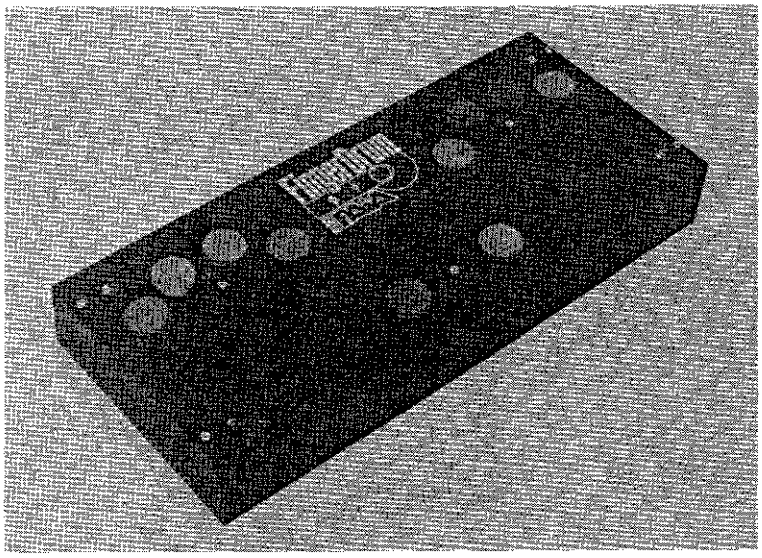
PAIA Electronics, Inc.
(405) 340-6300

Model 9150
FingerDrum^{tm} Controller
ASSEMBLY/USING MANUAL



MIDI keyboards or guitar controllers aren't exactly ideal for laying down a convincing drum part, and if you're not a percussionist, drum sticks may seem unwieldy. But chances are good that you sound great when you finger drum on a tabletop and that's the idea behind the FingerDrum.

The FingerDrum's ten pads are assigned to eight velocity sensitive outputs. On each hand, the first and middle finger tips appear at a single output so that these two fingers can be used for drum rolls and other difficult parts. Pad sensitivities are individually adjustable.

And for the maximum in versatility, the optional PAiA Trigger-to-MIDI brain mounts inside the FingerDrum and converts finger taps directly into MIDI note and velocity data.

Either with or without the brain, tapping out a part on the soft rubber pads of the FingerDrum is easy and fun. No matter what kind of music you're doing, the FingerDrum will get those drum parts out of your head and into your sequencer or recording project with a minimum of effort.

ASSEMBLING THE FingerDrum

Before beginning assembly, go through the manual. Look at the drawings. Feel the parts. We know that you're anxious to plunge right in, but take a few deep breaths first.

Notice that each step in the manual is marked with a check-off box like this:

() R27 100 ohm brown-black-brown

Checking off each step as your perform it may seem silly and ritualistic, but it greatly decreases the chance of your omitting a step and also provides some gratification and reward as each step is completed.

Numbered illustrations are printed in the Illustrations Supplement in the center of this manual. This page may be removed for easy reference during assembly.

THE CIRCUIT BOARD

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

TOOLS

You'll need a minimum of tools to assemble the kit - a small pair of diagonal wire cutters and pliers, screwdriver, sharp knife, ruler, 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 described in the SOLDERING section which follows.

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.

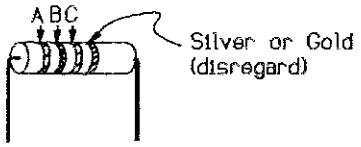
Use only rosin core solder (acid core solder is for plumbing, not electronics work). A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of lead

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 but 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.

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

RESISTORS

Solder each of the resistors in place following the parts placement designators printed on the circuit board and the assembly drawing Fig 1. Note that resistors are non-polarized and may be mounted with either of their two leads in either of the holes provided. Before mounting each resistor, bend its leads so that they are at a right angle to the body of the part. Put the lead through the holes and then push the resistor firmly into place. Cinch the resistor in place prior to soldering by bending the leads on the solder side of the board out to an angle of about 45 degrees. Solder both ends of each resistor in place as you install it. Clip each lead flush with the solder joint as the joint is made.



DESIGNATION	VALUE	COLOR CODE A-B-C
listed below:	1 megohm	brown-black-green

() R2	() R5	() R9	() R12
() R15	() R18	() R22	()R25

listed below:	1000 ohm	brown-black-red	
() R3	() R6	() R10	() R13
() R16	() R19	() R23	() R26

() R27	100 ohm	brown-black-brown

CAPACITORS

Most of the capacitors used in the FingerDrum are non-polarized ceramic disks, either lead can go in either of the holes on the circuit board. Leads are already parallel to one another so they will not require any bending prior to installation. Like the resistors, push the leads of the capacitors through the holes in the board and push the part against the circuit board as far as it wants to go. Don't force it, it's OK if it sits a little off the board.

Capacitors are rarely marked with something so simple as their values these days, instead component manufacturers prefer obscure codes. For example, the .01 mFd. capacitors may be marked "1M103K7". It is the "103" part of this that tells you that its value is .01 mFd, but the reasoning behind

this is beyond the discussion we can have here. You shouldn't have any problems since all of the ceramic disk capacitors are the same value

Disk Capacitors

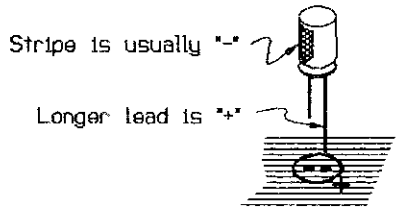
DESIGNATION	VALUE/TYPE	MARKING
listed below:	.01 uF ceramic disk	103

() C3	() C4	() C5	() C6
() C7	() C8	() C9	() C10

Two of the capacitors are electrolytic types. Unlike the previous components, electrolytic capacitors are polarized and the leads are not interchangeable. Leads are marked "+" and/or "-" and the "+" lead must go through the "+" hole in the circuit board. Frequently the positive lead of the capacitor is significantly longer than the negative lead.

Usually the Negative lead of the capacitor is marked rather than the positive. It naturally goes through the hole not marked "+".

Capacitors supplied with specific kits may have a higher Voltage (v) rating than that specified below.



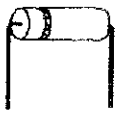
DESIGNATION	VALUE
() C1	100 uF / 16v
() C2	100 uF / 16v

DIODES

There are two types of diodes used in the FingerDrum, one 4001 power diode and twenty-one signal diodes. Of the two kinds, power diodes are bigger and are generally in an opaque case. Signal diodes are generally in a smaller transparent case. In the FingerDrum you'll have little difficulty telling the two apart, the one that looks different from the rest is the 1N4001 power diode.

