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Step attenuator selection guide

	Step size	Attenuation range	Frequency range				
			dc to 1000 MHz	dc to 4 GHz	dc to 18 GHz	dc to 26.5 GHz	dc to 40 GHz
Manual	1 dB	0 to 11 dB		8494A	8494B		
		0 to 12 dB	355C				
	10 dB	0 to 70 dB		8495A	8495B	8495D	
		0 to 110 dB		8496A	8496B		
		0 to 120 dB	355D				
Programmable	1 dB	0 to 11 dB		8494G	8494H	84904K	84904L
		0 to 12 dB	355E				
		0 to 70 dB		8495G	8495H	8495K	84907L
						84907K	
	10 dB	0 to 90 dB				8497K	
						84906K	84906L
		0 to 110 dB		8496G	8496H		
		0 to 120 dB	355F				

Agilent 355 series specifications

Manual	Agilent 355C	(0 to 12 dB, 1 dB steps)
	Agilent 355D	(0 to 120 dB, 10 dB steps)
Programmable	Agilent 355E	(0 to 12 dB, 1 dB steps)
	Agilent 355F	(0 to 120 dB, 10 dB steps)

The manual and programmable Agilent 355 series attenuators offer exceptional attenuation accuracy to 1 GHz; 0.1 dB to 1 kHz, 0.25 dB to 500 MHz, 0.35 dB to 1 GHz. They feature BNC (f) RF connectors, with optional type-N (Option 001) and TNC (Option 005) also available. To achieve 1 dB steps up to a range of 132 dB, serially connect two attenuators using a standard UG-491A/U BNC (m)-to-BNC (m) adapter. Programmable Agilent 355EF models feature a 7-pin connector. To protect your transistor driver against transients during the switching cycle, order Option 007 to install a protective diode between each solenoid and driver.

Agilent 355C/D



Agilent 84904L



Agilent 8494/95/96A/B/D



Agilent 8494/95/96G/H/K



Agilent 84904/906/907 series

This family of programmable step attenuators offers unmatched attenuation performance to 40 GHz. The K models brings superior accuracy and reliability to 26.5 GHz, and the L models offers unparalleled performance to 40 GHz.

Agilent step attenuators consist of 3 or 4 cascaded sections of specific attenuation values; e.g., 1, 2, 4, or 10, 20, 30, or 40 dB. Both families offer the selection, performance, accuracy, and reliability expected from Agilent: attenuation ranges of 11, 70, or 90 dB, 1 dB, and 10 dB step sizes, 5 million cycles per section and better than 0.03 dB repeatability. RF connector choices include precision 3.5 mm on the 26.5 GHz K models, and precision 2.4 mm or 2.92 mm on the L models. While the 2.92-mm connector format is compatible with both 3.5-mm and SMA connectors, Agilent Technologies recommends the more rugged 2.4-mm connectors.

Agilent programmable step attenuators feature electro-mechanical designs that achieve 20 milliseconds switching time, including settling time. The permanent magnet latching allows automatic interruption of the dc drive voltage to cut power consumption and simplify circuit design. They are equipped with 10-pin DIP sockets (m) and have optional interconnect cables available.

Agilent 8494/95/96/97 series

This family of manual step attenuators offers fast, precise signal-level control in three frequency ranges, dc to 4 GHz, dc to 18 GHz, and dc to 26.5 GHz. They feature exceptional repeatability and reliability in a wide range of frequency, attenuation, and connector options.

Attenuation repeatability is specified to be less than 0.03 dB (0.05 dB, 18 to 26.5 GHz) for 5 million cycles per section. This assures low-measurement uncertainty when designed into automatic test systems. Electromechanical step attenuators offer low SWR, low-insertion loss, and high-accuracy required by high-performance test and measurement equipment.

Precision-plated, leaf-spring contacts insert/remove attenuator sections (miniature tantalum nitride thin-film T-pads on sapphire and alumina substrates) from the signal path. Unique process controls and material selection ensure unmatched life and contact repeatability.

Programmable models

Miniature drive solenoids in the programmable models keep switching time, including settling, down to less than 20 milliseconds. Once switched, strong permanent magnets hold the solenoids (and attenuation value) in place. Current interrupts automatically disconnect solenoid current, simplifying driver circuit design, and minimizing heat dissipation. Programming is done through a 12-pin Viking socket or optional ribbon cables with DIP plugs. Automatic drive control is easy using the GPIB compatible Agilent 11713A or 87130A attenuator/switch driver and an external controller.

