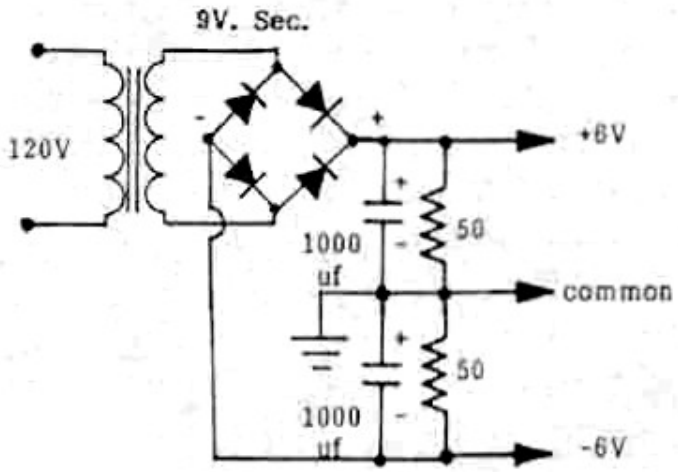
HELPFUL HINTS

BIPOLAR SUPPLY USING ANY FULL WAVE
RECTIFIER SYSTEM



THIS SYSTEM SHOULD BE USED WITH LOW CURRENT DEVICES

The 9 Volt Transformer provides a full 12 Volt Supply when rectified and filtered, due to the fact that the DC Voltage is found by multiplying 9 Volts times 1.414. This is the rectified Voltage, without a load.

The two 50 Ohm resistors provide for A VOLTAGE DIVIDER, which divides the 12 Volts into two parts, providing for a Plus and a Minus 6 Volt Supply. This Power Supply is perfect for Op Amps and small Mixer Circuits using Signal Transistors, etc. I use this Power Supply for a Microphone Preamplifier, which uses two 741 Op Amps, each using a Plus/Minus Voltage Supply.

As can be seen in the Schematic above, there will always be a load on the Power Supply due to the total resistance of the two 50 Ohm Resistors, totalling 100 ohms. Without any further Circuitry added, there will be a current drain in the Voltage Divider of 120 MA. This calculates to just under 1 Watt Dissipation for each resistor. The Power Rating of the resistors should be about 1-2 Watts, each resistor, depending upon the Total Load. Due to complexities resulting from large Loads, do not use this circuit where large amounts of current are required, such as in Power Amps, etc. as it tends to waste Power, as well as requiring very expensive resistors and transformers for such uses.

AUDIO HINTS

In many Radio installations, R.F. can be a problem when it enters the audio lines to the transmitter. The circuit shown below will reject R.F. and all frequencies below 50Hz. or above 15.000Hz. The audio level leaving the circuit will be reduced to 50% of the audio entering the device.

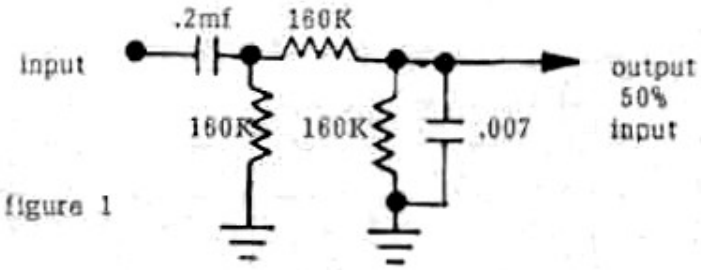


figure 1

Audio Response: 50 - 15,000 Hz.

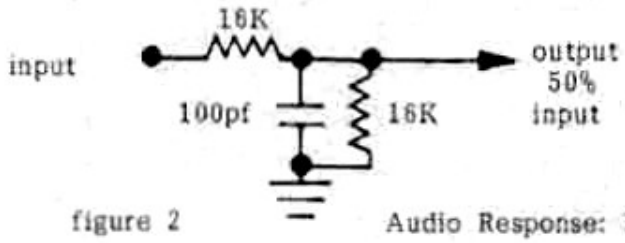


figure 2 Audio Response: 15 - 25,000 Hz.

In figure 2 is shown another R.F. rejection circuit which is easy to make. This device rejects all R.F. but passes all audio frequencies entering the network. The resistors used in these networks are 1/2 watt resistors. Capacitors may be 50 volt rating or greater. I recommend at least 400 volt capacitors in all circuits where possible. Experience shows that these usually last longer and are just as inexpensive to purchase as the lower voltage units. In cases where space is a problem, the smaller capacitors should naturally be used.

