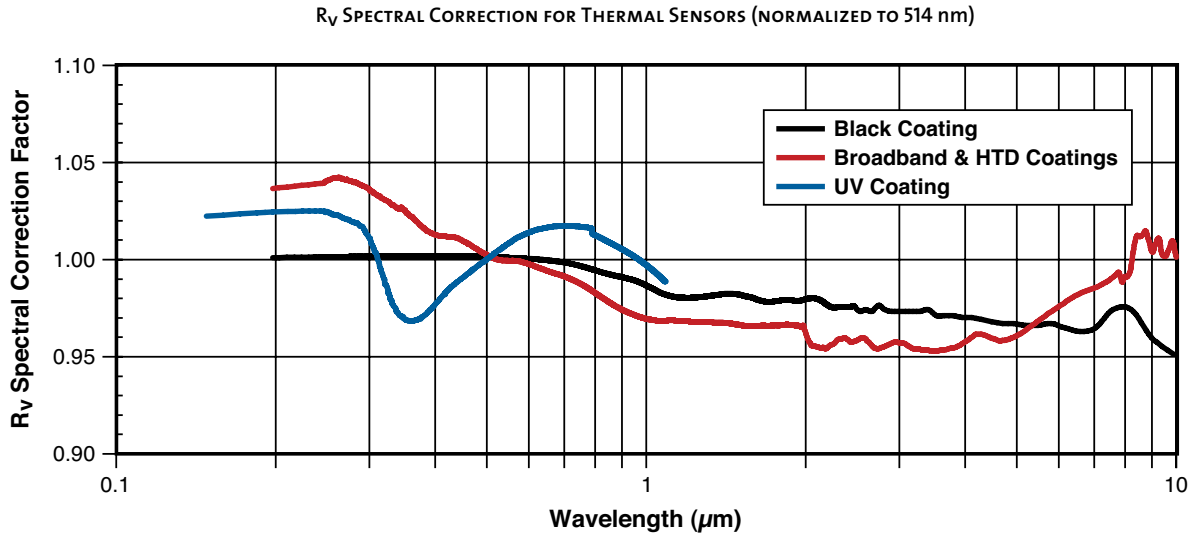


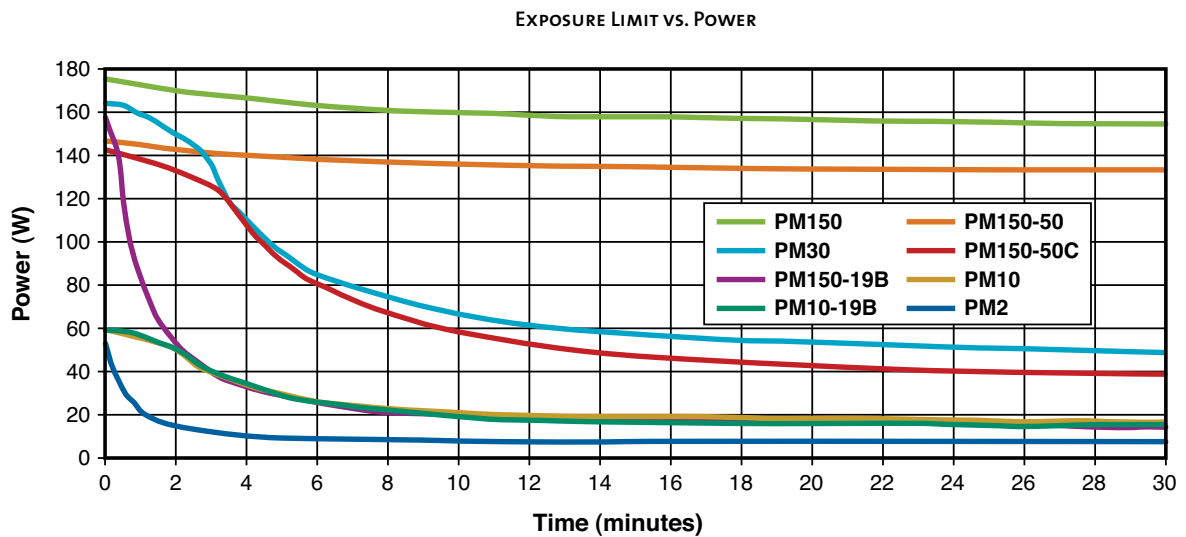
Power Sensors Introduction

Introduction and Selection Charts

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 meters.



Many of our thermal sensors can measure power at levels greater than the maximum power rating for limited amounts of time. The following chart outlines how much power can be measured over a range of exposure times (Note: Water-cooled sensors are power-rated in air-cooled mode in this chart).



Power Sensors Introduction

Long-Pulse Energy Measurement with a Thermopile



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

Application Example 1

Laser Pulse Width	50 ms
Maximum Energy	10J
Solution	Choose a PM10

Application Example 2

Laser Pulse Width	300 ms
Maximum Energy	80J
Solution	Choose a PM150 or PM150-50C*

* Specific sensor choice depends upon aperture and mechanical constraints.

Thermopile sensors are most commonly used for average power measurements on pulsed and CW lasers. Thermopiles are also capable of integrating long pulse widths. 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. Long-pulse measurement is only possible when the thermopiles are used in conjunction with LabMax-TOP, LabMax-TO, or FieldMaxII-TOP meters, or when using a PowerMax-USB/RS sensor.

This ability to integrate relatively long laser pulses with a thermopile is necessary when the laser pulse width exceeds the maximum pulse width rating of pyroelectric sensors. Pyroelectric sensors are typically limited to maximum pulse widths in the millisecond range. When the pulse width exceeds milliseconds, a thermopile is a good solution.

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 with the maximum power rating of a sensor (maximum power ratings can be found in the Power Sensor Summary Specifications on pages 32 to 33 or in the detailed product specifications contained on pages 34 to 44).

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 diode lasers that have large beam sizes and relatively long pulses. A detector 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).

Using a LabMax power/energy meter, or a PowerMax-USB/RS sensor, expands the range of long-pulse Joule measurements down into the low millijoule level when used with thermopiles such as the PS10, PS10Q, PS19, and PS19Q sensors.

Long-pulse measurements are limited to single pulses in order to achieve the most accurate measurements.

POWER & ENERGY

Power & Energy Meters

Power Sensors

Energy Sensors

Custom & OEM

BEAM DIAGNOSTICS

CALIBRATION & SERVICE

Laser Cross-Reference Index

Model Name Index

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.



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 XP, Vista (32-bit and 64-bit), and Windows 7 (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

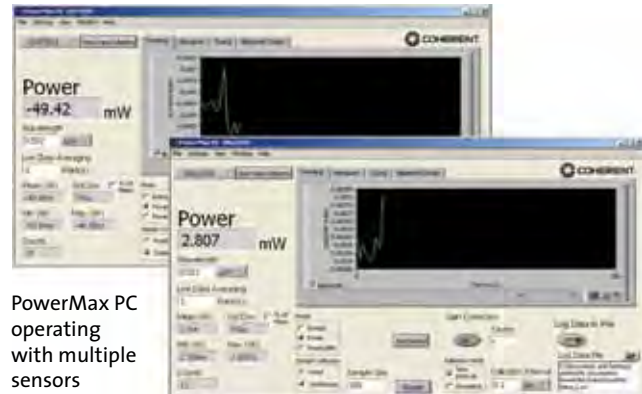
PowerMax-USB/RS Sensors

Product Overview

Software Features

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

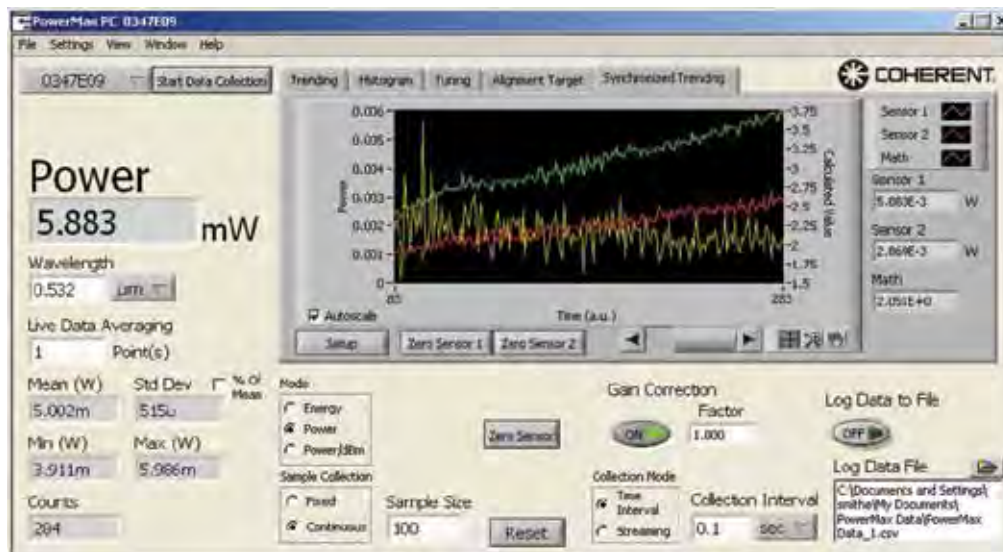
- Trending, tuning, histogram
- Statistics (mean, minimum, maximum, and standard deviation) and log batch to file
- Display beam position on position-sensing thermopiles and log results to file
- Operate multiple devices simultaneously and perform synchronized ratiometry (A/B analysis). Trend and log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

- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
- CALIBRATION & SERVICE
- Laser Cross-Reference Index
- Model Name Index

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:

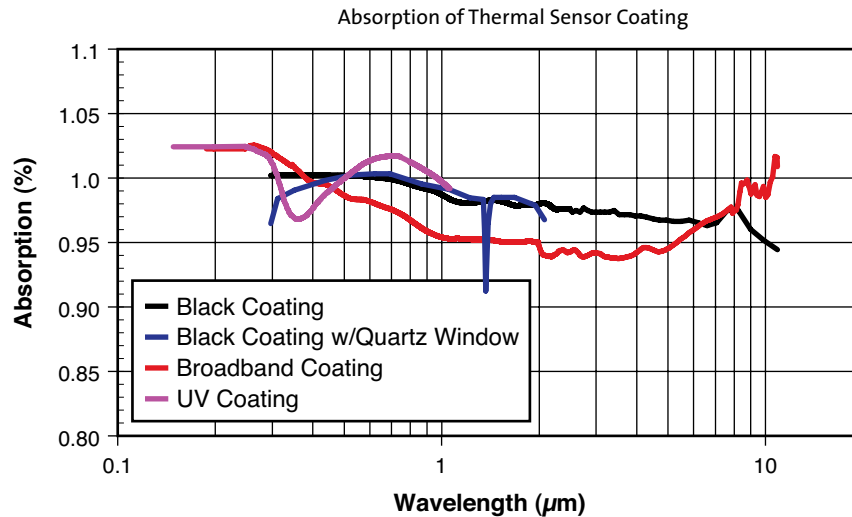
PowerMax-USB LM-10 used at 1064 nm

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

PowerMax-USB/RS Sensors

100 μ W to 2W



Models PS10, PS19Q, PM3

Features

- Thermally stabilized design for low power sensitivity
- Noise equivalent power down to 3 μ W
- Spectrally flat; good for broadband light sources

