

User's Manual

# 125 MHz PHOTORECEIVERS

MODELS 1801 AND 1811



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## Table of Contents

List of Figures and Tables .....	4
1 Warranty .....	5
1.1 Limitation of Warranty .....	5
2 Safety Information .....	6
2.1 Safety Procedures and Precautions .....	6
2.2 Symbols Used in This Instruction Manual .....	6
3 Operation .....	7
3.1 Introduction .....	7
3.2 Handling Precautions .....	8
3.3 Using the Photodetector .....	8
3.4 Theory .....	9
4 Characteristics .....	14
4.1 Physical Specifications .....	14
4.2 Photodetector Specifications .....	15
5 Customer Service .....	16
5.1 Technical Support .....	16
5.2 Service .....	16

## List of Figures and Tables

Figure 1: Functional block diagram of Models 1801 & 1811 (DC versions).....	10
Figure 2: Functional block diagram of Models 1801 & 1811 (AC versions).....	10
Figure 3: Responsivity of the photodiode used in the Model 1801 (DC version).....	11
Figure 4: Responsivity of the photodiode used in the Model 1811 (DC version).....	11
Figure 5: Typical frequency response .....	12
Figure 6: Typical input referred noise of the 18x1 products .....	12
Figure 7: Typical output noise of the 18x1 products.....	13
Table 1. 1801 and 1811 series specifications.....	15

# 1 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 first occurs.

## 1.1 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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### **CAUTION**

**These photodetectors and photoreceivers are sensitive to electrostatic discharges and could be permanently damaged if subjected to any discharges. Ground yourself adequately prior to handling these detectors or making connections. A ground strip provides the most effective grounding and minimizes the likelihood of electrostatic damage.**

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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.

## 2 Safety Information

### 2.1 Safety Procedures and Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of intended use of the instrument and may impair the protection provided by the equipment. MKS Instruments, Inc. assumes no liability for the customer's failure to comply with these requirements.

#### DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an MKS Calibration and Service Center for service and repair to ensure that all safety features are maintained.

#### SERVICE BY QUALIFIED PERSONNEL ONLY

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel only.

### 2.2 Symbols Used in This Instruction Manual

Definitions of, NOTE, CAUTION, WARNING and DANGER messages used throughout the manual.

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#### **NOTE**

The NOTE sign denotes important information. It calls attention to a procedure, practice, condition, or the like, which is essential to highlight.

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#### **CAUTION**

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of all or part of the product.

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#### **WARNING**

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in injury to personnel.

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#### **DANGER**

The DANGER sign indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

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## 3 Operation

### 3.1 Introduction

The Newport Models 1801 and 1811 125-MHz, low noise photoreceivers address the needs of the photodetector community in the area of low-noise, high-gain, RF photoreception. These photoreceivers are available either DC or AC coupled. Their typical bandwidth is 125 MHz with a current gain of 40 V/mA.

The performance of these units is achieved through the use of solid RF design together with the implementation of some of the latest advances in commercially available amplifier chips. The detector case is shielded to avoid RF pickup. Newport offers two models to match your different wavelength needs. The specifications at the rear of the manual list each model's characteristics.

These units address nearly all of the general purpose needs of the RF photo reception community. They all have a very large gain-bandwidth product, low noise, high drive capability and a large dynamic range. These receivers will enable wide bandwidth lower noise detection of signals distributed over fiber optic cables or found in high resolution spectroscopy, fiber optic sensors, optical metrology, and many other applications.

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**NOTE**

Do not discard any packing materials unless you have completed your inspection and are sure the unit arrived safely.

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**CAUTION**

Only qualified individuals should perform the installation and any adjustments. They must comply with all the necessary ESD and handling precautions while installing and adjusting the instrument. Proper handling is essential when working with all highly sensitive precision electronic instruments.

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### 3.2 Handling Precautions

Whenever handling the photo receiver, make sure to follow these precautions:

- Prior to handling the unit or making connections, be sure to ground yourself adequately—even small electrostatic discharges could permanently damage the device. A ground strap provides the most effective grounding and minimizes the likelihood of electrostatic damage.
- Make sure the optical connector is clean and undamaged before connecting it to the detector module.