Programmable and Manual Step

Programmable driver instruments

Programmable drive options for step attenuators include the Agilent 11713A attenuator/switch driver, which permits users to easily integrate the attenuator into GPIB compatible automatic test systems. Also, see page 179 for product descriptions of the Agilent 87130A and 70611A (MMS) attenuator/switch drivers.

Interconnect cable selections include various connector and ribbon cable configurations to match user applications. Standard interconnect cables are described in the Attenuator Cables table on page 53.

Manual models

These models provide excellent performance with the simplicity and convenience of positive manual switching. A low-torque camshaft activates the insertion and removal of the attenuation sections. Positive detents and an attenuation-level indicator ensures quick and accurate control.

Attenuator interconnecting kits

To achieve 1 dB step resolution up to 81 dB, 101 dB or 121 dB, combine the Agilent 8494 with 8495/96/97 using the Agilent 11716A,B,C interconnect kits to cascade attenuators in series.

Specifications

Agilent model (switching mode)	Frequency range (GHz)	Attenuation range	Insertion loss @ 0 dB	Maximum SWR	Repeatability ¹ life	Maximum RF input power	Shipping weight
355C (Manual)	dc to 1	0 to 12 dB 1 dB steps	↑ 0.2 dB + 2.3 dB/GHz ↓	↑ 1.2 to 250 MHz 1.3 to 500 MHz 1.5 to 1 GHz ↓	↑ 0.03 dB max 0.5 million cycles per section ↓	↑ 0.5 W avg. 350 W peak ² (10 μs max.) ↓	↑ 1.4 kg (3 lb) ↓
355E (Programmable)	dc to 1	0 to 12 dB 1 dB steps					
355D (Manual)	dc to 1	0 to 120 dB 10 dB steps					
355F (Programmable)	dc to 1	0 to 120 dB 10 dB steps					
8494A (Manual)	dc to 4	0 to 11 dB 1 dB steps	↑ 0.6 dB + 0.09 dB/GHz ↓	1.5 1.5 to 8 GHz 1.6 to 12.4 GHz 1.9 to 18 GHz	↑ 0.03 dB max 5 million cycles per section ↓	↑ 1 W avg. 100 W peak ² (10 μs max.) ↓	↑ 0.9 kg (2 lb) ↓
8494G (Programmable)	dc to 4	0 to 11 dB 1 dB steps					
8494B (Manual)	dc to 18	0 to 11 dB 1 dB steps					
8494H (Programmable)	dc to 18	0 to 11 dB 1 dB steps					
8495A (Manual)	dc to 4	0 to 70 dB 10 dB steps	↑ 0.4 dB + 0.07 dB/GHz ↓	1.35 1.35 to 8 GHz 1.5 to 12.4 GHz 1.7 to 18 GHz	↑ 0.03 dB max to 18 GHz 0.05 dB max to 26.5 GHz 5 million cycles per section ↓	↑ 1 W avg. 100 W peak ² (10 μs max.) ↓	↑ 0.9 kg (2 lb) ↓
8495G (Programmable)	dc to 4	0 to 70 dB 10 dB steps					
8495B (Manual)	dc to 18	0 to 70 dB 10 dB steps					
8495H (Programmable)	dc to 18	0 to 70 dB 10 dB steps					
8495D (Manual)	dc to 26.5	0 to 70 dB 10 dB steps	↑ 0.5 dB + 0.13 dB/GHz ↓	1.6 to 6 GHz 1.6 to 12.4 GHz 1.9 to 18 GHz 2.2 to 26.5 GHz	↑ 0.03 dB max to 18 GHz 0.05 dB max to 26.5 GHz 5 million cycles per section ↓	↑ 1 W avg. 100 W peak ² (10 μs max.) ↓	↑ 0.9 kg (2 lb) ↓
8495K (Programmable)	dc to 26.5	0 to 70 dB 10 dB steps					
8496A (Manual)	dc to 4	0 to 110 dB 10 dB steps	↑ 0.6 dB + 0.09 dB/GHz ↓	1.5 1.5 to 8 GHz 1.6 to 12.4 GHz 1.9 to 18 GHz	↑ 0.03 dB max 5 million cycles per section ↓	↑ 1 W avg. 100 W peak ² (10 μs max.) ↓	↑ 0.9 kg (2 lb) ↓
8496G (Programmable)	dc to 4	0 to 110 dB 10 dB steps					
8496B (Manual)	dc to 18	0 to 110 dB 10 dB steps					
8496H (Programmable)	dc to 18	0 to 110 dB 10 dB steps					
8497K (Programmable)	dc to 26.5	0 to 90 dB 10 dB steps	0.4 dB + 0.09 dB/GHz	1.25 to 6 GHz 1.45 to 12.4 GHz 1.6 to 18 GHz 1.8 to 26.5 GHz	0.03 dB max to 18 GHz 0.05 dB max to 26.5 GHz 5 million cycles per section	↑ 1 W avg. 100 W peak ² (10 μs max.) ↓	↑ 0.9 kg (2 lb) ↓

