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HEWLETT® PACKARD

HP 8153A Lightwave Multimeter

Technical Specifications

Product Specifications and Characteristics

The HP 8153A is produced to the ISO 9001 international quality system standard as part of HP's commitment to continually increasing customer satisfaction through improved quality control. Specifications describe the instrument's warranted performance. Supplementary performance characteristics describe the instrument's non-warranted typical performance.

Mainframe HP 8153A Specifications

Dual channel display. For each channel, there is a main display with six digits and an auxiliary display with eight characters.

Display ranges	
Power	+30 to -110 dBm or 1000.00 mW to 0.01 pW
Calibration factor (display offset)	±200.000 dB
Reference	±200.000 dBm/dB
Data acquisition	
Memory	500 measurement results/channel (acquisition time ≥20 ms/data point)
Selectable data averaging time	20 ms to 60 minutes
Selectable data total acquisition time	20 ms to 99:59:59 h
Environmental	
Storage temperature	-40 °C to +70 °C
Operating temperature	0 °C to +55 °C
Humidity	<95% R.H. from 0 °C to +40 °C
Power	AC 100–240 V_{rms}, ±10%, 48–66 Hz, 35 VA max.
Dimensions	89 mm H, 212.3 mm W, 355 mm D (3.5" x 8.36" x 14.0")
Weight	net 2.5 kg (5.5 lbs), shipping 4.5 kg (9.9 lbs)
HP-IB capability	modes and parameters can be programmed
Transfer time	20 ms for one measurement result <800 ms for 100 measurement results from memory
HP-IB interface function code	SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 SCPI command set

Ordering Information

HP 8153A Lightwave Multimeter.
Option 907 Front Handle Kit (part number 5062-3988).
Option 908 Rack Flange Kit (part number 5062-3972).
Option 916 Additional Operating and Programming Manual.
Option 050 DC Input 12 V to 30 V (if DC Power Cable required, order option 051 as well).
Option 051 DC Power Cable 5 m unterminated (requires option 050).

For plug-in modules, see configuration guide.
Option 916 of each module: additional operating manual for this specific module.

Power Sensor Module Specifications

	HP 81530A	HP 81536A	HP 81531A	HP 81532A
Sensor element	Si	InGaAs		
Wavelength range	450–1020 nm	800–1700 nm		
Power range	+3 to -100 dBm	+3 to -70 dBm	+3 to -90 dBm	+3 to -110 dBm
Display resolution	0.001 dB/dBm (0.0001 dB/dBm on printout), 0.01 pW to 10 pW (depending on power range)			
Application fiber type	9/125 µm–100/140 µm, NA ≤0.3			
Uncertainty (accuracy) at reference conditions	±2.5% (600–1020 nm) [1]	±2.5% (1000–1650 nm) [1]		
Total uncertainty	±5% ±0.5 pW (600–1020 nm) [2]	±5% ±50 pW (1000–1650 nm) [2]	±5% ±1.5 pW (1000–1650 nm) [2]	±5% ±0.5 pW (1000–1650 nm) [2]
Linearity (power) (18 °C to 28 °C, const. temp.) (0 °C to 55 °C, const. temp.)	(0 to -90 dBm) ±0.015 dB ±0.3 pW ±0.05 dB ±0.5 pW	(0 to -50 dBm) ±0.015 dB ±30 pW ±0.05 dB ±50 pW	(0 to -70 dBm) ±0.015 dB ±1 pW ±0.05 dB ±1.5 pW	(0 to -90 dBm) ±0.015 dB ±0.3 pW ±0.05 dB ±0.5 pW
Noise (peak to peak), averaging time 1 second	<0.5 pW (700–900 nm)	<50 pW (1200–1600 nm)	<1.5 pW (1200–1600 nm)	<0.5 pW (1200–1600 nm)
Dimensions	75 mm H, 32 mm W, 335 mm D (2.8" x 1.3" x 13.2")			
Weight	net 0.6 kg (1.3 lbs), shipping 1 kg (2.2 lbs)			
Recalibration period	2 years			
Warm-up time	20 minutes			
The display may vary by a count of ±1.				

[1] At the following reference conditions:
- Power level 10 µW (-20 dBm), continuous wave (CW).
- Fiber 50 µm graded-index, NA=0.2.
- Ambient temperature 23 °C ±5 k.
- Connector Diamond HMS-10/HP.
- On day of calibration (add 0.3% for aging over one year, add 0.6% over two years).
- Spectral width of source <10 nm.

