specified accuracy limits.

The repeatability specification for the model 671A is defined as the standard deviation of all measurements over a 10 minute period. This is ± 0.03 parts per million (± 0.06 parts per million with the IR version). Because of the logitudinal mode drift of the standard HeNe reference laser used in the model 671B, long-term measurement variations can be as high as ± 0.4 parts per million. However, the standard deviation over a period of one minute is ± 0.1 part per million.



Long-term wavelength measurement data of a DFB laser locked to an absorption line of acetylene. The specified accuracy is given by the dashed lines.

The measurement repeatability specification of the 671 Laser Wavelength Meter also defines its ability to detect small changes in laser wavelength. This wavelength resolution is approximately two times the specified repeatability. Therefore, the model 671A can detect wavelength changes as small as 0.06 parts per million (0.06 pm at 1000 nm). The 671B system can determine a wavelength deviation as small as 0.2 parts per million (0.2 pm at 1000 nm).

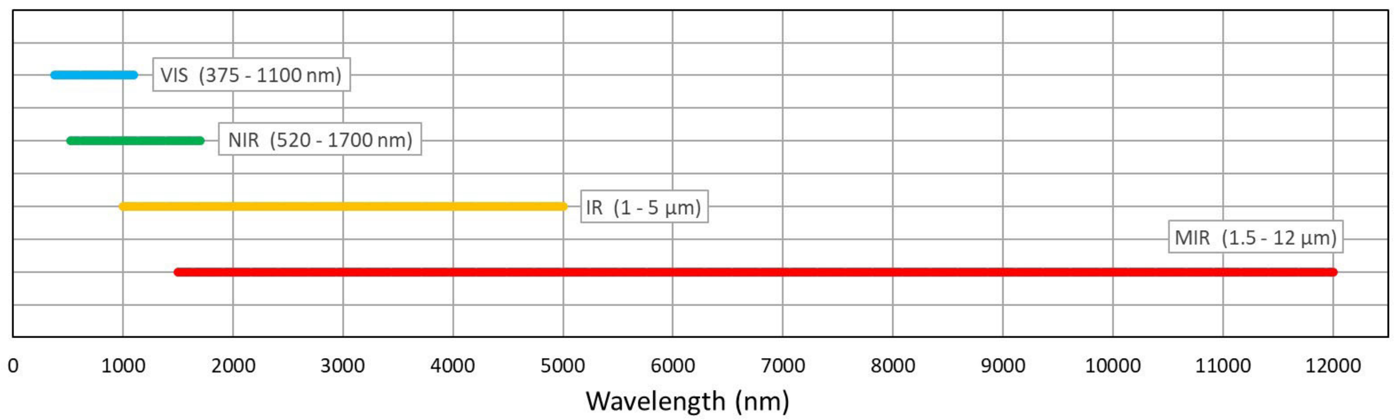
OPERATION

The 671 Laser Wavelength Meter measures laser wavelength with an unsurpassed level of reliability, versatility, and convenience. Four broad wavelength configurations are available, laser input is straightforward, and the system has a very high sensitivity. Wavelength is calculated using an on-board digital signal processor and then displayed on a PC, tablet, or smartphone. It is also easy to integrate the 671 Laser Wavelength Meter into an experiment for automatic wavelength reporting and control.

Broad Wavelength Coverage

The 671 Laser Wavelength Meter is available in four broad wavelength configurations to satisfy virtually any experimental requirement.

- **VIS (375 – 1100 nm)**
- **NIR (520 – 1700 nm)**
- **IR (1 – 5 µm)**
- **MIR (1.5 – 12 µm)**



Convenient Laser Input

A laser under test enters the VIS and NIR versions of the model 671 through a pre-aligned FC/UPC or FC/APC 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 671 system can be placed in an out of the way location, thereby conserving valuable "optical real-estate."

For free beam lasers, Bristol Instruments offers a variety of Fiber-Optic Input Couplers that provide 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 and MIR versions of the model 671 through a 2-3 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. This is accomplished by using the three adjustable-height legs (± 0.25") of the 671 system.

