

Displaywriter System

Product Support Manual

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IBM 6360 Diskette Unit
IBM 6580 Display Station

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4. Care must be used when working near moving parts. Keep hair away from moving parts. Avoid wearing loose clothing that might be caught in the machine. Shirt sleeves must be kept buttoned or rolled above the elbows. Ties must be tucked in the shirt or have a tie clasp approximately three inches from the end. Tie chains are not recommended.

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4. Power should be removed from the machine for servicing whenever possible. Remember, when checking voltages, avoid contacting ground potential, such as metal floor strips, machine frame, etc.
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4. Always place CSR tool kit away from walk areas where no one can trip over it.
5. Maintain safe conditions in the area of the machine while performing and after completing maintenance.
6. Before starting the equipment, make sure fellow CSRs and customer personnel are not in a hazardous position.
7. All the machine covers must be in place before the machine is returned to the customer.

Note: Refer to the Safety CEMs relating to this product(s) for further safety precautions.

PREFACE

This manual contains information necessary to understand the operational theory and to service the IBM Displaywriter System work station. Service personnel using this manual must have completed the student education course. This manual is in ten sections.

The Introduction section summarizes the IBM Displaywriter System. The components and features are introduced.

The Operating Instructions section provides an overview of basic operator procedures and activities. Future IBM Licensed Program releases could change the function of the Displaywriter System. The operator's reference material should be used for more specific information.

The 25-Line and Large Displays and the Keyboard sections contain operational theory, service information, adjustments, and removal/replacement procedures.

The Electronics/Power Supply section describes the function of the major components of this module and removal/replacement procedures.

The Diskette section contains operational theory, service information, adjustments, and removal/replacement procedures for the Type 1 Drive and the Type 2D drive (high density/two sided read/write function). The Type 1 Drive is shown when the part illustrated is not affected by the differences in the drives.

The Cables/Connectors/Test Points section contains cable and connector test points, AC wiring diagrams, flow charts, figures showing component locations and the system grounding schematic. The diskette AC wiring diagrams show the physical location of the grounds for these voltages.

The Diagnostic section describes the tests and utilities available to aid in servicing the system and identifying failing components in the system. The display formats and the printed outputs are controlled by the software and may differ from the formats actually displayed. The formats and outputs shown in this section are samples only.

The Intermittent Problem Diagnostic Approach section is a guide to aid service personnel in solving intermittent system problems.

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CHAPTER 1. INTRODUCTION

The IBM Displaywriter System is a modular family of word processing products. The available modules include a display module, an electronics module, a diskette unit, a keyboard module, a printer, and a Mag Card unit.

DISPLAY STATION

A display module, an electronics module, and a keyboard module make up a display station in the system configuration.

- The display module is available in two sizes:
 - A 25-Line Display which can contain up to 80 characters per line
 - A Large Display (66-Lines) which can contain up to 100 characters per line.

The display is attached to the electronics module and can be positioned to the needs of the operator

- The electronics module contains the electronics needed to operate the display and the keyboard. Included in the electronics module are the power supply and at least 128 K bytes of internal (working) memory.
- The keyboard module has either 92 or 96 alphanumeric characters and has various character arrangements. The keyboard is connected to the electronics module by a cable which permits keyboard movement for operator comfort.

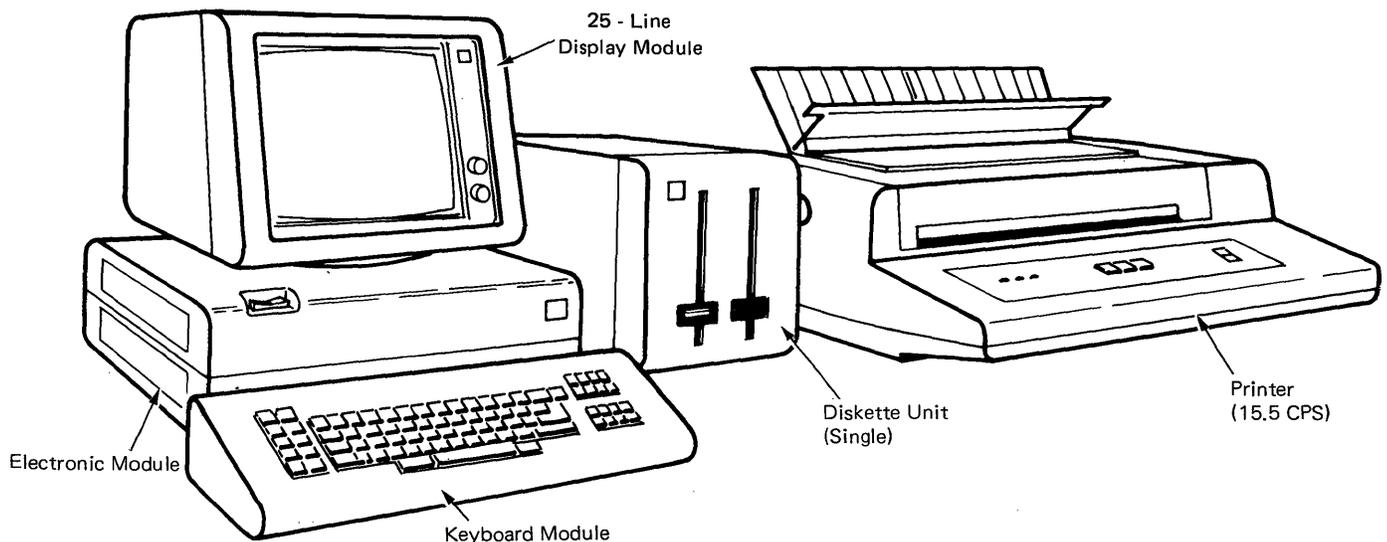


Figure 1-1. IBM Displaywriter System

WORK STATION

When a diskette unit is added to a display station, it becomes a work station.

The diskette unit is cable connected to the electronics module and contains the diskette adapter card and the diskette drive mechanism. The diskette unit is controlled by the electronics module and receives its power from the electronics module or the large display.

Optional features can be contained in, or connected to, either the electronics module or the diskette unit.

Work Station Data Flow

The operator controls the system and inputs data by using the keyboard which is connected to the electronics module.

The electronics module arranges and distributes the input data to the display module, and the diskette unit (Figure 1-2).

The display module is cable connected to and installed on top of the electronics module. The display module provides video feedback to the operator.

The diskette unit is used to read data from the diskette or write data on the diskette through the electronics module.

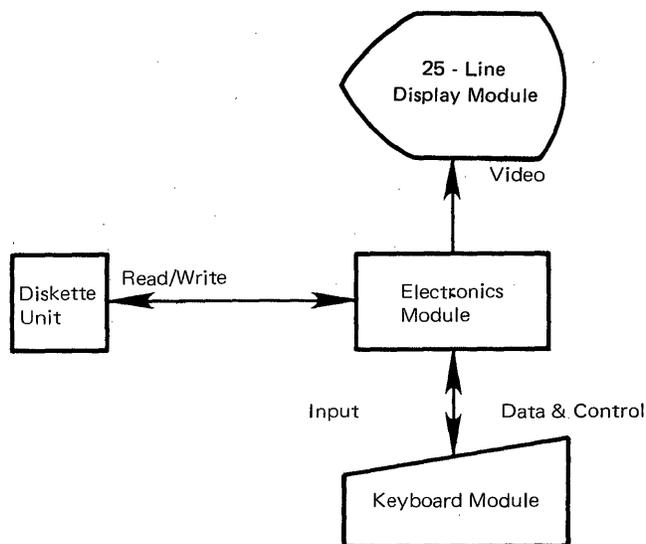


Figure 1-2. Work Station Data Flow

DISKETTE UNIT

Two types of diskette drives can be used in the diskette unit. The Type 1 diskette drive can read/record information on an IBM Diskette 1 (one-sided) only. The Type 2D diskette drive can read/record information on both the IBM Diskette 1 and Diskette 2D (two-sided).

Diskettes

The Type 1 diskette (one-sided diskette) can hold up to 284,000 bytes of usable information. The Type 2D diskette is a high density, two-sided diskette. The Type 2D diskette can hold up to 985,000 bytes by storing the information on both sides of the diskette.

PRINTERS

Several printers can be used with the IBM Displaywriter workstation

- The IBM "Selectric" Element Printer (Figure 1-3) is cable connected to the electronics module and can be used by only one work station. The printer's rated burst speed is up to 15.5 characters per second (CPS).

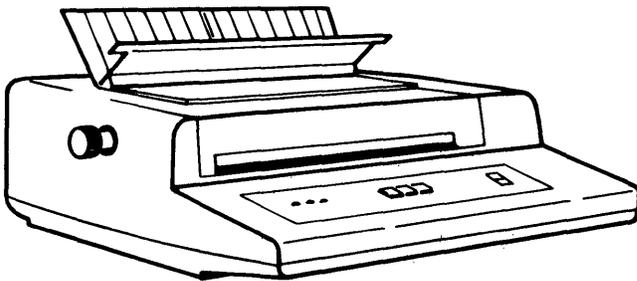


Figure 1-3. "Selectric" Element Printer

- Two bi-directional printwheel printers (Figure 1-4) also provide hard copy output for the Displaywriter work station. These cable connected printers can be shared by up to three work stations. The printwheel printers have rated burst speeds of up to 40 CPS and 60 CPS.

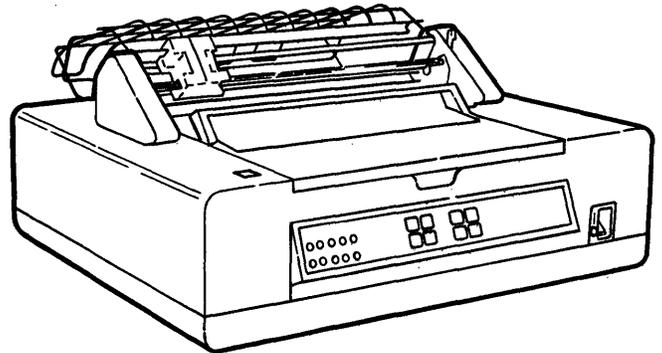


Figure 1-4. Printwheel Printer (With Optional Tractor Feed)

OPTIONAL PAPER FEED ASSEMBLIES

Two optional paper feed assemblies can be installed on the printwheel printers.

- The Tractor-feed attachment feeds continuous forms into the printer (Figure 1-4).
- The Sheet-Feed Paper Handler is a two-tray paper handler which holds up to 400 sheets of paper (200 sheets per tray). It feeds and stacks individual sheets of paper (Figure 1-5).

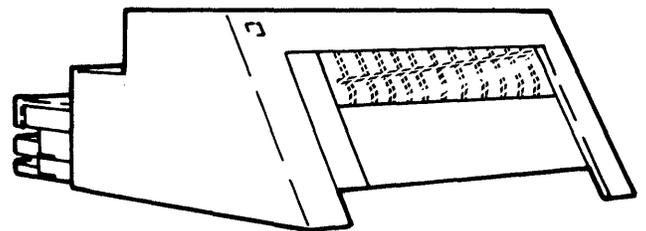


Figure 1-5. Sheet Feed Paper Handler

MAG CARD UNIT

The Mag Card Unit is cable connected to the electronics module and permits the reading and the recording of magnetic cards (Figure 1-6).

Note: The printers, the optional paper feed assemblies, and the Mag Card Unit are not discussed in this manual. They are included for information only, and their service theory will be covered in other manuals.

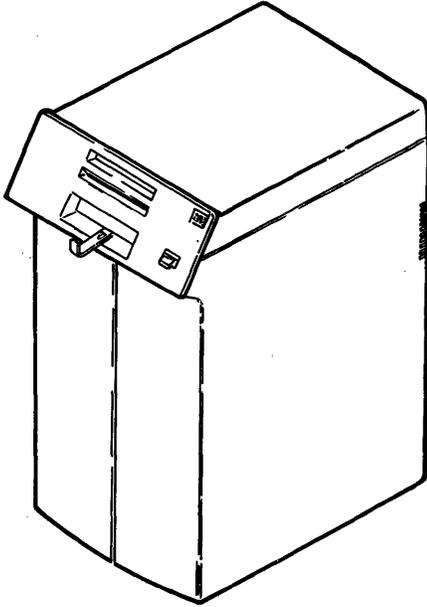


Figure 1-6. Mag Card Unit

CHAPTER 2. OPERATING INSTRUCTIONS

This section explains some of the basic operations of the IBM Displaywriter System. This is not a complete operator manual. If further information is needed, refer to the operator's reference information.

Two types of diskettes: (1) work diskettes and (2) program diskettes, are used to perform operator applications. Documents are stored on work diskettes, and program diskettes contain the various licenced programs that permit the operators to perform various tasks.

After the system successfully completes the Basic Assurance Test (BAT), the IBM logo is displayed. The system is now ready to accept a program that is stored on the program diskette. When the information on the program diskette is loaded, the system performs an Initial Program Load (IPL), and the TASK SELECTION Menu is displayed.

A task may be either a typing task, a work diskette task, a program diskette task or a spelling task. All tasks to be performed are selected from the

TASK SELECTION Menu. For example, typing tasks are selected to create or revise documents, and work diskette tasks are selected to delete documents or change document names. The task is loaded when the operator selects the task and presses the ENTER key.

All documents are created from the keyboard, and all menu selections are entered from the keyboard by typing the choice and pressing the ENTER key. The display permits the operator to see documents as they are created or revised and to see the selections available in the menus. Format instruction codes, such as Center and Word Underline, also display when the cursor is under them. Prompts and messages help the operator perform multi-step procedures such as COPY.

The buttons on the printer control panel turn on power, and start, stop, or cancel a print operation. The margins, line spacing and pitch formats are selected at the keyboard and are controlled by the system during printing.

DISPLAY FORMATS

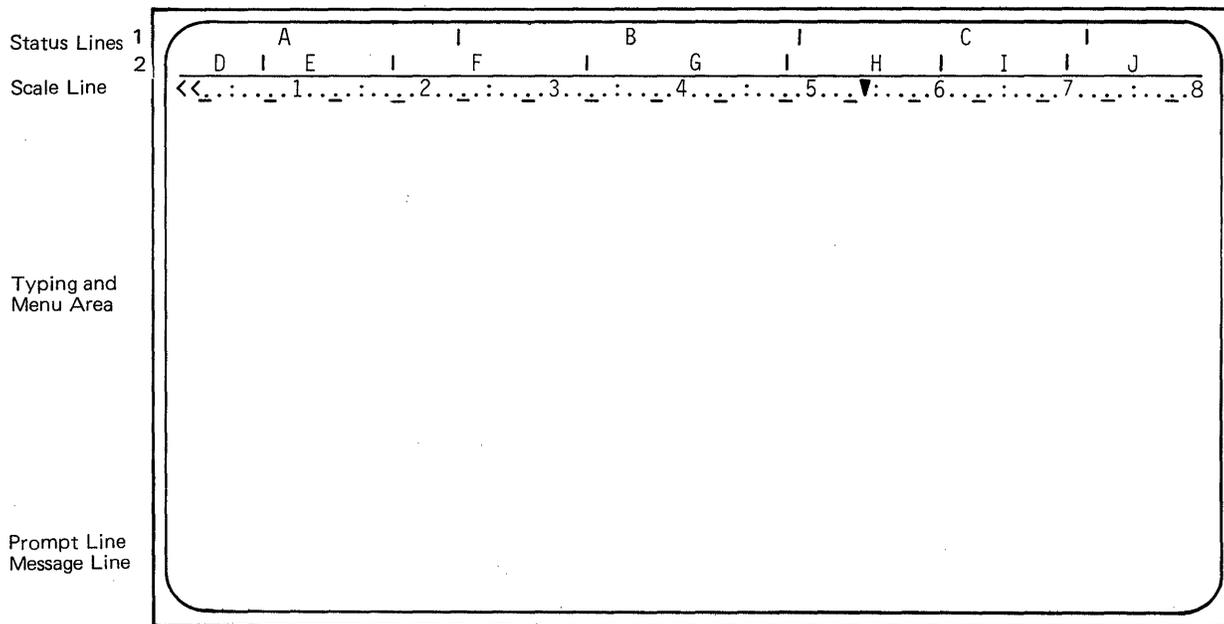


Figure 2-1. Display Formats

This section describes the five areas of the display:

- Status Lines
- Scale Line
- Typing and Menu Area
- Prompt Line
- Message Line.

Status Lines

The two status lines have information about the current task. (See Figure 2-1.) The first status line gives information about the following fields:

A Context Field. Displays the current function being performed. For example, when the COPY function is entered, the words "Copy Text" display in this area.

B Document Name Field. Displays the name of the document being created or revised.

C Audit Window Field. Displays the names of codes when they are cursoried in text. For example, when the cursor is under a Word Underline instruction in the typing area, WORD UND is displayed.

The second status line shows seven fields.

D Diskette Name - Left Drive Field. Displays the name of the diskette loaded in the left slot.

E Diskette Name - Right Drive Field. Displays the name of the diskette loaded in the right slot of a Dual Diskette Unit.

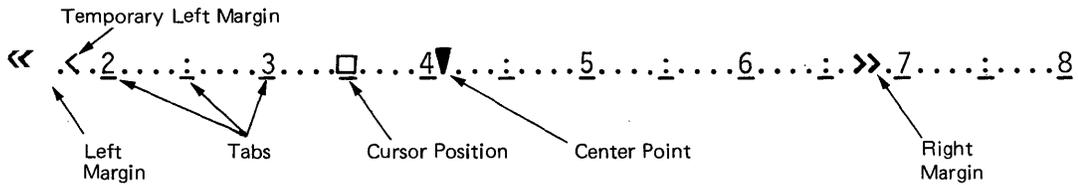


Figure 2-2. Scale Line

F Communication Status Field. Displays information when in the communications mode.

G Page Number Field. Displays the page number of the document page being created or revised.

H Line Number Field. Displays the number of the line that the cursor is on. Line numbering begins at the top edge of the paper.

I Keyboard Number Field. Displays the ID number of the keyboard in use.

J Pitch Field. Displays the pitch (10, 11, 12, or 15) of the typestyle in use. The proportional space mode is 11 pitch.

Scale Line

The scale line (Figure 2-2) displays when a document is being created or revised. It shows the margins, the temporary left margin, the tabs, the center point, and the cursor position in effect for the cursored line. The cursor position is represented by a highlighted scale line position. When typing text in the proportional space mode, the cursor character position in text may not match the cursor position on the scale line.

Typing and Menu Area

This area displays the menus or the text being created or revised. The cursor also displays in this area and appears as a brighter underline. When it is under a character position, that character is brighter.

The cursor can be moved to any character in the document by using the cursor movement keys on the keyboard. It can also be moved to an area of the display where there are no characters. An example would be to move the cursor past the carrier return on the writing line. This cursor placement causes the system to prompt that it is a non-keying area, and keyboard entry is inhibited until the cursor is moved back to a character in the document.

In the menus, the cursor is usually on the prompt line and moves only when text is inserted by typing or removed by backspacing.

Line length is the space between the left and right margins and can be up to 255 characters. Segmenting displays lines longer than the 80 character width of the display by moving the text horizontally through the display. Segmenting occurs when the cursor is moved past the first or last character position on the writing line.

Long document pages that do not fit on the screen can be displayed by scrolling. Scrolling moves the text vertically through the display. Attempting to move the cursor past the upper or

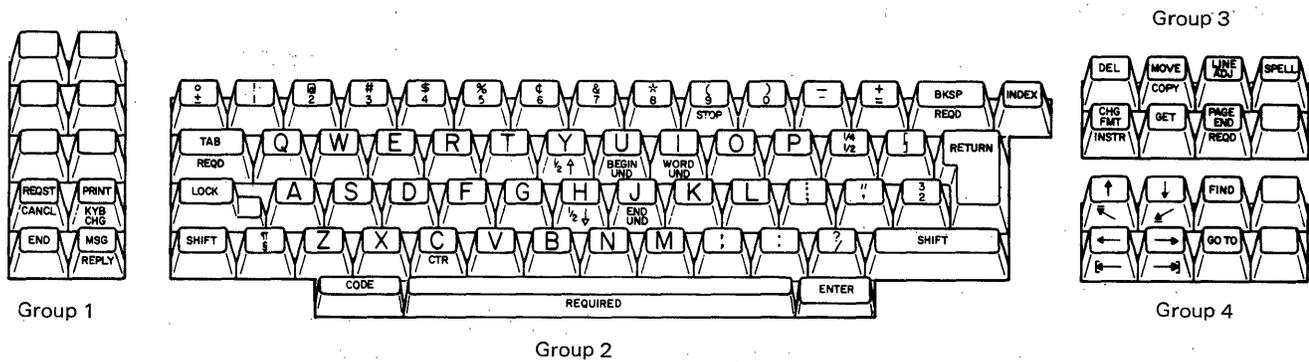


Figure 2-3. Displaywriter Keyboard

lower typing area boundaries will move the text through the display.

Prompt Line

The system uses the prompt line to indicate an action must be taken (example: inserting a diskette) or to guide the operator through functions one step at a time. When a prompt appears, the cursor moves to the prompt line so the operator can type the proper response. The prompt line is brighter than the other displayed lines.

Message Line

The system uses the message line to indicate the status of tasks (example: a print job completion), printer needs, or when an error occurs. The system can hold up to six messages.

Pressing the Message (MSG) key when the \Rightarrow symbol appears on the message line displays the oldest waiting message. Pressing the MSG key again will clear the message being displayed and display the next message, if any.

KEYBOARD OPERATION

The operator uses the four groups of keys on the keyboard (Figure 2-3) when typing documents, printing documents or selecting menus. The Alphanumeric Keys (Group 2) provide the standard upper and lower case characters, symbols and numbers.

The Cursor Movement Keys (Group 4) provide control of cursor movement and some text functions. The Function Control Keys (Group 3) and the Work Station Control Keys (Group 1) provide system functions and permit menu selections.

Many of the keys on the keyboard provide additional operations when they are pressed while holding down the CODE key. Most special keys have the additional operation name printed on the front of them.

Work Station Control Keys

1. REQST (Request). Displays additional operations that can be used during a task.
2. CANCL (Cancel). Cancels operations and clears prompts.
3. END. Ends a task.
4. PRINT. Prints the page currently displayed on the screen in the Create or Revise Document task.
5. KYB CHG (Keyboard Change). Permits the operator to change the keyboard arrangement.
6. MSG (Message). Displays messages when the ==> symbol is displayed and clears messages that are displayed.
7. REPLY. Clears insert diskette messages.

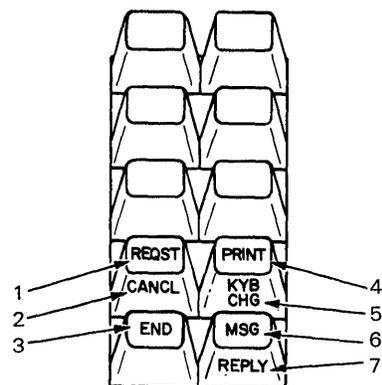


Figure 2-4. Work Station Control Keys (Group 1)

Alphanumeric Keys

1. TAB. Moves the cursor to the next tab setting.
2. REQD TAB (Required Tab). Sets up an indented (temporary) left margin.
3. CODE. Provides additional functions when used with keys that have names printed on the front of them.
4. CTR (Center). Centers text around the cursor position.
5. SPACEBAR. Adds one character space to the text.
6. REQUIRED (Required Space). Prevents words from being separated on two different lines.
7. 1/2 ↑ (Superscript). Moves text up one-half line.
8. 1/2 ↓ (Subscript). Moves text down one-half line.

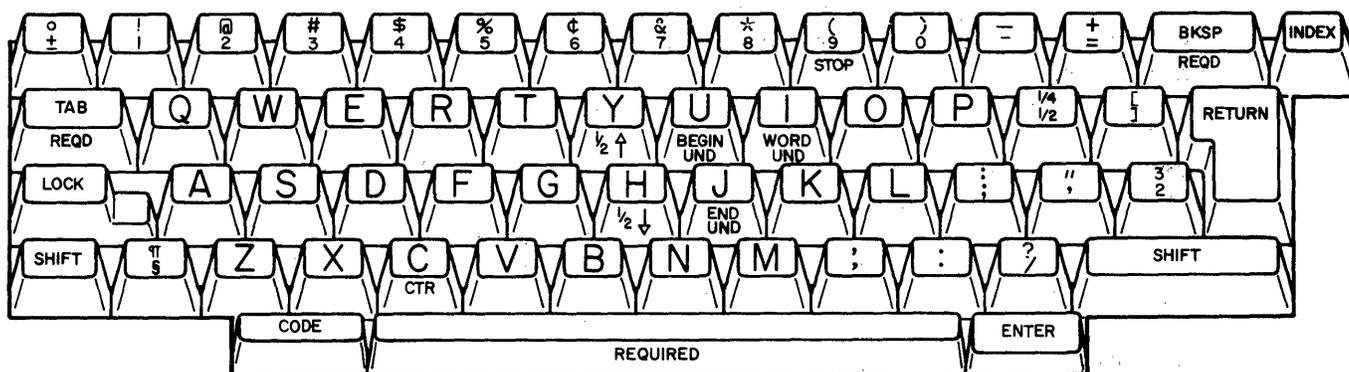


Figure 2-5. Alphanumeric Keys (Group 2)

9. **BEGIN UND** (Begin Underline). Marks the beginning of text to be underlined.
10. **END UND** (End Underline). Marks the end of text to be underlined.
11. **WORD UND** (Word Underline). Underlines the previous word.
12. **STOP**. Inserts a stop code at the cursor position.
13. **ENTER**. Causes the system to perform tasks and functions.
14. **BKSP** (Backspace). Moves the cursor one character position to the left and deletes the previous character.
15. **REQD BKSP** (Required Backspace). Moves the cursor and print position one character position to the left without deleting characters.
16. **RETURN** (Carrier Return). Ends the current line and moves the cursor and print position to the beginning of the next line.
17. **INDEX**. Moves the cursor and print position to the next line with no horizontal movement.

Function Control Keys

1. **DEL** (Delete). Permits the operator to delete text from a document.
2. **MOVE**. Permits the operator to move text to another place in the document, removing it from the original location.
3. **COPY**. Permits the operator to copy text and put it in another place in the document while leaving it in the original location.
4. **LINE ADJ** (Line Adjust). Permits the operator to make a line ending decision on the line of a document where the cursor is currently located.
5. **SPELL**. Compares the spelling of words in a document against the dictionary on the program diskette. When used with the **FIND** key, it locates words video reversed by the Spelling task that need checking.

6. CHG FMT (Change Format). Causes a Format Selection Menu to display during the Create or Revise Document task permitting the operator to make format changes.
7. INSTR (Instruction). Causes the Instruction Menu to display, permitting the operator to put an instruction in text.
8. GET (Single Diskette Unit). Copies a page from a document on the work diskette in use and puts it in at the cursor position in the currently displaying document.

GET (Dual Diskette Unit). Copies a page from a document on any work diskette and puts it in at the cursor position in the currently displaying document.
9. PAGE END. Inserts a temporary page end into a document. Pagination may move this page end if necessary.
10. REQD (Required Page End). Inserts a page end into a document. Pagination will not move this page end. A page will always end at this point.

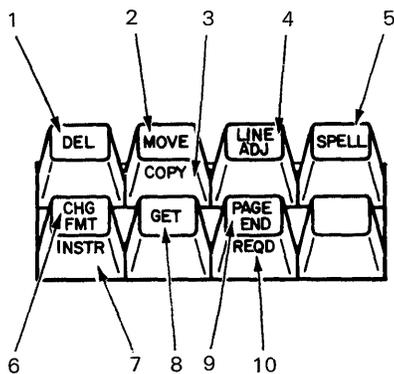


Figure 2-6. Function Control Keys (Group 3)

Cursor Movement Keys

1. ↑ (Cursor Up). Moves the cursor up one line.
2. ↖ (Boundary Up). Moves the cursor to the first character of the page being displayed.
3. ↓ (Cursor Down). Moves the cursor down one line.
4. ↙ (Boundary Down). Moves the cursor to the page end code on the page being displayed.
5. ← (Cursor Left). Moves the cursor to the left one character position.
6. ⇐ (Boundary Left). Moves the cursor to the first character of the line it is on.
7. → (Cursor Right). Moves the cursor to the right one character position.
8. ⇒ (Boundary Right). Moves the cursor to the last character of the line it is on.
9. FIND. Moves the cursor to the next character or string of characters that was selected.
10. GO TO. Moves the cursor to the beginning of the selected page in the document being created or revised.

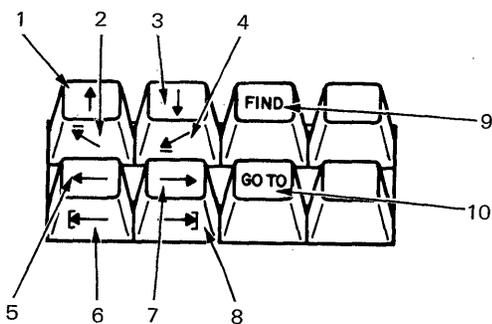


Figure 2-7. Cursor Movement Keys (Group 4)

Keyboard Arrangements

With the Keyboard Change (KYB CHG) function, either the default keyboard arrangement (the one engraved on the keys) or one of the five alternate keyboards from the program diskette can be selected. To print documents typed with alternate keyboards, the correct typing element should be on the printer.

MENU DESCRIPTION

A menu has three sections: name, choices and prompts. The name of the menu is centered on the first line. In the sample menu (Figure 2-8), TASK SELECTION is the name of the menu. The choices section (ITEM) contains the selections for a task or function. The prompt line instructs the operator how to make a selection. To choose an item, the identification (ID) letter of the item is typed and entered. In the TASK SELECTION Menu, when an ID has been typed and entered, that item will be video reversed and that task will be loaded into the system.

TASK SELECTION	
ID	ITEM
a	Typing Tasks: Create, Revise or Paginate Documents
b	Work Diskette Tasks: Delete or Duplicate Documents, Duplicate, Condense or Erase/Initialize (Name) Diskette, Print Index of Diskette Contents, Change Document or Diskette Name, Recover Documents
c	Program Diskette Tasks: Default Formats, Duplicate Setups, Printer and Work Station Description, Duplicate and Erase Program Diskette
d	Spelling Tasks

Type ID letter to choose ITEM; press ENTER: ▢

Figure 2-8. TASK SELECTION Menu

Menu Format

To enable the operator to select a task, such as Creating a document, and begin typing, the most common document format choices are already made on the program diskette. These choices are called defaults and display in the Your Choice column of the menus (Figure 2-9). Some of the defaults are margins, tabs, line spacing, and keyboard arrangements and are loaded each time the program diskette is loaded.

Defaults can be changed for all the documents by changing them on the program diskette or for a single document by changing them when creating or revising the document. Changing the defaults on the program diskette is called personalizing the program diskette.

If a specific application is used and the defaults (choices) on the program diskette are not suitable, the defaults can be changed by making selections in the menus. Menus show the defaults and what those defaults can be changed to. Menus also provide procedural instructions to aid in changing a default.

The Line Format Menu (Figure 2-9) shows the defaults and the available choices for the line formats. For example, to change the line spacing of a document, the letter "a" would be typed and the ENTER key pressed. The ID letter would then be video reversed, and prompt line would prompt "Type your choice, press ENTER." Typing the number of a choice from the Possible Choices column of the menu will cause the number (the default) in the Your Choice column to change to the new choice. If the defaults are not changed, the system will use the default shown under the column, "Your Choice." After all the changes are made, press ENTER.

LINE FORMAT		
ID ITEM	YOUR CHOICE	POSSIBLE CHOICES
a Line Spacing	1	1 = Single 2 = Double 3 = Triple 4 = Half 5 = 1 and 1/2
b Line Alignment	1	1 = Left 2 = Justify 3 = 1/2 Justify
c Typestyle Number	86	1 - 31 (10 Pitch) 80 - 111 (12 Pitch) 154 - 175 (Proportional)
d Lines/cm or in.	2	1 = 2.09/cm or 5.3/in. 2 = 2.36/cm or 6/in. 3 = 3.15/cm or 8/in. 4 = 9.45/cm or 24/in. 5 = 2.0/cm or 5.08 in.
e Adjust Line Endings	1	1 = Yes 2 = No
f Zone Width	6	1 - 30

When finished with this menu, press ENTER.
Type ID letter to choose ITEM; press ENTER: x

Figure 2-9. LINE FORMAT Menu

At any point in the document, the operator can end the job by pressing the END key. Pressing the PRINT key when text is displayed will print that page of text. The entire document can be printed by pressing the Request (REQST) key after ending a typing task and choosing Print Document from the REQUEST TASKS Menu.

REQUEST TASKS	
ID	ITEM
a	Print Document
b	Display Print Queue or Cancel Print Job
c	Change Printing Order
d	Display Index of Diskette Contents
e	Print With Element Now On Printer

Type ID letter to choose ITEM; press ENTER: x

Figure 2-10. REQUEST TASKS Menu

Margins and Tabs

The MARGINS AND TABS Menu (Figure 2-11) provides instructions for setting, clearing or moving tabs. Several types of tabs can be set in the MARGINS AND TABS Menu:

- Normal Tab. Characters typed at this tab setting are after the tab stop.
- Decimal Tab. Characters typed at this tab setting are to the left of the tab stop. When the period is typed, all characters are to the right of the tab stop.
- Comma Tab. Characters typed at this tab setting are to the left of the tab stop. When the comma is typed, all characters are to the right of the tab stop.
- Center Tab. Characters typed at this tab stop are centered on the tab stop until either a tab or carrier return is typed.
- Flush Right Tab. Characters typed at this tab setting are to the left of the tab stop until either a tab or carrier return is typed.

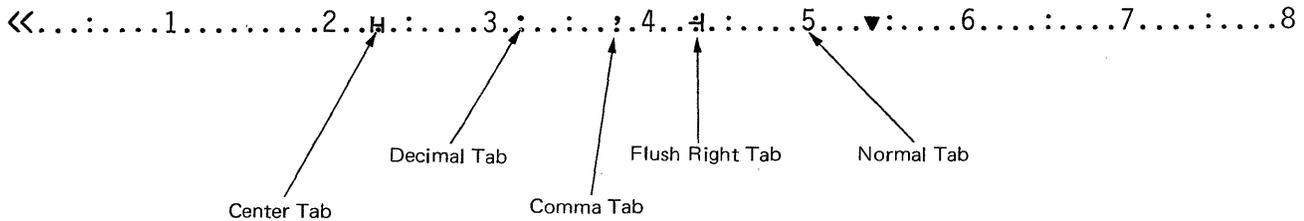


Figure 2-11. Margins and Tabs

Any type of tab can be set on the center point or the right margin, but only the symbol for a normal tab will display.

Keyboard and Printer Description

The WORK STATION DESCRIPTION Menu is used to select up to five keyboard arrangements. This permits the operator to use several different keyboards for various applications. The keyboard arrangements can be changed when creating or revising documents by pressing the Keyboard Change (KYB CHG) key and typing and entering the new keyboard number.

The WORK STATION DESCRIPTION Menu is also used to select Auto Carrier Return, Required Carrier Return and Required Hyphen. Auto Carrier Return permits the operator to type documents and have the system insert a carrier return in the right margin zone. The operator can also make a required carrier return or a required hyphen either a coded or a non-coded function.

The PRINTER DESCRIPTION Menu is used to change the defaults to match the printer being used in the system.

Menu Sequence - Typing Tasks

This is the first of a sequence of menus for each task or function. When the program diskette is loaded, the TASK SELECTION Menu displays. Since all tasks are selected from the TASK SELECTION Menu, "Go to Task Selection" displays in many of the menus.

The TYPING TASKS Menu is used to create, revise or paginate a document on a work diskette. Figure 2-12 shows the menu sequence for TYPING TASKS. The Request Tasks key can be used by the operator when typing text. This menu lists some functions that are necessary when documents are created, revised or printed.

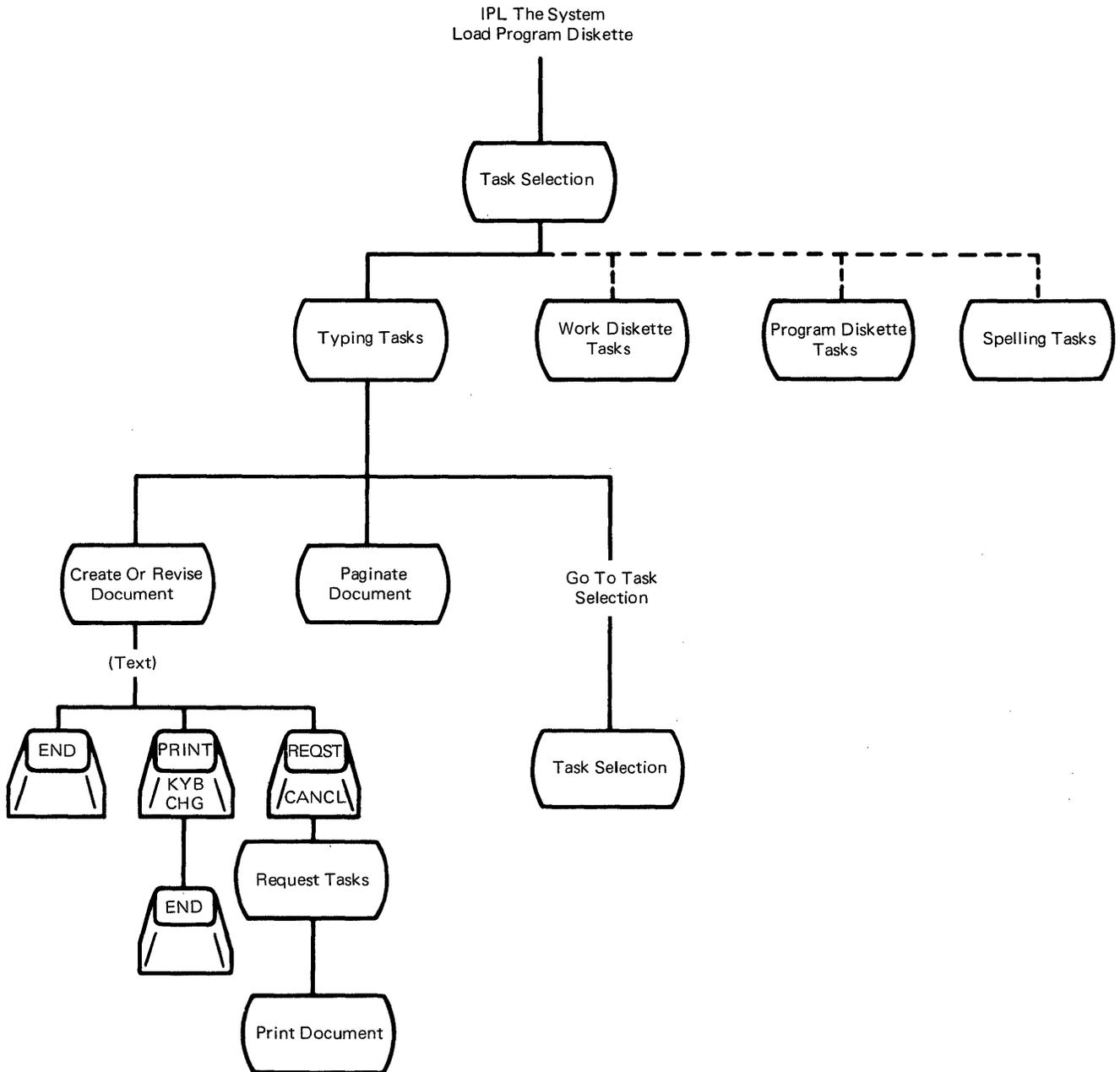


Figure 2-12. Menu Sequence - TYPING TASKS

Menu Sequence - Work Diskette Tasks

This menu sequence is used when the operator needs to perform tasks with complete diskettes or documents on a

diskette, such as duplicate a diskette, duplicate a document or change a document name. Recover Documents is used when a typing task ended with either a system error or a diskette error.

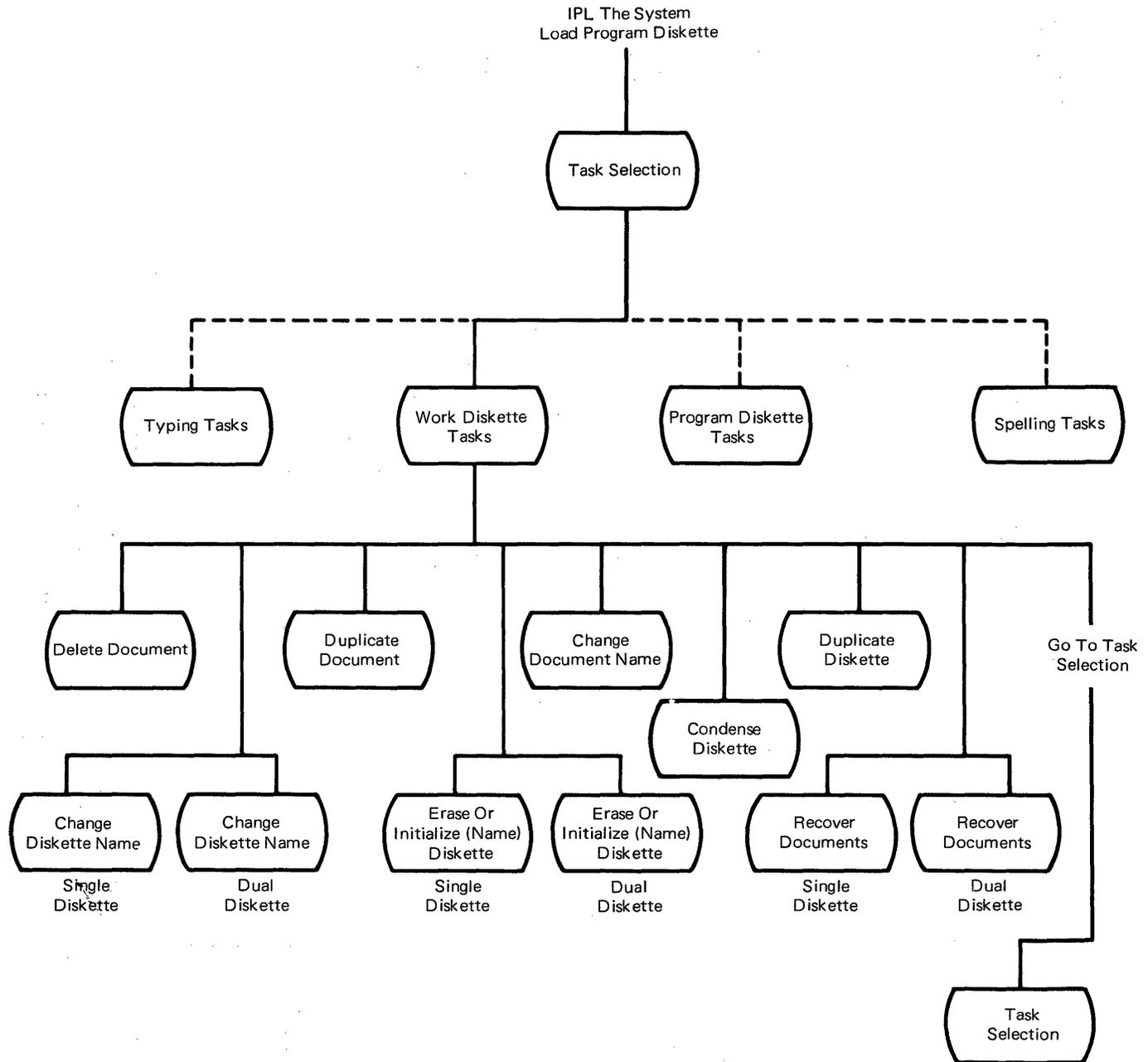


Figure 2-13. Menu Sequence - WORK DISKETTE TASKS

Menu Sequence - Program Diskette Tasks

The PROGRAM DISKETTE TASKS Menu sequence is used when the operator wants to change the system defaults or maintain a program diskette. To make the changes to a program diskette defaults effective, the operator must remove the program diskette, IPL the system and the reload the program diskette.

The Displaywriter System has two format defaults, the document format default and the alternate document format default. These defaults permit the operator to do several types of applications with minimal format changes. For example, for jobs that have tables or charts and require a tab grid of decimal tabs or flush right tabs, the alternate document format defaults can be used.

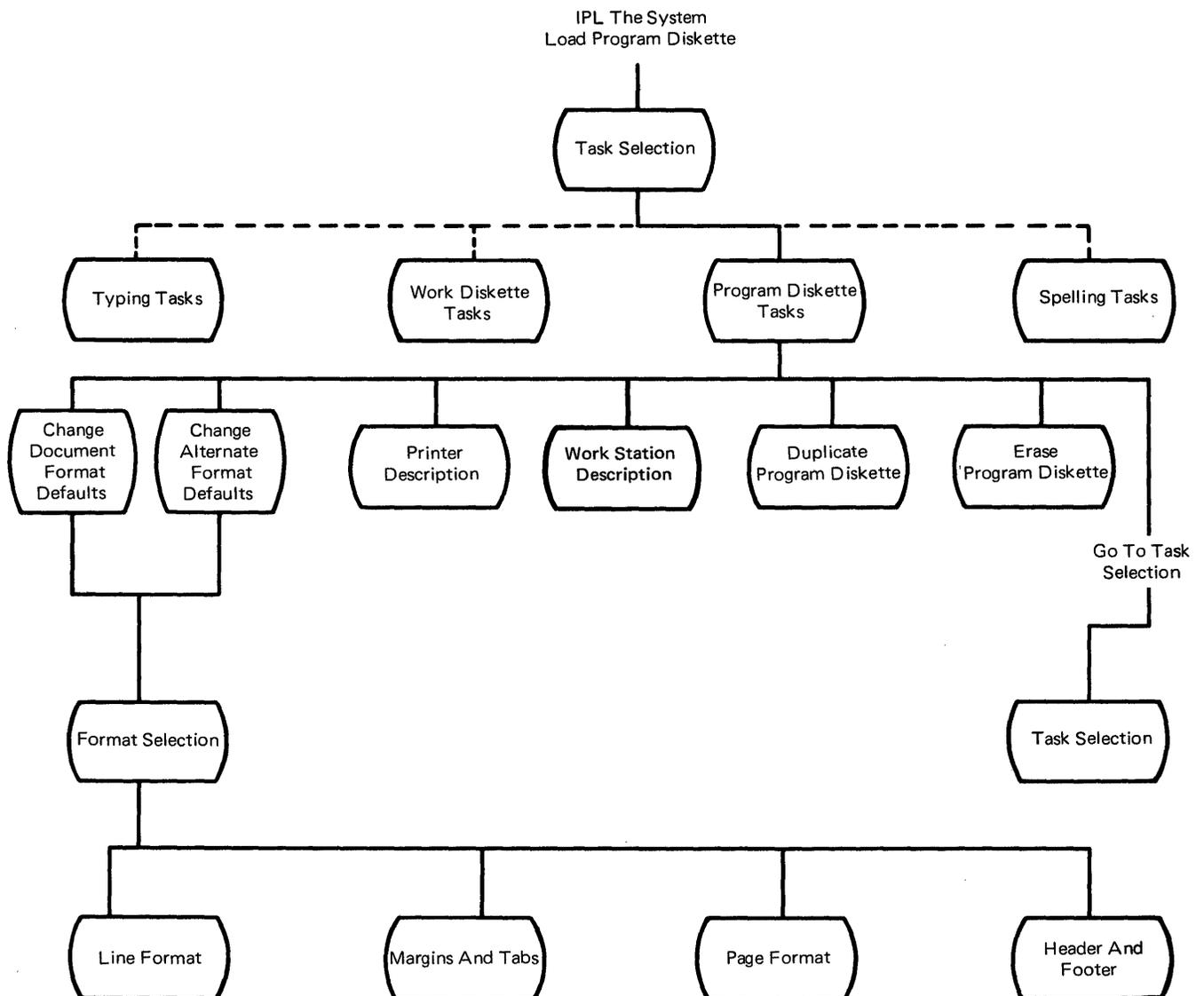


Figure 2-14. Menu Sequence - PROGRAM DISKETTE TASKS

Menu Sequence - Spelling Tasks

The Spelling Tasks are aids to check the spelling of words in a document. Using the SPELLING TASKS Menu, the operator can check the spelling in a document against the system dictionary, load a supplemental dic-

tionary, store a supplemental dictionary on the program diskette, or clear the supplemental dictionary in use. The operator can also check the spelling of a document after creating or revising it by pressing the SPELL key before ending or printing the document.

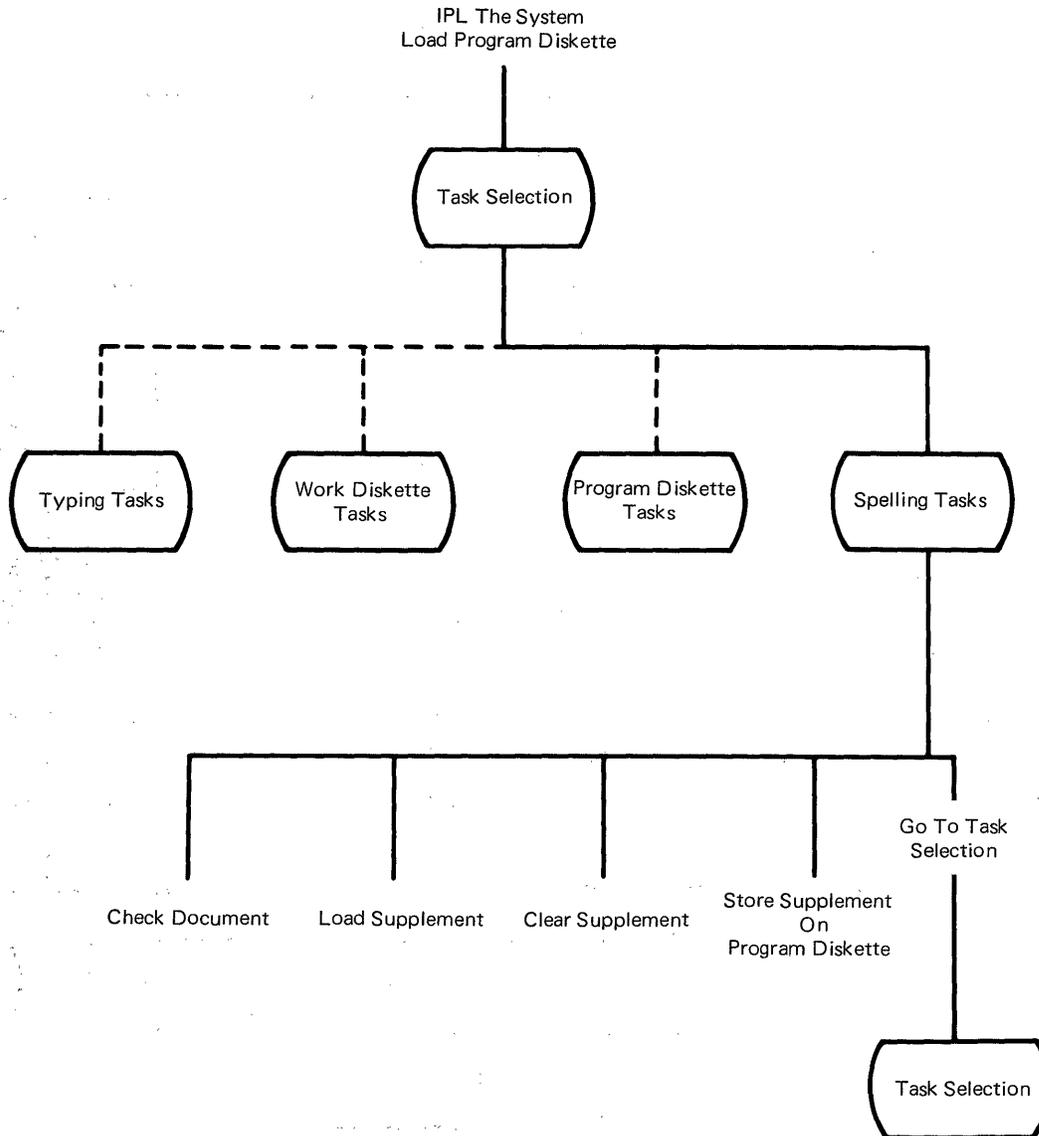


Figure 2-15. Menu Sequence - SPELLING TASKS

Menu Sequence - Change Format (CHG FMT) Key

The FORMAT SELECTION Menu permit the operator to change the document format at specific points in the document. Where the cursor is in the document determines what menus display. All

formats can be changed if the cursor is at the top of a page. Only line formats, margin and tab formats, and typestyle changes can be made if the cursor is at the beginning of a line. Only typestyle changes can be made if the cursor is away from the left margin.

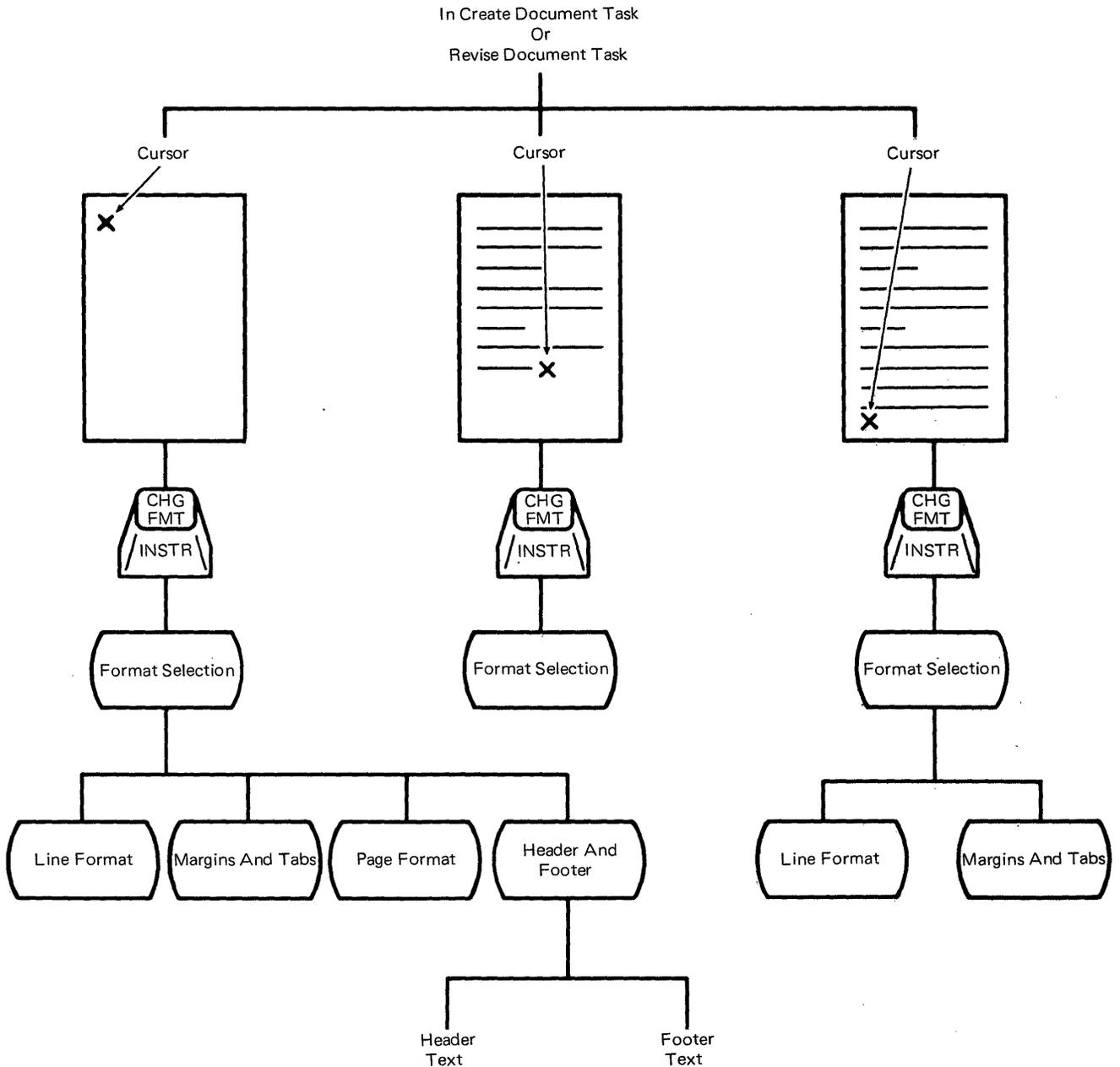


Figure 2-16. Menu Sequence - Change Format (CHG FMT) Key

Menu Sequence - Request (REQST) Key

The Request (REQST) key is used to display the REQUEST TASKS Menu. Different menus display depending on when

the key is pressed. The document format for the entire document can be changed at any time in the document. However, if the margins are changed, the text previously typed will not be adjusted to the proper line length until the document is paginated.

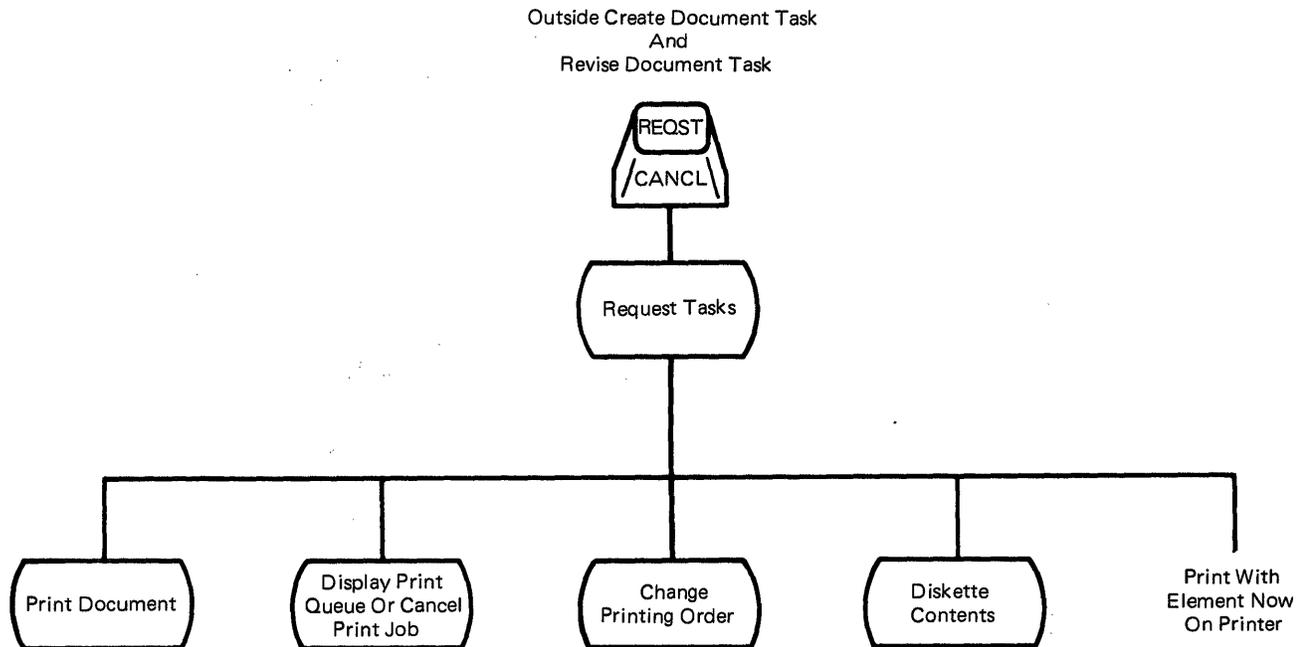


Figure 2-17. Menu Sequence - Request (REQST) Key

Menu Sequence - Instructions

The Instruction function serves two purposes. It is used in the Create or Revise Document Task when the operator wants to designate a block of text that must remain together. This text will always be on the same page.

This function is also used to change the page numbering of the system. When the cursor is at the top of the page and the Change Format (CHG FMT) key is pressed, the FORMAT SELECTION Menu displays. Selecting the HEADER AND FOOTER Menu will permit the operator to enter an Instruction to change the page numbering of the system.

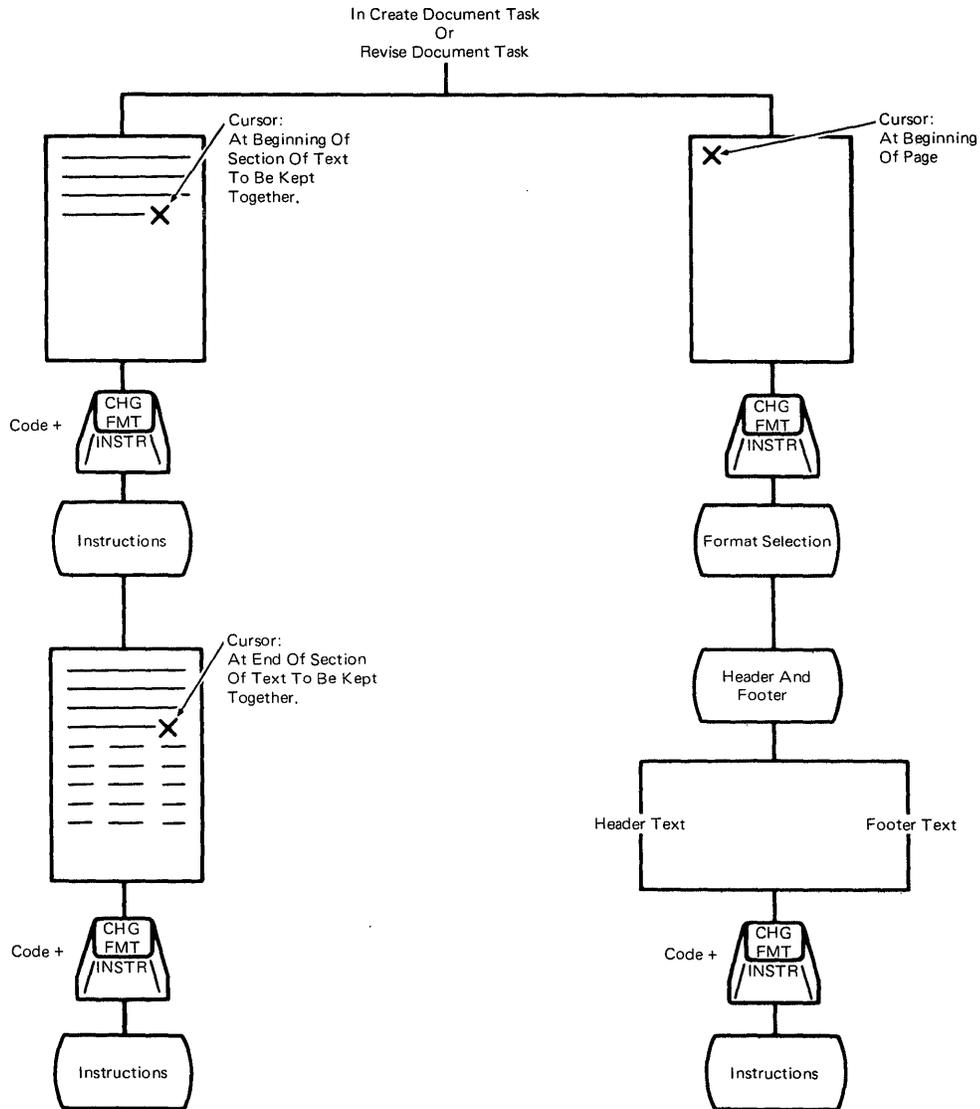


Figure 2-18. Menu Sequence - Instructions

CHAPTER 3. 25-LINE DISPLAY

25-LINE DISPLAY OPERATIONAL THEORY

The 25-Line Display Module is a Cathode Ray Tube (CRT) with a 254 mm (10 inch) cable which terminates in a 15 pin connector. The display is a Field Replaceable Unit (FRU) which requires no maintenance (Figure 3-1).

DANGER

Do not remove the display covers. Operating voltages up to 14,000 volts are present inside the display. No bleeder resistor is provided.

The 25-Line Display Module weighs 6.8 kg (15 pounds). The display screen measures 305 mm (12 inches) diagonally; 245 mm (9.6 inches) horizontally; and 170 mm (6.7 inches) vertically; and can display 25 lines of information. The typing area of the display screen available to the operator is 136 mm (5.4 inches) high and 245 mm (9.6 inches) wide. Up to 1600 characters in 20 lines of 80 characters each can be displayed in this area. Five additional lines contain control information.

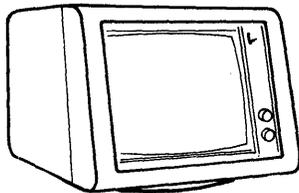


Figure 3-1. 25-Line Display Module

The display module is installed on top of the electronics module. The unit can be tilted twenty degrees (20°) and may also be turned left or right twelve degrees (12°) from center (Figure 3-2). The cable is attached to the bottom of the display module to prevent interference with the electronics module when tilting or turning the display.

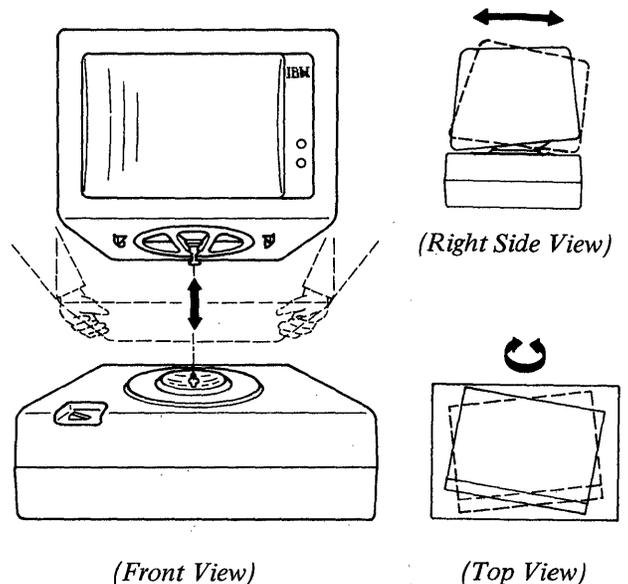


Figure 3-2. 25-Line Display Module Installation and Movement

Two operator controls (contrast and brightness) are on the front right side of the display module (Figure 3-3).

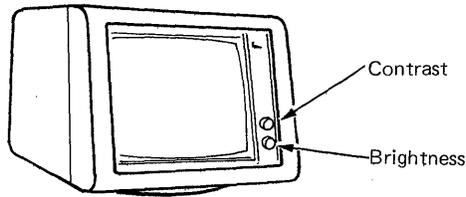


Figure 3-3. Operator Controls

Character Structure

The CRT forms character images with combinations of dots on the display screen. The dots are made by a pulsed electronic beam which moves across the screen. The display adapter card, located in the electronics module determines which dots are to be created as the beam moves from left to right, and from top to bottom on the screen.

The screen contains 640 columns and 400 rows of dots. Each dot is 0.32 mm by 0.34 mm (0.126 - 0.133 inches) and the screen is divided into 8 x 16 dot areas known as character boxes. Inside each character box is a dot matrix where this character is formed (Figure 3-4).

The display adapter card controls which dots are lighted in a character box. For example, the underscore is produced by the display adapter card turning on all the dots in row D of a character box (Figure 3-5).

Characters	Dot Matrix
Lower Case i, l	3 x 9
Number 0, 1	5 x 9
Upper Case I	5 x 9
Lower Case b, d, f, h, k, t	6 x 9
Upper Case A, B, C, D, E, F, H, K, L, M, N, O, P, R, S, U, V, X, W	6 x 9
Numbers 2, 3, 5, 6, 7, 8, 9	6 x 9
Upper Case G, J, Q, T, Y, Z	7 x 9
Number 4	7 x 9
Lower Case a, c, e, n, o, s, v, w, x, z	
Lower Case g, p, r, y	6 x 7
Lower Case j	4 x 10
Lower Case m, u	7 x 6
Lower Case q	7 x 7

Figure 3-4. Character Size

The cursor is a row of dots on the screen usually indicating where the next character will be entered. It is produced by the display adapter card lighting all of the dots in row E of the character box. The cursor is always a brighter intensity, and when the cursor is below a character, both the character and the cursor will be brighter (Figure 3-5).

When using superscripts (one-half index up) or subscripts (one-half index down), the displayed character is moved up or down by three dots (Figure 3-6). The display supports one level of half indexing.

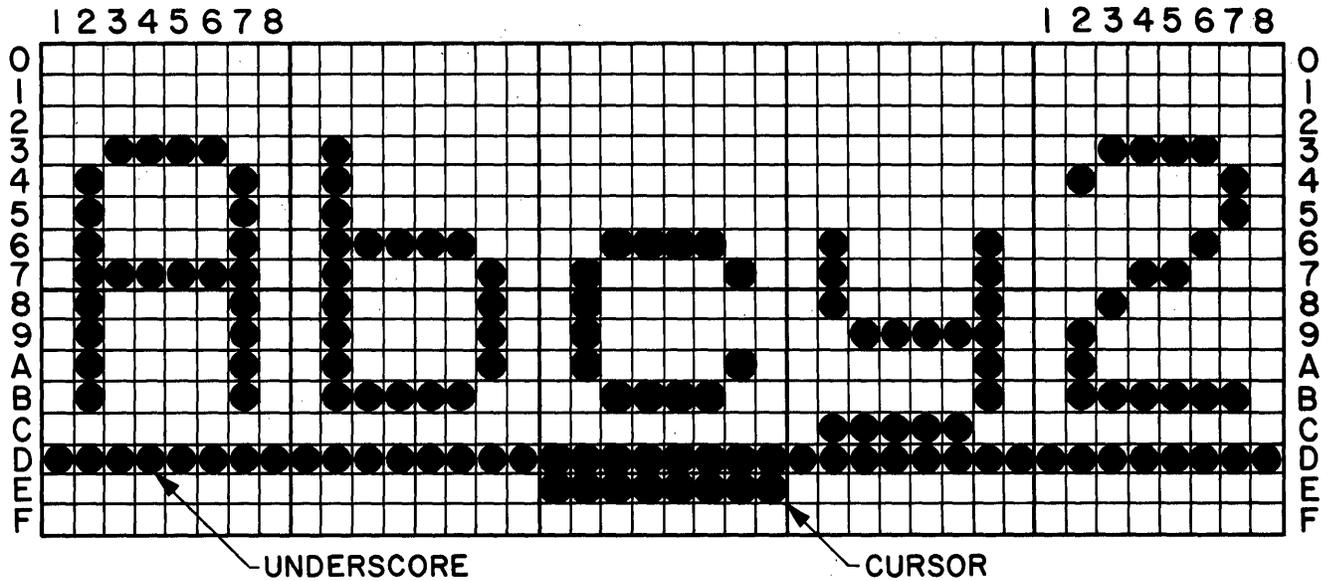


Figure 3-5. Character Box Structure

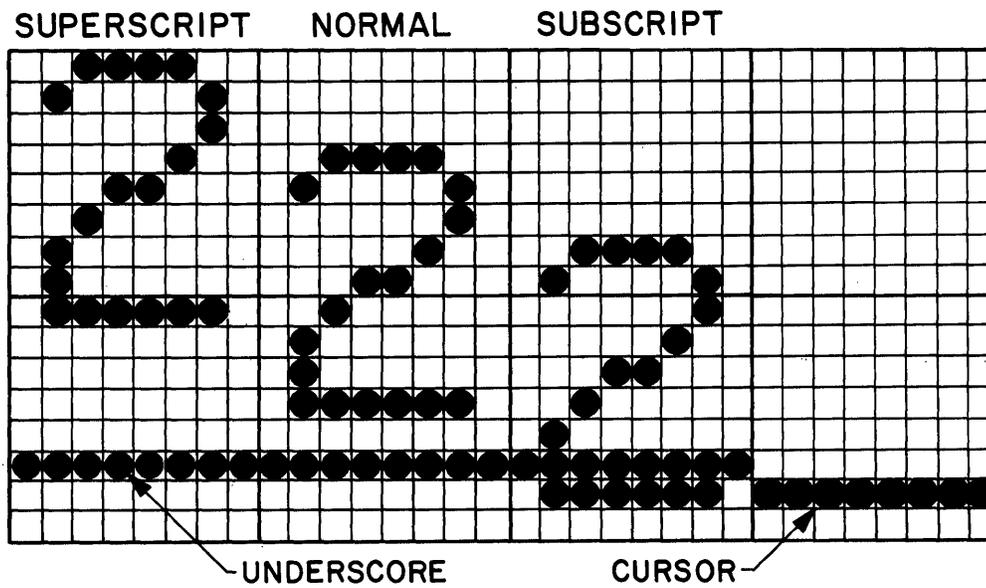


Figure 3-6. Superscripts and Subscripts

To indicate certain areas of the screen to the operator, either individual characters or blocks of characters are highlighted with reverse

video. The display adapter card turns off the dots in a character box that forms the character image and turns on the background dots (Figure 3-7).

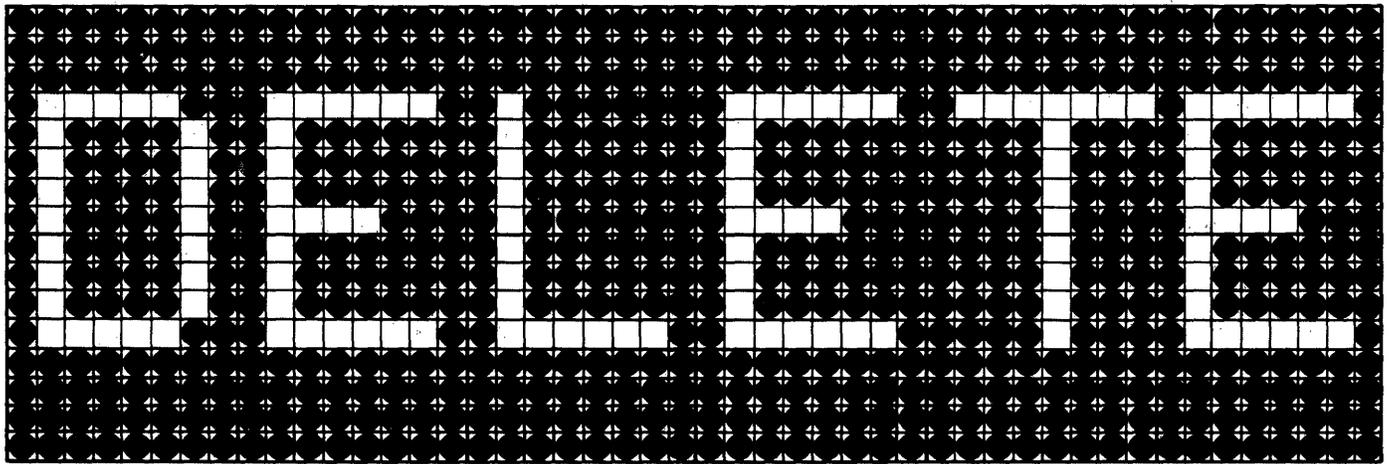


Figure 3-7. Highlighted Characters

25-LINE DISPLAY FONTS

There are two different fonts on the display adapter card (Figure 3-8). These fonts contain all the symbols and alphanumeric characters that can be displayed. Some of the symbols can not be printed by the printer (such as control code characters). The keyboard arrangement selected by the

operator will determine the different symbols that may be displayed.

Font 1 (Figure 3-8) contains alphanumeric characters and graphic symbols, and Font 2 (Figure 3-8) contains symbols, fractions, subscript numbers and superscript numbers. Each font contains a maximum of 256 characters.

1														2																			
0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
0	↑	↓	↔	&	≡	∅	∅	•	μ	€	{	}	\	0	0	e	l	ü	≤	≥	n	=	%	≈	o	{	}	\	0				
1	↖	↗	⊠	◊	é	/	É	a	j	~	€	A	J	1	1	+	A	í	š	▼	-	∑	u	α	θ	~	1	∇	≡	1			
2	⊠	⊠	⊠	â	ë	Ä	Ë	b	k	s	¥	B	K	S	2	2	Q	E	l	š	=	<	>	v	c	B	κ	σ	2	∞	Σ	2	
3	⊠	⊠	⊠	ä	ë	Ä	Ë	c	l	t	℞	C	L	T	3	3	h	z	z	r	-	>	^	∩	ψ	ω	τ	3	ψ	Ω	+	3	
4	⊠	⊠	⊠	à	è	À	È	d	m	u	f	D	M	U	4	4	g	Z	Z	R	+	R		⊕	⊕	μ	ε	4	⊕	∂	Σ	4	
5	⊠	⊠	⊠	á	i	Á	Í	e	n	v	S	E	N	V	5	5	I	ú	é	t	°	z	∠	L	ε	v	x	5	+	~	*	5	
6	⊠	⊠	⊠	ã	ï	Ã	Ï	f	o	w	π	F	O	W	6	6	Ĝ	Ū	Ĉ	Ĥ	°	∴	<										6
7	⊠	⊠	⊠	â	î	Â	Î	g	p	x	¼	G	P	X	7	7	ä	ë	Ï	ř	Δ	>	>										7
8	⊠	⊠	⊠	ä	ï	Ä	Ï	h	q	y	½	H	Q	Y	8	8	Ä	Ë	L	R	+	v	+	+	+	+	+	+	+	+	+	+	8
9	⊠	⊠	⊠	á	i	Á	Í	i	r	z	¾	I	R	Z	9	9	š	d	z	s	/	+	+	+	+	+	+	+	+	+	+	+	9
A	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	A	š	Ö	Ł	Š	[]	'	+	+	+	+	+	+	+	+	+	A	
B	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	B	t	ž	ň	t	+	+	+	+	+	+	+	+	+	+	+	+	+	B
C	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	C	T	ž	ň	T	<	≠	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	C
D	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	D	·	č	h	ö	()	·	·	·	·	·	·	·	·	·	·	·	D
E	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	E	·	č	h	ö	()	·	·	·	·	·	·	·	·	·	·	·	E
F	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	⊠	F	a	í	ú	š	√	·	·	·	·	·	·	·	·	·	·	·	·	F

Figure 3-8. Display Fonts

Operating Voltages

The display module is attached to the electronics module panel 1 with a fifteen pin connector. Five of the pins and wires are not used. The other ten wires are all input signals. These

signals are horizontal drive, vertical drive, brightness control, shielded video, +5 volts, +12 volts, and ground. The power supply voltages and the grounds can be checked at the panel 1 connector when the display is disconnected (Figure 3-9).

