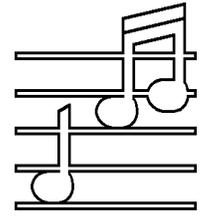


# AUDIO BASICS



A MONTHLY NEWSLETTER OF AUDIO INFORMATION  
VOLUME TWELVE NUMBER SEVEN JULY, 1993

## A New Construction Project – The Speaker Switch Box

This month it is time to do something hands on useful again. We are going to help you build a low cost but very functional speaker switch box – and it will drive two sets of stereo headphones too.

For a total cost of under thirty dollars with all easy to obtain parts from Radio Shack, you will have a clever little box that will allow you to switch two different stereo speaker pairs into your system (either one pair, or the other, or both pairs at the same time). In addition, the Speaker Switcher provides two stereo headphone jacks live all the time. You (and a friend) can listen to phones simply by turning both pairs of speakers off, or you can listen to phones and speakers at the same time too.

If your headphones are unusually efficient (or unusually inefficient) simply change the two internal resistors to match your phones and the Speaker Switcher will be adapted to whatever headphones you have. For externally energized electrostatic phones, use one set of the speaker terminals instead of a headphone jack.

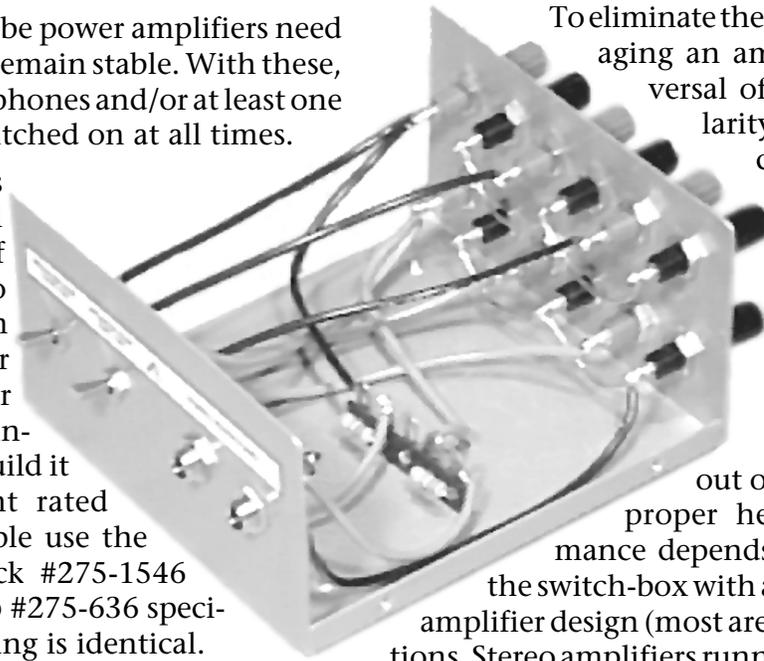
### There are a few cautions:

You should not use two pairs of four ohm (or less) speakers at the same time unless your amplifier is rated for two ohm loads.

Some old vacuum tube power amplifiers need a load connected to remain stable. With these, make sure that headphones and/or at least one set of speakers is switched on at all times.

This switch-box is specified for normal audio components. If you are planning to use it with a very high powered amplifier (over 150 watts per channel) and very inefficient speakers, build it with higher current rated switches. For example use the 10 amp Radio Shack #275-1546 instead of the 6 amp #275-636 specified herein. The wiring is identical.

Do all switching with the volume turned down. This will protect the switches (and your amplifier and speakers) from sudden transients and damage.



To eliminate the possibility of damaging an amplifier by the reversal of speaker wire polarity, the left and right channel grounds are kept isolated in the switch-box. The worst you can do by swapping a hot and ground connection is to throw a speaker out of phase. However, proper headphone performance depends upon the use of the switch-box with a common ground amplifier design (most are). There are exceptions. Stereo amplifiers running bridged mono

do not have a common ground and cannot be used with headphones. Some magnetic field amplifiers may not properly work with headphones either.

