

PM320E - November 18, 2021

Item # PM320E was discontinued on November 18, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

OPTICAL POWER AND ENERGY METER, DUAL-CHANNEL BENCHTOP CONSOLE

- ▶ Power and Energy Measurements for Free Space and Fiber
- ▶ Large 240 x 128 Pixel Graphics Display, USB 2.0 Interface
- ▶ Wide Array of Mathematical Functions
- ▶ Compatible with Over 25 Sensors



PM320E
Benchtop



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

OVERVIEW

Features

- Dual-Channel Power and Energy Meter Benchtop Console
- Over 25 Compatible Sensors
- Large Graphics Display
- Advanced Display and Measurement Features
- Programmable Channels: Monitor, Difference, Ratio, Math Functions, Linear and Log Values, Attenuation
- USB 2.0 Interface and Software Suite
- Continuous and Single-Shot Energy Measurement of Pulsed Laser Sources

Thorlabs' Dual Channel PM320E Power and Energy Meter offers many features not found in handheld devices. It is ideal for precise optical measurements, laser and photodiode characterization, lifecycle measurements and many more applications in the lab and on the manufacturing floor.

The dual-channel design enables differential and ratiometric measurements. Intuitive manual operation with the large graphics display, compatibility with conventional photodiodes, and excellent remote capabilities enable easy system integration.

The PM320E is compatible with all Thorlabs Photodiode Sensors, Thermal Sensors, and Pyroelectric Sensors. It also allows the connection of unamplified anode or cathode grounded photodiodes with up to 10 mA photocurrent, thermal elements with up to 1 V output voltage, and pyroelectric detectors with up to 100 V output voltage.

Additionally the PM320E offers energy measurements with all Thorlabs Pyroelectric Energy Sensors (both channels). More information can be found in the *Sensor Selection* tab. The PM320E is sold as a single benchtop device with the sensors available separately. The compatible sensors are listed below.

Console Design

The calibrated sensors connect via two sub-D connectors on the rear panel, which also provides two analog high bandwidth outputs to allow monitoring of each channel, plus the programmable analog output. Optical sources may be attenuated / gained electronically through the console (Note: Attenuating the source through the console will not attenuate the light at the detector and damage may still occur above the detector threshold power.) Optional user-supplied photodiodes connect via two BNC inputs on the front panel, which feature switchable bandwidth and a programmable bias voltage. The input can be switched between the front and rear connectors. The additional BNC output is gain-and-function programmable. It provides an analog voltage proportional to the output of one of the channels or as a difference or ratio of the two power meter channels. The measurement resolution is 16 bit for all power ranges. The PM320E is controlled locally via the front panel, which features a large 240 x 128 pixel LCD display, or remotely via USB 2.0.

Item #	PM320E
Compatible Sensors	Photodiode, Thermal, and Pyroelectric
Number of Channels	2
Optical Power Range ^a	100 pW to 200 W
Optical Energy Range ^a	10 μJ to 15 J
Available Sensor Wavelength Range ^a	185 nm - 25 μm
Display Refresh Rate	20 Hz
Bandwidth ^a	DC - 100 kHz
Photodiode Sensor Range ^b	100 nA - 10 mA
Thermopile Sensor Range ^b	1 mV - 1 V
Pyroelectric Sensor Range ^b	100 mV - 100 V

a. Sensor Dependent

b. Ranges Selectable in Watts (Photodiode and Thermopile) or Joules (Pyroelectric) and is dependent on the sensor used.

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
Complete Power Meters
Power Meter Bundles
Wireless Power Meters with Sensors
Compact USB Power Meters

In addition to the console, the following comes with each purchase: Software CD ROM, LabVIEW™ and LabWINDOWS™ /CVI Driver Set, Certificate of Calibration, and Operation Manual.

Field Power Meters for Terminated Fibers

USB Interfaces, External Readout

To view the full range of Thorlabs' power and energy meter consoles, please refer to the *Console Selection* tab.

Sensor Upgrade Service

Thorlabs' Sensors and PM320E Console 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 PM320E. Please contact our Tech Support team for details.

Recalibration Service

Thorlabs offers recalibration services for the PM320E console electronics (which can be ordered below using Item # CAL-PM2), our photodiode and thermal power sensors, and our pyroelectric energy sensors. We recommend recalibrating your Thorlabs sensor and console as a pair; however, each may be recalibrated individually. When ordered with a sensor recalibration, the PM320E console recalibration is offered at a discount; please contact Tech Support to request this service.

S P E C S

Item #	PM320E
Display	
Display Type	Graphical LCD 240 x 128 pixels
Display Screens	Numerical, Bargraph, Linegraph, Statistics, Simulated Analog Needle
Viewing Area	3.7" x 2.4"
Refresh Rate	20 Hz
Sensor Interface	
Compatible Sensors	All Photodiodes, Thermopiles, and Pyros See below for full sensor specs
Channels	2
Input Connection	2x DB9, Rear 2x BNC, Front
Trigger Connection	BNC, Rear
Analog Outputs	
Connector	2x BNC, Rear
Signal	Ch1, Ch2 Amplified Input Signal
Voltage Range	0 to ±10 V
Bandwidth	Up to 100 kHz, Dependent on Sensor and Settings
Programmable Analog Output	
Connector	BNC, Rear
Signal	Selectable: Ch1, Ch2, Ch1-Ch2, Ch1/Ch2
Voltage Range	0 to ±10 V
Bandwidth	up to 500 Hz, Dependent on Sensor and Settings
Digital Outputs	
Connector / Interface	USB, Rear / USB 2.0
Power Supply	
Line Voltage	100 / 115 / 230 V (-10%, +10%)
Line Frequency	50 to 60 Hz
Dimensions and Mounting	
Dimensions (L x W x H)	220 mm x 122 mm x 325 mm
Weight	<4 kg
Mounting Options	Benchtop
Operating Temperature	0 to 40 °C
Storage Temperature	-40 to 70 °C

