
THORLABS

Optical Power Monitor Operation Manual



2024

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We aim to develop and produce the best solution for your application in the field of optical measurement technique. To help us to live up to your expectations and constantly improve our products we need your ideas and suggestions. Therefore, please let us know about possible criticism or ideas. We and our international partners are looking forward to hearing from you.

Thorlabs GmbH

Warning

Sections marked by this symbol explain dangers that might result in personal injury or death. Always read the associated information carefully, before performing the indicated procedure.

Attention

Paragraphs preceded by this symbol explain hazards that could damage the instrument and the connected equipment or may cause loss of data.

Note

This manual also contains "NOTES" and "HINTS" written in this form.

Please read this advice carefully!

1 General Information

The Thorlabs Optical Power Monitor (OPM) is a graphical user interface ([GUI](#)) designed for the straightforward use of Thorlabs power meters in the table below. The OPM Software monitors and saves power meter measurements and features an interface for data viewing and analysis. A variety of settings for the connected devices, the display, and the measurement can be easily configured.

To control complex setups, the OPM Software can monitor up to 8 Thorlabs sensors or Thorlabs power meters connected in parallel via USB, Bluetooth, or Network on your computer.

The OPM Software provides continuous data logging for long-term measurements. Short-term measurements are monitored and recorded by the software with a high resolution.

The user can switch between displayed parameters and connected sensors at any time during an active measurement or use the simulated analog needle view for assistance during tuning.

Log files saved by the OPM Software or data saved by a [PM400](#), [PM5020](#), [PM60 Series](#), or [PM61 Series](#) power meter can be loaded into the Optical Power Monitor Data Viewer for viewing or analysis. Additionally, the Optical Power Monitor provides statistics parameters to evaluate the results.

The display language can be set to English, German, or Chinese.

Beyond these capabilities, the Optical Power Monitor provides a user-friendly design with reduced overall brightness for comfortable work in dark environments and high contrast and minimized use of color coding for operability with laser safety glasses.

The Optical Power Monitor supports the following Thorlabs devices and appropriate sensors and can administer them in parallel.

Power and Energy	Polarization	Detector	Sensor
PM5020 PM60 Series PM61 Series ¹⁾ PM101x PM102x PM103x PM400 PM100D PM100A PM200 PM100USB PM160x ¹⁾ PM16-Series	ERM-Series	SPCNT	TSP01 (REV B - Temperature and Humidity Sensor)

¹⁾ Bluetooth Connection Possible

Different Thorlabs devices provide additional functions, listed in the chapter [Optical Power Monitor with different Devices](#).

Note

The OPM Software contains the functions provided by the **Optical Power Meter Utility**, **Multi Power Meter**, and **Power Meter Monitor** software packages and provides many additional features.

Attention**New Instrument Driver**

Please note that the OPM installs and uses the newer power meter driver TLPMX.dll instead of the formerly used NI-VISA™-based driver [PM100D](#).dll. In case you want to use any of the old software packages **Optical Power Meter Utility**, **Multi Power Meter** or **Power Meter Monitor** or if you are using **Custom Made Software**, please read the [Instrument Driver for Thorlabs Power Meters](#) section to revert to the driver [PM100D](#).dll.

2 Requirements

These are the requirements for the PC intended to be used for the installation of the OPM Software.

Hardware Requirements

CPU	: 2.4 GHz or Faster
RAM	: Min. 4 GB
Graphic Card	: Min. 1024 x 768 Pixel Graphic Resolution
Hard Disc	: Min. 1 GB of Available Free Space (32-bit Operating System) Min. 2.3 GB of Available Free Space (64-bit Operating System)
Interface	: Free USB 2.0 Port, USB Cable According to the USB 2.0 Specification

Software Requirements

The OPM Software is compatible with the following operating systems:

- Windows® 10 (32-bit, 64-bit)
- Windows® 11

3 First Steps

The OPM Software can be downloaded [here](#).

Installing OPM Software

Note

Do not connect a power meter to the PC during software installation! Please make sure that the installation is carried out completely, including the reboot requests.

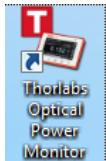
Note

Up to 8 power meters can be connected and monitored in parallel in a single software instance. If your PC does not provide a sufficient number of USB-ports, use a powered USB-HUB to ensure that enough power is supplied to the power meters.

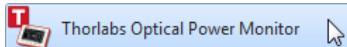
1. Save the ZIP file to your computer and unpack the archive.
2. Double click the setup.exe to install Shield Wizard.
3. Read and accept the End-user License Agreement and the GNU Lesser general Public License.
4. Note the Readme Information during the installation process: A new and improved instrument driver ([TLP MX Instrument Driver](#)) is installed.
5. After installing the OPM, connect the power meter(s) to the PC.

Start Application

Start the OPM from the **DESKTOP** icon:



or access the OPM from the **START** button:



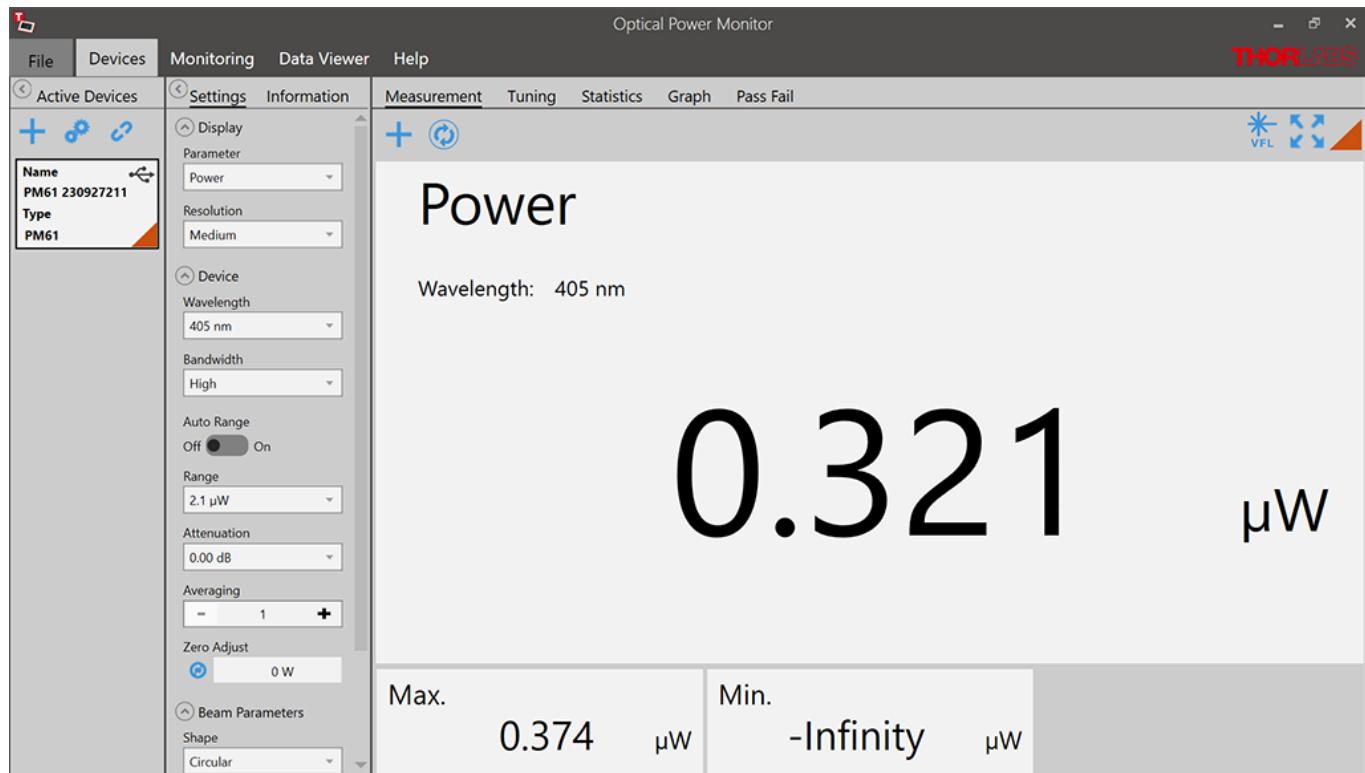
Note

When connecting an additional power meter, unknown to the PC, the driver for this power meter will be installed as indicated on the bottom right corner of the screen.

4 Graphical User Interface (GUI)

In this manual, the OPM interface is described based on a set up using a power meter console consisting of a Thorlabs PM61 Series connected to a PC running with OS Windows® 11. Variations in the interface due to certain power meter consoles are described in the section [OPM with Different Devices](#).

The OPM automatically connects the first recognized power meter, lists it in the left panel in [Active Devices](#) (here: PM61 Series) and shows the setting options for power measurements recorded by the connected power meter.



Menu Bar

File	Load File, Load Folder, Print Screen, Save Screen and Exit
Devices	Activate Devices, Settings and Measurements
Monitoring	Set Up a Measurement to be Logged and Saved (Active after Device Configuration)
Data Viewer	View and Analyze Loaded Files
Help	Options (Language Settings, Information on Manual, and Tools), About (Information on Supported Devices, Versions, and Drivers)

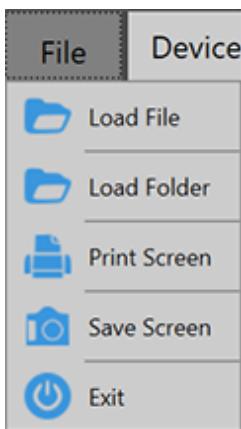
To setup a short measurement, go through the sub menu of [Devices](#) or use the [Monitoring menu](#) for long term logging.

Note

If no power meters are connected to the PC or automatically recognized, the OPM starts with the [Found Devices](#) panel instead of the [Measurement](#) panel. Use the [Found Devices](#) panel to scan for devices and connect them to the software.

4.1 File

The File menu provides the following options:



Load File	Load Files Generated in Monitoring
Load Folder	Load Files Generated by Thorlabs Devices
Print Screen	Print a Screen Shot
Save Screen	Generate a Screen Shot to be Saved as an Image
Exit	Exit OPM Software

Note

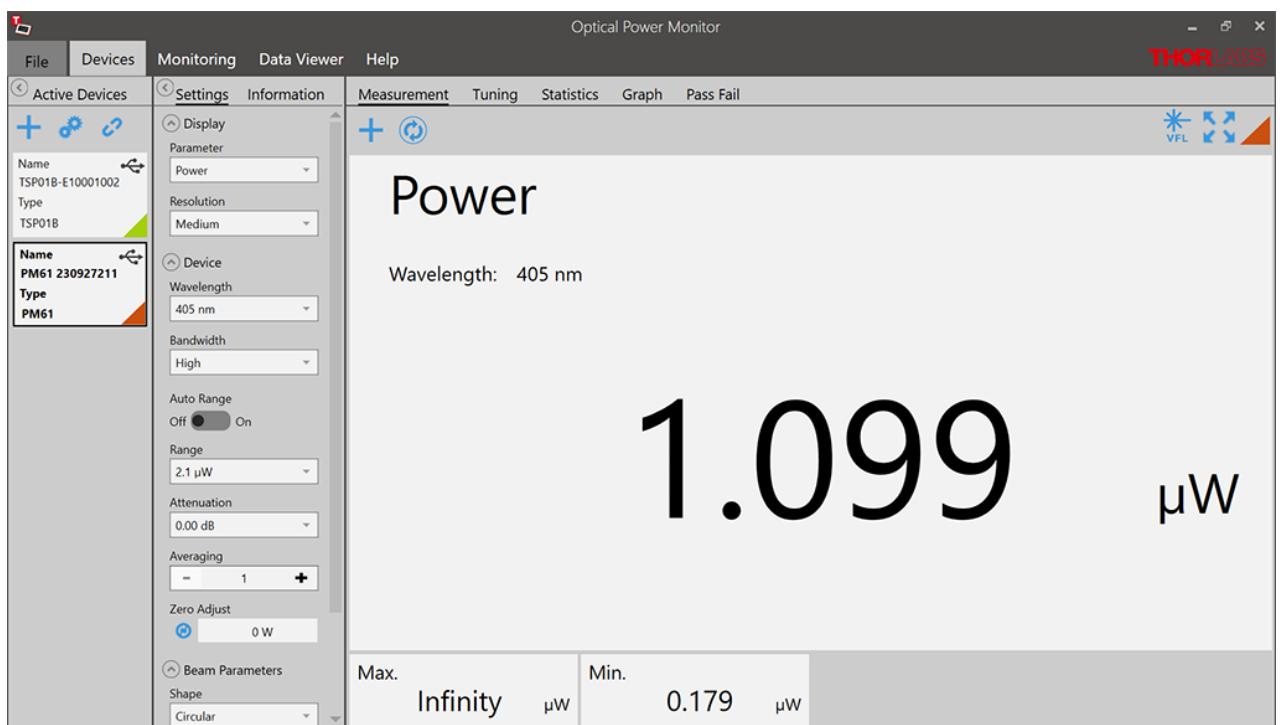
PM400 files: The file structure of data saved by the OPM and the PM400 differ. Both file formats can be loaded by the OPM by selecting the appropriate import option. Also note the information given in the chapter [File Format](#).

4.2 Devices

The Devices menu administers the currently connected devices, short-term measurements and the respective settings.

To start a measurement, follow the sequence suggested by the menu bar from left to right:

- [Activate Devices](#)
- Adjust [Settings](#)
- Observe the [Measurement](#)



Menu Bar

<u>Active Devices</u>	Administer Connected Power Meters
<u>Settings</u>	Administer Settings of the Display and Connected Devices
<u>Information</u>	Information about the Connected Devices
<u>Measurement</u>	Active Measurement Display
<u>Tuning</u>	Analog Needle Simulation with Digital Measurement Value
<u>Statistics</u>	Statistics Tool to Setup, Display, and Save Statistics of the Active Measurement
<u>Graph</u>	Tool for Short-Term Measurements with High Sampling Resolution

Note

If no power meters are connected to the PC or automatically recognized, the OPM starts with the [Found Devices](#) panel instead of the [Measurement](#) panel. Use [Found Devices](#) to scan for devices and connect them to the OPM Software. The OPM automatically connects the first recognized power meter.

4.2.1 Active Devices

Devices connected to the software will automatically appear in the list [Active Devices](#). To activate additional devices, connect them in the [Found Devices](#) panel. The OPM automatically recognizes devices connected to the PC and connects to the first recognized device any time the software is started.

In the example below, the PM61 Series power meter is connected to the PC. The PM61 Series power meter has automatically been connected to the OPM and therefore appears in the panel **Active Devices**.

Active devices receive a default name consisting of the power meter type and the serial number of the sensor. This default name can be [edited](#) to a name of choice.

Note

Devices that were connected to the software in the previous session are automatically reconnected to the software. Device name and settings from the previous session are automatically loaded in the new session.

Use the **Tool Bar**, to add or edit the active devices:



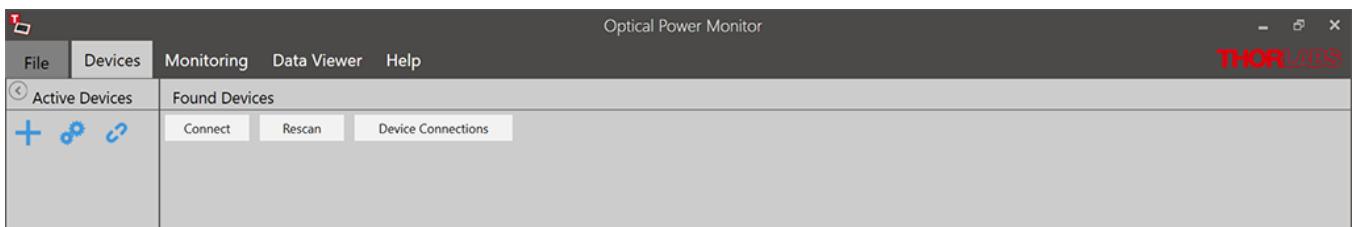
- [Add devices](#): Add Devices to the List of **Active Devices**.
- [Edit](#): Rename Devices.
- [Disconnect](#): Disconnect Devices from the OPM Software.

Note

In case a device was not recognized by the OPM, please reconnect the device to the PC.

4.2.1.1 Add Devices

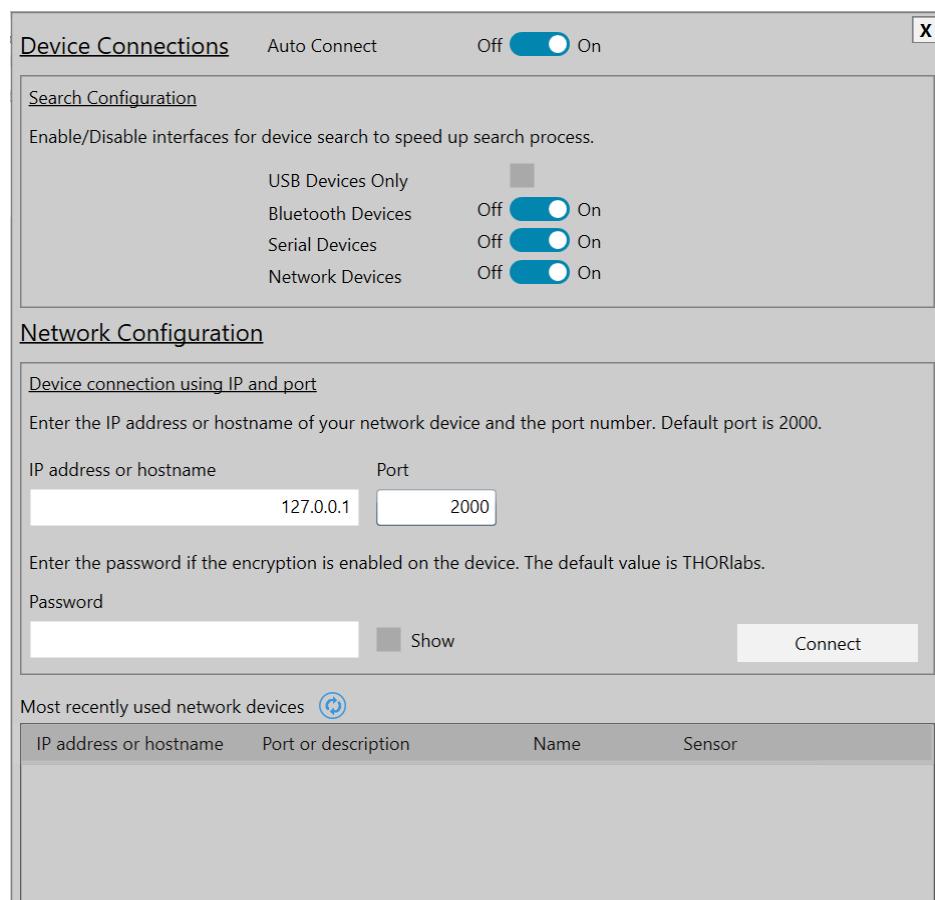
In addition to the direct connection (e.g. via USB), devices can also be connected via Bluetooth. After starting the OPM Software for the first time, the following settings must be made under the "Device Connections" tab in order to connect devices:



Device Connections

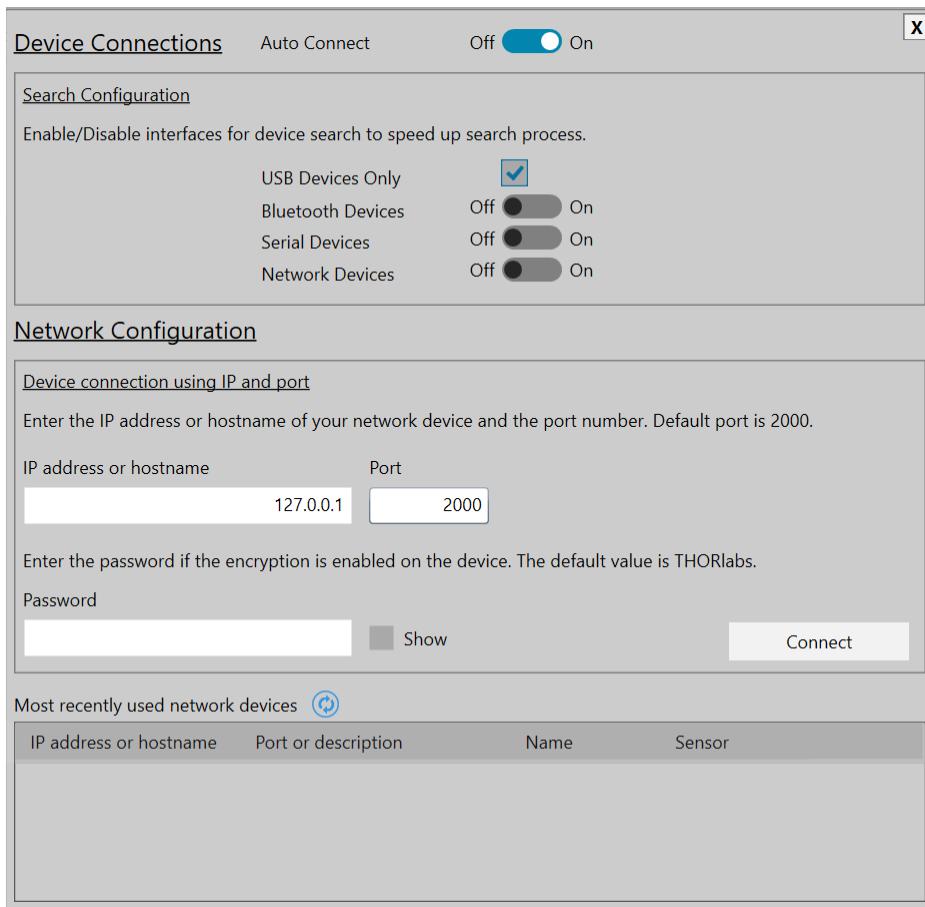
Devices can be connected automatically or manually. Use the slide control to select between On/Off whether the connection to a device should be automatic or manual.

When a device is connected via interface to the PC and "Auto Connect" is in state "On", the device connects automatically when the OPM Software is started.



Search Configuration

By default, the connection to devices via USB is permanently set via the OPM Software.



1. Click on the click box, to enable only USB connections.
2. Select one of the slide controllers to extend the connection to the following connection types:
 - Bluetooth
 - Serial Devices
 - Network Devices

It is recommended to customize the search configuration to enable a quick search of the devices. Therefore select the necessary interfaces to which you want to connect devices.

Network Configuration

The "Network configuration" allows you to add devices via the network. Before devices can be added via the "Network Configuration", the search for "Network Devices" must be in "On" mode.

Device Connection Using IP and Port

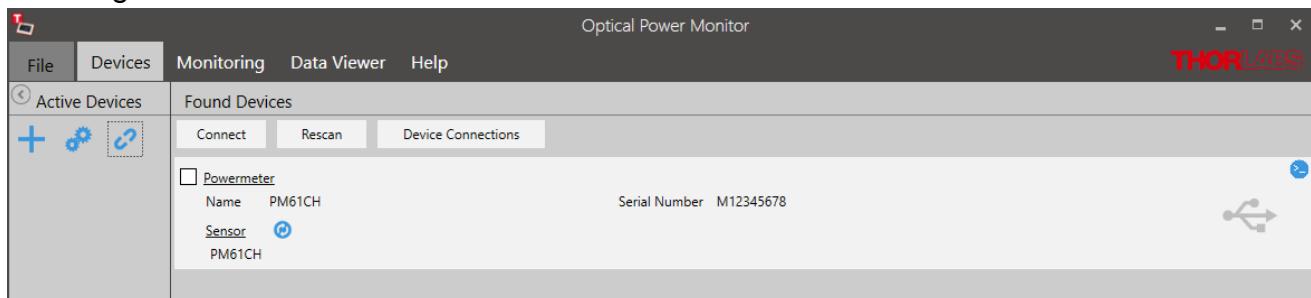
1. Enter the IP address or hostname of your network device and the port number in the entry fields. The default port is 2000.
2. Enter the Password of your the device in the entry fields, if the encryption is enabled.

Recently used network devices can be found under "Most recently used network devices".

Click on the button and refresh the list of recently used network devices.

Adding Devices to Connected Devices

Use the "Found Devices" panel to connect power meter devices to the OPM by activating them in the Active Devices list.



1. Click in the **Active Devices** table to add devices.
2. Click "Rescan" if no devices are detected to find all devices connected to the PC or reconnect devices to the PC.
Here, the are recognized. The panel **Found Devices** shows details about the devices that are connected to the PC.
3. Click to view sensor information.
 - Mark the click box in **Found Devices** and click "Connect" to activate devices.
 - Click on a device in **Active Devices** to return to the **Devices** menu and view measurements.

Note

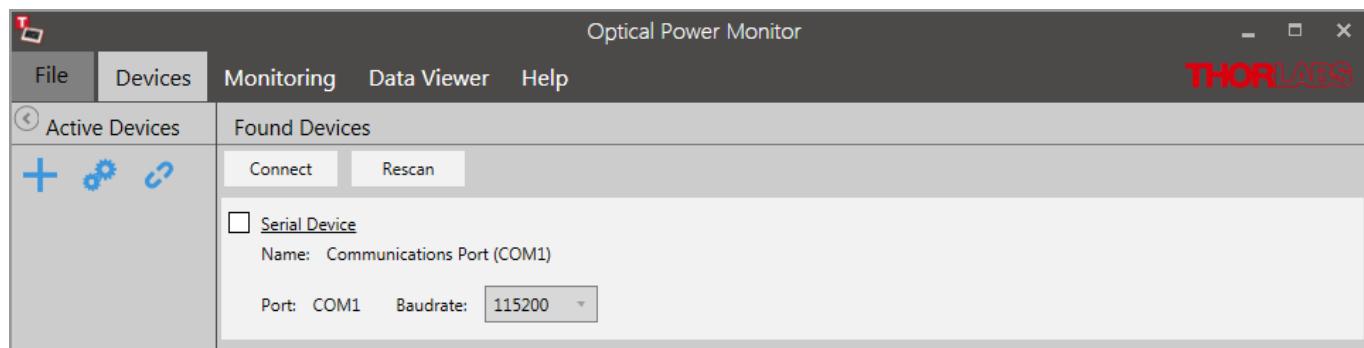
When the first recognized device is connected to the software, the display changes to monitor a measurement as shown in [Devices](#).

Note

If no power meters are connected to the PC or automatically recognized, the OPM starts with the [Found Devices](#) panel.

COM-PORT

When using a PM101, PM101R, PM102, or PM103 device over a serial interface, the COM Port can be selected by clicking the respective field. Please also adjust the Baud rate in this interface. For more information, please see the manuals for [PM101x](#) and [PM102x](#), [PM103x](#).



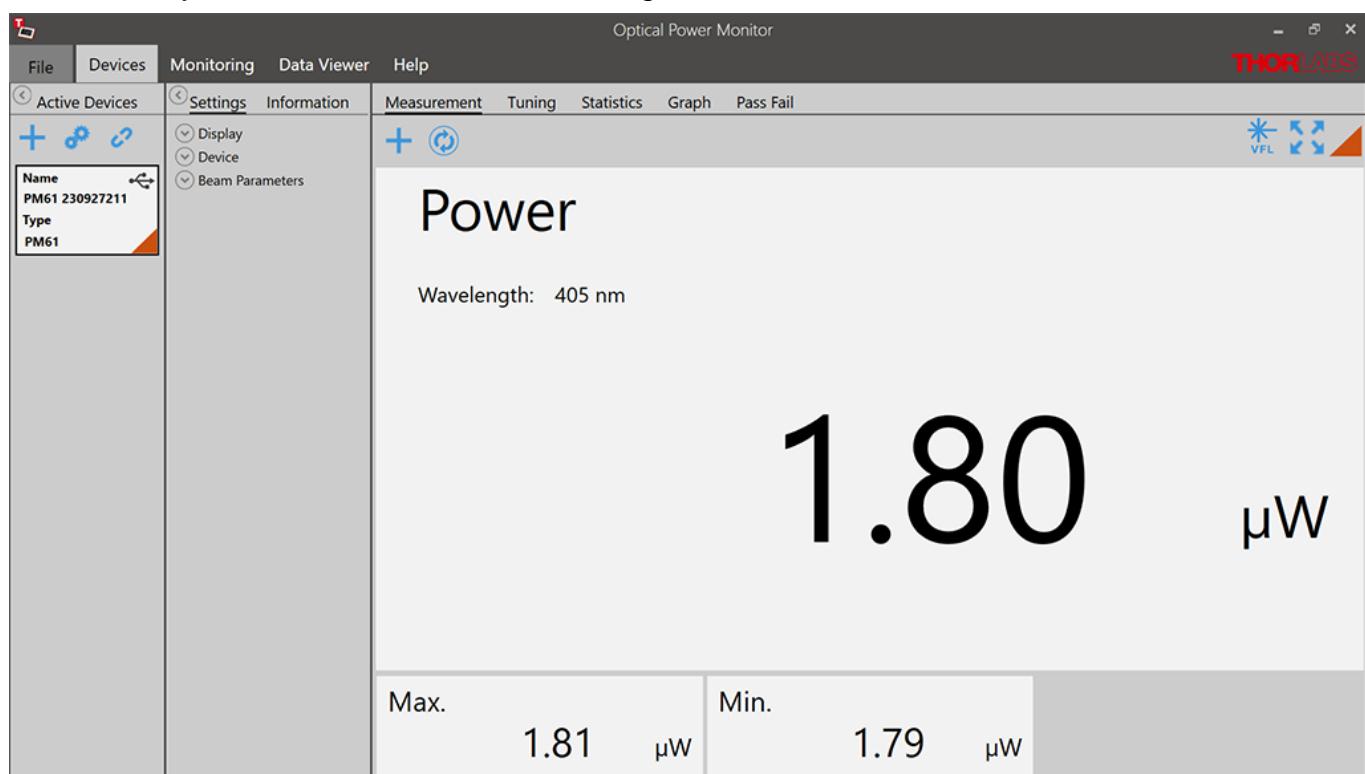


The power meter is now controlled via RS232 operation via the DE-9 or DA-15 port. The status is shown in the field Active Devices next to the device name.

Attention

Be aware that different [instrument drivers](#) may be used by your device. The OPM recognizes and runs with power meters using the new driver TLPMX or a legacy driver PM100D. However, when running the software with a connected PM400, PM101x, PM102x, or PM103x with the old PM100D driver, the software will not provide all functions.

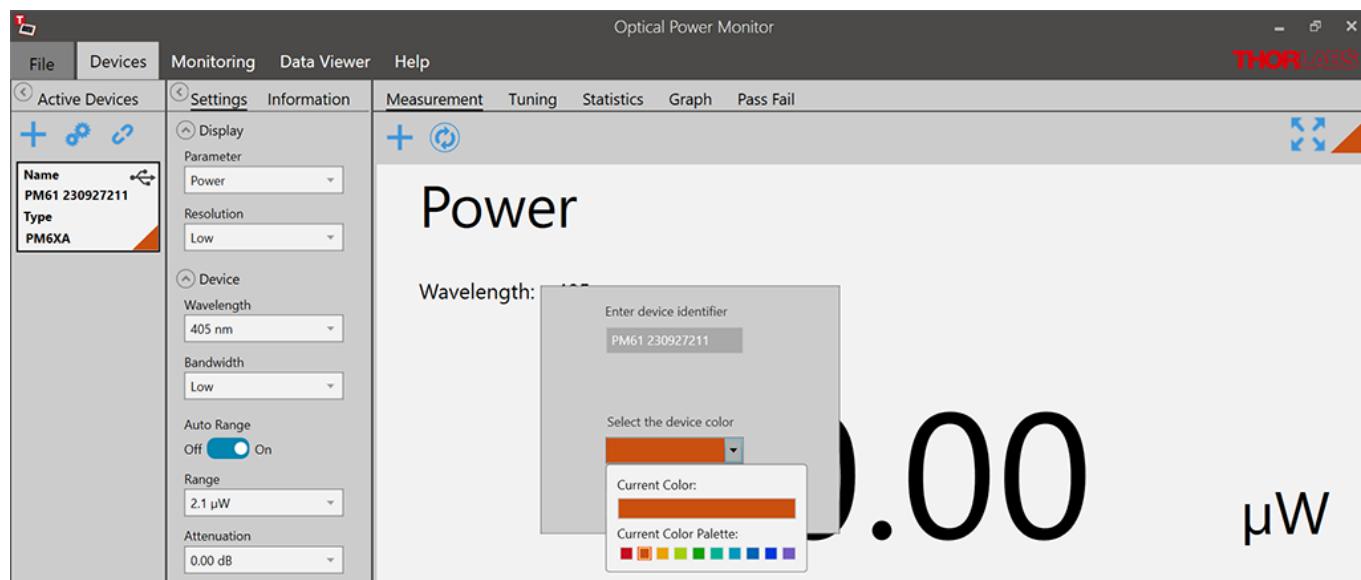
In case the legacy driver PM100D is used, the information panel under devices will show a field USB driver, indication NI-VISA™. In this case, please use the [driver switcher](#), that is automatically installed with the OPM to change to the new driver TLPMX.



4.2.1.2 Edit Devices

Click  to edit the Active Devices list.

Use the panel below to rename the device or change the identification color.



4.2.2 Settings

Device settings and measurement settings need to be adjusted in the Settings menu prior to the measurement by using the drop down menus shown below.

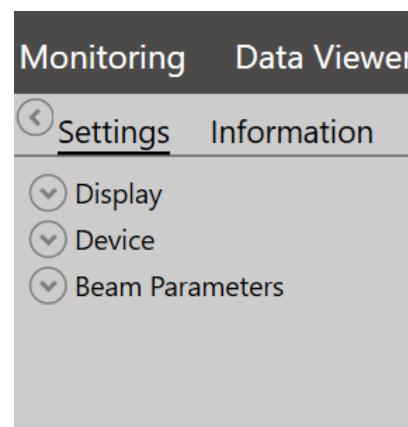
Note

Changes in the settings made during a measurement are applied immediately and impact the measurement. Changes in settings during active measurements are not saved!

Attention

As the OPM calculations depend on these settings, correct settings are essential for best measurement accuracy.

Settings



Display

Adjust Display Settings

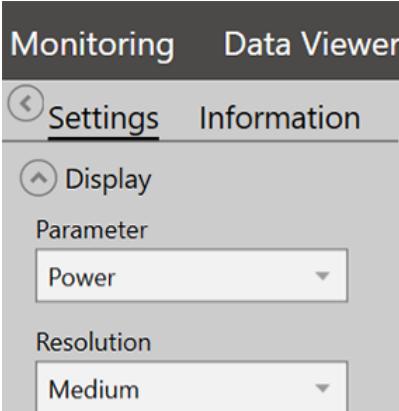
Device

Adjust Device Settings

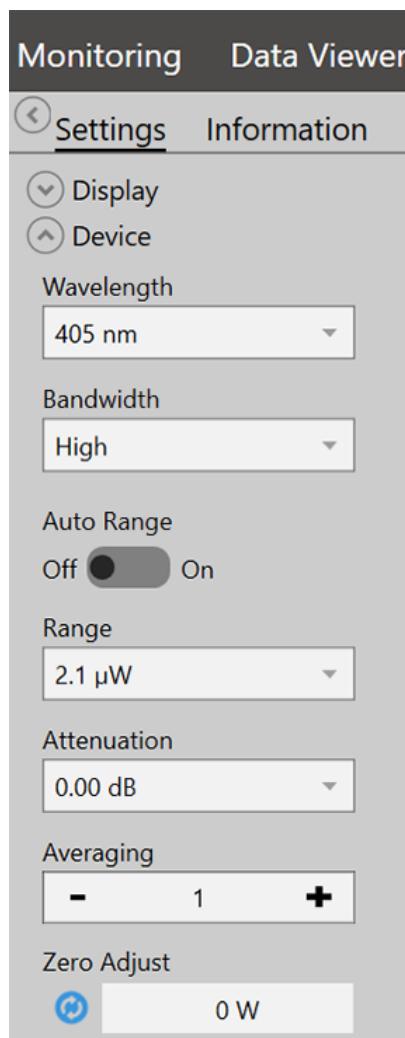
Beam Parameters

Adjust Light Source Settings

Display

 <p>The screenshot shows the software's main menu at the top with options: Monitoring, Data Viewer, Settings, Information, and Display. Under the Display section, there are two dropdown menus: 'Parameter' set to 'Power' and 'Resolution' set to 'Medium'.</p>	Parameter	Select the parameter that should be displayed as the main parameter in all 4 measurement monitors: Measurement, Tuning, Statistics, and Graph.
	Resolution	Set the desired measurement resolution.