To complete the headphone circuit the right amplifier channel ground is connected to the headphone jack ground. The Radio Shack headphone jack ground is connected to the switch-box chassis. Thus the switch-box chassis is common with the right amplifier channel ground side. To eliminate the possibility of ground loop hum, do not place the metal chassis of the switch-box directly on another component. It comes with rubber feet. Use them and keep the switch-box chassis isolated. It is possible to build the switch-box with chassis isolated stereo phone jacks – but these parts are not available from Radio Shack. We do use isolated jacks here in our new preamplifier production. We can supply them at \$7.50 per pair including shipping in the continental USA. With these the chassis is isolated from the amplifier ground. This is not a safety consideration, simply a technically better solution.

Let's get started.

### **Preliminary Instructions.**

First call your local Radio Shack to make sure they have all the parts available. They can (and will) order them for you if they are short on stock on any items. The numbers and prices given are from the 1993 catalog. The 1994 Radio Shack catalog is coming out soon, so you can assume that some prices (and possibly part numbers) may change a bit. Note that you can substitute 18 gauge hookup wire and two 10 amp rated Radio Shack #275-1546 DPDT switch with no other change in the instructions for heavy duty use.

If your headphones have mini-sized plugs instead of standard 1/4" stereo phono plugs, you can substitute one or more of the appropriate smaller mini-jacks (Radio Shack has two sizes of these also) and drill and wire the chassis appropriately.

Obviously, you need not use Radio Shack parts. We have specified them because of their universal availability and convenience and

they will do the job just fine. Certainly you can build the switches out of much more expensive parts if you desire as long as they have the same functionality.

*Never use speaker binding posts with exposed metal outside surfaces!* These are short circuits waiting to happen and can also expose you to hazardously high voltages. A 200 watt per channel amplifier can put out about half of the "kick" of a raw 120V raw wall power outlet – nothing you want yourself, or your child, to ever chance to touch!

You have our permission to make one photocopy of the drilling guide and the wiring diagram pages of this issue of *Audio Basics* to allow you to work more conveniently and without destroying your issue. We suggest you do this during your parts shopping trip so you will have the drilling guide ready to cut up and use.

We have prepared pressure adhesive backed printed labels for the front and rear of the Radio Shack chassis box based speaker switcher to neatly identify the jack and switch functions as shown in the computer photo of our completed unit. We will mail you a set of these ready to apply labels *free of charge*. All you have to do is send us a photograph of your completed speaker switcher and request the labels. Or you can send us the completed switch-box for a free checkout if you desire. Include \$10 for return shipping and packing. Then we will put the label set on for you.

Finally, we can build it for you. The price is \$85.00 wired using the parts described above plus \$10 shipping and handling to you in the continental USA. It is simply lots of labor time to drill the chassis and wire it up. That is the reason we have written the following instructions. Make good use of *Audio Basics* and pay yourself to do it instead of us.

### **Preparing the Chassis Box**

1. Install the four rubber feet in the bottom of the chassis box first to avoid scratching it during the build process.

Put the cover mounting screws and metal grommets away in a plastic bag now. Perhaps tape them inside the dark grey

### Speaker Switcher and Headphone Junction Box Parts List

(all parts available from Radio Shack – 1993 Catalog Number and Price Shown)

Quantity	Part Number	Description	Unit Price	Total Price
1	#270-253	Metal Cabinet (3" x 5 1/4" x 5 7/8")	6.99	6.99
1	#274-688	Five-Lug Tie Point (terminal strip)	1.29	1.29
1 pkg	#272-153	Pkg of two 1000 ohm 1 watt Resistor	.49	.49
6 pkg	#274-662	Pkg of two Nylon Binding Post (red and black)	1.59	9.54
1 pkg	#274-312a	Pkg of two Stereo Phone Jack	2.79	2.79
2	#275-636	DPDT Toggle Switch (6 amp)	3.39	6.78
			TOTAL	\$27.88

In addition you will need 3' each of 20 gauge red, green, and black insulated hookup wire and solder and one #6-32 screw, lockwasher, and nut.

