Operator's Manual

Modules of Series EMK

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1. INTRODUCTION

The SLT EMK series are high sensitivity precision instrument for measuring optical radiation from the ultraviolet to the far infrared, depending of the used sensor. The EMK modules combines high performance with the most popular user convenience features yet is simple and straightforward to operate.

The EMK analog modules are the link between laser output, laser controller and user. It allows a simple possibility for laser energy monitoring, laser control and visualisation of the laser energy.

The EMK200 USB is an easy to use interface between pyroelectric detector and computer via USB port. The firmware supports two modes. In "RAW" mode, each recorded energy value is transmitted via the interface. In "STATISTICS" mode, all relevant statistical values are recorded via an adjustable number of pulses and only these are sent. The communication protocol is kept very simple to facilitate integration into your own software. A Windows software is included and Labview examples can be supplied.

ELECTRICAL WARNING

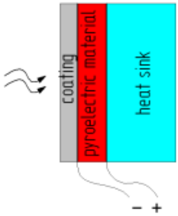
Do not attempt to operate the instrument with wrong power supply. Failure to correctly configure the power entry, voltage, current or polarity, module may result in serious damage to the instrument.

LASER SAFETY WARNING

This apparatus is normally used to measure the output from laser sources. The operator should be familiar with the appropriate laser safety procedures and regulations. In particular it should be noted that a small part of the laser beam incident on the detector head will be reflected. This can be hazardous and both incident and reflected beams should be enclosed if necessary.

2. INTRODUCTION DETECTORS

2.1 Basics Pyroelectric Detectors

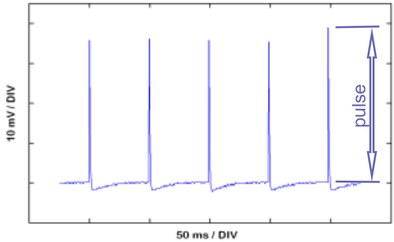


Pyroelectric detectors belong to the class of thermal detectors. Such detectors work independent of wavelength. They consist of an absorber in good thermal contact to the pyroelectric element. Pyroelectric detectors do not need cooling and have the same sensitivity for all wavelengths as long as the absorption process is perfect. The third element in the setup of a pyroelectric detector is the heat sink. It has good thermal contact to the pyroelectric sensor and is responsible for heat transfer to the surroundings.

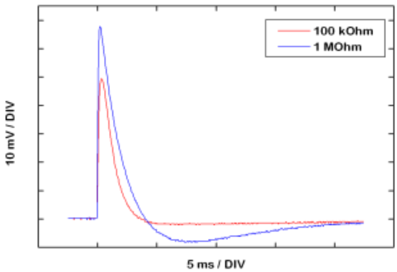
Pyroelectric sensors are only able to detect modulated or pulsed radiation. Every pyroelectric sensor generates a charge proportional to the temperature change (the laser pulse energy). Dependent on the detection circuit, the charge is detected as a voltage peak, or the deviation of the charge (a current) is detected proportional to the pulse power. For a correct measurement, the pulse duration must be smaller than the thermal time constant so no heat loss occurs during the measurement.

A good pyroelectric material shows linearity between energy and charge for at least 5 orders of magnitude.

Most of the detectors are coaxially arranged and very insensitive against electromagnetic disturbances. A benefit of such detector heads is that they can be directly connected to an oscilloscope and energies from µJ to J can be detected without an amplifier or readout unit.



typical output of an pyroelectric detector



output on dependence of load resistor

For a measurement of high rep. pulse lasers smaller thermal and electric time constants are desired. Dependent on the construction of the detectors, some types are able to detect pulse energies up to 100 kHz.

Three parameters limit the use of a pyroelectric detector:

Too high peak power destroys or partially evaporates the absorber

Too high average power and

Too high pulse energy is dangerous for the sensor material

The limits depend on the wavelength of the radiation and the pulse duration. High threshold coatings are available for most sensor types.

For all detectors the sensitivity (V/J) is specified for a load of 1MΩ (oscilloscope) and for 100kΩ for enabling higher rep. rates. For both loads the sensitivity is determined at 355nm by a comparison with a master detector calibrated at PTB Braunschweig.

