Hot Lyx Sustain

Model 5710
Assembly and Using Manual

IMPORTANT - Before beginning assembly of your new kit, check the supplied parts against the following parts list. If parts are missing or damaged contact PAiA Electronic Inc. phn: (405) 340-6300
email: *info@paia.com*

5710 Packing List

Qnty	Value	Desc (alternate markings)

All resistors 1/4W. 5%, values in ohms

2	100	(brown-black-brown)
3	1000	(brown-black-red)
1	4700	(yellow-violet-red)
3	10K	(brown-black-orange)
2	15K	(brown-green-orange)
1	27K	(red-violet-orange)
2	47K	(yellow-violet-orange)
7	100K	(brown-black-yellow)
1	150K	(brown-green-yellow)
1	330K	(orange-orange-yellow)
2	1 Meg	(brown-black-green)
2	2.2 Meg	(red-red-green)

Potentiometers:

2 - 500K trimmer
1 - 500K panel mount
1 - 1K panel mount

Capacitors

1	.01uF	ceramic disk
3	.05uF	ceramic disc may be .047uF
1	100pF	ceramic disc
1	500pF	ceramic disc may be 470pF
1	0.1uF	polyester capacitor

Electrolytic Capacitors:

1 - 10uF electrolytic capacitor
1 - 100uF electrolytic capacitor

Semiconductors:

1 - 1N4001 diode (may be 4002, 4003, etc.)
3 - 2N4124 transistor
2 - 2N4126 transistor
1 - 4136 quad op-amp IC
1 - 4016 analog switch IC
1 - 3080 transconductance op-amp IC

Misc:

2 - 14 pin IC socket
1 - 8 pin IC socket
1 - push on/off switch
1 - open circuit 1/4 inch phone jack
1 - stereo 1/4 inch phone jack
1 - 9v. battery connector
1 - battery holder
1 - 4-1/2 inch piece foam tape
1 - 15 inch bare wire
3 - 15 inch insulated wire
1 - 5710 PC board
2 - set screw knobs

INTRODUCTION

Thank you for buying the PAiA 5710 Hot Lyx Sustain kit. We realize that you are anxious to get on with the assembly, but before you start, please take the time to read the hints and suggestions that follow.

—BEFORE YOU BEGIN—

Familiarize yourself with this manual. It's not necessary to read the whole thing in detail, but at least go through and look at the illustrations. Get a feel for the parts and how they fit together. It is particularly important to check the parts supplied against the parts list in the front of this manual. This is a relatively simple kit and it will not take long to assemble. Nevertheless, please do us all a favor - TAKE YOUR TIME. Time invested in careful assembly now will pay great dividends in the time saved trouble-shooting when you're done.

SOLDERING

Successful operation of your kit, as well as it's longevity, is probably more dependent on how the components are soldered in place than any other one thing that the assembly involves. There are three key rules to go by, these are as follows:

TYPE OF SOLDER: Use ONLY ROSIN CORE SOLDER. Acid core solder or silver solder / paste flux should never be used to assemble electronic circuitry.

SOLDERING. TOOL: Use a soldering iron with a power rating of about 25 watts to 35 watts, and a small pointed tip. Soldering guns are completely unacceptable for soldering solid state components, as the large magnetic fields they generate can easily damage some components. Be sure to keep your soldering iron tip clean. Before soldering a connection, wipe the tip on a damp sponge - This will aid in heat transfer and prolong tip life.

SOLDERING TECHNIQUE: Look at the solder connections on commercially available amps and effects units and try to imitate them as closely as possible. A proper circuit board solder joint has just enough solder to cover the soldering pad and about 1/16" (2mm) of the component lead passing through it.

To solder, hold the tip of the iron against both the wire to be soldered and the circuit board trace (or jack lug, switch lug, or whatever). Hold it there for a second or two to let things heat up, then feed a small amount of solder onto the connection. Do not simply feed the solder onto the tip of the iron and expect it to run down onto the connection. Continue holding the iron against the connection until the solder melts fully and flows freely over the connection. Then remove the iron and let the joint cool. Do not move any of the wires while the solder is cooling; if this happens, re-heat the connection, feeding in a tiny bit more solder.