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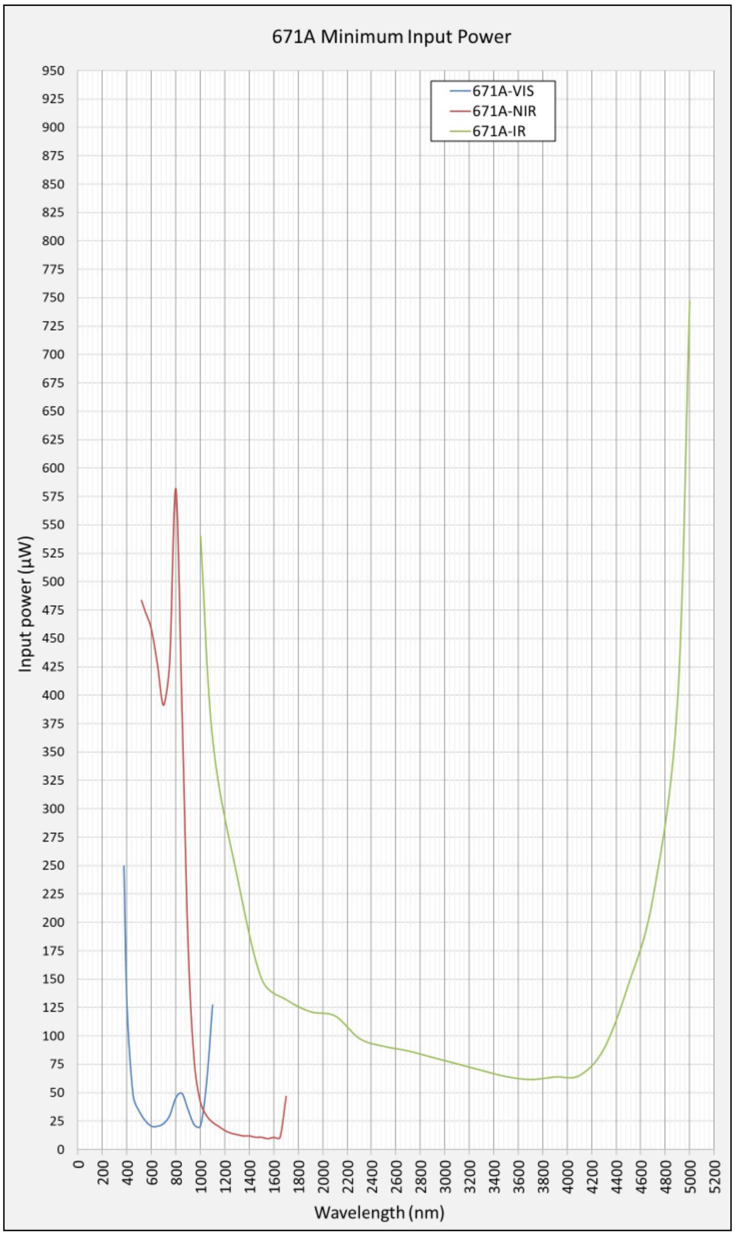
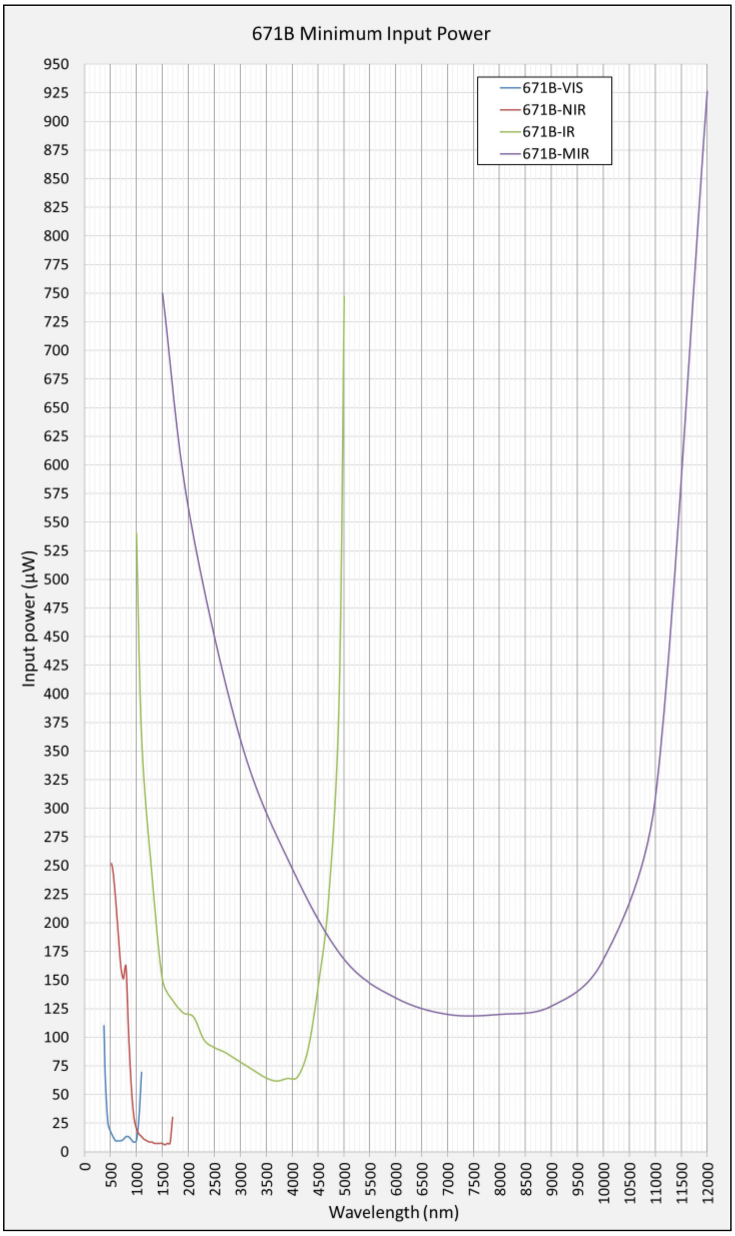
High Sensitivity

