CHIPSWITCH

Hardware Installation Guide

for the

HR2510-HR2600-LINCOLN Radios

********** WARNING **********

DO NOT REMOVE THE CHIPSWITCH INTEGRATED CIRCUIT (CHIP) FROM IT'S PROTECTIVE SHIPPING CONTAINER UNTIL YOU ARE INSTRUCTED TO DO SO. It can be DESTROYED by simple static electricity, as will be discussed below, and is only safe while inside the special anti-static protective container it was shipped in.

****

IMPORTANT NOTICE

Some types of modifications available for these radios are not compatible with CHIPSWITCH. Generally, if your radio was previously modified to change the functions of the channel up/down and/or microphone up/down buttons, you may have to restore your radio to it's original configuration for the CHIPSWITCH to work properly.

INTRODUCTION

You have purchased a micro-computer chip that will give your radio many more features than it used to have, and hopefully give you as much more enjoyment. To ensure that the installation is a success, and to prevent destroying the chip or damaging your radio;

****** READ THESE INSTRUCTIONS CAREFULLY AND FOLLOW THEM! ******

Your new CHIPSWITCH microcomputer chip has been manufactured using the latest in integrated-circuit technology, and has been thoroughly "burnt-in" and 100% tested at the factory to ensure you the most reliable product possible. Don't take any chances or shortcuts when installing it, or all this effort on our part (and your money) will have been wasted.

WHAT DOES THE INSTALLATION OF THE CHIPSWITCH MICROCOMPUTER CHIP ENTAIL?

As the name "CHIPSWITCH" implies, the basic modification of the radio is the replacement of the existing UNIDEN microcomputer chip. But because the removal of the old chip and the installation of the CHIPSWITCH is a delicate process with potential for damage; * ONLY A PERSON WITH PREVIOUS SOLDERING AND DE-SOLDERING EXPERIENCE SHOULD ATTEMPT IT! *** And even if you do have experience, the information contained herein is the result of many CHIPSWITCH installations, the precautions/techniques described take into account the unique procedures required, and it's important to know these things before you start the job. If, after reading these installation instructions, you don't feel comfortable changing the chip yourself, it is recommended you have a competent electronic technician do the job for you. A good radio service shop should have the equipment required and a technician experienced in soldering/desoldering techniques that can do the job for around $35.00 in most areas of the country. Be sure that whomever you have do the job READS THESE INSTRUCTIONS!**

Call for technical support in the USA at (801) 269-0130. Derrell does not work for *CHIPSWITCH*, but has agreed to help *CHIPSWITCH* customers with their installation questions. He is a reliable installer, and is also available if you need to pay someone else to install your *CHIPSWITCH* component/s or his 12 Meter Kit.

WHAT EQUIPMENT IS REQUIRED TO INSTALL THE CHIP?

Since there are numerous ways to remove the old chip, some better than others, the equipment required will vary depending on the method of removal. In most cases, the method used will probably be dictated by the equipment on hand. The section of this manual that details the chip removal methods will list the specific equipment required for each method, but at minimum you will need:

1. Soldering Iron...	A small-tip, temperature controlled type designed for printed circuit board work. **(* No oversized, high wattage, or "gun" types *)**
2. Solder.....	A quantity of small diameter, rosin core solder suitable for electronic printed circuit use. **(* NO ACID CORE SOLDER!!!! *)**
3. De-solder tools..	At minimum, a roll of small "solder wick" braid, a "bulb" or spring-loaded-piston suction type is better, and a professional vacuum-type de-soldering station is best.
4. Hand tools.....	Medium "Phillips" screwdriver(s), medium "flat-blade" screwdriver(s), small-tip needle-nose pliers, small tip wire cutters.
5. Miscellaneous....	A static-free work area (conductive "work bench" mat is best), a couple of "alligator-type" clip leads, a toothbrush and some alcohol or flux remover.

WHAT ARE THE MAIN DANGERS TO THE RADIO AND THE CHIPSWITCH IC?

To the radio:

a. Static electricity damage to other chips in the radio.
b. Damage to the circuit board or cables/connectors when removing or re-installing the board.
c. Damage to the circuit board or components caused by solder/de-solder.

To the Chipswitch IC:

a. Static discharge
b. Bent/broken pins
c. Installing the chip into the board backwards

As you can see by the dangers listed above, there are a few ways damage could occur during the chip replacement process. But don't get discouraged! Just follow the recommendations in this manual and you will be assured of a successful modification.

