Music from Outer Space
SoundLab Console Mini-Synthesiser

Construction and Design Notes

January 31st 2010

This document has been written around the original document released by Ray Wilson. It has been updated to be more specific to the kit supplied and this has been done with permission from Ray Wilson

Limited Warranty

The following is in lieu of any guarantees or warranties expressed or implied.

1. All components supplied with this kit are guaranteed to be free of manufacturing defects for a period of 30 days following the date of shipment. Components that are judged by Laurie Biddulph to have been defective as received by the customer will be replaced free of charge. Semiconductors are tested by the manufacturer prior to shipment and because of the volatile nature of these components they cannot be replaced free of charge after having been soldered in place. The use of sockets not supplied by Elby Designs voids the warranty of semiconductors.

2. All kits are guaranteed to perform as well or better than the published specifications at the time of shipment provided that they have been properly assembled using properly operating components. Kits that in Elby Designs opinion are not functioning properly due to faulty components supplied to the customer will be repaired free of charge provided they are returned post-paid to this repair facility. All other repairs will be charged at published rates in effect at that the inoperative unit is returned. NO UNITS WILL BE ACCEPTED BY ELBY DESIGNS WITHOUT PRIOR AUTHORISATION TO THE CUSTOMER IN WRITING. This is for your protection – some common carriers will not honour insurance claims on damaged items that in their opinion were improperly packed.

REFUNDS AND REPLACEMENTS: Examine the kit you have received. If any of the parts seem of sub-standard manufacture you should contact Elby Designs immediately. We are proud of our achievements in the kit field but if this kit is not what you expected or if the instructions seem inadequate to assure your successful completion of the kit, it may be returned within 10 days of the shipment date for a refund of the purchase price less a restocking charge amounting to 5% of the purchase price of the kit but not less than US$3.00 nor greater than US$25.00. ITEMS RETURNED WITHOUT PRIOR AUTHORISATION WILL NOT BE ACCEPTED. Refunds cannot be made on assembled or partially assembled kits.

Disclaimer:

The circuit board provided has been designed and built out of the components described and according to the schematics provided. If it is built properly, then it is guaranteed to work. If supplied with a component kit, we guarantee that all components are 100% new and are all high-quality components. Specifications for the components can be found in the datasheets section of the CD and also on the website.

All components used in the construction of this circuit board were commonly available at the time of development. To assist builders we can supply a full kit of components for dressing the circuit board as per the schematics.

Any questions can be directed to me – Laurie - via email at
elby_designs@ozemail.com.au.

IF PARTS ARE MISSING…

Every effort has been made to assure that this kit has been packed correctly. Should you find that a part or parts have been omitted, your replacement request will be honoured promptly if you use this form to supply the necessary information. This information is essential to our quality control efforts. Requests for missing parts cannot be honoured without this information. Requests can be made by mail or by e-mail.

Laurie Biddulph
9 Follan Close
Kariong
NSW 2250
Australia
E-mail: elby_designs@ozemail.com.au

Kit Code:

Invoice No. ____________________________________

Name: ____

Address: ____

City: ____

State: ____

Postcode/ZIP: ____

E-mail address (if available): ____

Missing Part(s):

Comments:

Send this form, or a photocopy, to the address listed above.

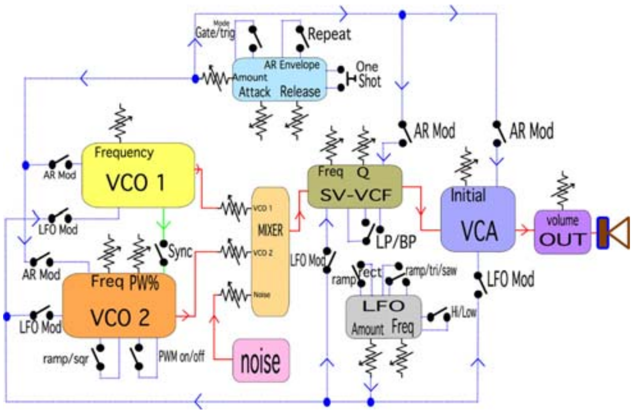
Ray Wilson's original SoundLab

Preamble

This document draws extensively from the text on the Music From Outer Space (MFOS) website and readers are advised to check on that website for updates and suggested modifications.

Introduction

This is an intermediate to advanced project for someone who wants to make cool sounds. It makes a great first synthesiser project but is interesting enough for the seasoned synthesiser person too. The SoundLab Mini-Synthesiser is a LOT of fun to play with and makes some very cool sounds. If you like electronic music you will definitely have fun with this. If you have a sampler you can use this unit as an analogue synthesiser sound source to make excellent samples with.



How does it work

Please refer to the Music From Outer Space website for details on how the SoundLab circuits function.

Construction

Assembly of the SoundLab PCB is relatively straight forward. It is recommended that you assemble the board in layers starting with the smallest components such as resistors and diodes and building up to the larger components.

PCB pins have been supplied to aid with wiring the board to the panel components. The location of these pins correlates with the pin labels A, B – RR as used in the MFOS drawings, although on the PCB the designations are actually the destination name for the pin. Refer to the drawing and place a pin in each location tagged by a letter(s). Please note that for C, PP and QQ that 2 sets of pins will be required.

With the board assembled we move on to the panels. The SoundLab Console has 2 panels, one for the rear panel and, of course, the main front panel. Dress both of these panels according to the parts list. When placing pots on to the front panel ensure that the legs all point downwards. This not only eases wiring but also ensures that the flat on the shaft is correctly positioned. Pot bodies will have a key-bump which should be snapped off using a pair of pliers. The nut and washer supplied with these pots should both go on the front face side of the panel. When attaching the switches keep one nut on the reverse face side of the panel along with the shakeproof washer. Discard the locating washer (large plain washer with a locating stub on it). Use the remaining nut to secure the switch making sure the switch is exactly vertical (or horizontal in a couple of cases).

