IBM INSTRUMENTS COMPUTER SYSTEM 9000

DISK AND DISKETTE UNIT

INSTALLATION AND CONFIGURATION

PRELIMINARY

GC22-9265

Safety Notes

This manual describes the procedures for installing and configuring disk and diskette drives for use with the IBM Instruments Computer System 9000 (CS 9000). Some of these procedures require access to the drives' internal circuitry.

It is the responsibility of the person performing these procedures to ensure that all power is disconnected from the CS 9000's processor and any diskette units while they are being worked on.

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POSSIBLE CONFIGURATIONS

The IBM Instruments Computer System 9000 can support up to four diskette drive units in any combination of 8-inch and 5-1/4 inch units. This provides up to four megabytes of on-line diskette storage. In addition, an optional hard disk controller board allows the attachment of up to four hard disk units providing ten megabytes of storage per formatted disk.

Installation is easily done and configuration-- identifying the drives to the CS 9000's operating system as "Drive 0", "Drive 1", etc.-- is straightforward.

SYSTEMS WITH 8-INCH DISKETTE UNITS ONLY

Two 8-inch diskette units can be housed in each cabinet and two cabinets can be connected to each other in a chain. Figure 1-1 shows a system equipped with four 8-inch drives (Drive 0 through Drive 3).
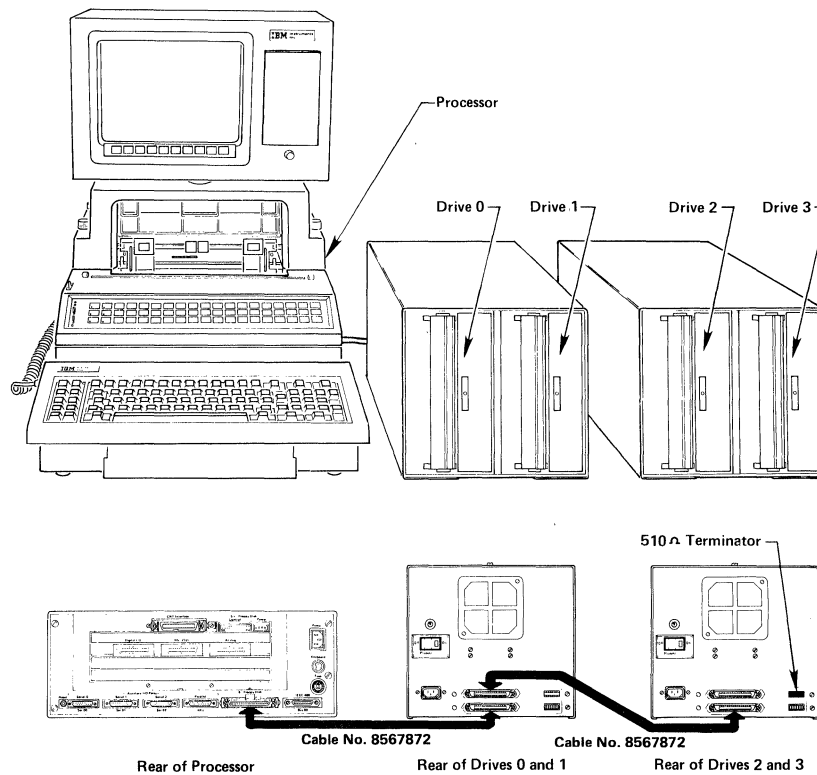

Figure 1-1. CS 9000 with 8-Inch Drives

Since 8-inch drives come already mounted in cabinets with all internal wiring completed, "installation" is simply a matter of unpacking a cabinet, power cord, and connecting cable from its shipping carton and attaching the power cord to the back of each cabinet as shown in Figure 1-2. For safety reasons, power cords should not be plugged in to a wall outlet until the drives are configured. Units are configured by:

a. Connecting the diskette unit cable from the processor to the first cabinet and from the first to the second cabinet (if present)

b. Inserting the appropriate terminator chip in the last drive in the chain, and

c. Setting the diskette drive address switches at the rear of the drive cabinet(s).
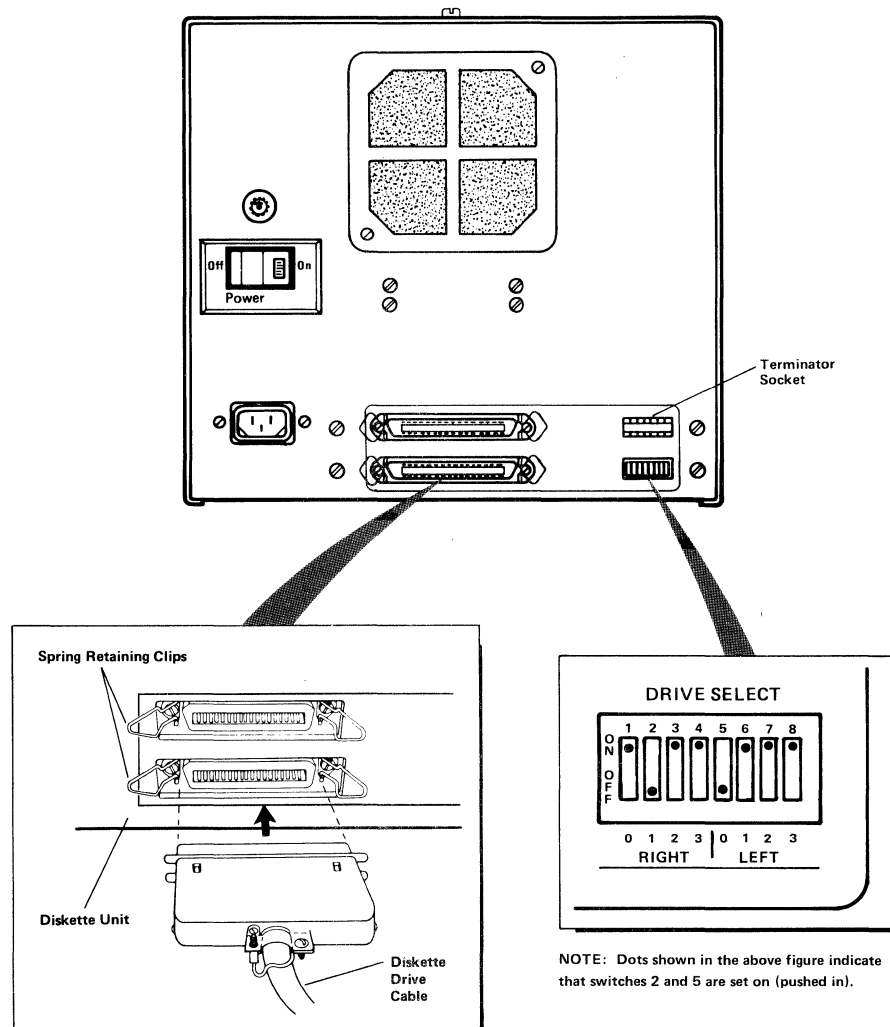
Figure 1-1 shows that for a system equipped with four 8-inch drives, the connecting cable runs from the "8" Floppy Disk" connector (FD00-03) on the rear of the processor unit to the lower connector at the rear of the first drive cabinet (see Figure 1-2). This first cable supports both "Drive 0" and "Drive 1". If there are additional drives as in our example, a second cable runs from the upper connector of the first cabinet to the lower connector of the second cabinet to support "Drive 2" and "Drive 3".