You will also need a Phillips screwdriver, a regular screwdriver, 5/32", 1/4", 5/16" and 3/8" drills, a solder pencil, a wire cutter, a wire stripper and a large pliers.

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| <p>cover. It is amazing how easy it is to lose these necessary little bits.</p> <p>2. Cut out copies of the front and rear panel drill guides and tape these copies directly to the front and rear surfaces of the light grey chassis.</p> <p>3. The aluminum box is easy to drill (the good news) but easy to deform too (the bad news). Always support the inside of the surface you are working on against a firm piece of scrap wood to avoid warping it while drilling.</p> <p>4. We suggest pre-marking all of the hole locations with a very small pilot hole to get a precise alignment of the parts. It is easy to exactly locate the hole centers with a tiny drill bit (an electric screwdriver and drill-bit set recommended for this detail work).</p> <p>5. After locating all of the hole centers on the metal, mask the surfaces with tape to avoid scratching them during the finish drilling operations.</p> <p>6. Use very sharp drill bits, a slow drill speed, and light pressure. A dull drill is guaranteed to tear and ruin the appearance of the chassis.</p> | <p>Drill the twelve 5/16" holes in the back panel and the two 1/4" holes and two 3/8" holes in the front panel. Also drill one 5/32" hole in the bottom near the middle for the terminal strip.</p> <p>Note that if you substitute different brands of parts (or if Radio Shack changes suppliers of a part – as they sometimes do) the mounting hole diameters may change to accommodate different parts dimensions. Check each part before you drill. A test hole in a scrap panel is much easier to accommodate than trying to locate a hole size reducing tool after the fact.</p> <p>7. Using a file (or a sharp very oversized drill bit by hand) de-burr the inside of the drilled holes. This is absolutely necessary to allow the parts to mount flat and reliably.</p> <p>8. Mount the six red and six black binding posts in accordance with our wiring diagram. Keep the side to side holes in the mounting posts straight up and down to allow easy access with bare speaker wires later if desired.</p> <p>Do not overtighten the metal nuts on the nylon bodies. Get them very snug with</p> |
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the pliers but not with as much force as if you were using all metal parts. Excess force can strip and ruin the binding post. For added reliability after the project is finished and de-bugged, you can 5-minute epoxy all the binding post hardware to the chassis to ensure they will not come loose in the future.

9. Mount the two toggle switches in the 1/4" holes on the front panel so that the switch lever action is up and down as shown. For each switch, back one control nut out from the body so that only the minimum amount of bushing protrudes through the panel to allow secure fitting of the second nut. Slip the lock-washer on the bushing then run the switch through the mounting hole and fasten with the second nut on the outside of the panel. The flat washers are not used.
10. Install the two stereo phone jacks as shown in the diagram in the 3/8" holes with a flat washer on the bushing and the control nut fastened firmly from the outside of the panel.

The diagram is a representation of the most current Radio Shack #274-312a jack (with a black plastic body). With this specific jack type mounted as shown, the ground lug (switch body) points to the left when viewed from the inside of the panel, the right channel lug (shortest side contact) points up, and the left channel lug (tip of jack contact) points to the right. Slightly rotate the jacks so that the adjacent lugs from the adjoining jacks cannot contact each other.

Other brands of 1/4" stereo phone jacks will work just as well, but will almost certainly have different solder lug configurations. It is up to you to figure out which is left, right, and ground on your jacks if you use a different type.

11. Mount the 5-lug terminal strip in the chassis bottom as shown. Note that there will not be a connection made to the center (grounded) #3 lug.

Your box should now look like our wiring diagram (before wires) with all the parts tight and carefully aligned and with the black and red binding posts alternating (three of each in the two rows). The two switches should toggle up and down, and all the side holes in the binding posts pointing straight up and down. Now it is time to wire the box.