Diodes are polarized and must be installed so that the lead on the banded end of the part corresponds to the banded end of the designator on the circuit board. Diodes are also somewhat heat sensitive so the soldering operation should be done as quickly as possible.

As with resistors, bend the leads so they are at a right angle to the body of the part.



DESIGNATION	TYPE	
() D1	1N4001	(may be '4002 - '4004)
listed below:	1N4148	(may be 1N914)

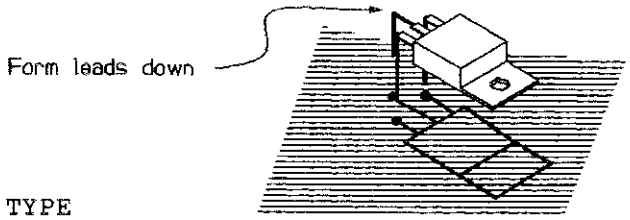
() D2	() D3	() D4	() D5
() D6	() D7	() D8	() D9
() D10	() D11	() D12	() D13
() D14	() D15	() D16	() D17
() D18	() D19	() D20	() D21
() D22			

JUMPERS

() Using appropriate lengths of the bare wire provided, form and install the 16 circuit board jumpers which are marked on the circuit board with a bold line intersected with the letter "J".

VOLTAGE REGULATOR

Locate the 7805 voltage regulator and form the leads as shown in the illustration below to match the holes in the circuit board. Press the Voltage Regulator against the board and solder the three leads. Clip excess lead off flush with the solder joint.

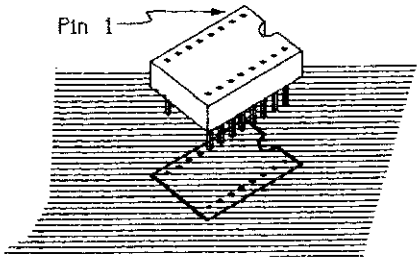


DESIGNATION	TYPE
() IC1	7805 Voltage Regulator

IC SOCKETS

The other two integrated circuits used in the FingerDrum are socketed in 14 pin DIP sockets. Sockets are polarized with a rectangular or semi-circular notch at one end of the part which corresponds to a similar indicator on the circuit board graphics. The socket would of course work just as well if it were inserted backward to the marked polarity, but this would surely generate much confusion when the time came to install or replace the ICs.

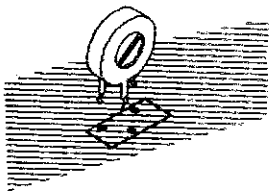
Insert the socket in the circuit board holes and initially solder two pins in diagonal corners of the pattern. Make sure that the socket is seated firmly against the pc board by pressing the socket against the board while re-melting the solder joint at first one corner, then the other. Finally, solder the remaining 12 connections.



DESIGNATION	TYPE
() IC2	14 pin DIP socket
() IC3	14 pin DIP socket

TRIMMER POTENTIOMETERS

Mount the 10 trimmer potentiometers by inserting their three pins into the holes provided, pressing them flush against the circuit board and soldering in place.



DESIGNATION	TYPE
listed below:	50k ohm vertical mount

() R1	() R4	() R7	() R8
() R11	() R14	() R17	() R20
() R21	() R24		

SOLDER SIDE PARTS

It is now time to mount the piezo sensors and POWER/LEVEL LED. We've saved these parts for near the end so you would have some practice soldering. Unlike previous components, these parts mount on the "solder" or trace side of the circuit board.

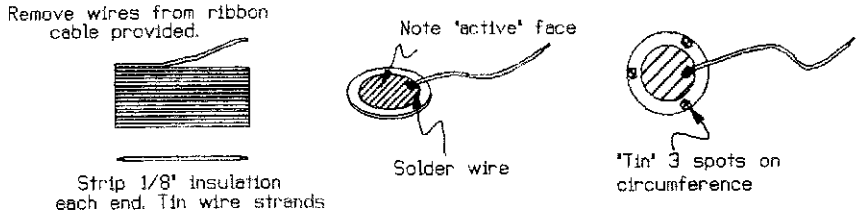
Begin by locating the ten piezo sensor disks and identifying their front (active) and rear faces. We're going to be doing some soldering to these disks and since they're essentially brass you'll notice that it takes quite a bit of heat. There are two implications to this; the first is that patience will be a virtue, don't try to hurry these operations.

The second implication is that when you're done with a solder joint the disk will be HOT; let everything cool before handling it.

Here's a pointer: make sure the tip of your iron is clean by wiping it with a damp sponge or rag and then melt enough solder onto the tip to form a *small* drop hanging from the end. This solder drop will help conduct heat into the disk. Hold the heat to the surface until fresh solder fed into the blob melts readily, but don't feed in too much new solder. Be careful that the solder "blob" you're forming doesn't form a bridge between the active face of the sensor and the rest of the disk.

() Locate the 2" length of multi-conductor ribbon cable supplied and separate one insulated wire. Strip 1/8" of insulation from each end of the wire and twist and

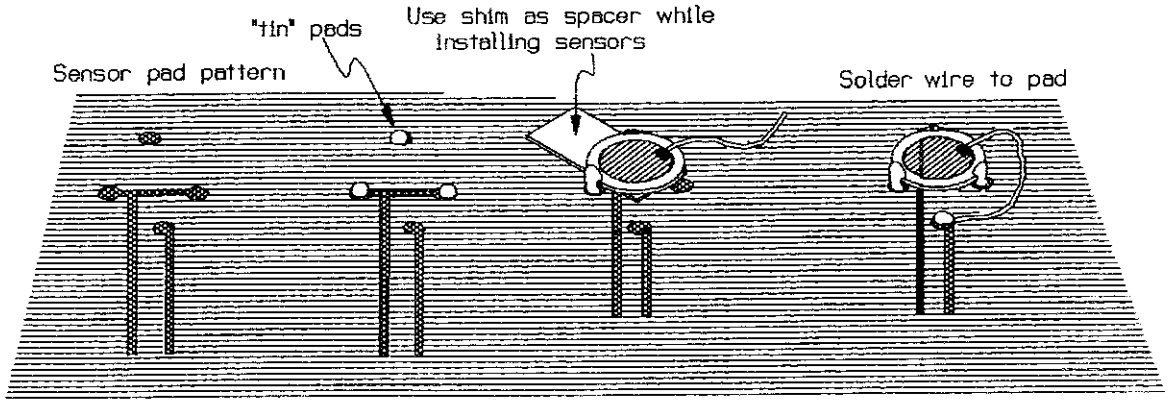
tin the exposed strands. Tin a small spot on the edge of the active face of one of the piezo disks. Solder one end of the ribbon cable wire to this tinned spot.



