PM100D - October 21, 2025

Item # PM100D was discontinued on October 21, 2025. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

DIGITAL HANDHELD OPTICAL POWER AND ENERGY METER CONSOLE

- Power and Energy Measurements for Free Space and Fiber Applications
- Designed for High Accuracy, Reliability, and Ease of Use
- Over 25 Compatible Sensors

PM100D

Multiple Display Options

Detector Options

Photodiode, Fiber, Integrating Sphere, Thermal, and Pyroelectric Sensors Available

Hide Overview

OVERVIEW

Features

- Handheld Digital Power Meter Console
- Designed for Coherent and Incoherent Light Source Measurements
- Power and Energy Measurements for CW and Pulsed Source Detection
- Advanced Measurement Capabilities
- Large 4" LCD Display with Multiple Display Options
- Compatible with Over 25 Sensors (Shown Below)
- Pre-Installed 8 GB SD Memory Card for Storing and Transferring Data
- USB 2.0 Interface
- Long-Life Internal Li-Polymer Battery
- Sensor Upgrade and Recalibration Services Available
- Optical Power Monitor PC Software Available (See *Software* Tab for Details)

Item #	PM100D
Compatible Sensors	Photodiode, Thermal, and Pyroelectric[a]
Optical Power Range[b]	100 pW to 200 W
Optical Energy Range[b]	10 µJ to 15 J
Available Sensor Wavelength Range[b]	185 nm - 25 µm
Max Repetition Rate[b]	3 kHz
Display Refresh Rate	20 Hz
Bandwidth[a]	DC - 100 kHz
Photodiode Sensor Range[c]	50 nA - 5 mA
Thermopile Sensor Range[c]	1 mV - 1 V
Pyroelectric Sensor Range[c]	100 mV - 100 V

a. The PM400 console is compatible with all Thorlabs' C-Series Pyroelectric Energy Sensors except the ES408C Fast Pyroelectric Energy Sensor.
b. Sensor Dependent
c. Ranges Selectable in Watts (Photodiode and Thermopile) or Joules (Pyroelectric) and is dependent on the sensor used.

The PM100D is the cornerstone of Thorlabs' optical power and energy meter consoles and is the digital counterpart to the PM100A analog power meter console. The console (and sensor, sold separately) is ideal for use as a CW and pulsed source power meter, incoherent optical source power meter, general light power meter, fiber power meter, and more. The display on the PM100D features adjustable brightness settings, with the option to turn off the backlight completely while still being readable.

The PM100D is compatible with more than 25 photodiode, slim photodiode, integrating sphere, fiber, thermal, and pyroelectric sensors designed for use from the UV to the Mid-IR. See the *Sensor Selection* tab for further information.

For a touchscreen version of the PM100D with more advanced spectral correction features, inputs for temperature and humidity sensors, data logging, and additional memory, we offer the PM400 capacitive touchscreen power and energy meter console. We also offer wireless, handheld, self-contained power meters, which feature an ultra-slim sensor with a built-in OLED display as well as *Bluetooth*® and USB features.

Power Meter Selection Guide
Sensors
Photodiode Power Sensors
Thermal Power Sensors
Thermal Position & Power Sensors
Pyroelectric Energy Sensors
Power Meter Consoles
Digital Handheld Console
Analog Handheld Console
Touchscreen Handheld Console
Dual-Channel Benchtop Console

Console Design

The compact housing has a large, 4" backlit display with a resolution of 320 x 240 pixels and illuminated buttons, all of which make operation in dark labs easy. The LCD's clear GUI offers easy data readouts with an intuitive navigation scheme. Interactive tooltips help to operate the device by giving the user step-by-step operating instructions, displaying the next step on the screen.

The PM100D features four standard measurement screens. The first option is a numeric readout useful for standard power and energy readings. The second option is a tuning needle typically seen on analog devices, however, optimized to run as a digital readout on the display screen. Third is a tuning graph, which is very convenient for fine tuning CW and pulsed sources.

Complete Power Meters
Power Meter Bundles
Wireless Power Meters with Sensors
Compact USB Power Meters
Field Power Meters for Terminated Fibers
USB Interfaces, External Readout

The unit can also be run in a data acquisition mode. Simply start the scan and the unit automatically starts recording data such as current power/energy, minimum, maximum, standard deviation, and other important statistics recorded over the acquisition period. The PM100D also features several user customizable displays and audio tuning for use when the detector is not within visual range. See the *Display Screens* tab for further information.

Click to Enlarge
Figure 1.1 Thorlabs' C-Series Power Meter Sensor Connectors Include the Sensor Calibration Data

Connectivity
The sensor connector, shown in Figure 1.1, enables "hot swappable" quick sensor exchange. The sensor connectors contain all the sensor information including NIST-traceable responsivity curves, sensor types, and model number.

A slot for an SD memory card (an 8 GB SD card is pre-installed) allows data recording even in stand-alone operation, giving the user large memory storage when recording data in the field or away from a computer in the lab. Data can also be recorded via the USB PC connection and optical power monitor software. This software is capable of handling up to eight consoles simultaneously. The features of the PC control software are highlighted in the *Software* tab.

In addition to remote control operation and data logging/recording, the USB connection can also act as the charging system for the Li-Polymer battery. Also included is an AC battery charger which uses an intelligent charging management system to improve battery lifetime and reduce battery memory effects.

Recalibration Services
Recalibration services are available for our thermal and photodiode power sensors, pyroelectric energy sensors, and consoles. We recommend your Thorlabs sensor and console be recalibrated as a pair; however, each may be recalibrated individually. All of the sensors on this page come with a manufacturer calibration by default, but we also offer an ISO 17025 accredited calibration for some items. For more information on calibration options, please see the *Recalibration* tab or the calibration sections at the bottom of this page.

Sensor Upgrade Service
Thorlabs' current line of C-Series sensors and power meter consoles are not compatible with old power meter consoles and sensor heads, respectively. We offer a sensor upgrade service if you want to use your existing sensors with a new power meter console. Note: upgraded sensors will be incompatible with old power meter consoles and new sensors converted to work with older consoles will not be compatible with the PM100D. Please contact our Tech Support team for details.

Hide Specs

SPECS

Table 2.1 Specifications

Item #	PM100D
Display	
Display Type	Graphical LCD 320 x 240 pixels, LED Backlight
Display Screens	Numerical, Bar Graph, Line Graph, Statistics, Simulated Analog Needle
Viewing Area	81.4 mm x 61.0 mm (3.20" x 2.40")
Refresh Rate	20 Hz
Audio	1x Speaker
Sensor Interface	
Compatible Sensors	All Photodiodes, Thermopiles, and Pyros[a] See Table 2.2 for Full Sensor Specs
Time Constant Correction	<1 s
AD Converter	16 bit
Trigger (Pulse Measurements, Pyroelectric Sensors)	Adjustable, 0.1 - 100%
Connector	DB9F, Left Side
Sensor Temperature Control	Thermistor
Temperature Range	-10 to 80 °C
Analog Outputs	
Signal	Amplified Input Signal (Not Corrected)
Voltage Range	0 to 2 V
Accuracy	±3%
Bandwidth	Up to 100 kHz, Dependent on Sensor and Settings
Connector	SMA, Left Side
Digital Outputs	
Memory	8 GB Removable SD Card
Connector / Interface	Mini USB / USB 2.0
Power	
Battery	Li-Polymer, 3.7 V, 1300 mAh
Charger / DC Input	5 V / 1 A
Dimensions and Mounting	

Dimensions (L x W x H)	180 mm x 105 mm x 38 mm (7.09" x 4.13" x 1.50")
Weight	<0.5 kg (<1.1 lb)
Mounting Options	Kickstand; 1/4"-20 Post Thread
Operating Temperature	0 to 40 °C
Storage Temperature	-40 to 70 °C

a. Except the ES408C Fast Pyroelectric Energy Sensor

Sensor Compatibility Specs

Table 2.2 Sensor Compatibility Specs

Item #	**PM100D**		
Detector Compatibility	**Photodiode Sensors: S1xxC Series** **Photodiodes (Max 5 mA)**	**Thermal Sensors: S3xxC Series** **Thermopiles (Max 1 V)**	**Pyroelectric Sensors: ESxxxC Series** **Pyros (Max 100 V)[a]**
Measurement Ranges	6 Decades; 50 nA - 5 mA Ranges Selectable in W or A, Sensor Dependent	4 Decades; 1 mV - 1 V Ranges Selectable in W or V, Sensor Dependent	4 Decades; 100 mV - 100 V Ranges Selectable in J or V, Sensor Dependent
Wavelength Ranges	200 nm - 1800 nm (Sensor Dependent)	190 nm - 25 µm (Sensor Dependent)	185 nm - 25 µm (Sensor Dependent)
Power / Energy Ranges	100 pW - 20 W	100 µW - 200 W	10 µJ - 15 J
Units	W, dBm, W/cm^2, A	W, dBm, W/cm^2, V	J, J/cm^2, W, W/cm^2, V
Accuracy	±0.2% of Full Scale (5 µA - 5 mA) ±0.5% of Full Scale (50 - 500 nA)	±0.5% of Full Scale (10 mV - 1 V) ±1% of Full Scale (1 mV)	±0.5% of Full Scale (100 mV - 100 V)
Display Resolution	1 pA / Responsivity Value (A/W)	1 µV / Responsivity Value (V/W)	100 µV / Responsivity Value (V/J)
Bandwidth	DC - 100 kHz, Dependent on Sensor and Settings	DC - 10 Hz, Dependent on Sensor and Settings	N/A
Max Repetition Rate	N/A	N/A	3 kHz
Wavelength Correction	Sensor Dependent; nm (A/W)	Sensor Dependent; nm, (V/W)	Sensor Dependent; nm, (V/J)

a. As this interface can only support sensors with repetition rates up to 3 kHz, it should not be used with the ES408C sensor, which detects repetition rates up to 10 kHz.

For a full list of the sensor head specifications please visit the Photodiode Power Sensors, Thermal Power Sensors, or Pyroelectric Energy Sensors pages. For other information, please contact Tech Support.

Hide Display

DISPLAY

Features

- Header line with sensor information, date/time and battery state
- Status line with warning annunciators Bar graph and configurable left and right sub display areas to display a minimum and a maximum value or a ratio of both values (numerical screen only)
- Tool tip text above the menu
- Easily accessible menu soft buttons

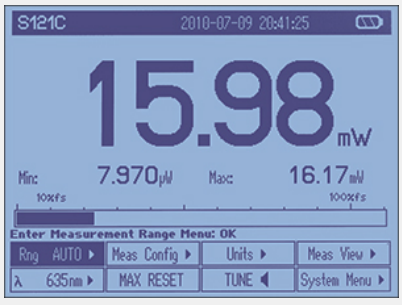
GUI Overview

On the top bar, the sensor, date and time, and battery life indicator are shown.

The main window contains one of the six standard display views described below. Here, the numerical readout is shown along with min and max values.

Below the main window is a bar graph displaying relative and absolute changes in power and energy.

The bottom bar on the PM100D contains the eight menus controlled by the D-pad.

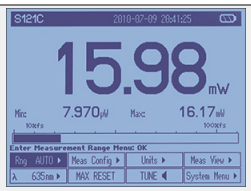
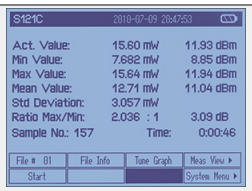
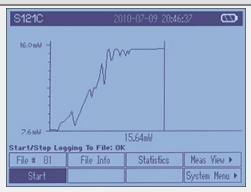
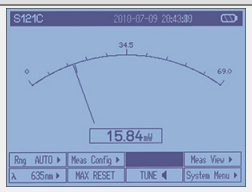
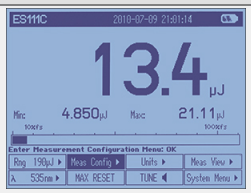
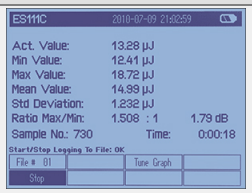
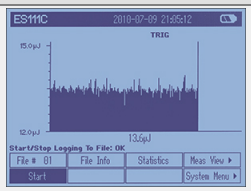


These menus at the bottom of the display access all the standard and customizable displays on the PM100D. The text display above the sub menus provides further assistance in navigating these menus.

Power and energy range, wavelength, measurement configuration, units, audio tuning, measurement views, and the system menu are all accessible from this bottom menu.

The bottom menu also allows customization of the display screen to include frequency, power density, and min and max values.

Numeric Screen (Power Mode) | **Statistics Screen (Power Mode)**

	This display combines a clear numerical 4-digit read out of the optical power, a bar-graph function with zooming capabilities, and configurable sub displays.		The statistics display shows the actual, minimum, maximum and mean power values in linear and logarithmic representation; further the standard deviation, the max/min ratio, the number of samples and the elapsed time.
Trend Graph (Power Mode)		**Needle Tuning (Power Mode)**	
	For laser tuning and beam alignment to visualize changes and trends together with an additional 4-digit numerical value of the absolute power.		A display imitating an analog needle together with an additional 4-digit numerical value for laser tuning tasks. A special feature is a resettable max hold indicator and a shiftable tuning sound.
Pulsed Numeric Screen (Energy Mode)		**Pulsed Statistics Screen (Energy Mode)**	
	This display combines a clear numerical 4-digit read out of the optical energy, a bar-graph function with zooming capabilities, and configurable sub displays.		The statistics display shows the actual, minimum, maximum and mean energy values in linear and logarithmic representation; further the standard deviation, the max/min ratio, the number of samples and the elapsed time.
Pulse Bar Graph (Energy Mode)			
	Like the Trend Graph (Power Mode) this easily shows changes and trends together with an additional 4-digit numerical value of the absolute energy of incident beam pulses.		

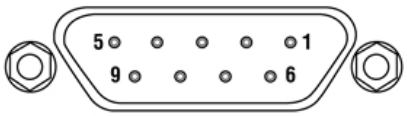
The user can customize the display screen by selecting various measurement tasks to be shown on the screen. Some screens are partly configurable by the user, for example, the user can display the min and max values within a certain time period or enable visual and audible peak indicator as a tuning aid. The display on the PM100D features adjustable brightness settings, with the option to turn off the backlight completely while still being readable.

Hide Pin Diagrams

PIN DIAGRAMS

PM100D Sensor Connectors

D-type Female



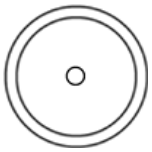
Pin	Connection
1	+5 V (Drive max 50 mA from this pin)
2	EEPROM Digital I/O
3	Photodiode Ground (Anode), Thermal and Pyro Sensor Ground, Analog Ground
4	Photodiode Cathode
5	Pyro-Electric Sensor +
6	DGND
7	PRESENT (Connect this pin via a 1kΩ - 10kΩ resistor to Pin 3 (AGND))
8	Thermal Sensor +
9	N.C.

Analog Output

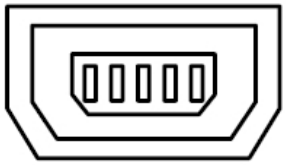
SMA Female

Computer Connection

USB Type Mini-B



0 ... 2 V



USB Type Mini-B to Type A Cable Included

Hide Applications

APPLICATIONS

Standard Photodiode Sensor Mounting Options

The compact design of Thorlabs' Standard Photodiode Sensors allows easy integration into existing setups. Typical mounting configurations including post, cage, and lens tube options are available. Shown on this page are several different choices for mounting these sensors.

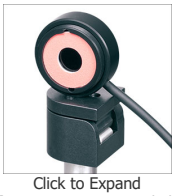
The Standard Photodiode Sensors are compatible with all S120-xx series fiber adapters. FC/PC and SMA adapters are shown in Figures 5.1 and 5.2. Adapters for FC/APC, SC, LC, and ST connections are also available.

