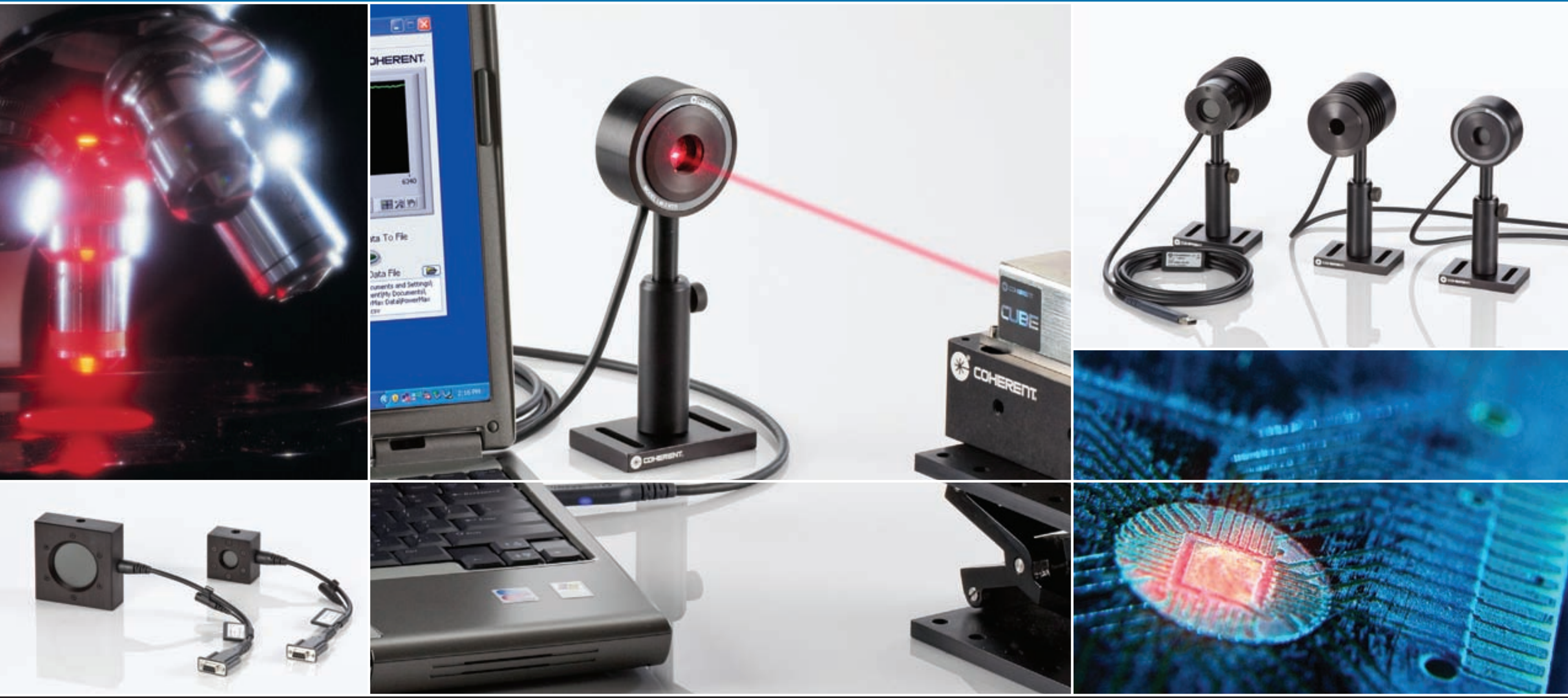
PowerMax-USB/ RS Sensors



USB and RS-232 Laser Power Measurement

Superior Reliability & Performance

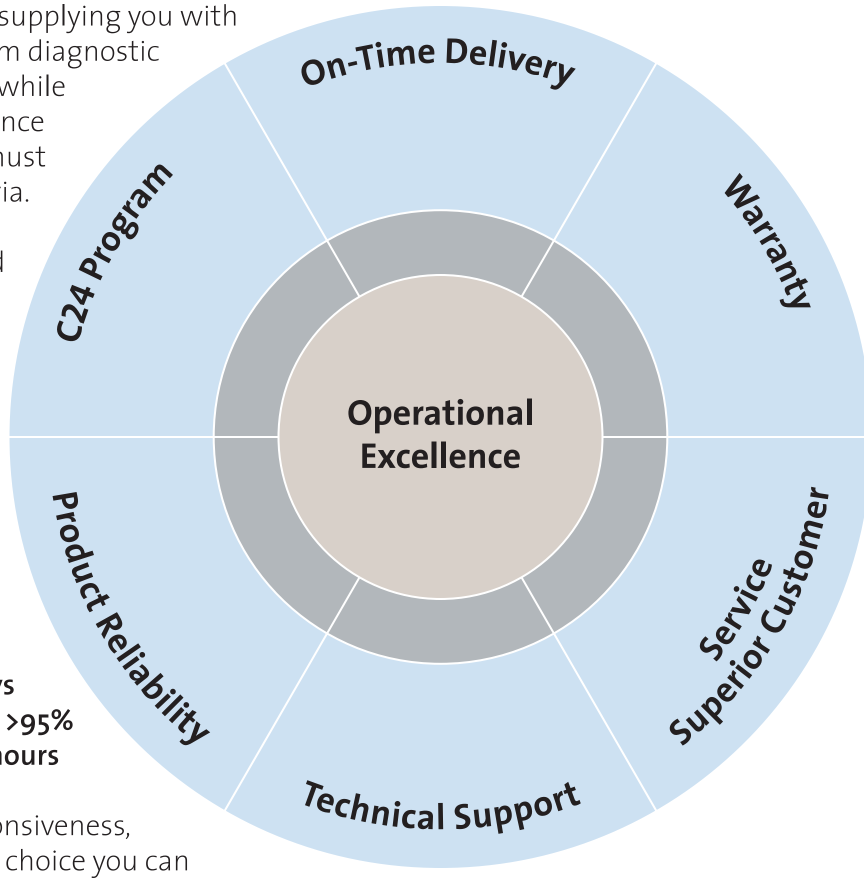
Coherent Operational Excellence

Operational Experience You Can Count On

For over 40 years, Coherent has been supplying you with the best laser measurement and beam diagnostic equipment available. We realize that while technical specifications greatly influence your purchasing decisions, you also must consider many other important criteria.