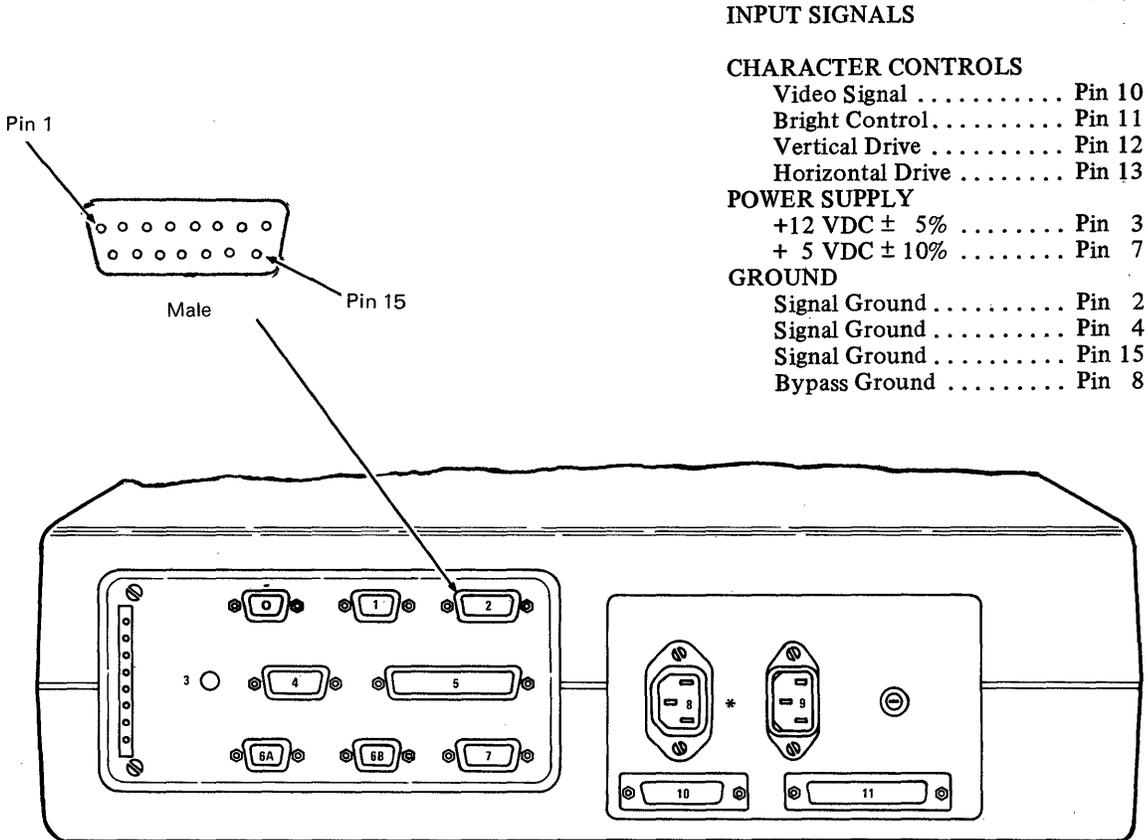


Figure 3-9. Display Connector

* Connector 8 will be labeled 12 if Large Display is installed.

Input Signals

The following character control signals and their functions are listed for reference information. They cannot be checked. The signal ground is used as a conductor for the return of the power supply and logic signals.

- Video Signal. The video signal carries the character information to the display.
- Bright Control. This signal is not used and is grounded at the display adapter card.
- Vertical Drive. This signal controls the circuit in the display module that drives the electronic beam from the top to the bottom of the screen.
- Horizontal Drive. This signal controls the circuit in the display module that drives the electronics beam from the left to the right of the screen. This signal is also used to generate the high voltage for the CRT.
- Bypass Ground. This is a frame ground.

25-LINE DISPLAY SERVICE AIDS

DANGER

Do not remove the display covers. Operating voltages up to 14,000 volts are present inside the display. No bleeder resistor is provided.

The 25-line display module is a field replaceable unit (FRU) which is not field serviceable.

The raster is a normal background image on the display screen which is visible when the brightness control is turned up (clockwise) all the way (see Figure 3-10).

A blank screen or blank area of the screen may not be a problem in the display module. The problem may be a change in or a loss of the input signals.

Note: When a displayed character is changed an "after image" will remain for a short time.

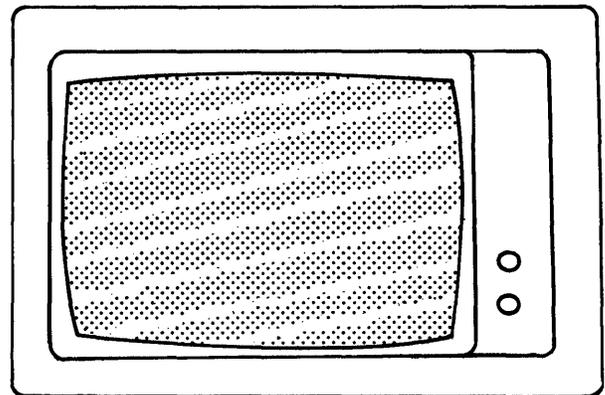


Figure 3-10. Display Raster

25-LINE DISPLAY REMOVAL/REPLACEMENT

1. Turn the system power off.
2. Disconnect the system AC power cord.
3. Disconnect the display connector from the electronics module panel 1.

4. Lift the display module up, releasing the interlock (Figure 3-11).

5. Pack the display in a display packing box.

CAUTION

DO NOT transport the display module unless it is suitably packed. The display may burst inward if broken.

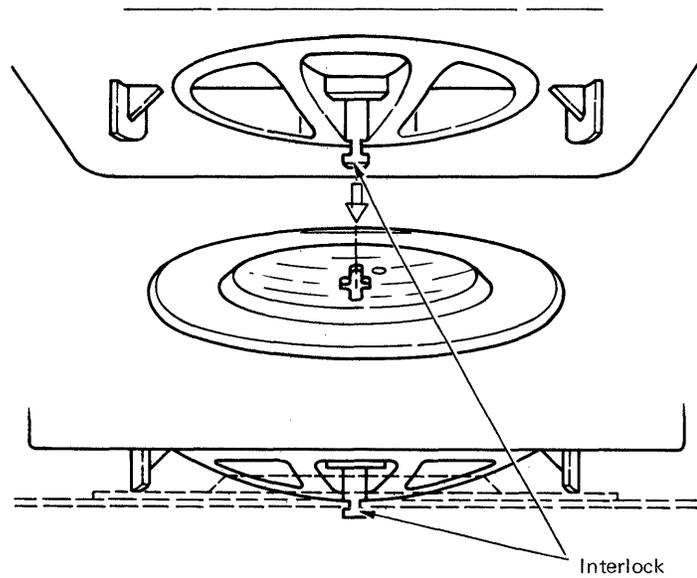
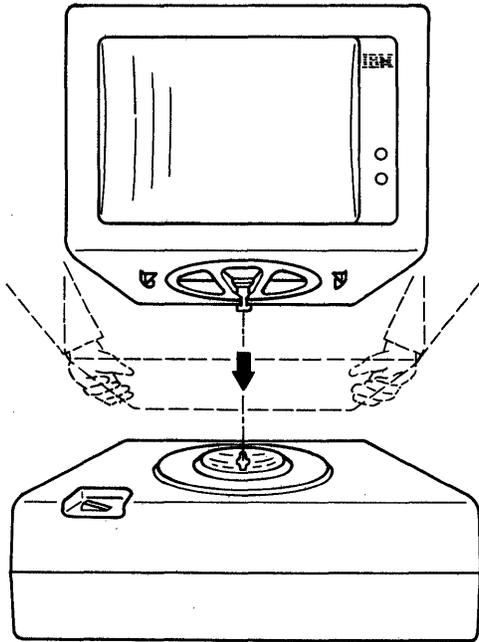


Figure 3-11. 25-Line Display Removal

CHAPTER 4. LARGE DISPLAY

LOCATOR

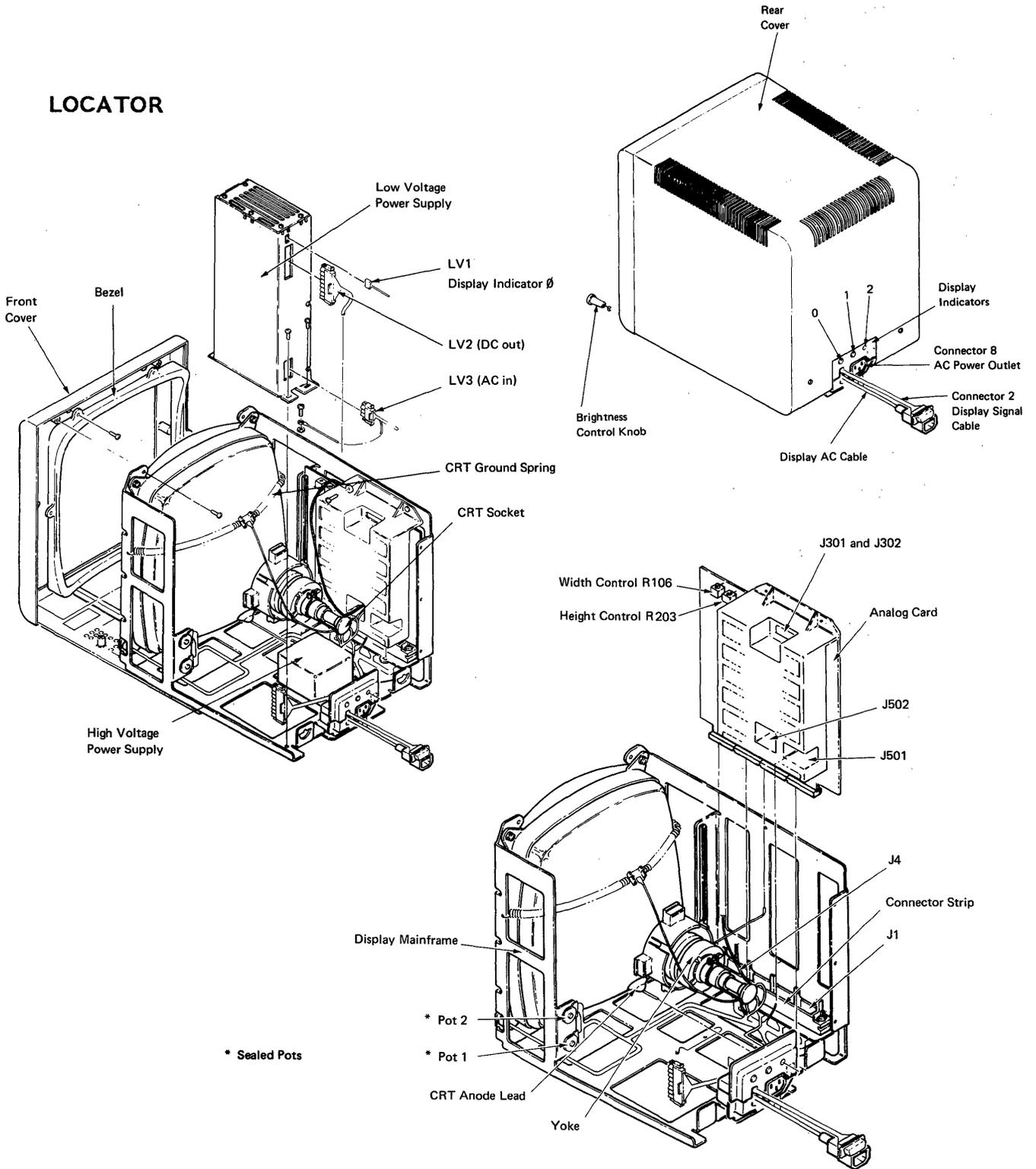


Figure 4-1. Large Display Module Locations

LARGE DISPLAY OPERATIONAL THEORY

The Large Display Module (Figure 4-2) is a Cathode Ray Tube (CRT) which functions similarly to the 25-Line Display Module. The primary differences between the two Display Modules are the size of the display screen and the internal field replaceable units (FRUs) located within the Large Display Module. The display screen of

the Large Display measures 203.0 mm (8.0 inches) horizontally and 270.0 mm (10.6 inches) vertically. Sixty-six lines are presented on the screen. These lines contain up to 100 characters each. The Large Display Module weighs 18.0 kg (39 lbs). The module is 404 mm (15.9 inches) high, 316 mm (12.4 inches) wide, and 404 mm (15.9 inches) deep. One operator control (brightness) is on the right front side of the Large Display.

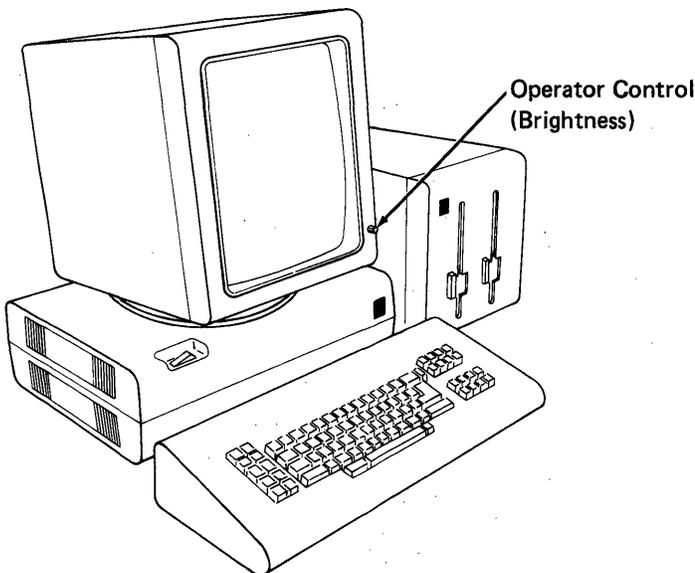


Figure 4-2. Large Display Module

Cabling

The Large Display Module is installed on top of the electronics module. The AC power for the diskette unit comes

from connector 8 on the Large Display. The Large Display Signal Cable is connected to connector 2 on the electronics module panel 1. (See Figure 4-3.)

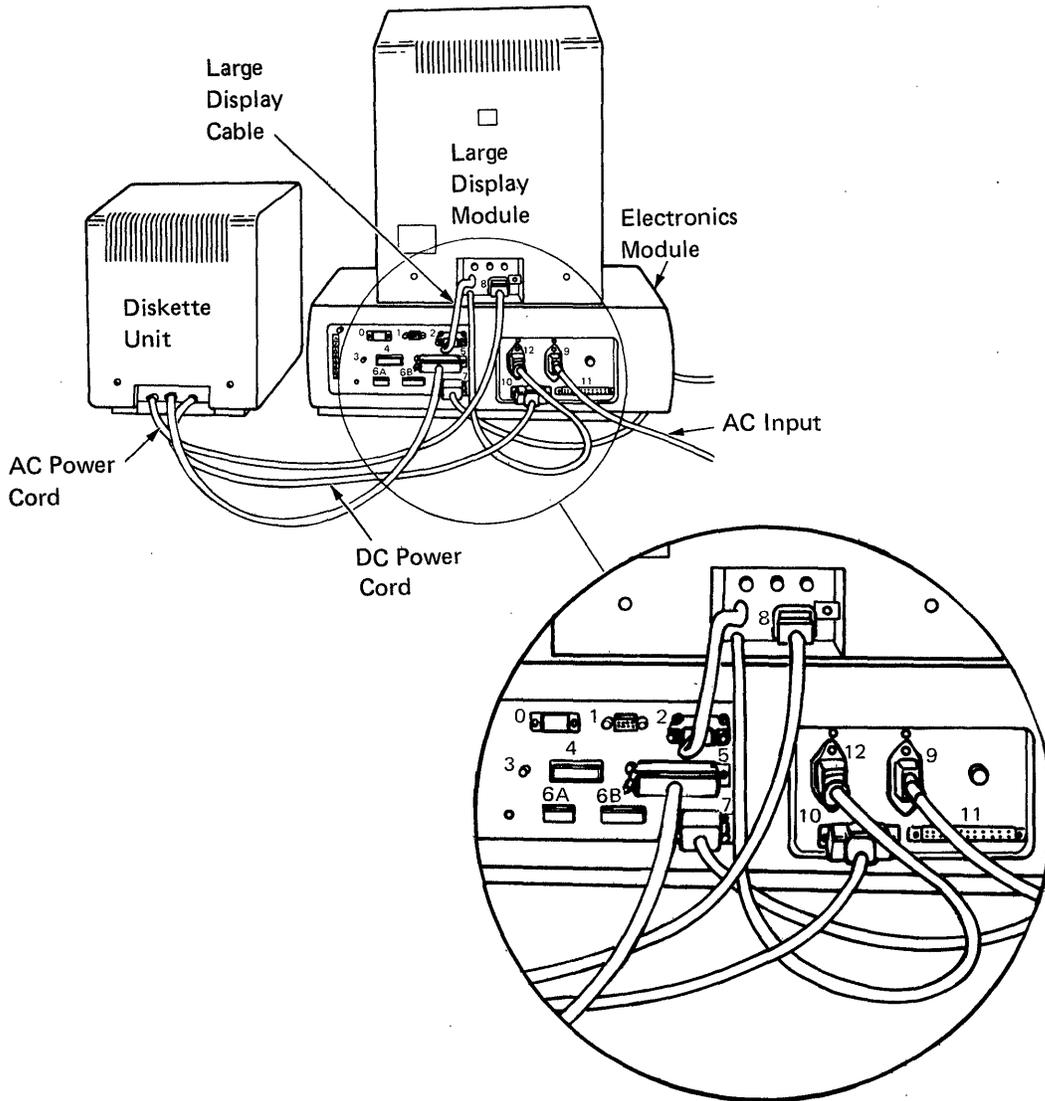


Figure 4-3. Large Display Module Cabling

Data Flow

Signals from the Displaywriter System Card are sent to the Display Adapter Card where they are converted to dot matrix and timing signals. (See

Figure 4-4.) The matrix and timing signals are sent to the Large Display Analog Card located in the display, where they are converted into waveforms which scan the character dots across the display screen.

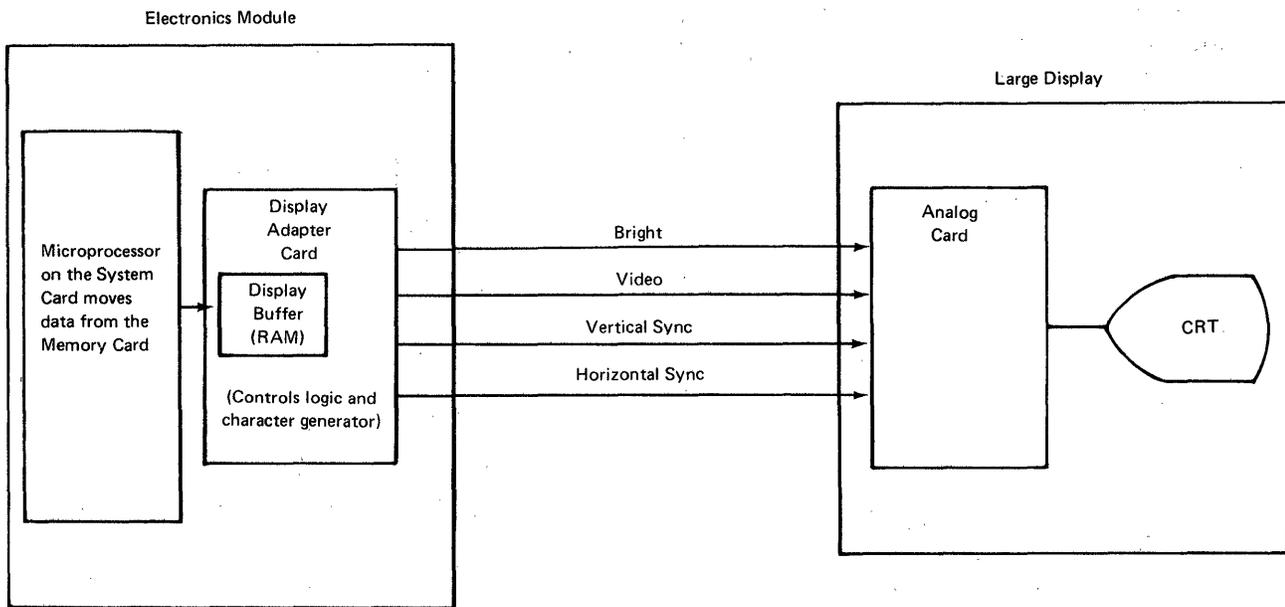


Figure 4-4. Large Display Data Flow

Character Structure

The dots on the display screen of the Large Display Module are smaller in size and larger in number than the dots on the screen of the 25-Line Display Module. 800 columns and 1056 rows of dots are presented on the Large Display Module screen. The size of a character box is 8 x 16 dots. Figure 4-5 summarizes the size of characters within the character boxes.

Character	Dot Matrix
Upper Case	6 x 11 or 7 x 11
Lower Case (Ascender)	6 x 8
Lower Case (Descender)	6 x 9

Figure 4-5. Character Size

Operating Voltages

The Large Display has its own power supplies. The low voltage power supply provides +32 VDC, +5 VDC and -5 VDC to the analog card to operate the Large Display Module.

The analog card supplies voltage to the High Voltage Power Supply (HVPS) which provides power for the anode. The High Voltage Power Supply is a modular, DC to DC converter-type power supply. (See Figure 4-6.)

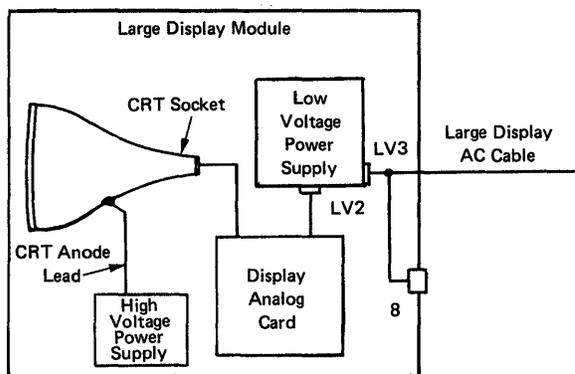
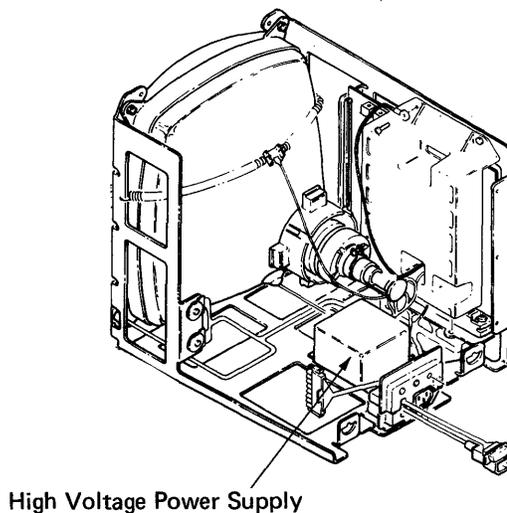


Figure 4-6. High Voltage Power Supply



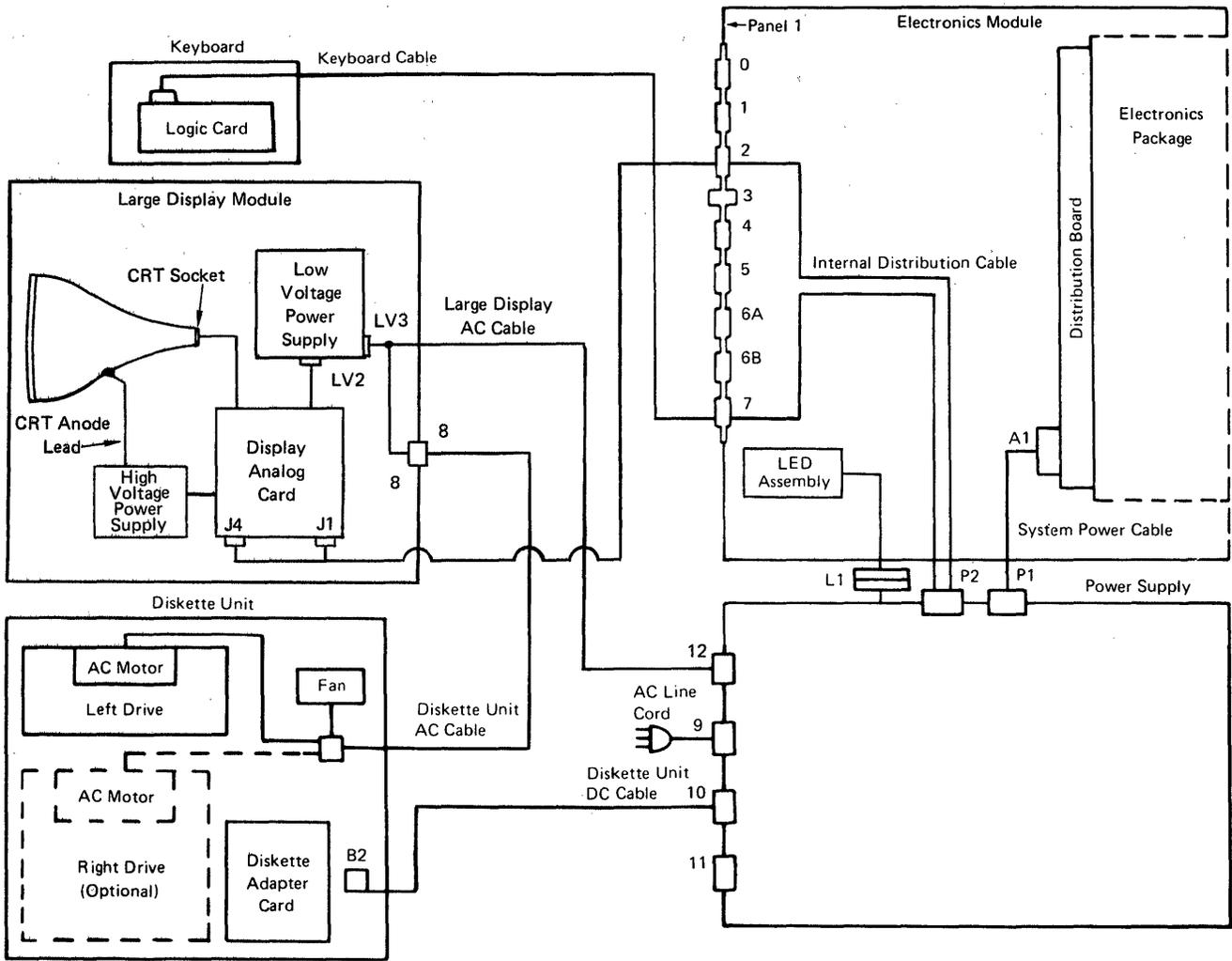


Figure 4-7. Power Supply Distribution Schematic

Internal Distribution Cable

The internal distribution cable carries the signals that control what characters appear on the display

screen. This cable connects D1 on the distribution board of the electronics module with connector 2, panel 1, of the electronics module. (See Figure 4-8.)

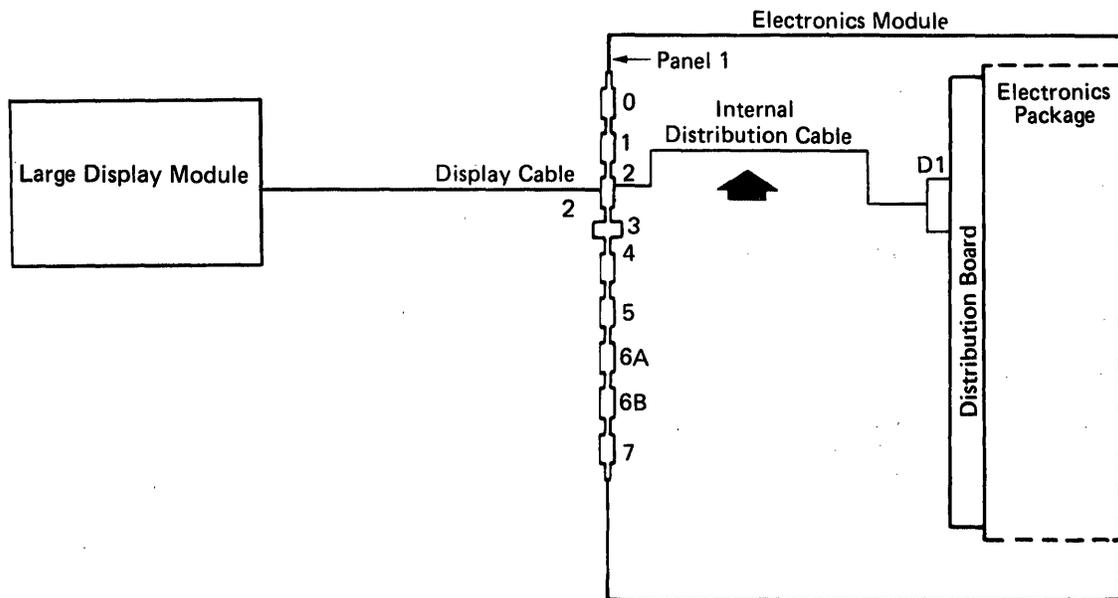


Figure 4-8. Internal Distribution Cable

Input Signals

Four signals control how characters appear on the display screen. (See Figure 4-9.) These signals are:

- Video
- Bright
- Vertical Sync
- Horizontal Sync.

The input signals are carried from connector 2, panel 1, of the electronics module to connectors J1, J4, and J501 on the Large Display Analog Card.

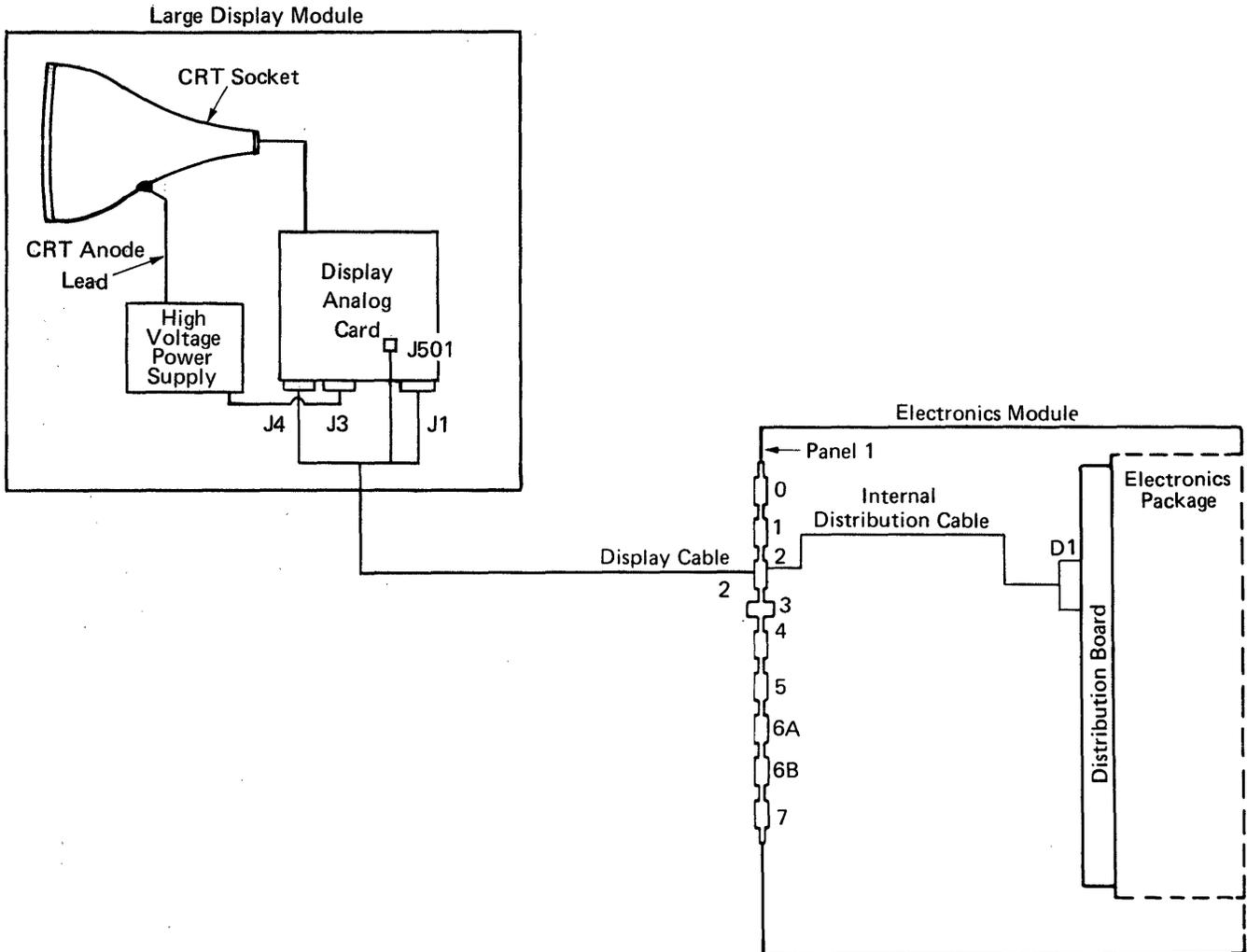


Figure 4-9. Signal Distribution Schematic

LARGE DISPLAY SERVICE INFORMATION

DANGER:

Operating voltages up to 17,000 volts are present inside the Large Display. A bleeder circuit is provided. You must wait at least 10 seconds after power is turned off for the voltages to reach a safe level (less than 60V).

Whenever the rear cover is removed from the large display, **ALWAYS** ensure that the CRT (Cathode Ray Tube) ground spring is in place and that it is connected to the CRT socket ①. (See Figure 4-10.) Do this before any type of service is performed.

Use the CRT Anode Discharge Procedure whenever continuity checks are made, and during removal/replacement procedures. This will ensure that no high voltage is present.

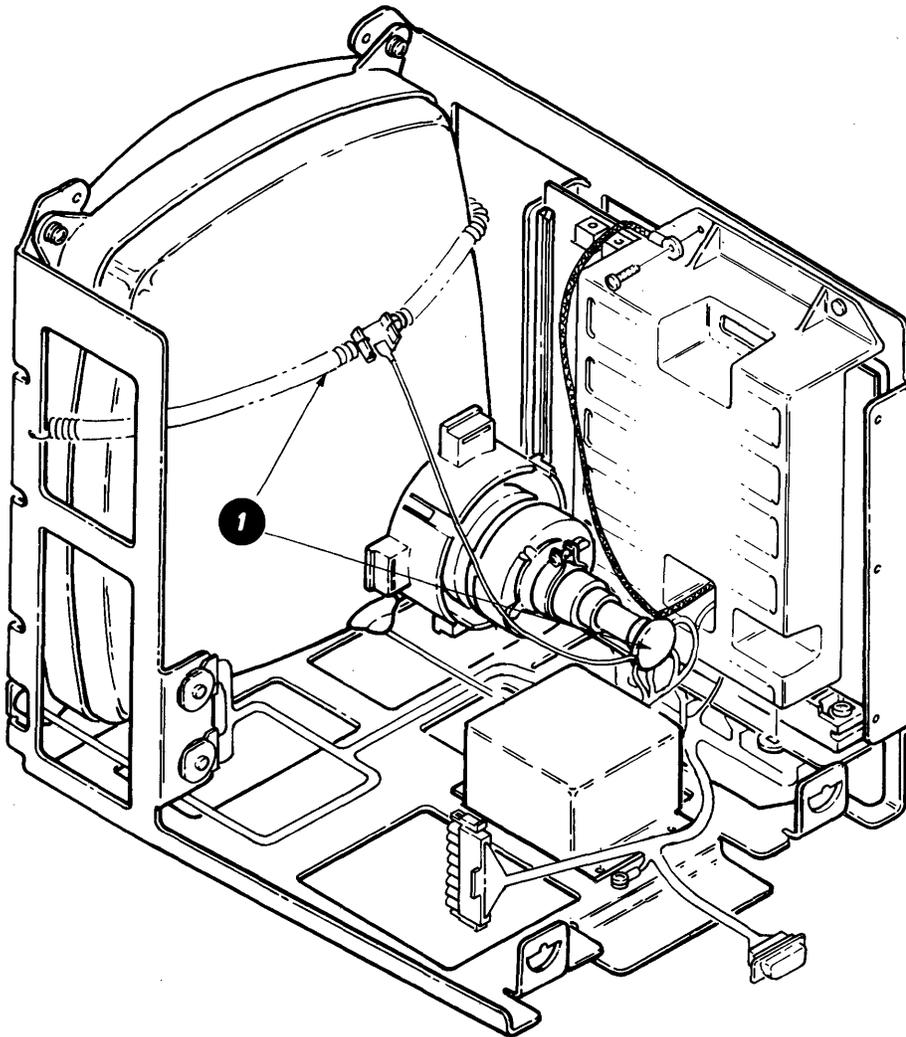


Figure 4-10. CRT Ground Spring

CRT Anode Discharge Procedure

1. Turn the system power off and disconnect the AC line cord from the wall outlet.
2. Wait 15 seconds.
3. Perform the rear cover removal.
4. Perform the low voltage power supply removal.
5. Use an alligator clip to connect the plug end of a Fluke* meter lead to the display mainframe.
6. Push the probe end of the meter lead under the boot on the anode **1**. Visually ensure that the probe tip touches the metal prongs on the anode lead. (See Figure 4-11.)
7. Remove the probe from the anode, and ensure that the anode boot is securely seated against surface of the CRT.

CAUTION:

Even though you use this safety procedure, if the anode lead is disconnected from the CRT, the CRT may slowly recharge.

When working near the CRT with the anode lead disconnected, make sure you discharge the anode hole of the CRT to the display mainframe:

- Every 5 to 10 minutes
- Before connecting the anode lead to the CRT
- When installing a new mainframe assembly or high voltage power supply.

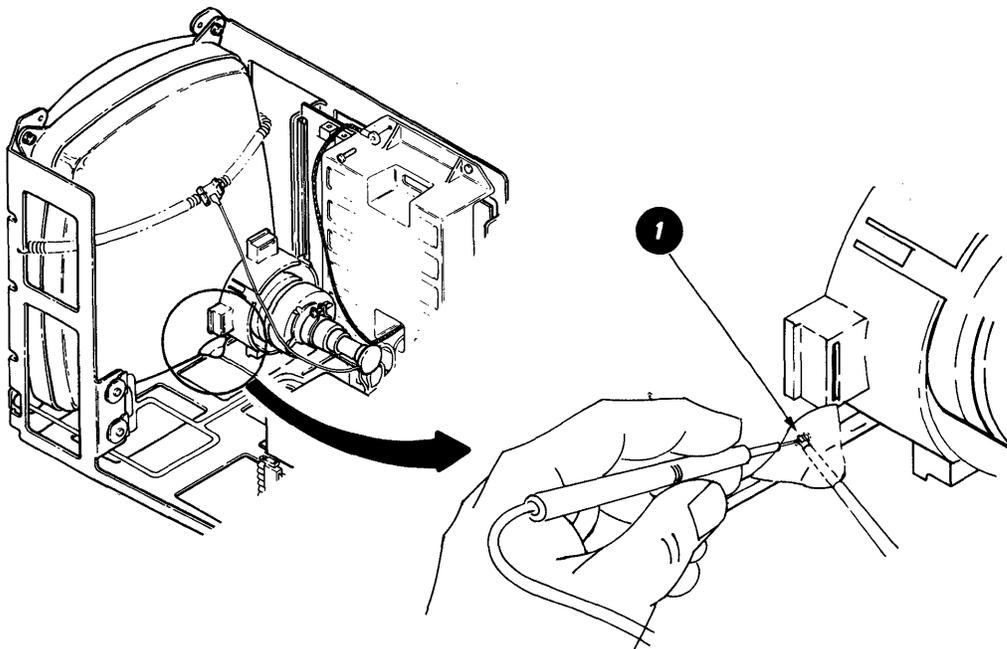


Figure 4-11. Anode Boot

SERVICE AIDS

The raster on the display screen is a normal display image which is usually visible when the brightness control is turned up (clockwise) all the way. (See Figure 4-12.) The raster consists of horizontal scan lines across the entire screen. These lines define all possible dot positions.

A blank screen or blank area of the screen may not be a problem in the display module. The problem may be a change in, or a loss of, the input signals.

Note: When a displayed character is changed an "after image" remains for a short time.

and the horizontal beam deflection circuit.

If an indicator is ON (glowing), it indicates correct operation.

If the indicator is OFF, it indicates a problem.

The problem may be caused by one or more of the following:

- Loose or defective indicator lamp
- Loose or defective cable or plug
- Defective low voltage or high voltage power supply
- Defective analog card.

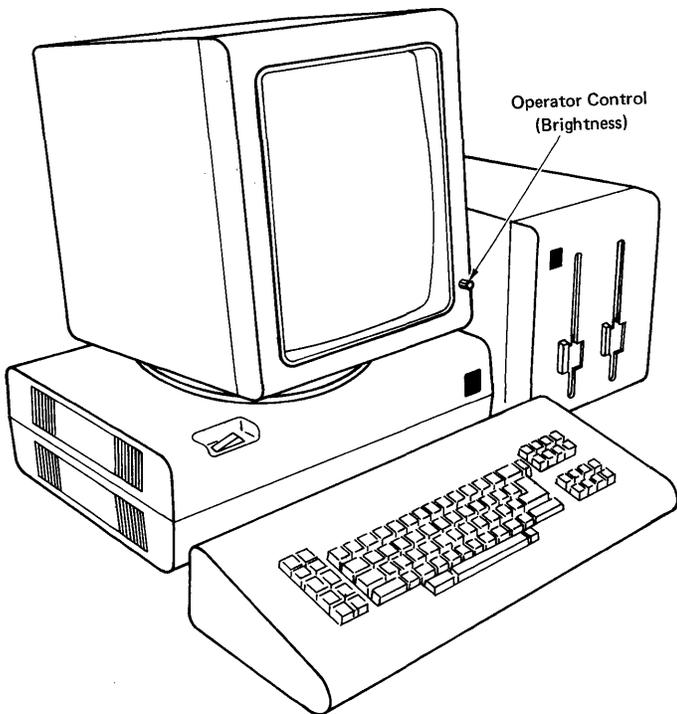


Figure 4-12. Large Display Screen

Display Indicators

Three display indicators are on the back of the display module. (See Figure 4-13.):

- 0 = Low Voltage Power Supply (LED)
- 1 = High Voltage Power Supply (Neon)
- 2 = Horizontal Beam Deflection Circuit (Neon)

These indicators show the operating condition of the two power supplies

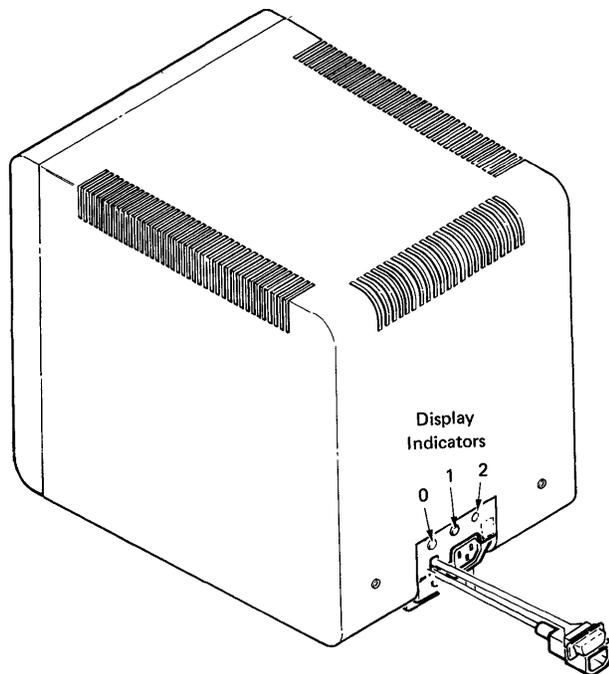


Figure 4-13. Display Indicator Lights

LARGE DISPLAY ADJUSTMENTS

Image Size Adjustment

1. Turn the system power off.
2. Perform the rear cover removal.

DANGER:

Operating voltages up to 17,000 volts are present inside the Large Display.

3. Turn system power on, load the CE Diagnostic Diskette and select UTILITIES. Press ENTER.
4. Select DISPLAY from the GROUP SELECTION Menu. Press ENTER.
5. Select TEST PATTERN. Press ENTER. (The H test pattern should appear.)
6. Turn the adjustment screws on R106 and R203 fully counterclockwise to make the image on the screen the minimum size. (See Figure 4-14.)

WARNING: Use care in the following steps. Component damage may occur if the image size is increased to where the edges or corners of the image extend beyond the inside edge of the display screen bezel.

7. Adjust R203 to increase the image height until the sum of the dimensions V and V' is 20 to 25 mm (0.8 to 1.0 inches). (See Figure 4-15.)
8. Adjust R106 to increase the image width until the sum of the dimensions H and H' is 20 to 25 mm (0.8 to 1.0 inches).

Note: If the image is noticeably off-center, use the Image Center-

ing Adjustment to correct the problem.

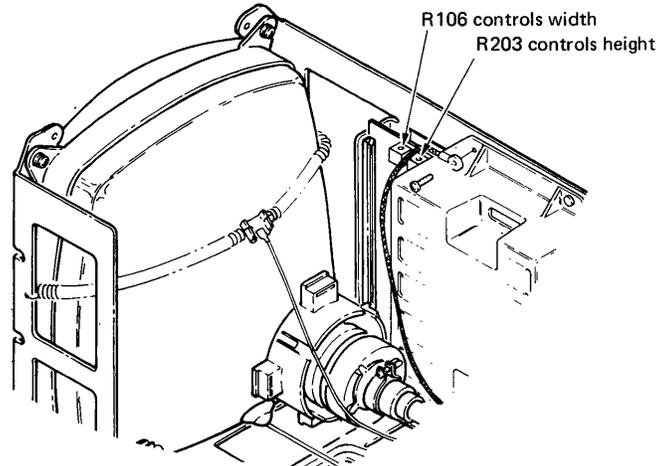


Figure 4-14. Image Adjustment Screws

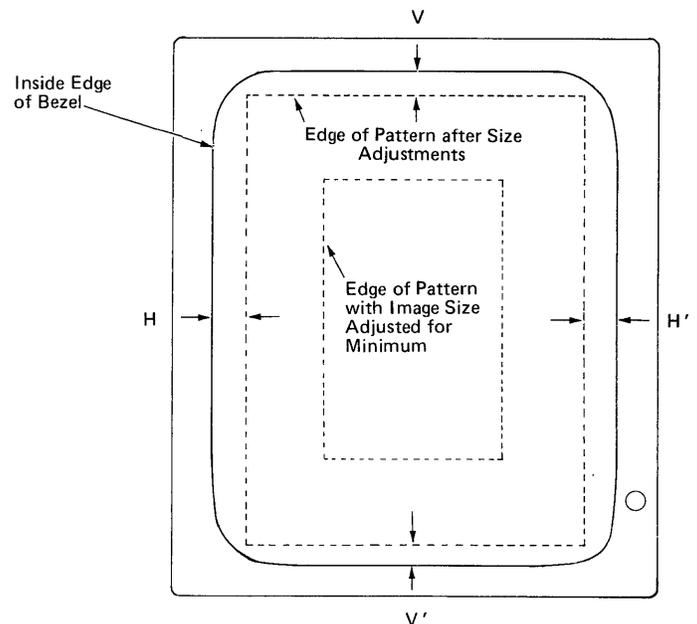


Figure 4-15. Image Size Adjustments

Image Centering Adjustment

CAUTION:

Be very careful when making this adjustment because power must be ON and the centering rings are in an area where high voltage is present.

Make this adjustment only when absolutely necessary.

Note: The image is properly centered when the outline of the H pattern is 2.5 mm (0.1 inch) from the bezel all the way around the complete screen, including the corners.

1. Verify the image size is correct. (See Image Size Adjustment)

2. With the test pattern showing on the display screen, rotate one of the centering rings ① until the square tabs on the two rings are aligned. (See Figure 4-16.)
3. With the square tabs aligned, rotate the rings together to center the image between the left and right edges of the bezel.

Note: The centering rings can be rotated 360 degrees.

4. Rotate the two rings in opposite directions, at the same time and in equal amounts, to center the image top to bottom on the screen. (See Figure 4-16 .)

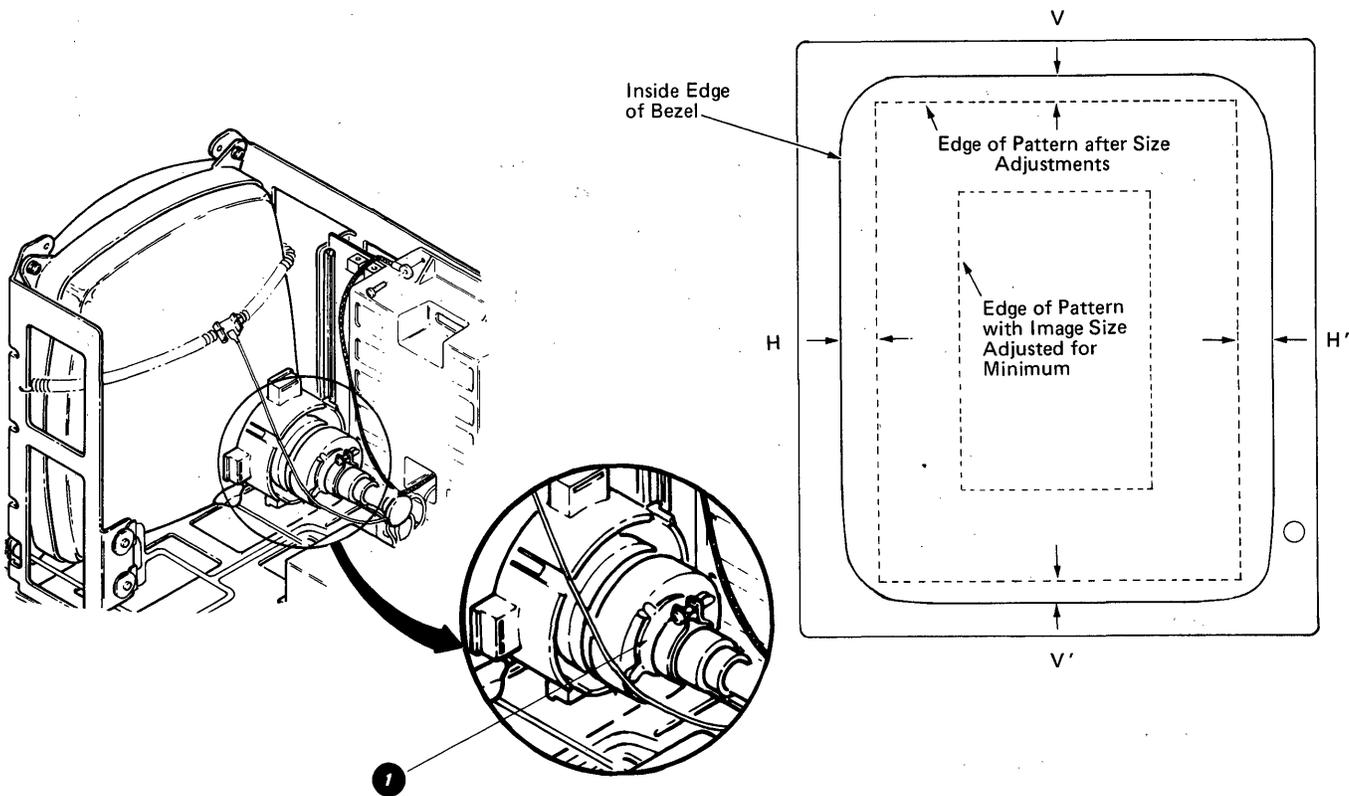


Figure 4-16. Centering Rings and Image Size After Adjustments

LARGE DISPLAY REMOVALS/REPLACEMENTS

Large Display Module Removal

1. Turn the system power off.
2. Disconnect the two AC power cords (diskette unit to display module and display module to electronics module panel 2).
3. Disconnect the display cable from the electronics module panel 1.
4. Be sure the display module is facing straight forward and is exactly level, (not tilted). (See Figure 4-17.)

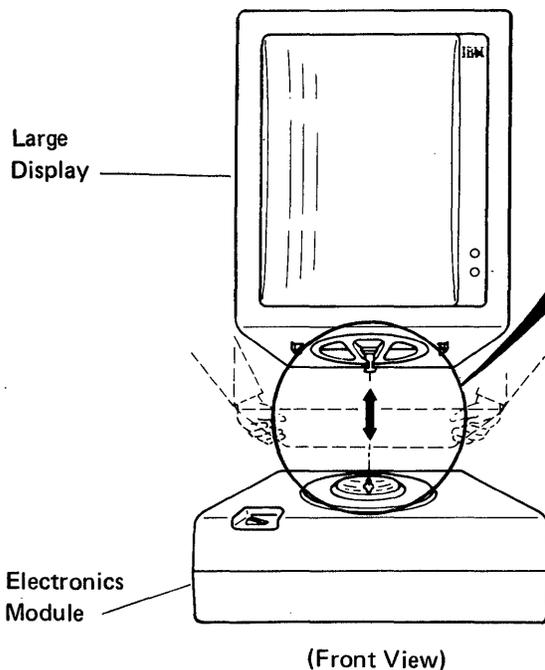


Figure 4-17. Large Display Module Removal

5. Lift the display module up to release the interlock. (See Figure 4-18.)
6. Pack the display in a display packing carton if it is to be transported.

DANGER:

Do not transport the display module unless it is suitably packed. The CRT may burst inward (implode) if broken.

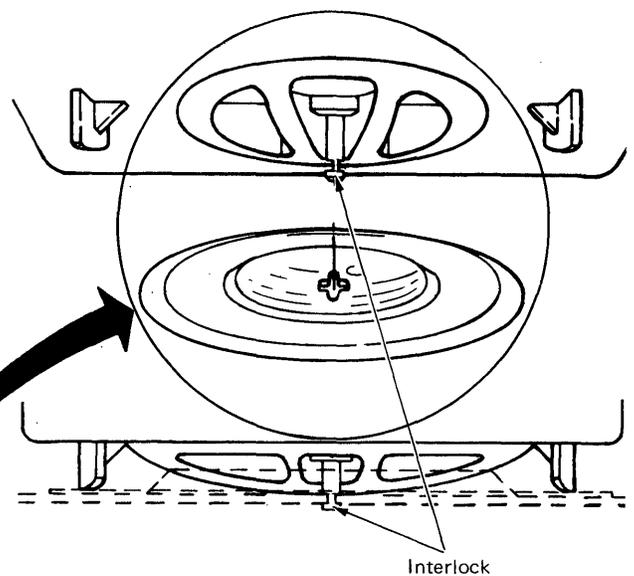


Figure 4-18. Large Display Module Interlock

Rear Cover Removal

1. Turn the system power off.
2. Release the quarter-turn cover fasteners in the back of the display module. (See Figure 4-19.)
3. Slide the cover to the rear to remove.
4. Always check to ensure the ground spring around the CRT is in place, and that it is connected to the CRT socket, before performing any type of service. (See Figure 4-10.)

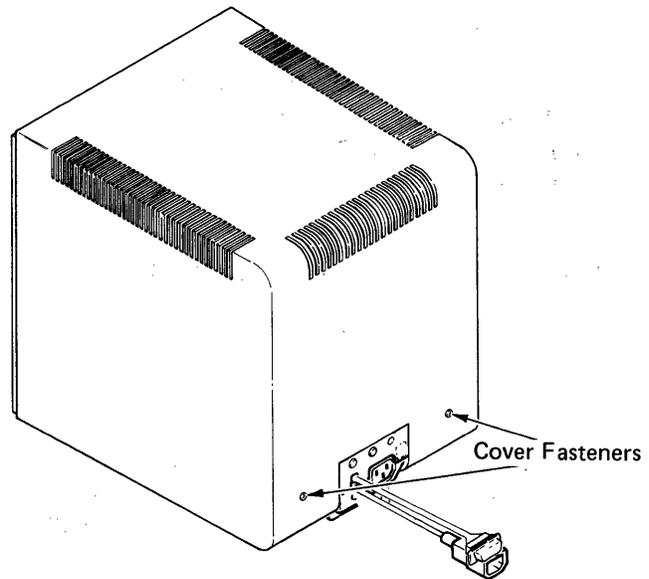


Figure 4-19. Quarter-Turn Cover Fasteners

DANGER:

Be extremely careful when working near the neck of the CRT. The CRT may burst inward (implode) if broken.

Display Analog Card Removal

1. Turn the system power off.
2. Perform the rear cover removal.
3. Disconnect the J301, J302, J501, and J502 connectors from the analog card ①. (See Figure 4-20.)
4. Cut the cable tie (if present) holding the ground wire to the analog card cover. (Cable tie does not need to be replaced; it is for shipping only.)
5. Remove the two screws ② that hold the analog card and ground strap to the mainframe.

CAUTION:

Do not touch the heat sink on the back of the analog card. It may be HOT.

6. Unseat the analog card by lifting the card removal levers ③.

7. Carefully slide the analog card ④ up and out of the card guides.

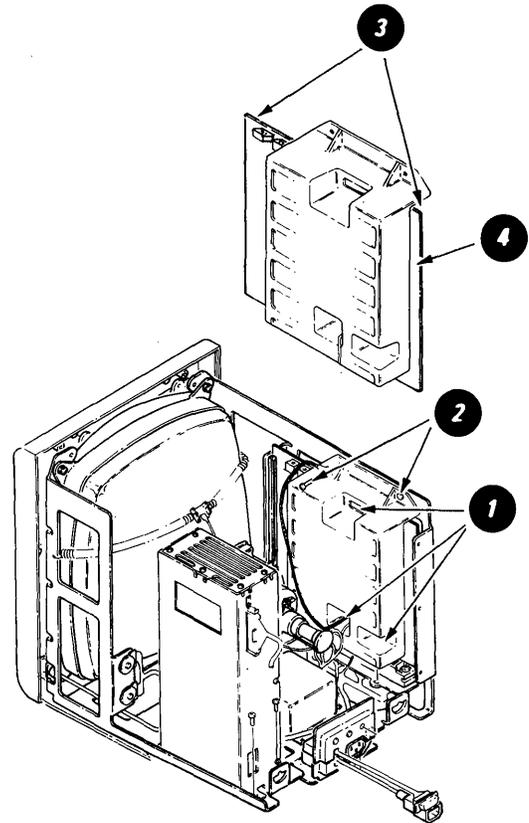


Figure 4-20. Analog Card Removal

Low Voltage Power Supply Removal

1. Turn the system power off.
2. Perform the rear cover removal.
3. Disconnect the two AC power cords (diskette unit to display module and display module to electronics module panel 2).
4. Disconnect LV1 (LED 0), LV2 (DC), and LV3 (AC) connectors ① from the low voltage power supply. (See Figure 4-21.)
5. Remove the four screws and the power supply ②.

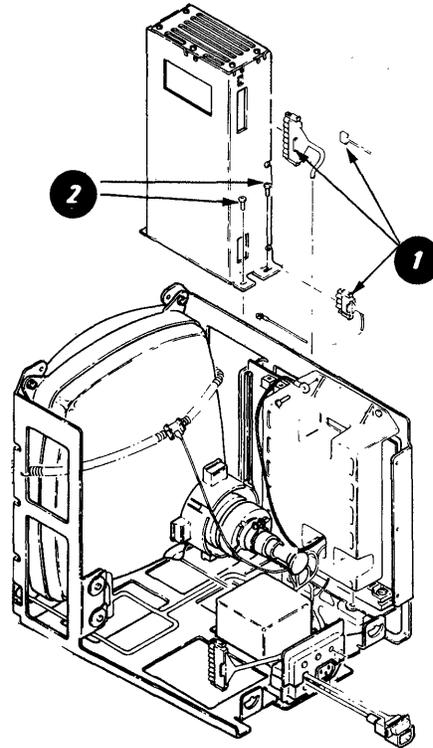


Figure 4-21. Low Voltage Power Supply Removal

High Voltage Power Supply Removal

1. Turn the system power off.
2. Perform the rear cover removal.
3. Perform the CRT Anode Discharge Procedure.

DANGER:

Be extremely careful when working near the neck of the CRT. The CRT may burst inward (implode) if broken.

4. Disconnect the anode lead ① from the CRT. (See Figure 4-22.)
5. Disconnect the cable plug J3 from the connector strip ②.
6. Remove the two screws ③, and slide the power supply to the rear until free. (Save the two starwashers that are between the power supply cover and the mainframe.)

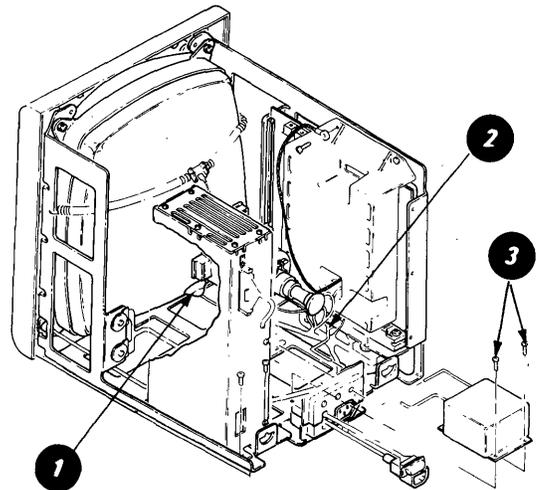


Figure 4-22. High Voltage Power Supply Removal

CAUTION:

The CRT may slowly recharge when the anode lead is disconnected. Be sure to perform the Anode Discharge Procedure in the anode hole in the CRT before replacing the high voltage power supply.

Mainframe Assembly and Front Cover Removal

1. Turn the system power off, and disconnect the AC line cord from the wall outlet.
2. Remove the brightness control knob ①. (See Figure 4-23.)
3. Perform the rear cover removal.
4. Perform the Display Analog Card Removal.
5. Perform the Low Voltage Power Supply Removal.
Note: If only removing the front cover, go to Step 8.
6. Remove the three screws, the Cable/Display Indicator Panel, and the AC Cable Assembly ② from the Mainframe Assembly. (Cable has three ground wires.)
7. Perform the CRT Anode Discharge Procedure and the High Voltage Power Supply Removal.

8. Disconnect the Display cable from the electronics module (Panel 1, Connector 2).

DANGER:

Be extremely careful when working near the neck of the CRT. The CRT may burst inward (implode) if broken.

9. Remove the eight screws ③ that hold the mainframe assembly to the front cover.
10. Lift the mainframe ④ from the front cover, and place it in a shipping carton for safe handling during transport.

CAUTION:

The CRT slowly recharges when the anode lead is disconnected; be sure to perform the Anode Discharge Procedure when replacing the mainframe assembly and before reconnecting the High Voltage Power Supply to the CRT. (This also applies to a new mainframe assembly being installed.)

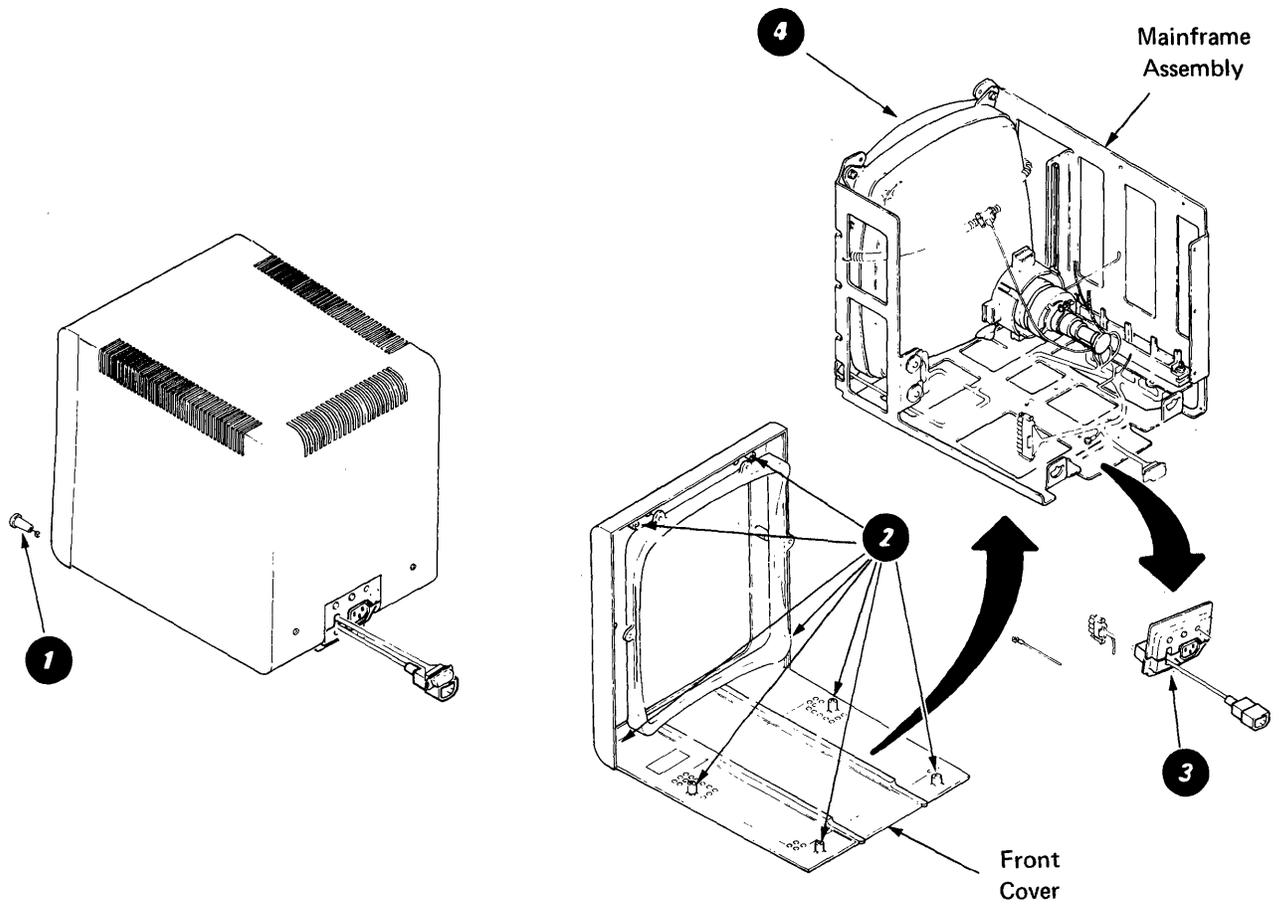


Figure 4-23. Mainframe Assembly and Front Cover Removal

CHAPTER 5. KEYBOARD

LOCATOR

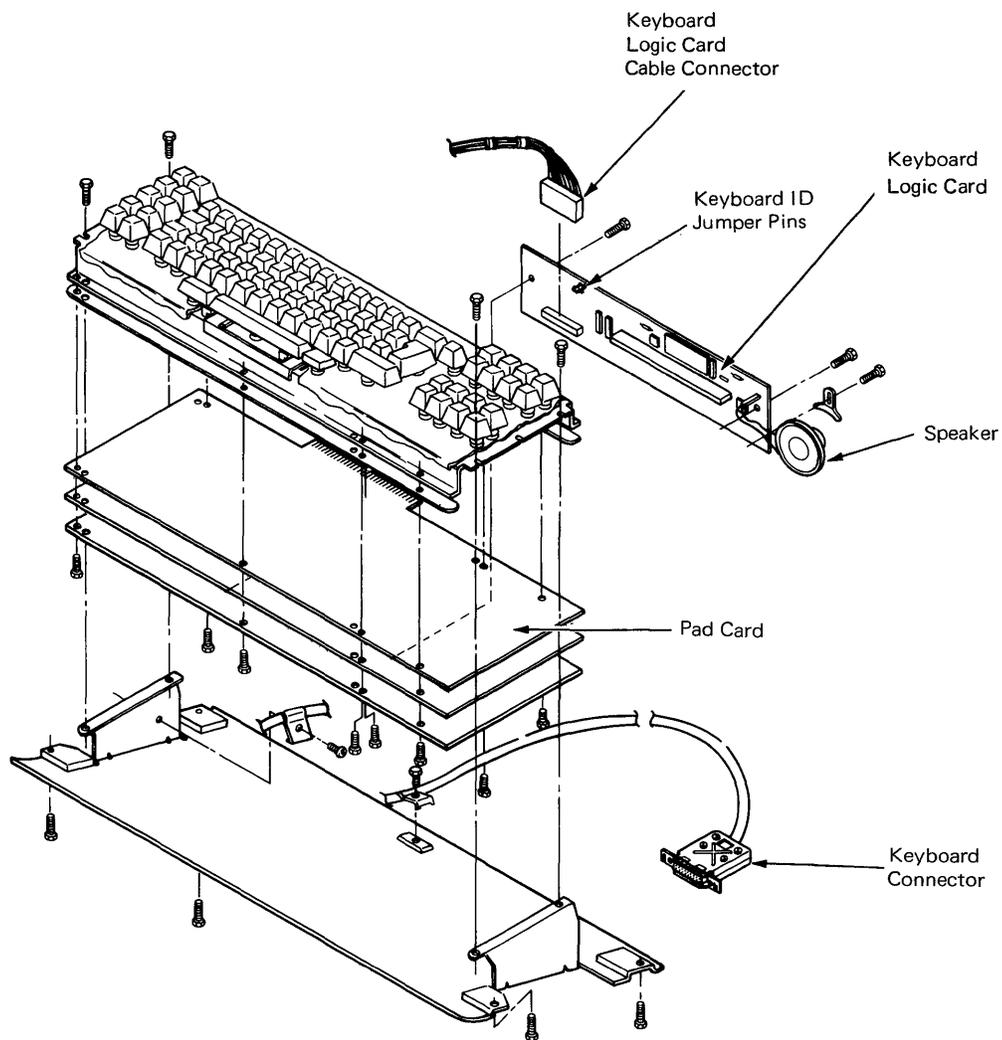


Figure 5-1. Type A Keyboard Locations

KEYBOARD OPERATIONAL THEORY

The IBM Displaywriter System uses two styles of the standard 92 and 96 character electronic keyboards, Type A and Type B. Optional keyboard arrangements including the Dvorak keyboard are available and will be simulated using the touch type method. Some key positions are typamatic. The major Type A keyboard components are the logic card, pad card, key modules and the keyboard cable (Figure 5-1). The Type B keyboard components are the keyboard common sub-assembly (CSA) which includes keybuttons, the keyboard cable and the speaker assembly (Figure 5-2).

The operator controls the system and inputs data through the keyboard.

Operator feedback is provided by the display and keyboard speaker. The display produces visual feedback, and the speaker electronically produces a clicking sound as an audio feedback when a key is pressed. The Type B speaker provides the operator with volume control.

The keyboard is connected to the system electronics by the keyboard cable which plugs into panel 1 on the back of the electronics module (Figure 5-3). The necessary voltages and signals are supplied by the electronics module, and the cable allows placement of the keyboard for individual operator comfort.

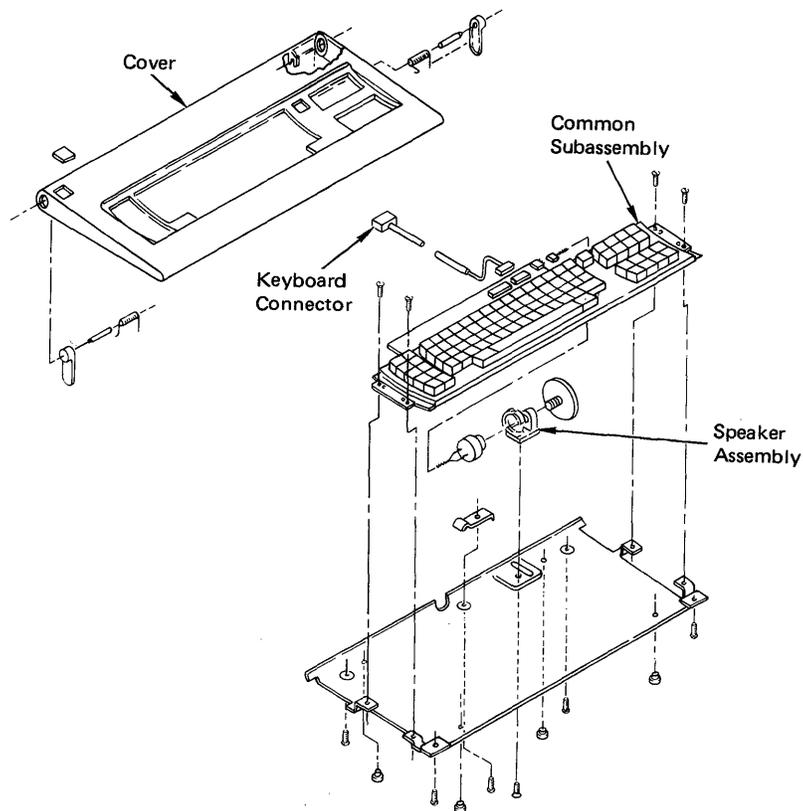


Figure 5-2. Type B Keyboard Assembly

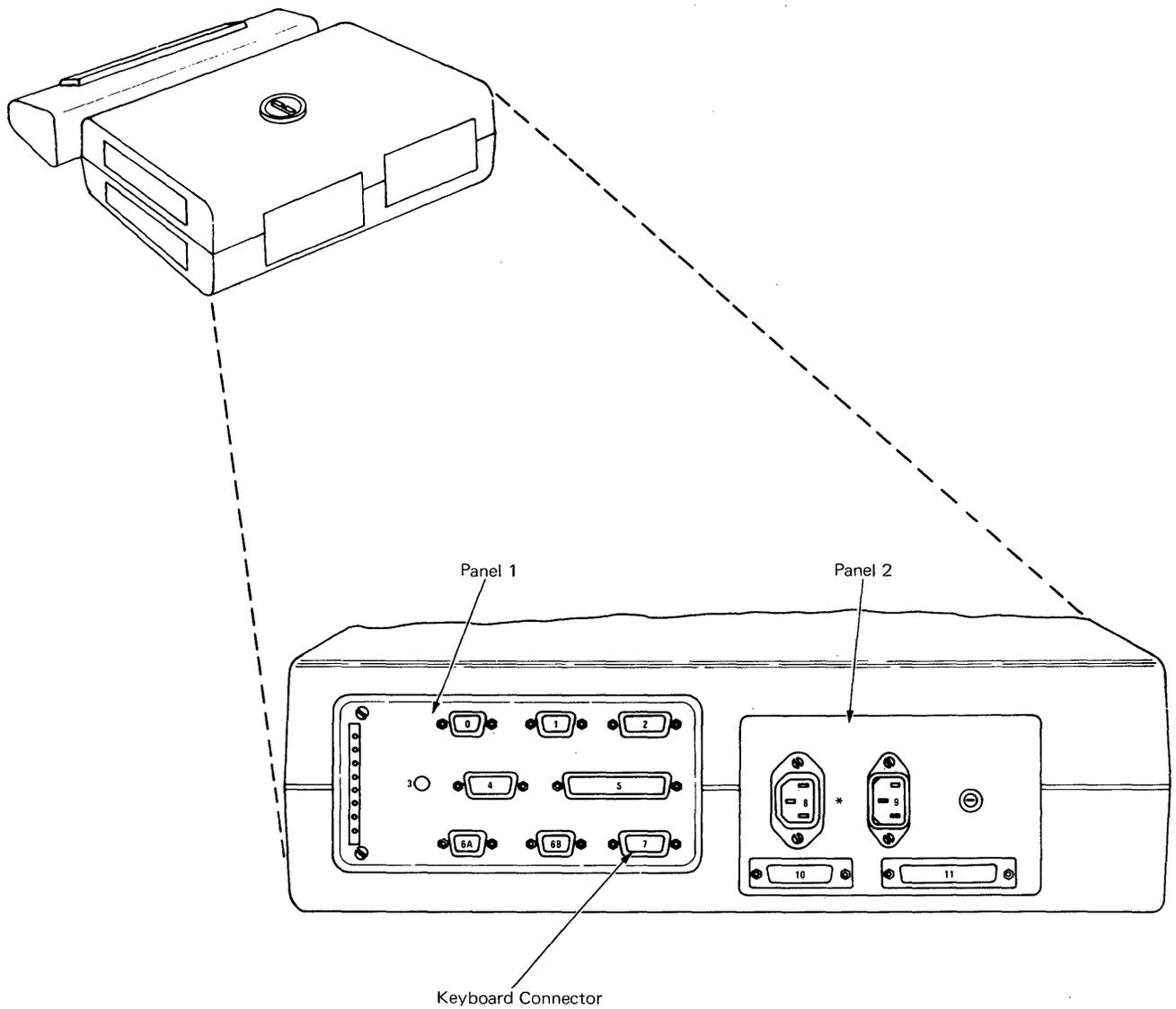


Figure 5-3. Keyboard Connector Location

Type A Key Modules

Keyboard data is produced by pressing on mechanical key modules mounted in openings in the keyboard chassis. Each module has a fly plate which contacts a set of capacitor plates on the pad card. Pressing the key moves the fly plate away from the capacitor plates (Figure 5-4), causing a change in the electrical condition of the capacitor plates. This electrical change is sensed by the keyboard electronics and is transmitted to the system electronics.

All key modules except the shift-lock module are the push/release type which operate when pressed and return to their normal position when released. The shift-lock is a push/release key module without a compression spring that remains in the down position by the action of the flat spring and the fly-plate spring. It is restored by pressing either shift key (Figure 5-5).

All key positions on the pad card are either typamatic or make/break. These keys cause the keyboard electronics to transmit data to the system when the key is pressed, and also when it is released. Make/break keys include the SHIFT, SHIFT LOCK, CODE, and control keys.

The functions of the control key are explained later in this section and in the Diagnostic section.

The SHIFT and CODE keys, when pressed and held while operating another key, will provide additional functions. These functions include the upper case characters and the function indicated on the front of the key.

Pressing and holding a typamatic key activates the repeat condition of that character or operation and the character will repeat at approximately 14 characters/second. Releasing the key or pressing another typamatic

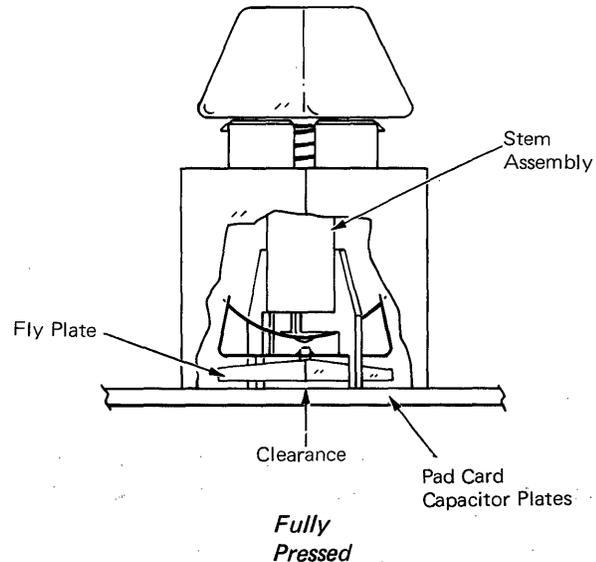
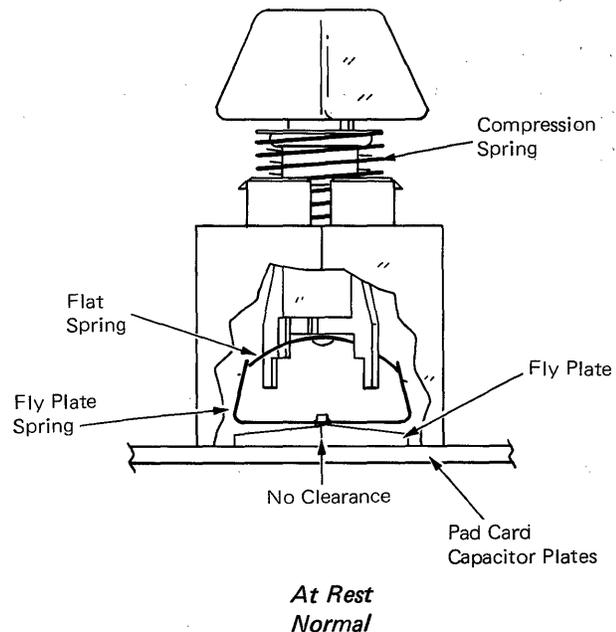


Figure 5-4. Key Module Operation

(non-make/break) key will cause the repeat action to stop. All non-make/break keys are typamatic at

the keyboard, and the system determines which keys will appear as typamatic to the operator.

