laserpoint

PLUS2

Power & Energy Meter

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Plus 2 Laser Power & Energy Meter

User's Manual

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1. Safety notes

Before operating this instrument, carefully review the following safety information to avoid personal injury and prevent damage to this instrument or any sensor head connected to it. This instrument does not contain any user-serviceable parts.

The measuring as well as the use of lasers is potentially dangerous. This instrument may operate over wavelengths including non-visible laser radiations.

Proper operating practice in accordance with laser manufacturer's recommendations is crucial; to ensure correct operating procedures, consult the laser manufacturer and your laser safety officer.

Eyewear and other personal protective equipment must be used in compliance with applicable laws and safety regulations.

Operate this instrument only within the specified range of operating conditions (refer to chapter 17 for environmental and operating conditions).

Do not operate this instrument in critical medical environments, in wet or damp conditions or in an explosive atmosphere.

Do not operate this instrument if in suspect of damage or failures. Refer about damaged equipment to LaserPoint for qualified service inspection.

2. LaserPoint intelligent connectors

All LaserPoint sensor heads feature an intelligent connector where the relevant data and information pertaining the sensor head are stored in a built in memory. The head model, its identification number, the head full scale, the calibration wavelength(s), the head sensitivity spectrum vs wavelength and the head calibration date are all stored in the connector memory.

In general, detectors feature different sensitivity values at different wavelengths depending on the detector nature (this is especially true for those based on semiconductor devices), so it is important to account for this when measuring power and energy values. All LaserPoint sensor heads are calibrated up to the rated power/energy head full scale at least at one desired wavelength. All sensor heads are now characterised over a large wavelength range too using a low power broadband source and the obtained sensitivity spectrum is loaded into the smart connector memory as a table of discrete sensitivity wavelength dependent data.

All standard LaserPoint thermopile and semiconductor sensor heads are equipped with a DB 15 pin intelligent connector.

3. Introduction to Plus 2 Power/Energy Meter

Plus 2 is an ergonomic micro computer based instrument with a high brightness, 4.3"- high resolution (480 x 272) TFT LC touch screen display. It is powered by a Li-Pol rechargeable battery. The battery recharge is carried out by connecting its USB connector cable to a PC or to the supplied line charger/power supply USB port.

Plus 2 keeps in memory all sensor head data and settings up to ten different heads that have been connected to the instrument; a further head connection to the instrument, displaces the first head data from the intelligent connector memory and records the last connected head settings. Plus 2 features a high speed algorithm suitable to accelerate the response and the recovery of thermopile sensor head signals.

The colour touch screen display on the front side of the instrument is the actual user interface; it can be operated by simple and very intuitive actions. It allows the user to easily interact with the instrument and quickly set it up

for measurements. A stainless steel stand gives the instrument an optimum tilt to offer the best screen view when the instrument is used on a laboratory table.

Fig.1 Front view of Plus 2 power/energy meter

Instrument switches and ports- The instrument TOP side, shown in Fig. 2, hosts the white On/Off switch, the external power supply cable USB plug and one DB 15 pin connector as the input port for all LaserPoint power/energy head signals.

Fig. 2 Top view of Plus 2 power/energy meter

The instrument left side hosts one USB port for connecting a memory key suitable to download selected data; the actual measurement signal voltage (2 V full scale) can be extracted by the analogue output port (Fig.3) placed at the instrument right side.
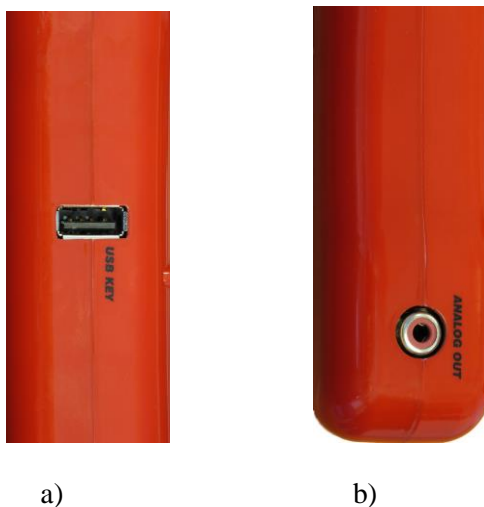

a)   b)

Fig. 3 Side views of Plus 2
a) instrument left side (USB data port)
b) instrument right side (Analogue output port)

Instrument battery and power supply- The instrument is powered by one 3,7 V rechargeable Li-Pol battery or by its line power supply that acts also as battery charger. LaserPoint recommend to use ONLY the power supply-battery charger supplied with the instrument.

Touch Screen Display- Figure 4 shows the touch screen display; in its upper right corner the display hosts an icon showing which type of power source is used.. A green battery icon with an associated figure indicating its charge level in percentage of its full charge (in 25% unit steps) shows the instrument is powered by its rechargeable battery. When the battery is about to be exhausted the green icon converts to a red vertical bar associated with a small white plug. When the instrument is plugged in its line power supply the icon converts in a white plug icon.
The instrument can be operated up to 9 hours by a fully charged battery.
The battery complete recharge takes approximately 7-8 hours if the instrument is not working and may take up to 20 hours if it is being used.

4. Head compatibility – important information

All LaserPoint heads are compatible with Plus 2 meter, but the stored information in the head EEPROM depends on the head manufacturing period and on the type of read out unit that was planned to be used in connection with such a head. The intelligent connector of the heads supplied together previously issued read out units like Plus, 4Pi and PC-Link meters contain more limited information especially regarding the calibration wavelengths and wavelength ranges; this may limit to exploit the full information potential Plus 2 read out unit can provide if used with a recently manufactured head. Therefore, in order to exploit the full potential offered by Plus 2 meter, LaserPoint recommend the upgrade of all the sensor heads supplied before the issue of Plus 2 meter at factory.
Contact LaserPoint to check if a previously supplied head needs to be upgraded for its use with Plus 2 read out unit.