Looking at the reverse side of the panel, the pot legs are numbered left to right 1, 2 & 3 which correspond with Clockwise (C), Wiper (W) and Anti-clockwise (A). The pins on the switches are numbered top to bottom 1, 2 & 3 which corresponds with Normally-Open (NO), Common (CO) and Normally-Closed (NC). The exception to the naming is the pushbutton switch S1 where pins 1, 2 & 3 corresponds with Common, Normally-Open and Normally-Closed.

Firstly you should follow the ‘Component on Panel’ chart and mount all off-board components. Then follow the Panel-Panel chart to add all the wiring between various points on the panel. Finally you should follow the ‘Board to Panel’ chart. For this stage I would suggest that the case base with the pcb installed be placed immediately in front of you and the case top be positioned directly above this as shown.

The finished unit is shown in the photo on the right. In this unit I have used lace-cord to tidy up the wiring but cable ties can be used to equal effect.

Ensure there is enough slack in the harnesses going between the two sections to allow the case to be opened and closed yet do not be overly generous.

The wiring charts supplied split the Board to Panel wiring in to two harnesses, one running up each side of the assembly. Although direct point-point wiring will result in much shorter cable runs, the proposed arrangement is much easier to work on should the need arise. Constructors may opt to use multi-colour wiring between the Board and Panel connections to assist with fault finding.

Calibration

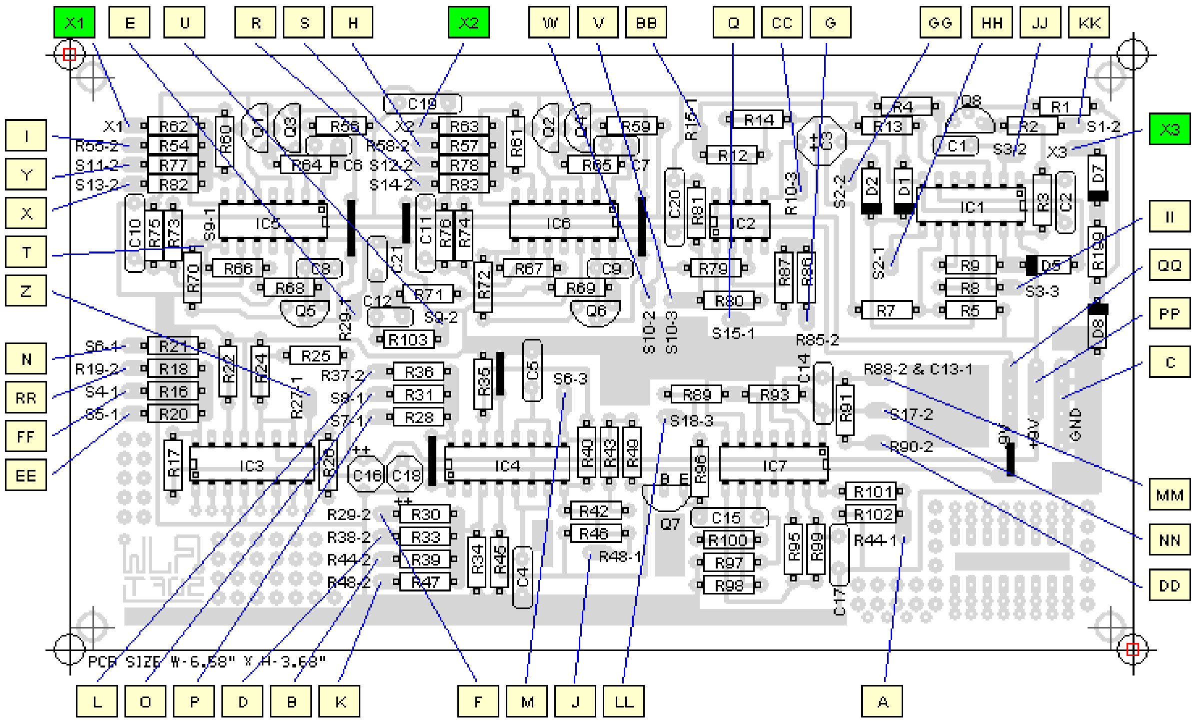
Before calibrating the SoundLab a final check should be made for any wiring and/or soldering faults. Once satisfied that all appears okay, we would suggest removing all IC's from their sockets and then applying power to the unit. With a digital multimeter (DMM) set to DC Volts (20 volt range) you should check the power pins on the IC sockets (refer to schematics for pin identification). If all is okay, then remove power and insert all the IC's paying particular attention to the orientation, IC2, IC3 and IC4 are the reverse orientation to the remaining IC's. Finally, re-apply power and recheck the power pins. If the power pins are reading low then immediately switch off the unit and recheck for solder shorts.

The only calibration required is that for the Volt/Octave settings. The default condition of the trimpots in their centre position will generally work fine for many users and so no adjustment would be necessary.

