

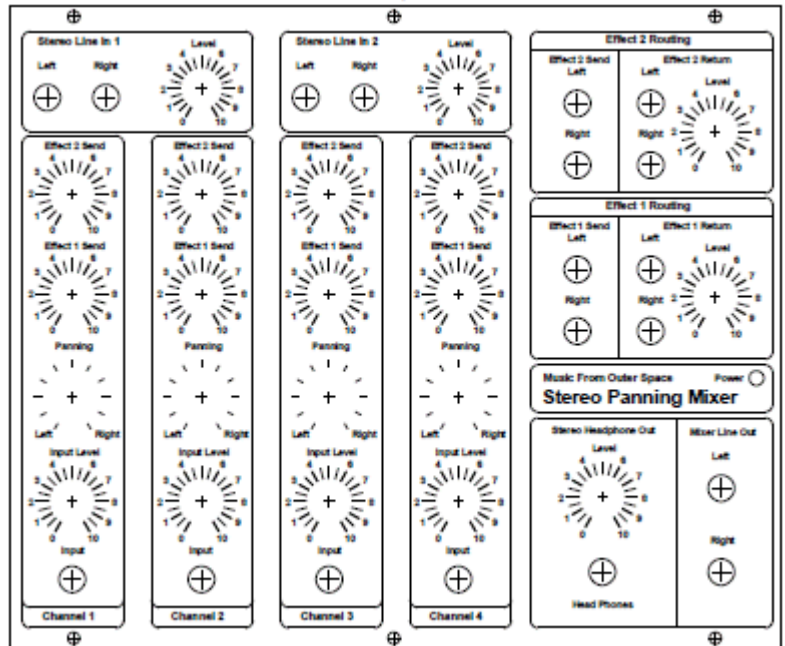
Stereo Mixer (+/-12V to +/-15V)

Article by Ray Wilson

This is an intermediate to advanced project and I do not recommend it as a first project if you are just getting started in synths or electronics. Only the circuit and some explanation are shown here. A lot of project building, troubleshooting and electronics experience is assumed. Additionally, electronic equipment ownership (scope, meters, etc.) is taken for granted. If you are interested in building this project please read the entire page before ordering PC boards to ensure that the information provided is thorough enough for you to complete the project successfully.

Features

- Four mono input channels each with Panning, Effect 1 Send and Effect 2 Send.
- Effect 1 and Effect 2 return can be used as additional stereo line inputs.
- Two stereo line inputs.
- Stereo Line Out
- Integral Stereo Headphone Amp
- Easy to add additional mono channels with another board.

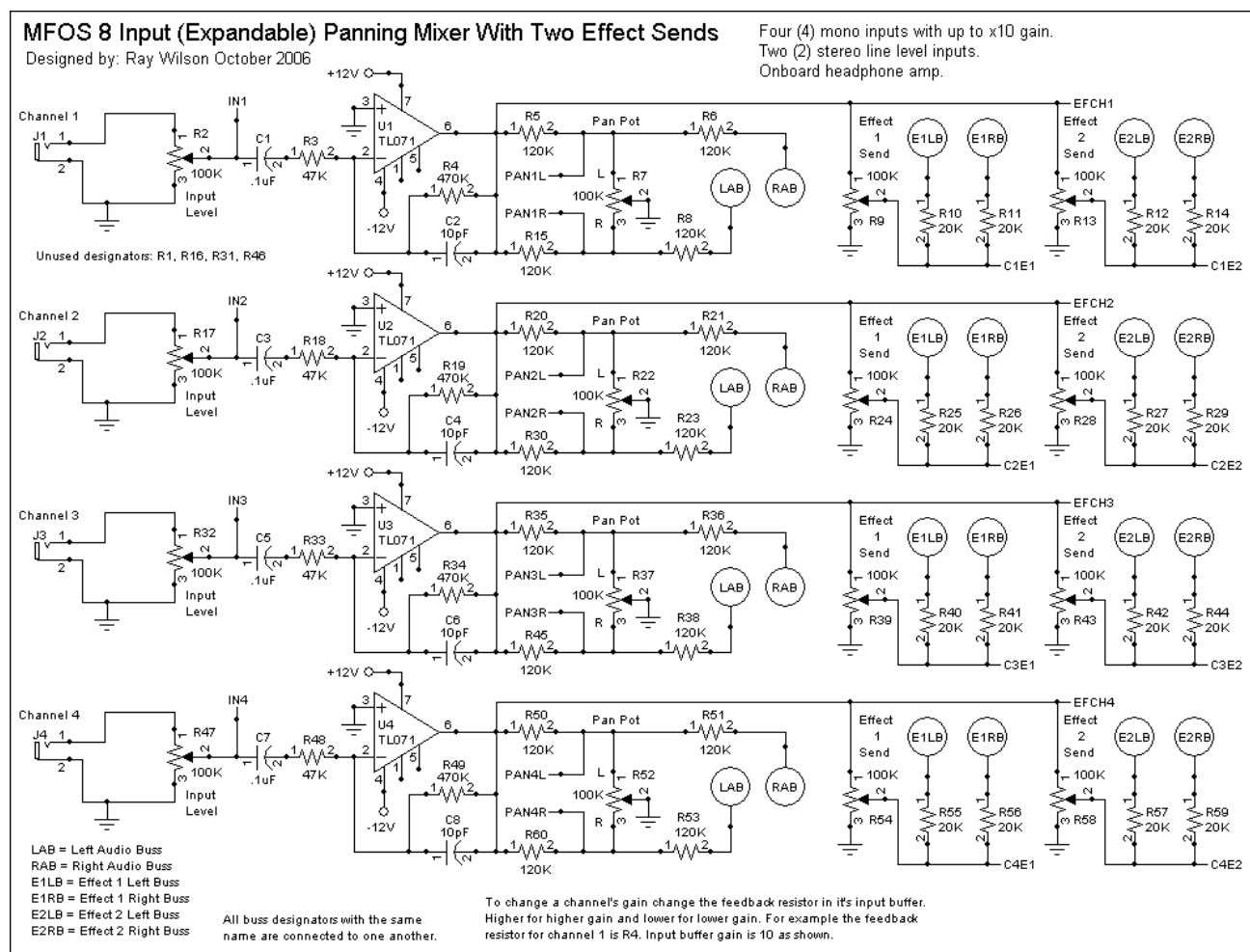


Introduction

Who in their right mind would *build* a mixer when you can *buy* a nice small Behringer Mixer for about 40 bucks? I don't know... probably me..., and maybe some other steely-eyed, hard-core, solder junkie, synth-diy'er *that's who* :-)

A versatile stereo mixer for use with your synth modules. You can easily change gains on the mono input channels to accommodate high-Z microphones (*not balanced input mics*), electric guitars or other instruments. By adding another board and populating only the mono inputs (or mono inputs and stereo input components) you can add more channels to the audio and effect busses of the first fully populated board. More details on this configuration can be found below.

