

818P Series High Power Detector



User's Manual



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Experience | Solutions

Warranty

Newport Corporation warrants that this product will be free from defects in material and workmanship and will comply with Newport's published specifications at the time of sale for a period of one year from date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's option.

To exercise this warranty, write or call your local Newport office or representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the product, freight prepaid, to the indicated service facility. Repairs will be made and the instrument returned freight prepaid. Repaired products are warranted for the remainder of the original warranty period or 90 days, whichever is longer.

Limitation of Warranty

The above warranties do not apply to products which have been repaired or modified without Newport's written approval, or products subjected to unusual physical, thermal or electrical stress, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE. NEWPORT CORPORATION SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM THE PURCHASE OR USE OF ITS PRODUCTS.

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This manual has been provided for information only and product specifications are subject to change without notice. Any change will be reflected in future printings.

Newport Corporation
1791 Deere Avenue
Irvine, CA, 92606

USA
P/N 41313-01 Rev. H

Declaration of Conformity

We declare that the accompanying product, the model 818P, identified with the  mark, meets the intent of the Electromagnetic Compatibility Directive, 89/336/EEC and Low Voltage Directive 73/23/EEC.

Manufacturer's Name: Newport Corporation
 Manufacturer's Address: 1791 Deere Avenue
 Irvine, CA 92606
 USA
 Type of Equipment: Laser Power Detector
 Model No.: 818P
 Year of test & manufacture: 2002

Standard(s) to which Conformity is declared:

| Standard | Description | Performance Criteria |
|-------------------|--|----------------------|
| EN 61326 :1997 | Limits and methods of measurement of radio interference characteristics of information technology equipment. Testing and measurements of conducted emission | Class A |
| EN 61326 : 1997 | Limits and methods of measurement of radio interference characteristics of information technology equipment. Testing and measurements of radiated emission | Class A |
| EN 61000-4-2:1995 | Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 4.2: Electrostatic discharge. | Class B |
| EN 61000-4-3:1996 | Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 3: Radiated, Radio Frequency immunity. | Class A |
| ENV 50204: 1995 | Radiated Electromagnetic field from digital radio telephones- immunity test 900MHz pulsed | Class A |
| EN 61000-4-4:1995 | Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 4: Electrical fast transient/burst immunity. | Class B |
| EN 61000-4-6:1996 | Electromagnetic compatibility (EMC) – Part 4: Testing and measurements techniques- Section 6: Immunity to conducted Radio Frequency. | Class A |

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).



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Safety Information

Do not use the 818P detector if it looks damaged, or if you suspect that the 818P is not operating properly.

Appropriate installation must be done for water-cooled and fan-cooled detectors. Refer to the specific instructions for more information. The user must wait for a while before handling these detectors after power is applied. Surfaces of the detectors get very hot and there is a risk of injury if they are not allowed to cool down.

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. 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, it is suggested to try to correct the interference by taking one or more of the following steps:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and receiver.
- Connect the equipment to an outlet that is on a different circuit than the receiver.
- Consult the dealer or an experienced radio/TV technician for help.

SYMBOLS

The following international symbols are used in this manual:



Refer to the manual for specific Warning or Caution information to avoid any damage to the product.

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Check Newport's website periodically for firmware, software and manual updates. Go to www.newport.com for the latest versions.

1 General Information

1.1 Introduction

Newport's 818P Series High Power Detector's are thermopile devices that are specifically designed to work with Newport's 841-PE, 842-PE Hand-Held Power/Energy Meter or the 841-P-USB Virtual Meter. They may also be used with other instruments by means of various adapter cables (see Sections 1.2 & 3.3 for more information).

The 818P Series Detectors may be grouped into seven distinct product families, based on active area size:

- 818P-001-12 detector has dimensions of 73 x 73 mm and an aperture of 12 mm.
- 818P-xx-12 detectors have dimensions of 38 x 38 mm and an aperture of 12 mm.
- 818P-006-17x detectors have dimensions of 46 x 46 mm and an aperture of 17 mm.
- 818P-xx-17W detectors have dimensions of 50 x 50 mm and an aperture of 17 mm.
- 818P-xx-18 and 818P-xx-18H detectors have dimensions of 50 x 50 mm and an aperture of 18 mm.
- 818P-xx-19 detectors have dimensions of 50 x 50 mm and an aperture of 19 mm.
- 818P-xx-25 detectors have dimensions of 89 x 89 mm and an aperture of 25 mm.
- 818P-050-50W detector has a dimension of 89 x 89 mm and an aperture of 50mm.
- 818P-xx-55 detectors have dimensions of 89 x 89 mm and an aperture of 55 mm.

Within each group are various individual detectors with different cooling options: stand alone, heat sink, fan or water. This does not apply to 818P-050-50W detector.

The 818P detectors can measure between:

- 1 μ W and 1 W of average power for 818P-001-12 series,
- 1 mW and 70 W of average power for 818P-xx-12 series,
- 1 mW and 6 W of average power for 818P-006-17x series,
- 1 mW and 50 W of average power for 818P-xx-17W series,
- 1 mW and 30 W of average power for 818P-xx-18 series,
- 1 mW and 30 W of average power for 818P-xx-18H series,
- 1 mW and 150 W of average power for 818P-xx-19 series,
- 3 mW and 300 W of average power for 818P-xx-25 series,
- 5 mW and 50W of average power for 818P-xx-50W series,
- 5 mW and 400 W of average power for 818P-xx-55 series.

All 818P series detectors are supplied with a 180 cm flexible cable with a DB-15 connector termination. More about this connector in the next section.