Sensor Compatibility Specs

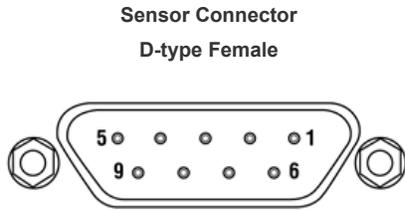
Item #	PM320E		
Detector Compatibility	Photodiode Sensors: S1xxC Series Photodiodes (Max 10 mA) ^a	Thermal Sensors: S3xxC Series Thermopiles (Max 100 mV)	Pyroelectric Sensors: ESxxC Series Pyros (Max 100V)
Input	Ch1, Ch2 / DB9, Rear / BNC, Front	Ch1, Ch2 / DB9, Rear	Ch1, Ch2 / DB9, Rear
Measurement Ranges	6 Decades; 100 nA - 10 mA Ranges Selectable in W, Sensor Dependent	4 Decades; 1 mV - 1 V Ranges Selectable in W, Sensor Dependent	4 Decades; 100 mV - 100 V Ranges Selectable in J, Sensor Dependent
Wavelength Ranges	200 nm - 1800 nm	190 nm - 25 µm	185 nm - 25 µm
Power / Energy Ranges	100 pW - 20 W	100 µW - 200 W	10 µJ - 15 J

Units	W, dBm, W/cm ² , A (Photodiodes only)	W, dBm, W/cm ²	J, J/cm ² , W, W/cm ²
Accuracy	±0.2% of Full Scale (1 µA - 10 mA) ±0.5% of Full Scale (100 nA)	±0.5% of Full Scale	±0.5% of Full Scale
Display Resolution	10 pA / Responsivity Value (A/W)	1 µV / Responsivity Value (V/W)	100 µV / Responsivity Value (V/W)
Bandwidth	DC - 100 kHz, Dependent on Sensor and Settings	DC - 10 Hz, Dependent on Sensor and Settings	3 kHz (Max. Rep. Rate)
Wavelength Correction	Sensor Dependent; nm (A/W)	Sensor Dependent; nm (V/W)	Sensor Dependent; nm (V/J)

- a. Compatible with Anode Grounded and Cathode Grounded photodiodes and bias voltages of 0 to ±10 V.

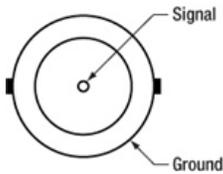
For a full list of the sensor head specifications please visit the Photodiode Power Sensors, Thermal Power Sensors, or Pyroelectric Energy Sensors pages. For other information, please contact Tech Support.

PIN DIAGRAMS

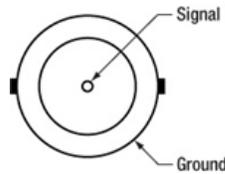


Pin	Connection	Pin	Connection
1	+5 V (Drive Max. 50 mA from this Pin)	5	Pyro-Electric Sensor +
2	EEPROM Digital I/O	6	DGND
3	Photodiode Ground (Anode), Thermal and Pyro Sensor Ground	7	PRESENT Connect this Pin via a 1 - 10 kΩ Resistor to Pin 3 (AGND)
		8	Thermal Sensor +
4	Photodiode Cathode	9	Not Connected

**Photodiode Input
BNC Female**

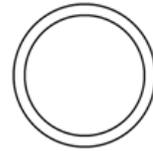


**Analog Output
BNC Female**

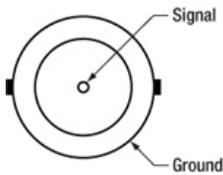


0 ... ± 10 V, Min Load 10 kΩ

**Chassis Ground
4 mm Banana Jack**

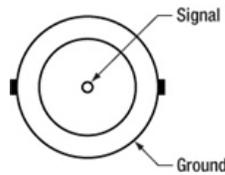


**Trigger Input
BNC Female**



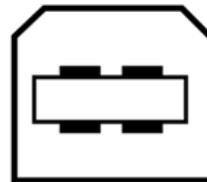
TTL, Max Frequency 1.5 kHz

**Programmable Analog Output
BNC Female**



0 ... ± 10 V, Min Load 10 kΩ

**Computer Connection
USB Type B**



USB Type B to Type A Cable Included

APPLICATIONS

Standard Photodiode Sensor Mounting Options

Thorlabs Standard Photodiode Sensors compact design allows easy integration into existing setups. Typical mounting configurations including post, cage, and lens tube 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 on the right. Adapters for FC/APC, SC, LC, and ST connections are also available.



S120C and S120-FC Fiber Adapter



S120C and S120-SMA Fiber Adapter

Flip up 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 Right Angle Flip-Mounts are shown to the right. Thorlabs also offers the TRB1

Articulating Post Mount. The lockable articulating mount offers almost unlimited positioning of the sensor head. The articulating mount is shown on an S13xC Slim Photodiode Sensor below.



S120C and Flip Mount



S120C and Flip Mount

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

Shown to the right are the KB1P Quick-Release Post Mount and QRC1A Quick-Release 30 mm Cage Mount. Both mounts feature SM1 threaded connections to the sensor heads.



