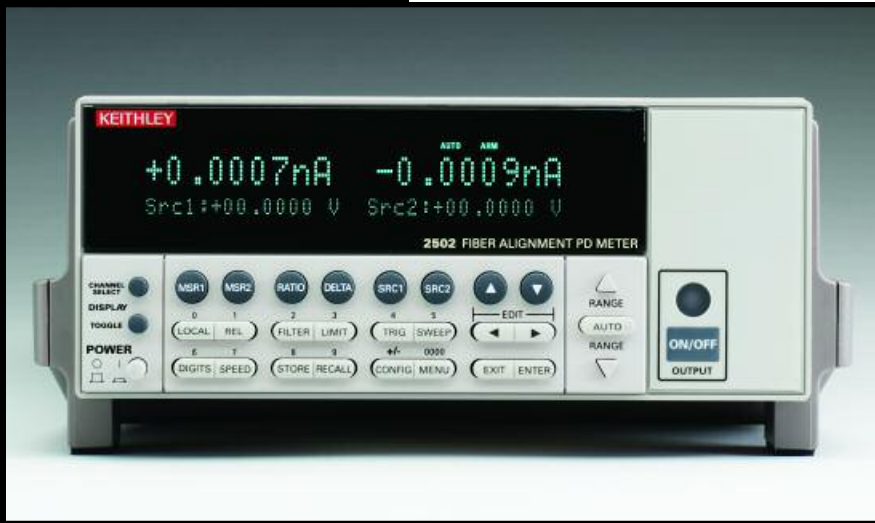


**2502**

# Dual Channel Picoammeter



- Dual-channel instrument for optical power measurements
- $\pm 100\text{V}$  photodetector bias capability
- Measure photodetector current from  $1\text{fA}$  to  $20\text{mA}$
- $1\text{fA}$  dark current measurement resolution
- Measure optical power directly when used with Model 2500INT Integrating Sphere
- $0\text{--}10\text{V}$  analog output for high resolution optical power feedback
- Provides a high accuracy, high speed fiber alignment solution
- Allows assembly process, final testing, parts binning, and specification
- Allows faster alignment of the fiber with the laser diode's optimum light emitting region
- Combines fiber alignment and device characterization processes
- User-programmable photodetector calibration coefficients
- 3000-point buffer memory on each channel allows data transfer after test completion
- Digital I/O and Trigger Link for binning and sweep test operations
- IEEE-488 and RS-232 interfaces

The Model 2502 Photodiode Meter is designed to increase the throughput of Keithley's LIV (light-current-voltage) test system for production testing of laser diode modules (LDMs). Developed in close cooperation with leading manufacturers of LDMs for fiberoptic telecommunication networks, this dual-channel instrument has features that make it easy to synchronize with other system elements for tight control over optical power measurements. The Model 2502 features a high speed analog output that allows using the LIV test system at the fiber alignment stage of the LDM manufacturing process. Through the use of buffer memory and a Trigger Link interface that's unique to Keithley instruments, the Model 2502 can offer the fastest throughput available today for LIV testing of laser diode modules. These instruments are ruggedly engineered to meet the reliability and repeatability demands of continuous operation in round-the-clock production environments.

## Low-Level, High Speed Measurements

The Model 2502 combines Keithley's expertise in low-level current measurements with high speed current measurement capabilities. Each channel of this instrument consists of a voltage source paired with a high speed picoammeter. Each of the two channels has an independent picoammeter and voltage source with measurements made simultaneously across both channels.

## Part of a High Speed LIV Test System

In a laser diode module DC/CW test stand, the Model 2502 provides the voltage bias to both the back facet monitor diode and a Model 2500INT Integrating Sphere or to a fiber-coupled photodetector. At the same time it applies the voltage biases, it measures the current outputs of the two photodetectors and converts these outputs to measurements of optical power. The conversion is performed with the user-programmed calibration coefficient for the wavelength of the laser diode module. Fast, accurate measurements of optical power are critical for analyzing the coupling efficiency and optical power characteristics of the laser diode being tested. When testing modules with multiple detectors, the Model 2502 packs more testing capabilities into less test rack space.