CAUTION



To eliminate possible damage, do not carry the detector using the connector cable.

When using a detector with a heat sink, the fins should always be oriented vertically. Call your nearest Newport distributor to replace the sensor disk and/or to recalibrate the detector.

1.2 818P Series DB-15 Connector

The DB-15 male connector found at the end of the cable contains an EEPROM (Erasable Electrical Programmable Read-Only Memory) programmed with calibration sensitivity and other data relating to the specific 818P detector in use.

Fast set-ups are attained because the 841-PE, 842-PE Handheld Meter and the 841-P-USB Virtual Meter automatically adjusts to the characteristics of the detector after reading the EEPROM. The 818E EEPROM can also be read by Newport's 1835-C and 2835-C meters when using the 818P-DIN adapter cable (sold separately).

The DB-15 connector pin-out is as follows:

| | |
|--------|-------------------------|
| 1- | USED BY 841-PE, 842-PE |
| 2- | " " " |
| 3- | " " " |
| 4- | " " " |
| 5- | " " " |
| 6- | "+" SIGNAL OUTPUT |
| 7- | USED BY 841-PE, 842-PE |
| 8- | " " " |
| 9- | " " " |
| 10- | " " " |
| 11- | " " " |
| 12- | " " " |
| 13- | "-" SIGNAL OUTPUT |
| 14- | USED BY 841-PE, 842-PE |
| 15- | " " " |
| SHELL- | COAX SHIELD / BODY GRND |

2 Specifications

2.1 Standard Operating Mode

The following ten tables contain specifications when operating in the standard power mode (i.e. when measuring average power, in Watts).

| | 818P-001-12 | |
|---|---|----------------------------------|
| Effective Aperture Diameter | 12 mm | |
| Wavelength Range^a | 190 nm – 11 μm | |
| Power Noise Level^{b, c} | $\pm 0.5 \mu$W | |
| Thermal Drift^d | 12 μW/$^{\circ}$C | |
| Typical Rise Time (0-95%)^e | 27 s (2.5 s with anticipation) | |
| Typical Sensitivity^{f, g} | 200 mV/W | |
| Calibration Uncertainty^h | $\pm 2.5 \%$ | |
| Linearity with Power | $\pm 2 \%$ | |
| Repeatability (Precision) | $\pm 0.5 \%$ | |
| Power Resolution | $\pm 0.5 \%$ | |
| Max. Average Power | 1 W | |
| Max. Average Power (2 min)ⁱ | 2 W | |
| Max. Average Power Density at 1064 μW | 1 kW/cm² | |
| Pulsed Laser Damage Thresholds | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m, 360 μ s, 5 Hz | 5 J/cm ² | 14 kW/cm ² |
| 1.064 μ m, 7 ns, 10 Hz | 1 J/cm ² | 143 MW/cm ² |
| 532 nm, 7 ns, 10 Hz | 0.6 J/cm ² | 86 MW/cm ² |
| 266 nm, 7 ns, 10 Hz | 0.3 J/cm ² | 43 MW/cm ² |
| Dimensions (mm) | With isolation tube: 73(H) x 73(W) x 20(D) Without isolation tube: 73(H) x 73(W) x 72(D) | |
| Weight | 0.312 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | $\pm 0.7 \%$ | |

^a With 818P-IRF1 Filter: 280 nm – 1.36 μ m

^b Nominal value, actual value depends on electrical noise in the measurement system.

^c Without anticipation. $\pm 5 \mu$ W with anticipation.

^d At 150 μ W. 12 μ W/ $^{\circ}$ C with 842-PE, 50 μ W/ $^{\circ}$ C with 841-P-USB.

^e With 842-PE, 841-P-USB, and 1916-C monitors

^f Maximum output voltage = sensitivity x maximum power.

^g With 818P-IRF1 Filter : 180 mV/W

^h Including linearity with power

ⁱ Cooling : minimum 3 min

| | 818P-010 / 020 / 070-12 | |
|---|--|----------------------------------|
| Effective Aperture Diameter | 12 mm | |
| Wavelength Range | 190 nm – 11 μm | |
| Power Noise Level | 1 mW | |
| Typical Rise Time (0 – 95 %) | 1.6 s (0.3 s with anticipation) | |
| Typical Sensitivity | 0.53 mV/W | |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | | |
| 818P-010-12 | 10 W | |
| 818P-020-12 | 20 W | |
| 818P-070-12 | 70 W | |
| Max. Average Power (2 min)¹ | | |
| 818P-010-12 | 15 W | |
| 818P-020-12 | 30 W | |
| 818P-070-12 | 90 W | |
| Max. Average Power Density | | |
| 1.064 μ m, 10W CW | 36 kW/cm² | |
| 10.6 μ m, 10W CW | 11 kW/cm² | |
| Pulsed Laser Damage Thresholds | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m, 360 μ s, 5 Hz | 5 J/cm² | 14 kW/cm² |
| 1.064 μ m, 7 ns, 10 Hz | 1.0 J/cm² | 143 MW/cm² |
| 532 nm, 7 ns, 10 Hz | 0.6 J/cm² | 86 MW/cm² |
| 266 nm, 7 ns, 10 Hz | 0.3 J/cm² | 43 MW/cm² |
| Dimensions (mm) | | |
| 818P-010-12 | 38(H) x 38(W) x 14(D) | |
| 818P-020-12 | 38(H) x 38(W) x 45(D) | |
| 818P-070-12 | 38(H) x 38(W) x 32(D) | |
| Weight | | |
| 818P-010-12 | 0.13 kg | |
| 818P-020-12 | 0.15 kg | |
| 818P-070-12 | 0.19 kg | |
| Minimum Cooling Flow² | 0.5 liter/min | |
| Recommended Cooling Flow | 1.0 liter/min | |
| Cooling | Heat sink / water | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.7 % | |

Specifications subject to change without notice

¹cooling : minimum 3 min.

