THORLABS

**USB and Bluetooth
Optical Power Meter**

PM160, PM160T
User Manual

2016

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Contents

THORLABS

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

Thorlabs GmbH

Warning

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

Attention

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

Note

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

Please read these advices carefully!

1 General Information

The PM160 Hand-held Bluetooth and USB Optical Power Meter is designed to measure the optical power of laser light or other monochromatic or near monochromatic light sources. The PM160T is capable to measure power of any light source due to it's thermal sensor's flat absorption curve and for this reason well suited e.g. for LED, SLED and MidIR QCL.

The space-saving, battery powered design opens a wide range of applications in Manufacturing, Quality Control, Quality Assurance, and R&D for stationary and field use.

The provided software, including drivers and applications for LabVIEW and C makes it easy to integrate the instrument in test and measurement systems.

The unit can be recharged via USB connection to a PC or laptop.

1.1 Safety

Attention

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

All modules must only be operated with proper shielded connection cables.

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

This precision device is only serviceable if properly packed into the <u>complete</u> original packaging including the plastic foam sleeves. If necessary, ask for a replacement package.

The power meter PM160(T) must not be operated in explosion endangered environments!

Control inputs / outputs must be connected with duly shielded connection cables.

Do not remove covers!

Refer servicing to qualified personal!

Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.
This product has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 meters (9.8 feet).

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

Note

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

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

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

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

1.2 Ordering Codes and Accessories

PM160(T)   Hand-held Power Meter

Fiber adapters:

Fiber Connector	Adapter Cap with internal SM05 thread	Adapter Cap with internal SM1 thread
FC	PM20-FC	S120-FC
SC	PM20-SC	S120-SC
LC	PM20-LC	S120-LC
SMA	PM20-SMA	S120-SMA
ST	PM20-ST	S120-ST

Please visit our homepage http://www.thorlabs.com for various accessories like fiber adapters, posts and post-holders, data sheets and further information.

2 Parts List

Inspect the shipping container for damage.

If the shipping container seems to be damaged, keep it until you have inspected the contents and you have inspected the PM160(T) mechanically and electrically.

Verify that you have received the following items within the package:

1. PM160(T) Wireless Handheld Power Meter
2. USB cable, type 'A' to 'micro USB'
3. SM05 Adapter (PM160) / SM1 Adapter (PM160T)
4. Quick-start guide
5. USB memory stick with instrument drivers, user application and operation manual
6. Certificate of Calibration

3   Operating Instruction

- The PM160(T) can be operated as a stand-alone device or remotely, via USB or wireless (Bluetooth). Please note that the internal battery is charged only when the device is connected to USB.
- Prior to connect the PM160(T) to a PC, the application software must be installed; if a wireless operation is desired, a Bluetooth connection must be established on the host system. Please see section Software Installation for details.

3.1   Operating Elements
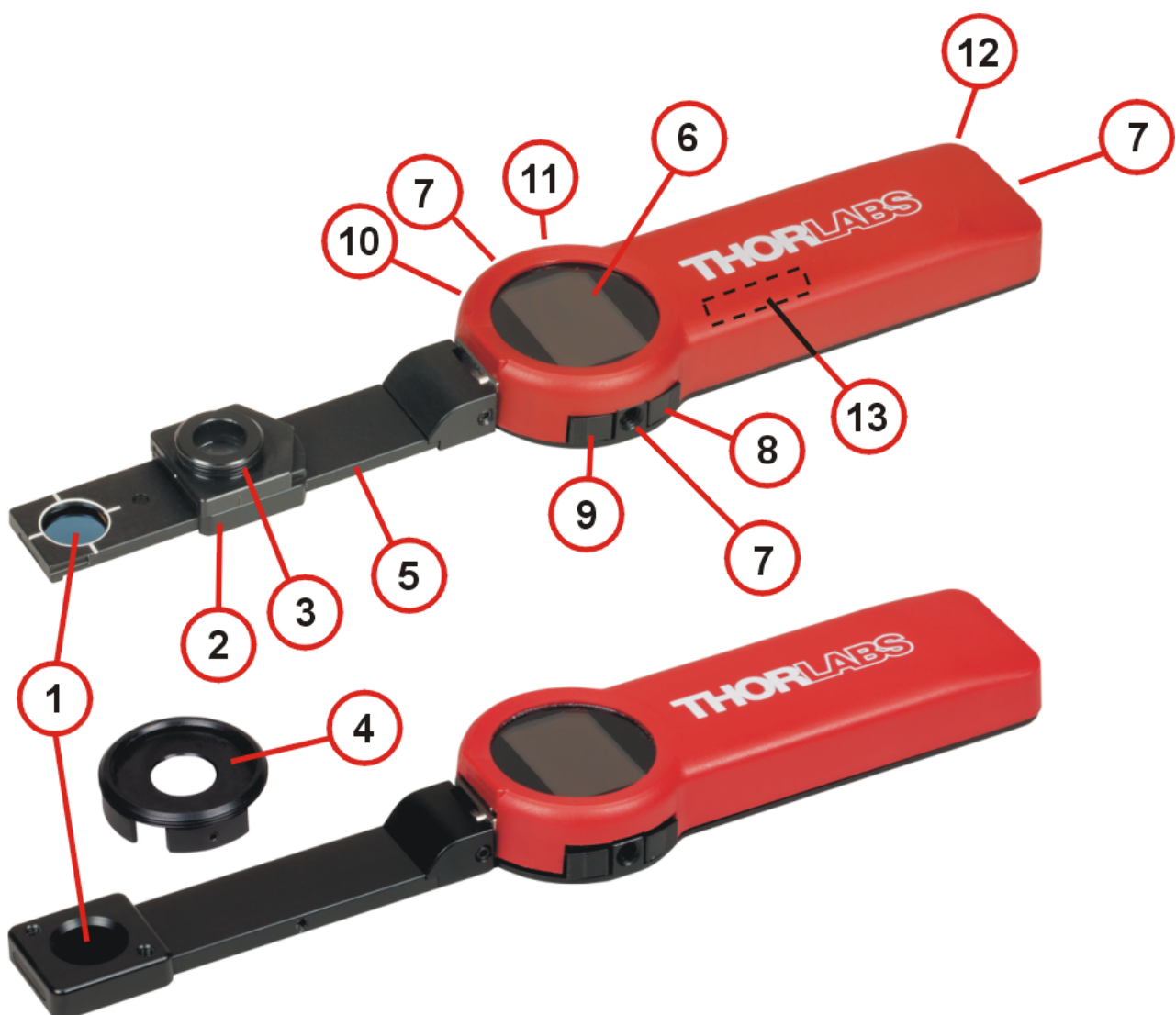
PM160 (above) and PM160T (bottom) Front View
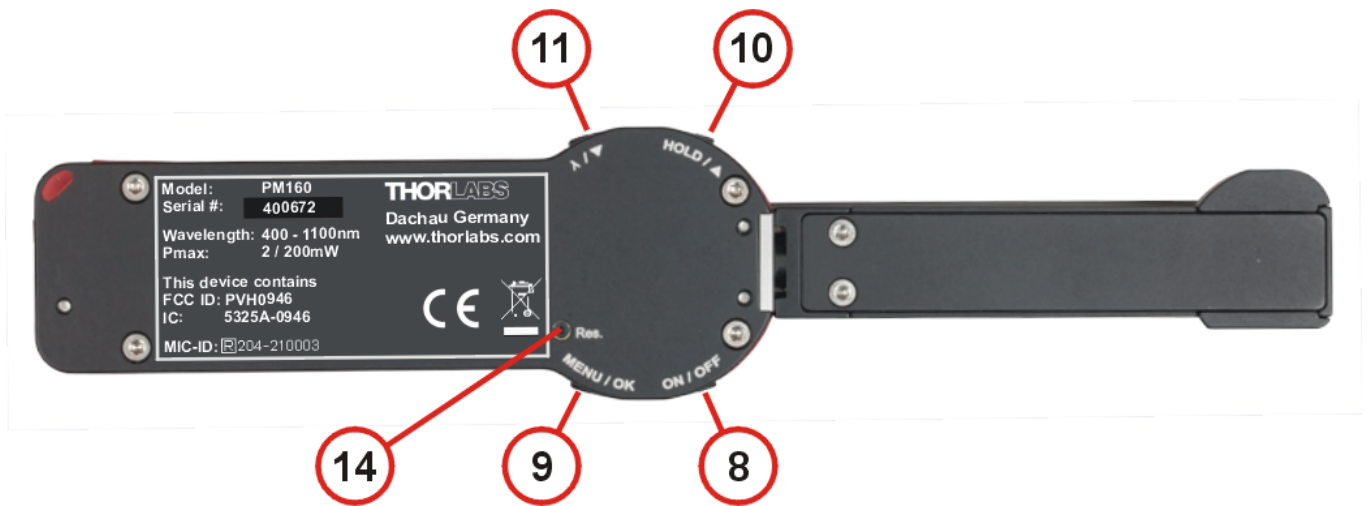
PM160(T) Rear View