QUESTIONS AND ANSWERS ON PREVENTING DAMAGE

Since the two most likely methods of damage are by static electricity and improper solder/de-solder techniques, these two subjects are covered in more detail in the following two question and answer sections.

Questions and answers on Electro-Static Discharge (ESD):

What is ESD?

Electro-static discharge is when static electricity is built up on one object that comes close to or touches another object, and the difference in voltages between the two objects is equalized by a momentary current flow. Everyone has experienced this effect when walking across a carpet and touching a doorknob, hearing the "crackle" when taking off a sweater, or sliding across the car seat and getting a spark when you touch the door.

What does ESD have to do with my new CHIPSWITCH?

ALL integrated circuits (ICs) are easily damaged by static electricity (ESD), but some are more sensitive than others. As a general rule, the more complex the circuitry inside the IC, the more sensitive it is to ESD. The CHIPSWITCH IC, just like the original UNIDEN chip, is classified as a "Very Large Scale Integration" (VLSI) CMOS device, and is thus one of the more ESD sensitive types.

How does ESD damage an Integrated Circuit?

There are over 35,000 transistors inside the CHIPSWITCH IC, and thus the insulation (actually it's glass) between the transistors and conductors on the silicon chip inside the IC are extremely thin, to allow so many transistors to be packed into such a small space. The insulating material is easily destroyed by "arcing" or "punch-through" caused by voltages on the pins exceeding the breakdown voltage of the glass insulator material.

What would the symptoms be if my CHIPSWITCH is damaged by ESD?

If this happens, the chip will either be destroyed instantly, or it may work for a few hours and then start acting up in one of many possible failure modes. The most common failure mode, assuming the chip is not destroyed completely, would be that the memory inside the chip would not stay programmed when the power is turned off for a period of time. If this happens, every time you turn off the radio, it will "forget" all the memory channels and other features that you had programmed in.

Is the CHIPSWITCH IC the only ESD sensitive part in my radio?

NO!!! ALL of the transistors and integrated circuits in your radio are ESD sensitive to some degree. Even the "beefy" final transistor would be destroyed if you gave it the same ESD you regularly give doorknobs! As long as the radio is assembled with the covers on, it is protected from ESD damage by the metal cabinet. But once you remove the covers, precautions are necessary to prevent static from damaging the radio's components.

Do I have to feel or hear a spark to damage a ESD sensitive part?

NO!!! To feel a spark off your fingertip takes about 5,000 volts of static electricity. If you touch a chip and feel a spark, you can bet your life that the chip has been completely destroyed...**PERIOD.** But it only takes about **75 volts** to damage a CMOS IC like the CHIPSWITCH, and you wouldn't even feel that small of a static discharge. Just sliding your pants across a fabric or plastic seat cushion creates about 100 volts, more than enough to kill a chip.

But I've handled IC's before, and haven't blown one yet!?

Then the possibilities are:

1... You've been darn lucky
2... You **have** blown one (or more) up and blamed it on "bad" parts
3... You've damaged a part that failed sometime later and didn't connect that later failure with an ESD event

Isn't it worth the effort involved to be sure that your radio will work reliably?

If integrated circuits are so sensitive, how can I install it in my radio without damaging it or my radio?

BY FOLLOWING THESE INSTRUCTIONS! The procedures described here are designed to PREVENT static electricity buildup. It's not hard, and doesn't cost anything. It just takes a conscious effort and a little knowledge to protect the investment you've made in your radio equipment.

Questions and answers on good soldering and de-soldering techniques:

Is removing the old UNIDEN chip and installing the CHIPSWITCH any harder than other component-replacement jobs?

Compared with most typical repairs/modifications done to these radios, yes. The reasons are as follows:

a. The **pin-to-pin spacing** of the microcomputer chip is **0.070** inch, much closer together than most other parts in radios.

b. The circuit board is a **double-sided, plated-through-hole** type and is easier to damage with excessive soldering/de-soldering heat or rough handling than the single-sided PC boards used in most radios.

c. On the bottom of the board, there are many **"surface-mount"** components that most other radios of this type don't have.