² Water temperature $\leq 22^{\circ}\text{C}$, 1/8 NPT compression fittings for 1/4 inch semi-rigid tube.

| | | |
|--|--|---------------------------|
| | 818P-006-17 | |
| Effective Aperture Diameter | 17 mm | |
| Wavelength Range | 190 nm – 11 μm | |
| Power Noise Level ^a | 1 mW | |
| Typical Rise Time (0 – 95 %) ^b | 2.5 s (0.8 s with anticipation) | |
| Typical Sensitivity ^c | 0.6 mV/W | |
| Calibration Uncertainty ^d | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | 6 W | |
| Max. Average Power (1 min) ^e | 7 W | |
| Max. Average Power Density | | |
| 1.064 μ m, 10W CW | 36 kW/cm ² | |
| 10.6 μ m, 10 W CW | 11 kW/cm ² | |
| Pulsed Laser Damage | Max. Energy Density | Peak Power Density |
| Thresholds | | |
| 1.064 μ m, 360 μ s, 5 Hz | 5 J/cm ² | 14 kW/cm ² |
| 1.064 μ m, 7 ns, 10 Hz | 1.0 J/cm ² | 143 MW/cm ² |
| 532 nm, 7 ns, 10 Hz | 0.6 J/cm ² | 86 MW/cm ² |
| 266 nm, 7 ns, 10 Hz | 0.3 J/cm ² | 43 MW/cm ² |
| Dimensions (mm) | 46(H) x 46(W) x 10.7(D) | |
| Weight | 0.1 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5 % | |

^a Nominal value, actual value depends on electrical noise in the measurement system.

^d Including linearity with power.

^b With 842-PE and 841-P-USB monitors.

^e Cooling : minimum 3 min.

^c Maximum output voltage = sensitivity x maximum power.

Specifications subject to change without notice

| | 818P-006-17W | |
|---|--------------------------------------|----------------------------------|
| Effective Aperture Diameter | 17 mm | |
| Wavelength Range | 190 nm – 10 μm | |
| Power Noise Level ^a | 1 mW | |
| Typical Rise Time (0 – 95 %) ^b | 5 s (1.4 s with anticipation) | |
| Typical Sensitivity ^c | 0.6 mV/W | |
| Calibration Uncertainty ^d | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | 6 W | |
| Max. Average Power (1 min) ^e | 7 W | |
| Max. Average Power Density 1.064 μm, 10W CW | 100 kW/cm² | |
| <u>Pulsed Laser Damage Thresholds</u> | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m, 360 μ s, 5 Hz | 100 J/cm ² | 667 kW/cm ² |
| 1.064 μ m, 7 ns, 10 Hz | 1.1 J/cm ² | 157 MW/cm ² |
| 532 nm, 7 ns, 10 Hz | 1.1 J/cm ² | 157 MW/cm ² |
| 266 nm, 7 ns, 10 Hz | 0.7 J/cm ² | 27 MW/cm ² |
| Dimensions (mm) | 46(H) x 46(W) x 10.7(D) | |
| Weight | 0.1 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5 % | |

^a Nominal value, actual value depends on electrical noise in the measurement system.

^d Including linearity with power.

^b With 842-PE and 841-P-USB monitors.

^e Cooling : minimum 3 min.

^c Maximum output voltage = sensitivity x maximum power.

Specifications subject to change without notice

| | | |
|---|--------------------------------------|----------------------------------|
| | 818P-015 / 030 / 050-17W | |
| Effective Aperture Diameter | 17 mm | |
| Wavelength Range | 190 nm – 10 μm | |
| Min. Measurable Power | 20 mW | |
| Power Noise Level | 1 mW | |
| Typical Rise time (0 – 95 %) | 5 s (1.4 s with anticipation) | |
| Typical Sensitivity | 0.65 mV/W | |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | | |
| 818P-15-17W | 15 W | |
| 818P-30-17W | 30 W | |
| 818P-50-17W | 50 W | |
| Max. Average Power (2 min.)³ | | |
| 818P-15-17W | 23 W | |
| 818P-30-17W | 45 W | |
| 818P-50-17W | 75 W | |
| Max. Average Power Density 1.064μm CW | 100 kW/cm² | |
| <u>Pulsed Laser Damage Thresholds</u> | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m , 150 μ s, 10 Hz | 100 J/cm² | 667 kW/cm² |
| 1.064 μ m , 7 ns, 10 Hz | 1.1 J/cm² | 157 MW/cm² |
| 532 nm , 7 ns, 10 Hz | 1.1 J /cm² | 157 MW/cm² |
| 248 nm , 26 ns, 10 Hz | 0.7J /cm² | 27 MW/cm² |
| Dimension (mm) | | |
| 818P-15-17W | 50(H) x 50(W) x 20.6(D) | |
| 818P-30-17W | 50(H) x 50(W) x 56.3(D) | |
| 818P-50-17W | 76.2(H) x 76.2(W) x 74.7(D) | |
| Weight | | |
| 818P-15-17W | 0.16 kg | |
| 818P-30-17W | 0.21 kg | |
| 818P-50-17W | 0.48 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5% | |

Specifications subject to change without notice

³ cooling : minimum 3 min.

