THORLABS

Optical Power Monitor

Operation Manual

2017

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Contents

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 improve our products permanently 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 preceeded 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 straightforward use of Thorlabs power meters. The OPM monitors and saves power meter measurements and features an interface for data viewing and analysis. Connected devices, as well as display and measurement settings, can be flexibly configured.

To control complex setups, the OPM can monitor up to 8 Thorlabs power meters in parallel.

The OPM software provides continuous data logging, also 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 at any time during an active measurement or use the simulated analog needle view for assistance during tuning.

To view and analyze measurements, log files saved by the OPM or data saved by a PM400 power meter can be loaded into the OPM Data Viewer. Additionally, the OPM provides statistics parameters to evaluate the results.

The user can set the display language English, German or Chinese.

Beyond these capabilities, the OPM 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 OPM supports the following Thorlabs power meters and appropriate sensors and can administer them in parallel.

- PM100USB
- PM16-Series
- PM160 [1)]
- PM160T [1)]
- PM160T-HP [1)]
- PM400
- PM100A
- PM100D
- PM200

[1)] only supported when connected via USB

Note

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

Attention

New Instrument Driver

Please note that the Optical Power Monitor uses new and improved instrument drivers. In case you want to use the old **Power Meter Monitor, Optical Power Meter Utility** or **Multi Power Meter** software or if you are using **Custom Made Software**, please read the Instrument Driver for Thorlabs Power Meters section.

2 Requirements

These are the requirements for the PC intended to be used for the installation of the Optical Power Monitor.

Hardware Requirements

CPU:	2.4 GHz or faster
RAM:	min. 2 GB
Graphic card	Min. 1024x768 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 USB2.0 port, USB cable according the USB 2.0 specification

Software Requirements

The OPM software is compatible with the following operating systems:

- Windows® 7 (32-bit, 64-bit)
- Windows® 8.1 (32-bit, 64-bit)
- Windows® 10 (32-bit, 64-bit)

For operation of the Optical Power Monitor, the following software is required:

- Microsoft® .Net (Version 4.6.1 or later)
- DirectX9® or higher

3 First Steps

The Optical Power Monitor can be downloaded from the Thorlabs website:
https://www.thorlabs.com/software_pages/ViewSoftwarePage.cfm?Code=OPM

Save the ZIP file to your computer and unpack this archive. The Install Shield Wizard starts by double-clicking the setup.exe. During the installation process, allow the installation of the **Power Meter Driver Package**.
After installing the OPM, connect the USB cable of your power meter(s) to the PC.

Note

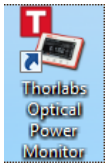
Do not connect a power meter to the PC before the software is installed! Please make sure that the installation was carried out completely, including the reboot requests. This is essential for proper operation.

Note

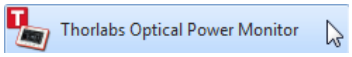
Up to 8 power meters can be connected at a time and monitored in parallel in a single software instance. If your PC does not provide a sufficient number of USB-ports, use a powered USB-HUB and ensure that enough power is supplied to the power meter.

Start Application

Start the OPM from the desktop icon:



or access the OPM from the START button:



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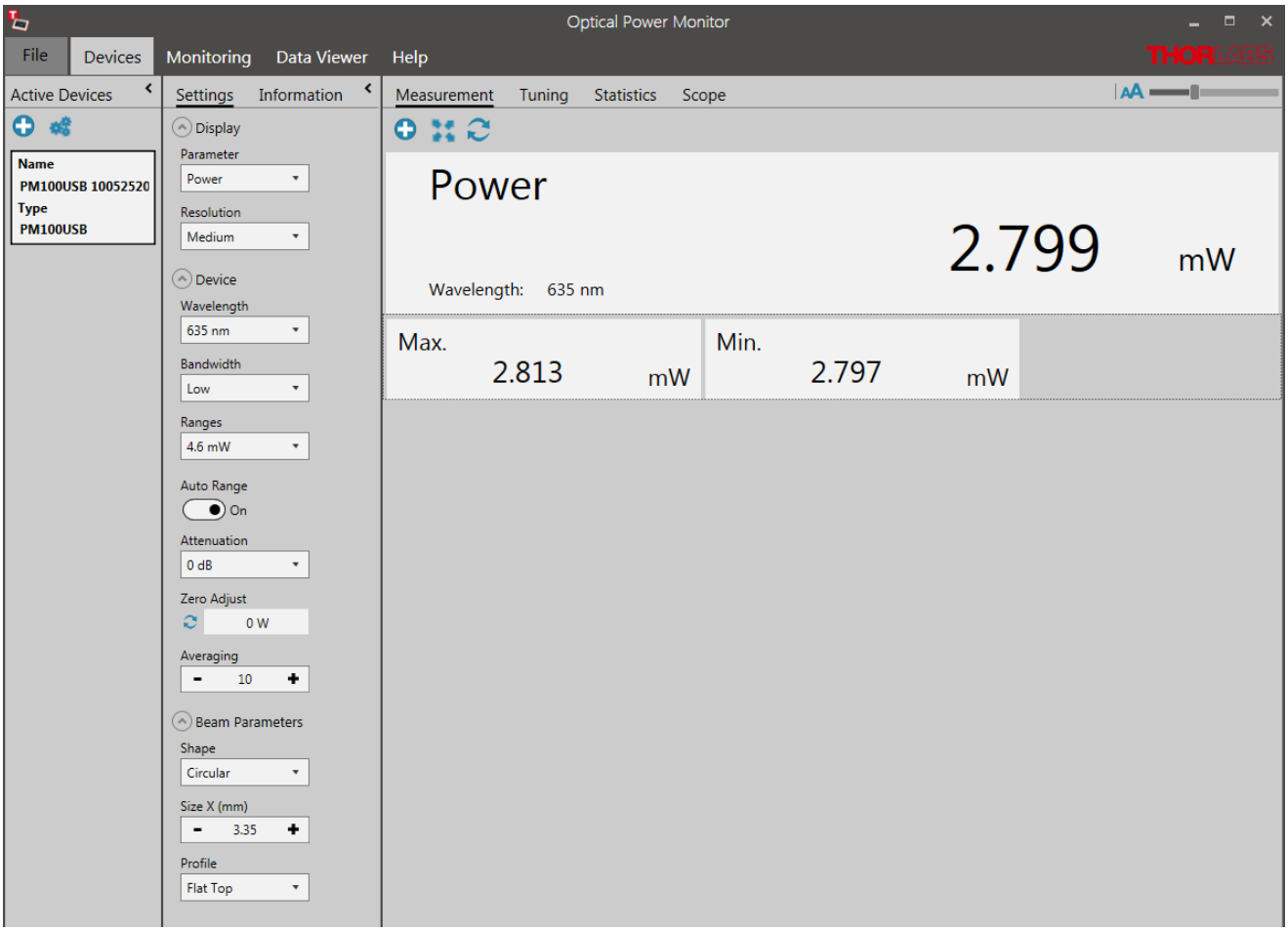
4 Graphical User Interface (GUI)

After starting the OPM and connecting a power meter to the PC, the default GUI window opens.

In this manual, the OPM interface is described based on a set up using a Power Meter Device consisting of a Thorlabs PM100USB with a Thorlabs Photodiode Power Sensor S120VC, connected to a PC running with OS Windows7. Variations in the interface due to different power meter consoles are described in the section **OPM with Different Devices**.

The OPM automatically connects the first recognized power meter and lists it in **Active Devices** (here: PM100USB).



Click on the Menu Bar in the screen shot to jump to the appropriate section in this manual.

Menu Bar

File	Load files, save and print screenshots and exit the software
Devices	Activate and administer devices and measurements
Monitoring	Set up a measurement to be logged and saved - active only after device setup
Data Viewer	View and analyze loaded files
Help	General software settings, software information and link to the manual

To setup a short measurement, go through the sub menu of **Devices** or use the **Monitoring menu** for long term logging.

Note

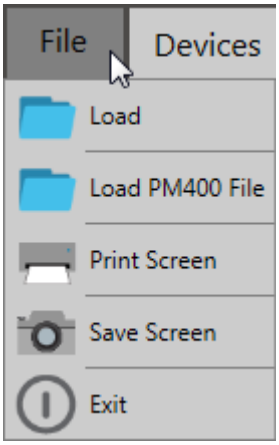
If no power meters are connected to the PC or automatically recognized, the OPM starts with the **Found Devices** panel instead of the **Measurement** panel. Use the **Found Devices** panel to scan for devices and connect them to the software.

Note

The user can now adjust the preferred display language in the **HELP** menu.

4.1 File

The **File menu** provides the following options:



Load *.tcsv files generated in **Monitoring**

Load *.csv files generated by the Thorlabs PM400

Print a screen shot

Generate a screen shot to be saved as an image

Close the OPM

Attention

File Formats

Two kinds of files are saved by the OPM, .tcsv-files and .csv files.

1. .tcsv Format

Logging files generated in the **Monitoring** menu (long term measurements) are saved in .tcsv format. The .tcsv files are compressed for fast loading into the **Data Viewer**. In addition, these data are saved in uncompressed .csv files in the same location in a Folder with the .tcsv file name. The uncompressed .csv files carry the name: filename_Raw#.

Note

DO NOT delete, move or rename the uncompressed .csv files in the .tcsv file folder. Because the uncompressed files are used by the OPM to zoom into the measurement from within the **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.

2. .csv Format

All OPM data that are saved but not logged in the **Monitoring** menu are saved as .csv files. This format can be opened in a text editor, but can not be loaded into the **Data Viewer**.

3. PM400 .csv Format

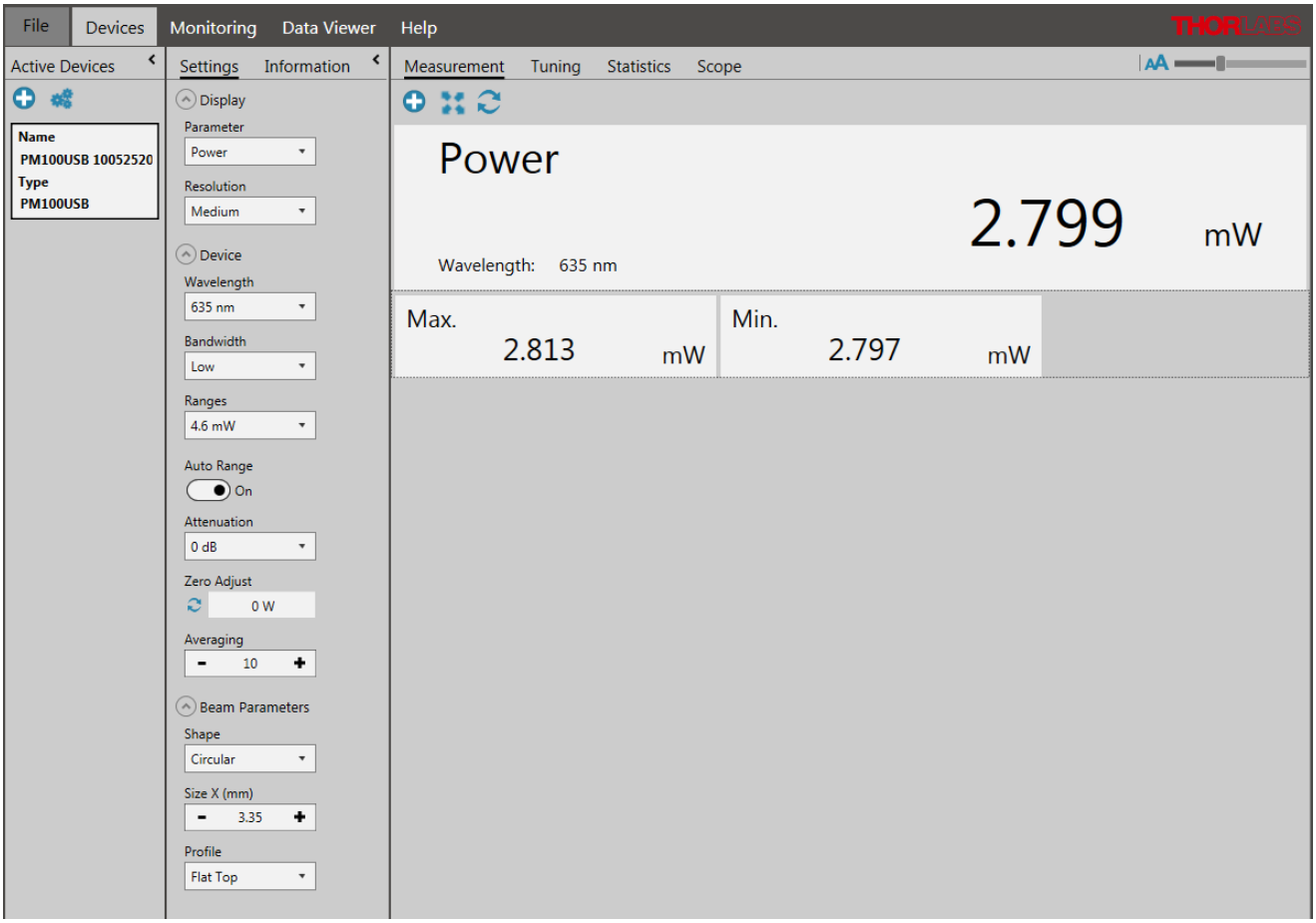
An exception are .csv files saved by the power meter PM400 which can be loaded into the **Data Viewer**.

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



Click the Menu Bar items in the screen shot to jump to the appropriate section in this manual.

Menu Bar

Active Devices	Administer the connected power meters
Settings	Administer settings of the display and connected devices
Information	Information about the connected devices
Measurement	Active measurement display
Tuning	Analog needle simulation with digital measurement value
Statistics	Statistics tool to setup, display and save statistics of the active measurement
Scope	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 the **Found Devices** panel to scan for devices and connect them to the software. The OPM automatically connects the first recognized power meter.

4.2.1 Active Devices

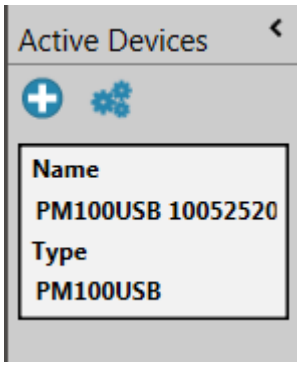
To monitor power meters, the devices need to be activated in the software in the **Found Devices** panel. The OPM automatically recognizes devices connected to the PC and connects to the first recognized device any time the software is started. Devices that are connected to the OPM then appear in the list **Active Devices**.

In the default example below, the PM100USB and a sensor with the Serial Number 10052520 is connected to the PC. This combination has automatically been connected to the OPM and therefore appears in the panel **Active Devices**.

