

## 2/ INSTALLATION AND CHECKOUT

Before you grab your screwdriver...

As you know, if you haven't opened your Model III Computer before, doing so will void your limited 90-day warranty, and may make your Repair Center a little upset if anything goes wrong - so you should read through the installation procedure and make sure that you understand what's involved. If you don't feel up to the task of moving two socketed integrated circuits and cutting one trace, consider getting help from someone with electronics experience. Your local computer or ham club is a good place to start, and if that option is not available, a electronics repair shop will usually be happy to do the job for you.

Willing to try? Here we go...

First, clear a working space about the size of a card table. (It is wise to use a soft, non-static surface to avoid scratching the Model III case.) Next, assemble the following tools:

- 1 Phillips head screwdriver
- 1 X-acto knife
- 1 integrated circuit puller or small screwdriver
- 1 hacksaw (optional)

Unplug the power cord, remove any external cables, and follow these steps:

1. Position the computer on its rear panel to provide easy access to the case bottom and remove the ten screws which hold the case together. (One will probably be covered by a black warranty sticker which you must either remove or poke the screwdriver through it). Note the different types and lengths of screws and their locations.
2. Set the computer upright and remove the black screw from the top center of the back panel of the case.

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WARNING!!! Use EXTREME CAUTION in the next steps when removing and replacing the cover to avoid damage to the Cathode Ray Tube!!! NEVER allow the rear of the CRT to strike any surface, as it may IMplode, and cause serious injury from flying glass!  
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3. Now, facing the front of the computer, carefully remove the case top by lifting straight up and setting it to the left on its side. Be careful not to pull on the

cables connecting the two case halves.

4. Now position the computer so that you are looking at the back panel, with the keyboard furthest from you. You will now probably be looking at the RF shielding; a flat metal panel with slits in the top. (Computers manufactured before January 1981 do not comply with FCC emission guidelines and do not have this panel.) To remove this panel and expose the main computer board, you must locate and remove the six screws holding it on. Two screws are located to the right, two on the top, and two on the left side of the panel. The metal shield should now be held in place only by the thick aluminum foil stuck to the bottom of the panel. Carefully peel this foil off without tearing it and remove the panel.
5. Locate the two integrated circuits U67 and U81. These IC's should be easy to find since, unlike most of the other IC's, these two are in sockets.
- 5a. Unless you have the J.E.S. Graphics 4MHz clock speedup board installed, go on to step 6. Otherwise, your actions in step 6 will be slightly modified. When you remove the 20 pin IC from U67 in step 6, unsolder the wire from pin 19 which is presently going to the J.E.S. board. Then bend pin 19 back in place before inserting the chip in the 80-GRAFIX board as explained in step 6. Pin 19 of the red 20 pin IC header located on the bottom of the 80-GRAFIX board should now be bent up and the wire from the J.E.S. board should be attached to it. An alternate way which is recommended if you can leave the metal shield off is to insert a level of low-profile sockets between the 80-GRAFIX board and the TRS-80 board. You can then bend up and solder to pin 19 of the socket instead of the 80-GRAFIX connector. Make sure that you know what you are doing since you may not return a modified board.
6. Pick up the Grafyx board and hold it so that the writing is right side up, and you can see how it will plug into the two sockets which presently contain the IC's mentioned in step 5. You may want to refer to Figure 1 which shows the board completely installed. Now, paying careful attention to the orientation of the two IC's, remove them from the CPU board, and plug them into the corresponding sockets on the Grafyx board. This step must be done with great care in order to keep from bending or breaking any of the pins on the IC's. If you have an IC puller, place it over the IC and rock it back and forth until the IC comes out of the socket. If you don't have an IC puller, use a metal nail file or a small flat blade screwdriver to pry up first one side of the IC and then the other until the IC is clear of the socket. When plugging the IC's into the Grafyx board,

make sure that none of the pins have been bent and that they all match up with the corresponding holes in the IC sockets.

**IMPORTANT - DO NOT** press the IC's into the Grafyx board without firmly supporting the board so that no pressure is placed on the pins protruding from the bottom of the Grafyx board. Bending any of these pins will weaken them and may cause problems later.

After inserting the IC's, make sure that the pins protruding from the bottom of the board are all straight. If they aren't, carefully straighten them with needle-nose pliers.

