OptoTest
Test Solutions for Fiber Optics

LASER COMPONENTS®

AN121

Stability Measurement
Application for 500 Series Optical Power Meter / Sensor

Overview

How does one measure the power stability of a light source and what are common pitfalls?

This application note describes how to setup the measurement with the OP500 series power meter modules. Data acquisition is controlled by a computer that runs OPL5 application software. The measurement results for the 980nm laser source are displayed in real time.

Why is source stability of interest?

To measure insertion loss of optical components, two measurements are taken; a reference measurement and a measurement that includes the device under test. Power fluctuations between the two measurements will add to the systematic error of the measurement. For this reason the fiber optic sources that are used for insertion loss measurements have to operate extremely stable. That way the fluctuations of the sources are relatively small compared to the actual loss measured. The standards (IEC61300) recommend a stability of <0.05dB or 1% of the attenuation/loss to be measured.

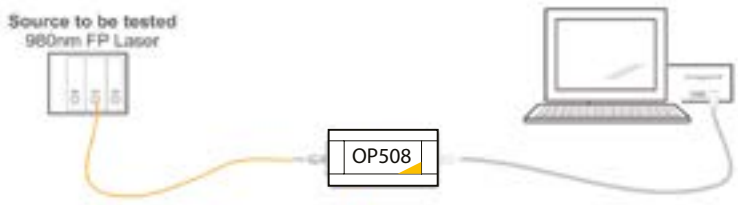
Any data logging fiber optic power meter can be used to measure source stability as long as the following requirements are met:

- The wavelength range of the photodetector matches the wavelength of the source (SI detector for 500nm to 1100nm, InGaAs or Ge detector for 830nm to 1650nm)
- The output power level of the source cannot exceed the sensitivity range of the optical power meter
- The measurement accuracy and resolution of the optical power meter should exceed the expected source stability. (Usually a 0.01dB resolution/accuracy is sufficient to quantify stability <0.05dB)

For long-term stability measurements special care needs to be given to the test setup in order to eliminate external influences that impair and falsify the stability data.

- Use only fiber optic cables with high quality and clean connectors. Specifically when measuring narrow line-width sources, for example DFB, reflections at connector interfaces can cause fabry-perot effects
- Use the appropriate core size and type of cable
- Secure measurement cables. Movement of fibers can cause changes in power readings. Bending a cable more or less induces additional loss. Moving fiber loops can change the polarization of light. Cables are easily moved by people walking by or forced air from air condition vents

Measurement Setup



The equipment required for a single channel stability test setup are: PC, USB cable, OP500 Series Power Meter Module (OP508 shown), OPL5 application software, the appropriate fiber cable and the source to be tested.

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To command the data logging, a PC based application software is needed. Either OPL5 is run or a similar program is executed. If OPL5 is used it is setup in data logging mode. The acquired data (absolute, relative power level as well as ambient temperature) is directly written to an EXCEL data file. The screen shot (right) shows the application with the graphing enabled.

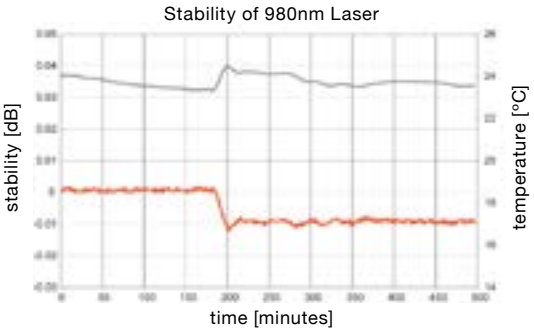
Other methods to capture power readings from an OptoTest optical power meter are the National Instruments Labview environment or custom VB6, VB.NET, C++, or Delphi windows applications. OptoTest provides for a DLL interface to the OP500 series that allows any of the above.

Test Example

For the purpose of illustration a 980nm FP laser is tested. This sample laser happens to exhibit a temperature dependancy that is nicely captured by this 500 minute test run.

To capture this data the OPL5 application is configured to acquire a power meter reading and temperature reading every 60 seconds. The captured data is directly written cell by cell into an XLS spreadsheet.

The resulting chart to the right illustrates the temperature step of approximately 1°C causing a power drop of 0.01 dB.



Common Pitfalls

To measure source stability, or the stability of any device, some precaution has to be taken. For example, make sure that:

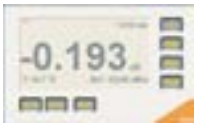
- The power meter stability is better than the expected stability of the device under test, typically <0.01dB
- Optical power levels do not saturate the power meter
- A high performance cable, such as an HPR reference cable, is used to ensure high quality connections
- Special attention is taken to maintain the highest standard of cleanliness on the fiber endfaces
- Organized routing of all optical fiber is maintained. Suggestions for fiber routing include keeping all bend radii greater than 2” radius (5cm) and gently taping the fiber in place so that there is no possible movement as a result of passers-by or forced airflow

Product discussed in this application note

The OP500 series of fiber optic power meter modules offer a very cost-effective solution to measure the stability of light sources. Specifically for long term measurements that occupy test equipment for an extensive period of time.

OP508 Fiber Optic Power Sensor

OP510 Optical Power Meter with bargraph display



OPL5 Power Meter application with datalogging

HPR High Performance Reference Cable

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