

PowerMax-Pro Sensors

Laser Power Sensors



PowerMax-Pro 150F HD and PowerMax-Pro 150 HD

PowerMax-Pro USB and RS sensors incorporate LabMax-Pro instrumentation directly within the sensor cable. Similar to other Coherent USB and RS sensors, this configuration offers a smaller form factor for use inside laser processing systems or production lines. Additionally, the cost of annual calibration is half that of a separate meter and sensor system. The PowerMax-Pro USB and RS sensors operate with LabMax-Pro PC applications software (included).

PowerMax-Pro (Patent #9,012,848) represents a dramatic technological advancement in laser power sensing that utilizes a thin-film detector only microns thick which rapidly senses thermal changes due to incident laser energy. The result is a measurement response time below 10 μ s, as compared to over 1 second for traditional thermopiles. These detectors can operate at high power over a spectral range as broad as 355 nm to 11 μ m, and incorporate a large 30 mm x 30 mm active area.

The high response speed of PowerMax-Pro sensors is particularly advantageous in a wide range of commercial and medical applications. It enables nearly instant measurement of CW laser power, resulting in increased throughput, and also supports high resolution analysis of modulated laser pulse shapes resulting in improved laser characterization and process control.

Features

- Enhance productivity and quality while improving measurement speed
- Measures power in tens of microseconds
- High power up to 150W
- Supports lasers from UV to Far-IR wavelengths
- Capable of tracing the individual pulse shape of modulated and long pulse lasers
- Large 30 x 30 mm active area

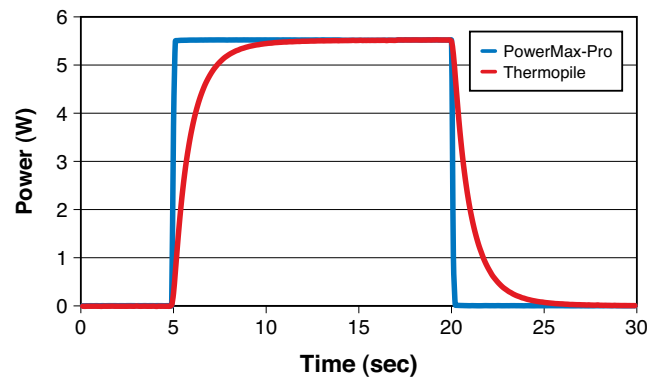


Figure 1: The rise time of a typical mid-power thermopile (30W) compared with the PowerMax-Pro

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PowerMax-Pro Sensors

Laser Power Sensors

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

In contrast to the traditional, radial flow thermopile, which has a sensing time constant value of several seconds, the time constant for PowerMax-Pro is in the microsecond range.

This enables the sensor to provide an essentially instant power measurement (Figure 1). The PowerMax-Pro sensor preserves the main benefits of the traditional thermopile architecture, namely large active area (30 mm x 30 mm), wide dynamic range (50 mW to 150W), high damage resistance (14 kW/cm²) and broad wavelength range (300 nm to 11 μm).