It is important that the disks be installed so that they are elevated above the board slightly. If they are flush with the board, transmission of mechanical shock through the circuit board will result in cross-talk between sensors. For the same reason it is important that the disks not touch one another (clearance is tight between E1/E2 and E9/E10). In the following steps the sensor locating shim provided will be used to mount the sensors with the appropriate spacing from the board.

() "Tin" three equally spaced spots around the circumference of the sensor disk as shown in the illustration on the previous page.

() Orient the circuit board so that the conductors are facing up and locate the trace patterns for the sensors. Apply solder bumps to the pads as shown.



() Locate the cardboard shim provided and place it over the sensor traces as shown (do E5, to the right of the LED D23 first). Place the sensor disk with the active face up on top of the cardboard so that the solder bumps on the sensor align with the sensor mounting pads. Carefully re-melt the solder on the disk and the pad so that they join. If the disk moves sightly or you're not happy with the alignment for any reason

re-do the operation.

() When you're satisfied with the alignment of the disk, permanently fasten it in place by re-melting the other two support points. Withdraw the shim.

() Finally, solder the free end of the wire coming from the active face of the sensor to its pad as shown. Be careful to dress the wire around the edge of the piezo disk and not across its top. We will be mounting a foam pad over these sensors shortly and we won't want the wire to get in the way.

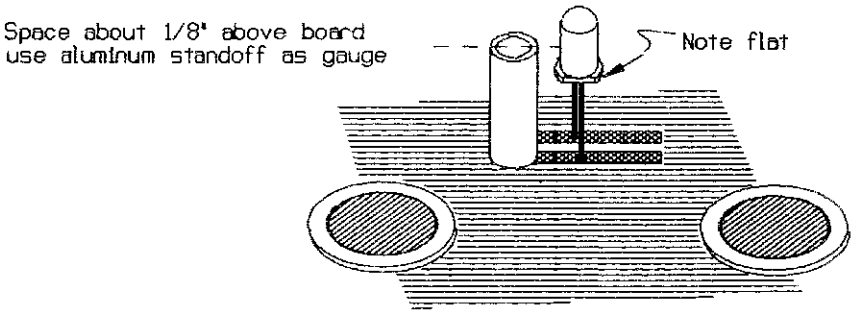
In the manner described above, prepare and mount the 9 remaining piezo sensor disks. The installation sequence may seem disjointed, but it will make dealing with the E1/E2 and E9/E10 clearance easier.

DESIGNATION	TYPE
listed below:	Piezo Sensor Disks

() E4	() E3	() E2	() E1
() E6	() E7	() E8	() E9
() E10			

LED

Locate the Light Emitting Diode and install it on the conductor side of the board. Push the LED's leads through the holes but do not push the part against the circuit board, instead, solder it in place so that it stands off from board by about 1/8" (one of the spacers that we'll use as standoffs for the board can be used for a handy gauge as shown below). Also, Notice that the LED is polarized and the lead marked by the flat on the case must go in the hole closest to the edge of the circuit board.



DESIGNATION	TYPE
() D23	Light Emitting Diode

TAKE A BREAK. Shake out and Lean back.

Let's think about this a little.

The FingerDrum can be built in either of two ways, with or without the MIDI Drum Trigger computer board and there will be difference in how we proceed from this point depending on which way we're going.

If you're building the unit for use with an external drum brain, you will be installing the 8 phone jacks on the rear apron of the case which be the source of trigger signals to the external unit.

On the other hand, if you are going to be installing the PAiA Trigger-to MIDI Brain, these phone jacks will not be used and in place of the wires from the FingerDrum circuit board to the jacks, a male IDC connector will be installed on the circuit board which will subsequently connect to the computer board.

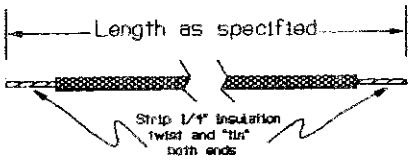
Because of these differences, you may be skipping some of the assembly steps which follow. We will use this convention:

```
+-------------------------------------------------------------
¦ Assembly steps which are to be performed if you are
¦ assembling the FingerDrum to be used with an external Drum
¦ Brain will be set off with a box like this.
¦
¦ If you are going to be adding the PAiA Trigger-to-MIDI
¦ brain you will NOT PERFORM THESE STEPS.
+-------------------------------------------------------------
```

OK? Let's get on with it.

"FLYING" WIRES
(i.e. those which go from circuit board to case mounted parts.)

In the following steps, wires will be soldered to the FingerDrum board which in later steps will be connected to the Power Switch and phone jacks (if they are going to be used). At each step, cut a piece of wire to the specified length and strip 1/4" of insulation from each end. Twist the exposed wire strands together and "tin" them by melting a small amount of solder into the strands. This will make soldering easier when the wires are installed and prevents fraying of the wire strands when they are pushed through the holes.



Solder each connection as it is made and clip any excess wire from the solder side of the board.

Prepare one wire for connection to the "power" box (upper right hand corner of the board).

PC POINT	WIRE LENGTH
() POWER "To S1"	1-1/2"

If you are going to be using the FingerDrum with an external Drum Brain you will also need to install these wires which will later connect to the Phone Jacks.

PC POINT	WIRE LENGTH
() J1-1	5"
() J1-2	4-1/2"
() J1-3	2-1/2"
() J1-4	2"
() J1-5	7"
() J1-6	6-1/2"
() J1-7	4"
() J1-8	2-1/2"
() J1-9	7"

Temporarily put the FingerDrum circuit board aside while we mount the Phone Jacks and/or Power Switch on the case. While working on the case, take care not to scratch the finish. A towel spread on your work surface will help protect against gouges and abrasions.

POWER SWITCH / PHONE JACK INSTALLATION

() Using (2) 4-40 X 1/4" machine screws and #4 nuts, mount the power slide switch as shown in Fig 2. If there are only two solder lugs on the back of the switch, make sure that they are oriented as shown.

If you are building the FingerDrum for use with an external Drum Brain you will need to mount and begin wiring the phone jacks as follows.

() Using the jack nuts and washers provided, mount the 8 open circuit phone jacks of the rear apron of the case as shown in Figs 2. Before fully

tightening the nuts, make sure that the jacks are oriented with the ground lug facing you as shown in Fig 3.

We will now make the connections to the ground lugs of the jacks. At each step prepare a wire of the length specified by stripping 1/4" of insulation from the end and twisting an tinning the exposed strands. It probably would not hurt to tin the solder lugs on the jacks also, they sometimes take a lot of heat to get started.