7. You should now double check the orientation of the IC's which you moved to the Grafyx board. The top of an integrated circuit is the end with an indentation of some sort in it. Holding the Grafyx board so that the name is right side up, the two IC's which you inserted should have their tops nearest the top of the board.
8. There is one trace on the main TRS-80 computer board which must be cut with an X-acto knife. The trace is located above and to the right of IC U82 and is shown in Figure 2. In order to insure that the trace is completely cut, it is best to make two cuts very close to each other (about 1/16") and scrape off the portion of the trace in between the two cuts. Be careful not to damage any of the traces close to the ones being cut. There is a second trace cut which is optional. Performing this modification prevents clear streaks from interfering with the Grafyx Solution display during screen updates. The interference is not too noticeable unless you have a white on black display so you might want to skip this step until you have everything else working properly. The second optional trace cut is performed in the same manner as the first one. It is the trace running down from pin 12 of IC U17 and is shown in Figure 4.
9. Now that that's done, the next step is to install the Grafyx board. First, fasten the yellow micro clip to pin 13 of IC U52 as shown in Figure 4. Try to place all of the micro-clips as close to parallel with the CPU board as possible. Be sure that the clip is firmly attached and does not touch any adjacent pins on the IC. Be careful not to pull on the micro clips since they are easily bent out of shape. You should next fasten the green micro-clip to pin 9 of IC U55.

Before proceeding, you need to determine what version of the TRS-80 board you own. Some computers manufactured after August 1982 have a minor modification which affects the way the Grafyx board is installed. The affected computers are those which have a G

following the seven digit number just above IC #U4. If this is not the case, go on to step 9a. The affected computers have three inductors; L2, L3, and L4 just to the right of IC U95 which stand up about 1/2 to 5/8 of an inch above the board and prevent the Grafyx board from being pressed all the way into the empty IC sockets.

There are several ways around the problem. One is to sandwich an 18 and 20 pin socket between the Grafyx and TRS-80 boards, thus raising the Grafyx board above the inductors. If you can bend the inductors so that they are no more than 1/2 and inch above the board, then only low profile sockets are needed; otherwise you need the non-low-profile kind. Either may be obtained from Micro-Labs at no charge. If this approach is used, be sure and place electrical tape over the top of the inductors so that they do not short out to the bottom of the Grafyx board.

The following solutions are recommended only for those with soldering expertise. The inductors were added to reduce RF interference when using the parallel printer port and are not essential. Therefore, it is possible to remove the inductors and place solid wire jumpers in their place. You might also be able to cut the inductors in half or use longer leads and lay the inductors down.

- 9a. Now, very carefully line up the Grafyx board with the two empty sockets. See Figure 1 for a picture showing how the board should look. Note that the board goes under the five wires from the cassette connector. You can now gently work the Grafyx pins into the sockets a little bit at a time, supporting the main TRS-80 circuit board with your hand as much as possible. If the pins will not go into the sockets without excessive pressure, you will need to "break in" the two IC sockets. This is done by inserting and removing a straight pin several times in each of the empty socket holes. After this is done, you will find that the Grafyx board will press all the way into the sockets without excessive force. Once the board has been plugged in, adjust the light so that you can look at it from the side and make sure that the board is plugged ALL THE WAY IN. If not, either apply more pressure or remove the board and "break in" the sockets before re-inserting.
10. Now all you have to do is connect the remaining micro-clips. The brown micro-clip is unique in that it clips onto a wire instead of an IC. The wire, shown in Figure 3, is in the second slot of the rightmost connector at the top of the TRS-80 main board. This wire should be pulled up OUT OF THE CONNECTOR and one-fourth an inch of



insulation removed from the end using a X-acto knife or wire strippers. The brown clip is then clipped onto the end of the wire and placed in a secure position behind the main board. Do not put the wire back in the connector. You should also place some electrical tape over the connection so that it does not accidentally make contact with the metal brackets. Be sure to keep the plastic clip away from the socketed memory in that corner since some brands of IC's get quite warm.

11. As shown in Figure 4, the red clip should be attached to pin 8 of IC U33. The orange clip goes to pin 12 of IC U18. The fourteen pin ribbon connector will now be attached to IC U20. A piece of double-stick tape is stuck to the bottom of the connector. An extra piece of tape is enclosed in case you remove the connector and want to re-attach it with a new piece of tape. Now remove the protective backing from the tape on the connector and press it firmly down onto the IC, rocking it back and forth to get it started. Make sure that all leads make contact with their respective IC leads and are not touching any other leads.

