

# Energy Sensors

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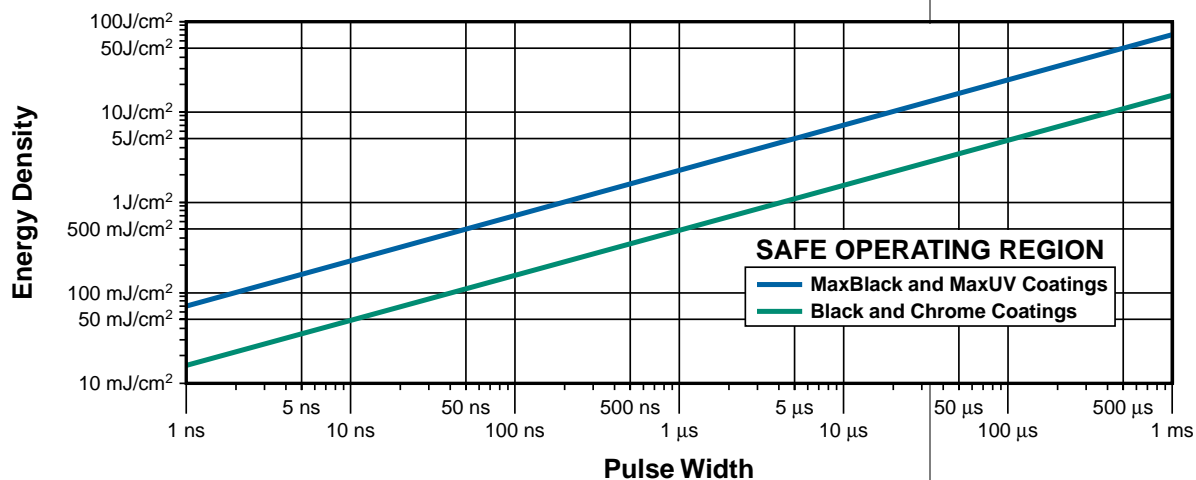
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## Energy Sensor Charts

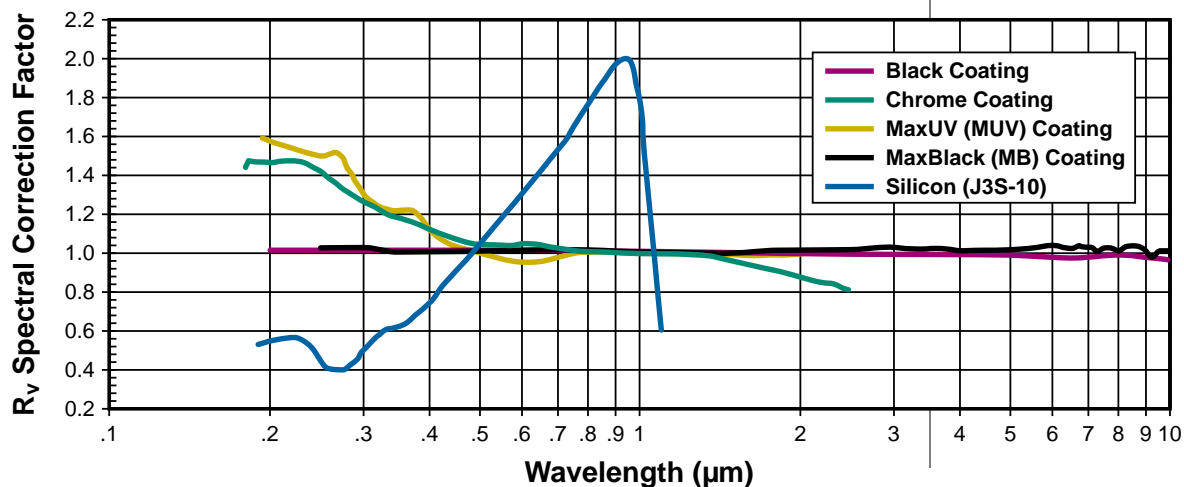
To avoid damage to pyroelectric sensors, only operate them with pulsed radiation and keep them below the maximum average power limit as shown in the selection chart and specifications (pages 64 to 85). In addition, the energy density must be kept below the limit shown in the chart below.

ENERGY SENSOR PULSED LASER DAMAGE THRESHOLD



Coherent utilizes several coatings to capture the incident radiation and convert it to heat to initiate the pyroelectric detection process. 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.

R<sub>v</sub> SPECTRAL CORRECTION FOR ENERGY SENSOR COATINGS (NORMALIZED TO 1064 NM)





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## The Amazing Versatile Pyroelectric

Unlike all other thermal detectors, pyroelectrics measure the rate of change of the detector temperature, rather than the temperature value itself. As a result, the response speed of the pyroelectric is usually limited only by its electrical circuit design and not by its thermal properties, and can reach sub-nanosecond levels. By contrast, other thermal detectors (such as thermopiles and bolometers) are limited by slower thermal response speeds, typically on the order of seconds. Pyroelectrics respond only to changing radiation that is chopped, pulsed, or otherwise modulated, so they ignore steady background radiation that is not changing with time. Their combination of wide uniform spectral response, sensitivity, and high speed, along with room temperature operation, makes pyroelectrics ideal choices for a vast number of electro-optic applications.

In a pyroelectric, when a temperature change occurs, the crystal lattice rearranges itself and shifts the ion positions. While the temperature is changing, the shifting ions generate a polarization current within the lattice. When the temperature stops changing state, the lattice stops moving and the polarization current stops. The intrinsic response speed of the pyroelectric is limited only by the time required to rearrange the crystal lattice, on the order of only one picosecond. In a practical pyroelectric, the response speed may be further limited by the heat transfer from coatings.

If electrodes are applied to the pyroelectric surfaces and connected through an external circuit as shown in Figure 1, then a current is generated in the external circuit to neutralize the polarization charge. This current is proportional to the rate of change of the crystal temperature, as expressed by:

$$I = p(T) A \, dT/dt$$

Where:  $I$  = current  
 $A$  = electroded surface area,  
 $dT/dt$  = time rate of temperature change, and  
 $p(T)$  is defined as the pyroelectric coefficient at temperature  $T$ .

The high frequency response of the pyroelectric is determined by the RC electrical time constant of the resistor and the effective capacitance of the electrical circuit. Fast laser pulses are electrically integrated by the detector circuit to produce an output voltage signal as illustrated in Figure 2. This output voltage has a sharply rising peak amplitude proportional to total pulse energy, followed by an exponential decay over a time scale determined by the RC electrical time constant. A pyroelectric operating in this mode can be useful as an energy sensor for pulsed lasers.

Pyroelectrics are amazingly versatile optical and infrared detectors. They maintain performance over a broad wavelength range spanning infrared, visible, and ultraviolet. They can be used to measure from nanowatts and nanojoules to watts and joules, over nine decades of dynamic range. These combined characteristics distinguish them from all other types of detectors. They can be rugged enough to withstand the direct beam of a high-energy pulsed laser or sensitive enough to measure nanowatts of blackbody radiation. Many techniques have been developed that enable pyroelectrics to be incorporated into measurement systems for a vast range of applications.