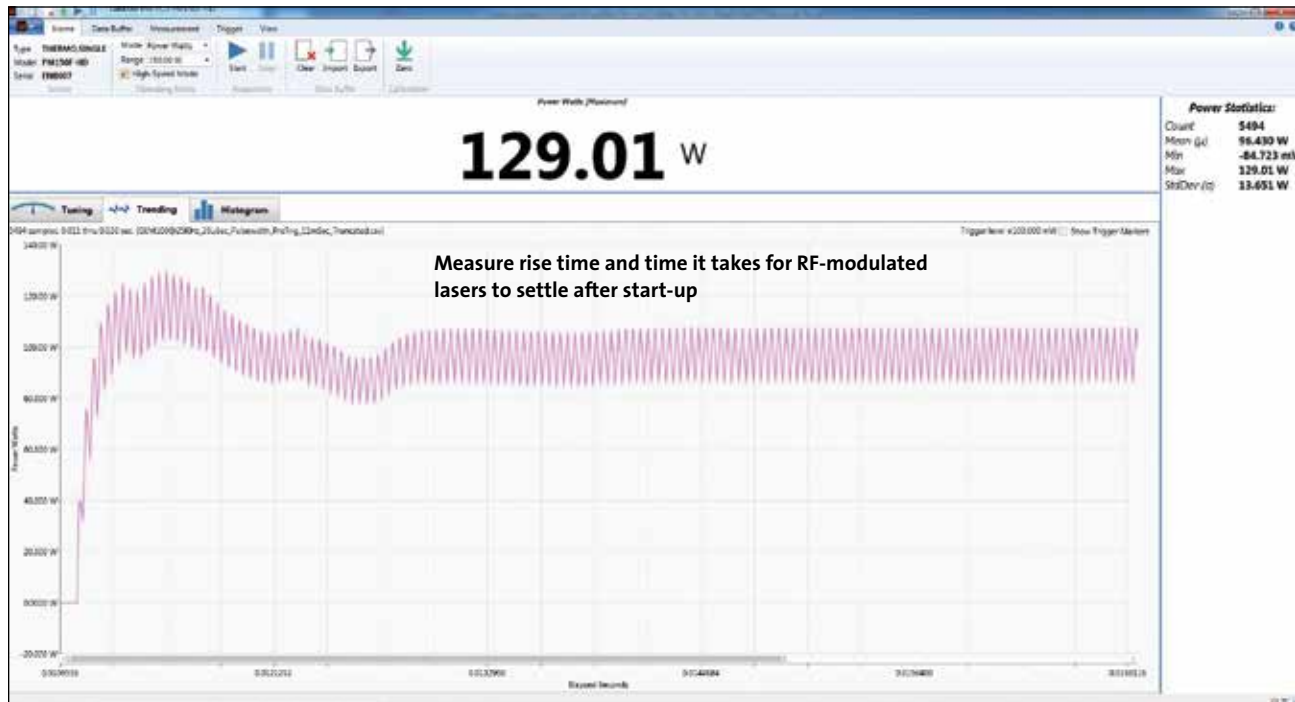
The response speed of PowerMax-Pro sensors allows users to move beyond just measuring average power, and enables analysis of the temporal pulse shape and peak power of modulated lasers with pulse lengths greater than 10 μs. These pulses can then be integrated to calculate individual pulse energy.

The following figures demonstrates PowerMax-Pro high speed analysis feature being used to track the power output of an RF-modulated CO₂ laser from the time the laser is first turned on until the laser stabilizes:

