

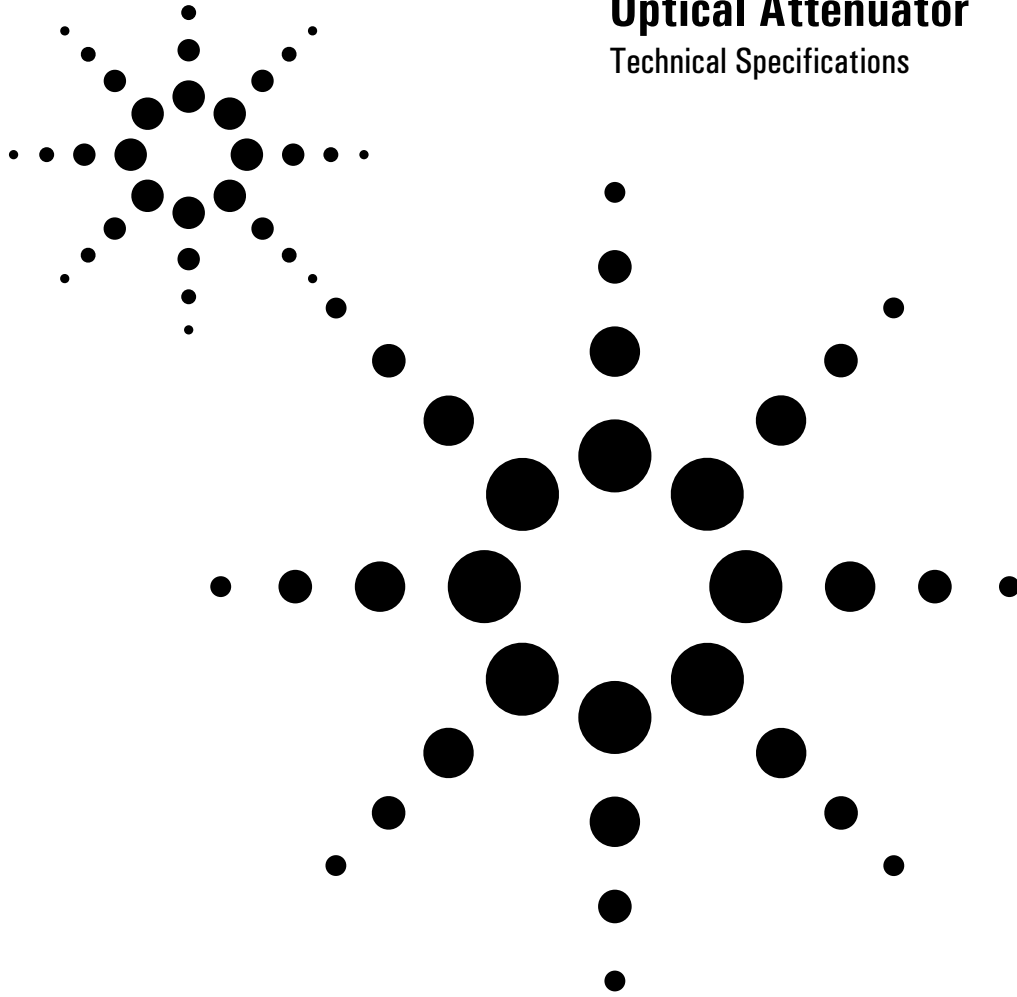
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**Helmut Singer Elektronik**

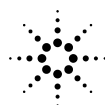
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## Agilent 8156A Optical Attenuator

Technical Specifications



The Agilent 8156A 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.



**Agilent Technologies**

Specifications describe the instrument's warranted performance.

They are measured at 1310 nm and 1550 nm using a Fabry Perot laser source, single-mode fiber and Agilent 81000AI or Agilent 81000SI connector interfaces.

### Optical Attenuator Specifications - Standard Options

	Agilent 8156A #100	Agilent 8156A #101	Agilent 8156A #201
Wavelength range	1200 - 1650 nm		
Attenuation range	60 dB (excluding insertion loss)		
Fiber type	9/125 $\mu$ m single-mode		
Connector type	straight contact		angled contact
Return loss <sup>(1)</sup>	> 35 dB	> 45 dB	> 60 dB
Insertion loss (typ.) <sup>(2)</sup>	4.5 dB	2.5 dB	
Attenuation accuracy (linearity) <sup>(3)</sup> typical	< $\pm 0.2$ dB <sup>(4)</sup> < $\pm 0.1$ dB <sup>(4)</sup>	< $\pm 0.1$ dB < $\pm 0.05$ dB	
Repeatability typical	< $\pm 0.01$ dB < $\pm 0.005$ dB		
Polarization dependent loss (PDL) typical	< 0.15 dB <sub>pp</sub> < 0.075 dB <sub>pp</sub>	< 0.08 dB <sub>pp</sub> < 0.02 dB <sub>pp</sub>	
Polarization mode dispersion (PMD)	4 fs		
Useful back reflection range	9.0 - 35 dB	5.0 - 45 dB	5.0 - 60 dB

<sup>(1)</sup> Typical, depends on performance of external connector.