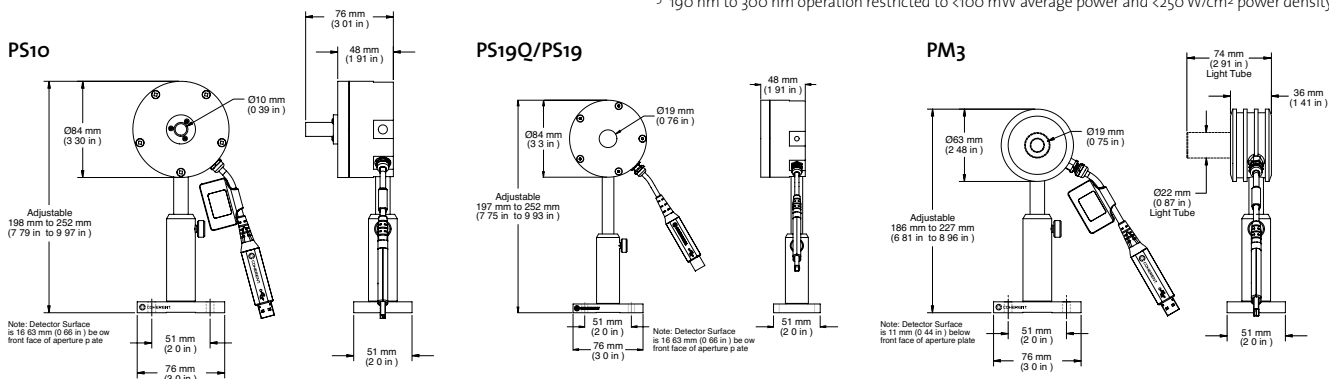
The PS10 and PS19 model sensors are thermally stabilized, amplified thermopile power sensors with a broad spectral response, high sensitivity, and a large active area. These sensors are ideal for measuring laser diodes, HeNe and HeCd lasers, and small ion lasers. The PS10 model includes a light tube 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 31). Where optimum stability is required, specify the PS19Q, which include a wedged quartz window for applications from 0.3 to 2.1 μ m. 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)		190 ³ to 11,000	300 to 2100	190 ³ to 11,000	190 ³ to 11,000
Power Range		100 μ W to 1W	100 μ W to 1W	100 μ W to 1W	500 μ W to 2W
Max. Intermittent Power (W)(\leq 5 min.)		3			
Long-pulse Joules (J)		0.001 to 1			
Noise Equivalent Power (μ W)		3	3	5	20
Maximum Thermal Drift ¹ (μ W)		\pm 40	\pm 25	\pm 400	\pm 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 (%)		\pm 2			
Power Linearity (%)		\pm 1			
Spectral Compensation Accuracy (%)		\pm 1.5			
Long-pulse Joules Accuracy (%)		\pm 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.

³ 190 nm to 300 nm operation restricted to <100 mW average power and <250 W/cm² power density.



PowerMax-USB/RS Sensors

5 μ W to >100 mW



Model UV/VIS

Features

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

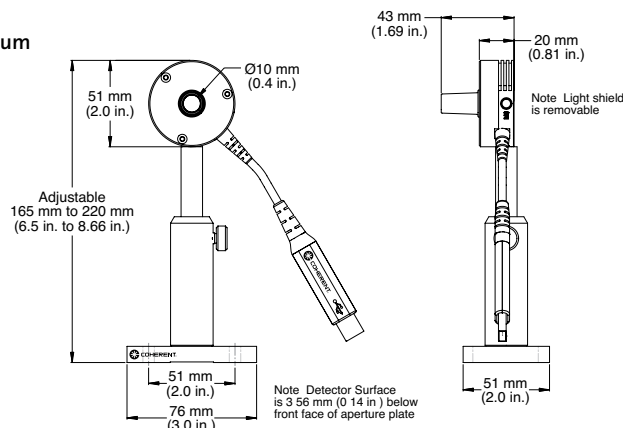
The PowerMax-USB UV/VIS Quantum sensor incorporates a Silicon photodiode, for measurement of power from 5 μ W to several hundred milliwatts. The measurable power varies significantly by wavelength. See the chart on the next page.

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 μ W to >100 mW (wavelength dependent, see chart on page 7)
Noise Equivalent Power (nW)		100
Maximum Power Density (W/cm ²)		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 (%)		\pm 2
Power Linearity (%)		\pm 1
Spectral Compensation Accuracy (%)		\pm 4 (325 to 900 nm) \pm 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

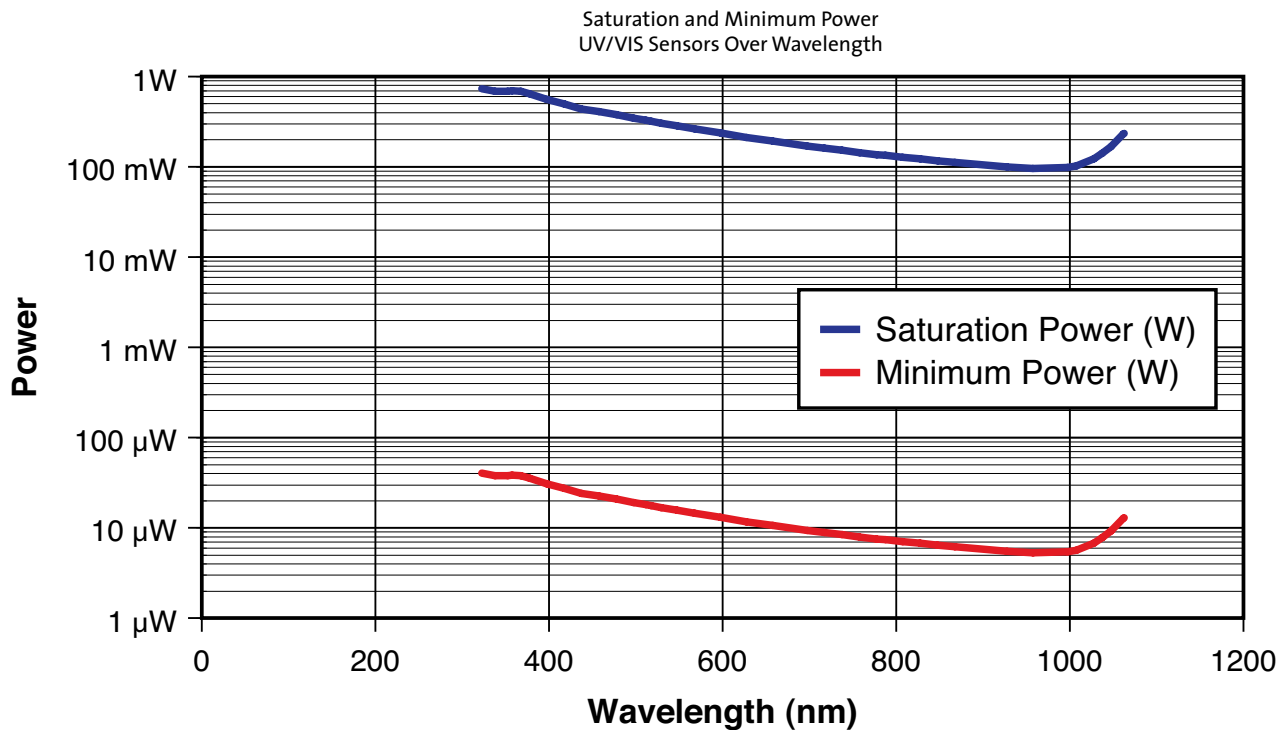


PowerMax-USB/RS Sensors

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 measurable 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.



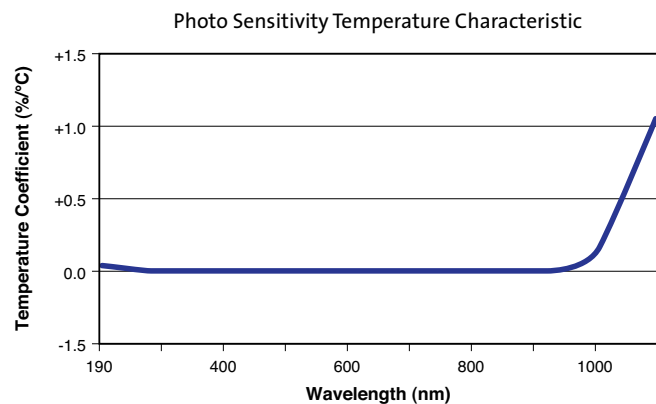
Measurement Linearity

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.



- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
- CALIBRATION & SERVICE
- Laser Cross-Reference Index
- Model Name Index

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

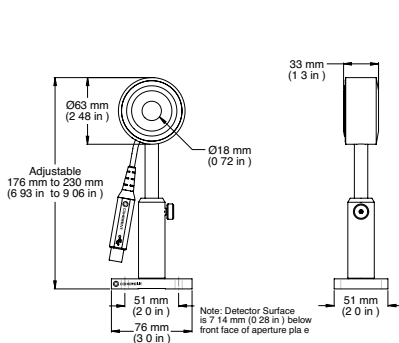


Thermopile sensors are a great all-purpose technology suitable for many lasers. They are used for measuring CW laser power, average power in pulsed lasers, and are often used to integrate the energy of long pulses. Thermopiles operate across a wide range of input powers, and unlike a photodiode-based 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 31.

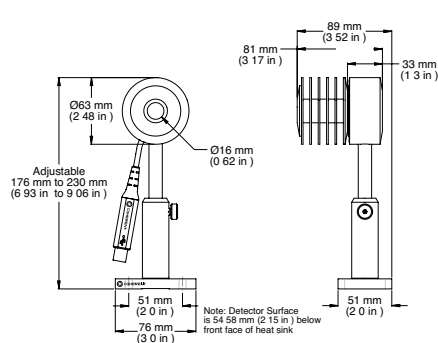
Device Specifications	Model	LM-3	LM-10	LM-45
Wavelength Range (μm)			0.25 to 10.6	
Power Range		10 mW to 3W	10 mW to 10W	100 mW to 25W
Max. Intermittent Power (W) (<5 min.)		10	12	45
Long-Pulse Joules (J)		0.5 to 10	0.5 to 10	0.5 to 50
Noise Equivalent Power (mW)		0.4	0.4	2
Maximum Power Density (kW/cm ²)			6	
Maximum Energy Density (mJ/cm ²)			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.