In a recent customer survey we found that Product Reliability, Speed of Responsiveness, and Technical Support are the three top criteria when choosing a laser test and measurement supplier. That's why we place as much emphasis on Operational Excellence as we do on technical superiority. Operational Excellence means:

- **Overall product warranty rate <1%**
- **Calibration turnaround time <5 days**
- **On-time delivery for all new orders >95%**
- **Shipment of C24 orders within 24 hours**



For Product Reliability, Speed of Responsiveness, and Technical Support, make the safe choice you can always count on – Coherent.

The Coherent Laser Measurement Newsletter

To keep informed about our latest laser measurement and beam diagnostics product releases, product upgrades, and special promotions, please sign up for our electronic newsletter at: www.Coherent.com/LMC.

We Want You to Know What's New

New Mailing Address

Coherent Inc., Portland
27650 SW 95th Avenue
Wilsonville, OR 97070

New Phone Number

Phone:
(800) 343-4912 or
(408) 764-4042

New Fax Number

Fax:
(503) 454-5727

Online:
www.Coherent.com

PowerMax-USB/RS Sensors

Product Overview

Models 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.

Features

- **PowerMax-USB provides direct USB 2.0 connection to PC. Power provided via USB connection.**
- **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

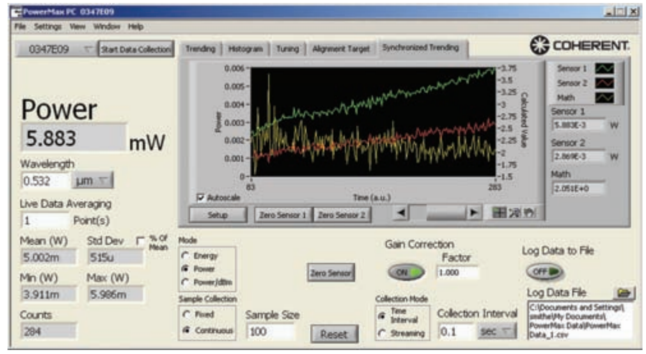
Software Features

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

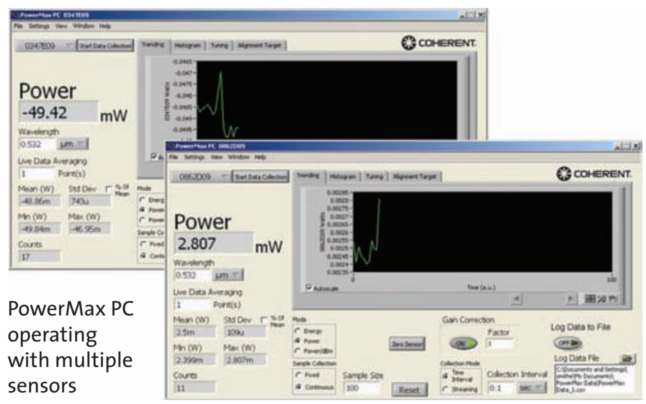
- **Trending, tuning, histogram**
- **Statistics (mean, minimum, maximum, and standard deviation) and log batch to file**
- **Display beam position on position-sensing thermopiles and log results to file**
- **Operate multiple devices simultaneously and perform synchronized ratiometery (A/B analysis).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

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



PowerMax PC operating with multiple sensors

Thermopile Technology

Thermopile sensors are a great all-purpose technology suitable for many lasers. They are used for measuring CW laser power, average power in pulsed lasers, and are often used to integrate the energy of long pulses. Thermopile sensors absorb incident laser radiation and convert it into heat. This heat ultimately flows to a heat sink that is held at ambient temperature by either convection-cooling or water-cooling. The temperature difference between the absorber and the heat sink is converted into an electrical signal by a thermocouple junction.

Thermopiles operate across a wide range of input powers, and unlike a photodiode-based sensor they will not saturate. The spectral range is dependent upon the coating applied to absorb the laser power. The coating used on many thermopiles is broadband in nature and is relatively flat from the ultraviolet through the infrared.

These sensors have natural response times on the order of several seconds for a low power sensor and up to one minute for a kilowatt sensor. The exponential nature of the natural thermopile output allows one to electronically accelerate the voltage to its final value ahead of the actual detector signal using a software algorithm. We typically call this capability a "speed-up" algorithm. When combined with the PowerMax-USB and PowerMax-RS circuitry, a speed-up algorithm can be applied to provide a much faster response – on the order of seconds or less for most thermopile sensors. This feature can be turned on and off in the software.

Quad Positioning Enabled

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.

PowerMax-USB/RS Sensors

Product Overview

Models PM10-19C, PM150-50C, PM150-19C

Long-pulse Energy Measurement with a Thermopile
Thermopile sensors are most commonly used for average power measurements on pulsed and CW lasers. A unique capability of thermopile sensors is the ability to integrate the power of a single "long" laser pulse. "Long" pulse refers to pulses roughly 1 msec up to several seconds in pulse length. The instrumentation analyzes the output of the thermopile and applies the integration through the use of an algorithm that results in a Joules reading. This allows the thermopile to measure the energy of single pulses between 1 millisecond and 10 seconds in length, and with energies from millijoules to hundreds of Joules. The measurement accuracy of this mode is typically better than ±3% when performed with PowerMax-USB and PowerMax-RS sensors.

This is very useful for what are commonly called long-pulse medical or industrial type lasers. Common applications for this type of measurement are in the medical field, especially skin resurfacing and hair removal, and in material processing applications such as laser welding. These laser systems often utilize high-energy lasers that have large beam sizes and relatively long pulses.

This type of measurement requires careful selection of the appropriate power sensor based upon the laser pulse being measured. A good "rule of thumb" for using a thermopile for this type of measurement is to compare the maximum pulse energy you need to measure (in Joules) with the maximum power rating of a sensor (in Watts).

Often times a sensor like the PM150-50C is ideal for these measurements. It features a large 50 mm aperture size, can handle pulse energies up to 150J, and can be used air-cooled for single pulse energy measurements. A PM150-50C will normally need to be water-cooled for continuous power measurements. The PS19Q sensors, on the other hand, will allow long pulse measurements down into the mJ level.

Thermopile joules mode specifications for each PowerMax-USB/RS sensor can be found on the individual product pages.