Click to Expand
Figure 5.1 S120C and S120-FC Fiber Adapter

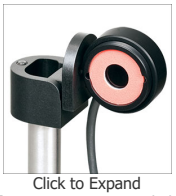
Click to Expand
Figure 5.2 S120C and S120-SMA Fiber Adapter

Flip mounts are convenient for quick power measurements from a static location. The sensor can be placed in the path of the laser beam for the power measurement and flipped down during normal operation of the system.

FM90(/M) Right-Angle Flip Mounts are shown in Figures 5.3 and 5.4. Thorlabs also offers the TRB1(/M) Articulating Post Mount. The lockable articulating mount offers almost unlimited positioning of the sensor head.



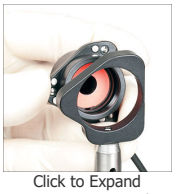
Click to Expand
Figure 5.3 S120C and Flip Mount



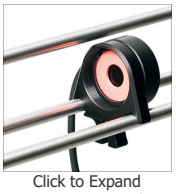
Click to Expand
Figure 5.4 S120C and Flip Mount

The Standard Photodiode Sensors also feature externally SM1-threaded connections on the front face. The SM1 threading provides easy mounting to 1" lens tube systems and quick-release mounts.

Shown in Figures 5.5 and 5.6 are the KB1P(/M) Quick-Release Post Mount and QRC1A Quick-Release 30 mm Cage Mount. Both mounts feature SM1-threaded connections to the sensor heads.



Click to Expand
Figure 5.5 S120C and KB1P Quick-Release Mount



Click to Expand
Figure 5.6 S120C and QRC1A Quick-Release Mount

Note: Due to the thickness of the S12xC sensor, the QRC1A and CP44F (shown below) quick-release mounts can only be fully removed from the cage system by backing them off an open end. The two mounts are easily removed from the cage system if only three cage rods are used. See the picture Figure 5.6.

Thorlabs also offers the CP44F 30 mm Cage Plates with Quick-Release Mounts. These mounts feature magnetically coupled front and back plates for easy and repeatable mounting.

Note: Like the QRC1A, the CP44F cannot be removed from a closed cage system.

Click to Expand
Figure 5.7 S120C and CP44F Quick-Release Mount

Slim Photodiode Sensor Mounting Options

Thorlabs' Slim Photodiode Sensors are designed to fit into space-restricted environments such as 30 mm cage systems and optic-dense free-space arrangements.

Shown in Figure 5.8 a S130C Sensor inserted into a 30 mm cage system. The application shown highlights the ease with which the sensor can be inserted into the cage, and the minimal space needed to take a power measurement.

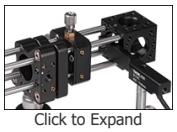
Click to Expand
Figure 5.8 S130C Sensor in a 30 mm Cage

The Slim Photodiode Sensors may also be mounted on a TRB1(/M) Articulating Mount. This mount allows repeatable insertion of the sensor into tight optic arrangements. After the measurement is made, the sensor may be rotated out of the beam path for normal operation.

Compact Slim Photodiode Sensor Mounting Options

Thorlabs' Compact Slim Photodiode Sensors are designed to fit into even tighter spaces such as 16 mm cage systems, our slotted Ø1/2" lens tubes, and other optic-dense free-space arrangements.

Shown in Figure 5.9 is a S116C Sensor inserted into a 16 mm cage system. The application shown highlights the ease with which the sensor can be inserted into the cage, and the minimal space needed to take a power measurement.


Click to Expand
Figure 5.9 S116C Sensor in a 16 mm Cage

The compact slim photodiode sensor has two 8-32 (M4) taps for post mounting. One tap mounts the sensor horizontally, as seen in Figure 5.9, and one allows it to be mounted vertically. The sensor may also be mounted on a TRB1(/M) Articulating Mount. This mount allows repeatable insertion of the sensor into tight optic arrangements. After the measurement is made, the sensor may be rotated out of the beam path for normal operation.

Microscope Slide Photodiode Sensor Mounting Options

Thorlabs' Microscope Slide Power Sensors are designed so they can be mounted directly in a microscope slide holder. The 76.0 mm x 25.2 mm x 5.0 mm sensor head has the same footprint as a standard microscope slide and is compatible with most standard upright and inverted microscopes. Figure 5.10 shows the S170C power sensor flipped over so that the engraved back of the housing can be used for alignment.

The S170C and NS170C power sensors also have an 8-32 (M4 x 0.7) tap for post mounting. In Figure 5.11, an RA90(/M) is used with two Ø1/2" posts to mount the S170C sensor head in a horizontal orientation.


Click to Expand
Figure 5.10 S170C in a Microscope Slide Holder


S170C Mounted on a Post
Figure 5.11 The S170C may be post mounted via the 8-32 (M4 x 0.7) tap in the side of the housing.

Integrating Sphere Photodiode Sensor Mounting Options

Thorlabs' Integrating Sphere Photodiode Sensor provides a low-loss cavity for diverging, non-uniform, or off-axis beam measurements. These integrating spheres are ideal for all fiber-based applications due to the beam divergence at the end of the fiber.

Shown in Figure 5.12 is an S140C Integrating Sphere with S120-FC Fiber Adapter. Also shown is an S140C with an S140-BFA Bare Fiber Adapter. The Bare Fiber Adapter features a mounting clamp and light shield to decrease interference from ambient light.


Click to Expand
Figure 5.12 S140C and S120-FC Fiber Adapter


Click to Expand
Figure 5.13 S140C and S140-BFA Fiber Adapter

Compact Fiber Photodiode Sensor Mounting Options

Thorlabs' Compact Fiber Photodiodes are the ideal choice for a portable, fiber-coupled power meter. The S15xC sensors are compatible with a wide variety of fiber connections. PM20-xx adapters are available to couple FC, APC, SMA, ST, SC, and LC connectors with the sensors. Shown in Figure 5.14 is an S150C Sensor with FC and SMA connector adapters.

Shown in Figure 5.15 is a PM100D console with S150C sensor connected to a FC connectorized optical fiber. This setup is ideal for portable use in the lab or in the field.


Click to Expand
Figure 5.14 S150C Sensor with FC and SMA Connectors


Click to Expand
Figure 5.15 PM100D with S150C Sensor

Pyroelectric Energy Sensor Mounting Options

Thorlabs' Pyroelectric Energy Sensors are ideal for measuring pulsed sources. These pyroelectric sensors provide direct energy readings for those sources. The sensors are designed to handle medium- to high-energy pulses from excimer, YAG, and other high-power lasers.

Each sensor ships with an insulating adapter for Ø1/2" post mounting, and they are also compatible with our 30 mm cage system, as shown in Figure 5.16.


Click to Expand
Figure 5.16 ES220C Mounted on 30 mm Cage Rods

Hide Software

SOFTWARE

Compatible Power Meters

- Consoles:
  - PM100A Analog Power and Energy Meter Console
  - PM200 Legacy Touch Screen Power and Energy Meter Console
  - PM100D Digital Power and Energy Meter Console
  - PM400 Capacitive Touchscreen Power and Energy Meter Console
  - PM5020 Dual-Channel Benchtop Optical Power and Energy Meter Console (Version 4.0 or Later)
- Complete Power Meters:
  - PM160, PM160T, and PM160T-HP Wireless Handheld Power Meters with Bluetooth® Technology
  - PM16 Series Compact USB Power Meters
  - PM60 and PM61 Fiber Optic Power Meter Series (Version 6.0 or Later)
- Interfaces:
  - PM101 Series Power Meter Interfaces with External Readout (Version 2.0 or Later)

- PM102 Series Power Meter Interfaces with External Readout (Version 2.1 or Later)
- PM103 Series Power Meter Interfaces with External Readout (Version 3.0 or Later)
- PM100USB USB Interface Digital Power and Energy Meter

Other Compatible Devices

- ERM2xx Series Extinction Ratio Meters
- SPCNT Single Photon Counting Device
- TSP01 USB Temperature and Humidity Data Logger
- TSP-TH Additional Temperature Probe
- WM202 Wavelength Meter

Optical Power Monitor

The Optical Power Monitor GUI software features readout from up to eight power meters or other compatible devices, or remote wireless operation.

For details on specific software features, please see the user manual.

Users interested in the legacy Power Meter Software can find it by visiting the software page.

The PM101 Series Power Meters are only compatible with version 2.0 or later. The PM102 Series Power Meters are only compatible with version 2.1 or later. The PM103 Series Power and Energy Meters are only compatible with version 3.0 or later. The PM5020 Console is only compatible with version 4.0 or later. The PM60 and PM61 Power Meter Series are only compatible with version 6.0 or later.

Software

Optical Power Monitor GUI Software for Touchscreen, Handheld, and USB-Interface Power Meters

Features

- Operate up to Eight Devices Simultaneously
- Record and Analyze Measurements in Real Time
- Intuitive Analog Display and Graphing Modes
- Configurable Long-Term Data Logging
- Also Supports Position Measurements with Thermal Position & Power Sensors
- Compatible with USB and Bluetooth® Connections

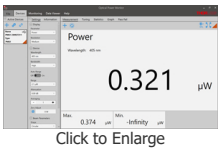
The Optical Power Monitor (OPM) software GUI enables seamless control of up to eight compatible devices that are connected via USB, RS232, or Bluetooth® wireless technology[a]. The latest software, firmware, drivers, and utilities for these power meters can be downloaded here.

Multiple data measurement and analysis functions are integrated into the GUI package. The interface offers a user-friendly design with minimal use of color and low brightness that is ideal for use in dark lab environments while wearing laser safety glasses. Measured data can be displayed in real time as a simulated analog needle, digital values, line graph, or bar graph. Continuously logged and short-term measurements can be recorded for data viewing and analysis at a later point. A built-in statistics mode analyzes measured data and updates continuously to reflect new measurements within the pre-determined measurement period. Beam position measurements are also supported when used with our thermal position & power sensors.

The OPM software package installs the GUI, which then can be used to control the touchscreen, handheld, or USB-interface power meters and other compatible devices. Firmware updates for supported power meters are also available. Programming examples and drivers for interfacing with our power and energy meter consoles using LabVIEW, C/C++, Visual C#, and Python are installed with the software; refer to the manual for details.

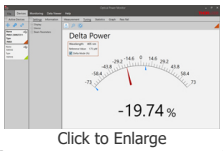
Please note that the OPM Software uses different drivers than the Power Meter Utilities Software and Thorlabs recommends using the new driver TLPM.dll. For users who wish to use the legacy Power Meter Software or use custom software designed using the older PM100D.dll driver, a Power Meter Driver Switcher program is included for easy swapping of the installed driver between the two versions.

a. The PM61 Series, PM160, PM160T, and PM160T-HP power meters are equipped with Bluetooth® connections.



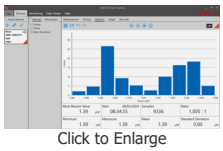
Click to Enlarge

Figure 149A Power Measurement Mode
Set up and configure up to eight power meters.



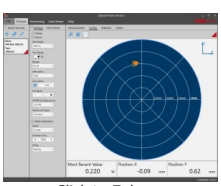
Click to Enlarge

Figure 149B Power Tuning Mode
Simulated analog needle and digital measurement value provided. Delta Mode, enabled here, shows the fluctuation range during the measurement period.

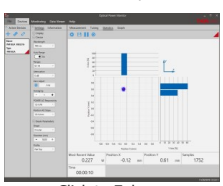


Click to Enlarge

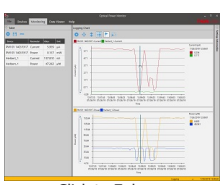
Figure 149C Power Statistics Mode
Calculate numerical statistics for a pre-determined measurement period. The panel displays the analyzed values in a bar graph and the results as numerical values.



Click to Enlarge



Click to Enlarge



Click to Enlarge

Figure 149D Position Tuning Mode
Tuning mode can be used with a thermal position & power sensor to aid in beam alignment.

Figure 149E Position Statistics Mode
Statistics mode also provides aggregate information for thermal position & power sensors.

Figure 149F Data Logging
Enable long-term measurement and simultaneous recording from up to eight power meters. Save data as .csv files for later processing while measurement results are displayed in a graph in real time.

Hide Sensor Selection

SENSOR SELECTION

This tab outlines the full selection of Thorlabs' power and energy sensors. Refer to Table 113B for power meter console and interface compatibility information.

In addition to the power and energy sensors listed below, Thorlabs also offers all-in-one, wireless, handheld power meters and compact USB power meter interfaces that contain either a photodiode or a thermal sensor, as well as power meter bundles that include a console, sensor head, and post mounting accessories.

Click to Enlarge
Figure 113A The PM160 wireless power meter, shown here with an iPad mini (not included), can be remotely operated using Apple mobile devices.

Thorlabs offers four types of sensors:

- **Photodiode Sensors:** These sensors are designed for power measurements of monochromatic or near-monochromatic sources, as they have a wavelength dependent responsivity. These sensors deliver a current that depends on the input optical power and the wavelength. The current is fed into a transimpedance amplifier, which outputs a voltage proportional to the input current.
- **Thermal Sensors:** Constructed from material with a relatively flat response function across a wide range of wavelengths, these thermopile sensors are suitable for power measurements of broadband sources such as LEDs and SLDs. Thermal sensors deliver a voltage proportional to the input optical power.
- **Thermal Position & Power Sensors:** These sensors incorporate four thermopiles arranged as quadrants of a square. By comparing the voltage output from each quadrant, the unit calculates the beam's position.
- **Pyroelectric Energy Sensors:** Our pyroelectric sensors produce an output voltage through the pyroelectric effect and are suitable for measuring pulsed sources, with a repetition rate limited by the time constant of the detector. These sensors will output a peak voltage proportional to the incident pulse energy.

Power and Energy Sensor Selection Guide

There are two options for comparing the specifications of our Power and Energy Sensors. Tables 113C, 113D, 113E, and 113F sort our sensors by type (e.g., photodiode, thermal, or pyroelectric) and provide key specifications.

Alternatively, the selection guide Figures 113G and 113H arrange our entire selection of photodiode and thermal power sensors by wavelength (Figure 113G) or optical power range (Figure 113H). Each box contains the item # and specified range of the sensor. These graphs allow for easy identification of the sensor heads available for a specific wavelength or power range.

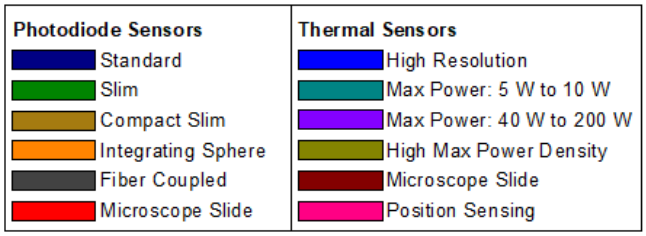
Table 113B Console Compatibility

Console Item #	PM100A	PM100D	PM400	PM5020	PM101 Series	PM102 Series	PM103 Series	PM100USB
Photodiode Power	✓	✓	✓	✓	✓	-	✓	✓
Thermal Power	✓	✓	✓	✓	✓	✓	-	✓
Thermal Position	-	-	✓	✓	-	✓	-	-
Pyroelectric Energy	-	✓[a]	✓[a]	✓	-	-	✓	✓[a]

a. As the PM100D and PM400 consoles and the PM100USB interface can only support repetition rates of up to 3 kHz, they should not be used with the ES408C sensor, which detects repetition rates up to 10 kHz.

