Polytec

Power Meters
Energy Meters

based on

- **Pyroelectric detectors**
- **Si-, Ge- and InGaAs- detectors**
- **Thermopile detectors**

especially for laser applications

Advancing Measurements by Light

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Product Overview

Universal Radiometer

This tremendously versatile instrument measures cw power, average power, and true energy per pulse up to 2 kHz, over a wide range of intensities and wavelengths. The single-channel Rm-3700 has a custom LCD with numeric and bargraph displays, statistical analysis of pulse sets, background cancel, autoranging, and a high-speed Rs-232 computer interface. Other Rm-3700 features include audible tuning, reference ratioing, and battery/AC operation.

Digital Energy Meters

The Rj-7600 Series Energy Meters measure the true integrated energy of discrete pulses, pJ to J, UV to far-IR, single-shot to 40 Hz. The single-channel Rj-7610 features an easy to read digital display, statistical analysis for sets of 10 or 100 pulses (mean, minimum, and maximum energies, plus standard deviation), GPIB computer interface, and 0-10VDC analog output. Other features include single-shot (capture and hold) mode, selectable correction factor, and internal/external triggering. The Rj-7620 adds a second channel for real-time ratioing.

Digital Power Meters

The Rk-5700 Series Power Meters are distinguished by their ability to perform total power (cw and average), absolute radiometry, and irradiance measurements. Integral synchronous detection (lock-in amplifier / optical chopper) support for the RkP-500 Series Probes provides superior signal-to-noise ratio and sensitivity. The single-channel Rk-5710 features Watts and dBm display modes, selectable internal/external chopping, GPIB computer interface, and a 0-10VDC analog output. Other functions include autoranging, background cancel, and variable averaging time. The dual-channel Rk-5720 accommodates a second probe for real-time ratioing over 12 decades of dynamic range.

Analog Power Meters

The Rk-3000 Series are dedicated power measurement systems consisting of an analog power readout and a compact detector head. The readouts feature an oversized, backlit, dual-scale analog meter, range selector knob, and 0-1VDC analog output. Several different models are available, ranging from the Rk-3260 Silicon based system for low-level, UV to near-IR (0.18 - 1.1 μm) applications to the Thermopile based systems for mid-to-high power (mW to 150W), UV to far-IR applications. All models are designed to have a fast response time with minimal overshoot for easy laser tuning.

Electrically Calibrated Pyroelectric Radiometer

Developed in conjunction with NIST, the Rs-5900 ECPR is a ±1% absolute accuracy radiometric transfer standard for the visible and near-IR (0.25 - 2.0 μm). The RsP-590 Pyroelectric Probe requires no cooling, and maintains ±1% accuracy from 1 μW to 100 mW. Option RsIR extends the ±1% accuracy to > 20 μm, and the RsFO Fiber Optic option configures the ECPR as a transfer standard for fiber optic instrumentation. The ECPR uses an auto-nulling, electrical substitution technique that allows the instrument to be referenced against NIST electrical standards, insuring maximum accuracy and precision. Unlike most electrically calibrated radiometers, there is a direct correlation between electrical and optical heating because the same material serves as both the optical absorber and electrical heating element.

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Energy Probes

Model	Detector	A (cm^2)	(μm)	Energy	PRR (Hz)	t_{max}
RjP-400 Series	**Use with: Universal Radiometers**					
RjP-435	Cavity Pyroelectric	1.0	0.2 - 20	1 μJ - 1 J	200	200 μs
RjP-445	Flat Pyroelectric	1.0	0.2 - 20	1 μJ - 1 J	1000	50 μs
RjP-465	Silicon	1.0	0.18 - 1.1	1 pJ - 250 nJ	500	50 μs
RjP-466	Silicon	1.0	0.18 - 1.1	1 pJ - 250 nJ	2000	10 μs
RjP-485a	InGaAs	0.2	0.7 - 1.8	1 pJ - 250 nJ	200	200 μs
RjP-495	Germanium	1.3	0.7 - 1.8	10 pJ - 3 μJ	200	200 μs
RjP-600 Series	**Use with: Universal Radiometers**					
RjP-636	Cavity Pyroelectric	1.0	0.2 - 20	1 μJ - 1 J	200	200 μs
RjP-637	Cavity Pyroelectric	1.0	0.2 - 20	1 μJ - 1 J	500	50 μs
RjP-667	Silicon	1.0	0.18 - 1.1	1 pJ - 250 nJ	500	50 μs
RjP-668	Silicon	1.0	0.18 - 1.1	1 pJ - 250 nJ	2000	10 μs
RjP-700 Series	**Use with: Universal Radiometers; Digital Energy Meters**					
RjP-734	Cavity Pyroelectric	5.0	0.2 - 20	10 μJ - 1 J	40	1 ms
RjP-735	Cavity Pyroelectric	1.0	0.2 - 20	1 μJ - 1 J	40	1 ms
RjP-736	Flat Pyroelectric	20.0	0.2 - 20	100 mJ - 10 J	40	1 ms
RjP-765a	Silicon	1.0	0.18 - 1.1	1 pJ - 1 μJ	40	0.5 ms

Power Probes

Model	Detector	A (cm^2)	(μm)	Power	Comments
RkP-400 Series	**Use with: Universal Radiometers**				
RkP-465	Silicon	1.0	0.18 - 1.1	1 pW - 1 mW	
RkP-485a	InGaAs	0.2	0.7 - 1.8	1 pW - 1 mW	
RkP-500 Series	**Use with: Digital Power Meters**				
RkP-575	Cavity Pyroelectric	1.0	0.2 - 20	1 μW - 10 W	Uses Rk-570C Chopper
RkP-576a	Silicon	1.0	0.18 - 1.1	1 pW - 1 mW	Uses Rk-570C Chopper
RkT-Series	**Use with: Universal Radiometers; Digital Power Meters**				
RkT-10	Surf Abs Thermopile	2.0	0.2 - 20	1 mW - 10 W	Air cooled
RkT-30-CAL	Surf Abs Thermopile	2.5	0.2 - 20	3 mW - 30 W	Air cooled
RkT-150F-CAL	Surf Abs Thermopile	2.5	0.2 - 20	10 mW - 150 W	Fan cooled

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Rm-3700
Universal Radiometer

- **Measure Both Power and Energy**
- **2 kHz Rs-232 Computer Interface**
- **Battery and AC Power**
- **Low Cost**

The Rm-3700 Universal Radiometer, when paired with the correct probe, can measure cw and average power (in Watts), as well as the energy (in Joules) of individual pulses up to 2 kHz, over a wide range of intensities and wavelengths. A high-speed Rs-232 computer interface, full statistical analysis of pulse sets, battery/AC power, and audible tuning are just some of the standard features. This tremendous versatility makes it the ideal instrument for research labs, universities, hospitals, and other facilities with multiple light sources and applications.

The front panel features a custom, two-color LCD display, dual-use numeric/function keypad, and power switch. The high-contrast, backlit LCD exhibits excellent "readability" over a wide viewing angle. The backlighting can be turned off for no-light measurements.

The display consists of a 4 digit numeric readout of the power/energy with the appropriate engineering notation units, a two-color bar graph with the 75 - 100% portion in red, and various enunciators that light when appropriate.

The Rm-3700 measures the true power of cw sources and the average power of pulsed (or chopped) sources. The Background Cancel function can be used to remove background noise from the measurement, leaving only the signal. When activated it records a power level, which is then subtracted from each subsequent measurement until the feature is deactivated. The power can be displayed in Watts or in dBm.

The Rm-3700 can measure the true integrated energy of discrete pulses up to 2 kHz and pass it in real time over the Rs-232 computer interface. Further, Event Averaging allows the operator to configure a number of pulses (2 - 2,000 pulses/set)

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Rj-7600
Series Energy Meter

- **UV to Far-IR; pJ to Joules**
- **Single or Dual Channel**
- **Statistical Analysis Package**
- **GPIB Computer Interface**

The Rj-7600 Series Energy Meters work with a variety of probes - pyroelectric, silicon, and thermopile - to measure true energy per pulse from single-shot to 40 Hz, picojoules to Joules, UV to far-IR. Sets of 10 or 100 pulses can be statistically analyzed, and data can be transferred to computer via the IEEE-488 GPIB computer interface. The Rj-7620 Dual-Channel Energy Meter accepts two probes and simultaneously displays the energy incident on Channels A and B, as well as the ratio of Channel B/Channel A.

The Rj-7600 Series Energy Meters feature a high-contrast, backlit, alphanumeric LCD display, dual-use numeric/function keys, and power switch. The default display mode continuously shows the Channel A energy per pulse, the number of pulses to be averaged (1, 10, or 100), a running counter of the number of events elapsed in the current pulse set (10 and 100 events only), and whether the instrument is in Local or Remote mode. In addition to this the Rj-7620 Dual Channel Energy Meter also displays the Channel B energy per pulse and the energy ratio (B/A).

When Averaging is set to 10 or 100 events the MODE key toggles the LCD between the three available displays: default, minimum and maximum energy (Channel A for Rj-7610; A and B for Rj-7620), and standard deviation (Channel A for Rj-7610; A and B for Rj-7620).

The Rj-7600 can be operated in Single Event (capture-and-hold) mode. When armed, the instrument will capture and display the energy recorded at the first trigger, and ignore all subsequent triggers until the instrument is rearmed or the feature disabled.

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Rk-5700 Series Power Meter

- **pW to kW; UV to Far-IR**
- **Single and Dual Channel**
- **Synchronous Detection**
- **GPIB Computer Interface**

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The Rk-5700 Series Power Meters accept a wide variety of probes - pyroelectric, silicon, and thermopile - enabling them to perform absolute radiometry, total laser power (cw and average), and irradiance measurements from the UV to far-IR, pW to kW. Integrated lock-in amplifier circuitry allows for synchronous detection of chopped optical signals, improving both S/N ratio and background rejection. The dual channel Rk-5720 simultaneously measures Channel A, Channel B, and the ratio B/A. An IEEE-488 GPIB computer interface, Analog Outputs, Background Cancel, and Autorange are all standard features.

The Rk-5700 Series Power Meters feature a high-contrast, backlit, alphanumeric LCD display, dual-use numeric/function keys, and power switch. The Rk-5710 single channel instrument continuously shows the Channel A power in engineering notation, along with a digital bargraph. An enunciator indicates whether the instrument is in local or remote (GPIB enabled) mode. In addition, the Rk-5720 dual channel instrument shows the Channel B power in engineering notation and the B/A ratio. The power can be displayed in absolute units (Watts) or relative units (dBm).

Connecting an RkP-500 Series probe and optical chopper to an Rk-5700 Power Meter activates the synchronous detection feature. Synchronous detection requires two signals, an optical signal and an electrical reference signal. The optical signal is generated by light striking the RkP-500 Series probe after it has passed through the optical chopper. The chopper itself generates the reference signal. The advantage of synchronous detection is that the instrument will selectively measure only the optical signal with the same frequency as the reference signal, and ignore all other optical signals. By positioning the chopper so that only the desired optical source is chopped virtually all background

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noise can be eliminated, insuring maximum S/N ratio. With this technique it is possible to measure a signal level that is smaller than the background.

The Background Cancel function is particularly useful for non-chopped probes that cannot take advantage of synchronous detection. When enabled it measures and stores the background power level, then subtracts it from all subsequent measurements leaving only the source power to be displayed.

Other useful functions include Autorange, which allows the instrument to automatically track a signal that is fluctuating over a wide power range. Fast Averaging sets the low-pass filter time constant to 1 second for more stable sources; Slow Averaging (10 sec) integrates over a longer period to give a better measure of the average power for a noisier source. Calibration Factors (one per channel) can be entered to compensate for non-linearity in the optical path, such as transmission loss through a filter or the wavelength response of a non-flat probe. The measured power is divided by the Calibration Factor and the corrected power is displayed.

Rear panel connectors for the Rk-5710 include the power entry module, Probe A, GPIB, Sync In, and Analog Out. The Rk-5720 also has Probe B, A Out and B Out, and replaces Analog Out with Ratio Out. The power entry module accepts a standard line cord and has a switchable 110/220 VAC card. The Sync In accepts a TTL reference signal for synchronizing the instrument to an external chopper (30 Hz, 50% duty cycle, 180° out of phase with the chopped optical signal).

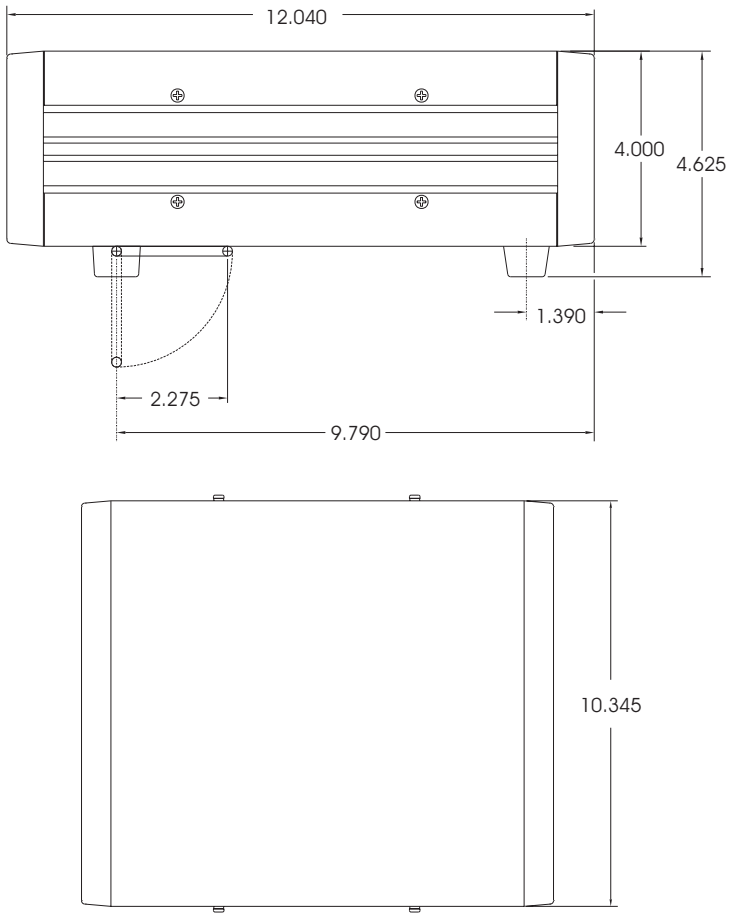
Analog Out, A Out, and B Out are 0 - 10 VDC, with 10 V corresponding to full scale in both linear (Watts) and logarithmic (dBm) mode. In linear mode the Ratio Out is 0-10 VDC where the voltage equals the mantissa; in log mode it is -10 V to +10 V, representing -100 dBm to +100 dBm. The IEEE-488 GPIB computer interface outputs in ASCII format the power in Watts (engineering notation) or dBm. For the Rk-5720 the Ratio B/A is also available in linear (scientific notation) or logarithmic (dB) format. All outputs update with the front panel display at 3 Hz.

The Rk-5700 Series instruments are compatible with the RkP-500 and RkT Series probes. Contact the factory for additional information regarding probe compatibility and available options.

The Rk-5700 Series instruments are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.

SPECIFICATIONS

Resolution	0.005% of F.S. (RkP-500 Series) 0.03% of F.S. (all other probes)
Ratio range	10^{15} to 1 (probe dependent)
Ratio accuracy	± 2 LSD
Calibration factor	0.100 to 1.000
Response time	1.0 sec, 10 sec
Background subtract	Up to P_{max} of probe
Chopping frequency	30 Hz ± 0.1 Hz; 50% duty cycle
Accuracy	± 0.5%
Analog Out, A Out, and B Out	0 - 10 VDC, 10 V equals F.S. for linear (Watts) and logarithmic (dBm) mode
Ratio Out	0 - 10 VDC, proportional to mantissa or -10 to +10 VDC, proportional to -100 to +100 dBm
GPIB	Talker/Listener; Address 0-30; Terminator LF/CR
Power supply	120/240 ±10% VAC; 50-60 Hz
Temperature range	O°C to 40°C operating; -20°C to 70°C storage
Dimensions (l x w x h)	30.6 cm x 26.3 cm x 10.1 cm (12.1" x 10.4" x 4.0")
Weight	4.1 kg (9.0 lb)



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Rk-3100
Laser Power Meter

- **100 μW Sensitivity**
- **Fast Response Time**
- **High Damage Threshold**
- **Compact Head**

The Rk-3100 Power Meter consists of a thermopile detector assembly ("head") and a large, backlit analog display. The compact head embodies all the best features of thermal detectors - large active area, μW sensitivity, broad spectral response, and high damage threshold. The analog meter is designed to provide a fast, smooth display of the optical power, ideal for aligning optics and peaking laser output.

The range of applications for this power meter is enormous. Use it to measure ophthalmic, surgical, and dentistry lasers. Monitor low power industrial lasers for marking, engraving, and resistor trimming. The broadband wavelength response lends itself to combustion, solar simulation, and spectroscopy applications. UV sterilization, germicidal, and lithography process control are possible. Field service technicians will appreciate the fast system response for aligning and calibrating lasers.

The Rk-3100's wide spectral response covers all the major laser wavelengths, from Excimer and Nitrogen in the UV, through Argon, Dye, and doubled Nd:YAG in the visible, to Nd:YLF, Holmium, and CO_2 in the IR. It accurately measures broadband sources like Xenon lamps and blackbodies as well.

The fast system response allows for accurate average power measurement of sources pulsed or chopped at 5 Hz or more. If the pulse repetition rate is known the average pulse energy in Joules can be obtained by dividing it into the measured average power.

The Rk-3100 head uses a thermopile detector with a unique black absorber coating that offers both a broad, flat spectral response and tremendous power handling capability - even focused beams can be measured without damaging the detector.

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SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	10 W
Max. average power density	20 kW/cm^2
Noise equivalent power	100 μW
Calibration accuracy	± 5%
Linearity	±0.5%
Response Time (10-90%)	< 2 sec
Detector active area dimensions	16.0 mm (2.0 cm^2)
Full scale ranges	8; 3 mW to 10 W
Head dimensions (dia x depth)	6.0 cm x 3.7 cm (2.4" x 1.5")
Meter dimensions (h x w x d)	9.0 cm x 19.2 cm x 22.1 cm (3.6" x 7.6" x 8.7")
System weight (head and readout)	2.3 kg (5.0 lb)

The compact, convection-cooled heat sink assembly features a side-mounted BNC connector, standard ¼-20 mounting hole, and a black anodize finish to reduce unwanted back-reflection.

The Rk-3100 operates by generating a voltage proportional to the difference in temperature between the detector surface (target) and heat sink (ambient). Thermally insulating the heatsink can improve accuracy and stability when measuring low power levels, by buffering it against fluctuations in the ambient temperature.

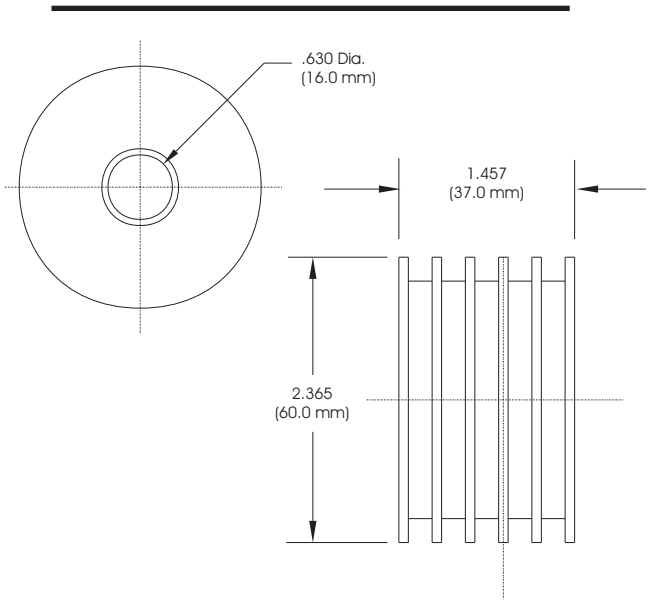
The Rk-3100 Power Meter features an oversized, backlit, dual-scale analog display. System response time is less than 2 seconds, resulting in smooth, real-time needle movement - none of the frustrating lag and overshoot associated with other meters that make it difficult to tweak a laser system.