### 3.3 Using the Photodetector

To obtain optical input:

1. Plug one end of the power cable to the connector on the back of the module and the other end into a  $\pm 15$  Volt power supply. Turn on the supply. Two different power cables have been shipped with your detector: a model 0924 banana plug to Pico (m8) cable and a Model 0923 Pico (m8) to Pico (m8) cable. The convention of the three banana plugs is:

Banana Plug	Voltage
Red	+15 V
Green	COM/GND
Black	-15 V

2. Turn on the optical beam.
3. For free space beam input, align the module so that the beam is incident on the detector surface. For fiber-optic input, connect the fiber-optic cable from your optical source to the FC input connector on the front of the module. The detector is designed to receive an FC/PC connectorized fiber.

#### NOTE

to operate the receiver in the linear region, keep the input power levels well below The CW saturation power specification on page 12 period (the input power is wavelength dependent and is inversely proportional to the responsivity.)

To set up the output connection:

1. if your RF measurement instrument has a male connector, connected directly to the SMA female output connector (labeled "AC" on AC-couple units) on the back of the module.



2. If your instrument has a female connector, connect with the appropriate cable.
3. On AC-coupled units, monitor the DC bias on the output labeled "DC" with the provided SMB-to-BNC cable.

### 3.4 Theory

The Model 1801 photoreceiver contains a silicon/PIN photodiode. The Model 1811 contains an InGaAs/PIN photodiode. In both models, the photodiode is followed by a low-noise transimpedance amplifier. A functional block diagram of the DC-coupled version is shown in Figure 1.

The AC-coupled versions incorporate blocking capacitors and a DC bias monitor circuit. The corner frequency of the high-pass filter on the AC-coupled output is approximately 25 kHz. The corner frequency of the low-pass filter on the DC bias monitor output is approximately 50 kHz. Refer to Figure 2 for a functional block diagram.

Figure 3 and Figure 4 show the responsivity of the photodiodes. Power is delivered through a connector on the back of the unit and the entire package is shielded to eliminate RF pickup.

The 3-dB bandwidth is typically in excess of 125 MHz for the Model 18x1 photoreceivers. See the typical frequency response plot in Figure 5.

The output noise for the 18x1 family is 5 mVrms when measured on a >250-MHz, 50-ohm oscilloscope. For additional information on 18x1 noise performance, see the typical Input Referred Noise and typical Output Noise plots in Figure 6 and 7.

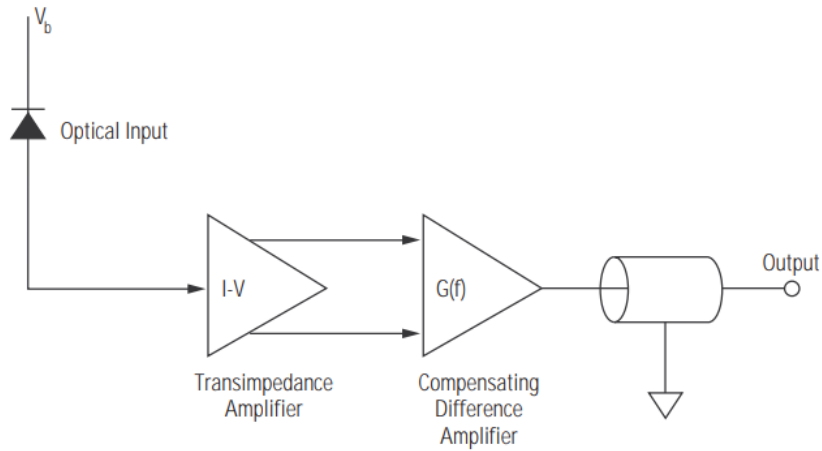


Figure 1: Functional block diagram of Models 1801 & 1811 (DC versions).