[2] At the following operating conditions:
- Fiber ≤50 µm, NA ≤0.2.
- For NA >0.2, add 1%.
- Ambient temperature 0 °C to 55 °C, non-condensing.
- Within one year after calibration, add 0.3% for second year.
- Add ±1% for Biconic connector.

Supplementary Performance Characteristics

- Add 1% to total uncertainty for full wavelength range.
- Outside the specified wavelength range, the noise will increase by up to five times the values shown above.

Analog output:
Bandwidth: ≥DC, ≤300 to 4000 Hz, depending on range and sensor module.
Output voltage: 0–2 V into open.
Output impedance: 600 Ω typical.
Max. input voltage: ±10 V.

Optical Head Specifications

	HP 81533B HP 81520A	HP 81533B HP 81521B	HP 81533B HP 81521B (#001)	HP 81533B HP 81524A	HP 81533B HP 81525A
Sensor element	Si, 5 mm	Ge, 5 mm	Ge, 5 mm	InGaAs, 5 mm	
Wavelength range	450–1020 nm	900–1700 nm	900–1700 nm	800–1650 nm	
Power range	+10 to -100 dBm	+3 to -80 dBm	+3 to -64 dBm	+3 to -90 dBm	+27 to -70 dBm (1250–1650 nm) +23 to -70 dBm (800–1650 nm)
Display resolution	0.001 dB/dBm (0.0001 dB/dBm on printout), 0.01 pW to 10 pW (depending on power range)				
Applicable fiber type	parallel beam, 9/125 µm–100/140 µm, NA ≤0.3				
Uncertainty (accuracy) at reference conditions	±2.2% (600–1020 nm) [1]	±2.2% (1000–1650 nm) [1]	±2.2% (1000–1650 nm) [1]	±2.2% (1000–1600 nm) [1]	±3.0% (900–1600 nm) [1]
Total uncertainty	±4% ±0.5 pW (600–1020 nm) [2]	±4% ±50 pW (1000–1650 nm) [2]	±4% ±600 pW (1000–1650 nm) [2]	±4% ±5 pW (1000–1600 nm) [2]	±5% ±500 pW [3] (900–1600 nm) [2]
Linearity (power) (18 °C to 28 °C, const. temp.) (operating temp. range, const. temp.)	(+3 to -80 dBm) ±0.04 dB ±0.5 pW ±0.15 dB ±0.5 pW	(0 to -60 dBm) ±0.04 dB ±50 pW ±0.15 dB ±50 pW	(0 to -44 dBm) ±0.04 dB ±600 pW ±0.15 dB ±600 pW	(+3 to -70 dBm) ±0.04 dB ±5 pW ±0.15 dB ±5 pW	(+10 to -50 dBm) [3] ±0.04 dB ±500 pW ±0.15 dB ±500 pW
Noise (peak to peak), averaging time 1 second	<0.5 pW (700–900 nm)	<50 pW (1200–1600 nm)	<600 pW (1200–1600 nm)	<5 pW (1000–1600 nm)	<500 pW (900–1600 nm)
Polarization sensitivity	—	—	0.003 dBpp [5]	—	—
Operating temperature	0 °C to +40 °C				0 °C to 35 °C [4]
Dimensions	37.5 mm diameter, 140 mm L (1.5" x 5.5")				
Weight	net 0.45 kg (1.0 lbs), shipping 1 kg (2.2 lbs)				
Recalibration period	2 years				
Warm-up time	20 minutes				
The display may vary by a count of ±1.					

[1] At the following reference conditions:
- Power level 10 µW (-20 dBm), continuous wave (CW).
- Parallel beam, 3 mm spot diameter on detector.
- Ambient temperature 23 °C ±5 k.
- On day of calibration (add 0.3% for aging over one year, add 0.6% over two years).
- Spectral width of source <10 nm.

[2] At the following operating conditions:
- Parallel beam, 3 mm spot diameter on detector or connectorized fiber with NA ≤0.2.
- Ambient temperature 0 °C to +40 °C, non-condensing.
- Within one year after calibration, add 0.3% for second year.

[3] Add ±0.008 dB/10mW between 10 and 27 dBm.
Lens required (e.g. for SM 81010BL, for MM 81050BL) or parallel beam, 3mm spot diameter on detector.
Wavelength range 950-1650nm

[4] 30 °C for >20 dBm input power.

[5] For single-mode fiber with NA ≤0.1, straight fiber end, 1250–1570 nm.

Supplementary Performance Characteristics

- Add 1% to total uncertainty for full wavelength range. (Except 81525A see footnote 3).
- Outside the specified wavelength range, the noise will increase by up to five times the value shown.
- For fiber applications with an NA between 0.2 and 0.3, use specific lenses and add 0.5% uncertainty for the 850 ±50 nm, 1300 ±50 nm, and 1550 ±50 nm ranges.