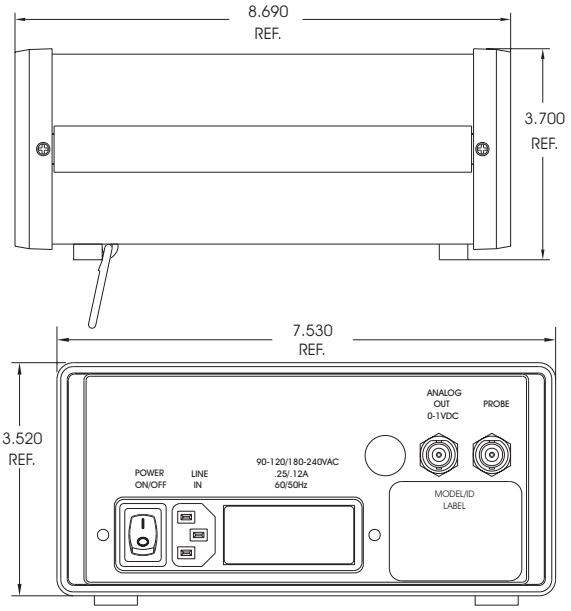
Front panel controls include the Zero Adjust knob and Range Select knob. The Zero Adjust allows for compensation of unwanted background radiation, and to a lesser extent, wavelength responsivity of the detector. The Range Select knob selects the appropriate full scale range for the incident power level.

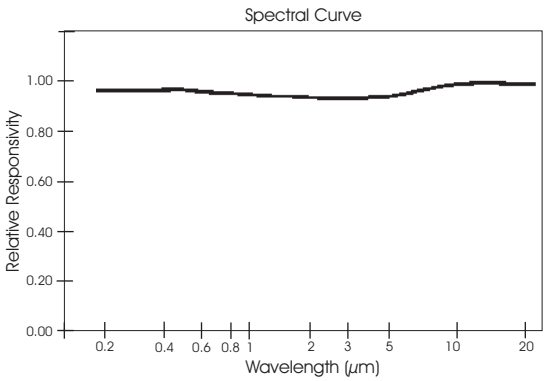
Rear panel features include the universal power entry module (90-240 VAC, 50-60 Hz input), Probe BNC, and Analog Out BNC. The Analog Output is 0-1 VDC, with 1 Volt corresponding to full scale for the selected range. Collapsible feet allow the viewing angle to be optimized to the experimental setup.

A removable light baffle is provided with the Rk-3100. Contact the factory for information regarding other options and accessories.

All Rk-3000 Series instruments are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.







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Rk-3103
Laser Power Meter

The Rk-3103 Power Meter consists of a thermopile detector assembly ("head") and a large, backlit analog display. The large area detector offers mW sensitivity, UV to far-IR spectral response, and high damage threshold - all in a compact, air-cooled head. The analog meter is designed to provide a fast, smooth display of the optical power, ideal for aligning optics and peaking laser output.

The Rk-3103 is well suited for any mid-power laser. Use it to calibrate ophthalmic and surgical lasers. Monitor industrial welding and drilling lasers, as well as resistor trimming systems. The broadband wavelength response lends itself to applications involving high power arc and flash lamps. The fast system response will be appreciated by technicians working on the factory floor, or while making service calls.

The Rk-3103 can measure the average power of pulsed and chopped light sources as easily as it does the true power of continuous wave sources. The fast system response time insures accurate average power measurement for sources chopped at 5 Hz or greater.

The high damage threshold enables it to measure the average power of a train of short laser pulses without harming the detector surface. If the pulse repetition rate is known the average pulse energy in Joules can be obtained by dividing it into the average power measured by the Rk-3103.

Pulsed or cw, UV to IR, mW to 30W - this versatile instrument can be used for a multitude of measurement requirements. Excimer, Argon, Ruby, Nd:YAG (fundamental and harmonics), Holmium, CO_2 - the list of applications is practically endless.

- **High Damage Threshold**
- **Fast Response Time**
- **mW Sensitivity**
- **Compact Head Design**

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SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	30 W
Max. average power density	20 kW/cm^2
Noise equivalent power	1 mW
Calibration accuracy	± 5%
Linearity	±0.5%
Response time (10-90%)	< 2 sec
Detector active area dimensions	18 mm (2.5 cm^2)
Full scale ranges	6; 100 mW to 30 W
Head dimensions (dia x depth)	8.5 cm x 4.3 cm (3.4" x 1.7")
Meter dimensions (h x w x d)	9.0 cm x 19.2 cm x 22.1 cm (3.6" x 7.6" x 8.7")
System weight (head and readout)	2.3 kg (5.0 lb)

The Rk-3103 probe uses a thermopile detector with a unique black absorber coating that offers both a broad, flat spectral response and tremendous power handling capability - even focused beams can be measured without damaging the detector. The compact, convection-cooled heat sink assembly features a side-mounted BNC connector, standard ¼-20 mounting hole, and a black anodize finish to reduce unwanted back-reflection.

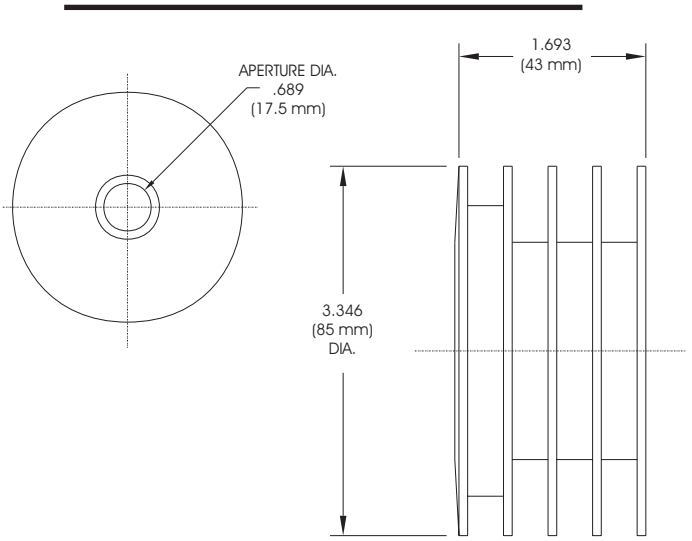
The Rk-3103 Power Meter features an oversized, backlit, dual-scale analog display. System response time is less than 2 seconds, resulting in smooth, real-time needle movement - none of the frustrating lag and overshoot associated with other meters that make it difficult to tweak a laser system.

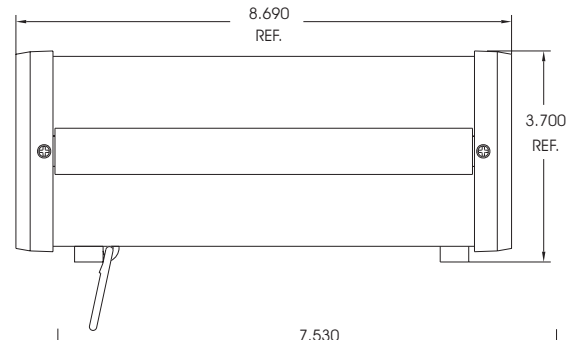
Front panel controls include the Zero Adjust knob and Range Select knob. The Zero Adjust allows for compensation of unwanted background radiation, and to a lesser extent, wavelength responsivity of the detector. The Range Select knob selects the appropriate full scale range for the incident power level.

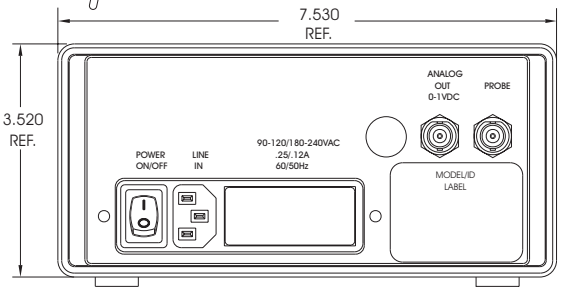
Rear panel features include the universal power entry module (90-240 VAC, 50-60 Hz input), Probe BNC, and Analog Out BNC. The Analog Output is 0-1 VDC, with 1 Volt corresponding to full scale for the selected range. Collapsible feet allow the viewing angle to be optimized to the experimental setup.

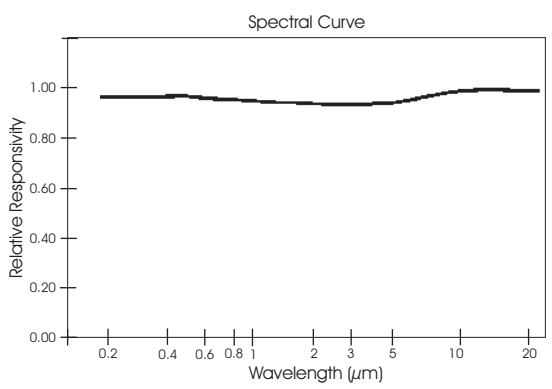
An adjustable head support stand is provided with the Rk-3103. Contact the factory for information regarding other options and accessories.

All Rk-3000 Series instruments are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.









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Rk-3115
Laser Power Meter

- **Compact Fan-Cooled Design**
- **Fast System Response**
- **Handles Up To 150 W**
- **Measure UV to IR**

The Rk-3115 Power Meter consists of a thermopile detector assembly ("head") and a large, backlit analog display. The detector is cooled by a built-in fan that can dissipate up to 150 W continuously, allowing for a much smaller head than is possible with traditional convection cooling techniques. The analog meter is precisely matched to the head to provide a fast, smooth display of the optical power, ideal for aligning optics and peaking laser output.

The Rk-3115 is perfectly suited for a variety of industrial and medical applications. Use it to quantify laser welding and cutting processes on the shop floor, or for routine maintenance of Nd:YAG, CO_2, and other industrial lasers. Take advantage of the high power density capability to calibrate surgical and ophthalmic lasers. The broadband wavelength response also lends itself to non-laser applications, such as high-power arc lamps.

The Rk-3115 can measure the average power of pulsed and chopped light sources as easily as it does the true power of continuous wave sources. The fast system response time insures accurate average power measurement for sources chopped at 5 Hz or greater. The high damage threshold enables it to measure the average power of a train of short laser pulses without harming the detector surface. If the pulse repetition rate is known the average pulse energy in Joules can be obtained by dividing it into the average power measured by the Rk-3115.

The Rk-3115's detector surface is engineered to withstand very high power densities, allowing even smaller diameter beams to be measured without damage. The flat spectral response covers the UV to far-IR range with ease.

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SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	150 W
Max. average power density	20 kW/cm^2
Noise equivalent power	10 mW
Calibration accuracy	± 5%
Linearity	±0.5%
Response time (10 - 90%)	< 2 sec
Detector active area dimensions	17.5 mm (2.4 cm^2)
Full scale ranges	6; 1 mW to 300 W
Head dimensions (h x w x d)	8.3 cm x 8.3 cm x 11.5 cm (3.3" x 3.3" x 4.6")
Meter dimensions (h x w x d)	9.0 cm x 19.2 cm x 22.1 cm (3.6" x 7.6" x 8.7")
System weight (head and readout)	2.8 kg (6.0 lb)

The rectangular head is approximately 8.5 cm on a side by 11.5 cm deep, with side-mounted connectors for the signal output and fan power input, as well as a ¼-20 mounting hole. This compact design is achieved by using a fan to actively force large amounts of air over a smaller heatsink, effectively dissipating the same amount of heat as a traditional convection-cooled thermopile with a larger, passively radiating heatsink. The black anodize finish reduces unwanted back-reflection.

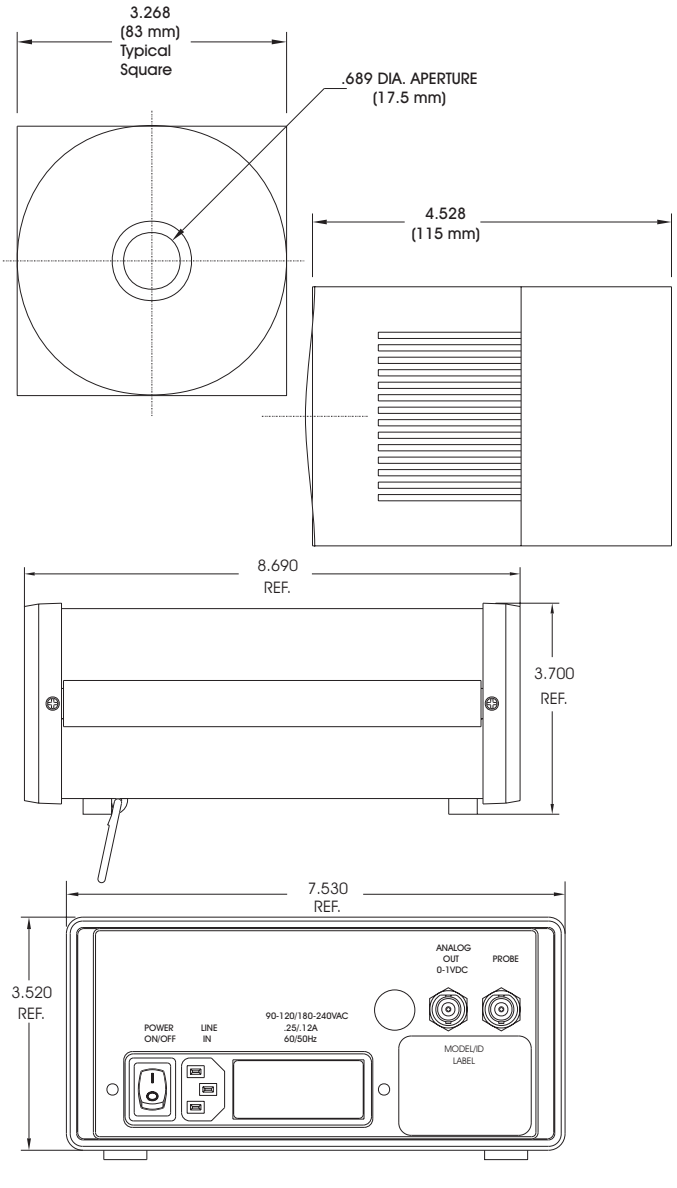
The Rk-3115 power meter features an oversized, backlit, dual-scale analog display. System response time is less than 2 seconds, resulting in smooth, real-time needle movement - none of the frustrating lag and overshoot associated with other meters that make it difficult to tweak a laser system.

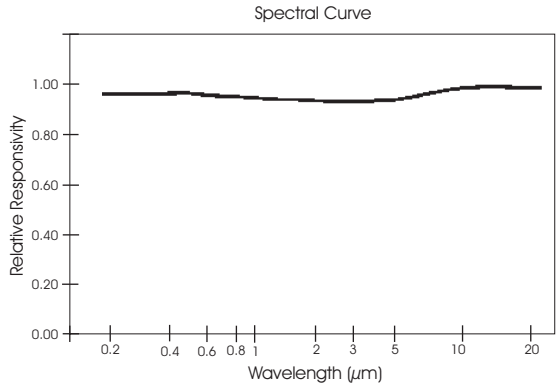
Front panel controls include the Zero Adjust knob and Range Select knob. The Zero Adjust allows for compensation of unwanted background radiation, and to a lesser extent, wavelength responsivity of the detector. The Range Select knob selects the appropriate full scale range for the incident power level.

Rear panel features include the universal power entry module (90-240 VAC, 50-60 Hz input), Probe BNC, and Analog Out BNC. The Analog Output is 0-1 VDC, with 1 Volt corresponding to full scale for the selected range. Collapsible feet allow the viewing angle to be optimized to the experimental setup.

An adjustable head support stand is provided with the Rk-3115. Contact the factory for information regarding other options and accessories.

All Rk-3000 Series instruments are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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Rs-5900 Electrically Calibrated Pyroelectric Radiometer

- ± 1% Absolute Accuracy
- Spectrally Flat, UV to far-IR
- Radiometric Transfer Standard
- Traceable to NIST Electrical Standards

LaserProbe inc.

The Rs-5900 Electrically Calibrated Pyroelectric Radiometer (ECPR) System is a ±1% absolute accuracy radiometer, developed in conjunction with NIST to be a transfer standard for the visible to mid-IR range. It can measure the total power and irradiance of free-space sources, or the total power exiting an optical fiber.

The standard ECPR System measures total power and irradiance of cw sources, from 5 μW to 100 mW, 0.25-3.0 μm, with ±1% absolute accuracy. Option RsIR expands the wavelength range to beyond 20 μm, and with the RsFO optical fiber option the ECPR becomes the definitive transfer standard for fiber optic power meters.

The most common application for the ECPR is to transfer an absolute radiometric calibration to another detector or light source with a high degree of accuracy. This is accomplished by measuring either the total power (Watts) of collimated sources that underfill the detector aperture or the irradiance (W/cm^2) of extended sources that overfill the precision 0.5 cm^2 detector aperture. The exceptionally flat spectral response insures broadband sources are measured with the same accuracy as monochromatic light, allowing the ECPR to calibrate visible and IR detectors, standard lamps, blackbody emitters, laser power meters, UV exposure meters, etc.

The ECPR System is composed of the Rs-5900 Readout, RsP-590 Pyroelectric Probe, and CTX-515 Optical Chopper. It operates as a fixed-frequency lock-in amplifier system, where the CTX-515 Chopper both modulates the optical signal impinging on the RsP-590 Probe and provides the reference signal to the lock-in circuitry in the Rs-5900 Readout. Further, the ECPR employs a unique auto-nulling electrical substitution technique that precisely generates and measures an electrical signal equivalent to the optical signal incident on the RsP-590 Probe, thereby allowing direct traceability to NIST electrical standards.

The Rs-5900 Readout displays the optical power in a 4½ digit scientific notation format. LED enunciators indicate the active measurement status (Watts or W/cm^2), the active probe (RsP-590 Pyroelectric or RsP-595 Silicon), the selected averaging time (Fast or Slow), and if the Autorange function is engaged. The Mode enunciator indicates whether the ECPR is in

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power measurement or system test mode. A 12-button keypad allows for numeric entry and selection of system functions such as Units (Watts and dBm), Range select, Autoranging, Calibration Factor Recall/Store, and the various Test Modes.

The ECPR provides access to various signal test points for system test and calibration, including the Preamp Out, Direct Out (0-10VDC analog out corresponding to the mantissa) and Mixer Out (synchronous rectifier output), along with a 0-10VDC input for direct testing of the A/D.

The rear-panel BCD connector is a bit-parallel, digit-serial computer interface that outputs a digital representation of the mantissa and exponent for remote data collection.

The optional RsP-595 Silicon Probe is used to verify the calibration of the RsP-590 Pyroelectric Probe. The RsP-595 is calibrated to better than ±1% accuracy at the HeNe laser wavelength (632.8 nm). When the RsP-590 and RsP-595 are compared at that wavelength they should agree to better than 1%.