In all of our tests, this type of connection has proven reliable. It is therefore not recommended that the connector be soldered directly to the IC since it makes the connector difficult to remove, and the IC may be damaged if overheated. Of course, if you have a lot of experience with this type of work, you may prefer to solder a low-profile socket to IC U20, and plug the connector into it.

12. The following connections are illustrated in Figure 4: The blue clip should be attached to pin 7 of IC U41. The purple clip goes to pin 4 of U57. The connection of the grey clip depends on whether or not you performed the optional trace cut in step 8. If you did make the modification, the grey clip should be connected to pin 12 of U17. If you did not, or have not yet made the second trace cut, DO NOT connect the grey clip. Make sure that it does not touch anything by putting electrical tape over the end of the clip or by cutting the clip off at the board. Lastly, the white clip should be connected to pin 13 of U57.

13. Now for the moment you've been waiting for! With the cover still off, and making sure that you stay clear of any of the computer electronics, plug in the power cord and turn the computer on. After the video warms up, your Model III display should come up just as it did before you installed The Grafyx Solution, with the date prompt for Disk systems or the 'Cass?' message for tape systems. If anything looks out of sorts, immediately turn off and unplug the computer! Go to the end of this section and follow the instructions for

trouble shooting your installation.

14. If everything looks normal, you can proceed to load and execute the machine language GTEST program as explained in section 4C. The GTEST program will verify every memory location in the Grafyx board and alert you to any problems. In case there is a problem, the GTEST program also displays the graphics screen so that the error can be pinpointed. If an error does occur, or the display looks incorrect, unplug the computer, and go to the trouble shooting instructions at the end of this section.
15. Assuming that everything now works, you can go ahead and finish the job by putting your Model III back together. Just to be safe, be sure to unplug your computer and wait 30 minutes before proceeding. Since the Grafyx board sits above the main computer board, the metal shield that we took off earlier may not go back because it hits the top of the Grafyx board. You will need to try it out since clearance is not a problem on later model computers. If there is a problem, you will probably want to modify the shield so that it can be put back in place and reduce RF interference although it is not necessary for proper electrical operation. If you do not need to modify the shield, or you're computer didn't come with one, you can go on to step 16.

The two cuts shown in Figure 5 should now be made in the shield with a hacksaw. Be sure and perform this operation AWAY from your computer and make sure that you wipe off the resulting metal particles. You may also need to use an X-acto knife to remove the burrs from the saw cut edges. The next step is to lay the shield flat on a table with the edge of the table being six inches from the bottom of the shield and push down to bend the shield. The section over the Grafyx Solution should be bent so that it is two inches higher than the rest of the shield at the bottom end. The shield can then be put back on over the CPU board if you press on the bottom of the protruding panel when installing it so that it is bowed. The section right over the Grafyx Solution will be about a fourth of an inch higher than before which should be just enough to clear the highest points on the Grafyx board. You should be able to replace all of the screws holding the shield on except for the one on the bottom side nearest the Grafyx board. Finally, stick the thick aluminum foil to the bottom of the shield, as it was before. You may need to replace the tape holding it on for it to stay in place, although it really isn't too important.

You should now go back and repeat step 14 to make sure that you didn't bump anything while putting the shield on.

16. The installation operation is completed by carefully placing the Model III case top over the case bottom, making sure that all wires are inside the case. AGAIN, BE CAREFUL NOT TO HIT THE CRT NECK SINCE IT COULD IMplode OR BREAK OFF. Install the black #6 x 3/8" sheet metal screw in the top rear panel of the case. Holding the two halves of the case together with your hands, turn the Model III on it's back, as before, and replace the ten screws: five 1" sheet metal screws towards the rear, three 7/8" screws along the front, and two 1" screws in the remaining positions.
17. Turn the computer right-side-up and plug it in! You will probably want to run the test program again just to make sure that nothing got bumped when putting the case back together. Assuming that everything is okay, skip the following material and go on to the next section.