The pages that follow outline Coherent's diverse line of pyroelectric energy sensors that cover nearly every energy, wavelength, and speed range necessary for most applications.



MODELS J25, J25HR AND J25LP-1

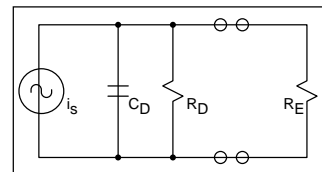


FIGURE 1: PYROELECTRIC EQUIVALENT CIRCUIT DIAGRAM

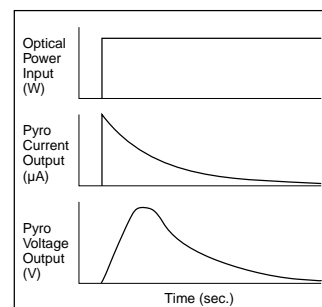


FIGURE 2: TYPICAL PYROELECTRIC DETECTOR OUTPUT FOR A STEP INPUT OF OPTICAL POWER

## POWER &amp; ENERGY

## Energy Sensor Summary Specifications

## Power &amp; Energy Meters

Part Number	Description	Wavelength Range (μm)	Energy		Max. Avg. Power (W)	Max. Rep. Rate (pps)	Max. Pulse Width (μs)	Detector Diameter (mm)	Detector Coating	Calibration Wavelength (nm)	Connector
			Min. (μJ)	Max. (mJ)							

## Power Sensors

## Small-Area High-Sensitivity Energy Sensors

0012-0031	J5-09	0.15-12	0.1	0.1	0.5	1000	10	9	Chrome	248	J DB-25
0012-0033	J5-09-2K	0.15-12	0.1	0.1	0.5	2000	10	9	Chrome	248	J DB-25
0012-4675	J5-09-10K	0.15-12	0.1	0.1	0.5	10000	10	9	Chrome	248	J DB-25
0010-0032	J5-09B	0.3-12	0.5	0.5	0.5	1000	10	9	Black	1064	J DB-25

## Energy Sensors

## Power &amp; Energy Accessories

## Small-Area BNC-Terminated Energy Sensors

0010-8602	J3S-10	0.19-1.1	0.0000002	0.0002	0.05	400 <sup>1</sup>	50 <sup>1</sup>	10	Silicon Detector	1064	BNC-terminated <sup>2</sup>
0010-1841	J3-02	0.15-12	0.2	0.2	1	400 <sup>1</sup>	50 <sup>1</sup>	2	Chrome	1064	BNC-terminated <sup>2</sup>
0010-1842	J3-05	0.15-12	0.2	1	2	400 <sup>1</sup>	50 <sup>1</sup>	5	Chrome	1064	BNC-terminated <sup>2</sup>
0010-6721	J3-09	0.15-12	0.4	2	2	400 <sup>1</sup>	50 <sup>1</sup>	9	Chrome	1064	BNC-terminated <sup>2</sup>
0010-0260	J4-05	0.3-12	0.2	1	2	400	50	5	Black	1064	BNC-terminated <sup>2</sup>
0011-0331	J4-09	0.3-12	0.4	2	2	300	100	9	Black	1064	BNC-terminated <sup>2</sup>

## Calibration &amp; Service

## Small-Area Energy Sensors

0011-5401	J8LP	0.3-12	2	20	0.5	400	50	8	Black	1064	BNC <sup>3</sup>
0011-5402	J8LP-4	0.15-12	2	20	0.5	1000	10	8	Chrome	248	BNC <sup>3</sup>
0011-1501	J9LP	0.3-12	2	20	2	400	50	8	Black	1064	BNC <sup>3</sup>

## Beam Diagnostics

## Large-Area High-Sensitivity Energy Sensors (25 mm)

0011-9245	J25LP-1A	0.3-12	1	4	5	100	100	25	Black	1064	J DB-25
0011-9246	J25LP-2A	0.3-3	1	4	5	100	100	25	Black	1064	J DB-25
0011-9247	J25LP-3A	0.19-3	1	4	5	1000	10	25	Chrome	248	J DB-25
0011-9248	J25LP-4A	0.15-12	1	4	5	1000	10	25	Chrome	248	J DB-25
0011-9451	J25LP-3A-2K	0.19-3	1	4	5	2000	10	25	Chrome	248	J DB-25
0011-9452	J25LP-4A-2K	0.15-12	1	4	5	2000	10	25	Chrome	248	J DB-25

## INDICES

## Large-Area High-Sensitivity Energy Sensors (50 mm)

0011-9241	J50LP-1A	0.3-12	3	7	5	50	250	50	Black	1064	J DB-25
0011-9242	J50LP-2A	0.3-3	3	7	5	50	250	50	Black	1064	J DB-25
0011-9243	J50LP-3A	0.19-3	2	7	5	1000	10	50	Chrome	248	J DB-25
0011-9244	J50LP-4A	0.15-12	2	7	5	1000	10	50	Chrome	248	J DB-25
0011-9543	J50LP-3A-2K	0.19-3	2	7	5	2000	10	50	Chrome	248	J DB-25
0011-9544	J50LP-4A-2K	0.15-12	2	7	5	2000	10	50	Chrome	248	J DB-25

<sup>1</sup> With Coherent meter in intermediate switch position.

<sup>2</sup> Sensor contains integral BNC plug.

<sup>3</sup> Sensor includes cable with BNC connector.

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## Energy Sensor Summary Specifications

Part Number	Description	Wavelength Range (µm)	Energy		Max. Avg. Power (W)	Max. Rep. Rate (pps)	Max. Pulse Width (µs)	Detector Diameter (mm)	Detector Coating	Calibration Wavelength (nm)	Connector
			Min. (µJ)	Max. (mJ)							

### Large-Area Energy Sensors (25 mm)

0010-6872	J25	0.3-12	200	1000	5	100	200	25	Black	1064	BNC-terminated <sup>1</sup>
0010-6874	J25HR	0.15-12	200	1000	5	1000	10	25	Chrome	248	BNC-terminated <sup>1</sup>
0010-8141	J25LP-1	0.3-12	200	1000	5	50	400	25	Black	1064	BNC <sup>2</sup>
0010-8142	J25LP-2	0.3-3	200	1000	5	50	400	25	Black	1064	BNC <sup>2</sup>
0010-8143	J25LP-3	0.19-3	200	1000	5	1000	10	25	Chrome	248	BNC <sup>2</sup>
0010-8145	J25LP-4	0.15-12	200	1000	5	1000	10	25	Chrome	248	BNC <sup>2</sup>