All keys are active, however some keys may be blank, or may have different functions, depending on the software in use.

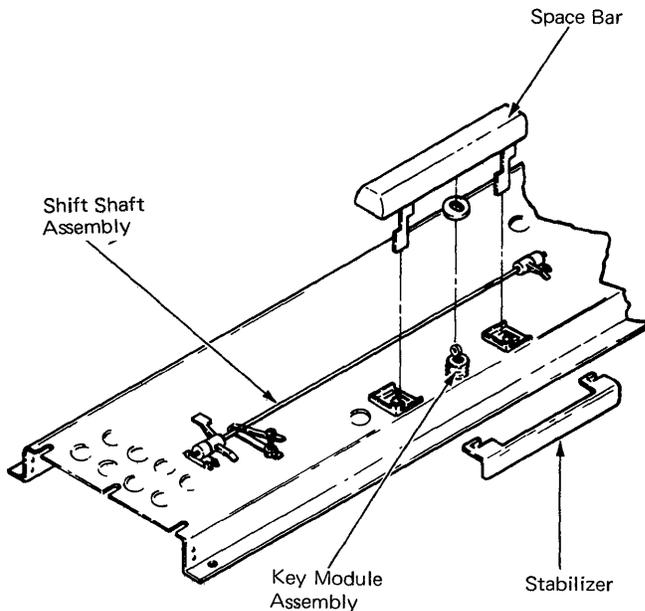


Figure 5-5. Shift-Lock Restoring Mechanism

Keyboard Electronics

The pad card and keyboard logic card are electronic parts of the keyboard. The keyboard logic card is connected to the pad card through a 30-pin connector and is the interface between the pad card and the system electronics.

The capacitor plates for each key module position on the pad card are continuously checked for changes in their electrical conditions. Pressing a key

causes the fly plate to move away from the pad card, changing the condition of the capacitor plates (Figure 5-6). Pressing a Type B key moves the flyplate toward the pad card. All other keyboard electronic operations are the same for Type B with the exception of the flyplate movement.

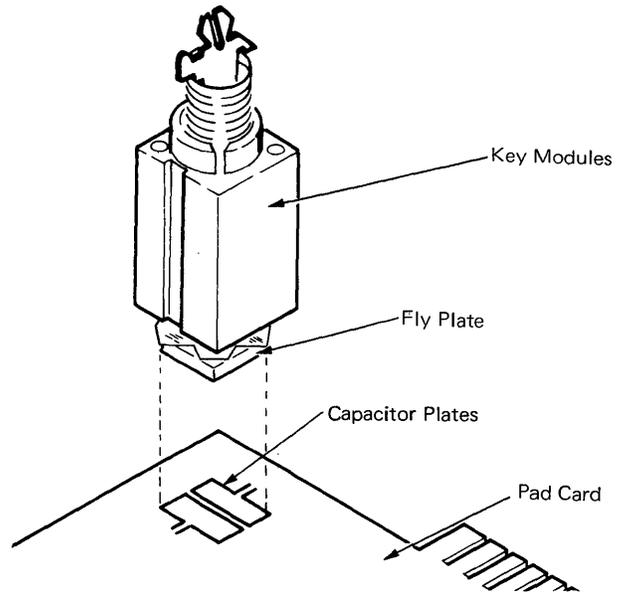


Figure 5-6. Key Module and Capacitor Plate

These changes in the electrical conditions of the capacitor plates (two for each key module) are read by the microprocessor on the logic card. The capacitor plates are connected by 12 drive lines and 8 sense lines, forming a 12x8 matrix (Figure 5-7).

One of the capacitor plates is connected to a drive line, and the other is connected to a sense line. The microprocessor will pulse a drive line and then check a sense line (through a sense amplifier) to see if there has been a change in the capacitance as a result of fly plate movement.

The microprocessor pulses the same drive line again and checks the next sense line. After checking all sense lines, the microprocessor pulses the next drive line and checks each sense

line again. This process of scanning the pad card matrix is continuous.

If a change is sensed when checking a sense line, the microprocessor will

store the new state of the key module (for example, pressed or released), and if required, transmit the data to the system.

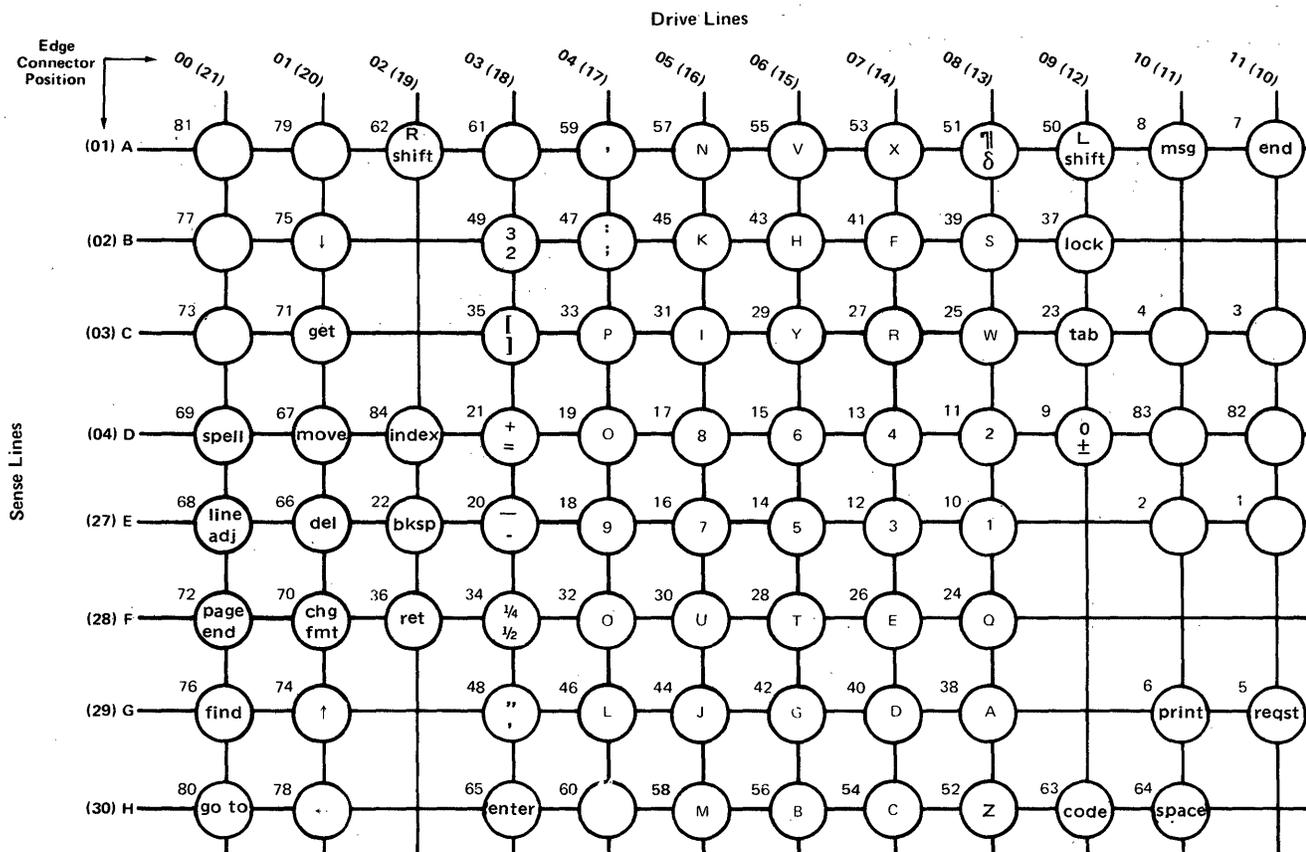


Figure 5-7. Keyboard Matrix Chart

The data is transmitted from the keyboard logic card through the keyboard cable to the system electronics in serial form. The transmission and line control of data from the keyboard to the system electronics is controlled by the Data Clock, the Data Strobe, the Keyboard Acknowledge, and the Serial Data line (Figure 5-8).

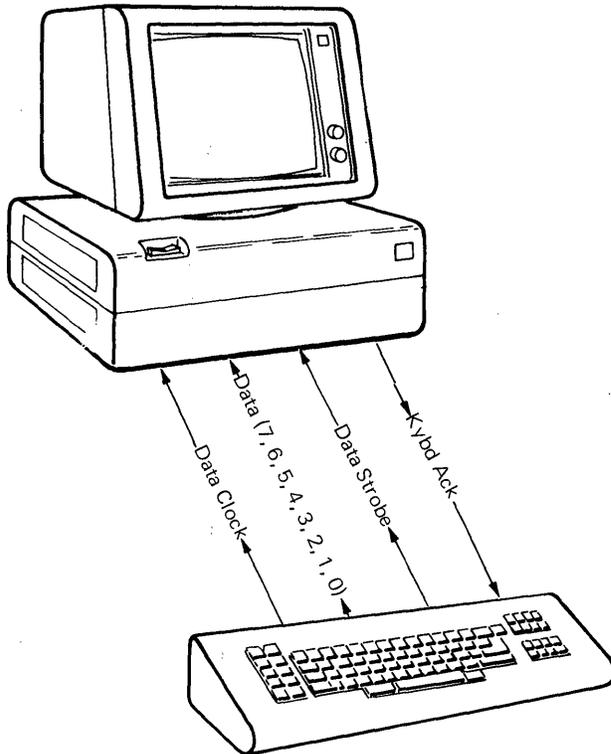


Figure 5-8. Keyboard Serial Data Transfer

- The Data Clock synchronizes the keyboard and the system electronics allowing data to be transmitted.
- One byte of data (8 data bits: 0, 1, 2, 3, 4, 5, 6, 7) is transmitted through the Data line.
- A Data Strobe bit is transmitted following the data byte to signal the system electronics that one byte of data has been transmitted.
- The Keyboard Acknowledge signal is transmitted by the system electronics and acknowledges receipt of the data. It inhibits the transmission of the next byte of data in the buffer until the present byte has been stored by the system electronics.

The data is converted to an eight bit data byte by the keyboard adapter in the system electronics. The data byte contains a seven bit code indicating the key position. The eighth bit in the data byte indicates a key depression and key release for make/break keys or repeat mode for typamatic keys.

The keyboard data flow is shown in Figure 5-9.

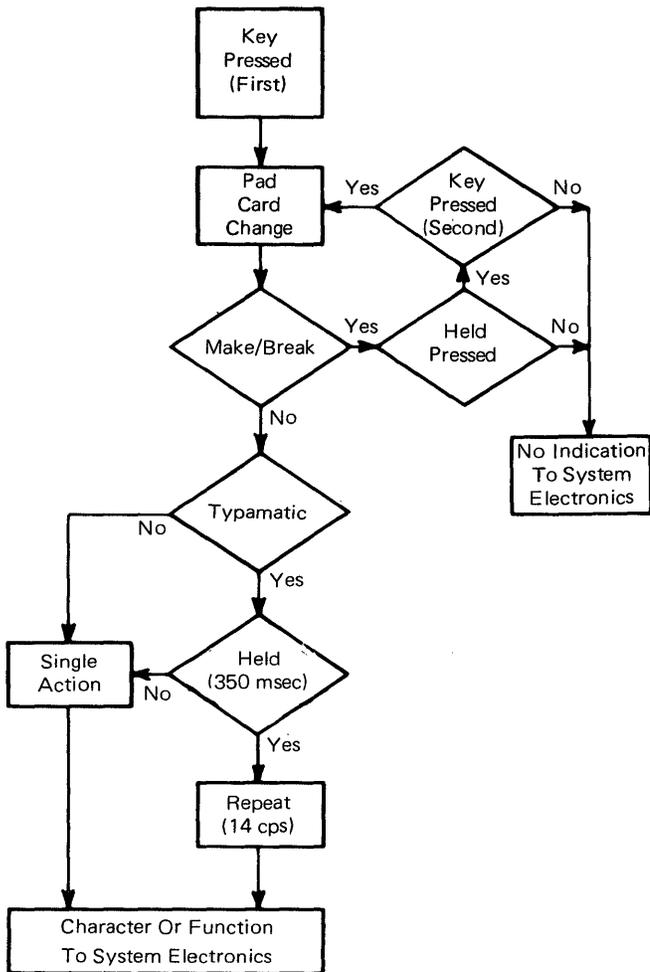


Figure 5-9. Keyboard Data Flow

BASIC ASSURANCE TEST (BAT)

A Power on Reset (POR) of the system will automatically start the keyboard Basic Assurance Test (BAT) and perform wrap tests on the keyboard adapter circuits of the system card.

The keyboard BAT verifies the keyboard microprocessor is operating correctly. The keyboard notifies the system processor of the keyboard status by transmitting a specified sequence of two bytes of data. Successful completion of the BAT is necessary for the keyboard to proceed with normal system operation (Figure 5-10).

A third byte containing the keyboard ID is also transmitted to provide configuration information.

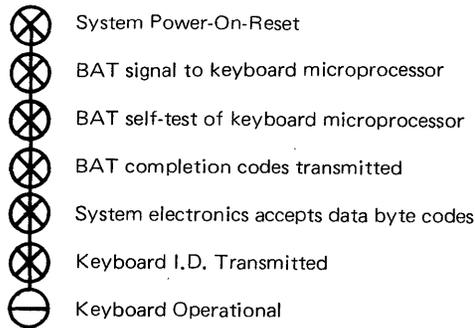


Figure 5-10. BAT Sequence

CHARACTER BUFFER

The keyboard contains a four character buffer to temporarily store data until the system electronics is ready to receive it. An overrun error occurs if the four buffer positions are filled and an additional character is keyed. The additional character and the fourth position character will be lost and the overrun error character will be entered into the fourth position of the buffer.

KEYBOARD IDENTIFICATION (ID)

On successful completion of the keyboard BAT, a keyboard identification (ID) data byte is sent to the system by the keyboard. The position of the logic card ID jumpers (shown in Figure 5-14) determine the keyboard ID byte.

The transmission of this byte signals the system electronics the completion of the keyboard BAT and identifies the keyboard arrangement. The keyboard then enters the normal operating mode.

KEY POSITION

The key positions are shown in (Figure 5-11). Key positions marked with a "T" are typamatic keys and

those keys marked "M" are make/break keys. The position of the typamatic keys are controlled by software and may be different for World Trade countries depending on the country layout.

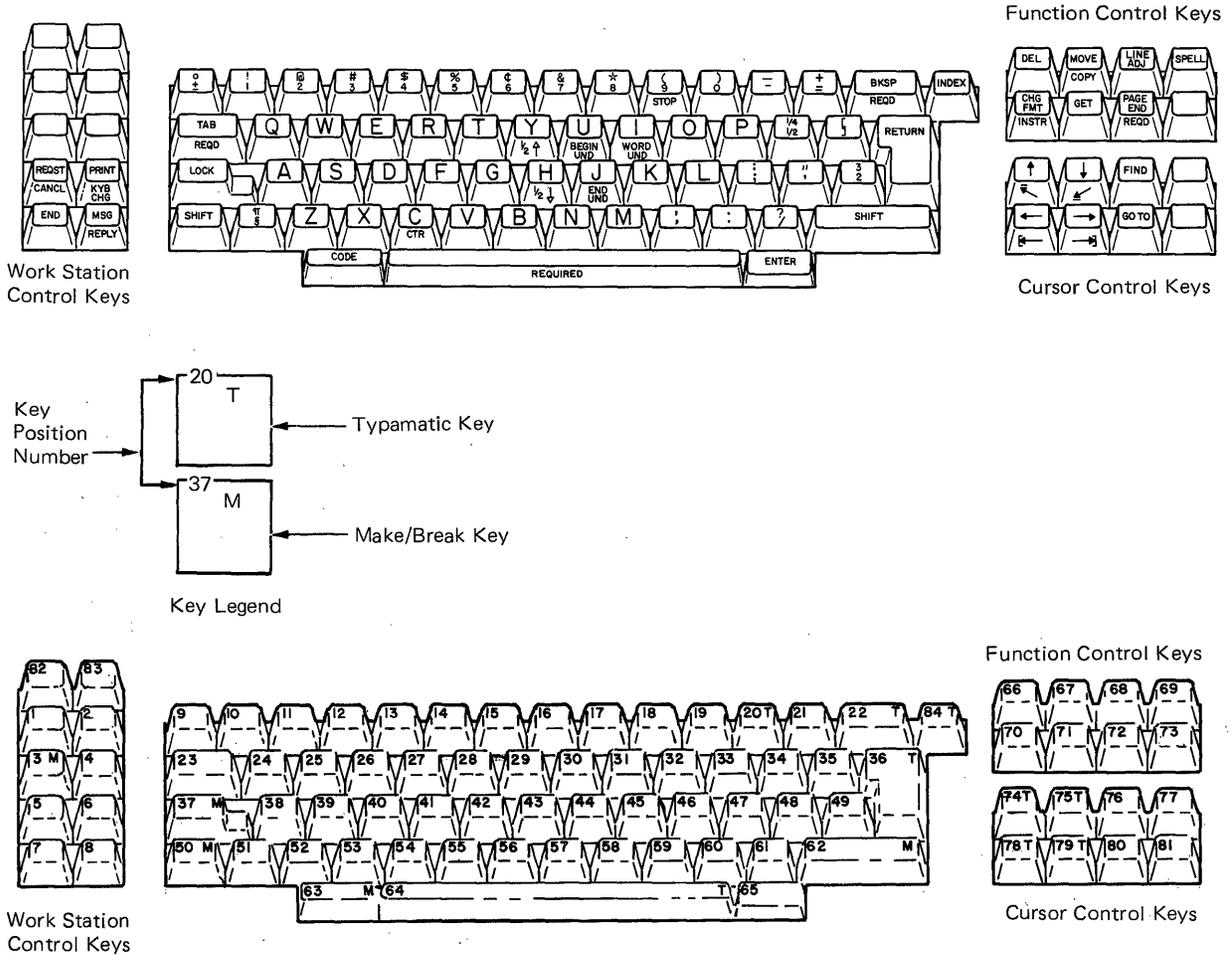


Figure 5-11. Keyboard Layout

Code Key

The CODE key (Figure 5-12) is located to the left of the spacebar. Its purpose is to allow alternate or additional functions to be performed using the existing keys. Holding the CODE key down, and pressing one of the function character keys will, cause the system to perform the function on the front of the function character key.

Enter Key

The ENTER key (Figure 5-12) is mounted to the right of the spacebar. It is recessed approximately 3 mm (0.120 inch) below the spacebar to prevent accidental keying. The ENTER key is used by the operator to enter functions, view format changes, or step through a sequence of prompts.

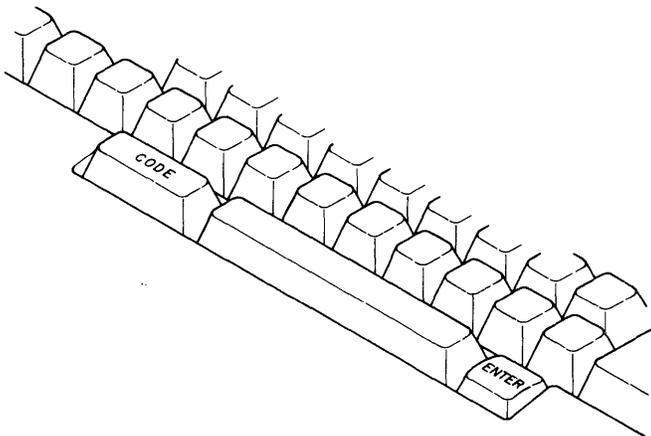
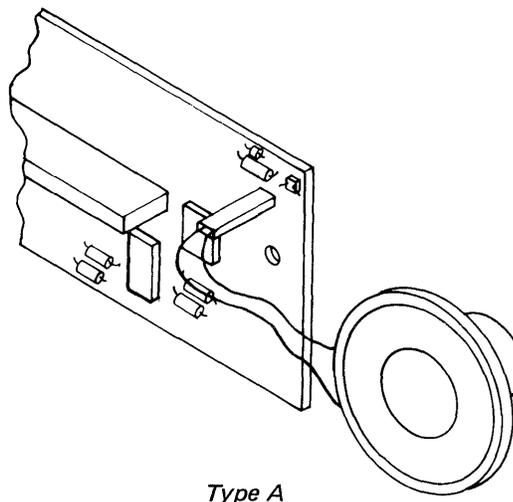


Figure 5-12. CODE and ENTER keys

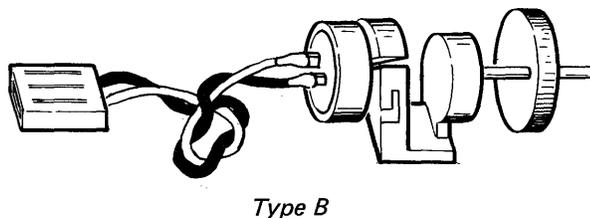
Keyboard Speakers

The speaker gives the operator two audio feedback responses. A clicking sound is produced after each valid keystroke and is repeated while a valid typamatic key is held pressed. A one kHz tone is produced for other operator feedback. The duration of the tone and the number of tones generated is determined by the system software based on the type of feedback required by the operator. The Type A keyboard speaker is attached to the keyboard frame and is electronically connected to the keyboard logic board by a two-pin connector (Figure 5-13).

The Type B keyboard speaker is a audio transducer mounted to the keyboard frame. The transducer is connected to the keyboard logic card by a three-pin connector. The volume of the speaker can be controlled by a thumb-wheel located on the bottom rear of the keyboard.



Type A



Type B

Figure 5-13. Keyboard Speakers

KEYBOARD ARRANGEMENT OPTION

The keyboard arrangement specifies the characters that may be typed and where they appear on the keyboard. The standard character arrangement of the keyboard appears on the tops of the keys. The coded function of a key is the character or function on the front of the key. The coded functions are accessed by holding the CODE key down and typing the desired function key.

The operator may select any of the five keyboards on the program diskette by pressing the KEYBOARD CHANGE KEY and entering the desired keyboard ID number. The operator can also change

any of the five keyboards on the program diskette to any keyboard ID.

When the Diagnostic Diskette is loaded, the keyboard ID that identifies the position of the jumpers is displayed in the Keyboard field. The chart (Figure 5-14) shows the keyboard IDs and the corresponding position of the ID jumpers in the keyboard.

The front of some character keys are not labeled but when pressed (while the CODE key is pressed) produce a character or function. These keys are provided for specialized application. (See Section 2, Operating Instructions.)

LANGUAGE SUPPORT	STRAP IDs			ID JUMPERS*						
	92	96	0	1	2	3	4	5	6	7
Australia/New Zealand		1	X	X	X	X	X	X	X	
Austria/Germany		29	X	X	X				X	
Belgium (Flemish)		247					X			
Canada-England		37	X	X		X	X		X	
Canada-France/Bilingual		39	X	X		X	X			
Czech-Czech		83	X		X		X	X		
Czech-Slovak		85	X		X		X		X	
Denmark		57	X	X				X	X	
Finland		248						X	X	X
France/Belgium (AZ)		251						X		
France (Qwerty)		252							X	X
Greece (Latin)		75	X		X	X		X		
Hong Kong (Latin)		119	X				X			
Hungary		91	X		X			X		
Italy (S.A.)		41	X	X		X		X	X	
Japan (English)		69	X		X	X	X		X	
Netherlands		43	X	X		X		X		
Norway		55	X	X			X			
Poland		93	X		X				X	
Portugal		63	X	X						
Rumania		87	X		X		X			
S. Africa		81	X		X		X	X	X	
Spain		45	X	X		X			X	
SP Speak/Puerto Rico		25	X	X	X			X	X	
Sweden		53	X	X			X		X	
Switzerland-Germany		51	X	X			X	X		
Switzerland-France		49	X	X			X	X	X	
Turkey		79	X		X	X				
U.K./Israel		67	X		X	X	X	X		
U.S.		1	X	X	X	X	X	X	X	
U.S.	249							X	X	
U.S. Dvorak		250						X		X
Yugoslavia (Latin)		95	X		X					

*X's Indicate Jumper Positions

Figure 5-14. Keyboard Arrangement Options

ASCII CODE SET

The keyboard supports the seven Bit-DP (ASCII) code set. This code set is used by some systems in

teleprocessing. The code set is accessed by pressing the Control key (Position 3) and typing the desired ASCII character (Figure 5-15).

Audit Window Code	Description	Key Pos
NUL - Null	NULL	64
SOH - Start of Heading	SOH	38
STX - Start of Text	STX	56
ETX - End of Text	ETX	54
EOT - End of Transmission	EOT	40
ENQ - Enquiry	ENQ	26
ACK - Acknowledge	ACK	41
BEL - Bell	STOP	42
BS - Backspace	Req. Backspace	43
HT - Horizontal Tab	Tab	31
LF - Line Feed	INDEX	34
VT - Vertical Tab	VT	45
FF - Form Feed	Page End	46
CR - Carriage Return	Zero Index CR	36
SO - Shift-Out	SO	57
SI - Shift-In	SI	32
DLE - Data Link Escape	DLE	33
DC1 - Device Control 1	DC1	24
DC2 - Device Control 2	DC2	27
DC3 - Device Control 3	DC3	39
DC4 - Device Control 4	DC4	28
NAK - Negative Acknowledge	NAK	30
SYN - Synchronous Idle	SYN	55
ETB - End of Trans Block	ETB	25
CAN - Cancel	CAN	53
EM - End of Media	EM	29
SUB - Substitute	Substitute	52
ESC - Escape	ESC	9
FS - Field Separator	FS	58
GS - Group Separator	GS	35
RS - Record Separator	RS	44
US - Unit Separator	US	34
DEL - Delete	DEL	22

Figure 5-15. Seven Bit-DP (ASCII) Code Chart

KEYBOARD LOGIC CARD

The Keyboard Logic Card is the interface between the pad card and the System. The Type A keyboard logic card is connected to the pad card by a 30-pin edge connector and to the system by the logic card cable connector.

The Type B keyboard logic card is solder-connected to the pad card and is part of the keyboard common subassembly.

The ground lines are the DC return for all power supplied to the keyboard and are connected to the frame and base plate of the keyboard assembly, through the logic card mounting screws.

The keyboard interface lines are described below:

- Kybd Ack. Sent from the system electronics to notify the keyboard the system electronics is ready to receive the next byte of data and acknowledges the receipt of a byte of data.
- Serial Data Clock. Synchronizes the keyboard and system electronics, and indicates to the system electronics a data byte is being transmitted.
- Serial Data. When transmitted to the system electronics, indicates which key has been pressed.
- Data Strobe. Signals the system electronics that eight data bits (one byte) have been transmitted.
- Power-on-Reset (POR). Sent from the system electronics to reset the keyboard electronics and begin the keyboard Basic Assurance Test (BAT).
- Speaker Tone. A one kHz tone whose duration and repetition rate are under control of the system electronics.
- Click. Triggers the keyboard electronics which generates a pulse that is used as one form of speaker drive. The click indicates a successful key operation.

KEYBOARD SERVICE AIDS

The Keyboard Assembly requires no scheduled preventive maintenance.

Tools and Equipment

The following equipment is required to service the Type A keyboard.

- Keybutton puller (Part Number 9900373)
- Alcohol Pad (Part Number 9900679)
- Lint-free Cloths (Part Number 2108930) or (Part Number 2123106) or Disposable Cleaning Cloths (Part Number 1650800).

Cleaning Procedures

Note: The Type B keyboard cannot be disassembled to clean the pad card and key modules. Keybuttons can not be replaced or repaired in the field due to contamination exposure. The complete keyboard CSA must be replaced if keybutton failure is present.

Plastic parts and painted covers can be cleaned with IBM cover cleaner, P/N 450891, or a mild non-abrasive hand soap. Other solvents or cleaners are not recommended as damage or discoloration of plastic or painted parts can result.

Cleanliness is important when working on the keyboard. Any particle between the key module fly plate and the pad card is a potential problem.

Before any keyboard disassembly, prepare a smooth, clean work area by wiping contamination away with an alcohol pad. Gently tap, brush, and shake the keyboard assembly to remove any loose particles which could get into the pad card and fly plate area during disassembly and reassembly.

The pad card and key module fly plates are cleaned by carefully wiping each with an alcohol pad followed by a lint-free cloth. Care should be taken not to dislodge or remove fly plates from key modules.

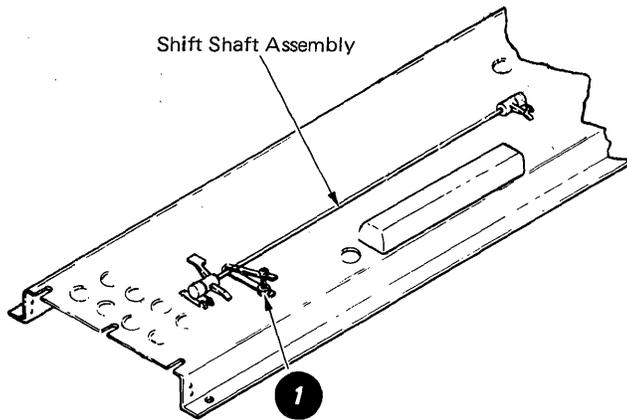
Some minor liquid spills, such as soft drinks or coffee with sugar, can be removed by first washing the pad card and affected fly plates with a lint-free cloth dampened with a mixture of water and a mild hand soap. Rinse with a water-dampened, lint-free cloth, then clean with an alcohol pad and dry with a lint-free cloth.

Note: Sticky key modules must be replaced. A severe liquid spill may necessitate replacement of the entire keyboard assembly.

ADJUSTMENTS

Shift Lock Brake Adjustment (Type A only)

1. Adjust the shift lock brake screw so the shift latches and locks reliably (clockwise increases brake tension).

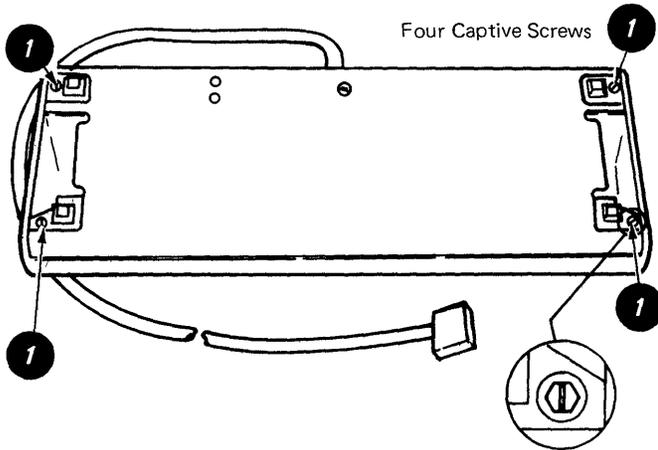


REMOVALS/REPLACEMENTS

Keyboard Cover (Type A & B)

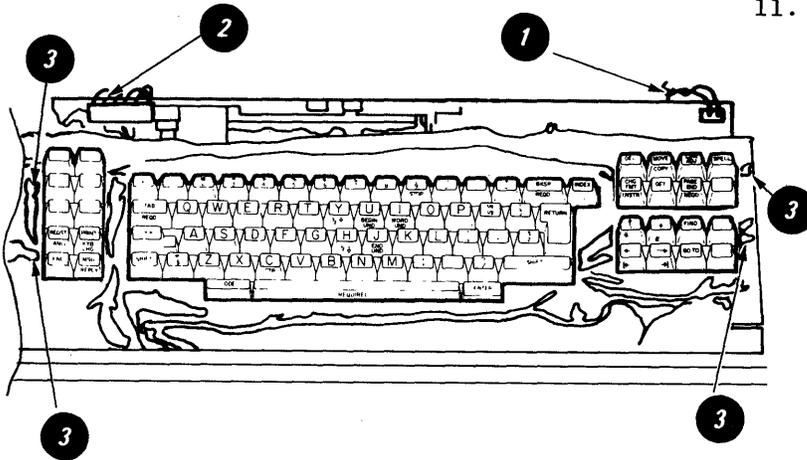
1. Turn system power off.

2. Remove the top cover by loosening the four captive screws on the bottom of the keyboard assembly ①.



Pad Card (Type A only)

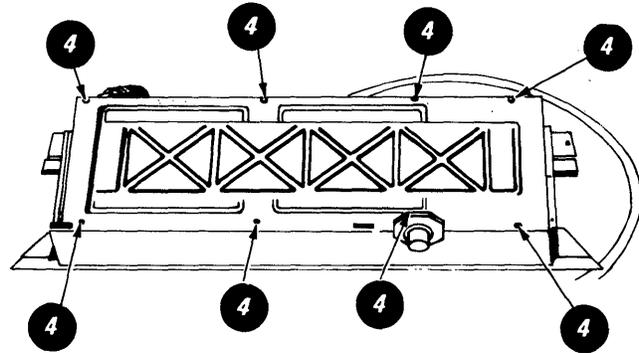
1. Turn system power off.
2. Perform Keyboard Cover Removal.
3. Remove the two screws holding the keyboard logic card. Disconnect the speaker cable ① and the keyboard cable ②. Remove the logic card.
4. If a key module is to be removed, locate the position of the key before the keyboard is inverted and remove the keybutton.
5. Remove the two mounting screws on each side of the keyboard under the contamination shield ③.



6. Lift the keyboard out of the keyboard frame.
7. Invert the keyboard and install it on the frame using a screw on each side to hold the assembly in place.

WARNING: Removing the pad card with a key pressed may cause the fly plate to spring out of the key module.

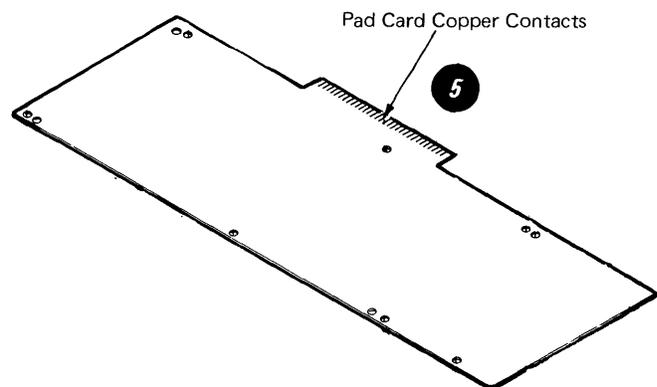
8. Ensure there is no pressure on any keys.
9. Remove the screws from the pad card ④.



Pad Card Screws

10. Lift the pad card from the keyboard assembly.
11. To assemble, reverse the above procedure. Before inserting the logic card, the pad card should be cleaned and lubricated as follows:

- a. Carefully wipe the pad card with an alcohol pad followed by a lint-free cloth.
- b. Use a light abrasive (Part Number 9900089 or a pencil eraser) to clean the top and bottom copper contacts of the 30 pin-edge connector ⑤.



- c. After cleaning the contacts, apply a thin layer of IBM No. 10 oil to the edge connector

(top and bottom) of the pad card. Coverage of about 50% of the tab area (as measured from the edge of the tab) will ensure the desired protection of the contacts.

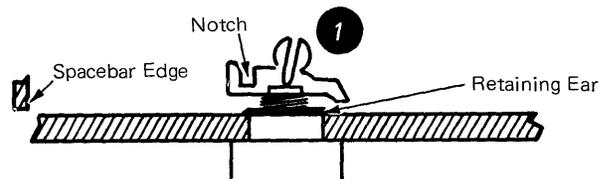
WARNING: Do not over-lubricate the edge connector, as permanent damage to the key modules may occur if lubricant gets on the pad card.

Key Module (Type A only)

Removal

1. Use the keybutton removal tool (Part Number 9900373) to lift the keybutton from the key module to be removed.
2. Disassemble the keyboard. (See Pad Card Removal.)
3. Reach under the key assembly and push the failing key module up until it is free ①.

Note: The module retaining ears must clear the frame.



WARNING: To prevent loosening a fly plate, ensure no keys are accidentally pressed while the pad card is removed.

Installation

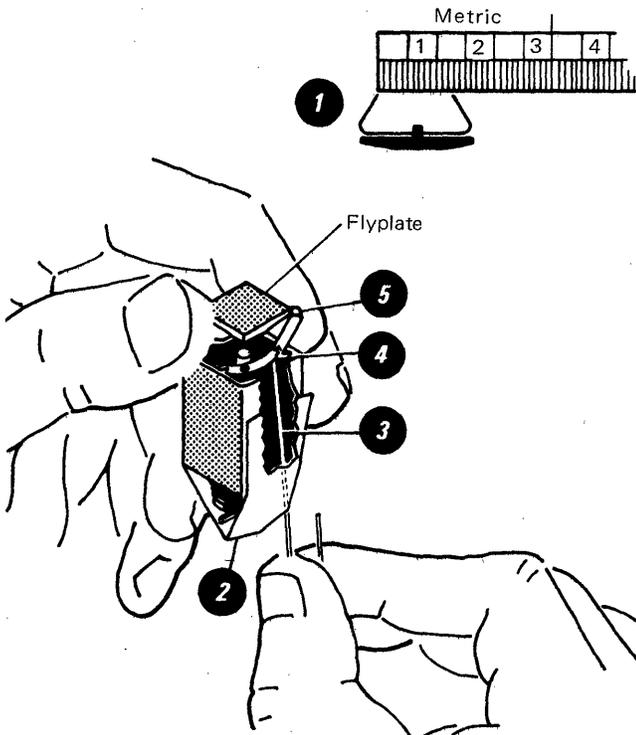
1. Insert the key module. Match the opening in the key module with the aligning lug in the mounting hole. The key stem notch must be positioned toward the spacebar edge of the keyboard.
2. Reinstall the pad card.
3. Turn the keyboard assembly over and, if necessary, reposition the contamination shield.
4. Put the keybutton on the key module.
5. Reinstall the logic board cables and covers.

Fly Plate Replacement (Type A only)

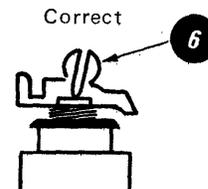
Reinstalling a disconnected fly plate in a key module is not recommended.

If replacement is necessary because a new key module is not available, inspect the fly plate to ensure the connection is not loose between the spring and fly plate and that the fly plate is not damaged.

1. Disassemble the keyboard (see Pad Card Removal)
2. Remove the key module (see Key Module Removal).
3. Form the spring on the fly plate so there is 12.7 mm (0.5 inch) between the ends of the spring **1**.
4. Tape the key stem down as shown **2**.



5. Hold the key module and fly plate as shown, line up the ends of the fly plate spring with the tips of the flat spring attached to the key stem.
6. Insert a small stylus or straightened paper clip through one of the access holes in the key module **3**.
7. Push the tip of the flat spring up on the inside of the fly plate spring **4**.
8. Move the flat spring down until the tab drops into the opening of the fly plate spring **5**.
9. Attach the other end of the spring in the same way.
10. Carefully remove the tape holding the key stem.
11. Check the key stem insert for taper in the center opening and form if necessary **6**.



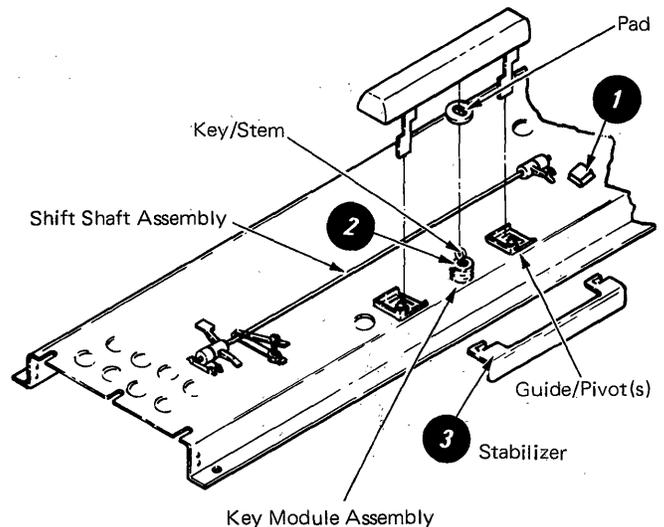
12. Install the key module in the key assembly frame.
13. Reassemble keyboard and replace the keybutton.

Shift-Lock Mechanism (Type A only)

1. Perform the keyboard cover removal procedures.
2. Remove both left and right shift keybuttons and the shift-lock keybutton.
3. Remove the screw and the shift lock brake from shaft assembly.
4. Slide the shaft assembly out of the pivot housings.
5. Remove the left and right pivot housings from keyboard frame. Pivot housings are removed from the bottom of the keyboard assembly in the same procedure as removing a key module. (See Key Module Removal.)

Spacebar Mechanism (Type A only)

1. Perform the keyboard cover removal procedures.
2. Remove the ENTER keybutton ①.
3. Hold the spacebar to keep it from being pressed.
4. Push the key module key stem ② down to disconnect it from the spacebar.
5. Slide the spacebar as far to the right as it will go.
6. Slide the stabilizer ③ to the left and pull the spacebar upward and out of the keyboard - be careful not to tear the contamination shield.
7. Remove the stabilizer by pulling it forward.



CHAPTER 6. SYSTEM ELECTRONICS/POWER SUPPLY

LOCATOR

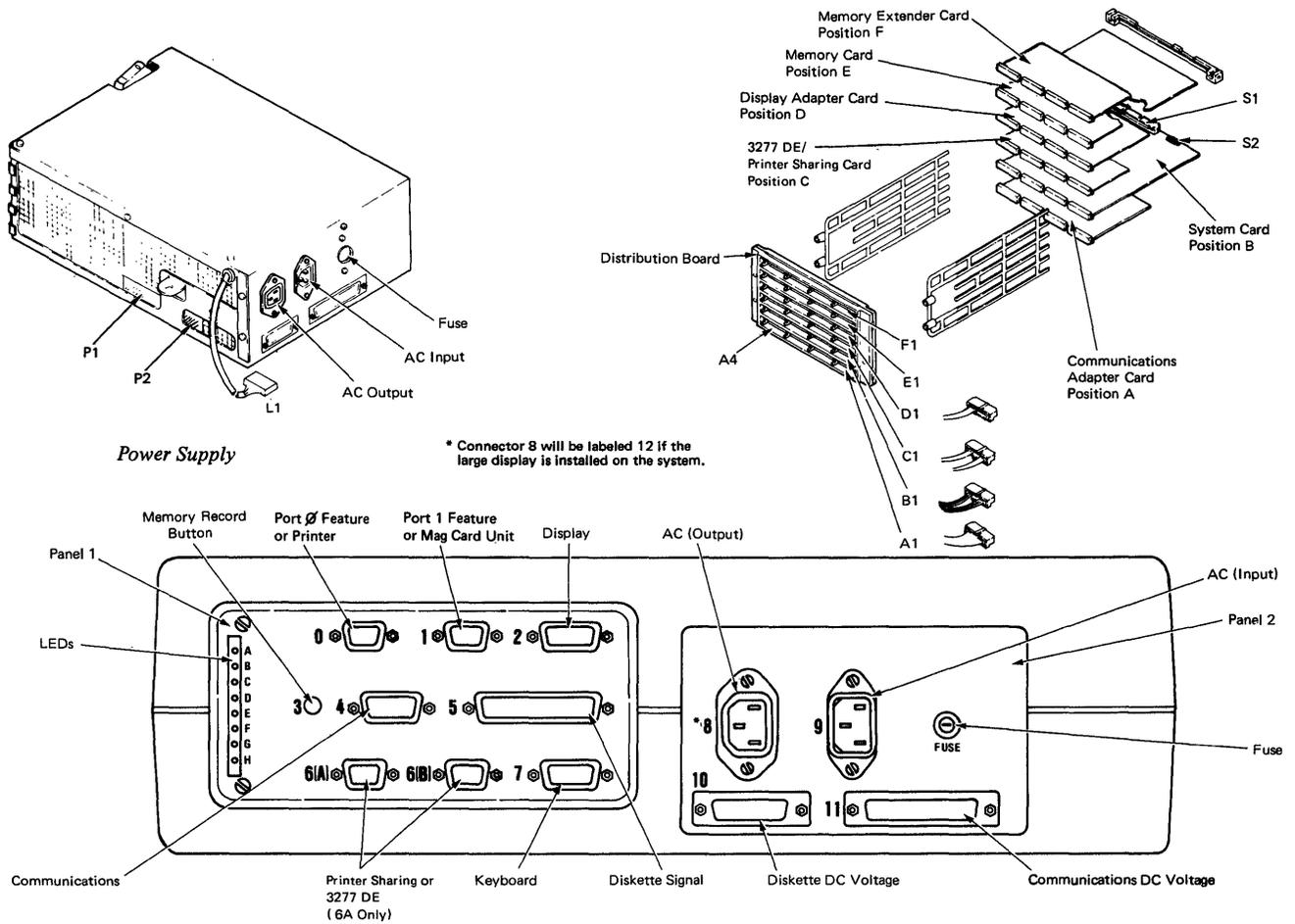


Figure 6-1. System Electronics/Power Supply Locations

SYSTEM ELECTRONICS/POWER SUPPLY THEORY

The electronics module contains electronic cards connected to a distribution board (Figure 6-2). Each card

controls a specific function in the system, and the system card controls several functions. The functions of each card are described in this section.

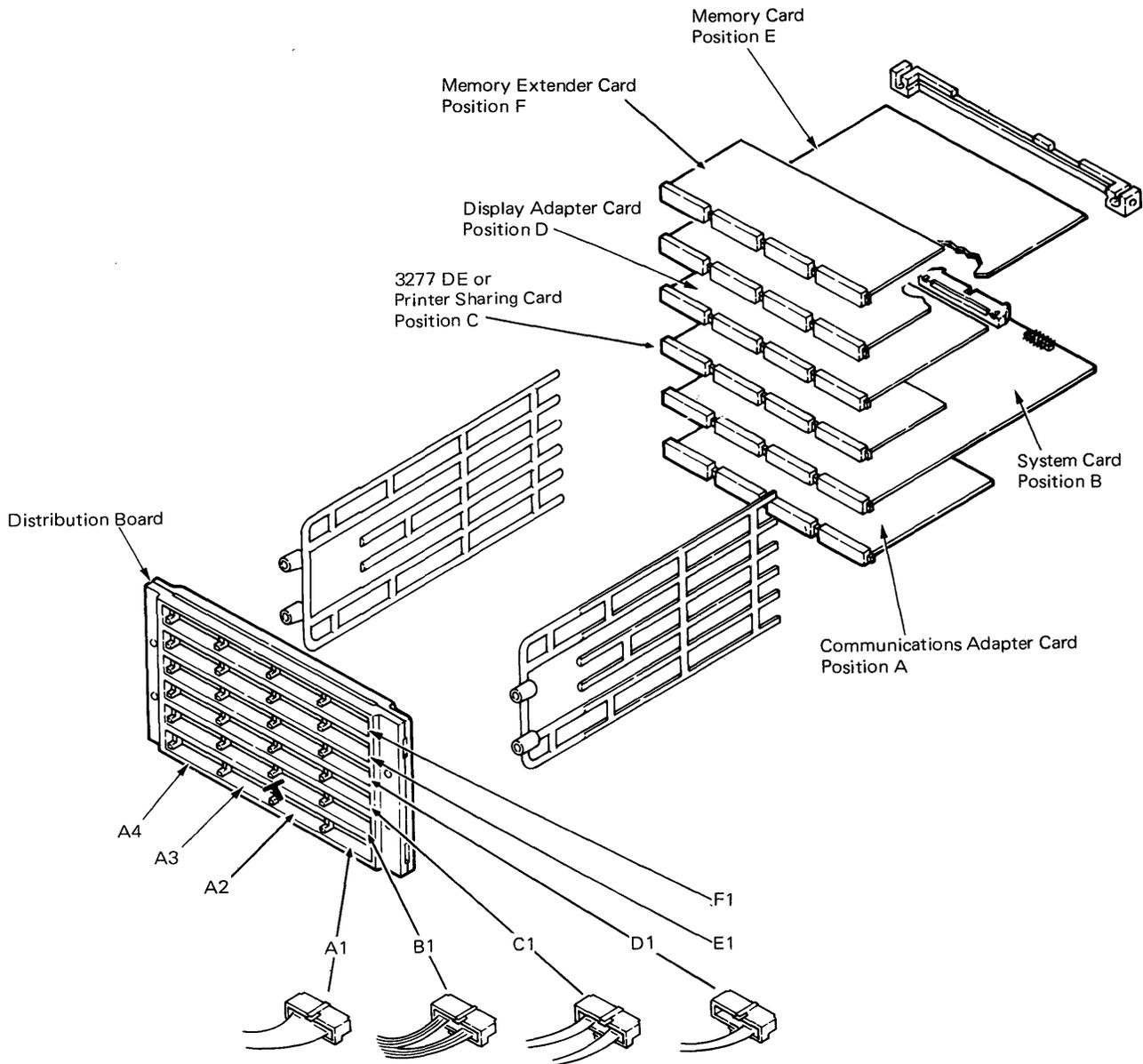


Figure 6-2. Work Station Electronics

SYSTEM CARD

The system card controls the following system functions.

- System Bus
- Microprocessor and Clock
- Read Only Storage (ROS)
- Interrupt Controller
- Keyboard Adapter
- Printer Data Link
- Timer.

The system card is connected to the distribution board in position B. The system card has two connectors on the back of the card for the system bus extension to the diskette drive (S1) and the signal wires for the lower five light emitting diodes (LEDs) on panel 1 (S2). These will be covered later in this section.

System Bus

The cards and function blocks (within the cards) are connected by the system bus (Figure 6-3) which carries data and instructions through the system.

The diskette adapter signal cable is an extension of the system bus. The diskette adapter card is in the diskette unit.

The bus buffers are system bus isolating devices (switches) used to separate the electronics into four sections (Figure 6-4) during the Basic Assurance Test (BAT) which occurs with each power on reset (POR). The sections of the electronics are tested one at a time.

During POR, the microprocessor, the clock, and Read Only Storage (ROS) are isolated and tested. Once the correct operation of this section is determined, the microprocessor turns on the bus buffers in sequence. Bus buffer 1 permits the microprocessor to check the timer, direct memory access (DMA), interrupt controller, printer data link, and keyboard adapter. Bus buffer 2 permits the microprocessor to check the memory card and the display adapter. Bus buffer 3 permits the microprocessor to test the diskette adapter to complete the BAT of the electronics (Figure 6-4).

If a failure is sensed, a pattern will be displayed on the lower five LEDs located on the electronics module base panel 1 or on the display.

Microprocessor

The system microprocessor is a single chip on the system card and controls

the system. It controls the system bus and the movement of data and has a clock to synchronize the data flow.

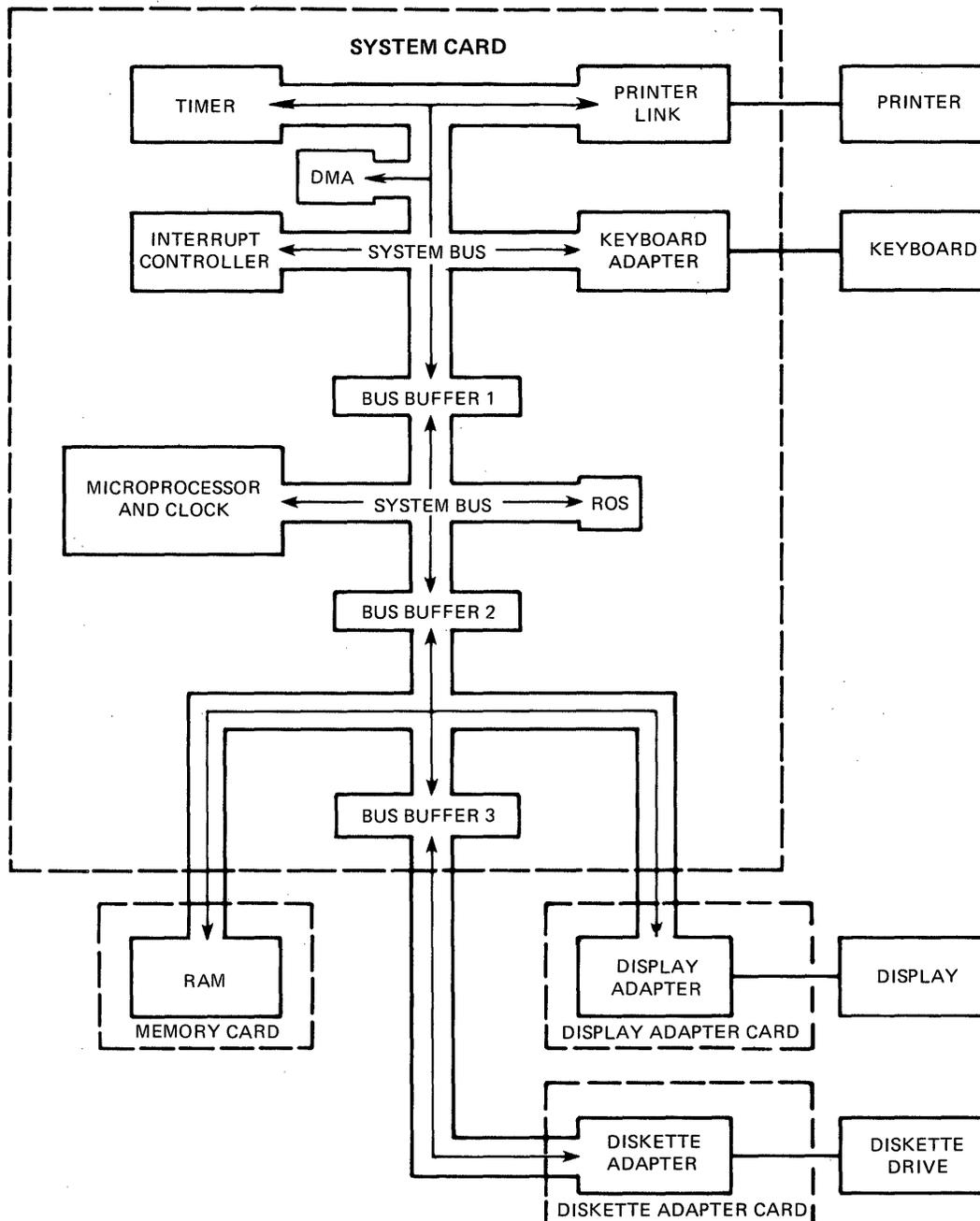


Figure 6-3. System Bus

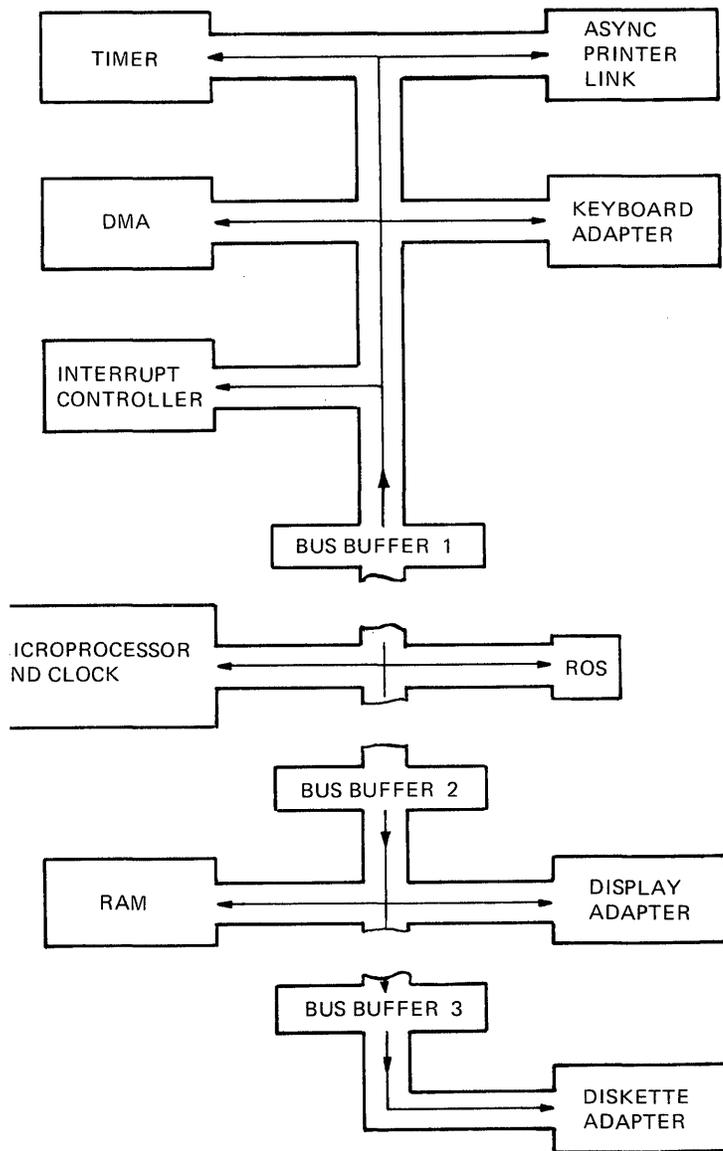


Figure 6-4. System Bus Isolation During BAT
Read Only Storage (ROS)

Read Only Storage is several electronic chips on the system card. It is a permanent storage area for the Basic Assurance Test (BAT), Resident Non-Automatic Diagnostics (RNA), Ini-

tial Program Load (IPL), and Memory Record program.

The instructions in ROS are a permanent part of the system hardware and cannot be changed. ROS is a storage area which can be read from, but cannot be written into.

Initial Program Load is a sequence of instructions stored in ROS that are automatically executed after each POR. These IPL instructions make it possible to load a program into the system.

Interrupt Controller

As the microprocessor moves and controls data, some system conditions may need attention. When these conditions occur, an interrupt request will be made to the microprocessor by the interrupt controller. The following interrupt requests are listed in their order priority and are maskable interrupts.

- Level 0 - Incoming data for printer sharing/3277 DE
- Level 1 - Transfer data to commo data link
- Level 2 - Printer and Mag Card data transfer
- Level 3 - Keyboard incoming data
- Level 4 - Diskette interrupt
- Level 5 - Not used
- Level 6 - Software timer
- Level 7 - Error on commo data link

When the microprocessor completes the instruction it is processing, it permits the interrupt. Any low level interrupt can be interrupted by a higher priority interrupt request (Figure 6-5). Once the maskable interrupt routine is complete, the main program will continue from where it was interrupted.

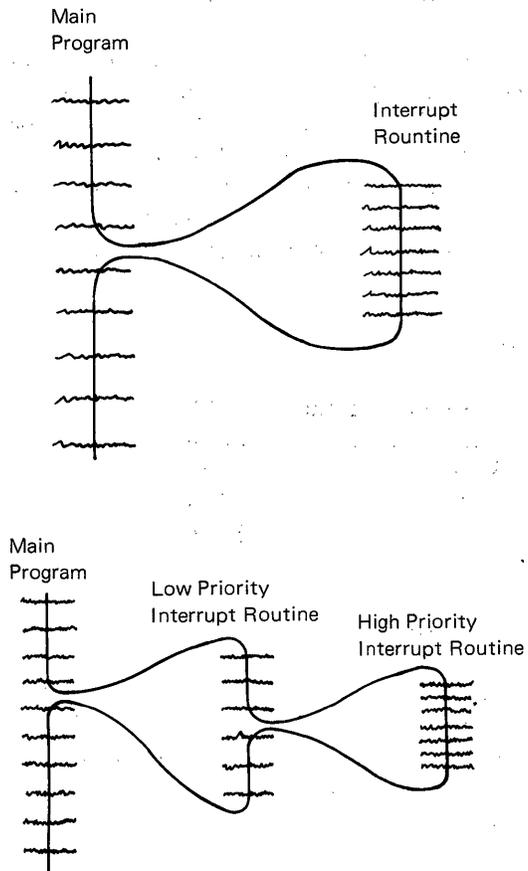


Figure 6-5. Interrupt Handling

There is also a non-maskable interrupt (NMI) which is a hardware interrupt. The NMI is an error reporting interrupt which reports errors in the system memory, system time out, or occurs when a dump switch operation is initiated.

Keyboard Adapter

This adapter is located on the system card and is the interface between the keyboard and the system electronics. It provides a path for data input and keyboard controls.

Direct Memory Access (DMA)

Direct Memory Access (DMA) controls the addressing of data to and from the diskette adapter card and the memory card during a read/write operation. DMA is also used during 3277 DE operations.

Timer

The timer is a clocking device on the system card that records the number of 50 millisecond intervals since the last IPL. The timer pulses are also used by the system software for diagnostic programs and customer programs.

Printer Data Link

The last major function on the system card is the printer data link, which is the interface between the system card and the printer. This interface provides a path for data transfer between the system electronics and the printer.

MEMORY CARDS

The Displaywriter has five memory types which are designated A to E. A description of the types follows:

- Type A. This memory configuration always consists of a 160A or a 192A base type memory card in row E of the distribution board.
- Type B. This memory configuration always consists of a 128K, 192K, 224K, or a 256K base memory card in row E of the distribution board.
- Type C. This memory configuration always consists of a 160A base type memory card in row E of the distribution board plus an appropriate type B memory extender card in row F.

- Type D. This memory configuration always consists of a 192A base type memory card in row E of the distribution board plus an appropriate type B memory extender card in row F.
- Type E. This memory configuration always consists of a 256B base type memory card in row E of the distribution board plus an appropriate type B memory extender card in row F.

See Figure 6-6 for memory configurations.

MEMORY CONFIGURATIONS

BYTES	MEMORY SIZE FIELD	ROW E	ROW F
128K	128B	128B*	
160K 160K	160A 160B	160A* 160B*	
192K 192K 192K	192A 192B 192C	192A* 192B* 160A*	32B**
224K 224K 224K	224B 224C 224D	224B* 160A* 192A*	64B** 32B**
256K 256K 256K	256B 256C 256D	256B* 160A* 192A*	96B** 64B**
320K 320K 320K	320C 320D 320E	160A* 192A* 256B*	160B** 128B** 64B**
384K	384E	256B*	128B**

* Base Memory Card

** Extender Memory Card

Figure 6-6. Memory Configurations

Program Memory Requirements

Listed are guidelines for IBM Licensed Program memory requirements. This list is only a guide, since system configurations and World Trade requirements may change the memory requirement. The proper sales literature has the latest requirements.

Texpack E	128K
Textpack 1	160K
Textpack 2	192K
ASYN Communcations	192K
BSC Communications	224K
Textpack 3	224K
Textpack 4	256K
Textpack 6	320K

DISKETTE ADAPTER CARD

The diskette adapter and file control cards are located in the diskette drive unit. The electronic signals needed for the diskette electronics are supplied through the extended system bus.

The display station supports the attachment of up to two diskette drives to provide high capacity storage. One diskette adapter card will support both the single and dual, type 1 and type 2D drive configurations.

The diskette adapter card is attached to the system bus through the bus extension. This adapter card provides the necessary control logic to interface between the diskette drives and the system bus. The diskette adapter card includes a microprocessor, a counter, a drive control, and the bus interface logic.

The track and sector information is located in the diskette address portion of the diskette adapter card. The command and status information which identify the current condition of the drives is contained in the command and status portions of the adapter card. The microprocessor pro-

vides automatic cyclic redundancy checks (CRC).

In a dual drive system, the software instructs the diskette adapter card microprocessor which diskette drive to use.

DISPLAY ADAPTER CARD

This card is connected to the distribution board assembly in position D. The display adapter card performs the following functions:

- Receive data from the system
- Generate a character dot flow
- Supply the display with vertical and horizontal signals
- Supply the display with RAM data

The system card microprocessor moves data to the random access memory (RAM) section of the display adapter card. The RAM is a 4K byte memory that performs a buffer function for the display. All data to be displayed is held in the buffer (RAM) and formed into a dot pattern. The dot pattern is sent to the display in time with the horizontal and vertical sweep signals generated by this card. This permits the character to be displayed in the correct form and position (Figure 6-7).

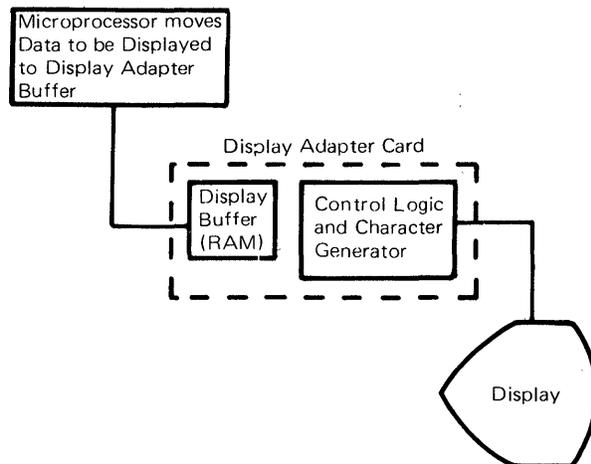


Figure 6-7. Display Data Flow

The display adapter card supplies the horizontal and vertical sweep signals that move the beam left to right and down the screen. These sweep signals generate a magnetic field that guides the beam to make a constant sweep pattern.

Each dot of the pattern sent by the display adapter makes a dot of light on the display screen. The display adapter keeps track of the beam while it sweeps across the display screen. When the beam is in the correct position a data signal is sent from the display adapter card, and a dot is seen at the correct position. While the sweep continues, more dots are sent to complete each character to be displayed (Figure 6-8).

Because the complete screen is covered by the sweep pattern approximately 35 times per second, the dots on the screen seem to be on constantly.

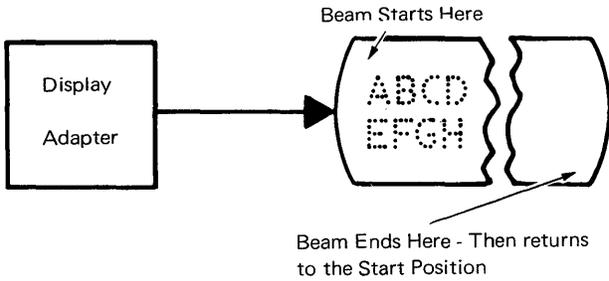


Figure 6-8. Display Character Formation

PRINTER SHARING CARD

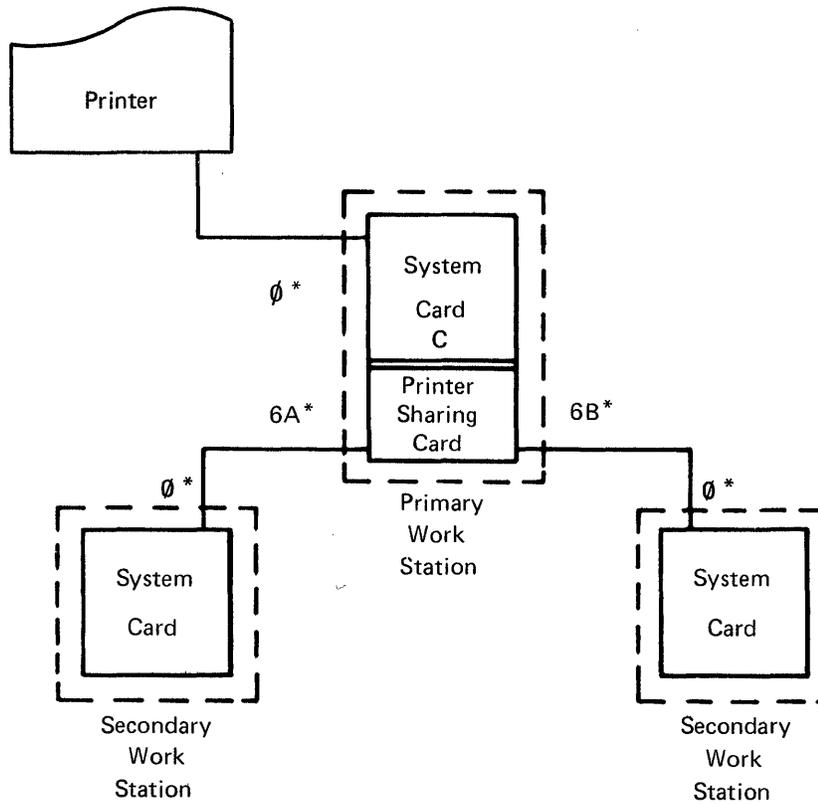
Printer sharing between work stations is a Displaywriter optional feature for the 40 and 60 CPS printers. Printer sharing is not supported for the 15.5 cps printer. One or two secondary work stations can share the printer of the primary work station.

In Figure 6-9, the work station that has the printer sharing card is the primary work station.

Printing tasks are sent from the secondary work stations to the primary work station. The primary work station handles printing priority, queuing of printer requests, and communications with the printer.

The status of the printer is displayed at the work station that requests tasks to be printed.

Control of the printer is assigned by the software, (Textpack II or above), and the work station is assigned by the printer sharing card. Once a work station has control of the printer, it maintains control until the operator releases control or until that work station's queue goes empty. Control will then go to the work station with the next queue number.



* Work station panel 1 connector positions.

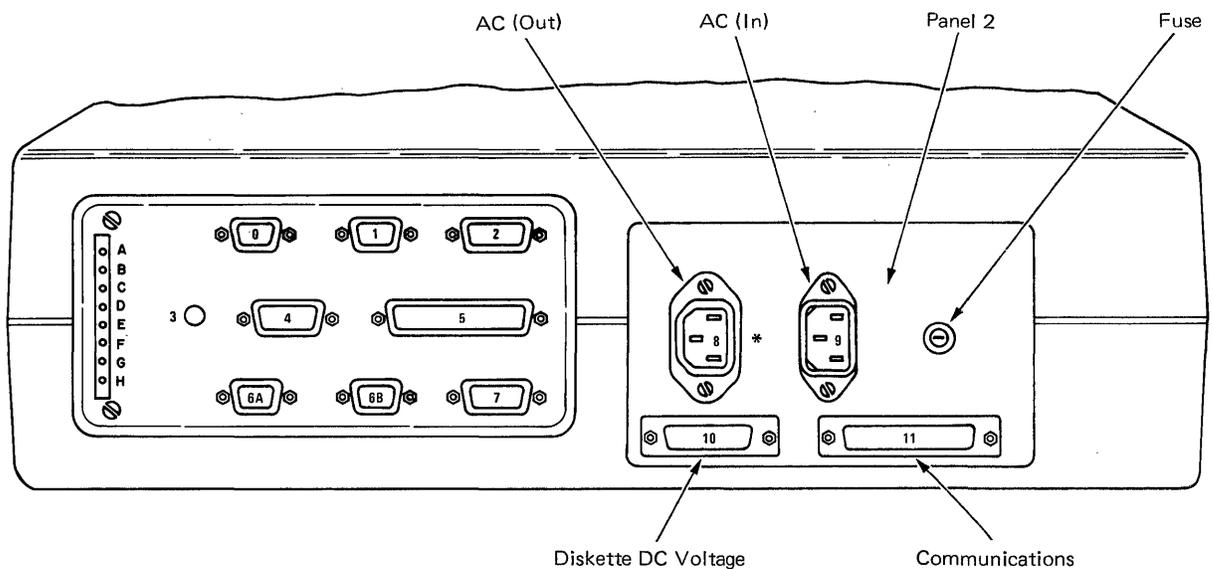
Figure 6-9. Printer Sharing Configuration

POWER SUPPLY THEORY

CAUTION

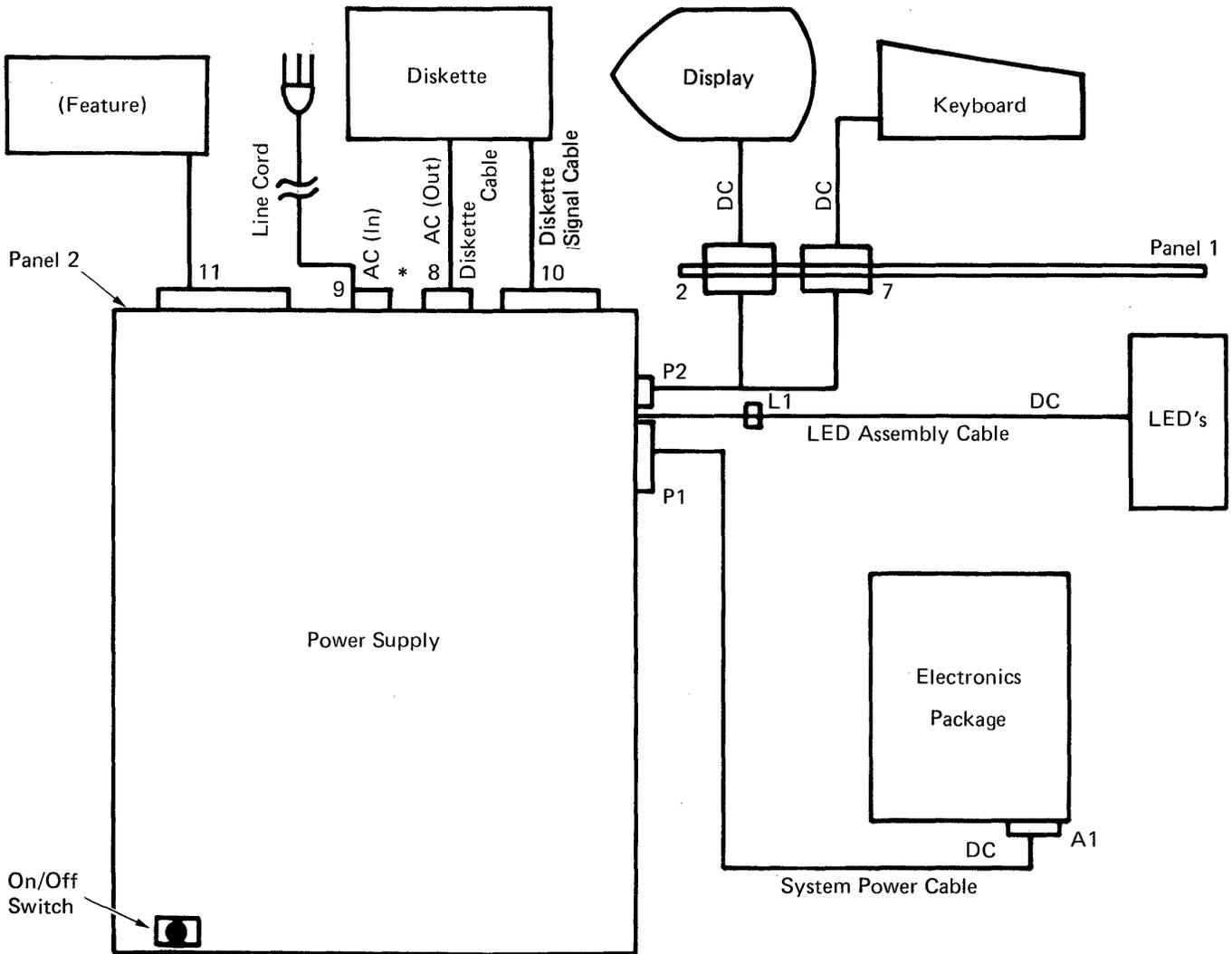
Do not remove the power supply covers. The power supply is a FRU and is replaced as a unit.

The system power supply contains the AC and DC distribution logic for the system and supplies DC voltage to the system electronics, keyboard, display, and diskette unit. The power on/off switch located on the front top cover of the supply controls all AC and DC voltage distribution (Figure 6-11).



* Connector 8 will be labeled 12 if Large Display is installed.

Figure 6-10. Electronics Panel 2 (Rear View)



* Connector 8 will be labeled 12 if Large Display is installed.

Figure 6-11. Power Supply Voltage Distribution

The power supply is fused, and operates with the following AC input voltages:

INPUT VOLTAGE	FUSE	
	Level 1	Level 2
US/Canada 104-127 VAC	7 Amp	10 Amp
WT (Except Canada) 90-137 VAC	6.3 Amp	10 Amp
WT (Except Canada) 180-254 VAC	5.0 Amp	5 Amp

The power supply is a field replaceable unit (FRU) and is located in the electronics module. The back panel of the power supply is electronic panel 2 (Figure 6-10). Located on panel 2 are the sockets for AC power in, switched AC power out (to the diskette module or the large display) DC voltage for communications, and the primary fuse.

The power supply provides the following DC voltages and currents to the system:

OUTPUT VOLTAGES	OPERATING CURRENT* (AMPERES)
+24.0 VDC	1.3
+12.0 VDC	.9
+12.0 VDC	1.6
+ 8.5 VDC	2.5
+ 5.0 VDC	16.0
- 5.0 VDC	0.5
-12.0 VDC	0.25

*Actual performance may exceed the current listed.

To prevent power supply and machine damage, overvoltage and undervoltage

protection circuits control the DC voltages. If any DC voltage level is under or over the voltage limits, the power supply will internally switch off. An overcurrent protection circuit is also supplied. It will cause a switch-off to occur if the combined current outputs are more than the power supply limits. Because the overcurrent protection controls the combined current flow in the power supply, a single DC circuit overcurrent may not cause an overcurrent switch-off. Overvoltage, undervoltage and overcurrent switch-off logic may be reset by turning the power switch off, then on.

A thermal protection circuit located inside the power supply protects the power supply and electronics from damage caused by too much heat. A fan in the power supply is used to distribute air through the electronics module to provide cooling. A thermal sensor will cause a thermal switch-off if the power supply overheats. A thermal switch-off can be reset by turning off the power switch and permitting the electronics module to cool.

DC VOLTAGE LEVEL	UNDERVOLTAGE/ OVERVOLTAGE LIMITS
+24.0 VDC	16.8 - 31.2
+12.0 VDC	8.4 - 15.6
+12.0 VDC	8.4 - 15.6
+ 8.5 VDC	5.95 - 11.05
+ 5.0 VDC	3.5 - 6.5
- 5.0 VDC	-3.5 - -6.5
-12.0 VDC	-8.4 - -15.6

When a switch-off occurs, the power supply will turn on one of the top three LEDs located on panel 1 to indicate which type of switch-off occurred (Figure 6-12).

