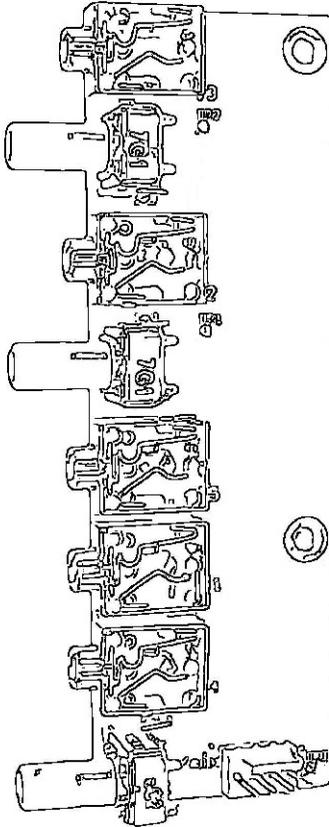




Dual CV Source + Attenuator/Mixer

Model 9744
Assembly and Using Manual



This second-generation 9700-series processing element for modular sound synthesizers is designed to provide great sound and excellent value.

A two-section, three-function module, the 9744 serves as a control voltage (CV) source, or, as patch-points for mixing or attenuating signals to & from other modules in a system.

The adjustable CV outputs can be used to set or bias parameters of voltage controlled modules. CV range is configurable for positive or negative 10V ranges, or, a 20 volt negative to positive range.

The patch-points section can be used to mix two audio or control signals, or, to attenuate or vary an audio or control signal from full amount to none.

This high-performance module is designed to be compatible with most modular synthesizer systems with little or no modification. Most active components are already mounted, making assembly a snap.

ASSEMBLING THE 9744 CV Source+Mixer/Attenuator

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. Check the parts supplied against the packing list at the back of this manual.

*In some cases, notes packed with the parts will be used to call your attention to special situations. **If parts are missing, please notify PAiA at missing@paia.com or by phone at (405) 340-6300, fax (405) 340-6378. A NOTES page is included at the end of this manual.***

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

DESIGNATION	DESC.	MARKING
() R27	100ohm	brn-blk-brn-gld

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. These pages may be removed for easy reference during assembly.

THE CIRCUIT BOARD

The 9744 CV Source is built on a double-sided circuit board. Note the “top” side of the board has the connector and control placement designators. Surface-mounted components are on the “bottom” of the board. Install parts to the top of the board and solder them on the bottom.

TOOLS

You'll need a minimum of tools to assemble the kit – a small pair of diagonal wire cutters, pliers, screwdriver, 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 in the SOLDERING section which follows.

SOLDERING

Select a soldering iron with a small tip and a power rating of 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 a high quality electronic solder. Your kit is compatible with lead-free and/or tin-lead flux-core solders made especially for electronic assembly. Plumbing solder will destroy your kit with its acid core. Jewelry solder (silver solder) will destroy your kit with its high working heat. Neither is for electronics work.

A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of the lead passing through it.

There are two improper connections to be aware of: Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a thin layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder.

Too much solder may produce a conducting bridge of excess solder between adjacent pads causing a short-circuit. Continued feeding of solder into a hot joint can result in accumulation on the underside of the board and may cause bridges or impede the action of mechanical components. If you see this, position the board above the iron tip and the excess will flow to the tip.

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

CONTROLS AND CONNECTORS

Controls and connectors will be installed on the top side of the board with the placement designators as shown in the illustration to the right.

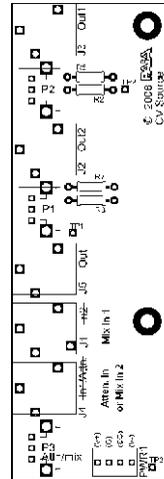
Miniature phone connectors referenced as “stereo phone jacks” in the manual parts list are specified below with the contact/terminal names, Tip, Ring and Sleeve (TRS) and are labeled on the board and schematic as such.

The potentiometers have tabs extending from their body for stability. They have a snap-fit to the board. Align the tabs and pins with their holes and press them into place. There is no need to bend the tabs or terminals.