5. Switching Plus 2 ON and OFF - Quick start

To start a power measurement in a quick easy way, simply follow this list of actions:
- Connect a LaserPoint head to Plus 2 by plugging the head connector into the instrument 15 pin socket (fig.2) and properly tighten the connector side screws.
- Switch Plus 2 on by keeping the On/Off switch (fig.2) pressed for few seconds until the instrument display lights on. Should the display show "NO HEAD", check the connector is properly plugged in the instrument 15 pin socket.
- Check the desired laser wavelength value is displayed in the Wavelength key (Fig.4 (g))
- Start the measurement cycle by placing the active area of the detector head in front of the laser source. <u>Carefully ensure the laser beam hits the active sensor area only to avoid possible head damage and misleading power measurements</u>. The measured laser beam power value is soon displayed on the instrument screen.
- To switch the instrument off press the ON/OFF switch until the display goes off.

6. The touch screen display

After Plus 2 has been switched on, its multifunctional touch screen becomes the actual interactive interface between the user and the instrument.
Fig.4 shows an image of Plus 2 meter touch screen; its display is split in two main parts: its upper part is dedicated to reports the measurement related information and is the read out only part of the touch screen display. The lower part is the actual interactive area of the instrument and is filled with the touch screen keys dedicated to the instrument and measurement settings.
After touching one of the screen keys, a window as first interaction user-instrument element appears on the display. The window generally offers two main interactive tools: a dialogue box with two or more options or a digital keyboard, depending on what kind of input the instrument needs. These two kind of tools allow the user to select an option or generate and enter a numerical input. Both parts of the display have horizontal sections dedicated to specific information or interactive actions as described below:
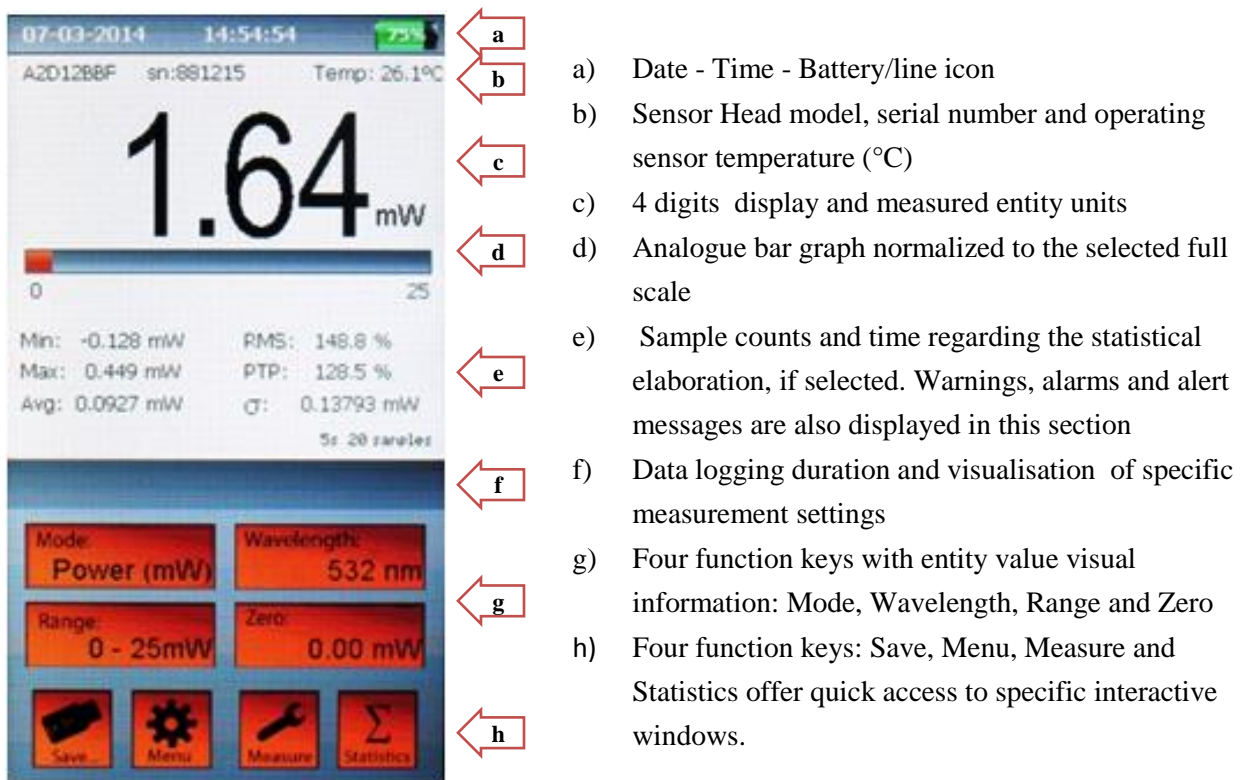

a) Date - Time - Battery/line icon
b) Sensor Head model, serial number and operating sensor temperature (°C)
c) 4 digits display and measured entity units
d) Analogue bar graph normalized to the selected full scale
e) Sample counts and time regarding the statistical elaboration, if selected. Warnings, alarms and alert messages are also displayed in this section
f) Data logging duration and visualisation of specific measurement settings
g) Four function keys with entity value visual information: Mode, Wavelength, Range and Zero
h) Four function keys: Save, Menu, Measure and Statistics offer quick access to specific interactive windows.

Fig. 4 The touch screen display

7. Instrument Function Keys: Menu key

MENU key allows access to the main instrument settings. Touching this key opens the Menu window as shown in Fig. 5a. This window features eight lines showing the information about:

Date: sets the date in the dd/mm/yy format.

Time: sets the time in the hour/min/sec format and the hour is displayed in the 0-24 h format.

Language: instrument language (english is the only available language in this instrument release, other languages will be available in the next firmware update).