| | | |
|--|--|----------------------------------|
| | 818P-015 / 030-18 | |
| Effective Aperture Diameter | 18 mm | |
| Wavelength Range | 190 nm – 2.5 μm | |
| Min. Measurable Power | 20 mW | |
| Power Noise Level | 1 mW | |
| Typical Rise time (0 – 95 %) | 7.7 s (1.8 s with anticipation) | |
| Typical Sensitivity | 0.75 mV/W | |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | | |
| 818P-15-18 | 15 W | |
| 818P-30-18 | 30 W | |
| Max. Average Power (2 min.)⁴ | | |
| 818P-15-18 | 23 W | |
| 818P-30-18 | 40 W | |
| Max. Average Power Density | | |
| 1.064 μ m CW | 110 W/cm² | |
| <u>Pulsed Laser Damage Thresholds</u> | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m , 360 μ s, 10 Hz | 11 J/cm ² | 30 kW/cm ² |
| 1.064 μ m , 7 ns, 10 Hz | 4 J/cm ² | 571 MW/cm ² |
| 532 nm , 7 ns, 10 Hz | 3 J /cm ² | 428 MW/cm ² |
| 266 nm , 7 ns, 10 Hz | 1J /cm ² | 143 MW/cm ² |
| Dimension (mm) | | |
| 818P-15-18 | 50(H) x 50(W) x 20.6(D) | |
| 818P-30-18 | 50(H) x 50(W) x 56.3(D) | |
| Weight | | |
| 818P-15-18 | 0.16 kg | |
| 818P-30-18 | 0.21 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5% | |

Specifications subject to change without notice

⁴ cooling : minimum 3 min.

| | | |
|---|---|----------------------------------|
| | 818P-015 / 030-18H | |
| Effective Aperture Diameter | 18 mm | |
| Wavelength Range | 0.19 – 1.44 μm except 600 - 925 nm YAG + harmonics | |
| Min. Measurable Power | 20 mW | |
| Power Noise Level | 1 mW | |
| Typical Rise time (0 – 95 %) | 40 s (2.5 s with anticipation) | |
| Typical Sensitivity | 0.65 mV/W | |
| Calibration Uncertainty | $\pm 2.5 \%$ | |
| Linearity with Power | $\pm 2 \%$ | |
| Repeatability (Precision) | $\pm 0.5 \%$ | |
| Power Resolution | $\pm 0.5 \%$ | |
| Max. Average Power | | |
| 818P-15-18H | 15 W | |
| 818P-30-18H | 30 W | |
| Max. Average Power (2 min.)⁵ | | |
| 818P-15-18H | 20 W | |
| 818P-30-18H | 35 W | |
| Max. Average Power Density | 300 W/cm² | |
| 1.064μm CW | | |
| <u>Pulsed Laser Damage Thresholds</u> | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μm , 360 μs , 10 Hz | 30 J/cm² | 83 kW/cm² |
| 1.064 μm , 7 ns, 10 Hz | 5 J/cm² | 714 MW/cm² |
| 532 nm , 7 ns, 10 Hz | 3 J/cm² | 428 MW/cm² |
| 266 nm , 7 ns, 10 Hz | 1J/cm² | 143 MW/cm² |
| Dimension (mm) | | |
| 818P-15-18H | 50(H) x 50(W) x 20.6(D) | |
| 818P-30-18H | 50(H) x 50(W) x 56.3(D) | |
| Weight | | |
| 818P-15-18H | 0.16 kg | |
| 818P-30-18H | 0.21 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | $\pm 0.5\%$ | |

Specifications subject to change without notice

⁵ cooling : minimum 3 min.

| | 818P-015 / 030 / 110 / 150-19 | |
|---|---|---|
| Effective Aperture Diameter | 19 mm | |
| Wavelength Range | 190 nm – 11 μm | |
| Min. Measurable Power | 20 mW | |
| Power Noise Level | 110 model: 3 mW Others: 1 mW | |
| Typical Rise time (0 – 95 %) | 4.5 s (1.5 s with anticipation) for 110 model 2.8 s (0.6 s with anticipation) for others | |
| Typical Sensitivity | 0.23 mV/W for 110 model and 0.65 mV/W for others | |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | | |
| 818P-15-19 | 15 W | |
| 818P-30-19 | 30 W | |
| 818P-110-19 | 110 W | |
| 818P-150-19 | 150 W | |
| Max. Average Power (2 min)⁶ | | |
| 818P-15-19 | 23 W | |
| 818P-30-19 | 45 W | |
| 818P-110-19 | 135 W | |
| 818P-150-19 | 170 W | |
| Max. Average Power Density | | |
| 1.064 μ m CW | 45 kW/cm² for 110 model and 36 kW/cm² for others | |
| 10.6 μ m CW | 14 kW/cm² for 110 model and 11 kW/cm² for others | |
| Pulsed Laser Damage Thresholds | Max. Energy Density | Peak Power Density |
| 1.064 μ m, 360 μ s, 5 Hz | 9 J/cm² for 110 model | 25 kW/cm² for 110 model |
| | 5 J/cm² for others | 14 kW/cm² for others |
| 1.064 μ m, 7 ns, 10 Hz | 1.0 J/cm² | 143 MW/cm² |
| 532 nm, 7 ns, 10 Hz | 0.6 J/cm² | 86 MW/cm² |
| 266 nm, 7 ns, 10 Hz | 0.3 J/cm² | 43 MW/cm² |
| Dimensions (mm) | | |
| 818P-15-19 | 50(H) x 50(W) x 20.6(D) | |
| 818P-30-19 | 50(H) x 50(W) x 56.3(D) | |
| 818P-110-19 | 54.2(H) x 54.2(W) x 55.6(D) | |
| 818P-150-19 | 50(H) x 50(W) x 33(D) | |
| Weight | | |
| 818P-15-19 | 0.16 kg | |
| 818P-30-19 | 0.21 kg | |
| 818P-110-19 | 0.25 kg | |
| 818P-150-19 | 0.24 kg | |
| Minimum Cooling Flow⁷ | 0.5 liter/min | |
| Recommended Cooling Flow | 1.0 liter/min | |
| Cooling | Heat sink / fan / water | |
| Recommended load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5 % | |