Application: Engraving, Light Cutting

Laser: 25 kHz RF-modulated CO₂ laser

Pulse Length: 20 μsec



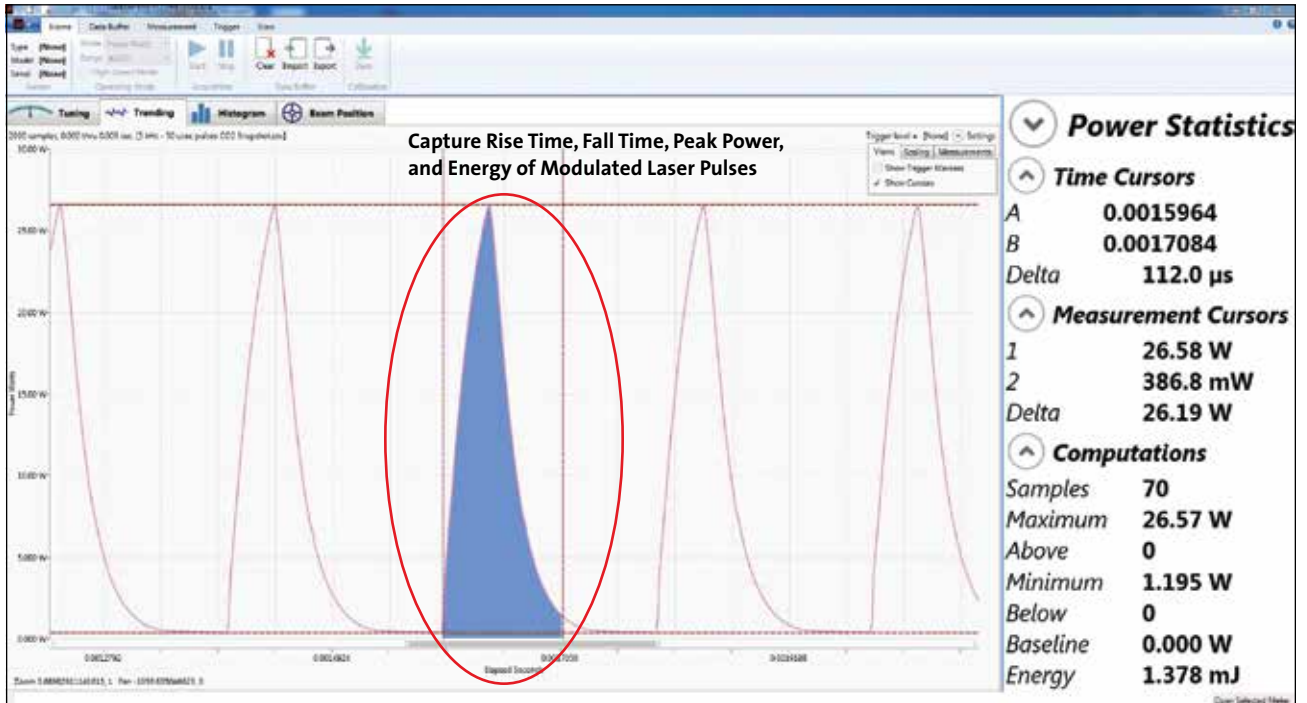
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PowerMax-Pro Sensors

Laser Power Sensors

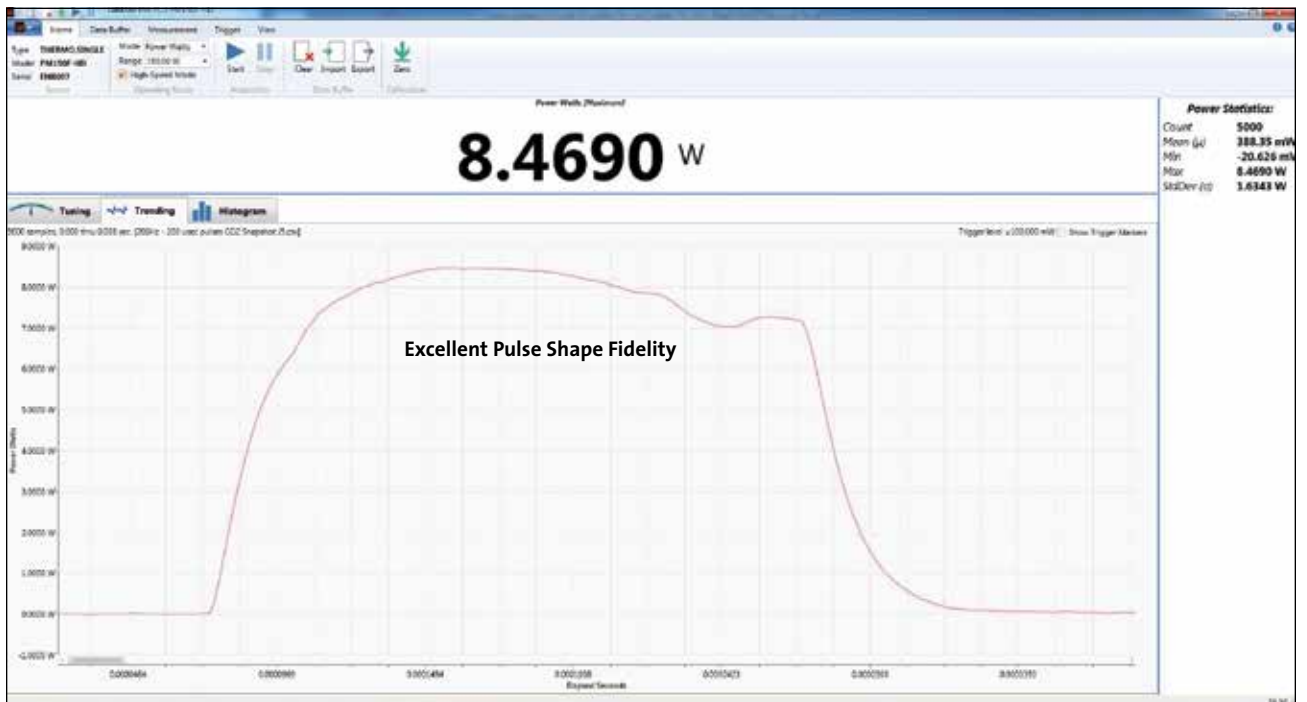
Application: Engraving, Light Cutting, Marking
Wavelength: 10.6 μm