Note

Devices that were connected to the software in the previous session are automatically reconnected to the software. In that case, 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** to the list **Active Devices**

: **Edit: Rename devices** or **Disconnect devices** from the software

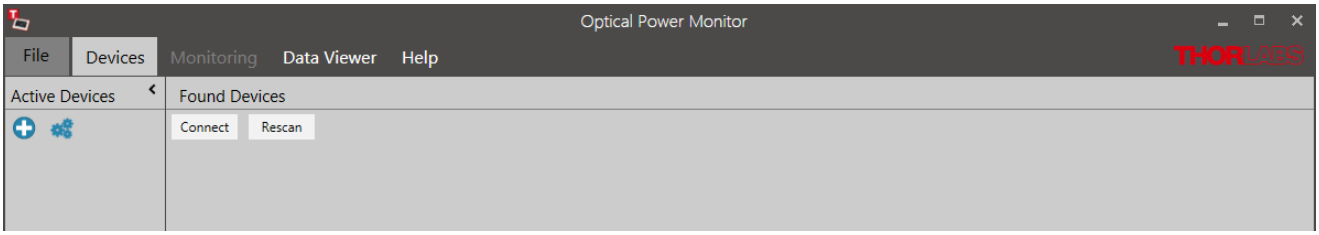
Note

In case a device was not recognized by the Optical Power Monitor, please reconnect it to the PC.

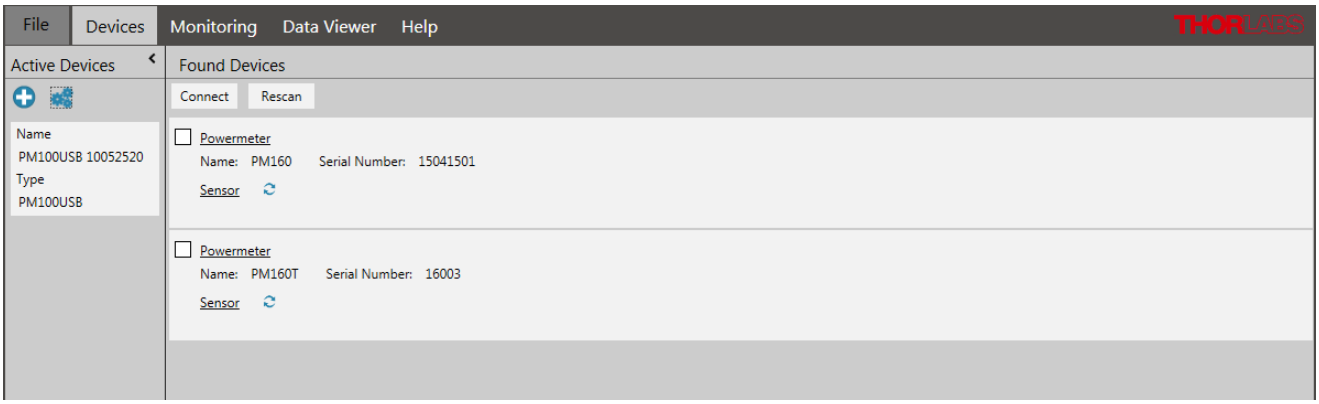
4.2.1.1 Add Devices

Use the **Found Devices** panel to activate devices in the OPM and by adding them to the list Active Devices.

- Click ⊕ in the **Active Devices** table to get to the following interface.



- If no devices are currently detected, click **Rescan** to list all devices connected to the PC or re-connect devices to the PC.



  - o Here, PM100USB, PM160 and PM 160T are recognized. The first recognized device (here: PM100USB) is automatically connected to the software.
  - o The panel **Found Devices** shows details about the devices that are connected to the PC.
  - o Click ⟳ to view sensor information.
- To activate devices, mark the tick-box in **Found Devices** and click **Connect**.
- 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. To add additional devices, click ⊕ in the Active Devices table.

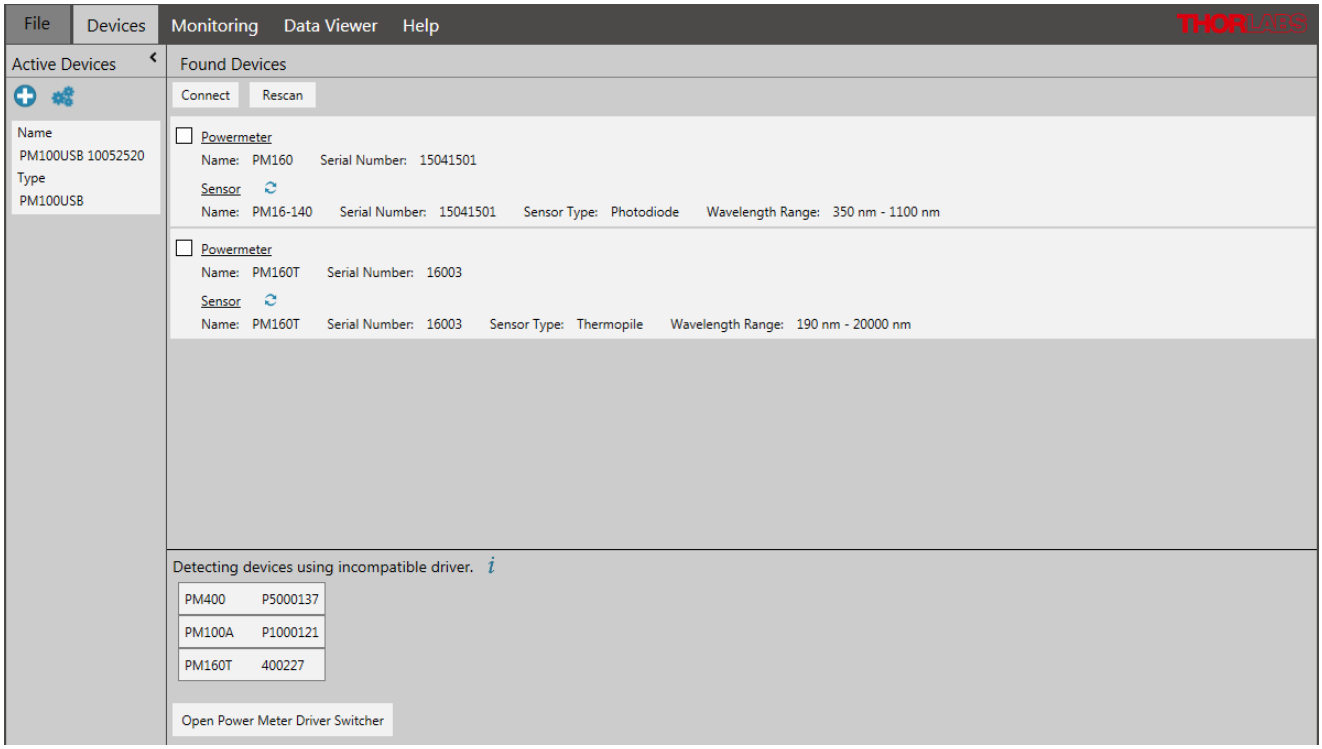
Note

If no power meters are connected to the PC or automatically recognized, the OPM starts with the **Found Devices** panel.

Attention

Devices with Incompatible Instrument Driver

Recognized devices that are using an incompatible instrument driver are listed on the bottom of the **Found Devices** panel.



This is because the Thorlabs Optical Power Monitor uses a different driver for the connected power meters than former Thorlabs Power Meter software applications. For information on which driver to choose, click *i* for information or read the section Instrument Driver for Thorlabs Power Meters in this manual.

To use the devices now listed with an incompatible driver, click **Open Power Meter Driver Switcher**.

Attention

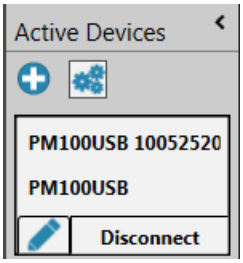
You need administrator rights on your PC to use the Power Meter Driver Switcher and change instrument drivers.

Attention

For customers who wish to keep using the **Power Meter Monitor**, **Optical Power Meter Utility** or **Multi Power Meter** software or who are using **Custom Made Software**, please read the section Instrument Driver for Thorlabs Power Meters to adjust driver or software.

4.2.1.2 Edit Devices

Click to edit the **Active Devices** list.



: Rename the device to describe its function in the experimental setup
Disconnect: Remove the device from the list of Active Devices
When **Edit** is active, the order of the list **Active Devices** can be changed by Drag'n'Drop.
Click to close editing options and prevent unintentional editing.

4.2.2 Settings

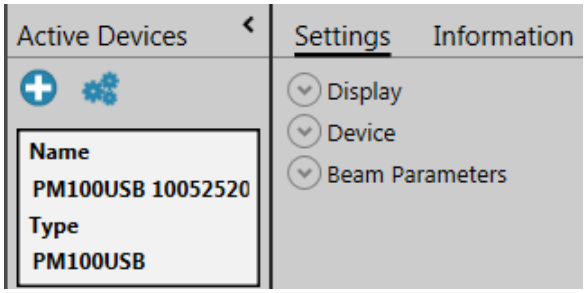
Device settings and measurement settings need to be adjusted in the **Settings** menu prior to the measurement by using the drop down menus shown below.

Attention

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

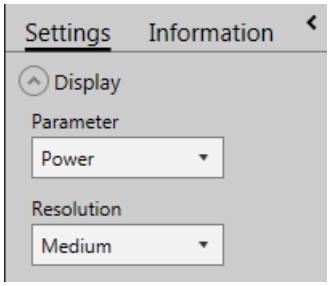
Note

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



Display: Adjust Display Settings
Device: Adjust Device Settings
Beam Parameters: Adjust Light Source Settings

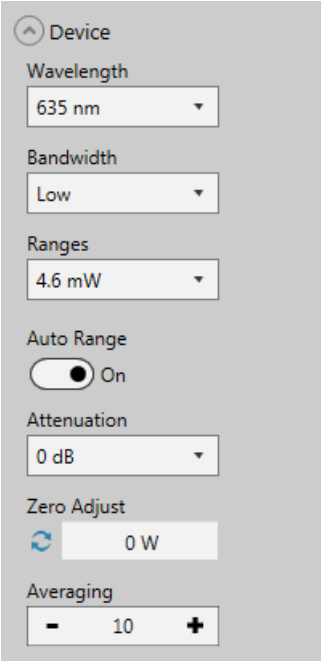
Display



Parameter: Select the parameter that should be displayed as the main parameter in all 4 measurement monitors: Measurement, Tuning, Statistics and Scope.

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).

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. For information, see Sensor-dependent variations in the OPM.

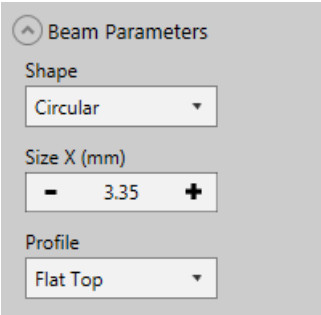
Attenuation: To account for the attenuation of optical components placed between the light source and the power meter sensor (e.g. filters, beam splitters, etc.), a correction factor can be assigned.

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

Averaging: Settings for the OPM to calculate the average. 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.

Beam Parameters

The Beam Paramters are relevant when calculating Irradiance or Fluence.



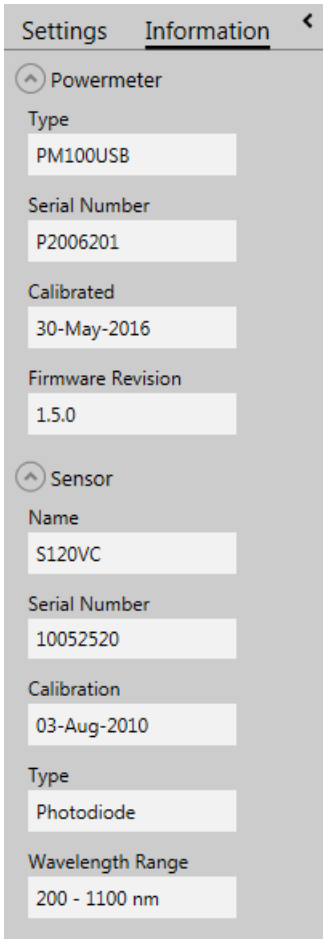
Shape: Choose between **Circular**, **Square** or **Rectangular** according to your light source and optics.

Size: 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.



