4. Optoelectronic

4.1 Energy detection

Photo diode with „Sample and Hold“
Universal usable and inexpensive photodiode with „Sample and Hold“ unit.
The **RD-PSH-01** is well suitable for an installation in existing laser systems because of its compact construction, e.g.. Nd:YAG-lasers for intensity measurements.

Internal and external triggering
adjustable trigger level
adjustable delay
prefixed time window
intensity measurements
pulse duration measurement up to 500 ps possible
as trigger source usable, exit: 8-9 Volt
power supply 12 V
dimensions: 60 mm x 75 mm x 33 mm

Band width detection
Together with our solid state etalon (page 9) the **RD-PSH-1** represents an inexpensive alternative to common bandwidth detection units. The **RD-PSH-1** is easily mounted to an y-t-writer or an AD-transformator, and gives you access to an easy and quantitative measurement of the spectral band-width of your laser.

Band width measurement set RD-PB-02
Consists of RD-PSH-1, solid state etalon with imaging lenses and a pinhole

Energy detectors

The detectors of the PEM series are suitable for measuring laser pulses in the range of some Mikrojoule up to several Joule and they cover the whole spectral range from the UV to the far IR. The PEMs do not need any external power source, because they work with the pyroelectric principle. At the output of each detector the voltage signal is measured off, with the amplitude proportional to the irradiated laser energy and determined by a calibration constant, which is ascertained for each PEM by the manufacturer. Each detector is equipped with standard BNC-plugs.

The **PEM 10** is especially designed for measuring small laser energies in the range of Micro- and Millijoule. The special coating of the active sensor diameter allows a broadband sensitivity of 0.19-10 mm. Because of short signal rise and drop times measurements with repetition rates up to 300 Hz are possible.
Higher repetition rates up to 500 Hz on request!

The PEM 25 has the same special broadband coating as the PEM 10, but with a larger active sensor diameter (∅25 mm).

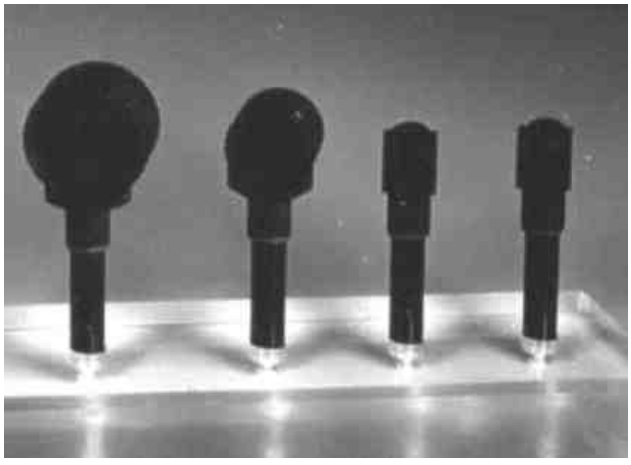
The outstanding feature of the PEM 48 is its high detector aperture of ∅48 mm for the easy pulse energy measurement when working with an excimer laser.
The **PEM 8 HP** is especially designed for lasers with low pulse energies and high energy densities at the same time (like dye and small Q-switched Nd:YAG-lasers). The damage threshold lies above 2 J/cm² with pulse widths of 5 ns at 1064 nm.

The **PEM 20 HP** is well suitable for high pulse energies (up to 6 J) and high energy densities at the same time (2 J/cm²), occurring with Q-switched Nd:YAG-lasers. Cooling fins at the housing allow capacities up to 60 Watt

	PEM 10	PEM 25	PEM 48	PEM 8 HP	PEM 20 HP	PEM 48 HP
Aperture Ø(mm)	10	25	48	8	20	48
Typ. sensitivity (V/J)	75	13	3	15	2	0.3
Max. repetition rate (Hz)	300	100	50	300	100	50
Min. detectable energy (µJ)	3	50	500	15	300	4000
Max. pulse energy (mJ)	60*	350*	1200*	100**	6000**	10000
Max. energy density (J/cm²)	0.07**	0.07**	0.07**	2**	2**	2**
Spectral range (mm)	0.19-10	0.19-10	0.19-10	0.2-3	0.36-3	0.2-3

* for pulse durations of 15 ns at 308 nm
** for pulse durations of 5 ns at 1064 nm

Pyroelectric energy detection for pulsed systems



	PEM 4	PEM 8	PEM 11	PEM 21
Active	4	8	11	21
Sensitivity at 1MΩ [V/J]	500-10³	50-100	100-300	50-80
Repetition rate [Hz]	500	500	500	500

Pyroelectric Energy Detector PEM 50K
with black ceramic absorption sheet for extremely high energies
The PEM 45K is a further developed PEM 50M, which is even more resistant against radiation through its ceramic absorption coating.

Energy measuring chip EMS 1.6

Technical data:

Detector sensitivity:	0.01 - 2000 V/J
Trigger level range:	0 .... 99,9%
Correction factor:	0 .... 99,9%

Type of measurement:

- Pulse energy with measuring range 20 mJ, 200 mJ, 2 J, 20 J and automatic range.
- Measuring of the mean with the choice of the pulse number (2 to 1000) and auto-reset.
- Pulse stability measuring „Peak to Peak“
- Measuring of the mean pulse stability

Statistical measurement for the choice of the pulse number: minimum, mean or maximum energy, standard deviation in %.
Preamplifier for Pyroelectric Energy detectors VST1N/VST2N
With these amplifiers it is possible to measure the smallest laser energies (some 100 nJ/ PEM 4). There is an extraordinary increase of the receiver as a result of the selected amplification and the omission of the capacity of the measurement head through the measurement wire. The bandwidth of the amplifier is especially designed for this application.
The amplifying is fixed by Radiant Dyes and selected by the customer with the order. The type **VST2N** has the possibility to switch the amplification (two amplification factors).
Through this modular type of construction the dynamic range of the measuring head is raised a lot. Also the losses of the sensitivity can be compensated by using a smaller resistance**.**

Specifications:

- Plugs BNC
- Amplifying 10-, 100-, or 1000-times
- Input resistance 1 MΩ
- Length of the supply 3 m
- Power unit (included) ± 15V

Neutral glass filter set RDNG 1-30
4 filters with transmission of approx. 1%, 5%, 10% and 30%. Maximum power density up to 100 MW/cm².

4.2 Pulse Energy and Power Measuring Instrument LEM 2410

A touch panel and function keys make this device comfortable and easy to handle.

The preamplifiers integrated into the device and the choice of sensor sensitivity, allow to use a wide range of sensor heads .
The large graphic display offers space for a variety of display and analysis choices. The digital display can be used for determining the energy, frequency and average power. The analogue part with its bar graph display is useful e.g. for laser adjustments. Laser stability can be monitored using the data logger and statistics window.

The LEM2410 is equipped with a RS232 interface and with a TCP/IP network connector. These ports allows remote control and transferring of all measuring data to a PC. Additionally, a MMC/ SD-Card slot to save the data is integrated.

- For pyroelectric energy sensor heads and thermoelectric power sensor heads
- Digital display, analogue display, graphic data logger, statistics
- Wide dynamic range, especially for energy measuring
- input of correction factors e.g. for mirrors or beam splitters
- Power plug or rechargeable battery with integrated charging unit
- Adjustable trigger level
- External trigger input
- HiRes Graphic display with background illumination
- Touch panel
- RS 232 interface
- TCP/IP-Network-Connector
- MMC/SD-Card slot
- Software update possible
- compatible to all heads of PEM, HP and BB series