There are two types of improper connections to watch out for; using too little solder (or too little heat) will result in a connection which will appear to be soldered when actually there is a layer of flux or oxidation insulating the component lead. To cure this, re-heat the connection and flow a small additional amount of solder on the joint. Using too much solder can lead to excess solder flowing between adjacent terminals or traces of a circuit board, causing a short circuit. Unintentional solder bridges of this type can be cleaned off onto the tip of a CLEAN, hot soldering iron while holding the board upside down. Another problem with using too much solder is that it can flow over to an adjacent hole, blocking it with solder.

If this happens, again hold the board upside down and flow solder away from the blocked hole and onto the tip of a clean hot iron. Use a pin to poke through any remaining solder left in the hole.

Finally, avoid using too much heat or leaving the iron on a connection for too long. Excessive heat can damage many types of electronic parts, and in extreme cases can cause the foil conductors to lift from the circuit board.

CIRCUIT BOARD PREPARATION

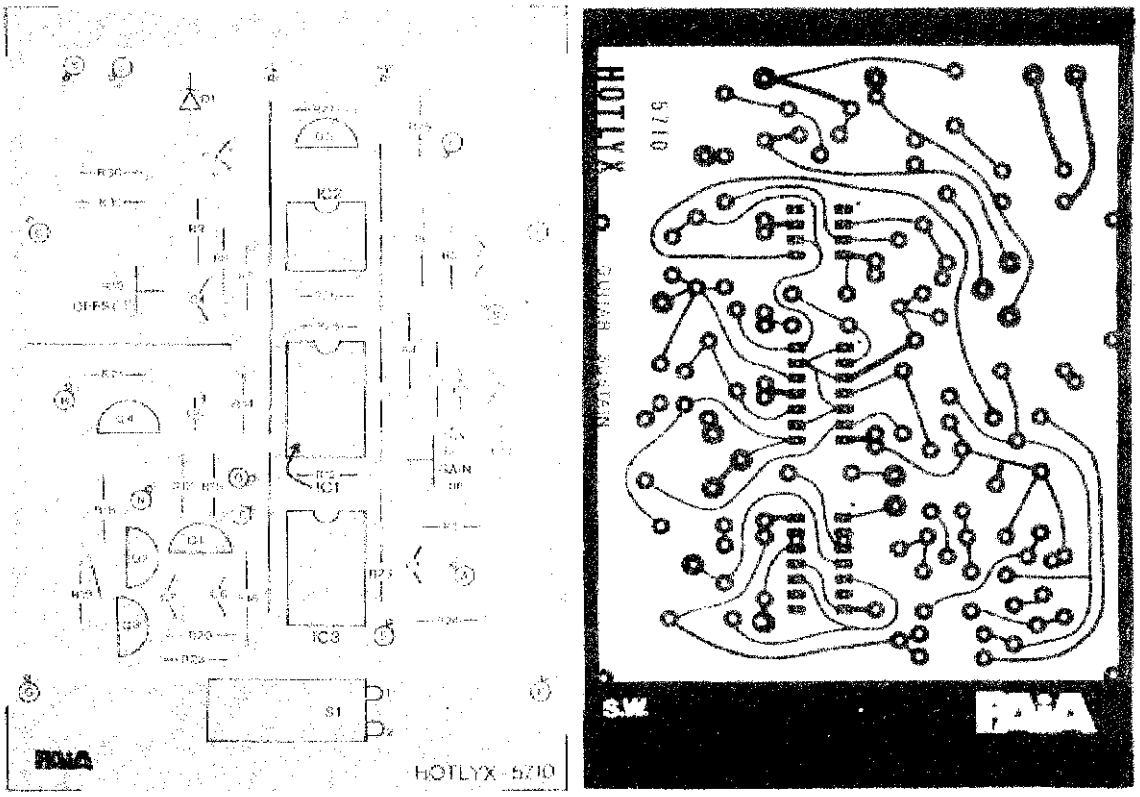
( ) Prepare the 5710 circuit board for assembly by thoroughly cleaning the conductor side of the board with a clean steel wool pad. Rinse completely with clear water and allow to dry. DO NOT USE PRE-SOAPED PADS.

A BRIGHT SHINY BOARD IS MANDATORY FOR SUCCESSFUL SOLDERING!