S120C and KB1P Quick-Release Mount



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 mounts are used. See the picture on the right.

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

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



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 to the right is 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.



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 $\varnothing 1/2$ " lens tubes, and other optic-dense free-space arrangements.

Shown to the right is an 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.



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 to the right, 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

The S170C microscope slide power Sensor is designed so that it can be mounted directly in a microscope slide holder. The 76.0 mm x 25.2 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. The photo to the right shows the power sensor flipped over so that the engraved back of the housing can be used for alignment.

This power sensor also has an 8-32 (M4) tap for post mounting. In the photo to the far right, an RA90 is used with two $\varnothing 1/2$ " posts to mount the sensor head in a horizontal orientation.



S170C in a Microscope Slide Holder



S170C Mounted on a Post
The S170C may be post mounted via the 8-32 (M4) 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 to the right is an S140C Integrating Sphere with S120-FC Fiber Adapter. Also shown is an S140C with a S140-BFA Bare Fiber Adapter. The Bare Fiber adapter

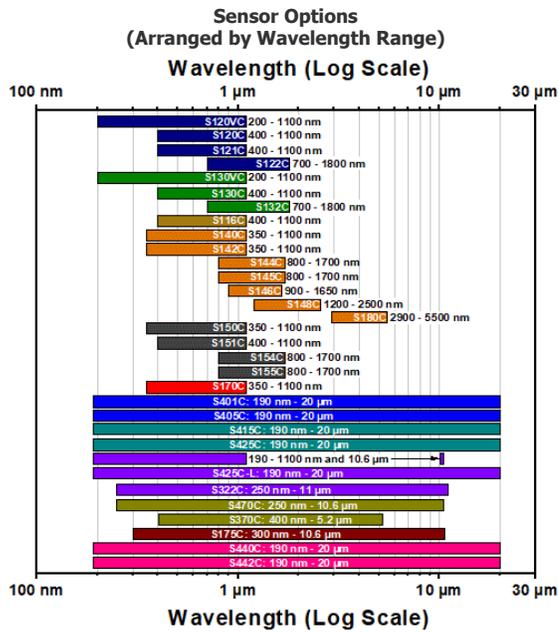
specifications.

Alternatively, the selection guide graphic further below arranges our entire selection of photodiode and thermal power sensors by wavelength (left) or optical power range (right). 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.

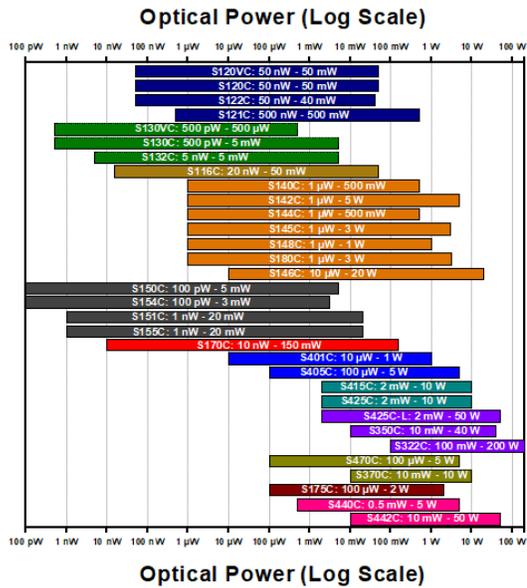
Power	✓	✓	✓	✓	✓	-	✓	✓
Thermal Power	✓	✓	✓	✓	✓	✓	-	✓
Thermal Position	-	-	✓	-	-	✓	-	-
Pyroelectric Energy	-	✓	✓	✓	-	-	✓	✓

Photodiode Power Sensors
Thermal Power Sensors
Thermal Position & Power Sensors
Pyroelectric Energy Sensors

- 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.
- 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 natural 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.
- With intermittent use: maximum exposure time of 20 minutes for the S401C, otherwise maximum exposure time is 2 minutes.
- All pyroelectric sensors have a 20 ms 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 $1/\tau$.



**Sensor Options
(Arranged by Power Range)**



Photodiode Sensors	Thermal Sensors
Standard	High Resolution
Slim	Max Power: 5 W to 10 W
Compact Slim	Max Power: 40 W to 200 W
Integrating Sphere	High Max Power Density
Fiber Coupled	Microscope Slide
Microscope Slide	Position Sensing

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 below 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	PM320E
(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 and Thermal Power; Pyroelectric		
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 29.3 mm)	4.8" x 8.7" x 12.8" (122 mm x 220 mm x 325 mm)

			29.5 mm)	325 mm)
Channels	1			2
External Temperature Sensor Input (Sensor not Included)	-	-	Instantaneous Readout and Record Temperature Over Time	-
External Humidity Sensor Input (Sensor not Included)	-	-	Instantaneous Readout and Record Humidity Over Time	-
GPIO Ports	-	-	4, Programmable	-
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	240 x 128 Pixels Graphical LCD 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)	3.7" x 2.4" (94.0 mm x 61.0 mm)
Refresh Rate	20 Hz		10 Hz (Numerical) 25 Hz (Analog Simulation)	20 Hz
Measurement Views^a				
Numerical	✓	✓	✓	✓
Mechanical Analog Needle	✓	-	-	-
Simulated Analog Needle	-	✓	✓	✓
Bar Graph	-	✓	✓	✓
Trend Graph	-	✓	✓	✓
Histogram	-	✓	-	✓
Statistics	✓	✓	✓	✓
Memory				
Type	-	SD Card	NAND Flash	-
Size	-	2 GB	4 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	Selectable Line Voltage: 100 V, 115 V, 230 V (±10%)

a. These are the measurement views built into the unit. All of our power meter consoles except the PM320E can be controlled using the Optical Power Monitor software package. The PM320E has its own software package.