<sup>(2)</sup> Includes insertion loss of two HMS-10 connectors. Typical variation over temperature range < 0.3 dB<sub>pp</sub>.

<sup>(3)</sup> Measured at constant temperature.

<sup>(4)</sup> With narrow linewidth lasers, such as DFB lasers, power fluctuations up to 0.2 dB<sub>pp</sub> may occur.

### Ordering Information

Two connector interfaces are required for each Agilent 8156A.

**Agilent 8156A** optical attenuator mainframe (non-modular).

#### Options

**100** standard performance version.

**101** high performance version.

**201** high performance, high return loss version.

**202** back reflector kit for option 201 and option 221 (consists of 1 ea Agilent 81000SI, Agilent 81000FI, Agilent 81113PC, Agilent 81000UM, Agilent 81000BR).

**OB2** additional operating manual.

Specifications describe the instrument's warranted performance. They are measured at 1310 nm and 1550 nm using a Fabry Perot laser source, single-mode fiber and Agilent 81000AI or Agilent 81000SI connector interfaces.

### Optical Attenuator Specifications - Monitor Output Options

	Agilent 8156A #121	Agilent 8156A #221
Wavelength range	1200 - 1650 nm	
Attenuation range	60 dB (excluding insertion loss)	
Fiber type	9/125 $\mu$ m single-mode	
Connector type	straight contact	angled contact
Insertion loss (typ.) <sup>(1)</sup>	3.3 dB	3.3 dB
Return loss <sup>(2)</sup>	> 45 dB	> 60 dB
Attenuation accuracy (linearity) <sup>(3)</sup> typical	< $\pm$ 0.1 dB < $\pm$ 0.05 dB	< $\pm$ 0.1 dB < $\pm$ 0.05 dB
Repeatability typical	< $\pm$ 0.01 dB < $\pm$ 0.005 dB	< $\pm$ 0.01 dB < $\pm$ 0.005 dB
Polarization dependent loss (PDL) typical	< 0.1 dB <sub>pp</sub> < 0.03 dB <sub>pp</sub>	< 0.1 dB <sub>pp</sub> < 0.03 dB <sub>pp</sub>
Polarization mode dispersion (PMD)	6 fs	6 fs
Monitor output (typ.)	13 dB tap (1:20)	
Useful back reflection range	6.6 - 45 dB	6.6 - 60 dB

(1) Includes insertion loss of two HMS-10 connectors. Typical variation over temperature range < 0.3 dB<sub>pp</sub>.

(2) Typical, depends on performance of external connector.

(3) Measured at constant temperature.

### Ordering Information

Three connector interfaces are required for each Agilent 8156A.

**Agilent 8156A** optical attenuator mainframe (non-modular).

#### Options

**121** high performance version, monitor output.

**221** high performance, high return loss version, monitor output.

**203** back reflector kit for option 201 and option 221 (consists of 1 ea Agilent 81000SI, Agilent 81000FI, Agilent 81113PC, Agilent 81000UM, Agilent 81000BR).

**0B2** additional operating manual

Specifications describe the instrument's warranted performance. They are measured at 1300 nm using an LED source, multi-mode fiber and Agilent 81000AI connector interface.

### Optical Attenuator Specifications - Multimode Option

	<b>Agilent 8156A #350</b>
<b>Wavelength range</b>	1200 - 1650 nm
<b>Attenuation range</b>	60 dB (excluding insertion loss)
<b>Fiber type</b>	50/125 $\mu$ m multimode
<b>Connector type</b>	straight contact
<b>Insertion loss (typ.)<sup>(1)</sup></b>	3 dB
<b>Return loss<sup>(2)</sup></b>	22 dB
<b>Attenuation accuracy (linearity)<sup>(3)</sup></b>	< $\pm$ 0.1 dB
<b>Typical</b>	< $\pm$ 0.08 dB
<b>Repeatability</b>	< $\pm$ 0.01 dB
<b>Typical</b>	$\pm$ 0.005 dB

<sup>(1)</sup> Includes insertion loss of two HMS-10 connectors.

<sup>(2)</sup> Typical, depends on performance of external connector.

<sup>(3)</sup> Measured at constant temperature.

### Ordering Information

Two connector interfaces are required for each Agilent 8156A.

**Agilent 8156A** optical attenuator mainframe (non-modular).

#### Options

**350** 50/125 m multimode option.

**OB2** additional operating manual.

## Supplementary Performance Characteristics

**Minimum Attenuation Step:** 0.001 dB.

**Settling Time:** 20 ms to 400 ms (depending on actual setting).

**Maximum Input Level:** 23 dBm (200 mW).

### Operating Modes

**Attn:** Attenuation is displayed and can be varied.

$\lambda$ : Entering of wavelength for automatic correction of attenuation using typical correction values.