Semiconductor Technology
Semiconductor photodiode-based sensors convert incident photons into current that can be measured by our instrumentation. We typically refer to these devices as optical or quantum sensors. The photodiodes used in these types of sensors offer high sensitivity and low noise, enabling them to detect very low light levels. The UV/VIS optical sensor in the PowerMax-USB line is designed to measure power of CW sources, as well as the average power of pulsed sources as long as the repetition rate is above 100 pps. Photodiodes also have a fast response time, making this senor convenient for tuning and peaking lasers.

These types of sensors have several orders of magnitude higher sensitivity than thermopile sensors and are quite stable. They do, however, suffer from photocurrent saturation. The UV/VIS sensor incorporated into the PowerMax-USB product line includes an attenuating filter that allows the sensor to be used into the hundreds of milliwatt level without saturation. This ND filter, and the light shield threaded onto the front of the sensor, also help to block stray light resulting in a lower noise floor.

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:

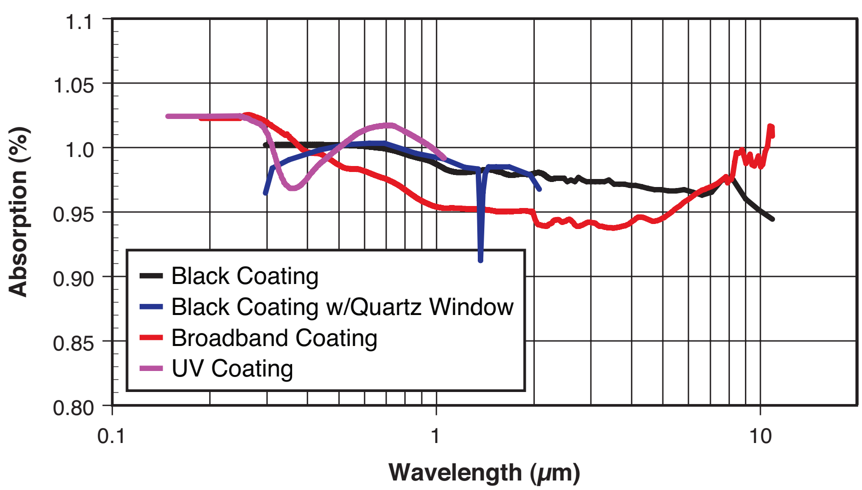
PowerMax-USB LM-10 used at 1064 nm

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.

Absorption of Thermal Sensor Coating



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

PowerMax-USB/RS Sensors

100 µW to 2W

Models PS10, PS19Q, PM3

Features

- **Thermally stabilized design for low power sensitivity**
- **Noise equivalent power down to 3 µW**
- **Large 10 mm and 19 mm apertures**

The PS10 and PS19 model sensors are thermally stabilized, amplified thermopile power sensors with a broad spectral response, high sensitivity, and a large active area. These sensors are ideal for measuring laser diodes, HeNe and HeCd lasers, and small ion lasers. The PS10 model includes a light tube mounted to the front of the housing, which minimizes the effects of background radiation. The light tube can be removed and replaced by FC or SMA fiber connectors (see Accessories - page 14). Where optimum stability is required, specify the PS19Q, which include a wedged quartz window for applications from 0.3 to 2.1 µm. The quartz window more effectively eliminates thermal background radiation and the effects of air currents.

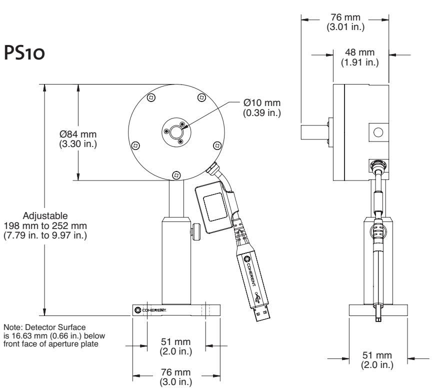
Device Specifications

Model	PS10	PS19Q	PS19	PM3
Wavelength Range (nm)	300 to 11,000	300 to 2100	300 to 11,000	300 to 11,000
Power Range	100 µW to 1W	100 µW to 1W	100 µW to 1W	500 µW to 2W
Max. Intermittent Power (W)(<5 min.)	3			
Long-pulse Joules (J)	0.001 to 1			
Noise Equivalent Power (µW)	3	3	5	20
Maximum Thermal Drift[1] (µW)	±40	±25	±400	±1000
Maximum Power Density (W/cm^2)	500			
Maximum Energy Density (mJ/cm^2)	50 (10 ns, 1064 nm)			
Response Time (sec.)(0% to 95%)				
Speed-up On	1.7	1.6	1.6	1.9
Speed-up Off	3.6	3.0	3.0	4.1
Detector Coating	Black			
Detector Element	Thermopile			
Optic	None	Quartz	None	None
Detector Diameter (mm)	10	19	19	19
Calibration Uncertainty (%)	±2			
Power Linearity (%)	±1			
Spectral Compensation Accuracy (%)	±1.5			
Long-pulse Joules Accuracy (%)	±3			
Calibration Wavelength (nm)	514	514	514	10,600
Cooling Method	Air			
Cable Type	USB			
Cable Length (m)	2.5			
Part Number[2]	1174260	1168343	1174261	1174263

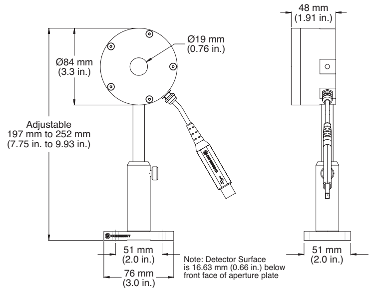
[1] Power stability over 30 minutes in typical lab environment.

[2] Software and post stand included.

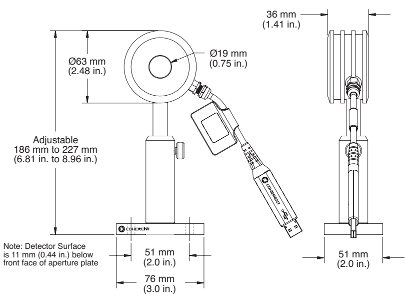
PS10



PS19Q/PS19



PM3



PowerMax-USB/RS Sensors

5 µW to >100 mW

Model UV/VIS

Features

- Large 10 mm aperture
- High-sensitivity Silicon photodiode
- Low power measurements down to 5 µW (wavelength dependent)
- Spectral response from 325 nm to 1065 nm

The PowerMax-USB UV/VIS Quantum sensor incorporates a Silicon photodiode, for measurement of power from 5 µW to several hundred milliwatts. The measureable power varies significantly by wavelength. See the chart on the next page.