### Large-Area Energy Sensors (50 mm)

0010-6871	J50	0.3-12	400	2000	10	50	400	50	Black	1064	BNC-terminated <sup>1</sup>
0010-6873	J50HR	0.15-12	400	2000	10	1000	10	50	Chrome	248	BNC-terminated <sup>1</sup>
0010-8101	J50LP-1	0.3-12	400	2000	5	30	400	50	Black	1064	BNC <sup>2</sup>
0010-8102	J50LP-2	0.3-3	400	2000	5	30	400	50	Black	1064	BNC <sup>2</sup>
0010-8103	J50LP-3	0.19-3	400	2000	5	1000	10	50	Chrome	248	BNC <sup>2</sup>
0010-8105	J50LP-4	0.15-12	400	2000	5	1000	10	50	Chrome	248	BNC <sup>2</sup>

### Large-Area High-Damage Energy Sensors

0012-4185	J25LP-MB	0.19-11	200	1000	5	1000	15	25	MaxBlack	1064	BNC <sup>2</sup>
0012-4200	J45LP-MB	0.19-11	400	2000	5	250	160	45	MaxBlack	1064	BNC <sup>2</sup>
0012-3590	J25LP-MUV	0.15-1.1	200	1000	5	400	80	25	MaxUV	193	BNC <sup>2</sup>
0012-3605	J45LP-MUV	0.15-1.1	400	2000	5	200	160	45	MaxUV	193	BNC <sup>2</sup>

### Specialty Energy Sensors

0011-9380	J25LP-YAG	1064	10000	10000	20	50	300	22	N/A	1064	BNC <sup>2</sup>
0011-8205	J25LP-RUBY	694	5000	50000	20	5	3000	22	N/A	694	BNC <sup>2</sup>
0011-8200	J25LP-ERBI	2940	1000	5000	20	50	500	22	N/A	2940	BNC <sup>2</sup>
0011-6100	J100	0.3-12	400	5000	20	50	200	95	Black	1064	BNC-terminated <sup>1</sup>

### LM-P Series Energy Sensors

33-1140-000	LM-P-209	0.3-12	1	3	2	200	100	9	Black	1064	LM DB-25
33-1157-000	LM-P5	0.3-12	200	1000	5	40	600	25	Black	1064	LM DB-25
33-1181-000	LM-P5LP	0.3-12	200	1000	5	40	600	25	Black	1064	LM DB-25
33-1165-000	LM-P10	0.3-12	400	2000	10	10	2300	50	Black	1064	LM DB-25
33-1199-000	LM-P10LP	0.3-12	400	2000	10	10	2300	50	Black	1064	LM DB-25

<sup>1</sup> Sensor contains integral BNC plug.

<sup>2</sup> Sensor includes cable with BNC connector.

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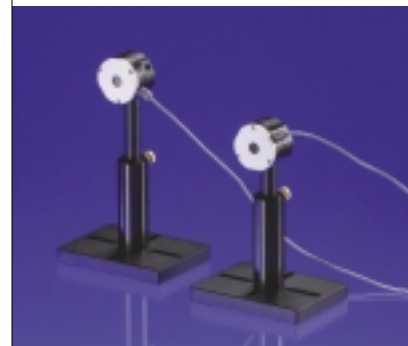
## Small-Area High-Sensitivity Energy Sensors\*

The J5-09 series of sensors combines a fast 9 mm active-area pyroelectric detector with a fast, high gain, operational amplifier. These sensors are optimized for linear integration of low energy, short laser pulses up to 10,000 pps.

The J5-09B model incorporates a high-absorbance black coating. This coating limits the repetition rate to 1,000 pps, but flattens the spectral response from the UV to the far-IR.

SPECIFICATIONS	J5-09	J5-09-2K	J5-09-10K	J5-09B
Wavelength Range ( $\mu\text{m}$ )	0.15 - 12	0.15 - 12	0.15 - 12	0.3 - 12
Energy Range <sup>1</sup>	0.1 $\mu\text{J}$ - 0.1 mJ	0.1 $\mu\text{J}$ - 0.1 mJ	0.1 $\mu\text{J}$ - 0.1 mJ	0.5 $\mu\text{J}$ - 0.5 mJ
Max. Avg. Power (W)	0.5	0.5	0.5	0.5
Typical Response (Rv) (V/J)	15000	15000	15000	3000
Max. Rep. Rate (pps)	1000	2000	10000	1000
Max. Pulse Width ( $\mu\text{s}$ )	10	10	10	10
Detector Coating	Chrome	Chrome	Chrome	Black
Detector Diameter (mm)	9	9	9	9
Dimensions (mm)	$\varnothing 38 \times 27$	$\varnothing 38 \times 27$	$\varnothing 38 \times 27$	$\varnothing 38 \times 27$
Calibration Uncertainty	$\pm 2\%$	$\pm 2\%$	$\pm 2\%$	$\pm 2\%$
Calibration Wavelength (nm)	248	248	248	1064
Connector Type	J DB-25	J DB-25	J DB-25	J DB-25
Cable Length (m)	2.5	2.5	2.5	2.5
Part Number	0012-0031	0012-0033	0012-4675	0010-0032

<sup>1</sup> Maximum energy is pulse-width dependent.



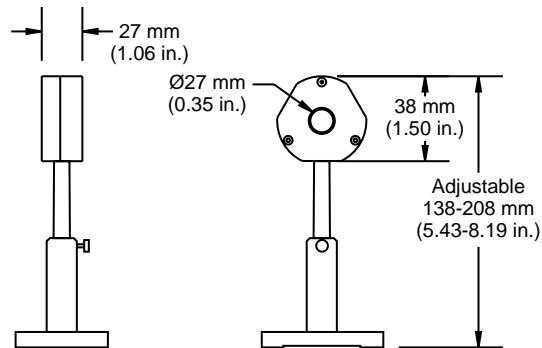
MODELS J5-09 AND J5-09B

- Energy range:  $\mu\text{J}$  to mJ
- Spectral range: DUV to far-IR
- High repetition rates to 10,000 pps
- 9 mm diameter aperture
- High sensitivity

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Small-Area High-Sensitivity Energy Sensors



Part Number	Description
0012-0031	J5-09
0012-0033	J5-09-2K
0012-4675	J5-09-10K
0012-0032	J5-09B

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## Small-Area BNC-Terminated Energy Sensors\*

These sensors include an integrated, fast pre-amplifier circuit, and are optimized for measuring low-energy, high-repetition-rate lasers. The sensors are BNC-terminated, and are ideal for use with an oscilloscope.

The J3- and J4- models utilize a pyroelectric detector, while the J3S-10 is based on a silicon detector. All sensors are EMI-shielded and contain a noise-free, onboard 9V battery power supply and a low-battery LED indicator.

The J3- models feature a broad spectral response and are ideal for high-repetition-rate, pulsed lasers in the sub-microjoule to low millijoule range. J4- models incorporate a high-absorbance black coating and excel at absolute pulse-to-pulse energy measurements at repetition rates up to 400 Hz.

A 1.5 m cable is shipped with each sensor.