Stereo Mixer Schematic Page 1 [PDF](#)



In the *Stereo Mixer* there are four mono input channels and four sets of stereo line inputs. Each mono input consists of a level pot, capacitively coupled to a buffer amplifier. Channel one for example has R2 (100K audio taper pot) as the input level control. The wiper is connected via C1 and R3 to U1 (TL071 low noise op amp) which provides a gain of 10.

Changing Channel Gains

Feedback resistors in any of the mono input channels can be independently adjusted to provide more or less gain for any channel. The formula for gain is very simple (feedback resistor value) divided by (input resistor value) or R_{FB}/R_{IN} . Each channel is shown with 47K input resistor and a 470K feedback resistor (giving a gain of 10 ($470,000/47,000$)). To decrease the input channel gain to 1.0 (for high level synth signals) use 470K resistors for the buffer input resistors (R3, R18, R33, R48). To increase the input channel gain to about 21 change the feedback resistors in the input buffers to 1M (R4, R19, R34, R49). Use the formula above to tailor the gain to your needs.

The small capacitor across the feedback resistor is there to prevent oscillation since the op-amps are not set for a gain of one. The channel 1 buffer feeds its panning circuit R5,R6,R7,R15,R8 which is used to send the signal to the right and left audio buss. The pan pot R7 brings the junction of R5,R6 or R15,R8 closer to or further from ground which causes the signal through either path to be attenuated when the wiper connected to ground is brought close to either one. This causes the signals being fed to the right and left audio buss to appear to be biased either left or right in the stereo field.

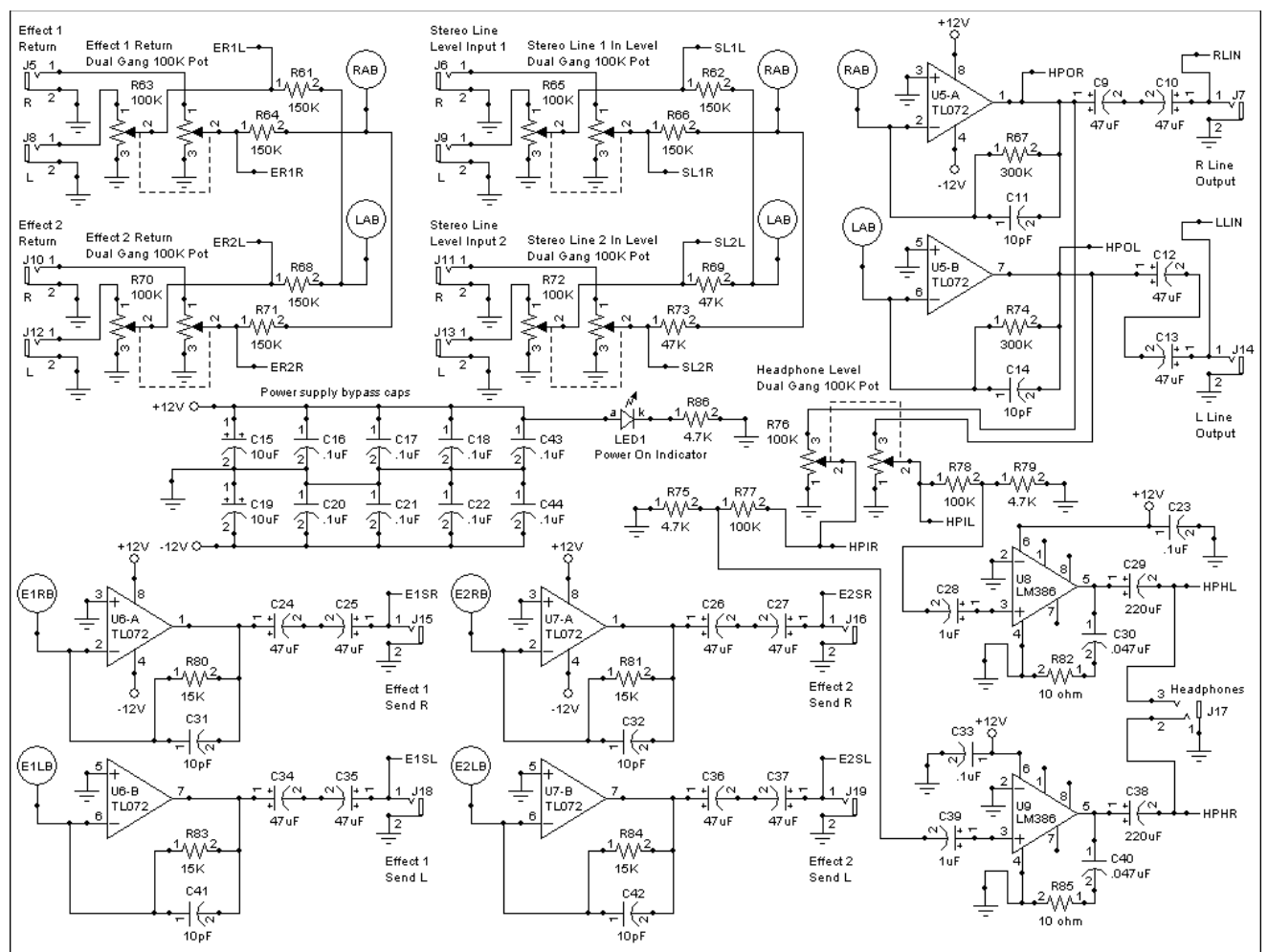
The channel buffer output also feeds the effect send pots for the channel. Each effect send pot has two resistors connected to its wiper that are fed to the effect buffer busses. The effect buffers for Effect Send 1 are U6-A and U6-B (TI072 dual low noise op amp). The effect buffers for Effect Send 2 are U7-A and U7-B (TI072 dual low noise op amp). The audio buss buffers are U5-A and U5-B (TI072

dual low noise op amp).

