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PowerMax-USB/RS Sensors

Product Overview



LM-45, LM-10 and LM-3

Coherent PowerMax-USB sensors provide plug-and-play laser power measurement directly on a PC without the need for additional electronic instrumentation. The measurement circuitry typically found in a standalone meter has been reduced in size to the extent that it can now fit inside a USB connector. The circuitry and USB connector have been adapted into a 'PowerMax-USB' cable that can be integrated to most Coherent power sensors providing accurate power measurements of all types of CW and pulsed sources from the UV to Far IR.

This measurement platform can also be used to measure the energy in a long laser pulse (typically greater than 1 millisecond in pulse width) by integrating the output of a thermopile sensor.

The PowerMax-RS sensors incorporate the same circuitry inside an RS-232 connector to provide a convenient platform for integrating power measurement inside laser processing systems that often incorporate RS-232 inputs instead of USB.



PowerMax-USB Connector

Features

- **PowerMax-USB provides direct USB 2.0 connection to PC. Power provided via USB connection. Software and driver is compatible with Microsoft Windows 7, 8, and 10 (32-bit and 64-bit). The driver is qualified and signed by Microsoft.**
- **PowerMax-RS provides RS-232 connectivity. Power input provided via +5 VDC input.**
- **Instrumentation platform is compatible with thermopiles and optical sensors**
- **Displays beam position with position-sensing quadrant thermopiles (with LM-model sensors like LM-10)**
- **High resolution 24-bit A/D converter supports measurement accuracy equivalent to that found in Coherent's top-of-the-line LabMax meter**
- **Four digits of measurement resolution**
- **Sensors include spectral compensation for accurate use at wavelengths that differ from the calibration wavelength. Each device receives a unique spectral compensation curve specific to the absorption of its specific element, as well as transmission characterization of any associated optics.**
- **Thermopile sensors include a speed-up algorithm that speeds up the natural response of the thermopile detector without overshoot**
- **LED status indicators inside USB and RS-232 connectors provide health-and-status information**
- **Long pulse joules capability using thermopile sensors**

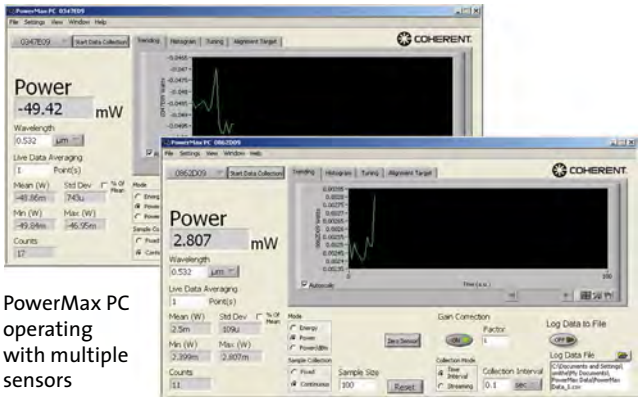
PowerMax-USB/RS Sensors

Product Overview

Software Features

PowerMax PC applications software is supplied free with sensor and includes the following features:

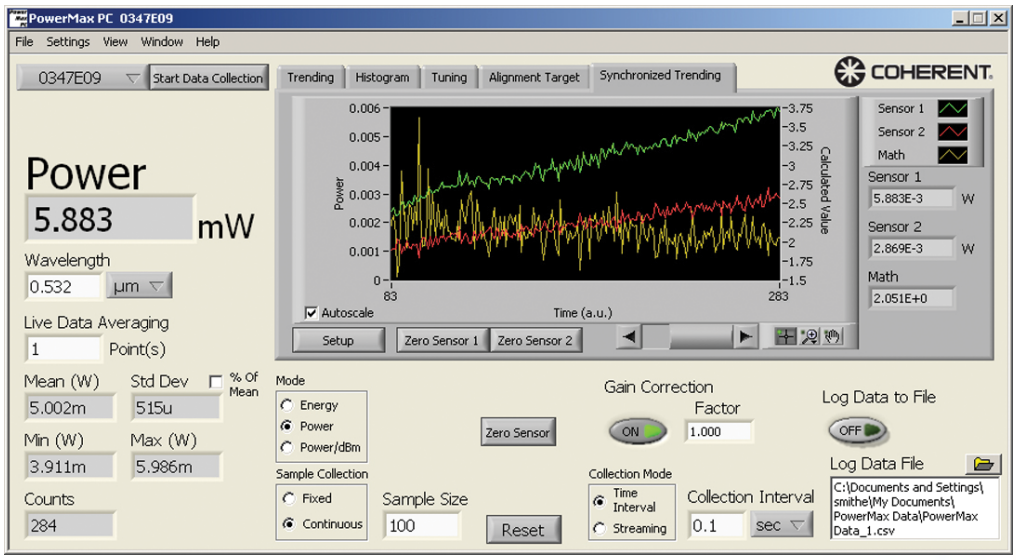
- **Trending, tuning, histogram**
- **Statistics (mean, minimum, maximum, and standard deviation) and log batch to file**
- **Display beam position on position-sensing thermopiles and log results to file**
- **Operate multiple devices simultaneously and perform synchronized ratiometery (A/B analysis). Trend and log results to file.**