CIRCUIT BOARD ASSEMBLY

WIRE JUMPER INSTALLATION

( ) Using the bare wire provided, form and install the 9 wire jumpers on the circuit board. Designations for these jumpers are the solid lines printed on the component side of the board and in the parts placement drawing. NOTE the wire supplied can be straightened by pulling it between your pinched thumb and forefinger several times. MAKE SURE 9 WIRE JUMPERS ARE INSTALLED.

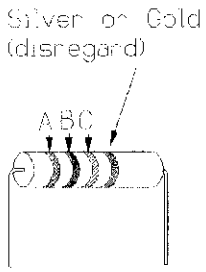


(component side) (conductor side)

Figure 1: 5710 HOTLYX parts placement

RESISTOR INSTALLATION

Solder each of the fixed resistors in place following the parts placement designators printed on the circuit board and shown in Figure 1. Note that the fixed resistors are non-polarized and may be mounted with either of their leads in either of the holes provided. Insert both leads in the mounting holes and push the resistor fully against the board. On the conductor side of the board, bend the leads outward to about a 45 degree angle to help hold the component in place while soldering. AFTER SOLDERING, clip off each lead flush with the top of the solder joint.

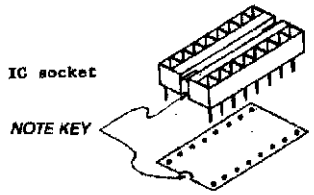


DESIGNATION	VALUE	COLOR CODE A -B-C
( ) R1	100K	brown-black-yellow
( ) R3	47K	yellow-violet-orange
( ) R4	10K	brown-black-orange
( ) R5	1 Meg	brown-black-green
( ) R6	47K	yellow-violet-orange
( ) R7	1K	brown-black-red
( ) R8	1K	brown-black-red
( ) R9	100K	brown-black-yellow
( ) R12	1K	brown-black-red
( ) R13	150K	brown-green-yellow
( ) R14	330K	orange-orange-yellow
( ) R15	10K	brown-black-orange
( ) R16	15K	brown-green-orange
( ) R17	15K	brown-green-orange
( ) R18	2.2 Meg	red-red-green
( ) R19	2.2 Meg	red-red-green
( ) R20	100K	brown-black-yellow
( ) R21	10K	brown-black-orange
( ) R23	4.7K	yellow-violet-red
( ) R24	100K	brown-black-yellow
( ) R25	100K	brown-black-yellow
( ) R26	27K	red-violet-orange
( ) R27	1 Meg	brown-black-green
( ) R28	100K	brown-black-yellow
( ) R29	100K	brown-black-yellow
( ) R30	100 ohm	brown-black-brown
( ) R31	100 ohm	brown-black-brown

SOCKET INSTALLATION

Install each IC socket by inserting its pins into the holes provided from the COMPONENT side of the circuit board and then soldering each pin to its respective pad on the CONDUCTOR side of the board. BE SURE THE SOCKET IS PRESSED DOWN FIRMLY ON THE BOARD AND THAT ALL THE PINS ARE PROTUDING THROUGH TO THE CONDUCTOR SIDE. Some sockets may bear orientation markings on one end. While there is no electrical significance to the orientation of the socket, it is good practice to acknowledge these marks and orient the socket accordingly. Normally the marked end will correspond to the semi-circle notch at one end of the parts placement designator for each IC.

( ) IC socket 1	14 pin	
( ) IC socket 2	8 pin	
( ) IC socket 3	14 pin	



Install the ceramic disk capacitors. Like resistors, these components are non-polarized. The value of the capacitor will be marked on the body of the part. Solder in place and clip the excess leads.

DESIGNATION	VALUE	ALTERNATE MARKINGS
( ) C2	100pF	100 or 101
( ) C3	500pF or 470pF	500 or 501 470 or 471
( ) C4	.01uF	103
( ) C5	.05uF or .047uF	503 or 473
( ) C6	.05uF "	"
( ) C7	.05uF "	"


ceramic disk capacitor

In the same manner, install the polyester capacitor, C1

DESIGNATION	VALUE	MARKINGS
( ) C1	.1uF	104


polyester capacitor

Up to this point, all components have been non-polarized, (i.e. either lead can go into either hole). Electrolytic capacitors are polarized; just like a battery they have a (+) and a (-) end; and like a battery, if installed incorrectly the circuit won't work. The capacitors supplied will have either the (+) or the (-) lead marked on the body of the part. The (+) lead must go through the circuit board hole marked positive (+). In the event the capacitors have their negative (-) lead marked, this lead should go through the unmarked hole on the circuit board.