Colour instrument background colour (other background colours will be available in the next firmware update).
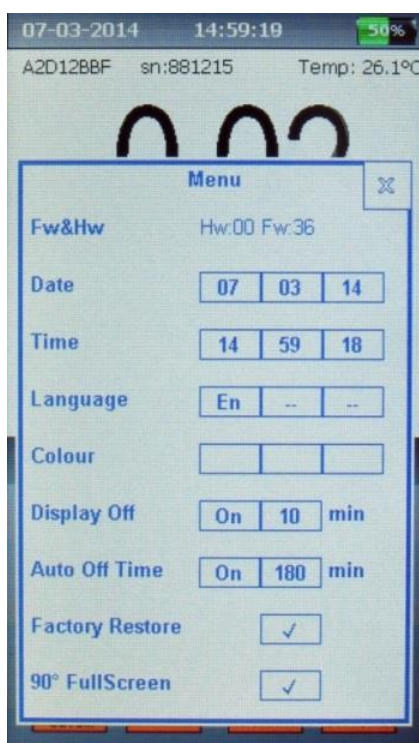

Fig. 5a The Menu Window   **Fig. 5b** The Digital Keyboard Window

Display off: For energy saving purposes it is possible to set a time of instrument inactivity after which the display is automatically switched off; a faint mobile "stand-by" notice will advise the user of the idle instrument state. Selecting ON/OFF activate/deactivate this option; if ON has been selected the display off time can be set from 1 to 30 minutes. When Plus2 is in stand-by mode, touch the screen in any place to recover immediately the instrument display operation.

Auto off: Time of instrument inactivity after which the whole instrument switches off; selecting ON/OFF activate/deactivate this feature; if ON has been selected, Auto off time can be set from 1 to 600 minutes.

Note*:* both **Auto off** and **Display off** features are active only when Plus 2 is powered by its battery. When Plus 2 is plugged in a power line both the instrument and its display remain on regardless to **Auto off** and **Display off** set values.

Factory restore: this function resets all measurement, statistics and wavelength settings back to the ex- factory conditions. Activating this option erases the information regarding all sensor heads previously connected to Plus 2 meter.

90° Full Screen: this option switches the screen content to a 90° rotated full screen high visibility and high contrast display and presently works in Power Mode only. When this display mode is activated the measured power value and its related units are shown only as shown in Fig.6. Click the "X" screen button to return to the main operating display configuration.

Each of the above listed parameters has a number of small boxes ranging from 1 to 3 placed at its right side in **Menu** window. Some boxes have options to validate or select, some need a parameter value to be entered. To change or enter a parameter value touch the pertaining parameter box; a digital keyboard as shown in Fig. 5b appears and allows the setting of the desired value to be entered in the touched box.
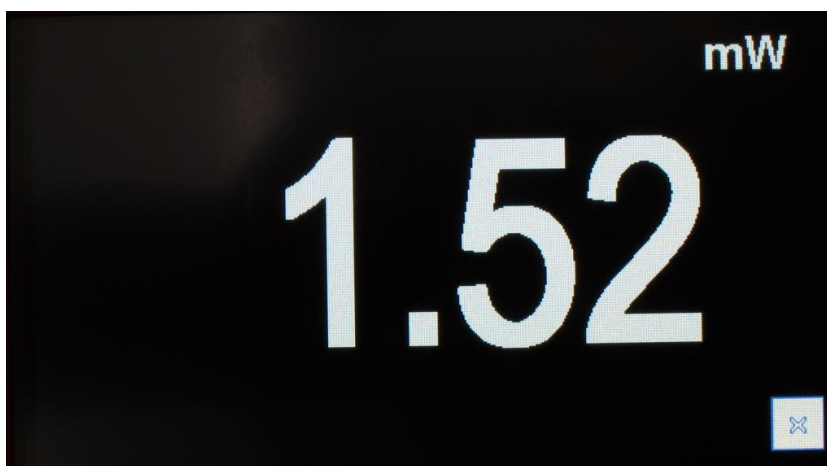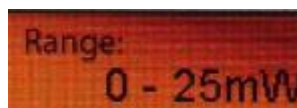

Fig. 6 Image of **90° Full Screen** activated option

8. Instrument Function Keys: Range Key

This key allows the measurement full scale (or range) to be adjusted according to user's needs. The selectable ranges depend on the sensor head type and usually are:

- Absolute Maximum Sensor Handling Power/Energy value
- 100% of Sensor Full scale value
- 10% of Sensor Full scale value
- Automatic range (only in Power Mode)

To select a desired measurement range touch the **Range** key and keep it pressed to scroll the available options; release the key when the desired option is displayed in the key area.

9. Instrument Function Keys: Zero key
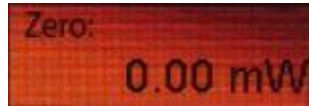
Zero function key helps the user defining the optical zero of the sensor head as well as the electrical zero by resetting the instrument ADC.
Zero function key may also be used to introduce a desired offset to a series of measurements.

All meter adjustments are carried out by Plus 2 firmware, however LaserPoint recommend to reset Plus 2 Meter every time a new sensor head is being plugged in.

Both head optical resetting and ADC electrical resetting have to be accomplished manually by using **Zero** key and following few simple steps as indicated below:

Important notice: before starting an electrical resetting sequence, ensure the sensor head is in thermal equilibrium with the environment that no laser radiation accidentally hit the sensor not to introduce an unwanted offset level. The head shall be properly blinded in the case of high sensitivity heads.

- To optically reset a head briefly touch **Zero** key .
- To reset the ADC keep **Zero** key pressed until the window shown in Fig. 7 appears on the screen in the display segment e) as described in Fig. 4
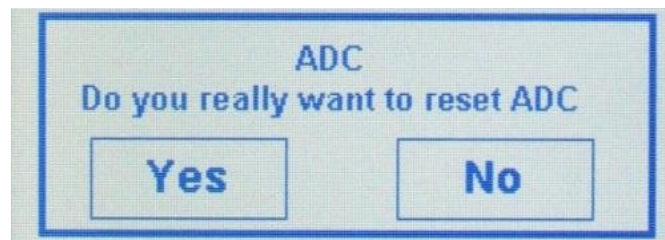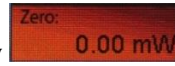