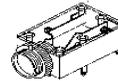
To ensure the best alignment with these parts with the front panel, begin by soldering only one of the multiple terminals associated with each of the following parts as it is installed. Then, if a part is tilted or crooked, it is only a matter of reheating the joint as the part is aligned.

Match the tab of the polarized power connector with the corresponding board marking.

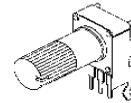
DESIG.	DESC.	MARKING
() J1	TRS socket, c.c.	4 terminals
() J2	TRS socket	3 terminals
() J3	TRS socket	3 terminals
() J4	TRS socket	3 terminals
() J5	TRS socket	3 terminals
() P1	10K ohm potentiometer, linear	B10K
() P2	10K ohm potentiometer, linear	B10K
() P3	100K ohm potentiometer, audio	A100K
() PWR1	Header	



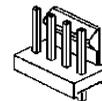
Top of circuit board



TRS socket
“stereo phone jack”



Potentiometer



Header

RESISTORS

Install resistors R2 and R3 for negative 10 to positive 10 volt CV, or, install wire jumpers at the R5 and R7 designations for zero to 10V CV.

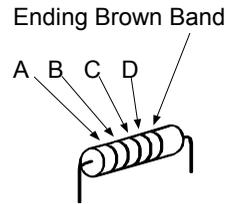
DESIG.	DESC.	MARKING A-B-C-D
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For 20 volt, -10 to +10 volt range:

() R2	2.49k	red-yellow-white-brown-brown
() R3	2.49k	red-yellow-white-brown-brown

For 10 volt, 0 to 10 volt range:

() R5	wire jumper (clipped resistor lead, or bare, solid wire)
() R7	wire jumper (clipped resistor lead, or bare, solid wire)



COMPLETION

The front panel is used for mounting the module in a rack system or cabinet. Complete the module assembly by mounting the 97xx PCB sub-assembly to the front panel as follows:

Referring to Fig. 1A of the illustration supplement, use the knurled phone jack nuts to secure the sub-assembly to the front panel. Check for clearance of the potentiometer shafts to ensure they rotate freely. Finger-tighten the phone jack nuts and then use the tips of the diagonal cutters to give them another quarter of a turn or so.

Complete the soldering of all multi-terminal parts. Take care the solder doesn't run through to the opposite side of the board when soldering the mounting tabs. With practice, it is possible to flow solder to cover the opening; otherwise, just flow a bit to secure the tab to the pad ring.

Cut a 3/8" (10mm) long shim sleeve for each pot from the length of polyethylene sleeve provided. Set the shafts fully counter-clockwise, slip the shims over the pot control shafts, put the knob in place with the pointer aligned to about a 7:00 setting, and use a small screwdriver to tighten the set-screw just enough that it grips.

POWERING AND TESTING

Power to the circuit is via a four-circuit, dual-polarity DC power supply. A power connector cable matches the header for connection with one of the PAiA 977x supplies at 15V or more. Connect the circuit labeled (+) to the positive DC source (V+), the circuit labeled (-) to the negative DC source (V-), the circuit labeled (G) to the power ground (G), and the circuit labeled (SG) to the signal ground (SG). For other supplies without separate signal and power grounds, use two wires to join the two grounds (G and SG) to the one ground (aka GND, 0VDC or common) at the supply.

Before applying power, check again, to be sure the wiring for the two DC polarities and that the polarized 4ckt connectors are as intended (see Fig.1B).