The **close pin-to-pin spacing** makes de-soldering difficult because when you are working on one pin, you don't want to be heating up the adjacent pins also. Everyone who has done de-soldering work has at some time "lifted" a pad or trace. This is caused by the temperature being too hot, or the right temperature being applied too long. You must apply the proper temperature for as short a time as possible to each pin to keep the chances of damage to a minimum. (The close pin-to-pin spacing also makes it necessary to be very careful when you are soldering in the new chip, so that you don't "bridge" or "short" a pin to it's neighboring pin(s), or to a nearby circuit board trace.)

A **double-sided, plated-through** board has some traces on one side that are electrically connected to the traces on the other side by means of the "plated-through" holes. If either trace is broken or "lifted" from the board, or the copper plating material on the inside diameter of the hole is damaged or gets pulled completely out of the hole, the circuit path is now broken and something is not going to work right. Proper de-soldering technique will prevent this from happening. (Note that only a few of the microcomputer chip's holes have traces on both sides of the board. These are the ones you should pay special attention to when you inspect the board for damage just prior to installing the new chip.)

The **surface mount components** on the back side of the board won't be a problem to you if you are cautious with the soldering iron, and watch for any solder that may drip or splatter and short something out.

If I do damage the circuit board, can it be repaired?

Actually, the repair of a broken trace or a damaged "feed-through" is quite easy. The important thing is to detect and repair the damage BEFORE the new chip is installed. To repair a broken trace, "tack" solder a small diameter wire to bridge the damaged area. To repair a feed-through hole, feed a short piece of 30 gauge "wire-wrap" wire through the hole and carefully "tack" solder it to the pads on both sides of the hole. Then when you are soldering in the new chip, try to get a little solder to "wick" through the hole to the pad on the top of the board.

Now that we've answered the most important pre-installation questions, the actual installation procedure follows.

STEP-BY-STEP CHIPSWITCH INSTALLATION INSTRUCTIONS

STEP 1: Setting up your static-safe work area

a. Clear off the top of your workbench. The installation will go smoother without clutter in the way.

b. If you have an anti-static workbench surface (conductive black plastic material), use it. If not, just make sure the bench top surface you do have is not the type of material that generates static electricity (no carpet or non-conductive plastic surfaces).

c. Prepare your soldering and de-soldering equipment. Make sure your soldering iron's tip is the proper size and in good shape. Replace it if not. Clean and wet the soldering iron's tip-cleaning sponge. If you are using a bulb or spring-loaded piston type solder sucker, or a professional vacuum type desoldering machine, clean the hollow tip and empty all solder balls and residue from the areas where they collect to insure they will perform at their best. If you are using a vacuum type de-soldering machine, make sure the hollow tip is the right size (too large a tip will heat the pins next to the one you are working on).

d. Gather up and place your hand tools, solder, solder flux, radio, anti-static box with the **CHIPSWITCH** chip in it, these instructions, something to drink, and anything else you might need, in convenient places around the work area so you won't have to get up or move around once you've started. The most likely time when something will be damaged by ESD is when you move around and build up a static charge on your body. Plan ahead to minimize, or hopefully eliminate, any reason to have to get up or move around much during the procedure (go to the bathroom, eat, etc). Also, warn anyone who may come close to you to stay at least 3 or 4 feet away since a static discharge from them to you will also damage an ESD sensitive device.

Now that you are prepared, the real work can begin!

STEP 2: Disassemble radio and remove the Microcomputer Circuit Board

a. Remove the 4 phillips-head screws that secure the bottom cover. Remove the bottom cover but be careful you don't stretch the speaker wires too much. (You may want to un-solder them at this point to prevent possible damage to them or the speaker.)

b. Back out, but don't completely remove, the 4 screws on the bare metal sides of the radio that hold the metal tray housing the Microcomputer circuit board. This is to provide the clearance needed to remove the board because the ends of these screws protrude into the metal tray enough to prevent the circuit board from being pulled out. (see Figure 1)

c. Place the radio upside down on your work bench with the front of the radio towards you.

*** *Be careful that you don't accidentally move any of the*
*** *potentiometers or other adjustable parts on the circuit*
*** *board while working on or handling it.*

d. Carefully unplug all the white rectangular connectors and the 2 coax connectors. They all will pull straight out and have no "catch" or "locking mechanism", but the white ones are a little stiff and may require a "rocking" action. You don't have to label them because the bundled wires are stiff enough to keep each connector close to where it goes for re-assembly.

e. Now remove the 4 phillips head screws holding down the Microcomputer circuit board. Use a magnet or needle nose pliers to keep them from falling down into the top part of the radio. (see Figure 1)

f. Now carefully lift the circuit board up and out of the radio and hold it by the edges in one hand while lightly pressing the pins of the 64 pin microcomputer chip (the big one) into the palm of your other hand. Count to 30 to allow enough time for the memory backup capacitor to slowly discharge through your skin to prevent a rapid discharge later. Now set the Microcomputer circuit board down on the bench top and move the rest of the radio chassis out of the way since it won't be needed again until you are ready to put it back together.