The output of the audio buss buffers are used to feed headphone level pot R76 (dual audio taper 100K pot) whose wiper feed the headphone amps (U8 and U9 LM386 low voltage audio power amplifiers) via attenuators (R75 & R77 and R78 & R79). The effect returns and stereo line inputs are fed to the audio buss via the pots used as attenuators for each of the input pairs and the summing resistors. This is a very simple design and gains can be changed anywhere in the circuit by changing the values of individual summing resistors or feedback resistors in any of the op amp circuits.

If you want more input channels you can build another board but do not add the audio buss buffers, effect send buffers, or headphone amplifiers. Connect the second boards busses to the completely assembled board and it will provide the buffers for all channels. See part layouts highlighting what I mean below. **It goes without saying (but obviously I'm saying it) that the second board will also need to be connected to the power supply.**

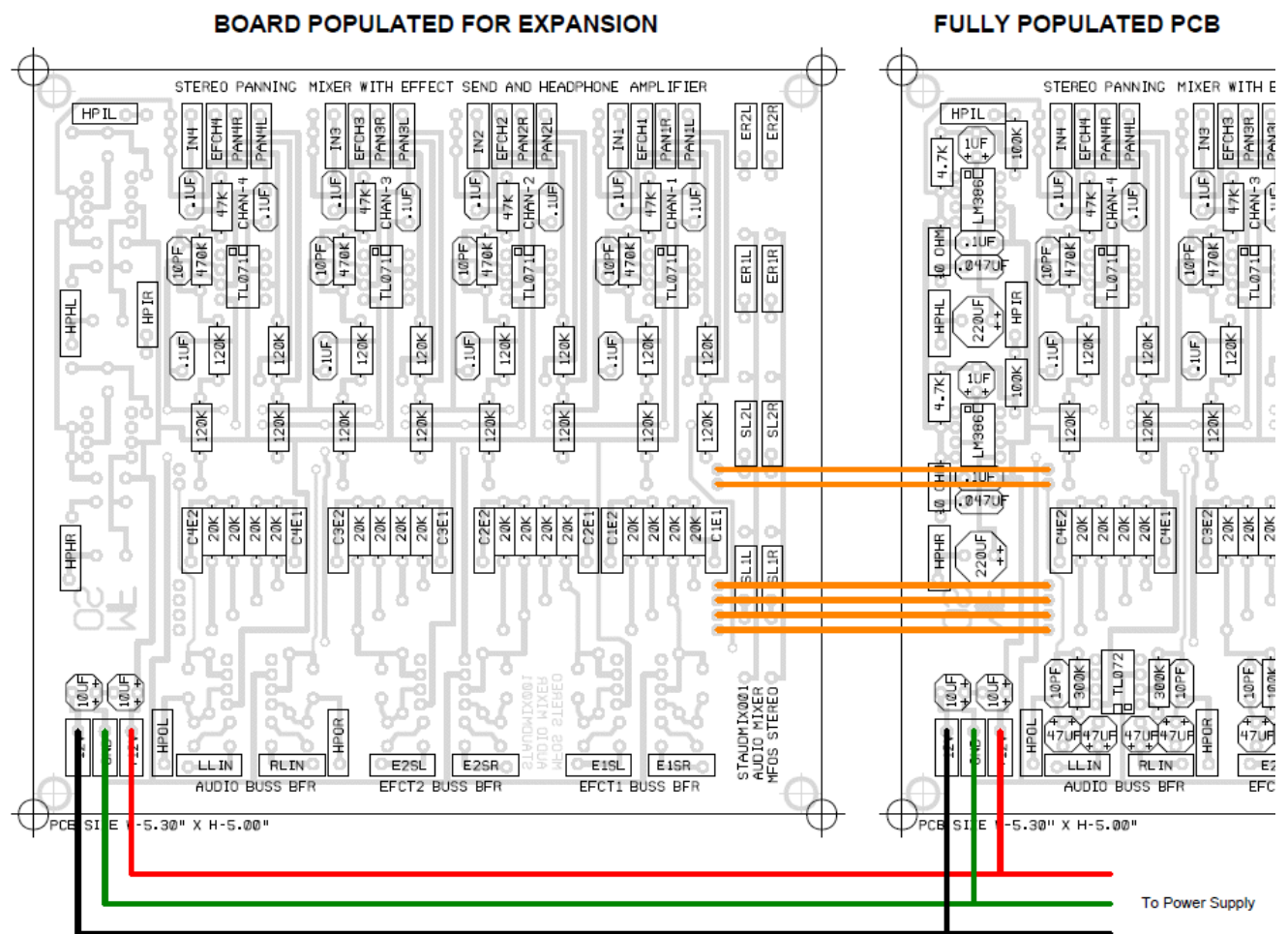
Stereo Mixer Schematic Page 2 [PDF](#)



Stereo Mixer Expanding For More Input Channels

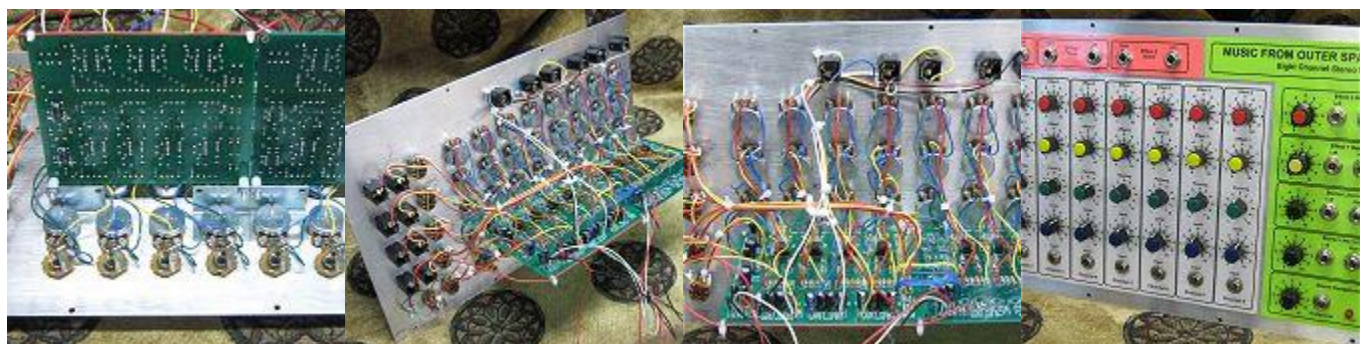
To expand to eight mono input channels you use another board and only populate the mono input sections. You can populate the stereo line input components too if you want more stereo line inputs. **Both boards must be powered from the supply and ground.** Run jumpers from the partially populated (expander) board to the fully populated board to bring the mono channels to the stereo buss, effect busses and headphone amplifiers. Of course you need another set of pots and jacks for the four mono input channels. They should be wired in the same manner as the original four channels. **I don't**

know a better way to explain this but if I have not described using another board for expansion clearly enough please consult one of your electronically oriented friends to see if they can help. Good luck.