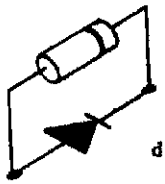
NOTE THAT THE SPECIFIED VOLTAGE RATING IS A MINIMUM RATING. CAPACITORS SUPPLIED WITH CERTAIN KITS MAY HAVE A HIGHER VOLTAGE RATING THAN THAT SPECIFIED.

DESIGNATION	VALUE
( ) C8	10uF/10V.
( ) C9	100uF/10V.


electrolytic capacitor

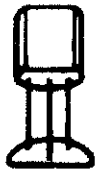
Next install the diode D1. Like all semiconductors, diodes are heat sensitive. To be on the safe side, heat sink each lead of the diode by grasping the lead with a pair of needlenose pliers or a small copper alligator clip at a point between the body of the component and the circuit board. Be sure to orient the diode as shown in the adjacent drawing.

DESIGNATION	VALUE
( ) D1	1N4001 or 1N4003


diode

Install the transistors. Note that there is a flat side on the transistor case and that there is a corresponding flat on the circuit board graphics. When viewed from the top, these flats should align. It will be necessary to bend the center lead forward to accommodate the triangular hole pattern drilled in the circuit board. Transistors, like the diode, are heat sensitive and the same care and heat sinking techniques should be used when installing these parts as described for installing the diode.

DESIGNATION	TYPE
( ) Q1	2N4124
( ) Q2	2N4124
( ) Q3	2N4124
( ) Q4	2N4126
( ) Q5	2N4126


transistor

Install the trimmer potentiometers.

DESIGNATION	VALUE	ALTERNATE MARKING
( ) R2	500K	504
( ) R10	500K	504


trimmer potentiometer

( ) Install the foot switch S1 by inserting the mounting shaft into the large hole in the circuit board from the COMPONENT side. Thread one of the hex nuts provided onto the shaft of the switch and tighten it against the conductor side of the board.

( ) Locate and install the battery connector. Connect the RED lead to the point on the circuit board marked "+V". Connect the BLACK lead to the point marked "-V". Insert the wire from the component side of the board and solder the connection on the conductor side.

POINT TO POINT WIRING

In the following steps the insulated wire provided with this kit will be used to make the connections from the two control potentiometers, the two plug-in jacks and S1 to the circuit board. At each step, prepare the wire by cutting it to the specified length and stripping 1/4 inch (.7 cm) of insulation from each end. "Tin" each end of the wire by twisting the strands together and melting just enough solder into the wire to hold the strands together. To be sure you will have sufficient wire for all steps, "rotate" through the strands supplied, at each step cutting from the longest strand available. At each step, solder both ends of the wire.

It is good practice to tin the solder lug on the jacks and controls before soldering the wire to it since the heat required to tin the lug may well be enough to melt the insulation on the stranded wire. Hold the component in a small vise during this operation. If no vise is handy, a pair of needlenose pliers held closed with a rubber band will help. Tin these lugs by holding your soldering iron against them for a few moments to allow the lug to heat completely. When the lug is hot, feed solder to the point where the lug and iron meet. If the solder does not flow out onto the lug, it is an indication that oxidation is interfering with the solder bond. Break down the oxidation by rubbing the soldering iron around while applying firm pressure until the solder adheres smoothly to the lug.