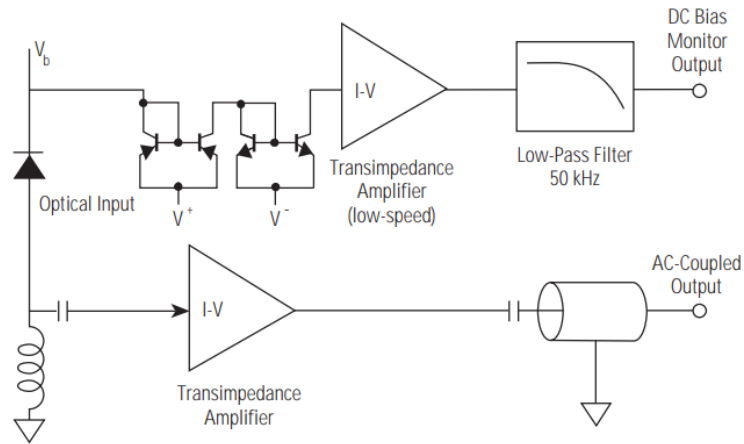


Figure 2: Functional block diagram of Models 1801 & 1811 (AC versions).

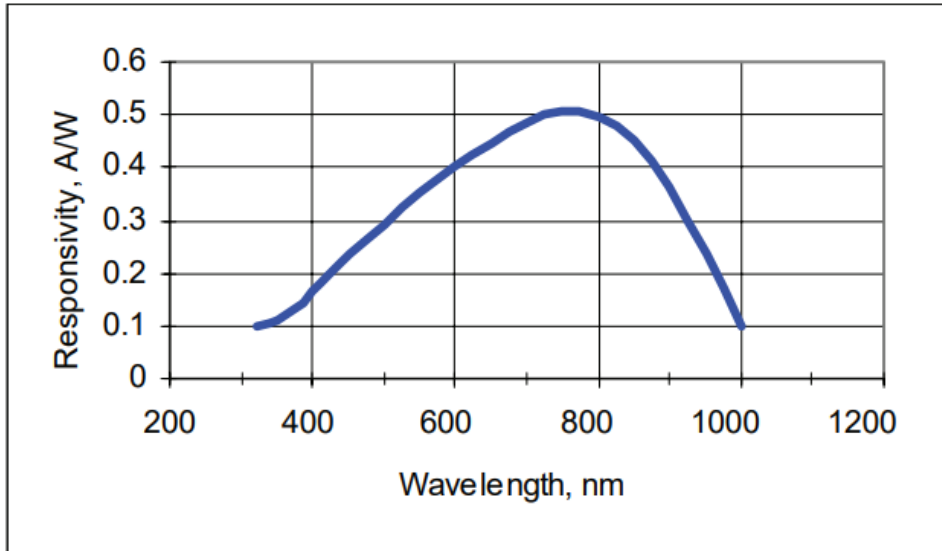


Figure 3: Responsivity of the photodiode used in the Model 1801 (DC version).