Interfaces

Item #	PM101	PM102	PM103	PM101A	PM102A	PM103A	PM101R	PM101U	PM102U	PM103U	PM100USB
(Click Photo to Enlarge)											
Operation Protocol	USB, RS232, UART, and Analog			USB and Analog SMA			USB and RS232	USB Operation			USB
Sensor Compatibility											
Photodiode	✓	-	✓	✓	-	✓	✓	✓	-	✓	✓
Thermal Power	✓	✓	-	✓	✓	-	✓	✓	✓	-	✓
Thermal Position & Power	-	✓	-	-	✓	-	-	-	✓	-	-
Pyroelectric	-	-	✓	-	-	✓	-	-	-	✓	✓
Key Features											
C-Series Sensor DE-9 Connector	✓		✓			✓		✓			✓
USB Connector	Lockable			Lockable			Lockable	Lockable			Not Lockable
Serial DE-9 Connector	-			-			✓	-			-
SMA Connector(s)	-			1 Analog Power Output	3 Ports: Power, X-Position, and Y-Position	3 Ports: AO1, AO2, and Digital I/O (Configurable as External Trigger Input)	-	-			-

DA-15 Universal Connector with 2 Auxiliary I/O Ports	✓	✓	GPIO Ports Also Configurable as Trigger Input (Pin 2) or for Pass/Fail Analysis (Pin 3)	-	-	-	-
External Temperature Sensor Input (Sensor Not Included)	NTC Thermistor			-	-	-	-
Display							
Type	No Built-In Display; Controlled via GUI for PC						
Refresh Rate ^a	Up to 1000 Hz	Up to 1000 Hz	Up to 1000 Hz	Up to 1000 Hz	Up to 1000 Hz	Up to 300 Hz	
Measurement Views^b							
Numerical	Requires PC						
Simulated Analog Needle	Requires PC						
Bar Graph	Requires PC						
Trend Graph	Requires PC						
Histogram	Requires PC						
Statistics	Requires PC						
Memory							
Type	Internal Non-Volatile Memory for All Settings	Internal Non-Volatile Memory for All Settings	Internal Non-Volatile Memory for All Settings	Internal Non-Volatile Memory for All Settings	Internal Non-Volatile Memory for All Settings		-
Power							
External	5 VDC via USB or 5 to 36 VDC via DA-15 Pins 1 and 9	5 VDC via USB	5 VDC via USB	5 VDC via USB	5 VDC via USB	5 VDC via USB	5 VDC via USB

a. Dependent on PC Settings

b. 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.

Optical Power and Energy Meter, Dual-Channel Benchtop Console



- ▶ Benchtop, Dual-Channel Power and Energy Meter Console
- ▶ Large LCD Display Screen with Multiple Display Features
- ▶ Programmable Channels with Mathematical Functions
- ▶ Factory Calibrated with Certificate of Calibration

Please note that sensors are not included with the PM320E console. Compatible sensor options are presented below. Thorlabs offers a recalibration service for the PM320E console, which can be ordered below (see Item # CAL-PM2). If you would like to order a sensor recalibration with the PM320E power meter console, the PM320E console recalibration is offered at a discount. Please contact Tech Support for ordering information.

Part Number	Description	Price	Availability
PM320E	Dual-Channel Benchtop Power and Energy Meter Console	\$2,512.67	Lead Time

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 Below)
- ▶ See the Full Web Presentation for More Information



Click to Enlarge
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 a recalibration service for these photodiode power sensors (Item # CAL-UVPD for UV-extended Si sensors, Item # CAL-PD for Si sensors and Item # CAL-IRPD for Ge sensors); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

Item # ^a	S120VC	S120C	S121C	S122C ^h
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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		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 NG9)
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-FC, S120-APC, S120-SMA, S120-ST, S120-LC, and S120-SC (Not Included)			
Compatible Consoles	PM400, PM100D, PM100A, and PM320E			
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, and PM100USB			

- For complete specifications, please see the *Specs* tab here.
- Measured with PM100D console in low bandwidth setting.
- Beam diameter > 1 mm.
- All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.
- 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 tap and M4 adapter. For additional information, please contact technical support.
- 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 8-32 tap and M4 adapter. For additional information, please contact technical support.
- For the S121C, these specifications are valid for devices with serial numbers 1203xxx or higher. Older versions had an absorptive ND diffuser (Schott NG9). Additionally, they came with an 8-32 tap and M4 adapter. For additional information, please contact technical support.
- 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 mW	\$450.16	Today
S120C	Standard Photodiode Power Sensor, Si, 400 - 1100 nm, 50 mW	\$324.64	Today
S121C	Standard Photodiode Power Sensor, Si, 400 - 1100 nm, 500 mW	\$352.78	7-10 Days
S122C	Standard Photodiode Power Sensor, Ge, 700 - 1800 nm, 40 mW	\$648.19	Today

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]
S130C Photodiode Sensor
Mounted in FiberBench
System Using FBSM Mount



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



Click to Enlarge
[APPLIST]
[APPLIST]
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 a recalibration service for these photodiode power sensors (Item # CAL-UVPD2 for UV-extended Si sensors, Item # CAL-PD2 for Si sensors and Item # CAL-IRPD2 for Ge sensors); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