Specifications subject to change without notice

⁶cooling : minimum 3 min.⁷ Water temperature $\leq 22^{\circ}\text{C}$, 1/8 NPT compression fittings for 1/4 inch semi-rigid tube.

| | 818P-040 / 100 / 250 / 300-25 | 818P-040 / 100 / 300 / 400-55 |
|---|--|--|
| Aperture Diameter | 25 mm | 55 mm |
| Spectral Range | 190 nm - 11 μm | |
| Min. Measurable Power | 60 mW | 100 mW |
| Power Noise Level | 3 mW | 5 mW |
| Typical Rise Time (0 – 95 %) | 5 s (1.3 s with anticipation) | 11 s (2 s with anticipation) |
| Typical Sensitivity | 0.23 mV/W | 0.12 mV/W |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power | 40: 40 W 100: 100 W 250: 250 W 300: 300 W | 40: 40 W 100: 100 W 300: 300 W 400: 400 W |
| Max. Average Power (2 min.)⁸ | 40: 60 W 100: 150 W 250: 300 W 300: 300 W | 40: 60 W 100: 150 W 300: 300 W 400: 400 W |
| Max. Average Power Density 1.064 μ m CW 10.6 μ m CW | 45 kW/cm ² 14 kW/cm ² | |
| Pulsed Laser Damage Thresholds 1.064 μ m, 360 μ s, 5 Hz 1.064 μ m, 7 ns, 10 Hz 532 nm, 7 ns, 10 Hz 266 nm, 7 ns, 10 Hz | Max. Energy Density 9 J/cm ² 1.0 J/cm ² 0.6J /cm ² 0.3J /cm ² | Peak Power Density 25 kW/cm ² 143 MW/cm ² 86 MW/cm ² 43 MW/cm ² |
| Dimensions (mm) | 40: 89(H) x 89(W) x 32(D) 100: 89(H) x 89(W) x 106(D) 250: 89(H) x 89(W) x 116(D) 300: 89(H) x 89(W) x 44(D) | 40: 89(H) x 89(W) x 32(D) 100: 89(H) x 89(W) x 106(D) 300: 89(H) x 89(W) x 116(D) 400: 89(H) x 89(W) x 44(D) |
| Weight (kg) | 40: 0.68 100: 0.99 250: 1.44 300: 0.90 | 40: 0.62 100: 0.93 300: 1.38 400: 0.84 |
| Minimum Cooling Flow⁹ | 1 liter/min | |
| Cooling | Heat sink/ Fan / Water | |
| Recommended Load Impedance | > 100 kΩ | > 100 kΩ |
| Linearity vs. Beam Dimension | ± 0.5% | ± 0.5% |

Specifications subject to change without notice

⁸ cooling : minimum 3 min.⁹ Water temperature $\leq 22^{\circ}\text{C}$, 1/8 NPT compression fittings for ¼ inch semi-rigid tube.

| | | |
|--|---------------------------------------|----------------------------------|
| | 818P-050-50W | |
| Effective Aperture Diameter | 50 mm | |
| Wavelength Range | 190 nm – 10 μm | |
| Min. Measurable Power | 100 mW | |
| Power Noise Level | 5 mW | |
| Typical Rise time (0 – 95 %) | 16 s (3.5 s with anticipation) | |
| Typical Sensitivity | 0.12 mV/W | |
| Calibration Uncertainty | ± 2.5 % | |
| Linearity with Power | ± 2 % | |
| Repeatability (Precision) | ± 0.5 % | |
| Power Resolution | ± 0.5 % | |
| Max. Average Power 818P-050-50W | 50 W | |
| Max. Average Power (2 min.)¹⁰ 818P-050-50W | 75 W | |
| Max. Average Power Density 1.064μm CW | 100 kW/cm² | |
| <u>Pulsed Laser Damage Thresholds</u> | <u>Max. Energy Density</u> | <u>Peak Power Density</u> |
| 1.064 μ m , 150 μ s, 10 Hz | 100 J/cm ² | 667 kW/cm ² |
| 1.064 μ m , 7 ns, 10 Hz | 1.1 J/cm ² | 157 MW/cm ² |
| 532 nm , 7 ns, 10 Hz | 1.1 J/cm ² | 157 MW/cm ² |
| 248 nm , 26 ns, 10 Hz | 0.7J /cm ² | 27 MW/cm ² |
| Dimension (mm) 818P-050-50W | 89(H) x 89(W) x 106(D) | |
| Weight 818P-050-50W | 0.93 kg | |
| Cooling | Heat sink | |
| Recommended Load Impedance | 100 kΩ | |
| Linearity vs. Beam Dimension | ± 0.5 % | |

Specifications subject to change without notice

¹⁰ cooling : minimum 3 min.