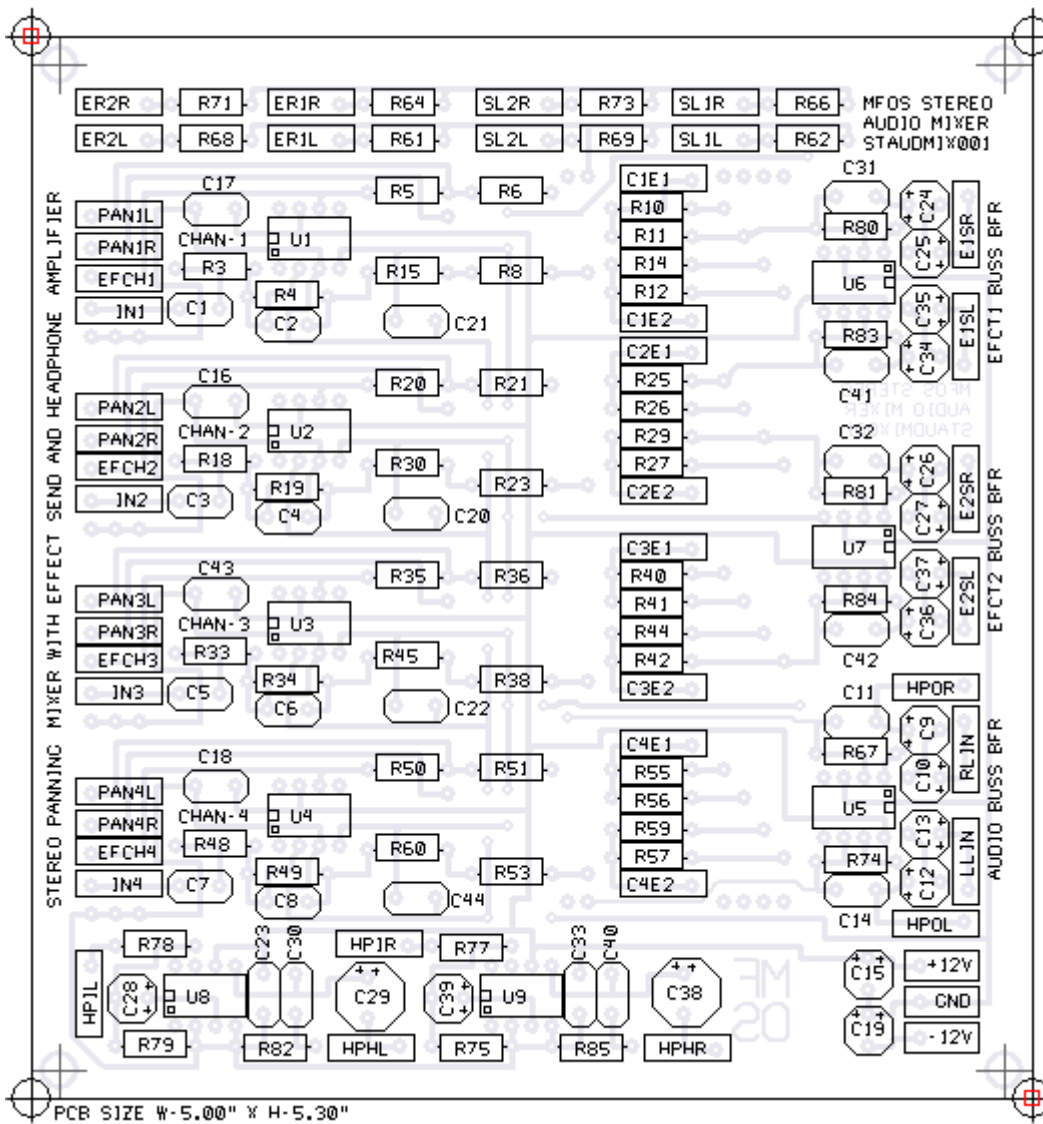
Some Pics Of My Expanded Eight Channel Mixer

You can see how the one board is fully populated with components but the second board only has the components to support the additional input channels.