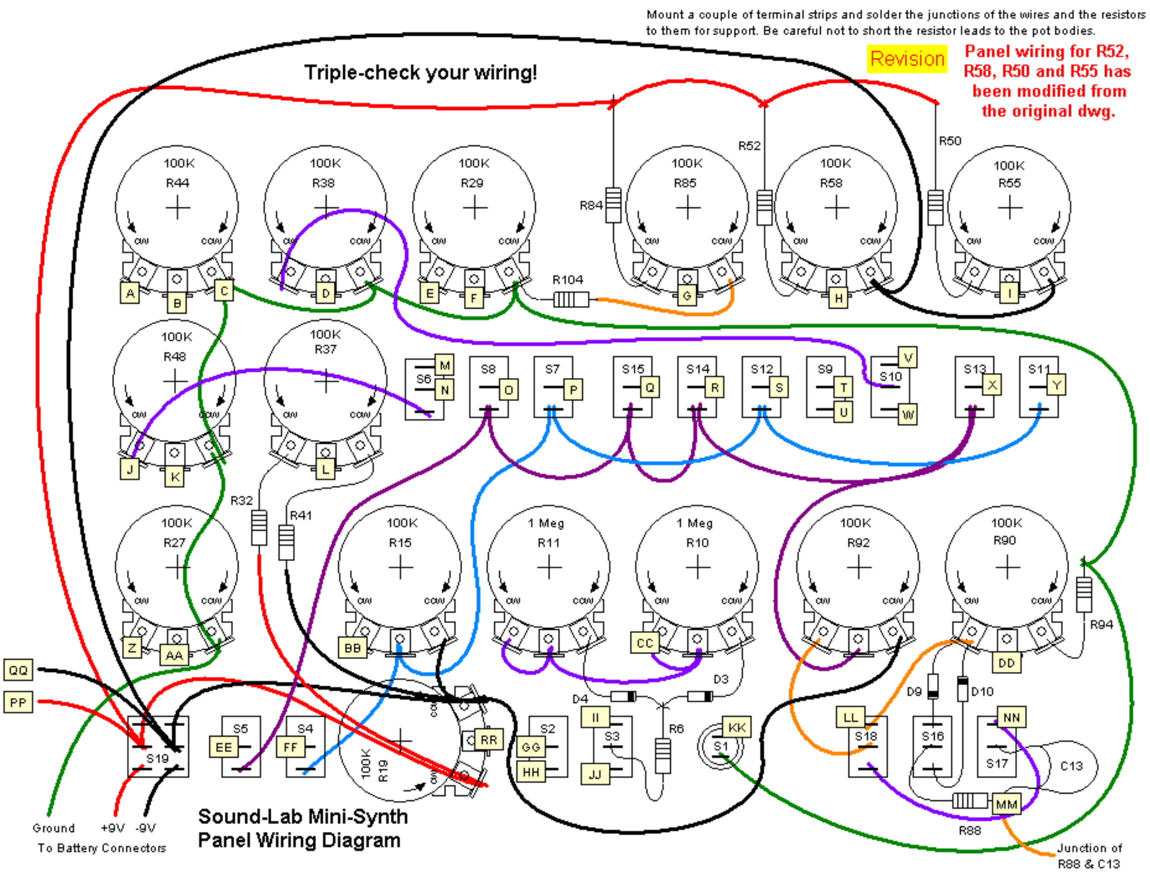
If you intend to use the SoundLab in conjunction with other musical instruments then you will want to set the Volt/Octave adjustments to give better tracking of the oscillators to the external control voltages.

APPENDIX A

The following drawings are taken directly from the MFOS website and should be used in conjunction with the wiring charts provided at the end of this document.



Use the MFOS 'SoundLab_Labels' picture to identify the cable identification (A, B, PP etc) with the designation on the board (R55-2, S9-1 etc).



NOTE: This panel layout is NOT the same as the SoundLab Console

APPENDIX B

The following details are taken from the Music From Outer Space website and readers should check the website for any updates that may have been released.
The Sound Lab Mini-Synth

Introduction
This is an intermediate to advanced project for someone who wants to make cool sounds. It makes a great first synth project but is interesting enough for the seasoned synth person too. The Sound Lab Mini-Synth is a LOT of fun to play with and makes some very cool sounds. If you like electronic music you will definitely have fun with this. If you have a sampler you can use this unit as an analog synth sound source to make excellent samples with.

The circuit will run a long time on two 9 volt batteries. The whole thing draws well under 10 mA.

AR (Attack - Release) Envelope Generator

With S2 in the off state and S3 set to "Triggered" the circuit functions as follows:-

- When S1 is momentarily pressed it discharges C2 (to about 1.6 volts) through R2 which causes pin 2 of IC1-A to go high. This pushes a positive pulse through C1 and D1 which sets the flip flop made up of IC1-E and IC1-F. IC1-F pin 12 goes high and C3 begins to charge at the rate set by the Attack pot R10 from -8 volts to about 6.5 volts (this voltage is buffered by IC2-B voltage follower) at which point IC1-B's output goes low and IC1-C's output goes high and the IC1-E/IC1-F flip flop is reset by the high logic level presented to pin 13 via D5. This causes IC1-F pin 12 to go low and discharge C3 at a rate determined by R11.
- When the Repeat switch is on and the voltage at IC2-B is lower than -6 volts then IC1-D pin 8 goes high and sets the IC1-E/IC1-F flip flop again thus causing the cycle to begin again and subsequently repeat. Notice that I am allowing negative voltages to reach the inputs of the schmidt triggers but that they are protected from drawing high current through their internal protection diodes during that time by the high value resistors in series with their inputs.
- When S3 is in the "Gated" position the repeat function is disabled. In this configuration a high level is presented to the "Attack" diode/pot combo as long as S1 is held pressed (because the output of IC1-A is high when S1 is held pressed). Gate mode allows C3 to charge from -8 volts to about +8 volts maximum. When S1 is released a low level is presented to the "Release" diode/pot combo (because the output of IC1-A is low when S1 is not pressed). The output of IC2-B is fed to R15, the AR Envelope output level adjustment pot. The circuit point "AR" is the wiper of R15, which is fed to the AR-Gen switches of the modules.

The zener on the external gate is meant to protect against gate signals greater than 9 volts. When the gate is high transistor Q8 will discharge C2 the same way switch S1 does.

Noise Source

The Noise Source utilises the well established fact that a reverse-biased emitter-base junction creates noise. This noise can be amplified, in this case by about 1000, to get a first-stage signal level in excess of 100mV. This signal is then both inputs of a second LF444 through two 1M resistors. We hang a capacitor off of the inverting input and voila the inverting input always lags the non-inverting one. As the noise voltage is taking its time trying to go up and down (due to the cap) on the inverting input it is racing up and down on the non-inverting input. This results in the voltage on the non-inverting input randomly being higher or lower than the voltage on the inverting input as the noise voltage randomly changes. Since the op-amp is wired as a full blast comparator its output is swinging up and down between the voltage limits of the LF444 in time to the noise fluctuations. Varying the cap and varying which input you hang the cap on will change the characteristics of the noise at the output of the second stage.

LFO (Low Frequency Oscillator)

The LFO is the same as the Super Simple Ramp and Sawtooth LFO. Notice that the switch is changed to be centre off so the circuit produces a triangular wave too. This was suggested synth-DIYer Harry Bissell (I remembered the little email logo H^) that came with the suggestion.) thanks. Additionally, you can change the range of oscillation for the LFO with the range switch. In low range a 2uF cap (C13) is placed in parallel with the integrator capacitor (C14) to reduce the range of frequency provided by the Frequency pot R90.