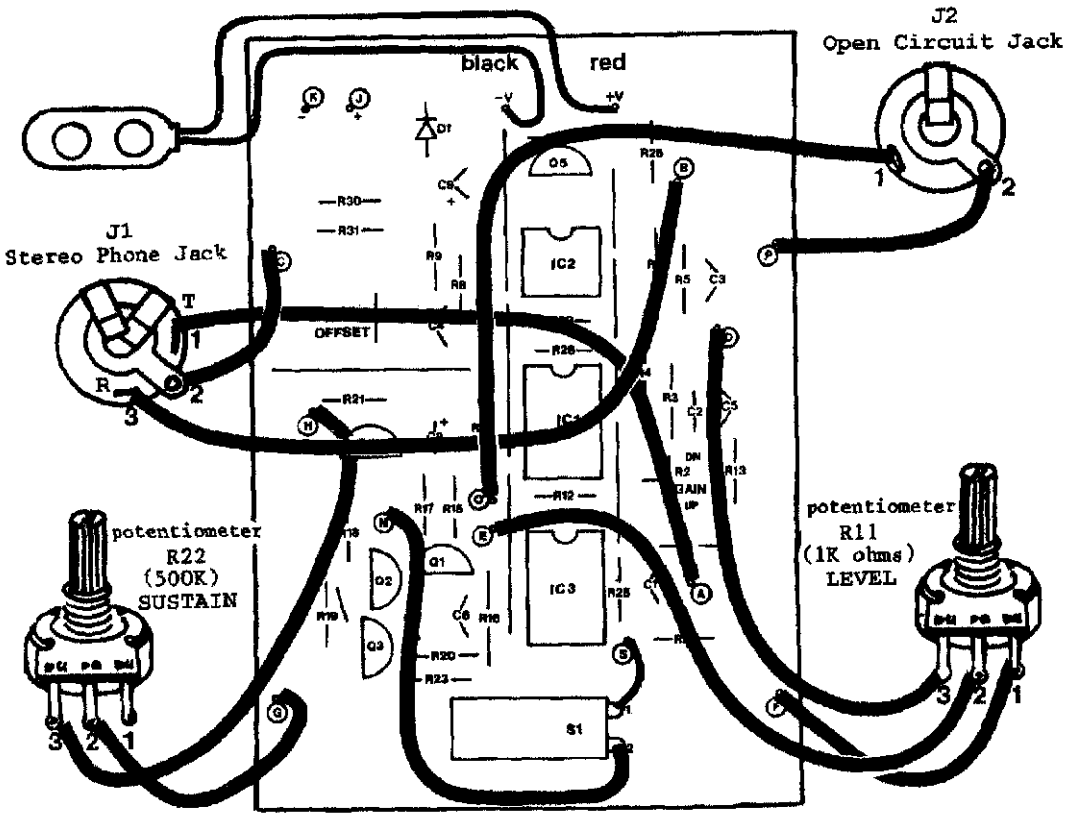
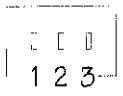


Figure 2: wiring diagram

LENGTH	FROM	TO
( ) 7" (17.8 cm)	J1 lug 1	A
( ) 4-3/4" (12.2 cm)	J1 lug 3	B
( ) 3" (7.7 cm)	J1 lug 2	C
( ) 3-1/2" (9 cm)	R11 lug 3	D
( ) 3-3/4" (9.6 cm)	R11 lug 2	E
( ) 2" (5.2 cm)	R11 lug 1	F
( ) 2-1/2" (6.4 cm)	R22 lug 2	G
( ) 2-1/2" (6.4 cm)	R22 lug 3	H
( ) 4" (10.2 cm)	S1 lug 2	N
( ) 5-1/2" (14 cm)	J2 lug 1	O
( ) 2" (5.2 cm)	J2 lug 2	P



Note: The foot switch (S1) supplied with this kit has three lugs as shown above. The switch is symmetrical, use the center terminal for lug 2 and either of the end terminals as lug 1.

( ) Using the bare wire provided, make the connection between point "S" and lug 1 of S1.

This completes assembly of the 5710 PC board. If you have the optional 5700 Stomp Box Case, set the board aside temporarily and prepare the case as follows.