SPECIFICATIONS	J3S-10	J3-02	J3-05	J3-09
Wavelength Range (µm)	0.19 - 1.1	0.15 - 12	0.15 - 12	0.15 - 12
Energy Range <sup>1</sup>	0.2 pJ - 0.2 µJ	0.2 µJ - 0.2 mJ	0.2 µJ - 1 mJ	0.4 µJ - 2 mJ
Max. Avg. Power	50 mW	1W	2W	2W
Typical Response (Rv) (V/J)	6.5 E +8	8500	2500	1200
Max. Rep. Rate (pps)	400	400	400	400
Max. Pulse Width <sup>2</sup>				
Long (µs)	250	250	250	250
Intermediate (µs)	50	50	50	50
Short (µs)	5	5	5	5
Detector Coating	Silicon	Chrome	Chrome	Chrome
Detector Diameter (mm)	10	2	5	9
Dimensions (mm)	∅ 48 x 108	∅ 48 x 108	∅ 48 x 108	∅ 48 x 108
Calibration Uncertainty	±10%	±2%	±2%	±2%
Calibration Wavelength (nm)	1064	1064	1064	1064
Connector Type	BNC	BNC	BNC	BNC
Cable Length (m)	1.5 (separate)	1.5 (separate)	1.5 (separate)	1.5 (separate)
Part Number	0010-8602	0010-1841	0010-1842	0010-6721

<sup>1</sup> Maximum energy is pulse-width dependent.

<sup>2</sup> Long, Intermediate, Short refer to time constant of the sensor for which there is a 3-position switch.

SPECIFICATIONS	J4-05	J4-09
Wavelength Range (µm)	0.3 - 12	0.3 - 12
Energy Range <sup>1</sup>	0.2 µJ - 1 mJ	0.4 µJ - 2 mJ
Max. Avg. Power	2	2
Typical Response (Rv) (V/J)	2500	1200
Max. Rep. Rate (pps)	400	300
Max. Pulse Width (µs)	50	100
Detector Coating	Black	Black
Detector Diameter (mm)	5	9
Dimensions (mm)	∅ 48 x 108	∅ 48 x 108
Calibration Uncertainty	±2%	±2%
Calibration Wavelength (nm)	1064	1064
Connector Type	BNC	BNC
Cable Length (m)	1.5 (separate)	1.5 (separate)
Part Number	0010-0260	0011-0331

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



MODELS J3-09 AND J4-09

- Energy range: nJ to mJ
- Spectral range: DUV to far-IR
- High repetition rates to 20,000 pps (with scope)
- Ideal for use with oscilloscopes
- 2 mm to 10 mm diameter aperture
- High sensitivity



### Small-Area BNC-Terminated Energy Sensors

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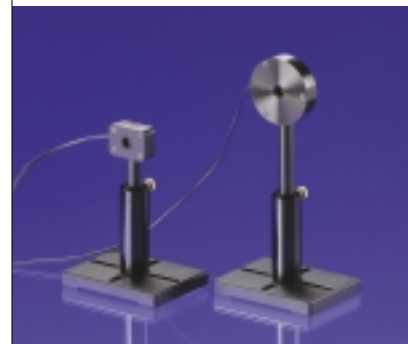
## Small-Area Energy Sensors\*

These compact, low-profile sensors are well suited to low-energy laser measurement needs. They feature a high-voltage response, typically 600 V/J, which results in a measurement range from 2  $\mu$ J to 20 mJ, with 200 nJ resolution. Their small size makes these sensors easy to integrate into systems.

J8LP includes a flat-black absorbing coating and 400 pps repetition rate capability, while the J8LP-4 features a partially absorbing, metallic coating and 1,000 pps capability. J9LP employs a slightly larger package than the J8LP to increase its maximum average power rating.

SPECIFICATIONS	J8LP	J8LP-4	J9LP
Wavelength Range ( $\mu$ m)	0.3 - 12	0.15 - 12	0.3 - 12
Energy Range <sup>1</sup>	2 $\mu$ J - 20 mJ	2 $\mu$ J - 20 mJ	2 $\mu$ J - 20 mJ
Max. Avg. Power	0.5	0.5	2
Typical Response (Rv) (V/J)	600	600	600
Max. Rep. Rate (pps)	400	1000	400
Max. Pulse Width ( $\mu$ s)	50	10	50
Detector Coating	Black	Chrome	Black
Detector Diameter (mm)	8	8	8
Dimensions (mm)	28 x 38 x 15	28 x 38 x 15	$\varnothing$ 58 x 14
Calibration Uncertainty	$\pm$ 2%	$\pm$ 2%	$\pm$ 2%
Calibration Wavelength (nm)	1064	248	1064
Connector Type	BNC	BNC	BNC
Cable Length (m)	1.5	1.5	1.5
Part Number	0011-5401	0011-5402	0011-1501

<sup>1</sup> Maximum energy is pulse-width dependent.



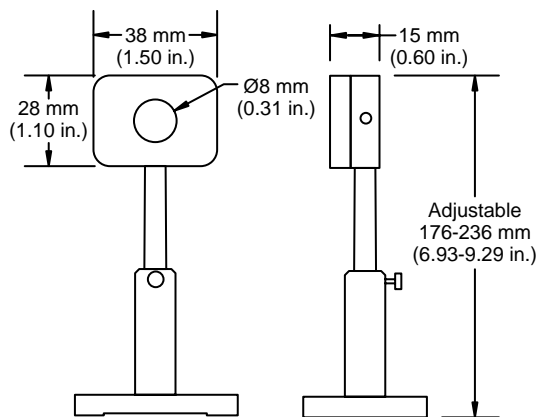
MODELS J8LP AND J9LP

- Energy range:  $\mu$ J to mJ
- Spectral range: UV to far-IR
- Repetition rates to 1,000 pps
- 8 mm diameter aperture
- Low-profile package

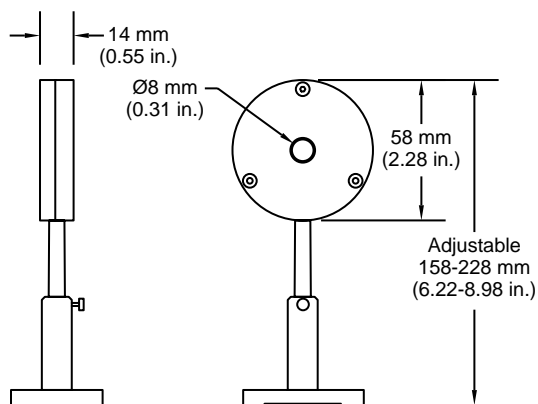
\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



Small-Area Energy Sensors



Part Number	Description
0011-5401	J8LP
0011-5402	J8LP-4



Part Number	Description
0011-1501	JgLP

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## Large-Area High-Sensitivity Energy Sensors (25 mm)\*

These sensors are intended for use with low-energy, large-diameter laser beams. They feature good stability and spatial uniformity, and include an integrated pre-amplifier.

Sensors ending with a -1A incorporate a broadband coating, and sensors ending with a -2A include an integral UV quartz diffuser; this provides some laser attenuation and beam spreading, thus extending the pulse energy range.

