SPECTRA SONICS

MODEL 110 AUDIO AMPLIFIER

Operating Instructions

GENERAL

The Model 110 Audio Amplifier is designed specifically for professional applications requiring both unequalled performance and reliability at a competitive cost. It performs such functions as microphone preamplifier, booster amplifier, mixing amplifier, program amplifier, line amplifier, and other such functions as required up to line levels. This unique amplifier contains an integral active isolation "transformer" which eliminates system ground loop problems without increased cost and performance limitations normally associated with conventional transformers.

UNCONDITIONAL GUARANTEE

When utilized in accordance with these operating instructions, the performance to published specifications, and the operational reliability of the Model 110 Audio Amplifiers are Unconditionally Guaranteed by SPECTRA SONICS for two years from the date of manufacture. Any returned amplifier will be repaired, without charge (except for postage), the same day received by SPECTRA SONICS.

TERMINATION

The Model 110 Audio Amplifier is mounted on a compact printed circuit card (2 1/2" X 5" X 1/2") and may be installed in a Model 201C Card Holder. The card holder contains a Model 230 Card Connector, which has 10 bifurcated terminal edge connectors to insure positive contact and provides a convenient, and orderly, method of wiring, grounding and a stable housing.

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Note: All measurements specified in dB are measured with respect to 0 dB = 0.775 volts. All data in dBM are with respect to 0 dBM = 1mW dissipated into a 600 ohms resistive load = 0.775 volts across 600 ohms.

INPUT TERMINATION/MICROPHONE LOADING APPLICATIONS

Microphone loading normally falls into two categories: Power matching and voltage loading. Most American dynamics, etc. fall into power matching and are loaded with their source impedance. Voltage source microphones, such as condensor microphones, however, may not be loaded in this manner as distortion and frequency discrimination will occur. All such microphones should see at least 5 times their source impedance - or operate unloaded. It is recommended that 50 ohms impedance be used.

ACTIVE ISOLATION TRANSFORMER

The Model 110 Audio Amplifier contains an intergral active electronic isolation transformer with 1:1 transfer ratio. This is unique among amplifiers in that the ground is not continuous through the amplifier (see Figure 1).

Two operating conditions of major significance are made possible:

1. Complete single-ended systems without transformers.
2. High frequency stability.

Since the active isolation transformer contains none of the band width compromises associated with conventional transformers, it does not exclude RF (without capacitor filter), and thus transformers are recommended at the input and output of the system with no transformers within the system.

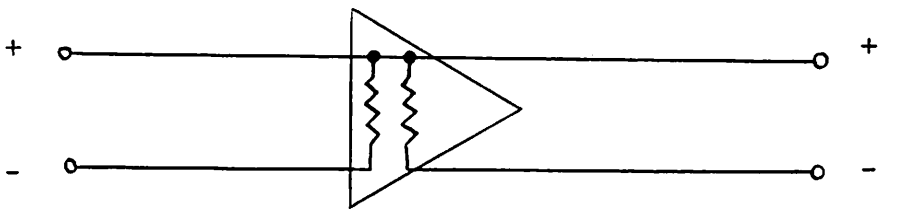
GROUND

In order to preclude the output modulating the input as a direct result of input ground potential fluctuations at high frequencies, and thus cause high frequency instability, the length of any lead carrying signal common to both output and input should be as short as possible (see Figure 2). Where ground returns exceed three feet in length, shielding is recommended (see Figure 3). An improper termination produces system oscillation at frequencies in the 1-5 MHz range and injects hum (ambient 60 cycle superimposed on an oscillation carrier) into the system.

Wherever branching ground circuits are designed, the amplifier itself may be employed as an active isolation transformer thus eliminating ground loops that would normally be encountered with conventional amplifiers in single-ended circuitry. Figure 4 illustrates the grounding system required, the only difference being the incorporation of a capacitor to allow high frequency grounding without disturbing low frequency ground isolation. This capacitor (.47 MFD, 10V) should be terminated at the amplifier connector with short leads, and all common path leads to ground in Figure 4 are shown with physical length, for illustration only.

