

# 2 General Information

## 2.1 Introduction

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The 1935/2935 Series Optical Meters are designed to provide a powerful combination of features to measure optical power and energy of near-monochromatic or monochromatic sources. Use of the extensive measurement modes and features have been simplified with an intuitive menu driven structure that provides quick access to all modes, features and settings. Some of the prominent specifications and features that will simplify your calibrated measurement applications are in the following:

- Compatibility with Photodiode, Thermopile and Pyroelectric detectors. (Low-Power (Semiconductor) Family, High-Power (Thermopile) Family, Energy (Pyroelectric) Family, InGaAs Cooled, Photometric, PMT, GaN, PbS, PbSe, and HgCdZnTe)
- Up to 20 kHz repetition rates for photodiode detectors and up to 10 kHz repetition rates for pyroelectric detectors with signal sampling rates of up to 250 kHz.
- Multiple measurement modes for power and energy measurements: Single, Continuous, Integrated, Peak-to-Peak and Frequency.
- Software suite, including LabVIEW drivers, .NET programming capability and high-speed data transfer utility.
- 250,000 of internal data point storage and external USB flash-memory compatibility.
- Triggering features to synchronize measurements with external events.
- Built-in temperature controller (1935T-C, 2935T-C and 2935T-C-1 only) for cooled detectors (e.g. 918D-IG-C1).
- USB and RS-232 Interfaces
- Rack Mountable in Single or Dual Set Configurations

The full color TFT 5.6" LCD renders excellent visibility both with the naked eye and laser goggles for single screen rendering of plotted and enumerate results. Measurements can be displayed in W, Joules, Amps, Volts, Hertz, dBm, dB or relative units, either directly or as relative ratio measurements from present or stored values. Statistical capabilities include the computation of Min, Max, Max-Min, Mean and Standard Deviation. Additional features such as digital and analog filtering, and data storage of up to 250,000 readings per channel are also offered.

Newport's experience with calibration, together with N.I.S.T. calibration traceability and high precision optical power meters provide users with accurate measurements and exceptional inter-instrument correlation. In R&D, QA/QC, and manufacturing environments, the 1935/2935 Series power meters enable users to benefit from high correlation between multiple locations at a price-to-performance ratio second to none. Among all the other practical tools provided, remote controlling with a computer and synchronization to other instruments are simplified with the inclusion of LabVIEW drivers, tools to develop in the .NET environment and a high-speed software utility that fully utilized the optical meter's ability to sample at 250 kHz and transfer data via USB interface at 8 Mbps.

## **2.2      Optical Meter Functionality**

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Optical meters in the 1935/2935 Series product line are designed to provide continuous wave (CW) and pulsed source measurements that support the testing and production needs of free space beams and fiber optics based sources. These optical meters come in one or two channel configurations and with cooled detector controllers. They require detectors having a 15-pin D-Sub type Male connector.

## **2.3      Model 1935-C**

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The model 1935-C optical meter is a 1-channel input optical meter compatible with all Newport detectors having a 15-pin D-sub type connector. All product features and capabilities described herein are included in this model, except a second detector channel or built in detector cooler controller.

## **2.4      Model 2935-C**

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The model 2935-C optical meter is a 2-channel input optical meter compatible with all Newport detectors having a 15-pin D-sub type connectors. All product features and capabilities described herein are included in this model, except a built in detector cooler controller.

## **2.5      Model 1935T-C**

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The model 1935T-C optical meter is a 1-channel input optical meter with a built in detector cooler controller compatible with all cooled detectors and detectors having a 15-pin D-sub type connector offered by Newport Corporation. All product features and capabilities described herein are included in this model, except a second detector channel.

## **2.6      Model 2935T-C**

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The model 2935T-C optical meter is a 2-channel input optical meter with two (2) built in detector cooler controllers compatible with cooled detectors and detectors having a 15-pin D-sub type connector offered by Newport Corporation. All product features and capabilities described herein are included in this model.

## 2.7 Calibration

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Calibration of the power meter is done at the factory by defining a slope and offset, for all ranges as determined for each detector type.

Newport recommends annual factory re-calibration to ensure the continued accuracy of power meter measurements.