Device



Wavelength Set the wavelength of the measured light. This is essential in order to compensate the measurement result for the wavelength-dependent responsivity of the sensor.

Bandwidth Set the bandwidth of the photodiode to low or high, depending on the incoming signal and the properties of your photodiode sensor (please see the specification of your sensor and the Thorlabs [Photodiode Tutorial](#)).

Auto Range Maximum value to be measured within the selected power range. This displayed value is calculated by the power meter. It is recommended to use the default setting Auto Range On.

Use Auto Range Off, to set the measurement range manually, for example for measurement of pulsed light sources.

Range Maximum value to be measured within the selected power range. This displayed value is calculated by the power meter. It is recommended to use the default setting Auto Range On.

Attenuation To account for the attenuation of optical components placed between the light source and the power meter sensor (e.g. filters, beam splitters, etc.), a correction factor can be assigned. For exceptions see the section [Power Meter Dependent Variations](#).

Averaging Choose the number of values averaged. Averaging is calculated by the software and thus the measurement values may differ from the values displayed on the power meter consoles. Measurement values are provided to the software by the connected Thorlabs power meter at the specified refresh rate described in the [power meter manual](#). When choosing to average the measurement values, all measurement values displayed within the OPM will be averaged.

Zero Adjust Compensate the measurement result for the measured dark signal or noise.

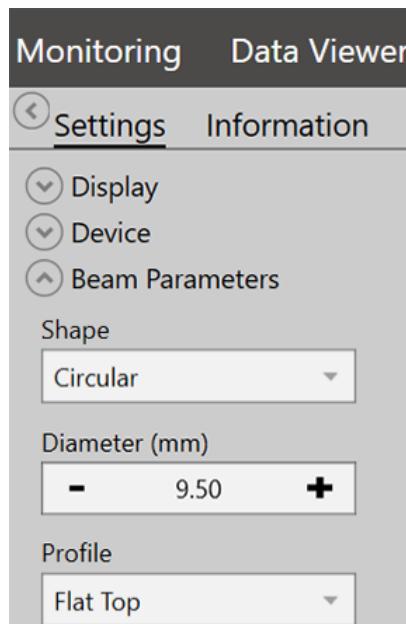
AOx Responsivity For PM101 (AO2) and PM101A (AO), PM102 and PM102A (POWER AO), PM103 and PM103A (AO2), and [PM5020](#) (AOx) the OPM allows to define the voltage level of the analog output by configuring the responsivity. Please see the manuals of [PM101x](#), [PM102x](#), [PM103x](#), and [PM5020](#) for more details.

Note

Depending on the power meter, not all options may be displayed.

Beam Parameters

The Beam Parameters are relevant when calculating Irradiance or Fluence (for pyro sensors).

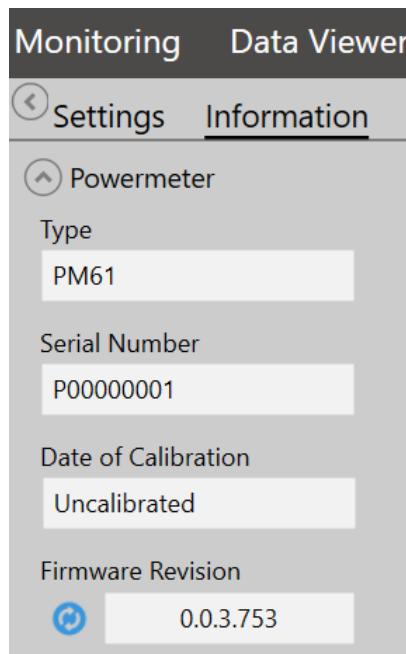


- Shape** Choose between circular, square or rectangular according to your light source and optics.
- Diameter** Adjust the size of the beam arriving on the photo sensor according to your light source and optics.
- Profile** Adjust beam profile arriving at the photo sensor according to your light source and optics.

4.2.3 Information

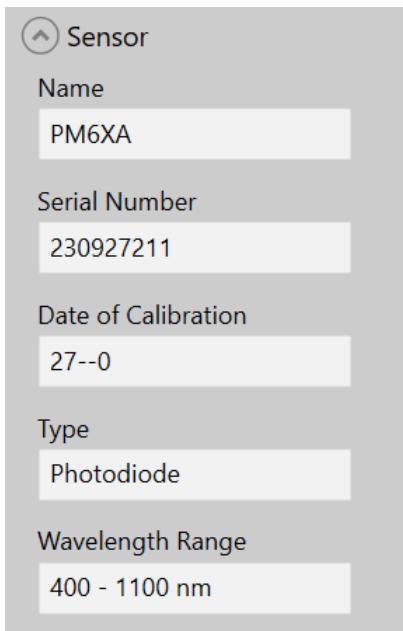
This menu lists information about the connected devices, Power Meters and Sensors, as retrieved from the connected device.

Powermeter



- Type** Type of Thorlabs power meter
- Serial Number** Serial number of the device
- Date of Calibration** Date of last sensor calibration
- Firmware Revision** Current firmware version of the device.
Update the firmware by clicking the button.

Sensor



Name	Sensor name
Serial Number	Serial number of the sensor
Date of Calibration	Date of last sensor calibration
Type	Type of sensor (photodiode, thermal-, or pyroelectric sensor)
Wavelength Range	Wavelength range of detection of the sensor

Attention

When the software uses the power meter driver PM100D.dll, this is shown in the interface in the power meter section below "Firmware". When running the software with a connected PM400, PM101x, PM102x, or PM103x with the old PM100D driver, the software will lack certain functions. To switch the driver, please see the chapter [Power Meter Driver Switcher](#).

4.2.3.1 User Calibration of Sensors

The OPM provides a Calibration Wizard for the user to calibrate Thorlabs Photodiode and Thermopile Sensors in combination with a power meter.

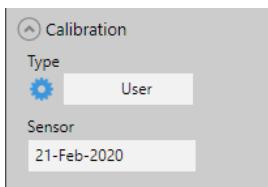
In principle, the Calibration Wizard uses a measured single point signal from a trusted reference sensor to calibrate the sensor connected to the power meter. The determined correction factor and calibration data are then saved with the serial numbers of the sensors in the internal memory of the power meter and retrieved by the OPM. Up to 5 datasets can be saved. Information remains there until new calibration data overrides it. The user can revert the recalibration any time and return to the factory calibration.

The following power meters support this function: PM400, PM101x, PM102x, PM103x.

Calibration protocol

Before starting the calibration, provide a power meter, a light source, a reference sensor, and the sensor to be calibrated.

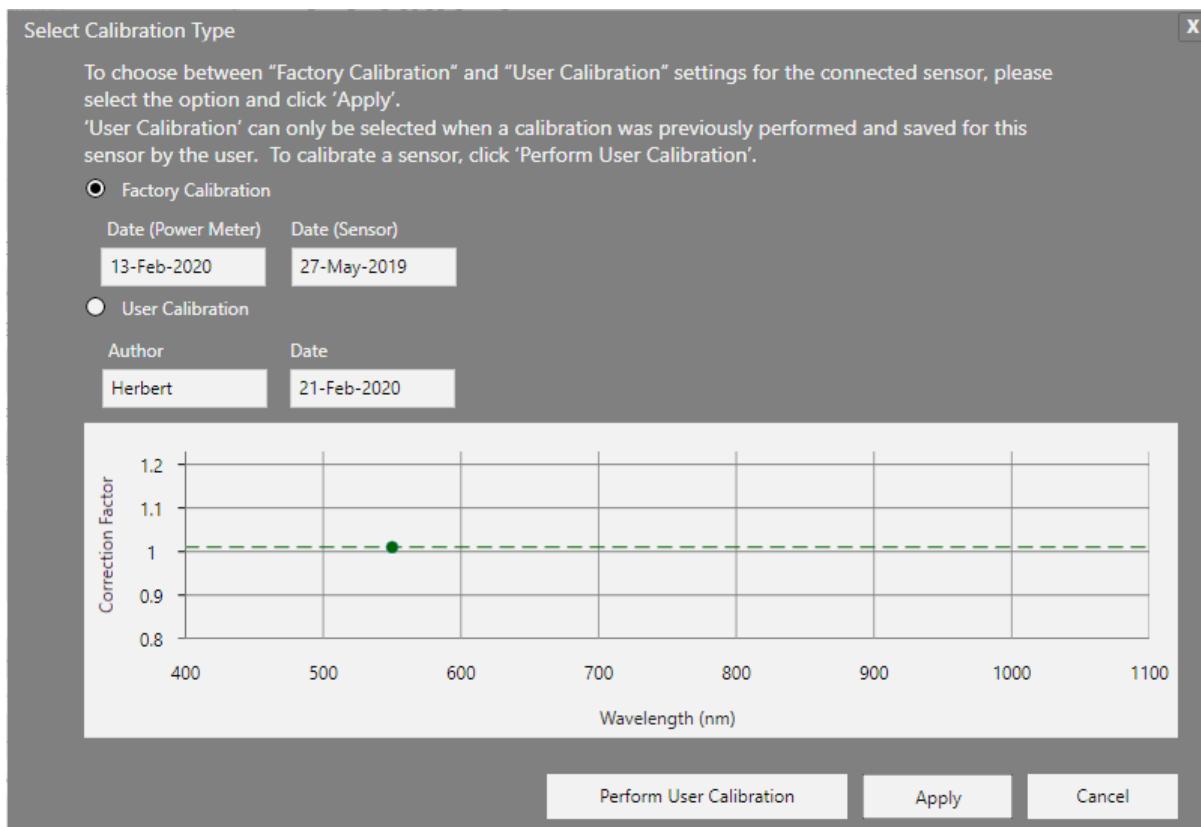
Open the Calibration Wizard by clicking in the Information panel.



The wizard leads the customer through the protocol.

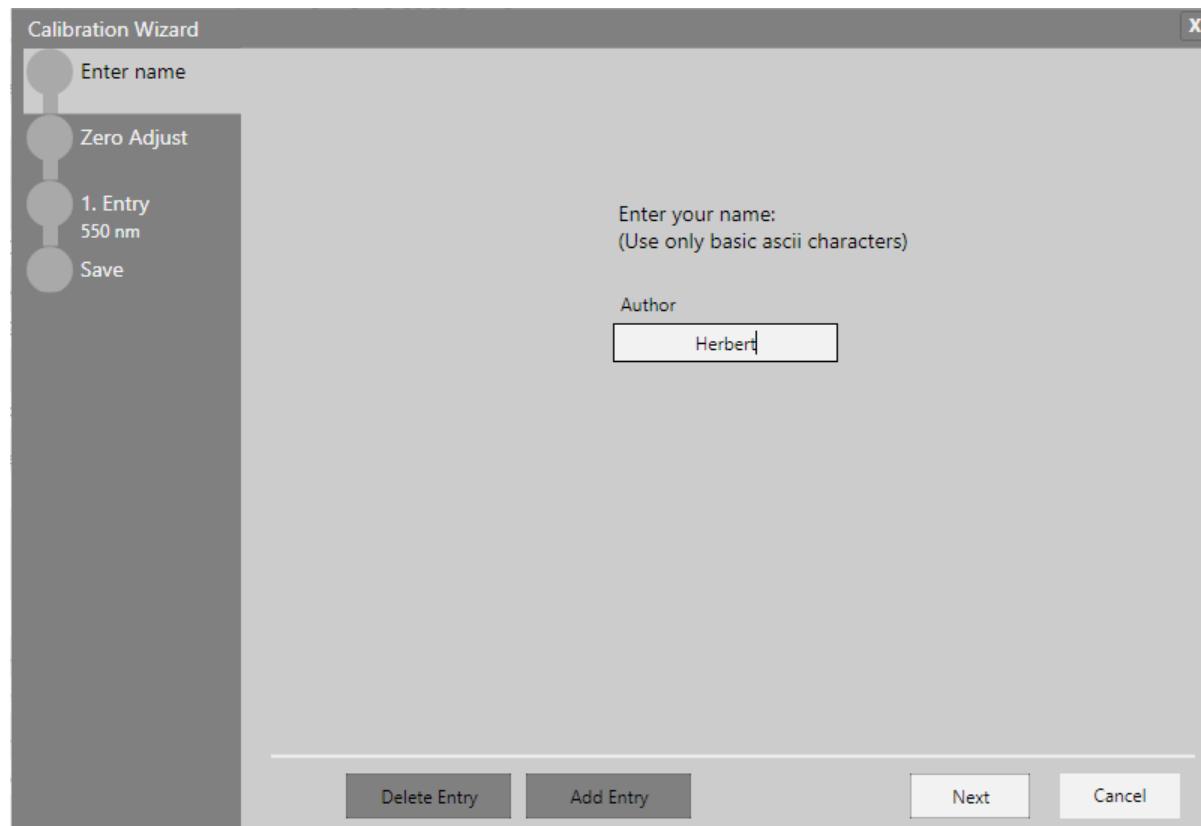
The start screen allows to choose between the factory calibration and a user calibration.

Optical Power Monitor

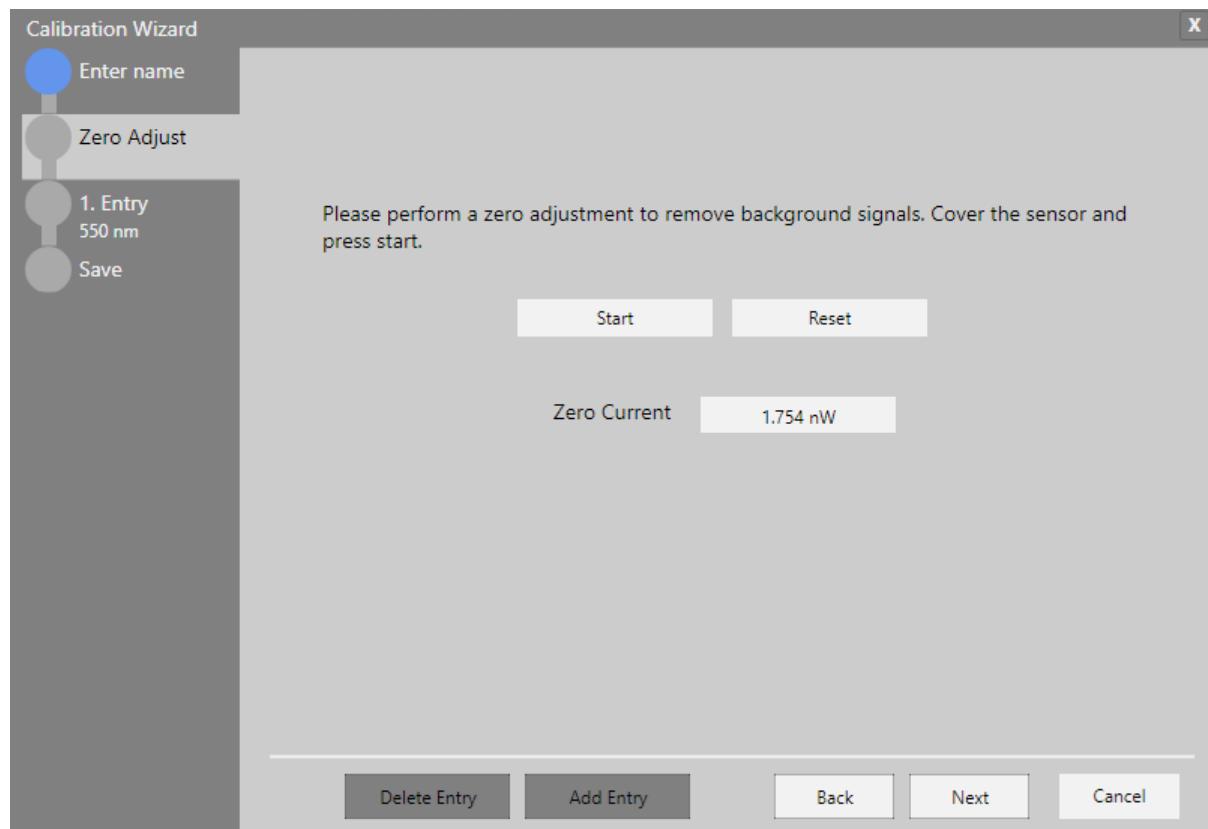


Click "Perform User Calibration" to start a calibration or select and apply a previously saved calibration.

To start a new calibration, define the user and click NEXT to adjust the background noise "Zero Adjust".

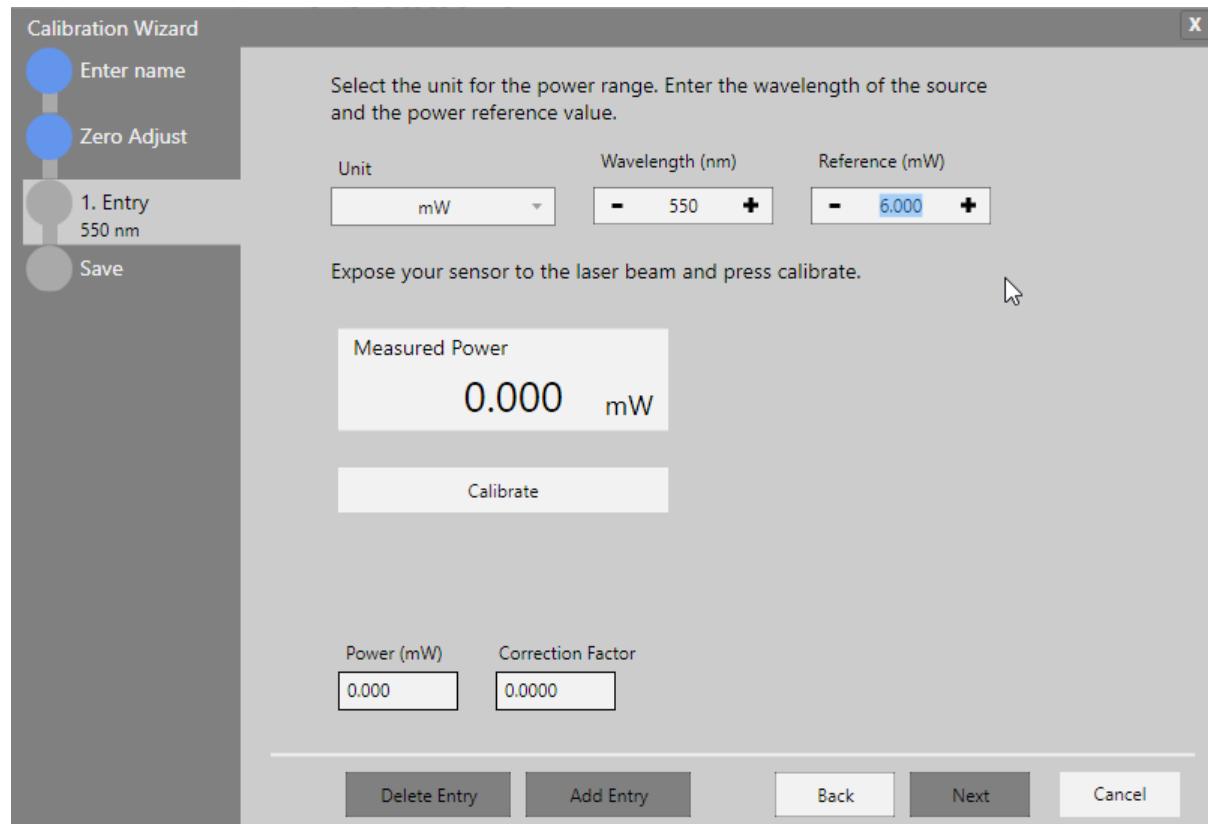


Follow the instructions and click "START".



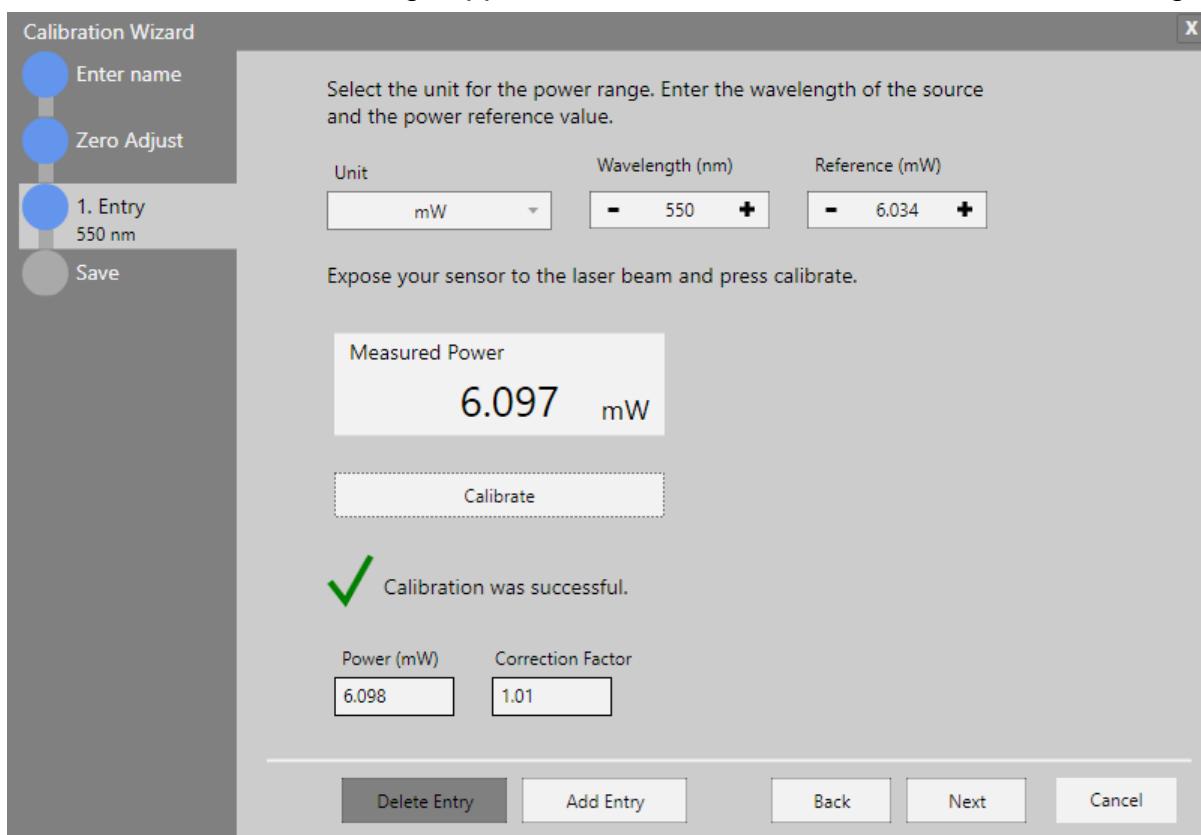
The background is measured. This can be repeated. When the background measurement is finished, click "NEXT" to proceed to the calibration.

Type the power (in mW) measured by the reference sensor into the field "Reference". Turn on the light source and click "Calibrate" to determine the correction factor.

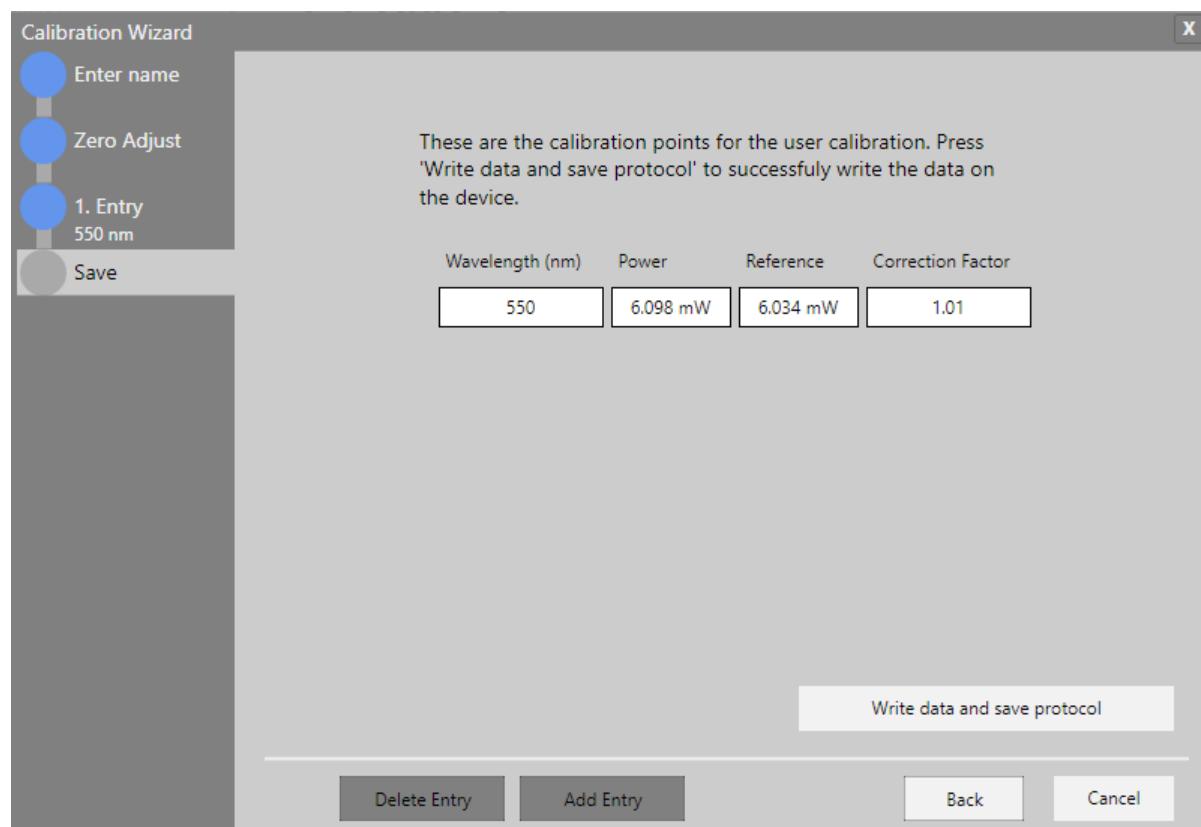


Optical Power Monitor

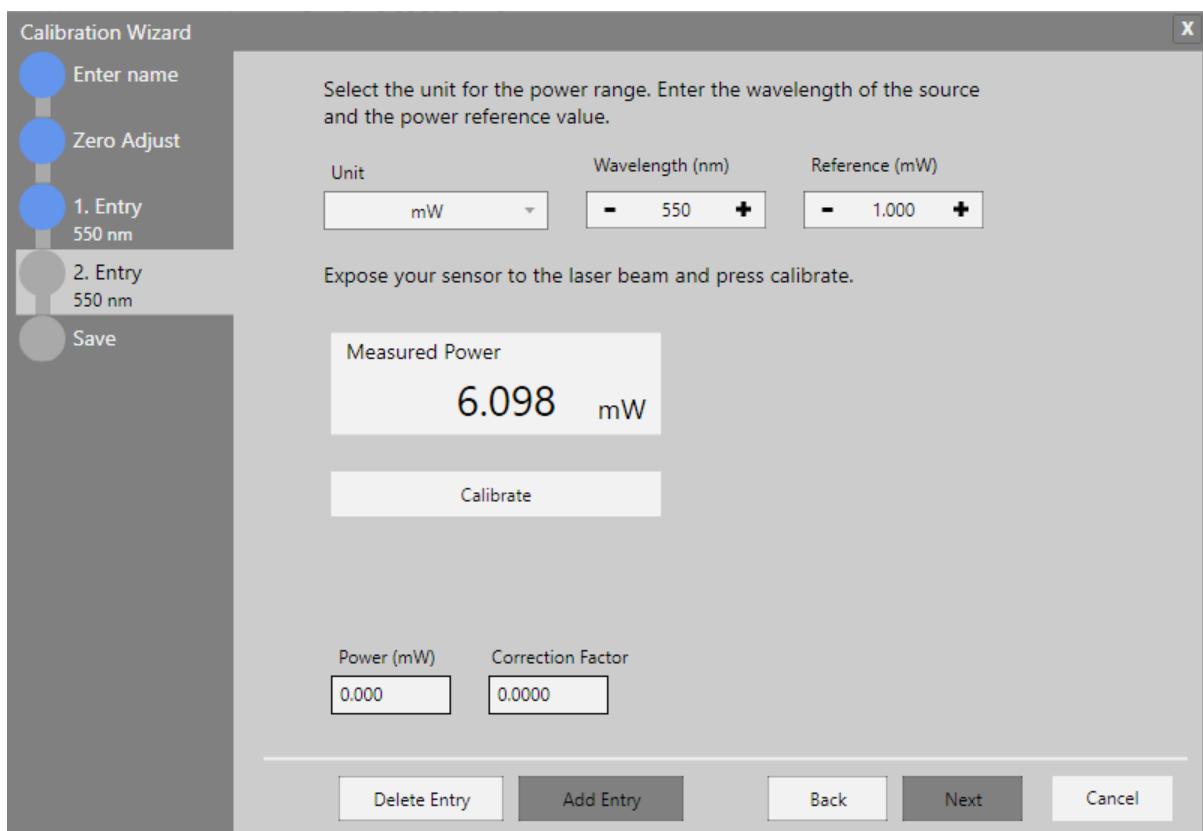
When the calibration is done the following screen appears. To ensure that the calibration is within a reasonable range, the calibration is limited to values differing less than 20% from the reference values. An error message appears if the sensor that is calibrated is out of range.



Click "NEXT" to write the calibration data in the internal memory of the power meter and save the results as a .pdf file on the PC.

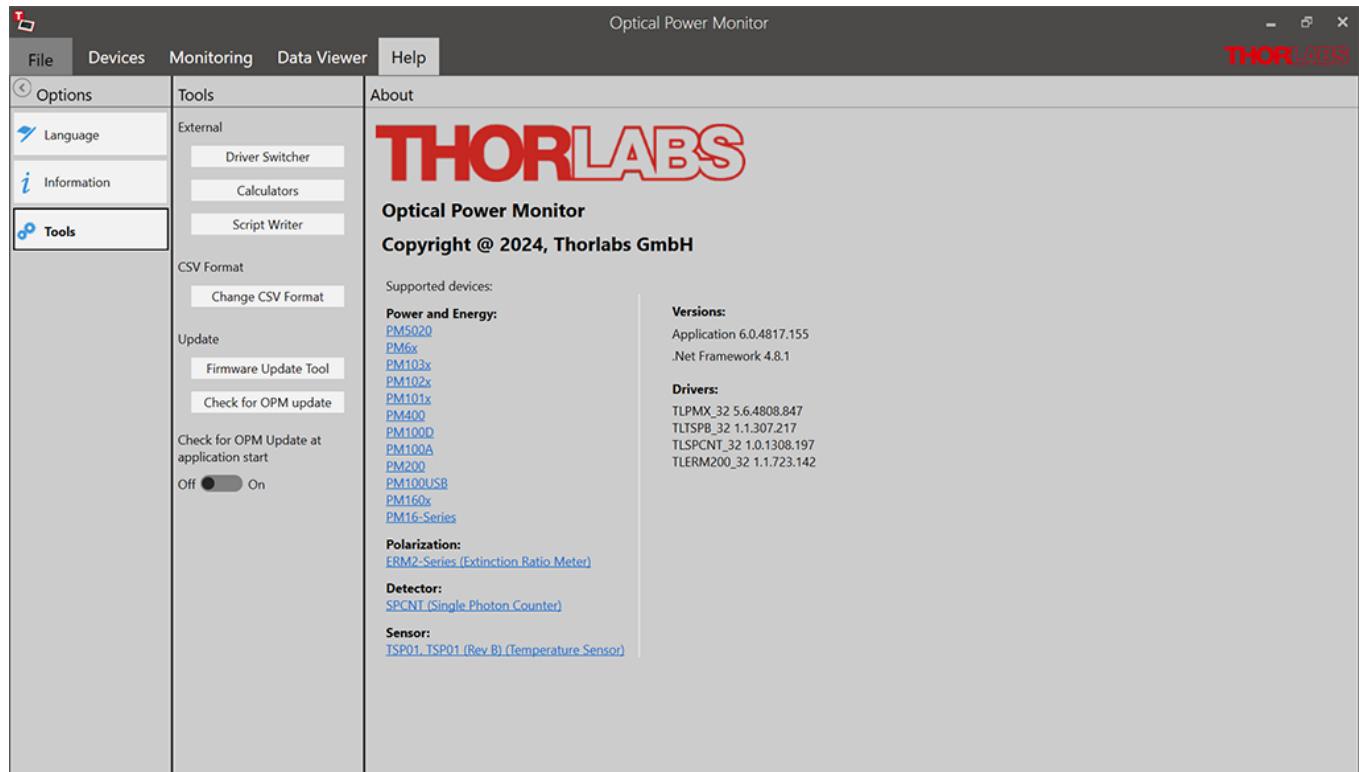


To take a second measurement at, for example, a different wavelength, click "Add Entry".



4.2.3.2 Firmware Update Tool for Power Meters

The OPM provides a GUI to update firmware of all Thorlabs power meter [supported by the OPM](#). For PM100A and PM100D, please see the respective manual.



The functions for the firmware updates can be found under the help menu in the tools panel.

To determine whether an firmware update is necessary, either click on "Check for OPM Update" below the tools panel or the "Check for OPM Update at application start" function.

The "Check for OPM Update at application start" function informs the user when starting the OPM Software if a newer version of the firmware is available. This function can be activated using the On/Off slide control in the tools panel.

If you want to update to a newer firmware version, click on the "Firmware Update Tool" button under the tools panel. The start screen for the installation wizard appears. Now follow the instructions of the installation wizard.

The about panel shows all devices supported by the OPM Software, the current software version, and the drivers.

4.2.4 Measurement

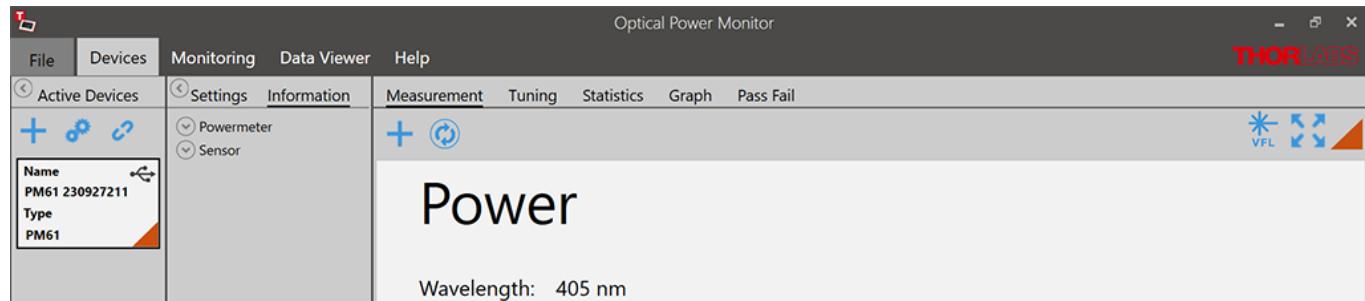
The **Measurement** panel shows the currently measured numerical values of selected parameters are displayed. Use the Tool Bar to add more parameters to the display, maximize the display screen, or reset the measurement.

The display resets when a different device is selected.