Power Meter

Type: Type of Thorlabs Power Meter

Serial Number: Serial Number of the Device

Calibrated: Date of last Calibration

Firmware Revision: Current Firmware Version of the Power Meter

Sensor

Name: Sensor Name

Serial Number: Serial Number of Sensor

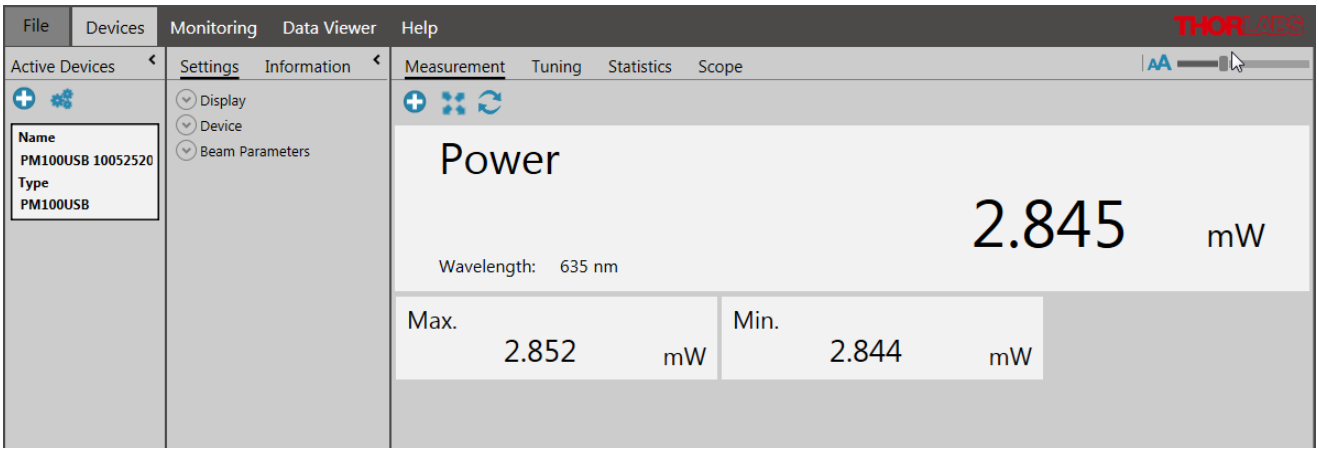
Calibration: Date of last Calibration

Type: Type of Sensor: Photodiode, Thermal Sensor

Wavelength Range: Wavelength Range of Detection of the Sensor

4.2.4 Measurement

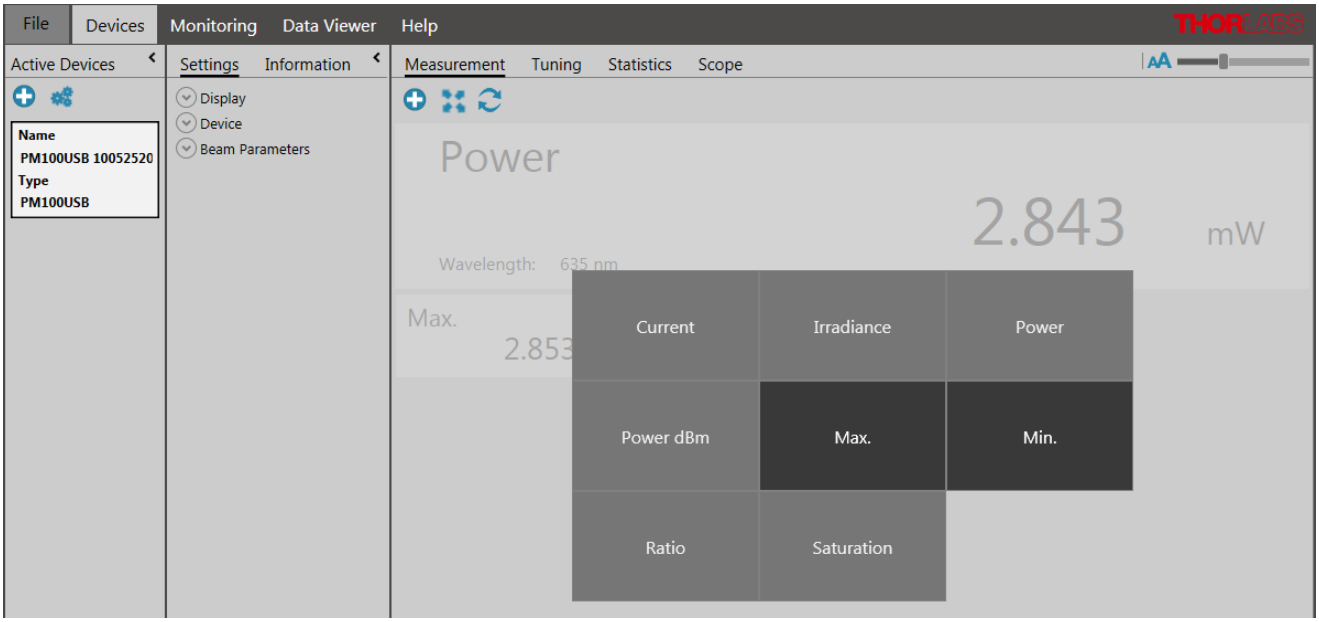
In the measurement panel, the currently measured numerical values of selected parameters are displayed. Use the **tool bar** to add more parameters to the display, maximize the display screen or reset the measurement.



Tool Bar

Add/Remove Parameter

Several numerical measurement values can be displayed simultaneously in the main screen. To select the parameter of interest from the panel, click ⊕ to open the following interface:

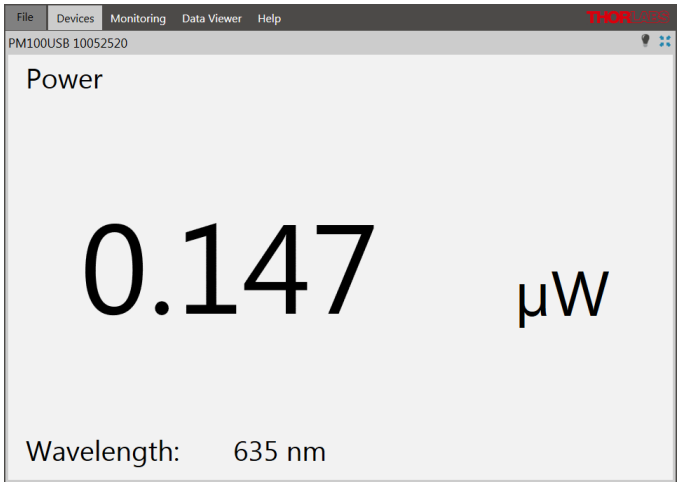


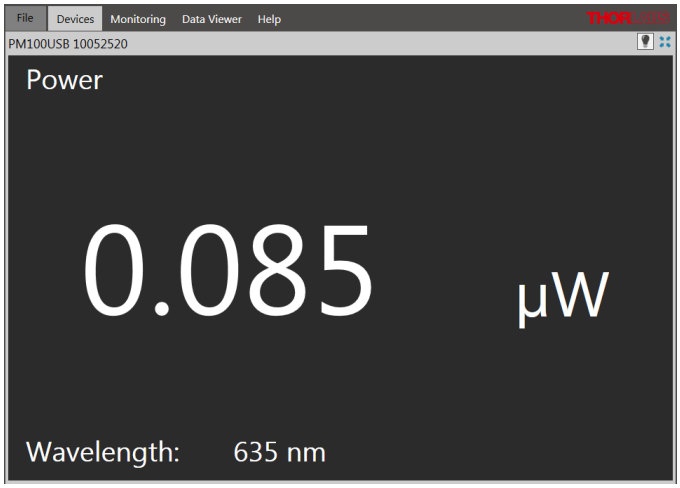
Maximize the Screen:

Switch to full screen mode. Only the main parameter and wavelength will appear on the display.

Bright/dark design:

Switched to dark design to reduce background light in the maximized display.





Shrink:

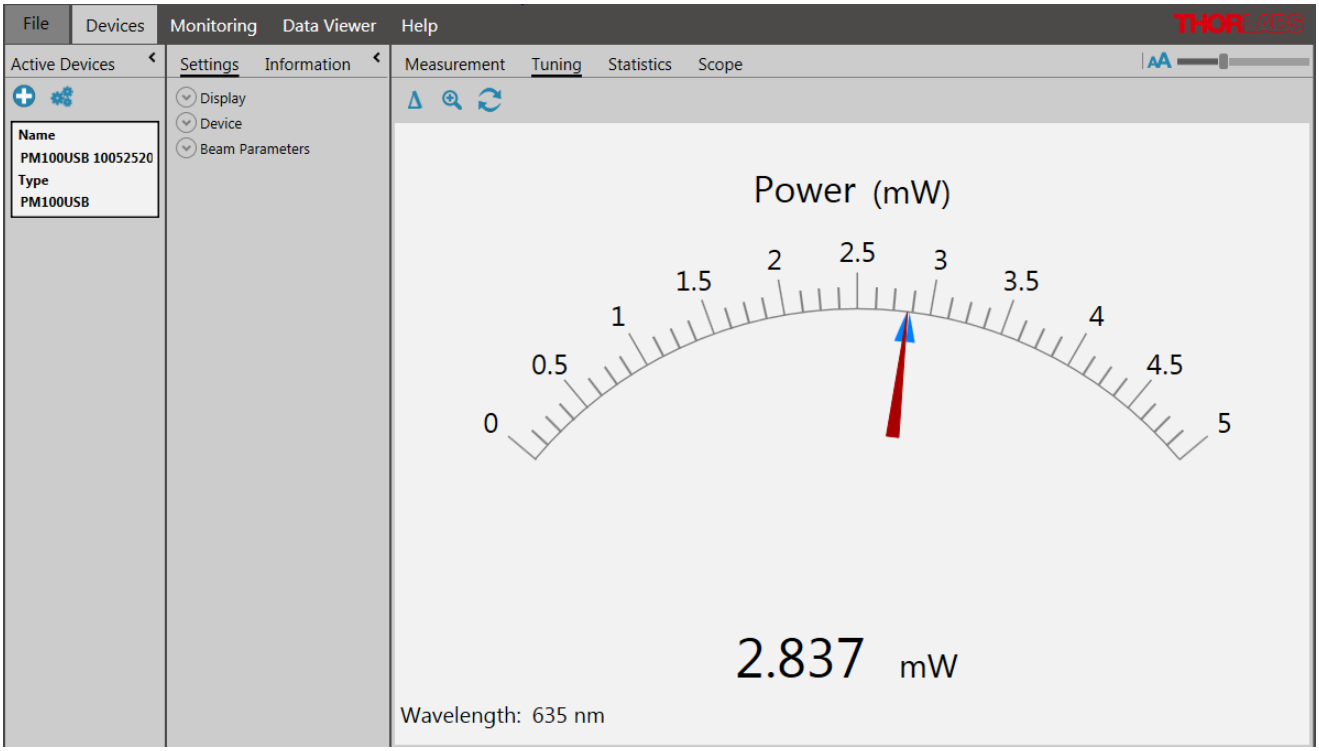
Reduce size of the display to view all selected parameters.

Reset min/max:

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

4.2.5 Tuning

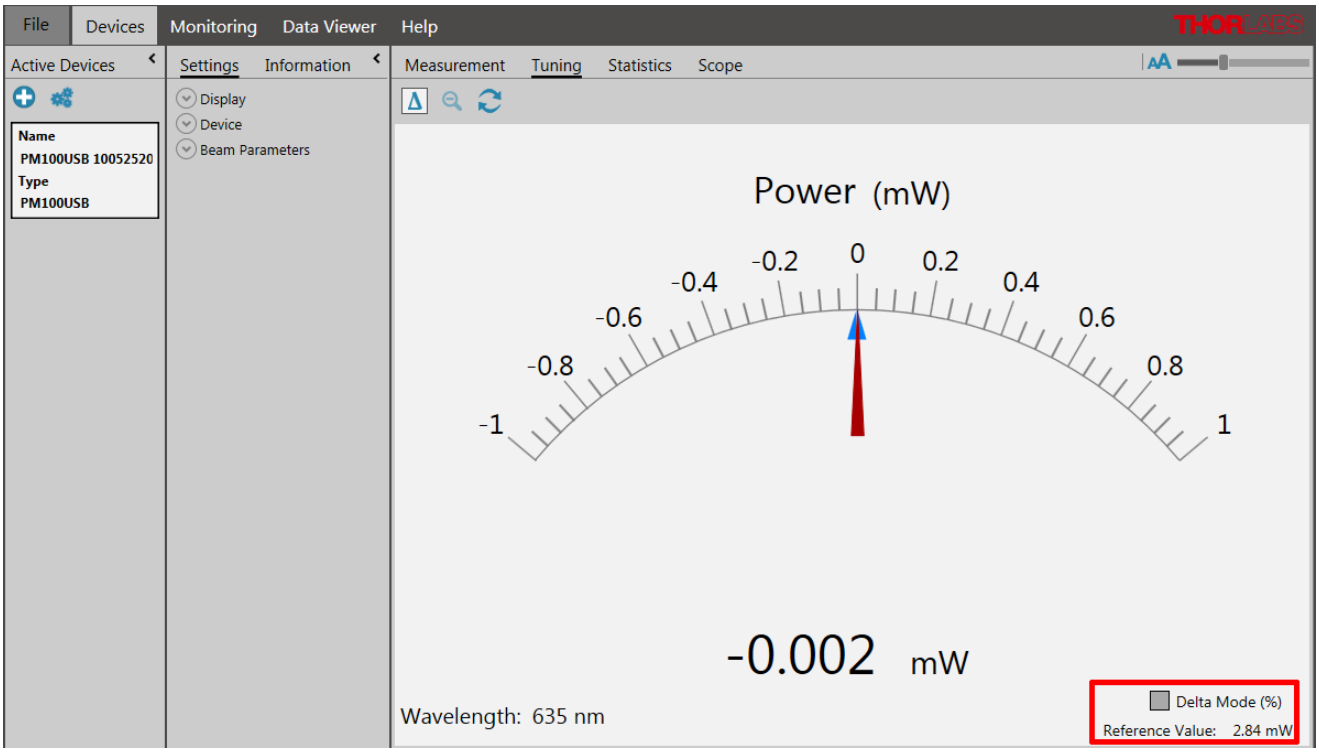
This panel shows the analog needle simulation of the currently measured value along with the digital numerical value.



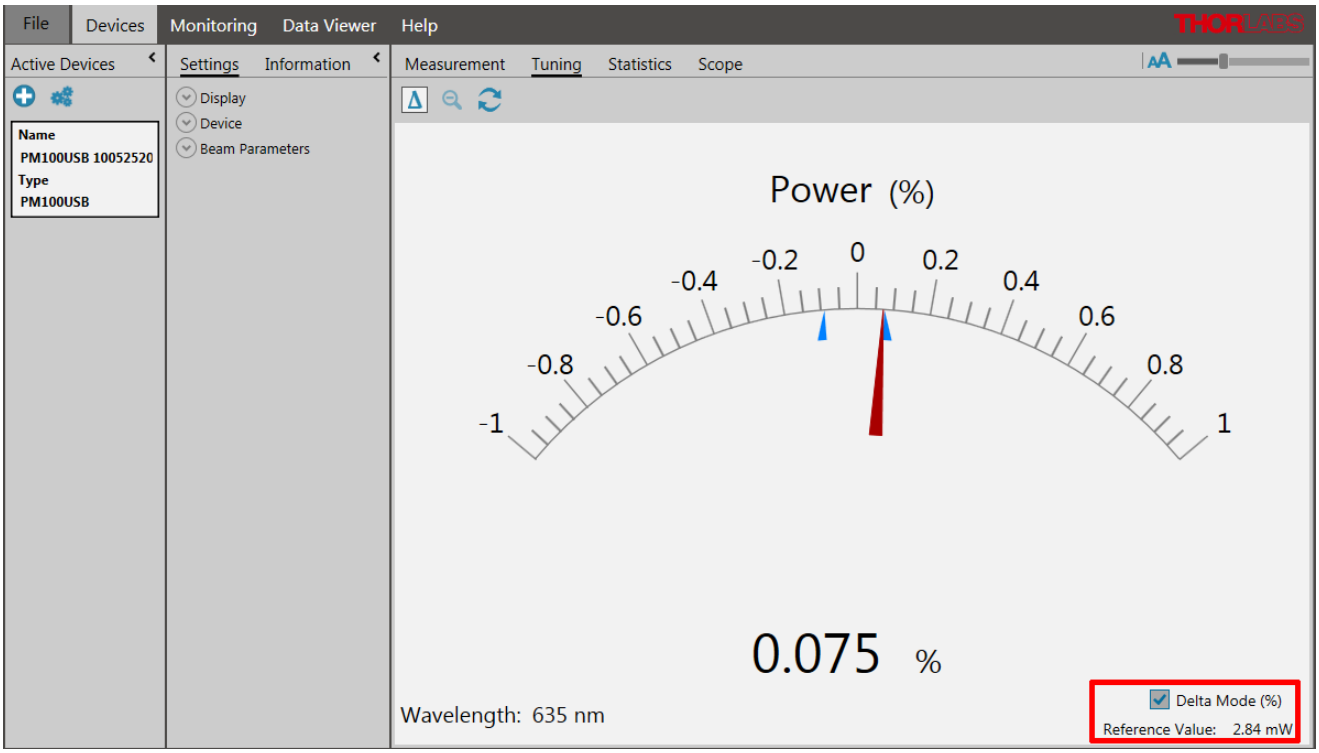
The display can be adjusted using the **Tool Bar**.