Battery Power Supply

Two 9-volt batteries power the circuit and the two by-pass caps absorb the larger current spikes. All of the circuits in the Sound Lab together draw less than 6mA.

VCA (Voltage Controlled Amplifier)

This circuit is practically straight out of the National Operational Amplifiers Databook data sheet for the LM13700. They have linear voltage control but for a sound box they're fine. The transconductance characteristic of these Op Amps makes them perfect for VCA's.

The control voltage controls the current flow through the amp and subsequent level of the signal at the output.

S4 switches the AR Gen control voltage on or off. When on, the level of the AR Generator output pot determines how much the AR Generator controls the signal amplitude at the output of the VCA.

S5 switches the LFO control voltage on or off. When on, the level of the LFO output pot determines how much the LFO controls the signal amplitude at the output of the VCA.

R19 controls the initial amplitude at the output of the VCA. When S4 or S5 is on it is best to turn R19 off or nearly off.

The input to the VCA is either the low pass output or the band pass output determined by the setting of switch S6.

VCF (Voltage Controlled Filter)

This circuit is practically straight out of the National Operational Amplifiers Databook data sheet for the LM13700. They have linear voltage control but for a sound box they're fine. The transconductance characteristic of these Op Amps makes them perfect for VCF's.

The OTAs act as voltage controlled resistors which change the pass-band (in band pass mode) and cut-off frequency (in low pass mode) from low (for low control voltage) to high (for high control voltage). The resonance control adjusts the feedback around the circuit and thus the gain at the cut-off frequency. At high resonance settings the filter rings adding harmonics to the filtered signal which give the classic synthesizer wahhhhh sound when the cut-off frequency is swept from low to high.

The filter also acts as the mixer as all of the signal sources are presented to its input via attenuation pots (R29, R38, and R44).

S7 switches the AR Gen control voltage on or off. When on, the level of the AR Generator output pot determines how much the AR Generator controls the cut-off frequency of the VCF.

S8 switches the LFO control voltage on or off. When on, the level of the LFO output pot determines how much the LFO controls the cut-off frequency of the VCF.

R37 controls the initial cut-off frequency of the VCF. When S7 or S8 is on it is best to turn R37 off or nearly off.

VCO's (Voltage Controlled Oscillators)

The SoundLab uses two voltage controlled ramp oscillators. IC5-B and IC5-A and associated transistors and components comprise a linear voltage to logarithmic current convertor. The control voltages which are summed by IC5-B range from -8 to 8 volts. The corresponding current ranges from around 1uA to 1mA and since the oscillators go up approximately 1 octave every time the current doubles this gives the oscillator a nice range from a sub-audible 0.6 Hz to beyond human hearing.

The explanation of the operation of oscillator 1 follows (oscillator 2 works the same way using its associated components). Oscillation occurs because as the current is sucked out of the input of integrator IC5-D its output goes high until IC5-C (comparator with hysteresis) pin 8 goes high and turns on the N-Channel FET (Q5) which shorts the integrating capacitor (C8) which causes the cycle to begin anew and subsequently repeat. IC6 is used in a similar configuration. The output of IC6-D (point ZZ) is fed into comparator IC2-A in order to provide a square/pulse wave shaper for Oscillator 2. The control voltage fed into IC2-A pin 2 via resistors R86 and R87 determine the comparator threshold and thus the point at which the output (pin 1) goes high and low.

Varying R85 will change the pulse width which will vary the timbre of Oscillator 2 when Rect Wave is selected. S15 permits the LFO output voltage to modulate the pulse width which can cause the output of Oscillator 2 to sound like 2 oscillators tuned very close together (when approximately 1HZ LFO frequency is used).

S11, S13, S12, and S14 are used to feed the AR Generator and LFO outputs to the CV inputs of the VCOs. When on, you will hear the obvious effect as you advance the LFO and/or AR Gen output adjustments.

S9 causes Oscillator 2 to sync to the frequency of Oscillator 1. This provides some very cool timbres which you will hear if you turn on Sync and then tune Oscillator 1 lower than Oscillator 2 and sweep Oscillator 1 upward in frequency.

General Trouble-shooting

VCF Control Range Change

The filter will hit the bottom of its range at various settings depending on what you are controlling it with. If you find that it makes the pass-band too low to pass anything of interest when you still have several degrees of pot rotation no matter what you have connected to it then increase the value of R41 (resistor from pin 3 of the Cut-Off Frequency pot to -9V). That will raise the bottom of the control range. Try something between 4.7K and 10K to start. It won't hurt to go higher than that in resistance if you want to try.

Signal bleed-through? A two pole filter will always allow a bit of the original signal to pass through but just a itsy bitsy teeny bit so if you have a lot of bleed-through at the bottom of the range look over all of the components associated with the filter to make sure everything is the correct value and connected properly.

VCA Voltage Controlled Amplifier

If the VCA is acting totally strangely make sure everything is wired correctly and that you have a good LM13700. Check the panel wiring to make sure that a ground or power connection hasn't been missed. The input to the VCA goes through R21 (33K) and is dropped across R22 (1K resistor to ground). Any patched in signals should go (via 100Ks) to the junction of IC3-B pin 14, R22 pin 2, and R21 pin 1. All this part of the circuit does is feed an attenuated signal to the non-inverting input of the LM13700 (the inverting input is grounded). Now on to the control voltage portion of the VCA. As you can see we are only applying current to pin 16 of IC3-B from the various control voltage inputs and we have biased the input toward the low end by R17, 100K to -9V. The VCA initial gain only applies a voltage of between -9V and +9V to pin 16 of IC3-B (via R18 470K). All of the control voltage inputs to the VCA are adding to or subtracting from the current arriving at pin 16 of IC3-B. So this is one of the simplest modules and it definitely works when everything is connected properly. Another thing to check is the average voltage at the junction of S6 pin 1 and R21 pin 2. This should be near ground and if the VCF has something connected improperly it could be applying a DC offset to this input thus causing the VCA circuit to misbehave so check that. All I can suggest is that you check all of the wiring, soldering and component values (including the components in the filter circuitry). Last but not least try another chip (LM13700) if something is amiss with this circuit module. R26, R42, and R43 must be tied to -9V or the bias of the circuit will be wacky. Also the biasing of the output buffer in the VCA is very critical make sure R24, R25, and R26 are all connected properly.