STEP 3: Remove the 64 pin UNIDEN Microcomputer chip

a. Make a mental note or write down on a piece of paper where the small "dimple" on the microcomputer chip is in respect to the circuit board. This marking indicates pin 1 of the chip, and the **CHIPSWITCH** chip must be installed in exactly the same orientation.

b. Using the soldering iron, remove the small capacitor that stretches over the top of the chip and is soldered between pins 32 and 53. (See fig. 1) Be careful not to damage the capacitor as it will be installed on the bottom of the board after the new **CHIPSWITCH** IC has been soldered in place. Use the "solder wick" to remove the excess solder from the 2 pins where the capacitor was connected.

c. Now you must decide what method you will use to remove the old chip. As mentioned previously in the section on equipment required, what method you decide on will probably be based on the de-soldering equipment and experience you possess. Obviously the best situation would be that you have a lot of previous experience with, and access to, a professional vacuum type de-soldering station. But if this is not the case, use your best judgement and remember the information given in the previous section of this manual on good soldering and de-soldering techniques and **BE CAREFUL!** (One important point to remember now is that you should not attempt to "salvage" the old UNIDEN chip when removing it. It will be of no value to you when the modification is complete, and it's **FAR** more important to minimize the risk of damage to the printed circuit board than worry

about getting the old chip out in good shape. Thus the preferred means to accomplish this is to use a very narrow and sharp pair of diagonal wire cutters to clip each pin of the old chip right where it comes out of the side of the black plastic body of the chip. When this is done, the black plastic body can be removed leaving all 64 pins sticking up out of the board. Then each one can be heated and pulled out independently. Then the remaining solder can be removed from the holes with a vacuum type solder sucker or even with some wick.)

Now, REMOVE THE OLD CHIP AND CLEAN OUT THE HOLES JUST ENOUGH SO THAT THE NEW CHIP CAN BE INSTALLED LATER.

d. INSPECT THE TRACES AND PADS CAREFULLY for any damage or breaks. Also look closely at the old chip's pins for "feed-throughs" that may have been pulled out of the holes. It is very important that you **REPAIR ANY DAMAGED CIRCUITS NOW**, as it is much harder to do so after the new chip is installed.

STEP 4: Install the new CHIPSWITCH Microcomputer chip into the board

a. Plug the new CHIPSWITCH microcomputer chip (or the optional chip socket, if purchased), into the circuit board. If installing the chip without the socket, make sure that it is **NOT INSTALLED BACKWARDS**. The "dimple" should be in the same position as it was on the original UNIDEN chip. SEE FIGURE 1

b. Carefully solder the new CHIPSWITCH IC (or the optional chip socket) into the circuit board. Observe the following cautions;

✓ Only apply heat to each pin for about 2 to 3 seconds.
✓ Keep your soldering iron tip clean using the wetted sponge.
✓ Use enough solder, but not too much. The solder should "flow" properly over the pin and the pad, but not into a bulge that might short to an adjacent pad or circuit board trace.
✓ Be careful that while soldering in the chip or socket you don't disturb any "tack-soldered" repairs you may have made previously.

c. Re-install the small capacitor that was removed from the top of the original UNIDEN chip to the BOTTOM of the circuit board. It goes between the same 2 pins as before (pins 32 and 53). Slip a piece of insulation from some scrap wire over the leads of the capacitor before soldering it in place to prevent it from shorting out to any traces on the bottom of the board. (See FIG 2)

When the soldering is complete, use a toothbrush or other similar tool and some alcohol or solder flux remover, and scrub around the pins on both sides of the board to remove any solder flux residue that remains. The alcohol or flux remover will not harm the surface-mount components, but be sure to let the circuit board **dry completely** before turning the power on.

If you are using the optional chip socket, carefully plug the ***CHIPSWITCH*** chip into the socket now. OBSERVE CHIP ORIENTATION (See FIG 1)

d. Now that the new CHIPSWITCH chip is installed and the soldered connections are clean, inspect the board carefully for any last-minute touch-up that may be needed. This is your last chance to detect and correct any damage or mistakes before the board goes back into the radio.