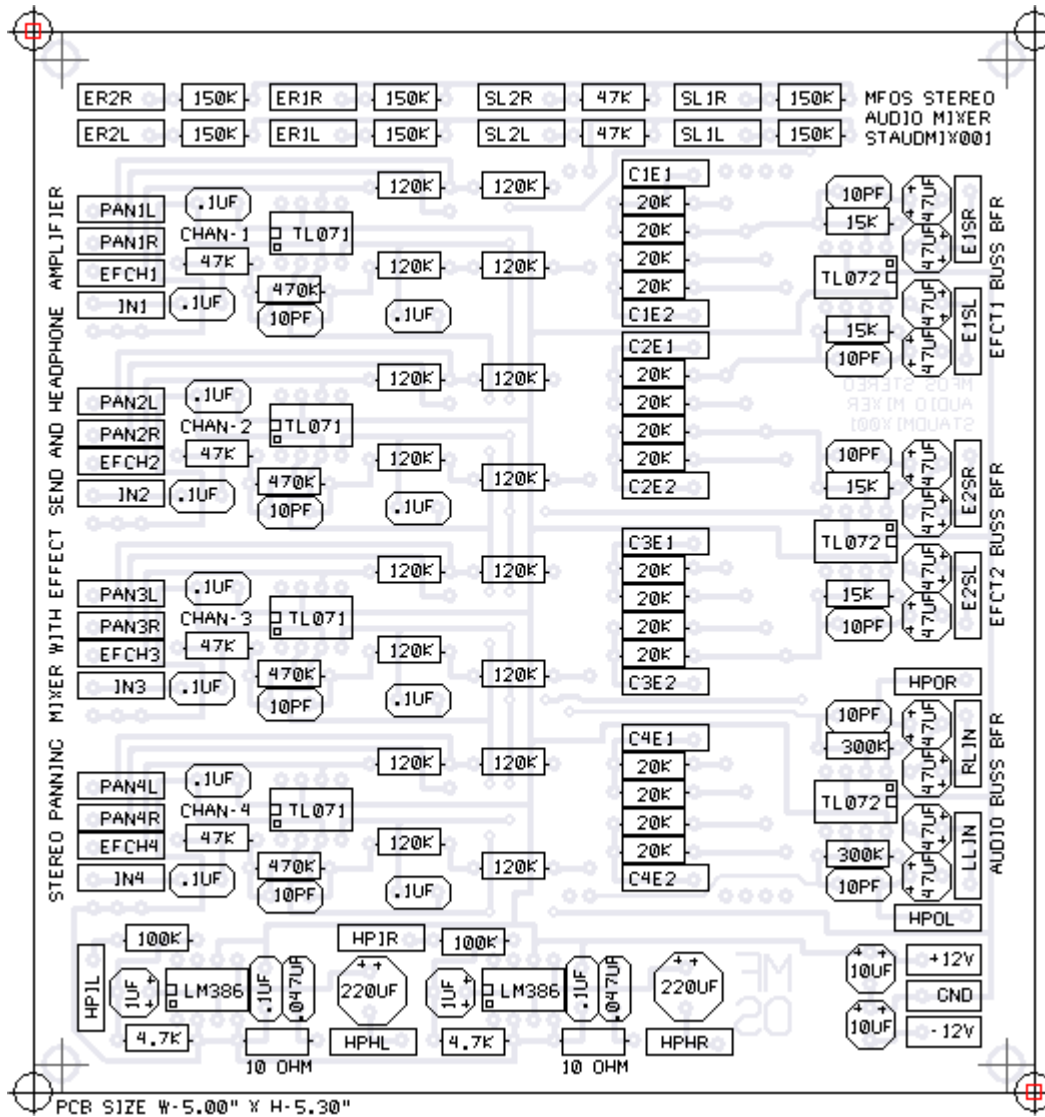
Approx. Current Consumption	
+12V	31 mA
-12V	19 mA
+15V	33 mA
-15V	19 mA

Stereo Mixer PCB Parts Layout (Parts Side Shown) [PDF](#)

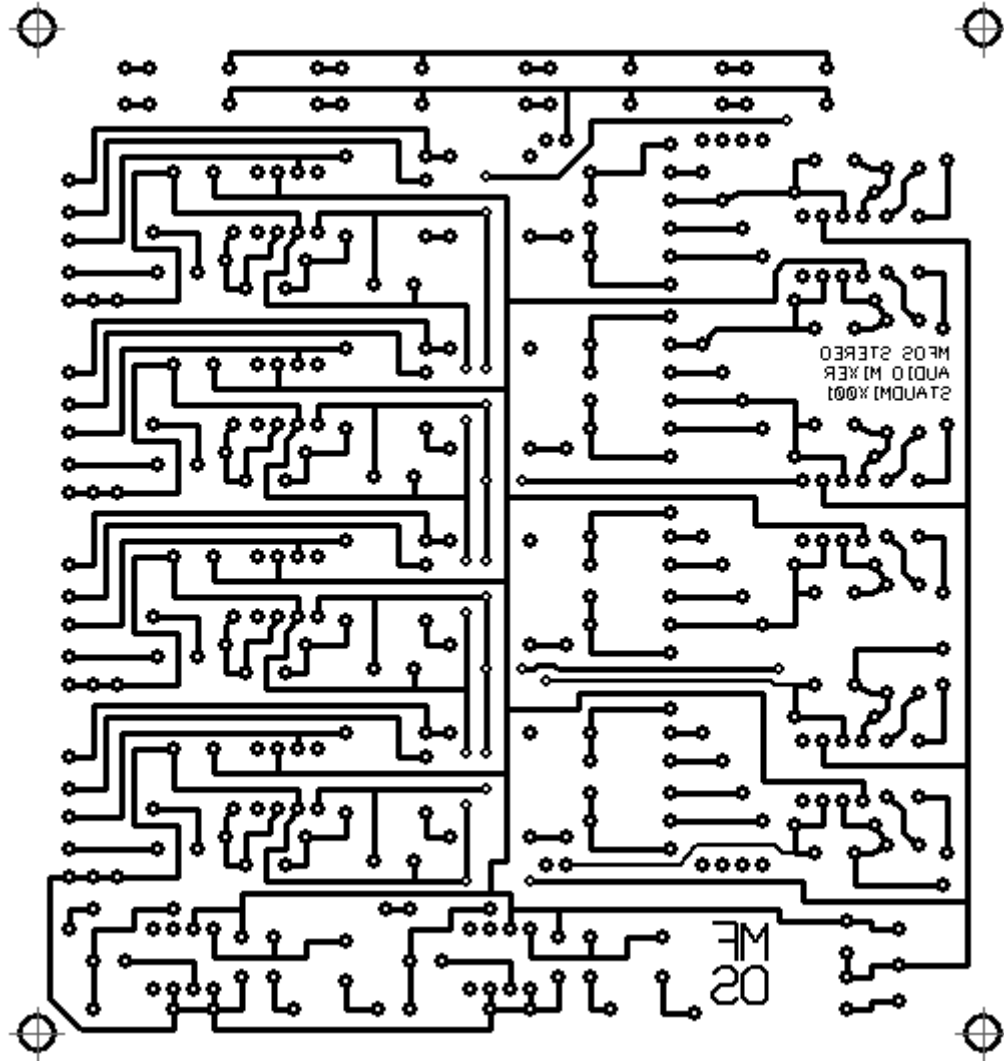


Stereo Mixer PCB Part Values Layout (Parts Side Shown) [PDF](#)

