



# PowerMax-Pro HP Sensor

## 1W to 15 kW

PowerMax-Pro (Patent #9,059,346) represents a dramatic technological advancement in laser power sensing that combines the broad wavelength sensitivity, dynamic range and laser damage resistance of a thermopile with the response speed of a semiconductor photodiode.

Coherent has invented a novel, thin-film technology to create a device which rapidly senses thermal changes due to incident laser energy. Unlike traditional thermopile detectors, in these new PowerMax-Pro sensors, heat flows vertically through a film which is only microns thick, rather than radially to the edge of the device over a distance of several centimeters. The result is a measurement response time below 10  $\mu$ s, as compared to over 1 second for traditional thermopiles. This HP model incorporates a ZnSe diffuser to enable peak power measurements up to 15 kW.

The high response speed of PowerMax-Pro sensors is particularly advantageous in commercial applications, where it enables CW laser power and pulsed laser energy to be sampled much more frequently, resulting in increased throughput and improved process control.



## FEATURES

- Measures power in tens of microseconds
- High power up to 350W continuous, 600W intermittent, 15 kW peak
- Supports lasers from the Near-IR to Far-IR wavelengths
- Capable of tracing the individual pulse shape of modulated and long pulse lasers
- Large active area

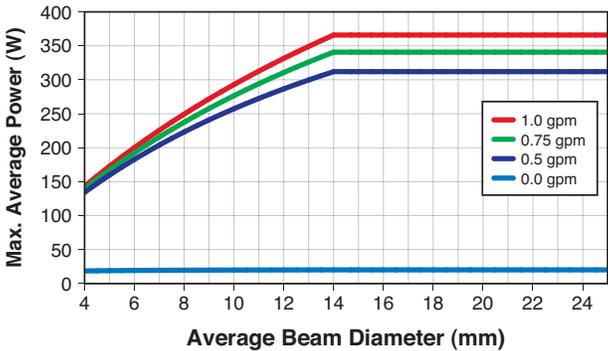
## APPLICATIONS

- Laser Processing including Cutting, Drilling, and Welding
- Medical Systems including Long Pulse Aesthetic applications
- Diode LIV Testing - increase resolution and shorten test time
- Scientific and Engineering
- Production and QA Testing

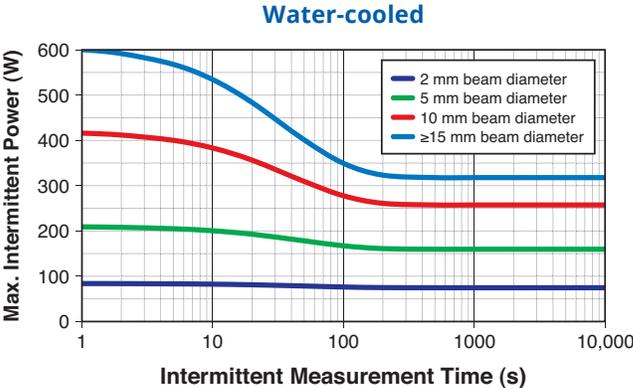
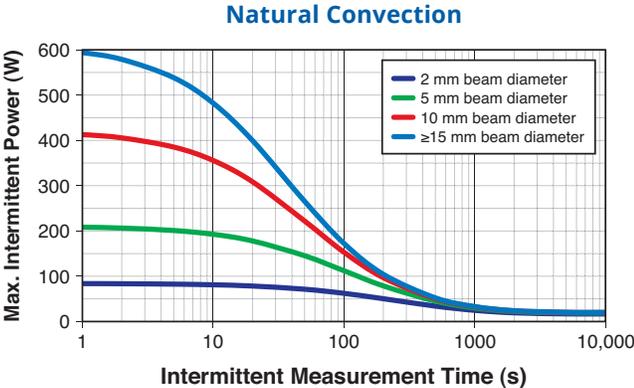
SPECIFICATIONS	PowerMax-Pro HP
Wavelength Range	700 nm to 1070 nm; 10.6 μm
Average Power Range <sup>1</sup> (W)	1 to 350 (22W max air-cooled, cont.) (75W max air-cooled, 5 min.)
Max. Pulsed Peak Power (W)	15000 (<10 msec burst) 1500 (continuous)
Noise Equivalent Power (mW) Standard Mode (10 Hz) High Speed Mode (20 kHz) Snapshot Mode (625 kHz)	<25 <100 <300 (low 5 kW range) <1.5W (high 40 kW range)
Max. Power Density (kW/cm <sup>2</sup> )	1.2 (150W)
Max. Peak Power Density (kW/cm <sup>2</sup> )	50 (1 ms; 1064 nm)
Max. Energy Density (J/cm <sup>2</sup> )	30 (3 ms; 755 nm)
Rise Time (μs)	≤10
Fall Time (μs)	≤10
Detector Coating	HD
Diffuser	ZnSe
Active Area (mm)	25 dia.
Minimum Beam Size (mm)	Set by damage threshold
Maximum Beam Size <sup>2</sup> (mm)	18
Calibration Uncertainty (%) (k=2) at 810 nm	±2
Spectral Compensation Accuracy (%)	±5
Power Linearity <sup>3</sup> (%)	±2 (1W to 10 kW) 3 to 10 (10 to 15 kW)
Spatial Uniformity (%) (center 64% of aperture; 2.5 mm beam)	±5
Calibration Wavelength (nm)	810
Cooling Method	Water/Air (intermittent)
Cable Type	DB25
Cable Length	2.5 m (8.2 ft.)
Part Number	1286588

<sup>1</sup> Beam size dependent. See steady-state and intermittent power charts.  
<sup>2</sup> See spatial uniformity and beam diameter charts for larger beams.  
<sup>3</sup> Beam size and pulse length dependent. See peak power and pulse length charts.

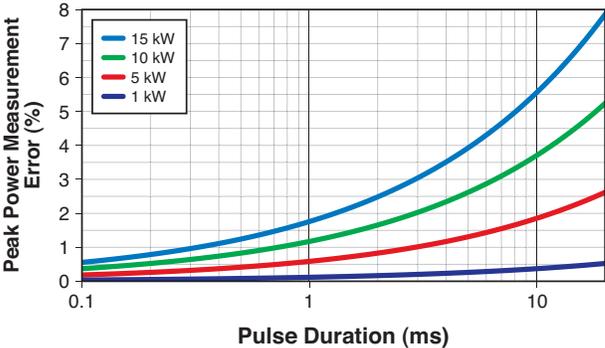
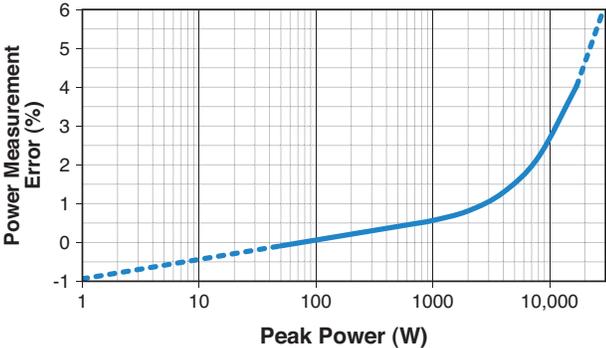
**PowerMax-Pro HP Maximum Steady-State Average Power**