Please refer to the “Maintenance and Troubleshooting” section for contact information for re-calibration of your power meter.

## 2.8 Specifications

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### 2.8.1 Physical Specifications:

Dimensions:	5.25 x 12.11 x 8.50 in (133 x 308 x 216 mm)
Weight:	max. 12.4 lb.
Enclosure:	Metal case, painted
Connectors:	Optical Detector 15-Pin D-Sub, TEC 15-Pin D-Sub (optional), BNC Analog Output, Trigger Output, Trigger Input, 9 Pin D-Sub RS-232, USB Host, USB Device
Power:	100/120/220/240VAC $\pm$ 10%, 50/60 Hz, 70 Watts
Display:	Graphical LCD $\frac{1}{4}$ VGA, 5.7 in diagonal
Display Update Rate:	$\geq$ 20 Hz
Operating Environment:	5°C to 40°C; < 70% RH non-condensing
Storage Environment:	-20°C to 60°C; < 90% RH non-condensing
Altitude	< 3000m
Installation Category	II
Pollution Degree	2
Use Location	Indoor use only



**D.C. Voltage Measurement (Thermopile)**

Signal Range <sup>2,3</sup>	0	1	2	3	4	5
Full-Scale Voltage	2.5mV	25.0 mV	250 mV	2.50 V	25.0 V	130 V
Resolution	76.3 nV	763 nV	7.63 $\mu$ V	76.3 $\mu$ V	763 $\mu$ V	3.96 mV
Accuracy (Filtered) <sup>1</sup>	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Accuracy (Maximum Measurement Rate=10kHz)	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Frequency Measurement (Square Wave Signal) <sup>7</sup>	130 Hz – 200 kHz	20 Hz – 220 kHz	0.5 Hz – 220 kHz	0.5 Hz – 250 kHz	0.5 Hz – 220 kHz	0.5 Hz – 200 kHz
Frequency Measurement (Sine Wave Signal) <sup>7</sup>	130 Hz – 200 kHz	20 Hz – 220 kHz	20 Hz – 220 kHz	20 Hz – 220 kHz	20 Hz – 220 kHz	20 Hz – 200 kHz
Frequency Measurement Accuracy <sup>7</sup>	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Bandwidth <sup>8</sup>	640 kHz	1600 kHz	1600 kHz	1900 kHz	640 kHz	1900 kHz
Signal to Noise Ratio <sup>1</sup>	80dB	90dB	100dB	100dB	100dB	100dB

**Pulse Voltage Measurement (Energy, Pyroelectric)**

Signal Range <sup>2,3</sup>	0	1	2	3	4	5
Full-Scale Current	2.5mV	25.0 mV	250 mV	2.50 V	25.0 V	130 V
Resolution	76.3 nV	763 nV	7.63 $\mu$ V	76.3 $\mu$ V	763 $\mu$ V	3.96 mV
Accuracy	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Frequency Measurement (Pulsed Signal) <sup>7</sup>	130 Hz – 200 kHz	20 Hz – 220 kHz	0.5 Hz – 220 kHz	0.5 Hz – 250 kHz	0.5 Hz – 220 kHz	0.5 Hz – 200 kHz
Frequency Measurement Accuracy <sup>7</sup>	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Bandwidth <sup>8</sup>	640 kHz	1600 kHz	1600 kHz	1900 kHz	640 kHz	1900 kHz
Maximum Pulse Repetition Rate <sup>5</sup>	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz

**RMS Measurement**

Maximum Pulse Repetition Rate	10 kHz
Accuracy	1.0 %

## Analog Output

Output Range	0	1	2	3
Full Scale Voltage (Load > 100 k $\Omega$ )	1 V	2 V	5 V	10 V
Full Scale Voltage (Load = 50 $\Omega$ )	0.5 V	1 V	2.5 V	-
Accuracy	1.0 %	1.0 %	1.0 %	1.0 %
Linearity	0.3%	0.3%	0.3%	0.3%

## Trigger Level

Programmable Level	0...100 % Full Scale
Resolution	0.39 % Full Scale

## TEC Controller

TEC Maximum Current	1.5 A
TEC Maximum Compliance Voltage	1.5 V
Available Output Power	2.25W
Temperature Sensor Type	Thermistor, 10k $\Omega$ @ 25 $^{\circ}$ C
Accuracy	1.0 %
Sensor Bias	100 $\mu$ A
Temperature Range <sup>6</sup>	-20 $^{\circ}$ C ... 70 $^{\circ}$ C

<sup>1</sup> With 5Hz filter on.