- LED A Indicates overvoltage or undervoltage
- LED B Indicates overcurrent
- LED C Indicates overheat

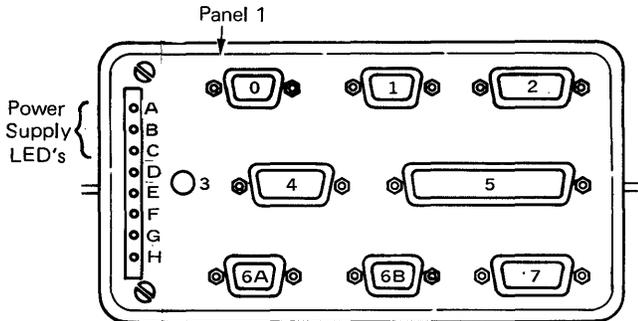


Figure 6-12. Electronics Panel 1 (Rear View)

POWER ON RESET

A power on reset (POR) sequence occurs each time the system power is turned

on. It ensures the electronic logic is set to start at a specific point. The power supply generates two reset signals to start the POR sequence. The first reset signal, POR system signal (-PORSYS), is sent to the system card. This signal permits the system card to generate a signal named system power on reset (-SPOR). The -SPOR signal initializes (resets) the system logic.

The second power supply POR signal, POR disconnect (-PORDIS), is sent to the diskette adapter card and has two functions. The first is to inhibit the write gate and the erase gate to prevent the writing on, or the erasing of, a diskette during power on reset. The second function is to initialize (reset) the diskette adapter card.

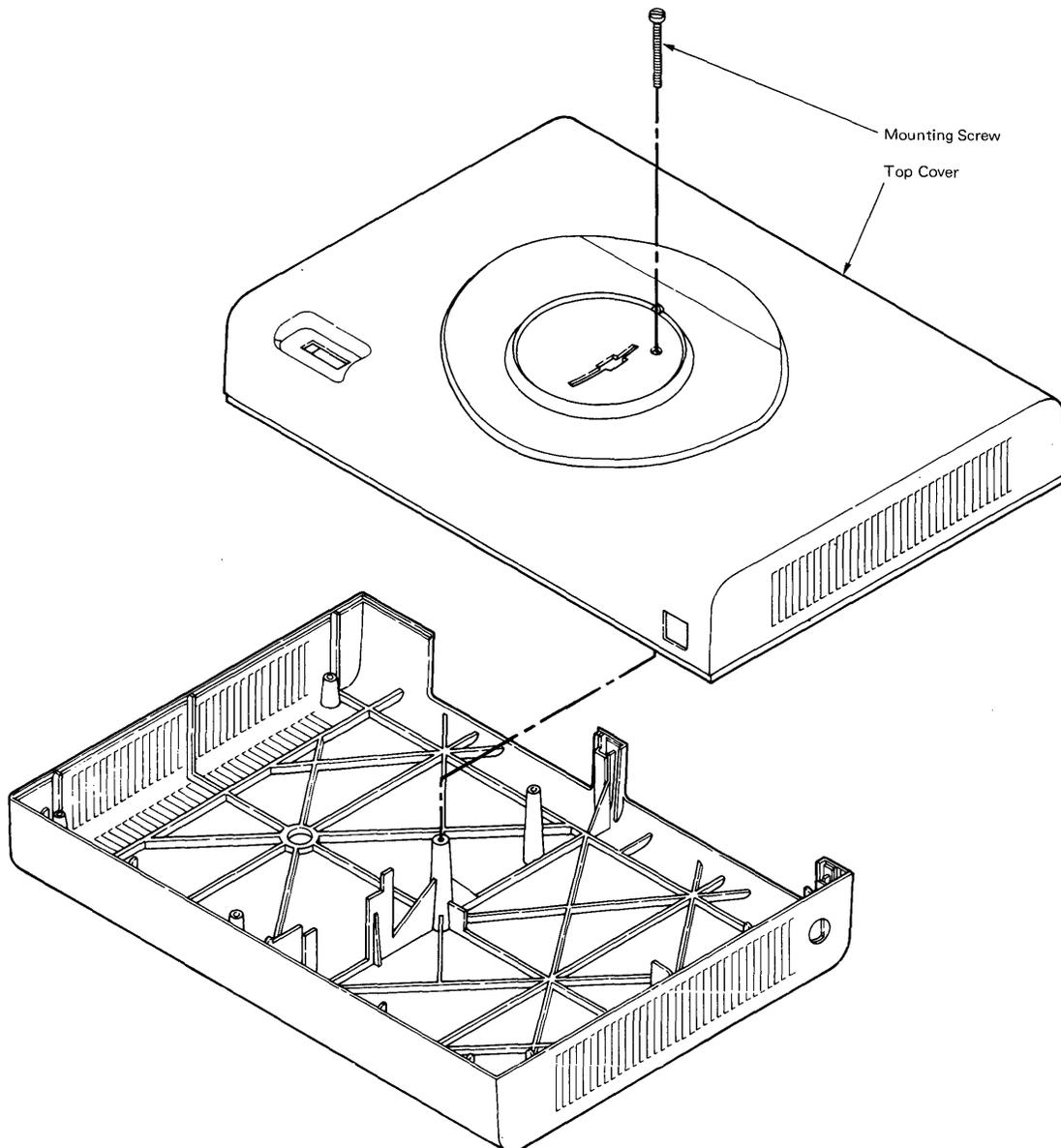
Note: Very fast power ON/OFF cycles are not recommended. This may prevent correct POR signal voltage levels. Whenever the power supply detects an error and turns on LEDs A or B, the power switch must be turned off for a minimum of eight seconds. This will allow the error detection circuits enough time to reset.

REMOVAL PROCEDURES

This section provides the removal procedures for the major assemblies of the electronics module. The parts drawings may be used to locate the components, if required. To install a part, reverse the procedures.

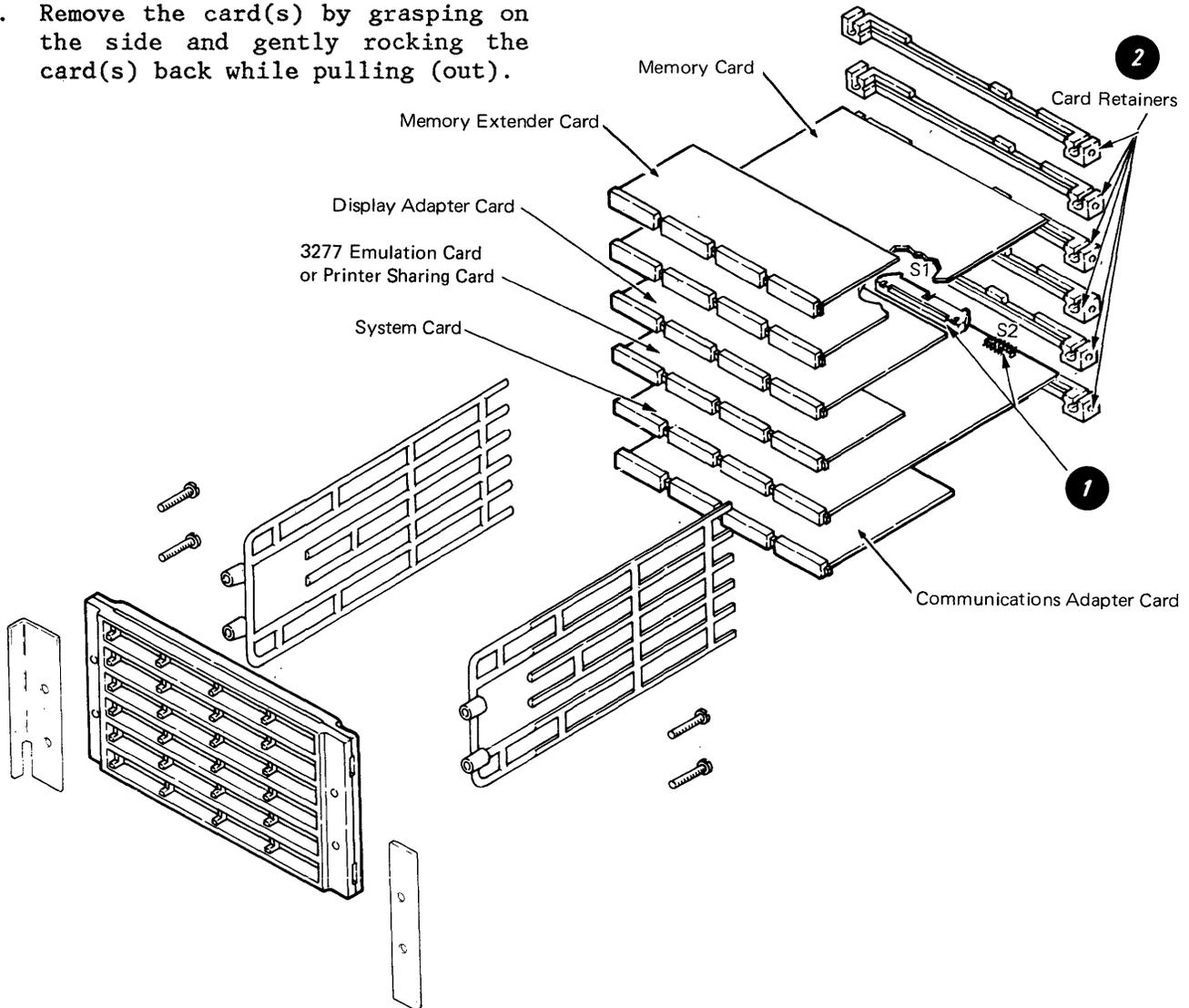
Cover Removal

1. Turn the system power off.
2. Perform the display module removal.
3. Remove the top cover mounting screw.
4. Remove the top cover.



Electronic Card(s) Removal

1. Turn the system power off.
2. Perform the display module removal.
3. Perform the electronic module cover removal.
4. Lift the electronic package out of the bottom cover.
5. Disconnect the S1 and S2 connectors if necessary ①.
6. Remove the card retainer(s) ②.
7. Remove the card(s) by grasping on the side and gently rocking the card(s) back while pulling (out).

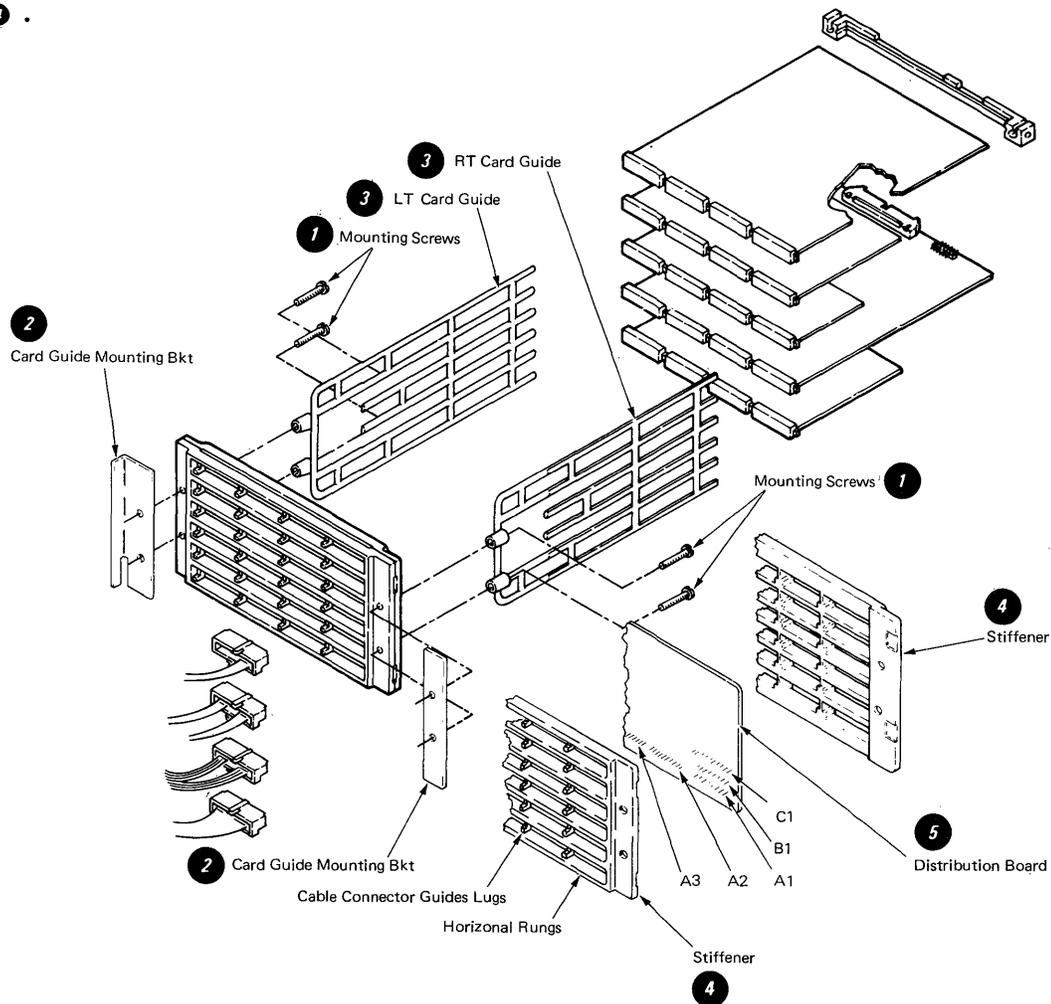


Distribution Board Removal

1. Turn the system power off.
2. Perform the display module removal.
3. Perform the top cover removal.
4. Disconnect the following connectors: S1, S2, A1, B1, C1, and D1.
5. Perform the electronics card(s) removal.
6. Remove the four card guide mounting screws ①, two card guide mounting brackets ②, and two card guides ③.
7. Separate the two stiffeners that enclose the distribution card ④.

Note: When reassembling the distribution board and stiffeners, use the following procedure to prevent multiple card damage.

8. Position the distribution board so connector A1 is in the lower right hand corner, as observed from the front of the electronics module ⑤.
9. The cable connector guide lugs must be on the top surface of the horizontal rungs on both stiffeners.
10. The cable connector openings must face away from the distribution board on both surfaces.

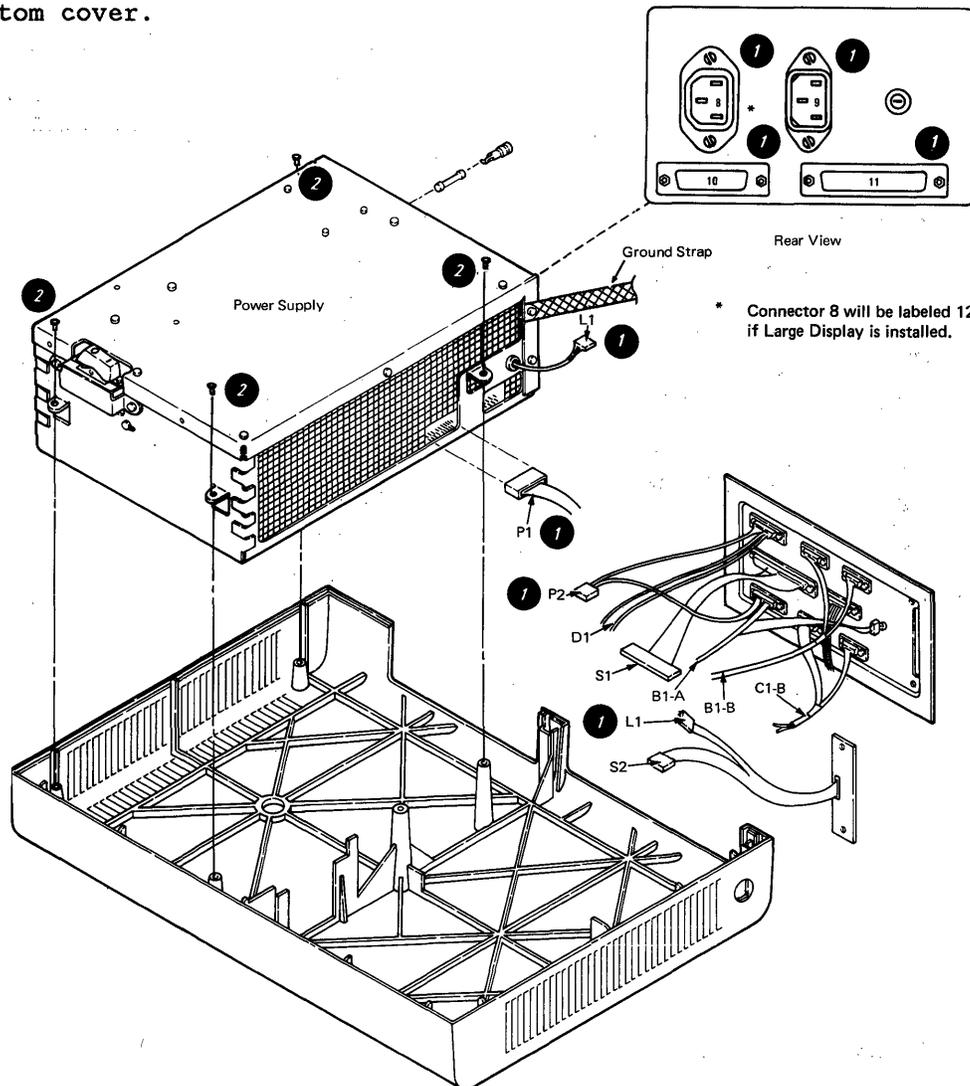


Power Supply Removal

CAUTION

Do not remove the power supply covers. The power supply is a FRU and is replaced as a unit. The power supply may be hot.

1. Turn the system power off and disconnect the system power cord.
2. Perform the display module removal.
3. Perform the top cover removal.
4. Lift the electronic package out of the bottom cover.
5. Disconnect the following connectors P-1, P-2, L-1 8, 9, 10, and 11 ①.
6. Disconnect the ground strap from the power supply.
7. Reinstall the electronic package.
8. Remove the four power supply mounting screws ②.
9. Lift the power supply up and out of the bottom cover.



CHAPTER 7. DISKETTE UNIT

LOCATOR

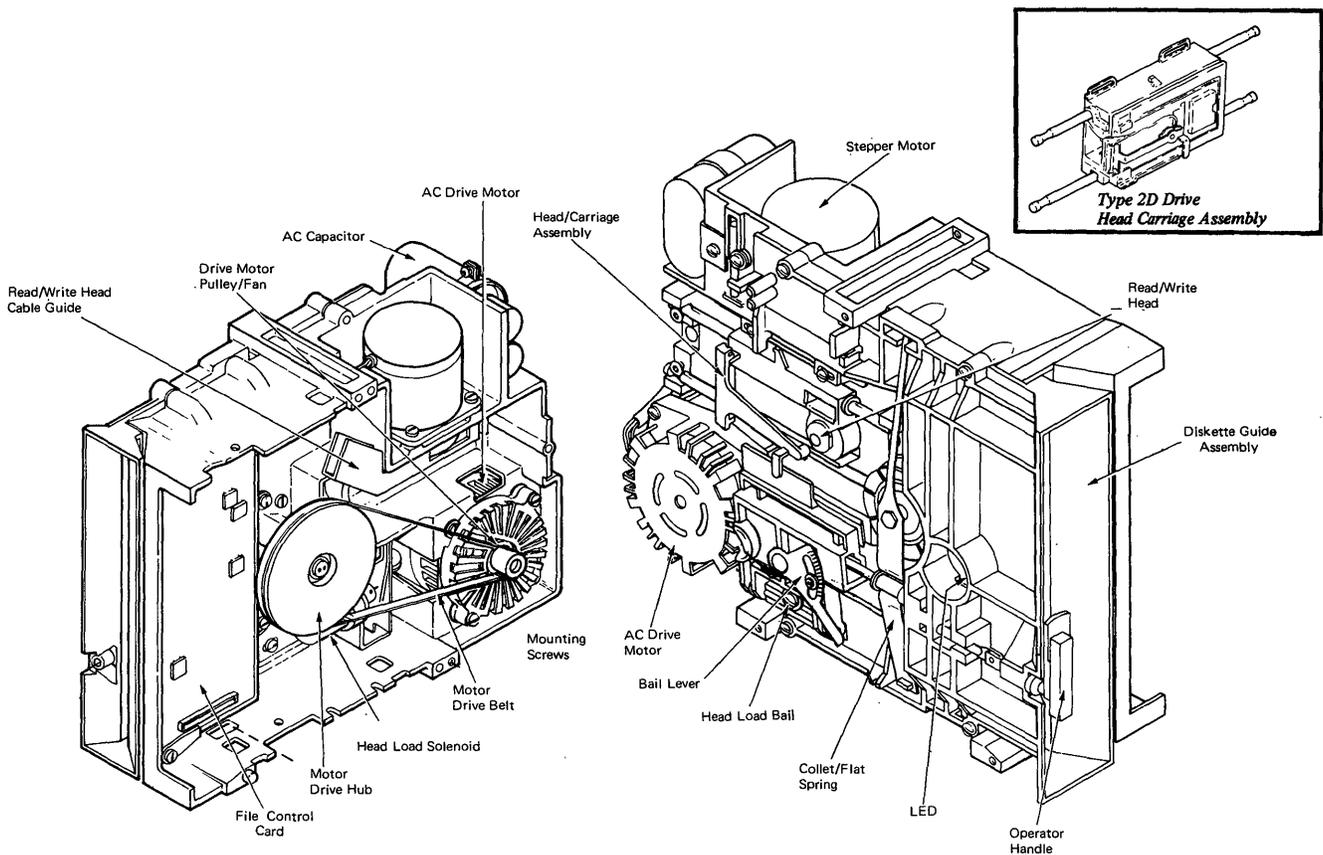


Figure 7-1. Diskette Unit Locations

DISKETTE UNIT THEORY

The diskette drive is used to read or write data on diskettes, and relies on the system for power, commands and controls. The diskette drive uses magnetic diskettes for data exchange and data storage (Figure 7-2). The IBM diskette is a thin, flexible disk, covered with metal oxide.

Data is written on the diskette by magnetically changing an area of the surface into a pattern of eight bits

known as a "byte". Each byte represents one data character, either alpha/numeric or a code.

An operator can create text in system memory and record it on the diskette. The operator can move text from the diskette to the memory area, and return revised material to the diskette. After checking for a correct diskette write operation, the system clears the memory and makes it available for other jobs.

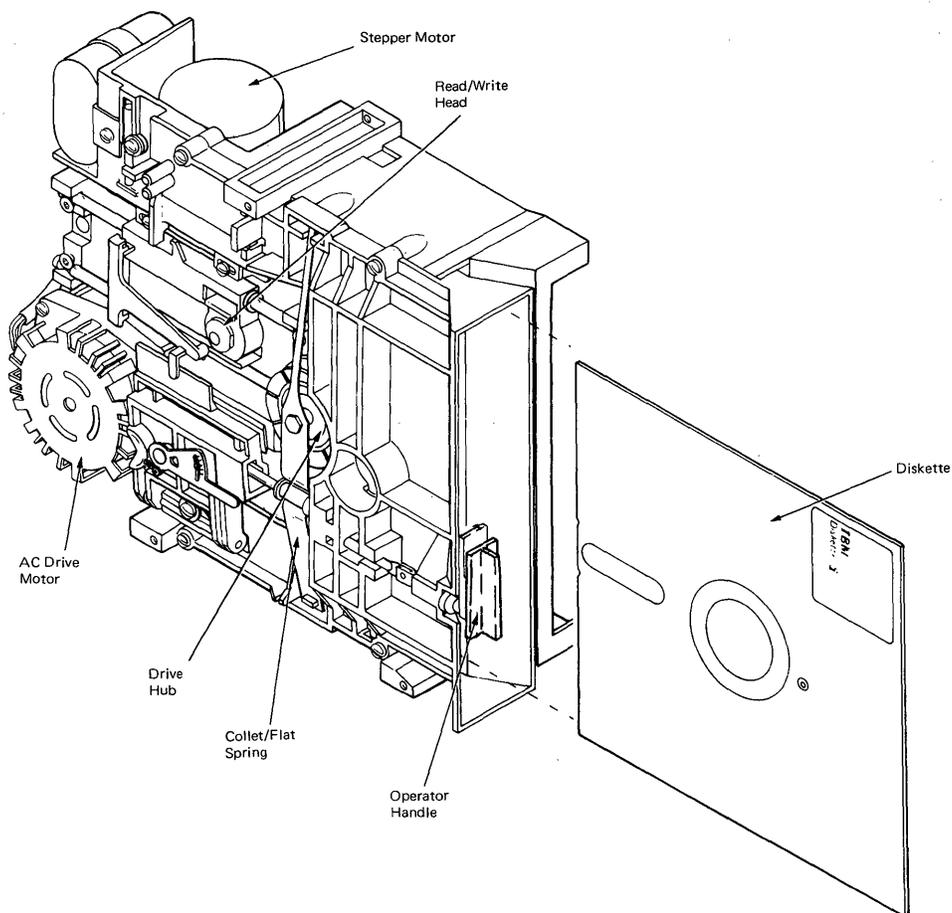


Figure 7-2. Diskette Drive Unit

DISKETTE THEORY

The IBM Diskette is divided into 77 circular tracks numbered 00 through 76 (Figure 7-3). As the diskette turns, data is magnetically recorded on these tracks by the read/write head. Track 00 is the index or address track and is divided into 26 sectors having 128 bytes of information each. This track contains the information necessary to identify the diskette and its contents. The index track cannot be used for data storage. Tracks 01 through 76 are data tracks and are divided into 15 sectors for the Type 2D diskette. Track numbers 75 and 76 are reserved to take the place of any primary tracks (01-74) that have failed. The Type 1 can hold up to 284,000 bytes of usable information and the Type 2D can hold up to 985,000 bytes of usable information.

Each sector of each data track starts with its own address and contains 256 bytes of data. Each time the diskette does a read or write operation, a complete sector on the selected track is either read into or written from the main storage area.

The IBM Diskette is permanently contained in an envelope for protection. The inner surface of the envelope is coated with a material which cleans the diskette as it turns inside the envelope.

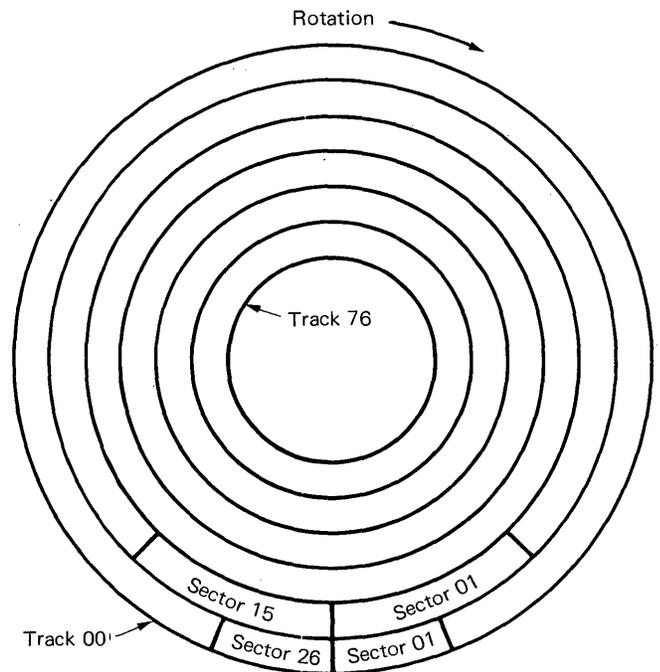


Figure 7-3. Diskette Tracks and Sectors

There are six physical features on Type 1 diskettes and seven on Type 2D. (Figure 7-4):

1. Permanent Diskette Label. This label is not removed. It is available to the user for identifying the diskette.
2. Temporary Label. This label is adhesive and should be used for temporary information such as the last user, date, name of user, etc.
3. Index Hole (Type 1 Diskette). The outer circle identifies a hole in the diskette 1 envelope; the inner circle shows the index hole in the diskette. When these two holes are aligned while the diskette is turning in the drive, the D1 Light Emitting Diode (LED) will transmit light to the D1 Photo Transistor (PTX).

4. Index Hole (Type 2D Diskette). The outer circle identifies a hole in the diskette 2D envelope; the inner circle shows the index hole in the diskette. When these two holes are aligned while the diskette is turning in the drive, the D2 Light Emitting Diode (LED) will transmit light to the D2 Photo Transistor (PTX).
5. Collet (Drive Sprindle) Hole. The outer circle identifies the hole in the diskette envelope, permitting the collet access to the diskette. The inner circle is where the collet will come into contact with the diskette and clamp it to the drive hub.
6. Read/Write Head Opening. The head opening permits the head access to the diskette surface. The read/write head moves along the length of the opening to a given position (track) on the diskette.
7. Stress Relief Notches. If the diskette is accidentally bent, the stress relief notches will aid in distributing the stress in the head opening area.

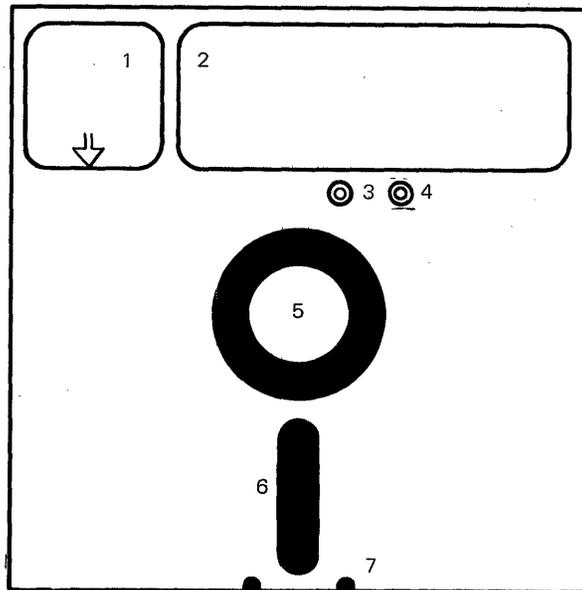


Figure 7-4. Diskette Features

DISKETTE HANDLING

To prevent diskette damage, observe the following procedures and precautions:

- Do not use paper clips or rubber bands on the diskette.
- Do not place heavy items on a diskette.
- Place diskettes in their envelopes and store in the following conditions:

Temperature: 10.0° to 51.5° C.
(50° to 125° F.)

Relative humidity: 8% to 80%

- If the diskette remains outside of the machine's temperature environmental range (shown above), do not use it for at least five minutes. The diskette should be removed from its shipping or storage envelope during this time.

- Keep the diskette away from magnetic fields.
- Always return the diskette to its storage envelope after it is removed from the diskette drive.
- Contaminated diskettes (pencil marks, finger prints, cleaning fluid) can cause data errors, equipment errors, or head damage.
- Diskettes that are creased or bent can cause read/write head damage and should not be used.
- Damaged diskettes should not be inserted into the drive.

The diskette must be inserted properly for correct operation. Follow this procedure (Figure 7-5):

1. Turn the handle to the open (vertical) position.
2. Remove the diskette from its shipping/storage envelope.
3. Place the diskette squarely into the diskette drive with the label up, facing the handle, read/write head opening first.
4. Turn the handle to the closed (horizontal) position.

Note: The type 1 drive handle is labeled 1, and the type 2D drive handle is labeled 1/2D.

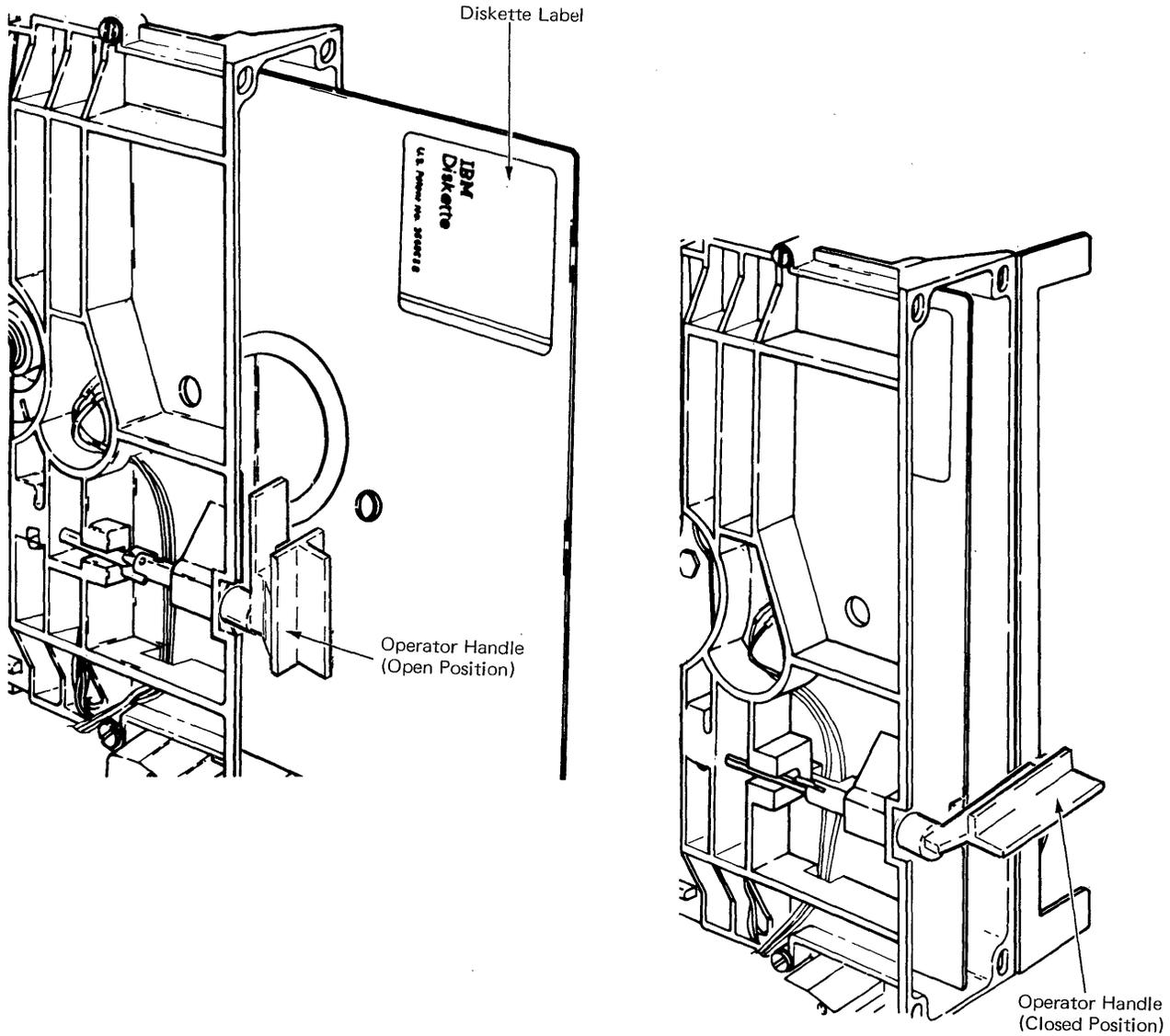


Figure 7-5. Inserting Diskette Into Drive Unit

MOTOR AND DRIVE

The purpose of the motor and drive is to turn the diskette at a constant speed (Figure 7-6). When the system is turned on, voltage is present at the drive motor terminal and the motor will turn. The drive motor is a capacitor start, 1800 rpm motor attached to the diskette frame by four

screws. The motor aligns itself in its mounting holes.

CAUTION

The system supplies AC and DC power to the diskette unit. AC line voltage is present at the drive motor and capacitor terminals anytime the system is turned on.

Motor and solenoid housings become hot after continuous use. Let surfaces cool before servicing them.

The drive motor pulley is attached to the drive motor shaft with a locking setscrew. The drive motor pulley turns the drive belt which turns the drive hub assembly. The drive hub

assembly is supported by two bearings attached to the diskette frame. The complete hub assembly is plant adjusted and cannot be replaced in the field. A problem with the drive hub assembly can only be corrected by exchanging the complete diskette drive unit.

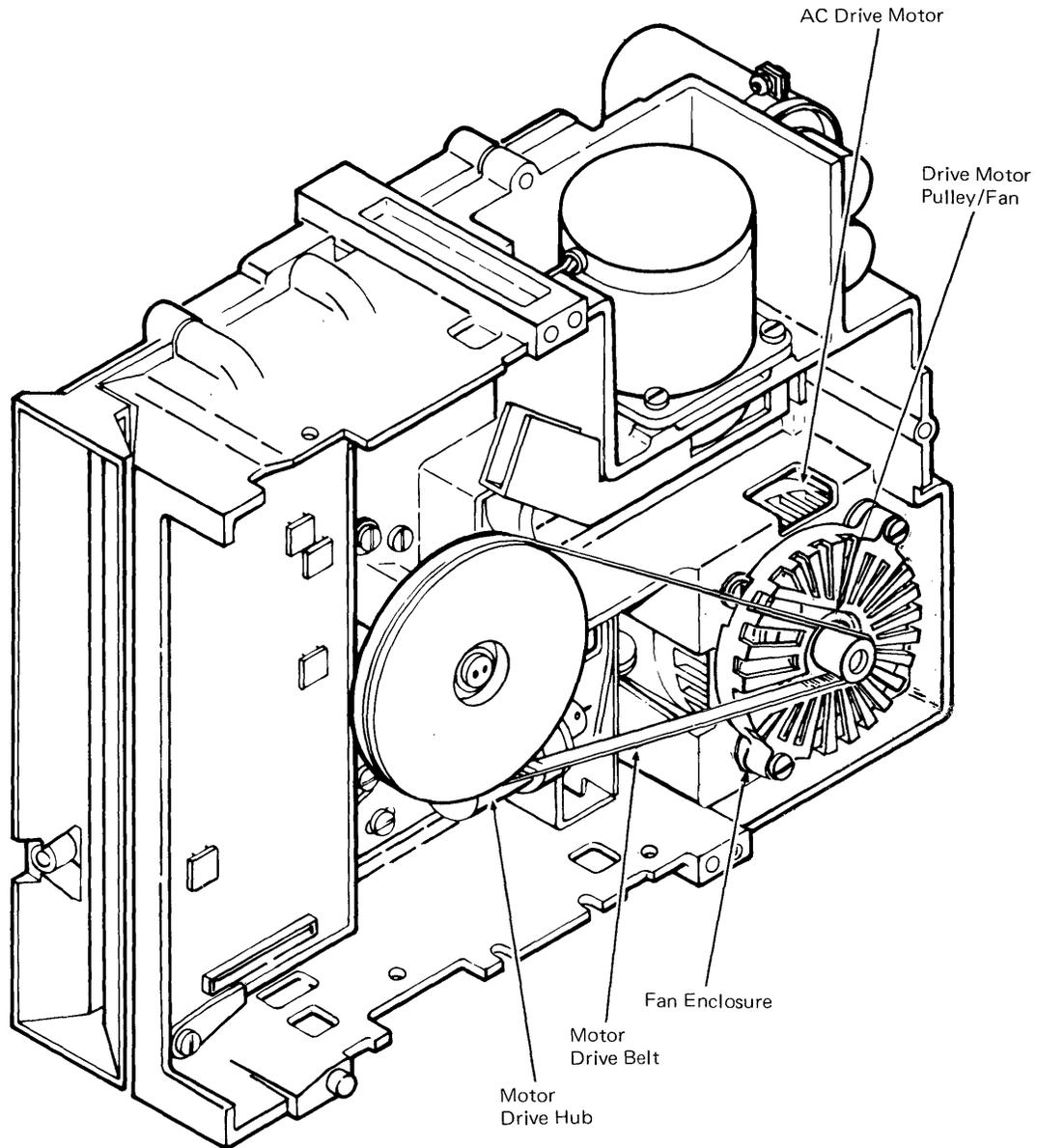


Figure 7-6. Motor and Drive

HUB DRIVE AND COLLET

The collet is a spring-loaded spindle attached to a large flat spring which clamps the center of the diskette to the drive hub and pulley assembly. When the operator handle is turned to

the closed position the actuator roll assembly, attached to the collet actuator rod, pushes the flat spring and collet spindle into the drive hub trapping the diskette (Figure 7-7). The diskette then turns with the drive hub assembly.

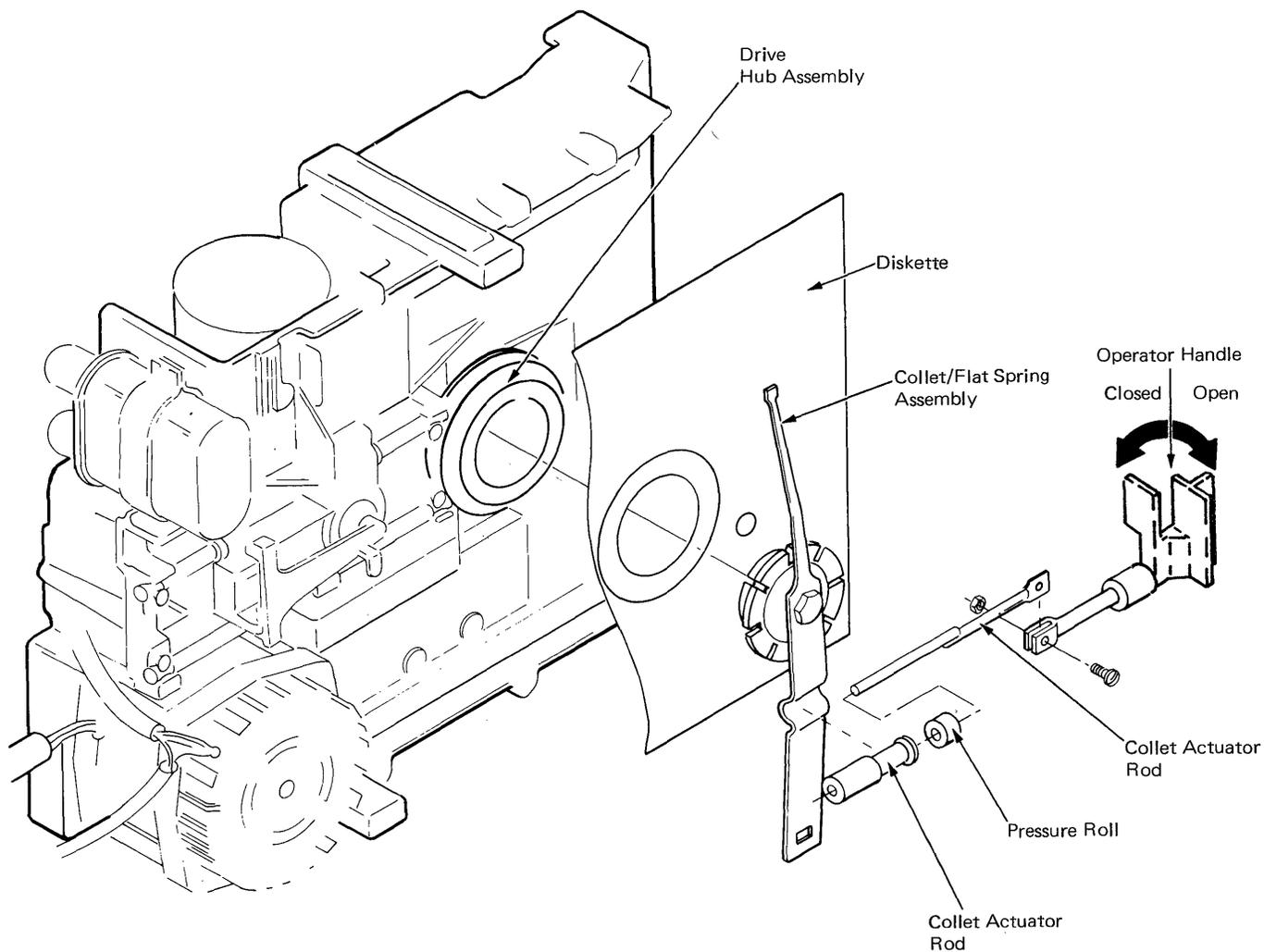


Figure 7-7. Hub Drive Collet (Left Rear View)

LED/PTX

A Light Emitting Diode (LED) and a Phototransistor (PTX) are used to sense diskette rotation (Figure 7-8). The diskette has a small hole in its inner edge which passes the LED and is sensed by the PTX with each revolution. As the diskette continues to turn, the light to the PTX is cut off. This causes a light pulse six times per second or every 166.7 milliseconds. These pulses indicate to the file control card that the diskette is

turning and are reference points for the diskette adapter to check the speed of the diskette (360 Revolutions per Minute (RPM)). Operation of the diskette drive will continue normally if the pulse period does not change from 166.7 ms by more than 4.2 ms (162.5 ms to 170.9 ms).

The type 2D drive operates the same except the LED is a dual LED that also indicates to the file control card the type of diskette turning in the drive.

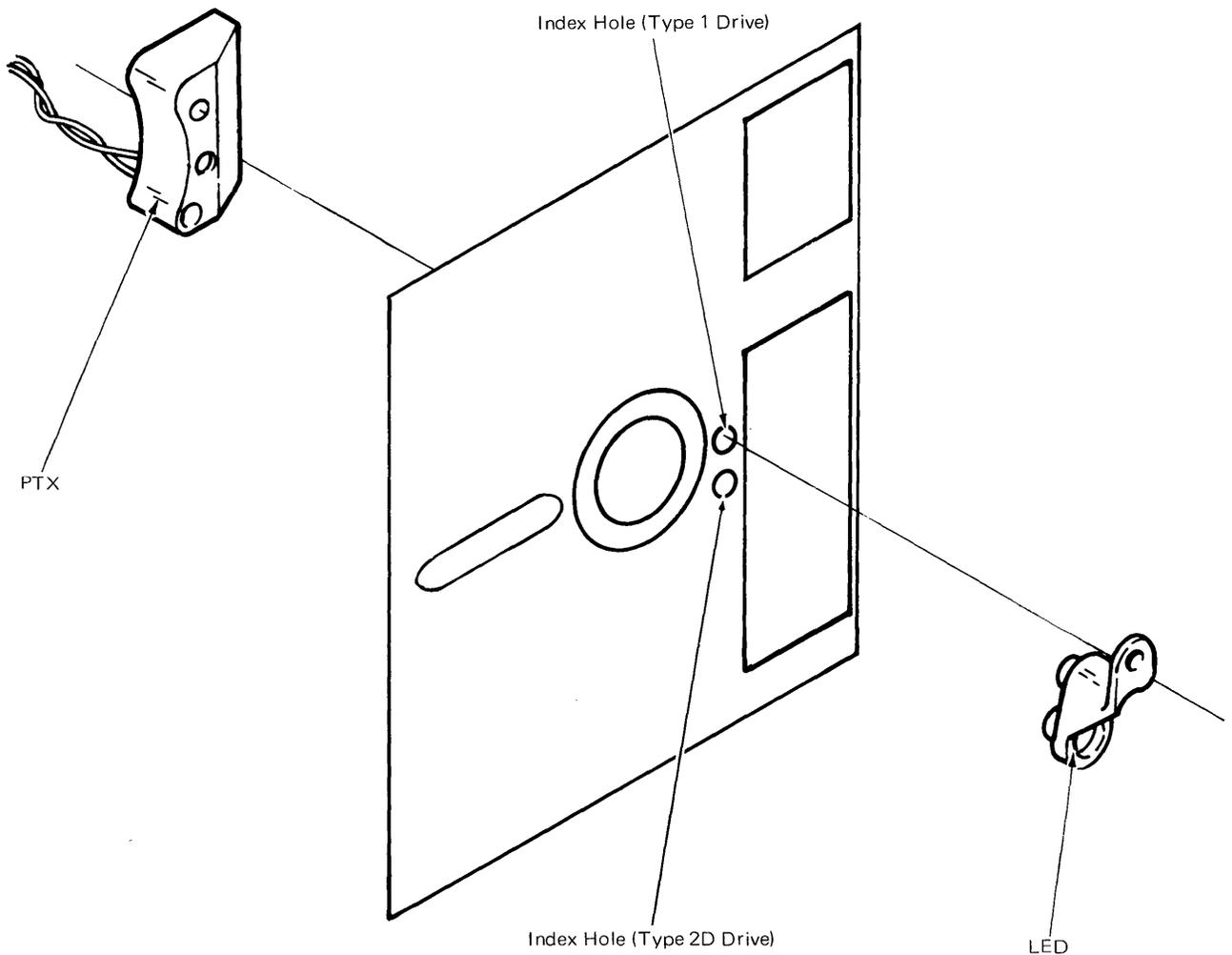


Figure 7-8. LED/PTX

HEAD LOAD

During a read/write operation (activated), the diskette is forced against the read/write head by the head load arm. In the de-activated position, the head load arm is held away from the diskette by the head load bail assembly (Figure 7-9). The head load

bail pivots on a rod attached to the diskette guide by a retainer screw and washer.

For the type 2D drive, both heads are loaded against the diskette during a read/write operation (the heads are on opposite sides of the diskette).

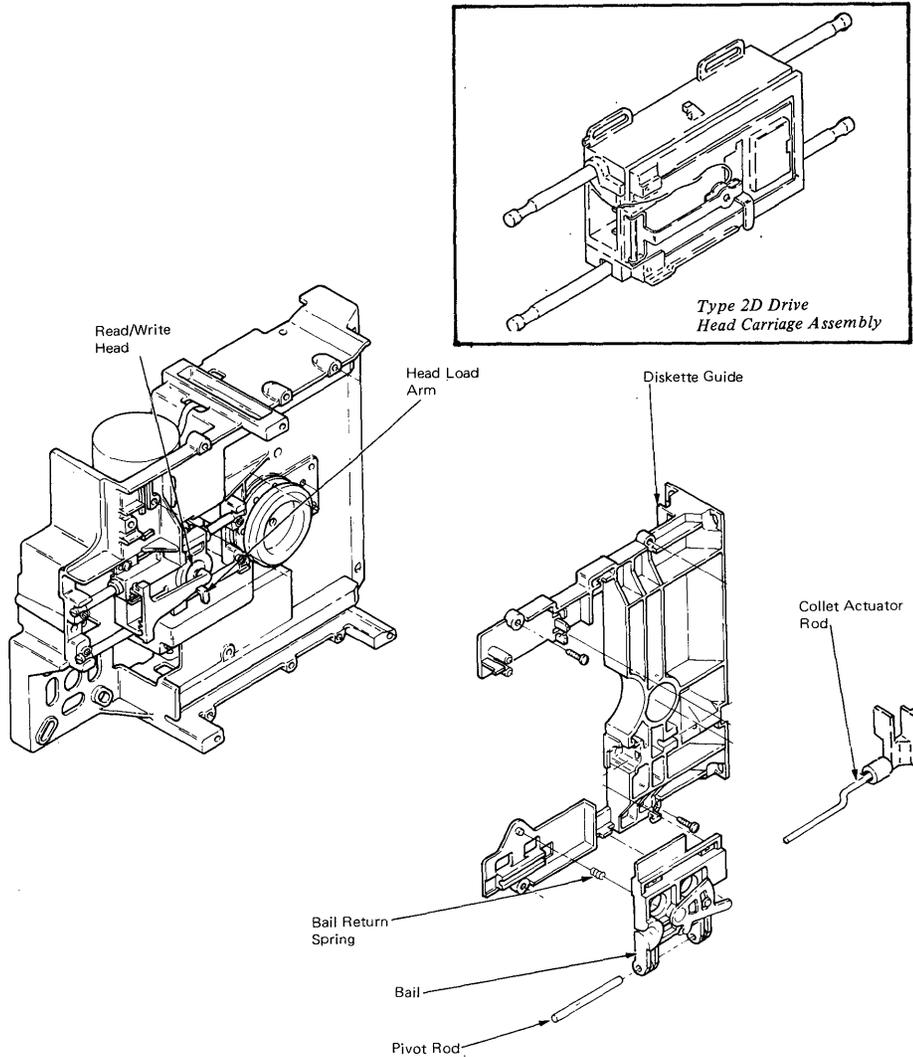


Figure 7-9. Head Load Assembly

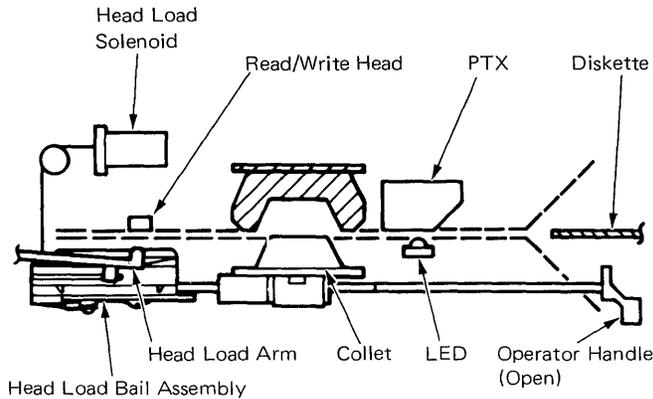


Figure 7-10. Head Load Mechanism

When the operator handle is turned to the closed position, the collet actuator rod releases its outward pressure on the head load bail assembly (Figure 7-11).

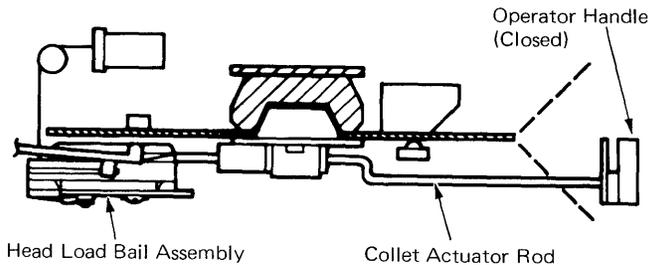


Figure 7-11. Head Load Solenoid De-activated

A head load command from the system electronics activates the head load

solenoid. When the head load solenoid is activated, the solenoid cable pulls the bail assembly toward the frame (Figure 7-12).

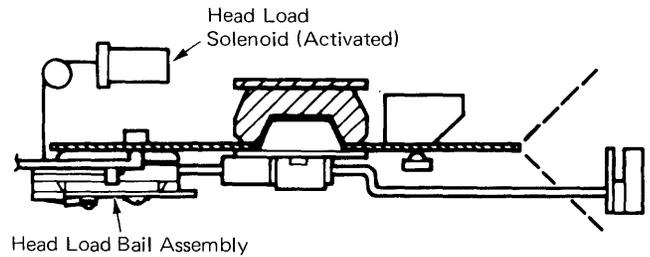


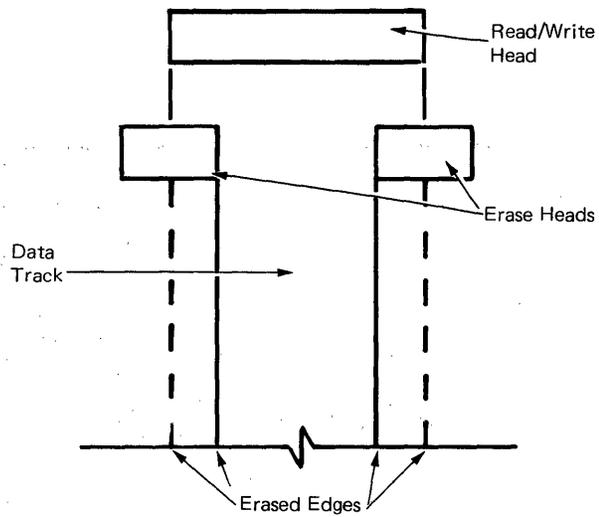
Figure 7-12. Head Load Solenoid Activated

The head load arm, which is spring loaded against the bail assembly, follows, pressing the diskette against the read/write head.

A head load pad inside the head load arm contacts the diskette. A badly worn or distorted head load pad can cause read/write problems or head damage. A head load pad repair kit for exchanging worn pads is available with instructions.

READ/WRITE HEAD

The read/write head is divided into three sections: A read/write section and two erase sections. The erase sections are located on either side of the data track and erase the edges of the data track during a write operation.



STEPPER MOTOR - HEAD CARRIAGE ASSEMBLY

A stepping operation moves the head carriage assembly from one track to another. The head carriage assembly slides on two guide rods and contains the read/write head(s). The 24 Volt DC stepper motor shaft turns 1.8 degrees in either direction under control of the access signals. This moves the head carriage one track. A flexible steel band attached to the stepper motor pulley, moves the head carriage assembly (Figure 7-14).

Figure 7-13. Read/Write Data Track

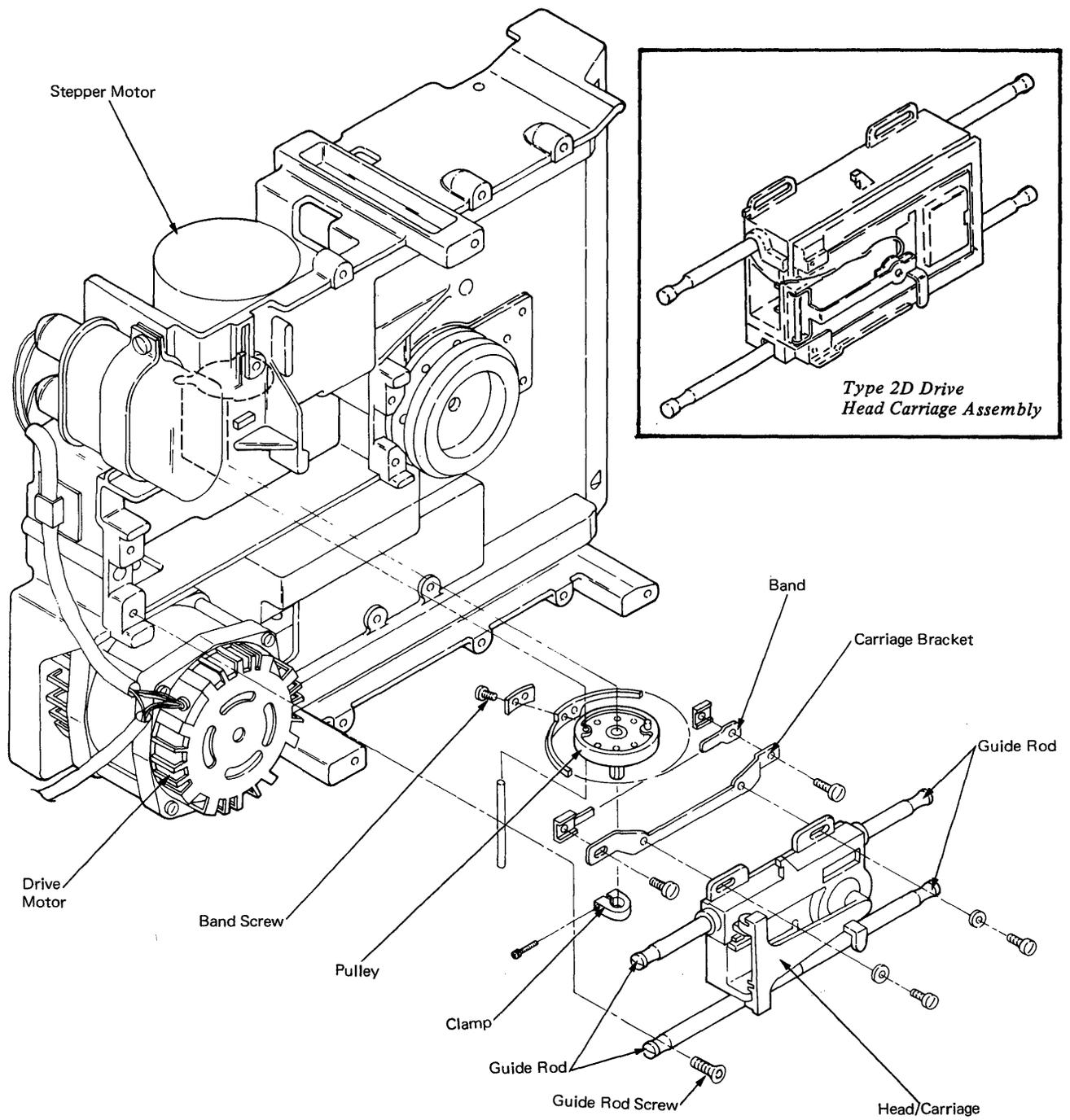


Figure 7-14. Head Carriage Assembly

DISKETTE ADAPTER CARD

The diskette adapter card controls the flow of data to and from the diskette unit. It accepts signals and control commands from the system card and uses them to supply all logic and signals required to operate the diskette drive.

The adapter card is an interface between the system card and the diskette drives and supplies the following circuits:

- Basic Assurance Test (BAT). The diskette adapter microprocessor controls the flow and timing of data under the control of the system card. The adapter tests itself following each power on reset.

This test is in two sections. First the cable from the system card to the adapter card is checked. Then the read function on the diskette adapter card is tested.
- Drive Status. This status includes fault, write protect, ready, track 0, two side, and head address data.
- Track Position. The adapter stores the track position in the track position counter.
- Diskette Drive Selection. The adapter controls the selection of the diskette unit. This selection depends upon the input of the application program diskette. The application program will select the proper diskette drive if a dual diskette drive unit is present.
- Track Step Timing. Clock circuits on the adapter card control the length of each step operation (5 milliseconds). At the end of the last step 35 milliseconds is added to allow the head/carriage assembly to settle.
- Diskette RPM Monitor. The adapter monitors the pulses from the light emitting diode/phototransistor.
- Access Line Encoding. The adapter card provides the correct combination of signals required to step the head carriage in the correct direction.
- Head Load Operation. The adapter activates and deactivates the head load solenoid.
- Error Sensing/Corrections. Error conditions are sensed, and corrected if possible, by the adapter card. Error conditions not corrected are relayed to the system card in the form of interrupt requests.
- Interrupt Request. The adapter card uses this line to signal the system card that the diskette drive needs attention from the system card. Drive status provides the input to interrupt request.
- Serialization-Deserialization (SERDES) of Data. Data is transmitted between the system card and the diskette adapter card through eight data bit lines at the same time and received at the card as parallel data. The SERDES circuit converts the parallel data to serial data.

FILE CONTROL CARD

The File Control Card, (Figure 7-15) attached to the right side of each diskette drive frame, contains circuits for the stepper motor, the head load solenoid, and the read/write functions. The card also contains the amplifier circuits for the read/write head and the LED/phototransistor (PTX).

This card is controlled by signals from the diskette adapter card, located behind the diskette drive unit. These signals and a description of their functions are:

- Write Data. A signal on this line causes current changes in the read/write head, and data is written on the diskette.
- Inner Tracks. This signal decreases write current on the inner tracks because of the higher bit density of these tracks. The signal changes between track 42 and 43. On the type 2D drive, the inner tracks signal is also used to increase the read amplifier gain from track 43 through track 76.
- Write Gate. This signal activates the write circuits.
- Select Head 1. This signal selects head 1.
- Erase Gate. This signal activates the erase circuits to erase the edges of the data track just written and prevents reading across tracks during read operations.
- Switch Filter. This line is active at tracks 62 and above and is used during high density read operations.
- Write/Erase Enable. This signal is activated by the file control card when the write or erase gate signals are sensed during a read operation.
- File Data. This is a series of clock and data pulses that represent the data read from the diskette.
- Index. A signal on this line indicates the beginning of a track to the diskette adapter. It is a 1.5 to 3.0 milliseconds pulse that occurs every revolution of the diskette.
- Diskette Sense. On the type 1 drive this signal is tied to ground to always indicate a diskette 1. On a type 2D drive, this signal indicates a diskette 2D is being used. A diskette 1 does not activate this line.
- Drive Present. This signal indicates to the diskette adapter that there is a drive unit present.
- Access 0 and 1. The two access lines are activated in sequence to cause the stepper motor to turn.
- Head Engage. This signal operates the head load solenoid and engages the head load bail.

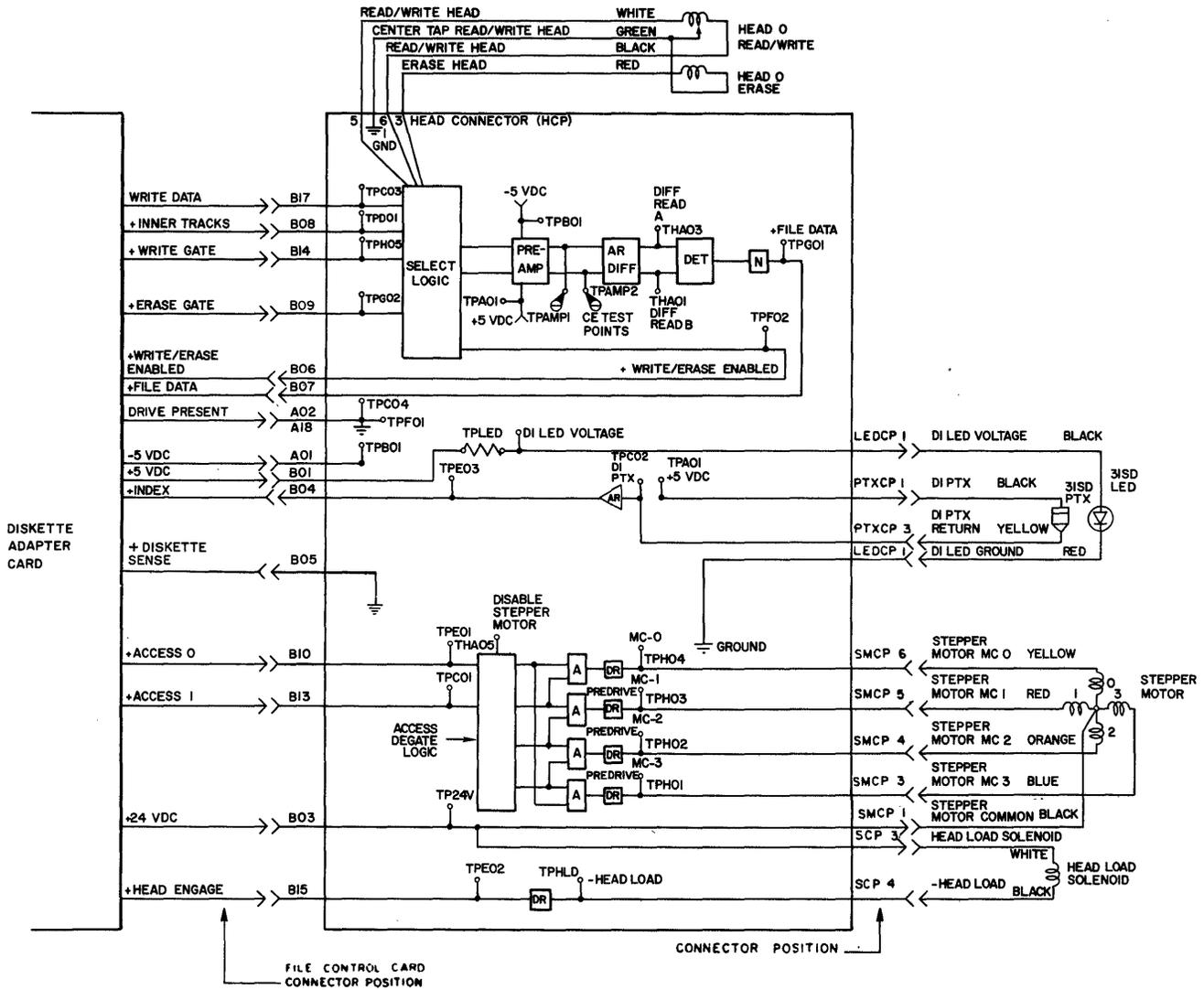


Figure 7-15. File Control Card - Type 1 Drive

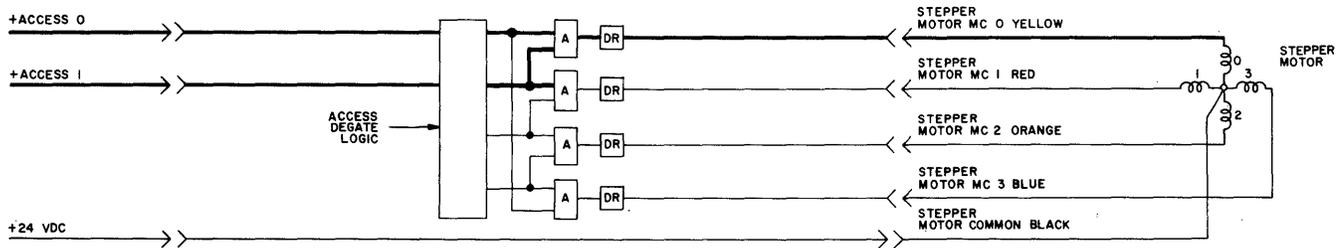


Figure 7-17. Stepping Signals

Two signals, access 0 and access 1, activate the stepper motor. These two signals are sent through an Access Degate logic block (Figure 7-17) through an AND (A) block where they are combined, then through an amplifier to increase the signal before going to the motor control line. At this point, motor control line becomes an electrical detent. The stepper motor armature will turn 1.8 to align with the detent made in the winding. The stepper motor will remain in this detented position until the system electronics signal the access lines again.

The next access signal through the access degate logic selects stepper motor line 1 (Figure 7-18). The stepper motor armature turns another 1.8 to the next track. The access lines remain active holding the motor and head carriage in this track until the next signal is received on the access lines to step the head either forward or back.

Fifteen separate step signals are needed to move the head carriage assembly from track 50 to track 65. The signals step the head carriage through a four condition sequence and repeat the sequence until fifteen steps have been completed (Figure 7-19).

Seven step signals are needed to move the read/write head from track 61 back to track 54.

If the system electronics cannot determine the track position, it recovers by sending 77 reverse step signals. This ensures the read/write head returns to track 00. A pin located in the stepper pulley stops against the casting to physically stop the read/write head at track 00. When the system electronics completes the 77 step signals, it will start a new count sequence by reading an address field on track 00.

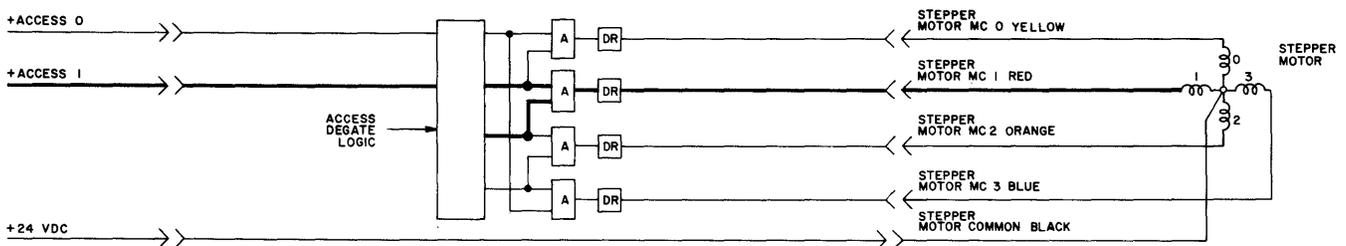


Figure 7-18. Stepping Signals

Track Location	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Access 0	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+
Access 1	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-

+ Indicates an active state.
 - Indicates an inactive state.

Figure 7-19. Stepping Signal Sequence

POWER/SIGNAL DISTRIBUTION

Three external cables connect the system and the diskette drive unit; AC power, DC power, and the signal distribution cable (Figure 7-20). All the cables are one meter (40 inches) long.

The AC power for the diskette unit is supplied through a three-wire cable from the system power supply. AC power inside the unit is distributed to drive assemblies and a fan. When the

system power is on, the AC drive motor(s) and the fan run continuously.

The DC power is distributed from the system power supply through a 16-wire cable to the diskette adapter card.

The signal cable is a 56-wire shielded cable connected from the system electronics to the diskette adapter card.

An internal cable connects the file control card to the diskette adapter card.

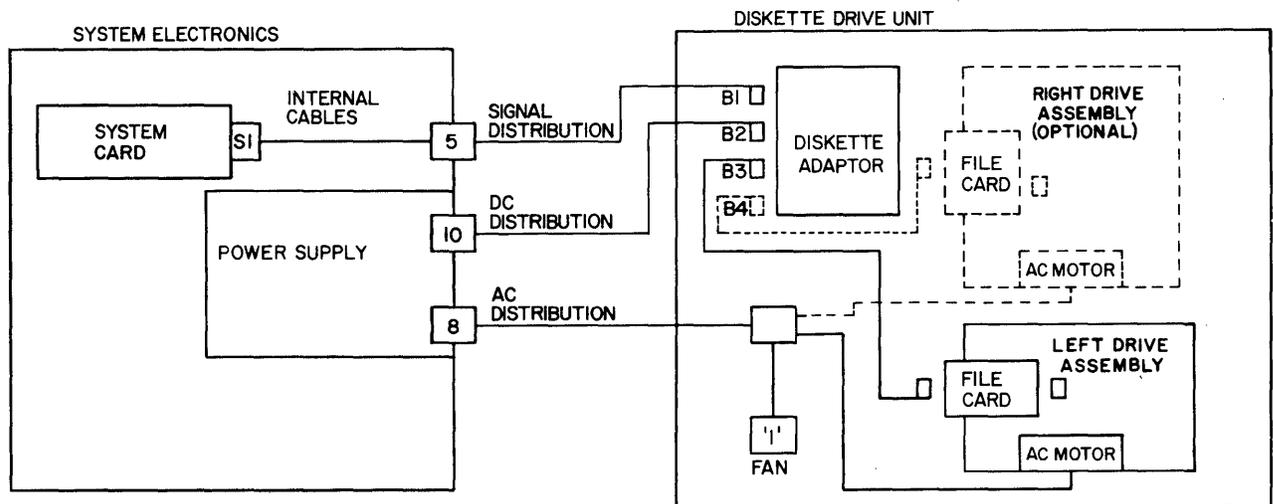


Figure 7-20. Diskette Drive/System Interface

ERROR SENSING

The system card and the diskette adapter supply the error sensing for the diskette drive. The system software maintains a counter in memory to record read/write errors. If an error occurs during a read/write operation, the error is counted and another read/write operation is performed. The read error sensing procedure is performed only three additional times.

When a successful read/write operation occurs before the counter reaches its limit, a soft error is recorded in the error log and the diskette operation proceeds normally. If the system electronics does not get a successful read/write operation, a diskette read/write error prompt will be displayed on the display. (Figure 7-21) is a flow chart showing the error routines for both read and write operations.

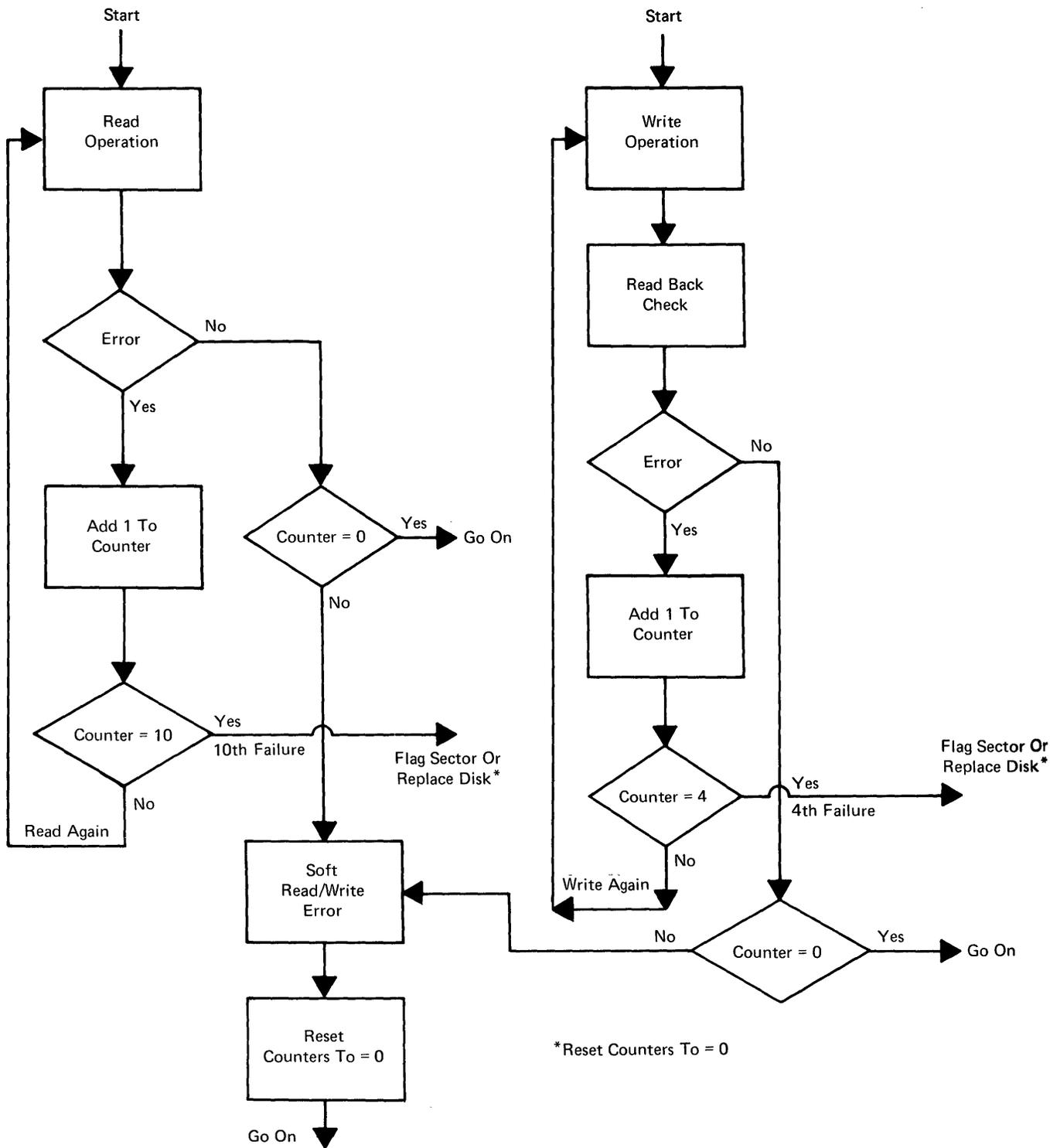


Figure 7-21. Read/Write Error Counting

DUAL DRIVE

The Diskette Unit can contain either one or two drive assemblies. When using two drive assemblies, the system can move or combine text from one drive to the other, but cannot access both drive assemblies at once for concurrent operation.

The two drive assemblies are the same in function, parts, and adjustments. All electronic and mechanical parts can be swapped.

The drive assemblies are aligned to each other with two alignment pins and connected with an upper and lower bracket (Figure 7-22).