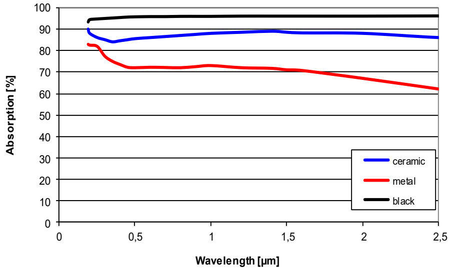
2.2 Coatings for Pyroelectric Detectors

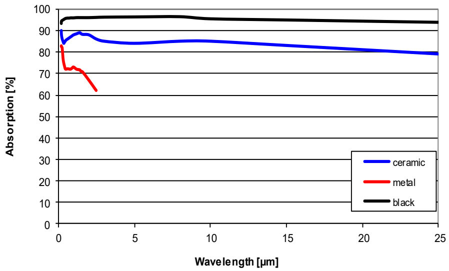
The absorber coating of the detector has to withstand the intense laser power. Its stability determines the lifetime of the detector. Nearly all absorbers are a compromise between wavelength independent absorption and stability.

We use three different coatings:

- Organic black coating with a high and nearly wavelength independent absorption of 97±1 % between 190 nm and 25 µm
- Ceramic based high power absorber, especially for all high peak power lasers (YAG, Excimer, CO_2)
- Metallic absorber with high thermal conductivity for high rep rates

For wavelengths larger than 100 µm, the absorption decreases for all known absorbers , caused by an increasing transparency. This can only be compensated for by a larger thickness of the absorber leading to disadvantages for power and energy sensors.
For the PEO-sensors we using metal or black coatings to realise high repetition rates.

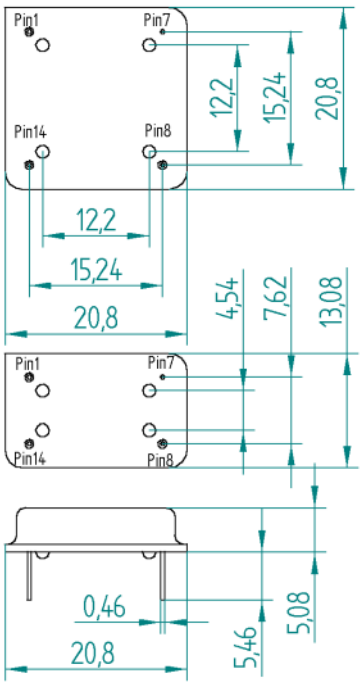




2.3 Pyroelectric OEM detectors series PEO

These sensors are characterised by a high sensitivity and a high repetition rate. Cause of the windowless design and the used metallic absorption coating an usage in the UV-range is also possible. If needed, for example when using the sensor at different wavelengths, we will also supply these sensors with our reliable, broadband black coating. The modular construction set EMK100 can be combined with PEO sensors.

max. energy density	50 mJ/cm²
max. average power	1 W
Calibration uncertainly	±3 %
Temperature environment	10°C .. 50°C
Temperature coefficient	+0,1%/K

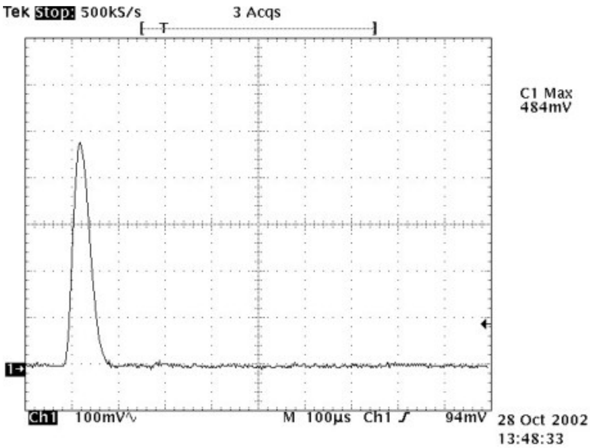


Using notes:

Pin 7	**Ground**
Pin 14	**Signal**
Pin 1, Pin 8	**NC**

Soldering max. 2 seconds per Pin
no reflow or oven soldering!

- For calculation the energy use the peak voltage
- We calibrate at 355 nm. Because of the metal coating the sensor should recalibrate by the user at the applied wavelength
- During our calibration the sensor output was loaded with 120 pF (1m coax cable // scope input capacitance)
- Because of the low sensor capacity a recalibration is necessary on other loads, for instance by mounting directly on the amplifier PCB.
- When using an current amplifier repetition rates up to 40 kHz are possible



	Aperture	Sensitivity [V/J]	Rep Rate [Hz]
PEO 8	Ø 8 mm	400..500 V/J at 1 MOhm 200..300 V/J at 100 kOhm	1 kHz at 1 MOhm 10 kHz at 100 kOhm
PEO 8 B	Ø 8 mm	300..400 V/J at 1 MOhm 200..300 V/J at 100 kOhm	750 Hz at 1 MOhm 1 kHz at 100 kOhm
PEO 12	Ø 12 mm	300..400 V/J at 1 MOhm 200..300 V/J at 100 kOhm	700 Hz at 1 MOhm 6 kHz at 100 kOhm
PEO 12 B	Ø 12 mm	20..40 V/J at 1 MOhm 10..20 V/J at 100 kOhm	500 Hz at 1 MOhm 750 Hz at 100 kOhm

3. Overview OEM-Module EMK

The OEM modules of the EMK series offer laser manufacturers a simple and inexpensive integration of the PEO series sensors into their own laser systems without a great deal of development effort.