Connecting cables to the processor is done by pushing the connector up under the grounding clip and then straight forward into the socket. Snap the spring retaining clips into position to lock the connector in place. There are no grounding clips on the cabinet connectors; simply push the connector into the socket and snap the spring retaining clips into position.

A 510 ohm terminator chip must then be inserted in the terminator socket of the last cabinet in the chain-- the second cabinet in our example (see Figures 1-1 and 1-2). Pin #1 of the socket is on the lower left side. (Since 8-inch drives are shipped with a 510 ohm terminator already in the socket, in our example you would actually be removing the terminator chip from the first cabinet, leaving only the one in the last cabinet.)

The next step in configuration is identifying the different drives to the operating system by setting the diskette drive address switches. For the 8-inch drives, this is done by setting the drive select switches at the rear of each cabinet. As shown in Figure 1-2, the switches are located in the lower right-hand corner of the cabinet. The first four switches control the right drive in the cabinet (as viewed from the front) and the second four switches control the left drive.

To set an address for a drive, turn the appropriate switch ON and all other switches for that drive OFF. In our example the first cabinet houses Drive 0 on the left and Drive 1 on the right. Therefore the switches for that cabinet should be set as shown in Figure 1-2. Switch #2 sets the right-hand drive as Drive 1 and switch #5 sets the left-hand drive as Drive 0. Note that the dots on the switches are only visible when the opposite side of the switches are pushed in; therefore switches #2 and #5 are pushed in and all others are not.

Terminator
Socket

Spring Retaining Clips

Diskette Unit

Diskette
Drive
Cable

DRIVE SELECT

```
      1  2  3  4  5  6  7  8
O
N
O
F
F
```

```
  0  1  2  3 | 0  1  2  3
   RIGHT     |    LEFT
```

NOTE: Dots shown in the above figure indicate that switches 2 and 5 are set on (pushed in).

INSTALLING CABLES FOR DISKETTE DRIVES

PLEASE NOTE: Cables for external diskette drives have ferrite "beads" installed at one end to reduce radio frequency interference. This end of the cable should be attached to the processor with the beads as close as possible to the processor's back plate.

Figure 1-2. 8—Inch Diskette Drive Connections and Switches.

On the second cabinet, switches #4 and #7 would be set ON to identify the left-hand drive as Drive 2 and the right-hand drive as Drive 3.

This completes the installation and configuration of a system equipped only with 8-inch drives. You may wish to run some of the CS 9000's diagnostic tests for your drives. These tests are described in the Computer System Problem Isolation Manual, GC22-9192.

SYSTEMS WITH 5-1/4 INCH DISKETTE UNITS ONLY

A 5-1/4 inch diskette drive can be located either in the CRT housing, in a separate cabinet, or in both locations. A maximum of four 5-1/4 inch diskette drives can be supported by the CS 9000. Figure 1-3 for example, shows a system with one drive in the CRT housing (Drive 0) and three drives in two separate cabinets (Drives 1, 2 and 3). The fourth cabinet position is blank (note the cover plate).
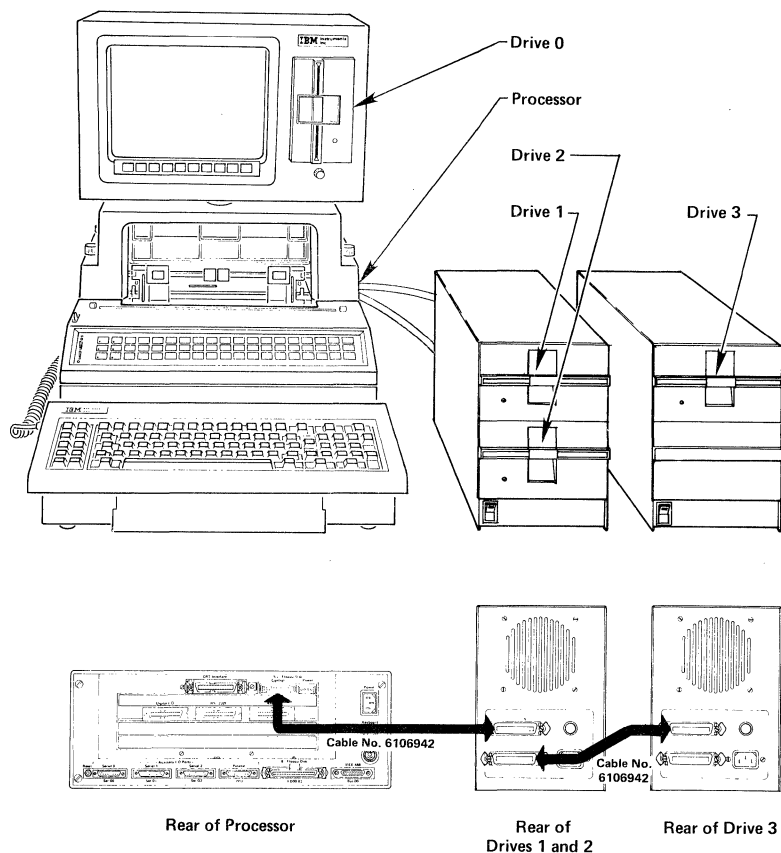

Figure 1-3. CS 9000 with 5¼-Inch Drives

5-1/4 inch drives ordered with a cabinet will come already installed in that cabinet, so before you proceed to the next steps in configuration, check Appendix A of this manual to determine what terminators were installed and what switch settings were selected when your 5-1/4 inch drives were packaged for shipment. IT MAY NOT BE NECESSARY TO CHANGE ANYTHING! If the terminators or settings do not meet your needs you should begin by configuring the drives as discussed on the following pages.

