PAiA Stak-In-A-Box

Model 9210
ASSEMBLY/USING MANUAL

Lusting after the sound of a tube pre-amp, but can't swing the price of admission? Stack-In-A-Box delivers that ever-popular tube tone at a cost that's easy to live with. It may be inexpensive, but it's no stripped down affair: There's a clean preamp stage, high- and low-impedance unbalanced inputs, two cabinet simulator settings, bright and fat switches, an effects loop, balanced XLR Outputs for interfacing with pro studio gear, and standard unbalanced 1/4" phone outputs.

Best of all: it sounds way cool.

ASSEMBLING THE Stak-In-A-Box

Before beginning assembly, go through the manual. Look at the drawings. Feel the parts. You're naturally eager to plunge right in, but take a few deep breaths first.

Notice that each step in the manual is marked with a checkoff box like this:

( ) R27 100 ohm brown-black-brown

Checking off each step as you do it may seem silly and ritualistic, but it greatly decreases the chance of omitting a step and also provides some gratification and reward as each step is completed.

Numbered figures are printed in the Illustrations Supplement in the center of this manual. This page may be removed for easy reference during assembly.

THE CIRCUIT BOARD

The Stak-In-A-Box is built on a single-sided circuit board.

Once you begin putting parts on the circuit board, it's a good idea not to stop until all the parts are mounted. Stopping overnight may allow the copper to oxidize and make soldering more difficult.

TOOLS

You'll need a minimum of tools to assemble the kit - a small pair of diagonal wire cutters and pliers, screwdriver, sharp knife, ruler, soldering iron and solder.

Modern electronic components are small (in case you hadn't noticed) and values marked on the part are often difficult to see. Another handy tool for your bench will be a good magnifying glass. Also

use the magnifier to examine each solder joint as it is made to make sure that it doesn't have any of the problems described in the SOLDERING section which follows.

SOLDERING

Select a soldering iron with a small tip and a power rating not more than 35 watts. Soldering guns are completely unacceptable for assembling solid state equipment because the large magnetic field they generate can damage components.

Use only rosin core solder (acid core solder is for plumbing, not electronics work). A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of lead passing through it. There are two improper connections to beware of: Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder. If too much solder is used on a joint there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Accidental bridges can be cleaned off by holding the board upside down and flowing the excess solder off onto a clean, hot soldering iron.

Use care when mounting all components. Never force a component into place.

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This product originated as a Do-It-Yourself article by Craig Anderton *and* John Simonton *in the February 1993 issue of* Guitar Player *magazine. There may be some differences between what appeared in the article and what is supplied with the kit. These differences, and any discussion of them, will be set aside with this italicized type.*

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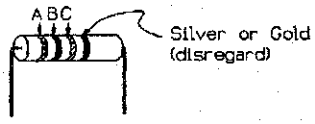
RESISTORS

Solder each resistor in place following the parts placement designators printed on the circuit board and the assembly drawing Fig 1. Note that resistors are nonpolarized and may be mounted with either lead in either of the holes provided. Before mounting each resistor, bend its leads so that they are at a right angle to the body of the part. Put the leads through the holes and then push the resistor firmly into place. Cinch the resistor in place by bending the leads on the solder side of the board out to an angle of about 45 degrees. Solder both ends of each resistor in place as you install it. Clip each lead flush with the solder joint as the joint is made. Save the clippings.



PART # VALUE COLOR CODE A-B-C

listed below:

	10k ohms	brown-black-orange
( ) R1	( ) R6	( ) R7 ( ) R27
( ) R28	( ) R32	( ) R33
( ) R2	39k	orange-white-orange
( ) R3	33k	orange-orange-orange
( ) R4	270k	red-violet-yellow
( ) R5	270k	red-violet-yellow
( ) R10	39k	orange-white-orange
( ) R12	1 megohm	brown-black-green
( ) R13	100k	brown-black-yellow
( ) R15	47k	yellow-violet-orange
( ) R16	1k	brown-black-red
( ) R18	470 ohm	yellow-violet-brown
( ) R20	1k	brown-black-red
( ) R21	39k	orange-white-orange
( ) R22	150k	brown-green-yellow
( ) R24	33k	orange-orange-orange
( ) R25	1k	brown-black-red

PART #	VALUE	COLOR CODE A-B-C
( ) R26	680	blue-grey-brown
( ) R29	1 megohm	brown-black-green
( ) R30	2700 ohm	red-violet-red
( ) R31	2700 ohm	red-violet-red
( ) R34	330 ohm	orange-orange-brown
( ) R36	4700 ohm	yellow-violet-red
( ) R37	33k	orange-orange-orange
( ) R38	33k	orange-orange-orange
( ) R39	330k	orange-orange-yellow

CERAMIC DISK AND POLYSTYRENE CAPACITORS

Capacitors

Disk

Polystyrene

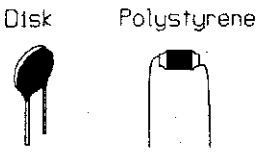
Many of the capacitors used in the Stak-In-A-Box are nonpolarized Ceramic Disk and Polystyrene types, either lead can go in either of the holes on the circuit board. The leads of the Ceramic Disk capacitors are already parallel to each other but still may need to be bent slightly to match the spacing of the circuit board holes. Like the resistors, push the leads through the holes in the board and push the part against the circuit board as far as it wants to go. Don't force it, it's OK if it sits a little off the board.

Capacitors are often marked with obscure codes that indicate their values. The 3 digit number that specifies value may be preceded or followed by letters indicating such things as tolerance. If you get confused about which capacitors are which, it may help to group then by same type and check them against quantities on the packing list at the end of this manual.

Install these capacitors as instructed on the following page.

DESIG	VALUE/TYPE	MARKINGS
( ) C1	560 pF Polystyrene	560
( ) C3	.05 uF Ceramic Disk	503
( ) C6	.05 uF "	503
( ) C7	.05 uF "	503
( ) C8	2000 pF "	202
( ) C10	2000 pF "	202
( ) C13	.05 uF "	503
( ) C14	560 pF Polystyrene	560
( ) C15	.022 uF Ceramic Disk	223
( ) C16	47 pF "	47
( ) C17	2000 pF "	202
( ) C18	2000 pF "	202
( ) C24	220 pF "	221

Capacitors



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C15 was .02 - changed to .022 standard value. 2200pf were erroneously specified as mylar and have been changed to 2000pf standard value.

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ELECTROLYTIC CAPACITORS

The remaining capacitors are electrolytic types. Unlike the previous components, electrolytic capacitors are polarized and the leads are not interchangeable. Leads are marked "+" and/or "-" and the "+" lead must go through the "+" hole in the circuit board. Frequently the positive lead of the capacitor is significantly longer than the negative lead. Usually the Negative lead of the capacitor is marked rather than the positive. It naturally goes through the hole not marked "+".

