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# Low-Power Detectors

## Key Features

- *Power levels from pW to 2W*
- *Wavelengths from 190–1800 nm*
- *Proprietary detector optics*
- *Patented, matched OD3 attenuator*
- *NIST/NPL-traceable calibration included*
- *EMI/RFI shielded*
- *Free-space and fiber optic versions available*

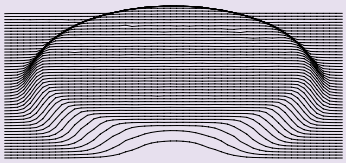


*Figure 1—Newport detector response uniformity with coherent light.*

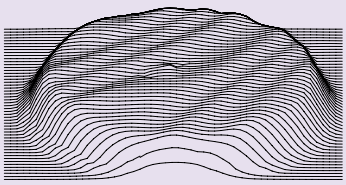


*Figure 2—Typical detector response uniformity with coherent light.*

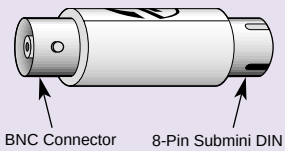



*Figure 3—"/CM" Calibration Module, Patent Pending*

Newport uses the highest quality semiconductor detector materials available in our **818 Series Low-Power Detectors.** In addition, each detector arrives with a complete full-spectrum calibration report detailing detector responsivity in 10 nm increments.

Proprietary detector optics are designed to address the problems associated with measuring coherent light (see Fig. 1 and 2). In ordinary detectors, coherent light causes reading errors across the detector surface and measurements are more sensitive to thermal drift. This results in an additional, unreported 5% to 8% calibration uncertainty when making laser power measurements. Newport's detector design eliminates these problems for stable, uniform detector response.

Newport's advanced in-house calibration facility performs the tightest calibrations in the business, further improving the absolute accuracy of our detectors. For more information, refer to Detector Calibration Services (see page 159).

**Exclusive OD3 attenuator technology** extends the calibrated optical dynamic range of our Cylindrical and Hand-Held Wand Detectors by three decades, as shown in Fig. 4. Our patented attenuator design provides low reflection, high damage threshold and spectral flatness, without the damage susceptibility problems of thin-film attenuators or the spectral variance of simple volume-absorbing attenuators.

Calibration modules are required when using Cylindrical and Hand-Held Wand Detectors with Newport's **Model 840-C, 1830-C, 1835-C, 2832-C, 2835-C or 4832-C optical meters**. The module, shown in Figure 3, is matched to an individual detector and provides the meter with detector calibration and operating information. The calibration module option is indicated by the /CM suffix in the detector Model number.

