USER MANUAL

MIRO ALTITUDE | Professional laser power & energy meter

gentec-eo
PARTNERS for ACCURACY

121-107115

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.

TABLE OF CONTENTS

1. MIRO ALTITUDE: LASER POWER AND ENERGY METER

1.1 INTRODUCTION

MIRO ALTITUDE is Gentec-EO new flagship product for reading your laser power and energy measurements. More than an evolution from our current product line, we see it as a revolution in the laser beam measurement industry that helps engineers and technicians increase productivity, thanks to numerous new features in both hardware and software. Enter the modern era of laser beam measurement with:

- 10" high-resolution, anti-glare touchscreen
- Remarkably strong and durable aluminum casing
- Robust, industrial-grade connectors
- Modern, quad-core processor
- On-board data storage
- Three display modes: scope chart, needle and bar graph
- Built-in file manager to save and view your recorded measurement sessions

To obtain optimum results from your MIRO ALTITUDE meter, we suggest you carefully read this manual.

This user manual corresponds to MIRO ALTITUDE software version 1.02.02.
Software updates are provided on the Gentec-EO website:
www.gentec-eo.com/products/miro-altitude.

1.2 WHAT'S INCLUDED WITH YOUR MIRO ALTITUDE

The following items are included with MIRO ALTITUDE.

Description	Part name	Part number
MIRO ALTITUDE power and energy meter	MIRO ALTITUDE	205516
USB-C cable, 2 m	MON-USB-C-A	206306
12-V power supply with a 1.8-m barrel jack cable and country-specific outlet cable	MON-12V-US MON-12V-UK MON-12V-EU MON-12V-CN	205519B 205519C 205519G 205519I
Carrying sleeve	MIROA-SLEEVE	206307
MIRO ALTITUDE box		
Calibration certificate		

The following item can be purchased separately.

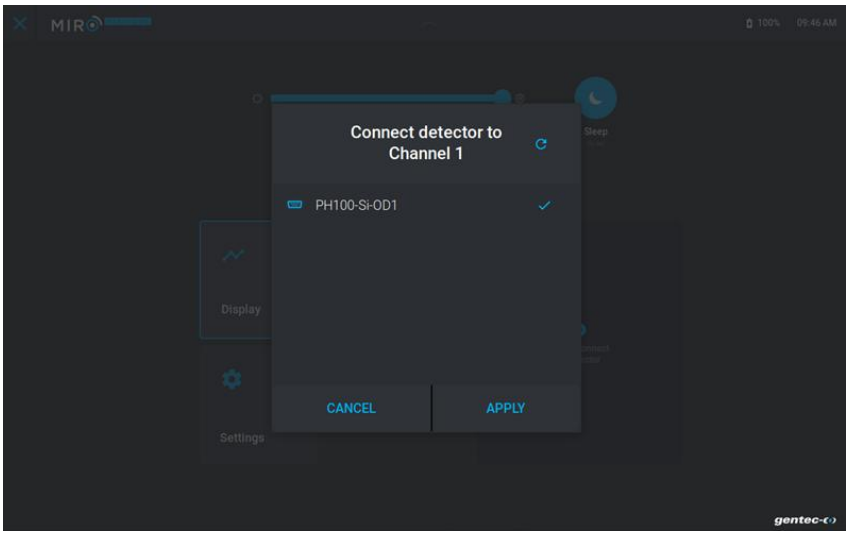
Description	Part name	Part number
Stand for MIRO ALTITUDE, 4" x 4" base, 3" arm, adjustable angle	STAND-R-443	205609

1.3 QUICK LAUNCH GUIDE

In this section you will find how to take a power or energy laser measurement with the MIRO ALTITUDE device and a Gentec-EO power or energy detector. Detailed instructions of all the device functionalities can be found in Section 2.

1.3.1 Quick procedure to measure power and energy

1. Press the power button to turn on the MIRO ALTITUDE, which is in the right upper part of the front of the device.
2. Connect the power or energy detector to the input port of the MIRO ALTITUDE.
3. Tap the menu icon (☰) to open the control center.
4. Tap on **Tap to connect a detector** and choose the corresponding detector, then tap on **Apply**.



5. Close the control center (✕) or select **Display** to view the measurements. The software will be configured by default for power measurements when a power detector is connected. In the same way, the software will be configured by default for energy measurements when an energy detector is connected. The screen will show data in scope display, which is the default measurement display, with automatic adjustment of the range (power or energy level).

There are three display options for the average laser power or energy:

a.  Chart mode: a scrolling graph in scope display to evaluate laser variations over time.

b.  Needle mode: a digital pointer or needle allowing for a precise adjustment. This allows seeing the instantaneous variation of the laser power or energy.

c.  Bar mode: a bar graph display for real-time measurements.

6. Remove the protection cover of the sensor and power on the laser.

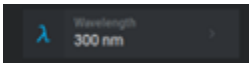
1.3.2 Startup with a detector already inserted

If a detector is plugged into the MIRO ALTITUDE before turning it on, MIRO ALTITUDE will automatically connect to the detector, in this order of priority:

- DB15
- USB1 or USB2

1.3.3 Wavelength adjustment

The wavelength can be set according to the laser being used. Tap on the wavelength setting in the left-hand tab:



A menu will appear which allows selection of the wavelength. MIRO ALTITUDE will then apply the calibration factor corresponding to the selected wavelength to convert the detector signal into measured values (see section 2.3.2 for more details).

1.3.4 Zero offset

The power measurement of the MIRO ALTITUDE might not be exactly zero even if there is no laser beam on the sensor. The Zero button sets the detector current value to zero. Subsequent measurements will be taken based on this new zero power level.

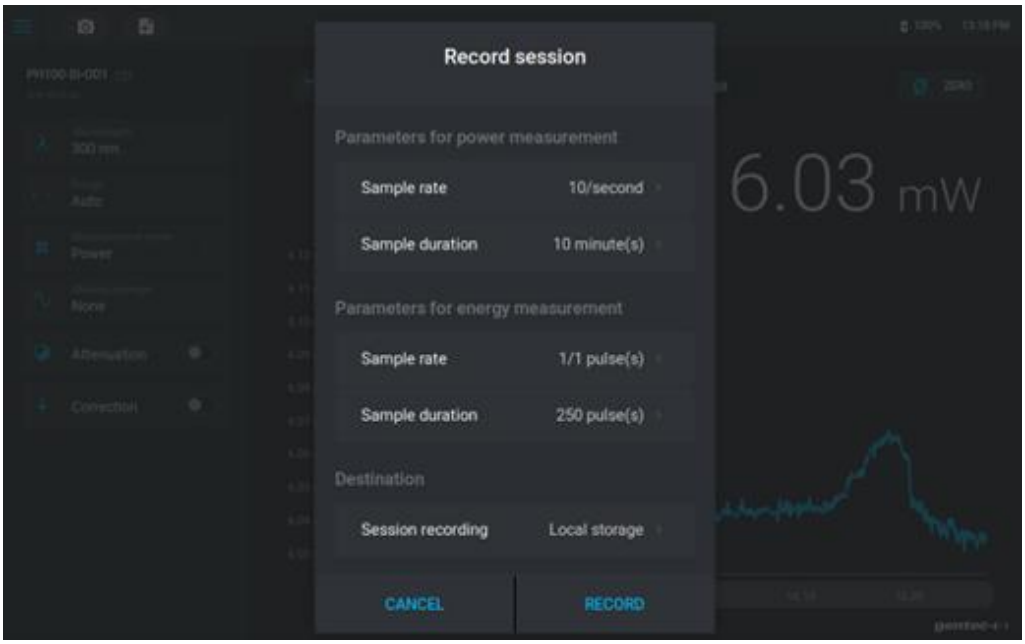
1. Place the detector in the optical path of the laser. The entire laser beam must be inside the detector aperture. Do not exceed the specified maximum energy or power density thresholds. Distribute the beam on 60% to 80% of the detection surface to obtain the most accurate measurements.
2. Wait a few minutes so the detector reaches thermal equilibrium.
3. Thermal detectors: block any laser radiation towards the detector. Wait until the measurement is stable.
4. Photodiodes: block the laser. There is no need to wait when using a photodiode.
5. Tap on Zero. The zero will be adjusted for the selected range, and it will be adjusted for all the ranges if you are in automatic range mode.

Notes

- Please refer to the specific documentation for your power detector to see the complete installation and operating instructions.
- Power detectors are sensitive to temperature variations.
- To perform high-precision measurements, we suggest the following:
    - Wait until the detector temperature is stable before adjusting the zero.
    - Do not touch the power detector. It is better to handle it touching its optical support.
    - Reduce air currents around the detector.

1.3.5 Data recording

The **Record session** button ( ) opens the data recording settings. Start the recording by tapping on **Record**. MIRO ALTITUDE has an internal memory with enough space to store several recordings (see section 2.4.3 for more details).



1.3.6 Session playback

The view function ( ) in the file manager displays recorded data such as screenshots and recordings that are stored on the internal memory and on a USB drive (see Section 2.4.6).

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 maximum relative humidity of 80%.

Power meter specifications	
Compatible detectors	XLP, UP and PH
Power range	4 pW to 100 kW
Power scales[1] (PH series photodetectors)	300 pW, 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[1] (UP, HP, XLP thermal detectors)	300 µW, 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, 100 kW
Resolution (digital)[2]	Selected range / 8388608 (in power mode) Selected range / 3754 (in power mode, pyroelectric mode)
Monitor accuracy	± 0.5% ± 3 µV, from 20% to 100% of the scale[3]
Data transfer rate[4]	15 Hz at a 24-bit resolution 15 Hz at a 12-bit resolution (pyroelectric detectors) One reading per pulse (energy mode)
Statistics	Current value, maximum, minimum, average, standard deviation, RMS stability, PTP stability
Data storage	On the device, USB drive (FAT, FAT32), 10 days max
Analog output update delay[5]	730 ms
Energy meter specifications	
Compatible detectors	QE, UP and XLP series in energy mode, calorimeters
Energy range	2 fJ to 30 kJ
Energy scales[1] (PH series photodetectors)	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 µJ, 3 µJ, 10 µJ, 30uJ, 100 µJ, 300 µJ, 1 mJ, 3 mJ, 10 mJ, 30 mJ
Energy ranges[1] (QE and UP thermal detectors)	10 µJ, 300 µJ, 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)[2]	Selected range / 3754
Accuracy[4]	1.0% ± 50 µV, < 500 Hz 2.0% ± 50 µV, 500 Hz to 10 kHz
Default trigger level	2%
Software trigger level	0.1% to 99%, 0.1% resolution
Data transfer rate, via serial commands[4]	2.5 kHz
Data logging rate, local storage	10 kHz (maximum)

[1] Values might vary according to the detector that is being used.
[2] Including linearity.
[3] When low-sensitivity detectors are used for low power measurements, the application of the polarization tension can produce a measurement error. It is fundamental to use the ZERO function to redefine the zero of the MIRO ALTITUDE before taking measurements under these conditions. It is a best practice to use the ZERO function.
[4] This transfer rate depends on the PC that is being used. The host PC must be fast enough to receive and handle incoming data. Recommended hardware: Intel Duo Core processor with a clock speed of 2.4 GHz or more.
[5] Analog output update time following a new measurement. Typical value. Hardware and firmware dependent. Takes into account the delay used by the monitor to interpret the measurement and update the analog output.

Frequency measurement	0.1 to 1000 Hz: 2% ± 0.1 Hz 1000 to 10,000 Hz: 5% ± 1 Hz
Energy meter specifications	
Statistics	Current value, maximum, minimum, average, standard deviation, RMS stability, PTP stability, number of pulses, repetition rate, average power
Data storage	On the device, USB drive (FAT, FAT32), 1 pulse up to 999999 pulses
Analog output update delay[5]	27.1 ms
General specifications	
User input correction factors	One multiplier and one offset (seven significant figures, floating comma)
Analog output	0 – 5 V, full scale, ± 1%
Analog output refresh rate[6]	50 Hz
External trigger	Signal from 2.5 V to 24 VDC Not isolated
External trigger pulse length	1 µs minimum
Temporal requirements for the external trigger	See below
Updates	USB drive
Dimensions	210 mm (L) x 190 mm (W) x 40 mm max (H)
Weight	1.57 kg
Power supply	Included power supply 12 VDC 3.33 A. Can also be charged with USB-C (charger not included). At least 18 W required to charge battery while in use.

Specifications are subject to change without notice

1.5 DETECTOR COMPATIBILITY

Connector type	Detector family	Power	Energy	Analog output	External trigger
DB15	UP / XLP	✓	SSE mode	✓	
	QE	✓	✓	✓	✓
	PH	✓		✓	
USB-A	INTEGRA V2 UP / XLP	✓	SSE mode		
	INTEGRA V2 QE	✓	✓		
	INTEGRA V2 PH	✓			

[6] Typical value. Hardware and firmware dependent. Contact your nearest Gentec-EO agent for more information.

1.6 MECHANICAL DESCRIPTION

Front panel of the MIRO ALTITUDE

Top panel of the MIRO ALTITUDE

Left side panel of the MIRO ALTITUDE

1.6.1 Features

1. Power button
2. Touchscreen
3. Detector input
4. BNC connectors
5. Programmable connectors (feature not yet available)
6. RS232 port
7. Ethernet port
8. USB-C port (PC connection)
9. Power input
10. USB-A connectors

1. Power button

To power on or off the MIRO ALTITUDE, hold your finger on the **Power** button for half a second.

In case of a problem, to reboot the device, keep the button pressed for approximately 6 seconds.

If the green LED indicator on the button is on or flashing, this means that the device is charging.

2. Touchscreen

The MIRO ALTITUDE has a 10.1" multi touchscreen with an active surface of 217.56 mm (L) x 136.2 mm (H).

To clean your screen, it is recommended to use a cleansing cloth or a soft, dry and lint-free cloth. If necessary, you can humidify the cloth with one of the following elements: water, isopropyl alcohol (IPA) 70% or lower, or a cleaner for eyeglasses.

3. Detector input

MIRO ALTITUDE has a female DB15 connector to connect Gentec-EO detectors.

MIRO ALTITUDE works with most Gentec-EO energy and power detectors that have a DB15 connector. See the table of specifications for additional information. The MIRO ALTITUDE can read the calibration information stored in each energy and power detector, thus ensuring precise operation. Furthermore, it uses the specific data from your detector included in the Personal Wavelength Correction™ certificate. It reads the information stored in the Smart Interface connector memory (as from version 5) and proceeds to a customized correction of the wavelength based on the spectral data measured for your detector.

The MIRO ALTITUDE device might not recognize certain older sensors.

This DB15 connector, though similar to that of the former TPM-310 and TPM-330 monitors, is incompatible with the power detector heads of PS-310 Series Version 1 and PS-330 Series Version 1. These heads used a different technology and do not have the same pin-out configuration.

4. BNC connectors

The analog output, synchronization signal output and the triggering signal input can be used with the BNCs on the device.

5. Analog output

Used to monitor the average laser power or energy with an independent device, such as a recorder, a computer with an analog interface, a voltmeter, etc. To use this feature, please use a standard BNC cable.

If you are making a power measurement, the output signal will be an analog DC voltage proportional to the amplified or anticipated signal. If you are making an energy measurement, the output signal will be an analog DC voltage corresponding to the pulse energy.

You must specify the maximum output voltage and the maximum value of the power or energy range through the MIRO ALTITUDE application or the series commands. The measured power or energy is then converted to the output voltage considering the measurement range specified according to the following equation:

V_{output} = (measurement × maximum output voltage) / maximum of the output analog range

For example, for a maximum output voltage of 2.0 V and an analog range with a maximum of 10 W:

2.0 V corresponds to 10 W
1.0 V corresponds to 5 W

Another practical example: to configure the analog output so that 1 V corresponds to a measured power of 56 W, with a maximum output voltage of 2 V, the analog output range must have a maximum power of 112 W, according to the following equation:

Maximum of the output analog range = 56 × 2.0 = 112

Specifications of the analog output:

Maximum output voltage:	5.0 V
Connector type:	female BNC
Precision at full range:	1% of the measured value, ± 5 mV

The analog output should be used with a high impedance load.

6. Synchronization output (coming soon)

7. Trigger signal

To perform energy measurements, you can connect the MIRO ALTITUDE to an external trigger, using a BNC cable.

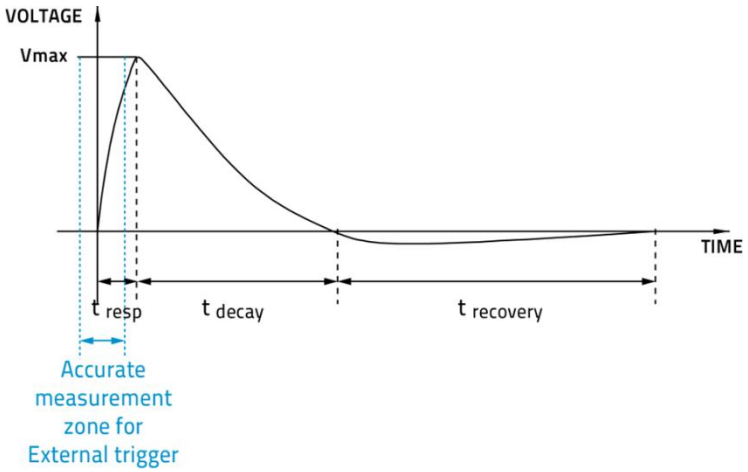
The beginning of the external trigger signal must arrive in a time window relative to the beginning of the laser pulse. This window begins 20% of the rise time before the laser pulse and ends one rise time after the beginning of the pulse minus the minimum trigger pulse width.

Example for the QE12LP-H-MB detector:

The following value is found in the QE series user manual:

Signal rise time = 550 µs
20% of rise time = 550 µs × 20% = 110 µs
Rise time minus minimum trigger pulse width = 550 µs – 1 µs = 549 µs

Therefore, the acceptable window for the beginning of the external trigger pulse is from 110 µs before the laser pulse begins to 549 µs after the laser pulse begins. Incorrect energy measurements may result if the trigger pulse arrives outside of this window.



8. Programmable connectors (coming soon)

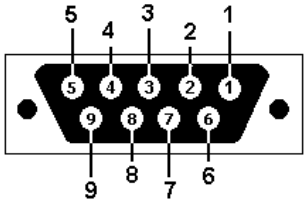
9. RS232 port

Any device that has a serial communication port (computer, terminal or another) can receive the data of the MIRO ALTITUDE through the serial port and control it remotely.

Output pin configuration RS232 of the MIRO ALTITUDE device

Pin no.	Signal
1	Not connected
2	TX
3	RX
4	Not connected
5	GND signal
6	Not connected
7	Not connected
8	Not connected
9	Not connected

TX: data transferred from the MIRO ALTITUDE (output)
RX: serial commands received by the MIRO ALTITUDE (input)



DB9: pin configuration of the female connector of the MIRO ALTITUDE RS232 connector

10. Ethernet port

This interface offers the possibility to send commands and transfer data between the MIRO ALTITUDE and a computer via the Ethernet port.

11. USB-C port (PC)

Through the USB-C communication port, a computer can receive data from the MIRO ALTITUDE and control it remotely.

The USB-C port can be used for charging the MIRO ALTITUDE. At least 18 W is required to charge the battery while the device is running.

12. Power supply

The power supply included with the MIRO ALTITUDE provides 12 VDC 3.33 A.

The device can be permanently damaged if an external power supply other than the Gentec-EO P/N 205519 is used. Please call Gentec-EO or your local distributor if extra power supplies are needed or for more information.