Item # ^a	S130VC	S130C	S132C
Sensor Image (Click the Image to Enlarge)			
Aperture Size	Ø9.5 mm		
Wavelength Range	200 - 1100 nm	400 - 1100 nm	700 - 1800 nm ^b
Power Range (with Filter)	500 pW - 0.5 mW ^c (Up to 50 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-FC, S120-APC, S120-SMA, S120-ST, S120-LC, and S120-SC FBSM: Integrate Sensor into FiberBench Setups		
Compatible Consoles	PM400, PM100D, PM100USB, PM100A, and PM320E		
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, and PM100USB		

- For complete specifications, please see the *Specs* tab here.
- 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 range from 700 nm to 1800 nm to 1200 nm to 1800 nm. For additional information, please contact technical support.
- 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) and a reflective ND diffuser (OD1). For additional information, please contact technical support.
- Measured with PM100D console in low bandwidth setting, without filter.
- Measured with PM100D console in low bandwidth setting at 1550 nm, without filter.
- Beam Diameter > 1 mm.
- All sensor responsivities are calibrated to a NIST-traceable source with measurements taken in 5 nm intervals.
- 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, please contact technical support.

Part Number	Description	Price	Availability
S130VC	Slim Photodiode Power Sensor, UV-Extended Si, 200 - 1100 nm, 50 mW	\$653.60	7-10 Days
S130C	Slim Photodiode Power Sensor, Si, 400 - 1100 nm, 500 mW	\$539.98	Today
S132C	Slim Photodiode Power Sensor, Ge, 700 - 1800 nm, 500 mW	\$767.23	Today
SM1A29	Customer Inspired! SM1 Thread Adapter for Slim Photodiode Sensors	\$44.64	7-10 Days
FBSM	FiberBench Mount for Slim Photodiode Sensors	\$44.36	Today

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

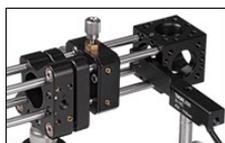
The S116C Compact Slim Photodiode Power Sensor is designed to

Item # ^a	S116C
Sensor Image (Click the Image to Enlarge)	

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 the application photo below, 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 below.

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 a recalibration service for these photodiode power sensors, which can be ordered below (see Item # CAL-PD for Si sensors). The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.



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



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

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% (451 - 1000 nm) ±5% (400 - 450 nm, 1001 - 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 PM320E
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM103, PM103A, PM103U, and PM100USB

- For complete specifications, please see the Specs tab here.
- Measured with PM100D console in low bandwidth setting.
- Beam Diameter > 1 mm.
- 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	NEW! Compact Slim Photodiode Power Sensor, Si, 400 - 1100 nm, 50 mW	\$400.00	Lead Time
SM05A29	NEW! SM05-Threaded Adapter for Compact Slim Photodiode Sensors	\$42.00	Today

Microscope Slide Photodiode Power Sensor

- ▶ Wavelength Range: 350 nm to 1100 nm
- ▶ Sensitive to Optical Powers from 10 nW to 150 mW
- ▶ 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 mm x 5.0 mm
- ▶ Index Matching Gel Utilized in Design to Prevent Internal Reflections
- ▶ Information Stored in Connector
 - Sensor Data
 - NIST- and PTB-Traceable Calibration Data
- ▶ Post Mountable via 8-32 (M4) Tap

The S170C Microscope Slide Power Sensor Head is a silicon photodiode sensor designed to measure the power at the sample in microscopy setups. The silicon photodiode can detect wavelengths between 350 nm and 1100 nm at optical powers between 10 nW and 150 mW. 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 photodiode has an 18 mm x 18 mm active area and is contained in a sealed housing behind a neutral density (ND) filter with OD 1.5. 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.

Item # ^a	S170C
Sensor Image (Click Image to Enlarge)	
Overall Dimensions	76.0 mm x 25.2 mm x 5.0 mm (2.99" x 0.99" x 0.20")
Active Detector Area	18 mm x 18 mm
Input Aperture	20 mm x 20 mm
Wavelength Range	350 - 1100 nm
Optical Power Working Range	10 nW - 150 mW
Detector Type	Silicon Photodiode
Linearity	±0.5%
Resolution ^b	1 nW
Calibration Uncertainty ^c	±3% (440 - 980 nm) ±5% (350 - 439 nm) ±7% (981 - 1100 nm)
Responsivity ^d (Click for Plot)	 Raw Data
Neutral Density Filter	Reflective (OD 1.5)
Cable Length	1.5 m

The bottom of the 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.

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-PD recalibration service; recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

Thorlabs also offers a Microscope Slide Sensor Head with a thermal sensor; for complete specifications, the full presentation can be found here.

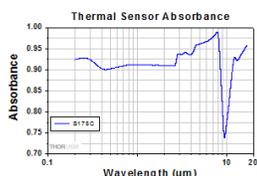
Post Mounting	Universal 8-32 / M4 Tap, Post Not Included
Compatible Consoles	PM400, PM100D, PM100A, and PM320E
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, and PM100USB

- For complete specifications, please see the *Specs* tab here.
- Measured with PM100D console in low bandwidth setting.
- Beam diameter > 1 mm.
- All sensor responsivities are 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, 150 mW	\$1,206.56	Today

Microscope Slide Thermal Power Sensor

- ▶ Wavelength Range:
300 nm - 10.6 μ m
- ▶ Sensitive to Optical Powers from 100 μ W 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



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.



