





APPLICATION NOTES

Application Note 33

ACCESSORIES FOR THE MODEL 460A/B AMPLIFIERS

The Model 460A/B Amplifiers are useful in many applications where you need true amplification of sine waves or fast pulses. Amplified signals are typically used to operate pulse analyzers, counters, scales, voltmeters, oscilloscopes, additional amplifiers, transmission lines and many others.

Since the 460A/B Amplifiers are useful in many applications,  has designed several amplifier accessories to enhance amplifier compatibility and versatility.

The accessories are intended to help you achieve greater utilization of your amplifiers, application to more of your measurements, and savings in time. You may obtain them from the Hewlett-Packard Company or from your  Engineering Representative.

The main accessory categories are:

- 1) Cables
- 2) Connectors
- 3) Adapters

I. Cables - These 200-ohm cables are recommended for use with the Models 460A/B, since they match the impedance of the amplifiers and permit the best possible amplifier performance. They are used to interconnect two or more amplifiers in cascade, or to connect amplifiers to other instruments.

46A-16A - Patch Cord - 200-ohm cable, two feet in length, each end terminated by a No. 46A-95B Cable Plug. Fits 460A and 460B panel jacks. \$14.50.

46A-16B - Patch Cord - Same as No. 46A-16A, except six feet in length. \$23.50.

812-52 - Cable - Special 200-ohm cable available in lengths to meet your requirements. \$2.25/foot.

II. Connectors - Special connectors have been designed for use with the 200-ohm cable used by the Models 460A/B. These items are used to terminate cables, to interconnect two cables, or to provide a connection for a cable into another instrument. They are especially valuable in making custom cables and installations.

46A-95A - Panel Jack - Special low capacitance panel jack designed for 200-ohm cable. Mates with Nos. 46A-16A and 46A-16B Patch Cords or No. 46A-95B Cable Plug. Requires 1-1/8 inch diameter mounting hole. \$5.00.

46A-95B - Cable Plug - Low capacitance plug designed for use with 200-ohm cable. Mates with No. 46A-95A Panel Jack and with No. 46A-95E Connector Sleeve. \$5.00.

III. Adapters - Many adapters are currently available which expand the usefulness of your amplifiers. These adapters have been designed to solve the special connection problems you are likely to encounter with the Models 460A/B. They may be divided into three groups:

A. Amplifier - to - Type N Adapters:

46A-95C - 50-Ohm Adapter - Provides a type N connection for coupling a 50-ohm transmission line to the input or output of a Model 460A/B Amplifier. Includes a terminating resistor which effectively loads the line with 50 ohms. Thus, there are no reflections along the line since the resistor eliminates any mismatch between the line and its termination. \$15.00.

46A-95H - 200-Ohm Adapter - Provides a type N connection for coupling a transmission line to the input or output of a Model 460A/B Amplifier. Similar to No. 46A-95C, only includes a terminating resistor of 200 ohms.

This adapter is used to match the Model 460A/B to high external impedances. The 200-ohm terminating resistor matches the internal impedance of the amplifier, and thus loads the 460A/B input or output with the recommended value. If external impedances are sufficiently high, they effectively appear as an open circuit in parallel with the 200-ohm terminating resistor. Thus, the amplifier effectively operates into its rated load and therefore no reflections are generated due to mismatch.

The adapter is extremely useful in connecting the Model 460A/B to circuits such as oscilloscope amplifiers, vacuum tube voltmeters and other high impedances. \$15.00.

46A-95J - No Load Adapter - Provides a type N connection for coupling a transmission line to the input or output of a Model 460A/B Amplifier. Achieves maximum voltage input from 460A/B by eliminating load resistor of No. 46A-95C or No. 46A-95H. Useful in working with small signals where performance of the 460 itself is not under study and reflections due to coupling mismatch are not bothersome. \$15.00.

B. Amplifier - to - Voltmeter Adapters:

46A-95D - Compensated Adapter for Model 410A/B Voltmeter Probe - Consists of a bayonet type sleeve with which a Model 410A/B probe may be connected directly to the output of a Model 460A/B Amplifier. The adapter includes frequency compensating components to extend the frequency response of the amplifier to 200 megacycles. Permits usefulness of your 460A/B over a greater frequency range. \$20.00.

