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SECTION 1

Thank you for selecting the MICRO MAINFRAME disk controller upgrade for your Model-III or Model-IV computer system. We at MMF are certain that you will discover that there is no finer unit available at any cost. Before you proceed any further, PLEASE READ THE FOLLOWING INSTRUCTIONS AT LEAST TWICE PRIOR TO PROCEEDING WITH THE INSTALLATION. MICRO MAINFRAME PRESUMES THAT YOU POSSESS A CERTAIN DEGREE OF COMPUTER LITERACY AND BASIC MECHANICAL SKILLS IN ORDER TO COMPLETE THE INSTALLATION. If you do not possess these skills, you should invest in the talents of someone who does have them to install your disk controller. Although the mechanical skills required are minimal, a working knowledge of computer circuitry is often helpful in troubleshooting your system if it does not work the first time.

If you have not purchased 32K (Model-III) or 64K (Model-IV) additional memory, we advise you to make this purchase prior to installing your disk controller so that you will be altering only one part of the computer at a time. This will help you determine whether you have any problems with any part of the installation before compounding your situation. Micro Mainframe has available from stock memory upgrade kits for both the Model-III and Model-IV computers. If your Model-III is a Level-I unit, it will not be capable of disk operation without the addition of a Level-II ROM set which is available only with installation from Tandy. We advise that you have this operation performed prior to breaking the seal on your new computer.

It is poor economy to have less than a full complement of memory, especially at today's prices. We advise strongly that you install at least 48K in your Model-III or 64K in your Model-IV so that it can do some useful work for you without any constraints on memory size. Please perform the tests described in PARAGRAPH 1.0.0 below before attempting to install the memory chips. You should perform these tests even if you elect not to expand your memory, and perform them once again after you have installed additional RAM to insure that you have properly installed the RAM chips. You must perform these tests prior to proceeding with the installation of your FDC-3 disk controller. Remember, if there is a hidden problem with your computer, Tandy is not obligated to repair the unit unless it has a Tandy installed disk upgrade. It is, therefore, to your advantage to have performed this series of tests prior to installing the MICRO MAINFRAME controller, so let us begin.

**1.0.0 TEST PROCEDURE**

1. Turn on the computer and enter the cassette mode. Answer the prompts with <ENTER> and type PRINT MEM. You can expect the following amounts of memory to be present with the Model-III and the Model-IV in the Model-III mode: 16K - 15314; 32K - 31698; and 48K - 48082.
2. If you have a line printer, verify that the parallel printer port is working properly by typing in a small BASIC program and then type LLIST. Don't forget to connect the printer before attempting this test. If the printer lists properly then you may safely assume that the printer port is functioning properly.
3. Verify proper operation of the RS-232 serial port if installed.
4. Verify proper operation of any devices or modifications you may have made previously to the machine.

5. Upon completion of the items listed above, you are now ready to proceed with the installation. **UNPLUG THE COMPUTER AT THIS TIME TO PREVENT SERIOUS SHOCK OR POTENTIAL DEATH! YOU ARE ALSO CAUTIONED NOT TO TOUCH THE HEAVY WIRE OR ANY PORTION OF THE CRT; BOTH HAVE 15,000 VOLTS ON THEM, WHICH CAN BE PRESENT ON THE CRT FOR SEVERAL MINUTES AFTER POWER HAS BEEN REMOVED, SO TREAT BOTH WITH ALL DUE RESPECT!**

### 1.1.0 UNPACKING YOUR FDC-3B/C DISK UPGRADE

The following list is an inventory of the component parts included with the purchase of each FDC-3BK and each FDC-3CK (controller and accessories kit). If you did not purchase the installation kit, you will only have the printed circuit board and these instructions. Please examine the package carefully for any shipping damage and to make certain that you have received a complete set of parts. **IF THE PACKAGE HAS BEEN DAMAGED BY THE CARRIER WHILE ENROUTE, YOU MUST NOTIFY THE CARRIER AND YOUR DEALER WITHIN (3) DAYS OF RECEIPT OF THE MERCHANDISE TO ESTABLISH YOUR CLAIM.** Each kit has been checked twice to assure that all parts have been included. **IF ANY PARTS ARE MISSING, YOU MUST NOTIFY THE DEALER FROM WHOM YOU PURCHASED THE KIT WITHIN (3) DAYS OF RECEIPT REGARDING THE SHORTAGE.**

#### IK-3 ACCESSORIES KIT COMPONENT INVENTORY

1. Mounting Brackets (2 ea, both are the same length)
2. 34 position ANSI standard\* drive cable (2 drive positions)
3. 8-32 x 3/8" pan head screws (4 ea)
4. 8-32 flat washers (4 ea)
5. 6-32 x 3/8" pan head screws (8 ea)
6. Disk Drive power cables (2 ea)
7. Packet of Disk Drive Mounting screws (4 ea)
8. Plastic Ty-Wrap (TM) for power supply mounting (2 ea)
9. Controller power cable (1 ea)
10. 8 conductor, 10" long ribbon cable (1 ea)
11. FDC-3B or FDC-3C disk controller board (if purchased, 1 ea)
12. Switching power supply (1 ea)

\* ANSI standard drive cables select the drive using the dip shunts on the drives instead of removing pins from the cable as Tandy does for drive selection.

### 1.2.0 COMPUTER DISASSEMBLY PROCEDURE

1. Before proceeding, you must **REMOVE ALL CABLES** attached to the bottom of the Computer (eg. printer, etc.). The easiest way to accomplish this is to place a soft towel or other material on the work surface and invert the Model-III on top of it. You will need both a **SLOT** and a **PHILLIPS** screwdriver to perform the installation. Using the **PHILLIPS** screwdriver, remove the 10 screws from the bottom of the case (removal of one of the rear corner screws will require that you break the seal that Tandy has placed on the bottom of the machine). **BREAKING THIS SEAL MAY VOID YOUR TANDY WARRANTY!** Please note that some of the screws are of different types and lengths. It is a good idea to tape similar screws together with masking tape, and write on the tape the location from whence they came.
2. You should now return the Computer to the upright position, taking great care to hold together the top and bottom parts with your hands while turning the unit over. You should now remove the screw located at the top rear apron of the computer enclosure. **MMF RECOMMENDS THE USE OF PROTECTIVE GOGGLES WHILE REMOVING AND REINSTALLING THE TOP OF THE COMPUTER.**

3. **WHILE EXERCISING EXTREME CAUTION**, you should now remove the top of the enclosure from the base plate by lifting the top enclosure slightly **TOWARD YOU AND OFF** the Computer. **NOTE WELL: IT IS POSSIBLE TO BREAK THE CRT (PICTURE TUBE) IF THE NECK OF THE CRT TUBE HANGS ON THE CHASSIS OR CABLING** (this frequently happens), so some extra precaution is applicable here. The CRT tube could implode (similar to explode) and do great damage to you especially if you were not wearing protective goggles. You may now unplug the cables going to the video board (left side of the cover component of the case).

Set the top cover aside and to the left of the computer before you attempt to remove the power cables to the video board. You may now remove the video plug and ground cable from the video unit. After you have accomplished this, you may move the top of the machine to any convenient, out of the way place.

### 1.3.0 CPU BOARD REMOVAL - REFER TO FIGURE 1.10.1

1. Rotate the Computer so that you are facing the rear of the computer case (the part we want is inside the metal chassis that is now visible).
2. Remove the metal chassis by removing the 4 sheet metal screws you see around the top and sides of the cover. Please note the location of all ground straps during this step so that they may be properly replaced during reassembly. Your RFI shielding must have all ground straps secure to assure that the original FCC noise specifications will be retained. **THE USER IS RESPONSIBLE FOR ALL VIOLATIONS OF THE FCC REGULATIONS IF THIS SHIELD IS LEFT OFF!** If you have an early version Model-III, you may disregard this step as this version of the Model-III does not require the RFI shield. Owners of these early units must, instead, remove a small metal bracket which is secured by two sheet metal screws to the vertical metal chassis prior to removing the CPU PC board. Please refer to **FIGURE 1.10.2** for the location of this bracket.
3. If you have not installed 32K or 64K of RAM memory (Model-IV only), you should do so at this time; please check the memory installation to make certain that there are no problems with it before proceeding any further.
  - a. **YOU MUST DISCONNECT THE AC POWER CORD BEFORE PROCEEDING.**
  - b. **REFER TO FIGURES 1.10.1 and 1.10.3 (MODEL-III ONLY) FOR THE LOCATION OF THE ADDITIONAL MEMORY CHIPS AND THE PROPER ORIENTATION OF THE 4116 CHIPS.** Instructions for adding 64K of RAM to your Model-IV are included with our Model-IV memory upgrade kit.
  - c. Insert each memory chip into the socket as per **FIGURES 1.10.1 and 1.10.3**. Make certain that each chip seats properly and that you have not bent under any pins during memory installation.
  - d. After completion of the previous step, you may reconnect the AC power and test for correct installation by performing step 1 of Paragraph 1.0.0. Don't forget to reconnect the cables from the CPU to the Video Monitor if you have already removed them. If the operation was successful, the Model-III should reply 48082 to your query **?MEM.**
4. Remove the power and video connectors in the upper right corner of the CPU PC board. Refer to **FIGURE 1.10.1** for the location of these connectors.
5. Remove the 20 pin jumper cable going from the RS-232 board (if installed). Refer to **FIGURE 1.10.1** for the location of this connector.

- ✓ 6. Remove the two screws holding the metal clamp against the keyboard cable located on the left end (as viewed from the rear) of the metal chassis. Take precaution when you remove this connector that you do not damage any of the pins or the connector shell (see FIGURE 1.10.1 for the location of this connector). Pull the connector off straight toward you so as not to bend or damage any of the connector pins. You may use a small slot screwdriver to gently pry this connection apart if necessary. Start by pulling gently on the cable assembly until you see some metal pins between the plastic pieces. Insert the screwdriver up against the pins at first one end and then the other, and by gently rotating the blade against both sides of the plastic, pry on the connector until it is easily removed by hand.
- ✓ 7. Remove the cassette port connector located just below the keyboard connector on the CPU PC board (see FIGURE 1.10.1 ).
8. Remove the screws that hold the CPU PC board to the vertical metal chassis. In the current version Model-III, there are seven (7) machine screws holding the CPU PC board to the chassis.
- ✓ 9. If you have one of the early version Model-III computers, you will have a combination of screws and plastic spacers holding the CPU board to the chassis. The plastic spacers may be released by squeezing the connector at the top to release the detent holding the board in place.

