SubMix Master

Model 9120
Assembly and Using Manual

One of the problems that seems to get worse as time qoes by is an extreme lack of inputs in most recording studios. And project studios, as they evolve into things resembling the bridge of the next generation Enterprise, seem to have everything but enough inputs.

Craig Anderton attacks this problem with the insight that has become his hallmark and the result is the SubMix Master. Who else would think of a no—knob mixer. Most MIDI wonder machines are stereo, with onboard effects and panning, and can be mixed via MIDI control change messages. Once these keyboards are set up and hooked into a sequencer they are essentially “set and forget" devices, yet they still take up two inputs each on your board.

Studios with lots of effects have a similar problem: So many processors these days are stereo, that boards never seem to have enough returns.

The SubMix Master combines up to eight stereo or mono keyboards into a master stereo output. Panning, effects, and levels are taken care of at the MIDI instrument itself. Feeding the SubMix Master output into two mixer inputs frees up all the mixer inputs that would otherwise be occupied by keyboards.

PARTS LIST

Check the parts supplied with the kit against this parts list prior to beginning assembly. Report any shortages or discrepancies immediately.

2	270 ohm resistors (red—violet —brown)
18	10K ohm resistors (brown—black—orange)
2	22K ohm resistors (red—red—orange)
2	47pF ceramic disk capacitors (47)
2	0.1uF capacitors (104, 100n)
2	33uF, 25 volt electrolytic capacitors
1	5532 dual, low-noise, op-amp
10	Phone Jacks, open circuit, 1/4”
8	Phone Jacks, closed circuit, 1/4”
1	9120 SubMix Master printed circuit board
1	Wire Pack, #22 insulated, stranded, 24"
1	Plastic sleeve, #18, 0.042”, or similar small size, 12"

ASSEMBLY

CLEAN THE CIRCUIT BOARD

Shine the printed circuit board traces, if unplated, using steel wool or similar. No cleaning is necessary for plated, masked pcbs.

SOLDERING

Use a pencil type soldering iron with a small tip and a power ratinq of 25 to 35 watts. Soldering guns are completely unacceptable for assembling electronic circuits because the large magnetic field they generate can damage solid state components. Use only rosin core solder (tin/lead alloy is recommended). Do not use acid-core or paste flux for PAiA kits. Keep the solderinq iron tip clean and avoid excessive heat when soldering components in place.

INSTALL COMPONENTS ON THE CIRCUIT BOARD

Following the parts placement diagram (Figure 1), and the designations printed on the circuit board, install the following components on the circuit board in the order listed below. Clip excess component leads off flush with the top of connection after soldering in place. Save component leads for use in a later step.

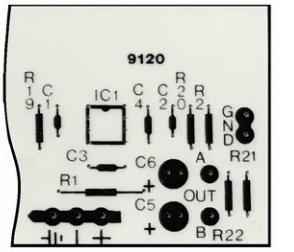
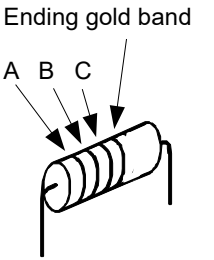


Figure 1
Parts Placement

RESISTORS

DESIGNATION	VALUE	COLOR CODE A-B-C
RI, R2	270 ohm	red-violet-brown
R19, R20	10K ohm	brown-black-orange
R21, R22	22K ohm	red-red-orange

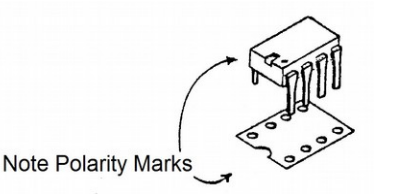
Resistors R3 through R18 will be installed in later steps.



INTEGRATED CIRCUIT

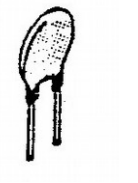
Install the 5532 IC. The notch or dot on one end of the integrated circuit aligns with the semi-circular key on the parts placement designator on the circuit board and shown in Figure 1.

IC1 5532



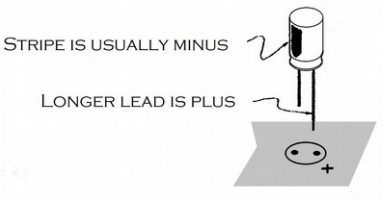
CAPACITORS

DESIGNATION	VALUE/'TYPE	MARKINGS
C1, C2	47pF CERAMIC DISC	47
C3, C4	0.1uF (100nF, 100000pF)	104



The following electrolytic capacitors are polarized and must be oriented according to the parts placement diagram and pc board designations.

Either the plus (+) or minus (-) lead of these capacitors may be marked. The plus lead must be installed in the circuit board hole marked (+) in order for the circuit to function.