Enable/Disable delta mode

The Delta Mode shows the fluctuation around the measured value at the moment of starting the delta mode. This 0-value will be reset when clicking .



View the **Delta Mode** in % by selecting the tick-box: **Delta Mode (%)** in the lower right display, marked red.

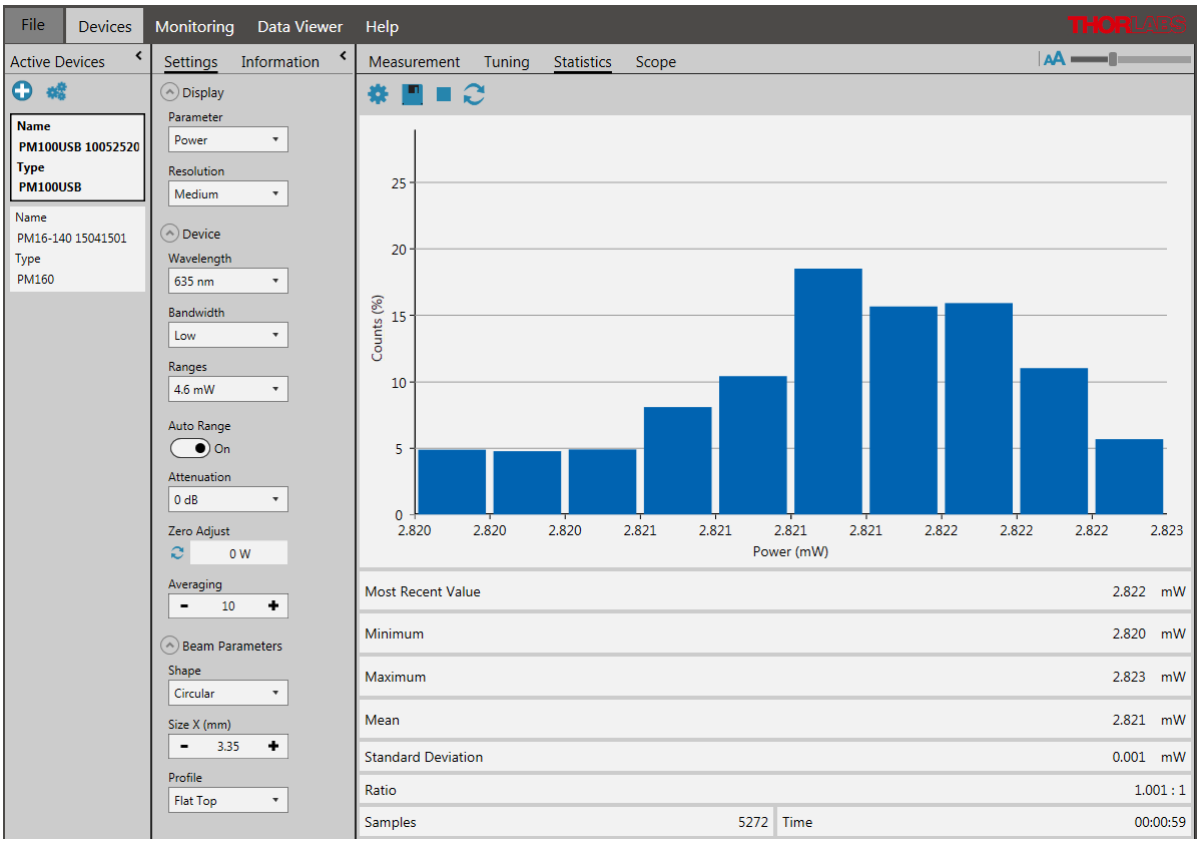


Zoom in/out: The zoom-factor is determined by the current Min and Max-values.

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.



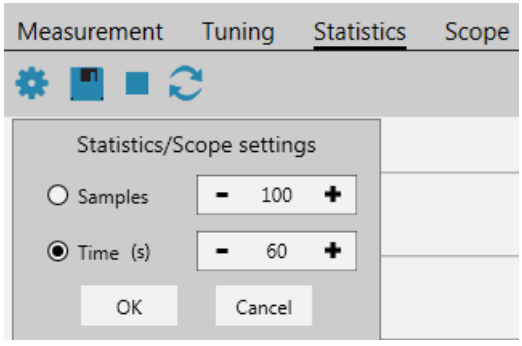
The chart displays the distribution of counts in percent for the parameter selected in **Settings**. This parameter can be changed during the active measurement. When parameter or monitored device are changed, the OPM starts a new data acquisition for statistical analysis.

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/Scope 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 **Scope** 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 is 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/Scope 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 scope mode data and starts a new acquisition for both, the statistics and scope mode. The same result is achieved when first clicking then .

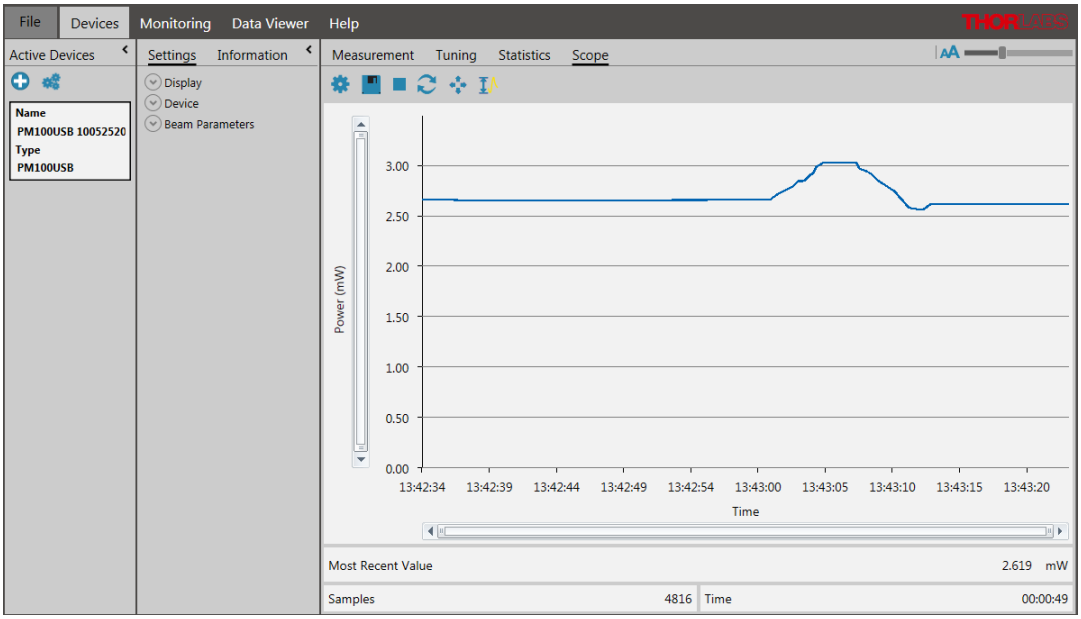
Status Bar

Most Recent Value:	Most recent value used for statistics
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/Scope settings
Standard Deviation:	Standard Deviation calculated based on the data recorded during the interval set in Statistics/Scope settings
Ratio:	Ratio between the minimum and maximum values recorded during the interval set in Statistics/Scope settings
Samples:	Number of samples acquired for statistics
Time:	Duration of acquisition for statistics

4.2.7 Scope

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

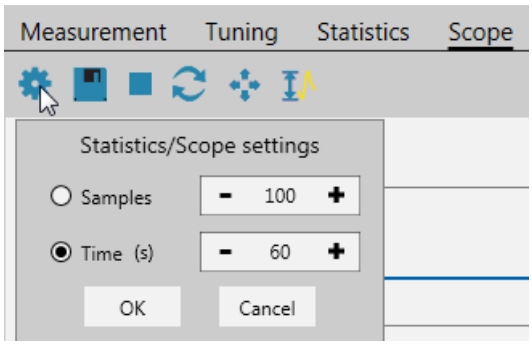
Data acquisition in **Scope** mode is reset when a different power meter is selected in the **Active Devices** panel.



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

Tool Bar

Settings: The displayed time interval of the measurement can be set in time or sample number. These settings are also applied in the **Statistics** panel



Save scope 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/Scope settings**, this incomplete set of data can be saved.

Start/Stop collecting data: Sampling for the scope mode can be stopped and re-started 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 **Scope** mode and **Statistics** and starts a new measurement and statistics evaluation. The same result is achieved by clicking ■ then ▶ .

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.

Note
In **Scope** 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.

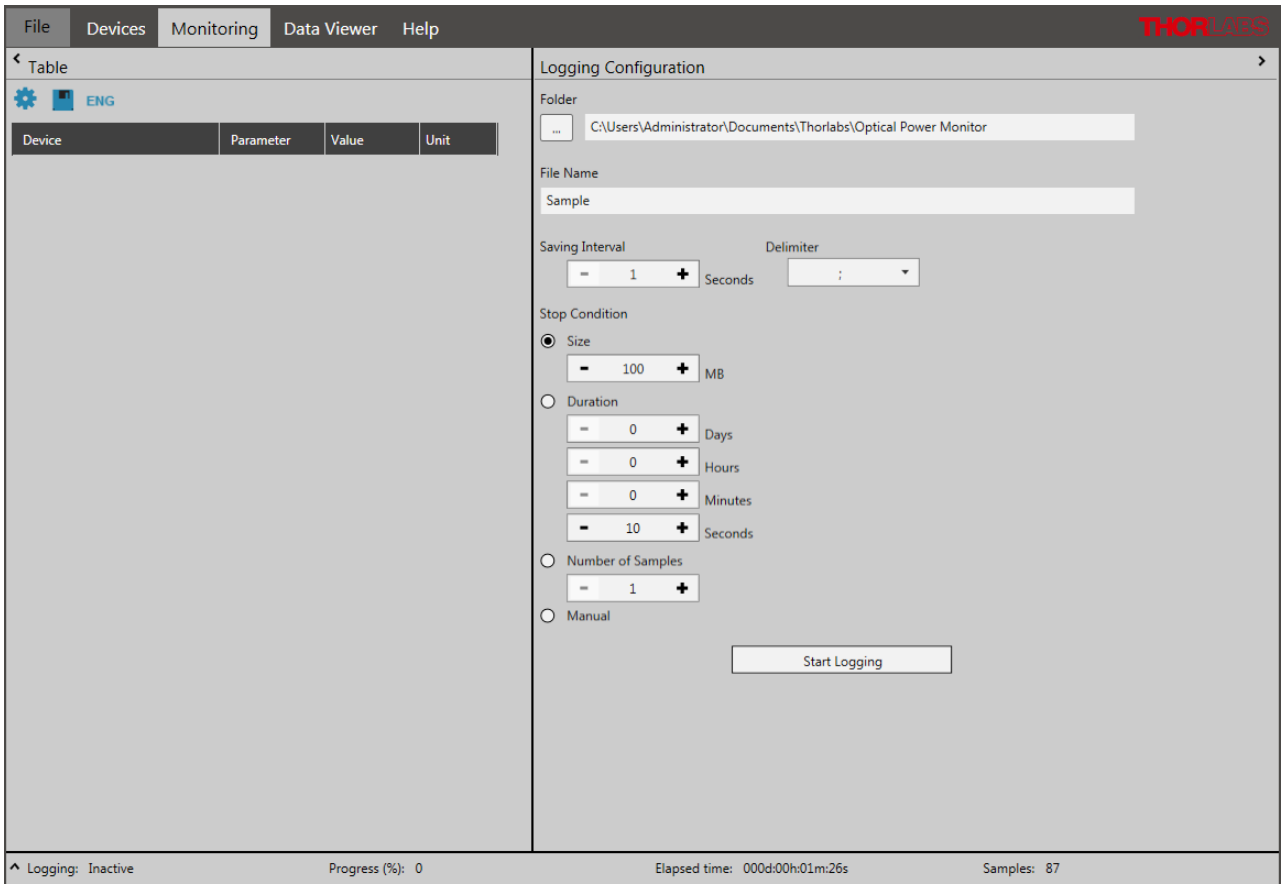
Samples: Number of samples acquired for the time interval set in **Statistics/Scope settings**.

Time: Recording time acquired for the display of the time interval set in **Statistics/Scope settings**.

4.3 Monitoring

Use the Monitoring panel to design, start, observe and save long-term monitoring of up to 8 connected power meters at a time 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 in parallel from devices with different refresh rates.

The measurement time is only limited by the available disc space. To approximate the required disc space: A measurement of 100 samples of one parameter from one power meter requires approx. 4kb disc space. The required disc space is not strictly linear. For long-term measurements, please approximate the required disc space for your measurement settings.

