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USER MANUAL
MAESTRO | Touch Screen Power & Energy Monitor

121-102013

gentec-EO
PARTNERS for ACCURACY

WARRANTY

All Gentec-EO products carry a one-year warranty from the date of shipment on material or workmanship defects when used under normal operating conditions.

Gentec-EO will repair or replace, at its sole discretion, any product that proves to be defective during the warranty period.

The warranty does not cover damages caused by product misuse, product modifications, accidents, abnormal operating or handling conditions, or third-party battery leakage. Any attempt by an unauthorized person to alter or repair the product voids the warranty. Gentec-EO is not liable for consequential damages of any kind.

CLAIMS

For warranty service, please contact your Gentec-EO representative or fill out an RMA request:

https://www.gentec-eo.com/contact-us/support-rma-request

To help us answer your request more efficiently, please have your product serial number ready before contacting customer support.

Upon receipt of return authorization, ship the product according to the RMA instructions. Do not ship items without a return authorization. Transport is at the customer's expense, in both directions, unless the product has been received damaged or non-functional. Gentec-EO assumes no responsibility for the damage caused in transit.

SAFETY INFORMATION

Do not use a Gentec-EO device if the monitor or the detector looks damaged or if you suspect that the device is not operating properly.

Appropriate installation must be done for water-cooled and fan-cooled detectors. Refer to the specific instructions for more information. Wait a few minutes before handling the detectors after they are powered up. The surfaces of the detectors get very hot, and there is a risk of injury if they have not cooled.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, try to correct the interference by taking one or more of the following steps:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and receiver.
- Connect the equipment to an outlet that is on a different circuit than the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Changes or modifications not expressly approved in writing by Gentec-EO Inc. may void the user's authority to operate this equipment.

SYMBOLS

The following international symbols are used in this manual:

 Refer to the manual for specific warning or caution information to avoid any damage to the product.

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1. MAESTRO

1.1. INCLUDED WITH YOUR MAESTRO

The following items are included with the MAESTRO.

Description	Part name	Part number
MAESTRO laser power and energy monitor		
USB-A to USB-mini cable	MAE-USB	100182
NiMH battery pack (replaceable)	MON-BAT	101199
Calibration certificate		
Power supply 9 V 1.67 A	MON-9V	200960
Country-specific power cord	Call	Call

The following items can also be purchased separately.

Description	Part name	Part number
Analog output cable	MAE-ANALOG	201958
External trigger cable	MAE-TRIG	201956
RS-232 cable	MAE-RS232	201860
Wall mount	MON-WALL	201241
Pelican carrying case	Call	Call

1.2. INTRODUCTION

To obtain the full performance from the MAESTRO, we recommend that you read this manual carefully.

The MAESTRO is a microprocessor-based power and energy meter that uses the latest technology to provide a multitude of options in a user-friendly environment. It is intuitively accessible using a touchscreen. It is a complete power and energy meter. The MAESTRO provides a statistical analysis of your measurements. It allows you to store data on an external USB key. Moreover, the MAESTRO can be updated by connecting a USB key with the new file available on our website in the download section.

The MAESTRO has enhanced network capabilities that take further advantage of the USB port for data acquisition and remote control. In addition to the external USB key, it can also transfer data files to a PC for more sophisticated data analysis. Furthermore, the MAESTRO responds to commands through the PC interface using the USB port. To transform your PC screen into a virtual MAESTRO, look for the easy-to-use communications software on our website.

There is no need to enter the head specifications when connecting the new Gentec-EO power or energy detector heads, for heads version 5 and above. The MAESTRO is already internally set to accept the latest Gentec-EO wattmeter and joulemeter heads with a DB-15 connector. The MAESTRO supports both fast and slow heads with a rise time from 5 μs to 10 s.

The MAESTRO can reread heads in hot plug situation. Before inserting a new head, wait for the MAESTRO to stop displaying numbers. Once the head has been detected, the monitor will wait 2 seconds to ensure that the head is properly inserted. If you do not respect these conditions and the head is not read correctly, reboot the MAESTRO.

1.3. EASY SOFTWARE UPGRADE

Keep in touch with the latest improvements to our user-friendly software by going to our website at www.gentec-eo.com. Download the latest software version anytime and install it on the MAESTRO with the USB key. You will find all the necessary information on downloading and upgrading in section 4.2.

1.4. SPECIFICATIONS

The following specifications are based on a one-year calibration cycle, an operating temperature of 18 °C to 28 °C (64 °F to 82 °F) and a relative humidity not exceeding 80%. Monitors must be stored in an environment between -20 °C to 60 °C (-4 °F to 140 °F) and a relative humidity not exceeding 90%.

Table 1. List of specifications

Power meter specifications	
Power range	4 pW to 30 kW
Power scales (photo diode head)	300 pW, 1 nW, 3 nW, 10 nW, 30 nW, 100 nW, 300 nW, 1 µW, 3 µW, 10 µW, 30 µW, 100 µW, 300 µW, 1 mW, 3 mW, 10 mW, 30 mW, 100 mW, 300 mW, 1 W, 3 W
Power scales (thermal head)	16 scales: 300 uW, 1 mW, 3 mW, 10 mW, 30 mW, 100 mW, 300 mW, 1 W, 3 W, 10 W, 30 W, 100 W, 300 W, 1 kW, 3 kW, 10 kW, 30 kW
Pyroelectric in power mode range (UM-B)	100 µW, 300 µW, 1 mW, 3 mW, 10 mW, 30 mW, 100 mW, 300 mW
Resolution (digital)	Current scale/8192
Monitor accuracy	±0.25% ±5 µV best scale[1]
Response time (accelerated)[2]	Head dependent (~1 sec)
Statistics	Current value, max, min, average, standard development, RMS stability, PTP stability, time
Data storage	Continuous on USB stick
Energy meter specifications	
Energy range	2 fJ to 30 kJ
Energy scales[2] (photo diode head)	300 fJ, 1 pJ, 3 pJ, 10 pJ, 30 pJ, 300 pJ, 1 nJ, 3 nJ, 10 nJ, 30 nJ, 100 nJ, 300 nJ, 1 uJ, 3 uJ,10 uJ, 30 uJ, 100 µJ, 300 µJ, 1 mJ, 3 mJ, 10 mJ, 30 mJ
Energy scales[2] (thermal head)	3 mJ, 10 mJ, 30 mJ, 100 mJ, 300 mJ, 1 J, 3 J, 10 J, 30 J, 100 J, 300 J, 1 kJ, 3 kJ, 10 kJ, 30 kJ
Resolution (digital)	Current scale/8192
Accuracy[3]	1.0% ± 50 µV < 6 kHz 2% ± 50 µV 6kHz to 10 kHz
Default trigger level	2%
Software trigger level	0.1% to 99.9%, 0.1% resolution
Repetition frequency[4]	2 kHz for data acquisition in the real-time full-screen display, no missing point 1.3 kHz for data acquisition in real time with time stamp, no missing point 2 kHz in statistics mode, no missing point From 2 kHz to 10 kHz the MAESTRO will send the latest energy pulse every 500 us (corresponding to a subsampling at 2 kHz)
Frequency measurement	Accurate frequency measurement up to 14 kHz 0-1000 Hz: 0.1% accuracy 1000-2000 Hz: 0.5% 2000-14000 Hz: 1%
Statistics	Current value, max, min, average, standard development, RMS stability, PTP stability, time, pulse #, repetition rate, average power
Data storage	Continuous on USB stick

[1] The 5µV offset can introduce an error into low power measurements with low sensitivity detectors. It is essential to use the zero offset to re-zero the MAESTRO before making a measurement in these conditions. It is always good practice to use the zero offset. See section 2.2.
[2] Varies with detector head.
[3] Including linearity, detector dependent.
[4] In a full-size statistic's windows, no scope display and no serial communication.

General specifications	
Digital display	112.9 x 84.7 mm RGB color LCD with touchscreen, 640 x 480 pixels
Display rate	3 Hz numeric display 15 Hz bar graph and needle display
Scope	500 divisions
Data displays	Real-time, scope, averaging, statistics, digital tuning needle
User input correction factors	1 multiplier and 1 offset (7-digit floating point)
Analog output	0 – 1 volt, full scale, ± 1%, cable length: 2.1 m Output impedance: 2.0 kΩ
Internet upgrades	USB stick
PC serial commands	USB, Ethernet[5] and RS-232 USB cable length: 1.8 m, RS232 cable length: 1.9 m
No missing point throughput serial frequency	300 Hz
Dimensions (without stand)	216 mm (W) x 122 mm (H) x 45.7 mm (D)
Weight (with stand)	0.670 kg
Battery pack	4 rechargeable 1.2 V Ni-MH AA
Battery life	6.5 hours[6]
Battery charge time	4 hours
Maximum battery cycle count (amount of charge cycles before the battery loses its efficiency)	Approximately 250 full charges (0-100%)
Universal external power supply	Input: 100/240 VAC 50-60 Hz, Output 9 VDC 1.66 A. Length power supply: 1.4 m, power cable length: 1.8 m

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[5] USB cable included. RS-232 cable must be purchased separately.
[6] Backlight at 50% in real-time display. The scope and averaging displays decrease the autonomy by 20%.

1.5. FRONT PANEL DESCRIPTION
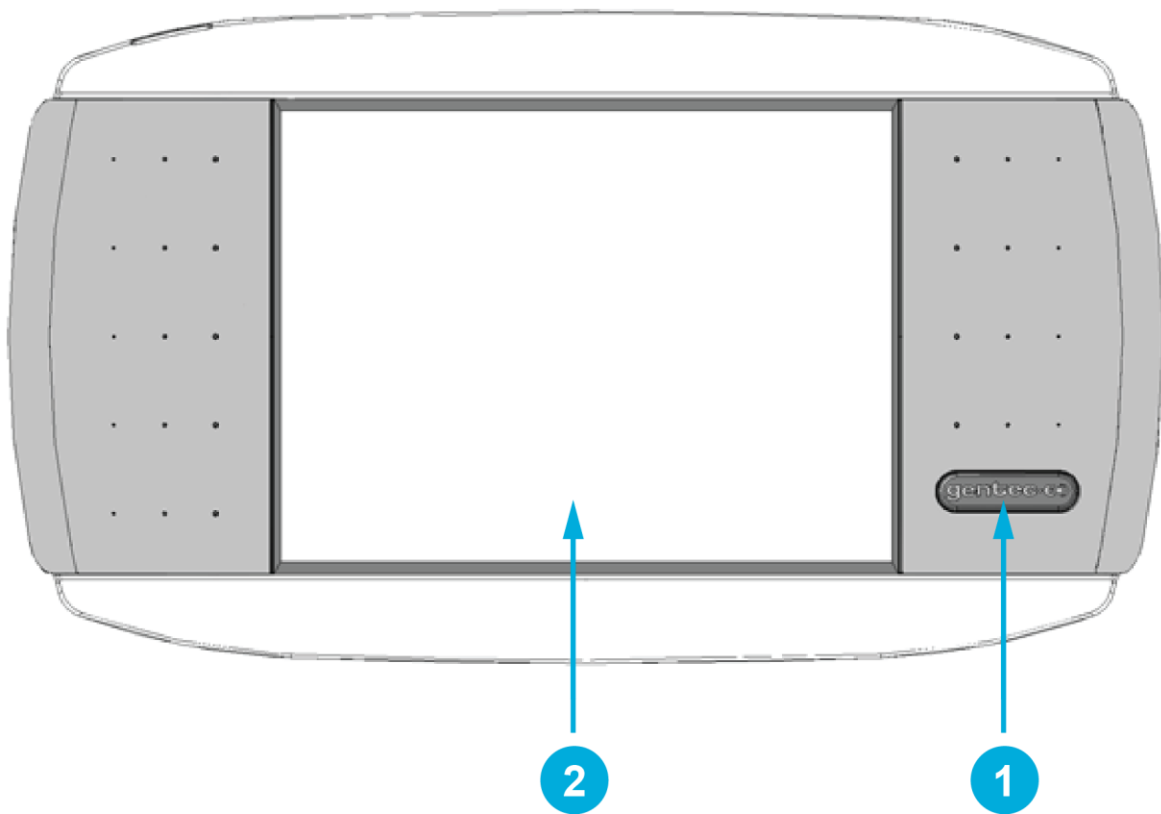
Figure 1. MAESTRO front panel

1 I/O control key

Pressing the I/O key quickly when the MAESTRO is turned off turns the MAESTRO on (do not hold the I/O key). To turn the MAESTRO off, press the I/O key. To prevent battery leakage and to increase battery life, we recommend switching the MAESTRO off when not in use.

2 LCD screen

Dimensions: 112.9 mm x 84.7 mm RGB color touchscreen LCD, 640 x 480 pixels.

To access any of the options or menus, simply touch the appropriate icon or button on the screen.

1.6. TOP PANEL DESCRIPTION
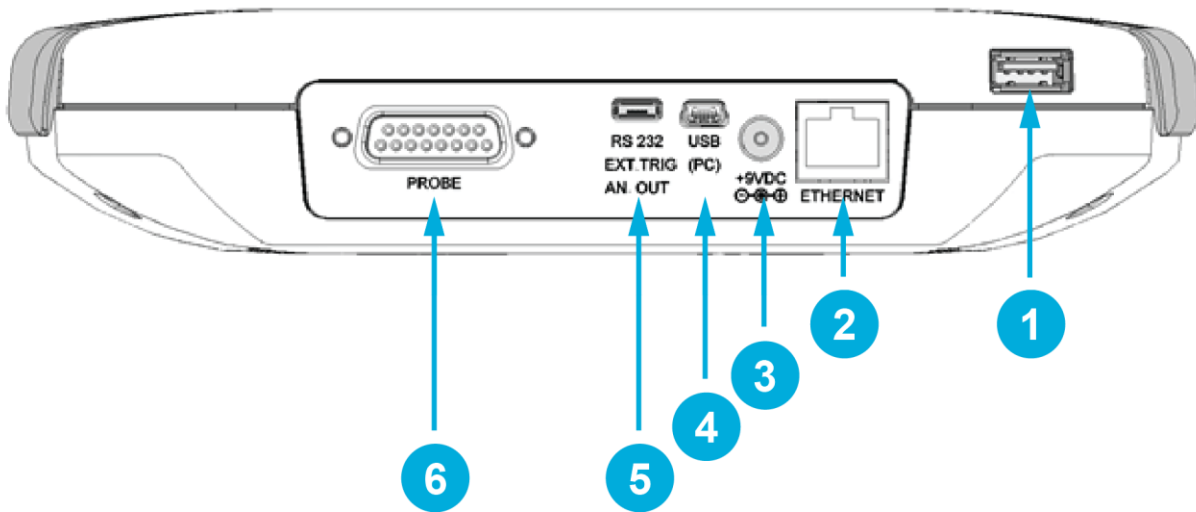
Figure 2. MAESTRO top panel

USB port for USB key

This interface allows you to insert a USB key for an easy and quick data transfer without having to connect the monitor to a PC. If your key is not recognized, try using a new one. Old and slow USB keys are not supported.

Ethernet port

This interface allows remote control and data transfers between the MAESTRO and a computer that has an Ethernet communication port.

External power supply jack

⚠ CAUTION

Permanent damage may occur to the optical meter if an external power supply other than the Gentec-EO P/N 200960A is used. Please call Gentec-EO or your local distributor if extra power supplies are needed.

The input voltage required is 9 VDC/1.66A. If the input voltage is between 15 and 25 volts, the monitor will switch to USB power or battery power. If the input power is above 26 volts, either the internal fuse will blow or the monitor may be damaged, depending on the voltage level and the waveform.

USB interface connectors

This interface allows remote control and data transfers between the MAESTRO and a computer that has a USB communication port.

5 **Serial interface connector (RS-232, analog out, external trigger)**

RS-232

The RS-232 interface allows remote control and data transfer between the MAESTRO and a computer, a terminal or any device that has a serial communication port. To use the RS-232 port, you must have a special cable (part number 201860).

RS-232 cable 201860 pinout	
1	No connection
2	TX
3	RX/external trigger
4	No connection
5	GND
6	Analog out
7	No connection
8	No connection
9	No connection

TX: Data transmitted from the MAESTRO (output)

RX: Serial commands received by the MAESTRO (input)

DB9: View looking into female connector on RS-232 cable 201860
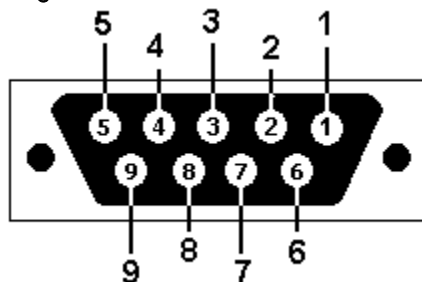
Analog out

It allows monitoring the laser average power or energy by using external equipment such as a chart recorder, a computer with an analog interface, a voltmeter, etc. To use the analog output port, you must have a special cable (part number 201958).

For power measurements: The output signal represents the amplified and anticipated power detector response.

For energy measurements: The output signal is a DC voltage representing the pulse energy value.

The 1 V value corresponds to the full-scale reading of the selected range. It provides the best signal-to-noise ratio. The measured power or energy is then related to the output voltage and to the selected range according to the following equations:

- V corresponds to 10 watt on the 10 W range
- 0.25 V corresponds to 2.5 watt on the 10 W range
- 0.10 V corresponds to 30 mW on the 300 mW range.

Specifications

- Maximum output voltage: 1 V
- Output impedance: 2 kΩ

External trigger

To use the external trigger, you must use a special cable (part number 201956). The external trigger is TTL compatible. The maximum voltage is 25 volts, the trigger needs a positive voltage, the minimum width is 1 µs. The monitor detects the trigger on the rising side of the external trigger signal. To measure accurately, the trigger must be just before the laser pulse or just after.

For example:

- A QE12SP-S-MT has a 20 µs rise time
- The external trigger must be 4 µs before or 19 µs after the laser pulse
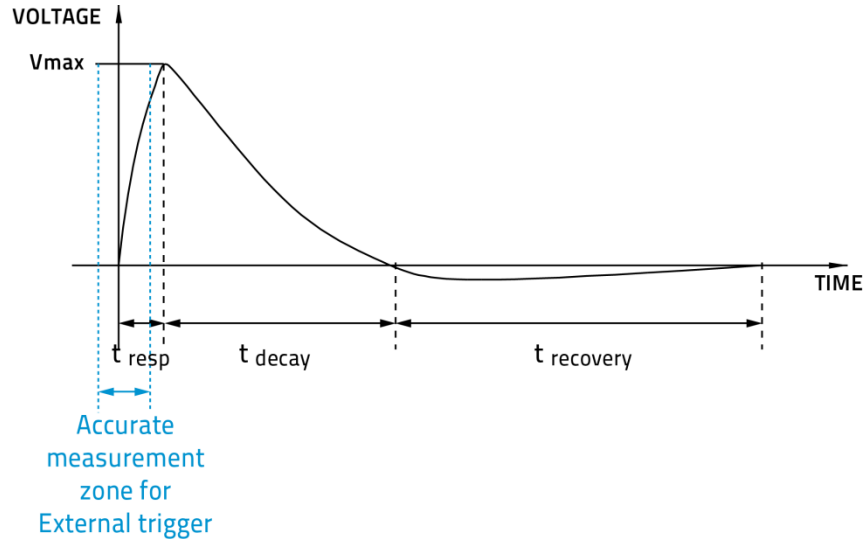
Figure 3. Typical pulse shape of a pyroelectric detector

Connector type: cable sold separately.

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Probe input jack

The MAESTRO uses a DB-15 female connector to mate with the detector heads (probes).