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The GP article generalized by saying all electrolytics should be 50V or greater. Only C2 must have a Working Voltage this high. The capacitors supplied with this kit may have a V rating greater than the minimum specified in the instruction.

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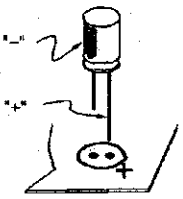
DESIGNATION VALUE

listed below: 1 uF / 50V

( ) C2 ( ) C5 ( ) C11
( ) C20 ( ) C21 ( ) C27



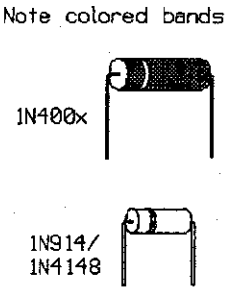
( ) C12 10 uF / 10V
( ) C22 100 uF / 16V
( ) C23 100 uF / 16V
( ) C25 100 uF / 16V
( ) C26 100 uF / 16V

DIODES

Two types of diodes are used in the Stak-In-A-Box, five 1N4148 silicon signal diodes in small transparent glass cases and two 1N400x power diodes in larger opaque cases.

Diodes are polarized and must be installed so that the lead on the banded end of the part corresponds to the banded end of the designator on the circuit board. Bend the leads so they are at right angles to the body of the part and insert them through the holes provided in the circuit board.

Diodes are also somewhat heat sensitive so the soldering operation should be done as quickly as possible.



DESIGNATION TYPE

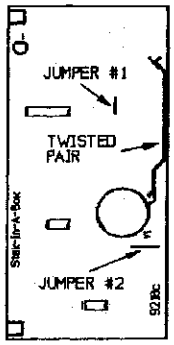
listed below: 1N914/1N4148 Silicon Diodes

( ) D3 ( ) D4 ( ) D5 ( ) D6
( ) D7

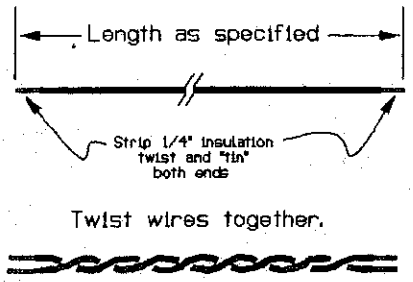
( ) D2 1N400x Power Diodes
( ) D8 1N400x Power Diodes

JUMPERS

( ) Using the excess leads clipped from resistors, form and install the two circuit board jumpers which are designated by bold lines. Be careful that the jumpers do not touch nearby component leads.



( ) Cut two 3-1/2" lengths of the #22 stranded wire supplied and prepare both ends of both pieces by stripping off 1/4" of insulation. Twist the exposed wire strands together and "tin" them by melting a little solder into the strands.

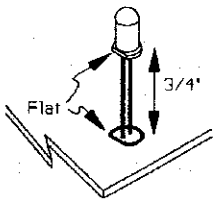


Twist wires together.

( ) Form the two wires from the above step into a "twisted pair" and use this cable to connect the pair of holes below V1 to the pair of holes below D8 as indicated by the bold lines on the circuit board parts placement graphics. The two leads are interchangeable, either lead can go either hole. Solder each connection as it is made and when done clip the excess lead on the conductor side of the circuit board off flush with the solder joint.

LED

Note that the LED is polarized by the flat in the collar at the base of part. When properly installed, this flat will align with the corresponding flat in the LED symbol printed on the circuit board.



( ) Push the two leads through the holes provided in the circuit board and space the LED above the board by about 3/4". Solder both leads and check the spacing from the board to the LED before trimming the leads off flush with the solder joint.

TUBE SOCKET

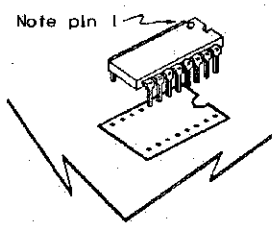
The 9210PC board has been updated and it is no longer necessary to trim the tube socket before installation, as shown on page 9. The middle socket pin is not used and should be bent flat or cut off.

( ) Install the 9 pin tube socket by pushing all 9 socket pins through the holes provided for them at V1 on the circuit board. Solder all 9 pins. The tube will be installed in a later step.

INTEGRATED CIRCUITS

Of all the parts, the ICs are the most easily damaged and should be treated with some respect. In particular, they may be destroyed by discharges of static electricity. Modern ICs are not nearly as sensitive to this kind of damage as were earlier versions, but it is still good practice to handle these parts as little as possible. Also good practice: don't wear nylon during assembly. Don't shuffle around on the carpet immediately before

assembly (or if you do, touch a lamp or something to make sure you're discharged). Don't be intimidated. It's rare for parts to be damaged this way.



ICs are polarized in one or both of two ways; A dot formed into the case of the IC corresponding to pin 1 or a semicircular notch that indicates the end of the package with pin 1. Take care that this polarizing indicator corresponds to the similar indicator on the circuit board graphics.

The pins of the ICs may be splayed somewhat and not match up exactly with the holes in the circuit board. Carefully re-form the leads if necessary so that they are at right angles to the part. Solder each IC in place as it is installed by initially soldering two pins in diagonal corners of the pattern. Make sure that the part is seated firmly against the pc board by pressing it down while re-melting the solder joint at first one corner, then the other. Finally, solder the remaining connections.

IC#	TYPE
( ) IC1	5532 Dual Low Noise Opamp
( ) IC2	5532
( ) IC3	4049 CMOS Hex Inverting Buffer

"FLYING" WIRES
(i.e. those which go from circuit board to panel mounted parts.)

In the following steps, wires will be soldered to lettered points on the Stak-In-A-Box circuit board. In later steps these wires will be connected to the front panel controls and phone jacks. At each step, cut a piece of wire to the specified length and strip 1/4" of insulation from each end. Twist and tin the exposed wire strands.

Notice that there will be some circuit board points that will not have wires connected to them until later (see Fig 7).

Solder each connection as it is made and clip any excess wire from the solder side of the board.