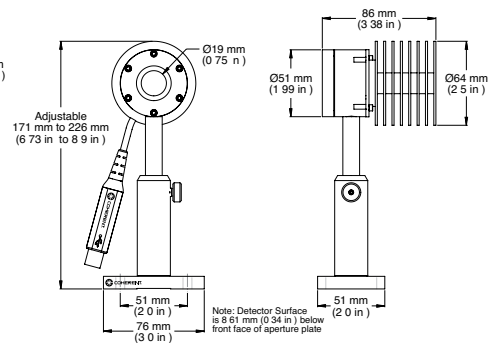
LM-3



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 CO₂ 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 31 for RS model power supply accessory.

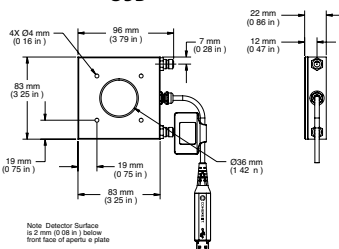
Device Specifications	Model	PM1K-36C	LM-1000
Wavelength Range (μm)		0.25 to 10.6	0.25 to 10.6
Power Range (W)		1 to 1000	1 to 1000
Noise Equivalent Power (mW)			20
Maximum Power Density ¹ (kW/cm ²)			1 to 2.5
Maximum Energy Density (mJ/cm ²)			500
Response Time (sec.)(0% to 95%)			
Speed-up On		2.3	3.5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

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.

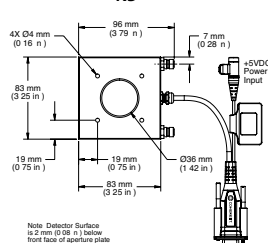
² Software and water fittings included for both models and post stand included with LM-1000.

PM1K-36C

USB

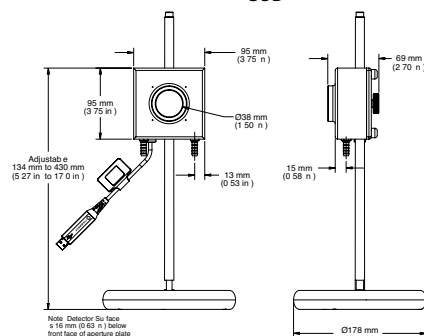


RS



LM-1000

USB



PowerMax-USB/RS Sensors

5 mW to 30W



Models PM2, PM10, PM30

Features

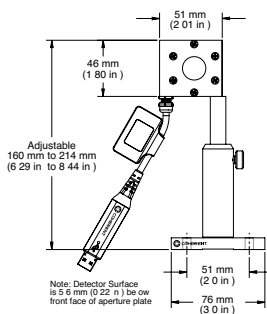
- Convective air-cooled
- Spectrally flat from 0.19 μm to 11 μm
- Noise equivalent power down to 0.2 mW
- 19 mm aperture

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.

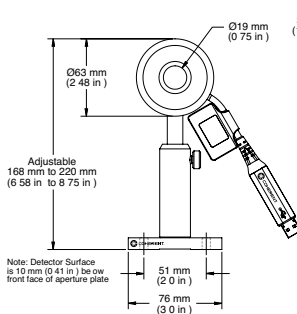
Device Specifications	Model	PM2	PM10	PM30
Wavelength Range (μm)			0.19 to 11	
Power Range		5 mW to 2W	5 mW to 10W	10 mW to 30W
Long-Pulse Joules Range (J)		0.5 to 2	0.5 to 10	0.5 to 50
Max. Intermittent Power (<5 min.)(W)		5	30	50
Noise Equivalent Power (mW)		0.2	0.2	0.5
Maximum Power Density (kW/cm^2)			6	
Maximum Energy Density (mJ/cm^2)			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.

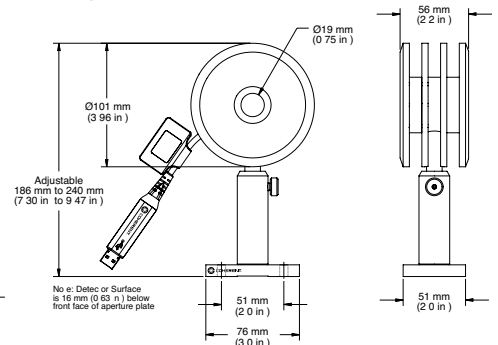
PM2



PM10



PM30



PowerMax-USB/RS Sensors

10 mW to 150W



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

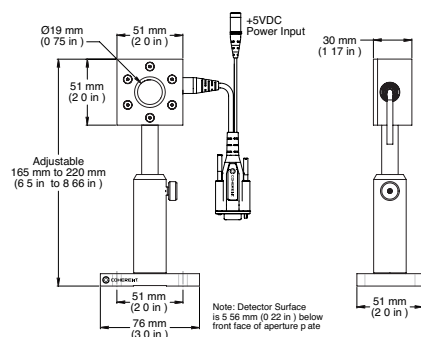
Features

- 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

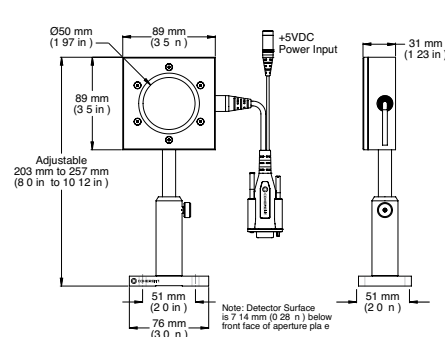
These compact sensors are ideal in tight spaces, but must be water-cooled in order to achieve their full power specification during continuous operation. They can also be mounted to a heat sink or used standalone for intermittent use without water-cooling. Tap or distilled cooling water is recommended 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 31 for RS model power supply accessory. Water fittings are included.

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

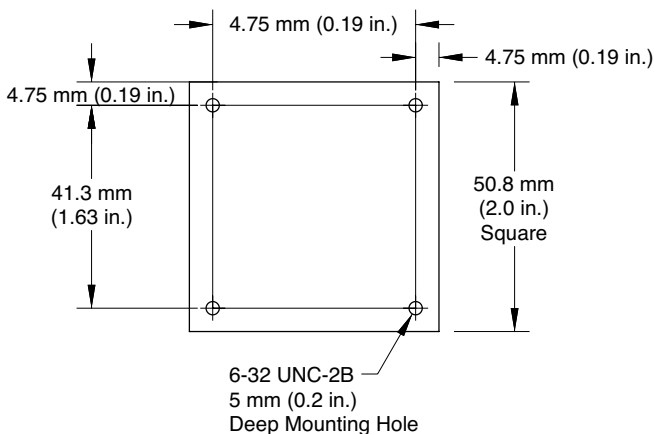
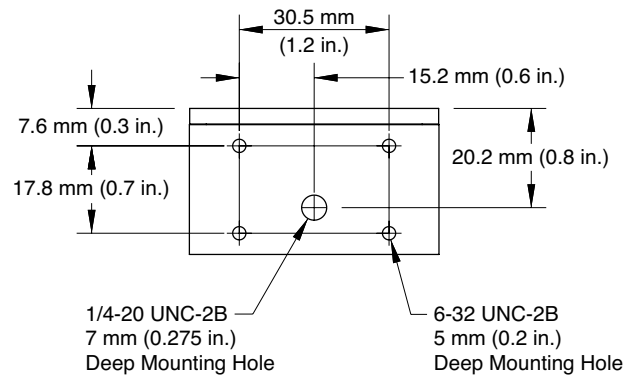
Unlike the PowerMax-USB that is powered through a PC's USB 2.0 connection, the PowerMax-RS sensors must be powered externally with a +5 VDC power source. An external power supply may be plugged into the 6 mm barrel receptacle, or alternatively, for custom OEM installations power may be provided on Pin 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

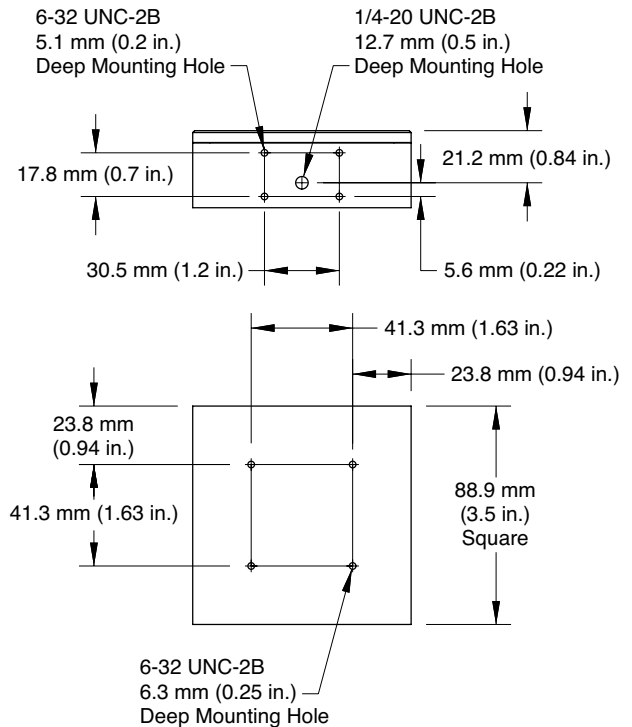
- PC Interface: RS-232
- Connector: DE-9 female
- Cable length: 300 mm. Use standard RS-232 cable to connect device to PC.
- Communication: Pin 2 – Receive Data; Pin 3 – Transmit Data; Pin 5 – Signal Ground
- Required Power: +5 VDC $\pm 5\%$ with less than 100 mV RMS noise
- Current draw: < 300 mA
- Power input connector: 6 mm barrel with 2 mm pin, center positive
- Power supply: Optional equipment, order #110557 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