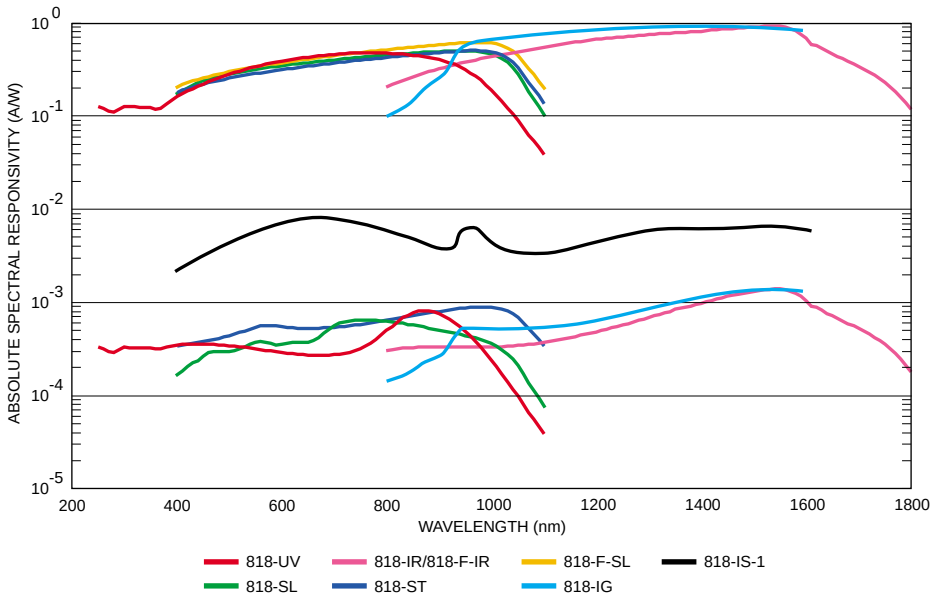



*Figure 4—Low-power detector responsivity curves.*

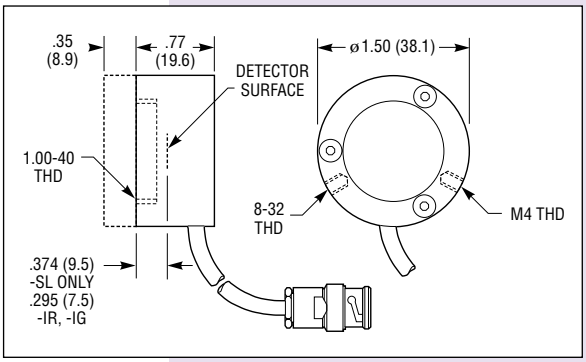




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## 818 Series Cylindrical Detectors




**The 818 Series Cylindrical Detectors (818-UV, 818-SL, 818-IR, 818-IG)** are offered for broad wavelength ranges covering UV, visible, near-IR, and IR regions. They use the finest large-area planar-diffused PIN silicon, indium gallium arsenide, germanium PIN or inverted-channel silicon detectors. Each is optimized for zero-bias operation to provide the low noise, high stability and uniformity demanded by critical radiometric measurements. Compact packaging, international mounting holes and BNC-terminated cabling make incorporation into experimental, production and field applications straightforward. Please see page 133 for Specifications and Ordering Information.

*818-SL and 818-IG detectors can be mounted to our 819 Series Integrating Spheres and calibrated as a system. Please see page 139 for more information.*

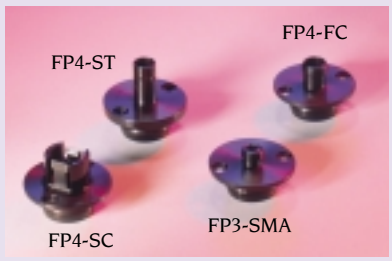
## Cylindrical Detector Accessories

Fiber optic adaptors for the **818 Series Cylindrical Detectors** allow the user to perform optical power measurements when working with bare and connector terminated optical fibers.

**The FP3-FH1 Bare Fiber Holder** is a cleverly designed clamp that is used to hold 250 µm bare fibers without damaging the fiber. It in turn plugs into the **818-FA2 Bare Fiber Holder Mount**, which allows one to attach the assembly to the front end of Newport's Cylindrical Detector housing.

**FP3/FP4 Series Connector Adaptors** accommodate optical fibers terminated in the most popular fiber optic connector styles: SMA, ST, FC and SC. The redesigned adaptors have more space around the threaded input and can be attached to the **818-FA Fiber Adaptor Mount** with two screws, allowing for easier insertion and unplugging of fiber optic connectors. When working with our small area detectors (**818-IR/818-IG**), we recommend using an **FP4-CORE-IR**, described next. **FP4-CORE-VIS/NIR Adaptor Cores** do not contain collimating optics, and are suitable only for use with our large area detectors.

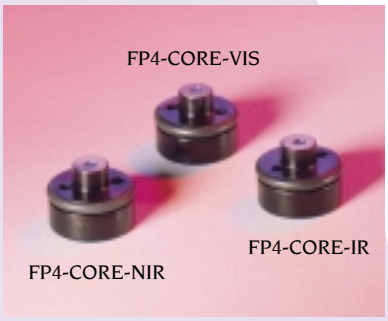






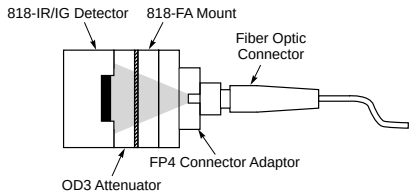
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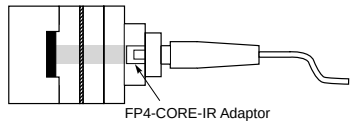

**FP4-CORE-IR Series Adaptor Cores** allow you to make accurate measurements from connectorized fibers regardless of input conditions by preventing detector overfill effects. The **FP4-CORE-IR** collimates the light emerging from the fiber tip to prevent detector overfill when using small area detectors (**818-IR, 818-IG**), even when the attenuator is used. Insertion loss and backreflection from the fiber tip may be reduced by applying a small amount of index matching gel to the air gap between the fiber tip and the fused silica input surface. The coating is optimized for 900–1600 nm.