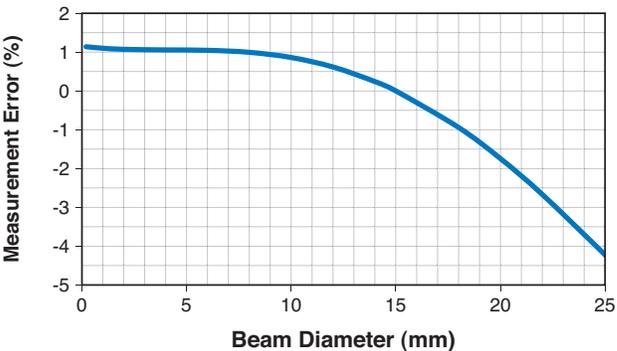
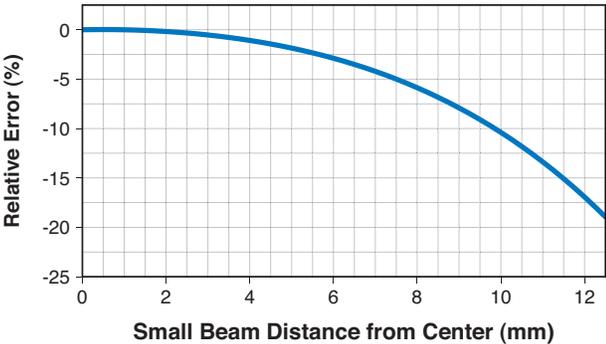
PowerMax-Pro HP Intermittent Average Power



PowerMax-Pro HP Measurement Error with Peak Power and Pulse Length

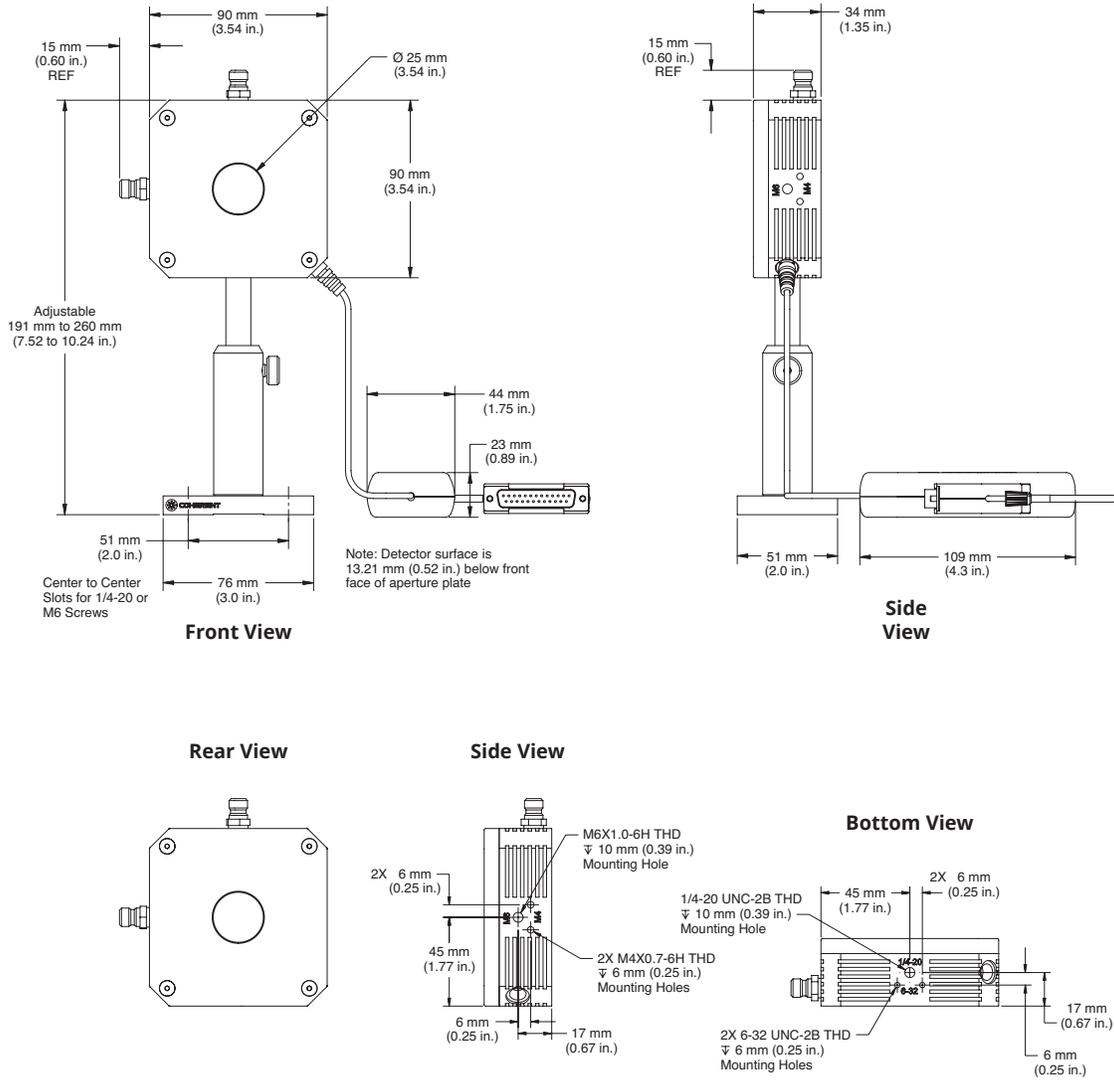


PowerMax-Pro HP Spatial Non-uniformity and Beam Diameter



## MECHANICAL SPECIFICATIONS

### PowerMax-Pro HP



SPECIFICATIONS	PowerMax-Pro USB/RS HP 2K
Wavelength Range	700 nm to 1070 nm; 10.6 $\mu\text{m}$
Average Power Range <sup>1</sup> (W)	3 to 350 (22W max air-cooled, cont.) (75W max air-cooled, 5 min.)
Max. Pulsed Peak Power (W)	2000
Noise Equivalent Power (mW)	
Standard Mode (10 Hz)	<150
High Speed Mode (20 kHz)	<200
Snapshot Mode (625 kHz)	<300
Max. Power Density ( $\text{kW}/\text{cm}^2$ )	1.2 (150W)
Max. Peak Power Density ( $\text{kW}/\text{cm}^2$ )	50 (1 ms; 1064 nm)
Max. Energy Density ( $\text{J}/\text{cm}^2$ )	30 (3 ms; 755 nm)
Rise Time ( $\mu\text{s}$ )	$\leq 10$
Fall Time ( $\mu\text{s}$ )	$\leq 10$
Detector Coating	HD
Diffuser	ZnSe
Active Area (mm)	25 dia.
Minimum Beam Size (mm)	Set by damage threshold
Maximum Beam Size <sup>2</sup> (mm)	18
Calibration Uncertainty (%) ( $k=2$ ) at 810 nm	$\pm 2$
Spectral Compensation Accuracy (%)	$\pm 5$
Power Linearity <sup>3</sup> (%)	$\pm 2$
Spatial Uniformity (%) (center 64% of aperture; 2.5 mm beam)	$\pm 5$
Calibration Wavelength (nm)	810
Cooling Method	Water/Air (intermittent)
Cable Type	USB/RS-232
Cable Length	4.2 m (13.8 ft.)
Part Number	1315456 (USB) 1315457 (RS-232)