The RsP-590 Probe consists of a Pyroelectric detector assembly and preamplifier in a common housing. The gold-black coating on the detector surface functions as both a spectrally flat absorber for the incident optical radiation and the heating resistor for the auto-nulling electrical substitution servo-loop circuit. A precision-etched 0.5 cm^2 detector aperture allows for easy irradiance measurements. The front of the Probe housing is threaded to accept windows and other accessories.

Available window materials include Suprasil and KRS-5, blank window holders are available as well. The RsIR Option provides spectral correction factors to extend the ±1% system accuracy to >20 μm. Option RsFO consists of a fiber adapter that mounts on the front of the RsP-590 Probe and a 15 Hz signal generator circuit in the Rs-5900 Readout that can be used to modulate the light source (LED, laser diode, etc.). The RsFO fiber adapter can accept up to 500 μm diameter fiber, with a maximum numerical aperture of 0.98.

The CTX-515 is a 15 Hz, 50% duty cycle optical chopper. The 1 inch diameter aperture can be rotated to adjust the phase relationship between the optical signal and the electrical reference signal. The chopper can be set for normal operation or test mode. In normal operation the chopper blade spins, in test mode the blade does not spin but the TTL sync signal is active.

What sets the ECPR apart from other radiometers is the electrical substitution technique it employs. This is composed of two primary subsystems, the analog servo-loop and the digital measurement/control system. When the chopper is open the pyroelectric detector produces a thermal signal proportional to the optical power incident on the gold-black absorber material. When the chopper shuts the servo-loop generates electrical current pulses that pass through the gold-black, which now functions as a precision heating resistor. This electrical power (I^2xR) causes the pyroelectric detector to produce a thermal signal proportional to the electrical power. The servo-loop increases the magnitude of the current pulses until the null condition is reached at the output of the synchronous rectifier circuit. At this point the optical power is equal to the electrical power, and the electrical power is digitized and displayed. This makes the ECPR virtually immune to ambient fluctuations, as the auto-nulling occurs at every chopper cycle.

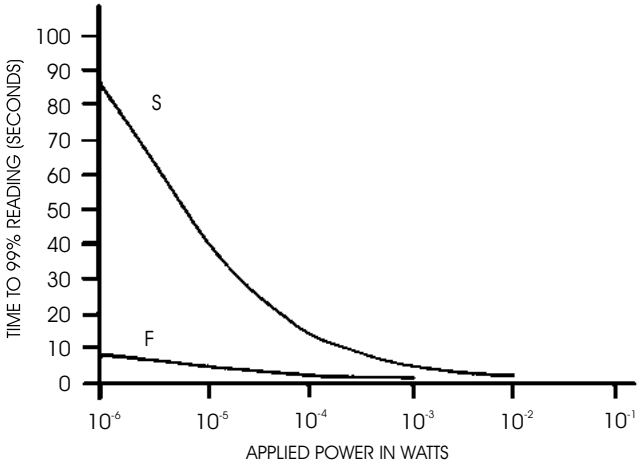
The ECPR also incorporates frequency sensitive AC voltmeter (lock-in amplifier) circuitry that automatically rejects any input optical signal that is not frequency matched to the chopping rate, thereby insuring that any optical radiation that strikes the detector without having passed through the optical chopper is ignored. This further reduces ambient drift and maximizes signal-to-noise ratio.

It is important to note that most electrically calibrated radiometers employ a resistive heating element that is physically independent of the detector's optical absorbing surface, which means that any changes in the detector's absorption characteristics are not accounted for in the electrical calibration. In the ECPR, however, the gold-black optical absorber is also the resistive heating element, so once the differences between optically and electrically heating the gold-black are characterized (the electro-optical equivalence factor) the system is balanced. Thus, a small change to the gold-black absorber will effect the electrical and optical heating equally, and consequently be nulled out.

The Rs-5900 ECPR System is provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.

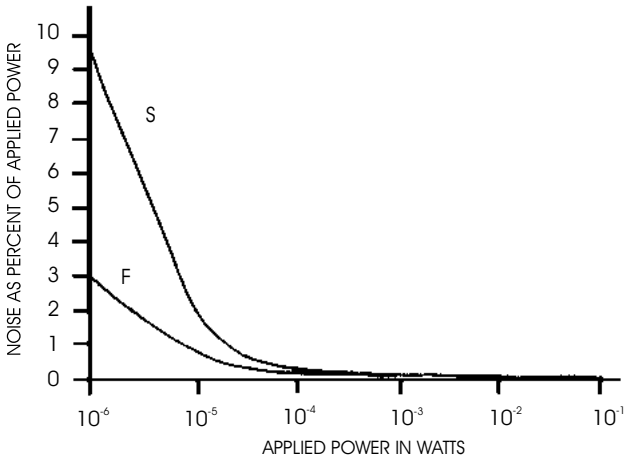
SPECIFICATIONS

System uncertainty	± 1%, 2σ limits (0.25-2.0 μm)
Electrical substitute accuracy	± 0.1%
Scale ratio accuracy	± 0.1%
Full scale ranges	5; 9.999 E-6 W to 9.999 E-2 W
Resolution	0.015% of F.S.
System response time	see curve 1
Spectral response	see curve 3
Maximum total power	100 mW
Maximum power density	200 mW/cm^2
Noise equivalent power	see curve 2
Detector aperture dimensions	7.98 mm (0.5 cm^2)
Det. plane to aperture distance	0.445 cm
Chopping frequency	15 Hz ± 0.1 Hz; 50% duty cycle
Analog output	0-9.99 VDC, voltage = mantissa value
Power supply	120/240 ± 10% VAC; 50-60 Hz
Temperature range	0°C to 40°C operating; -20°C to 70°C storage
Dimensions:	
Rs-5900 (l x w x h)	28.0 cm x 28.5 cm x 9.0 cm (11.0" x 11.2" x 3.5")
RsP-590 (dia x depth)	6.4 cm x 9.6 cm (2.5" x 3.8")
CTX-515 (dia x depth)	15.2 cm x 6.4 cm (6.0" x 2.5")
Weight (system)	7.0 kg (15.0 lb)



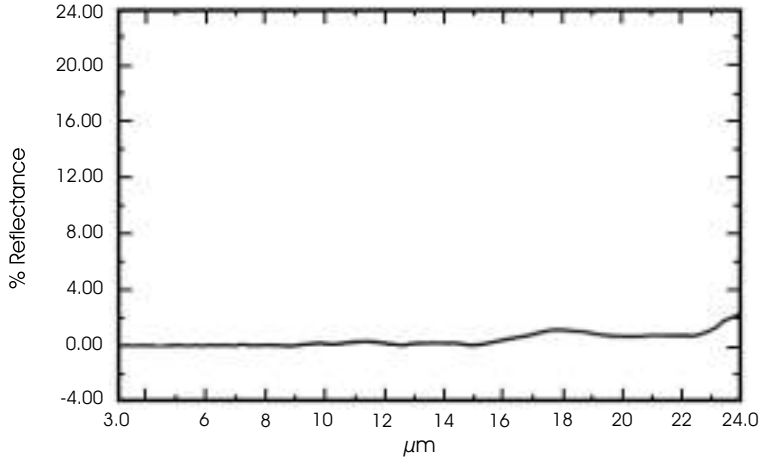
NOTE: FAST RESPONSE NOT USABLE FOR POWER LEVELS GREATER THAN 10 mW.

CURVE 1 SYSTEM REPSONSE TIME (STANDARD SYSTEM)

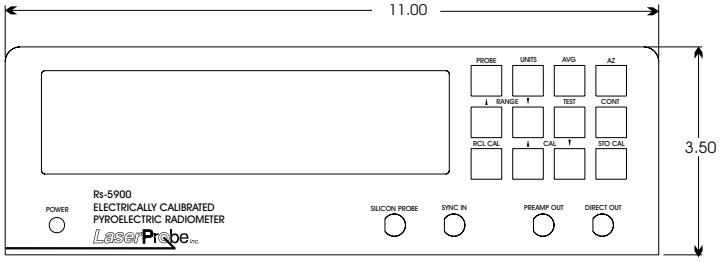


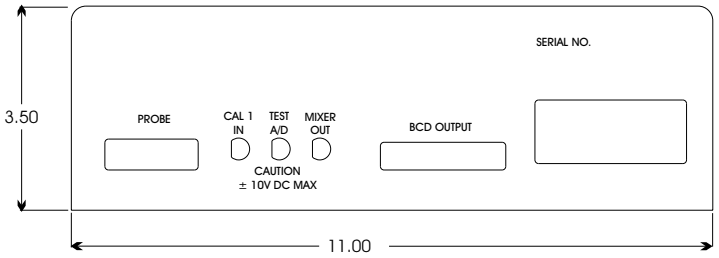
NOTE: FAST RESPONSE NOT USABLE FOR POWER LEVELS GREATER THAN 10 mW.

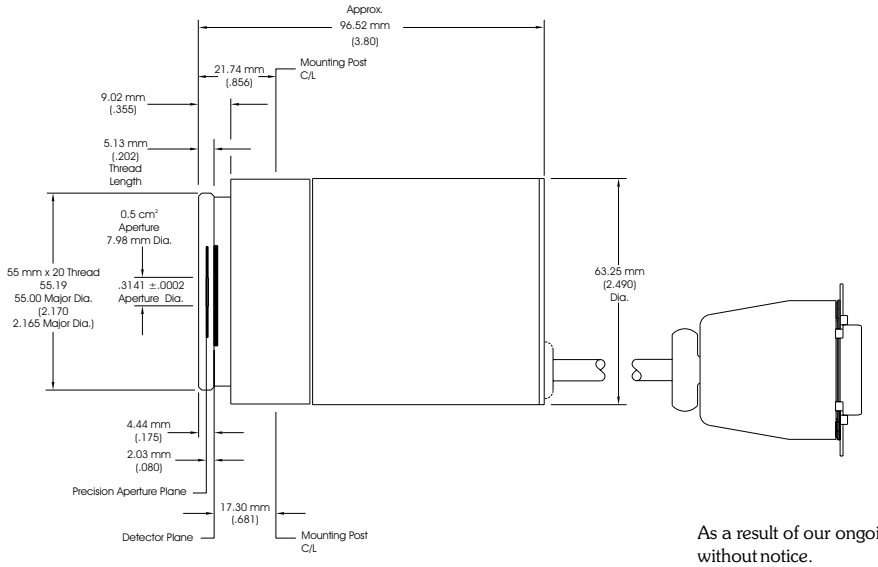
CURVE 2 NOISE EQUIVALENT POWER (STANDARD SYSTEM)

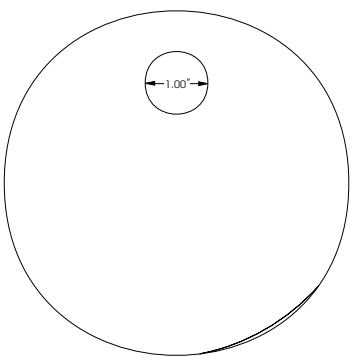


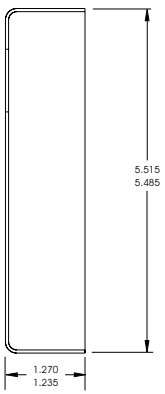
CURVE 3 SPECTRAL RESPONSE











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SPECIFICATIONS

Spectral response	0.18 - 20 μm
Maximum total energy	1.0 J
Maximum energy density	1.0 J/cm^2
Max. peak pulse power density *(30 ns pulse)*	1.0 MW/cm^2
Max. average power density	5.0 W/cm^2
Minimum detectable energy	100 nJ
Maximum pulse rep rate	200 Hz
Maximum pulse width	200 μsec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	1.0 cm^2
Full scale ranges	6; 30 μJ - 1J
Head dimensions (dia x depth)	6.0 cm x 5.0 cm (2.4" x 2.0")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

In a conventional flat detector photons incident on its surface have only one point of contact, at which they are either absorbed or reflected away. However, the geometry of the RjP-435 cavity detector insures that virtually all of the photons that are not absorbed at the initial contact point will be reflected further into the cavity, where they contact the detector surface again and again. This "light trap" configuration produces almost total light absorption, resulting in an extremely broad, flat wavelength response.

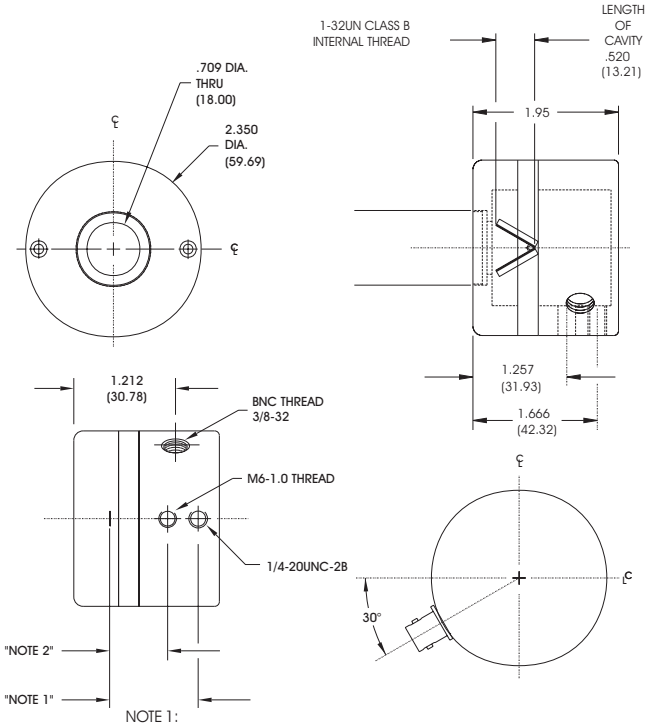
As a member of the 400 Series Probe family, the RjP-435 uses the same detector housing and preamplifier enclosure as all other 400 series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

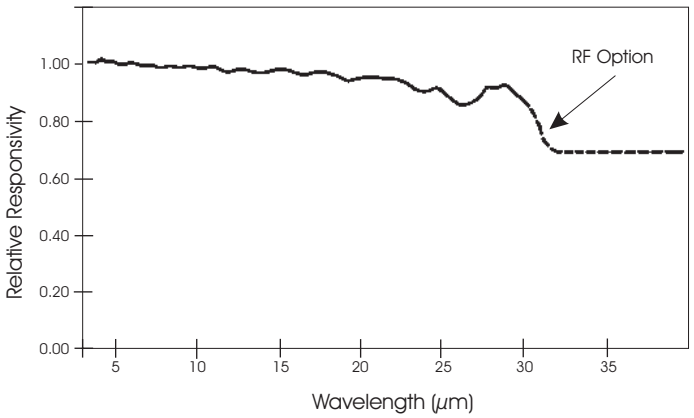
There are many options and accessories available for the RjP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. The options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



NOTE 1:
The distance from the center of the cavity to the center line of the ¼ - 20 mounting is 1.100±.005" (27.94mm).
NOTE 2:
The distance from the center of the cavity to the center line of the M6 mounting is 17.58mm (.692").

Spectral Curve



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RjP-445
Pyroelectric Energy Probe

- **Measure Energy up to 1 kHz**
- **Sub-μJ Sensitivity**
- **1.0 cm² Active Area**
- **Deep-UV to Far-IR Response**

Measurement of high pulse repetition rate lasers is no longer limited to average power. The RjP-445 Pyroelectric energy probe can measure the integrated energy of individual pulses, in real time, at pulse repetition rates up to 1 kHz. Its combination of speed and sensitivity, unprecedented in a large area (1.0 cm^2) detector, makes this the probe of choice for high rep rate, short pulse width sources.

The surface absorber material for the RjP-445 was selected in part for its broad spectral response, which extends from below 180 nm to greater than 20 μm. The flat spectral response makes the RjP-445 perfectly suited for tunable laser sources like Ti:Sapphire, Dye, and Optical Parametric Oscillators. Short pulse flashlamps also benefit from the RjP-445's broad spectral response. The 1 kHz pulse repetition capability is utilized when measuring fixed wavelength lasers like Nd:YAG, Nd:YLF, Nitrogen, CO, and CO_2.

For many applications it is essential to know the integrated energy of each pulse in real time. The traditional methods for this have been to use a photodiode to observe the pulses on an oscilloscope, or to monitor fluctuations in the average power with a calorimeter. In both cases information about the individual pulses is lost. This is particularly true for IR sources that fall outside the response range of photodiodes. Fortunately this is no longer the case. When used with the Rm-3700 or Rm-6600 Universal Radiometers the RjP-445 can measure, calculate, and transmit (via the Rs-232 or GPIB computer interface) the integrated energy of individual pulses at 1 kHz. Thus it is now possible to carefully monitor the conversion efficiency of biochemical reactions, study non-linear optical effects, etc. Couple the RjP-445 with the Rm-6600 Dual Channel Universal Radiometer and a second

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RjP-435
Pyroelectric Energy Probe

- **Unique Cavity Detector Design**
- **μJ Sensitivity**
- **±1% Wavelength Response**
- **Measure Energy up to 200 Hz**

The RjP-435 Cavity Pyroelectric Energy Probe offers unmatched versatility - μJ to J, UV to Far-IR, single-shot to 200 Hz - making it the right probe for almost every application. The unique cavity, or light-trap, detector assembly is a nearly perfect absorber, resulting in a flatter spectral response and greater sensitivity than a conventional pyroelectric detector of comparable size.

The extremely wide spectral response make this probe the ideal measurement tool for broadband sources like flashlamps and blackbody emitters. Cover the full spectral range of Ti:Sapphire, Dye, OPOs, and other tunable laser sources without having to worry about wavelength correction factors. The RjP-435 is equally adept at measuring Nd:YAG, Er:YAG, Nd:YLF, Excimer, Nitrogen, Copper Vapor, and CO_2 lasers.

Besides being a versatile research instrument the RjP-435 is an excellent energy transfer standard. Use calibrated neutral density filters to extend its dynamic range to match both low-energy semiconductor probes and high-energy calorimeter probes.

The extended UV response is well suited for photolithography, sterilization, and curing applications. Use it to calibrate ophthalmic and surgical lasers. Perform real-time analysis of LIDAR, rangefinder, and fire control systems. Or monitor the source laser in laser ablation, laser-induced fluorescence, and non-linear optics experiments.

The compact size and modular design make the RjP-435 ideal for OEM applications as well. Incorporate the detector and preamplifier directly into lasers, detector calibration fixtures, or fire-control systems for real-time diagnostics, output stabilization, and process control.

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SPECIFICATIONS

Spectral response	0.18-20 μm
Maximum total energy	1.0 J
Maximum energy density	1.0 J/cm^2
Max. peak pulse power density *(30 ns pulse)*	1.0 MW/cm^2
Max. average power density	5.0 W/cm^2
Minimum detectable energy	100 nJ
Maximum pulse rep rate	1 kHz
Maximum pulse width	50 μsec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	1.0 cm^2
Full scale ranges	6; 30 μJ - 1 J
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

probe to do high-speed, automated transmission measurements of filters, attenuators, and laser goggles. Or take it in the field to characterize laser rangefinders and target designators.