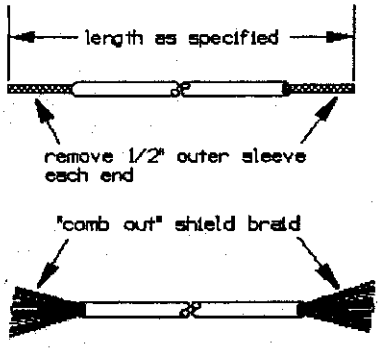
PC POINT	LENGTH	PC POINT	LENGTH
( ) "N"	12"	( ) "D"	6-1/2"
( ) "M"	9-1/2"	( ) "H"	9-1/2"
( ) "S"	7"	( ) "C"	5-1/2"
( ) "T"	7"	( ) "E"	8-1/2"
( ) "F"	7"	( ) "R"	9"
( ) "G"	12-1/2"	( ) "A"	4"

SHIELDED CABLE

RG-174/U coaxial cable will be used to make shielded connections between the circuit board and input/output jacks. Each of the pieces of co-ax should be prepared as follows:

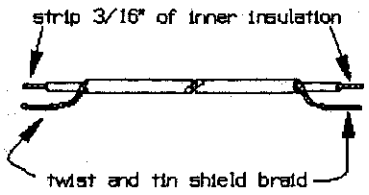
Cut a section of co-ax to the length specified and strip 1/2" of the outer insulation at each end to expose the braided shield beneath it.

Unbraid the shield by "combing" it with the dull edge of a knife blade or a ball-point pen. This will expose the separately insulated inner conductor.



On each end, pull the strands of shield to one side and twist them together. Tin these pigtails by melting a small amount of solder into them.

On each end, strip about 3/16" of the insulation from the inner conductor and twist and tin the exposed strands.

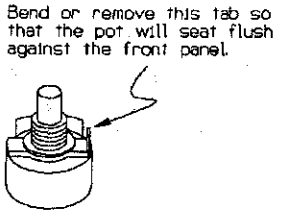


Using the specified lengths of co-ax prepared as above, solder the inner conductor and shield to the circuit board points listed on the following page. See Fig 5.

PC POINT		LENGTH
( ) "O"	(center)	3"
( ) "P"	(shield)	
( ) "I"	(center)	9-1/2"
( ) "J"	(shield)	
( ) "K"	(center)	9-1/2"
( ) "L"	(shield)	

PANEL CONTROLS

If you have the optional panel available from PAiA, you will be installing these parts as shown in Fig 2. Note that this figure shows the panel from the rear.



( ) Using the flat washers and nuts provided, mount the 3 potentiometers as shown in Fig 2. Note that a 250k ohm pot is used for R17 and 10kohms at R14 and R23. Orient the pots as shown in Fig 4 and fully tighten the nuts to secure these parts.

( ) In a similar manner mount the 4 Open Circuit jacks J2, J4, J5 and J6 as shown in Figs 2 & 3. Orient as shown in Fig 4 and tighten the hardware.

Open Circuit Jack has two solder lugs

( ) In a similar manner mount the 2 Closed Circuit Jacks J1 and J3 and orient as shown in Fig 4 before fully tightening the hardware.

Closed Circuit has three lugs

( ) Mount the 5 slide switches S1-S5 using two 4-40 X 1/4" machine screws and two #4 nuts as shown in Figs 2 & 3. Fully tighten the hardware.

( ) Using the 4-40 X 3/4" and one of the 4-40 X 1/4" machine screws, two #4 nuts, two #4 flat-washers and 5/16" rolled aluminum spacer, mount the DPDT slide switch S6 and cable clamp as shown in Fig 2. Fully tighten the hardware.

( ) Using the two 4-40 X 1/2" screws and two #4 nuts install the 3-pin Male XLR connector J7 as shown in Fig 3. Fully tighten the hardware.

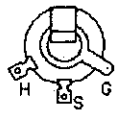
PANEL PRE-WIRING

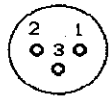
Now we'll do some preliminary wiring on the front panel jacks and controls as shown in Fig 4. At each step prepare a wire of the length specified by stripping 1/4" of insulation from the end and twisting and tinning the exposed strands.

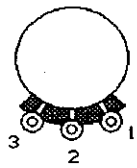
This convention will be followed in these steps: Do not solder a connection to a lug until told to do so with an instruction such as (S-2), which means that at that point there will be two wires on the lug in question. If there are not the number of wires specified at the lug when you get ready to solder, recheck to see what has gone wrong. Connections which should not be soldered yet will be marked (NS) for No Solder.

On unsoldered connections simply push the end of the wire through the lug and crimp it back to mechanically secure it.

LENGTH	FROM		TO	
( ) 3"	S5-4	(S-1)	S5-1	(NS)
( ) 3"	S5-3	(S-1)	S5-6	(NS)
( ) 3-1/2"	S5-6	(S-2)	J5-H	(NS)
( ) 3-1/2"	S5-1	(S-2)	J6-H	(NS)
( ) 3-3/4"	S5-2	(S-1)	J7-3	(S-1)
( ) 5-1/2"	S5-5	(S-1)	J7-2	(S-1)
( ) 3-1/2"	J7-1	(S-1)	J6-G	(NS)
( ) 3"	J6-G	(NS)	J5-G	(NS)
( ) 3"	J5-G	(S-2)	R23-1	(NS)
( ) 4"	R23-1	(NS)	J2-G	(NS)
( ) 3"	J5-H	(S-2)	R23-2	(NS)
( ) 3"	J2-G	(S-2)	J1-G	(NS)
( ) 2"	J1-G	(S-2)	J4-G	(NS)
( ) 2"	J4-G	(NS)	J3-G	(S-1)
( ) 5"	S4-3	(NS)	J2-H	(S-1)
( ) 5"	S4-1	(NS)	S1-2	(S-1)
( ) 4-1/4"	S1-1	(S-1)	S4-6	(NS)
( ) 1-1/2"	S4-6	(S-2)	S3-1	(NS)
( ) 3-1/2"	S4-5	(S-1)	S1-3	(S-1)
( ) 3-1/4"	S4-4	(S-1)	S3-6	(NS)
( ) 4-3/4"	S2-3	(NS)	J1-S	(S-1)







PANEL MOUNTED COMPONENTS

Some resistors and capacitors are mounted on the front panel. Be careful to position the component so that its leads will not short out against adjacent solder lugs or metal parts (note the insulated sleeving slipped over one of the leads of R8.) Fig 5 shows the location of these components; the circuit board also shown in this figure will be mounted shortly. Watch polarity of Electrolytics.

DESIG.	VALUE	MARKING	FROM		TO	
( ) R8	33k	orng-orng-orng	R23-1	(NS)	*R17-1	(S-1)
( ) R9	680k	blue-grey-yelo	S2-3	(S-2)	R17-3	(NS)
( ) R11	680k	blue-grey-yelo	S4-3	(S-2)	R17-3	(S-2)
( ) R19	270k	red-violt-yelo	J6-G	(S-3)	S4-1	(NS)
( ) R35	10k	brwn-blck-orng	J4-G	(S-3)	J3-S	(NS)
( ) C4	2000pF	Disk 202	S2-4	(NS)	S2-5	(NS)
( ) C9	10uF /16V	Electrolytic	+ S4-1	(S-3)	-R23-3	(S-1)
( ) C19	2.2uF	"	+ J4-H	(S-1)	-J3-S	(S-2)

* slip a 3/4" length of the insulated sleeve provided over the lead to R17

The circuit board should now be mounted to the rear of the front panel as shown in Fig 6.