1	Sensor aperture
2	Slideable optical filter
3	SM05 adapter (PM160)
4	SM1 adapter (PM160T)
5	270° rotatable arm with build-in sensor (PM160: and optical filter)
6	OLED display
7	Combined #8-32 / M4 threads for mounting (3 places)
8 to 11	Push buttons for local control
12	USB connector
13	Integrated bluetooth antenna
14	RESET button

The position of the slideable optical filter (PM160; 2) is detected in order to correct the power read-out accordingly.

The push buttons (8) to (11) are soft keys, their function is shown in the display. The functions as stated on the rear panel are the defaults when the PM160(T) is switched off.

The SM05 (PM160) / SM1 (PM160T) adapter can accommodate a Thorlabs fiber adapter.

3.2 Operating the PM160(T)

The PM160(T) can be operated as a stand-alone device or remotely, via USB or wireless (Bluetooth).

 Note

In any operating mode, the internal battery can be charged by connecting the PM160(T) to a PC or to USB charger using the attached USB cable.

3.2.1 Local Operation

Push the "ON/OFF" button (8) to switch on the PM160(T). A start-up screen is displayed for a moment

then the standard measurement display comes up, indicating the measured optical power and wavelength:

Additionally, in the header the connection type (USB or Bluetooth) and the battery status are shown.

Note

1. When in local operation mode the PM160(T) is connected to a USB terminal, it switches on automatically and starts to charge the battery.
2. Auto shut down: In local mode 20 sec after a button was pressed. If the PM160(T) is charging via a USB cable in local mode, it falls to stand-by (display switches off) after 20 sec.

To set the correct wavelength, push the "Wave" button.

Using the up ▲ or down ▼ buttons to adjust the wavelength of the incident light. Confirm the entry by pressing OK button or cancel the entry by pressing the ⊠ escape button.

Max-Hold function: As long as the button Hold is pressed, the PM160(T) detects the maximum power. After the button is released, the MAX power is displayed together with the "delta", the difference between the actual and MAX value.

Push the Run button to return to the normal measurement mode.

Menues

Menu Push this button to scroll through the menu screens. Each time this button is pressed, the next menu item appears. Return to the measurement screen by pressing the ⊠ ESC button.

Menu "Zero Adjust"

This function is used to compensate the photo diode's dark current (PM160) or the thermal sensor's offset voltage (PM160T). Cover the sensor aperture and push the Run button.
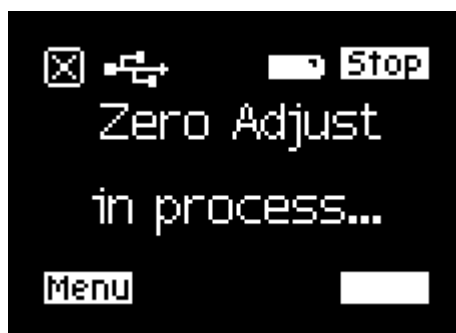
If the zeroing was carried out successful, the PM160(T) returns to normal operation, else the error screen appears:

Menu "Interface"

To operate the PM160(T) remotely (see sections "Operation via USB" and/or "Operation via Bluetooth"), the appropriate interface needs to be selected. Push the menu button until the "Interface" menu appears. Use the up ▲ or down ▼ buttons to select Bluetooth or USB interface or to disable the interface ("Local Only"). Push OK to confirm or ⊠ to cancel.

Menu "Orientation"

The display can be rotated in 90° steps for convenient reading. Use the up ▲ or down ▼ buttons to select the desired orientation, shown by the smiley, then press OK to confirm or ⊠ to cancel:

Note

The control buttons are soft keys. When changing the display orientation, the soft keys, including the switch off button, rotate with the display orientation. Switch the PM160(T) on again by pressing button (8).

Menu "Brightness"

Using the up ▲ or down ▼ buttons, the display brightness can be adjusted. When pressing any button, the brightness will be set to max. for 7 sec.

The value "Min." is the minimum readable brightness in local mode.
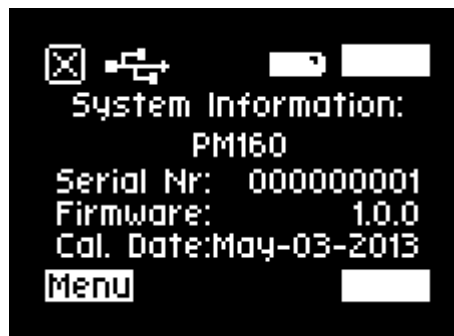
Note

If the PM160(T) is operated remotely via USB or Bluetooth and the brightness is set to "Min.", the display will be switched off 7 sec after a button was pressed. Wake it up by pressing any button.

Menu "Sound Output"

Enable or disable the sound output.

Menu "System Information"

```
System Information:
        PM160
Serial Nr:  000000001
Firmware:        1.0.0
Cal. Date:May-03-2013
Menu
```

Displays the item name, serial number, firmware version and most recent calibration date.

3.2.2 Remote Operation

The PM160(T) can be operated remotely. Prior to connect the PM160(T), the application software must be installed, see section Software Installation.

