THORLABS

# PM103, PM103A, PM103U, PM103E

# Optical Power Meter Interfaces

## User Guide



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# Chapter 1 Safety

**Attention**

The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

All statements regarding safety of operation and technical data in this user guide will only apply when the unit is operated correctly as it was designed for.

The PM103x must not be operated in explosion endangered environments!

Only with written consent from Thorlabs may changes to single components be made or components not supplied by Thorlabs be used.

All modules including control inputs / outputs and the sensor must be connected with duly shielded connection cables.

**Attention**

The following statement applies to the products covered in this user guide, unless otherwise specified herein. The statement for other products will appear in the accompanying documentation.

**Note**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Standard ICES-003 for digital apparatus. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Thorlabs GmbH is not responsible for any radio or television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Thorlabs GmbH. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

**Attention**

Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

This product has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 meters (9.8 feet).

# Chapter 2 General Information

The PM103x Optical Power and Energy Meter Interfaces measure the optical power of laser light or other monochromatic or near monochromatic light detected by a connected sensor. Their high repetition rate up to 80 kHz supports even fast pyroelectric sensors.

The interfaces of the PM103x power meter are compatible with all Thorlabs "C-Series" Photodiodes, Pyroelectric sensors, sensors without EEPROM, and corresponding customized sensors.

To flexibly integrate the PM103x into a setup, the PM103x models offer different electronic interfaces for instrument control and output.

**PM103** USB Port, Dual I/O Port, and DA-15 Connector

**PM103A** USB Port and SMA Analog Interface (Output Only)

**PM103U** USB Port Only

**PM103E** Ethernet Port, Phoenix DMC Connector

The USB port features a fixture for secure connection of the cable to the housing.

For the PM103U and PM103A power meters, instrument control, and power supply are facilitated via the USB port. The PM103 can alternatively use the DA-15 interface for instrument control and to connect a power supply. Furthermore, the PM103 can be controlled via an external micro-controller, supplied by the customer.

The PM103E can use the Ethernet cable for power supply, if the network supplies Power over Ethernet (PoE). Alternatively the PM103E can be powered via its Phoenix DMC Connector.

For instrument control and data analysis through a connected PC, tablet or laptop, Thorlabs offers the Optical Power Monitor (OPM) Software. Instead of the OPM Software, the user can write custom made software. For this, information on driver and SCPI commands are provided in the user guide WriteYourOwnApplication (WYOA) for the PM103x.

In summary, the PM103x models give the customer the choice of different interfaces, provide a supplied control and analysis software, and have the option to use custom made software. These features allow for maximum flexibility to integrate the instrument in test and measurement systems and a wide range of industrial and scientific applications in manufacturing, quality control, quality assurance, and R&D for stationary and field use.

The PM103x Optical Power and Energy Meter Interface offers the customer the option of implementing several power meters in parallel and simultaneously in their application.

**Attention**

Please find all safety information and warnings concerning this product in the chapter Safety.

## 2.1 PM103x Model Comparison

| Feature | PM103 | PM103A | PM103U | PM103E |
|---|---|---|---|---|
| Ethernet Connection and Operation | ✘ | ✘ | ✘ | ✓ |
| USB Connector and Operation | ✓ | ✓ | ✓ | ✘ |
| SMA Connector | ✘ | ✓ | ✘ | ✘ |
| DA-15 Universal Connector | ✓ | ✘ | ✘ | ✘ |
| DMC 0,5/7 Connector | ✘ | ✘ | ✘ | ✓ |
| RS232 Operation | ✓ | ✘ | ✘ | ✓ |
| Analog Output Operation | ✓ | ✓ | ✘ | ✓ |
| Autonomous Operation to Analog Output | ✓ | ✓ | ✘ | ✓ |
| Real Analog Output | ✓ | ✓ | ✘ | ✓ |
| Sensitivity Configurable Analog Output | ✓ | ✓ | ✘ | ✓ |
| UART Operation | ✓ | ✘ | ✘ | ✘ |
| 2 Digital I/O Ports | ✓ | ✘ | ✘ | ✓ |
| 1 Digital I/O Ports | ✘ | ✓ | ✘ | ✘ |
| NTC Input | ✓ | ✘ | ✘ | ✓ |
| Power Supply 5 V to 36 V | ✓ | ✘ | ✘ | ✓ |

***Table 1 PM103x Model Comparison***

## 2.2 Ordering Codes and Accessories

**Item #**

**PM103** Power and Energy Meter Interface with DA-15 Connector; USB, RS232, or UART Operation. Digital or Analog Signal Output; Two Digital I/O Ports; NTC Input; USB Interface for Control and Power Supply.

**PM103A** Power and Energy Meter Interface with SMA Connectors for two Analog Outputs and one Digital I/O Port; USB Interface for Control and Power Supply.

**PM103U** Power and Energy Meter Interface with USB Connector and USB Operation for Control, Read Out, and Power Supply.

**PM103E** Power and Energy Meter Interface with Ethernet Connector for Control and Power Supply (Power over Ethernet, PoE) and Phoenix DMC Connector 0,5/7 with RS232 Interface, Two Digital Configurable In/Outputs, Two Analog Outputs; NTC Input, and Connection for External Power Supply.

**Included Accessories**

The PM103x Power and Energy Meters include certain cables. Further cables are recommended in the section Optional Accessories.

**Item #**

| | |
|---|---|
| **PM103** | DA-15 Connector and Connector Housing; USB Cable, Type A to Mini B, with Locking Screw, 1.5 m |
| **PM103A** | USB Cable, Type A to Mini B, with Locking Screw, 1.5 m |
| **PM103U** | USB Cable, Type A to Mini B, with Locking Screw, 1.5 m |
| **PM103E** | RJ45 Patchcable 1.5 m, Phoenix DFMC Connector with 2x7 Pins: DFMC 0,5/ 7-ST-2,54 - PCB Connector |

**Optional Accessories**

To run the PM103x Power and Energy Meters, additional cables or mounting devices may be required.

**Item #**

| | |
|---|---|
| **PM103** | Cable to Attach to the Provided DA-15 Connector Housing |
| **PM103A** | SMA Cable: Please provide a cable with a SMA connector for your PM103A. Thorlabs offers a variety of SMA connector cables. |
| **PM103E** | Wires (AWG 26-20; 0.14 mm² - 0.5 mm²) to Connect with the DFMC 0,5/7 Push-in Spring Contacts |
| **CABRU15** | Adapter Cable: USB to Serial Flying Leads, 60'' (1.5 m) Long. Suitable for PM103E, PM101R, and PM5020, and any Device with an RS232 Interface to Adapt it to a USB Interface |

**Required Accessories**

**Item #**

| | |
|---|---|
| **PM103** | Please provide an appropriate cable to be attached to the DA-15 connector. |
| **PM103A** | Please provide appropriate cables to connect to the SMA ports. |
| **PM103E** | Please provide an appropriate cable to be attached to the Phoenix DMC connector, (DMC 0,5/7). |

## 2.3 Requirements

**Accessories**

**Item #**

| | |
|---|---|
| **PM103** | Please provide an appropriate cable to be attached to the DA-15 connector. |
| **PM103A** | Please provide appropriate cables to connect to the SMA ports. |
| **PM103E** | Please provide an appropriate cable to be attached to the Phoenix DMC connector, (DMC 0,5/7). |

**Software Requirements**

The PM103x Power and Energy Meters can be run with the Thorlabs' OPM Software. Please see the software requirements for the OPM Software on the website.

**Sensor Requirements**

The PM103x supports all Thorlabs C-Series photodiode and pyroelectric sensors. The C-Series can be easily identified by the red connector-housing of the DE-9 connector, compared to older versions of Thorlabs power sensors. The PM103x also supports sensors without EEPROM.

Please refer to the section Connecting a Power Sensor on how to use older Thorlabs sensors or custom sensors.

# Chapter 3 Getting Started

Please inspect the shipping container for damage. Please do not cut through the cardboard. You might need the box for storage or for returns.

If the shipping container seems to be damaged, inspect the contents for completeness and test the PM103x mechanically and electrically. Keep the container for storage or in order to return the product in case of future problems.

# Chapter 4 Operating Instructions

This section describes how to install the PM103x for standard measurements.

## 4.1 Mounting

The PM103x offers the following mounting options:

- Horizontal Mounting Clamp (ECM225) to Mount the PM103x onto a Post
- Vertical Mounting Clamp (ECM100) to Mount the Narrow Side of the PM103x onto a Post
- Double Sided Horizontal Mounting Clamp (EPS225) to Securely Mount two Devices on Top of Each Other

Please visit our website for various accessories like power and energy sensors, fiber adapters, posts and post-holders.

## 4.2 Installation

1. Download and install the Optical Power Monitor software on the device that will be used to control the power meter interface (PC, laptop or tablet).
   **Note**
   Install the software prior to connecting the power meter interface to the PC (see section Software).
2. Connect the PM103x to a PC (Status LED turns yellow) or other power source (status LED power supply turns green) via either the USB port or for the PM103x.
   ➤ The PM103 accepts external power supplies with 5 V to 36 V via the DA-15 interface (see section Pin Output Connector DA-15). When connecting the USB port while using an external power supply via the DA-15 port, connecting the USB port will automatically switch to the 5 V power supply via USB.
   ➤ The status LED for the power supply is yellow in USB mode and green when connected to an external power supply via the DA-15 connector.
3. Connect the PM103x to a readout instrument (PC) using the USB cable or a matching cable for the respective output port (DE-9, SMA, DA-15, or Phoenix DMC Connector). For PM103A and PM103, please provide cables.
4. Connect a suitable sensor to the PM103x.
   ➤ The sensor status LED indicates, when a sensor has been detected (green) or when no sensor or no recognizable sensor is connected (red).
   ➤ The power meter interface is now ready for operation and is recognized by the OPM Software.

**Note**
For detailed instructions on controlling of the PM103x through the OPM Software, please download the user guide.

## 4.3 Connecting a Power Sensor

The PM103x supports all Thorlabs C-Series photodiode and pyroelectric sensors, that can be identified by the red connector-housing of the DE-9 connector, compared to older versions of Thorlabs power sensors. Sensor type and calibration data are saved in the non-volatile memory of the DE-9 connector. Upon connection, this information is automatically sent to the PM103x and to the controlling device and software. The OPM Software will automatically recognize the sensor.

To plug-in or remove a sensor, slightly press on the two bolts in the connector housing, that fix it by tension.




***Figure 1 DE-9 Connector***

**Older Thorlabs Sensors Without a DE-9 Connector**

**Note**

The PM103x will NOT automatically recognize sensors lacking a DE-9 connector, as for the case of the "A" and "B" series. Please contact Thorlabs for an upgrade of old sensors with DE-9 connectors.

**Custom Sensors**

**Note**

To use sensors without a DE-9 connector, manufactured by Thorlabs or else, the user may provide an appropriate adapter. To build the adapter, refer to the Pin-out of the DE-9 connector shown in the section Pin Sensor Connector . The adapter will per default automatically be recognized by the Optical Power Monitor (OPM) Software as "Photodiode Adapter" or "Pyro Adapter". The sensor type can then be adjusted in the OPM Software.