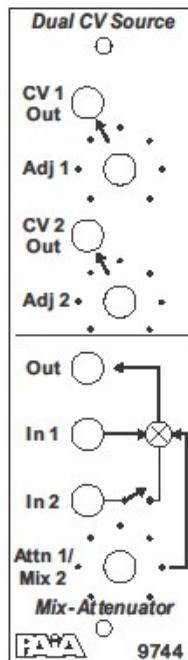
CV Outputs

A multimeter with a digital read-out may be used to test the CV1 and CV2 outputs by measuring the Tip and Sleeve circuits of the sockets (marked T and S on the bottom of the board) or the ends of a two-circuit TS patch cord. The black probe goes to the sleeve and the red probe to the tip. The negative range of dc output will be indicated with a minus symbol preceding the digits. To use a tester with a needle that swings across a scale, you'll need to reference the negative dc supply for the measurement so the needle doesn't try to swing left of its at rest, zero volt setting when the dc being measured is negative. In this instance, touch the black probe to the negative power supply circuit-board Test Point 2, TP2, and the red probe to, well since we're at the board level, terminal T for tip of either CV1 or CV2 output, or, the tip of a plug for a patch cord plugged into the connector being tested. The DC Voltage measured by the tester will range to 20 volts for the -10 to +10 configuration—10V for a 0 to 10 configuration. Only make the reference to TP2 if you anticipate a negative DC reading. Note the reading is offset when referencing the negative 12V supply and a 12V reading is actually zero volts DC—a 2V reading is -10VDC.

Attenuator/Mixer

The attenuation and mixing functions of the lower section of this module are most easily tested using two audio signal sources and an input to a mixer or amplifier connected for listening. One signal connected to In 2 is adjusted from minimum (attenuated) to maximum amount on through to the Out connector and following device. Two signals can be combined (mixed) or balanced by connecting one to In 1 AND the other to In 2. The Mix control will work to vary their relative amounts. Neither can be minimized to be eliminated, but if one is particularly strong and the other not so, then a balance between the two can be achieved.

Use two-circuit, Tip-Sleeve (TS or mono), cords for patching in or out of the Attenuator/Mixer section when connecting with external devices. Within a 9700-series system, either single conductor (Tip-only), or TS cords may be used. If this seems confusing, remember that a regular mono cable will always work for most home studios. PAiA equipment allows tip-only connections for professional applications where star grounding is required.

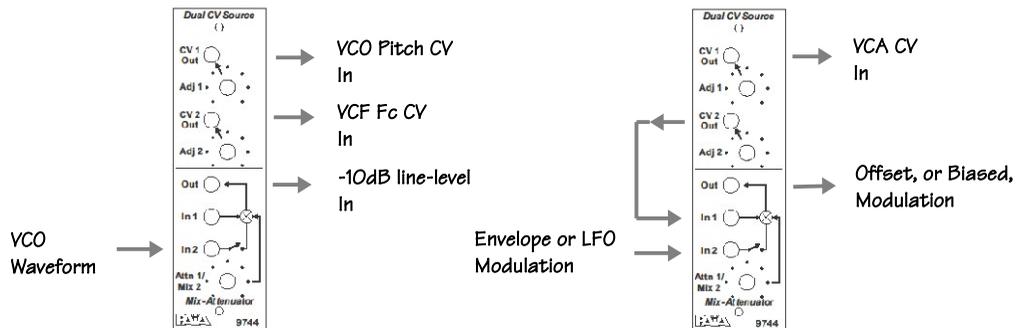


APPLICATIONS

Only connect the CV Source to inputs of modules. It is important that the outputs are not short-circuited with ground as could be the situation if a patch cord has contact between it's tip and sleeve circuits. The usual slip of the tip past the sleeve as a plug is inserted into a socket will be quick enough so as to not be a problem, but making the patch to the CV Source the second of the two connections will decrease any possible trouble with shorts. These are not power outputs, but DC voltage levels for use as Control Voltage sources.

Typical CV Source patches are to the Pitch CV input or Pulse Width CV input of a VCO or a VCF's Fc or Resonance CV input. A split can be made of the CV using a 9746 Patch Bay with one branch to an inverter. The other branch or tap from the 9746 will be a CV which follows the CV Adjust with the inverter section outputting an opposing range. This set-up patched to a Dual VCA such as the 9741 would work for a pan or left to right sweep of stereo signals patched through the VCAs. The 9745 Mixer, or even the mix section of this module, can be used to provide offset or a shift in range to a modulation CV.

Remember the Manual Transposer from the PAiA 4700 series? Connect a Pitch CV (exponential or V/Hz) through the In 2 of the Mixer and Out to a CV input of a VCO. Varying the Mix control will offset the pitch produced by the VCO.