NOTE: While you are removing the CPU PC board, carefully examine between each screw and the Metal Chassis to determine whether or not there is a small flat plastic insulator between the PC board and the Metal Chassis. Please refer to FIGURE 1.10.1 for the location of these spacers. **SOME VERSIONS OF THE MODEL-III DO NOT HAVE THESE SPACERS.** Make certain that you correctly reinstall the spacers during reassembly of the computer after completion of the installation procedure if they were included with your Model-III. **FAILURE TO REPLACE THESE SPACERS IN THE PROPER LOCATIONS WILL RESULT IN SHORTING OUT SOME OF THE DISK CONTROLLER INTERFACE CIRCUITRY, AND THE CONTROLLER MAY NOT WORK.** Put these screws and spacers in a safe place so that you will not lose them.

#### 1.4.0 FDC-3B/C PCB INSTALLATION

PLEASE REFER TO FIGURE 1.10.4 FOR THE FOLLOWING STEPS.

- ✓ 1. Remove the FDC-3B/C PC board from the protective packaging. Check the board at this time for any obvious problems (such as broken components, missing components, etc.).
2. Mount the FDC-3B/C PC board up against the metal spacers on the left side of the chassis that holds the CPU PC board. The component side of the board should be facing you and the lettering on the board should be right side up when you have properly accomplished this. Take the four (4) 6-32 x 3/8" pan head screws (supplied) and insert one into each of the two top mounting holes of the FDC-3B/C. **DO NOT USE ANY METAL WASHERS ON EITHER SIDE OF THE FDC-3B/C PC BOARD.** The bottom screws are tricky to install and you may have to hold the screw with a pair of long nose pliers or tweezers as you insert a screwdriver through the hole in the metal chassis and then mate the screw to the screwdriver. Install the screw into the threaded metal spacer on the metal chassis and then repeat for the other screw.

PLEASE NOTE: If yours is a early version Model-III and does not have the metal standoffs installed, you may obtain some that are appropriate from Micro Mainframe for \$4.50 plus shipping and handling. Instructions are provided with this kit for the installation of the controller.

3. Locate the gray drive cable in your accessories kit (if purchased). Install this cable to the top connector on the FDC-3B/C PC board so that the connector that is farthest from the other connectors is connected to the FDC-3B/C. The colored stripe on the gray cable (pin 1) should be to the outside edge (left side of the computer as viewed from the rear) of the Computer if you have properly performed this step.
4. Locate the controller power cable (it has a red 4 pin, header socket on each end) and connect it to either SK-2, SK-3, or SK-4 on the FDC-3B/C controller board. Route the drive cable, the 20 pin Flex Jumper, and the controller power cable through the opening between the two parts of the metal frame that the CPU PC board is mounted upon. Refer to FIGURE 1.10.4 to clarify this point.
5. You may now reinstall the CPU PC board at this time by reversing the procedure outlined in PARAGRAPH 1.3.0 above.
6. Connect the free end of the 20 position Flex jumper on the FDC-3 controller to J7 on the Model-III PC board. Refer to FIGURE 1.10.1 to locate J7 on your CPU card. Take extra precaution when performing this step to make certain that each pin of the cable is lined up with the metal contacts of the connector. Once installed, you may put two creases in the jumper cable to make the installation neat. If this connector is properly mated, you should be able to tug gently on the cable and it should resist your attempts to remove it from the black connector. PLEASE NOTE: it is very easy to misalign the cable in the connector. The improper mating of this cable is the principal reason that some people have difficulty making the controller operate properly upon power up.
7. Refer to FIGURE 1.10.1 for the proper location and connect the 8 position Flex Jumper (supplied only with optional accessories kit) as shown. This jumper connects the required address and data lines to the disk controller and RS-232 bus connectors. Make certain that you connect pin 1 to pin 1. You may crease this cable as necessary to neaten up the installation. If you have an RS-232 board installed in your computer this jumper will already be installed. MODEL-IV USERS NOTE: THIS JUMPER IS NOT REQUIRED AND MAY BE DISCARDED.
8. Replace the cables that you have removed from the CPU board at this time. Do not forget to replace the metal cover on the rear of the Model-III and the metal clamp on the keyboard cable. Make certain that the copper shield is grounded to the metal clamp.

#### 1.5.0 INSTALLING THE ACCESSORIES KIT

PLEASE REFER TO FIGURE 1.10.2 FOR THE FOLLOWING STEPS.

MICRO MAINFRAME supplies mounting brackets that are identical in length for both sides. These brackets have holes drilled in the sides to accommodate two floppy disk drives. The holes that mount the brackets to the TRS-80 are slotted to allow you to adjust the spacing between the front of your drive and the TRS-80 Computer. This feature allows you to compensate for any manufacturing inconsistencies in the Radio Shack case and for disk drives with different thickness front panels (INCLUDING HARD DRIVES).

1. Turn the Computer so that you are facing the Keyboard. On the right side of the computer just behind the keyboard, locate the drive mounting area (four holes in a rectangle spaced about 6" apart). REFER TO FIGURE 1.10.5 FOR THE LOCATION OF THESE HOLES. The proper mounting holes will have threaded brass nuts imbedded into the plastic.

2. Locate one of the mounting brackets and install it on the right side of the drive mounting area using the 8-32 x 3/8" screws and washers provided. Install the mounting brackets on the floor of the computer so that the screw is approximately in the middle of the slot for now. After you have completed the installation, you may move these brackets forward or backward to achieve perfect alignment with your Computer and Drive combination. Do not overtighten these screws, as it is possible to strip out the brass nuts imbedded in the plastic case.
3. Install the remaining bracket on the left side of the drive mounting area in the same manner as step 2 above.
4. If you purchased the SPS-1 power supply from Micro Mainframe it is a switching power supply. Locate the two white plastic Ty-Wraps (TM) included with your installation kit. You will use these plastic straps to mount the SPS-1 power supply to the bottom of the Computer case (please refer to FIGURE 1.10.2 for the locations and mounting procedures).

If you purchased a power supply from your dealer, you should determine what type of power supply he has provided. The vendor should have provided you with some instructions as to where to mount the power supply. If he has provided an Astec switching power supply, you should mount it identically as for the MICRO MAINFRAME power supply noted above. If you purchased a linear power supply, you may not be able to mount it under the CRT due to size limitations or possible video interference due to the magnetic flux of the transformer. Check with your dealer if you have questions regarding your particular installation.

#### 1.6.0 POWER SUPPLY CONNECTIONS

PLEASE REFER TO FIGURES 1.10.6, 1.10.7, 1.10.8 & 1.10.9 FOR THE FOLLOWING STEPS.

1. Locate the white power connector in the Computer's wiring harness. It has one black and one white wire and is usually secured with a white plastic strap. Cut the plastic strap with your wire cutters or scissors.
2. Connect the cable from Step 1 to the SK-1 connector on the power supply. This plug supplies the 115 volt AC current to the power supply and it will not work without this connection. MAKE CERTAIN THAT THE BLACK WIRE GOES TO THE TERMINAL MARKED "L" AND THE WHITE WIRE GOES TO THE TERMINAL MARKED "N" ON THE SPS-1 POWER SUPPLY.
3. Locate the controller power cable (Refer to Step 4 of PARAGRAPH 1.4.0 above) and connect the free end (it has a RED connector) to socket SK-2 on the switching power supply. SOCKETS SK-2, SK-3, AND SK-4 ARE ALL IDENTICAL. MAKE ABSOLUTELY CERTAIN THAT THE CABLES ARE CONNECTED AS SHOWN IN FIGURE 1.10.7 OR YOU COULD DESTROY BOTH THE SPS-1 POWER SUPPLY AND THE DISK CONTROLLER. MICRO MAINFRAME WILL NOT REPLACE UNITS DETERMINED BY US TO HAVE BEEN DAMAGED BY INCORRECTLY CONNECTING ANY OF THE CABLES. If you have some other type power supply you should refer to the instructions provided by the dealer providing the power supply.
4. Locate the two drive power cables included with your accessories kit and connect the RED connectors to SK-3 and SK-4 on the SPS-1 switching power supply supply. MAKE CERTAIN THAT THEY ARE ALIGNED ACCORDING TO FIGURE 1.10.7.

5. Verify that JU-1 on the power supply is connected to the correct pin for your AC supply voltage. Please refer to FIGURE 1.10.6 for the location of this jumper. MMF ships all units with JU-1 connected to the 115 VAC position denoted as A in FIGURE 1.10.6. If your power source is 230 VAC (foreign operation only), then reconnect JU-1 to position B. PLEASE NOTE: THIS CHANGE APPLIES ONLY TO FOREIGN USERS WITH 230 VAC MAINS.
6. THIS COMPLETES THE CONNECTIONS TO THE POWER SUPPLY.

## 1.7.0 CONFIGURING YOUR DISK DRIVES

### 1.7.1 CONFIGURATION FOR INTERNAL DRIVES

You must now prepare your disk drives for the installation by configuring them for Drives 0 and 1 respectively. Before performing this operation, you should check the documentation supplied by the drive manufacturer (usually, but not always included with your drives by the dealer). If he did not supply the documentation, you may refer to FIGURES 1.10.10, 1.10.11, or 1.10.12 for an outline drawing of the configuration for MPI, Tandon, or TEC disk drives. We have included diagrams for these types of drives since they seem to be the most popular of all the drives used for disk upgrade kits. If you are using another type drive, you are on your own if your dealer cannot help you. MICRO MAINFRAME CANNOT PROVIDE INFORMATION FOR ANY OTHER TYPES OF DRIVES.