Fig. 7 ADC resetting request window

- Touch Yes and wait few seconds while the screen shows the notice "Wait for zeroing" (Fig. 8a). When the ADC has been finally reset the notice "Zeroing Completed" (Fig. 8b) appears on the display and the meter is ready for use again.
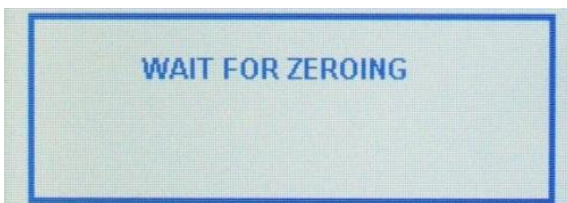

Fig. 8a "ADC resetting in progress" notice   **Fig. 8b** "ADC reset" notice
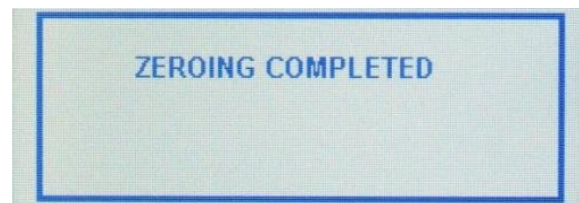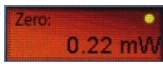
Offset: the introduction of an offset level in a measurement may be useful in certain cases. Plus 2 can easily introduce an offset power value and to do it, briefly touch **Zero** key and the currently measured power level is accounted by Plus 2 and introduced as the offset power level. When an offset has been introduced, its value and units are shown in the **Zero** key area. An additional yellow spot appears in the

upper right corner of the key area **Zero: 0.22 mW** to highlight that an offset has been introduced. To cancel the offset level, briefly touch **Zero** key again.

10. Instrument Function Keys: Wavelength key **Wavelength: 532 nm**

In general detectors exhibit different sensitivity values versus different wavelengths depending on the detector nature; detectors based on semiconductor devices may show very important variations of their sensitivity against wavelength, so it is important to account for this effect when measuring a laser beam power or energy.

All LaserPoint sensor heads are calibrated up to the rated power/energy full scale at least at one desired wavelength and can optionally be calibrated at many other wavelengths between 200nm and 2100nm and at 2940nm (Er-YAG laser) and 10600nm (CO2 laser); this information is stored in the head intelligent connector memory and is read by the instrument upon connection of the head to it. Furthermore LaserPoint heads are characterised over a wider wavelength range using a low power broad band optical source; the broad band thermal heads are all characterised between 200nm and 2100nm; photodiode heads are characterised up to the detector cut-off wavelength. The obtained sensitivity spectrum is loaded into the head smart connector memory as a table of meaningful discrete wavelength dependent sensitivity values. If the desired wavelength does not fit one of the loaded sensitivity points, the instrument calculates the detector sensitivity value at the desired wavelength by an interpolation algorithm.
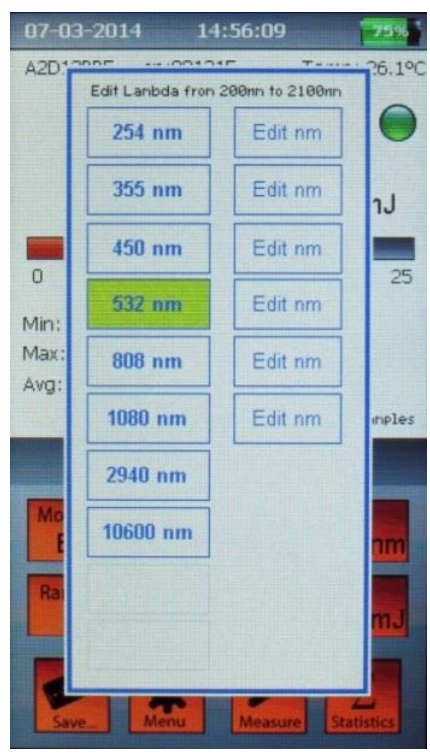

Fig. 9a The Wavelength Window (example) **Fig. 9b** The Digital Keyboard Window

To set a measurement wavelength touch the **Wavelength** key **Wavelength: 532 nm** to open the wavelength dialogue window shown in Fig. 9a. Select a wavelength from the list shown at the left hand side of the window or touch an "edit nm" box at the right hand side of the window to input a specific wavelength not shown in existing list.

Touching one of the "edit nm" boxes makes a digital keyboard to pop up as shown in Fig. 9b and allow the wavelength selection. The desired wavelength value in nanometer units must be comprised in the

specific head wavelength range shown at the top of the wavelength selection window. Touch the "OK" button to enter the selected wavelength; its value is then shown in the box with a green background in the left hand side list. Touch the green box to be confirm the choice.

Note: The available wavelengths and editable wavelength range depend on each sensor head characteristics and calibration. In any case beyond 2100nm the only selectable wavelengths are 2940nm and 10600nm if the sensor head has been requested to be calibrated at these wavelengths.

11. Instrument Function Keys: Measure key

Measure key allows to account for specific conditions of measurement and set parameters like the sensor signal acceleration, gain and averaging option. When in Power Mode (see paragraph 12) touching this key opens the "Measure settings" windows allowing the view and setting of the above parameters; this window allows also to specify the laser beam shape and its dimensions enabling the calculation of the laser beam power or energy density and to change the DAC calibration value if necessary to enhance the analogue output sensitivity. The instrument last calibration date is also shown at the bottom of the window. The "Measure Settings" window for Energy Mode is somehow different and is described in the following chapter **Mode** Key.

"Measure Settings" window (Fig.10) opens by touching **Measure** key .