1. USB remote control from a Windows® PC with installed NI-VISA Runtime and a PM160(T) control application ("PM160 Software" or "PM100 Utility")

2. Bluetooth remote control from a Windows® PC (NI-VISA Runtime and "PM160 Software" or "PM100 Utility")

3. Bluetooth remote control from Apple® MAC® or iPod devices (iPad®, iPod® and iPhone®) - PM160 app, available in the AppStore

Note

Auto shutdown when a remote interface (USB or Bluetooth) is enabled:

1. USB cable connected, no remote connection active: the PM160(T) will automatically shut down after 5 minutes.

2. USB cable connected and USB remote connection: the PM160(T) will never shut down.

3. Active bluetooth remote connection, no USB cable connected: the PM160(T) will never shut down until battery is down. Only the display will be darkened to save battery and the OLED's life time.

See also Appendix, section "Energy Saving"

3.2.2.1 Software Installation

The PM160(T) application software can be found on the supplied USB stick.

Hardware Requirements

> CPU: 1 GHz or higher
> RAM: 256 MB
> Graphic card with at least 32 MB memory
> Hard disc with at least 100 MB free storage space
> Free USB2.0 port
> USB cable according the USB 2.0 specification

Software Requirements

The PM160(T) software is compatible with the following operating systems:

- Windows® XP (32-bit) SP3
- Windows® Vista (32-bit, 64-bit)
- Windows® 7 (32-bit, 64-bit)

For operation of the PM160(T), also an NI-VISA (version 5.0.3 or higher) is required. This NI-VISA engines comes with the Thorlabs PM160(T) installation CD, but can be downloaded also from National Instruments' website www.ni.com.

Installing PM160(T) Application Software

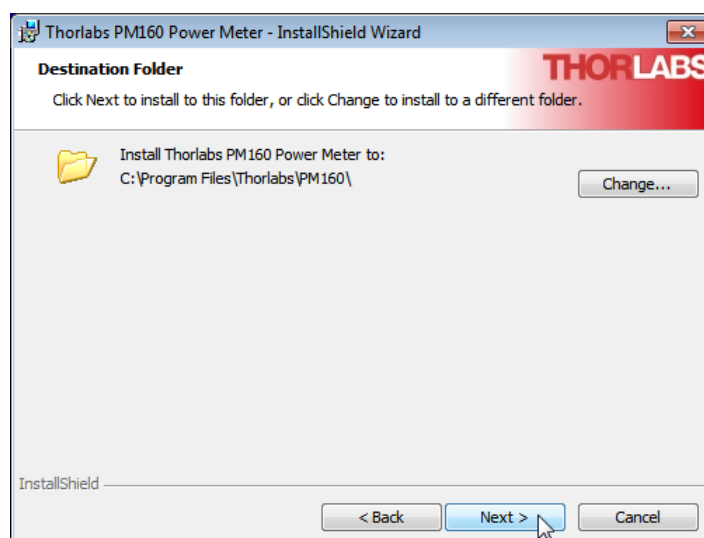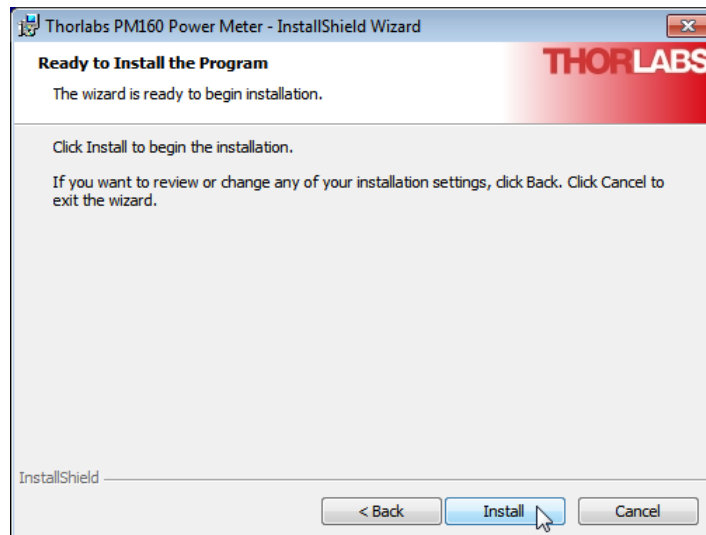Insert the USB stick and run the 'setup.exe':
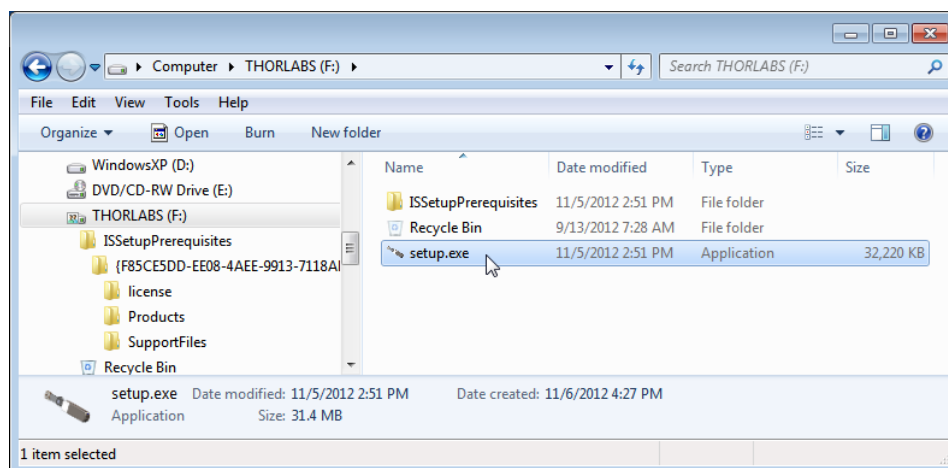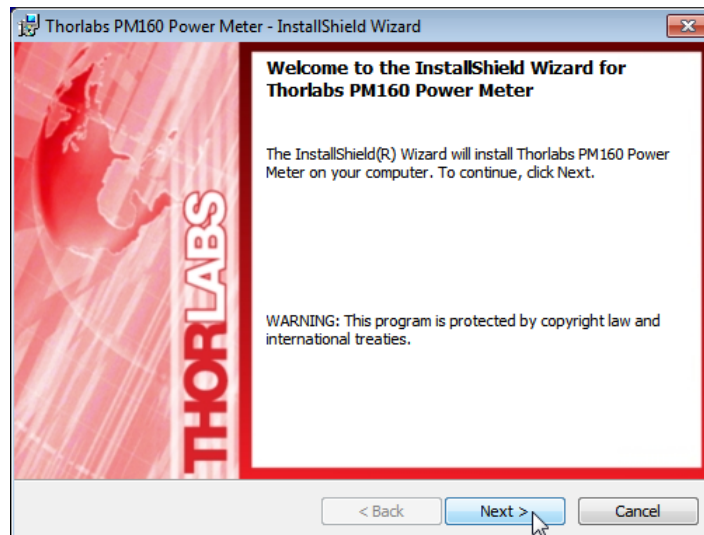
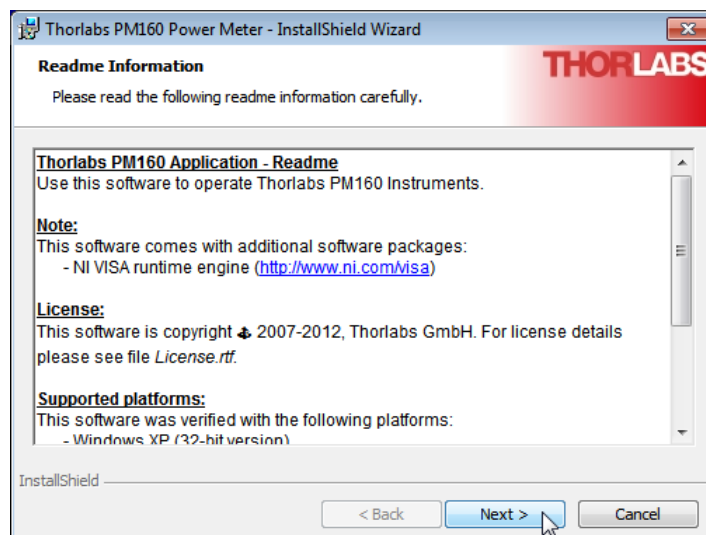Click 'Next' to continue.

