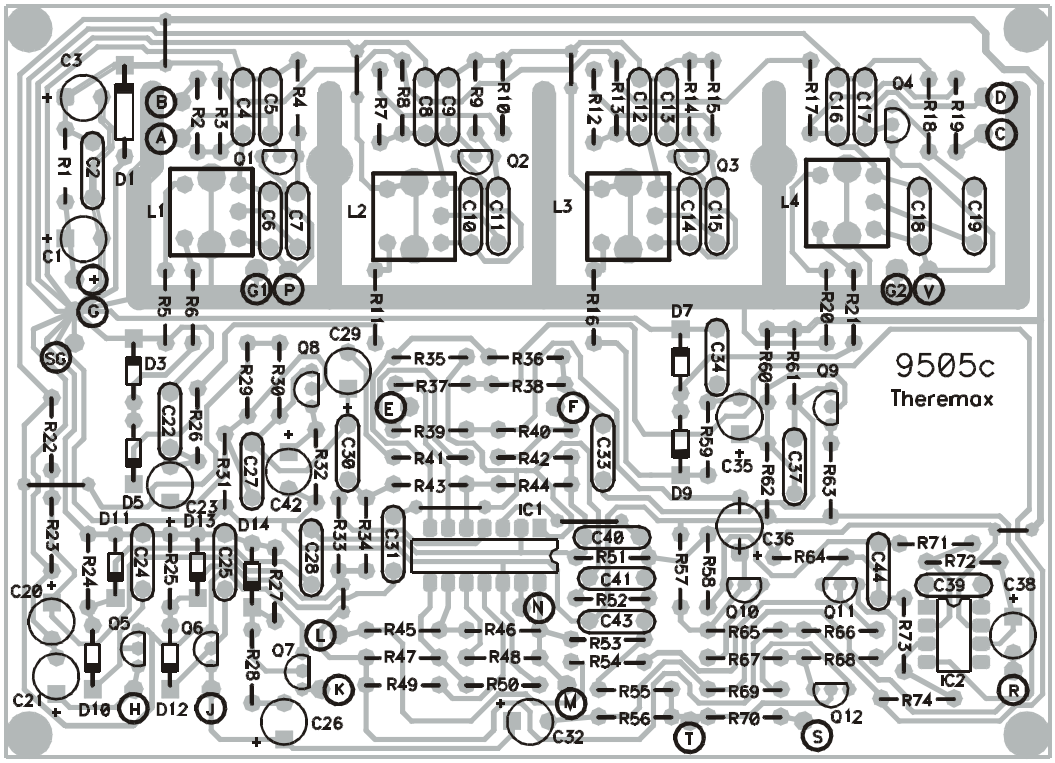


Fig 1. Components mount on the circuit board at the locations shown above. Solder-side conductors are shown in phantom view.