The **Acceleration** factor is a useful tool when using large and intrinsically slow thermal heads whose typical response time can reach several seconds. When this option is activated an instrument algorithm accelerate the signal response in order to speed the instrument response up. LaserPoint recommend to keep this option always selected when using thermopile sensor heads, unless the laser output is instable or the detected power signal is weak and noisy.
The selection/de-selection of **Acceleration** option is straightforward and is accomplished by touching the small box at the right of this parameter writing.
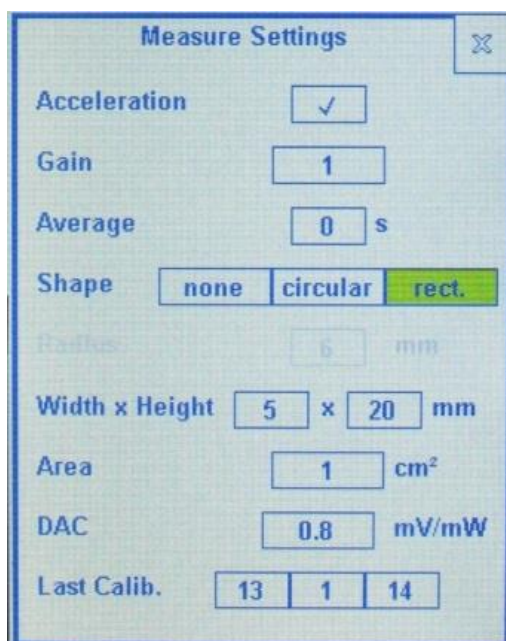

Fig. 10 Measure Settings Window (Power Mode)

The **Gain** factor (factory default setting = 1) is a useful tool especially when measurements are carried out in complex optical systems.

Typically this tool is particularly useful to normalise a measurement or when the measurement is taken out of a complex optical systems where, for instance, a beam splitter is used to extract a fraction of an optical signal; in most cases the beam splitter has two output optical ports with significantly different splitting ratios to allow the laser beam to exit the main port of this component almost unaltered and enabling the monitoring of the beam power or energy by measuring the small fraction of the beam at the monitoring port output.

If the power meter is connected to a sensor head placed at the monitoring port, a gain factor can be set to take into account the device optical splitting ratio by adjusting **Gain** factor and make the instrument show a power reading as though the sensor head were placed in front of the original laser beam. The selection of **Gain** option need the input of a number by means of the digital keyboard popping up upon touching the small box at the right of this parameter writing; the parameter input is accomplished in a similar way as described in the previous paragraph 10 for the measurement wavelength selection.

The **Average** factor is a useful tool when the signal is low and noisy and allows a cleaner signal read out; its settable value represents the time period during which the head signal averaging occurs.

Average value can be set from 0.1 sec to 99 sec and when a value greater than zero has been entered a yellow frame borders **Measure** key and an "Avg." notice appears just in the right side of the display segment f) (see Fig. 4).

Measure function key allows also to set and take into account the laser beam **Shape** and dimensions; this feature is particularly useful when irradiance and/or fluence are important information to the user like in the case of certain medical protocols that have to guarantee the deposit a certain dose of photonic power or energy per unit surface.

The measurement of Irradiance (power density) or Fluence (energy density) requires the selection of a laser beam **Shape** and the definition of the beam area. This selection has to be done among the following options: <u>none</u>, <u>circular</u>, <u>rectangular</u>.

If <u>none</u> option is being selected, the integral beam power or energy will be measured and the display keeps on showing the measurement power or energy values in W or J or their sub-units.

If the <u>circular</u> beam shape is being selected the **Radius** box is activated and upon touching it the beam radius in millimeters can be entered after touching the relative box by the already described digital keyboard.

If the <u>rectangular</u> beam shape is being selected the **Width x Height** boxes are activated and their relative dimensions in millimeters have to be entered by the usual digital keyboard.

In both cases of circular and rectangular beam shape selection, the Irradiance measurement values are expressed in W/cm2 units or sub-units and the Fluence measurement values are expressed in J/cm2 units or sub-units. The beam area in square centimeters is calculated by the instrument and shown in the box aside the **Area** writing.

To de-activate Irradiance/Fluence mode, select <u>none</u> for Shape in the "Measure Settings" window.

The last two parameters reported at the bottom of "Measure Settings" window are **DAC** and **Last Calib.**

DAC stands for the analogue output sensitivity and is stored in the head intelligent connector memory. Its value is factory set and is expressed in mV/W. In certain cases it might be convenient to expand the sensitivity of the analogue output signal and this coefficient can be changed by the user by means of the digital keyboard popping up after touching the small box aside **DAC** writing.

Last Calib. Indicates the instrument last calibration date and is for information only.

Note: in the case Energy Mode has been selected, "Measure Settings" window shows some parameters that are specific of pulse energy measurements, hence further information pertaining to energy measurement settings is reported in **Mode** key chapter 12.

12. Instrument Function Keys: Mode key
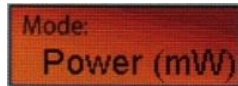
Mode key is basically a switch allowing to change the instrument settings in order to make a laser beam power measurement or energy measurement.

Selecting a power beam measurement or energy measurement is quite easy: just touch **Mode** key and switch from power to energy mode or viceversa.

The measurement units are than changed according to the mode selected and to the used sensor head type and function (power or energy) range. To recover the original mode just touch **Mode** key again.

Upon switching from power to energy mode the instrument display may report the message "Zeroing is necessary" as shown below in Fig.11; in this case press "OK" and follow the procedure already described in **Zero** key paragraph 9.

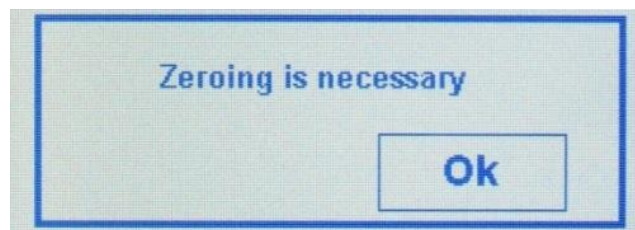**Fig. 11** Resetting request notice in Energy Mode

Fig. 12 Measure Settings Window (Power Mode)

In energy mode both single pulse energy detection and burst pulse (multiple pulses) energy detection is possible.

Important notice: operating Plus2 meter in an energy mode however implies that the measurement signal shall exceed a pre-set energy threshold. The instrument has been designed to measure the energy

of pulses above a preset energy threshold to avoid unwanted contribution of thermal noise or background radiation to the measured pulse energy.

To set an Energy Threshold ensure the instrument is already in Energy Mode, then touch **Measure key** [icon] to open the "Measure Settings" window.

Briefly touch **Start threshold** box and scroll to select the threshold among three possible options: "high", "med" or "low" by short touches on the box. The instrument factory setting for energy threshold is always "med", i.e threshold medium level.