A shunt means a SHORT circuit (or connection) between two points in a circuit. Most drives are supplied with one of two types of SHUNT. MPI and TANDON drives come with 14 pin plastic package (DIP SHUNT) that resembles a 14 pin Integrated Circuit that has a piece of metal shorting across from one side to the other. The easiest way to program this shunt is to remove the SHUNT from its socket, determine which 2 out of the 7 connections that you want shorted, and then bend one side of the connection up for each connection that you want to be open. FIGURE 1.10.13 IS REPRESENTATIVE OF THIS TYPE OF PROGRAMMING.

The second type of SHUNT supplied is a small piece of plastic that slips over two adjacent pins of a HEADER SOCKET. This is the method used with the TEC disk drive. It is also very simple to perform this operation, as one merely removes the SHUNT from the position in which it was shipped, and reinstalls it in the desired position. This is a much faster programming operation than with the other type.

1. Locate the TERMINATING RESISTOR PACKAGE (TRP) for each drive in your system. PLEASE REFER TO FIGURES 1.10.10, 1.10.11, OR 1.10.12 FOR THE LOCATION OF THE TRP (it resembles an integrated circuit). If you intend to install Drive 0 into the bottom slot of the computer (this is the normal preference), then make certain that the drive that you are going to program as Drive 0 has the TRP installed since it is the last drive on the cable.
2. Remove the TRP from the remaining drive. This may be accomplished by taking a small screwdriver or nail file and gently prying first upon one end and then the other until the chip pops out of the socket. Save this chip for a spare.
3. You are now ready to program the drives for the desired selection. This is accomplished by changing the configuration of the DIP SHUNT as follows:



- a. If you are using MPI drives, program the DIP SHUNT as per FIGURE 1.10.10. Make certain that you have a jumper installed to select the drive and load the head. If you wish to load the head with DRIVE SELECT, then you will want to install a jumper across pins 1 and 16. If you desire to load the head when the motor is turned on (this is the usual choice since the continual loading and unloading of the head can be annoying after awhile), then you should install a jumper across pins 8 & 9. NOTE: If you do not make a selection of one of these options, the head will never load and the drive will NEVER read anything from the disk.
- b. If you are using Tandon disk drives, you should program the DIP SHUNT as per FIGURE 1.10.11.
- c. If you are using full size TEC disk drives (FB-502), you should program the SHUNT as per FIGURE 1.10.12. Notice that you only have to move the jumper supplied from set of pins to another. This is by far the most easily configured disk drive as there is only one change to make to reconfigure the drive. Leave the other SHUNT IN POSITION B as noted in FIGURE 1.10.12.

### 1.7.2 EXTERNAL DISK DRIVE CONFIGURATION

1. You may optionally install all of your drives external to the computer. If you desire to do this, you should purchase an external drive cable from Micro Mainframe or make one of your own. The primary difference between the Radio Shack cable and the MMF cable is that Radio Shack selects the physical drive position by removing the select contact for that position from the connector. The MMF method of selecting drives is consistent with the ANSI standard and drives may be configured by installing a small jumper called a SHUNT in the appropriate position in a connector on the disk drive. This procedure was previously outlined under configuring your disk drive (Paragraph 1.7.0). If you have purchased a Radio Shack cable, you can make it work by turning the cable over so that the colored stripe identifying pin 1 is on the opposite side from the normal position on both the drive and the connection on the bottom of the computer.

Program your external drives the same as you would the internal internal disk drives; i.e- you must select drives 0,1,2, or 3 when programming the DIP SHUNT. If you elect to have both internal and external disk drives, program the external drives as drives 2 and 3. If you elect to put all of the drives external to the computer, the first drive must be programmed as drive 0. You may program the other drives for any other drive you want between 1 and 3. Do not forget to program the head select if you are using MPI drives. If you fail to do this, your drive will select, but you will never read any of the information on the diskette. You may obtain the location of the head select jumper by referencing the figures noted above.

2. You must install a TRP in the last drive on the external cable as well as the internal disk cable for the system to work properly. If drive 0 is the only drive on the computer, it must have a TRP properly installed in order to work.

3. Take the 34 conductor cable extending from your external drive(s) and plug the cable into the 34 pin connector located on the bottom of the FDC-3B/C that you just installed. Radio Shack has provided an access hole for this connector on the bottom of the computer. Make certain that pin 1 on the drive cable (usually denoted by a colored stripe) is to the outside (right side of the TRS-80 as seen from the front) for a Micro Mainframe cable. If you are using the Tandy Cable, you will have to put the colored stripe to the inside of the computer and the connection to your disk drives must have the connection installed to the inside of the disk drive.

## 1.8.0 INSTALLING THE DISK DRIVES

### 1.8.1 INTERNAL DRIVE INSTALLATION

After you have properly configured and double checked your work, you may install the disk drives into your Computer. You will probably want to mount Drive 0 as the bottom drive and Drive 1 as the top drive. The the correct procedure to accomplish this follows:

1. Connect one of the drive power cables (one end of which is already attached to the power supply) to the bottom drive. The drive power connector is a four position, white connector that plugs into a mating connector on the bottom of the drive PC board. See FIGURE 1.10.8 for the pin out on this connector.
2. Install drive 0 into the mounting brackets at the bottom position using four of 6-32 x 3/8" drive mounting screws.
3. Install drive 1 into the mounting brackets at the top position using four of the 6-32 x 3/8" drive mounting screws.
4. Remove the fake disk drive cover(s) from the top cabinet of your computer at this time. A close inspection of the inside portion of the covers will reveal nine locations on the ribs holding the covers to the case (to remove both covers). You should cut each of these locations with a pair of heavy diagonal pliers. After you have made the cuts along the sides of the covers, you may rap on them gently from the front with a hammer or heavy screwdriver if necessary to separate them from the framework that is holding them in place. Take care not to break the CRT when you do this. If you have only one disk drive, leave the other cover in place.
5. Reconnect the video and ground cables to the video monitor board mounted at the left side of the cabinet, and reinstall the top cabinet. Make certain that all wires are inside the case and are not pinched between the top half and bottom half of the cabinet. Check to make certain that the drives are properly aligned in the openings provided. You are now ready to power up and check the installation. This procedure will be further outlined in Section 2.

### 1.8.2 EXTERNAL DRIVES

If you wish, you may install drives 0 and 1 outside of the cabinet. If this is your desire, you will need to have a separate power supply for the drive(s). The configuration is identical to the one for the internal drives noted in PARAGRAPH 1.7.1. You will have to install only the controller board and the necessary jumpers if you plan to install the drives outside. You will need to purchase an external drive cable from Micro Mainframe to attach to your disk drives or you may build one with 34 conductor ribbon cable and IDC connectors. If you desire build your own cable, place the colored stripe so that it is at Pin 1, and crimp the cable in a small vice. DO NOT REMOVE ANY WIRES FROM THE CABLE AS RADIO SHACK DOES FOR WE WILL SELECT THE DRIVE BY USING THE DIP SHUNT ON THE

DISK DRIVE. Program the first drive as Drive 0, the second as Drive 1, etc. Remember that you must terminate the last drive on the system with a TRP. Connect your completed cable to the connector extending through the bottom of the FDC-3 controller with the colored stripe to the inside of the computer. This completes the installation of external disk drives.

#### 1.9.0 EIGHT INCH DRIVES – FDC-3C ONLY

If you desire to operate the 8" floppy disk drives (available only with the FDC-3C), you will have to fabricate a drive cable. Instructions for making this cable will be found in APPENDIX A. YOU WILL NEED TO INSTALL A SPEED-UP BOARD IF YOU WISH TO SUPPORT 8" DOUBLE DENSITY DRIVES AS THE 2 MHz. MODEL-III IS INCAPABLE OF CLOCKING OUT DATA FAST ENOUGH TO KEEP UP WITH THE NEEDS OF AN 8" DOUBLE DENSITY DISK DRIVE.

In addition to the procedure outlined above and in APPENDIX A, you will need an operating system that supports 8" disk drives. One is available from Micro Systems Software in Florida. Any version of DosPlus 3.4 or later will support the Micro Mainframe FDC-3C disk controller in the 8" mode.

The new DOSPLUS 3.5 is, in our opinion, the best conceived operating system yet devised for the Model-III computer. If you have not tried this superb operating system, you are missing something. Model-IV users will want to obtain a copy of DOSPLUS-IV for the Model-IV computer. The device independent structure makes it possible to configure for any of Micro Mainframe's products with a minimum amount of work. Our hat is off to Micro Systems Software for a job well done.

Apparat does not presently support the FDC-3C with NewDos 80, as their controller uses a different scheme to select 8" disk operation. Since Micro Mainframe was the first to produce a disk controller capable of 8" operation (FDC-3A in 1980) we established the standard at that time. Although Apparat knew of our scheme, they elected to use a different procedure for use with their own controller and wrote NewDos80 around that scheme. Micro Mainframe will provide continued support for all of our previous customers who purchased our product by continuing to use our standard method. This method was incorporated by DOSPLUS long before Apparat published NewDos80. If you are using DOSPLUS 3.4 OR 4.0 please use Micro Systems Software's DISKZAP program to verify that the following bytes are present. If they are not, then Patch your copy of DOSPLUS by doing the following:

Enter the display mode and display :

Track 0F, Sector 03

Enter the Modify mode by pressing M and change the following bytes in that sector :

<u>Byte</u>	<u>From</u>	<u>To</u>
75	00	0F
77	20	30

This concludes the modifications to DOSPLUS 3.4 or 4.0 to make it work properly with the FDC-3C disk controller board.