The MAESTRO works with all the latest Gentec-EO detectors except the specialty high rep rate detectors. It automatically recognizes every power detector head, which ensures accurate auto-calibration. More importantly, it can take advantage of the personal wavelength correction data. It reads the memory in the smart interface connector (version 5 and higher) to provide a wavelength correction that is based on spectral data measured from that specific detector.

The MAESTRO may not recognize some of the old head EEPROM versions. An error message "Detector not supported!" will appear in a popup window. Please contact a Gentec-EO representative to resolve this issue. If no message is displayed, either the head is not supported or is broken.

Energy detector heads prior to version 4 have a BNC connector. You must use a universal BNC/DB-15 adaptor to connect an energy detector head to the MAESTRO. This adaptor is compatible with all the Gentec-EO pyroelectric joulemeters except the EPD.

Power detectors of version 5 and higher and energy detectors of version 6 and higher are equipped with an "intelligent" DB-15 male connector that mates directly to the DB-15 female connector. They do not require an adaptor.

WARNING

The DB-15 connector, though similar to that of the former TPM-310 and TPM-330 monitors, is incompatible with the power detector heads of the PS-310 series version 1 and the PS-330 series version 1. These heads used a different technology and do not have the same pinout configuration. Any attempt to modify connectors of the early version heads to mate with the MAESTRO can result in damage to the monitor.

2. GETTING STARTED

This section contains important information concerning the installation and operation of the MAESTRO.

The MAESTRO is delivered ready to use. Just insert a detector head in the probe input jack (item 6 in Figure 2) and press the I/O key. The following window will appear on the monitor (Figure 4). It is separated into four different areas.
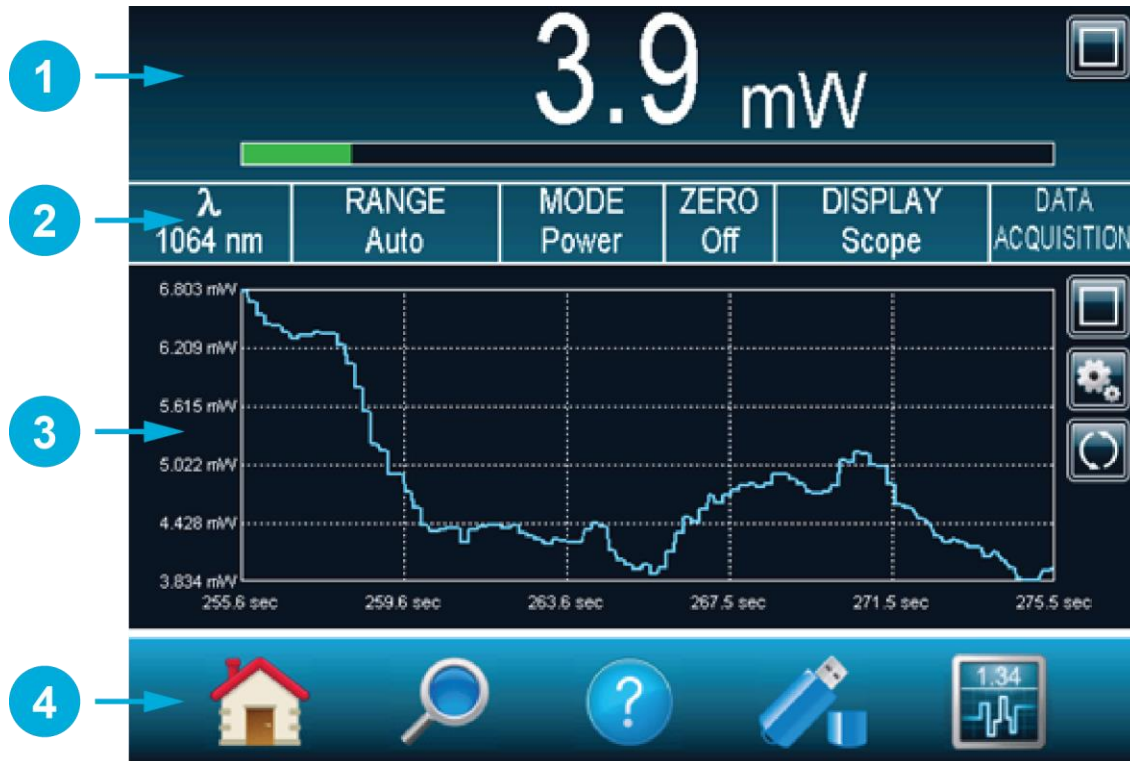
Figure 4. MAESTRO startup window

① Real-time display (in dual mode)

The real-time display shows the current measured value by the detector head.

② Display parameter menu bar

The display parameter menu bar gives you quick access to the MAESTRO's main settings.

③ Scope display (in dual mode)

The scope display gives a quick look at the laser beam's long-term stability and trend as a function of time. This display can be easily changed using the display parameter menu bar.

④ Navigation menu (main menu)

The **navigation** menu allows you to navigate through the different menu windows to set the MAESTRO's options to your specific needs.

2.1. HOW TO ACCESS THE DIFFERENT MENUS OF THE MAESTRO'S USER INTERFACE

The powerful CPU of the MAESTRO, combined with the Windows™ CE operating system, provides an easy and intuitive access to all of its functions. You control the intuitive interface using the touchscreen. To access any option or functionality, simply touch the appropriate icon or button on the touchscreen. To help you navigate through the different menus, Figure 5 represents the MAESTRO's user interface hierarchy. Each menu and submenu is represented by its icon and referenced to its corresponding detailed section (some functions may not be available in your software version, check our website for new release).
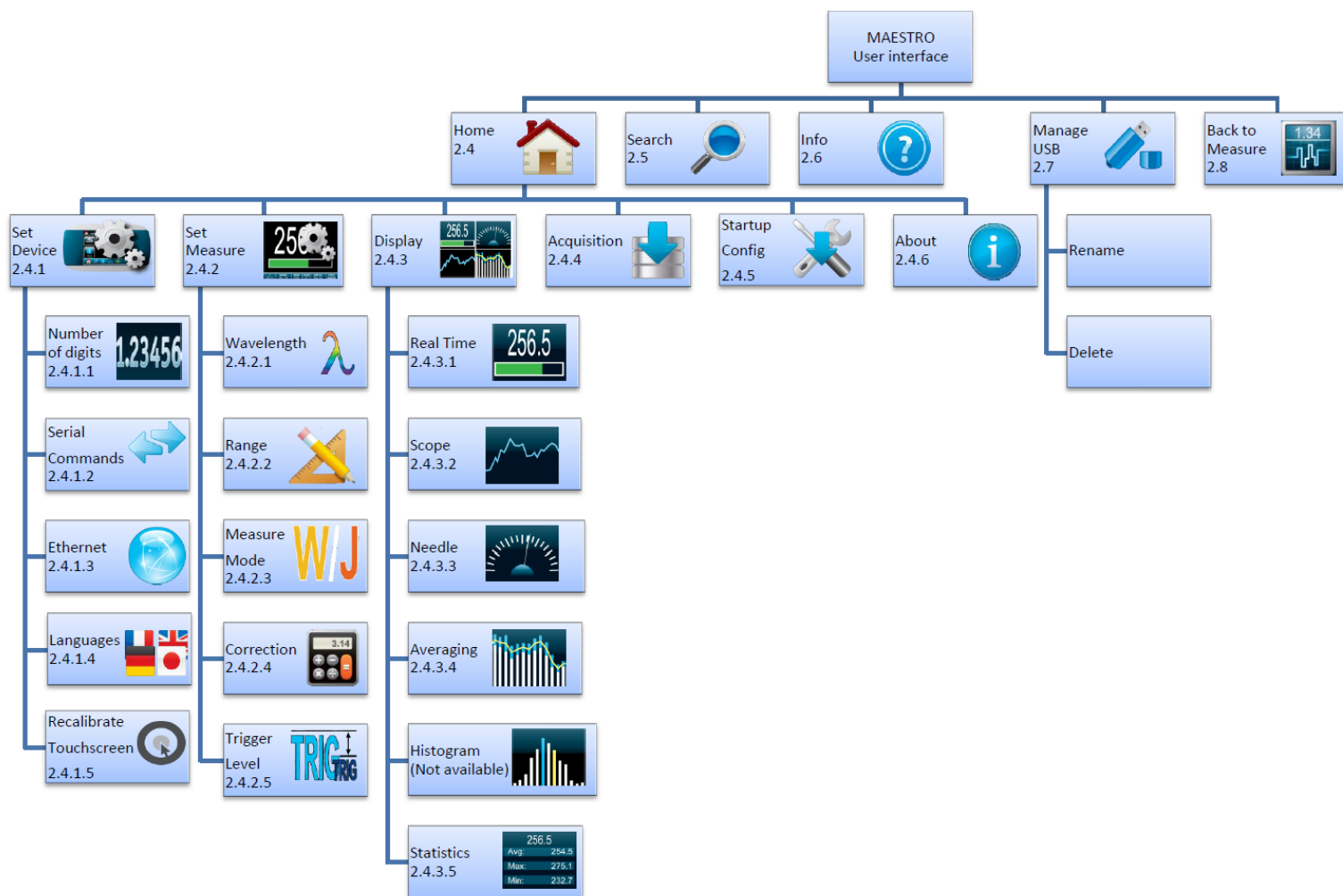
Figure 5. Hierarchy of the MAESTRO's user interface structure

A set of different buttons and icons allows you to interact with the MAESTRO's user interface. The following table describes the different buttons and icons present in the MAESTRO.

Table 2. MAESTRO buttons and icons

Icon	Name	Type	Description
	Cancel	Button	Closes current window without saving changes.
	OK	Button	Saves changes and closes current window.
	Warning	Icon	Identifies a warning window.
	Hint	Icon	Identifies a useful hint.
	Full screen	Button	Switches to the single, full-screen display mode.
	Minimize	Button	Switches to the dual-screen display mode.
	Settings	Button	Allows the user to change the display settings.
	Play	Button	Starts computing the statistics.
	Refresh	Button	Refreshes the data in the display (used for scope, averaging and histogram).
	Stop	Button	Stops computing the statistics.
	Check box (empty)	Check box	Deactivates the option.
	Check box (full)	Check box	Activates the option.
	Edit	Button	Allows the user to edit the field.
	Delete	Button	Erases the field.
	Add	Button	Automatically adds a file name. Pressing the add button again increments the name.

Icon	Name	Type	Description
	Next page	Button	Displays the next page in the menu.
	Previous page	Button	Displays the previous page in the menu.
	Scroll up (not available)	Button	Displays the upper part of the page.
	Scroll down (not available)	Button	Displays the lower part of the page.

2.2. QUICK POWER AND ENERGY MEASUREMENT PROCEDURE

This section applies to all MAESTRO versions. It will show you the fastest way of making a laser power and energy measurement with the MAESTRO and a Gentec-EO power or energy detector.

The monitor automatically recognizes all the Gentec-EO power heads and energy heads of version 4 or higher. All customized technical data required for optimum operation of the detector will be automatically downloaded from the EEPROM in the DB-15 connector. These data include all the necessary head parameters such as sensitivity, model, serial number, version, wavelength correction factors, time response and others. The MAESTRO does not support energy detectors before version 4.

Quick power and energy measurement procedure

1. Install the power or energy detector head on its optical stand.

2. Slide the connector latch to the right to unlock the connector.

3. Turn the MAESTRO off and connect a compatible power or energy detector head to the MAESTRO using the probe input jack. The MAESTRO allows hot-swapping between heads.

4. Slide the latch to the left to lock the connector into place.

5. Switch the MAESTRO on using the I/O key.

6. Power heads will default the MAESTRO to power measurement; energy heads will default the MAESTRO to energy measurement. The display will default to a dual display in real time and scope (Figure 4) in **auto range** mode.

7. Remove the head protective cover and start the laser.

   Put the detector head into the laser beam path. Leave it there for a few minutes until the detector has reached an equilibrium temperature. The entire laser beam must be within the sensor aperture. Do not exceed maximum specified densities, energies or powers. For the most accurate measurement, spread the beam across 60% to 80% of the sensor area.

WARNING

Power heads can be used with both CW and pulsed lasers.
Energy heads can only be used with pulsed lasers.
Adjusting the zero (step 8. a. for power heads and 8. b. for photodiode heads).

8. The power read by the MAESTRO when no laser beam is incident on the detector may not be exactly zero. For power measures, this is because the detector is not thermally stabilized OR there was a heat source in the field of view of the detector when the MAESTRO was turned on. As for photodiode measures, zeroing will remove the detector offset.

    a. Block off laser radiation to the detector. To reset the zero, wait until the reading has stabilized and touch "Zero" in the display parameter menu bar. Two options will appear: On or Off. Select "On". You are now ready to take an accurate measurement. To turn the zero offset off, select "Off".

Figure 6. Display parameter menu bar to set the detector zero level

    b. If you have connected a photodiode to the MAESTRO, you must cover the diode, and the zero has to be done for all scales. You will not have to do this manually for each scale as this is automatically done when you turn on the zero. In some software versions, a message appears requesting you to put the black cover over your photodiode. Touch the **OK** button after you have done so. The MAESTRO passes through all the scales to determine the zero diode for each scale. The message "Diode Zero Done" appears when the MAESTRO has determined the zero diode.

Notes:
- Refer to specific power detector documentation for complete installation and operating instructions.
- Power detectors are thermal sensors and are thus sensitive to temperature variations.

For high-precision measurements, it is recommended to:

- Allow the power detector temperature to stabilize before zeroing the MAESTRO.
- Touch only the stand when handling the power detector. Do not touch the detector head.
- Do not zero adjust the energy detectors, such as the QE series.
- Avoid forced airflow or drafts around the detector.

9. Apply the laser beam to the detector head.

10. The laser beam average power or energy can be displayed in four ways for your convenience:

    a. Digitally for real-time measurements

    b. On a scope graph to evaluate the laser variations in time

    c. On a digitally produced analog display using a needle for easy visualization of the laser beam power variation during laser fine-tuning

    d. Averaged over a certain number of measurements

    e. Complete statistical results over a certain period of time

2.3. DESCRIPTION OF THE MAESTRO NAVIGATION MENU

This section describes the first group of menus essential to the MAESTRO operation. Refer to Figure 5 for a schematic view of the menu structure.

The navigation menu bar provides access, at any time, to the five main options by touching the appropriate icon.

Figure 7. The navigation menu bar

Table 3. List of the navigation menu bar options

Option	Icon	Description
Home		Allows the user to manage the MAESTRO and the detector head settings. You will have access to: • Device settings • Measurement settings • Display settings • Acquisition settings • Information about the MAESTRO device
Search		This option allows the user to easily access, in alphabetical order, some of the available functions on the MAESTRO.
Info		Displays the MAESTRO and the connected detector head information and settings.
Manage USB		Allows the user to manage the USB key. It displays the files currently on the USB key and lets the user rename or delete a file.
Back to measure		Returns to the measurement window.

By touching an icon in the navigation menu, the MAESTRO will display the appropriate menu window, allowing you to set or select the desired settings or options.

2.4. HOME

The **home** menu allows you to access and change any settings for the MAESTRO and the connected detector head. You can choose between five options:

- **Set Device** controls the MAESTRO basic parameters.
- **Set Measure** controls the data measured by the detector head.
- **Display** controls the display mode of the data measured by the detector head.
- **Acquisition** controls the acquisition parameters to save the measured data on the USB key.
- **Startup Config** configures the measurement settings at start-up.
- **About** displays all the information relative to the current MAESTRO monitor.

Figure 8. Home menu window

2.4.1. Set device

The **set device** button lets you set and save the MAESTRO with customized parameters. You can set the time and date of the device (not yet available), set the displayed significant digit, set the serial commands, configure the Ethernet and set the language (English, French, German or Japanese). To exit the device settings window, touch the exit button ![X] or select any other option from the navigation bar at the bottom of the window.

Figure 9. Set device menu window

Number of digits

To set the significant figures of the numerically displayed value, touch the **number of digits** button. You will be able to choose the precision of 3, 4 or 5 digits. You can also choose the default settings, which will let the device choose the best resolution to fit the scale. Absolute accuracy depends on the head. When the number of digits is set, touch the OK button to save the changes or touch the X to ignore the changes.
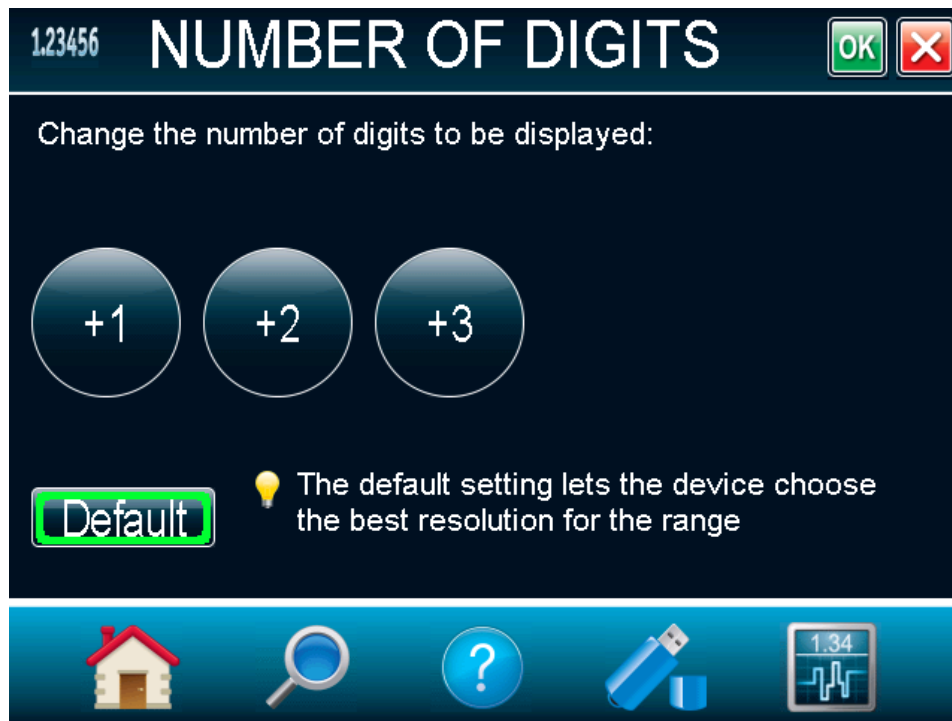
Figure 10. Number of digits menu window

Serial commands

The **serial commands** menu allows you to configure the serial communication and input/output port settings. Refer to section 3.4.3 for the complete serial commands directory. All the settings in this menu are automatically saved, which means that at each reboot, the last changed settings will be loaded.

In order to ease the integration of the MAESTRO with setups using our legacy monitors, select **SOLO2 Serial Compatibility**. Note that only the ASCII commands are available. This feature is only available when using the USB port for serial communication. Refer to section 0.1 for more information about the available SOLO2 commands.

For fast data acquisition in energy mode, select **Serial Binary Measurement**. Refer to section 0 for more information on how to use the MAESTRO serial binary measurement mode.

The serial communication can be done via a USB port or an RS-232 port. To use the RS-232 port, you must use the special cable (part number 201860). Before using the serial communication after it was changed, you must reboot the MAESTRO.

To use the analog output using the special cable (part number 201958), select **Analog Output**. The MAESTRO will not need to be rebooted. This output allows the monitoring of the laser average power or energy with external equipment such as a chart recorder, a computer with an analog interface, a voltmeter, etc. In the case of a power measurement, the output signal represents the amplified and anticipated power detector response. In the case of an energy measurement, the output signal is a DC voltage representing the pulse energy value. In order to improve the signal-to-noise ratio, the 1-volt value corresponds to the full-scale reading of the selected range. The measured power or energy is then related to the output voltage and to the selected range according to the following equations:

$$Power = V_{output} \times Range$$

$$Energy = V_{output} \times Range$$

For example, an output of 0.4 V on the 30 W scale corresponds to 12 watts of laser power. If on the 10 W scale, then 0.4 V is equivalent to 4 watts.