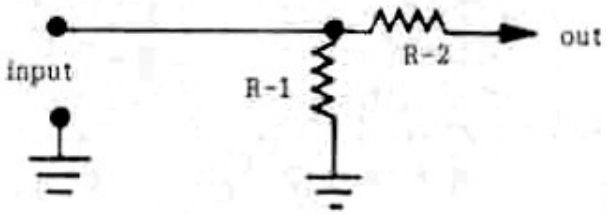
The above circuits are normally used in the lines driving the transmitter, but if necessary, may be used in any other location where R.F. is a problem.

In many Studios and installations throughout the world, inexpensive equipment is used with surprising results instead of the high priced equipment supplied by Dealers. One of the most expensive devices used in Radio Work is the Audio Console. A "cheap" Console will cost over $4000.00 and the prices soar to over a half-million dollars for "custom-made" units!

For someone just starting out in the Business, you do not have to have all the fancy "doo-dads" and "gizmos" in order to have a perfect audio quality production. In the world of audio equipment, you do not always get what you pay for. With a simple audio mixer costing $200.00, you can get the same frequency response as with higher priced units. The difference is the fancy case, the **NAME**, and the extra features. Most features are only a convenience and not a requirement.

The problem with using semi-professional equipment for Broadcast or Studio work is the interface. The impedances must match or even the best equipment will sound like junk. Balanced lines are usually used on Professional equipment while unbalanced lines are used with home-style equipment.

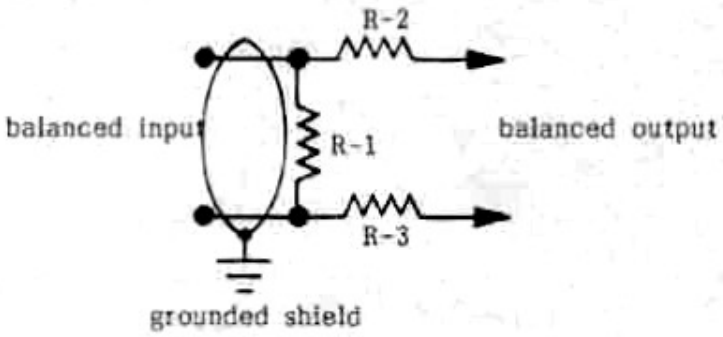
First of all, you should find a way to match the impedances because most professional Consoles will accept "unbalanced" lines by simply grounding one of the inputs. Shown below is the easiest way I know to match these impedances when using unbalanced lines.



The resistors shown are 1/2 watt carbon-film type available anywhere. R-1 is to match the load of the device providing the signal and R-2 is to match the input of the Console, Recorder, Amplifier, or other signal using device. When these impedances are matched, there is seldom a problem with distortion. If hum shows up in the lines, there are several easy to use methods which I will show in order to eliminate it.

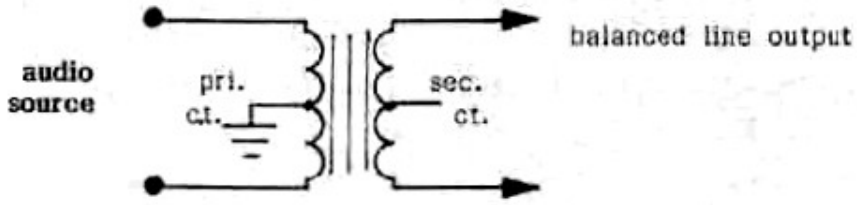
In the example just shown. R-1 is always the value of the output impedance of the device supplying the Audio Signal. This could be, for example, a cassette tape player with an 8 ohm "ear phone jack." The input of the resistive pad is connected to this jack. R-1 is 8 ohms in order to match the output circuit of the cassette player. Now, if the signal is to be fed into an audio Console with an input impedance of 20,000 ohms, R-2 will be made 20,000 ohms and the volume of the cassette player adjusted about 1/4 to 1/2 volume to provide a usable signal level for the Board. The same applies when matching high to low impedances. When both loads are properly matched, and volume levels are set, there should be no distortion unlessfrom R.F. or hum pickup. This is about the easiest way I know to match lines. The same applies to low level lines. The resistors themselves seldom pick up any hum or noise. If there is any doubt, build the resistive pad into a metal case and provide a separate ground for the case than the one used for the low side of the unbalanced line.