46A-95K - Adapter for Model 410A/B Voltmeter Probe Permits connection of a Model 410A/B voltmeter probe directly to the output of a Model 460A/B Amplifier. Similar to No. 46A-95D except for elimination of the compensating network.

This adapter is used in calibrating the actual frequency response of an individual 460A/B. \$25.00.

C. Amplifier - to - Oscilloscope Adapters:

46A-95F - Adapter - Provides for connection of No. 46A-95B Cable Plug to 5XP cathode ray tube. Permits direct input to tube deflection plates from 460A/B. \$7.50.

46A-95G - Adapter - Provides for connection of No. 46A-95B Cable Plug to terminal plate of Tektronix type Oscilloscopes. Permits direct input to oscilloscope deflection plates from 460A/B. \$12.50.

460B-95A - Adapter - Provides for connection of No. 46A-95B Cable Plug to deflection plate terminal board of ϕ Model 150A/AR Oscilloscopes. Permits direct input to oscilloscope deflection plates from 460A/B. \$20.00.

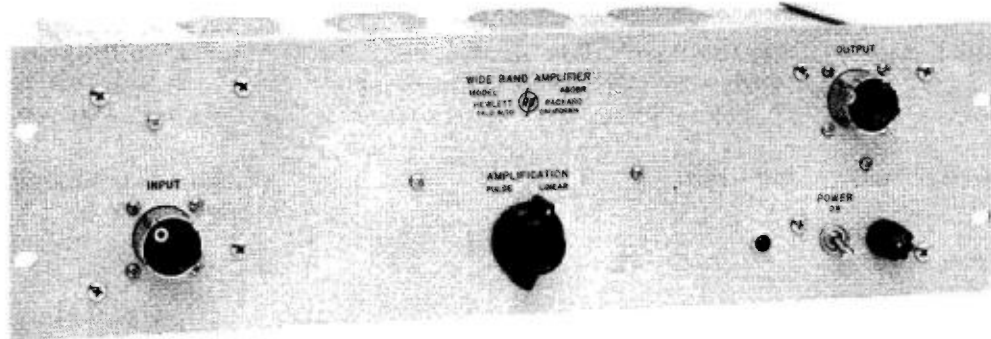
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TENTATIVE DATA

HEWLETT-PACKARD COMPANY • 1501 PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U.S.A.
CABLE "HEWPACK" TELEPHONE DAVENPORT 6-7000

- Ⓜ MODEL 460AR WIDE BAND AMPLIFIER
- Ⓜ MODEL 460BR FAST PULSE AMPLIFIER



ADVANTAGES:

- 20 db gain--up to 90 db in cascade
- True amplification of millimicro-second pulses
- Rise time 0.003 μ sec
- No ringing or overshoot
- 125-volt open circuit output
- Response follows Gaussian curve

USES:

- TV, VHF, Fast-pulse nuclear work
- 100 mc pre-amplifier for oscilloscope
- Increases VTVM sensitivity 10times over 200 MC range
- Simplifies measurement of small outputs

WIDE BAND DISTORTION-FREE FAST PULSE AMPLIFIER

With Model 460A/B Amplifiers you can obtain at moderate cost true amplification of fast pulses to power levels sufficient to operate scalars, counting meters and cathode ray tubes.

Ⓜ 460A Wide Band Amplifier is designed to provide voltage gain of approximately 20 db. Its companion equipment, Ⓜ 460B, is designed as a terminal amplifier to deliver high pulse power or voltage to a load. Ⓜ 460B cascaded with 460A provides linear amplification of 16 volts peak output; and with two 460B's, pulse amplification to 125 volts is available. This permits full deflection of 5XP cathode ray tubes. The amplifier's ultra-short rise time of 0.003 μ sec, combined with zero overshoot, insures distortion-free amplification of pulses faster than 0.01 μ sec.

This unusual combination gives maximum usefulness for fast-pulse application, nuclear radiation problems, television, MF, HF, and VHF work. It also means the bandwidth of your standard oscilloscope can be increased to over 100 mc, and volt-meter sensitivity multiplied by 10. In cascade or singly, the amplifiers offer still further convenience as general-duty wideband amplifiers for all types of laboratory problems.