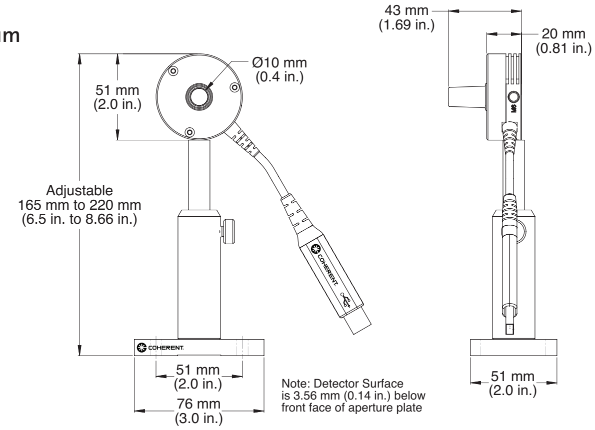
A spectrally calibrated ND2 filter is used to attenuate the laser beam, thus allowing for a higher average power measurement than is typically possible with a photodiode. The sensor works with CW (continuous wave) as well as pulsed sources greater than 100 pps, and has a removable nose cone that can be used to reduce stray light which is helpful when measuring on the low end of the power range.

Device Specifications

Model	UV/VIS
Wavelength Range (nm)	325 to 1065
Power Range	5 µW to >100 mW (wavelength dependent, see chart on page 7)
Noise Equivalent Power (nW)	100
Maximum Power Density (W/cm²)	20
Response Time (sec.)	
Speed-up On	-
Speed-up Off (0% to 100%)	0.1
Detector Element	Silicon photodiode
Optic	ND2
Detector Diameter (mm)	10
Calibration Uncertainty (%)	±2
Power Linearity (%)	±1
Spectral Compensation Accuracy (%)	±4 (325 to 900 nm) ±5 (900 to 1065 nm)
Calibration Wavelength (nm)	514
Cooling Method	Air
Cable Type	USB
Cable Length (m)	2.5
Part Number[1]	1168337

[1] Software and post stand included.

UV/VIS Quantum



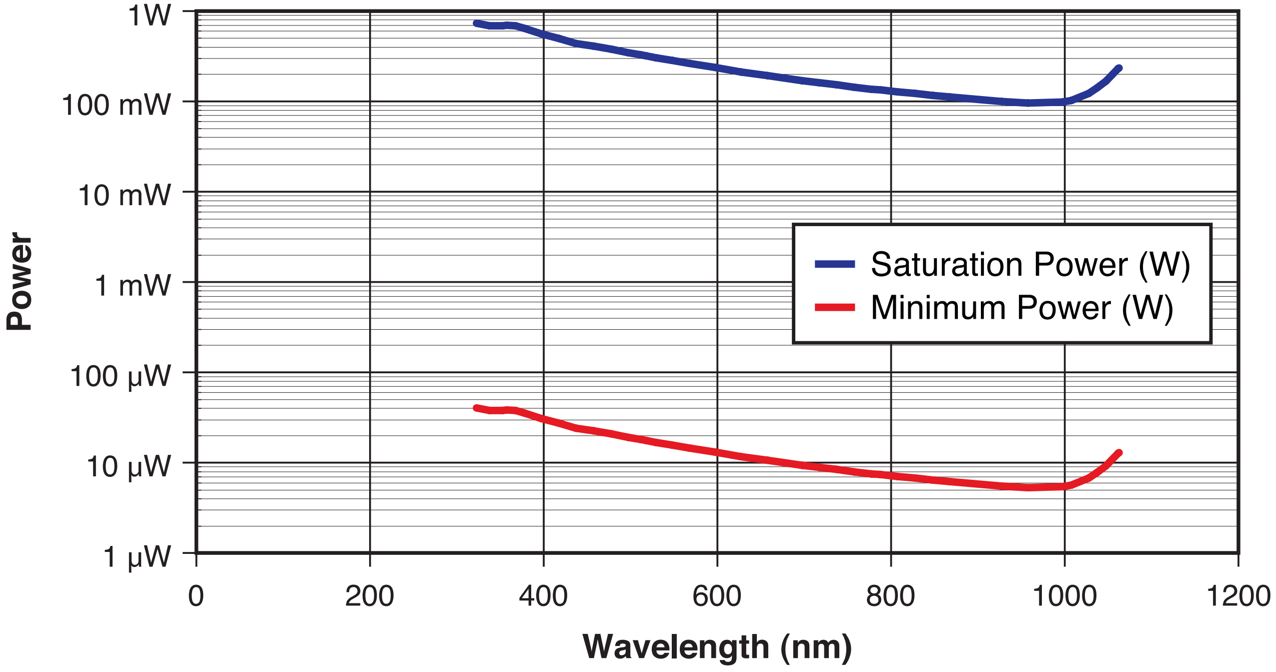
PowerMax-USB/RS Sensors

UV/VIS Quantum Overview

We incorporate spectral compensation in the PowerMax-USB UV/VIS sensor to provide accurate measurements across the 325 to 1065 nm spectrum. Because the spectral response of the ND filter and photodiode varies significantly across this wavelength range it is important to check the maximum measureable power at the wavelength of use to make sure the sensor is not being saturated.

The following curve plots the maximum measurable power, which is the saturation level of the photodiode, as well as the minimum recommended power level, by wavelength.

Saturation and Minimum Power
UV/VIS Sensors Over Wavelength



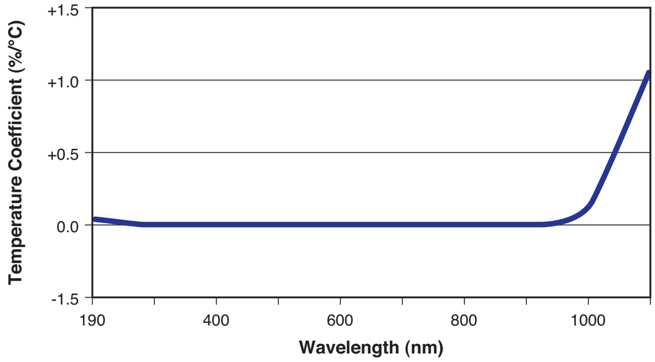
Measurement Linearity
Like all silicon photodiodes, the UV/VIS Quantum sensor has temperature sensitivity in the infrared region.

