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## Power Wizard PW-250 Operating Instructions

**Important Note:** Power Wizard® power meters are designed as diagnostic and service tools for verifying laser power. They are not intended for use in validating critical process parameters and should not be used in such applications.

**Note:** Read these instructions thoroughly before using the PW-250. Certain steps in the measurement process must be made in a timely manner to prevent erroneous power readings.

### Setup

- 1 Position a beam block in a manner that prevents the laser beam from traveling beyond the work area during power measurements.
- 2 Ensure that all personnel in the area are wearing the appropriate protective eyewear.
- 3 Apply power to the laser. Enable lasing just as you are ready to begin power measurements.

 **Danger**  
serious  
personal  
injury

Direct or diffuse laser radiation can inflict severe bodily damage, including, but not limited to, permanent eye damage or blindness, and severe burns to human or animal tissue. Always wear the appropriate eye protection when in the same area as an operating laser. Do not allow a direct or reflected beam to contact a person.

Always be aware of the laser's beam path when using a laser power meter and always use a beam block to prevent the beam from traveling beyond the intended work area.

# Power Wizard PW-250 Operating Instructions (cont.)

## Power measurements

- 1 Hold the PW-250 so that the LCD display is in your hand with the black anodized target facing away from you.
- 2 Press and **hold** the RESET/POWER button for at least two seconds. This activates the PW-250 and initializes the measurement computer.
- 3 Release the RESET/POWER button to begin the six-second measurement sequence. The LCD display should read 00.0 Watts ( $\pm 0.3$  W). If the reading is not within this range, repeat Step 2.
- 4 Quickly insert the PW-250 target into the beam path. Position the PW-250 so the beam is centered in the middle of target and hold the PW-250 as steady as possible.

### Caution

possible  
equipment  
damage

Take all power measurements at a point in the beam path where the laser beam is **unfocused**. To prevent damage to the PW-250, never measure a laser beam at the point of focus!

Do not use the Power Wizard to measure power levels exceeding 250 watts as this may damage internal components.

**Note:** Avoid moving the target after insertion into the beam path. Excessive target motion may result in an erroneous power reading.

- 5 The Power Wizard's LCD display will show readings increasing to the final value within three to four seconds after insertion into the beam.
- 6 Remove the PW-250 from the beam path when you hear a series of five beeps. This indicates the measurement sequence is complete and begins a 12–15 second “hold” sequence.

**Note:** The “hold” feature locks the displayed power reading for a period of 12–15 seconds after the measurement sequence is complete. This allows the PW-250 to be inserted into areas where it is difficult or dangerous to visually monitor the LCD display while the laser is operating.

- 7 After the 12–15 second “hold” sequence, a series of fast beeps indicates the PW-250 is automatically shutting down.
- 8 To perform another power measurement, repeat Steps 1–6.

## Measurement notes/guidelines

- The heat capacity of the target is sufficient to allow multiple, low-power measurements in rapid succession without immediate cooling. On a 25 W laser, approximately ten consecutive readings may be taken. About two measurements in rapid succession can be taken on a 100 W laser. Only a single measurement can be taken around the 250 W level before the unit must be allowed to cool.
- When using the PW-250 on medium power lasers in the range of 100 watts or more, caution should be exercised not to overheat the sensor or case by excessive exposure time. An overheated target is indicated by continuous beeping, at which time the target must be allowed to cool. You can accelerate cooling by placing the PW-250 under a fan. Do not cool the PW-250 by immersing it in water; this will damage the electronics.
- Use care to place the beam on the target, rather than the PW-250 case. Move the PW-250 in and out of the beam quickly, without letting the beam dwell on the case. It is permissible to turn on the laser after the PW-250 target has been placed in the beam path; however, be sure the measurement is complete before the six-second measurement period has elapsed. Never press the RESET/POWER button while the target is exposed to the laser beam, the computer will not be initialized properly.

# Power Wizard PW-250 Operating Instructions (cont.)

- The PW-250 can be used to measure laser power anywhere along the beam path, including between a focusing lens and work piece, and can be used to measure power emitted from optical fibers.