Models **FP4-CORE-NIR** and **FP4-CORE-VIS** do not have the collimating optics, and are intended only for use with our large area detectors (**818-UV, 818-SL**). They do have the fused silica window, and can be used with index matching gel to obtain low backreflection and low insertion loss connections. The modularity of the **FP4 Series** allows quick interchangeability of the cores into the various **FP4 Series** connector adaptors. The FP4 cores cannot be used with the **FP3-SMA** connector adaptor.

*Please see page 133 for ordering information on Newport's cylindrical detector accessories.*

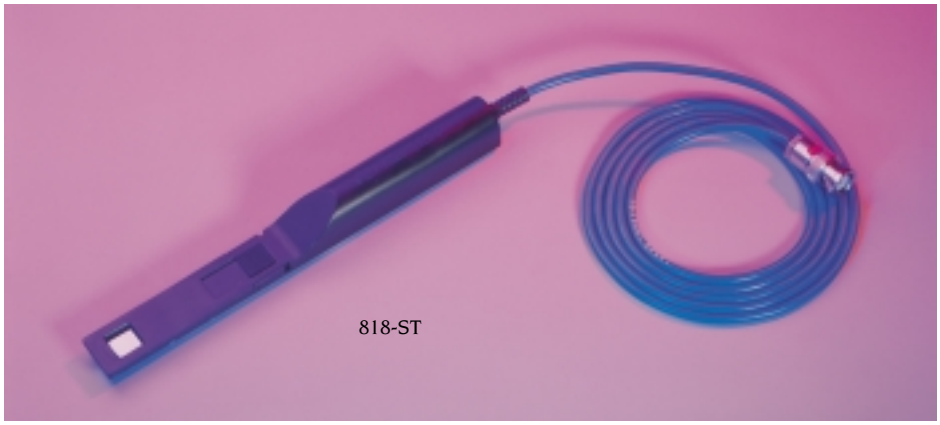



Diverging beam overfills detector area




FP4-CORE-IR collimates beam onto small area detector, even with use of OD3 attenuator

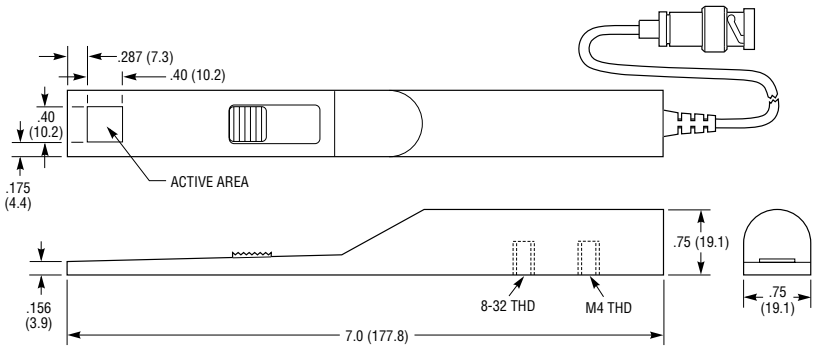
## 818-ST Hand-Held Wand Detector

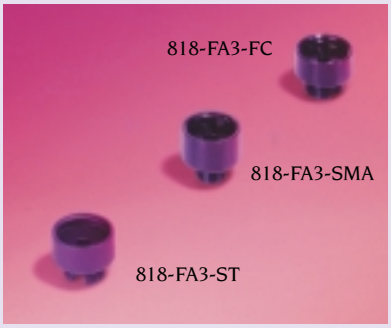





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## 818-F Series Fiber Optic Detector Modules



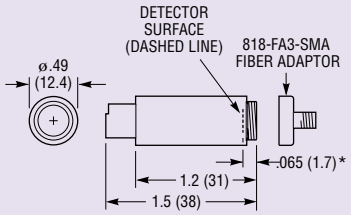

**818-F Series Fiber Optic Detector Modules** are optimized for measurements on connectorized fiber optics. These compact detector modules allow the connection of an optical fiber directly to the meter, configuring it as a dedicated fiber optic power meter. These detector modules are only compatible with Newport meters that support the /CM detector option. They are not BNC-terminated.

*Please see page 133 for specifications*

Connector adaptors for the **818-F Series Fiber Optic Detector Modules** are available for five popular fiber optic connectors. An SMA adaptor comes with each fiber optic module.

The **818-ST** Hand-Held Wand puts all the performance of the 818-SL detector into a narrow-profile, hand-held wand. It even provides a built-in OD3 attenuator at the flick of a button. BNC termination provides compatibility with Newport optical meters. The wand is compatible with both English and metric post mounts. Please see page 133 for specifications and ordering information.