Pulse Width Modulation Circuit

The output of IC6-D needs to be present for the pulse width modulator (IC2-A) to work. Check pin 14 of IC6. A sawtooth wave should be present and the frequency should vary when R58 is adjusted. The same saw tooth signal should be present on pin 1 of R79 (the side not connected to pin 3 of IC2A). The sawtooth should also be present on pin 2 of IC2-A (it may look a bit attenuated depending on the impedance of your scope probe). Make sure S15 is turned off for the following checks. When you adjust R85 the voltage present at pin 1 of R86 (the side not connected to pin 2 of IC2-A) should vary in the same manner as the voltage seen at the wiper of R85. If it does not then check that the wiper of R85 is connected to the circuit board via a wire. If the voltage at the wiper of R85 does not vary when it is adjusted then the resistive element terminals may not properly connected to both +9V and GND via R84 and R104 respectively. If it is connected then you may have a bad pot. If the voltage is varying properly on R85 then check the output of IC2-A (IC2 pin 1). You should see a pulse wave whose frequency is the same as the sawtooth you saw on pin 1 of R79 and whose pulse width varies in response to adjusting R85. If you have checked everything so far and still don't have a pulse wave on the output of IC2-A you may need to replace IC2. If you have the pulse wave on pin 1 of IC2 then make sure you have it at pin 3 of S10 (it will be attenuated by a factor of about 5). If you have it there then make sure that the schematic point O2 is properly connected to R38. You should see the same attenuated pulse wave on pin 1 of R38. The wiper of R38 should be connected to R33 on the PCB. IF you have the signal to here you are good to go as far as the Pulse Width Modulated waveform is concerned.

Attack Release Generator

As always, check the associated part values and orientations to ensure they are correct. Disconnect the external gate if you are using the external gate feature. With no external gate connected, S3 (AR Mode switch) set to "Gated" and S1 not pushed you should see +8 to +9 volts (depending on your meter's impedance) between pin 1 of C2 and ground. In this state IC1-A pin 2 should be low. When you press S1, you see about 1.5 volts between C2 pin 1 and ground and IC1-A pin 2 should go high and return low when you release S1. You should see a positive 8V to 9V pulse across R4 whenever you press S1. Set both Attack and Decay to the fully counter-clock-wise position (minimum attack and decay times). When you press S1 the voltage between C3 pin 1 and ground should go to between 8 and 9 volts (IC2-B pin 7 should also go to 8 to 9 volts). When you release S1 the voltage between C3 pin 1 and ground should go to 0 volts (IC2-B pin 7 go to between -8 and -9 volts). You should see the same voltage on pin 1 of R15 as you see on IC2-B pin 7. When IC2-B pin 7 is greater than about +6 volts IC1-C pin 6 should be at 9 volts. Set S3 (AR Mode switch) to Trig'd. Pressing S1 should cause IC1-E pin 10 to go to ground and then almost immediately return to +9V. Pressing S1 should cause IC1-F pin 12 to go to +9 volts and then almost immediately return to ground. Turn R10 a bit clockwise. Pressing S1 should cause IC1-E pin 10 to go to ground and then return to +9V after a delay. Pressing S1 should cause IC1-F pin 12 to go to +9 volts and then return to ground after a short delay. The further clockwise you turn R10 the longer the delay should become. The voltage envelope on IC2-B pin 7 should have an attack curve and a very very short decay curve. The further clockwise you turn R10 the longer the attack curve should become. Advancing R11 clockwise should cause the decay curve to lengthen. Return to a very short attack and decay time setting and set S2 (AR Repeat) to on. You should see a repeating attack decay envelope at IC2-B pin 7. Changing R10 or R11 should cause the envelope to change appropriately.

Some causes for problems include:
Defective IC1 (will not function) Try a known good one.
Incorrect values of resistors or capacitors (will not function appropriately or at all)
Attack and Decay pots mis-wired (inappropriate envelope change with R10 & R11 adjustment)
S1 not connected or pin 1 not connected to ground (Manual trigger will not work (repeat may work))
Defective IC2 (will not function) Try a known good one.
Triple check the panel wiring because if you are missing a ground or power connection on the front panel you could be starving several circuit points of necessary ground or power and the whole unit will be hosed and act very funkily (and not in a good way).
Diode reversed or shorted (will not function appropriately or at all)
Check all solder joints re-solder any that look cold (dull and gray instead of shiney).

White Noise Generator

As always, check the associated part values and orientations to ensure they are correct. Once you've done that make sure that you have the emitter and base of Q7 oriented correctly on the PCB. You should see a positive voltage at the emitter of Q7 of between 4.5 to 6 volts (depending on the impedance of your meter or scope it could be lower but it should at least be a couple of volts above ground). Check the output of IC7-C (pin 8) you should measure a voltage that is near ground (depending on the leakage of the IC). You should see white noise at a level of at least 100mV or more at pin 8 of IC7-C when you look at it with an oscilloscope. If you do, great, if you don't then hold one end of a short wire and touch the other end of it to IC7-C pin 10. The output of IC7-C (pin 8) should oscillate at 60 hertz at or near the rails (+/-9V). If you don't see this oscillation or IC7-C (pin 8) is stuck high or low replace IC7 and try again. If you see the oscillation but you don't see noise you probably have a quiet 2N3904 and you are going to have to dig through your box of general purpose NPNs and test them until you find a noisy one. YOU DO NOT NEED TO CUT THE COLLECTORS OFF JUST TO TEST THEM. When you finally find the noisiest one cut its collector off and use it. The reason you do this is because the collector acts like an antenna and unless you WANT radio signals in your white noise you probably want to reduce the size of this impromptu antenna to the shortest possible length. OK once you have noise at pin 8 of IC-7 the rest of the circuit should work. You should see rail-to-rail digital looking noise at the output of IC7-D (pin 14). If you don't see that then make sure the associated components (R95, R99 and C17) are soldered to the board and that you have ground on pin 2 of C17. If you have noise at pin 8 of IC7 and you don't have noise at pin 14 of IC7 try replacing IC7. The point marked NS should see 1/6 the level of noise you see at the output of IC7-D. The most likely cause of no noise is the transistor not being noisy.

