

CALIBRATION



Gentec-EO offers its customers state-of-the-art calibration, traceable to the NIST. Each detector is calibrated precisely to your chosen wavelengths. Furthermore, we include measured, not typical, calibration data in nm steps outside these wavelengths. Treat your laser with the most accurate detectors on the market!

CALIBRATION

THE TERMS

ACCURACY

The accuracy of a measurement is defined as the closeness of the agreement between the result of a measurement and the true value.

UNCERTAINTY

Uncertainty is a measure of the "goodness" of a result. The definition and concept of uncertainty is a quantitative attribute to the final result of measurement, considering all systematic and random components of all known input quantities.

ERROR

The error on a measurement is the difference between the measurement result and the true value.

REPEATABILITY

The repeatability is the closeness of the agreement between the results of successive measurements under the same conditions of measurements.

REPRODUCIBILITY

The reproducibility is the closeness of the agreement between the results of successive measurements under changed conditions of measurements. This is also defined as "precision under reproducibility conditions".

PRECISION

The precision of a measurement is defined as the closeness of agreement between independent test results obtained under stipulated conditions.

The above definitions come from the Technical Note #1297 of the NIST.

THE TECHNIQUE

HOW NIST CALIBRATES OUR GOLD STANDARDS

Gentec-EO's gold laser power detector heads are compared to NIST standard calorimeters at different wavelengths, in accordance to the different lasers used to calibrate your own detector heads. The laser beam has a nominal diameter appropriate for the detector, and is centered on the detector's absorbing surface. The laser energy impinging upon the test instrument is measured concurrently using a NIST standard calorimeter and a calibrated beam splitter. The beam splitter ratio is measured using NIST standard calorimeters. Before the measurements are performed, the test instrument is allowed to reach equilibrium with the laboratory environment. The calibration factor is found by dividing the instrument output reading by the calculated average incident laser power. The calculation is based on the output reading of the NIST standard calorimeters.

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ELECTRICAL INSTRUMENTS

All of our electrical instruments are calibrated by certified calibration suppliers. They certify that, at the time of calibration, the instruments used for calibration meet or exceed all published specifications and have been calibrated using standards whose calibrations are traceable to the NIST and/or other recognized international standards. The electrical and physical properties of their laboratories meet the highest requirements for ambient temperature, relative humidity and cleanliness. Their equipment is maintained by procedures that meet the requirements of ISO 9001:2000 and ISO 10012:2003.