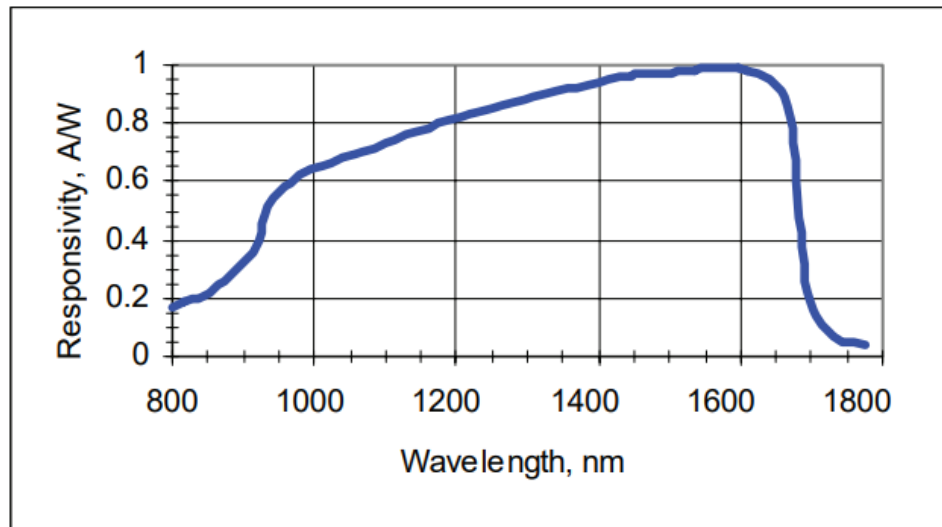


Figure 4: Responsivity of the photodiode used in the Model 1811 (DC version).