20 PIN FLEX JUMPER  
TO DISK CONTROLLER

20 PIN FLEX JUMPER  
TO RS232 BOARD

POWER AND VIDEO CONNECTIONS

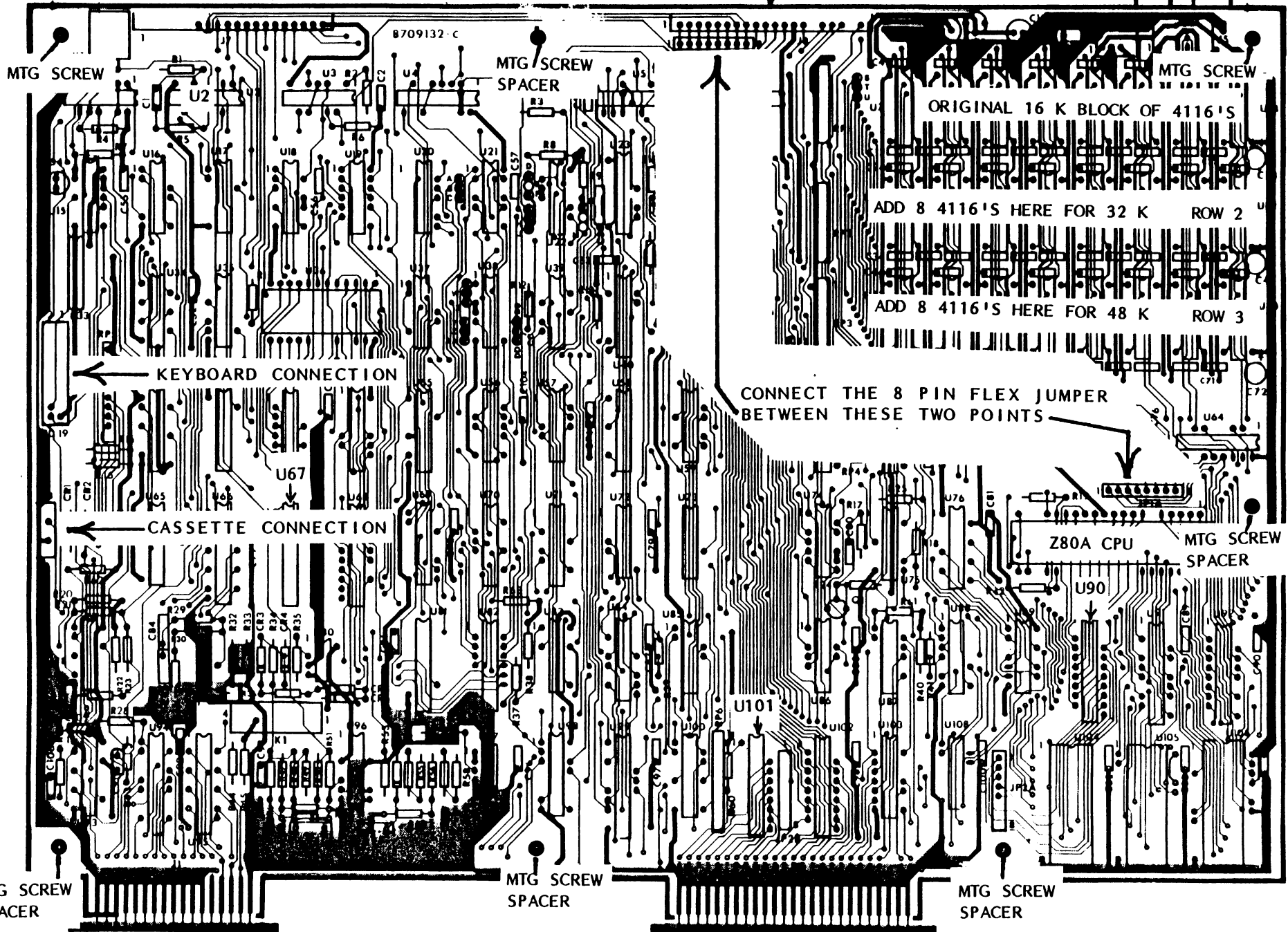


FIGURE 1.10.1 CPU PRINTED CIRCUIT BOARD

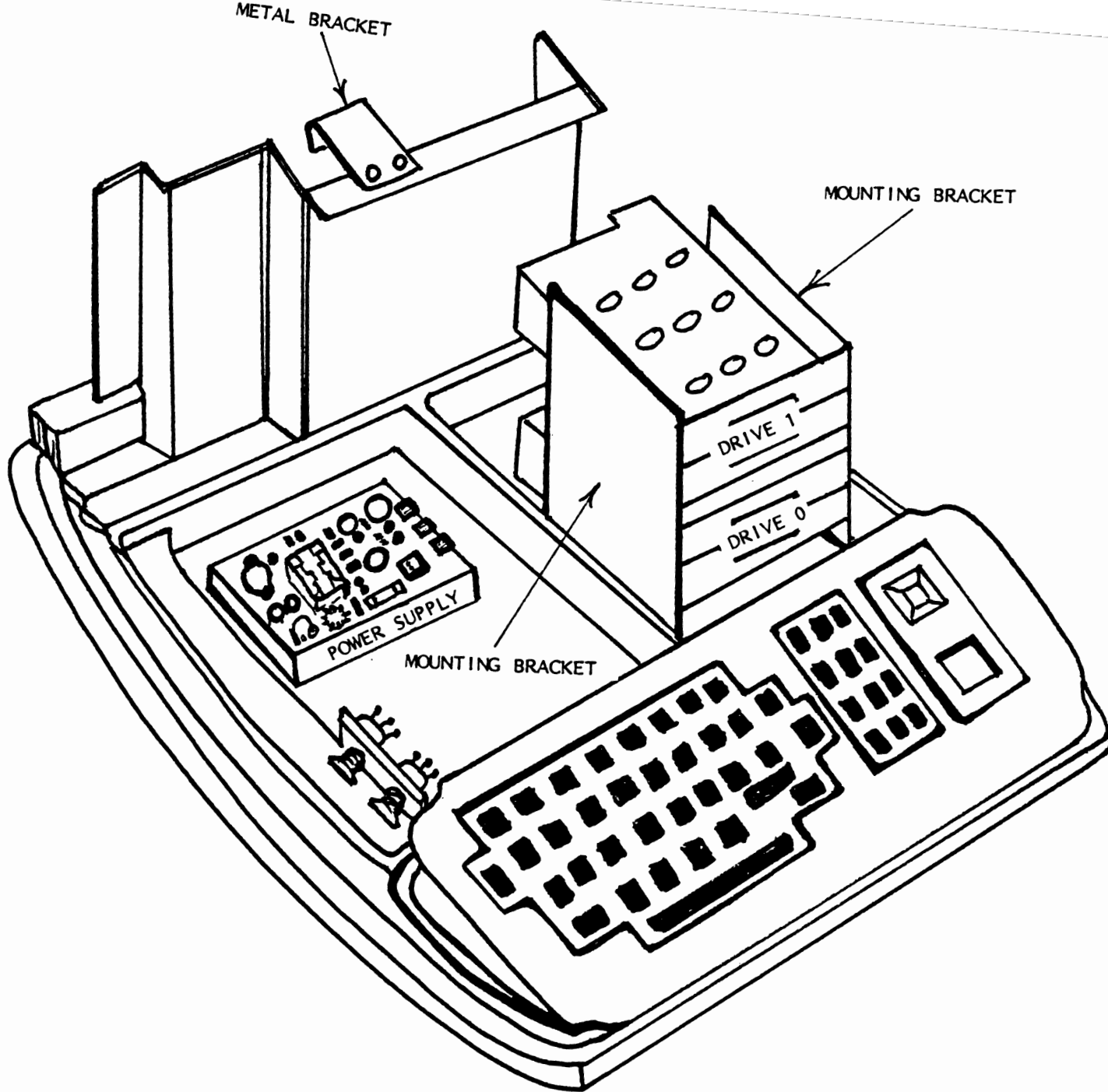
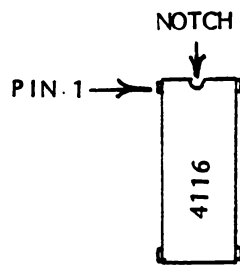


FIGURE 1.10.2 POWER SUPPLY MOUNTING LOCATION



INSTALL MEMORY CHIPS IN THE 2ND & 3 ROWS  
 MAKING CERTAIN THAT THEY ARE ORIENTED AS SHOWN

FIGURE 1.10.3 MEMORY INSTALLATION (MOD-III)

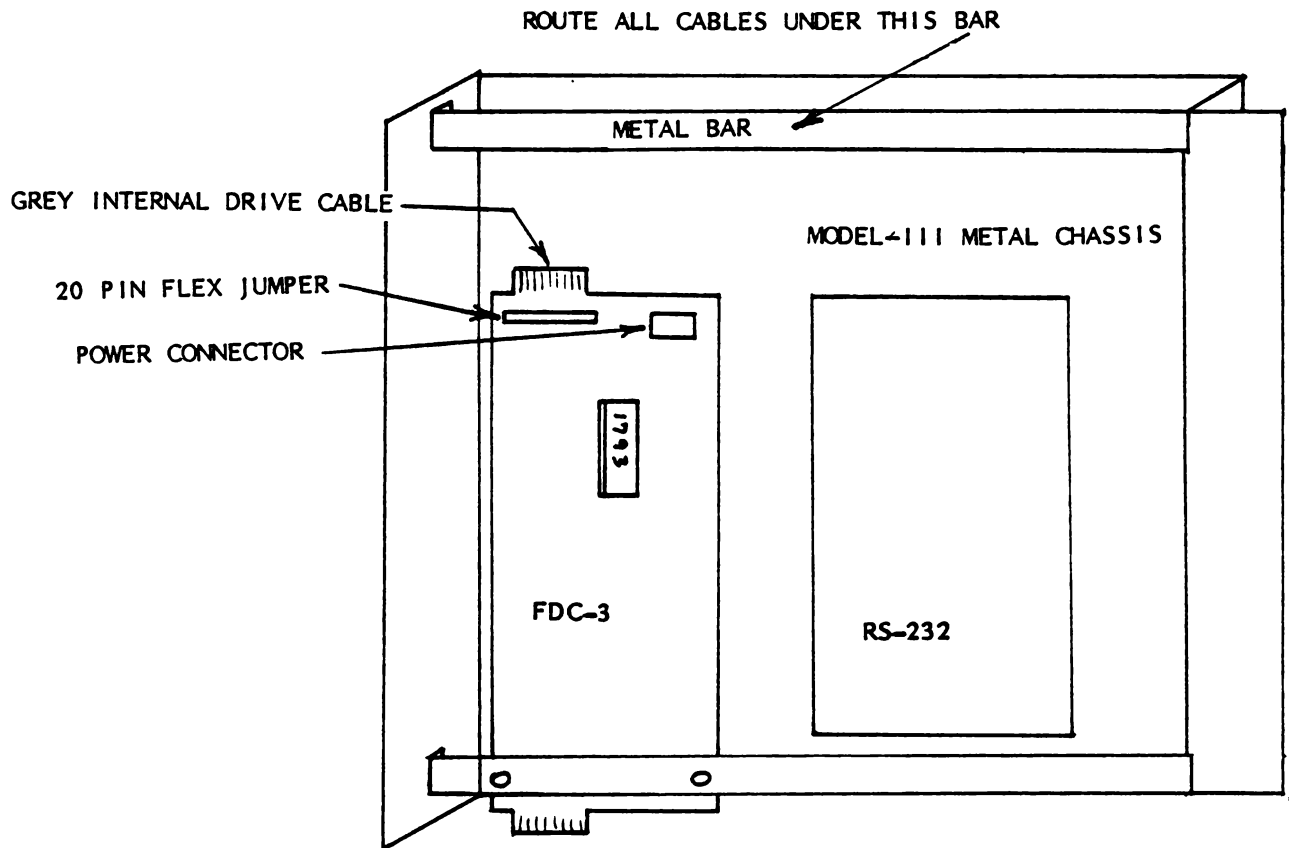
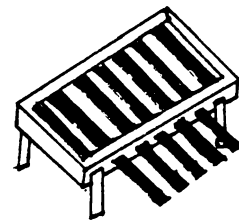