13. USB-A connectors

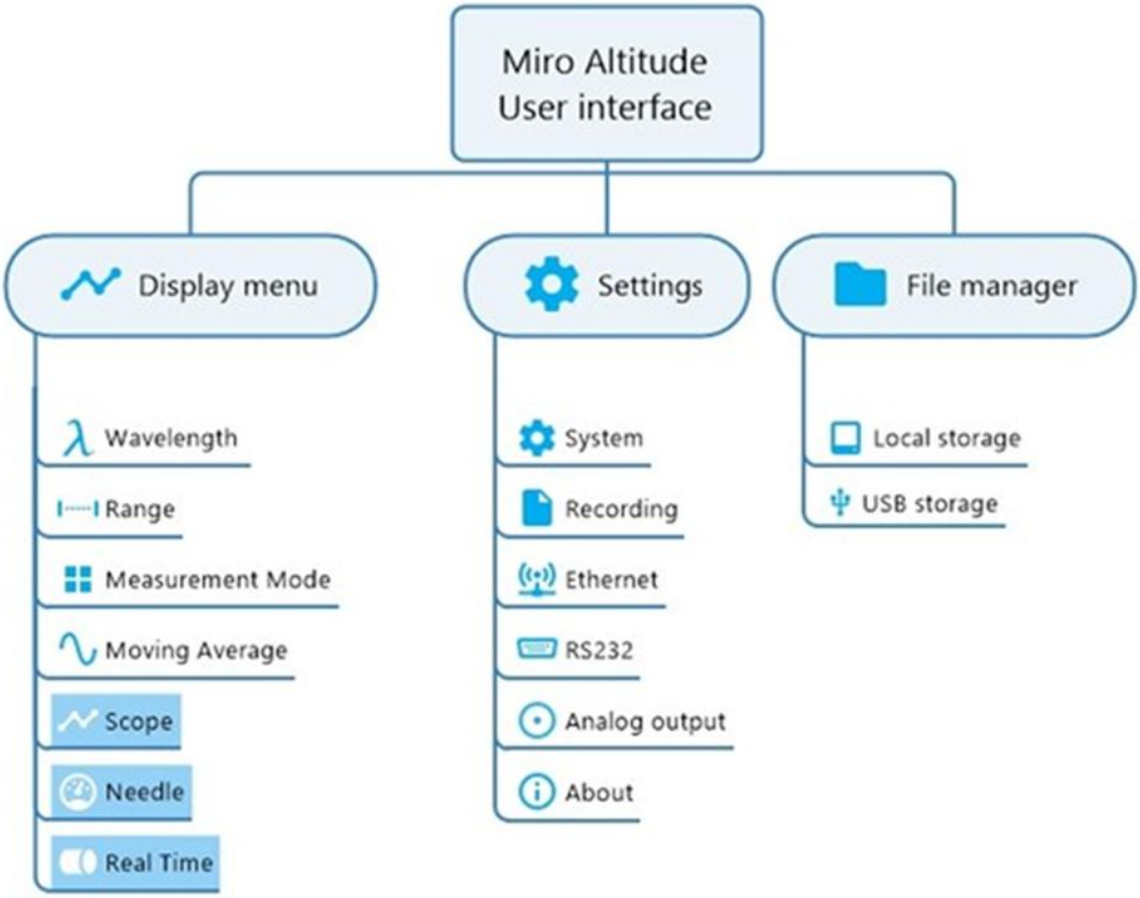
When a USB drive is plugged in one of these ports, it is possible to save data to it. It is also possible to manage the files on a USB drive via the file manager where you can view, copy, delete or rename the files.

Both USB-A ports can also be used to connect detectors from the INTEGRA family (see Section 1.5 for the list of compatible detectors).

2. USER INTERFACE

2.1 USER INTERFACE STRUCTURE

The powerful processor of the MIRO ALTITUDE, combined with the on-board operating system, offers easy and intuitive access to all its functionalities. You control the intuitive interface using the touchscreen. To access options and functions, simply tap on the related button on the touchscreen. To help you explore the different menus, the following image illustrates the MIRO ALTITUDE user interface structure. The items highlighted in blue are the three display modes. Only one is active at a time.



Different buttons and icons allow you to interact with the MIRO ALTITUDE user interface. The following table describes the different buttons and icons on the MIRO ALTITUDE.

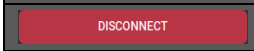
Measurement menu (display menu)

Icon	Name	Type	Description
Navigation bar			
	Menu	Button	Opens the MIRO ALTITUDE control center
	Screenshot	Button	Takes a screenshot and saves it to memory
	Data logging	Button	Opens the data logging menu to start a log
	Safe connect / disconnect	Button	Visible when a USB storage is found, safely connect or disconnect the media
	Battery	Icon	Shows the battery level and status

Icon	Name	Type	Description
Measurement settings panel			
	Wavelength	Button and Indicator	Opens the **Wavelength** menu and displays the currently used wavelength
	Range	Button and indicator	Opens the **Range** menu and displays the current range
	Measurement mode	Button and indicator	Opens the **Measurement mode** selection menu and displays the active measurement mode
	Moving average	Button and indicator	Opens the **Averaging time** selection menu and displays the **Moving average** time window
	XNR Anticipation™	Toggle	Activates or deactivates the thermopile speedup algorithm (only available for thermal power detectors)
	Attenuation	Toggle	Activates or deactivates the calibrated value for the detector with an attenuator (only available for certain detector models)
	External trigger	Toggle	Activates or deactivates the external trigger (only available for energy measurements and DB15 detectors)
	Trigger level	Button and indicator	When the external trigger is deactivated, activates the **Internal trigger level setting** menu (only available for energy measurements and DB15 detectors)
	Correction	Toggle	Shows the multiplier and offset options
	Multiplier	Button and indicator	Opens the **Multiplier** selection menu and identifies the multiplier that was entered
	Offset	Button and indicator	Opens the **Offset** selection menu and identifies the offset that was entered
Measurement display area			
	Clear	Button	Clears (resets) the current chart and starts again with the time at zero
	Zero	Button	Sets the detector signal to zero for all active ranges
	Scope	Button	Opens the scope display
	Needle	Button	Opens the needle display
	Bar graph	Button	Opens the bar display
	Maximum	Icon and indicator	Displays the maximum measured value since the last reset
	Minimum	Icon and indicator	Displays the minimum measured value since the last reset
	Average	Icon and indicator	Displays the average of all measured values since the last reset

Icon	Name	Type	Description
	Standard deviation	Icon and indicator	Displays the standard deviation of all measured values since the last reset
	PTP stability	Icon and indicator	Displays the spread between the highest and lowest point in the sample as a percentage of the average
	RMS stability	Icon and indicator	Displays the spread of the data around the average value
	Repetition rate	Icon and indicator	Displays the average repetition rate (for energy measurements only)
	Average power	Icon and indicator	Displays the average power when using a joulemeter In power mode, it is equal to the average

Control center

Icon	Name	Type	Description
	Display	Button	Opens the measurement screen
	File manager	Button	Opens the data file manager
	Settings	Button	Opens the system **Settings** menu
	Tap to connect	Button	Opens the list of available detectors
	Disconnect	Button	Disconnects the detector
	Sleep	Button	Activates the sleep mode as configured in the settings
	Brightness	Slider	Adjusts the screen brightness
	Exit	Button	Exits the control center

System settings

Icon	Name	Type	Description
	System	Button	Opens the **System settings** menu
	Recording	Button	Opens the **Data recording settings** menu
	Ethernet	Button	Opens the **Ethernet connection settings** menu
	RS232	Button	Opens the **RS232 communication settings** menu
	Analog output	Button	Opens the **Analog output settings** menu
	About	Button	Opens the **MIRO ALTITUDE information** menu

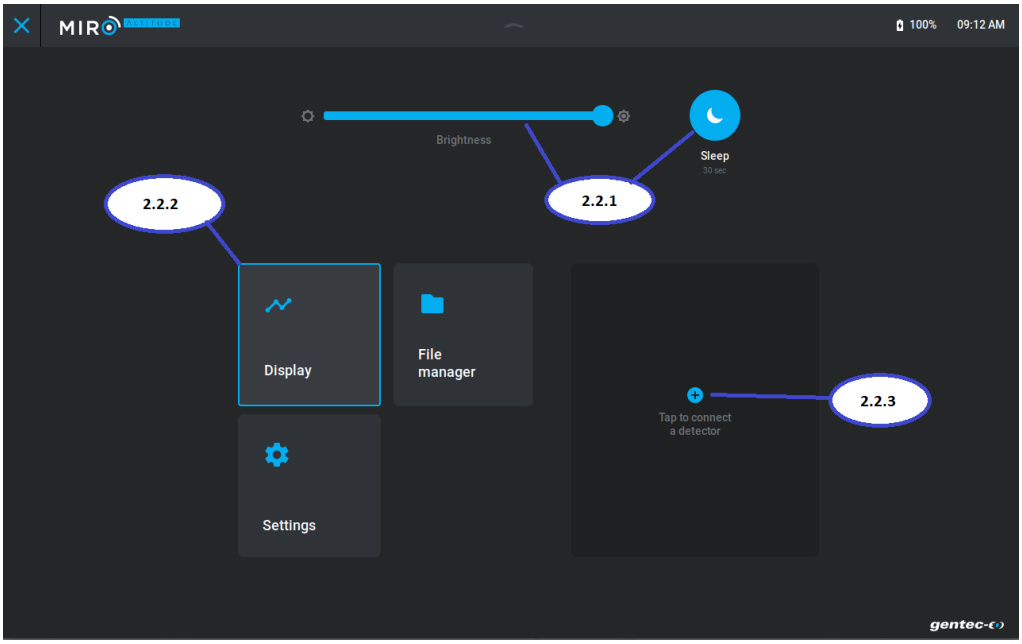
File manager

Icon	Name	Type	Description
	Local storage	Button	Opens the on-board storage folder
	USB storage	Button	Opens the file folder of an attached USB drive
	File / folder actions	Button	Displays file management options such as move, delete and rename
	Open folder	Button	Opens the folder
	Read file	Button	Opens the file
	Recording	Icon	Indicates that a file is a recording
	Screenshot	Icon	Indicates that the file is a screenshot

2.2 CONTROL CENTER

The control center is the main hub of the software. It includes three sections:

1. Quick controls for commonly used device settings
2. Navigation buttons to access the display, the file manager and the settings
3. Detector connection panel



2.2.1 Quick controls

The screen brightness can be adjusted by moving the cursor on the scroll bar.

The sleep mode can be activated or deactivated by tapping on **Sleep**. The button turns blue to indicate that the sleep mode is active. The delay time before the sleep mode is entered is indicated in grey under the button. The delay time can be modified in the settings menu.

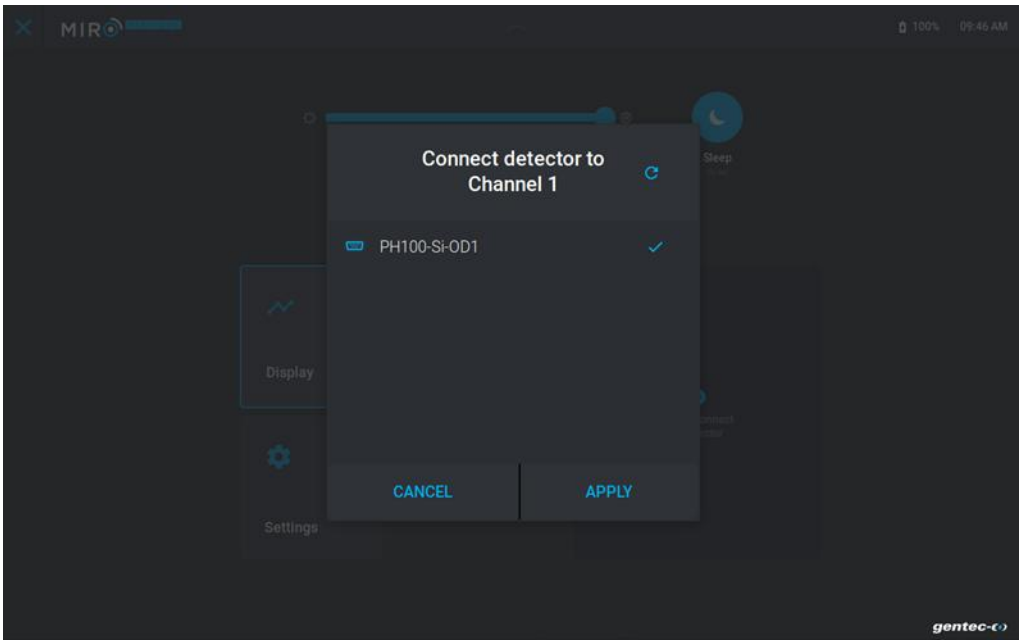
2.2.2 Navigation

The control center allows you to quickly access the three main interfaces of the MIRO ALTITUDE by tapping the corresponding buttons. The active interface is identified with a blue border. When the instrument is turned on, it enters the display interface.

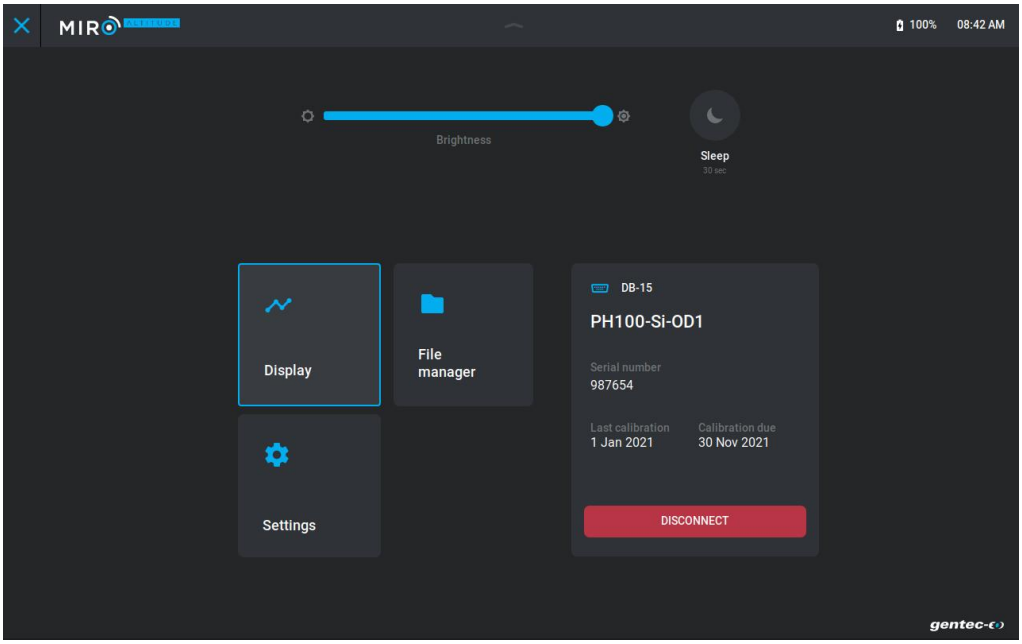
The active interface in the control center is shown according to your last choice. When the control center is closed by tapping on the X in the upper left corner, you will return to the previous view (the one with the blue border).

2.2.3 Detector connection

To connect a detector that is currently plugged into the device, tap on Tap to connect (⊕). A menu will be displayed with the list of currently available connectors. If a detector is connected to the instrument at that time and it does not appear on the list, tap on Refresh (↻) so that the software can look for it. When a detector is selected, a blue check mark will appear at the end of the line. By tapping on Apply, the detector will be connected.



The detector connection panel then shows the specific information of the detector. In this section you will find the detector connection type, its name, its serial number, its calibration date, its next calibration due date and a disconnect button that will disconnect the detector from the MIRO ALTITUDE.



2.3 DISPLAY

The display interface is composed of three sections:

1. A navigation bar at the top of the display
2. A measurement settings panel at the left of the display
3. The main part of the screen shows the measurement area

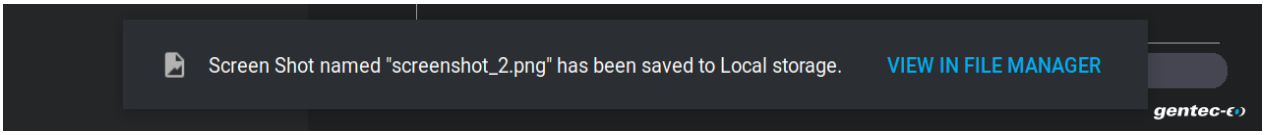
2.3.1 Navigation bar

1. Open the control center

The navigation bar has a link ☰ to the control center.

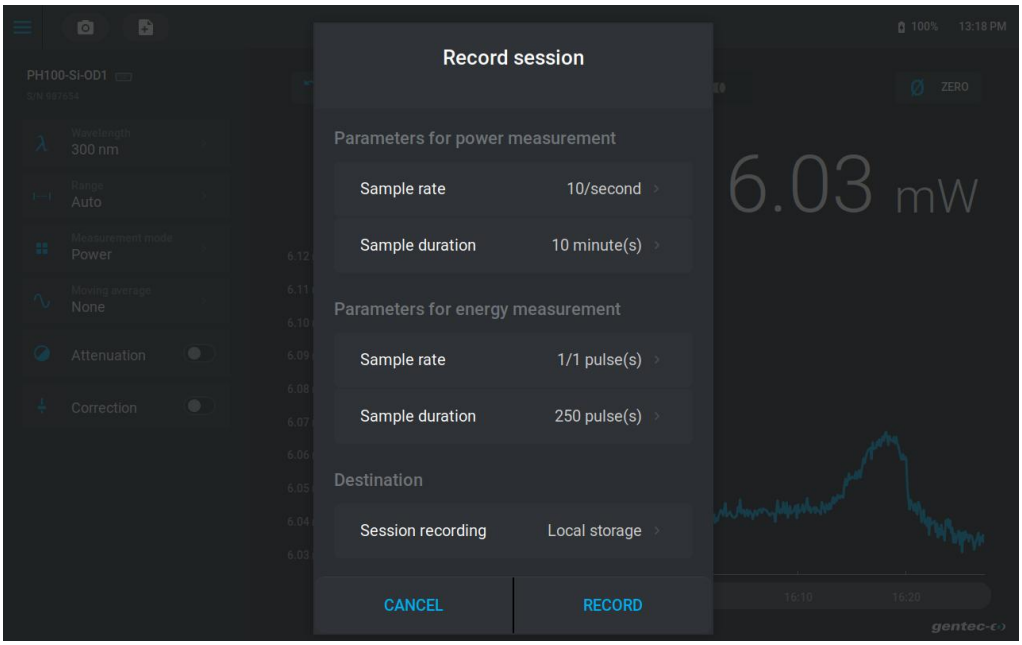
2. Screenshot

The following button 📷 takes a screenshot of the MIRO ALTITUDE screen. When you tap on it, a notification will appear in the lower part of the screen saying that the operation has been successful, and a direct link will also show up to see the screenshot as stored in the internal file system of the MIRO ALTITUDE.

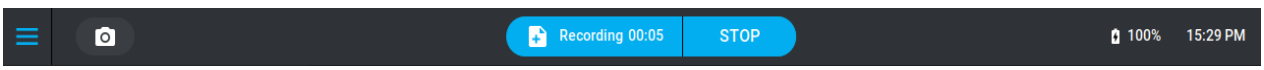


3. Recording

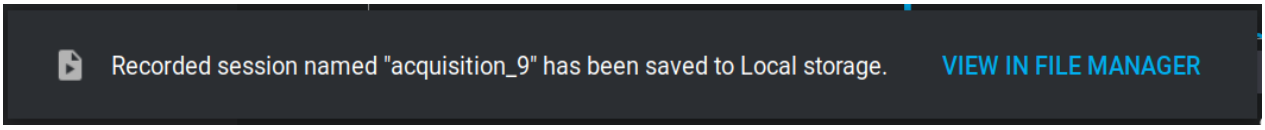
The following button 📄+ opens the data recording settings. Start the recording by tapping on **Record**. The MIRO ALTITUDE has an internal memory with enough space to store many recordings. It is possible to record directly on a USB drive or in the MIRO ALTITUDE internal memory. See Section 2.4.5 for how to move recorded files. It is possible to set the default recording settings to facilitate data recording. To do this, please refer to Section 2.5.2 of this manual.