Figure 1

AMPLIFIER INTERNAL GROUND CONFIGURATION



(Internal Ground Not Continuous)

Figure 2

THEORY

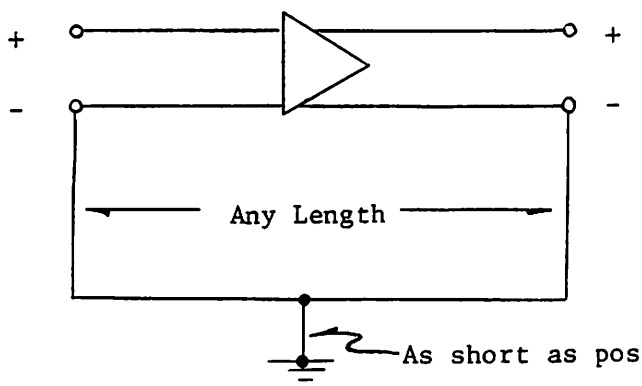


Figure 3

PREFERRED CONNECTION

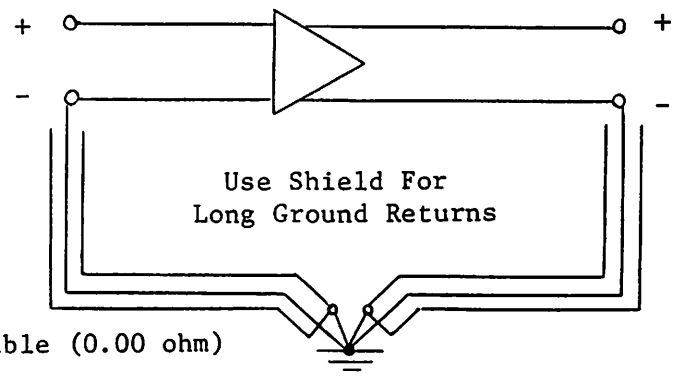
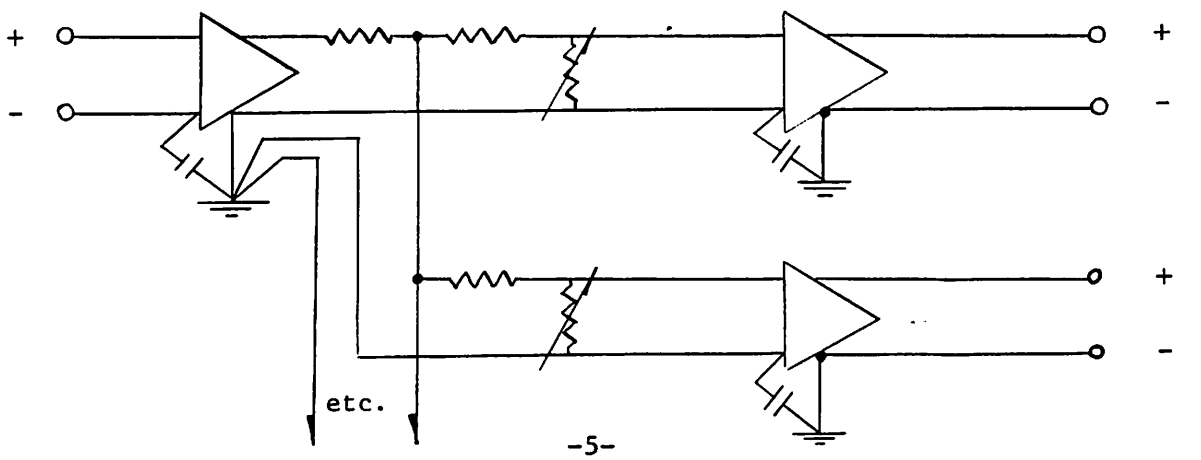


