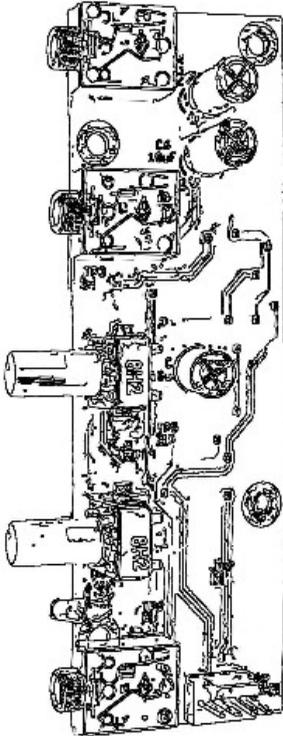




Balanced Modulator

Model 9748 Assembly and Using Manual



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

Audio signals applied to the inputs of the 9748 Balanced Modulator appear at the output, with added new frequencies which are the sums and differences of the applied signals. Create complex tones characteristic of bells and chimes. Frequency doubling and de-tuned short-wave radio or robotic voice effects are other possibilities with single or multiple signal sources as inputs. Features separate Carrier and Modulation Null controls for optimum results with a wide range of input signals.

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 9748 Balanced Modulator

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 9748 Balanced Modulator 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, LED

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. The LED indicator will also be installed at this time.

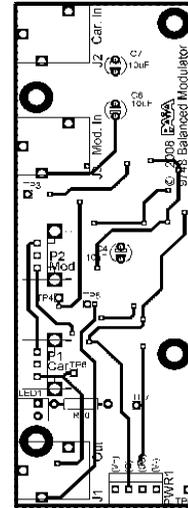
Miniature phone connectors referenced as “stereo phone jacks” in the manual parts list are specified below with the contact/terminal names, Tip, Ring and Sleeve (TRS) and are labeled on the board and schematic as such.

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.

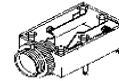
To ensure the best alignment with these parts with the front panel, begin by soldering only one of the multiple terminals associated with each of the following parts as it is installed. Then, if a part is tilted or crooked, it is only a matter of reheating the joint as the part is aligned.

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

DESIG.	DESC.	MARKING
() J1	TRS socket	
() J2	TRS socket	
() J3	TRS socket	
() LED1	Housed LED	
() P1	100K ohm potentiometer, linear	B100K
() P2	100K ohm potentiometer, linear	B100K
() PWR1	header	



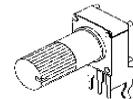
Top of circuit board



TRS socket
“stereo phone jack”



Housed LED



Potentiometer

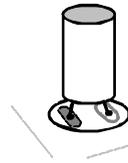


Header

CAPACITORS

Install the non-polarized electrolytic capacitor. Note that even though one leg is longer than the other and the board shows a difference for the two holes, either lead can go in either hole.

Solder each leg on the bottom of the board and clip the excess at the top of the joint.



Non-polarized electrolytic capacitor

- () C4 10uF/35v Non-Polar. Electrolytic Capacitor
- () C6 10uF/35v Non-Polar. Electrolytic Capacitor
- () C7 10uF/35v Non-Polar. Electrolytic Capacitor

COMPLETION

The front panel is used for mounting the module in a rack system or cabinet. Complete the module assembly by mounting the 9748 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.