Figure 11. Serial commands menu window

Ethernet

The MAESTRO allows you to remotely control and acquire data. To configure the Ethernet settings, touch the **Ethernet** button.

By default, the Ethernet capability is disabled. Check the box

 to enable it. Note that enabling the Ethernet port may increase the noise of the device if used without an Ethernet cable. You must always reboot the MAESTRO after changing the Ethernet settings.

The MAESTRO runs TCP server applications. It can assign static or dynamic IP addresses. It is recommended to use a dynamic IP address for most applications in order to prevent problems on your network. When using a static IP address, please make sure you enter A valid and available IP address. **Always ask your IT specialist for an available IP address.** This will prevent conflicts and problems on your network. If you are not sure which IP address to use, please use the dynamic IP address type, which will automatically assign an available address.

Before booting the MAESTRO, connect it to a network cable. Boot the MAESTRO and access the Ethernet configuration menu via home/set device. Click on the **Ethernet** button. You can choose to specify a static IP address and enter your own IP address or you can choose a dynamic IP address and the server will automatically assign an IP address to the MAESTRO. If needed, you can change the port number. When you are done with the setup, simply touch the **OK** button and reboot the MAESTRO. If the address type was set to dynamic, access the **Ethernet configuration** menu to retrieve the assigned IP address.

The device can now be accessed with a serial terminal emulator, such as CoolTerm. Only native MAESTRO commands are supported with the Ethernet communication. Please make sure that the SOLO2 Serial Compatibility is unchecked in the **serial commands** menu (refer to section 3.4.4). Please refer to section 3.1.1 for installation instruction on the PC.
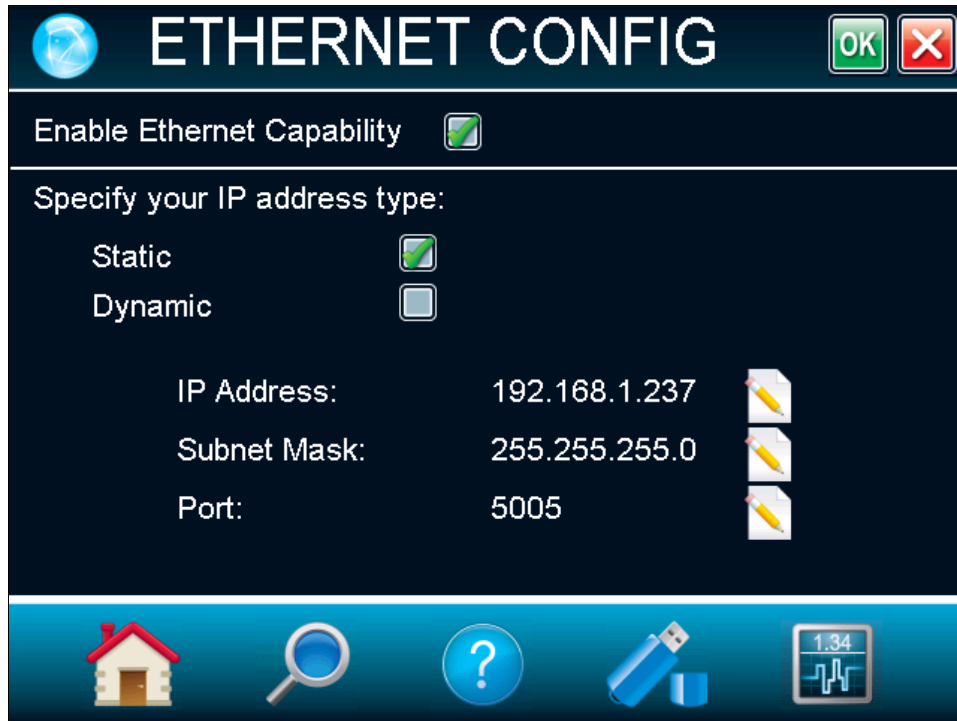
Figure 12. Ethernet configuration menu window

Languages

The MAESTRO allows you to choose between an English, French, German or Japanese display. Chinese will also be available in the future. Check Gentec-EO's website for updates.

Figure 13. Languages menu window

Recalibrate touchscreen

After several updates, the MAESTRO touchscreen might not respond as accurately as before. In such a case, you can recalibrate your touchscreen in the **Recalibrate Touchscreen** menu.

As fingers are often too wide, please use a stylus or a sharp pencil to calibrate the touchscreen. Follow the instructions and use the stylus to press on the center of the cross. The cross will move from the center to each corner of the screen. Once you have pressed the center of the cross five times, your calibration is done, and you can press anywhere on the screen to exit the recalibration touchscreen mode. If you want to cancel the procedure before it is done, you will need to turn off the MAESTRO or plug a keyboard in the USB key port and press the "Esc" key.
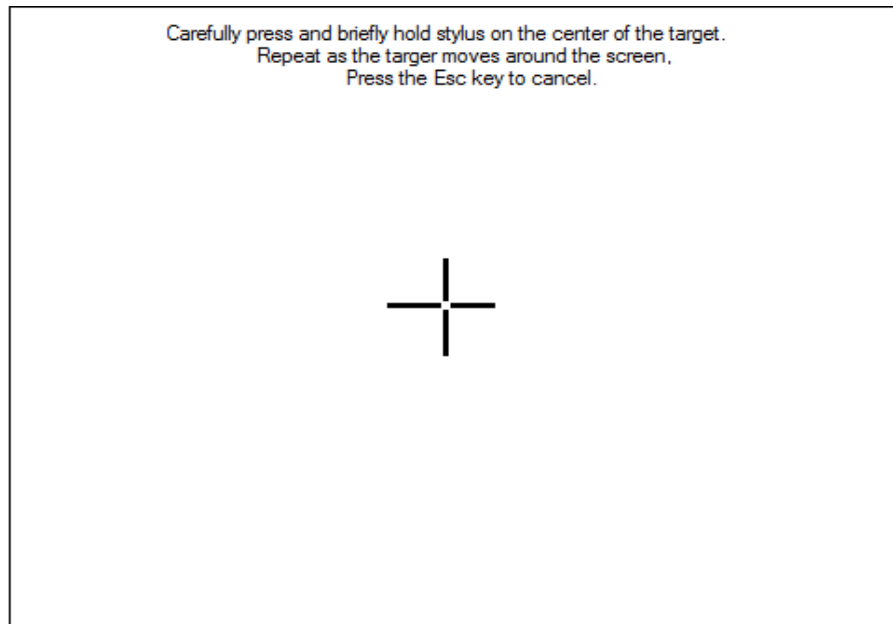
Figure 14. Recalibrating touchscreen
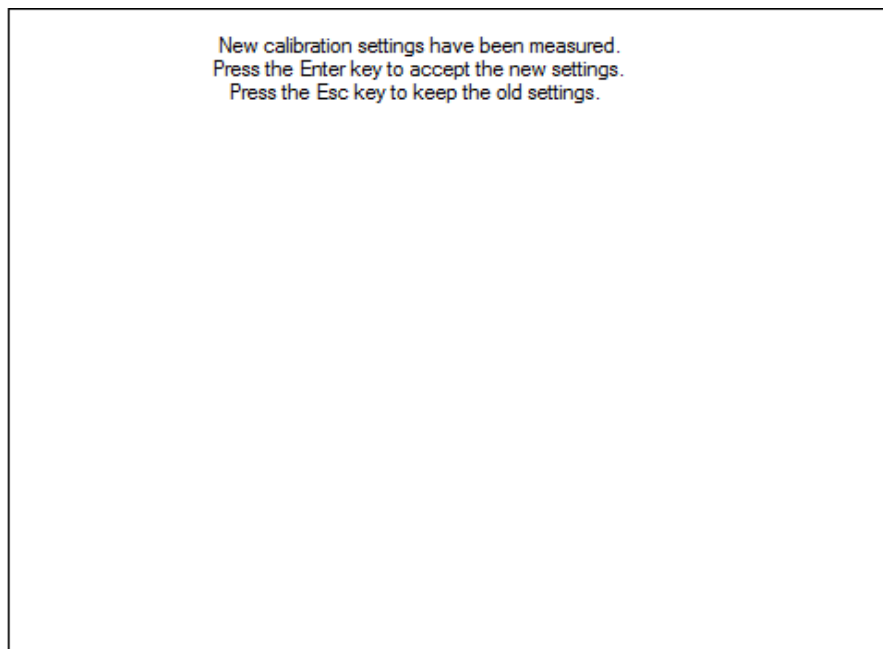
Figure 15. Touchscreen is recalibrated

2.4.2. Set measure

Options in the **Set measure** menu define user-adjustable measured data parameters. The button **Wavelength** can be used to change it in order to set it to the wavelength at which the detector is used. The button **Range** allows you to adjust the scale in order to obtain the best possible resolution. The button **Corrections** display the factors that will affect the reading. They can be easily programmed and be used for a beam sampler, attenuator or other optics that require you to multiply or add offsets to the detector reading. The **Trigger Level** and Measure Mode buttons are also found in the set measure menu.

Figure 16. Set measure menu window

Wavelength

The **Wavelength** button is used to select the proper wavelength at which the detector is used. It applies a correction to adjust for the variation in responsivity at different wavelengths. Pre-programmed wavelength correction factors dedicated to each detector head are available and automatically loaded from the detector EEPROM, for version 5 and higher detector heads. When a new detector is plugged in, the calibration wavelength is the default selection.

To change the wavelength, select the appropriate one from the wavelength menu. For photodiodes, left and right arrows will allow you to access all the available wavelengths. Once the wavelength is set, touch the OK button to save the changes or touch the X button to ignore the changes.

Figure 17. Wavelength menu windows

The MAESTRO automatically recognizes the latest energy and power detector for accurate auto-calibration. More importantly, it takes advantage of the personal wavelength correction data. It reads the memory in the smart interface connector to provide a wavelength correction based on spectral data measured from that specific detector. Your measurements across the band have never been this precise or easy.

You can also adjust for a wavelength other than the preset wavelength. The MAESTRO will use the pre-programmed data in the detector EEPROM. When working at such a wavelength, it will not be available in

the wavelength menu. You must manually enter the desired wavelength by touching the **Edit** button [pencil icon]. A popup window menu will appear to prompt you to enter the wavelength. When the wavelength is set, touch the OK button to save the changes or touch the X button to ignore the changes. The MAESTRO only allows you to choose values that fall within the detector's range. If you enter an invalid value, a menu pops up to signal the error, and the MAESTRO automatically selects the default value which is the wavelength used for calibration at Gentec-EO during manufacturing or subsequent service.

Figure 18. Popup window to enter a user-defined wavelength

Once you have entered a new wavelength in the MAESTRO, you can save your settings (refer to section 2.4.5).

Range

The button **Range** is used to select the signal level read by a detector head. When a new head is plugged in, the auto mode is the default option. In this condition, the MAESTRO automatically selects the best range for the value being measured. You can also choose a fixed scale according to the specific connected detector head. The MAESTRO only shows range values that fall within the detector head's range. You can only choose from these available ranges.
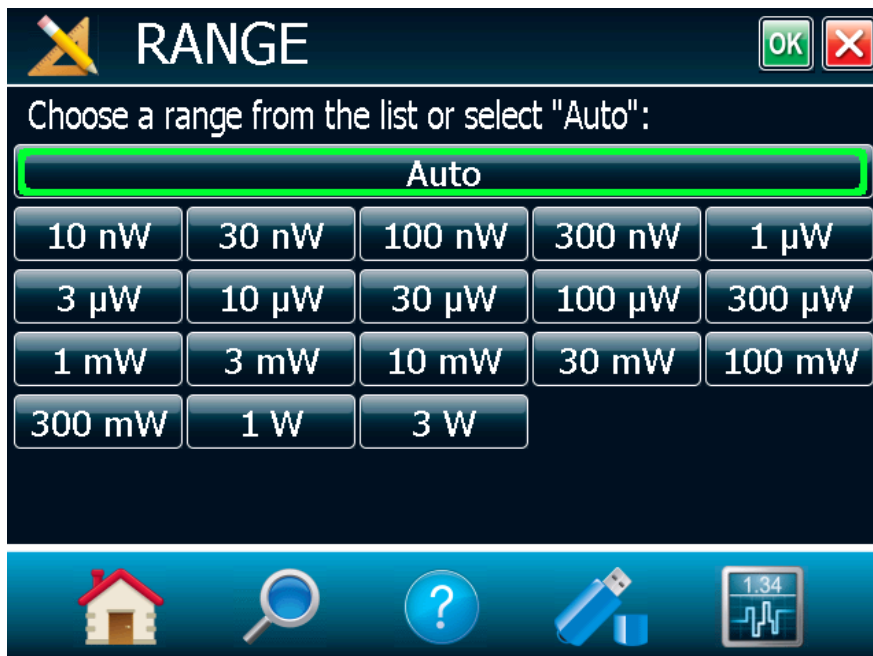
Figure 19. Range menu window

To change the range, simply touch a range value from the appropriate range. When the range is set, touch the OK button to save the changes or touch the X button to ignore the changes.

When in a manually selected range, you should always use the next higher range to the measured value, for maximum precision.

Special care must be taken in the case of widely varying pulse energy to ensure that every pulse is detected. Contrary to the case of a power measurement where the auto mode adjusts continuously to the measured value, the auto mode in energy mode bases its range selection on the energy of the previous pulse. A pulse with energy less than 2% of the current scale will not be detected. Always set the scale to the best one available. To be sure to measure lower energies, set the scale manually to the lowest level and set the autoscale by pressing the **Auto** button. The MAESTRO will autoscale to the best scale. In this case, the pulses that saturated the scale while the autoscale was searching for the best scale will be invalid.

Measure mode

Depending on the type of detector head connected to the MAESTRO, you can choose different measure modes. Figure 20 shows an example of the **measure mode menu** window when a thermopile detector head is connected to the MAESTRO. Once the **measure** mode is set, touch the **OK** button to save changes or touch the **cancel** button to ignore the changes.
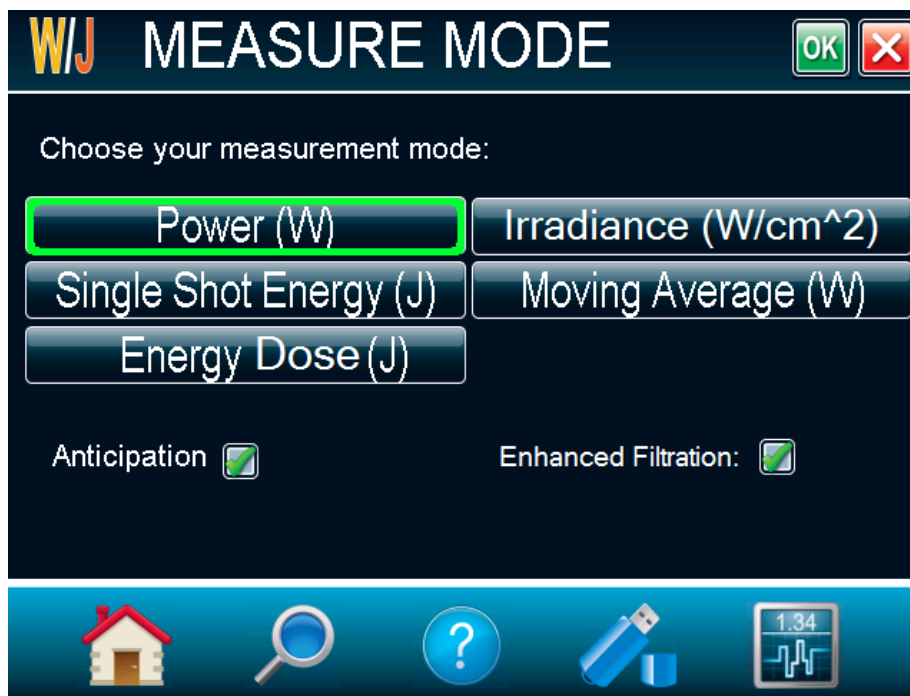
Figure 20. Measure mode menu window for a thermopile detector head

Depending on the type of detector head connected to the MAESTRO, you will have different choices for the measure modes.

For thermopiles, you have the following measure modes:

- Power in watts (default)
- Single-shot energy in joules[7] (energy mode/calorimeter mode)
- Moving average in watts
- Energy dose in joules
- Irradiance in W/cm^2 (you must enter the beam diameter after pressing OK)

---

[7] This function allows you to measure the energy contained in a laser pulse with a Gentec-EO power detector head. This mode of operation gives access to the same options as in the case of an energy pyroelectric joulemeter. The only restriction is that the time delay between pulses, $Delay = \left(\dfrac{1}{Rep.\ Rate} \right)$ must be compatible with the detector specification (please refer to the user manual for the specific power detector you are using).

You must select the range manually because the autoscale is deactivated when you select the energy mode.

Keep in mind that the power detectors are optimized to sustain high average power, not high peak energy. Always keep the energy density below the maximum energy density quoted in the manual for that specific detector.

The energy mode is always available for power detectors with a typical sensitivity value. A precision of ± 3% in the pulse energy measurement can be achieved if the power detector head is specifically calibrated in energy mode. Please contact your local Gentec-EO distributor or nearest Gentec-EO office for more information on obtaining a pulse energy measurement calibration.

For photo detectors, you have the following measure modes:

- Power in watts (default)
- Irradiance in W/cm (you must enter the beam diameter after pressing OK)
- Moving average in watts
- Power in dBm (dBm = log [power in Watts/0.001W])

For pyroelectrics:

- Energy in joules (default)
- Average power in watts
- Energy dose in joules
- Fluency in J/cm (you must enter the beam diameter after pressing OK)

When selecting the moving average option for thermopiles or photo detectors, or the average power option for the pyroelectrics, a popup window will appear to select the averaging period. This will automatically turn on the statistics in continuous mode. Please do not turn off the statistics nor change to non-continuous mode to continue using the moving average or the average power options. Also note that if an acquisition is done while the MAESTRO is in one of these modes, the saved data will also be in the same format.

The moving average is available for those head types:

- Thermopile
- Photodiode
- Pyroelectric head that works in average power (radiometer)

The average power is available for those head types:

- Pyroelectrics
- Photodiodes configured in energy mode

Uncheck "Anticipation" to deactivate the power meter acceleration software that provides accelerated response. By using advanced algorithms and known properties of the detector, this software allows the MAESTRO to provide a very accurate power measurement a few seconds faster than the natural response of a thermopile power detector. It accelerates the natural response by a factor of 5 to 10. Turning off the anticipation will result in a slower response but will reduce the noise level and provide a more stable measured value in a noisy environment.

By default, the "Enhanced Filtration" is activated for thermopiles. The enhanced filtration uses our noise reduction algorithm for an increased signal quality. By deactivating the enhanced filtration, the thermopile's response time will decrease (the measurements will be faster), but you will have a slightly higher noise level.

Version 7 energy heads have been calibrated with and without the attenuator at a chosen wavelength. When enabling the attenuator, only the wavelength at which it has been calibrated will be available in the wavelength menu. Similarly, photodiodes have been calibrated with and without the attenuator at chosen wavelengths. When enabling the attenuator and touching the OK button, the MAESTRO will prompt the wavelength menu because the available wavelengths with and without the attenuator are different.

A checkmark shows when the anticipation or attenuator is activated. It is a toggle switch – select it to change between on and off. For the anticipation, the default is on and for the attenuator, the default is off. However, these defaults can be changed in the startup configuration menu (refer to section 2.4.5).