¹ Measured at 25 °C. ² Not to exceed average power.

Agilent 355 series options

	Std.	Opt. 001	Opt. 005
RF connectors	BNC (f)	N (f)	TNC (f)
Drive circuit protection	Opt. 007: Protection diodes for Agilent 355E,F		

Agilent 8494/95/96/97 series options

	Std.	Opt. 011	Opt. 015
Supply voltage			
Supply voltage range	20 to 30 Vdc	4.5 to 7 Vdc	13 to 22 Vdc
Supply voltage (nom)	24 Vdc	5 Vdc	15 Vdc
Current drawn	125 ma	300 ma	187 ma
RF connectors			
A,B,G,H models	Opt. 001: N (f)	Opt. 002: SMA (f)	Opt. 003: APC-7
K models	Opt. 004: 3.5 mm (f)		
DC connectors			
G,H,K models	Std: 12-pin Viking connector		
	Opt. 008: 8-inch ribbon cable with 14-pin DIP plug		
	Opt. 016: 16-inch ribbon cable with 14-pin DIP plug		
Calibration documentation	See ordering information		

Specifications

Agilent Model (switching mode)	Frequency range (GHz)	Attenuation range	Insertion loss (dB)	Maximum SWR Std. (Opt. 006)	Repeatability ¹ life	Maximum RF input power	Shipping weight		
84904K (Programmable)	dc to 26.5	0 to 11 dB 1 dB steps	0.8 dB + 0.04 dB/GHz	1.3 (1.5) to 12.4 GHz 1.7 (1.9) to 34 GHz 1.8 (2.0) to 40 GHz	0.03 dB max. 5 million cycles per section	1 W avg. 100 W peak ² (10 μs max)	0.29 kg (10.32 oz)		
84904L (Programmable)	dc to 40								
84906K (Programmable)	dc to 26.5	0 to 90 dB 10 dB steps	0.8 dB + 0.04 dB/GHz	1.3 (1.5) to 12.4 GHz 1.7 (1.9) to 34 GHz 1.8 (2.0) to 40 GHz			0.03 dB max. 5 million cycles per section	1 W avg. 100 W peak ² (10 μs max)	0.29 kg (10.32 oz)
84906L (Programmable)	dc to 40								
84907K (Programmable)	dc to 26.5	0 to 70 dB 10 dB steps	0.6 dB + 0.03 dB/GHz	1.25 (1.4) to 12.4 GHz 1.5 (1.7) to 34 GHz 1.7 (1.9) to 40 GHz					0.03 dB max. 5 million cycles per section
84907L (Programmable)	dc to 40								

¹ Measured at 25 °C.
² Not to exceed average power.

Agilent 84904/906/907 series options

	Std.	Opt. 011	Opt. 015
Supply voltage			
Supply voltage range	20 to 30 Vdc	4.5 to 7 Vdc	13 to 22 Vdc
Supply voltage (nom)	24 Vdc 125 mA	5 Vdc 322 mA	15 Vdc 187 mA
RF connectors			
K models	Std.: 3.5 mm (f)	Opt. 104: 3.5 mm (f) ³ 3.5 mm (m) ⁴	
L models	Std.: 2.4 mm (f)	Opt. 006: 2.92 mm (f)	Opt. 100: 2.4 mm (f) ³ 2.4 mm (m) ⁴ Opt. 106: 2.92 mm (f) ³ 2.92 mm (m) ⁴
Calibration documentation	See ordering information		

³ Drive cable end.
⁴ End opposite to drive cable.