SMA and FC 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



SMA and FC Adapters

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

POWER & ENERGY

Power & Energy Meters

Power Sensors

Energy Sensors

Custom & OEM

BEAM DIAGNOSTICS

CALIBRATION & SERVICE

Laser Cross-Reference Index

Model Name Index

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

Power Sensors Introduction

Summary of Specifications

Part Number	Description	Wavelength Range (μm)	Power			Long-Pulse Energy Range (J)	Detector Diameter (mm)	Detector Coating	Detector Type	Calibration Wavelength (nm)	Calibration Uncertainty (±%)	Connector
			Min.	Max.	Resolution							
High-Sensitivity Semiconductor Sensors (to 50 mW)												
1098401	OP-2 UV	0.25 to 0.4	10 nW	30 mW	1 nW	–	6.0	–	Silicon	–	8	OP DB-25
1098313	OP-2 VIS	0.4 to 1.064	10 nW	30 mW	1 nW	–	7.9	–	Silicon	–	5	OP DB-25
1098416	OP-2 IR	0.8 to 1.8	10 nW	10 mW	1 nW	–	5.0	–	Germanium	–	4.5	OP DB-25
1098390	LM-2 UV	0.25 to 0.4	10 nW	30 mW	1 nW	–	6.0	–	Silicon	–	8	LM DB-25
1098298	LM-2 VIS	0.4 to 1.064	10 nW	30 mW	1 nW	–	7.9	–	Silicon	–	5	LM DB-25
1098342	LM-2 IR	0.8 to 1.55	10 nW	10 mW	1 nW	–	5.0	–	Germanium	–	4.5	LM DB-25
High-Sensitivity Thermopile Sensors (to 2W)												
1098350	PS10	0.19 to 11.0	100 μW	1W	10 μW	0.001 to 1	10	Black	–	514	1	PM DB-25
1098400	PS10Q	0.3 to 2.0	100 μW	1W	10 μW	0.001 to 1	10	Black	–	514	1	PM DB-25
1098413	PS19	0.19 to 11.0	100 μW	1W	10 μW	0.001 to 1	19	Black	–	514	1	PM DB-25
1098341	PS19Q	0.3 to 2.0	100 μW	1W	10 μW	0.001 to 1	19	Black	–	514	1	PM DB-25
1098336	PM3	0.19 to 11.0	500 μW	2W	50 μW	–	19	Black	–	514	1	PM DB-25
1098419	PM3Q	0.3 to 2.0	500 μW	2W	50 μW	–	10	Black	–	514	1	PM DB-25
Air-Cooled Thermopile Sensors (to 150W)												
1098329	PM2	0.19 to 11.0	10 mW	2W	1 mW	0.5 to 2	19	Broadband	–	514	1	PM DB-25
1098457	PM2X	0.15 to 1.0	10 mW	2W	1 mW	0.5 to 2	19	UV	–	514	1	PM DB-25
1097901	PM10	0.19 to 11.0	10 mW	10W	1 mW	0.5 to 10	19	Broadband	–	514	1	PM DB-25
1098423	PM10X	0.15 to 1.0	10 mW	10W	1 mW	0.5 to 10	19	UV	–	514	1	PM DB-25
1098314	PM30	0.19 to 11.0	100 mW	30W	10 mW	0.5 to 50	19	Broadband	–	514	1	PM DB-25
1098498	PM30X	0.15 to 1.0	100 mW	30W	10 mW	0.5 to 50	19	UV	–	514	1	PM DB-25
1098483	PM100-19C	0.19 to 11.0	300 mW	100W	30 mW	1 to 100	19	Broadband	–	514	1	PM DB-25
1098407	PM150	0.19 to 11.0	300 mW	150W	30 mW	1 to 150	19	Broadband	–	514	1	PM DB-25
1098398	PM150-50	0.19 to 11.0	300 mW	150W	30 mW	1 to 150	50	Broadband	–	514	1	PM DB-25
1098455	PM150X	0.15 to 1.0	300 mW	150W	30 mW	1 to 150	50	UV	–	514	1	PM DB-25
Water-Cooled Thermopile Sensors (to 300W)												
1098397	PM10-19C	0.19 to 11.0	10 mW	10W	1 mW	0.5 to 10	19	Broadband	–	514	1	PM DB-25
1098444	PM150-19C	0.19 to 11.0	300 mW	150W	30 mW	1 to 150	19	Broadband	–	514	1	PM DB-25
1098412	PM150-50C	0.19 to 11.0	300 mW	150W	30 mW	1 to 150	50	Broadband	–	514	1	PM DB-25
1098443	PM150-50XC	0.15 to 1.0	300 mW	150W	30 mW	1 to 150	50	UV	–	514	1	PM DB-25
1141474	PM300	0.19 to 11.0	1W	300W	0.1W	–	19	Broadband	–	514	1	PM DB-25
Fan-Cooled Thermopile Sensors (to 300W)												
1098480	PM200F-19	0.19 to 11.0	1W	200W	100 mW	1 to 200	19	Broadband	–	514	1	PM DB-25
1098472	PM200F-50	0.19 to 11.0	1W	200W	100 mW	1 to 200	50	Broadband	–	514	1	PM DB-25
1113493	PM200F-50X	0.15 to 1.0	1W	200W	100 mW	1 to 200	50	UV	–	514	1	PM DB-25
1098509	PM300F-19	0.19 to 11.0	1W	300W	100 mW	1 to 300	19	Broadband	–	514	1	PM DB-25
1098417	PM300F-50	0.19 to 11.0	1W	300W	100 mW	1 to 300	50	Broadband	–	514	1	PM DB-25
1098481	PM300F-50X	0.15 to 1.0	1W	300W	100 mW	1 to 300	50	UV	–	514	1	PM DB-25

Power Sensors Introduction

Summary of Specifications

Part Number	Description	Wavelength Range (µm)	Power		Resolution	Long-Pulse Energy Range (J)	Detector Diameter (mm)	Detector Coating	Calibration Wavelength (nm)	Calibration Uncertainty (±%)	Connector
			Min.	Max.							
High-Power Water-Cooled Thermopile Sensors (to 5 kW)											
1098392	PM1K	0.19 to 11.0	100W	1000W	1W	–	50	Broadband	1064	5	PM DB-25
1098462	PM3K	0.19 to 11.0	100W	3000W	1W	–	50	Broadband	1064	5	PM DB-25
1098454	PM5K	0.19 to 11.0	100W	5000W	1W	–	50	Broadband	1064	5	PM DB-25
Large-Area High-Power Water-Cooled Thermopile Sensors (to 5 kW)											
1098490	PM1K-100	0.19 to 11.0	100W	1000W	1W	–	100	Broadband	1064	5	PM DB-25
1098506	PM3K-100	0.19 to 11.0	100W	3000W	1W	–	100	Broadband	1064	5	PM DB-25
1098461	PM5K-100	0.19 to 11.0	100W	5000W	1W	–	100	Broadband	1064	5	PM DB-25
1098505	PM5K-200	0.19 to 11.0	100W	5000W	1W	–	200	Broadband	1064	5	PM DB-25
Position-Sensing Air-Cooled Thermopile Sensors (to 200W)											
1098328	LM-3	0.25 to 10.6	10 mW	3W	1 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098304	LM-10	0.25 to 10.6	10 mW	10W	1 mW	0.5 to 10	16	HTD	10600	2	LM DB-25
1098456	LM-20	0.25 to 10.6	100 mW	20W	10 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098320	LM-45	0.25 to 10.6	100 mW	45W	10 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098346	LM-100	0.25 to 10.6	100 mW	100W	10 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098394	LM-150 FS	0.25 to 10.6	100 mW	150W	10 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098452	LM-150 LS	0.25 to 10.6	100 mW	150W	10 mW	0.5 to 10	19	HTD	10600	2	LM DB-25
1098450	LM-200 220V	0.25 to 10.6	100 mW	200W	10 mW	0.5 to 100	19	HTD	10600	5	LM DB-25
1098440	LM-200 110V	0.25 to 10.6	100 mW	200W	10 mW	0.5 to 100	19	HTD	10600	5	LM DB-25
Position-Sensing Water-Cooled Thermopile Sensors (to 5 kW)											
1098409	LM-1000	0.25 to 10.6	100W	1000W	1W	–	38	Broadband	10600	5	LM DB-25
1098437	LM-2500	0.25 to 10.6	100W	2500W	1W	–	55	Broadband	10600	5	LM DB-25
1098421	LM-5000	0.25 to 10.6	100W	5000W	1W	–	55	Broadband	10600	5	LM DB-25
High-Peak-Power Thermopile Sensors (to 30W)											
1098338	PM10V1	0.25 to 3.0	10 mW	10W	1 mW	–	19	Volume Absorber	514	1	PM DB-25
1098429	PM30V1	0.25 to 3.0	100 mW	30W	10 mW	–	19	Volume Absorber	514	1	PM DB-25
Off-the-Shelf OEM Power Sensors (to 1 kW)											
1098334	PM10-19A	0.19 to 11.0	100 mW	10W	10 mW	–	19	Broadband	514	1	4-pin connector
1098343	PM10-19B	0.19 to 11.0	100 mW	10W	10 mW	–	19	Broadband	514	1	BNC-terminated
1098418	PM150-19A	0.19 to 11.0	300 mW	150W	30 mW	–	19	Broadband	514	1	4-pin connector
1098321	PM150-19B	0.19 to 11.0	300 mW	150W	30 mW	–	19	Broadband	514	1	BNC-terminated
1098510	PM150-50A	0.19 to 11.0	300 mW	150W	30 mW	–	50	Broadband	514	1	4-pin connector
1098415	PM150-50B	0.19 to 11.0	300 mW	150W	30 mW	–	50	Broadband	514	1	BNC-terminated
1098441	PM150-50XB	0.15 to 1.0	300 mW	150W	30 mW	–	50	UV	514	1	BNC-terminated
1098333	PM1K-36B	0.19 to 11.0	100W	1000W	1W	–	36	Broadband	1064	5	BNC-terminated
1098427	BeamFinder	0.25 to 10.6	100W	1000W	1W	–	35	Broadband	10600	5	LM DB-25

- POWER & ENERGY
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- Power Sensors
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Beam Position Sensing Thermopile Sensors

10 mW to 45W



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

Features

- Spectrally flat from 0.19 to 11 μm
- 10 mW to 100 mW resolution
- 16 mm to 19 mm apertures
- FC and SMA fiber connectors available (see page 51)

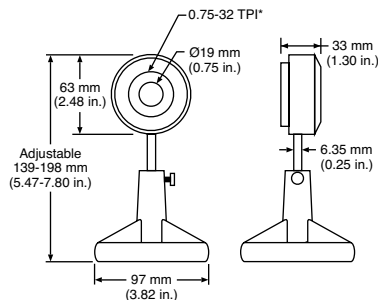


Use with LabMax (see page 10)

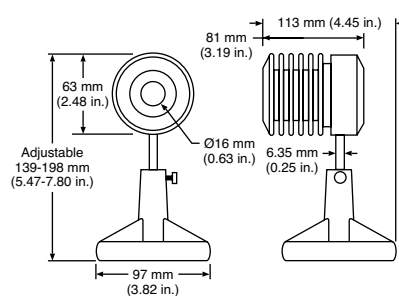
These unique thermopiles incorporate a quadrant thermopile disk that enables them to sense the position of the beam on the detector surface. This information is displayed by meters such as LabMax. All Coherent products which incorporate this position sensing technology are identified with the logo shown on the right.

