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# Programmable Attenuator

The JDS Uniphase Programmable Attenuator is a high-resolution, extended-range, programmable attenuator ideal for testing power meters and for general test and laboratory work. The attenuator has a nominal resolution of 0.01 dB (0.001 dB for the HA1 series) and an extended attenuation range of 100 dB. The standard operating wavelength is 1200-1700 nm (750-1700 nm is available to use with a reduced attenuation range of 60 dB for the HA9W attenuator).

The HA1 attenuator is a single-mode, ultra-high resolution, and programmable attenuator ideal for bit error rate testing and general laboratory work.

The HA2 series Programmable Attenuator provides a wavelength dependence of ± 0.05 dB and input power up to 1 W (30 dBm). The HA2 is suitable for a variety of applications including amplifier testing and DWDM system characterization.

HA attenuators are ideal for use in such demanding applications as multichannel AM systems and high bit-rate digital pulse code modulation (PCM) systems. Discrete internal optical reflections are minimized to better than 60 dB, and cavity effects are virtually eliminated. All HA attenuators are offered with high return loss and low spectral ripple for CATV AM systems.

The inherently linear design of these attenuators, combined with built-in calibration and offset functions, allows the user to match the display to an optical power meter over a wide power range. This feature is useful in tests requiring control of the absolute optical power source for the test device. The built-in beam blocking switch provides fast access from any attenuation setting to infinite attenuation (> 90 dB).




## Key Features & Benefits

*100 dB range*

*0.01 or 0.001 dB resolution*

*0.01 dB repeatability*

*Accuracy of ± 0.1 dB*

*Typical polarization dependent loss (PDL) of 0.03 dB*

*1200-1700 nm or 750-1700 nm wavelength ranges*

*Built-in beam block*

*GPIB and RS232 remote control*

*Single-mode or multimode fiber*

*SCPI compatible command set*

*Optional couplers or switches*

*High power input of 1000 mW*

*Wavelength dependence of less than ± 0.05 dB over 1530-1625 nm range*

*Complies to CE requirements plus UL3101-1 and CAN/CSA-C22.2 No. 1010.1*

## Applications

*Precise optical power control*

*Power meter linearity calibration*

*Analog transmission tests*

*Bit error rate tests*

*Loss simulation in fiberoptic links*

*EDFA output power characterization*



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# Programmable Attenuator

Front panel access provides the option of increasing functionality through the addition of other devices, such as couplers or switches. The 5 V driver key on the front panel (connected to the 5 V driver on the back) acts as a toggle for an external or internal (if installed) switch.

The HA9 and HA1 attenuators can be fitted with 10/90 or 50/50 couplers. Optional built-in couplers or switches provide an output tap or access to two inputs or outputs. Both models have a SCPI/HP8156A compatible command set and can be controlled from the front panel keyboard or by the GPIB or RS232 interfaces.