PowerMax PC operating with multiple sensors

For system integration and for implementations involving customer written software the sensors provide an in depth command set that is easy to access:

- **DLL driver supports simple ASCII host commands for remote interfacing using both USB and RS-232 sensors**
- **National Instruments LabVIEW drivers are supplied for easy LabVIEW integration**



PowerMax PC in synchronized ratiometric trending mode

Coherent has two main types of thermopile sensors. The "LM Model" line utilizes a unique thermopile disk in which the thermocouples are split into four quadrants, allowing the sensors to provide beam position information in addition to power measurement. The "PM Model" line incorporates traditional thermopile disks that provide power measurement without beam position information. Both types of sensors can be used with the PowerMax-USB and PowerMax-RS sensors.



Quad Positioning Enabled

PowerMax-USB/RS Sensors

Applying Wavelength Compensation Accuracy

Overall measurement accuracy is a combination of calibration uncertainty (found in the sensor specification tables) and the wavelength compensation accuracy (found in the "Wavelength Compensation Accuracy" table, below).

The combined accuracy is based upon practices outlined in the National Institute of Standards Guidelines for Evaluating and Expressing Uncertainty (NIST Technical Note 1297, 1994 Edition). The combined accuracy of the measurement is calculated by using the law of propagation of uncertainty using the "root-sum-of-square" (square root of the sum of squares), sometimes described as "summing in quadrature" where:

$$\text{Measurement Accuracy} = \sqrt{U^2 + W^2}$$

where U = 'Percent Calibration Uncertainty' and W = 'Wavelength Accuracy'

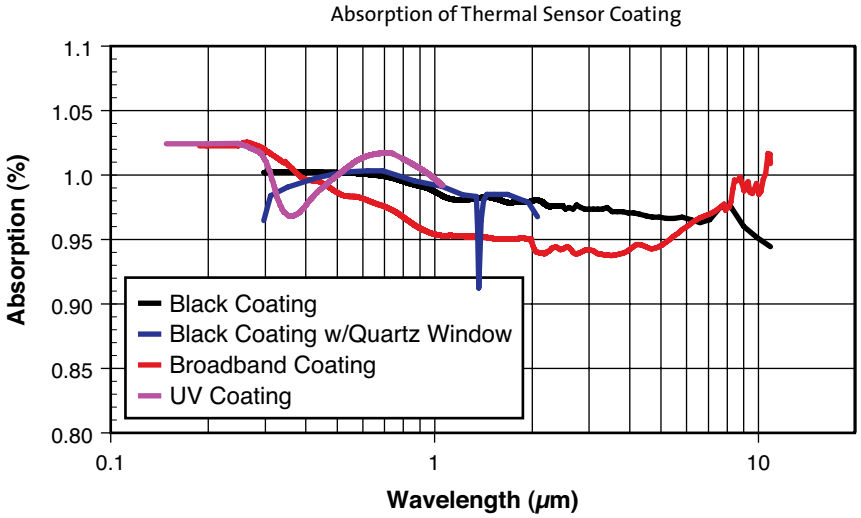
Example:

PowerMax-USB LM-10 used at 1064 nm

U = 2%
W = 1.5%

$$\text{Measurement Accuracy} = \sqrt{2^2 + 1.5^2} = \sqrt{4 + 2.3} = 2.5\%$$

Coherent uses three primary coatings to capture the incident radiation on our thermal sensors. The specifications for each sensor list which coating is used. Typical wavelength ranges and response curves for these coatings are shown in the chart below. Each sensor contains a spectral curve generated from reflectance measurements taken with spectrometers. The reflectance data are converted into a wavelength compensation look-up table that is loaded into the sensor. This data is accessed by selecting a wavelength of operation in the software.



Wavelength Compensation Accuracy

Sensor	Wavelength Compensation Accuracy (%)	Calibration Wavelength (nm)
All PM-model and LM-model thermopiles	±1.5	10,600
PS-model	±1.5	514
UV/VIS optical sensor	±4% (325 nm to 900 nm) ±5% (900 nm to 1065 nm)	514

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