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 45W
Long-Pulse Joules Range (J)			0.5 to 10	
Resolution (mW)		1		100
Max. Power Density			6 kW/cm ²	
Max. Energy Density			0.5 J/cm ² , 1064 nm, 10 ns	
Detector Coating			HTD	
Detector Diameter (mm)		19	16	19
Dimensions (mm)		$\varnothing 63 \times 33$ (2.4 x 1.2 in.)	$\varnothing 63 \times 81$ (2.4 x 3.1 in.)	$\varnothing 64 \times 86$ (2.5 x 3.3 in.)
Calibration Uncertainty (%)			± 2	
Calibration Wavelength (μm)			10.6	
Cooling Method			Air-cooled	
Cable Type			LM DB-25	
Cable Length (m)			1.8	
Part Number		1098328	1098304	1098320

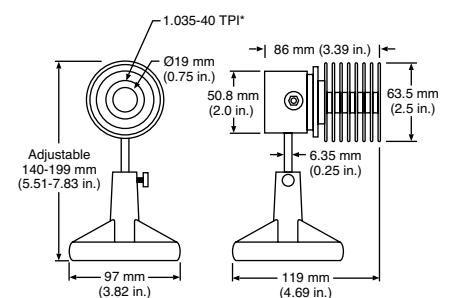
LM-3



LM-10



LM-45



* Threads per inch

Beam Position Sensing Thermopile Sensors

100 mW to 200W



Models LM-100, LM-200

Features

- Spectrally flat from 0.19 to 11 μm
- 10 mW resolution
- 19 mm apertures
- FC and SMA fiber connectors available (see page 51)

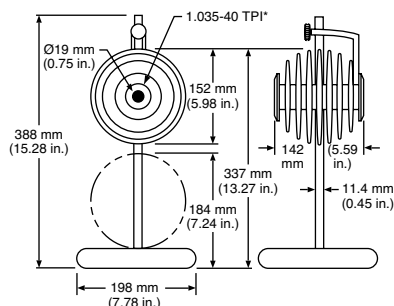


Use with LabMax (see page 10)

The LM-100 sensor is convectively-cooled for powers up to 100W. The LM-200 sensor is fan-cooled and is available in 110 VAC and 220 VAC configurations. Water fittings are included.

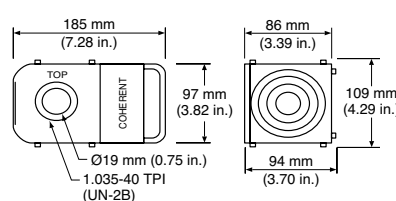
Device Specifications	Model	LM-100	LM-200
Wavelength Range (μm)		0.25 to 10.6	
Power Range (water-cooled)		100 mW to 100W	100 mW to 200W
Long-Pulse Joules Range (J)		0.5 to 10	
Resolution (mW)		10	
Max. Power Density		6 kW/cm ²	
Max. Energy Density		0.5 J/cm ² , 1064 nm, 10 ns	
Detector Coating		HTD	
Detector Diameter (mm)		19	
Dimensions (mm)		$\text{\O}152 \times 142$ (5.9 x 5.5 in.)	185 x 94 x 109 (7.3 x 3.7 x 4.3 in.)
Calibration Uncertainty (%)		± 2	± 5
Calibration Wavelength (μm)		10.6	
Cooling Method		Air-cooled	Fan-cooled
Cable Type		LM DB-25	
Cable Length (m)		1.8	
Part Number		1098346	1098440 (110VAC) 1098450 (220 VAC)

LM-100



*Threads per inch

LM-200



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Beam Position Sensing Thermopile Sensors

100 mW to 150W



Models LM-150LS, LM-150FS, LM-20

Features

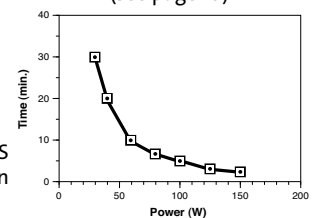
- Spectrally flat from 0.19 to 11 μm
- 10 mW to 100 mW resolution
- 19 mm apertures
- FC and SMA fiber connectors available (see page 51)



Use with LabMax (see page 10)

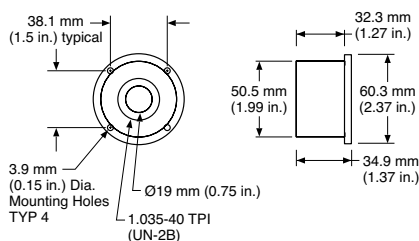
The LM-20 is designed for embedded use and must be mounted on a heat sink. The LM-150 FS and LS sensors are designed for intermittent operation. Light shield is removable.

LM-150 FS and LS Power Duration

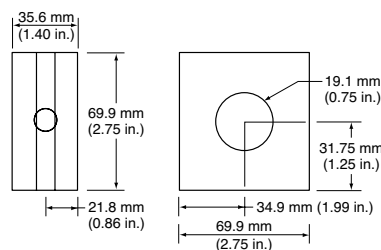


Device Specifications	Model	LM-20	LM-150 LS	LM-150 FS
Wavelength Range (μm)			0.25 to 10.6	
Power Range		100 mW to 20W	100 mW to 150W	100 mW to 150W
Long-Pulse Joules Range (J)			0.5 to 10	
Resolution (mW)			10	
Max. Power Density			6 kW/cm ²	
Max. Energy Density			0.5 J/cm ² , 1064 nm, 10 ns	
Detector Coating			HTD	
Detector Diameter (mm)			19	
Dimensions (mm)		$\varnothing 60 \times 32$ (2.4 x 1.3 in.)	70 x 70 x 36 (2.8 x 2.8 x 1.4 in.)	$\varnothing 89 \times 38$ (3.5 x 1.4 in.)
Calibration Uncertainty (%)			± 2	
Calibration Wavelength (μm)			10.6	
Cooling Method		Conductive-cooled		Air-cooled
Cable Type			LM DB-25	
Cable Length (m)			1.8	
Part Number		1098456	1098452	1098394

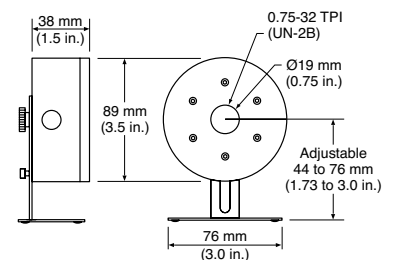
LM-20



LM-150 LS



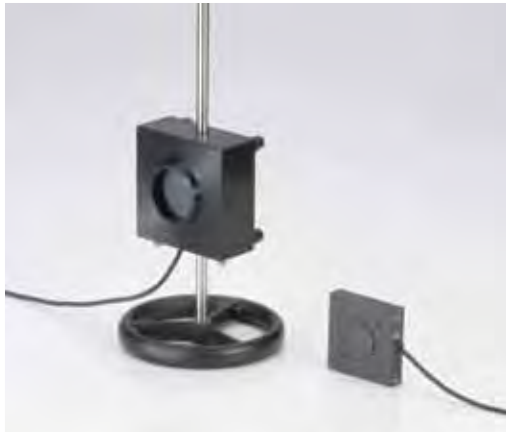
LM-150 FS



* Threads per inch

Beam Position Sensing Thermopile Sensors

100W to 5 kW



Models LM5000, BeamFinder

Features

- Water-cooled
- Spectrally flat from 0.19 μm to 11 μm
- 1W resolution
- 35 mm to 55 mm apertures



Use with LabMax (see page 10)

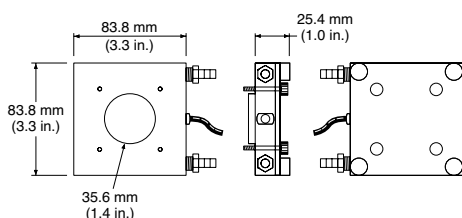
These kilowatt thermopile sensors are water-cooled for measuring output over 100W and are excellent for use with CO₂ and Nd:YAG lasers.

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). Water fittings are included.

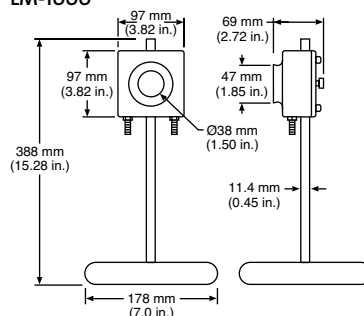
Device Specifications	Model	BeamFinder	LM-1000	LM-2500	LM-5000
Wavelength Range (μm)		0.3 to 10.6		0.25 to 10.6	
Power Range (W)		100 to 1000		100 to 2500	100 to 5000
Resolution (W)		1			
Max. Power Density ¹		1 to 2.5 kW/cm ²			
Max. Energy Density		0.5 J/cm ² , 1064 nm, 10 ns			
Detector Coating		H			
Active Area Diameter (mm)		35	38	55	
Dimensions (mm)		84 x 84 x 25.4 (3.3 x 3.3 x 1.0 in.)	97 x 97 x 69 (3.8 x 3.8 x 2.7 in.)	122 x 122 x 69 (4.8 x 4.8 x 2.7 in.)	
Calibration Uncertainty (%)		±5			
Calibration Wavelength (μm)		10.6			
Cooling Method		Water-cooled			
Cable Type		LM DB-25			
Cable Length (m)		6			
Part Number		1098427	1098409	1098437	1098421

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.

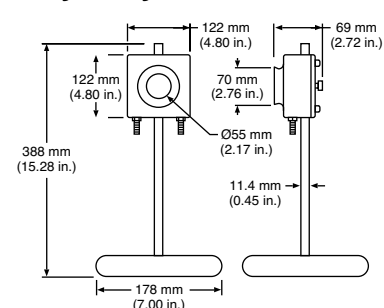
BeamFinder



LM-1000



LM-2500/LM-5000



- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
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High-Sensitivity Optical Power Sensors

10 nW to 50 mW, CW



Model OP-2/LM-2

Features

- Si, Ge photodiodes
- Spectral range: 250 nm to 1800 nm
- Fiber-optic connector (optional, see page 51)
- 1000:1 attenuator for measurement to 5W (optional, see page 50)

These high-sensitivity semiconductor sensors are ideal for CW laser measurements in the nW to low mW level. They typically saturate in the 10 to 50 mW level, depending upon the model. For linear operation up to a maximum of 5 Watts, an optional 1000:1 attenuator is used. Light shield is removable.