Laser: CO₂



Application: Cutting, Drilling
Wavelength: 10.6 μm

Pulse Length: 1 msec
Laser: CO₂



Read more about PowerMax-Pro technology fundamentals on page 5. Further details about high speed analysis are available on the LabMax-Pro section on pages 10 to 13.

PowerMax-Pro Sensors

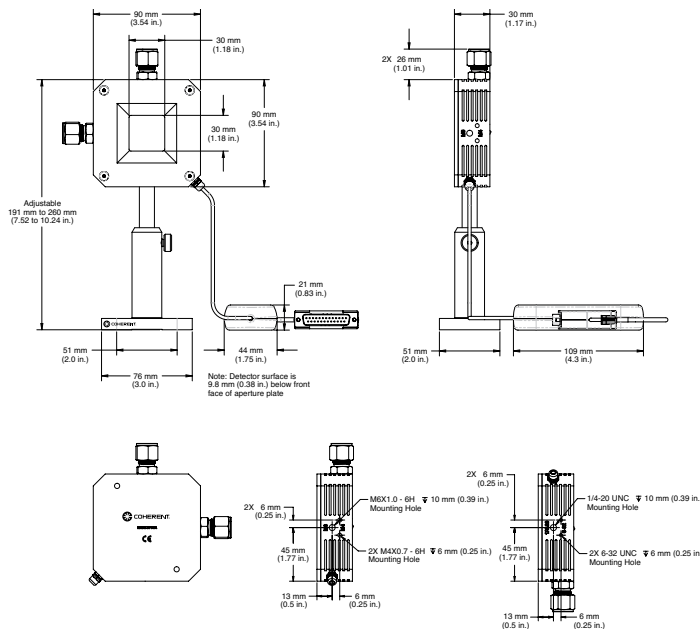
100 mW to 150W

Device Specifications	Model	PowerMax-Pro 150 HD	PowerMax-Pro 150F HD
Wavelength Range		355 nm to 1100 nm; 9 μm to 11 μm	355 nm to 1100 nm; 9 μm to 11 μm
Power Range		100 mW to 150W	100 mW to 150W
	Water-cooled ¹	100 mW to 150W	
	Air-cooled	100 mW to 17W	100 mW to 150W
Maximum Peak Power (W)		170	
Maximum Intermittent Power (W)(<5 min.)		65 (air-cooled)	150 maximum
Noise Equivalent Power (mW)			
	Standard Mode	<1	
	High Speed Mode	<4	
	Snapshot Mode	<9	
Maximum Power Density (kW/cm ²)		0.2 (150W)	
Maximum Peak Power Density (kW/cm ²)		14	
Maximum Energy Density (mJ/cm ²)		700 (10 ns; 355 nm)	
Rise & Fall Time (μs)		≤10	
Detector Coating		HD	
Active Area (mm)		30 x 30	
Minimum Beam Size (mm)		2.0 (1.0 mm - up to 3% error)	
Calibration Uncertainty (%) (k=2)		±2	
Power Linearity (%)			
	100 mW to 150W	±3	
Spectral Compensation Accuracy (%)		±3	
Spatial Uniformity (%) (center 75% of aperture; 2.5 mm beam)		±5	
Calibration Wavelength (nm)		810	
Cooling Method		Water/Air (intermittent)	Fan
Cable Type			DB25
Cable Length			2.5m (8.2 ft.)
Part Number		1266709	1266708