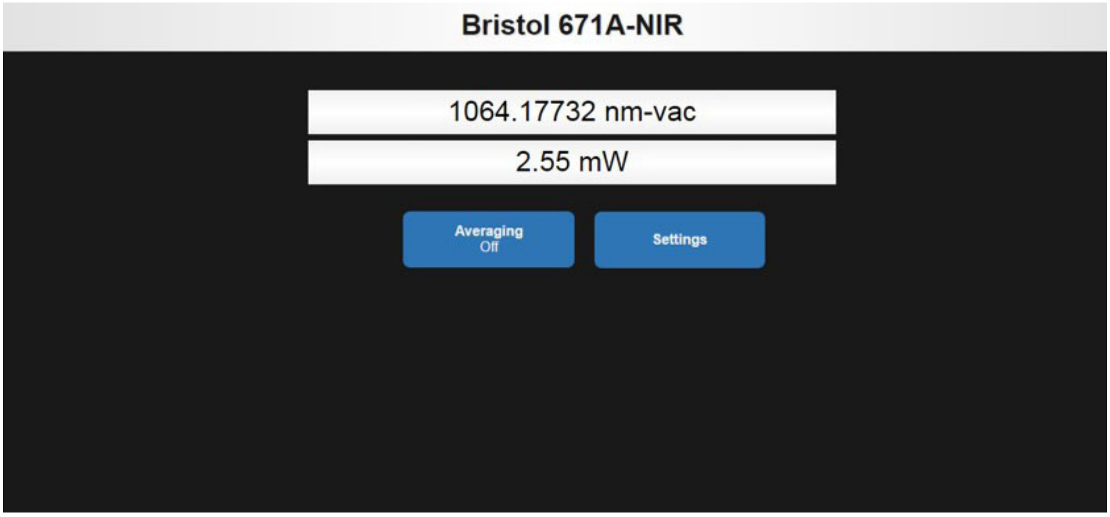
The minimum input signal required by the 671 Laser Wavelength Meter is as low as 10 µW. Therefore, only a small portion of the laser under test needs to be diverted from an experiment. In addition, the electronic gain of the 671 system is adjusted automatically to accommodate changes in the input signal. This is particularly useful when scanning a tunable laser over its operational wavelength range.





Tablet and Smartphone Display

A web-based display application provides a convenient way to display wavelength information anywhere in the laboratory. The 671 Laser Wavelength Meter, connected to a router via Ethernet, can be accessed by any wireless capable computer, tablet, or smartphone connected to the same network.



The display application offers customizable features similar to the 671 system software. Measurement units can be expressed in wavelength (nm or μm), wavenumber (cm^{-1}), or frequency (GHz or THz). Power for the VIS and NIR versions is reported in a linear (mW) or logarithmic (dBm) format. The displayed wavelength and power values can be updated with each new measurement, or a rolling average of as many as 100 measurements can be calculated automatically.

Simultaneous Optical Power Measurement

In order to provide a more complete analysis of laser performance, the VIS and NIR versions of the 671 Laser Wavelength Meter measure the total optical power of the input signal. The accuracy of the power measurement is ± 15%.

The IR and MIR versions do not measure power, but they do display a graphical representation of the relative input intensity to aid with instrument alignment.