Table 113C Photodiode Power Sensors	More [+]
Table 113D Thermal Power Sensors	More [+]
Table 113E Thermal Position & Power Sensors	More [+]
Table 113F Pyroelectric Energy Sensors	More [+]

a. The response time of the photodiode sensor. The actual response time of a power meter using these sensors will be limited by the update rate of your power meter console.
b. The power range provided is for lasers with a repetition rate of 80 MHz. Because the peak power and peak power density are dependent on the average power and repetition rate of the laser, the upper limit to the working average power range will be lower for lower repetition rates. Please see the *Specs* tab here for more details.
c. Typical natural response time (0 - 95%). Our power consoles can provide estimated measurements of optical power on an accelerated time scale (typically <1 s) when the natual response time is approximately 1 s or greater. As the natural response times of the S415C, S425C, and S425C-L are fast, these do not benefit from accelerated measurements and this function cannot be enabled. For more information, see the *Operation* tab here.
d. With intermittent use: maximum exposure time of 20 minutes for the S401C, otherwise maximum exposure time is 2 minutes.
e. All pyroelectric sensors have a thermal time constant, τ. This value indicates how long it takes the sensor to recover from a single pulse. To detect the correct energy levels, pulses must be shorter than 0.1τ and the repetition rate of your source must be well below 1/τ. Please see the Specs tab here for the τ value of each sensor.



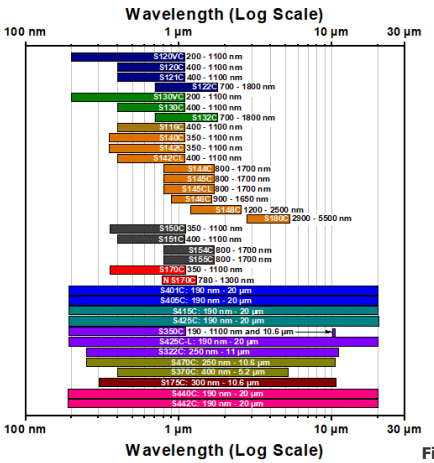


Figure 113G Sensor Options Arranged by Wavelength Range

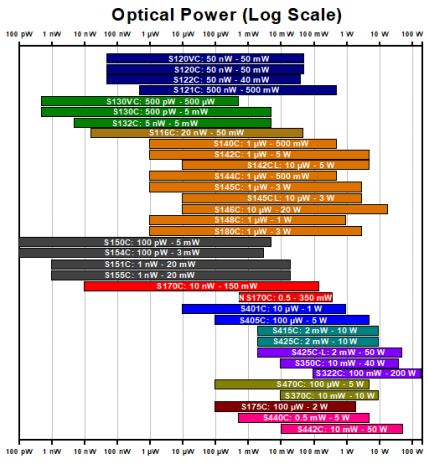


Figure 113H Sensor Options Arranged by Power Range

Hide Recalibration

RECALIBRATION

Recalibration Services

Thorlabs offers two types of recalibration services in-house for our power and energy meter electronics and photodiode power sensors: ISO 17025 accredited calibrations and manufacturer calibrations. Only the manufacturer calibration is available for the NS170C microscope slide peak power sensor, our thermal power sensors, and our pyroelectric energy sensors. All new products are delivered with a manufacturer calibration by default; if an ISO 17025 accredited calibration is desired for a new device, please contact Tech Sales.

Figure 796A DAkkS-accredited calibrations are performed in accordance with DIN EN ISO/IEC 17025:2018.

ISO 17025 accredited calibrations are performed in-house in accordance with DIN EN ISO/IEC 17025:2018. Thorlabs GmbH's calibration laboratory is accredited by the German Accreditation Body (DAkkS), the national accreditation authority of the Federal Republic of Germany. The scope of services is described here in English or German. Accredited calibrated power and/or energy meter electronics come with a dedicated certificate of calibration proving the specified accuracy and traceability of calibration data. This certification may be required in certain applications or industries, such as the medical market.

In contrast, our manufacturer calibrations are subject to the quality management requirements of ISO 9001. The certificate of calibration lists the equipment used for the calibration procedure as well as the calibration data acquired. The manufacturer calibration of a power sensor includes recalibration of a single-channel console or interface at no additional cost. If you wish to calibrate one or more sensors with a dual-channel console, each sensor and console calibration service will need to be purchased individually.

Both types of calibration can be offered for third-party equipment or adjusted for special requirements upon request. Please reach out to Tech Sales for further details.

We recommend recalibrating your Thorlabs sensor and console as a pair; however, each may be recalibrated individually. To ensure accurate measurements, we recommend recalibrating annually. To order one or more sensor recalibrations with a dual-channel console, we offer two options: either 1) fill out the Returns Material Authorization (RMA) form with each console and sensor Item # to be recalibrated and specify either manufacturer calibration or ISO 17025 accredited calibration in the "Further Details" field, or 2) separately add each recalibration service Item # offered below to your cart.

Hide Console Selection

CONSOLE SELECTION

Thorlabs offers a wide selection of power and energy meter consoles and interfaces for operating our power and energy sensors. Key specifications of all of our power meter consoles and interfaces are presented in this tab to help you decide which device is best for your application. We also offer self-contained wireless power meters and compact USB power meters.

When used with our C-series sensors, Thorlabs' power meter consoles and interfaces recognize the type of connected sensor and measure the current or voltage as appropriate. Our C-series sensors have responsivity calibration data stored in their connectors. The console will read out the responsivity value for the user-entered wavelength and calculate a power or energy reading.

- Photodiode sensors deliver a current that depends on the input optical power and the wavelength. The current is fed into a transimpedance amplifier, which outputs a voltage proportional to the input current. The photodiode's responsivity is wavelength dependent, so the correct wavelength must be entered into the console for an accurate power reading. The console reads out the responsivity for this wavelength from the connected sensor and calculates the optical power from the measured photocurrent.
- Thermal sensors deliver a voltage proportional to the input optical power. Based on the measured sensor output voltage and the sensor's responsivity, the console will calculate the incident optical power.
- Energy sensors are based on the pyroelectric effect. They deliver a voltage peak proportional to the pulse energy. If an energy sensor is recognized, the console will use a peak voltage detector and the pulse energy will be calculated from the sensor's responsivity.

The consoles and interfaces are also capable of providing a readout of the current or voltage delivered by the sensor. Select models also feature an analog output.

Consoles

Item #	PM100A	PM100D	PM400	PM5020

(Click Photo to Enlarge)				
Key Features	Analog Power Measurements	Digital Power and Energy Measurements	Digital Power and Energy Measurements, Touchscreen Control	Dual Channel
Compatible Sensors	Photodiode and Thermal Power	Photodiode Power, Thermal Power, and Pyroelectric Energy[a]	Photodiode Power, Thermal Power, Thermal Power and Position, and Pyroelectric Energy[a]	Photodiode Power, Thermal Power, Thermal Power and Position, and Pyroelectric Energy
Housing Dimensions (H x W x D)	7.24" x 4.29" x 1.61" (184 mm x 109 mm x 41 mm)	7.09" x 4.13" x 1.50" (180 mm x 105 mm x 38 mm)	5.35" x 3.78" x 1.16" (136.0 mm x 96.0 mm x 29.5 mm)	9.97" x 4.35" x 11.56" (253.2 mm x 110.6 mm x 293.6 mm)
Channels	1			2
External Temperature Sensor Input (Sensor not Included)	-	-	Readout and Record Temperature Over Time	Readout and Record Temperature Over Time
External Humidity Sensor Input (Sensor not Included)	-	-	Readout and Record Humidity Over Time	Readout and Record Humidity Over Time
Input/Output Ports	-		4 GPIO, Programmable	4 Configurable Digital I/O Channels
Shutter Control	-	-	-	Support for SH05R(/M) or SH1(/M) Optical Shutter with Interlock Input
Fan Control	-	-	-	✓
Source Spectral Correction	-	-	✓	✓
Attenuation Correction	-	-	✓	✓
External Trigger Input	-	-	-	✓
Display				
Type	Mechanical Needle and LCD Display with Digital Readout	320 x 240 Pixel Backlit Graphical LCD Display	Protected Capacitive Touchscreen with Color Display	
Dimensions	Digital: 1.9" x 0.5" (48.2 mm x 13.2 mm) Analog: 3.54" x 1.65" (90.0 mm x 42.0 mm)	3.17" x 2.36" (81.4 mm x 61.0 mm)	3.7" x 2.1" (95 mm x 54 mm)	4.32" x 2.43" (109.7 mm x 61.6 mm)
Refresh Rate	20 Hz		10 Hz (Numerical) 25 Hz (Analog Simulation)	25 Hz
Measurement Views[b]				
Numerical	✓	✓	✓	✓
Mechanical Analog Needle	✓	-	-	-
Simulated Analog Needle	-	✓	✓	✓
Bar Graph	-	✓	✓	✓
Trend Graph	-	✓	✓	✓
Histogram	-	✓	-	-
Statistics	✓	✓	✓	✓
Memory				
Type	-	SD Card	NAND Flash	SD Card
Size	-	2 GB	4 GB	8 GB
Power				
Battery	LiPo 3.7 V 1300 mAh		LiPo 3.7 V 2600 mAh	-
External	5 VDC via USB or Included AC Adapter		5 VDC via USB	Line Voltage: 100 - 240 V

a. As the PM100D and PM400 consoles can only support repetition rates of up to 3 kHz, they should not be used with the ES408C sensor, which detects repetition rates up to 10 kHz.
b. These are the measurement views built into the unit.

Interfaces

Item #	PM101	PM102	PM103	PM101A	PM102A	PM103A
(Click Photo to Enlarge)						
Operation Protocol	USB, RS232, UART, and Analog			USB and Analog SMA		
Sensor Compatibility						
Photodiode	✓	-	✓	✓	-	✓

Thermal Power	✓	✓	-	✓	✓	-
Thermal Position & Power	-	✓	-	-	✓	-
Pyroelectric	-	-	✓	-	-	✓
More [+]						

Item #	**PM103E**	**PM101R**	**PM101U**	**PM102U**	**PM103U**	**PM100USB**
(Click Photo to Enlarge)						
Operation Protocol	Ethernet, RS232, and Analog	USB and RS232	USB Operation			USB
Sensor Compatibility						
Photodiode	✓	✓	✓	-	✓	✓
Thermal Power		✓	✓	✓	-	✓
Thermal Position & Power		-	-	✓	-	-
Pyroelectric	✓	-	-	-	✓	✓[a]
More [+]						

a. As the PM100USB interface can only support repetition rates of up to 3 kHz, it should not be used with the ES408C sensor, which detects repetition rates up to 10 kHz.
b. Dependent on PC Settings
c. These power meter interfaces do not have a built-in monitor, so all data must be displayed through a PC running the Optical Power Monitor Software.
d. 48 V is the nominal voltage over the network, but can range from 36 V - 57 V.

Hide Digital Optical Power and Energy Meter

Digital Optical Power and Energy Meter

- Compact, Handheld, Power and Energy Meter Console
- Large 4" LCD Screen
- Long-Life Internal Li-Polymer Battery
- Pre-Installed 8 GB SD Memory Card for Data Storage
- Console is Calibrated and Includes Certificate of Calibration

Please note that sensors are not included with the PM100D console. For information about our compatible sensors, please see the sensor descriptions below.

Thorlabs offers recalibration services for the PM100D, which can be ordered below (see Item #s CAL-PM1 or CAL-PM1D). Alternatively, if you have a corresponding sensor that needs recalibrating, you can include the PM100D with the sensor for factory recalibration at no additional cost (Item # CAL-PM1 only). To order these services, scroll to the bottom of the page and select the appropriate Item # that corresponds to your sensor and desired calibration.

Part Number	Description	Price	Availability
PM100D	**Compact Power and Energy Meter Console, Digital 4" LCD**	**$1,359.32**	**In Stock Overseas**

Hide Standard Photodiode Power Sensors

Standard Photodiode Power Sensors

- For General Purpose Optical Power Measurements
- Integrated Viewing Target for Easy Sensor Alignment
- Ø9.5 mm Sensor Aperture
- Sensor, Protective Cap, IR Target, and Thread Adapter Included
- Fiber Adapters Available Separately (See Table 614B)
- See the Full Web Presentation for More Information


Click to Enlarge
Figure 614A S120C and CP44F Quick-Release Mount

These Standard Photodiode Power Sensors are ideal for metering low power coherent and incoherent sources from the UV to the NIR. Each NIST-Traceable, calibrated sensor features an integrated viewing target for easy alignment, enhanced shielding against electromagnetic interference, an over-temperature-alert device, and a large Ø9.5 mm sensor aperture. The sensors are compatible with 30 mm cage systems, Ø1/2" posts, and SM1 (1.035"-40) lens tubes, and are ideal for free-space and fiber-coupled sources.

Thorlabs offers recalibration services for these photodiode power sensors, which can be ordered below (see Item #s CAL-UVPD or CAL-UVPDD for UV-extended Si sensors, Item #s CAL-PD or CAL-PDD for Si sensors and Item #s CAL-IRPD or CAL-IRPDD for Ge sensors).

Table 614B Specifications				
Item #[a]	**S120VC**	**S120C**	**S121C**	**S122C[h]**

Sensor Image (Click the Image to Enlarge)				
Aperture Size	Ø9.5 mm			
Wavelength Range	200 - 1100 nm	400 - 1100 nm	400 - 1100 nm	700 - 1800 nm
Power Range	50 nW - 50 mW (200 - 450 nm) 50 nW - 20 mW (450 -1100 nm)	50 nW - 50 mW	500 nW - 500 mW	50 nW - 40 mW
Detector Type	Si Photodiode (UV Extended)	Si Photodiode		Ge Photodiode
Linearity	±0.5%			
Resolution[b]	1 nW		10 nW	2 nW
Measurement Uncertainty[c]	±3% (440 - 980 nm) ±5% (280 - 439 nm) ±7% (200 - 279 nm, 981 - 1100 nm)	±3% (440 - 980 nm) ±5% (400 - 439 nm) ±7% (981 - 1100 nm)		±5%
Responsivity[d] (Click for Plot)	Raw Data	Raw Data	Raw Data	Raw Data
Coating/Diffuser	Reflective ND (OD1.5)[e]	Reflective ND (OD1)[f]	Reflective ND (OD2)[g]	Absorptive ND (Schott N
Head Temperature Measurement	NTC Thermistor 4.7 kΩ			
Housing Dimensions	Ø30.5 mm x 12.7 mm			
Cable Length	1.5 m			
Post Mounting[e,f,g]	Universal 8-32 / M4 Tap, Post Not Included			
Aperture Thread	External SM1 (1.035"-40)			
Compatible Fiber Adapters	S120-FC2, S120-FC, S120-APC2, S120-APC, S120-SMA, S120-ST, S120-LC, and S120-SC (Not Included)			
Compatible Consoles	PM400, PM100D, PM100A, and PM5020			
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB			

a. For complete specifications, please see the *Specs* tab here.
b. Measured with PM100D console in low bandwidth setting.
c. Beam diameter > 1 mm.
d. All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.
e. For the S120VC, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had a reflective ND diffuser (OD1). Additionally, they came with an 8-32 ta adapter. For additional information, please contact technical support.
f. For the S120C, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had an absorptive ND diffuser (Schott NG3). Additionally, they came with an and M4 adapter. For additional information, please contact technical support.
g. For the S121C, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had a absorptive ND diffuser (Schott NG9). Additionally, they came with an 8 and M4 adapter. For additional information, please contact technical support.
h. Previously, S122C came with an 8-32 tap and M4 adapter. For additional information, please contact technical support.