Drives ordered for insertion in the CRT housing or additional drives ordered for a previously purchased cabinet must be installed as follows:

1. Unplug all power to the CS 9000 and the drive cabinet(s).

2. Remove the 5-1/4 inch drive cover plates from the cabinet(s) or from the CRT housing. They are held in place by spring clips; simply pull them out of their position.

    CRT cover plates have attached terminator cards that contain a single terminator chip and connectors for power and signal cables; cabinet cover plates have no terminator cards. (NOTE: Some earlier models of the CS 9000 have CRT cover plates without terminator cards; if yours is such a system, you should have received a new CRT cover plate with your 5-1/4 inch diskette unit. If you did not, please notify IBM Instruments.)

3. Disconnect the power cable and the signal cable from the terminator card on the cover plate (if necessary) or locate the two cables within the cabinet and pull them out of the opening a few inches. (The power connector is the smaller of the two.)

4. Attach the signal cable to the signal connector on the diskette drive's control board as shown in Figure 1-4.

5. Attach the power cable to the power connector on the diskette drive's control board as shown in Figure 1-4.

5-1/4 inch drives installed in cabinets are held in place by four screws-- two on each side of the cabinet. 5-1/4 inch drives in the CRT are held in place by two captive screws on the underside of the CRT housing as shown in the inset to Figure 1-4. However, since 5-1/4 inch drive configuration requires access to the drive control board, do not continue installing the drives until configuration is complete.
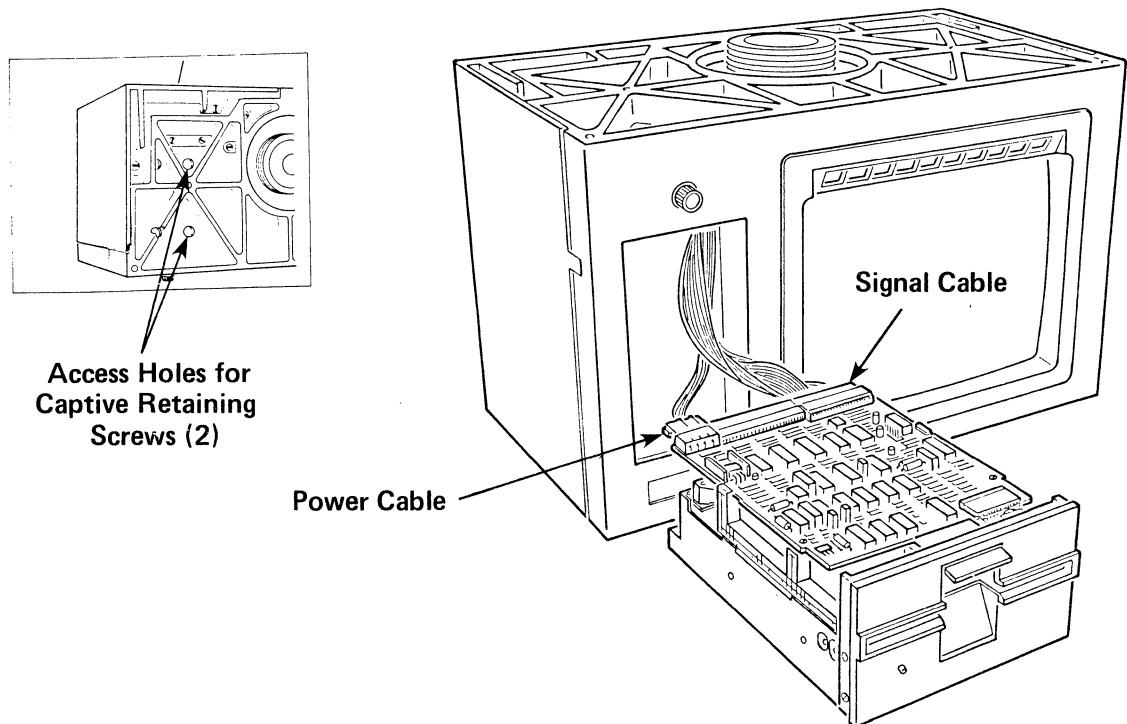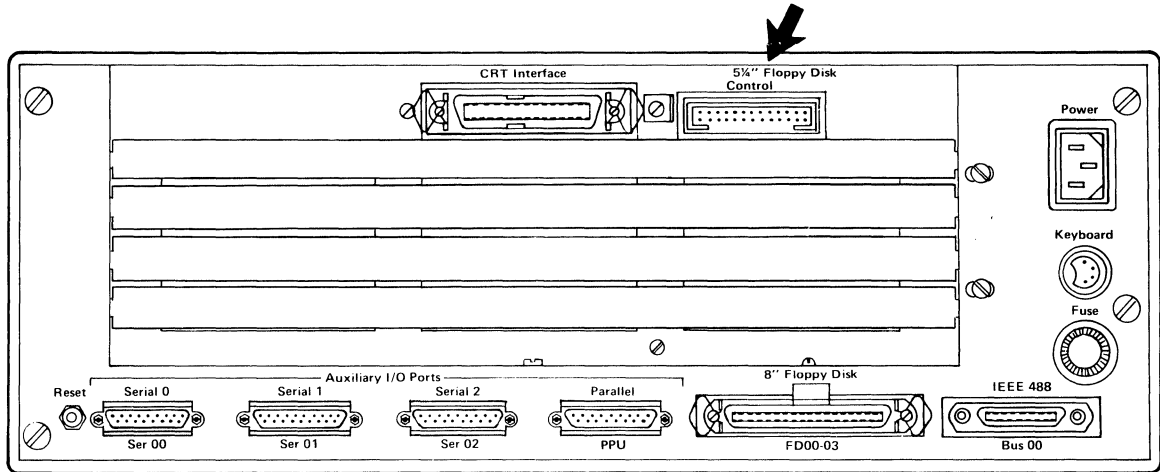
Access Holes for Captive Retaining Screws (2)

Signal Cable

Power Cable

Figure 1-4. 5-1/4 inch Drive in the CRT Housing

5-1/4 inch diskette drive configuration consists of:

    a.   For drive units in cabinets: connecting the drive unit cable(s) from the rear of the processor to the first cabinet and from the first to the second cabinet (if present). Cabling is internal for drives located in the CRT housing.

    b.   Inserting the appropriate terminator chip in the control board of the CRT drive (or terminator card) and the control board for the last drive in the chain, and

    c.   Connecting or "jumpering" the diskette drive address pins on each drive's control board.