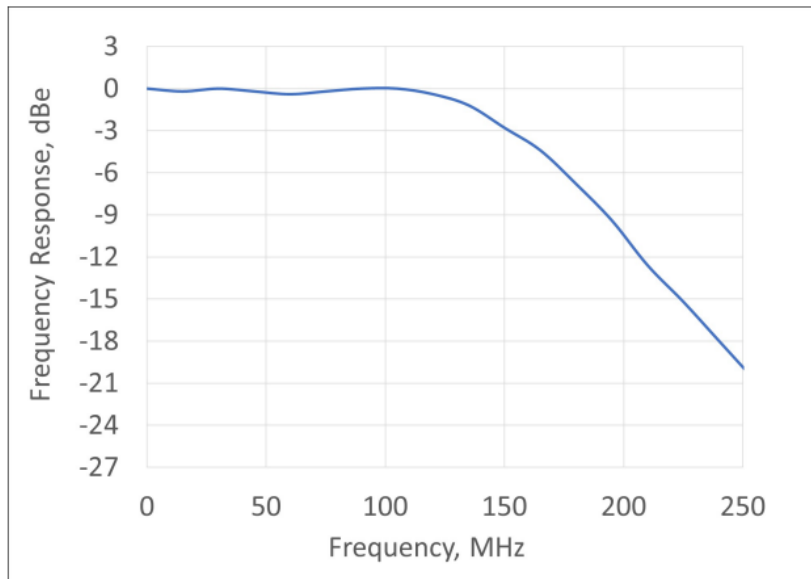


Figure 5: Typical frequency response

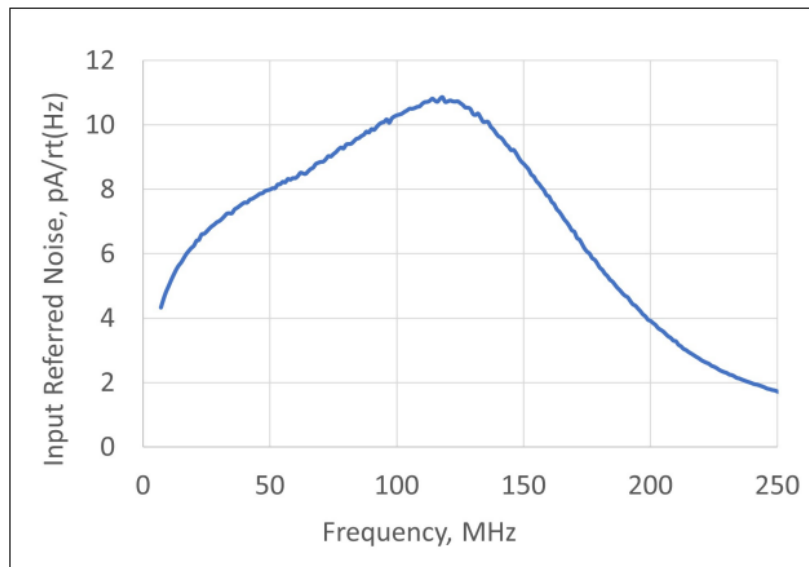


Figure 6: Typical input referred noise of the 18x1 products

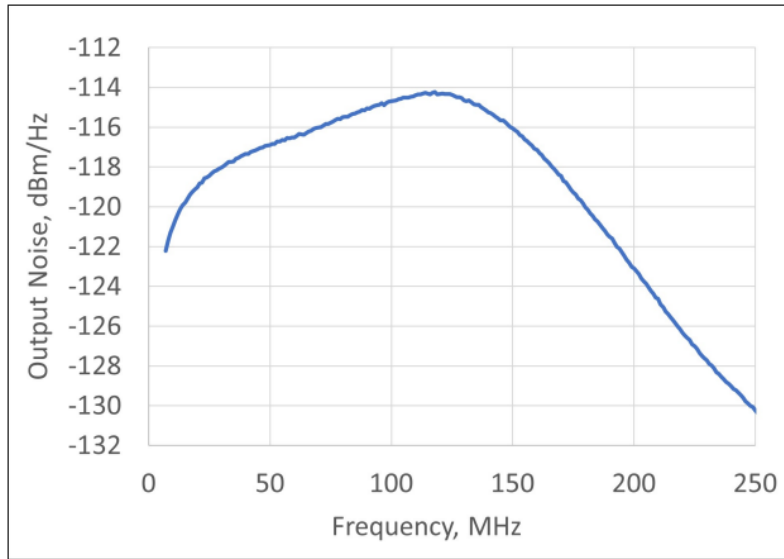


Figure 7: Typical output noise of the 18x1 products

## 4 Characteristics

### 4.1 Physical Specifications

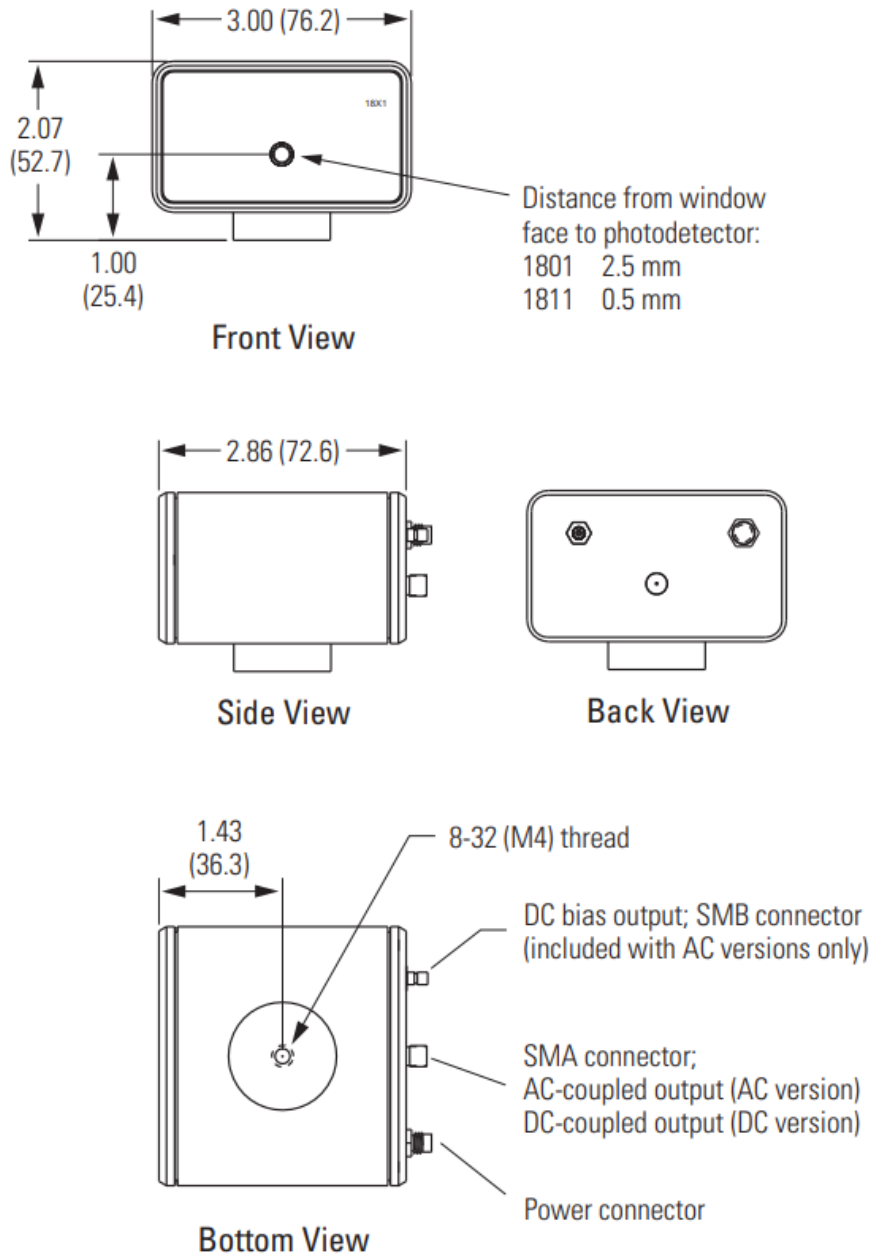


Figure 8. Mechanical drawings of the Model 18X1 housing.

## 4.2 Photodetector Specifications

Table 1. 1801 and 1811 series specifications.

Model	1801	1811
Wavelength Range	320–1000 nm	900–1700 nm
Coupling	DC or AC	DC or AC
3-dB Bandwidth (DC versions)	DC–125 MHz typical	DC–125 MHz typical
3-dB Bandwidth (AC versions)	25 kHz–125 MHz typical	25 kHz–125 MHz typical
DC Bias Monitor Bandwidth (AC versions only)	DC–50 kHz typical	DC–50 kHz typical
Risetime	3 ns (typical)	3 ns (typical)
Transimpedance Gain* (AC-coupled version)	40 V/mA (AC) 10 V/mA (DC)	40 V/mA (AC) 10 V/mA (DC)
Transimpedance Gain* (DC-coupled version)	40 V/mA	40 V/mA
Output Impedance	33 $\Omega$	33 $\Omega$
Integrated Noise	5 mVrms	5 mVrms
Conversion Gain*	$2 \times 10^4$ V/W @ 760 nm	$4 \times 10^4$ V/W @ 1550 nm
Saturation Power	110 $\mu$ W @ 760 nm	55 $\mu$ W @ 1550 nm
Maximum Optical Power	10 mW @ 760 nm	5 mW @ 1550 nm
Detector Material/Type	Silicon/PIN	InGaAs/PIN
Detector Diameter	0.4 mm	0.3 mm (FS) 0.15 mm (FC)