## 4.4 Power Meter Interface Features

PM103x Optical Power Meters offer full functionality to process signal from compatible photodiode or pyroelectric sensors to be displayed and analyzed on a connected PC.

**PM103x General Features**

- All PM103x optical power meters have a non-volatile memory which prevents power meter settings from being lost upon shutting down or rebooting.
- A fast readout rate of 100 kS/s permits online signal monitoring (Exception: Serial Interface).
- Finely graduated power and energy ranges permit optimal resolution for power measurements.
- A reset "Button" allows quick rebooting of the micro controller.

- The PM103/A/U are powered via the USB interface. Additionally, PM103 can be powered via the DA-15 interface. Similar, the PM103E is powered either via Power over Ethernet (PoE) or via the phoenix DMC connector.
  The status LED indicates appropriate connection to a power supply. It turns yellow when the PM103x is connected to the PC or green after connecting to an external power supply.
- All PM103x can calibrate up to sensors with the help of the OPM Software. Please see the software user guide for more information.
- Different electrical interfaces in the PM103x for integration into different systems in industrial and scientific applications. The different electrical interfaces come with further functions, described in the following chapters.

### 4.4.1 PM103x Sensor Connector

All PM103x Optical Power Meters have the same powermeter-sensor connector shown below. The Pin assignment is engraved on the front of the PM103x.

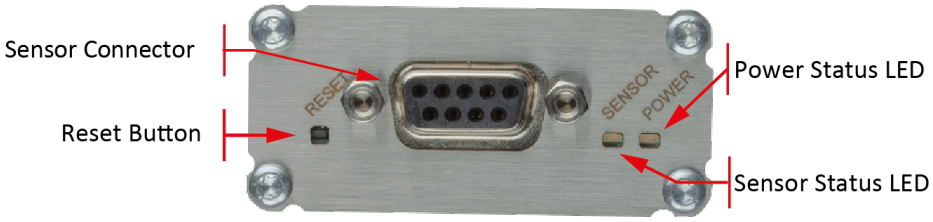



***Figure 2 PM103x Sensor Connector***

### 4.4.2 PM103/A/U

**Overview PM103x Series**




***Figure 3 PM103***




***Figure 4 PM103A***




***Figure 5 PM103U***

**PM103/A/U Special Features**

In the following is a description of the special features of the PM103/A/U/E powermeter sensors.

While the PM103/A/U are equipped with an USB-connector, the PM103E features an Ethernet connector.

Due to further differences, the characteristics of PM103 /A /U are described in this section PM103/A/U, while the PM103E has its own description in the section PM103E.

#### 4.4.2.1 PM103

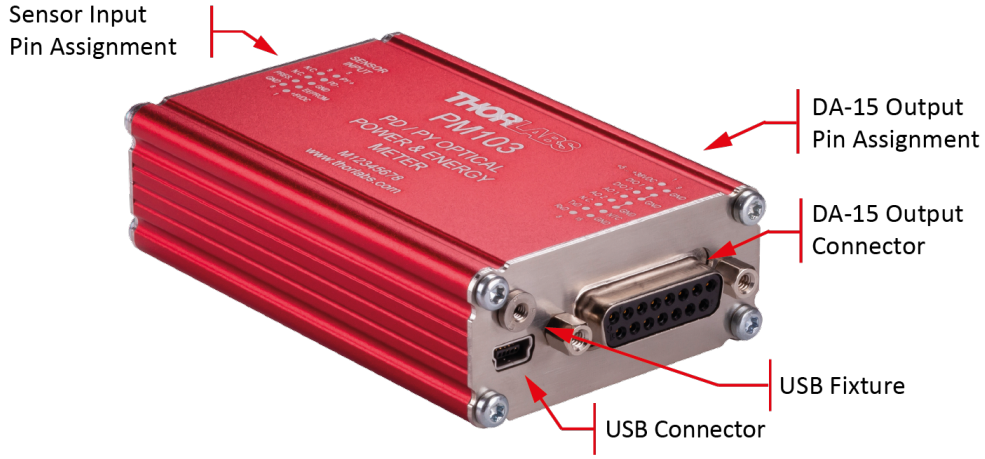



***Figure 6 PM103***

**PM103 Special Features**

The PM103 features a number of additional options, due to the DA-15 output connector.

The PM103 is per default configured to RS232 configuration (±5 V voltage level). This can be changed to a UART configuration (0/5 V voltage level) such that the PM103 can be accessed by external micro-controllers for instrument control and data export. The PM103 can also be adjusted to accommodate micro-controllers using 3.3 V.

- DA-15 Interface
- Two Digital I/O Ports
- NTC Input
- Two Analog Output Ports
- Real Analog Output
- Autonomous Operation to Analog Output
- Optional Use of 5 V - 36 V Power Supply
- RS232 Operation
- Adjustable Baud Rate via USB or Serial Communication (SCPI Commands)
  The default Baud Rate is 115 200 Bd.
- UART Operation (i.e. for Control via an External Micro-Controller)
- Instrument Control Using SCPI Commands (Serial Communication) via USB
- Power Meter Control and Output via USB

#### 4.4.2.2 PM103A

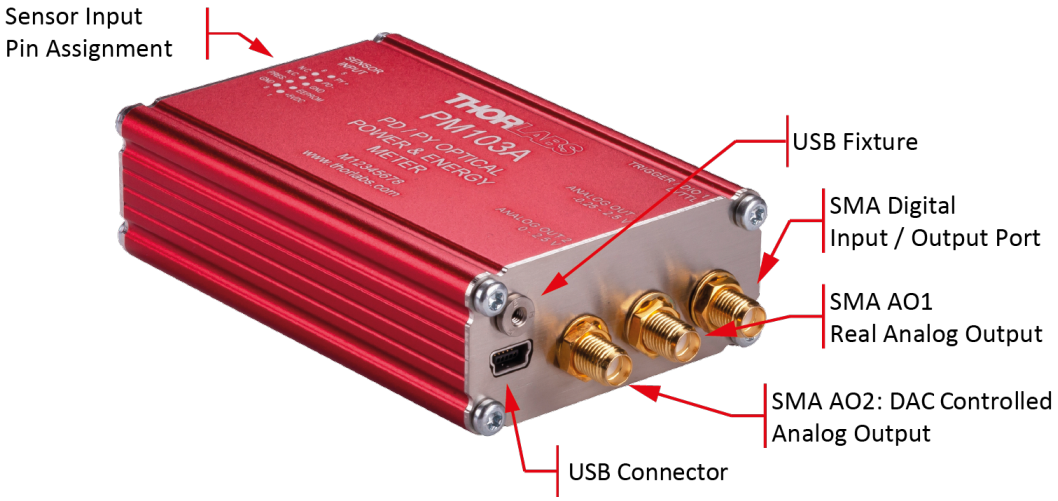



***Figure 7 PM103A***

**PM103A Special Features**

- Autonomous Operation to Analog Output
- Configurable Analog Output
- Configurable Digital In/Output
- Power Meter Control and Output via USB

#### 4.4.2.3 PM103U

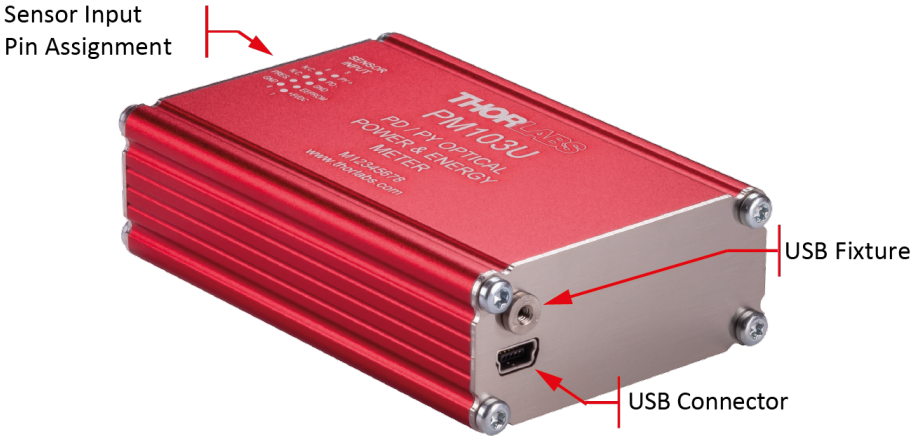



***Figure 8 PM103U***

**PM103U Special Features**

- Power Meter Control
- Output via USB

#### 4.4.2.4 USB Operation

The PM103/A/U models can be run via the USB port. The USB interface on all PM103x models also serves to connect a power supply and to update firmware of the PM103x.

The PM103U uses the USB interface as the only port for control and output.

**Note**

**USB vs UART Operation for PM103**

In case a USB communication is established in addition to the DA-15 connection, the PM103 switches to USB-Mode and the DA-15 serial interface becomes inactive. Only after actively closing the USB connection, the serial communication is reestablished.

When switching the PM103 in the opposite direction, from USB to RS232 operation or to UART operation, PM103 uses the DA-15 interface for control and output.

#### 4.4.2.5 UART Operation

The PM103 is delivered in RS232 operation but can be switched to UART operation.

**UART Dependent PM103 Functions**

The PM103 may need to be switched from RS232 to UART operation when using an external micro controller for PM103 control. In RS232 operation the PM103 uses voltage levels of ±5 V, while in UART mode the voltage level is shifted to 0/5 V. The PM103 can also be adjusted to accommodate micro-controllers using 3.3 V. When switched to 3.3 V, UART operation is tolerant for 5 V input signal.

For instructions on how to change the voltage level for UART operation, please refer to the document Write-Your-Own-Applications (WYOA) for PM103x.

For UART operation, please use standard protocols for UART communication and the SCPI commands listed in WYOA for PM103x.

#### 4.4.2.6 Serial Operation

The power meter PM103 can be operated with serial communication via RS 232.

Please use a RS 232 standard protocol for RS 232 communications. For questions, please contact Thorlabs.

Please set up the port as follows:

| Parameter | Settings |
|---|---|
| **Baud Rate** | 115 200 Bd (Default)<br>Supported Range of Baud Rate: 9600 to 921 600 Bd |
| **Data Bits** | 8 |
| **Parity** | None |
| **Stop Bits** | 1 |
| **Flow Control** | None |
| **Termination Character** | Line Feed (x0A; \n)<br>The termination character needs to be enabled. |

***Table 2 PM103x RS232 Port Set Up***

**Note**

To operate the PM103 via RS232, RxD, TxD, and GND need to be wired from the DA-15 connector to a 9 Pin female connector to perform the connections.

| PM103 DA-15 Pin | Male DE-9 Pin | Female DE-9 Pin (PC) |
|---|---|---|
| Pin 7: TxD | Pin 2 | Pin 2: RxD |
| Pin 8: RxD | Pin 3 | Pin 3: TxD |
| Pin 15: GND | Pin 5 | Pin 5: GND |

***Table 3 PM103x RS232 Port Set Up***

#### 4.4.2.7 Reset Button

The reset button reboots the internal micro controller of the PM103x. To press the button, please use a small device that will not break inside the instrument. All settings are saved due to the internal non-volatile memory.