A couple of hints to adjust the threshold level are given below.

- If the head intrinsic noise is high enough to trigger the meter, set the threshold to "high".
- If the pulse energy is weak and triggering the meter might be critical, set the threshold to "low."

After adjusting the threshold level, reset the instrument in the case the "Zero notice" appears as shown in Fig. 11.

Set the energy range manually (as described for power in Chapter 8). In energy mode only manual range setting is allowed.

A green spot at the upper right side of the display shows the instrument is ready to carry out a pulse or a burst energy measurement.
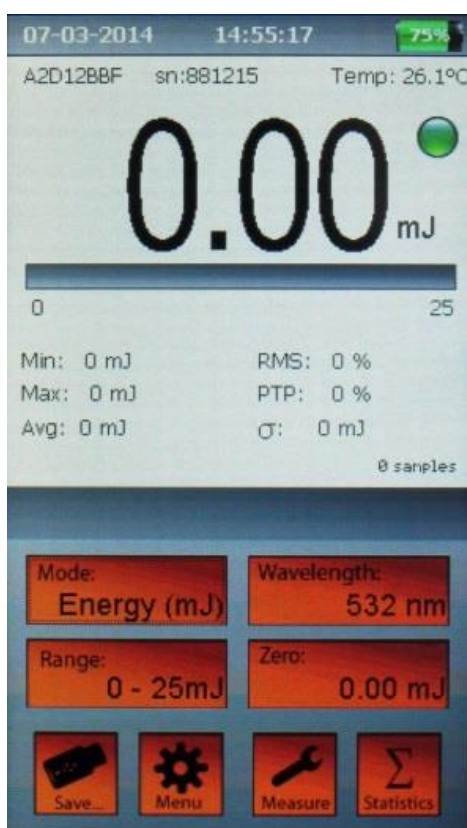
Fig. 13 Energy Mode display when ready for a pulse or burst detection

Shoot the laser pulse or burst and during the shot the display shows a window with the "Acquisition" notice (Fig. 14a) and the green spot at the upper right side of the display turns red.

When using a thermopile sensor head the "Acquisition" time usually ranges from 1 to 5 seconds depending on the used sensor head and if a single pulse or multiple pulse energy has to be detected.
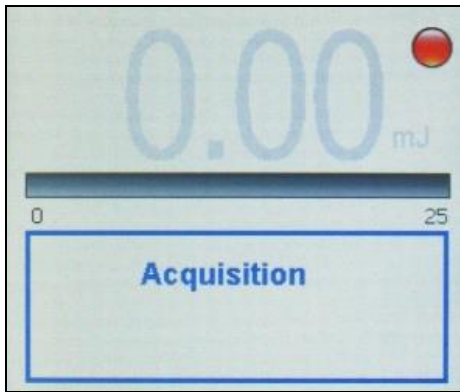
14a "Energy measurement in progress" notice   **Fig. 14b** "Energy measurement over" display aspect

As soon as the pulse energy detection is over, the energy measured value is displayed and the spot turns green again indicating the meter is ready for a further pulse energy measurement (Fig 14b).

Note: The correct measurement of the integral energy of a burst of two or more pulses carried out by a thermopile head requires that the pulse repetition rate is greater than 1Hz to avoid incurring in possible individual pulse energy detection.

13. Instrument Function Keys: Statistics key

Statistics key enables the statistical elaboration of the measured data and its settings.

When the instrument operates in Power Mode four statistics elaboration options are possible:

- **Off**: no statistics.
- **Continuous**: the data elaboration is made on a continuous data collection basis.
- **Repeated**: the data are repeatedly collected and elaborated within a user's defined time period.
- **Single**: the data are collected and elaborated once only within a user's defined time period.

Touch the **Statistics** key to open the "Statistics" windows (Fig. 15) and access these four options displayed as four rectangular interactive boxes in the window.
Upon touching a box its background becomes green indicating its selection.
"Off" or "Continuous" options need no more instructions.
"Repeated" or "Single" options require the definition of a time period that limits the statistical data collection and elaboration, hence after selecting one of these two options the needed period information in hours, minute and/or seconds has to be entered in the three small rectangular boxes just below these option keys.
Upon touching each time-information boxes the usual digital keyboard pops up allowing the desired time setting.
To enter the newly generated option and where it applies its time entity touch "Reset" box.

To exit "Statistics" window without changing any selection touch the "X" cross at the upper right corner of the window.
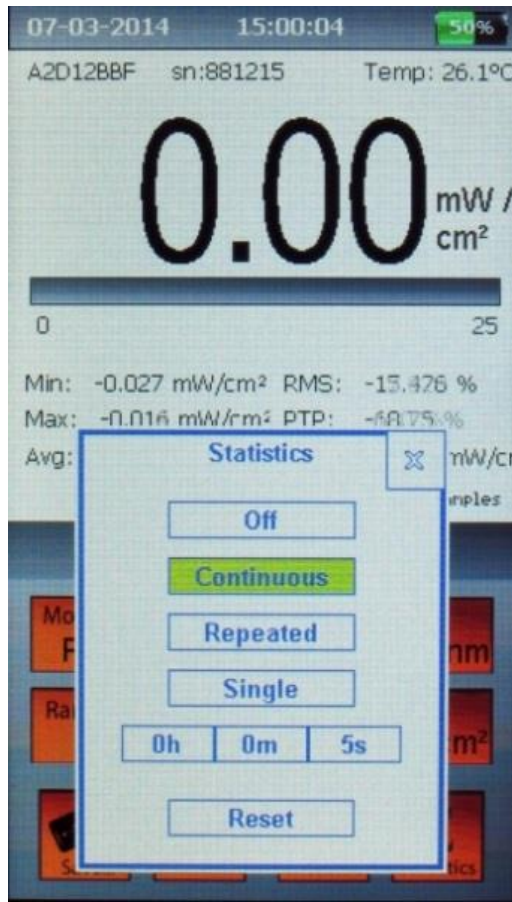
Fig. 15 The "Statistics" Window (Power measurement)

When the instrument operates in Energy Mode two statistics options only are possible: **Off** and **Continuous**. Therefore "Repeated" and "Single" option and period setting boxes in "Statistics" window are inactive.