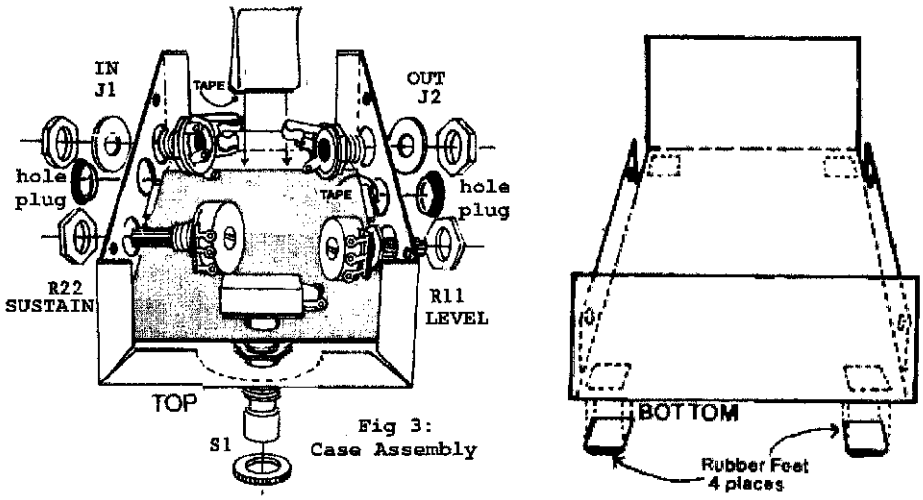


Fig 3:
Case Assembly

( ) Locate the foam tape and cut off 1/2" (1.3 cm) from the length provided. DO NOT REMOVE THE PROTECTIVE PAPER FROM THE TAPE.

Of these two pieces of tape, the shorter will be used to attach the battery clip to the case and the longer will be used as an insulator to prevent the unsupported end of the circuit board from touching the case top.

To get a feel for the location of the tape section and the battery clip, trial fit the circuit board by passing the shaft of the stomp switch into the hole while dropping the circuit board in place. Notice that a small space must be allowed between the clip and the folded lip of the case to provide clearance to the case bottom when it is installed.

Remove the circuit board and proceed.

( ) Install the longest piece of tape on the inside top of the case as shown in Figure 3. DO NOT PEEL OF THE PAPER BACKING.

( ) Locate the "U" shaped battery holder and stick the small piece of foam tape to the bottom of it. Remove the protective paper and position it to the inside of the case top as shown in Figure 3.

( ) Install the circuit board in the case by inserting the threaded shank of S1 up through the CANCEL hole from the inside of the case top. From the outside, thread the knurled finish nut onto the shank of S1 and tighten it firmly against the case top.

( ) Install J1 ("IN") by inserting the threaded shank of the jack through the hole from the inside and threading the nut onto it from the outside. Tighten securely.

( ) In a similar manner, install "OUT" jack J2.

( ) In a similar manner, install the 500K "SUSTAIN" potentiometer R22.

( ) In a similar manner, install the 1K "LEVEL" potentiometer R11.

( ) Locate the four rubber feet and install them on the outside case bottom. Remove the protective paper and stick them into place.

We will now install the integrated circuits. Note that the orientation of the IC is keyed by a circular indentation or notch at one end of the case. This aligns with the semicircular key drawn on the circuit board graphics. Install each IC by carefully inserting its pins into the receptacles of the socket you installed earlier and pressing the device firmly into place.

DESIGNATION	TYPE
( ) IC1	4136 quad op-amp
( ) IC2	3080 transconductance op-amp
( ) IC3	4016 quad analog switch

Now we are ready for testing and calibration. Snap in a fresh 9 volt battery and plug your axe into the "IN" of the HOT LYX, and connect the "OUT" to the input of your amp. Set the LEVEL control to about 25% and the SUSTAIN control to MAX. Check to see that the calibration trimmers, R2 and R10 are set to about center position.

You should now be able to play normally. Setting of the LEVEL control allows the level of the processed signal to be louder or softer or match the level of the straight signal. Setting this control to between 50% and MAX causes the HOT LYX to serve as an over-driving pre-amp.

The SUSTAIN control increases the sustaining power of the HOT LYX as it is rotated towards MAX.

CALIBRATION

The GAIN trimmer R2 is not a critical calibration. It can be set to taste. The most common settings are between 50% and 75%. If your guitar has unusually hot pickups on it, you may need to back off on the GAIN trimmer some. This should be necessary only if clipping results from too high gain. (Clipping is a fuzzy sounding distortion that occurs when the output from the guitar is strongest, like when a chord is played hard.)

The offset trimmer is correctly set when the popping caused by pushing the CANCEL switch is made as quiet as possible. This calibration is best done after the unit has had a few minutes of "burn in" time and also after a favorite setting of SUSTAIN control has been decided on (i.e. if you like to keep the sustain control at MAX, it should be at that setting when the OFFSET trimmer is set).