Corrections

You can apply a multiplier and an offset value to the detector reading. Correction factors are most useful when sampling a percentage of a powerful laser beam or correcting for absorption along an optical chain. The menu displays the values of the correction factors that are being applied to the measurements.
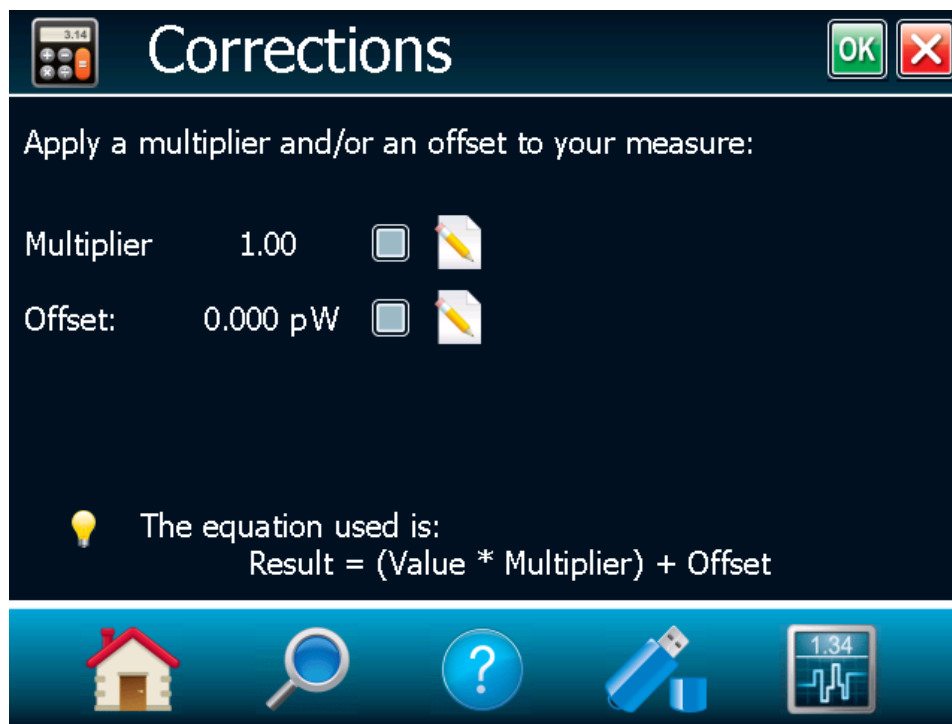
Figure 21. Corrections menu

The default value for the multipliers is 1, and the default for the offset is 0. To activate the correction factors, touch the **Corrections** button in the measurement settings menu and then select "Multiplier" or "Offset" by touching the appropriate check box. To change the multiplier or the offset value, touch the "Edit" button. A dialog box opens where you can enter the correction value. This number will be multiplied with or added to the actual measured value to calculate the corrected value. Once the correction values are set, touch the OK button to save the changes or the X to ignore the changes. The MAESTRO will then display the corrected value.

For example, if you are measuring the laser beam passing through the 99.9% back reflector of a laser (giving 1/1000th of the real value), choose "Multiplier" and enter 1000 in the dialog box. The MAESTRO will display the laser power rather than the measured 0.1% sample on the main display.

It is essential to make sure that the actual measured value also complies with the power and energy limits of the detector head. The auto range option is the default selection. You can select a specific range, but it must always be based on the actual physical measured values and **not on the corrected value**. Of course, the displayed values and the display scale selection are then calculated to take into account the correction factors.

Note that the statistics are computed for the corrected values only.

To disable the correction factor, touch the check box corresponding to the correction factor (multiplier or offset) in the **Corrections** button window.

Trigger level

The trigger level only functions if an energy detector head is connected or if a power detector head is used in pulse energy (calorimeter) mode. This option allows you to change the Trigger Level from 2% of the full-scale default value. This proves to be especially useful in noisy environments. Acceptable values range from 0.1% to 99.9% with 0.1% steps. Caution should be taken when choosing a lower trigger level than the 2% default value in a high noise environment.

To change the trigger level value, access the menu window by selecting **Trigger Level** from the set measure menu. Touch the edit button and enter the desired number in percentages. Once the trigger level is set, touch the OK button to save the changes or the X button to ignore the changes. The MAESTRO will not detect pulses with a value under the trigger level. Be careful to select a scale that is close to the measured value if the trigger level is high. To reset the default value to 2.0%, simply touch the **Default** button.

Figure 22. Trigger level window

Caution! If you select a high value trigger level, the MAESTRO may not be able to detect all the values of widely varying energy levels in auto range mode. The auto range function uses the energy level of the last pulse to set the scale level. Therefore, it will not detect the next pulses if they are lower than the trigger level. As a result, the auto range may become caught on a high scale value. To avoid this problem, select a lower value for the trigger level, change the scale manually or reset the auto range mode by reselecting "Auto" in the range menu.

Erratic triggering?

In electrically noisy environments, it is possible that the MAESTRO will inadvertently trigger on the noise. If this is the case, increase the trigger level to 3% or higher if necessary.

It is always good practice to reduce electrical noise generation or shield the detector and monitor when measuring very low pulse energies.

You can also set the MAESTRO to be triggered externally, via the RS-232 port using a special cable (part number 201956). Just touch the **External Trigger** check box.

2.4.3. <u>Display</u>

The various displays offered by the MAESTRO allow you to quickly view measurements in several different ways. You will appreciate the easy-to-view high resolution, color graphic in dual- or full-screen mode on the 112.9 x 84.7 mm LCD. You can choose five different display modes:

- Real-time
- Scope
- Needle
- Averaging
- Statistics
- Histogram (not available on this version; check our website for new versions)

This allows you to select the best way to display measurements according to your specific needs. You can switch from one option to another without interfering with the measurements.

Figure 23. Display menu window

The MAESTRO allows you to have a single full-screen display or a dual-screen display. To select the desired display, touch the appropriate button. If you choose dual display, one of the displays must be in real time. Select **Real Time**, then select any other display mode by touching it. To return to the single-display mode, simply touch the unwanted display mode to cancel it. Once the selection is made, touch the OK button or the X button to ignore the changes.

The MAESTRO's default mode is dual real-time and scope display (Figure 23).

Display parameter menu bar

The full-screen display fills the entire window, hiding the **navigation** menu bar. The **display parameter** menu bar is at the bottom of the window to allow you to quickly view and access different settings. To retrieve the

navigation menu bar, switch to the **dual-screen display** mode by touching the **minimize** button ⬛. In the **dual-screen display** mode, the **display parameter** menu bar (Figure 24) is located under the real-time display.

λ 1064 nm	RANGE Auto	MODE Power	ZERO Off	DISPLAY Scope	DATA ACQUISITION

Figure 24. Display parameter menu bar

The current display settings are easily changed by touching the desired parameter in this menu. Touch anywhere on the screen to deselect the setting.

Table 4. List of the display parameters menu bar options

Option	Icon	Description
Wavelength (λ)	λ 1064 nm	Sets and displays the source's wavelength. If the desired wavelength is not on display, touch "More…", which will take you to the wavelength menu window. The wavelength value tells you what NIST-based calibration factor is active. You can find the factors on the calibration and the personal wavelength correction data that are shipped with your detector.
Range	RANGE Auto	Sets and displays the detector's range. Touch "Auto" to be in auto range mode, + to increase the range and – to decrease the range. Touch "More…" to go to the **Range** menu window.
Mode	MODE Power	Sets and displays the measure mode depending on the connected detector head. Quickly access all the detector head's available measure modes using this button. For more information.
Zero	ZERO Off	Resets the zero reading level. It does this by subtracting the power reading on the display as soon as the **on** button is touched. Subsequent measurements will be relative to this zero power level. The main purpose of this option is to remove reading offset caused by thermal noise in the environment. Thermal noise is caused by a detector that has not been thermally stabilized OR there was a heat source in the field of view of the detector when the MAESTRO was turned on (for example, the hand or body of the user). Use this function once your power meter has achieved thermal equilibrium to ensure accurate measurements. For instructions on the proper way to adjust your detector's offset to zero, see step 8 in section 2.2 Quick power and energy measurement procedure. In energy mode the zero clears the current value.

Option	Icon	Description
Display	DISPLAY Scope	Sets and displays the monitor's display mode. You can choose between the following displays: • Scope • Needle • Averaging • Statistics • Histogram (not available on this version) In the **dual-screen** mode, it corresponds to the bottom display. For more information, refer to section 2.4.3.
DATA Acquisition	DATA ACQUISITION	Lets you start, stop and configure the data acquisition on a connected USB key at any time. Touch "Start" to start the acquisition on the USB key and touch "Stop" to stop before the end of the total duration of the acquisition. Touch "Configure" to access the **acquisition** menu window (refer to section 0), which will allow you to set the acquisition parameters.

Real-time display

The power or energy digital display is presented in a giant format for easy reading in all conditions. Directly below it, as wide as the screen, is the bar graph display, which presents the measurement in analog format. It is very useful for rapidly varying values.
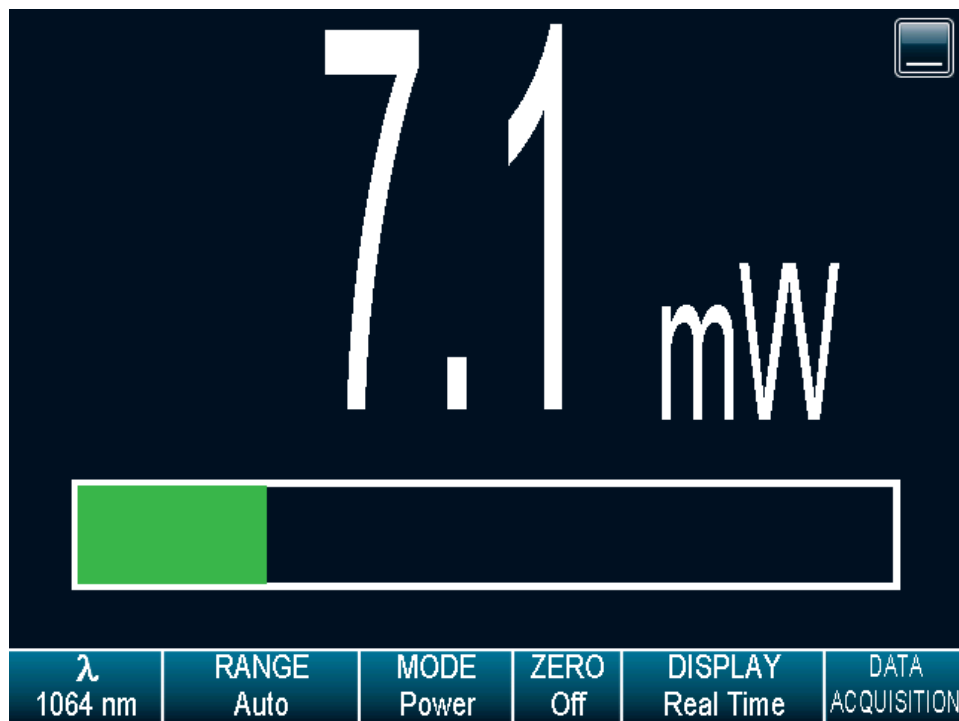
Figure 25. Real-time display

With a MAESTRO, you can also choose between the high-resolution mode for the most significant digits available or the standard resolution to filter out unimportant fluctuations in measurement. You can adjust the number of digits in the set device menu window accessible through the home menu.

Scope display

The Scope display gives a quick look at the laser beam long-term stability and trend as a function of time. The current data is also displayed at the top of the graphic display.

To refresh the scope, touch the **refresh** button [icon]. The graphic will be erased before new data is displayed. This is useful when an out-of-range value has been measured.

Touch the **settings** button [icon] to access the Scope settings. This will allow you to change the X-axis scale, the Y-axis scale (not available), and to display the statistics. Just touch the edit button to change the X-axis and Y-axis scale (not available). For the X-axis value, enter the desired display time. In case you enter an incorrect value, an error popup menu will prompt you to change it to a valid value. To view the maximum, minimum and average values of the measured data (in wattmeter mode only), touch the **display stats** check box.
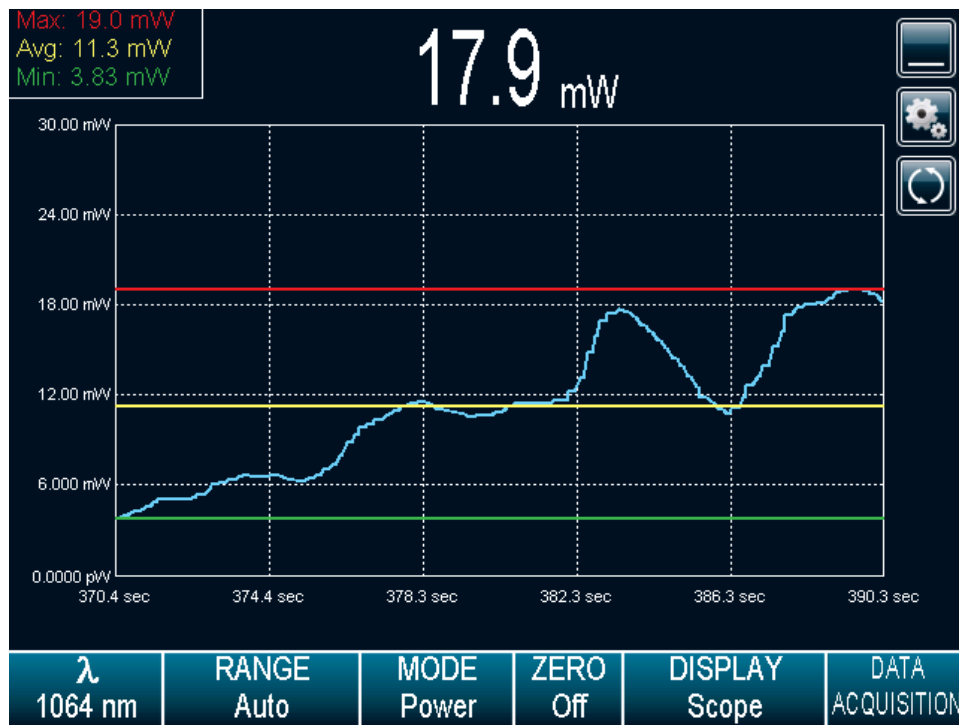
Figure 26. Scope time display

Display stats: When using the single full-screen mode, this will display the maximum, minimum and average values of the measured data values in the upper left corner (available only in wattmeter mode on this version, check our website for new versions). The graphic yellow line will correspond to the maximum value, the green line to the average value and the red line to the minimum value. When the scope parameters are set, touch the OK button to save the changes or touch the X button to ignore the changes.

Needle display

When you select **Needle**, a graphical interface shows a real-time digital needle. The deflection of the digital needle is proportional to the real-time measurement. The 0 is on the left-hand side of the needle, whereas the range's maximum value is on the right-hand side of the needle. The numerical value of the real-time measurement is also displayed above the digital needle. The 15 Hz refresh rate makes it an excellent tool for laser tuning and alignment.
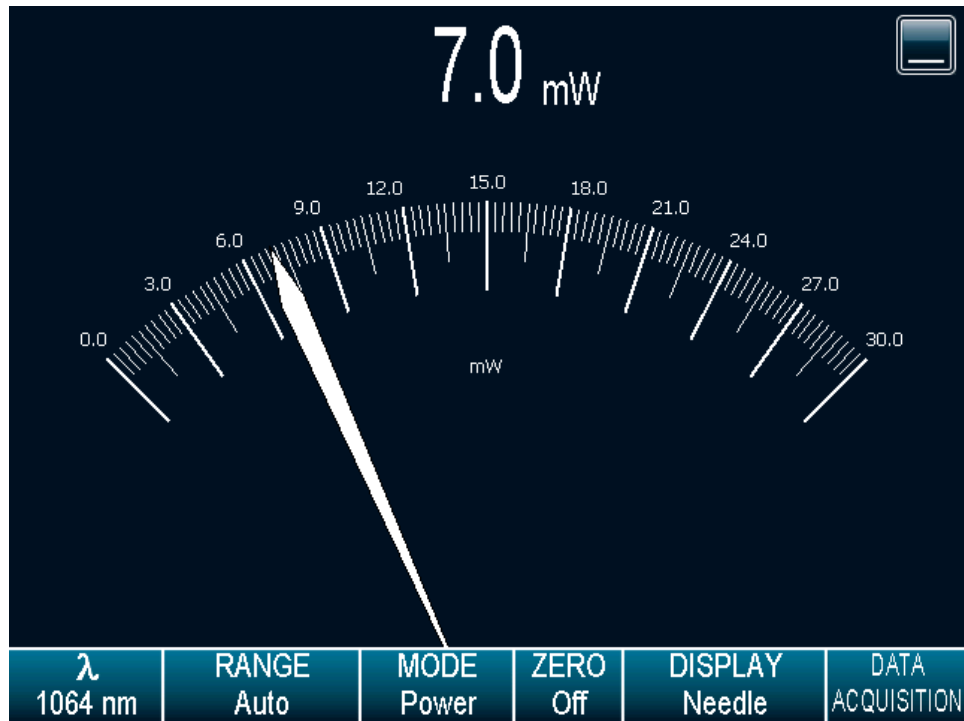
Figure 27. Digital needle display

Averaging display

The averaging display is a bar graph that presents the statistics of a set of measures as a function of time. The MAESTRO measures a series of data during a user-defined period of time. Each bar represents the maximum, average and minimum values of the measured data. The top of the white bar represents the minimum value while the top of the blue bar represents the maximum value. The yellow line represents the average value for each set of bars. This allows you to quickly evaluate the trends of the average, maximum and minimum values in time. You can change the sampling period by touching the settings button. Just touch the edit button to change the period in seconds. If you enter an incorrect value, an error popup window will prompt you to change it to a valid value between 1 and 120 seconds. When the averaging period is set, touch the OK button to save the changes or touch the X button to ignore the changes. Statistics always run in the background in this mode. This mode is a real-time average of a group of data defined in the data sampling setting.
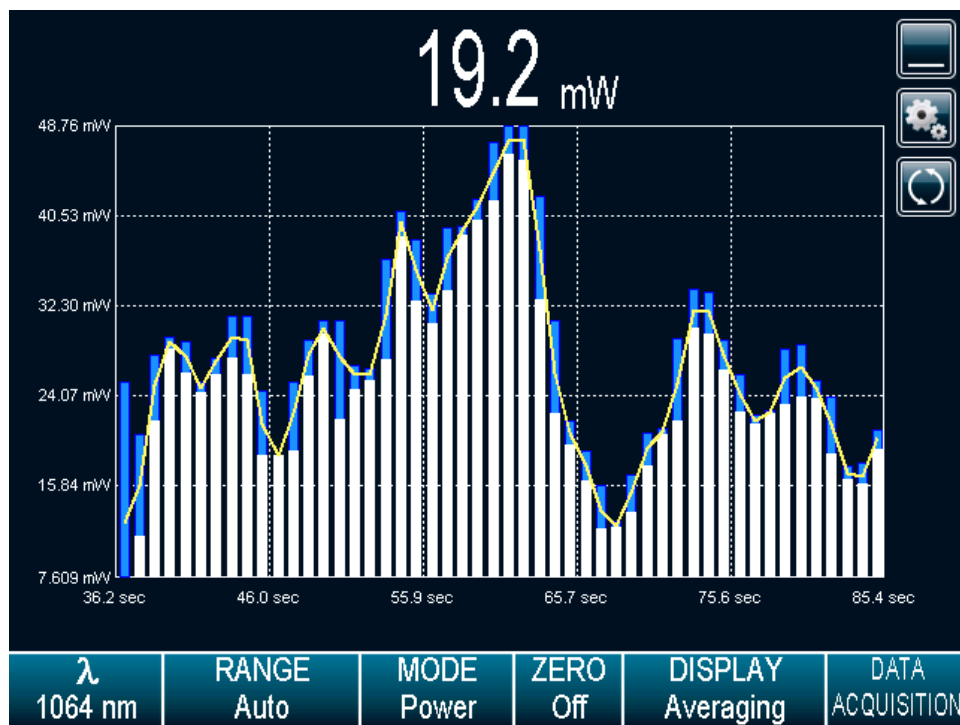
Figure 28. Averaging display

Power detectors

In the averaging display mode, the power measurement is the average value defined in the averaging settings. For optimum averaging, when measuring the average power of a pulsing laser, it is preferable to use a sample period that is a multiple of your laser repetition rate. For instance, if you are running at 1 Hz, use an average period of 1, 2, 3, etc. seconds. If it is at 1.5 Hz, use 3, 6, 9, etc. seconds, as the sample period. Take note that if one data point is out of the current scale, the resulting period average will be OUT. You should set the scale higher than your maximum unfiltered measurement to avoid this situation.