FIGURE 1.10.4 FDC-3 DISK CONTROLLER LOCATION

FIGURE 1.10.13 DIP SHUNT OUTLINE DRAWING



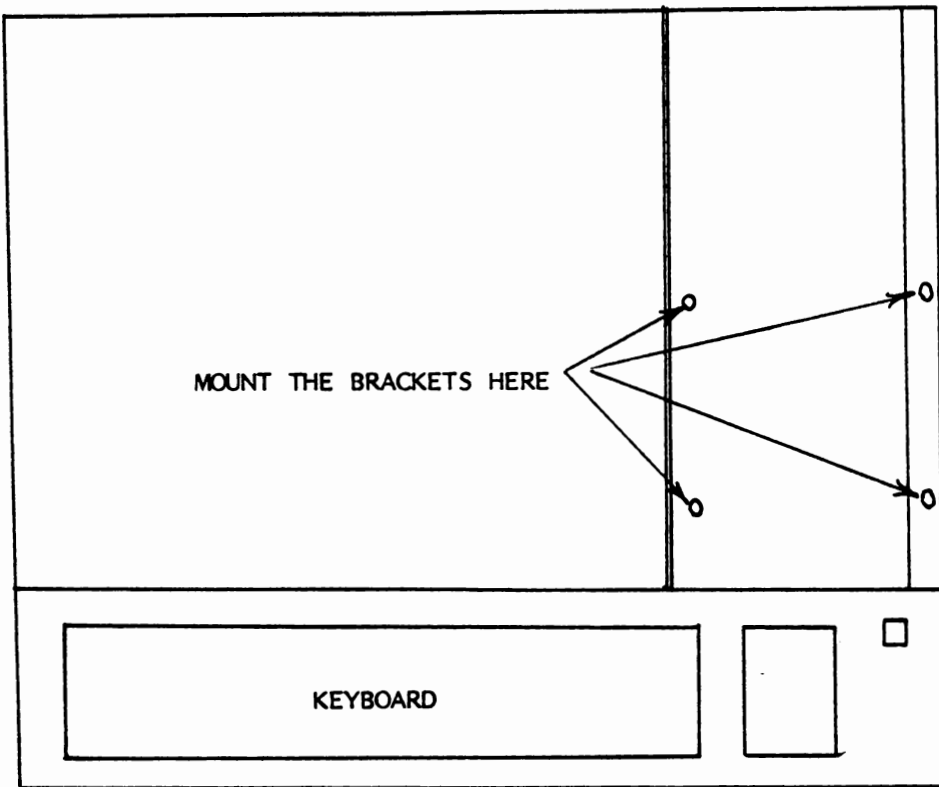


FIGURE 1.10.5 BRACKET MOUNTING LOCATIONS

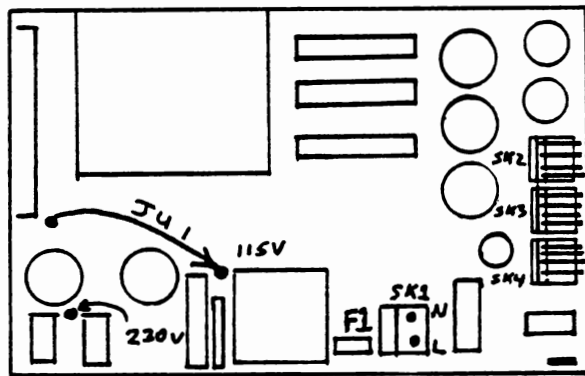


FIGURE 1.10.6 SPS-1 OUTLINE DRAWING

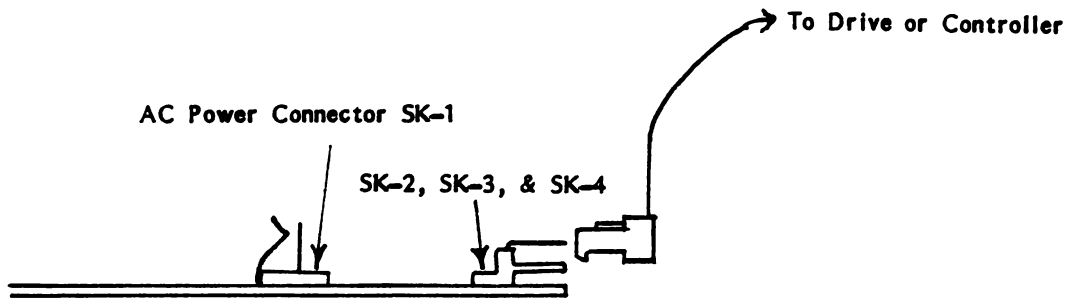


FIGURE 1.10.7 SPS-1 CONNECTIONS

TYPICAL PINOUT SK-2, SK-3, & SK-4

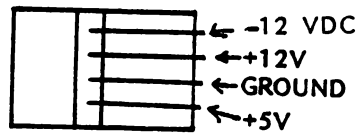


FIGURE 1.10.8 SPS-1 PINOUT DIAGRAM

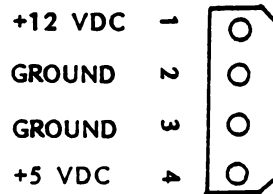
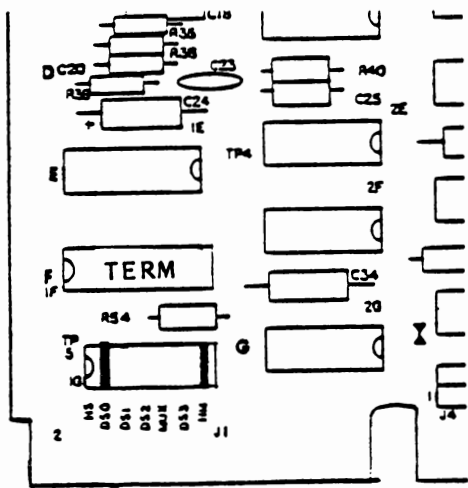
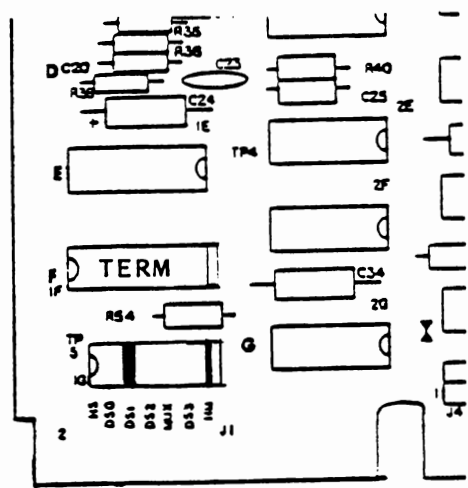