( ) After the calibrations are complete, install the case bottom by slipping it into position and inserting the four #6-32 X 3/8" self-tap screws through the holes in the sides of the case top.

( ) Install the knobs.

( ) Install the hole plugs in the unused holes.

This completes assembly of the Hot Lyx Sustain.

REMEMBER THAT THE POWER (battery) TO YOUR HOT LYX IS TURNED ON AUTOMATICALLY WHEN A PLUG IS INSERTED INTO THE INPUT (IN) JACK. TO PRESERVE BATTERY LIFE, UNPLUG THE CORD FROM THE INPUT WHEN THE UNIT IS NOT IN USE.

DESIGN ANALYSIS

When you plug your guitar cord into the HOT LYX "IN", the "shield" or ground portion of the plug makes contact with lug 3 of J1, grounding the otherwise floating end of R26. Q5 is turned on, providing power to the rest of the circuitry. The power supply voltage across C9 is divided by 2 at the junction of R28 and R29 and buffered by IC1d to form an "active ground". This places the rest of the circuitry on a "bi-polar" scheme with +4.5 volts and -4.5 volts.

The signal enters at lug 1 of J1 and is coupled directly to the in/out switching chip, IC3, for bypassing and also to the first amplifier stage IC1a, through C1 and R1. This amp has a gain control (PC mount trim pot R2), to allow adjustment for differences in pickups from one instrument to another as well as different playing styles. R3 and C2 form the feedback loop for this amp and the output is directly coupled to the next stage by R4. Feedback resistor R5 sets the overall gain for this second inverting amplifier and C3 suppresses any tendency toward high frequency oscillation.

The output of IC1b is coupled to the non-inverting input of IC2. The output of IC2 is then returned to the inverting input of IC1b placing IC2 in the feedback loop along with R5 and C3. This configuration makes feedback signal through IC2 a degenerative one due to the inversion at the input of IC1b since IC2 in non-inverting. So if the gain of IC2 is increased, the gain of IC1b will decrease, compressing the input signal.

The gain of IC2 is controlled by the amount of current flowing through pin 5 of the device (IC2 is a tranconductance op-amp). In this case, that current is governed by Q4. Q4 is controlled by the voltage across C8.

Backing up to the output of IC1b again, the signal from this point is also coupled by C5 and R13 to the input of another amplifier, IC1c. This amp's output signal, centered about ground, is coupled to the base of Q1. Q1 serves as a common phase splitter, developing signal voltages of about equal amplitude and opposing phase on its emitter and collector. Transistors Q2 and Q3 "rectify" these signals to produce an average DC voltage across C8, and R21/22 that is representative of the source signal amplitude after processing. This DC voltage is used to drive Q4.