### **Wiring the Speaker Switch Box.**

It is nice to have three colors of wire available (we suggest red for the right channel wiring, green for the left channel wiring, and black for the ground wiring and that is how we will specify the wires in the steps below). Because the wiring lengths inside the box are very short, it really matters little how heavy a gauge of wire you use. It is much more important that you get each wire in the right place and solder each connection reliably. 20 gauge solid hookup wire is heavy enough so there will be no power loss in the box and yet will be small enough to fit reliably through the toggle switch terminals. Too heavy a wire won't fit and may break parts. Stray ends of stranded wire may short together at the switches. If you pay more than 10¢ a foot for your hookup wire, you just screwed yourself. The old adage that "a fool and his money are soon parted" is probably truer in the work of esoteric audio witchcraft than anywhere else. Radio Shack has 80' rolls of various color 20 gauge solid insulated hookup wire available for \$3.99 each. It is all you need.

We will not specify exact wire lengths. Cut to fit (with a little slack) as you go. Look at our video photo for a guide.

The 1000 ohm 1 watt resistors (1K $\Omega$  1W) were selected to provide approximately correct attenuation of the signal to the headphone jacks for many modern headphones (such as the superb Grado SR-200s). If your headphones are much more efficient – such as the little "walkman" type, you may need a large resistor value. If you are using older 8 ohm lower efficiency headphones (such as many Koss models) you may need a lower value but higher power rated resistor. Use what works best for your application. The object is to get high

fidelity, a good signal to noise ratio, and adequate gain with the headphones you like.

1. Install the two 1K $\Omega$  1W (brown, black, red stripes) headphone resistors as shown. Actually you can install the resistors on the other side of the terminal strip to keep the wiring away from the fastening lug and nut - we drew it on this side to make it easier to visualize. Solder one to the lower holes in the 5-lug terminal strip lugs 1 and 2, the other to the lower holes in lugs 4 and 5 and solder all four connections. Make sure the wiring or flowed solder cannot contact the chassis bottom or lug #3 or its mounting hardware.
2. Install a short red wire from the R lug on headphone jack 1 to the R lug on headphone jack 2, solder only at jack 1.
3. Install a red wire from the R lug on headphone jack 2 to lug #1 on the 5-lug terminal strip and solder both connections.
4. Install a short green wire from the L lug on headphone jack 1 to the L lug on headphone jack 2, solder only at jack 2.
5. Install a green wire from the L lug on headphone jack 1 to lug #4 on the 5-lug terminal strip and solder both connections.
6. Install a short black wire from the G lug on headphone jack 1 to the G lug on headphone jack 2, solder only at jack 1.
7. Install a black wire from the G lug on headphone jack 2 to the metal end of black binding post #1 (right channel pair 2 output ground), solder only at the G lug of headphone jack 2.
8. Connect a short black wire from black binding post #1 to black binding post #3, solder only at binding post #1.
9. Connect a short black wire from black binding post #3 to black binding post #5 and solder both connections.
10. Connect a short black wire from black binding post #7 to black binding post #9, solder only at post #7.
11. Connect a short black wire from black binding post #9 to black binding post #11 and solder both connections.
12. Connect a red wire from 5-lug terminal strip lug 2 to red binding post #6, solder only at terminal strip lug 2.
13. Connect a green wire from 5-lug terminal strip lug 5 to red binding post #12, solder only at terminal strip lug 5.
14. Connect a red wire from speaker switch two lug 6 to red binding post #2 and solder both connections.
15. Connect a red wire from speaker switch one lug 6 to red binding post #4 and solder both connections.
16. Connect a short red wire from speaker switch two lugs 4 and 5 to speaker switch one lugs 4 and 5 and solder at all four lugs. Be careful not to cook the switches or gob-solder to adjacent lugs. An improper connection here could damage your power amplifier!!
17. Connect a short green wire from speaker switch two lugs 1 and 2 to speaker switch one lugs 1 and 2 and solder at all four lugs. The same cautions apply.
18. Connect a red wire from the wire between lugs 4 and 5 on speaker switch two to red binding post #6 and solder both connections.
19. Connect a green wire from the wire between lugs 1 and 2 on speaker switch one to red binding post #12 and solder both connections.
20. Connect a green wire from speaker switch two lug 3 to red binding post #8 and solder both connections.
21. Connect a green wire from speaker switch one lug 3 to red binding post #10 and solder both connections.
22. It is all done!