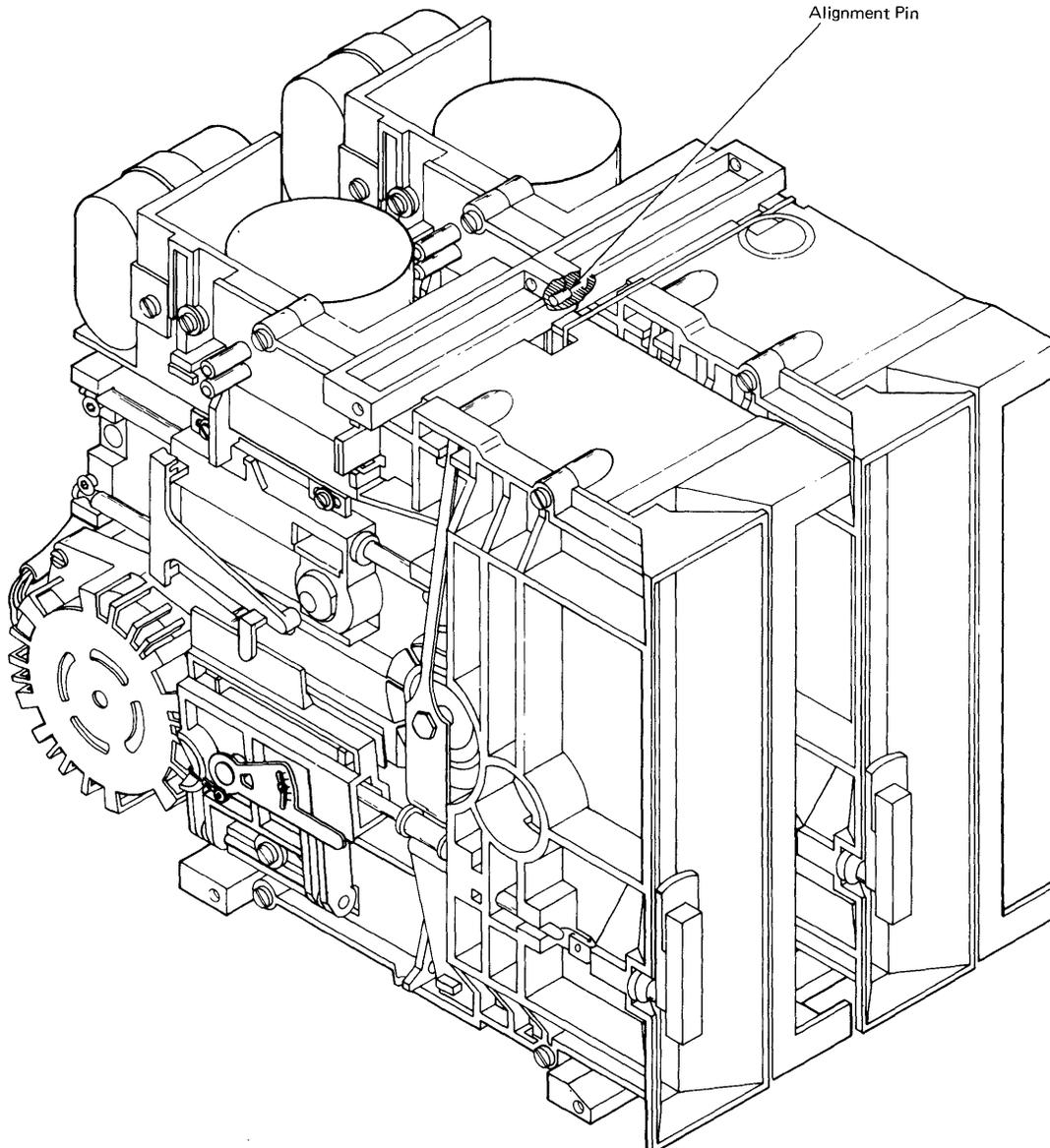


Figure 7-22. Dual Diskette Unit

SERVICE AID

The diskette drive requires no scheduled maintenance.

WARNING: The drive hub and pulley assembly are plant adjusted and cannot be replaced in the field. The head carriage assembly can be replaced in the field; however, any attempt to repair or clean the head carriage assembly may cause damage to the read/write head. Voltage or resistance checks of the read/write head made with a multimeter may damage the head and should not be attempted.

Note: The Type 2D head is shown only when it is necessary for adjustments or removals.

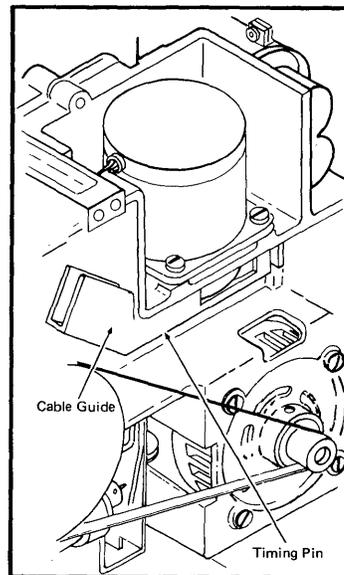
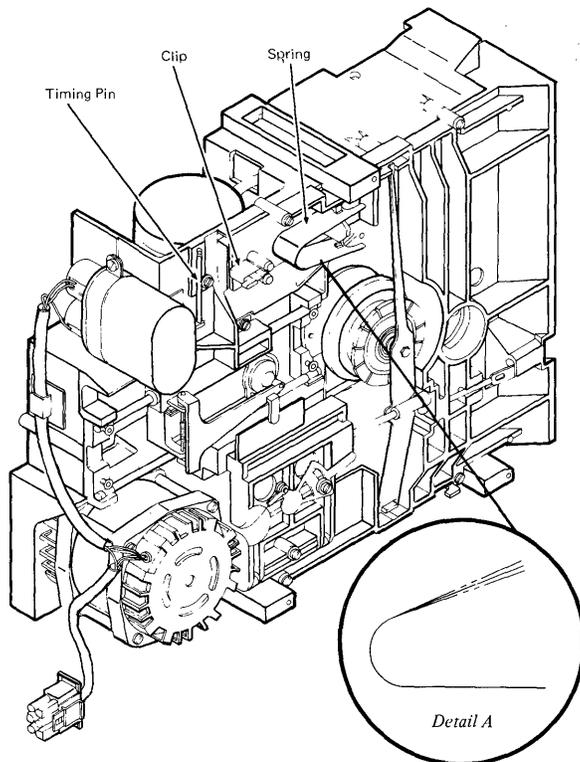
Special Tools

The three special tools needed to service the diskette drive are stored on the frame of each drive. Their use is described in the Adjustments section.

1. The timing Pin is used to mechanically align the stepper motor shaft and pulley.

Note: The timing pin may be stored on the diskette drive frame or under the head cable guide. (Ref. Figure)

2. The track 40 feeler gauge clip is used to keep the gauge in contact with the track 40 adjustment surface.
3. The head carriage assembly spring is used to keep the head carriage against the feeler gauge during this adjustment. The spring angle must match the view as shown at detail A with an acceptable deviation of $\pm 1.5\text{mm}$ (0.060 inch).



ADJUSTMENTS

Operator Handle Adjustment, Collet/Flat Spring Adjustment Check

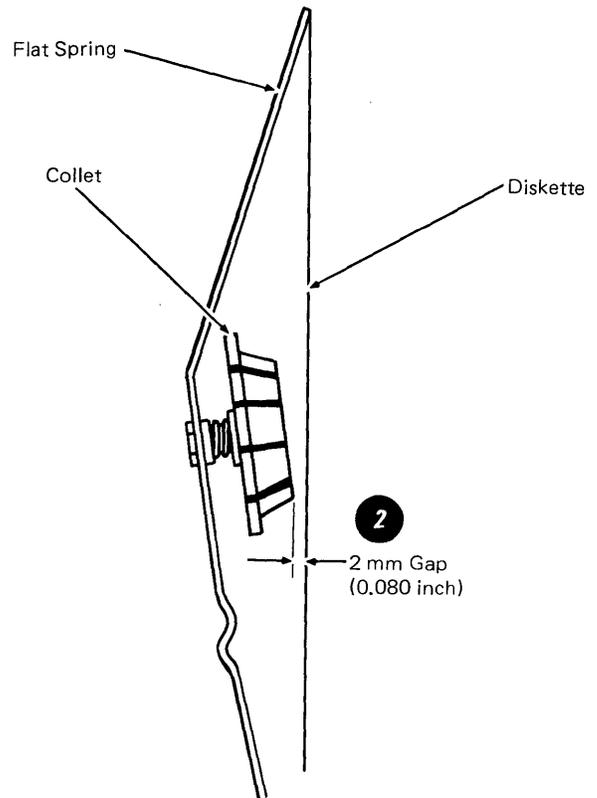
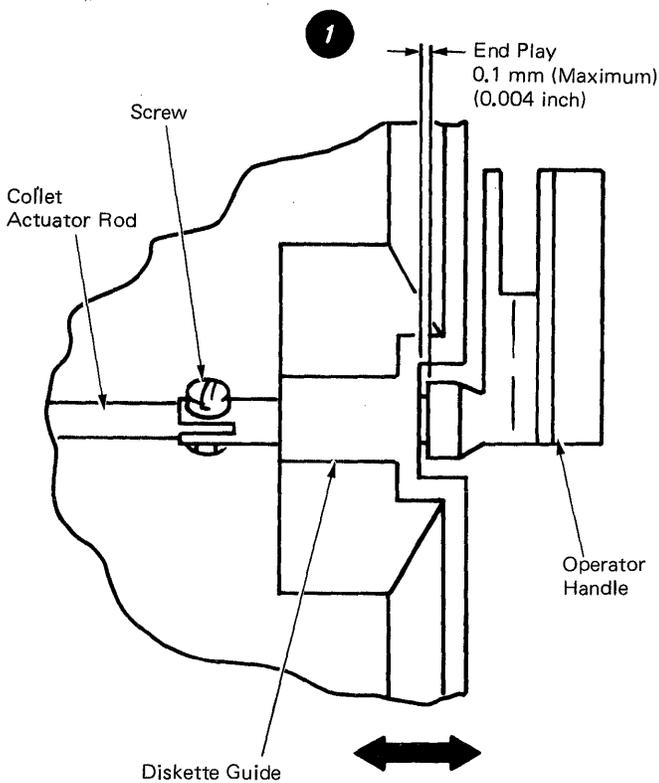
CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Open the diskette drive handle and insert a diskette. Move the

diskette in and out of the drive to verify it does not hit the collet. If the diskette will not move smoothly, the collet/flat spring assembly has been damaged or the collet actuator roll was installed improperly. Insert a diskette and with the operator handle open, check for a 2 mm

The flat spring is not adjustable and should be replaced if the above condition exists.



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Solenoid and Bail Adjustment

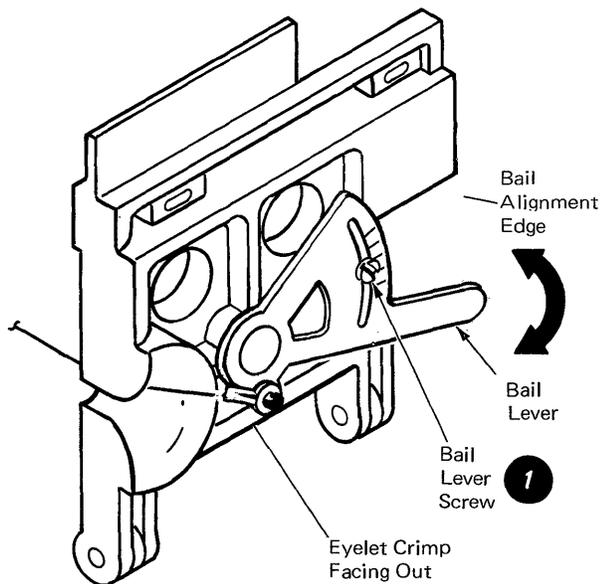
CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Disconnect the Diskette Unit AC cable from Connector 8.
3. Close the diskette handle.
4. While looking into the diskette guide opening, loosen the bail level screw ①.

For the type 1 drive, move the bail lever until the head load arm pad just touches the head.

For the type 2D drive, insert a piece of paper between the heads and move the bail lever until the two heads just touch.



5. Observe the marks on the bail lever relative to the bail alignment edge.
6. For the type 1 drive, turn the bail lever one and one half spaces (marks) clockwise and tighten the bail lever screw.

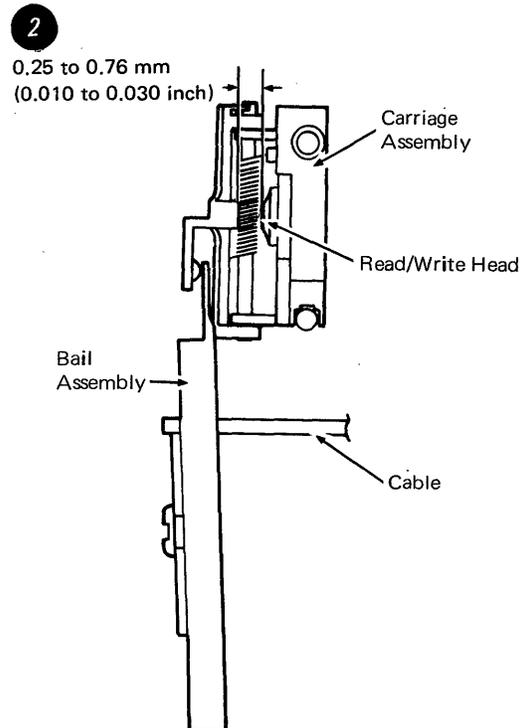
For the type 2D drive, turn the bail lever one space (mark) clockwise.

7. For the type 1 drive, the gap should now be 3 to 4 mm (0.118 to 0.159 inches) between the head and head load arm. Check visually only ②.

For the type 2D drive, the gap between the head surfaces should be 2 to 3 mm (0.079 to 0.118 inches). Check visually only.

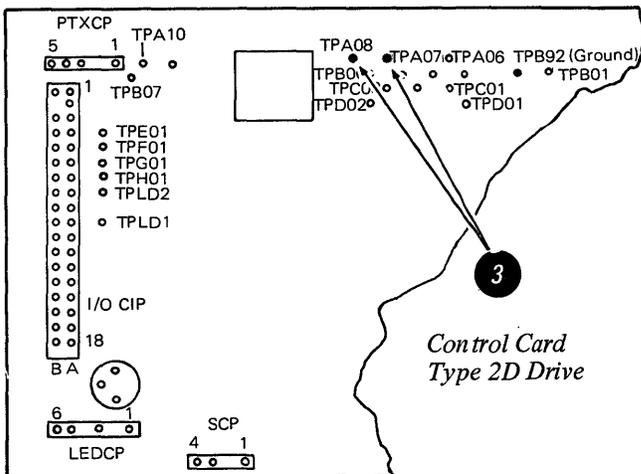
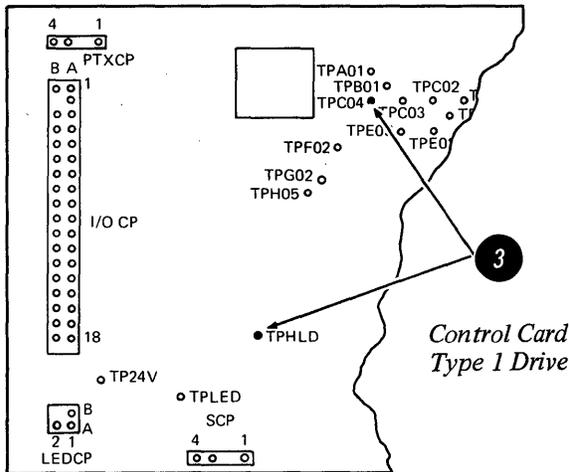
8. Load the diskette and turn the system power on.

Note: DC voltage will be present at this time to activate the head load solenoid.



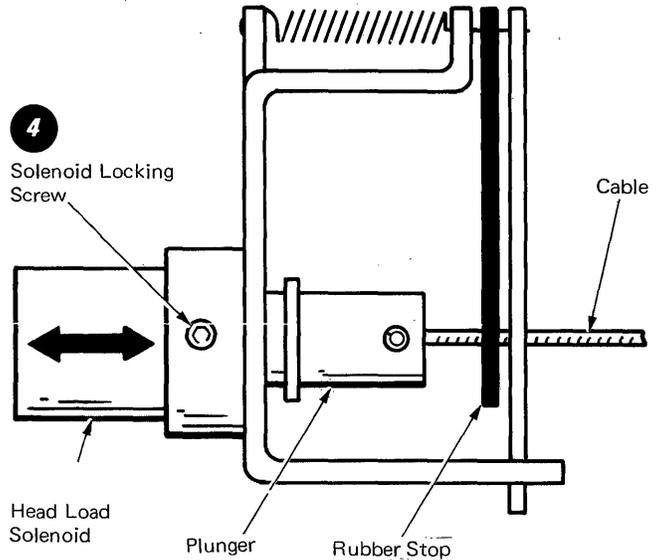
- For the type 1 drive, activate the solenoid by jumpering from TPC04 (ground) to TPHLD (head load) ③.

For the type 2D drive, activate the solenoid by jumpering from TPA07 (ground) to TPA08 (head load) ③.



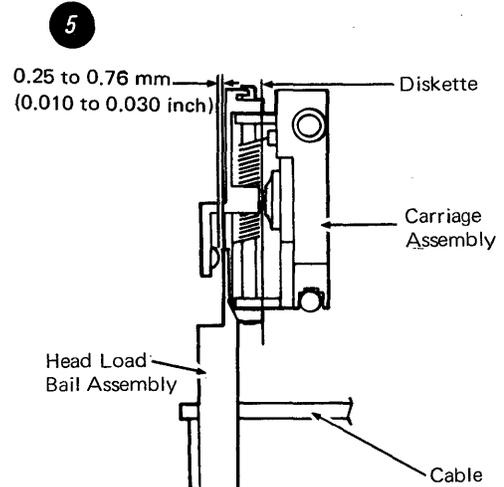
- Loosen the solenoid locking screw ④.

WARNING: Do not let the solenoid plunger and cable turn while making this adjustment.



- Turn the solenoid in the mounting bracket to obtain 0.25 mm to 0.76 mm (0.010 to 0.030 inches) gap ⑤ between the head load arm and the head load bail. Tighten the locking screw. Remove the jumper.

- Turn the system power off.
- Reconnect the Diskette Unit AC cable.



Stepper Drive Band Adjustment

CAUTION

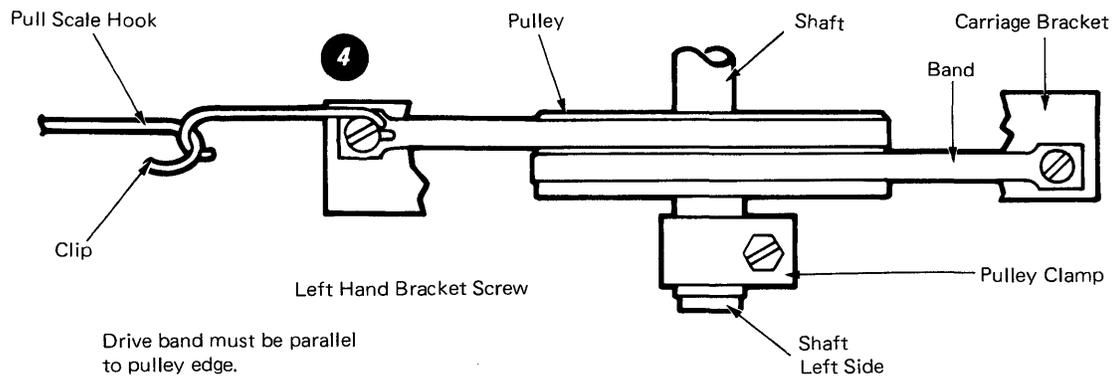
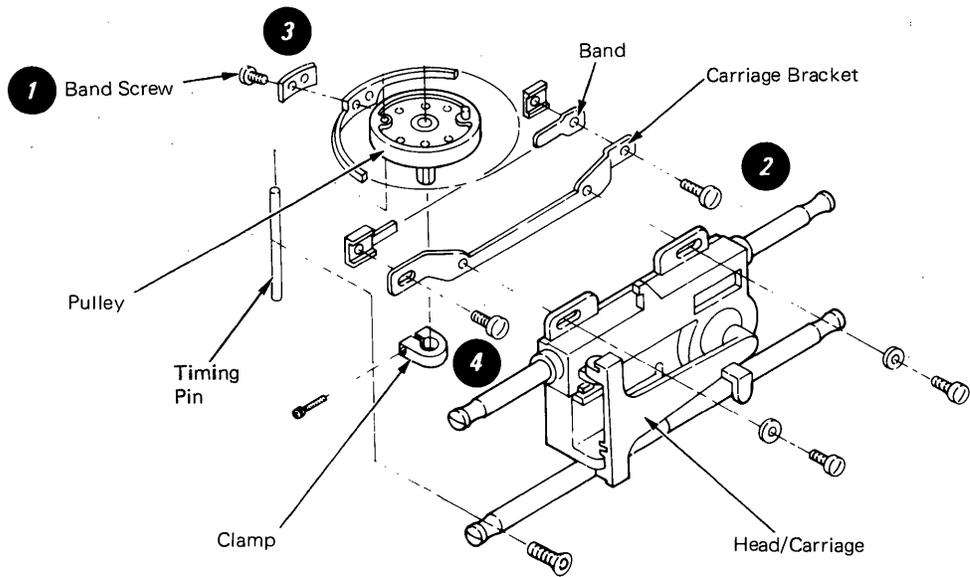
When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Remove the read/write head cable connector and guide.
3. Place the head carriage at track 40 (timing holes in pulley and casting are aligned). Observe this condition visually.
4. Loosen the screws that attach the band to the pulley and the carriage bracket ①.
5. Tighten the right hand carriage bracket screw ② and the band clamp screw keeping the band par-

allel to the edge of the pulley ③.

6. Block the head carriage approximately 25.40 mm (1 inch) from the casting.
7. Use a paper clip and the push/pull scale to pull the loose end of the band with 1135 grams \pm 10% (2.5 pounds \pm 10%) of force, and tighten the left hand carriage bracket screw. This adjustment ensures the drive band tracks evenly and tightly over the stepper pulley ④.
8. Carriage must move freely from track 00 to track 76.
9. Load the diagnostic diskette and run the alignment verification test. The display will indicate correct or incorrect alignment.

Note: Check the Head Carriage Adjustment and adjust if necessary.



Head Carriage Adjustment

CAUTION

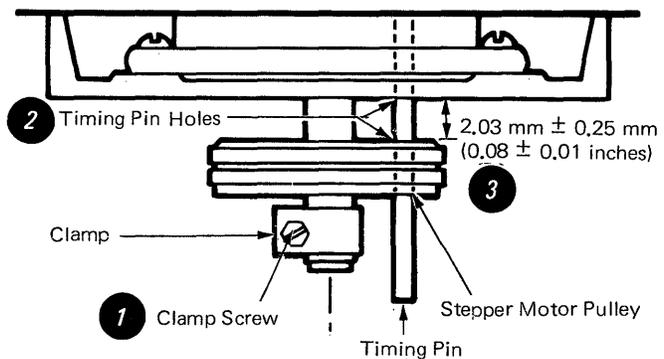
When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Power on with the Memory Record Button pressed to place the system in resident non-automatic diagnostics. Select the diskette drive to be adjusted (Test D).
2. Load a diskette.
3. Execute Test L to place the stepper motor at Phase 0. (Disregard the results of the test.)
4. Remove the read/write cable head guide.

WARNING: Do not allow the head cable to touch the drive belt.

5. Loosen the stepper motor pulley clamp screw ① and rotate the pulley to align the timing pin holes in the pulley and casting ②.
6. Insert the timing pin into the timing pin holes and tighten the pulley, keeping the band parallel to the pulley $2.03\text{mm} \pm 0.25\text{mm}$ (0.08 ± 0.01 inches) from the casting ③.

7. Remove the diskette and the timing pin. Select and execute test N. This places the head carriage detent at track 40.
8. Verify timing pin hole alignment between the pulley and casting. Step the head carriage from track 40 to track 39 and back to track 40 by pressing the spacebar twice. The stepping action is necessary because of the torque characteristics of the stepper motor. It provides a positive detent for this adjustment.
9. Loosen the carriage bracket screws ④. Attach a 0.508mm (0.02 inch) feeler gauge to the track 40 adjusting surface using the clip ⑤.
10. Install the carriage pressure spring to hold the carriage against the feeler gauge ⑥. Tighten the carriage bracket screws ④.



11. Remove the pressure spring and the feeler gauge. Press the spacebar twice to step the head from track 40 to track 39 and again to 40. Verify the adjustment by inserting the feeler gauge between the adjusting surface and pointer. Go = 0.483 mm (0.019 inches), No Go = 0.533 mm (0.021 inches).

12. Load the diagnostic diskette, and run the alignment verification test.

Note: To check the head carriage adjustment, perform steps 1, 7, 8, and 11.

The head carriage can be stepped by hand from track 40 to track 39 and back to track 40 by using the following alternate procedures. (Refer to the Cable and Connector Section for test point locations.)

- For the type 1 drive, install a jumper between TPC04 (ground) and TH05 (disable stepper). This prevents accidental stepping.

For the type 2D drive, install a jumper between TPB02 (grnd) and TH05 (disable stepper). This prevents accidental stepping.

- For the type 1 drive, install a second jumper between TPF01 (ground) and TPH04 (motor control 0).

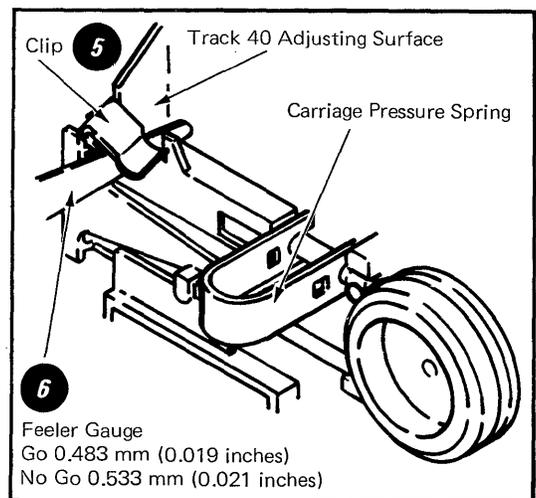
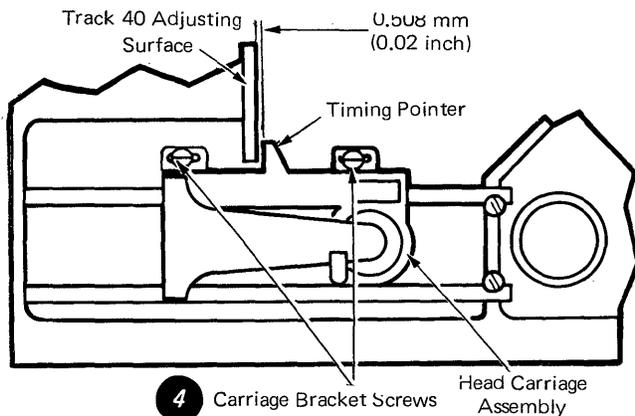
For the type 2D drive, install a second jumper between TPA07 (ground) and TPA04 (motor control 0).

- For the type 1 drive, remove jumper end from TPH04 and install it on TPH01 (motor control 3). The carriage will move from track 40 to track 39.

For the type 2D drive, remove the jumper end from TPA04 and install it on TPA01 (motor control 3). The carriage will move from track 40 to track 39.

- For the type 1 drive, remove jumper end from TPH01 and install it on TPH04. This will move the carriage back to track 40.

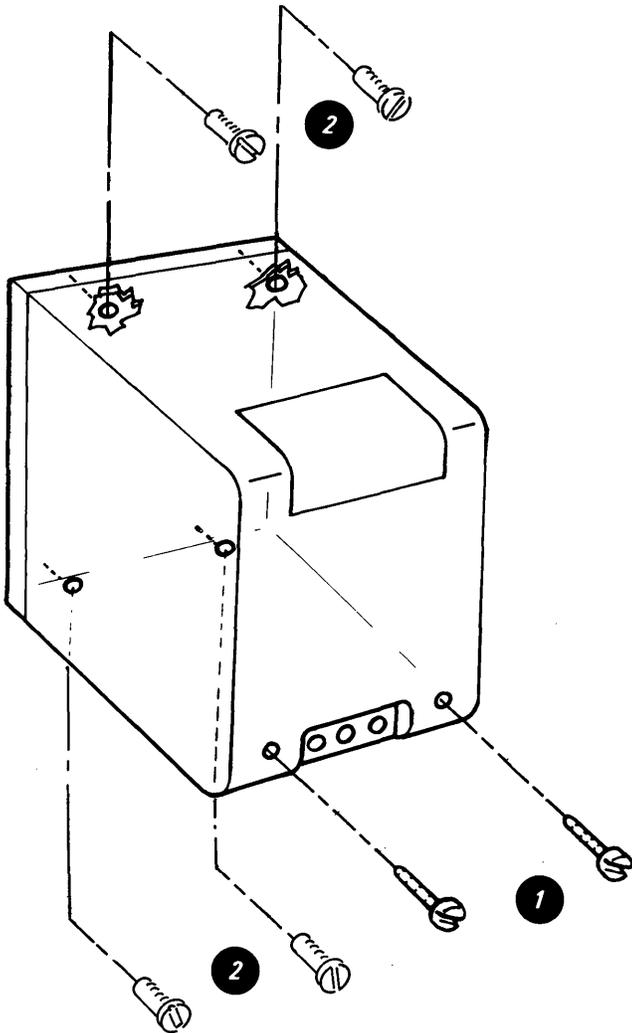
For the type 2D drive, remove the jumper from TPA01 and install it on TPA04. This will move the carriage back to track 40.



REMOVALS/REPLACEMENTS

Cover Removal

1. Turn the system power off.
2. On early level machines, remove two screws in the back of the module. On later level machines, release the two quarter-turn fasteners ①.
3. Slide the top cover to the rear.
4. Remove four screws holding the front cover ②.
5. Slide the front cover forward.



Head Load Bail Removal

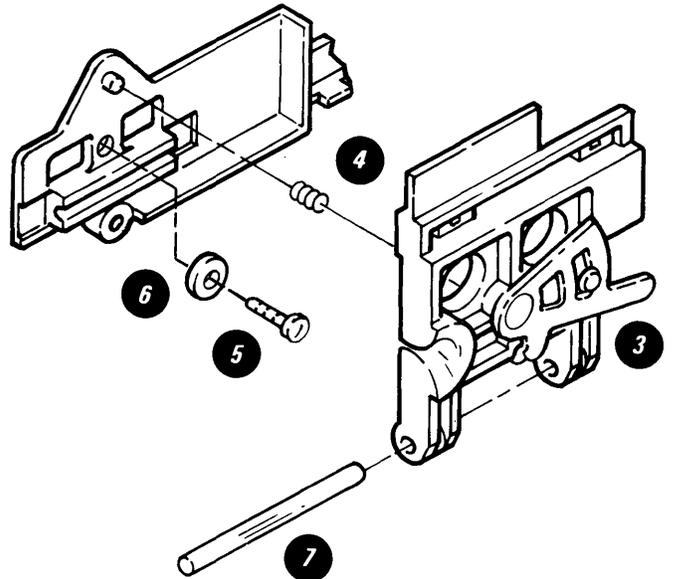
CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Close the diskette handle.
3. Disconnect the bail actuator cable from the bail cable stud ③.
4. Open the handle.

WARNING: Damage to the head can occur if the pressure pad arm is permitted to hit the head.

5. Observe the position of the bail return spring ④ and loosen the bail screw ⑤ and pivot the bail retainer down ⑥.
6. Remove the bail, bail return spring, and pivot rod ⑦.



Collet/Flat Spring Removal

WARNING: Do not attempt to remove the collet/flat spring before removing the bail. Too much pressure or binding can damage the spring.

1. Turn the system power off.
2. Close the diskette handle.
3. Push the bail slightly, and disconnect the bail actuator cable from the bail cable stud ①.
4. Open the diskette handle.

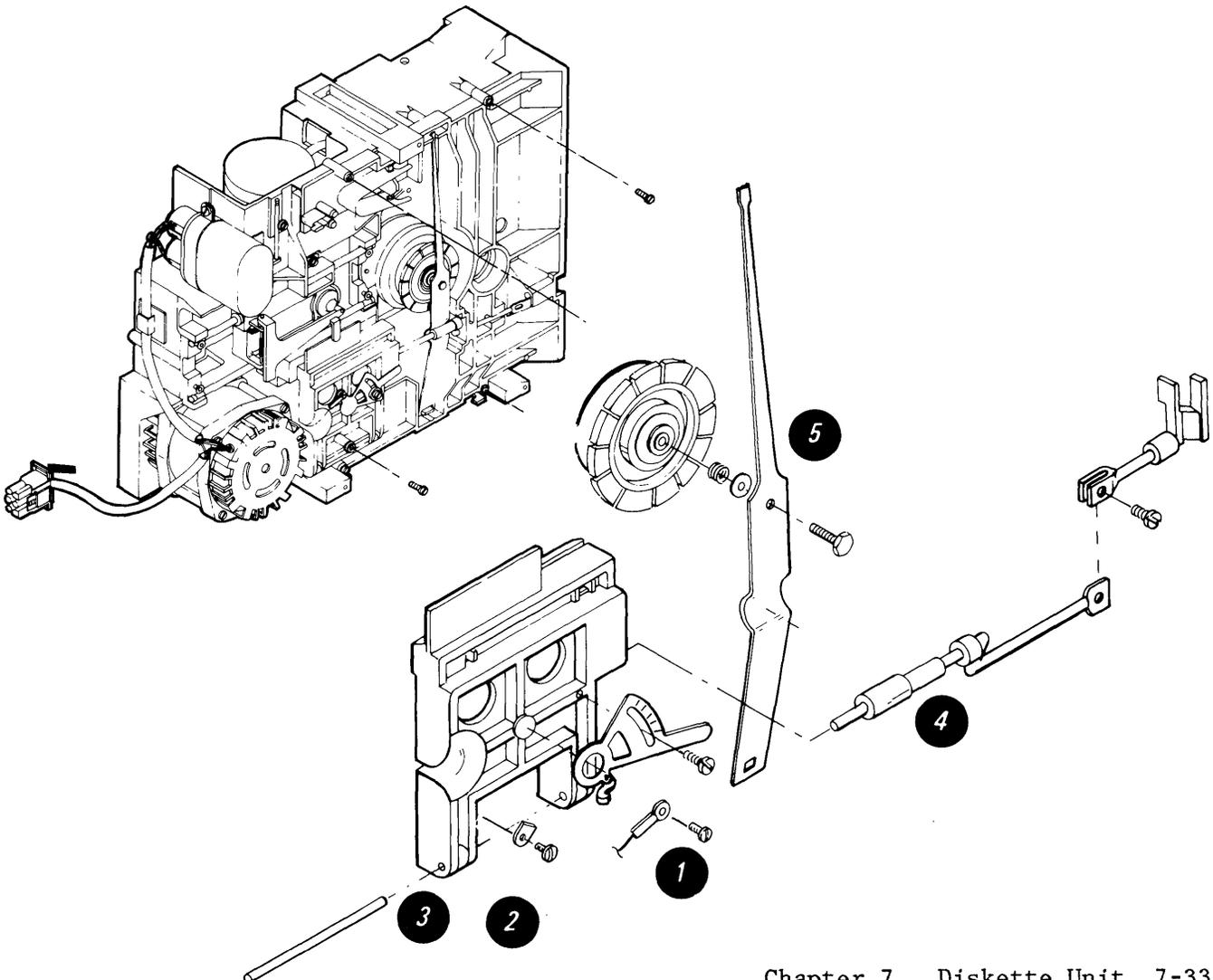
WARNING: Damage to the head can occur if the pressure pad is permitted to hit it.

5. Remove the diskette handle.

6. Observe the position of the bail return spring, and loosen the bail retainer screw. Pivot the retainer down ②.
7. Remove the bail, the bail return spring, and the pivot rod ③.
8. Remove the collet actuator roll and the pressure roll ④.
9. Turn the collet actuator rod up and out of the way.

WARNING: Do not put too much pressure on the flat spring.

10. Remove the collet/flat spring assembly ⑤.
11. Remove the collet actuator rod.

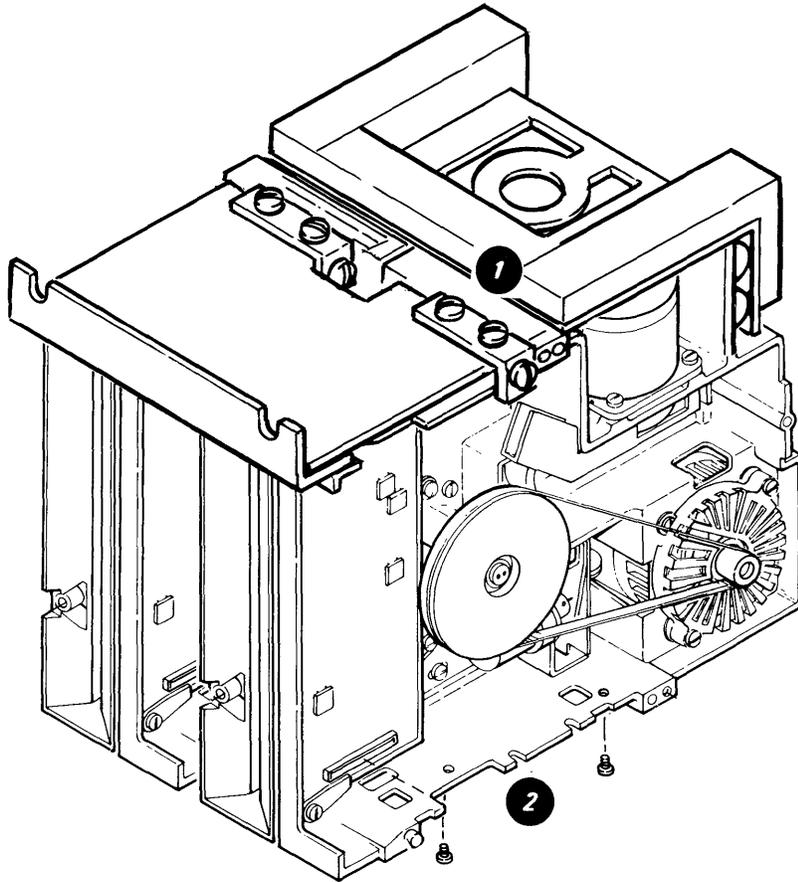


Right Diskette Drive Removal

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Disconnect the Diskette Unit AC cable from Connector 8.
3. Perform Cover Removal.
4. Loosen the two screws on the fan mounting bracket and slide bracket ①.
5. Loosen the two screws that hold the drive mounting bracket ②.
6. Slide the drive mounting bracket, and lift the drive up and out of the Diskette Unit.



Diskette Guide Assembly Removal

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Close the diskette handle.
3. Push the bail in slightly, and disconnect the bail actuator cable from the bail cable stud ①.
4. Open the diskette handle.

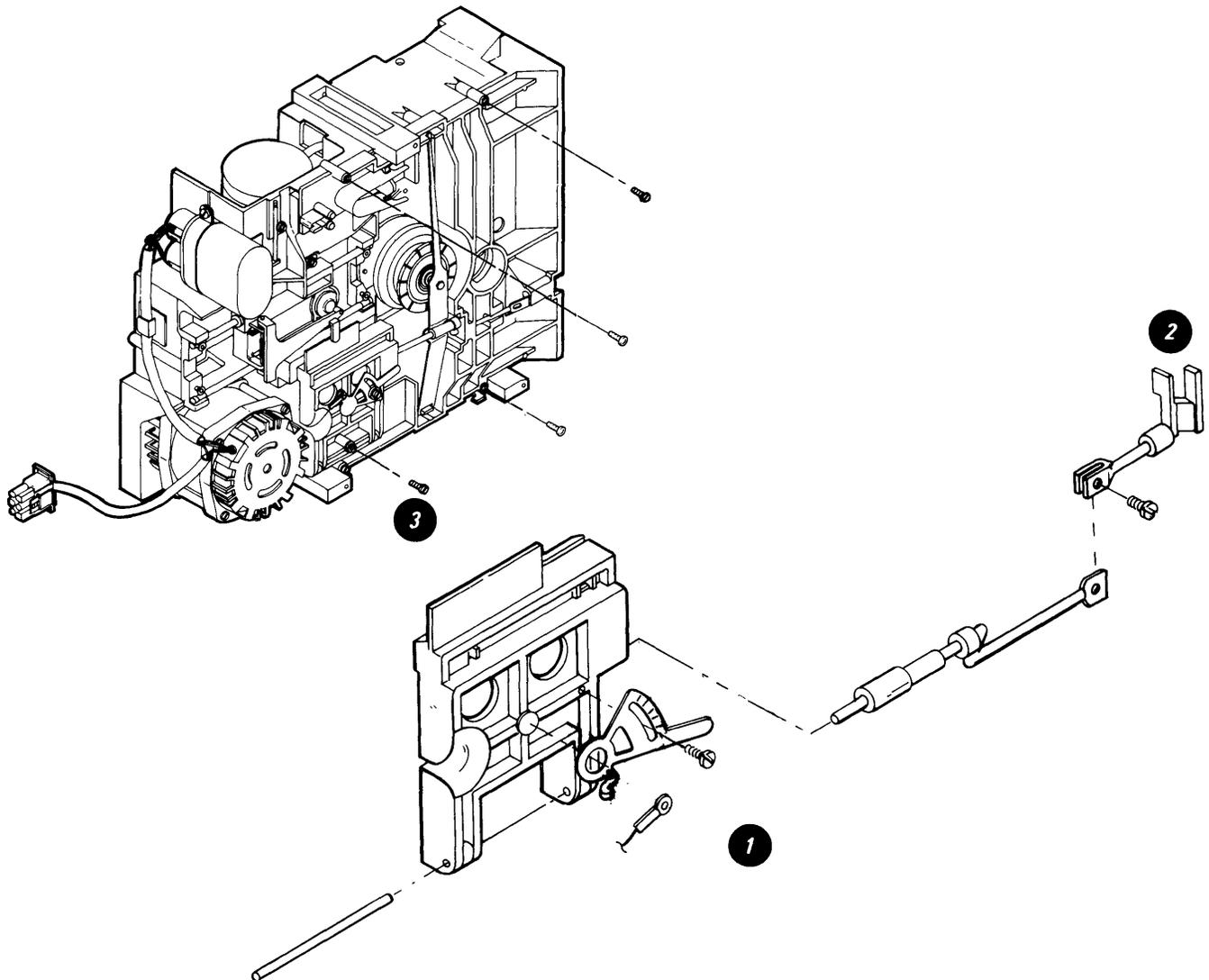
5. Remove the diskette handle ②.
6. Remove the LED cable from the file control card.

Warning: Damage to the head can occur if the pressure pad is permitted to hit it.

7. Remove the four guide screws and remove the guide ③.

Note: After replacement, perform the following adjustments:

- Operator Handle Adjustment
- Solenoid and Bail Adjustment

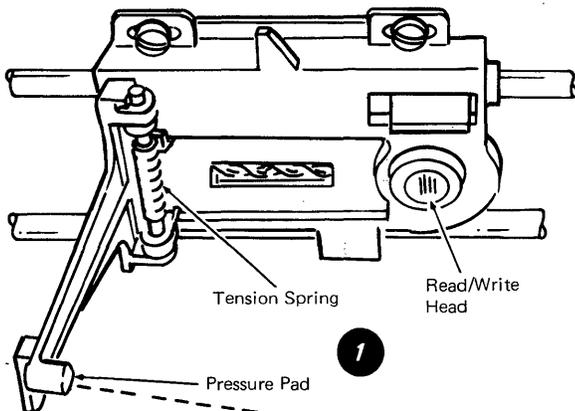


HEAD LOAD ARM PAD

SERVICE WARNING

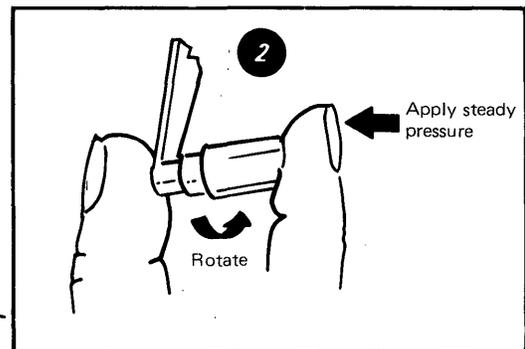
The head area can be easily damaged or contaminated. When changing a pressure pad, observe the following precautions:

- Ensure all tools are clean. Use an alcohol pad (P/N 9900679) to clean the tools.
- Do not touch the new pressure pad with fingers. (Use the pressure pad tool included with new pressure pad.)
- Be careful not to damage the new pressure pad or loosen any of the pad surface. The layer of adhesive on the new pad is very thin; do not damage the adhesive. Do not let the adhesive touch the surface of the pad that will touch the diskette. Do not use damaged pads.
- Do not make any scratches on the head load arm.
- Do not let the head load arm hit the read/write head.
- Move the head load arm as little as possible. The tension spring can become disconnected.



Head Load Arm Pad Removal/Replacement

1. Move the head load arm away from the read/write head.
2. Pull the worn pad off the arm with tweezers ①.
3. Carefully remove any adhesive that remains on the arm.
4. Use an alcohol pad to ensure that the pressure pad mounting surface is lint-free. If the surface is not completely clean, the new pad may not seat correctly.
5. Carefully remove the new pad from the other pads using scissor clamp.
6. Use a knife or similar thin blade to lift off the paper cover that protects the adhesive layer on the new pad.
7. Place the new pad on the head load arm.
8. Using the small end of the pressure pad tool, press at 90° to the head load arm while turning the tool at least one revolution ②.
9. Carefully restore the head load arm to its operating position.

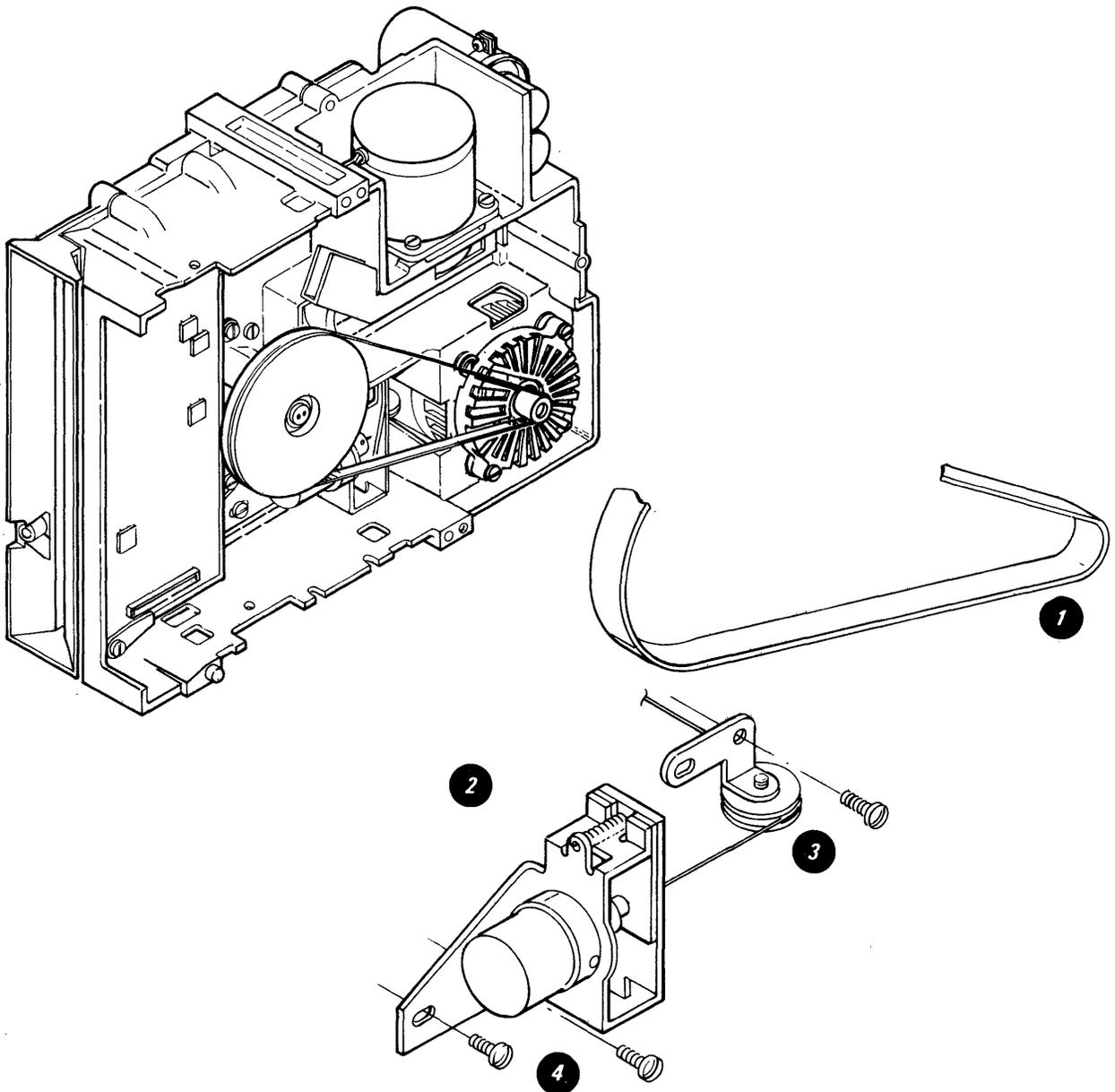


Bail Solenoid and Idler Removal

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Disconnect the bail actuator cable from the bail cable stud.
3. Remove the solenoid cable connector from the file control card.
4. Remove the AC motor drive belt ①.
5. Remove the solenoid, bracket and cable as a unit ②.
6. Remove the idler ③.
7. Loosen the solenoid locking setscrew and unscrew the solenoid from the bracket ④.

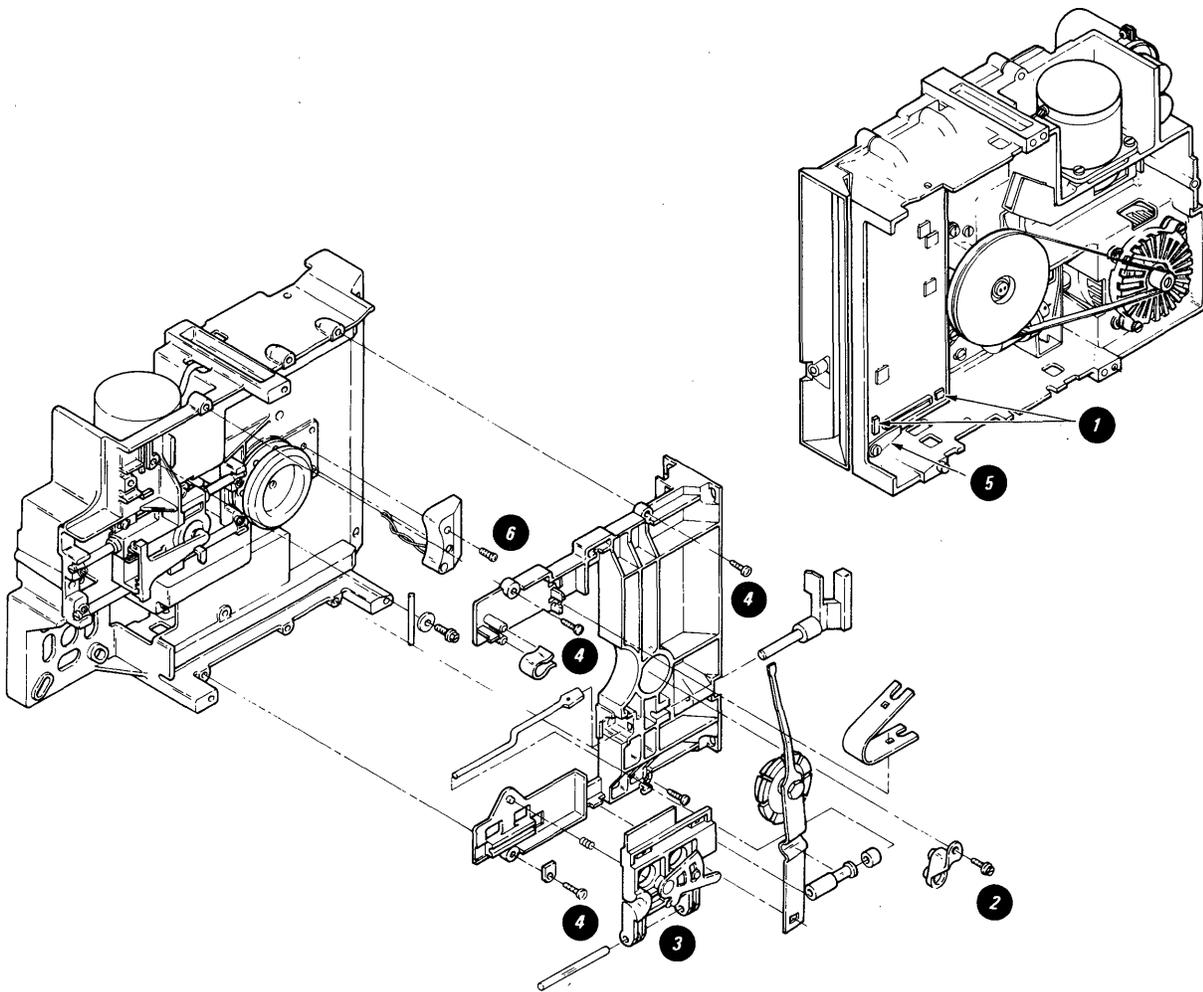


LED and PTX/File Control Card Removal

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Perform cover removal.
3. Remove the LED and PTX cable connectors ①. Note the cable path for replacement.
4. Remove the one screw holding the LED in place and remove the LED ②.
5. Remove the diskette drive unit from the brackets.
6. Disconnect the bail actuator cable from the bail cable stud ③.
7. Remove the four screws holding the diskette guide and remove the guide ④.
8. Remove the remaining cable connectors from the file control card.
9. Remove the file control card from the retainer clamp ⑤.
10. Remove one screw holding the PTX and remove the PTX ⑥.



Diskette Adapter Card Removal

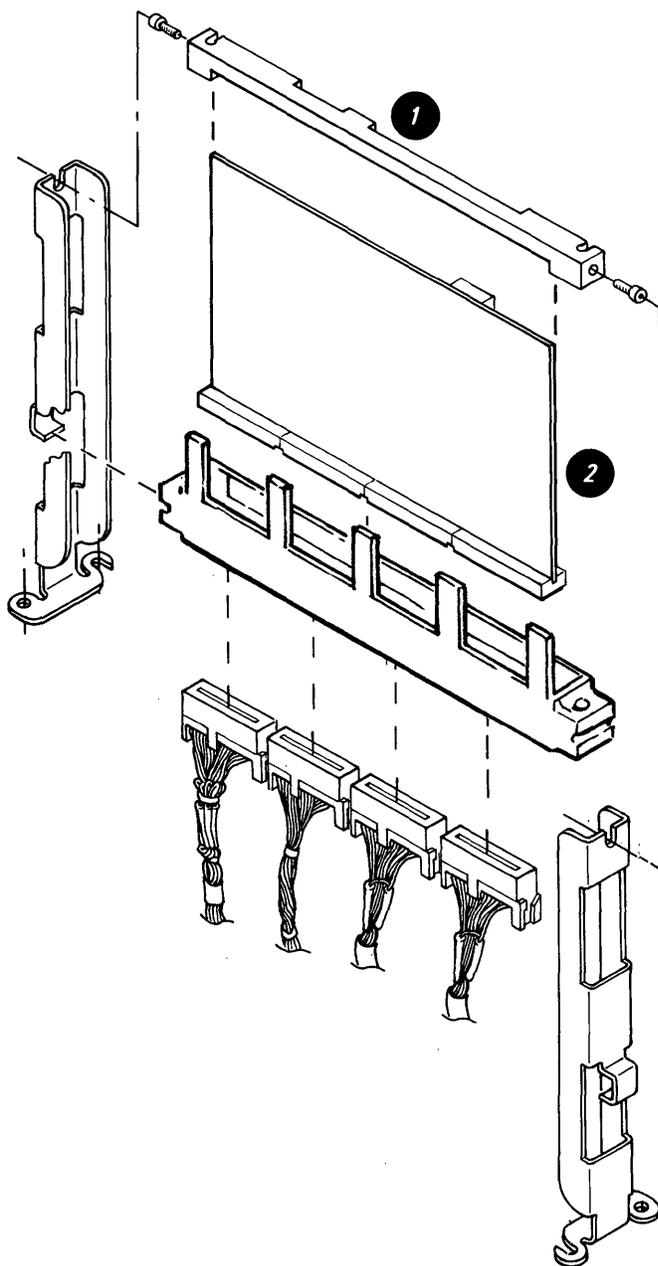
the Communications Service Manual,
S241-6439.

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

Note: For Displaywriters with the communication feature installed, see

1. Turn the system power off.
2. Remove the card retainer ①.
3. Remove the card ②.

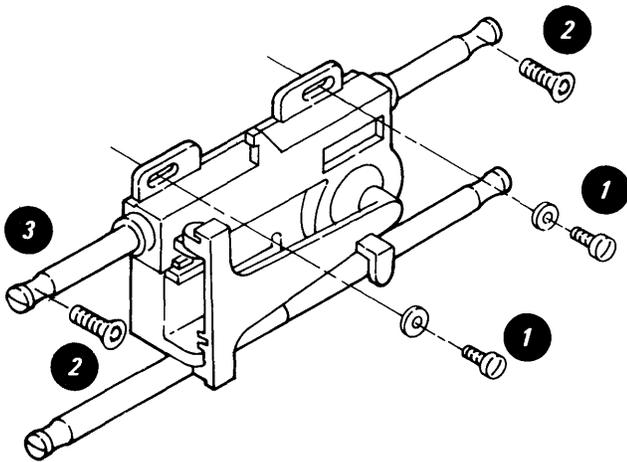


Head/Carriage Assembly Removal (Type 1 and Type 2D Drive)

CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Remove the Read/Write head cable from the file control card and cable guide.



3. Remove the cable guide.

WARNING: The head carriage band must not be bent or damaged.

4. Remove the carriage bracket from the head carriage band ①.
5. Loosen the two top guide rod screws ②.
6. Slide the top guide rod to the left and remove the head carriage assembly ③.

Pulley and Drive Band Removal

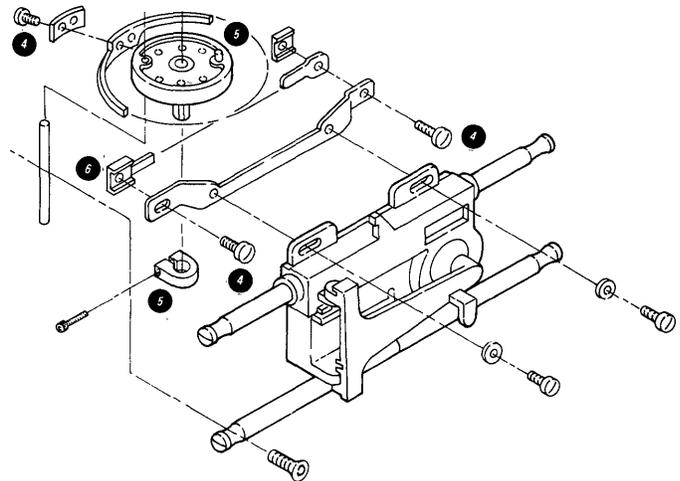
CAUTION

When a diskette drive is removed from its mounting, verify the ground through the AC connector. Check for 0 ohms between the diskette unit base and the diskette drive.

1. Turn the system power off.
2. Remove the head cable connector and cable guide.

WARNING: The drive band is easily damaged. (Do not bend, crease or scratch the drive band.)

3. Remove the three mounting screws and clamps that attach the band to the pulley and carriage ④.
4. Remove the stepper pulley and pulley clamp ⑤.

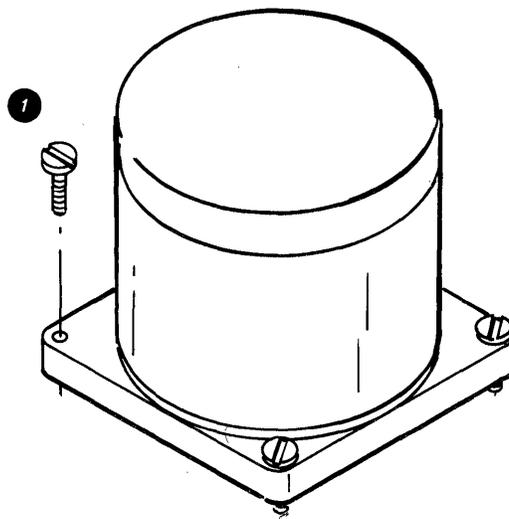


Drive Band Replacement

1. Attach the end of the band with the welded adapter to the adjustable end of the carriage bracket. Leave the screw loose ⑥.
2. Attach the band to the drive pulley with the screw and clamp. Ensure that the band is parallel to the edge of the pulley (leave the screw loose) ④.
3. Attach the other end of the band to the carriage bracket. Ensure that the band is parallel to the carriage bracket ④.
4. Perform stepper drive band adjustment.

Stepper Motor Removal

1. Turn the system power off.
2. Remove the head cable connector and cable guide.
3. Remove the stepper motor cable connector.
4. Move the read/write head to track 40 and insert the timing pin into the timing pin holes.
5. Loosen the stepper pulley clamp.
6. While holding the pulley and the timing pin, remove the four screws that mount the stepper motor ⑦.
7. Remove the stepper motor.

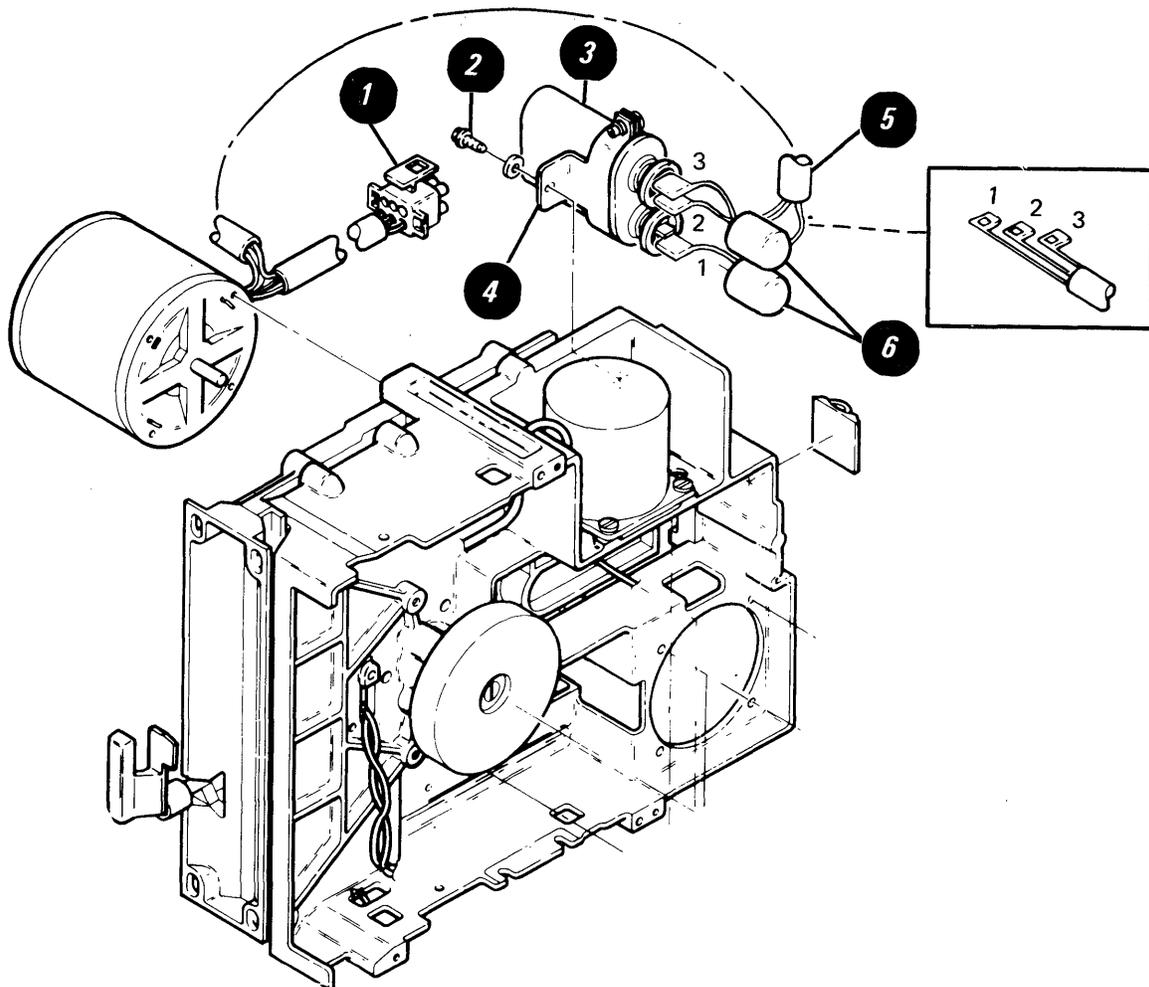


AC Drive Motor Capacitor Removal

1. Turn the system power off.
2. Disconnect the diskette AC power cable from Connector 8.
3. Perform the Cover Removal.
4. If necessary, perform the Right Diskette Drive Removal.
5. Disconnect the AC drive motor power cable ① .
6. Remove the two insulator caps ⑥ from the capacitor terminals.
7. Discharge the capacitor ③ by jumpering its terminals with a large-bladed screwdriver.
8. Remove the three motor leads ⑤ from the capacitor terminals.
9. Remove the screw ② and remove the capacitor bracket assembly ④ .

DANGER

High voltage may be present at the capacitor terminals.



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AC Drive Motor Removal

1. Turn the system power off.
2. Disconnect the diskette AC power cable from Connector 8.
3. Perform the Cover Removal.
4. If necessary, perform the Right Diskette Drive Removal.
5. Disconnect the AC drive motor power cable ②.
6. Remove the AC drive motor belt ⑦.

CAUTION

The motor case becomes HOT after continuous use.

7. On all domestic machines or World Trade machines (before EC841505), remove the two fan enclosure mounting screws ⑧ and remove the fan ⑨. On World Trade machines with EC841505 and later, remove the two mounting screws ⑧ and remove the AC drive motor ⑩.
8. Loosen the setscrew ⑥, then remove the AC drive motor pulley/fan assembly ⑦.

DANGER

High voltage may be present at capacitor terminals.

9. Remove the two insulator caps ④ from the capacitor terminals.
10. Discharge the capacitor by jumpering its terminals with a large-bladed screwdriver.

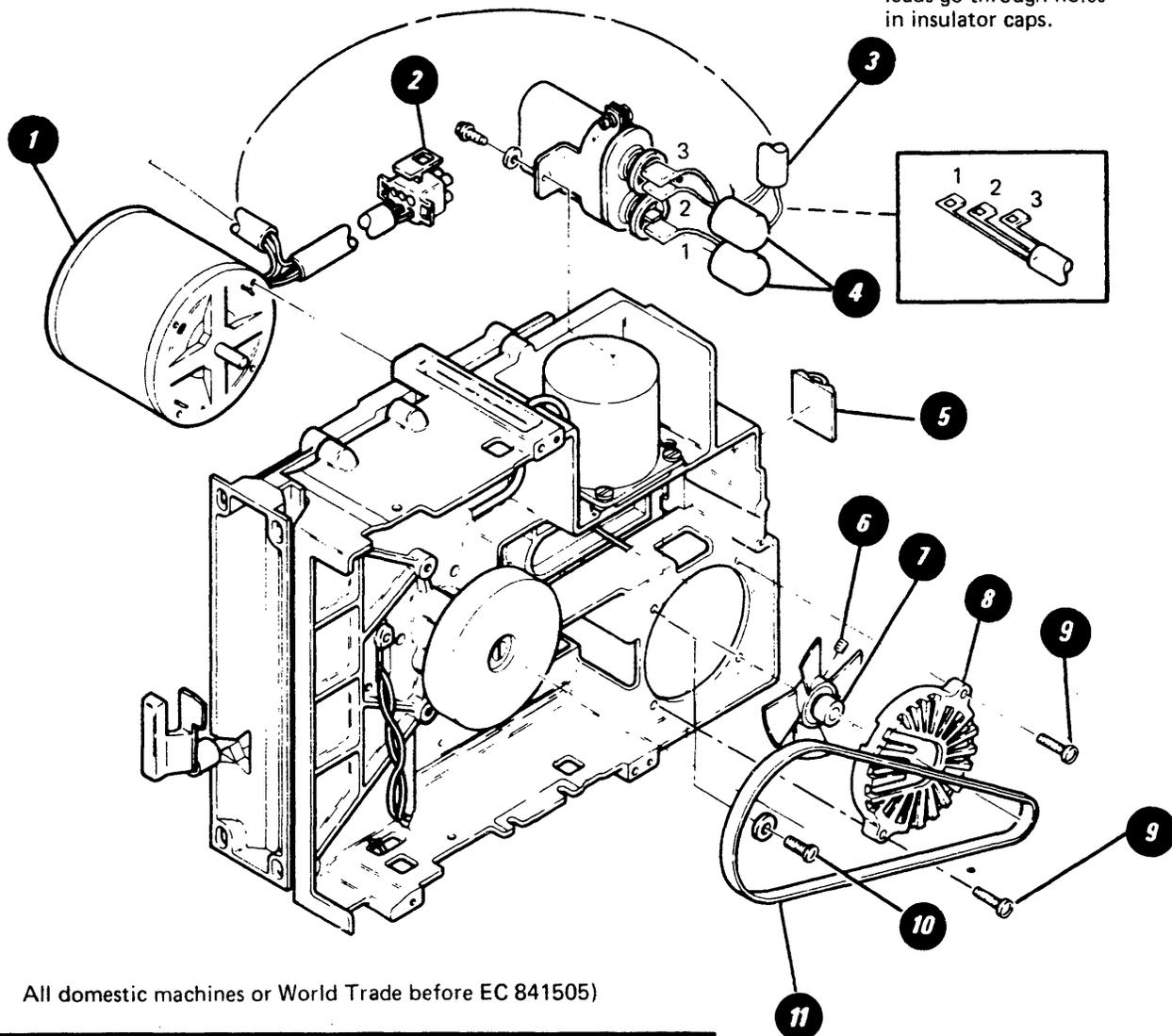
11. Remove the AC drive motor leads ③ from the capacitor terminals.
12. Remove the AC drive motor capacitor leads from the cable guide ⑤ on the casting.
13. Remove the two insulator caps from the AC drive motor capacitor leads.
14. On all domestic machines or World Trade machines (before EC841505), remove the two remaining motor mount screws ⑩ and remove the AC drive motor ⑩. On World Trade machines with EC841505 and later, skip this step.

AC Drive Motor Replacement

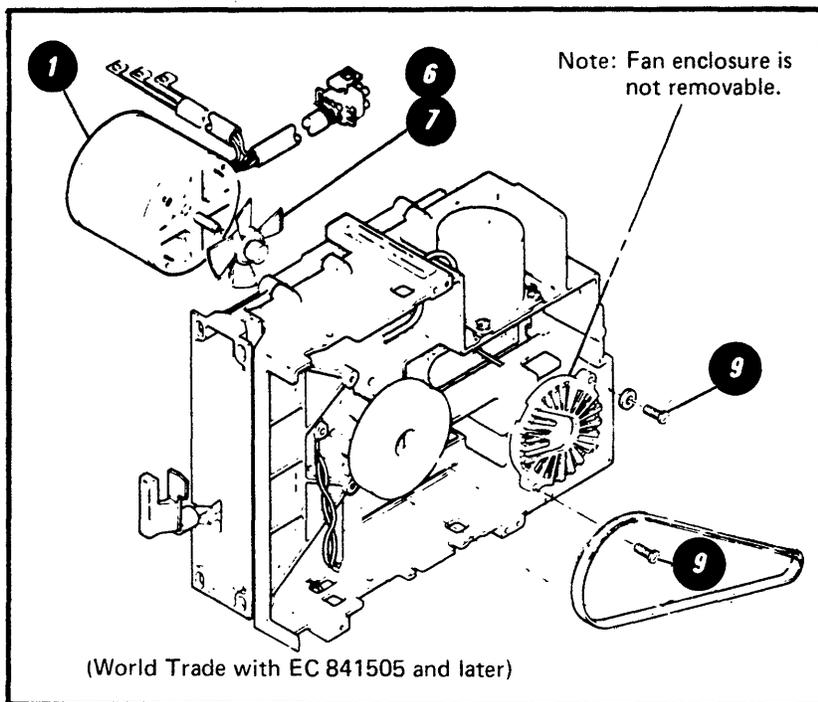
To reinstall the AC drive motor, observe the following exceptions and reverse the steps in the removal procedure.

1. When installing the AC drive motor leads on the capacitor, note the cable numbers to determine which lead goes on which terminal.
2. When installing the pulley/fan assembly on the AC drive motor, ensure that the setscrew is centered on the flat surface of the motor shaft.
3. Place the pulley/fan assembly on the AC drive motor shaft with a gap ⑫ of 0.5 mm \pm 0.1 mm (0.020 inches \pm 0.004 inches) between the motor face and the fan hub.

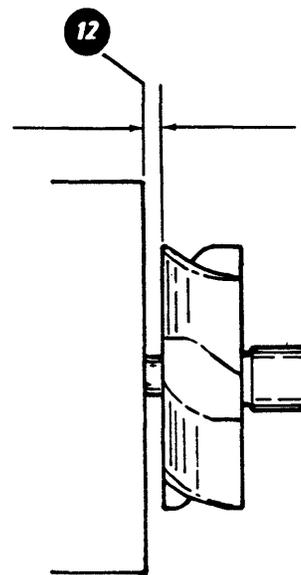
Note: Motor capacitor leads go through holes in insulator caps.



All domestic machines or World Trade before EC 841505)



(World Trade with EC 841505 and later)



CHAPTER 8. CABLES/CONNECTORS/TEST POINTS

This section will aid in locating cables, connectors and test points in the IBM Displaywriter system. Wire termination points are also given for doing continuity checks.

When instructed by MAPs to measure a voltage:

- Refer to the Locator Chart (Figure 8-1) to find the name of the card or connector to be measured. The cards and connectors are listed by module.
- The Connector/Card column shows where the connector or card is located.
- Refer to the figure number in the "Go To Figure" column for detailed information about the connector or card test point to be measured.

The cables, connectors and test points figure (Figure 8-2) shows the hardware locations and can be used with the Hardware Locator Chart (Figure 8-3) and the "Go To Figure" column for more detailed information.

Signal Ground is to be used when measuring voltages.

Frame Ground is earth ground and is used only for electrostatic discharge grounding. The use of frame ground when measuring voltages should only be used when instructed by MAPs.

Warning: Only use Fluke* digital multimeter or its equivalent for all voltage readings while servicing the IBM Displaywriter System. The use of any other multimeter to check voltages may cause circuit damage.

