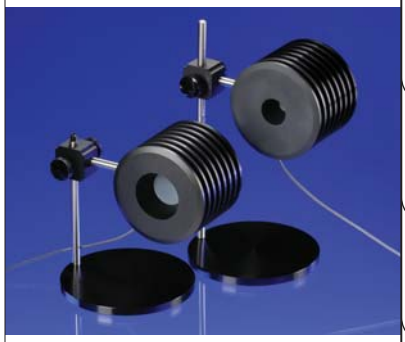
Thermal Sensors

Ideal for CW laser power, average power in pulsed lasers or total energy from a long pulse.

Thermal sensors (also called thermopiles) absorb incident laser radiation and convert it into heat. This heat ultimately flows to a heat sink that is held at a near constant ambient temperature by either air- or water-cooling. The temperature difference between the absorber and heat sink is converted into an electrical signal by a thermocouple junction.

Thermal sensors work over an extremely broad spectral range, as well as a wide range of input powers. Thermal sensors also offer very uniform spatial response, and are unaffected by changes in beam size, position or uniformity. Thermal sensors have uncompensated response times on the order of 1-45 seconds, depending upon sensor size. Electronic compensation within most meters results in 1-10 second response. Therefore, power sensors are best suited for measuring CW laser power, average power in pulsed lasers or the energy of long pulses.



Semiconductor Photodiodes

Ideal for low-power measurements in CW lasers.

Semiconductor photodiodes convert incident photons into charge carriers (electrons and holes), which can be sensed as current or voltage. Photodiodes offer high sensitivity and low noise, enabling them to detect very low light levels. They saturate above approximately 1 mW/cm², so attenuating filters must be used when operating at higher powers. Photodiodes also have a fast response time, so they can be convenient for tuning and peaking lasers.

Photodiodes have a much more limited spectral range and lower spatial uniformity than thermal sensors. The latter can affect the measurement repeatability of non-uniform beams or of beams that wander over the detector surface between measurements. These devices are also often referred to as optical sensors.

Pyroelectric Sensors

Ideal for pulsed lasers.

Our energy sensors utilize a pyroelectric crystal that has a permanent electrical polarization. Incident light heats the crystal, thus changing its dipole moment and causing current to flow. Because pyroelectrics respond to the rate of change of temperature, the source must be pulsed or modulated.

When designed into a joulemeter sensor, pyroelectrics essentially act like capacitors in that they integrate pulses and produce a signal with a peak proportional to the pulse energy.

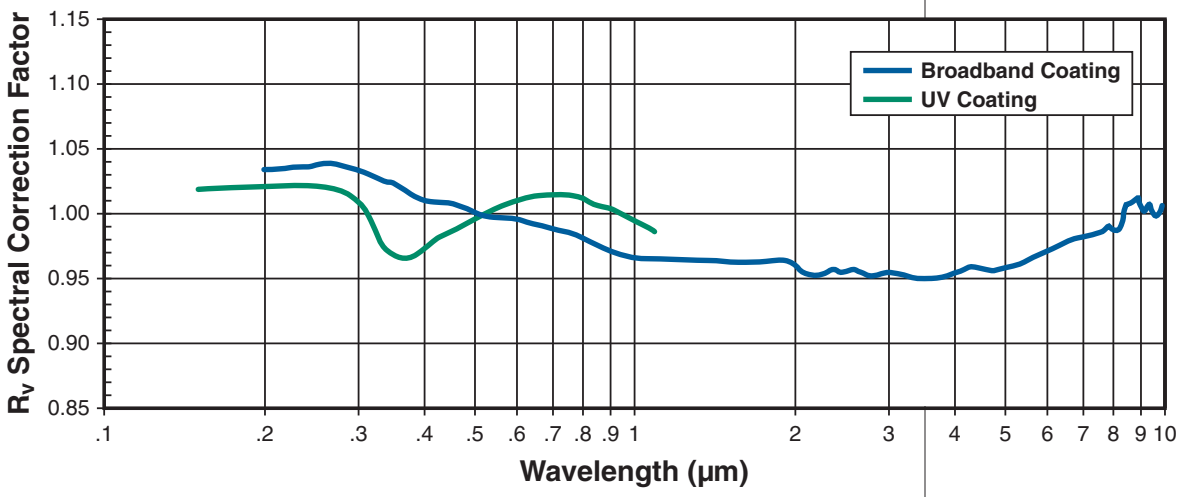
See page 63 for a technical description.

Power Sensors

Power Sensor Charts

Coherent utilizes two primary coatings to capture the incident radiation on our thermal sensors. The specifications for each sensor list which coating is used. Typical wavelength ranges and response curves for these coatings are shown in the figure below.

R_V Spectral Correction for Thermal Sensor Coatings (normalized to 514 nm)



Some of our thermal sensors can measure power at levels greater than the maximum power rating for limited amounts of time. The following chart outlines how much power can be measured over a range of exposure times.

Exposure Limit vs. Power