## Dimensions



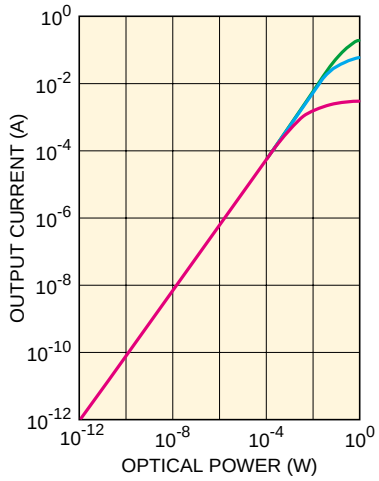

* This dimension is also the fiber tip-to-detector distance.




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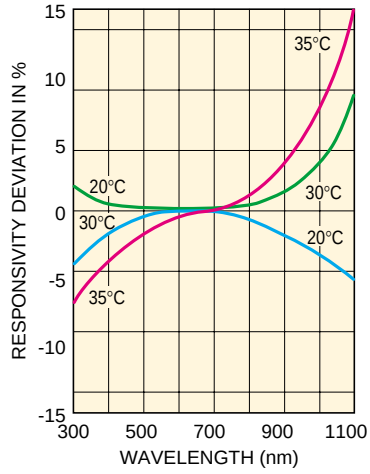
## Ordering Information

| Model | Description |
|---|---|
| 818-F-SL | Detector Module 400–1100 nm |
| 818-F-IR | Detector Module 780–1800 nm |
| 818-FA3-SMA | SMA Adaptor |
| 818-FA3-FC | FC Adaptor |
| 818-FA3-ST | ST Adaptor |

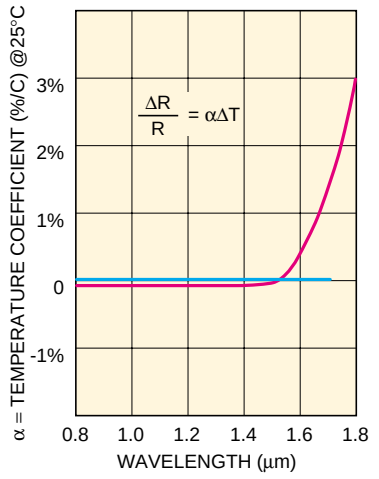



*Linearity of photodiode response*

818-UV
818-SL, 818-ST, 818-IS-1
818-IR, 818-IG

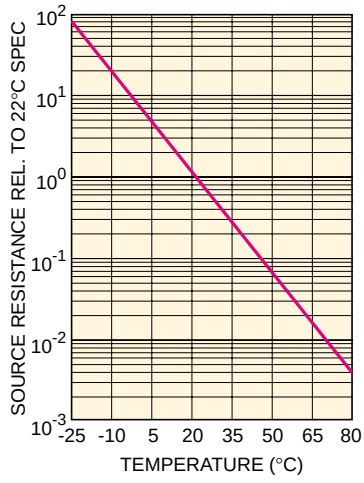



*Temperature variation of response vs. wavelength for* 818-UV, 818-SL, 818-ST




*Temperature variation of response vs. wavelength*

818-IG
818-IR




*Relative shunt resistance vs. temperature*



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# 818 Series Detector Specifications and Ordering Information