( ) Using the two "L" brackets, two #4 nuts and four 4-40 X 1/4" machine screws provided, attach the partially wired circuit board to the rear of the rack panel as shown in Fig 6. Notice that the "L" brackets have both threaded and unthreaded holes. Use the unthreaded holes and machine nuts to attach the bracket to the circuit board and the threaded holes to attach the bracket to the panel. Bend the LED's leads so that it protrudes through the hole in the panel.

Wiring of the Stak-In-A-Box continues by connecting the wires previously soldered to the circuit board to the pots and jacks as detailed in Figs 5 & 7. Notice that previous wiring has been eliminated from these drawings to give a better view of the present operations.

The following connections are made with the center and shield conductors of the 3 co-ax sections as shown in Fig 5.

ORIGIN	TO
( ) "I" (center)	S3-5 (S-1)
( ) "J" (shield)	S3-6 (S-2)
( ) "K" (center)	S3-2 (S-1)
( ) "L" (shield)	S3-1 (S-2)
( ) "O" (center)	R14-2 (NS)
( ) "P" (shield)	R14-1 (S-1)

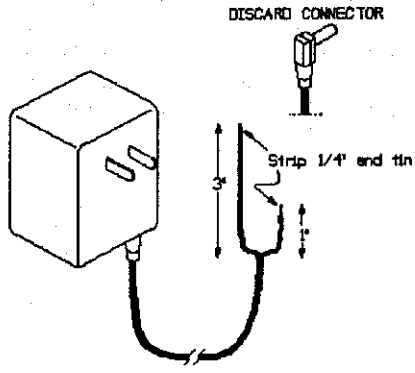
( ) Use an excess component lead clipping to connect R14-2 (S-2) to R14-3 (S-1)

These connections are made with the #22 stranded wires coming from the circuit board. See Fig 7.

ORIGIN	TO		ORIGIN	TO	
( ) "N"	J6-H	(S-2)	( ) "H"	R17-2	(S-1)
( ) "S"	S1-4	(S-1)	( ) "C"	J3-H	(S-1)
( ) "T"	S1-5	(S-1)	( ) "E"	S2-5	(S-2)
( ) "M"	R23-2	(S-2)	( ) "R"	S1-6	(S-1)
( ) "F"	S2-4	(S-2)	( ) "G"	R23-1	(S-4)
( ) "D"	J1-H	(S-1)	( ) "A"	S6-4	(S-1)

POWER TRANSFORMER

The final connections are made using the wires from the wall-mount power transformer PWR1. If this part has a connector on the end of its cable, remove and discard it as shown.

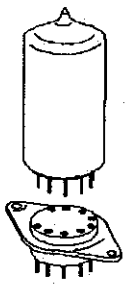


( ) Separate the power cord coming from PWR1 into two wires for a distance of 3"and cut one of the two wires off to a length of 1". Strip 1/4" of insulation from the ends. Twist and tin the exposed wire strands.

( ) Loop the cord from the power supply through the cable clamp attached to power switch S1. Connect the shorter wire to S6-5 (S-1). See Fig 7.

( ) Connect the longer wire of the power cord to circuit board point "B"

( ) Plug the 12AX7 Dual Triode Vacuum tube into the 9 pin tube socket at V1.



( ) Install the knobs. Rotate the shaft of the control on which the knob will be placed fully CCW and align the pointer with the marking at the extreme counterclockwise end of the dial. Push the knob on only slightly and rotate it back and forth to see how well it's range of rotation is balanced with the panel graphic. Reorient if not satisfied and then push the knob firmly in place on the shaft.

THIS COMPLETES THE ELECTRONIC ASSEMBLY OF THE Stak-In-A-Box. Before plugging the unit in and testing it, take a break then come back and check your work completely.

TESTING IT

After rechecking your work, it's time for the all important smoke test. If anything unfortunate is going to happen, this is the most likely time.

Plug the wall-mount transformer into a 120VAC outlet and slide the Stak-In-A-Box power switch to "ON." The LED below the switch should light and if it doesn't, you should immediately unplug the unit from the wall and find out why. The problem could be nothing more than a dead wall outlet. improperly placed components or solder bridges on the circuit board may be the cause. Check the orientation of the Integrated Circuits.

When the LED lights let the unit idle for a few minutes while you check for parts that may be getting hot (other than the tube, of course) or any unusual smell, smoke, etc. Observe the tube filaments to make sure they're glowing - if not, check solder connection on the tube socket and the twisted pair that connects the filament circuit to the power supply.

If nothing seems out of place after a few minutes, do a quick initial test of the Stak-In-A-Box. With your amp volume turned down, plug your guitar into jack J3 or connect a low-impedance source, such as a synth output to J4. Connect a 1/4" unbalanced amp or mixer input into J5 (non-inverting out), or an XLR balanced input into output J7.

Set the SIAB's Crunch, Drive and Level control to about midrange. Set the SPEAKER IN/OUT switch to "OUT". Play a note and advance the volume control on you amp. You should hear an output. Change the settings of the INPUT Crunch, TUBE Drive and OUTPUT Level controls and obvserve that each effects the sound. Simlarly change the settings of the SPEAKER switches and observe their action.

( ) When you're satisfied that everything is working properly, complete assembly by installing the power supply shield using two 4-40 X 1/4" machine screws and two #4 nuts. Tighten this hardware completely. See Fig 6.

USING IT

There are some "sweet spot" control combinations, so don't be discouraged if the SIAB doesn't sound great the second you plug it in. It takes some experimenting to match the various controls to your set-up. For example:

* The Crunch control provides clean gain for overloading the tube and creating more distortion. Too much crunch with high-level inputs could overload the input preamp, creating solid-state distortion. This will contribute an ugly, buzzing sound to the smooth tube distortion.

* Start with the Drive control halfway up (this knob affects waveform symmetry). Rotate it clockwise to add a subtle attack or edge to the sound; counterclockwise movement imparts a more mellow tone.

* If you're plugged into a guitar amp, turn the speaker simulator off. Going into a mixer, engage the speaker simulator switch, select Sim 2, and turn Bright off and Fat on. Experiment with different Simulator, Bright and Fat settings to see which combination works best for you.