Part Number	Description	Price	Availability
S120VC	Standard Photodiode Power Sensor, UV-Extended Si, 200 - 1100 nm, 50 nW - 50 mW	$528.76	Lead Time
S120C	Standard Photodiode Power Sensor, Si, 400 - 1100 nm, 50 nW - 50 mW	$381.34	Lead Time
S121C	Standard Photodiode Power Sensor, Si, 400 - 1100 nm, 500 nW - 500 mW	$414.38	In Stock Overseas
S122C	Standard Photodiode Power Sensor, Ge, 700 - 1800 nm, 50 nW - 40 mW	$761.37	Lead Time

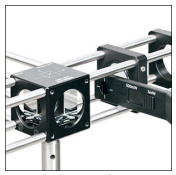
Hide Slim Photodiode Power Sensors

Slim Photodiode Power Sensors

- For Optical Power Measurements in Confined Spaces
- Very Slim Design: 5 mm Thin on Sensor Side
- Ø9.5 mm Sensor Aperture
- Slideable ND Filter Automatically Changes Sensor Power Range
- Optional SM1A29 Adapter with VIS/IR Target and External SM1 Threading (More Details)
- Optional FBSM Mount with VIS/IR Target for FiberBench Systems (More Details)
- See the Full Web Presentation for More Information


Click for Details
[APPLIST]
Figure 615A S130C Photodiode Sensor Mounted in FiberBench System Using FBSM Mount


Click for Details
Figure 615B SM1A29 SM1 Thread Adapter Mounted on a S130C Sensor


Click to Enlarge
[APPLIST]
[APPLIST]
Figure 615C S130C Sensor in a 30 mm Cage

These Slim Photodiode Power Sensors are designed to take optical source power measurements in locations where space and accessibility are at a premium. The 5 mm thin sensor end can fit between closely spaced optics, cage systems, and other arrangements where standard power meters may not fit. The NIST-Traceable, calibrated sensors also feature a large Ø9.5 mm sensor aperture and slideable neutral density filter for dual power ranges in one compact device.

A separately available SM1A29 adapter can be attached by 2 setscrews to any S130 series power sensor to mount fiber adapters, light shields, filters or any other SM1-threaded (1.035"-40) mechanics or optics. The FBSM Mount allows our S130 series power sensors to be mounted vertically into FiberBench systems for stable

mounting with a minimal footprint.

Thorlabs offers recalibration services for these photodiode power sensors, which can be ordered below (see Item #s CAL-UVPD2 or CAL-UVPD2D for UV-extended Si sensors, Item #s CAL-PD2 or CAL-PD2D for Si sensors, and Item #s CAL-IRPD2 or CAL-IRPD2D for Ge sensors).

Table 615D Specifications				
Item #[a]	**S130VC**		**S130C**	**S132C**
Sensor Image (Click the Image to Enlarge)				
Aperture Size	Ø9.5 mm			
Wavelength Range	200 - 450 nm	450 - 1100 nm	400 - 1100 nm	700 - 1800 nm[b]
Power Range (with Filter)	500 pW - 0.5 mW (Up to 50 mW)[c]	500 pW - 0.2 mW (Up to 20 mW)[c]	500 pW - 5 mW (Up to 500 mW)	5 nW - 5 mW (Up to 500 mW)
Detector Type	Si Photodiode (UV Extended)		Si Photodiode	Ge Photodiode
Linearity	±0.5%			
Resolution	100 pW[d]			1 nW[e]
Measurement Uncertainty[f]	±3% (440 - 980 nm) ±5% (280 - 439 nm) ±7% (200 - 279 nm, 981 - 1100 nm)		±3% (440 - 980 nm) ±5% (400 - 439 nm) ±7% (981 - 1100 nm)	±5%
Responsivity[g] (Click for Plot)	Raw Data		Raw Data	Raw Data
Coating/Diffuser	Reflective ND (OD1.5)[c]		Reflective ND (OD2)[h]	Absorptive ND (Schott NG9/KG3)[b]
Housing Dimensions	150 mm x 19 mm x 10 mm; 5 mm Thickness on Sensor Side			
Cable Length	1.5 m			
Post Mounting	8-32 and M4 Taps			
Adapters (Not Included)	SM1A29: Add SM1 Thread and Viewing Target to Aperture Fiber Adapters Compatible with SM1A29 Adapter: S120-FC2, S120-FC, S120-APC2, S120-APC, S120-SMA, S120-ST, S120-SC, and S120-LC FBSM: Integrate Sensor into FiberBench Setups			
Compatible Consoles	PM400, PM100D, PM100USB, PM100A, and PM5020			
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB			

a. For complete specifications, please see the *Specs* tab here.
b. For the S132C, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had a reflective ND diffuser (OD1), which would decrease the wavelength ra 700 nm to 1800 nm to 1200 nm to 1800 nm. For additional information, please contact technical support.
c. For the S130VC, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had an optical power range of 5 nW to 5 mW (50 nW to 50 mW with filter) reflective ND diffuser (OD1). For additional information, please contact technical support.
d. Measured with PM100D console in low bandwidth setting, without filter.
e. Measured with PM100D console in low bandwidth setting at 1550 nm, without filter.
f. Beam Diameter > 1 mm.
g. All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.
h. For the S130C, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had an absorptive ND diffuser (Schott NG9). For additional information, plea contact technical support.

Part Number	Description	Price	Availability
S130VC	**Slim Photodiode Power Sensor, UV-Extended Si, 200 - 1100 nm, 500 pW - 0.5 mW, Up to 50 mW with Filter**	**$767.74**	**Lead Time**
S130C	**Slim Photodiode Power Sensor, Si, 400 - 1100 nm, 500 pW - 5 mW, Up to 500 mW with Filter**	**$634.26**	**Lead Time**
S132C	**Slim Photodiode Power Sensor, Ge, 700 - 1800 nm, 5 nW - 5 mW, Up to 500 mW with Filter**	**$901.20**	**Lead Time**
SM1A29	**Customer Inspired! SM1 Thread Adapter for Slim Photodiode Sensors**	**$52.44**	**In Stock Overseas**
FBSM	**FiberBench Mount for Slim Photodiode Sensors**	**$52.10**	**In Stock Overseas**

Hide Compact Slim Photodiode Power Sensor

Compact Slim Photodiode Power Sensor

- For Optical Power Measurements in Tiny Spaces Such as 16 mm Cage Systems
- Wavelength Range: 400 - 1100 nm
- Very Slim Design: 10.0 mm Wide and 4.5 mm Thin on Sensor Side
- Silicon Photodiode with Ø6 mm Sensor Aperture
- Designed for Power Measurements for Low Power Lasers
- Post Mountable via 8-32 (M4) Taps

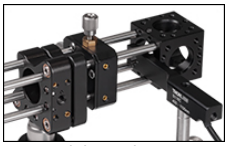
Table 728A Specifications	
Item #[a]	**S116C**

- SM05A29 Adapter with External SM05 (0.535"-40) Threading Available Separately (More Details)
- See the Full Web Presentation for More Information

The S116C Compact Slim Photodiode Power Sensor is designed to take optical source power measurements in locations where space and accessibility are at a premium. The 4.5 mm thin photodiode sensor can fit between the rods of a 16 mm cage system, as seen in Figure 728C, as well as through the side openings of our slotted Ø1/2" lens tubes (Item #s SM05L20C and SM05L30C). This sensor also features a Ø6 mm sensor aperture.

A separately available SM05A29 adapter can be attached by two 0.05" (1.3 mm) hex setscrews to an S116C power sensor to mount fiber adapters, light shields, filters or any other SM05-threaded (0.535"-40) mechanics or optics. The adapter mounted on the S116C power sensor is shown in Figure 728B.

Each sensor is shipped with NIST- and PTB-traceable calibration data. The included data is determined with the help of a certified reference diode, which corresponds to the spectral range of the sensor to be calibrated. Thorlabs offers recalibration services for these photodiode power sensors, which can be ordered below (see Item #s CAL-PD or CAL-PDD for Si sensors).



Click to Enlarge
[APPLIST]
[APPLIST]
Figure 728C S116C Sensor in a 16 mm Cage System

Click for Details
Figure 728B SM05A29 SM05 Thread Adapter (Sold Separately) Mounted on an S116C Sensor

Sensor Image (Click the Image to Enlarge)	
Aperture Size	Ø6 mm
Wavelength Range	400 - 1100 nm
Power Range	20 nW - 50 mW
Detector Type	Si Photodiode
Linearity	±0.5%
Resolution	1 nW[b]
Measurement Uncertainty[c]	±3% (440 - 980 nm) ±5% (400 - 439 nm) ±7% (981 - 1100 nm)
Responsivity[d] (Click for Plot)	 Raw Data
Coating/Diffuser	Absorptive ND (NG9)
Housing Dimensions (L x W x T)	70.0 mm x 11.0 mm x 8.9 mm; 10.0 mm Width and 4.5 mm Thickness on Sensor Side
Active Detector Area	7 mm x 7 mm
Cable Length	1.5 m
Mounting Threads	2 Universal 8-32 / M4 Taps (One on the Back, One on the Bottom), Posts Not Included
Adapters (Not Included)	SM05A29: Add SM05 Thread to Aperture Fiber Adapters Compatible with SM05A29 Adapter: PM20-FC2, PM20-FC, PM20-APC2, PM20-APC, PM20-SMA, PM20-ST, PM20-SC, and PM20-LC
Compatible Consoles	PM400, PM100D, PM100A, and PM5020
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB

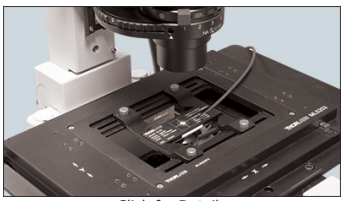
a. For complete specifications, please see the *Specs* tab here.
b. Measured with PM100D console in low bandwidth setting.
c. Beam Diameter > 1 mm.
d. The sensor responsivity shown in these plots were calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.

Part Number	Description	Price	Availability
S116C	Compact Slim Photodiode Power Sensor, Si, 400 - 1100 nm, 20 nW - 50 mW	$469.85	In Stock Overseas
SM05A29	SM05-Threaded Adapter for Compact Slim Photodiode Sensors	$49.33	Today

Hide Microscope Slide Photodiode Power Sensors

Microscope Slide Photodiode Power Sensors

- Designed to Measure Optical Power at the Sample Plane of a Microscope
- Silicon Photodiode with Large 18 mm x 18 mm Active Area
- Sensor Housing Dimensions: 76.0 mm x 25.2 x 5.0 mm
- Novel Optical Design Accommodates High NA Objectives
- Information Stored in Connector
  - Sensor Data
  - NIST- and PTB-Traceable Calibration Data
- Post Mountable via 8-32 (M4 x 0.7) Tap



Click for Details
Figure 616A Using the engraved alignment target on the back of the sensor housing, a user can position the stage so that when the sensor is flipped, the beam strikes the center of the sensor. The S170C sensor is shown in this image.

The Microscope Slide Power Sensor Heads with silicon photodiodes are designed to measure the power at the sample plane in microscopy setups. The S170C sensor can detect wavelengths from 350 nm to 1100 nm at optical powers from 10 nW to 150 mW. The NS170C sensor is designed to measure the relative peak power of femtosecond lasers with center wavelengths from 780 nm to 1300 nm and average powers from 0.5 mW to 350 mW. Each sensor head's 76.0 mm x 25.2 mm footprint matches that of a standard microscope slide and is compatible with most standard upright and inverted microscopes.

The photodiode used in the S170C sensor has 18 mm x 18 mm active area and is contained in a sealed housing behind a neutral density (ND) filter. A 20 mm x 20 mm indentation around the surface of the ND filter is sized to accept standard microscope cover slips. An immersion medium (water, glycerol, oil) may be placed in this well directly over the ND filter, or a cover slip may be inserted first to simplify clean up. The gap between the photodiode and the neutral density filter has been filled with an index matching gel in order to prevent internal reflections from causing significant measurement errors when using high NA objectives with oil or water.

The NS170C sensor is designed to measure the relative peak power of two-photon lasers by utilizing a second-order nonlinear β-BBO crystal to convert incident ultrafast NIR pulses into their visible second harmonic. Shortpass filters underneath the β-BBO crystal reject the residual NIR light, allowing only the second harmonic

light to transmit down to a large area silicon photodiode sensor. At the entrance of the sensor is a 170 µm thick cover glass sealed to the sensor housing, allowing the sensor to be used with dry, water immersion, and oil immersion objectives. The working distance from the top of the cover glass to the β-BBO crystal is 0.22 mm.

The bottom of each sensor housing features a laser-engraved grid to aid in aligning and focusing the beam. In standard microscopes, this grid can be used for beam alignment before flipping the sensor head to face the objective for power measurements. In inverted microscopes, turn on the transmitted illuminator to align the grid on the detector housing with the beam, thereby centering the sensor in front of the objective. Alternatively, the diffusive surface of the ND filter can be used as a focusing plane.

To avoid damaging the sensor, we recommend positioning it in the light path at a location where the beam is not focused. It is important not to exceed the Max Average Power Density over the beam's spot size for the S170C sensor, and the Max Peak Power Density for the NS170C sensor (see *Specs* tab).

Each sensor is shipped with NIST- or PTB-traceable calibration data. The included data will match the calibration certification of the photodiode used to test the individual sensor. Sensor specifications and the included NIST- or PTB-traceable calibration data are stored in non-volatile memory in the sensor connector and can be read out by the latest generation of Thorlabs power meters. Please note that the NS170C sensor's NIST and PTB calibration is for the visible light incident on the detector; however, the magnitude of that visible light is specific to the illumination conditions of the NIR femtosecond pulses. We recommend yearly recalibration to ensure accuracy and performance, which can be ordered below (see Item #s CAL-PD or CAL-PDD for the S170C sensor, and Item # CAL-NS for the NS170C sensor). Please contact Tech Support for more information.

The complete set of specifications are presented on the *Specs* tab. Thorlabs also offers a Microscope Slide Sensor Head with a thermal sensor; the full presentation can be found here.

Item #[a]	S170C	NS170C
Sensor Image (Click Image to Enlarge)		
Dimensions	76.0 mm x 25.2 mm x 5.0 mm (2.99" x 0.99" x 0.20")	Base: 76.0 mm x 25.2 mm x 5.0 mm (2.99" x 0.99" x 0.20") Overall: 76.0 mm x 30.0 mm x 11.0 mm (2.99" x 1.18" x 0.43")
Active Detector Area	18 mm x 18 mm	
Input Aperture	20 mm x 20 mm	Ø4.5 mm
Wavelength Range	350 - 1100 nm	Laser: 780 - 1300 nm SHG: 390 - 650 nm
Optical Power Working Range	10 nW - 150 mW	Laser: 0.5 - 350 mW[b] SHG: 10 nW - 5 mW
Max Peak Power Density[c]	-	10 TW/cm^2
Detector Type	Silicon Photodiode	Second-Order Nonlinear Crystal with Silicon Photodiode
Linearity	±0.5%	±0.5%[d]
Resolution	1 nW[e]	1 nW[d,e]
Measurement Uncertainty[f]	±3% (440 - 980 nm) ±5% (350 - 439 nm) ±7% (981 - 1100 nm)	±3% (440 - 650 nm)[d] ±5% (390 - 439 nm)[d]
Responsivity[g] (Click for Plot)	 Raw Data	 Raw Data
Neutral Density Filter	Reflective (OD 1.5)	N/A
Cable Length	1.5 m	
Mounting Thread	Universal 8-32 / M4 x 0.7 Tap, Post Not Included	
Compatible Consoles	PM400, PM100D, PM100A, and PM5020	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB	

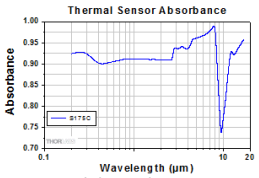
a. For complete specifications, please see the *Specs* tab.
b. The working range provided is for lasers with a repetition rate of 80 MHz. Because the peak power and peak power density are dependent on the average power and repetition rate of the l upper limit to the working average power range will be lower for lower repetition rates. Exceeding the maximum average power may result in damage to the sensor's optical components.
c. The specified damage threshold is for objectives with NA > 0.5. The damage threshold will be lower for NA < 0.5.
d. This specification is for the measured second harmonic generation (SHG) signal.
e. Measured with PM100D console in low bandwidth setting.
f. Beam Diameter >1 mm
g. The sensor responsivity shown in this plot was calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.