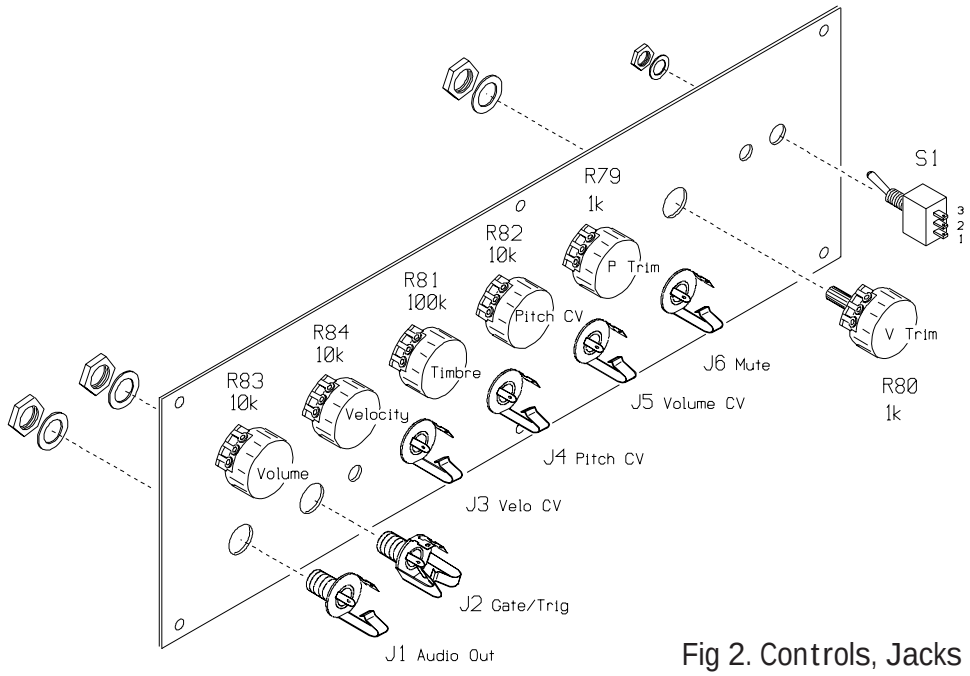


Fig 2. Controls, Jacks and Power Switch mount from the rear of the panel as shown. Orient parts as shown in fig 3 before tightening hardware.

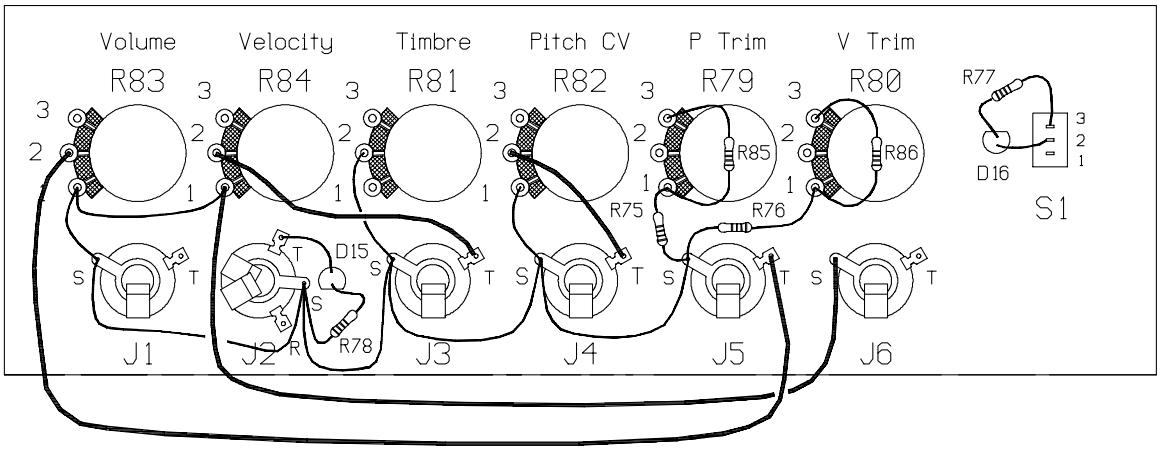


Fig 3. Bare wire and #22 insulated, stranded wire are used to make connections between front panel controls, jacks and switches. Note the resistors and LEDs that mount directly to solder lugs.