Check your connections carefully. Look for unsoldered wires – every solder lug is used except lug #3 on the 5-lug terminal strip. The black left channel (top row) binding posts are connected together. The black right channel

(bottom row) binding posts are connected together and are connected to the headphone jack ground. Red binding posts #6 and #12 (the amplifier inputs) connect to the input of the switches and to the resistors in series with the headphone hot connections. The other four red binding posts connect to the outputs of the two switches. Make sure everything goes where it supposed to, and only where it is supposed to.

Whoops – one more suggested step – epoxy those black and red binding posts to the back panel now on the inside. Simply set the box up on its back on the terminals and make sure the epoxy flows from the plastic, across the nut, and to the back panel at each binding post. Work fast, or mix up more than one small batch.

Install the cover (we hope you still can find those little screws) and you are in business.

**Here is how it works.**

Each switch is actually two switches in one, row 1, 2, and 3, is a separate switch isolated from row 4, 5, and 6. When the switch toggle is down, lugs 1 and 2 are isolated from lug 3, and lugs 4 and 5 are isolated from lug 6. So the signal from the amplifier coming in from binding posts #6 and #12 goes nowhere - the speakers are turned off. (Note that switch one and two are simply connected together and to the inputs from the amplifier so that each can handle a set of speakers independently from the other. If you wanted to handle more sets of speakers, simply add more switches – taking care that the load resistance does not go too low!)

Anyway, when the switch toggle is up, lugs 1 and 2 are connected to lug 3, and lugs 4 and 5 are connected to lug 6, sending the audio signal on to the speakers connected to the appropriate binding post sets. That isn't hard, is it?

Meanwhile, back at the input terminals, the signal is also sent through the series resistors (which reduces its level down to that suitable for headphones) and on to the left and right channels of the two headphone jacks. If you want to listen to headphones, plug them in

(and they will work independently of whether the speakers are turned on or off. Caution, when you are not using headphones, be sure to unplug them. It is possible to overpower the headphones if you forget they are connected while feeding lots of power to the loudspeakers.

Now to be absolutely safe, send us the completed switch-box for a free checkout before you use it. The \$10 return shipping fee is a lot less than new amplifier output transistors if you did it wrong. We will install the labels as shown herein too. Or, if you are really certain of your work, send us a photo and we will mail you the labels, free of charge.

Enjoy your enhanced audio system functionality.

**Special announcement!** Buy two pair of speakers from us between now and October 1st and we will build the switchbox for you at no extra charge (and we will give you a very good deal on the speakers too!) FVA