Tool Bar

Add/Remove Parameter

Several numerical measurement values can be displayed simultaneously in the main screen. Click  to select the parameter of interest from the panel.

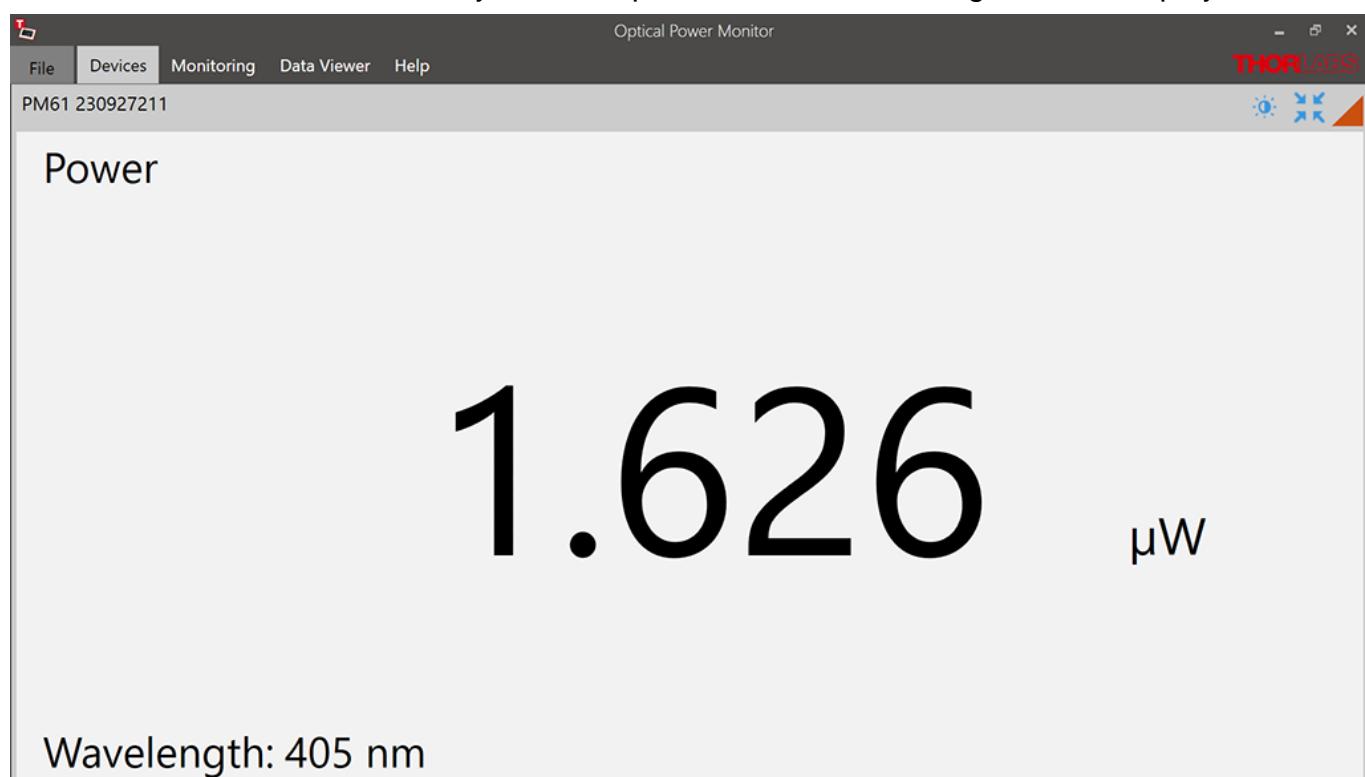


Reset Min/Max

Click  to reset the displayed minimum and maximum values and recalculate their ratio.

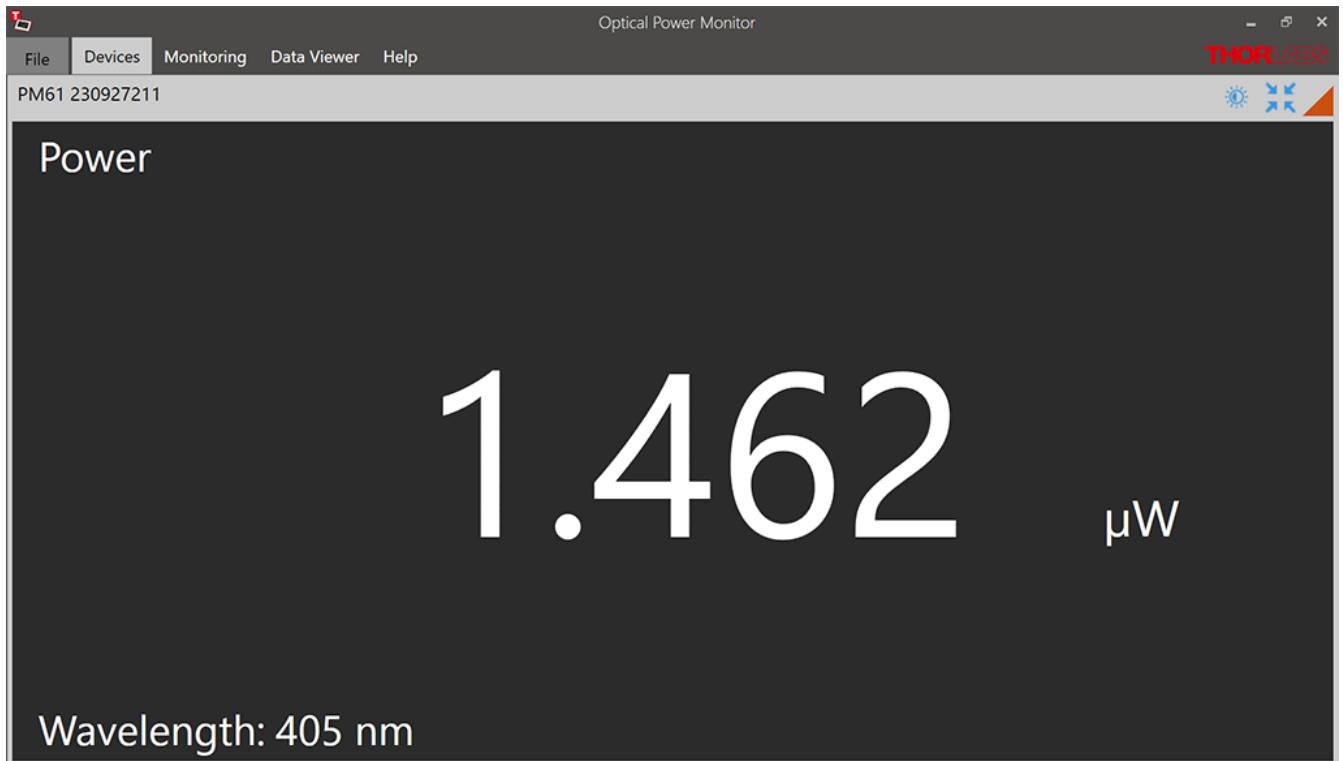
Maximize the Screen

Click  to full screen mode. Only the main parameter and wavelength will be displayed.



Bright/Dark Design

When the screen is maximized, the user can click  to switch between bright and dark design.

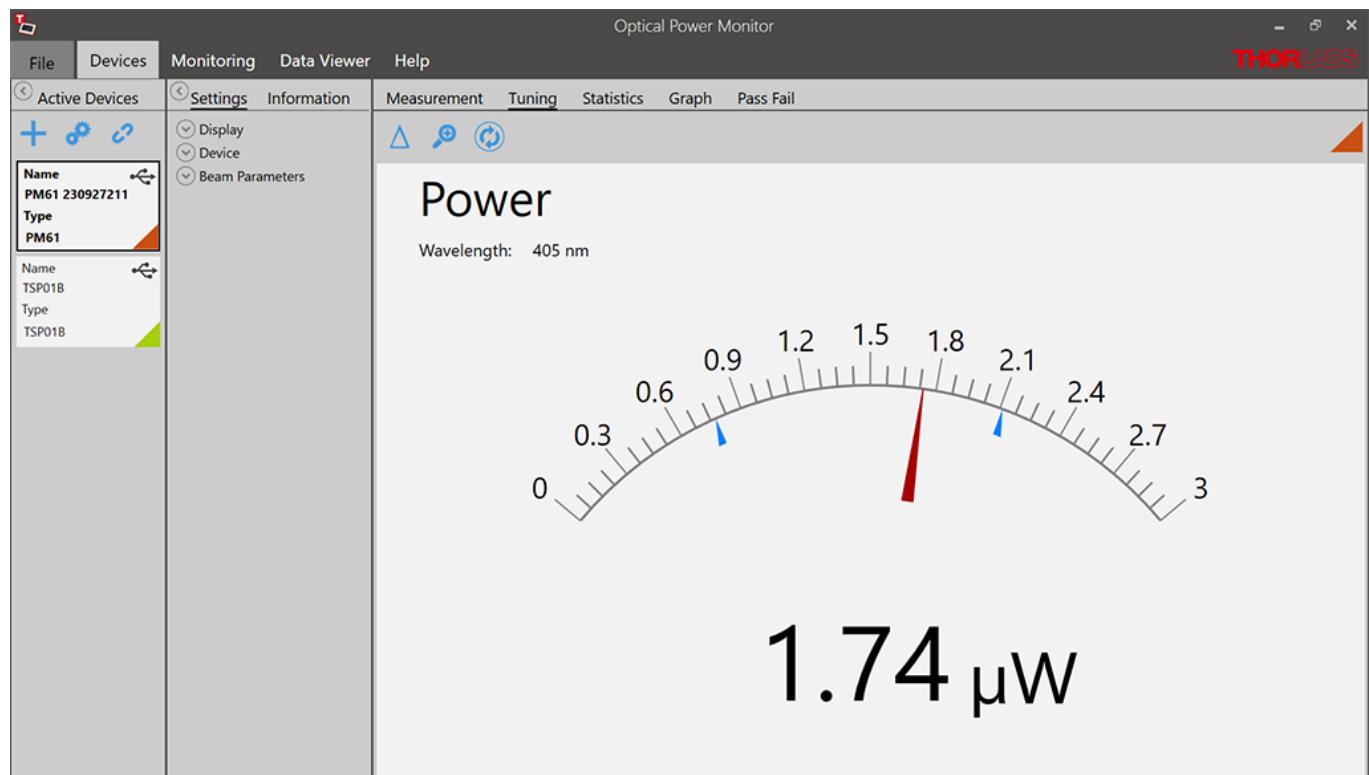


Shrink

Click  to reduce the size of the display to view all selected parameters.

4.2.5 Tuning

The **Tuning** panel shows the analog needle simulation of the currently measured value along with the digital numerical value.

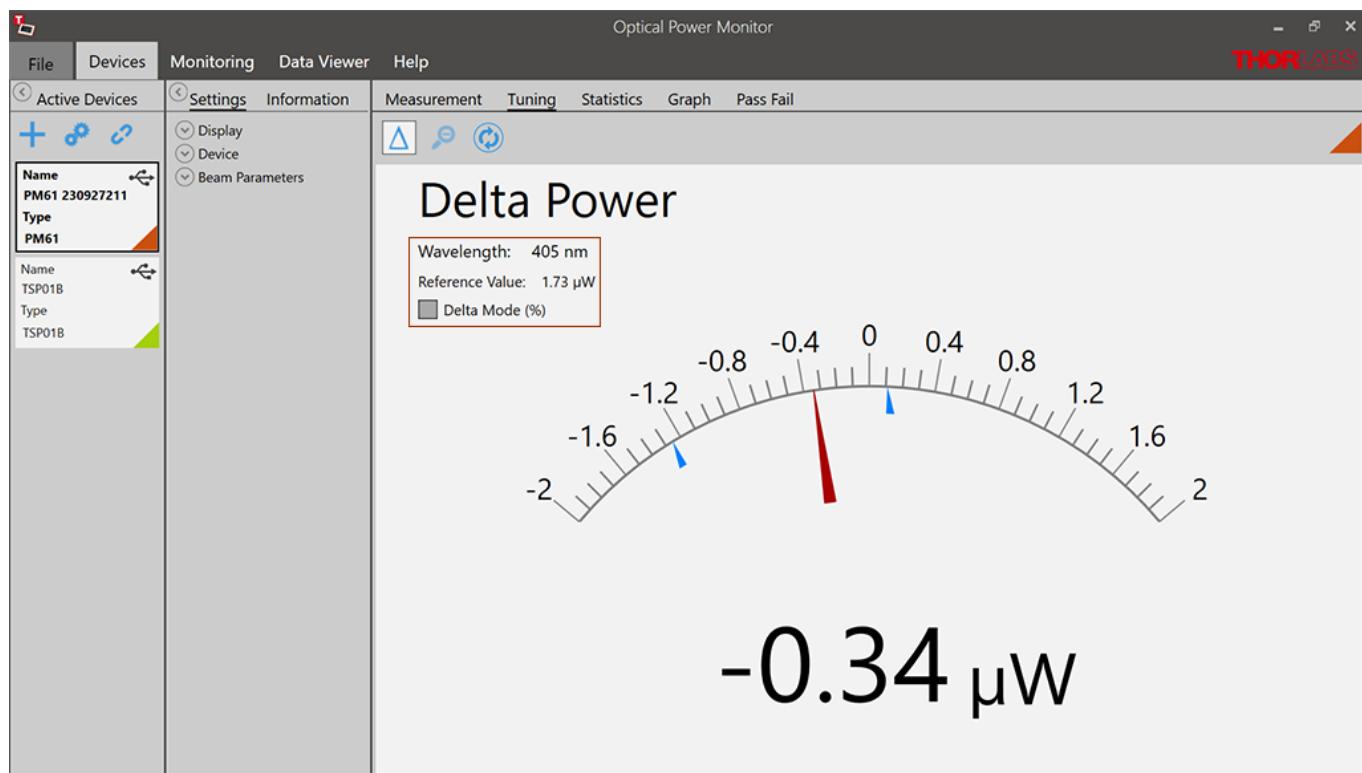


The display can be adjusted using the **Tool Bar**.

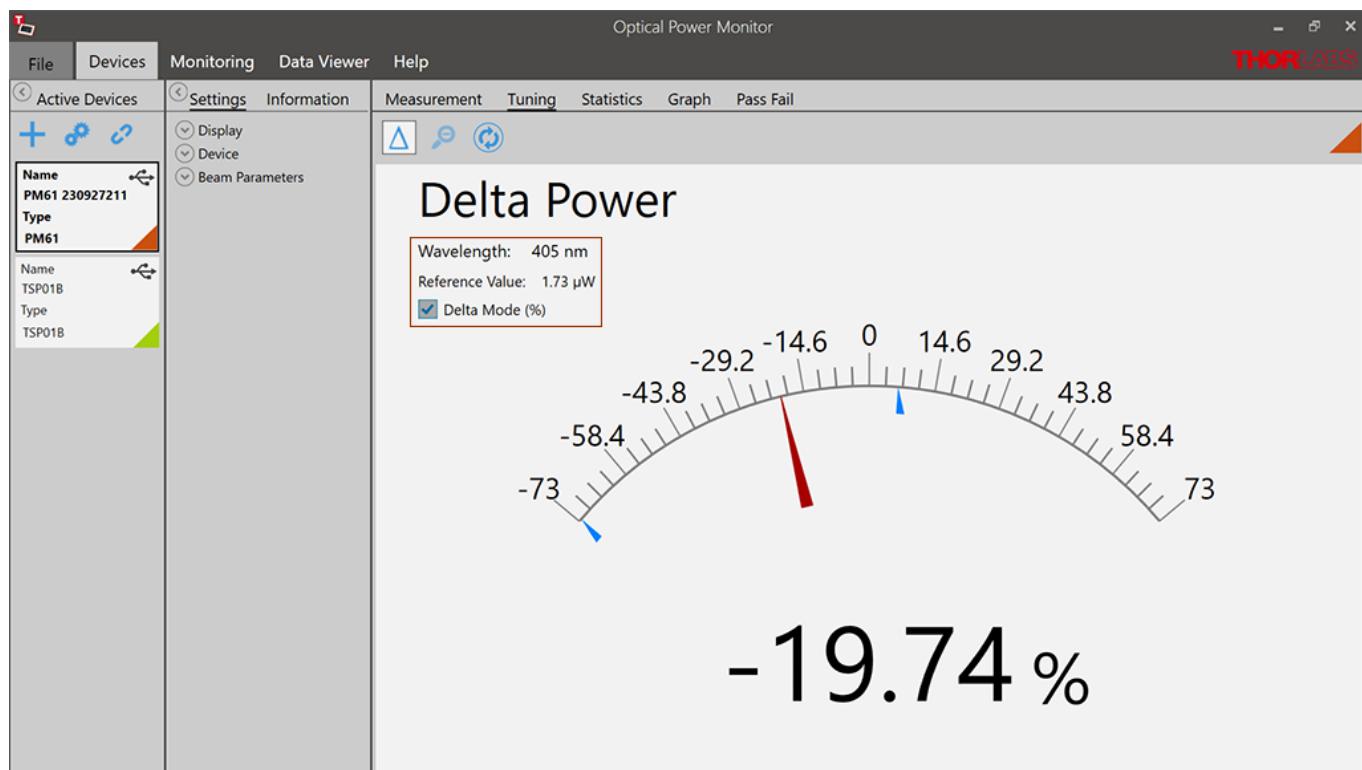
△ Enable/Disable Delta Mode

The Delta Mode shows the fluctuation around the measured value at the moment of starting the delta mode. This value is reset to zero by clicking .

Optical Power Monitor



View the "Delta Mode" in % by selecting the check-box: "Delta Mode" (%) in the higher left display

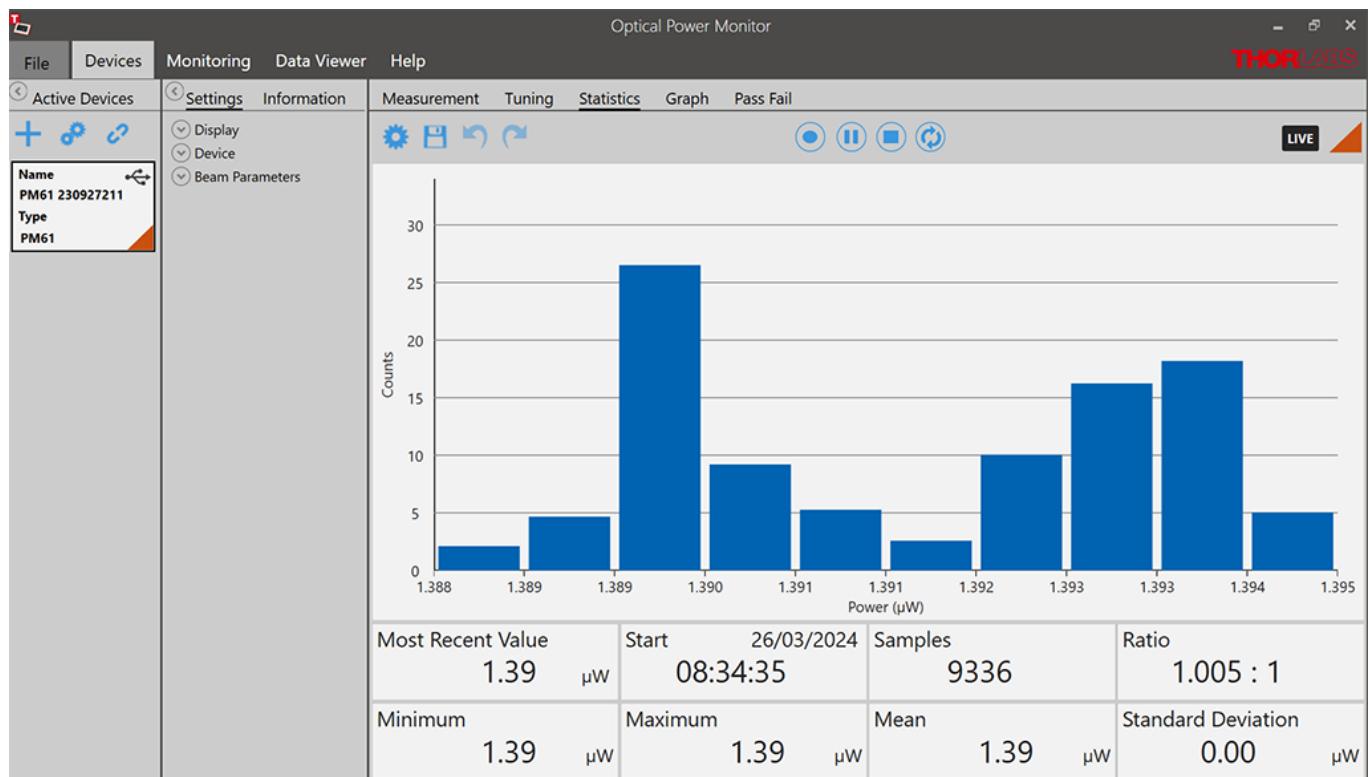


Zoom in/out: The zoom-factor is determined by the current Min and Max-values.

Reset min/max: Reset the displayed zero-, minimum and maximum values and recalculate their ratio.

4.2.6 Statistics

The **Statistics** panel shows the measurement statistics in chart and table format.



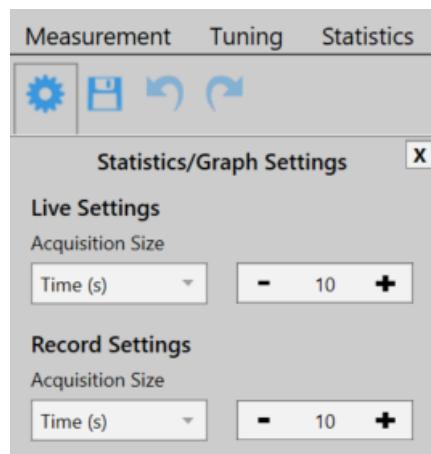
The chart displays the distribution of counts [%] for the parameter selected in [Settings](#). This parameter can be changed during the active measurement. The OPM starts a new data acquisition for statistical analysis when parameter or monitored device were changed.

To configure, save, start and restart measurement statistics, use the **Tool Bar**. The **Status Bar** below shows the currently measured values and the measurement progress.

Tool Bar

Statistics/Graph Settings

The number of data points used for statistics can be set as the duration of acquisition (Time) or number of data points (Sample). These settings are also applied in the [Graph](#) panel for the display of power meter signal over time.



Note

Statistics are calculated as a rolling average. After the set duration or number of samples is reached, the next sample data point is evaluated at the expense of the first data point. Statistics are shown even when the set sample number or measurement time is incomplete.

Save Histogram Data

Saves a snapshot of the statistics. The file will be saved in .csv-format and can be opened in a text editor. When the recording is stopped prior to full data acquisition as set in **Statistics/Graph** setting, this incomplete set of data can be saved.

Stop/Start Collecting Data

Sampling for statistics can be stopped and restarted at any time. When the recording is stopped prior to full data acquisition, this incomplete set of data is statistically evaluated and can be saved. At **START**, the last set of acquired data is deleted.

Restart

Deletes the acquired statistics and graph mode data and starts a new acquisition for both, the statistics and graph mode.

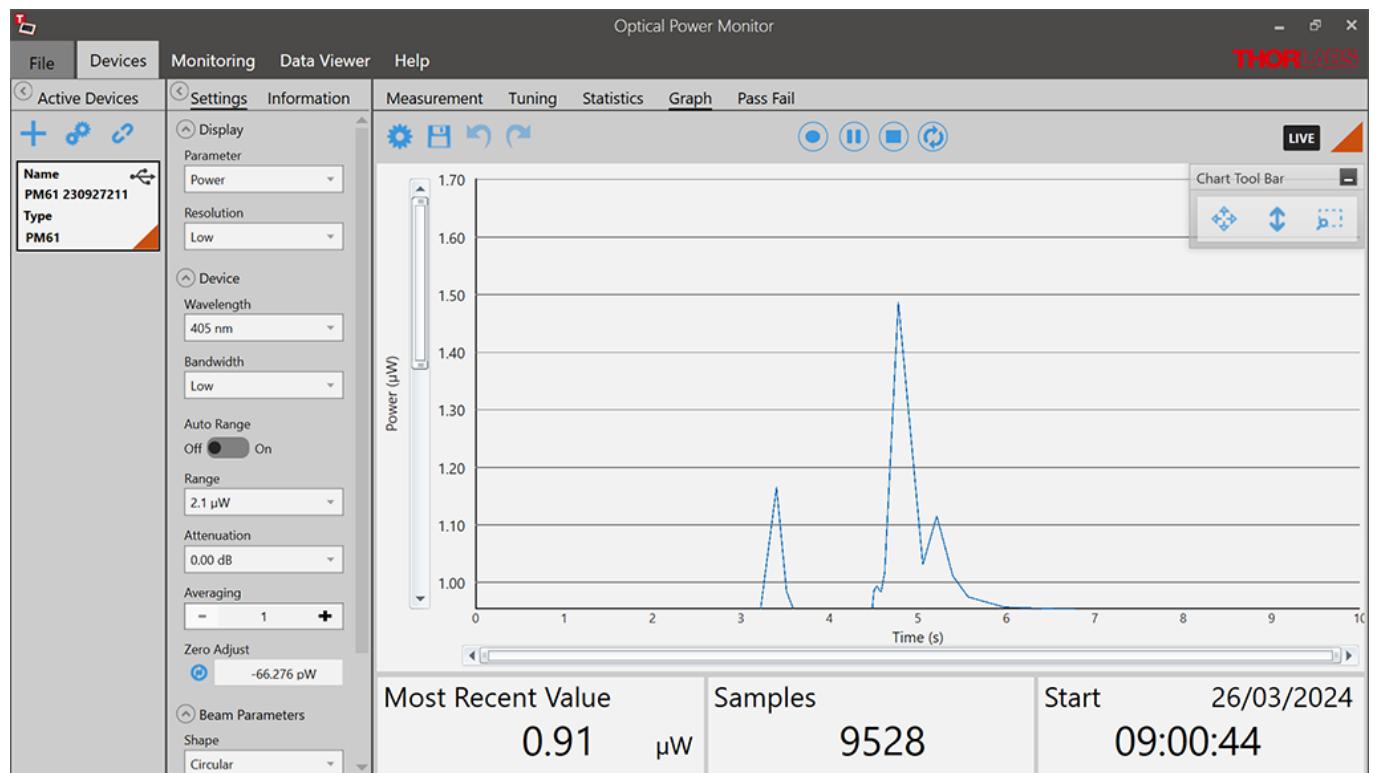
Status Bar

Most Recent Value	Most Recent Value Used for Statistics
Samples	Number of Samples Acquired for Statistics
Time	Duration of Acquisition for Statistics
Ratio	Ratio Between the Minimum and Maximum Values Recorded During the Interval Set in Statistics/Graph Settings
Minimum	Lowest Value Recorded During the Interval Used for the Statistics Calculation
Maximum	Highest Value Recorded During the Interval Used for the Statistics Calculation
Mean	Mean Calculated Based on the Data Recorded During the Interval Set in Statistics/Graph Settings
Standard Deviation	Standard Deviation Calculated Based on the Data Recorded During the Interval Set in Statistics/Graph Settings

4.2.7 Graph

The **Graph** panel displays the signal over time as measured by the power meter. Shorter power meter measurements can be configured, flexibly displayed and saved, using the options given in the Tool Bar. Use the Graph panel to acquire high-resolution measurements of over 100 Hz, depending on the refresh rate of the power meter.

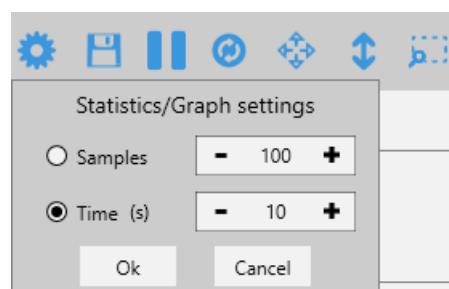
Data acquisition in **Graph** panel is reset when a different power meter is selected in the **Active Devices** panel.



Zoom: To zoom into the chart, place the mouse cursor over the diagram and scroll.

Tool Bar

- ⚙️ **Settings:** Set the displayed time interval of the measurement in time or sample number. These settings are also applied in the [Statistics](#) panel



-  **Save graph data:** Save a snap shot of the measurement in .csv format. When the recording is stopped prior to full data acquisition as set in **Statistics/Graph settings**, this incomplete set of data can be saved.
-  **Start/Pause collecting data:** Sampling for the graph mode can be stopped and restarted at any time. When the recording is stopped prior to full data acquisition, this incomplete set of data is displayed and can be saved.
-  **Restart:** This deletes the acquired data in **Graph** mode and **Statistics** and starts a new measurement and statistics evaluation.
-  **Zoom out:** Zooms out to the original resolution in both, the X and Y axis.
-  **Zoom out Y-Axis:** Zooms out to the original resolution in the Y axis only.
-  **Zoom selection:** Zooms into an area selected with the mouse.

Note

In **Graph** mode, data are acquired in a rolling manner: After the set duration or number of samples is reached, the next sample data point is inserted at the expense of the first data point.

Status Bar: The status bar at the bottom shows the data acquisition progress with the following values

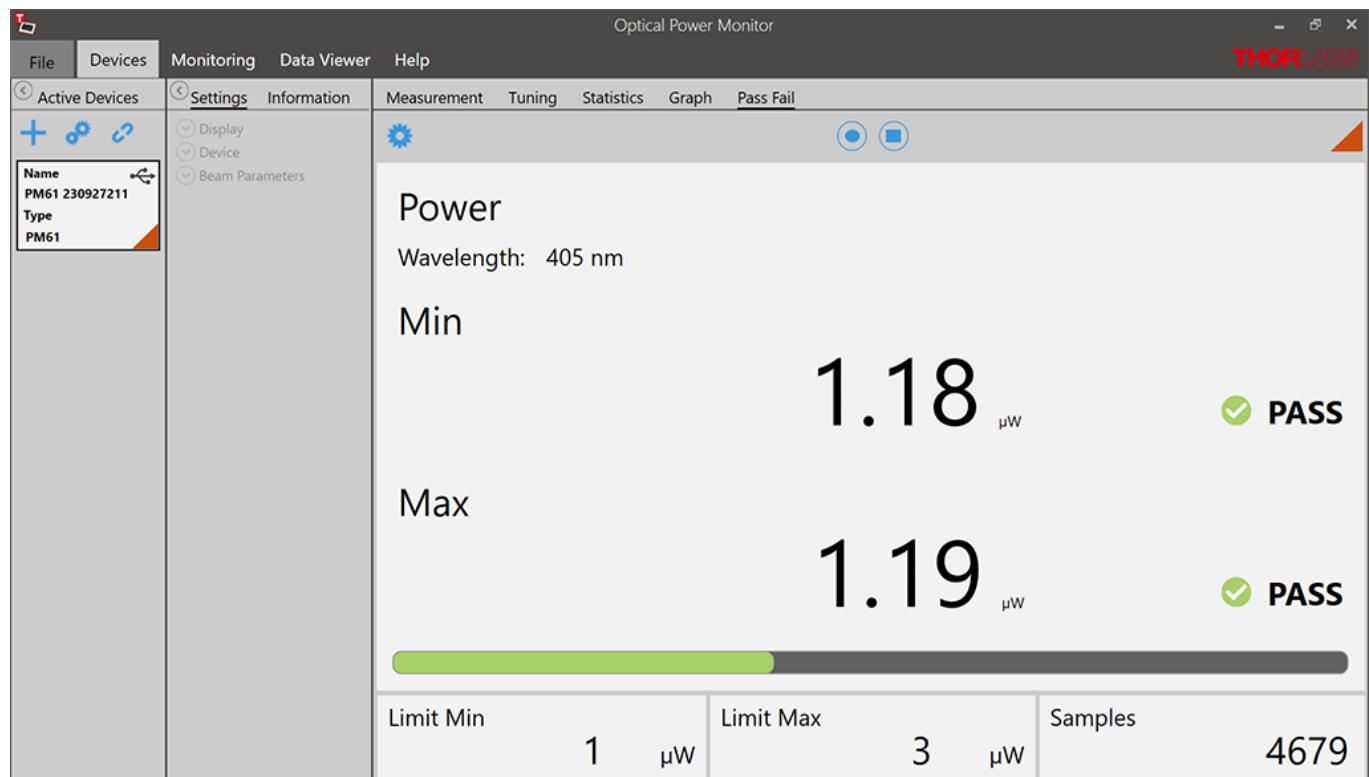
Most Recent Value: The value of the most recent data point collected in the time interval.

Samples: Number of samples acquired for the time interval set in [Statistics/Graph settings](#) .

Time: Recording time acquired for the display of the time interval set in [Statistics/Graph settings](#) .

4.2.8 Pass Fail

When using power meters, the OPM Software offers the **Pass Fail** panel. With the **Pass Fail** panel power can be recorded and analyzed over previously defined power ranges and time.

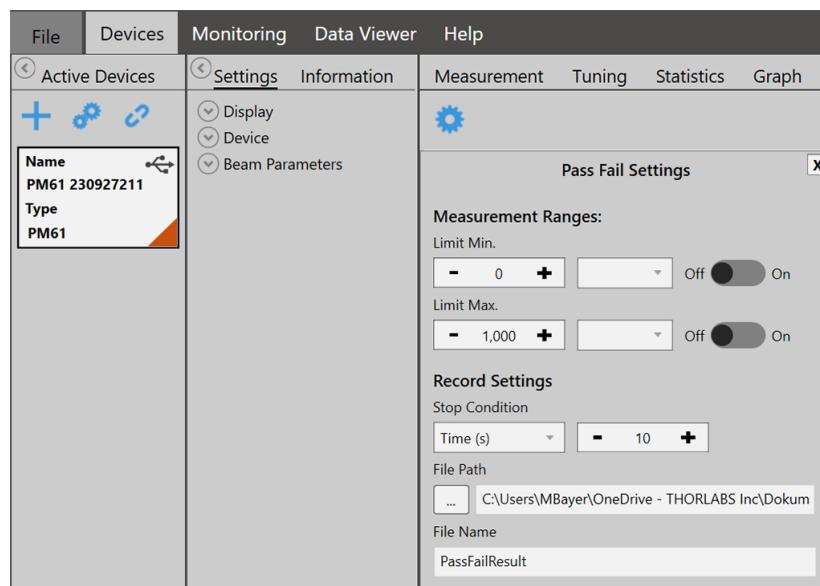


Measurement Ranges: Set the displayed minimum and maximum power and switch it On/Off with the slide control.

Record Settings: Set the displayed recording time interval of the measurement in time or sample number. These settings are independent from the settings applied in the [Statistics](#) panel.