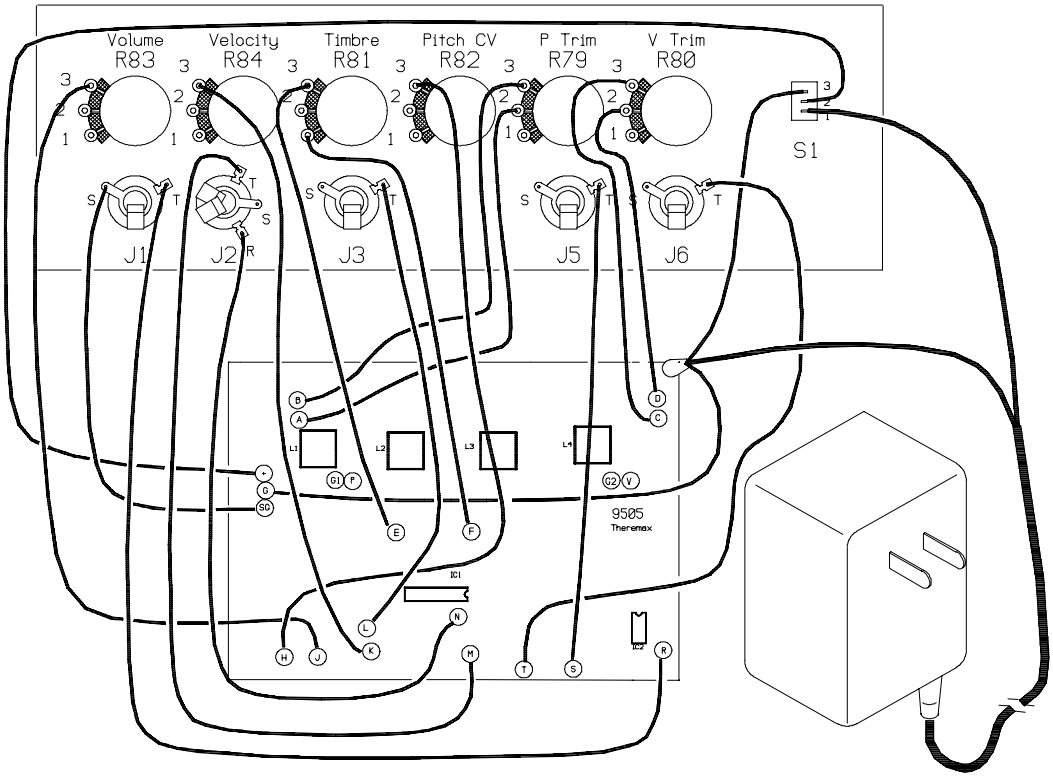


Fig 4. #22 insulated, stranded wire is used for connections between circuit board and front panel. Notice the solder lug which mounts under the circuit board mounting hardware and provides an important connection to the bottom plate.