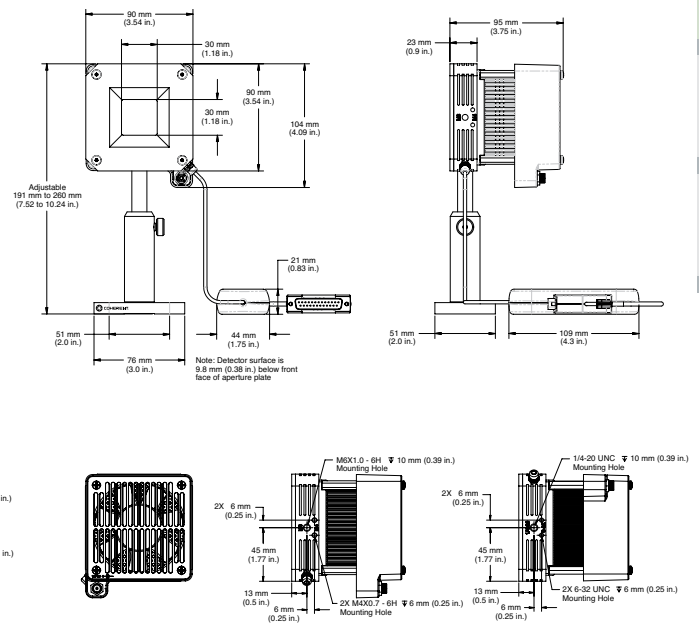
¹ Water flow rate for water-cooled sensors must be >0.5 GPM (>2 LPM).

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PowerMax-Pro 150 HD



PowerMax-Pro 150F HD



PowerMax-Pro HP Sensors

1W to 15 kW

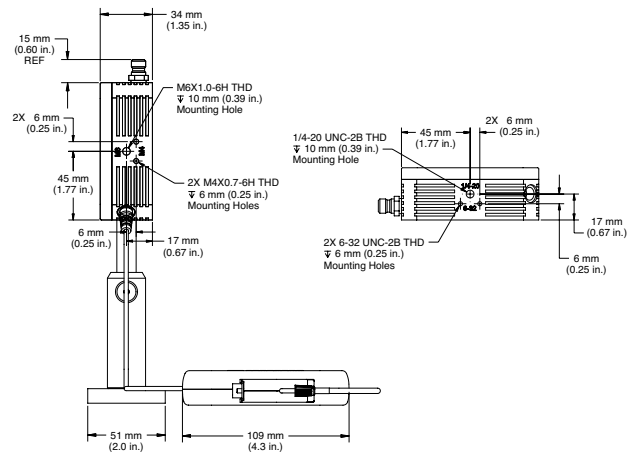
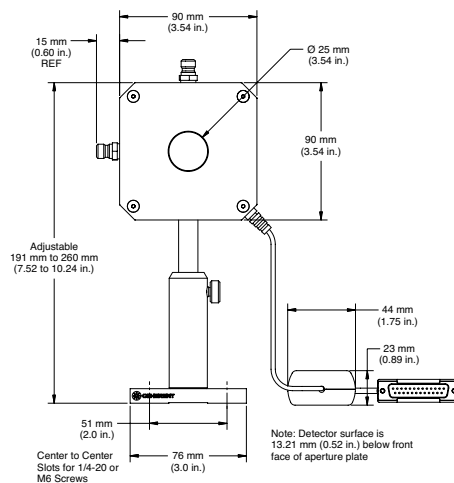
Device Specifications	Model	PowerMax-Pro HP
Wavelength Range		700 nm to 1070 nm; 10.6 μ m
Average Power Range ¹		1W to 350W (22W max air-cooled, cont.) (75W max air-cooled, 5 min.)
Maximum Pulsed Peak Power (W)		15000 (<10 msec burst) 1500 (continuous)
Noise Equivalent Power (mW)		
Standard Mode (10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

¹ Beam size dependent. See steady-state and intermittent power charts.