The basic model EMK100 delivers a corresponding analog voltage for each laser pulse, which can be easily read in via the laser control unit. Additional header contacts for power supply, measurement and trigger signals offer the option of plugging the circuit board onto your own circuit board and thus reducing the amount of cabling.

Significantly higher repetition rates are possible with the EMK200. The power supply has also been simplified and the output signal has been made available at an SMA socket to reduce interference. Power and trigger signals can be contacted either via a 9-pin D-Sub connection or a simple wire-to-board connector. The trigger signals are decoupled via optocouplers.

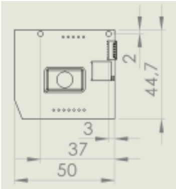
With the EMK200, the measured values reach the laser control via USB without having to take a detour via an analogue signal. Power is also supplied via USB. The communication protocol is kept very simple to facilitate integration into your own software. Labview examples can be supplied. The firmware supports two modes. In "Stream" mode, each recorded energy value is transmitted via the interface. In "Statistics" mode, all relevant statistical values are recorded via an adjustable number of pulses and only these are sent.

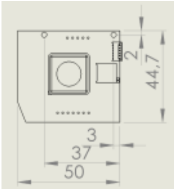
All variants have 2 measuring ranges. With the analogue versions, the switching is done via a 5V signal, with the USB version via software.

Optional housings are available for all variants. Required mounting holes can be discussed.

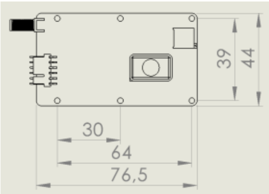
	EMK100	EMK200 DSUB or WTB	EMK200 USB
Dimension PCB	44 mm x 50 mm	44 mm x 77 mm	44 mm x 100 mm
Dimension housing	55 mm x 52 mm x 16 mm	55 mm x 100 mm x 16 mm	50 mm x 100 mm x 16 mm
Ranges *	15µJ - 1mJ 150µJ - 5mJ	5µJ - 100µJ 50µJ - 1mJ	5µJ - 100µJ 50µJ - 1mJ
Rep. rate	up to 5kHz	up to 25kHz	up to 25kHz
Trigger	Internal	External/Internal Selectable by jumper	External/Internal Selectable by jumper
Power supply	±12V .. ±15V	+12 V	from USB
In- Output	6-pol. Molex, pitch 1.27 0-10V	SMA coaxial connector for analog output 0-10V 6-pol. Molex, pitch 2.54mm or alternatively DSUB for trigger and supply	SMA coaxial connector for trigger input

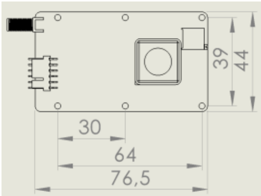
* Adjustable, also depends on the sensor



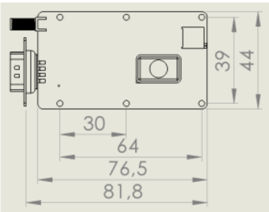


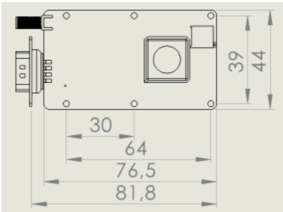
EMK100 with PEO8 sensor

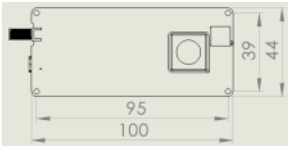




EMK200 with PEO12 sensor,
DSUB9 connector







EMK200USB with PEO12 sensor

EMK100 with PEO12 sensor
and housing

EMK200USB with PEO12 sensor
and housing

3.1 EMK 100

The EMK100 module includes all components necessary for the internal energy measurement of a laser. The circuit board included the sensor, a switchable preamplifier and a peak detector. As an output it provides an analog output and a trigger output.

The types PEO8, PEO8B and PEO12, PEO12B are intended as sensors. When ordering, the sensitivities and repetition rates can be adjusted to the laser system. Typically the module is placed behind a beam splitter or uses the back reflection or leakage radiation of an optical component in the laser.