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## Specifications

| PARAMETER | HIGH RESOLUTION HA1 | HIGHLY CONFIGURABLE HA9 | WIDE WAVELENGTH RANGE HA9W | FLEXCOR FIBER HA9P | HIGH POWER AND WAVELENGTH FLAT HA2 |
|---|---|---|---|---|---|
| Operating wavelength range | 1200-1700 nm | 1200-1700 nm | 750-1700 nm | 980-1100 nm | 1280-1670 nm |
| Attenuation[1] range | 100 dB | 100 dB | 60 dB | 60 dB | 50 dB |
| resolution | 0.001 dB | 0.01 dB | 0.01 dB | 0.01 dB | 0.01 dB |
| repeatability[2] | ± 0.01 dB | ± 0.01 dB | ± 0.01 dB | ± 0.01 dB | ± 0.01 dB |
| change rate | < 2.5 s | < 2.5 s | < 1.5 s | < 1.5 s | < 1.5 s |
| | 0-100 dB | 0-100 dB | 0-60 dB | 0-60 dB | 0-50 dB |
| accuracy[3] | ± 0.1 dB | ± 0.1 dB | ± 0.1 dB | ± 0.1 dB | ± 0.1 dB |
| Insertion loss[4,5,6] single-mode (SM) | < 1.5 dB | < 1.5 dB | < 5.0 dB | NA | < 1.0 dB[8] |
| multimode (MM), 50/125µm | NA | < 2.2 dB | < 3.2 dB | NA | NA |
| MM, other | NA | < 2.9 dB | < 3.9 dB | NA | NA |
| Flexcor 1060 | NA | NA | NA | < 2.5 dB | NA |
| Return loss[4,5] SM | NA | > 45 dB | > 45 dB | NA | NA |
| SM, analog[7] | > 60 dB | > 60 dB | > 60 dB | NA | > 50 dB |
| MM, 50/125 µm | NA | > 35 dB | > 35 dB | NA | NA |
| MM, other | NA | > 30 dB | > 30 dB | NA | NA |
| Flexcor 1060 | NA | NA | NA | > 60 dB | NA |
| Wavelength dependence[4,9] | NA | NA | NA | NA | ± 0.05 dB (0-20 dB attenuation) |
| (1530-1625 nm) | | | | | ± 0.10 dB (20-30 dB attenuation) |
| Maximum optical input power | 200 mW | 200 mW | 200 mW | 200 mW | 1000 mW |
| Recalibration period (recommended) | 2 years | | | | |
| Polarization dependent loss[4,5] | 0.03 dB typical, 0.08 dB maximum | | | | |
| Beam block attenuation | > 90 dB | | | | |
| Input voltage | 100-240 V AC, 50-60 Hz | | | | |
| Power consumption | 100 VA maximum | | | | |
| Dimensions (W x H x D) | 21.2 x 8.9 x 35.5 cm 19-inch (48.26 cm) rackmounting 2U high | | | | |
| Weight | 4 kg | | | | |
| Operating temperature | 0 to 40 °C | | | | |
| Storage temperature | - 40 to 60 °C | | | | |
| Humidity | maximum 90 % up to 40 °C | | | | |

1. The attenuation range is a continuous function of wavelength.
2. At constant temperature, wavelength, and polarization state after half hour warm-up.
3. Up to 60 dB of attenuation for single-mode and 45 dB of attenuation for multimode. Maximum specification at calibrated wavelength ±15 nm. Outside these wavelength ranges, the typical accuracy is the greater of ± 0.1 dB or ± 0.003 dB/dB.
4. Measured at 23 °C with a laser source.
5. Not including connectors, switch, or coupler (if installed).
6. Over 850-1600 nm. Insertion loss is typically highest at wavelength extremes.
7. Total of discrete reflections. Does not include distributed reflection in fiber.
8. From 1375-1670 nm, <1.5 dB from 1280 to 1375 nm.
9. Relative to reference 0 dB setting.



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## Ordering Information

Indicate your requirements by selecting one option from each configuration table.
Print the corresponding codes in the available boxes to form your part number.

**SAMPLE ORDER: HA097+28KFA1**

HA ☐ ☐ ☐ +2 ☐ ☐ ☐ ☐ ☐

| code | model |
|---|---|
| 01 | HA1 (high resolution, 1200-1700 nm) |
| 02 | HA2 (high power, wavelength flat) |
| 09 | HA9 (1200-1700 nm) |
| 9P | HA9P (Flexcor 1060, 980-1100 nm) |
| 9W | HA9W (750-1700 nm) |

| code | fiber type (µm) |
|---|---|
| 1 | 50/125 (HA9 and HA9W only) |
| 2 | 62.5/125 (HA9 and HA9W only) |
| 7 | 9/125 |
| 8 | Flexcor 1060 (HA9P only) |

| code | built-in options |
|---|---|
| 0 | None |
| 1 | 50/50 coupler (9/125 µm only) |
| 8 | 1:2 switch (HA1 and HA9 only) |
| 9 | 10/90 coupler (9/125 µm only) |

| code | port type |
|---|---|
| 1 | Bulkheads on front |
| 2 | Bulkheads on back |
| 3 | Pigtails on front |
| 4 | Pigtails on back |

| code | connector type (all ports) |
|---|---|
| NC | No connector |
| FP | FC/PC |
| FA | FC/APC |
| SC | SC/PC |
| SU | SC/APC |
| SP | ST/PC |

| code | return loss |
|---|---|
| K | Standard |
| A | Analog |



**If the configurations available do not meet your performance requirements, please contact our global sales and customer service team to discuss the potential for specialized solutions.**

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