**Important Note:** While the PW-250 target has a very high damage threshold, the target should never be placed at the focal point of a lens. Place the PW-250 target either in front/above or behind/below the beam's focal point, thus minimizing power density without overfilling the target area. The maximum allowable power density at the target is 20 kW/cm<sup>2</sup>; exposure to power densities above this value may damage the target, leading to loss of accuracy and calibrated performance.

- Erroneous readings may indicate one or more of the following conditions exists: a) the PW-250 was not reset for at least two seconds, b) the target is not being held stationary in the beam path, c) the beam is not completely within the target area, d) laser power is fluctuating too rapidly, or e) the PW-250 is malfunctioning.

## Calibration

Each PW-250 is individually calibrated to  $\pm 5\%$  accuracy at the 10.6 micron ( $\mu\text{m}$ ) CO<sub>2</sub> wavelength with calibration traceable to the National Institute of Standards and Technology (NIST).

## Maintenance

PW-250 battery life is approximately five years, even with constant use, for a capacity of about 25,000 measurement cycles. Current drain of the unit is less than 0.5 mA. Replace batteries when "BAT" appears on the LCD display. To access the three CR2025 lithium batteries, remove the three screws on the rear half of the PW-250 case and lift the rear cover away. DO NOT remove the screws on the front (display) side.

## Warranty

The PW-250 is warranted for twelve (12) months from the date of purchase, provided it is used per the operating instructions described above. SYNRAD, Inc. is not responsible for damage caused by improper use, particularly water immersion or overheating. SYNRAD, Inc. will repair or replace at no charge any PW-250 that fails due to manufacturing or design defect. Defective unit must be returned to SYNRAD, Inc. freight prepaid. Prior to returning the unit, you must first obtain a Return Authorization (RA) number by calling SYNRAD Customer Service at 1.800.796.7231, outside the U.S. at 1.425.349.3500 or fax to 1.425.349.3667.

## Theory of operation

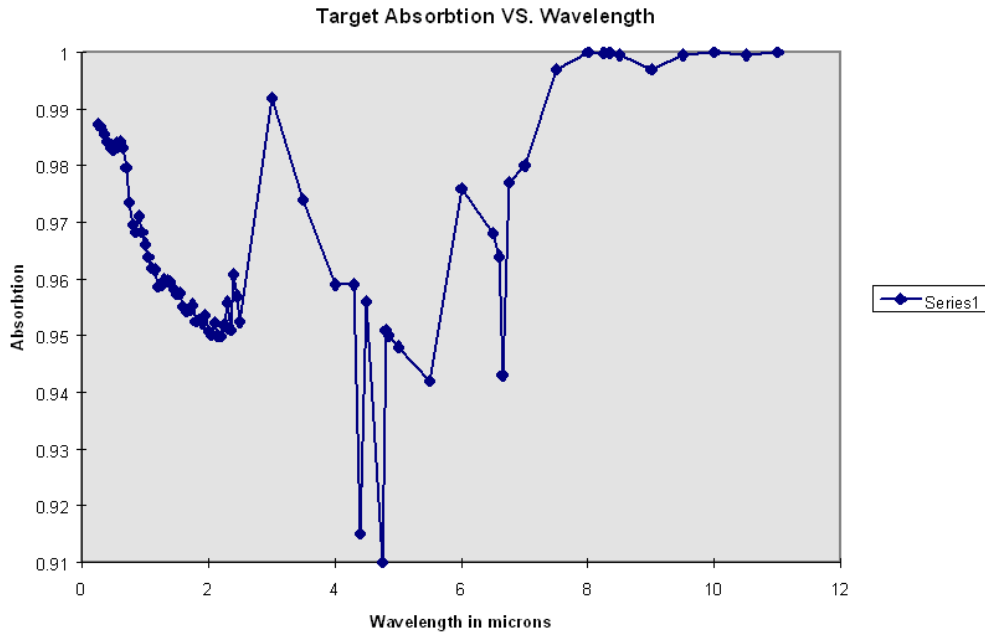
The PW-250 uses a patented measurement principle to achieve unprecedented convenience and performance. The unit measures the rate of change of temperature (both heating and cooling) induced in an aluminum mass by incident laser power. A sophisticated analog computer evaluates the temperature of the probe, the cooling rate before laser application, and the heating rate of the probe during laser application. Knowledge of these three values is sufficient to compute incident power using mathematical formulas, regardless of the target's immediate thermal history.