For our four-drive example shown in Figure 1-3, the first cable runs from the "Floppy Disk" connector at the back of the processor (see Figure 1-5) to the upper connector at the rear of the first drive cabinet (housing Drives 1 and 2) and from the lower connector of the first cabinet to the upper connector at the rear of the second cabinet (housing Drive 3).

Connecting cables to the processor is done simply by pushing the connector straight forward into the socket and then snapping the spring retaining clips into position to lock the connector in place.

INSTALLING CABLES FOR DISKETTE DRIVES

PLEASE NOTE: Cables for external diskette drives have ferrite "beads" installed at one end to reduce radio frequency interference. This end of the cable should be attached to the processor with the beads as close as possible to the processor's back plate.

Figure 1-5. Floppy Disk Connector on Rear of Processor

Figure 1-6 shows the location of the terminator socket on the control board of a 5-1/4 inch diskette drive. For our example (one drive in the head and three in cabinets) a 330/470 ohm terminator chip must be inserted in the socket of the CRT drive's control board and another 330/470 ohm terminator chip in the socket of the control board for the last drive in the chain, in this case Drive 3.
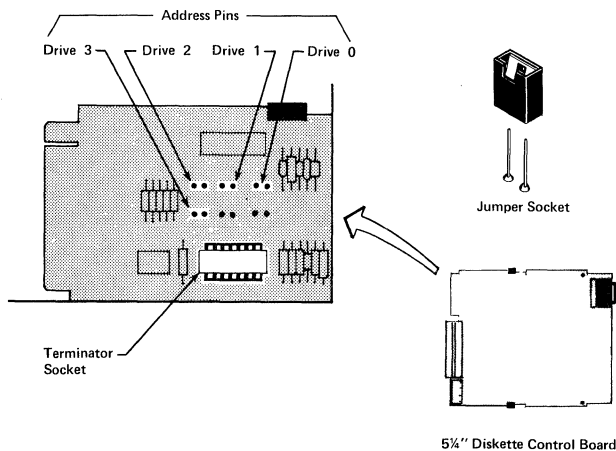

Figure 1-6. 5¼-Inch Drive Control Board

If all four 5-1/4 inch drives were in the cabinets, a 330/470 ohm terminator chip would be required on the terminator card of the CRT cover plate and another 330/470 ohm chip on the control board of the last drive in the chain.

A terminator chip must <u>always</u> be present on the control board of the <u>last drive in the chain.</u> Naturally, if only one 5-1/4 inch drive were installed in the CRT housing, the terminator would be required on that drive's control board; it would be a 220/330 ohm terminator, however.

The last step in 5-1/4 inch disk drive configuration is identifying each of the drives to the operating system as Drive 0, Drive 1, etc. This is done by connecting together or "jumpering" sets of pins on each drive's control board. The location of these pins is shown in Figure 1-6. Address pins are jumpered together by pushing a tiny, plastic connector (shaped like a hollow box) over a set of pins. Metal inside the connector makes the connection between the pins. Simply determine which drive you wish to address as Drive 0, Drive 1, etc. and then push the connector over the appropriate set of pins. Do this for each 5-1/4 inch drive in your system. Remember, no two drives can be assigned the same address!

In our example (Figure 1-3) the drive in the CRT housing is known to the operating system as Drive 0 because the pins in the upper right-hand corner of the address pin block have been jumpered together.

This completes the configuration of a system equipped only with 5-1/4 inch drives. You can now continue with the installation of your drives by following these steps:

1. Make sure that the power and signal cables are snugly connected to the control boards of all drives.

2. Slide the drives into position in the CRT housing and/or cabinet(s).

3. Tighten the mounting screws.

    a. For CRT drives, these mounting screws (2) are located beneath the CRT housing as shown in the inset to Figure 1-4.

    b. For cabinet drives, the mounting screws (4) are on either side of the cabinet.

4. Attach the power cord to the back of the drive cabinet (if it is a newly ordered cabinet and you have not already done so.)

5. Plug the power cable of the cabinet(s) into the wall outlet.

6. Plug the power cable of the CS 9000 into the wall outlet.

Installation and configuration is now complete. You may wish to run some of the
CS 9000's diagnostic tests for your drives. These tests are described in the
Computer System Problem Isolation Manual, GC22-9192.