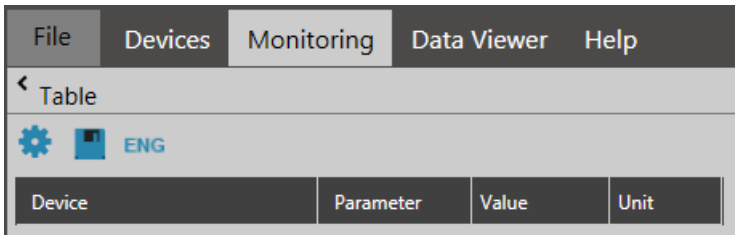


To log a measurement, follow the sequence suggested by the **Menu Bar**:

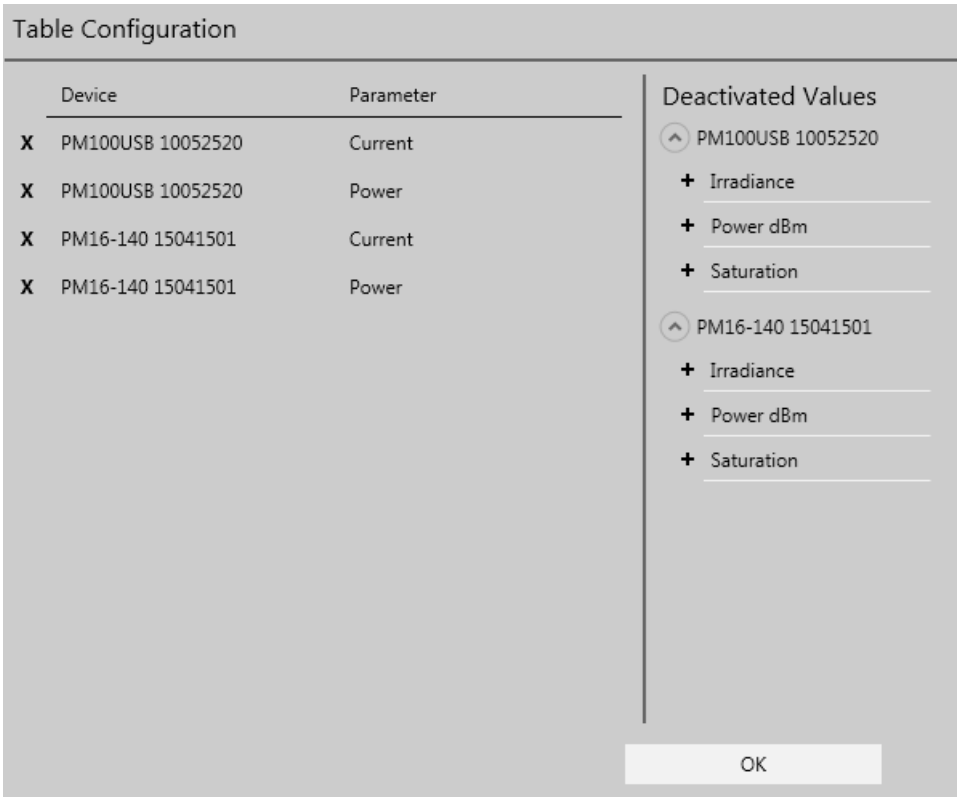
1. **Table:** Select the devices and parameters to be monitored.
2. **Logging Configuration**: Select settings for recording and saving of the measurement. **Start Logging** leads to the **Logging Chart**.
3. **Logging Chart:** Select the parameters to be displayed.

4.3.1 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**.



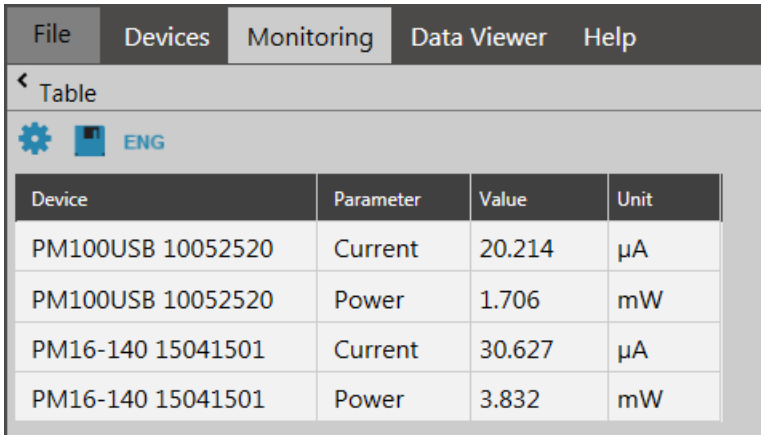
+: Add devices and parameters from the list of **Deactivated Values** to the **Table Configuration**.

X: Remove Values by deselecting them in the left panel.

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.



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

ENG **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 Configuration

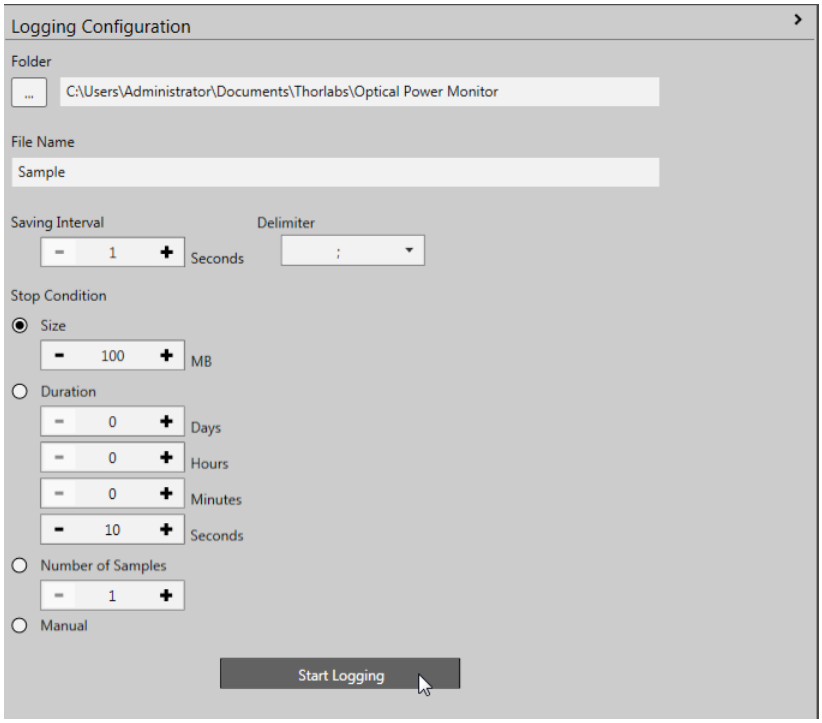
Determine the output file location and set the duration and resolution for logging in the **Logging Configuration** menu.

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

- the device information (power meter and sensor with serial numbers)
- the values of the selected devices and parameters, saved with the selected sampling interval (data are sorted by sample number and date and time down to seconds),
- the wavelength

Note

If the display shows the **Logging Chart** of a previous logging experiment, click ▶ to return to the **Logging Configuration** menu.



Go through the **Logging Configuration menu** before you start logging:

Folder: 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.
- **Delimiter:** Choose the delimiter for easy access and analysis of your saved data.
- **Stop Condition:** Select the criteria for terminating the logging process.

  Available options are:

  o **Size:** Measure until the file reaches a certain size

  o **Duration:** Measure for a certain duration

  o **Number of Samples:** Measure a set number of samples

  o **Manual:** Stop logging manually

Attention

Ensure that hibernation as well as the sleep mode of the used PC are disabled. Otherwise, the PC looses the connection to the devices, the measurement stops and the OPM software freezes when entering sleep mode or hibernation.

Note

To save more than 9GB of data, please configure the logging via **Duration** or **Manual**.

Start Logging

Start Logging of the measurement. If the file name was already used, a warning window appears.

Note

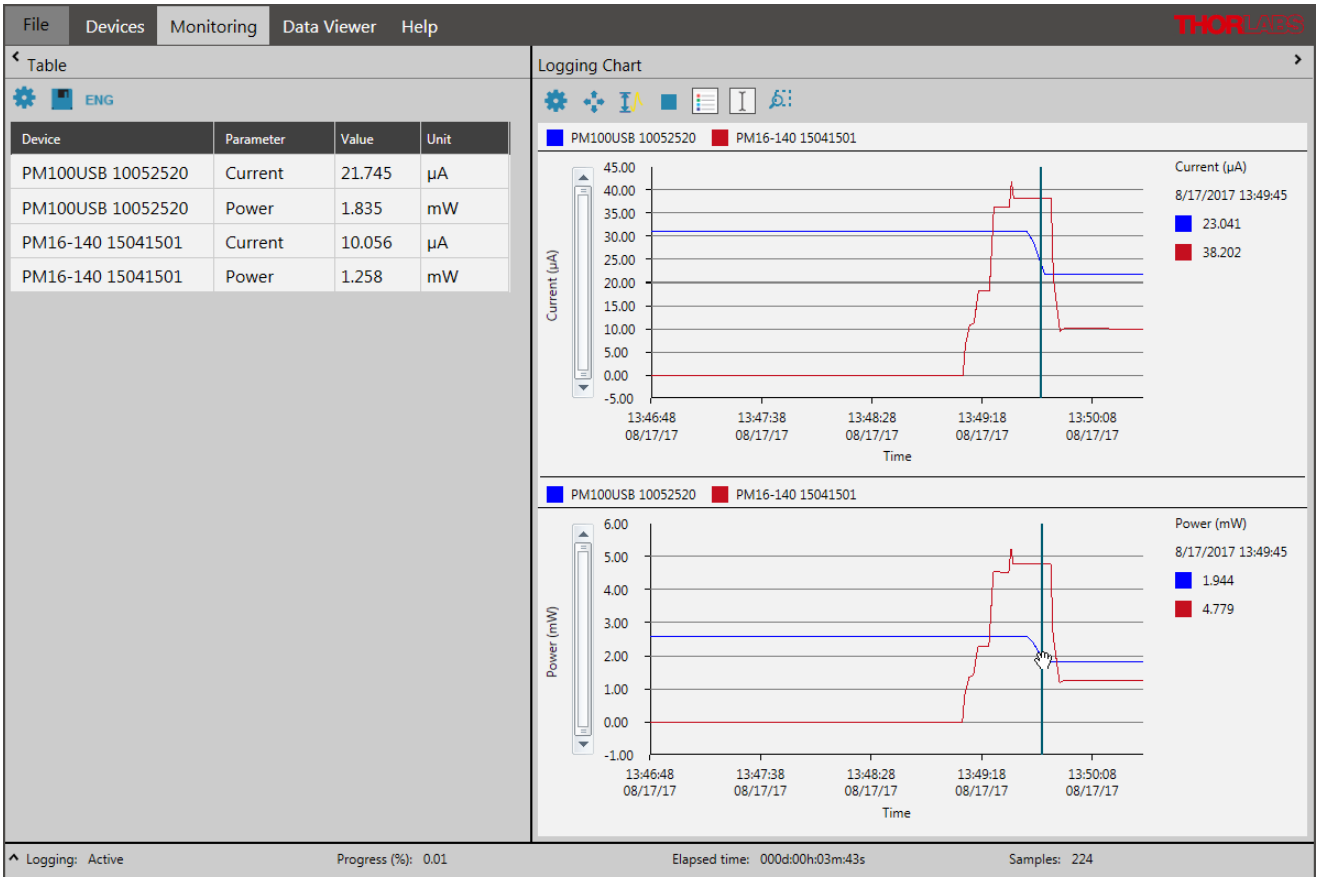
Logging can not be started if no parameters were selected in the **Table Configuration**.

Attention

General settings in the **Settings** panel can be changed even during a logged long-term measurement. Although changes will be applied immediately, settings and changes hereof will not be saved in the logged file (.tcsv or uncompressed .csv). Please note such changes, as evaluation of such data may otherwise be complicated.

4.3.3 Logging Chart

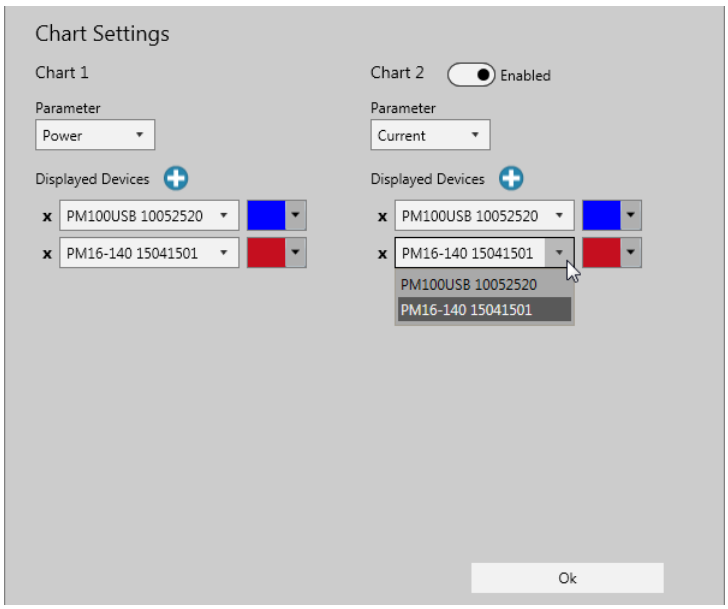
The **Logging Chart** displays the logged data over time. Use the **Tool Bar** to set up the display and analyze the data. The display optionally includes a legend for the monitored devices and a cursor to choose the display of a specific measurement value. The **Status Bar** informs about the progress 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** when the selection is finished.

Note

If parameters or devices do not appear for selection, they were not selected in the **Table** menu. To add them, click ■ to stop logging and return to the Table menu on the left side of the display. Add the desired devices and parameters as described above. Then click ▶ in the **Logging Chart** menu and start a new logging session. The screen returns to the **Logging Configuration** menu and prompts the logging and chart configuration.

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.

■ / ▶ **Stop/Start** a new logging session. This returns the user to **Logging Configuration** menu.

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.

4.3.4 File Format

Two kinds of files are saved by the OPM, .tcsv-files and .csv files.

1. .tcsv Format

Logging files generated in the **Monitoring** menu (long term measurements) are saved in .tcsv format. The .tcsv files are compressed for fast loading into the **Data Viewer**. In addition, these data are saved in uncompressed .csv files in the same location in a Folder with the .tcsv file name. The uncompressed .csv files carry the name: filename_Raw#.

Note

DO NOT delete, move or rename the uncompressed .csv files in the .tcsv file folder. Because the uncompressed files are used by the OPM to zoom into the measurement from within the **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.

2. .csv Format

All OPM data that are saved but not logged in the **Monitoring** menu are saved as .csv files. This format can be opened in a text editor, but can not be loaded into the **Data Viewer**.

3. PM400 .csv Format

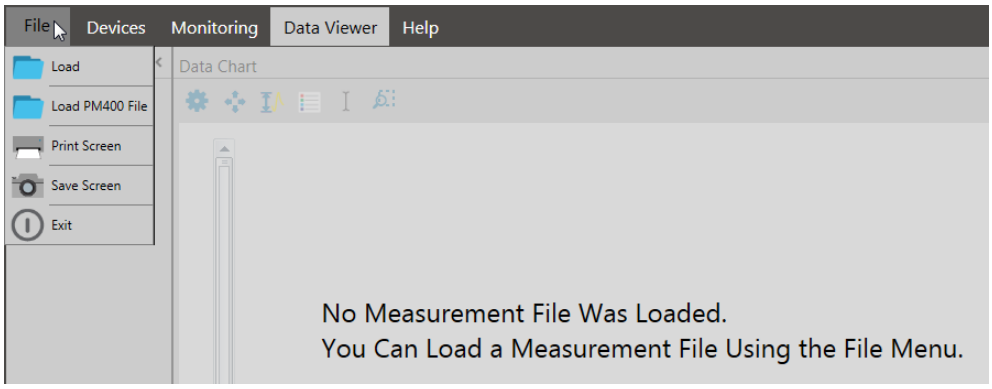
An exception are .csv files saved by the power meter PM400 which can be loaded into the **Data Viewer**.

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.