Click 'I accept...' if you do so, then 'Next' to continue.

Click 'Next' to continue.

Click 'Install' to continue.

Click 'Next' to continue.

Click 'Finish' to exit the installation wizard.

3.2.2.2 USB Remote Operation

1. Make sure the PM160(T) Application Software is installed (see section Software Installation)

2. Set the PM160(T) interface to USB.

3. Connect the PM160(T) to the PC using the supplied USB cable.

4. The operating system recognizes the USB device:
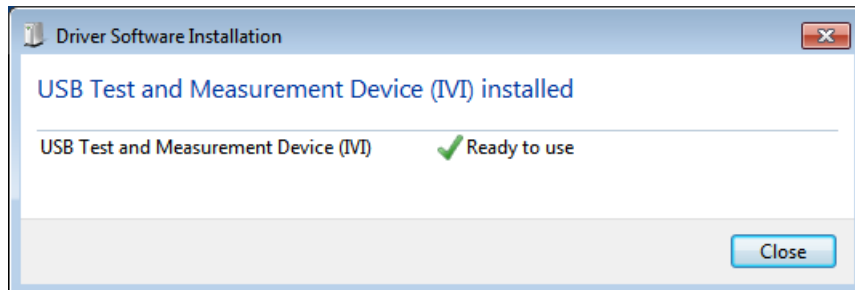
5. Start the PM160(T) application software

6. The GUI opens and automatically connects to the PM160(T).

7. If automatic connection fails, open the Device Menu and select "Open Device...":
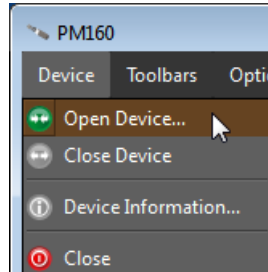
If no instruments are displayed, click to "Refresh", then select the desired instrument and click "Connect":

3.2.2.3 Bluetooth Remote Operation (Windows®)

1. Make sure the bluetooth interface of the control PC is enabled and active.

 Note

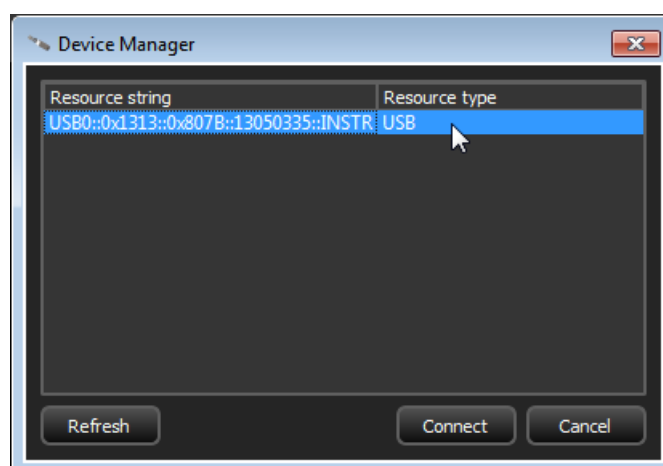The appearance and control screens of the Bluetooth connection may vary depending on operating system and manufacturer. Below an example is given for a bluetooth dongle and Windows® 7.

2. Switch the PM160(T) on and set it's interface to Bluetooth.

3. Right click to the bluetooth icon 🔵 in the task bar and select "Add a device". Windows looks up for a visible bluetooth device and adds it.

4. The PM160(T) is ready for use in wireless mode.

 Important note:

In bluetooth mode, the PM160(T) communicates with the PM160(T) Application via a virtual serial interface (COM port). When a device is added as described above, the link reserves an incoming and an outgoing COM port. The PM160(T) GUI uses only the outgoing COM port, typically the one with the higher number.

5. Start the PM160(T) application software

8. The GUI opens and connects automatically to the PM160(T).

9. If automatic connection fails, open the Device Menu and select "Open Device...":

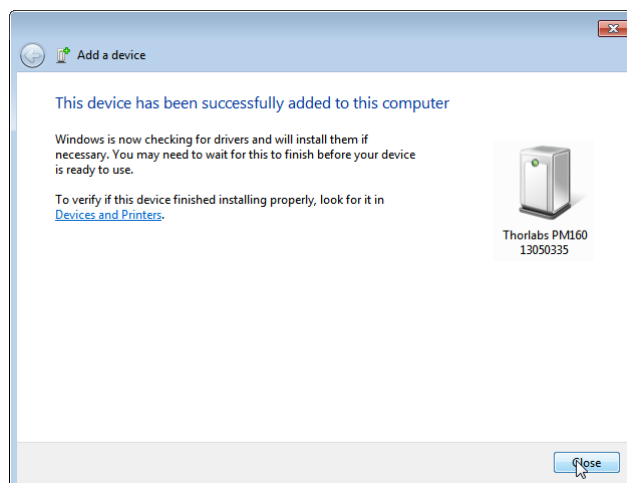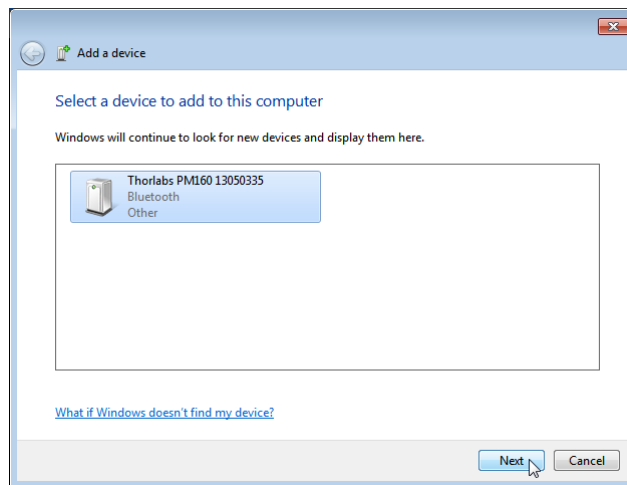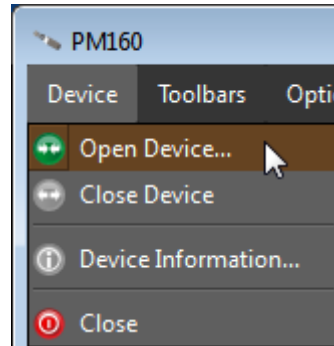If no instruments are displayed, click to "Refresh", then select the desired COM port (port ASRL15 is equivalent to outgoing virtual COM15 port) and click "Connect":
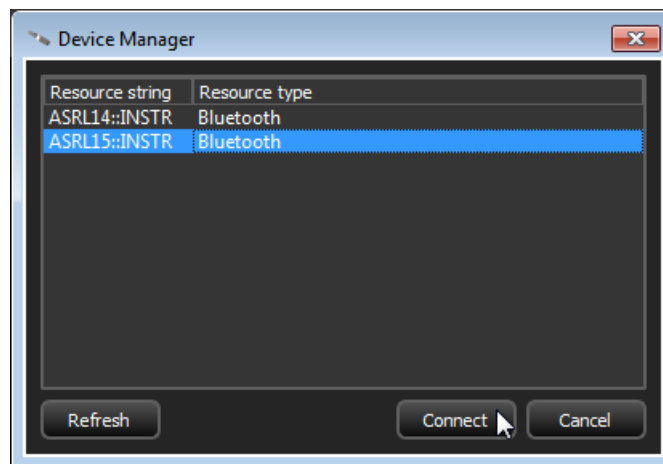
3.2.2.4 Bluetooth Remote Operation (iOS)