2.2 Calorimeter Mode

The 818P Series High Power Detectors have an optional mode that is called Calorimeter Mode. It allows you to measure single shot pulse energy. This mode is accessible when you use a 818P with an 841-PE, 842-PE, the 841-P-USB, or with your own data acquisition system. The following specifications apply specifically to this mode. For more information, refer to the 841-PE, 842-PE and the 841-P-USB instruction manuals or call Newport.

| | 818P-001 -12 | 818P-xx -12 | 818P-006 -17 | 818P-006 -17W | 818P-xx -17W | 818P-xx -18 |
|---|-------------------------|------------------------|-------------------------|--------------------------|-------------------------|------------------------|
| Typical Sensitivity | 25 mV/J | 0.84 mV/J | 0.7 mV/J | 0.2 mV/J | 0.33 mV/J | 0.28 mV/J |
| Power Sensitivity / Energy Sensitivity | 6 J/W | 0.63 J/W | 0.86 J/W | 3 J/W | 2 J/W | 2.67 J/W |
| Typical Rise Time | 1000 ms | 150 ms | 328 ms | 575 ms | 400 ms | 900 ms |
| Min. Repetition Period | 16 s | 1.5 s | 4 s | 5 s | 5 s | 8 s |
| Max. Pulse Width | 300 ms | 50 ms | 88 ms | 133 ms | 133 ms | 300 ms |
| Max. Measurable Energy ¹¹ | 5 J | 5 J | 15 J | 200 J | 200 J | 28 J |
| Noise Equivalent Energy | 12 μ J | 20 mJ | 20 mJ | 20 mJ | 23 mJ | 28 mJ |
| Accuracy | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ |

| | 818P-xx -18H | 818P-xx -19 | 818P-xx -25 | 818P-xx -50W | 818P-xx -55 |
|---|-------------------------|------------------------|------------------------|-------------------------|------------------------|
| Typical Sensitivity | 0.13 mV/J | 0.65 mV/J | 0.14 mV/J | 0.020 mV/J | 0.028 mV/J |
| Power Sensitivity / Energy Sensitivity | 5 J/W | 0.99 J/W | 1.67 J/W | 5.28 J/W | 4.25 J/W |
| Typical Rise Time | 1000 ms | 264 ms | 370 ms | 1400 ms | 1300 ms |
| Min. Repetition Period | 30 s | 4 s | 4.6 s | 11.1 s | 11.1 s |
| Max. Pulse Width | 330 ms | 88 ms | 123 ms | 467 ms | 433 ms |
| Max. Measurable Energy ¹¹ | 35 J | 15 J | 40 J | 500 J | 200 J |
| Noise Equivalent Energy | 50 mJ | 20 mJ | 200 mJ | 250 mJ | 250 mJ |
| Accuracy | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ | $\pm 5 \%$ |

Specifications subject to change without notice

¹¹ For 1.064 μ m; 360 μ s pulses.

3 Operating Instructions

3.1 Detector Preparation

Depending upon whether your particular detector is air-, fan-, or water-cooled, some preliminary steps may be required, as follows:

3.1.1 Fan-Cooled Detectors

Simply connect the fan to a power supply.

3.1.2 Water-cooled detectors

Connect the detector head to a cooling water supply. Use with ¼" outer diameter plastic tubing.

NOTE:

The end of the tube must be cut perpendicular to the tubing; the portion of the outer tubing wall that slips into the fitting must not be deformed or damaged, otherwise the connection will not be water-tight.

To connect the detector head fittings to the water supply tubing, unscrew the two parts of the fitting, push the tubing into the part not connected to the detector until it comes to the end of the fitting; then screw in the two parts of the fitting.

The direction of flow through the head is unimportant. Once you have connected the fittings, check them for leaks. If you find a leak, check to see if the tubes are pushed in far enough and that the tubing has not been damaged.

To disconnect the detector head fittings, remove the water pressure and drain the water from the tubing. Unscrew the two parts of the fitting and pull out the tubing.

NOTE:

Water will usually remain in the detector head after it is disconnected. It is possible to remove it by blowing it out, but be careful not to blow the water on yourself or on the detector aperture. Dry the detector body off before storing it.

Be sure that flow rates satisfy the minimum values, as indicated on the specifications pages (see Section 2). Time variations of water flow rates or water temperature will cause corresponding oscillations in measurements.

3.2 Using with the 841-PE, 842-PE or 841-P-USB

Connect the DB15 connector at the end of the cable to the input connector on the 841-PE, 842-PE or the 841-P-USB meter (see the 841-PE, 842-PE or 841-P-USB instruction manuals).

Before performing the measurements, shield the detector head to prevent it from sensing heat from random sources. To obtain an accurate reading the 841-PE, 842-PE and the 841-P-USB meters must also be zero adjusted.

Allow the detector head to thermally stabilize before making any measurements. Let the signal stabilize for a few seconds before adjusting the offset. Refer to the 841-PE, 842-PE and the 841-P-USB operating instructions for further details.

For the most accurate measurements, center the beam on the sensor face. The beam diameter on the sensor should ideally be the same size as the beam diameter of the original calibration, which is 86.5% encircled power (>98% encircled power at full aperture) of a TEM 01 beam (at $1/e^2$) over 50% of the sensor's surface (this complies with the International Electrotechnical Commission standard #1040: "Power and Energy Measuring Detector...").

3.3 Using without the 841-PE, 842-PE or 841-P-USB

The 818P Series High Power Detectors can be used with a voltmeter or oscilloscope. Usually these devices have a BNC input connector. For this reason, an adapter cable (Newport part number 818P-BNC) is available. This cable is sold separately.