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 μ m at optical powers between 100 μ W 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 the image to the right, 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; recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering 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.

Item # ^a	S175C
Sensor Image (Click Image to Enlarge)	
Active Detector Area	18 mm x 18 mm
Wavelength Range	0.3 - 10.6 μ m
Power Range	100 μ W - 2 W
Detector Type	Thermal Surface Absorber (Thermopile)
Linearity	$\pm 0.5\%$
Resolution^b	10 μ W
Measurement Uncertainty^c	$\pm 3\%$ @ 1064 nm; $\pm 5\%$ @ 300 nm - 10.6 μ m
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 PM320E
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U, and PM100USB

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

Part Number	Description	Price	Availability
S175C	Customer Inspired! Microscope Slide Thermal Power Sensor, 300 nm - 10.6 μ m, 2 W	\$1,206.56	Today

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, or Ø12 mm Input Aperture
- ▶ Removable S120-FC Fiber Adapter (FC/PC and FC/APC) Included
- ▶ Compatible Fiber Adapters for Terminated and Bare Fiber (See Table Below)
- ▶ See the Full Web Presentation for More Information



Click to Enlarge
S142C with the S120-FC Fiber Adapter (Included)



Click to Enlarge
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.

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 below feature large Ø5 mm, Ø7 mm, or Ø12 mm apertures, externally SM1-threaded (1.035"-40) front connections, enhanced shielding against electromagnetic interference, and an over-temperature alert sensor. 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. NIST-traceable data is stored in the sensor connector.

Thorlabs offers a recalibration service for these photodiode power sensors (Item # CAL-PD for Si sensors, Item # CAL-IRPD for InGaAs sensors, and Item # CAL-MIRPD for extended InGaAs or MCT sensors); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

Item # ^a	S140C	S142C	S144C	S145C	S146C	S148C	S180C	
Sensor Image (Click the Image to Enlarge)								
Aperture	Ø5 mm	Ø12 mm	Ø5 mm	Ø12 mm		Ø5 mm	Ø7 mm	
Wavelength Range	350 - 1100 nm		800 - 1700 nm		900 - 1650 nm	1200 - 2500 nm	2.9 µm - 5.5 µm	
Power Range	1 µW - 500 mW	1 µW - 5 W	1 µW - 500 mW	1 µW - 3 W	10 µW - 20 W	1 µW - 1 W	1 µW - 3 W	
Detector Type	Si Photodiode		InGaAs Photodiode			Extended InGaAs Photodiode	MCT (HgCdTe) Photodiode	
Linearity	±0.5%							
Resolution ^b	1 nW							
Measurement Uncertainty ^c	±3% (440 - 980 nm) ±5% (350 - 439 nm) ±7% (981 - 1100 nm)		±5%					
Responsivity ^d (Click for Plot)								
Integrating Sphere Material (Size)	Zenith® PTFE (Ø1")	Zenith® PTFE (Ø2")	Zenith® PTFE (Ø1")	Zenith® PTFE (Ø2")		Zenith® PTFE (Ø1")	Gold Plating (Two Ø20 mm Spheres)	
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	59.0 mm x 50.0 mm x 28.5 mm	
Cable Length	1.5 m							
Post Mounting	8-32 and M4 Taps							
Aperture Thread	Included Adapter with SM1 (1.035"-40) External Thread							
Compatible Fiber Adapters	S120-FC (Included) S120-APC, S120-SMA, S120-ST, S120-SC, S120-LC, and S140-BFA Bare Fiber Adapter (Not Included)							
Compatible Consoles	PM400, PM100D, PM100A, and PM320E							
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, and PM100USB							

- For complete specifications, please see the Specs tab here.
- Measured with PM100D console in low bandwidth setting.
- Beam diameter > 1 mm
- 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-traceable reference points.

Part Number	Description	Price	Availability
S140C	Integrating Sphere Photodiode Power Sensor, Si, 350 - 1100 nm, 500 mW	\$745.58	7-10 Days
S142C	Integrating Sphere Photodiode Power Sensor, Si, 350 - 1100 nm, 5 W	\$1,034.50	7-10 Days

S144C	Integrating Sphere Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 500 mW	\$875.44	7-10 Days
S145C	Integrating Sphere Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 3 W	\$1,074.55	7-10 Days
S146C	Integrating Sphere Photodiode Power Sensor, InGaAs, 900 - 1650 nm, 20 W	\$1,074.55	7-10 Days
S148C	Customer Inspired! Integrating Sphere Photodiode Power Sensor, Extended InGaAs, 1200 - 2500 nm, 1 W	\$899.24	Lead Time
S180C	Integrating Sphere Photodiode Power Sensor, MCT (HgCdTe), 2.9 - 5.5 μ m, 3 W	\$3,909.69	Today

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 Below)
- ▶ See the Full Web Presentation for More Information



Click to Enlarge
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 a recalibration service for these photodiode power sensors (Item # CAL-PD for Si sensors and Item # CAL-IRPD for InGaAs sensors); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

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)				
Coating/Diffuser	N/A	Absorptive ND (Schott NG3)	N/A	
Head Temperature Measurement ^e	NTC Thermistor 3 k Ω			
Aperture Thread	External SM05 (0.535"-40)			
Fiber Adapters	Included: PM20-FC and PM20-SMA Optional: PM20-APC, PM20-LC, PM20-SC, and PM20-ST		Included: PM20-FC Optional: PM20-APC, PM20-LC, PM20-SC, PM20-ST, and PM20-SMA	
Compatible Consoles	PM400, PM100D, PM100A, and PM320E			
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, 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, 5 mW	\$324.64	Today
S151C	Compact Fiber Photodiode Power Sensor, Si, 400 - 1100 nm, 20 mW	\$370.09	Today
S154C	Compact Fiber Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 3 mW	\$466.39	7-10 Days
S155C	Compact Fiber Photodiode Power Sensor, InGaAs, 800 - 1700 nm, 20 mW	\$534.57	Today

High-Resolution Thermal Power Sensors

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 mm 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 PM320E	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U and PM100USB	

- For complete specifications, please see the *Specs* tab here.
- 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.
- 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.
- 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.
- 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.