DESIGNATION VALUE

C5, C6 33uF, 25V electrolytic capacitor

PANEL MOUNTED COMPONENTS

Orient the panel as illustrated in Figure 2. Notice the panel is up-side down and you will be working from the rear of the panel.

Studying the illustration, notice the circuit board is mounted directly on the sleeve lugs of open circuit phone jacks J1, J3, J5, J7, J9, J11, J13, and J15. Prior to installing these jacks on the panel, bend their sleeve lugs inward slightly to about a 90 degree angle to facilitate circuit board installation in a later step. Use the hardware supplied with the jacks to install the jacks on the panel.

MOUNT OPEN CIRCUIT PHONE JACKS ON THE PANEL

J1, J3, J5, J7, J9, J11, J13, and J15

Orient these jacks as illustrated in Figure 2, with their sleeve lugs parallel to the lower edge of the panel.

Mount open circuit phone jacks for outputs.

J17 and J18

Orient as illustrated in Figure 2 for easy wiring reference.

MOUNT CLOSED CIRCUIT PHONE JACKS ON THE PANEL

J2, J4, J6, J8, J10, J12, J14, and J16.

Orient these jacks so that their sleeve lugs are slightly off parallel with the upper edge of the panel (there is some leeway here). Adjust the position of these jacks so there is adequate

spacing between the lugs of the open circuit jacks previously installed. The objective in positioning these jacks is to keep the tip contacts from shorting when a plug is in the jack.

JACK LUG COMPONENT CONNECTIONS AND WIRING

In the following steps, lay the panel face down on your work surface. Orient the panel as illustrated in Figure 2 for easy reference. To ensure good solder flow you may wish to "tin" the lugs with a small amount of solder prior to making component connections.

Begin by connecting a 10K ohm resistor to the Tip lug (T) of J2, J4, J6, J8, J10, J12, J14, and J16, respectively. Leave about 1/4 inch of component lead between the connection and the body of the resistor (see Fig. 3A). For easy reference and ease of assembly, lay the resistor body across the center opening of the jack, inserting the lead through the T lug and solder. Trim the excess lead at the solder connection and bend the resistor perpendicular to the panel (see Fig. 3B).

Connect 10K ohm resistors (brown-black-orange) as follows:

J2-T
J4-T
J6-T
J8-T
J10-T
J12-T
J14-T
J16-T

Next make the wire jumper connections. Slip ½ inch of insulating plastic tubing over a length of resistor lead saved from previous steps. Insert the lead between each of the following jack lugs (see Fig. 3C). Solder only as directed below. *s1=solder 1, point*

POINT	to	POINT	
J2-T		J1-X	s1, J2
J4-T		J3-X	s1, J4
J6-T		J5-X	s1, J6
J8-T		J7-X	s1, J8
J10-T		J9-X	s1, J10
J12-T		J11-X	s1, J12
J14-T		J13-X	s1, J14
J16-T		J15-X	s1, J16

In a manner similar to resistor installation in previous steps, install 10K ohm resistors on the following jack lugs, leaving approximately 1/4 inch of component lead between the resistor body and the solder lug. Insert the resistor from the same side that the wire jumper inserts (see Fig. 3D). Clip excess leads and bend outwards after soldering (see Fig. 3E). *s2=solder 2*

J1-T	s2
J3-T	s2
J5-T	s2
J7-T	s2
J9-T	s2
J11-T	s2
J13-T	s2
J15-T	s2

SLEEVE LUG CONNECTIONS

Following Figure 2, connect the Sleeve (S) lugs of Jacks J2, 4, 6, 8, 10, 12, 14, and 16 using a 1-1/4 inch length of the insulated, stranded wire. Prepare each wire by cutting to the length specified below and stripping 1/4 inch of insulation from each end. Twist the exposed strands and "tin" by flowing a small amount of solder into the strands.

Make the following Sleeve (S) connections. *s1=solder 1, point*

POINT	to	POINT	SOLDER
J2-S		J4-S	s1, J2
J4-S		J6-S	s1, J4
J6-S		J8-S	s1, J6
J8-S		J10-S	s1, J8
J10-S		J12-S	s1, J10
J12-S		J14-S	s1, J12
J14-S		J16-S	s1, J14

J16-S will be soldered in the following step.

Cut and prepare a 3 inch length of insulated wire. Connect one end at J16-S and solder the two wires on this terminal. The other end of this wire will connect to the circuit board in a later step.

INSPECT YOUR WORK

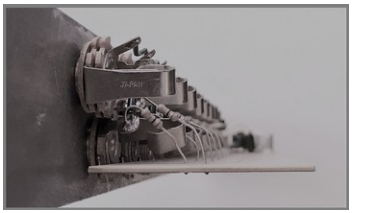
Carefully inspect the jacks to be sure that no lead clippings have lodged between jack's contacts or lugs, or, between the panel and the jacks.