#### 4.4.2.8 Baud Rate

For PM103, the Baud Rate can be adjusted from 9600 to 921 600 Bd. This can be done either via the USB interface or via the serial interface using SCPI commands or driver functions. Please see the document Write-Your-Own-Applications (WYOA) for PM103x. The default Baud Rate is 115 200 Bd and the maximum Baud Rate is 921 600 Bd.

**Note**

After adjusting the Baud Rate via RS232 or UART, close the RS232 or UART connection and reconnect with the desired Baud Rate in order for the Baud Rate to communicate it via RS232/UART. This is not required for operation via USB.

#### 4.4.2.9 Non-Volatile Memory

All PM103x models have an internal non-volatile memory for all settings (i.e. wavelength setting, ranging, analog output configuration). The PM103x will start in the same configuration as prior to shut-down.

#### 4.4.2.10 Digital I/O Ports

**PM103**

The PM103 has two configurable gerneral purpose digital ports, DIO1 (DA-15 Pin 2) and DIO2 (DA-15 Pin 3). Both ports can be configured as digital input or output and queried per remote control command. These digital I/O ports use 5 V logic.

DIO1 can additionally be configured as trigger in and output, when reading the data in the 100 kS/s mode. The trigger function is supported by the Optical Power Monitor software. Alternatively, the DIO1 port can be controlled or monitored through SCPI commands in custom made software, as described in the document WYOA for PM103x.

DIO2 can be configured as pass/fail analysis flag and queried per remote control command.

**PM103A**

The PM103A has one auxiliary digital port, DIO1, with an SMA connector.

The port can be configured as digital input or output and queried per remote control command.

The DIO1 port can be configured as trigger in and output, when reading the data in the 100 kS/s mode. The trigger function is supported by the OPM Software. Alternatively, the DIO1 port can be controlled or monitored through SCPI commands in custom made software, as described in the document WYOA for PM103x.

#### 4.4.2.11 Analog Output

**PM103**

The PM103 has two analog outputs, AO1 and AO2 (please see the section Pin Output Connector DA-15). The Analog Output ports provide the amplified photo-diode current or the pyroelectic sensor voltage, depending on the sensor. The signal from the analog output AO1 is not wavelength- or zero- corrected.

The signal is measurement range dependent and can be calculated to:

$$U_{out} = 2.5\ V\ \frac{\text{Measured Scale}}{\text{Full Scale Value}}$$

AO1: The AO1 (DA-15 Pin 4) delivers the amplified direct real analog signal without a Digital-Analog-Converter (DAC). Therefore, the AO1 delivers a proportional output voltage for each measurement range. This analog output voltage can range from -0.25 V to +2.5 V. The real analog signal is not wavelength- or zero- corrected and offers the full bandwidth (up to 1 MHz) without quantization error.

**Note**

The bandwidth is in accordance with the settings of the sensor and power meter.

**AO2**

The AO2 (DA-15 Pin 5) delivers a range independent voltage which is DAC controlled. The output voltage is proportional to a configured value in V/W or V/J. This constant can be adjusted via the OPM software or, for custom made software, using the SCPI/driver commands in the WYOA for PM103x. The constant can be set in the Thorlabs OPM software under the Settings tab: AO2 Responsivity. The signal of the AO2 is generated with a 16-Bit DAC with an update rate of 1 kHz. The analog output voltage can range from -0 V to +2.5 V.

The analog signal following the DAC is of advantage when large signal dynamics are expected because the DAC range changes and the output signal stays largely the same. Additionally, the output signal is wavelength corrected and corrected regarding the sensor calibration data.

**PM103A**

The PM103A has two analog output ports with a SMA output connectors. The functions match the function of AO1 and AO2 of the PM103 respectively.

#### 4.4.2.12 Autonomous Operation to Analog Output

Power meters PM103 and PM103A can be run autonomously by simply connecting a power supply and using one of the analog output ports. In that case, no control device is required.

#### 4.4.2.13 NTC Input

To monitor the temperature in a test environment, the PM103 has an NTC Input (DA-15, Pin 14) which allows connection of an NTC thermistor. To connect the ground of the TSP-TH, please use one of the GND connectors DA-15 Pin 10 through Pin 13. The measurement range is 0.1 to 100 kΩ. The set range R0 and the bandwidth B for the NTC thermistor can be adjusted in the OPM Software or through SCPI commands. The default settings are 10 kΩ and 3988 K to directly access the TSP-TH temperature probe. The measurement range with the PM103 is then -10 °C to 120 °C with the TSP-TH.

### 4.4.3 PM103E

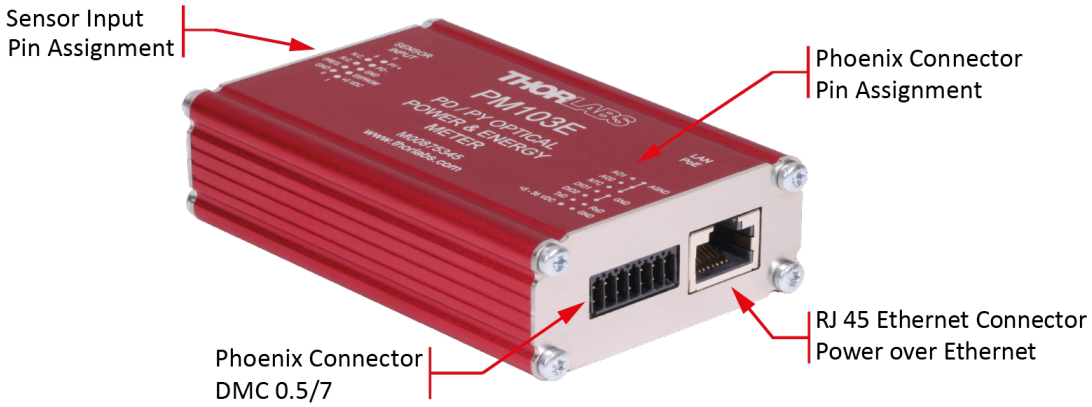



***Figure 9 PM103U***

**PM103E Special Features**

- Power Meter Control and Output via Ethernet
- Phoenix DMC Connector
- Two Digital I/O ports
- NTC Input
- Two Analog Output Ports
- Real Analog Output
- Autonomous Operation to Analog Output
- Optional Use of 5 V - 36 V Power Supply
- RS232 Operation
- Adjustable Baud Rate via USB or Serial Communication (SCPI commands); The default Baud Rate is 115 200 Bd.
- Instrument Control Using SCPI Commands (via Serial Communication and Ethernet)

#### 4.4.3.1 Ethernet Connection

The PM103E features an Ethernet connector port, which can also be used to provide power to the device.

This chapter provides in-depth explanation concerning the Ethernet connection. The following chapters describe functionalities similar to the other PM103x devices, but here accessible via the Phoenix DMC connector.

##### 4.4.3.1.1 Introduction and Prerequisites

**Important Terms**

- **OSI and TCP/IP**
  The OSI (Open System Interconnection) model is a conceptual layer model that characterizes and standardizes how various software and hardware components involved in a network communication should divide the work and interact with each other. TCP/IP is also a layered model, but also describes the commonly used data transfer protocol. In fact, it is a set of protocols. TCP/IP stands for Transmission Control Protocol and Internet Protocol.

- **LAN**
  The abbreviation LAN stands for Local Area Network and describes a network, that is limited to a local area in terms of its spatial extent.
- **WLAN**
  The term WLAN is the abbreviation for Wireless Local Area Network
- **VPN**
  A Virtual Private Network (VPN) is a network that imitates a private network using a public one. Thanks to the VPN connection, it is guaranteed that your internet traffic, including your IP address, remains encrypted.
  IP address. An IP address is an address in computer networks which – like the internet – are based on the internet protocol. It is assigned to devices that are connected to the network, making the devices addressable and therefore accessible.
- **Port**
  A port is the part of a network address that causes operating systems to assign TCP connections and data packets to server and client programs. Ports are primarily a feature used to distinguish multiple connections between the same pair of endpoints.
  Thorlabs devices use the standardized TCP port number 80 for http protocols, the registered ports 2000 for SCPI command-based communication with the instrument, and 27007 for firmware updates.
  **Subnet-mask**
  In computer networks, the subnet mask or network mask, in conjunction with the IP address, determines which IP addresses a device in its own network can reach without the aid of a router.
- **Hostname**
  The hostname is the unique name of a device within a network.
- **MAC address**
  The MAC (Media Access Control) address is the number of a device on a data connection. This number is used to assign data running over the connection to the devices. The MAC address is the hardware address of each individual network adapter, which serves as a unique identifier for the device in a computer network.
- **DHCP**
  DHCP stands for Dynamic Host Configuration Protocol. It is a standardized communication protocol, with which the clients of a TCP/IP-based network can be automatically assigned their network configuration.
- **Encryption**
  Data encryption is a computer process that encodes plain/plaintext (unencrypted human-readable data) into ciphertext (encrypted data) that can only be accessed by authorized users with the correct cryptographic key.
- **PoE**
  The PM103E has the special feature that the device can be powered via Power over Ethernet (PoE). Therefore, no additional power supply unit is required. Of course, the Ethernet interface on the network side is then required to provide the power supply, for example utilizing a PoE-capable switch.

**Supporting Tools**

To making the Ethernet connection as convenient as possible, Thorlabs provides within their OPM Software useful guidance and wizards.

- A search function that finds all approved Thorlabs devices within the same network.
- Simple configuration of network devices via serial interface within an included terminal program and device individual full command reference.
  This is very helpful when issuing static IP addresses, getting the IP address of hidden instruments, or getting MAC address or hostname on devices without display.
- Reconnect the last used devices with a known IP address by double-clicking. This is very practical since the network search from another network does not work due to a WLAN or VPN connection.
- Identification of the remote interface type using clear symbols.

#### 4.4.3.1.2 Establish an Ethernet Connection via LAN

The easiest way to create a remote connection to the PM103E Ethernet device is to connect it via the included RJ45 cable to the local network.

**Establish Connection via the OPM Software**

1. After the connection is physically established, open the OPM Software.
2. Check the box to enable the search for Ethernet devices.
   **Note**
   Ensure that the device is supplied with power, i.e. either via the power supply unit or PoE.
3. Press the "Rescan" button.
   ➤ All identifiable power meters that are connected to this network will be listed and marked with a LAN symbol.
4. Select the meter to be connected to and press the "Connect" button.
   ➤ In case encryption is set at the power meter, the correct password will be required in addition to connect.

Should the PM103E powermeter not be listed, i.e. because the PC running the power meter software accesses the network via WLAN or VPN, the device can still be connected: It's correct IP address must be known.

In this case press the "Network Configuration" button and manually enter the IP address, SCPI port number 2000, and the encryption password if required. Finally press "Connect".

If a box with network adapters is shown, choose the one that is connected to the same network as the device.