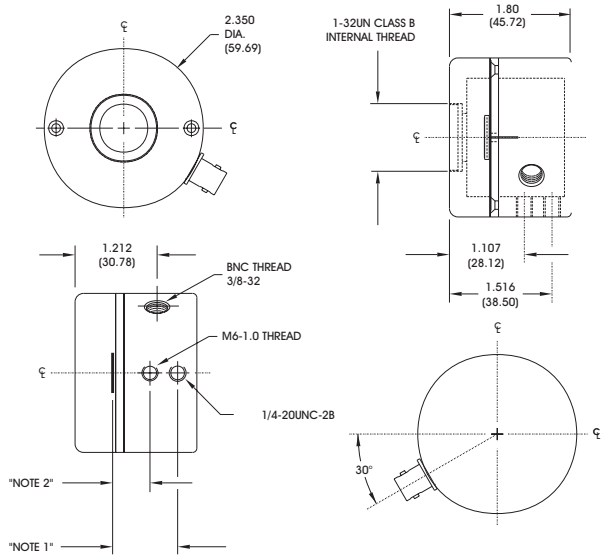
The compact size and modular design make the RjP-445 ideal for OEM applications as well. Incorporate the detector and preamplifier directly into lasers, detector calibration fixtures, or fire-control systems for real-time diagnostics, output stabilization, and process control.

The RjP-445 uses a $LiTaO_3$ pyroelectric detector element manufactured specifically to minimize noise, providing superior sensitivity and signal-to-noise ratio over other comparably sized detectors. The spectrally flat surface absorber material is applied in a manner designed to maximize surface uniformity, making the probe's response more uniform with input angle.

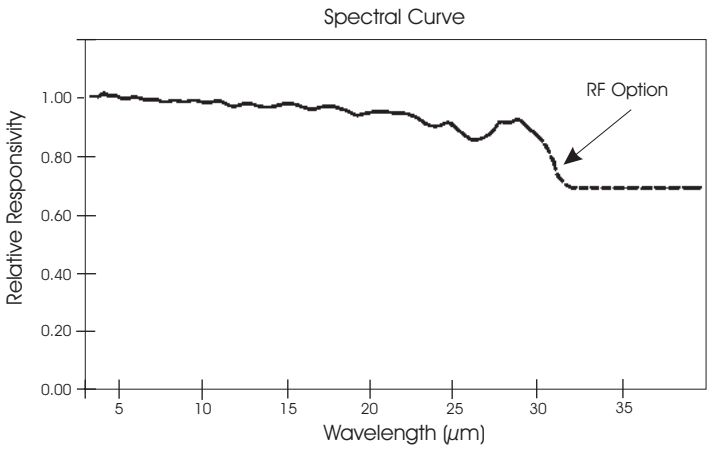
As a member of the 400 Series Probe family, the RjP-445 uses the same detector housing and preamplifier enclosure as all other 400 series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment. The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection. A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

There are many options and accessories available for the RjP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. The options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



NOTE 1: The distance from the detector plane to the center of the ¼ - 20 mounting is 1.00" (25.4mm).
NOTE 2: The distance from the detector plane to the center line of the M6 mounting is .552" (14.02mm)



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RjP-465
Silicon Energy Probe

- **UV-Enhanced Response from 180 nm to 1.1 μm**
- **pJ Sensitivity; fJ Resolution**
- **Large, 1.0 cm² Active Area**
- **Measure Energy per Pulse up to 500 Hz**

LaserProbe inc.

Measurement of low-energy, high rep rate sources is no longer limited to average power - with the RjP-465 you can directly measure the integrated energy of each pulse in real time. This UV-Enhanced Silicon energy probe is designed specifically for measuring low energy, pulsed sources from the near-UV to the near-IR. Picojoule sensitivity, 500 Hz speed, and a 1 cm^2 active area guarantee unmatched versatility and ease of use.

Nd:YAG, Nd:YLF, Ti:Sapphire, Nitrogen, Excimer, Dye - these are just some of the lasers that can be measured with the RjP-465. The probe works equally well with other sources, such as flashlamps, LEDs, and laser diodes.

The range of applications for the RjP-465 is enormous. Raman spectroscopy, bioluminescence, laser induced fluorescence, and non-linear optics, to name a few. Mate the appropriate filter to the probe and make photopic measurements, or isolate the UV-A / UV-B range for germicidal studies. Use the RjP-465 with the battery powered Rm-3700 Universal Radiometer for field testing weapons simulation systems, LIDAR, and target rangefinder/designator systems. Couple it with the Rm-6600 Dual-Channel Universal Radiometer and a pyroelectric energy probe to ratiometrically measure the transmission of laser goggles, filters, and attenuators over 6 decades of dynamic range.

The compact size and modular design make the RjP-465 ideal for OEM applications as well. Incorporate the detector and preamplifier directly into lasers, detector calibration fixtures, or fire-control systems for real-time diagnostics, output stabilization, and process control.

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SPECIFICATIONS

Spectral response (see curve)	180 - 1100 nm
Maximum total energy	250 nJ
Maximum energy density	1.25 μJ/cm^2
Max. peak pulse power density *(30 ns pulse)*	100 mW/cm^2
Max. average power density	5.0 mW/cm^2
Minimum detectable energy	500 fJ
Maximum pulse rep rate	500 Hz (2 kHz available)
Maximum pulse width	50 μsec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	10 x 10 mm (1.0 cm^2)
Full scale ranges	6; 3 pJ - 300 nJ
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

The RjP-465 is calibrated for absolute energy measurement at 950 nm (the wavelength of peak spectral response). The typical wavelength response curve, normalized to 100% relative responsivity at 950 nm, is stored in the preamplifier. When a wavelength other than 950 nm is entered via the "Wavelength Select" function of the Universal Radiometers the appropriate wavelength correction factor is automatically applied, and the true energy displayed. Two absolute wavelength calibrations are available, VIS-IR (350 - 1100 nm) and UV (200 - 350 nm).

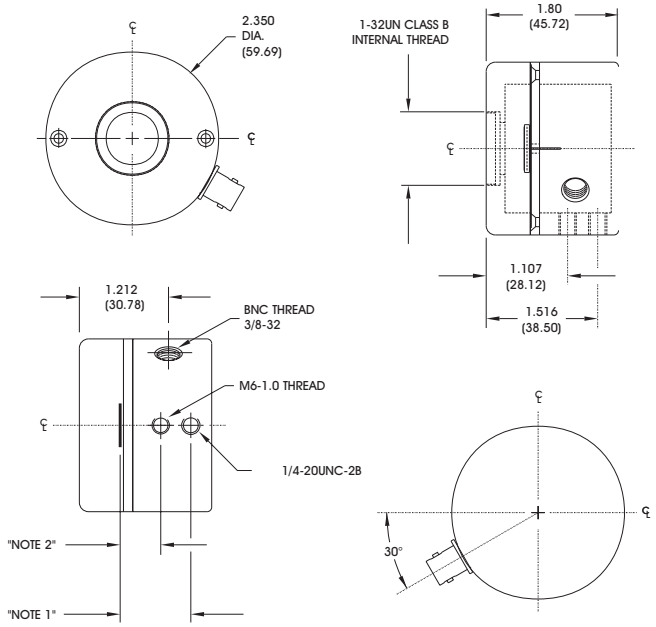
As a member of the 400 Series Probe family, the RjP-465 uses the same detector housing and preamplifier enclosure as all other 400 Series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

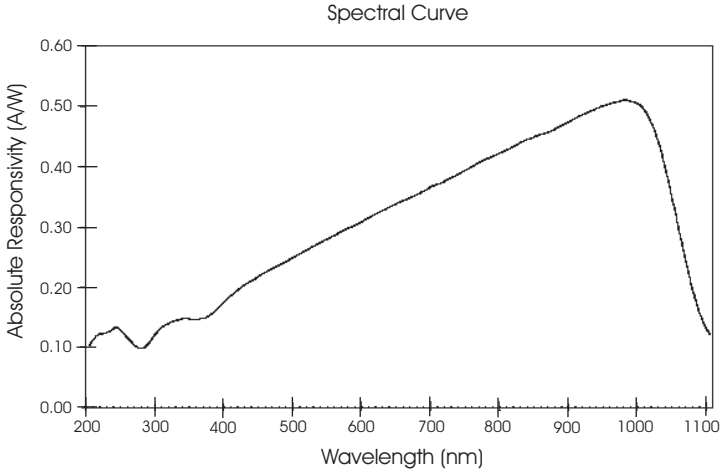
A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

There are many options and accessories available for the RjP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. The options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



NOTE 1: The distance from the detector plane to the center of the ¼ - 20 mounting is 1.00" (25.4mm).
NOTE 2: The distance from the detector plane to the center line of the M6 mounting is .552" (14.02mm)



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RjP-485

InGaAs Energy Probe

The RjP-485 is the first InGaAs Probe designed specifically for pulsed laser energy measurements. The custom InGaAs detector is 5 mm in diameter (0.2 cm^2 active area) - over six times larger than the typical InGaAs detector - making it very easy to use for "real world" measurements. Picojoule sensitivity, 200 Hz speed, and superior thermal stability make it the probe of choice for mid-IR energy measurements.

Use the probe with Nd:YAG, Er:YAG, Ti:Sapphire, Optical Parametric Oscillator, laser diode, and other mid-IR sources. All the major fiber optic wavelengths are covered, making the RjP-485 well suited for testing and calibrating fiber power meters, loss test sets, and other fiber test instrumentation.

Take the RjP-485 probe and Rm-3700 Universal Radiometer to the test range to characterize the far-field performance of eye-safe laser rangefinders, target designators, and fire-control systems. Couple it with a Pyroelectric probe and the Rm-6600 Dual Channel Universal Radiometer to ratiometrically measure the transmission of laser goggles, filters, and other optical components over 6 decades of dynamic range. Other applications include Raman spectroscopy, non-linear optical materials, and laser induced fluorescence studies.

The compact size and modular design make the 400 Series ideal for OEM applications as well. Incorporate the detector and preamplifier into mid-IR lasers, LIDAR systems, or fire-control systems for real-time diagnostics, output stabilization, and process control.

- **First Large Area InGaAs Energy Probe**
- **Ideal for Eye-Safe Laser Applications**
- **Measure Energy Per Pulse at 200 Hz**
- **pJ Sensitivity at 1.5 μm**

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Spectral response (see curve)	0.7 - 1.8 μm
Maximum total energy	250 nJ
Maximum energy density	1.25 μJ/cm^2
Max. peak pulse power density *(30 ns pulse)*	100 mW/cm^2
Max. average power density	5.0 mW/cm^2
Minimum detectable energy	500 fJ
Maximum pulse rep rate	200 Hz
Maximum pulse width	200 μs
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	5 mm (0.196 cm^2)
Full scale ranges	6; 3 pJ - 300 nJ
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

InGaAs has distinct advantages over other semiconductor detectors. For example, it is more sensitive than silicon at 1064 nm, and its spectral response in the region about 1064 nm is much flatter. Therefore small fluctuations in source wavelength have far less impact on the measured energy. In addition, InGaAs has a lower temperature coefficient than both silicon and germanium - over most of its spectral response range, the RjP-485's responsivity varies less than 2% from -30° to +25°C - insuring repeatable results without expensive temperature stabilization.

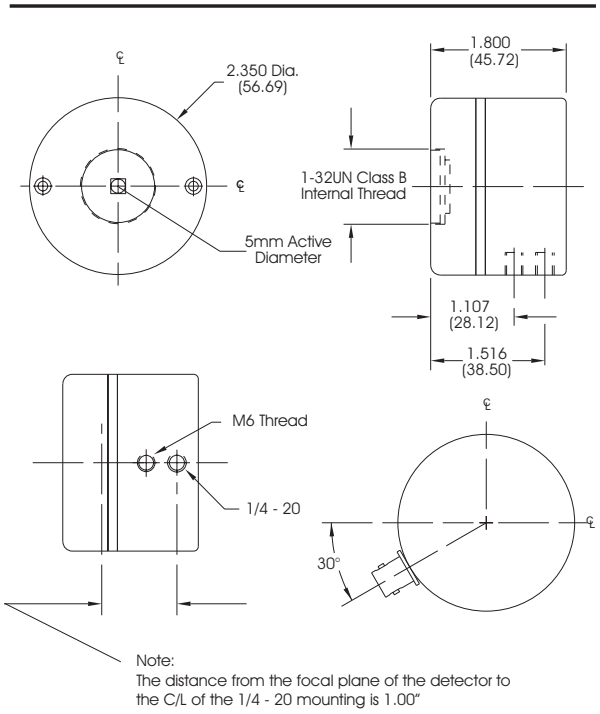
As a member of the 400 Series Probe family, the RjP-485 uses the same detector housing and preamplifier enclosure as all other 400 Series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

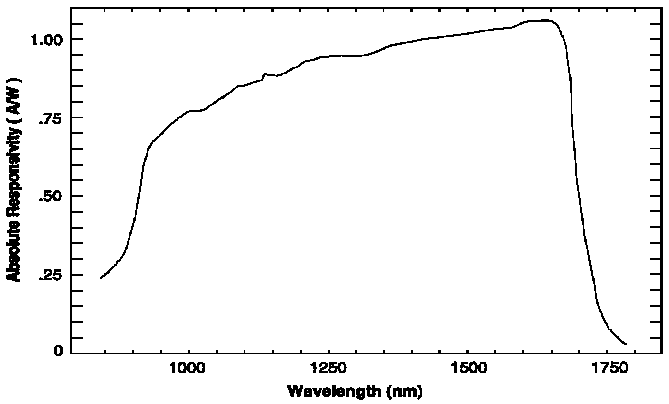
A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

There are many options and accessories available for the RjP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. The options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



RjP-485 Spectral Curve



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RjP-495

Germanium Energy Probe

- **Large Area Germanium Energy Probe**
- **Ideal for Eye-Safe Laser Applications**
- **Measure Energy Per Pulse at 200 Hz**
- **pJ Sensitivity at 1.5 μm**

The RjP-495 Germanium Probe is designed specifically for mid-IR, pulsed energy measurements. The large size (13 mm diameter) detector is ideal for measuring total energy and fluence of eye-safe laser sources. Picojoule sensitivity, 200 Hz speed, and room temperature operation make it the probe of choice for mid-IR energy measurements.

Many pulsed lasers fall within the RjP-495's measurement range, including Nd:YAG, Er:YAG, Ti:Sapphire, Optical Parametric Oscillators, and laser diodes. Flashlamps, arc lamps, and other non-laser sources can be measured as well. All the major fiber optic wavelengths are covered, allowing the RjP-495 to test and calibrate fiber power meters, loss test sets, and other fiber test instrumentation.

Take the RjP-495 probe and Rm-3700 Universal Radiometer to the test range to characterize the far-field performance of eye-safe laser rangefinders, target designators, and fire control systems. Couple it with a Pyroelectric probe and the Rm-6600 Dual Channel Universal Radiometer to ratiometrically measure the transmission of laser goggles, filters, and other optical components over 6 decades of dynamic range. Other applications include Raman spectroscopy, non-linear optical materials, and laser induced fluorescence studies.

The compact size and modular design make the 400 Series ideal for OEM applications as well. Incorporate the detector and preamplifier into mid-IR lasers, LIDAR systems, or fire-control systems for real-time diagnostics, output stabilization, and process control.

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SPECIFICATIONS

Spectral response (see curve)	0.8 - 1.8 μm
Maximum total energy	3 μJ
Maximum energy density	25 μJ/cm^2
Max. peak pulse power density *(30 ns pulse)*	100 mW/cm^2
Max. average power density	10 mW/cm^2
Minimum detectable energy	10 pJ
Maximum pulse rep rate	200 Hz
Maximum pulse width	200 μs
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	13 mm (1.3 cm^2)
Full scale ranges	6; 30 pJ - 3 μJ
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

Germanium has advantages over the other semiconductor detectors for certain applications. For example, it is nearly as sensitive as silicon at 1064 nm, and its spectral response in the region about 1064 nm is much flatter. Therefore small fluctuations in source wavelength have far less impact on the measured energy. Germanium covers the same wavelength range as InGaAs, and the larger detector active area allows for measuring higher pulse energy levels. Below 1.5 μm the temperature coefficient of Germanium is also comparable to that of InGaAs, resulting in accurate measurements without the need for temperature stabilization.

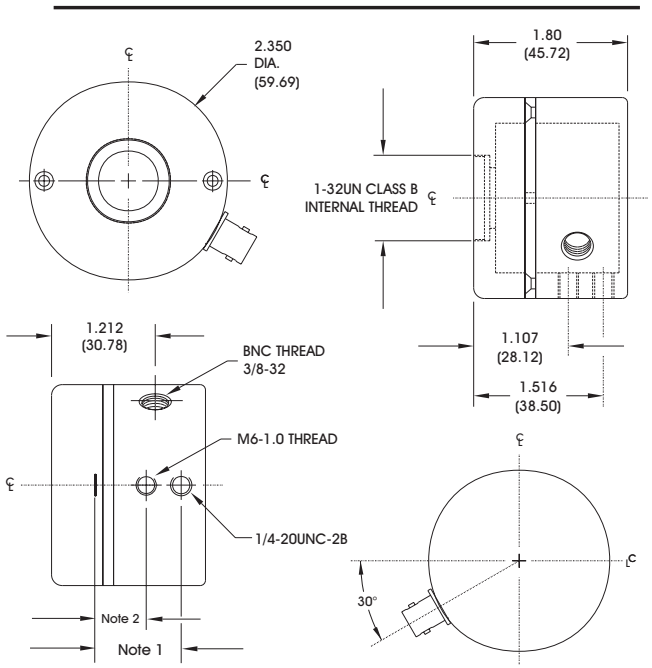
As a member of the 400 Series Probe family, the RjP-495 uses the same detector housing and preamplifier enclosure as all other 400 Series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

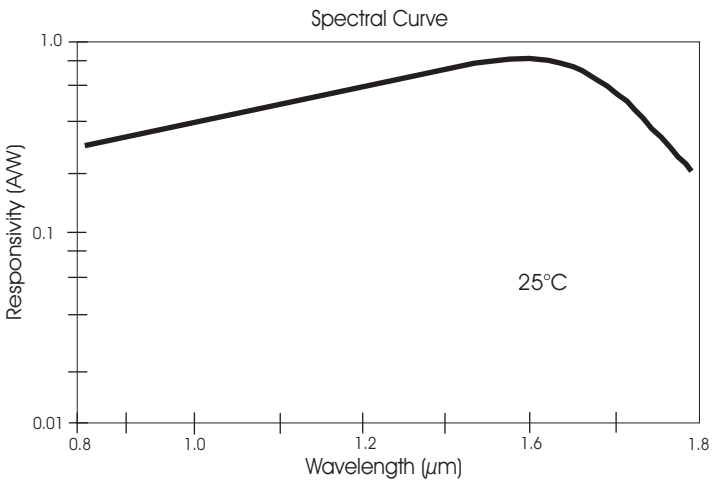
A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

There are many options and accessories available for the RjP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. The options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



Note 1:
The distance from the detector plane to the center line of the 1/4 - 20 mounting is 1.011" (25.68 mm)
Note 2:
The distance from the detector plane to the center line of the M6 mounting is .602" (15.29 mm)



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RjP-637
Pyroelectric Energy Probe

- **Unique Cavity Detector Design**
- **μJ Sensitivity**
- **Measure Energy up to 500 Hz**
- **±1% Wavelength Response**

The unique cavity, or light-trap, detector assembly used in the RjP-637 Pyroelectric Energy Probe is a nearly perfect absorber, yielding a flatter spectral response and greater sensitivity than a conventional pyroelectric detector of comparable size. Its tremendous versatility - μJ to J, UV to Far-IR, single-shot to 500 Hz - makes it the right probe for almost any application.

The extremely wide spectral response makes this probe the ideal measurement tool for broadband sources like flashlamps, or for diffractive/dispersive instruments like monochromaters.Cover the full spectral range of Ti:Sapphire, Dye, OPOs, and other tunable laser sources without having to worry about wavelength correction factors. The RjP-637 is equally adept at measuring Nd:YAG, Er:YAG, Nd:YLF, Excimer, Nitrogen, Copper Vapor, and CO_2 lasers.

