

TECHNICAL NOTE

SAME LASER, DIFFERENT MEASUREMENTS, WHAT'S THE PROBLEM?



We often have questions by customers that get a significant difference when measuring the same laser source with two different power meters. The purpose of this technical note is to guide you through the basic precautions and good practices that will allow you to get the most accurate measurements possible using a Gentec-EO meter. It will also give you tools to help identify the possible sources of the discrepancies between the measurements.

THINGS TO VERIFY BEFORE DOING THE MEASUREMENTS

- 1. Do not Compare Apples with Oranges:** Make sure that both detectors are comparable in terms of measurement capabilities. For example, do not try to compare the measurements of a 10 W laser using a 20 W and a 500 W detector.
- 2. Check the Specifications:** Make sure that each detector is used within the specified limits. For maximum accuracy, your detectors should be used at ~50% of their capabilities.
- 3. Verify the Alignment:** Make sure the laser is aligned with the center of the absorbing surface and that all the light is contained within the aperture.
- 4. Measure the Beam Area:** For Gentec-EO detectors, the beam area should not exceed 80% or be less than 10% of the effective area.
- 5. Check for Damages:** Are there any visual damages to any of the detectors: ablated absorber, scratches, discoloration, grease spots, etc?
- 6. Verify the Calibration Due Date:** Check the calibration due date on the calibration certificates of both the monitors and the detectors. Maybe it is time for one of them to be sent back for a recalibration?

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STEPS TO TAKE WHEN MAKING THE MEASUREMENTS

- 1. Set the Correct Wavelength:** Check if both monitors are set at the correct wavelength. This will apply the appropriate correction factors and thus adjust the measurements to the spectral response of each detector.
- 2. Allow the Detectors to Thermally Stabilize:** Make sure the detectors are thermally stable before you make your measurements. For most Gentec-EO thermopile power detectors, you need to wait at least one minute before firing the laser and making a measurement. As a rule of thumb, the larger the detector, the longer the wait.
- 3. Make a Zero:** Always make a zero before performing power measurements. This will subtract the background noise and allow you to compare both measurements on the same baseline.
- 4. Verify the Uncertainty Ranges:** Compare the calibration uncertainty ranges of both detectors and add them up, this will give you the total range where your measurements may fall and still be within tolerance. For example, most Gentec-EO power detectors have a $\pm 2.5\%$ calibration uncertainty. If your other detector (which can be from another manufacturer) has a $\pm 3\%$ uncertainty, your total tolerance range is $\pm 5.5\%$ (or 11% between the lower and upper limits). This means that a 150 W laser can have measured values ranging between 142 W and 158 W and still be within tolerance.

SOME EXTRA PRECAUTIONS THAT YOU CAN TAKE

- **Closing the Loop:** Close the loop to make sure that possible laser instability will not affect the measurements. To do so, measure the power with the first detector, then with the other, and finally, come back to the first one. If the first and last measurements are not within tolerance (considering the accuracy range), there is either a problem with the detector or the laser, or both.
- **Third Reference:** If possible, make the same measurements with a third detector (and third monitor if possible). This could give you some information on where the problem comes from.

WHEN ALL THIS FAILS!

If you followed all these tips and steps and still find a significant difference between both measurements, it is time to contact us for support at service@gentec-eo.com or 1-418-651-8003 #302. If you do so, please provide us with the following information:

- Serial number of each detector (if both are from Gentec-EO)
- Environmental conditions (lab conditions)
- Laser specifications (type, power, beam size, etc.)
- Apparent damage to the absorber
- And any other relevant information.

With all this information, we will be able to quickly suggest possible solutions for your problem.