STEP 5: Re-install the Microcomputer Circuit Board back in the radio

a. Put the radio chassis back on the work surface upside down, with the front facing you. If your radio is a HR-2600 or a later model HR-2510, check to see if there is a piece of black tape on the metal support that holds the upper left corner of the board. If so, make sure it has not been damaged as it keeps the pins of a couple of components from "grounding out" to the support when the screw is tightened. If in doubt, place another piece of black tape over the original piece just to be sure. (see Figure 1)

b. Place the board down in the metal tray, making sure it's oriented in the right direction. Install each of the 4 corner screws, but don't tighten them down yet.

c. Carefully plug in all the connectors to their proper sockets.

d. If your radio did have a piece of black tape on the upper left metal support leg, or if there are components very near that support, take a small flat-blade screwdriver and wedge it between the upper left hand side of the board and the left wall of the metal tray so that the board will be pushed slightly to the right, and at the same time finish tightening all 4 screws holding the board down. This is to help assure that the leads of those components won't ground out to the support. If your radio did not have any black tape or any components real close to the support, just tighten all 4 screws holding the board down.

e. Tighten the 4 screws that hold the metal tray to the sides of the radio chassis. Make one last final inspection that everything looks ok, all screws should be tightened, and all wires connected up.

STEP 6: Testing before final assembly

a. Make sure the On/Off/Volume control is OFF. Re-solder the speaker wires if you previously had them disconnected. Connect an antenna or dummy load to the antenna jack. Connect 12 Volts DC to the power jack (WATCH POLARITY!!!).

b. Turn the radio right-side-up, facing you. Turn on the power switch and confirm that the display reads "**Hr 2510**". If it doesn't, turn off the power and refer to the troubleshooting section, part 1.

c. Push the SPAN button and confirm that the display reads "**HR2600**". If it doesn't, refer to the troubleshooting section, part 2.

d. Push the SPAN button until the display indicates the proper radio type. (**HR2510 HR2600 Lincoln**) Now push the BAND button and confirm that the display reads **24.800.0**. If when you pushed the BAND button nothing happened, refer to the troubleshooting section, part 3.

e. Make sure the **F.LOCK** button is **OUT**, and push the **SPAN** button until the underline cursor is under the far-right zero. Now turn the **VFO** knob (the big knob) to the **RIGHT** (clockwise) and confirm that the underlined digit counts UP. If it didn't change at all, refer to the troubleshooting section, part 4. If it **did change**, but counted **backwards**, refer to the troubleshooting section, part 5.

f. Turn the **VFO** knob to the **LEFT** (counter-clockwise) and confirm that the display counts **DOWN**. If it didn't, refer to the troubleshooting section, part 5.

STEP 7: Final assembly of the radio

a. Put the bottom cover on the radio and re-install the 4 screws that hold it.

Now, refer to the **OPERATOR'S MANUAL** for information on programming the radio.

Note: If you are planning on installing the **PRIORITY** board or doing the **low-frequency mods**, it is recommended that you use the radio now enough to prove that everything is working properly before doing so. (This is to make it easier to determine what is wrong if something doesn't work right)

TROUBLESHOOTING SECTION:

Part 1: Symptom = Display did not read "HR2510" on initial power-up.
(Display is "blank")

- Is the *CHIPSWITCH* chip installed backwards? (see FIG 1)
- Are any of the soldered pins shorted or not soldered?
- If you used the optional chip socket, are any of the chip's pins bent or otherwise not seated properly in the socket?
- Are all the cables plugged into the proper sockets on the board?
- Carefully inspect pins 1 thru 5 as these pins drive the display.
- If you used the optional chip socket, try removing the chip and then re-seating it again. (If this fixes the problem, you may have a bad connection or the socket may have been damaged)

Part 2: Symptom = SPAN button does not work.

- Carefully check pins 11 and 14 as these carry the signal for the SPAN button.

Part 3: Symptom = BAND button does not work.

- Carefully check pins 12 and 14 as these carry the signal for the BAND button.

Part 4: Symptom = VFO knob does not change frequency.

- Be sure the F-LOCK button is OUT.
- Carefully check pin 22 for problems. (This pin should go low momentarily for each "click" of the VFO knob.)
- Carefully check pin 48 for problems. (It should be about +5 Volt)

Part 5: Symptom = VFO knob works backwards.