For energy detectors and power detectors in energy mode

In the averaging display mode, the energy measurement is the average value defined in the averaging settings.

To refresh the graphic, touch the refresh button. The bars will be erased before new data is displayed. This is useful when an out-of-range value has been measured.

Statistics display

In the statistics mode, the MAESTRO displays a complete statistical analysis of power or energy measurements. Touch the **Play** button [image] to start or restart the data sampling and statistical calculations. Touch the **Stop** button [image] to stop the data sampling and statistics before you reach the end of the selected sampling time. The last statistical values calculated remain on the screen so you can view them later, even if you switch display modes and return to the Statistics display. The data sampling and statistical calculations continue whether the window is closed or open, no matter what display you select.
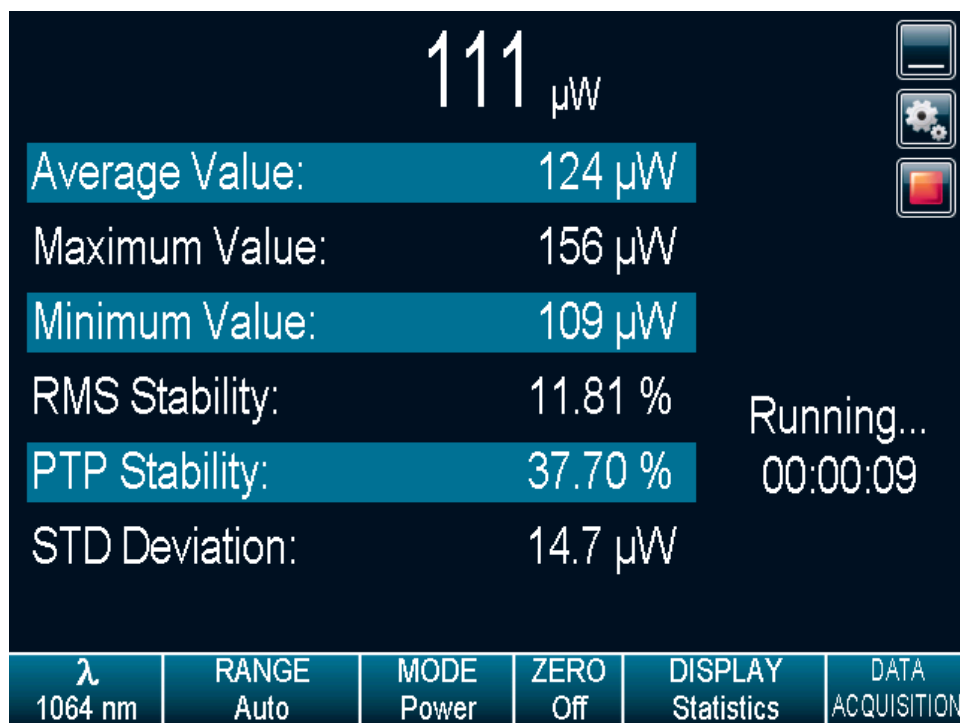
Figure 29. Statistics display

The values in this display provide an additional digit of resolution to allow you to benefit from the improved precision of large samples. You must understand your sample size well enough to know if this additional digit is significant.

The MAESTRO uses default sample parameters unless you set them yourself. Touch the settings button to access the Statistics settings to set up the data sampling parameters for calculating the statistics. Use the defaults or select your own duration sample period to do the statistics.

You can also decide to save only the statistics instead of the entire acquisition, or the entire acquisition followed by the statistics at the end of the file. To do so, check the **Save to file** option and configure the output file name. If you want to save only the statistics, press the start button in the statistics mode. If you also want to save the entire acquisition and the statistics, touch the data acquisition button on the display parameter menu bar and then touch start (refer to section 0). In this case, note that the sample rate will only affect the acquisition as the sample rate for the statistics is fixed[8]. Furthermore, if the acquisition is stopped before the end of the acquisition duration, the statistics will not be saved to the output file.

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[8] The sample rate for the statistics is fixed at 12.302 Hz for power detectors and 1 pulse per pulse for energy detectors.
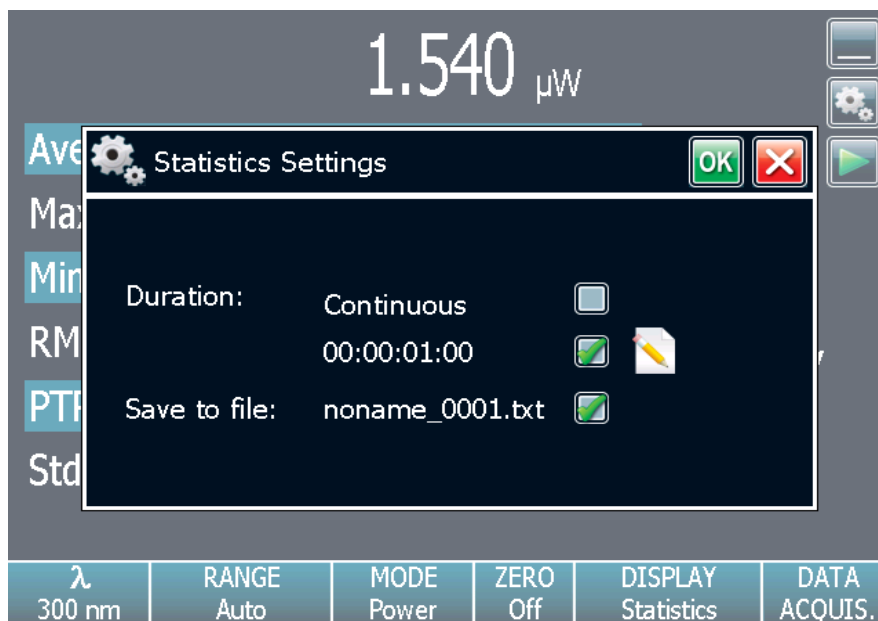
Figure 30. Statistics settings popup window

You can set the MAESTRO either to calculate the statistics for a single sample and stop or to repeat continuously. Take data for a few seconds or a few days. You have the flexibility to handle any application, from analyzing a single short pulse with high resolution to sampling performance over a period of months.

You can choose to compute the statistical analysis continuously, which is the default option, or to compute it only during a specific time interval. Touch the edit button for the duration in the statistics settings popup window to display the statistics duration settings popup window. To change the total duration of the acquisition, touch the edit button under each time value. Touch the OK button to save the changes or touch the X button to ignore the changes. The format of the duration is dd:hh:mm:ss, which corresponds to days, followed by hours, minutes and seconds. When the total duration is set, touch the OK button to save the changes or touch the X button to ignore the changes.

The MAESTRO automatically clears and recalculates the statistics at the end of each sample period unless you manually stop it.
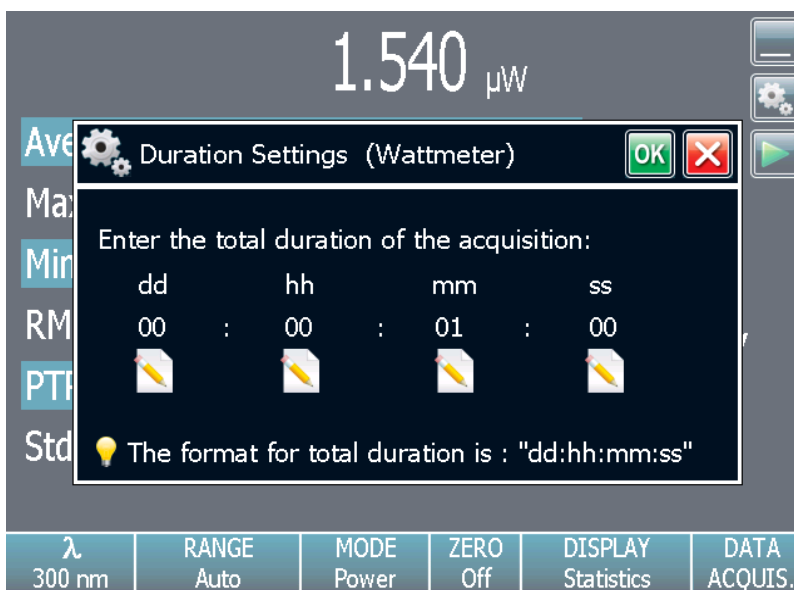
Figure 31. Statistics duration settings popup window

The statistical parameters that are calculated are listed in Table 5.

Table 5. Statistical parameters

Statistical parameters	Power	Energy	Definition
Current value	✔	✔	Value of the most recent measurement
Average value	✔	✔	Average from the start of values in the sample, E_{avg} or P_{avg}
Maximum value	✔	✔	Highest value in the sample period, E_{max} or P_{max}
Minimum value	✔	✔	Lowest value in the sample period, E_{min} or P_{min}
RMS stability	✔	✔	Root mean square stability represents the standard deviation as a percentage of the average $$RMS = \frac{STD}{E_{avg}} \times 100 , \quad RMS = \frac{STD}{P_{avg}} \times 100$$
PTP Stability	✔	✔	Shows the spread between the highest and lowest point in the sample as a percent $$PTP = \frac{E_{max} - E_{min}}{E_{avg}} \times 100 , \quad PTP = \frac{P_{max} - P_{min}}{P_{avg}} \times 100$$
STD deviation (only available for the single full-screen mode)	✔	✔	A measure of the spread of the data around the average $$STD = \sqrt{\frac{\sum_{i=1}^{n}(E_i - E_{avg})^2}{n-1}} , \quad STD = \sqrt{\frac{\sum_{i=1}^{n}(P_i - P_{avg})^2}{n-1}}$$
Repetition rate (only available for the single full-screen mode)		✔	Frequency of pulses coming from the laser, PRR
Average power (only available for the single full-screen mode)		✔	Power calculated from the pulse energies and repetition rate $$P_{avg} = E_{avg} \times PRR$$

2.4.4. Acquisition

The MAESTRO allows you to easily acquire data and save it on a USB key for post analysis and processing. If you did not connect a USB key to the MAESTRO, the monitor will prompt an error message, and the **acquisition** option will not be available.

You have complete control over the data sampling. The key points to remember whether using a joulemeter or wattmeter are listed below.

Sample rate	Controls how fast you collect data.	e.g., 10 points/second or 50% of the pulses
Duration	Controls how long the MAESTRO will acquire data or do statistics.	e.g., 1 period, 5 hours or 1,000 pulses
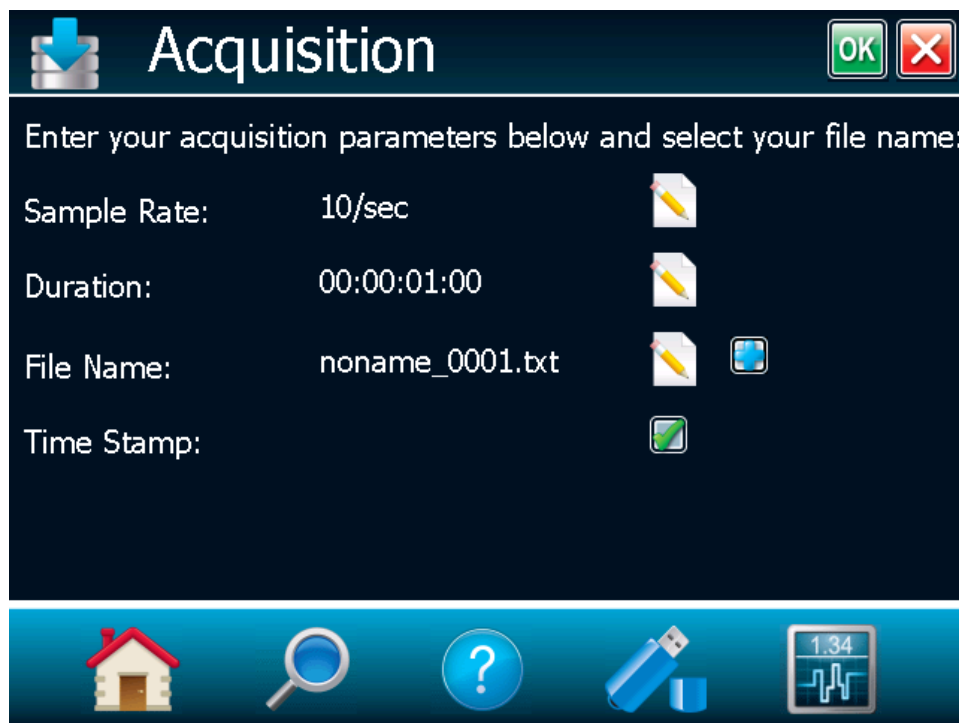
Figure 32. Data sampling parameters window menu

The different available options are presented in Table 6. To edit one of the data sampling parameters, touch the edit button. Touch the OK button to save the changes or touch the X button to ignore the changes.

Table 6. Data acquisition parameters

Parameter	Choices	Description	Default
Sample rate **Power only**	Integers pts/second pts/minute pts/hour pts/day	The current setting is 10 samples per seconds. It sets the time between each sample and specifies the number of points per unit of time (e.g., for 1 second between samples, set to 60 points per minute). Next, you must set the time for the number of points entered. Maximum is 10 points/second. Minimum is 1 point/day. Time between samples = 1/(sample rate).	10 per second
Sample rate **Energy only**	Integers 1/x pulses	Sets the fraction (1/x pulses) of the incoming pulses sampled for the statistic calculations and data recording.	1/1 pulses of the incoming pulses
Duration **Power only**	Time format dd:hh:mm:ss 00:00:00:00	The time for which samples are reported (to the display and output). The format of the duration is dd:hh:mm:ss, which corresponds to days, followed by hours, minutes and seconds. The MAESTRO automatically clears and recalculates the statistics at the end of each sample period unless you manually stop it.	1 minute
Duration **Energy only**	Integers Number of pulses	The number of pulses for which samples are reported (to the display and output). The MAESTRO automatically clears and recalculates the statistics at the end of each sample period unless you manually stop it.	10,000 pulses
File name	Alphanumeric characters Output file name	Use the displayed keyboard to enter the new output file name with an extension (.csv, .txt or .dat). Note that you must enter a file name to be able to start an acquisition. Use the **Add** button to increment the file name. If no name was entered, the add button automatically adds a file name.	noname_0001.txt
Time stamp	Yes No	To have a time stamp appear with the data, touch the associated check box. Selecting the check box writes a time stamp with each data point. This is a relative time stamp that always begins with zero. Note that, with the time stamp, the maximum sampling rate without missing points is 1.3 kHz instead of 2 kHz without time stamp.	No

To start the acquisition, you must return to the display window in dual or single mode. Touch the data acquisition button on the display parameter menu bar and then touch start. The MAESTRO begins storing data according to your data sampling settings. The stop command stops the data recording before the end of the acquisition total duration. Even if the acquisition is stopped, the MAESTRO will continue to provide measurements to the display. If you want to be able to open the file in Excel, use .csv in your file name extension.

Startup configuration

The MAESTRO can be configured to store and load certain settings for a specific measurement head in the startup configuration menu. By default, the MAESTRO will always remember the last saved settings and load them at the startup when the **Autosave** box is checked.

To load factory settings at the startup, select "Use factory settings". Note that selecting this option will not change the current configuration, but will only load the factory settings at the next reboot.

It is also possible to save a specific configuration. To do so, change all the desired settings and return to the startup configuration menu. Click on the **Apply** button. The **use current configuration** check box will be selected and the MAESTRO's current configuration will be saved. Even if the settings are changed after this operation, these changes will not be saved, and at the startup, the MAESTRO will be configured in the same manner as when the apply button was touched.
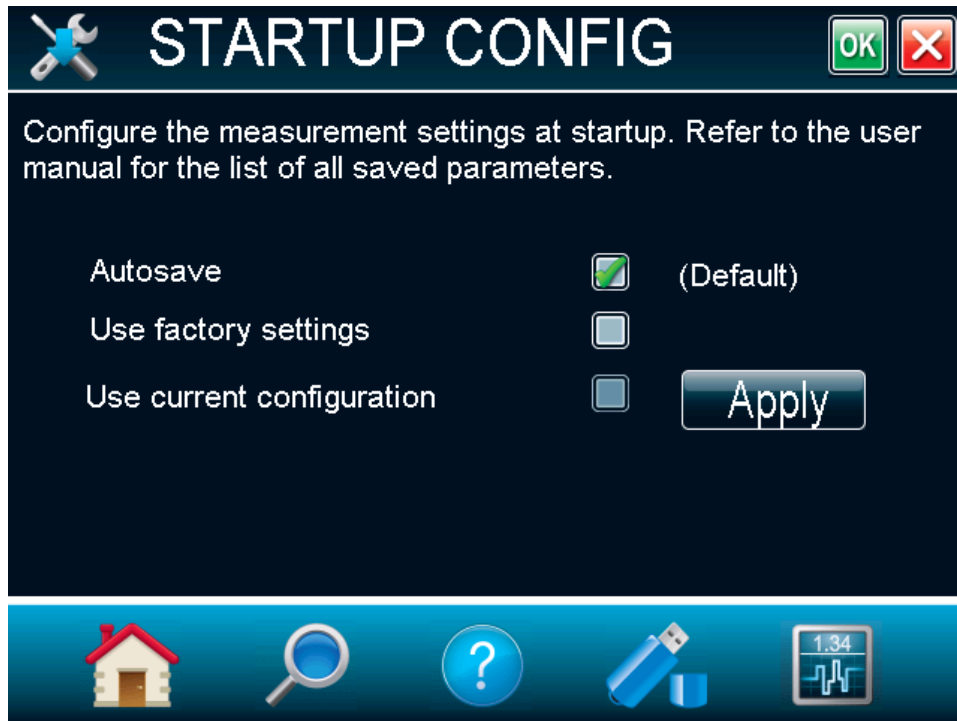
Figure 33. Startup configuration menu window

These are the saved parameters:

- Range
- Anticipation (on or off)
- Attenuation (on or off)
- Wavelength
- Multiplier and offset
- Trigger level
- Acquisition sample rate
- Acquisition and statistics duration
- Acquisition time stamp (on or off)
- Save statistics to file (on or off)
- Measure mode (power, single-shot energy, dBm, energy)
- Display (scope, needle, statistics)
- Number of digits

If another head is connected, it will not be able to retrieve these saved parameters since they are head specific: these parameters can be loaded only if the same type of head is connected to the MAESTRO.