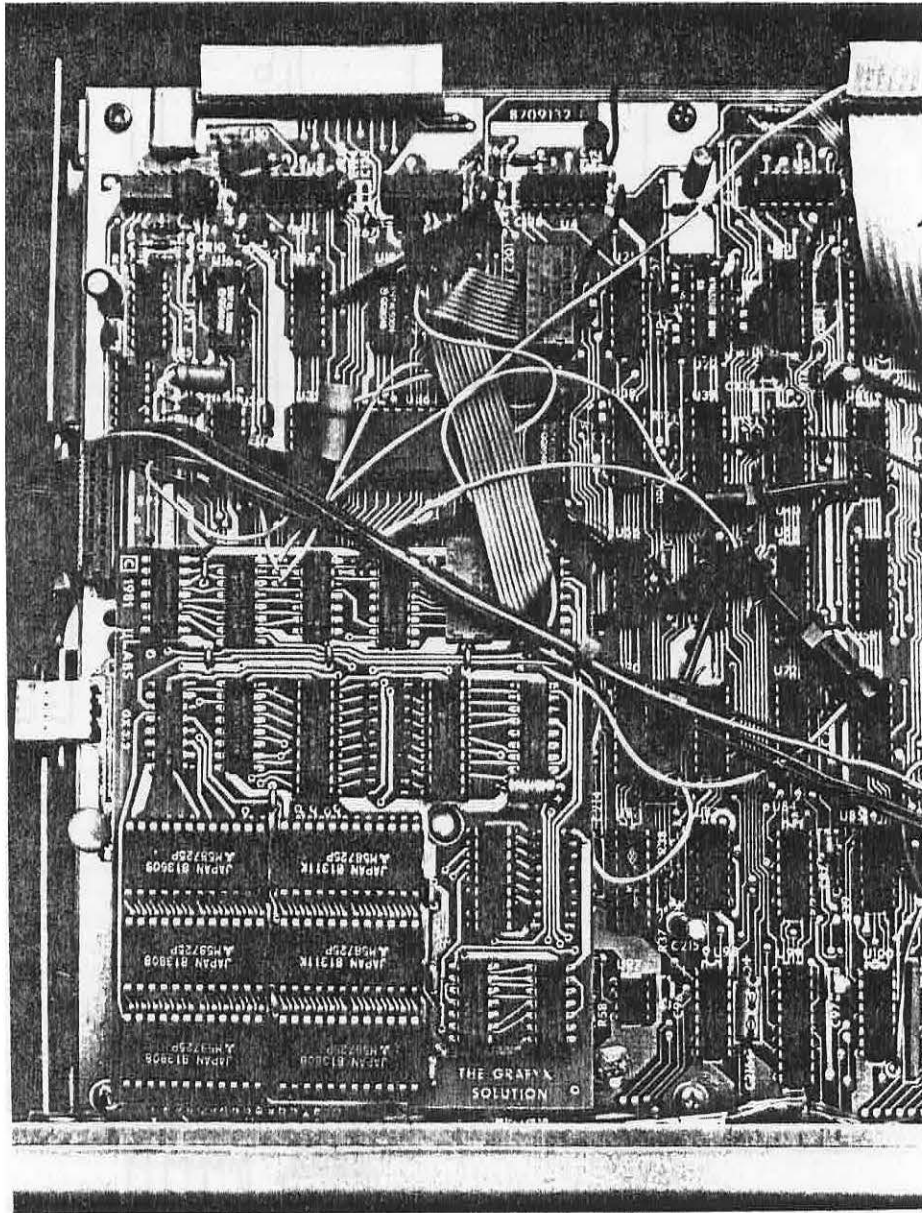


Figure 1 Installed Grafyx Board



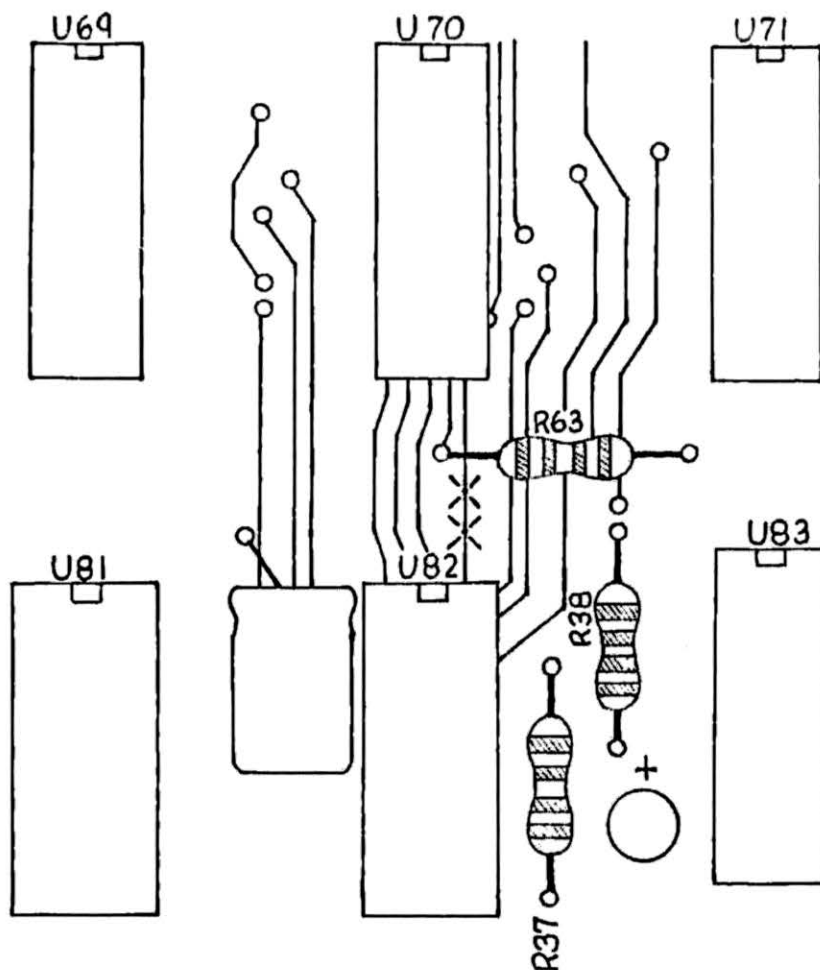


