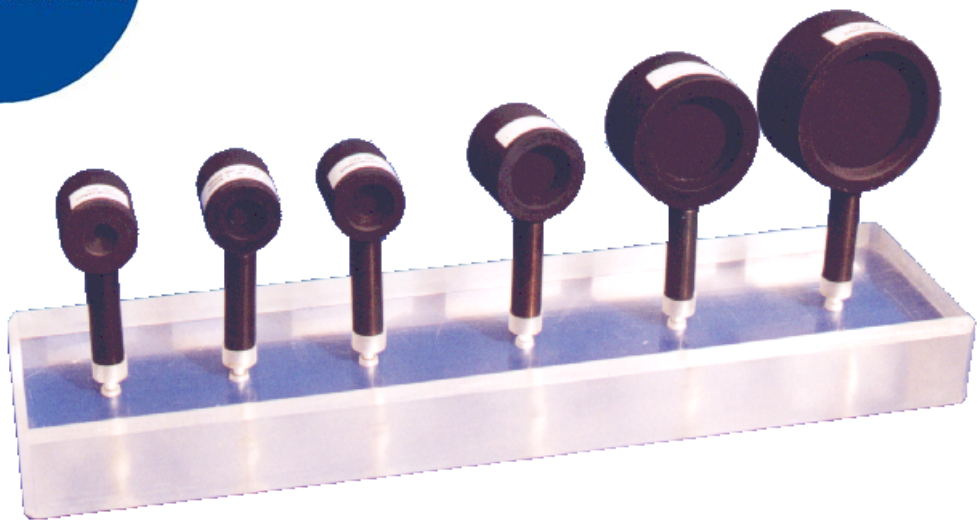
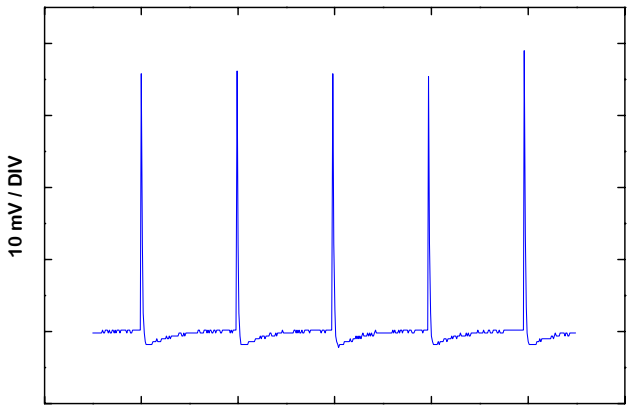
Energy Sensor Heads

with black absorption coating



Pyroelectric sensors can be classified as thermal detectors. They permit independent of the wavelength of the incidence radiation, the direct transformation of the radiation energy pulse into a voltage pulse. The detectors are strictly built on a coaxial basis and are therefore extremely insensitive to interference from electromagnetic radiation (pulsed gas laser).

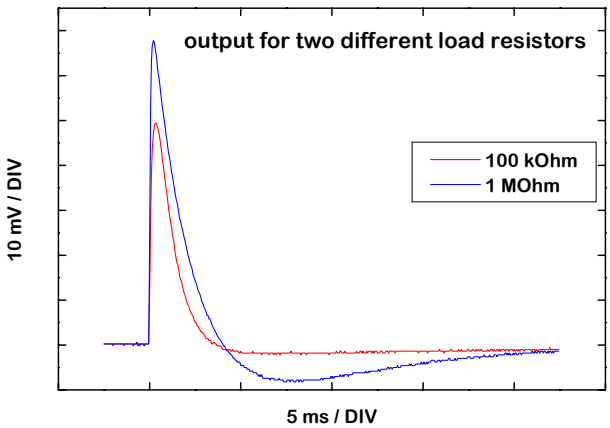


typical output of a pyroelectric detector

Corresponding to the range of possible applications detectors with diameters from 4 to 45 mm are available to purchase. We advise to choose a detector with an area slightly larger than the beam cross section.

The detectors are coated with a black absorption layer which possesses an almost constant absorption in the wavelength range from 185 nm to 25 µm. A particular advantage is the comparatively high sensitivity of these detectors enable a laser pulse measurements in the µJ range.