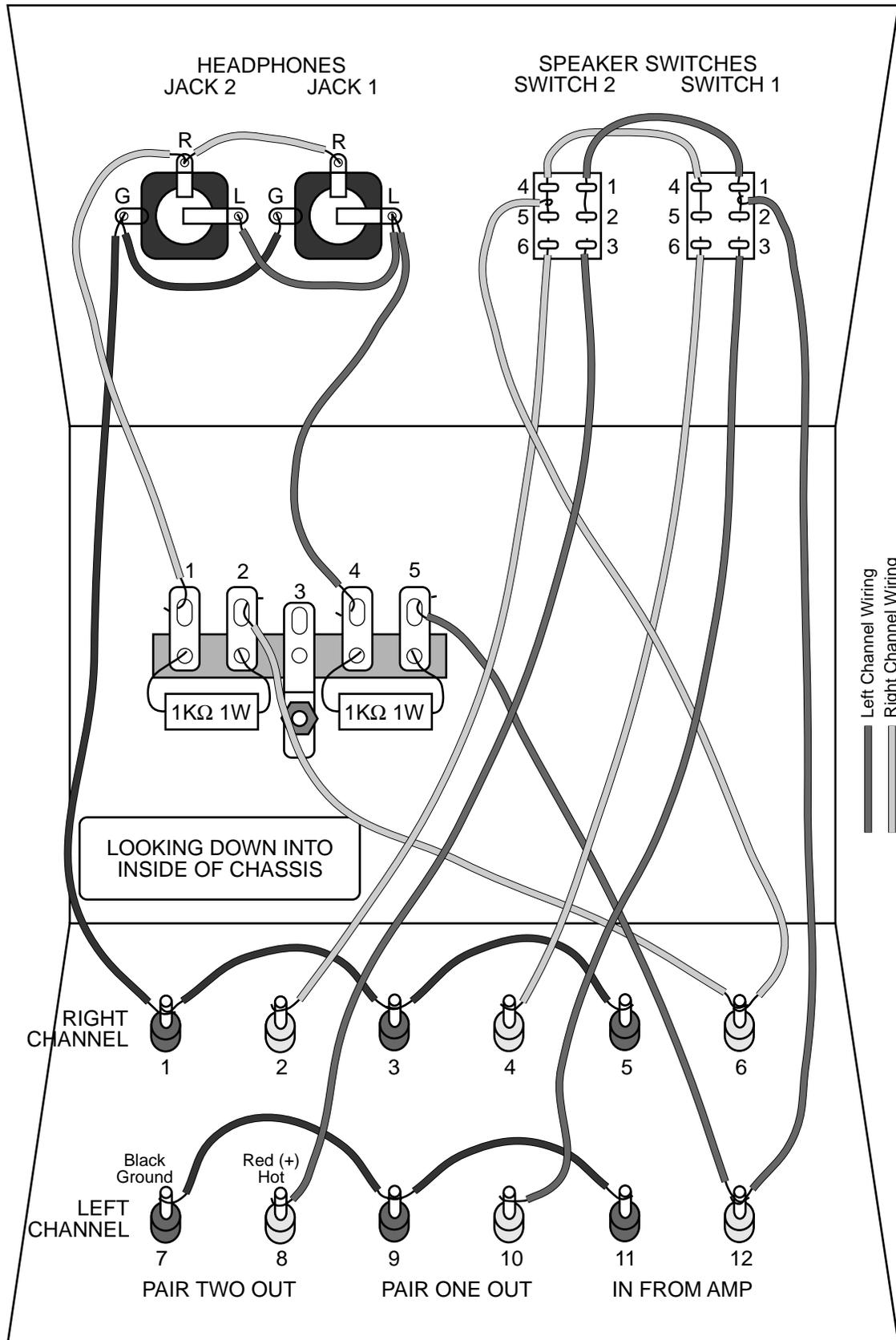
**USED EQUIPMENT**

**Super Pas Three Omega II Preamplifier.** This is a superbly wired kit built unit just traded in on a Super Pas 4i because the client needed the headphone amplifier. It has everything – Omega II phono and line buffers, gold AVA jack set, ceramic selector switch, black AVA faceplate and knob set, good select Chinese tube set, and very fresh construction (built in 1991). It works and looks like near new. The price is \$495.00 plus \$10 shipping in the continental USA. It includes the new AD843 buffers and the 8.2 $\mu$ F film capacitor upgrade to the line section previously discussed in *Audio Basics* which gives it brand new performance. We will provide a six months parts and labor warranty on all the AVA circuits in this great preamplifier.