| Model w/ Calib. Module | 818-UV<br>818-UV/CM | 818-SL<br>818-SL/CM | 818-F-SL | 818-ST<br>818-ST/CM | 818-IR / 818-F-IR<br>818-IR/CM | 818-IG<br>818-IG/CM |
|---|---|---|---|---|---|---|
| Spectral Range | 0.19–1.1 µm | 0.4–1.1 µm | 0.4–1.1 µm | 0.4–1.1 µm | 0.78–1.8 µm | 0.8–1.65 µm |
| Power, Average Max w/ Attenuator[1] | 0.2 W/cm² | 2 W/cm² | | 2 W/cm² | 2 W/cm² | 2 W/cm² |
| Power, Average Maximum w/o Attenuator[1] | 0.2 mW/cm² | 2 mW/cm² | 2 mW/cm² | 2 mW/cm² | 3 mW/cm² | 3 mW/cm² |
| Pulse Energy, Maximum - w/ Attenuator[2] | 0.10 µJ/cm² | 1 µJ/cm² | | 0.03 µJ/cm² | 0.35 µJ/cm²<br>Not Avail.[3] | 0.35 µJ/cm² |
| Pulse Energy, Maximum - w/o Attenuator[2] | 0.1 nJ/cm² | 1 nJ/cm² | 0.03 nJ/cm² | 0.03 nJ/cm² | 0.35 nJ/cm² | 0.35 nJ/cm² |
| Accuracy at constant temperature | ±7% @ 0.19; ±2% @ 0.20-1.1 | ±2% @ 0.4-1.1 | ±2% @ 0.4 - 1.1 | ±2% @ 0.4-1.1 | ±3% @ 0.78-1.7; ±5% @ 1.71-1.8; ±7% w/ Attenuator[5] | ±2% @ 0.8-1.65 |
| Uniformity[4] | ±2% | ±2% | ±2% | ±2% | ±2% | ±2% |
| Linearity | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% |
| Saturation Current | 0.1 mA/cm² | 4.6 mA/cm² | 2 mA/cm² | 8 mA/cm² | 400 mA/cm² | 250 mA/cm² |
| Responsivity | ≥0.09 A/W<br>250–1000 nm | >0.1 A/W<br>400–1000 nm | >0.1 A/W<br>400–1000 nm | >0.1 A/W<br>400–1000 nm | ≥0.2 A/W<br>850–1700 nm | ≥0.1 A/W<br>800–1600 nm |
| Responsivity (Peak) | >0.4 A/W<br>@ 850 ± 100 A/W | >0.5 A/W<br>@ 920 A/W | >0.4 A/W<br>@ 960 A/W | >0.5 A/W<br>@ 960 A/W | >0.8 A/W<br>@ 1550 A/W | >0.9 A/W<br>@ 1550 A/W |
| Rise Time | ≤2 µs | ≤2 µs | ≤1 µs | ≤3 µs | ≤2 µs | ≤2 µs |
| Shunt Resistance | ≥2 MΩ (typ) | ≥2 MΩ (typ) | ≥200 MΩ (typ) | ≥50 MΩ (typ) | ≥35 kΩ (typ) | ≥20 MΩ (typ) |
| Die Capacitance | 8,800 pF | 12,000 pF | 160 pF | 1,100 pF | 14 nF | 1500 pF |
| Reverse Bias, Maximum | 100 V | 10 V | 5 V | 5 V | 0.25 V | 2 V |
| NEP | $8.9 \times 10^{-13}$ W/√Hz | $5.5 \times 10^{-13}$ W/√Hz | $1.1 \times 10^{-14}$ W/√Hz | $1.5 \times 10^{-14}$ W/√Hz | $0.7 \times 10^{-12}$ W/√Hz | $3.0 \times 10^{-14}$ W/√Hz |
| Material | Silicon | Silicon | Silicon | Silicon | Germanium | Indium Gallium Arsenide |
| Active Area | 1 cm² | 1 cm² | 0.071 cm² | 1 cm² | 0.071 cm² | 0.071 cm² |
| Active Diameter | 1.13 cm | 1.13 cm | 0.3 cm | 1x1 cm | 0.3 cm | 0.3 cm |
| Shape | Cylinder | Cylinder | Fiber Module | Wand | Cylinder[5]<br>Fiber Module[3] | Cylinder |
| Attenuator, OD3 | Detachable | Detachable | | Built-In | Detachable[5]<br>Not Avail.[3] | Detachable |

1) Applies to entire spectral response
2) 15 ns pulse width
3) Applies to 818-F-IR
4) When measured with 1.0 mm diameter beam centered within 80% of active area
5) Applies to 818-IR and 818-IR/CM

## Cylindrical Detector Accessories Ordering Information

| Model | Description |
|---|---|
| 818-FA2 | Bare Fiber Holder Mount |
| FP3-FH1 | Bare Fiber Holder |
| 818-FA | Fiber Adaptor Mount |
| FP3-SMA | Connector Adaptor |
| FP4-ST | ST Connector Adaptor |
| FP4-LC | LC Connector Adapter |

| Model | Description |
|---|---|
| FP4-FC | FC Connector Adaptor |
| FP4-SC | SC Connector Adaptor |
| FP4-CORE-VIS | Adaptor Core (430-700 nm) |
| FP4-CORE-NIR | Adaptor Core (650-1000 nm) |
| FP4-CORE-IR | Lensed Adaptor Core (1000-1550 nm) |




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