The following settings are always saved automatically on the MAESTRO, regardless of the head that is connected:

- Serial commands settings
- Ethernet configuration
- Language

2.4.5. About

The **About** button in the home menu displays any help and service information available for this version of the MAESTRO firmware. You can find all the information about the monitor and the connected detector head such as:

- The model name
- The serial number of the monitor
- The firmware version of the monitor
- The last calibration date of the monitor
- The model name of the connected detector
- The serial number of the connected detector

Figure 34. About window

You can also find all the information concerning Gentec-EO for service support. If you should need help or additional information on the MAESTRO or any Gentec-EO products, do not hesitate to contact us. We will be glad to help you.

2.5. SEARCH

The **Search** option allows you to quickly look up and find the most common of the MAESTRO's functions. The functions are displayed in alphabetical order. Just touch one of the displayed functions to directly access the corresponding menu window. To exit the search window, just touch the X button.

Figure 35. Search window

2.6. INFO

The **info** menu window displays the information about the detector head connected to the MAESTRO and the current measurement settings. In a quick glance, you will be able to see the information listed below.

- Information about the connector detector head:
    - Name
    - Serial number
    - Sensitivity
    - Range (minimum and maximum)

- Information about the measurement settings (refer to section 0):
    - Multiplier and offset
    - Wavelength
    - Measure mode
    - Trigger level
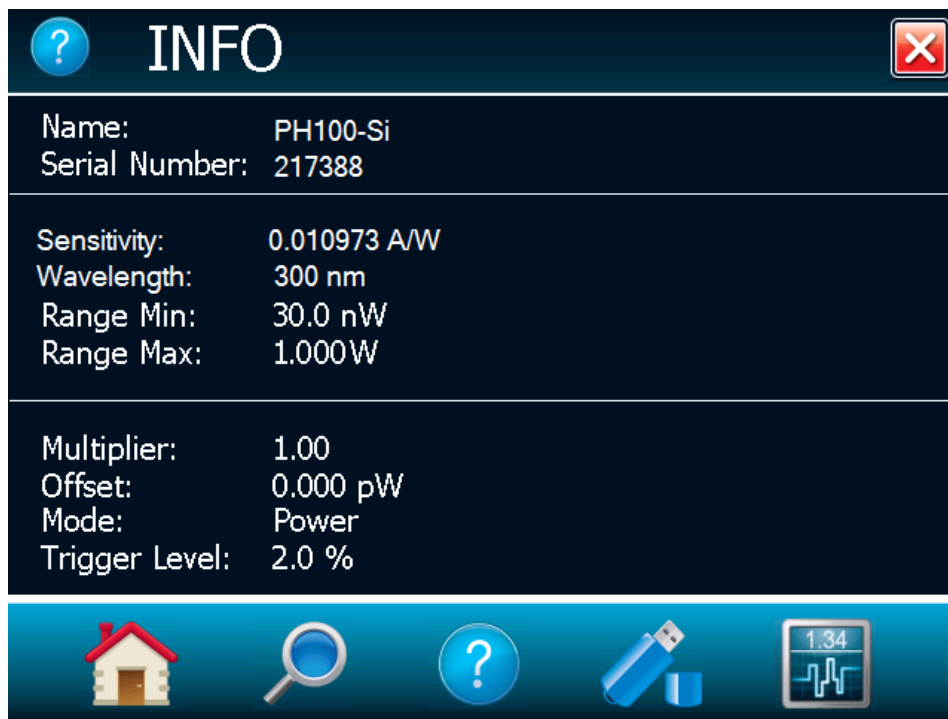
Figure 36. Info menu window

2.7. MANAGE USB

The **manage USB** menu is a file manager, which lets you work with the file system on the connected USB key. You can easily view the folders and files already on the USB key in an intuitive hierarchy. You can also rename a file and delete a file. This allows you to have full control over the USB key for easy acquisition.

Figure 37. Manage USB menu window

You can scroll up and down the list by sliding your finger on the right-hand side of the screen. You can also collapse the USB key's tree structure by touching the small square next to "\Hard Disk". By doing so, you will have access to different folders on your USB key.

2.8. BACK TO MEASURE BUTTON

The **Back to measure** button allows you to easily return to the current measurement window. It will return to the last selected display option. For instance, if you were in the needle display, touching the back to measure button will return to the needle display.

3. SERIAL COMMUNICATION INTERFACE

3.1. USB SERIAL COMMUNICATION

3.1.1. Installation

Connect the MAESTRO USB port, located on the top panel of the instrument (Figure 2) to the host device serial connector using the proper cable. The MAESTRO comes with a standard USB cable.

Installation for Windows™

Plug the MAESTRO into a USB port on the PC. If the PC supports USB 1.1, Windows™ will detect the new device and prompt you for the software drivers. A "Found New Hardware – USB Device" window will open and, after several seconds to a minute, the "Found New Hardware" wizard will appear.

Please get the latest MAESTRO USB drivers on our website in the **Downloads** section at www.gentec-eo.com. Execute the downloaded program.

At the end of this process, a new serial COM port will be added to the list of communication ports. It may be used as any other serial port. See the Installation PDF to verify or change the COM port assignment. You will need to know the COM port number to set up the serial connection to the MAESTRO.

3.1.2. Setting up communication to the MAESTRO

Connect the monitor

Use your favourite serial terminal emulator to connect to the COM port. Some example serial terminal programs are:

- CoolTerm: https://freeware.the-meiers.org/
- PuTTY: http://www.putty.org/
- RealTerm: https://realterm.sourceforge.io/

If you need to know the COM port number, you can find it in the Windows device manager.

Use the following communication parameter settings:

Bits per second	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

To echo commands

The commands you type will not appear in the terminal window unless you set up the terminal emulator to do so. Only the response from the monitor will be displayed. If you prefer to see the commands you are typing, enable "Local Echo" or the equivalent setting.

Test the connection

In the terminal window, type *VER. If the response you receive tells you the version of your MAESTRO, you are successfully connected and ready for serial command action.

3.2. ETHERNET COMMUNICATION

The MAESTRO Ethernet communication is based on Transmission Control Protocol (TCP). Through a well-configured channel, the user will be able to send commands and receive a response from the device.

Gentec-EO provides an application to help users communicate with the MAESTRO via Ethernet communication. You can download the "MAESTRO examples for Ethernet communication" application in the Gentec-EO software download section or in the Gentec-EO LabVIEW driver download section.

You must enter the right configuration:

1. Plug the MAESTRO to a network cable.
2. Boot the MAESTRO.
3. Open the Ethernet configuration menu, set device, Ethernet.
4. Check **Enable Ethernet Capability**.
5. Choose your IP address type (static or dynamic).
6. If the address type is static, enter a valid and available IP address. Always make sure the IP address is available to avoid any conflicts in your network. Always ask your IT specialist for an available IP address or use the ping command followed by the desired IP address in the Windows' cmd application to make sure the address is available.

7. Change the communication port if necessary.
8. Touch the OK button.
9. Reboot the device.
10. Open the MAESTRO Ethernet Communication Example application on your PC.
11. Enter the MAESTRO's IP address and port number. If the address type is dynamic, return to the Ethernet configuration page to retrieve the assigned address.
12. Click on the connect button in the MAESTRO Ethernet Communication Example application.
13. A popup will ask if you want to start a continuous reading. If you choose yes, the command *CAU will be automatically sent to the MAESTRO, and you will start to receive data from the device.
14. You can send other commands to the MAESTRO using the **command edit** box and the **send** button. Note that only native MAESTRO serial commands are valid with Ethernet communication. Please make sure the **SOLO2 serial compatibility** check box is disabled in the serial commands menu.
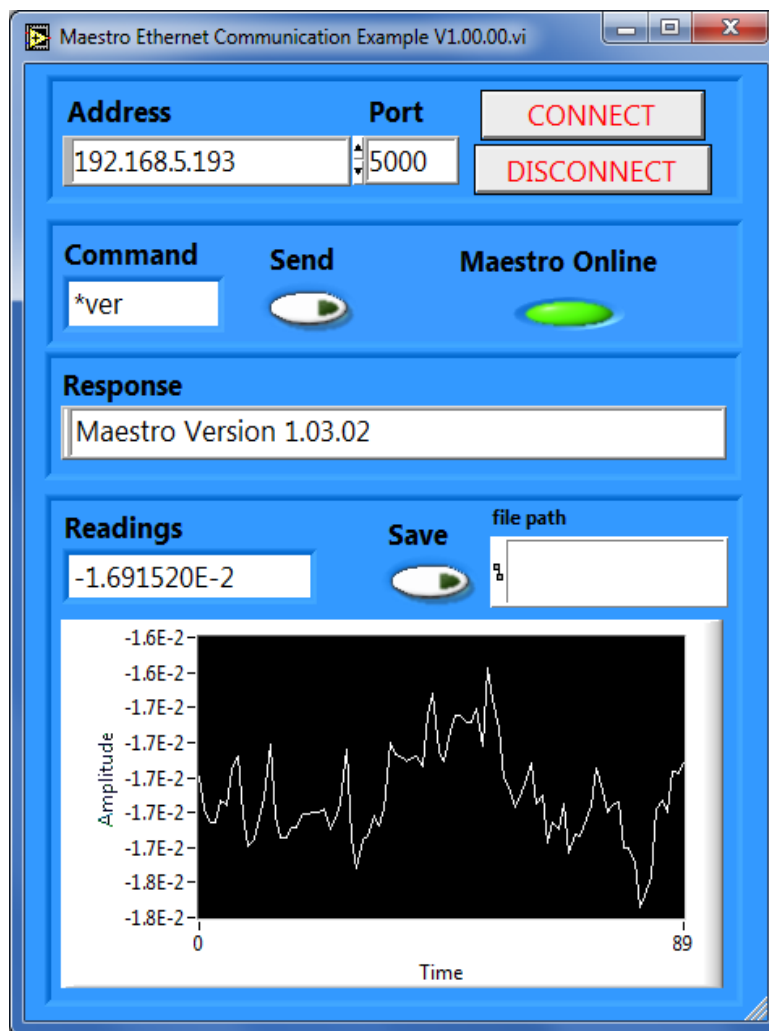
Figure 38. MAESTRO Ethernet Communication Example application

3.3. PC-GENTEC-EO USER-FRIENDLY SERIAL DATA SOFTWARE

User-friendly communication software specially made for Gentec-EO monitors, including the MAESTRO, is available for free through our website (www.gentec-eo.com). This software basically transforms your PC screen into a large MAESTRO screen enabling you to control and see your information from a distance, while saving data. LabVIEW™ drivers are also available to let you customize MAESTRO applications on your PC.

You can download the PC-Gentec-EO program, access our website and go to the **Downloads** section. Click on the file name and download it to your PC. The specific actions necessary vary by browser and browser settings. After it is transferred, open the file on your PC and follow the instructions to decompress and install it.

The user manual is integrated in the PC-Gentec-EO's interface. The context help menu displays basic information about the PC-Gentec-EO's functionalities when you move the cursor over each object and button. You can display the context help menu by selecting "Help/Show Context Help" in the menu bar or by pressing the <Ctrl-H> keys.

If you try to install the same PC-Gentec-EO version twice on your computer, you will have the following warning:

- Installation summary
- No software will be installed or removed

In such a case, please press enter and continue using the installed version of PC-Gentec-EO.

When disconnecting a head on the MAESTRO while using PC-Gentec-EO, the software might not see the disconnection and might continue to try to read data. In such a case, please close and restart the application.

3.4. TRADITIONAL COMMUNICATION SETTINGS

The traditional serial communication interface also allows you to operate the MAESTRO from a remote location. We recommend using the specific serial data acquisition software PC-Gentec-EO if no automated acquisition is involved because it is much easier to use. In the case of automated measurement controlled by other software, use the following commands to control the MAESTRO. They are divided into two groups:

- The control commands allow you to change the MAESTRO's settings without using the MAESTRO's touchscreen. Remote control commands do not yield any data, they only confirm that the command has been executed.

- The acquisition commands are used to obtain information on the current status of the MAESTRO. They do not change the MAESTRO's settings, they return the requested information.

3.4.1. Serial command format

Serial protocol rules

Commands are sent as text strings. The response will either be data or an empty string.

Text mode rules

All-text commands must begin with a trigger character (*). You do not need to end with a line feed, a carriage return or both. Parameters must NOT be separated by any spaces. Characters do not have to be capitals, a mix of upper and lower cases is fine. Replies to all-text mode commands are also in text mode and end with a carriage return and line feed.

3.4.2. <u>Maestro binary mode description</u>

<u>Description</u>

The MAESTRO has two communication modes: the binary mode for fast data acquisition and the ASCII mode. The resolution is 14 bits in both cases.

Only the joulemeters support the binary mode. Thermopiles in energy mode, thermal heads in standard mode and photodiodes are coded in ASCII. To select the binary mode, select "home/set device/serial commands/serial binary measurement". If you wish the MAESTRO to remember this setting, touch the set as default button.

The value in binary mode is coded in two bytes.

Binary joulemeter mode

Byte #1

O	Y	X	X	X	X	X	X

Byte #2

O	X	X	X	X	X	X	X

B = the sign
Y = the MSB for the wattmeter mode
X = bits of the codification

For all modes
         O = order
         0 = first byte (MSB)
         1 = second byte

<u>Codification</u>

Measurement in joule = current scale *value in decimal/16382

Example:

     For 151 mJ on the 300 mJ scale on Channel 1, the MAESTRO will send you: 40B6 HEX VALUE, where:
         10 = 0 1000000.

The first second bit (0) is the order of the MSB.

1000000 is the MSB of the codification.
         9B =10110110

The first bit (1) is for the order, so this is the LSB of the codification.

The total codification is 10000000110110, which is 8246 in decimal (8246/16382 * 300 mW = 151.007 mW).

The codification 11111111111111 = no connector.

The codification 11111111111110 = out detected.

3.4.3. Serial command directory

Command name	Command	Description
Display commands		
Set Range	SCS	Manually sets range.
Set Range Up	SSU	Changes the scale to the next higher range.
Set Range Down	SSD	Changes the scale to the next lower range.
Get Current Range Index	GCR	Returns the scale index between 0 to 41.
Get Autoscale	GAS	Returns the autoscale status.
Set trigger level	STL	Sets the internal trigger level when measuring pulse energy.
Get Trigger Level	GTL	Returns the trigger level value.
Get Mode Display	GMD	Returns the current display mode on MAESTRO.
Measurement commands		
Measurement data acquisition		
Query Current Value	CVU	Gets the value currently displayed on the screen.
Download Points	CAU	Sends the values in ASCII to the serial port with the data sampling setting.
Stop the CAU Command	CSU	Stops the CAU command.
Query New Value Ready	NVU	Determines if the new reading is available.
Set the Autoscale	SAS	Sets the autoscale.
Get Laser Rep Rate Frequency	GRR	Sends the value in ASCII to the serial port.
Set Joulemeter Binary Mode	SS1	Sets the joulemeter binary mode or ASCII mode.
Get Binary Joulemeter Mode	GBM	Returns the binary joulemeter mode or ASCII mode.
Set Analog Output	ANO	Enables or disables analog output.
Measurement setup		
Set Personal Wavelength Correction	PWC	Specifies the wavelength.
Get Wavelength	GWL	Returns the wavelength in nm.
Measurement control		
Set Anticipation	ANT	Turns anticipation on or off.
Get Anticipation Status	GAN	Returns the anticipation status.
Set Zero Offset	SOU	Zeroes the reading.
Clear Zero Offset	COU	Undoes the zeroing of the reading.
Get Zero Offset	GZO	Returns the zero offset status.
Set Diode Zero Offset	SDZ	Zeroes the reading for all scales for the photodiode.
Set User Multiplier	MUL	Sets the value of the multiplier's correction value.
Get User Multiplier	GUM	Returns the current multiplier's correction value.
Set User Offset	OFF	Sets the value of the offset correction value.
Get User Offset	GUO	Returns the current offset correction value.
SET Single Shot Energy Mode	SSE	Sets the energy mode for the calorimeter mode.
Set Attenuator	ATT	Sets the attenuator.
Get Attenuator	GAT	Returns the attenuator status.
Instrument and detector information commands		
Return Acknowledgement	KPA	Returns acknowledgement ACK.
Query Version	VER	Gets firmware version of the monitor.
Query Status	STS	Retrieves the detector information and monitors the settings.
Query Extended Status	ST2	Returns extended status.
Save Detector Settings	SDS	Saves the current detector settings.
Load Detector Settings	LDS	Loads previously saved detector settings.

3.4.4. <u>Serial commands</u>

3.4.4.1.   Serial command format

The serial command format is as such:

*MUL + 8-character numeral value, e.g. « *MUL1.000000 » or « *MUL-1.34e-3 » or «*MUL0.000543 »
*OFF + 8-character numeral value like above
*STL + 4-character numeral value like « *STL10.2 » or « *STL0.22 »
*SSE1 / *SSE0: single shoot energy ON or OFF
*ATT1 / *ATT0: attenuator ON / OFF (when available)

All-text commands must begin with a trigger character (*) and DO NOT end with a line feed or a carriage return. All parameters must NOT have a space between the command and the list of parameters, nor between the parameters themselves. The characters do not have to be capitals and mixed cases are fine. Replies to all-text mode commands are also in text mode and end with a carriage return and line feed.

Here are a few tips you must follow:

- Never send more than a single command at a time
- Never append a carriage return or line feed to the command
- After sending a command, wait for at least 100 ms before sending the next one

3.4.4.2.   Display commands

<u>Set range</u>

This command is used to force the display of the current data into a specific range. The auto range mode applies the best range for the current values in real time. The parameter must be one of the identifiers in the table below and have two digits. The available ranges depend on the detector head model. Providing an out-of-bound value as a parameter cancels the command.

Command	Parameters	Return
SCS	Range index	

Range identifiers

Range index	Range
00	1 picowatt or picojoule
01	3 picowatts or picojoules
02	10 picowatts or picojoules
03	30 picowatts or picojoules
04	100 picowatts or picojoules
05	300 picowatts or picojoules
06	1 nanowatt or nanojoule
07	3 nanowatts or nanojoules
08	10 nanowatts or nanojoules
09	30 nanowatts or nanojoules
10	100 nanowatts or nanojoules
11	300 nanowatts or nanojoules
12	1 microwatt or microjoule
13	3 microwatts or microjoules
14	10 microwatts or microjoules
15	30 microwatts or microjoules
16	100 microwatts or microjoules
17	300 microwatts or microjoules
18	1 milliwatt or millijoule
19	3 milliwatts or millijoules

Range index	Range
20	10 milliwatts or millijoules
21	30 milliwatts or millijoules
22	100 milliwatts or millijoules
23	300 milliwatts or millijoules
24	1 Watt or Joule
25	3 watts or joules
26	10 watts or joules
27	30 watts or joules
28	100 watts or joules
29	300 watts or joules
30	1 kilowatt or kilojoule
31	3 kilowatts or kilojoules
32	10 kilowatts or kilojoules
33	30 kilowatts or kilojoules
34	100 kilowatts or kilojoules
35	300 kilowatts or kilojoules
36	1 megawatt or megajoule
37	3 megawatts or megajoules
38	10 megawatts or megajoules
39	30 megawatts or megajoules
40	100 megawatts or megajoules
41	300 megawatts or megajoules

Default: Auto range

The following example sets the range to 3 nanowatts or nanojoules.

Example

Command:	*SCS07	Answer:

Get current range index

This command returns the range index between 0 and 41. Please refer to the set range command (SCS) details for the complete range index table.

Command	Parameters	Return
GCR	None	Index from 0 to 41

Example

Command:	*GCR	Answer: Range: 10<CR><LF>

Set range up

This command is used to force the display of the current data into a higher range.

Command	Parameters	Return
SSU	None	

Set range down

This command is used to force the display of the current data into a lower range.