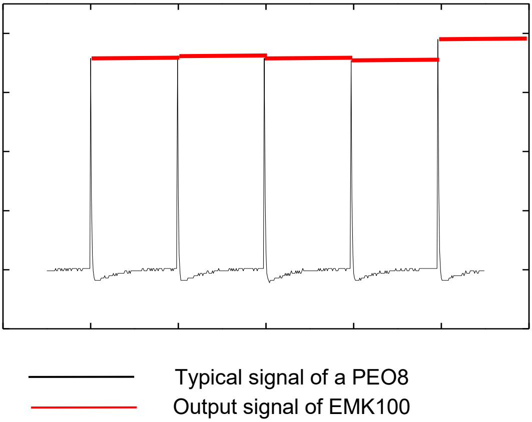
The module provides an output voltage proportional to the energy at its analog output after each laser pulse. This voltage remains until the next laser pulse. Due to leakage currents, the voltage drops again after a few seconds. However, at typical repetition rates, this drop is not noticeable. This analog voltage can be evaluated using a voltmeter or an A/D converter and used, for example, for laser control and monitoring. The level of the output signal can be calibrated using the potentiometer. With a supply voltage of ±15V, the output voltage range is a maximum of 12V. The trigger output can be used to start an ADC.

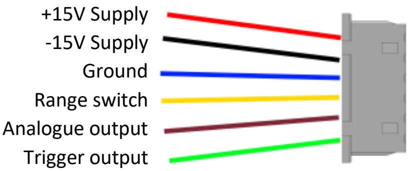
Typically, the connection to the laser system is made via a 6-pin connector (Molex Picoblade, The Molex part number of the crimp housing is 51021-0600, there are also pre crimped wires available, part number 06-66-0015). However, it is also possible to plug the circuit board directly onto your own circuit board. For this purpose, pads with a 2.45mm grid are provided on two sides, which provide all the necessary inputs and outputs.

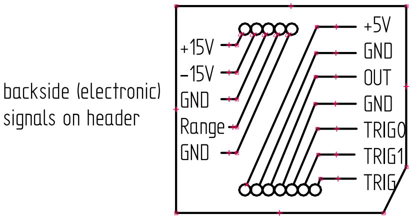
Additionally, we can supply the modules with housing. The outside dimension of the housing is 54mmx55mmx16mm.

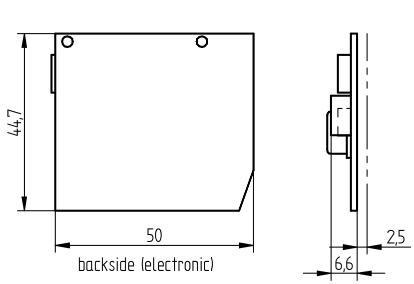
- Power supply ±12V .. ±15V
- Sensitivity is precalibrated at 355nm. You should calibrate the system after mounting
- with the blue potentiometer with your laser.
- Max. repetition rate 1.6-2 kHz, can adapted up to 5 kHz.
- Trigger output 5V
- Range switch. When connected to +5V or +15 amplification is x10, When connected to Ground amplification is x1, When unused, it should connect to ground

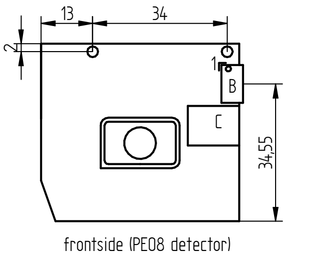
EMK100 with PEO12 sensor

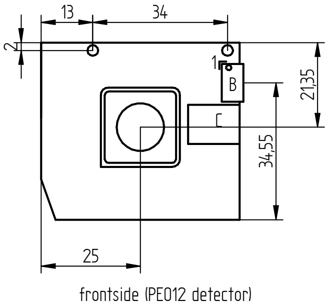

Typical signal of a PEO8
Output signal of EMK100


+15V Supply
-15V Supply
Ground
Range switch
Analogue output
Trigger output


backside (electronic)
signals on header
+15V
-15V
GND
Range
GND
+5V
GND
OUT
GND
TRIG0
TRIG1
TRIG


44,7
50
backside (electronic)
2,5
6,6


13
34
2
1
B
C
34,55
frontside (PE08 detector)

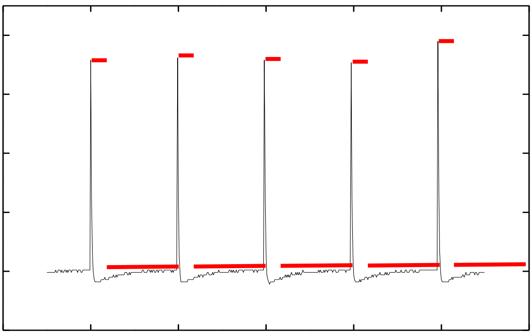

13
34
2
1
B
C
21,35
34,55
25
frontside (PE012 detector)