* The SIAB can produce substantial gain, so don't turn up the output control so much that it overloads subsequent stages in your amp or mixer (unless, of course, that's the effect you want).

If the device you're feeding has a 1/4" stereo jack balanced input, wire a patch cord that connects the SIAB inverted out (J6) to a stereo plug's ring connection, SIAB non-inverted out (J5) to the tip connection and the ground for both outputs to the plug ground.

If you're working in the studio, try the SIAB with other sound sources - it can really warm up the sound of synthesizers, drum machines and even vocals.

WHY TUBES SOUND SO GOOD

All amplifiers distort if you drive them hard enough, but tubes and transistors distort differently. Engineers use transfer curves to show the relationship of an amplifier's output signal to its input. In the figures on the facing page, the input (entering from the bottom) "reflects" off the curve to produce the output at the right.

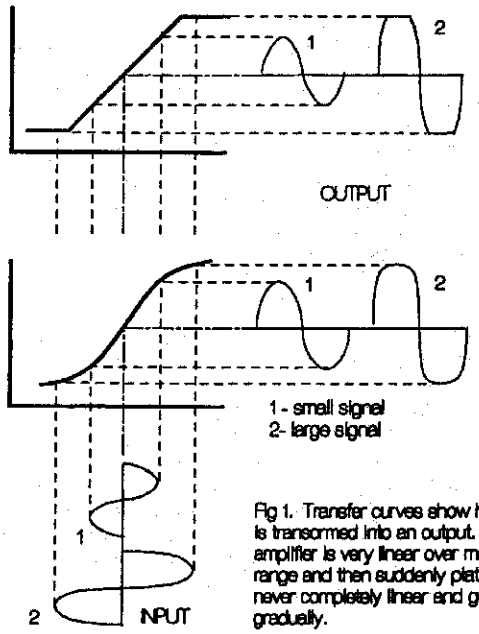
Fig a) a transistor amplifier transfer curve. This curve shows that everything is linear until you suddenly run out of headroom, at which point the signal clips. This drastic clipping produces high-amplitude, odd order harmonics that give the sound a bright, buzzy quality that is not particularly pleasing.

Fig b), a tube transfer curve, is linear only for small signals. The curve's ends, which bend over gradually rather than suddenly reaching a plateau, "squash" the signal at higher levels rather than clipping it. This produces a more rounded waveform that's responsible for much of the characteristic "tube tone".

The SIAB exaggerates the naturally soft curve common to all tubes, resulting in almost a caricature of a tube amp. Running the 12AX7 at low supply voltages and plate currents puts the tube

way down in a non-linear region of its operating range. This region is generally considered so uninteresting that it doesn't even show up in reference books, but it's great for guitar preamps.

The two cascaded tube stages complement one another; one rounds the upper end of the transfer curve while the other rounds the bottom, providing a symmetrical transfer curve. Altering the TUBE Drive control changes this symmetry.



a) Solid State

"Clipping" produces higher order, higher amplitude harmonics.

b) Tube Amp

"Squashing" produces lower order harmonics with smaller amplitudes.

Fig 1. Transfer curves show how an input is transormed into an output. (a) The solid state amplifier is very linear over most of its useful range and then suddenly plateaus. (b) A tube amp is never completely linear and goes into saturation gradually.

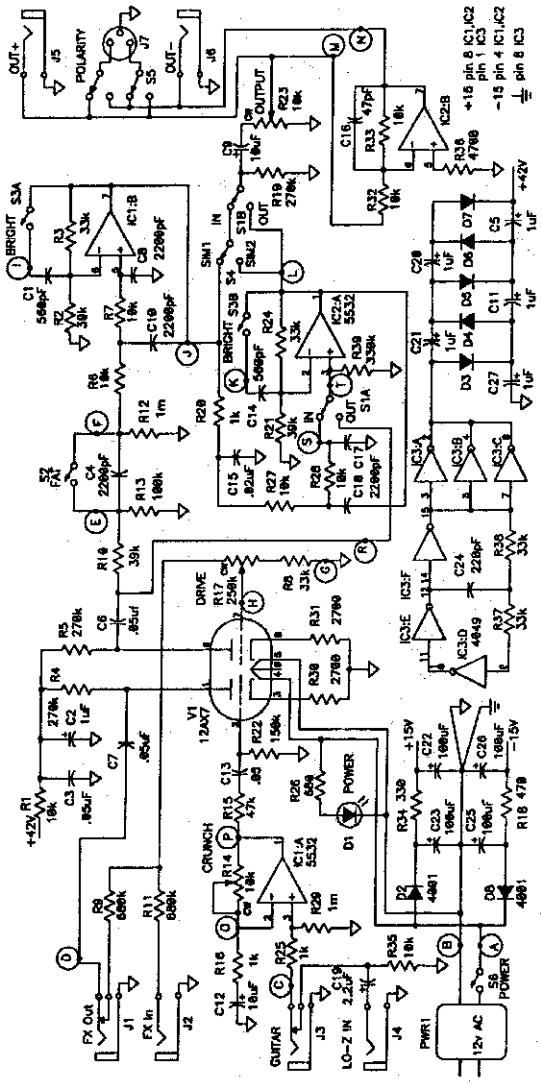
HOW IT WORKS

The SIAB combines solid-state and tube circuitry. Preamp IC1:A provides clean gain (up to 10x, set by the Crunch control) to overload the first tube stage. This, in turn, feeds effects loop J1 and J2. To avoid compromising the sound, the effect should have a high input impedance (greater than 100k). The signal goes to the second tube stage via Drive control R17, which adjust the waveform symmetry and distortion amount.

Next comes the cabinet simulator, a 5-pole filter built around IC1:B and IC2:A; this mimics the high-frequency rolloff of a typical cabinet with 12" speakers. S4 chooses between the full simulator (Sim 2) and a brighter, buzzier version (Sim 1). Fat switch S2 affects the lows; Bright switch S3 alters the highs. The simulator is ideal for use with a mixer. When using SIAB to feed an amp and guitar speaker cabinet you can bypass the simulators circuit with S1 (the Bright switch is still active).

Output control R23 sets the overall level and feeds the non-inverting output (J5) as well as a stage that inverts the phase to provide an inverted output (J6). J7 is a balanced XLR Male connector for connecting directly to studio consoles; S5 chooses whether pin 2 or 3 is "hot" to insure compatibility with balanced gear that does not follow the IEC standard for XLR pin polarity.

Tubes require higher voltages than solid-state gear; this implies a high-voltage transformer that can be both expensive and potentially hazardous. IC3 and D3-D7 provide a voltage multiplying circuit that allows us to use a 12 volt transformer yet still deliver 42 volts to power the tube plates.