SYSTEMS WITH HARD DISK DRIVE UNITS ONLY

The CS 9000 can support up to four hard disk units once the optional hard disk
controller board has been installed.   Two of these 5-1/4 inch units can be
housed in each cabinet and two cabinets can be connected to each other in a
chain.   (Hard disk units cannot be installed in the CRT housing like 5-1/4 inch
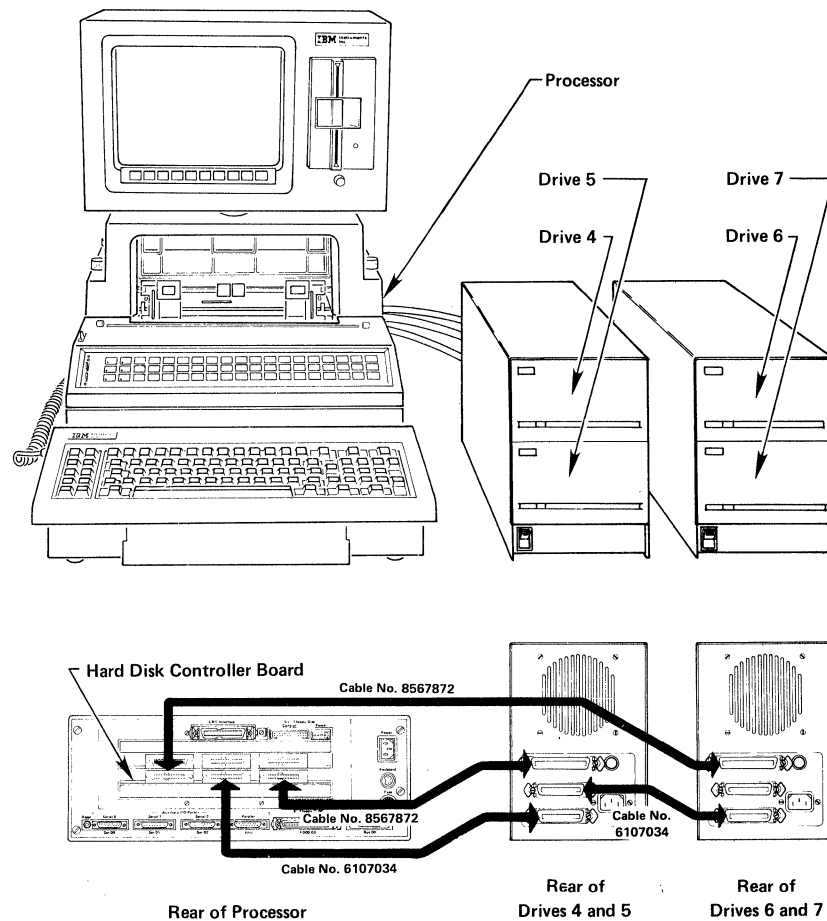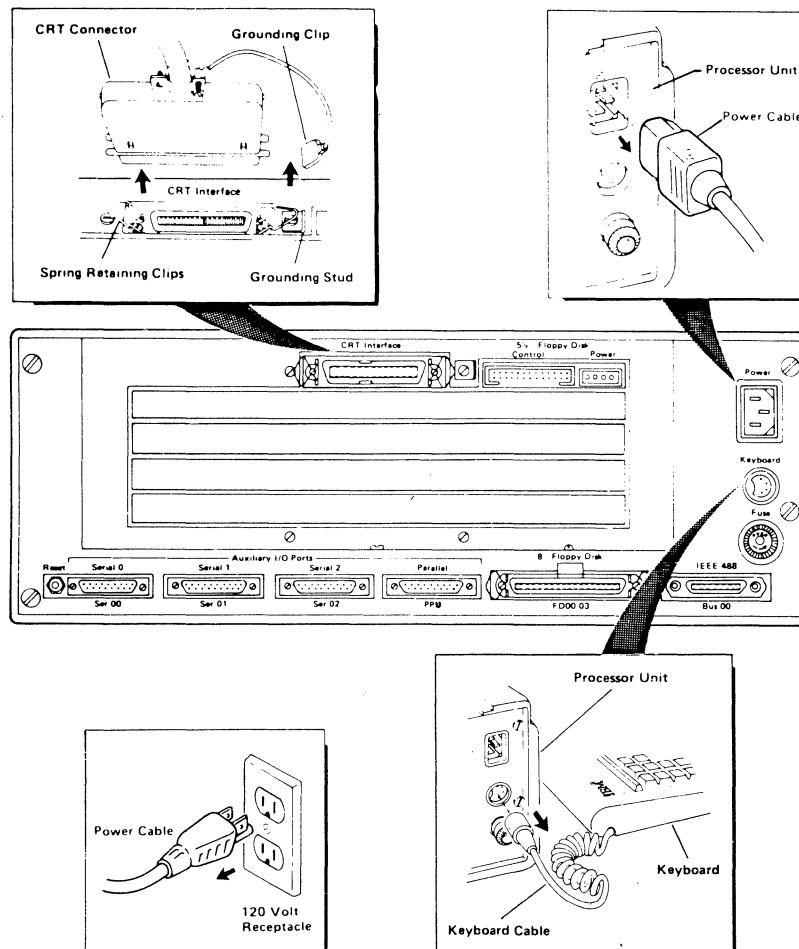floppy diskette drives). Figure 1-7 shows a system equipped with four hard disk
units.

Figure 1-7. CS 9000 with Hard Disk Drives

The first step of hard disk installation is inserting the hard disk controller board in the processor unit. This requires a partial disassembly of the CS 9000. To do this, first make sure that you have enough work space to disassemble the system and remember that the display unit weighs approximately 20 pounds (9.3kg); you may wish to use two people when removing it. Then, follow these steps:

1. Position the Computer System Power switch Off and unplug the main power cord from the wall outlet (See Figure 1-8).

INSTALLING CABLES FOR DISKETTE DRIVES

PLEASE NOTE: Cables for external diskette drives have ferrite "beads" installed at one end to reduce radio frequency interference. This end of the cable should be attached to the processor with the beads as close as possible to the processor's back plate.

Figure 1-8. Processor Rear Panel Connections.

2. Remove the main power cord from the back of the processor unit. (See Figure 1-8).

3. Remove the keyboard connector from the back of the processor unit and move the keyboard to another area to provide work space (See Figure 1-8). Remove all other connectors from the rear of the processor.

    NOTE: If a printer/plotter is not installed proceed to step 5.

4. Tear off and remove any paper remaining in the paper tray and move the paper tray to another area to provide access to the printer/plotter.

5. Disconnect the CRT cable assembly by spreading the spring retaining clips holding the connector in place and pulling it away from the rear of the processor unit. (See Figure 1-8).

    NOTE: When removing the CRT display unit and bridge assembly note the placement of the bridge assembly over the tractor drive shaft on the printer/plotter. The bridge assembly must be placed over the tractor drive shaft when replacing the assembly.
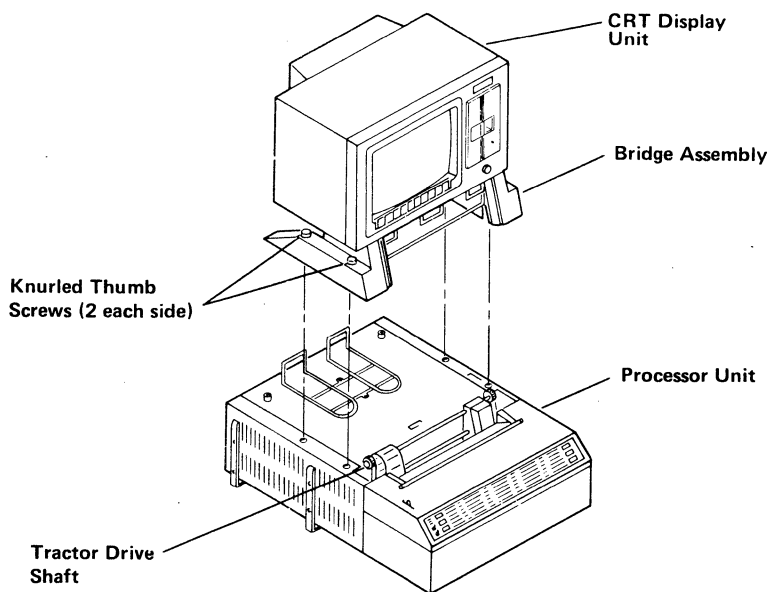

Figure 1-9. CRT Display Unit and Bridge Assembly.