<sup>2</sup> Listed signal ranges specify meter capability. Available signal ranges are detector dependent.

<sup>3</sup> Maximum measurable signal is detector dependent.

<sup>4</sup> While the maximum repetition range may equal the bandwidth, it really depends on the signal duty-cycle or the signal shape.

<sup>5</sup> The Maximum Repetition Rate refers to the meter pulse-by-pulse measuring capability. Due to its high bandwidth, the 1935/2935 can take in signals with higher repetitive rates and outputs them undistorted at the Analog Output.

<sup>6</sup> The Temperature Range is detector dependent.

<sup>7</sup> The Frequency Measurement min/max values are signal shape dependent. The specified frequency measurement range and accuracy are defined for an amplitude of half full scale.

<sup>8</sup> The instrument bandwidth is determined by the detector used. Please refer to Newport Corporation's complete offering on detector type. The specified bandwidth is measured from the instrument input (detector) to the Analog Output BNC.

## 2.9 Unpacking and Handling

It is recommended that the Models 1935/2935 Series Optical Power Meters be unpacked in a lab environment or work site. Unpack the system carefully; small parts and cables are included with the instrument. Inspect the box carefully for loose parts before disposing of the packaging. You are urged to save the packaging material in case you need to ship your equipment in the future.

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## 2.10 Inspection for Damage

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The Models 1935/2935 Series Optical Power Meters are carefully packaged at the factory to minimize the possibility of damage during shipping. Inspect the box for external signs of damage or mishandling. Inspect the contents for damage. If there is visible damage to the instrument upon receipt, inform the shipping company and Newport Corporation immediately.



### WARNING

**Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.**

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## 2.11 Available Options and Accessories

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Newport Corporation also supplies temperature controlled mounts, lenses, and other accessories. Please consult with your representative for additional information.

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## 2.12 Parts List

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The following is a list of parts included with the 1935/2935 Series Optical Power Meters:

1. User's Manual (Hardcopy)
2. Software Drivers and Utilities (CD)
3. Power cord
4. Two fuses

If you are missing any hardware or have questions about the hardware you have received, please contact Newport Corporation.

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## 2.13 Choosing and Preparing a Suitable Work Surface

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The Models 1935/2935 Series Optical Power Meters may be placed on any reasonably firm table or bench during operation. The front legs of the unit can be pulled out to tilt the unit at an angle, if desired.

Provide adequate distance between the 1935/2935 Series Optical Power Meters and adjacent walls for ventilation purposes. Approximately 2-inch spacing for all surfaces is adequate.

## 2.14 Electrical Requirements

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Before attempting to power up the unit for the first time, the following precautions must be followed:



### WARNING

To avoid electric shock, connect the instrument to properly earth-grounded, 3-prong receptacles only. Failure to observe this precaution can result in severe injury.

- Have a qualified electrician verify the wall socket that will be used is properly polarized and properly grounded.
- Set the mains selector tumbler to the voltage that matches the power outlet AC voltage.
- Verify the correct rated fuses are installed according to the fuse marking on the rear panel.

## 2.15 Power Supplies

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AC power is supplied through the rear panel input power connector that provides in-line transient protection and RF filtering. The input power connector contains the fuses and the switch to select series or parallel connection of the transformer primaries for operation at 100VAC, 120VAC, 220VAC or 240VAC. The product is shipped with the setting on 110V. Please make sure you select the right setting according to your AC voltage level. Also, please make sure you insert the right fuses. The product is shipped with a spare of fuses for the 220VAC/240VAC settings.



### CAUTION

Permanent damage will occur to the power meter if the input power connector settings are at either 100 or 120VAC and applied power is above 180VAC RMS