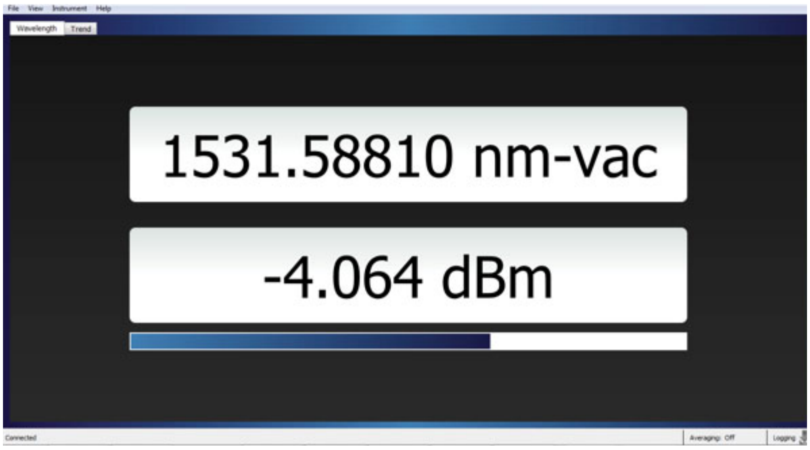
Versatile Instrument Interface

The 671 Laser Wavelength Meter determines wavelength in real-time using an on-board digital signal processor. Therefore, the measured wavelength information can be reported or used in a variety of ways.

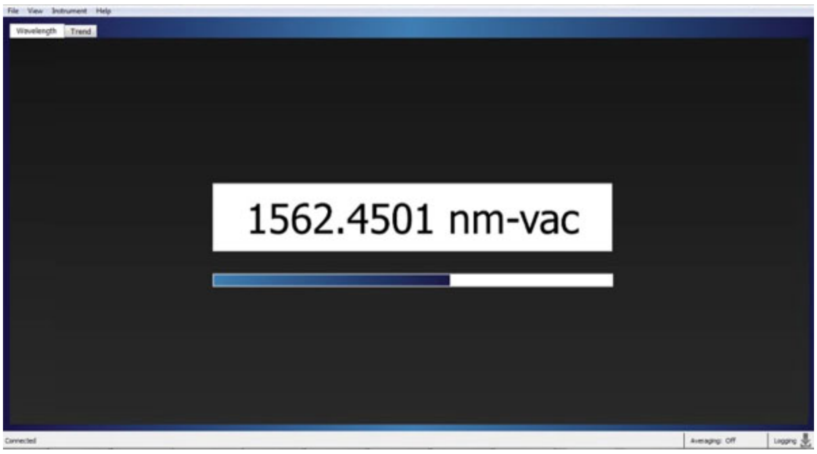
- Data can be transferred to a PC and displayed using a Windows-based software program provided by Bristol Instruments. The 671 system can connect directly to the PC using USB, or over a local area network using Ethernet.
- The 671 system, when connected to a wireless capable local area network, can report wavelength measurements anywhere in the laboratory on a tablet or smartphone using a web-based display application.
- The 671 Laser Wavelength Meter can be integrated into an experiment for automatic wavelength reporting and control. Wavelength information can be sent directly to a PC via USB or Ethernet for use with custom or LabVIEW programming. This eliminates the need for a dedicated PC. What's more, the system's SCPI (Standard Commands for Programmable Instruments) commands can be used with any PC and with any operating system.

Wavelength Measurement Display

The software provided with the 671 Laser Wavelength Meter reports measurement data with an easy-to-read display. It offers many user customizable features to tailor measurements to a specific application. Measurement units can be expressed in wavelength (nm or μm), wavenumber (cm^{-1}), or frequency (GHz or THz). Power is reported in a linear (mW) or logarithmic (dBm) format. Every measurement can be displayed, or a rolling average of as many as 100 measurements can be calculated automatically.



The IR and MIR versions of the model 671 do not measure optical power, and therefore only display wavelength measurements and a graphical respresentation of relative intensity to aid with instrument alignment.



Wavelength data can also be logged to a file using a *.csv format for analysis with other graphing programs. Data can be logged by number of measurements, amount of time, or continuously until the logging is stopped manually.

Wavelength Measurement Trends

The 671 Laser Wavelength Meter display software offers an integrated wavelength trending feature that automatically charts a laser's wavelength over time. A rolling graphical trace of up to 100,000 wavelength measurements is displayed. A variety of statistics over the measurement period are also computed. These include the maximum and minimum wavelength measurements, laser drift (current wavelength - start wavelength), standard deviation, and mean. These values are reported in a table below the trend graph.