Power Requirements	$\pm 15$ V DC; <200 mA	$\pm 15$ V DC; <200 mA
Optical Input	FC or free space	FC or free space
RF Output	SMA	SMA
DC Bias Monitor output (AC-coupled units only)	SMB	SMB
Operating Temperature	10 - 35 $^{\circ}$ C, < 70% RH	10 - 35 $^{\circ}$ C, < 70% RH

\* When driving a 50  $\Omega$  load.



## 5 Customer Service

### 5.1 Technical Support

Information and advice about the operation of any Newport product is available from our technical support engineers. For quickest response, ask for “Technical Support” and know the model number and serial number of your photoreceiver.

Hours: 8:00-5:00 PST, Monday through Friday (excluding holidays)

Phone: 1-877-835-9620

Support is also available by email and chat

Chat: Connect with us at [www.Newport.com](http://www.Newport.com)

Email: [tech@newport.com](mailto:tech@newport.com)

We typically respond to email within one business day.

### 5.2 Service

In the event that your photoreceiver malfunctions or becomes damaged, please contact Newport for a return merchant authorization (RMA) number and instructions on shipping the unit back for evaluation and repair.

## Index

### B

Block diagram, 4, 9, 10

### D

DC bias, 9

### E

Electrostatic discharges, 5

### F

Frequency response, 4, 9, 12

### I

Input referred noise, 4, 12

### N

Noise, 4, 7, 9, 13

### P

Power supply, 8

### R

Responsivity, 4, 11

### S

Specifications, 3, 14, 15