3.2 EMK 200

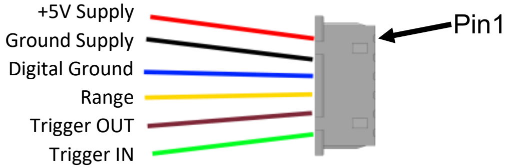
The EMK200 family is a further development of the EMK100 in which we incorporated customer wishes and experiences from the many EMK100s sold. The operating voltage supply on the customer side was simplified and better cabling options, some of which were galvanically isolated, were implemented.

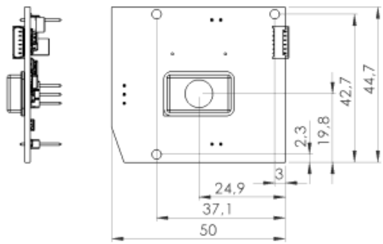
The EMK200 (without add-on) is the smallest module. The digital lines are NOT galvanically isolated.

- Internal or external triggering is possible. The switch over takes place using jumper J4. With internal triggering, the measurement is triggered via an internal trigger circuit. A corresponding TTL signal is available at the trigger out pin to control an ADC. With external triggering, the start signal for the peak detector comes from the laser.
- After each measurement, the trigger output goes to 5V for a predefined time, for example to start an ADC. The selection is made using jumper J8. The maximum repetition rate depends on the selected trigger length. The analog signal is available for evaluation for exactly the same amount of time
- SMP socket for transmitting the analogue signal
- There are 2 measuring ranges available. The switchover takes place via J7
- The boards are pre-calibrated at 337nm. The final calibration takes place after installation using potentiometer P1.
- Enclosures can be ordered and customized



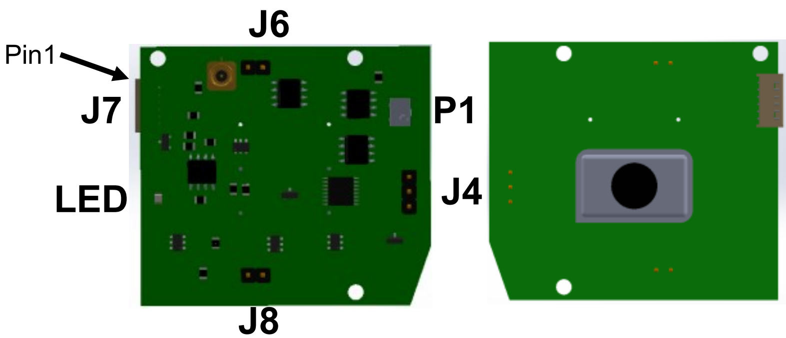
Typical signal of a PEO8
Output signal of EMK200 — the length of hold time can adapted





Connector J7

- Power supply +5V, 80mA
- Compatible connector for J7: Molex part number 51021-0600, pre crimped wires 06-66-0015
- Range switch: TTL compatible input: low range 100µJ — 2mJ
high range 10µJ — 200µJ
- Trigger OUT: TTL compatible output: active at internal triggering, see J4
=high during Hold Time of the peak detector
- Trigger IN: TTL compatible input active at external triggering, see J4
rising edge starts the peakdetector



- J4 Trigger source internal: 5V TTL with every laser pulse at Trigger Out
external start impulse comes from laser supply
- J6 Analog out same as SMP, for alternative connection
- J8 Trigger length closed 30µs max. Rep Rate 25kHz
open 120 µs max. Rep Rate 7 kHz

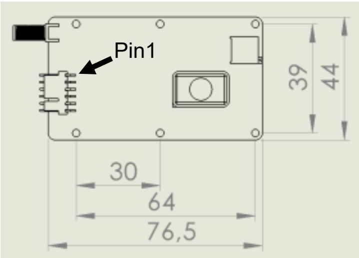
3.3 EMK 200 WTB

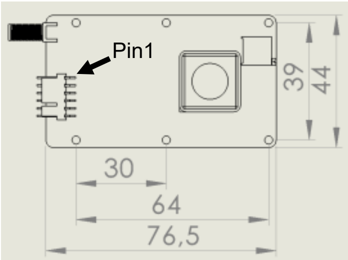
The EMK200 family is a further development of the EMK100 in which we incorporated customer wishes and experiences from the many EMK100s sold. The operating voltage supply on the customer side was simplified and better cabling options, some of which were galvanically isolated, were implemented

EMK100 WTB uses a 6-pol Wire to board connector with a 2.54mm pitch for digital lines and power supply. The digital lines are galvanically isolated.