This convention will be followed in the instructions: Do not solder a connection to a lug until instructed to do so with an instruction such as (S-2) which means that at that point there will be two wires on the lug in question. Connections which should be made mechanically but not soldered will be marked (NS) for No Solder.

WIRE LENGTH	FROM	TO
() 1-1/2"	J2-2 (S-1)	J3-2 (NS)
() 2-1/2"	J3-2 (S-2)	J4-2 (NS)
() 1-1/2"	J4-2 (S-2)	J5-2 (NS)
() 2-1/2"	J5-2 (S-2)	J6-2 (NS)
() 1-1/2"	J6-2 (S-2)	J7-2 (NS)
() 2-1/2"	J7-2 (S-2)	J8-2 (NS)
() 1-1/2"	J8-2 (S-2)	J9-2 (NS)

() Locate the wall-mount power supply and clip off the jack on the end of the cord. Separate the two wires and strip 1/4" of insulation from each before twisting and tinning the exposed strands.

() Install the rubber grommet provided in the hole immediately to the right of the power Switch S1 as shown in Figs 2 & 3.

() Pass the end of the cord from the wall-mount power supply through the grommet mounted above and knot the cord so that approximately 2" of the cord is inside the case.

() Notice that of the two wires in the cord from the wall-mount power supply, one is marked with a stripe. Solder this wire to lug #1 of S1.

OK, we are now ready to mount the nearly completed FingerDrum circuit board in the case, so this is a good time to closely inspect your work looking for solder bridges and connections

that might not be the best possible.

One connection must be made to the circuit board before physically mounting it in the case.

() Solder the free wire from the wall-mount power supply cord (the wire NOT marked with a stripe) to the circuit board point marked "To Power -".

() Mount the circuit board in the case top using the (7) 4-40 X 1/2" machine screws and #4 nuts provided. Space the board away from the case top using the (7) 3/16" rolled aluminum spacers as shown in Fig 4.

The circuit board should now be firmly installed in the case and we're ready to make the final electrical connections between the wires attached to the circuit board and the lugs of the jacks J2 to J9 and switch S1.

Solder the wires originating at the circuit board point specified to the solder lug of the jack or switch as required.

FROM PC POINT	TO
() POWER "To S1"	S1-2 (Solder this connection)
() J1-1	J2-1 (S-1)
() J1-2	J3-1 (S-1)
() J1-3	J4-1 (S-1)
() J1-4	J5-1 (S-1)
(note break in sequence)	
() J1-5	J9-1 (S-1)
() J1-6	J8-1 (S-1)
() J1-7	J7-1 (S-1)
() J1-8	J8-1 (S-1)
() J1-9	J9-2 (S-2)

This completes all of the wiring of the FingerDrum. At this point the unit should look something like Fig 5.

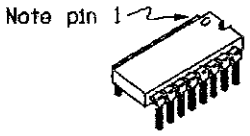
INTEGRATED CIRCUITS

Now we finish component installation by placing the Integrated Circuits in their sockets. Of all the parts installed so far, the ICs are the most easily damaged and should be treated with some respect. In particular they may be susceptible to damage by discharges of static electricity. Modern ICs are not nearly as sensitive to this kind of damage as were earlier versions, but it is still good practice to handle them as little as possible. Also good practice: don't wear nylon during assembly. Don't shuffle around on the

carpet immediately before assembly (or if you do, touch a lamp or something to make sure you're discharged). Don't be intimidated, it's rare for parts to be damaged this way.

ICs are polarized in one or both of two ways; a dot formed into the case of the IC corresponding to pin 1 or a semi-circular notch that indicates the end of the package with pin 1. You may remember that the IC socket is marked with a similar indicator.

The pins of the ICs may be splayed somewhat and not match up exactly with the holes in the socket. Carefully re-form the leads if necessary so that they are at right angles to the part. Push the IC into the socket making sure that it's fully seated.



DESIGNATOR	PART NO.	DESCRIPTION
() IC2	324	Quad Operational Amplifier
() IC3	324	Quad Operational Amplifier

PERCUSSION PADS

The 10 silicon percussion pads are mounted to the surface of the piezo sensors using the double-stick foam tape provided. See fig 6 for details.

() Locate the 3/4" wide strip of double-stick foam tape, cut a 1/2" long piece and remove the paper backing from one side. Press the sticky side of the foam through the hole above the piezo sensor and press it in place. Do not cover the solder joint on the sensor with this tape, primarily because it will result in a tilted percussion pad.

() Remove the backing from the top of the tape to expose the sticky surface and press the percussion pad through the hole in the case. Center the pad so that it is not touching the case at any point.

() In a similar manner, mount the remaining 9 percussion pads.

TESTING

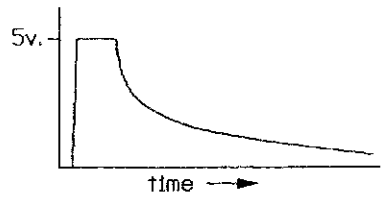
The big moment has arrived; it's now time to apply power to the FingerDrum and test it to see that it's working properly. Before turning on the power, use a small screwdriver to reach through the small access holes in the rear apron of the case and adjusting all trimmer potentiometers fully clockwise (this will be their maximum sensitivity setting).

Plug the wall transformer in and slide the power switch up to its ON position. The Power/Level LED will glow giving an initial indication that things are going well.

But in addition to indicating power, the LED is also a quick and convenient means of "calibrating" the FingerDrum sensor sensitivity without test equipment. We'll get to the calibrating part of things shortly, but for now we'll simply use the LED as an indicator that individual pads are producing an output.

Tap firmly on a pad and observe the LED. With the pad's sensitivity set to maximum (trimmers fully clockwise) you should see the LED clearly blink for even moderate force taps. Tap each percussion pad in turn to see that each pad has a response.

An oscilloscope or Volt-Ohm Meter (VOM) can be used to check the outputs directly, and while this is useful in the same way that any learning experience is useful, it's not completely necessary. Measure the voltage between the "hot" side of the jacks (Lug #1) and ground (such as Lug #2). On a 'scope you should see a trace something like that shown below. A VOM, when set to a scale which can measure 5 volts, will indicate a signal is present with a momentary up-scale meter deflection.



At maximum sensitivity outputs will look like this on a 'scope. "Calibration" will remove clipping.

If you run into problems, isolate the defect by focusing on the section of the circuitry with the problem. For example, if one channel won't trigger, concentrate on the circuitry for that particular channel. If nothing works, use a VOM to check that the power supply and the +5v. reference supply are present.