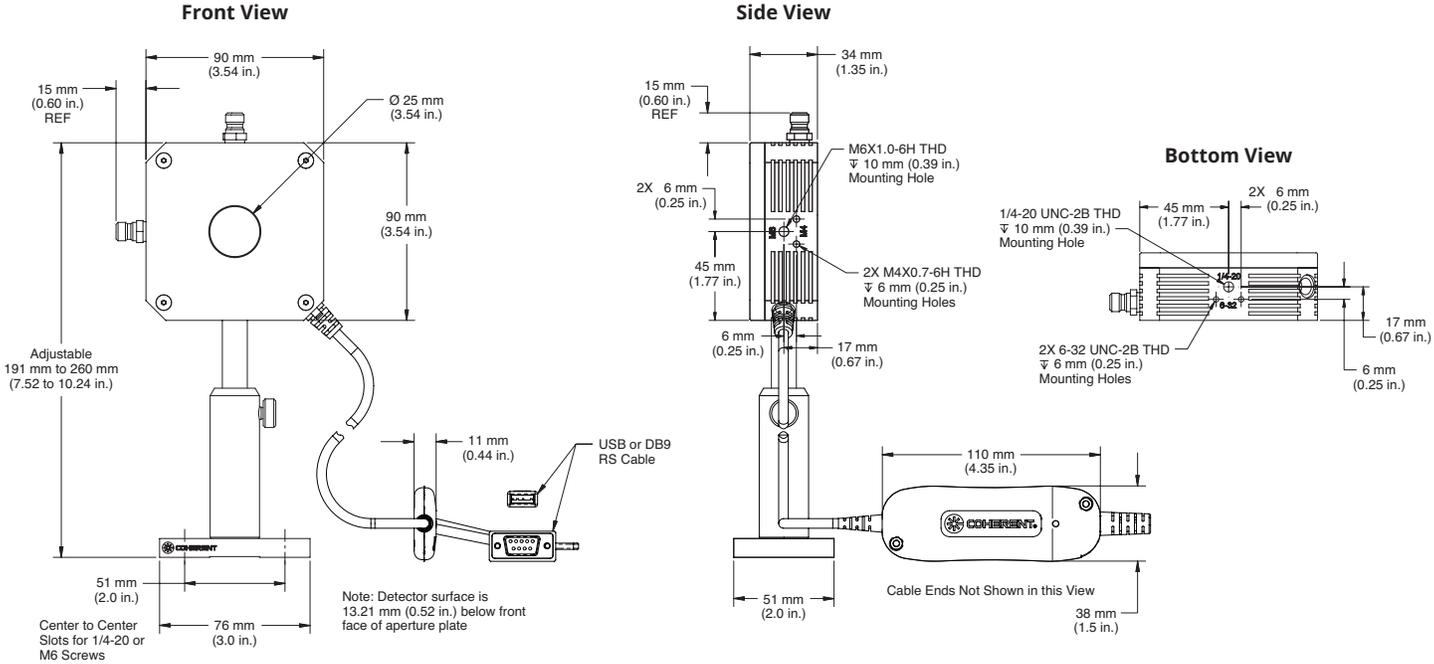
<sup>1</sup> Beam size dependent. See steady-state and intermittent power charts.

<sup>2</sup> See spatial uniformity and beam diameter charts for larger beams.

<sup>3</sup> Beam size and pulse length dependent. See peak power and pulse length charts.

MECHANICAL SPECIFICATIONS

PowerMax-Pro  
USB/RS HP 2K



Coherent, Inc.,  
5100 Patrick Henry Drive Santa Clara, CA 95054  
p. (800) 527-3786 | (408) 764-4983  
f. (408) 764-4646

tech.sales@Coherent.com [www.Coherent.com](http://www.Coherent.com)



[www.boselec.com](http://www.boselec.com)  
[shop.boselec.com](http://shop.boselec.com)  
[boselec@boselec.com](mailto:boselec@boselec.com)  
617.566.3821

Coherent follows a policy of continuous product improvement. Specifications are subject to change without notice. Coherent's scientific and industrial lasers are certified to comply with the Federal Regulations (21 CFR Subchapter J) as administered by the Center for Devices and Radiological Health on all systems ordered for shipment after August 2, 1976.

Coherent offers a limited warranty for all PowerMax-Pro sensors. For full details of this warranty coverage, please refer to the Service section at [www.Coherent.com](http://www.Coherent.com) or contact your local Sales or Service Representative. Printed in the U.S.A. MC-006-16-0M0117Rev.A Copyright ©2017 Coherent, Inc.



**PMP HP -- Fast Power Sensor**

1 to 350W fast power sensor, up to 15 kW peak power, water-cooled, 700 nm to 1070 nm; 10.6  $\mu\text{m}$  spectral range, 25 mm maximum beam size. Can handle up to 15 kW for durations less than 100 msec to enable rapid measurement of laser bursts without water cooling.

**PMP RS 2K HP -- Fast Power Sensor**

RS232-enabled, 3 to 350W fast power sensor, up to 2 kW peak power, water-cooled, 700 nm to 1070 nm; 10.6  $\mu\text{m}$  spectral range, 25 mm maximum beam size.

**PMP USB 2K HP -- Fast Power Sensor**

USB-enabled, 3 to 350W fast power sensor, up to 2 kW peak power, water-cooled, 700 nm to 1070 nm; 10.6  $\mu\text{m}$  spectral range, 25 mm maximum beam size.

**Product Specifications**

Name	PMP HP -- Fast Power Sensor	PMP RS 2K HP -- Fast Power Sensor	PMP USB 2K HP -- Fast Power Sensor
Price	\$2,975.00 USD	\$3,975.00 USD	\$3,975.00 USD
Rise Time (microseconds)	<10	<10	<10
Minimum Beam Size (millimeters)	Set by damage threshold specs	Set by damage threshold specs	Set by damage threshold specs
Maximum Power Density (kilowatts per square centimeter)	1.2 (at 150W)	1.2 (at 150W)	1.2 (at 150W)
Cooling Type	Water/Air	Water/Air	Water/Air
Power Range for Continuous Usage Air Cooled	1W to 22W	3W to 22W	3W to 22W
Power Range for Continuous Usage Water-cooled	1W to 350W	3W to 350W	3W to 350W
Max Peak Power (for modulated lasers)	15000 (10 ms), 10000 (50 ms), 5000 (100 ms)	2000W (> 1 $\mu\text{sec}$ pulses)	2000W (> 1 $\mu\text{sec}$ pulses)
Active Area Size	25 mm (diameter)	25 mm (diameter)	25 mm (diameter)
Wavelength Range	700 nm to 1070 nm; 10.6 $\mu\text{m}$	700 nm to 1070 nm; 10.6 $\mu\text{m}$	700 nm to 1070 nm; 10.6 $\mu\text{m}$
Cable Type	DB-25	RS232	USB
Calibration Uncertainty (%) (k=2)	$\pm 2$	$\pm 2$	$\pm 2$
Calibration Wavelength (nanometers)	801	801	801
Max. Energy Density	30 J/ $\text{cm}^2$ (3 msec; 755 nm)	30 J/ $\text{cm}^2$ (3 msec; 755 nm)	30 J/ $\text{cm}^2$ (3 msec; 755 nm)
Max. Peak Power Density (kilowatts per square centimeter)	50 (1 msec; 1064 nm)	50 (1 msec; 1064 nm)	50 (1 msec; 1064 nm)