Besides being a versatile research instrument the RjP-637 is an excellent energy transfer standard. Use calibrated neutral density filters to extend its dynamic range to match both low-energy semiconductor probes and high-energy calorimeter probes. Use it to calibrate ophthalmic and surgical lasers. Perform real-time analysis of LIDAR, rangefinder, and fire control systems. Or monitor the source laser in laser ablation, laser-induced fluorescence, and non-linear optics experiments.

The RjP-637 can be used to measure total energy (Joules) or fluence (J/cm^2). Underfilling the detector aperture so the whole beam strikes the detector measures the total pulse energy. Because the detector aperture is machined to 1.0 cm^2 with a high degree of precision, flooding the aperture with a uniform beam directly gives fluence measurements.

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SPECIFICATIONS

Spectral response	0.18 - 20 μm
Maximum total energy	1.0 J
Maximum energy density	1.0 J/cm^2
Max. peak pulse power density *(30 ns pulse)*	1.0 MW/cm^2
Max. average power density	5.0 W/cm^2
Minimum detectable energy	250 nJ
Maximum pulse rep rate (RjP-636)	500 (200) Hz
Maximum pulse width (RjP-636)	50 (200) μsec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	1.0 cm^2
Full scale ranges	6; 30 μJ - 1J
Probe dimensions (dia x depth)	7.7 cm x 9.9 cm (3.0" x 3.9")
Probe weight	0.8 kg (1.8 lb)

In a conventional flat detector photons incident on its surface have only one point of contact, at which they are either absorbed or reflected away. However, the geometry of the RjP-637 cavity detector insures that virtually all of the photons that are not absorbed at the initial contact point will be reflected further into the cavity, where they contact the detector surface again and again. This "light-trap" configuration produces almost total light absorption, resulting in an extremely broad, flat wavelength response.

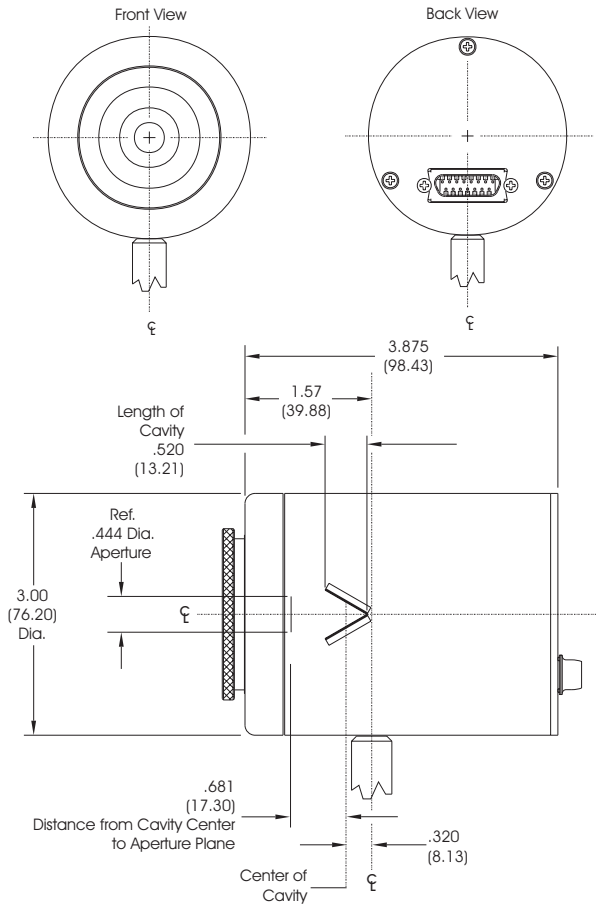
The RjP-637 is configured to measure up to 500 Hz, with a maximum pulse width of 50 μs. However, the preamplifier can be modified to increase the maximum pulse width to 200 μs, with a maximum pulse repetition rate of 200 Hz. This version is given the model number RjP-636. Consult the factory for additional details.

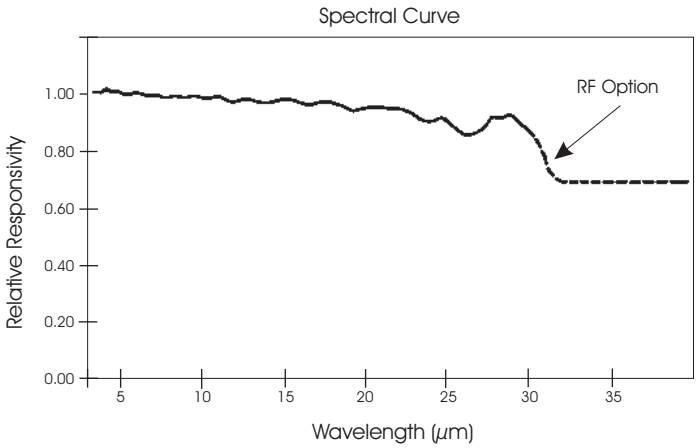
The RjP-600 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

The front of the RjP-637 is threaded to accept accessories. A 25 mm diameter filter holder is included with the Probe. A standard ¼-20 threaded hole is provided for mounting the probe to an optics bench. The probe is black anodized to reduce unwanted back-reflection.

There are many options and accessories available for the RjP-600 Series probes, including various size filter holders, probe extension cables, and the kTA-141 support stand. These options and accessories are detailed in a separate data sheet.

All RjP-600 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RjP-667
Silicon Energy Probe

- **Measure Energy per Pulse up to 2 kHz**
- **UV - Enhanced Response from 180 nm to 1.1 μm**
- **pJ Sensitivity**
- **Large, 1.0 cm² Active Area**

Measurement of low energy, high rep rate sources is no longer limited to average power - with the RjP-667 you can directly measure the integrated energy of each pulse in real time. This UV-Enhanced Silicon Energy probe is designed specifically for measuring low energy, pulsed sources from the near-UV to the near-IR. Picojoule sensitivity, 2 kHz speed, and a 1 cm^2 active area guarantee unmatched versatility and ease of use.

The RjP-667 can measure a number of pulsed lasers, including Nd:YAG, Nd:YLF, Ti:Sapphire, Nitrogen, Excimer, and Dye. The Probe works equally well with other sources, such as short pulse flashlamps, LEDs, and laser diodes.

Bioluminescence, laser induced fluorescence, and non-linear optics are a just few examples of the wide range of applications for the RjP-667. Mate the appropriate filter to the probe to isolate specific spectral regions, such as the UV-A / UV-B range for germicidal studies. Take advantage of its sensitivity in the near-IR to test Nd:YAG based LIDAR, tracking, and target rangefinder/designator systems.

Couple the RjP-667 with the Rm-6600 Dual-Channel Universal Radiometer and a pyroelectric energy probe to ratiometrically measure the transmission of laser goggles, filters, and attenuators over 6 decades of dynamic range.

The RjP-667 is calibrated for absolute energy measurement at 950 nm (the wavelength of peak spectral response). The typical wavelength response curve, normalized to 100% relative responsivity at 950 nm, is stored in the

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SPECIFICATIONS

Spectral response (see curve)	180 - 1100 nm
Maximum total energy (RjP-668)	250 (50) nJ
Maximum energy density	1.25 μJ/cm^2
Max. peak pulse power density *(30 ns pulse)*	100 mW/cm^2
Max. average power density	5.0 mW/cm^2
Minimum detectable energy	500 fJ
Maximum pulse rep rate (RjP-668)	500 Hz (2 kHz)
Maximum pulse width (RjP-668)	50 (10) μs
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	10 mm x 10 mm (1.0 cm^2)
Full scale ranges	6; 3 pJ - 300 nJ
Probe dimensions (h x w x depth)	10.2 cm x 7.7 cm x 7.2 cm (4.0" x 3.0" x 2.8")
Probe Weight	0.5 kg (1.0 lb)

preamplifier. When a wavelength other than 950 nm is entered via the "Wavelength Select" function of the Universal Radiometers the appropriate wavelength correction factor is automatically applied, and the true energy displayed. Two absolute wavelength calibration options are available, UV (200 - 350 nm) and VIS-IR (350 - 1100 nm).

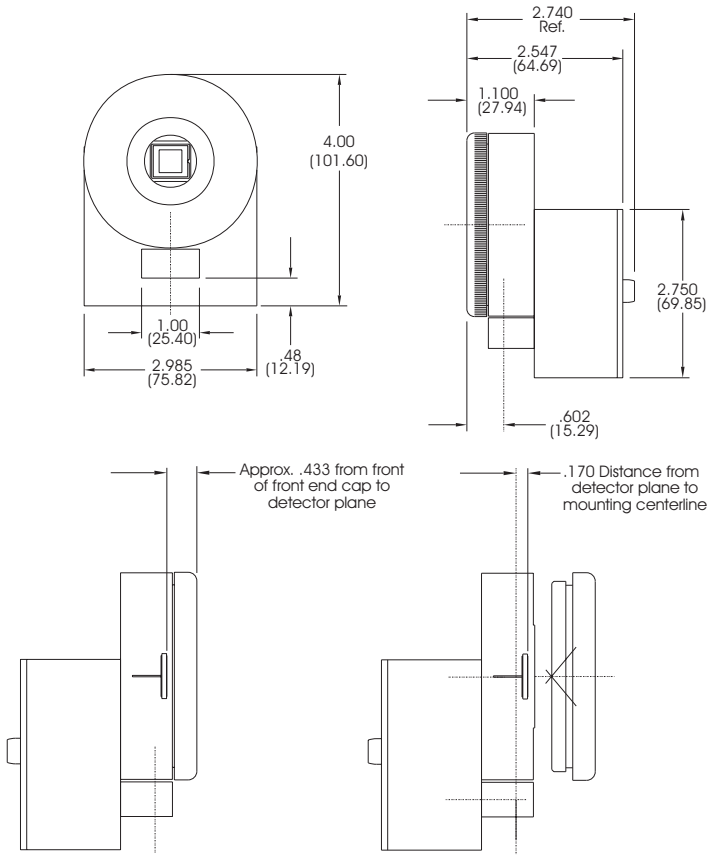
The RjP-667 is configured to measure up to 500 Hz, with a maximum pulse width of 50 μs. However, the preamplifier can be modified to measure up to 2 kHz, with a maximum pulse width of 10 μs. This version is given the model number RjP-668. Consult the factory for additional details.

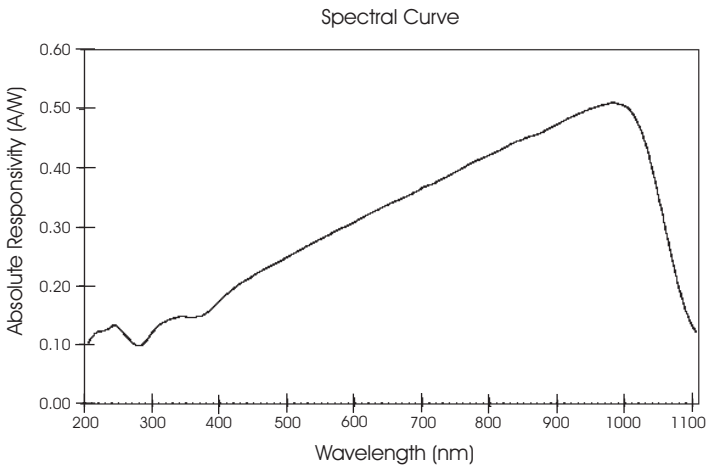
The RjP-600 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

The front of the RjP-667 is threaded to accept accessories. A 25 mm diameter filter holder is included with the Probe. A standard ¼-20 threading hole is provided for mounting the probe to an optics bench. The probe is black anodized to reduce unwanted back-reflection.

There are many options and accessories available for the RjP-600 Series probes, including various size filter holders, probe extension cables, and the kTA-141 support stand. These options and accessories are detailed in a separate data sheet.

All RjP-600 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RjP-734

Pyroelectric Energy Probe

The RjP-734 is a large area, Cavity Pyroelectric Energy Probe that can measure single-shot to 40 Hz, μJ to Joules, over a broad wavelength range. This Probe has all the advantages associated with a cavity detector - higher total absorption, flatter spectral response, increased sensitivity - with the added benefit of accepting beams up to 25 mm in diameter.

Because of its wide spectral response this probe is the ideal measurement tool for high-energy flashlamps and other white light sources. Cover the full spectral range of Ti:Sapphire, Dye, OPO, and other tunable laser sources without having to worry about wavelength correction factors. The RjP-734 is equally adept at measuring Nd:YAG, Er:YAG, Nd:YLF, Nitrogen, CO_2, and other fixed-wavelength lasers.

The RjP-734 is particularly useful for measuring larger diameter beams, such as those produced by Excimer lasers. Accurate energy per pulse measurements can be made without having to use optics to squeeze the beam onto a smaller detector. This reduces the complexity of the beam path and eliminates any potential error associated with the focusing optics. Conversely, for high-energy sources, expanding the beam and using a larger area probe is an alternative to neutral density filters and beamsplitters for reducing the fluence to a measurable level. The large area is also convenient when working with highly divergent sources like laser diodes or bare optical fibers.

- **Large Area Cavity Detector**
- **μJ to Joules**
- **Single-Shot to 40 Hz**
- **Flat Wavelength Response**

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SPECIFICATIONS

Spectral response	0.18 - 20 μm
Maximum total energy	2.0 J
Maximum energy density	0.4 J/cm^2
Max. peak pulse power density *(30 ns pulse)*	1.0 MW/cm^2
Max. average power density	2.0 W/cm^2
Minimum detectable energy	10 μJ
Maximum pulse rep rate	40 Hz
Maximum pulse width	1.0 msec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	25.0 mm (4.9 cm^2)
Full scale ranges	5; 200 (300) μJ - 2(3) J (readout dependent)
Head dimensions (dia x depth)	5.8 cm x 19.5 cm (2.3" x 7.7")
Probe weight	0.5 kg (1.0 lb)

The extended spectral response qualifies the RjP-734 for UV applications like photolithography, sterilization, and curing. Use it to repair and calibrate ophthalmic and surgical lasers, by looking at the defocused beam. Perform real-time analysis of LIDAR, rangefinder, and fire control systems. Or monitor the source laser in laser ablation, laser-induced fluorescence, and non-linear optics experiments.

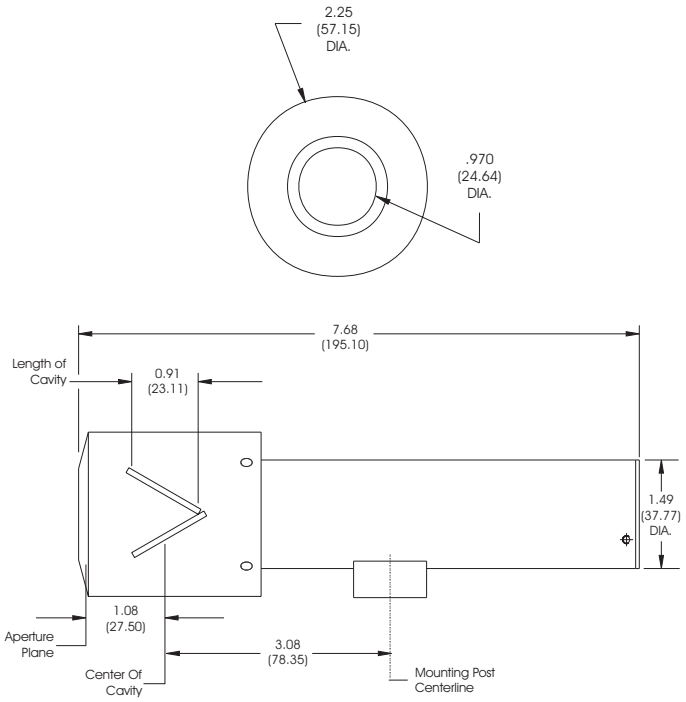
In a conventional flat detector photons incident on its surface have only one point of contact, at which they are either absorbed or reflected away. However, the geometry of the RjP-734 cavity detector insures that nearly all of the photons that are not absorbed at the initial contact point will be reflected deeper into the cavity, where they strike the detector surface again and again. This "light-trap" configuration produces almost total light absorption, resulting in an extremely broad, flat wavelength response.

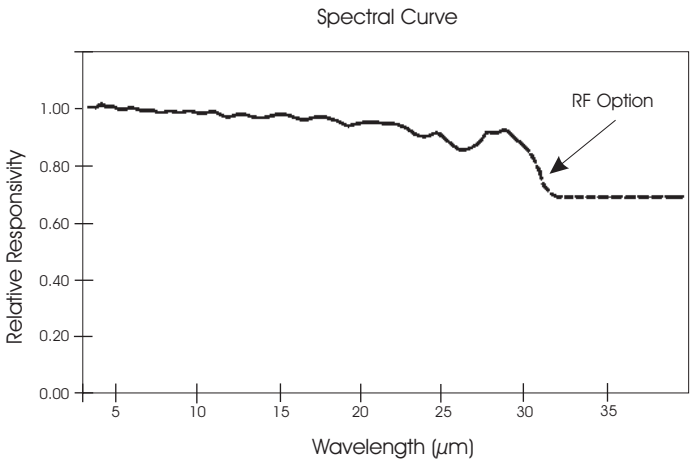
The RjP-700 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

A mounting block with the standard ¼ - 20 mounting hole is attached to the probe housing. It can be removed for inserting the probe in a cylindrical fixture. A matte black finish reduces unwanted back-reflection.

There are many options and accessories available for the RjP-700 Series probes, including the kTA-141 support stand, probe extension cables, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RjP-700 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RjP-735
Pyroelectric Energy Probe

- **Unique Cavity Detector Design**
- **μJ Sensitivity**
- **±1% Wavelength Response**
- **Energy Transfer Standard**

The RjP-735 Cavity Pyroelectric Energy Probe measures μJ to Joules, single-shot to 40 Hz, from the UV to Far-IR - making it suitable for a wide variety of applications. The unique cavity detector assembly is a nearly perfect absorber, producing a flatter spectral response and greater sensitivity than a conventional pyroelectric detector of comparable size.

Because of its wide spectral response this probe is the ideal measurement tool for broadband sources like flashlamps and blackbody emitters. Cover the full spectral range of Ti:Sapphire, Dye, OPOs, and other tunable laser sources without having to worry about wavelength correction factors. The RjP-735 is equally adept at measuring Nd:YAG, Er:YAG, Nd:YLF, Excimer, Nitrogen, Copper Vapor, and CO_2 lasers.

Besides being a versatile research instrument the RjP-735 is an excellent energy transfer standard. It can be used with calibrated neutral density filters to extend its dynamic range to match both low-energy semiconductor probes and high-energy thermopile probes. A removable aperture plate (RkR-700) defines the detector active area to be 1 cm^2, so overfilling the aperture automatically results in fluence (J/cm^2) measurements.

The extended UV response is well suited for photolithography, sterilization, and curing applications. Use it to calibrate ophthalmic and surgical lasers. Perform real-time analysis of LIDAR, rangefinder, and fire control systems. Or monitor the source laser in laser ablation, laser-induced fluorescence, and non-linear optics experiments.

LaserProbe inc.

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SPECIFICATIONS

Spectral response	0.18 - 20 μm
Maximum total energy	1.0 J
Maximum energy density	1.0 J/cm^2
Max. peak pulse power density *(30 ns pulse)*	1.0 MW/cm^2
Max. average power density	5.0 W/cm^2
Minimum detectable energy	100 nJ
Maximum pulse rep rate	40 Hz
Maximum pulse width	1.0 msec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	1.0 cm^2
Full scale ranges	6; 20 (30) μJ - 1J (readout dependent)
Head dimensions (dia x depth)	3.2 cm x 17.6 cm (1.5" x 6.9")
Probe weight	0.4 kg (0.8 lb)

The RjP-735/RF uses a different electrode material to extend the IR response to 1,000 μm or more. Absolute calibration in this wavelength range is not available, but collaboration with customers indicates that the wavelength response from approximately 100 - 1,000 μm is relatively flat.