6. Remove the CRT display unit and bridge assembly by loosening the four (4) knurled thumb screws and lifting the entire assembly. Move the entire assembly out of your way. (See Figure 1-9).

7. Remove the back plate from the processor unit by loosening the four (4) retaining screws at the four corners of the plate and pulling it away (See Figure 1-10). NOTE: If your system has been updated with the Release 1.1 upgrade kit, it will be necessary to remove the eight additional screws that hold the back plate to the I/O connectors on the planar board.
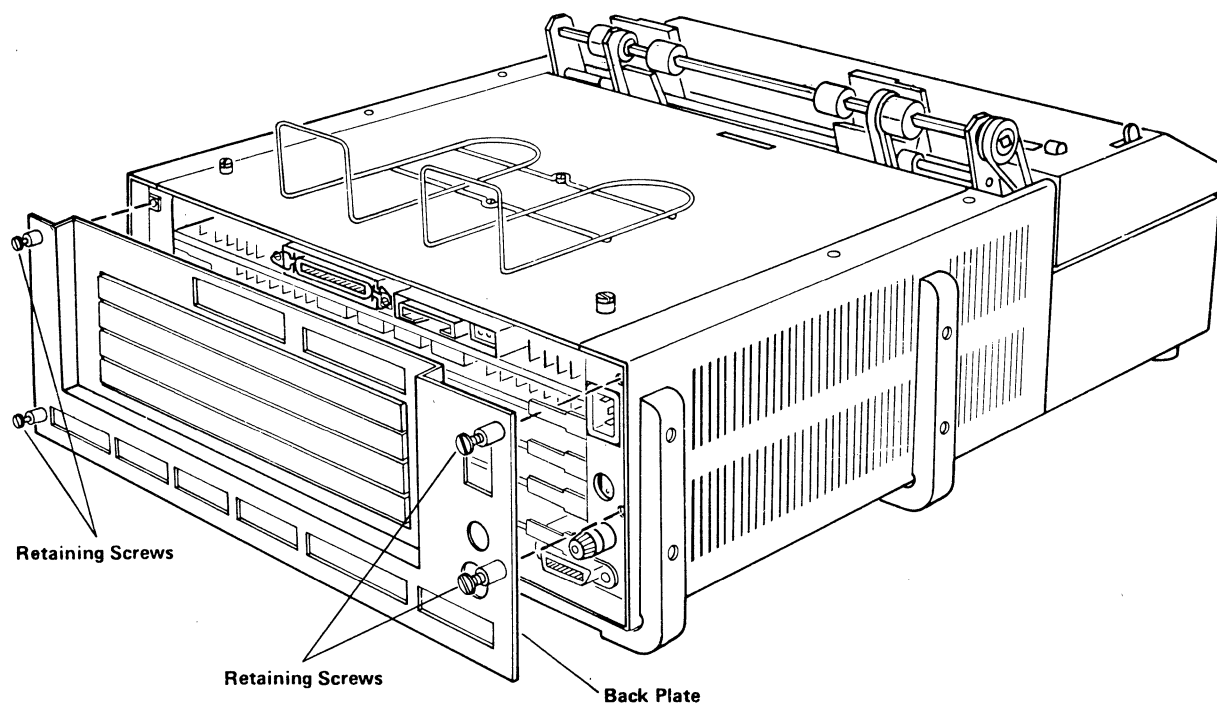

Figure 1-10. Processor Unit Back Plate.

8. Slide the hard disk controller board into one of the free positions in your processor. NOTE : If your system is also equipped with an optional memory board, the hard disk controller board must be positioned above that board (See Figure 1-11.)

9. Slide the hard disk controller board all the way forward in the board guides until it touches the expansion board at the front of the processor; the ejector levers should be level with the rear edge of the processor housing.

10. Use the ejector levers to push the board fully into position by hooking the levers onto the edge of the housing and pushing the levers in toward the rear edge of the controller board. You should feel the board snap into position.

Ejector Levers

Note: Shown with
Printer/Plotter Board Removed

Figure 1-11. Hard Disk Controller Board Installation

You can now begin to reassemble the system as follows:

1. Remove the appropriate slat of the back plate so that the connectors of the hard disk controller board can protrude. On older back plates the slats are made of plastic and can be bent and removed. Newer back plates installed as part of the Release 1.1 upgrade have slats made of metal. To remove these slats:

    a. loosen the two retaining screws on the right-hand side of the panel (beneath the voltage warning label and above the fuse warning label)

    b. slide the screws to the right (to release a bracket on the inside of the panel)

c. remove the appropriate slat and

d. tighten the two retaining screws.

2. Reinstall the back plate of the processor unit by tightening the four (4) retaining screws at the corners of the plate (and re-inserting and tightening the eight screws of the I/O connectors if necessary).

3. Remount the CRT display unit and bridge assembly by lowering the assembly into position over the tractor drive shaft of the printer/plotter and tightening the (4) knurled thumb screws.

4. Reconnect the CRT cable to the back of the processor by pushing it straight into the CRT socket and then snapping the spring retaining clips back into position.

5. Reconnect the keyboard cable, any other (non-hard disk) cables, and the power cord to the back of the processor. DO NOT plug the power cord into the wall outlet until the hard disk units have been fully configured.

"Installation" of the hard disk units consists only of unpacking the units and their associated cords and cables and attaching the cabinet end of the power cord, so the next step is the configuration of the units; this consists of:

a. Connecting the drive unit cable(s) from the rear of the processor to the first cabinet and from the first to the second cabinet (if present).

b. Inserting the appropriate terminator chip in the control board of the last drive in the chain, and

c. Setting the hard disk drive address/option switches on each hard disk drive's control board.