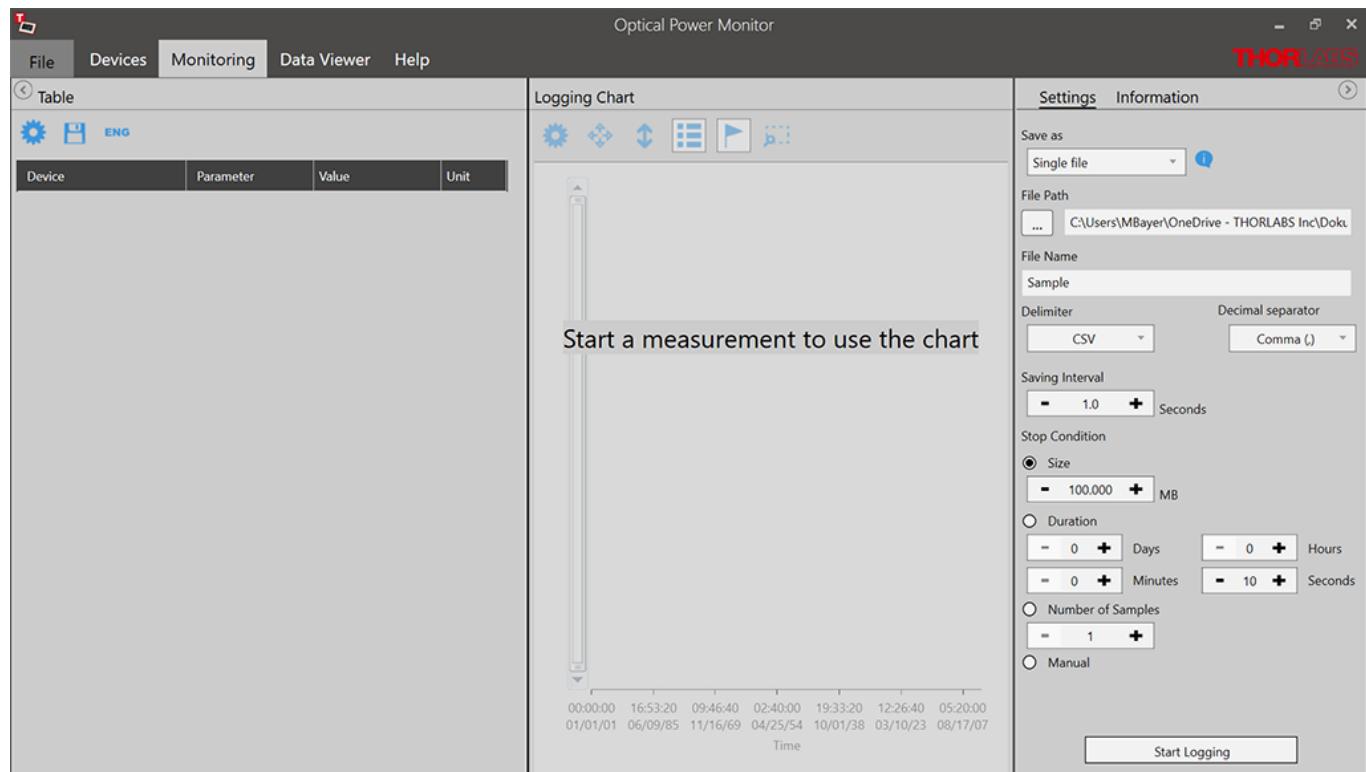
Recordings can be saved via "File Path".

Under "File Name" The recording can be changed to a name of your choice.



4.3 Monitoring

Use the Monitoring panel to configure, execute, observe, and save long-term monitoring of up to 8 connected power meters in parallel and for different parameters. Long-term measurements can be recorded with a minimal interval of one second. The Optical Power Monitor uses this resolution in order to display data acquired from devices with different refresh rates in parallel.



To log a measurement, follow the sequence below:

1. [Table](#)
2. [Logging Settings and Logging Information](#)
3. [Logging Chart](#)

Select the devices and parameters to be monitored.

Select the settings for recording and saving of the measurement and review settings in the panel **Information**. **Start Logging**.

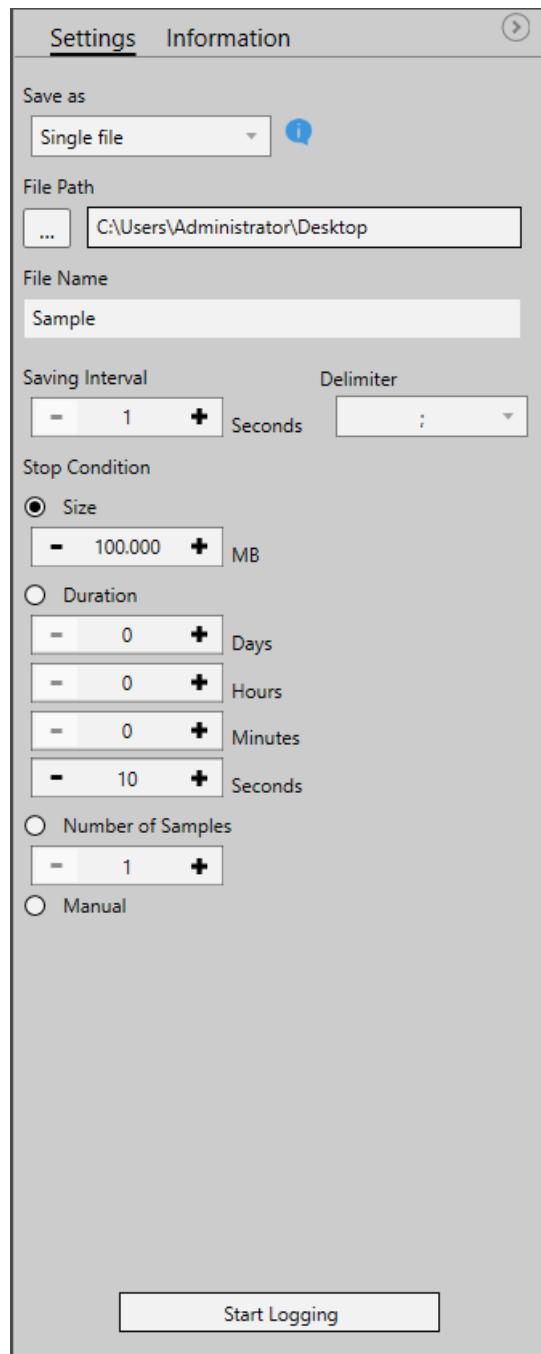
Select the displayed parameters.

4.3.1 Logging Settings and Information

Configure the logging of a measurement and select the output file format, location and name and set the duration and resolution for logging in the **Settings** menu.

Please read the section [File Format](#) to learn about the data saved in the log files.

Review the **Logging Settings** prior to starting the measurement:



Save as: Choose to save data either as single files or multiple files, depending on the data volume.

- Single files: The Optical Power Meter saves a .csv file for short measurements with small data volume.
- Multiple files: The Optical Power Meter saves multiple .cvs files for measurements with large data volumes such as longer measurements or measurements with multiple power meters in parallel. When the software saves multiple files, an associated .csv file is saved for accelerated loading of data into the data viewer. Do not move or delete any files from the common folder. Please find more information in the section [File Format](#).

File Path: Select the Output File location

File Name: Choose the file name

Saving Interval: Set the time interval between saved data points. The minimal interval is one second. Choose the **Delimiter** for easy access and analysis of your saved data.

Stop Condition: Select the criteria for terminating the logging process.

- Size: Measure up to a file size of 99 999 MB. Approximation of the file size: 100 samples of one parameter of one power meter require ~ 4kb disc space. The required disc space is not strictly linear. To log measurements > 99 999 MB, choose either the stop condition "Duration" or "Manual".
- Duration: Measure for a certain duration
- Number of Samples: Measure a set number of samples
- Manual: Stop logging manually

Note

Logging can not be started if no parameters were selected in the **Table Settings**.

Attention

General settings in the [Settings](#) panel can be changed even during a logged long-term measurement. Changes will be applied immediately but the changes in the settings will not be saved in the logged file. Please note such changes, as evaluation of such data may otherwise be complicated.

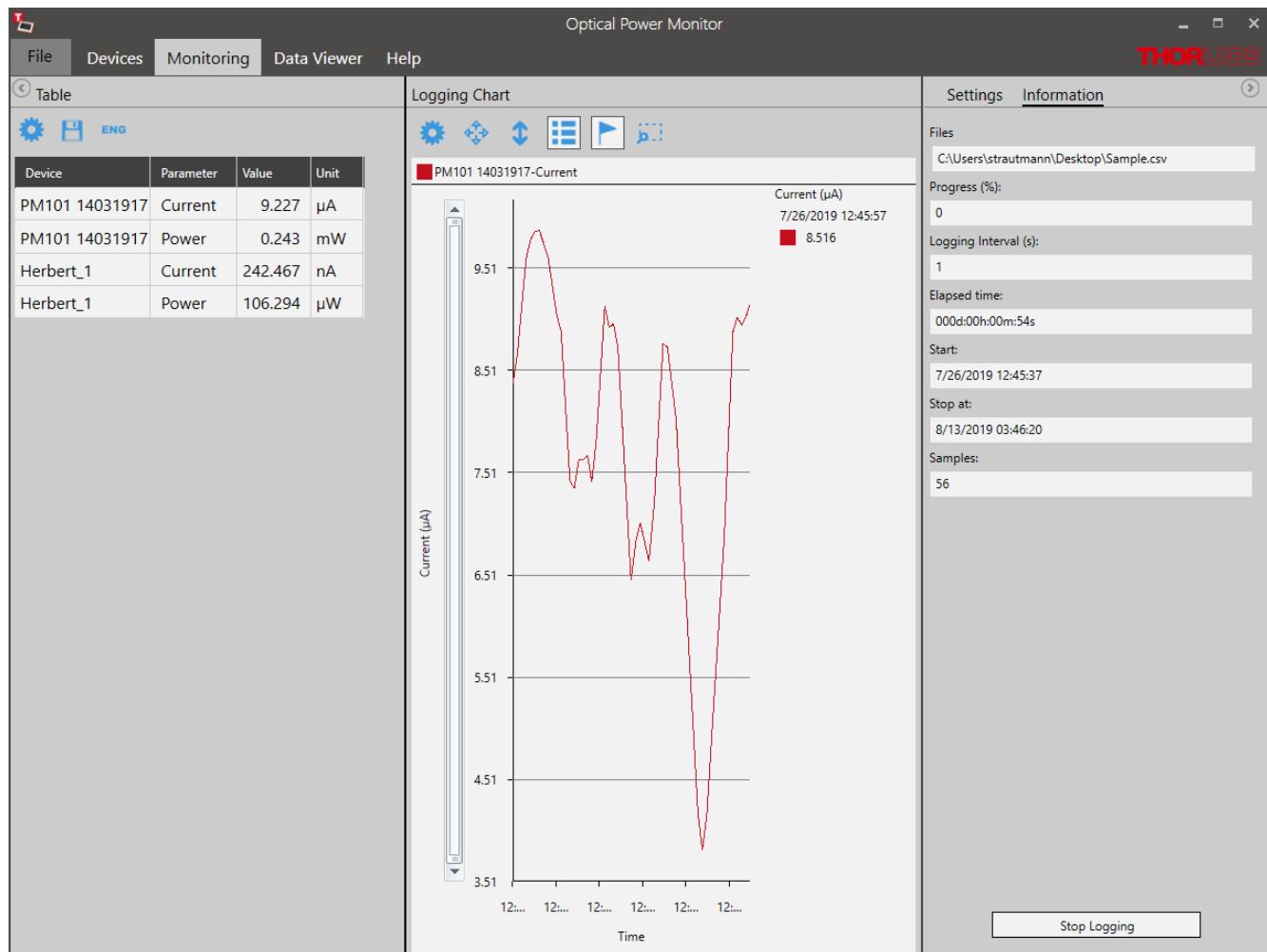
Attention

Disable hibernation and sleep mode of the PC. Otherwise, the PC loses the connection to the monitored devices, the measurement stops, and the OPM software may freeze when entering sleep mode or hibernation.

Start Logging

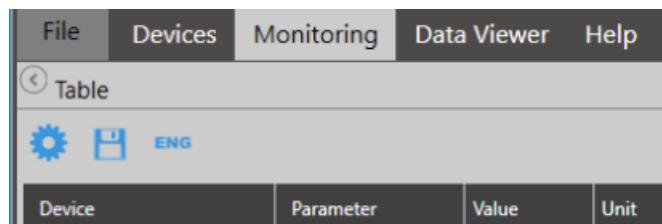
Click this button to start logging of the measurement. If the file name was already used, a warning window appears.

The Logging Settings panel will change to the **Logging Information** panel and show the status of the measurement.

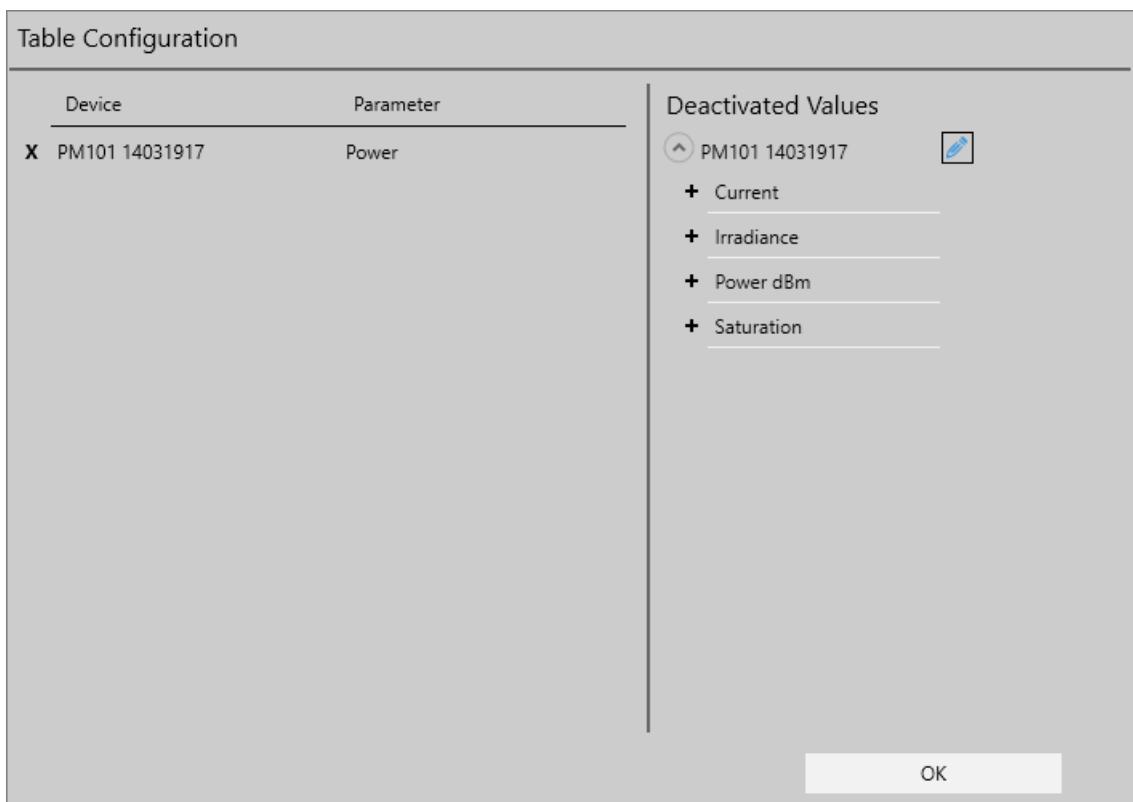


4.3.1.1 Table Configuration

The **Table** menu lists the devices and parameters to be logged in the experiment and continuously displays the currently measured values. To add devices and parameters to the table, use the **Tool Bar**.

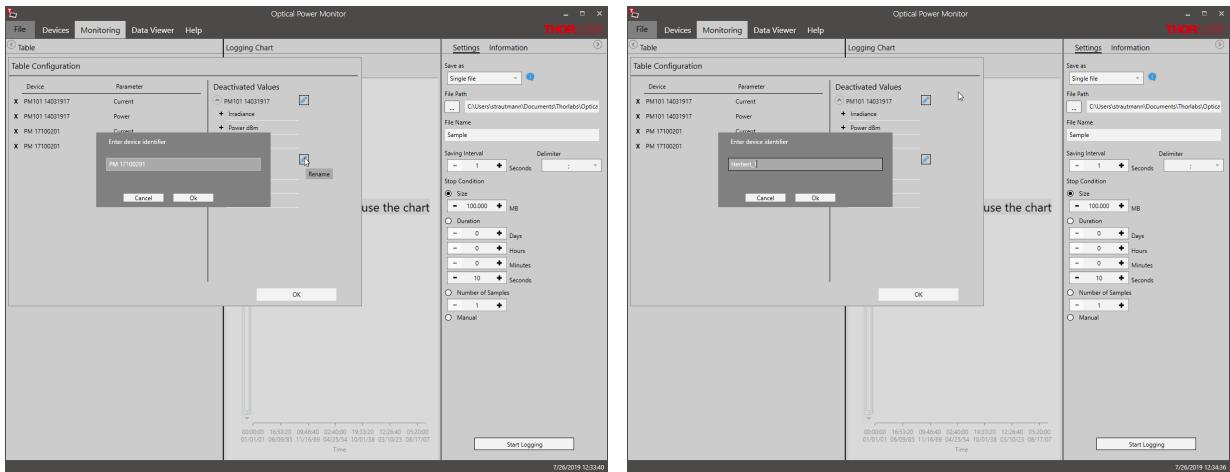


⚙️ Configuration: Configure the devices and parameters to be monitored in the table, logged in the measurement and displayed in the [Logging Chart](#).



- + Add devices and parameters from the list of **Deactivated Values** to the **Table Configuration**.
- ✗ Remove Values by deselecting them in the left panel.
- ✍ Choose a custom name for the device in your setup.

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The order of the selected values can be changed using the mouse.

Click **OK** to return to the **Table**.

The monitoring **Table** now lists the devices and parameters with their currently recorded data that are logged in the experiment.

A screenshot of the Thorlabs Optical Power Monitor software interface. The top menu bar has tabs: File, Devices, Monitoring (which is selected), Data Viewer, and Help. Below the menu is a toolbar with icons for Snapshot (blue square with white icon), Engineering Notation (ENG), and a refresh symbol. The main area is titled 'Table'. It contains a table with four rows:

Device	Parameter	Value	Unit
PM101 14031917	Current	5.856	μA
PM101 14031917	Power	0.154	mW
Herbert_1	Current	107.219	nA
Herbert_1	Power	47.003	μW

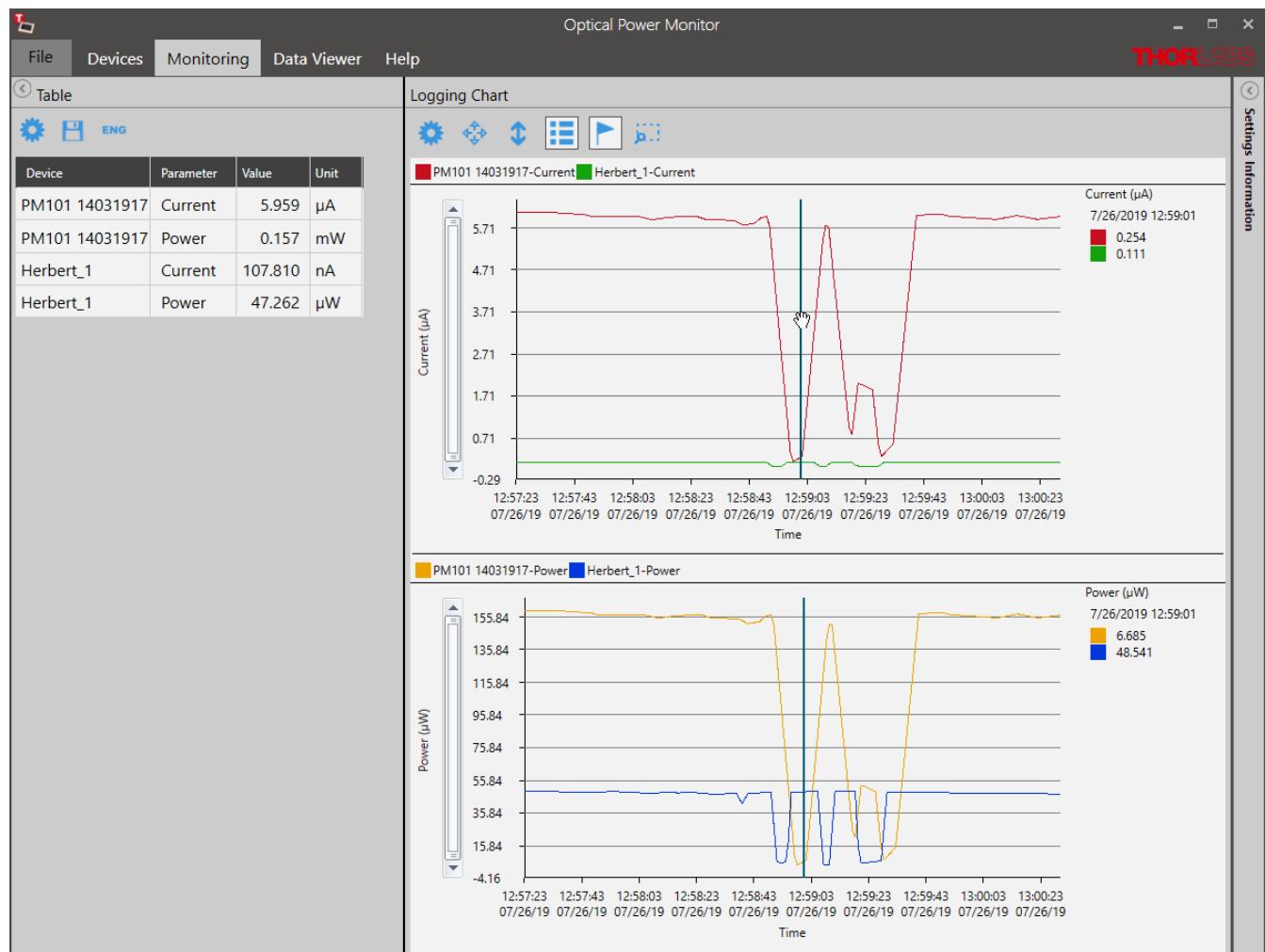
Snapshot: Save a snapshot of the current values in .csv-format.

Engineering Notation: Switch the table to engineering notation of the monitored values.

Following the selection of devices and parameters to be monitored, go to the Logging Configuration menu.

4.3.2 Logging Chart

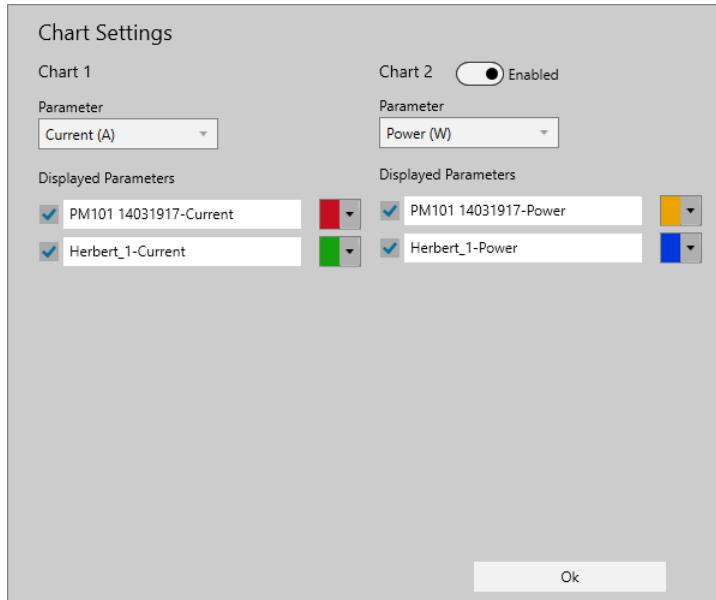
The **Logging Chart** displays the logged data over time. Use the **Tool Bar** to set up the display and analyze the data. The **Logging information** panel displays the progress of the measurement.



Tool Bar

Settings

To configure the chart display settings in the real-time measurement, choose any parameter and device (**Displayed Devices**) selected in the monitoring [Table](#). Assign different colors to easily distinguish power meters and parameters in the display. Enable a second chart by moving the toggle switch in **Chart 2** to **Enabled**.



Click **Ok** to set the selection.

Note

If parameters or devices do not appear for selection, they were not selected in the [Table](#) menu. To add them, click "**Stop Logging**" in the **Logging Information** panel, go to the [Table](#) menu on the left side of the display, add the desired devices and parameters and **Start Logging** in the **Logging Information** panel.

Zoom: To zoom into the chart, place the mouse pointer over the chart and scroll.

- ❖ **Zoom out:** Zooms out to the original resolution in both, the X and Y axis.
- ❖ **Zoom out Y-Axis:** Zooms out to the original resolution in the Y axis only.
- ❖ **Enable/Disable Legend:** Add the legend listing the used devices to the chart area as shown above
- ❖ **Enable/Disable Marker:** Add the marker to display the measurement value at a chosen single time point next to the chart.
- ❖ **Zoom selection:** Zoom into the region of interest (ROI) by selecting the area. You can then move a window of the size of the ROI through the whole chart area. Click ❖ for the chart to resume the original resolution.

4.3.3 File Format

The user can record and save data in different formats, depending on the size of the measurement data.

Small Data Volumes

All data saved in the [Statistics](#) or [Graph](#) panel are saved as .csv files. Choose this setting to save data than can easily be opened in a text editor without reaching the line limit of about 1 million lines. This format can be opened in a text editor, but can not be loaded into the [Data Viewer](#).

Data recorded in the [Monitoring](#) panel when choosing to save as single file only are also saved as .csv files. These data can be opened in the [Data Viewer](#) or in a text editor.

Large Data Volumes

All data saved in the [Monitoring](#) panel when choosing to save as "multiple files" are saved as multiple .csv files with an associated .tcsv file in the same folder.

The .tcsv files are compressed files of the associated .csv files for fast loading into the [Data Viewer](#). For high resolution viewing in the data viewer, the .csv files are required to be in the same location as the .tcsv file. The uncompressed .csv files carry the name: filename_Raw#.

The log-file in .tcsv format saves the following data:

- Device Information (Power Meter and Sensor with Serial Numbers)
- Values of the Selected Devices and Parameters, Saved with the Selected Sampling Interval (Sorted by Sample Number, Date and Time down to Seconds)
- Wavelength

Note

DO NOT DELETE, MOVE or RENAME the uncompressed .csv files in the .tcsv file folder, because the uncompressed files are required for high resolution viewing in the data [Data Viewer](#). However, the uncompressed "raw" csv files can be used in your own analysis software. To do this, please copy the desired files first to a location different from the original location.

PM400 .csv Format

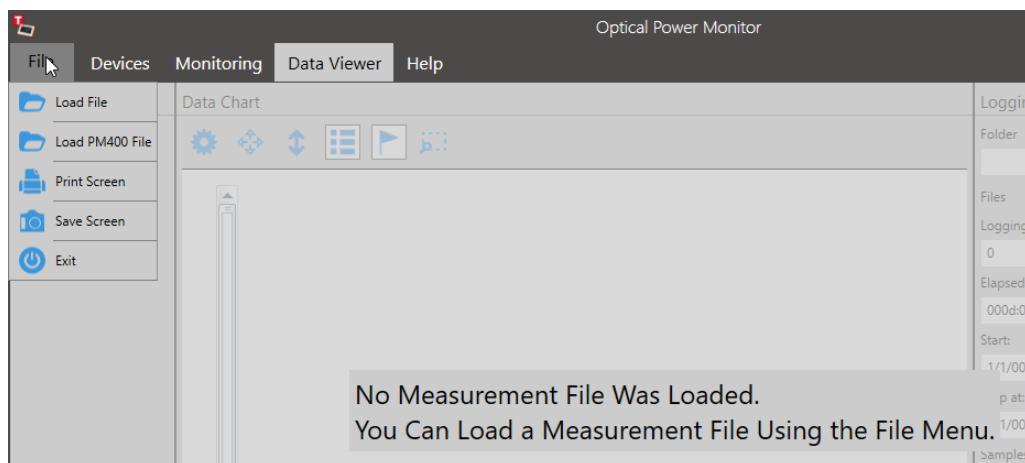
To load data saved by the PM400 into the Data Viewer of the OPM, go to the File Menu and choose Load PM400 File.

4.4 Data Viewer

Data logged by the OPM can be loaded and displayed in the [Data Viewer](#).

Loading Data

To load data into the Data Viewer, go to [File](#) and select **Load** to open the file of interest.



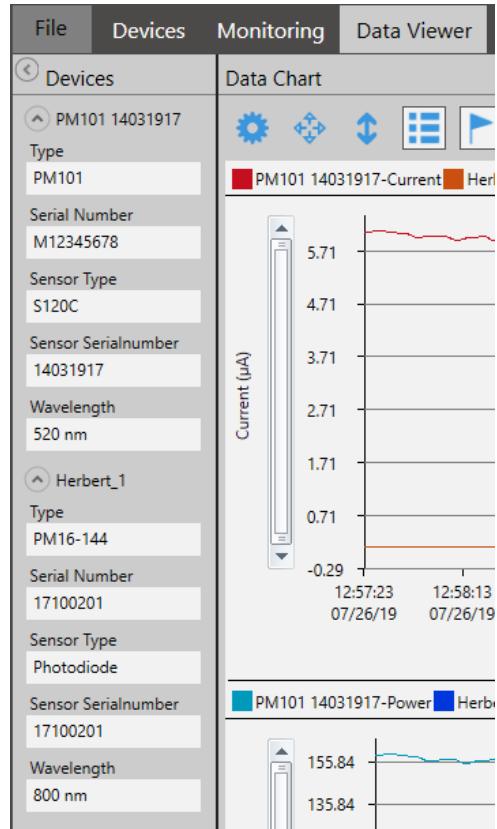
The loaded data are displayed as a list of **Devices**, the **Data Chart** of data points over time and the **Logging Information**.

Devices

The **Devices** menu lists the power meters and sensors that were used in the loaded measurement.

- First Device:** Name as Set in [Edit Devices](#) →
Type of the Power Meter →
Serial Number of the Power Meter →
Type of the Sensor →
Serial Number of the Sensor →
Wavelength Analyzed in the Optical Setup →

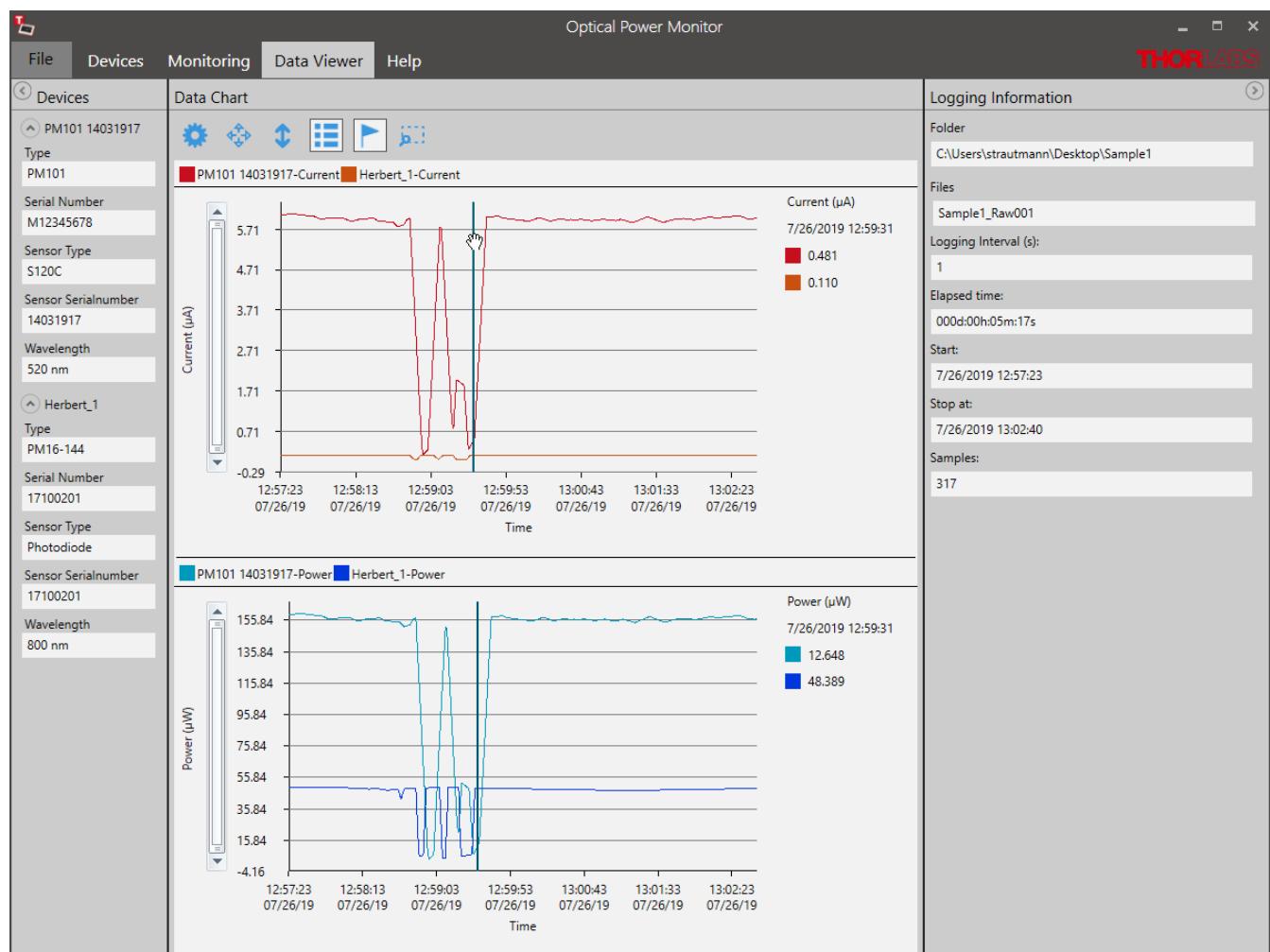
- Second Device:** Name as Set in [Edit Device](#) →



Go to the **Data Chart** and use the [Tool Bar](#) to configure the display of devices and parameters.

Data Chart

The **Data Chart** displays the loaded data over time. The display optionally includes a legend for the monitored devices and a cursor to choose the display of a specific measurement value. Use the **Tool Bar** on top of the chart to edit the display and analyze the data set.

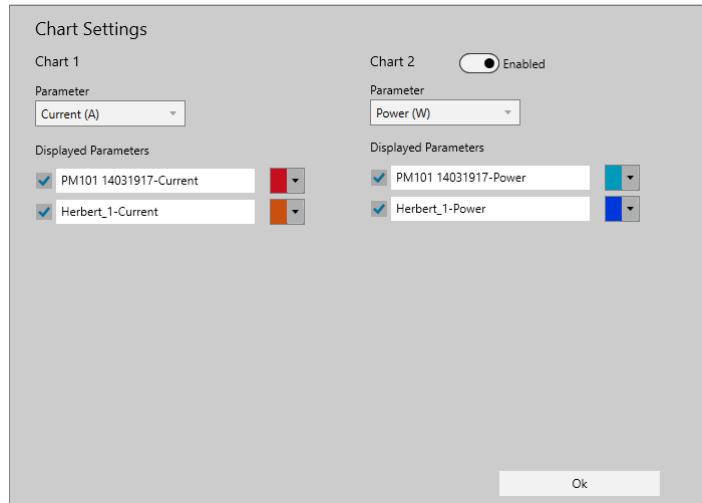


Tool Bar

Settings:

To analyze the measurement, add any parameter and device (Displayed Devices) of the loaded file to the **Data Chart**. Assign different colors to easily distinguish power meters and parameters in the display. Move the toggle switch in **Chart 2** to **Enabled** to display the second chart.