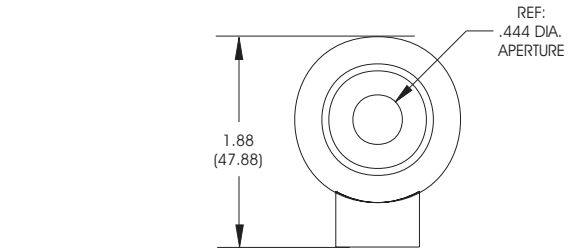
In a conventional flat detector photons incident on its surface have only one point of contact, at which they are either absorbed or reflected away. However, the geometry of the RjP-735 cavity detector insures that nearly all of the photons that are not absorbed at the initial contact point will be reflected deeper into the cavity, where they strike the detector surface again and again. This "light-trap" configuration produces almost total light absorption, resulting in an extremely broad, flat wavelength response.

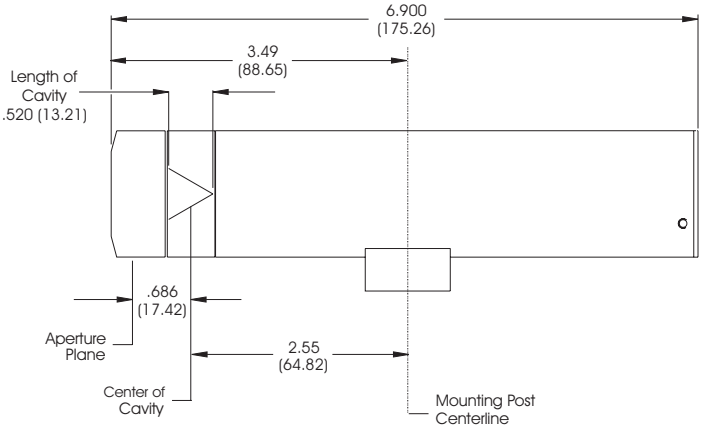
The RjP-700 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

A mounting block with the standard ¼ - 20 mounting hole is attached to the probe housing. It can be removed for inserting the probe in a cylindrical fixture. A matte black finish reduces unwanted back-reflection.

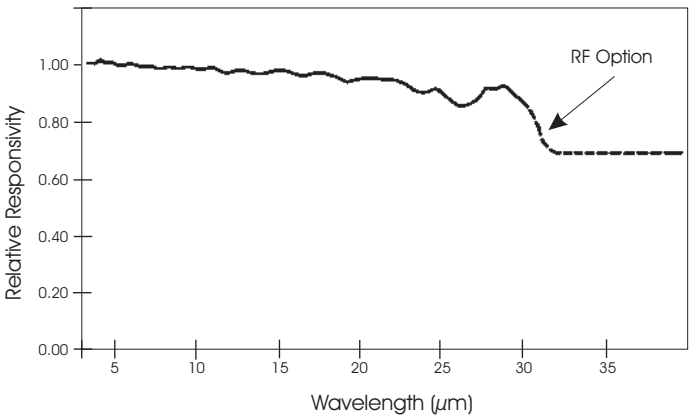
There are many options and accessories available for the RjP-700 Series probes, including the kTA-141 support stand, probe extension cables, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RjP-700 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





Spectral Curve



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RjP-736
Pyroelectric Energy Probe

The RjP-736 Pyroelectric Energy Probe is designed for lower repetition rate, high-energy pulsed sources. It is ideal for lasers with large beams, such as Excimer lasers, or for capturing the total output of a highly divergent source. With UV to IR spectral response, single-shot to 40 Hz speed, and up to 10 Joules total energy capability, the RjP-736 is an invaluable measurement tool.

Use this probe to measure the defocused beam from industrial Nd:YAG, Er:YAG, Nd:YLF, Ruby, and CO_2 lasers. Capture the total integrated energy of high energy flashlamps and arc lamps. Cover the full spectral range of Ti:Sapphire, Dye, OPOs, and other tunable sources. Take advantage of the large active area to measure laser diode bars and Excimer lasers.

Because of its 50 mm diameter the energy per pulse of a large beam can be measured directly, without having to use optics to squeeze the beam onto a smaller detector. This reduces the complexity of the beam path and eliminates any potential error associated with the focusing optics. Conversely, for high-energy sources, expanding the beam and using a larger area probe is an alternative to neutral density filters and beamsplitters for reducing the fluence to a measurable level. The large area is also convenient when working with highly divergent sources like laser diodes or bare optical fibers.

The RjP-736 can be used to monitor sterilization, curing, and other UV processes. Use it as a reference detector for optical testbeds with large, collimated beams, such as those used to calibrate the throughput of large diameter optics, or that

- **50 mm Diameter Detector**
- **Measures mJ to 10 Joules**
- **Single-Shot to 40 Hz**
- **Ideal for Large Beams**

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SPECIFICATIONS

Spectral response	0.18 - 20 μm
Maximum total energy	10.0 J
Maximum energy density	0.5 J/cm^2
Max. peak pulse power density *(30 ns pulses)*	0.5 MW/cm^2
Max. average power density	0.5 W/cm^2
Minimum detectable energy	100 μJ
Maximum pulse rep rate	40 Hz
Maximum pulse width	1.0 msec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	50.0 mm (19.7 cm^2)
Full scale ranges	4; 20 (30) mJ - 10 J (readout dependent)
Head dimensions (dia x depth)	7.7 cm x 16.9 cm (3.0" x 6.7")
Probe weight	0.6 kg (1.3 lb)

flood a smaller detector's total active area. Repair and calibrate ophthalmic and surgical lasers by looking at the defocused beam. Sample the output of industrial Nd:YAG and CO_2 lasers for real time control of welding, marking, and cutting, processes.

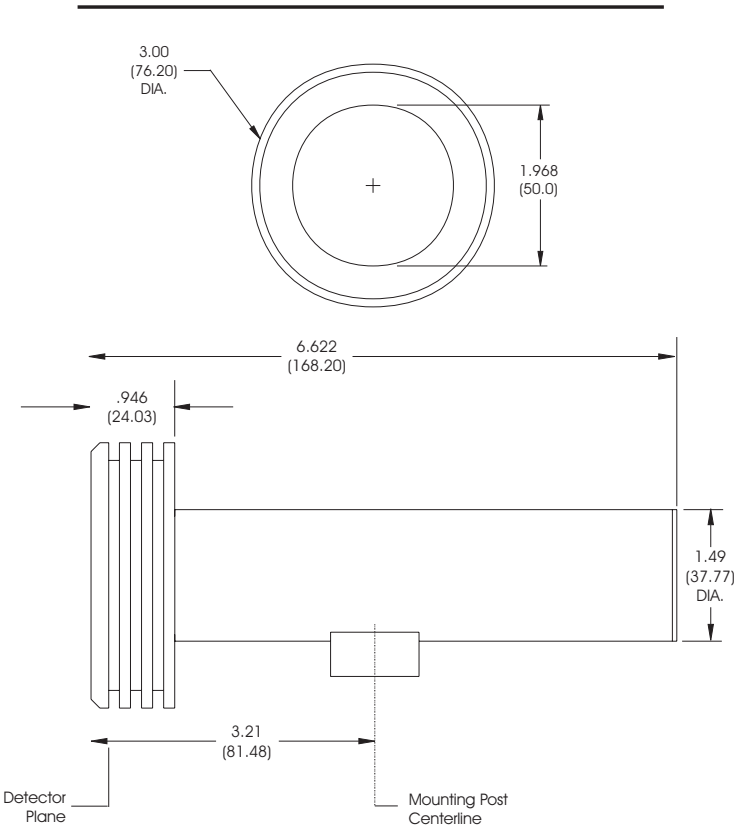
The RjP-736 is designed to measure high energy, large area beams. Expanding the beam so that it covers most of the Probe's active area allows it to measure up to 10 Joules per pulse at a 1 Hz pulse repetition rate. A black absorbing material is applied to the detector surface, to provide a flatter spectral response and higher total absorption. While exceeding the rated fluence level will sometimes oblate this absorber layer, the durable detector element itself is generally unharmed. Recoating and recalibrating the probe restores it to original operating specifications.

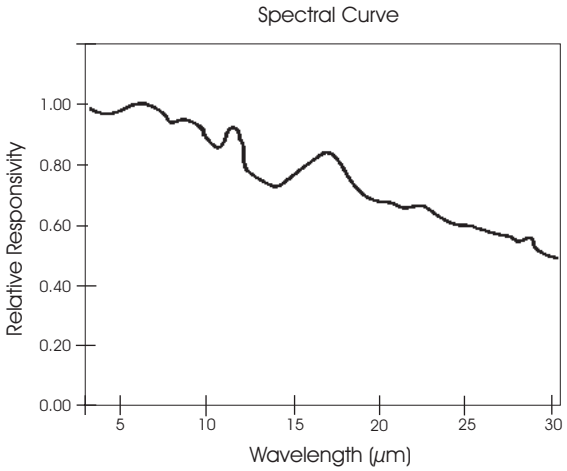
The RjP-700 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

A mounting block with the standard ¼-20 mounting hole is attached to the probe housing. It can be removed for inserting the probe in a cylindrical fixture. A matte black finish reduces unwanted back-reflection.

There are many options and accessories available for the RjP-700 Series probes, including the kTA-141 support stand, probe extension cables, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RjP-700 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RjP-765a
Silicon Energy Probe

- **UV - Enhanced Response from 180 nm to 1.1 μm**
- **pJ Sensitivity**
- **Large, 1.0 cm^2 Active Area**
- **Wide Range of Applications**

Measurement of low energy, pulsed sources is no longer limited to average power - the RjP-765a can directly measure the integrated energy of each pulse in real time. This UV-Enhanced Silicon Energy probe is designed specifically for measuring lower repetition rate, longer pulse duration (up to 1 msec) sources, from the near-UV to the near-IR. Picojoule sensitivity, single-shot to 40 Hz rep rates, psec to msec pulse widths, and a 1 cm^2 active area insure tremendous versatility and ease of use.

A number of sources fall within the RjP-765's measurement range. Lasers include Nd:YAG (fundamental and harmonics), Nd:YLF, Nitrogen, Excimer, and Dye. Non-laser sources like flashlamps, LEDs, and laser diodes are also accommodated.

Because it can measure pulses up to 1 msec long, continuous wave sources that are chopped with a small duty cycle blade at 30 - 40 Hz can be measured with the RjP-765a. This technique is useful for monitoring the power fluctuations of a cw source that are occurring too rapidly for a traditional power meter to resolve. It can also be used to transfer absolute calibration between power meters and energy meters.

The scope of application for the RjP-765a is enormous. Raman spectroscopy, bioluminescence, laser-induced flourescence, and non-linear optics are just a few examples. With the appropriate filter it can be used for photopic measurements, or to isolate the UV-A/UV-B range for germicidal studies. Use the RjP-765a with the

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SPECIFICATIONS

Spectral response	180 - 1100 nm
Maximum total energy	2.0 μJ
Maximum energy density	2.0 μJ/cm^2
Max. peak pulse power density *(30 ns pulse)*	100 mW/cm^2
Max. average power density	5.0 mW/cm^2
Minimum detectable energy	1.0 pJ
Maximum pulse rep rate	40 Hz
Maximum pulse width	1.0 msec
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area	1.0 cm^2
Full scale ranges	6; 20 (30) pJ - 2 (3) μJ (readout dependent)
Head dimensions (dia x depth)	3.2 cm 17.6 cm (1.5" x 6.9")
Probe weight	0.4 kg (0.8 lb)

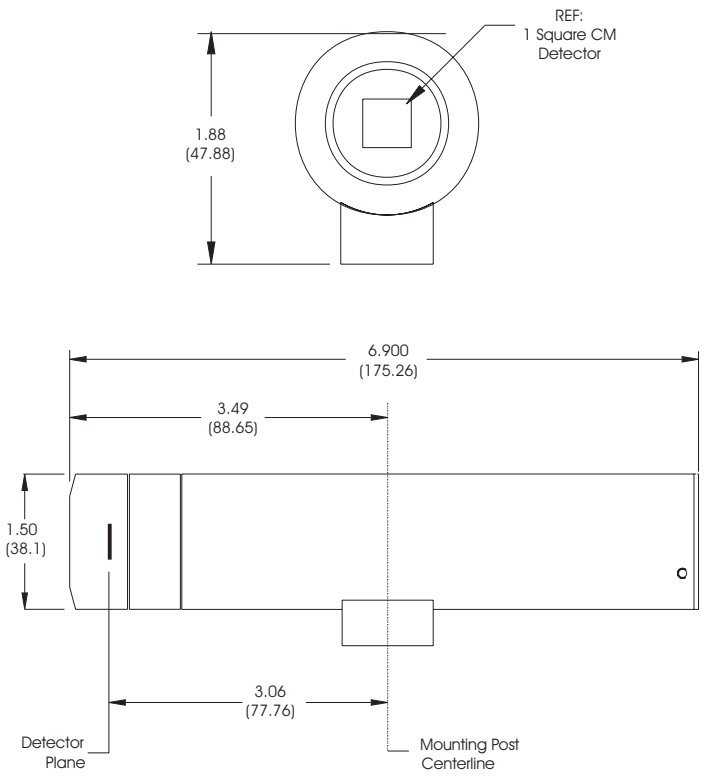
battery powered Rm-3700 Universal Radiometer for field testing weapons simulation systems, LIDAR, and target rangefinder/designator systems. Or couple it with the Rm-6600 Dual-Channel Universal Radiometer and a pyroelectric energy probe to ratiometrically measure the transmission of laser goggles, filters, and attenuators over 6 decades of dynamic range.

The RjP-765a is calibrated for absolute energy measurement at 950 nm (the wavelength of peak spectral response). The typical wavelength response curve, normalized to 100% relative responsivity at 950 nm, is provided for working at wavelengths other than the peak. Two absolute wavelength calibration options are available, UV (200 - 350 nm) and VIS-IR (350 - 1100 nm).

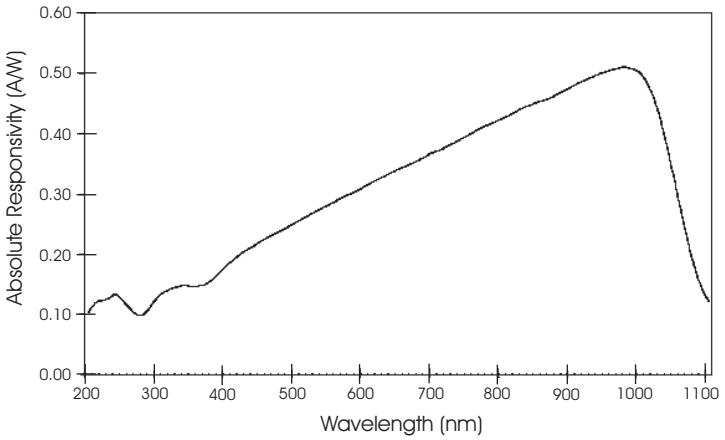
The RjP-700 Series probes have the detector assembly and preamplifier in a common housing. This minimizes the signal path between the detector and preamplifier and surrounds them with a continuous Faraday cage, giving optimal EMI/RFI immunity.

A mounting block with the standard ¼-20 mounting hole is attached to the probe housing. It can be removed for inserting the probe in a cylindrical fixture. A matte black finish reduces unwanted back-reflection. There are many options and accessories available for the RjP-700 Series probes, including the kTA-141 support stand, probe extension cables, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RjP-700 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



Spectral Curve



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RkP-465
Silicon Power Probe

- **UV-Enhanced Response from 180 nm to 1.1 μm**
- **pW Sensitivity; fW Resolution**
- **Large, 1.0 cm² Active Area**
- **Windowless Version Optional**

LaserProbe inc.

This UV-Enhanced Silicon Power probe is designed specifically for measuring low intensity, continuous wave or pulsed sources, from the near-UV to the near-IR. Picowatt sensitivity, a low noise preamplifier, and a 1 cm^2 active area combine for unprecedented versatility and accuracy.

The RkP-465 is suitable for a number of lasers - HeNe, Argon, Nd:YAG, Nd:YLF, Ti:Sapphire, Nitrogen, Excimer, Dye - just to name a few. It works equally well with other light sources such as Xenon lamps, LEDs, and laser diodes.

Bioluminescence, laser induced fluorescence, holography, non-linear optics - these are just a few of the uses for the RkP-465. Mate the appropriate filter to the probe for photopic and scotopic measurements, or isolate the UV-A / UV-B range for germicidal studies. Use the RkP-465 with the battery powered Rm-3700 Universal Radiometer for field testing weapons simulation systems, LIDAR, and target rangefinder/designator systems. Couple it with the Rm-6600 Dual Channel Universal Radiometer and a thermopile power probe to ratiometrically measure the transmission of laser goggles, filters, and attenuators over 6 decades of dynamic range.

The compact size and modular design make the RkP-465 ideal for OEM applications as well. Incorporate the detector and preamplifier directly into lasers, detector calibration fixtures, or fire-control systems for real-time diagnostics, output stabilization, and process control.

The RkP-465 is calibrated for absolute power measurement at 950 nm (the wavelength of peak spectral response). The typical wavelength

SPECIFICATIONS

Spectral response (see curve)	200 - 1100 nm
Maximum total power	1 mW
Maximum average power density	5.0 mW/cm^2
Noise equivalent power	1 pW
Calibration accuracy	± 5%
Linearity	± 0.5%
Detector active area dimensions	10 x 10 mm (1.0 cm^2)
Full scale ranges	7; 3 nW - 3 mW
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

response curve, normalized to 100% relative responsivity at 950 nm, is stored in the preamplifier. When a wavelength other than 950 nm is entered via the "Wavelength Select" function of the Universal Radiometers the appropriate wavelength correction factor is automatically applied, and the true power displayed. Two absolute wavelength calibrations are available, VIS/IR (350-1100 nm) and UV (200-350 nm).

A windowless version is available as well. Removing the window improves the surface uniformity and reduces back-reflection. However, care must be exercised in humid environments as silicon is slightly hygroscopic, thus the detector responsivity may vary over a period of years.

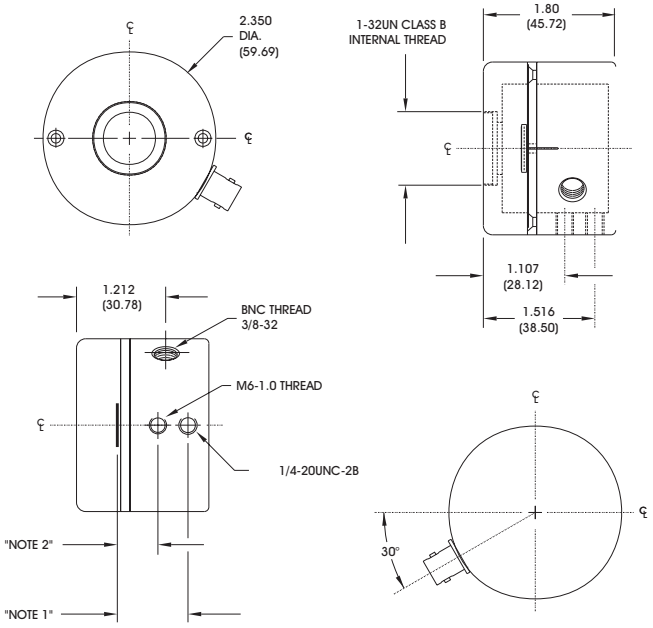
As a member of the 400 Series Probe family, the RkP-465 uses the same detector housing and preamplifier enclosure as all other 400 Series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometers. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

There are many options and accessories available for the RkP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. These options and accessories are detailed in a separate data sheet.