## Novel Laser Power Sensor Improves Process Control

**A dramatic technological advancement from Coherent has yielded a completely new type of fast response power detector. The high response speed is particularly advantageous in commercial applications where it enables CW laser power to be sampled faster and more frequently; with modulated sources it delivers peak power and temporal pulse shape data, from which pulse energy can be derived. This real-time feedback can be used to improve laser system throughput and quality, and to improve process precision, with minimal engineering investment.**

### Introduction and Overview

Lasers are used to process materials in an extraordinarily diverse array of applications – in industries such as semiconductor electronics, medical product manufacturing, consumer product packaging and automotive production. While these uses involve numerous different laser technologies working with many different materials, they often share a common requirement. Namely, the need to regularly measure laser output characteristics such as power, pulse energy, pulse shape or beam profile to ensure optimum and consistent processing. Furthermore, this need for accurate laser characterization is becoming more critical today due to two overarching trends occurring simultaneously in many different industries. The first of these is a growing requirement for increased process precision, and the second is a drive to reduce production costs. This document reviews a new laser power measurement technology specifically designed for use in laser-based processing tools, which directly addresses these needs.

### Measurement Requirements

For most laser processes, regardless of the operating regime (millisecond, nanosecond or femtosecond) or output wavelength, average power is a critical parameter since it usually directly affects material removal or transformation rates. And for many applications, the actual laser power delivered to the work surface is subject to fluctuations since it can be impacted by a number of different factors. These include inherent variations in laser output, as well as

changes in optical alignment within a beam delivery system, and degradation in the performance of individual beam delivery optics (such as a drop in reflectivity on a mirror).

Pulse shape is also an important parameter, particularly for applications in the thermal processing regime that commonly utilize modulated CO<sub>2</sub> lasers. Relatively small changes in the modulated pulses can affect process results such as cut edge quality or hole shape. Laser variations can make a process difficult to control, or may require the process to be slowed down to achieve the precision required.

A general move in industry towards higher process precision or increased throughput typically narrows the process window, making it more intolerant of any changes in either delivered laser power or pulse shape. The narrower this window gets, the more frequent the need to measure laser output characteristics to verify that it remains within acceptable bounds. Real-time pulse shape monitoring (which can be used to monitor peak power and calculate pulse energy) can provide a feedback loop back to the laser, which translates into improved process speed and feature uniformity.

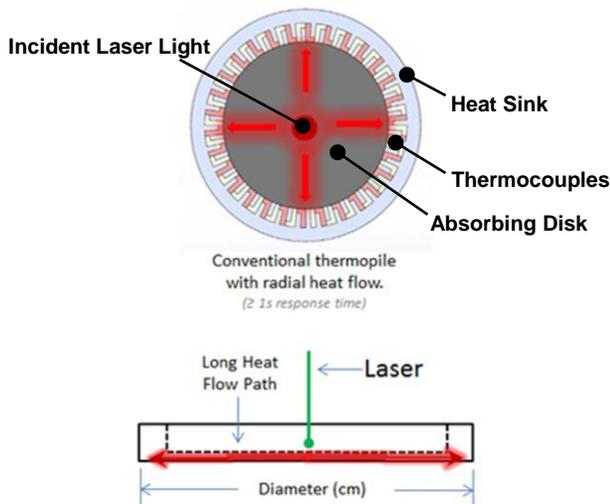
The frequency of laser measurement also strongly impacts costs because it enables quicker identification of production problems. Specifically, it can identify nascent problems, or problems that have just occurred, and therefore prevent the fabrication of poor quality parts before they move down the line and become expensive scrap or rework.

Given the benefits of frequent laser power monitoring, why isn't this simply common practice in most industries? The answer is that the power measurement technology currently employed for many laser types is relatively slow, and thus, can't keep pace with the speed of the production line. As a result, laser power is measured only intermittently in order to minimize stopping or slowing of production; and due to limitations of photodiodes, pulse shape monitoring is rarely employed.

### Traditional Laser Power Sensors

There are two dominant technologies in use for measuring the average power of lasers. These are thermopiles and semiconductor photodiodes.

*Thermopiles* have been used for many years as the detector of choice for high power lasers. These detectors operate on the thermoelectric principle in which thermal energy is converted into electrical energy. The typical thermopile consists of a central light absorbing disk, a series of thermocouples that surround this disk, and an annular heat sink around the ring of thermocouples (Figure 1).



**Figure 1**  
**Construction of a Traditional Thermopile**

In operation, incident laser energy falls on the absorbing disk in the center of the detector and is converted into heat. This disk is typically coated with a material that absorbs light over a very broad wavelength range in order to enhance sensitivity. The heat then flows across the width of the thermopile disk to the heat sink which is held at a near constant ambient temperature by either air- or water-cooling. The temperature difference between the absorber and heat sink is converted into an electrical signal by the thermocouples. Calibrated electronics in the meter convert this electrical signal into a laser power reading.

Thermopile sensors have several advantages, including an extremely broad spectral range, an ability to work over a wide range of input powers, high laser damage resistance, and uniform spatial response

(meaning insensitivity to changes in beam size, position or uniformity). The limitation of the technology is that the transfer of heat across the width of the thermopile disk makes this technology inherently slow. Specifically, it often takes several seconds before the heat flow induced by the laser reaches equilibrium, and the power measurement becomes steady on the display. Physically larger sensors take longer to reach this steady state. This slow response time makes thermopiles best suited for measuring CW laser power. For pulsed lasers, the best they can deliver is average power over a finite time interval, or total integrated energy from a long burst of pulses.

*Semiconductor photodiodes* are essentially a solid-state diode (*pn* junction). Incident laser photons are absorbed by the device and converted into charge carriers (electron and holes). These can be sensed as current or voltage depending upon how the junction is biased.

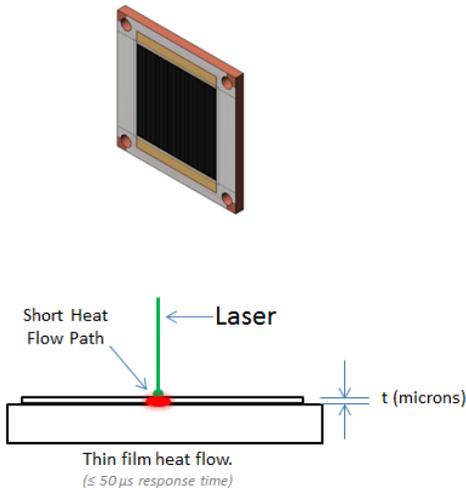
Photodiodes offer high sensitivity enabling them to detect very low light levels. They saturate approximately 1 mW/cm<sup>2</sup>, so attenuating filters must be used when operating at higher powers. Photodiodes have a fast response time and thus can be useful for looking at pulse shapes.

The drawback of photodiodes is that they have smaller active areas, a much more limited spectral range, and lower spatial uniformity than thermal sensors. The latter can affect the measurement repeatability of non-uniform beams or beams that wander over the detector surface between measurements. Several different semiconductor material combinations are available to produce photodiodes that work in the visible, near infrared or far infrared regions. Together, these characteristics make photodiodes most useful for low power measurements of CW lasers, as well as pulse shape characterization of nanosecond pulsed lasers.