Models ending with -3A utilize a chrome coating and are suitable for use in the DUV. They also include a quartz diffuser. Models ending in -4A have this same performance, but do not have the quartz diffuser.

Models ending in -2K can measure to 2 kHz.

SPECIFICATIONS	J25LP-1A	J25LP-2A	J25LP-3A	J25LP-4A	J25LP-3A-2K	J25LP-4A-2K
Wavelength Range (μm)	0.3 - 12	0.3 - 3	0.19 - 3	0.15 - 12	0.19 - 3	0.15 - 12
Energy Range <sup>1</sup>	1 μJ - 4 mJ	1 μJ - 4 mJ	1 μJ - 4 mJ	1 μJ - 4 mJ	1 μJ - 4 mJ	1 μJ - 4 mJ
Max. Avg. Power	5	5	5	5	5	5
Typical Response (Rv) (V/J)	350	350	250	400	250	400
Max. Rep. Rate (pps)	100	100	1000	1000	2000	2000
Max. Pulse Width (μs)	100	100	10	10	10	10
Detector Coating	Black	Black	Chrome	Chrome	Chrome	Chrome
Quartz Diffuser	-	Yes	Yes	-	Yes	-
Detector Diameter (mm)	25	25	25	25	25	25
Dimensions (mm)	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16
Calibration Uncertainty	±2%	±2%	±2%	±2%	±2%	±2%
Calibration Wavelength (nm)	1064	1064	248	248	248	248
Connector Type	J DB-25	J DB-25	J DB-25	J DB-25	J DB-25	J DB-25
Cable Length (m)	2.5	2.5	2.5	2.5	2.5	2.5
Part Number	0011-9245	0011-9246	0011-9247	0011-9248	0011-9451	0011-9542

<sup>1</sup> Maximum energy is pulse-width dependent.



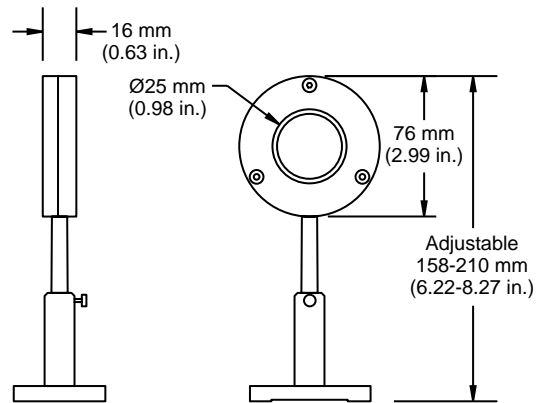
MODEL J25LP-4A

- Energy range: μJ to mJ
- Spectral range: DUV to far-IR
- Repetition rates to 2,000 pps
- 25 mm diameter aperture
- Low-profile package
- High sensitivity

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Large-Area High-Sensitivity Energy Sensors (25 mm)



Part Number	Description
0011-9245	J25LP-1A
0011-9246	J25LP-2A
0011-9247	J25LP-3A
0011-9248	J25LP-4A
0011-9541	J25LP-3A-2K
0011-9542	J25LP-4A-2K

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## Large-Area High-Sensitivity Energy Sensors (50 mm)\*

These sensors are intended for use with low-energy, large-diameter laser beams. They feature good stability and spatial uniformity, and include an integrated pre-amplifier.

Sensors ending with a -1A incorporate a broadband coating, and sensors ending with a -2A include an integral UV quartz diffuser; this provides some laser attenuation and beam spreading, thus extending the pulse energy range.

Models ending with -3A utilize a chrome coating and are suitable for use in the DUV. They also include a quartz diffuser. Models ending in -4A have this same performance, but do not have the quartz diffuser.

Models ending in -2K can measure to 2 kHz.

SPECIFICATIONS	J50LP-1A	J50LP-2A	J50LP-3A	J50LP-4A	J50LP-3A-2K	J50LP-4A-2K
<b>Wavelength Range (μm)</b>	0.3 - 12	0.3 - 3	0.19 - 3	0.15 - 12	0.19 - 3	0.15 - 12
<b>Energy Range<sup>1</sup></b>	3 μJ - 7 mJ	3 μJ - 7 mJ	2 μJ - 7 mJ	2 μJ - 7 mJ	2 μJ - 7 mJ	2 μJ - 7 mJ
<b>Max. Avg. Power</b>	5	5	5	5	5	5
<b>Typical Response (Rv) (V/J)</b>	180	180	150	180	150	180
<b>Max. Rep. Rate (pps)</b>	50	50	1000	1000	2000	2000
<b>Max. Pulse Width (μs)</b>	250	250	10	10	10	10
<b>Detector Coating</b>	Black	Black	Chrome	Chrome	Chrome	Chrome
<b>Quartz Diffuser</b>	-	Yes	Yes	-	Yes	-
<b>Detector Diameter (mm)</b>	50	50	50	50	50	50
<b>Dimensions (mm)</b>	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16
<b>Calibration Uncertainty</b>	±2%	±2%	±2%	±2%	±2%	±2%
<b>Calibration Wavelength (nm)</b>	1064	1064	248	248	248	248
<b>Connector Type</b>	J DB-25	J DB-25	J DB-25	J DB-25	J DB-25	J DB-25
<b>Cable Length (m)</b>	2.5	2.5	2.5	2.5	2.5	2.5
<b>Part Number</b>	0011-9241	0011-9242	0011-9243	0011-9244	0011-9543	0011-9544

<sup>1</sup> Maximum energy is pulse-width dependent.



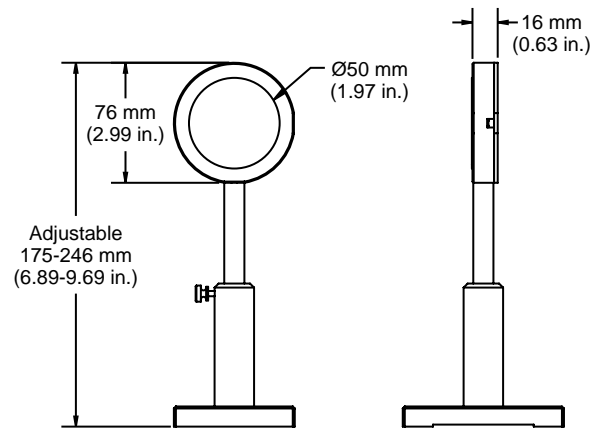
MODEL J50LP-1A

- Energy range: μJ to mJ
- Spectral range: DUV to far-IR
- Repetition rates to 2,000 pps
- 50 mm diameter aperture
- Low-profile package
- High sensitivity

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Large-Area High-Sensitivity Energy Sensors (50 mm)



Part Number	Description
0011-9241	J50LP-1A
0011-9242	J50LP-2A
0011-9243	J50LP-3A
0011-9244	J50LP-4A
0011-9543	J50LP-3A-2K
0011-9544	J50LP-4A-2K

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## Large-Area High-Damage Energy Sensors\*

The J25LP-MB and J45LP-MB use a proprietary coating technology that delivers greater speed, sensitivity, scratch resistance and damage threshold than traditional black-painted detectors.