Part Number	Description	Price	Availability
S170C	**Customer Inspired! Microscope Slide Power Sensor, 350 - 1100 nm, 10 nW - 150 mW**	**$1,417.25**	**Lead Time**
NS170C	**Microscope Slide Peak Power Sensor for Two-Photon Lasers, 780 - 1300 nm**	**$2,835.50**	**Today**

Hide Microscope Slide Thermal Power Sensor

Microscope Slide Thermal Power Sensor

- Wavelength Range: 300 nm - 10.6 µm
- Sensitive to Optical Powers from 100 µW to 2 W
- Designed to Measure Optical Power in the Sample Plane of a Microscope
- Thermal Sensor with 18 mm x 18 mm Active Area
- 76.0 mm x 25.2 mm Footprint Matches Standard Microscope Slides
- Information Stored in Connector
  - Sensor Data
  - NIST- and PTB-Traceable Calibration Data
- See the Full Web Presentation for More Information



Click to Enlarge

Figure 617A Typical absorption curve for the S175C (glass and absorber). Note that this curve is representative, and the actual absorption across the spectrum will vary from unit to unit.

Click to Enlarge

Figure 617C The back of the S175C housing is engraved with the sensor specifications and a target for centering the beam on the sensor.

The S175C Microscope Slide Thermal Power Sensor Head is designed to measure the power at the sample in microscopy setups. The thermal sensor can detect wavelengths between 300 nm and 10.6 µm at optical powers between 100 µW and 2 W. The sensor head's 76.0 mm x 25.2 mm footprint matches that of a standard microscope slide and is compatible with most standard upright and inverted microscopes.

The thermal sensor has an 18 mm x 18 mm active area and is contained in a sealed housing behind a glass cover. An immersion medium (water, glycerol, oil) may be placed over the glass cover plate.

As seen in Figure 617C, the bottom of the sensor housing features a laser-engraved target to aid in aligning and focusing the beam. In standard microscopes, the target can be used for beam alignment before flipping the sensor head to face the objective for power measurements. In inverted microscopes, turn on the trans-illumination lamp and align the target on the detector housing with the beam; this will center the sensor in front of the objective.

Sensor specifications and the NIST- and PTB-traceable calibration data are stored in non-volatile memory in the sensor connector and can be read out by the latest generation of Thorlabs power meters. We recommend yearly recalibration to ensure accuracy and performance. Calibration may be ordered using the CAL-THPY recalibration service available below. Please contact technical support for more information.

Thorlabs also offers a Microscope Slide Sensor Head with a photodiode sensor for low-power, high-resolution measurements; the full presentation may be found here.

Table 617B Specifications

Item #[a]	S175C
Sensor Image (Click Image to Enlarge)	
Active Detector Area	18 mm x 18 mm
Wavelength Range	0.3 - 10.6 µm
Power Range	100 µW - 2 W
Detector Type	Thermal Surface Absorber (Thermopile)
Linearity	±0.5%
Resolution[b]	10 µW
Measurement Uncertainty[c]	±3% @ 1064 nm; ±5% @ 300 nm - 10.6 µm
Response Time	3 s (<2 s from 0 to 90%)
Housing Dimensions	76 mm x 25.2 mm x 4.8 mm (2.99" x 0.99" x 0.19")
Cable Length	1.5 m
Housing Features	Integrated Glass Cover Engraved Laser Target on Back
Post Mounting	N/A
Cage Mounting	N/A
Aperture Thread	N/A
Compatible Consoles	PM400, PM100D, PM100A, and PM5020
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB

a. For complete specifications, please see the *Specs* tab here.
b. Measured with the legacy PM200 Touch Screen
c. Console Beam Diameter: >1 mm

Part Number	Description	Price	Availability
S175C	Customer Inspired! Microscope Slide Thermal Power Sensor, 300 nm - 10.6 µm, 100 µW - 2 W	$1,417.25	In Stock Overseas

Hide Integrating Sphere Photodiode Power Sensors

Integrating Sphere Photodiode Power Sensors

- For Measurements Independent of Beam Shape and Entrance Angle
- Integrating Sphere Design Acts as a Diffuser with Minimal Power Loss
- Ø5 mm, Ø7 mm, Ø12 mm, or Ø22 mm Input Sensor Aperture
- Spheres with Apertures ≤Ø12 mm Include a Removable S120-FC Fiber Adapter (FC/PC and FC/APC)
- Fiber Adapters for Terminated and Bare Fiber (See Table 618D) are Compatible with Spheres with Apertures ≤Ø12 mm
- See the Full Web Presentation for More Information

Click to Enlarge

Figure 618A S142C with the S120-FC Fiber Adapter (Included)

Click to Enlarge

Figure 618B S142C and S140-BFA Bare Fiber Adapter (Sold Separately)

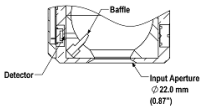
These Integrating Sphere Photodiode Power Sensors are the ideal choice for power measurements independent of beam uniformity, divergence angle, beam shape, or entrance angle, making them excellent for use with fiber sources and off-axis free space sources. They feature enhanced shielding to avoid electromagnetic interference and an over-temperature alert sensor to warn against damage and measurement errors due to overheating of the sensor.

Our integrating spheres are designed for wavelength ranges from the visible through the NIR. Sensor heads for use between 350 and 2500 nm use a single Ø1" or Ø2" sphere made from Zenith® PTFE and feature a black housing to minimize reflected light around the entrance aperture. These sensors use either a silicon photodiode for detection in the 350 - 1100 nm range or an InGaAs photodiode for detection in the 800 - 1700 nm, 900 - 1650 nm, or 1200 - 2500 nm wavelength range.

The S180C integrating sphere for 2.9 - 5.5 µm uses two connected, gold-plated Ø20 mm spheres, with an entrance port in the first sphere and a port for the MCT (HgCdTe) detector located in the second sphere. Compared to single-sphere designs, the two-sphere configuration improves device sensitivity by minimizing the internal sphere surface area while still effectively shielding the detector from direct illumination. This design reduces the effect of input angle, divergence, and beam shape on the measurement result by effectively shielding the photodiode without the use of a baffle or other shielding mechanism.

The integrating spheres with Ø5 mm, Ø7 mm, or Ø12 mm apertures feature large active detector areas, and externally SM1-threaded (1.035"-40) adapters for compatibility with the included S120-FC fiber adapter. Because of the large active detector areas of these sensors, the included S120-FC fiber adapter can be used with FC/PC- or FC/APC-terminated fiber. The externally SM1-threaded adapter can be removed using a size 1 screwdriver to place components closer to the window.

The S142CL and S145CL integrating spheres feature a large Ø22 mm input aperture and a baffle within the sphere which prevents direct illumination of the photodiode. The large aperture and baffle enable measurements of large and divergent beams, such as those emitted from LED and VCSEL light sources. The input face of the detectors have four 4-40 threads for mounting 30 mm cage system components. Additionally, insertion of a second or third port in the sensor head is possible on request, please contact Tech Support for details.



Click to Enlarge
Figure 618C A baffle on the S142CL and S145CL spheres blocks light from directly hitting the detector.

Each sensor is shipped with NIST- or PTB-traceable calibration data. The included data will match the calibration certification of the photodiode used to test the individual sensor. NIST- or PTB-traceable data is stored in the sensor connector. Thorlabs offers recalibration services for these photodiode power sensors, which can be ordered below (see Item #s CAL-PD or CAL-PDD for Si sensors, Item #s CAL-IRPD or CAL-IRPDD for InGaAs sensors, Item # CAL-MIRPD for extended InGaAs or MCT sensors, or Item # CAL-MIRPDD for extended InGaAs sensors).

Table 618D Specifications									
Item #[a]	S140C	S142C	S142CL	S144C	S145C	S145CL	S146C	S148C	
Sensor Image (Click the Image to Enlarge)									
Aperture Size	Ø5 mm	Ø12 mm	Ø22 mm	Ø5 mm	Ø12 mm	Ø22 mm	Ø12 mm	Ø5 mm	
Wavelength Range	350 - 1100 nm		400 - 1100 nm	800 - 1700 nm			900 - 1650 nm	1200 - 2500 nm	
Power Range	1 µW - 500 mW	1 µW - 5 W	10 µW - 5 W	1 µW - 500 mW	1 µW - 3 W	10 µW - 3 W	10 µW - 20 W	1 µW - 1 W	1
Detector Type	Si Photodiode		Si Photodiode with Baffle	InGaAs Photodiode		InGaAs Photodiode with Baffle	InGaAs Photodiode	Extended InGaAs Photodiode	
Linearity	±0.5%								
Resolution[b]	1 nW		10 nW	1 nW		10 nW		1 nW	
Measurement Uncertainty[c,d]	±3% (440 - 980 nm) ±5% (350 - 439 nm) ±7% (981 - 1100 nm)		±3% (440 - 980 nm) ±5% (400 - 439 nm) ±7% (981 - 1100 nm)	±5%					
Responsivity[e] (Click for Plot)	Raw Data	Raw Data	Raw Data	Raw Data	Raw Data	Raw Data	Raw Data	Raw Data	
Integrating Sphere Material (Size)	Zenith® PTFE (Ø1")	Zenith® PTFE (Ø2")		Zenith® PTFE (Ø1")	Zenith® PTFE (Ø2")			Zenith® PTFE (Ø1")	
Head Temperature Measurement	NTC Thermistor 4.7 kΩ								
Housing Dimensions	Ø45 mm x 30.5 mm	70 mm x 74 mm x 70 mm		Ø45 mm x 30.5 mm	70 mm x 74 mm x 70 mm			Ø45 mm x 30.5 mm	
Active Detector Area	3.6 mm x 3.6 mm				Ø2 mm	Ø3 mm	Ø1 mm	Ø1 mm	
Cable Length	1.5 m								
Mounting Thread	Separate 8-32 and M4 Taps, Posts Not Included		Universal 8-32 / M4 Thread, Post Not Included	Separate 8-32 and M4 Taps, Posts Not Included		Universal 8-32 / M4 Thread, Post Not Included	Separate 8-32 and M4 Taps, Posts Not Included		
Aperture Thread	Included Adapter with SM1 (1.035"-40) External Thread		None	Included Adapter with SM1 (1.035"-40) External Thread		None	Included Adapter with SM1 (1.035"-40) Extern		
Compatible Fiber Adapters	S120-FC (Included) S120-FC2, S120-APC2, S120-APC, S120-SMA, S120-ST, S120-SC, S120-LC, S120-25, and S140-BFA (Not Included)		None	S120-FC (Included) S120-FC2, S120-APC2, S120-APC, S120-SMA, S120-ST, S120-SC, S120-LC, S120-25, and S140-BFA (Not Included)		None	S120-FC (Included) S120-FC2, S120-APC2, S120-APC, S120-SM ST, S120-SC, S120-LC, S120-25, and S140- Included)		
Compatible Consoles	PM400, PM100D, PM100A, and PM5020								
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB								

a. For complete specifications, please see the *Specs* tab here.
b. Measured with PM100D console in low bandwidth setting.
c. Beam diameter > 1 mm
d. Uncertainties for S142CL and S145CL are valid at a temperature of 24 °C ± 2 °C.
e. All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals except for the S180C. See the S180C responsivity graph to see the NIST-tra reference points.

Part Number	Description	Price	Availability
S140C	Integrating Sphere Photodiode Power Sensor, Si, 350 - 1100 nm, 1 µW - 500 mW	$875.77	Lead Time
S142C	Integrating Sphere Photodiode Power Sensor, Si, 350 - 1100 nm, 1 µW - 5 W	$1,215.15	Lead Time
S142CL	Customer Inspired! Large Aperture Integrating Sphere Photodiode Power Sensor, Si, 400 - 1100 nm, 10 µW - 5 W	$1,309.68	Lead Time
S144C	Integrating Sphere Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 1 µW - 500 mW	$1,028.31	Lead Time
S145C	Integrating Sphere Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 1 µW - 3 W	$1,262.18	Lead Time
S145CL	Customer Inspired! Large Aperture Integrating Sphere Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 10 µW - 3 W	$1,358.79	In Stock Overseas
S146C	Integrating Sphere Photodiode Power Sensor, InGaAs, 900 - 1650 nm, 10 µW - 20 W	$1,262.18	Lead Time

S148C	Customer Inspired! Integrating Sphere Photodiode Power Sensor, Extended InGaAs, 1200 - 2500 nm, 1 µW - 1 W	$1,056.27	Today
S180C	Integrating Sphere Photodiode Power Sensor, MCT (HgCdTe), 2.9 - 5.5 µm, 1 µW - 3 W	$4,592.40	Today

Hide Fiber Photodiode Power Sensors

Fiber Photodiode Power Sensors

- For Fiber-Based Optical Power Measurements
- Compact Sensor Integrated into the Connector
- Integrated Design for Use in the Field and Lab
- Includes PM20-FC Fiber Adapter
  - S150C and S151C Sensors also Include PM20-SMA Adapters
  - Compatible FC/APC, LC/PC, SC/PC, and ST®* Fiber Adapters Also Available (See Table 619B)
- See the Full Web Presentation for More Information

Click to Enlarge
Figure 619A PM100D with S150C Sensor and FC Cable

The S15xC Compact Fiber Photodiode Power Sensor is designed to take power measurements from a wide variety of fiber coupled sources. The compact sensor, integrated into the power meter connector, features a unique integrated design housing the photodiode sensor, fiber coupling, and NIST-traceable data. Standard FC (and SMA - S150C and S151C) connectors are easily interchanged with a variety of standard fiber connectors.

Thorlabs offers recalibration services for these photodiode power sensors, which can be ordered below (see Item #s CAL-PD or CAL-PDD for Si sensors and Item #s CAL-IRPD or CAL-IRPDD for InGaAs sensors).

*ST® is a registered trademark of Lucent Technologies, Inc.

Table 619B Specifications

Item #[a]	S150C	S151C	S154C	S155C
Sensor Image (Click the Image to Enlarge)				
Included Connectors	FC[b] & SMA		FC[b]	
Wavelength Range	350 - 1100 nm	400 - 1100 nm	800 - 1700 nm	
Power Range	100 pW to 5 mW (-70 dBm to +7 dBm)	1 nW to 20 mW (-60 dBm to +13 dBm)	100 pW to 3 mW (-70 dBm to +5 dBm)	1 nW to 20 mW (-60 dBm to +13 dBm
Detector Type	Si Photodiode		InGaAs Photodiode	
Linearity	±0.5%			
Resolution[c]	10 pW (-80 dBm)	100 pW (-70 dBm)	10 pW (-80 dBm)	100 pW (-70 dBm)
Measurement Uncertainty[d]	±3% (440 - 980 nm) ±5% (350 - 439 nm) ±7% (981 - 1100 nm)	±3% (440 - 980 nm) ±5% (400 - 439 nm) ±7% (981 - 1100 nm)	±5%	
Responsivity[f] (Click for Details)	Raw Data	Raw Data	Raw Data	Raw Data
Coating/Diffuser	N/A	Absorptive ND (Schott NG3)	N/A	
Head Temperature Measurement[e]	NTC Thermistor 3 kΩ			
Aperture Thread	External SM05 (0.535"-40)			
Fiber Adapters	Included: PM20-FC and PM20-SMA Optional: PM20-FC2, PM20-APC2, PM20-APC, PM20-ST, PM20-SC, and PM20-LC		Included: PM20-FC Optional: PM20-FC2, PM20-APC2, PM20-APC, PM20-SMA, PM20-ST, PM20-SC, and PM20-LC	
Compatible Consoles	PM400, PM100D, PM100A, and PM5020			
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103E, PM103U, and PM100USB			

a. For complete specifications, please see the *Specs* tab here.
b. Because of the large active detector area of these sensors, the included PM20-FC fiber adapter can be used with both FC/PC- and FC/APC-terminated fiber.
c. Measured with PM100D console in low bandwidth setting.
d. For a beam diameter > 1 mm incident on the active area of the detector (i.e. at the detector surface after the light has exited the fiber and passed through any internal optics).
e. This specification is valid for devices with serial numbers 1203xxx and higher. For older versions, please contact technical support.
f. All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.