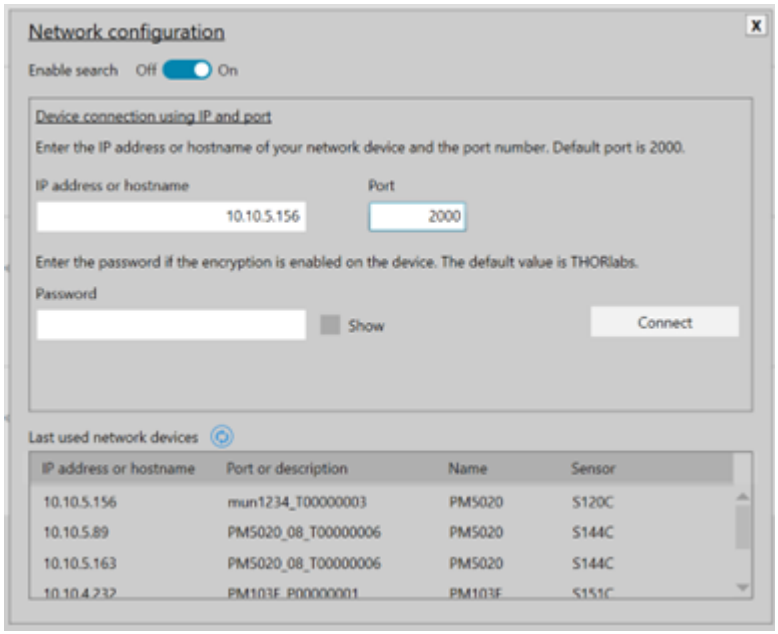



***Figure 10 Screenshot of the Network Configuration Tab in the OPM Software***

For working with static IP on the power meter, please note the MAC ID of the meter and contact your system administrator.

Static IP address and subnet mask can then be entered. Finally, DHCP must be deactivated, for more details refer to chapter Static-IP.

All recently used Ethernet devices are listed in the bottom of the Network configuration dialogue window. A reconnection can be done by double-clicking the line.

Firmware upgrades are possible as well with the Ethernet connection.

Open the update wizard, open the associated dfu file, enter the device IP address and port number 27007. Or double click the device if it is listed in the dialog window.

Press "Next" and wait until completion.

Within the network, per LAN or WLAN or via VPN, it is further possible to open within any web browser a web viewer typing the known instrument's IP address. This viewer is limited to one user per instrument.

The web viewer shows the current measurement values, device settings and configurations. For the PM103E, there is a password protected SCPI console to send commands or query results from the instrument. The password is the same as for the encryption, with "THORlabs" as default.

#### 4.4.3.1.3 Ethernet between PC and PM103E with Static IP

1. Configure your PC to static IP.
   ➤ Go to Settings\Network & Internet\Change Adapter Options or open the run window and type "ncpa-cpl" (peer to peer).
   ➤ Confirm by pressing the OK button.

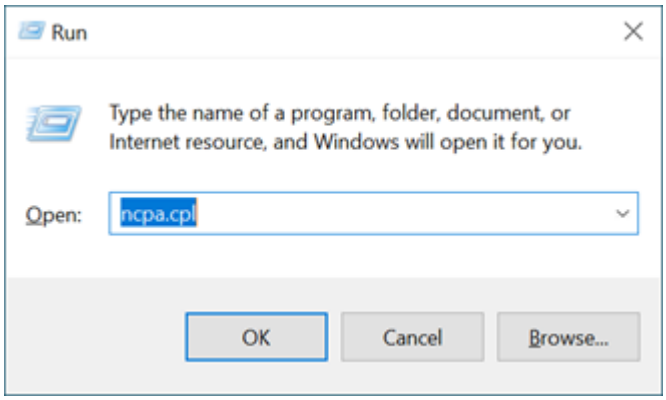



***Figure 11 Screenshot of the "Run Window"***

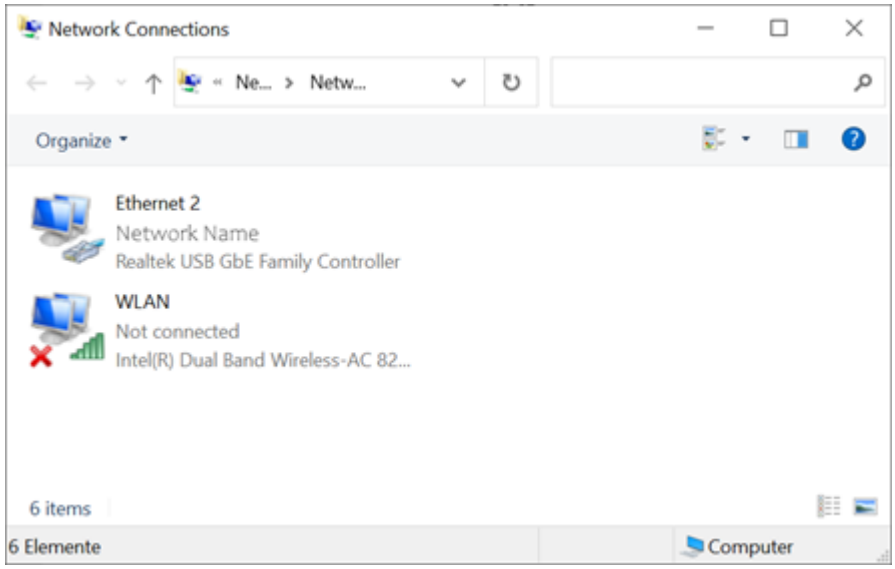



***Figure 12 Screenshot of the Window "Network Connections"***

2. Right-click the active Ethernet symbol.
   ➤ Open Properties.
3. Select the TCP/IPv4 protocol.
4. Open properties of TCP/IPv4 and perform static settings as shown below.

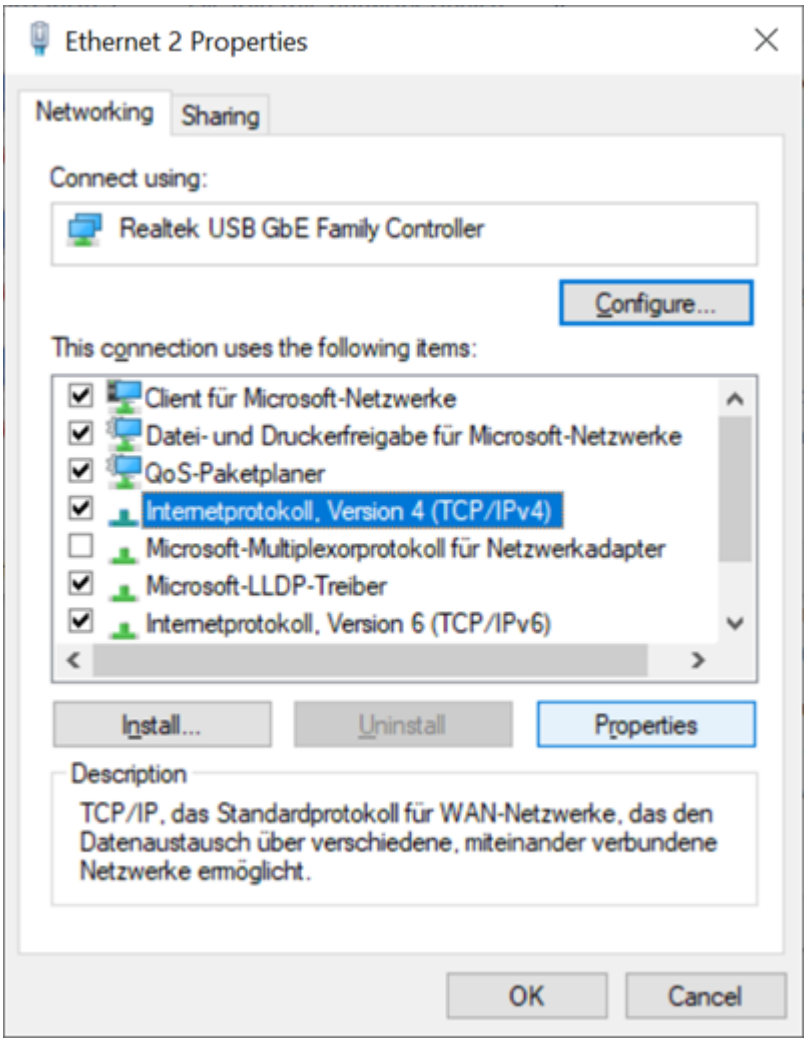



***Figure 13 Screenshot of the Window "Ethernet 2 Porperties"***

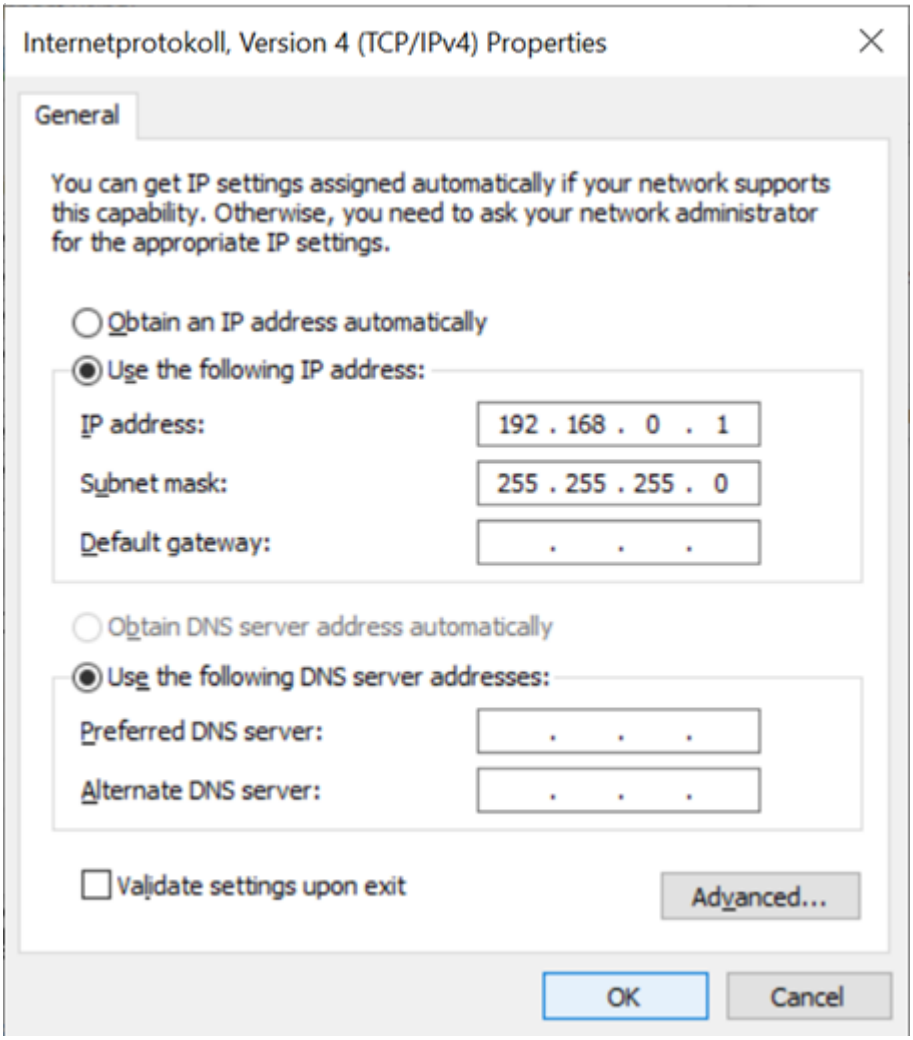



***Figure 14 Screenshot of the Window "Internetprotokoll"***

5. Press the OK button.
6. Connect the powermeter via RS232 cable.
7. Open the OPM Software.
8. Open the terminal program for the serial port by pressing the blue ">_" termincal icon.