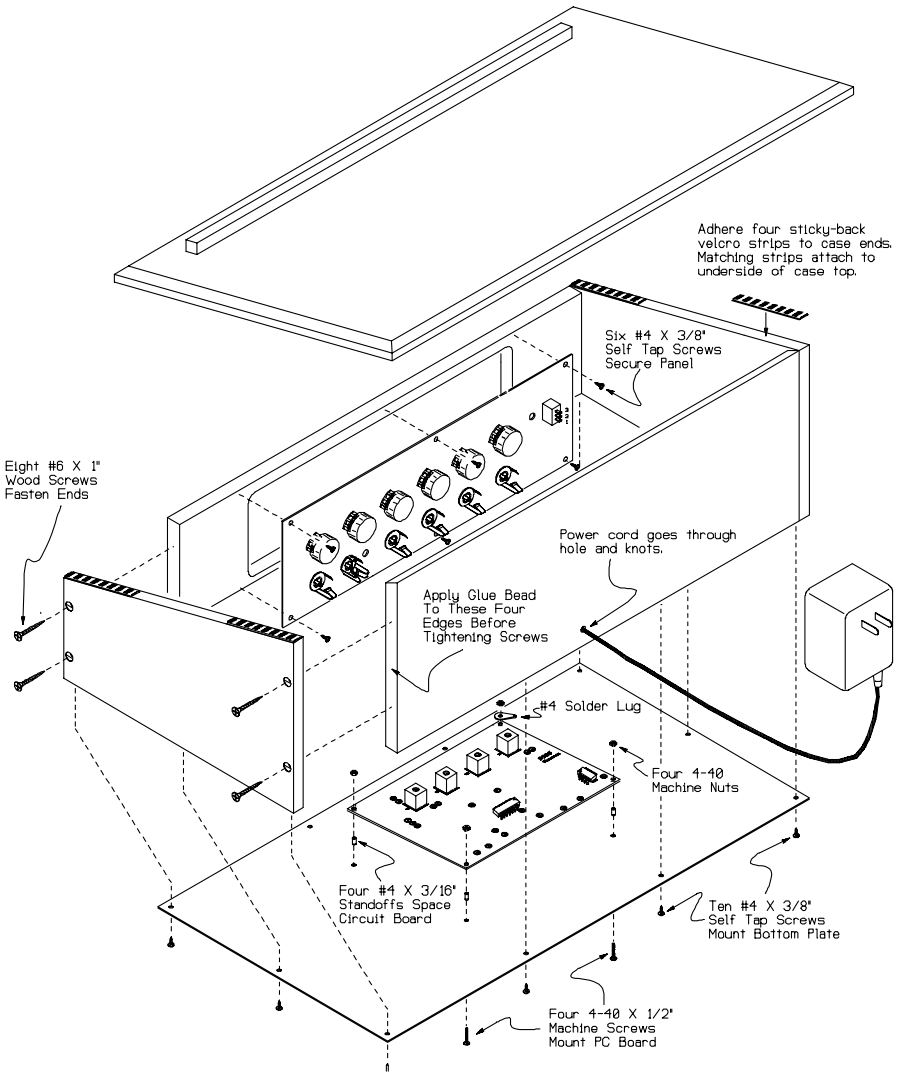


Fig 5. Case assembly details

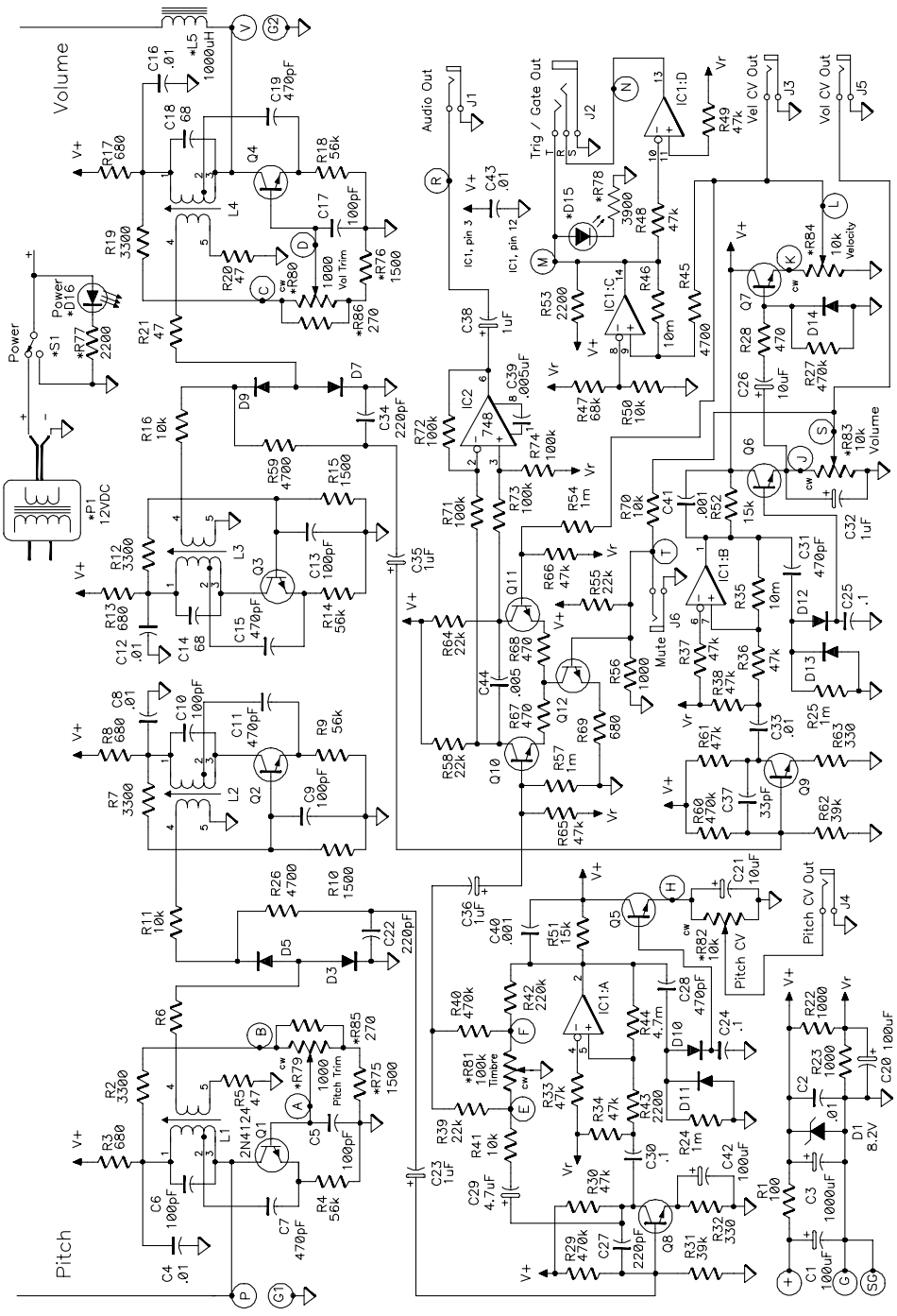


Fig 6. Theremax schematic diagram. The design is analyzed in the assembly manual. Note that designations D2, D4, D6 and D8 are not used.

CONTROLLER MODE SETUP

One of Tmax's unique features is that it can be used like a traditional theremin, where volume is increased by removing your hand from the Volume antenna, and can also be set up in a "Controller Mode" where approaching the antenna increases volume. Calling this the Controller Mode does not mean that the Theremin Mode can't be used as a controller, the Volume Control Voltage increases as volume increases, whether set up in Controller Mode or Theremin Mode. It simply means that this mode may be more useful when Tmax is used as a controller in synth or performance art applications.

To set up for Controller Mode operation, tune L3 for volume null with your hand removed from the antenna. Remember that as L3 is turned, there will be two peaks in volume. It is the null between these peaks that is your target, not the "quiet zones" when the slug is fully "out" or "in". You will find that the front panel Vol Trim control has much more effect when operating in Controller Mode than in Theremin Mode and that after you have gotten close to null by adjusting L3, an exact null can be dialed in with this control. Actually, response is increased if the Volume Trim is just a little CW from null. Turn the knob fully CW then back off until the output just goes quiet - turning any further CCW than this will reduce hand range. Range of response is from about 14 inches down to 1/2 inch, but getting your hand too close to the antenna will cause the volume to decrease and finally go off when the antenna is touched.

You can expect that peak volume will be slightly lower in Controller Mode, but dynamic range will remain the same, so the slight difference in overall level can be compensated by turning up the amplifier gain.

Tmax Unplugged:

Tmax likes to have a ground, but it doesn't have to be a very good ground. In most cases, the connection from Tmax to the amplifier being used will be enough. But when using Tmax with battery powered practice amps, or small amps that use a wall-wart for power, you may need a better ground. If there are Pitch or Volume shifts when you simply touch the front panel it is a clear indication that this is the situation.

There are several alternatives for dealing with this. If you're running Tmax from outlet power you can run a wire from Tmax ground to the center screw of the electrical outlet cover. You can get Tmax's ground a number of places, such as by attaching a wire to the bottom plate or, a little neater, by using the ground (Sleeve) connection of a phone plug plugged into an otherwise unused output jack. At a totally unplugged venue where both Tmax and the amp are running from batteries your best bet is to wear an anti-static wrist strap connected to Tmax ground.

TROUBLE SHOOTING GUIDE

If you are having trouble with your Tmax, the first rule is:

DON'T PANIC.

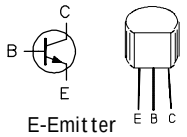
Which is, of course, good advice in any situation.