For our sample system equipped with four hard disk units as shown in Figure 1-7, the cabling appears complex but is actually quite simple.

1. The first cable runs from the middle connector on the hard disk controller board to the bottom connector on the first drive cabinet.

2. The second cable runs from the rightmost connector on the hard disk controller board (viewed from the rear of the processor) to the top connector on the first drive cabinet.

3. The third cable runs from the leftmost connector on the hard disk controller board (viewed from the rear of the processor) to the top connector on the second drive cabinet.

4. The fourth and final cable runs from the <u>middle</u> connector on the first drive cabinet to the <u>bottom</u> connector on the second drive cabinet.

To attach these cables, simply push the connector straight forward into the socket and then snap the spring retaining clips into position to lock the connector in place.

Before you proceed to the next steps in configuration, check Appendix A of this manual to determine what terminators were installed and what switch settings were selected when your hard disk drives were packaged for shipment. IT MAY NOT BE NECESSARY TO CHANGE ANYTHING! Naturally, if you are adding a hard disk drive to a cabinet, you will have to configure it in relation to the other drives.

In addition to the hard disk controller board located in the CS 9000, each hard disk unit has its own attached control "card". Figure 1-12 shows the location of the terminator socket on this attached control card. To gain access to this control card you must remove the drive from its cabinet; to do this:

1. Remove the two retaining screws (one on each side of the cabinet).

2. Slide the hard disk drive out until you can locate the three power and signal connectors and the grounding wire. (Refer to Figure 1-12 for the location of these connectors on the control board.)

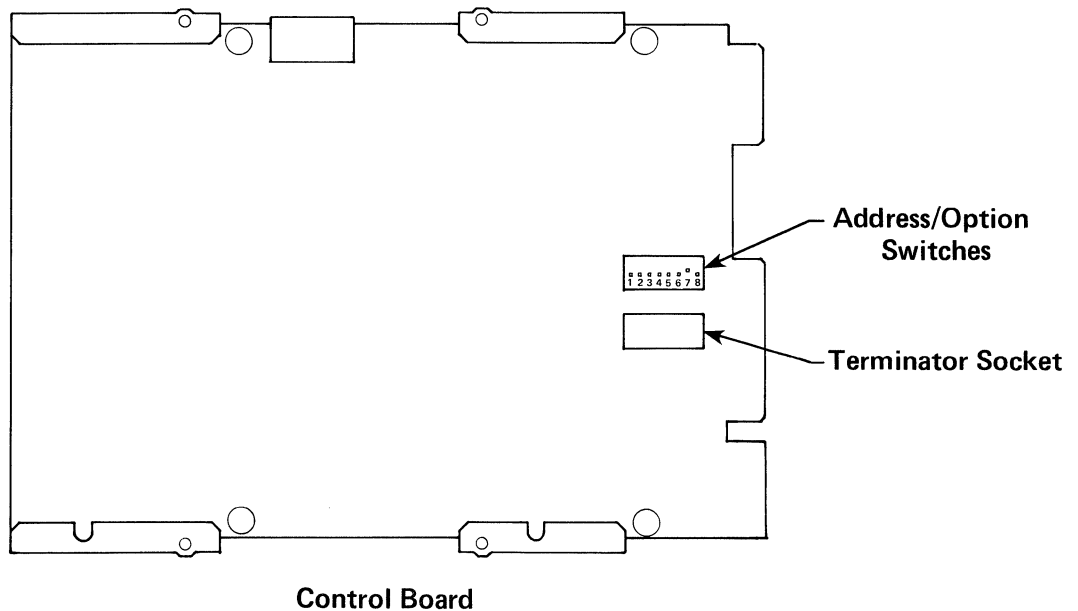3. Remove these connectors and then slide the drive all the way out of the cabinet.

Control Board

Figure 1-12. Hard Disk Drive

A 220/330 ohm terminator must be inserted into the socket of the control card for the last hard disk unit in the chain. No intermediate hard disk units should have terminators inserted.

The last step in hard disk configuration is the setting of address/option switches to identify the hard disk units to the operating system as "Hard Disk Drive 4", "Hard Disk Drive 5", etc. and to select certain options for hard disk operation such as "Radial" or "Half Step". (These options are explained below.) Figure 1-12 shows the location of the bank of eight address/option switches on the hard disk control card. To set an option or designate a drive, you must turn the appropriate switch ON. The switches have the following meanings.

SWITCH	MEANING
#1	Radial Option
#2	(Defeat) Recal Option
#3	Not Used
#4	Half Step Option
#5	Set Unit to Drive 7
#6	Set Unit to Drive 6
#7	Set Unit to Drive 5
#8	Set Unit to Drive 4

To set a drive as "Hard Disk Drive 4" with the "Defeat Recal" and "Half Step" options in effect, for example, switches 2, 3, 4, and 8 would be set ON, while switches 1, 5, 6, and 7 would be set OFF.

The RADIAL option (ON) sets the hard disk drives so that all output signals are active, even if the drive is not selected. In this case the LED on the front of the drive will not be on. However, since the CS 9000 uses hard disk drives in a "chained" configuration, we recommend that this switch be set to OFF.

The RECAL option (ON) sets the hard disk drives so that whenever a power-up sequence is performed, the heads will automatically be positioned to Track 0. The DEFEAT RECAL option (OFF) will allow the hard disk drive to become "Ready" earlier. However, during power-up, the stepper circuitry will always put Phase "A" active. Thus, there is no guarantee that the drive heads will be positioned at the same cylinder as the one where they were when the drive was powered off. The drive heads will start at the same track only if that track corresponded to one which utilizes Phase "A". We recommend that you set this switch ON for hard disk drives used with the CS 9000.

The HALF STEP option (ON) sets the hard disk drives so that step pulses are applied to the interface at an interval of 3 milliseconds. Setting this switch OFF results in a significant decrease in access time but requires a user-written

software algorithm. Therefore, we recommend that you set this switch ON.

This completes the installation and configuration of a system equipped only with hard disk drives. You may wish to run some of the CS 9000's diagnostic tests for your drives. These tests are described in the Computer System Problem Isolation Manual, GC22-9192.