THE FACTS

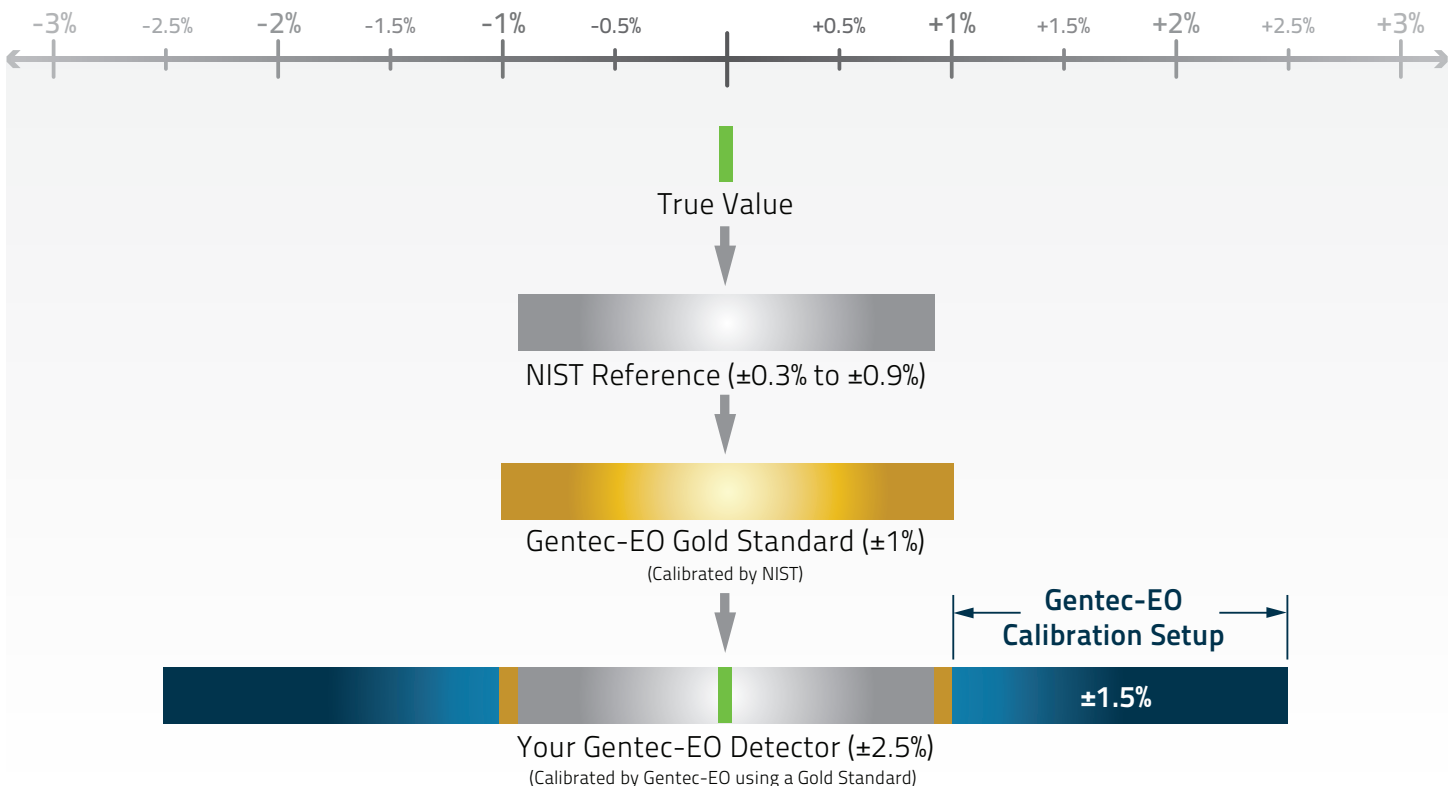
HOW GENTEC-EO CALIBRATES YOUR DETECTOR

Every detector is individually calibrated to the best possible accuracy traceable to NIST standards. Stable laser sources at various wavelengths are used in our calibration process.

UNCERTAINTY

One very common misconception is the absolute value of calibration uncertainty. Be aware that this value is made using a complex statistical method that takes in account ALL the sources of uncertainty that are present in the process. Figure 1 below shows these steps and their respective contribution to the value of uncertainty. As you can see, the manufacturer itself is only one of these sources.

Figure 1. Sources of uncertainty in the calibration of a detector



CALIBRATION

CALIBRATION WAVELENGTHS

Another misconception is that any wavelength can be NIST calibrated: this is not true. The NIST only supplies distinct wavelengths in the range comprised between 193 nm (ArF excimer laser) to 10.6 mm (CO₂ laser). Any wavelength outside this range or other than the ones supplied within the range is subject to an additional error on the calibration value. You can refer to table 1 for the list of wavelengths from the NIST and the related calibration uncertainties.

Table 1. NIST Calibration Wavelengths as listed in document 42110C-42111C (Laser Power and Energy Meter (or Detectors Used with Lasers) Calibrations)

Primary Standard	Wavelength	Power Range	Typical Relative Expanded Uncertainty (%)
C-series	325 nm	100 nW to 10 mW	1 to 2
	488 nm	1 nW to 1 W	0.5 to 1
	514 nm	1 nW to 2 W	0.5 to 1
	532 nm	1 nW to 20 mW	0.5 to 1
	633 nm	1 nW to 20 mW	0.5 to 1
	830 nm	1 nW to 20 mW	0.5 to 1
	1064 nm	1 nW to 2 W	0.5 to 1
	1319 nm	1 μW to 10 mW	0.5 to 1
	1550 nm	1 μW to 10 mW	0.5 to 1
Q-series (Q-switched)	1.06 μm	1 μJ/pulse to 300 mJ/pulse	1.1 to 1.5
	(pulsed)	200 μW to 6 W	
K-series	1.06 μm	2 W to 300 W	1.6 to 2.0
	10.6 μm	2 W to 900 W	1.6 to 2.0
QUV-series	248 nm	0.05 mJ/pulse to 150 mJ/pulse	1 to 3
	(pulsed)	3 mW to 7.5 W	
	193 nm	0.02 mJ/pulse to 150 mJ/pulse	1 to 3
	(pulsed)	3 mW to 3 W	

For your information only. The above content was taken from document 42110C-42111C as last updated in December 2010 by NIST. For more information on these wavelengths, please contact the NIST directly.

PERSONAL WAVELENGTH CORRECTION™

To fill the gaps between the NIST references, Gentec-EO offers you the only NIST traceable calibration in nm steps, from 250 nm to 2.5 mm. We achieve this using our proprietary setup that is based on a NIST traceable spectrophotometer. This way, instead of supplying you with typical values, we offer you a NIST traceable calibration. What you get is an overall accuracy that is not more than ±1% away from the original calibration accuracy, in the spectrum of 300 to 2200 nm.

This data is stored in the Smart Interface so all you need to do is enter your wavelength in your Gentec-EO monitor and you are ready for accurate and precise laser measurements. This wavelength correction is based on measurements of your individual detector instead of a general curve for the absorber material. That means you have the best wavelength correction available anywhere.