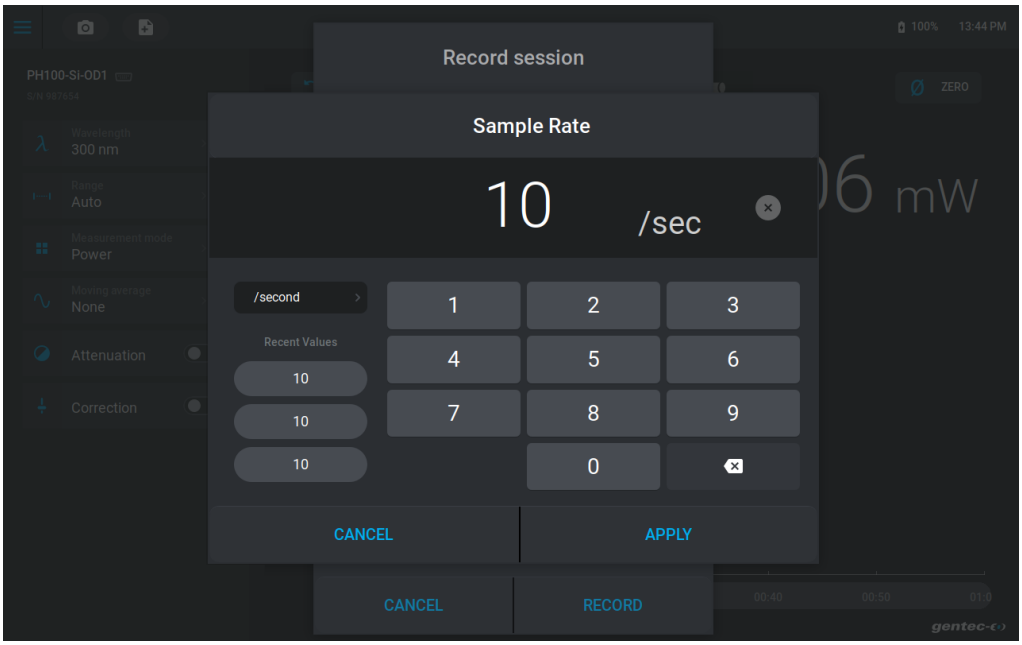
When a data recording session is active, a new item will appear in the center of the navigation bar. A timer indicates the current session length. The **Stop** button can terminate the recording before the time-lapse that was predefined in the settings.



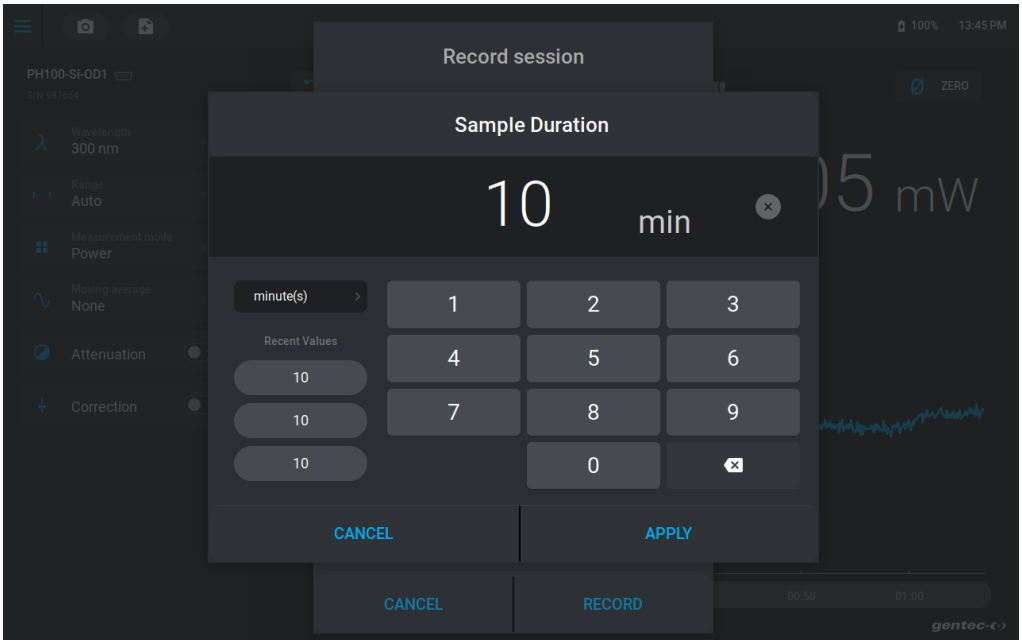
When a data recording session is automatically or manually terminated, a notification will appear in the lower part of the screen saying that the operation was successful, together with a direct link to see the recording on the internal file system of the MIRO ALTITUDE.



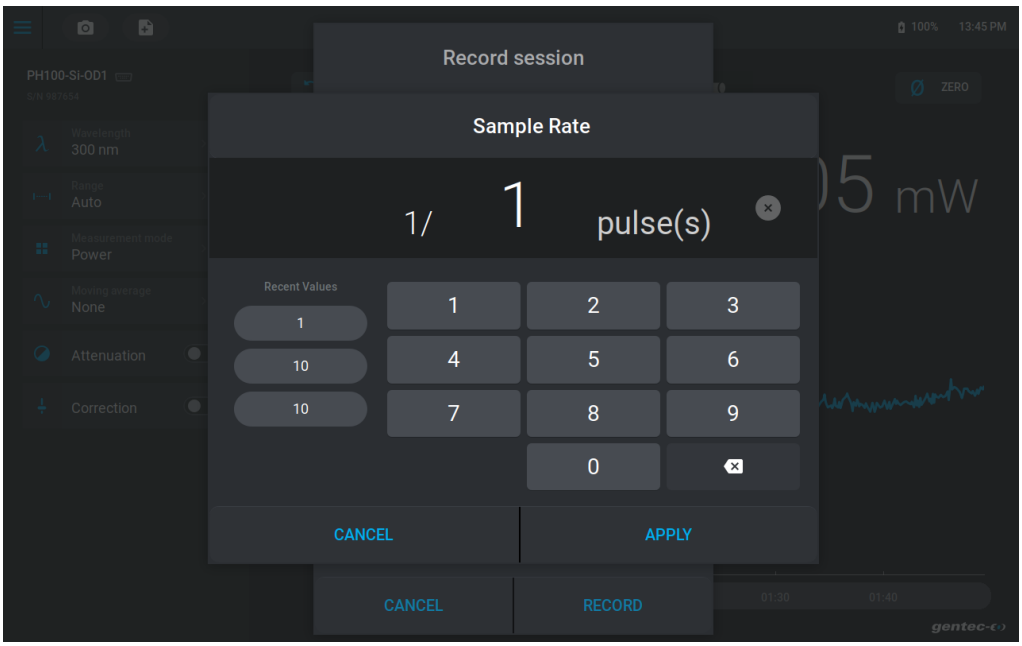
When logging data in power mode (wattmeter), the sample rate controls the speed at which data is saved. The maximum sample rate is 15 points per second, and the minimum is 1 point per day. Available time units are second, minute, hour and day. In the following example of a wattmeter, the sample rate is 10 points per second, which is the default.



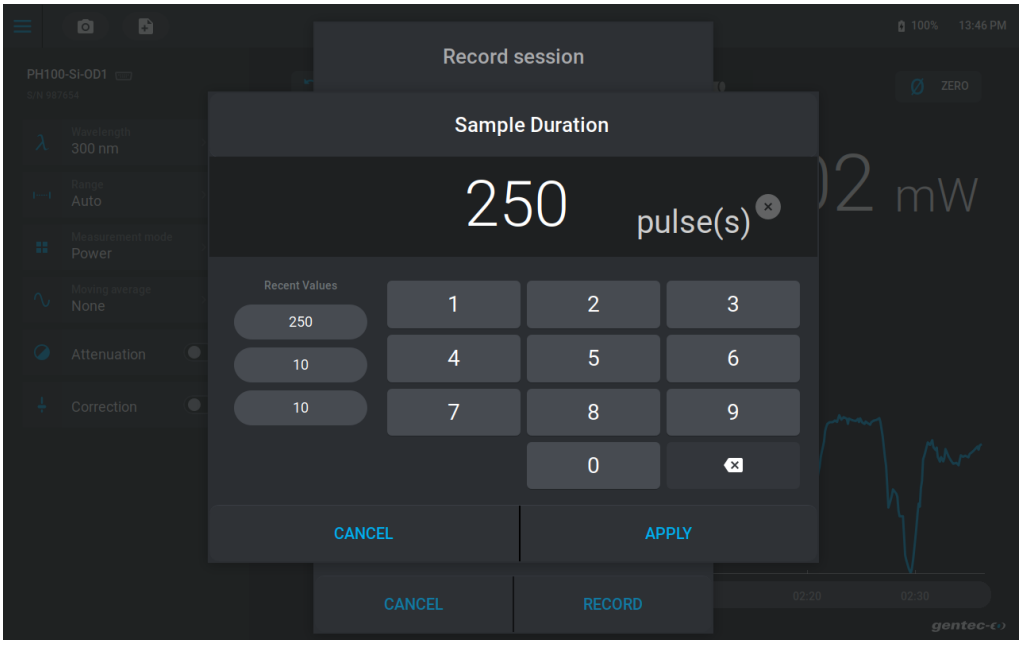
The sample duration defines the time during which the MIRO ALTITUDE will perform the data recording. Available time units are second, minute, hour and day. By default, the duration is 10 minutes. Minimum duration is 1 second, and maximum duration is 10 days.



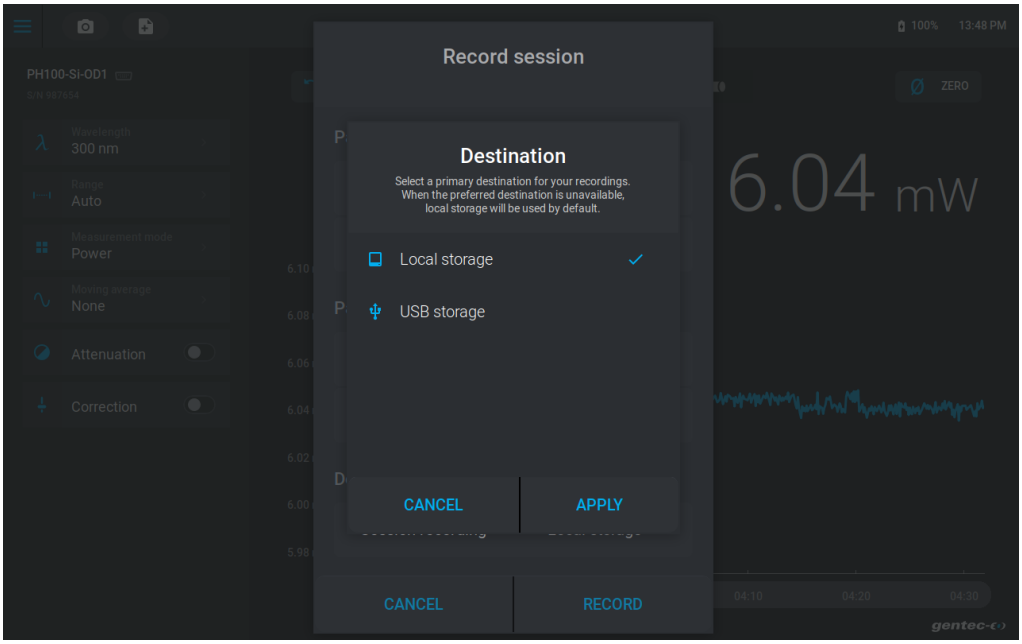
When acquiring data in energy mode (joulemeter), the sample rate is defined as the fraction (1/x pulses) of incoming pulses that were sampled. This setting is for both the statistics calculation and the data log. Maximum sampling will then be of 1/1 (all detected pulses) up to a fraction of 1/1,000,000 (one in every million pulses will be recorded).



The sampling duration in energy mode is defined as a total number of pulses and not as fixed time measurement. In the following example, the recording will be possible if the MIRO ALTITUDE does not receive 250 pulses according to its sampling frequency. Accepted values are between 1 pulse up to 999,999 pulses in total.



Finally, it is possible to define where the recording will be saved. By default, the recordings will be stored in the internal memory of the MIRO ALTITUDE, but it is also possible to record directly on a USB drive. Of course, you need to make sure you have enough space on the drive.



4. Safe connect / disconnect

The following button in the navigation bar appears only if you connect a USB storage to the MIRO ALTITUDE. When you tap on it, it will safely connect your media to the device and make it available in the file manager for doing files and folders operations. The icon colour will also change to blue, meaning it is now active. When you tap on it again, a notification will appear and ask if you want to safely remove the USB device from the MIRO ALTITUDE.

5. Battery

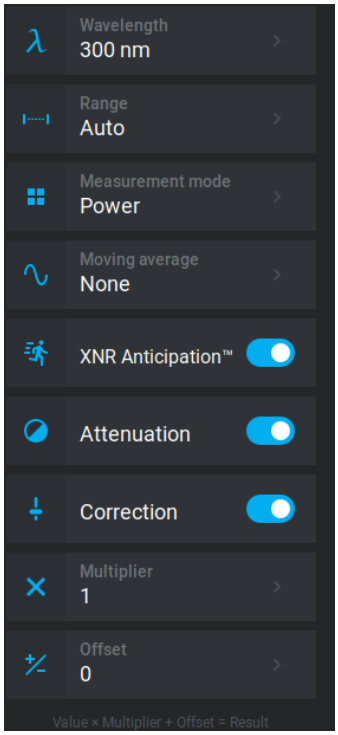
The MIRO ALTITUDE has a lithium-ion battery that offers 6 hours of running time. The status of the battery is represented by an icon and a percentage that indicates the available capacity. When the low battery icon appears (< 10%), it is suggested to connect the device to the external power supply. The icon will change depending on if the instrument is charging.

6. Date and time

See Section 2.5.1.

2.3.2 Measurement settings panel

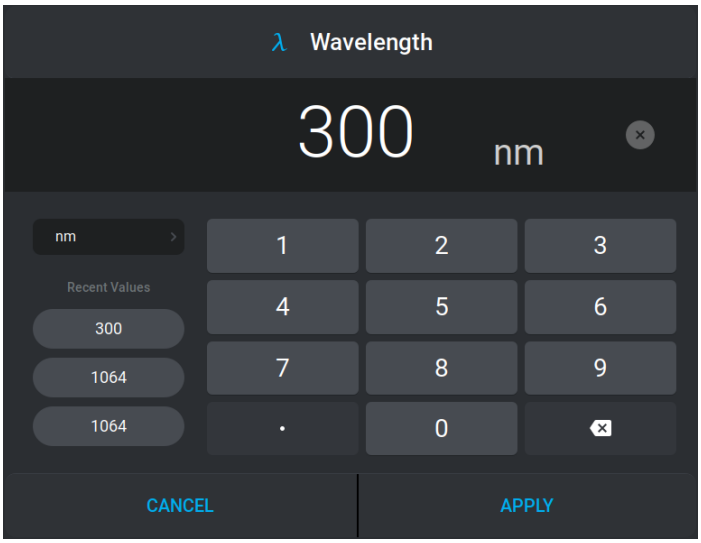
The options listed on the left side of the screen define the measurement settings and can be set by you. Certain settings are available only for specific detector types.



1. Wavelength

The wavelength can be set according to the laser that is being used. When the setting is tapped, a menu will show up to select the wavelength. A correction factor will thus be applied to the measurement to compensate the detector absorption at different wavelengths. The wavelength selection menu proposes two choices of

units: micrometres or nanometres. Accepted values depend on the detector that is being used. The values that were previously entered are on the left of the menu to facilitate the selection.

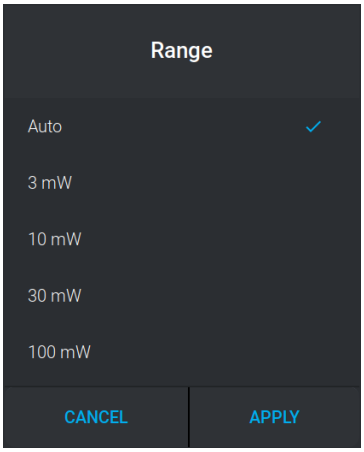


2. Range

The power or energy range menu is used to select the signal level that is being read by the detector to obtain the best possible measurement. When a detector is initially connected, the auto range mode will be selected by default. In this operating mode, the MIRO ALTITUDE will select the proper range according to the current measurement. It is possible to manually select a fixed range amongst those available. For maximum accuracy, when the reading is made in a manually selected range, you should always use the next highest range that will be measured. For example, if the current measurement is 200 mW, the 300-mW range will be ideal.

For energy measurements, pay special attention if the pulse energy varies. In this case, you will need to make sure that each pulse is detected. As opposed to the power measurement, in which the automatic mode is continuously adjusted according to the measured value, the automatic mode of the energy measurement makes its range selection according to the previous pulse energy.

In self-triggering mode, the trigger threshold is set to 2% of the current range. In other words, a pulse with an energy below 2% of the current range will not be detected. To be able to measure the lowest energies, manually set the range at the lowest level and then select the automatic range. By doing this, the MIRO ALTITUDE will start in the lowest scale, then automatically select higher scales as necessary. Afterwards, you can automatically adjust to lower scales. While increasing scales, incoming pulses that exceed the current scale will be reported as out of scale and invalid until the automatic system selects the correct scale.



3. Measurement mode

The measurement mode can sometimes be modified depending on the detector type.

According to the detector type, different measurement modes can be selected.

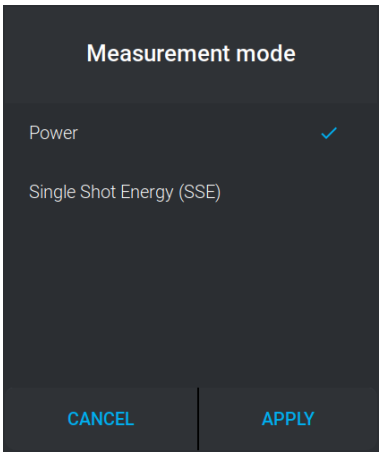
- Power detectors (thermopiles and photodiodes)
  - Power (watts)
  - Single-shot energy (joules) (energy mode/calorimeter)*
- Energy detectors (pyrometers and photodiodes)
  - Energy (joules)

**This function allows measuring the energy contained in a laser pulse using a Gentec-EO thermal power detector. This operating mode gives access to the same options as energy detectors. The only restriction is that the delay between the pulses must be compatible with the power detector specifications (please refer to the user guide for the specific power detector you are using).*

$$Delay = \left(\frac{1}{Rep.\ Rate} \right)$$

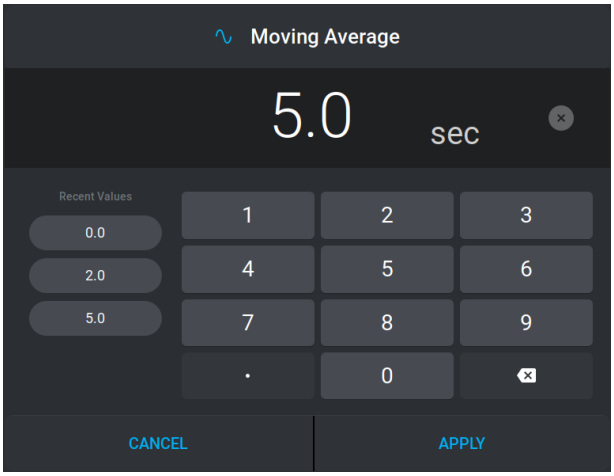
Keep in mind that power detectors are optimized to support a high average power and not a high peak energy. Always keep the energy density under the maximum energy density specified in the detector specifications.