The J25LP-MUV and J45LP-MUV sensors are designed specifically for use in excimer laser applications where energy density damage issues are of concern. With a damage threshold of 250 mJ/cm<sup>2</sup>, these sensors deliver five times improvement over our black paint and chrome surfaces. They also exhibit exceptional spatial uniformity.

SPECIFICATIONS	J25LP-MB	J25LP-MUV	J45LP-MB	J45LP-MUV
Wavelength Range (µm)	0.19 - 11	0.15 - 1.1	0.19 - 11	0.15 - 1.1
Energy Range <sup>1</sup>	0.2 mJ - 1J	0.2 mJ - 1J	0.4 mJ - 2J	0.4 mJ - 2J
Max. Avg. Power	5	5	5	5
Typical Response (Rv) (V/J)	20	20	15	15
Max. Rep. Rate (pps)	1000	400	250	200
Max. Pulse Width (µs)	15	80	160	160
Detector Coating	MaxBlack	MaxUV	MaxBlack	MaxUV
Detector Diameter (mm)	25	25	45	45
Dimensions (mm)	Ø 58 x 14	Ø 58 x 14	Ø 76 x 16	Ø 76 x 16
Calibration Uncertainty	±3%	±3%	±3%	±3%
Calibration Wavelength (nm)	1064	193	1064	193
Connector Type	BNC	BNC	BNC	BNC
Cable Length (m)	1.5	1.5	1.5	1.5
Part Number	0012-4185	0012-3590	0012-4200	0012-3605

<sup>1</sup> Maximum energy is pulse-width dependent.



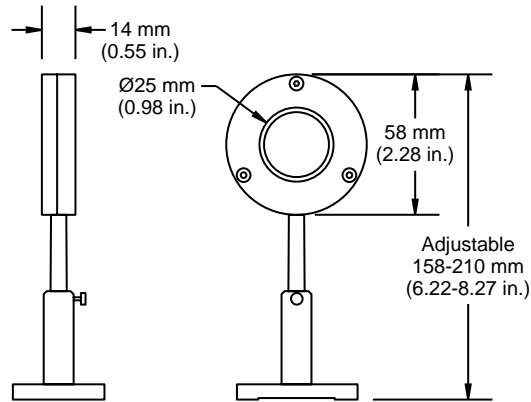
MODELS J45LP-MUV AND J25LP-MB

- Energy range: sub-mJ to J
- Spectral range: DUV to far-IR
- Repetition rates to 1,000 pps
- High damage threshold
- Scratch-resistant coating
- 25 mm and 45 mm diameter aperture
- Low-profile package

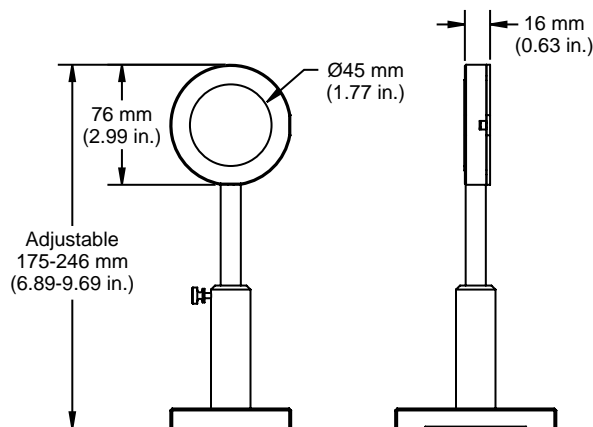
\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Large-Area High-Damage Energy Sensors



Part Number	Description
0012-4185	J25LP-MB
0012-3590	J25LP-MUV



Part Number	Description
0012-4200	J45LP-MB
0012-3605	J45LP-MUV

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## Large-Area Energy Sensors (25 mm)\*

The J25 provides a nearly flat spectral response from the UV to the far-IR. The J25HR utilizes a partially absorptive metallic coating, allowing these models to be used at high pulse repetition rates.

Sensors with an LP in the product name are low profile, working well in tight spaces. The J25LP-2 and J25LP-3 have an integral UV quartz diffuser; this provides some laser attenuation and beam spreading, thus extending their pulse energy range.

A 1.5 m BNC cable is included with each sensor.



MODELS J25, J25HR AND J25LP-1

SPECIFICATIONS	J25	J25HR	J25LP-1	J25LP-2	J25LP-3	J25LP-4
<b>Wavelength Range (μm)</b>	0.3 - 12	0.15 - 12	0.3 - 12	0.3 - 3	0.19 - 3	0.15 - 12
<b>Energy Range<sup>1</sup></b>	0.2 mJ - 1J	0.2 mJ - 1J	0.2 mJ - 1J	0.2 mJ - 1J	0.2 mJ - 1J	0.2 mJ - 1J
<b>Max. Avg. Power</b>	5	5	5	5	5	5
<b>Typical Response (Rv) (V/J)</b>	9	16	17	17	10	17
<b>Max. Rep. Rate (pps)</b>	100	1000	50	50	1000	1000
<b>Max. Pulse Width (μs)</b>	200	10	400	400	10	10
<b>Detector Coating</b>	Black	Chrome	Black	Black	Chrome	Chrome
<b>Quartz Diffuser</b>	-	-	-	Yes	Yes	-
<b>Detector Diameter (mm)</b>	25	25	25	25	25	25
<b>Dimensions (mm)</b>	∅ 70 x 48	∅ 70 x 48	∅ 58 x 14	∅ 58 x 14	∅ 58 x 14	∅ 58 x 14
<b>Calibration Uncertainty</b>	±2%	±2%	±2%	±2%	±2%	±2%
<b>Calibration Wavelength (nm)</b>	1064	248	1064	1064	248	248
<b>Connector Type</b>	BNC	BNC	BNC	BNC	BNC	BNC
<b>Cable Length (m)</b>	1.5 (cable separate)	1.5 (cable separate)	1.5	1.5	1.5	1.5
<b>Part Number</b>	0010-6872	0010-6874	0010-8141	0010-8142	0010-8143	0010-8145

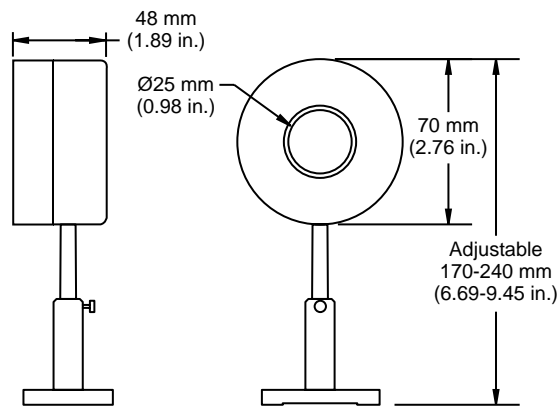
<sup>1</sup> Maximum energy is pulse-width dependent.