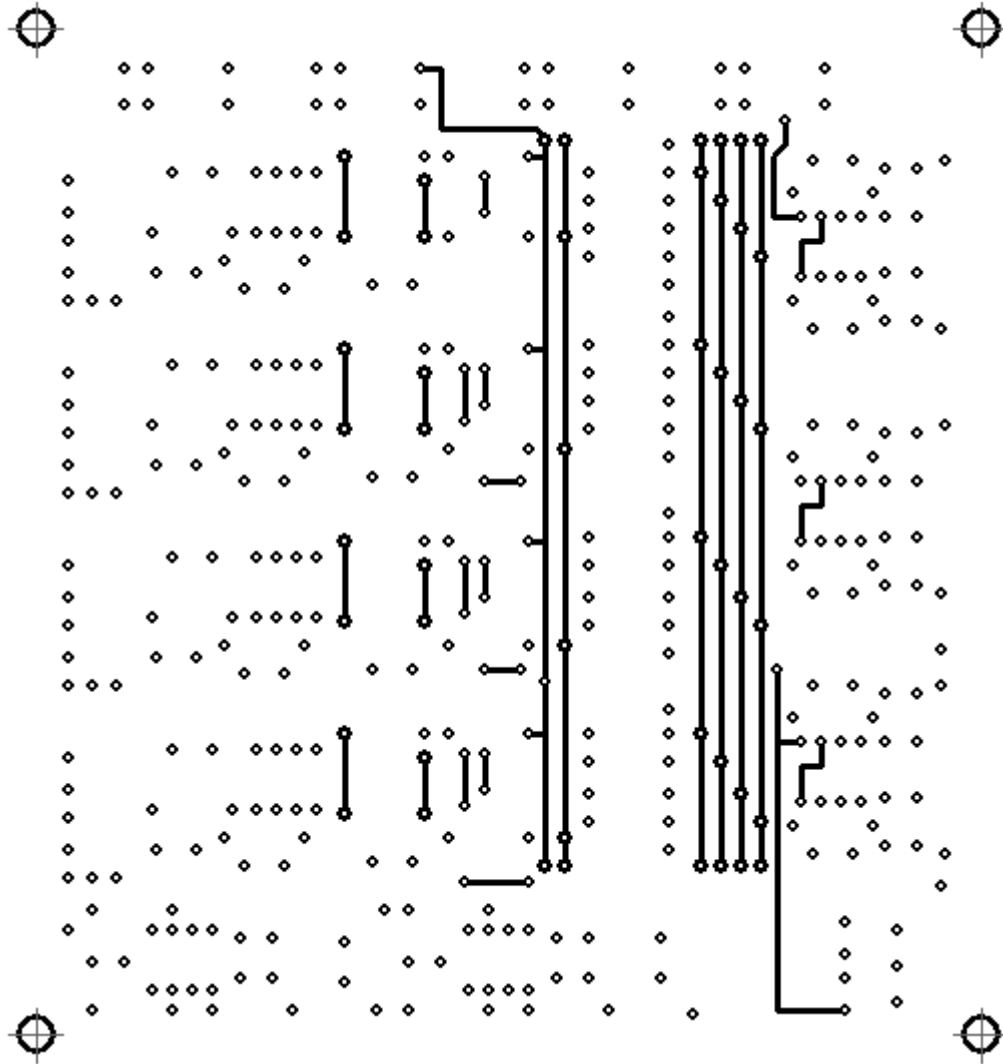
I find this view useful when I'm populating the board. I don't have to go back and forth from the designator to the value. It speeds up construction. Click the "Larger GIF" link and print the image as landscape.



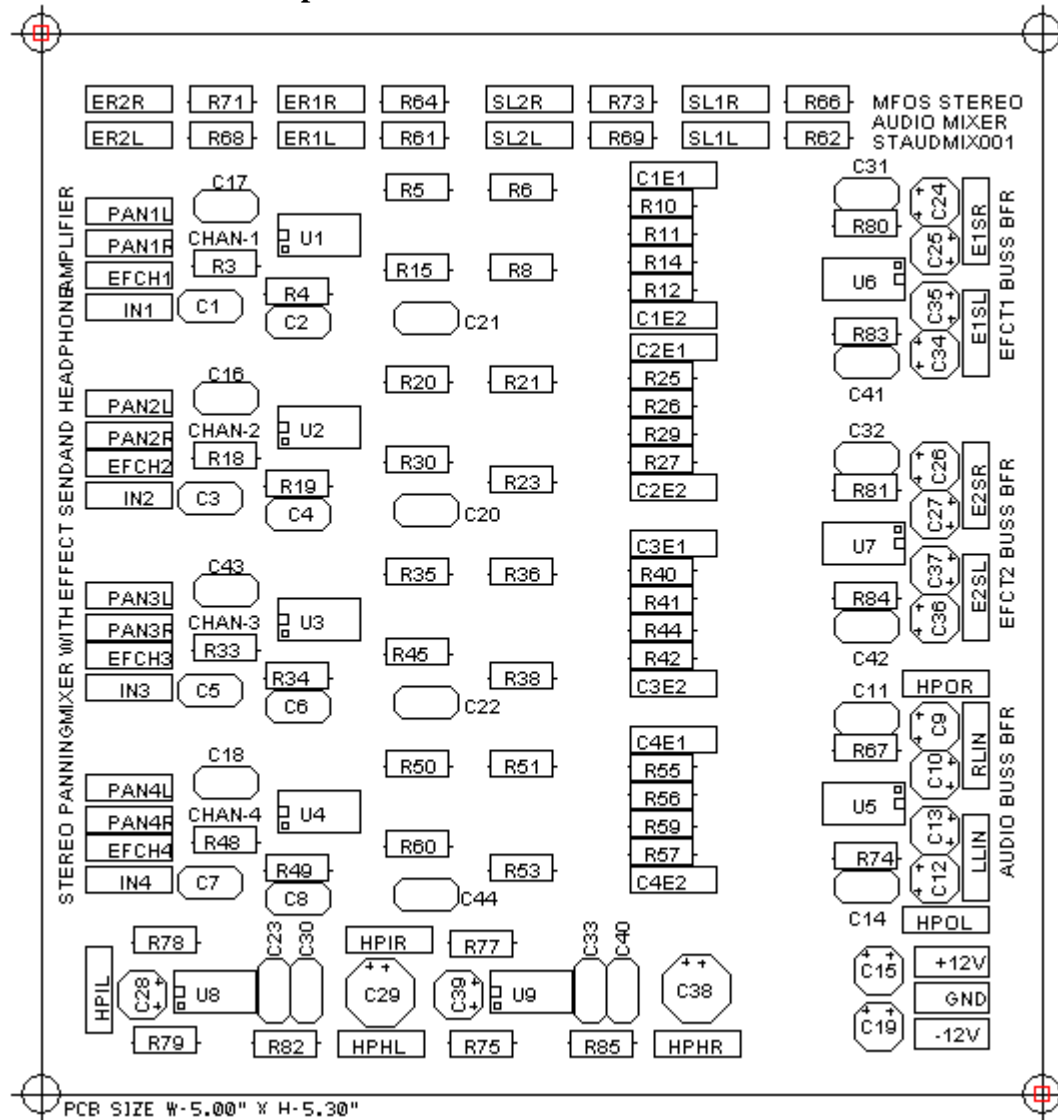
Stereo Mixer PCB Bottom Copper (Parts Side Shown)



Stereo Mixer PCB Top Copper(Parts Side Shown)



Stereo Mixer PCB Top Silk Screen



Panel Drawings Updated

I updated this panel drawing so that it is 10.5 inches wide and 8.75 inches tall. This panel will take up 3 bays of a synth panel designed for 2 rows of 5 modules using 3.5" x 8.75" inch modular panels. Here are links to the old documents for reference.