When trouble shooting, test equipment is always an issue. Do you have an oscilloscope ('scope)? Probably not, but this is the most versatile piece of equipment you can use and so there will be some advice given on what to look for if you do have one available. Do you have a Volt Ohm Meter (VOM)? You should, good ones are available from Radio Shack and other suppliers at very modest cost. In our opinion, the old style analog meters are more useful than digital versions because you can often see the pointer "kick" in response to transients or vibrate at low frequency signals. Meters that have ranges that include 10 or 15 volt scales will be more useful than those that jump from 5V to 25V with no scales in between. Tiny little meters are hard to read, but better than no meter at all.

No test equipment at all? This makes things more difficult, but there still a lot of tricks you can use to try to pinpoint problem areas. For example, if there was no output at all when you were forcing the VCA on with the test lead, try holding a resistor clipping in your hand and touching it to the base (center lead) of Q10. You should hear a hum from the amplifier,

and if not there may be a problem in the VCA (Q10-Q12, IC2 and associated components). Maybe there is some problem in the wiring of the front panel Volume control (*R83) that is causing too much or too little control voltage to get to the VCA. Or it may be a bad audio cable to the amp, or maybe that the outlet that powers the amp is dead.

If you hear hum OK, but can't find a tuning of L2 that produces an output then perhaps one of the high frequency oscillators is not working. If you have a 'scope available you can verify the operation of the oscillators by looking at the emitters of the transistors Q1 - Q4 and observing the 600 kHz to 1100 kHz sine waves with 250 - 500 mV p-p amplitudes and DC offset from ground of about two volts. If you don't find this signal on one or more of the oscillators it is a definite problem - cold solder joints and bridges should always be your first suspects, but the transistor may be bad, or the coil open circuited.



E-Emitter
B-Base
C-Collector

If only a Volt-Ohm Meter (VOM) is available, read the voltage of the Q1-Q4 emitters. If you don't get a reading of 1-3VDC there may be a problem in that oscillator. If you read 0V, the transistor may be shorted or the coil open circuited. If you read a little over 8V the transistor may be open circuit or biasing off because of a wiring problem to the trim controls (*R79 and *R75 on the front panel, for example, if the Q1 oscillator is not right).

If there is no other test equipment available you may be able to verify the operation of the oscillators with an AM pocket radio. Set the frequency to between 700 - 900kHz, turn the radio volume up and place it as close to the oscillators as possible. As you adjust the tuning slugs of the coils up and down there should be a place where you will hear a "swish" or squeal from the radio that correlates with turning the slug. If you find an oscillator that doesn't respond like the others, it is suspect - though unfortunately this test doesn't give much of an indication which of the possible oscillator problems described earlier is causing the malfunction.

If you're able to get an output when the test clip is in place, but can't get a response with it removed, it is an indication that there may be problems with the control voltage going to the VCA. Assuming that you have used one of the methods above to verify that the oscillators are working, you should then check that the balanced modulator is producing a difference frequency. Check the collector of Q9 for a 0-12 kHz sinewave riding on a DC offset of 5 to 6V. No signal here could be caused by bad diodes in the modulator (D6-D9 for volume) or the connections to the oscillator coil secondaries or some problem with the amplifier Q9 and it's associated components.

If the difference frequency is present, check to see that the comparator IC1:B is switching. At lower difference frequencies you should see a 0 to 8V square wave of the same frequency at pin 1 (on a VOM, this will register as about 4VDC - at very low frequencies you will see the pointer vibrate). As frequency goes higher, the output will become a spike with decreasing amplitude - a VOM will show a voltage that decreases from the 4VDC reading and finally gets to 0V. Absence of these indicators may mean problems with the IC or the components associated with this comparator (R35-R38, R52 and C41, primarily).

If everything still looks OK, check the emitter of Q6 to see that there is a voltage there that increases as the difference frequency increases up to about 10kHz, then decreases as the frequency goes higher. If there's a problem here check D12, D13 and Q6 and the surrounding resistors and capacitors.

If trouble persists, read through the Design Analysis section of the manual. It may seem like greek the first (and even second) time through, but think about what's being said and see if it seems to relate to your problem.

Finally, if all else fails, call us and let us help.