ELECTRONICS MODULE

Connector/Card	Go To Figure
0 Panel 1 - Printer	8-9,8-11
1 Panel 1 - MCU	8-9,8-12
2 Panel 1 - Display Modules	8-9,8-13,8-14
3 Panel 1 - Dump Switch	8-9
4 Panel 1 - Communications	8-9,8-12
5 Panel 1 - Diskette Signal	8-9,8-23
6a Panel 1 - Printer Sharing 1	8-9,8-25
6b Panel 1 - Printer Sharing 2	8-9,8-25
7 Panel 1 - Keyboard	8-9,8-26
8 AC Output	8-4
9 AC Input	8-4
10 Diskette DC	8-4,8-23
11C Communications	8-4
12 Large Display	8-4
A1 To Distribution Board	8-6,8-8
B1 To Distribution Board	8-6,8-8
C1 To Distribution Board	8-6,8-8
D1 To Distribution Board	8-6,8-8
L1 LED Board to P/S L1	8-4,8-10
P1 To Power Supply	8-4
P2 To Power Supply	8-4
S1 To System Card	8-5,8-7,8-10
S2 To System Card	8-5,8-7,8-10
Communications Adapter Card	8-8
Display Adapter Card	8-8
Memory Card	8-8
Memory Control Card	8-8
Printer Sharing Card or 3277 Emulation	8-8
System Card	8-8
Memory Extender Card	8-8

LARGE DISPLAY MODULE

Connector/Card	Go To Figure
2 (Panel 1 - Large Display Module)	8-9, 8-14
J1 (Display Cable Connector)	8-14, 8-16
J4 (Display Cable Connector)	8-14, 8-16
J501 (Video Input Cable)	8-14, 8-17
LV1 (Low Voltage Power Supply Cable)	8-15
LV2 (Low Voltage Power Supply Cable)	8-15
LV3 (Low Voltage Power Supply Cable)	8-15
Analog Card Connector Strip	8-16
J2 (Display Cable Connector)	8-16
J3 (Display Cable Connector)	8-16
CRT Socket	8-16
J301 (Deflection Output Cable)	8-17
J302 (Deflection Indicator Cable)	8-17
J502 (Video Output Cable)	8-17

KEYBOARD MODULE

Connector/Card	Go To Figure
30-Pin Connector For Pad Card	8-26
Keyboard Cable Connector (To 7)	8-26
Keyboard Logic Card	8-26
Keyboard Logic Card Connector	8-26
Pad Card	8-26
Speaker Connector	8-26

DISKETTE UNIT

Connector/Card	Go To Figure
B1 To Diskette Adapter Card	8-18,8-22
B2 To Diskette Adapter Card	8-18,8-22
B3 To Diskette Adapter Card	8-18,8-22
B4 To Diskette Adapter Card	8-18,8-22
AC Fan Connector	8-18
Diskette AC Connector	8-4,8-18
Diskette DC Connector (To 10)	8-4,8-18,8-19
Diskette Adapter Card	8-18
Diskette Signal Connector (To 5)	8-9,8-18,8-19
File Control Card	8-18,8-20
File Control Card Connector	8-18,8-19
Stepper Motor Connector	8-23,8-24
LED Connector	8-23,8-24
PTX Connector	8-23,8-24
Solenoid Connector	8-23,8-24
Head Connector	8-23,8-24

MISCELLANEOUS PARTS

Description	Go To Figure
Diskette Connector Strip	8-18
Distribution Board Assembly	8-6,8-8
Fuse (7 or 10 Amp)	8-4
Keyboard Jumpers	8-26
Memory Jumpers	8-8
LED Board	8-10
On/Off Switch	8-5,8-9,8-11, 8-12, 8-13,
Ring Terminal (Frame Ground)	8-4,8-7
Stiffener	8-6

Figure 8-1. Locator Chart

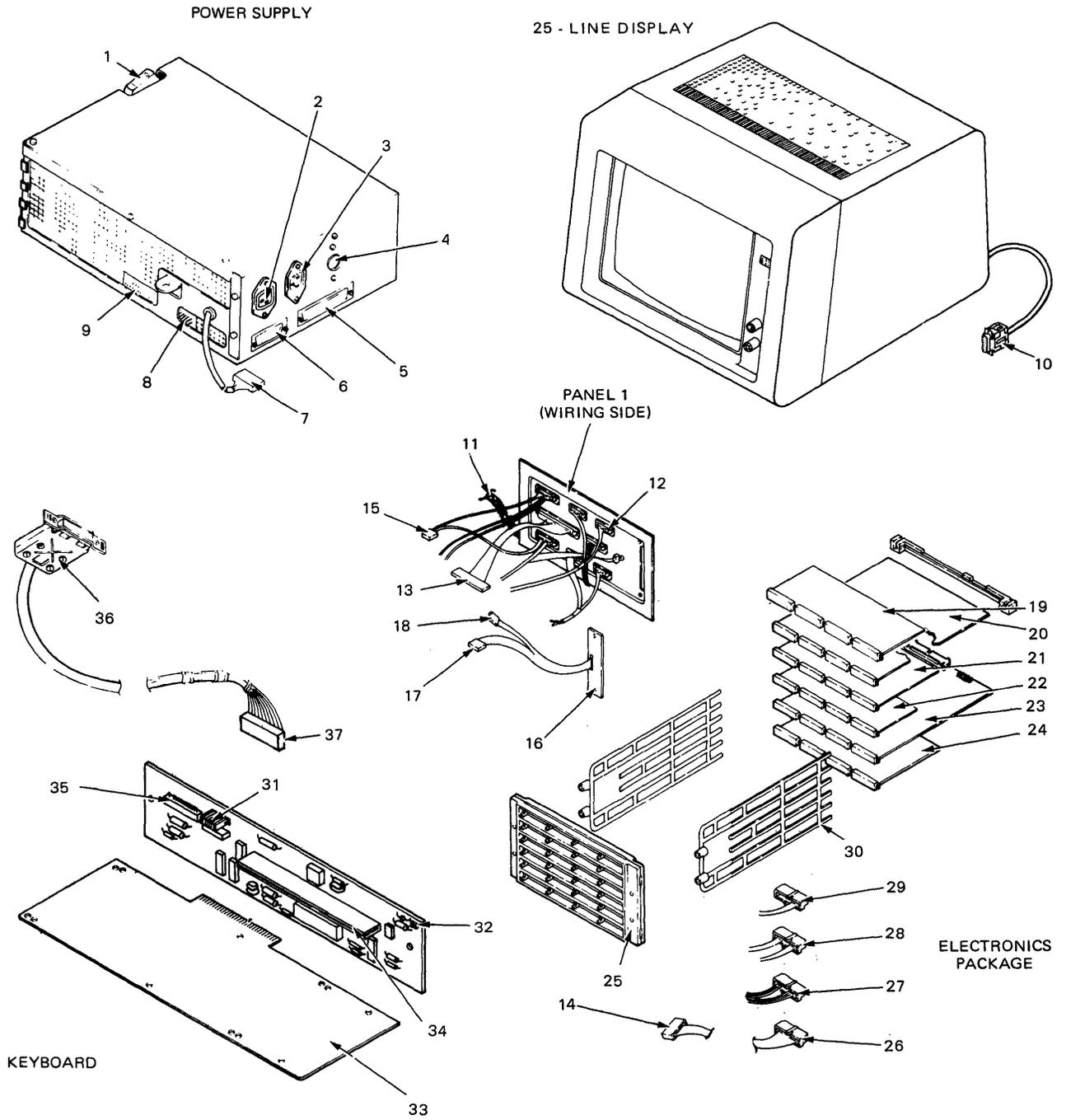


Figure 8-2 (Part 1 of 3). Cables, Connectors and Test Points Locators

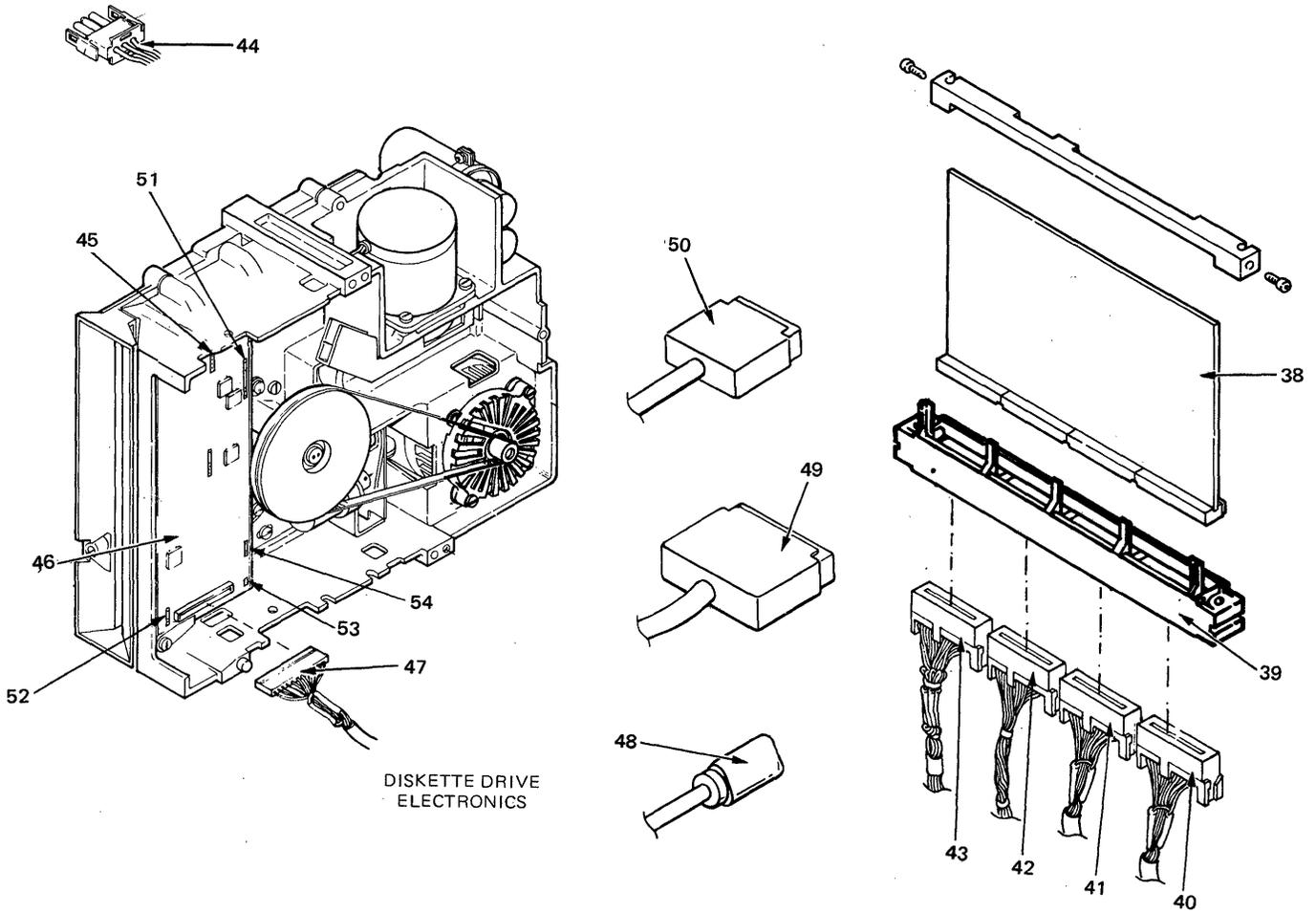


Figure 8-2 (Part 2 of 3). Cables, Connectors and Test Points Locators

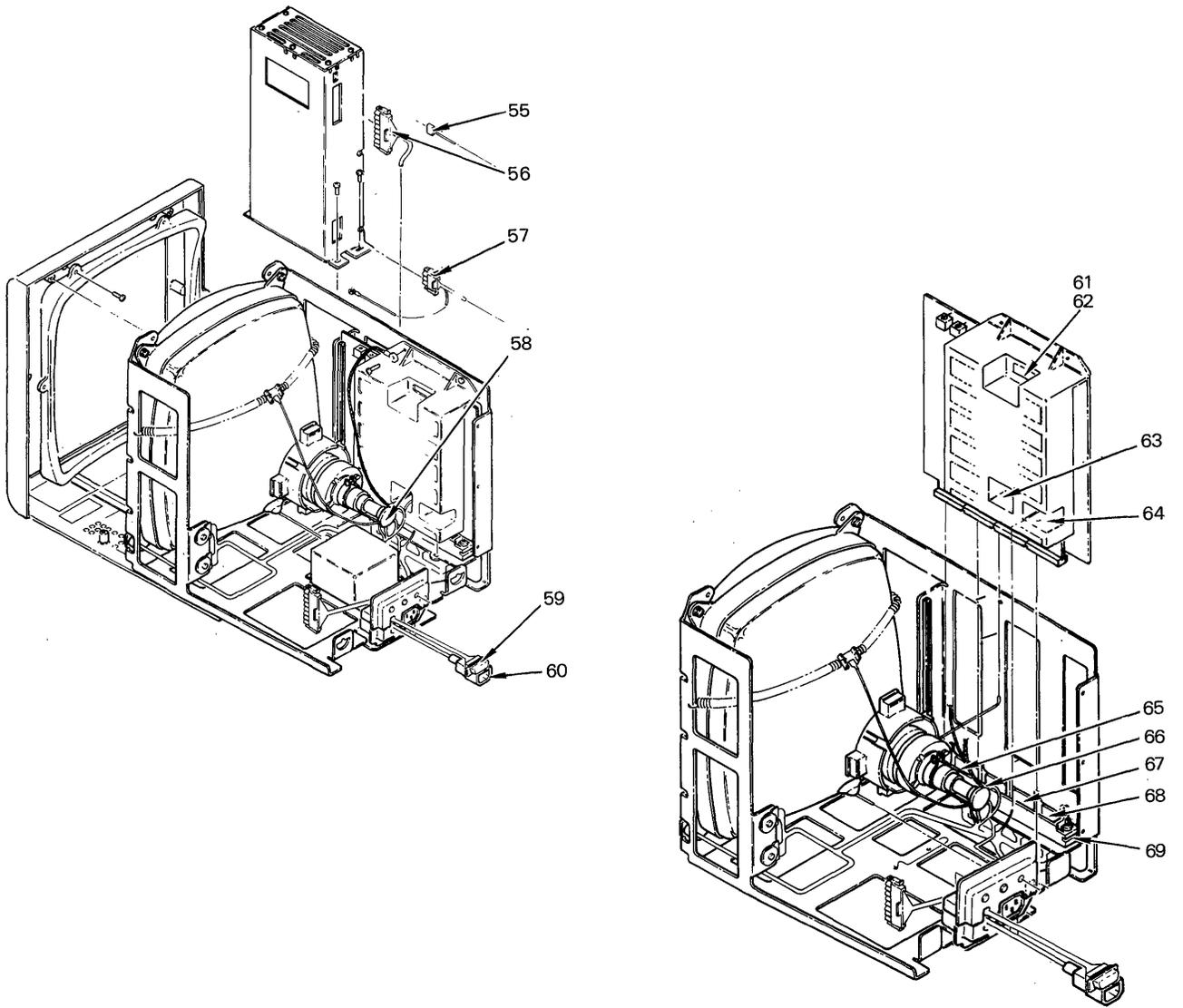


Figure 8-2 (Part 3 of 3). Cables, Connectors and Test Points Locators

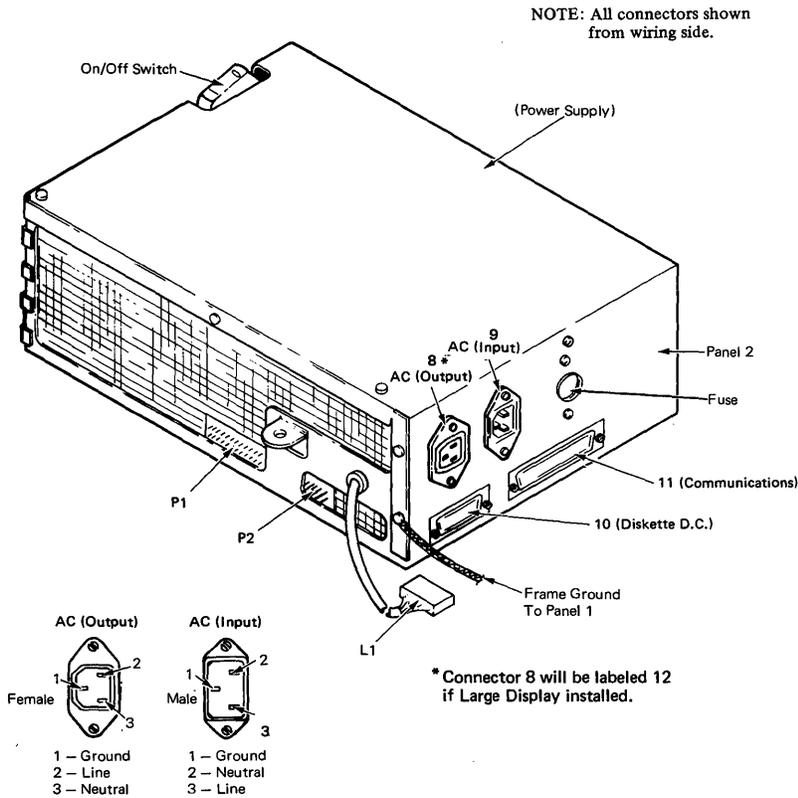
No.	Name	Go To Figure
1	On/Off Switch	8-4
2	Connector 8 or 12 (AC Output)	8-4, 8-18
3	Connector 9 (AC Input)	8-4
4	Fuse	8-4
5	Connector 11 (Communications)	8-4
6	Connector 10 (Diskette DC)	8-4, 8-18
7	Connector L1 (P/S to LED Board L1)	8-4, 8-10
8	Connector P2 (Power Supply)	8-4
9	Connector P1 (Power Supply)	8-4
10	Connector 2 (Display Module)	8-4, 8-13, 8-14
11	Ring Terminal (Frame Ground)	8-4
12	Panel 1 (Electronics Module)	8-5, 9, 11, 12, 13
13	Connector S1 (To System Card)	8-5, 8-7
14	Connector P1 (To Power Supply)	8-4
15	Connector P2 (To Power Supply)	8-4
16	LED Board	8-10
17	Connector S2 (To System Card)	8-5, 8-7, 8-10
18	Connector L1 (LED Board to P/S L1)	8-4, 8-10
19	Memory Extender Card	8-8
20	Memory Card	8-8
21	Display Adapter Card	8-8
22	Printer Sharing Card	8-8
23	System Card	8-8
24	Communications Adapter Card	8-8
25	Distribution Board Assembly	8-6, 8-8
26	Connector A1 (To Distribution Board)	8-6, 8-8
27	Connector B1 (To Distribution Board)	8-6, 8-8
28	Connector C1 (To Distribution Board)	8-6, 8-8
29	Connector D1 (To Distribution Board)	8-6, 8-8
30	Stiffener	8-6
31	Keyboard ID Jumpers	8-26, 8-27
32	Speaker Connector	8-26, 8-27
33	Pad Card	8-26
34	30-Pin Pad Card Connector	8-26
35	Keyboard Logic Card	8-26, 8-27
36	Keyboard Cable Connector (To 7)	8-26, 8-27
37	Logic Card Connector	8-26, 8-27
38	Diskette Adapter Card	8-18
39	Diskette Connector Strip	8-18
40	Connector B4 (To Diskette Adapter Card)	8-18, 8-22
41	Connector B3 (To Diskette Adapter Card)	8-18, 8-22
42	Connector B2 (To Diskette Adapter Card)	8-18, 8-22
43	Connector B1 (To Diskette Adapter Card)	8-18, 8-22
44	AC Fan Connector	8-18
45	Stepper Motor Connector	8-23, 8-24
46	File Control Card	8-18, 8-23, 8-24
47	File Control Card Connector	8-18, 8-22
48	Diskette AC Connector (To 8)	8-4, 8-18
49	Diskette Signal Connector (To 5)	8-9, 8-18, 8-22
50	Diskette DC Connector (To 10)	8-4, 8-18, 8-22
51	Head Connector	8-23, 8-24
52	PTX Connector	8-23, 8-24
53	LED Connector	8-23, 8-24
54	Solenoid Connector	8-23, 8-24
55	LV1 (Low Voltage Power Supply Cable)	8-15
56	LV2 (Low Voltage Power Supply Cable)	8-15
57	LV3 (Low Voltage Power Supply Cable)	8-15
58	CRT Socket	8-16
59	Connector 2	8-14
60	Display AC Cable	8-2
61	J301 (Deflection Output Cable)	8-17
62	J302 (Deflection Indicator Cable)	8-17
63	J502 (Video Output Cable)	8-17
64	J501 (Video Input Cable)	8-17
65	J4 (Display Cable Connector)	8-15, 8-16
66	J3 (Display Cable Connector)	8-15, 8-16
67	J2 (Display Cable Connector)	8-15, 8-16
68	J1 (Display Cable Connector)	8-15, 8-16
69	Analog Card Connector Strip	8-16

Figure 8-3. Hardware Locator Chart

POWER SUPPLY

Power to the display, keyboard, diskette, and system electronics is supplied by a power supply located in

the electronics module. The power supply is shielded to prevent electromagnetic interference. The following voltage levels are supplied: +24V, +12V, +8.5V, +5V, -5V, and -12V.



P 1 (SYSTEM POWER CABLE)

Termination Conn.

Pin No.	A 1	Identification
1	8	-12.0 VDC
2	13	-5.0 VDC
3	-	-
4	16	Frame Ground
5	18	Frame Ground
6	17	Frame Ground
7	-	-
8	-	-
9	-	-
10	22	+5.0 VDC
11	23	+5.0 VDC
12	24	+5.0 VDC
13	21	POR (+5.0 VDC)
14	15	+8.5 VDC
15	20	+12.0 VDC
16	-	-
17	4	Frame Ground
18	5	Frame Ground
19	6	Frame Ground
20	3	Frame Ground
21	9	+5.0 VDC
22	10	+5.0 VDC
23	11	+5.0 VDC
24	12	+5.0 VDC

Figure 8-4 (Part 1 of 3). Power Supply, Connector Pin Locations



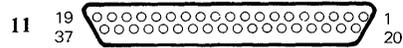
L 1 (LED ASSEMBLY CABLE)

Pin No.	Termination		Identification
	LED Board		
1	7		LED C (Thermal)
2	8		LED B (Over Current)
3	9		LED A (Over/Under Voltage)
4 (Key)	—		Not Used
5	10		+16.0 VDC



P 2 (INTERNAL DISTRIBUTION CABLE)

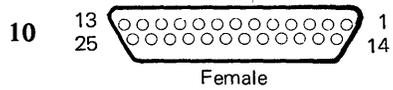
Pin No.	Termination Conn.		Identification
	2	7	
1	—	—	—
2	—	—	—
3	—	11	+5.0 VDC
4	—	9	+8.5 VDC
5	—	—	—
6	4	—	Signal Ground
7	2	—	Signal Ground
8	7	—	+5.0 VDC
9	—	—	—
10	3	—	+12.0 VDC



Female
11 (COMMUNICATIONS D.C. CABLE)

Pin No.	Termination		Identification
	Connector 11		
1	—		Signal Ground
2	—		Signal Ground
3	—		Signal Ground
4	—		Signal Ground
5	—		Signal Ground
6	—		Signal Ground
7	—		Signal Ground
8	—		Signal Ground
9	—		+12.0 VDC
10	—		+5.0 VDC
11	—		+5.0 VDC
12	—		+5.0 VDC
13	—		+5.0 VDC
14	—		+5.0 VDC
15	—		+5.0 VDC
16	—		+8.5 VDC
17	—		+8.5 VDC
18	—		-5.0 VDC
19	—		-12.0 VDC
20	—		Signal Ground
21	—		Signal Ground
22	—		Signal Ground
23	—		Signal Ground
24	—		Signal Ground
25	—		Signal Ground
26	—		Signal Ground
27	—		+12.0 VDC
28	—		+5.0 VDC
29	—		+5.0 VDC
30	—		+5.0 VDC
31	—		+5.0 VDC
32	—		+5.0 VDC
33	—		+5.0 VDC
34	—		+8.5 VDC
35	—		+8.5 VDC
36	—		-5.0 VDC
37	—		-12.0 VDC

Figure 8-4 (Part 2 of 3). Power Supply, Connector Pin Locations



10 (DISKETTE DC CABLE)

Pin No.	Termination	
	Connector B2	Identification
1	13	+5.0 VDC
2	14	+5.0 VDC
3	1	+5.0 VDC
4	2	+5.0 VDC
5	10	+12.0 VDC
6	6	POR DIS (+18VDC)
7	15	Signal Ground
8	16	Signal Ground
9	17	Signal Ground
10	18	Signal Ground
11	19	Signal Ground
12	5	-5.0 VDC
13	12	+24.0 VDC
14	3	+5.0 VDC
15	—	—
16	—	—
17	—	—
18	—	—
19	—	—
20	20	Signal Ground
21	21	Signal Ground
22	—	—
23	—	—
24	—	—
25	—	—

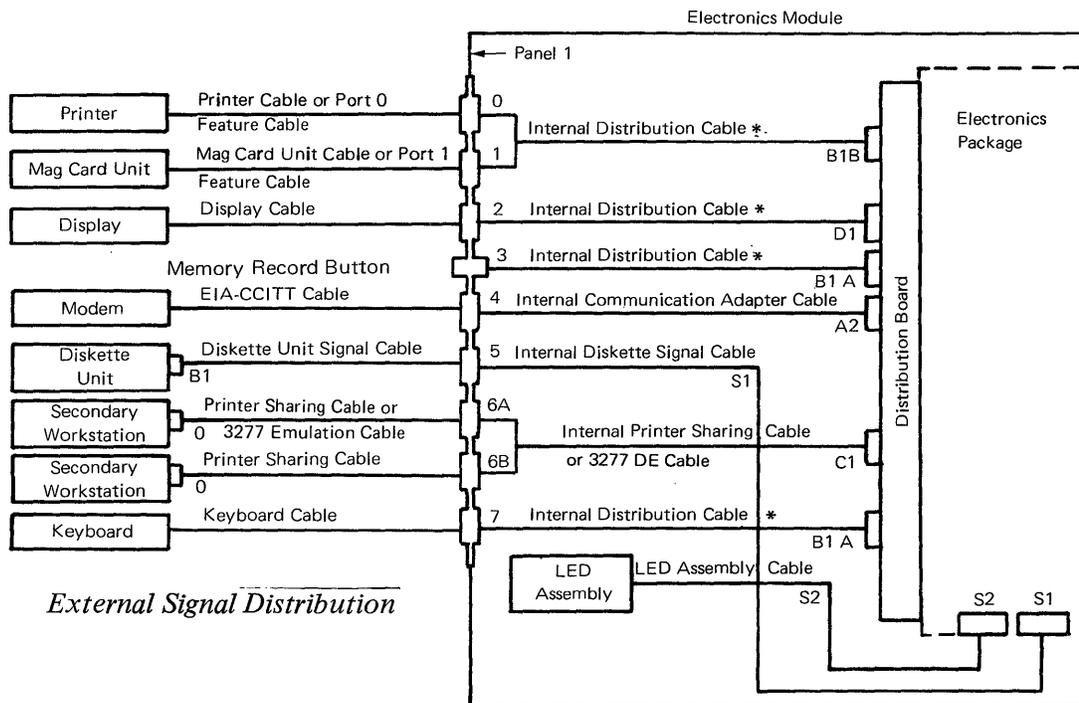
Figure 8-4 (Part 3 of 3). Power Supply, Connector Pin Locations

ELECTRONICS MODULE

The System Electronics Package consists of a distribution board and plugable cards: the communications cards, the system card, the memory cards, the display adapter card, and a printer sharing card. The distribution board cable connector positions are labeled A through F (bottom to top) and 1 through 4 (right to left) as viewed from the wiring side of the connectors. All connectors are 24-pin connectors.

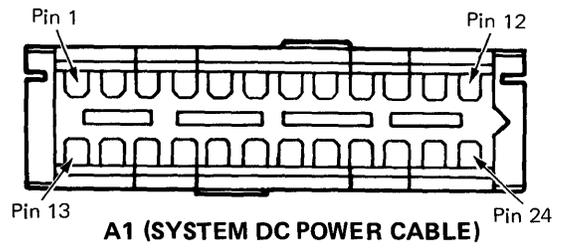
The system power supply provides input voltages to the electronics package at distribution board connector A1. The electronics package is cable-connected to the electronics module panel 1.

All electronics module panel 1 connectors are numbered left-to-right, top-to-bottom as viewed from the wiring side of female connectors or the pin side of the male connectors.



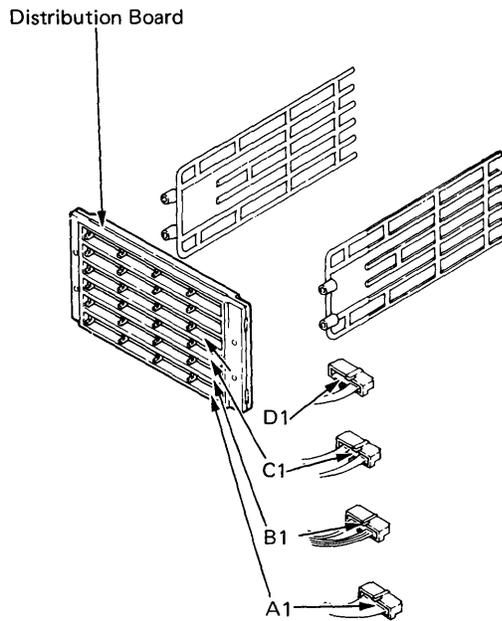
*The internal distribution cable has several connectors. Each connector plugs into a different position.

Figure 8-5. Signal Distribution Schematic



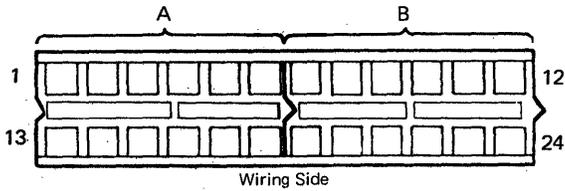
Termination Conn.

Pin No.	P1	Identification
1	—	—
2	—	—
3	20	Ground
4	17	Ground
5	18	Ground
6	19	Ground
7	—	—
8	1	-12.0 VDC
9	21	+5.0 VDC
10	22	+5.0 VDC
11	23	+5.0 VDC
12	24	+5.0 VDC
13	2	-5.0 VDC
14	—	—
15	14	+8.5 VDC
16	4	Ground
17	6	Ground
18	5	Ground
19	—	—
20	15	+12.0 VDC
21	13	POR
22	10	+5.0 VDC
23	11	+5.0 VDC
24	12	+5.0 VDC



NOTE: All connectors shown from wiring side.

Figure 8-6 (Part 1 of 2). Distribution Board Connectors



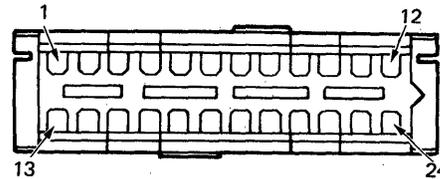
B 1 (INTERNAL DISTRIBUTION CABLE)

Pin No.	Termination Connectors			Identification
	1	7	0	
1	—	8	—	Data Strobe
2	—	6	—	Tone (Speaker)
3	—	5	—	Click (Speaker)
4	—	3	—	Serial Data Clock
5	—	1	—	Serial Data
6	(See note)			Frame Ground
7	—	—	9	Data Set Ready
8	—	—	3	Receive High
9	—	—	4	Receive Low
10	—	—	1	Transmit High
11	—	—	—	—
12	—	—	2	Transmit Low
13	—	—	—	Not Used
14	—	7	—	Keyboard Acknowledge
15	(See note)			System Dump
16	—	4	—	Power-On-Reset
17	—	—	—	—
18	—	—	—	—
19	9	—	—	Data Set Ready
20	—	—	—	—
21	3	—	—	Receive High
22	4	—	—	Receive Low
23	1	—	—	Transmit High
24	2	—	—	Transmit Low

Note: B1 Pin 6 (Frame Ground) Terminates at the Memory Record Switch N/O.
 B1 Pin 15 (System Dump) Terminates at the Memory Record Switch Common.

C 1 (INTERNAL PRINTER SHARING CABLE)

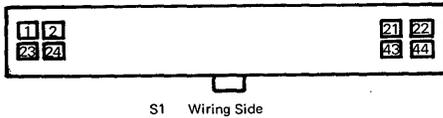
Pin No.	Termination Connectors		Identification
	6A	6B	
1	—	—	—
2	—	—	—
3	—	—	—
4	—	—	—
5	—	—	—
6	—	—	—
7	9	—	Data Set Ready
8	3	—	Receive Low
9	4	—	Receive High
10	1	—	Transmit Low
11	—	—	—
12	2	—	Transmit High
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	—	9	Data Set Ready
20	—	—	—
21	—	3	Receive Low
22	—	4	Receive High
23	—	1	Transmit Low
24	—	2	Transmit High



D 1 (INTERNAL DISPLAY CABLE CONNECTOR)

Pin No.	Termination Connector 2	Identification
2	11	Brightness
3	12	Vertical
4	13	Horizontal Drive
5	—	—
6	15	Signal Ground
7-24	—	(Not Used)

Figure 8-6 (Part 2 of 2). Distribution Board Connectors



S1 Wiring Side

S 1 (INTERNAL DISKETTE SIGNAL CABLE)

Pin No.	Termination Connector 5	Identification
1	—	—
2	—	—
3	—	—
4	—	—
5	5	Address Bit 8
6	20	DMA Request Receive
7	—	—
8	22	DMA Request Transmit
9	36	Data Bus Bit 2
10	37	Data Bus Bit 0
11	27	Interrupt 4
12	26	Interrupt 1
13	29	DMA Request
14	30	Reset
15	31	I/O Read
16	32	Address Bit 4
17	—	—
18	—	—
19	—	—
20	8	Select
21	33	Address Bit 2
22	—	—
23	—	—
24	—	—
25	—	—
26	—	—
27	34	Data Bus Bit 6
28	1	DMA Acknowledge Receive
29	4 & 13	Twisted Pair Ground
30	19	Data Bus Bit 1
31	35	Data Bus Bit 4
32	18	Data Bus Bit 3
33	7	Interrupt 7
34	10	Diskette Ready
35	11	DMA Acknowledge
36	12	Diskette Select
37	9	I/O Write
38	14	Address Bit 3
39	15	Address Bit 1
40	16	Data Bus Bit 7
41	17	Data Bus Bit 5
42	28	Terminal Count
43	21	DMA Acknowledge Transmit
44	—	—



S 2 (LED ASSEMBLY CABLE)

Pin No.	Termination LED Board	Identification
1	—	—
2	6	LED D (Error)
3	5	LED E (Error)
4	(Key)	(Not Used)
5	4	LED F (Error)
6	3	LED G (Error)
7	2	LED H (Error)
8	1	+5.0 VDC

NOTE: All connectors shown from wiring side.

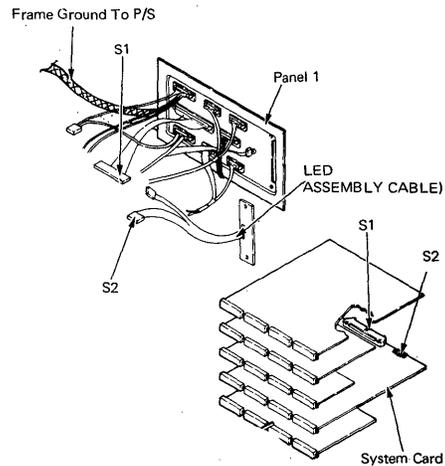
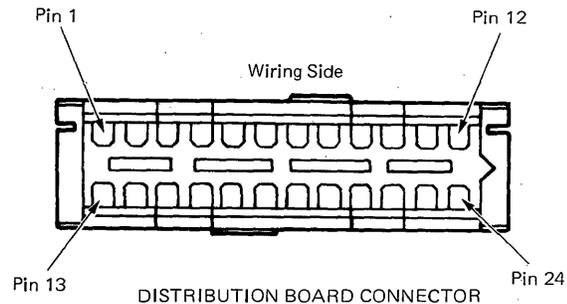


Figure 8-7. System Card Connectors

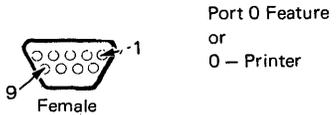
Pin	Voltage	Pin	Voltage	Pin	Voltage	Pin	Voltage
F4		F3		F2		F1	
6	Ground	6	Ground	6	Ground	6	Ground
11	+5 VDC	11	+5 VDC	11	+5 VDC	11	+5 VDC
				13	-5 VDC	13	-5 VDC
				15	+8.5 VDC	15	+8.5 VDC
				20	+12 VDC	20	+12 VDC
E4		E3		E2		E1	
6	Ground	6	Ground	6	Ground	6	Ground
11	+5 VDC	11	+5 VDC	11	+5 VDC	11	+5 VDC
				13	-5 VDC	13	-5 VDC
				15	+8.5 VDC	15	+8.5 VDC
				20	+12 VDC	20	+12 VDC
D4		D3		D2		D1	
6	Ground	6	Ground	6	Ground	6	Ground
11	+5 VDC	11	+5 VDC	11	+5 VDC	11	+5 VDC
						13	-5 VDC
						15	+8.5 VDC
						20	+12 VDC
C4		C3		C2		C1	
6	Ground	6	Ground	6	Ground	6	Ground
11	+5 VDC	11	+5 VDC	11	+5 VDC	11	+5 VDC
						13	-5 VDC
						15	+8.5 VDC
B4		B3		B2		B1	
6	Ground	6	Ground	6	Ground	6	Ground
11	+5 VDC	11	+5 VDC	11	+5 VDC	11	+5 VDC
A4		A3		A2		A1	
		6	Ground	6	Ground	Pin	Voltage
						3	Ground
						4	Ground
						5	Ground
						6	Ground
						8	-12 VDC
						9	+5 VDC
						10	+5 VDC
						11	+5 VDC
						12	+5 VDC
						13	-5 VDC
						15	+8.5 VDC
						16	Ground
						17	Ground
						18	Ground
						20	+12 VDC
						22	+5 VDC
						23	+5 VDC
						24	+5 VDC

F4	F3	F2	F1	Memory Extender Card (Position F)
E4	E3	E2	E1	Memory Card (Position E)
D4	D3	D2	D1	Display Adapter Card (Position D)
C4	C3	C2	C1	Printer Sharing Card (Position C) or 3277 Emulation Card
B4	B3	B2	B1	System Card (Position B)
A4	A3	A2	A1	Communications Card (Position A)



NOTE: All connectors shown from wiring side.

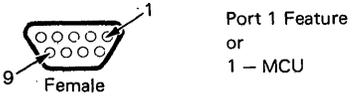
Figure 8-8. Distribution Board - Pin, Test Point and Card Locator



**0 (INTERNAL DISTRIBUTION CABLE)
Termination
Connectors**

Pin No.	B1	B	1	Identification
1	10	—	—	Transmit High
2	12	—	—	Transmit Low
3	8	—	—	Receive High
4	—	9	—	Receive Low
5*	—	—	5	Frame Ground
6*	—	—	6	Frame Ground
7**	—	—	—	Data Set Ready
8**	—	—	—	Data Set Ready
9**	7	—	—	Data Set Ready

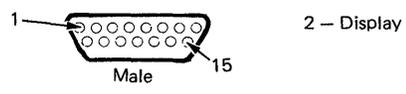
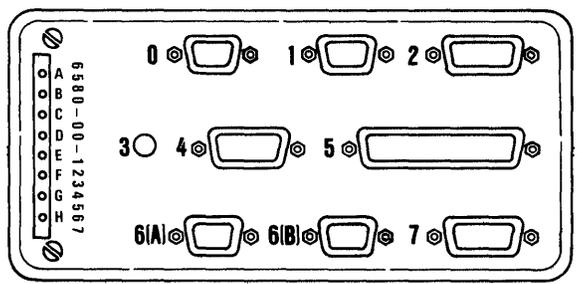
*Ring Terminal
**STRAP



**1 (INTERNAL DISTRIBUTION CABLE)
Termination
Connectors**

Pin No.	B1	B	0	Identification
1	23	—	—	Transmit High
2	24	—	—	Transmit Low
3	21	—	—	Receive High
4	22	—	—	Receive Low
5	—	—	5	Frame Ground
6*	—	—	6	Frame Ground
7**	—	—	—	Data Set Ready
8**	—	—	—	Data Set Ready
9**	19	—	—	Data Set Ready

*Ring Terminal
**STRAP



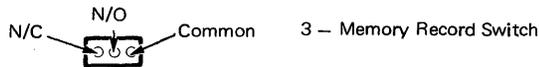
**2 (INTERNAL DISTRIBUTION CABLE)
Termination
Connectors**

Pin No.	P 2	D 1	Identification
1	—	—	—
2	7	—	Signal Ground
3	10	—	+12.0 VDC
4	6	—	Signal Ground
5	—	—	—
6	—	—	—
7	8	—	+5.0 VDC
8*	—	—	Frame Ground
9	—	—	—
10	—	1	Video
11	—	2	Brightness
12	—	3	Vertical
13	—	4	Horizontal Drive
14	—	—	—
15	—	6	Signal Ground

*Ring Terminal

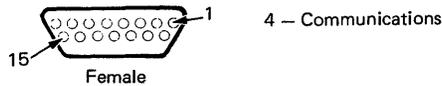
NOTE: All connectors shown from wiring side.

Figure 8-9 (Part 1 of 3). Panel 1 Connectors



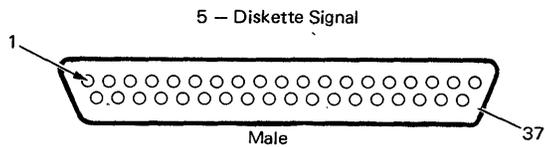
**3 MEMORY RECORD SWITCH
(INTERNAL DISTRIBUTION CABLE)**

Pin No.	Termination Connector B1A	Identification
N/C	—	—
N/O	6	Frame Ground
Common	15	System Dump



4 (INTERNAL COMMUNICATION ADAPTER CABLE)

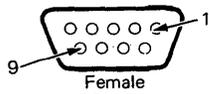
Pin No.	Termination Connector A2	Identification
1	19	Transmit Data
2	22	Receive Data
3	23	Request To Send
4	16	Clear to Send
5	5	Data Set Ready
6	—	Shield Ground
7	2	Carrier Detect
8	21	Select Standby
9	6	Signal Ground
10	10	Transmit Clock
11	4	Receive Clock
12	7	Test
13	12	Data Terminal Ready
14	13	Ring Indicate
15	8	Data Rate Select



5 INTERNAL (DISKETTE) SIGNAL CABLE

Pin No.	Termination Connector S1	Identification
1	28	DMA Acknowledge Rec.
2	—	Shield Ground
3	—	Shield Ground
4	29	Twisted Pair Ground
5	5	Address Bit 8
6	—	—
7	33	Interrupt 7
8	20	Select
9	37	I/O Write
10	34	Diskette Ready
11	35	DMA Acknowledge
12	36	Diskette Select
13	29	Twisted Pair Ground
14	38	Address Bit 3
15	39	Address Bit 1
16	40	Data Bus Bit 7
17	41	Data Bus Bit 5
18	32	Data Bus Bit 3
19	30	Data Bus Bit 1
20	6	DMA Request Receive
21	43	DMA Acknowledge Trans
22	8	DMA Request Transmit
23	—	Shield Ground
24	—	—
25	—	Shield Ground
26	12	Interrupt 1
27	11	Interrupt 4
28	42	Terminal Count
29	13	DMA Request
30	14	Reset
31	15	I/O Read
32	16	Address Bit 4
33	21	Address Bit 2
34	27	Data Bus Bit 6
35	31	Data Bus Bit 4
36	9	Data Bus Bit 2
37	10	Data Bus Bit 0

Figure 8-9 (Part 2 of 3). Panel 1 Connectors

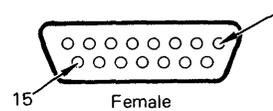
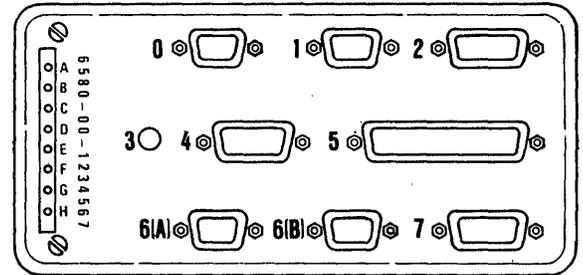


6A – Printer Sharing – 1

6 A (INTERNAL PRINTER SHARING CABLE)

Pin No.	Termination Connectors		Identification
	C1	6B	
1	10	–	Transmit Low
2	12	–	Transmit High
3	8	–	Receive Low
4	9	–	Receive High
5	–	5	Frame Ground
6	–	6	Frame Ground
7*	–	–	Data Set Ready
8*	–	–	Data Set Ready
9*	7	–	Data Set Ready

*STRAP

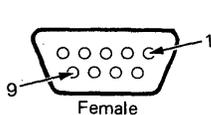


7 – Keyboard

7 (INTERNAL DISTRIBUTION CABLE)

Pin No.	Termination Connectors		Identification
	P2	B1 A	
1	–	5	Serial Data
2	–	–	–
3	–	4	Serial Data Clock
4	–	16	Power-Out-Reset
5	–	3	Click (Speaker)
6	–	2	Tone (Speaker)
7	–	14	Kybd Acknowledge
8	–	1	Data Strobe
9	4	–	+8.5 VDC
10	–	–	Frame Ground
11	3	–	+5.0 VDC
12	–	–	Frame Ground
13*	–	–	Frame Ground
14*	–	–	Frame Ground
15	–	–	–

*Ring Terminal



6B – Printer Sharing – 2

6 B (INTERNAL PRINTER SHARING CABLE)

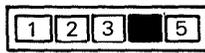
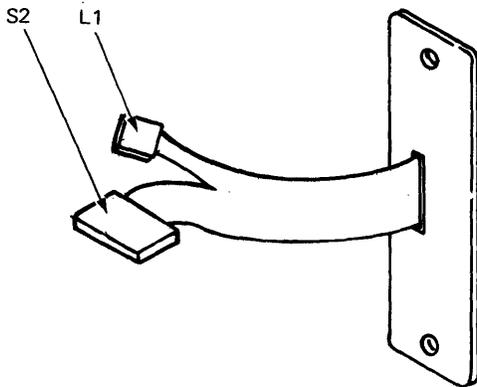
Pin No.	Termination Connectors		Identification
	C1	6A	
1	23	–	Transmit Low
2	24	–	Transmit High
3	21	–	Receive Low
4	22	–	Receive High
5	–	5	Frame Ground
6	–	6	Frame Ground
7*	–	–	Data Set Ready
8*	–	–	Data Set Ready
9*	19	–	Data Set Ready

*STRAP

Figure 8-9 (Part 3 of 3). Panel 1 Connectors

LIGHT EMITTING DIODE (LED) BOARD

The LED board is connected to the system power supply by connector L1 and to the system card by connector S2.

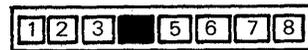


Wiring Side

L 1 (LED ASSEMBLY CABLE)

Pin No.	Termination LED Board	Identification
1	7	LED C (Thermal)
2	8	LED B (Over Current)
3	9	LED A (Over/Under V)
4	(Key)	Not Used
5	10	+16.0 VDC

LED Board Connectors



Wiring Side

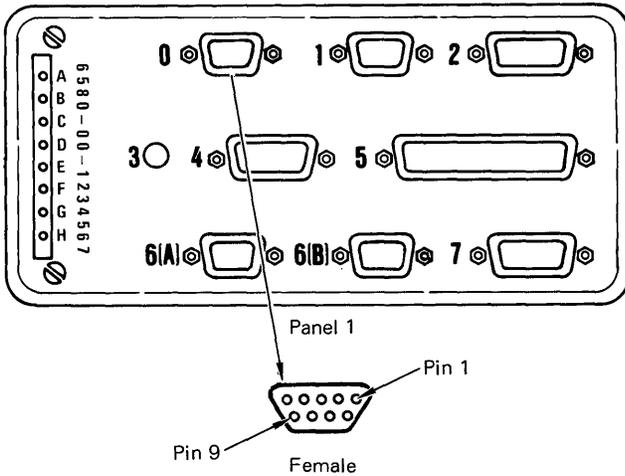
S2 (LED ASSEMBLY CABLE)

Pin No.	Termination LED Board	Identification
1	—	—
2	6	LED D (Error)
3	5	LED E (Error)
4	(Key)	(Not Used)
5	4	LED F (Error)
6	3	LED G (Error)
7	2	LED H (Error)
8	1	+5.0 VDC

Figure 8-10. LED Board Connectors

PRINTER

The printer to work station interface connection is at the system electronics module, panel 1 at connector 0, or port 0 feature if present.



Pin No.	Termination Connector	Identification
1	*	Transmit High
2	*	Transmit Low
3	*	Receive High
4	*	Receive Low
5	*	Frame Ground
6	*	Frame Ground
7	*	Data Set Ready
8	*	Data Set Ready
9	*	Data Set Ready

* Refer to Printer Manual

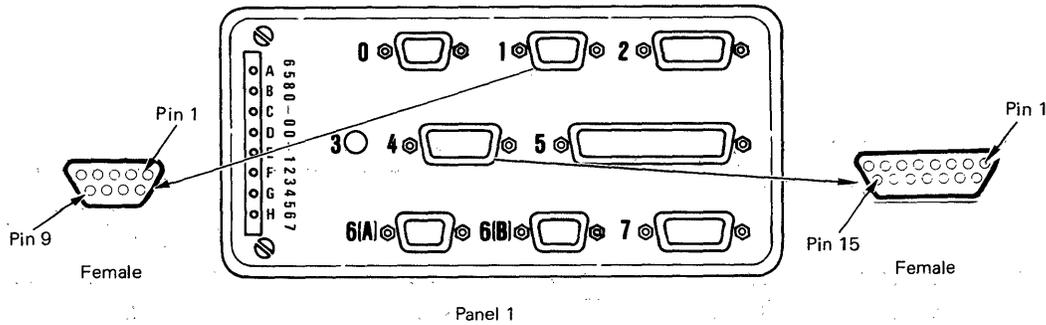
Figure 8-11. Printer Connector Panel 1

MAG CARD UNIT

Electronic module panel 1, connector 1 is provided for Mag Card Unit feature attachment (Figure 8-12).

COMMUNICATIONS CONNECTORS

A 15-pin Communications Adapter connection is located on electronics module panel 1, connector 4 (Figure 8-12).



Pin No.	Termination Connector	Identification
1	*	Transmit High
2	*	Transmit Low
3	*	Receive High
4	*	Receive Low
5	*	Frame Ground
6**	*	Frame Ground
7	*	Data Set Ready
8	*	Data Set Ready
9	*	Data Set Ready

* Refer to MCU Manual
 ** Ring Terminal

Mag Card Unit

Pin No.	Termination External Modem Cable	Identification
1	2	Transmit Data
2	3	Receive Data
3	4	Request To Send
4	5	Clear To Send
5	6	Data Set Ready
6	1	Shield Ground
7	8	Carrier Detect
8	11	Select Standby
9	7	Signal Ground
10	15	Transmit Clock
11	17	Receive Clock
12	18	Test
13	20	Data Terminal Ready
14	22	Ring Indicate
15	23	Data Rate Select

Communications

Figure 8-12. Mag Card Unit and Communications Connector Panel 1

25-LINE DISPLAY MODULE

The display module is cable-connected to the electronics module panel 1,

connector 2. The electronic signals and voltages for the display module are shown in (Figure 8-13).

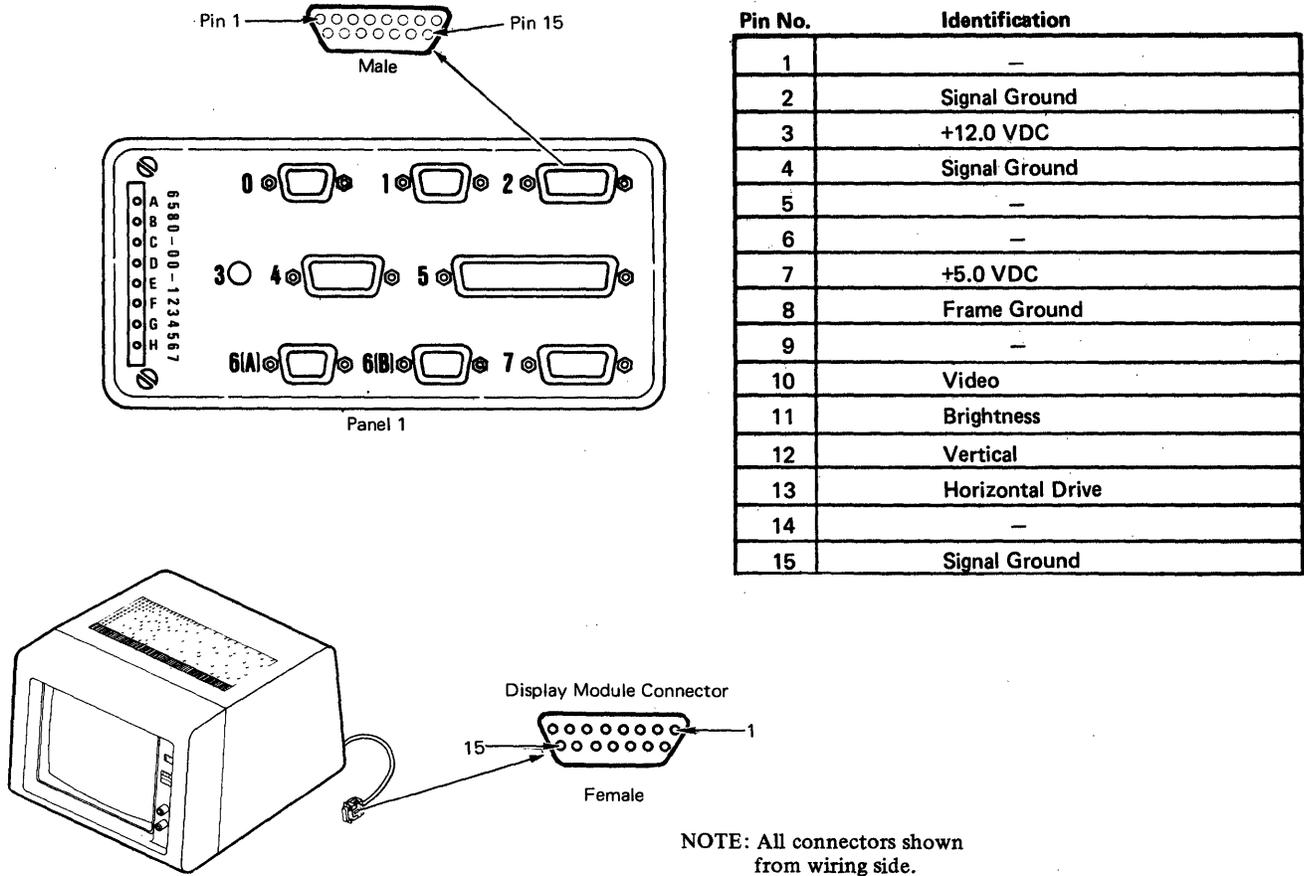
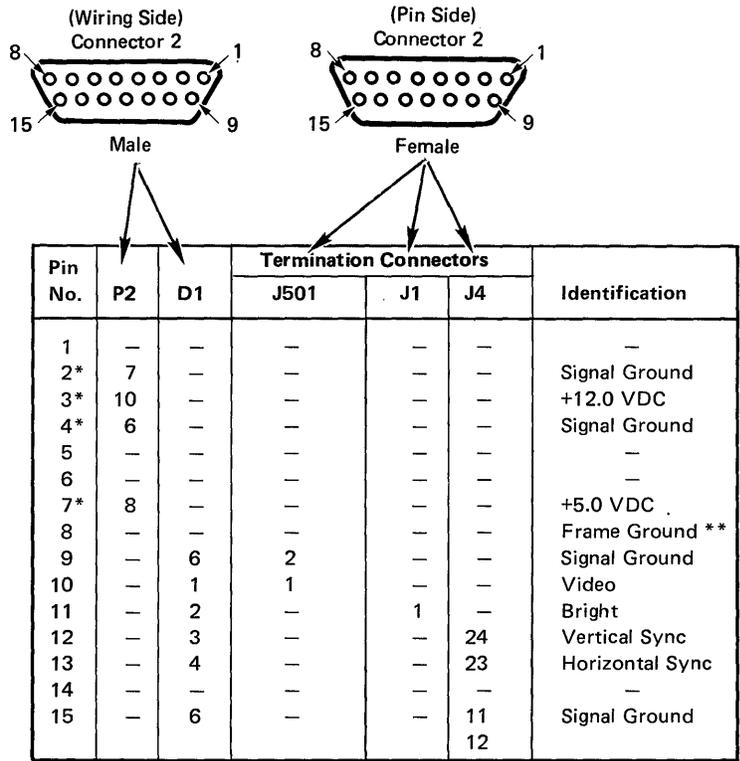


Figure 8-13. 25-Line Display Module Connectors

LARGE DISPLAY



* NOTE: The two signal grounds and the two DC voltages shown between Connector P2 and Connector 2 are present, but are not used by the Large Display.

** Ring Terminal

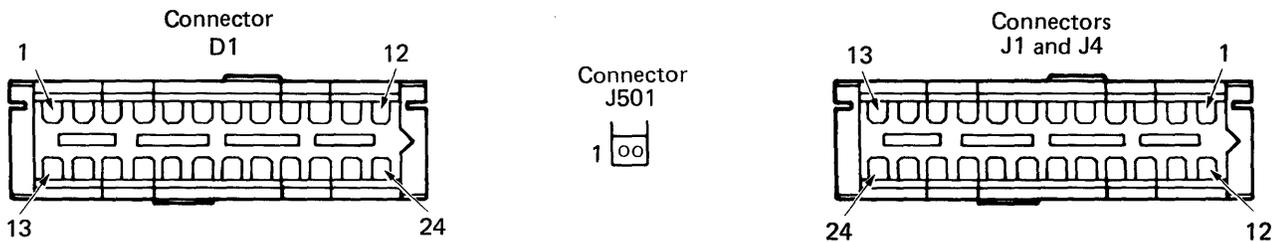
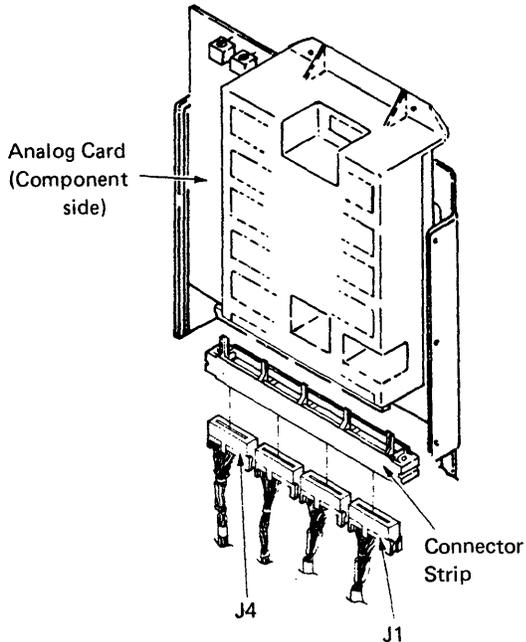
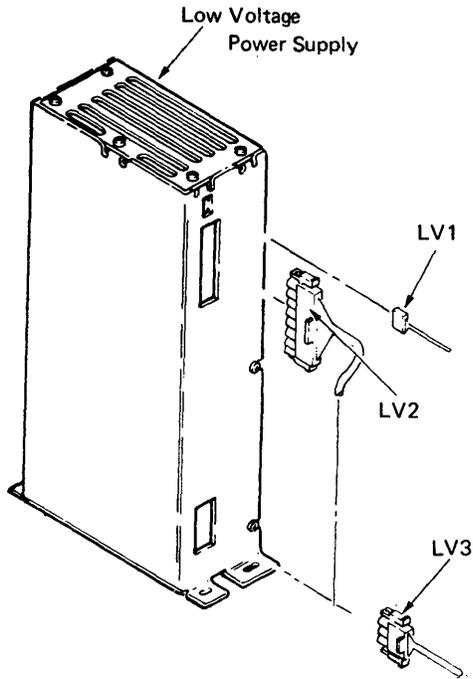


Figure 8-14. Panel 1, Connector 2

NOTE: All connectors shown from wiring side.



LV1		LV1	
	Pin No.	Identification	
4	○	4	Not Used
3	○	3	Indicator 0
2	●	2	(Key)
1	○	1	Indicator 0

LV2		Termination Connectors		
	Pin No.	J1	J4	Identification
8	⓪	11	—	- 5 VDC
7	○	—	17	+ 5 VDC
6	○	2	—	+ 5 VDC
5	○	—	3	Signal Ground
4	○	—	1	Signal Ground
3	○	15	—	Signal Ground
2	○	—	13	+ 32 VDC
1	⓪	7	—	+ 32 VDC

LV3		LV3	
	Pin No.	Identification	
3	○	3	AC (in)
2	○	2	Frame Ground
1	⓪	1	AC (in)

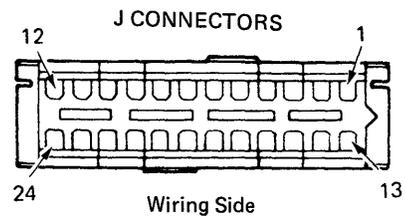
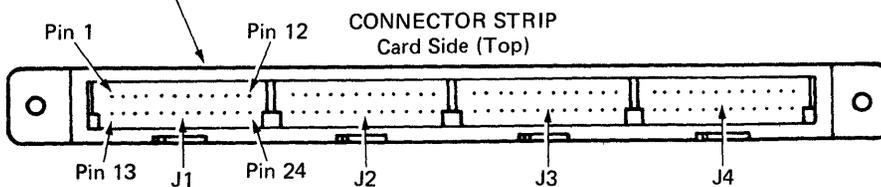
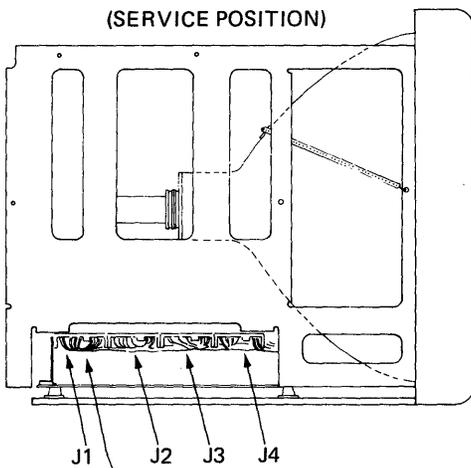
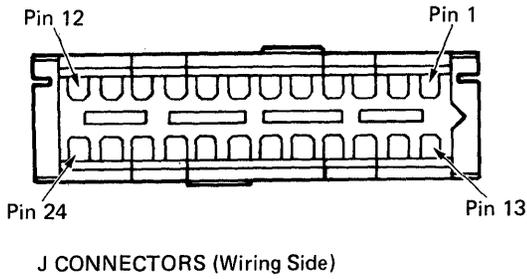


Figure 8-15. Large Display Low Voltage Power Supply Cable Connectors



NOTE: Voltage and continuity checks on the Connector Strip pins are taken from the top (card side) with the Analog Card removed.

J1

Termination Connectors

Pin No.	2	Bright Control	LV2	Identification
1	11	—	—	Bright (Info. Only)
2	—	—	6	+ 5.0 VDC
3	—	—	—	Not Used
4	—	—	—	Not Used
5	—	2 3	—	Intensity
6	—	—	—	Not Used
7	—	—	1	+ 32 VDC
8	—	—	—	Not Used
9	—	—	—	+ 18 VDC
10	—	—	—	Not Used
11	—	—	8	- 5 VDC
12-14	—	—	—	Not Used
15	—	—	3	Signal Ground
16	—	—	—	Not Used
17 *	—	—	—	Frame Ground
18	—	—	—	Not Used
19 *	—	—	—	Frame Ground
20	—	—	—	Not Used
21 *	—	—	—	Frame Ground
22	—	—	—	Not Used
23 *	—	—	—	Frame Ground
24	—	—	—	Not Used

* Ring Terminal

Figure 8-16 (Part 1 of 3). Large Display Analog Card Connector Strip, Cable Connectors J1 through J4, and CRT Socket

CONNECTOR J2

Termination Connectors

Pin No.	CRT Socket	HVPS Neon	Bright Control	Pot 2	Pot 1	Identification
1	1	—	—	—	—	Heater Ground
2	—	*	—	—	—	Ground
3	—	*	—	—	—	— 135 VDC
4 - 12	—	—	—	—	—	Not Used
13	8	—	—	—	—	Heater Power (6.3 VAC)
14	—	—	—	—	—	Not Used
15	—	—	1	—	—	— 135 VDC
16	—	—	—	—	—	Not Used
17	—	—	—	3	—	(Info Only)
18	—	—	—	—	—	Not Used
19	4	—	—	—	—	Focus Grid
20	—	—	—	—	—	Not Used
21	—	—	—	2	—	(Info Only)
22-23	—	—	—	—	—	Not Used
24	—	—	—	—	3	+ 1200 VDC

CONNECTOR J3

Pin No.	Identification
1 - 11	Not Used
12	HVPS Ground
13	+ 1200 VDC
14 - 15	Not Used
16	— 135 VDC
17 - 21	Not Used
22	Inhibit Line (Info Only)
23	Not Used
24	+ 32 VDC

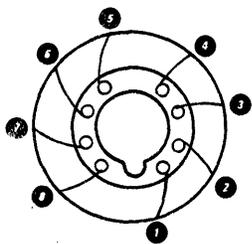
CONNECTOR J4

Termination Connectors

Pin No.	2	LV2	Pot 2	Pot 1	Identification
1	—	4	—	—	Signal Ground
2	—	—	—	—	Not Used
3	—	5	—	—	Signal Ground
4	—	—	—	—	Not Used
5	—	—	1	1	Signal Ground
6-10	—	—	—	—	Not Used
11	15	—	—	—	Signal Ground
12	15	—	—	—	Signal Ground
13	—	2	—	—	+ 32 VDC
14	—	—	—	—	Not Used
15	—	—	—	—	+ 18 VDC
16	—	—	—	—	Not Used
17	—	7	—	—	+ 5 VDC
18-22	—	—	—	—	Not Used
23	13	—	—	—	Horizontal Sync
24	12	—	—	—	Vertical Sync

Figure 8-16 (Part 2 of 3). Large Display Analog Card Connector Strip, Cable Connectors J1 through J4, and CRT Socket

CRT SOCKET

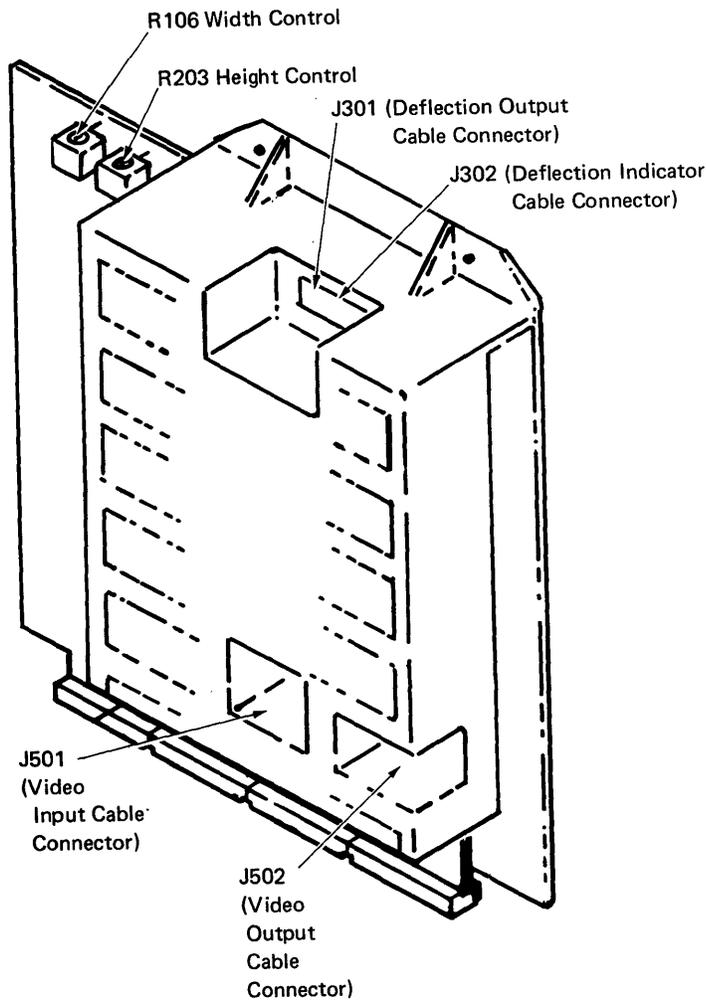


CRT SOCKET (Pin Side)

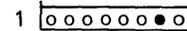
Termination Connectors

Pin No.	J2	J502	Pot 1	Identification
1	1	—	—	Heater Ground
2	—	—	—	Not Used
3	—	—	2	
4	19	—	—	Focus Grid G4
5	—	—	—	To Ground Spring
6	—	4	—	Grid 1
7	—	1	—	Cathode
8	13	—	—	Heater Power (6.3 VAC)

Figure 8-16 (Part 3 of 3). Large Display Analog Card Connector Strip, Cable Connectors J1 through J4, and CRT Socket

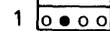


J301 (DEFLECTION OUTPUT CABLE)



Pin No.	*Termination Connector Yoke	Identification
1	*	Vertical Yoke
2	*	Vertical Yoke
3	*	Vertical Yoke Center Tap
4		+ 32 VDC
5		+ 32 VDC
6	*	Horizontal Yoke
7	(Key)	(Not Used)
8	*	Horizontal Yoke

J302 (DEFLECTION INDICATOR CABLE)



Pin No.	Identification
1	To Sweep Indicator (Neon 2)
2	(Key)
3	Not Used
4	To Sweep Indicator (Ground)

J502 (VIDEO OUTPUT CABLE)



Pin. No.	Termination Connector CRT Socket	Identification
1	7	Cathode
2	—	(Not Used)
3	(Key)	(Not Used)
4	6	Grid 1

J501 (VIDEO INPUT CABLE)



Pin No.	Termination Connector 2	Identification
1	10	Video Input Signal
2	9	Signal Ground

Figure 8-17. Large Display Cables, Connectors and Test Point Locators

DISKETTE UNIT

The signal, AC, and DC cables from the diskette unit connect to the electronics module at sockets 5, 8 and 10 on systems with the 25-Line Display installed. Systems with the Large Display installed use connectors 5 and 10 on the electronics module for sig-

nal and DC and Connector 8 on the rear of the display module for AC. The signal cable attaches to the diskette adaptor card connector strip at B1 and the DC cable connects to the connector strip in position B2. The file control card cables attach to connector strip positions B3 and B4.

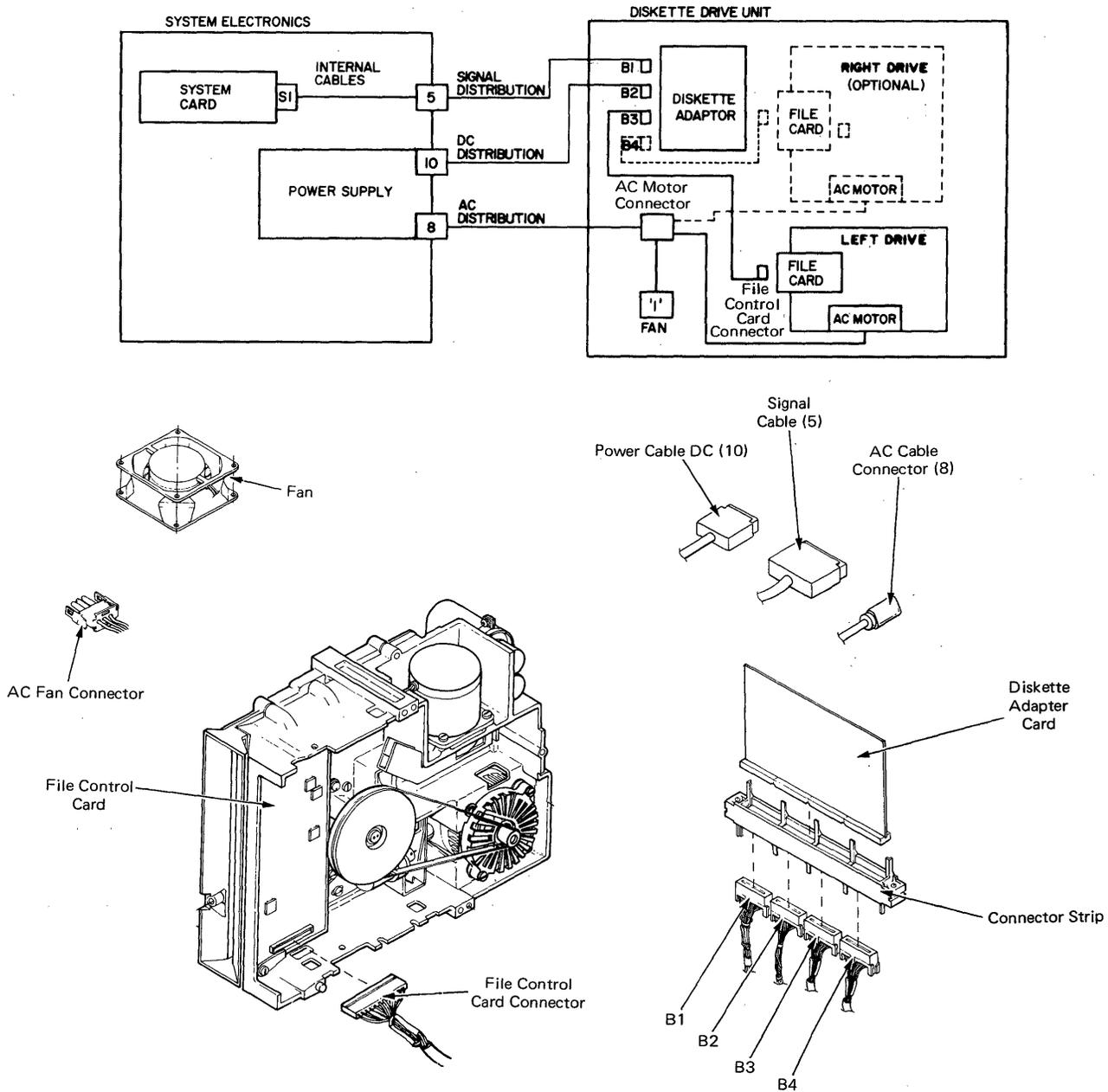
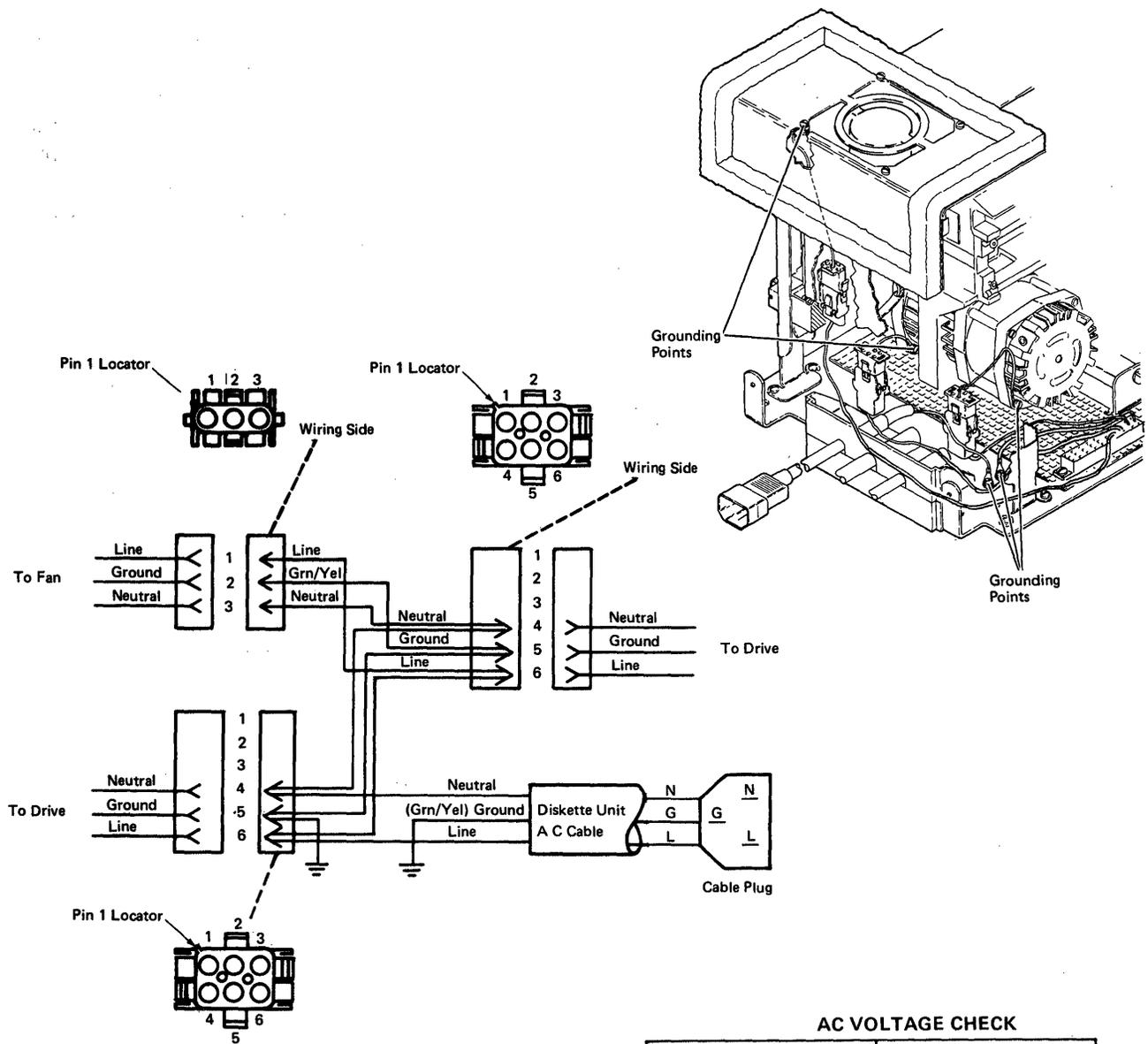


Figure 8-18. Diskette Drive Connectors

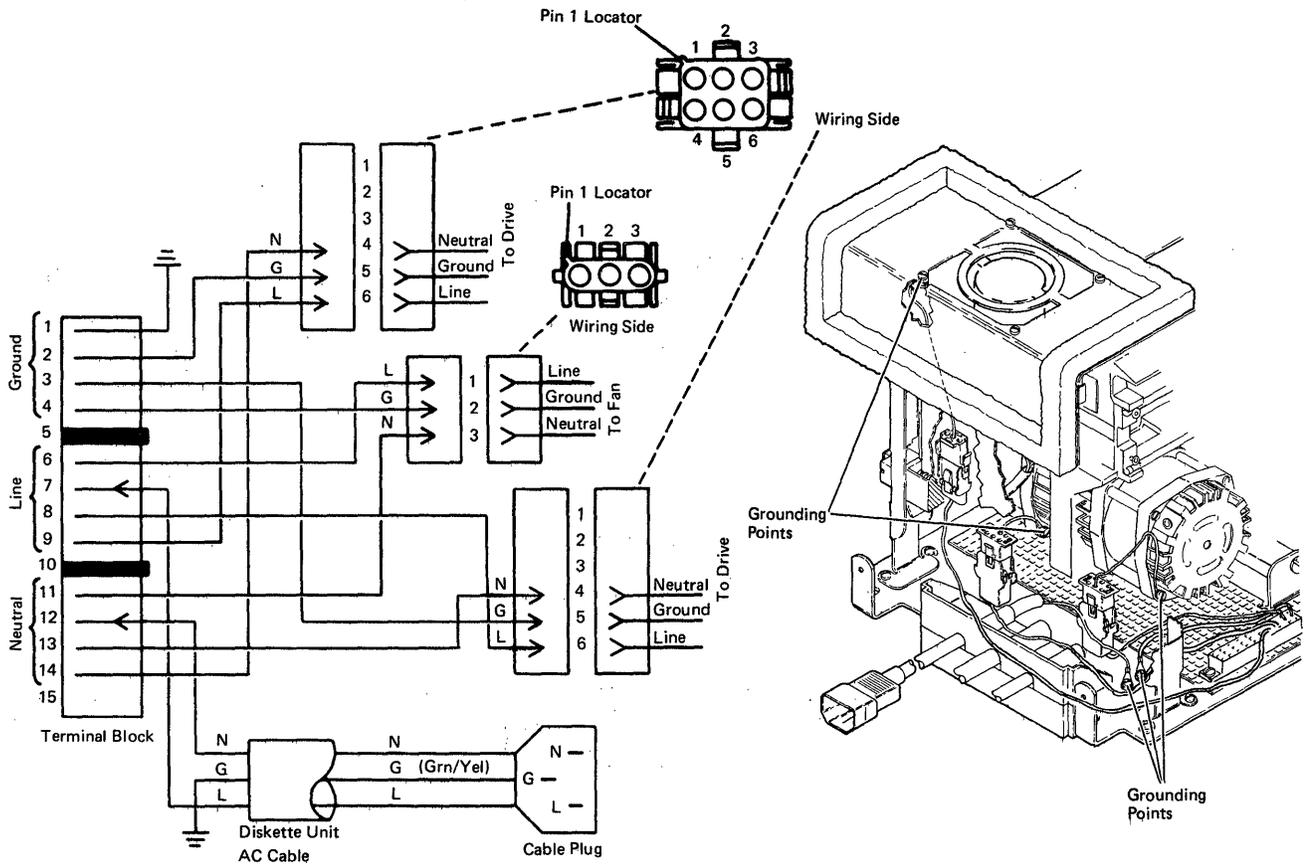


AC VOLTAGE CHECK

Line To Gound	Read AC Voltage
Line To Neutral	Read AC Voltage
Ground To Neutral	0 Volts

Left or Right Drive Conn.	Fan Conn.	Description
Pin 4	Pin 3	Neutral
Pin 5	Pin 2	Ground
Pin 6	Pin 1	Line

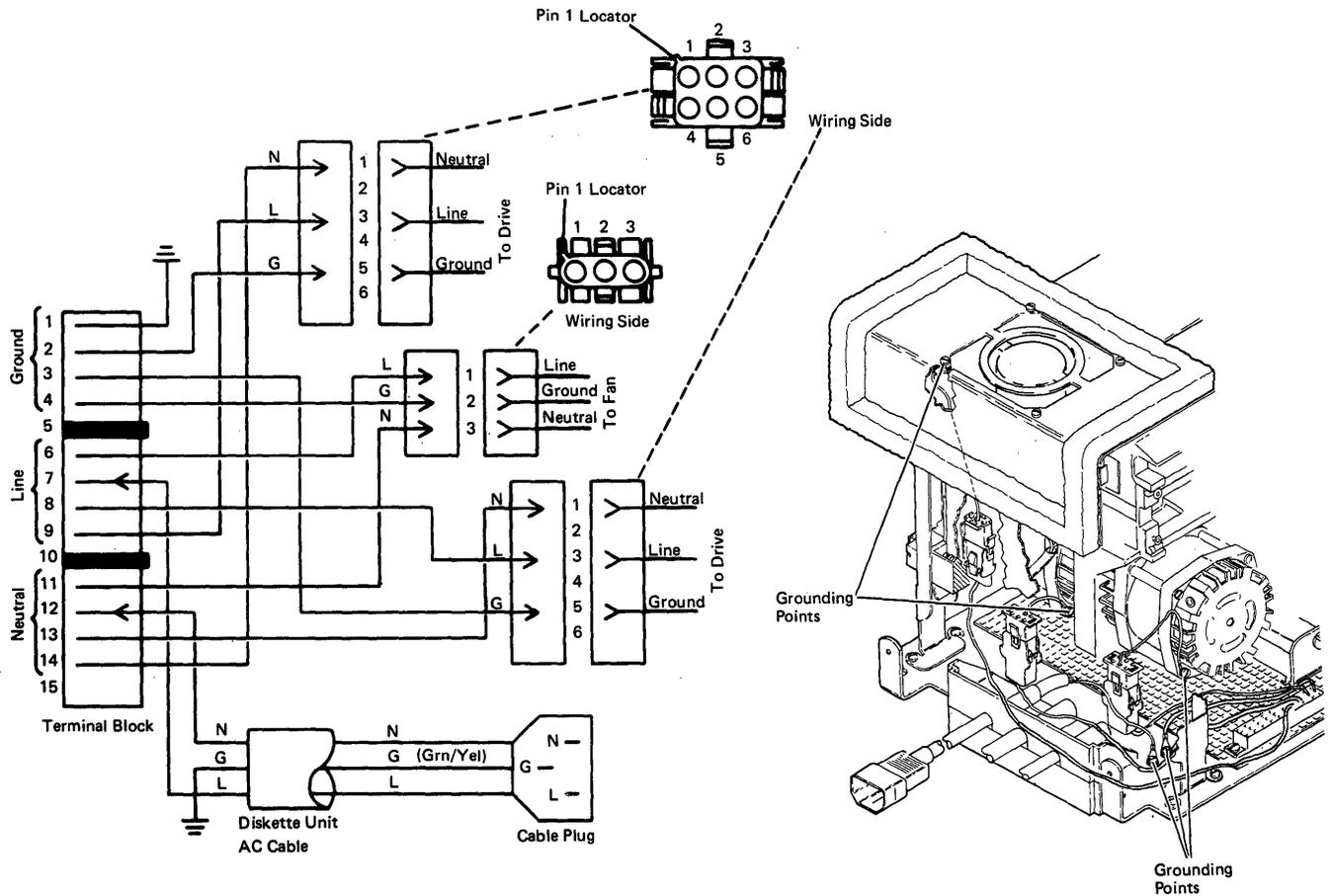
Figure 8-19. Diskette Drive Connectors - AC Wiring Diagram



AC VOLTAGE CHECK	
Line To Ground	Read AC Voltage
Line To Neutral	Read AC Voltage
Ground To Neutral	0 Volts

Terminal Block Positions	Left or Right Drive Conn.	Fan Conn.	Description
Pin 6, 7, 8, 9	Pin 6	Pin 1	Line
Pin 1, 2, 3, 4	Pin 5	Pin 2	Ground
Pin 11, 12, 13, 14	Pin 4	Pin 3	Neutral
Pin 5, 10			Separator

Figure 8-20. W.T. Diskette Drive AC Wiring Diagram 100/120 VAC, 50 Hz Power Supply



AC VOLTAGE CHECK

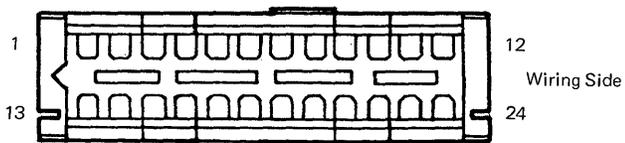
Line To Ground	Read AC Voltage
Line To Neutral	Read AC Voltage
Ground To Neutral	0 Volts

Terminal Block Positions	Left or Right Drive Conn.	Fan Conn.	Description
Pin 6, 7, 8, 9	Pin 3	Pin 1	Line
Pin 1, 2, 3, 4	Pin 5	Pin 2	Ground
Pin 11, 12, 13, 14	Pin 1	Pin 3	Neutral
Pin 5, 10			Separator

Figure 8-21. W.T. Diskette Drive AC Wiring Diagram 200/240 VAC, 50/60 Hz Power Supply

Note: For Displaywriters with the communications feature, see the **Communications Service Manual, S241-6439**

for cable, connector and test point information.