FIGURE 1.10.9 DISK DRIVE PINOUT DIAGRAM



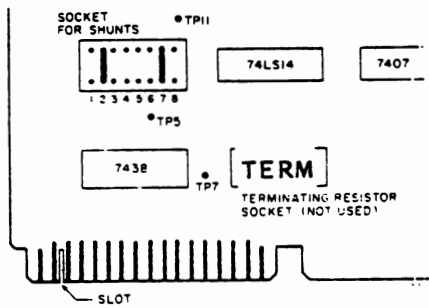


(A) DRIVE 0

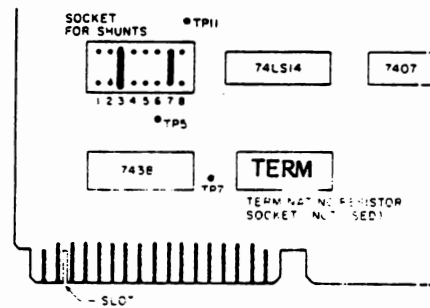


(B) DRIVE 1

FIGURE 1.10.10 MPI DRIVE CONFIGURATION

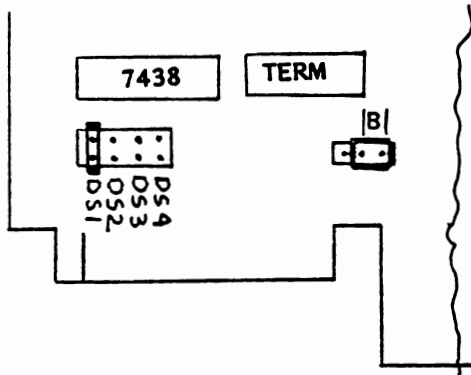


(A) DRIVE 0

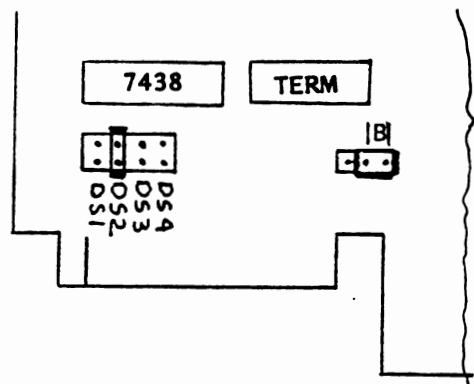


(B) DRIVE 1

FIGURE 1.10.11 TANDON DRIVE CONFIGURATION



(A) DRIVE 0



(B) DRIVE 1

FIGURE 1.10.12 TEC DRIVE CONFIGURATION

## ANSI DISK DRIVE CONNECTOR PIN ASSIGNMENTS

<u>SIGNAL NAME</u>	<u>PIN NUMBER</u>
SPARE .....	2
SPARE .....	4
DRIVE SELECT 4 .....	6
INDEX/SECTOR .....	8
DRIVE SELECT 1 .....	10
DRIVE SELECT 2 .....	12
DRIVE SELECT 3 .....	14
MOTOR ON .....	16
DIRECTION .....	18
STEP .....	20
WRITE DATA .....	22
WRITE GATE .....	24
TRACK 0 DETECT .....	26
WRITE PROTECT .....	28
READ DATA .....	30
SIDE SELECT .....	32
SPARE .....	34

All odd numbered pins are at Logic Ground.

The TEC drive model FB-202 does not have circuit traces for Pins 2, 4, & 34. These drives will work properly although there are only 26 contacts available on the drive.

You cannot stack two of the new half height, lever operated disk drives in the space provided by Tandy without cutting the plastic housing on the Model-III or Model-IV computers. This is because Tandy elected to take the inexpensive route and cut an undersized hole in the top cabinet of their computers. If you are willing to modify your machine, two drives will fit nicely in the same space as one drive did previously. This would allow you to have two floppies and one full size or two half size hard disks all in one cabinet.

## FDC-3 BUS CONNECTOR SIGNALS

<u>SIGNAL NAME</u>	<u>PIN NUMBER</u>
DATA BIT 0 .....	1
DATA BIT 1 .....	2
DATA BIT 2 .....	3
DATA BIT 3 .....	4
DATA BIT 4 .....	5
DATA BIT 5 .....	6
DATA BIT 6 .....	7
DATA BIT 7 .....	8
DISKIN* .....	9
DISKOUT* .....	10
ADDRESS 0 .....	11
ADDRESS 1 .....	12
NMI* .....	13
RESET* .....	14
INTAK* .....	15
WRNMIMASKREG* .....	16
RDNMISTATUS* .....	17
DRVSEL* .....	18
WAIT* .....	19
SIGNAL GROUND .....	20

## POWER CONNECTOR

<u>SIGNAL NAME</u>	<u>PIN NUMBER</u>
+5 VOLTS .....	1
GROUND .....	2
+12 VOLTS .....	3
-12 VOLTS .....	4

## SECTION 2

### 2.0.0 POWER UP TECHNIQUES AND PROCEDURES

Your FDC-IIIB/C floppy disk controller has been carefully tested and burned in at the factory. Nevertheless, some individuals still seem to have difficulty with the installation. Experience has shown that very few individuals understand the principals involved in disk operation, and are, therefore, unable to troubleshoot the system when it does not appear to work properly.

The following information when used in conjunction with the theory of operation presented in the OPERATIONS MANUAL will provide the user with the tools necessary to localize his problem. The information is presented in a logical sequence and it is recommended that the steps be followed in order. The section on problems with the Model-III computer has been compiled from three years of data both from the field and other sources. The Model-IV has not been in the field long enough to collect any information as yet. Micro Mainframe will continue to collect data on this machine and will distribute the information to our users as we obtain it.

### 2.1.0 MAJOR KNOWN PROBLEMS WITH THE MODEL-III COMPUTER

#### 1. TANDY HAS CONTINUALLY HAD A MASTER CLOCK PROBLEM.

The various revisions of the Model-III CPU card have been modified by TANDY in an attempt to eliminate this problem. The revision number is found in the top center of the board and will be either C, F, or G. The F revision has more capacitance in the master clock circuit to load down and filter the master clock to an approximate sine wave of 2V peak to peak. The 74LS04 (U2) frequently is unable to put out enough current to drive the system, causing the sine wave to warp, jitter, or have less than 2V peak to peak. R1 and R5 just above and below U2 have been changed from 910 ohms to 560 ohms in order to correct this on the G version board and on some F version boards. Resistors tend to increase in value over a period of time, causing the 910 ohm resistors to become more troublesome. The symptoms are that the computer resets or locks up intermittently; also, the video may flicker. If you have an F version board, you should change the resistors.

Check the PCLOCK signal at U62-8. It should be at least 1 volt peak to peak. If the level is low, then Q1 on the CPU is usually defective. PCLOCK must be a decent square wave. A sine wave will not drive the Z80, especially on power up. If the square wave is poor, then replace U62 on the CPU card.

#### 2. GROUNDING AND SHIELDING PROBLEMS (NOISE)

In some Model-III computers, Tandy ran a ground wire from the left rear, under the CRT to the drive power supply. This wire can behave like an antenna and pick up noise from both the video and the switching power supply. If you have one of these units, you will probably want to re-route this wire away from these noisy areas. Tandy has also had problems with the shield under the video board, as it tends to work loose and short out the video board. The flexible metallic RFI shielding at the bottom of the CPU card has also been known to short out some of the CPU circuitry. Please make certain that you have none of these problems.

#### 3. CONNECTOR PROBLEMS

Tandy has had problems with the crimps on the Video and Power connectors. These can cause the machine to re-boot in the middle of some critical operation. You may sometimes be able to create this condition by rapping the Model-III case on the top left rear of the case while performing disk I/O. Tandy has previously recommended stripping and soldering the wires into the connector. If you do this, make certain that you get the

wires into the right position on the connector. Tandy is now using a crimped connector instead of an IDC connector.

Tandy has used three different types of connector on the Model-III for the disk expansion and the RS-232 expansion ports. The early units were white and had contacts on both sides of the connector. The later units had a black connector with only a single row of contacts. The sides of these connectors sometimes warp during soldering and will sometimes make it impossible to make a good solid connection. Units with these connectors have been shipped with some or all of the connectors shorted together, or even with some of the connections missing. The latest computers now have connectors with contacts on both sides, but can exhibit the same problems as the black connectors with the single row of contacts.

#### 4. INCOMPLETE TESTING BY TANDY FACTORY

**THE CPU BOARDS ARE NOT TESTED FOR ADDITIONAL RAM, RS-232, or DISK DRIVE OPERATION BY THE FACTORY!** Some of the problems regarding the installation of any or all of these features by the individual will appear to have insurmountable problems that are generally considered to be the problem of the company manufacturing the disk drive controller. You could have defective RAM decoding, Port decoding, or the disk drive and/or RS-232 connectors could have missing connections or even traces on the CPU PC board.

#### 2.2.0 POWER UP PROCEDURE

1. After verification that all connections have been made correctly during the installation, you may apply power to the computer while the top is still off of the Model-III computer.
2. With the doors of both disk drives open and no diskete inserted, turn on the power switch. The CRT screen should now show either DISKETTE? or CASS?. If it does not, then you have probably forgotten something or connected something incorrectly. **TURN OFF THE POWER IF THIS IS THE CASE AND RE-CHECK EVERYTHING.**
3. If the word DISKETTE? appears on the CRT screen, insert a diskette containing an TRSDOS, DOSPLUS, NEWDOS80, OR MULTIDOS (NOT SUPPLIED BY MICRO MAINFRAME) into the drive that you have programmed as Drive 0 and close the door. The RED LED should illuminate, the spindle motor on the disk, drive should spin, and the disk should rotate. If this happens, the disk should boot up and you should see the logo of the company that produced the Operating System followed by the prompt TRSDOS READY, NEWDOS80 READY, or DOS PLUS. **IF YOU DO NOT HAVE AN OPERATING SYSTEM, WE RECOMEND THAT YOU GO TO RADIO SHACK AND PURCHASE TRSDOS AND THE ACCOMPANYING MANUAL.**

Although TRSDOS lacks some of the features found in some of the more esoteric operating systems, we feel, nevertheless, that the user must become familiar with the basic procedures of TRSDOS. The RADIO SHACK manuals are an excellent introduction to DISK OPERATION and DISK BASIC. This is not always true of the manuals supplied with the more esoteric operating systems. In fact, most of them are impossible to understand without at least some familiarity with TRSDOS procedures.

If your disk controller unit appears not to operate properly, the information and test routines provided below should help you determine the nature of your problem. We have also included a new test program called FDCTEST/BAS which is listed in APPENDIX B. You may either use the procedures listed below or type in FDCTEST/BAS. The routines given will work from either ROM BASIC or DISK BASIC. If your controller appears to be inoperative, enter ROM Basic by holding down the <BREAK> key and simultaneously pressing the RED <RESET> key. Answer all questions with an <ENTER>.

1. We should first determine whether the CPU recognizes the controller on the bus. This may be accomplished by typing the following statement from the keyboard:

```
PRINT INP(240)
```

If the computer recognizes the disk controller, the FDC will return a status of 128 decimal (80H) indicating that the controller is on line, but not ready. This is the desired status at this time, and its presence indicates that your 20-pin bus connector is probably connected properly. If the returned status is 255, then you either have forgotten to connect power to the controller or your power supply is defective.