The maximum pulse repetition rate depends on the internal capacitance of the detector as well as on the load resistor. All detectors can be directly connected using the BNC socket to the 1 MΩ-Input of an oscilloscope. A lower load resistor can be used to obtain higher pulse repetition rate. Repetition rates of up to 100 Hz are then possible. A load resistor of 100 KΩ is part of the set. The corresponding sensitivity of the sensors for both resistors is specified.



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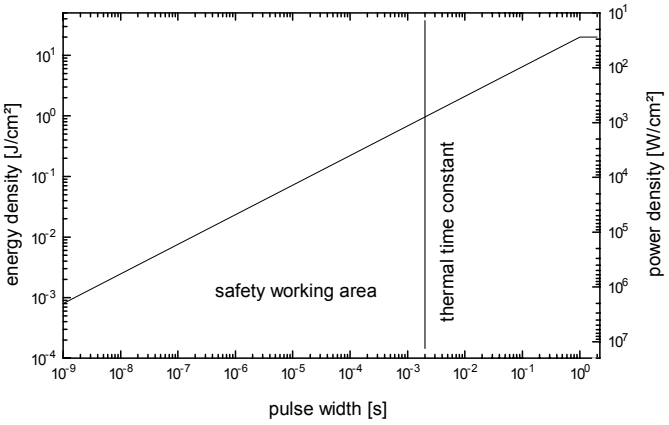
The pyroelectric effect facilitates generally only the measurement of temperature change. All the detectors are in this way just suitable for the detection of radiation pulses or modulated radiation. In regard to shorter impulses there are no restrictions, as the energy of the shortest impulse is converted into heat flow in the absorption layer. The maximum possible pulse duration can be estimated from the size of the R-C constant (Sensor capacity · load resistance) as well as the stipulation that up to the point of measurement evaluation the thermal time constant (thermal dissipation from the sensor into the heat sink) does not play a roll. All sensors reach a sufficiently large value of approx. 20 ms so that application for almost all normal sources of radiation pulses is possible.

The maximum load allowed is determined by the absorption layer (too high a power density on the surface causes damage) as well as the sensor material (the sensor temperature must remain under certain tolerance limits). This leads to limits not only for the power density during a pulse (MΩ/cm^2), but also for energy density (J/cm^2) as well as for average power (W/cm^2). The tolerance limits are so high that the PEM 45K is especially suited for high performance applications.



power and energy density dependence on pulse with

The sensitivity specified for every sensor (1 MΩ / 100 kΩ) is evaluated at a wavelength of 355nm by comparison with a master detector.

Type	PEM 4	PEM 8	PEM 11	PEM 21	PEM 34	PEM 45 **
active diameter	4 mm	8 mm	11 mm	21 mm	34 mm	45 mm
working range *	1 µJ .. 20 mJ	2 µJ .. 75 mJ	3 µJ .. 150 mJ	5 µJ .. 500 mJ	15 µJ .. 1,4 J	30 µJ .. 2 J
sensitivity [V/J]	500..1000 at 1 MΩ 130..250 at 100 kΩ	200..500 at 1 MΩ 50..200 at 100 kΩ	100..400 at 1 MΩ 50..150 at 100 kΩ	50..150 at 1 MΩ 30..80 at 100 kΩ	20.. 70 at 1 MΩ 10..40 at 100 kΩ	8.. 15 at 1 MΩ 4..8 at 100 kΩ
Repetition rates	80 Hz at 1 MΩ 120 Hz at 100 kΩ	40 Hz at 1 MΩ 100 Hz at 100 kΩ	40 Hz at 1 MΩ 80 Hz at 100 kΩ	25 Hz at 1 MΩ 50 Hz at 100 kΩ	25 Hz at 1 MΩ 80 Hz at 100 kΩ	25 Hz at 1 MΩ 100 Hz at 100 kΩ
max. pulse duration	2 ms					
spectral range	0,19 .. >25 µm					
power density	8 MW/cm² (10 ns - pulse)					
energy density	0,15 J/cm²					
average power	0,15 W/cm²					0,5 W/cm²
accuracy	5 %					
dimension (diameter · length)	30 x 47 mm	30 x 47 mm	30 x 47 mm	39 x 47 mm	50 x 47 mm	70 x 47 mm
connector	BNC					

* - the lower limit: without amplifier at 1 mV input of an oscilloscope, upper limit: homogeneous illumination of the active area
- higher repetition rates on request

** - this detector has a switch on the back side to choose between higher rep rate or higher sensitivity

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