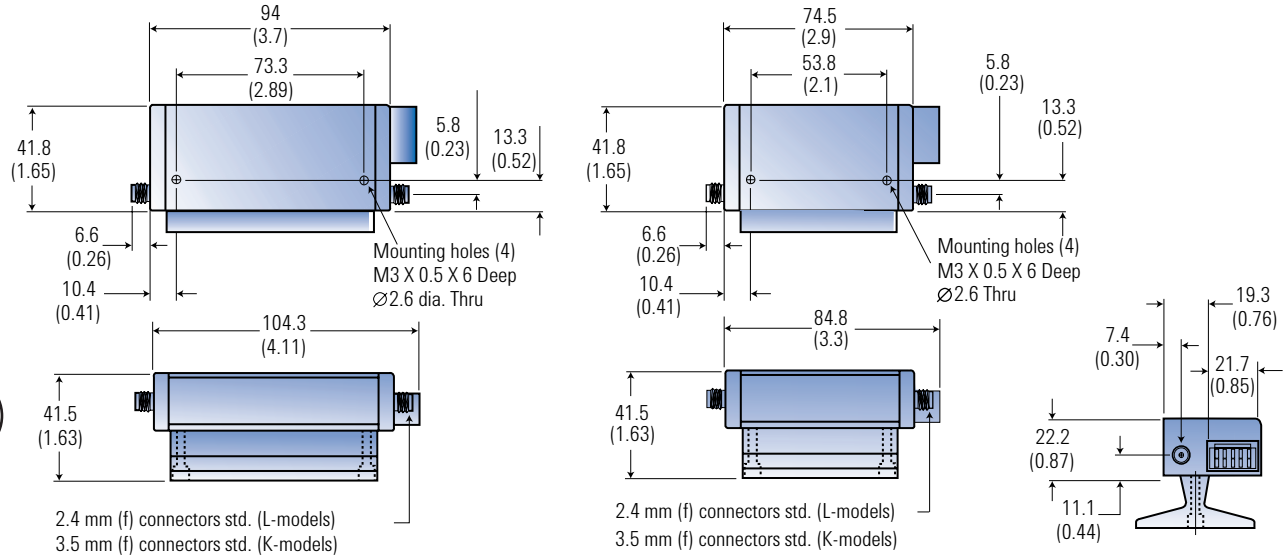
Some Agilent attenuators were available as OEM equivalents to standard models. This table shows the corresponding model numbers.

Agilent Model Number	OEM Model Number	Agilent Model Number	OEM Model Number
8494A	33320A	8496H	33322H
8494B	33320B	8497K	33323K
8494G	33320G	84904K	33324K
8494H	33320H	84904L	33324L
8495G	33321G	84906K	33326K
8495H	33321H	84906L	33326L
8495K	33321K	84907K	33327K
8496G	33322G	84907L	33327L

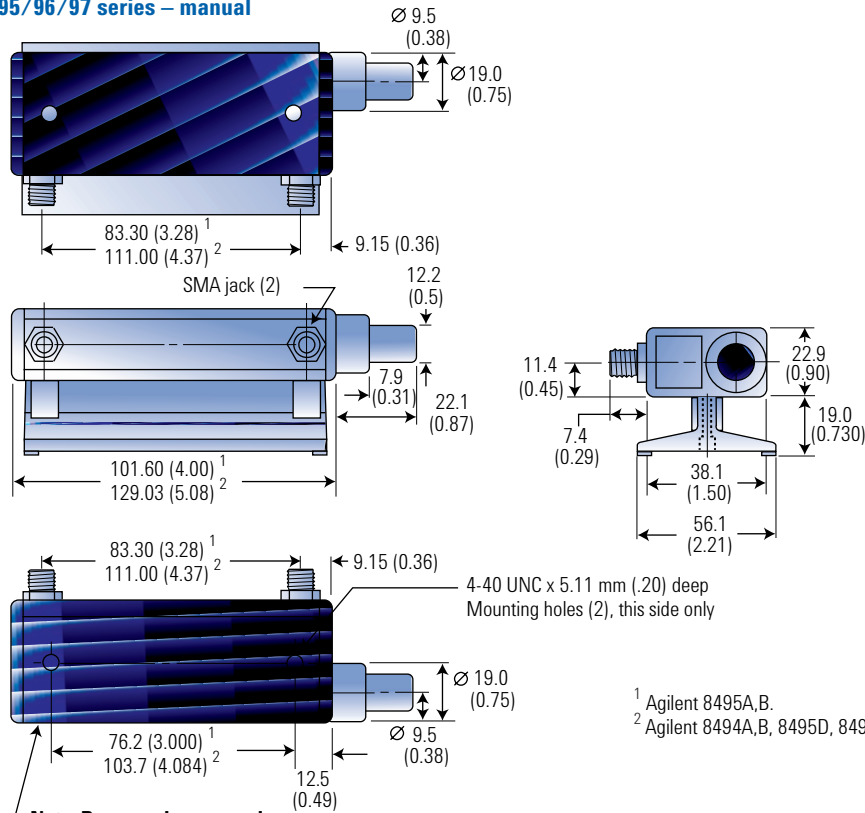
OEM models of step attenuators are furnished without a base.