Overall Signal Check

Once you have verified that both the panel wiring is correct and all component values are correct try observing the following circuit points.

A good place to start looking is at the Sound Lab Mini-Synth VCA (Voltage Controlled Amplifier) and VCF (Voltage Controlled Filter) schematic. You will notice several circuit points (circles with letters in them) throughout the page.

O1 - Raw Oscillator 1 output.
O2 - Raw Oscillator 2 output
NS - Raw Noise output.
BP - Raw output of bandpass filter.
LP - Raw output of lowpass filter.
AR - Attenuated output of the Attack Release generator.
LFO - Attenuated output of the Low frequency oscillator.

Locate these points in your sound lab and listen to them (or observe them with your oscope). You should have a hefty signal at each of these points which is several volts in amplitude. If you don't then trouble shoot any of the circuits that seem too low.

As you test O1 sweep the Oscillator 1 frequency knob to insure you are listening to (or observing the right point).

Do the same for O2, additionally flick the Ramp/Rect switch up and down a bit to make sure the waveform changes properly between ramp and square.

Point NS should be the raw noise output (very noisey).

BP is the output of the bandpass filter. Sweep the cutoff frequency as you observe this point. Turn the resonance down all the way. As you advance it the sound should become more resonant (contain more harmonic overtones).

LP is the output of the lowpass filter. Sweep the cutoff frequency as you observe this point. Turn the resonance down all the way. As you advance it the sound should become more resonant (contain more harmonic overtones).

The filter may oscillate when resonance is all the way up (that's OK).

Observe the signal level at pin 9 of IC3. This should be the main output prior to the output pot (which is wired as an adjustable voltage divider).

The signal at R27's wiper should go from 0V to the same signal seen at Pin 9 of IC3 as you advance it.

LFO and AR should go from 0V to the same levels as observed at LFS (on low frequency oscillator schematic) and pin 7 of IC2 (on Attack Release envelope generator schematic) respectively as you advance their respective controls (R92 and R15).

APPENDIX C

The following pages provide wiring charts to assist you with wiring up your SoundLab system.

Terminal identification is derived from the original MFOS drawings as provided on the MFOS website

The colour coding for the Panel-Panel wiring follows that shown in the MFOS drawing. There is no colour coding used for the Board-Panel wiring which is done with white wire.

Recommended wire is 7/0.2mm up to 16/0.2mm or 24AWG to 22AWG.

Start by wiring the additional components C13, D3, D4, D9, D10, R6, R50, R52, R84, R94 & R104 to the front panel as shown in the attached panel layout.

FROM	DESIGNATION		TO	PIN	INSTALLED	CHECKED
X2	X2	-	SK2	TIP		
H	R58-2	-	R58	W		
S	S12-2	-	S12	COM		
R	S14-2	-	S14	COM		
U	S9-2	-	S9	NC		
E	R29-1	-	R29	C		
X1	X1	-	SK1	TIP		
I	R55-2	-	R55	W		
Y	S11-2	-	S11	COM		
X	S13-2	-	S13	COM		
T	S9-1	-	S9	COM		
N	S6-1	-	S6	COM		
RR	R19-2	-	R19	W		
FF	S4-1	-	S4	COM		
EE	S5-1	-	S5	COM		
Z	S8-1	-	R27	C		
L	R37-2	-	R37	W		
O	S8-1	-	S8	COM		
P	S7-1	-	S7	COM		
F	R29-2	-	R29	W		
D	R38-2	-	R38	W		
B	R44-2	-	R44	W		
K	R48-2	-	R48	W		
FROM	DESIGNATION		TO	PIN	INSTALLED	CHECKED
W	S10-2	-	S10	NC		
V	S10-3	-	S10	NO		
BB	R15-1	-	R15	C		
Q	S15-1	-	S15	COM		
CC	R10-3	-	R10	C		
G	R85-2	-	R85	W		
GG	S2-2	-	S2	COM		
HH	S2-1	-	S2	NC		
JJ	S3-2	-	S3	NC		
KK	S1-2	-	S1	NO		
X3	X3	-	SK3	TIP		
II	S3-3	-	S3	NO		
QQ(2)	-9V	-	R19	A		
QQ(1)	-9V	-	S19	COM-1		
PP(2)	+9V	-	R19	C		
PP(1)	+9V	-	S19	COM-2		
C(2)	GND	-	BATTERY	COM		
C(1)	GND	-	R27	A		
MM	R88-2 & C13-1	-	R88	FLY-2		
NN	S17-2	-	S17	NO		
DD	R90-2	-	R90	W		
A	R44-1	-	R44	C		
LL	S18-3	-	S18	NO		
J	R48-1	-	R48	C		
M	S6-3	-	S6	NO		

x

FROM	PIN		TO	PIN	INSTALLED	CHECKED
R48	C	-	S6	NO		
R38	C	-	S10	COM		
R11	W	-	R11	C		
R11	C	-	R10	C		
R10	C	-	R10	W		

S18	COM	-	S17	NO		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
R27	C	-	S1	COM		
S1	COM	-	R48	A		
R48	A	-	R29	A		
R29	A	-	R38	A		
R38	A	-	R44	A		
R44	A	-	R94	FLY-2		