At 1064 nm, for example, it has a 0.5%/°C thermal coefficient. Measurement error of up to 2% are present at 1064 nm after a 10 minute warm-up time due to the electronics inside the sensor, and additional error can be present if the ambient measurement environment differs from the calibration wavelength listed on the calibration certificate.

In practice, wavelengths shorter than 1000 nm have insignificant effects due to temperature.

See the chart below to reference the thermal coefficient at the wavelength of use.

Photo Sensitivity Temperature Characteristic



PowerMax-USB/RS Sensors

10 mW to 25W

Models LM-45, LM-10, LM-3

Features

- **Thermopile detector element for high power measurements**
- **Measures beam position on detector surface**
- **Noise equivalent power down to 0.4 mW**
- **Large 16 and 19 mm apertures**

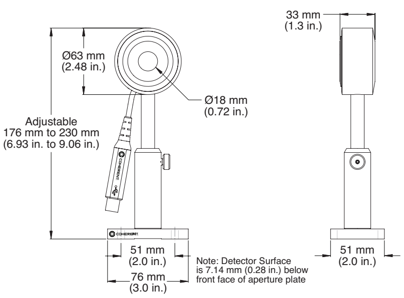
Thermopile sensors are a great all-purpose technology suitable for many lasers. They are used for measuring CW laser power, average power in pulsed lasers, and are often used to integrate the energy of long pulses. Thermopiles operate across a wide range of input powers, and unlike a photodiode-based sensor they will not saturate. These unique thermopiles incorporate a quadrant thermopile detector disk that enables them to sense the position of the laser beam on the detector surface while measuring the laser power. Fiber optic adapters are available on page 14.

Device Specifications

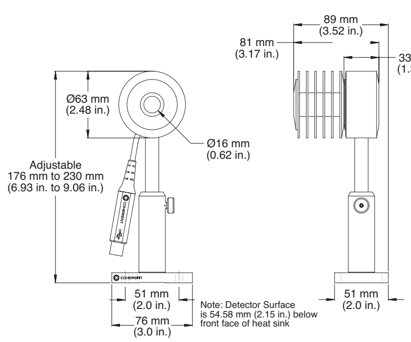
Model	LM-3	LM-10	LM-45
Wavelength Range (µm)		0.25 to 10.6	
Power Range	10 mW to 3W	10 mW to 10W	100 mW to 25W
Max. Intermittent Power (W)(<5 min.)	10	12	45
Long-Pulse Joules (J)	0.5 to 10	0.5 to 10	0.5 to 50
Noise Equivalent Power (mW)	0.4	0.4	2
Maximum Power Density (kW/cm²)		6	
Maximum Energy Density (mJ/cm²)		600 (10 ns, 1064 nm)	
Response Time (sec.)(0% to 95%)			
Speed-up On	1.6	1.6	2.6
Speed-up Off	3.5	3.5	3.9
Detector Coating		Broadband	
Detector Element		Thermopile	
Optic		None	
Detector Diameter (mm)	19	16	19
Calibration Uncertainty (%)		±2	
Power Linearity (%)		±1	
Spectral Compensation Accuracy (%)		±1.5	
Long-Pulse Joules Accuracy (%)		±3	
Calibration Wavelength (nm)		10,600	
Cooling Method		Air	
Cable Type		USB	
Cable Length (m)		2.5	
Part Number[1]	1168339	1168340	1168342

[1] Software and post stand included.

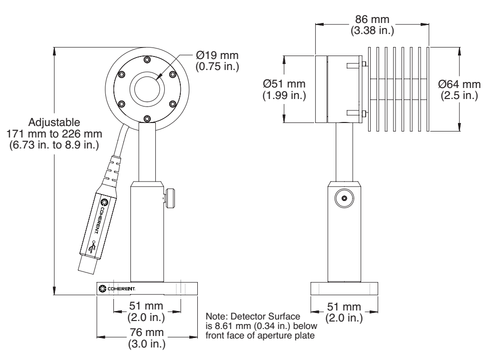
LM-3



LM-10

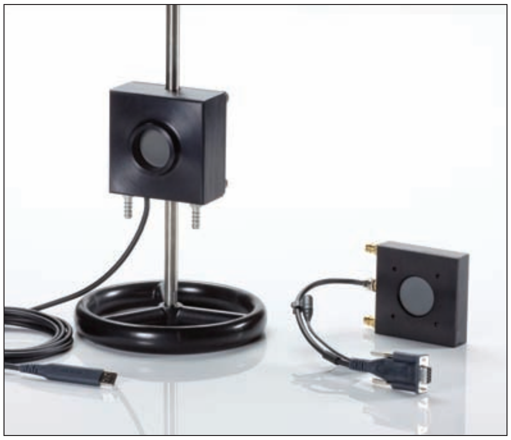


LM-45



PowerMax-USB/RS Sensors

1W to 1 kW



Models LM-1000, PM1K-36C

Features

- **Water-cooled**
- **Spectrally flat from 0.25 µm to 10.6 µm**
- **LM-1000 measures beam position**
- **36 mm to 38 mm apertures**

Quad Positioning Enabled (LM-1000 only)

These kilowatt thermopile sensors are water-cooled for measuring laser output up to 1 kW and are excellent for use with CO_2 and Nd:YAG lasers.

Tap or distilled cooling water is recommended with these sensors – DI water can not be used. Flow rates are power dependent and range from 0.5 to 4 gallons per minute; pressure depends upon flow rate and ranges from 3 to 40 PSI (visit product pages at www.Coherent.com/LMC for more technical details). See page 14 for RS model power supply accessory.