For Analog output a SMA connector is used. The other functions are comparable to EMK200. With a supply voltage of 12V an output signal of 10V is possible. The board is only pre-calibrated to a sensitivity of 10kV/J / 100kV/J. The final calibration must be carried out using the potentiometer when installed

Enclosures can be ordered and customized





Pinout:

1	8-12V Power supply
2	Trigger IN
3	Trigger COM
4	Range IN
5	Range COM
6	Power supply GROUND

Jumper line 4

External Trigger
Laser controller starts the peak detector

Internal Trigger
Peak detector starts by the pyro signal

Remarks

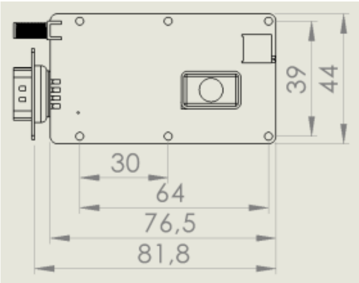
Trigger and Range signals should be TTL compatible
The hold time of the peak detector is defined by R35. Please consult us for your requirenments.

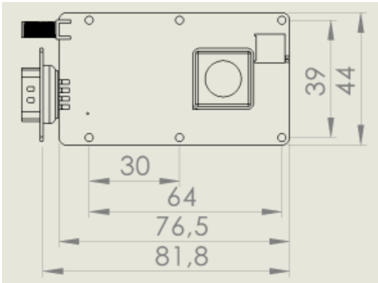
3.4 EMK 200 DSUB

EMK100 DSUB uses a 9-pol-DSU connector for digital lines and power supply. This reduces the cabling effort and reducing electromagnetic interferences because of shielded wires. The digital lines are galvanically isolated.

For analogue output a SMA connector is used. The other functions are comparable to EMK200. With a supply voltage of 12V an output signal of 10V is possible. The board is only pre-calibrated to a sensitivity of 10kV/J / 100kV/J. The final calibration must be carried out using the potentiometer when installed

Enclosures can be ordered and customized





Pinout:

1	8-12V Power supply
2	Trigger IN
3	n.c.
4	n.c.
5	Trigger COM
6	Power supply GROUND
7	n.c.
8	Range COM
9	Range IN

Jumper line 4

External Trigger
Laser controller starts the peak detector

Internal Trigger
Peak detector starts by the pyro signal

Remarks

Trigger and Range signals should be TTL compatible
The hold time of the peak detector is defined by R35. Please consult us for your requirenments.

EMK200 DSUB with PEO12 sensor

4. EMK200 USB

Pyroelectric detectors are designed for measurement of individual laser . The measuring heads transform the laser pulses in the absorption layer into thermal pulses, which are transformed into voltage pulses by using of a pyroelectric material. The voltage between baseline and maximum is measured. The laser energy is calculated from the voltage value and the calibration values of the sensor and amplifier.
Due to the measurement criterion and the high sensitivity of the sensors, vibrations, oscillations, and air movement should be avoided. Especially in the case of small energy measurements attention must be paid to avoid interference's. It is often enough to raise the trigger level or to darken the room.

4.1 INSTRUMENT DESCRIPTION

4.1.1 Connectors and Ports

As user interface the EMK200USB use a typical PC with Windows as operating system. A comfortable windows software, based on Labview allows to display a lot of information and different types of visualisation of the measuring results.

The USB communication port emulates a serial COM-port for easy remote control and data transfer with a computer. Because of this design and the simple ASCII data transfer protocol the Interfaces is very simple to integrate into own measuring setups. The handling is described in chapter 4.

For stable measurement it is helpful to hold the housing of the EMK200USB isolated from ground to avoid ground loops.

4.1.2 Operation

Check that all the parts of the EMK200USB are available and appear in good condition.

Appropriately position the sensor head along the axis of the beam to be measured. Know the approximate power/energy irradiance of the beam to be measured and ensure that they are within the specification range of the instrument.

Switch on the instrument by connecting with an USB-port and set the instrument range. This device is normally used to measure the output from a laser source. Turn on the laser beam, **ensure that the entire beam is striking the sensor disc.** Viewing devices can often identify misalignment. If one is not available, maximizing the output by horizontally and vertically translating the sensor assembly will indicate potential problems. Ensure that the beam is normally or near-normally incident on the disc surface.

The operator should be familiar with the appropriate laser safety procedures and regulations. In particular it should be noted that a small part of the laser beam incident on the detector head will be reflected. This can be hazardous and both incident and reflected beams should be enclosed if necessary.