The Stak-In-A-Box schematic. Parts inside the dotted borders are mounted off the circuit board.

Stak-In-A-Box
Packing List

1	12AX7	Dual Triode
1	4049	CMOS Hex Inverter
2	5532	Dual Low Noise OpAmp
5	1N4148	Silicon Diodes
2	1N4001	Power Diodes
1	T1-3/4	red LED
1	.022 uF	Ceramic Disk Capacitor
4	.05 uF	" " "
5	2000 pF	" " "
1	220pF	" " "
1	47pF	" " "
2	560pF	Polystyrene Capacitor
4	100uF / 16V	Electrolytic Capacitor
2	10uF / 10V	" "
6	1uF / 50V	" "
1	2.2uF / 16V	" "
1	100k	1/4w 5% resistors
8	10k	
1	150k	
3	1k	
2	1m	
2	2700	
3	270k	
1	330	
1	330k	
5	33k	
3	39k	
1	470	
1	4700	
1	47k	
1	680	
2	680k	

2	10k Potentiometer
1	250k Potentiometer
6	DPDT Slide Switches
4	1/4" Open Circuit Phone Jack
2	1/4" Closed Circuit Phone Jack
1	Panel Mount Male XLR Connector
1	12VAC 200mA Wall Mount Transformer
3	Push-On knobs
2	"L" Brackets
17	4-40 X 1/4" Machine Screws
2	4-40 X 1/2" Machine Screws
1	4-40 X 3/4" Machine Screws
18	#4 nuts
2	#4 flatwashers
1	#4 X 5/16" rolled aluminum standoff
1	Small Cable Clamp
1	9 pin Tube Socket
15	ft. #22 stranded wire
2	ft. RG-174/U co-ax
1	3" length small diameter tubing
1	Circuit Board
1	Aluminum Power Supply Shield

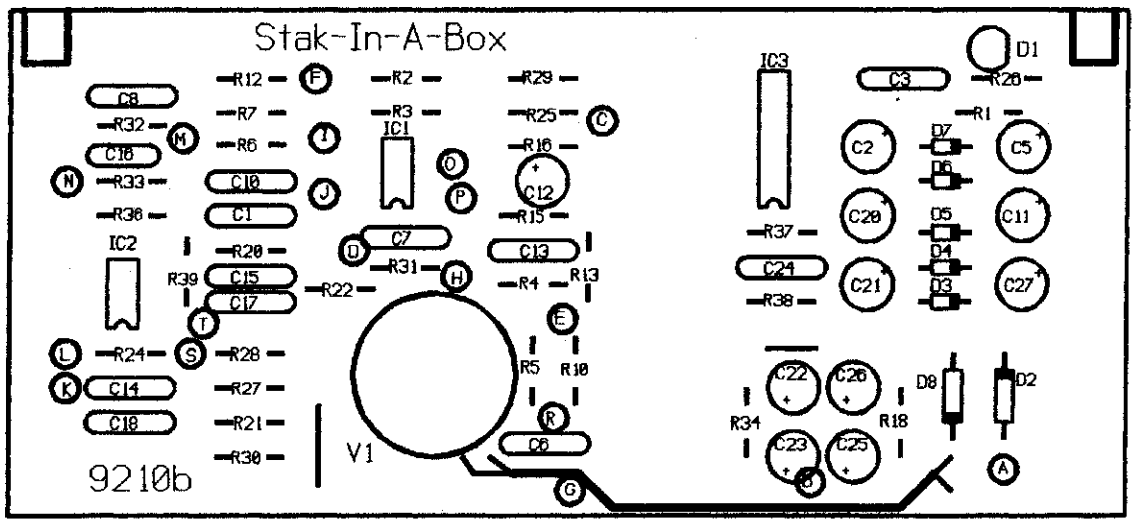


Fig 1a. Components mount on the circuit board in the locations shown by this parts placement drawing. Note that there are two Jumpers on the board. A pair of insulated wires twisted together will be used to supply the tube's filament power as shown by the graphic from V1 to the two holes below D8.

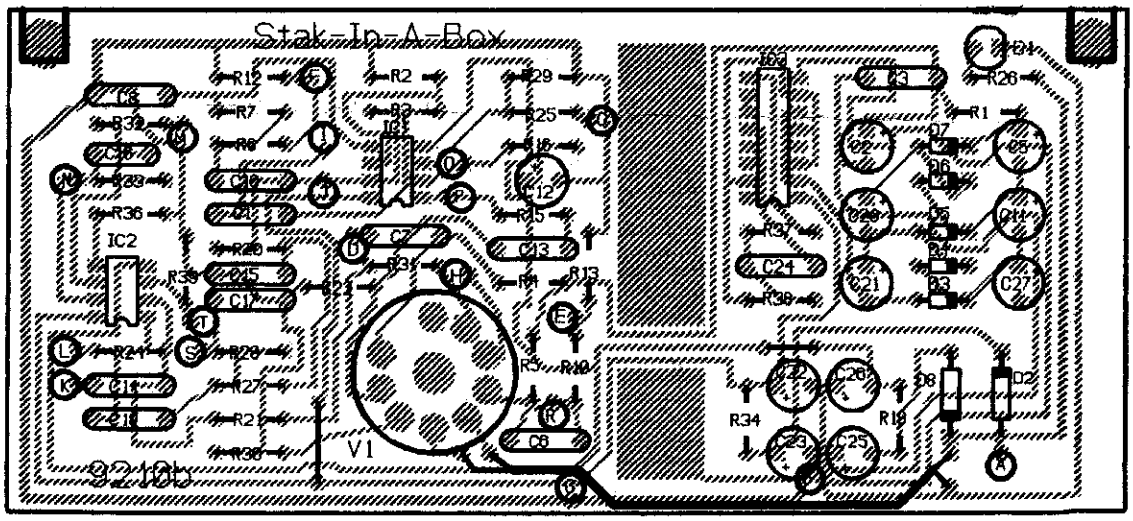


Fig 1b. This phantom view of the circuit board conductors will be useful if you have to trace out the circuit.