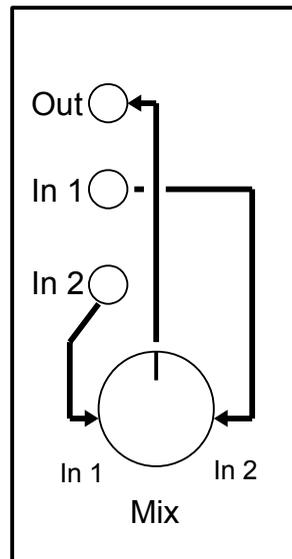
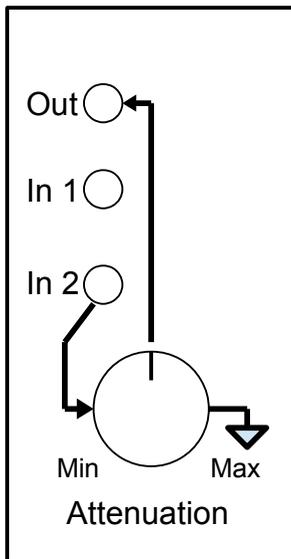


Notes

This manual includes the updates noted with a previous page and post dated 02/03/10.

Not updated are the board labels for Mix Inputs, In1 and In2. Please reference the page 4 illustration for the proper identification for the inputs via connectors J1 and J4.

The diagrams below detail the Attenuate and Mix functions that occur according to the connections to the section. With one signal connected to In 2, the panel control adjusts the amount of attenuation from minimum to maximum. With signals connected to In 1 and In 2, the panel control provides a mix or blend of the two.



Builder's Notes

Design Analysis

The Dual CV Source and combination Attenuator and Mixer module makes use of potentiometers as voltage dividers. In the CV section the voltage is tapped at a variable point in the resistive element resulting in voltage that ranges between limits set by the voltage(s) at the control extremes. Options exist for the potentiometer voltages to range either from zero to a unipolar voltage level (either positive or negative) or over a bi-polar negative to positive range. The Attenuator section divides an externally applied voltage which may be an audio signal voltage or a CV. The Mixer function makes use of the potentiometer in this section as a variable resistance. The setting of this control adjusts the amount of resistance between the signal source and a combination through a fixed resistor of a second signal source. Consider too, these mixing resistors are the upper branches of another voltage divider which results when the output is connected to the resistance or impedance of the following device.

When the CV Source is connected to a following device, it also becomes an extension to a complete circuit that results in another voltage divider. Modular synthesizer control inputs have high enough resistance or impedance that they don't work as a load on the voltage source—nearly all the voltage output from the CV Source will appear as adjusted to the input to which it feeds. Conversely, if the resistance of the input is low, the voltage will be less.

9744 Parts List

Please check the parts against this list. As you locate a part type and verify the quantity (and mounting hardware -- if required) check it off in the space provided.

Because we have introduced surface-mount parts with these kits, we are providing the printed circuit card as a sub-assembly with the surface-mount parts already in place.

Also, we want to make you aware that we are using both linear- and audio-taper potentiometers in some of the modules. They are marked differently so we are asking that you check carefully.

If anything is missing please notify PAiA at missing@paia.com or by phone at (405) 340-6300, fax (405) 340-6378.

Quan	Description	Ref Des	Marking
() 1	9744 PCB Sub-assembly, Dual CV Source + Mixer/Attenuator		
() 1	9744 Front Panel, Dual CV Source + Mixer/Attenuator		
() 2	10K ohm Potentiometer, 9 mm Snap-In, Linear	P1, P2	B10K
() 1	100K ohm Potentiometer, 9 mm Snap-In, Audio	P3	A100K
() 4	Phone Jack, Stereo, 3.5mm	J4, J2, J3, J5	
() 1	Phone Jack, Stereo, 3.5mm, w/switch	J1	
() 3	Knob, Set Screw		
() 1	Shim, Knob, Polyethylene Sleeve		
() 2	2.49K ohm Resistor, Metal Film, 1%, 1/4W, Axial	R2, R3	
() 1	Header, Vertical, 1row, 4pin	PWR1	
() 1	Cable Assembly, Power, 4-wire		
() 2	Screw, Self tap, #4 x 3/8, Pan Head Phillips, Black Oxide		

9744 Test Point Data

TP1	+12VDC
TP2	-12VDC
TP3	0VDC

9744 Power Requirements

Voltage	Current
+15VDC	7.1mA
-15VDC	7.1mA

9744 CV Source + Attenuator / Mixer