The energy mode is typically available for thermal power detectors with a typical sensitivity value. A ± 3% uncertainty in pulse energy measurement can be achieved if the power detector is specifically calibrated for energy mode. Please contact your Gentec-EO distributor or the closest Gentec-EO office to obtain more information on how to obtain a pulse energy measurement calibration.



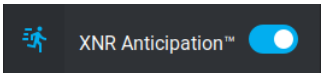
4. Moving average

The moving average smooths the measurements over an averaging period selected you. Accepted values are between 0 and 600 seconds. For example, if you indicate 5 seconds, the currently displayed measurement will be an average of all the samples taken over the last 5 seconds.



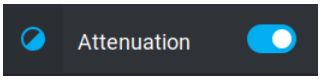
5. XNR Anticipation™

Activate the anticipation to activate the power meter acceleration software that provides an accelerated response of the detector. By using advanced algorithms and known physical properties of the detector, this function allows the MIRO ALTITUDE to provide a very accurate power measurement faster than the natural response of a thermopile power detector. It accelerates the natural response by a factor of up 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.



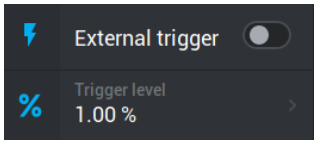
6. Attenuation

This setting is available for detectors that are calibrated by Gentec-EO with an attenuator (for example, QE series energy detectors with a QED attenuator or PH series power detectors). Toggle the attenuation setting into the correct mode so that MIRO ALTITUDE can use the correct calibrated sensitivity. By activating the attenuation setting, only the wavelengths at which the detector is calibrated with the attenuator will be available in the wavelength menu.



7. Trigger

To analyze the energy of a pulse, it is important to know the measurement trigger settings to make sure all pulses are properly detected and measured. Pyroelectric and photodiode energy detectors use the trigger, as well as thermal detectors in energy mode. The trigger signal can come from an external source connected to the BNC connector, or an internal software trigger can be used.



External trigger

When the external trigger is activated, the **Trigger level** option turns grey as it is not used. The external trigger allows connecting an external device such as a laser with a trigger output to the MIRO ALTITUDE to trigger

the pulse measurement. See the specification table in Section 1.4 for electrical and pulse duration specifications. The meter detects a trigger on the rising edge of the external trigger signal.

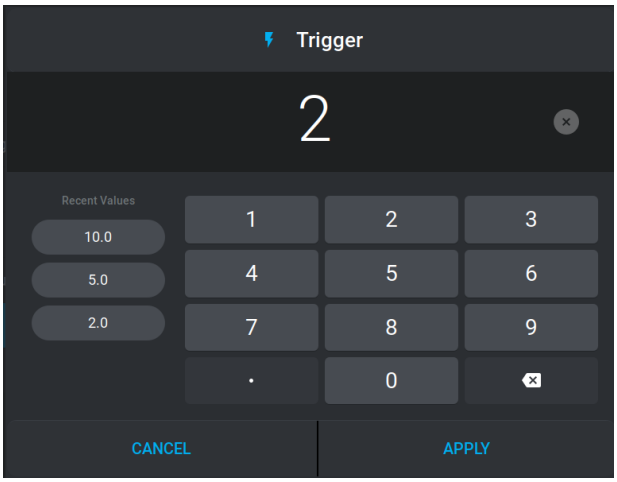
The beginning of the external trigger signal must arrive in a time window relative to the beginning of the laser pulse. This window begins 20% of the rise time before the laser pulse and ends one rise time after the beginning of the pulse minus the minimum trigger pulse width.

Please note that the external trigger feature is available **only** for detectors equipped with a **DB15 connector**.

Trigger level

For internal, software-triggered measurements, the trigger level setting sets the signal threshold as a percentage of the range. Only signals above this threshold will be measured. This can be 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.

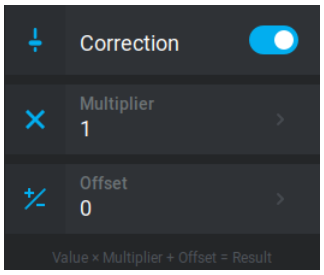
By tapping on the trigger level setting, the following menu appears. Please note that this percentage is based on the selected range. For example, if the range is 10 J and the triggering level is at 10%, no measurements will be made under 1 J. Please pay attention when there is a range change as if the range changes from 10 J to 30 J, only pulses above 3 J will be measured.



Warning: if you select a trigger level with a high value, the MIRO ALTITUDE might not be able to detect all the pulses of widely varying energy levels in auto range mode. The auto range function uses the energy level of the last measured pulse to establish the range 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 range. To avoid this problem, select a lower value for the trigger level or change the range manually.

8. Correction

This feature adds a custom correction multiplier and offset that are applied to the measurement. Correction factors are mostly useful when sampling a small percentage of a powerful laser beam or to compensate for absorption. The menu displays the values of the correction factors that are applied to the measurement.

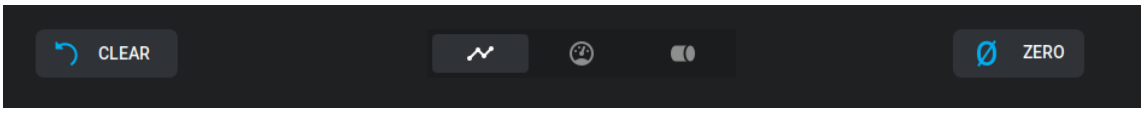


The default value for the multiplier is 1, and for the offset is 0. It is essential to ensure that the real measured value (before correction) is always within the power and energy limits of the detector.

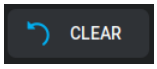
Only the automatic range setting is available when corrections are enabled. Please note that the statistics are only calculated for the corrected values.

2.3.3 Display area

At the top of the display area, there are three buttons for quick access to commonly used controls: clear, zero and the display mode toggle.

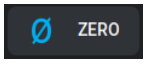


1. Clear



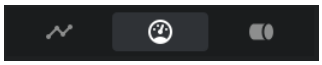
The **Clear** button above the main view on the left erases the scope chart, resets the cursors in all displays and resets the statistics.

2. Zero



The **Zero** button sets the detector current value to zero. Subsequent measurements will be taken relative to this new zero power level. The purpose of this feature 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 MIRO ALTITUDE was turned on (for example, the hand or body of the user). This feature can also be used to take relative measurements. Use this function once your power meter has achieved thermal equilibrium to ensure accurate measurements.

3. Display toggle



The MIRO ALTITUDE offers three different display modes: scope (scrolling graphic), needle and bar. This allows you to select the best way to display the measurements according to your specific needs. The transition from one display option to the other is made without affecting the measurement.

The selection of the display mode is done through the three buttons shown above.

4. Scope display (scrolling graph)

The scope display gives a quick look at the laser beam long-term stability and trend as a function of time (as could be seen on an oscilloscope). The chart x-axis is 60 seconds. When at least one minute of recording has passed, the chart will scroll to show the most recent 60 seconds of data. You can scroll back by pressing and sliding on the timeline at the bottom. To go back to real time, tap on the button on the right side, below the graph.

In the scope display, you may control whether the average cursor is visible or not. Press on the graph area for 1 second to activate or deactivate the average cursor. When the average cursor is activated in the scope display, it is also visible in the needle and bar displays.

5. Needle display

The needle display is a simple and intuitive way to view the measured value. It is an excellent tool for laser tuning or alignment. The deflection of the digital needle is proportional to the real-time measurement. The 0 is on the left-hand side of the dial, whereas the range's maximum value is on the right-hand side. Minimum and maximum values are indicated by the small white triangles on the perimeter of the dial. As mentioned on the scope display section, if the average cursor has been activated, it will be visible through the small blue triangle.

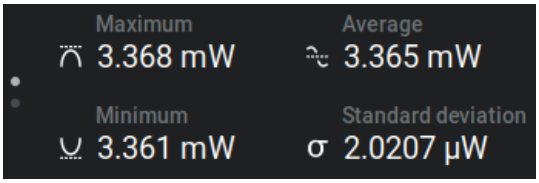
It is possible to zoom with the **+** button on the right side of the screen to fine-tune the adjustment. When zoomed in, the dial is scaled from the minimum to the maximum measured values since the last clear. Please note that in zoom mode, the minimum, maximum and average values will disappear. To go back to normal mode, simply tap on the **–** button.

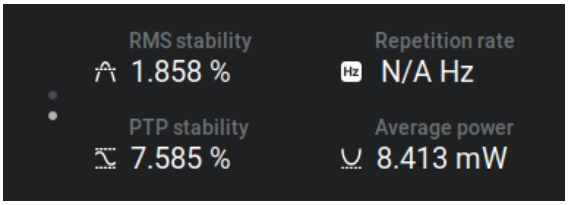
6. Bar display

This display features a large band that fills up in blue from left to right according to the measurement. The current measurement value is displayed in larger digits than in the scope and needle displays. Once again, the minimum and maximum values are indicated by the small white triangles. The average value is indicated by the small blue triangle if it has been previously activated in the scope display.

2.3.4 Statistics

All display modes show a complete analysis of the power or energy measurement statistics, which are updated in real time with each new measured value. The statistics panel is divided into two sections with four values which give eight different statistical measurements that can help you analyze your results. Scroll between the two sections by sliding up or down.





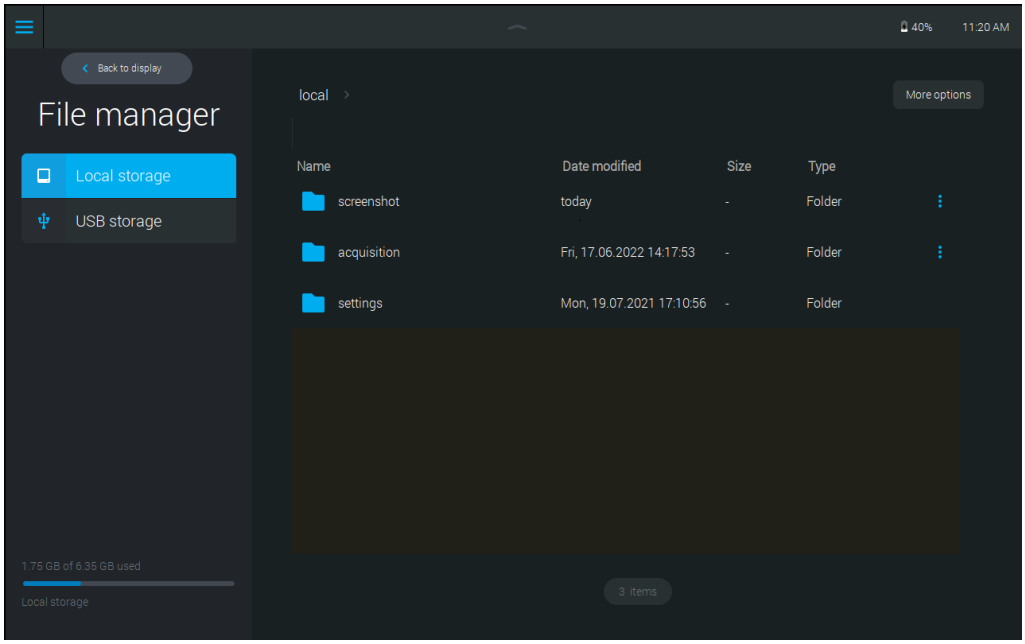
The statistics that are calculated can be found in the following table:

Statistical parameters	Power	Energy	Definition
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}
Average value	✓	✓	Average from the start of values in the sample, E_{avg} or P_{avg}
Standard deviation	✓	✓	A measure of the spread of the data around the average $STD = \sqrt{\frac{\sum_{i=1}^{n}(E_i - E_{avg})^2}{n-1}}$, $STD = \sqrt{\frac{\sum_{i=1}^{n}(P_i - P_{avg})^2}{n-1}}$
RMS stability	✓	✓	The root mean square stability represents the standard deviation as a percentage of the average $RMS = \frac{STD}{\lvert E_{avg} \rvert} \times 100$, $RMS = \frac{STD}{\lvert P_{avg} \rvert} \times 100$
PTP stability	✓	✓	Shows the spread between the highest and lowest point in the sample as a percentage $PTP = \left\lvert \frac{E_{max} - E_{min}}{E_{Avg}} \right\rvert \times 100$, $PTP = \left\lvert \frac{P_{max} - P_{min}}{P_{Avg}} \right\rvert \times 100$
Repetition rate		✓	Frequency of pulses coming from the laser, *PRR*
Average power		✓	Power calculated from the pulse energies and repetition rate $P_{avg} = E_{avg} \times PRR$

2.4 FILE MANAGER

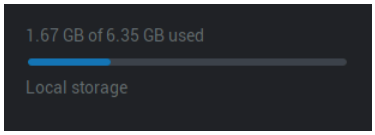
2.4.1 File management

The file manager shows the content of the internal memory of your MIRO ALTITUDE (Local storage) and of any USB drives connected to the device (USB storage). In the file manager, you can rename files and folders, delete them, move or copy them to a USB drive to analyze the data on a PC or to share them with your colleagues. Finally, it is also possible to view the screenshots and data recordings.

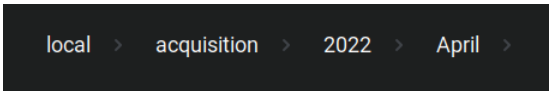


2.4.2 User interface

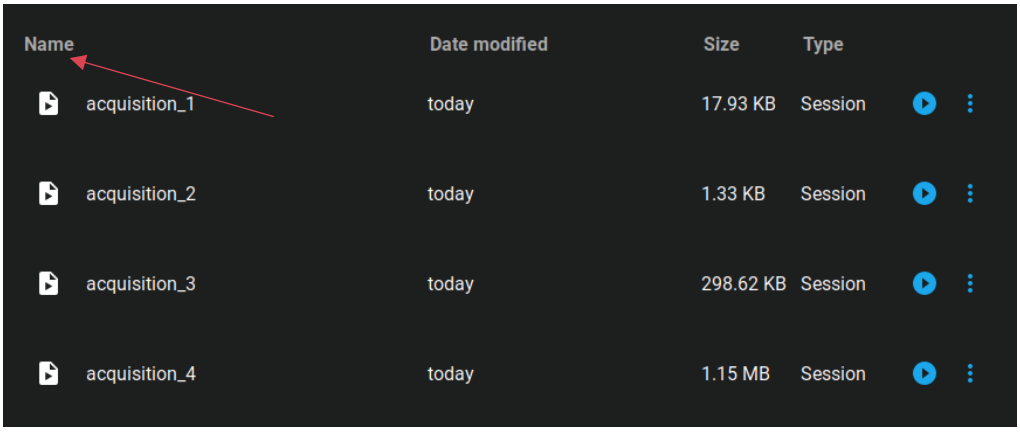
The control center icon (☰) in the top left of the screen opens the control center. Below, the **Back to display** button closes the file manager and goes directly to the live measurement display. The column on the left is the list of drives that can be explored. “Local storage” is always listed and “USB storage” appears if a USB drive is connected. In this menu you will find an indicator of the available and used on-board memory.



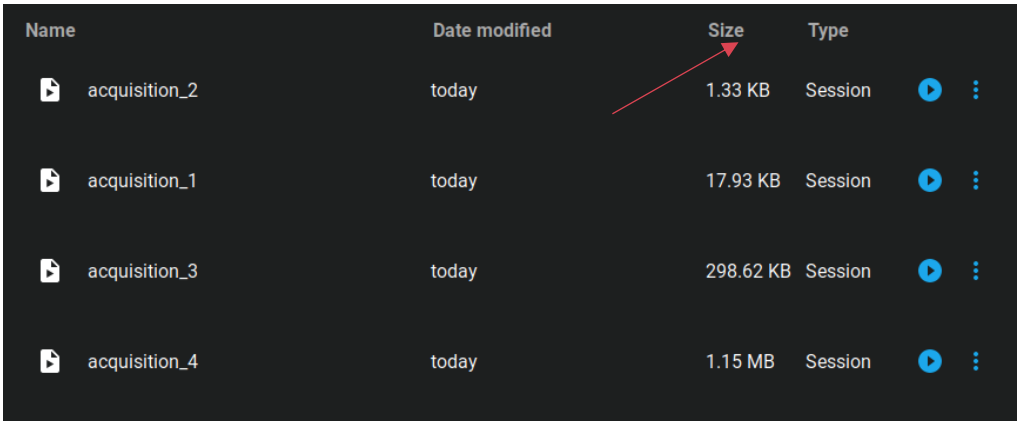
In the central part of the screen is the file manager. On the top, the breadcrumb navigator shows the currently opened folder and its parent folders. Each of the folder names can be tapped to quickly go back one or several levels in the folder hierarchy. Please note that the folder called “local” is the root of the on-board file system.



The files and the folders of the tree are presented in four columns: name, date modified, size and type. Tap on the title of each column to sort the list. A first tap sorts in increasing order and a second tap on the same column title sorts in decreasing order.

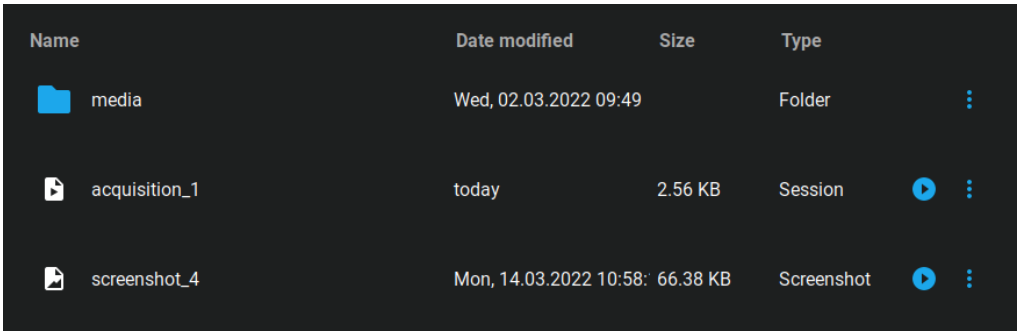


Alphabetic order sort



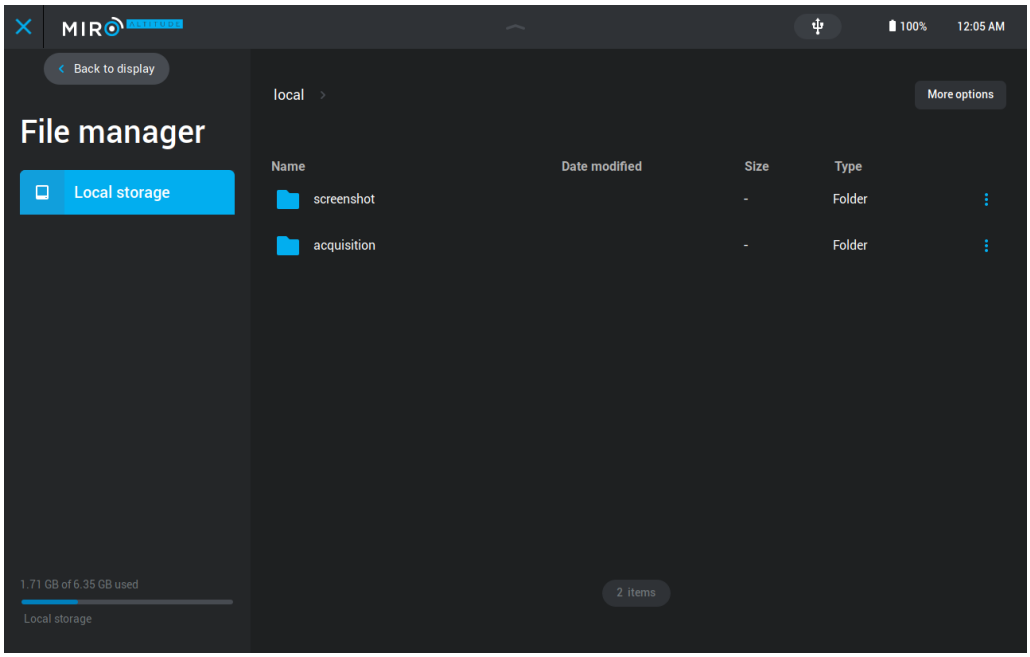
File size sort in increasing order

The items that are displayed in the file manager can be of three types: folder, session and screenshot. For the last two, we can see a button ( ) that opens a session recording or a screenshot directly on the MIRO ALTITUDE when tapped. For files and folders, there is a vertical menu icon ( ) for accessing a list of specific operations as we will see in Section 2.4.5.



