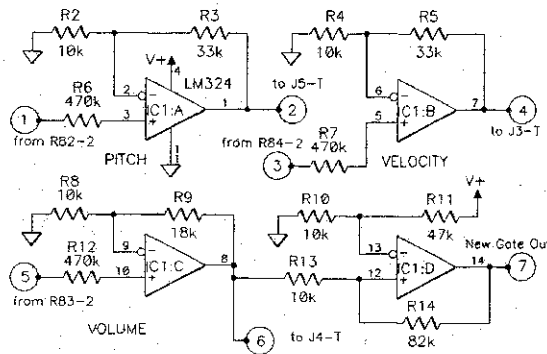
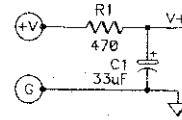




# Tmax Control Voltage Booster



## Model 9801k Assembly and Using Instructions



Op amp stages a-c are configured as voltage followers with gain while stage d is a Schmitt trigger that has a high output when the Volume exceeds a 2 Volt threshold.

While the 0 - 4 Volt CV Outputs of a stock Thermax are appropriate and adequate for most applications, this CV Booster amplifies them to cover a full 0 - 10V range.

The Booster also provides an alternative to the Velocity sensitive Gate signal of a stock Tmax. The new Volume Gate is based on the volume hand's position, not it's change in position, an easier skill to master.

A Tmax will give best results as a CV controller when tuned for Controller Mode as outlined in the manual. The Volume Trim control on the front panel has it's biggest effect on nulling the Volume CV Output. Trim changes that make little difference in the audio output level will make significant changes in the Volume CV.

With the Booster installed you may want to shorten the time constant of the velocity circuit to make it less sensitive to slow changes in hand position. Changing C26 from 10uF to 1uF is recommended and a capacitor is included with this kit. You may want to make it even smaller.

When using Tmax as a traditional theremin you will find that Volume and Velocity control settings need to be much lower than before the Booster was installed. High control settings may prevent the operation of Tmax internal circuitry but will do no damage.

### CV Booster Parts List

Qty	Description	Designation
1	LM324 Quad Op Amp	IC1
<b>Capacitors</b>		
1	33 uF 16V Electrolytic	C1
1	1 uF 16V Electrolytic	(see text)
<b>1/4W, 5% resistors</b>		
5	10k brown-black-orange	R2,R4,R8,R10,R13
1	18k brown-grey-orange	R9
2	33k orange-orange-orange	R3,R5
1	470 yellow-violet-brown	R1
3	470k yellow-violet-yellow	R6,R7,R12
1	47k yellow-violet-orange	R11
1	82k grey-red-orange	R14
<b>Misc.</b>		
1	36" #22 Stranded Wire	
1	9801 Circuit Board	

## THE CIRCUIT BOARD

The Tmax CV Booster is built on a single-sided circuit board. Before beginning assembly, clean oxidation from the copper side of the board using scouring cleanser and water. The copper should be bright and shiny before beginning assembly.

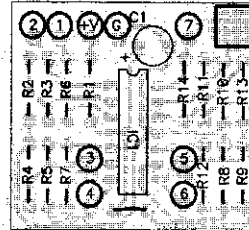
### SOLDERING

Select a soldering iron with a small tip and a power rating 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.

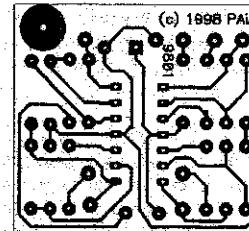
Use only rosin core solder (acid core solder is for plumbing, not electronics work). A proper solder joint has just enough solder to cover the soldering pad and about 1/16 inch of lead passing through it. There are two improper connections to beware of. Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder. If too much solder is used on a joint there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Accidental bridges can be cleaned off by holding the board upside down and flowing the excess solder off onto a clean, hot soldering iron.

Mount the circuit board components by passing their leads through the holes provided for them on the silk-screen legended side of the board and solder on the copper side. Clip off any excess component lead flush with the solder joint. Use care when mounting all components. Never force a component into place.

Check off each component as it is mounted. Resistors and disk capacitors are not polarized and may be mounted with either lead in either of the holes in the circuit board. The electrolytic capacitors and IC are polarized and must be oriented as shown in the illustrations.



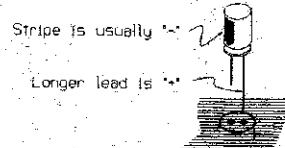
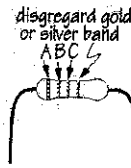
Components are mounted on the board in the locations shown. Phantom traces show connections between parts.



This foil pattern art will be useful if you need to check for solder bridges.