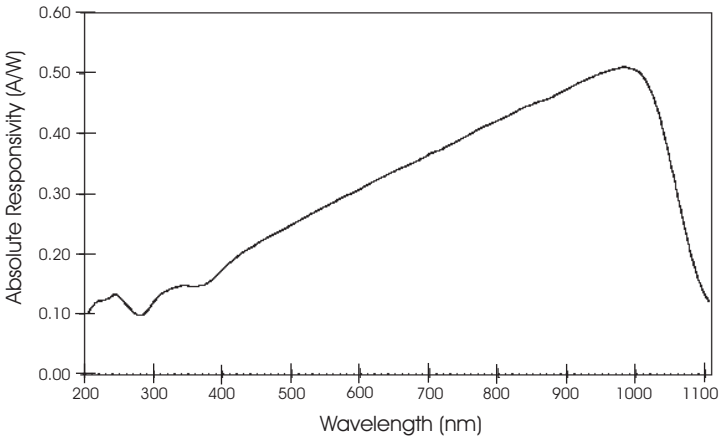
All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



NOTE 1: The distance from the detector plane to the center of the ¼ - 20 mounting is 1.00" (25.4mm).

NOTE 2: The distance from the detector plane to the center line of the M6 mounting is .552" (14.02mm)

Spectral Curve



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RkP-485a
InGaAs Power Probe

- **Custom Large Area InGaAs Detector**
- **Ideal for Eye-Safe Laser Applications**
- **Excellent Thermal Stability**
- **pW Sensitivity at 1.5 μm**

LaserProbe inc.

The RkP-485a is the first InGaAs Probe designed specifically for high accuracy laser power measurements. The custom InGaAs detector is 5 mm in diameter (0.2 cm^2 active area) - over six times larger than the typical InGaAs detector - making it very easy to use for "real world" measurements. Picowatt sensitivity and superior thermal stability make it the probe of choice for mid-IR power measurements.

The RkP-485a is ideal for measuring the power of Raman-shifted Nd:YAG, Er:YAG, and Ti:Sapphire lasers, Optical Parametric Oscillators, laser diodes, and other mid-IR sources. All the major fiber optic wavelengths are covered, making the RkP-485a well suited for testing and calibrating fiber power meters, loss test sets, and other fiber test instrumentation.

Use the RkP-485a with the battery powered Rm-3700 Universal Radiometer to field-test *eye-safe* laser rangefinders, target designators, and fire-control systems. Couple it with a thermopile power probe and the Rm-6600 Dual Channel Universal Radiometer to ratiometrically measure the transmission of laser goggles, filters, and other optical components over 6 decades of dynamic range. Other applications include mid-IR and Raman spectroscopy, and non-linear optics.

The compact size and modular design make the 400 Series ideal for OEM applications as well. Incorporate the detector and preamplifier into mid-IR lasers, LIDAR systems, or fire-control systems for real-time diagnostics, output stabilization, and process control.

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SPECIFICATIONS

Spectral response (see curve)	0.8 - 1.7 μm
Maximum total power	1 mW
Maximum average power density	5 mW/cm^2
Noise equivalent power	3 pW
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	5 mm (0.196 cm^2)
Full scale ranges	7; 3 nW - 3 mW
Head dimensions (dia x depth)	6.0 cm x 4.6 cm (2.4" x 1.8")
Preamplifier dimensions (l x w x h)	11.5 cm x 7.7 cm x 5.1 cm (4.5" x 3.0" x 2.0")
Probe weight (head and preamp)	0.5 kg (1.0 lb)

InGaAs has distinct advantages over other semiconductor detectors. It is more sensitive than silicon at 1064 nm, and is operating in a much more linear portion of its spectral response range. Therefore small fluctuations in wavelength have far less impact on the measured energy. In addition, InGaAs has a lower temperature coefficient than both silicon and germanium - over most of its spectral response range the RkP-485a's responsivity varies less than 2% from -30° to +25°C - insuring repeatable results without expensive temperature stabilization.

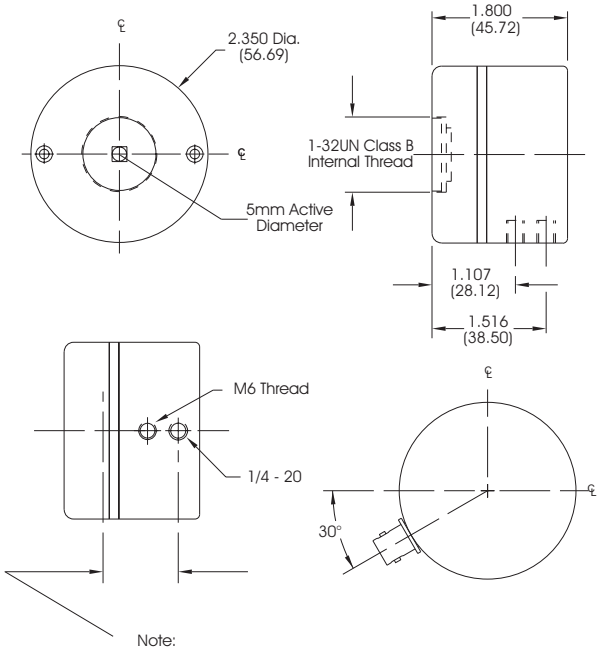
As a member of the 400 Series Probe family the RkP-485a uses the same detector housing and preamplifier enclosure as all other 400 Series probes. In addition, most 400 Series probes are designed so the detector plane is the same distance from the mounting post plane, allowing for easy interchange of probes in an experiment.

The compact 400 Series detector housing measures 2.35" in diameter by 1.8" deep. The side-mounted BNC connector requires no additional clearance in the beam path. Standard metric and English mounting holes and a 1" (25 mm) filter holder facilitate use, while the black anodized finish reduces unwanted back-reflection.

A separate enclosure houses the preamplifier. Probe parameters, including wavelength correction factors and calibration date, are stored in memory for access by Laser Probe's Universal Radiometer instruments. Carefully designed gain stages insure excellent linearity and S/N ratio over 6 decades of dynamic range.

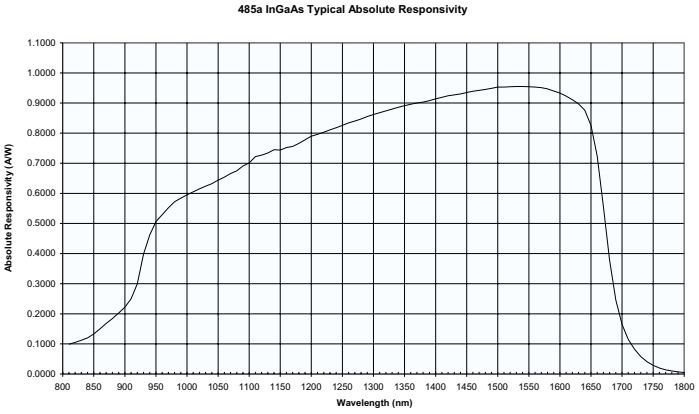
There are many options and accessories available for the RkP-400 Series probes, including a precision aperture, light baffle, and the kTA-141 support stand. These options and accessories are detailed in a separate data sheet.

All 400 Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



Note:
The distance from the focal plane of the detector to the C/L of the 1/4 - 20 mounting is 1.00"

RkP-485a Spectral Curve



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RkP-575
Pyroelectric Power Probe

- **Unique Cavity Configuration**
- **Flat Response, UV to Far-IR**
- **μW to 10 W**
- **Built-in Chopper**

LaserProbe inc.

The RkP-575 Probe is among the most versatile light measurement instruments available today. The unique cavity configuration yields a remarkably flat spectral response - better than ±1% from 0.25 - 2.0 μm. The durable surface absorber can handle up to 10 Watts (100 W/cm^2 power density), yet maintains msec risetime and μW sensitivity. The integrated Rk-570C optical chopper supports synchronous detection, resulting in superior S/N ratio and background rejection compared to other non-chopped thermal detectors.

The extremely wide spectral response and dynamic range make this probe the ideal measurement tool for broadband sources like flashlamps and blackbody emitters. Cover the full spectral range of Ti:Sapphire, Dye, OPO, and other tunable laser sources without having to worry about wavelength correction factors. The RkP-575 is equally suited to measuring Nd:YAG (fundamental and harmonics), Er:YAG, Nd:YLF, Excimer, Nitrogen, Copper Vapor, and CO_2 lasers.

The RkP-575 can be used for absolute radiometry, irradiance, and total power measurements. The flat spectral response and μW sensitivity allow for broadband radiometry, or mate the probe with the appropriate filter to examine specific wavelength ranges (photometry, for example). The detector aperture is manufactured to 1.0 cm^2 with a high degree of precision, so by flooding the aperture irradiance is automatically measured. By confining the light within the detector aperture the total output power of low-to-mid power lasers can be measured.

Besides being a versatile research instrument the RkP-575 is a superb transfer standard. Use calibrated neutral density filters to extend its dynamic range to match both low-power semiconductor detectors and high-power thermopile detectors.

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SPECIFICATIONS

Spectral response	0.2 - 20.0 μm
Maximum total power	10 W
Maximum average power density	100 W/cm^2
Noise equivalent power	100 nW
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	11.3 mm (1.0 cm^2)
Full scale ranges	6; 200 (300) μW - 10 W (instrument dependent)
Probe dimensions (l x w x h)	17.0 cm x 9.0 cm x 5.0 cm (6.7" x 3.6" x 2.0")
Probe and chopper (l x w x h)	19.0 cm x 9.0 cm x 10.5 cm (7.5" x 3.6" x 4.2")
Probe weight	0.7 kg (1.5 lb)
Probe and chopper weight	1.6 kg (3.5 lb)

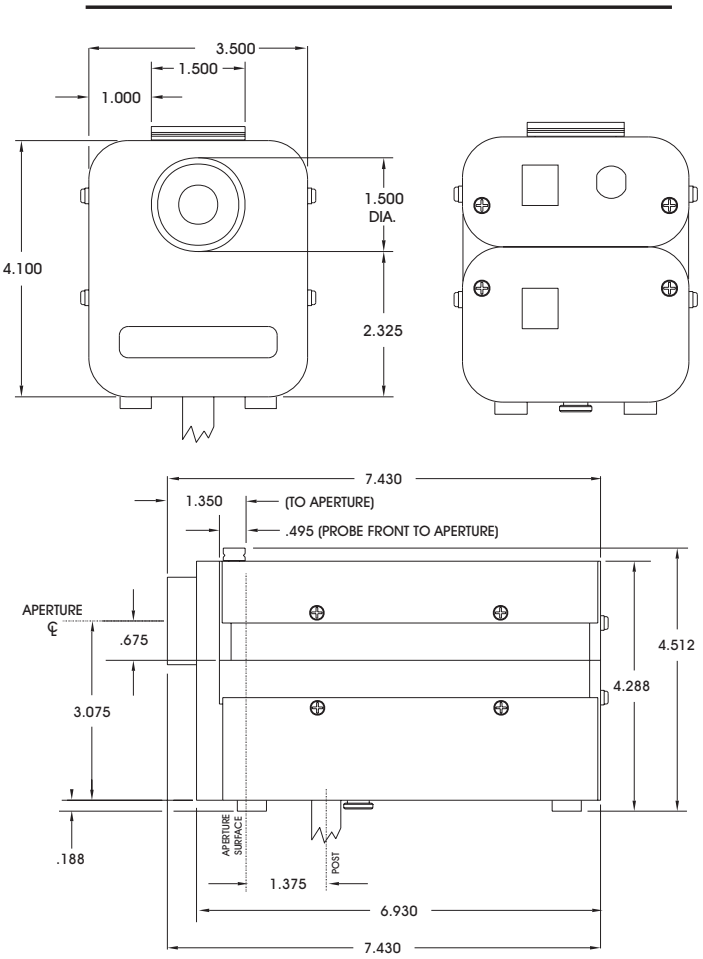
In a conventional flat detector photons strike the detector's surface only once, at which point they are either absorbed into the detector or reflected away. However, the geometry of the RkP-575 cavity detector insures that nearly all of the photons that are not absorbed at the initial contact point will be reflected further into the cavity, striking the detector surface again and again. This "light-trap" configuration produces almost total light absorption, resulting in an extremely broad, flat wavelength response and excellent sensitivity.

Because pyroelectric detectors respond only to changes in temperature (ΔT), cw light sources must be chopped to produce the ΔT necessary to stimulate the detector. The Rk-570C Optical Chopper, designed to mate directly to the RkP-575, accurately chops the optical source. In addition, when used with the appropriate instrument it provides the electrical reference signal required for synchronous detection. The advantage of synchronous detection is that only the optical signal with the same frequency as the reference signal will be measured - all other optical signals are ignored. Positioning the chopper so that just the source is chopped minimizes background noise, yielding the maximum S/N ratio. With this technique it is possible to measure a signal level that is smaller than the background.

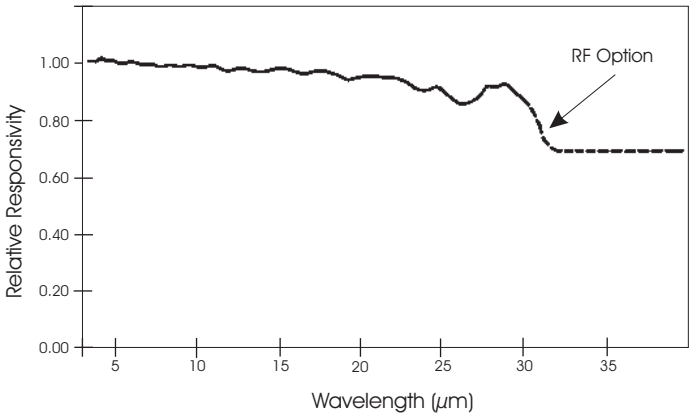
The RkP-500 Series probes are designed to work with the Rk-570C Optical Chopper. The probe's detector assembly and preamplifier are in one housing, the chopper's motor and control circuitry in another. The probe housing mates to the chopper housing, aligning the detector aperture directly behind the chopper aperture. Electrical connections to the instrument are made via a jumper from the probe. A longer jumper is provided for remote chopping.

There are several accessories available for the RkP-500 Series, including probe extension cables, the kTA-141 support stand, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RkP-500 Series probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



Spectral Curve



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RkP-576a
Silicon Power Probe

- **UV - Enhanced Response**
- **pW Sensitivity**
- **Large Area Detector**
- **Built-in Optical Chopper**

The RkP-576a is a UV-Enhanced Silicon Power Probe designed specifically for measuring low intensity, cw or quasi-cw sources, from the UV to near-IR. Picowatt sensitivity, a low-noise preamplifier, and a 1 cm^2 active area combine for unprecedented versatility and accuracy. The integrated Rk-570C optical chopper supports synchronous detection, resulting in superior S/N ratio and background rejection compared to other non-chopped semiconductor detectors.

The RkP-576a is suitable for measuring a number of lasers - HeNe, Argon, Nd:YAG (fundamental and harmonics), and Dye - just to name a few. It works equally well with other light sources, such as Xenon lamps, LEDs, and laser diodes. Use the RkP-576a as a reference standard to monitor the output of a monochromator when measuring a detector's responsivity as a function of wavelength.

Bioluminescence, non-linear optics, photometry (with the appropriate filter), and germicidal studies are a few examples of the diverse range of applications for the RkP-576a. Use it with a pyroelectric or thermopile probe and a dual-channel instrument to measure the throughput of filters and attenuators over 6 decades.

Silicon detectors operate on the photoelectric principle - when a photon of sufficient energy strikes the doped silicon lattice it is absorbed, and its energy forces an electron to be freed from the lattice. When the silicon detector is wired in a circuit the liberated electrons become charge carriers, resulting in an electric current whose magnitude is proportional to the number of photons striking the detector. Because of this direct

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Spectral response	200 - 1100 nm
Maximum total power	1 mW
Maximum average power density	5 mW/cm^2
Noise equivalent power	1 pW
Calibration accuracy	±5%
Linearity	±0.5%
Detector active area dimensions	11.3 mm (1.0 cm^2)
Full scale ranges	6; 20 (30) nW - 1 mW (instrument dependent)
Probe dimensions (l x w x h)	17.0 cm x 9.0 cm x 5.0 cm (6.7" x 3.6" x 2.0")
Probe and chopper (l x w x h)	19.0 cm x 9.0 cm x 10.5 cm (7.5" x 3.6" x 4.2")
Probe weight	0.7 kg (1.5 lb)
Probe and chopper weight	1.6 kg (3.5 lb)

photon-to-electron conversion silicon detectors can be used in dc (non-chopped) or ac (chopped) probes.

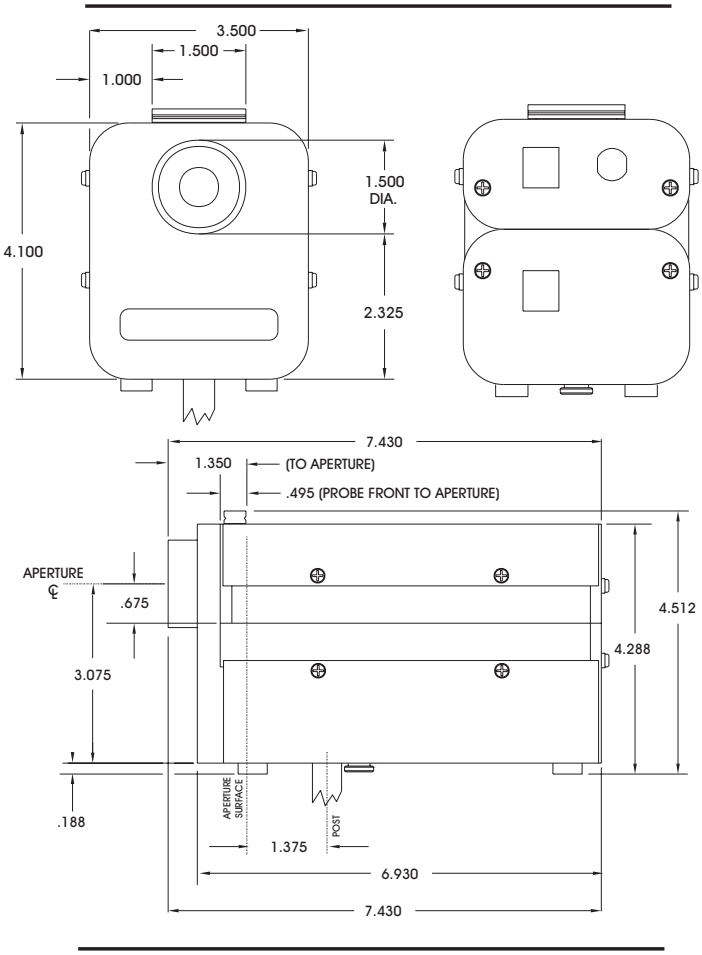
The RkP-576a is designed for use with an optical chopper and a suitable instrument to take advantage of synchronous detection. Synchronous detection requires two signals - an optical signal and an electrical reference signal. The optical signal is generated when the chopped light strikes the detector. The chopper itself produces the reference signal. The advantage of synchronous detection is that only the optical signal with the same frequency as the reference signal will be measured - all other optical signals are ignored. Positioning the chopper so that just the source is chopped minimizes background noise, yielding the maximum S/N ratio. With this technique it is possible to measure a signal level that is smaller than the background.