Part Number	Description	Price	Availability
S150C	Compact Fiber Photodiode Power Sensor, Si, 350 - 1100 nm, 100 pW - 5 mW	$381.34	Lead Time
S151C	Compact Fiber Photodiode Power Sensor, Si, 400 - 1100 nm, 1 nW - 20 mW	$434.72	Today
S154C	Compact Fiber Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 100 pW - 3 mW	$547.83	In Stock Overseas
S155C	Compact Fiber Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 1 nW - 20 mW	$627.92	In Stock Overseas

Hide High-Resolution Thermal Power Sensors

High-Resolution Thermal Power Sensors

- High Resolution of 1 µW or 5 µW
- S401C and S405C Have Thermistors Used to Monitor Temperature of Sensor Head
- S401C: Background Compensation for Low-Drift Measurements
- S405C: Accommodates Average Optical Power Densities Up to 1.5 kW/cm^2;
- See the Full Web Presentation for More Information

Thorlabs offers two broadband thermal power sensors designed to measure low optical power sources with high resolution. Each thermal sensor's broadband coating has a flat spectral response over a wide wavelength range, as shown in Figure 624C.

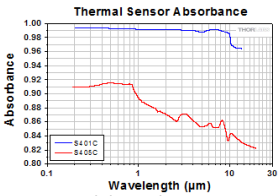
Click to Enlarge
Figure 624B S401C Thermal Sensor with Included Light Shield

An aperture size of Ø10 mm allows for easy alignment and measurement of large-spot-size laser sources. For easy integration with Thorlabs' lens tube systems and SM1-threaded (1.035"-40) fiber adapters, each sensor has either external SM1 threading or includes an externally SM1-threaded adapter.

The S401C uses active thermal background compensation to provide low-drift power measurements. This is implemented through the use of two similar sensor circuits. One sensor circuit is the type all thermal power sensors share: it measures heat flow from light absorber to heat sink. The other sensor circuit monitors the ambient temperature. It is located within the housing and measures heat flow from heat sink towards the absorber. The measurements of the two sensor circuits are subtracted, which minimizes the effect of thermal drift on the laser power measurement. (For information about how the external thermal disturbances can affect thermal power sensor readings, see the *Operation* tab.) The broadband coating used on this thermal sensor offers high absorption at wavelengths between 0.19 and 20 µm (shown in the graph), which makes the sensor ideal for use with aligning and measuring Mid-IR Quantum Cascade Lasers (QCLs). The included, internally SM05-threaded (0.535"-40) light shield is shown in Figure 624B.

The S405C has internal SM05 (0.535"-40) threading that is directly compatible with SM05 lens tubes, and it can also connect directly to Thorlabs' 30 mm Cage Systems.

Thorlabs offers a recalibration service for these sensors, which can be ordered below (see Item # CAL-THPY).



Click to Enlarge
Figure 624C The S405 shares the same absorption curve with the S415C, S425C, and S245C-L. (All are sold below.)

Table 624A Specifications		
Item #[a]	**S401C**	**S405C**
Sensor Image (Click the Image to Enlarge)		
Wavelength Range	190 nm - 20 µm	190 nm - 20 µm
Optical Power Range	10 µW - 1 W (3 W[b])	100 µW - 5 W
Input Aperture Size	Ø10 mm	Ø10 mm
Active Detector Area	10 mm x 10 mm	10 mm x 10 mm
Max Optical Power Density	500 W/cm^2 (Avg.)	1.5 kW/cm^2 (Avg.)
Detector Type	Thermal Surface Absorber (Thermopile) with Background Compensation	Thermal Surface Absorber (Thermopile)
Linearity	±0.5%	±0.5%
Resolution[c]	1 µW	5 µW
Measurement Uncertainty[d]	±3% @ 1064 nm ±5% @ 190 nm - 10.6 µm	±3% @ 1064 nm ±5% @ 250 nm - 17 µm
Response Time[e]	1.1 s	1.1 s
Cooling	Convection (Passive)	
Housing Dimensions (Without Adapter)	33.0 m x 43.0 mm x 15.0 mm (1.30" x 1.69" x 0.59")	40.6 mm x 40.6 mm x 16.0 mm (1.60" x 1.60" x 0.63")
Temperature Sensor (In Sensor Head)	NTC Thermistor	NTC Thermistor
Cable Length	1.5 m	
Post Mounting	Universal 8-32 / M4 Taps (Post Not Included)	Universal 8-32 / M4 Taps (Post Not Included)
30 mm Cage Mounting	-	Two 4-40 Tapped Holes & Two Ø6 mm Through Holes
Aperture Threads	-	Internal SM05
Accessories	Externally SM1-Threaded Adapter Light Shield with Internal SM05 Threading	Externally SM1-Threaded Adapter
Compatible Consoles	PM400, PM100D, PM100A, and PM5020	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB	

a. For complete specifications, please see the *Specs* tab here.
b. For conditions of intermittent use, with a maximum exposure time of 20 minutes for the S401C. The S405C saturates for optical input powers >5 W.
c. Measurement taken with the legacy PM200 console for the S401C and the PM400 console for the S405C. In all cases, the acceleration circuit was switched off. Resolution performance will be similar with our other power meter consoles.
d. Defined as the measurement uncertainty during calibration at the specified wavelengths for a beam diameter > 1 mm. The ±3% specification was determined by laser calibration, and the ±5%specification was determined through spectral calibration, in which values were interpolated using the laser calibration data and the absorption curve for the absorber. Calibration can be performed at 10.6 µm upon request.
e. Typical natural response time (0 - 95%). Our power consoles can provide estimated measurements of optical power on an accelerated time scale (typically <1 s). See the *Operation* tab for additional information.

Part Number	Description	Price	Availability
S401C	**Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 µm, 10 µW - 1 W, Ø10 mm**	**$922.80**	**Lead Time**
S405C	**Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 µm, 100 µW - 5 W, Ø10 mm**	**$877.29**	**Lead Time**

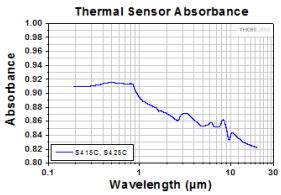
Hide Thermal Sensors for Max Powers of 10 W

- 100 µW Optical Power Resolution
- Thermistors Used to Monitor Temperature of Sensor Head
- Removable Heat Sinks Included
- See the Full Web Presentation for More Information

These thermal power sensors are designed for general broadband power measurements of low and medium power light sources. All include an externally SM1-threaded (1.035"-40) adapter, with threading concentric with the input aperture. The adapters are useful for mounting Ø1" Lens Tubes and Fiber Adapters (available below). The apertures of the S415C and S425C have internal SM1 threading.

These sensors operate with fast (<0.6 s) natural response times, and their removable heat sinks provide a high degree of flexibility to those interested in integrating them into custom setups or replacing the included heat sink with one that is water or fan cooled. If replacing the heat sink, please note that the replacement must provide heat dissipation adequate for the application.

Thorlabs offers a recalibration service for these sensors, which can be ordered below (see Item # CAL-THPY).



Click to Enlarge

Figure 620B The absorption curves of each of the thermal power sensors designed for use with low and medium power optical sources.

Table 620A Specifications		
Item #[a]	**S415C**	**S425C**
Sensor Image (Click Image to Enlarge)		
Wavelength Range	190 nm - 20 µm	190 nm - 20 µm
Optical Power Range	2 mW - 10 W (20 W[b])	2 mW - 10 W (20 W[b])
Input Aperture Size	Ø15 mm	Ø25.4 mm
Active Detector Area	Ø15 mm	Ø27 mm
Max Optical Power Density	1.5 kW/cm^2 (Avg.)	1.5 kW/cm^2 (Avg.)
Detector Type	Thermal Surface Absorber (Thermopile)	
Linearity	±0.5%	±0.5%
Resolution[c]	100 µW	100 µW
Measurement Uncertainty[d]	±3% @ 1064 nm ±5% @ 250 nm - 17 µm	±3% @ 1064 nm ±5% @ 250 nm - 17 µm
Response Time[e]	0.6 s	0.6 s
Cooling	Convection (Passive)	
Housing Dimensions (Without Adapter)	50.8 mm x 50.8 mm x 35.0 mm (2.00" x 2.00" x 1.38")	50.8 mm x 50.8 mm x 35.0 mm (2.00" x 2.00" x 1.38")
Temperature Sensor (In Sensor Head)	NTC Thermistor	
Cable Length	1.5 m	
Post Mounting	Universal 8-32 / M4 Taps (Post Not Included)	Universal 8-32 / M4 Taps (Post Not Included)
30 mm Cage Mounting	-	-
Aperture Threads	Internal SM1	Internal SM1
Removable Heatsink	Yes	Yes
Accessories	Externally SM1-Threaded Adapter	Externally SM1-Threaded Adapter
Compatible Consoles	PM400, PM100D, PM100A, and PM5020	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB	

a. For complete specifications, please see the *Specs* tab here.
b. Two Minute Maximum Exposure Time
c. Measurement taken with the PM400 with the acceleration circuit switched off. Resolution performance will be similar with our other power meter consoles.
d. Defined as the measurement uncertainty during calibration at the specified wavelengths for a beam diameter > 1 mm. The ±3% specification was determined by laser calibration, and the ±5%specification was determined through spectral calibration, in which values were interpolated using the laser calibration data and the absorption curve for the absorber. Calibration can be performed at 10.6 µm upon request.
e. Typical natural response time (0 - 95%). Our power consoles can provide estimated measurements of optical power on an accelerated time scale (typically <1 s). As the natural response times of the S415C and S425C are fast, these do not benefit from accelerated measurements and this function cannot be enabled. See the *Operation* tab for additional information.

Part Number	Description	Price	Availability
S415C	**Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 µm, 2 mW - 10 W, Ø15 mm**	**$904.71**	**Lead Time**
S425C	**Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 µm, 2 mW - 10 W, Ø25.4 mm**	**$986.96**	**Lead Time**

Hide Thermal Sensors for Max Powers from 40 W to 200 W

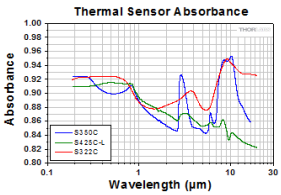
Thermal Sensors for Max Powers from 40 W to 200 W

- Thermistors Used to Monitor Temperature of Sensor Head
- S322C Has 4-40 Taps for Use with Our 30 mm Cage Systems
- S350C Has Ø40 mm Aperture Well Suited to Excimer and Other Lasers with Large Spot Sizes
- S425C-L Features Removable Heat Sink
- S322C is Fan Cooled with an Optical Power Range Up to 200 W
- See the Full Web Presentation for More Information

These thermal power sensors are designed for general broadband power measurements of low and medium power light sources. With the exception of the S350C, all include an adapter with external SM1 (1.035"-40) threading concentric with the input aperture. This allows the sensors to be integrated into existing Ø1" lens tube systems in addition to being compatible with fiber adapters (available below). The aperture of the S425C-L has internal SM1 threading.

The S425C-L operates with a fast (<0.6 s) natural response time and has a removable heat sink, which provides a high degree of flexibility to those interested in integrating them into custom setups or replacing the included heat sink with one that is water or fan cooled. If replacing the heat sink, please note that the replacement must provide heat dissipation adequate for the application.

Thorlabs offers a recalibration service for these sensors, which can be ordered below (see Item # CAL-THPY).



Click to Enlarge

Figure 621A The absorption curves of each of the thermal power sensors designed for use with low and medium power optical sources.

Table 621B Specifications

Item #[a]	S350C	S425C-L	S322C
Sensor Image (Click Image to Enlarge)			
Wavelength Range	190 nm- 1.1 µm, 10.6 µm	190 nm - 20 µm	250 nm - 11 µm
Optical Power Range	10 mW - 40 W (60 W[b])	2 mW - 50 W (75 W[b])	100 mW - 200 W (250 W[b])
Input Aperture Size	Ø40 mm	Ø25.4 mm	Ø25 mm
Active Detector Area	Ø40 mm	Ø27 mm	Ø25 mm
Max Optical Power Density	2 kW/cm^2 (Avg.)	1.5 kW/cm^2 (Avg.)	4 kW/cm^2 (Avg., CO_2)
Detector Type	Thermal Surface Absorber (Thermopile)		
Linearity	±1%	±0.5%	±1%
Resolution[c]	1 mW	100 µW	5 mW
Measurement Uncertainty[d]	±3% @ 1064 nm ±5% @ 190 nm - 1100 nm, 10.6 µm	±3% @ 1064 nm ±5% @ 250 nm - 17 µm	±3% @ 1064 nm ±5% @ 266 nm - 1064 nm
Response Time[e]	9 s (1 s from 0 to 90%)	0.6 s	5 s (1 s from 0 to 90%)
Cooling	Convection (Passive)		Forced Air with Fan[f]
Housing Dimensions (Without Adapter, if Applicable)	100 mm x 100 mm x 54.2 mm (3.94" x 3.94" x 2.13")	100.0 mm x 100.0 mm x 58.0 mm (3.94" x 3.94" x 2.28")	100 mm x 100 mm x 86.7 mm (3.94" x 3.94" x 3.41")
Temperature Sensor (In Sensor Head)	NTC Thermistor		
Cable Length	1.5 m		
Post Mounting	M6 Threaded Taps, Includes Ø1/2" Post, 75 mm Long	Universal 8-32 / M4 Taps (Post Not Included)	M6 Threaded Taps, Includes Ø1/2" Post, 75 mm Long
30 mm Cage Mounting	-	-	Four 4-40 Tapped Holes
Aperture Threads	-	Internal SM1	-
Removable Heatsink	-	Yes	-
Accessories	-	Externally SM1-Threaded Adapter	Externally SM1-Threaded Adapter
Compatible Consoles	PM400, PM100D, PM100A, and PM5020		
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB		

a. For complete specifications, please see the *Specs* tab here.
b. Two Minute Maximum Exposure Time
c. Measurement taken with the PM100D console, except for the S425C-L in which the PM400 was used. In all cases, the acceleration circuit was switched off. Resolution performance will be with our other power meter consoles.
d. Defined as the measurement uncertainty during calibration at the specified wavelengths for a beam diameter > 1 mm. The ±3% specification was determined by laser calibration, and the ± specification was determined through spectral calibration, in which values were interpolated using the laser calibration data and the absorption curve for the absorber. Calibration can be pe at 10.6 µm upon request.
e. Typical natural response time (0 - 95%). Our power consoles can provide estimated measurements of optical power on an accelerated time scale (typically <1 s) for the S350C and S322C natural response time of the S425C-L is fast, the S425C-L does not benefit from acceleration and this function cannot be enabled. See the *Operation* tab for additional information.
f. 12 VDC power supply is included.

Part Number	Description	Price	Availability
S350C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 1.1 µm and 10.6 µm, 10 mW - 40 W, Ø40 mm	$1,365.13	In Stock Overseas
S425C-L	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 µm, 2 mW - 50 W, Ø25.4 mm	$1,069.20	Lead Time
S322C	Thermal Power Sensor Head, Surface Absorber, 0.25 - 11 µm, 100 mW - 200 W, Ø25 mm, Fan Cooled	$1,690.54	Lead Time

Hide Thermal Sensors for High Max Power Density Laser Pulses

Thermal Sensors for High Max Power Density Laser Pulses

- Designed for Optical Power Measurements of Nd:YAG Lasers
- Ideal for Applications with High Peak Pulse Powers
- S370C: Ø25 mm Aperture for Large-Spot-Size Beams
- S470C: High-Sensitivity for High-Peak-Power Pulses with Low Average Power
- See the Full Web Presentation for More Information

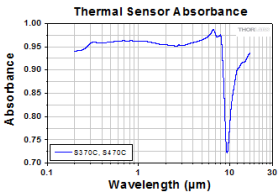
The S370C and S470C Thermal Sensors are designed to measure short and highly energetic laser pulses. All of these units are post-mountable for free-space applications and feature NIST-traceable data stored in the sensor connector.