- ▶ 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/cm²
- ▶ 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 the plot below.



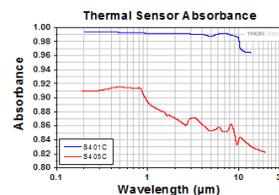
Click to Enlarge S401C Thermal Sensor with Included Light Shield

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 the photo to the right.

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 (Item # CAL-THPY); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.



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

below.)

Part Number	Description	Price	Availability
S401C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 μm , 1 W, \varnothing 10 mm	\$785.62	7-10 Days
S405C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 μm , 5 W, \varnothing 10 mm	\$746.87	Lead Time

Thermal Sensors for Max Powers of 10 W

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	\varnothing 15 mm	\varnothing 25.4 mm
Active Detector Area	\varnothing 15 mm	\varnothing 27 mm
Max Optical Power Density	1.5 kW/cm ² (Avg.)	1.5 kW/cm ² (Avg.)
Detector Type	Thermal Surface Absorber (Thermopile)	
Linearity	\pm 0.5%	\pm 0.5%
Resolution ^c	100 μW	100 μW
Measurement Uncertainty ^d	\pm 3% @ 1064 nm \pm 5% @ 250 nm - 17 μm	\pm 3% @ 1064 nm \pm 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 PM320E	
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U and PM100USB	

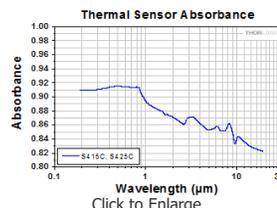
- ▶ 100 μW Optical Power Resolution
- ▶ Thermistors Used to Monitor Temperature of Sensor Head
- ▶ Removable Heat Sinks Included
- ▶ See the Full Web Presentation for More Information

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 \varnothing 1" 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 (Item # CAL-THPY); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

- 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 \pm 3% specification was determined by laser calibration, and the \pm 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.



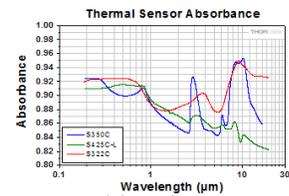
Click to Enlarge
The absorption curves of each of the thermal power sensors designed for use with low and medium power optical sources.

Part Number	Description	Price	Availability
S415C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 μm , 10 W, \varnothing 15 mm	\$770.21	Today
S425C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 μm , 10 W, \varnothing 25.4 mm	\$840.23	Today

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 \varnothing 40 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 \varnothing 1" lens tube systems in addition to being compatible with fiber adapters (available below). The aperture of the S425C-L has internal SM1 threading.



Click to Enlarge
The absorption curves of each of the thermal power sensors designed for use with low and medium power optical sources.

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 (Item # CAL-THPY); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

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	\varnothing 40 mm	\varnothing 25.4 mm	\varnothing 25 mm
Active Detector Area	\varnothing 40 mm	\varnothing 27 mm	\varnothing 25 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	\pm 1%	\pm 0.5%	\pm 1%
Resolution ^c	1 mW	100 μW	5 mW
Measurement Uncertainty ^d	\pm 3% @ 351 nm \pm 5% @ 190 nm - 1100 nm	\pm 3% @ 1064 nm \pm 5% @ 250 nm - 17 μm	\pm 3% @ 1064 nm \pm 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 \varnothing 1/2" Post, 75 mm Long	Universal 8-32 / M4 Taps (Post Not Included)	M6 Threaded Taps, Includes \varnothing 1/2" 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 PM320E		
Compatible Interfaces	PM101, PM101A, PM101R, PM101U, PM102, PM102A, PM102U and PM100USB		

- For complete specifications, please see the *Specs* tab here.
- Two Minute Maximum Exposure Time
- 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 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 $\pm 3\%$ specification was determined by laser calibration, and the $\pm 5\%$ 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) for the S350C and S322C. As the 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
S322C	Thermal Power Sensor Head, Surface Absorber, 0.25 - 11 μm , 200 W, $\varnothing 25$ mm, Fan Cooled	\$1,439.22	Today
S350C	Thermal Power Sensor Head, Surface Absorber, 0.19 - 1.1 μm and 10.6 μm , 40 W, $\varnothing 40$ mm	\$1,162.19	Today
S425C-L	Thermal Power Sensor Head, Surface Absorber, 0.19 - 20 μm , 50 W, $\varnothing 25.4$ mm	\$910.25	Today

Thermal Sensors for High Max Power Density Laser Pulses

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	$\varnothing 25$ mm	$\varnothing 15$ mm
Active Detector Area	$\varnothing 25$ mm	$\varnothing 16$ mm
Max Optical Power Density	35 W/cm ² (Avg.); 100 GW/cm ² (Peak)	
Detector Type	Thermal Volume Absorber (Thermopile)	
Linearity	$\pm 1\%$	$\pm 0.5\%$
Resolution ^c	250 μW	10 μW
Measurement Uncertainty ^d	$\pm 3\%$ @ 1064 nm $\pm 5\%$ @ 400 nm - 1064 nm	$\pm 3\%$ @ 1064 nm $\pm 5\%$ @ 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 $\varnothing 1/2$ " 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 PM320E	
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 $\pm 3\%$ specification was determined by laser calibration, and the $\pm 5\%$ 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 <2 s). See the *Operation* tab for additional information.