## Fiber Alignment

The Model 2502's built-in high speed analog output makes it suitable for precision fiber alignment tasks. This instrument combines the ability to align the optical fiber quickly and accurately with a laser diode's optimum light emitting region and the capability to make precision LIV measurements, all in the same test fixture. The Model 2502's wide dynamic range allows early beam skirt detection, reducing the time required for fiber alignment. An LIV sweep can be performed during the alignment process to optimize fiber location for an entire operating range. High speed feedback minimizes delays in the alignment process, so it's unnecessary to sacrifice alignment speed to ensure accurate device characterization.

## Wide Dynamic Measurement Range

The Model 2502 offers current measurement ranges from  $2\text{nA}$  to  $20\text{mA}$  in decade steps. This provides for all photodetector current measurement ranges for testing laser diodes and LEDs in applications such as LIV testing, LED total radiance measurements, measurements of cross-talk and insertion loss on optical switches, and many others. The Model 2502 meets industry testing requirements for the transmitter as well as pump laser modules.

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## 2502

## Dual Channel Picoammeter

The Model 2502 Dual Photodiode Meter can measure and display either photodiode current or optical power for two photodiodes with appropriate user-supplied optical power gain/wavelength calibration factors.

The Model 2502 includes an analog output jack on the rear panel for each channel.

## Measurement Specifications

RANGE	MAXIMUM RESOLUTION	ACCURACY <sup>1,2</sup> 23°C ±5°C ±(% rdg. + offset)	TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C ±(%rdg. + offset)/°C	DC INPUT IMPEDANCE <sup>3</sup> (Maximum)
2.000000 nA	1 fA	1.00% + 2 pA	0.01 + 200 fA	20 kΩ
20.00000 nA	10 fA	0.40% + 2 pA	0.01 + 200 fA	20 kΩ
200.0000 nA	100 fA	0.30% + 200 pA	0.02 + 20 pA	200 Ω
2.000000 μA	1 pA	0.20% + 200 pA	0.02 + 20 pA	200 Ω
20.00000 μA	10 pA	0.10% + 20 nA	0.01 + 2 nA	2.0 Ω
200.0000 μA	100 pA	0.10% + 20 nA	0.01 + 2 nA	2.0 Ω
2.000000 mA	1 nA	0.10% + 2 μA	0.02 + 200 nA	0.2 Ω
20.00000 mA	10 nA	0.10% + 2 μA	0.02 + 200 nA	0.2 Ω

MAXIMUM INPUT: ±20.0mA.

TYPICAL SPEED AND NOISE REJECTION<sup>4</sup>

DIGITS	READINGS/s GPIB (SCPI)	GPIB (488.1)	NPLC	NMRR
4½	700	900	0.01	—
5½	460	475	0.1	—
6½	58	58	1	60 dB

PHOTODIODE VOLTAGE BIAS SPECIFICATIONS<sup>2</sup>

RANGE	RESOLUTION	ACCURACY 23°C ±5°C ±(0.15% of setting + 5 mV)	MAXIMUM CURRENT	LOAD REGULATION <sup>5</sup>	TEMPERATURE COEFFICIENT
0 to ±10 V	<400 μV	±(0.15% of setting + 5 mV)	20 mA	< 0.30%, 0 to 20 mA	150 ppm/°C
0 to ±100 V	<4 mV	±(0.3% of setting + 50 mV)	20 mA	< 0.30%, 0 to 20 mA	300 ppm/°C

## NOTES:

- Speed = Normal (1.0 NPLC), Filter On.
- 1 year.
- Measured as  $\Delta V_{in}/\Delta I_{in}$  at full scale (and zero) input currents.
- Dual channel, internal trigger, measure only, display off, Autorange off, Auto Zero off, source delay = 0, filters off, limits off, CALC5 and CALC6 off, 60Hz.
- Measured as  $\Delta V_{in}/\Delta I_{in}$  at full scale (20mA) and zero load currents.
- Noise floor measured as rms (1 standard deviation), 100 samples, Filter off, open (capped) input.
- Specification by design.
- Measured (at input triax) as  $\Delta V_{in}$  at full scale (20mA) vs. zero input currents.