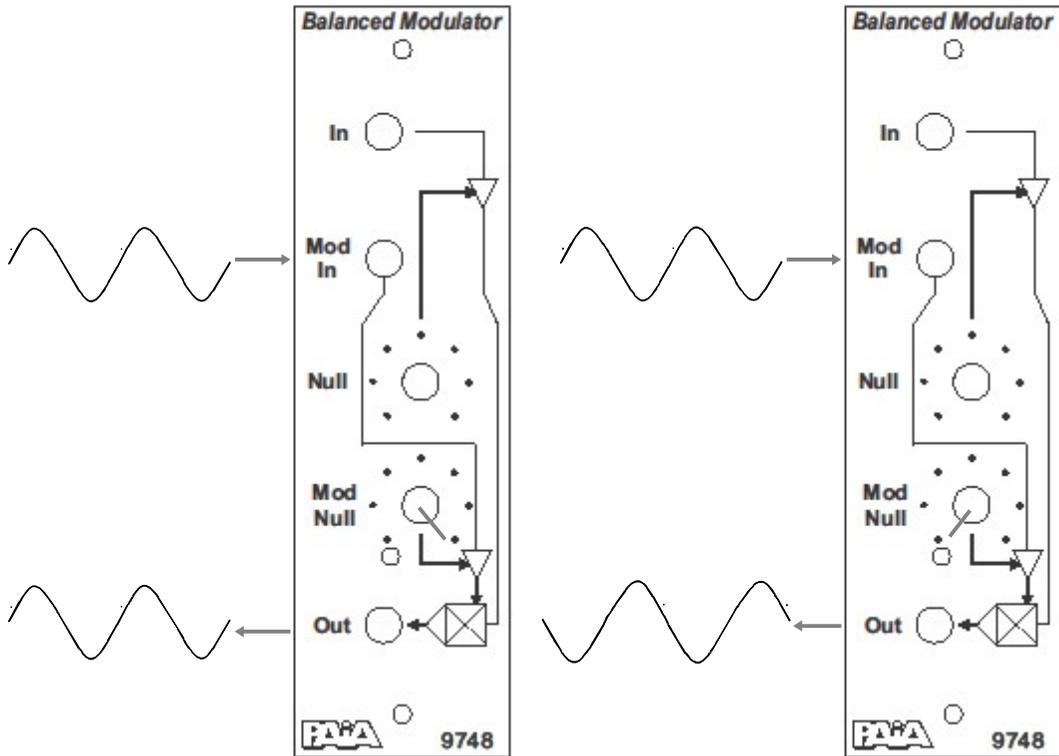
POWERING AND TESTING

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).

Use two-circuit, Tip-Sleeve (TS or mono), cords for patching in or out of the Balanced Modulator 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.

Connect a triangle or sine wave output from a 9720 VCO or similar to the Modulation Input (Mod In) of the 9748 Balanced Modulator. The VCO waves are about 4Vpp but the 9748 will accept up to 10vpp. It should be observed that rotation of the Modulation Null control (Mod Null) works to minimize the audio at the Output. The LED indicator dims for this null condition. A visualization of the Output signal with respect to the Input signal shows that as the Mod Null is advanced from the null condition, the resulting waveform is in-phase with the input signal—retarded from null the output is inverted.



Notes

Mounting holes are provided on the printed-circuit-board for custom applications.

Resistor R20 is not used in normal applications. If a different color LED is installed, a resistor may be installed here to optimize the current to the LED and its resulting intensity.

The use of unregulated power supplies with this module could attribute to hum in the output. If in a system with other 97xx modules, the regulated voltages can be tapped at test points as a solution.

P1 and P2 board labels conflict with schematic.

Builder's Notes

DESIGN ANALYSIS

The balanced modulator is built around a MC1496 balanced modulator/demodulator IC. The Carrier and Modulation input signals are capacitively coupled to resistive dividers R1/R2 and R10/R4, respectively, which feed the heterodyning mixer. Potentiometers P1 and P2 are used to adjust the null of the mixer and are brought out to the front panel to allow for interesting distortion options that aren't typically available from a balanced modulator. The output and LED driver consists of identical op-amp gain stages that both the output and signal level indicator.

9748 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
()	1	9748 PCB Sub-assembly, Balanced Modulator	
()	1	9748 Front Panel, Balanced Modulator	
()	2	100K ohm Potentiometer, 9 mm Snap-In, Linear	P1, P2
()	3	Phone Jack, Stereo, 3.5mm	J1, J2, J3
()	2	Knob, Set Screw	
()	1	Shim, Knob, Polyethylene Sleeve	
()	3	10uF, 35V Capacitor, Electrolytic, Non-Polarized, Radial	
()	1	LED, Yellow Diffused, RA, PCB Mount	
()	1	Header, Vertical, 1row, 4pin	

9748 Test Point Data

TP1	na	TP5	Output
TP2	na	TP6	+12 VDC
TP3	Modulation In	TP7	-12 VDC
TP4	Carrier In	TP8	0 VDC

9748 Power Requirements

Voltage	Current
+15 VDC	15.7 mA
-15 VDC	13.5 mA

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