BUTTONING UP

Once you're confident that everything is working properly, close the unit up by installing the bottom.

() Using (6) 4-40 X 1/4 machine screws and (6) 4-40 nuts, attach the (6) "L" brackets to the case bottom as shown in Fig 7. Notice that the "L" brackets each have one threaded hole and one unthreaded hole. The holes that are unthreaded are the ones used in this step.

() Install the case bottom as shown in Fig 7. Secure it with (6) 4-40 X 1/4" machine screws through the threaded holes in the "L" brackets and (4) #4 X 1/4" self tap screws as shown. If you have not installed the Drum Brain option, cover the MIDI IN and MIDI OUT holes with the nylon hole plugs provided.

CALIBRATION

Because of individual differences in the piezo sensors, calibration of sensitivity of each pad is necessary. As has already been mentioned, the LED makes this fairly quick and easy. Thinking of it as comparable to the clipping or overload indicator so common on audio equipment will give you the correct conceptual handle. You want to adjust the trimmer associated with each pad so that the LED just barely blinks when you're striking the percussion pad harder than you think you ever will when using the unit.

This is a fairly important adjustment since too much sensitivity will result in cross talk between the sensors (striking one pad will cause the sound associated with another pad to be produced at a reduced level). Too little sensitivity will result in reduced dynamic range in the output.

SETUP

Once you're satisfied that everything is in order, hook up the FingerDrum and the Drum Brain that you'll be using as shown in Fig 8.

The setup of your drum interface will vary depending on the model. For example with a Simmons MTM a good starting point is to set the input gain to "MIC", the threshold to "MIN" and the sensitivity to somewhere around the halfway position.

Remember, if your brain has been set up for use with another type of pad or sensor, you may have to change its setting before it will work with the FingerDrum.

APPLICATIONS

When everything is working properly, it's time to work on getting the most from the FingerDrum. Check your drum interface for special features that offer especially useful capabilities. For instance, velocity switching and layering will allow you to trigger two or more MIDI notes form a single pad, which is useful for hi-hats, congas, or anywhere you need several variations of a particular sound.

While the FingerDrum was originally designed to play drum parts, you can use it to play other parts, too. For example, rappers can mix sampled scratches and sound effects along with a drum part. Advanced users can use a hardware or software-based mapping device to trigger almost any kind of MIDI message.

PAD ASSIGNMENTS

Some time has been spent playing with different pad assignments for the FingerDrum and the layout in Fig 9 works well for most drummers and non-drummers who have used the device.

With this layout, right-handed users can play the kick and snare drums with their strongest digits, the thumb and forefinger. This lets you play a driving groove without tiring. On the left hand, three pads are dedicated to the hi-hats. By alternating between your second and third fingers, you can play fairly busy hi-hat patterns without fatigue. Since the toms are usually reserved for rills, they can be left to the weaker digits. Left-handers can use a mirror-image layout, while musicians into hardcore thrash or hip-hop may want to use one or more pads for the all important kick drum.

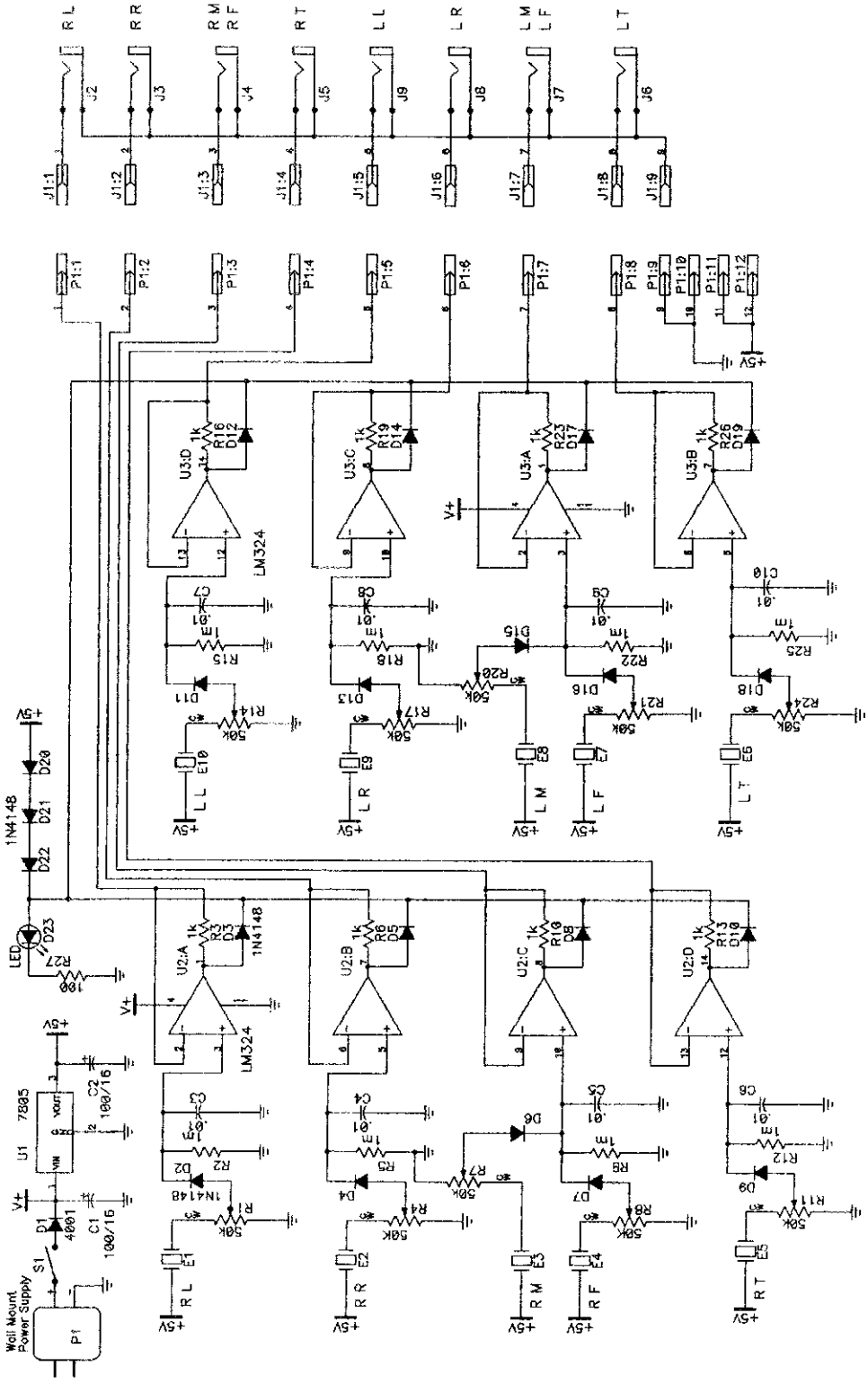
DESIGN ANALYSIS

The schematic of the FingerDrum is shown in fig 10. For simplicity, the operation of channel 1 will be discussed; the remaining 7 channels are virtually identical.

