

# LIGHTWAVE MULTIMETER & ACCESSORIES

Lightwave Multimeter

HP 8153A

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- User-exchangeable plug-in modules for tailor-made measurements
- Traceable to NIST and PTB for accurate absolute power measurements
- Installed application software for standard measurements without external controller

- Dump to printer and dump to plotter for easy documentation
- Measurement of absolute power, insertion loss, and return loss
- Solutions for parallel-beam, unpackaged-chip, connectorized, and bare-fiber measurements



HP 8153A



## HP 8153A Lightwave Multimeter

### High Flexibility through Modular Design

The HP 8153A lightwave multimeter mainframe offers two slots for plug-in modules. Since modules can be combined in any configuration, the instrument can be used as a 1/2-channel power meter, as a 1/2-channel light source, as a loss test set, or even as a return-loss test set.

### Power Sensor Modules with High Accuracy and Sensitivity

Four different power sensor modules, with different sensitivities from  $-70$  dBm down to  $-110$  dBm, cover the 450 nm to 1700 nm wavelength range. Each is individually calibrated over its entire wavelength range and is traceable to NIST and PTB for precise optical power measurements. Their excellent linearity and the high stability of the sourcemodules provide the basis for precise determination of optical insertion loss for both single-mode and multimode components.

### Stabilized Laser- and LED-Source Modules

The source modules offer very good short-term and long-term stability. The high output power can be internally attenuated by up to 6 dB. All sources output CW or pulse-modulated light (internal modulation at 270 Hz, 1 kHz, or 2 kHz).

### Return-Loss Measurements with Unsurpassed Accuracy

By calibrating directly at the connector under test using the HP 81000BR reference reflector, an exceptional accuracy is achieved:  $\pm 0.4$  dB for return-loss measurements over a dynamic range of 50 dB ( $\pm 0.65$  dB between 50 dB and 60 dB). The reference reflector is a gold-plated connector capable of providing a 96 percent reflection with just  $\pm 2$  percent uncertainty. Unwanted reflections in front of the DUT can also be calibrated and compensated for. Both steps require just the push of a button.

### Built-In Software for Advanced Applications

Without the need for an external controller, long-term power, insertion loss, or return-loss monitoring up to 100 hours can be performed. For easy documentation, the measured curves can be dumped to the HP ThinkJet or to any HP-GL plotter. Automatic loss measurements can be made simultaneously at 2 wavelengths. Procedures to maximize the amount of coupled light are supported as well.

### Optical Heads Featuring Large-Area Detectors

The HP 81520A, HP 81521B, HP 81524A, and HP 81525A optical heads and their various accessories offer elegant solutions for every sophisticated measurement. They can be used for high-precision power measurements in both parallel-beam and connectorized applications. Together with the HP 81230FL attenuating lens adapter, they can easily be used to perform calibrated absolute power measurements on unpackaged laser chips or LED chips. The HP 81000BA/CA bare-fiber adapter facilitates interfacing to a fiber pigtail with a typical repeatability of less than 0.02 db. For more detailed information about accessories and specification, see the *Lightwave Test and Measurement Catalog*.