- Energy range: mJ to J
- Spectral range: DUV to far-IR
- Repetition rates to 1,000 pps
- 25 mm diameter aperture
- Low-profile package (LP models)

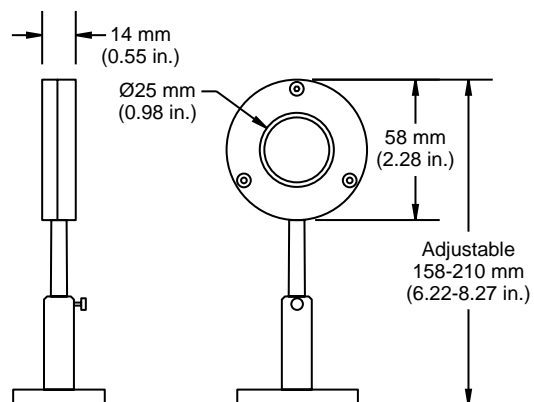
\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Large-Area Energy Sensors (25 mm)



Part Number	Description
0010-6872	J25
0010-6874	J25HR



Part Number	Description
0010-8141	J25LP-1
0010-8142	J25LP-2
0010-8143	J25LP-3
0010-8145	J25LP-4

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## Large-Area Energy Sensors (50 mm)\*

The J50 provides a nearly flat spectral response from the UV to the far-IR. The J50HR utilizes a partially absorptive metallic coating, allowing these models to be used at high pulse repetition rates.

Sensors with an LP in the product name are low profile, working well in tight spaces. The J50LP-2 and J50LP-3 have an integral UV quartz diffuser; this provides some laser attenuation and beam spreading, thus extending their pulse energy range.

SPECIFICATIONS	J50	J50HR	J50LP-1	J50LP-2	J50LP-3	J50LP-4
Wavelength Range (µm)	0.3 - 12	0.15 - 12	0.3 - 12	0.3 - 3	0.19 - 3	0.15 - 12
Energy Range <sup>1</sup>	0.4 mJ - 2J	0.4 mJ - 2J	0.4 mJ - 2J	0.4 mJ - 2J	0.4 mJ - 2J	0.4 mJ - 2J
Max. Avg. Power	10	10	5	5	5	5
Typical Response (Rv) (V/J)	2	5	9	9	4	9
Max. Rep. Rate (pps)	50	1000	30	30	1000	1000
Max. Pulse Width (µs)	400	10	400	400	10	10
Detector Coating	Black	Chrome	Black	Black	Chrome	Chrome
Quartz Diffuser	-	-	-	Yes	Yes	-
Detector Diameter (mm)	50	50	50	50	50	50
Dimensions (mm)	Ø 70 x 48	Ø 70 x 48	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16	Ø 76 x 16
Calibration Uncertainty	±2%	±2%	±2%	±2%	±2%	±2%
Calibration Wavelength (nm)	1064	248	1064	1064	248	248
Connector Type	BNC	BNC	BNC	BNC	BNC	BNC
Cable Length (m)	1.5 (cable separate)	1.5 (cable separate)	1.5	1.5	1.5	1.5
Part Number	0010-6871	0010-6873	0010-8101	0010-8102	0010-8103	0010-8105

<sup>1</sup> Maximum energy is pulse-width dependent.



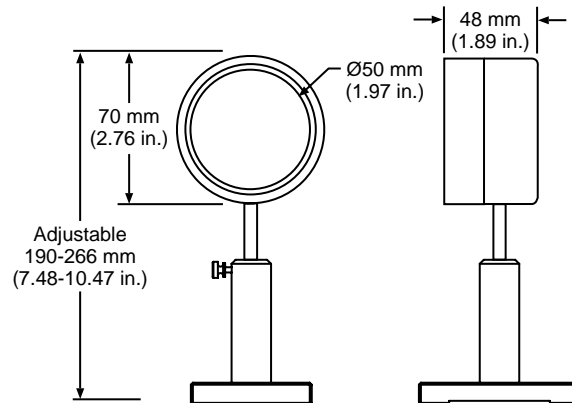
MODELS J50LP-1, J50HR AND J50

- Energy range: mJ to J
- Spectral range: DUV to far-IR
- Repetition rates to 1,000 pps
- 50 mm diameter aperture
- Low-profile package (LP models)

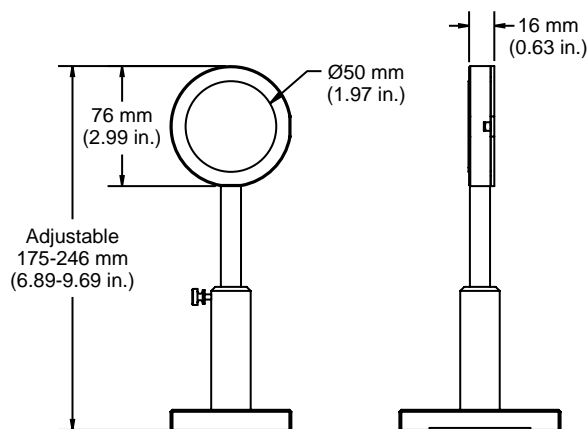
\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



## Large-Area Energy Sensors (50 mm)



Part Number	Description
0010-6871	J50
0010-6873	J50HR



Part Number	Description
0010-8101	J50LP-1
0010-8102	J50LP-2
0010-8103	J50LP-3
0010-8105	J50LP-4

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## Specialty Energy Sensors\*

These sensors are optimized for specific lasers and applications.

The J25LP-YAG, calibrated at 1064 nm, can withstand a punishing 10J/cm<sup>2</sup> from a Q-switched laser.

The J25LP-RUBY, calibrated at 694 nm, can withstand 50J maximum energy.

The J25LP-ERBI, calibrated at 2940 nm, is ideal for skin resurfacing fluence checks and can easily handle energy levels as high as 5J.

The J100, calibrated at 1064 nm, offers an exceptionally large measuring aperture for use with large-area pulsed laser beams. The 95 mm diameter active area is ideal for large-beam laser rangefinder applications and high energy/power divergent diode arrays.

The J100 incorporates a BNC connector and ships with a 1.5 m BNC cable.

SPECIFICATIONS	J25LP-YAG	J25LP-RUBY	J25LP-ERBI	J100
Wavelength Range	1064 nm	694 nm	2940 nm	0.3 - 12 μm
Energy Range <sup>1</sup>	10 mJ - 10J	50 mJ - 50J	1 mJ - 5J	0.4 mJ - 5J
Max. Avg. Power	20	20	20	20
Typical Response (Rv) (V/J)	2	0.1	2	3
Max. Rep. Rate (pps)	50	5	50	50
Max. Pulse Width	300 μs	3 ms	500 μs	200 μs
Detector Coating	Custom Attenuator	Custom Attenuator	Custom Attenuator	Black
Detector Diameter (mm)	22	22	22	95
Dimensions (mm)	Ø 58 x 21	Ø 58 x 21	Ø 58 x 21	Ø 153 x 65
Calibration Uncertainty	±3%	±3%	±3%	±2%
Calibration Wavelength (nm)	1064	694	2940	1064
Connector Type	BNC	BNC	BNC	BNC
Cable Length (m)	1.5	1.5	1.5	1.5 (separate)
Part Number	0011-9380	0011-8205	0011-8200	0011-6100

<sup>1</sup> Maximum energy is pulse-width dependent.