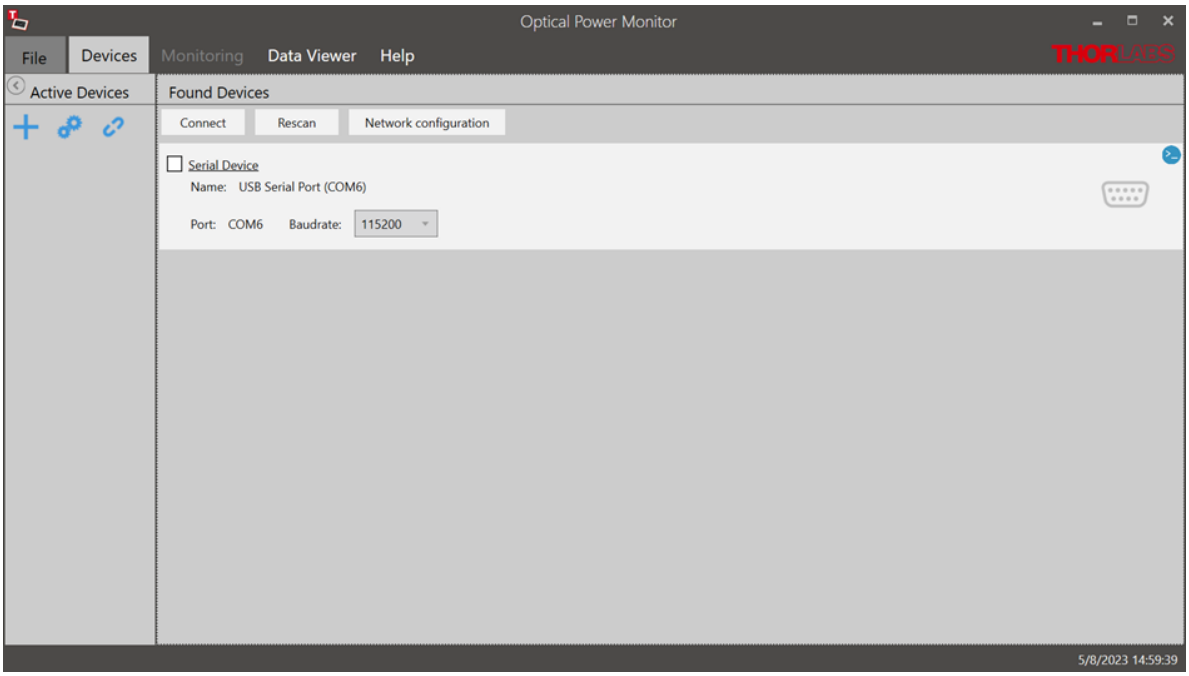



***Figure 15 Screenshot of the Devices Tab of the OPM Software (Found Devices)***

9. Configure the device using the following commands - IP address must be different from the PCs address; the subnet mask must be identical:
   ≥ SYST:COMM:LAN:ADDR "192.168.0.2"
   ≥ SYST:COMM:LAN:SMAS "255.255.255.0"
   ≥ SYST:COMM:LAN:DHCP 0

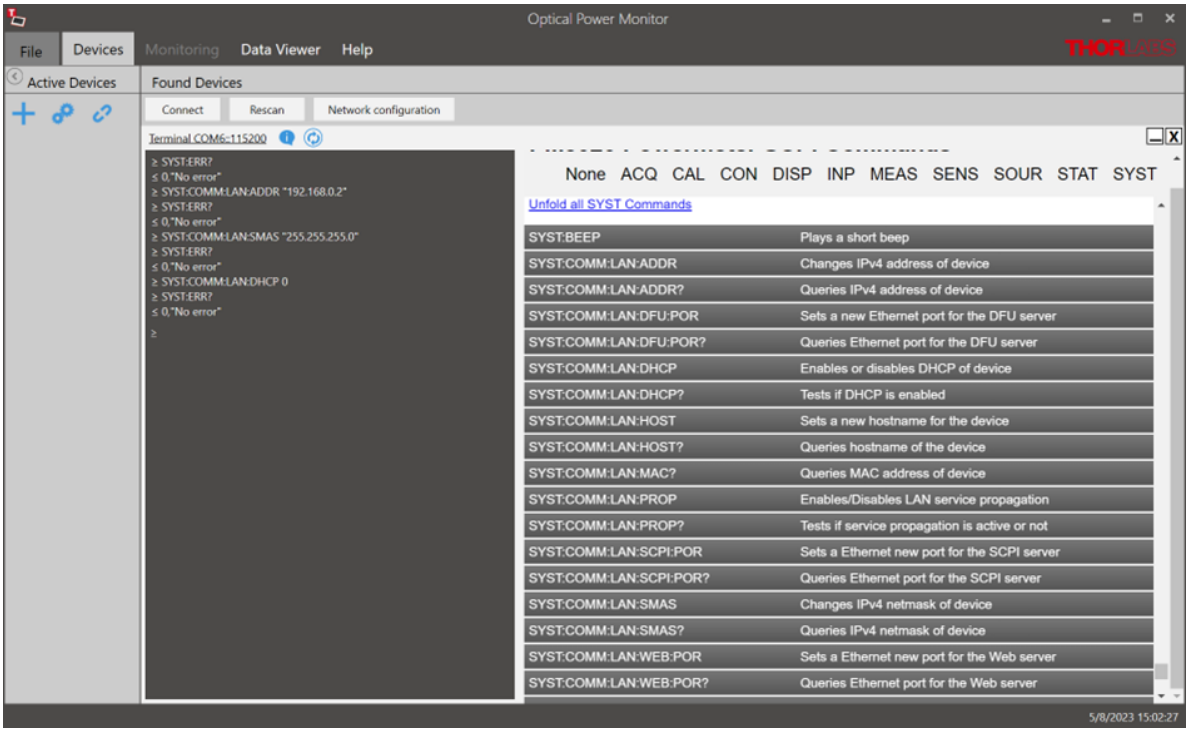



***Figure 16 Screenshot of the Devices Tab of the OPM Software***

10. Open the Network Configuration.
    ➤ Check that the correct Ethernet adapter is set under Netmask (There might be a WLAN or another network card)
    ➤ Take the one with the static IP address you gave the PC.

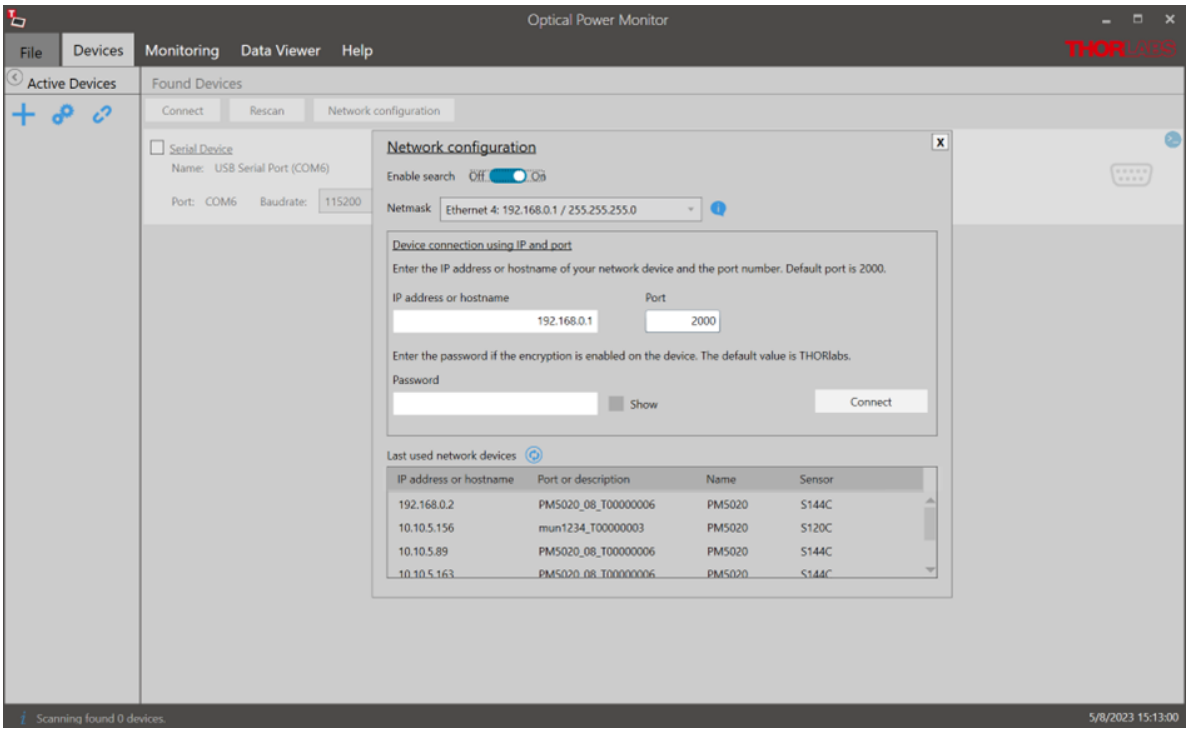



***Figure 17 Screenshot of the Devices Tab of the OPM Software (Network Configuration)***

11. Enter the static device IP address and port number 2000
    ➤ Either enter the encryption password and press "Connect" or close the window and perform the network search with "Rescan".

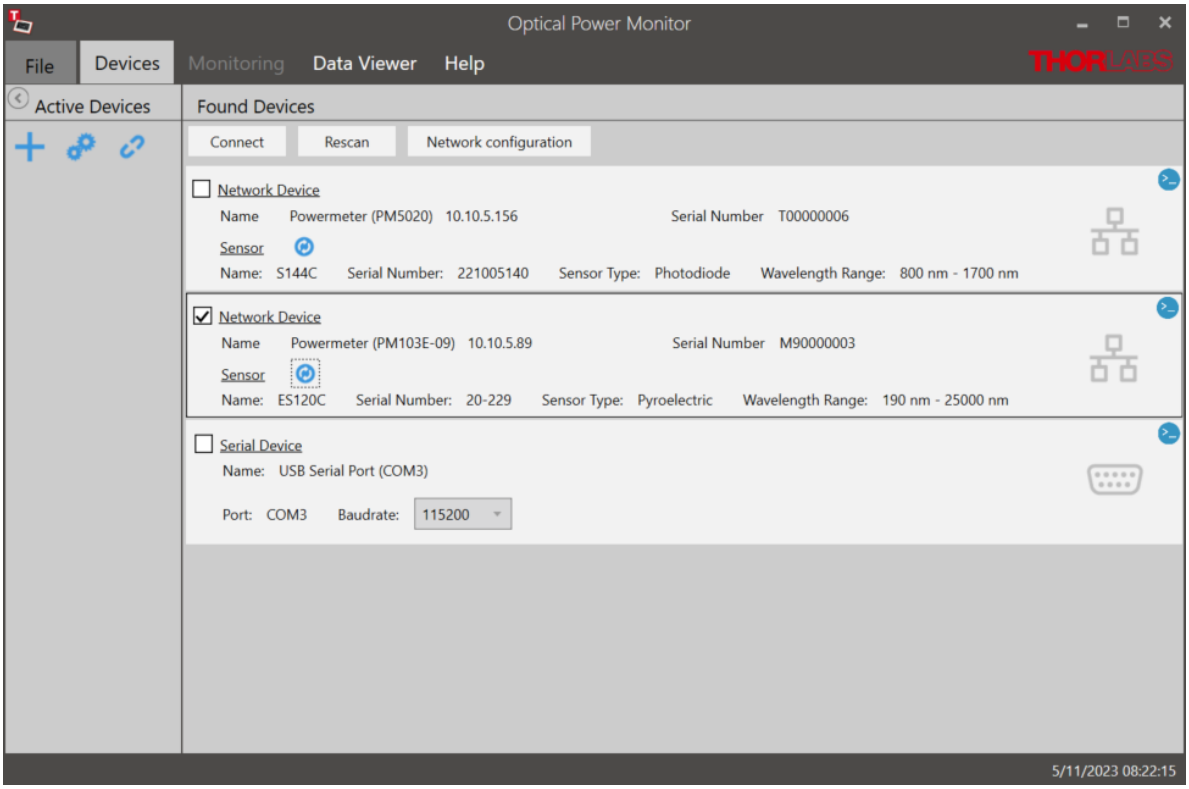



***Figure 18 Screenshot of the Devices Tab of the OPM Software (Device Selected)***

12. Connect to the found power meter with its static IP.
    ➤ Successful connection to a PM103E power meter with static IP is established.