2.4.3 Internal memory

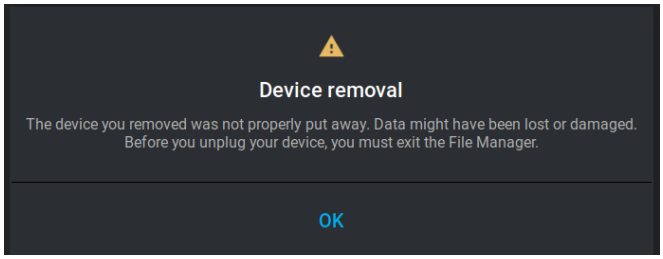
The MIRO ALTITUDE has a large internal memory which allows the recording of thousands of screenshots and recordings. A USB drive can be connected to expand storage. Certain folders are in the device by default, such as acquisition and screenshot and are the folders where data and screenshots are respectively stored. These folders cannot be renamed, moved or deleted.



2.4.4 USB drive

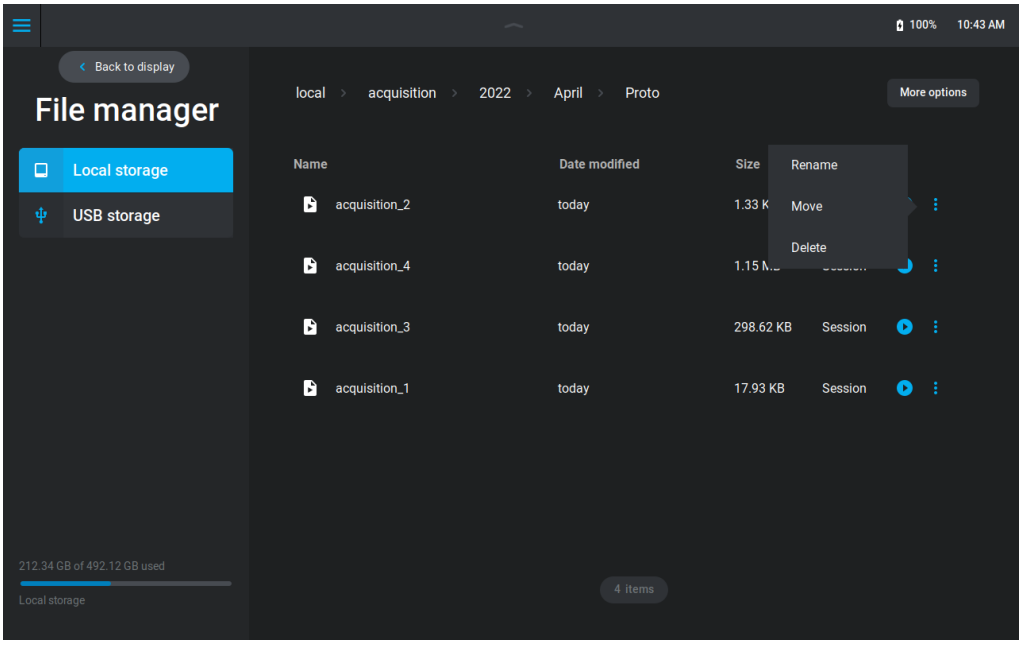
A USB drive (ideally in FAT32 format) can be plugged into the MIRO ALTITUDE at any time. The file manager will be updated to show the “USB storage” drive. Files can be copied from the local storage drive to the external drive. It is not possible to move files from the USB drive to internal memory.

It is important to exit the file manager BEFORE removing the USB drive from the device to ensure the integrity of the files that were copied to the device.



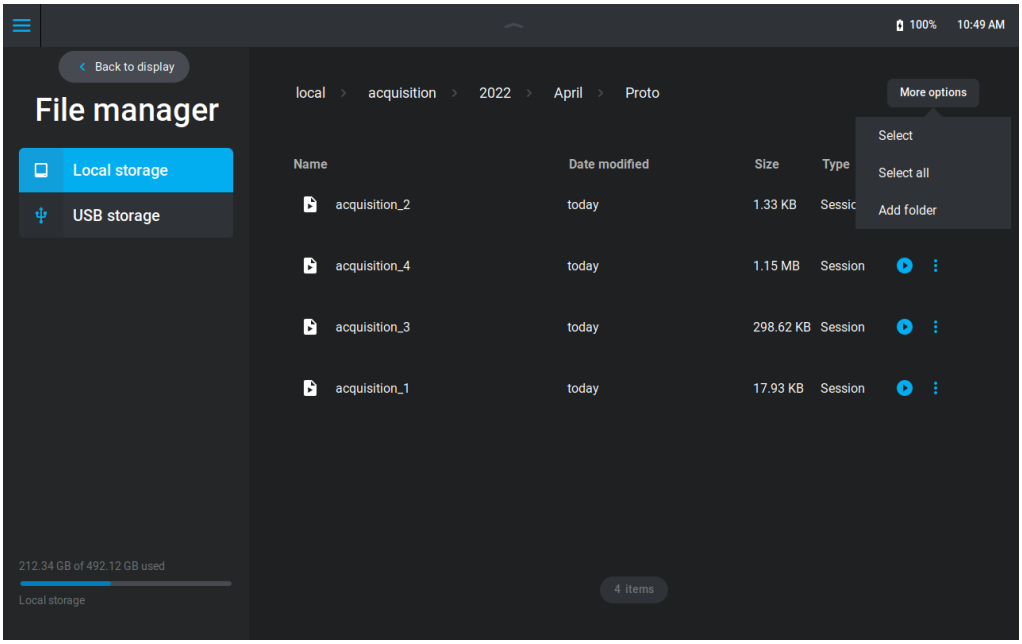
2.4.5 File and folders management

The file manager allows you to create a folder, to rename a file or a folder, to copy files and folders from the internal memory to a USB drive and to delete files and folders. These operations can be performed on either single or multiple items in the list. To perform an operation on a single file or folder, tap on (⋮) next to the file or folder. A context menu will appear to show the available operations, as seen in the following example:

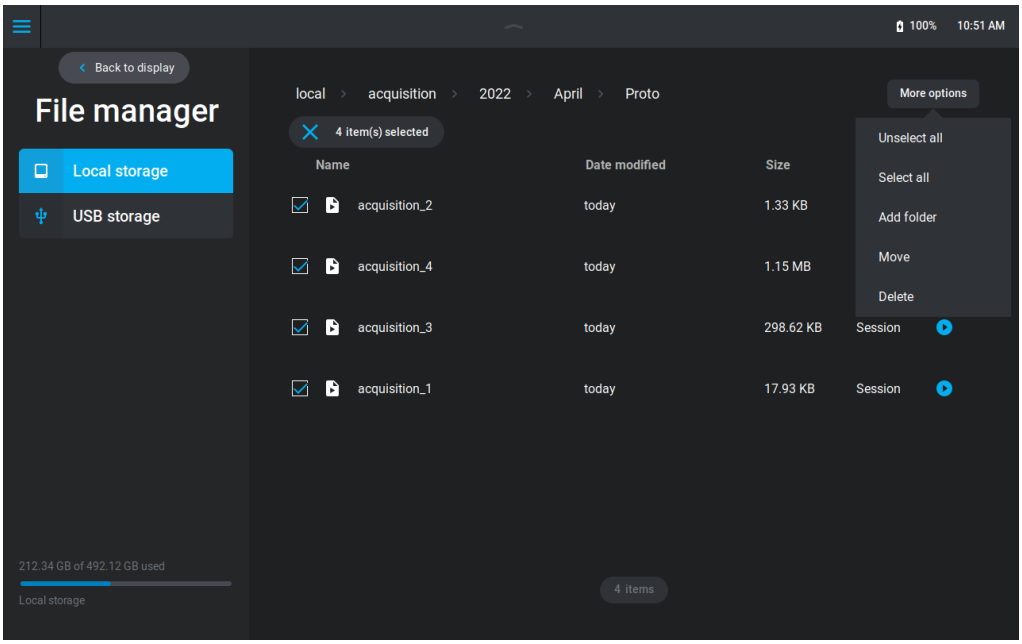


The **Rename** option allows you to rename a file or a folder. The **Move** option will move a file or a folder and its contents to your USB drive. This option is only available if a USB drive is connected to your MIRO ALTITUDE.

The **More options** menu in the higher right part of the screen allows operations on several files at a time.

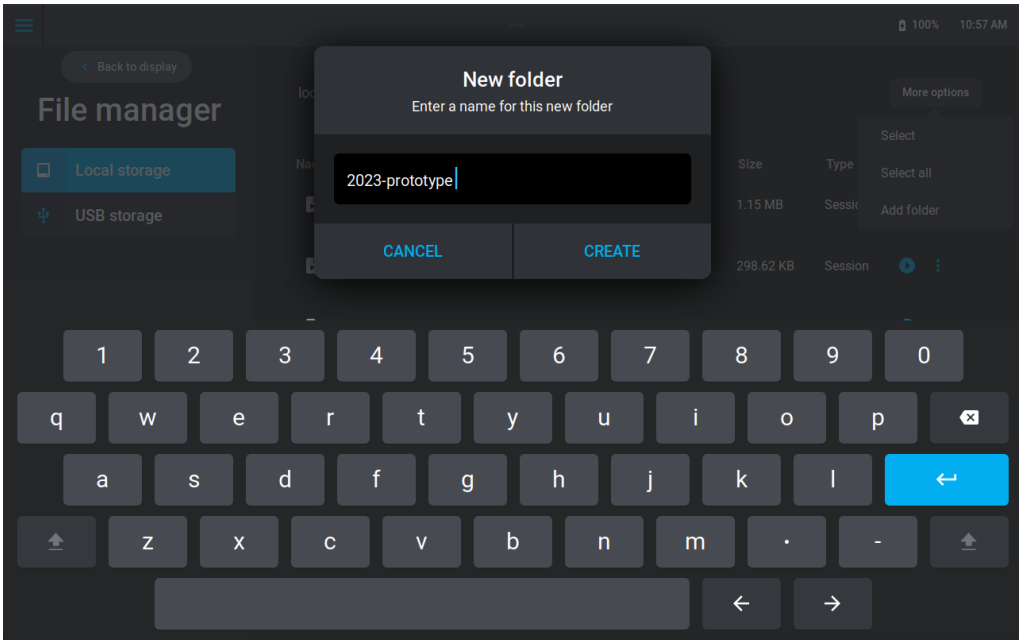


The choices in this menu are updated according to the items selected.



To exit the multi-selection mode, tap on ✕ above the item list.

Folders can also be created from the More options menu.



2.4.6 Viewing screenshots and data recordings

The view function ( ) opens saved screenshots or recordings that are stored on the internal memory or on a USB drive. Tap on **Show** to confirm you want to view the file.

When viewing a screenshot, the saved image is displayed, and the only available option for you is to tap on **Close** to go back to the file manager.

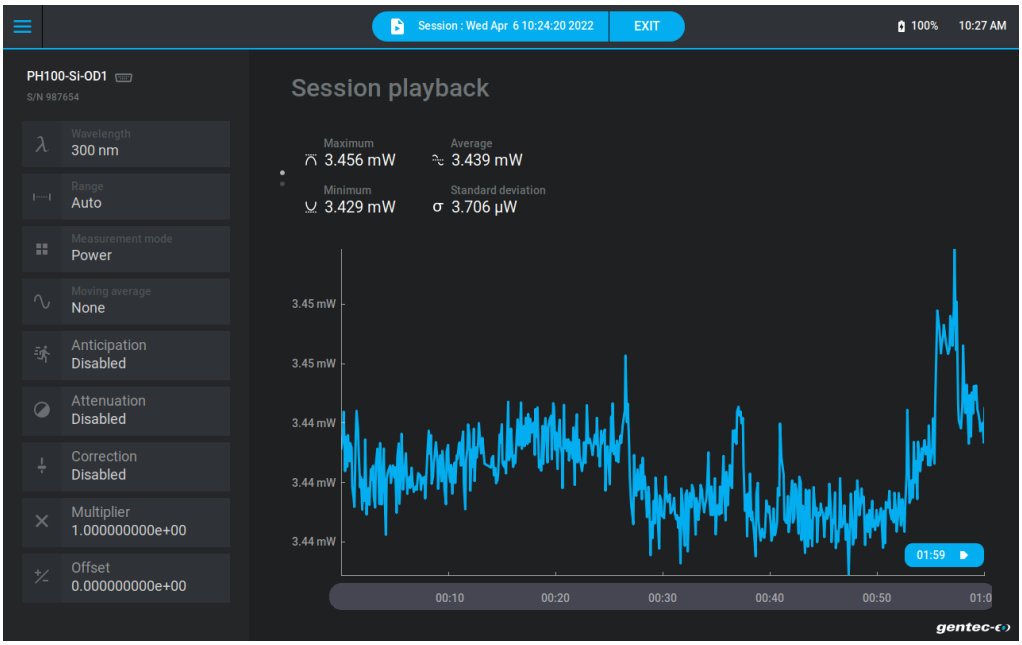
When viewing a recording, the detector settings will be shown in the left panel. These settings are also written in a human-readable format in the .txt file log when the log file is opened in a text editor on a PC.

```
Name: PH100-Si-OD1
Serial Number: 987654
Input Source: DB-15
Wavelength: 300 nm
Range: Auto
Mode: Power
Moving Average: None
Anticipation: Disabled
Attenuation: Disabled
Correction: Disabled
Multiplier: 1
Offset: 0
Sample Rate: 10/sec
Total Duration: 2 min

-----------------------------------------------------
index   Time    (realTime)      Measurement
0       0.000   (0.027)         1.600458054e-03
1       0.100   (0.094)         1.599687035e-03
2       0.200   (0.161)         1.601258991e-03
3       0.300   (0.237)         1.601141994e-03
4       0.400   (0.370)         1.600807998e-03
5       0.500   (0.495)         1.600453048e-03
6       0.600   (0.561)         1.600453048e-03
7       0.700   (0.695)         1.600307995e-03
8       0.800   (0.762)         1.598787960e-03
9       0.900   (0.962)         1.600150950e-03
10      1.000   (0.962)         1.600150950e-03
```

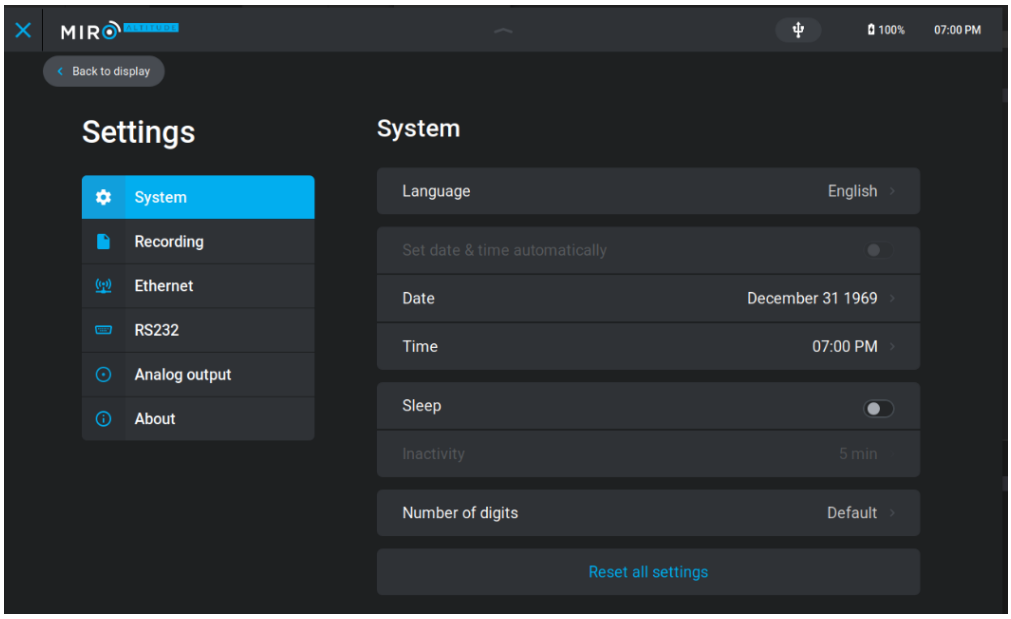
On your MIRO ALTITUDE, you can press on the graph to see a vertical cursor that indicates the measurement at that point. By sliding your finger along the data, this cursor moves along for you to be able to easily view the desired data.

When the recording time is longer than the available time range, you can slide your finger on the time range to scroll through the data. To exit the recording viewer, tap on **Exit** in the upper part of the screen and confirm you want to exit the session playback.



2.5 SETTINGS

The **Settings** menu allows you to configure and save several useful settings that will help make the most of the MIRO ALTITUDE. You can configure the recorded data, the Ethernet connection, the RS232 connection, the analog output and the measurement trigger level. In addition, the **About** menu contains information on the MIRO ALTITUDE. The following image shows the settings menu.

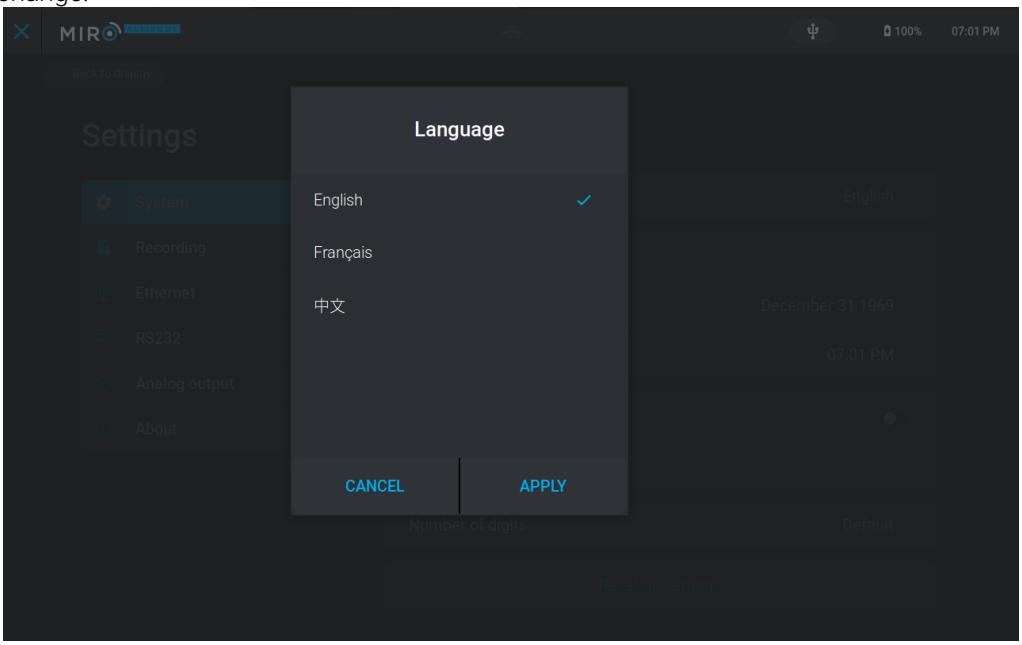


2.5.1 System

The **System** menu allows controlling certain parameters of the MIRO ALTITUDE.