Outline Drawings

Agilent 84904/906/907 series – programmable

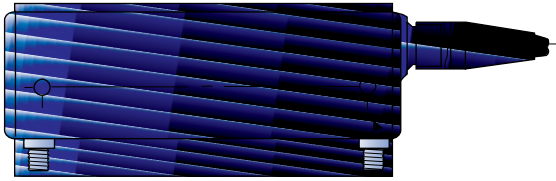


Agilent 8494/95/96/97 series – manual

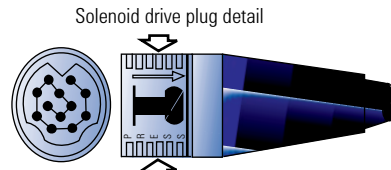
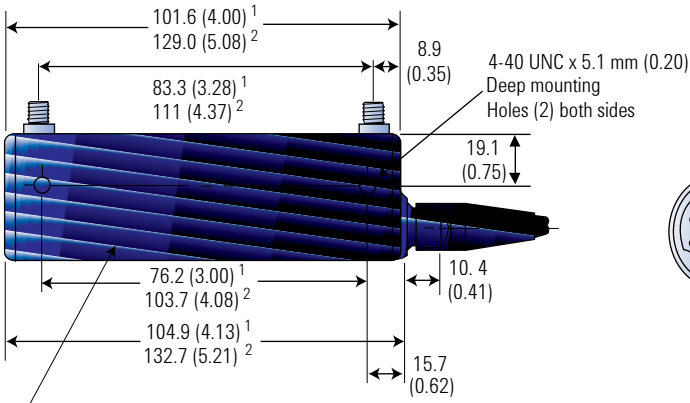
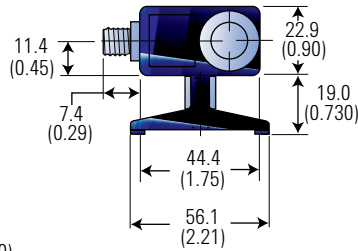
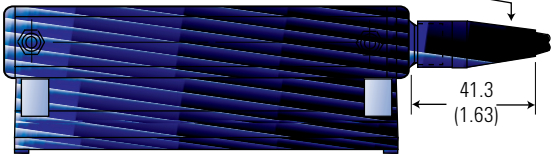


Dimensions are in mm (inches) nominal, unless otherwise specified.

Agilent 8494/95/96/97 series – programmable

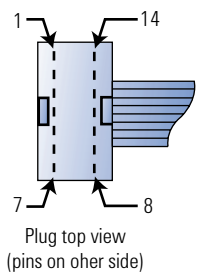
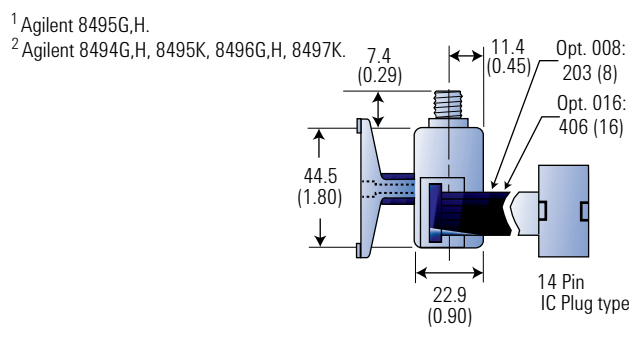


Solenoid drive plug and 5 ft. cable supplied, 6.3 (0.25) dia.