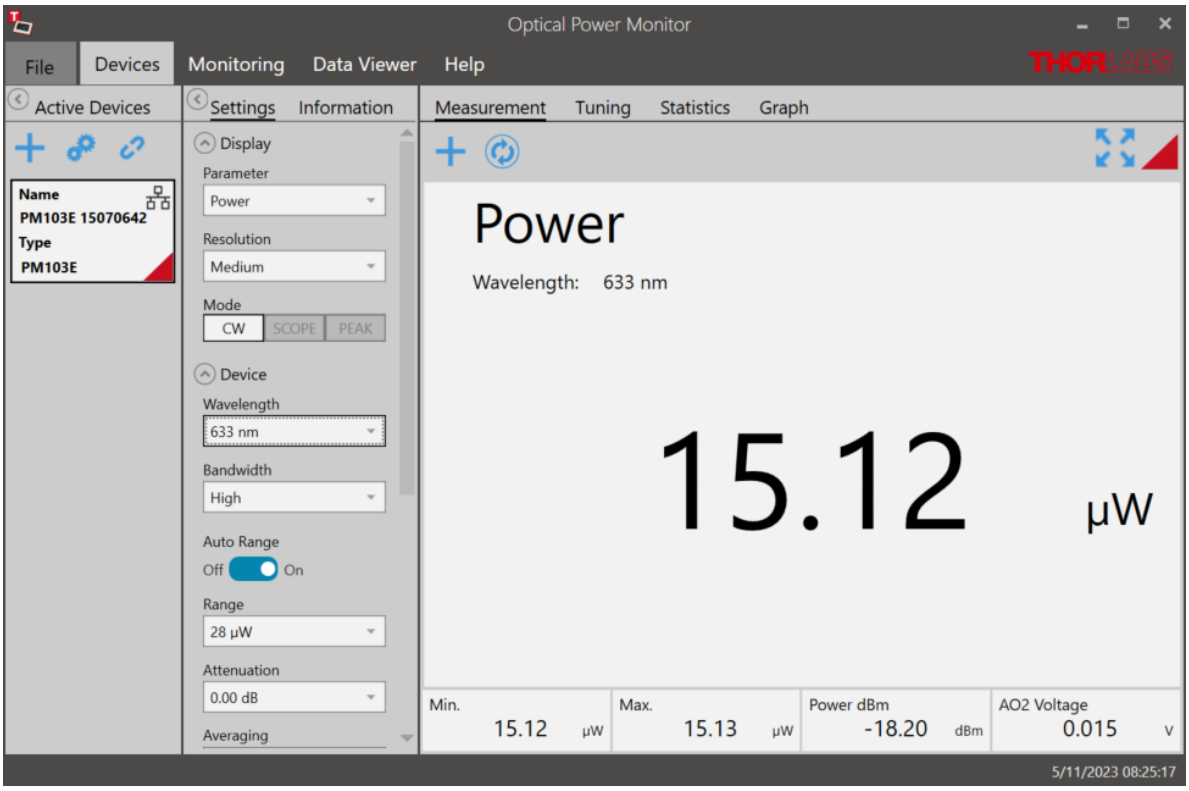



***Figure 19 Screenshot of the OPM Software (Device Connected)***

#### 4.4.3.2 Serial Operation

The power meter PM103E can be operated with serial communication via RS232. Unlike the PM103, it is not possible to switch the device to UART operation.
Please use a RS232 standard protocol for RS232 communications. For questions, please contact Thorlabs.

Please set up the port as follows:

| Parameter | Settings |
|---|---|
| **Baud Rate** | 115 200 Bd (Default)<br>Supported range of Baud Rate: 9600 to 921 600 Bd |
| **Data Bits** | 8 |
| **Parity** | None |
| **Stop Bits** | 1 |
| **Flow Control** | None |
| **Termination Character** | LF (x0A; \n)<br>The termination character needs to be enabled. |

***Table 4 PM103x RS232 Port Set Up***

**Note**

To operate the PM103E via RS232, RxD, TxD, and GND need to be wired from the DMC 0,5/7 connector to a 9 Pin female connector to perform the connections.

| PM103E DMC 0,5/7 Pin | Male DE-9 Pin | Female DE-9 Pin (PC) |
|---|---|---|
| Pin 3: TxD | Pin 2 | Pin 2: RxD |
| Pin 4: RxD | Pin 3 | Pin 3: TxD |
| Pin 2: GND | Pin 5 | Pin 5: GND |

***Table 5 PM103x RS232 Port Set Up***

#### 4.4.3.3 Baud Rate

For PM103E, the Baud Rate can be adjusted from 9600 to 921 600 Bd. This can be done either via the Ethernet or via the serial interface using SCPI commands or driver functions. Please see the document Write-Your-Own-Applications (WYOA) for PM103x. The default Baud Rate is 115 200 Bd.

**Note**

After adjusting the Baud Rate via RS232, close the RS232 and reconnect with the desired Baud Rate in order for the Baud Rate to communicate it via RS232.

#### 4.4.3.4 Reset Button

The reset button reboots the internal micro controller of the PM103x. To press the button, please use a small device that will not break inside the instrument. All settings are saved due to the internal non-volatile memory.

#### 4.4.3.5 Non-Volatile Memory

All PM103x models have an internal non-volatile memory for all settings (i.e. wavelength setting, ranging, analog output configuration). The PM103x will start in the same configuration as prior to shut-down. This only works for Thorlabs sensors with EEPROM.

#### 4.4.3.6 Digital I/O Ports

The PM103E has two configurable general purpose digital ports, DIO1 (Phoenix DMC connector, PIN 7) and DIO2 (Phoenix DMC connector, PIN 5). Both ports can be configured as digital input or output and queried per remote control command. These digital I/O ports use 5 V logic for output and are tolerant for 5 V input signal. However, it is possible to reassign the ports so that they then tolerate 3.3 V (see UART pins).

DIO1 can additionally be configured as trigger in and output, when reading the data in the 100 kS/s mode. The trigger function is supported by the OPM Software. Alternatively, the DIO1 port can be controlled or monitored through SCPI commands in custom made software, as described in the document WYOA for PM103x.

DIO2 can be configured as pass/fail analysis flag and queried per remote control command.

#### 4.4.3.7 Analog Output

**PM103E**

The PM103E has two analog outputs, AO1 and AO2 (please see the section Pin Output Connector DMC 0,5/7).

The Analog Output ports provide the amplified photo-diode current or the pyroelectic sensor voltage, depending on the sensor. The signal from the analog output AO1 is not wavelength- or zero- corrected.

The signal is measurement range dependent and can be calculated to:

$$U_{out} = 2.5\ V\ \frac{\text{Measured Scale}}{\text{Full Scale Value}}$$

**AO1**

The AO1 (Phoenix Contact Connector DMC, Pin 13) delivers the amplified direct real analog signal without a Digital-Analog-Converter (DAC). Therefore, the AO1 delivers a proportional output voltage for each measurement range. This analog output voltage can range from -0.25 V to +2.5 V. The real analog signal is neither wavelength- nor zero-corrected and offers the full bandwidth (up to 1 MHz) without quantization error.

**Note**

The bandwidth is in accordance with the settings of the sensor and power meter.

**AO2**

The AO2 (Phoenix DMC Connector, Pin 11) delivers a range independent voltage which is DAC controlled. The output voltage is proportional to a configured value in V/W or V/J. This constant can be adjusted via the OPM Software, or for custom made software, using the SCPI/driver commands in the WYOA for PM103x. The constant can be set in the OPM Software under the Settings tab: AO2 responsivity. The signal of the AO2 is generated with a 16-Bit DAC with an update rate of 1 kHz. The analog output voltage can range from -0 V to +2.5 V.

The analog signal following the DAC is an advantage when large signal dynamics are expected because the DAC range changes and the output signal stays largely the same. Additionally, the output signal is wavelength corrected and corrected with respect to the sensor calibration data.

#### 4.4.3.8 Autonomous Operation to Analog Output

Power meters PM103, PM103A and PM103E can be run autonomously by simply connecting a power supply and using one of the analog output ports. In that case, no control device is required.

#### 4.4.3.9 NTC Input

To monitor the temperature in a test environment, the PM103E has an NTC Input (Phoenix DMC connector, Pin 9) which allows connection of a NTC-thermistor. To connect the ground of the TSP-TH, please use one of the analog GND at Phoenix DMC connector, Pins 10/12/14. The measurement range is 0.1 to 100 kΩ. The set range R0 and the bandwidth B for the NTC thermistor can be adjusted in the OPM Software or through SCPI commands. The default settings are 10 kΩ and 3988 K to directly access the TSP-TH temperature probe. The measurement range with the PM103 is then -10 °C to 120 °C with the TSP-TH.

### 4.4.4 Power Supply

In contrast to other models in the PM103x Series, the PM103E can be powered either via its Ethernet port using Power over Ethernet (PoE) or through Phoenix DMC Connector.

**Note**

The PM103E supports a wide-range DC input from 5 V to 36 V via the Phoenix DMC connector. PoE is also supported. If both power sources are connected simultaneously, the external DC supply takes priority.

The RS232 interface itself does not provide power, and therefore cannot be used as a power source.

For external powering, we recommend using a regulated supply such as the DS15 Power Supply, which supports the required voltage range.

## 4.5 Software

The PM103x is operated remotely from a PC, laptop or tablet.

**Thorlabs OPM Software**

The Optical Power Monitor (OPM) Software provides a Graphical User Interface (GUI) to view, log, and analyze measurement data. Download the latest OPM Software version from the Thorlabs website.

All information on software installation, device control and data management software can be found in the OPM Software user guide.