Device Specifications

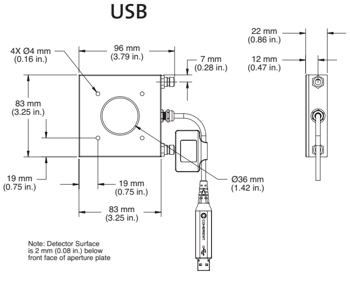
<table>
<tr><th>Model</th><th>PM1K-36C</th><th>LM-1000</th></tr>
<tr><td>Wavelength Range (µm)</td><td>0.25 to 10.6</td><td>0.25 to 10.6</td></tr>
<tr><td>Power Range (W)</td><td>1 to 1000</td><td>1 to 1000</td></tr>
<tr><td>Noise Equivalent Power (mW)</td><td colspan="2">20</td></tr>
<tr><td>Maximum Power Density[1] (kW/cm²)</td><td colspan="2">1 to 2.5</td></tr>
<tr><td>Maximum Energy Density (mJ/cm²)</td><td colspan="2">500</td></tr>
<tr><td>Response Time (sec.)(0% to 95%)</td><td></td><td></td></tr>
<tr><td>Speed-up On</td><td>2.3</td><td>3.5</td></tr>
<tr><td>Speed-up Off</td><td>6.0</td><td>6.1</td></tr>
<tr><td>Detector Coating</td><td colspan="2">Broadband</td></tr>
<tr><td>Detector Element</td><td colspan="2">Thermopile</td></tr>
<tr><td>Detector Diameter (mm)</td><td>36</td><td>38</td></tr>
<tr><td>Calibration Uncertainty (%)</td><td colspan="2">±5</td></tr>
<tr><td>Power Linearity (%)</td><td colspan="2">±1</td></tr>
<tr><td>Spectral Compensation Accuracy (%)</td><td colspan="2">±1.5</td></tr>
<tr><td>Calibration Wavelength (nm)</td><td colspan="2">10,600</td></tr>
<tr><td>Cooling Method</td><td colspan="2">Water</td></tr>
<tr><td>Cable Type</td><td colspan="2">USB and RS</td></tr>
<tr><td>Cable Length (m)</td><td colspan="2">2.5 (USB), 0.3 (RS)</td></tr>
<tr><td>Part Number[2]</td><td>1174266 (USB)
1174267 (RS)</td><td>1174268 (USB)</td></tr>
</table>

1 The damage resistance of the coating is dependent upon the beam size and profile, the average power level, and the water flow rate. Contact Coherent or your local representative for details related to your application.

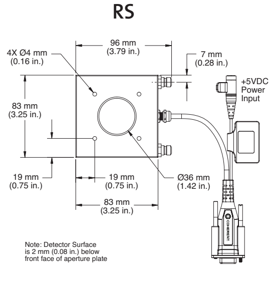
2 Software included for both models and post stand is included in LM-1000..

PM1K-36C

USB

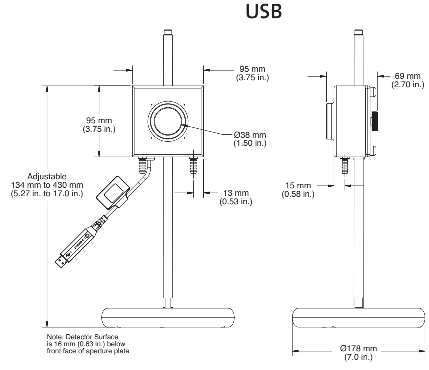


RS



LM-1000

USB



PowerMax-USB/RS Sensors

5 mW to 30W

Models PM2, PM10, PM30

Features

- Convective air-cooled
- Spectrally flat from 0.19 μm to 11 μm
- Noise equivalent power down to 0.2 mW
- 19 mm aperture

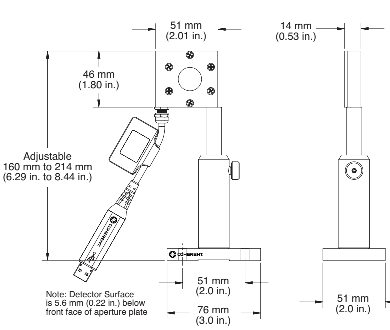
These thermopile sensors are used to measure CW and pulsed lasers from 5 mW up to 30W average power output. These sensors are able to dissipate heat via convection cooling, which makes them convenient to use.

Device Specifications

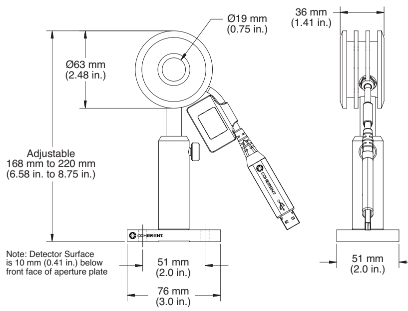
Model	PM2	PM10	PM30
Wavelength Range (μm)		0.19 to 11	
Power Range	5 mW to 2W	5 mW to 10W	10 mW to 30W
Long-Pulse Joules Range (J)	0.5 to 2	0.5 to 10	0.5 to 50
Max. Intermittent Power (<5 min.)(W)	5	30	50
Noise Equivalent Power (mW)	0.2	0.2	0.5
Maximum Power Density (kW/cm²)		6	
Maximum Energy Density (mJ/cm²)		600 (10 ns, 1064 nm)	
Response Time (sec.)(0% to 95%)			
Speed-up On	1.9	1.8	2.3
Speed-up Off	3.4	3.4	3.6
Detector Coating		Broadband	
Detector Element		Thermopile	
Optic		None	
Detector Diameter (mm)		19	
Calibration Uncertainty (%)		±2	
Power Linearity (%)		±1	
Spectral Compensation Accuracy (%)		±1.5	
Long-Pulse Joules Accuracy (%)		±3	
Calibration Wavelength (nm)		10,600	
Cooling Method		Air	
Cable Type		USB	
Cable Length (m)		2.5	
Part Number[1]	1174264	1174262	1174257

[1] Software and post stand included.

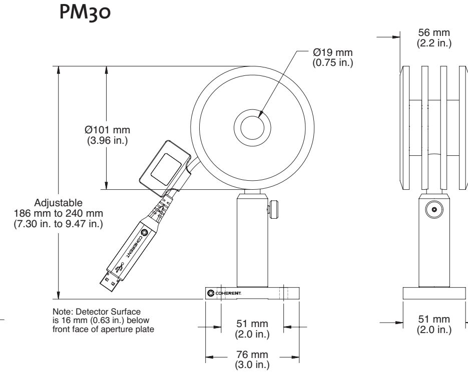
PM2



PM10



PM30



PowerMax-USB/RS Sensors

1W to 300W

Model PM300F-50

Features

- Fan-cooled
- Spectrally flat from 0.19 µm to 11 µm
- 20 mW noise equivalent power
- 50 mm aperture

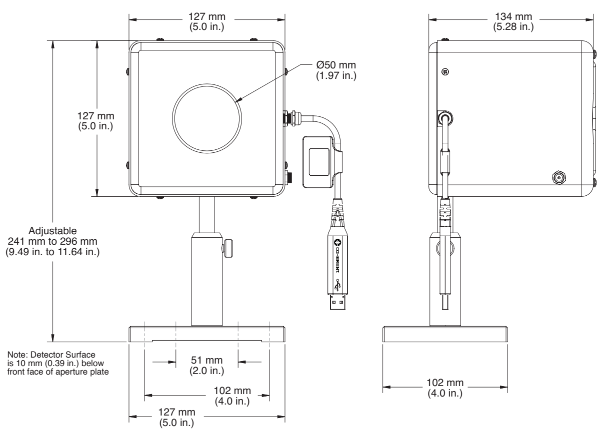
Fan-cooled sensors are an excellent choice for measuring high-power lasers when water-cooling is not possible. A compact power supply provides the 12 VDC required to power the fan.