Specifications apply to the end of a 2 m long fiber cable (as specified under fiber type) with Diamond HMS-10 connectors attached. All specifications are valid for an attenuation setting of 0.0 dB.

Source Module Specifications

	HP 81551MM	HP 81552SM	HP 81553SM	HP 81554SM	HP 81542MM
Type	Fabry-Perot Laser				LED
Central wavelength [1]	850 ±10 nm	1310 ±20 nm	1550 ±20 nm	1310 ±20 nm 1550 ±20 nm	1300 ±40 nm
Fiber type	multimode 50/125 µm	single-mode 9/125 µm	single-mode 9/125 µm	single-mode 9/125 µm	multimode 50/125 µm
Spectral bandwidth [2]	<1.5 nm rms	<2.5 nm rms	<4 nm rms	<2.5/4 nm rms	<90 nm FWHM
Output power	>-2 dBm [3]	>0 dBm [4]	>0 dBm [4]	>-1 dBm [4]	>-20 dBm
CW stability [5] **Short term** **(15 min., T=const.)** **Long term** **(6 h, T=0 °C to 55 °C ±1 k)**	±0.01 dB ±0.06 dB	±0.003 dB ±0.03 dB	±0.003 dB ±0.03 dB	±0.005 dB ±0.05 dB	±0.002 dB ±0.01 dB
Operating temperature	0 °C to +55 °C				
Dimensions	75 mm H, 32 mm W, 335 mm D (2.8" x 1.3" x 13.2")				
Weight	net 0.7 kg (1.5 lbs), shipping 1 kg (2.2 lbs)				
Recalibration period	1 year				

[1] Central wavelength is shown on the display.
[2] rms: root mean square, FWHM: Full Width Half Maximum.
[3] Class 3A according to IEC 825-1 (1993), Class 1 according to FDA CFR 21 (1986).
[4] Class 1 according to IEC 825-1 (1993) and FDR CFR 21 (1986).
[5] After a warm-up time of 60 min. with output enabled. If previously stored at the same temperature, 20 min. only.

Analog output:
Bandwidth: ≥DC, ≤300 to 1000 Hz, depending on range and optical head.
Output voltage: 0–2 V into open.
Output impedance: 600 Ω typical.
Max. input voltage: ±10 V.

Supplementary Performance Characteristics

Internal digital modulation mode:
270 Hz, 1 kHz, selectable. All output signals are pulse-shaped. Duty cycle 50%.

Output attenuation:
The output power of all source modules can be attenuated from 0 dB to 6 dB (4 dB for HP 81551MM) in steps of 0.1 dB.

Stability:
The value for the long term CW stability will increase by a factor of two with just one minute of warm-up time (laser enabled).

Return Loss Module Specifications

	HP 81534A Connector output	HP 81534A Opt 001 Pigtail output
Sensor element	InGaAs	
Wavelength range	1250–1600 nm	
Applicable fiber type	9/125 µm	
Dynamic range [1]	60 dB	65 dB
Relative uncertainty [2], [3]	±0.25 dB (0 to 50 dB)/ ±0.50 dB (50 to 60 dB)	±0.25 dB (0 to 55 dB)/ ±0.50 dB (55 to 65 dB)
Total uncertainty (typical) [4]	±0.40 dB (0 to 50 dB)/ ±0.65 dB (50 to 60 dB)	±0.40 dB (0 to 55 dB)/ ±0.65 dB (55 to 65 dB)
Operating temperature	0 °C to +55 °C	
Dimensions	75 mm H, 32 mm W, 335 mm D (2.8” x 1.3” x 13.2”)	
Weight	net 0.6 kg (1.3 lbs), shipping 1 kg (2.2 lbs)	
Recalibration period	1 year	
Warm-up time	5 minutes	

[1] Measured with source output power of 0 dBm.
[2] Measured with HP 81552SM/HP 81553SM/HP 81554SM modules.
[3] Mainly due to polarization sensitivity of coupler. With a mechanically stable setup, this can typically be reduced to <±0.05 dB.
[4] Includes relative uncertainty, uncertainty of reference reflection (HP 81000BR) and linearity.

HP Related Literature

- HP 8153A Lightwave Multimeter, Modular System for Optical Power, Loss and Return Loss Measurements, brochure, p/n 5963-7132E.
- HP 8153A Lightwave Multimeter, configuration guide, p/n 5963-3366E.

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