CIRCUIT BOARD INSTALLATION

Check to be sure that the Sleeve (S) lugs of J1, J3, J5, J7, J9, J11, J13, and J15 are perpendicular to the panel. Make any necessary adjustments now. “Tin” the circuit board solder pads by melting a generous amount of solder on the pads to which the lugs will attach. Likewise, “tin” the jack sleeve lugs.

At this point, it is a good idea to insert a plug into Jack J1 for gauging the installation of the board so as to prevent possible obstruction.

Align the circuit board pads with the jack lugs oriented as illustrated in Figure 2 and in the image to the right. Notice the circuit board mounts on the inside of these jack lugs between the lug and jack center opening. While pressing the board against the lugs, heat each connection until the solder flows between the lug and solder pad.



Board mounts on jack sleeve lugs and at right angle to panel.

PANEL TO CIRCUIT BOARD CONNECTIONS

Insert the resistors extending from the jack lugs into the designated board locations and solder.

JACK	PC POINT
J1-T	R3
J2-T	R4
J3-T	R5
J4-T	R6
J5-T	R7
J6-T	R8
J7-T	R9
J8-T	R10
J9-T	R11
J10-T	R12
J11-T	R13
J12-T	R14

PANEL TO CIRCUIT BOARD CONNECTIONS, CONT.

J13-T	R15
J14-T	R16
J15-T	R17
J16-T	R18

Connect the wire extending from J16-S to either of the two holes at circuit board wiring point “GND” and solder.

Cut and prepare the following insulated wire lengths and make the following connections. *(s) solder, (s1) solder 1, (s2) solder 2,..., (ns) no solder*

WIRE	POINT	to	POINT
2-1/2 inch	J17-S (s1)		J18-S (ns)
2-1/2 inch	J18-S (s2)		pcb “GND” (s)
2-1/4 inch	J17-T (s1)		pcb “A” (s)
2-1/4 inch	J18-T (s1)		pcb “B” (s)

End of Assembly Steps

HOW IT WORKS

Many of today's keyboards feature stereo outputs, built-in effects, panning, and automated level control via MIDI control change cc7. In essence, they already have an automated mixer built-in, yet each keyboard takes up to two mixer inputs that will never be used to their full capacity. You can probably even trim the overall level with the synth's master level control. You don't necessarily need nifty faders, an effects bus, or mic preamps: What you need is more inputs.

The Submix Master accepts eight stereo or mono keyboard outputs and mixes them into a stereo pair. This feeds 2 inputs of your existing mixer, so you basically give up 2 inputs in order to get 16 more.

A 5532 dual op amp is the heart of the circuit. IC1B mixes together the eight left or “A” inputs (J1, J3, J5,..., J15) and IC1A mixes the eight right or "B" inputs (J2, J4, J6,...,J16). You'll notice no input coupling caps or level controls; they simply aren't necessary since you can adjust levels at the synth itself, and synth outputs are normally already capacitor-coupled. Also to minimize noise, the input impedance is restricted to 10K. This makes the Submix Master unsuited to passive and other high impedance outputs.

While not essential, C1 and C2 remove extreme high frequency signals. R1/C5 and R2/C6 couple the op-amp outputs to the subsequent mixer inputs; R21 and R22 bleed any charge off C5 and C6 to prevent "pops" when you plug the outputs into your mixer. C3 and C4 provide power supply bypassing. These are necessary only if the leads connectinq the op amps to their power supply exceed several inches, but it's good practice to leave the capacitors in, regardless.

The power supply can be any ±15VDC capable of delivering ±20mA. Two batteries will do in a pinch or bipolar supplies of lesser voltage; however, lower voltages decrease the available headroom, hence the signal to noise ratio.

USING THE SUBMIX MASTER

Operation is simple. Plug a keyboard's stereo outputs into any input jack pair (e.g., 1A and 1B). For mono synths, plug into only the A jack of the pair. Because of the way the input jacks are wired, this signal will appear in both channels and therefore end up in the center of the stereo spread.

It's also possible to weight a stereo signal left or right of center, although this uses up two input pairs. Plug the left output into In 1A. This places the signal in both channels.

Plug the right output into In 2B, and the stereo image will tilt toward the right.

To tilt the image to the left, plug the right output into In1A, the left output into In 2A, and insert a dummy plug into In 2B (this is necessary to defeat In 2B's switching action, which would otherwise send what was plugged into In 2A to both channels).

Plug the outputs into the two mixer inputs, which should be panned left and right.

MODIFICATIONS

R19 and R20 set the overall gain at x1 (unity). For more gain, install resistors with greater values at these locations according to the formula:

(desired gain) x 10,000 = new feedback resistor value

For example for a gain of five, use 50,000 ohms. However, too much gain may lead to distortion. Use a fractional gain value to attenuate the overall output level.

Circuit design by: Craig Anderton & Associates
Kit design and production: PAiA Electronics, Inc.