To remove: Press at arrows with thumb and finger, pull to detach. Caution: Do not twist.

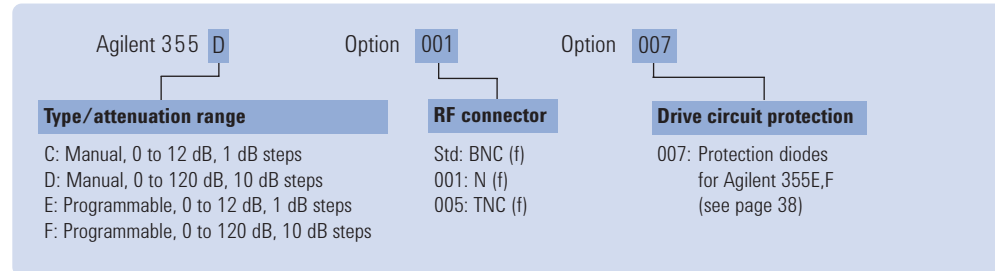
Note: Base can be removed by user to access mounting holes as shown above.



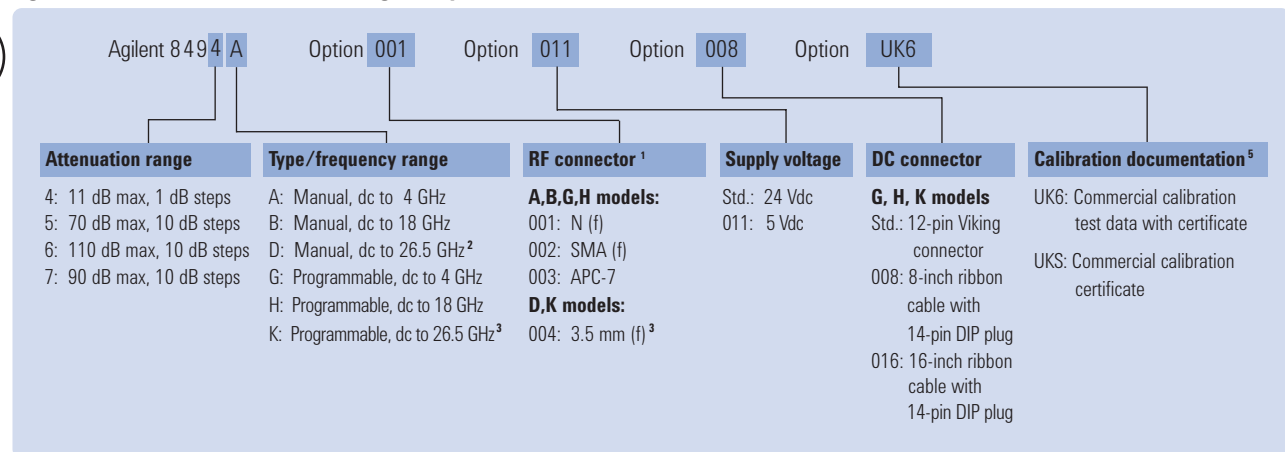
Dimensions are in mm (inches) nominal, unless otherwise specified.