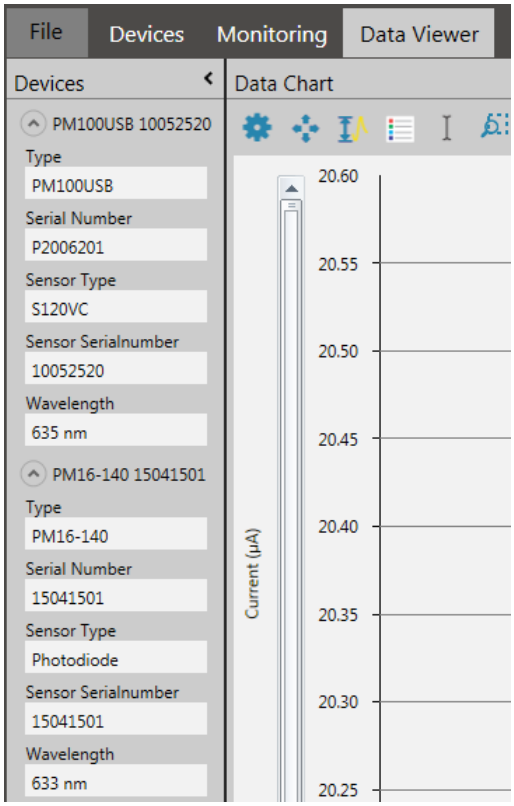


The loaded data are displayed as a list of **Devices** and a **Data Chart** of data points over time.

Devices:

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

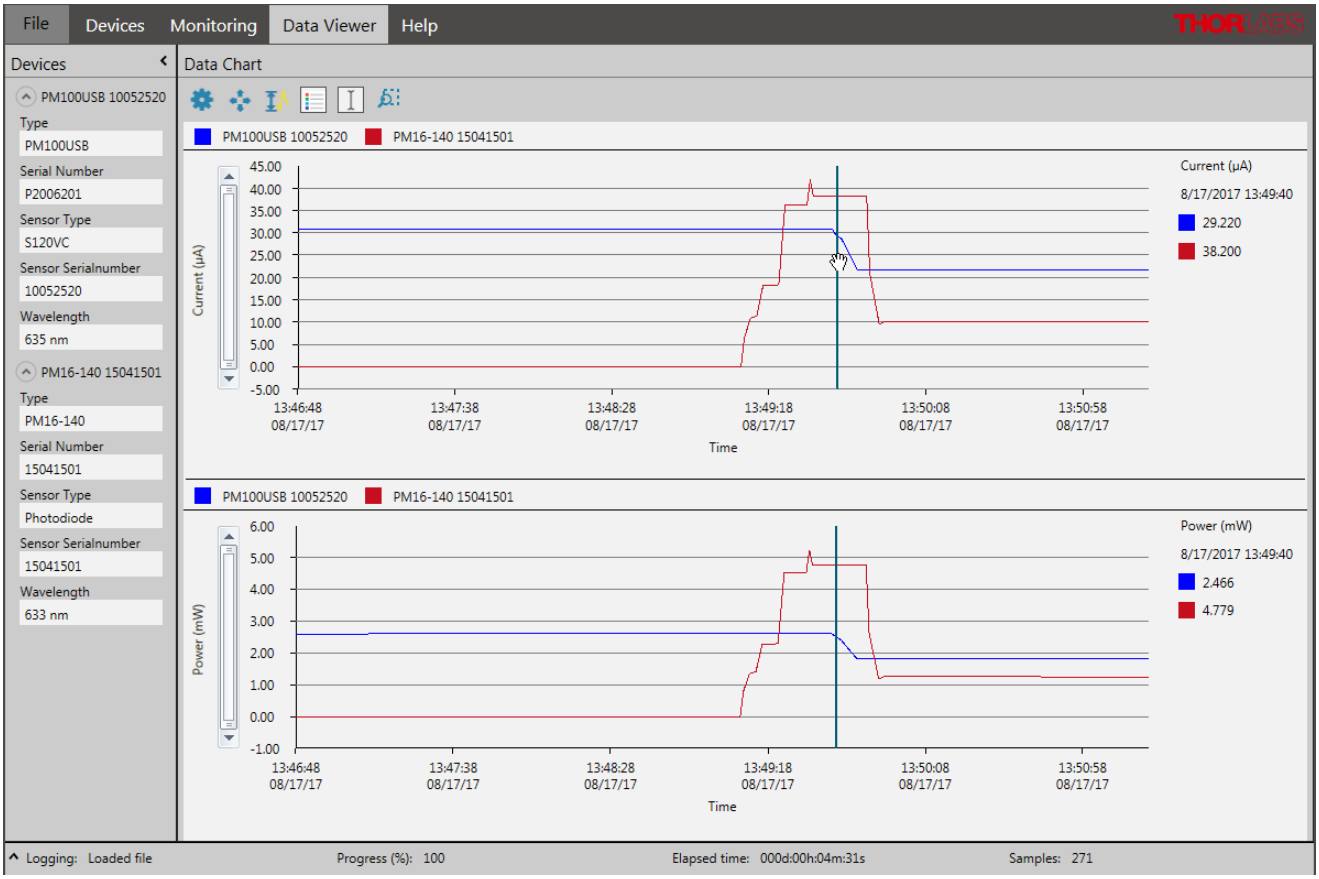
First Device: Name as set in Edit Devices →
Type of the Power Meter →
Serial Number of the Power Meter →
Type of the Sensor →
Serial Number of the Sensor →
Wavelength Analyzed in the Optical Setup →
Second Device: Name as set in Edit Device →



Go to the **Data Chart** and use the **Tool Bar** to configure the display of devices and parameters.

Data Chart:

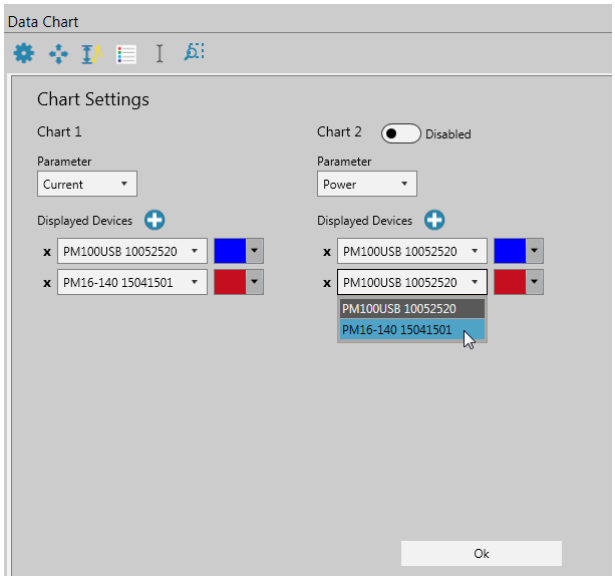
The **Data Chart** displays the loaded data over time. The display optionally includes a legend for the monitored devices and a cursor to choose the display of a specific measurement value. Use the **Tool Bar** on top of the chart to edit the display and analyze the data set.



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.



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.

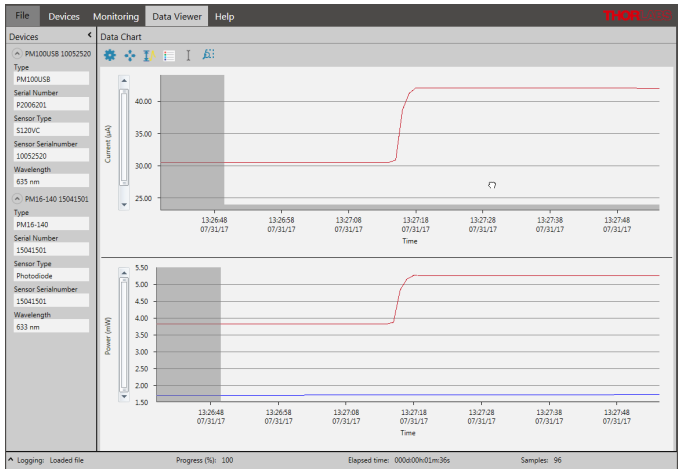
Enable/Disable Legend: Add the legend listing the used devices to the chart area as shown above

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:

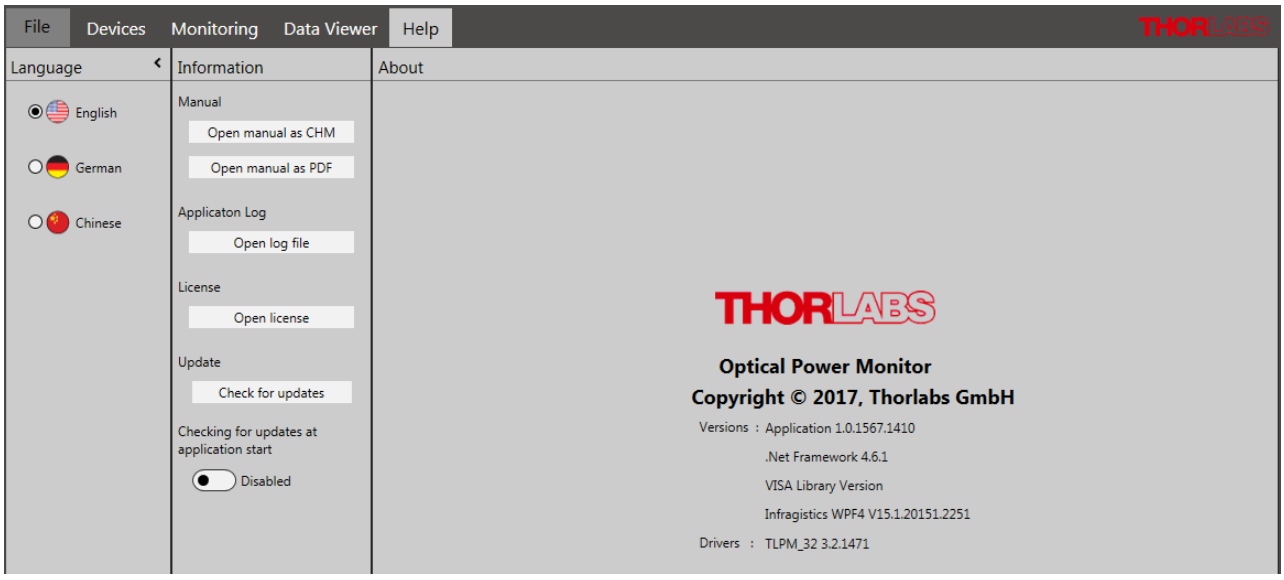
Move selected window



4.5 Help

Change Language settings, download the manual, get access to the log-file, open the license and get information on the software version here.

Please feel free to check for updates frequently.



5 OPM-GUI with Different Devices

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

This Chapter describes these differences and additional options with respect to different power meter consoles and/or sensors compared to the example settings with a PM100USB and a Photodiode Power Sensor S120VC.

5.1 Power Meter Dependent Variations

5.1.1 PM16/PM160

When using the power meters PM16 or PM160, the measurement **Range** can not be adjusted automatically.

5.2 Sensor-Dependent Variations

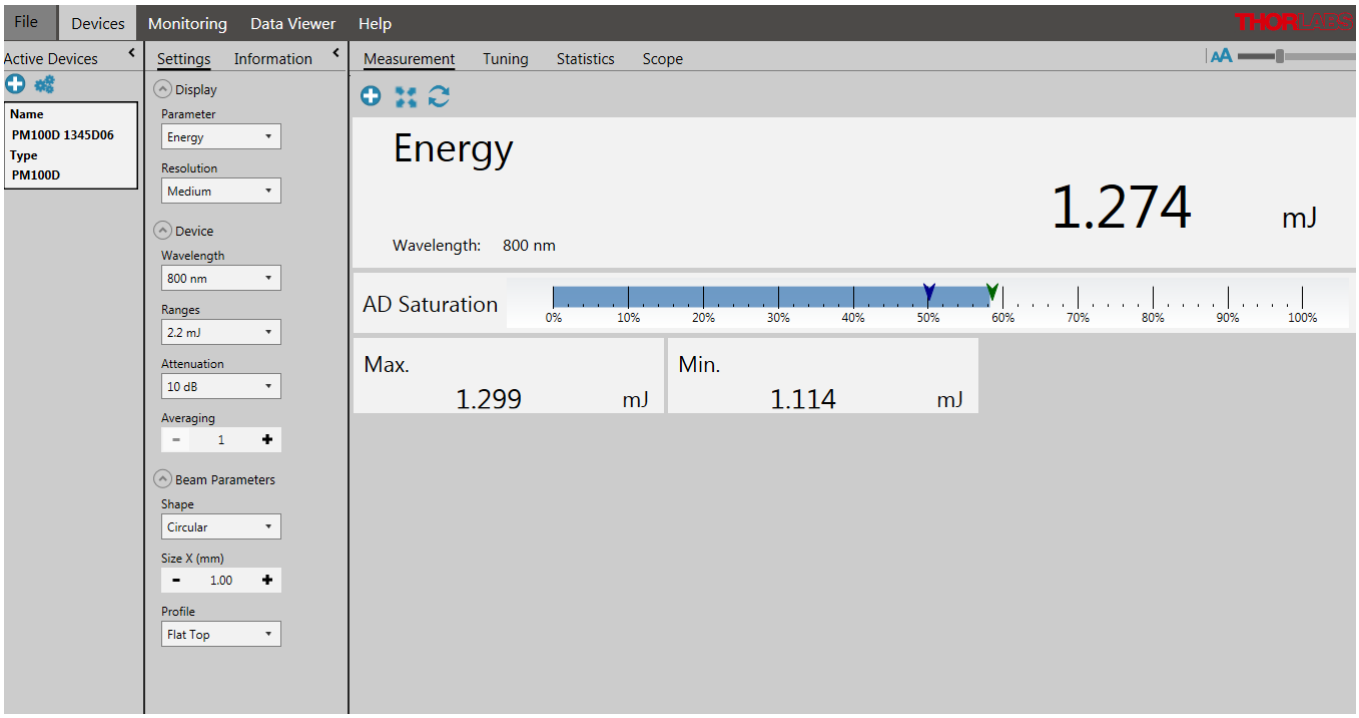
5.2.1 Pyroelectric Energy Sensors ESxxxC

The Thorlabs ESxxxC pyroelectric sensors are designed to measure pulsed coherent and incoherent sources. Pyroelectric sensors convert energy from light pulses into voltage pulses.

Because the ESxxxC sensors measure pulsed light sources, the signal is not continuous and requires different settings, processing and display.

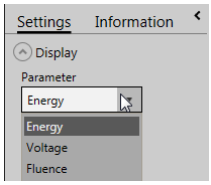
Please find below the relevant changes in the OPM when using a pyroelectric energy sensor, described for a setup using a ES111C pyroelectric sensor connected to a PM100D power meter.