Device Specifications

Model	PM300F-50
Wavelength Range (µm)	0.19 to 11
Power Range (W)	1 to 300
Long-Pulse Joules Range (J)	1 to 300
Max. Intermittent Power (<5 min.)(W)	450
Noise Equivalent Power (mW)	20
Maximum Power Density (kW/cm^2)	6
Maximum Energy Density (mJ/cm^2)	600 (1064 nm, 10 ns)
Response Time (sec.)(0% to 95%)	
Speed-up On	2.9
Speed-up Off	11.9
Detector Coating	Broadband
Detector Element	Thermopile
Optic	None
Detector Diameter (mm)	50
Calibration Uncertainty (%)	±2
Power Linearity (%)	±1
Spectral Compensation Accuracy (%)	±1.5
Long-Pulse Joules Accuracy (%)	±3
Calibration Wavelength (nm)	10,600
Cooling Method	Fan
Cable Type	USB
Cable Length (m)	2.5
Part Number[1]	1174265

[1] Software and post stand included.

PM300F-50



PowerMax-USB/RS Sensors

10 mW to 150W

Models PM10-19C, PM150-19C, PM150-50C

Features

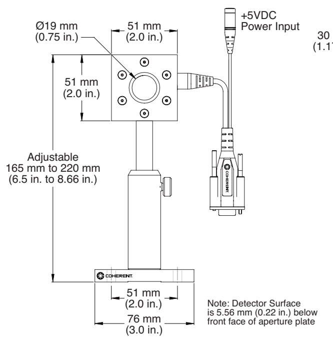
- Water-cooled
- Spectrally flat from 0.19 µm to 11 µm
- Noise equivalent 0.2 mW to 1 mW
- 19 mm and 50 mm apertures

These compact sensors are ideal in tight spaces, but must be water-cooled in order to achieve their full power specification during continuous operation. They can also be mounted to a heat sink or used standalone for intermittent use without water-cooling. Tap or distilled cooling water is recommended at a flow rate of 0.2 gallons per minute with these sensors – DI water can not be used. These sensors are also very useful for air-cooled energy measurement of long-pulse (>1 ms) lasers using the long-pulsed Joules mode. See page 14 for RS model power supply accessory.

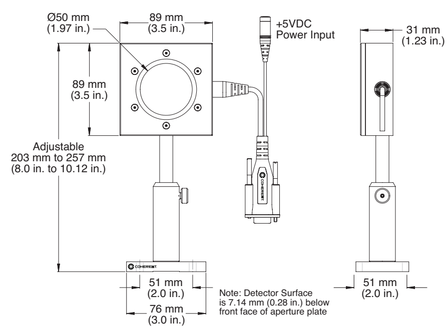
Device Specifications

Model	PM10-19C	PM150-19C	PM150-50C
Wavelength Range (µm)		0.19 to 11	
Power Range (water-cooled)	10 mW to 10W	300 mW to 150W	300 mW to 150W
Max. Intermittent Power (W)(<5 min.)	5 (air-cooled)	20 (air-cooled)	80 (air-cooled)
Long-Pulse Joules (J)	0.5 to 10	1 to 150	1 to 150
Noise Equivalent Power (mW)	0.2	1	1
Maximum Power Density (kW/cm^2)		6	
Maximum Energy Density (mJ/cm^2)		600 (10 ns, 1064 nm)	
Response Time (sec.)(0% to 95%)			
Speed-up On	1.7	2.1	2.9
Speed-up Off	3.4	3.2	11.9
Detector Coating		Broadband	
Detector Element		Thermopile	
Optic		None	
Detector Diameter (mm)	19	19	50
Calibration Uncertainty (%)		±2	
Power Linearity (%)		±1	
Spectral Compensation Accuracy (%)		±1.5	
Long-Pulse Joules Accuracy (%)		±3	
Calibration Wavelength (nm)		10,600	
Cooling Method		Water/Air (intermittent)	
Cable Type		USB and RS	
Cable Length (m)		2.5 (USB)/0.3 (RS)	
Part Number	1168344 (USB) 1168345 (RS)	1168346 (USB) 1168347 (RS)	1168348 (USB) 1168349 (RS)

PM10-19C/PM150-19C (shown with PowerMax-RS cable)



PM150-50C (shown with PowerMax-RS cable)



PowerMax-USB/RS Sensors

OEM Thermopiles Overview

Models PM150-50C, PM150-19C

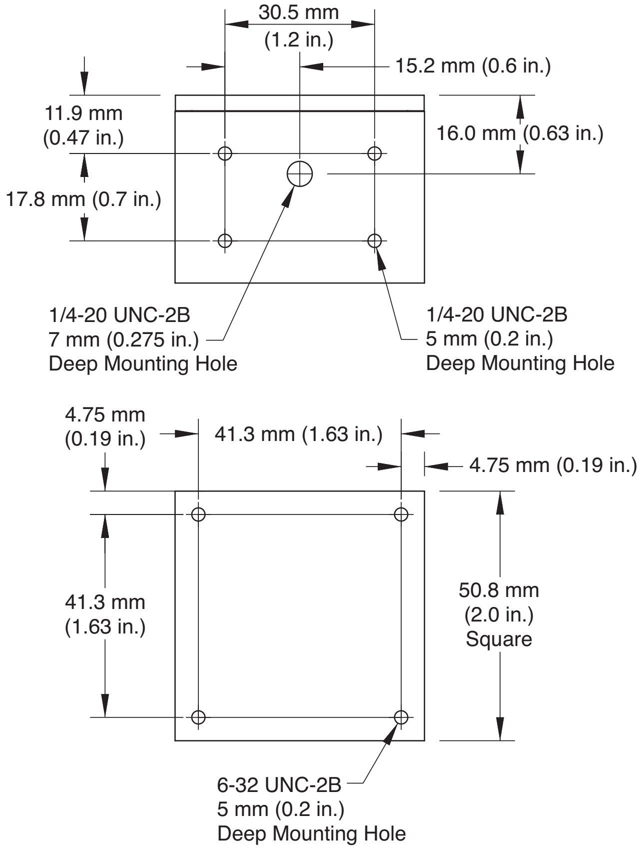
Unlike the PowerMax-USB that is powered through a PC's USB 2.0 connection, the PowerMax-RS sensors must powered externally with a +5 VDC power source. An external power supply may be plugged into the 6 mm barrel receptacle, or alternatively, for custom OEM installations power may be provided on the unused Pin 1 through the DE-9 connector. Additional information concerning integration of the OEM thermopiles, including detailed housing drawings, can be found below.