SK1	BODY	-	SK2	BODY		
SK2	BODY	-	SK3	BODY		
SK3	BODY	-	SK4	BODY		
BATTERY	B1 -VE	-	BATTERY	B2 +VE		
BATTERY	B2 +VE	-	SK1	BODY		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
S4	NC	-	R15	W		
R15	W	-	S7	NC		
S7	NC	-	S12	NC		
S12	NC	-	S11	NC		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
R92	C	-	S18	COM		
S18	NO	-	R90	COM		
S18	NO	-	D9-D10	FLY-2		

R27	W	-	C22	FLY-2		
SK4	LEFT	-	SK4	RIGHT		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
R84	FLY-2	-	R52	FLY-2		
R52	FLY-2	-	R50	FLY-2		
R50	FLY-2	-	R32	FLY-2		
R32	FLY-2	-	R19	C		

S19	NO1	-	BATTERY	B1 +VE		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
S5	NC	-	S8	NC		
S8	NC	-	R92	W		
R92	W	-	S15	NC		
S15	NC	-	S14	NC		
S14	NC	-	S13	NC		

FROM	PIN		TO	PIN	INSTALLED	CHECKED
R19	A	-	R15	A		
R15	A	-	R92	A		
R92	A	-	R41	FLY-2		
R41	FLY-2	-	R58	A		
R58	A	-	R55	A		

S19	NO-2	-	BATTERY	B2 -VE		

Music From Outer Space
SoundLab Console Wiring (1)

FROM	PIN		TO	PIN	INSTALLED	CHECKED
SK4	TIP	-	R23	FLY-1		
R23	FLY-2	-	C22	FLY-1		
R84	FLY-1	-	R85	C		
R52	FLY-1	-	R58	C		
R50	FLY-1	-	R55	C		
R94	FLY-1	-	R90	A		
R104	FLY-1	-	R29	A		
R32	FLY-1	-	R37	C		
R41	FLY-1	-	R37	A		

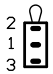
D4	ANODE	-	R11	A		
D3	CATHODE	-	R10	A		
R6	FLY-1	-	S3	COM		
D3	ANODE	-	R6	FLY-2		
D4	CATHODE	-	R6	FLY-1		

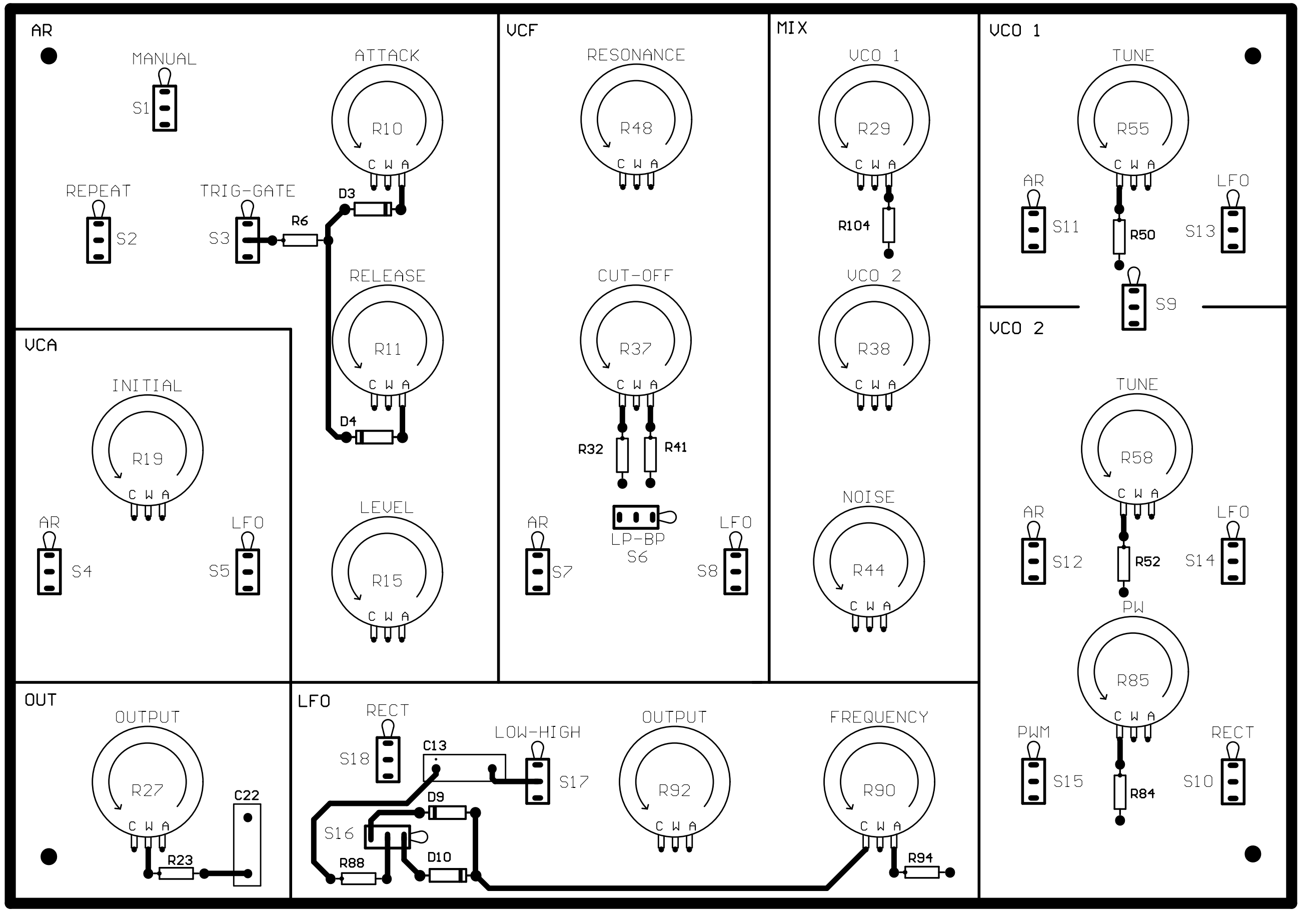
D9	CATHODE	-	S16	NO		
D10	ANODE	-	S16	NC		
D9	ANODE	-	D10	CATHODE		