Underneath each pad is a piezo electric sensor that converts the force of a finger striking the pad into an electrical impulse, which must be attenuated and processed for use with the drum interface. The output of the piezo sensor E1 is wired to trimpot R1, which controls the sensor's output level. The trimpot allows for compensation for differences in output from specific sensor and individual differences in finger strength, etc.

After attenuation, the piezo output is processed by a simple peak-detector consisting of D2, R2 and C3. This converts the transient signal into a more predictable envelope with an almost instantaneous attack and a slightly slower decay, which works especially well with Drum Brain inputs. The peak level of this envelope is proportional to the force with which the sensor is struck. This characteristic makes the pads touch-sensitive, which can be translated by the drum interface into MIDI velocity data. The processed signal is buffered by IC2a, and the buffered signal is used as the trigger output for the channel. Each opamp buffer has a low output impedance; this lets it drive long cable lengths with ease. Both IC2 and IC3 are quad op-amps.

LED D23 serves two functions; it shows that the power is on and provides a simple way of calibrating the sensitivity of all eight channels without needing test equipment. The voltage drops across the diodes D20-D22 cause the junction of D22 and D23 to be at about 3v with respect to ground. When to output of IC2a reaches a voltage slightly less than 4v, D3 forward biases and begins to add current to the current already flowing into D23 through D20-D22 and as a result the LED glows more brightly. This increase in brightness becomes noticeable when the output of IC2a begins to approach its maximum output of slightly less than 5v.


R L
R R
R M
R F
R T
L L
L R
L M
L F
L T
J1:1
J1:2
J1:3
J1:4
J1:5
J1:6
J1:7
J1:8
J1:9
P1:1
P1:2
P1:3
P1:4
P1:5
P1:6
P1:7
P1:8
P1:9
P1:10
P1:11
P1:12
+5V
U3:D
U3:C
U3:A
U3:B
LM324
V+
LL
LR
LM
LF
LT
1N4148
LED
U2:A
U2:B
U2:C
U2:D
7805
U1
Wall Mount Power Supply
P1
RL
RR
RM
RF
RT

A

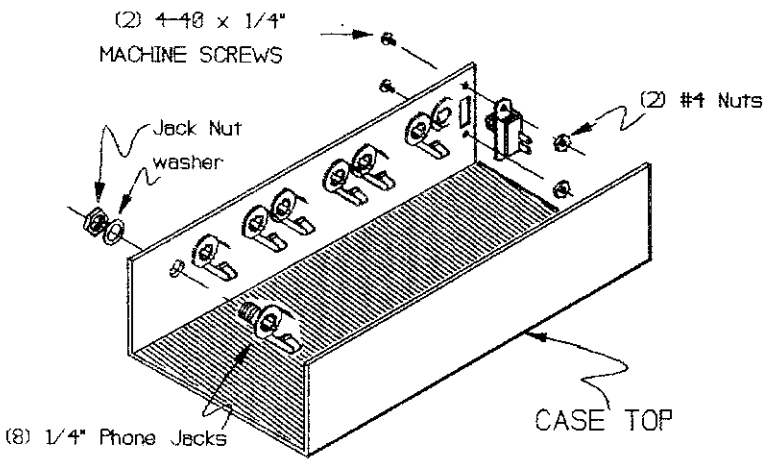
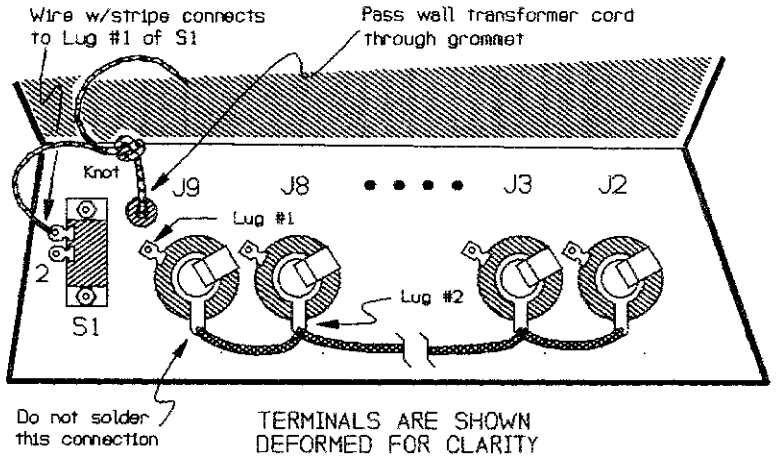


Fig 2. If the PAIA trogger-to-MIDI computer is going to be installed, the jacks will not be installed.



FNGR_DR7

Fig 3. Phone jacks must be oriented as shown to prevent interference with trim pots on the circuit board

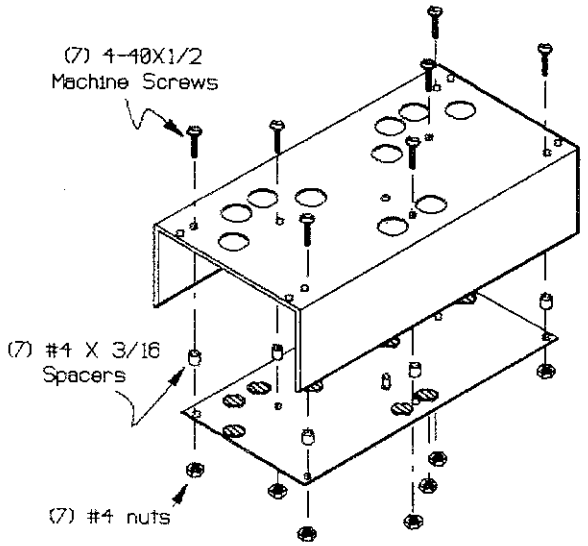
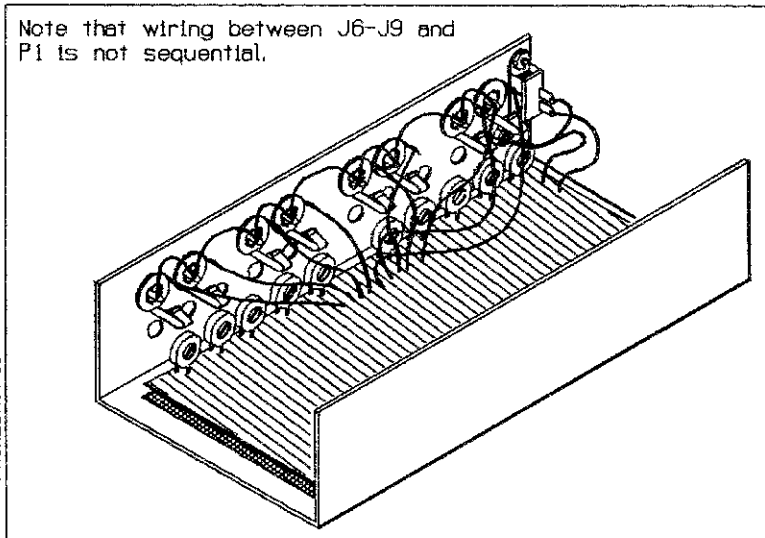


Fig 4. 3/16 inch rolled aluminum stand-offs space the circuit board away from the case top.