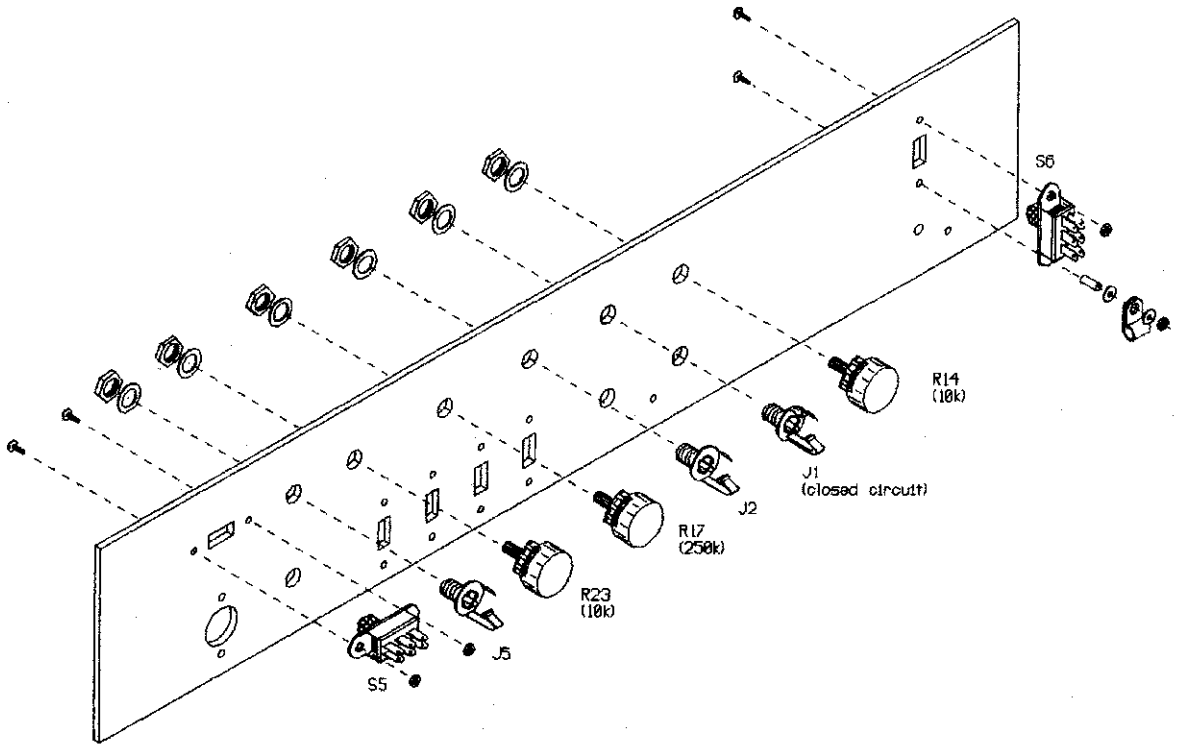


Fig 2. Potentiometers and Jacks mount to the panel using the 3/8" hardware supplied with them. Note the 1/2" machine screw that attaches the cable clamp to S6. J1 is a Closed Circuit Phone Jack.

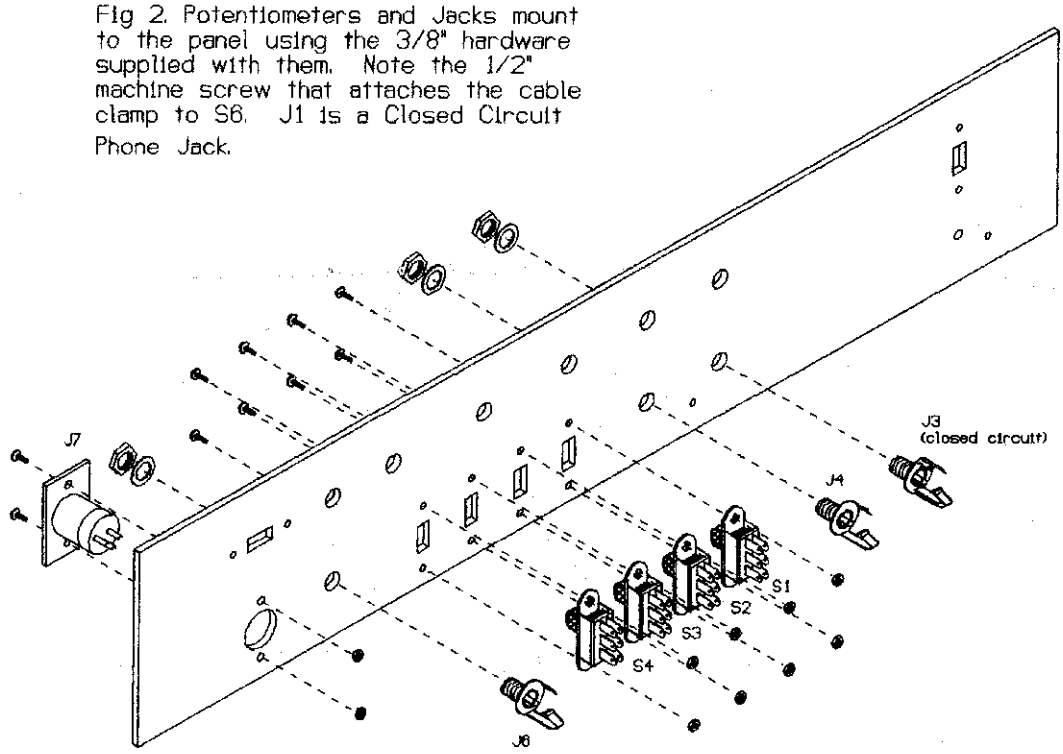


Fig 3. 1/4" machine screws are used to mount the slide switches and XLR connector J7. Note that J3 is a Closed Circuit Phone Jack.

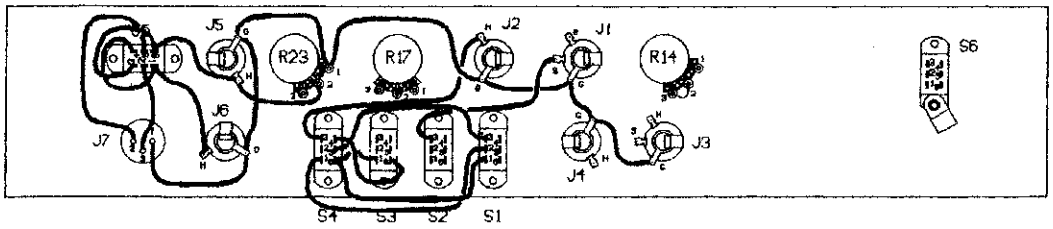


Fig 4. #22 stranded wire is used for the connections between front panel control and jacks as shown above.