Figure 2. POSITION OF TRACE CUT

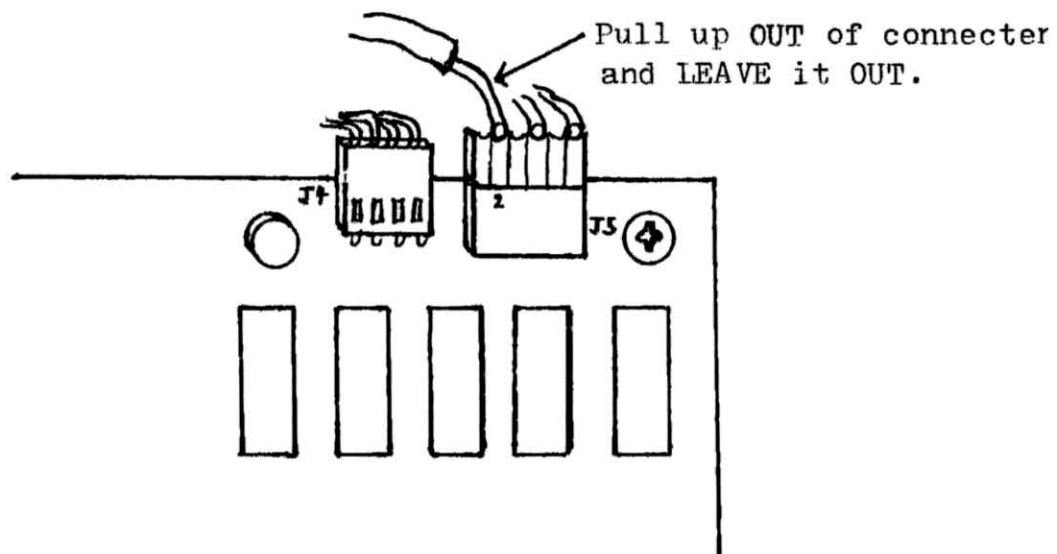


Figure 3.