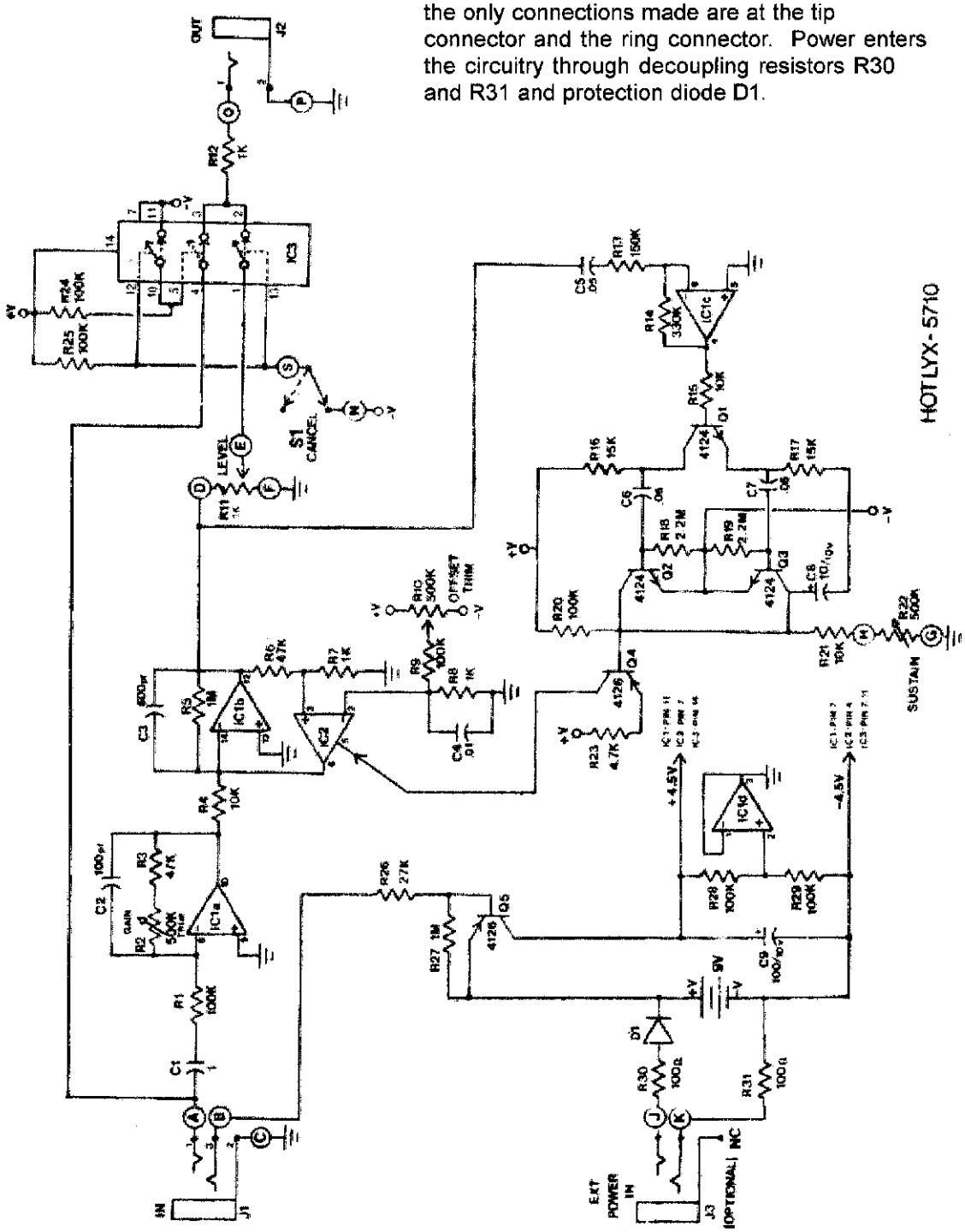
Q2 and Q3 can saturate with the signal transients at the beginning of the envelope, and drag the voltage at the base of Q4 in a negative direction very quickly so that the compressing action of the variable gain stage can follow the attack of the envelope. However, because the release time is determined by the rate at which C8 can charge through R20, the gain of the variable gain stage increases slowly and smoothly after the initial attack, while the input signal is dying out. The maximum value of positive voltage, that can develop at the base of Q4 is determined by the value of R21/22. As R22's value is increased, the range over which the rectifier output voltage can move is increased, so the dynamic range of the variable gain stage increases.

The signal voltage from the output of IC1b is also dropped across the LEVEL control R11 to become the processed output signal. The desired level is picked off by the wiper and directly coupled to one of the inputs of IC3.

IC3 is a four channel analog switching device. Two of the channels are used to switch between processed an unprocessed output signals while a third channel provides an inversion between the control signals to the two output signal switching channels. The fourth channel is not used here. CANCEL switch S1 dictates the status of IC3. When S1 is open, the processed signal is selected. When S1 is closed, the straight signal is selected. Isolating the mechanical switch in this way yields quiet in/out switching

provided there is no DC voltage difference between either of the two switching channel inputs and the output. R10 provides nulling for these "offset" voltages that may manifest at the output of IC1b as a result of offsets in IC1a, IC1b or IC2. This calibration control should be set after the unit has had at least 15 minutes "burn-in time" and after a favorite setting of the SUSTAIN control has been established.

External power can be supplied by way of an optional input jack J3. J3 should be an insulated jack. A non-insulated stereo jack can be used if the only connections made are at the tip connector and the ring connector. Power enters the circuitry through decoupling resistors R30 and R31 and protection diode D1.



Notes

Notes

PAiA Electronics, Inc
phn 405-340-6300
email: info@paia.com