The interface looks the following way:



1. Settings Menu

The list of settings differs in the following:



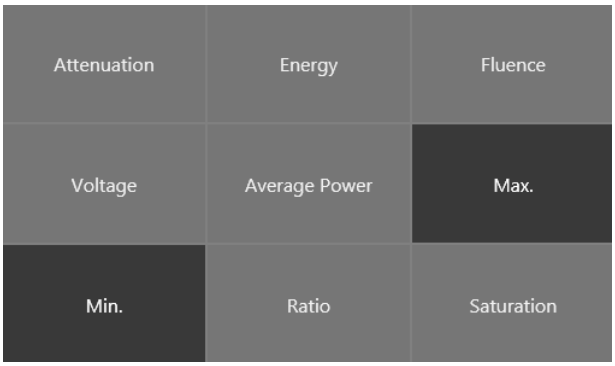
Parameter: Energy and **Fluence** are parameters of choice instead of Power and Irradiance as Energy and Fluence are calculated independent of time.

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

2. Measurement Menu: Add/Remove Parameters

For Pyrosensors, the measurement interface additionally displays the **AD Saturation** in a bar, as shown above.

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



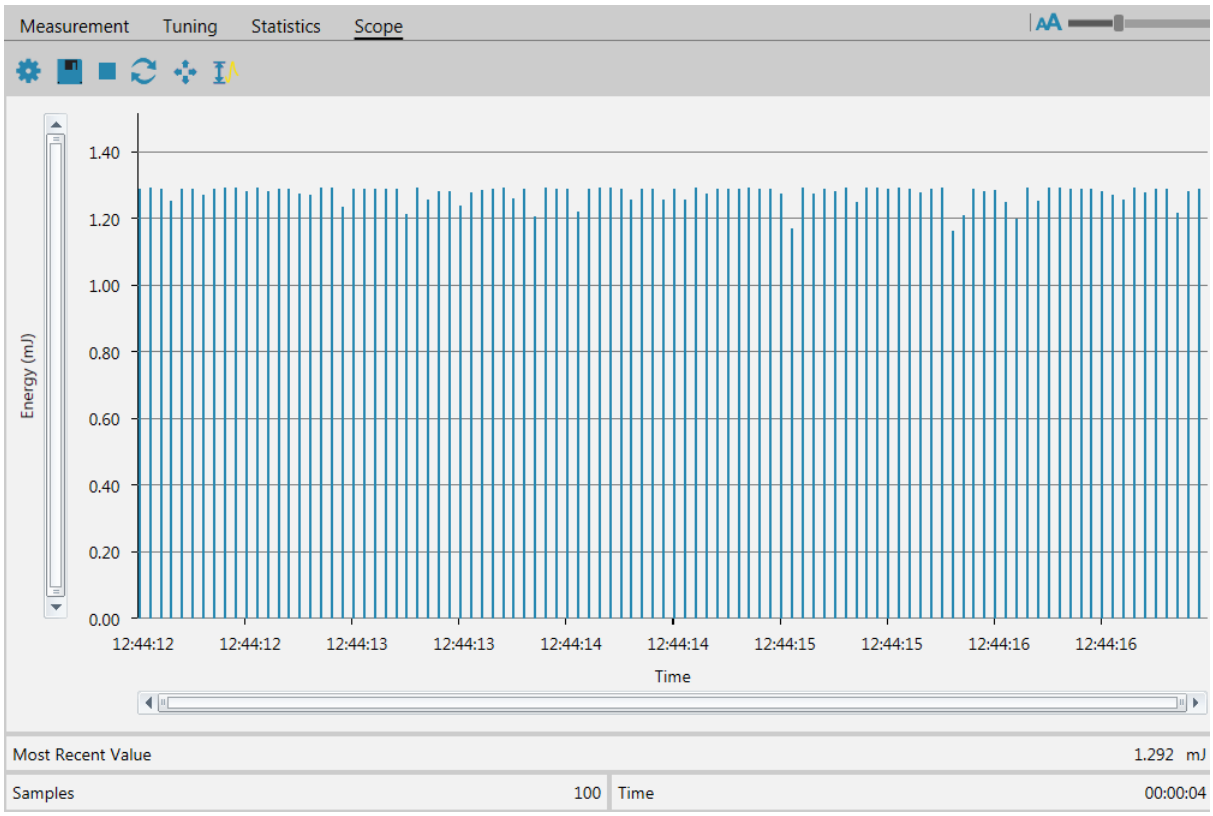
Average Power: The Average Power is calculated as an average of 3 measurement values. The calculation of the measurement values is based on the set **Averaging**.

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. Scope Menu

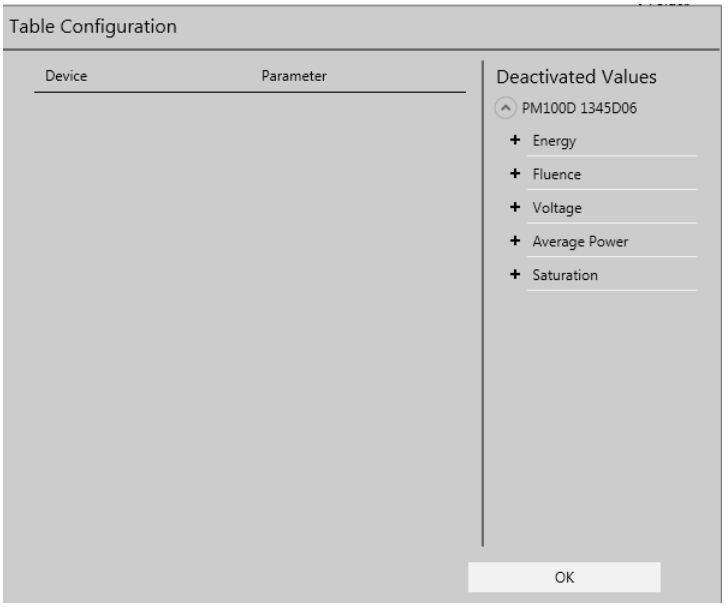
For pulsed laser applications, the scope panel changes from a line-display, as shown for continuous signal, to a bar graph.



4. Monitoring Menu

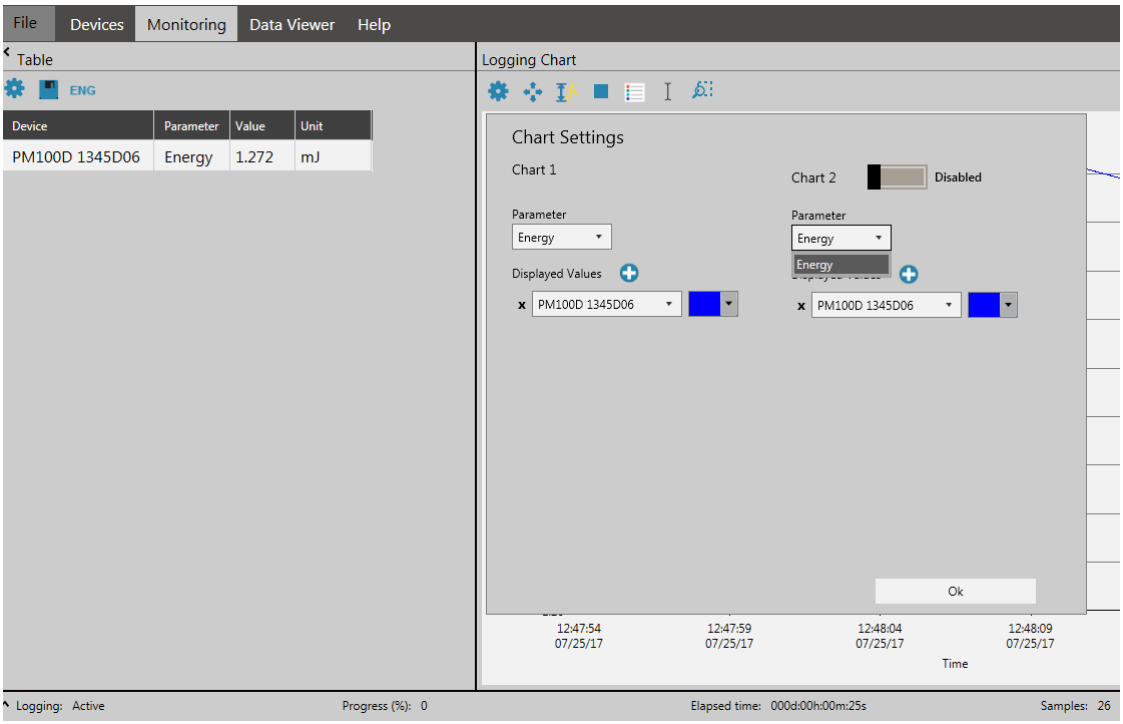
Table configuration

For Pyrosensors, the Table Configuration now additionally lists the parameters **Energy**, **Fluence** and **Average Power** that can to be logged in the experiment and continuously displayed.

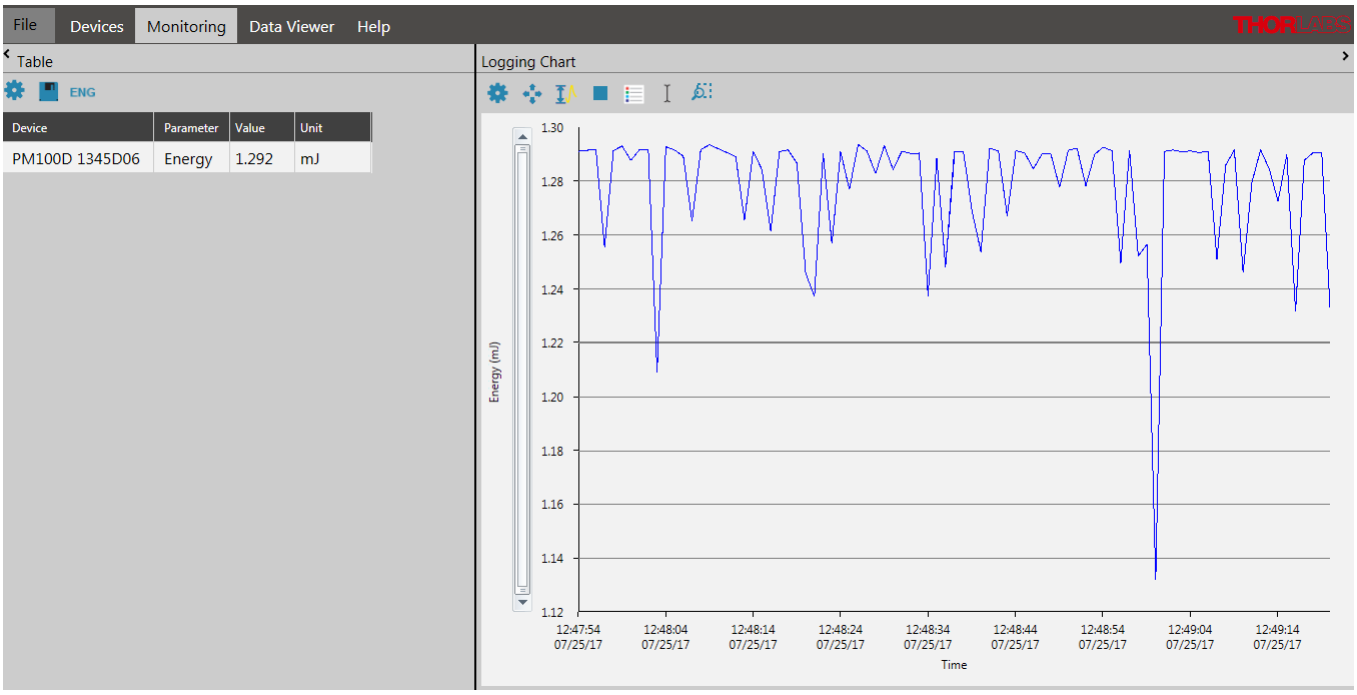


5. Logging Chart

Corresponding to the parameters selected in the above **Table Configuration**, the additional parameters can be selected for display in the Logging Chart.



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 point 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 **Scope** mode.



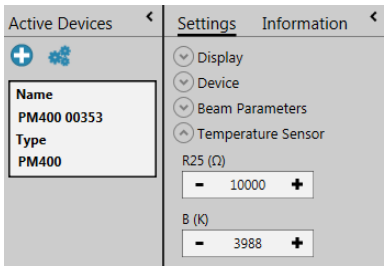
5.2.2 Temperature Sensor TSP-TH on PM400

Temperature can be recorded by the Optical Power Monitor if a Thorlabs Temperature Sensor TSP-TH is attached to a PM400 in addition to any Thorlabs C-Series sensor. Please see the PM400 Manual for more details.

This section describes the additional options available in the software when a temperature sensor is recognized.

1. Settings Menu

Specify the following **Temperature Sensor** settings.



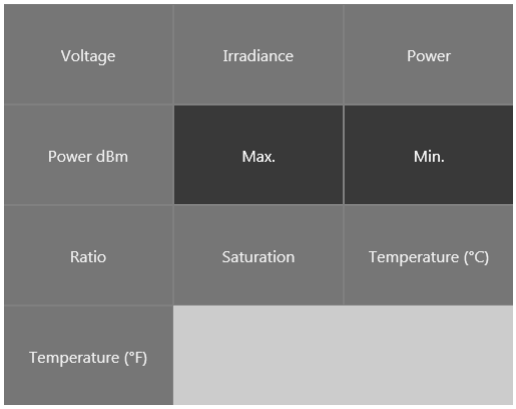
R25: Resistance @ 25°C in Ohm [Ω]

B: NTC-Constant (NTC: Negative Temperature Coefficient) [K]

To find the appropriate parameters, please see the specifications of the Temperature Sensor.

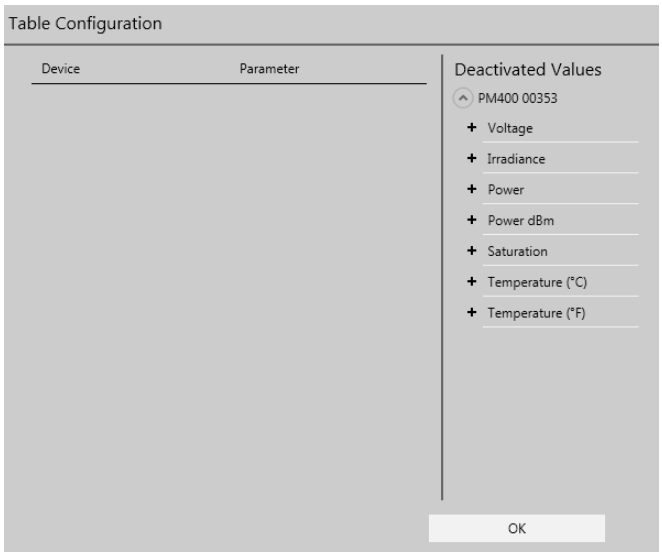
2. Measurement Menu: Add/Remove Parameters

For temperature sensors, the available parameters list temperature in °C and °F, when selecting ⊕.