2. We should now determine if we can select drive 0. This is accomplished by typing the following statement from the keyboard:

```
OUT 244,1
```

This command should turn on the drive spindle motor and the RED LED for approximately 3 seconds. You may select Drives 1, 2, and 3 by changing the 1 to 2, 4, or 8 respectively. Obviously, you will be able to select these additional drives only if you have them installed in the system.

3. If your controller passes the tests outlined above, you have apparently installed the controller correctly. You should now insert a TRSDOS diskette and hit the RED <RESET> button on the computer keyboard. If all is well, you will get the Tandy logo on the screen and you will be asked to supply the date and time. Please respond accordingly.
4. You should now become familiar with the Operating System that you will be using and attempt to make a backup of your master diskette by following the procedure outlined in the DOS Manual (supplied by DOS vendor). PLEASE INSTALL A WRITE PROTECT TAB ON YOUR MASTER DISKETTE PRIOR TO PERFORMING THE BACKUP. This is a good habit to develop for any program that is your only copy, and will save you considerable frustration if you give the wrong command. Many people have copied a blank disk onto their only copy of a program.
5. If you are still having problems, then please refer to SECTION 3 - WHEN THINGS GO WRONG.



## SECTION 3

### WHEN THINGS GO WRONG

We have recently discovered that many of the strange problems people have had upgrading Model-III computers to disk operation may be completely eliminated by replacing three of the chips on the CPU PC board. These chips are either 74LS245 or 74LS645 parts (both are interchangeable) and are usually manufactured by Motorola. Fortunately, all three of these chips are in sockets (Tandy probably knew that this was a problem area all along). Try to replace these chips with those made by Texas Instruments if possible, as these seem to perform the best. Other problems have been fixed by replacing the Z80 CPU with a Z80A CPU. LATE FLASH - THE LATEST G VERSION BOARDS FROM TANDY WERE SHIPPED WITH A Z80A CPU. PLEASE TRY SUBSTITUTING A Z80A CPU BEFORE YOU PANIC.

#### NOTHING APPEARS ON THE SCREEN AT ALL

You have either forgotten to reconnect one of the cables to the video board, or you have accidentally turned one of the two controls located on the bottom of the computer down during the installation process. One of these controls affects the brightness of the picture. Please check both of these items before you call for assistance.

#### SCREEN DISPLAYS GARBAGE

This problem is generally related to the problem with the 74LS245's mentioned above. Try to replace U67, U90, & U101 before going into AutoPanic. The usual symptom is that the screen displays random characters after a reset. First press <RESET> several times; if the system still displays garbage, then one or more of the floppy disk controller data lines or control lines could be shorted. Check for shorts and/or solder bridges where the 20 position Flex jumper is soldered to the FDC-3 controller board. If none are found, check the connector on the Model-III computer board. Believe it or not, Tandy has shipped out units with shorted connectors or in some cases, most of the connections missing. Naturally, this would make it impossible for anyone but Tandy to upgrade to disk operation. If you discover that this is your problem, Micro Mainframe can supply a spare connector for \$2.50 plus shipping and handling charges. If you have none of the problems outlined above, reinstall the 20 pin jumper cable going from the CPU board to the floppy disk controller and press <RESET>; if the screen still displays garbage, contact your dealer for further assistance.

#### SCREEN DISPLAYS 'CASS'

SEE FIGURES 1.10.8 & 1.10.9 FOR PINOUTS.

- \* Check for +5vdc on the floppy disk controller (P1-1)
- \* Check for +12vdc on the floppy disk controller (P1-3)
- \* If there is no voltage then the power supply or the power cable is defective.

First press <RESET> several times; if the system still displays CASS press <RESET> and <BREAK> at the same time to get into ROM BASIC. Then type ?INP(240) and hit <RETURN>. The 240 in the input statement is the decimal equivalent of the FDC COMMAND/STATUS register located at PORT 0F0H. THE FDC STATUS SHOULD BE 128; IF IT IS ANYTHING OTHER THAN 128, REMOVE AND REINSTALL the 20 and 34 conductor cables going from the drives and CPU to the floppy disk controller. Press <RESET> and check the FDC status register again, if this value changed from the previous value, one of the following conditions could be causing the problem: one of the cables is probably defective; the 20 or 34 conductor cable is still connected wrong; one or more of the conductors on the cables is shorted; or one or more of the Control/Data bits 0-7 (S1-1to20) on the floppy disk controller board are shorted together. Please refer to the discussion on SCREEN DISPLAYS GARBAGE noted above and check everything mentioned, especially the connectors on the Tandy PC board. If the status register returns 255, then you are not getting power to the FDC-3 controller board. Check the power connector on the FDC-3 printed circuit



board for the correct voltages. If you cannot make the FDC status register return 128 then contact your dealer for assistance.

#### DRIVE 0 MOTOR AND LED ARE INOPERATIVE

Reinstall both drive cables going to the floppy disk controller board and press <RESET>. If drive 0 still does not come on, make sure drive 0 is configured properly (check your drive Owner's Manual or FIGURES 1.10.10, 1.10.11, or 1.10.12 for drive configuration procedures). Make certain that the drive is getting +5V and +12V on the proper pins. Enter BASIC by pressing the <RESET> and <BREAK> key at the same time, and type OUT 244,1. This should turn on the RED LED and the drive spindle motor for Drive 0. If this does not work then type OUT 244,255. If you have made an error in the configuration procedure, this command will turn on any drive position if you have selected the wrong one in error. If nothing happens you may have forgotten to install the DIP SHUNT or a TRP. If none of the above fixes the problem you should contact your dealer for assistance.

#### BOTH DRIVES ARE SELECTED SIMULTANEOUSLY AFTER A RESET

Reinstall both cables going to the floppy disk controller board. Make sure drive 1 is configured properly, checking your Owner's Manual if necessary. Enter BASIC by pressing the <RESET> and <BREAK> keys simultaneously. Type OUT 244,1. The RED LED and spindle Motor on drive 1 only should come on. If both drives still come on simultaneously, then the probable cause is one of the following: The disk drive cable cable is defective or shorted; the control lines coming out of the FDC-3 disk controller are shorted or open; the disk drive is defective; your DIP SHUNT programming is incorrect; or you forgot to install a TRP on the last drive in the system. If none of the above fixes the problem you should contact your dealer for assistance.

#### DRIVE 0 STAYS SELECTED CONTINUOUSLY

Remove and reinstall the 34 conductor disk drive cable going from the floppy disk controller to the disk drives. Configure drive 1 to be drive 0 (don't forget the DIP SHUNT PROGRAMMING) so both drives will now be drive 0 and hit <RESET>. If both drives come on continuously and your configuration is correct (this includes TRP placement) then the probable causes are: a defective disk drive; some of the control lines on the FDC-3 are shorted, or the Drive Cable (Gray cable) is shorted. Try replacing the 34 conductor disk cable to correct this problem.

#### DOS WILL NOT BOOT UP OR LOAD A FILE

Make certain that you have a good copy of your operating system. Push the READ/WRITE head on the disk drive towards the front of the drive approximately one inch; hit <RESET> and see if the disk drive read/write head restores (moves back to the outside track of the diskette). Exercise CAUTION here as you could damage the disk drive. Disconnect drive 0 and configure drive 1 as drive 0 then try a single drive backup. If this works, drive 0 is probably at fault. If none of the above fixes the problem you should contact your dealer for assistance.

#### DOS WILL NOT FORMAT OR MAKE A BACKUP

Exchange drive 0 with drive 1 (don't forget the DIP SHUNT programming and TRP placement) and again attempt to make a backup. Try a single drive backup on each drive. If the problem disappears, the disk drive is probably at fault. If none of the above fixes the problem you should contact your dealer for assistance.

## DISK DRIVE WILL NOT FORMAT PAST TRACK 22

Make sure the copy of the DOS you are using is good. Use a good brand of certified diskettes to format or make a backup on. Try a format on both Drive 0 and Drive 1 (PLEASE DON'T FORMAT OVER YOUR OPERATING SYSTEM DISKETTE). If one drive formats properly and the other one doesn't, then, most likely, you have problems with one of your disk drives. Try to borrow another disk drive from a friend and try it on your system. If no drive will format beyond track 22, then you may need to purchase a MICRO MAINFRAME DS-1A data separator to work in conjunction with your FDC-3B controller (this is not required for use with the FDC-3C controller as it already has the DS-1A data separator incorporated into the circuit).

Your Disk Drives may be exhibiting an excessive amount of bit shift and not be performing properly on the inner tracks. Have your disk drive checked for head compliance, proper track 0 detect, and radial alignment. Data jitter translates into data instability due to the drive speed varying sharply in a short period of time. Probable causes are a defective drive belt, drive motor, or spindle bearing. One additional factor may be that the high voltage RF pulse that provides Horizontal Deflection on your CRT may be interfering with the data separator due to excessive radiation. We have experienced several reports from the field that this RADIO FREQUENCY INTERFERENCE can put a pulse so large into the head of the disk drive that the data separator is unable to take it out. This causes errors to be detected and the drive will cease to function properly. Some individuals have solved this problem by installing a shield around the disk drive. Some have reported using tin foil with good results while others have reported that they had to use galvanized sheet metal shields to eliminate the problem. If you use any method of shielding, exercise caution to insulate the metal from the circuit board, or you can burn up a disk drive. If none of the above fixes the problem you should contact your dealer for assistance.

This completes the TROUBLESHOOTING SECTION.



**A.0 8 INCH DISK OPERATION**

In order to implement 8 inch disk operation on your FDC-3C disk controller, you will have to build a special cable, which will effectively translate the 34 pin cable required by the 5" disk drive to the 50 pin cable required by the 8 inch disk drive. The 8 inch selection logic is already present on the FDC-C disk controller, but you will have to use an operating system designed to work with this controller such as DOS Plus 3.4 or greater. FDC-3B owners please disregard this section, as 8" operation is available only with the FDC-3C controller.

**A.1 CS-5 CABLE ASSEMBLY - PARTS REQUIRED**

1. 50 pin card edge connector (1 required for each 8" drive).
2. 34 pin card edge connector (1 required).
3. 34 pin conductor ribbon cable (maximum length of 10 feet).