### PowerMax-Pro Technology

Coherent developed PowerMax-Pro technology (Patent Pending) to meet the growing need for a laser power sensor that offers the broad wavelength sensitivity, large dynamic range and high damage resistance of a thermopile, together with the fast response speed approaching that of a semiconductor photodiode. The PowerMax-Pro is constructed and configured

differently than a thermopile. Specifically, in this device the heat flows vertically through the detector, and the electrical field that is generated moves perpendicular to the heat flow (Figure 2).

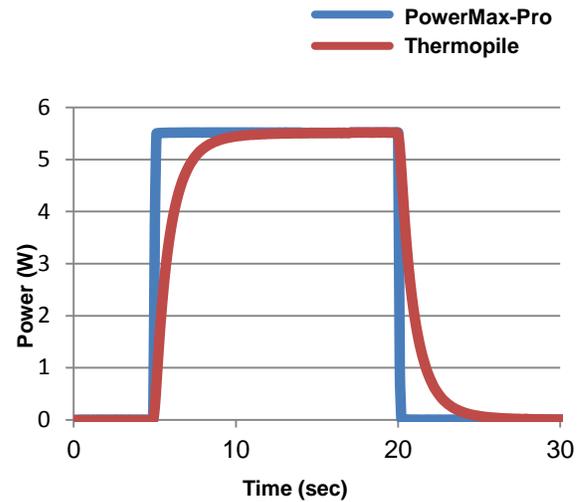


**Figure 2**  
**Basic Configuration of a PowerMax-Pro Sensor**

The materials used in this sensor are a stack of films which have layer thicknesses on the order of microns. Incident laser light is absorbed and generates heat which is able to flow very quickly through these thin layers to the heat sink below the detector where it is dissipated. The electrical signal from the thin film layers moves laterally to the edges of the device where it can be measured by tapping into the sensor electrodes.

### High Speed Measurements

In contrast to the traditional, radial flow thermopile, which has a sensing time constant value of several seconds, the time constant for the thin film configuration is in the microsecond range. This enables the sensor to provide an essentially instant power measurement without any overshoot (Figure 3). The PowerMax-Pro sensor preserves the main benefits of the traditional thermopile architecture, namely large active area (30 mm x 30 mm), wide dynamic range (50 mW to 150W), high damage resistance (14 kW/cm<sup>2</sup>) and broad wavelength range (300 nm to 11 μm).



**Figure 3**  
**The Rise Time of a Typical Mid-Power Thermopile (30W) Compared with the PowerMax-Pro**

The response speed of PowerMax-Pro sensors allows users to move beyond just measuring average power, and enables visualization of the temporal pulse shape and peak power of modulated lasers with pulse lengths greater than 10 μs. These pulses can then be integrated to calculate individual pulse energy. Previously, it was only possible to measure the shapes of CO<sub>2</sub> laser pulses of this duration using mercury cadmium telluride (MCT or HgCdTe) photodiodes. However, these exotic detectors have a number of significant drawbacks. For example, they have a small active area, typically on the order of 1 mm<sup>2</sup> or even smaller, which makes it impossible to monitor true pulse energy or total output power. Also, photodiodes saturate at very low powers and can be easily damaged if exposed to too much power. Because of these two factors, MCT photodiodes usually only sample a portion of the beam, and are used to monitor for missed pulses, or to check for large changes in relative power output.

Another problem with MCT photodiodes is that their noise level is high, making them unsuitable for accurate peak power and precise pulse energy monitoring. Expensive, multi-stage, thermoelectric coolers may be required to stabilize the baseline noise if these sensors are used to do anything other than detecting missed pulses. Performance at less than 20 kHz, which is common in modulated CO<sub>2</sub> applications, is further

compromised due to flicker, or 1/f noise, again making absolute power or energy measurement difficult.

### Meter Electronics

A sensor is just part of a measurement system, and can only deliver high quality data if it is matched with electronics to properly acquire, condition and process the raw signal from the sensor. Coherent has developed the LabMax-Pro SSIM laser power meter specifically to fully capitalize on the inherent capabilities of PowerMax-Pro sensors.

To minimize user cost and maximize flexibility, the LabMax-Pro is packaged as a Smart Sensor Interface Module (SSIM) that interfaces with a host computer through either USB or RS-232. LabMax-Pro PC, a new Windows PC application, then enables instrument control and displays measurement results, including laser tuning and pulse shape visualization, on a host computer. The software also performs a wide range of analysis functions such as live statistics, histograms, trending and data logging. In addition, a complete set of host commands can be sent through either the USB or RS-232 interface which is particularly useful for embedded applications.

### High Speed Sampling for Pulse Visualization

The standard operating mode of the LabMax-Pro SSIM utilizes a typical 10 Hz sampling rate. At this data rate, it allows PowerMax-Pro sensors to provide an instant power reading, much like a photodiode, but, of course, taking advantage of the sensor's ability to directly read very high powers. High volume processes that use high repetition rate or quasi-CW lasers, such as picosecond and femtosecond lasers, can benefit significantly from fast power measurements. Time currently spent monitoring the process with thermopiles can be spent processing parts, and with such rapid measurements, the process can be monitored more frequently. Instead of spending up to a minute or more taking a reading, the measurement can be performed in less than a second with PowerMax-Pro technology, enabling throughput improvement with very little engineering investment.

The standard operating mode is best used to measure the power of CW lasers, or the average power of high repetition rates lasers. Two High Speed sampling modes have been implemented in the meter electronics

and software to fully exploit the rapid response speed of PowerMax-Pro sensors for measuring pulsed lasers operating between these two extremes. These modes enable advanced analysis of high power, pulsed lasers in a way that has never been possible before.

The first High Speed mode utilizes a continuous data sampling rate of 20 kHz, allowing pulse shape analysis of modulated lasers with repetition rates of up to 2 kHz. These types of pulse trains are common in many laser-based medical treatments and some materials processing applications such as micro welding.

The accompanying screen capture shows data gathered using a 20W CO<sub>2</sub> laser to illustrate the type of detail that can be obtained in this mode.

**Coherent PowerMax-Pro**



**Figure 4**  
**Pulse Shape Visualization Obtained with a PowerMax-Pro Sensor and LabMax-Pro Electronics and Software**

The second High Speed mode is called "Snapshot Mode," which provides burst sampling at a rate of 625 kHz for a period of time up to 384 milliseconds. This is fast enough to enable visualization of the pulse shape of the modulated lasers common in various commercial cutting, engraving and drilling applications, as well as