FNGR_DR5.FCD

Fig 5. When all of the wiring is completed the FingerDrum looks like this.

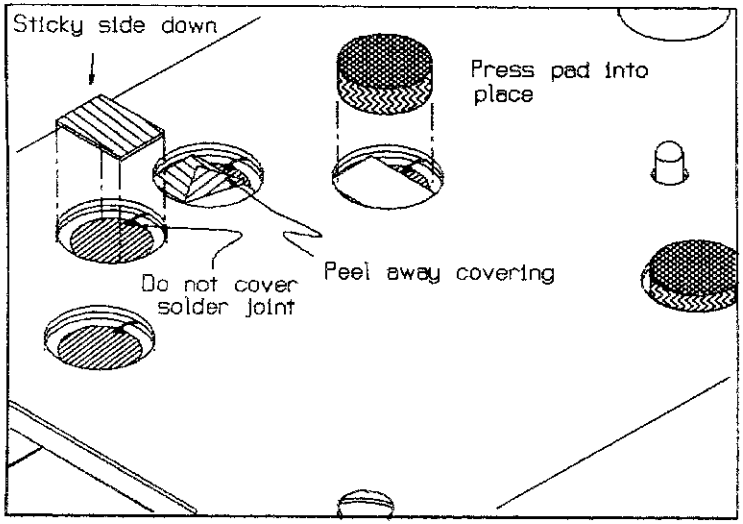
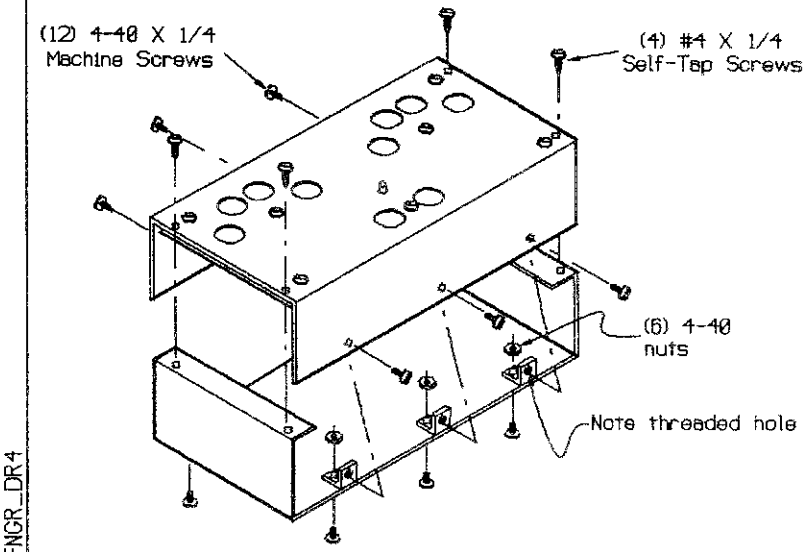


Fig 6. Use double sticky foam tape to fasten percussion pads to sensors.



FNGR_DR4

Fig 7. A combination of self-tap and machine screws are used to fasten the cases top and bottom sections together.

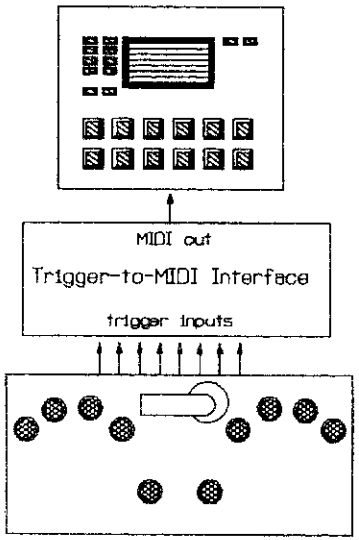
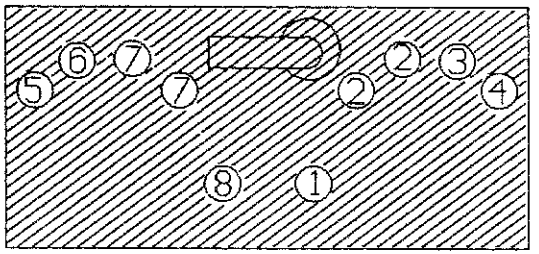


Fig 8. Some drum boxes will accept FingerDrum triggers directly.



1) Kick drum
2) Snare drum
3) High tom
4) Medium tom
5) Low tom
6) Cymbal
7) Closed hi-hat
8) Open hi-hat