**A.2 CS-5 ASSEMBLY INSTRUCTIONS - PLEASE REFER TO FIGURE A.1**

1. Locate the colored stripe designating line 1 on the 34 conductor cable and align it so that it will go to Pin 1 of the 34 pin card edge connector. **MAKE ABSOLUTELY CERTAIN THAT YOU HAVE EACH OF THE INDIVIDUAL CONDUCTORS OF THE CABLE PROPERLY ALIGNED WITH EACH OF THE PINS OF THE CONNECTOR.** When all is correct, crimp the connector together using a small vice or press to make the crimp.
2. **THE 50 PIN CONNECTOR WILL BE ASSEMBLED IN THE FOLLOWING SPECIAL CONFIGURATION:**
  - a. Locate the following wires in the 34 conductor cable and peel them out of the cable so that they are 2 1/2" long: Wire Numbers 2,4,6,8,16,32, and 34 will be pulled back and separated from the remainder of the cable. **DO NOT CUT THESE WIRES, AS WE MUST RECONNECT THEM IN A SEQUENCE THAT IS DIFFERENT THAN NORMAL FOR IDC CONNECTORS.**
  - b. While keeping these wires pulled back and out of the way, align the remaining lines of the cable as shown in FIGURE A.1 so that Line 1 goes to Pin 17 and line 33 goes to Pin 49 of the 50 Pin connector. This will leave some of the connections on the even numbered side of the 50 position connector open where you have peeled wires out of the cable. Do not attempt to connect any of the remaining wires to any of these open connectors at this time. **MAKE CERTAIN THAT EACH OF THE INDIVIDUAL CONDUCTORS REMAINING IS PROPERLY ALIGNED WITH EACH OF THE PINS OF THE 50 CONDUCTOR CABLE AND CRIMP THE CONNECTOR TO THE CABLE AS ABOVE, MAKING CERTAIN THAT THE 34 CONDUCTOR CABLE EXTENDS BEYOND THE OPPOSITE SIDE OF THE 50 PIN CONNECTOR AT LEAST 2 INCHES.**
3. You should now cut off the excess cable extending beyond the edge of the connector with a sharp razor knife (**DO NOT CUT ANY OF THE WIRES THAT YOU HAVE PEELED BACK**). Check your work to make absolutely certain that you did not cause any shorts at the ends of the wires you cut off. Carefully remove the back portion of the previously crimped 50 pin card edge connector with a knife. Some connectors are easily destroyed, so take extra precaution while performing this step.

4. Make the following connections with the lines you have just removed in STEP 2.b above.

- a. Connect Line 2 to Pin 22.
- b. CUT LINE 4.
- c. Connect Line 6 to Pin 32.
- d. Connect Line 8 to Pin 20.
- e. Connect Line 16 to Pin 18.
- f. Connect Line 32 to Pin 14.
- g. CUT LINE 34.
- h. Replace the back portion of the 50 pin card edge connector and recrimp the connection.
- i. You may attach up to 3 additional 50 pin card edge connectors on this cable in the same fashion.

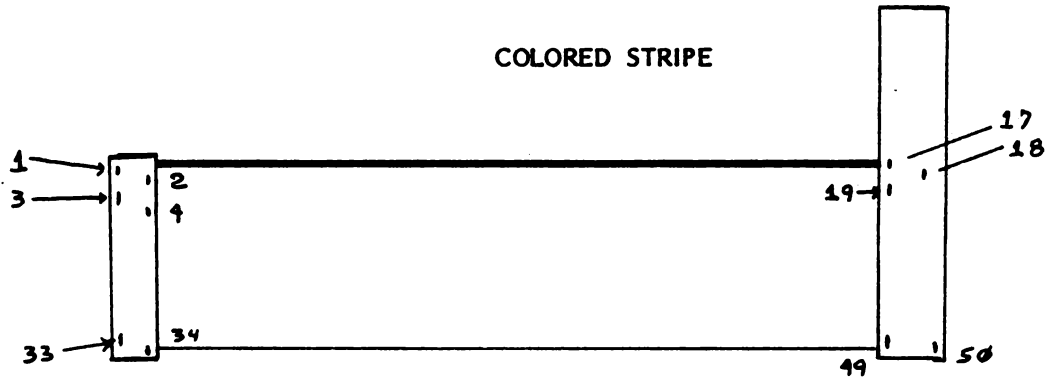


FIGURE A.1 ASSEMBLY DIAGRAM - 8 INCH DRIVE CABLE

WIRE #	CONN #	WIRE #	CONN #
1	PIN 17	18	PIN 34
2	PIN 22	19	PIN 35
3	PIN 19	20	PIN 36
4	CUT	21	PIN 37
5	PIN 21	22	PIN 38
6	PIN 32	23	PIN 39
7	PIN 23	24	PIN 40
8	PIN 20	25	PIN 41
9	PIN 25	26	PIN 42
10	PIN 26	27	PIN 43
11	PIN 27	28	PIN 44
12	PIN 28	29	PIN 45
13	PIN 29	30	PIN 46
14	PIN 30	31	PIN 47
15	PIN 31	32	PIN 14
16	PIN 18	33	PIN 49
17	PIN 33	34	CUT

FIGURE A.2 WIRE ASSIGNMENTS FOR 8 INCH CABLE

APPENDIX B  
FCDTEST PROGRAM

The following program is to test the functions of your FDC-3 series controller. If you are having problems with your installation, type in this program and save it to cassette or disk (if it is operative). This program should help you determine what problems you might be having.

```
1  REM ***** FDC TEST PROGRAM *****
2  REM ***** JULY 15, 1983 *****
3  REM ***** COPYRIGHT 1983, MICRO MAINFRAME *****
4  REM
10 CLEAR 5000
20 DIM ST$(16),CD(8)
30 DATA NOT READY,PROTECTED,HEAD LOADED,SEEK ERROR
32 DATA CRC ERROR,TRACK 00,INDEX,BUSY
40 DATA NOT READY,WRITE PROTECT
42 DATA RECORD TYPE/WRITE FAULT,RECORD NOT FOUND
44 DATA CRC ERROR,LOST DATA,DATA REQUEST,BUSY
50 FOR G=1 TO 16
53   READ ST$(G)
55 NEXT G
60 DATA 128,64,32,16,8,4,2,1
70 FOR G=1 TO 8
73   READ CD(G)
75 NEXTG
100 CLS
110 PRINT"WHICH DRIVE (0-3)";:INPUTA$
120 IFVAL(A$)<0 OR VAL(A$)>3 THEN 110
130 IF VAL(A$)=0 THEN DR=1
140 IFVAL(A$)=1THEN DR=2
150 IFVAL(A$)=2THENDR=4
160. IFVAL(A$)=3THEN DR=8
170 OUT243,170:X=INP(243):IF X<>170THENPRINT@0,CHR$(30);"BAD FDC DATA REG"
   :STOP
180 OUT243,85:X=INP(243):IFX<>85 THENPRINT@0,CHR$(31);"BAD FDC DATA REG":STOP
181 OUT242,170:X=INP(242):IFX<>170THENPRINT@0,CHR$(31);"BAD FDC SECTOR
   REG":STOP
182 OUT242,85:X=INP(242):IFX<>85THENPRINT@0,CHR$(31);"BAD FDC SECTOR REG":STOP
183 OUT242,170:X=INP(242):IFX<>170THENPRINT@0,CHR$(31);"BAD FDC TRACK REG"
   :STOP
184 OUT241,85:X=INP(241):IFX<>85THENPRINT@0,CHR$(31);"BAD FDC TRACK REG":STOP
185 PRINT@0,CHR$(31);"FDC REGISTERS OK"
200 GOTO 2000
500 PRINT@448,CHR$(31);"FDC   : STATUS"
505 FD=INP(240)
510 PRINT@512,USING"###   :";FD
515 A=FD
520 GOSUB 8000
530 FOR G=1TO8
540 IFMID$(BN$,G,1)="1"THENPRINT"       :";ST$(G)
550 NEXTG
560 RETURN
2000 GOSUB 500
2001 IF FD<>128THENPRINT@0,"   STRANGE           "ELSEPRINT@0," OK "
```

```

2005 B=10
2010 OUT244,DR:GOSUB500
2020 OUT244,DR:OUT240,0
2030 GOSUB 500
2035 B=B-1:IFB=0THEN PRINT@0,CHR$(30);"NO TRK0 FROM DRIVE"
      :STOP
2036 IF MID$(BN$,6,1)="1"THEN 2050
2040 IF RIGHT$(BN$,1)="1"THENGOTO2020
2050 PRINT@0,CHR$(30);"TRACK 00      OK"
2055 B=50
2060 PRINT@64,CHR$(30);"REMOVE DISKETTE FROM DRIVE"
2070 OUT244,DR:GOSUB 500
2080 IFMID$(BN$,7,1)="1"THENPRINT@0,CHR$(30);"INDEX PULSE OK" :GO 02120
2090 B=B-1:IFB=0THENPRINT@0,CHR$(30);"NO INDEX PULSE OR DISKETTE NOT
      REMOVED":STOP
2100 GOTO 2060
2120 REM
2130 OUT244,DR:OUT240,64:GOSUB500
2140 IF MID$(BN$,6,1)="1"THEN PRINT@0,CHR$(30);"TRK 00 STUCK ON":STOP
2150 PRINT@0,CHR$(30);"TRK 00 OFF OK/ STEP IN OK"
2160 OUT244,DR:OUT240,96:GOSUB 500
2170 IFMID$(BN$,6,1)="0"THENPRINT@0,CHR$(30);"STEP OUT BAD " :STOP
2180 PRINT@0,CHR$(30);"STEP OUT OK"
3000 PRINT@0,CHR$(31);"BASIC TESTABLE CONDITIONS TEST GOOD"
7999 STOP
8000 BN$="00000000"
8010 FOR G=1TO8
8020 IF A-CD(G)<0 THEN 8040
8030 MID$(BN$,G,1)="1":A=A-CD(G)
8040 NEXTG
8050 RETURN

```