Balanced lines can be matched using similar techniques - only 3 resistors are needed instead of the usual two.



In the above example, R-1 has a value equal to the incoming line and R-2, R-3 each have 1/2 the value of the outgoing line. Balanced lines from 4 ohms to 30,000 ohms may be matched this way. At higher impedances, hum pickup may become problematic. To overcome this tendency, the balanced "line transformer" is the least expensive way to go. Telephone "repeat coils" may also be used to assure that there are no stray hums on audio lines.

The audio line transformer is the best way to eliminate "ground loops" or hum from audio signals at low cost. Line matching transformers are almost always provided with "center taps" on primary and secondary windings. These aid in both impedance matching and hum elimination.



The method of hook-up shown above is most often used to stop stray hums found on incoming lines. The center tap on the incoming line side is properly grounded which balances out the stray hum fields giving top-notch performance at the least possible cost. These transformers tend to be expensive, but much cheaper than the Commercial "Hum Loop Eliminators" which cost from several hundred to thousands of dollars. As a general rule, only ground shielded cable on the " **Board** " end of the line.

In using balanced audio lines, the most common error is to attempt to ground both ends of the shield. This must never be done, especially where the transmitter is located in the same building as the Studio. The "twisted pair" wires which are usually used have a shielded braid which may be grounded at whichever end works best. For error-safe installations, never buy or use shielded pair which does not have a plastic jacket over the shield. Most R.F. and hum pickup problems which can not be solved are due to its common use. When every single audio line in the Studio or Station maintains its own isolation and integrity, "ground loops" are easy to isolate and eliminate. In some cases it may be necessary to re-wire the entire facility with modern jacketed cables in order to cure the D.J.'s headache. When using bare cables, they will have to be braided together their entire length and soldered at times to the Station Ground System, **plus** the frequent use of isolation transformers or other devices. To assure easy installations, I recommend the use of fully jacketed cables in every case, except perhaps inside equipment cases where other techniques are normally used.

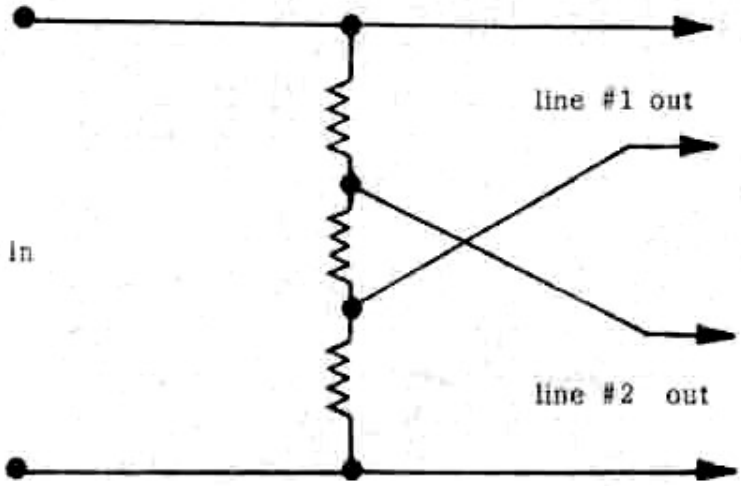
When an isolation transformer is needed at the input to a piece of equipment, the primary center tap often must be grounded only to the shield and not to the equipment ground in order to break the ground loop. There is no hard fast rule except, "Whatever works best, do it."

I have found that in most installations there is no worry about hum pick up if everything is done uniformly. The balanced inputs to Professional Boards usually adapt well to unbalanced lines without hum pickup if there is sufficient incoming audio drive. In cases where the Board must bring up the volume level significantly, it may be wise to install a pre-amp before the Board. If this is not done, no transformer in the world will solve your problems with hum, noise, distortion and even interference from nearby radio and TV Stations.

In cases where a slight sacrifice in audio quality is not feared, it is possible to permit a slight mis-match in impedances in order to interface equipment. I have found it impossible to find certain transformers which perfectly match some equipment. There have been times when I have had to use "build-out resistors" on standard transformers in order to make a reasonable match. As an example, if you had a transformer matching 150 ohms to 600 ohms, but you **needed** and could not find a 600 to 600 ohm transformer, you could use **resistors** on the 150 ohm winding to increase the impedance. The result would be a reasonable match with some loss in audio levels. A pre-amplifier may be needed to bring the audio up to the desired level.