Accessories



1000:1 Attenuator



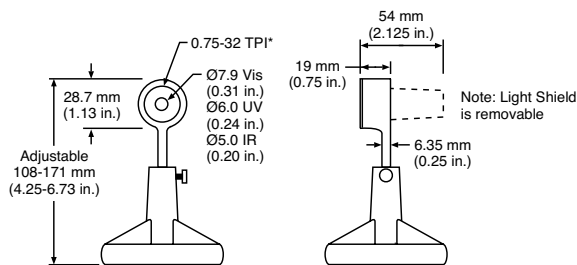
Fiber-Optic Connector Adapters

Device Specifications	Model	OP-2/LM-2 UV	OP-2/LM-2 VIS	OP-2/LM-2 IR
Detector Material		Silicon		Germanium
Wavelength Range (µm)		0.25 to 0.4	0.4 to 1.06	0.8 to 1.80/0.8 to 1.5 ¹
Power Range		10 nW to 30 mW	10 nW to 30 mW ²	10 nW to 10 mW
Resolution (nW)		1		
Active Area Diameter (mm)		6	7.9	5
Dimensions (mm)		Ø29 x 54 (1.1 x 2.1 in.)		
Calibration Uncertainty (%)		±8	±5	±4.5
Calibration Wavelength (nm)		Monochromator calibration across wavelength range		
Cooling Method		Air-cooled		
Connector Type		OP DB-25/LM DB-25		
Cable Length (m)		1.8		
Part Number				
	OP-2	1098401	1098313	1098416
	LM-2	1098390	1098298	1098342

¹ OP-2 IR and LM-2 IR have different spectral ranges.

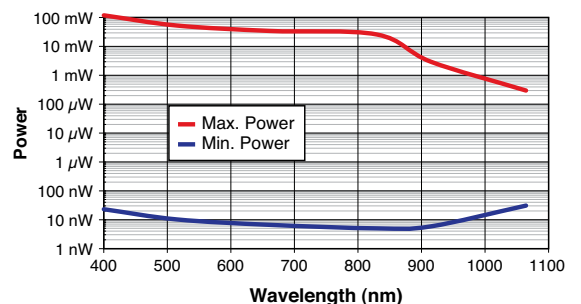
² Power range is wavelength dependent. See chart below.

OP-2 UV/OP-2 VIS/OP-2 IR
LM-2 UV/LM-2 VIS/LM-2 IR



* Threads Per Inch

Measurable Power vs. Wavelength
OP-2 VIS and LM-2 VIS



High-Sensitivity Thermopile Power Sensors

100 μ W to 2W



Models PS19Q, PS19, PS10, PM3

Features

- Thermally stabilized designs
- Spectrally flat from 0.3 μ m to 11 μ m
- 10 μ W resolution
- Fiber-optic connectors (optional, see page 51)

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 51). Where optimum stability is required, specify the PS10Q or PS19Q, which include a wedged quartz window for applications from 0.3 to 2.0 μ m. The quartz window more effectively eliminates thermal background radiation and the effects of air currents.

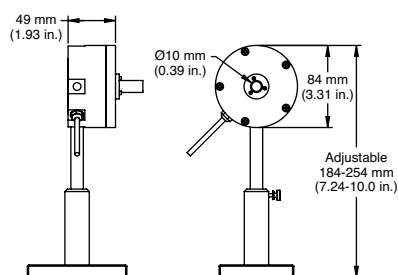
Device Specifications	Model	PS10 ²	PS10Q	PS19	PS19Q	PM3 ²	PM3Q
Wavelength Range (μ m)		0.19 ³ to 11	0.3 to 2	0.19 ³ to 11	0.3 to 2	0.19 ³ to 11	0.3 to 2
Power Range		100 μ W to 1W				500 μ W to 2W	
Resolution (μ W)		10				50	
Max. Thermal Drift ¹		\pm 40 μ W	\pm 20 μ W	\pm 400 μ W	\pm 20 μ W	\pm 1 mW	\pm 500 μ W
Max. Avg. Power Density		0.5 kW/cm ²					
Max. Pulse Energy Density		50 mJ/cm ² , 10 ns, 1064 nm					
Response Time (sec.)		2					
Detector Coating		Black					
Quartz Filter Window		No	Yes	No	Yes	No	Yes
Active Area Diameter (mm)		10		19		19	10
Dimensions (mm)		\varnothing 84 x 49 (3.3 x 1.9 in.)				\varnothing 63 x 36 (2.4 x 1.4 in.)	
Calibration Uncertainty (%)		\pm 1					
Calibration Wavelength (nm)		514					
Cooling Method		Air-cooled					
Cable Type		PM DB-25					
Cable Length (m)		2					
Part Number		1098350	1098400	1098413	1098341	1098336	1098419

¹ Power stability over 30 minutes in a typical lab environment.

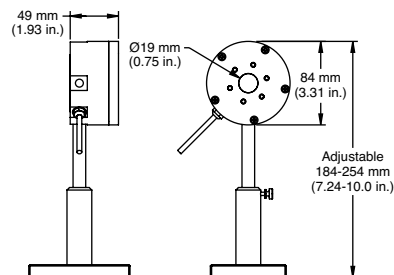
² Light tube supplied with PS10 and PM3 models only.

³ 190nm to 300 nm operation restricted to <100 mW average power and <250W/cm² power density.

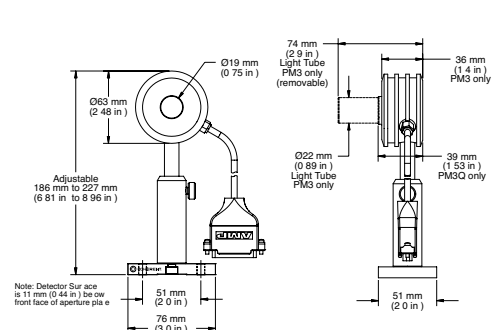
PS10/PS10Q



PS19/PS19Q



PM3/PM3Q



Air-Cooled Thermopile Sensors

10 mW to 30W



Features

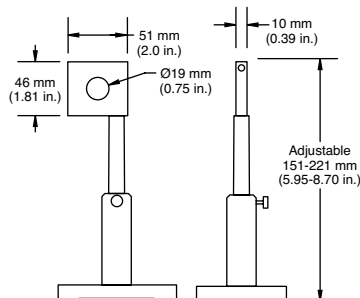
- Convective air-cooled
- Spectrally flat from 0.19 μm to 11 μm
- 1 to 10 mW resolution
- 19 mm aperture

These thermopile sensors are used to measure CW and pulsed lasers from 10 mW up to 30W average power output. These sensors are able to dissipate heat via convection cooling, which makes them convenient to use.

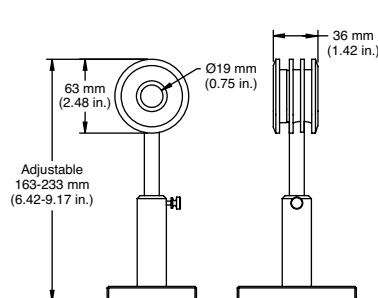
Models PM2, PM10, PM30

Device Specifications	Model	PM2	PM10	PM30
Wavelength Range (μm)			0.19 to 11	
Power Range		10 mW to 2W	10 mW to 10W	100 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
Resolution (mW)			1	10
Max. Power Density		26 kW/cm ²		
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns		
Response Time (sec.)		2		
Detector Coating		Broadband		
Active Area Diameter (mm)		19		
Dimensions (mm)		46 x 51 x 10 (1.8 x 2.0 x 0.3 in.)	$\varnothing 63$ x 36 (2.4 x 1.4 in.)	$\varnothing 101$ x 56 (3.9 x 2.2 in.)
Calibration Uncertainty (%)		± 1		
Calibration Wavelength (nm)		514		
Cooling Method		Air-cooled		
Cable Type		PM DB-25		
Cable Length (m)		2		
Part Number		1098329	1097901	1098314

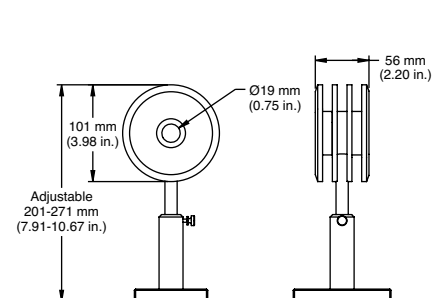
PM2



PM10



PM30



Air-Cooled Thermopile Sensors

300 mW to 150W



Models PM150-50, PM150, PM100-19C

Features

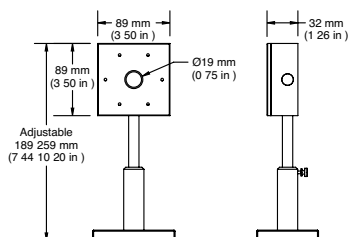
- Convective air-cooled
- Spectrally flat from 0.19 μm to 11 μm
- 30 mW resolution
- 19 mm and 50 mm apertures

- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
- CALIBRATION & SERVICE
- Laser Cross-Reference Index
- Model Name Index

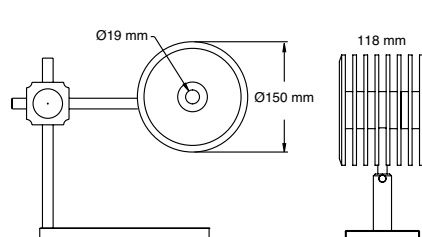
Device Specifications	Model	PM100-19C ¹	PM150	PM150-50
Wavelength Range (μm)			0.19 to 11	
Power Range		300 mW to 100W	300 mW to 150W	
Long-Pulse Joules Range (J)		1 to 100	1 to 150	
Max. Intermittent Power (<5 min.)(W)		100	300	
Resolution (mW)			30	
Max. Power Density			26 kW/cm ²	
Max. Energy Density			0.6 J/cm ² , 1064 nm, 10 ns	
Response Time (sec.)		2		5
Detector Coating			Broadband	
Active Area Diameter (mm)		19		50
Dimensions (mm)		89 x 89 x 32 (3.5 x 3.5 x 1.2 in.)	\varnothing 150 x 118 (5.9 x 4.6 in.)	
Calibration Uncertainty (%)			\pm 1	
Calibration Wavelength (nm)			514	
Cooling Method			Air-cooled	
Cable Type			PM DB-25	
Cable Length (m)			2	
Part Number		1098483	1098407	1098398

¹ This sensor is designed for intermittent use only.

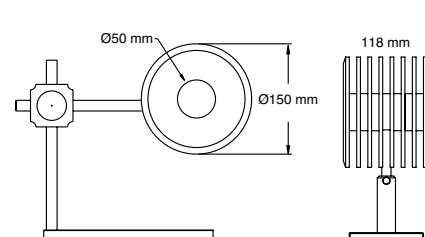
PM100-19C



PM150



PM150-50



Water-Cooled Thermopile Sensors

10 mW to 300W



Models PM300, PM150-50C, PM150-19C

Features

- Water-cooled; but can be used air-cooled for short periods of time
- Spectrally flat from 0.19 μm to 11 μm
- 1 mW to 100 mW resolution
- 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. 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). Water fittings are included.

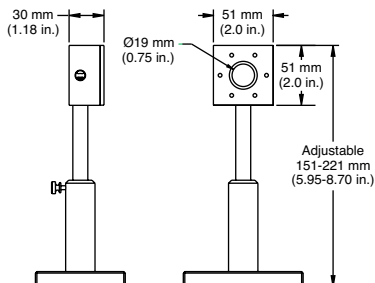
OEM versions of these sensors with passive and amplified outputs can be found on page 69.