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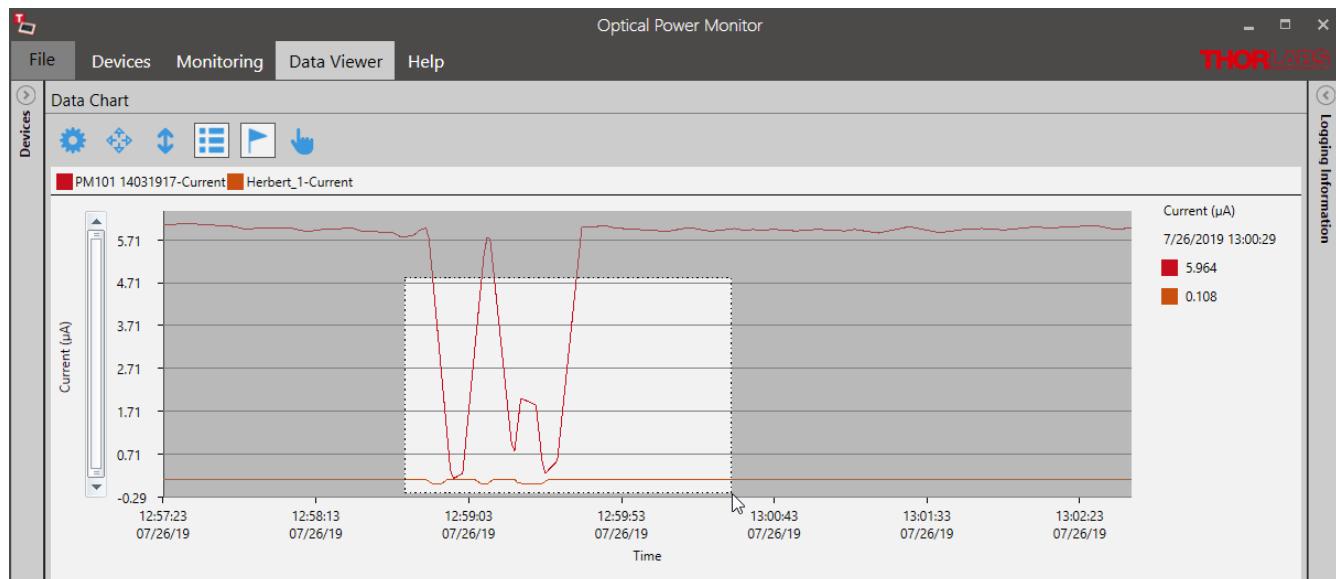


Click **OK** when the selection is finished.

Zoom: To zoom into the chart, place the cursor over the chart and scroll.

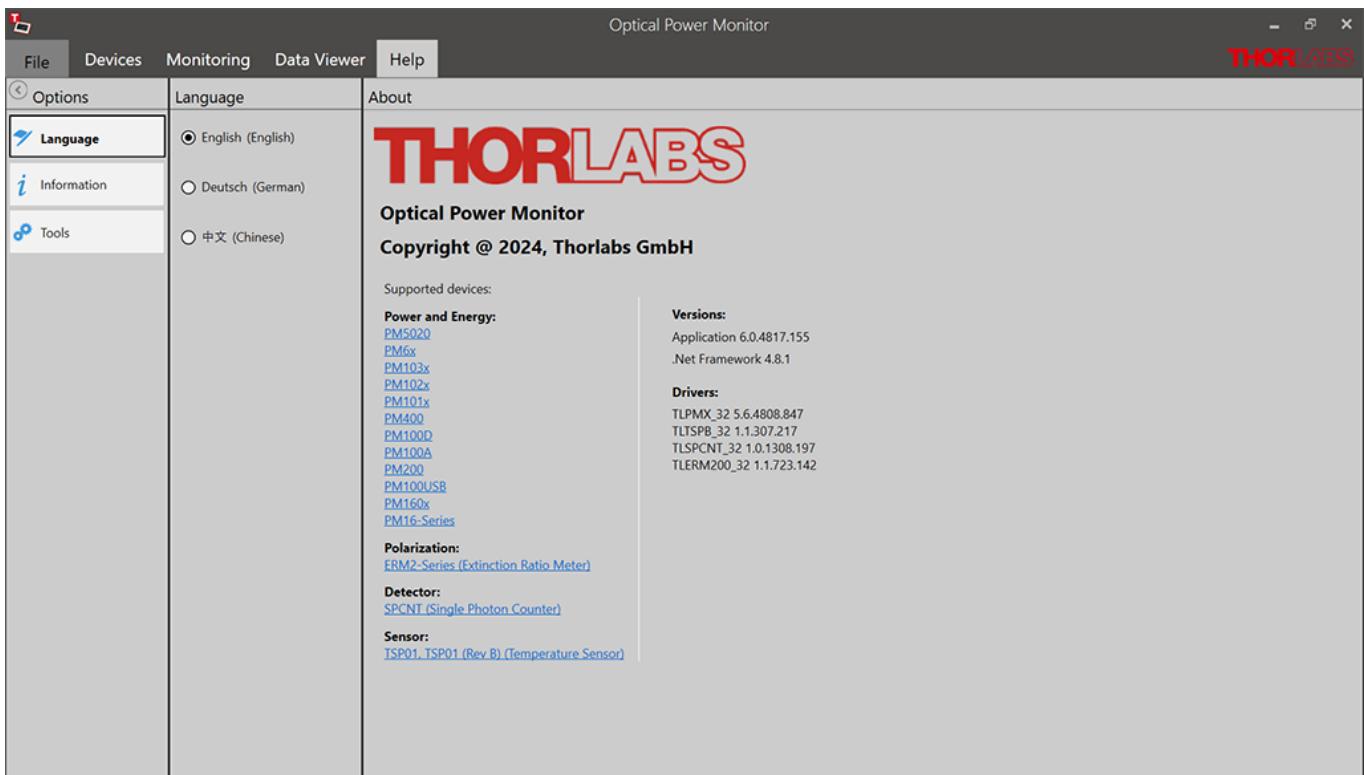
- ◀▶ **Zoom out:** Zooms out to the original resolution in both, the X and Y axis.
- ↑↓ **Zoom out Y-axis:** Zooms out to the original resolution in the Y axis only.
- ☰ **Enable/Disable Legend:** Add the legend listing the used devices to the chart area as shown above.
- 🚩 **Enable/Disable Marker:** Add the marker to display the measurement value at a chosen single time point next to the chart.
- ▣ **Zoom Selection:** Zoom into a ROI by selecting the area. The user can then move a window of the size of the ROI through the whole chart area.

Zoom Selection

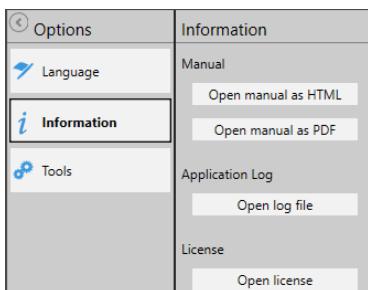


4.5 Help

In the help interface, you can choose between English, German and Chinese under Language. Under Information you will find the manual, the application log and the license.



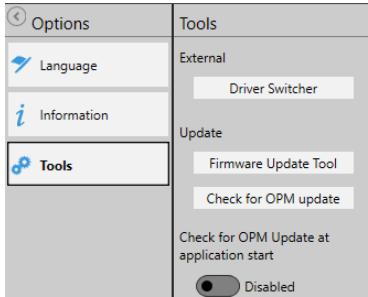
Information



Please find the operating manual as online help (.chm file) or .pdf as well are the log file and the software license here.

Please feel free to check for updates frequently.

Tools



This interface leads you to the driver switcher to change the power meter driver from the former PM100D.dll to the newer TL.dll. While the PM100D.dll supports older software, generated with the older driver, the TL.dll supports all functions of all Thorlabs power meters. Visit the section [Instrument Driver for Thorlabs Power Meters](#) for more details.

The Firmware Update tool allows to search your PC for already downloaded firmware. In case you did not download a firmware and

wish to search the web for the update, please go to the DEVICES menu and open the panel [Information](#). Here, you will find a firmware update tool which searches the web for updates of the firmware for the connected power meter. For questions, please contact [Thorlabs Worldwide Contacts](#).

5 Optical Power Monitor with Different Devices

The OPM automatically responds to the functional differences of connected devices and adjusts the interface with the additional options.

This chapter describes differences and additional options with respect to different power meter consoles or sensors compared to [PM100USB](#) and a Photodiode Power Sensor [S120VC](#).

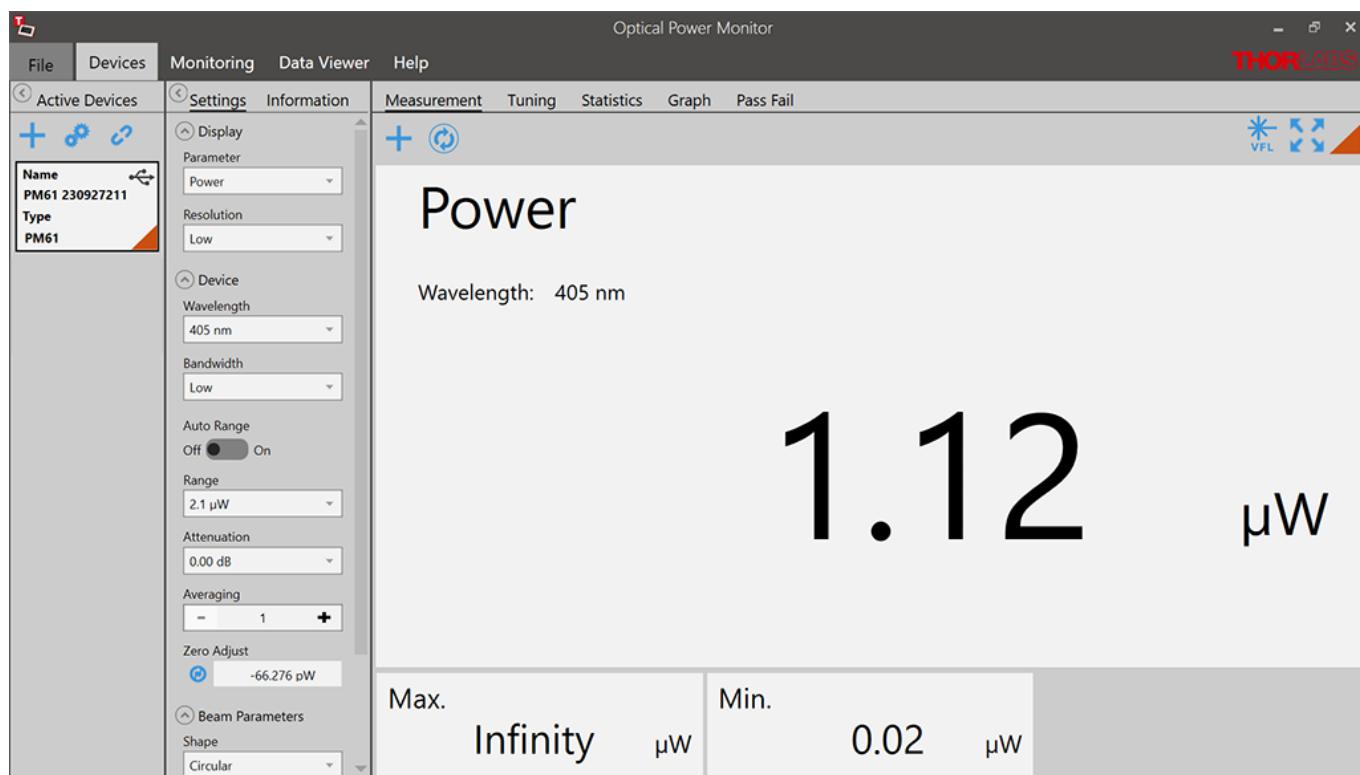
5.1 Power Meter Dependent Variations

5.1.1 PM61x

When using a [PM61 Series](#) power meter, the software offers control of the **Visual Fault Locator (VFL)** as an additional option.

The **Visual Fault Locator (VFL)** of the [PM61 Series](#) is used to identify fibers in a fiber bundle or to detect cable breaks. The laser is fully remote-controlled via the OPM Software.

Click  to start the Visual Fault Locator (VFL).



Warning

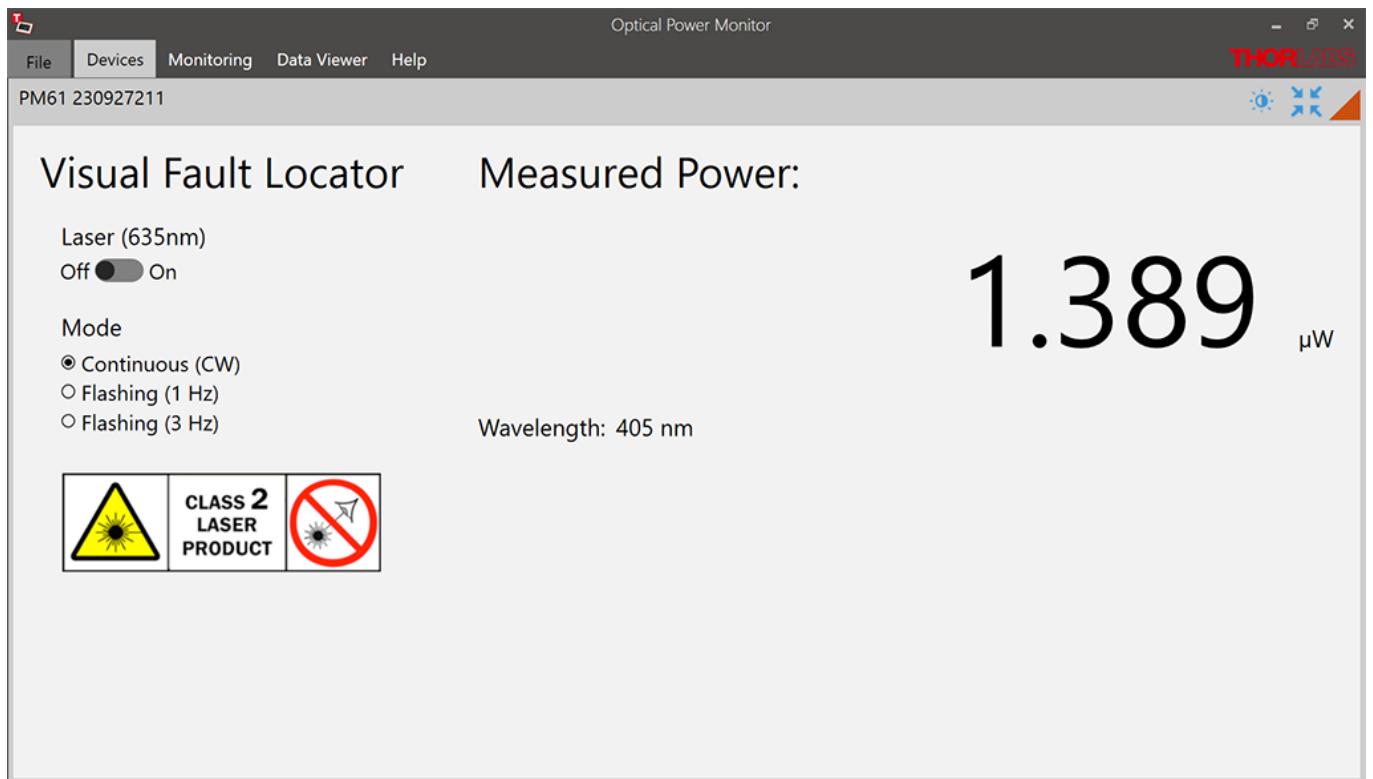
The PM61 Series field service optical power meters qualify as class 2 laser instruments due to safety measurements. When operated incorrectly, such as opening the internal mechanism of the device, this can cause severe damage to your eyes and health! Be sure to pay strict attention to the safety recommendations of the appropriate laser safety class, as stated for the used light source. Please ensure appropriate laser safety measures.

Warning

Do not look into the laser aperture while the laser is on. Injury to the eye may result.

The visible laser can be switched On/Off by the slide control. Switch between the the following modes:

- Continuous (CW)
- Flashing (1 Hz)
- Flashing (3 Hz)



5.1.2 PM101x

When using the power meters of the [PM101x](#) Series, the OPM Software shows the following additional options:

PM101

- Analog Output: For the [PM101](#), the OPM allows to define the voltage level of the analog output by configuring the responsivity. Please see the chapter Settings under [Device](#) for more information or the [PM101x manual](#) for more details.
- NTC: With the PM101, the user can monitor the temperature with an attached NTC. for more information on this feature, please see the PM101x manual or the section [Temperature Sensor on Power Meters](#).
- COM-Port: The PM101 can use a DB-15 connector run with RS232 operation for input and output. The OPM provides an interface to switch to the COM-port of the power meter. Please see the chapter [Add Devices](#) for more information.

PM101A

- Analog Output: For the [PM101A](#), the OPM allows to define the voltage level of the analog output by configuring the responsivity. Please see the chapter Settings under [Device](#) for more information or the [PM101x manual](#) for more details.

PM101R

- COM-Port: The [PM101R](#) can use a serial DE-9 connector run with RS232 operation for input and output. The OPM provides an interface to switch to the COM-port of the power meter. Please see the chapter [Add Devices](#) for more information.

5.1.3 PM102x

When using the power meters of the [PM102x](#) Series, the software shows the following additional options:

PM102

- Analog Output: For the [PM102](#), the OPM allows to define the voltage level of the analog output by configuring the responsivity. Please see the chapter [Settings under Device](#) for more information or the [PM102x manual](#) for more details.
- NTC: With the PM102, the user can monitor the temperature with an attached NTC. For more information on this feature, please see the [PM102x manual](#) or the section [Temperature Sensor on PM400, PM101, PM102, PM103, PM5020](#).
- COM-Port: The PM102 can use a DB-15 connector run with RS232 operation for input and output. The OPM provides an interface to switch to the COM-port of the power meter. Please see the chapter [Add Devices](#) for more information.

PM102A

- Analog Output: For the [PM102A](#), the OPM allows to define the voltage level of the analog output by configuring the responsivity. Please see the chapter [Settings under Device](#) for more information or the [PM102x manual](#) for more details

PM102x with Thermal Position Sensors S44xC

All [PM102x](#) power meters are compatible with Thorlabs Thermal Position Sensors. When connected to a [S44xC](#) sensor, the OPM shows the interfaces described in the section [Thermal Position Sensors](#) in the chapter "Sensor Dependent Functions".

5.1.4 PM103x

When using the power meters of the [PM103x](#) Series, the software shows the following additional options:

PM103

- Analog Output AO2: For the [PM103](#), the OPM allows to define the voltage level of the analog output AO2 by configuring the responsivity. Please see the chapter [Settings under Device](#) for more information or the [PM103x manual](#) for more details.
- NTC: With the PM103, the user can monitor the temperature with an attached NTC. For more information on this feature, please see the PM103x manual or the section [Temperature Sensor on Power Meters](#).
- COM-Port: The PM103 can use a DB-15 connector run with RS232 operation for input and output. The OPM provides an interface to switch to the COM-port of the power meter. Please see the chapter [Add Devices](#) for more information.

PM103A

- Analog Output AO2: For the [PM103A](#), the OPM allows to define the voltage level of the analog output AO2 by configuring the responsivity. Please see the chapter [Settings under Device](#) for more information or the [PM103x manual](#) for more details.

PM103E

- Analog Output AO2: For the [PM103E](#), the OPM allows to define the voltage level of the analog output AO2 by configuring the responsivity. Please see the chapter [Settings under Device](#) for more information or the [PM103x manual](#) for more details.
- NTC: With the PM103E, the user can monitor the temperature with an attached NTC. For more information on this feature, please see the PM103x manual or the section [Temperature Sensor on Power Meters](#).
- COM-Port: The PM103E can use a DB-15 connector run with RS232 operation for input and output. The OPM provides an interface to switch to the COM-port of the power meter. Please see the chapter [Add Devices](#) for more information.

5.1.5 PM400

The file structure of data saved by the Optical Power Monitor and the [PM400](#) differ. Both file formats can be loaded by the OPM by selecting the appropriate import option. Also note the information given in the section [file formats](#).

5.1.6 PM5020

When using the [PM5020](#) Dual-Channel Optical Power and Energy Meter, the software shows the following additional options:

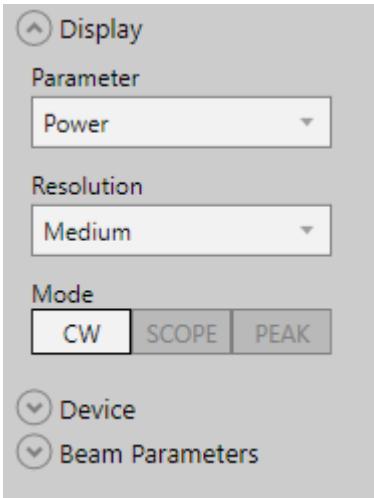
- The [PM5020](#) power meter offers connection to two sensors simultaneously. Correspondingly, signal from both channels is accommodated for by the OPM Software. Two channels are displayed under "Active Devices" as shown below. Switch between the displayed channels by clicking the respective field.



- X Analog Output X OUT: For the [PM5020](#), the OPM allows to define the voltage level and the maximum output voltage of the analog output X OUT by configuring the responsivity and the range. Please see the chapter Settings under [Device](#) for more information or the [PM5020](#) manual for more details.

When using Thermal Position & Power Sensors, two analog signals can be configured for the X and Y positional signal. Both provide a configurable voltage, proportional to the position.

- NTC: With the [PM5020](#), the user can monitor the temperature with two attached NTCs in the OPM Software. For more information on this feature, please see the [PM5020](#) manual or the section [Temperature Sensor on Power Meters](#).
- CW/PEAK/SCOPE selection: When photodiode sensors are connected, the settings can be selected to continuous wave (CW), peak or scope mode in the settings menu below "display":

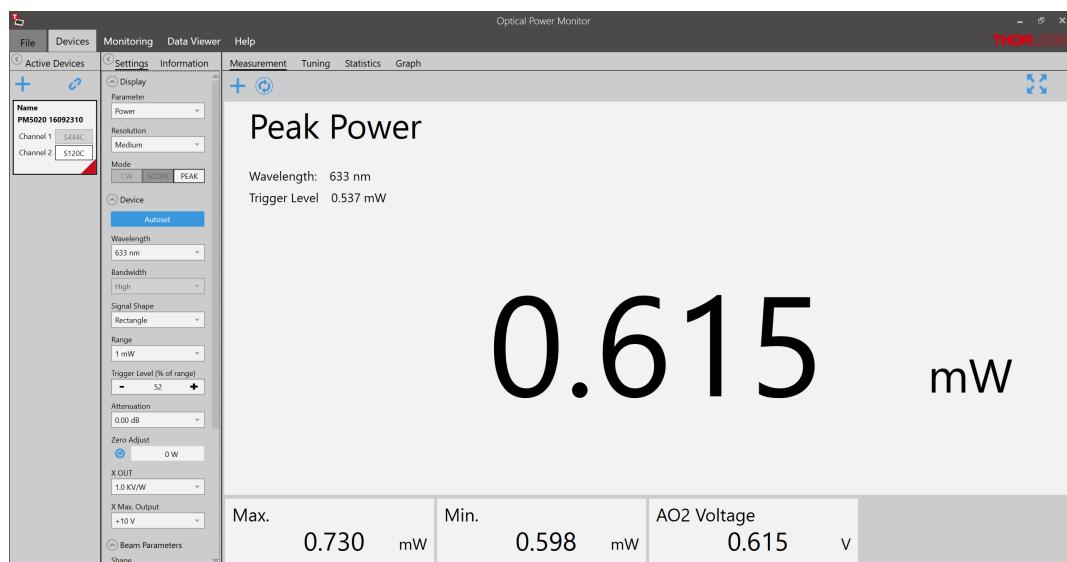


CW

In this setting, the display shows the default recorded signal as provided by the power meter.

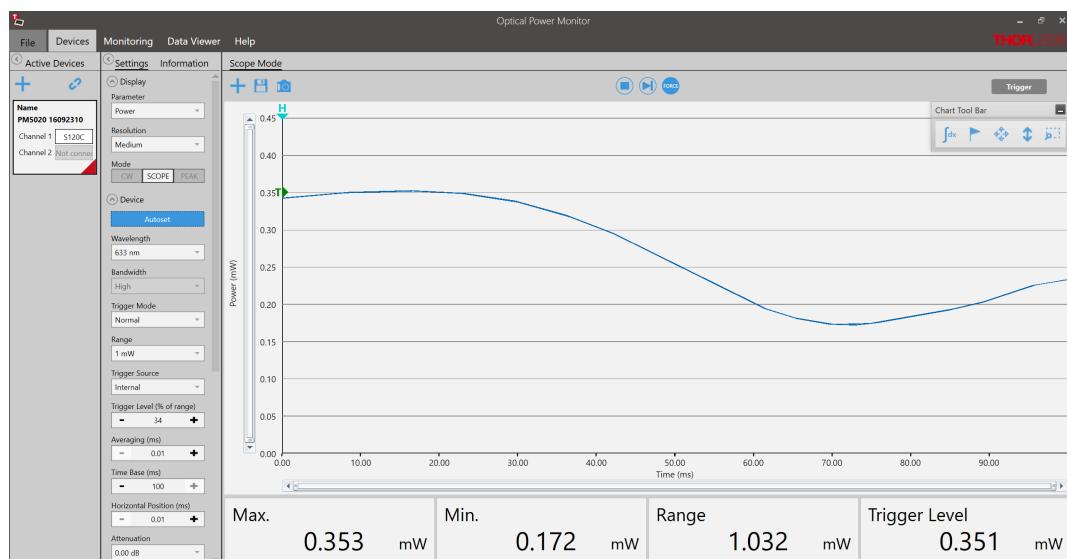
PEAK

If a signal exceeds the set trigger threshold, as set on the [PM5020](#), the peak value occurring after the trigger is displayed.



SCOPE

The scope mode can be used for the visualization for alternating signals.



When using the mode SCOPE, additional settings appear in the settings panel and the display panel:

- **Autoset:** Automatically adjusts measurement range and trigger level.
- **Trigger Mode:** "Normal" waits for the next valid trigger condition. After that the acquisition is started.
"Auto" starts the acquisition periodically, even without a valid trigger condition.
- **Trigger source:** Set the trigger source to "Internal" or "External" when applying a respective TTL signal.
- **Averaging:** Averages the measurement values over a multiple of 10µs.

- Time base: Sets the time for 10.000 samples.
- Horizontal Pos.: This allows to set the point in a periodically recurring signal event when to start the trigger. The vertical line can be moved along the horizontal axis.
- Above the main display panel, additional buttons "Start/Stop", "Single", and "Force Trigger" will appear:
 - Start/Stop: Starts a continuous measurement.
 - Single: Starts a single measurement.
 - Force trigger: Triggers the measurement in normal mode after pressing the button.
- The tool bar Integral sign allows to mark the area under a pulse to display the pulse energy.

5.2 Sensor-Dependent Variations

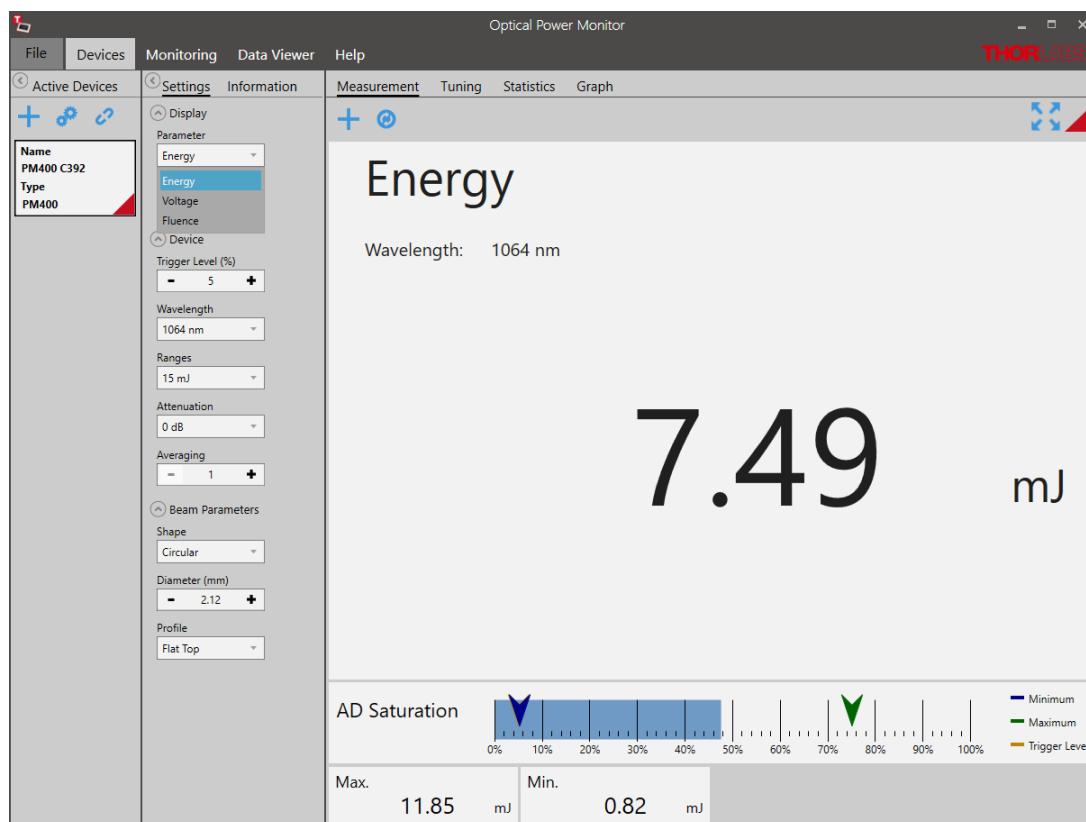
5.2.1 Pyroelectric Energy Sensors ESxxxC

The Thorlabs [ESxxxC Pyroelectric Sensors](#) are designed to measure pulsed light from coherent and incoherent sources. Pyroelectric sensors convert energy from light pulses into voltage pulses.

In this case the measured light signal is not continuous, the OPM Software requires different settings for processing and display.

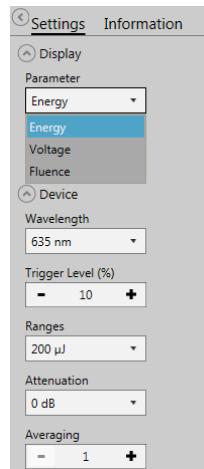
Find below the relevant changes in the OPM when using a pyroelectric energy sensor, described for a setup using a ES111C pyroelectric sensor connected to a PM400 power meter.

The interface looks the following way:



1. Settings Menu

The list of settings differs in the following:



Parameter: **Energy** and **Fluence** are parameters of choice instead of Power and Irradiance as Energy and Fluence are calculated independent of time.

Range: **Auto Range** is not available when using a pyroelectric sensor because this can not be accommodated with pulsed signals.

Trigger Level: The Trigger Level can be set as a threshold to eliminate small pulses caused by fluctuations in the light source or intrinsic noise from the detector.

When an incoming pulse exceeds the set trigger level, the peak detector circuit gets armed and is waiting until the pulse peak is reached. After finding the maximum voltage the level is kept and the microprocessor reads the AD converted voltage for displaying the pulse energy. Finally the peak detector circuit gets a reset and is ready for the next pulse.

The trigger level can be adjusted as a percentage of each selected energy range. Only pulses that are higher than the adjusted trigger level are recognized by the OPM. The trigger level should be set between the noise level and the expected pulse height.

2. Measurement Menu: Add/Remove Parameters

For pyroelectric sensors, the measurement interface additionally displays the **AD Saturation** in a bar, as shown on the [previous page](#).

When selecting  , the available parameters now list **Energy**, **Fluence** and **Average Power**.

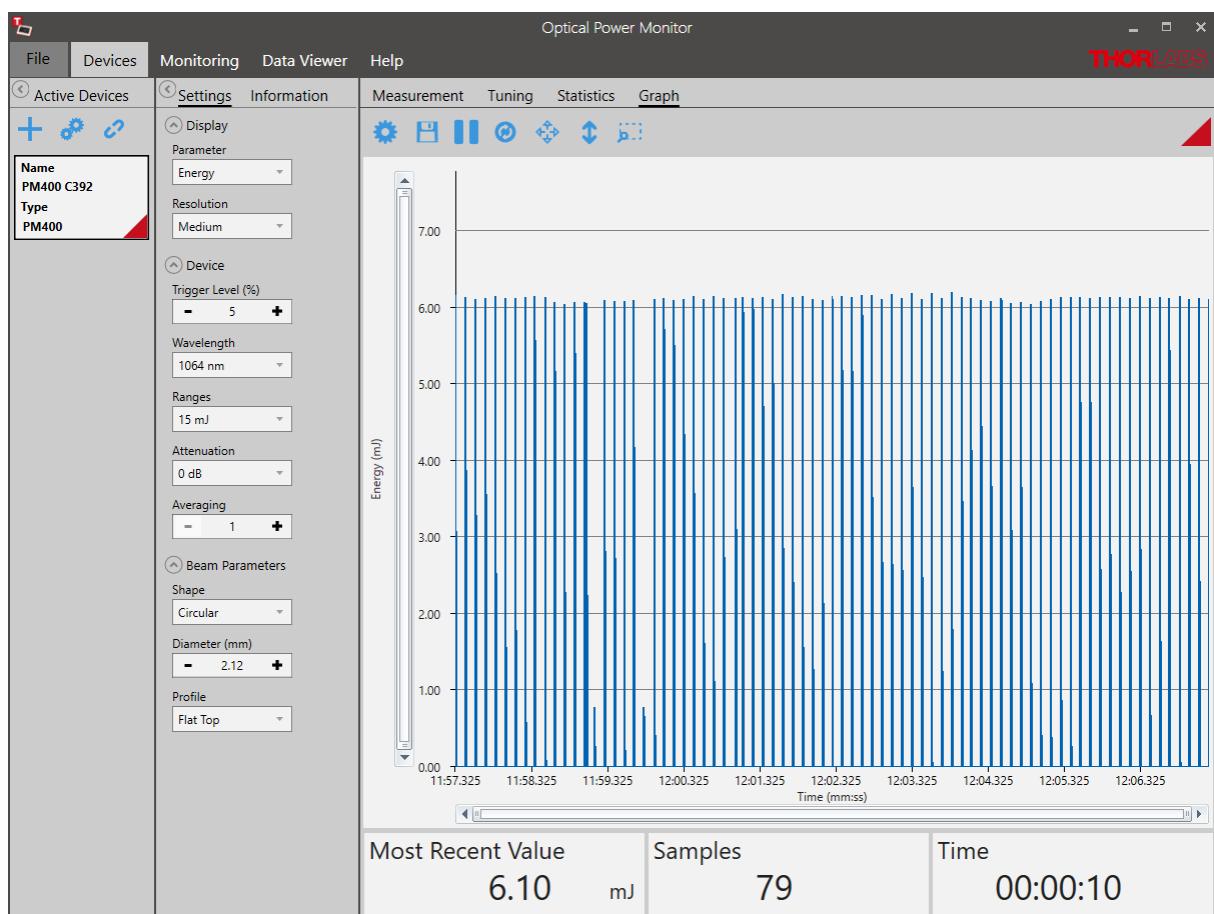


When **Averaging** is set to 1, each signal pulse results in one measurement value. Since this is a rolling average, the second value of the average power is calculated using the pulse signals 2 to 4 and so on.

When **Averaging** is set to 2, the average of pulse 1 and 2 generates the first measurement value. The average of pulse 2 and 3 gives the second measurement value and so on. As above, the average power is calculated as the average of measurement values 1-3 calculated from signal pulses 1-4. Since this is a rolling average, the second average power value is calculated using signal pulse 2 to 5 and so on.

3. Graph Menu

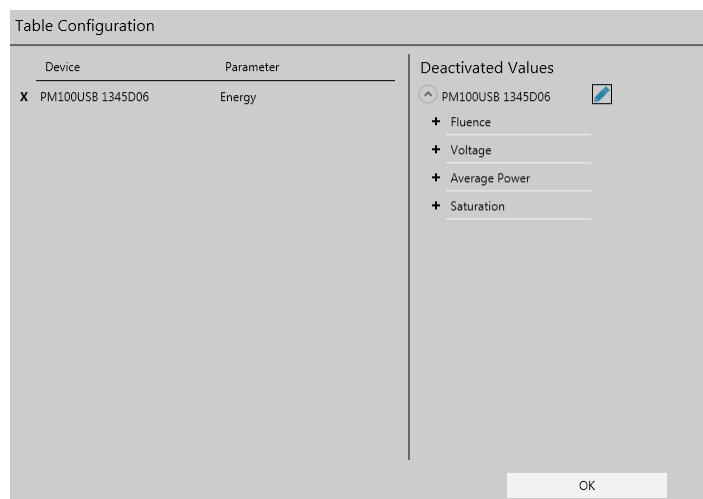
For pulsed laser applications, the Graph panel changes from a line-display, as shown for continuous signal, to a bar graph.