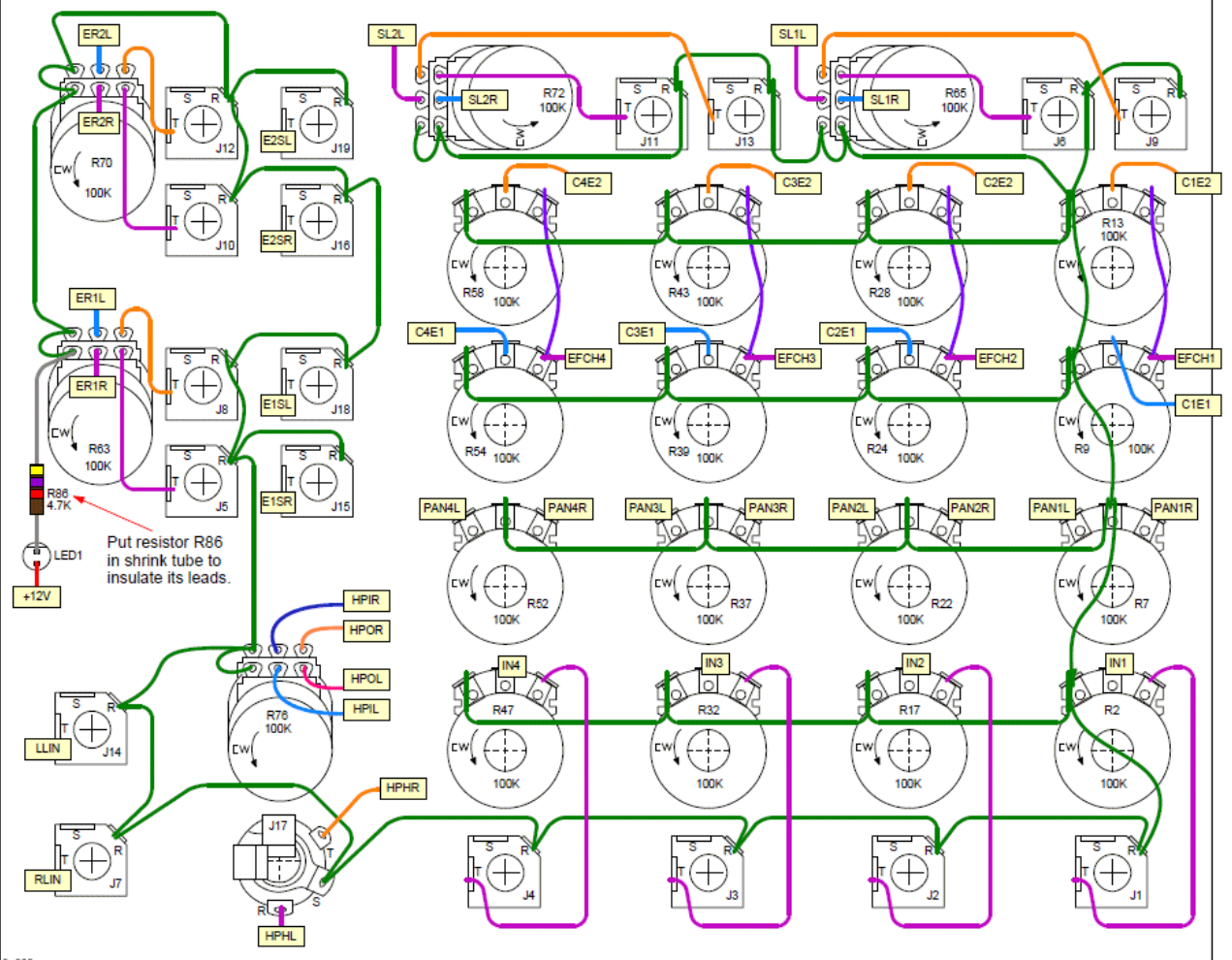
- [Old Front Panel Image](#)
- [Old Front Panel Wiring Image](#)
- [Old Front Panel PDF](#)
- [Old Front Panel Wiring PDF](#)

Stereo Mixer Front Panel and Wiring [PDF](#)

This wiring layout and front panel are only suggestions. The wiring drawing is meant to show how the front panel is connected to the wiring points on the PCB. Whether you use coax cable is up to you for the panel to board wiring. Don't write to me about this. You can also shield the unit by building it into an aluminum box.