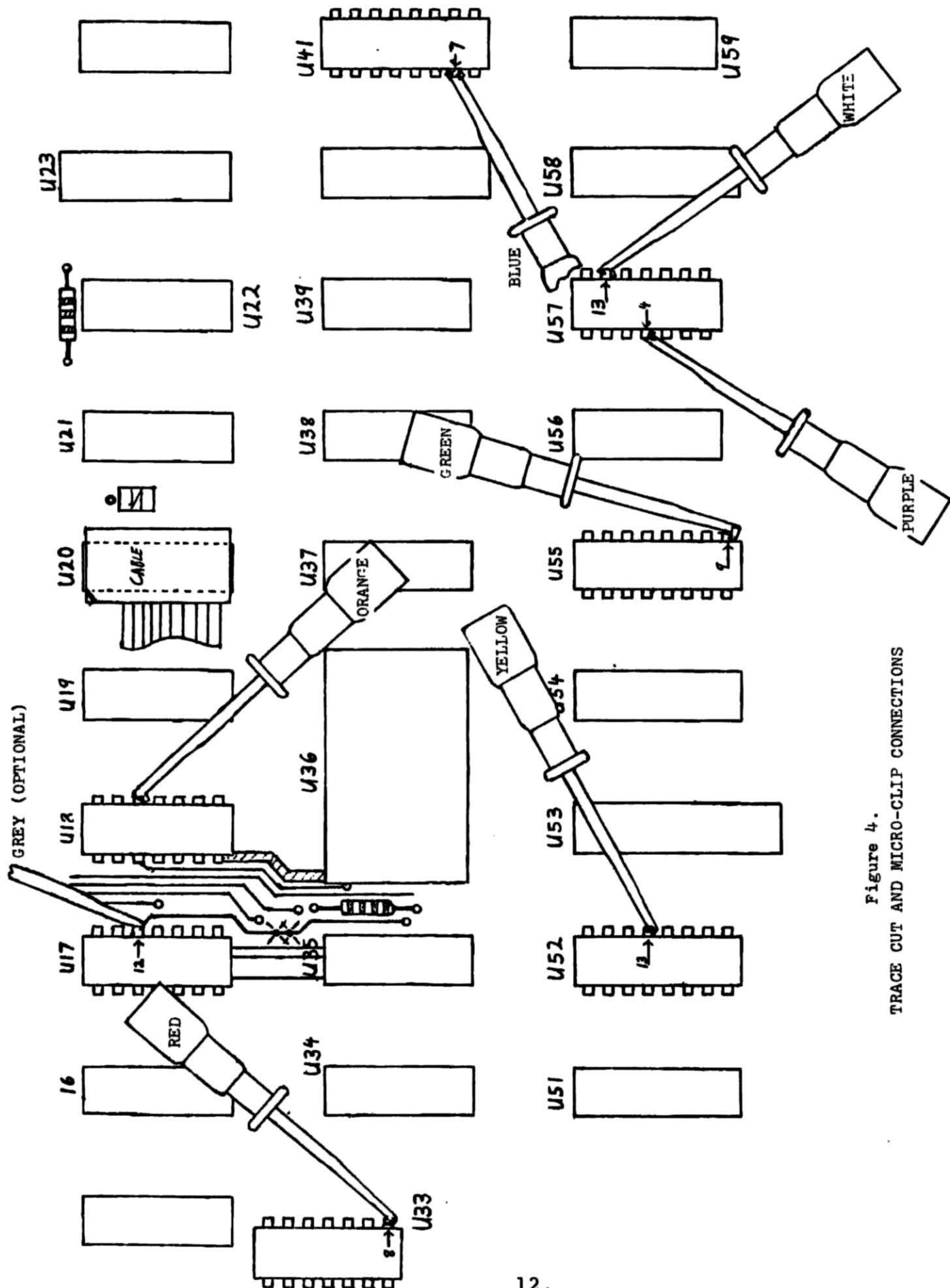


Figure 4.  
TRACE CUT AND MICRO-CLIP CONNECTIONS

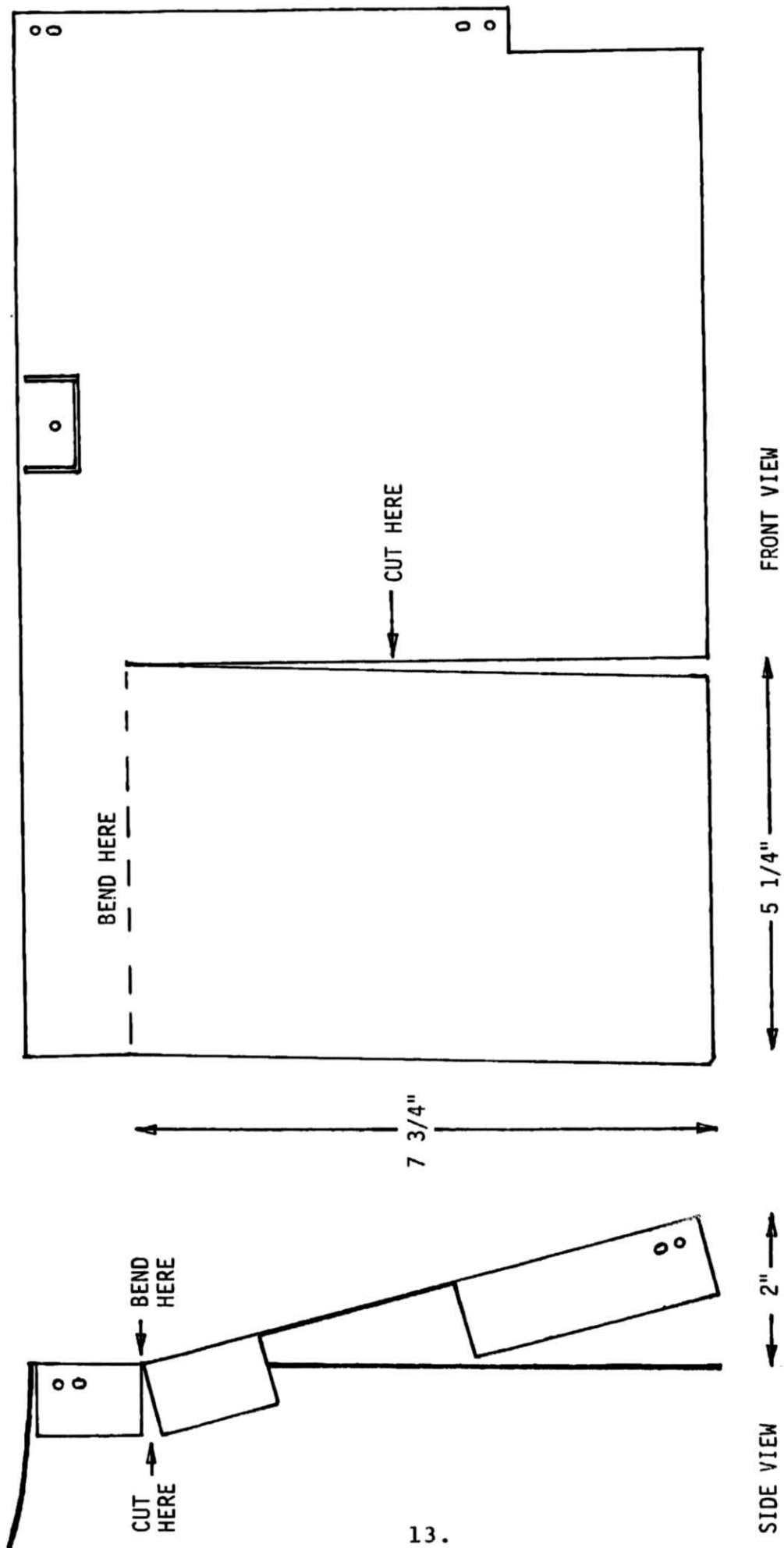


Figure 5. RF SHIELD MODIFICATIONS

## TROUBLE SHOOTING YOUR INSTALLATION

Every Grafyx Solution board is thoroughly tested before it leaves the factory. Therefore, if any problems in operation are encountered, you should first suspect an installation problem.

In general, you should carefully check every connection to make sure that it is in the right place and that the connectors are oriented properly. Go back and compare what you did to see if it matches the illustrations. Look at the connections of the micro clips with a magnifying glass and make sure that they are firmly attached and do not touch any adjacent pins. Also make sure that the connectors and IC's are well seated and making good contact. Stand back and look at the cables and connectors on the main TRS-80 board to make sure that you did not accidentally bump any of them while installing the board. If you can't find anything wrong, it is a good idea to have someone else go through the steps of installation with you as they might notice something that you missed.