**Note**

Do not connect the PM103x prior to software installation!

**Attention**

Exit all running applications on your PC as the installer may require a reboot of your PC during installation!

**Custom Made Software**

The PM103x can also be run using custom made software. For this, please refer to the document Write-Your-Own-Application (WYOA) for PM103x.

**Note**

Please note that you cannot write RAW to the TMC socket with SCPI commands, but that a simple framing protocol is implemented there. An example of the implementation of the protocol in Python is available via the Github from Tech Support.

### 4.5.1 Software Requirements

Please find the requirements for the PC intended to be used for operation of the PM103x on the website.

### 4.5.2 PM103x Specific Software Functions

When using a PM103x Power Meter Interface, the OPM Software shows several power meter specific functions. Details can be found in the OPM Software user guide.

#### 4.5.2.1 PM103 Specific Software Functions

When a PM103x Power Meter is connected, the OPM Software recognizes NTCs in the devices section. The OPM Software now allows users to adjust settings, view measurement results and to integrate the NTC measurement results in long-term monitoring experiments. For more information, please see the OPM Software user guide.

When a PM103 or a PM103E is connected, it is possible to configure the analog AO2 port and display the output voltage.

#### 4.5.2.2 PM103A Specific Software Functions

When a PM103A is connected, it is possible to configure the analog AO2 SMA port and display the output voltage.

When using the "Scope Mode" in the OPM Software, the digital I/O SMA port can be used as an external trigger or as a monitor output for the internal trigger.

### 4.5.3 Firmware Update

To update the firmware of the PM103x, please download the latest firmware through the website and use the firmware update tool in the OPM Software. For more information, please see the OPM Software user guide.

**Note**

Please note that the PM103/A/U have their own common firmware. The PM103E has its own firmware.

### 4.5.4 Sensor Calibration

All models of the PM103x Series can be used to calibrate signal detected by Thorlabs photodiodes to a known reference.

For this, the sensor calibration tool within the OPM Software is used. All the user needs to provide is a signal from a reference sensor. The signal from the sensor to be calibrated is then adjusted and the calibration along with the serial number of the calibrated sensor and the reference are saved in the power meter EEPROM and are retrieved by the software. For more information, please see the OPM Software user guide.

# Chapter 5 Specifications

## 5.1 PM103/A/U

All technical data are valid at 23 ± 5°C and 45 ± 15% rel. humidity (non-condensing).

| Item # | PM103 | PM103A | PM103U |
|---|---|---|---|
| **Interfaces** | | | |
| **Input/Output Interface** | Mini USB, DA-15 | Mini USB, Analog SMA | Mini USB |
| **Operation Protocol** | USB, RS232, UART, Autonomous Operation | USB, Analog, Autonomous Operation | USB |
| **Current Input (Photodiode Sensor)** | | | |
| **Connector** | DE-9 (Left Housing Side) | | |
| **Units** | W, dBm, W/cm², A | | |
| **Measurement Range** | 21 Ranges:<br>nA: 2, 4, 10, 20, 40, 100, 200, 400;<br>µA: 1, 2, 4, 10, 20, 40, 100, 200, 400;<br>mA: 1, 2, 4, 10<br>Range Selectable [W], Sensor Dependent | | |
| **Display Resolution** | 1 pA / Responsivity Value (A/W) | | |
| **Measurement Uncertainty** | ±0.2% Full Scale (400 nA - 10 mA)<br>±0.5% Full Scale (2 nA - 200 nA) | | |
| **Analog Bandwidth** | DC - 150 kHz, Dependent on Sensor and Settings | | |
| **Wavelength Correction** | nm (A/W) | | |
| **Beam Area Setting** | Diameter 1/e² or Rectangular x,y | | |
| **AD Converter** | 16-Bit (400 kSPS) | | |
| **Voltage Input (Pyroelectric Sensors)** | | | |
| **Connector** | DE-9 (Left Housing Side) | | |
| **Units** | J, J/cm², W, dBm, W/cm², V | | |
| **Measurement Range** | 13 Ranges;<br>mV: 20, 40, 100, 200, 400;<br>V: 1, 2, 4, 10, 20, 40, 100, 200;<br>Ranges Selectable in J, Sensor Dependent | | |
| **Display Resolution** | 100 µV / Responsivity Value (V/W) | | |
| **Measurement Uncertainty** | ±0.5% Full Scale (1 V - 200 V)<br>±1% Full Scale (20 mV, 400 mV) | | |
| **Trigger Level** | 3% - 90% Full Scale | | |
| **Repetition Rate** | Single Shot - 80 kHz, Dependent on Sensor | | |
| **Wavelength Correction** | Sensor Dependent; nm, V/W | | |
| **Beam Area Setting** | Diameter 1/e² or Rectangular x,y | | |
| **AD Converter** | 16-Bit (400 kSPS) | | |
| **Sensor Temperature Measurement** | | | |
| **Supported Temperature Sensor** | Thermistor | | |
| **Temperature Measurement Range** | -10 °C to 120 °C | | |

| Item # | PM103 | PM103A | PM103U |
|---|---|---|---|
| **Sensor Power Supply** | | | |
| **Connector** | DE-9 Pin 1 | | |
| **Voltage** | 5 V | | |
| **Maximum Current** | 50 mA | | |
| **Remote Interfaces** | | | |
| **Remote Interface Type 1** | USB 2.0 (High Speed) | | |
| **Connector** | Mini-B USB, Lockable | | |
| **Measurement Speed** | 1 kS/s + 100 kS/s, Mode | | |
| **Remote Interface Type 2** | RS232 | | |
| **Connector** | DA-15 Pin 7/8 | NA | NA |
| **Baud Rate** | 9600 to 921 600 Bd<br>115 200 Bd (Default) | NA | NA |
| **Settings** | 115 200 Bd - 8N1 | NA | NA |
| **Measurement Speed** | 0.2 kS/s | NA | NA |
| **Analog Output AO2, Configurable** | | | |
| **Connector** | DA-15 Pin 5 | SMA | NA |
| **Signal** | Gain Signal Configurable | Gain Signal Configurable | NA |
| **Voltage Range** | 0 to 2.5 V | 0 to 2.5 V | NA |
| **Accuracy** | ±1% | ±1% | NA |
| **Bandwidth** | 1 kHz | 1 kHz | NA |
| **Analog Output AO1, Not Corrected** | | | |
| **Connector** | DA-15 Pin 4 | SMA | NA |
| **Signal** | Amplified Input Signal - Not Corrected | Amplified Input Signal - Not Corrected | NA |
| **Voltage Range** | -0.25 V to 2.5 V | -0.25 V to 2.5 V | NA |
| **Accuracy** | ±3% | ±3% | NA |
| **Bandwidth** | Up to 1 MHz, Dependent on Sensor and Settings | NA | NA |
| **Auxiliary Temperature Measurement** | | | |
| **Connector** | DA-15 Pin 14 | NA | NA |
| **Supported Temperature Sensor** | Thermistor NTC<br>0.1 kΩ to 100 kΩ,<br>B-Value:<br>1000 K to 9999 K | NA | NA |
| **Temperature Measurement Range** | -40 °C to 200 °C<br>(NTC dependent) | NA | NA |
| **Digital Control Pins I/O** | | | |
| **Connector** | DA-15 Pins 2/3 | SMA | NA |
| **Function** | 2 x GPIO<br>or Configurable as Trigger Input/Output, Pass/Fail Analysis | GPIO or Configurable as Trigger Input/Output | 5 V (3.3 V if Unequipped)<br>Each Output Drives up to 10 mA |

| Item # | PM103 | PM103A | PM103U |
|---|---|---|---|
| **Power Management** | | | |
| **DC Input 1 / Connector** | +5 VDC to +36 VDC / DA-15 Pins 1, 9 | NA | NA |
| **DC Input 2 / Connector** | 5 V / USB | | |
| **Power Consumption** | 1 W | | |
| **Display** | | | |
| **Display Type** | None; External PC - Windows Application or Driver Set | | |
| **Display Screens** | Windows Application Software Provided | | |
| **GUI Refresh Rate** | 1000 Hz (Dependent on PC and Settings) | | |
| **General** | | | |
| **Detectors Compatibility** | Photodiode Sensors S100C Series<br>Energy Sensors ES100C, ES200C Series<br>Photodiodes (Max 10 mA)<br>Pyro Detectors (Max 200 V) | | |
| **Status LED** | Power, Sensor, PGM Error, USB | | |
| **Operating Temperature** | 0 °C to +40 °C | | |
| **Storage Temperature** | -40 °C to +70 °C | | |
| **Dimensions (L x W x H)** | 96.5 x 57.2 x 25.4 mm (3.80" x 2.25" x 1.00") | 100.2 x 57.2 x 25.4 mm (3.94" x 2.25" x 1.00") | 93.6 x 57.2 x 25.4 mm (3.68" x 2.25" x 1.00") |
| **Weight** | 0.15 kg (0.33 lbs) | | |

***Table 6 Specifications of the PM103/A/U***

## 5.2 PM103E

All technical data are valid at 23 ± 5°C and 45 ± 15% rel. humidity (non condensing).

| Item # | PM103E |
|---|---|
| **Sensor Compatibility** | |
| **Compatible Sensor Types** | Thorlabs' C-Series Photodiode and Pyroelectric Sensors<br>Photodiodes mA (Max)<br>Pyroelectric Detectors 200 V (Max), Pulse Only |
| **Auxiliary Input / Output** | |
| **Digital I/O** | Phoenix DMC connector 0,5/7 |
| **Interfaces** | |
| **Ethernet** | RJ45 (100 Mbit; IPv4) |
| **RS232/UART (5V)** | Phoenix DMC Connector 0,5/7 |
| **Photodiode Sensor: Current Input** | |
| **Connector** | Female DE-9 |
| **Units** | W, dBm, W/cm², A |
| **Measurement Range** | 21 Ranges:<br>nA: 2, 4, 10, 20, 40, 100, 200, 400;<br>µA: 1, 2, 4, 10, 20, 40, 100, 200, 400;<br>mA: 1, 2, 4, 10<br>Range Selectable [W], Sensor Dependent |
| **Display Resolution** | 1 pA / Responsivity Value (A/W) |
| **Measurement Uncertainty** | ±0.2% Full Scale (100 nA - 10 mA)<br>±0.5% Full Scale (2 nA - 40 nA) |
| **Analog Bandwidth** | DC - 100 kHz, Dependent on Sensor and Settings |
| **Wavelength Correction** | Sensor Dependent; nm, (V/W) |
| **Beam Area Setting** | Diameter 1/e² or Rectangular x,y |
| **AD Converter** | 16-Bit (400 kSPS) |
| **Pyroelectric Sensors: Pulsed Voltage Input** | |
| **Connector** | Female DE-9 |
| **Units** | J, J/cm², W, dBm, W/cm², V |
| **Measurement Range** | 13 Ranges;<br>mV: 20, 40, 100, 200, 400;<br>V: 1, 2, 4, 10, 20, 40, 100, 200;<br>Ranges Selectable in J, Sensor Dependent |
| **Display Resolution** | 1 µV / Responsivity Value (V/W) |
| **Measurement Uncertainty** | ±0.5% Full Scale (100 mV - 200 V)<br>±1% Full Scale (20 mV, 40 mV) |
| **Trigger Level** | 3% - 90% Full Scale |
| **Repetition Rate** | Single Shot - 80 kHz, Dependent on Sensor |
| **Wavelength Correction** | nm, (V/W) (Sensor Dependent) |
| **Beam Area Setting** | Diameter 1/e² or Rectangular x,y |
| **AD Converter** | 16-Bit (400 kSPS) |
| **Sensor Temperature Measurement** | |
| **Supported Temperature Sensor** | Thermistor |
| **Temperature Measurement Range** | -10 °C to 80 °C |