This description is related to the remote operation of a PM160(T) from an iPad.

Connect the PM160(T) with the iPad

1. Make sure the PM160(T) app has been installed properly.

2. Switch the PM160(T) on and set the [interface](#) to Bluetooth

3. Open the iPad settings (the icon can be found in the dock bar) and select the Bluetooth tab

4. Switch on the iPad Bluetooth interface, using the slide button on the top right.

5. In the Devices List an entry "Thorlabs PM160(T) xxxxxxxxx" should be found, where xxxxxxxxx stands for PM160(T)'s serial number. Compare that number with the serial number printed on the PM160(T)'s back or in the PM160(T)'s System Information menu screen. Click the "Not Paired" or the "Not Connected" text. It should quickly change to "Connected".

6. Exit the Settings screen by clicking the Home button.

7. Click the PM160(T) App Icon in the dock bar. The app will start and immediately show measurement values.

Disconnect the Bluetooth connection

As long as the PM160(T) is connected to the iPad no other Bluetooth connections (e.g. from a Windows PC) can be established. Follow the procedure described below to free the PM160(T)'s Bluetooth interface:

1. Press the Home button to set the PM160(T) App to background

2. Start the Settings screen

3. Enter the Bluetooth tab

4. Find the PM160(T)'s entry in the Devices list and click the arrow on the right of this entry

5. On the following screen click on Forget this Device and confirm

6. The display returns to the Bluetooth device list and should now show the PM160(T)'s entry with the text Not Paired. The PM160(T) now can connect to other Bluetooth hosts.

7. Warning: If you start the PM160(T)App now, with no PM160(T) available it will run in a demo mode with fake measurement.

8. If you want to reconnect the PM160(T) with the PM160(T)App then proceed as described in Connect the PM160(T) with the iPad

Troubleshooting

If the app or the connection hangs up, a restart might be required. Follow this procedure:

1. Disconnect the Bluetooth connection as described in the previous section.

2. Click the Home button once to set the active App to background.

3. Click the Home button twice, like a double click. The list of active Apps appears at the bottom.

4. Press and hold the PM160(T)App icon for about 3 seconds until a Minus symbol appears at the top left corner of the App's icon:
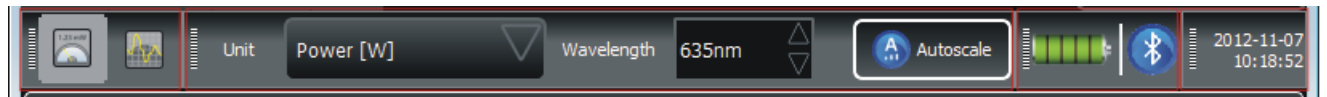

5. Click the Minus symbol. The App is stopped.

6. Click the Home button twice to leave.

7. Connect the PM160(T) with the iPad as described above to reestablish the setup.

3.2.2.5 PM160 GUI (Windows® OS)

Toolbars

The GUI has 4 toolbars, which can be enabled independently each from the other:

View	Switch between Needle View and Statistics View	
Configure	Unit	Select between Power [W], Power [dBm] and Current [A]
	Wavelength	Edit the operating wavelength (350...1100 nm)
	Autoscale	Switch between automatic and manual measurement scale setting
Status	Battery	Shows battery status
	Connect	Shows connection status (USB or bluetooth)
Date / Time	Shows actual date and time	

Drop-down menues

"Device"

Open Device...	Opens dialog to select a device from a list of available devices
Close Device	Disconnect the active device
Device Information...	Displays detailed information about the connected device
Close	Exits the application

"Toolbars"
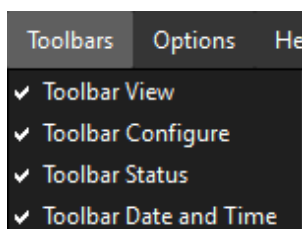
The toolbars as described above can be enabled / disabled.

"Options"
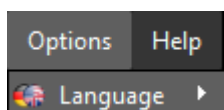
Select the language (English or German)

"Help"
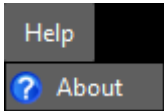
Displays detailed information about the application software.

Needle View
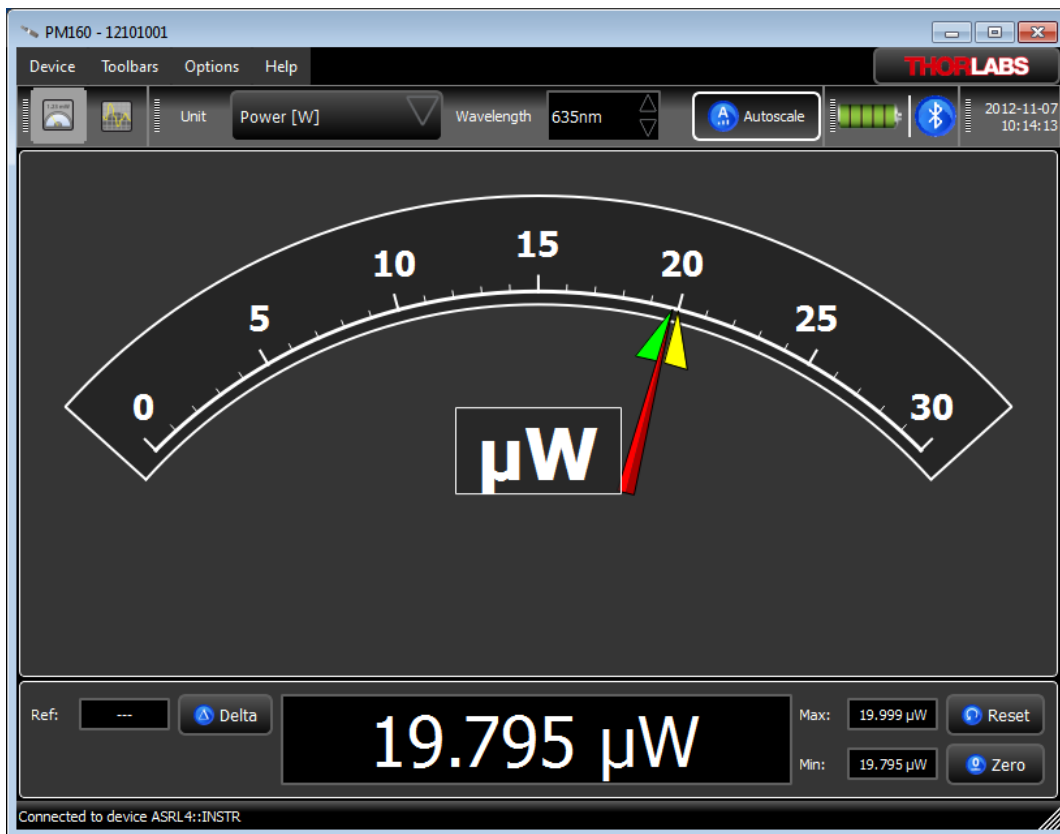
This is the default start screen of the GUI with "Autoscale" enabled. When disable "Autoscale", two additional buttons "Scale Down" and "Scale Up" appear for manual scale range change.