To make a measurement, follow these steps:

1. Let the detector head thermally stabilize for at least 10 minutes.
2. Connect the power head to a precision microvoltmeter, oscilloscope, or data acquisition system, with a load impedance that is greater than 100 k Ω . Because of the very low voltages at lower power levels for some of these detectors, analog or digital filters may be required to remove ambient electrical noise.

NOTE:

For the most accurate measurements, center the beam on the sensor face. The beam diameter on the sensor should ideally be the same size as the beam diameter of the original calibration, which is 86.5% encircled power (>98% encircled power at full aperture) of a TEM 01 beam (at $1/e^2$) over 50% of the sensor's surface (this complies with the International Electrotechnical Commission standard #1040: "Power and Energy Measuring Detector...").


WARNING:

Be careful not to exceed the maximum levels and densities stated in the specifications.

- 4 Place the detector head into the laser beam path (the laser beam must be contained within the sensor area) for about a minute.
5. Block off any laser radiation to the detector.
6. Switch on the microvoltmeter and adjust its voltage range to the range required for the measurement. To determine the voltage range to be measured, refer to the detector head specifications (see Section 2):

$$V_{\text{out}} = (\text{expected power}) \times (\text{calibration sensitivity of power detector})$$

7. Wait until the signal has stabilized (fluctuations representing less than 1% of the voltage level being measured are negligible), then measure the zero level voltage offset from the detector. Strong fluctuations in the zero level are usually caused by one of the following:
 - Rapid fluctuations in the rate of water flow,
 - Rapid fluctuations in water temperature,
 - Strong drafts or stray radiation (especially visible when you are taking low power measurements),
 - Ambient electrical noise (should be filtered out).
8. Apply the laser beam to the detector head.
9. Wait until the signal has stabilized (between one to three minutes for optimum measurements), then measure the voltage output from the detector (see Section 2 for individual detector 0-95% non anticipated response times).

10. The measured power is calculated as follows:

$$\begin{aligned}
 \text{Measured power} &= (\text{output voltage} - \text{zero level voltage}) / (\text{calibration sensitivity}) \\
 &= 1000 \times (V_{\text{out}} - V_{\text{zero level}}) / \text{calibration sensitivity (mV/W)} \\
 &= \text{Watts}
 \end{aligned}$$

3.4 Safety Notes

3.4.1 Diffusive surfaces

When using the 818P, be aware of the $\sim 5\text{-}15\%$ diffused back reflection. Exception: the 818P-015/030-18 have a 5% specular reflection.

As on any diffusive surface, the light on the sensor coating is scattered more or less uniformly as a Lambertian diffuser. It is recommended to use the detector with a black protective sleeve. This will limit wide-angled diffused reflections.

3.4.2 Detector temperature

Detectors can become hot enough during usage and can cause burns.

3.5 Damage to the Optical Absorber Material

Damage to the optical absorber material is usually caused by exceeding the manufacturer's specified maximum incident:

- Average Power Density
- Pulse Energy Density

Refer to the specifications pages (Section 2) for the 818P Series High Power Detector specifications.

Damage may also be caused by using a detector with a contaminated absorber surface.

Slight discoloration of the coating may occur, but this usually does not affect the calibration.

In the event of major damage to the coating, the 818P Series sensors can be recoated. Contact your local Newport representative for information on repair and recalibration. See page iv: "Technical Support Contacts."

4 Service Information

The Model 818P High Power Detector contains no user serviceable parts. To obtain information regarding factory service, contact Newport Corporation or your Newport representative. Please have the following information available:

1. Detector model number (818P-xx)
2. Detector serial number (on rear panel)
3. Description of the problem.

If the detector is to be returned to Newport Corporation, you will be given a Return Number, which you should reference in your shipping documents. Please fill out a copy of the service form, located on the following page, and have the information ready when contacting Newport Corporation. Return the completed service form with the instrument.

To obtain warranty service, contact your nearest Newport agent or send the product, with a description of the problem, transportation and insurance prepaid, to the nearest Newport agent. Newport Corporation assumes no risk for the damage in transit. Newport Corporation will, at its option, repair or replace the defective product free of charge. However, if Newport Corporation determines that the failure is caused by misuse, alterations, accident or abnormal condition of operation or handling, you will be billed for the repair and the repaired product will be returned to you, transportation prepaid.

Appendix A: Custom Heat Sink

Usually, the detector is calibrated and shipped with its final back panel. But the 818P can also be installed onto a heat sink supplied by the customer or onto another back panel. If this is the case, follow the instructions listed below.

Instructions :

1. Remove the four front screws of the detector, being sure to hold together the front cover and the central housing.
2. Discard the back panel.
3. Apply thermal paste (for example *Wakefield Engineering Inc. thermal paste part no. 120-2*) to the back of the central housing to assure good thermal contact with the new back panel.
4. Recommended : Apply removable thread locker (for example *Loctite removable thread locker 242*) to the ends of the four original screws and into the four holes on back panel.
5. Use the four original screws to install the new back panel onto the detector. Be sure to apply the same torque to all four screws.