These thermal power sensors are unique in that they have thermal volume absorbers, where our other thermal power sensors have thermal surface absorbers. The volume absorber consists of a Schott glass filter. Incident pulses are absorbed and the heat is distributed throughout the volume. In this way, pulses that would have damaged the absorption coating of a thermal surface absorber are safely measured by these thermal volume absorbers.

The S370C features a large Ø25 mm aperture ideal for large-spot-size beams, and it is compatible with average powers from 10 mW to 10 W (CW).

In comparison, the S470C is faster, as the glass absorber volume is reduced and other design parameters have been optimized for speed. This results in a different optical power range, with the ability to measure powers down to 100 µW. The Ø15 mm aperture is of the S470C is smaller, and it has a lower max average power of 5 W. Its 10 µW resolution is better than the 250 µW resolution of the S370C.

Thorlabs offers a recalibration service for these sensors, which can be ordered below (see Item # CAL-THPY).



Click to Enlarge

Figure 622B This absorption curve is shown over a broader wavelength range than the sensors' operating ranges. See Table 622A for the operating wavelength range of each sensor.

Table 622A Specifications		
Item #[a]	**S370C**	**S470C**
Sensor Image (Click the Image to Enlarge)		
Wavelength Range	400 nm - 5.2 µm	250 nm - 10.6 µm
Optical Power Range	10 mW - 10 W (15 W[b])	100 µW - 5 W (Pulsed and CW)
Input Aperture Size	Ø25 mm	Ø15 mm
Active Detector Area	Ø25 mm	Ø16 mm
Max Optical Power Density	35 W/cm^2 (Avg.); 100 GW/cm^2 (Peak)	
Detector Type	Thermal Volume Absorber (Thermopile)	
Linearity	±1%	±0.5%
Resolution[c]	250 µW	10 µW
Measurement Uncertainty[d]	±3% @ 1064 nm ±5% @ 400 nm - 1064 nm	±3% @ 1064 nm ±5% @ 250 nm - 10.6 µm
Response Time[e]	45 s (3 s from 0 to 90%)	6.5 s (<2 s from 0 to 90%)
Cooling	Convection (Passive)	
Housing Dimensions (Without Adapter, if Applicable)	75 mm x 75 mm x 51.2 mm (2.95" x 2.95" x 2.02")	45.0 mm x 45.0 mm x 18.0 mm (1.77" x 1.77" x 0.71")
Temperature Sensor (In Sensor Head)	N/A	N/A
Cable Length	1.5 m	
Post Mounting	M6 Threaded Taps, Includes Ø1/2" Post, 75 mm Long	Universal 8-32 / M4 Tap (Post Not Included)
30 mm Cage Mounting	Four 4-40 Tapped Holes	-
Aperture Threads	-	External SM1
Accessories	Externally SM1-Threaded Adapter	-
Compatible Consoles	PM400, PM100D, PM100A, and PM5020	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB	

a. For complete specifications, please see the *Specs* tab here.
b. Two Minute Maximum Exposure Time
c. Measurement taken with the PM100D console for the S370C and with the legacy PM200 for the S470C. In all cases, the acceleration circuit was switched off. Resolution performance will be similar with our other power meter consoles.
d. Defined as the measurement uncertainty during calibration at the specified wavelengths for a beam diameter > 1 mm. The ±3% specification was determined by laser calibration, and the ±5%specification was determined through spectral calibration, in which values were interpolated using the laser calibration data and the absorption curve for the absorber.
e. Calibration can be performed at 10.6 µm upon request.
Typical natural response time (0 - 95%). Our power consoles can provide estimated measurements of optical power on an accelerated time scale (typically <2 s). See the *Operation* tab for additional information.

Part Number	Description	Price	Availability
S370C	Thermal Power Sensor Head, Volume Absorber, 0.4 - 5.2 µm, 10 mW - 10 W, Ø25 mm	$1,417.25	Today
S470C	Thermal Power Sensor Head, Volume Absorber, 0.25 - 10.6 µm, 100 µW - 5 W, Ø15 mm	$1,442.68	Lead Time

Hide Standard Pyroelectric Energy Sensors

Standard Pyroelectric Energy Sensors

- For General Purpose Optical Pulse Measurements
- Black Broadband Coating with Flat Response Over a Wide Wavelength Range
- Ø11 mm, Ø20 mm, or Ø45 mm Sensor Area

Table 623A Specifications			
Item #[a]	**ES111C**	**ES120C**	**ES145C**
Sensor Image (Click the Image to Enlarge)			

- BNC Connector for Oscilloscope Use
- Each Sensor Includes:
  - C-Series Connector Adapter for Use with Compatible Thorlabs' Consoles (See Table 623A or the *Console Selection* Tab)
  - Two Electrically Isolating Post Adapters (One Imperial and One Metric)
- See the Full Web Presentation for More Information

Input Aperture Size	Ø11 mm	Ø20 mm	Ø45 mm
Wavelength Range	0.185 - 25 µm		
Energy Range	10 µJ - 150 mJ	100 µJ - 500 mJ	500 µJ - 2 J
Max Repetition Rate[b]	40 Hz	30 Hz	30 Hz
Max Power Density (Pulse Width)	8 MW/cm^2 (10 ns Pulse)		
Max Pulse Energy Density (Pulse Width)	0.15 J/cm^2 (1 µs Pulse)		
Coating (Click for Plot)	Black Broadband		
Resolution	100 nJ	1 µJ	1 µJ
Linearity	±1%		
Measurement Uncertainty	±5% @ 190 nm - 25 µm	±5% @ 185 nm - 25 µm	±5% @ 185 nm - 25 µm
Housing Dimensions	Ø36 mm x 16 mm	Ø50 mm x 18 mm	Ø75 mm x 21 mm
Active Detector Area	95.0 mm^2	314.2 mm^2	1590.4 mm^2
Cable Length	1.5 m (60")		
Post Mounting	8-32 Mounting Thread, 8-32 and M4 Insulating Adapters Included		
Cage Mounting	N/A	Four 4-40 Threaded Holes for 30 mm Cage Systems	N/A
Compatible Consoles	PM400, PM100D, and PM5020		
Compatible Interfaces	PM103, PM103A, PM103E, PM103U, and PM100USB		

a. For complete specifications, please see the Specs tab here.
b. @ 1 MΩ Load Resistor

The ES1xxC Standard Pyroelectric Sensors are designed to measure pulsed coherent and incoherent sources. Pyroelectric sensors are not suited for CW measurements, as they convert energy from light pulses into voltage pulses. The black broadband coating on these sensors is ideal for low power, wavelength-independent energy measurements due to its flat absorption profile (see Table 623A). Large sensor areas of Ø11 mm, Ø20 mm, or Ø45 mm aid with easy alignment. The sensors can be connected directly to an oscilloscope with a 1 MΩ input resistance via the BNC connector. To accommodate higher repetition rates when connected to an oscilloscope, the load resistance can be reduced. Each energy sensor includes a BNC to C-Series adapter that contains NIST- and PTB-traceable calibration data.

Thorlabs offers a recalibration service for these energy sensors, which can be ordered below (see Item # CAL-THPY).

Part Number	Description	Price	Availability
ES111C	**Pyroelectric Energy Sensor, Black Coating, 0.185 - 25 µm, 150 mJ, Ø11 mm, 40 Hz**	**$1,611.71**	**In Stock Overseas**
ES120C	**Pyroelectric Energy Sensor, Black Coating, 0.185 - 25 µm, 500 mJ, Ø20 mm, 30 Hz**	**$1,677.82**	**In Stock Overseas**
ES145C	**Pyroelectric Energy Sensor, Black Coating, 0.185 - 25 µm, 2 J, Ø45 mm, 30 Hz**	**$1,937.12**	**Today**

Hide High-Energy Pyroelectric Energy Sensors

High-Energy Pyroelectric Energy Sensors

- For High-Energy Optical Pulse Measurements Up to 15 J
- Ceramic Coating with High Damage Threshold for High-Energy-Density (Up to 0.45 J/cm^2) Lasers
- Ø20 mm or Ø45 mm Sensor Area
- BNC Connector for Oscilloscope Use
- Each Sensor Includes:
  - C-Series Connector Adapter for Use with Compatible Thorlabs' Consoles (See Table 744B or the *Console Selection* Tab)
  - Two Electrically Isolating Post Adapters (One Imperial and One Metric)
- See the Full Web Presentation for More Information

Click to Enlarge
Figure 744A ES220C Sensor Mounted in a 30 mm Cage System

The ES2xxC High-Energy Pyroelectric Sensors are designed to measure pulsed coherent and incoherent sources. Pyroelectric sensors are not suited for CW measurements, as they convert energy from light pulses into voltage pulses. A ceramic coating is used for high energy measurements as high as 3 J for the ES220C sensor or 15 J for the ES245C sensor. Large Ø20 mm or Ø45 mm sensor areas aid with easy alignment. The sensors can be connected directly to an oscilloscope with a 1 MΩ input resistance via the BNC connector. To accommodate higher repetition rates when connected to an oscilloscope, the load resistance can be reduced. Each energy sensor also includes a BNC to C-Series adapter that contains NIST- and PTB-traceable calibration data.

Thorlabs offers a recalibration service for these energy sensors, which can be ordered below (see Item # CAL-THPY).

Table 744B Specifications		
Item #[a]	**ES220C**	**ES245C**
Sensor Image (Click the Image to Enlarge)		
Input Aperture Size	Ø20 mm	Ø45 mm
Wavelength Range	0.185 - 25 µm	
Energy Range	500 µJ - 3 J	1 mJ - 15 J
Max Repetition Rate[b]	30 Hz	30 Hz

Max Power Density (Pulse Width)	65 MW/cm^2 (7 ns Pulse @ 355 nm)	
Max Pulse Energy Density (Pulse Width)	0.45 J/cm^2 (7 ns Pulse @ 355 nm)	
Coating (Click for Plot)	Ceramic	
Resolution	25 µJ	50 µJ
Linearity	±1%	
Measurement Uncertainty	±5% @ 0.185 - 25 µm	
Housing Dimensions	Ø50 mm x 18 mm	Ø75 mm x 21 mm
Active Detector Area	314.2 mm^2	1590.4 mm^2
Cable Length	1.5 m (60")	
Post Mounting	8-32 Mounting Thread, 8-32 and M4 Insulating Adapters Included	
Cage Mounting	Four 4-40 Threaded Holes for 30 mm Cage Systems	N/A
Compatible Consoles	PM400, PM100D, and PM5020	
Compatible Interfaces	PM103, PM103A, PM103E, PM103U, and PM100USB	

a. For complete specifications, please see the *Specs* tab here.
b. @ 1 MΩ Load Resistor

Part Number	Description	Price	Availability
ES220C	**Pyroelectric Energy Sensor, Ceramic Coating, 0.185 - 25 µm, 3 J, Ø20 mm, 30 Hz**	**$2,014.66**	**Today**
ES245C	**Pyroelectric Energy Sensor, Ceramic Coating, 0.185 - 25 µm, 15 J, Ø45 mm, 30 Hz**	**$2,340.04**	**Lead Time**

Hide Fast Pyroelectric Energy Sensors

Fast Pyroelectric Energy Sensors

- For Measurements of Repetition Rates up to 10 kHz
- Two Coating Options:
  - Black Broadband Coating with Flat Response from 185 nm to 25 µm
  - Metal Coating for 185 nm to 2.5 µm to Support Detecting Repetition Rates up to 2 kHz*
- Ø8 mm or Ø12 mm Sensor Areas
- BNC Connector for Oscilloscope Use
- Includes C-Series Connector Adapter for Use with Compatible Thorlabs' Consoles (See Table 742A or the *Console Selection* Tab)
- See the Full Web Presentation for More Information

Table 742A Specifications			
Item #[a]	**ES308C**	**ES312C**	**ES412C**
Sensor Image (Click the Image to Enlarge)			
Input Aperture Size	Ø8 mm	Ø12 mm	Ø12 mm
Wavelength Range	0.185 - 25 µm	0.185 - 25 µm	0.185 - 2.5 µm
Energy Range	500 µJ - 1 J	100 µJ - 1 J	50 µJ - 500 mJ
Max. Repetition Rate[b]	1 kHz	250 Hz	2 kHz
Max Power Density (Pulse Width)	8 MW/cm^2 (10 ns Pulse)		5 MW/cm^2 (10 ns Pulse)
Max Pulse Energy Density (Pulse Width)	80 mJ/cm^2 (10 ns Pulse)		50 mJ/cm^2 (10 ns Pulse)
Coating (Click for Plot)	Black Broadband		Metal
Resolution	5 µJ	1 µJ	1 µJ
Linearity	±1%		
Measurement Uncertainty	±5% @ 0.185 - 25 µm		±5% @ 0.185 - 2.5 µm
Housing Dimensions[c]	Ø38 mm x 15 mm	Ø38 mm x 15 mm	Ø38 mm x 15 mm
Active Detector Area	50.3 mm^2	113.1 mm^2	113.1 mm^2
Cable Length	1.5 m (60")		
Post Mounting	8-32 and M4 Combi Mounting Thread		
Aperture Thread	External SM1 (1.035"-40) Thread Thread Depth: 3.0 mm (0.12")		
Compatible Consoles	PM400, PM100D, and PM5020		
Compatible Interfaces	PM103, PM103A, PM103E, PM103U, and PM100USB		

a. For complete specifications, please see the *Specs* tab here.
b. @ 1 MΩ Load Resistor
c. Including SM1 Thread Depth

The ES3xxC and ES412C Fast Pyroelectric Sensors are designed to measure pulsed coherent and incoherent sources with high repetition rates up to 2 kHz. Pyroelectric sensors are not suited for CW measurements, as they convert energy from light pulses into voltage pulses. The ES3xxC sensors have a black broadband that provides a flat response from 185 nm to 25 µm, and, depending on the sensor size, can support measurements of repetition rates up to 1 kHz. The metal-coated ES412C sensor can detect repetition rates up to 2 kHz over a more limited wavelength range of 185 nm to 2.5 µm. Ø8 mm or Ø12 mm sensor areas are available, and each input aperture has external SM1 (1.035"-40) threads for compatibility with our SM1-threaded lens tubes. These energy sensors have BNC connectors for connection to an oscilloscope with a 1 MΩ load input resistance; using these sensors with a different load resistance may lead to reduced speed. A BNC to C-Series adapter containing NIST- and PTB-traceable calibration data is also included with each sensor.

Thorlabs offers a recalibration service for these energy sensors, which can be ordered below (see Item # CAL-THPY).

*To detect repetition rates up to 10 kHz, Thorlabs also offers the ES408C Pyroelectric Sensor, which can be controlled using the PM103 Series Power and Energy Meter Interfaces; as the PM400 console, PM100D console, and PM100USB interface can only support sensors with repetition rates up to 3 kHz, they should not be used with the ES408C sensor.

Part Number	Description	Price	Availability
ES308C	Pyroelectric Energy Sensor, Black Coating, 0.185 - 25 µm, 1 J, Ø8 mm, 1 kHz	$1,489.76	In Stock Overseas
ES312C	Pyroelectric Energy Sensor, Black Coating, 0.185 - 25 µm, 1 J, Ø12 mm, 250 Hz	$1,547.06	Today
ES412C	Pyroelectric Energy Sensor, Metal Coating, 0.185 - 2.5 µm, 500 mJ, Ø12 mm, 2 kHz	$1,604.36	Today

Hide Manufacturer Recalibration Service for Photodiode Power Sensors

Manufacturer Recalibration Service for Photodiode Power Sensors

Thorlabs offers traceable recalibration services for our photodiode optical power sensors. To ensure accurate measurements, we recommend recalibrating the sensors annually. The manufacturer calibration of a power sensor includes recalibration of a single-channel console or interface at no additional cost; this is unavailable for the accredited calibration option. If you wish to calibrate one or more sensors with a dual-channel console, each sensor and console calibration service will need to be purchased individually. For more details on these recalibration services, please click the Documents ( ) icons below.