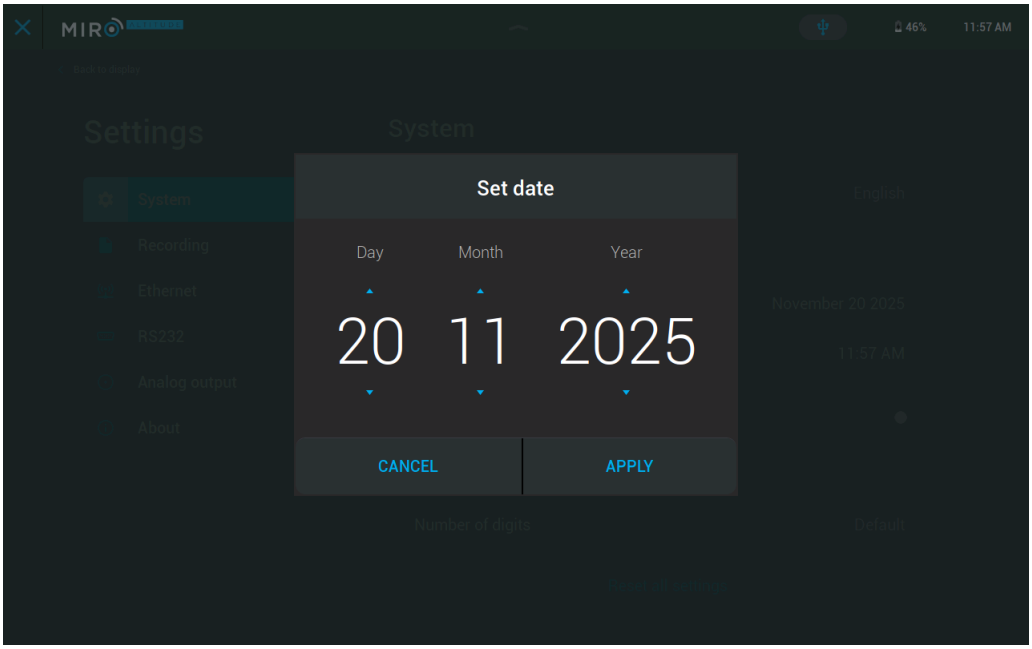
1. Language

This option allows you to change the device language. Tap on **Language** to open the menu and select one of the available languages: English, French, or Chinese. Changing this setting will turn off MIRO ALTITUDE to apply the change.

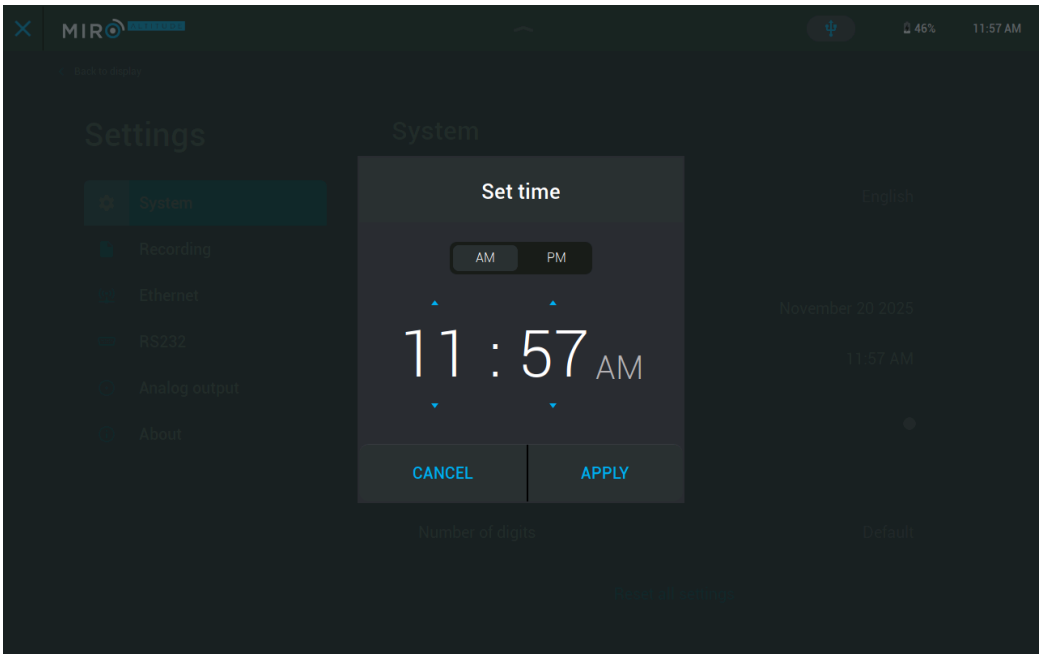


2. Date and time

This option allows changing the date and time of the device. Tap on **Date** to open the menu and adjust the date. Tap on the arrows to adjust the day, month and year.



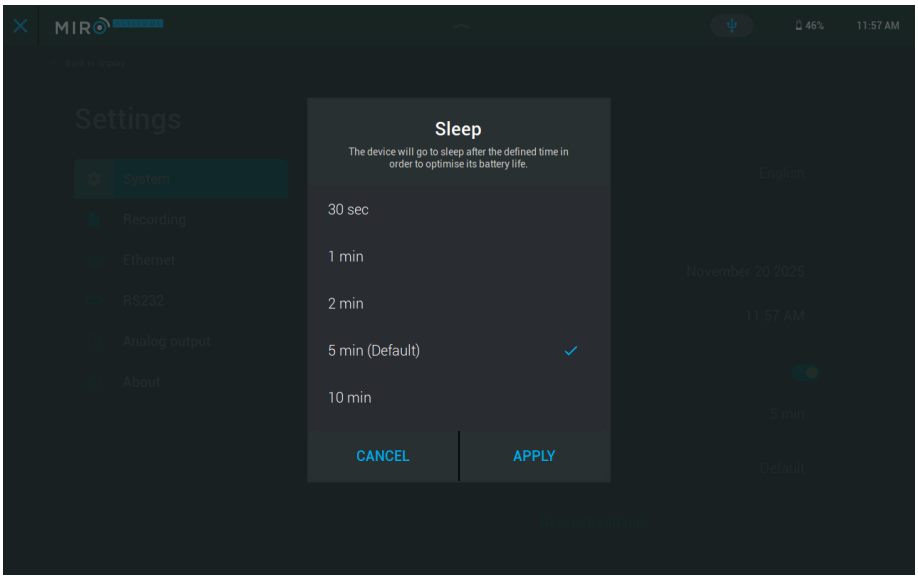
Tap on **Time** to adjust the time, in the same way as the date adjustment, except that you can tap on AM or PM.



3. Sleep

The **Sleep** feature, which turns off the screen but keeps the instrument running, is used to prolong the battery run-time. After the screen has not been touched for the specified amount of time, its brightness is reduced for 10 seconds, and then the display turns off completely. The MIRO ALTITUDE keeps working normally when the screen is off: if a recording is in progress, it will not be interrupted. Turn the screen back on with a short tap on the power button.

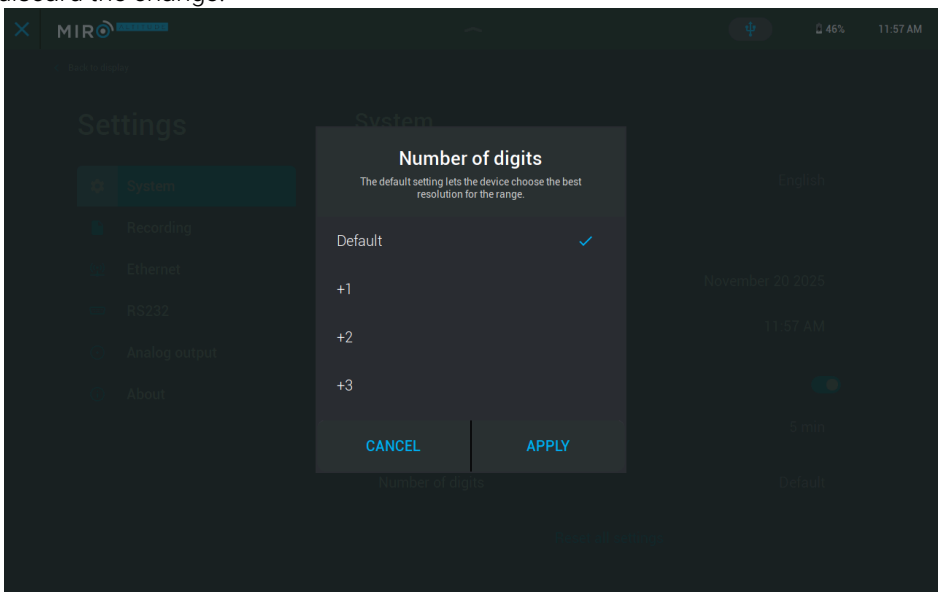
To choose the delay before entering sleep mode, tap on **Inactivity** and choose the time.



The sleep mode can also be enabled by tapping on **Sleep** in the control center. Please see Section 2.2.1 of this manual for more information.

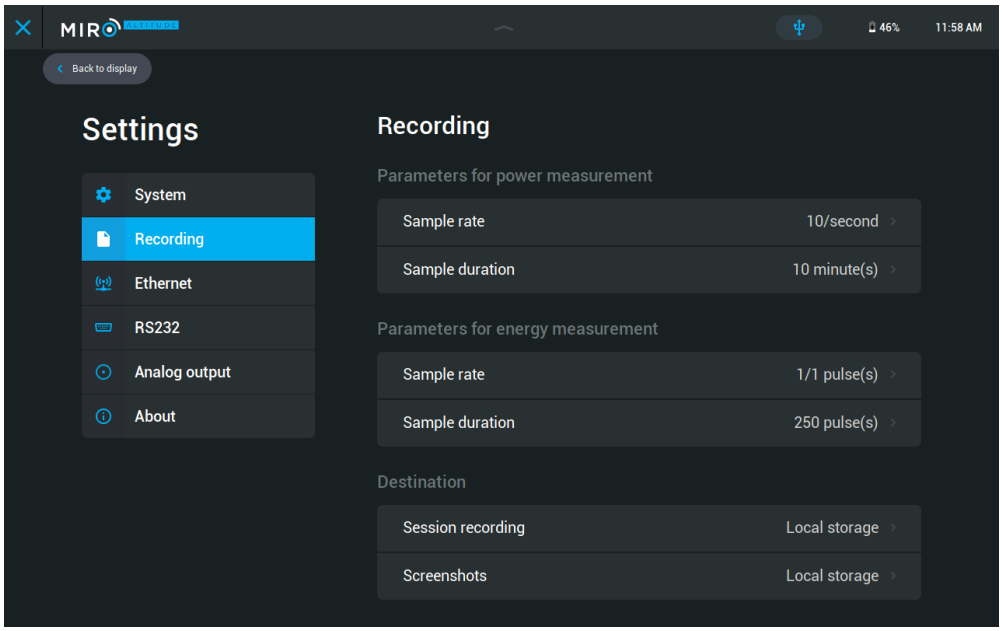
4. Number of digits

This setting changes the number of digits after the comma that are displayed when making a measurement. Tap on the button to show the list of options. The default setting lets the device choose the best option according to the range. The absolute accuracy depends on the detector and the experimental conditions and is not changed in this menu. When the number of digits is selected, tap on **Apply** to save the change or tap on **Cancel** to discard the change.



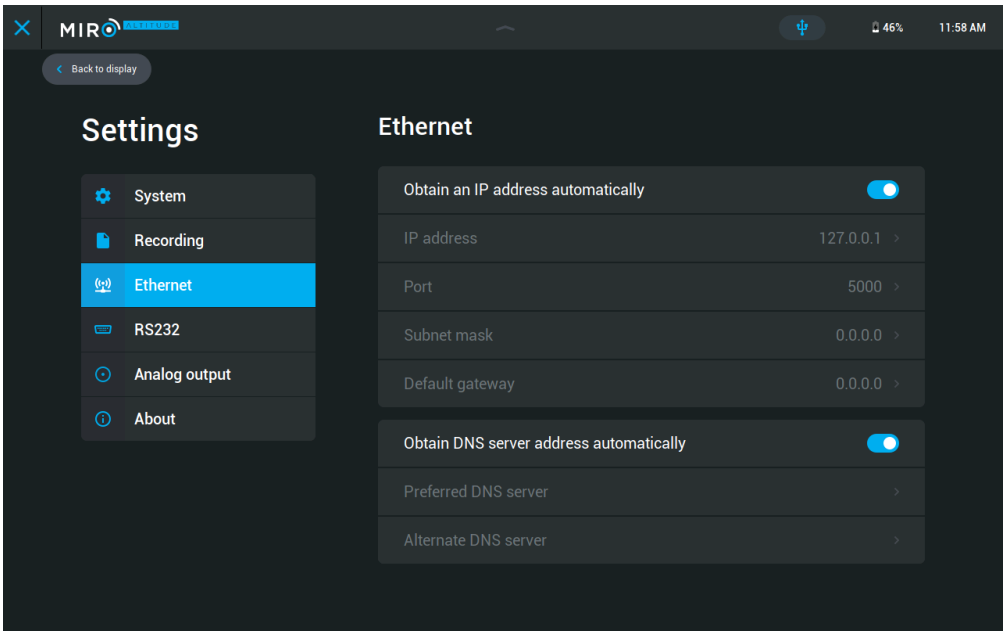
2.5.2 Recording

Recording settings allow saving the default settings when starting a recording. If the same recordings are regularly used, saving the default settings will prevent having to reconfigure the settings for each new recording. Adjustments in this section are made in the same way as when starting a recording.



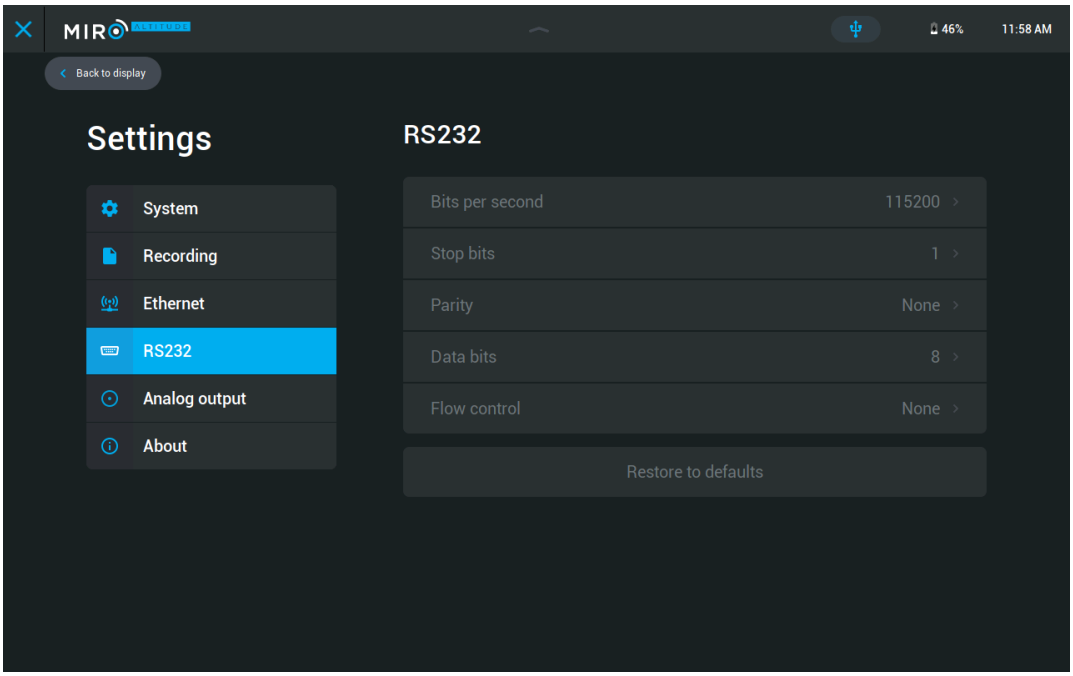
2.5.3 Ethernet

The Ethernet settings manage the Ethernet communication parameters of MIRO ALTITUDE. For the moment, these settings can be viewed but cannot be modified. These settings will be available soon in a new software update that will be accessible for download on the Gentec-EO website.



2.5.4 RS232

The RS232 settings manage the parameters for RS232 communication with MIRO ALTITUDE. For the moment, these settings can be viewed but cannot be modified. These settings will be available soon in a new software update that will be accessible for download on the Gentec-EO website.



2.5.5 Analog output

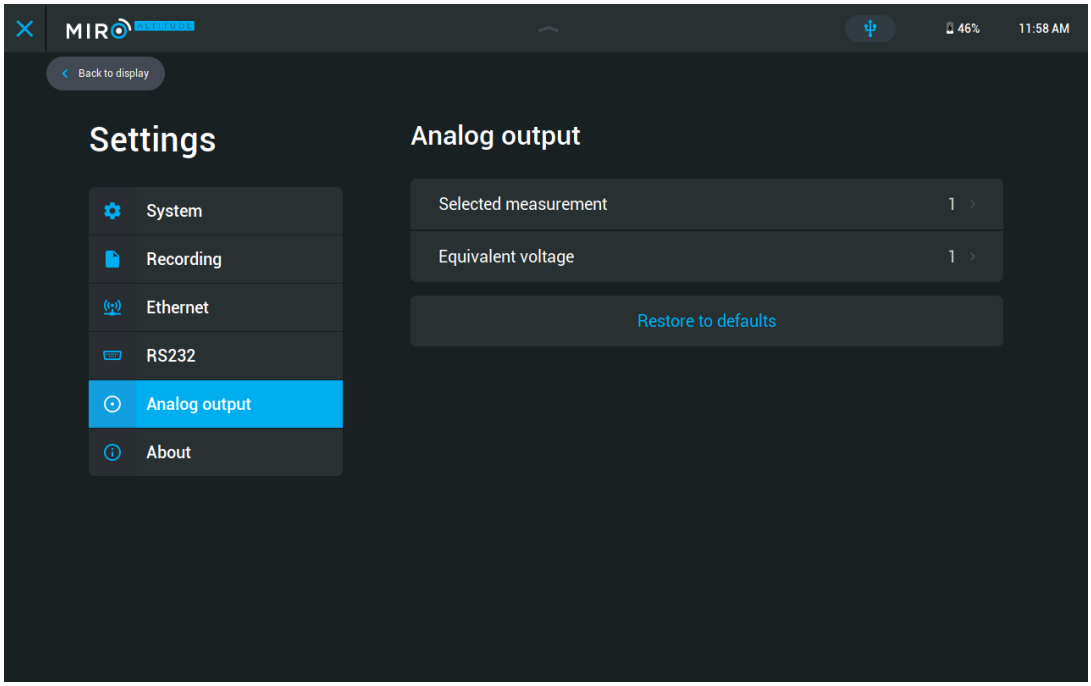
The analog output settings allow you to obtain a signal coming from the MIRO ALTITUDE by using external equipment, such as a continuous line recorder, a computer with an analog interface and a voltmeter. To use this feature, use a standard BNC cable.

This output voltage is proportional to the signal that comes from the detector. You must configure two settings, the input measurement and the output voltage. You must know the ratio to be obtained so as to be able to configure these two settings. For example, if you wish to obtain 500 mV for each measured watt, they must enter 1 W under **Selected measurement** and 0.5 V under **Equivalent voltage**. As it is a ratio, it could also have 2 W and 1 V as settings.