Sensor Module Specifications

	HP 81530A	HP 81536A	HP 81531A	HP 81532A	HP 81533B + 81520A	HP 81533B + 81521B	HP 81533B + 81524A	HP 81533B + 81525A
Sensor element	Si	InGaAs			Si, 5 mm	Ge, 5 mm	InGaAs, 5 mm	InGaAs, 5 mm
Wavelength range	450 to 1020 nm	800 to 1700 nm			450 to 1020 nm	900 to 1700 nm	800 to 1650 nm	800 to 1650 nm
Power range	+3 to $-100$ dBm	+3 to $-70$ dBm	+3 to $-90$ dBm	+3 to $-110$ dBm	+10 to $-100$ dBm	+3 to $-80$ dBm	+3 to $-90$ dBm	+27 to $-70$ dBm
Display resolution (dB)	0.001 dBm, 0.001 dB (0.0001 dB/dBm on printout)							
Display resolution (W)	0.01 pW	100 pW	1 pW	0.01 pW	0.1 pW	10 pW	1 pW	100 pW
Applicable fiber type	9/125 to 100/140 $\mu$ m, (NA $\leq 0.3$ )				Parallel beam, 9/125 to 100/140 $\mu$ m (NA $\leq 0.3$ )			
Accuracy (at ref. cond.)	$\pm 2.5\%$ (600 to 1020 nm)	$\pm 2.5\%$ (1000 to 1650 nm)			$\pm 2.2\%$ (600 to 1020 nm)	$\pm 2.2\%$ (1000 to 1650 nm)	$\pm 2.2\%$ (1000 to 1600 nm)	$\pm 3\%$ (900 to 1600 nm)
Total uncertainty	$\pm 5\% \pm 0.5$ pW (600 to 1020 nm)	$\pm 5\% \pm 50$ pW (1000 to 1650 nm)	$\pm 5\% \pm 1.5$ pW (1000 to 1650 nm)	$\pm 5\% \pm 0.5$ pW (1000 to 1650 nm)	$\pm 4\% \pm 0.5$ pW (600 to 1020 nm)	$\pm 4\% \pm 50$ pW (1000 to 1650 nm)	$\pm 4\% \pm 5$ pW (1000 to 1600 nm)	$\pm 5\% \pm 500$ pW (900 to 1600 nm)
Linearity	18° to 28° C, const. temp. $\pm 0.015$ dB $\pm 0.3$ pW 0° to 55° C, const. temp. $\pm 0.05$ dB $\pm 0.5$ pW							
	$\pm 0.015$ dB $\pm 0.3$ pW	$\pm 0.015$ dB $\pm 30$ pW	$\pm 0.015$ dB $\pm 1$ pW	$\pm 0.015$ dB $\pm 0.3$ pW	$\pm 0.04$ dB $\pm 0.5$ pW	$\pm 0.04$ dB $\pm 50$ pW	$\pm 0.04$ dB $\pm 5$ pW	$\pm 0.04$ dB $\pm 500$ pW
	$\pm 0.05$ dB $\pm 0.5$ pW	$\pm 0.05$ dB $\pm 50$ pW	$\pm 0.05$ dB $\pm 1.5$ pW	$\pm 0.05$ dB $\pm 0.5$ pW	$\pm 0.15$ dB $\pm 0.5$ pW	$\pm 0.15$ dB $\pm 50$ pW	$\pm 0.15$ dB $\pm 5$ pW	$\pm 0.15$ dB $\pm 500$ pW

The display may vary by  $\pm 1$  count.

Source Module Specifications

	81551MM	81552SM	81553SM	81554SM	81541MM	81542MM	81542MM Opt 001
Diode type	Laser	Laser	Laser	Laser	LED	LED	LED
Central wavelength (nm)	850 $\pm 10$	1310 $\pm 20$	1550 $\pm 20$	1310/1550 $\pm 20$	850 $\pm 30$	1300 $\pm 40$	1300 $\pm 40$
Fiber type	50/125 $\mu$ m	9/125 $\mu$ m	9/125 $\mu$ m	9/125 $\mu$ m	50/125 $\mu$ m	50/125 $\mu$ m	62.5/125 $\mu$ m
Spectral bandwidth	< 1.5 nm	< 2.5 nm	< 4 nm	< 2.5/4 nm	< 90 nm	< 90 nm	< 90 nm
Output power	> $-2$ dBm	> 0 dBm	> 0 dBm	> $-1$ dBm	> $-17$ dBm	> $-20$ dBm	> $-20$ dBm
CW stability (15 min, T-const.)	$\pm 0.01$ dB	$\pm 0.003$ dB	$\pm 0.003$ dB	$\pm 0.005$ dB	$\pm 0.003$ dB	$\pm 0.002$ dB	$\pm 0.002$ dB