PowerMax-RS Information

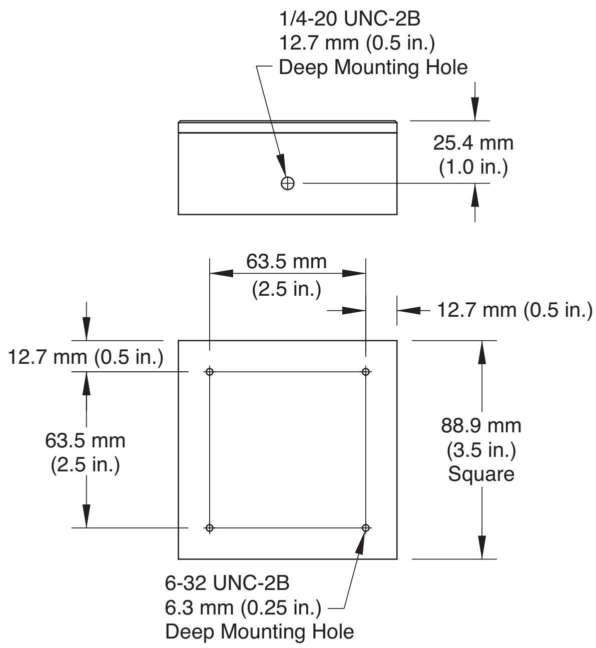
PC Interface: RS-232
Connector: DE-9
Cable length: 300 mm. Use standard RS-232 cable to connect device to PC.
Communication: Pin 2 – Receive Data; Pin 3 – Transmit Data;
Pin 5 – Signal Ground
Required Power: +5 VDC ±5% with less than 100 mV RMS noise
Current draw: <300 mA
Power input connector: 6 mm barrel connector
Power supply: Optional equipment, order #1105557 for UL and PSE certified power supply with power cord.
Alternate OEM power input: +5 VDC on Pin 1; Pin 5 – Ground (shared with Signal Ground)

Mounting Hole Locations

PM10-19C/PM150-19C



PM150-50C



PowerMax-USB/RS Sensor Accessories

Fiber-Optic Connector Adapters

The following fiber-optic adapters can be mounted directly onto the 3/4-32 threads on the front of LM-3 and LM-10 sensors. These fiber adapters can also be used with our 1.035-40M adapter ring to fit on the LM-45 sensor.

Part Number	Description	Sensors
1098589	SMA-Type Connector	LM-3, LM-10
1098339	FC/PC-Type Connector	LM-3, LM-10
33-9432-000	1.035-40M Adapter Ring	LM-45

The following fiber adapters can be mounted onto the front of the PS10 sensor in place of the removable light tube.

Part Number	Description	Sensors
0012-3860	PS-SMA-Type Connector	PS10
0012-3863	PS-FC-Type Connector	PS10

PowerMax-RS Sensor Accessory

PowerMax-RS Sensor Power Supply

Part Number	Description	PowerMax-RS Sensor Models
1105557	5V External Power Supply	PM1K-36C, PM10-19C, PM150-19C, PM150-50C

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Coherent, Inc., Corporate Headquarters
5100 Patrick Henry Drive
Santa Clara, CA 95054

United States
Coherent, Inc., Portland
27650 SW 95th Avenue
Wilsonville, OR 97070
United States
Toll Free: 1-800-343-4912
Tel: (408) 764-4042
Fax: (503) 454-5727
www.Coherent.com

China
Coherent, Inc., Beijing
Room 215 Yin Gu Building
No. 9 Beisihuan Xi Road
Haidian District
Beijing, 100080, China
Tel: +86-10-6280-0209
Fax: +86-10-6280-0129
www.Coherent.com.cn

France
Coherent France
Domaine Technologique de Saclay
Bâtiment Azur
4, Rue René Razel
91892 Orsay Cedex
France
Tel: +33-1-69-85-51-45
Fax: +33-1-60-19-40-00
www.Coherent.fr

Germany
Coherent GmbH
Dieselstraße 5b
D-64807 Dieburg
Germany
Tel: +49-6071-968-333
Fax: +49-6071-968-499
www.Coherent.de

Italy
Coherent Italia
Via Borgese, 14
Milano, 20154
Italy
Tel: +39-02-34-530-214
Fax: +39-02-34-934-165
www.Coherent.it

Japan
Coherent Japan, Inc.
Toyo MK Building
7-2-14 Toyo
Koto-ku, Tokyo 135-0016
Japan
Tel: +81 3-5635-8680
Fax: +81 3-5635-8701
www.Coherent.co.jp

Korea
Coherent Korea
No. 101, Eagle Town
278-20, 3 dong
Seongsu 2 ga
Seongdong-gu, Seoul
133-832, South Korea
Tel: +82 2 460 7900
www.Coherent.com

Netherlands
Coherent B.V.
Smart Business Park
Kanaalweg 18A
3526 KL Utrecht
Netherlands
Tel: +31-30-280-6060
Fax: +31-30-280-6077
www.Coherent.nl

United Kingdom
Coherent UK Ltd.
St Thomas' Place
Cambridgeshire Business Park
Ely
CB7 4EX
United Kingdom
Tel: +44-1353-658-833
Fax: +44-1353-659-110
www.Coherent.com

Printed in the U.S.A. MC-007-10-0M0510Rev.A