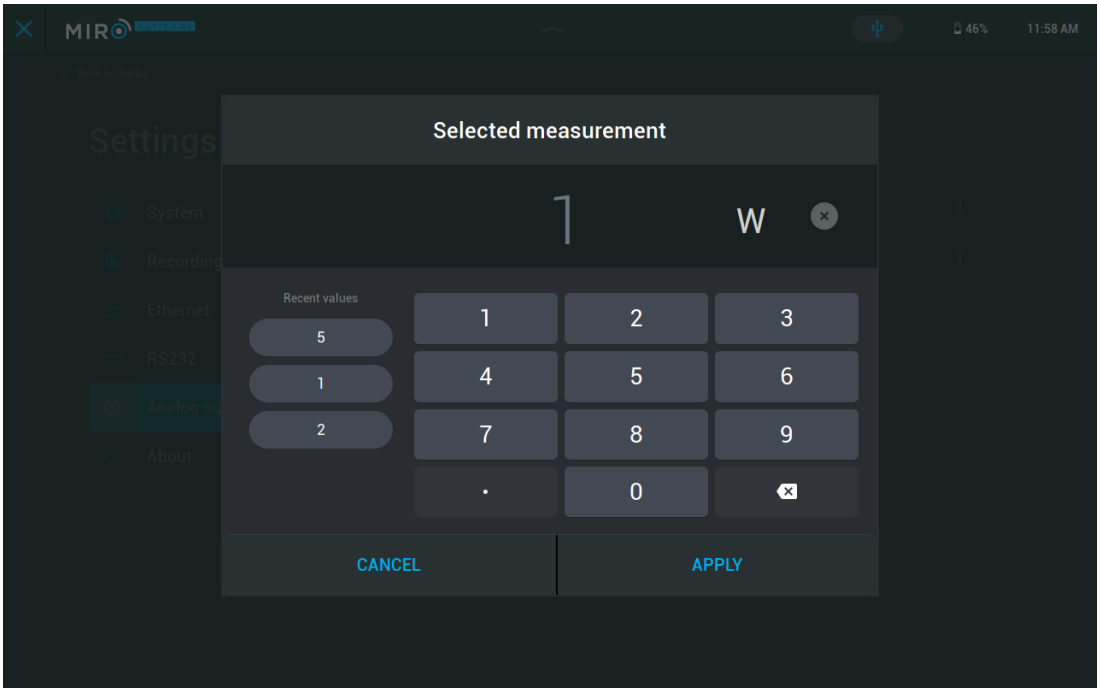
Specifications of the analog output:

Maximum output voltage:	5.0 V
Connector type:	female BNC
Full-range precision:	1% of the measured value

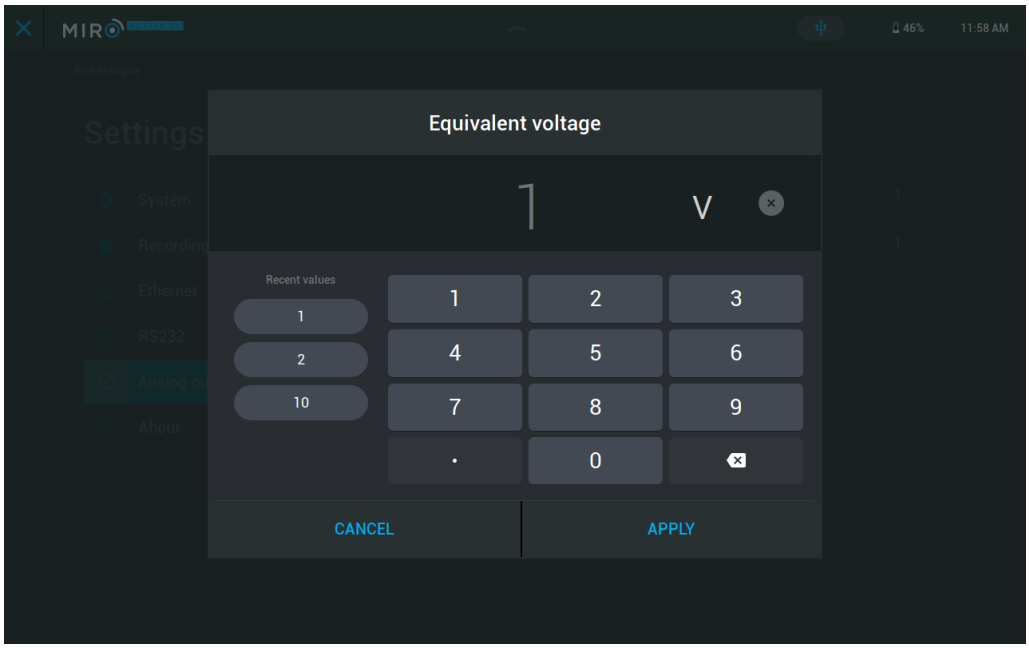
The analog output should be used with a high impedance charge.



To select the input signal that comes from the detector, tap on Selected measurement. The following menu will appear. The unit will be determined according to the connected detector. For a wattmeter, the unit will be W for watt, and for a joulemeter the unit will be J for joule.

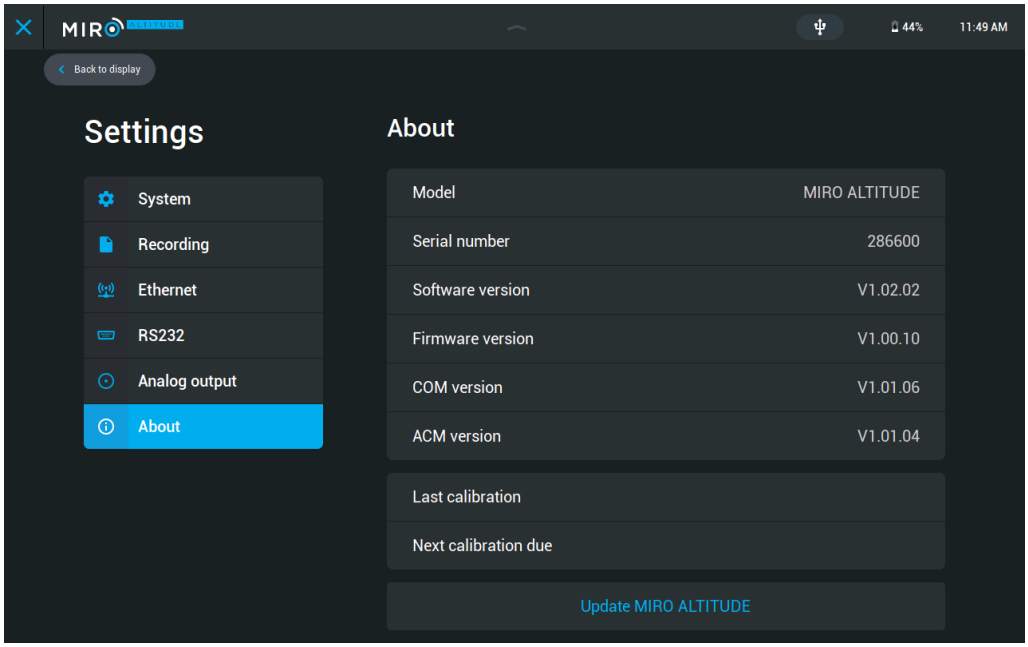


To select the output voltage, tap on **Equivalent voltage**. The following menu will appear. The unit will be V for volt. The minimum value that can be entered is 0.5, and the maximum value is 4.9.



2.5.6 About

This section displays information about your MIRO ALTITUDE. The information to be regularly checked is the last calibration date and the recommended next calibration due date. The software and firmware versions can be compared with the updates available on the website. This information will tell you if your device is up to date. If you must get in touch with one of our representatives regarding your MIRO ALTITUDE, they may ask you to provide the information in this section.



3. MIRADOR: PC SOFTWARE TO CONTROL MIRO ALTITUDE

User-friendly communication software specially made for Gentec-EO MIRO ALTITUDE, is available for free through our website (www.gentec-eo.com). This software basically transforms your PC screen into a large MIRO ALTITUDE screen enabling you to control and see your information remotely, and log data directly on your computer.

To download the MIRADOR software, 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 install it.

Please refer to the MIRADOR manual for more information concerning the user interface. The manual can be downloaded on our website at https://www.gentec-eo.com/resources/download-center.

4. SERIAL COMMUNICATION

MIRO ALTITUDE can be controlled via text input commands which must follow the rules stated in this section.

The USB class used by MIRO ALTITUDE is a CDC or communications device class. This means it shows up in the host PC as a COM port, but it is not a COM port, rather a true full-speed USB port or Virtual Com Port (VCP). You can talk to it as if it were an RS232 port and take advantage of faster speeds offered by USB. Follow the Windows prompts (if necessary) to install the USB drivers. The USB drivers are fully tested and digitally signed by Microsoft.

Open the appropriate port in your software with standard COM port tools. None of the port settings matter with a VCP, so leave them at whatever default they are in. It is a real USB connection.

4.1 SETTING UP COMMUNICATION WITH MIRO ALTITUDE

Connect the monitor

Use your favorite serial terminal emulator to connect the device via USB, RS232 or TCP/IP communication. 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.

For the RS232 communication, here are the default communication parameter settings:

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

For the TCP communication, please go on under device settings then click on the Ethernet section as shown on section 2.5.3. There you will find the **IP address** and the **number of the port** required to establish the communication.

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 MIRO ALTITUDE, you are successfully connected and ready for serial command action.

4.2 SERIAL COMMAND FORMAT

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

All text commands must begin with a trigger character (*). You do not need to end with a line feed or a carriage return. Parameters must NOT be separated by spaces. Characters do not have to be capitalized; mixed upper and lower cases are OK. Replies to all text mode commands are also in text mode and end with a carriage return <CR> and a line feed <LF> .

4.3 LIST OF ERROR MESSAGES

This section describes the different error messages that may be generated by the device. Each message is presented with its triggering condition and a brief explanation to help identify and resolve the issue.

Message	Description
: Invalid command<CR><LF>	If a command is mistyped
Invalid parameter<CR><LF>	If a parameter is out of range
Not supported<CR><LF>	If the command requires a detector that is not connected or If the command is not compatible with the type or mode

4.4 LIST OF SERIAL COMMANDS FOR MIRO ALTITUDE

Command	Command name	Description
Streaming commands		
*CAU	Start continuous acquisition	Sends values to the serial port using the data-sampling setting
*CSU	Stop continuous acquisition	Stops the *CAU output
*CVU	Get current value	Returns the current value in ASCII
Information commands		
*VER	Get monitor version	Returns the version of the monitor
*QSN	Get monitor information	Returns the monitor's name and serial number
*IDN	Get detector information	Returns the detector's name and serial number
*SOC	Get state of charge	Returns the monitor's state of charge
Measurement Mode Commands		
*GMD	Get measurement mode	Returns the current measurement mode of the monitor
*SMM	Set measurement mode	Sets the measurement mode to power, energy or SEE
Wavelength Commands		
*GWL	Get wavelength	Returns the wavelength in nm
*PWC	Set wavelength	Sets the wavelength in nm
Anticipation Commands		
*GAN	Get anticipation state	Returns the anticipation state
*ANT	Set anticipation ON/OFF	Activates or deactivates the anticipation
Attenuator Commands		
*GAT	Get attenuator state	Returns the attenuator state
*ATT	Set attenuator ON/OFF	Activates or deactivates the attenuator
Scale Commands		
*GAS	Get auto-scale state	Returns the auto-scale state
*SAS	Set auto-scale ON/OFF	Activates or deactivates the auto-scale mode
*DVS	Get valid scales	Returns the list of valid scales
*SCS	Set current scale	Sets the scale
*GCR	Get current scale	Returns the current scale
Moving Average Commands		
*QTM	Get moving average	Returns the averaging window
*TIM	Set moving average	Sets the averaging window
User Correction Commands		
*SOU	Set zero	Zeroes the measurements (power detectors)
*GUM	Get user multiplier	Returns the current multiplier
*MUL	Set user multiplier	Sets the user-defined multiplier value
*GUO	Get user offset	Returns the current offset

Command	Command name	Description
*OFF	Set user offset	Sets the user-defined offset value
*COR	Set corrections ON/OFF	Activates or deactivates the user corrections
*GUC	Get user corrections state	Returns user correction state
Trigger Commands		
*GTL	Get trigger level	Returns the trigger level value
*STL	Set trigger level	Sets the internal trigger level (energy mode)
*ET	Set external trigger ON/OFF	Activates or deactivates the external trigger
*QET	Get external trigger state	Returns the external trigger state
Analog Output Commands		
*QAO	Get analog output scale	Returns the analog output scale in W/V or J/V
*AOB	Set analog output scale	Sets the analog output maximum scale in joules or watts

4.5 DETAILED DESCRIPTION OF THE SERIAL COMMANDS FOR MIRO ALTITUDE

When connected via the serial interface, MIRO ALTITUDE sends the startup message “Serial go!<CR><LF>” to confirm that communication is initialized and ready for command exchange. This message is sent at every connection and on all available communication modes.

4.5.1 Streaming commands

Measurement values will be the same as shown on the MIRO ALTITUDE screen and include the following corrections:

- Wavelength sensitivity adjustments
- Zero offset, if applied
- Attenuator adjustments
- Anticipation algorithm, if enabled
- Moving average filter, if non-zero
- Offset and multiplier, if enabled

1 - Start continuous acquisition

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

Command	Parameters	Answer
CAU	None	Data in ASCII (scientific notation)

Example

For example, with a wattmeter (or joulemeter), a reading of around 500 milliwatts (or millijoules) would be displayed like this until the command *CSU is sent.

Command: *CAU

Answer:
+5.066010e-01<CR><LF>
+5.066012e-01<CR><LF>
+5.066014e-01<CR><LF>
+5.066022e-01<CR><LF>
+5.066032e-01<CR><LF>
+5.066042e-01<CR><LF>
…

2 - Stop continuous acquisition

This command will stop the real-time transfer enabled by the CAU command.

Command	Parameters	Answer
CSU	None	ACK

Example

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

3 - Query current value

This command will return the last measured value. The value is displayed in watts or in joules.

Command	Parameters	Answer
CVU	None	Data in ASCII (scientific notation)

Examples

For example, a 506.601 W reading and a -12.25631 mW reading would be displayed as shown below.

Command: *CVU Answer: +5.066010e+02<CR><LF>
Command: *CVU Answer: -1.225631e-02<CR><LF>

4.5.2 Information commands

4 - Get monitor version

This command will return information about the device name and its software version.

Command	Parameters	Answer
VER	None	Monitor name and version

Example

Command: *VER Answer: MIRO ALTITUDE - V1.02.02<CR><LF>

5 - Get monitor information

This command will return the monitor's model name and serial number.

Command	Parameters	Answer
QSN	None	Monitor name and serial number

Example

Command:	QSN	Answer:	MIRO ALTITUDE<CR><LF> S/N: 234567<CR><LF>

6 - Get detector identification

This command will return the connected detector's model name and serial number.

Command	Parameters	Answer
IDN	None	Detector name and serial number

Example

Command:	*IDN	Answer:	QE25LP-S-MB<CR><LF> S/N: 234567<CR><LF>

7 - Get state of charge

This command will return the monitor's state of charge.

Command	Parameters	Answer
SOC	None	Battery level, in %

Example

Command:	SOC	Answer:	State of charge: 98<CR><LF>

Note: the value is right-aligned.

4.5.3 Measurement commands

8 - Get measurement mode

This command will return the current measurement mode. Depending on the detector, it can be power mode in W, energy mode in J or single shot energy (SSE) mode in J.

Command	Parameters	Answer
GMD	None	Power = 0 Energy = 1 SSE = 2

Example

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

9 - Set measurement mode

This command will set the monitor's measurement mode.

Command	Parameters	Answer
SMM	0: Power 1: Energy 2: SSE	ACK

Example

Command: *SMM0 Answer: ACK<CR><LF>

4.5.4 Wavelength commands

10 - Get wavelength

This command will return the wavelength in nm.

Command	Parameters	Answer
GWL	None	Wavelength, in nm

Example

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

11 - Set wavelength

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. 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, to set the wavelength at 514 nm, you must enter 00514.

Specifying zero as a wavelength or providing an out-of-bound value as a parameter has no effect.

Command	Parameters	Answer
PWC	Wavelength nm	ACK

Default: Calibration wavelength (typically 1064 nm, varies with the detector model)

Example

The following example sets the wavelength to 1550 nm.

Command: *PWC01550 Answer: ACK<CR><LF>

4.5.5 Anticipation commands

12 - Get anticipation state

This command will return the anticipation state. If the anticipation is not available, it will always be at “off”.

Command	Parameters	Answer
GAN	None	1: On 0: Off

Example

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

13 - Set anticipation ON/OFF

This command will enable or disable the anticipation processing when the device is reading from a wattmeter. Anticipation is a software-based acceleration algorithm that provides faster readings using the detector’s calibration.

Command	Parameters	Answer
ANT	1: On 0: Off	ACK

Default: On

Example

The following example turns on the anticipation.

Command: *ANT1 Answer: ACK<CR><LF>

4.5.6 Attenuator commands

14 - Get attenuator state

This command will return the attenuator state. If the attenuator is not available, it will always be off.

Command	Parameters	Answer
GAT	None	1: On 0: Off

Example

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

15 - Set attenuator ON/OFF

This command is used to adjust the processing of the monitor with the readings of the detector, depending on whether the detector is using an external attenuator or not. This function is only available for detectors calibrated by Gentec-EO both with and without an attenuator.

Command	Parameters	Answer
ATT	1: On 0: Off	ACK

Default: Off

Example

The following example turns on the attenuator, which means that the attenuator is on the detector.

Command: *ATT1 Answer: ACK<CR><LF>

4.5.7 Scale commands

16 - Get auto-scale state

This command will return whether or not the auto-scale option is activated.

Command	Parameters	Answer
GAS	None	1: on 0: off

Example

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

17 - Set auto-scale ON/OFF

This command will enable or disable the auto-scale mode.

Command	Parameters	Answer
SAS	1: on 0: off	ACK

Default: 1 (on)

Example

Command: *SAS0 Answer: ACK<CR><LF>

18 - Get valid scales

This command will return a list of all the valid scales supported by the connected detector. The scales are displayed alongside their scale index. Please refer to the set scale section for the list of scales.

Command	Parameters	Answer
DVS	None	The list of valid scales

The following example is for a UP19K, which can have scales from 100 mW to 100 W.

Example

Command: *DVS

Answer:
[22]: 100.0 m<CR><LF>
[23]: 300 m<CR><LF>
[24]: 1.000<CR><LF>
[25]: 3.00<CR><LF>
[26]: 10.00<CR><LF>
[27]: 30.0<CR><LF>
[28]: 100.0<CR><LF>

19 - Set current scale

This command will set the scale used by the monitor. The minimum value of each scale is always zero. The maximum value of each scale can be found in the table below. The parameter must be one of the identifiers in the table below and have two digits. Sending this command will disable the auto-scale function.

Command	Parameters	Answer
SCS	Range index	ACK

Measurement scale indexes

Index	Value	Index	Value
00	1 picowatt or picojoule	21	30 milliwatts or millijoules
01	3 picowatts or picojoules	22	100 milliwatts or millijoules
02	10 picowatts or picojoules	23	300 milliwatts or millijoules
03	30 picowatts or picojoules	24	1 watt or joule
04	100 picowatts or picojoules	25	3 watts or joules
05	300 picowatts or picojoules	26	10 watts or joules
06	1 nanowatt or nanojoule	27	30 watts or joules
07	3 nanowatts or nanojoules	28	100 watts or joules
08	10 nanowatts or nanojoules	29	300 watts or joules
09	30 nanowatts or nanojoules	30	1 kilowatt or kilojoule
10	100 nanowatts or nanojoules	31	3 kilowatts or kilojoules
11	300 nanowatts or nanojoules	32	10 kilowatts or kilojoules
12	1 microwatt or microjoule	33	30 kilowatts or kilojoules
13	3 microwatts or microjoules	34	100 kilowatts or kilojoules
14	10 microwatts or microjoules	35	300 kilowatts or kilojoules
15	30 microwatts or microjoules	36	1 megawatt or megajoule
16	100 microwatts or microjoules	37	3 megawatts or megajoules
17	300 microwatts or microjoules	38	10 megawatts or megajoules
18	1 milliwatt or millijoule	39	30 megawatts or megajoules
19	3 milliwatts or millijoules	40	100 megawatts or megajoules
20	10 milliwatts or millijoules	41	300 megawatts or megajoules

Default: Auto-scale selection

Example

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

Command: *SCS07	Answer: ACK<CR><LF>

20 - Get current scale

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

Command	Parameters	Answer
GCR	None	Index from 0 to 41

Example

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

4.5.8 Moving average commands

21 - Get moving average

This command will return the moving average window time in seconds.