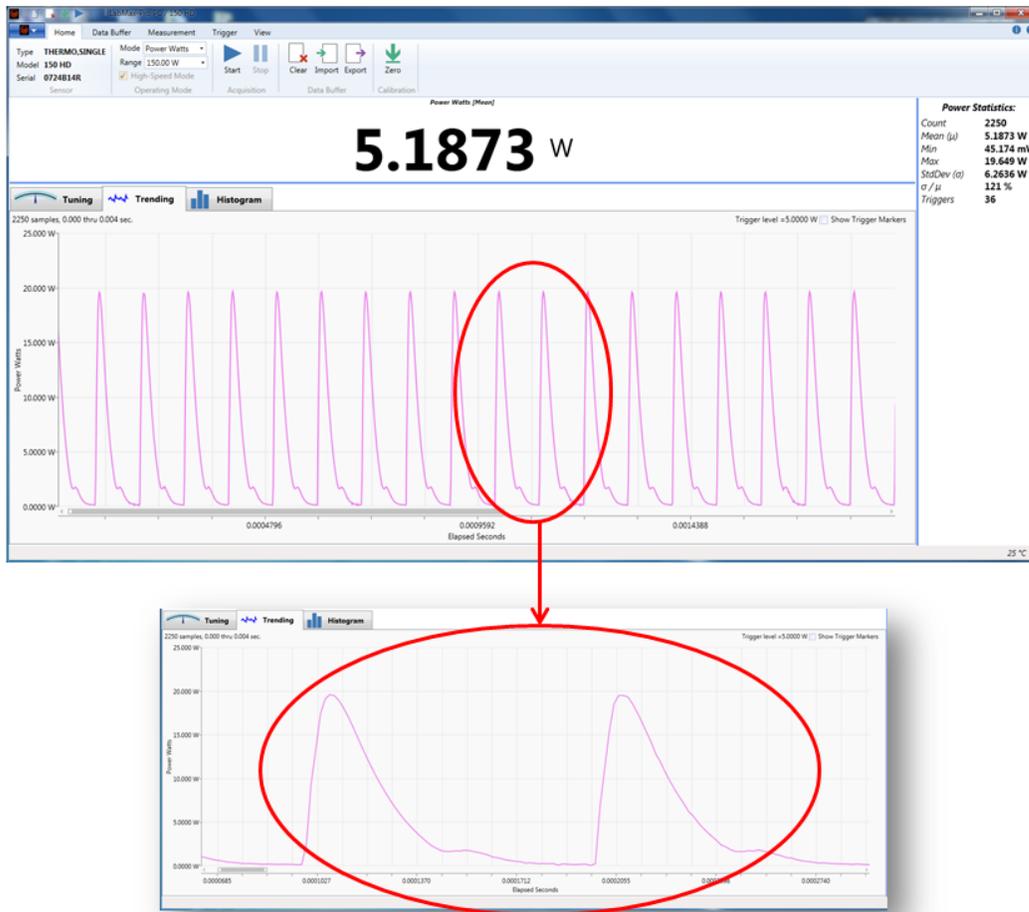
long pulses and pulse trains used in aesthetic medical applications. This type of temporal visualization offers new insight into the true performance of the laser previously masked by slow thermopiles. This new information, now available to engineers, removes some of the “magic” involved in setting up materials processing applications. It provides developers with more repeatable methods to transfer processes from engineering to manufacturing and to control and

monitor the process once it’s up and running. Many thermal-based materials processing applications can be better controlled with this information, leading to faster processing with higher yield; at the same time, the quality of laser produced features can be enhanced.

The following figures demonstrate the data quality and high pulse shape fidelity that can be achieved.

**Modulated 10.6  $\mu\text{m}$  CO<sub>2</sub> Laser**

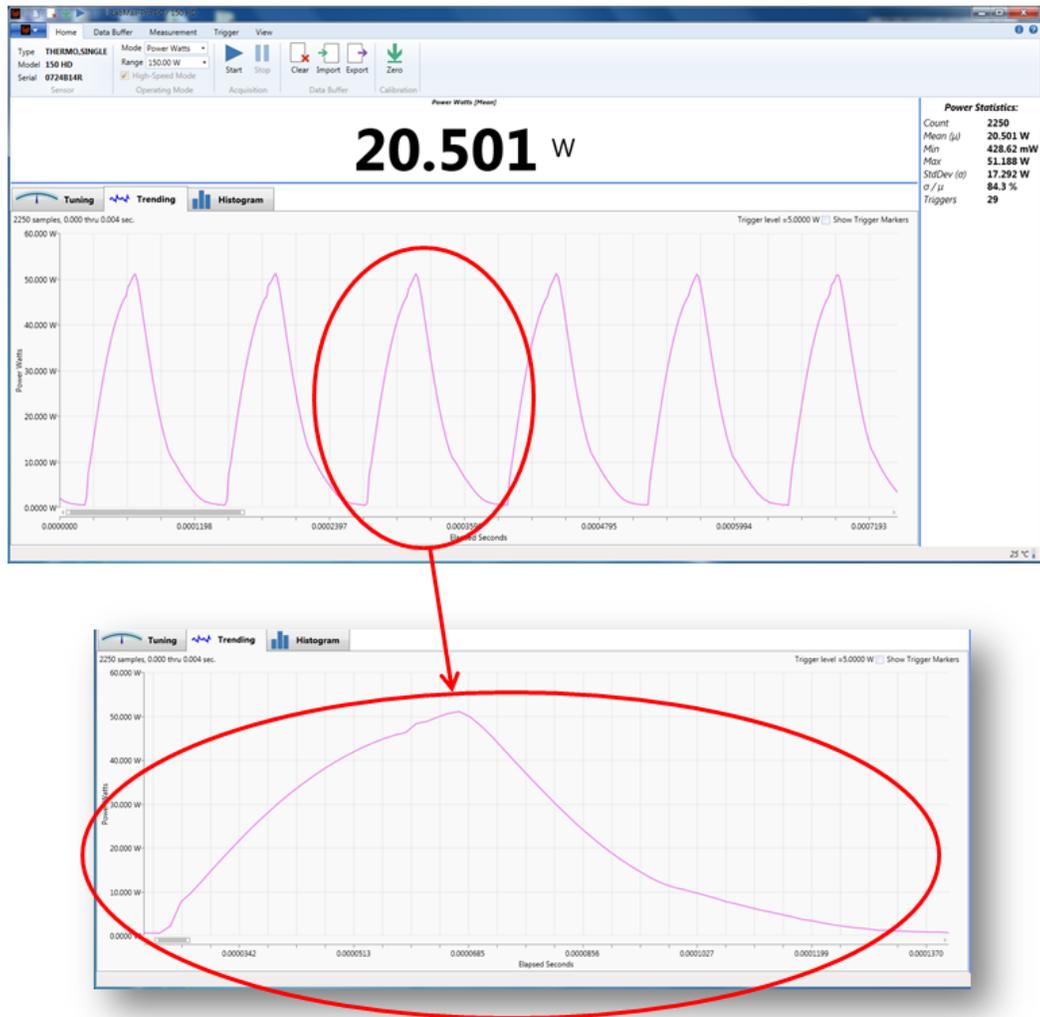
- 10  $\mu\text{s}$  PW
- 10 kHz PRF
- 10% Duty Cycle



**Figure 5**  
**The New LabMax-Pro Offers a “Snapshot Mode” Which Enables Visualization of Pulses as Short as 10  $\mu\text{s}$  and at High Duty Cycles**