Relative Measurements

By toggling the [🔺 Delta] button the GUI switches between normal and relative measurement mode:
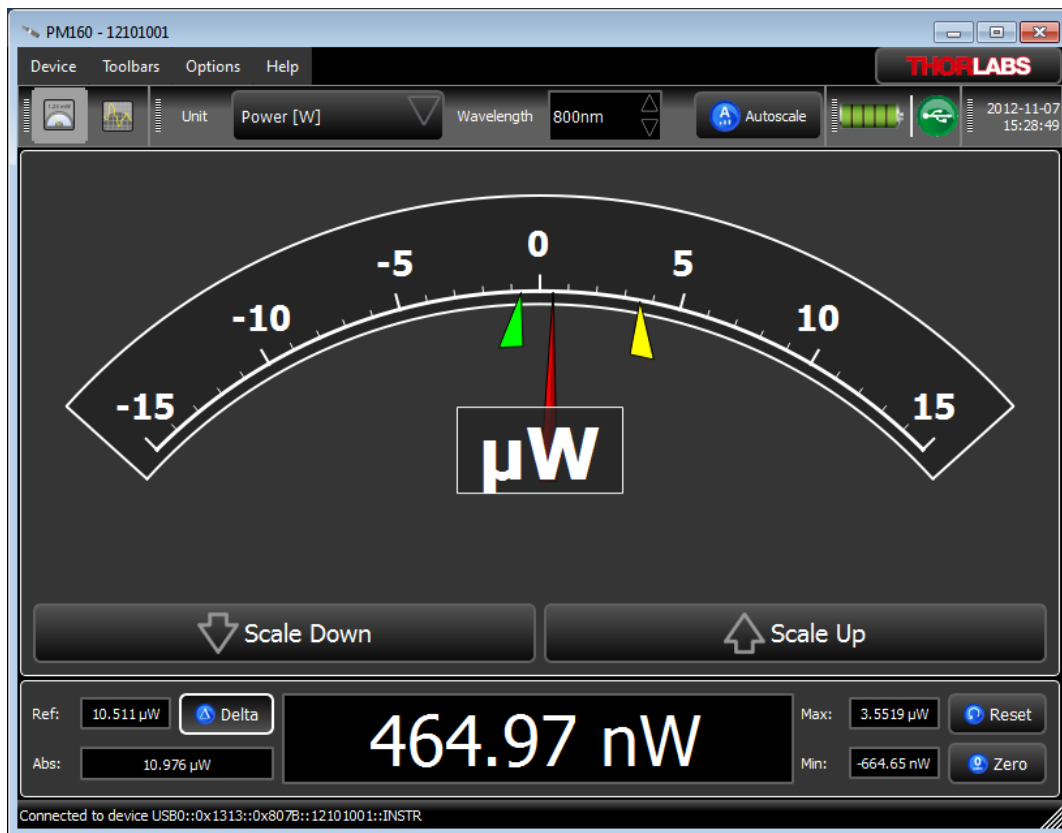
The needle scale changes to a zero-symmetric display. '0' is equivalent to the displayed reference value (above `Ref: 10.511 µW`); this is the readout in the moment when the 'Delta' button was pressed. The needle displays the difference from the reference; this value is shown in numeric representation as well (above: `464.97 nW`).

The actual absolute value is displayed as well `Abs: 10.976 µW`.

Min and max values are shown on the needle scale as green and yellow markers and in numerical representation in the `Min:` and `Max:` boxes.

Both values can be reset to the reference value by pressing the `Reset` button.

Zeroing

Zeroing is useful to compensate the photo diode's dark current when measuring low power levels.

- Cover the sensor's aperture carefully.
- Press the `Zero` button.
- After successful execution a message appears.

Logging View
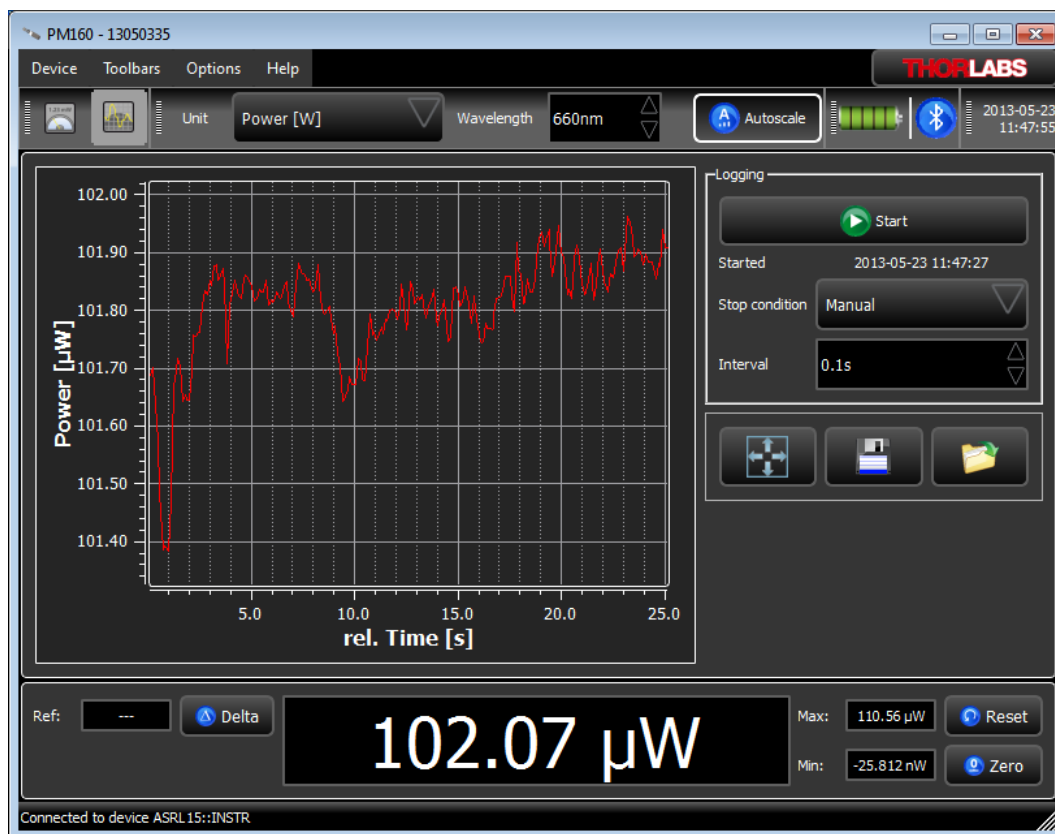
By selecting the logging pane, the central area changes to the logging diagram.