Command	Parameters	Answer
QTM	None	Window length in seconds

Default: The default value is 0.2 seconds for UP series with DB15 connector.

Example

Command: *QTM	Answer: Moving average: 5<CR><LF>

22 - Set moving average

This command will set the window for the moving average calculation. This moving average is applied as a smoothing factor to all power measurements. The window value is in seconds.

Command	Parameters	Answer
TIM	Moving average window (3 digits decimal number) examples: 600, 060, 006	ACK

Default: The default value is 0.2 seconds for UP series with DB15 connector.

 **Example**

The following example sets the window length to 2.5 seconds.

Command: *TIM2.5 Answer: ACK<CR><LF>

4.5.9 User correction commands

23 - Set zero

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

Command	Parameters	Answer
SOU	None	Please wait… Done!

 **Example**

Command: *SOU Answer: Please wait…<CR><LF>
Done!<CR><LF>

24 - Get user multiplier

This command will return the multiplier value.

Command	Parameters	Answer
GUM	None	Current multiplier value

 **Example**

Command: *GUM Answer:
Multiplier: +1.000000e+00<CR><LF>

25 - Set user multiplier

This command will set the value of the user-specified multiplier.

Command	Parameters	Answer
MUL	8-character numerical value	ACK

Default: 1

Example

The following example sets multiplier = 33

Command:	*MUL00000033 Or *MUL3.3000e1	Answer:	ACK<CR><LF>

26 - Get user offset

This command will return the offset value.

Command	Parameters	Answer
GUO	None	Current offset value

Example

Command:	*GUO	Answer: Offset: +1.500000e-03<CR><LF>	

27 - Set user offset

This command will set the value of the user-specified offset.

Command	Parameters	Answer
OFF	8-character numerical value	ACK

Default: 0

Example

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

Command:	*OFF0.001500 or *OFF1.500e-3	Answer:	ACK<CR><LF>

The other option available is the zero offset. The zero offset operation is done first, before the user multiplier and user offset are added to the calculation.

28 - Set user corrections ON/OFF

This command enables or disables the application of correction coefficients (Multiplier and Offset). If the user manually activates either the Multiplier or the Offset, the *COR argument will automatically switch to 1. Also note that the current scale will be automatically set to auto when correction is active.

Command	Parameters	Answer
*COR	1: on 0: off	ACK

Example

Command: *COR0 Answer: ACK<CR><LF>

29 - Get corrections state

This command will return the corrections state.

Command	Parameters	Answer
GUC	None	1: On 0: Off

Example

Command: *GUC Answer: Corrections: 0<CR><LF>

4.5.10 Trigger commands

30 - Get trigger level

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

This is for joulemeters and wattmeters in energy mode only.

Command	Parameters	Answer
GTL	None	Returns the trigger level in %.

Example

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

31 - Set trigger level

This command will set the internal software trigger level when using the device in energy mode.

Command	Parameters	Answer
STL	Trigger level (in percentage) must be four characters	ACK

Default: 2%

The value should be set between 0.1 and 99.9.

Example

Command: *STL15.4 (15.4%)
*STL00.2 (0.2%)
Answer: ACK<CR><LF>

32 - Set external trigger ON/OFF

This command activates or deactivates the external trigger for monitors which have an external trigger option.

Command	Parameters	Answer
ET	1: On 0: Off	ACK

Example

Command: *ET1
Answer: ACK<CR><LF>

33 - Get external trigger state

This command will return the external trigger status.

Command	Parameters	Answer
QET	None	1: on 0: off

Example

Command: *QET
Answer: External trigger: 0<CR><LF>

4.5.11 Analog output commands

34 - Get analog output scale

This command will return the output scale of the analog output feature. Please see the item “Analog output” in Section 1.4 for more information.

Command	Parameters	Answer
QAO	None	Analog scale, in W/V or J/V

Default: 1.00 W/V or J/V

Example

The following example sets the analog output scale to 0.5 watts/volt.

Command: *QAO Answer: Analog output scale: 0.500000<CR><LF>

35 - Set analog output scale

This command will set the output scale of the analog output feature. The value entered is the maximum value of the analog output in watts or joules. Please see the item “Analog output” in Section 1.4 for more information. The value entered must be entered in scientific notation as the example below and must contain exactly eight characters.

Command	Parameters	Answer
AOB	Analog scale W/V or J/V	ACK

Default: 1.00 W/V or J/V

Example

The following example sets the analog output scale to 5 watts/volt.

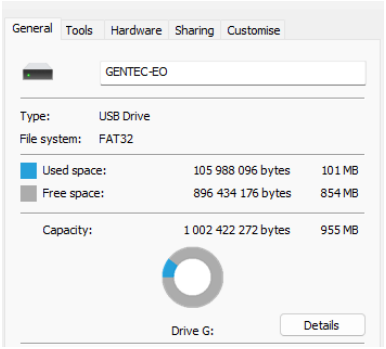
Command: *AOB5.00E+00 Answer: ACK<CR><LF>

5. FIRMWARE UPDATE PROCEDURE

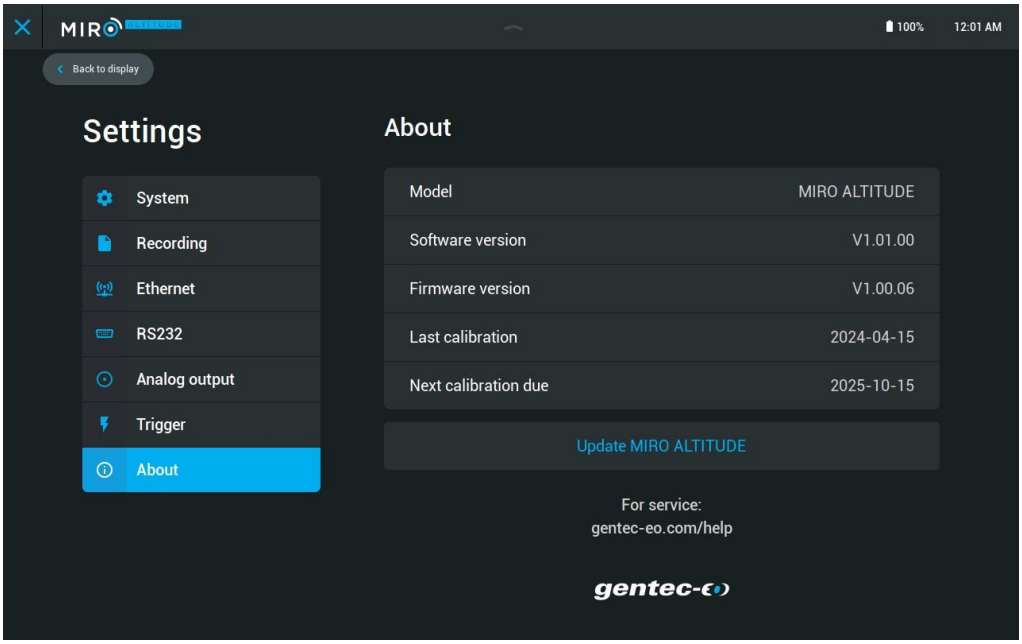
Note: the following instructions are for updating from V1.00.04 and above. If your MIRO ALTITUDE unit has software version V1.00.02, contact Gentec-EO.

Updating the MIRO ALTITUDE firmware is done by following these easy steps:

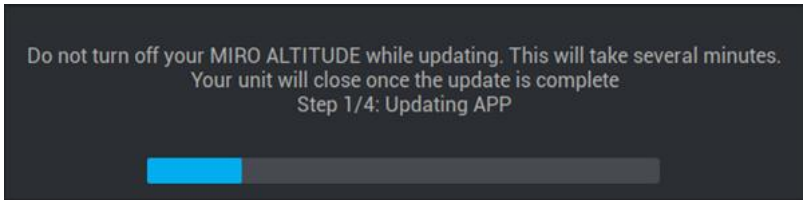
1. Look for the latest MIRO ALTITUDE firmware update and download the file on your computer: https://www.gentec-eo.com/resources/download-center.
2. Copy the update file (.zip package) on a USB key. Make sure your USB key is using the FAT32 format.



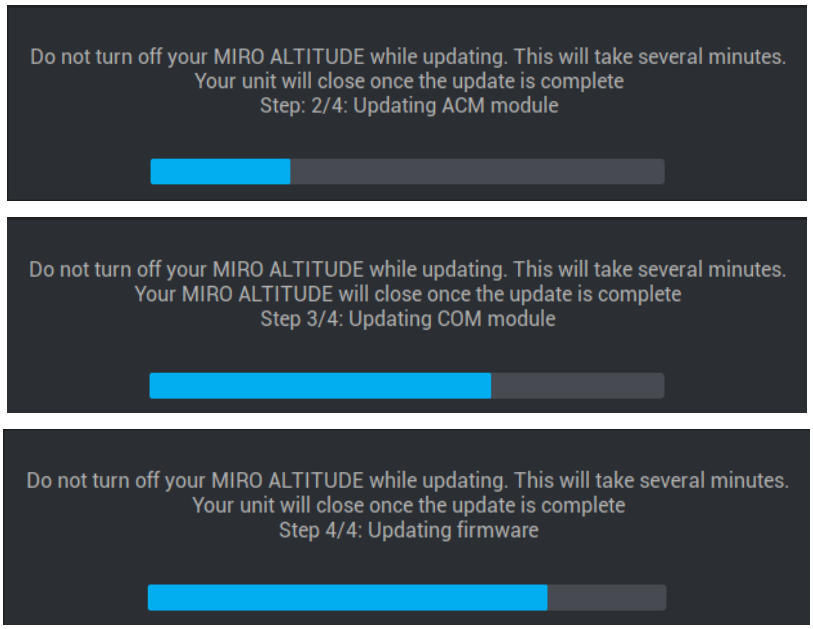
3. Insert the USB key into either USB-A port of the MIRO ALTITUDE.
4. Go to the settings/about menu and tap on Update MIRO ALTITUDE. Make sure that no detector is connected and that your power cable is plugged in.



5. The update process is done in four steps and does not require any input from you. DO NOT shut down or restart the device during this time. The update will take about 15 to 30 minutes.



After the first step, the MIRO ALTITUDE will restart itself automatically.



When the update is complete, the MIRO ALTITUDE will shut down.

6. DECLARATION OF CONFORMITY

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

CE

Manufacturer's Name:	Gentec Electro-Optics, inc.
Manufacturer's Address:	445, St-Jean-Baptiste, office 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 wattmeter/joulemeter
Model Number:	MIRO ALTITUDE
Year of test & manufacture:	2021

Declared conformity with the following regulations:

- Electromagnetic compatibility directive 2014/30/EU as part of the requirements leading to the CE marking
- FCC part 15 subpart B
- ICES-001 Issue 5 (2020), ICES-001(2020) calls CSA CISPR 11:19 as test standard, test parameters and limits
- EN61326-1 (2013) – Electrical equipment for measurement, control, and laboratory use. The immunity test requirements used for this qualification are for the equipment intended to be used in an industrial electromagnetic environment.

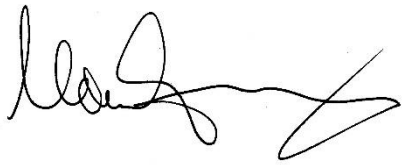
Product regulations

Test Name Standards	Test Specifications	Minimum Performance Criterion Required	EUT Test Configuration	EUT Serial Number	Results
Conducted Emissions FCC part 15 (2020) subpart B	Class A 150kHz-30MHz	N/A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Emissions FCC part 15 (2020) subpart B	Class A 30MHz-5GHz	N/A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Conducted Emissions ICES-001 Issue 5 (2020)	CSA CISPR 11:19 Group 1 - class A 150kHz-30MHz	N/A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Emissions ICES-001 Issue 5 (2020)	CSA CISPR 11:19 Group 1 - class A 30MHz-1GHz	N/A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Electrostatic Discharge Immunity IEC61000-4-2 (2008)	Contact: ±4kV Air: ±2kV, ±4kV, ±8kV	B	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Electromagnetic Field Immunity IEC61000-4-3 (2006) A1 (2007) A2 (2010)	80MHz-1000MHz: 10V/m 1GHz-2GHz: 3V/m 2GHz-2.7GHz: 1V/m	A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Electrical Fast Transient Immunity IEC61000-4-4 (2012)	Power: ±2kV / 5kHz I/O Ports: ±1kV / 5kHz Communication Ports: ±1kV / 5kHz	B	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass

Surge Immunity IEC61000-4-5 (2014)	Power: ±2kV L-PE / ±1kV L-L I/O Ports: N/A Communication Ports: N/A	B	DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields IEC61000-4-6 (2013)	Power: 3V I/O Ports: 3V Communication Ports: 3V	A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Power Frequency Magnetic Field Immunity IEC61000-4-8 (2009)	Continuous Field: 30A/m / 50Hz & 60Hz	A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC Input IEC61000-4-11 (2004) A1 (2017)	Voltage dips: 0%Un during half cycle 0%Un during 1 cycle 40%Un during 10 cycles (at 50Hz) 40%Un during 12 cycles (at 60Hz) 70%Un during 25 cycles (at 50Hz) 70%Un during 30 cycles (at 60Hz) Short interruptions: 0%Un during 250 cycles(at 50Hz) 0%Un during 300 cycles (at 60Hz)	B B C C C C C C	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass

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

Place: Québec
Date: Wednesday, April 14, 2021



(President)

7. UKCA DECLARATION OF CONFORMITY

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

Manufacturer's Name:	Gentec Electro-Optics, inc.
Manufacturer's Address:	445, St-Jean-Baptiste, office 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 wattmeter/joulemeter
Model Number:	MIRO ALTITUDE
Year of test & manufacture:	2021

Declared conformity with the following regulations:

- Electromagnetic compatibility directive 2014/30/EU as part of the requirements leading to the CE marking
- FCC part 15 subpart B
- ICES-001 Issue 5 (2020), ICES-001(2020) calls CSA CISPR 11:19 as test standard, test parameters and limits
- EN61326-1 (2013) – Electrical equipment for measurement, control, and laboratory use. The immunity test requirements used for this qualification are for the equipment intended to be used in an industrial electromagnetic environment.

Product regulations

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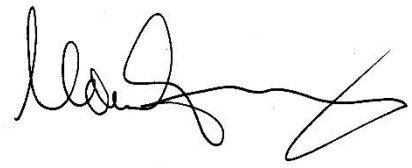
Conducted Emissions FCC part 15 (2020) subpart B	Class A 150kHz-30MHz	N/A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Emissions FCC part 15 (2020) subpart B	Class A 30MHz-5GHz	N/A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Conducted Emissions ICES-001 Issue 5 (2020)	CSA CISPR 11:19 Group 1 - class A 150kHz-30MHz	N/A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Emissions ICES-001 Issue 5 (2020)	CSA CISPR 11:19 Group 1 - class A 30MHz-1GHz	N/A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Electrostatic Discharge Immunity IEC61000-4-2 (2008)	Contact: ±4kV Air: ±2kV, ±4kV, ±8kV	B	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Radiated Electromagnetic Field Immunity IEC61000-4-3 (2006) A1 (2007) A2 (2010)	80MHz-1000MHz: 10V/m 1GHz-2GHz: 3V/m 2GHz-2.7GHz: 1V/m	A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Electrical Fast Transient Immunity IEC61000-4-4 (2012)	Power: ±2kV / 5kHz I/O Ports: ±1kV / 5kHz Communication Ports: ±1kV / 5kHz	B	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass

Surge Immunity IEC61000-4-5 (2014)	Power: ±2kV L-PE / ±1kV L-L I/O Ports: N/A Communication Ports: N/A	B	DC Jack Mode	LABCEM# 2841	Pass
			USB-C Mode	LABCEM# 2841	Pass
Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields IEC61000-4-6 (2013)	Power: 3V I/O Ports: 3V Communication Ports: 3V	A	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Power Frequency Magnetic Field Immunity IEC61000-4-8 (2009)	Continuous Field: 30A/m / 50Hz & 60Hz	A	Battery	LABCEM# 2840	Pass
			DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass
Voltage Dips, Short Interruptions and Voltage Variation Immunity on AC Input IEC61000-4-11 (2004) A1 (2017)	Voltage dips: 0%Un during half cycle 0%Un during 1 cycle 40%Un during 10 cycles (at 50Hz) 40%Un during 12 cycles (at 60Hz) 70%Un during 25 cycles (at 50Hz) 70%Un during 30 cycles (at 60Hz) Short interruptions: 0%Un during 250 cycles(at 50Hz) 0%Un during 300 cycles (at 60Hz)	B B C C C C C C	DC Jack Mode	LABCEM# 2840	Pass
			USB-C Mode	LABCEM# 2840	Pass

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

Place: Québec
Date: Wednesday, May 25, 2022



(President)

8. WEEE DIRECTIVE

Recycling and sorting procedure from WEEE Directive 2002/96/EC

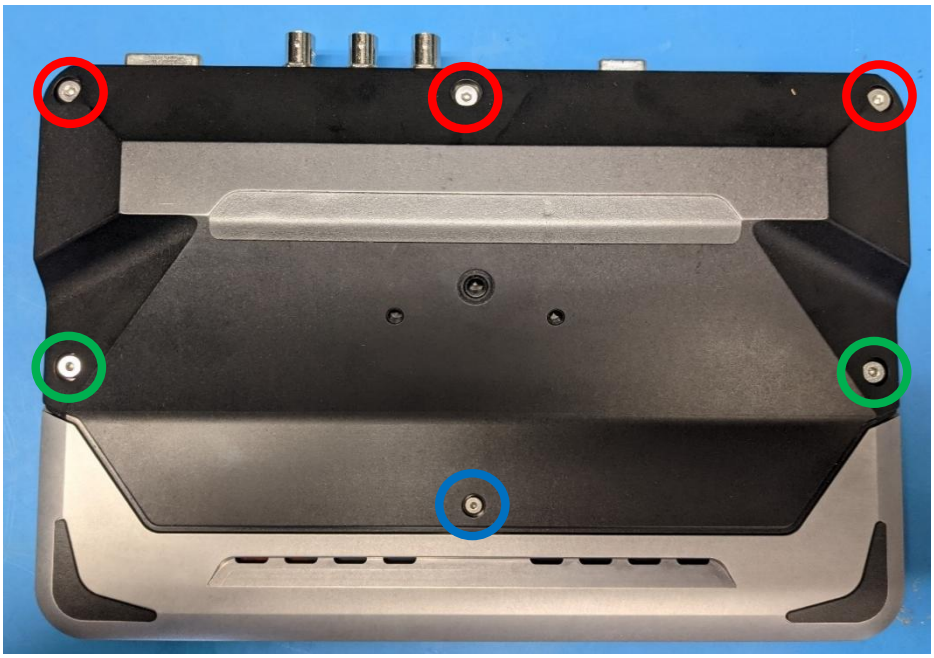
This section is meant for the recycling center when the device has reached its end life. Breaking the calibration seal or opening the device will void the MIRO ALTITUDE's warranty.

Sorting

Paper: manual and certificate
Plastic: button
Cables: USB-C cable and supply cable
Printed circuit board: inside the device and on the screen
Aluminum: device casing
Glass: screen

Opening the device

Remove the six screws in the back of the device (see below).



Remove the three screws with the BNC in the front of the device (see below).

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PARTNERS for ACCURACY

WWW.GENTEC-EO.COM

LEADER IN LASER BEAM MEASUREMENT **SINCE 1972**

POWER & ENERGY METERS

BEAM PROFILING

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  114-0023, JAPAN