**Modulated 10.6  $\mu\text{m}$  CO<sub>2</sub> Laser**

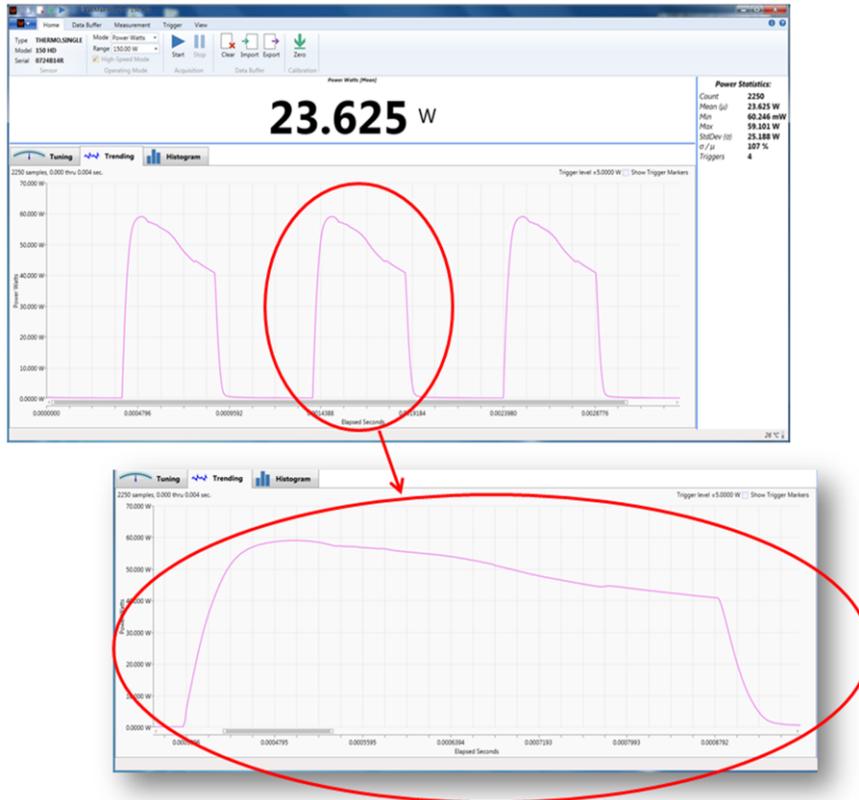
- 50  $\mu\text{s}$  PW
- 8 kHz PRF
- 40% Duty Cycle



**Figure 6**  
**Pulse Shape Visualization Obtained with a PowerMax-Pro Sensor**  
**and LabMax-Pro Electronics and Software**

**Modulated 10.6  $\mu\text{m}$  CO<sub>2</sub> Laser**

- 500  $\mu\text{s}$  PW
- 1 kHz PRF
- 50% Duty Cycle



**Figure 7**  
*Pulse Shape Visualization Obtained with a PowerMax-Pro Sensor and LabMax-Pro Electronics and Software*

**Conclusion**

In conclusion, traditional laser power sensors have masked some of the instability in lasers by averaging out pulse-to-pulse variation. Additionally, the slow speed of these sensors required a compromise between measuring frequently (to ensure quality) and throughput reduction resulting from time spent taking those measurements. In a major paradigm shift, Coherent's new PowerMax-Pro sensor technology,

coupled with our LabMax-Pro hardware and software, have now eliminated that compromise. The result is a laser analysis platform that will deliver several important benefits to users of laser-based processes. These are improved throughput due to increased measurement speed, reduced costs from the reduction of scrap and rework, and higher quality product enabled by quicker feedback on variations in laser power or pulse shape.

# LabMax-Pro SSIM

## Laser Power and Energy Meter

The LabMax-Pro represents the next generation of Coherent's groundbreaking LabMax line. This power meter combines the power and versatility of the LabMax, with two new higher speed sampling modes when used with PowerMax-Pro technology (Patent Pending). High speed mode increases the continuous sampling rate to 20 kHz, enabling analysis of laser pulse trains common in medical and micro welding applications. Snapshot mode provides burst sampling at a rate of 625 kHz, enabling users to view the rise time and pulse shape, while integrating the energy of modulated lasers which are common in various commercial cutting and drilling applications.

High speed sampling mode can improve processes in numerous applications. For example, it has also been used to speed up diode testing with faster LIV curve sampling combined with higher sampling resolution.

In the traditional 10 Hz sampling mode, PowerMax-Pro sensors provide an instant power reading, much like a photodiode but at very high powers. Legacy thermopiles and optical sensors are also compatible with the 10 Hz sampling mode, just like in past meters.

The product includes a new Windows-based PC application that enables a wide range of analysis functions including statistics and histogram, trending, tuning, data logging, as well as a new ability to zoom in on detailed pulse shapes and pulse bursts with cursors and energy integration using PowerMax-Pro technology. The software interface allows for flexible sizing of informational panes within the application, in which contents are auto-sized dynamically as the panes are adjusted, allowing the user to size the information of greatest importance.

Data is analyzed on the PC through USB or RS-232 interfaces through the Windows PC application, or directly through host commands.

In addition to PC interfacing, LabMax-Pro SSIM also includes an analog output with user-selectable voltages of 0 to 1V, 2V, or 4V. Triggering can be achieved with an external trigger input or an internal trigger that is user adjustable.

The meter is configured as a module for direct PC control and is compatible with PM model thermopiles and PowerMax-Pro sensors.



**Superior Reliability & Performance**

### LabMax-Pro SSIM Features:

- **Laser power and energy meter**
- **Compatible with PowerMax-Pro and PM Model thermopiles, LM model position-sensing thermopiles, LM-2 & OP-2 optical sensors, and EnergyMax DB-25 pyroelectric energy sensors**
- **High speed sampling for laser pulse analysis and energy integration**
- **Operation up to 10 kHz every pulse with pyroelectric sensors**
- **USB and RS-232 interfaces**
- **Windows PC application**
- **Direct host commands support OEM integration**
- **Windows 7 and 8 compatible (32 and 64-bit)**

### LabMax-Pro SSIM Applications:

- **Production/QA**
- **Engineering & Scientific**
- **Commercial OEM Integration**

[www.Coherent.com/LabMax-Pro-SSIM](http://www.Coherent.com/LabMax-Pro-SSIM)

# LabMax-Pro SSIM

## Laser Power and Energy Meter

### Device Specifications

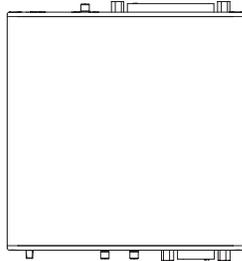
		LabMax-Pro SSIM
Measurement Resolution (%) (full-scale)		
at 10 Hz speed		0.1
at 20 KHz high speed		0.2
Sensor Compatibility		PM Model Thermopile; PowerMax-Pro; LM Model Thermopile, OP-2 & LM-2 Optical, DB-25 EnergyMax pyroelectric
Measurement Range		Sensor dependent (reference sensor specifications)
Accuracy (%)		
Digital Meter		±1
System		Meter + sensor
Analog Output		±1
Calibration Uncertainty (%) (k=2)		±1
Power Sampling Rate		
Pyroelectric (Hz)		10,000
LM-2/OP-2 Optical (Hz)		10
Thermopile (Hz)		10
PowerMax-Pro - Low Speed (Hz)		10
PowerMax-Pro - High Speed (Hz)		20,000
PowerMax-Pro - Snapshot Mode (Hz)		625,000
Analog Output (VDC)		0 to 1, 2, or 4.096 (selectable)
Analog Output Resolution (mV)		1
Analog Output Update Rate (kHz)		19
Measurement Analysis		Trending, tuning, histogram, data logging, statistics (min., max., mean, range, std. dev., dose, stability), pulse shape and pulse energy (with PowerMax-Pro in High Speed and Snapshot mode), long pulse Joules with thermopiles, beam position with LM Model thermopiles
Computer Interface		USB and RS-232
Pulse Triggering		Internal and External
Temperature		
Operating Range		5 to 40°C (41 to 104°F)
Storage Range		-20 to 70°C (-68 to 158°F)
Instrument Power (external supply)		90 to 260 VAC, 50/60 Hz
Compliance		CE, RoHS, WEEE
Dimensions		105 x 105 x 32 mm (4.1 x 4.1 x 1.3 in.)
Weight		0.3 kg (0.6 lbs.)
Front Panel		Power switch USB hi-speed port (mini B connector) Trigger output (SMB connector) Analog output (SMB connector) RS-232 port (DB-9F connector)
Rear Panel		DB-25 sensor port External trigger input (SMB connector, 3 to 5 Vin, 2 to 10 mA, 50 ohm AC, 300 ohm DC impedance) Power jack (12VDC - center positive)
Part Number <sup>1</sup>		1268881