MFOS Stereo Mixer Panel - Rear Wiring View

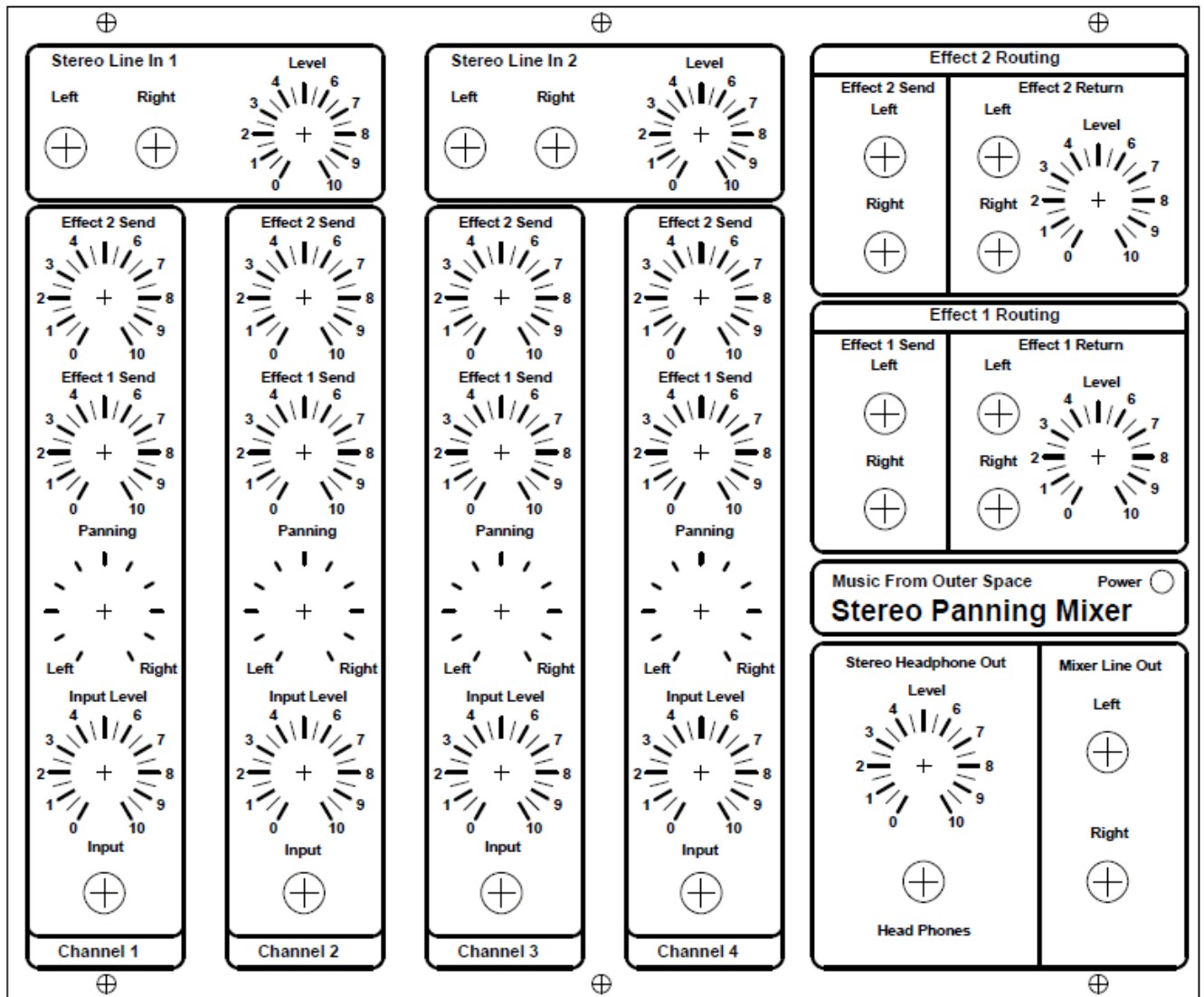
Jacks: T = Tip, R = Ring (ground), S = Switch (never used)



0.00"
0.00"
PANEL SIZE W-10.50" X H-8.75" X 0.063" AL 6061

Stereo Mixer Front Panel Overlay [PDF](#)

MFOS Stereo Mixer Panel - Three 3.5" module panels wide 10.5" x 8.75" tall



Stereo Mixer Project Parts List

- Lower noise higher performance (higher cost) Op-Amps are always welcome.
- Usually biFET amps (quads, duals, singles) can be replaced with an equivalent from another manufacturer.
- Capacitors can be film, ceramic, or silver mica.

Stereo Mixer Project Parts List

Qty.	Description	Value	Designators
4	TL071 Op Amp(s)	TL071	U1, U2, U3, U4
3	TL072 Dual Op Amp(s)	TL072	U5, U6, U7
2	LM386N-4 Low Voltage Audio Power Amp(s)	LM386N-4	U8, U9
1	LED	LED	LED1
2	Capacitor Electrolytic(s)	10uF	C19, C15
2	Capacitor Electrolytic(s)	1uF	C28, C39

2	Capacitor Electrolytic(s)	220uF	C29, C38
12	Capacitor Electrolytic(s)	47uF	C9, C12, C37, C24, C36, C27, C26, C34, C35, C25, C10, C13
2	Ceramic Capacitor(s)	.047uF	C40, C30
14	Ceramic Capacitor(s)	.1uF	C1, C3, C5, C7, C16, C20, C17, C21, C18, C22, C23, C33, C44, C43
10	Ceramic Capacitor(s)	10pF	C2, C4, C6, C8, C32, C42, C41, C31, C14, C11
5	Dual Gang Pot(s) Audio Taper	100K	R63, R70, R65, R72, R76
12	Potentiometer(s) Audio Taper	100K	R2, R9, R13, R17, R24, R28, R32, R39, R43, R47, R54, R58
4	Potentiometer(s) Linear Taper	100K	R7, R22, R37, R52
21	Knobs		For all pots
2	Resistor 1/4 Watt 5%(s)	10 ohm	R82, R85
2	Resistor 1/4 Watt 5%(s)	100K	R77, R78
16	Resistor 1/4 Watt 5%(s)	120K	R5, R6, R15, R8, R20, R21, R30, R23, R35, R36, R45, R38, R50, R51, R60, R53
6	Resistor 1/4 Watt 5%(s)	150K	R61, R68, R64, R71, R66, R62
4	Resistor 1/4 Watt 5%(s)	15K	R80, R83, R81, R84
16	Resistor 1/4 Watt 5%(s)	20K	R10, R12, R11, R14, R25, R27, R26, R29, R40, R42, R41, R44, R55, R57, R56, R59
2	Resistor 1/4 Watt 5%(s)	300K	R67, R74
3	Resistor 1/4 Watt 5%(s)	4.7K	R79, R75, R86
4	Resistor 1/4 Watt 5%(s)	470K	R4, R19, R34, R49
6	Resistor 1/4 Watt 5%(s)	47K	R3, R18, R33, R48, R69, R73
1	Stereo Headphone Jack	Stereo Jack	J17
18	1/4" Phone Jack(s)	Phone Jack	J2, J3, J4, J1, J7, J14, J15, J18, J16, J19, J5, J8, J10, J12, J6, J9, J11, J13

Miscellaneous

- 1/16" Thick aluminum plate for mounting the pots and switches.
- Unit is typically mounted in a synth case with other synth modules.
- Assorted hardware 1" 6-32 nuts and bolts, 1/2" #8 wood screws, etc
- **Lots of Knobs for potentiometers**, wire and solder.
- Digital Volt Meter and a Signal Tracer or oscilloscope for testing.