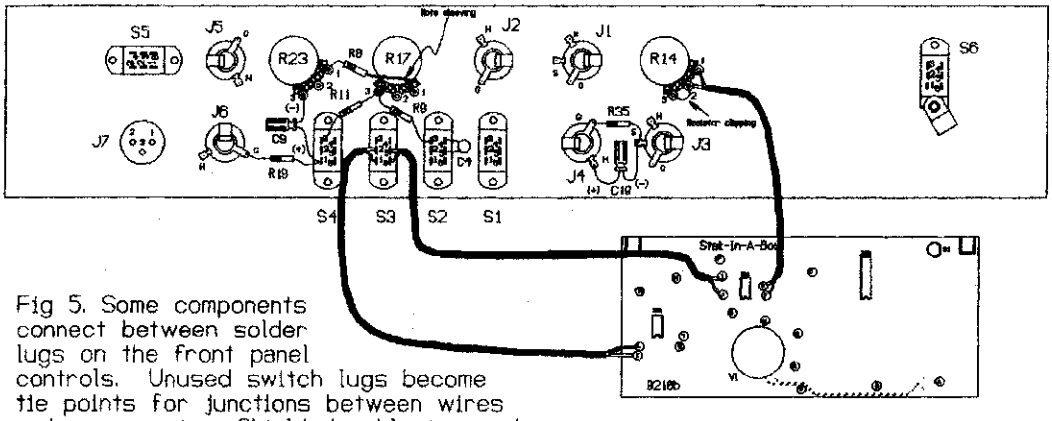


Fig 5. Some components connect between solder lugs on the front panel controls. Unused switch lugs become tie points for junctions between wires and components. Shielded cable is used for noise sensitive wiring.

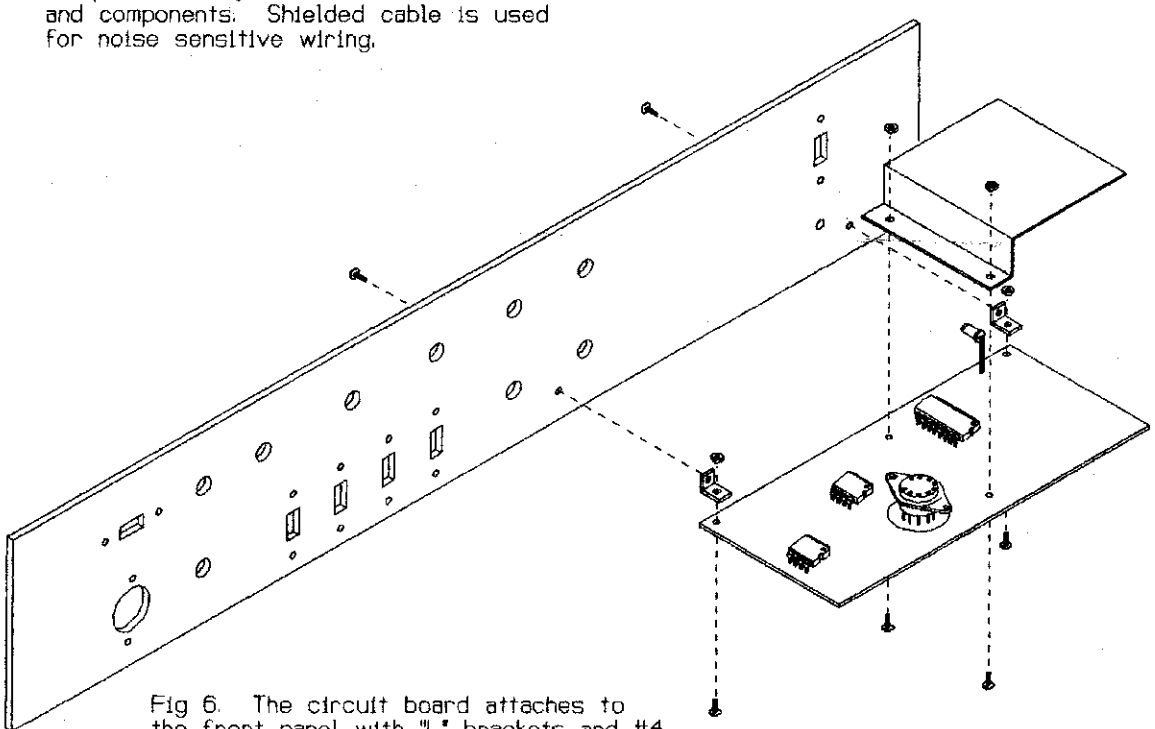


Fig 6. The circuit board attaches to the front panel with "L" brackets and #4 hardware. Do not attach the power supply shield until the unit has been tested.

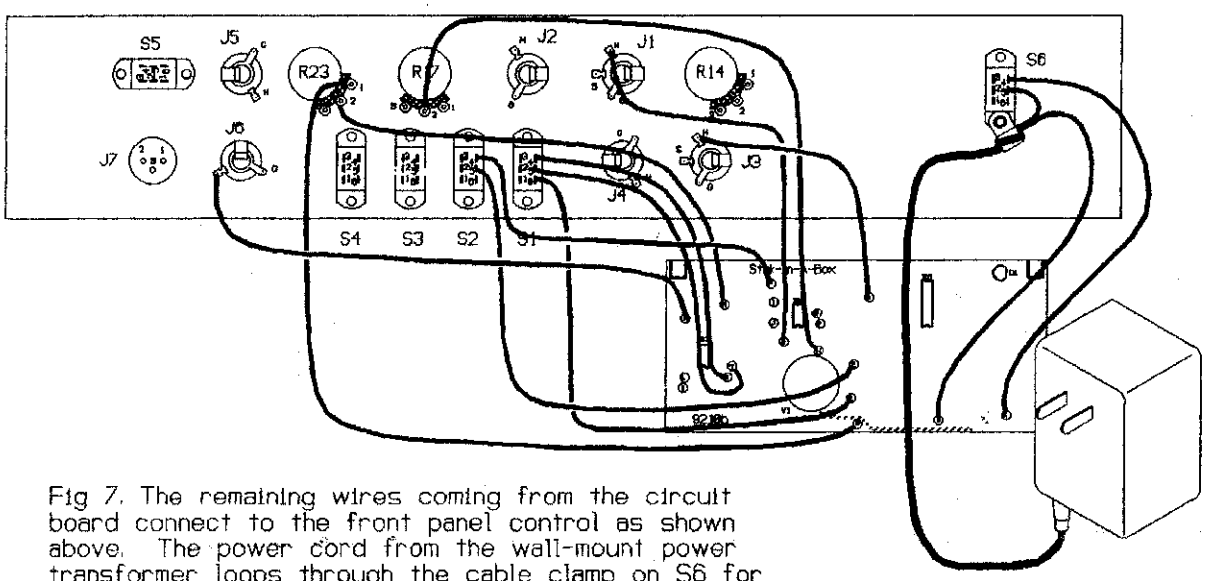


Fig 7. The remaining wires coming from the circuit board connect to the front panel control as shown above. The power cord from the wall-mount power transformer loops through the cable clamp on S6 for strain relief.