Referring to the Chapter on transformers, I have stated that in emergency situations it is possible to use even power transformers for audio use if impedances are made to match. Much care must be exercised in doing this and everything must be pre-tested for ratio and frequency response before putting it to use. On the other hand, using the **build-out resistors** method above, better results may be had by using audio transformers of just about any kind. For example, an output transformer (with center taps) may be adapted to line isolation or impedance matching use and made to match nearly any impedance using the resistor method. So long as audio levels are kept sufficiently above **noise levels**, this works really well, and I see no reason to prohibit its use when needed. Many audio problems can be prevented simply by raising audio levels dramatically **before** the signal enters the lines. Levels can easily be brought down later at the destination using resistive pads, etc.

Shown here is the popular "Y" Pad. It is used to take two outputs from a single incoming line. It can also be reversed so as to mix two signals into a single line. The "Y" Pad is simple to build. All the resistors have the same value - the characteristic impedance value of the line. If the line is 600 ohms, all resistors are 600 ohms. If the line is an 8 ohm speaker line, all resistors are 8 ohms in value, with (of course) sufficient wattage size to handle the



THE "Y" PAD

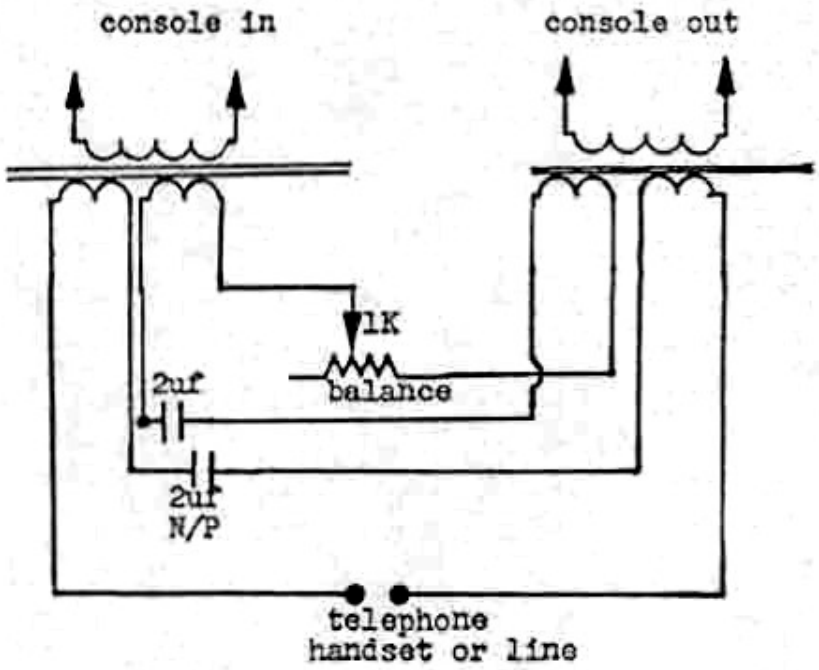
power demands. This is an impedance device and therefore should not be depended upon for power usage as its primary **FUNCTION.** This pad has only a 6db. loss, which is very small considering its versatility.

There are many other pads which may be constructed using resistors, and for those, I recommend consulting a Broadcast Engineering Handbook such as provided by the N.A.B.

SPECIAL NOTE:

When feeding one piece of equipment into another, be sure to consult the schematics of each and determine if one transformer is feeding another transformer. If so, you **absolutely must use a resistor pad between the two devices!** If you fail to do so, you will have mysterious distortion, frequency attenuations and boosts for no apparent reason. Don't try to correct the problem with **an equalizer.** Nothing is wrong with the equipment - the problem is due to feeding one transformer into another. The pad is the solution!

BASIC HYBRID TELEPHONE CIRCUIT



NOTE: The two transformers are identical and are usually 600 ohms value.

USES [IN STUDIO]

The telephone unit is used for putting audio from the phone lines directly "On The Air" in a radio station or Recording Studio. The audio from the announce mike is coupled into the unit and makes a proper "mix" coming from the audio console. The 1 K. Pot. is a ten turn Pot. for achieving a good balance between the Announce Mike and the audio coming in from the phone lines. Both caller and Announcer will be heard "On The Air" and over the phone lines at the same time. The Radio Transmitter is connected to "Console Out" or a tape recorder may be used here if desired. In most cases, resistive pads should be used at the three inputs to this unit for correct loading.