NOTE: All connectors shown from wiring side.

B 1 (DISKETTE SIGNAL CABLE)

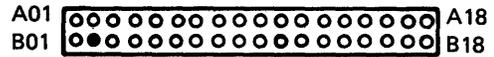
Pin No.	Termination Connector 5	Identification
1	—	—
2	27	Interrupt 4
3	28	Terminal Count
4	29	DMA Request
5	—	—
6	31	I/O Read
7	32	Address Bit 4
8	33	Address Bit 2
9	34	Data Bus Bit 6
10	35	Data Bus Bit 4
11	36	Data Bus Bit 2
12	37	Data Bus Bit 0
13	—	—
14	9	I/O Write
15	10	Interface Ready
16	11	DMA Acknowledge
17	12	Diskette Select
18	14	Address Bit 3
19	—	Twisted Pair Ground
20	15	Address Bit 1
21	16	Data Bus Bit 7
22	17	Data Bus Bit 5
23	18	Data Bus Bit 3
24	19	Data Bus Bit 1

B 2 (DISKETTE DC CABLE)

Pin No.	Termination Connector 10	Identification
1	3	+5.0 VDC
2	4	+5.0 VDC
3	14	+5.0 VDC
4	—	—
5	12	-5.0 VDC
6	6	POR DIS
7	11	Frame Ground
8	—	—
9	—	—
10	5	+12.0 VDC
11	—	—
12	13	+24.0 VDC
13	1	+5.0 VDC
14	2	+5.0 VDC
15	7	Frame Ground
16	8	Frame Ground
17	9	Frame Ground
18	10	Frame Ground
19	11	Frame Ground
20	20	Frame Ground
21	21	Frame Ground
22	—	—
23	—	—
24	—	—

NOTE: For Displaywriters with the communications feature, see the Communications Service Manual for Cables, Connectors and test point information.

Figure 8-22 (Part 1 of 2). Diskette Drive Cable Connectors



FILE CONTROL CARD CONNECTOR

B 3 & B-4 (DISKETTE DRIVE CABLE)

Pin No.	Termination File Card	Identification
1	B04	Index Pulse
2	B05	Diskette Sense
3	B06	Write/Erase Enable
4	B07	File Data
5	A01	-5.0 VDC
6	A18	Drive Present
7	A12	Ground
8	B16	Switch Filter (2D Drive)
9	B09	Erase Gate
10	-	-
11	B14	Write Gate
12	B03	+24.0 VDC
13	B10	Access 0
14	B01	+5.0 VDC
15	B13	Access 1
16	B11	Select Head 1 (2D Drive)
17	B15	Head Engage
18	B08	Inner Tracks
19	A02	Ground
20	A03	Ground
21	B17	Write Data
22	-	-
23	-	-
24	A16	Twisted Pair Ground

Pin No.	Termination Connectors B3 & B4	Identification
A01	5	-5.0 VDC
A02	19	Frame Ground
A03	20	Frame Ground
A04	-	-
A05	-	-
A06	-	-
A07	-	-
A08	-	-
A09	-	-
A10	-	-
A11	-	-
A12	7	Frame Ground
A13	-	-
A14	-	-
A15	-	-
A16	24	Twisted Pair Ground
A17	-	-
A18	6	Drive Present
B01	14	+5.0 VDC
B02	(Key)	-
B03	12	+24.0 VDC
B04	1	Index Pulse
B05	2	Diskette Sense
B06	3	Write/Erase Enable
B07	4	File Data
B08	18	Inner Tracks
B09	9	Erase Gate
B10	13	Access 0
B11	16	Select Head (2D Drive)
B12	-	-
B13	15	Access 1
B14	11	Write Gate
B15	17	Head Engage
B16	8	Switch Filter (2D Drive)
B17	21	Write Data
B18	-	-

Figure 8-22 (Part 2 of 2). Diskette Drive Cable Connectors

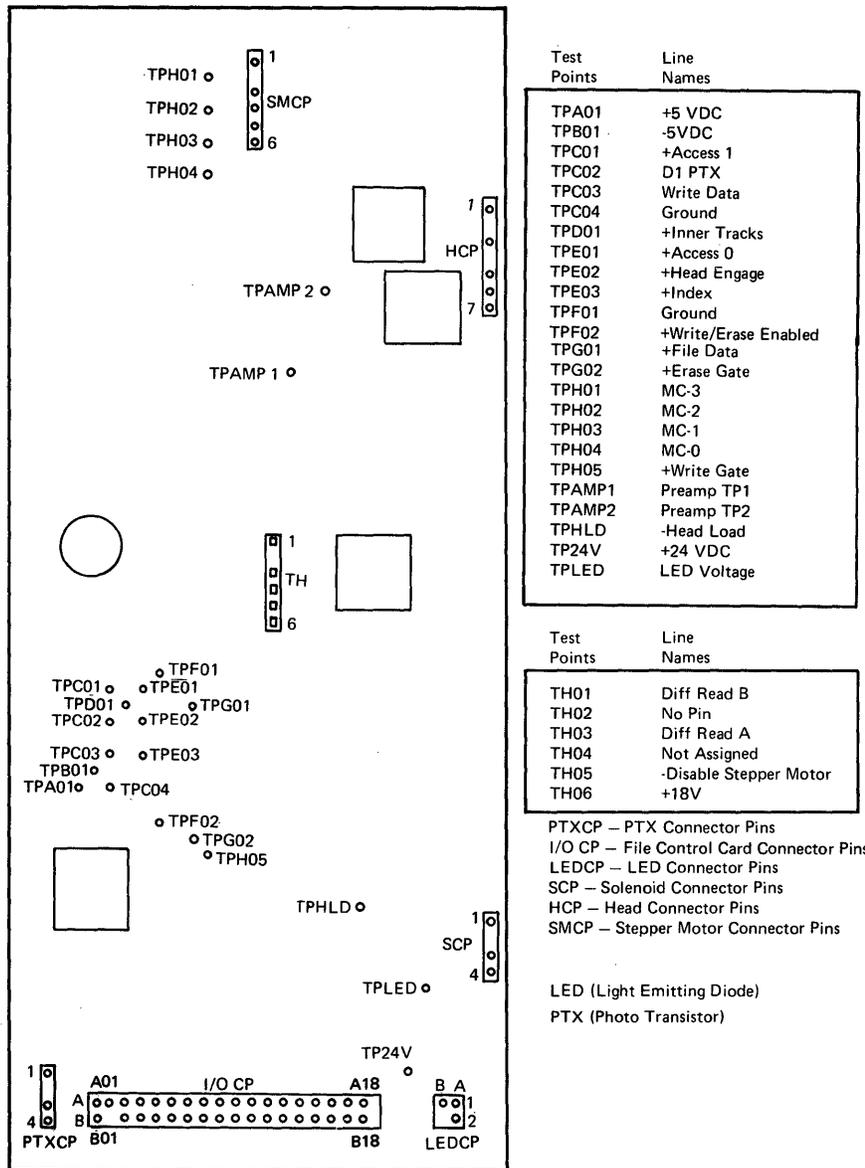


Figure 8-23 (Part 1 of 3). Type 1 Drive - File Control Card, Test Points, Signals and Connectors

LED Connector

		Pin No.	Identification
	1	A1	LED Ground
	2	A2	—
		B1	+5.0 VDC
		B2	(Key)

PTX Connector

		Pin No.	Identification
	1	PT1	+5.0 VDC
		PT2	(Key)
		PT3	PTX Return
	4	PT4	—

Solenoid Connector

		Pin No.	Identification
	1	SCP1	—
		SCP2	(Key)
		SCP3	+24 VDC —Head Load
	4	SCP4	+24 VDC +Head Load

Head Connector

		Pin No.	Identification
	1	HC1	Ground
		HC2	(Key)
		HC3	Read/Write Head
		HC4	(Key)
		HC5	Read/Write Head
		HC6	Erase Head
	7	HC7	—

Stepper Motor Connector

		Pin No.	Identification
	1	SMC1	+24.0 VDC
		SMC2	(Key)
		SMC3	Stepper Mtr. MC3
		SMC4	Stepper Mtr. MC2
		SMC5	Stepper Mtr. MC1
	6	SMC6	Stepper Mtr. MC0

Figure 8-23 (Part 2 of 3). Type 1 Drive - File Control Card, Test Points, Signals and Connectors

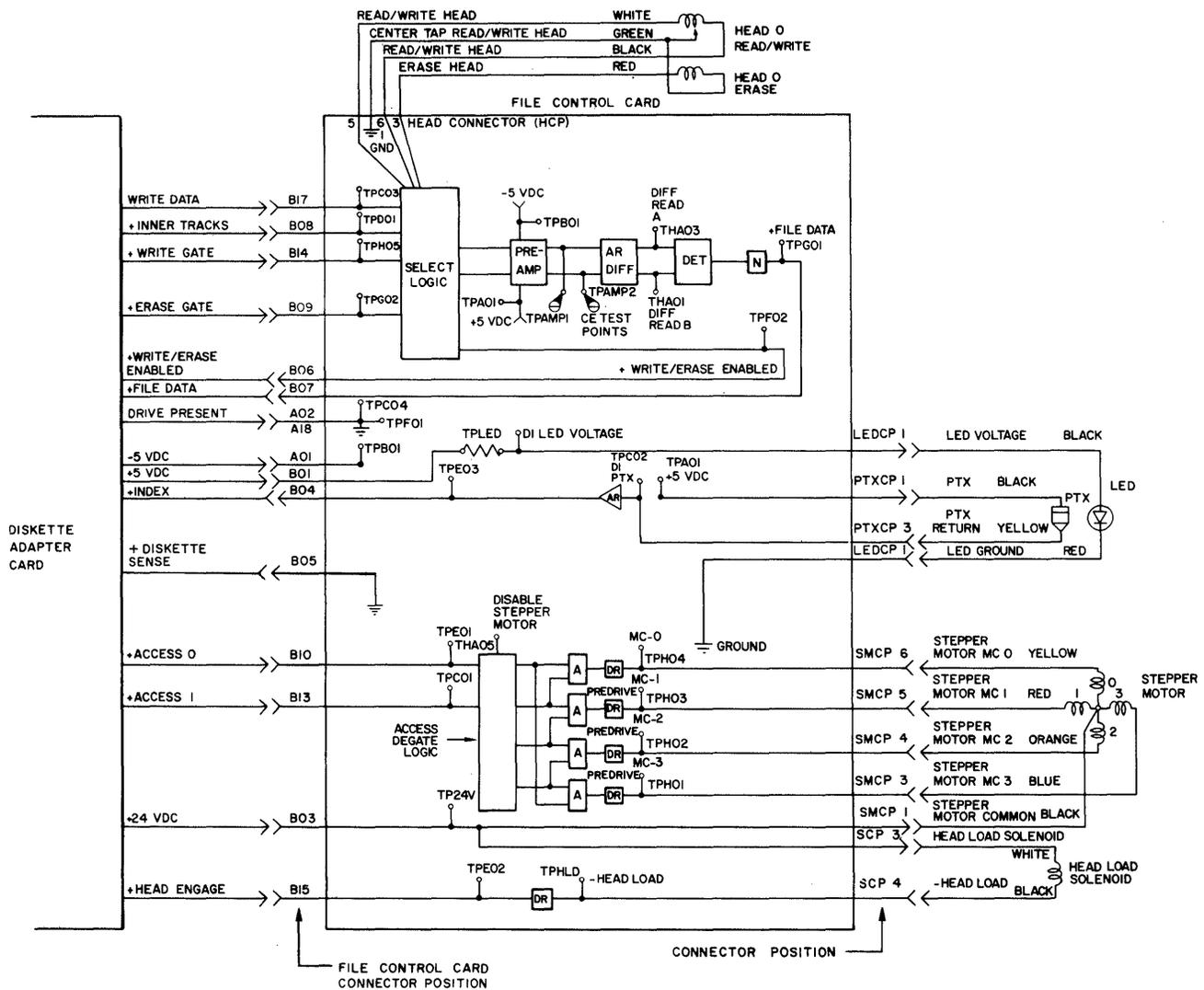


Figure 8-23 (Part 3 of 3). Type 1 Drive - File Control Card, Test Points, Signals and Connectors

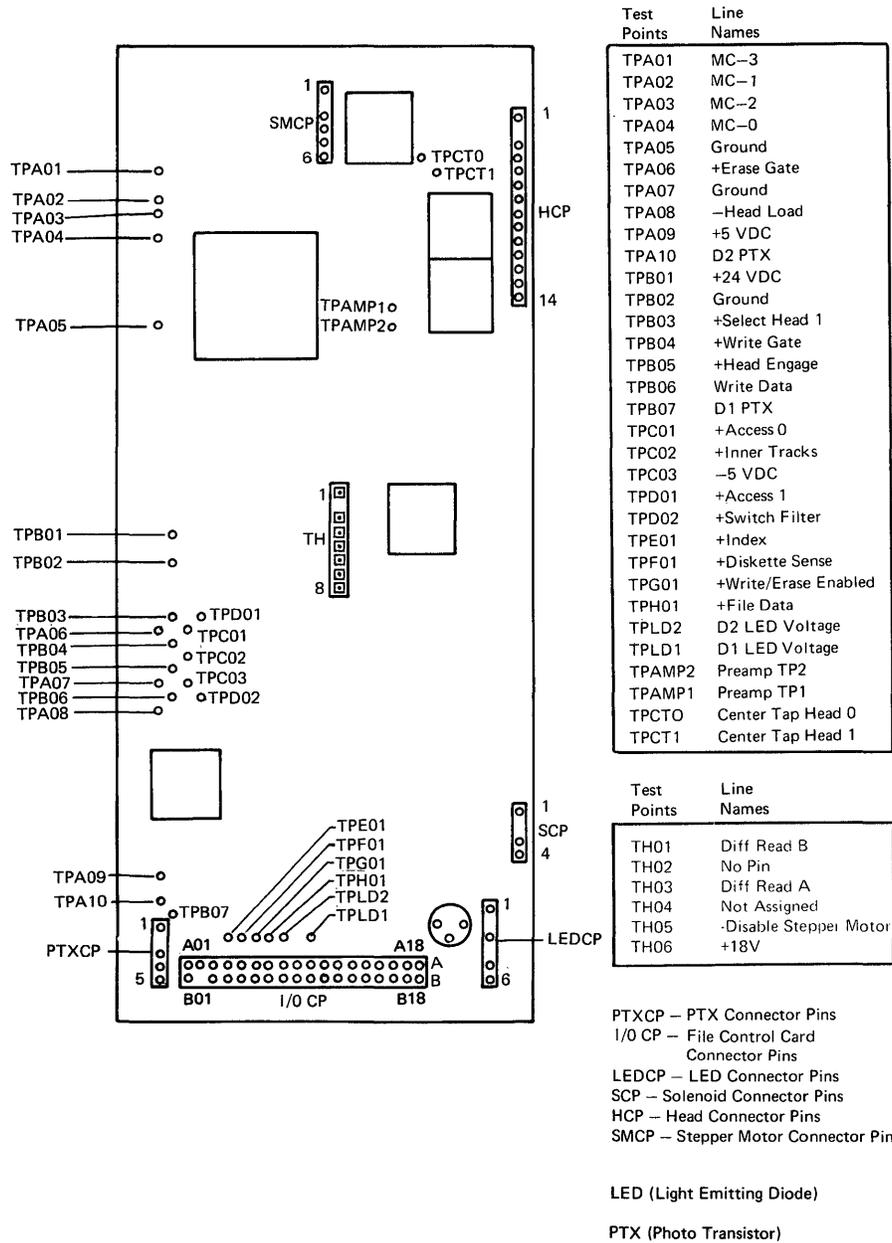


Figure 8-24 (Part 1 of 3). Type 2D Drive - File Control Card Test Points, Signals and Connectors

Solenoid Connector

Pin No.	Identification
1	SC1
	SC2 (Key)
4	SC3 Head Load Solenoid
	SC4 +24.0 VDC

LED Connector

Pin No.	Identification
1	LED1 LED Ground (Key)
	LED2 +5.0 VDC
	LED3 (Key)
	LED4 LED Ground
6	LED5 +5.0 VDC
	LED6

Stepper Motor Connector

Pin No.	Identification
1	SM1 +24.0 VDC
	SM2 (Key)
	SM3 Stepper Mtr. MC3
	SM4 Stepper Mtr. MC2
	SM5 Stepper Mtr. MC1
6	SM6 Stepper Mtr. MC0

PTX Connector

Pin No.	Identification
1	PT1 +5.0 VDC (D1)
	PT2 (Key)
	PT3 D1 PTX Return
	PT4 D2 PTX Return
5	PT5 +5.0 VDC (D2)

Head Connector

Pin No.	Identification
1	HC1
	HC2 (Key)
	HC3 R/W Head 0
	HC4 Center Tap R/W 0
	HC5 R/W Head 0
	HC6 Erase Head 0
	HC7 Erase Head 0
	HC8 Cable Shield Hd. 0
	HC9 Cable Shield Hd. 1
	HC10 Erase Head 1
	HC11 Erase Head 1
	HC12 R/W Head 1
	HC13 Center Tap R/W 1
14	HC14 R/W Head 1

Figure 8-24 (Part 2 of 3). Type 2D Drive - File Control Card Test Points, Signals and Connectors

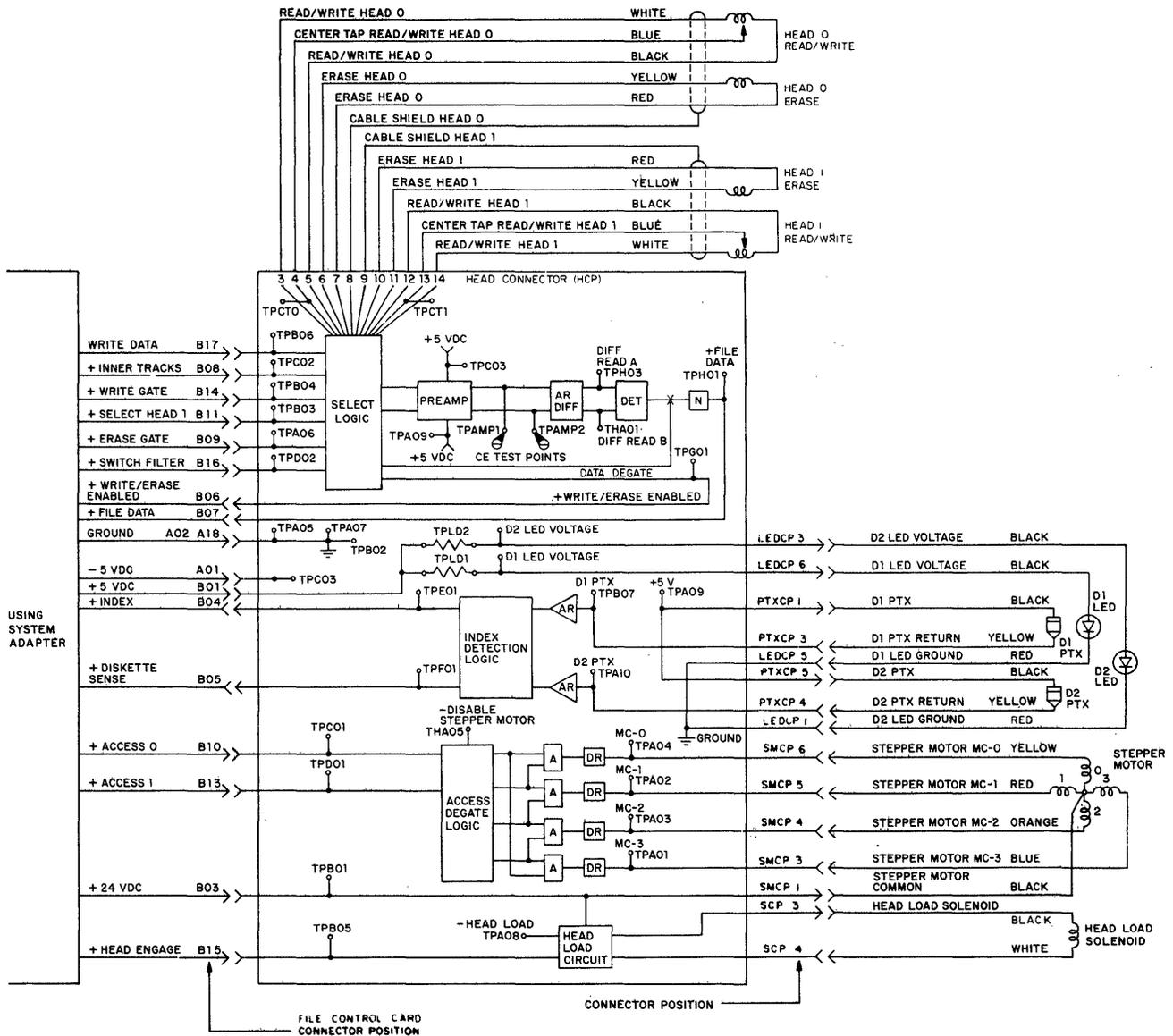


Figure 8-24 (Part 3 of 3). Type 2D Drive - File Control Card Test Points, Signals and Connectors

PRINTER SHARING

The Printer Sharing feature permits up to three work stations to share a single printwheel printer. Cable connectors 6A and 6B are provided on

electronics module panel 1 for the secondary work station attachments. The printer sharing cables terminate at Connector 0 of the secondary work station.

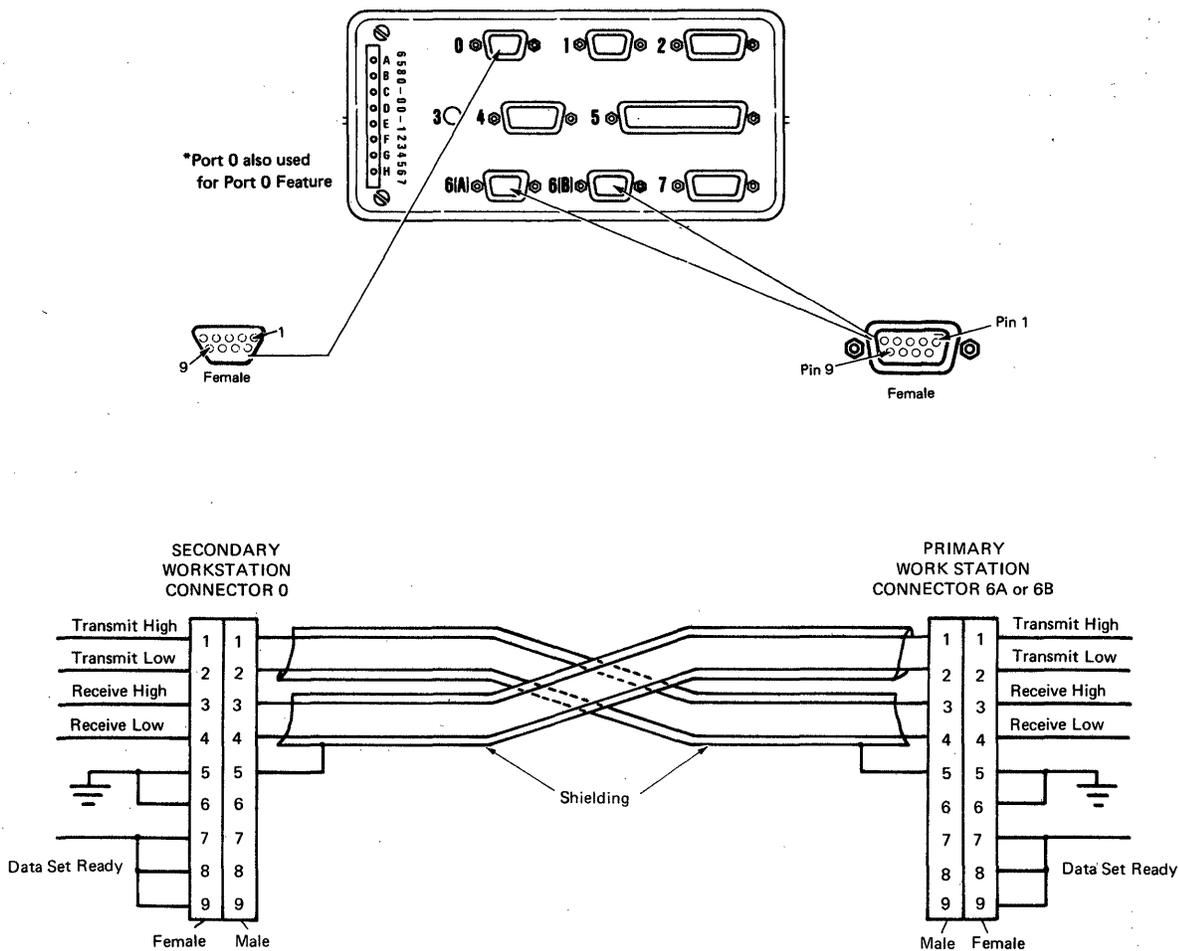
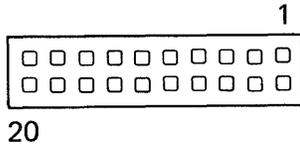


Figure 8-25. Printer Sharing Cabling and Connectors

TYPE B KEYBOARD MODULE

The Type B keyboard and operational voltages and signals are provided to

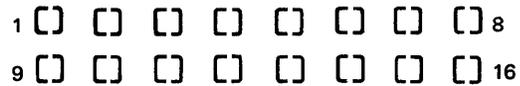
LOGIC CARD CONNECTOR



Pin No.	Termination Connector	Identification
1	-	-
2	-	-
3	-	-
4	6	Tone
5	9	+8.5 VDC
6	8	Data Strobe
7	2	(Spare)
8	4	Reset
9	11	+5.0 VDC
10	-	-
11	-	-
12	-	-
13	-	-
14	5	Click
15	10	Frame Ground
16	7	Kybd. Acknowledge
17	3	Serial Data Clock
18	23	Frame Ground
19	1	Serial Data
20	-	-

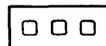
the keyboard through Connector 7 of the electronics module. The keyboard cable connector, speaker connector and the keyboard pads are shown in Figure 8-27.

KEYBOARD PADS



Pin No.	Signal Name
1	-
2	-
3	Click
4	Ground
5	Kybd. Acknowledge
6	Serial Data Clock
7	Ground
8	Serial Data
9	-
10	-
11	Tone
12	+8.5 VDC
13	Data Strobe
14	-
15	Reset
16	+5.0 VDC

SPEAKER CONNECTOR



Pin No.	Termination Connector	Identification
1	Speaker	+8.5 VDC
2	Speaker	Speaker Drive
3	Speaker	+8.5 VDC

Figure 8-27. Type B Keyboard Connectors

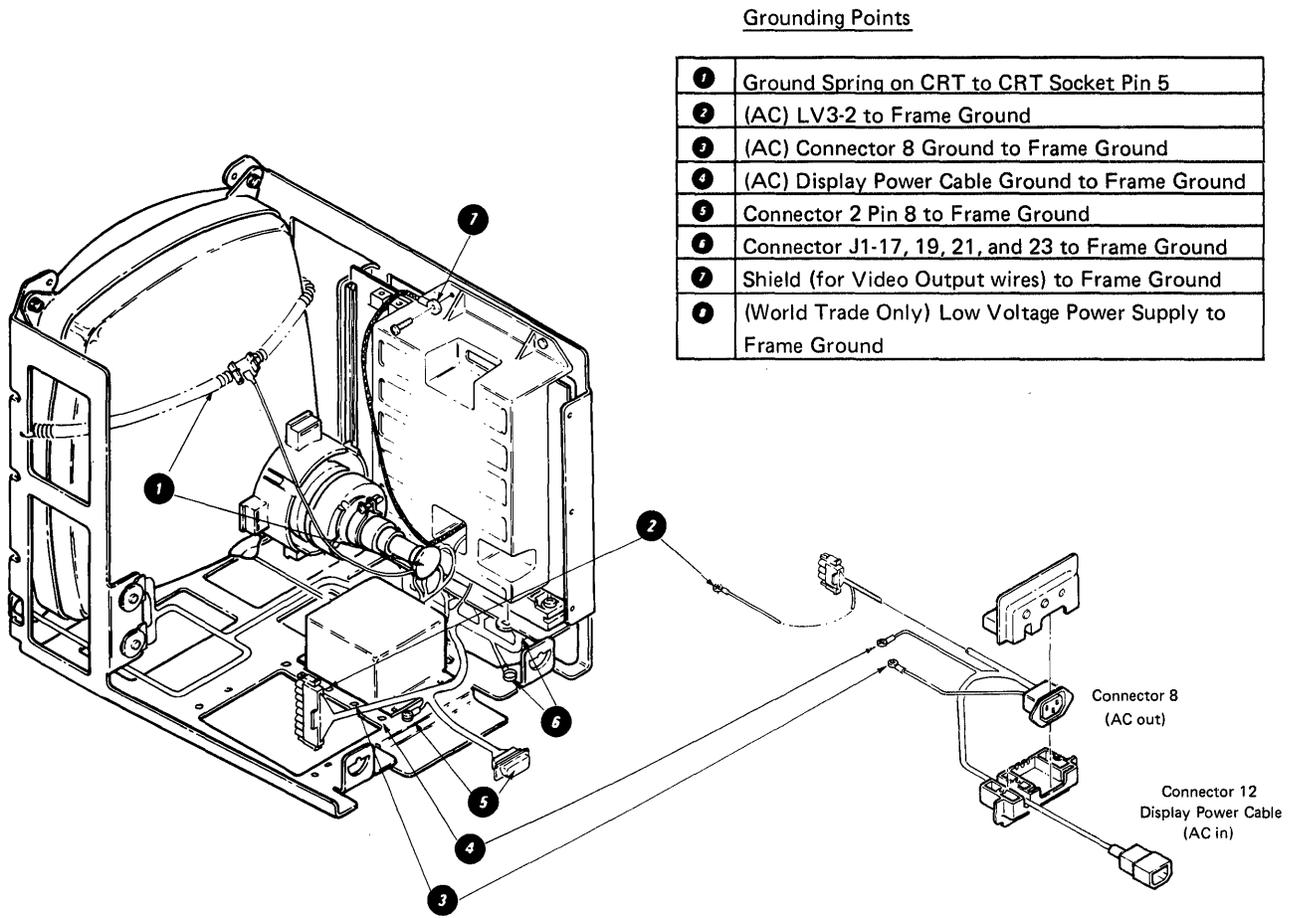
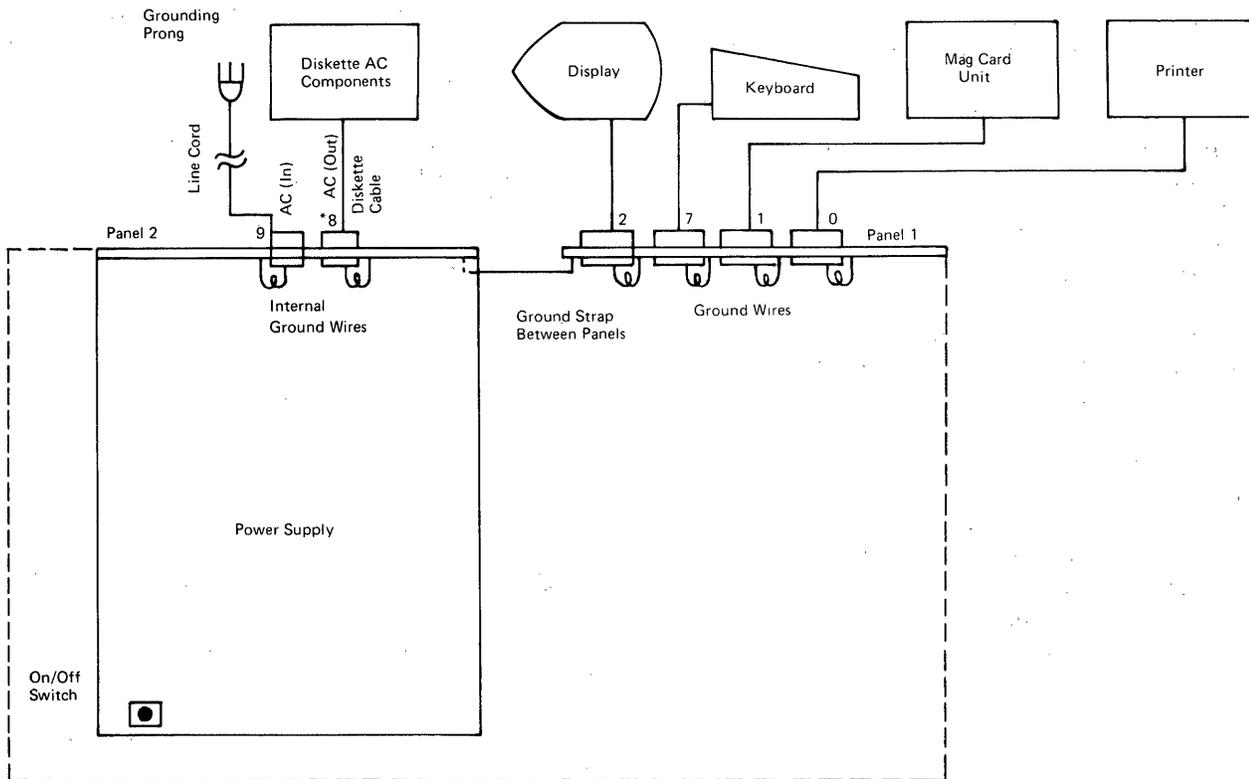


Figure 8-28 (Part 1 of &@FF4R.). Large Display Grounding Point Locator



*Connector 8 will be labeled 12 on systems with the Large Display.

PANEL 1—GROUND WIRE CONNECTIONS

Conn/Pin	Identification
0-5	Printer DC Cable to Frame Ground
0-6	
1-5	Mag Card Unit DC Cable to Frame Ground
1-6	
2-8	Display DC Cable to Frame Ground
7-10	Keyboard DC Cable to Frame Ground
7-12	
7-13	
7-14	

PANEL 2—GROUND WIRE CONNECTIONS

Con/Pin	Identification
*8-1	Diskette AC Cable to Frame Ground
9-1	System AC Line Cord Ground

Figure 8-29. System Grounding Path Schematic

CHAPTER 9. DIAGNOSTICS

DIAGNOSTICS THEORY

Note: The display formats and the printed outputs are controlled by the software and may differ in appearance from the examples used in this book.

The diagnostics support for the IBM Displaywriter System includes tests and utilities that are built into the system (resident) or can be loaded through the diskette unit. The diagnostic support package includes resident diagnostics, loadable diagnostics, maintenance analysis procedures (MAPS), and customer loaded diagnostics.

The resident diagnostics are located in the system and have tests and utilities used by both the customer and the customer service representative. A part of these diagnostics operate when the system is powered on and include a Power On Reset (POR), and Basic Assurance Test (BAT).

The other part of these diagnostics supply additional tests and utilities used for special testing (for example, when the diskette unit is not operational and the diagnostic diskette can not be loaded). These tests and utilities are described in the Resident Diagnostic Description Section.

Loadable diagnostics are tests and utilities on the diagnostic diskette (CEDD) and are loaded into the system from the diskette unit. The automated operation of these diagnostics speeds repair actions. These diagnostics are in three areas.

- The MAP Diagnostic Intergration (MDI) procedures are used to diagnose failures not sensed by the resident diagnostics.

- The Utilities give service personnel the ability to perform additional diagnostic functions.
- The System Exerciser is a diagnostic program that thoroughly tests the system.

The tests and utilities are described in the Loadable Diagnostics section.

The Maintenance Analysis Procedures (MAPs) are printed procedures that are used in the initial stage of problem determination. The Start of Call MAP is used to enter either the System Entry MAP or an area MAP when problems prevent the use of MDIs.

The Customer Loadable Diagnostics are tests and utilities on the Problem Determination Diskette (PDD) and are loaded into the system from the diskette unit. The operation of these tests is automatic to assist the customer in problem determination.

These tests are customer tests used to diagnose system hardware failures and are described in the Customer Loadable Diagnostic Description Section.

RESIDENT DIAGNOSTICS DESCRIPTION

The resident diagnostics are in the system in read only storage (ROS) and include a Power On Reset (POR), Basic Assurance Test (BAT), and Resident Non-Automatic Diagnostics (RNA). The BAT sequence supplies diagnostic support during the power on of the system. The Resident Non-Automatic Diagnostics (RNA) are additional tests that do not run during POR and BAT.

When a failure prevents access to the diskette, but requires more diagnosis

than is available in BAT, the Resident Non-Automatic Diagnostics can be used. They are described later in this section.

Power On Reset (POR)

When the system is powered on, the power supply will set the system electronics to a known condition until all power supply voltages are at the proper level. This is known as a Power On Reset (POR). During POR, all eight LEDs on electronics panel 1 are turned on for approximately one second and then off. If there is a power supply problem, one or more of the power supply LEDs (A through C) will remain on. If no power supply problem is found, the Basic Assurance Test (BAT) starts testing the System.

Basic Assurance Test (BAT)

The Basic Assurance Test (BAT) is a series of tests executed in sequence. The BAT is part of ROS and is automatically started when the power supply successfully completes POR. BAT can be restarted by using the Memory Record Button located on electronics panel 1. The run time of the BAT is from 10 to 20 seconds, depending on the amount of RAM that is tested.

The function of the BAT is to perform a quick status check on the system. The BAT operation requires no user action unless system problems are sensed. The BAT should normally be followed by a system Initial Program Load (IPL).

The system areas tested include the system card, the memory card, the display adapter card, the diskette adapter, the keyboard adapter, and the keyboard logic card. These components are required for the following purposes:

- Loading the Application Program from the Application Program Diskette into Random Access Memory (RAM).
- Sensing errors or handling hardware and software failures during and after the system IPL.
- Loading diagnostics from the Diagnostic Diskette into RAM.
- Loading Problem Determination Procedures from the customer Problem Determination Diskette into RAM.
- Indicating error symptoms or progress during execution of system IPL, Diagnostics, or customer Problem Determination Procedures.

The BAT is divided in two major parts; BAT before the display is operational (initialized), and BAT after display initialization. If a failure occurs before display initialization, the system will attempt to post a display failure code (see BAT progress error codes). The code will be displayed only if the display adapter and display are operational. If the code cannot be displayed, the LEDs may be used to determine the failure. During a normal BAT, display initialization occurs after the display adapter has been tested (Figure 9-1).

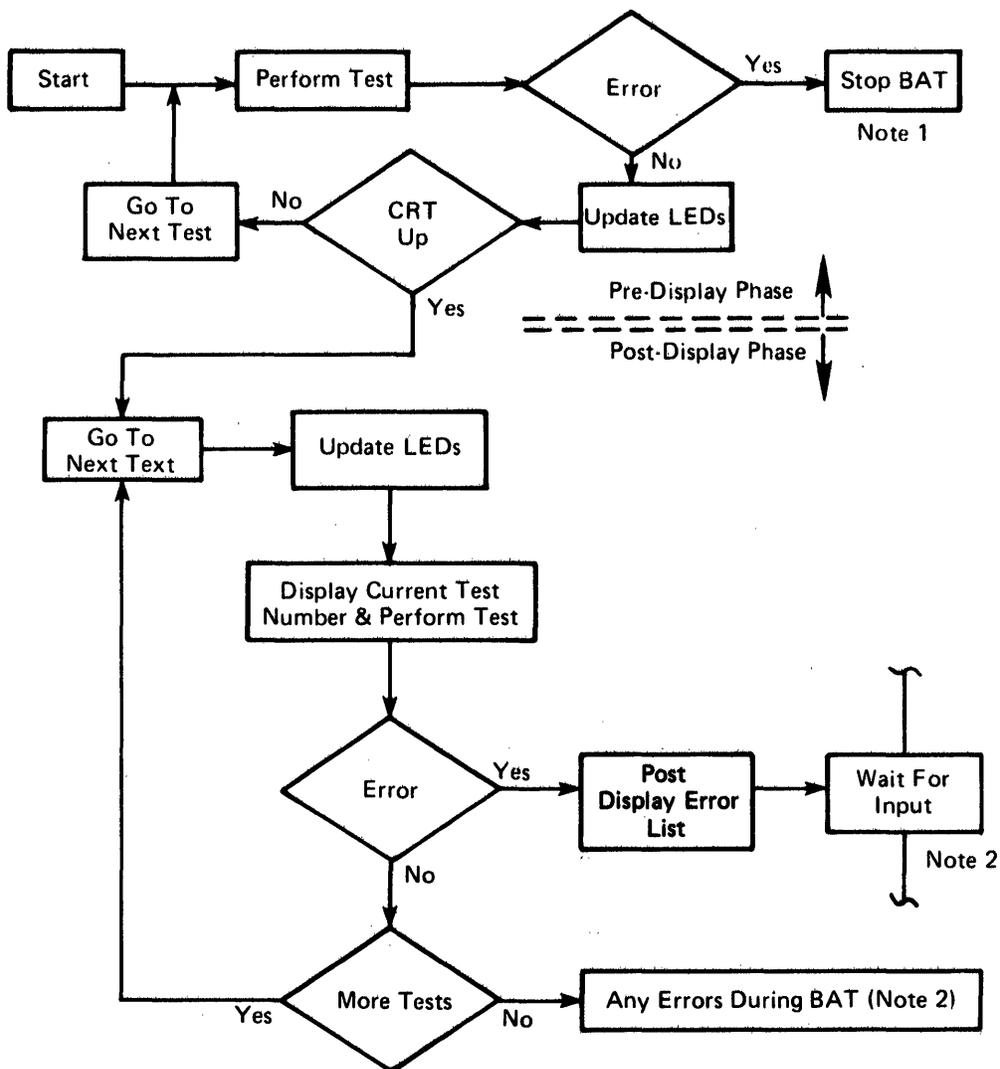


Figure 9-1. Basic Assurance Test (BAT) Flowchart

There are two methods of indicating BAT progress. The first is the LEDs (Figure 9-2). The second is the dis-

play which is used to show BAT progress after the display adapter is tested and operational (initialized).

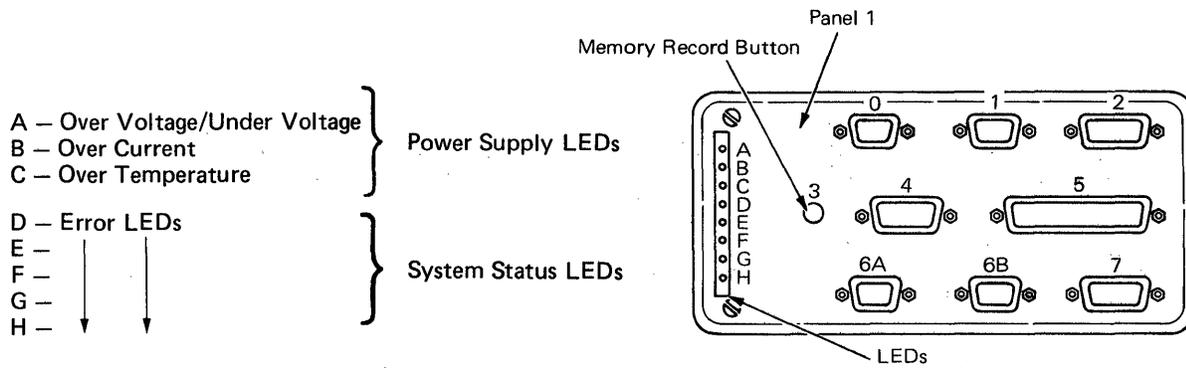


Figure 9-2. Electronics Module (LEDs)

BAT Before Display Initialization

BAT before display initialization is a sequence of tests that run before the display is operational. Progress and error codes are indicated on electronic panel 1 where the five system status LEDs show the BAT progress. The status is shown by the electronics by switching LEDs D through H on or off. This generates patterns which are read as BAT progress codes. These LED patterns change as the BAT sequence continues. BAT before display initialization is shown in Figure 9-3.

The BAT stops when a test fails, which permits the LED pattern to be read. The five LEDs, D through H, display system status.

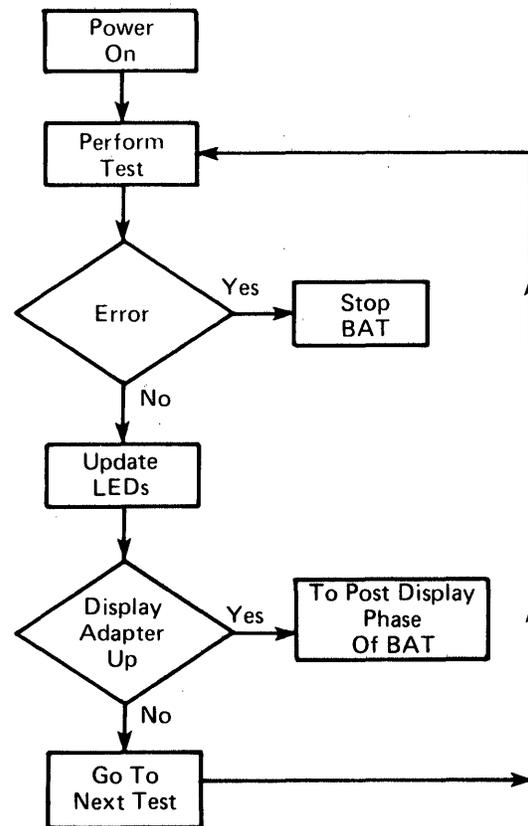


Figure 9-3. BAT Before Display Initialization

BAT After Display Initialization

As the BAT is completed in system bus buffer 1, it expands to system bus buffer 2, and the display adapter is tested. When the BAT determines the display adapter is operational, the number of the test being performed appears at the bottom of the display. The IBM logo is displayed when the BAT completes correctly. Figure 9-4 is a flowchart of the BAT after display initialization.

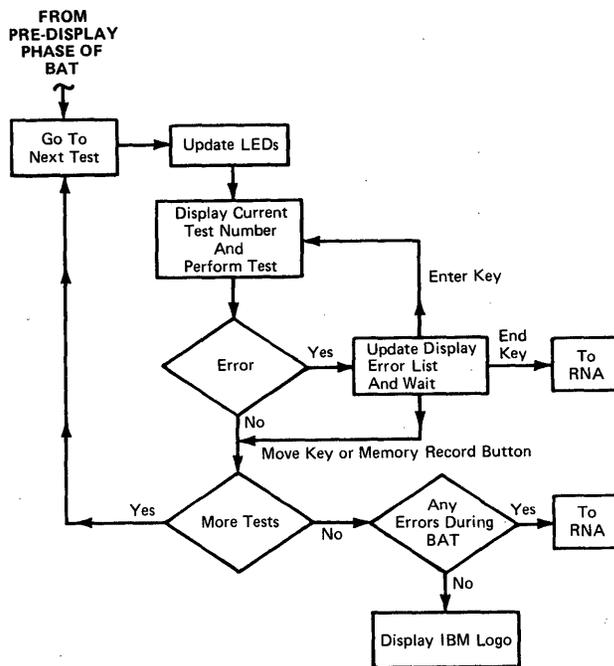


Figure 9-4. BAT After Display Initialization

If the BAT could not complete because of an error, further diagnosis is possible through the use of the keyboard.

- Pressing the ENTER key causes the BAT to retry the test which failed.
- Pressing the MOVE key or (if the keyboard is not operational) the Memory Record Button causes the BAT to skip the failing test and continue with the next test. Because of the error, control is passed to the Resident Non-Automatic (RNA) Diagnostics controller when the BAT completes.
- Pressing the END key will cause the system control to go from the BAT to the Resident Non-Automatic (RNA) Diagnostic controller.

Any message, test, or error numbers displayed will be removed from the display when any of the above are pressed.

BAT Progress/Error Codes

Figure 9-5 shows the BAT display format when an error occurs during BAT.

The table (Figure 9-6) lists the tests in the order in which they occur. The LED pattern and the display failure codes indicate which test failed.

The LEDs are read in binary. That is, 0 is off and 1 is on. Where an LED (E-H) pattern is shown (for example 0101 for the display adapter timing test), it is read as follows: the "E" LED is off, "F" is on, "G" is off and "H" is on.

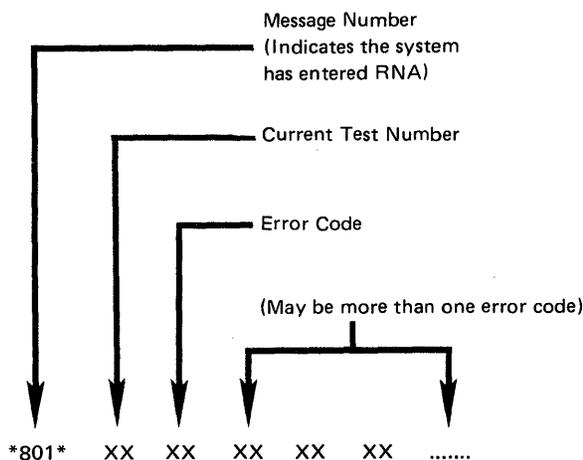


Figure 9-5. BAT Display Format

When the BAT will not complete because of an error, the system will be placed in the Resident Non-Automatic Diagnostics mode. The Resident Non-Automatic Diagnostics will permit further diagnosis through the use of the keyboard or the Memory Record Button (located on the electronics module panel 1). These diagnostics are used with hard copy MAPS.

Description of Test	Error LED		Display Failure Codes
	D	LEDs EFGH	
Power On Reset (POR)	1	XXXX*	N/A
Processor & ROS CRC Tests	1	XXXX	N/A
Local I/O Bus Wrap Test	1	XXXX	N/A
Timer Test	0	1111	N/A
Interrupt Controller Test	0	1111	N/A
Memory Record Switch Latch Test	0	1111	N/A
Keyboard Adapter Test	0	1111	N/A
Mini-RAM	0	0010**	N/A
	0	0011**	N/A
Parity Generator/Checker	0	0001	N/A
Base RAM Test	0	1110	N/A
Processor Extension Test	0	0011	N/A
Display RAM Test	0	0100	N/A
Display Adapter Timing	0	0101	N/A
Display Adapter Video Test	0	0101	N/A
Keyboard Cable Test	0	0110	01
Physical Keyboard Test	0	0110	02
DMA Controller Test	0	0111***	03
Diskette Module Wrap Test	0	1000	04
Diskette Adapter Test	0	1000	05
Extra RAM Test	0	1001****	N/A
Bus Time-Out Test	0	1010	08
RAM Addressability Test	0	1100	09

- * The XXXX pattern means an unknown state of the LEDs.
- ** The test will fail with 0010 in error LEDs if there is a bad Memory Card or 0011 in the LEDs if there is a bad System Card.
- *** A short tone (less than one second) is generated. This occurs at the start of the Direct Memory Access (DMA) test. During this test, a failure could cause the processor to lose control of the system. If the DMA test fails, a continuous tone is generated. When this occurs, the LED pattern and displayed error list may not be accurate. In this event, the information displayed by the LEDs and/or the display may not be correct.
- **** An extra RAM Test will not display a failing code. This will allow a degraded mode of operation. It is Test Number 06.

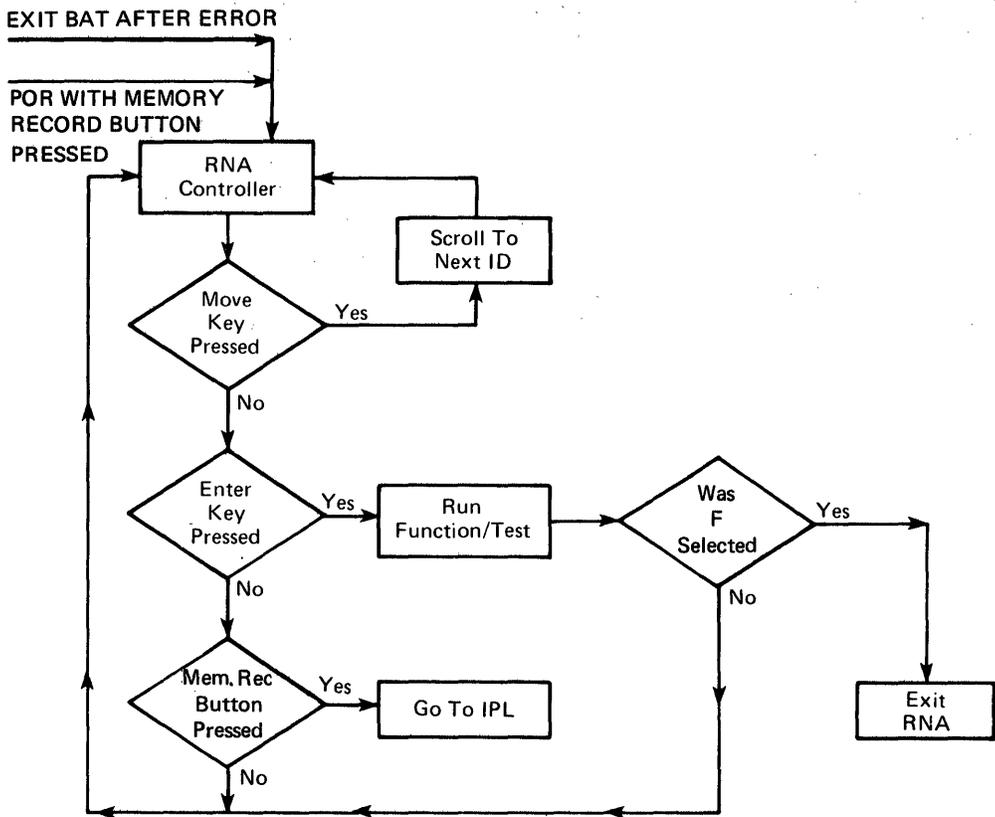
Figure 9-6. BAT Progress/Error Codes

RESIDENT NON-AUTOMATIC (RNA) DIAGNOSTICS

The Resident Non-Automatic Diagnostics (RNA) are contained in the system electronics but do not run during BAT. They are used when the diagnostics cannot be loaded from the Diagnostic Diskette. The RNA diagnostics aid in isolating problems in the diskette drive and intermittent system bus failures. These diagnostic tests are selected through the keyboard using the Resident Non-Automatic Diagnostic Flow chart in Figure 9-7.

A Resident Non-Automatic Diagnostic Controller is located in the system electronics to control the Resident Non-Automatic Diagnostics. After the RNA controller has been entered, the test IDs appear one at a time on the display. Pressing the MOVE key will select the next test ID. The ID list will loop from the last to the first entry when the last test in the list is being displayed and the MOVE key is pressed. When the ENTER key is pressed, the RNA controller will execute the selected test.

Function/ Test ID	Description	Test Exit	Conditions
D	Switch to Opposite Diskette Drive	N/A	
F	Run BAT Once	N/A	
G	Run BAT in Loop Mode	Memory Record Button	
L	Diskette Drive Set Ready Test	N/A	Diskette Must Be Inserted
M	Diskette Stepper Motor Phase Test	N/A	Diskette Must Be Inserted
N	Diskette Drive Alignment Aid	END Key	Diskette Must Be Removed
P	Looping ROS CRC Test	END Key	
Q	Looping Display Path Test	END Key	
R	Looping Base RAM Test	END Key	Screen Blank During Test
S	Looping Diskette Adapter Wrap Test	END Key	Screen Blank During Test
T	Track Step Test	END Key	Diskette Must Be Removed



Note: To scroll (step) to the next function or test ID, press the MOVE key. To start or execute a function or test, press the ENTER key.

Figure 9-7. Resident Non-Automatic Diagnostic Flowchart

Resident Non-Automatic Diagnostic Display Format

The format of the RNA diagnostics will be shown on the display as it appears in Figure 9-8.

801 A three-digit message number with an asterisk on either side which references the customer to the Problem Determination Guide.

■ This symbol appears when the system is waiting for operator input.

M This Function or Test ID identifies the test which will be executed when the ENTER key is pressed.

FSB This character is a test result indicator; S is for a successful test; F is for a failure,

and B occurs while the test is busy.

Ø1 This is a two-digit failure code used with MAPs.

L (Ø) The selected drive number is L (or Ø) for the left drive or R (1) for the right drive.

The field to the right of the selected drive number is the test feedback field. This will display test information which is not in code form. All tests stop when an error is found and the system remains in RNA.

Shown in Figure 9-9 is the initial RNA display format as it appears when RNA is first entered. The operator message number *801* is used by the operator. Note there is nothing displayed in test status, test failure code or test feedback fields at this time.

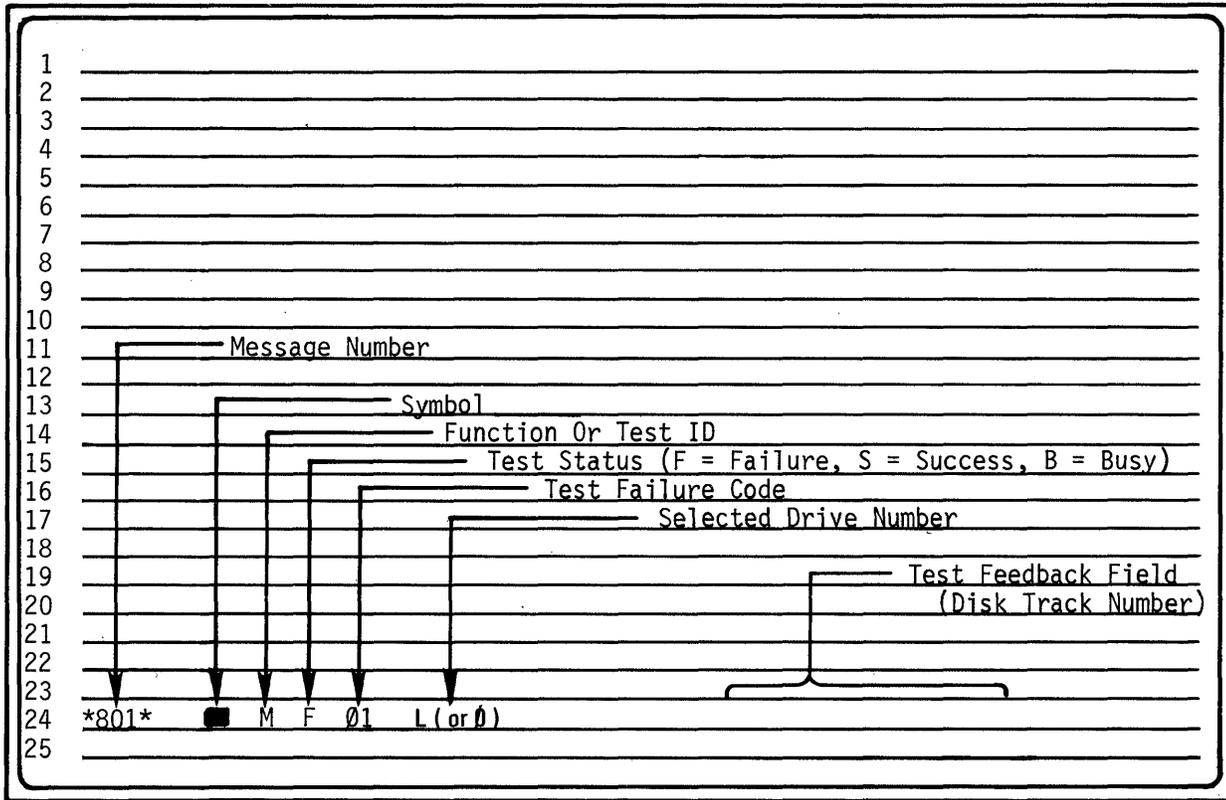


Figure 9-8. RNA Diagnostic Display Format

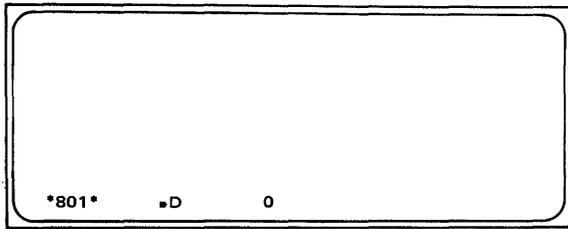


Figure 9-9. Initial RNA Display Format.

RNA Diagnostic Tests and Functions

The following is a description of a Resident Non-Automatic Diagnostic Function. By pressing the Memory Record Button, the Force IPL Function will cause an Initial Program Load (IPL) to occur without first passing

the Basic Assurance Test (BAT), so the diagnostic diskette may be loaded.

This is not possible if the BAT error occurs in the processor. If the RNA Diagnostic Controller was entered with the Memory Record Button, the Memory Record Button must be pressed a second time to perform a Force IPL. The following are the Resident Non-Automatic Diagnostic tests, ID functions, and descriptions:

- D** Switch To Opposite Diskette Drive. The system will switch from one diskette drive to the other to execute diskette drive tests on a Dual Diskette Drive system. The selected drive will default to the left drive (L or 0) when RNA is first entered. Each time the ENTER key is pressed while this function ID is

displayed, the opposite drive will be selected. Any drive test selected after this function is run will be executed from the last selected drive.

F Execute BAT Once. This causes the BAT to run once from the start of the test. At the end of this test the processor will pass system control to the IPL function, if the test is acceptable.

G Execute BAT In Loop Mode. The BAT will run continuously in the loop mode until an error is found or the Memory Record Button is pressed. It is only possible to exit this mode at a specific time during the test. This period of time is known as the exit window. The exit window can be recognized by a distinct LED pattern (1110) which will be displayed continuously during the exit window.

When BAT is run from the RNA controller, the system control goes to The exit window occurs during the RAM part of the BAT and is four to five seconds long. During this period the Memory Record Button must be pressed and released. When the test is terminated this way, the processor will return system control to the RNA controller. The test will not stop immediately, because it must complete the BAT sequence. the BAT controller. Because of this, the RNA display will disappear, and the interface with BAT will be through the normal BAT display format.

L Run Diskette Drive Set Ready Test. The Diagnostic Diskette must be loaded in the selected drive before running this test. This test performs in the following sequence:

1. PORs the Diskette Adapter Cards

2. Samples the Diskette Index Pulse
3. Checks the Drive Set Ready Signal
4. Engages the Read/Write Head
5. Checks the Write/Erase Enable Line (This ensures the system will not write on the customer's diskette.)
6. Reads the Track ID
7. Disengages the Head.

The system will return to RNA controller and wait for the next test selection at the end of this test.

M Diskette Stepper Motor Phase Test. The Diagnostic Diskette must be loaded in the selected drive before running this test. This test determines if the diskette stepper motor is operating correctly. When an error occurs during this test, the last correct track ID that was read will be displayed in the test feedback field. The Write/Erase Enable line is checked to ensure a write unsafe condition is not present. This ensures the system will not write on the customer's diskette by accident. The system will return to RNA controller at the end of this test.

N Diskette Drive Alignment Aid. The diskette must be removed from the diskette drive before starting this test. This test is used with an adjustment procedure to ensure the read/write head is correctly aligned. The adjustment procedure is described in the Diskette Drive section of this manual. When the ENTER key is pressed, the head is positioned to track 40. When this test is running, pressing the spacebar will cause the read/write head to step between tracks 39 and 40. Pressing the END key will end this test. The system will return to RNA con-

troller and wait for the next test selection at the end of this test.

T Track Step Test. The diskette must be removed from the diskette drive before starting this test. This test is used to track step the diskette drive from track 0 to track 76. When this test is running, pressing the spacebar will cause a track step up. If the head is in track 76, it will not move. Pressing the MOVE key will end the test and return control to RNA controller.

The following four looping tests are available to isolate intermittent system bus failures. Once started, these tests continue to execute until an error is found or the END key is pressed. When an error is found, a

short tone is heard and an "F" will appear in the test results field. When the END key is pressed, the system returns to the RNA test selection mode.

P Looping ROS CRC Test. This test checks the ROS on the processor card in the same way the BAT does.

Q Looping Display Path Test. Checks the Display Adapter RAM.

R Looping Base RAM Test. Checks the system RAM contained on the Memory Card. The display is blank while this test is running.

S Looping Diskette Path Test. Checks the diskette path with a wrap test. The display is blank while this test is running.

LOADABLE DIAGNOSTICS

Loadable Diagnostics are on the Diagnostic Diskette. They include:

- MAP Diagnostic Integration (MDI)
- Utilities
- System Exerciser
- Load Program Diskette.

Entry into these diagnostics is by loading the diagnostic diskette. An interface to the loadable diagnostics is provided through the keyboard and display.

The diagnostic diskette program can be loaded only after an IPL caused by a power on reset or a soft IPL. The soft IPL can occur only when the TASK SELECTION Menu is displayed. To cause

a soft IPL when the TASK SELECTION Menu is displayed:

- Remove all diskettes from the Diskette Unit.
- While holding the CONTROL KEY (Position 3) down, press and release the RETURN KEY.
- Press ENTER.

This function is used when the customer/user has a program loaded and the diagnostic diskette needs to be loaded without turning the machine off. When the diagnostic diskette is loaded, the program loads, and the FUNCTION SELECTION Menu is displayed. The diagnostic display follows much the same format as the operator's display. A Loadable Diagnostics flowchart is shown in Figure 9-10.

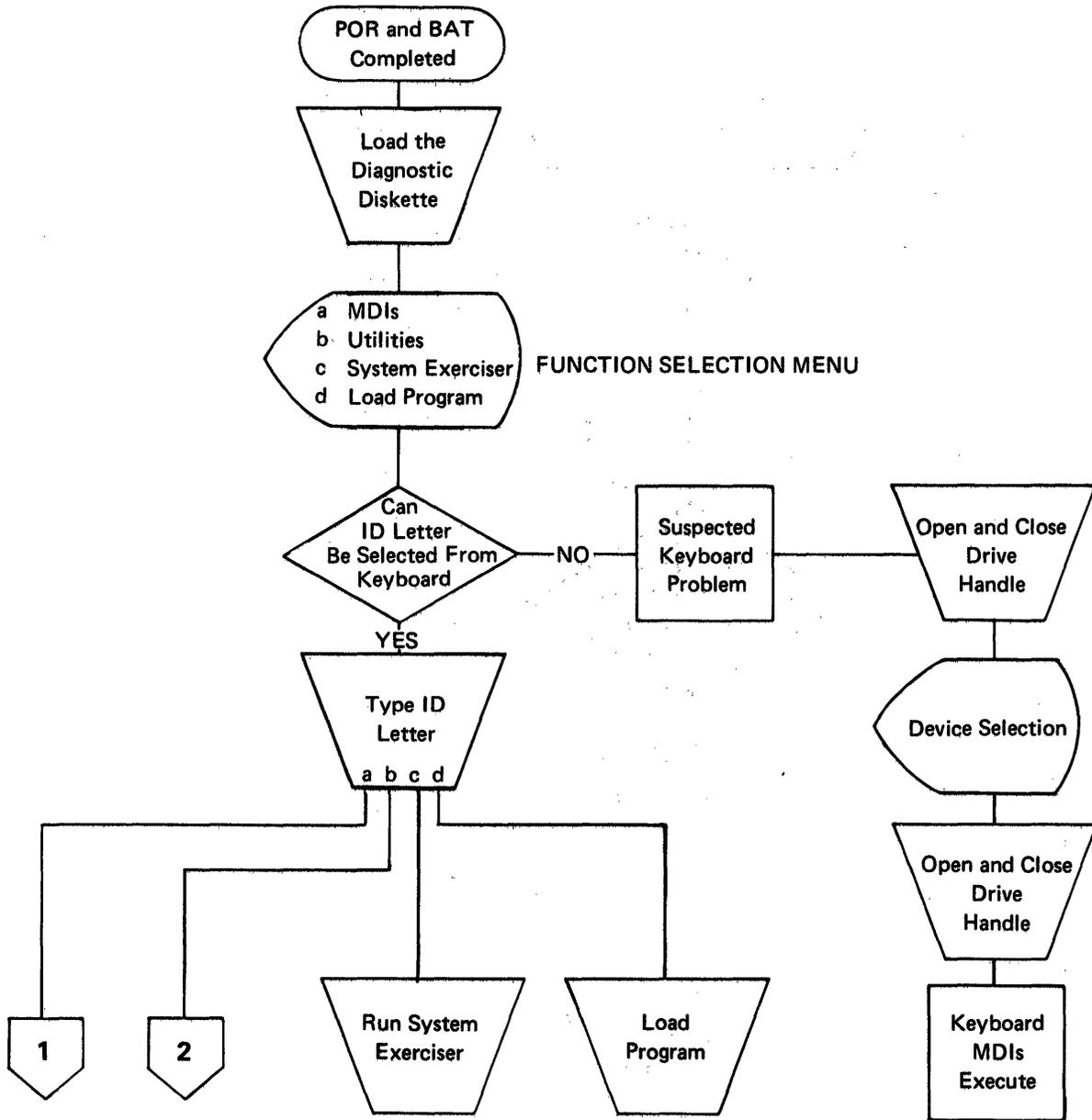


Figure 9-10 (Part 1 of 4). Loadable Diagnostics Flowchart

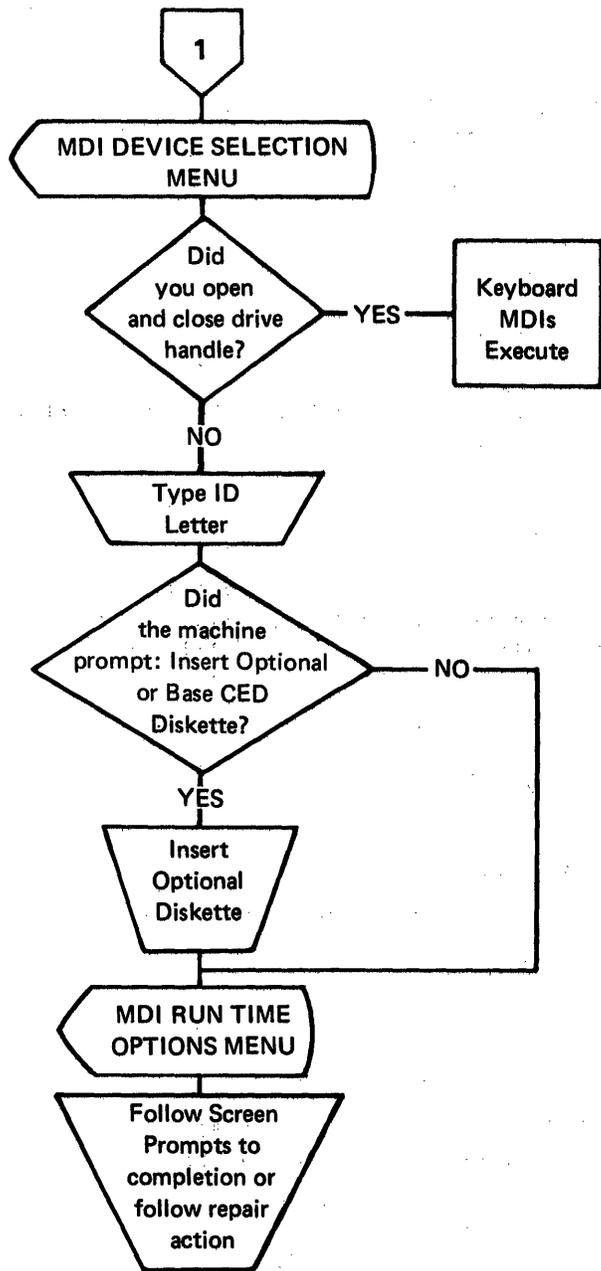


Figure 9-10 (Part 2 of 4). Loadable Diagnostics Flowchart

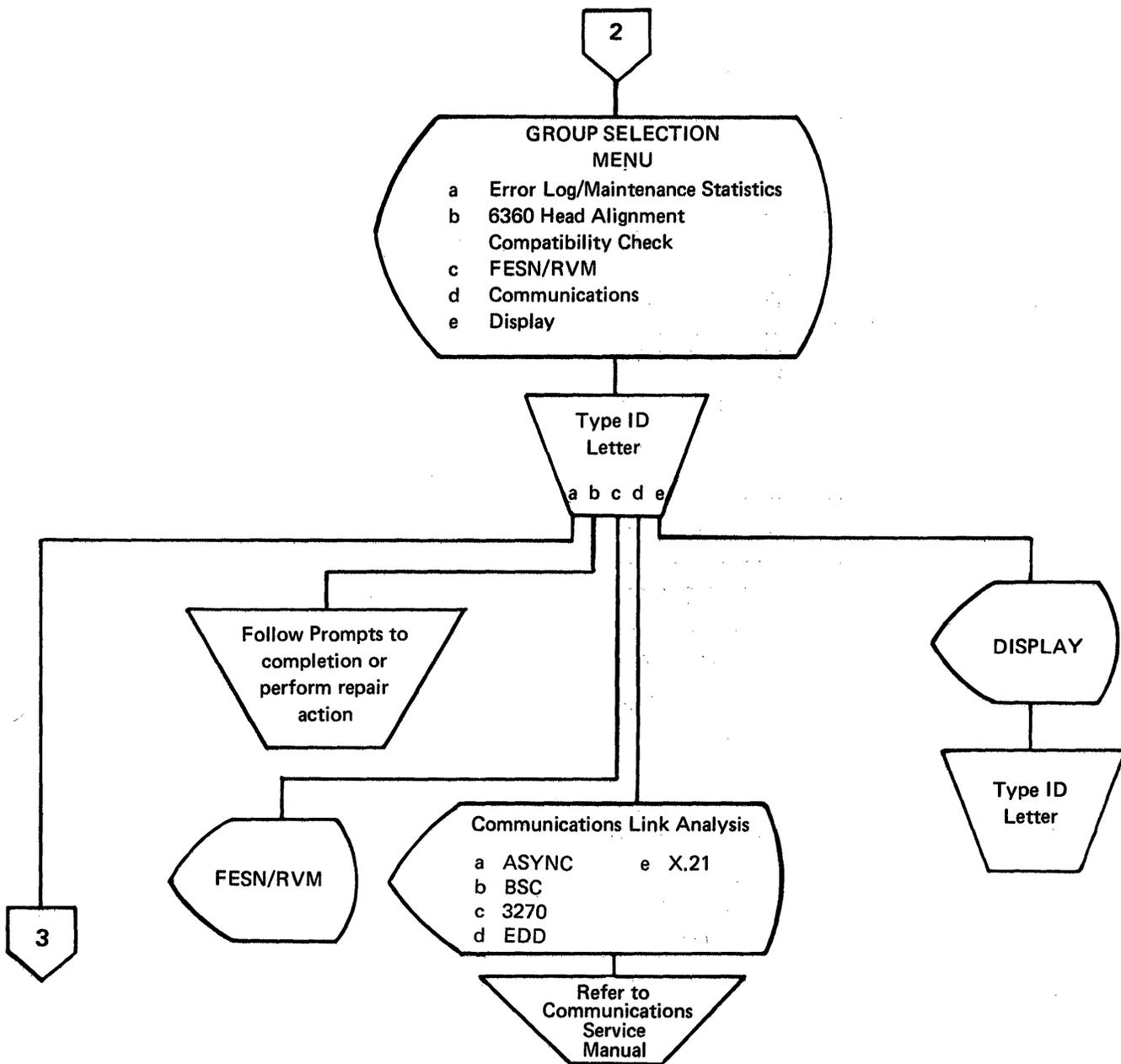


Figure 9-10 (Part 3 of 4). Loadable Diagnostics Flowchart

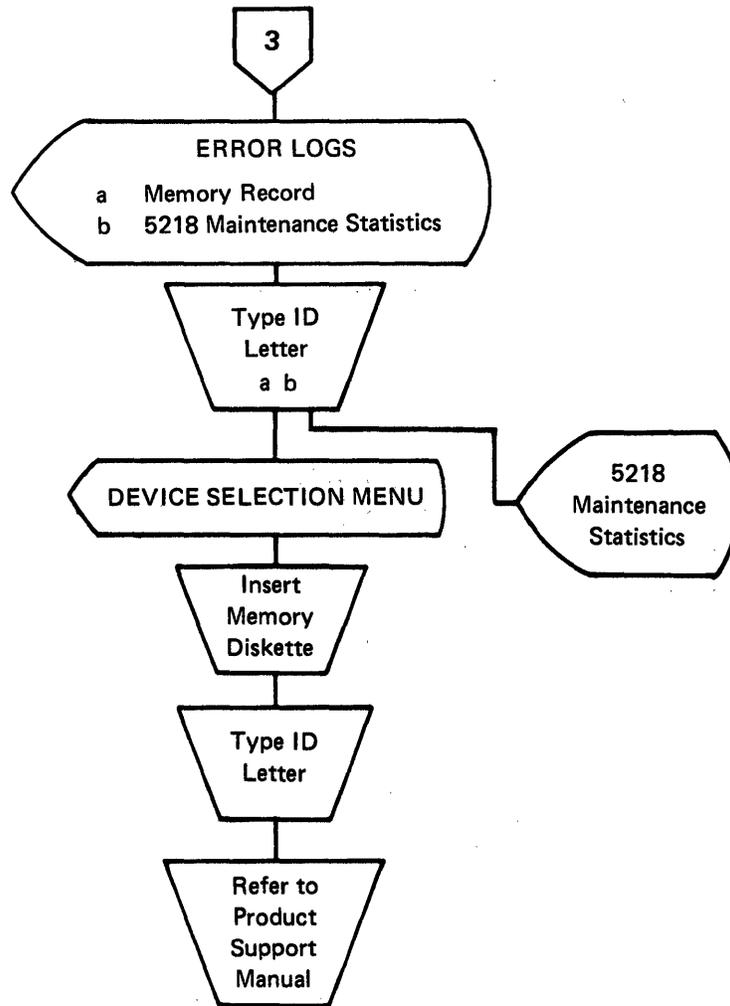


Figure 9-10 (Part 4 of 4). Loadable Diagnostics Flowchart

Loadable Diagnostics Display Format

The 25 lines of the diagnostic display show the following line information (Figure 9-11).