² See spatial uniformity and beam diameter charts for larger beams.

³ Beam size and pulse length dependent. See peak power and pulse length charts.

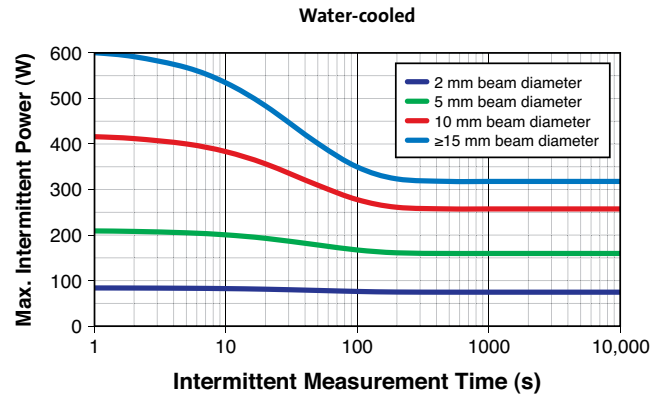
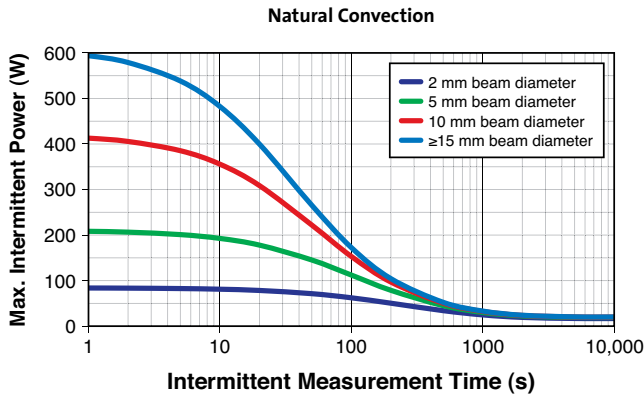
PowerMax-Pro HP



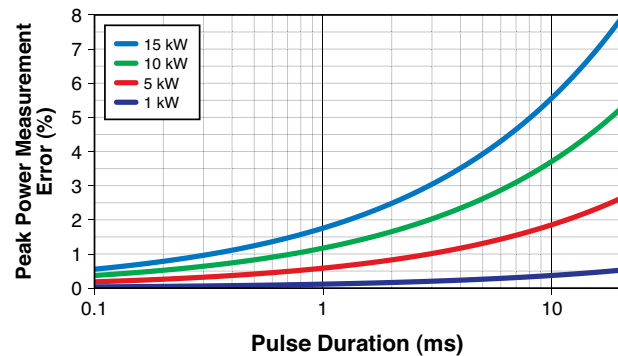
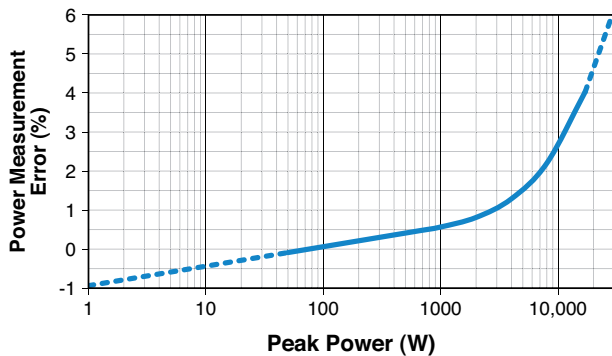
PowerMax-Pro HP Sensors