<sup>1</sup> Meter supplied with AC power adapter, power cord, USB cable, BNC-to-SMB trigger cable, software and driver CD, and certificate of calibration.

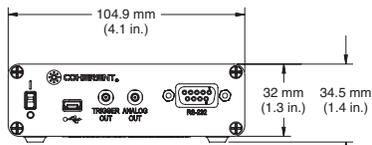
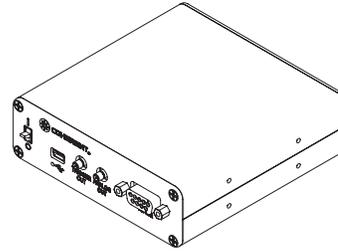
# LabMax-Pro SSIM

Laser Power and Energy Meter

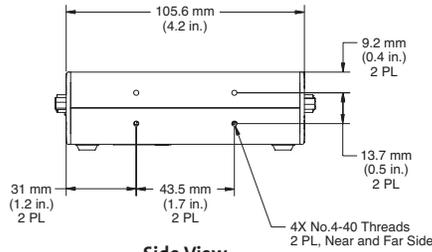
## Mechanical Specifications



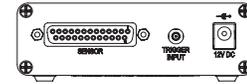
Top View



Front View



Side View



Rear View



[www.Coherent.com](http://www.Coherent.com)

**Coherent, Inc.,**  
 27650 SW 95th Avenue  
 Wilsonville, OR 97070  
 phone (800) 343-4912  
 (408) 764-4042  
 fax (408) 764-4646  
 e-mail LMC.sales@Coherent.com

Benelux +31 (30) 280 6060  
 China +86 (10) 8215 3600  
 France +33 (0)1 8038 1000  
 Germany/Austria/  
 Switzerland +49 (6071) 968 333  
 Italy +39 (02) 31 03 951  
 Japan +81 (3) 5635 8700  
 Korea +82 (2) 460 7900  
 Taiwan +886 (3) 505 2900  
 UK/Ireland +44 (1353) 658 833

Coherent follows a policy of continuous product improvement. Specifications are subject to change without notice.

Coherent's scientific and industrial lasers are certified to comply with the Federal Regulations (21 CFR Subchapter J) as administered by the Center for Devices and Radiological Health on all systems ordered for shipment after August 2, 1976.

Coherent offers a limited warranty for all LabMax-Pro SSIM laser power and energy meters. For full details of this warranty coverage, please refer to the Service section at [www.Coherent.com](http://www.Coherent.com) or contact your local Sales or Service Representative.



[www.boselec.com](http://www.boselec.com)  
[shop.boselec.com](http://shop.boselec.com)  
[boselec@boselec.com](mailto:boselec@boselec.com)  
 617.566.3821

# Set-Up Instructions

## Meterless PowerMax-Pro USB or RS Sensor: Direct Connect to a Workstation



**CAUTION:**  
Take precautions to avoid damage to electronics in the PowerMax-Pro Sensor from Electrostatic Discharge (ESD).

- Step 1. Connect the high-speed USB 2.0 cable from a PowerMax Pro USB meterless sensor to a workstation. For a Power-Max Pro RS sensor, connect the RS-232 cable to the workstation.
- Step 2. Connect the optional power supply to the connector on the sensor cable, and plug the power supply into an outlet.
- Step 3. Run the Coherent Meter Connection software, and select the COM port for the sensor.



Follow instructions in the *Coherent Meter Connection User Manual* to complete set-up and configuration.

## PowerMax-Pro: Connect to a Workstation with a LabMax-Pro SSIM Meter



**WARNING—LASER RADIATION!**  
Carefully follow all laser safety procedures. Either block or switch OFF the laser before starting any operations.

- Step 1. Attach a PowerMax Pro sensor to the back of the LabMax-Pro SSIM meter using a DB-25 connector.
- Step 2. Attach the LabMax-Pro SSIM meter to a workstation using a USB 2.0 high-speed cable.
- Step 3. Connect the power supply to the LabMax-Pro SSIM meter, and turn power ON.
- Step 4. Run the Coherent Meter Connection software, and select the COM port for the LabMax-Pro SSIM meter.



Follow instructions in the *Coherent Meter Connection User Manual* to complete set-up and configuration.

# Laser Safety



When working with Lasers, ensure that all personnel are protected at all times from accidental or unnecessary exposure to laser radiation.



## WARNING!

Exposure to laser radiation can be harmful. Avoid eye or skin exposure to both DIRECT and SCATTERED radiation. Direct eye contact with the output beam from a laser causes serious eye injury and possible blindness.

## Laser Safety Precautions

Because of its optical qualities, laser light poses safety hazards not associated with light from conventional light sources. Avoid direct exposure to the laser light, and follow these control measures:

- Always wear appropriate laser safety eye wear for protection against the specific wavelengths and laser energy being generated.
- Never look directly into the laser light source or at scattered laser light from any reflective surface, even when wearing laser safety eye wear.
- Laser beams can easily cause flesh burns or ignite clothing.
- Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
- Terminate the laser beam with a light-absorbing material, and use energy-absorbing targets for beam blocking.



Coherent Meter Connection Quick Start Guide  
© Coherent Inc., 2018 (RoHS), Printed in the USA  
Part No. 1343659, Rev. AA

## Coherent Meter Connection Quick Start Guide

Along with PowerMax Pro technology and the LabMax-Pro SSIM meter, Coherent Meter Connection displays individual pulse shapes and pulse bursts, as well as performs energy integration.

This Quick Start Guide provides basic steps to set up and run the Coherent Meter Connection software with the LabMax-Pro SSIM meter and PowerMax-Pro USB/RS sensors. For more complete information, see the applicable *User Manual* for the applicable Coherent meter or sensor.

## Install Software v1.0

See the User Manual for system requirements. To install software:

Step 1. Close all programs on your workstation before you begin.

Step 2. Run the following file and follow on-screen prompts.

**Coherent Meter Connection v1.0.x.x Release Setup.exe**

Step 3. Select the language for installation.

Step 4. Read and accept the terms and conditions of the License.

Step 5. Browse to the folder for installation.

Step 6. Set up a shortcut on the desktop.

Step 7. Follow instructions in the Wizard to install all recommended device drivers for your hardware.

Step 8. Continue installation until the Finish button is displayed.

After the software is installed, a shortcut is placed on the desktop. Review the *Release Notes* to learn about new features.