Fig 9. Suggested pad assignments

FNGR_D10

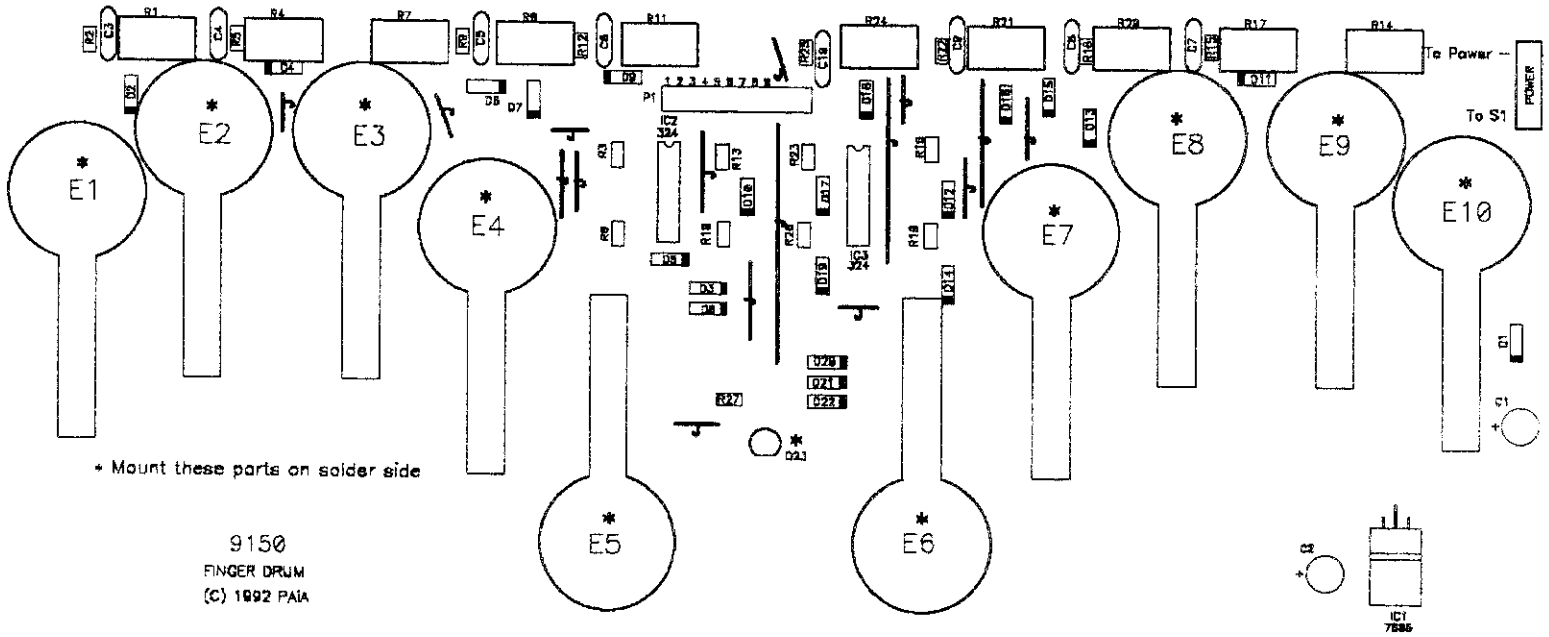
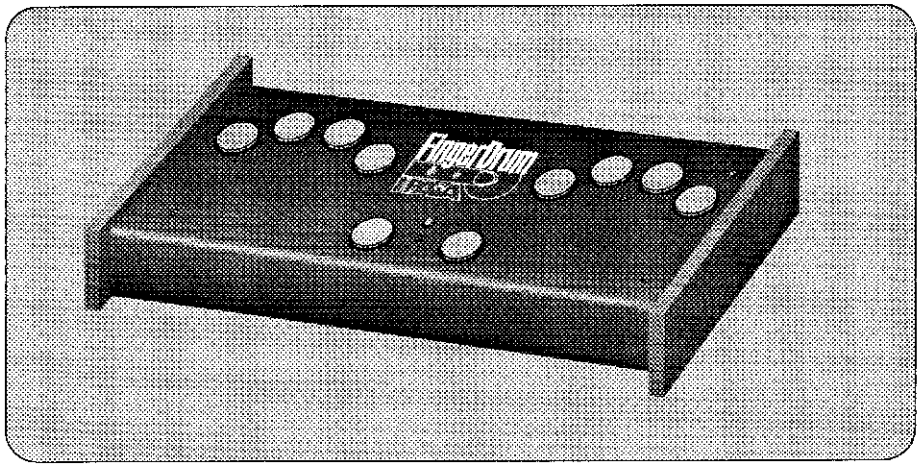


Fig 1. Most of the electronic components mount on the top of the circuit board, but notice that the piezo sensors and LED D23 mount on the "solder" side.

9150 FingerDrum



SUPPLEMENTAL CASE ASSEMBLY INSTRUCTIONS

We've made some major changes in the configuration of the case that houses the FingerDrum.

A little background: the original FingerDrum case was a design that only its creator could love. When the designer also fell out of love with it, it was obviously time to change.

The case had several individually minor flaws that summed together to produce a perfectly horrible result. Synergism at work. The two metal parts that formed the case had to be made to aerospace tolerance and even when perfectly formed produced an enclosure with unsightly gaps.

It rattled. Despite having enough screws, nuts and "L" brackets to build an Erector Set Ferris Wheel, it still made its own mechanical "boingy" noises when you hit the percussion pads. Worst of all, it was really ugly.

The redesigned case overcomes these disadvantages; the new wooden end caps join the top and bottom case parts together without gaps and rattles. The wood ends improve the appearance of the product enormously and also allow a significant reduction in the amount of hardware exposed to view. Holes for the optional MIDI In and Out jacks have been moved from the end panels to the rear apron of the case.

The down-side to these modifications is that we are still developing a complete instruction set to reflect the changes and it will take several weeks to complete this manual. Rather than delay your order, we are shipping your kit with the original manual and this sheet which will cover the changes in final assembly.

Follow the instructions normally until you reach pg 17, then refer to the material on the reverse side of this page for new **"BUTTONING UP"** instructions. The new drawing on the other side of this page replaces Fig 7 of the manual. When finished with final assembly of the FingerDrum, you will return to the original manual to continue with **CALIBRATION, SETUP** and so on.

BUTTONING UP

When you're through testing the unit and have confirmed that everything is working properly, the case can be fully assembled.

The wood case ends supplied with this kit are unfinished and, while not absolutely necessary, an oil finish will keep the wood from staining and discoloring nonuniformly. This is not complicated, simply wipe the exposed wood with Tung oil available from any hardware store. The ends may be darkened by applying several coats of Tung oil that has a stain of the desired color.

Trial fit the wood ends into the open case ends as shown in the illustration below. When fully assembled, the edges of the bottom plate should be hidden by the front and rear aprons of the case top. If the ends do not fit far enough into the case for this to happen, it may be because the right angle cuts of the wood ends are not fitting into the slight radius of the bend in the case top. Use a sharp knife to remove the point of these right angles in the wood end.

( ) When you have assured proper fit, fasten the wood ends in place with the (4) #4 X 1/4" self-tap screws supplied. To keep the wood from splitting and provide a better fit, pilot holes for these screws should be predrilled with a 1/16" drill bit. If a drill is inconvenient a small finishing nail may be used as a center punch to make this hole, but having a pilot hole is very important.

( ) In a similar manner, use the remaining (4) #4 X 1/4" self-tap screws to mount the bottom plate. Notice that the bend in this metal is the "front" edge of the bottom.

( ) Install the (4) self adhesive rubber feet by peeling their backing and placing them in the corners of the case bottom as shown in the new illustration.

You may now return to pg 17 of the FingerDrum Assembly/Using manual and continue with CALIBRATION.