Figure 4

GROUND MIXING OR BRANCHING CIRCUITS

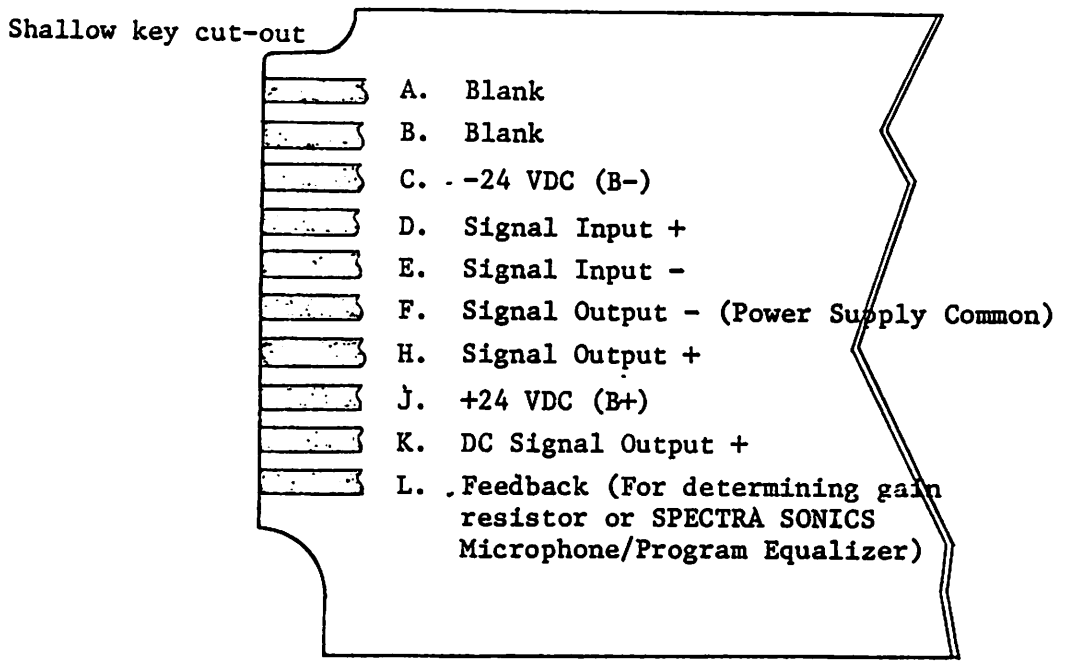


REPAIR/SCHEMATICS

In the event of a malfunction or failure, it is recommended that the Model 110 Audio Amplifier be repaired only at the factory. Replacement of components with other than those pre-tested and identified by SPECTRA SONICS test procedures can result in catastrophic failure of the amplifier and should not be undertaken.

For this reason, schematics are not provided and the factory is geared to repair damaged products the same day received. All repaired products are tested and performance must meet the product specifications prior to return to the customer.

The card connector must be wired to align with the printed circuit card terminals as shown in the sketch below:



Power requirement is ±24 VDC at approximately 20mA per amplifier, and any supply with better than -60dBM noise (less than 1mV ripple) can be used without adding noise to the output of the amplifier. The amplifier printed circuit card module may be inserted in or withdrawn from the card holder, with power applied, without harm to the amplifier.

Each amplifier possesses an individual input and output ground and these must be wired in accordance with the grounding instructions.

All amplifiers should be allowed to warm up for approximately 15 minutes prior to any critical measurements, although the performance is instantaneous with slightly increased distortion for the first few minutes.

WARNING: The following details should be carefully observed when using the amplifier or the amplifier may be damaged.

1. Do not accidentally short the DC Signal Output + to ground.
2. Do not reverse the power supplies ±24 VDC.
3. When applying continuous signals through the amplifier, load the amplifier output with from 600 ohms to infinity.
4. Do not allow an oscillation to continue. Typical causes of oscillation are due to improper wiring and grounding practices such as: Capacitive coupling between high and low signal levels in very close proximity (eg. bundled cables) where excessive loop gain from a single or series of amplifiers exists; grounding of input and output signal negatives through common wire to ground plane, etc.
5. Power should not be applied when inserting the amplifier into an unrestrained connector, as misalignment may cause contact shorting.

GAIN

The overall gain of the amplifier is determined solely by the value of one resistor, R_f (in feedback circuit). This resistor is intended to be utilized externally (on the circuit card connector: terminals K and L) thereby allowing all circuit cards to be interchangeable, irrespective of the gain desired in any given amplifier plug-in location. Resistance values for normally employed gains are:

40dB (40.0) = 10.7K ohms, low noise
45dB (44.6) = 20K ohms, low noise
50dB (49.6) = 42.2K ohms, low noise

$$\text{Gain, dB} = 20 \text{ Log } \frac{R_f \times 1.032K}{R_f + 100K}$$

Any desired gain between the above indicated values may be obtained (using the above gain equation) by an appropriate change in R_f, the feedback resistor. The resistor should be low noise, metal film, for optimum amplifier noise considerations.

FREQUENCY RESPONSE

The high end response of the Model 110 Audio Amplifier may be tailored in the same manner as the gain. High frequency cut-off is accomplished by placing a capacitor directly across the signal input terminals of the circuit card connector, again allowing interchangeability of amplifiers irrespective of response differences in various amplifier locations.

IMPEDANCE MATCHING

There exists no requirement to match input and output impedance with the Model 110 Audio Amplifier, since the amplifier is purely resistive in nature.

The amplifier may be terminated with any source resistance, 0 ohm to infinity, with a corresponding change in performance. Noise output will decrease as the source impedance is decreased. Refer to the paragraph on noise for additional data.

The output of the amplifier may be loaded with 600 ohms to infinity with no performance change. Loading of 600 ohms or greater should be observed for amplifier maximum power capability considerations (output stage current). Overloading the output with less than 600 ohms will distort the output, but not damage it.

NOISE

Noise output, with respect to the input, varies from -132dB to -125.5dB for input sources of 0 ohm to infinity, respectively. Typical sources of 50 ohms to 600 ohms give -130dB and -127dBM, respectively. In order to maintain the specified noise figure, the amplifier should not be located in or near strong magnetic fields produced by transformers, motors, etc.

As an example, the unequalled low equivalent input noise measurement of -127dBM is based on: Unweighted response; 20Hz to 20kHz bandpass filter; and input terminated with 600 ohms low noise (eg. metal film) resistor.