The RkP-576a is calibrated for absolute power measurement at 950 nm (the wavelength of peak spectral response). The typical wavelength response curve, normalized to 100% relative responsivity at 950 nm, is provided. Two absolute wavelength calibration options are available, VIS-IR (350 - 1100 nm) and UV (200 - 350 nm).

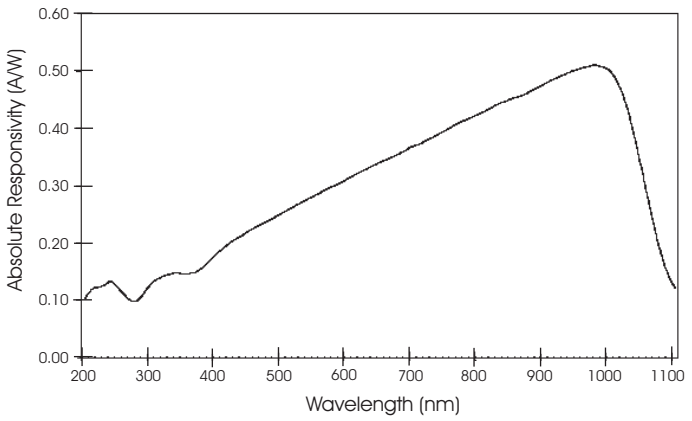
The RkP-500 Series probes are designed to work with the Rk-570C Optical Chopper. The probe's detector assembly and preamplifier are in one housing, the chopper's motor and control circuitry in another. The probe housing mates to the chopper housing, aligning the detector aperture directly behind the chopper aperture. Electrical connections to the instrument are made via a short jumper cable from the probe. A longer jumper is provided for remote chopping.

There are several accessories available for the RkP-500 Series, including probe extension cables, the kTA-141 support stand, and various filters and windows. The options and accessories are detailed in a separate data sheet.

All RkP-500 Series probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.



Spectral Curve



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RkT-10

Thermopile Power Probe

- **High Damage Threshold**
- **100 μW Sensitivity**
- **Broad Spectral Response**
- **Compact Head**

The RkT-10 Thermopile Probe measures both continuous wave and average power, 100 μW to 10 Watts, from the UV to far-IR. The spectrally flat absorber material can withstand average power densities up to 20 kW/cm^2 and peak pulse power densities of 15 MW/cm^2. Advanced thermal management techniques allow for a compact probe design that is capable of continuously dissipating 10 W total power.

The RkT-10's wide spectral response covers all the major laser wavelengths, from Excimer and Nitrogen in the UV, through Argon, Dye, and doubled Nd:YAG in the visible, to Nd:YLF, Holmium, and CO_2 in the IR. It accurately measures broadband sources like Xenon lamps and blackbodies as well.

The range of applications for this probe is enormous. Use it to measure ophthalmic, surgical, and dentistry lasers. Monitor low power industrial lasers for marking, engraving, and resistor trimming. The broadband wavelength response lends itself to combustion, solar simulation, and spectroscopy applications. UV sterilization, germicidal and lithography process control are possible. Service and Production technicians will appreciate the RkT-10's fast response time when aligning and calibrating lasers.

The fast response allows for accurate average power measurement of sources pulsed or chopped at 5 Hz or more. If the pulse repetition rate is known the average pulse energy in Joules can be obtained by dividing the average power by the pulse repetition rate.

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SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	10 W
Maximum average power density	20 kW/cm^2
Noise equivalent power	100 μW
Calibration accuracy	± 5%
Linearity	± 0.5%
Detector active area dimensions	16.0 mm (2.0 cm^2)
Full scale ranges	3; 300 mW - 10 W
Head dimensions (dia x depth)	6.0 cm x 3.7 cm (2.4" x 1.5")
Preamplifier dimensions (l x w x h)	8.9 cm x 3.8 cm x 2.5 cm (3.5" x 1.5" x 1.0")
Probe weight (head and preamp)	0.54 kg (1.2 lb)

The RkT-10 uses a thermopile detector with a unique black absorber coating that offers both a broad, flat spectral response and tremendous power handling capability - even focused beams can be measured without damaging the detector. The compact, convection-cooled heat sink assembly features a side-mounted BNC connector, standard ¼-20 mounting hole, and a black anodize finish to reduce unwanted back-reflection.

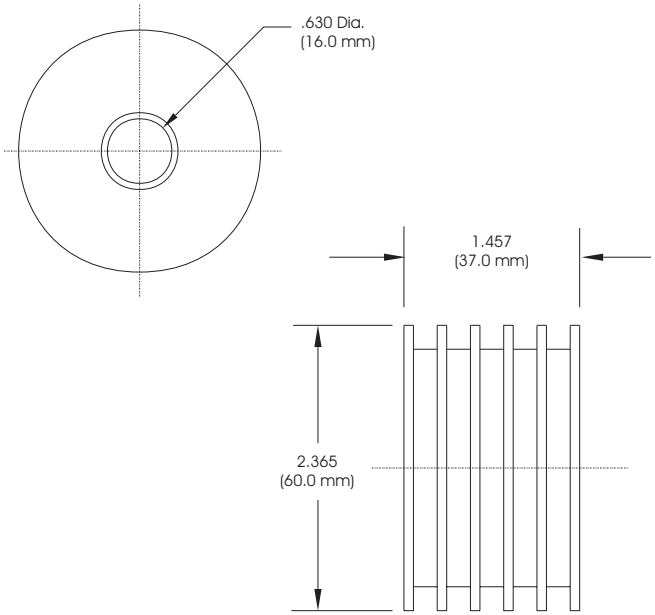
The thermopile detector functions by generating a voltage proportional to the difference in temperature between the detector surface (target) and heat sink (ambient). Thermally insulating the heatsink can improve accuracy and stability when measuring low power levels by isolating it from fluctuations in the ambient temperature.

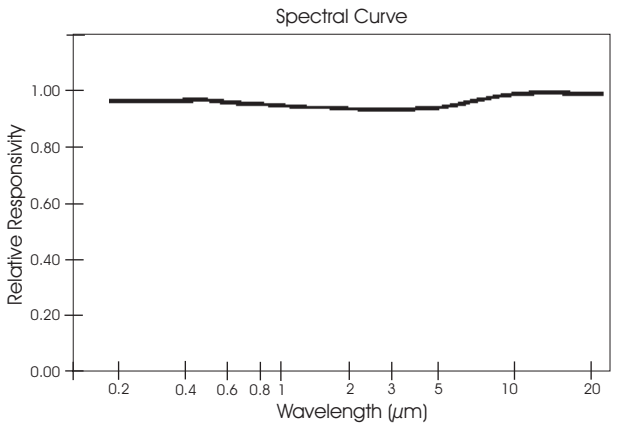
The RkT Series Probes consist of the thermopile detector assembly, or "head", and a preamplifier housed in its own enclosure. The preamplifier is attached directly to the probe input connector of the appropriate Laser Probe instrument; the head is then connected to the preamplifier with a BNC cable. The head and preamplifier are calibrated together as a set to insure maximum accuracy and linearity over 5 decades of dynamic range. This also allows the RkT-10 to be used with any Laser Probe instrument without having to enter a responsivity correction factor - the instrument reads the Probe's ID and configures itself accordingly.

The compact size and modular design make the RkT-10 ideal for OEM applications. Incorporate the probe head directly into laser systems, industrial making and materials processing stations, or dedicated research setups for real-time diagnostics, data logging, and process control. Use the RkT-10 preamplifier to interface to the head, or feed the head output directly to an A/D card, DVM, or other measuring device.

A removable light baffle and head support stand are provided with the RkT-10. Contact the factory for information regarding other options and accessories.

All RkT Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RkT-30-CAL

Thermopile Power Probe

- **High Damage Threshold**
- **mW Sensitivity**
- **Broad Spectral Response**
- **Compact Head**

The RkT-30-CAL Thermopile Probe measures up to 30 Watts of continuous wave or average power, from the UV to far-IR. The spectrally flat absorber material can withstand average power densities to 20 kW/cm^2 and peak pulse power densities of 15 MW/cm^2. Advanced thermal management techniques allow for a compact probe design that is capable of continuously dissipating 30 W total power while maintaining mW sensitivity. Electrical substitution calibration with the CAL feature insures maximum measurement accuracy.

The RkT-30-CAL is ideal for any mid-power laser, such as Excimer, Argon, Ruby, Nd:YAG (fundamental and harmonics), Holmium, or CO_2. The broadband wavelength response lends itself equally well to applications involving high power lamps and other white-light sources.

Use the probe to calibrate ophthalmic and surgical lasers. Monitor industrial welding and drilling lasers, as well as resistor trimming systems. Capture the total output of high power laser diodes, fiber-delivered industrial lasers, and other divergent sources with the large area detector. Laser technicians performing field installations or repairs will appreciate the probe's fast response time and ease of use.

The RkT-30-CAL can measure the average power of pulsed and chopped light sources as easily as it does the true power of continuous wave sources. Accurate average power measurements can be made on sources chopped or pulsed at 5 Hz or greater. If the pulse repetition rate is known the average pulse energy in Joules can be obtained by dividing the average power by the pulse repetition rate.

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SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	30 W
Maximum average power density	20 kW/cm^2
Noise equivalent power	1 mW
Calibration accuracy	± 5%
Linearity	± 0.5%
Detector active area dimensions	18.0 mm (2.5 cm^2)
Full scale ranges	3; 300 mW - 30 W
Head dimensions (dia x depth)	8.5 cm x 4.3 cm (3.4" x 1.7")
Preamplifier dimensions (l x w x h)	8.9 cm x 3.8 cm x 2.5 cm (3.5" x 1.5" x 1.0")
Probe weight (head and preamp)	0.7 kg (1.6 lb)

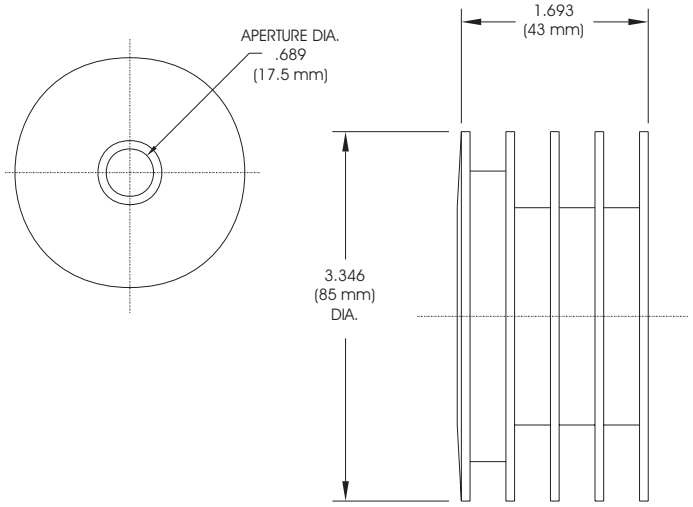
The RkT-30-CAL uses a thermopile detector with a unique black absorber coating that offers both a broad, flat spectral response and tremendous power handling capability - even focused beams can be measured without damaging the detector. The compact, convection-cooled heat sink assembly features a side-mounted BNC connector, standard ¼-20 mounting hole, and a black anodize finish to reduce unwanted back-reflection.

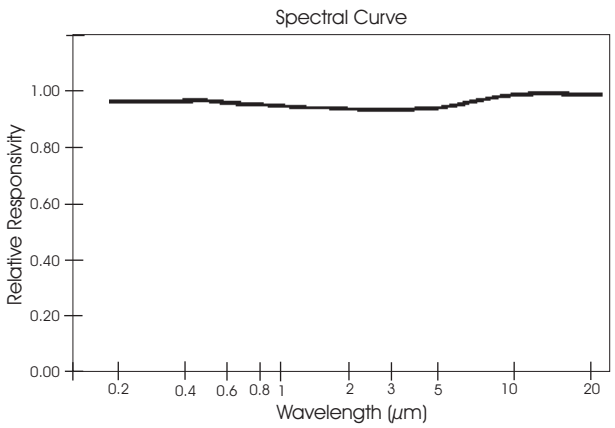
The "E-CAL" feature allows the probe to be calibrated by electrical substitution. Applying a known amount of electrical power to the jacks on the probe's rear plate and then multiplying that power value by the appropriate electro-optical equivalency factor yields the correct optical power level; the probe's output is then adjusted to this value. The electro-optical equivalency factor takes into account the differences between optically and electrically heating the thermopile detector.

The RkT Series Probes consist of the thermopile detector assembly, or "head", and a preamplifier housed in its own enclosure. The preamplifier is attached directly to the probe input connector of the appropriate Laser Probe instrument; the head is then connected to the preamplifier with a BNC cable. The head and preamplifier are calibrated together as a set to insure maximum accuracy and linearity over 5 decades of dynamic range. This also allows the RkT-30 to be used with any Laser Probe instrument without having to enter a responsivity correction factor - the instrument reads the probe's ID and configures itself accordingly.

Various options and accessories are available for the RkT Series probes. Contact the factory for additional information.

All RkT Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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RkT-150F-CAL
Thermopile Power Probe

- **High Damage Threshold**
- **Handles Up To 150 W**
- **Measure UV to IR**
- **Compact Fan-Cooled Design**

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The RkT-150F-CAL is a fan-cooled thermopile probe designed to measure up to 150 Watts of continuous wave or average power, from the UV to far-IR. The spectrally flat absorber material can withstand average power densities to 20 kW/cm^2 and peak pulse power densities of 15 MW/cm^2. The cooling fan enables the probe to continuously dissipate 150 Watts, despite using a much smaller heatsink than would be required by a passive, convection-cooled design. Electrical substitution calibration with the CAL feature insures maximum measurement accuracy.

The RkT-150F-CAL can be used to measure any light source with output powers ranging from a few Watts to 150 Watts, including Nd:YAG, Nd:YLF, Holmium, Ruby, Copper Vapor, and CO_2 lasers. The broadband wavelength response also lends itself to non-laser applications, such as high-power arc lamps.

The RkT-150F-CAL is perfectly suited for a variety of industrial and medical applications. Use it to quantify laser welding and cutting processes on the shop floor, or for routine maintenance of Nd:YAG, CO_2, and other industrial lasers. Take advantage of the high power density capability to calibrate surgical and ophthalmic lasers. The large active area makes it easy to measure divergent sources such as high-power laser diode bars and fiber-delivered industrial lasers.

Besides measuring the power of continuous wave sources, the RkT-150F-CAL can be used to measure the average power of sources chopped or pulsed at 5 Hz or more. The high damage threshold enables it to measure the average power of a train of short laser pulses without harming the detector surface. If the pulse

SPECIFICATIONS

Spectral response (see curve)	0.2 - 20 μm
Maximum total power	150 W
Maximum average power density	20 kW/cm^2
Noise equivalent power	10 mW
Calibration accuracy	± 5%
Linearity	± 0.5%
Detector active area dimensions	17.5 mm (2.4 cm^2)
Full scale ranges	3; 1.5 W to 150 W
Head dimensions (h x w x d)	8.3 cm x 8.3 cm x 11.5 cm (3.3" x 3.3" x 4.6")
Preamplifier dimensions (h x w x d)	8.9 cm x 3.8 cm x 2.5 cm (3.5" x 1.5" x 1.0")
Probe weight (head and preamp)	1.3 kg (2.8 lb)

repetition rate is known the average pulse energy in Joules can be calculated by dividing the average power by the pulse repetition rate.

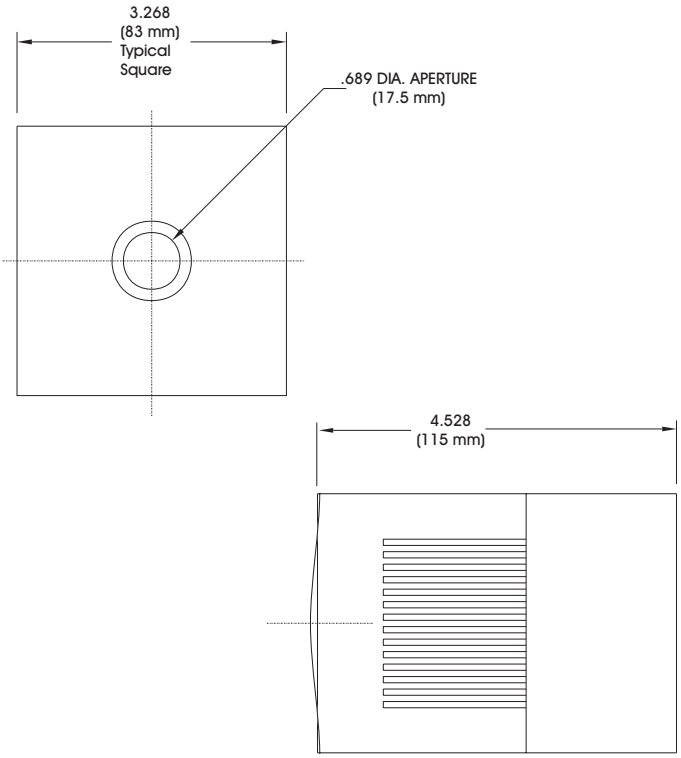
The RkT-150F-CAL's compact design is achieved by using a fan to actively force large amounts of air over a smaller heat sink, effectively dissipating the same amount of heat as a traditional convection-cooled thermopile with a larger, passively radiating heat sink. The spectrally flat detector can withstand very high power densities, allowing even small diameter beams to be measured without damage.

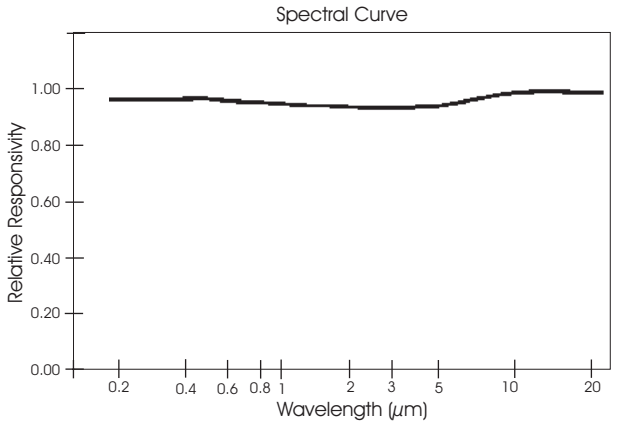
The "E-CAL" feature allows the probe to be calibrated by electrical substitution. Applying a known amount of electrical power to the jacks on the probe's rear plate and then multiplying that power value by the appropriate electro-optical equivalency factor yields the correct optical power; the probe's output is then adjusted to this value. The electro-optical equivalency factor takes into account the various differences between optically and electrically heating the thermopile detector.

The RkT Series Probes consist of the thermopile detector assembly, or "head", and a preamplifier housed in its own enclosure. The preamplifier is attached directly to the probe input connector of the appropriate Laser Probe instrument; the head is then connected to the preamplifier with a BNC cable. The head and preamplifier are calibrated together as set to insure maximum accuracy and linearity over 5 decades of dynamic range. This also allows the RkT-150F-CAL to be used with any compatible Laser Probe instrument without having to enter a responsivity correction factor - the instrument reads the Probe's ID and configures itself accordingly.

Various options and accessories are available for the RkT Series probes. Contact the factory for additional information.

All RkT Series Probes are provided with a certificate of calibration showing traceability to the National Institute of Standards and Technology (NIST) and compliance with MIL-45662 and ANSI-Z540 Sections 7-18.





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