3. Monitoring Menu

Table configuration

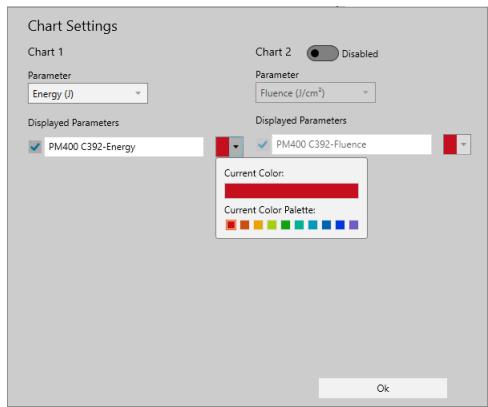
For pyroelectric sensors, the [Table Configuration](#) now additionally lists the parameters **Energy**, **Fluence** and **Average Power** that can be logged in the experiment and continuously displayed.



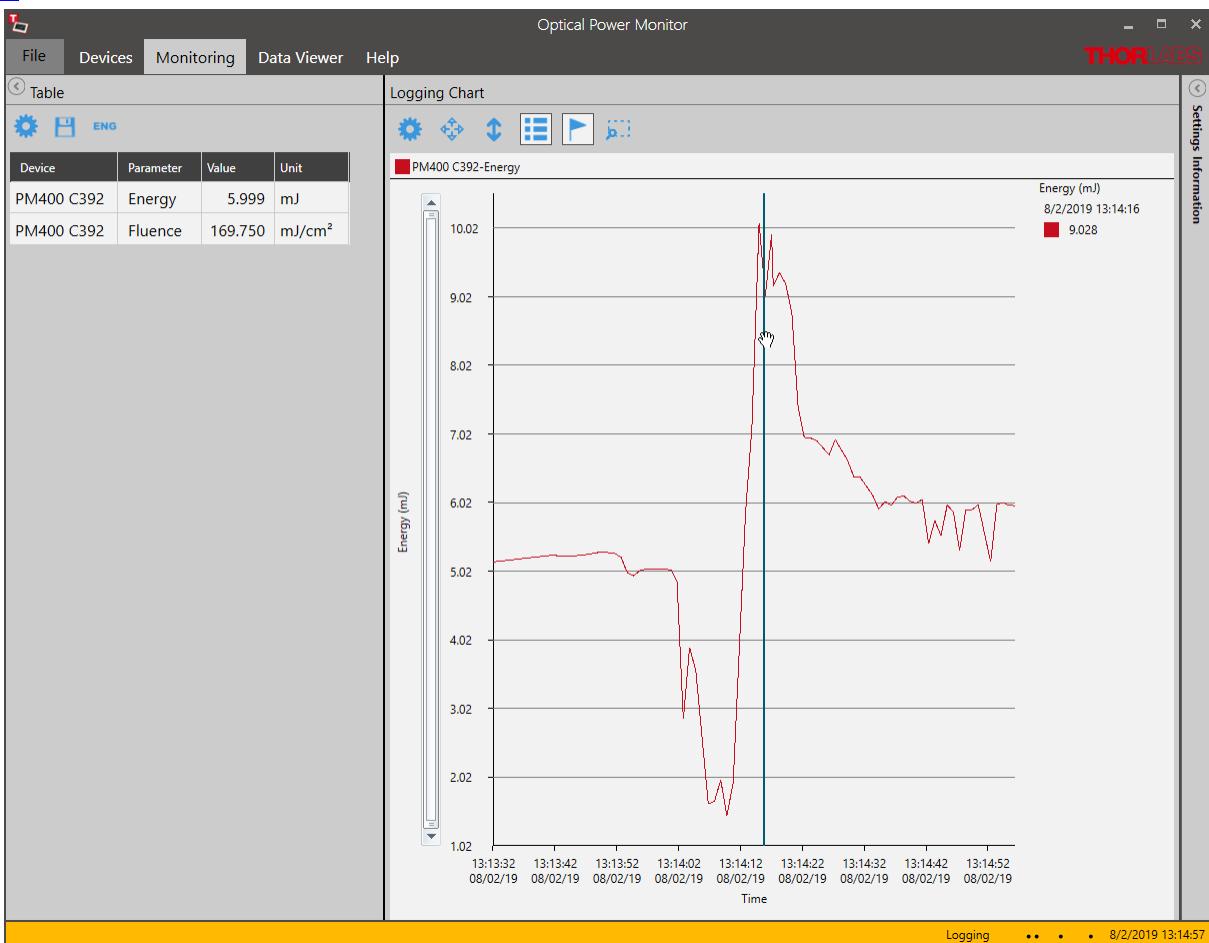
4. Logging Chart

Corresponding to the parameters selected in the above [Table Configuration](#), the additional parameters can be selected for display in the [Logging Chart](#).

Optical Power Monitor



The **Logging Chart** displays the pulse energy values in a continuous line. Please adjust the saving interval according to the interval between the laser pulses in your setup to avoid data points without signal. For pulse intervals shorter than the saving interval, the displayed value is the last value sent by the power meter. For higher resolution measurements, please use the [Graph mode](#).



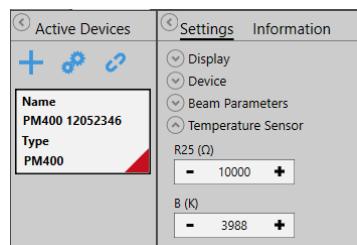
5.2.2 Temperature Sensor

For [PM400](#), [PM101](#), [PM102](#), [PM103](#), [PM103E](#), and [PM5020](#) the temperature can be recorded by the Optical Power Monitor if one or, for [PM5020](#), two Thorlabs Temperature Sensors or alternative NTC sensors are attached. Please see the [PM400 Manual](#) and the manual for [PM101x](#), [PM102x](#), [PM103x](#), or [PM5020](#) for more details.

This section describes the additional options available in the Optical Power Monitor when a temperature sensor (here: PM400) is recognized.

1. Settings Menu

Specify the following **Temperature Sensor** settings.



R25 (Ω) : Resistance at 25 °C in Ohm [Ω]
B (K) : Material Constant in Kelvin [K]

To find the appropriate parameters, please see the specifications of the temperature sensor.

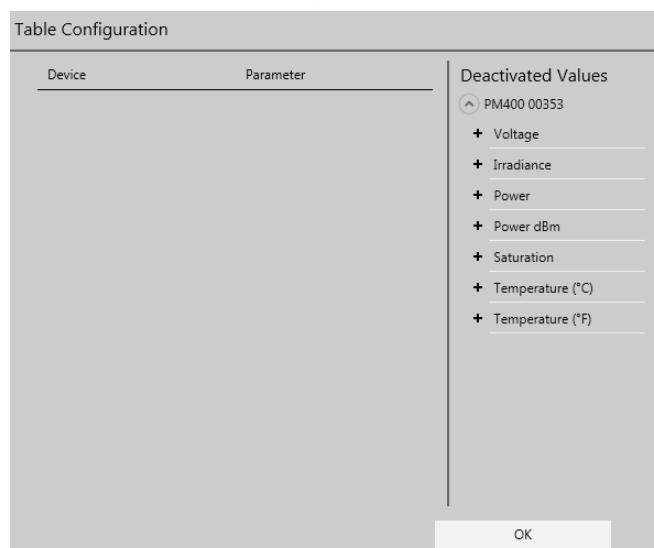
2. Measurement Menu: Add/Remove Parameters

For temperature sensors, the parameters list temperature in °C and °F, when selecting **+**.

Voltage	Irradiance	Power
Power dBm	Max.	Min.
Ratio	Saturation	Temperature (°C)
Temperature (°F)		

3. Monitoring Menu

When using a temperature sensor, the temperature in °C and °F can be logged and monitored by adding these parameters in the [Table](#) configuration panel.

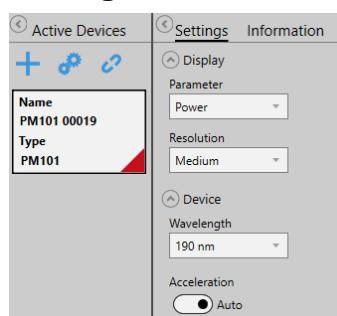


5.2.3 Thermal Sensors

Thermal detectors measure the optical power of incident light radiation. The absorber on the detector surface converts the incident light into heat energy. The heat flows from the absorber across the sensor into a heat sink. Due to the thermoelectric effect, the resulting temperature gradient across the multiple thermocouples in the sensor generates a voltage that is proportional to the optical power of the incident radiation.

Certain thermal sensors can show a fairly slow response. When laser power hits the active area in these sensors, it may take up to 20 seconds until the power reading shows the maximum power value. A slow sensor can be accelerated to up to 1-3 seconds by predicting the maximum power value based on the initial power reading.

Settings



Acceleration:

Set the Acceleration to **Auto** when using a slow thermal sensor. As this function has a disadvantage in that it induces noise to the measurement value, the acceleration circuit can be set to **Off**.

Information: Power Measurement Prediction

The typical natural response of a thermal sensor to an instantaneous transition from darkness to being steadily illuminated is a step function. It produces a response that can be modeled using an exponential function.

The sensor time constant is defined in terms of the duration until the sensor response reaches 99% of its maximum response. When the sensor has reached the 99% level, a time period equal to five sensor time constants has elapsed.

When the sensor's natural response characteristic function is known, the final power reading can be modeled and predicted well before the sensor reading has stabilized. Thorlabs' power meter consoles calculate and display predictions of the stabilized power reading when Thorlabs sensors with sensor time constants larger or equal to 0.5 s (natural response time larger than 1s) are connected. For this calculation, the sensor information stored in the EEPROM built into the C-Series connectors is used. Please refer to the specifications sheet of the used sensor for the response time of your sensor.

When Acceleration is switched to **Auto**, the first prediction is made after a duration equal to a single sensor time constant. This prediction is updated at time intervals of one sensor time constant until a total duration of seven sensor time constants has elapsed. Prediction is then turned off; the power reading after seven time constants is 99.9% of the final reading.

After prediction is turned off, the gradient of the power reading is monitored, and prediction is re-enabled if an increase is detected which exceeds a defined threshold.

5.2.4 Thermal Position Sensor

The Thorlabs Thermal Position Sensors [S44xC](#) measure the power and position of a light beam originating from low and medium power lasers and are controlled via a connected compatible power meter, either a PM400 or a PM102x. The OPM features an interface to display and analyse the signal from these Thorlabs Thermal Position Sensors.

At the core of the S440C and S442C are the Thorlabs Thermal Position Detectors [TD4HR18XP](#) and [TD4HP18XA](#), respectively. The sensors are wire connected to a D-Sub-9 Pin Male connector for instrument control via a compatible Thorlabs power meter.

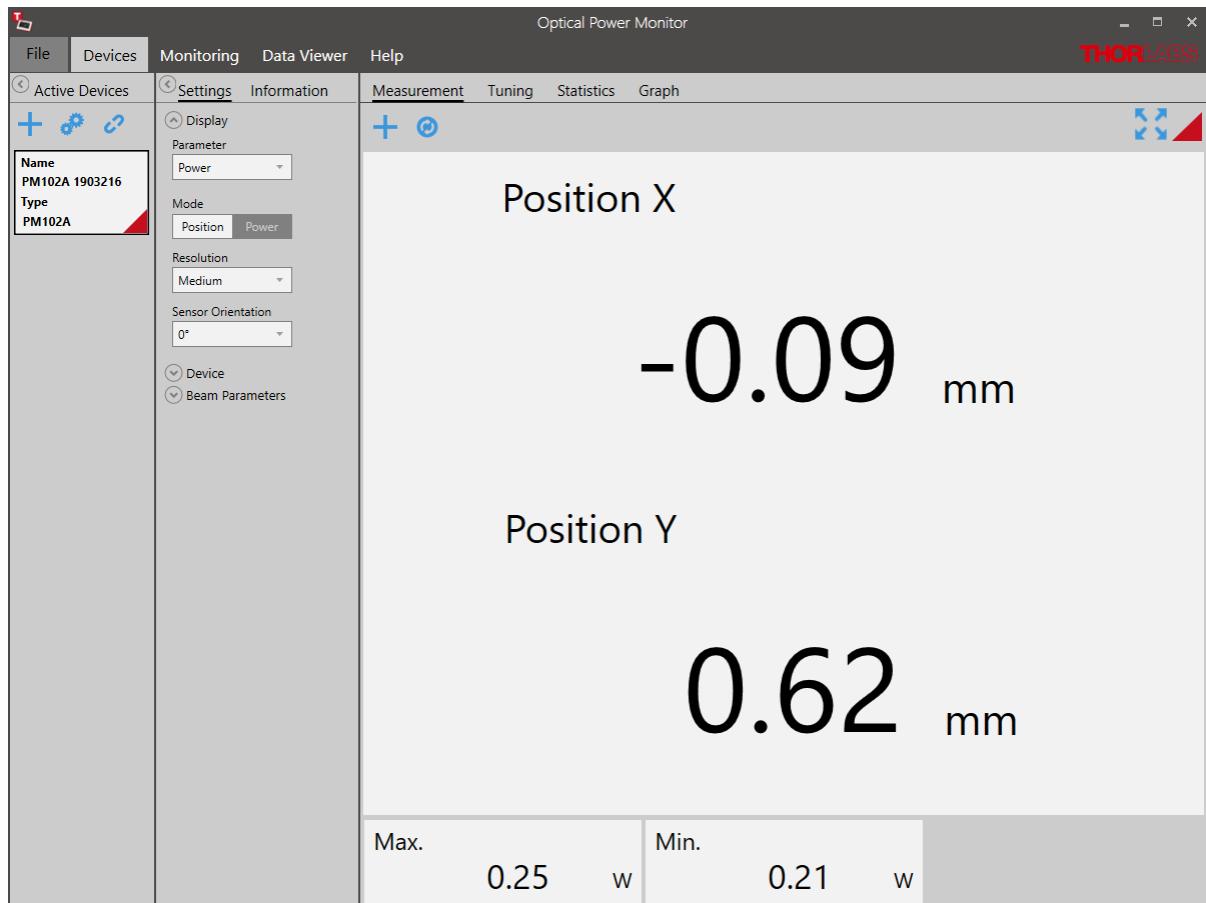
The core S44xC consists of four contiguous thermopile-based sensors arranged as quadrants of a square. Their mechanical integration thermally couples the four quadrants. However, the sensor in each quadrant is electrically independent and connected to only the thermocouples in that quadrant. This mechanical integration and electrical separation forms a position sensitive device (PSD). If the beam spot is incident on one quadrant, the output signal from this quadrant will be higher than the output signals of the other three quadrants. If the beam moves towards the center of the PSD, the signals from the four quadrants will become more similar. The X and Y position of the beam is determined by comparing the signal intensities of all four quadrants.

OPM Interface

Find below the relevant changes in the OPM when using a Thermal Position Sensor, described for a setup using a S440C thermal position sensor connected to a PM102 power meter. The Thorlabs Thermal Position Sensors S44xC can be run using the PM400, PM102, PM102A, or PM102U and the OPM interface will appear correspondingly.

1. Devices - Settings Menu

Display

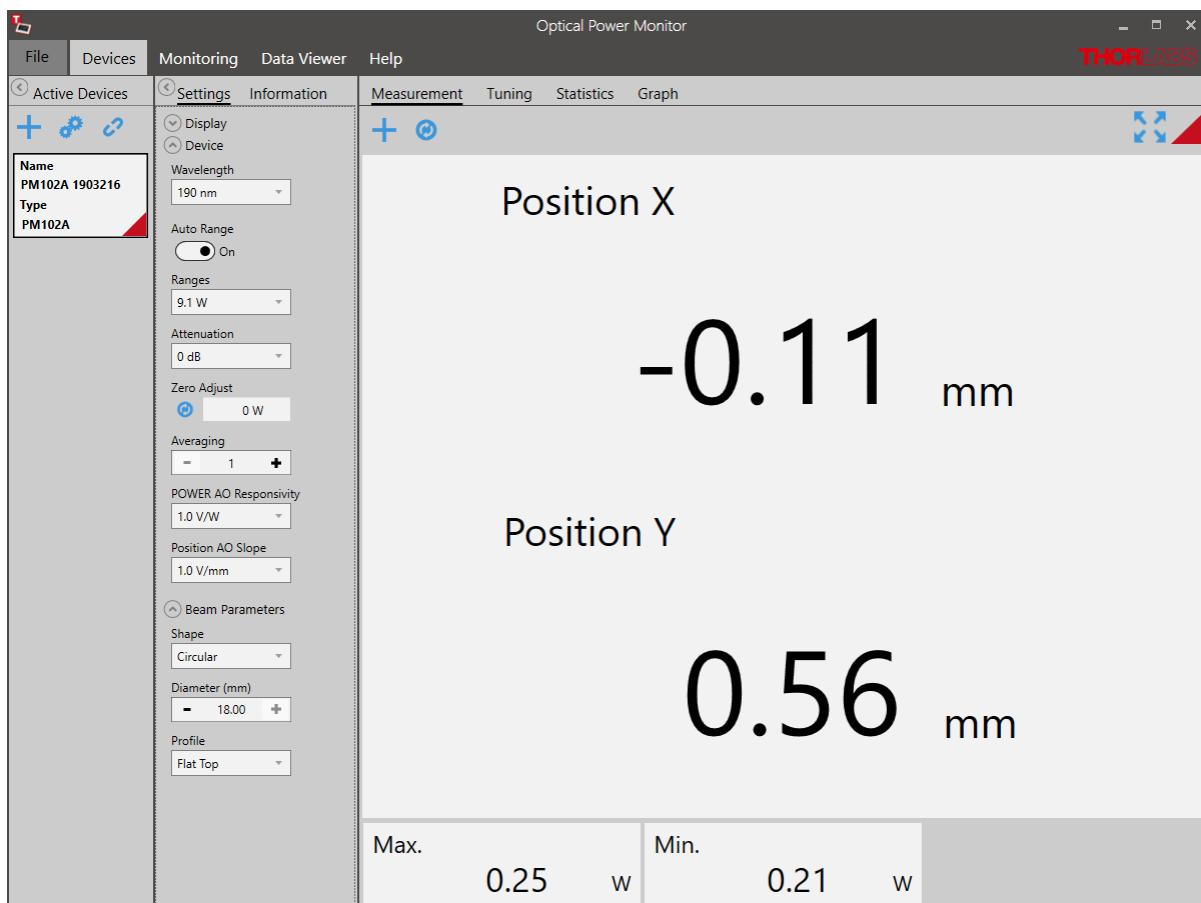


When a Thorlabs Thermal Position Sensor is connected to a power meter and run via the OPM, the OPM menu for "Devices" gives the option to display either the power signal or the positional signal.

When the "Power" is chosen in the section "Parameter", the OPM shows the standard interface.

When "Position" is chosen, the coordinates are shown in x and y. The user has the option to change the resolution and sensor orientation.

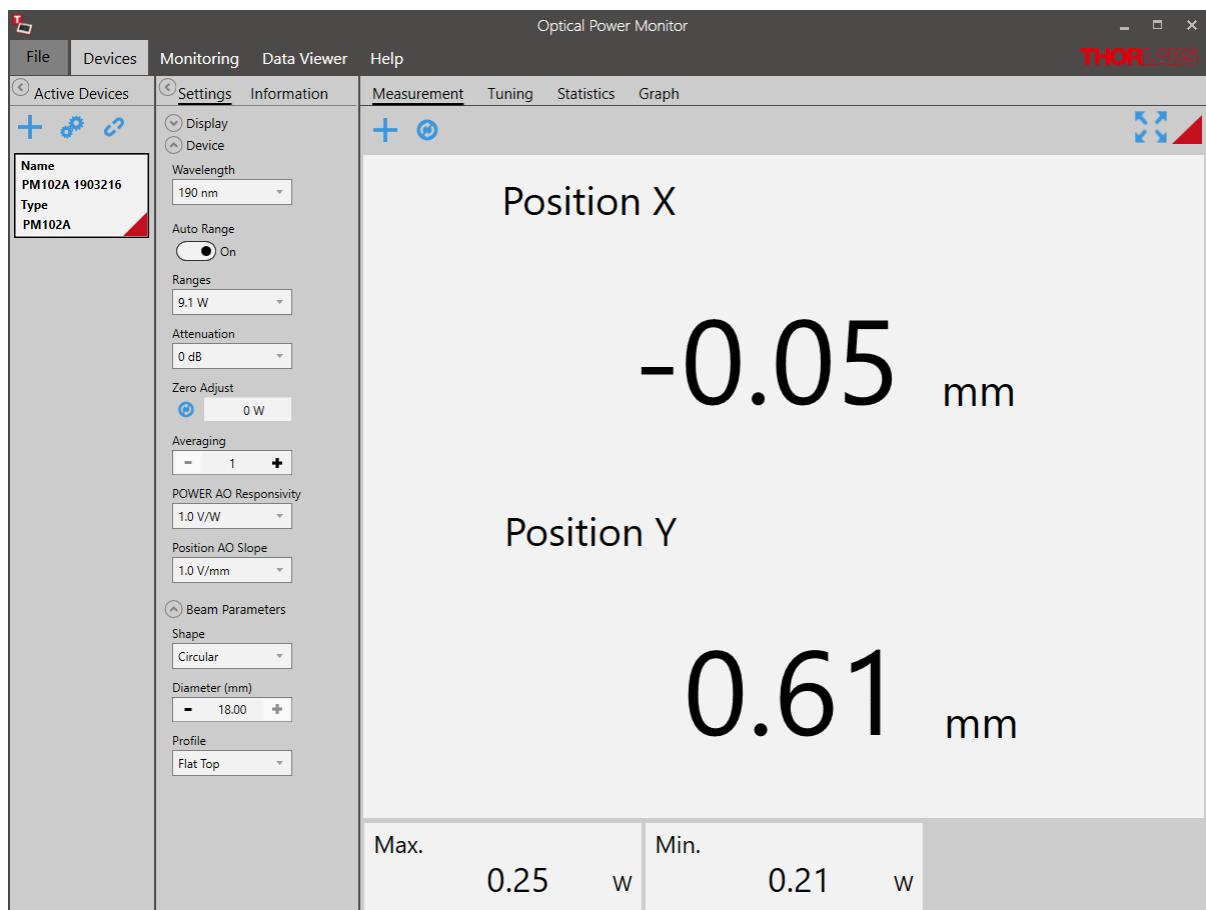
Device



Under devices, the standard settings described in the chapter [Settings](#) in the general section can be adjusted.

The Responsivity for the software-configurable analog output port POWER AO can be adjusted as well as the analog position output ports X POS and Y POS.

2. Devices - Measurement Menu



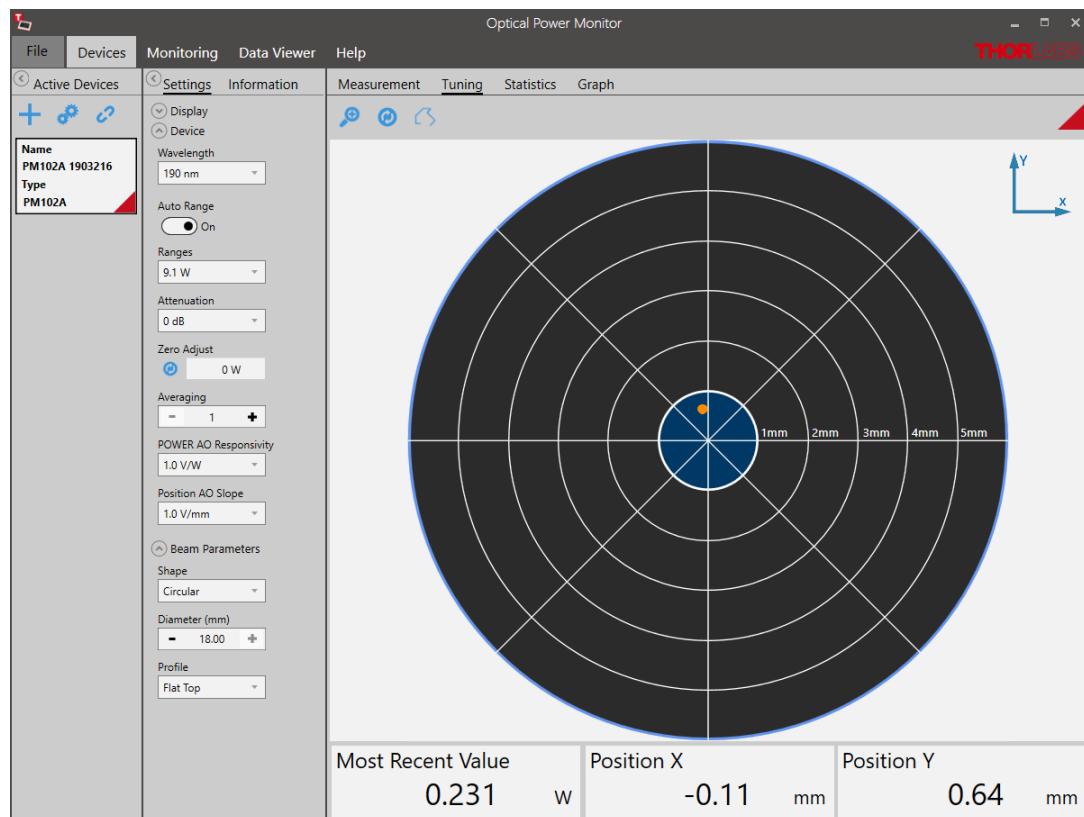
The Measurement interface displays the X and Y - position values and other values selected via the + icon. Options are shown below.

POWER AO Voltage	X POS AO Voltage	Y POS AO Voltage
Position X	Position Y	Voltage
Irradiance	Power	Power dBm
Max.	Min.	Ratio
Saturation		

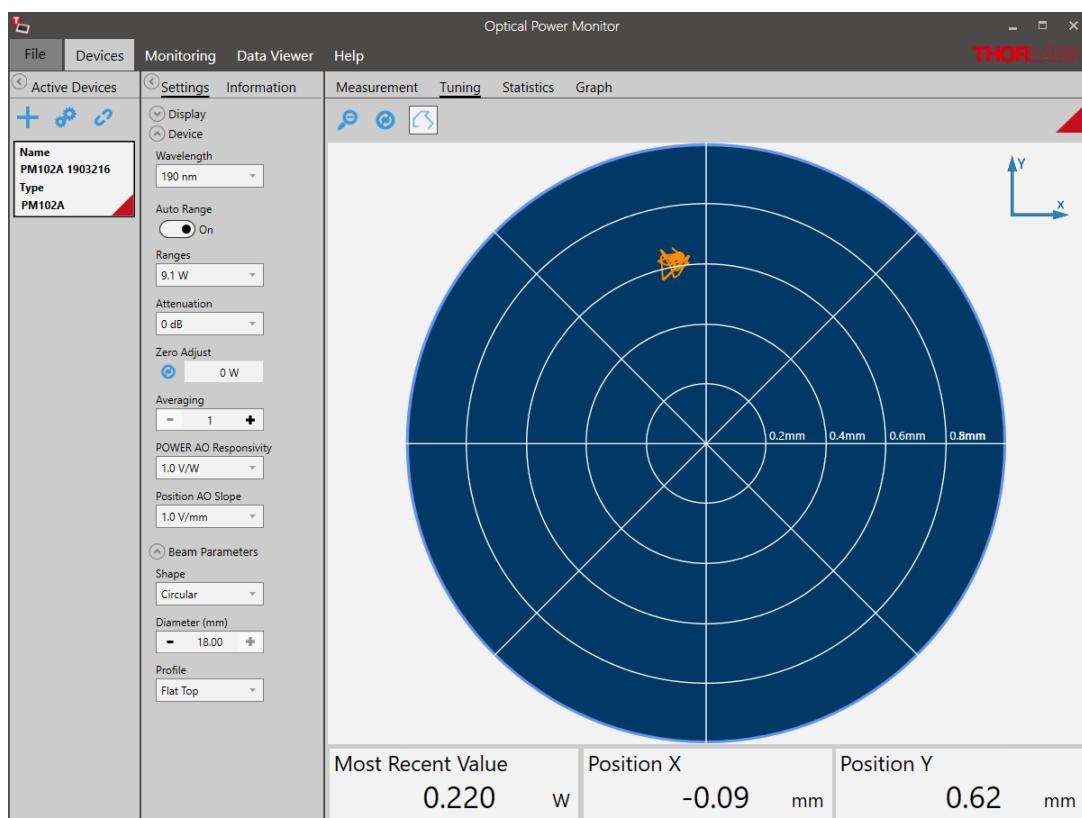
Optical Power Monitor

3. Devices - Tuning Menu

The interface "Tuning" shows a graphic display of the beam position in a target. Use the icon to zoom into the target.

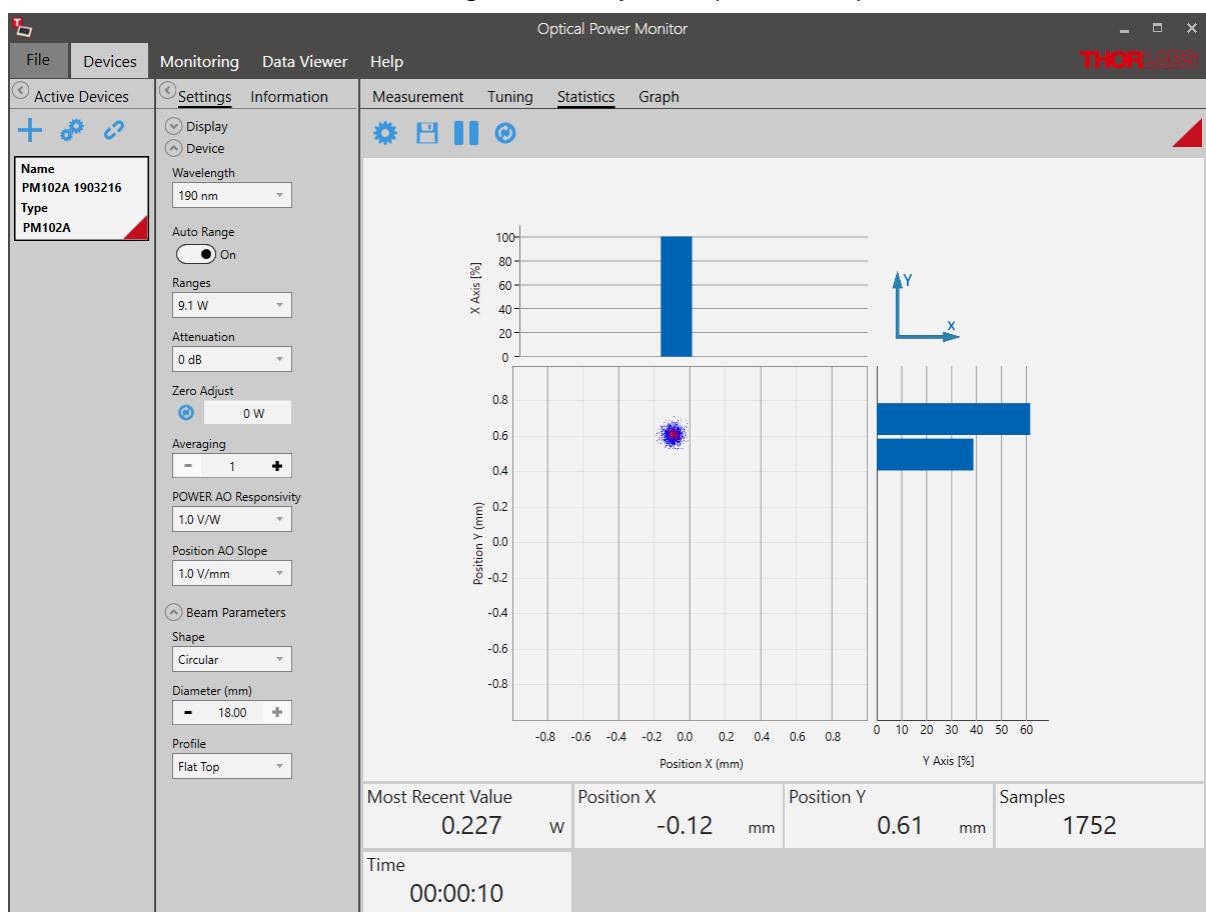


Use the button to trace the position over time and the icon to refresh the trace.



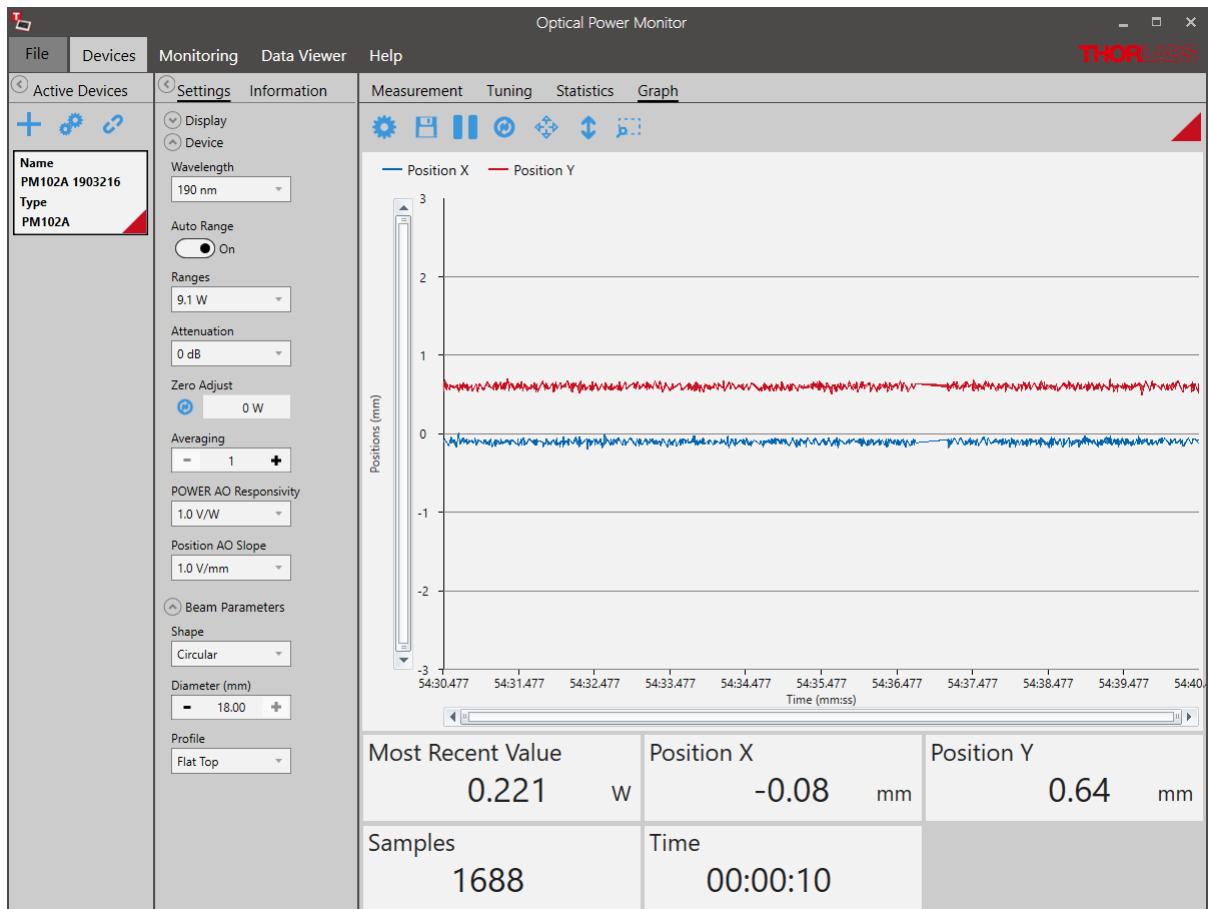
4. Devices - Statistics Menu

The interface "Statistics" shows the signal density on a particular position.