Command	Parameters	Return
SSD	None	

Set autoscale

This command is used to force the display into autoscale.

Command	Parameters	Return
SAS	0 = off 1 = on	

Get autoscale

This command returns whether or not the **autoscale** option is activated.

Text command	Parameters	Return
GAS	None	1: On 0: Off

Example

Command:	*GAS	Answer: Autoscale: 1<CR><LF>

Set trigger level

This command sets the internal trigger level when using the device in energy reading mode.

Text command	Parameters	Return
STL	Trigger level (in percentage) must be four numeral values	

Default: 2%

The value should be set between 0.1 and 99.9. Providing an out-of-bound value as a parameter cancels the command.

Example

Command:	*STL15.4 (15.4%) *STL0.20 (0.2%)	Answer:

Get trigger level

This command returns the trigger level in %. The value is between 0.1% and 99.9%.

Text command	Parameters	Return
GTL	None	Returns the trigger level in %.

Example

Command:	*GTL	Answer: Trigger level: 2.0 <CR><LF>

Get mode display

This command returns the MAESTRO's power mode. Depending on the head, it can be the power mode in W, the power mode in dBm (DBM), the energy mode in J, the single shot energy mode in J (SSE), or simply no detector is connected to the MAESTRO.

Text command	Parameters	Return
GMD	None	POWER = 0 ENERGY = 1 SSE = 2 FLUENCE = 3 IRRADIANCE = 4 ENERGY DOSE = 5 DBM = 6 NO_DETECTOR = 7

Example

Command:	*GMD	Answer: Mode: 0 <CR><LF>

3.4.4.3.   Measurement commands – data acquisition

Query current value

This command is used to query the current value from the device. The values are displayed with six significant digits, and the last digits are not displayed if they are zeros.

Text command	Parameters	Return
CVU	None	Data in ASCII

Example

Command:	*CVU	Answer: 0.50661<CR><LF> *(the last zero is not sent)*
Command:	*CVU	-0.100151<CR><LF>
Command:	*CVU	0.0374116<CR><LF>
Command:	*CVU	0.000440277<CR><LF>
Command:	*CVU	-7.26146e-005<CR><LF>
Command:	*CVU	3.40282e+038<CR><LF> *(out of range)*

Continuous transmission of data

This command is used to send data to the serial port, according to the data sampling setting. The maximum transfer speed is 200 Hz.

Power values are displayed in watts, with six significant digits. Energy values are displayed in joules, with five significant digits.

Text command	Parameters	Return
CAU	None	Data in ASCII

For example, with a wattmeter, a reading of around 500 milliwatts would be displayed like this until the command *CSU is sent:

Example

Command:	*CAU	Answer: 0.506601<CR><LF>
		0.506601<CR><LF>
		0.506602<CR><LF>
		0.506602<CR><LF>
		0.506601<CR><LF>
		...

Stop the CAU command

This command is used to stop the real-time transfer enabled by the CAU command.

Text command	Parameters	Return
CSU	None	

Query new value ready

This command is used to check whether a new value is available from the device. Though optional, its use is recommended when used with single pulse operations.

Text command	Parameters	Return
NVU		Available/not available

Example

Command:	*NVU<enter>	Answer: New data not available<CR><LF>

Note that the query current value command will return the current values from the device even if they have not been updated since the last query.

Get the laser frequency

This command is used to getting the laser frequency. This is for joulemeters only.

Text command	Parameters	Return
GRR	None	Data in ASCII

<u>Set the joulemeter binary mode</u>

This command is used to set the monitor in binary or ASCII mode. Refer to section 3.4.2 for the MAESTRO binary mode description. This is for joulemeters only.

Command	Parameters	Return
SS1	0= ASCII 1= binary	

<u>Get binary joulemeter mode</u>

This command returns whether or not the binary joulemeter mode is activated for serial communication. Refer to section 3.4.2 for the MAESTRO binary mode description. This is for joulemeters only.

Text command	Parameters	Return
GBM	None	1: on 0: off

Example

Command: *GBM   Answer: Binary joulemeter mode: 0 <CR><LF>

<u>Set analog output</u>

This command is used to enable or disable the output of the current value on the analog port of the device.

Text command	Parameters	Return
ANO	**1** to enable, **0** to disable	

3.4.4.4.   Measurement commands – setup

<u>Set personal wavelength correction</u>

This command is used to specify the wavelength in nm being used on the detector. The EEPROM in the detector contains measured spectral data for a wide range of wavelengths. A valid value is set between the lowest and highest wavelengths supported by the device, and it should not be a floating point value. Providing an out-of-bounds value as a parameter cancels the command. The input parameter must have five digits. If the desired wavelength does not have five digits, you must enter a zero-padded number. For example, for 514 nm, you must enter 00514.

Text command	Parameters	Return
PWC	Wavelength	

Default: Calibration wavelength (typically 1064 nm)

The following example sets the wavelength to 1550 nm.

Example

Command: *PWC01550   Answer:

Get personal wavelength

This command returns the wavelength in nm being used on the detector.

Text command	Parameters	Return
GWL	None	Returns the wavelength value in nm

Example

Command:	*GWL	Answer: PWC: 1064<CR><LF>

3.4.4.5.   Measurement commands – Control

Set anticipation

This command is used to enable or disable the anticipation processing when the device is reading from a wattmeter. The anticipation is a software-reading acceleration algorithm that provides faster readings using the detector's calibration.

Text command	Parameters	Return
ANT	**1** to turn on, **0** to turn off	

Default: on

The following example sets the anticipation on.

Example

Command:	*ANT1	Answer:

Get anticipation status

This command returns the anticipation status. If the anticipation is not available, it will always be at off.

Text command	Parameters	Return
GAN	None	1: on 0: off

Example

Command:	*GAN	Answer: Anticipation: 0<CR><LF>

Zero offset

This command subtracts the current value from all future measurements the moment the command is issued to set a new zero point.

Text command	Parameters	Return
SOU	None	

Clear zero offset

This command undoes the zero offset command to set the zero point at zero.

Text command	Parameters	Return
COU	None	

Set diode zero

This command subtracts the current value for all available scales from all future measurements the moment the command is issued to set a new zero point for a photodiode only.

Text command	Parameters	Return
SDZ	None	Please Wait... Done!

Set user multipliers

This command is used to set the value of the multipliers. The default value is 1.

Text command	Parameters	Return
MUL	8-character numeral value	

The following example sets multiplier = 33.

Example

Command:	*MUL00000033	Answer:
	or	
	*MUL3.3000e1	

Get user multiplier

This command returns the MAESTRO's correction multiplier value.

Text command	Parameters	Return
GUM	None	Current multiplier value

Example

Command:	*GUM	Answer: User multiplier: 1<CR><LF>

Set user offset

This command is used to set the value of the offset.

Text command	Parameters	Return
OFF	8-character numeral value	

Default: 0

The following example sets the offset to 1.5 milliwatts or 1.5 millijoules.

Example

Command:	*OFF0.001500	Answer:
	or	
	*OFF1.500e-3	

The other option available is the zero-offset. The zero-offset operation is done first, before those of the multipliers and offsets.

Get user offset

This command returns the MAESTRO's correction offset value.

Text command	Parameters	Return
GUO	None	Current offset value

Example

Command:	*GUO	Answer: User offset: 0.0015 <CR><LF>

Get zero offset

This command returns whether the zero offset has been activated or not.

Text command	Parameters	Return
GZO	None	1: on 0: off

Example

Command:	*GZO	Answer: Zero: 0 <CR><LF>

Set energy mode

This command is used to toggle the energy mode when using a wattmeter.

Text command	Parameters	Return
SSE	**1** to turn on, **0** to turn off	

Default: off

<u>Set attenuator</u>

This command is used to adjust the processing of the monitor with the readings of the head, depending on whether the head is using an external attenuator or not.

Text command	Parameters	Return
ATT	**1** to turn on, **0** to turn off	

Default: off

The following example sets ATT on. This means that the attenuator in on the detector.

Example

Command:	*ATT1	Answer:	

<u>Get attenuator</u>

This command returns the attenuator status. If the attenuator is not available, it will always be off.

Text command	Parameters	Return
GAT	None	1: on 0: off

Example

Command:	*GAT	Answer: Attenuator: 0<CR><LF>

3.4.4.6. Instrument and detector information commands

<u>Return acknowledgement</u>

This command is used to verify if the MAESTRO is still connected and responsive.

Text command	Parameters	Return
KPA	None	ACK

Example

Command:	*KPA	Answer: ACK<CR><LF>

Query version

This command is used to query the device to get information about the firmware version and the device type.

Text command	Parameters	Return
VER	None	Version number and device type.

 Example

Command: *VER   Answer: Maestro Version 1.04.26<CR><LF>

Query status

This command is used to query the device to get information about the following characteristics:

- Measure mode (not yet available)
- Maximum, minimum and current scale
- Maximum, minimum and current wavelength with and without attenuation
- Attenuator availability and status
- Detector head model
- Detector serial number

Text command	Parameters	Return
STS	None	A hexadecimal structure described in the table below

The first byte represents the validity of the structure: 0 represents a valid line while 1 is the end of the structure. The next 4 bytes represent the address line, and the last 4 bytes are the actual value. The values are written on 32 bits, which means that all the values are written on two lines. The first line represents the LSB, and the second line represents the MSB.

The following table shows the output when a XLP12-3S-H2-D0 serial number 199672 is connected to the MAESTRO.

Note that text data values such as the detector name and the serial number are in ASCII-encoded little-endian 16-bit chunks. Byte order must be reversed to be converted into a readable format.

Hexadecimal structure			Converted	Definition
Valid	Address	Value	Value	
:0	0000	0003	3	Reserved
:0	0001	0000	0	Reserved
:0	0002	0003	3	Reserved
:0	0003	0000	0	Reserved
:0	0004	0000	0	Measure mode LSB (not yet available)
:0	0005	0000	0	Measure mode MSB (not yet available)
:0	0006	0015	21	Current scale LSB (refer to scale index *SCS)
:0	0007	0000	0	Current scale MSB (refer to scale index *SCS)
:0	0008	0019	25	Maximum scale LSB (refer to scale index *SCS)
:0	0009	0000	0	Maximum scale MSB (refer to scale index *SCS)
:0	000A	0011	17	Minimum scale LSB (refer to scale index *SCS)
:0	000B	0000	0	Minimum scale MSB (refer to scale index *SCS)
:0	000C	0428	1064	Current wavelength LSB (nm)
:0	000D	0000	0	Current wavelength MSB (nm)
:0	000E	2968	10600	Maximum wavelength LSB (nm)
:0	000F	0000	0	Maximum wavelength MSB (nm)
:0	0010	00C1	193	Minimum wavelength LSB (nm)

Hexadecimal structure			Converted		Definition
Valid	Address	Value	Value		
:0	0011	0000	0		Minimum wavelength MSB (nm)
:0	0012	0001	1		Is attenuator available LSB (1= yes 0 = no)
:0	0013	0000	0		Is attenuator available MSB (1= yes 0 = no)
:0	0014	0000	0		Is attenuator on LSB (1= yes 0 = no)
:0	0015	0000	0		Is attenuator on MSB (1= yes 0 = no)
:0	0016	2968	10600		Maximum wavelength with attenuation LSB (nm)
:0	0017	0000	0		Maximum wavelength with attenuation MSB (nm)
:0	0018	00C1	193		Minimum wavelength with attenuation LSB (nm)
:0	0019	0000	0		Minimum wavelength with attenuation MSB (nm)
:0	001A	4C	58	L	X	Detector name, in ASCII (XLP12-3S-H2-D0)
:0	001B	31	50	1	P	
:0	001C	2D	32	-	2	
:0	001D	53	33	S	3	
:0	001E	48	2D	H	-	
:0	001F	2D	32	-	2	
:0	0020	30	44	0	D	
:0	0021	00	00			00 = null termination character
:0	0022	00	00			Bytes reserved for longer detector names. May contain invalid data.
:0	0023	00	00			
:0	0024	1F	00			
:0	0025	40	03		@	
:0	0026	00	1A			
:0	0027	00	00			
:0	0028	E1	20		á	
:0	0029	00	3A	:		
:0	002A	39	31	9	1	Detector serial number, in ASCII (199672)
:0	002B	36	39	6	9	
:0	002C	32	37	2	7	
:0	002D	00	00			00 = null termination character
:1	0000	00	00			End of structure

Query extended status

This command is used to query the device to get information about the following characteristics:

- Measure mode
- Maximum, minimum and current scale
- Maximum, minimum and current wavelength with and without attenuation
- Attenuator availability and status
- Detector head model
- Detector serial number
- Trigger level (0.001 to 0.999)
- Autoscale mode
- Anticipation mode
- Zero offset mode
- User correction multiplier
- User correction offset

Text command	Parameters	Return
ST2	None	A hexadecimal structure described in the table below.

The first byte represents the validity of the structure: 0 represents a valid line, while 1 is the end of the structure. The next 4 bytes represent the address line, and the last 4 bytes are the actual value. The values

are written on 32 bits, which means that all the values are written on two lines. The first line represents the LSB, and the second line represents the MSB.

The following table shows the output when a XLP12-3S-H2-D0 serial number 199672 is connected to the MAESTRO.

Valid	Address	Value		Converted Value		Definition
:0	0000	3		3		Reserved
:0	0001	0		0		Reserved
:0	0002	3		3		Reserved
:0	0003	0		0		Reserved
:0	0004	0		0		Measure mode LSB
:0	0005	0		0		Measure mode MSB
:0	0006	11		17		Current scale LSB (refer to scale index *SCS)
:0	7	0		0		Current scale MSB (refer to scale index *SCS)
:0	0008	19		25		Maximum scale LSB (refer to scale index *SCS)
:0	0009	0		0		Maximum scale MSB (refer to scale index *SCS)
:0	000A	11		17		Minimum scale LSB (refer to scale index *SCS)
:0	000B	0		0		Minimum scale MSB (refer to scale index *SCS)
:0	000C	428		1064		Current wavelength LSB (nm)
:0	000D	0		0		Current wavelength MSB (nm)
:0	000E	2968		10600		Maximum wavelength LSB (nm)
:0	000F	0		0		Maximum wavelength MSB (nm)
:0	0010	00C1		193		Minimum wavelength LSB (nm)
:0	0011	0		0		Minimum wavelength MSB (nm)
:0	0012	1		1		Is attenuator available LSB (1= yes 0 = no)
:0	0013	0		0		Is attenuator available MSB (1= yes 0 = no)
:0	0014	0		0		Is attenuator on LSB (1= yes 0 = no)
:0	0015	0		0		Is attenuator on MSB (1= yes 0 = no)
:0	0016	2968		10600		Maximum wavelength with attenuation LSB (nm)
:0	0017	0		0		Maximum wavelength with attenuation MSB (nm)
:0	0018	00C1		193		Minimum wavelength with attenuation LSB (nm)
:0	0019	0		0		Minimum wavelength with attenuation MSB (nm)
:0	001A	4C	58	L	X	Detector name, in ASCII (XLP12-3S-H2-D0)
:0	001B	31	50	1	P	
:0	001C	2D	32	-	2	
:0	001D	53	33	S	3	
:0	001E	48	2D	H	-	
:0	001F	2D	32	-	2	
:0	0020	30	44	0	D	
:0	0021	0	0			00 = null termination character
:0	0022	0	0			Bytes reserved for longer detector names. May contain invalid data.
:0	0023	0	0			
:0	0024	1F	0			
:0	0025	40	3		@	
:0	0026	0	1A			
:0	0027	0	0			
:0	0028	E1	20		á	
:0	0029	0	3A		:	
:0	002A	39	31	9	1	Detector serial number, in ASCII (199672)
:0	002B	36	39	6	9	
:0	002C	32	37	2	7	
:0	002D	0	0			00 = null termination character
:0	002E	D70A		0.0200		Trigger level LSB (between 0.001 and 0.999)
:0	002F	3CA3				Trigger level MSB (between 0.001 and 0.999)
:0	0030	0001		1		Is autoscale mode on? LSB
:0	0031	0000		0		Is autoscale mode on? MSB

Hexadecimal structure			Converted	Definition
Valid	Address	Value	Value	
:0	0032	0000	0	Is anticipation on? LSB
:0	0033	0000	0	Is anticipation on? MSB
:0	0034	0000	0	Is zero offset on? LSB
:0	0035	0000	0	Is zero offset on? MSB
:0	0036	0000	1.0000	Correction multiplier LSB
:0	0037	3F80		Correction multiplier MSB
:0	0038	0000	0.0000	Correction offset LSB
:0	0039	0000		Correction offset MSB
:1	0000	0000	0	End of structure

Save detector settings

This saves the current detector settings. It will be used at the start-up, and it can also be loaded by sending the LDS command

Text command	Parameters	Return
SDS	None	Acknowledgement message

 Example

Command:	*SDS	Answer: Your current configuration has been saved and will be used at the startup.<CR><LF>

Load detector settings

This loads the saved detector settings.

Text command	Parameters	Return
LDS	None	Acknowledgement message

 Example

Command:	*LDS	Answer: Done!<CR><LF>

3.4.4.7.   Error messages

#	Error	Comment
1	Command not found	The command is invalid.
2	No Connector	The detector is not connected.

3.4.5. Legacy monitor serial commands

The MAESTRO has the ability to emulate the serial commands of our legacy monitors. Set the MAESTRO in the **home/set device/serial** commands to SOLO2 serial compatibility. You can make it the default setting when the MAESTRO boots up in the same window.

Supported legacy monitor:

- The SOLO2 binary commands are not supported.

3.4.5.1. Emulated SOLO2 serial commands

SOLO2 serial command format

All-text commands must begin with a trigger character (*) and must end with a line feed or a carriage return. All parameters must be separated by one or many spaces. The characters do not have to be capitals, and mixed cases are fine. Replies to all-text mode commands are also in text mode and end with a carriage return and line feed.

Display commands

Command name	Command	Description
Set scale	SSA	Manually sets scale.
Set high-resolution display	SHL	Changes to high-resolution display.
Set dBm display	DBU	Changes the on-screen display to dBm.

Measurement commands

Measurement data acquisition

Command name	Command	Description
Query current value	CVU	Gets the value currently displayed on the screen.
Query statistic data	VSU	Reads statistics data.
Set logging start/stop	LOG	Starts storing data in monitor (PCMCIA card or EEPROM).
Download points	CAU	Sends the values in ASCII to the serial port with the data sampling setting.
Stop the CAU command	CSU	Stops the CAU command.
Query new value ready	NVU	Determines if new reading is available.
Set analog output	ANO	Enables or disable analog output.

Measurement setup

Command name	Command	Description
Set personal wavelength correction	SWA	Specifies the wavelength.
Set multipliers	SMU	Sets the value of the multipliers.
Set offsets	SOU	Sets the value of the offsets.
Set trigger level	TLA	Sets the internal trigger level when measuring the pulse energy.

Measurement control

Command name	Command	Description
Enable statistics	ESU	Starts, stops or resets the statistic calculations.
Set energy mode	SCA	Turns energy mode on or off.
Set anticipation	EAA	Turns the power measurement anticipation on or off.
Set zero offset	EOA	Zeroes the reading to remove noise.

Instrument and detector information commands

Command name	Command	Description
Query version	VER	Gets the firmware version of the monitor.
Query head name	HEA	Gets the model name of the detector head.
Query battery power	BAT	Gets the state of remaining battery power.

Instrument control commands

Command name	Command	Description
Set backlight	BKL	Turns the display backlight on or off.

Communication commands

Command name	Command	Description
Test communication	KPA	Tests the communication between monitor and PC.