SYSTEMS WITH A MIXTURE OF DISK AND DISKETTE DRIVES

Since the CS 9000 can accommodate four diskette drives of either size in combination as well as up to four hard disk drives, it is likely that your system will have a variety of drives. The hard disk units operate independent of the diskette units, so you need not do anything special to them; simply follow the instructions in the preceding section. Installation and cabling of the diskette drives does not change either, so you can follow the 8-inch drive and 5-1/4 inch drive installation instructions earlier in this manual. BUT BEFORE YOU DO, a little planning is in order. You will not be inserting the same value terminators as before, and the drive settings that you choose may differ.

For example, Figure 1-13 shows a CS 9000 equipped with a 5-1/4 inch diskette drive in the CRT housing, two 8-inch drives in an external cabinet, and two hard disk drives in a cabinet.
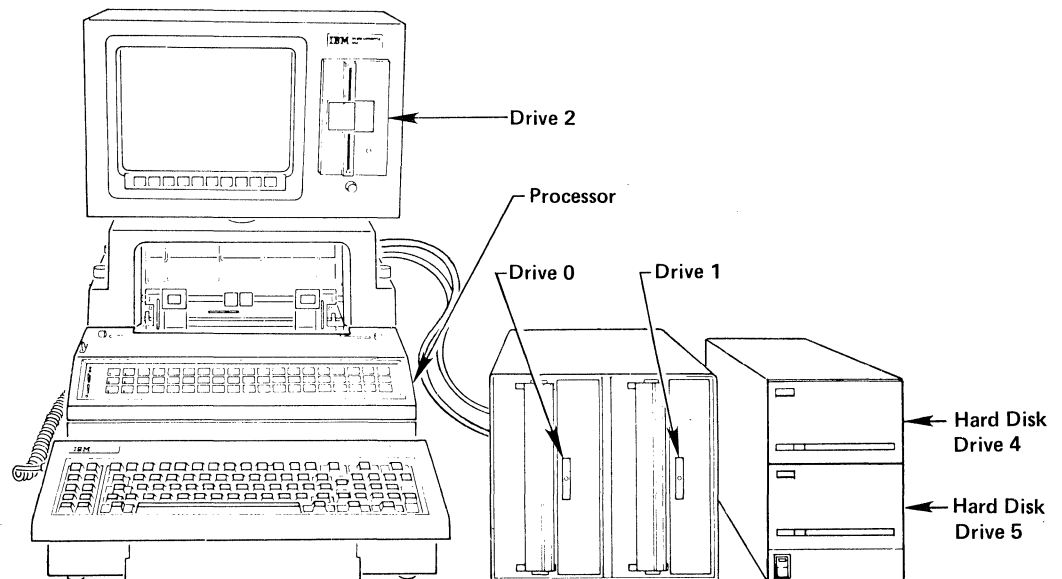

Figure 1-13. CS 9000 with a Mixture of Disk and Diskette Drives

The first step is to plan how the drives will actually be used in normal operation. Keep in mind that the operating system will always look for information on the default drive- Drive 0 for diskette systems only or Drive 4 if the system is equipped with a hard disk. You may wish to have your default drive be an 8-inch drive with the 5-1/4 inch drive as backup, so let our example show the 8-inch drives as Drive 0 (left) and Drive 1 (right) with the 5-1/4 inch drive set as Drive 2. The hard disk drives will be called Hard Disk Drive 0 and Hard Disk Drive 1.

The next step is to determine the value of the terminators that must be inserted in the CRT drive's control board and the 8-inch drive cabinet. (The hard disk drive terminator(s) are unaffected.) To do this, refer to Appendix B of this manual. You will see that for our example, a 220/330 ohm terminator must be inserted in the CRT drive's terminator socket and a 510 ohm terminator must be inserted in the socket at the rear of the 8-inch drive cabinet.

The final step is identifying the drives to the operating system. For our example, the 8-inch drive settings would be the same as those shown in Figure 1-2 (switches #2 and #5 ON and all others OFF). The 5-1/4 inch drive would now be Drive 2, so the two pins in the upper left-hand corner of the address pin block on the drive's control board would be jumpered together (see Figure 1-6). The hard disk units would be known to the operating system as Hard Disk 0 (switch #8 ON) and Hard Disk 1 (switch #7 ON).

After you have planned the configuration, inserted the appropriate terminators, and selected the proper drive addresses, you can return the units to their housings and tighten all retaining screws.

APPENDIX A: FACTORY SETTINGS FOR TERMINATORS AND ADDRESS SWITCHES

DRIVE TYPE	TERMINATOR AND SWITCH SETTING
Two 8-inch drives in a cabinet	510 ohm terminator on cabinet Left-hand drive is Drive 0 Right-hand drive is Drive 1
One 5-1/4 inch drive in a cabinet	330/470 ohm terminator on drive Drive is set as Drive 0
Two 5-1/4 inch drives in a cabinet	330/470 ohm terminator in last drive (Drive 1) Upper drive is Drive 0 Lower drive is Drive 1
No drive in the CRT but a terminator card instead	220/330 ohm terminator on the terminator card
5-1/4 inch drive in the CRT	220/330 ohm terminator on drive control board Drive is set as Drive 2
8-inch drive not installed in cabinet	No terminator; drive is set as Drive 0
5-1/4 inch drive not installed in cabinet	220/330 ohm terminator on drive control board; drive is set as Drive 0.

APPENDIX B: TERMINATORS USED FOR MIXED SYSTEMS

SYSTEM CONFIGURATION	TERMINATOR(S) REQUIRED
Two 8-inch drives only	510 ohm terminator on rear of cabinet; 220/330 ohm terminator in card in CRT
One 5-1/4 inch drive in the CRT only	220/330 ohm terminator in the drive control board
One 5-1/4 inch drive in the CRT and 8-inch drives in a cabinet	220/330 ohm terminator in 5-1/4 inch drive control board; 510 ohm terminator on rear of last cabinet.
Two 5-1/4 inch drives in cabinet and 8-inch drives in cabinet	330/470 ohm terminator in card in CRT; 330/470 ohm terminator on last 5-1/4 inch drive in chain; 510 ohm terminator on rear of last cabinet.
5-1/4 inch drive in the CRT and more 5-1/4 inch drives in cabinet(s)	330/470 ohm terminator on CRT drive control board; 330/470 ohm terminator on last 5-1/4 inch drive in the chain.
5-1/4 inch drive(s) in cabinet(s) only- none in CRT	330/470 ohm terminator in the CRT card; 330/470 ohm terminator on last 5-1/4 inch drive in the chain