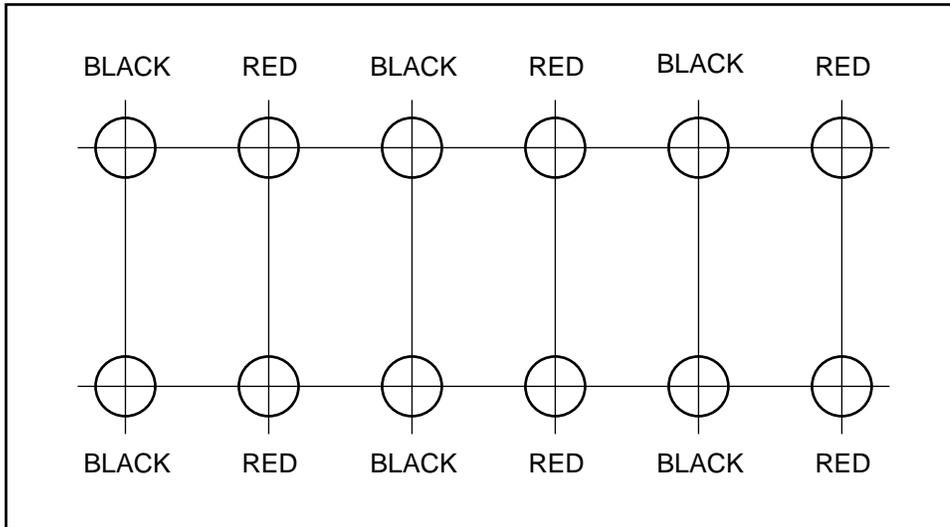
**Good Used Dyna St-120 Chassis for Delta 120 or Omega II 170 circuits.** You pay for the new circuit set installed and we will throw in this chassis for just \$50 extra plus \$15 shipping in the USA with new two year warranty too.

*Frank and Darlene Van Alstine*

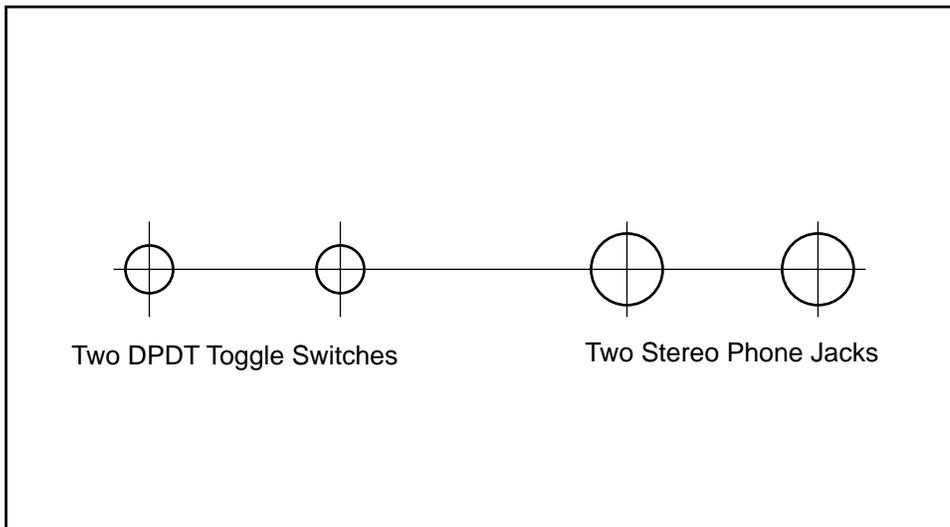
**Audio by Van Alstine Speaker Switcher and Headphone Junction Box  
Wiring Diagram 8/7/93 FVA**



Back Panel Drill Guide (Outside View) Drill Twelve 5/16" Holes for Binding Posts



Front Panel Drill Guide (Outside View) Drill Two 1/4" Holes and Two 3/8" Holes



Note: If the Radio Shack #270-253 cabinet is used for this project, take care when drilling the holes. The aluminum is soft and may tear or deform if excess force is used. For best results use a sharp Greenlee 1/2" 8 step step-drill in a Black and Decker electric screwdriver and a slow drilling speed and a firm backing for the other side when drilling.