R88	FLY-1	-	S16	COM		
C13	FLY-1	-	S17	COM		
C13	FLY-2	-	R88	FLY-2		

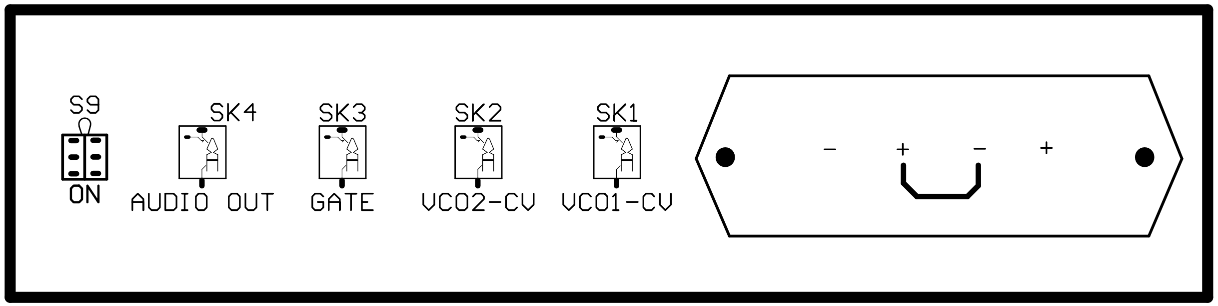
Pushbutton Switch	
1	COM
2	NC
3	NO

Toggle Switch	
1	NO
2	COM
3	NC





Ciew from rear of panels (component wiring side)

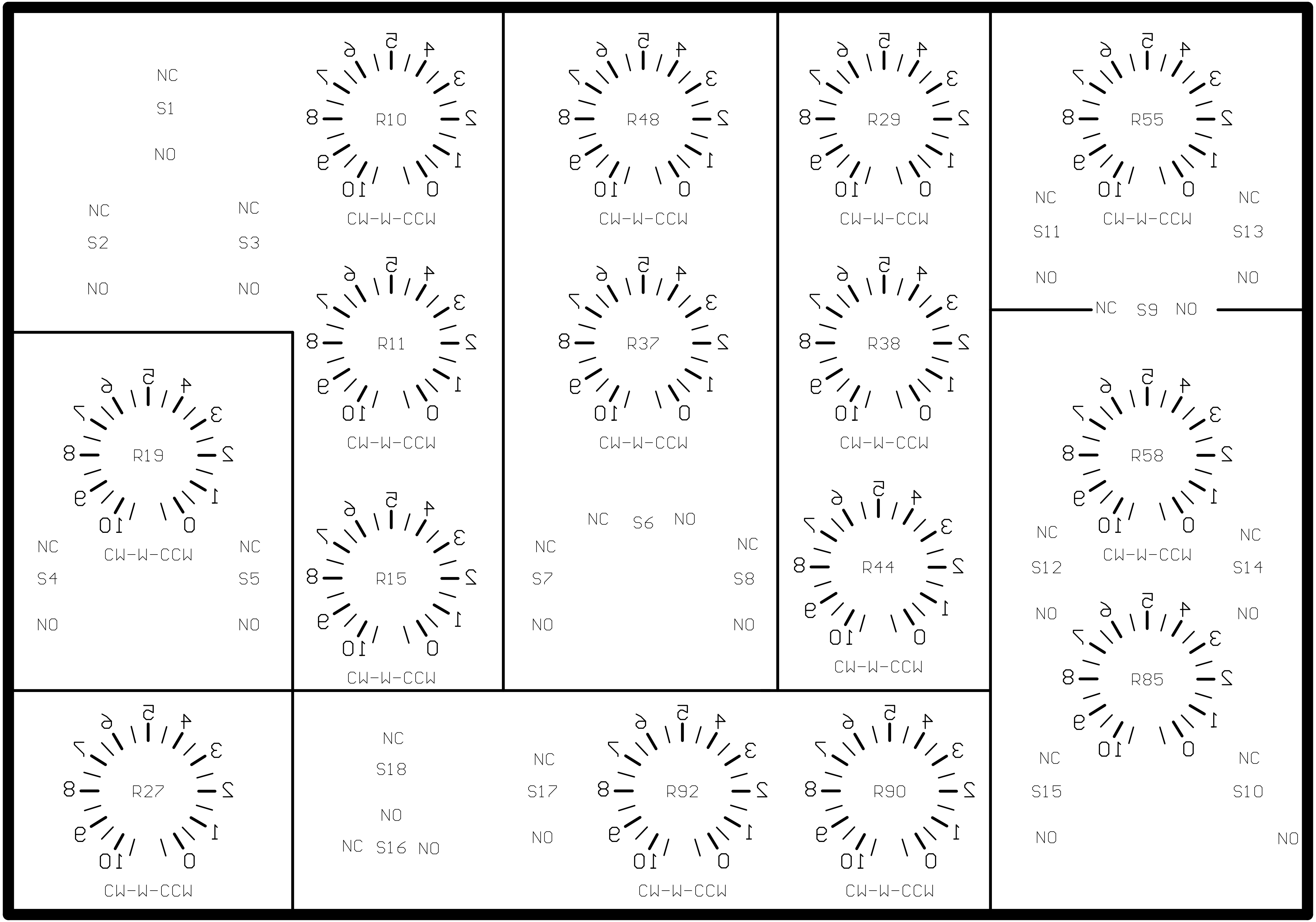


Elby Designs
Kariong, NSW 2250
Australia
www.elby-designs.com

SoundLab Console
Panel Wiring

All dimensions in millimeters unless stated otherwise.

(A3) Not to scale | Rev: 1 | Date: 06/06/08


NC
S1
NO
NC
S2
NO
NC
S3
NO
R10
R11
R15
R19
R27
R48
R37
R29
R38
R44
R55
R58
R85
R92
R90
NC
S4
NO
NC
S5
NO
NC
S6
NO
NC
S7
NO
NC
S8
NO
NC
S9
NO
NC
S11
NO
NC
S13
NO
NC
S12
NO
NC
S14
NO
NC
S15
NO
NC
S10
NO
NC
S18
NO
NC
S16
NO
NC
S17
NO