These parts are nonpolarized, either lead can go in either circuit board hole.

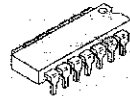
- |                                     |       |                      |
|-------------------------------------|-------|----------------------|
| Design.                             | Value | Color code A-B-C     |
| ( ) R2                              | 10k   | brown-black-orange   |
| also: ( ) R4 ( ) R8 ( ) R10 ( ) R13 |       |                      |
| ( ) R9                              | 18k   | brown-grey-orange    |
| ( ) R3                              | 33k   | orange-orange-orange |
| also: ( ) R5                        |       |                      |
| ( ) R1                              | 470   | yellow-violet-brown  |
| ( ) R6                              | 470k  | yellow-violet-yellow |
| also: ( ) R7 ( ) R12                |       |                      |
| ( ) R11                             | 47k   | yellow-violet-orange |
| ( ) R14                             | 82k   | grey-red-orange      |



These parts are polarized - observe orientation in the drawings

- |         |          |                        |
|---------|----------|------------------------|
| ( ) C1  | 33uF 16V | Electrolytic Capacitor |
| ( ) IC1 | LM324    | Quad Op Amp            |

Electrolytic capacitors  
LM324



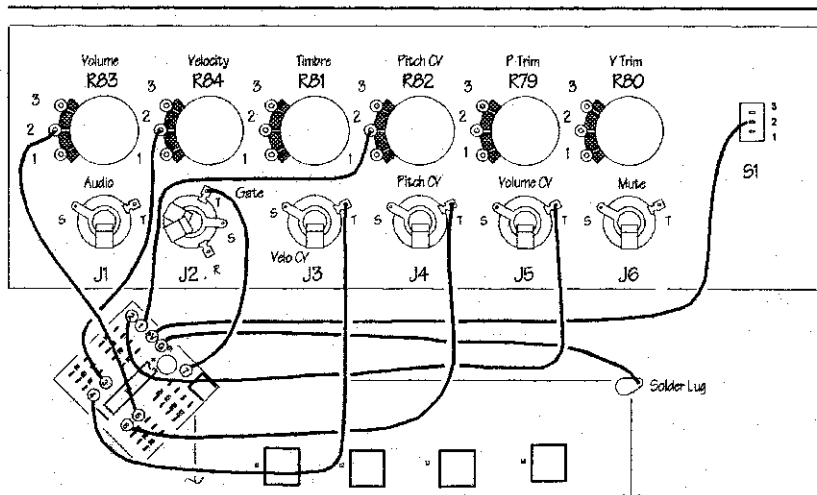
( ) Use a resistor lead clipping to form the circuit board jumper at the bottom of IC1. Solder in place.

This completes the installation of the circuit board mounted components. If you are installing the Booster in a PAIA Lectern case proceed by disconnecting existing front panel wiring from the following points and reconnecting them to the CV Booster board as follows:

Disconnect from	Reconnect to
( ) R82-2	"2"
( ) R83-2	"4"
( ) R84-2	"6"

Solder new wires between the circuit board and front panel controls. Prepare each wire by cutting it to the length specified and stripping 1/4" of insulation from each end. Twist and tin the exposed wire strands.

pc point	length	connect to
( ) +V	9 in.	S1-2
( ) "G"	8 in.	Ground Solder lug
( ) "5"	4 in.	R83-2
( ) "2"	6 in.	J4-T
( ) "4"	5 in.	R82-2
( ) "3"	3 in.	R84-2



The CV Booster board splices into the connections between Panel Controls and CV Output jacks. The Tmax circuit board is shown for orientation in mounting the Booster board and locating the ground solder lug. No connections are made to the Tmax circuit board.

There are several options on how to deal with the new Gate Output; adding a new jack to the panel, for instance.

The approach I took was to re-wire the present Gate Output jack (J2). I really didn't need the "S" trigger of the Velocity Gate so I disconnected it at J2-R.

Connecting point "7" of the 9801 board to J2-R would produce a short circuit at the output of the Booster's IC1:d stage if a mono plug were inserted, so instead I re-routed the Velo Gate output from J2-T to J2-R then connected the new Gate to the then-unused J2-T. This works great. A mono plug inserted fully into the jack accesses the Volume Gate (which I think is most useful). And the Velo Gate is still available either by using a TRS plug or inserting a mono plug only far enough to engage the Ring blade of the jack.

Mount the 9801 circuit board by removing the machine nut securing the corner of the Theremax circuit board and sliding the hole in the Booster board over the machine screw. Rotate the new circuit board as shown in the illustration and replace and tighten the nut to secure both boards.