SPECIFICATIONS

Frequency Response:

Ⓜ Model 460AR Wide Band Amplifier
High Frequency - closely matches Gaussian curve when operating into a 200-ohm resistive load. 3 db point is 120 mc.
Low Frequency - off approx. 3 db at 100 kc when operating into a matched load. Off approx. 3 db at 3 kc when operating into an open circuit (i. e., CRT plates) or succeeding amplifier.
With Ⓜ 410B VTVM - when used with Ⓜ 46A-95D Adapter, response \pm 1 db, 200 kc to 200 mc.

Ⓜ Model 460BR Fast Pulse Amplifier
 High Frequency - same as 460AR

Low Frequency - same as 460AR

SPECIFICATIONS (Cont'd.)

	<u>hp Model 460AR</u> (cont'd.)	<u>hp Model 460BR</u> (cont'd.)
Gain:	Approximately 20 db into 200 ohms load. Gain control has range of 6 db. Five amplifiers may be cascaded.	Approximately 15 db into 200 ohm load.
Output Impedance:	Approximately 300 Ω .	Approximately 200 Ω .
Rated Output:	Approximately 8 volts peak open circuit, less than 5% distortion.	<u>Linear Amplifier</u> - Approximately 8 volts peak into a 200 ohm load or 16 volts peak into open circuit.
Maximum Output:	Approximately 8 volts peak into 200 ohms, approximately 20 volts peak into an open circuit.	<u>Pulse Amplifier</u> - Approximately 125 volts negative peak open circuit (unilateral) pulse operation) 10% duty cycle.
Input Impedance:	200 ohms.	200 ohms (+8 volts input required for 125 volts output).
Noise Figure:	Less than 10 db.	Less than 6 db.
Delay Characteristics:	Approximately .014 μ sec.	Approximately .016 μ sec.
Rise Time:	Approximately 0.003 μ sec (10% to 90% amplitude). No appreciable overshoot.	Approximately 0.003 μ sec. No appreciable overshoot.
Power Supply:	115/230 volts \pm 10%, 50/1000 cps, 50 watts.	Same as 460AR
Size:	19" relay rack panel, 5-1/4" high; 6-3/4" deep.	Same as 460AR
Weight:	Net 12 lbs., shipping 18 lbs.	Same as 460AR
Price:	Rack Mount \$185.00.	Rack Mount \$225.00.

hp Models 460A and 460B Amplifier Accessories

<u>hp 46A-16A</u> Patch Cord:	200 ohms, 2' long. \$14. 50
<u>hp 46A-16B</u> Patch Cord:	200 ohms, 6' long. \$23. 50.
<u>hp 46A-95A</u> Panel Jack:	For 200-ohm cables, low capacitance. \$5. 00.
<u>hp 46A-95B</u> Cable Plug:	For 200-ohm systems, \$5. 00.
<u>hp 812-52</u> Cable:	200 ohm cable in length to specification. Per foot \$2. 25.
<u>hp 46A-95C</u> 50-ohm Adapter:	Type N to <u>hp 460</u> , 50 ohm termination, \$15. 00.
<u>hp 46A-95D</u> Adapter:	<u>hp 410B</u> VTVM to <u>hp 460</u> , no termination, \$20. 00
<u>hp 46A-95E</u> Connector Sleeve:	Joins two 46A-95B Cable Plugs, \$7. 50.
<u>hp 46A-95F</u> Adapter:	For connecting to 5XP CRT. \$7. 50.
<u>hp 46A-95H</u> Adapter:	Type N to <u>hp 460</u> , 200 ohm termination, \$15. 00.
<u>hp 46A-95J</u> Adapter:	Type N to <u>hp 460</u> no termination, \$15. 00.
<u>hp 46A-95K</u> Adapter:	<u>hp 410</u> VTVM to <u>hp 460</u> , 200 ohm termination, \$25. 00
<u>hp 460B-95A</u> Adapter:	For connecting to <u>hp Model 150A</u> Oscilloscope plates, \$20. 00.

All Prices f. o. b. Palo Alto, California

DATA SUBJECT TO CHANGE WITHOUT NOTICE

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