## ANALOG OUTPUT SPECIFICATIONS

OUTPUT VOLTAGE RANGE<sup>1</sup>: Output is inverting: –10V out for positive full scale input.  
+10V out for negative full scale input.

OUTPUT IMPEDANCE: 1kΩ typical.

## GENERAL

TYPICAL NOISE FLOOR MEASUREMENT SPECIFICATION<sup>6</sup>

RANGE	TYPICAL NOISE FLOOR RMS (1 STDEV), 100 SAMPLES			
	0.01 NPLC	0.1 NPLC	1.0 NPLC	10 NPLC
2.000000 nA	2 pA	1 pA	40 fA	15 fA
20.00000 nA	2 pA	1 pA	40 fA	15 fA
200.0000 nA	200 pA	100 pA	2 pA	500 fA
2.000000 μA	200 pA	100 pA	2 pA	500 fA
20.00000 μA	20 nA	10 nA	200 pA	50 pA
200.0000 μA	20 nA	10 nA	200 pA	50 pA
2.000000 mA	2 μA	1 μA	25 nA	5 nA
20.00000 mA	2 μA	1 μA	25 nA	5 nA

SOURCE CAPACITANCE: Stable to 10.0nF typical.

INPUT BIAS CURRENT<sup>7</sup>: 50fA max. @ 23°C.

INPUT VOLTAGE BURDEN<sup>8</sup>: 4.0mV max.

VOLTAGE SOURCE SLEW RATE: 3.0ms/V typical.

COMMON MODE VOLTAGE: 200VDC.

COMMON MODE ISOLATION: Typically 10<sup>9</sup>Ω in parallel with 150nF.

OVERRANGE: 105% of measurement range.

MEMORY BUFFER: 6000 readings (two 3000 point buffers). Includes selected measured value(s) and time stamp.

PROGRAMMABILITY: IEEE-488 (SCPI-1995.0), RS-232, five user-definable power-up states plus factory default and \*RST.

## DIGITAL INTERFACE:

Enable: Active low input.

Handler Interface: Start of test, end of test, 3 category bits. +5V @ 300mA supply.

Digital I/O: 1 trigger input, 4 TTL/Relay Drive outputs (33V @ 500mA, diode clamped).

POWER SUPPLY: 100V/120V/220V/240V ±10%.

LINE FREQUENCY: 50, 60Hz.

POWER DISSIPATION: 60VA.

WARRANTY: 1 year.

EMC: Complies with European Union Directive 89/336/EEC.

VIBRATION: MIL-T-28800F Random Class 3.

SAFETY: Complies with European Directive 73/23/EEC.

WARM-UP: 1 hour to rated accuracy.

DIMENSIONS: 89mm high × 213mm wide × 370mm deep (3½ in × 8½ in × 14½ in). Bench configuration (with handle and feet): 104mm high × 238mm wide × 370mm deep (4½ in × 9½ in × 14½ in).

WEIGHT: 23.1kg (10.5 lbs).

## ENVIRONMENT:

Operating: 0°–50°C, 70% R.H. up to 35°C non-condensing. Derate 3% R.H./°C, 35°–50°C.

Storage: –25° to 65°C, non-condensing.

RANGE	ACCURACY 23°C ±5°C ±(%output + offset)	TEMPERATURE COEFFICIENT 0°–18°C & 28°–50°C ±(%output + offset)/°C	RISE TIME Typical (10% to 90%)
2.000000 nA	6.0% + 90 mV	0.30% + 7 mV	6.1 ms
20.00000 nA	3.0% + 9 mV	0.11% + 700 μV	6.1 ms
200.0000 nA	6.0% + 90 mV	0.30% + 4 mV	395 μs
2.000000 μA	3.0% + 9 mV	0.11% + 400 μV	395 μs
20.00000 μA	6.0% + 90 mV	0.30% + 4 mV	135 μs
200.0000 μA	2.5% + 9 mV	0.11% + 400 μV	135 μs
2.000000 mA	6.0% + 90 mV	0.30% + 4 mV	21 μs
20.00000 mA	2.5% + 9 mV	0.11% + 400 μV	21 μs

<sup>1</sup>The analog output voltage for each channel is referenced to that channel's floating ground.

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