Line one has three fields. Each field is separated by a vertical line.

- **Foreground Mode Field.** Displays the function being performed. When in the service diagnostic mode, this field will display the diagnostics.
- **Function Name Field.** Displays the name of the operation being performed in the foreground mode. The contents will include one of the following: MDI, Utilities, System Exerciser or Program Diskette.
- **Memory Size Field.** Displays the size of good memory and memory card information. The first three

characters show the size of good memory, and the last character (an A, B, C, D, or E) shows the card(s) configuration and position of the distribution board where the card(s) are installed.

- A Type A card in position E.
- B Type B card in position E.
- C 160A card in position E, extender card in position F.
- D 192A card in position E, extender card in position F.
- E 256B card in position E, extender card in position F.

Note: The error code *900* 00D0 will display if an operator tries to load a program diskette into a system that does not have enough memory to hold the program. This error can be caused by a memory failure.

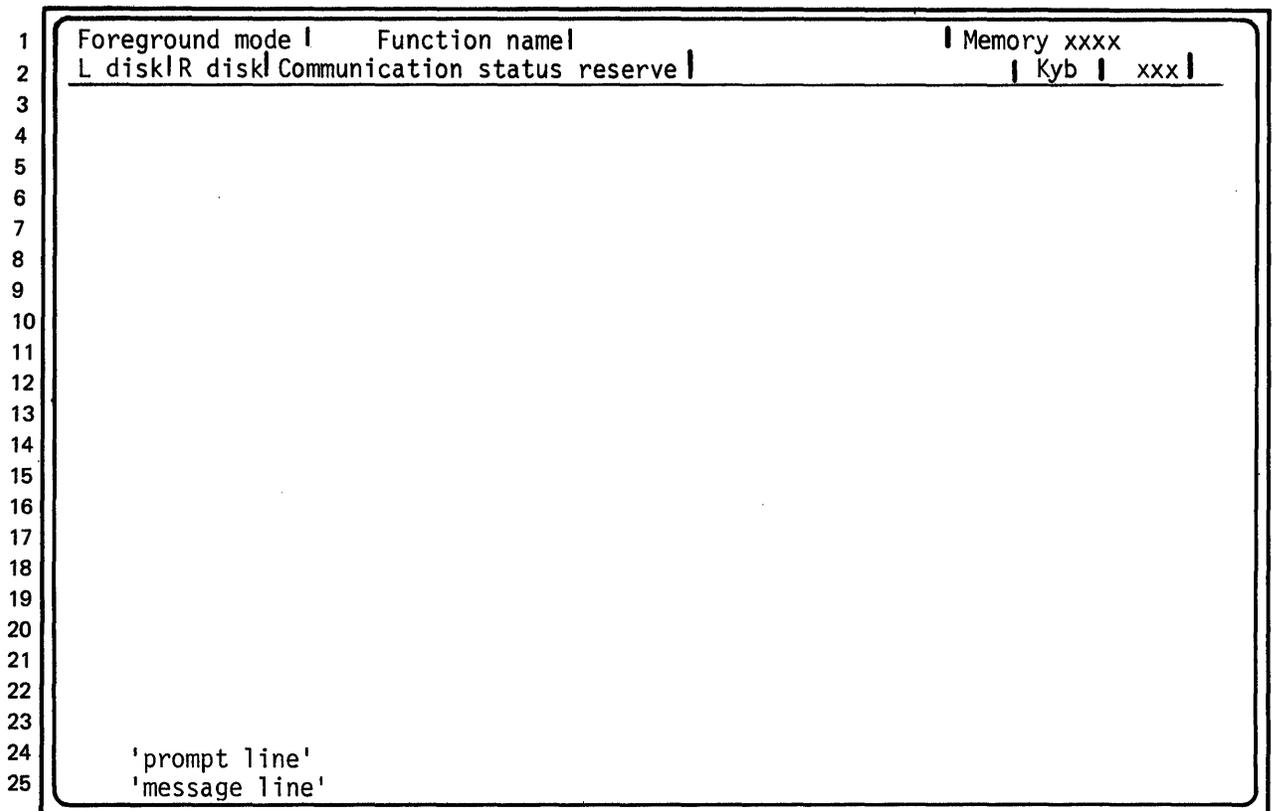


Figure 9-11. Loadable Diagnostics Display Format

Line two has six fields separated by vertical lines and is completely underscored.

- Left Diskette Name Field. Displays the name of the diskette in the left (L or 0) diskette drive.
- Right Diskette Name Field. Displays the name of the diskette in the right (R or 1) diskette drive of a dual drive system. This field is blank for a single drive system.
- Communications Status Field. Indicates the status of communications. The display in this field changes with the protocol (ASYNCR, BSCR, or SDLC).
- Keyboard ID Field. Displays the keyboard identification code that is selected with the keyboard logic board jumpers. For more information on keyboard ID see the Keyboard section of this MIM.

Lines 3 through 23 make up the typing or menu area.

Typing or Menu Area - May display a menu or be used as a window into the current function.

Line 24 contains prompt information.

The Prompt Line displays prompts that need keyboard action before the function can continue. All prompts are displayed as video reversed (brighter) on this line. The reply symbol ,

an open square with a cursor under it, appears immediately to the right of the prompt. The reply symbol and the reply will not be video reversed. The symbol is removed when a reply is entered from the keyboard.

Line 25 contains messages concerning job status or conditions requiring action.

The Message Line displays messages to the operator such as an error, a device failure, a device service request, or a job complete message. All messages start on the character position farthest to the left on the screen. Pressing MSG key clears the current message displayed; and will display the next if one exist.

Loadable Diagnostics Keyboard Functions

Note: When diagnostics are loaded or selected from the diagnostic diskette, the cables to the feature attachments (for example, the printer or Mag Card Unit) are wrapped. A time delay of up to one minute can occur during this wrap test. Typing or opening the diskette handle during the test will cause the diagnostics to work incorrectly.

The END key is used to stop the function selected, returning the user to the FUNCTION SELECTION menu.

The CANCL key is used to cancel functions and clear prompts. The exact function of CANCL is determined by the status of the system when the key is pressed. For example, if the system is displaying the RUN-TIME OPTIONS Menu and a response is typed, pressing the CANCL key clears the response and displays the reply symbol to the immediate right of the prompt. System control remains in the menu. If the system is displaying a prompt, and a response is not yet typed, pressing

the CANCL key returns to the DEVICE SELECTION Menu.

The ENTER key instructs the system to continue to the next step of the function being performed.

The PRINT key will cause lines 3 through 23 on the display screen to print exactly as they are displayed. The PRINT key is only active when the message: "Press PRINT to print screen" appears in the typing area or menu area. In a printer sharing configuration, the PRINT key works only if the diagnostics are performed at the primary work station.

The printer must be turned on and ready to print before the PRINT key is pressed. While printing, pressing the CANCEL key on the printer will cause the printer to stop. Any printer problems during printing will cause the printer to stop and a printer error message to appear on the message line.

Loadable Diagnostics Function Selection

When the loadable diagnostics diskette is loaded, the display will show a menu of the functions available (Figure 9-12). Selection of a function is made from the keyboard. To select a function, type a letter from the ID column and press the ENTER key. Once a function has been selected, additional menu displays and keyboard entries identify the specific diagnostic function to be performed.

If a response is entered which is not valid, the message: "Invalid ID Specified" will appear on the message line. The FUNCTION SELECTION Menu will remain on the screen with the prompt: "Type ID letter to choose item, Press ENTER: x (The character "x" represents the invalid ID letter).

FUNCTION SELECTION

ID	ITEM
a	MDIs
b	Utilities
c	System Exerciser
d	Load Program

Type ID letter to choose ITEM; Press ENTER:

Figure 9-12. Diagnostic FUNCTION SELECTION Menu

Map Diagnostic Integration (MDI)

The term "integration" means hard-copy (printed) MAPs have been combined with the loadable diagnostics on the diagnostic diskette. Much of the decision making and test selection is performed automatically by the diagnostic program.

MDI Entry

Note: A time delay of up to one minute can occur during the wrap test. Typing or opening the diskette unit during the test will cause the diagnostics to work incorrectly.

When the diagnostic diskette is loaded, any function from the FUNCTION

SELECTION menu can be selected. If there is a keyboard problem, the MDIs may be entered by opening and then closing the active diskette unit handle. If a wrong keyboard response is entered, the FUNCTION SELECTION menu remains on the screen. When there is a keyboard problem, the MDI for the keyboard may be entered by again opening and then closing the diskette unit handle.

MDI Function

The interface with MDI is through the keyboard and display. First the device to be tested (ID column) is selected from the DEVICE SELECTION menu (Figure 9-13). The run time option for the device is then selected from the RUN-TIME OPTIONS Menu. As the MDI executes, the correct steps will be automatically selected by the MDI controller which controls the MDI program. Steps taken by the MDI controller are determined by test results and CSR responses to questions. The MDI display will show:

- Commands
- Questions
- Text
- Test Results
- Repair Actions.

During long tests, the CSR is informed of the system status by a test status display.

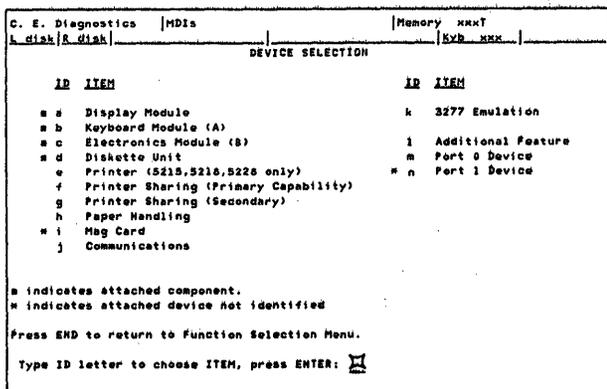


Figure 9-13. MDI DEVICE SELECTION Menu

MDI Device Selection Menu

Once the MDI Function has been selected, the controller will display the DEVICE SELECTION Menu. The menu will prompt the CSR to select the device ID to be tested.

If a device selection is made for a device not attached, the message "Device Not Present" will appear on the message line. The DEVICE SELECTION Menu will remain on the screen with the prompt: Type ID Letter to Choose Item; Press ENTER: x (The character x represents the invalid ID letter.)

If a wrong selection is entered, the message "Invalid ID Specified" will appear on the message line. The DEVICE SELECTION Menu remains on the screen with the prompt: Type Your Choice; Press ENTER: x (the character x represents the invalid ID letter.)

MDI Run Time Options

Run time options are entered through the MDI RUN-TIME OPTIONS Menu (Figure 9-14). This menu is displayed after the device ID letter to be tested is entered from the DEVICE SELECTION Menu.

If the MDI function and the keyboard device are selected by opening and closing the diskette unit handle, this menu will not be presented. In this case, the MDI will execute with the default options from this menu. The default options are those which are displayed under the "Your Choice" heading when the RUN-TIME OPTIONS Menu is first displayed.

If the run time options are to be the normal default options, the CSR may press the ENTER key while displaying this menu, and the MDI will run automatically.

Run time mode options are:

- 1 = RUN. Advance automatically through the steps. Perform the tests, display the results, and stop only when a question must be answered or when a repair action is displayed. This is the default option.
- 2 = STEP. Perform a step, display test results and wait for a keyboard response before continuing to the next step.
- 3 = LOOP. Repeat (loop) the step or steps specified until a device failure stops the loop, or until the system requires a keyboard response before it can continue the loop mode. If the loop mode is selected, the MDI SUBSECTION, START ON STEP and END ON STEP values must be selected or the loop mode will use the default options. An MDI SUBSECTION is a specific part of a device (section) MDI. (For example, the stepper motor

subsection of the diskette MDI.)
To stop the loop, press the REQST key.

The choice may be selected (entered) at the same time the ID letter is selected. For example, instead of just selecting "a" to choose the mode, the choice may be selected by entering "a space 2" (a 2). This will select the step mode. When this is selected, the ID, Item and Choice will be video reversed.

C.E. Diagnostics MDIs Keyboard Module. Memory xxxx
CED201 Kyb xxx

RUN-TIME OPTIONS			
ID	ITEM	YOUR CHOICE	POSSIBLE CHOICES
a	Mode	1	1 = Run 2 = Step 3 = Loop
b	Section	10	10 - 95
c	Subsection	70	70 - 89
d	Start on Step	001	001 - 061
e	End on step	061	001 - 061
f	Stop on	0	0 = Don't stop 1 = Yes 2 = No

Press CANCEL to return to Device Selection Menu.
Press END to return to Function Selection Menu.
When finished, press ENTER.
Type ID Letter to choose ITEM; press ENTER:

Figure 9-14. MDI RUN-TIME OPTIONS Menu

MDI Test Unit Menu Numbering

Each device is assigned a two-digit section number from the possible MDI section numbers from 10 through 90 (Figure 9-15). Each section is divided into subsections. Subsections are also given a two-digit number from possible subsection numbers from 70 through 89. A subsection is made up of steps. These step numbers have the same numbering method as steps in the MAPs. The step numbers in a subsection are given a three-digit number from 001 through 999.

Section	Subsection	Test Group
10	XX	Keyboard
20	XX	Electronics
30	XX	Mag Card
40	XX	Shared Resources
50	XX	Printer
60	XX	Power Supply
70	XX	Communications
80	XX	Diskette
90	XX	Display

Figure 9-15. MDI Test Unit Numbering

MDI Run Time Options Menu - Stop On Options

The Stop On option is valid for all modes of operation and is selected from the MDI RUN-TIME OPTIONS Menu. If no Stop On option is selected, the MDI supervisor will default to the 0 or Don't Stop option. In this option, the following values are assigned to zero through two.

0 - Don't Stop (the automatic system default)

1 - Yes (Stop if the answer is YES)

2 - No (Stop if the answer is NO)

Trace Display

The display permits up to 100 MDI step entries to be seen at once and enables a review of the steps taken in MDI when a wrong step is suspected. The format of each entry is:

- nnn = Step Number (from 001-999)
- d = Decision (y, n, f, or m)
- y = Step result was Yes
- n = Step result was No
- f = Step result was a fix

- m = Step result was go to another MAP
- mmss= The MDI ID number for a GO TO MAP step

mm = Section Number (10-90)

ss = Subsection Number (70-89)

The trace information is displayed from left to right and top to bottom on the display in the order the steps occurred (Figure 9-16). This information is always available during MDI. The trace table is deleted and started again when a new MDI device (section) is selected from the MDI DEVICE SELECTION Menu.

The MDI trace table may contain a maximum of 100 steps. The start of the table is indicated by the word START, and the end of the table is indicated by the END.

The trace table may be printed as it is displayed by pressing the PRINT key while displaying the part of the trace table which is to be printed (except on a secondary station W/S).

C.E. Diagnostics CED201	MDIs	Diskette	Module	Memory xxxx Kyb xxx
START mmss				
001-y	003-y	005-y	007-y	009-y
	011-y	013-y	015-y	017y
				-END-

Press PRINT to print screen.
Press ENTER to continue:

Section - 80
Subsection - 70
Step - 019
Mode - Run

Figure 9-16. MDI Trace Display

MDI Display Typing Area or Menu Area

The MDI typing area or menu area displays the following information (Figure 9-17):.

- COMMAND, QUESTION, or FIX TEXT AREA
- SUPPLEMENTARY TEXT AREA (Additional information about the step)
- Prompts and Message Lines
- Status Area (Mode or Step Number)
- DECISION DATA AREA or Test Condition.

C.E. Diagnostics CED201	MDIs	Memory xxxx Kyb xxx
COMMAND TEXT, FIX TEXT, and QUESTION TEXT AREA (19 lines of 39 characters)		SUPPLEMENTARY TEXT AREA (13 lines of 39 characters)
		TEST UNIT UNIQUE AREA (4 lines of 39 characters)
DIRECTIVE TEXT AREA	DECISION DATA AREA	STATUS AREA
'Prompt Line' 'Message Line'		

Figure 9-17. Typing Area Or Menu Area

MDI Prompt Responses

The following is a description of the responses which can be used during MDI.

- o = Option. Return to the MDI RUN-TIME OPTIONS Menu (Figure 9-14) to enter new options. From the options menu, press ENTER to return to the step you were on.

- t = Trace. Display a trace of the steps performed and the decisions made in each step. Decisions may be:

While displaying the trace table, press ENTER to return to the step you were on.

- y = Yes. The answer to this question is yes. Continue on the yes column of the MDI.
- n = No. The answer to this question is no. Continue on the no column of the MDI.
- b = BACK UP. Return to the last step which was performed. This response is not valid if entered at the start of a subsection. When it is necessary to back up more than one or two step, return to the RUN-TIME OPTIONS Menu and enter a Start On step number.
- r = RESUME. Return to the same step in the MDIs after the system is turned off. There are two modes of resume, automatic and manual (Figure 9-18). Automatic resume occurs when the MDI step instructs you to turn the system off to perform a service check. When the diagnostic diskette is reloaded, and MDIs are selected, the system will instruct you to press ENTER to resume MDI processing. To resume on an MDI step that is not automatic, you must type an r, and press ENTER before turning the system off.

```

C.E. Diagnostics   MDIs Shared Primary   Memory xxxxx
CED201                                                    Kyb xxx

Disconnect the rear panel wrap plug      MAP 4312 determines which part in the
from Rear Panel Connector 6A (Six A).    Electronics Module is causing the
GO TO MAP 4312, ENTRY POINT A.          failure.

Automatic RESUME at Step 132

Section - 42
Subsection - 70
Step - 131
Mode - Run

CANCEL to return to Device Selection.
END to return to Function Selection.
Type y,n,(b,o,t,r); press ENTER:

```

Figure 9-18. Manual Resume Prompt

MDI Prompts

Following is a description of the prompts displayed during MDI.

- Question Prompt. The following is displayed when an MDI question must be answered (Figure 9-19). The answer may be "y" (Yes) or "n" (No) or to select one of the specified options "b" (Back up), "o" (Return to the options menu), "t" (Display the trace table), or "r" (Resume). When ENTER is pressed, the MDI controller looks at the response and takes the needed action.

```

C.E. Diagnostics  MDIs Keyboard          Memory xxxxx
CED201              Kyb xxx

Did all Keys work without fault?

Section - 10
Subsection - 70
Step - 005
Mode - Step

CANCL to return to Device Selection;
END to return to Function Selection.
Type y,n,(b,o,t,r); press ENTER:

```

Figure 9-19. Question Prompt

- **Command Test Prompt.** The following is displayed when command text is specified with an MDI step. Command text gives instructions which must be performed before continuing with MDI. If one of the options (b, o, t, r) is entered, that option is taken. If no option is entered, the MDI will continue with the next step. When ENTER is pressed, the MDI controller looks at the response and takes the needed action (Figure 9-20).

```

C.E. Diagnostics  MDIs Keyboard Module  Memory xxxxx
CED201              Kyb xxx

In order to check the Make/Break Key.
codes a given sequence must be
followed. As an aid to the Operator
conducting the test, the next Key in
the sequence appears BLINKING on the
screen.

The Shift Lock must be up before
starting the test.

Section - 10
Subsection - 70
Step - 005
Mode - Step

CANCL to return to Device Selection;
END to return to Function Selection.
Type (b,o,t,r); press ENTER:

```

Figure 9-20. Command Test Prompt

- **Test Unit Prompt.** One of the following is displayed when a step is run in the step mode (Figure 9-21). The results of the test unit are checked, and a decision is made by the MDI controller. This may be overridden by entering another value or one of the other options (b,o,t,r). When ENTER is pressed, the MDI controller looks at the response and takes the needed actions.

```

C.E. Diagnostics   MDIs Keyboard Module           Memory xxxx
CED201                                                    Kyb xxx
-----
Good Test Unit results?      MAP Description:
                               This MAP isolates Keyboard problems.
                               Overrun test for the keyboard

Test      - YES   Section - 10
Received - YES   Subsection - 70
                               Step - 001
                               Mode - Step

CANCEL to return to Device Selection;
END to return to Function Selection.
Type y,n,(b,o,t,r); press ENTER: y

```

Figure 9-21 (Part 1 of 2). Test Unit Prompt Display

- Test Unit - Question Prompt. The following is displayed when a test or step unit is running and needs a response (Figure 9-22). The test unit runs until "REQST" is pressed, then the MDI question is displayed.

```

C.E. Diagnostics   MDIs                               Memory xxxx
CED201                                                    Kyb xxx
-----
QUESTION TEXT AREA                                SUPPLEMENTARY TEXT AREA
(19 lines of 39 characters)                       (13 lines of 39 characters)

TEST UNIT UNIQUE AREA
(4 lines of 39 characters)

CANCEL to return to Device Selection;              Section - xx
END to return to Function Selection.              Subsection - xx
To reply, press REQST:                            Step - 024
                                                    Mode - Run

```

Figure 9-22. Test Unit - Question Prompt

- Fix/Stop Prompt. The following is displayed when a Fix or Stop step is indicated (Figure 8-27). No response before pressing ENTER causes the MDI controller to return to the DEVICE SELECTION menu. When ENTER is pressed, the MDI controller looks at the response and takes the needed action.

```

C.E. Diagnostics   MDIs Keyboard Module           Memory xxxx
CED201                                                    Kyb xxx
-----
Good Test Unit results?

Test      - EQ   Section - 10
Received - 0000 Subsection - 70
Expected - 0000 Step - 001
                               Mode - Step

CANCEL to return to Device Selection;
END to return to Function Selection.
Type y,n,(b,o,t,r); press ENTER: y

```

Figure 9-21 (Part 2 of 2). Test Unit Prompt Display

```

C.E. Diagnostics  MDIs Keyboard      Memory xxxx
CED201           Kyb xxx
Exchange key modules.

```

Select the Keyboard ID to execute the CE Diagnostic MAP 1070 which is located on the CE Diagnostic Diskette.

```

Section - 10
Subsection - 70
Step - 007
Node - Step

```

CANCL to return to Device Selection;
 END to return to Function Selection.
 Type (b,o,t,r); press ENTER:

Figure 9-23. Fix/Stop Display

LOADABLE UTILITIES

The loadable diagnostics include utilities normally used with MAPS. When the utilities are selected from the FUNCTION SELECTION Menu (Figure 9-24), the GROUP SELECTION Menu will be displayed (Figure 9-25). Once the utility group has been selected, a specific group utility menu will be displayed. The specific group utility menu will change with the utility group selected.

```

C.E. Diagnostics  Memory xxxx
CED201           Kyb xxx
FUNCTION SELECTION

```

```

ID  Item
a   MDIs
b   Utilities
c   System Exerciser
d   Load Program

```

Type ID Letter to choose ITEM, press ENTER:

Figure 9-24. Loadable Diagnostics FUNCTION SELECTION Menu

```

C. E. Diagnostics | Utilities | Memory xxxT
L disk | R disk | Kyb xxx
GROUP SELECTION

ID  ITEM
a   Error Log/Maintenance Statistics
b   6360 Head Alignment Compatibility Check
c   FESN/RVM
d   Communications
e   Large Display

Press END to return to Function Selection Menu.
Type ID letter to choose ITEM, press ENTER:  #

```

Figure 9-25. Utility Group Selection Menu

Error Log Utility Group

The Error Log utilities permit a review of error log information stored in RAM and then written (dumped) to a diskette(s) called the Memory Record Diskette(s). This error log information helps find intermittent failures by showing where the failure(s) have occurred. The Error Log utilities format and display the contents of the Memory Record Diskette(s).

When the Error Log utility is selected, the menu shown in Figure 9-26 is displayed, and the device error log is selected. When the device is selected, a prompt to insert the Memory Record Diskette is displayed, and the Error Log for the selected device will be displayed.

C.E. Diagnostics CED201	Utilities	Memory xxxx Kyb xxx
DEVICE SELECTION		
ID	Item	
a	Diskette Drive Left Error Log	
b	Diskette Drive Right Error Log	
c	Printer Error Log	
d	Keyboard Error Log	
e	Display Error Log	
f	Mag Card Error Log	

Press CANCEL to return to Utility Group Selection Menu.
Press END to return to Function Selection Menu.
Insert Memory Record Diskette into slot.
Type ID Letter to choose Item, press ENTER:

Figure 9-26. Error Log Utility DEVICE SELECTION Menu

All the Error Logs follow the same basic format as the one shown in Figure 9-27, and all counters start from the latest IPL.

- Lines 1 and 2 are the same as all other Diagnostic Displays in Loadable Diagnostics.
- Line 3 is the name of the device for which the Error Log is being displayed.
- Line 4 is blank.
- Line 5 is the period of time from the last IPL to the time when memory was dumped to the Memory Record Diskette(s) or when a 900 error code was received.
- Line 6 is blank.
- Lines 7 through 11 contain the number and types operations.
- Lines 12 through 16 contain the number and types of errors.
- Lines 17 and 18 are status registers.
- Lines 19 through 25 have the messages and prompts.

C.E. Diagnostics CED201	Memory xxxx Kyb xxx		
DISKETTE DRIVE ERROR LOG			
Duration of Logging	2 hrs 17 min 41 sec	Program Disk	xxxxxx
Read Operations xxxxxxxxxx	Write Operations xxxxxxxxxx	Seek Operations xxxxxxxxxx	Data Field Errors xxxxxxxxxx
Read Data Errors xxxxxxxxxx	Write Fault Errors xxxxxxxxxx	Seek Errors xxxxxxxxxx	No Data Errors xxxxxxxxxx
Status Reg 1 10110100	Status Reg 2 11110111	Status Reg 3 10111011	Last Diskette xxxxxx

Press CANCEL to return to Device Selection Menu.
Press END to return to Function Selection Menu.
Press PRINT to print screen.
To continue to next DEVICE, press ENTER:

Figure 9-27. Device Error Log

System Error Log

The system logs (records) errors in the system memory. This information can be stored on a diskette by either the operator or the CSR. The CSR can display the error log to determine what errors have occurred in the system.

The errors are detected by a combination of hardware error circuits, which include RAM parity checks, Cyclic Redundancy Check (CRC), and electro-mechanical sensors.

Hardware error circuit outputs are made available to software error controlling routines. These routines control the status of indicators (LEDs or display error codes), prompts and messages for the operator or the CSR for use in problem determination and diagnostics.

The system logs both soft and hard errors. Soft errors can be recovered from by an automatic re-try of the failing operation. An example is a diskette read or write error. (See Figure 9-28.) This error may be recovered from by re-trying the read/write operation. When a soft

error occurs, it is logged in the system error log.

A limit is set in the system for the maximum number of times a soft error may be re-tried. When the number of re-tries for an error is more than the set limit, the error will be recognized as "hard" and will need manual correction procedures to recover.

For errors that need manual correction procedures, the customer will be instructed to use the Prompts and Messages section of the Operator Reference Manual to recover. These errors may include machine checks for processor or RAM failure, mechanical paper jams in a printer, card jams in a Mag Card deck, and similar failures. For errors that cannot be recovered from, the Problem Determination Procedures will guide the customer through data collection procedures such as dumping the error logs to the Memory Record Diskette and making a note of the status of indicators.

Note: Because the error log is contained in RAM, it will be lost when system power is turned off, or when a program diskette is loaded, if it is not first dumped to a diskette.

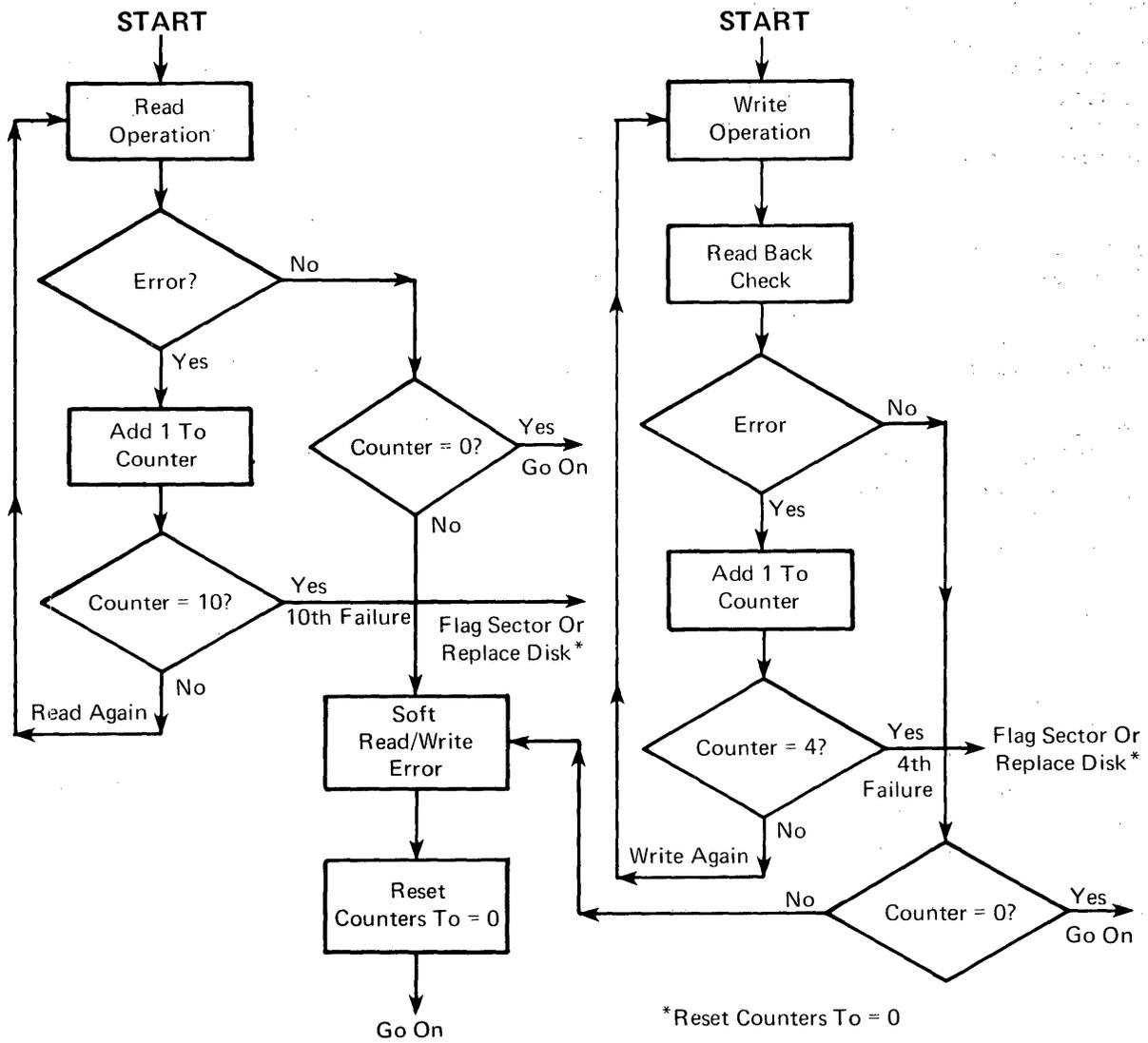


Figure 9-28. Diskette Read/Write Error Recovery Routine

A variation in return codes of the drives indicates head alignments are not identical. A variation of not more than one, for example +1 and 0 or 0 and -1, is generally acceptable.

If the variation between the drives is more than one, for example +1 and -1, the head alignment is not acceptable and must be adjusted to reduce the variation to one or less. Adjustments should be performed on the smallest group of like return codes.

- The diskette drive problems identified are head alignment, head sensitivity, and stepper mechanism problems. If the head alignment is beyond the +1 or -1 range, a prompt will reference the head alignment adjustment in this PSM and the MIM. When head sensitivity or stepper mechanism problems are found, the prompt will reference a MAP.
- Unexpected diskette failures can occur during this test. If this occurs, a prompt to re-run the test is displayed.

Field Engineering Service Number/Release Version Modification (FESN/RVM)

The FESN/RVM utility is selected from the GROUP SELECTION Menu to identify and check the level of the customer program diskette. When the utility is selected and the program diskette is loaded, the program diskette name, spelling support, the FESN, and the RVM are displayed (Figure 9-30).

The FESN and RVM are used to call report software problems and are recorded on the I/PAR when a software problem is found.

C. E. Diagnostics		Memory XXXX
CED201 1A9A1A		Kyb XXX
DISKETTE	FESN	RVM
Textpack 2 (IPL) U.S. English	xxxxxxx	xxx

Figure 9-30. FESN/RVM Utility

System Exerciser

The system exerciser is a system functional check which runs the system devices concurrently. It operates the processor in more than a one level program processing mode. It also operates all devices in the interrupt mode as they would operate in the operator mode.

When the system exerciser is selected from the FUNCTION SELECTION Menu, it starts to test the system. This system centers the printer carrier on the writing line, so the operator may prepare the printer. After preparing the printer, the operator presses ENTER. The frame shown in Figure 9-31 appears on the display while the system exerciser is operating. This frame will vary depending on which devices are attached to the system.

An optional keyboard test is available to the operator or CSR. The keyboard may be tested anytime during the test.

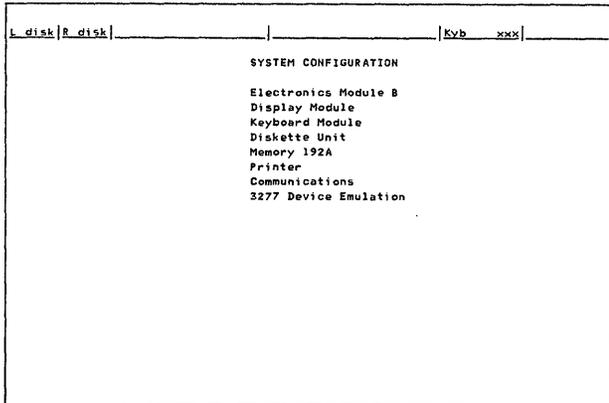


Figure 9-31. System Exerciser Display

While the test is operating, the timer count is continuously updated to show that testing is in process. If the system exerciser fails to complete normally, the devices exercised frame will be displayed and show which device or combination of devices are suspected. The printed output, shown in Figure 9-32, should also be checked for errors.

The system exerciser takes approximately 3 minutes to complete. When the system exerciser is completed, press the END key to return to the FUNCTION SELECTION Menu, or press the ENTER key to place the system exerciser in a loop mode.

In a loop mode the exerciser will repeat until an error is sensed or the CANCL key is pressed.

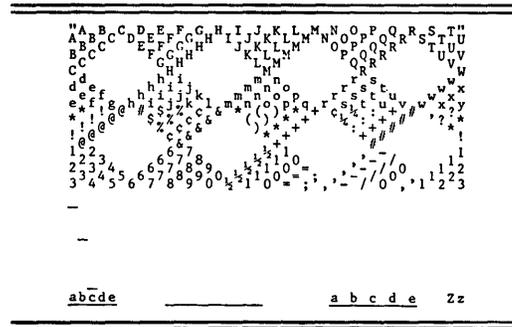


Figure 9-32. System Exerciser Printed Output

Load Program Function

The Load Program Function is used to execute Diskette MDIs from the opposite diskette drive. It can also be selected from the diagnostic selection menu to perform a soft Initial Program Load (IPL) of the customer program diskette. A soft IPL is an Initial Program Load performed without turning the system off and going through the normal POR and BAT sequence.

When Load Program Function is selected from the FUNCTION SELECTION Menu, the information displayed in the typing area or menu area will disappear. The prompt "Insert desired program diskette, press ENTER:" will be highlighted on the prompt line (Figure 9-33). In this mode, any program diskette (CEDD, PDD, IPL, feature diagnostics, and customer's program diskettes) may be inserted in the diskette drive in place of the diagnostic diskette. The system will IPL the inserted program diskette.

Insert desired program diskette, press ENTER: 

Figure 9-33. Load Program Function Display

MAINTENANCE ANALYSIS PROCEDURES (MAPS)

The MAPs include directions for the following activities: Start of Call, Power Distribution, IPL failures, repair action verification (which is system entry), and other procedures not suitable for MDIs.

The System Entry MAP is a symptom-oriented hard-copy MAP that identifies an entry point into the MAPs or MDIs. This entry point will shorten the number of steps needed to diagnose a failure. Data gathering such as interpreting the state of LEDs, making meter readings, using resident diagnostic programs, and performing a system dump will be directed by the System Entry MAP. The System Entry MAP should be used on all calls.

MAP Format

Maintenance Analysis Procedures (MAPs) are formatted to aid in isolating the cause of a failure. MAPs are printed charts that require answers to yes/no

questions. They indicate either another step, another MAP, or an area of the service manuals for repair action. Figure 9-34 and Figure 9-35 are examples of MAP formatting.

- The MAP name is located in the upper left-hand corner of the page **1**.
- The number of pages in this MAP is located under the MAP name **2**.
- The MAP number is located in the upper and lower right-hand corners of the pages **3**.
- The Entry Points chart shows which MAP's step are referred to this MAP **4**.
- The Exit Points chart indicates to which MAP the current MAP may direct the user **5**.
- MAP entry procedures are listed above the first MAP question; Entry Point A, Step 001. These procedures describe the system set up or the first test necessary to start the MAP **6**.
- MAP questions are written so they may be answered yes (Y) or no (N). The questions are charted by a vertical line, or trace, located under the Y and N **7**.
- Reference information is always contained in parenthesis **8**.
- The on column/page connector indicates the page of this MAP the traces are continued from **9**.
- The off column/page connector gives the page number and column, trace let, of the next step. If no page number appears above a trace, the trace continues at the top of another column on that page **10**.

ENTER THIS MAP			
FROM	ENTRY POINT	PAGE NUMBER	STEP NUMBER
MAP NUMBER	ENTRY POINT	PAGE NUMBER	STEP NUMBER
0015	A	1	001
8061	A	1	001
8062	A	1	001

EXIT POINTS

EXIT THIS MAP		TO	
PAGE NUMBER	STEP NUMBER	MAP NUMBER	ENTRY POINT
3	022	0015	A
3	020	0017	A
3	023	6010	A
4	033	8020	A
4	034	8020	A
5	040	8020	A
3	014	8064	A
4	030	9020	A
3	017	9030	A
4	026	9040	A

001
 (ENTRY POINT A)

POWER-OFF.

Remove any diskette that may be in the Drive. **6**

POWER-ON.

Wait 20 seconds for BAT to complete .

Is the IBM LOGO visible on the Display?

Y N

002

Is an Error Code displayed at the bottom of the screen?

Y N

003

Check the LED Indicators

Are there any Led Indicators ON?

Y N

4 4 3 2 **7**
 A B C D **10**

Figure 9-34. MAP Format Sample

004 Q00015

Check to see if the Fan in the Electronic Module is running.

Is the Fan in the Electronic Module running?

Y N

005

It appears that AC Power is not present at the Power Supply.

POWER-OFF.

Remove the Primary Power Fuse from Panel 2.

Using the lowest ohms scale, check the continuity of the fuse.(less than 2 ohms)

Is the Power Supply Fuse bad?

Y N

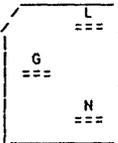
006

DANGER

HIGH VOLTAGE IS PRESENT AT THE POWER CORD CONNECTOR.

Disconnect the Power Cord connector (9) at Panel 2.

Power Cord connector (9) configuration.



Using the (ac) scale, measure the voltage at Power Cord connector (9).

Connector | (ac)
(Step 006 continues)

(Step 006 continued)

Pins	Voltage
L to G	104 to 127 volts
L to N	104 to 127 volts
N to G	zero volts

(WI-GBG/I refer to Voltage Chart in the Product Support Manual.)

Is the (ac) voltage in the correct voltage range?

Y N

007

Disconnect the Power Cord connector from the wall outlet.

Using the (ac) scale, measure the voltage at the outlet.

Is the (ac) voltage in the correct voltage range?

Y N

008

Inform the Customer.

009

Install a new Power Cord.

Go to Map 0010, Entry Point, A. This is the System Entry Map.

010

POWER-OFF.

Install a new Power Supply.

Go to Map 0010, Entry Point, A. This is the System Entry Map.

Figure 9-35. MAP Format Sample

PROBLEM DETERMINATION PROCEDURES (PDP)

Problem Determination Procedures (PDPs) are customer diagnostics. The operator becomes involved with diagnostic procedures only if a failure prevents normal use of the system. The operator will be directed to the Problem Determination Guide (PDG). The correct operator information will be given in the PDG and will be based on error codes displayed on the screen, or by the LEDs. In some cases, there will be nothing displayed on the screen and the operator will be directed to perform a power-on-reset. The operator will then be asked to take note of the system indicators, such as LEDs, keyboard tone, or diskette noise.

The operator may then be directed by the PDG to load the Problem Determination Diskette (PDD). This diskette contains system verification tests that can be selected and run by the operator. When the operator selects system verification, the PDD will continue to run with additional automatically sequenced tests under the control of the system. Progress and error indications will be shown on the display. During lengthy tests, the display will be updated to show the diagnostics which are operating. This will be reinforced by the use of audible signals. These additional tests are not in the BAT.

The tests on the Problem Determination Diskette (PDD) may require operator intervention.

Examples of acceptable customer problem determination procedures include:

- Referring to the Problem Determination Guide
- Handling paper and magnetic media
- Reading display prompts
- Keying simple entries
- Observing LEDs
- Noting system sounds
- Comparing print quality
- Recording data for further analysis.

If the symptoms or error codes show a failure for which the operator cannot perform further diagnosis, the Problem Determination Guide will direct the operator to do one of two things:

- Place a service call and give a description of the problem along with a service request number
- Place a call to the Office System Support Center (OSSC) for further problem determination.

CHAPTER 10. INTERMITTENT PROBLEM DIAGNOSTIC APPROACH

INTRODUCTION

The Intermittent Problem Diagnostic Approach is a guide to aid service personnel in solving system problems that appear to be intermittent. The purpose of this diagnostic approach is to collect data and use the Displaywriter diagnostic aids to lead to a repair action. These procedures are only guidelines to aid in solving intermittent problems. Service personnel can develop and use other diagnostic approaches as knowledge of the Displaywriter system increases.

Note: These procedures should be used only after MAPs have failed to isolate the problem. At all times, follow the Required Action Guidelines.

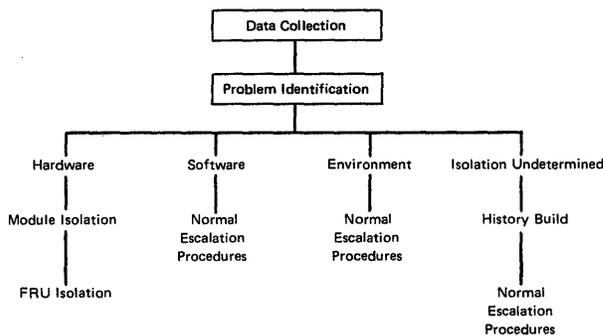


Figure 10-1. Intermittent Problem Diagnostic Approach Flow Chart

DATA COLLECTION

The purpose of this section is to inform service personnel of ways to collect general data that could lead to intermittent problem identification.

Instructions

Collect all the available customer information, including: the application or job being performed at the time of failure; the regularity of the failure; the time of day the failure occurs; any unusual module sounds; a hard copy of the job; the Memory Record Diskette; any error indicators, and similar information.

Check the system history records for installed Engineering Changes, CEMs, and earlier service calls that might have caused the problem.

Review all CEMs for existing information that may supply a solution to the problem.

If possible, have the customer repeat the problem.

- Look for a module or function failure while the customer is operating the system.
- See if the job fails in the same place, exactly the same way.
- Listen for any unusual system sounds.
- Observe what areas (modules) of the system were operating at the time of the failure.

Learn the sequence leading up to the failure.

- Observe which keys are pressed.
- Look for unusual operator actions that may cause intermittent failures.

- Observe which drive unit had the work diskette and which drive unit had the licensed program diskette.
- Observe, if possible, where in the job(s) the failure occurs.

Collect as many failure symptoms as possible.

- Make a note of BAT error codes and/or the Problem Determination Diskette (PDD) service request numbers.
- If possible, run the customer's job(s) on another Displaywriter, located in the same environment with the same EC/CEM level.

Look at the error log(s) if a Memory Record Diskette is available. If any errors are indicated, print the error log.

PROBLEM ISOLATION

The following questions are designed to lead the CSR in problem isolation.

1. Does the problem only occur when a specific licensed program is loaded?
2. Does the problem occur only when a specific job or application is performed?
3. Does the problem occur if the job is run on another Displaywriter with the same features and EC/CEM level?
4. Does the problem occur only when typing?
5. What areas (modules) of the system are operating at the time of failure?
6. Does the failure only occur when other equipment is turned on or operated?
7. On a dual diskette unit, does the problem occur on both the left and right side?
8. Does the problem occur at a specific time of day?
9. Do other Displaywriters in the account have the same problem?
10. Does the same operator have the problem on different machines?
11. Are there any errors in any of the device error logs? Section 16, "Guidelines for Error Log Interpretation," will aid in error log interpretation.
12. Does the customer have any service request numbers? If so, check Figure 10-2.

SERVICE REQUEST NUMBERS	SUSPECTED AREA
x1xxxx	Keyboard
x2xxxx	System Electronics
x4xxxx	Printer Sharing
x5xxxx	Printer
x6xxxx	Power Supply
x61xxxx	3277 Emulation
x8xxxx	Diskette Unit

Figure 10-2. Service Request Number Chart

Using the information from Data Collection, and the decisions made in Problem Isolation, see one or more of the following sections for further isolation.

- Keyboard. See Section 1.
- Display. See Section 2.
- Electronics Module. See Section 3.

- Diskette Unit. See Section 4.
- 5215 Printer. See Section 5.
- 5218 Printer. See Section 6.
- 6361 Mag Card Unit. See the Mag Card Unit Product Support Manual.
- Printer Sharing. See Section 7.
- Communications. See the Communications Service Manual.
- Power Supply. See Section 8.
- Isolation Undetermined. See Section 9.
- Software or Operator Procedure. See Section 10.
- Environment. See Section 11.
- 3277 Emulation. See the DWS 3277 Emulation RPQ Product Service Manual.
- Port 0 - Port 1 Features. See Section 7b.

SECTION 1. KEYBOARD ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the keyboard MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on BAT (RNA Test G)
 - Failure. Use the BAT error code with MAPs to determine the cause, and see Section 14, BAT Failures.
 - No Failure. Continue with this procedure.
2. Loop on BAT (RNA Test G) while flexing (moving) the following:
 - The keyboard cable and keyboard cable connectors
 - The internal distribution cable and connectors 7, B1-A, and P2.

- Failure. Check the cable and connector.
- No Failure. Continue with this procedure.

3. Loop on keyboard MDIs

- Failure. Print the trace table, and perform the fix as instructed.
- No Failure. Continue with this procedure.

4. Loop on keyboard MDIs while flexing (moving) the cables referenced in Step 2.

- Failure. Print the trace table, and check the cable and connector.
- No Failure. Check all ground wires for a good ground.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 2. DISPLAY ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the display MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on BAT (RNA Test G)

- Failure. Use the BAT error code with MAPs to determine the cause, and see Section 14, BAT Failures.
- No Failure. Continue with this procedure.

2. Loop on BAT (RNA Test G) while flexing (moving) the following:

- The display cable and display cable connector 2.

- The internal distribution cable and internal distribution cable connectors 2, D1, and P2.

- Failure. Check the cable and connector.
- No Failure. Continue with this procedure.

3. Loop on Display Path Test (RNA Test Q)

- Failure. A failure to read or write to the display buffer memory is indicated. Reseat the system and display adapter cards.
- No Failure. Continue with this procedure.

4. Loop on display MDIs

- Failure. Print the trace table, and perform the fix as instructed.
- No Failure. Continue with this procedure.

5. Loop on keyboard MDIs while flexing (moving) the cables referenced in Step 2.

- Failure. Print the trace table, and check the cable and connector.
- No Failure. Check all ground wires for a good ground.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 3. ELECTRONIC MODULE ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the system MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below:

1. Loop on BAT (RNA Test G)
 - Failure. Use the BAT error code with MAPs to determine the cause, and see Section 14, BAT Failures.
 - No Failure. Continue with this procedure.
2. Loop on BAT (RNA Test G) while flexing (moving) all Electronics Module cables and connectors.
 - Failure. Check each cable and connector.
 - No Failure. Continue with this procedure.
3. Loop on Base RAM TEST (RNA Test R)
 - Failure. A failure to read or write to main memory is indicated. Reseat the system and memory cards.
4. Loop on ROS CRC Test (RNA Test P)
 - Failure. A CRC error is sensed. Reseat the system card.
 - No Failure. Continue with this procedure.
5. Loop on system MDIs
 - Failure. Print the trace table, and perform the fix as instructed.
 - No Failure. Continue with this procedure.
6. Loop on keyboard MDIs while flexing (moving) the cables referenced in Step 2.
 - Failure. Print the trace table, and check the cable and connector.
 - No Failure. Check all ground wires for a good ground.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 4. DISKETTE UNIT ISO-LATION

Did the customer have a service request number leading to this area?

YES, loop on the diskette MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on BAT (RNA Test G)
 - Failure. Use the BAT error code with MAPs to determine the cause, and see Section 14, BAT Failures.
 - No Failure. Continue with this procedure.
2. Loop on BAT (RNA Test G) while flexing (moving) the following:
 - The diskette DC cable and diskette DC cable connectors 10 and B2
 - The Diskette Unit signal cable and Diskette Unit signal cable connectors 5 and B1
 - The internal diskette signal cable and internal diskette signal cable connectors 5 and S1.
 - Failure. Check the cable and connector.
 - No Failure. Continue with this procedure.
3. Loop on diskette MDIs
 - Failure. Print the trace table, and perform the fix as instructed.
 - No Failure. Continue with this procedure.
4. Loop on diskette MDIs while flexing (moving) the following:
 - The cables referenced in Step 2
 - The diskette drive cable, diskette drive cable connectors B3 and B4, and the file control card
 - All file control card connectors.
 - Failure. Print the trace table, and check the cable and connector.
 - No Failure. Continue with this procedure.
5. Perform the Diskette Unit (6360) Head Alignment Compatibility check and use the Diagnostic section in this manual for data interpretation.
 - Failure. Align the head to be compatible with other diskette units in the account.
 - No Failure. Continue with this procedure.
6. Check the solenoid and bail adjustment.
 - Not Correct. Adjust as specified.
 - Correct. Continue with this procedure.
7. Loop on diskette path test (RNA Test S)
 - Failure. Visually check for no head movement.
 - No Failure. Continue with this procedure.
8. Run the Track Step Test (RNA Test T)
 - Failure. Visually check for no head movement.

9. Run the Track Step Test (RNA Test T) while flexing (moving) the following:
- The cables referenced in Step 2
 - The diskette drive cable, diskette drive cable connectors B3, B4, and the file control card
 - The stepper motor cable and connector.
- Failure. Check the cable and connector.
 - No Failure. Continue with this procedure.
10. Run the Diskette Stepper Motor Phase Test (RNA Test M)
- Failure. See Section 15 for failure codes. Reseat the system and diskette adapter cards. Check the cables and connectors referenced in Steps 2 and 9, and check the track stepping mechanisms.
 - No Failure. Continue with this procedure.
11. Run the Diskette Stepper Motor Phase Test (RNA Test M) while flexing (moving) the cables and connectors referenced in Steps 2 and 9.
- Failure. Check the cable and connector.
 - No Failure. Continue with this procedure.
12. Run the Diskette Drive Set Ready Test (RNA Test L)
- Failure. See Section 15 for failure codes. Reseat the system and diskette adapter cards. Check the cables and connectors referenced in Steps 2 and 9, and check the track stepping mechanisms.
 - No Failure. Continue with this procedure.
13. Run the Diskette Drive Set Ready Test (RNA Test L) while flexing (moving) the cables and connectors referenced in Steps 2 and 9.
- Failure. Check the cable and connector.
 - No Failure. Check all ground wires for a good ground.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 5. 5215 PRINTER ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the printer MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on printer MDIs

- Failure. Print the trace table, and perform the fix as instructed.
- No Failure. Continue with this procedure.

2. Loop on printer MDIs while flexing (moving) the following:

- The internal distribution cable and internal distribution cable connectors O and B1-B
- The printer cable and printer cable connector O

- The I/O connector in the printer.

- Failure. Print the trace table, and check the cable and connector.
- No Failure. Continue with this procedure.

3. Thoroughly exercise the printer using the Printer Tests - Diagnostic/Adjustment

- Failure. Perform any adjustments or repairs needed.
- No Failure. Check all ground wires for a good ground; perform a static voltage check; and check all adjustments that affect the feedback circuits and timing.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 6. 5218 PRINTER ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the printer MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on printer MDIs

- Failure. Print the trace table, and perform the fix as instructed.
- No Failure. Continue with this procedure.

2. Loop on printer MDIs while flexing (moving) the following:

- The internal distribution cable and internal distribution cable connectors 0 and B1-B

- The printer cable and printer cable connector 0

- The printer connector on the printer attachment panel.

- Failure. Print the trace table, and check the cable and connector.

- No Failure. Continue with this procedure.

3. See the 5218 Intermittent MAP.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 7. PRINTER SHARING ISOLATION

Did the customer have a service request number leading to this area?

YES, loop on the printer sharing MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on printer sharing MDIs at the primary work station.
 - Failure. Print the trace table, and perform the fix as instructed.
 - No Failure. Continue with this procedure.
 2. Loop on printer sharing MDIs at the primary work station while flexing (moving) the following:
 - The primary work station internal printer sharing cable and internal printer sharing cable connectors 6A, 6B, and C1
 - The external printer sharing cable and external printer sharing cable connectors 6A, 6B, and 0.
 3. Loop on printer sharing MDIs at the secondary work station.
 - No Failure. Continue with this procedure.
 4. Loop on printer sharing MDIs at the secondary work station while flexing (moving) the following:
 - Secondary work station internal distribution cable and the internal distribution cable connectors 0 and B1-B.
- Failure. Print the trace table, and check the cable and connector.
 - No Failure. Continue with this procedure.
- Failure. Check the cable and connector.
 - No Failure. Check all ground wires for a good ground.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 7A. 3277 DEVICE EMULATION

See the DWS/3277 Emulation RPQ Product Service Manual.

SECTION 7B. PORT 0 AND PORT 1 FEATURES

Did the customer have a service request number leading to this area?

YES, loop on the failing area MDIs and see Section 13, Service Request Numbers.

NO, follow the procedure below.

1. Loop on the Port 0 and Port 1 Features, one feature at a time, while flexing the internal cables pertaining to the area being tested.

- **Failure.** Print the trace table, and perform the fix as instructed.
- **No Failure.** Consult error logs (if used), check all ground wires and cable shields for good connections. Check external cables connected to Port 0 or Port 1.

SECTION 8. POWER SUPPLY ISOLATION

1. Using a ground indicator or CSR multimeter, verify that the AC outlet is wired correctly.
2. Verify the AC input voltage at the wall outlet is in the following specifications:

US/Canada	104 - 127 VAC
WT	90 - 137 VAC
WT	180 - 254 VAC
3. Verify the AC output voltage to the diskette unit at connector 8 of panel 2 is in the above specification.
4. Verify all power supply voltages at P1, P2, and 10 are in the following specifications: (See the Cables, Connectors, and Test Points section of this manual for pin locations.)

+24VDC	+22.08 to +26.4
+12VDC	+11.04 to +13.20
+12VDC*	+11.40 to +12.60
+ 8.5VDC	+8.245 to +8.925
+ 5VDC	+4.6 to +5.5
- 5VDC	-4.6 to -5.5
-12VDC	-11.04 to -13.20

* (only connector P2, Pin 10)

5. Verify there are no DC or AC voltages on any ground loop. Measure between frame ground and signal ground with the multimeter.

Turn the system power off, and measure for continuity (less than 2 Ohms) between frame ground and all ground wires.

6. Run the BAT in a loop mode (RNA Test G) while flexing (moving) all cables going from the power supply.
7. Run the system exerciser in a loop mode while flexing (moving) all cables going from the power supply.
8. AC ripple on a DC supply may cause intermittent failures. Check for excessive AC ripple by using the 2 VAC scale and measure from frame ground to the DC voltage point being checked. If AC ripple exceeds .2VAC the power supply should be suspect.

Note: Excessive AC ripple may not be present at all times.

Note: If you suspect another area, see that section. If not, see Section 9.

SECTION 9. ISOLATION UNDETERMINED

1. Loop on BAT (RNA Test G)

- Failure. Use the BAT error code with MAPs to determine the cause, and see Section 14, BAT Failures.

- No Failure. Continue with this procedure.

2. Loop on System Exerciser

- Failure. See the isolation section for that device.
- No Failure. Continue with this procedure.

3. Run the Problem Determination Diskette (PDD)

- Failure. See the Problem Isolation section, Service Request Number Chart in Figure 10-2 on page 10-2.

- No Failure. Continue with this procedure.

4. Run all MDIs

- Failure. Print the trace table, and perform the fix as instructed.
- No Failure. Continue with this procedure.

5. Analyze the error logs. If errors are indicated, print the error logs and see the Section 16, Guidelines for Error Log Interpretation. If no errors are indicated, see Section 12, History Build.

SECTION 10. SOFTWARE/OPERATOR PROCEDURES

This section assumes that the problem is suspected to be the licensed program or operator procedures.

- Carefully observe the procedures being followed when the operator

repeats the problem. Determine if correct operator procedures are used.

- If you suspect a software failure, follow your normal escalation procedures for aid. The RETAIN data base may have a solution to the problem.

SECTION 11. ENVIRONMENT

The purpose of this section is to aid service personnel in identifying external causes of machine failures.

1. Ensure the system environment meets printed specifications for the Displaywriter and its supplies. The physical environmental limits are:
 - 15.6°C to 32.2°C (60°F to 90°F)
 - 15.6°C to 29.4°C (60°F to 85°F) (with the sheet-feed attachment)
 - 8% to 80% relative humidity
 - 30% to 65% relative humidity (with the sheet-feed attachment)
2. Using a ground indicator or CE multimeter, verify the AC outlet is wired correctly. This does not verify a good earth ground.
3. Verify the AC input voltage at the wall outlet is in the following specifications:

US/Canada	104 - 127 VAC
WT	90 - 137 VAC
WT	180 - 254 VAC

Note: A dedicated line is recommended if the communication feature is attached.
4. If Radio Frequency Interference (RFI) is suspected, follow this procedure:
 - Use the IBM triplatt VOM P/N 9900167.
 - Select the lowest AC voltage setting.

- With both test leads plugged into the multimeter, extend the two probe ends into the air near the system.
- Spread both leads as far apart as possible.
- Move the leads around to simulate a receiving antenna. A strong RFI signal will cause a meter needle deflection.
- Floor covering and/or humidity may cause Electrostatic Discharge (ESD) problems. Floor covering material can contribute to the buildup of high static electrical charges. This problem is more severe as room humidity decreases.

Questions

1. Are the system vents clear, and is there enough space around the system modules to permit cooling?
2. Is the system near one of the following:
 - Radio/television station transmission antenna
 - Airport
 - Microwave station
 - Radar installation
 - X-ray equipment.
3. Does any other equipment at the customer location have intermittent problems?
4. When other equipment is turned on or operated, does the intermittent failure occur?

Copiers
Air Conditioners
DP/WP Systems
Elevator
Refrigerator
Portable Heater
Coffee Pot
Water Fountains
(hot or cold)

Recommendation

If you suspect environment, follow your normal escalation procedures and inform local management.

SECTION 12. HISTORY BUILD

This section outlines a series of procedures that may be useful when a problem is either difficult to repeat or cannot be repeated in a customer's office.

If (a) the preceding procedures fail to find the cause of the intermittent problem or (b) the problem could not be repeated at the time of the call, the following is recommended:

1. Keep a history of all data obtained to this point, and store it with the system for future use.
2. Obtain error logs, if possible, by requesting the customer to dump the Displaywriter's memory each time the failure occurs, one per diskette. This could aid in future analysis.
3. Request the customer to keep any samples or hard copy of the job and to record the time of failure.
4. Request the customer to list all steps and operations performed that led to the failure.

Inform management of any continuing unresolved problems, and follow your normal escalation procedures.

SECTION 13. SERVICE REQUEST NUMBERS

1. x1xxxx numbers indicate keyboard function failures. For all x1xxxx series numbers:
 - Clean the pad card (Type A only)
 - Reseat the system card and the keyboard logic card.
 - Check the logic card connector.
 - Check the internal distribution cable connectors 7 and B1-A.
2. x2xxxx numbers indicate electronics function failures. For all x2xxxx series numbers:
 - Reseat the memory, system, and display adapter cards.
 - Check the system power cable connectors P1 and A1.
3. x4xxxx numbers indicate printer sharing function failures. For all x4xxxx series numbers:
 - Reseat the printer sharing card.
 - Reseat the system card in the primary and/or secondary station.
 - Check the secondary work station Panel 1, connector 0.
 - Check the secondary work station internal distribution cable connector B1-B.
 - Check the primary work station Panel 1, connectors 6A and/or 6B.
4. x5xxxx numbers indicate printer function failures.
 - Check the primary work station internal distribution cable connector C1.
 - x50xxx numbers indicate a printer link problem.
 - Reseat the system card.
 - Check the printer cable connectors.
 - Check the printer electronics and cables.
 - x51xxx numbers indicate a 5215 Printer problem.
 - Thoroughly test the printer using the printer test Diagnostic/Adjustment.
 - x52xxx numbers indicate a 5218 Printer problem.
 - Go to the 5218 Intermittent MAP.
 - x53xxx numbers indicate a 5218 sheet feed problem.
 - Go to the 5218 Intermittent MAP.
 - x54xxx numbers indicate a 5218 tractor feed problem.
 - Go to the 5218 Intermittent MAP.
5. x6xxxx numbers indicate power supply function failures. For all x6xxxx series numbers:
 - Check the AC input voltage.
 - Check all DC supply voltages.
6. x61xxxx numbers indicate 3277 Emulation failures. For all x61xxxx series numbers:

- Reseat the system and 3277 Emulation cards.
 - Check the internal 3277 Emulation feature cables.
 - Check ground and shield connections on the cables.
7. x8xxxx numbers indicate diskette function failures.
- 480016
 - The drive belt may be slipping
 - The diskette may be slipping on collet
 - Check the AC input voltage to the Diskette Unit.
 - 580010
 - Test all diskette connectors (B1, B2, B3, B4, and file control card)
 - Reseat diskette adapter card
 - Check the stepper drive band adjustment
 - The head carriage assembly may be binding on guide rods.
 - 680011
 - Check the head alignment
 - 780018
 - Same as 680011.
 - 880013
 - Same as 480016.
 - For all other x8xxxx numbers:
 - Reseat the diskette adapter and system cards
 - Check all diskette connectors (B1, B2, B3, B4, and file control card)
 - Check Panel 2, connectors 8, and 10
 - Check internal diskette signal cable connectors 5 and S1.
8. x9xxxx numbers indicate display function failures. For all x9xxxx series numbers:
- Reseat the display adapter and system cards.
 - Check the display module connector (3) and the internal distribution cable connectors (D1 and P2).

SECTION 14. BAT FAILURES

Pre-CRT Initialization BAT Failures

Check the following:

- DC supply voltages.
- AC input voltage.
- Reseat all electronic cards and check all connectors inside the Electronics Module.
- Reseat the Display Module connector 2.
- AC input voltage.
- Reseat all electronic cards and check all connectors inside the Electronics Module.
- Reseat the Display Module connector 2.

Post-CRT Initialization BAT Failures

Check the following:

- DC supply voltages.

- AC input voltage.
- Reseat all electronic cards and check all connectors inside the Electronics Module.
- Reseat the Display Module connector 2.
- Reseat the keyboard logic card and the diskette adapter card.
- Check the keyboard logic card connector and the keyboard cable connector 7.
- Check all connectors on the Diskette Unit.
- Check panel 1, connectors 5, 8.
- Check panel 2, connector 10.

SECTION 15. DISKETTE RNA TEST FAILURE CODES

Drive Set Ready Test (L)

- L F 01. Read ID Error (head is not being engaged)
- L F 02. Drive Not Ready (slow diskette speed)
- L F 03. Recalibrate Not Successful
- L F 04. Write Fault Error
- L F 07. Head Engage Signal Set Incorrectly
- L F 09. Head Cannot Be Engaged
- L F 10. Drive Not Present
- L F 14. Unexpected Transition (change in diskette speed)
- L F 17. Read ID Shows Incorrect Track Location (seek/track step problem).
- L F 19. No Index Pulse Detected
- L F 20. Index Pulse Will Not Reset

Stepper Motor Phase Test (M)

- M F 01. Read ID Error* (head is not being engaged)
- M F 02. Drive Not Ready (slow diskette speed)
- M F 03. Recalibrate Not Successful

- M F 05. Write/Erase Enabled Incorrectly
- M F 07. Head Engage Signal Set Incorrectly
- M F 08. Seek Error* (seek/track step problem)
- M F 09. Head Cannot Be Engaged
- M F 10. Drive Not Present
- M F 14. Unexpected Transition (change in diskette speed)
- M F 15. Inner Track Signal Set Incorrectly*
- M F 16. Inner Track Signal Not Set*
- M F 17. Read ID Shows Incorrect Track Location* (seek/track step problem).

* Current Track Location Display in Test Feedback Field

Track Step Test (T)

- T F 02. Drive Not Ready (slow diskette speed)
- T F 03. Recalibrate Not Successful
- T F 08. Seek Error (seek/track step problem)
- T F 10. Drive Not Present
- T F 14. Unexpected Transition (change in diskette speed)

SECTION 16. GUIDELINES FOR ERROR LOG INTERPRETATION

1. Diskette Error Log

- Write Fault Error
 - A write fault causes that drive to be made unavailable to the user.
 - The number of write faults will never be more than one, because no operations are permitted on the drive after a write fault occurs.
 - A write fault may be caused by either a bad file card, a bad diskette adapter card, or cables.
- No Data Error
 - A no data error indicates that a sector to be read could not be located.
 - The probable cause of a no data error is a bad diskette.
- Seek Error
 - A seek error is caused by a failure to track step to the correct track.
 - Most seek errors will be corrected by an automatic retry. Frequent seek errors indicate a problem in the head track step area.
- Data Field Error *
 - Data field errors indicate an error in reading customer data. Many will be corrected by an automatic retry.

- Data field errors may indicate a bad diskette, a file card problem, a diskette adapter card problem, or a head alignment problem.

- Data Error *

- Data errors indicate an error in reading sector identification data or customer data. Many will be corrected by an automatic retry.
- If the number of data errors is much larger than the number of data field errors, this may indicate poor diskette initialization or poor head alignment.

* If read operations equal seek operations, then all data errors and data field errors were corrected by automatic retrys without informing the operator.

2. Keyboard Error Log

- Queue Overruns
 - Queue overruns are possible during normal operation.
 - A large number of queue overruns indicates a keyboard electronics failure.
 - Queue overruns may appear to the operator as missing key strokes.
- Code MAP Errors
 - Code MAP errors may be caused by bad keyboard electronics or electrical noise picked up by the keyboard cable.

3. Printer Error Logs

- Parity/Frame and Print Parity/Frame Errors

- If both parity/frame errors and print parity/frame errors occur, there may be electrical transients (AC Line) in the environment.

- If only parity/frame errors or only print pari-

ty/frame errors occur, the system card or the printer electronics is probably failing.

- Print Overrun Errors

- Print overrun errors may be caused by slow printer responses. Slow printer responses can be caused by a sluggish printer or maladjusted print feedback circuitry.

SECTION 17. TRACE TABLE USAGE

The trace table can be used to analyze the path of the steps taken in the MDI. When in the loop mode, comparison of the steps in each loop will show any differences in the path taken. For example:

Diskette MDI trace.

001-y 003-y 005-y 009-y 013-y 015-f

001-y 003-y 005-y 009-n 010-y 012-n

This trace shows step 009 was answered differently. The supplementary information at MDI step 009 might supply a clue to the cause of the intermittent problem. The supplementary information displayed at MDI step 009 reads: "The purpose of this test is to check the diskette drive's speed." Because this step had failed, the diskette unit should be checked for any problems that might cause slow diskette rotation (slipping drive belt, etc.).

GLOSSARY

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The glossary does not include terms that are defined in nontechnical dictionaries and that have no special meaning in data processing. Some terms may have different meanings in other contexts, or to people not familiar with data processing industry usage.

In the interest of clarity and consistency of style, the glossary uses the same method of arranging, organizing, and cross-referencing entries as the **AMERICAN NATIONAL DICTIONARY FOR INFORMATION PROCESSING**

A

asynchronous communication. A communication mode in which each single byte of data is synchronized, usually by the addition of start/stop bits. Sometimes called start/stop communication.

B

Basic Assurance Test (BAT). A series of tests executed in sequence that are automatically started at POR.

BAT. Basic Assurance Test.

bisynchronous communication. A uniform procedure, using a standardized set of control characters and control character sequences, for synchronous transmission of binary coded data between stations.

Buffer. * An isolating circuit used to prevent a driven circuit from influencing the driving circuit.

bus. One or more conductors used for transmitting signals or power.

bypass ground. Frame ground.

byte. * A binary character operated on as a unit.

C

characteristic. A distinguishing feature or attribute.

choice. A selection made from a menu.

configuration. A collection of devices that make up a system.

CRC. Cyclic redundancy check.

CSR. Customer Service Representative

cursor. A moveable spot of light on the screen of a display device, usually indicating where the next character will be entered.

cyclic redundancy check (CRC). (ISO) A check using a modified cyclic code for error detection and correction.

D

data. * (ISO) A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or automatic means.

*** data processing.** (ISO) The execution of a systematic sequence of operations performed upon data, for example, handling, merging, sorting, computing. Synonymous with information processing.

default. An alternate value, attribute, or option that is assumed when none has been specified.

device. A mechanical, electrical, or electronic part with a specific purpose.

display station. A keyboard, electronics module, and display.

document. A collection of one or more lines of text that can be named and stored as a separate entity.

dot matrix. (SC1) A matrix of dots used for constructing a display.

E

error log. A record of hard errors and soft errors that is stored in Random Access Memory and system memory.

F

*** font.** (1) A family or assortment of characters of a given size and style. (2) See **TYPE FONT**.

format. * A set of specific conditions that determines the final position of text on a page.

function. * A specific purpose of an entity, or its characteristic action.

H

hard error. An error that is not recovered from by an automatic re-try of the failing operation.

hard-copy MAP. A printed MAP used to diagnose system problems.

hardware. * (ISO) Physical equipment used in data processing, as opposed to computer programs, procedures, rules and associated documentation.

highlight. To emphasize characters on the display by making them brighter.

I

IBM Licensed Program. A software application program written and owned by IBM that provides the functional capabilities to the system.

ID. Identifier.

identifier (ID). * (ISO) A character or group of characters used to identify or name an item of data and possibly to indicate certain properties of that data.

information processing. (ISO) Synonym for data processing.

initialize. * (1) To set counters, switches, addresses, or contents of storage to zero or other starting values. (2) To prepare a diskette for use by naming the diskette.

initial program load (IPL). (1) The initialization procedure that causes the system to commence operation. (2) The process by which a program diskette is loaded into storage after the power on of the system.

IPL. Initial program load.

L

Loadable Diagnostics. Diagnostics that are loaded from a diagnostic diskette and used for problem determination.

Loadable Utilities. Programs used in system problem determination.

logo. The name, symbol, or trademark of a company.

M

MAP Diagnostic Integration (MDI). A diagnostic program on the CE Diagnos-

tic Diskette that is a combination of MAPs and CE loadable diagnostics.

maskable interrupt. An interrupt the system can ignore.

matrix. * (ISO) A rectangular array of elements, arranged in rows and columns, that may be manipulated according to the rules of matrix algebra.

MDI. MAP Diagnostic Integration

Memory Record Diskette. The diskette used to store the error log when it is dumped from the system memory.

menu. Options listed in a display image that can be selected by the user of the display device.

message. * (ISO) An ordered set of characters intended to convey information.
SEE OPERATOR MESSAGE.

module. * A packaged functional hardware unit designed for use with other components.

N

NMI.. Non-maskable interrupt.

non-key area. An area of the display screen where keyboard input is inhibited.

non-maskable interrupt. An interrupt that can immediately halt the system processing.

O

operator message. A message from the operating system or a problem program directing the operator to perform a specific function or informing the operator of specific conditions within the system, such as an error function.

P

PDD. Problem Determination Diskette.

problem determination. The process of identifying the source of a problem for example, a machine failure.

Problem Determination Diskette. The diskette on which the automated and semi-automated problem determination tests are stored.

Problem Determination Guide. The manual used by the customer when executing Problem Determination Procedures.

problem determination procedures. A prescribed sequence of steps aimed at recovery from, or circumvention of problem conditions.

process. (ISO) A course of events occurring according to an intended purpose or effect.

program diskette. The diskette on which the IBM Licensed Program is stored.

prompt. Information on the display screen that indicates a required action or provides step by step procedures.

Q

queue. A list formed by items in a system waiting for service; for example, tasks to be performed or messages waiting to be transmitted.

R

RAM. Random Access Memory

Random Access Memory (RAM). A portion of the memory card that holds the customer application program that is being executed and temporarily stores the data records as they are.

raster. A predetermined pattern of scanning lines that provides uniform coverage of a display space.

Resident Non-Automatic Diagnostics (RNA). Diagnostics contained in the system electronics that do not run during BAT.

reverse video. See VIDEO REVERSED CHARACTER.

RNA. Resident Non-Automatic Diagnostics.

ROS. Read Only Storage.

S

scale line. The line on the display that shows the margins, temporary left margin, tabs, center point, and the cursor position currently in effect.

scroll. To move text vertically through the display.

sector. That portion of a track that can be accessed by a magnetic head during a read/write operation.

segment. To move text horizontally through the display.

SERDES. Serializer/deserializer. A circuit that converts parallel data to serial data and serial data to parallel data.

signal ground. The ground reference point of the power supply.

soft error. An error that can be recovered from by an automatic re-try of the failing operation.

software. * (ISO) Computer programs, procedures, rules, and possibly associated documentation concerned with the operation of a data processing system.

status lines. The lines on the display that contain information about the current task or function.

system. The IBM Displaywriter System.

system exerciser. A system functional check which runs the system devices concurrently.

T

task. (ISO) A basic unit of work to be accomplished.

threshold. A predetermined limit.

trace. In diagnostics, the tracking of MDI steps on the display.

*** type font.** Type of a given size and style.

typing and menu area. The area of the display screen that displays the menus or text being created or revised.

V

verify. * To determine whether a transcription of data or other operation has been accomplished accurately.

video reversed character. A character formed by turning off the dots that make up the character and turning on all the background dots in the character box.

W

work station. A display station and a single or dual diskette unit.



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