Logging settings:
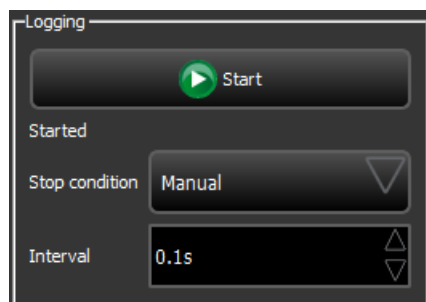
Stop Condition:

Can be selected to **Manual** (start/stop), elapsed **Time** (0h:1min to 1000h:60min) and number of **Samples** (1 to 1.000.000)

Interval is the time between two samples and ranges from 0.1 to 6.000 sec with a min. step size of 0.1 sec.

Advanced logging functions

 Zoom Home

 Save logging results to a *.csv file.

 Load logging results from a *.csv file

Structure of the logging file:

- separator: tab
- header line:

- 1st column: elapsed time after logging start in msec
- 2nd column: measured value

Zooming and panning

Locate the mouse pointer within the diagram area, press left and hold mouse button and draw a rectangle. Release mouse button, the marked area is zoomed in:
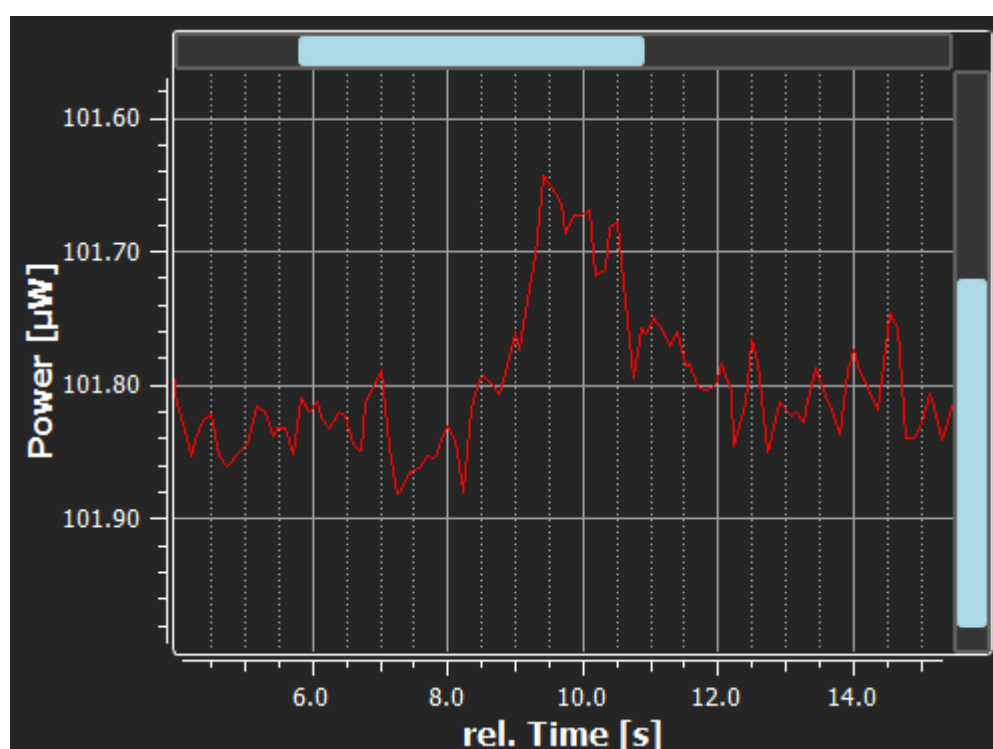
Using the light blue sliders, the zoomed in area can be panned. Return to the entire diagram area by right clicking on the diagram area or pressing the Zoom Home button.

4 Appendix

4.1 Technical Data

Specification	PM160	PM160T
Wavelength Correction Range	400 to 1100 nm	190 to 10600 nm
Optical Power Measurement Range	10 nW to 2 mW (200 mW)	100 µW to 2 W
Optical Power Resolution	100 pW (10 nW)	10 µW
Accuracy	+/- 3% @ 451 to 1000 nm +/- 5% @ 400 to 450nm and 1001nm – 1100nm	+/- 3% @ 1064 nm +/- 5% (Entire Range)
Power Linearity	± 1%	
Active Area Uniformity	± 1%	
Optical Filter	None / (Reflective ND [OD1.5] with diffuser)	None
Max. Average Power Density	1 W/cm² (20 W/cm²)	500 W / cm²
Sensor Aperture	Ø 9.5 mm	Ø 10.0 mm (0.39 ")
Sensor Coating	-	Black Broadband
Aperture Thread	SM05 with included adapter	SM1 with included adapter
Distance to Sensor	1.7 mm (4.2 mm with filter)	2.5 mm
Sensor Thickness	3.5 mm (6.0 mm with filter)	5.5 mm
Overall Dimensions	172.6 mm x 36.4 mm x 13.0 mm	
Weight	60 g	
Built-in Display	Monochrome white OLED 0.95", 96 x 64 px	
Local Operation	4 push buttons	
Analog Measurement Ranges	500 nA, 50 µA, 5 mA	1.6 mV, 25 mV, 400 mV
AD Converter	24 bit	
Analog Bandwidth	10 Hz	
Interface	USB 2.0, Bluetooth (Class II)	
Power Supply	External: 5VDC via USB Internal: LiPo+ 380 mAh with charger	
Mounting Options	#8-32 / M4 combined, 3 positions	

Values in ( ) are with filter slided in

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

4.2 Energy Saving

The PM160(T) features display dimming and an automatic shut down in order to save battery and the lifetime of the OLED display.

Display Dimming

When a button is pressed, the display brightness is set to 100%. 7 sec after a button was pressed last time, the display is dimmed to the brightness that can be adjusted in the menu "Brightness", between a "Min" value and 100%.

Note

The "Min" value is 1 % in local operation mode (Interface: "Local Only") and 0% in remote mode (USB or Bluetooth interface enabled *and* remote connection established). This is a convenient feature when using the PM160(T) remotely in a dark room: The stray light from the OLED display is eliminated.

Auto Shut Down

During battery charging via the USB cable, the auto shut down is disabled, but after a certain time the display is switched off ("Stand-by").