5. Devices - Graph Menu

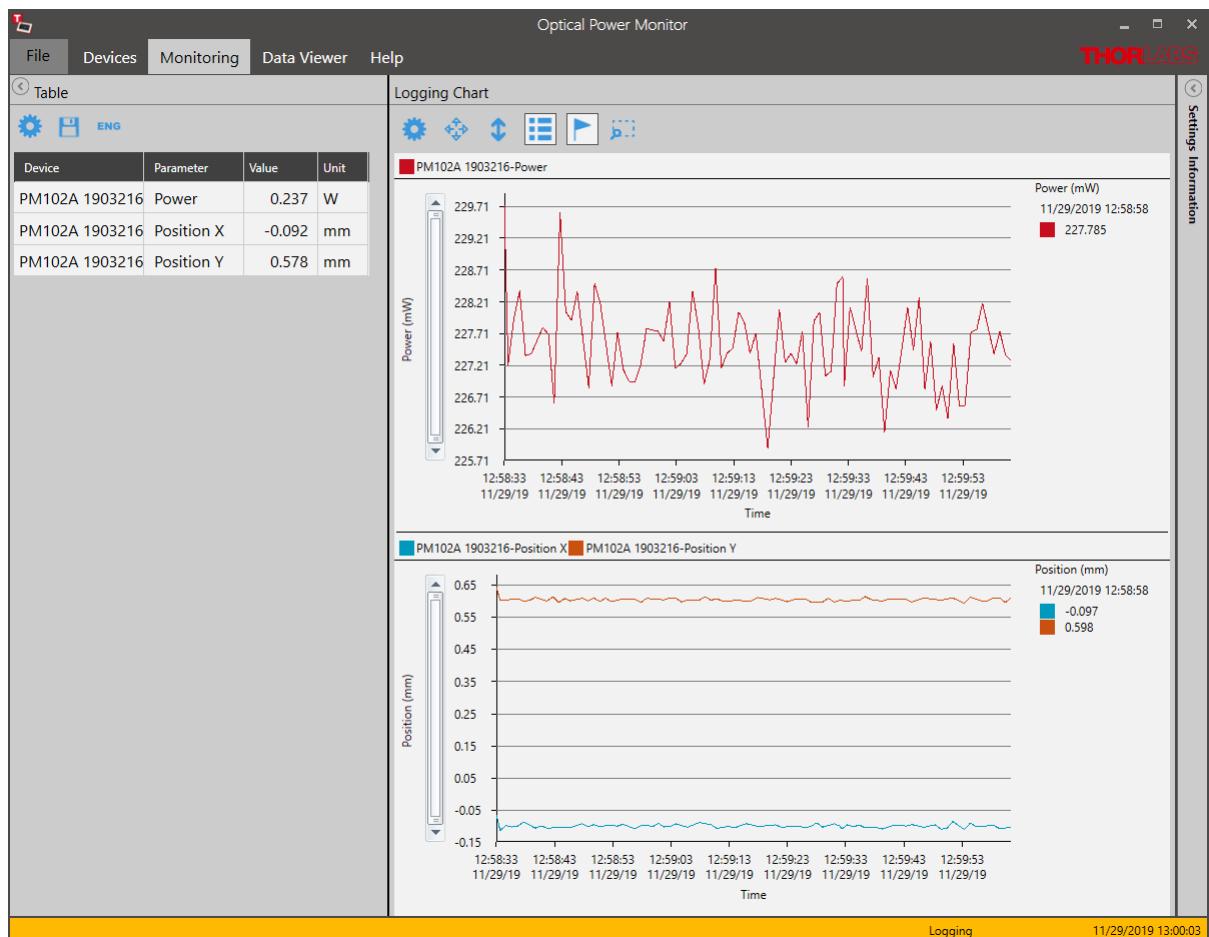
The interface "Graph" shows the signal position over time as a two-dimensional plot for the X and Y position.



The user can now change setting and zoom into the plot as for other graph displays.

6. Monitoring

When monitoring measurements with Thermal Position Sensors over time, the interface offers to view positional information in addition to the options available for other thermal sensors. To select those, go to the top left icon .



5.2.5 Custom Sensors

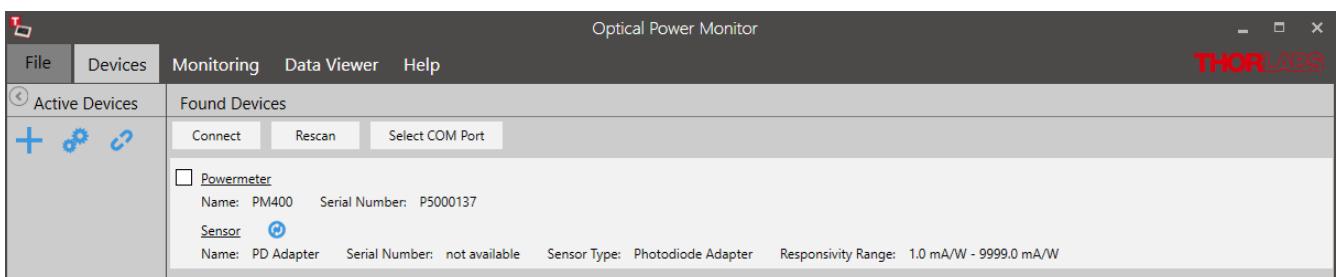
In addition to Thorlabs sensors, custom sensors can be used with the Optical Power Monitor.

Note

Please be aware that an adapter needs to be used to connect a custom sensor to a Thorlabs power meter. An adapter is not provided by Thorlabs. To build the adapter, please refer to the instructions in the manual of the respective power meter.

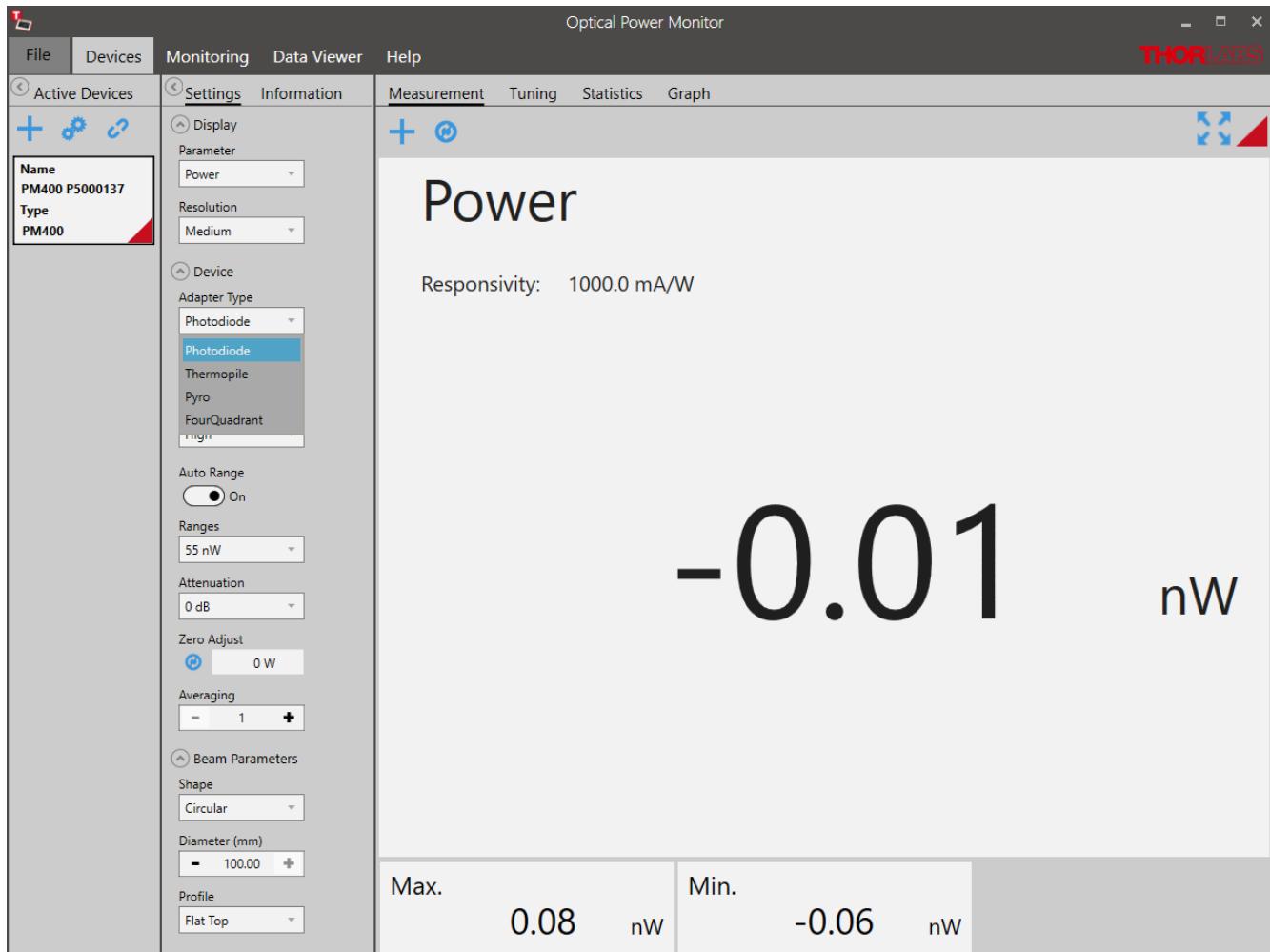
Setting the Sensor Type

The power meter and the OPM Software will automatically recognize the adapter and set the sensor type in Found Devices to the last used adapter type.



Optical Power Monitor

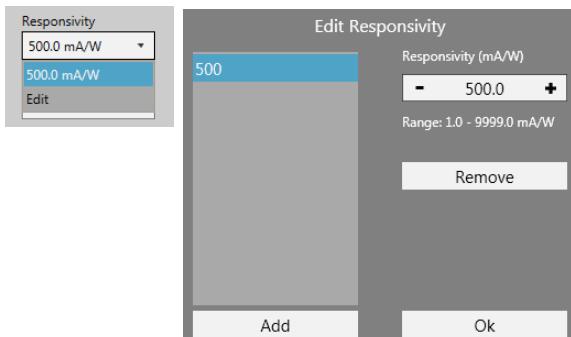
The custom sensor type can be changed under **Settings** in the **Active Devices** panel to either "Photodiode Adapter", "Thermopile Adapter", "Pyro Adapter", or "Four Quadrant" sensor for thermal position sensors.



Required Setting Adjustments

The responsivity of the custom sensor is not recognized by the power meter and therefore not sent to the OPM Software. This is indicated in the Found Devices Panel above: Responsivity Range: 1.0 mA/W - 9999.0 mA/W.

Therefore, it is necessary to account for it in your analysis or to set the responsivity of the used sensor at the operating wavelength in the **Settings** panel shown below.



Several responsivities can be added to a list. This way, the correct responsivity can be quickly selected when using different wavelengths.

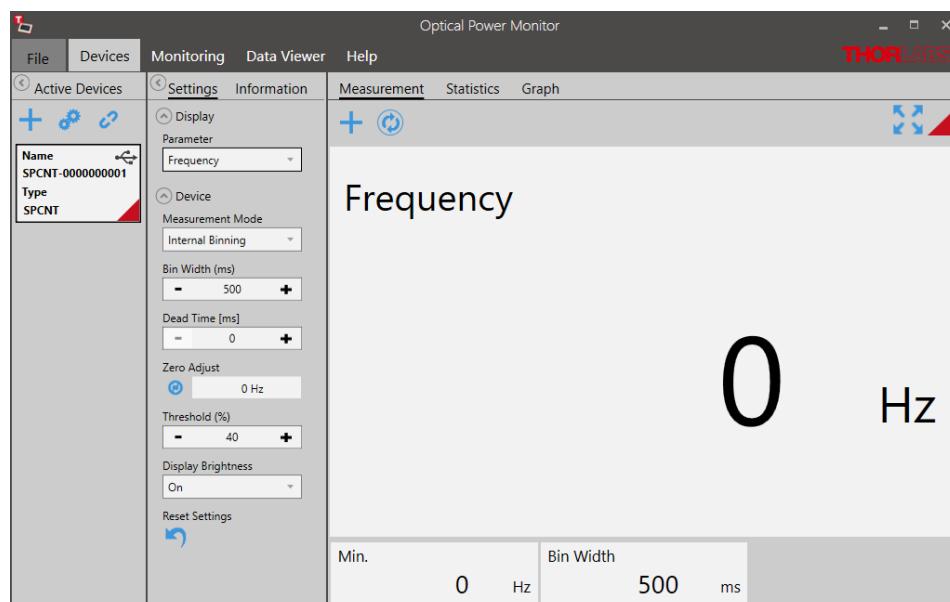
Note

If the adapter is not automatically recognized or the settings can not be adjusted in the OPM Software, please contact Thorlabs.

5.3 Single Photon Counting Device

After connecting of the SPCNT counting device to the PC running the installed OPM software, open the software and select the SPCNT as the active device in the left panel.

The OPM software will then show the following interface. This chapter describe the functions for the SPCNT in the OPM software.



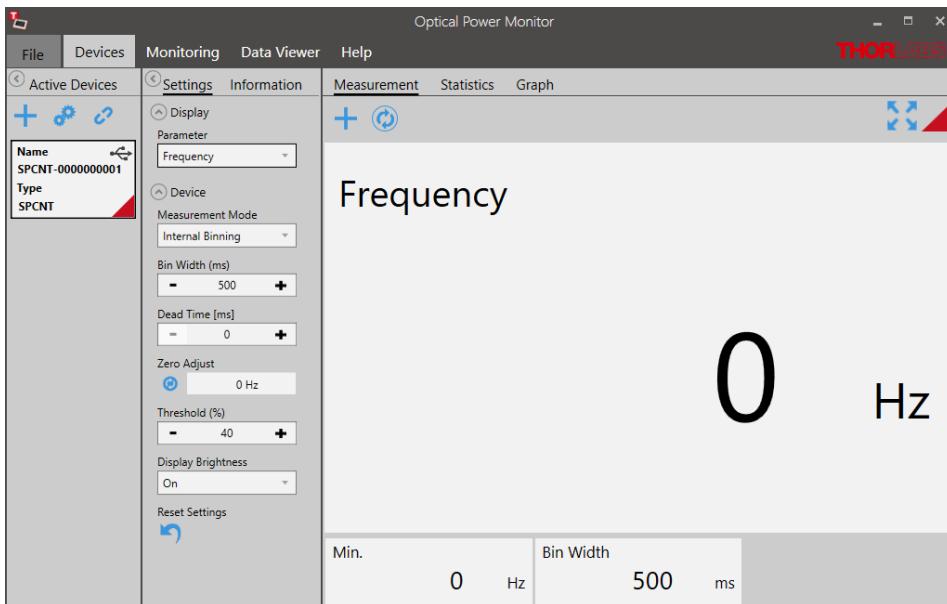
Optical Power Monitor

The Devices menu administers the currently connected devices, short-term measurements and the respective settings.

To start a measurement, follow the sequence suggested by the menu bar from left to right:

- Activate Devices
- Adjust Settings
- Observe the Measurement

In the following interface, adjust the settings for the SPCNT:



1. Active Devices Panel

This left panel lists the recognized, connected devices.

Additional devices (up to 8 SPCNT in parallel) may be added via the icon .

To change the displayed name or assign a color in the OPM for a selected device, click the icon . Disconnect devices via the link icon .

2. Settings Panel

Use the settings panel to configure the SPCNT counting device.

- a. Display - Parameter: Select between display of Frequency or Counts in the main panel Measurement.
- b. Device:
 - i. Measurement Mode: Choose between Internal Binning to set the binning from within the OPM software, or Gated to use a TTL start/stop signal from an external device to define the binning.

Internal Binning

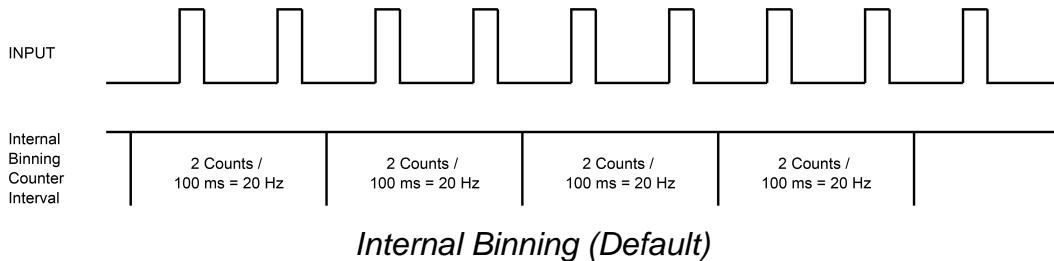
Use internal binning to set binning from within the OPM software. Internal Binning provides adjustment of the following parameters:

2. Bin Width [ms]

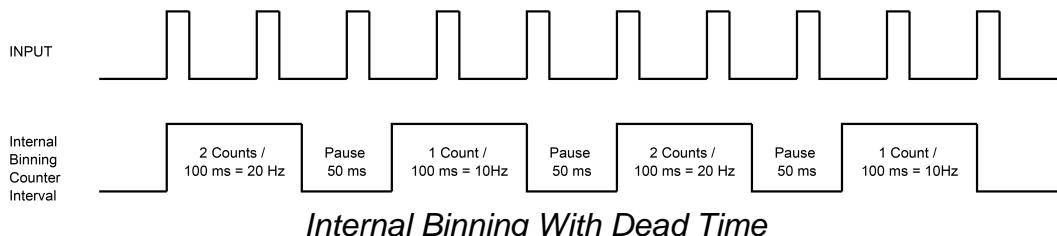
The bin width determines the duration within which pulses are counted.

The displayed frequency is calculated based on the number of pulses during the set bin width.

$$\text{Frequency} = \frac{\text{Counts}}{\text{Bin Width} * 1000}$$

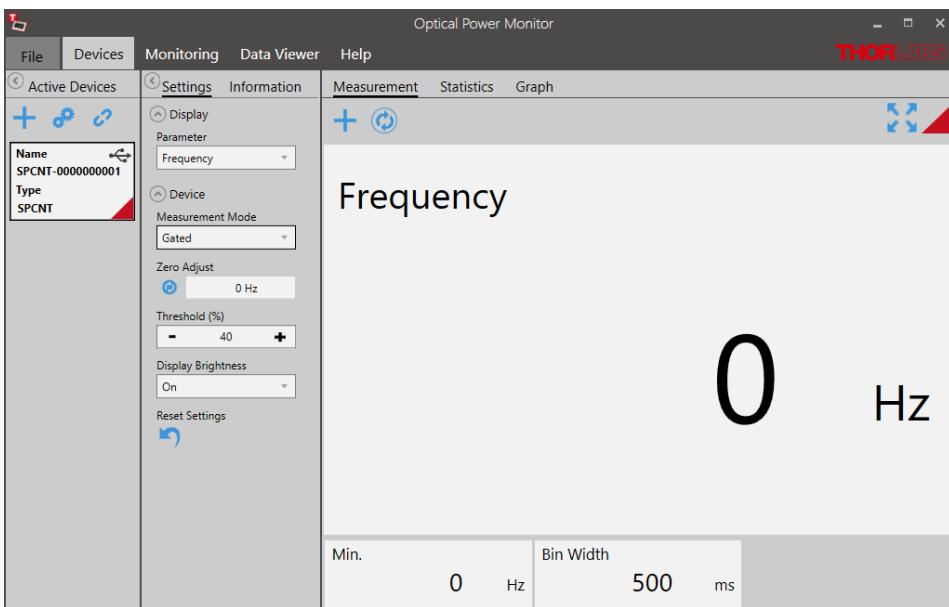


- 2. Dead Time [ms]** introduces a periodic interruption between bins. During the dead time, pulse counts are discarded. The dead time can be configured between 0 seconds (disabled) and 6 seconds with a microsecond accuracy. An example is shown in the figure below.



Gated

In Gated mode, an external device provides an Active High TTL Signal to define the binning. The OPM software in Gated mode provides adjustment via the following interface with the parameters described below:



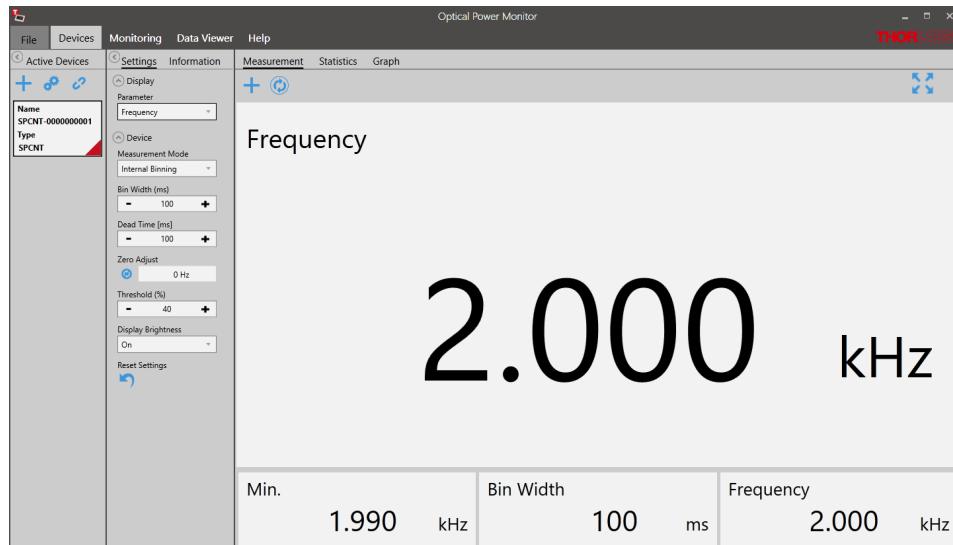
- i. Zero Adjust eliminates background noise originating from the connected Single Photon Detector or other unwanted background signal. When connected to a PC running the OPM software, the zero button on SPCNT device is disabled. To set Zero to eliminate background, set up the detector as used but in the absence of the desired signal. Cover the detector and click the icon .
- ii. Threshold [%] defines the signal level above which signal is counted. This function can be used to eliminate afterpulsing. The default settings for the threshold are optimal for the Thorlabs SPDMA and SPDMHx single photon detectors. To compensate for afterpulsing in other detectors, first determine the afterpulsing characteristics of the connected single photon detector and then set the threshold level.
- iii. Display Brightness adjusts the brightness of the display.

3. Information Panel

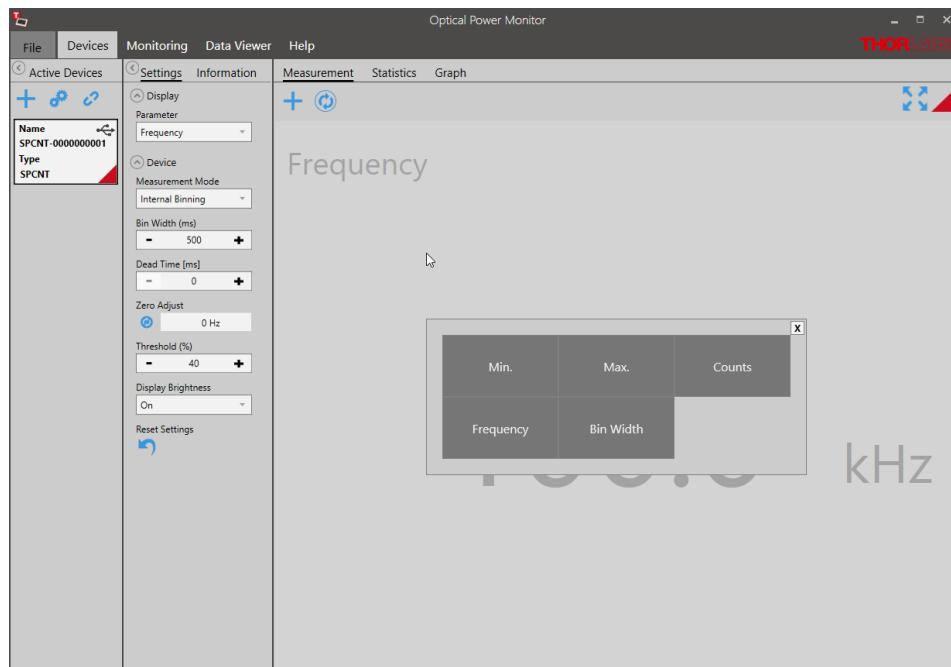
The panel Information shows the Name of the device, the serial number as well as the firmware revision.

4. Measurement Panel

The panel Measurement displays the numeric counts or frequency data as set in the settings panel as shown above. Click the refresh icon  to reset the cumulative value that is displayed.

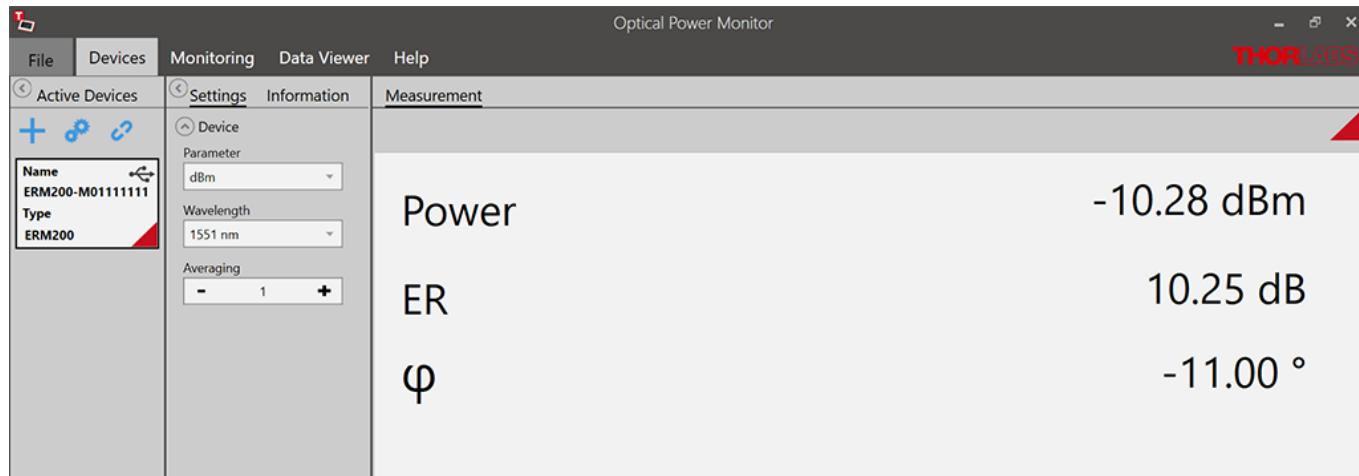


As in other applications of the Optical Power Monitor software, click the icon to add display of more features.



5.4 Benchtop Extinction Ratio Meter ERM2xx

When connecting the extinction ratio meters [ERM200](#), [ERM210](#), or [ERM220](#), to the OPM Software the start screen below is displayed.



The extinction ratio meters [ERM200](#), [ERM210](#), or [ERM220](#) shows the following additional options.

Settings

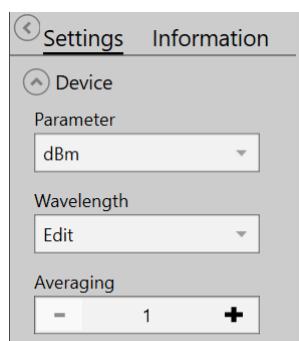
Device settings and measurement settings need to be adjusted in the **Settings** menu prior to the measurement by using the drop down menus shown below.

Note

Changes in the settings made during a measurement are applied immediately and impact the measurement. Changes in settings during active measurements are not saved!

Attention

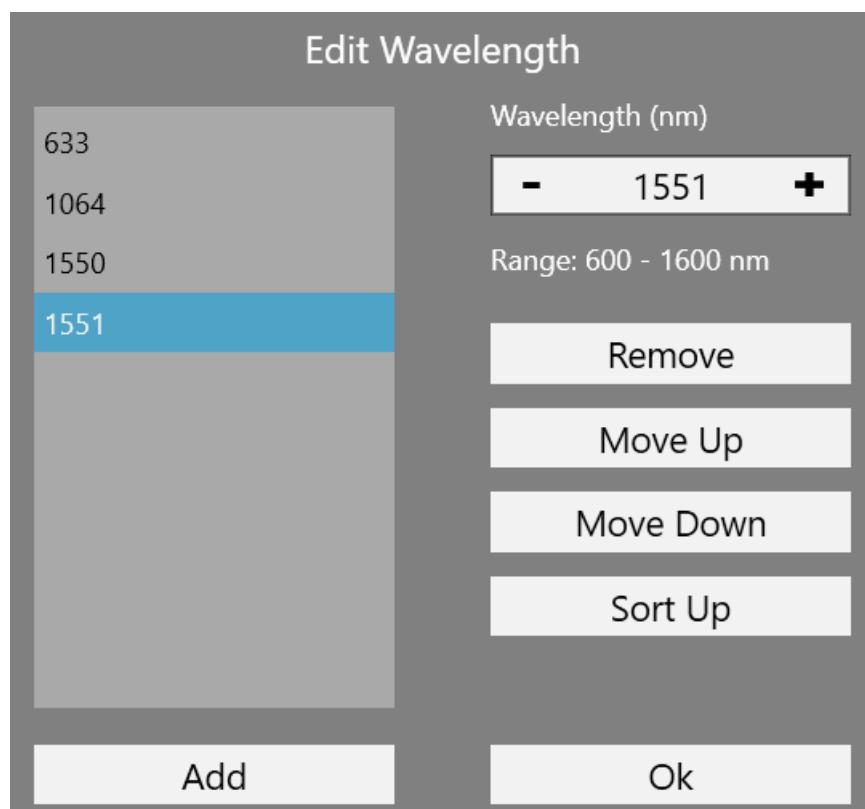
As the OPM calculations depend on these settings, correct settings are essential for best measurement accuracy.



Parameter	Choose between the units dbM and W that should be displayed.
Wavelength	Choose between predefined wavelengths or define and add a wavelength using the "Edit Wavelength" function (see below).
Averaging	Choose between different average factors.

Edit Wavelength

With the "Edit Wavelength" option, the wavelength can be changed and added to the existing predefined wavelengths within the range of the corresponding device. Shown below is an [ERM200](#) with a wavelength range of 600 - 1600 nm.



Information

Extinction Ratio Meter

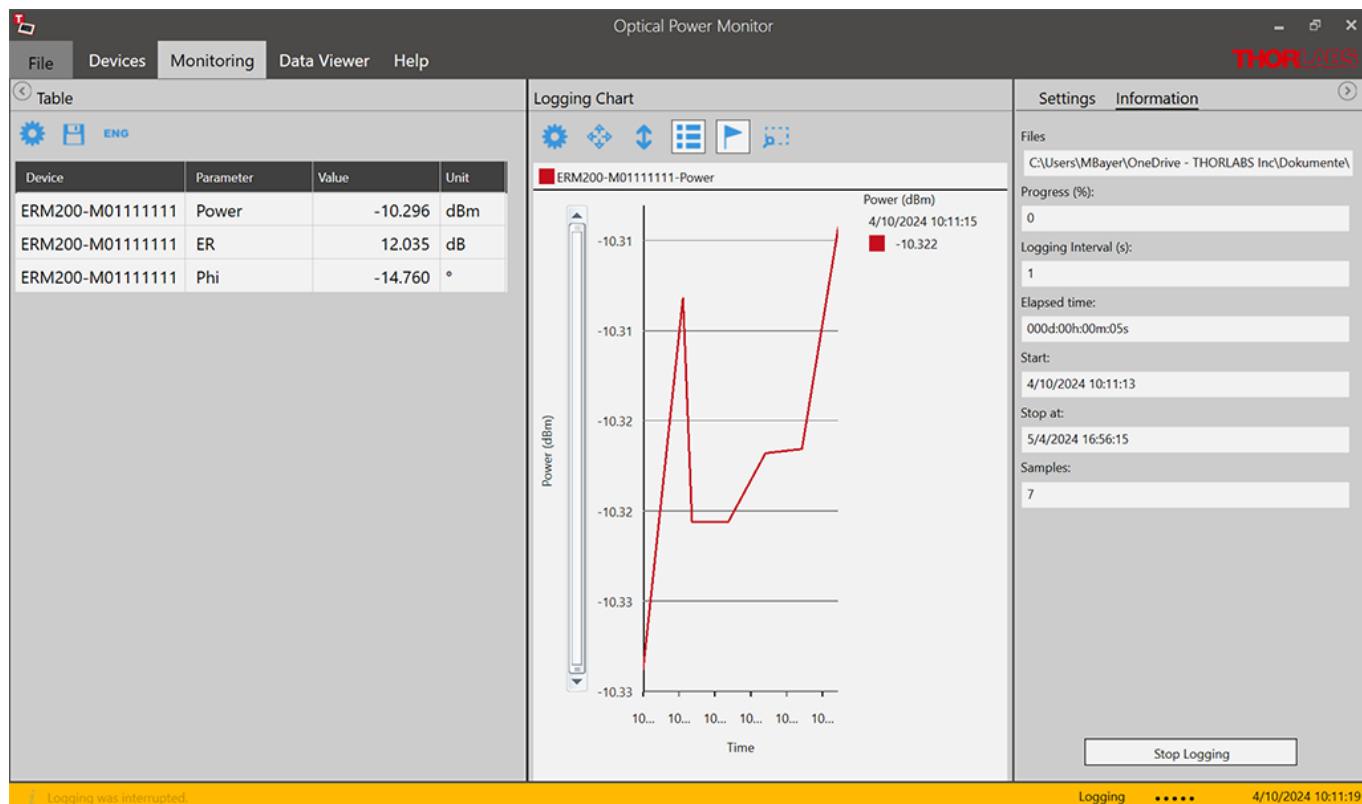
Name	ERM200	Name	Name of device
Serial Number	M01111111	Serial Number	Serial number of the device
Firmware Revision	1.0.0.164	Firmware Revision	Current firmware version of the device. Update the firmware by clicking the button.
Sensor		Sensor	
Date of Calibration	15-Feb-2024	Date of Calibration	Date of last sensor calibration.

Monitoring

Use the Monitoring panel to configure, execute, observe, and save long-term monitoring of connected ERM2xx Series. Long-term measurements can be recorded with a minimal interval of one second.

The table configuration for the ERM2xx Series in the OPM Software is described in the chapter [Table Configuration](#). The procedure is the same as for other devices.