1W to 15 kW

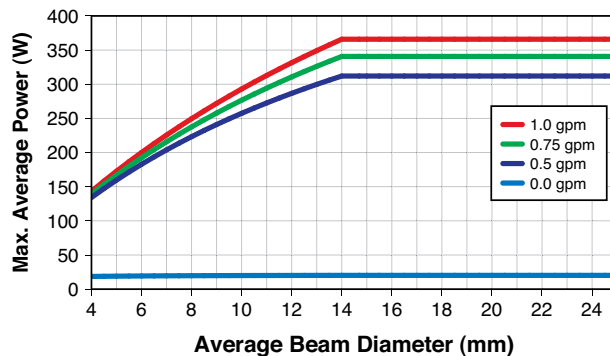
PowerMax-Pro HP Intermittent Average Power



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



PowerMax-Pro HP Maximum Steady-State Average Power



POWER & ENERGY

Power & Energy Meters

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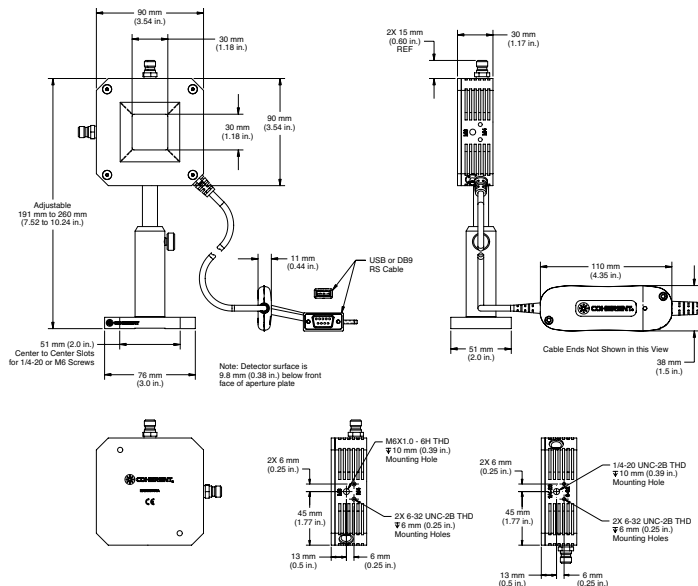
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PowerMax-Pro USB/RS HD Sensors