Here are some of the more common problems and their probable causes:

1. If on power-up, you get a totally blank screen, then you should first suspect the connection of the brown micro-clip.
2. If the screen is covered with a fuzzy, grey picture with lines in it, you should check the yellow clip.
3. One possible problem is evidenced by a lot of strange characters being displayed on the screen. However, when something is typed on the keyboard you can see that the display is changed and that characters are being put on the screen properly, even though the wrong characters are being displayed. This problem is most likely caused by the Grafyx board not being pressed into the sockets all the way and not making good contact. (See step 9 of the installation instructions.)
4. If all you see is a screen full of random or double-width characters, you should check to make sure that the two IC's taken from the TRS-80 were inserted in the Grafyx board in the proper orientation and that no pins were bent underneath the IC's when they were inserted. You should also check to make sure that the proper trace(s) were cut without damaging any other traces in the vicinity. Also make absolutely sure that you have dug into the circuit board far enough to insure that the

trace(s) are completely severed.

5. If the computer or graphics board quite working after the metal shield was put back on, you should remove the shield and attempt to get the computer and board to work without it. Most likely, the Grafyx board was not pressed into the sockets as far as it could have been and/or the shield did not clear the board and placed pressure on one side of the Grafyx board causing it to be tilted and come part way out of the sockets. Also check for any micro-clips which may have been knocked loose.
6. If the disk drives don't work properly after putting the computer back together, take the computer top and shield off. You will then be able to see a flat white connecting cable located at the top of the TRS-80 board above the Grafyx board. This type of cable connection is very poor and it probably got bumped or bent during installation. First try wiggling this cable in order to get it to make contact. If that doesn't work, remove the cable from the TRS-80 main board and re-insert it. When you do this, be absolutely sure that the conductors line up with the contacts. It is also possible that the cable was pulled loose from the other end, but be warned that if you disconnect the cable from that end that it is very difficult to re-insert.

The following problems are ones which are only apparent when the GTEST program is run and the results shown on the screen. The GTEST program should alternate showing patterns in the top and bottom halves of the screen. In the blank half of the screen, the number of read errors is shown.

7. If the screen goes completely white when GTEST is executed, then check to make sure that pins 3, 4, 5, and 6 of the ribbon cable connector are making contact with the IC leads underneath. You may have to remove the connector and bend the pins inward slightly.
8. If the hi-resolution dots appear all over the screen, and no read errors are shown, then you should suspect the purple micro-clip. However, if there are a large number of read errors, check the orange clip.
9. If no hi-resolution dots appear and a large number of read errors are reported, take a second look at the blue micro-clip.
10. If no hi-resolution dots appear and there are no read errors, check the red and green micro-clips for the proper connections.



11. If the cross-hatch pattern has several horizontal lines duplicated, but doesn't give any read errors, check to make sure that the fourteen pin header is well seated, making good contact, and is on the correct IC (U20).
12. If the hi-resolution display mode is not disabled when you press the orange reset button, then the white clip is not properly in place.

If you are still unable to find and correct the problem, completely remove the board and then try installing it again, being careful to READ EVERY STEP as you go along. While the board is out, check to make sure that you didn't bend any of the pins on the bottom of the Grafyx board when inserting it. If you did, carefully straighten the pin(s) with needle nose pliers and try installing the board a second time.

If you still can't find the problem, write to the factory and give a detailed description of all aspects of the problem. If you do find and correct error(s) in installation, and the Grafyx Solution still fails to perform properly, it is possible, although not likely, that one of your mistake(s) may have damaged the Grafyx board, the TRS-80, or both. If this is the case, be sure to describe everything you did in your letter.

#### REMOVING THE GRAFYX BOARD

If you decide to remove the Grafyx board now or at a later date, you will need to restore the TRS-80 to its original configuration. This is done by first removing the two socketed IC's from the Grafyx board and putting them in the corresponding sockets on the TRS-80. You may then try to solder the cut trace(s) back but this is difficult because of the skill required. We recommend using a jumper with a micro-clip at each end instead. These can be purchased from Radio Shack. You will need to jumper pin 10 of U19 to pin 10 of U81. A jumper from pin 12 of U17 to pin 8 of U39 is required if the optional trace cut shown in Figure 4 was performed. You will also need to re-insert the wire removed from the connector in the upper-right portion of the TRS-80 board. You can refer to the drawing which was used to show you how to remove it. Your computer should now work exactly as it did before it was modified.