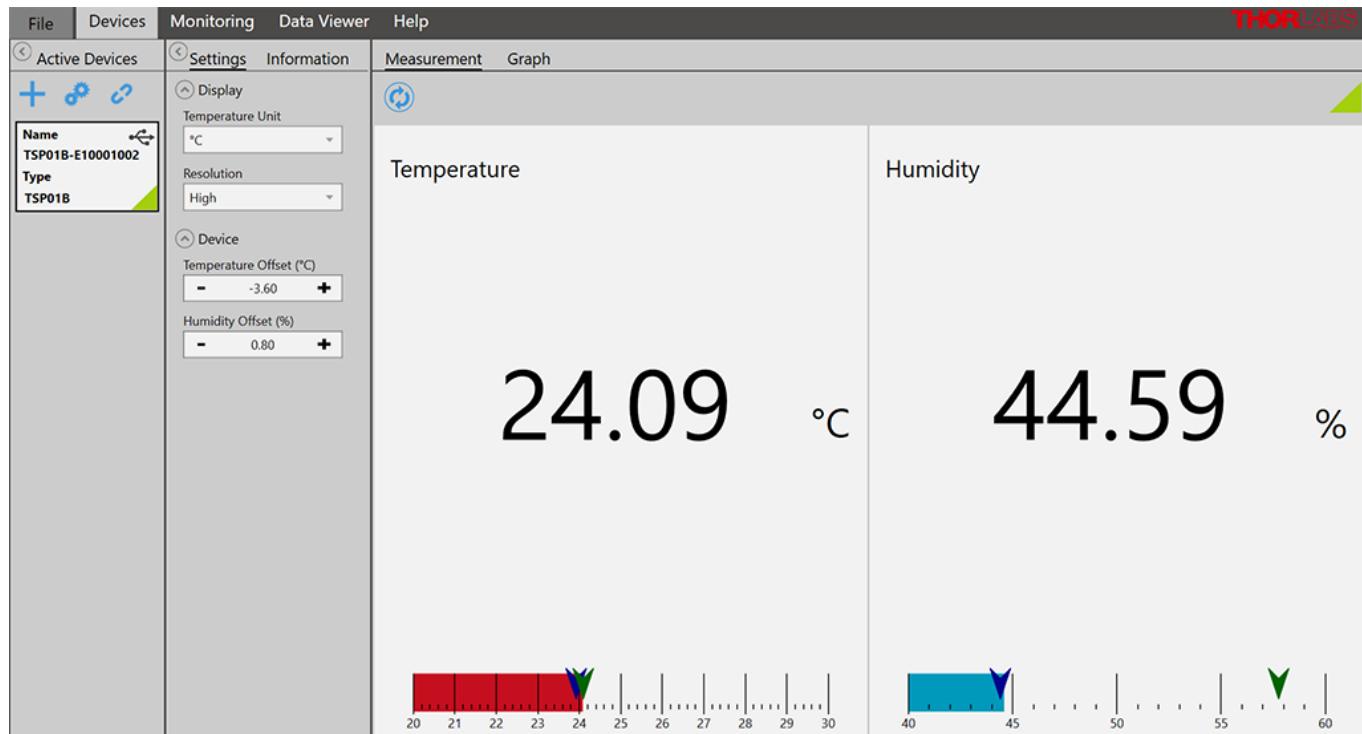
Optical Power Monitor



5.5 TSP01 Temperature and Humidity Sensor

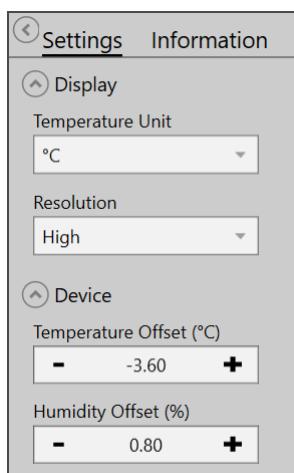
This section describes the options available in the Optical Power Monitor when the temperature sensor [TSP01 Temperature and Humidity Sensor](#) is connected to the OPM Software.

When connecting [TSP01 Temperature and Humidity Sensor](#) to the OPM Software, the start screen below is displayed.



1. Settings Menu

Specify the following **Temperature Sensor** settings.



Display

Temperature Unit Choose unit between °C and °F

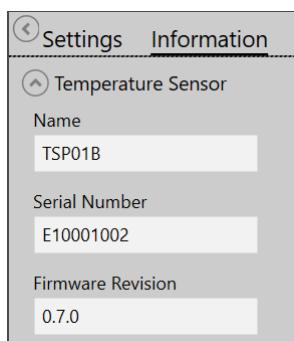
Resolution Choose resolution between Low, Medium, and High

Device

Temperature Offset (°C) Set temperature offset

Humidity Offset (%) Set humidity offset

2. Information Menu



Temperature Sensor

Name Name of temperature sensor

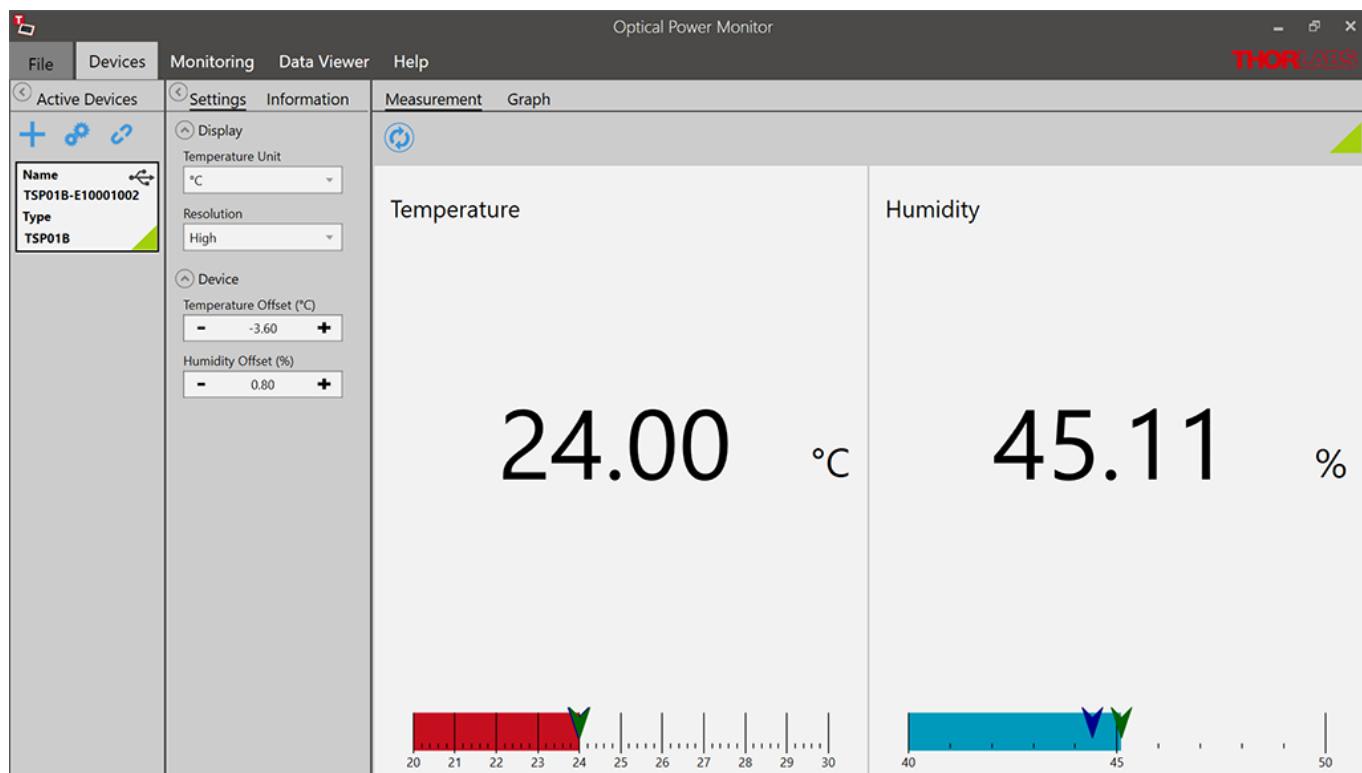
Serial Number Serial number of temperature sensor

Firmware Revision Current firmware revision of temperature sensor

3. Measurement Menu

The view of the "Measurement" screen is the same as the start screen. Depending on the parameters set under "Settings", the current temperature and humidity are displayed.

Optical Power Monitor

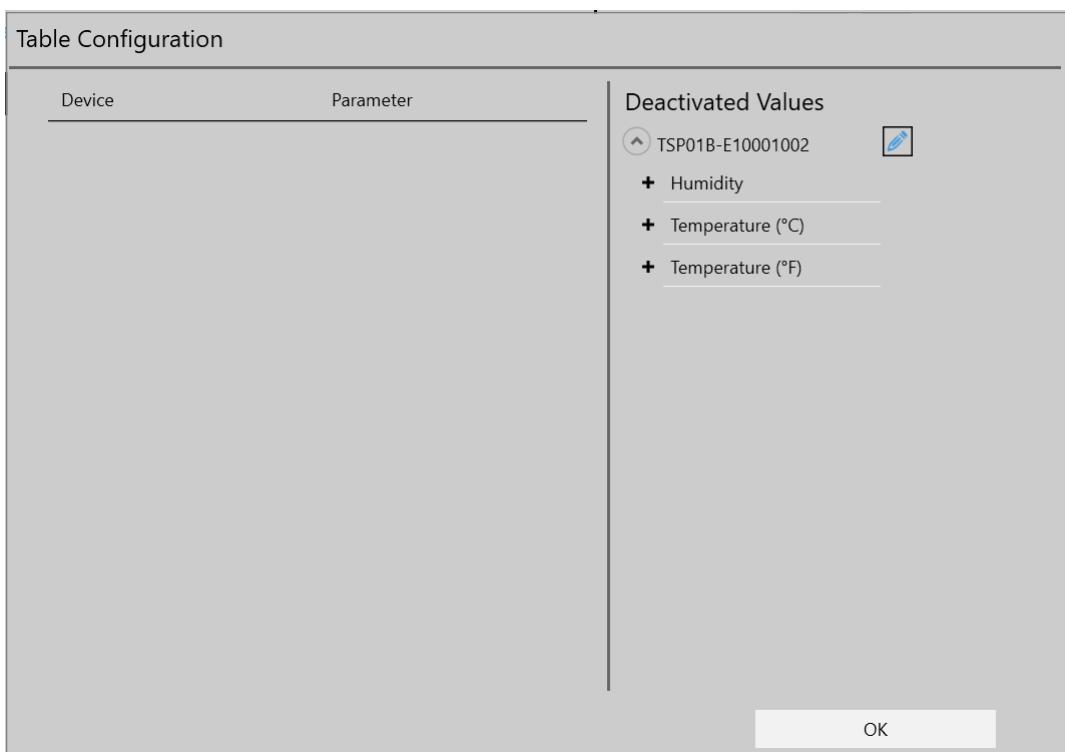


4. Graph Menu

Operation of the graph panel is similar to other devices and is described in the chapter [Graph](#).

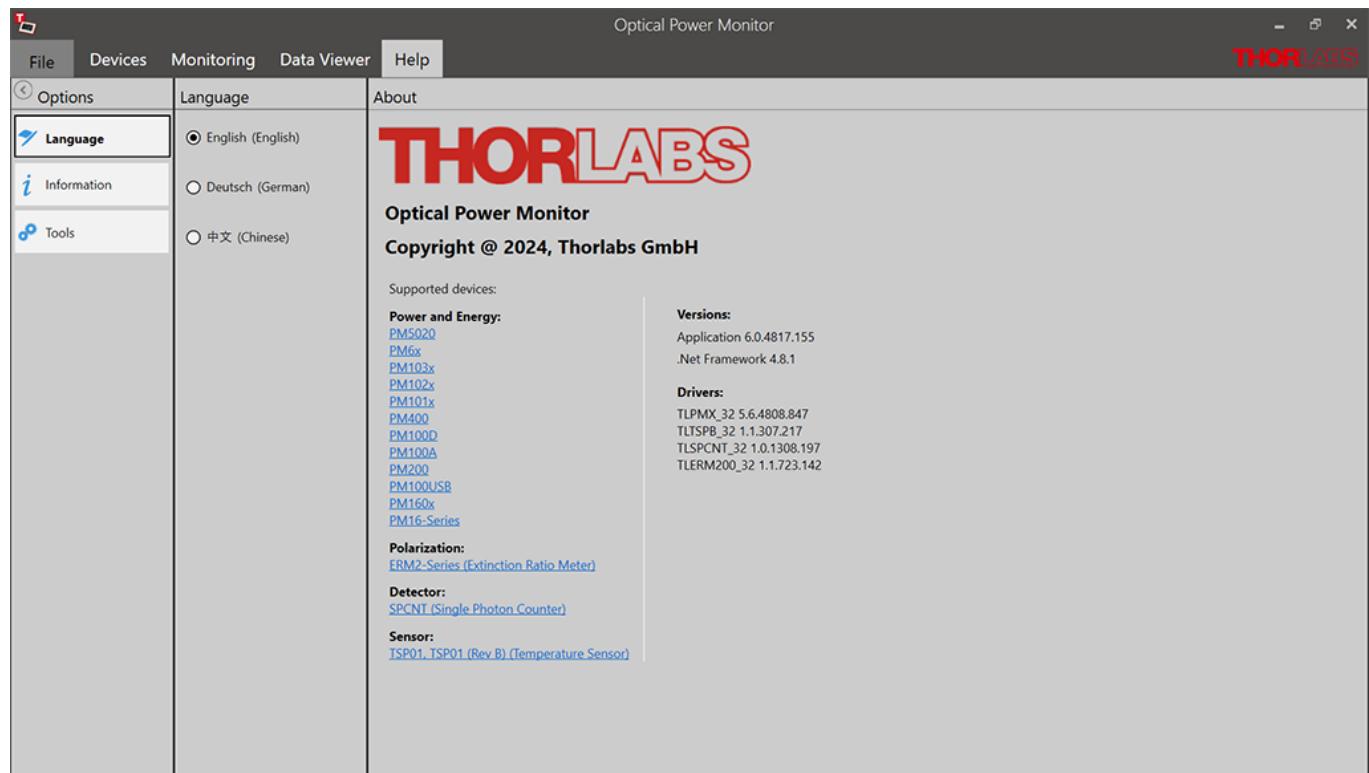
3. Monitoring Menu

When using the [TSP01 Temperature and Humidity Sensor](#), the temperature in °C and °F and the humidity in % can be logged and monitored by adding these parameters in the [Table](#) configuration panel.



6 Version Information

For information on the software version, please go to the Help menu.



7 Instrument Driver for Thorlabs Power Meters

The Thorlabs Optical Power Monitor (OPM) uses the newer power meter driver TLPMX.dll instead of the Formerly used NI-VISA™-based driver PM100D.dll.

The new driver TLPMX.dll is automatically installed with the OPM installation. We recommend using this driver as it is easier to install, uses less disk space and has a more robust algorithm for recognizing devices than the previously used NI-VISA™-based driver PM100D.dll. To change to the new driver or revert from the TLPMX driver to the PM100D driver, please use the program [Power Meter Driver Switcher](#).

Attention

Custom Made Software

Be aware that the driver assignment of the power meters is changed upon installation of the OPM. If you created your own software for remote operation of Thorlabs power meters based on the PM100D.dll driver, the software needs to be modified to use the new TLPMX.dll driver. Please read the chapters [Adaptation of Customer Software](#) and [Write Your Own Application \(WYOA\)](#) for instructions.

Alternatively, you can use the tool [Power Meter Driver Switcher](#) to switch between the two drivers, the PM100D.dll driver and the new TLPMX.dll driver, according to your needs. The [Power Meter Driver Switcher](#), is installed together with the Optical Power Monitor.

Attention

Power Meter Monitor, Optical Power Meter Utility and Multi Power Meter

To keep using the software packages **Power Meter Monitor**, **Optical Power Meter Utility** or **Multi Power Meter** software after installing the Optical Power Monitor with the TLPMX.dll driver, the user needs to revert to the driver PM100D.dll. To switch between the old PM100D.dll driver and the new TLPMX.dll driver, a software tool, the [Power Meter Driver Switcher](#), is installed together with the Optical Power Monitor.

7.1 Power Meter Driver Switcher

The Power Meter Driver Switcher is a tool to switch between the NI-VISA™-based PM100D.dll driver and the TLPMX.dll driver installed with the Optical Power Monitor in [cases listed above](#).

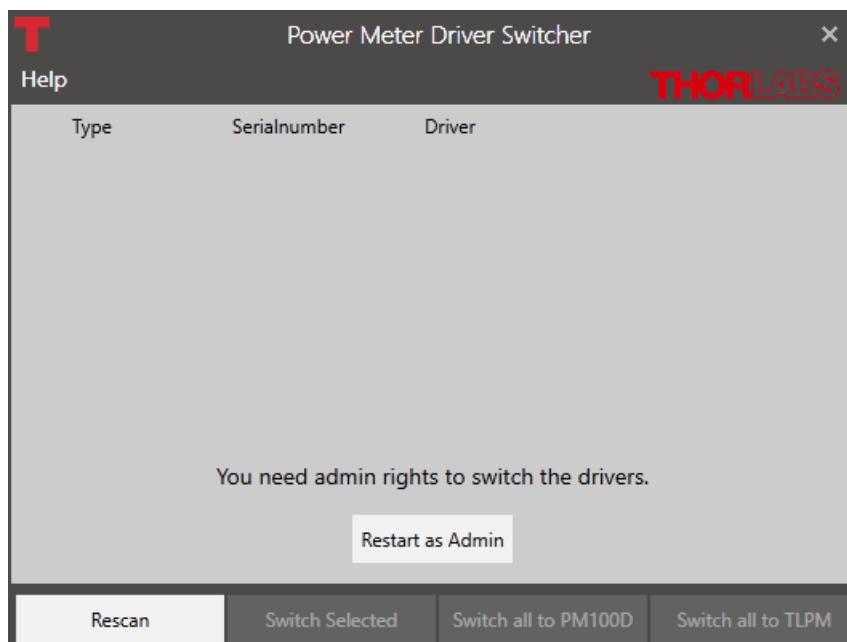
Attention

To use the Power Meter Driver Switcher and change instrument drivers, you need administrator rights on your PC.

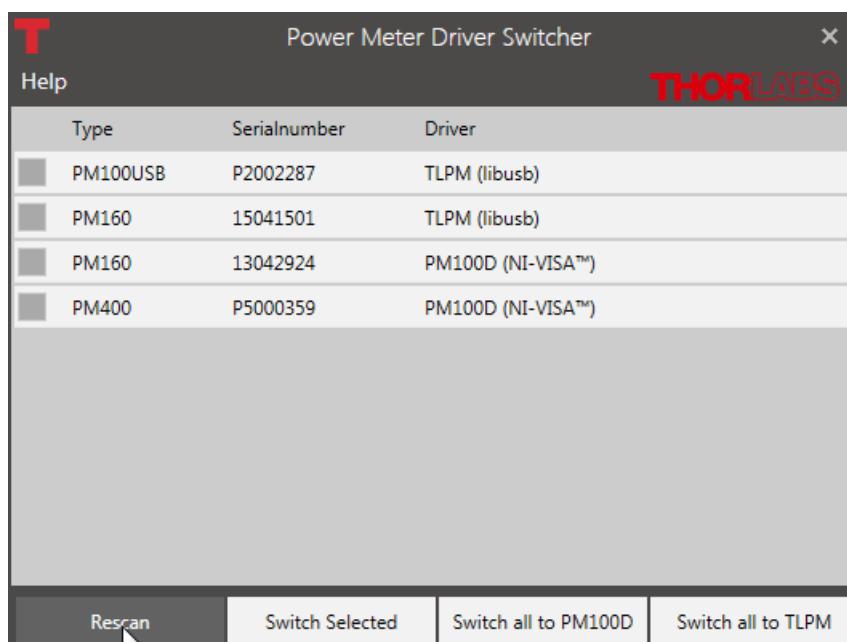
Open the Power Meter Driver Switcher through the Start button or from the Program Folder:

- Start Button:
All programs > Thorlabs > Power Meter > Tools > Power Meter Driver Switcher
- Program folder:
C:\Program File (x86)\Thorlabs\PowerMeters\Tools\DriverSwitcher

The Power Meter Driver Switcher opens with the following interface:



Use the **Menu Bar** at the bottom, to **Rescan** and see all attached devices. The table lists the **Type** of instrument, its **Serial Number** and the currently installed **Driver**.

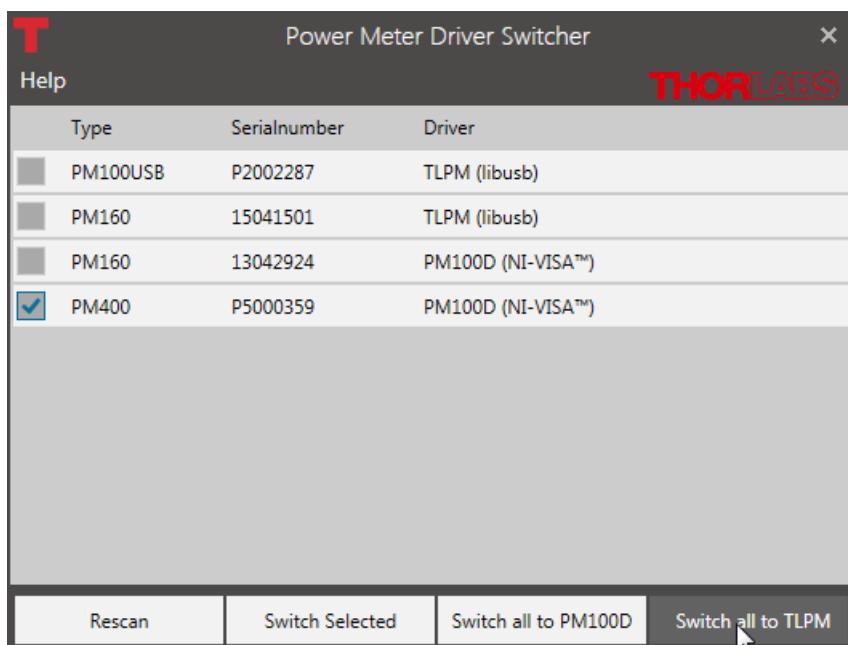


You can now convert the drivers for all or the selected devices to the driver appropriate for your application.

Note

Use the PM100D.dll for the Power Meter Monitor, Optical Power Meter Utility, or Multi Power Meter software.

The OPM can operate with either driver. However, some functions of PM101x, PM102x, PM103x, and PM400 will not appear when using the PM100D.dll.



The **Help** panel guides you to the Thorlabs website, the license agreement, and the software version number.

Close the Power Meter Driver Switcher after the driver exchange to prevent unintentional use.

Note

You can use the different drivers for different devices in parallel. Example: Power Meter PM100USB SerialNumber 1 and Power Meter PM100USB SerialNumber 2 are both connected to the PC. You can now use PM100USB SerialNumber 1 with driver TLPMD.dll in the Optical Power Monitor and PM100USB SerialNumber 2 with the driver PM100D.dll using another software in parallel.

7.2 Adaptation of Customer Software

The driver assignment of the power meters is changed upon installation of the OPM. If you created your own software for remote operation of Thorlabs power meters based on the PM100D.dll driver, the software needs to be modified to use the new TLPMX.dll driver.

Alternatively, you can use the tool [Power Meter Driver Switcher](#) to switch between the two drivers, the PM100D.dll driver and the new TLPMX.dll driver, according to your needs. The [Power Meter Driver Switcher](#), is installed together with the Optical Power Monitor.

Instruction to switch to the new TLPMX driver:

1. Replace the Header files in the project:

PM100D implementation:

```
#include "visa.h"
```

```
#include "PM100D.h"
```

→ TLPMX Implementation:

```
#include "TLPMX.h"
```

2. Replace the prefix of all functions and defines PM100D_ → TLPMX_

E.g.:

PM100D_init → TLPMX_init

PM100D_ATTR_SET_VAL

→ TLPMX_ATTR_SET_VAL

3. Add the library TLPMX_32.lib to the project

In the project settings add “TLPMX_32.lib” to the project.

4. Be sure that the library “TLPMX_32.dll” is either beside the application, in the path of the environment variable VXIPNPPATH or PATH or in the system folder. Use the same location as the PM100D_32.dll.

8 Troubleshooting

- **The OPM does not show all functions of PM101x, PM102x, or PM400**
 - **Reason :** The instrument might be using the older legacy instrument driver PM100D.dll for the connected power meters. That is why some functions displayed in the GUI are missing.
 - **Solution:** The problem is solved by switching to the new driver TLPMX.dll. To switch between from the PM100D.dll to the TLPMX.dll, use the [Power Meter Driver Switcher](#) tool. Read about the different instrument drivers in the section [Instrument Driver for Thorlabs Power Meters](#).
- **A power meter can not be connected, although it was found by the GUI (appears in the Found Devices Panel)**
 - **Reason:** The power meter may have been recognized by the OPM while the sensor was not connected.
 - **Solution:** Please ensure that the sensor is properly connected to the power meter, then unplug and replug the USB cable between the PC and the power meter. In case the problem persists, reboot the power meter.
- **A power meter is not automatically connected to the OPM after a hot-swap (disconnecting one sensor on the power meter and connecting a different one)**
 - **Reason:** The power meter may have been recognized by the OPM while the sensor was not connected.
 - **Solution:** Unplug and replug the USB cable between the PC and the power meter. In case the problem persists, reboot the power meter.
- **I can not use the software Power Meter Monitor**
 - **Reason:** The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters than the Thorlabs Power Meter Monitor. The instrument driver of the power meters was changed to the new driver upon installation of the Optical Power Monitor. That is why a driver may be incompatible.
Former instrument driver: NI-VISA™-based driver PM100D.dll.
OPM instrument driver: TLPMX.dll.
 - **Solution:** To revert to the PM100D.dll, use the [Power Meter Driver Switcher](#) tool supplied with the Optical Power Monitor software package. Read about the different instrument drivers in the section [Instrument Driver for Thorlabs Power Meters](#).
- **I can not use the software Optical Power Meter Utility**
 - **Reason:** The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters than Thorlabs power meter software application Optical Power Meter Utility. The instrument driver of the power meters was changed to the new driver upon installation of the Optical Power Monitor. That is why a driver may be incompatible.
Former instrument driver: NI-VISA™-based driver PM100D.dll.
OPM instrument driver: TLPMX.dll.

➤ **Solution:** To revert to the PM100D.dll, use the [Power Meter Driver Switcher](#) tool supplied with the Optical Power Monitor software package. Read about the different instrument drivers in the section [Instrument Driver for Thorlabs Power Meters](#).

- **I can not use the software Multi Power Meter**

➤ **Reason:** The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters than Thorlabs power meter software application Multi Power Meter. The instrument driver of the power meters was changed to the new driver upon installation of the Optical Power Monitor. That is why a driver may be incompatible.

Former instrument driver: NI-VISA™-based driver PM100D.dll.

OPM instrument driver: TLPMX.dll.

➤ **Solution:** To revert to the PM100D.dll, use the [Power Meter Driver Switcher](#) tool supplied with the Optical Power Monitor software package. Read about the different instrument drivers in the section [Instrument Driver for Thorlabs Power Meters](#).

- **I can not use my Custom Made Software to steer Thorlabs power meters anymore**

➤ **Reason:** The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters than former Thorlabs power meter software applications. The instrument driver of the power meters was changed to the new driver upon installation of the Optical Power Monitor. You may have used the former instrument driver when writing your software and now that the driver is changed, your software no longer recognizes the power meters.

Former instrument driver: NI-VISA™-based driver PM100D.dll.

OPM instrument driver: TLPMX.dll.

➤ **Solution:** You can either [adjust your custom made software](#) or switch between the PM100D.dll and the TLPMX.dll by using the [Power Meter Driver Switcher](#) tool supplied with the Optical Power Monitor software package. Read about the different instrument drivers in the section [Instrument Driver for Thorlabs Power Meters](#).

- **The PC freezes/ OPM freezes when logging a long term experiment**

➤ **Reason:** When logging a long-term measurement, the PC may go into hibernation or sleep mode. This causes the Optical Power Monitor to loose contact to the power meters and results in freezing of the Optical Power Monitor

➤ **Solution:** Turn off hibernation and sleep settings on your PC for long-term experiments read the section [Logging Configuration](#).

9 Write Your Own Application

In order to write your own application, you need a specific instrument driver and some tools for use in different programming environments. The driver and tools are being installed to your computer during software installation and cannot be found in the installation package.

In this section the location of drivers and files, required for programming in different environments, are given for installation under Windows® 10 (32 bit and 64 bit) and Windows® 11.

In order to fully support 64 bit LabVIEW™ version, the installation offers two installer versions:

- For Windows® 10 (32/64 bit): Install "xxxx VXIpnnp Instrument Driver (32bit)"
- For Windows® 10 (64 bit) and Windows® 11: Install "xxxx VXIpnnp Instrument Driver (64 bit)"

The 32 bit VXIpnnp driver works with both 32 and 64 bit operating systems, while the 64 bit driver requires a 64 bit operating system.

Note

The Thorlabs Optical Power Meter software and drivers contains 32 bit and 64 bit applications.

In 32 bit systems, only the 32 bit components are installed to

`C:\Program Files\...`

In 64 bit systems the 64 bit components are being installed to

`C:\Program Files\...`

while 32 bit components can be found at

`C:\Program Files (x86)\...`

In the table below you will find a summary of what files you need for particular programming environments.

Programming environment	Necessary files
C, CVI	*.h (header file) *.lib (static library)
C#	.net wrapper dll
Visual Studio	*.h (header file) *.lib (static library) or .net wrapper dll
LabVIEW™	*.fp (function panel) and VXIpnnp Instrument Driver. Beside that, LabVIEW™ driver vi's are provided with the *.llb container file
Python	*.py wrapper

Note

All above environments require also the VXIpnnp Instrument Driver dll!

During Runtime installation, a system environment variable `VXIPNPPATH` for including files is created. It contains the information where the drivers are installed to, usually to `C:\Program Files\IVI Foundation\VISA\WinNT\`.

This environment variable is necessary for installation of the instrument driver software components. In the next sections the locations of above files are described in detail.

9.1 32 bit Operating System

Note

According to the VPP6 (Rev6.1) Standard the installation of the 32 bit VXIpnnp driver includes both the WINNT and GWINNT frameworks.

VXIpnnp Instrument Driver:

C:\Program Files\IVI Foundation\VISA\WinNT\Bin\TLPMX_32.dll

Note

This instrument driver is required for all development environments!

Header File

C:\Program Files\IVI Foundation\VISA\WinNT\include\TLPMX.h

Static Library

C:\Program Files\IVI Foundation\VISA\WinNT\lib\msc\TLPMX_32.lib

Function Panel

C:\Program Files\IVI Foundation\VISA\WinNT\TLPMX\TLPMX.fp

Online Help for VXIpnnp Instrument Driver:

C:\Program Files\IVI Foundation\VISA\WinNT\TLPMX\Manual\TLPMX.html

NI LabVIEW™ Driver

The LabVIEW™ Driver is a 32 bit driver and compatible with 32 bit NI-LabVIEW™ versions 8.5 and higher.

C:\Program Files\National Instruments\LabVIEW xxxx\Instr.lib\TLPMX ...
...\\TLPMX.llb

LabVIEW™ container file with driver vi's and an example. "LabVIEW xxxx" stands for actual LabVIEW™ installation folder.

In case LabVIEW™ is not installed or if LabVIEW™ versions 2017 and higher are installed, the LabVIEW™ driver will be installed in:

C:\Program Files\Thorlabs\PowerMeters\LabVIEW\LabVIEW
32bit\TLPMX\TLPMX.llb

.net wrapper dll

C:\Program Files\Microsoft.NET\Primary Interop Assemblies ...
...\\Thorlabs.TLPMX_32.Interop.dll

C:\Program Files\IVI Foundation\VISA\VisaCom ...
...\\Primary Interop Assemblies\\Thorlabs.TLPMX_32.Interop.dll

Python Wrapper

C:\Program Files (x86)\IVI
Foundation\VISA\WinNT\TLPMX\Example\Python\TLPMX.py

Example for C

Source file:

C:\Program Files\IVI Foundation\VISA\WinNT\TLPMX\Example\C ...
...\\sample.c

Example for C#

Solution file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPMX\Example ...
...\\MS.NET_CS\Thorlabs.TLPMX.Interop.Sample.sln
```

Project file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPMX\Examples ...
...\\MS.NET_CS\Thorlabs.TLPMX.Interop.Sample\
Thorlabs.TLPMX.Interop.Sample.csproj
```

Example for LabVIEW™

```
C:\Program Files\National Instruments\LabVIEW xxxx\Instr.lib\TLPMX ...
...\\TLPMX.llb
```

LabVIEW™ container file with driver vi's and an example. "LabVIEW™ xxxx" stands for actual LabVIEW™ installation folder.

Example for Python

Solution file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Example ...
...\\Python\\PowermeterSample.py
```

9.2 64 bit Operating System

Note

According to the VPP6 (Rev6.1) Standard the installation of the 64 bit VXIpnnp driver includes the WINNT, WIN64, GWINNT and GWIN64 frameworks. That means, that the 64 bit driver includes the 32 bit driver as well.

In case of a 64 bit operating system, 64 bit drivers and applications are installed to

"C:\\Program Files"

while the 32 bit files - to

"C:\\Program Files (x86)"

Below are listed both installation locations, so far applicable.

VXIpnnp Instrument Driver:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\Bin\TLPMX_32.dll
C:\Program Files\IVI Foundation\VISA\Win64\Bin\TLPMX_64.dll
```

Note

This instrument driver is required for all development environments!

Header File

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\include\TLPMX.h
C:\Program Files\IVI Foundation\VISA\Win64\include\TLPMX.h
```

Static Library

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\lib\msc ...
...\\TLPMX_32.lib
C:\Program Files\IVI Foundation\VISA\Win64\lib\msc\TLPMX_32.lib
C:\Program Files\IVI Foundation\VISA\Win64\Lib_x64\msc\TLPMX_64.lib
```

Function Panel

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\TLPMX.fp
```

Online Help for VXIpnnp Instrument Driver:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Manual\TLPMX.html
```

NI LabVIEW™ Driver

The LabVIEW™ driver supports 32 bit and 64 bit NI-LabVIEW™ 2009 and higher.

```
C:\Program Files\National Instruments\LabVIEW xxxx\Instr.lib\TLPMX ...
...\\TLPMX.llb
```

LabVIEW™ container file with driver vi's and an example. "LabVIEW xxxx" stands for actual LabVIEW™ installation folder.

In case LabVIEW™ is not installed or if LabVIEW™ versions 2017 and higher are installed, the LabVIEW™ driver will be installed in:

```
C:\Program Files\Thorlabs\PowerMeters\LabVIEW\LabVIEW 64bit\TLPMX ...
...\\TLPMX.llb
```

.net wrapper dll

```
C:\Program Files (x86)\Microsoft.NET\Primary Interop Assemblies ...
...\\Thorlabs.TLPMX_32.Interop.dll
C:\Program Files (x86)\IVI Foundation\VISA\VisaCom ...
...\\Primary Interop Assemblies\\Thorlabs.TLPMX_32.Interop.dll
C:\Program Files\IVI Foundation\VISA\VisaCom64 ...
...\\Primary Interop Assemblies\\Thorlabs.TLPMX_64.Interop.dll
```

Python Wrapper

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Example\Python\TLPMX.py
```

Example for C

Source file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Example\C ...
...\\sample.c
```

Example for C#

Solution file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Example ...
...\\MS.NET_CS\Thorlabs.TLPMX.Interop.Sample.sln
```

Project file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Examples ...
...\\MS.NET_CS\Thorlabs.TLPMX.Interop.Sample\
Thorlabs.TLPMX.Interop.Sample.csproj
```

Example for LabVIEW™

```
C:\Program Files (x86)\National Instruments\LabVIEW
xxxx\Instr.lib\TLPMX ...
...\\TLPMX.llb
```

LabVIEW™ container file with driver vi's and an example. "LabVIEW xxxx" stands for actual LabVIEW™ installation folder.

Example for Python

Solution file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPMX\Example ...
...\\Python\\PowermeterSample.py
```

10 Appendix

10.1 Warranty

Thorlabs warrants the hard- and/or software determined by Thorlabs for this unit to operate fault-free provided that they are handled according to our requirements. However, Thorlabs does not warrant a fault free and uninterrupted operation of the unit, of the software or firmware for special applications nor this instruction manual to be error free. Thorlabs is not liable for consequential damages.

Restriction of Warranty

The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient stated by us or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. Thorlabs does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs reserves the right to change this instruction manual or the technical data of the described unit at any time.

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10.3 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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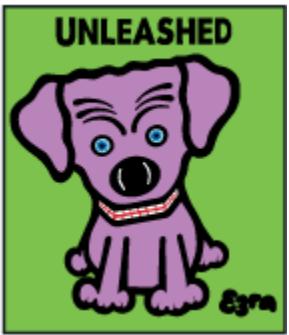
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