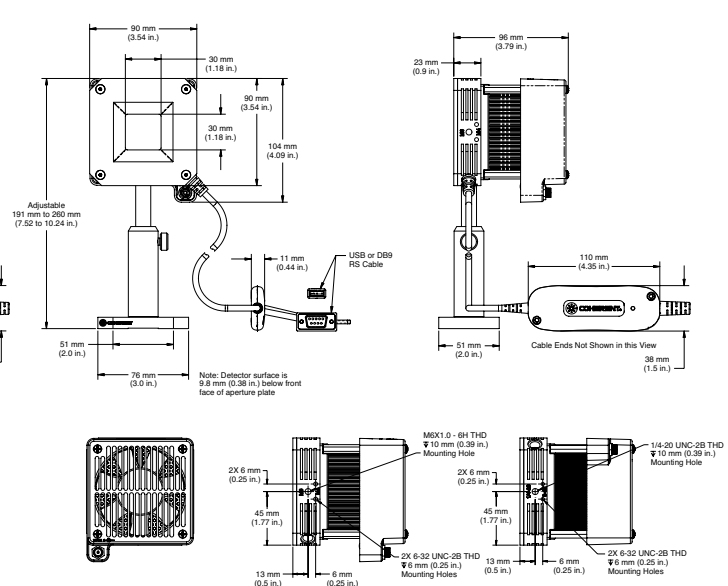
200 mW to 150W

Device Specifications	Model	PowerMax-Pro USB/RS 150 HD	PowerMax-Pro USB/RS 150F HD
Wavelength Range		355 nm to 1100 nm; 9 μm to 11 μm	355 nm to 1100 nm; 9 μm to 11 μm
Average Power Range		200 mW to 150W (17W max air-cooled, cont.) (65W max air-cooled, 5 min.)	200 mW to 150W
Maximum Pulsed Peak Power (W)			200
Noise Equivalent Power (mW)			
Standard Mode (10 Hz)		<4	
High Speed Mode (20 kHz)		<8	
Snapshot Mode (625 kHz)		<16	
Maximum Power Density (kW/cm ²)		0.2 (150W)	
Maximum Peak Power Density (kW/cm ²)		14	
Maximum Energy Density (J/cm ²)		0.700 (10 ns; 355 nm)	
Rise Time (μs)		≤10	
Fall Time (μs)		≤10	
Detector Coating		HD	
Diffuser		None	
Active Area (mm)		30 x 30	
Minimum Beam Size (mm)		2.0	
		1.0 (up to 3% error)	
Maximum Beam Size (mm)		30	
Calibration Uncertainty (%) (k=2) at 810 nm		±2	
Spectral Compensation Accuracy (%)		±5	
Power Linearity (%)		±3	
Spatial Uniformity (%) (center 75% of aperture; 2.5 mm beam)		±5	
Calibration Wavelength (nm)		810	
Cooling Method		Water/Air (intermittent)	Fan
Cable Type		USB/RS-232	
Cable Length		4.2m (13.8 ft.)	
Part Number		1295921 (USB) 1295923 (RS-232)	1295920 (USB) 1295922 (RS-232)

PowerMax-Pro USB/RS 150 HD



PowerMax-Pro USB/RS 150F HD



PowerMax-Pro USB/RS HP Sensors

3W to 2 kW

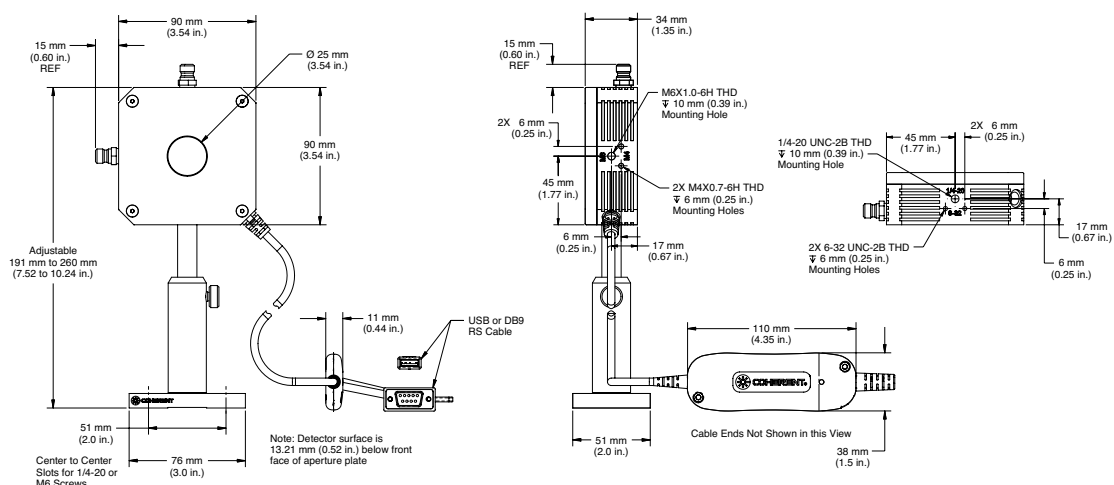
Device Specifications	Model	PowerMax-Pro USB/RS HP 2K
Wavelength Range		700 nm to 1070 nm; 10.6 μm
Average Power Range ¹		3W to 350W (22W max air-cooled, cont.) (75W max air-cooled, 5 min.)
Maximum Pulsed Peak Power (W)		2000
Noise Equivalent Power (mW)		
Standard Mode (10 Hz)		<150
High Speed Mode (20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

¹ Beam size dependent. See steady-state and intermittent power charts.

² See spatial uniformity and beam diameter charts for larger beams.

³ Beam size and pulse length dependent. See peak power and pulse length charts.

PowerMax-Pro USB/RS HP 2K



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