**Cal:** Offset factor to adjust display within 99.99 dB range.

**Disp** → **Cal:** Sets displayed attenuation value to 0.00 dB.

**Sweep:** Manual or automatic up and down sweep of attenuation. Start, stop, stepsize, and dwell time (not in manual mode) can be entered.

**Back Reflect:** For entering desired return loss (back reflection level). Return loss is displayed and can be varied within insertion loss and return loss of connector used. Requires Agilent 81000BR backreflector.

**Enable/Disable:** Optical signal path interrupted with shutter (> 80 dB blocking).

**Store/Recall:** 9 user-selectable parameter settings may be stored and recalled. Recall of default setting.

## General

**Recalibration period:** 1 year.

**Warm-up time:** not required if previously stored within operating temperature range.

**GPIB Capability:** all modes and parameters can be programmed, SCPI command set, Agilent 8157A compatibility mode.

**GPIB Interface Function Code:** SH1, AH1, T6, L4, SR1, RL1, PPO, DC1, DTO, CO.

## 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:** 100/120/220/240 Vrms, 10%, 90 VA max., 48 – 400 Hz.

**Battery Back-up** (for non-volatile memory): with instrument switched off all current modes and data will be maintained for at least 10 years after delivery.

**Dimensions:**  
89 mm H, 212.3 mm W, 345 mm D  
(3.5" x 8.36" x 13.6").

**Weight:** net 5.3 kg (11.7 lbs), shipping 9.6 kg (21.2 lbs).

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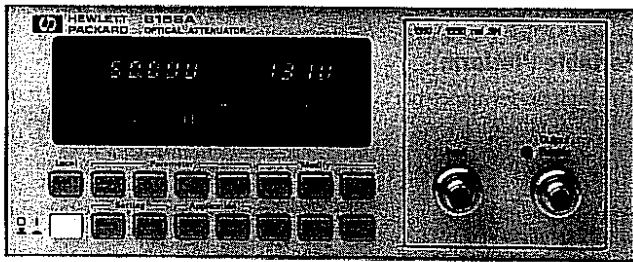
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## Optical Component Test

### Attenuator and Automatic Polarization Controllers

457

- 0.05 dB attenuation accuracy, 0.001 dB resolution
- 0.02 dBp-p polarization sensitivity
- Optional monitor output
- Back reflector mode



HP 8156A

### HP 8156A Attenuator



The HP 8156A is a high performance attenuator for single-mode and multimode applications.

Options are available to select the desired return loss performance (up to 60 dB.) An optional 13 dB monitor output allows you to measure the signal power at the output of the attenuator. Using the built-in back reflector mode and an external reference reflector (HP 81000BR), the HP 8156A can be used as a programmable back reflector to measure component and system sensitivity against reflections.

The attenuation range is 60 dB with 0.001 dB resolution between 1200 nm and 1650 nm. Due to a novel single filter design, no ranging occurs. This completely eliminates dark spots or potential attenuation overshoots or undershoots. Attenuation accuracy is typically better than  $\pm 0.05$  dB with a polarization sensitivity of less than 0.02 dB peak-to-peak.

For more detailed information, see the *Lightwave Test and Measurement Catalog*.

### Specifications

	HP 8156A Opt 100	HP 8156A Opt 101/201	HP 8156A Opt 121/221	HP 8156A Opt 350
Wavelength range	1200 to 1650 nm			
Fiber type	single-mode		50 $\mu$ m multimode	
Attenuation range	60 dB			
Resolution	0.001 dB			
Return loss	>35 dB	>45 dB/>60 dB	>45 dB/>60 dB	>22 dB
Insertion loss (typical)*	4.5 dB	2.5 dB	3.3 dB	3.0 dB
Attenuation accuracy (typical)	$\pm 0.1$ dB	$\pm 0.05$ dB	$\pm 0.05$ dB	$\pm 0.08$ dB
Polarization sensitivity (typical)	<0.075 dBp-p	<0.02 dBp-p	<0.03 dBp-p	—
Repeatability (typical)	$\pm 0.005$ dB			
Switching time	20–400 ms			
Maximum input power	+23 dBm			

\*Includes insertion loss of two HMS-10 connectors.

Size: 212.3 mm W x 89 mm H x 345 mm D (8.36 in x 3.5 in x 13.6 in)

Weight: Net, 5.3 kg (11.7 lb); shipping, 9.6 kg (21.2 lb)

### Ordering Information

Two connector interfaces (three for Option 121/221) are required for each HP 8156A

- HP 8156A Optical Attenuator Mainframe
  - Opt 100 Standard Performance Version
  - Opt 101 High Performance Version
  - Opt 121 Monitor Output, 45 dB Return Loss
  - Opt 201 High Performance, High Return Loss Version
  - Opt 203 Back Reflector Kit for Option 201\*
  - Opt 221 Monitor Output, 60 dB Return Loss
  - Opt 350 50/125  $\mu$ m Multimode

HP 81000A/F/G/KI/N/P/SI/VI/WI Connector Interfaces

\* Kit consists of one each: 81000SI, 81000FI, 81113PC, 81000JM, and 81000BR.