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.



6 Instrument Driver for Thorlabs Power Meters

The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters and sensors than the former Thorlabs Power Meter software applications.

- The formerly used driver was the NI-VISA™-based driver PM100D.dll.
- The power meter driver used for the OPM software is the driver TLPM.dll.

The new driver TLPM.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.

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 TLPM.dll driver. Please read the chapter 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 TLPM.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 TLPM.dll driver, the user needs to revert to the driver PM100D.dll. To switch between the old PM100D.dll driver and the new TLPM.dll driver, a software tool, the Power Meter Driver Switcher, is installed together with the Optical Power Monitor.

6.1 Power Meter Driver Switcher

The Power Meter Driver Switcher (PMDS) is a tool to switch between the NI-VISA™-based PM100D.dll driver and the TLPM.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.

The PMDS tool can be opened as a separate tool (a) or from within the OPM software (b).

a) Open Power Meter Driver Switcher as a Seperate Tool

You can either 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

Attention

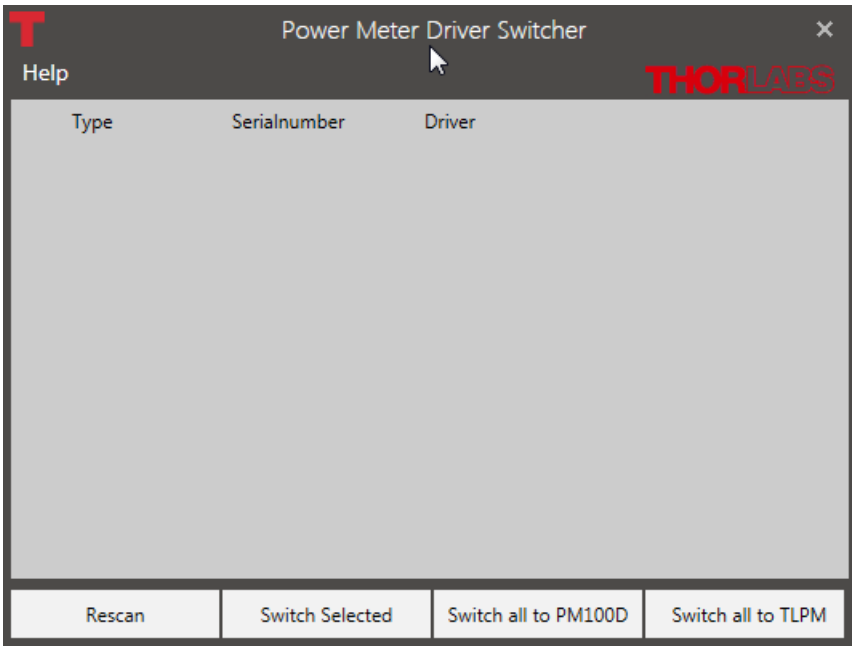
To use the Power Meter Driver Switcher and change instrument drivers, you need administrator rights on your PC.

b) Open Power Meter Driver Switcher inside OPM

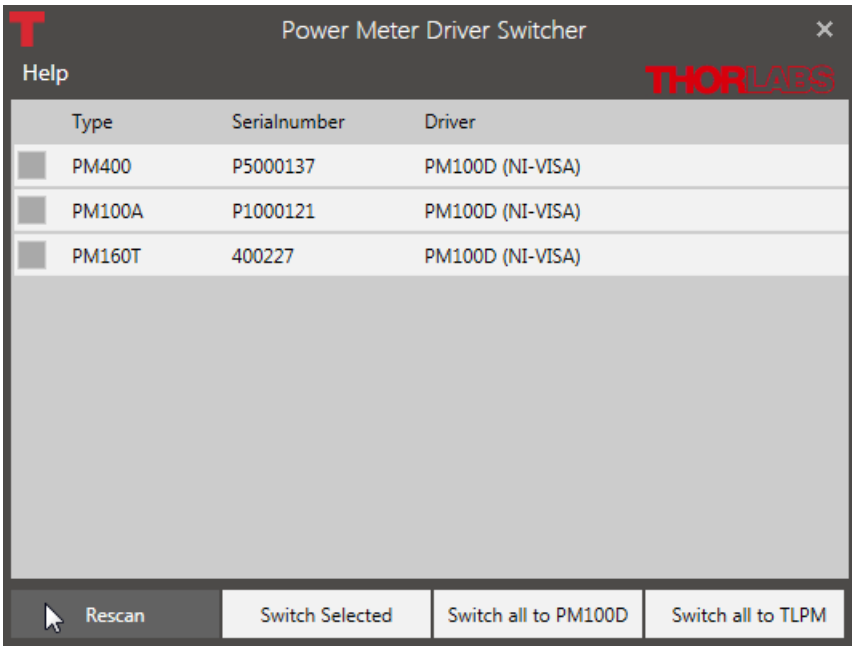
This is only possible when devices with the driver PM100D.dll are found.

- go to the panel Devices,
- click Add devices and
- click **Open Power Meter Driver Switcher** on the bottom of the interface

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**.

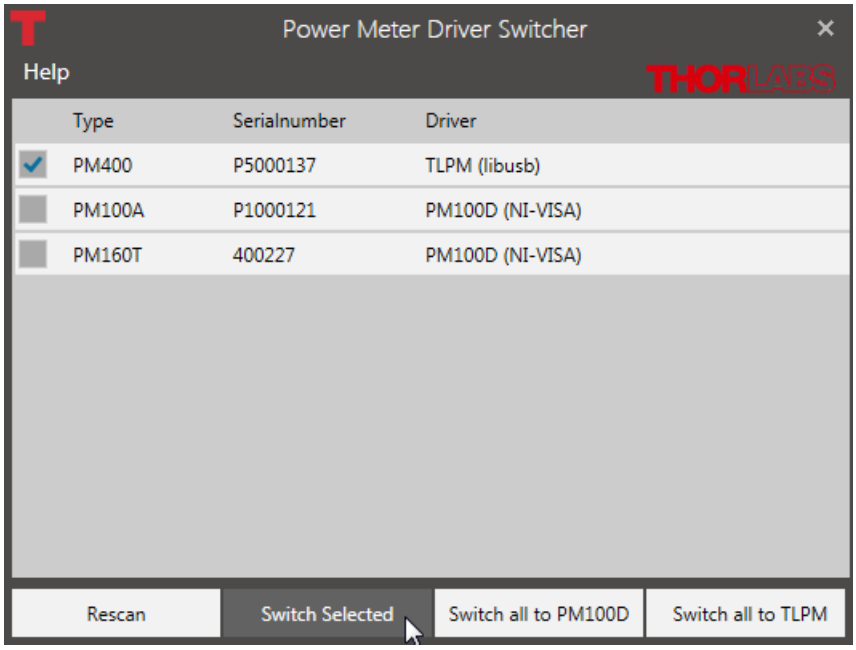


You can now convert the drivers for all or the selected devices to the driver appropriate for your application.

Note

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

Use the TLPM.dll for the Optical Power Monitor.



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

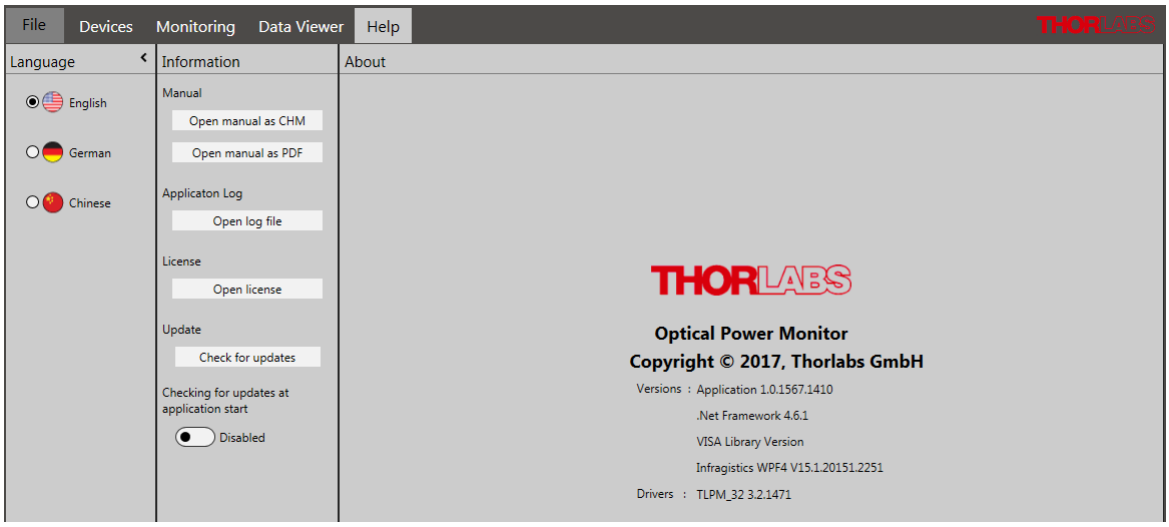
Close the Power Meter Driver Switcher after the driver exchange to prevent unintentional use.

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 TLPM.dll in the Optical Power Monitor and PM100USB SerialNumber 2 with the driver PM100D.dll using another software in parallel.

7 Version Information

For Information on the software version, please go to the HELP menu



8 Troubleshooting

- **Devices with Incompatible Instrument Drivers**
  - **Reason:** The Thorlabs Optical Power Monitor (OPM) uses a different driver for the connected power meters than Thorlabs power meter software applications (Power Meter Monitor, Optical Power Meter Utility or Multi Power Meter). That is why a driver may be incompatible.
    Former instrument driver: NI-VISA™-based driver PM100D.dll.
    OPM instrument driver: TLPM.dll.
  - **Solution:**

    To switch between the PM100D.dll and the TLPM.dll, use the Power Meter Driver Switcher tool. Read about the different instrument drivers in the section Instrument Driver for Thorlabs Power Meters.

- **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: TLPM.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: TLPM.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: TLPM.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.
    New instrument driver: TLPM.dll.

  - **Solution:** You can either adjust your custom made software or switch between the PM100D.dll and the TLPM.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 7, Windows 8.1 and Windows 10 (32 and 64 bit).

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

- for Windows 7 (32/64 bit), Windows 8.x (32/64 bit) and Windows 10 (32/64 bit): Install "xxxx VXIpnp Instrument Driver (32bit)"
- for Windows 7 (64 bit), Windows 8.x (64 bit) and Windows 10 (64 bit): Install "xxxx VXIpnp Instrument Driver (64 bit)"

In other words, the 32 bit VXIpnp 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, 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 VXIpnp Instrument Driver. Beside that, LabVIEW driver vi's are provided with the *.llb container file **Note:** LabVIEW drivers and components are installed only, if a LabVIEW installation was recognized.

Note

All above environments require also the VXIpnp 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.

1.1 32 bit Operating System

Note

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

VXIpnp Instrument driver:

```
C:\Program Files\IVI Foundation\VISA\WinNT\Bin\TLPM_32.dll
```

Note

This instrument driver is required for all development environments!

Header file

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

Static Library

```
C:\Program Files\IVI Foundation\VISA\WinNT\lib\msc\TLPM_32.lib
```

Function Panel

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPM\TLPM.fp
```

Online Help for VXIpnp Instrument driver:

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

NI LabVIEW driver

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

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

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

.net wrapper dll

```
C:\Program Files\Microsoft.NET\Primary Interop Assemblies…
…\ Thorlabs.TLPM_32.Interop.dll
```

```
C:\Program Files\IVI Foundation\VISA\VisaCom\…
…\Primary Interop Assemblies\ Thorlabs.TLPM_32.Interop.dll
```

Example for C

Source file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPM\Example\C\…
…sample.c
```

Example for C++

Solution file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPM\Example\…
…MS_VCpp\thorlabs_tlpm_sample.sln
```

Project file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPM\Example\…
…MS_VCpp\thorlabs_tlpm_sample.vcproj
```

Example for C#

Solution file:

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

Project file:

```
C:\Program Files\IVI Foundation\VISA\WinNT\TLPM\Examples…
…\MS.NET_CS\Thorlabs.TLPM.Interop.Sample\ Thorlabs.TLPM.In-
terop.Sample.csproj
```

Example for LabView

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

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

1.2 64 bit Operating System

Note

According to the VPP6 (Rev6.1) Standard the installation of the 64 bit VXIpnp 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, 64bit 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.

VXIpnp Instrument driver:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\Bin\TLPM_32.dll
C:\Program Files\IVI Foundation\VISA\Win64\Bin\TLPM_64.dll
```

Note

This instrument driver is required for all development environments!

Header file

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


Static Library

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\lib\msc...
...\TLPM_32.lib
```

```
C:\Program Files\IVI Foundation\VISA\Win64\lib\msc\TLPM_32.lib
```

```
C:\Program Files\IVI Foundation\VISA\Win64\Lib_x64\msc\TLPM_64.lib
```

Function Panel

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

Online Help for VXIpnp Instrument driver:

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

NI LabVIEW driver

The LabVIEW Driver supports 32bit and 64bit NI-LabVIEW2009 and higher.

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

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

.net wrapper dll

```
C:\Program Files (x86)\Microsoft.NET\Primary Interop Assemblies…
…\ Thorlabs.TLPM_32.Interop.dll
```

```
C:\Program Files (x86)\IVI Foundation\VISA\VisaCom\…
…\Primary Interop Assemblies\ Thorlabs.TLPM_32.Interop.dll
```

```
C:\Program Files\IVI Foundation\VISA\VisaCom64\…
…\Primary Interop Assemblies\ Thorlabs.TLPM_64.Interop.dll
```

Example for C

Source file:

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

Example for C++

Solution file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPM\Example\…
…MS_VCpp\thorlabs_tlpm_sample.sln
```

Project file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPM\Example\…
…MS_VCpp\thorlabs_tlpm_sample.vcproj
```

Example for C#

Solution file:

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

Project file:

```
C:\Program Files (x86)\IVI Foundation\VISA\WinNT\TLPM\Examples…
…\MS.NET_CS\Thorlabs.TLPM.Interop.Sample\ Thorlabs.TLPM.In-
terop.Sample.csproj
```

Example for LabView

```
C:\Program Files (x86)\National Instruments\LabVIEW xxxx\In-
str.lib\TLPM…
…\TLPM.llb
```

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

10 Appendix

10.1 Warranty

Thorlabs GmbH warrants the hard- and/or software determined by Thorlabs GmbH for this unit to operate fault-free provided that they are handled according to our requirements. However, Thorlabs GmbH 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 GmbH 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 GmbH does explicitly not warrant the usability or the economical use for certain cases of application.

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

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Index

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