14. Instrument Function Keys: Save key

Save key allows to plan the data collection mode and save the measured and/or the statistics elaboration data in a USB key by means of "Data Logging" window option selection.
Two data acquisition mode options are possible:

Manual: the data acquisition starts and stops by means of manual commands.
Timed: the data acquisition occurs automatically within a pre-defined time.

Touching **Save** key opens "Data Logging and Acquisition " window (Fig 16) that is the main tool to define which data (measured values and/or statistics) have to be acquired and saved as well as the acquisition mode option (Manual or Timed).

First plug a USB key in the instrument USB port (Fig 3a).
Depending on the USB flash memory speed, the USB drive might not be ready yet and in this case the "USB not ready" notice (Fig. 17) is displayed. Wait few seconds until this notice disappears.
Select the desired data to be saved by just ticking the small box at the right side of the writings **Values** and/or **Statistics**. Touch the small box at the right side of **Sample rate** to make the usual digital keyboard appear and set the desired sample rate between 0.5 and 99 seconds.

Important note: If "Continuous" statistics has been selected, the sample rate value refers to both measurement Values and Statistics data.
If "Single" or "Repeated" statistics have been selected the sample rate refers to measurement data only, because in these two cases Statistics data are saved each time they are refreshed.

Should the data acquisition be started and stopped manually select **Manual acq**. by ticking the small box at this writing right side.
Should the data acquisition be automatically stopped after a predetermined period of time select **Timed acq**. by first de-selecting **Manual acq**. box, if ticked, and entering the desired acquisition time value in hours and/or minutes.

Touch "OK" button to input all the selections and exit "Data Logging and Acquisition" window.
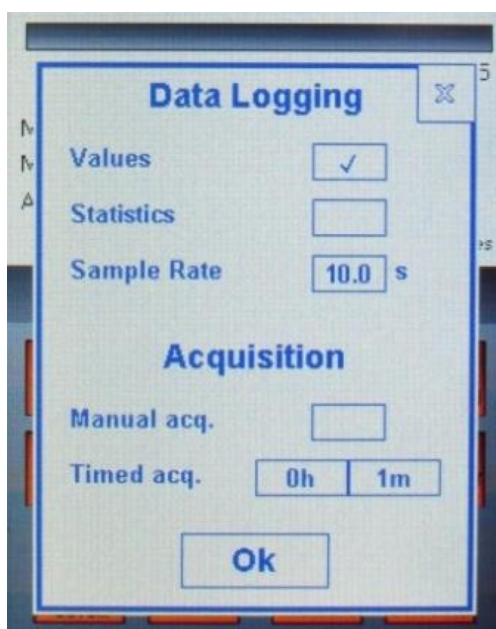

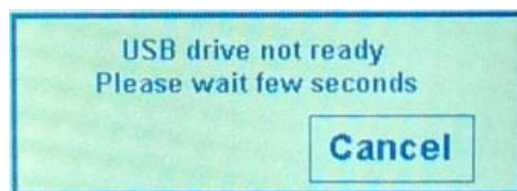**Fig. 16** The "Data Logging and Acquisition" Window

Fig. 17 Slow USB key notice

After all the mentioned selection actions have been completed the instrument is ready to start the measurements and save the measured and/or statistics data.

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At this moment **Save** key converts in a "Start" button . Touch it to start the data acquisition and their logging; in these conditions the lower part of the instrument display gets the aspect shown in Fig. 18a.
During data acquisition and logging the lower part of the instrument display assumes the aspect shown in Fig. 18b.

After the data acquisition has started, the "Start" button converts in a "Stop" button allowing the user to stop the data acquisition if Manual acquisition mode has been selected or to stop the data acquisition for any reason.
During the data acquisition the display segment f) in Fig. 4 shows a timer in its upper left part. The time shown by this timer is the elapsed time in the case a Manual acquisition mode has been selected and the residual time in the case a Timed acquisition mode has been selected.

Fig. 18a The "Acquisition ready" display image   **Fig. 18b** The "Data Logging" display image

The logged data are then saved in an automatically generated folder in the USB memory named according the following format:

 X:\PLUS2\head serial number

The measured Values and Statistics data are saved in separate files contained in the previously described folder and respectively named according the following formats:

DATA_nnn.txt and **STAT_nnn.txt**

15. Instrument alarms

This instrument displays two types of alarms: the head excess temperature alarm and measurement overflow alarm. The instrument issues a warning message that appears on the display and remains up until the cause of the alarm is being removed.

Overflow Alarm: This alarm appears when the signal detected by the instrument exceeds the instantaneous maximum power the sensor head can bear or the manually selected measurement range has been overcome.

Temperature Alarm: This alarm is active for thermopile sensor heads and it appears when the sensor head temperature exceeds its specified safety limit (typically 80°C).

16. Firmware updates

Among its innovating features Plus 2 allows firmware updates to be accomplished at customer's site using a simple and quick (less than 2 min) procedure. The firmware update file will be provided by LaserPoint via an e-mail message attachment.

To update the instrument firmware simply follow the instruction steps given below:

- Switch the instrument ON and plug the instrument to its external power supply.
- Copy the firmware update file in a free USB drive
- Plug the USB drive in the instrument USB port.
- After 10 seconds the display will show the image of Fig 19a, touch "Yes" to proceed.
- During the FW update file downloading Fig. 19b is shown and a moving bar indicates the file downloading progress .
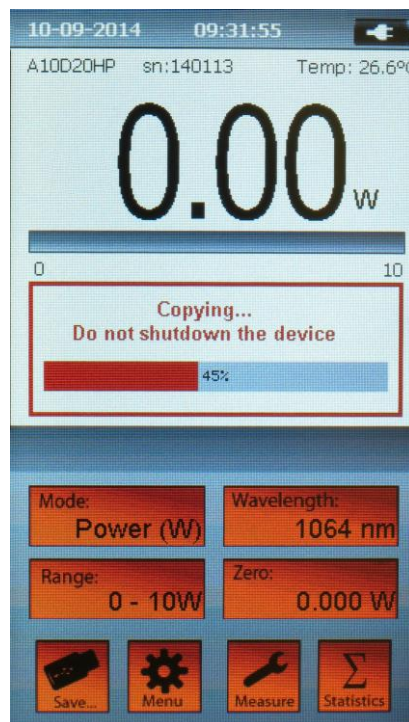
Fig. 19a FW update?   **Fig. 19b** FW downloading…   **Fig. 19c** FW downloading done