The table below illustrates all possible states:

Interface setting	Operation mode	USB Cable	Stand-bye	Shut down
Local Only	local	no	never	20 sec
		yes	20 sec	never
USB or Bluetooth		no	never	5 min
		yes	5 min	never
USB	remote control	yes	never	never
Bluetooth		no	never	when battery empty
		yes	never	never

4.3 Dimensions

270° ROTATING JOINT

SLIDING ND FILTER

Ø9.5mm [0.37in]

24.0mm [0.95in]

21.5mm [0.85in]

15.0mm [0.59in]

28.0mm [1.10in]

36.4mm [1.43in]

7.5mm [0.30in]

18.2mm [0.72in]

BLUETOOTH ANTENNA

#8-32 & M4

4.5mm [0.18in]

6.0mm [0.24in]

4.5mm [0.18in]

3.5mm [0.14in]

1.7mm [0.07in]

13.0mm [0.51in]

40.0mm [1.57in]

#8-32 & M4

75.0mm [2.95in]

92.3mm [3.63in]

172.7mm [6.80in]
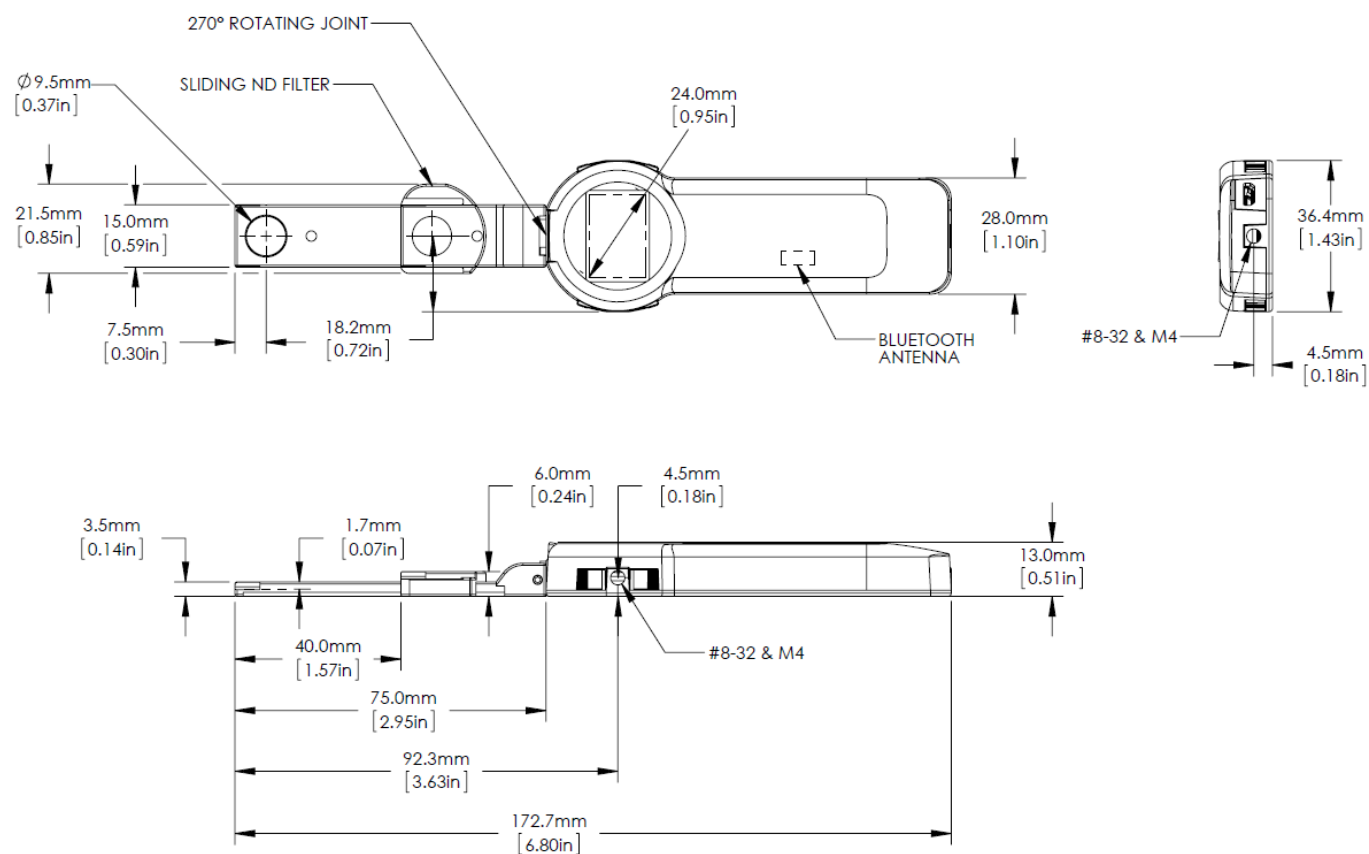
4.4 Certifications and Compliances

Category	Standards or description	
EC Declaration of Conformity - EMC	Meets intent of Directive 2004/108/EC[1] for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 61326-1:2006	EMC requirements for Class A electrical equipment for measurement, control and laboratory use, including Class A Radiated and Conducted Emissions [2,3,4]) and Immunity. [2,3,4])
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance Criterion B)
	IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance Criterion A)
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance Criterion B)
	IEC 61000-4-6	Conducted RF Immunity (Performance Criterion A)
FCC EMC Compliance	Emissions comply with the Class A Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B [2,3,4].	
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 2006/95/EC [5]	
	EN 61010-1:2010	
U.S. Nationally Recognized Testing Laboratory Listing	UL 61010-1 2nd ed.	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements
Canadian Certification	CAN/CSA C22.2 No. 61010-1 3nd ed.	
Additional Compliance	IEC 61010-1:2010	
Equipment Type	Test and Measuring	
Safety Class	Class I equipment (as defined in IEC 60950-1:2001)	

[1] Replaces 89/336/EEC.

[2] Compliance demonstrated using high-quality shielded interface cables shorter than or equal to 3 meters.

[3] Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.

[4] Minimum Immunity Test requirement

[5] Replaces 73/23/EEC, amended by 93/68/EEC

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions;

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

This device contains
FCC ID: PVH0946
IC: 5325A-0946

$C\mathcal{E}$

The cB-0946 module with the product name cB-OBS421 complies with the Japanese Technical Regulation Conformity Certification of Specified Radio Equipment (ordinance of MPT N°. 37, 1981), Article 2, Paragraph 1, Item 19, "2.4GHz band wide band low power data communication system". The cB-0946 MIC certification number is 204-210003.

4.5 Warranty

Thorlabs warrants material and production of the PM160(T) for a period of 24 months starting with the date of shipment. During this warranty period Thorlabs will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to Thorlabs. The customer will carry the shipping costs to Thorlabs, in case of warranty repairs Thorlabs will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer.

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

Restriction of warranty

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

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

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

4.6 Copyright and Exclusion of Reliability

Thorlabs has taken every possible care in preparing this Operation Manual. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this manual is regularly updated and adapted to reflect the current status of the software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.

Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.

Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.

Please note that the content of this User Manual is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of *Thorlabs* result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this User Manual. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the User Manual, please contact your local *Thorlabs* dealer or system installer.

All rights reserved. This manual may not be reproduced, transmitted or translated to another language, either as a whole or in parts, without the prior written permission of *Thorlabs.*

4.7 Thorlabs 'End of Life' Policy (WEEE)

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see figure below)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self contained operational electrical and electronic products, this "end of life" take back service does not refer to other Thorlabs products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

Waste treatment on your own responsibility

If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

WEEE Number (Germany) : DE97581288

Ecological background

It is well known that waste treatment pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS Directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE Directive is to enforce the recycling of WEEE. A controlled recycling of end-of-life products will thereby avoid negative impacts on the environment.

Crossed out
"Wheelie Bin" symbol

4.8 Thorlabs Worldwide Contacts

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