Minimize as much as possible electromagnetic, acoustic and infrared background as possible.

4.1.3 Parameters and Limits

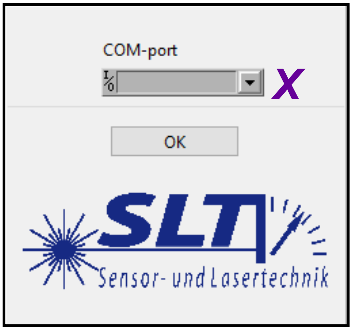
	PEO12
Active diameter	12 mm
Max. average power	1 W
Max. pulse width	10 µs
Max peak power density	8 MW/cm²
Max. power density	3 W/cm²
Max. energy density	100 mJ/cm² (at 20 ns)
Max. repetition rate	20 kHz
Linearity	±1%
Calibration uncertainty	±3%
Spectral range	190 nm - 2.5 µm
Dimensions [mm]	55 x 100 x 18

4.1.4 Software

The delivered software CD contains a Setup program, executables and drivers. By starting Setup.exe the user interface and a Labview Runtime library will be installed on your PC. When an actual library is installed already, than it is possible to start the executable Pyrosensor.exe from the path _exe on the CD without any installation.

The interfaces are equipped with a serial-USB-converter FT232 from the company FTDI. The newest drivers for common operating systems are downloadable from www.ftdichip.com. Also a detailed instruction file for setup is also available. On the most PC's the driver package for the virtual COM port is available. In the case, that it is not available the CD contains the drivers too.

On the start of the software a small window is opening and it is necessary to choose the right COM port. For this step it is necessary that the EMK200USB is connected with the PC. Please use the drop down menu, marked with the red cross symbol. After successful operation please press button “OK”. Now the software should use the right COM-port. All other COM-port parameters will be set automatically. If not press the small red dot to stop software and restart with the arrow above the word Overview.



4.1.5 User Interface

The user interface is separated into two “Tabs”. In addition, the measuring range selection and switching of the trigger source are located on the right side.
“Internal “or “external” can be selected as the trigger source. With "external" the SMA socket must be connected to the trigger output of the laser. With "internal" the electronics generate the trigger signal from the measurement signal of the sensor. If the EMK200USB is operated in environments with strong sources of interference, we recommend external triggering.

Raw mode

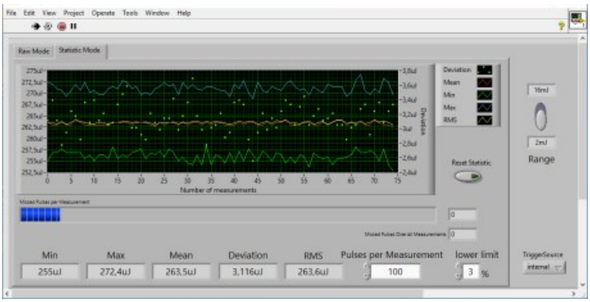
In raw mode, each individual measured value is displayed graphically. In the diagram you can estimate the pulse-to-pulse stability and any drift. With high repetition rates, however, a large number of measured values are obtained. The y-axis is scaled automatically. The length of the x-axis can be set via the "data points" field. Once the number of measured values has been reached, the first measured values are discarded again. Pressing "Reset" deletes the measured value array. Changing "data points" also deletes the array.

It is possible to save all measured values recorded on a data medium. To do this, the storage path and file name must first be selected in the "setup" tab. After pressing the small path symbol, a corresponding window opens. To start saving press “Record”. During storing the color of the “Record” button is highlighted. A second press stops recording.

Statistic mode

In "Raw mode" there are a lot of measured values. The "Statistics mode" offers a better overview. The EMK200 measures the energy of each laser pulse and calculates the statistically relevant values using the laser pulses set in the "Pulses per Measurement" field. Only these values are then transferred to the computer.

Another interesting value are lost pulses or laser pulses with insufficient energy. With external triggering, these are counted. With internal triggering, the pulses below the "lower limit" are discarded and counted as a missing pulse. The value set in “lower limit” corresponds to % full scale.



4.2 OEM INTEGRATION

On first-time connection of the detector heads with a Windows PC, a message window is opened with easy to follow installation steps. During installation an USB-serial-converter and an USB-serial-port will be installed. After the driver installation the detector heads can be used with every terminal software (e.g. TeraTerm) or with own software.

The detector head is equipped with a serial-USB-converter FT232 from the company FTDI. The newest drivers for common operating systems are downloadable from www.ftdichip.com. Also a detailed instruction file for setup is also available. In most Windows installations, the necessary drivers are already pre-installed. Then the above steps are not necessary.