3.4.5.2. Commands (SOLO2)

*SSA

<u>Set scale</u>

This command is used to force the display of the current data into a specific range. The lower range is always zero, and the higher ranges can be found in the table below. The autoscale applies the best scale for the current values in real time. In text mode, the parameter must be one of the identifiers in the table below. Remember that the serial protocol is not case-sensitive in text mode.

Text command	Parameters	Return
SSA	Scale identifier or index	ACK

Scale identifiers:

Text mode	Scale
Auto	optimum
1p	1 picowatt or picojoule
3p	3 picowatts or picojoules
10p	10 picowatts or picojoules
30p	30 picowatts or picojoules
100p	100 picowatts or picojoules
300p	300 picowatts or picojoules
1n	1 nanowatt or nanojoule
3n	3 nanowatts or nanojoules
10n	10 nanowatts or nanojoules
30n	30 nanowatts or nanojoules
100n	100 nanowatts or nanojoules
300n	300 nanowatts or nanojoules
1u	1 microwatt or microjoule
3u	3 microwatts or microjoules
10u	10 microwatts or microjoules
30u	30 microwatts or microjoules
100u	100 microwatts or microjoules
300u	300 microwatts or microjoules
1m	1 milliwatt or millijoule
3m	3 milliwatts or millijoules
10m	10 milliwatts or millijoules
30m	30 milliwatts or millijoules
100m	100 milliwatts or millijoules
300m	300 milliwatts or millijoules
1	1 watt or Joule
3	3 watts or joules
10	10 watts or joules
30	30 watts or joules
100	100 watts or joules
300	300 watts or joules
1k	1 kilowatt or kilojoule
3k	3 kilowatts or kilojoules
10k	10 kilowatts or kilojoules
30k	30 kilowatts or kilojoules
100k	100 kilowatts or kilojoules
300k	300 kilowatts or kilojoules
1 meg	1 megawatt or megajoule

Text mode	Scale
3 meg	3 megawatts or megajoules
10 meg	10 megawatts or megajoules
30 meg	30 megawatts or megajoules
100 meg	100 megawatts or megajoules
300 meg	300 megawatts or megajoules

Example

Command:	*SSA<space>10 m<enter>	Answer: ACK<CR><LF> and the MAESTRO is set to the 10 mW or 10 mJ range

*SHL

Set high-resolution display

This command is used to add significant digits to the on-screen reading.

Text command	Parameters	Return
SHL	1 to turn on, 0 to turn off	ACK

Default: off

*DBU

Set dBm display

This command changes the on-screen display unit to dBm. This option is only available with photodiodes.

Text command	Parameters	Return
DBU	1 to turn on, 0 to turn off	ACK

Default: off

*CVU

Query current value

This command is used to query the value that is currently being displayed on the device screen.

Text command	Parameters	Return
CVU		Current value

For example, a 12-milliwatt reading would be displayed like this:

Example

Command:	*CVU<enter>	Answer: Current value: 1.23541e-002 <CR><LF>

*VSU

Query statistic data

This command is used to read all the statistics data, provided that the device has previously been set into statistics mode.

Text command	Parameters	Return
VSU		Statistics

In text mode, all the data and relevant identifiers are formatted into a tab-separated string. In binary mode, the following structure is sent:

Statistics:

Current value	This value should be divided by the current value unit.
Current value unit	This is a divider.
Maximum	This value should be divided by the maximum unit.
Maximum Unit	This is a divider
Minimum	This value should be divided by the Minimum Unit.
Minimum unit	This is a divider.
Average	This value should be divided by the average unit.
Average unit	This is a divider.
Standard deviation	This value should be divided by the standard deviation unit.
Standard deviation unit	This is a divider.
RMS stability	This value should be divided by 1000.
PTP stability	This value should be divided by 1000.
Current time in period	Power measurement only. Default is 0.
Total time of period	Power measurement only. Default is 0.
Pulse number	Energy measurement only. Default is 0.
Total pulses	Energy measurement only. Default is 0.
Average power	Energy measurement only. Default is 0. This value should be divided by the average power unit.
Average power unit	This is a divider.
Repetition rate	Energy measurement only. Default is 0. This value should be divided by the rep rate unit.
Rep rate unit	This is a divider.
Uncorrected value	This value should be divided by the uncorrected value unit.
Uncorrected value unit	This is a divider.

*LOG

Set logging start/stop

This command is used to log data on the connected USB stick (be sure you have a USB stick connected and that you have configured an acquisition file name).

Text command	Parameters	Return
LOG	**1** to start, **0** to stop	ACK

This command starts or stops logging data on the USB stick. This is done using the data sampling settings (sample rate, time, period, etc.).

Passing 0 as a parameter stops the acquisition. 1 starts a raw data acquisition.

The logging starts when the command is issued.

*CAU

Download data

This command is used to send data to the serial port, according to the data sampling setting.

Text command	Parameters	Return
CAU	None	Data in ASCII

*CSU

Stop the CAU command

This command is used to stop the real-time transfer enabled by the **CAU** command.

Text command	Parameters	Return
CSU	None	N/A

*NVU

Query new value ready

This command is used to check whether a new value is available from the device. Though optional, its use is recommended when used with single pulse operations.

Text command	Parameters	Return
NVU		Available/not available <CR><LF> 1/0

 Example

Command: *NVU<enter>   Answer: New data not available<CR><LF>

Note that the query current value and the query statistic data commands will return the current values from the device even if they have not been updated since the last query.

*SWA

Set personal wavelength correction

This command is used to specify the wavelength being used on the detector. The EEPROM in the detector contains measured spectral data for a wide range of wavelengths. Specifying zero as a wavelength or providing an out-of-bound value as a parameter cancels the command. A valid value is set between the lowest and highest wavelengths supported by the device, and it should not be a floating point value.

Text command	Parameters	Return
SWA	Wavelength	ACK

Default: calibration wavelength (typically 1064 nm)

 Example

Command: *SWA<space>600<enter>   Answer: ACK<CR><LF>

*SMU

Set multiplier

This command is used to set the multiplier's value. Note that the MAESTRO only allows one multiplier instead of two unlike the SOLO2. This means that only the multiplier 1 can be set.

Text command	Parameters	Return
SMU	Multiplier **1** +, <Multiplier value>	ACK

The following example sets multipliers 1 to 3.3.

Example

Command: *SMU<space>1<space>3.3 <enter>   Answer: ACK<CR><LF>

*SOU

Set offsets

This command is used to set the offset's value. Note that the MAESTRO only allows one offset instead of two unlike the SOLO2. This means that only offset 1 can be set.

Text command	Parameters	Return
SOU	Offset **1** + <Offset value>	ACK

The following example sets offset 1 to 1.5 milli.

Example

Command: *SOU<space>1<space>0.0015   Answer: ACK<CR><LF>
           <enter>

The other option available is the zero-offset. The zero-offset operation is done first, before those of the multipliers and offsets.

*TLA

Set trigger level

This command sets the internal trigger level when using the device in **energy reading** mode.

Text command	Parameters	Return
TLA	Trigger level (percentage)	ACK

Default: 2%

The value should be set between 1 and 100 (floating point values are allowed). In text mode, you may add a percentage symbol (%) after the value for clarity.

Example

Command: *TLA<space>15.4%<enter>   Answer: ACK<CR><LF>

*ESU

Enable statistics

This command is used to start, stop and reset the statistics calculating the process on the data currently acquisitioned by the specified channel (upper or lower).

Text command	Parameters	Return
ESU	0, 1 (to stop, play)	ACK

Default: stop

*SCA

Set energy mode

This command is used to toggle the energy mode when using a wattmeter.

Text command	Parameters	Return
SCA	1 to turn on, 0 to turn off	ACK

Default: off

*EAA

Set anticipation

This command is used to enable or disable the anticipation processing when the device is reading from a wattmeter. The anticipation is a software-reading acceleration algorithm that provides faster readings using the detector calibration.

Text command	Parameters	Return
EAA	1 to turn on, 0 to turn off	ACK

Default: on

*EOA

Zero offset

This command subtracts the current value from all future measurements the moment the command is issued to set a new zero point.

Text command	Parameters	Return
EOA	0 to turn off, 1 to turn on	ACK

Default: off

*VER

Query version

This command is used to query the device to get information about the firmware version and the device type.

Text command	Parameters	Return
VER		Version number and device type

Example

Command: *VER<enter>   Answer: Maestro version 1.04.26

*HEA

This command is used to query the model name of the current head.

Text command	Parameters	Return
HEA		Name of the current head

Example

Command:　*HEA<enter>　　　　　　　　　Answer: Head: PH100-Si<CR><LF>

*BAT

Query battery power

This command is used to query the device battery's remaining power. In text mode, it returns a string mentioning whether the power is low or high.

Text command	Parameters	Return
BAT		Low, high

Example

Command:　*BAT<enter>　　　　　　　　　Answer: The battery power is high

*BKL

Set backlight

This command is used to turn the backlight of the device display on or off.

Text command	Parameters	Return
BKL	**1** to turn on, **0** to turn off	ACK

Default: off

*KPA

Test communication

This command is used to test communication with your SOLO2. The PC is communicating with the monitor if you receive the ACK response.

Text command	Parameters	Return
KPA		ACK

3.4.5.3.   Error messages for SOLO2 serial mode

#	Error	Comment
1	Error 1: command not found	Command is invalid.
2	Error 2: invalid parameter	The parameter value is out of valid range or not of expected type (text, numeric, flag).
3	Error 3: not enough parameters	The expected number of parameters should always be sent.
4	Error 4: head is not available	Verifies that the detector's DB15 connector is fully engaged with the meter.
5	Error 5: scale setting not available for specified head	Refers to the scale table in the set scale command.
6	Error 6: anticipation is not available	Makes sure that the detector is in power-reading mode.
7	Error 7: PWC is not available	Makes sure that the detector head version supports personal wavelength correction.
8	Error 8: invalid command: too long	The command must not be over 255 characters long.
9	Error 9: too many parameters	The correct number of parameters must be sent to the device.
10	Error 10: energy mode is not available with current head	Energy mode works only with 818P series high power detectors.
11	Error 11: option only available with photodiode	Makes sure the head is a photodiode.
12	Error 12: attenuator not available with current head	Makes sure the head support attenuator.

4. MAINTENANCE

4.1. USB INSTALLATION FOR THE MAESTRO

The MAESTRO has a USB-type mini B port. When connected to a PC, it emulates a standard serial port. This means that it is possible to connect many MAESTROs on one computer, without tying up the ordinary serial ports, while keeping a simple interface that is easy to design software for. The MAESTRO can function using the USB port power only. It does not utilize the battery energy when it is linked to a computer through the USB port.

4.2. FREE SOFTWARE UPGRADE

Keep up to date with the latest versions of MAESTRO software including new features and options. As new and improved versions of the device firmware are created, it is in your best interest to update your MAESTRO. The latest device firmware can be downloaded from the Gentec-EO website.

Access our website at www.gentec-eo.com. Go to the downloads section. Find the file that corresponds to your MAESTRO in the downloads section and follow our simple, easy-to-use instructions.

In summary you will download a .bin file that you will have to copy to a USB key. Remove any old .bin files on the USB key. Insert the USB key and touch the update button in the About menu. This should take a few minutes after which you will need to turn off and restart the MAESTRO.

4.3. BATTERY CHARGING

As mentioned previously, the MAESTRO meter is operated using four standard rechargeable Ni-MH batteries. When the low battery window pops up, recharge the batteries by connecting the external power supply for four hours. The MAESTRO can be either on or off during this procedure. One battery charge provides up to 6.5 hours of operation autonomy.

The MAESTRO may not function properly when the battery level is very low. In which case, connect the power supply to the MAESTRO to recharge the battery.

You can operate the MAESTRO by plugging it into a USB port when the battery is low, or even removed, but it will not charge. Charging requires the external power supply.

4.4. TROUBLESHOOTING

If your Maestro does not turn on or off, remove all power supplies including the battery and reconnect them.

<u>Measuring all energy points</u>

For energy acquisition of 100 Hz and higher, use the full-size real-time display to log data on the USB key, the graphic display needs a lot of computing and you may lose some points, do not surf in other menus or resize the display. Avoid using the PC-Gentec-EO.

When using the external trigger, avoid sending voltage pulses while the Maestro boots up as it may hang (which causes the Maestro to crash) the Maestro. Contact Gentec-EO for a special external trigger cable if this solution is not acceptable.

5. DECLARATION OF CONFORMITY

Application of Council Directive(s):　　　2014/30/EU　　　EMC Directive

Manufacturer's Name:　　　　　　　　Gentec Electro Optics, Inc.
Manufacturer's Address:　　　　　　　445, avenue Saintt-Jean Baptiste, Suite 160
　　　　　　　　　　　　　　　　　　(Québec) Québec G2E 5N7
　　　　　　　　　　　　　　　　　　Canada

European Representative's Name:　　Laser Components S.A.S.
Representative's Address:　　　　　　45 bis Route des Gardes
　　　　　　　　　　　　　　　　　　92190 Meudon (France)

Type of Equipment:　　　　　　　　Laser Power/Energy Meter
Model No.:　　　　　　　　　　　　MAESTRO
Year of test & manufacture:　　　　2011

Standard(s) to which Conformity is declared:
EN 61326-1: 2006 Emission generic standard

Standard	Description	Performance Criteria
CISPR 11 :2009 +A1 2010	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	Class A
EN 61000-3-2:2006 +A2:2009	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤16 A per phase)	Class A
EN 61000-3-3:2008	Electromagnetic compatibility (EMC) - Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems (for equipment with rated current ≤16 A per phase and not subject to conditional connection.)	Class A
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques- Electrostatic discharge.	Class B
EN 61000-4-3:2006 +A2:2010	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques- Radiated, Radio Frequency, electromagnetic field immunity test.	Class A
EN 61000-4-4:2004 +A1:2010	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques- Electrical fast transient/burst immunity test.	Class B
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques- Surge immunity test.	Class B
EN 61000-4-6:2009	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurements techniques- Immunity to conducted Radio Frequency.	Class A
EN 61000-4-11:2004	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques- Voltage dips, short interruptions and voltage variations immunity tests	Class B Class B Class C Class C

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

　　　Place:　　Québec (Québec)
　　　Date :　　Juillet 15, 2016

　　　(President)

6. UKCA DECLARATION OF CONFORMITY

UK CA

Application of Council Directive(s):   2014/30/EU   EMC Directive

Manufacturer's Name: Gentec Electro Optics, Inc.
Manufacturer's Address: 445, avenue Saint-Jean Baptiste, Suite 160
                                              (Québec), Canada   G2E 5N7

European Representative's Name: Laser Components S.A.S.
Representative's Address: 45 bis Route des Gardes
                                              92190 Meudon (France)

Type of Equipment: Laser Power/Energy Meter
Model No.:   MAESTRO
Year of test & manufacture: 2011

Standard(s) to which Conformity is declared:
EN 61326-1: 2006 Emission generic standard

Standard	Description	Performance criteria
CISPR 11 :2009 +A1 2010	Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement	Class A
EN 61000-3-2:2006 +A2:2009	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤16 A per phase)	Class A
EN 61000-3-3:2008	Electromagnetic compatibility (EMC) - Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems (for equipment with rated current ≤16 A per phase and not subject to conditional connection.)	Class A
EN 61000-4-2:2009	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques- Electrostatic discharge.	Class B
EN 61000-4-3:2006 +A2:2010	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques- Radiated, Radio Frequency, electromagnetic field immunity test.	Class A
EN 61000-4-4:2004 +A1:2010	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques- Electrical fast transient/burst immunity test.	Class B
EN 61000-4-5:2006	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques- Surge immunity test.	Class B
EN 61000-4-6:2009	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurements techniques- Immunity to conducted Radio Frequency.	Class A
EN 61000-4-11:2004	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques- Voltage dips, short interruptions and voltage variations immunity tests	Class B Class B Class C Class C

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

Place: Québec (Québec)
Date :   November 29, 2021

(President)

7. APPENDIX A: QED

QED/12/25/50/65/95 Attenuator/Diffuser Calibration Procedure

Introduction

These "Attenuator/Diffusers" must be **user** calibrated. The calibration procedure is relatively simple. First make measurement without the attenuator, then with the attenuator. The ratio of these measurements will be your correction. This procedure is suitable at any wavelength.

When using an oscilloscope

Divide the joulemeter voltage output by the calibration sensitivity we provide to calculate the energy reading (see joulemeter manual).

To use this procedure at a wavelength other than the wavelength stated on the calibration certificate, you must first manually adjust the sensitivity value (of the cal. certificate) with the wavelength **correction multiplier** from the Personal Wavelength Correction certificate. Use this wavelength-adjusted sensitivity to calculate the energy readings used in the procedure that follows.

When using a Gentec-EO MAESTRO

The attenuator setting in the **measure** mode **must not be check marked**. That is, it must be off, otherwise you cannot access the **wavelength** menu window. You need this window to input the wavelength that you are calibrating at (see monitor manual). The *Attenuator* setting should also be checked off if you are redoing a calibration at the same wavelength as stated on joulemeter calibration certificate.

Procedure

Step 1: Setup your joulemeter to measure the energy of your pulsed laser. If you are working at a wavelength other than the calibrated wavelength, adjust the sensitivity of your joulemeter for that wavelength; see *When using an oscilloscope or When using a Gentec-EO MAESTRO,* above. Make sure that the energy level is below the detector's damage threshold and your laser still has good stability.

Step 2: Apply energy for a few minutes to warm up the detector. This will reduce any thermal bias.

Step 3: Measure the energy level without the attenuator. To reduce random uncertainty, you should average a number of shots. We recommend at least one hundred shots. This should reduce random errors by a factor of 10. (Square root of "n" assuming Gaussian distribution).

Step 4: Install the attenuator. Without changing the laser settings, measure the energy level by averaging the same number of shots. All laser settings must be the same as Step 3 (including beam size and position on the detector).

Step 5: Repeat the first measurement (Step 3) to make sure that nothing changed during the procedure to invalidate the calibration. A change larger than the uncertainty of your measurements means that something in the laser or environment changed. You can add this to your ± uncertainty when you use the attenuator or try to stabilize the laser and environment and begin again with Step 3.

The correction multiplier for the MAESTRO and an Oscilloscope will be given by:

$$T_f = \frac{\text{Reading without attenuator}}{\text{Reading with attenuator}} \quad \text{(No unit)}$$

Now use this calibration factor in the **correction** menu for the "Attenuator/Diffuser" when using it at the wavelength established in Step 1.

8. APPENDIX B: WEEE DIRECTIVE

<u>Recycling and separation procedure</u>

This section is used by the recycling center when the monitor reaches its end of life.   Breaking the calibration seal or opening the monitor will void the MAESTRO warranty.

The complete Monitor contains:

- 1 Monitor
- 1 Power supply (not manufactured by Gentec-EO)
- 1 USB cable
- 1- Battery pack
- 1 Instruction manual
- 1 Calibration certificate

<u>Separation</u>

Paper: Manual and certificate.

Plastic: Bottom monitor enclosure, LCD enclosure.

Plastic and rubber: Top monitor Enclosure.

Wires: USB cable and power supply plug.

NimH batteries: in the Battery compartment at the back.

Liquid crystal display.

Printed circuit board: inside the monitor.

<u>Dismantling procedure</u>

Remove the DB15 post using pliers.

Remove the 4 screw on the bottom of the monitor using a Philips screwdriver.

Disconnect the Battery and LCD.

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LEADER IN LASER BEAM MEASUREMENT **SINCE 1972**

POWER & ENERGY METERS

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THZ MEASUREMENT

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• Werner von Siemens Str. 15
  82140 Olching, GERMANY

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