- Carefully check pin 23 for problems.

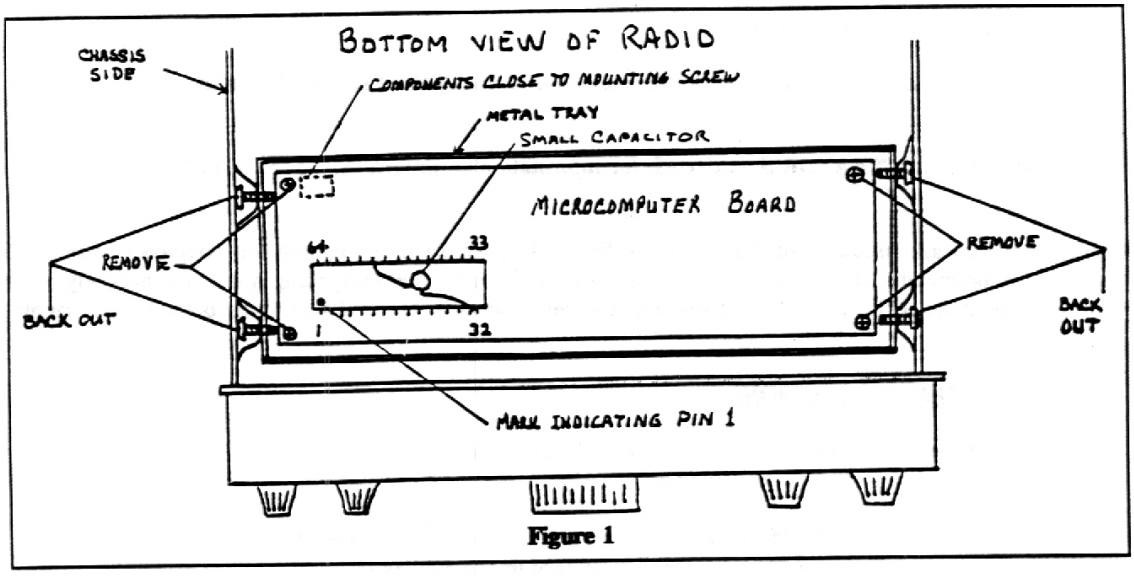

Figure 1

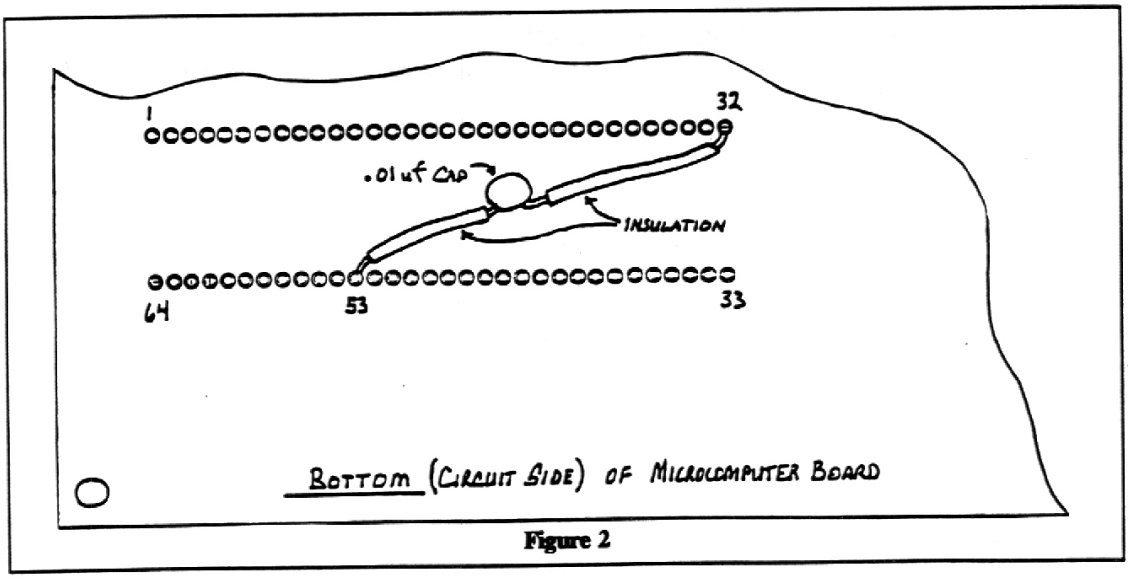

Figure 2