# LIGHTWAVE MULTIMETER & ACCESSORIES

## Lightwave Multimeter/Accessories (cont'd)

### HP 8153A, Accessories

Ordering Information	Price
<b>HP 8153A</b> Lightwave Multimeter Mainframe	\$3,160
<b>Power Sensor Modules<sup>1</sup></b>	
<b>HP 81530A</b> Si, +3 to -100 dBm, 450 to 1020 nm	\$3,315
<b>HP 81531A</b> InGaAs, +3 to -90 dBm, 800 to 1700 nm	\$3,620
<b>HP 81532A</b> InGaAs, +3 to -110 dBm, 800 to 1700 nm	\$5,460
<b>HP 81536A</b> InGaAs, +3 to -70 dBm, 800 to 1700 nm	\$2,960
<b>Optical Heads<sup>2</sup></b>	
<b>HP 81533B</b> Optical Head Interface Module <sup>3</sup>	\$1,375
<b>HP 81520A</b> Optical Head, Si, +10 to -100 dBm, 450 to 1020 nm	\$2,805
<b>HP 81521B</b> Optical Head, Ge, +3 to -80 dBm, 900 to 1700 nm	\$3,060
<b>HP 81524A</b> Optical Head, InGaAs, +3 to -90 dBm, 800 to 1650 nm	\$5,920
<b>HP 81525A</b> Optical Head, InGaAs, +27 to -70 dBm, 800 to 1650 nm	\$6,430
<b>Laser-Source Modules<sup>1</sup></b>	
<b>HP 81551MM</b> 850 nm, Multimode	\$6,530
<b>HP 81552SM</b> 1310 nm, Single-Mode	\$6,680
<b>HP 81553SM</b> 1550 nm, Single-Mode	\$10,100
<b>HP 81554SM</b> 1310/1550 nm, Single-Mode	\$13,450
<b>LED-Source Modules<sup>1</sup></b>	
<b>HP 81541MM</b> 850 nm, 50 $\mu$ m Multimode Fiber Output	\$3,620
<b>HP 81542MM</b> 1300 nm, 50 $\mu$ m Multimode Fiber Output	\$4,945
<b>HP 81542MM Opt 001</b> 62.5 $\mu$ m Fiber instead of 50 $\mu$ m fiber output	\$325
<b>Return Loss Module<sup>4</sup> and Accessories</b>	
<b>HP 81534A</b> Return Loss Module	\$6,120
<b>HP 81102AC</b> Patchcord HP/HRL, HP/HRL	\$735
<b>HP 81102BC</b> Patchcord HP/HRL, Bare Fiber	\$450
<b>HP 81102DC</b> Patchcord HP/HRL, Radial VFO/DF	\$735
<b>HP 81102PC</b> Patchcord HP/HRL, FC/APC	\$735
<b>HP 81102SC</b> Patchcord HP/HRL, Diamond HRL-10	\$735
<b>HP 81109AC</b> Patchcord HP/HRL, Diamond HMS-10/HP	\$735
<b>HP 81000UM</b> Universal Through Adapter	\$97
<b>HP 81000BR</b> Reference Reflector	\$235

<sup>1</sup>One connector interface (HP 81000xl) required per module.

<sup>2</sup>For required lenses and adapters, see *Lightwave Test and Measurement Catalog*.

<sup>3</sup>Required to connect the optical head to the mainframe.

<sup>4</sup>Two connector interfaces (HP 81000xl) required per module.

## Accessories

### Optical Power Splitter for HP 81521B

The optical power splitter, HP 81010BS accepts single-mode fibers only and offers high return loss for physical-contact connectors. Depending on connector type, the return loss is up to 40 dB. Split ratio is approximately 10:1.

### High-Performance Bare-Fiber Adapters for Optical Heads

The HP 81000BA for fibers with 125  $\mu$ m cladding diameter and the HP 81000CA for fibers with 140  $\mu$ m cladding diameter are capable of interfacing fiber pigtails to the 81520A/81521B/81524A/81525A optical heads with typically 0.02 dB repeatability. The sophisticated design makes them very easy to use and ensures not only high accuracy but also high throughput in serial testing.

### Attenuating Lens Adapter for Direct Chip Measurements

With the HP 81230FL mounted on an HP 81521B or HP 81524A optical head, the output power of LED or laser chips up to 200 mW can be measured precisely, before the pigtail is attached. Anti-reflection coating on all optical surfaces guarantees minimum back-reflections. The maximum acceptable numerical aperture is NA=0.5 in the wavelength range from 1200 nm to 1650 nm.

### Connector Interfaces for Both Easy Cleaning and Easy Adaptation

User-exchangeable connector interfaces permit easy cleaning of the instrument's front end connector, and also allow the use of different connector types with the same instrument. They are available for Diamond HMS-10, FC/PC, D4, SMA, SC, ST, DIN, and Biconic.

### Depolarizing Adapters for Optical Heads

The HP 81000DF is a detachable adapter for the HP 81521B, HP 81524A, and HP 81525A. It reduces the polarization sensitivity to less than 0.006 dB p-p in parallel beam applications with bare fibers or straight output connectors.

### A Variety of Other Accessories Help Solve Your Measurement Problems

Patch cords and adapters enable users to interface virtually every connector type to the instruments. Filters and filter holders extend the measurement range to higher power levels. For more detailed information about accessories, please see the *Lightwave Test and Measurement Catalog*.

### Key Literature

*Lightwave Test and Measurement Catalog*, p/n 5962-6832E.

Ordering Information	Price
<b>Connector Interfaces</b>	
<b>HP 81000AI</b> Diamond HMS-10/HP	\$173
<b>HP 81000FI</b> FC/PC	\$173
<b>HP 81000GI</b> D4	\$173
<b>HP 81000JI</b> SMA (lensed interface only)	\$173
<b>HP 81000KI</b> SC	\$173
<b>HP 81000SI</b> DIN 47256	\$173
<b>HP 81000VI</b> ST	\$173
<b>HP 81000WI</b> Biconic	\$173