- Upon FW update file downloading is completed Fig. 19c image is shown on the display.
- Read carefully the instructions shown in the window before touching "Ok" key to start the instrument switch off.
- After few seconds the instrument switches off; remove the USB drive and then push the instrument ON/OFF button and keep it pressed until the display turns on again (this step takes about 10 sec).
- Upon the instrument switch on its FW is been updated and Plus 2 meter is now ready for new measurements.

17. Instrument specifications

Detector Compatibility	Thermopile, Photodiode and OEM LaserPoint Sensor Heads
Input Ranges	7 mV – 700mV full scale, in 9 ranges
A to D Sampling rate	64 Hz
A to D Resolution	23 bit ADC resolution, 16bit processing resolution
Electrical accuracy	± 0.5%
Electrical Input Noise	500nV
Input Offset Voltage drift	-4nV/°C (typical)
Dynamic Range	8 decades
Analogue Output	0.025 - 2 Volt, with 16-bit (0.0015% resolution.)
Analogue Output Accuracy	±0.1% ±2mV relative to display
Display	4.3" TFT LCD high brightness, 480 x 272 resolution, resistive touch panel 96 x 55 mm HxW
Display Digit Height	15mm Standard Operation - 25mm Full Screen Operation
Bargraph Segments	250 pixel width
Instrument Dimensions	170 x 100 x 36-50 (mm) HxWxD
Weight	380 g
Battery	Built in rechargeable Li-Pol. 3.7V 3700mAh
Battery run time	> 9 hours in normal operation > 15 hours in stand-by display mode
Battery charge time	7-8 hours not working 15-20 hours working
Power Supply- Battery Charger	Input 100/240Vac 50/60Hz Out 5Vdc 1A, (Plus 2 can be charged through a PC USB port).
Charge Current	0.5A
Operating Temperature Range	+5° to +40°C
Storage Temperature Range	-20° to 70°C
Max relative humidity	70%
International Regulations	CE, RoHS compliant.

18. Warranty

Plus 2 instrument is covered by one-year warranty from the date of shipment.
Warranty applies against material and/or workmanship defects, provided that the instrument has been used under specified operating conditions; the warranty does not cover damages related to accident or misuse.
During the warranty period LaserPoint srl will repair or, at their option, replace any Plus 2 instrument or instrument component that proves to be defective provided the parts are returned, shipping prepaid to LaserPoint Customer Service or to another facility, authorized by LaserPoint.
Any attempt by an unauthorized person or entity to alter or repair the product voids its warranty.
No other expressed warranty is given by LaserPoint.
Customers must fill in and mail the warranty card in order to validate the guarantee.
In case of instrument malfunctioning or failure, contact LaserPoint directly or its local distributor to obtain a Return Material Authorization Number (RMA).
The material should be returned, transportation and insurance prepaid, to:

> LaserPoint srl
> Customer Service
> Via Burona, 51
> I-20090 Vimodrone
> Italy
> E-mail: sales@laserpoint.it

LaserPoint assumes no risk for the possible damage during shipping.

19. Limited Liability

For a free of charge warranty service, please provide a description of failure or encountered problems when filling the RMA request form.
LaserPoint will, at its option, repair or replace the defective product free of charge . However, if LaserPoint determines that the failure was caused by misuse, alterations, accident or abnormal condition of operation or handling, Customer will be billed for the repair and the repaired product will be returned to Customer, transportation and insurance prepaid.

20. Declaration of Conformity

CE

Application of Council Directive(s) :   89/336/EEC   The EMC Directive
                                            73/23/EEC   Low Voltage Directive

Manufacturer's Name :   LaserPoint srl.
Manufacturer's Address :   LaserPoint srl- Via Burona, 51- Vimodrone-20090 Italy

Type of Equipment: Laser Power/Energy Meter
Model No.:   **Plus 2 Power & Energy Meter**
Year of manufacture and test: 2014

Standard(s) to which Conformity is Declared:

EN 50081-1:1992 Emission generic standard - Part 1: Residential, commercial and light industrial
EN 50082-2:1995 Immunity generic standard - Part 1: Industrial

Standard	Description	Performance Criteria
EN 55022:1994 amendment 1: 1995 amendment 2: 1997	Limits and methods of measurement of radio interference characteristics of information technology equipment	Class B
EN 61000-4-2:1995	Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 4.2: Electrostatic discharge.	Class B
EN 61000-4-4:1995	Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 4: Electrical fast transient/burst immunity.	Class B

I, the undersigned, hereby declare that the equipment specified above
conforms to the above Directive(s) and Standard(s).

      Place: Vimodrone -Italy   _____
                                                    (Signature)

      Date : 03.09.2014   Dr Luigi Argenti

                                              Technical Director

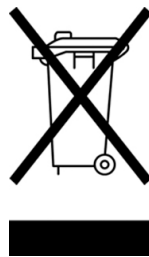## 21. Compliance to RoHS Directive (RoHS *2002/95/EC*)

The European (RoHS) Directive about Restriction of Hazardous Substances (2002/95/EC) aims to minimise the environmental impact of waste of electrical and electronic equipment by reducing the quantities of four heavy metals and two brominated flame retardants.

Products placed on the EU market on or after 1 July 2006 must not contain more than the limits of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) as specified by RoHS directive.

LaserPoint Plus 2 power & energy meter is a product compliant to RoHS European Directive.

22. European Union WEEE Directive (WEEE *2002/96/EC*)

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is represented by a crossed-out garbage container label (see below). The purpose of this directive is to avoid the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.

************End of Document*************