Device Specifications	Model	PM10-19C	PM150-19C	PM150-50C	PM300
Wavelength Range (μm)		0.19 to 11			
Power Range (water-cooled)		10 mW to 10W	300 mW to 150W		1 W to 300W
Max. Intermittent Power (≤ 5 min.) (W)		5W ¹	20W ¹	80W ¹	450W ²
Long-Pulse Joules Range (J)		0.5 to 10	1 to 150		–
Resolution (mW)		1	30		100
Max. Power Density		26 kW/cm ²			
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns			
Response Time (sec.)		2		5	
Detector Coating		Broadband			
Active Area Diameter (mm)		19		50	19
Dimensions (mm)		51 x 51 x 30 (2.0 x 2.0 x 1.1 in.)		89 x 89 x 32 (3.5 x 3.5 x 1.2 in.)	$\varnothing 76$ x 56 (2.9 x 2.2 in.)
Calibration Uncertainty (%)		± 1			
Calibration Wavelength (nm)		514			
Cooling Method		Water-cooled			
Cable Type		PM DB-25			
Cable Length (m)		2			
Part Number		1098397	1098444	1098412	1141474

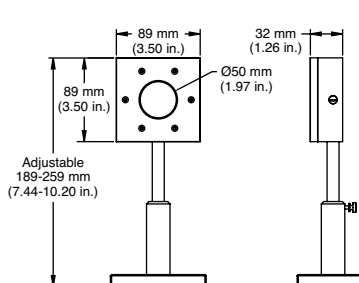
¹ This intermittent power rating is for when the sensor is used without water-cooling.

² This intermittent power rating is for when the sensor is used with water-cooling.

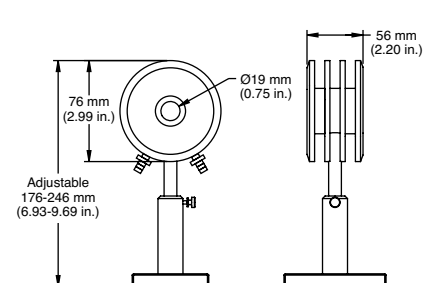
PM10-19C/PM150-19C



PM150-50C



PM300



Fan-Cooled Thermopile Sensors

1W to 300W



Models PM200F-50, PM300F-50

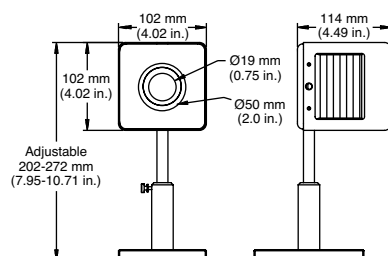
Features

- Fan-cooled
- Spectrally flat from 0.19 μm to 11 μm
- 100 mW resolution
- 19 mm and 50 mm apertures

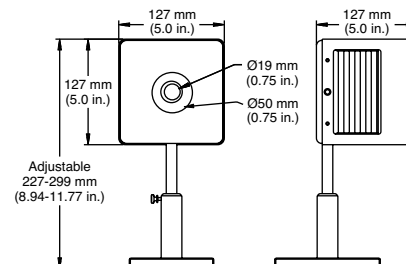
Fan-cooled sensors are an excellent choice for measuring high-power lasers when water-cooling is not possible. A compact power supply provides the 12 VDC required to power the fan.

Device Specifications	Model	PM200F-19	PM200F-50	PM300F-19	PM300F-50
Wavelength Range (μm)		0.19 to 11			
Power Range (W)		1 to 200		1 to 300	
Long-Pulse Joules Range (J)		1 to 200		1 to 300	
Max. Intermittent Power (<5 min.)(W)		300		450	
Resolution (mW)		100			
Max. Power Density		26 kW/cm ²			
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns			
Response Time (sec.)		2	5	2	5
Detector Coating		Broadband			
Active Area Diameter (mm)		19	50	19	50
Dimensions (mm)		102 x 102 x 114 (4.0 x 4.0 x 4.4 in.)		127 x 127 x 127 (5 x 5 x 5 in.)	
Calibration Uncertainty (%)		±1			
Calibration Wavelength (nm)		514			
Cooling Method		Fan-cooled			
Cable Type		PM DB-25			
Cable Length (m)		2			
Part Number		1098480	1098472	1098509	1098417

PM200F-19/PM200F-50



PM300F-19/PM300F-50



- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
- CALIBRATION & SERVICE
- Laser Cross-Reference Index
- Model Name Index

Water-Cooled Thermopile Sensors

100W to 5 kW



Model PM1K

Features

- Water-cooled
- Spectrally flat from 0.19 μm to 11 μm
- 1W resolution
- 50 mm apertures

These water-cooled sensors are used to measure lasers over 300W average power output. They are excellent choices for measuring CO₂ and Nd:YAG lasers. Larger-area versions are available on the next page.

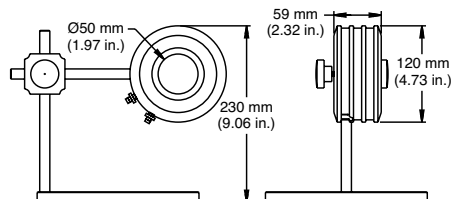
Tap or distilled cooling water is recommended with these sensors – DI water can not be used. Flow rates are power dependent and range from 0.5 to 4 gallons per minute; pressure depends upon flow rate and ranges from 3 to 40 PSI (visit product pages at www.Coherent.com/LMC for more technical details).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

Device Specifications	Model	PM1K	PM3K	PM5K
Wavelength Range (μm)			0.19 to 11	
Power Range (W)		100 to 1000	100 to 3000	100 to 5000
Max. Intermittent Power (≤ 5 min.)(W) ¹		3000	5000	10000
Resolution (W)			1	
Max. Power Density ²			1 to 10 kW/cm ²	
Max. Energy Density			0.6 J/cm ² , 1064 nm, 10 ns	
Response Time (sec.)			30	
Detector Coating			Broadband	
Active Area Diameter (mm)			50	
Dimensions (mm)			$\varnothing 120 \times 59$ (4.7 x 2.3 in.)	
Calibration Uncertainty (%)			± 5	
Calibration Wavelength (nm)			1064	
Cooling Method			Water-cooled	
Cable Type			PM DB-25	
Cable Length (m)			2	
Part Number		1098392	1098462	1098454

¹ Intermittent power levels may be sustainable for longer than 5 minutes when used with lasers with large diameter, non-Gaussian beam profiles. Monitor closely for coating damage if used longer than five minutes at higher powers.

² 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.

PM1K/PM3K/PM5K



Large-Area High-Power Water-Cooled Thermopile Sensors

10 mW to 5 kW



Models PM5K-200, PM3K-100

Features

- Water-cooled
- 100 mm and 200 mm apertures
- Spectrally flat from 0.19 μm to 11 μm

These large-area, water-cooled thermopiles are designed to measure large laser diode stacks and arrays, and other high-power divergent sources. Water fittings are included

POWER & ENERGY

Power & Energy Meters

Power Sensors

Energy Sensors

Custom & OEM

BEAM DIAGNOSTICS

CALIBRATION & SERVICE

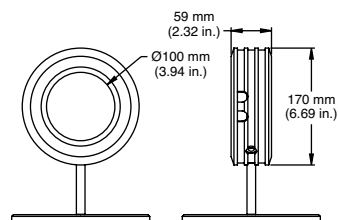
Laser Cross-Reference Index

Model Name Index

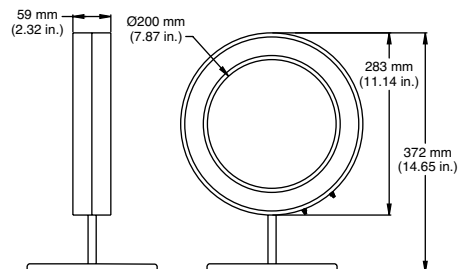
Device Specifications	Model	PM1K-100	PM3K-100	PM5K-100	PM5K-200
Wavelength Range (μm)		0.19 to 11			
Power Range (W)		100 to 1000	100 to 3000	100 to 5000	100 to 5000
Max. Intermittent Power (<5 min.)(W)		1500	4000	7500	7500
Resolution (W)		1			
Max. Power Density ¹		1 to 10 kW/cm ²			
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns			
Response Time (sec.)		45			
Detector Coating ¹		Broadband			
Detector Diameter (mm)		100		200	
Dimensions (mm)		$\varnothing 170 \times 59$ (6.6 x 2.3 in.)		$\varnothing 283 \times 59$ (11.1 x 2.3 in.)	
Calibration Uncertainty (%)		± 5			
Calibration Wavelength (nm)		1064			
Cooling Method		Water-cooled			
Cable Type		PM DB-25			
Cable Length (m)		2			
Part Number		1098490	1098506	1098461	1098505

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.

PM1K-100/PM3K-100/PM5K-100



PM5K-200



High-Peak-Power Thermopile Sensors

10 mW to 30W



Models PM30V1, PM10V1

Features

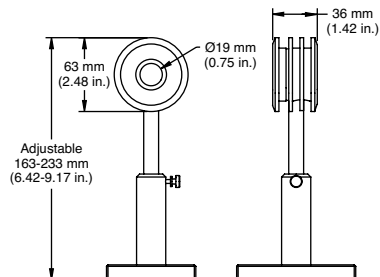
- Volume absorber
- 2 J/cm² at 1064 nm

These sensors are designed for use with high-peak-power, low repetition rate, Q-switched Nd:YAG lasers. A volume-absorbing substrate mounted in front of the detector absorbs the bulk of the laser energy rather than all of the energy striking the front surface of the detector element. This results in a much higher damage threshold, approaching 2 J/cm², at relatively low repetition rates of approximately 10 pps. For damage thresholds approaching 5 J/cm² the PM30V1Q uses an additional quartz diffuser to help scatter the beam before it hits the absorber surface. A removable front aperture allows easy replacement of the volume-absorbing substrate should it be damaged (replacement absorbers may be ordered using part number 0011-8935, PMV1-KIT).

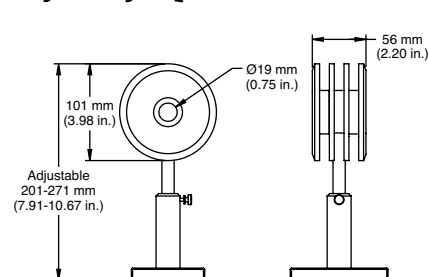
Device Specifications	Model	PM10V1	PM30V1
Wavelength Range (μm)			0.25 to 3
Power Range		10 mW to 10W	100 mW to 30W
Max. Intermittent Power (<5 min.)(W)		15	50
Resolution (mW)		1	10
Max. Power Density			50 W/cm ²
Max. Energy Density			2 J/cm ² , 1064 nm, 10 ns
Response Time (sec.)			3
Detector Coating			Volume Absorbing
Active Area Diameter (mm)			19
Dimensions (mm)		Ø63 x 36 (2.4 x 1.4 in.)	Ø101 x 56 (3.9 x 2.2 in.)
Calibration Uncertainty (%)			±1
Calibration Wavelength (nm)			514
Cooling Method			Air-cooled
Cable Type			PM DB-25
Cable Length (m)			2
Part Number ¹		1098338	1098429

¹ Diffuser transmission calibrated at 266 nm, 355 nm, 532 nm and 1064 nm.