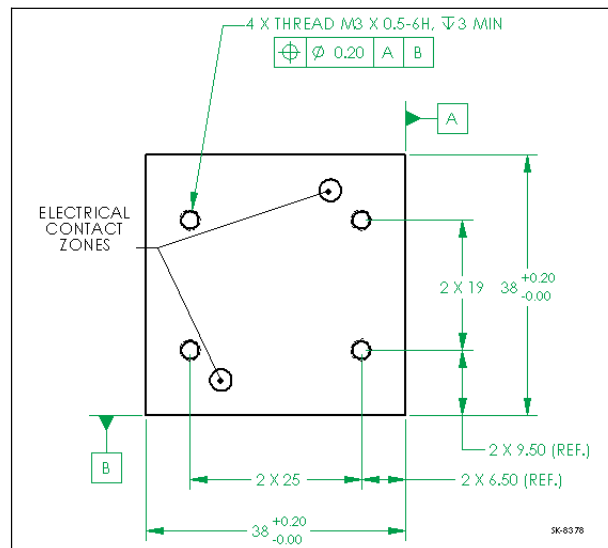


Figure 1 Tapped hole positions - 818P-xx-12

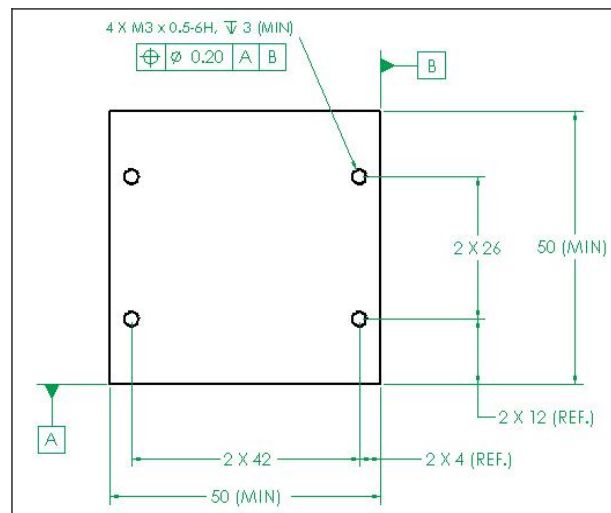


Figure 2 Tapped hole positions - 818P-xx-17W and 818P-xx-19

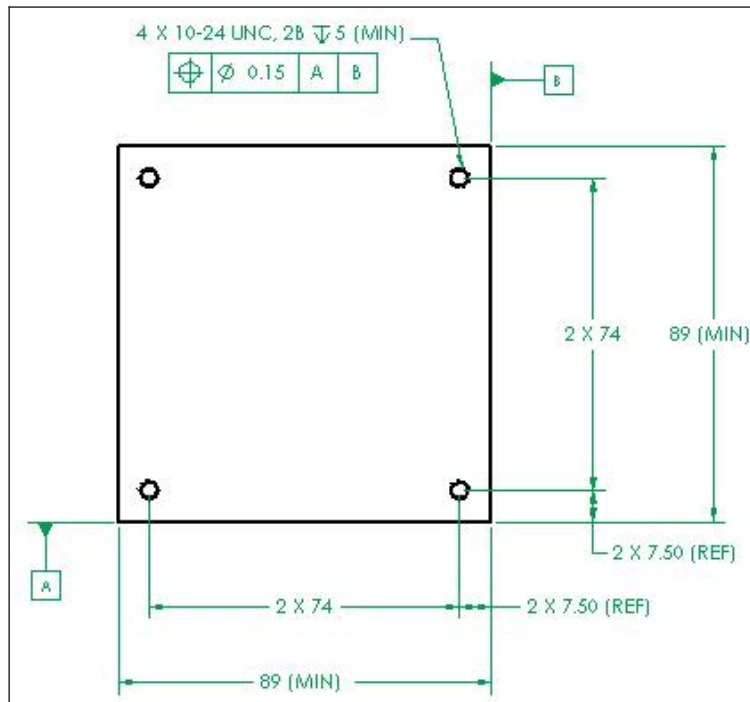


Figure 3 Tapped hole positions - 818P-xx-25, 818P-xx-50W and 818P-xx-55

Appendix B: WEEE directive

1.1 Recycling and separation procedure for WEEE directive 2002/96/EC:

This section is used by the recycling center when the detector reaches its end of life.
Breaking the calibration seal or opening the monitor will void the detector warranty.

The complete Detector contains

- 1 Detector with wires or DB-15.
- 1 instruction manual
- 1 calibration certificate

1.2 Separation:

Paper : Manual and certificate

Wires: Cable Detector.

Printed circuit board: inside DB-15, no need to separate (less than 10 cm²).

Aluminum: Detector casing.

Appendix C: Using the 818P-001-12 wattmeter with the 818P-001-12 filter:

The 818P-001-12 filter features ease of installation and removal. To use an 818P-001-12 series wattmeter (@ any wavelength) with the 818P-001-12 filter, the user must calibrate the assembly using the following procedure:

Step 1: Set up the 818P-001-12 wattmeter to measure the power of your laser. Adjust the sensitivity of the wattmeter to your working wavelength. Verify that the power level is below the detector's damage threshold and that the laser has a good stability.

Step 2: Warm up the detector by applying power to it for a few minutes. This will reduce thermal bias.

Step 3: Measure the power level without the filter. To reduce random uncertainty, we recommend taking the average of 5 distinct measurements.

Step 4: Install the filter. Without changing the laser settings, measure the power level by averaging the same number of measurements. All laser settings must be identical as in Step 3, including beam size and position on detector.

Step 5: Repeat the first measurement (Step 3) to verify that there hasn't been any change during the procedure that would invalidate the calibration. A difference that is larger than the uncertainty of your measurement means that something in the laser or environment changed. You may add this to your \pm uncertainty when using the filter or you may try stabilizing the laser and environment and repeat from Step 3.

The correction multiplier for the 842-PE will be given by:

$$T_f = \frac{\text{Reading without attenuator}}{\text{Reading with attenuator}} (\text{no units})$$

Now use calibration factor F_s for the filter when using it at the wavelength established in Step 1.