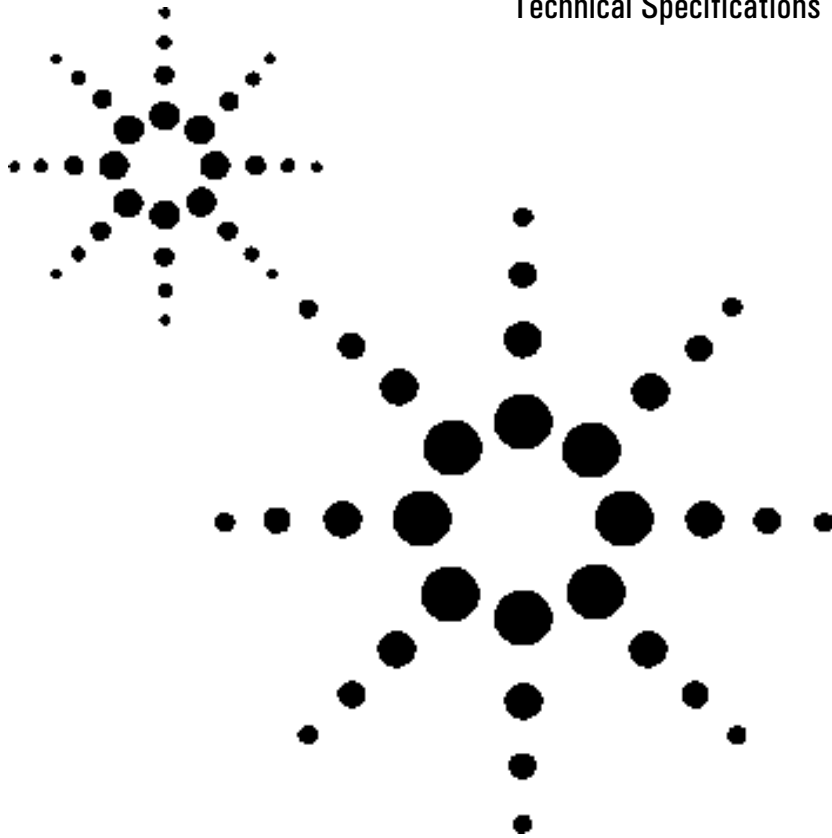


# Agilent 8153A Lightwave Multimeter

## Technical Specifications



The Agilent 8153A is produced to the ISO 9001 international quality system standard as part of Agilent'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.



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## Mainframe Agilent 8153A Specifications

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

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

### Ordering Information

**Agilent 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

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

<sup>[1]</sup> At the following reference conditions:

- Power level 10  $\mu\text{W}$  (–20 dBm), continuous wave (CW).
- Fiber 50  $\mu\text{m}$  graded-index, NA=0.2.
- Ambient temperature 23 °C  $\pm$  5 k.
- Connector Diamond HMS-10/Agilent.
- On day of calibration (add 0.3% for aging over one year, add 0.6% over two years).
- Spectral width of source  $<$  10 nm.

<sup>[2]</sup> At the following operating conditions:

- Fiber  $\leq$  50  $\mu\text{m}$ , NA  $\leq$  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  $\pm$  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:**  $\geq$  DC,  $\leq$  300 to 4000 Hz, depending on range and sensor module.

**Output voltage:** 0–2 V into open.

**Output impedance:**

600  $\Omega$  typical.

**Max. input voltage:**  $\pm$  10 V.

## Optical Head Specifications

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

<sup>[1]</sup> At the following reference conditions:

- Power level 10  $\mu$ W (–20 dBm), continuous wave (CW).
- Parallel beam, 3 mm spot diameter on detector.
- Ambient temperature 23 °C  $\pm$  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.

<sup>[2]</sup> At the following operating conditions:

- Parallel beam, 3 mm spot diameter on detector or connectorized fiber with NA  $\leq$  0.2.
- Ambient temperature 0 °C to +40 °C, non-condensing.
- Within one year after calibration, add 0.3% for second year.

<sup>[3]</sup> Add  $\pm$  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

<sup>[4]</sup> 30 °C for > 20 dBm input power.

<sup>[5]</sup> For single-mode fiber with NA  $\leq$  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  $\pm$  50 nm, 1300  $\pm$  50 nm, and 1550  $\pm$  50 nm ranges.

## Source Module Specifications

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.

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

<sup>[1]</sup> Central wavelength is shown on the display.

<sup>[2]</sup> rms: root mean square, FWHM: Full Width Half Maximum.

<sup>[3]</sup> Class 3A according to IEC 825-1 (1993), Class 1 according to FDA CFR 21 (1986).

<sup>[4]</sup> Class 1 according to IEC 825-1 (1993) and FDR CFR 21 (1986).

<sup>[5]</sup> 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.

### 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 Agilent 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

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

[1] Measured with source output power of 0 dBm.

[2] Measured with Agilent 81552SM/Agilent 81553SM/Agilent 81554SM modules.

[3] Mainly due to polarization sensitivity of coupler. With a mechanically stable setup, this can typically be reduced to  $< \pm 0.05$  dB.

[4] Includes relative uncertainty, uncertainty of reference reflection (Agilent 81000BR) and linearity.



## Related Agilent Literature

Agilent 8153A Lightwave Multimeter,  
Modular System for Optical Power,  
Loss and Return Loss Measurements,  
brochure,  
p/n **5963-7132E**.

Agilent 8153A Lightwave Multimeter,  
configuration guide,  
p/n **5963-3366E**.

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