| Item # | PM103E |
|---|---|
| **Sensor Power Supply** | |
| **Connector** | DE-9 Pin 1 |
| **Voltage** | 5 V |
| **Maximum Current** | 50 mA |
| **Remote Interfaces** | |
| **Remote Interface Type 1** | Ethernet |
| **Connector** | RJ45 |
| **Measurement Speed** | 1 kS/s + 100 kS/s Bulk Mode |
| **Remote Interface Type 2** | RS232 |
| **Connector** | Phoenix DMC 0,5/7 Pin 3 and Pin 4 |
| **Baud Rate** | 9600 to 921 600 Bd<br>Default: 115 200 Bd |
| **Settings** | 115 200 Bd - 8N1 |
| **Measurement Speed** | 0.2 kS/s |
| **Analog Output AO2, Configurable** | |
| **Connector** | Phoenix DMC 0,5/7, Pin 11 |
| **Signal** | Gain Signal Configurable |
| **Voltage Range** | 0 V to 2.5 V |
| **Accuracy** | ±1% |
| **Bandwidth** | 1 kHz |
| **Analog Output AO1, Not Corrected** | |
| **Connector** | Analog , Phoenix DMC 0,5 /7, Pin 13 |
| **Signal** | Amplified Input Signal - Not Corrected |
| **Voltage Range** | -0.25 V to 2.5 V |
| **Accuracy** | ±3% |
| **Bandwidth** | Up to 1 MHz, Dependent on Sensor and Settings |
| **Auxiliary Temperature Measurement** | |
| **Connector** | Phoenix DMC 0,5/7, Pin 9 |
| **Supported Temperature Sensor** | Thermistor NTC<br>0.1 kΩ to 100 kΩ,<br>B-Value:<br>1000 K to 9999 K |
| **Temperature Measurement Range** | -40 °C to +200 °C<br>(NTC Dependent) |
| **Digital Control Pins I/O** | |
| **Connector** | Phoenix DMC 0,5/7, Pins 5 and 7 |
| **Function** | 2 x GPIO<br>or Configurable as Trigger Input/Output, Pass/Fail Analysis<br>GPIO or Configurable as Trigger Input/Output |
| **Power Management** | |
| **Power over Ethernet** | RJ45 Connection |
| **Alternative DC Input** | +5... +36 VDC, Phoenix DMC 0,5/7 Pin 1 and 2 (GND) |
| **Power Consumption** | 1 W |

| Item # | PM103E |
|---|---|
| **Display** | |
| **Display Type** | None; External PC - Windows Application or Driver Set |
| **Display Screens** | Windows Application Software Provided |
| **Data Sampling Rate** | 1 kS/s; 100 kS/s |
| **General** | |
| **Status LED** | Power, Sensor, PGM Error |
| **Operating Temperature** | 0 °C to +40 °C |
| **Storage Temperature** | -40 °C to 70 °C |
| **Dimensions (L x W x H)** | 93.8 x 57.2 x 25.4 mm<br>(3.69" x 2.25" x 1.00") |
| **Weight** | 0.16 kg (0.33 lbs) |

***Table 7 Specifications of the PM103E***

## 5.3 Pin Sensor Connector

The sensor connector allows the access of all Thorlabs "C-type" photodiode and pyroelectric sensors. The power meter interface uses the sensor calibration data, stored in the sensor connector, to calculate the corresponding actual power levels.

Additionally, the PM103x is capable to support custom made detectors. Please read the following instruction prior to connecting a self made sensor.

**Warning**

**Pin 2 is uniquely used for the EEPROM Digital I/O (memory in Thorlabs sensor heads) and MUST NOT be used. Connecting this Pin may cause malfunction of the PM103x**.

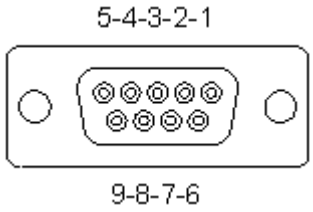



***Figure 20 Pin Out of the DE-9 Female Connector***

| Pin | Function | Descripiton |
|---|---|---|
| **1** | Power Supply | 5 V; Current 50 mA (Max) from this Pin |
| **2** | EEPROM | Sensor Memory for the Calibration Data |
| **3** | AGND | Analog Ground for Photodiode, Pyroelectric Sensor, NTC |
| **4** | PD - | Photodiode Cathode Input |
| **5** | PY + | Pyroelectric Sensor Input |
| **6** | DGND | Digital Ground for EEPROM and 5 V Output |
| **7** | PRESENT | Sensor Recognition, NTC Input. For Custom Sensors: Connect via a 1 kΩ to 10 kΩ Resistor to Pin 3 (AGND) to Enable a Custom Sensor |
| **8** | N.C. | Not Connected |
| **9** | N.C. | Not Connected |

***Table 8 Pins of the DE-9 Female Connector***

## 5.4 Pin Output Connector DA-15

PM103 has a universal DA-15 connector. The Pins are assigned as follows:

| Pin | Function | Descripiton |
|---|---|---|
| **1** | Power Supply | Pin for Alternative Power Supply with 5 VDC to 36 VDC, when not powered by USB. |
| **2** | D I/O 1 | General Digital Input / Output Port; 5 V Logic, 3 V Logic (Available on Request) |
| **3** | D I/O 2 | General Digital Input / Output Port; 5 V Logic, 3 V Logic (Available on Request) |
| **4** | AO1 | Analog Output; -0.25 V to 2.5 V per Measurement Range |
| **5** | AO2 | Software Configurable Analog Output; 0 V to 2.5 V |
| **6** | N.C. | Not Connected |
| **7** | TxD | RS232; Connect to PC Terminal RxD (PC DE-9 Pin 2); switchable to 5 V UART |
| **8** | RxD | RS232; Connect to PC Terminal TxD (PC DE-9 Pin 3); switchable to 5 V UART |
| **9** | GND | Power Supply Ground |
| **10** | GND | Ground |
| **11** | GND | Analog Ground |
| **12** | GND | Analog Ground |
| **13** | GND | Ground |
| **14** | NTC | NTC Thermistor Input; Measurement Range 0.1 to 100 kΩ |
| **15** | GND | RS232 Signal Ground; Connect to PC Terminal Ground (PC DS-9 Pin 5) |

***Table 9 Pins of the DA-15 Connector***

## 5.5 Pin Output Connector DMC 0,5/7

PM103E has a Phoenix DMC Connector DMC 0,5/7 connector.

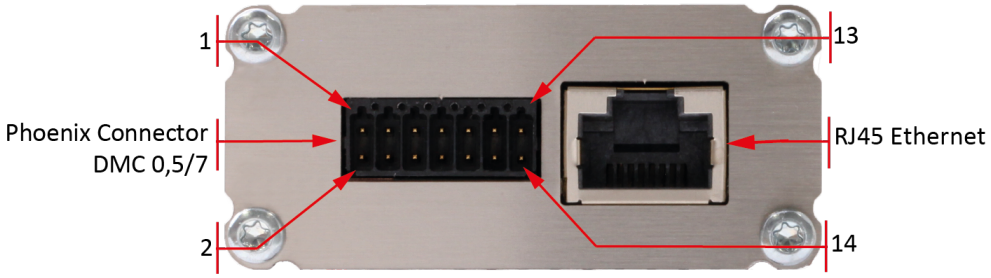



***Figure 21 Pin Out of the DE-9 Female Connector***

The Pins are assigned as follows:

| Pin | Function | Descripiton |
|---|---|---|
| **1** | +5 … +36 VDC | Pin for Alternative Power Supply with 5 VDC to 36 VDC |
| **2** | GND | Power Supply Ground / Digital Ground |
| **3** | TxD | RS232; Connect to PC terminal RxD( PC DE-9 Pin 2) |
| **4** | RxD | RS232; Connect to PC terminal TxD( PC DE-9 Pin 3) |
| **5** | D I/O 2 | General Digital Input / Output Port; 5 V Logic |
| **6** | GND | Digital Ground |
| **7** | D I/O 1 | General Digital Input / Output Port; 5 V Logic |
| **8** | GND | Digital Ground |
| **9** | NTC | NTC Thermistor Input; Measurement Range 0.1 kΩ to 100 kΩ |

| Pin | Function | Descripiton |
|---|---|---|
| **10** | A GND | Analog Ground |
| **11** | AO 2 | Software Configurable Analog Output; 0 V to 2.5 V |
| **12** | GND | Analog Ground |
| **13** | AO 1 | Analog Output; -0.25 V to 2.5 V per Measurement Range |
| **14** | A GND | Analog Ground |

***Table 10 Pins of the DMC 0,5/7 Connector***

# Chapter 6 Certifications and Compliances

## EU Declaration of Conformity

*Manufacturer:* Thorlabs GmbH

*Address:* Münchner Weg 1, D-85232 Bergkirchen

*We hereby declare under our sole responsibility that:*

*Product:* **PM103, PM103A, PM103U, PM103E**

*Product description:* **Power Meter for Photodiode and Pyro Sensors**

*is/are in conformity with the following directive(s):*

| | | |
|---|---|---|
| 2014/30/EU | Electromagnetic Compatibility (EMC) Directive | |
| 2011/65/EU | Restriction of Use of Certain Hazardous Substances (RoHS), including 2015/863 | |

*and (harmonized) standards / technical specifications :*

| | | |
|---|---|---|
| EN 61326-1 | Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements | 2021 |
| EN IEC 63000 | Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances | 2018 |

*I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications and complies with all applicable Essential Requirements of the Directives.*

*Signed:* 

*Name:* Julien Vigroux *On:* 6/19/2023

*Position:* General Manager

CE

# Chapter 7 Maintenance and Service

Protect the PM103x from adverse weather conditions. The PM103x is not water resistant.

**Attention**

**To avoid damage to the instrument, do not expose it to spray, liquids or solvents!**

The unit does not need a regular maintenance by the user. It does not contain any modules and/or components that could be repaired by the user himself.
If a malfunction occurs, please contact Thorlabs for return instructions.

# Chapter 8 Warranty

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

General Terms and Conditions:

https://www.thorlabs.com/Images/PDF/LG-PO-001_Thorlabs_terms_and_%20agreements.pdf

and

https://www.thorlabs.com/images/PDF/Terms%20and%20Conditions%20of%20Sales_Thorlabs-GmbH_English.pdf

## 8.1 Return of Devices

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

## 8.2 WEEE Policy

**Thorlabs 'End of Life' Policy (WEEE)**



Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return “end of life” Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the users responsibility to delete all private data stored on the device prior to disposal.

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Please refer to the general terms and conditions linked under Warranty.

# Chapter 11 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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