MODELS J25LP-ERBI AND J100

- Optimized for high-energy and long-pulse lasers
- Equipped with special absorbing filters for specific wavelengths
- Low-profile packages (LP models)

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



Specialty Energy Sensors

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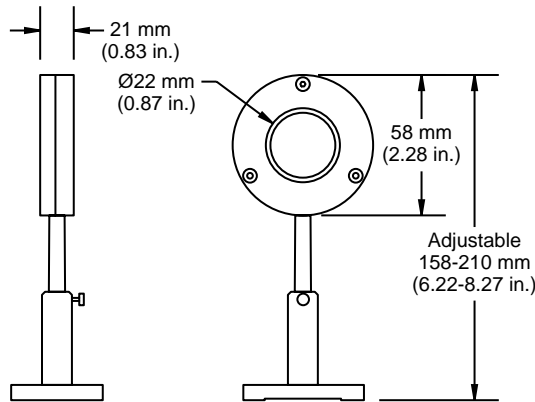
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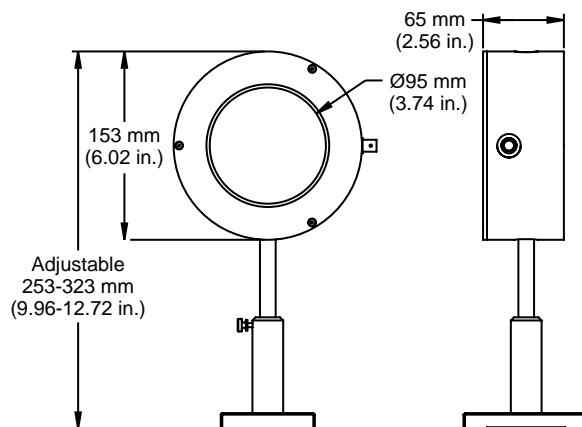
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Part Number	Description
0011-9380	J25LP-YAG
0011-8205	J25LP-RUBY
0011-8200	J25LP-ERBI



Part Number	Description
0011-6100	J100

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## LM-P Series Energy Sensors\*

These sensors were designed to function with FieldMaster-GS and Ultima LabMaster power and energy meters. All sensors feature a high-absorbance black coating. Active areas range from 9 mm to 50 mm.

SPECIFICATIONS	LM-P-209	LM-P5	LM-P5LP	LM-P10	LM-P10LP
Wavelength Range ( $\mu\text{m}$ )	0.3 - 12	0.3 - 12	0.3 - 12	0.3 - 12	0.3 - 12
Energy Range <sup>1</sup>	1 $\mu\text{J}$ - 3 mJ	0.2 mJ - 1J	0.2 mJ - 1J	0.4 mJ - 2J	0.4 mJ - 2J
Max. Avg. Power	2	5	5	10	10
Typical Response (Rv) (V/J)	1200	9	17	2	9
Max. Rep. Rate (pps)	200	40	40	10	10
Max. Pulse Width	100 $\mu\text{s}$	0.6 ms	0.6 ms	2.3 ms	2.3 ms
Detector Coating	Black	Black	Black	Black	Black
Detector Diameter (mm)	9	25	25	50	50
Dimensions (mm)	$\varnothing$ 48 x 108	$\varnothing$ 70 x 48	$\varnothing$ 58 x 14	$\varnothing$ 70 x 48	$\varnothing$ 76 x 16
Calibration Uncertainty	$\pm$ 2%	$\pm$ 2%	$\pm$ 2%	$\pm$ 2%	$\pm$ 2%
Calibration Wavelength (nm)	1064	1064	1064	1064	1064
Connector Type	LM DB-25	LM DB-25	LM DB-25	LM DB-25	LM DB-25
Cable Length (m)	1.5	1.5	1.5	1.5	1.5
Part Number	33-1140-000	33-1157-000	33-1181-000	33-1165-000	33-1199-000

<sup>1</sup> Maximum energy is pulse-width dependent.



MODELS LM-5, LM-P10, LM-P-209, LM-P5LP AND LM-P10LP

- Energy range:  $\mu\text{J}$  to J
- Spectral range: UV to far-IR
- Repetition rates to 200 pps
- Low-profile packages (LP models)

\* See the Power and Energy Sensor Compatibility Charts on page 11 for compatibility with meters.



LM-P Series Energy Sensors

POWER & ENERGY

Power & Energy Meters

Power Sensors

Energy Sensors

Power & Energy Accessories

Custom & OEM

Calibration & Service

BEAM DIAGNOSTICS & SPECTRAL ANALYSIS

Beam Diagnostics

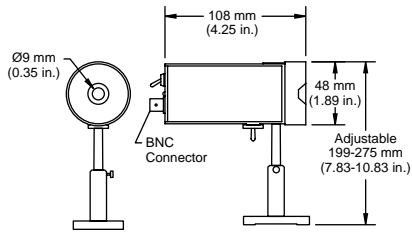
Spectral Analysis

INDICES

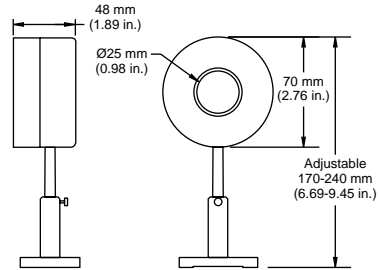
Laser Cross-Reference Index

Part Number Index

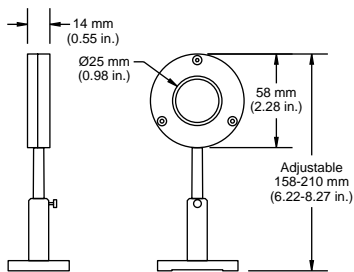
Product Name Index



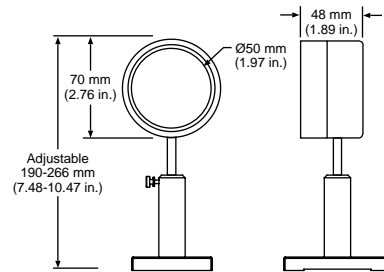
Part Number	Description
33-1140-000	LM-P-209



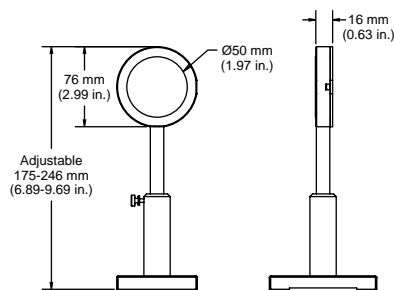
Part Number	Description
33-1157-000	LM-P5



Part Number	Description
33-1181-000	LM-P5LP



Part Number	Description
33-1165-000	LM-P10



Part Number	Description
33-1199-000	LM-P10LP