Refer to Table 236A for the appropriate calibration service Item # that corresponds to your power sensor.

Table 236A Compatibility	
Calibration Service Item #	**Compatible Sensors**
CAL-UVPD	S120VC
CAL-PD	S116C, S120C, S121C, S170C, S140C, S142C, S142CL, S150C, S151C, PM16-120, PM16-121, PM16-140
CAL-UVPD2	S130VC
CAL-PD2	S130C, PM16-130, PM160
CAL-NS	NS170C
CAL-IRPD	S122C, S144C, S145C, S145CL, S146C, S154C, S155C, PM16-122, PM16-144
CAL-IRPD2	S132C
CAL-MIRPD	S148C, S180C

Requesting a Calibration
Thorlabs provides two options for requesting a calibration:

1. Complete the Returns Material Authorization (RMA) form. When completing the RMA form, please enter your name, contact information, the Part #, and the Serial # of each item being returned for calibration; in the *Reason for Return* field, select "I would like an item to be calibrated." In the *Further Details* field, please indicate "Manufacturer Calibration" or the desired calibration part number below in order to differentiate from the ISO 17025 accredited calibration option. Once the form has been submitted, a member of our RMA team will reach out to provide an RMA Number, return instructions, and to verify billing and payment information.

   Submit Calibration Request

2. Select the appropriate sensor calibration Item # below, enter the Part # and Serial # of the sensor that requires recalibration, and then Add to Cart. If you would like a console calibrated with your sensor, repeat this process for Item # CAL-PM1 or CAL-PM2 below, entering the console Item # and Serial #. A member of our RMA team will reach out to coordinate the return of the item(s) for calibration. Note that each console calibration Item # represents the cost of calibrating a console alone; if requesting a single-channel console calibration with a sensor calibration, the appropriate discount will be applied when your request is processed. Should you have other items in your cart, note that the calibration request will be split off from your order for RMA processing.

Please Note: To ensure your item being returned for calibration is routed appropriately once it arrives at our facility, please do not ship it prior to being provided an RMA Number and return instructions by a member of our team.

Part Number	Description	Price	Availability
CAL-UVPD	Manufacturer Recalibration Service for S120VC UV-Extended Silicon Photodiode Power Sensor	$206.73	Lead Time
CAL-PD	Manufacturer Recalibration Service for Single-Power-Range Silicon Photodiode Power Sensors	$179.20	Lead Time
CAL-UVPD2	Manufacturer Recalibration Service for S130VC Extended-UV Silicon Photodiode Power Sensor	$245.50	Lead Time
CAL-PD2	Manufacturer Recalibration Service for Dual-Power-Range Silicon Photodiode Power Sensors	$208.47	Lead Time
CAL-NS	Manufacturer Recalibration Service for Second-Order Nonlinear Crystal with Silicon Photodiode Sensor	$358.45	Lead Time
CAL-IRPD	Manufacturer Recalibration Service for Single-Power-Range Germanium or InGaAs Photodiode Power Sensors	$202.10	Lead Time
CAL-IRPD2	Manufacturer Recalibration Service for Dual-Power-Range Germanium or InGaAs Photodiode Power Sensors	$221.16	Lead Time
CAL-MIRPD	Manufacturer Recalibration Service for Extended InGaAs or MCT Photodiode Power Sensors	$360.99	Lead Time

Hide In-House ISO 17025 Accredited Recalibration Service for Photodiode Power Sensors

In-House ISO 17025 Accredited Recalibration Service for Photodiode Power Sensors

Thorlabs offers ISO 17025 accredited recalibration services for our photodiode optical power sensors. If you wish to calibrate one or more sensors with a console, each sensor and console calibration service will need to be purchased individually. ISO 17025 accredited calibrations are performed in accordance with DIN EN ISO/IEC 17025:2018. Thorlabs GmbH's calibration laboratory is accredited by the German Accreditation Body (DAkkS), the national accreditation authority of the Federal Republic of Germany. The scope of services is described here in English or German. For more details on these recalibration services, please see the *Recalibration* tab or click the Documents ( ) icons below.

Table 791A Compatibility	
Calibration Service Item #	**Compatible Sensors**
CAL-UVPDD	S120VC
CAL-PDD	S116C, S120C, S121C, S170C, S140C, S142C, S142CL, S150C, S151C, PM16-120, PM16-121, PM16-140
CAL-UVPD2D	S130VC
CAL-PD2D	S130C, PM16-130, PM160

Refer to Table 791A for the appropriate calibration service Item # that corresponds to your power sensor.

CAL-IRPDD	S122C, S144C, S145C, S145CL, S146C, S154C, S155C, PM16-122, PM16-144
CAL-IRPD2D	S132C
CAL-MIRPDD	S148C

Requesting a Calibration
Thorlabs provides two options for requesting a calibration:

1. Complete the Returns Material Authorization (RMA) form. When completing the RMA form, please enter your name, contact information, the Part #, and the Serial # of each item being returned for calibration; in the *Reason for Return* field, select "I would like an item to be calibrated." In the *Further Details* field, please indicate "ISO 17025 Accredited Calibration" or the desired calibration part number below in order to differentiate from the manufacturer calibration option. Once the form has been submitted, a member of our RMA team will reach out to provide an RMA Number, return instructions, and to verify billing and payment information.

Submit Calibration Request

2. Select the appropriate sensor calibration Item # below, enter the Part # and Serial # of the sensor that requires recalibration, and then Add to Cart. If you would like a console calibrated with your sensor, repeat this process for Item # CAL-PM1, CAL-PM1D, CAL-PM2, or CAL-PM2D below, entering the console Item # and Serial #. A member of our RMA team will reach out to coordinate the return of the item(s) for calibration. Note that each console calibration Item # represents the cost of calibrating a console alone; if requesting a single-channel console calibration with a sensor calibration, the appropriate discount will be applied when your request is processed. Should you have other items in your cart, note that the calibration request will be split off from your order for RMA processing.

Please Note: To ensure your item being returned for calibration is routed appropriately once it arrives at our facility, please do not ship it prior to being provided an RMA Number and return instructions by a member of our team.

Part Number	Description	Price	Availability
CAL-UVPDD	ISO 17025 Accredited Calibration Service for S120VC UV-Extended Silicon Photodiode Power Sensor	$597.98	Lead Time
CAL-PDD	ISO 17025 Accredited Calibration Service for Single-Power-Range Silicon Photodiode Power Sensors	$518.35	Lead Time
CAL-UVPD2D	ISO 17025 Accredited Calibration Service for S130VC Extended-UV Silicon Photodiode Power Sensor	$710.10	Lead Time
CAL-PD2D	ISO 17025 Accredited Calibration Service for Dual-Power-Range Silicon Photodiode Power Sensors	$531.30	Lead Time
CAL-IRPDD	ISO 17025 Accredited Calibration Service for Single-Power-Range Germanium or InGaAs Photodiode Power Sensors	$584.57	Lead Time
CAL-IRPD2D	ISO 17025 Accredited Calibration Service for Dual-Power-Range Germanium or InGaAs Photodiode Power Sensors	$639.69	Lead Time
CAL-MIRPDD	ISO 17025 Accredited Calibration Service for Extended InGaAs Photodiode Power Sensors	$921.23	Lead Time

Hide Manufacturer Recalibration Service for Thermal Power and Pyroelectric Energy Sensors

Manufacturer Recalibration Service for Thermal Power and Pyroelectric Energy Sensors

Thorlabs offers recalibration services for our Thermal Power and Pyroelectric Energy Sensors. To ensure accurate measurements, we recommend recalibrating the sensors annually. Recalibration of a single-channel power and/or energy meter console or interface is included with the recalibration of a sensor at no additional cost. If you wish to calibrate one or more sensors with a dual-channel console, each sensor and console calibration service will need to be purchased individually.

Please note that the CAL-THPY recalibration service cannot be used for our Thermal Position & Power Sensors; recalibration for these sensors can be requested by contacting Tech Support. Table 317A lists the sensors for which the CAL-THPY recalibration service is available.

Table 317A Compatibility	
Sensor Type	**Sensor Item #s**
Thermal Power	S175C, S302C[a], S305C[a], S310C[a], S314C[a],S322C, S350C, S370C, S401C, S405C, S415C, S425C, S425C-L, S470C, PM160T, PM160T-HP, PM16-401, PM16-405
Pyroelectric Energy	ES111C, ES120C, ES145C, ES220C, ES245C, ES308C, ES312C, ES408C, ES412C

a. This former catalog item is now offered as a special.

Requesting a Calibration
Thorlabs provides two options for requesting a calibration:

1. Complete the Returns Material Authorization (RMA) form. When completing the RMA form, please enter your name, contact information, the Part #s, and the Serial #s of all sensors or consoles being returned for calibration; in the *Reason for Return* field, select "I would like an item to be calibrated." All other fields are optional. Once the form has been submitted, a member of our RMA team will reach out to provide an RMA Number, return instructions, and to verify billing and payment information.

Submit Calibration Request

2. Enter the Part # and Serial # of the item that requires recalibration below and then Add to Cart. If you would like a console calibrated with your sensor, repeat this process for Item # CAL-PM1 or CAL-PM2 below, entering the console Item # and Serial #. A member of our RMA team will reach out to coordinate the return of the item(s) for calibration. Note that each console calibration Item # represents the cost of calibrating a console alone; if requesting a single-channel console calibration with a sensor calibration, the appropriate discount will be applied when your request is processed. Should you have other items in your cart, note that the calibration request will be split off from your order for RMA processing.

Please Note: To ensure your item being returned for calibration is routed appropriately once it arrives at our facility, please do not ship it prior to being provided an RMA Number and return instructions by a member of our team. Pyroelectric energy sensors returned for recalibration or servicing must include the separate BNC to DB9 adapter, which contains the sensor EEPROM.

Part Number	Description	Price	Availability
CAL-THPY	Recalibration Service for Thermal Power and Pyroelectric Energy Sensors at 1064 nm	$227.50	Lead Time

Hide Manufacturer Recalibration of Power & Energy Meter Electronics

Manufacturer Recalibration of Power & Energy Meter Electronics

These traceable recalibration services are for the power and/or energy meter electronics of our consoles and interfaces. To ensure accurate measurements, we recommend recalibrating annually. The manufacturer calibration of a power sensor includes recalibration of a single-channel console or interface at no additional cost; this is unavailable for the accredited calibration option. If you wish to calibrate one or more sensors with a dual-channel console, each sensor and console calibration service will need to be purchased individually. For more details on these recalibration services, please click the Documents ( ) icons below.

Table 719A Compatibility	
Calibration Service Item #	**Compatible Consoles & Interfaces**
Single-Channel	
CAL-PM1	PM100D, PM100A, PM400, PM100USB, PM101 Series, PM102 Series, PM103 Series
Dual-Channel	
CAL-PM2	PM5020, Previous-Generation PM320E

Table 719A lists the power and/or energy meter consoles and interfaces that can be calibrated using the CAL-PM1 and CAL-PM2 recalibration services.

Requesting a Calibration
Thorlabs provides two options for requesting a calibration:

1. Complete the Returns Material Authorization (RMA) form. When completing the RMA form, please enter your name, contact information, the Part #, and the Serial # of each item being returned for calibration; in the *Reason for Return* field, select "I would like an item to be calibrated." In the *Further Details* field, please indicate "Manufacturer Calibration" or the desired calibration part number below in order to differentiate from the ISO 17025 accredited calibration option. Once the form has been submitted, a member of our RMA team will reach out to provide an RMA Number, return instructions, and to verify billing and payment information.

   Submit Calibration Request

2. Select the appropriate Item # below, enter the Part # and Serial # of the item that requires recalibration, and then Add to Cart. If you would like to calibrate one or more sensors with your console, repeat this process for the appropriate sensor recalibration service above, entering the console Item # and Serial #. A member of our RMA team will reach out to coordinate return of the item(s) for calibration. Note that each console calibration Item # represents the cost of calibrating a console alone; if requesting a single-channel console calibration with a sensor calibration, the appropriate discount will be applied when your request is processed. Should you have other items in your cart, note that the calibration request will be split off from your order for RMA processing.

Please Note: To ensure your item being returned for calibration is routed appropriately once it arrives at our facility, please do not ship it prior to being provided an RMA Number and return instructions by a member of our team.

Part Number	Description	Price	Availability
CAL-PM1	**Manufacturer Recalibration of Single-Channel Power and/or Energy Meter Electronics**	**$84.32**	**Lead Time**
CAL-PM2	**Manufacturer Recalibration of Dual-Channel Power and Energy Meter Electronics**	**$224.83**	**Lead Time**

Hide In-House ISO 17025 Accredited Recalibration of Power & Energy Meter Electronics

In-House ISO 17025 Accredited Recalibration of Power & Energy Meter Electronics

These ISO 17025 accredited recalibration services are for the power and/or energy meter electronics of our consoles and interfaces. If you wish to calibrate one or more sensors with a console, each sensor and console calibration service will need to be purchased individually. ISO 17025 accredited calibrations are performed in accordance with DIN EN ISO/IEC 17025:2018. Thorlabs GmbH's calibration laboratory is accredited by the German Accreditation Body (DAkkS), the national accreditation authority of the Federal Republic of Germany. The scope of services is described here in English or German. For more details on these recalibration services, please see the *Recalibration* tab or click the Documents ( ) icons below.

Table 792A Compatibility	
Calibration Service Item #	**Compatible Consoles & Interfaces**
Single-Channel	
CAL-PM1D	PM100D, PM100A, PM400, PM100USB, PM101 Series, PM102 Series, PM103 Series
Dual-Channel	
CAL-PM2D	PM5020

Table 792A lists the power and/or energy meter consoles and interfaces that can be calibrated using the CAL-PM1D and CAL-PM2D recalibration services.

Requesting a Calibration
Thorlabs provides two options for requesting a calibration:

1. Complete the Returns Material Authorization (RMA) form. When completing the RMA form, please enter your name, contact information, the Part #, and the Serial # of each item being returned for calibration; in the *Reason for Return* field, select "I would like an item to be calibrated." In the *Further Details* field, please indicate "ISO 17025 Accredited Calibration" or the desired calibration part number below in order to differentiate from the manufacturer calibration option. Once the form has been submitted, a member of our RMA team will reach out to provide an RMA Number, return instructions, and to verify billing and payment information.

   Submit Calibration Request

2. Select the appropriate Item # below, enter the Part # and Serial # of the item that requires recalibration, and then Add to Cart. If you would like to calibrate one or more sensors with your console, repeat this process for the appropriate sensor recalibration service above, entering the console Item # and Serial #. A member of our RMA team will reach out to coordinate return of the item(s) for calibration. Note that each console calibration Item # represents the cost of calibrating a console alone; if requesting a single-channel console calibration with a sensor calibration, the appropriate discount will be applied when your request is processed. Should you have other items in your cart, note that the calibration request will be split off from your order for RMA processing.

Please Note: To ensure your item being returned for calibration is routed appropriately once it arrives at our facility, please do not ship it prior to being provided an RMA Number and return instructions by a member of our team.

Part Number	Description	Price	Availability
CAL-PM1D	ISO 17025 Accredited Calibration for Single-Channel Power and/or Energy Meter Electronics	$244.22	Lead Time
CAL-PM2D	ISO 17025 Accredited Calibration for Dual-Channel Power and/or Energy Meter Electronics	$545.51	Lead Time