Step attenuator ordering information

Agilent 355 series ordering example



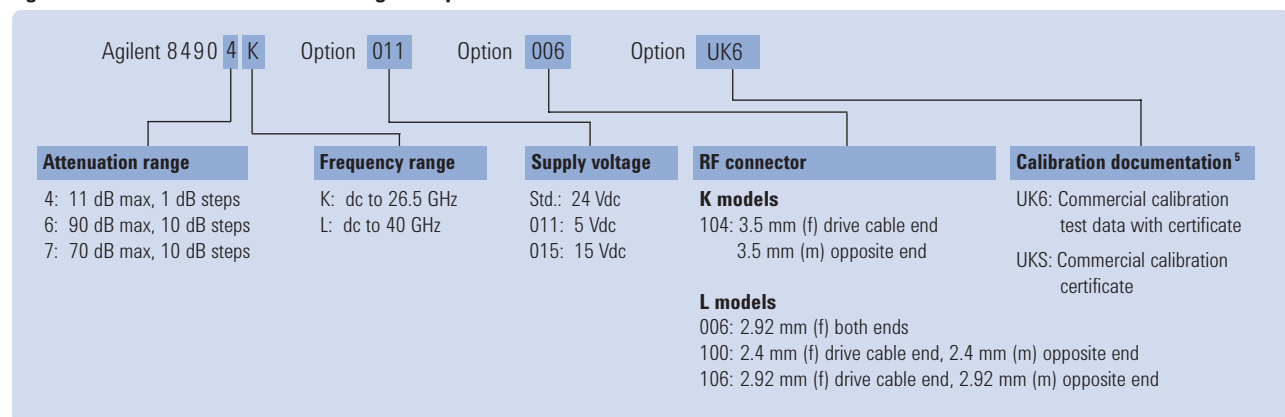
Agilent 8494/95/96/97 series ordering example



¹ Each order must include RF connector option.

² Available with Agilent 8495 only.

³ Available with Agilent 8495/97 only.

Agilent 84904/906/907 series ordering example⁴

⁴ Drive cable not included. See Attenuator Cables table on next page.

⁵ Option UK6/UKS not available with Option 106.

Attenuator drive cables

Agilent model number	Agilent part number	Where used	Description
11764A		11713A to 84904/906/907	10-pin DIP to Viking conn., 60 inches
11764B		84904/906/907 to ribbon	10-pin DIP to 60 inch ribbon cable, bare leads
11764C		84904/906/907 to DIP	10-pin DIP to 14-pin DIP, 8-inch ribbon cable
11764D		84904/906/907 to DIP	10-pin DIP to 14-pin DIP, 16-inch ribbon cable
	11764-60005	84941A dist bd to 8494/95/96/97	Viking to (4) 4-pin Berg conn., 30 inches
	11764-60006	84941A dist bd to 84904/906/907	10-pin DIP to (4) 4-pin Berg conn., 30 inches
	70612-60017	84941A dist bd to 8494/95/96/97	Viking to (4) 4-pin Berg conn., 20 inches
	70612-60018	84941A dist bd to 84904/906/907	10-pin DIP to (4) 4-pin Berg conn., 20 inches

For complete cable configuration information, request publication number 5963-2038E, *Agilent 70611A, Agilent 87130A and Agilent 11713A Switch Attenuator Driver Configuration Guide.*

Attenuator/switch driver attenuator accessories

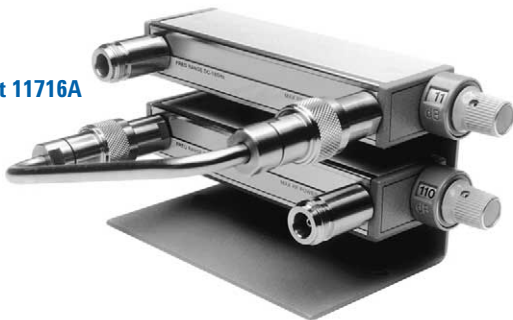
Agilent 11713A



Agilent 11713A attenuator/switch driver

This driver provides GPIB or “local” front panel drive control for programmable attenuators and electromechanical switches. Concurrently, drive up to two Agilent 8494/95/96 and Agilent 87904/906/907 programmable attenuators and two electro-mechanical switches (Agilent 8761, 8762, or 8765 series). The Agilent 11713A can also be used to supply +24V common and ten pairs of current sinking contacts (total current draw <1.25A peak for 1 sec., 0.65A steady state) to independently control up to 10 relays. An integral power supply (with short circuit protection) eliminates the need for an external power source. Each Agilent 11713A is supplied with two plug-in drive cables to simplify connection to programmable attenuators. Switching time is less than 10 milliseconds.

Agilent 11716A



Attenuator accessories

Agilent 11716 series attenuator interconnect kits

These kits can be utilized to connect any two of the Agilent 8494/95/96 attenuators in series. The rigid interconnect cable is available in type-N, APC-7, and SMA connectors as described below.

- Agilent 11716A Attenuator Interconnect Kit (type-N)
- Agilent 11716C Attenuator Interconnect Kit (SMA)