For the serial port the following parameters have to be set:
- 2 Mbaud, *8 data bits, 1 stop bit, none parity*

The appropriate commands can be found on the next pages. Data exchange occurs principally in ASCII format. Connecting cables are normal USB 2.0 A—mini B cables. We recommend cables as short as possible and with good shielding.

4.2.1 Data Transfer

After switching on, the “raw” mode is preset. Start the process with the start command. With the laser switched on, ASCII strings between 0 and 4095 should now be transmitted. All commands must end with a line feet.

The device only sends the pure raw values of the analog to digital converter in order to save time for calculating the floating point values. This ensures that as many laser pulses as possible are recorded. In order to determine the energy values from this, the calibration values of the sensor and the amplifier are required. These values are stored in the EEPROM and can be read out with the allcal command. The energy value of the laser pulses is calculated using the following formulas:

$$Energy = \frac{ADCvalue - hoff}{cal \times hcal} \quad \text{respectively} \quad Energy = \frac{ADCvalue - loff}{cal \times lcal}$$

4.2.2 Remote Control

For remote control a number of commands are available. The commands are case sensitive. Every command must finished by LF (line feed). The EMK200 don’t send a local echo. When a command is unknown it answer with “Command unknown”. Some command needs additional parameters.

Command	Description	Parameters/ Example
start	starts data acquisition	NOPARAMS
stop	stops data acquisition	NOPARAMS
raw	Switch to mode “raw”, every sampled value will transmit	NOPARAMS
stat	Switch to mode “statistics”, only the statistical values will transmit, the number of values will defined by the command “numbers”	NOPARAMS
allcal?	Gets all relevant calibration values and parameters stored in the EEPROM	NOPARAMS
range	sets range, two ranges are available	range high range low
range?	Gets selected range	NOPARAMS
trigger	Switch between external and internal trigger Standard is internal trigger	trigger intern trigger extern
trigger?	Gets selected trigger source	NOPARAMS
tres	Sets a lower limit for the statistics to identify the missing number of laser pulses of pulses with too low energy. The set value corresponds to the ADC raw value	tres <integer> tres 200
tres?	Gets selected lower limit	NOPARAMS
numbers	Number of numbers for statistic calculation	numbers <integer> numbers 1000
numbers?	Gets selected numbers for statistic calculation	NOPARAMS
cal	Sets the calibration value of the sensor	cal <float>
hcal	Sets the calibration value for the upper range	hcal <float>
hoff	Sets the offset for the upper range in ADC raw values	hoff <integer> hoff –21
lcal	Sets the calibration value for the lower range	lcal <float>
loff	Sets the offset for the lower range in ADC raw values	loff <integer> loff –12

The greyed out parameters were saved during the calibration of the EMK200USB. These should only be changed if the device needs to be recalibrated. Otherwise the calibration is no longer valid and incorrect measurements are the result.

5. Warranty and Technical Support

5.1 Warranty statement

All SLT products are warranted against defective materials and workmanship for a period of twelve months from the date of delivery, unless otherwise specified. SLT will at its own option repair or replace with-out charge any item found to be defective.

SLT supplies comprehensive technical data regarding all of its products. In addition, technical assistance is available to aid customers in the selection and use of their products. Specifications are current at time of publication, however, the right to change and improve products without notice is reserved. There are no limited warranties of merchantability or of fitness for a particular purpose given in connection with the sale of any goods. SLT does not assume liability for consequential, incidental or special damages. The purchaser's sole and exclusive remedy and the limit of SLT's liability for any loss whatsoever, shall not exceed the purchase price paid by the customer for the unit(s) or equipment to which claim is made.

5.2 Routine calibration

SLT recommends that the *Power / Energy* Meter should be return for recalibration every twenty-four months. The procedures outlined in section 5.3 should be followed when returning the unit for service.

5.3 Return Procedures

Prior to shipping parts back to SLT for return, repair or service, contact your nearest SLT office. Parts must be returned in their original packaging and all shipping costs prepaid.

6. SLT 'End of Life' policy (WEEE)

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, SLT offers all end users in the EC the possibility to return 'end of life" units without incurring disposal charges.

This offer is valid for SLT's electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out 'wheelie bin" logo
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self contained operational electrical and electronic products, this 'end of life' take back service does not refer to other Thorlabs products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- left over parts of units disassembled by the user (PCB's, housings etc.).

6.1 Waste treatment on your own responsibility

If you do not return an 'end of life" unit to SLT, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

6.2 Ecological background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future. The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.

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