- ▶ Designed for Optical Power Measurements of Nd:YAG Lasers
- ▶ Ideal for Applications with High Peak Pulse Powers
- ▶ S370C: $\varnothing 25$ 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

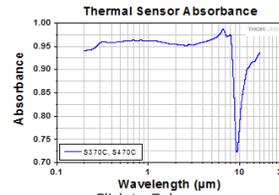
The S370C and S470C Thermal Sensors are designed to measure short and highly energetic laser pulses. All of these units are post-mountable for free-space applications and feature NIST-traceable data stored in the sensor connector.

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 $\varnothing 25$ 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 $\varnothing 15$ 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 (Item # CAL-THPY); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.



Click to Enlarge
 This absorption curve is shown over a broader wavelength range than the sensors' operating ranges. See the table for the operating wavelength range of each sensor.

Part Number	Description	Price	Availability
S370C	Thermal Power Sensor Head, Volume Absorber, 0.4 - 5.2 µm, 10 W, Ø25 mm	\$1,206.56	Today
S470C	Thermal Power Sensor Head, Volume Absorber, 0.25 - 10.6 µm, 0.1mW - 5W, Ø15 mm	\$1,228.20	Today

Pyroelectric Energy Sensors

- ▶ For General Purpose and High Energy Optical Pulse Measurements
- ▶ Black Broadband Coating with Flat Response Over a Wide Wavelength Range
- ▶ Ceramic Coating with High Damage Thresholds for High-Energy-Density Lasers
- ▶ Sensor Areas from Ø11 mm to Ø45 mm
- ▶ BNC Connector for Oscilloscope Use
- ▶ C-Series Connector Adapter for Use with Compatible Thorlabs Consoles and Interfaces (See Table Below)
- ▶ See the Full Web Presentation for More Information



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

These 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 black broadband or ceramic coating is used for low or high power measurements, respectively. Large sensor areas from

Ø11 mm - Ø45 mm allow easy alignment. The energy sensors features BNC connectors for use with an oscilloscope, as well as standard power meter connectors which contain NIST and PTB-traceable calibration data.

These sensors are not compatible with the PM100A Analog Power Meter Console or the PM101 Series Power Meter Interfaces.

Thorlabs offers a recalibration service for these energy sensors (Item # CAL-THPY); recalibration of one single-channel console is included with the recalibration of a sensor at no additional cost. The PM320E dual-channel console recalibration is offered at a discount when ordered with a sensor recalibration; please contact Tech Support for ordering information.

Item # ^a	ES111C	ES120C	ES145C	ES220C	ES245C
Sensor Image (Click the Image to Enlarge)					
Aperture Size	Ø11 mm	Ø20 mm	Ø45 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	500 µJ - 3 J	1 mJ - 15 J
Detector Type	Pyroelectric Energy Sensor with Black Broadband Coating			Pyroelectric Energy Sensor with Ceramic Coating	
Resolution	100 nJ	1 µJ	1 µJ	25 µJ	50 µJ
Linearity	±1%				
Measurement Uncertainty	±5% @ 0.185 - 25 µm				
Housing Dimensions	Ø36 mm x 16 mm	Ø50 mm x 18 mm	Ø75 mm x 21 mm	Ø50 mm x 18 mm	Ø75 mm x 21 mm
Cable Length	1.5 m				
Post Mounting	8-32 Mounting Thread, 8-32 and M4 Insulating Adapters Included				
Cage Mounting	N/A	Four 4-40 Taps for 30 mm Cage Systems	N/A	Four 4-40 Taps for 30 mm Cage Systems	N/A
Compatible Consoles	PM400, PM100D, and PM320E				
Compatible Interfaces	PM100USB				

a. For complete specifications, please see the [Specs](#) tab here.

Part Number	Description	Price	Availability

ES111C	Pyroelectric Energy Sensor, Broadband Coating, 0.185 - 25 μm , 150 mJ	\$1,372.12	Today
ES120C	Pyroelectric Energy Sensor, Broadband Coating, 0.185 - 25 μm , 500 mJ	\$1,428.39	Today
ES145C	Pyroelectric Energy Sensor, Broadband Coating, 0.185 - 25 μm , 2 J	\$1,649.14	Today
ES220C	Pyroelectric Energy Sensor, Ceramic Coating, 0.185 - 25 μm , 3 J	\$1,715.16	Today
ES245C	Pyroelectric Energy Sensor, Ceramic Coating, 0.185 - 25 μm , 15 J	\$1,992.17	Today

Recalibration Service for PM320E

This recalibration service is for the electronics of our PM320E dual-channel power and energy meter console. Alternatively, the PM320E console recalibration can be ordered with a sensor recalibration service by contacting Tech Support; when ordered together, the PM320E recalibration service is offered at a discount. To ensure accurate measurements, we recommend recalibrating annually.

To order the CAL-PM2 recalibration service, enter the Part # and Serial # of the console that requires recalibration prior to selecting Add to Cart.

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-PM2	Recalibration of Dual-Channel Power and Energy Meter Electronics	\$191.40	Lead Time