PM10V1



PM30V1/PM30V1Q



Thermopile Sensors with UV Coating

10 mW to 30W



Model PM2X, PM10X, PM30X

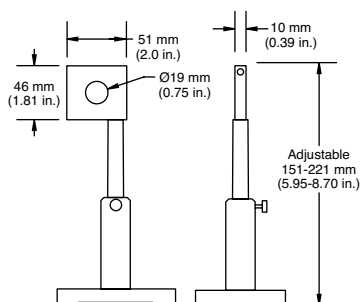
Features

- UV coating is optimized for DUV
- Spectral range: 0.15 μm to 1 μm
- 1 mW to 10 mW resolution
- 19 mm apertures

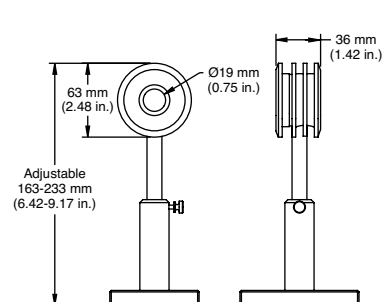
The following sensors are similar to models shown on previous pages, except they incorporate a UV coating that is optimized for use at ultraviolet wavelengths. Spectral compensation allows the sensors to be used from 157 nm to 1064 nm.

Device Specifications	Model	PM2X	PM10X	PM30X
Wavelength Range (μm)			0.15 to 1	
Power Range		10 mW to 2W	10 mW to 10W	100 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)		3	30	50
Resolution (mW)		1	1	10
Max. Power Density			26 kW/cm ²	
Max. Energy Density			0.6 J/cm ² , 1064 nm, 10 ns	
Response Time (sec.)			2	
Detector Coating			UV	
Active Area Diameter (mm)			19	
Dimensions (mm)		46 x 51 x 10 (1.8 x 2.0 x 0.3 in.)	\varnothing 63 x 36 (2.4 x 1.4 in.)	\varnothing 101 x 56 (3.9 x 2.2 in.)
Calibration Uncertainty (%)			\pm 1	
Calibration Wavelength (nm)			514	
Cooling Method			Air-cooled	
Cable Type			PM DB-25	
Cable Length (m)			2	
Part Number		1098457	1098423	1098498

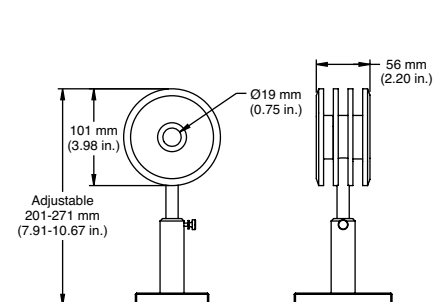
PM2X



PM10X



PM30X



- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
- CALIBRATION & SERVICE
- Laser Cross-Reference Index
- Model Name Index

Thermopile Sensors with UV Coating

300 mW to 150W



Model PM150X, PM150-50XC

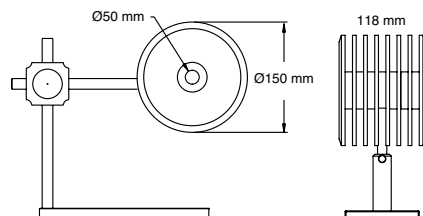
Features

- UV coating is optimized for DUV
- Spectral Range: 0.15 μm to 1 μm
- 30 mW resolution
- 50 mm apertures

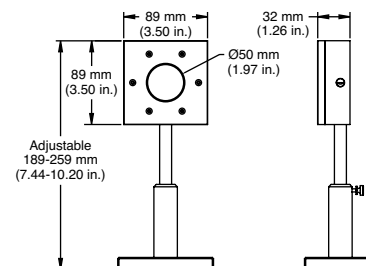
Device Specifications	Model	PM150X	PM150-50XC
Wavelength Range (μm)		0.15 to 1	
Power Range		300 mW to 150W	
Long-Pulse Joules Range (J)		1 to 150	
Max. Intermittent Power (≤ 5 min.)(W)		300	80 (air-cooled)
Resolution (mW)		30	
Max. Power Density		26 kW/cm ²	
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns	
Response Time (sec.)		5	
Detector Coating		UV	
Active Area Diameter (mm)		50	
Dimensions (mm)		150 x 118 (5.9 x 4.6 in.)	89 x 89 x 32 (3.5 x 3.5 x 1.2 in.)
Calibration Uncertainty (%)		± 1	
Calibration Wavelength (nm)		514	
Cooling Method		Air-cooled	Water-cooled
Cable Type		PM DB-25	
Cable Length (m)		2	
Part Number ¹		1098455	1098443

¹ Water fittings are included with PM150-50XC.

PM150X



PM150-50XC



Thermopile Sensors with UV Coating

1W to 1 kW



Model PM200F-50X, PM300F-50X, PM1KX

Features

- UV coating is optimized for DUV
- Spectral Range: 0.15 μm to 1 μm
- 100 mW to 1W resolution
- 50 mm apertures

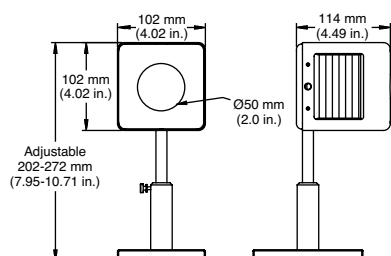
- POWER & ENERGY
- Power & Energy Meters
- Power Sensors
- Energy Sensors
- Custom & OEM
- BEAM DIAGNOSTICS
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Device Specifications	Model	PM200F-50X	PM300F-50X	PM1KX
Wavelength Range (μm)		0.15 to 1		0.15 to 1
Power Range (W)		1 to 200	1 to 300	100 to 1000
Long-Pulse Joules Range (J)		1 to 200	1 to 300	–
Max. Intermittent Power (<5 min.)(W)		300	450	1500
Resolution (mW)		100	100	1000
Max. Power Density		26 kW/cm ²		1 to 10 kW/cm ² ¹
Max. Energy Density		0.6 J/cm ² , 1064 nm, 10 ns		0.6 J/cm ² , 1064 nm, 10 ns
Response Time (sec.)		5		30
Detector Coating		UV		UV
Active Area Diameter (mm)		50		50
Dimensions (mm)		102 x 102 x 114 (4.0 x 4.0 x 4.4 in.)	127 x 127 x 127 (5 x 5 x 5 in.)	\varnothing 120 x 59 (4.7 x 2.3 in.)
Calibration Uncertainty (%)		± 1		± 5
Calibration Wavelength (nm)		514		1064
Cooling Method		Fan-cooled		Water-cooled
Cable Type		PM DB-25		PM DB-25
Cable Length (m)		2		2
Part Number ²		1113493	1098481	1115484

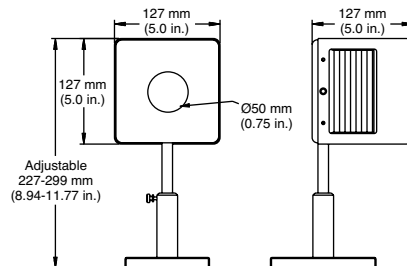
¹ The damage resistance of the coating is dependent upon the beam size and profile, the average power level, and the water flow rate. Contact Coherent or your local representative for details related to your application.

² Water fittings are included with PM1KX.

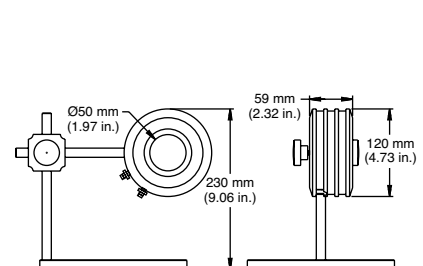
PM200F-50X



PM300F-50X



PM1KX



Power Sensor Accessories

Thermal SmartSensor Adapter



Thermal SmartSensor Adapter

The Thermal SmartSensor Adapter converts LM-model position-sensing thermopiles and LM-2 optical sensors for use with FieldMaxII, FieldMate and EPM2000 meters.

Designed for use with multiple sensors, this adapter can read the sensor EEPROM contents and program itself when powered up via the meter connection.

Note: Beam position information is not available when using these meters.

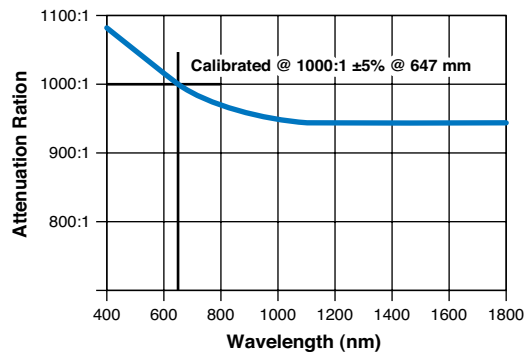
Part Number	Description
1056827	Thermal SmartSensor Adapter

1000:1 Attenuator



1000:1 Attenuator

This attenuator is used with OP-2 VIS, LM-2 VIS, OP-2 IR and LM-2 IR sensors to allow operation up to 5W in the visible and 3W in the infrared regions. The attenuator threads into the sensor in place of the light shield to provide from 1100:1 to 950:1 attenuation. Each attenuator is calibrated for 1000:1 $\pm 5\%$ at 647 nm and is supplied with a calibration certificate. The useful spectral range is 400 to 1800 nm.



Part Number	Description
1098318	1000:1 Attenuator for OP-2 and LM-2 Sensors

Power Sensor Accessories

Fiber-Optic Connector Adapters



SMA and FC Adapters

The following fiber-optic adapters can be mounted directly onto the 3/4-32 threads on the front of LM-2, OP-2, LM-3, LM-10, and LM-150FS sensors. These fiber adapters can also be used with our 1.035-40M adapter ring to fit on the LM-20, LM-45, LM-100, LM-150 LS, and LM-200 sensors.

Part Number	Description	Sensors
1098589	SMA-Type Connector	LM-2, OP-2, LM-3, LM-10, LM-150 FS
1098339	FC/PC-Type Connector	LM-2, OP-2, LM-3, LM-10, LM-150 FS
33-9432-000	1.035-40M Adapter Ring	LM-20, LM-45, LM-100, LM-150 LS, LM-200



SMA and FC Adapters

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

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