Upon activating and initializing the computer (by pressing and holding the RESET/POWER button for two seconds), the present cooling rate of the laser target is stored into memory. If the target was not previously exposed, the current cooling rate is zero. Releasing the RESET/POWER button starts a timer that produces an audible beeping signal after approximately six seconds. During the six-second measurement window, the target is exposed to laser power and the heating rate is then calculated. The calculated power value, based on the stored cooling rate and present heating rate, is continuously updated on the LCD display. When the heating rate settles and stabilizes about three seconds after exposure, the correct power reading is displayed. The thermal settling rate is sufficiently shorter than the six-second timing sequence, to allow adequate time to place the target into the beam and allow stabilized conditions to be reached. After the timing sequence has elapsed (indicated by a series of beeps), the power reading remains locked on the LCD display for a period of 12–15 seconds so the PW-250 can be removed from the laser beam and the reading can be recorded. After 12–15 seconds, a series of fast beeps indicates the PW-250 is automatically shutting down.

# Power Wizard PW-250 Operating Instructions (cont.)

The useful temperature range of the target is 0–150 °C (32–302 °F). Accurate measurements can be performed at any temperature in between. Damage to the target and sensor can occur if the temperature of the target exceeds 180 °C (356 °F). The PW-250 will beep continuously if the target temperature exceeds 150 °C (302 °F).

The target’s absorption is relatively constant as a function of wavelength (see Figure 1). No calibration factors are required when using the PW-250 with CO<sub>2</sub>, YAG, near IR (diode), Visible or Excimer lasers because the change in target absorption is less than 3%. When using the PW-250 with Carbon Monoxide (CO) lasers, multiply the displayed reading by a factor of 1.03 for improved accuracy.



**Figure 1** Target absorption versus wavelength

## Specifications

Range (3 1/2 digits) .....	1–250 W	Max. peak energy density <sup>3</sup> (J/cm <sup>2</sup> ).....	1
Resolution .....	0.1 W	Max. target temperature (°C).....	180
Wavelength range <sup>1</sup> .....	190 nm–11 µm	Typical target temperature rise per measurement (°C/W) .....	0.4
Individual calibrated wavelength <sup>1</sup> .....	10.6 µm	Battery life, typ.....	5 years / 25,000 readings
Target absorption <sup>1</sup> , 190 nm–1.1 µm, 9–11 µm .....	0.96–0.99	Battery type, 3 each .....	CR2025 Lithium
Target absorption <sup>1</sup> , 190 nm–11 µm .....	0.93–0.99	Auto shut-off time <sup>4</sup> (seconds).....	25
Accuracy .....	±5%	Data hold time (seconds).....	15
Target diameter (mm).....	22	Size (mm).....	159 × 30 × 12
Settling time (seconds).....	<4	Weight (g).....	80
Max. allowable input power (single application, W).....	300	* specifications subject to change without notice.	
Max. average power density <sup>2</sup> (kW/cm <sup>2</sup> ) .....	20	1 Typical absorption curve supplied with each meter.	
		2 Damage to coating may occur above this value.	
		3 For pulsed lasers and 50 µs pulse width.	
		4 After release of RESET/POWER button.	

# Declaration of Conformity

## Declaration of Conformity

in accordance with ISO / IEC 17050-2:2004

We,

**Manufacturer's Name:** SYNRAD, Inc.

**Manufacturer's Address:** 4600 Campus Place  
Mukilteo, WA 98275  
U.S.A.

hereby declare under our sole responsibility that the following equipment:

**Product Name:** Power Wizard

**Model Number:** PW-250

conforms to the following Directive(s) and Standard(s):

**Applicable Directive(s):** 2004/108/EC          Electromagnetic Compatibility Directive

**Applicable Standard(s):** EN 61000-6-3:2001      Generic Immunity and Emissions  
EN 55011:1998                      Conducted and Radiated Emissions, Class A  
EN 50082-1:1997                    RF Electromagnetic Immunity  
IEC 1000-4-2:1995                  Electrostatic Discharge Immunity  
IEC 1000-4-3:1995                  RF Electromagnetic Fields Immunity  
IEC 1000-4-4:1995                  Electrical Fast Transient/Burst Immunity

**Corporate Officer:**



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Dated 01 September 2009